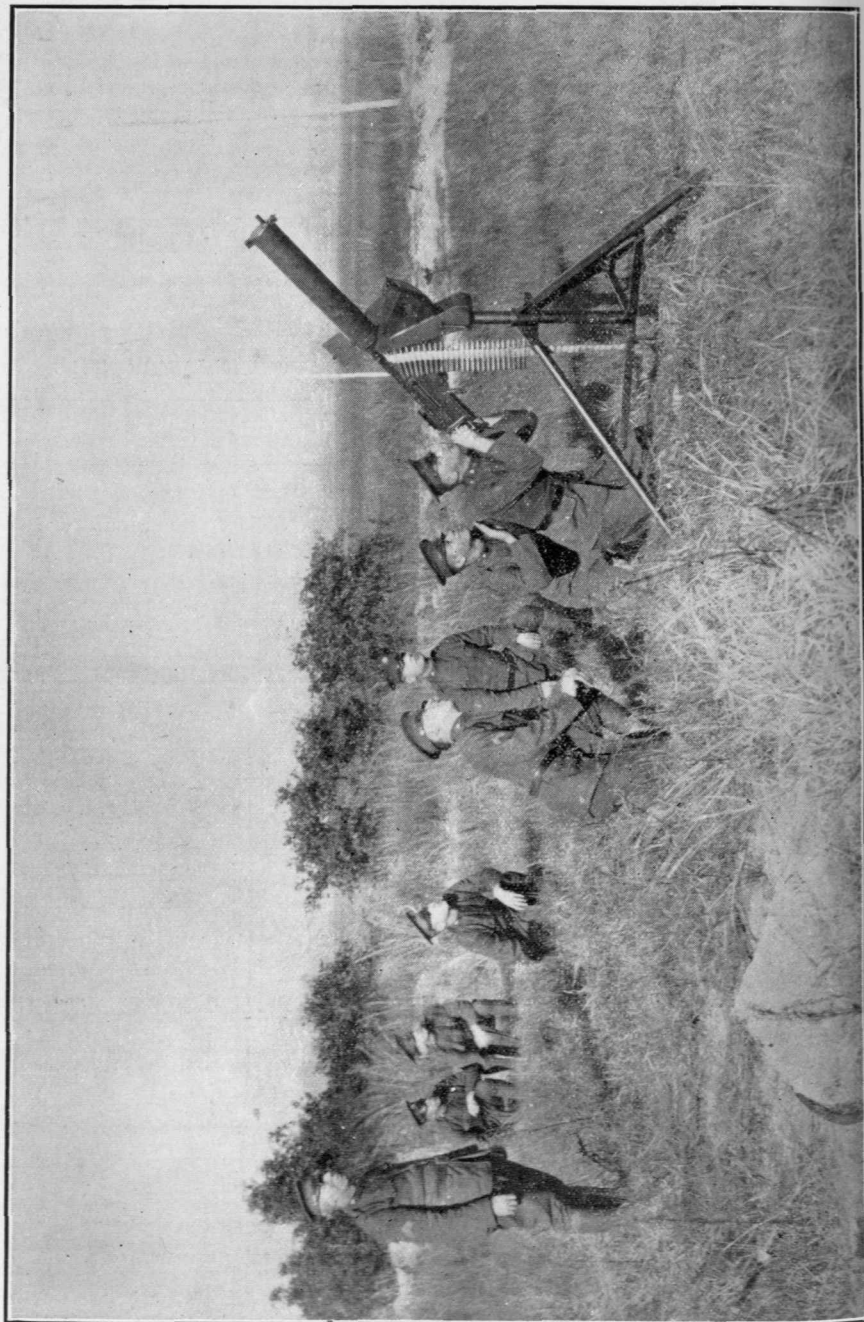


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A Reply to General Hagood

ON

Spotting for the Coast Artillery

By Colonel H. J. Hatch, C. A. C.

GENERAL JOHNSON HAGOOD'S article on Spotting for Coast Artillery, which appeared in the February issue of THE COAST ARTILLERY JOURNAL, is deserving of the careful consideration of every Coast Artilleryman. He has sounded a timely note of warning against the post war tendency to exaggerate the importance of spotting in the regulation of fire against moving targets. The war experience of the Coast Artillery was in land operations exclusively and, quite properly, the methods employed approximated those in use by the Field Artillery services of our own and other armies, with such modifications as the employment of heavier calibers and difference in targets naturally dictated.

The great majority of our present Coast Artillery officers below field grade received their initial, and in some cases their only artillery instruction, through the solution of field artillery problems. It is but natural that they, as well as some of the more impressionable and less analytical of our older officers, in an honest attempt to profit by the lessons of the World War, should attempt to apply field artillery methods not only to conditions to which they properly are applicable but likewise to conditions to which they are not.

We are prone to go to extremes. There was a period before the war during which we were required to depend for accuracy of fire entirely on preparation of fire made prior to the opening shots at the target itself. This preparation resulted in the determination of a ballistic correction based on meteorological conditions and on an assumed muzzle velocity; the latter being based on the observed deviation of a group of trial shots fired at a fixed point at a known range. Further changes in the applied correction, except as the ballistic correction was affected by the changing position of the target and varying meteorological conditions, were absolutely prohibited. This doctrine has been ridiculed as the extreme of absurdity since the war by those who, like Captain A of General Hagood's article, place their dependence for regulation of fire on elaborate preparations for terrestrial or aerial observation, or both.

Within a few years the pendulum of Coast Artillery doctrine has swung from the extreme of prohibited corrections based on observation of fire to the extreme of dependence on observations, the latter being regarded, not simply as desirable when practicable for verification or adjustment of the original ballistic correction, but as a positive necessity for effective fire.

While General Hagood in his excellent article has pointed out some of the fallacies of dependence on spotting, it has not been demonstrated that arrangements to provide continuous and precise information concerning the fall of our shots are without value when observation is practicable, as is conceivable it may be, under certain conditions.

You may not be willing to follow the General to the prewar extreme, but neither can you dismiss his contention that generally better target practice has resulted without spotting corrections than with them, for the records back him up. It is possible that there is a sounder doctrine than either extreme, but as between the two, that is, entire dependence on spotting or on a proper preparation of fire without equipment for subsequent corrections, the writer is inclined to favor the latter.

In placing entire dependence on the original ballistic correction, as we did in prewar days, it was admitted that inaccuracies in meteorological and velocity determinations occurred, but experience indicated that better firing resulted from accepting these errors than by disregarding the evidence of the carefully determined ballistic correction and basing corrections entirely on the evidence of the observed deviations of a few shots fired rapidly at a moving target. It should be noted that meteorological measurements are more reliable now than before the war.

With the best equipment for observing fire, the deviation of impacts from the range expected from the laying of the gun cannot be determined during continuous fire at a moving target with the same accuracy as in deliberate fire at a fixed target with uniform laying.

In the former case deviations from the target must be corrected for the difference between the ranges of the setforward point and target, since this may be considerable due to deviation of the target from a straight course. Spotting methods which contemplate plotting splashes for comparison of ranges of splashes and setforward points, require elaborate equipment and unnecessary personnel, with greater probability of error than when the target is the origin for the determination of deviations of splashes and correction is made for deviation of the target from setforward point. Even when accurately determined, deviations determined at one range are not applicable as flat corrections at a different range. For the rapidly moving targets to be expected in action, the difference in yards between the deviation or deviations on which a flat correction is based and the deviation which would have occurred had the same shot been fired at the range at which the correction is to be applied, may be as great as thirty or forty percent, conditions other than range being identical.

Errors of observation and the probable range error of the shot, (that is, deviation of the range of the particular shot from the range of the center of impact of a group of shots, if fired with the same laying), increase the error in a correction based on a single observed deviation. Successive shots even at fixed targets may be expected to differ in range by more than 1.4 probable errors, fifty percent of the time.

In target practice for heavy guns the number of shots allowed generally is insufficient to warrant a change in the correction even assuming that the deviations of all of the splashes are observed accurately. In action, smoke screens, movements of enemy vessels, smoke from enemy fire, and frequency of splashes, may prevent positive observations at all ranges from terrestrial stations, and radio communication with observing planes (granting that such planes might be available) probably will be unreliable or impracticable.

When instrumental observation is possible such that continuous and accurate information of the fall of shots is available, it is conceivable that the time would come when the observed deviations would furnish evidence of sufficient reliability to warrant an adjustment of, or change in, the ballistic correction. This con-

dition occurs frequently in mortar target practice, in which the ammunition allowance usually is larger than for guns. However, the original ballistic correction determined during preparation of fire, immediately before the opening shots at the target, should not be changed on insufficient evidence. Evidence which would warrant adjustment of the ballistic correction should consist of the reliable observations of a sufficient number of shots to convince the battery commander that his centers of impact are continuously short of or beyond his setforward ranges. The ordinary major caliber gun target practice allowance does not provide enough shots to warrant such a conclusion, if the preparation of fire be conducted properly. If meteorological data be determined carefully and the estimate of the muzzle velocity correction based on three or more accurately observed shots fired at the approximate range and azimuth at which fire will be opened on the target and not more than two or three minutes prior thereto, changes in the determined correction should be extremely conservative. If the conditions of the preparation of fire are less satisfactory, greater weight may be given properly to spotted deviations from the moving target, when corrected for inaccuracies in locating the setforward point.

It is doubtful if, during an engagement with hostile war vessels, the duration of the fire of any battery under conditions permitting reliable observation of fire, would be sufficient to warrant any change in the ballistic correction, except such changes as would be due to changing meteorological conditions and changes in azimuth or range of the target. The possibility still exists, however, that satisfactory preparation of fire may be impracticable, or that an engagement would last long enough and that sufficient reliable observation of deviations could be made to warrant corrections. These should not interfere with the rate of fire. Except for a two or three minute cessation of fire between trial fire and battery fire there should be no delay nor interruption of continuous fire for the purpose of utilizing the results of observation of deviations.

The deviation in range of a shot from that expected from the laying of the piece may be due to so called armament errors, to personnel errors, to inaccuracies in the determination of the elements of the applied ballistic correction or to a combination of these errors and inaccuracies. The first two mentioned causes are accidental errors which cannot be compensated by corrections. If these are large, the observed deviation of one or two shots is of little value as evidence of the deviation to be expected of the center of impact of shots remaining to be fired, and consequently of the proper correction to apply.

The smaller these errors the fewer the number of shots necessary to determine the proper correction from observation of fire. Both inaccuracies of observation and accidental errors are likely to be less in registration fire than in rapid fire at a moving target.

Whether due to inaccurately determined atmospheric conditions or muzzle velocity, or both, deviations increase with increasing ranges and decrease with decreasing ranges. A correction based on observed deviations, therefore, should be applied in the form of an adjustment of the ballistic correction, and to that element of the ballistic correction most likely to be in error. *A correct assumption as to the cause of the deviation is not important so long as the correction is applied so that its rate of variation will be such as to obviate the necessity for continuous change in the correction due to changing range.* This will be accomplished for considerable changes in range if the correction be applied on the range correction board, either to the retardation curves or to the velocity curves. Preferably the adjustment should be applied to the assumed muzzle velocity since facilities for measuring muzzle velocities are not available in the field or at posts. The improved meteorological equipment now furnished to Coast Defense commands permits more reliable determination of atmospheric conditions than are the estimates of the changes which have occurred in the powder during storage under local conditions since the charge to give normal velocity was established at the Proving Ground.

Retests of powder frequently show material changes in the velocity to be expected under different conditions of storage and density of loading. Changes in velocity which are not unusual cause greater changes in range at elevations common to direct fire guns than normally may be expected from differences in atmospheric conditions. For example, range tables for the 12-inch and 14-inch guns give the change in range at 10,000 yards for a difference of 10 f.s., as approximately the same as the change in range due to a 50-mile wind or 5 per cent change in density of the atmosphere. A correction of 100 yards or more at 10,000 yards could not be applied to wind curves for the 14-inch gun, (1660 lb. projectile, 2250 f.s.), since the maximum wind velocity provided for is 50 m.p.h., the range effect of which is only 90 yards. For high angle fire the atmospheric effect is relatively much greater.

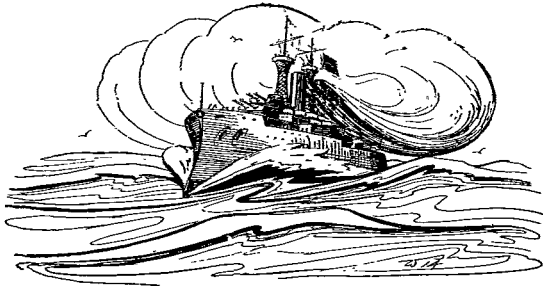
If a range correction board (Pratt Range Board) be not available, the correction based on the mean deviation of the trial shots may be applied as a percentage correction and treated as a ballistic correction, since the ballistic correction as a rule varies approximately as the range varies. Flat corrections in range never

should be applied as an addition to the ballistic correction, but should be incorporated either in the ballistic correction as an adjustment of the assumed muzzle velocity or, applied as a percentage correction, so that the net correction will vary automatically with the range.

It is to meet the condition of a prolonged engagement during which observation of fire is practicable, that the cost and labor of the installation of spotting equipment and the training of a spotting section is warranted. It should be noted also that the spotting section can be used to observe trial fire leaving the plotting section free to track the target, at which it may be desired to open fire quickly.

To insure efficient operation of the spotting system at such times as observation may be possible in action, training in determining deviations during target practice is necessary, but it will be an unusual condition that will warrant corrections based on such observations during ordinary heavy gun practice, or that will justify the application of such corrections frequently in action.

The only "problem" to be solved in target practice is to deliver the maximum number of hits within a given time. Attempts to embellish the instructions for target practice to make the practice appear as a tactical problem are frills—probably harmless ones. The benefit to be derived from target practice is in the training of a battery to deliver accurate and rapid fire at a designated moving target. With efficient batteries, higher commanders will have satisfactory tools for solving tactical coast defense problems.



Artillery Fire

EDITOR'S NOTE: *The following paper concerning the volume and effect of artillery fire in modern warfare, and the types of cannon developed during the war, was recently delivered as a lecture to the officers of the Advanced Course, Coast Artillery School.*

ARTILLERY has no independent role on the battlefield. It is there to deliver defensive or counter battery fires, to prepare for the infantry attack and to accompany and cover the attack. The Field Service Regulations states "Victory is won only by the combined employment of all arms in battle The full utilization of mechanical devices for military ends prevents useless sacrifices and conserves man power."

It is believed that full utilization of these mechanical devices can be made only by those who have an accurate conception of the powers and limitations of them. All of you have heard anecdotes about absurd calls made on artillery by staff officers and troop commanders. But it isn't only they who are poorly informed. There are many illustrations of bad judgment on the part of artillerymen.

The importance of artillery in modern battle is illustrated forcibly by consideration of the quantity produced on both sides between 1914 and 1918. France in 1914 had on hand

3840 75's with 1300 rounds of ammunition per
piece and a program for daily manufacture
of 13,600 rounds, and
308 pieces of heavy artillery.

At the end of the war she had

4968 75's with daily ammunition production of
200,000 rounds and
5128 heavy cannon.

Germany had on hand in 1914

5400 pieces of "field artillery,"
2020 pieces of "heavy artillery."

while at the armistice she had

11,948 pieces of "field artillery" and
7850 pieces of "heavy."

The following figures as to the expenditure of ammunition in various battles will still further accentuate this growing importance:

1863	Chickamagua	2 days duration	Union Army	7320 rds.
1863	Gettysburg	3 days duration	Union Army	32781 rds.
1870	St. Privat	1 days duration	German Army	39000 rds.
1904	Nan Shan	1 days duration	Japanese Army	34047 rds.
1904	Liao Yang	9 days duration	Russian Army	134400 rds.
1904	Shan Ho	9 days duration	Russian Army	274360 rds.
1915	Neuve Chapelle	3 days duration	British Army	197000 rds.
1916	Somme	7 days duration	British Army	4000000 rds.
1917	Messines Ridge	7 days duration	British Army	2753000 rds.
1918	St. Mihiel	4 days duration	U. S. Army	1093217 rds.

With such masses of artillery and such volume of ammunition expenditures the artilleryman must inform himself in order that he may at all times be able clearly to demonstrate to the less well informed any wasteful or improper employment of his cannon. In other words he must know both the powers and limitations of his weapon.

To complete the picture I will give you two more sets of figures, the percentage of casualties due to artillery fire in various wars and the ratio of casualties to ammunition expenditures:

<i>War</i>	<i>Nation</i>	<i>Percent. of Casualties due to Artillery Fire</i>
Crimean	French	45%
1870	French	25%
1870	German	9%
1914	German	75%
Verdun 1917	German	77.2%
Picardy 1918	German	51½%
1918	German (3, 4, 6, 10th Armies)	68%
Russo Japanese	Japanese	8½%
Russo Japanese	Russian	14%
World War	American	80%*

Figures concerning German Artillery ammunition fired on the front occupied by three French Armies during five months of 1917, at a time when German artillery was at its maximum efficiency, show that a total of 3,609,000 shells were fired by the Germans. 13,265 French are reported to have been killed and 55,412 wounded by artillery fire during this period. This gives a ratio of one casualty for every 54 shells and one death to every 271 shells. As-

*Includes 90% of all gas casualties. 27.3% of American casualties were from gas.

suming an average of 22 lbs. per shell this would give one killed and five wounded men for each three-ton truck load of ammunition.

Making some very broad assumptions some statistician has estimated that on all American fronts in 1917, the ratio of American casualties to German shells was one to fourteen.

The section of Artillery Notes included in your reading gives data accepted as to the destructive effect of various calibers and types of artillery.

These and the data above as to casualties are not matters to make us over proud. They show plenty of room for improvement for both the ordnance and artillery but they are figures we must accept until we can prove we can better them. And we must admit them to the other branches. And they particularly emphasize the fact that in the general case destructive fires do not justify themselves and that the most efficient employment of artillery both with and without gas is neutralization during critical periods. Fire for destruction except in very special cases is an unwarranted extravagance.

Standard artillery equipment on hand or in reserve.

<i>Number</i>	<i>Type</i>
113	2.95" Mountain Guns
5573	75-mm. (3854 French type)
200	105-mm. Hows.
300	4.7-mm. guns
200	60-pdrs.
3009	155-mm. Hows.
100	6" guns, Mk. XIX
2090	155-mm. guns (G.P.F.)
516	8" Hows.
45	9.2" Hows.
320	240-mm. Hows.

In a lecture to be delivered later, you will be told of the developments made in ordnance material since the war. (EDITOR'S NOTE: This lecture was recently delivered by Major J. B. Rose, Ord. Dept., and will be published in a later issue of the JOURNAL.) But with the above guns and howitzers on hand it is obvious that any war within a quite extended period of time would be fought with them and only in case of a serious prolonged war would any adequate production of new material be entered into. For this reason we will give a brief description of the more important of the above types.

Of the existing material the most important from the standpoint of tactics of the combined arms is the 75-mm. gun. As laid

down by the Caliber Board the ideal supplementary weapon is a howitzer of about 105-mm. caliber. We have but 200 of these. Too few to be given serious consideration. The 155-mm. howitzer used during the war is heavy and its ammunition cumbersome. As a consequence our present divisional artillery has organically no howitzers but in all service schools it is generally assumed that for a division acting alone the 155-mm. howitzer will be attached. The cases in which divisions within a corps will or will not have howitzers attached will be covered in your course at Leavenworth.

We have on hand about 1700 British and American type 75's but for purposes of our study here their differences from the French type are of no vital importance; we base our work on the French. This gun is 34.5 calibers in length and is designed to fire a 12.3 lbs. shell with mv of 1930 fs to a range of 9350 yards. The shrapnel for this gun weighs 16 lbs. and has a range of 7440 yards. The gun has an axle traverse on the carriage of about 6° ; it has an independent line of sight and an elevation, without digging in the trail, of 19° . The recoil is of the hydro-pneumatic type. In firing position, the gun and carriage weighs 2657 pounds.

The 4.7-inch gun, Model 1906, while a very accurate weapon, had too limited a range (8750 yards.) to be of prime value. A modified type with an improved projectile has given a range of 14,000 yards. However, of those now available, the number prevents their serious consideration in spite of the Caliber Board's fixing a 4.7-inch as the ideal Corps Artillery type.

The 155-mm. howitzer, Model 1918, approved as the proper Corps Artillery howitzer, is a splendid weapon within the limitations of its range. It is 15 calibers long, is mounted on a hydro-pneumatic recoil mechanism and fires a 95-lb. projectile with an mv of 1476 fs to a range of 12,300 yards. The carriage provides axle traverse of 6° and has $42\frac{1}{2}^{\circ}$ elevation. It weighs 7600 pounds in firing position.

It is a very satisfactory counter battery weapon and is very effective for smoke screens and gas concentrations. While considered too heavy for ideal divisional employment it gave excellent results during the war and met general approval by the artillery of all the Allies.

The 155-mm. G.P.F. gun, Model 1918, is 38 calibers long and is mounted on a hydro-pneumatic recoil mechanism of variable recoil. It fires a 95-lb. projectile with a m.v. of 2380 f.s. to a range of 17,800 yards. The carriage provides traverse of 60° and an elevation of 35° .

While the following quotation sounds like the rhapsody of an enthusiast it is an accurate description, for the gun is, from an ordnance engineering standpoint, the finest product of the war.

"The 155-mm. G.P.F. gun has an extreme range of almost exactly 10 miles (16 km.) and a traversing arc of 60 degrees ($1/6$ of a circle). These are extraordinary characteristics. By virtue of them a single grouping has in one day supported the infantry on the fronts of three army corps. On the other hand, three groupings widely separated in three corps areas have cooperated to fire at one time in front of the infantry of the center corps.

The gun fires a powerful shell with fuses appropriate to various conditions and produces very severe effects.

The gun is made for long range work. It is accurate for ranges up to about 12 km. but has considerable and increasing dispersion in range as the latter increases. It is very accurate in direction. So far as its shooting qualities go it is very suitable for counter-battery up to about 12 km. Beyond this it is the appropriate gun for harassing, interdiction, prohibitive fire, for destruction of large targets like towns, camps, etc., and for enfilading railroads, trenches, ravines, etc. It is not suitable for destruction of dug-outs or trench systems.

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 $1\frac{1}{2}$ minutes. Besides, it is expensive and the facilities for replacement and retubing are not sufficient. The normal rate of fire is one round in 3 minutes. There are several other guns and howitzers suitable for counter-battery at ranges less than 12 km.

In order to save its life and devote it to its best purposes (for which no other gun is at hand) the 155-mm. G.P.F. has since 25 September been kept at the disposal of the 1st Army. But not without exception, for a whole brigade of 72 guns was turned over to an army corps for one operation, and much counter-battery has been undertaken at the request of various corps from time to time.

The gun has other limitations. Its track is very wide—8 feet. It is very mobile, considering its qualities, but it is slow. Its ammunition is heavy and the supply is difficult. It takes several hours to emplace and some time to prepare for travelling. It often stirs a foolish impatience and resentment among military police, traffic regulators and staffs very unworthy of them. The gun has been and will continue to be a saviour of doughboy lives and I can vouch for it that those who command and serve it are devoted to the sup-

port of the infantry as their first duty. Prisoners' testimony is plentiful as to the great effect of artillery in their back areas. The 155-mm. G.P.F. is the gun that they testify for in the main."

A good many examples could be quoted from the Army Artillery diary to show failures to use this powerful weapon. For example, fire of Army Artillery south of parallel 288 was stopped either September 27 or 28. Yet this parallel was not reached until 26 October and the jumping off line of 1 November was approximately on it. On a certain part of the front fire was stopped south of parallel 301 on 2 November but no infantry came near that line even on 3 November. There seems to be either an over-confidence as to advances to be made not borne out by experience or an unwarranted fear that losses will be suffered from friendly artillery fire. The latter is often claimed by inexperienced troops, rarely proven and often shown to have been utterly impossible. When it does happen it is not because the advance runs into it but usually through defective ammunition. If shell bursts are in front of the infantry the latter will not run into them. If large areas are to be taken it is ordinarily not worth while to keep artillery fire out of them for fear of injuring a few lost, small patrols.

In the attack of 1 November one corps asked for preparatory fire by 155-mm. G.P.F.'s on objectives about a kilometer in front of its line. The fire was delivered accurately and very effectively by a distant Army Artillery Grouping. Moreover, fire from G.P.F.'s preceded this corps' attack during a whole day, not as a barrage, but according to a pre-determined program. See the Boche communique as to the character of the artillery fire and as to the result—a piercing of the Hun artillery position. It is not thought for a moment that the 155-mm. G.P.F. should be credited with more than its fair part in the accomplishment. Divisional and corps artillery certainly did their's also.

The Army Artillery P. C. is always open. The Army Artillery Grouping Commanders maintain liaison with Group Chiefs of Artillery. They are ordered to cooperate freely, undertaking any mission that they can accomplish without interference with a mission assigned by higher authority. They are even authorized to set aside an assigned mission of their own responsibility. If they cannot do what is asked they may refer the matter up to another grouping. They are willing and anxious to do these things. They know their business, the powers and limitations of their guns. They attempt through officers and runners to keep in touch with the situation in divisions. At least one such Army Artillery liaison officer went "over the top" with the infantry on 1 November.

The field of application of long range guns is broad and deep. Their dispositions are the same. Liaison, either metallic or personal, is therefore difficult, especially laterally. The telephone usually works from front to rear and rear to front. For fugitive targets the army artillery cannot usually be depended upon unless fire is called for by aerial observers. Usually, however, timely fire can be brought upon stationary targets, such as concentrations, works, sensitive points, etc., by use of the telephone. Fire in close support of an advance cannot be made safe except by prearranged schedule, easy to draw up but sometimes requiring several hours work.

The Army Artillery cannot force its amicable intentions upon any corps but it offers its services, describes above its powers and limitations and bespeaks the good will of G-1's and the Military Police in order that its powerful assistance may be devoted to the support of the infantry.

The 8" howitzer fires a 200-lb. projectile with an m.v. of 1525 f.s. to a range of 12,000 yards. In the firing position it weighs 19,100 lbs. There are three types of carriage on hand and a total of this caliber of 516 pieces. Its range is short for its caliber and it is very unwieldy. While it will be necessary to employ it in case of a serious war, there are none now manned by any troops. It, the 9.2" and the 240-mm. howitzer have been placed in reserve together with the less effective smaller calibers, the 60-pounders and the 6" guns. For any data on these you are referred to Ordnance Handbooks. They do not enter into your work here or at Leavenworth.

Considering the ammunition to be provided for these various types, we have:

For the 75-mm. gun	H. E. Shell Shrapnel Smoke.
For the 155-mm. How.	H. E. Shell Gas Smoke.
For the 155-mm. gun	H. E. Shell.

For all shell (H. E. or smoke) the super-quick fuze is provided in addition to those firing short delay.

For shrapnel a combination fuze is required.

These projectiles with appropriate fuzes may be classified as:

- (1) Those for use against personnel.
- (2) Those for use against materiel.
- (3) Special shell. (Star and smoke are examples of special shells).

Against personnel we may use H. E. Shell with instantaneous or super-quick fuzes, gas shell or shrapnel.

Against materiel we generally employ H. E. Shell with the short delay fuze. In some cases against inflammable materials, shrapnel or smoke shell may be used for incendiary effect.

There are limitations to the use of all these except the H. E. Shell. To be effective, shrapnel must be burst in the air and the fire must be observed. It cannot, therefore, be satisfactorily used at night or in fog, rain or snow or at ranges beyond the limit of observation.

For gas shell, winds must be favorable and the area shelled with any gas having appreciable persistence cannot be immediately occupied.

Smoke shell can be used under nearly all conditions but high wind makes it very expensive and difficult to maintain and it is in general superfluous under conditions of very low visibility.

As to the relative merits of shell and shrapnel, the future of the latter is not assured even though it has survived the war. The shrapnel is much less effective in howitzers than in guns, because the high angle of fall of the howitzer contracts the ground pattern of shrapnel very much. In guns firing at long range, the dispersion of the fuze becomes great and makes the effect unreliable; in addition, there is difficulty in making a time fuze of a time capacity adequate for long range firing. The shrapnel and its fuze are more difficult and costly to manufacture than the shell. The firing of shrapnel is limited practically to the day time and other conditions which permit the bursts to be observed. The technical conduct of shrapnel fire is much more difficult than that of shell; in fact it is questionable whether a hastily trained war officer can be expected to handle shrapnel effectively. While a well placed shrapnel is more effective against animate targets in the open than shell, dispersion causes a certain proportion of those fired to burst or graze with little effect. On the other hand, the new shell fuzes give bursts effective practically entirely above the ground, making their action not unlike that of shrapnel. These projectiles are independent of fuze dispersion and can be used effectively without observation. Thus simplicity of materiel, ammunition supply,

training and firing, as well as considerations of production and general utility, point to the abandonment of the shrapnel, which must justify itself in its greater effectiveness at least under certain conditions. The effectiveness of the shrapnel is none too firmly established, and it is possible that future investigations will result in its complete elimination. It is a fact that, whereas the light artillery carried habitually before the war about 25% shell and 75% shrapnel, the future proportions will be at least an equality of shell and shrapnel, with more probably a considerably predominating proportion of shell. Another factor to be considered is the fact that the neutralizing effect of shrapnel has been replaced largely by the special shells, gas and smoke.

To quote from general Summerall's remarks, during his conference with the Caliber Board:

"The French did not use shrapnel to any great extent with the 75 because they could not make satisfactory shrapnel. The Germans had developed a mechanical time fuze which they used at the beginning of the war but apparently that gave out. During the last three months of the war, the Boche used more shrapnel on us than through all the rest of the war, and the results they secured were heavy. They did not use it well, but its effect on us was very deadly for all that. We used it to a greater extent during the last part of the War. Towards the last we had one battery always using shrapnel."

The great disadvantage of shrapnel is that fire by it must be adjusted. This cannot be done at night, during bad weather. To properly adjust with shrapnel requires a better trained personnel which in time of war is a most difficult problem. The efficiency of well directed shrapnel against personnel in the open is far superior to shell. It has been estimated as being from 5 to 7 times as effective.

The following table gives the proportion of H. E. Shell, shrapnel and smoke shell carried by the 75-mm. gun batteries and the 155-mm. Howitzer:

75-mm.	$\left\{ \begin{array}{l} \text{H. E. Shell} \\ \text{Shrapnel} \\ \text{Smoke} \end{array} \right.$	50—75%
		15—40%
		10%
155-mm. How.	$\left\{ \begin{array}{l} \text{H. E. Shell} \\ \text{Smoke} \end{array} \right.$	90%
		10%

Special Shells.—The recent Disarmament Conference left the status of the use of gas in warfare uncertain. The discussion today and the consideration given the use of gas by artillery during the rest of this course is, of course, only applicable in case gas shells are retained. It is being taught at Leavenworth now, that they are only furnished to divisional types in special situations. At Edgewood Arsenal there are on hand two million gas shells for the 75 ready to fill and several hundred thousand already filled with mustard gas. There are also on hand seven hundred thousand gas shells for the 155-mm. ready to fill. The present plans call for the complete assembly of gas shells at Edgewood Arsenal. Large quantities of mustard gas are on hand, as well as two years' supply of the world's production of phosphorus. During the war special shell bodies for gas shells and other form of chemical shell were in general not used. Bodies designed for a high explosive filler commonly were used. There was considerable difficulty during the war in designing a satisfactory container for the bursting charge used in chemical shell. This bursting charge is contained in what is commonly called a booster or gaine. It fits into an adapter which screws into the nose and to date considerable difficulty has been experienced in making the various joints gas tight. This leads in some cases to the gas leaking into the high explosive charge and causes duds. It also leads to leaky gas shells. Such leaky shells must be destroyed whenever discovered at dumps or in rear areas. At the front, of course, they can be fired. This difficulty will undoubtedly be solved in the future. In filling gas shells a void amounting to from six to fourteen percent of the total gas capacity of the shell must be left to take care of the expansion of the filler when heated by the discharge. In your course on the Tactics and Technique of Other Arms you will consider the Chemical Warfare Service as such and the use of gas from a command standpoint. Today we merely wish to cover such phases of the use of gas shells as should be known as a basis for the technical consideration we will give it during the rest of this course.

Classification of Gas Shells.—Gasses used as fillers in American shell may be classified as follows:

- Lethal (deadly)
- Vesicant (burning the skin)
- Irritant (affecting the nose, throat, and lungs,
but not deadly)
- Lachrymatory (tear gas)

Some gasses may combine two or more of these properties. A more usual classification is based upon the rapidity of evaporation and from the artilleryman's point of view this is the normal classification. It divides gasses into:

Non-persistent
Semi-persistent, and
Persistent.

I am not going to attempt a complete description of types of gasses now on hand nor of the markings on gas shell, and so forth. In practical operations gas manuals will undoubtedly be published similar to those we had in France which will give all data concerning the nature of these gasses, the marking of the shell and also very elaborate data as to the amount of gas it is necessary to deliver on any particular area to secure a particular effect. With the use of these tables, it becomes a purely mathematical calculation as to the number of rounds that should be fired upon an area and the rates of fire that should be used when complying with any orders for the use of gas.

In brief the characteristics of the three classifications mentioned are as follows:

(a) Non-persistent.—The non-persistent gasses volatilize without any special agency when the shell bursts, necessitating only a small bursting charge. A high initial concentration of the gas cloud is desired. This cloud can then drift downward and envelope the objective. Secondly, complete vaporization at the instant of burst is desired, but if the bursting charge is too strong, the liquid contents may scatter unduly and also in an upward direction, which is undesirable. Non-persistent gasses boil at 20° C.

(b) Semi-persistent.—The semi-persistent gasses boil from 20° to 200° C. In consequence, a heavier bursting charge is required for them than for non-persistent gasses, in order that the explosion may atomize the shell's contents. The bursting charge must not be so strong as to unduly disturb the cloud formed or to cause a disassociation of the gas through excessive heat.

(c) Persistent.—With mustard gas the formation of an immediate cloud is not desired. With such shells the bursting charge should be such as to throw a coarse spray over a maximum area. A considerable bursting charge is necessary but its order of detonation should be lower than that for the two preceding classes. Persistent gasses boil at a temperature above 200° C. and if complete vaporization is desired it is secured by an especially large bursting charge. The increased heat and pressure produce the effect desired.

A mustard gas shell with a very large bursting charge is very much more deadly at the time of bursting but its persistency is also much less. Such a shell has recently been developed.

Amount and Kind of Gas Shell Fillers For Different Calibers.—The amounts and kinds of shell fillers used for the various calibers, of course, vary. We would expect to see the non-persistent types of gas used principally in the large calibers, because of the greater volume of gas delivered in a single burst. With such gasses the concentrations must be quickly built up. Inasmuch as the 155-mm. gun and howitzer are the most numerous of the various types of medium calibers in our army, they may fire the bulk of the non-persistent gasses. With persistent gasses the concentration does not have to be so quickly built up. Moreover, each 75-mm. shell can gas 25 square yards effectively with mustard gas. It would therefore seem probable that the 75 will deliver a large part of such gas within the limits of their range. On the other hand, the large number of 75's which will presumably be present in any of our operations, will probably make it advisable to use them for firing a considerable amount of the other gasses. Also, in many cases, it will be desirable to use persistent gasses beyond the range of the 75's, and the heavier calibers must thus often fire persistent gasses. It is therefore to be expected that all types of armament will be used for firing any one type of gas, and that any one type of armament will be used to fire all types of gasses.

Fuzes for Gas Shells.—In firing gas shell, it is necessary to use a fuze which will burst the shell practically entirely above the ground. As we have seen before, this requires either that a time fuze or an instantaneous fuze be used or that ricochets be obtained when non-delay or short delay fuzes are to be used.

Handling Gas Shells.—In transporting and handling gas shell, the only danger to be expected is from leaky shells. All personnel handling gas shell should carry masks. In handling leaky shells, special clothing, especially gloves should be worn if the shells are filled with a vesicant gas. All leaky shell must be fired at once or be destroyed.

Characteristics of Smoke Shell.—Smoke shell are filled with either white phosphorous (W P) or titanium tetrachloride (F M). These two kinds of shell are used, respectively, for forming smoke screens and for the adjustment of gas shell fire. Either can be used for either purpose, but the W P shell is much superior for forming smoke screens and the F M shell for ranging; in fact, the F M shell is only about 40% as efficient as the W P shell for screening purposes. When using F M shell for ranging, preceding a gas

shoot, the necessary corrections must be made for the difference between shells when passing to fire for effect.

Use of Smoke Shells.—Smoke shell is used to form a smoke screen to blind the enemy. These screens may be used against observation posts, machine gun emplacements or even against the troops themselves. Smoke shells are also used to define the limits of an attack or raid, to draw fire and to divert attention from some other operation, or to simulate gas attacks. Its use came more and more into favor during the World War. It was used, on occasion, in the near edge of our own rolling barrage to mark it clearly for our own troops, and to screen our troops from the observation of the enemy. Such use is apparently somewhat debatable. It reduces the number of guns firing shell and shrapnel and some claim that it furnished the enemy a definite point to aim on. The British artillery often put down smoke in a barrage just before it began to move forward in order to mark the line of the barrage and as a signal to the infantry that the movement of the barrage had begun. Smoke shell cannot be depended upon for much screening effect when fired in wind of much over twenty miles per hour. The amounts of smoke shell required to fire screens under various conditions are given in detail in your Artillery Notes. The figures there given were taken from the latest data obtainable from the Chemical Warfare Service and are believed to be as nearly correct as any available today.

A study of these figures will show you that it is only under fairly favorable conditions that one can hope to effect much screening. On the other hand, favorable conditions, dull light, damp atmosphere, small wind, and so forth, are liable to be met with very frequently. The remarks concerning fuzes for gas shell are equally applicable to smoke shell. Smoke shell are normally carried by all division types.

Technical and Tactical Employment of Special Shell.—As we have stated above, the technical employment of special shell will be controlled by orders from division, corps and army commanders and not by the orders of artillery commanders. The following discussion of the tactics and use of special shell is taken from a paper by Lt. Col. M. E. Locke, F. A.:

“Destructive fire is intended to produce casualties. Lethal gasses are employed and as they are of low persistency the concentration must be quickly built up. This is secured for any given number of rounds by using as many guns as possible, firing simultaneously with a high rate of fire. The usual length of time is about

two minutes, although under very favorable conditions, such as dead calm in thick woods or at night, fire may last for five minutes as a maximum.

“Neutralizing fire is intended to paralyze or greatly reduce human activity by wearing down morale and causing the mask to be worn for long periods of time. For this purpose recourse is generally had to persistent gasses, preferably to mustard. This concentration does not have to be quickly built up. Fewer guns and a slower fire are admissible.

“For counter battery work a burst of lethal gas is often given followed by a slow neutralizing fire with persistent gas. If this latter fire has been kept up for three or four hours, it is well to ‘top off’ with another burst of toxic gas after the mask’s effectiveness has been reduced by a long period of use.

“Harassing fire is usually effected with tear gas, which makes long continual wearing of the mask obligatory to escape its annoying effects. Interdiction fire with gas in substance means simply to fill a hostile area so full of mustard that the enemy cannot stay there. An example of this was the town of Armentieres in the attack of March 21, 1918, by the Germans. There are also a great many stratagems that can be practiced. Among them may be mentioned the mixing of lethal gas with a blinding smoke cloud, mixing gas with high explosive, the firing of a nauseating or coughing gas, causing the removal of the mask and following it with a burst of lethal gas, firing gas at night where men may be resting with masks off and possibly not near at hand, the mixing of a small amount of gas in our own rolling barrage, not enough to do real harm but enough to scare the enemy into putting on his mask. About one gun per battery (25%) can be so used. With a four-mile per hour wind our troops can follow this barrage in one minute and without their masks. However, to sacrifice 25% of the guns in barrage for this artifice is open to debate. This by no means exhausts the list of devices to fire gas with increased damage to the enemy.

“In the offensive, gas may be used for the attack, during the attack, during lulls in the action and while consolidating a captured position. As previously stated, the offensive usually demands the use of non-persistent gasses in areas over which our troops can be expected to advance within a short time. It is necessary in an offensive to calculate a safe interval as to time before the attacking troops arrive at successive stages of their advance when using semi-persistent gas. This calculation must be made both for the preliminary bombardment and for the attack. For support during

consolidation use either semi-persistent or persistent gasses. Choice as between the two involves an estimate as to the probable time elapsing before another advance. If it is probable that no further advance will be made for a number of days, use persistent gas, especially if dangerous counter attacks must be warded off.

“In defense or in retreat the use of persistent gas is the rule, mustard preferred. The area vacated must be made untenable as possible for the enemy and for the maximum length of time, Mustard surpasses all other gasses for this purpose. This does not mean that gas is necessarily the best type of projectile to use. The effects of mustard are not immediately apparent and the hostile advance may be so rapid that casualties must be inflicted in the shortest space of time and in the greatest numbers. In such instances, we must come back to shrapnel and high explosive shell, if the enemy wear masks. In any stabilized condition, such as obtained during the first three years of the World War, persistent gas can be freely used.”

It is the purpose of our military policy to create a force as a first line of defense consisting of the Regular Army and the National Guard, ready to take the field immediately upon the outbreak of war and protect our frontiers until the man-power of the nation can be mobilized in the Organized Reserves. At best, the former force would be insufficient to do more than hold the line temporarily. On the other hand, without the protection of this force, the Organized Reserves would themselves be helpless against even a weak attack.—Annual Report of the Chief of Staff.

History's Verdict on Foch and Ludendorff

By EDWARD F. MCGLACHLIN

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DIFFICULTIES OF ESTIMATING MILITARY GENIUS SO SOON
AFTER THE WAR — BOTH THE FRENCH AND GERMAN
LEADERS UNDOUBTED MASTERS OF THE ART OF WARFARE

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A MILITARY hero is a political asset to a State that desires to conquer or to hold over its neighbors a threat of force to establish or maintain its dominance. Prior to and, particularly, after the Franco-Prussian War, there was developed a painstaking and successfully nurtured cult of the elder von Moltke. So now, it may be more than suspected, there are organized efforts to idolize both Foch and Ludendorff. Were Hindenburg a younger man, he might be the object of such glorification on the German side.

Perhaps because propaganda is so clearly sensed, these deifications are attacked by counter-assaults upon such leaders. As von Moltke was belittled by Frenchmen, so Foch and Ludendorff are depreciated by partisans who forget that to humble one is equivalent to lowering the prestige of the other. After the Franco-Prussian War, defense of Bazaine was impossible, of MacMahon difficult. Contempt of von Moltke, however, could not cloud their reputations, though it may have encouraged the confidence and self-reliance of the French people.

The present situation is different in that German political opinion is divided into strongly imperialistic, democratic and communistic elements. Ludendorff is both harshly criticized (for example, by the historian Hans Delbrueck) and extravagantly praised in Germany. Foch is generously supported by the French people.

Among the prominent advocates of Ludendorff is General von Kuhl, whose article (*Current History Magazine*, Feb., 1924) as a

contribution to controversial military literature, is both interesting and valuable. It is not, however, conclusive. Clearly it is not a thorough, coldly scientific historical inquiry into his chosen subject. At this day we are among the mists of fiction or mythical tradition regarding the World War and its leading figures. No final, incontrovertible estimate of the leaders in that war can yet be made. The sketch under consideration may, on the whole, seem fair, yet the scant quotation submitted does not warrant either a charge of injustice against Foch for his alleged comments on Ludendorff or a prejudiced investigation of his conduct.

It may be agreed that Foch had a magnetic personality, inspiring Frenchmen to go forward, to do and to die. Judging Ludendorff by his photographs, his own writings, by intimate friendly descriptions of his personality, even by his decisions and actions in some circumstances, he was most austere and domineering—a technician, a doctrinaire who fought war absolutely as an art and as a science without understanding of the mass psychology (especially as that psychology changed and developed) of the men under him or of the people whom he served. A man of such attributes could not successfully have commanded the allied armies, although he seems to have functioned effectively during the period of iron discipline in the German Imperial Army.

As a writer and as a teacher of strategy, Foch clearly excels Ludendorff. The Marshal's two books, "The Principles of Warfare" and "The Conduct of War," mark him as a writer of the highest order. No books produced by Ludendorff before the World War compare with those of Foch.

Marshal Foch was not pitted against General Ludendorff, mind to mind, until after the drive of March 21, 1918, when the situation very much resembled that of the Civil War during the final campaign of 1864-65. The death knell of the Germans had all but sounded. They were capable of but one more thrust. To base a comparison of Lee and Grant upon the final campaign alone and to judge them by their accomplishments therein, would be like comparing Ludendorff with Foch in the concluding campaign of the World War. Any deductions would be unfair to both Generals, for each was functioning under circumstances entirely different from the other.

FOCH'S STRATEGY IN THE WORLD WAR

Let us analyze more in detail the careers of these two men in the World War. Foch starts out as Commander of the Twentieth

Army Corps. Ludendorff is head Quartermaster of von Bülow's Second Army. Their accomplishments in the opening campaign reflect on each the greatest credit. During the early operations in Lorraine, Foch handled his Army Corps tactically in an excellent manner. Upon the withdrawal of the French Army, this corps assisted greatly in covering the retreat. During the preliminary fighting up to the battle of Nancy of September 6th it contributed to holding back the Germans.

The withdrawal of the French Army in Lorraine, whether voluntary or forced, was one of the first causes of the breakdown of the German plan that led to the Teutons' defeat on the Marne. The Germans virtually were drawn on and compelled to throw their centre of gravity to their left instead of to their right, as they had intended. Thus they permitted themselves, though superior in number, to be pinned to the ground by lesser numbers of French. The French were able to move reinforcements to their fighting line on the Marne, whereas the Germans were unable to send assistance to their hard-pressed First, Second and Third Armies. Any French corps commander who took part in this affair with credit is entitled to high praise.

Many French writers refer to Foch as the victor of La Fère Champenoise. They consider the fighting in that locality most decisive, and try to convey the impression that an attack by Grosetti's Forty-second Division was what pierced the German centre between the Second Army of Bülow and the Third Army of Hausen, and caused the entire right wing of the German Army to fall back. This statement is not true. The German decision to retreat had been made hours before the pressure of the Forty-second Division began to be felt. The Forty-second Division was withdrawn from the line, not with the deliberate intention of putting it into a counter-attack, but because it was exhausted and needed rest. As to the statement alleged to have been made by Foch on September 9th, and quoted by General von Kuhl, it is too full of absurdity to be seriously considered as coming from any military student, much less from the accomplished scholar Foch. At any rate, during those trying days he was optimistic, and would not even think of defeat, illustrating the truth of the saying: "No one is defeated until he is willing to admit defeat."

The race to the sea started before Foch was placed in command of the Northern Army group, and was really a race between the railroads of France and the French and Belgian railroads which Germany had taken over. The French railroads won—to the everlasting credit of General Payot and his efficient staff. The hard

fighting that occurred on this wing after Foch took command presents many evidences of skill in tactical handling of troops and disposition of reserves. From that time on there is apparently nothing in which Foch took part that outshone the work of others.

At the time Marshal Foch was elevated to the position of Generalissimo the floodgate of American troops had been opened. German reserves were almost exhausted, but before the full American supply could arrive the Aisne-Marne drive occurred. The counter-attack against the base of the salient in the direction of Soissons, in which the First and Second American Divisions participated, was skillfully carried out, and the point selected for the attack is open to no criticism. If the Germans were deliberately allowed to advance until they formed a long wedge with the apex on the Marne so that they could be attacked later at the base of the salient, it was a clever piece of strategy, but this is unbelievable by any who saw the ill effects of the German advance upon French confidence and morale. However, if the point of attack was conceived after the German drive had stopped, it is hard to see an example of strategical genius. The failure of the Germans on the other flank of the salient, toward Rheims, was due to the skillful dispositions of General Gouraud made possible by his advance information of the exact hour of the coming attack, that is, by the absence of the element of surprise.

In the final operations subsequent to this Aisne-Marne drive, the Allies had a supply of reserves so great as to make them stronger than the Germans at any point. Notwithstanding this there appears to have been no attempt at strategic manoeuvres. There was to be an attack all along the line from the Moselle to the coast, later to the Swiss frontier. One cannot say whether or not a Cannae, a Sedan, a Tannenberg, could have been brought about had it not been for the armistice. It is somewhat doubtful whether Foch should be given credit for placing the freshest army and the one with the greatest élan at the most difficult point, that is, near the pivot. There was strong insistence by the Americans on the formation of their own army in an important area. It was an American conception that its first great task should be the flattening of the St. Mihiel salient and the capture from the Germans of necessary national resources, such as coal and iron. That its use on the Meuse-Argonne front was no long foreseen and matured plan is indicated by the two major changes that took place in the original objectives and dispositions for the St. Mihiel campaign, involving vital shifts of army artillery. At first our furthest line was to touch or to include Metz. The final decision was that

we were merely to set free the railways and canals for use as rocade lines. These changes now seem to have been made to conform to the subsequent operation, the object of which was a grasp on the traffic throat of the Germans. Had it been in mind from the beginning, they would not have been necessary.

LUDENDORFF'S BRILLIANT WAR RECORD

Let us turn to General Ludendorff. If we judge solely by the brilliancy of the operations in which he participated, there is no question that he outshone Marshal Foch. In the Hindenburg-Ludendorff partnership we do not know positively whether or not the master mind was Ludendorff; but any one who studies the various campaigns must gain a fixed impression that General Ludendorff was no figure-head.

In the operations on the eastern front it must be borne in mind that the Central Powers did not have that unity of command which writers have stated was responsible for their success. There was no more unity of command than there was on the allied (western) front, but Ludendorff's dominating personality enabled him to impose his will upon the Austro-Hungarian Army and the armies of the other allies.

Tannenberg was unquestionably Ludendorff's own work, and will stand as a classic equal to Cannae or Sedan. The great German drive in the Spring and Summer of 1915 will also be for future generations a perfect illustration of strategic penetration on a grand scale. These two campaigns Ludendorff conceived and conducted. They ended in decisive victories. At Tannenberg, Samsonov's Army of the Nareva was destroyed. Subsequently the Army of the Niemen was driven from East Prussia, and then the Mackensen advance on the Donajec practically forced the Russians out of all occupied territory. The elimination of the armies of Rumania provides another example of proper strategic conception in connection with a mountain range and of the attack on flank and rear. The success of the Austro-German operation that culminated with the Italians back on the Piave marked yet another brilliant piece of strategy.

With these four phases of the World War Ludendorff is intimately connected. No other military commander has such a record.

With the withdrawal to the Hindenburg line in 1916 and with the fiasco at Verdun, Ludendorff had no appreciable concern, nor

can he be charged with any responsibility for the strategy of the Central Powers after the first Marne battle until after Hindenburg became Chief of Staff.

He was, however, responsible for the famous offensive of March 21. That this drive failed to accomplish its entire object cannot be charged to the inferiority of its conception. Ludendorff struck exactly where Napoleon would have struck, at the junction point between two allied armies.

The final Aisne-Marne offensive was the last desperate attempt that Germany made to conclude the war victoriously. These two campaigns, viewed in the retrospect, would better not have taken place, for all they did was to weaken Germany, to use up reserves that she could not spare, to force her to drop back on the defensive and to surrender the initiative to Foch.

They were the product of the initiative, decision and determination of Ludendorff. His was no unified command. Austro-Hungarians, Turks and Bulgarians were bound to Germany by no tie except that of self-interest. Only success would hold them true, and positive success was necessary. His would have been no Frederician defensive, backed by a solid nation with almost tribal sentiment. Instead of support he could look only to the early falling away of each party—each on the best terms available from the enemy. His cause was certain to meet defeat. Notwithstanding all this, his operations were strategically well directed. He gambled as all great military leaders must. If he is to be condemned it is because he did not consider or, considering, did not estimate truly the numbers and efficiency of the United States troops, whose strength was swiftly growing.

Let us end by admitting that both Marshal Foch and General Ludendorff are great soldiers and by leaving to calmer minds at a time when facts are better established the analysis of their attributes and accomplishments. Which is the greater matters little if the student can determine the qualities of each worthy of emulation, the weaknesses of either which should be avoided.

Calibrating the Guns of the 59th Artillery

By 1ST LIEUTENANT J. H. SMITH, C. A. C.

AUTHOR'S NOTE: The greater part of this article is an extract from the report submitted by the Commanding Officer, 59th Artillery, Fort Mills, P. I.

THE 59th Artillery, stationed at Fort Mills, Corregidor, P. I., has for its equipment, twenty-four 155-mm. guns. While every gun in the regiment had at sometime previous to the calibration firing been fired, there was no reliable data available on the shooting ability of all the guns with respect to each other. The necessity for the calibration fire being obvious, authority to expend three hundred and ninety rounds of ammunition for the purpose was readily obtained. The firing took place April 10th, 1923.

The guns were emplaced on the east end of Corregidor Island on a straight line about 1100 yards long, and at 50 yard intervals. Shelters were constructed as a safety precaution against premature bursts or accidents of similar nature.

The Regimental Orienteur officer computed the base lines and coordinates for all observing stations, of which there were five. It was decided to use parallel fire, with all guns laid in the direction of the China Sea. A pyramidal target was anchored at a range beyond ten thousand yards as a reference mark for the observers. Guns were given tactical numbers, one to twenty-four from the right. A station for obtaining ballistic wind was established in the vicinity of the guns. Each gun was inspected by an ordnance machinist after being placed, and before firing. Field communications were installed under the direct supervision of the Commanding Officer, Headquarters Battery.

A major of the regiment was detailed in charge of the firing and another as executive. In addition, each was assigned a lieutenant as assistant, and an officer (lieutenant or captain) was assigned to each of the observing stations.

The regiment was divided into two battalions; the 2nd Battalion serving Guns Nos. 1 to 16, and the 1st Battalion, Guns 17 to 24.

Special forms for recording the data were prepared and used. The form for use at each gun included the following: tactical number of gun; serial number of gun; elevation; azimuth in mils; powder pressure; seating of projectile; time of firing each shot. The

form for use at the station of the officer in charge included the following: ballistic wind data; barometer (each 15 minutes); thermometer (each 15 minutes); powder temperature (each 30 minutes); wet and dry bulb thermometer (each 30 minutes). The form in use at each observing station included the following: azimuth of datum points; azimuth of each burst or splash; and time of fall of each shot.

THE PLAN OF FIRE AND OBSERVATION

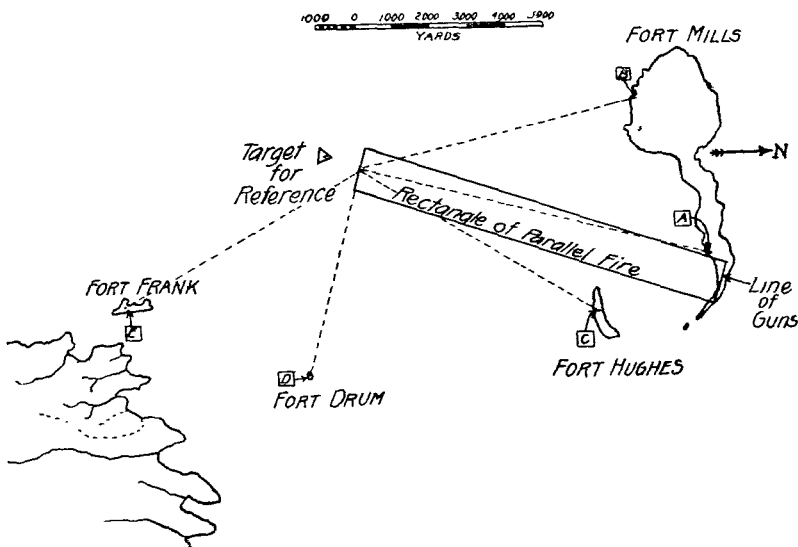


FIG. 1

Shortly before firing commenced, all watches were synchronized.

All guns were carefully laid for 10,000 yards with an elevation of 283 mils.

No corrections were applied before firing. (Decision was reached that it would be best to fire all shots without corrections, carefully prepare all correction data, apply it to each of the three hundred and eighty four shots after first firing, and thus obtain results as if all the shots had been fired at the same instant.)

The first shot was fired at 8:50 a. m. April 10. Fire was suspended at 11:54 a.m. and resumed at 1:34 p.m. and completed at 3:57 p.m. 384 shots were fired, (16 per gun).

A Firing Board, scale 100 yards to the inch, was constructed with O. P's and guns in proper position. Five readings were used in plotting each shot. Table II shows range attained for each shot and corresponding correction. There were no erratic shots,

and no shots lost. The readings recorded by Observers were excellent, with not less than 4 intersections on same point.

As a result of firing, some changes were necessary in assignments of guns to batteries. New assignments:

<i>Batteries</i>	<i>Tactical Number</i>	<i>Serial Number</i>	<i>Probable Error, Yards</i>
A	9,22,23,24	156, 402,1030, 282	64,81,55,46, Average 61
B	8,17,19,20	360, 369, 407,1027	78,66,59,40, Average 61
C	4,11,12,14	287, 333, 384, 347	40,82,65,57, Average 61
D	2, 3, 6, 7	398, 380, 275, 318	57,46,55,48, Average 52
E	21,13,15,16	1037, 273, 193, 364	54,62,59,60, Average 59
F	1, 5,10,18	284,1031, 963, 248	34,66,51,56, Average 52

Comparing Centers of Impact of guns assigned to each battery gives the following results:

Greatest variation of range shown by centers of impact:

A Battery—13 yards	D Battery—21 yards
B Battery—16 yards	E Battery—35 yards
C Battery—27 yards	F Battery—45 yards*

The chart on the opposite page shows the corrected plot of all shots, and the relative position of the centers of impact. It is of interest to note the close approximation of numbers falling in each division of the 100% Zone to those expected by percentage adopted by Coast Artillery. (See following chart)

<i>RECTANGLE OF DISPERSION</i>										
<i>%</i>	<i>1/2</i>	<i>1 1/2</i>	<i>7</i>	<i>16</i>	<i>25</i>	<i>25</i>	<i>16</i>	<i>7</i>	<i>1 1/2</i>	<i>1/2</i>
<i>Expected fall of Shots</i>	2	6	27	61	96	96	61	27	6	2
<i>Actual fall of Shots</i>	0	3	26	67	97	98	60	24	8	1
<i>100 % ZONE</i>										

FIG. 2

With a developed Probable Error of 58 yards at mean fall of shots (9785 yards), the following table gives P. E. for all ranges for these guns:

<i>Range</i>	<i>Probable Error</i>	<i>Range</i>	<i>Probable Error</i>
1000	13 yards.	8000	46 yards.
2000	17 yards.	9000	53 yards.
3000	20 yards.	10000	60 yards.
4000	24 yards.	11000	68 yards.
5000	29 yards.	12000	77 yards.
6000	34 yards.	13000	87 yards.
7000	39 yards.	14000	97 yards.

*Correction of minus 60 yards to be applied in firing to gun number 1031, (Tactical No. 5).

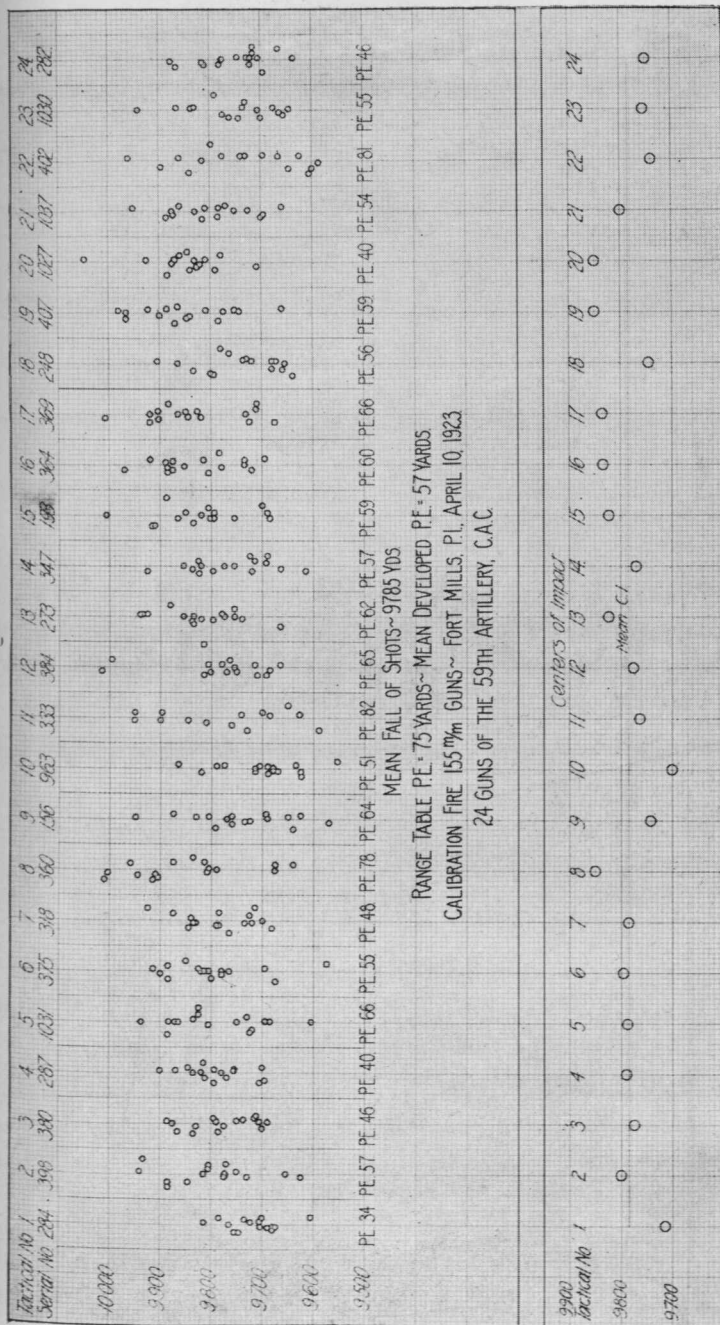


FIG. 3

DENSITY

Time	Barometer	Temperature	Density %	Humidity	Humidity %	Total Density Correction
8:00 am	29.80	80.2	3.5	90.0	-.20	3.30
8:30 "	29.80	80.7	3.7	88.0	-.16	3.54
9:00 "	29.80	81.1	3.7	86.5	-.07	3.63
9:30 "	29.80	81.5	3.8	83.1	-.05	3.75
10:00 "	29.80	82.0	3.9	82.0	-.04	3.86
10:30 "	29.78	82.4	4.0	80.0	0.00	4.00
11:00 "	29.78	82.7	4.1	78.0	+.02	4.12
11:30 "	29.77	83.0	4.2	75.0	+.04	4.24
12:00 M	29.76	83.4	4.2	73.0	+.06	4.26
12:30 pm	29.74	83.9	4.5	70.0	+.14	4.64
1:00 "	29.70	84.2	4.7	69.0	+.18	4.88
1:30 "	29.70	84.5	4.8	66.0	+.21	5.01
2:00 "	29.69	84.7	4.9	64.0	+.26	5.16
2:30 "	29.69	84.8	4.9	60.0	+.30	5.20
3:00 "	29.66	84.9	5.0	58.0	+.37	5.37
3:30 "	29.66	85.0	5.0	55.0	+.38	5.38
4:00 "	29.66	85.1	5.0	53.0	+.40	5.40

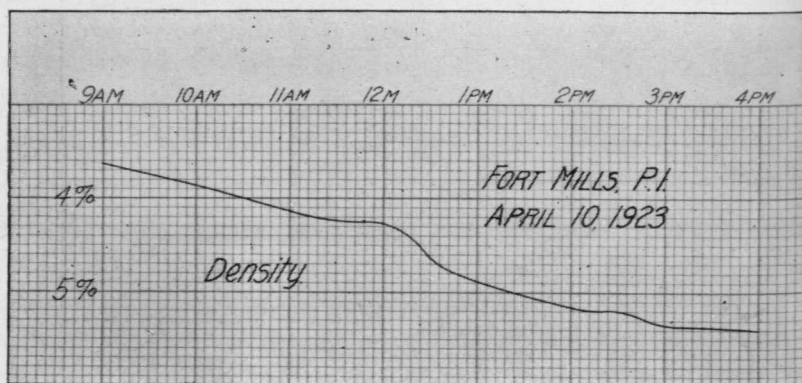


FIG. 4

Professor Adie holds it probable that atmospheric temperatures change twice as fast in the tropics as in temperate zones. This will materially affect the density percentage at Corregidor, and may account for the centers of impact being short of 10,000 yards.

HUMIDITY

The humidity varied from 90% to 53% during the firing period, the changes being fairly uniform.

Using table provided in Appendix VIII of Meteorology for Coast Artillery, corrections were applied algebraically to the Density percentages.

ELASTICITY

The corrections for elasticity were applied as indicated on Page 46 of Firing Tables for 155-mm. Guns, edition of 1922. (See curve below).

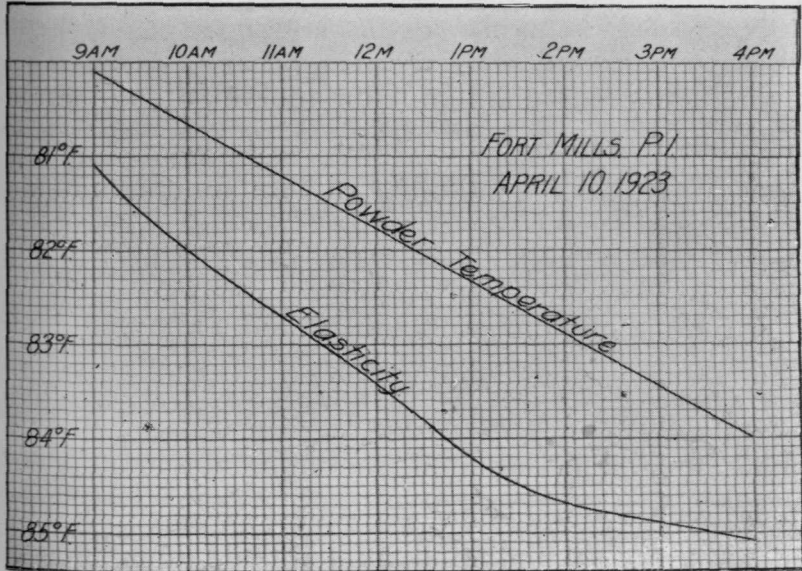


FIG. 5

POWDER

The Charge used in all 24 guns was Lot No. X—1697 of 1918. Weight 19 lbs. 15½ oz. Normal 2 bis. Velocity 1955 f.s. Tested at 70 degrees Fah. Normal expected pressure 17650 lbs. per sq. inch.

Daily readings for magazine, covering several weeks, were Max. 89 deg. Fah. and Min. 79 deg. Fah. Length of time in magazine nineteen months. Powder was removed from magazine at 1 p.m. April 9th, transported two miles and placed in dumps. At 8:30 a. m. April 10th, the temperature of powder was 79¾ deg. Fah. At 4 p.m. that day the temperature was 83¾ deg. Fah. The exact temperature was found by taking an extra charge from same magazine under identical conditions, removing plug from cover, making hole in charge, and inserting a tubular thermometer well down among powder grains. The thermometer was withdrawn, and read each 30 minutes. Application of Range Table corrections is shown in tabulations of Table II. The uniformity of temperature change is indicated by curve in the table above.

The pressure tabulation following this paragraph, was not altogether satisfactory. Of the 384 shots, there was secured 283 pressures, but due to conditions existing, two guns obtained none, two guns obtained two each, one gun had three, and another gun secured but four. Another condition that tended to destroy the value of these readings lay in the fact that only a few of each lot of cylinders were on hand. Several different lots were used, and it is believed that the copper cylinders for guns 21, 22, 23, and 24, were incorrectly listed. These guns shot uniformly low, but using the Tarage Table for this set of coppers give the highest pressures. Unfortunately there were no unused ones left by which the initial pressure could be verified, however, the fall of shots indicate that

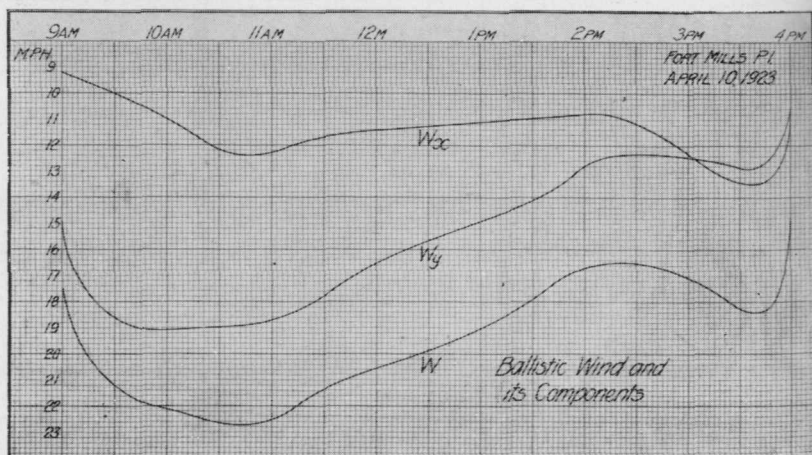


FIG. 6

these were 15-15 coppers. There is no proof of this, and the statement is worth consideration only in discussion. The pressures recorded herewith, give a mean pressure of 17,000 lbs., which is manifestly not borne out by fall of shots. Had the 15-15 Tarage table been used for the last four guns, the average pressure would have been 16,800 lbs. By the principles of Interior Ballistics, this would account for about 151 yards of the 215 yards that the mean of all centers of impact falls short of the expected range of 10,000 yds. leaving 64 yards unaccounted for except as indicated under density above.

BALLISTIC WIND

The single theodolite method was used for obtaining the ballistic wind. The time intervals for reading, considering the table of accelerations were, first reading 2 min. 11 sec. Second reading,

4 min. 31 sec. These gave altitudes of 500 and 1000 yards respectively. Maximum ordinate at 10,000 yards is 2818 feet. The balloon was given a free lift of 4.66 ounces and weighed one ounce. The course of the balloon changed constantly in a clockwise direction. One balloon was followed for nearly an hour, and had changed 193 degrees in direction and attained a height of 11,500 yards.

Each observation was plotted on cross section paper, weighting factors applied, and on second reading the triangle completed. The measured resultant gave the azimuth and velocity of the Ballistic Wind. The components were taken from the Range Table chart. The results follow:

Time of Day	Height Yds.	Azi-muth deg.	Eleva-tion deg.	Hor. Travel yds.	Ballis-tic Wind m.p.h.	Az. of Ball. Wd.	Wy m.p.h.	Wx m.p.h.
9:00 am	0-500	245.00	0	866	17.5	1336 mils	14.85	9 2
	500-1000	254.20	24	1400				
9:30 am	0- 500	236.40	23	1178	21.2	1392 mils	18.6	10
	500-1000	256.40	19.9	1700				
10:00 am	0- 500	231.10	24.7	1087	22.1	1349 mils.	19.1	11
	500-1000	253.70	19.6	1860				
10:45 am	0- 500	226.00	25.37	1502	22.7	1293 mils	18.9	12.4
	500-1000	245.00	18.58	1720				
11:45 am	0- 500	229.00	20.25	1381	20.9	1297 mils	17.3	11.5
	500-1000	250.00	19.63	1540				
1:24 pm	0- 500	231.00	23.06	1189	18.1	1218 mils	14.3	11
	500-1000	245.00	24.50	1080				
2:20 pm	0- 500	228.00	23.70	1183	16.5	3153 mils	12.4	10.9
	500-1000	242.67	24.77	1100				
3:45 pm	0- 500	231.00	23.70	1150	18.4	1055 mils	12.7	13.4
	500-1000	239.00	22.55	1330				
4:00 pm	0- 500	228.00	26.52	1016	14.9	1077 mils	10.5	10.5
	500-1000	239.00	25.70	1120				

HEIGHT OF SITE

The line of guns passed over rolling ground, causing the heights of site to vary from 77.1 feet to 103.3 feet above m.l.w. The average was approximately 90 feet. The height of site of individual guns was considered in application of meteorological data, and in making corrections for the range. (See Table II).

WEIGHT OF PROJECTILES

H. E. Shell Mark III, Lot 1178 (4 punch marks), and Mark IV Star Fuses were used in all the firing. The projectiles were

weighed, marked with chalk, and issued to batteries, as far as possible in uniform lots. None were up to the standard as given in the Range Table—95 lbs, but varied between the limits of 94.1 and 94.5, with a few slightly heavier. Range Table corrections were applied to all shots (See Table II) in accordance with Part 2a-1 of Table D.

SEATING OF PROJECTILES

At each shot a record was taken of the seating of the projectile, and correction later made for the shot (See Table II). The normal distance adopted for position of base of projectile in reference to face of breech, was 120.6 centimeters. Measurements were made along gun axis from projectile to the median horizontal line of face of breech. The measuring scale read to millimeters, and by using the chamfered edge of an office ruler at breech, the readings could be accurately taken.

Sixteen guns had Filipino crews, and their ramming was not as accurate as the white gun crews. Lack of experience was one reason, but the principal cause was due to the light weight of the Filipino soldier. This physical deficiency will scarcely be overcome by training.

QUADRANT ERRORS

There are two means of setting elevation for these guns:

Gunners' Quadrant, Model 1918.

Quadrant Sight, Model 1918 (Schneider).

The setting was made by the Gunners' Quadrant, and the reading of the Quadrant Sight also recorded.

Using a clinometer with 6" bore rest, it was found that there were *inaccuracies in both sights*. These inaccurate settings can be eliminated by shimming train of elevating gears to reduce backlash, and in changing the seat for the hand quadrant.

Quadrant seats are constructed of German Silver, and repeated polishing of this soft metal has so changed the surfaces as to make them uneven and take them out of a plane parallel to the gun axis. The Ordnance Department has been asked to remedy these deficiencies in armament. Errors in elevation up to 10 mils can be made if quadrants are not placed exactly in center of seats. Pins should be dowelled into quadrant seats on gun for guides, to insure correct placing of quadrants.

Four quadrants in use in regiment had errors of ten mils in the high angle calibration. This does not affect fire under 800 mils elevation. The Ordnance Department has been notified of this error.

All inaccuracies due to quadrant settings and gun laying is taken care of in Table II.

ERRORS IN LAYING

Through error, the gun pointers of tactical guns 9 and 10, set their elevations at 238 instead of 283 mils.

All corrections (Table II), for these guns were applied for the range table range for a setting of 238 mils. Then the range table difference between a setting of 238 and 283 mils was applied in yards, so as to permit comparison with other guns.

CENTERS OF IMPACT

Due to reduced powder pressure, and other causes, the mean center of impact of all guns when referred to the expected range of 10,000 yards, fell short by 215 yards. With this mean of 215 yards as a reference the guns shot as follows:

Tactical No.	Serial No.	Center of Impact Diff. from mean C.I. Yards	Probable error Yards
9	156	-43	61 Battery "A"
22	402	-45	81 " "
23	1030	-32	55 " "
24	282	-38	46 " "
8	360	63	78 Battery "B"
17	369	47	66 " "
19	407	63	59 " "
20	1027	61	40 " "
4	287	4	40 Battery "C" ("G")
11	333	-23	82 " " "
12	384	-12	65 " " "
14	347	-19	57 " " "
2	398	13	57 Battery "D" ("H")
3	380	- 8	46 " " "
6	375	11	55 " " "
7	318	- 1	48 " " "
21	1037	13	51 Battery "E"
13	273	36	62 " "
15	193	38	59 " "
16	364	48	60 " "
1	284	-70	31 Battery "F"
5	1031	4	66 " "
10	963	-85	51 " "
18	248	-40	56 " "

TABLE I.

POWDER PRESSURE FOR CALIBRATION FIRING FOR 155-MM. GUNS BY 59TH ARTILLERY

Fort Mills, P. I., April 10, 1923.

Shot No.	Gun No. 1	Gun No. 2	Gun No. 3	Gun No. 4	Gun No. 5	Gun No. 6	Gun No. 7	Gun No. 8	Gun No. 9	Gun No. 11	Gun No. 13	Gun No. 14	Gun No. 15	Gun No. 16	Gun No. 17	Gun No. 18	Gun No. 19	Gun No. 20	Gun No. 21	Gun No. 22	Gun No. 23	Gun No. 24	
1	17000	17800	16800	17400	17100	17250	15300	17200	17300	17600	17100	17500			17400	17450	16350	16700	17350	17350	17250	16400	16700
2	17350	16750	16700	16950	16900	17200	17100	16250	18750	17150	16900	16150	17600	17600	17950	16150	17300	17200	17300	17300	18300	17150	17500
3	17100	16800	16750	17250	17900	17900	17900	16200			16650	17550	15650	15650	17250	17150	17500	17200	17400	17400	17750	17000	16000
4	16600	16550	16400	17100	16900	15700	17100	17300			16600		15400	15900	17100	17500	18000	17700	17000	17000	17900	17000	17100
5	17350	16750	17100	16950	16750	16900	17600	17800			16600				16250	16900	17950	17600	17450	17400	17400	16000	17150
6	17300	16600	17100	17200	15950	16400	16300	17300			16600				16250	17050	17050	17300	17500	17450	17650	17700	16200
7	16850	17150	17150	18300	17150	16150	17500	17450			16650				14850	17900	17250	16250	17450	17450	17050	17350	17750
8	17150	17650	16600	17200	16350	15750	16750	17100			15800			15800	16900	17250	15900	17000	17200	17200	17350	16850	17000
9	17100	16900	17050	17500	16400	16450	15800	16900			16650			16650	17650	16700	17400	17550	17550	17600	17600	17300	16300
10	16350	16800	17800	16300	17350	16600	16500	16850			17300			17300	16550	18100	16400	16850	16300	17600	16700	16600	18000
11	16300	16750	16900	17700	16200	15000	16500	15900			17150			17150	16200	18300	17250	17900	17200	16500	17850	17000	17800
12	16400	17050	17450	17000	16800	16100	15250	17800			16550			16550	14950	15300	16550	17100	17100	17650	17200	17500	18400
13	16400	17000	18050	17600	15750	17400	15900	16600			16300			16300	16500	17050	16750	16900	16900	18500	18500	18000	17700
14	15400	17100	16750	17450	17000	16600	15850	17650			16400			16400	17000	18400	16800	17250	17650	18550	18200	17000	18400
15	17450	17450	16950	17550	15750		16200				16200			16200	16050	17150	17300	17350	17500	17500	17050	17150	17500
16	16300	17700	17550	17900			15600				15600			15600	15900	17550	16500	18500	18200	18050	17200	17200	17850

TABLE II.

CALIBRATION FIRE, 155-MM. GUNS, 59TH ARTILLERY

Gun Serial No. 284

Fort Mills, P. I., April 10, 1923

Tactical No. 1.

RANGE CORRECTIONS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Shot Number.....	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988
Gun Setting.....	10257	10258	10248	10171	10205	10246	10230	10213	10254	10235	10170	10239	10285	10338	10346	10253
Burst Yards.....	-141	-149	-153	-157	-160	-163	-165	-165	-198	-200	-202	-203	-209	-209	-209	-209
Density Correction.....	-51	-53	-54	-55	-55	-56	-56	-57	-59	-60	-60	-60	-60	-60	-60	-61
Elasticity.....	-104	-109	-113	-116	-118	-121	-124	-126	-136	-138	-141	-141	-142	-143	-145	-145
Powder Temperature.....	-86	-103	-108	-117	-117	-114	-108	-106	-103	-101	-101	-107	-126	-129	-126	-108
Wind Wx.....	-62	-62	-62	-62	-62	-62	-62	-62	-62	-62	-62	-62	-62	-62	-62	-62
Height of Site.....	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Weight of Projectile.....	-15	-12	-12	-12	-12	-12	-12	-12	-12	-12	-18	-9	-15	-9	-12	-6
Seating Projectile.....	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Error Quad.....	-440	-469	-483	-500	-505	-509	-508	-509	-551	-548	-565	-563	-595	-593	-595	-572
Total Correction.....	9817	9789	9765	9671	9700	9737	9722	9704	9703	9687	9605	9676	9690	9745	9751	9681
Corrected Range.....	-183	-211	-235	-329	-300	-263	-278	-296	-297	-313	-395	-324	-310	-355	-349	-319
Short of Expected Range.....	102	74	50	44	45	22	71	11	12	28	110	39	25	30	36	34
Longitudinal Error.....	8	10	10	10	9	9	9	7	7	7	6	6	7	7	7	6
Drift, mils.....	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Correction.....	20	22	22	22	21	21	21	19	19	19	18	18	19	19	19	18

DEFLECTION CORRECTION

Note.—Setting of quadrant 283 mils (282.4 for 10,000 yards, and a plus correction of 0.6 mils for jump). Center of impact was short of the expected range of 10,000 yds. by 285 yards, and short of mean center of impact for the 24 guns by 70 yards. This gun is assigned to Battery "F" with the following guns: 1031, 963 and 248. See page 5 for P. E. and plot of shots. A record sheet like this was used for each of the 24 guns.

The 215 yards that the mean center of impact falls short of 10,000 yards may be accounted for by reduced powder pressure (150 yards), and possible inaccuracies in density, elasticity, and similar formulas. No. 5 (1031 of Battery "F") must have an arbitrary correction applied to enable it to shoot with the other three guns of the battery. In multiples of 10, correction should be applied to No. 5 as follows:

10	2000	50	9000
10	3000	60	10000
20	4000	70	11000
20	5000	80	12000
30	6000	90	13000
40	7000	100	14000

BATTERY INSTRUMENTS

The meteorological instruments furnished the batteries are wholly unreliable, and at least a better type of barometer should be issued. Battery barometers if given the slightest shock, will change reading.

The thermometers issued vary from a full degree to nearly two degrees when assembled and read under identical conditions.

CONCLUSIONS

The firing proved beyond doubt that constant drill must be had if uniform results in ramming are to be obtained. This is important, as irregularities in seating of projectile may produce errors as great as a probable error.

In determining the muzzle velocity correction due to average pressure of propelling charges, the following empirical formula gives fairly accurate results where the actual pressure does not differ widely from the standard or normal pressure.

$$D = C \left\{ \frac{P-p}{p} \right\}$$

D=per cent of change in muzzle velocity.

C=1/3.

P=Normal powder pressure.

p=Actual mean pressure of a number of shots.

Example

M.V.=1955 f.s.	1150	
P =17,650		$\frac{1}{3} X \frac{1150}{17650} = .0217$
p =16,500		2.17 per cent of 1955 = 42.42 f.s.
P-p =1150		At 6,000 yards this gives correction of 153 yards.

The final conclusion in the minds of all officers connected with the Regiment was never to lose faith in the excellent shooting abilities of the 155-mm. gun (G.P.F.). Furthermore, the results of the firing proved beyond doubt the soundness of the theory of probabilities applied to Coast Artillery guns.

Heretofore requirements of service have forced the Army Officer to spend a large portion of his career out of touch with the everyday life of the American citizen. Today, however, the officer finds his principal mission to be the instruction and guidance of those patriotic fellow citizens who volunteer their services for the National Defense. No longer is the Regular Army officer primarily concerned with the command of seasoned Regular troops and the problems of service along our frontiers or in our insular possessions. His most important tasks lie in the lecture halls, the armories, the schools, the colleges, and the summer training camps. His daily contacts are with civilians. To succeed in this service he must know and understand his fellow citizens, and be able to work with them. To secure their cooperation in the development of the National Defense, he must create a bond of common patriotic purpose.—General Pershing in "The Pointer."

Training Camps at Fort H. G. Wright

The 1923 R.O.T.C. Camp

EDITORS NOTE: *Brigadier General Mark L. Hersey, commanding the 1st Coast Artillery District, in forwarding this article, stated in part as follows:*

"The enclosed Reserve Officers' Training Camp report is submitted as of interest for publication. One important feature of this camp is not noted in this report viz: That the First Class from the United States Military Academy was there during the Reserve Officers' Training Camp, in two sections of a week each. Their splendid appearance was an example worthy of emulation by these college students—a source of comment, pride and personal example for them and by which they truly profited; in turn these Cadets, soon to be officers, became acquainted by service and social contact with the very best of American College men—men who will contribute largely to the support of the Army itself in the next quarter of a century. This entirely accidental contact for two weeks should by design be made a special feature of notable value to all concerned.

IN ALL previous summers the Coast Artillery R. O. T. C. students from the First Corps Area had been trained at Fort Monroe, Virginia, but it was decided, largely for reasons of economy, to hold the 1923 camp at Fort H. G. Wright, N. Y., where a number of other instruction camps were also held.

The camp was commanded by Colonel Frederick W. Phisterer, C.A.C., and the following officers, all of whom were on R.O.T.C. duty, comprised the commissioned personnel of the camp:

Major E. W. Putney, C.A.C.	Executive Officer
Major E. B. Walker, C.A.C.	Senior Instructor
Major P. H. Ottosen, C.A.C.	Battery Commander
Major W. C. Foote, C.A.C.	Materiel Officer
Captain J. Church, Inf.	Supply and Mess Officer
Captain C. R. Crim, Inf.	Athletic Officer and Instructor in Infantry Drill
1st Lieut. G. H. Passmore, Inf.	Adjutant and Personnel Adj't.
1st Lieut., J. E. McGill, C.A.C.	Battery Officer

Five enlisted men from the R. O. T. C. Units were also on duty with the camp.

There were sixty-four students who reported for the camp, forty-four from the Massachusetts Institute of Technology, and ten

each from Columbia University and the New Hampshire State College. Sixty-two of these students successfully completed the camp.

The student battery occupied a permanent barrack building facing the parade ground while barracks of the cantonment type were comfortably fixed up as camp headquarters and officers' quarters.

The program of artillery instruction included drill, subcaliber and service practice with 10-inch guns, drill and subcaliber practice with 12-inch mortars, drill and target practice with 3-inch anti-aircraft guns, and emplacing a 155-mm. G.P.F. gun and firing at a fixed target (indirect fire with fuzed projectiles). Infantry instruction consisted of daily drills and inspections and participation in several reviews before general officers as part of a mixed command of Regulars, National Guard, and R.O.T.C. In the service practice with 10-inch guns at a moving target, five hits were made out of eight shots, a highly creditable performance for a battery composed entirely of students from the battery commander to the last cannoneer.

One week was set aside for small arms target practice and all students fired Course "D" with the rifle and also the dismounted pistol course. In addition, the six best shots were given additional practice firing Course "A," and the two high men were sent to Camp Perry as members of the First Corps Area team in the National Matches.

Lectures and demonstrations were also given on such subjects as the submarine mine system, sub-aqueous sound ranging, chemical warfare, and other matters of interest which time did not permit to be taken up more fully.

One of the most interesting events of the camp was the review of a mixed command before the Chief of Coast Artillery. At this ceremony General Coe personally handed commissions in the O.R.C. to five of the students, after which the newly commissioned Reserve Officers took charge of platoons of Regulars and commanded them in the march in review.

The climate proved ideal, quite cool throughout and with very little rain to interfere with the schedule instruction. The health of the camp was excellent, the food good, and the facilities for athletics and recreation exceptional. Swimming, tennis, baseball, volley ball, and track events made up most of the athletic program and numerous dances both on the post and at hotels on the island furnished amusement in the evening.

A very interesting and instructive trip was taken to the submarine base at New London, and another to Fort Michie to examine

the installation of a new 16-inch gun on disappearing carriage. Another enjoyable trip was that on a government boat to witness the Yale-Harvard boat race.

The Coast Defense Commander, Colonel Abernethy, and his entire command cooperated splendidly to make the camp a success, giving freely of their time and energy and going out of their way to help. A large share of credit for the success of the camp is due them. It is believed that results have well justified the selection of Fort Wright as a site for the First Corps Area R.O.T.C. Camp as all connected with the camp returned with only praise for it.



C.M.T. Camp, 1st Coast Artillery District

By Lieutenant Colonel S. G. Shartle, C. A. C.

The Coast Artillery C.M.T. Camp, 1923, of the First Coast Artillery District, was held at Fort H. G. Wright, Fisher's Island, New York, during the month of August. This location combined the advantages of an active artillery center and a favorite summer resort of the Long Island Sound. The weather was cool, the quarters comfortable and the mess good. Place here the pick of New England's youth with an able and enthusiastic staff of instructors, the camp must be a success and was.

Ninety-one student candidates reported, divided as follows:

Advanced Red	39
White	34
Blue	18

They were organized into two companies with cadet officers chosen in turn from the Blue Students and non-commissioned officers from the White Students. Drills and exercises were supervised by the Regular and Reserve Officers attached to each company. The following officers were on duty with the companies:

Captain Moses Goodman, C.A.C.
 Captain Arthur J. Lacouture, C.A.C.
 Captain Joseph H. Hurney, C.A.O.R.C.
 1st Lieut. William H. Papenfoth, C.A.C.
 1st Lieut. David A. Pfromm, C.A.O.R.C.
 2nd Lieut. Francis B. Kane, C.A.C.
 2nd Lieut. Myron Leady, C.A.C.
 2nd Lieut. Arthur W. Glass, C.A.C.

The Headquarters of the Camp was composed of the following officers:

Lt. Col. Samuel G. Shartle, C.A.C.	Camp Commander
Major Reuben H. Perley, C.A.C.	Executive
Captain Herbert F.E. Bultman C.A.C.,	Supply and Mess Officer
Captain Adam J. Bennett, C.A.C.	Adjutant
Major John A. Hoag, C.A.C.	Senior Instructor
Captain Harry C. Fraser	Chaplain

This over-head was found quite sufficient for the needs of this small camp and could well conduct a camp of 400 men without addition. The same office force was used for the O.R.C. Camp, which was held during the first two weeks of the C.M.T.C.,—the commander as assistant commander (in actual charge), the Supply and Mess Officer and the Adjutant. The O.R.C. Camp had its own Executive and instructors.

The work of the non-commissioned officers of the Regular Army on duty with the camp deserves special mention. These were: Staff Sergeants Lawyer, Dodd, and Hodges; Mess Sergeant Doods; Sergeants Presley, Swann, Martin and Parliament.

The arrangements for the reception, examination and equipment of the students were simple and worked smoothly. They were met at the trains in New London and at the boat landings on Fisher's Island, conducted in groups to headquarters for registration, to the hospital for physical examination, to the Q. M. storehouse for issue of clothing and to the barracks. They occupied a vacant barracks and had one mess.

The work of these students in infantry showed the value of their preliminary training at Camp Devens. All had had one or two camps. After a week at Fort Wright they easily surpassed in appearance and precision all other units on the parade ground, Regular and National Guard.

In artillery, their work was even more gratifying. In less than two weeks, they manned and fired the 3-inch guns in the Reserve Officers' practice. Later each company of students conducted its own practice, the cadet officers solving their problems in adjustment of fire in good time and with excellent results. The Second Company smashed the target. The students also served the 155-mm. gun in a practice conducted by Reserve Officers, and drilled at the 12-inch guns and mortars, but did not fire these in practice. The target practice reports prepared by the students were very creditable.

Infantry and artillery with their subsidiary subjects naturally formed the greater part of the program. Next to these were athletics

and recreation. There was of course instruction in personal hygiene, first aid, leadership, and citizenship, and talks on related subjects.

The day's work began at 6:00 A.M. and ended at 8:00 P.M. All were required to be in at 10:00 P.M. Following reveille, there was a 15 minute period of calisthenics, then breakfast at 7 A.M. Beginning at 8 A.M. there were two periods of drill of one hour each; a rest of 30 minutes, a talk of 15 minutes on hygiene or first aid or citizenship; and a drill period of 45 minutes. Beginning at 1 P.M. there were three 45 minute drill periods ending at 3:45 P.M. The period from 4 to 5:30 P.M. was devoted to athletics. This ended the day for the advanced Red Students. After supper from 6:15 to 7:50 there were two conference and lecture periods for White and Blue Students. From 8 to 10 P.M. there was optional recreation; movies every night, dancing once a week, or barrack games as desired.

An effort was made to keep the students interested and busy without fatigue. They were treated as responsible young men, on a par with the West Point Cadets, with a minimum of restraint. As a result discipline was maintained without resort to coercive measures. In fact not a single case of individual discipline required the attention of the Camp Commander.

Competitive athletics were encouraged. Money for prizes was donated by the Y.M.C.A., and citizens of New London. A series of baseball games between the two companies and a track meet were held to determine the winners of the prizes, which consisted of appropriate medals. A cup was presented the company receiving the highest number of points. This will be competed for each year.

Among the events of interest during the camp, in addition to the routine work, were: participation in memorial ceremonies for President Harding; reviews for the Governor of Connecticut, for the Corps Area Commander, the Coast Artillery District Commander, and the lunching of these officers with the students; camping out at Fort Michie including a camp-fire, a shore dinner and individual cooking of breakfast; presentation of C.M.T.C. Colors.

The following statistics may be of interest. In respect to occupation there was considerable diversity, but 52 of the 91 men in Camp were reported as "Students." The average ages were:

Blue	18-9/12
Whites	19
Advanced Reds	18-5/12

Twenty-three men enlisted while at camp in the Organized Reserves.

Eighteen Blue Students were recommended for examination for Second Lieutenant in the Reserves. Twenty-nine White and thirty-three Advanced Reds were advanced to the next course; three and six respectively to be continued in the same course, one White not to be enrolled again, and one dropped.

Sixty-two men gained an average of 5.3 lbs. in weight during the month. Twelve lost an average of 1.1 lbs. Twenty-nine gained an average of 1.2 inches in chest expansion.

The following is a description of the composite student:

Age	18
Height	67.4 inches
Weight	138.9 lbs
Chest	32.1—35.6 inches
Expansion	3.5 inches

The above brief account of the organization of the camp, course of instruction, manner of conducting it, the materiel, morale and general results, is given in order to add something to the knowledge of this splendid institution of our country—the C.M.T. CAMPS.

To present the camp ideal permit me to quote from my "Foreword" in the souvenir booklet published by the camp.

" . . . 'Service is the supreme undertaking of life, and its fruits the chief compensation' (President Harding).

"To render the best service you must have knowledge, you must have health, you must have the will to serve. It has been the high ideal of this camp to prepare you for the service of your country, both as citizens and as soldiers; to make of you true Americans to the end that in your hands America will be safe. And any real and lasting personal distinction among your fellows must be based on the solid principles of SERVICE, HONOR, LOYALTY."

EDITORIAL

Preparedness On Sane Lines

EDITOR'S NOTE: The following Editorial, written by General C. B. Blethen, Manager of the SEATTLE TIMES, and recently published in that paper, is interesting and refreshing. It recognizes that our national security can be preserved only by a proper coordination and use of all our arms, and not by any "one arm" plan of defense so often advocated by well meaning but poorly informed or visionary persons.

THERE is more piffle being talked about this country's ability to defend itself by the use of airplanes alone than has burdened the atmosphere since the time the New England Coast shuddered over the possibility of a Spanish naval raid. Unfortunately, some widely read newspaper editors see fit to reiterate the positive statement that battleships have no defense against airplanes, and that airplanes alone can prevent invasion, or even attack, of our shores.

The professional enthusiasm of the specialists in some branches of the American service has caused a gassy contribution to the mess. One group claims that airplane defense can prevent any damage from an enemy fleet by destroying it; the other side says that all coast defense efforts have been rendered worthless because of the damage that could be inflicted by planes brought by the attacking fleets!

In some ways this reminds us of the argument over priority rights between the hen and the egg. It is the country's misfortune, however, that it more nearly resembles Bryan's arrangement with the powers above to have a million fully armed soldiers spring into ranks over night.

* * * * *

O, the valor of ignorance!

Everybody remembers we needed nearer 4,000,000 than 1,000,000 men and also that the twenty-four hours required by the long-haired but short-sighted one, came nearer drifting into twenty-four months.

Every American citizen who has studied the problem of preparedness understands fully the folly of the "one arm" theories. Way back in the Spanish War we were going to bust all the navies and all the coast defenses by pitching dynamite at them out of

pneumatic tubes. Next, we are going to control the world by the use of submarines. Now we are safe if we build enough airplanes; but in the same breath we hear that the nation that builds the most airplanes will dominate the world.

Bunk!

Instead of being obsolete, the battleship has hardly begun its work.

Instead of being useless, the coast defense fort, backed by a land army, is the one certain means of preventing an enemy fleet from using a port.

Flying machines cannot even delay armies, let alone destroy fleets.

* * * * *

The destruction of the battleships Virginia and New Jersey by the bombers of the Army Air Service last summer brought out nothing new whatever in the science of war. Both ships were finally destroyed, it is true; but neither ship was manned, and both were anchored. Neither was defended by friendly aircraft, nor its own antiaircraft guns, and the job took hours.

How does anybody suppose America moved her millions of soldiers to Europe?

Solely by the use of the defense furnished by the Navy—against all the submarine and all the aerial power the enemy could muster!

If any more is needed to prove the asininity of the “one arm” conversation, let the reader remember the following facts:

The Allies bombed the Zeebrugge flood gate for four years without hitting it.

For years the Germans tried to wreck the flood gate at Dunkirk by aerial bombs without success.

The battle cruiser Goeben, aground for a week, was bombed a thousand times—hit sixteen times—and then went merrily on her way, as good as new, to cruise the Black Sea.

In the end—always—real preparedness on sane lines pays big dividends.

Publicity

The Editor received a letter a few days ago from a Coast Artillery officer of high rank and standing, of which the following is an extract: “Generally speaking I think that this is a good time to speak up about the present needs of the Coast Artillery Corps.

We don't want to be noisy or quarrelsome or to whine, but if we don't say something, no one will." These remarks, and there is a lot to them, were brought forth in the course of some comments on the excellent article by Colonel Hatch and Captain Stiley entitled "Coast Defense—Logical and Visionary", published in the January issue of COAST ARTILLERY JOURNAL. Such articles as this one—and it has been commented on directly and indirectly to some extent throughout the press of the country—serve to present the true role and importance of our harbor and antiaircraft defenses. If their real importance were appreciated there would be little difficulty in securing necessary funds to carry on needed development work and to modernize our defenses.

We read everywhere of the great importance of the Air Service, and of the soldierly Marines—but we hear far too little concerning the big guns that defend our seacoast cities, and of the greatly improved antiaircraft guns that in time of war will prevent enemy planes from massacring innocent women and children. And should aircraft be of more interest to the people of this country than the antiaircraft weapons designed to combat them? Are the Marines—fine soldiers that they are—really braver or more soldierly than the troops of the Coast Artillery Corps? No—but everyone knows about the Marines. The press keeps the public informed concerning them. There are people today who think the Marines, backed up by the Navy's railway artillery, won the World War—that the Germans quit when they heard the Marines were at the front. The Marines took part this past fall in the enacting of the battle of Newmarket, and every newspaper in the country reported it, and every movie house reproduced its scenes. It was good copy and it was spectacular—but have the Marines a more important role in the defense of the country than the Coast Artillery Corps? The point is this. We belong to an essential branch of the service—the first line of land defense. The successful accomplishment of our mission will prevent an enemy from bombarding our cities from the water and from the air. Without an efficient Coast Artillery, and with enemy control of the sea, untold horrors could and would be visited upon us. We are proud of our service, but the great majority of people do not appreciate its importance. Why should we not tell them about it? In doing this we will not only be serving our Corps, but the country as well, for it cannot appreciate a proper military policy until it realizes the mission and proper service of the various arms. How may this be done? Every Coast Artillery officer (and there are nearly five thousand of us) has more influence than he knows. Not a one but has his news-

paper friend, and these newspaper men are always out for good copy. Why not give it to them? It matters not whether our work is reported in a small or large newspaper. It will reach some of the people. If a short account is sent to the newspaper of his home town each time Private Bill Jones is promoted to the grade of Corporal, or wins the hundred yard dash, or pulls the lanyard that fires the gun that smashes the target, it will not only make Bill's parents and sisters and brothers proud and happy and make of Bill a better soldier; but in addition it will advertise the Coast Artillery Corps. The big thing is for the people to see the words Coast Artillery Corps so often that they will begin to wonder what it really is. Thereafter they will learn soon enough that it is the *thin red line* along our coast maintained for the purpose of preventing an enemy from gaining our shores, bombing and ravaging our cities, and making of it another Belgium. When they commence to realize this truth, we will have no more trouble securing modernized batteries of all kinds and sufficient personnel to man them.

Let us understand the necessity for National Defense—and preach it. Let us appreciate the importance of each of the other branches of the service—and say a good word for each; but above all, let us realize the mission and extreme importance in the scheme of National Defense of our own branch—the COAST ARTILLERY CORPS—and let us never lose an opportunity to advertise its merits.

Good Advice From General Coe

(*The Army and Navy Register*)

Daily newspapers that desire to impart diversity of expression to the contents of their editorial columns cannot be too careful in undertaking to discuss matters pertaining to the military-naval establishment. It is always safe and in order and helpful to a deserving cause when they urge maintenance of national defense or when they protest vigorously against a degree of pacifism that will render futile the defense of the nation against enemies. They are on less secure ground, however, when they present views of the highly technical details of forms of protection. They are opening the door to dissension rather than discussion and they are apt to create erroneous impressions that are injurious in proportion to the misinforming criticism. A daily newspaper, fully capable of passing in judgment upon a political situation in Congress or on the merits

of tax or bonus legislation may well proceed with caution and reserve—to say nothing of silence—when it comes to determining whether this or that form or means of warfare is supreme and is calculated to drive into obscurity or obsolescence some other instrumentality hitherto employed in the conduct of battle on land or sea. It is perfectly safe, also, and of a high grade of usefulness in the enlightenment of the public to declare in favor of control of the air and the necessary development of the personnel and mechanism in flight in its relation to national defense and offense. That is assuredly helpful in a practical way to the end that Americans generally may comprehend and come to adopt the principle that aircraft should be provided in adequate measure to meet a possible foe with superiority of power.

It is quite another thing when attempt is made in those quarters to prove that aviation has reached the stage when it shall be regarded as displacing, for example, the coast artillery and battleships. That is getting into a very complicated question, upon which the experts of great experience and knowledge differ. No newspaper possesses the space which may justly be devoted to an exchange of comment required for an impartial presentation of such a controversial topic. Unless both sides—when there are only two sides—of such a problem are given, the presentation of one side or one angle is so prejudiced as to be misleading and unfair. Any newspaper, therefore, that presumes to express editorial views in this direction must be identified as possessing a temerity born of ignorance.

A pertinent illustration of this invasion of a field, unknown and unknowable to a daily newspaper, has been furnished by some recent observations on the part of the *Washington Post*, the editorial comments of which are, in other respects, entitled to the greatest respect and admiration. They are invariably when it comes to a discussion of current subjects notably regarding national and international situations, of surpassing interest and real importance. They are, in other words, among the best newspaper expressions in this country. The editorial that provides a rare exception to this record was entitled “New Coast Defense Plans Needed.” Among the claims set forth were those to the effect that “it has been demonstrated long ago that airships are virtually immune to attack from the ground;” that bombing planes can accomplish “the utter destruction within a few minutes” of battleships; that the development of “defensive ordnance against aircraft” constitutes “a confession of the defenselessness of coast fortifications against attacks from the air,” and a “revelation of the uselessness of coast artillery

in keeping off an invading naval force unless this coast artillery is supported by the air force.”

Service people, generally, and those of the coast artillery, the air service and the Navy, in particular, are entirely familiar with these assertions. They convey no new information on the problem dealing with technical and strategic elements involving personnel and materiel. An expert has only to advance any of these theories to immediately incur rejoinder in equally positive terms supported by equally convincing arguments, statistics and examples. In connection with the comment of the *Washington Post*, it could not prove otherwise than largely informing that there was forthcoming a reply from an authoritative source. This message came from the chief of coast artillery in language that was as courteous as it was frank. The communication was helpful in giving briefly the other side of the case, with correction of misstatements employed to sustain misleading, because inaccurate, assertions. General Coe's letter appears elsewhere in this issue and will be read with appreciation by the service people who, through technical knowledge of the situation, are capable of participating in a controversy while preventing its degeneration into altercation. [*This letter was published on page 59 of the Coast Artillery Journal for Jan. 1924*]

General Coe's appeal for moderation should prove effective not only to newspapers that enter an untried field as disputants but to service experts, themselves, whose public utterances, as the President has reminded them, may do great harm to the cause of national defense. It does not require much of such discussion to create an impression in Congress that there is no need to appropriate funds for the maintenance and improvement of the coast defenses or of a Navy. Congressional reluctance in that direction would be disastrous, of course, and should not be manifested until the heads of the executive departments and the President, responsible for the selection of the means of defense of the country, agree that any branch of the military-naval establishment can be safely and profitably "junked." There would appear to be no necessity for going to the extremity of denouncing as useless the coast defenses or the Navy or any part of either in order to create public sentiment and obtain congressional provision for aviation. It is creditable to those whose duty it is to present and support the claims of control of the air to be loyal to that worthy issue which does not require for its proper recognition the excesses of zealots.

Aviation and all that it means as an arm of national defense stands in need of no campaign of destruction.

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.—H. J. HATCH, President, Coast Artillery Board.

Work of the Board for the Month of January, 1924

A. NEW PROJECTS INITIATED DURING THE MONTH OF JANUARY, 1924

Project No. 191, Functioning of Browning Machine Gun (High Angle Fire).—The attention of the Board was invited to the fact that when the angle of fire with the Browning water-cooled machine gun, Model of 1917, is such as would be normal in its use as an anti-aircraft weapon it is difficult, in many cases, to keep a sufficient amount of water in the water jacket to cover the upper portion of the barrel. The matter was referred to the Coast Artillery by the Chief of Ordnance for any information concerning the effect of firing on the gun, particularly on the barrel, which would make it unserviceable for ordinary machine gun fire.

The Board finds that there is no record of undue difficulty caused by the depletion of the water supply and resultant exposure of the barrel.

Naturally leaky glands, evaporation or failure to fill the water jacket would tend to expose the end of the barrel just inside the front of the water jacket during high angle fire. Actually there is no record of gun failure definitely attributable to that cause. Bulges that have occurred in gun barrels have been distributed and not confined to the front end of the barrel.

It is the opinion of the Board that ordinary precautions in caring for the Browning machine gun, is preparing it for fire and in replenishing the water supply would obviate the difficulty under question.

Project No. 192, Training of Antiaircraft Gun Crews—The Board recommended that definite instructions be published to all troops manning anti-aircraft guns. The suggestion was originally made in Annual Report of Target Practice, 62nd Artillery, Sept. 8, 1923. It is believed that failure to recognize the importance of the question involved is general in the service, and that attention thereto will result in an immediate and considerable improvement in anti-aircraft fire.

The fire control instruments now issued to anti-aircraft troops are designed for a constant "dead time," that is, time elapsed between the determination of the fuse range and firing of the gun, ordinarily taken as 8 seconds. During this time the fuse range is transmitted to the fuse setter, the fuse is set on the projectile, the projectile loaded and the gun fired. It is a prerequisite to accurately delivered anti-aircraft fire that this series of operations be performed in an assumed fixed interval as 8 seconds, neither more nor less. It is the duty of

battery commanders to check the details concerned with a stop watch and to insure by training that the minimum dead time value be obtained and held constant. Without this dead time accuracy and constancy, accurate fire would be impossible even with perfect fire control instruments, because such instruments are based on the shot being fired at that definite time after determination.

The magnitude of the error may be visualized by the following example: The rate of change of range of plane is 30 yards per second. Based on an actual velocity of 50 to 60 yards per second this is an average condition. A shot, perfectly predicted, is fired 4 seconds late, (i.e. dead time 12 seconds). This results in a range error of 120 yards, in addition to the concurrent error in elevation introduced.

A careful analysis of past firing would show a great percentage of shots fired with a variation in dead time of 4 seconds or more.

Project No. 193, Test of Radio Set S. C. R. 132—The latest type of radio sending and receiving apparatus designed by the Signal Corps.

This set has been received, is set up, and is in operation at Fort Monroe. It will be subject to intensive service for at least one month. It is apparently an excellent piece of radio apparatus, superior to anything yet produced by the Army. It is designed to give especially good results in working with airplanes. Further report will be published on completion of test.

Project No. 194, Test of 60-Inch H. I. G. E. Semi-automatic Searchlight.—The General Electric Company has designed a semi-automatic searchlight lamp which has been received at Fort Monroe for service test. Its utility as a fixed defense lamp will be considered as well as its value for field service, especially with anti-aircraft outfits. It is simple and rugged in construction and very nearly automatic in operation. The thermostat control of length and position of arc is eliminated, the carbons being rotated and fed at a uniform rate by means of a motor. The rate of feeding can be controlled by the operator and when once adjusted the lamp should require very little attention, its operation being practically automatic over short periods of time. The chief advantage claimed for the lamp is the simplicity of construction secured by elimination of the thermostat with its more or less complicated mechanism at a sacrifice of very few of the advantages that go with a fully automatic lamp.

Project No. 195, Comparison of Medium and High Intensity Searchlights for Anti-aircraft Work.—It has been claimed that under some atmospheric conditions an airplane can be seen more plainly in the beam of a medium intensity light than in the beam of a high intensity light. During one preliminary test, a plane at about an elevation of 2600 feet flew through both high intensity and medium intensity beams. The night was very clear and cold, temperature about 40 degrees F. The plane could be seen much more clearly in the H. I. beam. Further tests will be held under different atmospheric conditions before a final report can be made.

Project No. 196, Distant Electric Control (General Electric Impulse Type) For Anti-aircraft Searchlights.—It has been demonstrated that an observer at some distance from a searchlight can see a target in the beam more clearly than an observer close to the lamp. Our present anti-aircraft searchlight control keeps the observer within about 12 feet of the lamp. Experiments have shown that the best position from which to observe an airplane in a searchlight beam is about 100 feet from the light. Visibility does not increase greatly beyond that distance. The General Electric Company has submitted for test an experi-

mental anti-aircraft searchlight equipped with an electric control of the impulse type that will enable an observer any distance from the light to train the light in azimuth and elevation. This control has received a preliminary test that was very satisfactory. The makers claim that the speed of rotation (horizontal plane) can be varied from one revolution in 25 hours to three revolutions per minute, and that the speed of elevation and depression can be varied within limits of about two-thirds of those for rotation in the horizontal plane, provided the voltage is kept up to that normal for the lamp, about 80 volts. The control appears to do what is claimed for it and gave excellent results in a preliminary test. A more complete report on the performance of this device will be published when test is finished.

Project No. 197, Desirable Characteristics of Self-Contained Anti-aircraft Altimeters.—Under date of January 9, 1924, The Bausch and Lomb Optical Company requested a summary embodying the type of Anti-aircraft Range Finder which the Coast Artillery Board deems best adapted to the needs of the Service. The following comments and recommendations of the Coast Artillery Board were submitted:

1. The Coast Artillery Board is not prepared at this time to recommend final specifications for an Anti-aircraft Altimeter. Further comparative tests must be made with range finders based on the coincidence and stereoscopic principles before either one can be definitely given preference. At the present time the officers who have used both types of range finders are divided in their opinions as to the relative merits of the two types. It is proposed to complete this investigation on receipt of the stereoscopic telemeter from the *Societe Optique et Precision* in France. From the descriptive material on this instrument it appears to have many extremely desirable features and should be thoroughly investigated and tested before any final decision is reached on the specifications for an Anti-aircraft Altimeter.

2. Coincidence and stereoscopic instruments having relatively the same optical properties, length of base, ease and facility of traversing, and altitude determining and reading features should be given comparative tests on moving airplanes at varying speeds and altitudes before final decision or definite recommendations can be made. It is not known if a coincidence instrument can be built through which the power of *seeing* will be as great as in the stereoscopic instruments.

3. From tests held to date it is believed that stereoscopic and coincidence range finders of about the same base will give approximately the same accuracy in taking ranges on fixed points or slow moving targets. An exceedingly important point yet to be determined is the relative ease with which the two types of instruments can be kept on a rapidly moving aerial target in azimuth with a sufficient degree of accuracy to permit range taking. The stereoscopic instrument possesses the advantage that it is an excellent instrument for spotting purposes. It gives a perception of depth that enables the operator to determine readily if a burst or splash is over or short, with respect to the target. It does not necessarily follow that it is advisable to use a range finder for spotting. Range taking and spotting should be performed by different individuals. A spotting glass constructed on the stereoscopic principle without the range finding features and with about a two-meter base might prove to be a valuable asset for observing fire from either fixed, mobile, or anti-aircraft artillery.

4. From tests and investigations held to date it is believed that any self-contained base Anti-aircraft Altimeter should conform to the following specifications:

a. Length of base: This, per se, is not a limiting factor, but will be controlled by consideration of accuracy, stability and weight. It is believed that a base length of about 4 meters will give satisfactory results.

b. Accuracy: A reasonable immediate expectation is a probable error in reading altitude not greater than 30 yards (1%) at 3000 yards altitude and 4000 yards range.

c. Stability and mount: The instrument must be easily and accurately levelled and not be susceptible of being thrown out of level by the normal operation of the instrument. The mount and pedestal for the 4-meter Zeiss stereoscopic range finder is the best in this respect of any yet tested by the Board.

d. Weight: The instrument and mount should be of such weight that they can be handled conveniently by the operating personnel, consisting of three or four men. If, however, the correct solution of the problem necessitates a very heavy instrument, it is to be noted that great weight is not a deterrent factor for fixed defenses and that for field use a heavy instrument can be made mobile and portable by means of a wheeled mount.

e. Sectionalization: The sectional type of instrument is preferred because of the transportation space saved by this compactness and because of the attendant ease of mounting the instrument. The sections should be separate and not hinged. Again it is to be noted that this feature is of no importance for fixed defenses.

f. Ruggedness: It must be able to undergo the strain of field transportation without disarrangement of any part as well as extreme conditions of temperature and humidity.

g. Elevation: Minus 10 degrees to plus 90 degrees elevation. The elevating system of the Zeiss 4-meter stereoscopic instrument is entirely satisfactory. It consists of a small elevating handwheel operated by the range taker which permits of smooth rapid elevation with the application of very little force. All features of the elevating system mentioned are desirable including the adjustable arm rest. It is designed to be operated by the range taker.

h. Traversing: 360 degrees traverse. To be accomplished by an operator other than the range taker by means of a traversing handwheel and suitable gearing and a collimated traversing telescope. The traversing mechanism should be capable of imparting fast or slow motion. The Barr and Stroud traversing gear used on the 2-meter height and range finder is the most satisfactory of any yet tested.

i. Range Scale: To be externally visible and have a least reading of 100 yards at 10,000 yards range or just twice the scale of the Zeiss 4-meter stereoscopic. The divisions of the scale beyond 15,000 are of little importance and can well be sacrificed for larger divisions at the more important ranges.

j. Altitude Scale: To be direct reading and externally visible similar to the range scale on ordinary range finders or to the dial scale on the Barr and Stroud Height and Range Finder. The least altitude reading should be about 20 yards below mid altitude and should, if practicable, be not greater than one per cent of the altitude throughout the entire scale.

k. Adjustments: For range the ordinary adjusting system is satisfactory, except that the divisions of the corrector scale should bear some known ratio to the range. The instrument whose adjustment is more nearly constant through great changes in range, and conditions of visibility, is the most desirable. The adjustment for angular height should be capable of being effected easily and rapidly by means of a level bubble or some other means not requiring the use of

external instruments or devices. Since horizontal distance cannot be shown on a dial scale, the "3-4-5" triangle method of verification of the altitude scale cannot be made. Some other simple check system therefore must be provided. The range adjustment on infinity by use of an adjusting lath is essential for field work.

l. The instruments should be equipped with a storage battery and lights to be used for illuminating scales and reticule symbols.

m. The optical properties of the main and auxiliary optical systems of the Zeiss 4-meter stereoscopic instrument are excellent and systems of equal quality should be provided with changes to be suggested hereafter. The arrangement and optical characteristics of the Zeiss 4-meter Stereoscopic Range Finder and suggested changes are as follows:

(1) Finder:

Exit pupil	4 power
Field of view	4-mm.
Magnification	9 degrees

This is simply a low power collimator situated on top of the instrument and convenient to the traversing detail. Its exact optical properties are of no great import.

(2) Traversing Telescope:

Magnification	6 power
Exit pupil	6-mm.
Field of view	6.25 degrees.

This telescope is bent under the tube of the range finder with a resultant convenience to the traversing detail at high angles. As now constructed its vertical hair does not extend through the center of the glass; instead the field of the main optical system is represented thereon by a circle. It must be possible for the traversing detail to keep the instrument directed exactly at the point ranged on and therefore this glass should be equipped with a vertical hair and in addition have a slight independent azimuth motion, or play, in order that exact collimation with the main glass may be adjusted.

(3) Observer's Telescope (Binocular):

Magnification	6 power
Exit pupil	5-mm.
Field of view	6.5 degrees

This glass is suspended under the tube of the instrument to the left of the range taker. The arrangement for adjusting inter-pupillary distance might be improved.

(4) Range Finder:

Magnification	19 power
Exit pupil	Equal to a circle of 2.2-mm. diameter
Field of view	1 degree 22 minues or 24 meters at 1000 meters range.

The only objection to this optical system is that the small field limits its utility for spotting. A larger field would be of more value for this purpose.

n. A definite recommendation as to the size and arrangement of the reticule symbols cannot be made at this time. The size and arrangement of the symbols in the Zeiss two-meter stereoscopic instrument are believed to be more satisfactory than those in the Zeiss 4-meter instrument, but further comparative tests must be made before a final decision can be reached.

c. Amber and blue ray filters should be provided for traversing, observing and ranging systems.

p. *The Societe Optique et Precision* claims to have a stereoscopic telemeter in which stereoscopic contact is maintained on an altitude rather than a range basis. That principle, if of practicable application, should be the basis of any altimeter accepted for antiaircraft use.

Project No. 198, Range Correction Chart (Subcaliber) for 12-inch Mortar 2.95-inch Subcaliber Gun for Use With Range Correction Board, Model E, 1923.—Charts are being constructed.

Project No. 199, Test of Portable Battery Charging Set For Use of the Coast Artillery.—There has been received for test one 500-watt, 32-volt, gasoline driven, portable battery charging set, equipped with switchboard. The generator set is the standard plant known as the "Home Lité," manufactured by the Simms Magneto Company. The switchboard is of special construction in accordance with Signal Corps specifications. The advantage or special value claimed for this set is that it is compact, light, and portable for field purposes where a small charging unit for storage batteries is desired. The outfit has already been tested by the Signal Corps and gave very satisfactory results. Test by the Coast Artillery Board is in progress.

Project No. 200, Motor Driven and Clock Driven, Portable Compact, T. I. Apparatus For Mobile Artillery Units.—The motor driven unit is submitted for test in accordance with the Board's recommendations following test of T. I. apparatus reported on under Project No. 56, (See Coast Artillery Board Notes, March, 1923, issue of COAST ARTILLERY JOURNAL). It is apparently a big improvement over the motor driven apparatus previously submitted. A new portable clock driven T. I. apparatus has also been received and a comparative test will be made to determine which will give the best results under both laboratory and field service conditions.

Project No. 201, Study of Antiaircraft Target Practice.—An article on the above subject has been prepared by the Board with the idea of publication in periodicals to bring before the public the performance and capabilities of Antiaircraft Artillery.

B. PROJECTS AND STUDIES COMPLETED DURING THE MONTH OF JANUARY, 1924.

Project No. 80, Automatic Telephones (Installation at Ft. Monroe).—**History of the Project.**—On March 24, 1920, the Coast Artillery Board after making a study of automatic telephone systems, recommended that an experimental automatic telephone system be installed at Ft. Monroe, Va., to replace the manual system then in service but in need of extensive repairs, changes and additions.

Acting upon this recommendation and its approval by the Chief of Coast Artillery, the Signal Corps purchased in June, 1920, a 400-line private automatic exchange, manufactured by the Automatic Electric Company, Chicago, Ill., for installation at Fort Monroe to replace the 300-line manual system. The installation included the necessary automatic switching apparatus, a power board, a

storage battery (the old battery needing replacing), a motor generator for charging the storage battery and for taking the exchange load direct when the battery is not on the line, an attendant's cabinet which is in reality a switchboard of the Universal type, the necessary automatic desk and wall phones, actually 425, and the cables, power and signal, necessary for installing the new exchange.

Except for the additions necessitated by the increase in the number of post telephones from 300 to 400, few changes were made in the outside cable system of the old manual system. The old installation is utilized in the automatic system.

Features of the Automatic System at Fort Monroe.—1. General. The system installed is that known as a "selector-system, two-wire, three-figure, common-battery, automatic ring."

2. Automatic ring on intercommunicating calls. This feature, characteristic of automatic telephone systems, is so well known as to require no description.

3. In and out trunks to Hampton, Va., and camp sites and mobile artillery stations at Fort Monroe or vicinity. Included in this feature is a manually operated switchboard upon which calls from Hampton, Va., both local and long distance, are signalled in the manner common to manual boards. Upon such a call coming into the switchboard, the attendant on duty extends the call to the proper phone of the automatic system by means of cord circuits of the Universal type and the dial which is associated with the attendant's cord circuits.

A party at Fort Monroe desiring communication with Hampton, either local or long distance, dials on his phone the number "00." This connects him to the switchboard of the attendant in the switchboard room, who then extends the call to Hampton by means of his cord circuits.

Switchboards of the magneto type, such as the Signal Corps Monocord type, at camp sites or mobile artillery sites are connected to the attendant's switchboard by means of trunks provided for that purpose. Upon a call coming in from such a switchboard (magneto type) the attendant by means of his cord circuits extends the call to the proper phone, whether it be a Fort Monroe Automatic, the Hampton Central or a magneto switchboard of another system.

4. Conference Call. By means of this feature the Commanding Officer or other person may hold a conference with any number of persons up to ten over the telephone, all being able to hear what any one is saying.

5. The Commanding Officer's priority feature, or "butt in." This gives the Commanding Officer priority in the use of any called phone, enables him to connect his own phone with any other, even though the latter may be busy, and to use it for his own purposes.

6. Fire Trunk. By dialing "01" any party's phone is at once connected to the Fire Department, and at the same time a bell is rung in the switchboard room notifying the attendant on duty that the Fire Department is being called. The attendant then listens in on the conversation and learns the details of the fire.

7. Police Trunks. As utilized at Fort Monroe this enables a person at any one of six outside phones to get into communication with the Fire Department by simply removing the receiver from the hook. The attendant on duty in the switchboard room is warned as in 3 and he can listen in.

8. Code Calling. This provides for code ringing of a system of bells placed at suitable locations whereby a person hearing his code number being rung, can by going to the nearest phone, and dialing a given number, get into

communication with the person calling. This feature is not complete in the Fort Monroe installation, the bells for the code ringing not being on hand.

Record of Operation.—The following record of operation of the automatic telephone system covering the period Dec. 1, 1921-Dec. 31, 1923 (25 months) has been submitted by the Commanding Officer, Coast Defenses of Chesapeake Bay:

1. Daily Record of Failures.—The following is a summary of the failures during this period:

Failures of switchboard equipment:	
Line switches	30
Master switches	13
Selectors	72
Connectors	112
Ringng machines	12
Wiring in Exchange	30
Power panel	2
Attendant's cabinet	54
Total	325
Failures of telephone instruments:	
Dials	227
Other than dials	78
Total	305
Grand total of failures	630

None of the failures were of a serious nature—many of them requiring nothing more than an adjustment or the cleaning of a contact.

It will be noted that approximately half of the grand total of failures occurred in the telephone instruments and that the majority of these failures were dial troubles. The records of the telephone exchange show that the bulk of the dial troubles occurred on desk telephones. These were probably caused by the dropping or upsetting of the desk telephones.

2. Daily or Weekly Record of Repairs.—The repairs were practically identical with the failures. In almost every case the above failures were corrected and repaired the same day they were noticed or reported.

3. Total Cost of System.—The initial cost of the system was approximately \$43,000.00, as follows:

Switchboard	\$26,000.00
Batteries and charging equipment	2,000.00
425 telephones @ \$22.00	9,250.00
Cable and wiring incidental to installation	5,750.00
Total	\$43,000.00

In addition to the above certain outside equipment and electrical installations such as the cables, conduits and manholes, terminal boxes and strips and minor incidental installations used in connection with the former manual telephone system will have to be included. No accurate figures are available on these items. A reasonable estimate, however, is \$25,000.00.

4. Annual cost of repairs exclusive of labor.—An accurate account of material used has been kept for the period from October, 1922, to December 31, 1923. This record includes all parts used as well as such minor details as tape and oil.

The following is a summary of the cost of repairs per month:

October, 1922	\$ 44.27
November, 1922	3.06
December, 1922	23.84
January, 1923	39.78
February, 1923	25.08
March, 1923	19.68
April, 1923	29.19
May, 1923	35.06
June, 1923	3.50
July, 1923	9.87
August, 1923	22.95
September, 1923	14.51
October, 1923	6.99
November, 1923	2.60
December, 1923	2.30
	\$282.68
Total	

The monthly average cost of repairs as per above figures is \$18.84.

5. Record of labor required for maintenance.—The exchange is maintained exclusively by enlisted personnel. One Technical Sergeant has charge of and supervises the maintenance and operation of the Exchange; and one Staff or Technical Sergeant repairs outside defects such as faulty telephones and cable work. In addition, three privates are used as switchboard operators (only one being on duty at a time).

Comparison of the Automatic System With the Manual System.—1. The automatic telephone system has the following advantages as compared with the manual system:

a. Greater ease and convenience in making connection and disconnection. It is not necessary for the calling party to translate his desires into sound, and an operator to translate these desires into action.

b. Greater speed of connection and disconnection. Nothing but automatic switches between two parties is required in the automatic system whereas in the manual system one or more human intermediaries are necessary. The automatic obviates the chances of delay through misunderstanding on the part of the operator.

c. Uniformity of service, the service of the automatic being almost completely independent of traffic, personnel and public health; in other words, the automatic is not seriously affected by heavy traffic loads, by the personality and health of operators, by strikes and by epidemics, as the manual system is.

d. Definite control of the automatic switches by the calling party. Connection broken when calling party hangs up.

e. Accurate connection through accurate response of the switches to control over lines of varying properties.

f. Absence of human co-operation except when desired and requested.

g. For large exchanges, economy of personnel and space.

h. Twenty-four hour service without keeping an operator constantly on watch. Late long distance traffic can be handled by having a night bell for calling an operator, or by placing a dial phone of the automatic system (by contract) in the nearest commercial exchange.

i. Positive information is obtained at once by the calling party as to whether the telephone called is ringing or is busy. The called phone, unless busy, rings intermittently until the called party answers or until the calling party hangs up. He is also informed at once if his own phone is out of order.

j. A given number of lines can handle a greater amount of traffic than in the manual system because of the fact that the connections are made and broken promptly.

k. Communication is secret; that is, there is no way of ascertaining if a given phone is being used except by dialing its number or by the operator breaking in.

l. The automatic system lends itself to a considerable number of auxiliary uses, such as fire and police alarms, conference service, code calling service, supervision over watchmen and guards, and many others.

m. The switching equipment is made up to a large extent of easily removable units which facilitate the making of minor repairs and adjustments.

2. The automatic system has the following disadvantages as compared with the manual system:

a. It is 10 to 25 percent more expensive in its first cost. The cost of lines, cables, storage batteries, and other equipment common to both systems is, of course, the same in both.

b. The limits of operation, so far as dialing and ringing are concerned, are 1200 ohms copper or line resistance and 20,000 ohms insulation resistance. With standard cable No. 22 B. & S., the limits of operation are approximately 12 to 14 miles.

c. In small installations (300 to 400 straight lines) the cost of upkeep is greater than in the manual system.

d. The cost of an automatic telephone is greater than that of an ordinary telephone by the cost of the dialing device. The dialing device can be purchased separately, however, and attached to the ordinary telephone, wall or desk type.

Discussion.—1. The automatic telephone system as installed at Fort Monroe comprises, not only the post telephone system, that is the phones in administrative offices, barracks, quarters and other buildings, but also phones in the following principal stations of the Fort Monroe fire control system:

Coast Defense Commander's station	(1)
Coast Defense Commander's Primary station	(1)
Spotting station	(1)
Meteorological station	(1)
Message center	(3)
Radio station	(1)
Signal station	(1)
Tide station	(1)
Mine command	(6)

(These include one phone at each of the following stations: Mine Commander, Casemate, Boathouse, Storehouse, Mine Wharf.)

Fort Commander's station	(2)
Battery and searchlight power plants	(11)
Searchlights No's 5, 6, 7 and 11	(4)
Fire control switchboard rooms No's 1 and 2	(2)
Battery Commander's station of 8 batteries	(8)

The automatic system is not used as a part of the fire control or spotting system of any battery or of the mine command.

2. The automatic telephone system as installed at Fort Monroe has given eminently satisfactory service over a period of 27 months. No serious interruptions of service of the system as a whole or of individual phones have occurred during that period. The convenience, rapidity and accuracy of making connections and disconnections in the automatic system are in themselves alone features which make it preferable at all times to the manual system. A direct comparison of the two systems is feasible at all times at Fort Monroe, where calls to Hampton, Va., and vicinity are put through the manual central at Hampton. The slowness, and at times, uncertainty of the manual system is accentuated for those who are accustomed to the rapid and positive action of the automatic.

3. In coast defenses where telephone communication requirements can be satisfied by a system of not more than 500 to 700 phones the personnel required for operation and upkeep of an automatic system should be no greater than for a manual system. There is no positive saving in operating personnel in an automatic system the size of that installed at Fort Monroe, but an exchange twice the size of that at Fort Monroe can be operated by the same numbers. In exchanges of 100 to 200 lines a headquarters clerk might perform the duties of the switchboard attendant in addition to other duties if the location of the switchboard room were convenient.

4. As regards limits of operating distance, that is, for dialing and ringing, a system such as installed at Fort Monroe will meet the requirements of most of our coast defenses. For those defenses requiring communication facilities over distances greater than 12 to 14 miles special provisions can be made. For example, assume that Fort Story, Va., is equipped with an automatic system of any number of phones, and that it is desired to connect it to the Fort Monroe system so as to obtain prompt service between any phone at Fort Story and any phone at Fort Monroe. One method of accomplishing this is to have a number of toll trunks connecting the two exchanges and having calls between the two put through by the operators on duty at each exchange. The Automatic Electric Company have several other methods of accomplishing the same result, all of them more or less meso-automatic but all requiring a human intermediary.

Conclusions.—The Coast Artillery Board is of the opinion that the automatic telephone system excels the manual system in convenience, rapidity of connection and disconnection, and positiveness of action; that these considerations more than offset the greater cost of the automatic system; that with the sizes of exchanges that may be necessary in the majority of coast defenses, no material saving in personnel is made by installing the automatic system; that even where toll trunks are necessary in a coast defense between forts too widely separated to be served by one automatic exchange, an automatic system at each fort is to be preferred to the manual system; and, that nothing is to be gained by installing the automatic system as part of the fire control system of any fixed defense battery or mine command, but that at forts where it is installed it should include the principal stations of the coast defense and fort fire control installation.

Recommendations.—The Board therefore made the following recommendations:

1. That no installed manual system that is giving reasonably satisfactory service be replaced by the automatic system.
2. That at posts where the present manual system is in need of extensive repairs, alterations and additions, the manual system be replaced entirely by the automatic system.
3. That all future original installations be of the automatic system.
4. That the automatic system be not used as a communication system in the fire control of any fixed defense battery or mine command.

Project No. 129, Angular Units of Measurement for Coast Artillery.—

This study was made with the idea of securing one unit of angular measure for the coast artillery, either the mil or the degree, the choice being to a large extent determined by the cost of conversion of materiel. A brief resume of the study made on this subject was published under Project No. 129 in the Coast Artillery Board Notes of the July, 1923, issue of the COAST ARTILLERY JOURNAL. In acting on the recommendations of the Board, the Chief of Coast Artillery secured an estimate of the approximate cost of converting all Coast Artillery armament and equipment to a single unit, for the measurement of both vertical and horizontal angles, cost of conversion to either mils or degrees being furnished by the Ordnance Department.

The Chief of Ordnance submitted the following opinion after a careful study of the entire project:

"The conclusions of the Board * * * are in the main concurred in, especially that relative to the adoption of the policy for eventual and complete conversion of all coast artillery armament to but one angular unit of measure; but in view of the estimates * * * amounting to more than one-half million dollars for conversion of instruments alone to either the mil or degree system, and in view of the funds now available and the uncertainty of obtaining sufficient funds in the future to carry the project to a satisfactory completion, there is some question as to whether the project should be attempted."

The policy of adopting the mil for use with new materiel, particularly the 14-inch and 16-inch guns and howitzers, was then considered. This would involve only the expense of regraduating the quadrants and azimuth circles for the armament already emplaced.

The final action of the Chief of Coast Artillery on the whole project was as follows:

"The converting of all non-obsolete coast artillery materiel to a standard unit of measure for both vertical and horizontal angles is not believed desirable. In regard to the old materiel the results to be expected from such a change would not warrant the cost. It is therefore believed that no further study on this project is justified except for new materiel," and further,

"This office does not at this time contemplate approving the making of any changes in the angular graduations on new materiel such as the 16-inch barbette gun and howitzer, and the 14-inch railway gun."

Project No. 133, Azimuth Origin For Coast Artillery.—The Artillery Board's report on this study is published in the July, 1923, issue of the COAST ARTILLERY JOURNAL. In acting on the recommendations of the Board the Chief of Coast Artillery obtained an estimate of the cost of converting all non-obsolete

Coast Artillery Materiel to the North azimuth origin. The estimated cost of the conversion was considered to be too great to warrant making the proposed change. The recommendation of the Board to the effect that the azimuth origin in Coast Artillery be the true North and that conversion of materiel such as ~~azimuth~~ circles on guns, mortars and plotting boards as well as changes in posted orientation data, where necessary, be made to that point, was therefore disapproved.

Project No. 176, Zeiss 4-Meter Self-Contained Base Stereoscopic Antiaircraft Range Finder and Altimeter.—The test of this instrument has been partially completed and a preliminary report submitted. A comparative test was run which included the 4-meter Zeiss, 4-meter Goerz Coincidence, and the 9-foot, 15-foot and 30-foot Bausch and Lomb Coincidence Range Finders. Readings were taken with all instruments on fixed targets and moving ships. Complete report of test with graphs and tabulations showing results is too long and voluminous for publication here. The best results were obtained by the 30-foot Range Finder as would be expected on account of the longer base. The 7-foot Range Finder gave such poor results as to cause its elimination early in the test. The 4-meter Range Finders were found to be superior to the 15-foot instrument. The performance of the 30-foot Range Finder will be reported on in a later issue of the JOURNAL.

The readings on fixed targets gave a measure of the accuracy obtainable. The following tabulation gives the average errors reference target made by the 4-meter instruments as a result of observations on moving targets. The ships were tracked by two horizontal base systems, average of ranges obtained from horizontal base systems are assumed to be correct and are taken as the basis of comparison.

Average Errors Reference Target

<i>Range</i>	<i>Goerz 4-meter Stereoscopic R. F.</i>	<i>Zeiss 4-meter Stereoscopic R. F.</i>
2,000	30 yards	30 yards
4,000	50 yards	50 yards
6,000	100 yards	100 yards
8,000	160 yards	160 yards
10,000	220 yards	240 yards
12,000	310 yards	310 yards
14,000	400 yards	410 yards
16,000	520 yards	550 yards
18,000	580 yards	650 yards
20,000	710 yards	800 yards

The above figures give the measure of the accuracy to be expected from the 4-meter instruments when used for ranging on moving terrestrial (seaward) targets.

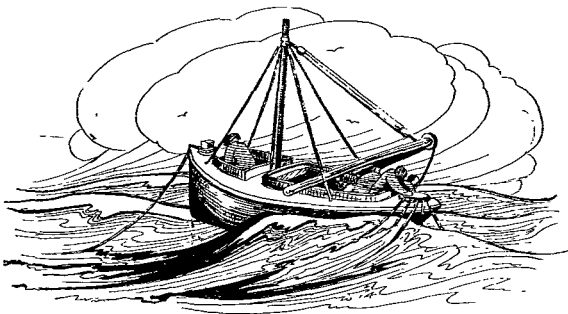
The test has not progressed much beyond this point. Sufficient observations on airplanes have not been made to warrant conclusions as to the capabilities of this instrument as an antiaircraft altimeter. The present altimeter attachment on this instrument is not satisfactory. Further discussion of various features of the Zeiss Range Finder, with a resume of the specifications required for a satisfactory self-contained antiaircraft altimeter will be found under Project No. 197

supra. The Artillery Board expects to receive for test a French self-contained altimeter, the stereoscopic telemeter of the *Socite Optique et Precision*. This telemeter will be tested in comparison with the Zeiss 4-meter Altimeter on moving aerial targets, after which further information will be published.

Project No. 185, Questionnaire For Battery Commanders Concerning Devices For Moving Target Firing.—This project has been discontinued and questionnaires recalled for revision.

Project No. 151, Subcaliber Gun For Tractor Artillery.—Reference is had to a complete report on this project published in the Coast Artillery Board Notes of December, 1923, issue of the *COAST ARTILLERY JOURNAL*. The Board considered the feasibility of mounting a 37-mm. gun on the 155-mm. gun for sub-caliber work and recommended that this be done. The Chief of Coast Artillery approved the recommendations of the board with reference to the use and issue of 37-mm. guns for subcaliber purposes by tractor artillery units. The 37-mm. gun will be included in Tables of Basic Allowances when these tables are revised. The Chief of Ordnance has reported that steps have been taken to design a new subcaliber mounting, Model 1924 E for 37-mm. gun Model 1916 on 155-mm. gun Model 1918 and to test this at Aberdeen Proving Ground, and later send it to Fort Eustis for test by the Coast Artillery Board. The base of the new mounting has been simplified considerably to facilitate manufacturing in quantity. It is impracticable to estimate the date of completion of this pilot mounting at this time.

Project No. 158, Mine Defense of the Pacific Entrance to the Panama Canal.—This project has been completed and forwarded. Owing to its secret nature the report on this project cannot be published here.



BULLETIN BOARD

Policy Regulating Assignment of Coast Artillery Officers

Several changes of policy in connection with the assignment of Coast Artillery officers have recently been put into effect by the office of the Chief of Coast Artillery. By these changes it is hoped to secure a greater number of officers for assignment to branch activities, to reduce the frequency of moves of commissioned personnel, to secure less interruption of training in Coast Artillery organizations, and to more nearly equalize the foreign service of first and second lieutenants.

A change that will materially increase the number of lieutenants for assignment to branch activities is one discontinuing the practice of sending all graduates of West Point, appointed in the Coast Artillery Corps, to Fort Monroe, Va., for initial station. In future the officers from the graduating class will be distributed to various Coast Artillery commands in groups of from five to seven. They will be assigned to the normal duties pertaining to their grade and will be required to pursue, during the regular school period, basic courses of instruction. About half of this year's graduating class will be assigned to foreign service, in approximately equal numbers to the Philippines, Hawaii and Panama. The others will be assigned to the larger coast defense commands in the United States. It is the present plan to send none to Fort Monroe this year since there is now an excess of lieutenants at this post.

As a further means of avoiding frequent moves of commissioned personnel, a special effort will be made to secure students for this year's courses at Fort Monroe from among those officers who are either due for a move this coming summer or fall, or who have been at their stations for at least two years. R. O. T. C., National Guard, Organized Reserves and similar details are normally for a period of four years. If it can be avoided officers who have been on such details for a shorter period will not be relieved for the purpose of attendance at the Battery Officers' or Field Officers' courses. Of course, the National Defense Act may operate to affect the relief of an officer on duty such as with an R. O. T. C. Unit. In this connection the War Department has recently decided that all R. O. T. C. duty since July 1, 1920, shall be counted as detached service.

It has been decided to extend the length of the Field Officers' course at Fort Monroe from five months to nine months beginning this year. The additional period of four months will be devoted largely to practical courses in artillery. The course will begin about September 15th instead of in January as heretofore. Due to the fact that the number of field officers available is gradually becoming more limited, it has been found necessary to detail a few captains for this course. Captains, who are expected to be promoted within four years, are considered eligible and will be detailed as students each year in a number sufficient to complete the authorized quota for the class. The four year provision is based upon the fact that graduates of the Field Officers' Course are normally sent on to the

Command and General Staff School at Leavenworth, for which course Captains who are expected to be promoted within three years are eligible.

The number of first lieutenants now on foreign service relative to the second lieutenants on this duty is to be gradually reduced by substituting second lieutenants as replacement for first lieutenants until approximately the same number of officers of these grades will be found in each of our foreign possessions. The present distribution was based upon conditions which have now ceased to exist due to the commissioning of a large number of second lieutenants since this distribution was determined. This will result in materially slowing up the rate at which first lieutenants will be assigned to foreign service duty for the next two or three years.

Coast Artillery Marching Song

EDITOR'S NOTE: *The following song was sung extensively at the Training Camps at Fort Monroe during the World War. It is here published in order that it may be made of permanent record, and because it is believed that there is today a need for such a song among the units of the Coast Artillery Corps.*

(TUNE, "One Keg of Beer for the Four of Us.")

First Verse

Enlisted in the army
 Turned down in the field
 Almost joined the dough-boys
 Glad I didn't yield.
 Assigned to the Coast
 I'm as happy as can be
 For now I am a member of the Coast Artillery.

Chorus

Rorious, rorious,
 We'll make the Coast Artillery glorious
 Load her up with shell
 And we'll give the Kaiser HELL
 As we blast the bloody Germans out of France.

Second Verse

On to Monroe
 Then to France,
 Limber up the big boys
 And make the Dutchman dance;
 We'll clear our way
 For our gallant infantry
 For we are the gunners of the Coast Artillery.

Chorus

Rorious, rorious, etc.

Third Verse

Says Von Hindenburg
 To Kaiser Bill

Says Von Hindenburg
 To Kaiser Bill
 Damn that Artillery
 It never will be still
 They're shooting like the devil
 And it's very plain to me
 That we're up against the gunners of the C. A. C.

Chorus

Rorious, rorious, etc.

Fourth Verse

Says Black Jack Pershing
 He says, says he
 Send along another bunch
 Of Coast Artillery;
 They'll blast us a way
 Through the lines of the Hun,
 So send along your Mortars and your twelve-inch guns.

Chorus

Rorious, rorious, etc.

A Word For Contentment

In checking up the minor horrors resulting from the recent scrap, if one may be so disrespectful toward a great event, we find among them a decided tendency on the part of many army officers to complain because they can't afford an automobile.

Now such a state of mind can be explained only by the facts that the roads of France were excellent and the A. E. F. autos plentiful. This combination developed among our army men a large group of Cadillac cranks, a larger one of Dodge devotees, and a general desire all around to step on the gas. And the trouble seems to be incurable. Doctor Coue's system of auto-suggestion only aggravates it. Here the little string with its twenty knots is as useless as a traffic cop in Venice.

The complaints, be it noted, are by no means confined to those who take their bumps on the street car back platforms. In fact, the owners are more numerous among the kickers just now, for many of them bought wisdom along with their cars and have learned somewhat late that they have invested in something they cannot well afford.

One gets used these days to being held up in the middle of the sidewalk to listen to his friends argue that an army officer's pay should not be so small in this age of gasoline that he has to figure too painfully before buying a benzine buggy. Nowadays when one sees two army files talking in the midst of a busy street, it is better than a 2 to 1 bet that one is saying he had just had to pay the garage pirate \$47.85 for repairs, and the other is announcing that since he cannot afford to take his bus out for more than three days a week he is hoping the blamed thing will burn up so he can collect his insurance.

Here we are going to beat the reader to it by a neck and say that of course it is none of our business if so many of our army friends want to try travelling

a champagne route on a hootch income. Neither have we any license to preach on this point—and if we did we should remember the army chaplain's rule and preach to enlisted men only, since, according to his expert observations, army officers are all bound for hell anyway!

Still it should not be counted either as preaching or buttin' in if a word is said for the advantages of being contented though car-less. For better or worse that word is spoken here, and it is spoken by one who has passed through all stages of this ailment from the Cadillac fever to that resigned Ford feeling that came over us when we thought, for a time, that we might be able to buy a Henry—and become a bounding bandit of the boulevards.

Now let's look at this thing dispassionately. This means that the reader must forget the price he is paying for gas as well as the fact that he needs new tires all around. For one thing, leaving finances out of the question, a car can mean only pleasure to an army owner. It can never help him in his business as one did in the famous case of Professor Todd who bought a used machine and acquired so much nerve running it that he found the courage to strike the president of his little one-horse college for a raise in salary—and got it. The army man can never profit by this example. On the contrary, the very fact that so many of our Service families drive their own gets all of us in bad. *Verbum sap.* In such cases the army man's critics of course do not realize that in many instances his wife is doing her own work in order to hang on to the car. But the critics remain critics nevertheless, particularly if the army file gives them grounds to work on by complaining publicly as he steps on the gas.

For another thing, riding around on air seems to carry with it a tendency to splurge in other directions, and, no matter how discreetly done, splurging does come high.

A plea, therefore, for contentment cannot be amiss at this time even though it is clear that the high cost of flivin' will have to be higher before arguments have any effect.

Candidly, now, don't many of us try to fly a bit too high? There has been much talk, for example, about how an army officer's "position" *demand*s that he own an automobile. This may seem reasonable to some, but to the rest of us it sounds like the stuff homebrew is made of. Years of observation have convinced many of us (and we also spend all of our pay each month) that, except for maintaining a presentable outfit of uniforms, and aside from certain expenses contingent upon re-establishing a home after a change of station, the average army man's "position" does not entail the expenditure of money for any purpose other than mere living unless he *wants* to spend it. And yet this year's class at the U. S. M. A. are being permitted to plunge to the extent of \$125.00 per man for boots and shoes alone—including a pair of Peale boots at \$67.00 per!

Contentment is a great blessing and it comes in many curious guises. For instance, we recall the satisfaction with her lot shown by Mrs. Cassidy, the heroine of the story "A Harlem Tragedy." This lady, married to a drinking wife-beater, maintained sufficient morale to announce to all comers that she wouldn't have a husband that didn't beat her up at least once a week, and she used to add as a clincher that she'd just like to catch her man trying to beat up any other woman!

Now the methods adopted by Mrs. Cassidy's husband were of course a bit drastic, and they are not recommended for the use of army officers except in those extreme cases where, for instance, the woman insists on having a new hat during the same month the busted radiator has to be paid for. On such occasions

the lid should be lifted, after all the furniture with sharp corners has been carefully pushed back out of the way. In no other manner can the wolf be kept from the garage.

The writer realizes that he has displayed all the delicacy of a Tasmanian warthog in presenting this subject. So it will not be in the least surprising if no one takes his advice. However, he feels considerably better for having gotten it out of his system and his own spirit of contentment is reinforced thereby. If it does no more, this message should make it clear that others beside auto owners can count on receiving free air—this screed being a sample!

(Signed) "HENRY"

Military Motor Transportation

The Cavalry Journal in its review of new books, has the following to say of *Military Motor Transportation*, a book recently published by the Book Department, Coast Artillery School:

"The matter in this volume covers generally the basic principles of motor vehicle construction and operation, and in detail the construction, operation and care of the standard Army Motor transportation assigned to the Coast Artillery. In this latter respect this book is supplementary to the Ordnance Department handbook on the different kinds of motor vehicles.

"The book is well illustrated with photographs and has many fine drawings. It is written in a simple style. Its readability contributes much to its efficacy."

Radio Educates the People

The educational value of the radio to families in their homes on the farms is becoming more fully appreciated. From one Western broadcasting station people in 114 cities and towns, and thousands of farm homes in the country enjoy daily entertainment.

Lectures from great educational centers scattered over thirty-one states are heard from one super-station.

A family in Ferndale, California hears concerts from Portland, Oregon, and farmers at Livingstone, Montana enjoy concerts from Des Moines, Iowa.

The pleasure that a whole family gets from nation-wide music and lectures is intensified by the fact that they have been deprived of these things until the discovery of the radio.—*Industrial News Bureau*.

A Good Word For the Coast Artillery Journal

Colonel C. J. Smith, commanding the 213th Artillery (A. A.), Pennsylvania National Guard, in a circular letter to his command has, among other things, the following to say:

"Officers who are subscribers to the COAST ARTILLERY JOURNAL ought to find the article on Chemical Warfare in the December number very interesting matter to give to the batteries during a drill period. There are frequently other articles in the JOURNAL that make excellent matter to transmit to the personnel during drill periods."

Public Documents

The Superintendent of Documents, United States Government Printing Office, Washington, D. C., is authorized by law to sell public documents at cost. Price lists, covering a wide range of subjects and including such general topics as agriculture, engineering, health and hygiene, and political economy, will be mailed free upon application.

General Helmick Inspects the Coast Artillery School

The following are extracts from the report of Major General Eli A. Helmick, Inspector General, made as a result of his recent visit to Fort Monroe, Va.

"In addition to the Coast Artillery, the following organizations are stationed at Fort Monroe: 35th, 41st, 58th and 69th Companies, C. A. C., 61st Artillery Battalion, A. A., and the usual detachments, all under Colonel James F. Howell, Coast Defense Commander. Brigadier General William R. Smith commands the School, the Coast Defense troops mentioned, as well as the Artillery organizations at Fort Eustis.

"Conditions at the School and in the Coast Defense Commands were most satisfactory. The buildings and equipment of the School appeared complete in all details. They were spotlessly clean and perfect as to order. I visited the classes of officers and non-commissioned officers, among the former being a number of National Guard officers. While I was not able to make a careful examination of the work of the School, I was impressed with the efficiency of the plant and instruction, and the interest and spirit of the students.

"The School impressed me as performing its mission in a most satisfactory manner. Theory and technique have not been pursued to the exclusion of soldierly efficiency; all military activities are utilized in the instruction of the students. The uniform and soldierly appearance of the student officers showed that careful attention had been given to these important features of military training. Belts and footwear were polished; brasses shined; and uniforms pressed.

"A sane and logical statement of policy for the conduct of the Coast Artillery School is contained in the following extracts from a letter from the Commandant:

Not only are the student officers of the Coast Artillery School given the opportunity to inspect the various activities of the coast defenses, but they are required to inspect them, to note the organization of the various departments, and the condition and arrangement of the storehouses, barracks, etc., pertaining thereto.

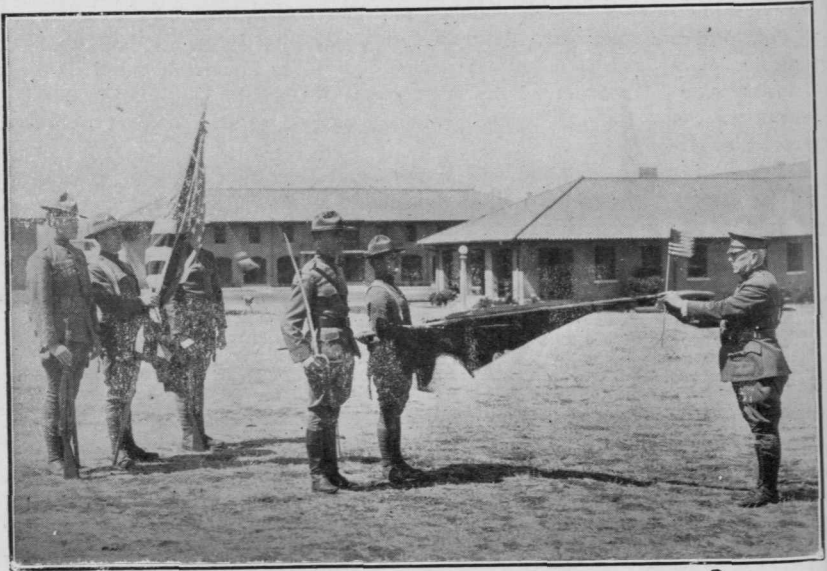
They are required to inspect the batteries and their materiel and to become acquainted with their organization and in addition they conduct target practice at these same batteries. They also are taught how to conduct rifle practice and the afternoons of two months, October and November, are devoted to this subject.

The Officers' Mess and the Club and the social life of the garrison are conducted as a standard for the happiness and contentment of the garrison and at our entertainments we try to keep the expenses small so as to allow the younger officers to take full part in them. In fact, everything at Fort Monroe is looked upon as a part of the School and is so conducted as to establish a standard which the student officer may afterwards use at other posts. In other words, the post is an adjunct of

the School and it is attempted to show him a model post, and draw his attention to every part of it.

My experience at this School as instructor, director and commandant, has taught me that, of the two basic principles, namely, soldierly efficiency and technique, the first is more likely to be neglected at a technical school such as this than the second. I have therefore always tried to balance the two as nearly as possible since I have deemed it not sufficient that this school turn out good Coast Artillerymen, but that it must produce good soldiers as well.

The 250th Artillery



DECORATING THE COLORS OF THE 250TH ARTILLERY, C. A. C.

The ceremony shown in the photograph above took place at Fort MacArthur during the 1923 Encampment of the California Coast Artillery National Guard. It shows the decoration of colors of the 250th Artillery, C. A. C., (Fixed Defenses) California National Guard, by Brigadier General Ira A. Haynes, U. S. A., with streamers for the Battle of Manila (Spanish-American War), Battle of Manila (Philippine Insurrection), Meuse-Argonne, and St. Mihiel.

The 250th Artillery is commanded by Colonel Richard E. Mittelstaedt and is made up of units located in San Francisco, San Diego, San Pedro and Long Beach. The regiment earned the streamers for the Spanish-American War and the Philippine Insurrection as part of the 1st California Volunteers. In the World War, as the 1st Coast Defense Command, California National Guard, it was used to form part of the Army Artillery Park and various units of artillery in the 40th, 62nd and 67th Regiments and as such earned the streamers covering the Meuse-Argonne and St. Mihiel engagements.

PROFESSIONAL NOTES

Can An Airplane In Flight Be Stopped?

By Henri Dackweiler, appearing in Bulletin Belge des Sciences Militaires.

Translated by Captain A. M. Jackson, C. A. C.

EDITOR'S NOTE: *Mr. Dackweiler is Chief of the Laboratory of the Institute of Hygiene, Chemistry and Biology of the Army of Belgium.*

The daily press has lately spoken several times of a new war invention made in Germany. The means of stopping airplanes, dirigibles, automobiles, etc., from a distance has been discovered beyond the Rhine. I thought that it would be interesting for the readers of the "Bulletin des Sciences Militaires" to learn how it was possible to realize this thing which at first glance appears astonishing; to stop a motor from a distance. This phenomenon is possible, and instead of condemning the researches of the German scholars, as certain Allied newspapers have done, it would be useful to seek to penetrate their secrets.

In 1898, Tesla, in America, made his experiments with high frequency currents. Now it happened that one day the powerful dynamos of the Colorado Electric Light and Power Company, of which the central station was situated several kilometers from Tesla's laboratory were all burned out and put out of service. Tesla had certainly not foreseen such consequences of his experiments, but the fact was patent.

Since then the study of high frequency currents and their action at a distance has been pursued more and more, and at the present time they transport the human voice thousands of kilometers.

An electric current, for example, in a copper wire, is constituted by a stream of electrons flowing between the atoms, from which they arise, moreover. The material atom is, in effect, a veritable planetary system with a central sun about which the electrons gravitate in well determined, more or less complex orbits.

But the electric current is not limited to this. The space surrounding the wire also contains free electrons and these are influenced by the movement of those in the interior of the wire. About the conductor thru which a current is flowing there is produced an electric field, an electro-magnetic disturbance. There is nothing astonishing about this when it is recalled that electrons are particles of negative electricity exposed to the same actions of attraction and repulsion as all electrified bodies.

When the current flowing in the wire is continuous, the exterior disturbance is permanent and the system, once established, remains constant.

But when the current is alternating the disturbance becomes periodic like the current.

It is transmitted, moreover, from place to place unto infinity; it constitutes a radiation.

In the industrial current of 50 cycles, the current changes direction about one hundred times a second and the wave-length of the electro-magnetic disturbance that surrounds the conductor is considerable, since it is equal to $300,000/50$ (300,000 kilometers, mean velocity of propagation in space, per second; 50, number of cycles per second) or 6,000 kilometers.

It is easily seen that if the number of cycles per second increases, the wave-length will diminish and in wireless telegraphy where use is made of currents of frequency up to 1,500,000 and even more, the wave-length will hence be shortened to 200 metres and even less.

When the frequency increases we arrive at the heat waves and when the quadrillions are attained, the waves produce an impression on the retina and constitute light, and then higher yet the ultra-violet and X-rays.

Suppose now an electric conductor, for example a metallic wire forming part of a closed circuit, is placed in such an electric field. There exists about it a periodic electro-magnetic disturbance of electrons in space. As we have seen that the interior electrons of our wire of a little while ago influence the electrons of space, so the electrons of space will influence now those of our new conductor, and the result will be the production in the wire of an alternating current of the same period as that of the primary current. This is the phenomenon of induction discovered by Ampere and upon which most of our electrical appliances are based. It is evident that the closer the conductors are the stronger will be their action on one another, but theoretically this action goes to infinity like radiation.

Wireless telegraphy is the most handsome confirmation of this theory; the sending station by means of artifices too long to develop here, produces an electro-magnetic disturbance in the electrons of space. This is done always, whatever be the system employed, by generating in the conductors, alternating currents of well determined frequency.

At some distance from the sender if there be placed another conductive circuit, there will be produced therein a current of the same frequency, and if we possess the means sensitive enough to reveal this current, we will have realized a wireless telegraph receiver. In practice this minute current is amplified by De Forest's marvelous three-electrode lamp until it is given power sufficient to make vibrate the diaphragm of a telephone, or to move the stylus of a Morse recorder.

The currents now used in wireless telegraphy are rather variable but do not exceed, in general, several kilowatts. And the receivers are so sensitive that one can listen to concerts coming from America (more than 6,000 kilometers) when the transmission hardly amounts to more than one or two kilowatts.

Evidently, the primary current received by the receiver is infinitesimal and there is no risk of damaging the apparatus.

Suppose now that instead of being at a distance of thousands of kilometers the sender and receiver are only several kilometers apart; the current produced in the receiving circuit will be strong enough to affect a telephone without the help of any amplification.

If, further than that, we give the sending station a power of ten times, a hundred times, and even a thousand times greater, what will happen? The current produced in the receiving circuit will become itself more and more intense until the moment when the circuit will be destroyed by the heat developed. In effect everyone knows that an electric circuit thru which is passed an excessive current, burns; the electric energy is transformed into heat, the wire reddens, the insulation burns and finally the conductor melts and burns itself. This is

the consequence of a short-circuit in any electric installation and is the reason for the use of fuses and automatic circuit-breakers.

Now airplanes, automobiles and dirigibles are at present actuated by internal combustion (explosion) engines with electrical ignition. The necessary current is produced more often by a magneto or sometimes by an induction coil. These two devices contain closed electric circuits, placed in a sort of short-circuit and are constituted besides of very fine wire in view of the weak current that must pass thru them.

If these delicate coils of copper wire find themselves in the proximity of a powerful sending station they will incontestably be burned in no time, provoking the irremediable arrest of the motor.

And with the currents to be expected, there is no need of antennae. Tesla burned in 1898 the powerful dynamos of the Colorado Electric Light and Power Company from a distance of several kilometers and without the help of any antenna. The power of his installation was three hundred kilowatts.

In conclusion, the problem is not very difficult to solve and it would be rather simple to surround no matter what zone of territory, were it an entire country, with an electric curtain, preventing all airplanes, automobiles or dirigibles to penetrate into the interior; at least until the day, perhaps near at hand, when the internal combustion engine (Diesel type) will definitely replace the explosion motor.

A.A. Gun Practice

By Major T. C. Newton, D. S. O., O. B. E., R. F. A.

Ever since the war, when the Germans obligingly flew for us, the problem of finding an A. A. target has presented very great difficulties. All the obvious expedients such as balloons, smoke bursts and the like suffer from overwhelming drawbacks. They have no independent movement and rely entirely on the wind; they do not resemble the real thing in either appearance or movement; they are unrealistic to the last degree. The next possibility is the glider launched from an aeroplane in mid-air. This again, however, is not a natural target. It descends at too steep an angle, and in addition is very difficult to handle, very expensive, and liable to be lost in the sea on descent.

Many other expedients have been tried abroad, among them the following:

Targets towed behind an aeroplane—for technical reasons a target suitable only for quite elementary practice.

Throw-off fire—requires special apparatus for observing and sighting and is excessively unrealistic.

Use of false heights—Gives very restricted movement and falsifies the relative speed of target.

After all this catalogue of failures let us examine the single exception which promises well.

It was suggested that a reduced charge giving the shell a ceiling of 8,000 to 9,000 feet might be used in conjunction with a target aeroplane flying well above this height. In addition to altering the charge it was also necessary to modify the fuse composition in such a way as to give bursts on the line of sight with similar times of burning of those of normal fuses fired with full charges. That is to say, at corresponding fuse settings and angles of sight both full and reduced charge ammunition give bursts on the same line of sight but at quite

different heights, one bursting at the true height of the target and the other at some lesser height below 8,000 feet. The only alteration required on the gun and predicting instruments is regraduation of the tangent elevation dial and of the Brocq time rheostat dial.

By this means fire can take place with reduced charges at any aeroplane flying above the ceiling of the gun without making any change of the normal procedure. The time of flight is practically the same as the true time of flight and all the usual difficulties of picking up and following the target are reproduced. In everything except height a full scale A. A. shoot is carried out at an aeroplane target.

As regards judging the effectiveness or otherwise of the fire, errors in line can be observed from the gun but not errors in height. To check the latter it is necessary to observe the heights of the shell bursts and compare them with the corresponding height of the target. Further, owing to parallax, it is necessary to observe the fire for line from a position very close to the guns. This method of fire suffers also from the disadvantage that there is no target which can actually be hit, and the full inconvenience of the noise and recoil of full charge ammunition is not experienced by the detachments. It is necessary for them to fire in addition some full charge ammunition to learn how their gun behaves in action.

Against these disadvantages many advantages are gained not given by any other method yet evolved. Fire is at an actual aeroplane flying at normal heights and unrestricted as to course or speed. We need only consider the safety limits of the range, and the range itself can be considerably shorter than with full charges. The airman who obligingly serves as target is not endangered in any way. He is safe but bored. The laying and instrumental work is normal throughout and, more important still, the times of flight are the true times for the target in question. They are not reduced or minimized in any way and the most important factor in A. A. fire thus retains its full power. Wear of guns, usually a serious matter with the comparatively high rate of fire of A. A. equipments, becomes reduced to a fraction of the normal figure.

There seems no doubt that reduced charge ammunition for A. A. practice has come to stay. It is not the ideal solution of the problem, but it has many important advantages.—*The Journal of the Royal Artillery*, January, 1924.

The Test

At 7:30 p. m., January 16, in a 70-mile gale, the *Shenandoah* was torn from her mooring mast at Lakehurst, N. J., and blown violently inland through the darkness and rain. In the first seconds she nosed down, her blunt bow was smashed, and the duralumin structure near the nose was partially ripped away, one gas bag was torn away, another was torn, the top of the steering rudder was rent. Only a skeleton crew of 21 men was on board, with Lieutenant Commander Maurice G. Pearce in command, and Anton Heinen at the wheel. To prevent nosing to the ground, 1,200 pounds of water ballast and three fuel tanks containing 40 gallons of gasoline each were instantaneously dropped. The engines were started. After the first wild five minutes, Captain Heinen had the ship under perfect control, engines all out, altitude 1,500 feet—ample for safety—running with the gale in the general direction of Manhattan. When the *Shenandoah* reached the metropolitan district the storm had lessened somewhat, and it was thought safe to fight the wind instead of flying with it. The ship cruised over Staten Island, made steady progress down the coast against a 25-mile wind,

passed over Perth Amboy, Keyport, Freehold, reached Lakehurst shortly after 2 a. m. Throughout the wild trip the dirigible had been in radio communication with its home station. When finally sighted over Lakehurst she was rapidly hauled down by 300 Navy men and towed into the safety of the huge hangar. The damage, including the loss of a large quantity of valuable helium gas, is estimated at \$80,000.

There is not a shadow of doubt in all technical circles that any dirigible other than the *Shenandoah* would have perished in similar circumstances. In the *Shenandoah* the Navy constructors had probed even more deeply than the Germans into the minutest points of strength analysis. Their patient efforts were fully rewarded. There remains almost no condition in the air that the *Shenandoah* cannot meet with confidence as far as structural strength goes. Her helium prevents fire and explosion. A reinforcement of the steering gear, a false nose, which could tear away, leaving the rest of the structure uninjured in case of a similar loosening from the mooring mast, and the *Shenandoah* should be able to face any and all hazards of the Polar flight.—*Time*, Jan. 28, 1924:

Telephoning Europe

Using the telephone to call up a friend in Europe is one of the promised developments of a combination of radio and telephone. It was as recently as July, 1914, that the first transcontinental telephone conversation took place between officials of two telephone companies speaking respectively from New York and San Francisco.

To engineers interested in telephone and radio development the mechanical problem is merely one of working out details. They say that the chief obstacle in the way of practical intercontinental use of the telephone business is the five-hour difference in time. But that, from the standpoint of the business men or other persons to be accommodated, is just another matter of adjusted details. Any message important enough to be telephoned across the Atlantic will probably be important enough to lose a little sleep over ungrudgingly.—*Hudson, Mass., Sun*.

Strategical Importance of the Panama Canal

Secretary Weeks in a discussion of the Panama Canal has the following to say regarding its importance from a strategical viewpoint:

"From the standpoint of national defense the Panama Canal has two aspects. In the first place it would have more than normal commercial value in war due to the increased transportation needs then incident to the movement of troops and military supplies. In the second place, the Canal enters fundamentally into our plans for defense. Only by its use can we presume that our Navy could be concentrated in time for the most effective operation in either ocean. Upon such a presumption are founded, not only Naval plans, but those for the mobilization and operation of our land forces.

One of the most important duties of our Regular Army is to provide that protection which will assure maintenance of the Panama Canal in operating condition under our possession. It must be protected against seizure by a quick thrust so we must not count upon the dispatch of reinforcements after hostilities have become imminent. Men alone will not suffice. Our defense works must be

modern, our armament effective, and supplemented by the best practical means for scouting, communication and interior transportation.

There are several ways in which the Canal might be attacked. Hostile agents might injure some vital part of the Canal. Therefore there must be military guards at all such points. An enemy might use its entire naval strength in a great effort to secure its possession. In that event the decisive battle for control of the seas would be waged there. Or again, the enemy might simply endeavor to close the Canal in order to prevent the combining of our fleets. This engagement would be preparatory to the decisive naval engagements between each of our divided Naval forces and the enemy's combined strength.—*United States Army Recruiting News.*

Army Engineers Test New Pontoon

A new type of pontoon bridge made from the fiber of the silk cotton tree, or kapok tree, has recently been given rigid tests by the Second Engineers at Fort Sam Houston, and it is believed that the new bridge is in every way superior to the Lampert bridge, the type that is now used in the Army. It will now be only a matter of time, in the opinion of engineer officers, until the Lampert-type bridge will be replaced by that made from the fiber of the kapok tree. This tree is a product of Java. The Chief of the Corps of Engineers recently sent eleven sections of the new bridge to the Second Engineers for experimental purposes. Having a whole division at Fort Sam Houston, it was very easy to test the bridge out under virtually war-time conditions. The bridge is a series of floating rafts, each section weighing 225 pounds; is twelve feet long, three and one-half feet wide, and about seven inches thick. Each raft is nothing more than a mattress of fiber from the kapok tree and is enclosed in a wooden frame, which forms a bridge floor. It is not necessary to lay a cable across a stream in order to set up the bridge. One raft is pushed out into the water and another joined to it, which is in turn pushed into the stream. The kapok fiber is one of the most buoyant substances known, having a greater buoyancy even than cork. The tests of the new bridge were conducted by Major J. N. Hodges, and Captain C. R. Moore, of the Second Engineers, and Sergeant George Clement, Company C., of the same regiment. The engineer officers recommend several alterations for the bridge, which it is believed will make it the best pontoon yet developed.

The Lampert bridge which is now in use consists of a series of platforms supported by folding canvas boats. The boats can easily be riddled with rifle bullets when put up under fire, while the kapok bridge cannot possibly sink. The fact that it is immune to rifle fire is one of its chief assets. Other features of the new bridge are that it can be put up in half the time that it takes to construct the Lampert bridge, and fewer men are required to do the work. Engineers at Fort Sam Houston consider the new bridge as one of the greatest developments in their line of the service in many years, and much credit is due to those officers in the Second Engineers who conducted the experiments with it and recommended certain changes.—*Army and Navy Register.*

BOOK REVIEWS

Scott's Last Expedition. The personal Journals of Captain R. F. Scott, R. N., C. V. O., on his journey to the South Pole, with biographical introduction by Sir J. M. Barrie, Bart. And a preface by Sir Clements R. Markham, K. C. B., F. R. S. Dodd Mead and Company. New York. 1923. 520 pp. Price, \$3.00.

This is a record of absorbing interest not only on account of the clear cut and straightforward style in which it is written and the minuteness with which each phase of the expedition is treated, but also the interest is undoubtedly heightened by the fact that the writer gave his life to the work. The last part telling in detail of the final dash for the pole was not found until it was discovered with the body of the writer eight months after his death.

Probably most people consider a dash for the pole as an attempt on the part of the leader to gratify a great and absorbing ambition and that the whole purpose of the expedition is for this end alone. Such an idea will be quickly dissipated upon reading Captain Scott's book. He shows clearly that the primary object of his expedition was to gain as complete knowledge as possible of all conditions in the Antarctic. The dash for the pole was not of first importance, whether it was successful or not would not make or break the expedition. His party was most carefully selected and contained trained experts in meteorological, geological, zoological lives as well as others. The most complete records of all observations along these lines were carefully kept and the knowledge gained is of inestimable value to science.

Finally the book is a record of absolute heroism of man in the attempt to conquer the almost unbelievable cold and desolation of the polar regions. There is something very fine in the way all members of the polar party met their death showing that they were entirely unselfish and self-sacrificing in the face of death.

Where Are We Going? By David Lloyd George. The George H. Doran Co. New York. 1923. 6"x 9". 370 pp. Price \$3.00.

This book contains thirty-one chapters discussing a variety of subjects dealing with the political situation in Europe today. Among these are the League of Nations, the Versailles Treaty, Reparations, French Invasion of Ruhr, Prospect of a New War, British Debt to America, The Allies' Debt, Ireland, Palestine and the Jews, and the Turkish Situation. Many of the chapters are reprints of speeches delivered by the author during the latter part of 1922 and during 1923. No one can read this book without being impressed with the author's views of the critical condition of affairs in Europe today. At one point he states "Europe is a seething caldron of international hates with powerful men in command of fuel stores, feeding the flames and stoking the fires." He speaks with the most direct openness of the difficulties created by France to a peaceful solution of the present

situation. His survey of affairs is direct, uncompromising and outspoken. Written by a man concerned primarily with the future of the British Empire, and possibly with his own political future, and consequently prejudiced, there are many points at which the reader is apt to disagree with the author. However, no one can read "Where Are We Going?" without being appalled by the political chaos existing in Europe today. The title of the book is most appropriate.

Unless some of the European nations radically change their policies and views, the author sees no prospect of a long continued peace in Europe. The book is well worth reading. It is interesting from cover to cover.

The A B C of Atoms. By Bertrand Russell, F. R. S. New York. 1923. E. P. Dutton. $5\frac{1}{2}$ " x $7\frac{3}{4}$ ". 162 pp. Price \$2.00.

The author explains in non-technical language the present knowledge of the structure of atoms, obtained through the use of the spectroscope and the study of X-ray and radio activities. He states how further discoveries may lead to revolutionary effects on the practice of science and the theory of physics. The theories of Bohr, rather than those of Langmuir, concerning the arrangement of electrons within the atom, are detailed.

Both the Quantum Theory and the Theory of Relativity are made somewhat comprehensible to the beginner by the use of homely analogies.

Army Retirements. The U. S. Infantry Association, Washington, D. C. 1923. 6" x $9\frac{1}{4}$ ". 197 pp.

Army Retirements is a book in which all the officers of the Army are arranged in the order of retirement for age. It also includes the promotion list for 1923.

By reference to the text of the book one may

(a) Determine just what his chances are for reaching the grade of Colonel in the Army and where he will eventually stand in the Army and in his own branch of the service.

(b) Determine just how many block files there are i.e. how many officers who rank him who are younger than he is.

(c) The approximate date when he will reach the various grades based on retirement for age. Then by keeping track of those who drop out of the list from one cause or another he is able to see just how his chances are improving.

(d) Determine whether or not it is to his ultimate advantage to make a transfer to another branch.

The introduction contains complete instruction for the use of the data contained in the book which, if kept posted up to date, will enable an officer to keep informed of his prospects for promotion all the time.

My Rhineland Journal. By General Henry T. Allen, U. S. Army. Houghton Mifflin Co., New York. $5\frac{3}{4}$ " x $8\frac{3}{4}$ ". 592 pp. Price \$6.00.

An extremely interesting book, well worth reading and undoubtedly important for the future historian of the period following the Armistice. It is a sincere effort of an interested observer and participant to set down his daily impressions of the fluctuating conditions in Europe and affords an interesting study of the typical American psychology in handling a conquered people, as contrasted with the French, Belgian and English. It shows continually how Gen. Allen tempered justice with mercy and even allowed himself to come into conflict with his Allied

co-workers in an endeavor to insure against possible oppression of the conquered people, who until recently have never admitted their defeat. It is surprising that the Government should permit the publication of "My Rhineland Journal" at the present time.

Elements of Radio Communication. By Ellery W. Stone. D. Van Nostrand Co. New York. 1923. 5"x 7 $\frac{3}{4}$ ". 318 pp. Price \$2.50.

A book containing 145 illustrations and 39 plates, written primarily for radio students in the U. S. Navy. It should prove useful to all who are interested in the subject.

Besides covering the fundamental principles of radio communication it reviews the various systems of radio transmission and reception from the Marconi 1896 Transmitter down to the present and the development of the vacuum tube, and presents a brief but clear description of the various electrical instruments employed in radio communication.

Chapter VII, in which Regeneration is discussed, is particularly worthy of mention.

The print is very readable and the illustrations well drawn up, sharp and clear.

The French Revolution, A Historical Sketch. By Walter Geer. Brentano's. New York. 6"x 9 $\frac{1}{2}$ ". 413 pp.

There is little that is new offered in this most recent account of the French Revolution. Yet the author has grouped his facts so carefully that the trend of events is easy to follow; and the tedium of dates is so relieved by intimate, personal incidents concerning the lives and characters of the Revolutionary figures that they become living, breathing men and women. There is no undue sympathy with, nor extravagant glorification of, any of the leaders of either side, but justice has been done to all. The book will stand as an authentic and most entertaining record of the events of one of the great dramatic periods in the history of nations.

Tides and Tidal Streams. By H. D. Warburg. The MacMillan Co. New York. 1923. 6 $\frac{3}{4}$ "x 9 $\frac{3}{4}$ ". 95 pp.

Commander H. D. Warburg, R. N. (retired), Superintendent of Tidal Work, Hydrographic Department, Admiralty, has produced a technical book that is profoundly interesting. He could the more easily have written a highly technical and deeply scientific work with the object of proving or disproving a particular theory; he preferred to write a manual, the primary object of which is to explain the tides to seamen.

Prompted by the knowledge that "tidal instruction as given in the navigation schools, both of the Royal Navy and the Mercantile Marine, is incomplete and faulty and has undergone less improvement than any other branch of navigation," he endeavors to "give an adequate explanation of the causes of all tidal phenomena, and, whilst explaining the correct methods of using the tidal information now available, to introduce improved methods of giving such information by means of harmonic constants, and to explain how, from these constants, the height of the tide may be calculated, at any port in the world and at any moment, with the necessary degree of accuracy."

A detailed study of the text reveals much interesting material, for not only are the causes of all tidal phenomena, and the methods of obtaining approximate and exact tidal predictions explained, but tables for the calculation of approximate predictions, and for harmonic tidal constants for certain ports, are included as well.

The Encyclopedia of Food. By Artemas Ward. A. Ward, New York. 1923. 8½" x 11½". 596 pp. Buckram. Price \$10.00.

An unusually attractive volume, containing eighty color plates and hundreds of illustrations in half-tone, with just the information that one needs about every food that comes to the American's table, and also about the many new and foreign foods that are being introduced from time to time. It offers fascinating articles on the strange and unusual, such as the Chinese egg of great age, many unfamiliar sausages, bamboo shoots, and various other odd dishes.

The information is in condensed but interesting form. One is led to turn page after page, and easily absorbs knowledge that is of practical value, for the short articles contain information that is quickly and easily read and assimilated. An appendix contains a food dictionary in six languages: English, French, German, Italian, Spanish and Swedish. There is an eight page article on food values, vitamins and dietetics.

The make-up of the book is unusually good. Typography, half-tone and color work is excellent, and the binding deserves special mention. The signatures have been sewn on straps, attached to the covers, and the plates have been folded into place, instead of the cheaper "tipping-in." The book will be of great value and interest in the home, and will be an absolute necessity in the reference set of anyone who is in any way connected with the purchasing, handling or preparing of foods.

History of the Far East. By Hutton Webster. D. C. Heath Co. New York. 1923. 5½" x 8". 173 pp.

Dr. Webster's little book is an outline history of the Far East. It is an attempt to summarize the contributions in industry, science, religion, philosophy, art, literature, politics, economics, and the refinement of social life which India, China, Japan and Oceania have made and are still making to the common welfare of mankind.

The author's point of view is historical and not propagandist, so that his estimate of the extent and value of these contributions should receive the appreciation they deserve.

"The time is surely passing," writes Dr. Webster, "if indeed it has not already passed, when educated people in Europe and America can afford to remain ignorant of the Far East." Current events rather strikingly confirm this opinion.

In these days of much heralded outlines this modest volume, intended to introduce pupils in school and college and the general reader to the Far East, is worthy of its author's reputation as an historian. For the general reader it may be supplemented by a wealth of additional reading. And the fact that there are so many books on what is one of the controversial issues of today, is proof that not only are there a great many authors trying to give facts but there is an ever-increasing army of readers ready to read them. The volume is provided with a bibliographical note, a chronological summary and an index.