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The Coast Artillery Journal

Vol. 58 No. 4 APRIL, 1923 Whole No. 200

Doctrine and Command

By Brigadier General Richmond P. Davis, U. S. A.

Fort Monroe, Virginia,
22nd December, 1922.

My dear Clark:

In accordance with your request I have incorporated in the following such items of my talk on doctrine and command at the opening of the school as seem to be of general interest.

The subject matter is given as delivered in my talk rather than as an article.

Sincerely,
(Sgd) Richmond P. Davis,
Brigadier General, U. S. A.,
Commandant, Coast Artillery School.

* * * *

OU are assembled, gentlemen, for me to outline to you,

1st The Doctrine of the School.
2nd The General Rules Under which we Operate.
3rd The Fundamental Principles of Command.

Some of the senior officers are familiar with what I have to say but a review of fundamentals is never a loss for anyone. Those who have the military spirit never tire of the old old story. Those who do tire need to hear it again.

Ever since attaining command rank some years ago, it has been my custom in taking over a command or in having a considerable acquisition take place, as at the beginning of the school year, to assemble the officers for a mutual understanding of aims, ideals, and rules of operation. The results have been so satisfactory that I think the procedure should be considered as standard practice.

I. DOCTRINE

The school work is laid out and conducted with a view to fulfilling the conditions imposed by the following items of doctrine.

1st. *Every Officer shall become a better soldier.*
2nd. *Every Officer shall be qualified better to shoot a battery.*
3rd. *Every Officer shall be qualified better to command.*
4th. *Every Officer shall have broader vision and shall acquire as much general information as is possible in the time available.*
5th. *Every Officer shall work, have recreation, exercise and sleep in proper proportion to produce highest efficiency.*

These planks of our platform will now be considered in turn and in the course of this detailed consideration the general rules of operation will appear.

1ST. EVERY OFFICER SHALL BECOME A BETTER SOLDIER

Another way of stating this and one used by me constantly in discussing our aims is this—*Soldier First, Technician Afterwards.*

It is all too true that many officers of our schools and for that matter in our garrisons become so engrossed in the technique of their jobs that the above fundamental maxim goes into the discard. My creed is that for any branch of the service the acquirement of technique is simple when the system of the individual has been impregnated with the fundamental characteristics which must be possessed by a man if he is properly to be called a soldier. Of course technique must be acquired to a certain extent during the acquirement of soldierly qualifications but the latter is the determining factor in considering the worth of the man, be he commissioned or enlisted.

Is he a soldier? That is the paramount question as to his greatest usefulness. If not a soldier all the technique in the world will not avail; if a soldier, with ordinary opportunity he will have acquired ample technique to play an important rôle. This item of soldierly development is considered so important that attention to it is my first duty in the operation of this school. Subordinates look after the technical details—my duty in connection with technique except in the matter of policy is secondary to that outlined above. The creed of the soldier from my point of view is summed up in the following which I am pleased to term his precepts. These will bear close analysis and it will be found that all the cardinal principles are covered. They follow; it will be noted the precepts are ten in number—the parallel is readily appreciated.

THE PRECEPTS OF A SOLDIER

(1) **Be loyal ever. Loyalty is the keystone of the military arch.**
(2) **Salute with a gleam in your eye and a snap in your motions, showing that you take pride in the military appearance of your organization and in yourself as a soldier.**

(3) **Be cheerful always, whatever comes, meet it with a smile. The grumbler is a man to be shunned.**

(4) **Never say "No" when asked if you can accomplish something—the ways and means may not be apparent but you can find them.**

(5) **Be firm and just. Human nature always responds to fairness and firmness.**

(6) **Be courteous always. Courtesy is a foundation stone of both military and civil life.**

(7) **Never discuss nor question orders. Execute them to the best of your ability, with the spirit of accomplishment.**

(8) **Never explain unless directed to do so. If corrected say "Yes, Sir," and conform cheerfully to instructions.**

(9) **Live in peace and charity with the other members of the command. Duty first, self afterwards. He who concentrates on self will never be a soldier.**

(10) **Make yourself appreciate sub-consciously the foregoing precepts. Unless you do and live up to them you are not a soldier.**

Time will not permit the analysis of all these today, some will be considered now; others as the term progresses.

Precept 1. Be loyal ever, loyalty is the keystone of the military arch

Everyone here knows what loyalty means and knows its bearing in the premises. Yet how many preach and practice it continually in their daily lives? Disloyalty may be practiced both in word and in deed and often such word or deed is not meant as a disloyal action. And yet with some men this unintentional disloyalty becomes a habit and passes into a chronic state. How often have you heard dissatisfaction expressed upon receipt of an order? How often criticism of the policy of the Commanding Officer? All disloyal to a greater or less degree. Unswerving loyalty absolutely prohibits such comments and criticism. It is very easy I know and yet very harmful. An extreme instance of loyalty may be cited in the action of a subordinate commander, who announced at a gathering of his officers—"Now you must remember that if the commanding officer says black is white, white it is." This is metaphorical of course but it embodies the idea in a bully manner. Some day each of you will be a commanding officer and then is the time for you to put your ideas into play. Not until you anticipate and carry out in letter and in spirit the orders of your commanding officer is your soul filled with the spirit of loyalty.

Do not confound this idea with one that a subordinate should find out what his commanding officer thinks and then recommend those ideas when he believes them to be wrong. This is not loyalty; until a decision is reached or properly announced a subordinate should give the best in him with a view to the highest efficiency of the command, whether he is or is not in agreement with his commanding officer. But when a de-

cision is made and properly announced there are no two sides to the question. Your loyalty requires you to conform to the decision, independently of all other considerations; and further, it requires such conformity with cheerfulness and determination. The acquirement of the characteristic of disloyalty is well illustrated by the following quotation:

"Vice is a monster of so hideous mien,
To be hated needs but to be seen,
Yet seen too oft, familiar with his face,
We first endure, then pity, then embrace."

Precept 2. Salute with a gleam in your eye and a snap in your motions, showing that you take pride in the military appearance of your organization and in yourself as a soldier

It is my opinion that there is nothing in military life so little understood as the real meaning of the salute. This is true not only of civilians but also of a great many officers themselves. To me it is a feature second to none in developing *esprit;* and in addition the manner of the execution of the salute is a very valuable indication to the commanding officer as to the other items of his command. By the time an organization has reached the point where its members uniformly salute properly, it has reached a good state of efficiency all along the line. This is not an infallible test, but a fine indication of conditions generally. I trust it will not be necessary for me to refer many times to the fact that saluting in accordance with this principle will be a rule in this command, and it will begin today.

The following must be borne in mind constantly—

a. It is incumbent upon a senior to return a salute in as good and as snappy a manner as it is given by the junior. It is quite remarkable that so many officers do not realize the force of this and equally remarkable that in getting the command to a proper state of efficiency as to saluting the greatest trouble has been with senior officers. Now I am the oldest officer of this command and if I can execute a salute with vigor and action the other officers can do the same thing. Even after the emphasis with which I am going into this matter today it will be a long time before you return the salute of enlisted men in the same military manner that you salute me. There is something psychological about this. There will be only a few instances when I am not saluted properly and there will be many instances where I am saluted properly and enlisted men not fifty yards behind will not be saluted properly. This is entirely a subconscious action and I am trying to impress it upon you today in order that this defect may be eliminated at the earliest practicable date. Again I emphasize that the obligation of the salute is reciprocal, except that the junior begins it.

b. The salute should not be perfunctorily performed. A member of the command should experience a thrill of satisfaction when the

junior comes to attention with life and action, and the salute of the senior in return should show that he has experienced such thrill. One of the most satisfying things that I have experienced in my whole service has been the fine rendition of the salute when I have been passing through my area and have appreciated what the rendition of the salute stood for.

c. Salutes are to be rendered in this command without reference to distance and strictly in accordance with orders which have been issued. Copies have been supplied; read them carefully and begin to conform at once.

If you feel that the salute is irksome you have not the spirit of what it means.

Precept 4. Never say No when asked if you can accomplish something. The ways and means may not be apparent but you can find them

This involves the spirit of accomplishment—accomplishment is the crux of every situation. You may not be able to accomplish everything expected of you but if you have 100% spirit of accomplishment you will do things which appeared utterly impossible when first presented.

The spirit of accomplishment will be referred to again as one of the military trinity.

Precept 5. Be courteous always. Courtesy is a foundation stone of both military and civil life

This should be one of the simplest things of life and yet in the military service it is more often violated than any other precept. This violation involves one of the saddest frailties of human nature—lack of consideration for a subordinate. How familiar all of you are with instances of extreme courtesy to superiors always, and terrible discourtesy to subordinates always. This lack of consideration is the most serious defect in the military profession. It is so common that it may be considered a rule rather than an exception and I call upon each of you henceforth to make every effort to overcome this fault. Neither reprove nor punish in anger. Never become excited nor raise the voice in making corrections—very easy to say but very hard to do. It will take much effort and strong determination to overcome this defect but it must be done if you hope to function at anything like your possible efficiency. Many a man has been made by courtesy and likewise many ruined by discourtesy.

Precept 9. Live in peace and charity with the other members of the command. Duty first, self afterwards. He who concentrates on self will never be a soldier

Notice especially the words duty first, self afterwards. Rather reversing matters as viewed by too many men, but fundamental in one

who has dedicated his life to public service and has grasped the idea that success in life is measured by service to others and not by gain to one's self. Working with and helping others involves another member of the military trinity, the spirit of cooperation. This great principle incorporating the idea of team work probably is referred to more often than any other item in modern military literature.

The spirit of cooperation, the spirit of the team, the spirit of service—wonderful conceptions, beautiful ideas, synonymous terms; all standing for what is most worth while in life.

An insight has thus been given into the code of the soldier and we will now proceed to the other items of our Doctrine.

2. Every Officer Shall Be Qualified Better to Shoot a Battery

Hits per gun per minute tells the story in a few words; if you cannot get hits and get them with facility, commanding a battery is no place for you. We will teach you the fundamental principles involved in this matter and how they are applied. This will qualify you to shoot the battery; combine these principles with coolness, common sense, judgment and initiative and you will get hits per gun per minute. This is a pretty large order but all the items enumerated are necessary to make a cracker-jack battery commander.

3. Every Officer Shall Be Qualified Better to Command

The discussion bearing on this will be given under the subsequent discussion of *Command.* At this juncture however it may be stated that this item involves the highest ambition of the soldier, namely—*To Command Men in Battle.*

Many of our officers are wandering from this fundamental principle, too much emphasis being laid upon service on the staff as the true ambition of a soldier. This latter tendency is producing a more or less unfortunate reaction and it may well be stated that it involves the idea of the tail wagging dog. However there is a distinct indication of return to the true gospel that command is the breath of life in the nostrils of the soldier. Knowledge of staff service is necessary to command because the commander exercises his command through the staff. I wish to emphasize at this point that there is only one road to learn how to command and that is by commanding!

4. Every Officer Shall Have Broader Vision and Shall Acquire as Much General Information as Is Possible in the Time Available

One of the most serious deficiencies of officers is lack of vision. In fact breadth of vision and highly detailed technique do not seem to go hand in hand. Too much concentration on technique almost always

produces a narrowing effect and a loss of sense of proportion. You must bear in mind, and fight against it continually.

The acquirement of general information and breadth of vision go together; the former being very conducive to the latter. The general conferences referred to later, general reading, association and interchange of ideas with other officers and civilians are the important factors in broadening vision. Any officer who stays within himself and his technical matters will never rise to the heights of which he is capable.

And now for the last proposition of the doctrine.

5. Every Officer Shall work, Have Recreation, Exercise and Sleep in Proportion to Produce Highest Efficiency

This involves the items which should obtain if possible in the program for every day—and while I advocate recreation in every day's program the fact that work, play, exercise and sleep must be in the proper proportion and in the proper order is the paramount consideration. The slogan is work first and play later; when you work, work hard; and when you play, play hard; and when you sleep, sleep hard; but the work must be given first consideration. It is to be regretted that such is often not the case. Too much emphasis can not be laid upon the importance of getting the necessary exercise and sleep, especially when you work intensively and the major part of the work requires real mental effort.

I cannot too strongly emphasize that the maintenance of good physical condition, through regular and systematic exercise, amounts to more than fifty per cent of the game. No officer, with all the other good qualities in the world, can be depended on to meet a great emergency if he lacks an abundant reserve of physical stamina.

While at the school you should work intensively. As a rule the idea of going to a school is more or less distasteful, but it should not be so. We proceed upon the principle here that the authorities and those of you present in the course are working together to the common end that you and the government shall receive a maximum return for the expense involved in sending you here for the course of instruction. We do not operate in the manner of slave drivers but rather as helpers and guides so that you may obtain maximum results in the time at your disposal.

Minimum requirements are outlined in our programs and schedules, but in completing these you have not done full duty to the government nor to yourself in the event all of your time for work is not occupied on professional matters. Expenditure of the government in sending officers to schools is staggering; you are relieved from all administrative and other duties with organizations and put upon your own responsibility in a manner to profit as much as possible by your work under exceptional conditions. Thus, there is imposed a moral obligation to make the best

use of your opportunities. Remember that this does not mean that you spend all your time on the technical tasks of the course. This latter is most important but as stated above you must take a proper amount of recreation and spend the proper amount of time on matters tending to breadth of vision and acquirement of general knowledge. There is a good library covering professional subjects, and supplied with fiction, and current periodicals. If perchance your allotted tasks do not consume all of your time, take advantage of the opportunity for general reading, an item in which officers in general are very deficient.

Keep in touch with what is going on in the command. One of the principal features of this school is the establishment of standards in the units stationed here as an object lesson to you. Your course involves certain requirements—combine the technique acquired in the course with the conception of what maximum standards of organizations are and your tour not only will have been valuable to you but will have been an important factor in raising the standard of excellence throughout the commands to which you may be assigned upon completion of your school work.

We have certain specified hours for work known as academic hours. And when a particular hour is set it means that hour—not a minute before nor yet a minute after. No specific hours are required for evening work, but Monday, Tuesday, Wednesday and Thursday evenings you are not expected to spend in social and recreational activities. There is no objection to going out to dinner or to the movies but anything in these evenings which makes for late hours or prevents at least two hours attention to matters bearing on your work is strictly taboo; it is not necessary to go further into detail with men of your years and experience.

There are some who think that you should be turned loose absolutely, during the hours not specified as academic but, after years of experience under all systems, I know the present one most nearly meets all conditions and may well be described as working on a man's basis. In no line of endeavor may men be turned loose. Proper guiding with a light rein is a *sine qua non*, for the majority—and a very tight rein for a small minority. We are the people who will tighten the rein as soon as a member of that small minority shows himself. Anyone who wants to be treated as a boy will be accommodated in every way, and I am sorry to say it has been necessary in previous years to put even some captains of considerable service on a boy's basis of reporting in the evening for specific study hours—such cases are getting rarer and rarer and I trust that none of you will be found on the wrong side of the ledger.

License and freedom of action are often confused but if you proceed along the line of my conception you will find all the freedom of action desired by men of highest attainments and highest sensibilities. All

that is necessary is for you to catch the spirit of the place and the spirit of our conceptions.

A few words as to your results. In times past and even now at some educational institutions men are injuring their health in attempting to obtain *fictitious* class standing. A man who does this is lacking in the first requisite of a soldier—common sense. A man in danger of failing who will not take any chance to keep from failing is not worth while. Our rule is this—*An Honest Day's Work every Day!* There is no man who does not know when he has done an honest day's work. If by chance you are bright and get your tasks with much spare time and do not then do some of the other things outlined you have not done an honest day's work. An absolute corollary is this, if you do an honest day's work every day, you will come out in this class exactly in accordance with your talents as compared to the talents of others who are doing the same thing; and, you will come out ahead of those who are not doing their honest day's work every day. No man can ask more of himself; no employer more of his employees. I do not decry class standing but I do decry *fictitious* class standing, and I do decry concentration along certain lines with class standing as the objective.

You will be informed from time to time as to your work and you will be helped to obtain the maximum profit to yourself, helped if you want to be helped, forced if you want to be forced! It is entirely up to you.

You must remember that school courses cannot take proper cognizance of the principal factors in the make up of a commander, namely, leadership, initiative, and similar qualifications. It is not my custom to take the highest scholastic man willynilly for an important job—such attainment simply draws attention to him for further investigation of *all* his characteristics.

The main items controlling our procedure have been outlined, the details you will get from those immediately over you, however one final word—I am always available for information and advice. The man next after yourself most interested in your work is your commanding officer.

II. COMMAND

Early in this talk I have given as the highest ambition of a soldier—"*To Command Men in Battle.*" In attaining this ambition, a man takes unto himself the greatest responsibility which may befall to any man. I make the statement because the commander in battle has a job to perform and his tools are the lives of men. That statement needs neither extension nor elucidation. Now I ask you how many crimes have been committed by incompetent men in command? How many additional crimes have been committed by those who have been a party to putting incompetent men in position of command?

When anyone appreciates fully the foregoing statement of the case it will take no further argument to convince him of his duty in connection with preparing himself against the time when he will be called upon to exercise the responsibilities imposed by the attainment of his ambition. In order to fit himself to accomplish his ultimate duty everyone must appreciate the characteristics necessary in a commander, must know the principles of command and must understand thoroughly the application of those principles.

Although the general principles involved are the same, exercise of a military command in time of peace, differs in many important particulars from similar exercise in time of war, on account of the diametrically opposite conditions under which the command is exercised.

Time will not permit me to note the differentiation but it is important for you to realize this and to bear it in mind in your own development. Suffice it to say that many a man who has been rated high in time of peace has failed signally in time of war, because he has not been able to change his coordinates in applying general principles under war conditions.

The main characteristics of a commander are: Organizing ability, courage, vision, decision, initiative, energy, technique and above all judgment, common sense and the human touch. Some men inherit many of these qualifications and from the beginning are leaders—so called natural leaders. But by appreciation of these characteristics one not so fortunate as to inherit them may acquire them and develop them to a high extent by keeping them constantly in mind. Acquired leadership will never reach the height of natural leadership but nevertheless a very high order of leadership may be obtained with even a moderate foundation, and however fortunate the natural leader may be in his original endowment he will not measure up to the talents given him unless he too strives constantly for his highest development.

Military commands may be divided into three classes:

1. Efficient and unhappy
2. Inefficient and happy
3. Efficient and happy.

The first is that in which the commander has imposed his will by force upon the members of his command, they do his bidding, they accomplish much when his presence is felt; the command disintegrates as soon as his presence disappears. The type of the commander is martinet—the type of the command, discipline with low morale.

The second class is that in which the commander has no will of his own. Everyone is allowed to follow his particular bent. It is only too true that in a majority of cases the ideal of happiness is doing as one pleases. In such a command there will be no coordination, no standards; type of commander easy goer with no force; type of command, poor discipline, good morale.

The third class is that in which the commander has imposed his will in such a way as to cause the members of the command to know and do his bidding with joy in their souls, they do their duty well because they want to do it that way. They think straight, they see straight, and they act straight. The spirit of the commander is felt, whether he is present or not. Type of commander, real leader; type of command, ideal; good discipline, high morale.

Ah, my friends that is the thing to strive for and I repeat you may attain it only by constant endeavor, by preaching and practicing the precepts of the soldier, and by applying the fundamentals of command, daily keeping in the foreground common sense and the human touch.

Of course efficiency involves technique and while I do not belittle technique I must impress upon you again that straight thinking, straight seeing, and straight acting, come first.

All the principles of command and responsibilities attached thereto apply to every unit from the Army down to the smallest group of the military establishment. The degree of application varies of course with the size of the unit but I will make no differentiation for the principles must be a part of every commander's being and the application made as the circumstances demand.

You may have noted that I mentioned first organizing ability. I do not mean that it is the most important characteristic of a leader but I do think that it is so important that it should be discussed first.

You will hear from me in the course of the term reiteration of this fact to the *nth* power; namely organization is the basis of success in any undertaking. Everyone knows this fundamental principle of life but how few really apply it always. Many of our maxims involve the idea of organization. Preparation of work for the event is organizing; arranging in a logical and systematic order the items of a speech is organizing. Organization is nothing more or less than the systematic arrangement of several parts so that they will work together as a unit.

I will not refer further to the other characteristics mentioned but the question of decision needs additional comment. Being able to arrive at a correct decision with more or less indefinite data is a wonderful characteristic, and being able to do so quickly is not a secondary consideration. I must warn you however, that having arrived at a decision you must not stick to it through thick and thin; many a man has gone on the rocks because he would not change a decision which was wrong. Next in impossibility to the vacillating man who will not decide and having decided is always changing his mind is the one who never makes a mistake. Recognize and correct your own errors in exactly the same manner that you do those of your subordinates. Few items of command make so much for satisfaction to subordinates as that of prompt decision.

Just a few words as to the human touch. This is the controlling factor in the development of morale. As soon as the members of a command get the idea that the commanding officer is for them, first, last, and all the time, the response is electrical. This does not mean coddling, overlooking faults and similar things; it means requiring exact conformity to rules and regulations, dispensing rewards and punishments in accordance with the performance of individuals, along with the evident interest in the welfare and happiness of each and every member of the command. Every day opportunity of one kind or another is presented for doing some good for some one of the command. Never fail to take advantage of such opportunity. Now I put in italics a fundamental rule of action. *Never Overlook an Opportunity to Commend; Never Fail to Give Admonition when Admonition is Necessary.* There is no one rule of procedure which makes more for efficiency and contentment.

There is much more I might say in elaboration of some of the ideas presented today but I will make such elaboration from time to time at our general conferences.

I will give you now a definition for power to command which I consider the best I have ever heard: I found it in the *Journal of the Royal Artillery* before the world war; it is this:

Character + Determination + Tact = Power to Command.

Analyze this and you will find the terms of that equation involve the characteristics enumerated and discussed earlier in this talk.

In conclusion I will enunciate what I am pleased to call the military trinity—in which is included the essence of the talk today:

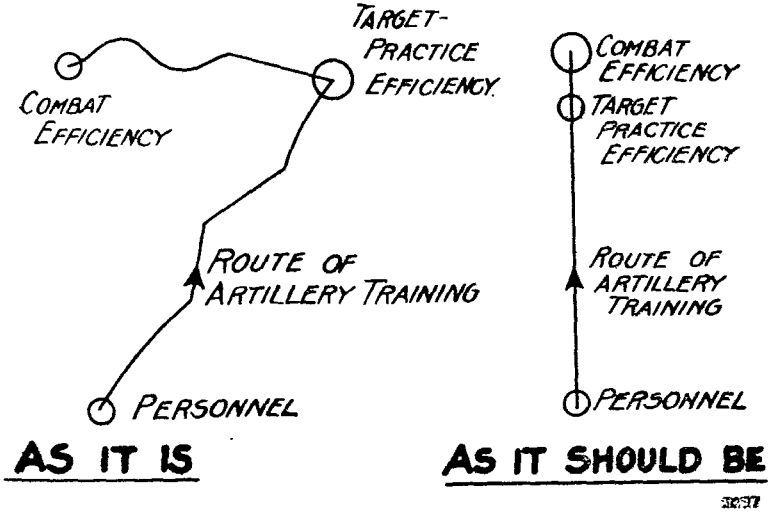
The Spirit of Organization, The Spirit of Accomplishment, The Spirit of The Service.

I consider so important an appreciation of these wonderful conceptions that if I accomplish nothing else as your commandant than impressing their full meaning on you, my service will not have been in vain.

Second Prize, Essay Competition, 1922

Notes on Target Practice Methods

By Captain Herbert H. Blackwell, C. A. C.



THE above illustration may or may not present the true conditions. The purpose of this picture in the beginning is to show the attitude of the writer in what is to follow. Fire control consists of two problems; first, to reduce dispersion to a minimum, and second, to keep the center of the zone of dispersion on the target. The notes that follow concern the latter problem as applied to moving targets.

I. TIME OF FLIGHT

In the use of Case III on moving targets it is essential that the gun be fired at a predetermined time for which the data has been computed and set. The method in general use provides for the computation of the travel during time of flight in the plotting room, so that the gun may be fired on uniform time intervals. It would appear to be more practicable for the plotter to adopt a uniform prediction for his set-forward point so that the splash will occur on a uniform time interval.

Since the gun commander has to fire his gun on a predetermined time in either case; using a time of flight table, he could just as easily fire at the proper time to place the time of impact on the set-forward point. It is believed that time can be more accurately measured from a stop-watch than distance corresponding to time can be measured on the plotting ruler.

This simple change has no apparent disadvantages, yet it should prove more accurate, will greatly simplify the plotting, and will furnish the plotter with a positive check on his predictions of the set-forward point, which should coincide with a subsequent plotted point. Having the splash occur on the bell should also facilitate spotting. This in itself is rather a minor point, but taken into consideration with what is to follow is very essential.

II. SYSTEM OF PREDICTION AND SPOTTING

The following is a brief description of a proposed method of plotting and spotting, whereby both can be done by the same range section.

The plotter plots only the actual successive positions of the target, the predictions for the set-forward point being made on the time-range and time-azimuth boards, respectively. This is considerably facilitated by having the set-forward point on an even time interval as stated above. It will only be necessary to extend the curve in either case to intersect the proper time interval line. No measurements are necessary. Two extra observers are to be used, one in each observing station, with azimuth instruments to read on the splash, which will occur on the bell. Immediately after the data for the plotted point (which will be the position of target at instant of splash) is sent to the plotting room the extra observers will send in the readings on the splash. The plotter under this system has ample time to plot the splash, its range and azimuth being plotted on the proper time interval line on the time-range and time-azimuth boards. The time-range board operator will now have on the same time interval line, plotted in their respective relations to each other, the set-forward point, the plotted point at instant of splash, and the splash. He will be able, therefore, to apply immediately the proper adjustment correction. The same is true for the time-azimuth board.

In the above connection it is interesting to note that adjustment can be made with equal facility on either the deviation of the splash from the target or on the deviation of the splash from the set-forward point. This feature is much more important than it would appear from the records of our target practices, which are fired on straight courses of uniform speed. If this statement is doubted estimate the consequences of attempting to apply deflection corrections on a target traveling at five hundred yards per minute on a zig-zag course, where a two-minute prediction is required.

III. A TARGETLESS TARGET PRACTICE

Why is it necessary to have a visible target in firing in case III?

First; it is necessary in order that the observers may take part in the practice. But observers are usually removed from the battery firing and, therefore, their training is not much different during target practice from their usual routine. Then, too, the observers will be able to see the splash and can thereby get valuable training in spotting.

Second; it is necessary for airplane spotting. But that is a part of the training of the Air Service. The Coast Artillery should train to do its own spotting.

Third; it is necessary in order to obtain camera deviations. But haven't we enough observing instruments to plot a splash accurately, which remains in plain view for a considerable length of time?

Fourth; it is necessary from the standpoint of the spectator. But we have no need for trained spectators.

Is it necessary for the organization firing? If we do not gain a great deal by its use, can we profit by its absence?

Suppose we used, instead of a visible target, a predetermined hypothetical course. This course could be made of any desired speed, direction, or variations therefrom. It could be any course that the enemy may be expected to follow, or as many such courses running simultaneously as desired. They could represent a possible attack of an entire enemy fleet. Our target practices could be conducted under conditions which would approach very nearly to combat conditions. One hundred per cent flexibility in our problems would be obtained. It is an obvious fact that in order for an enemy ship ever to get within range of our guns it has first to advance, yet we never have any practice on an advancing ship. It is an equally obvious fact that an enemy ship will not take an absolutely straight course in the face of destructive gun fire, yet all of our target practices have been fired on practically straight courses. Are these zig-zag courses too difficult for us in practice? Then what will we do in combat?

Besides the advantage of flexibility, which should be given much more elaboration than has been attempted, there are other evident advantages of this method. It would tend to increase the morale of the personnel, be less expensive, be more convenient, and should greatly relieve the routine and drudgery, which accompanies our target practices. Since the expenditure of ammunition limits our major calibre practices, real combat problems, involving fire and fort commands, using sub-calibre ammunition should become of primary importance.

Have we a mill-stone around our necks?

IV. METHOD OF ADJUSTMENT

Without any comments on the methods of adjustment now in use,

a brief discussion will be had of the underlying principles of any correct method of adjustment.

The laws of probability and the method of least squares as deduced therefrom have been a subject of considerable importance since the eighteenth century. And the application of the theories and formulae derived therefrom have been very valuable in the measurement of unknown quantities. It is believed, however, that a distinction should be made between the *Law of Probabilities* and the *Method of Least Squares*, the former is fundamental and is derived by a synthetic process of observation upon happenings of nature, and the latter is a deduction from an analysis of the former. As stated above the method of least squares has been very valuable in obtaining values for *unknown quantities*, and in all discussions on the subject this is admittedly the purpose of its existence.

However, in adjustment of artillery fire it is not of primary importance to learn the value of an unknown quantity, but what is of primary importance is that each shot that is fired will have the best probability of hitting the target. The fundamental law of probability, independent of the method of least squares, provides that the average or arithmetical mean be employed for the determination of the most probable value of a quantity observed several times with equal care. This applied to adjustment of artillery fire means that the average of the corrected deviations of previous shots fired in any particular series furnishes the best probable data on which to fire a succeeding shot. This, of course, is Whistler's Rule, and is obviously correct where there is no constant error introduced.

To revert to the statement that we are not primarily interested in finding a value for an unknown quantity; this unknown quantity is the true center of impact. Since our method of measuring (by firing a series of shots) is very inaccurate, we can never hope to determine this value with a great degree of accuracy. According to the method of least squares if we were to fire one hundred shots under identical conditions, (which is an impossibility) each with a probable error of one hundred yards, the center of impact of this group will still have a possible error of from forty to fifty yards. In order to double this precision we would have to fire four times as many shots. From this it will appear that our search for a true center of impact in a single finite series of shots is hopeless. It is believed that this hopeless chase has led us astray.

We are used to considering *true center* of *impact* and *errors*, when we should be considering *arithmetic mean*, and *residuals*. The latter have the same relation to a finite series as the former have to an infinite quantity.

Since in practice the infinite is impossible we should, in practice, discard the use of true center of impact and errors referred thereto.

The statement is reiterated that we are not primarily concerned with the determination of the true center of impact. We can also add that we are not primarily concerned with the accuracy arrived at on the conclusion of a series. But what is of primary importance is that every shot in the series be fired with the best probability of hitting. Does not the law of probability provide an absolute means whereby this can be done?

The following is quoted from *Method of Least Squares* by Mansfield Merriman, Prof. of Civil Engineering, Lehigh University:

"Art.-27-The average or arithmetical mean has always been accepted and used as the best rule for combining direct observations of equal precision upon one and the same quantity. This universal acceptance may be regarded as sufficient to justify the axiom that it gives the most probable value,---for after all as Laplace has said, the theory or probability is nothing but common sense reduced to calculation. If the measurements be but two in number, the arithmetical mean is undoubtedly the most probable value; and for a greater number, mankind, from the remotest antiquity, has been accustomed to regard it as such.

It is characteristic of the arithmetical mean that it renders the algebraic sum of the residual errors zero."

This last statement which is italicised seems to furnish a key for a correct method of adjustment. Let us assume that each time we fire a shot that we fire it on the absolutely correct data. We will of course fire each shot on the most probable data, therefore, the error of the above assumption will be less than the error of any other assumption that we could make. This assumption then has the greatest probability of being the correct one. After the shot is fired and the deviation is known, let us treat this deviation as a residual error. As each succeeding shot is fired their deviations, considered as residual errors, will be added algebraically. If our assumption that the data used are the correct data be true, then the algebraic sum of our residuals will be held within minimum limits. Should the algebraic sum of the residuals increase beyond certain limits either positive or negative then make a new assumption of correct data, the correction being such that had it been applied to the previous shots, would have resulted in the sum of the residuals being zero. To make our adjustment perfect we would of course have to make a correction after each shot such as to render the sum of our residuals zero. This is what Whistler's Rule does. But since errors have a decided tendency to compensate, it undoubtedly would be more practicable, and nearly as accurate, to fix some limits for the sum of the residuals, and make a reasonable correction thereon, in order to eliminate too many small corrections which may be compensating. This method will at least furnish the artilleryman with *positive* information on the reported deviation of any shot, of whether his center of impact, as developed, is over or short of the target, and in each case how much over or short. With this positive information of

the whereabouts of the center of impact, it should be a comparatively simple matter to control it. There is only one law of probabilities, why should there be more than one method of adjustment?

In the discussion so far the method of least squares and the probable error as derived thereby have had no particular importance; however, valuable use can be made of this theory of probability. For example, in our present method of adjusting by Whistler's Rule we carefully compute the ballistic data for the first shot to be fired, and as carelessly discard these data as soon as the deviation of the first shot is known. We know the probability factor of the shot, and there is no reason why we cannot determine the probability factor of our computed data. Should the probability factor of the computed data equal the probability factor of the first shot, then we should give the two equal weight, and accordingly a correction of one half the deviation should be made. Again should we find that the probability factor of the computed data be one half that of the shot then we should give the computed data the weight of 4 to 1 as compared with the shot, or correct by one fifth of the deviation of the first shot. It is the conviction of the writer that this latter condition is more nearly true. Let us assume that our probable error for a shot is 100 yards, this will give us a dispersion of 800 yards. We compute our ballistic correction from all known conditions which might cause a constant error, say for a range of 15,000 yards. It seems reasonable to assume that we at least correct for the major portion of the conditions which may produce a constant error, and if this major portion provides for a correction of say 400 yards, it may be assumed that the unknown conditions which could not be accounted for will cause a less error than is contemplated for the major portion which can be measured. Then if our maximum error (which has to be a constant error) is less than 400 yards, the probable error will be less than 100 yards. There is no reason why this important relation should not be determined, and valuable use made of it in our adjustments. No doubt the prescribed methods of adjustments as stated in Coast Artillery Memorandum No. 4, would have a more practical application if a distinction were made therein between the *probable error* of a *single shot* and the *probable error* of a *salvo center of impact* of two or more shots.

Again we could make use of the method of least squares in determining the probability factor of our previous firings so that we may assign their appropriate weight in the determination of new data. Evidently a great field exists for the application of this method to the adjustment of artillery fire. This entire subject is believed to be equally as vital to the artilleryman as the subject of Ballistics.

To prove the practical application of this "Most Probable" method of adjustment a great many problems have been used, including "hit bag" problems and deviations from actual firings. To give the results

in detail of these experiments, showing the comparisons of the various methods of adjustment against this method would take up entirely too much space for these notes, which are intended merely to indicate certain possibilities. However, the results of these experiments indicate the following conclusions:

1. That this method by virtue of itself is the most accurate method of adjustment, and that the relative effectiveness of any other method is in direct proportion to the extent of its use of this fundamental method.

2. That certain more or less arbitrary rules can be laid down in its application which will considerably simplify its practical use without disturbing its relative accuracy; it being especially adaptable to a graphic chart whereby each deviation is plotted as referred to the preceding deviation, and the algebraic sum thereby automatically carried forward successively, the limits of which may be represented by lines drawn on each side of the chart an equal distance from the center. Whenever a correction is applied this sum of the residuals should be reduced to zero. The amount of correction to be applied should in general be equal to the algebraic sum divided by the number of shots fired since the next preceding correction. This latter may be simplified by adopting a maximum and a minimum correction to be applied, and by adopting a convenient unit for intermediate corrections.

3. That the greatest possible future use of this method lies in the fact that it is peculiarly adapted for use in connection with the time-range board, and means can easily be devised whereby a mechanical device placed on the T-square of the time range board, on which may be set the deviation of each shot, will automatically take care of the correction for each shot, and the true corrected range may be immediately called off to the gun. These corrections being absorbed rather than applied, the impracticability of applying small corrections after each shot is, therefore, removed. A number of problems were worked out whereby the time-range board operator received the corrected range from the plotting room for the first two or three readings only, these data being used to indicate the probable curve of ballistic ranges on which prediction was made for the first shot. Thereafter the range section did the spotting only and the time-range board operator continued his ballistic curve on the strength of deviations reported, furnishing the corrected ranges to the gun. It was found that perfect adjustment could be maintained as long as the firing continued. This ballistic curve responds to any constant changes due to changing conditions of atmosphere or travel, and makes it possible to predict ballistic ranges which have the greatest probability of obtaining hits. Should the firing be suspended, then the range section, having no spotting to do, will be able to give the data to the time-range board for continuing the ballistic range curve. This means that it is not only possible but very practicable to maintain fire for effect on a moving target under

any changing conditions without any fire control system other than a spotting system. An observation balloon alone should furnish an effective fire control for any battery.

4. These experiments show further that a rather crude system of spotting can be used without any appreciable effect on the accuracy of the results. For all practical purposes the deviations may be known only to the nearest probable error, and in problems where only the sense of the deviations are known, by assigning an average weight of say one probable error, either positive or negative, to each deviation very satisfactory results were obtained. This establishes our ballistic curve in such a manner as to equalize the shorts and overs.

5. That this method gives a positive and continuous analysis of any problem, at any time during the conduct of the problem, and renders a "post mortem" analysis superfluous.

All that has been said concerning range adjustment applies equally as well to deflection adjustment. These discussions and the conclusions therefrom are intended only to be of a tentative nature. It is hoped that more extensive investigation and experiment will be conducted along this line in order to prove or disprove these contentions. The above notes are therefore, presented not so much for what value, if any, they may contain, as for what possibilities they may indicate.

Long Range Firing with Rectangular Coordinates

By Captain Stanley R. Mickelson, C. A. C.

IN pursuance of the problem of fire direction for long range conditions, the following system was developed and tested in the Coast Defenses of Long Island Sound with promising results. Certain interesting departures from the standard method of obtaining firing data and spotting were involved, i.e.:

(a) Central Plotting System.
(b) Rectangular Coordinates.
(c) Improvised plotting board.
(d) Improvised data scale.
(e) Spotting, by an experimental method.

The results obtained in an experimental firing of Battery Stoneman (12-inch Mortars), Fort Terry, appear to justify an outline of the system with a view to further development. The test was elementary. No effort was made for speed but rather a methodical analysis of the system as a whole. Theoretically, neither the target nor the fall of shots were at any time visible to the battery personnel. Observation from the battery was carried on only as a safety precaution.

CENTRAL PLOTTING SYSTEM

An article on the use of rectangular coordinates for long range firing by Colonel R. S. Abernethy, appeared in the March, 1922, number of the JOURNAL. This article included a discussion of a central plotting system. A mere summary of this method of locating a target and transmitting its location to the interested batteries will be given here. The plan involves the centralizing and pooling of all base end stations within a Fort or Coast Defense Command. A greater number of base lines is thereby created which in turn makes for greater freedom in the selection of a base line best adapted to the problem in hand. If it were possible to use any two base end stations in a Fort (or Coast Defense if compact) in the plotting of targets in certain areas, the accuracy and facility that might be gained are apparent. The plan of centralizing the system of locating targets fosters the specializing of men for an important duty.

The function of the Central Plotting System is to determine periodically the position of any target and to transmit that data to the battery or batteries selected for use against the objective. It is recognized that

there should be as many base lines available for the central plotting system as there are targets.

In the test firing held at Fort Terry, N. Y., the central plotting station was located at Fort H. G. Wright, a distance of some 16,000 yards from the battery. A base line of about 12,000 yards was chosen (Fort Michie to Fort Wright). It may be noted that the target was at times practically on the prolongation of the battery's standard base line and consequently, with the use of standard facilities, action by that battery on that target would have been precluded. The central plotting system used a 360° plotting board with an oriented grid superimposed and transmitted the position of the target in terms of rectangular coordinates to the battery at Fort Terry.

RECTANGULAR COORDINATES

The above-mentioned article in the March, 1922, number of the JOURNAL treated the adaptability of rectangular coordinates to the determination and transmission of positions of moving targets. The merits of rectangular coordinates in this connection may be summarized as:

(a) Universal application. The rectangular coordinates of a target establish its position exactly for any battery, whereas, the range and azimuth of a target are good for but one directing point and necessitates relocating if desired to be used by another battery.

(b) Facilitates prediction. The X coordinate and Y coordinate may be predicted independently without the introduction of an error, while the prediction of the range and azimuth, independently, produces an inherent error due to the existence of a second difference (except where target is traveling in a circle around the battery or on a line radiating from the battery). This factor of errorless independent prediction eliminates the necessity for a plotting board.

(c) Offers solution of spotting problem: The coordinates of the set-forward point being available and the coordinates of the splash being easily determinable, the relation between the two gives an accurate sensing of the shot. The most desirable feature of the use of rectangular coordinates in spotting lies in the fact that the sensing so obtained is the deviation from the set-forward point (the point aimed at) and not the target, which may be considerably off the set-forward point.

IMPROVISED PLOTTING BOARD

While the regular plotting board might have been used by removing all arms except the gun arm, it was believed that the small scale of the board would have imposed unnecessary strain on the plotter and men who set the coordinates for the periodic determination of the position of the target. It was considered advisable, therefor, to construct a new plotting board of a larger scale (1 in. = 100 yards) having several in-

novations. A sketch of this board and the entire equipment used in its operation is shown in Fig. 1. This sketch represents only one section of the field of fire. The maze of lines shown was clarified by the use of colored inks. The bold rectangular lines represent the 1000 yard

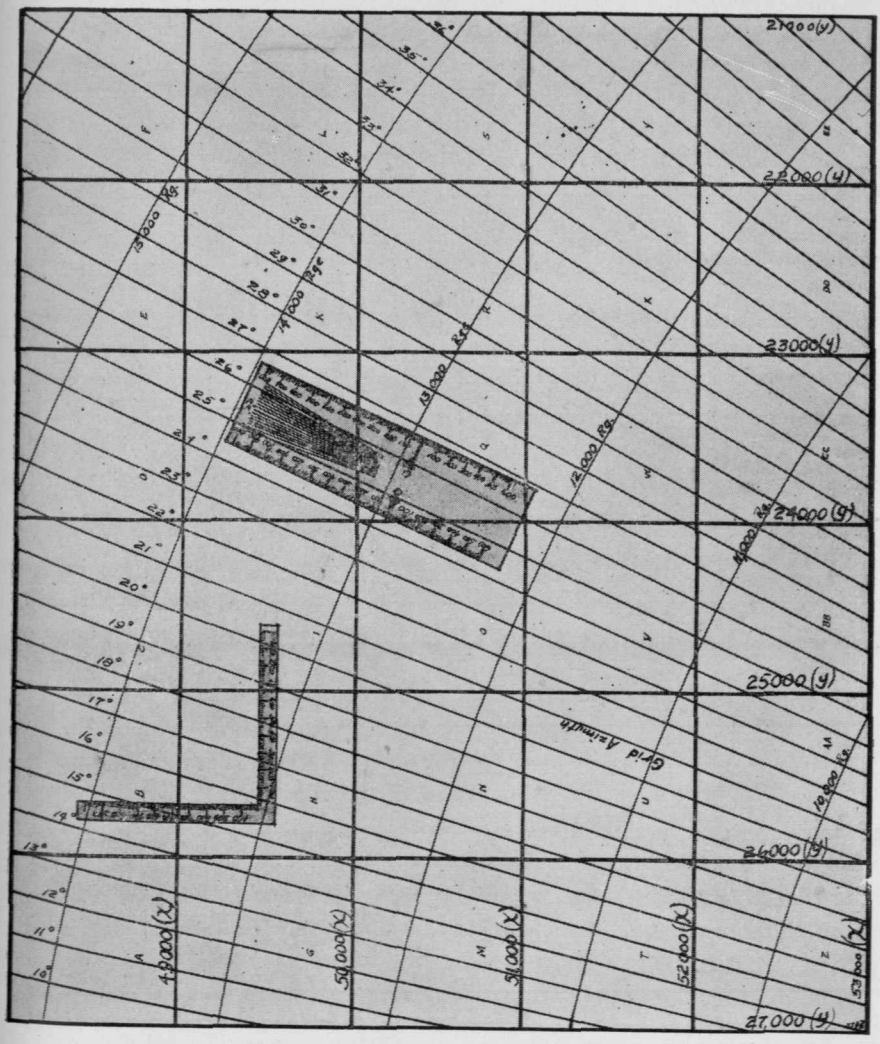


FIG. 1.

iso-coordinates (grid); the lighter radial lines represent even degrees of azimuth from the directing point and the arcs the even thousands of yards range from the directing point.

The position of the target was relocated on the board from the rectangular coordinates furnished by the central plotting system at

Ft. H. G. Wright. The usual L shaped scale shown in Fig. 1, was used in this operation.

Data Scale

The process of predicting was carried on by means of a prediction scale which was constructed on the long edges of the device shown in the center of Fig. 1, and on a larger scale in Fig. 2. This scale which we shall call for convenience the "Data Scale" was required in obtaining the range and azimuth of the set-forward point (and azimuth of predicted point) from the arcs and radial lines on the plotting board. It was made of celluloid.

The range was read on the scale on the side of the "Data Scale" by placing the zero index on the proper range arc, with said edge approximately on a radial line, and adding the number of yards from the arc to the set-forward point to that of the range arc.

The evaluation of the azimuth of the set-forward point required some device for determining the exact location of said point with relation to the two radial lines (even degrees of azimuth) between which it fell. This was accomplished through the use of the fan shaped diagram superimposed on the data scale. This "fan" diagram consisted of 21 radial lines forming 20 equal segments.

Consulting Figure 2 it will be seen that if the "fan" diagram is superimposed on the board in such a way that the two outer lines intersect the radial lines at the intersecting points of a chord passing through the set-forward point and, further, that the center line (or, .50 degree line) is placed radially from the directing point, the chord is divided into 20 equal parts (.05° each) and the hundredths of a degree may be read. In the illustration the azimuth of the set-forward point is 25.23°. The two scales on the "Data Scale" are identical. They enable the plotter to predict with equal ease when target is going in either direction. It may appear difficult to place the data scale properly and quickly, but this manipulation proved to be remarkably simple. During the practice the plotter and his assistants worked as rapidly and more accurately than the average range section on the 360° board. The replot of the target practice course showed that but one personnel error had been made by the plotting board personnel and that of but 10 yards. A considerable degree of that accuracy may be attributed to the large scale of the board. The combining of three required devices on the "Data Scale," namely, prediction, range, and azimuth scales resulted in increased speed and facility in handling.

In practice this board may be made up in fitted sections or according to the plan shown in Figure 3.

This latter method offers 360° field of fire on one chart which may be unrolled from one truncated cone over a table onto another as desired.

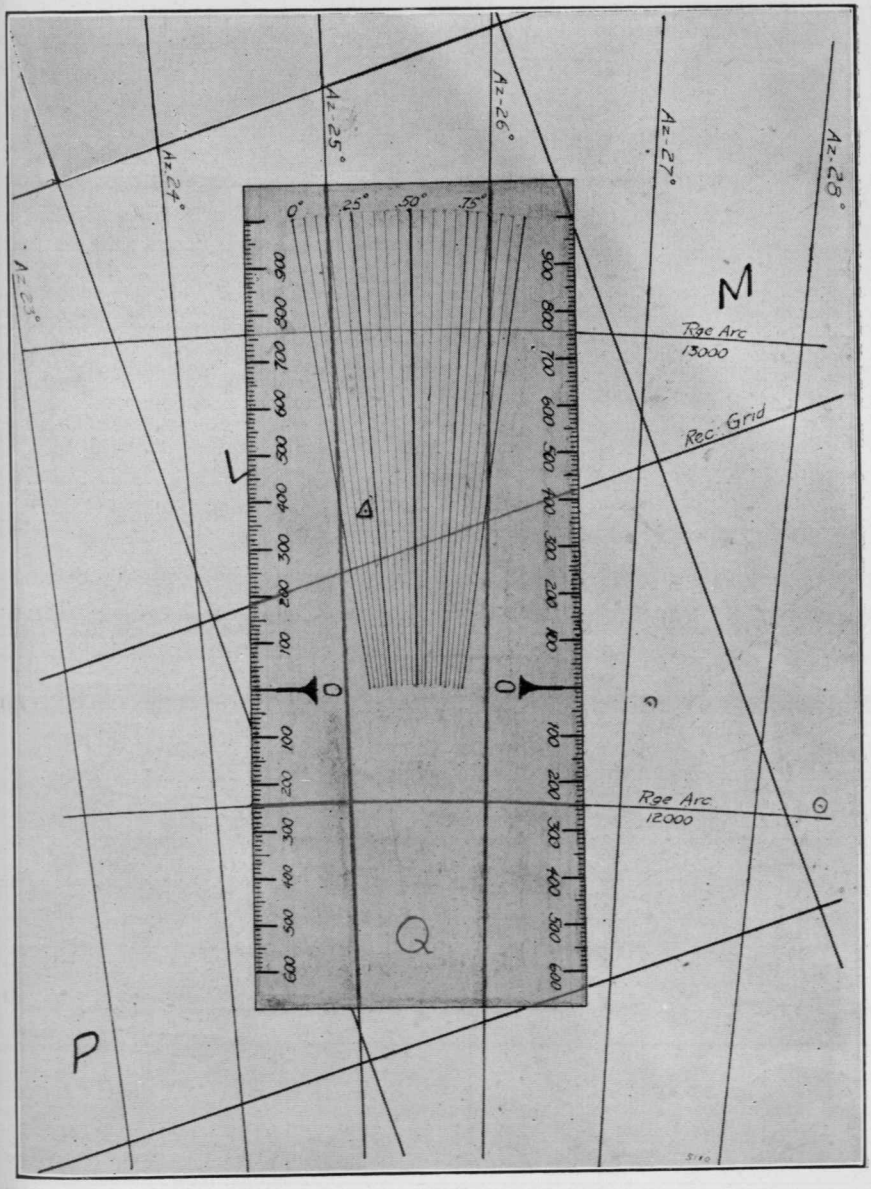

Az-23°
Az-24°
Az-25°
Az-26°
Az-27°
Az-28°
0°
25°
50°
75°
Rge Arc
13000
Rec. Grid
Rge Arc
12000
P
Q
M
L
N
O

FIG. 2.

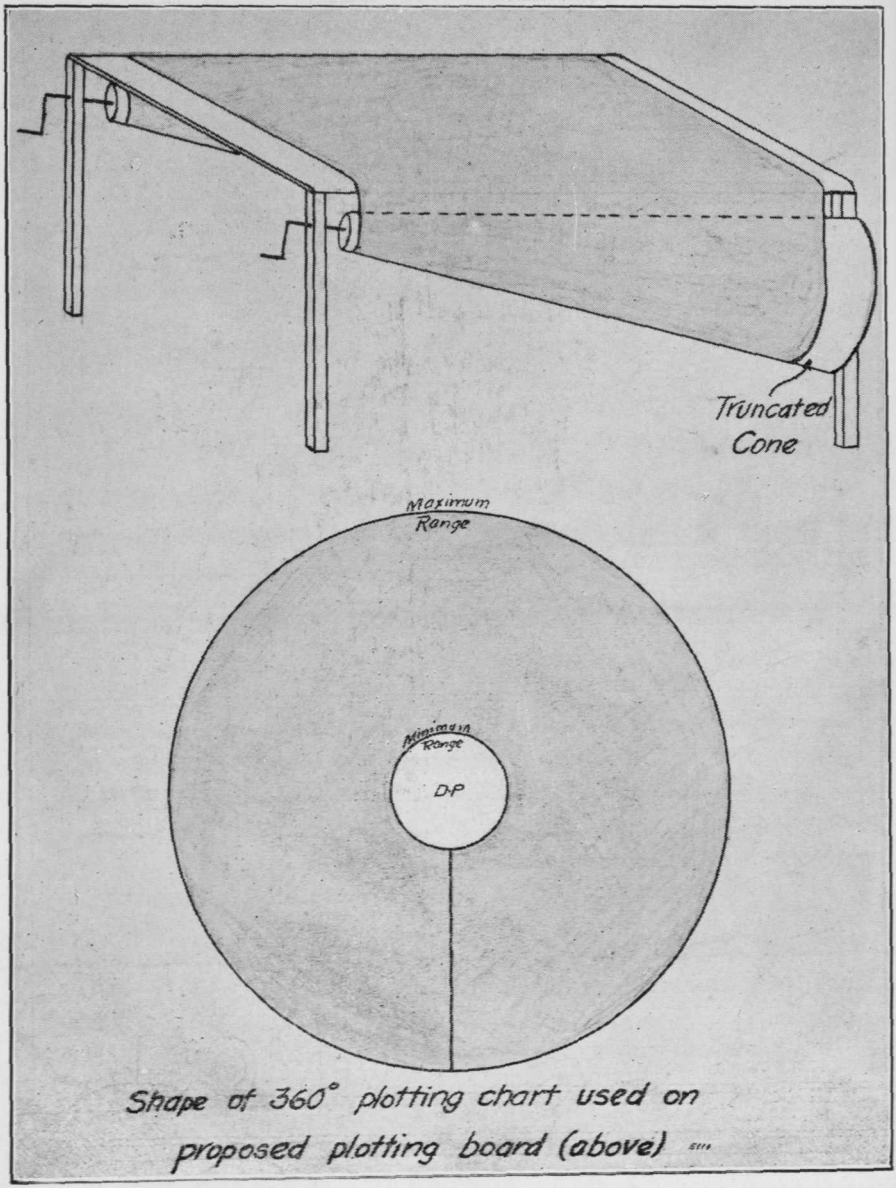

Truncated Cone
Maximum Range
Minimum Range
D-P
Shape of 360° plotting chart used on proposed plotting board (above)

FIG. 3.

SPOTTING

The development and status of the method of spotting will not be discussed in this article except in so far as it concerns the practice. It must be claimed without reservation that this method of spotting is in its present development a success as a medium for spotting for all mortar firing and for long range gun fire. The discussion of the method used would require an involved treatise. Consequently the discussion on the

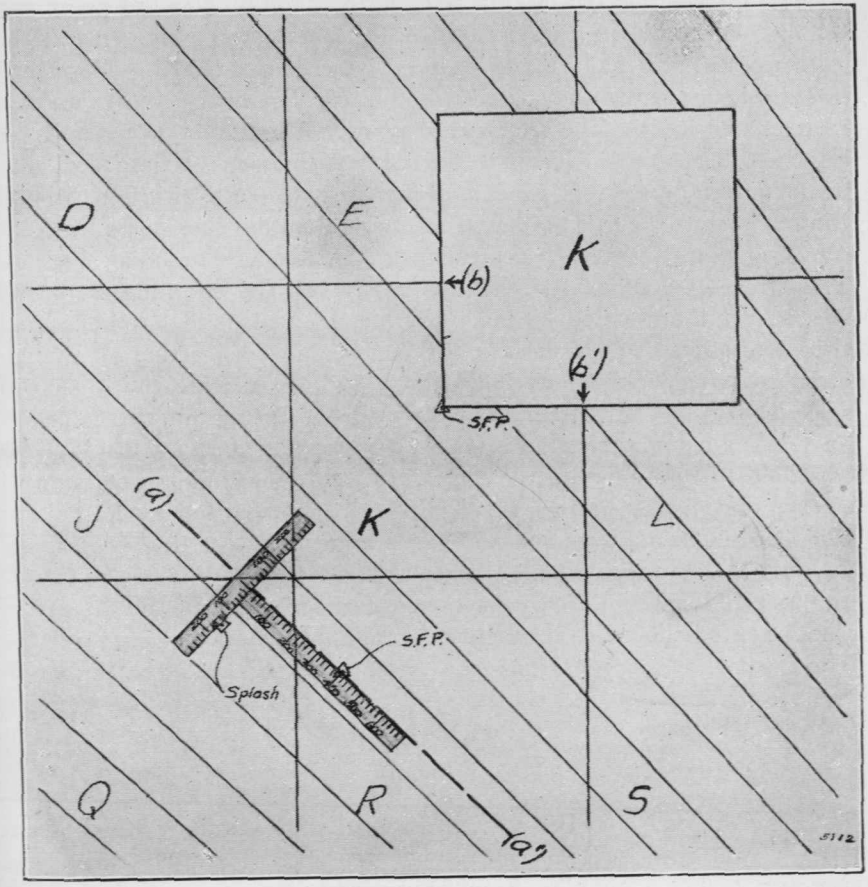


FIG. 4.

matter of spotting will touch only upon the data received from the spotting section, and not upon the manner in which this section arrived at these data. Approximately one to three minutes after the fall of a shot the battery was furnished with the coordinates of the splash. A method was necessary, therefore, to find the lateral and longitudinal relationship between the coordinates of the splash and those of the set-forward point. The problem was solved in this manner. A replica of

the plotting board was used by the spotter. He was furnished with the location of the set-forward point aimed at. This was done graphically. After the set-forward point was located on the plotting board, and its data transmitted to the operator of the range board and azimuth correction board, a sheet of card-board ten inches square (the size of the grid) was placed on the plotting board in such a way that the edges were parallel to the grid lines and its corner fell on the set-forward point. See Fig. 4.

The intersection of the grid lines nearest the set-forward point and the two edges of the card-board were marked (b–b′, Fig. 4) and the letter of the grid square was written on the card-board. This card-board was handed to the spotter who placed it on his board in the same manner and located the set-forward point. This method obviated the disconcerting noise incident to verbal transmission of data and also made for fewer errors. By means of parallel rulers he drew a line through the set-forward point parallel to the nearest radial line (azimuth from directing point), this line representing the line of fire (a a′, Fig. 4). This procedure completed, he was ready for the coordinates of the splash from the spotting station. Having received these data he located the coordinates of the splash in the same manner as setting off the coordinates of plotted points in plotting, and, by placing the T shaped scale shown in Fig. 4 in such a way that the long graduated edge lay on the line of fire while the other fell on the position of the splash, he was able to read off directly the lateral and longitudinal deviation of the shot from the set-forward point. The sensing of the example in Fig. 4 is 400 yards over and 150 yards left. The fact that the experimental method of spotting lends itself readily to determining the lateral and longitudinal deviation from the set-forward point rather than from the target is believed to be one of the most important incidental merits. The rules of adjustment demand that the deviation used be the longitudinal distance between the splash and the point for which the gun is laid. The target is rarely on the point for which the gun was laid.

CONCLUSIONS

In conclusion it may be said that the result of the entire test developed:

1. That the use of a central plotting system for long range fire direction makes available a number of otherwise unprovided base lines, the best suited of which may be selected for the problem in hand. Through the development of special apparatus (slide rules, mechanical or electrical predictors, etc.) for determining the firing data from the rectangular coordinates furnished by the central plotting system it is believed that work in the plotting room may be made simpler and as a result more dependable.

2. That the improvised plotting board and the equipment incident to its operation lends itself readily to the use of rectangular coordinates.

It was more accurate than the 360° plotting board due to its larger scale and the fact that inherent shrinkage or stretching of paper containing grids on the latter board destroys accurate location of grid lines, while on the improvised board the range arcs and azimuth lines shrank or stretched with the paper. It was remarkably simple in operation.

Training for the Try-out

By Captain Wade W. Rhein, C. A. C., Team Coach,
C. A. C. Rifle Team, 1922

WITH the opening of the spring practice the rifle enthusiast begins to show unmistakable signs of the "trigger finger itch." After each year's try-out you hear the same old resolutions, "Never again," but somehow the new year brings forth the same old nuts, the same reunion of some of the old timers, and the introduction of a score of new faces.

The purpose of this annual try-out is to pick from among the competitors, the most promising timber for a representative team in the National Team Match. It is expected that these competitors will have had preliminary work outs on their home ranges, but every year many who report have fired but a few rounds, and the great majority have not fired at distances greater than 300 yards. This latter of course is due to the lack of longer ranges, but can be overcome to a great extent by the application of *Dry Shooting* and other training methods which I will try to make clear.

It is a well known fact that few Coast Defenses have ranges greater than 300 yards. This condition is a disadvantage, but not nearly as serious as it would seem inasmuch as it may be overcome by application of the proper training methods. Of course, one cannot do as well without long range practice as with it, but he can get wonderful results by applying first, the dry shooting practice, and then, a system of intensive training on the 200 and 300 yard ranges.

Dry Shooting, to the novice, simply means pulling the trigger on an empty chamber, but to the experienced shot it means everything that the same kind of shooting would mean in the biggest match of the season. I wish to make myself clear because it is the utmost of importance that this practice be carried on with the earnestness of the most careful shooting. One's active mind must not be hampered with having to think out the minute details as these must come naturally, in proper sequence and without effort. Dry shooting will develop this precision.

There has been much discussion on this subject and I believe that the majority will agree with me that it is a most valuable method of training. It has been my experience that, with proper coaching, a moderately good shot who will consistently drill dry shooting every day

for six or eight weeks before the outdoor period, can go on the range and qualify as expert rifleman with very little difficulty. He acquires self confidence and comes to the try-out well prepared to take advantage of the intensive training which he has to undergo.

The best example of the value of dry shooting is to be found in the record made by Sergeant Otto Bentz, Coast Artillery Team for 1922. Sergeant Bentz was also a member of the squad at the National Matches in 1921, but did not make the final line-up. At that time he was a left hand shooter, quite a handicap, especially at rapid fire. Sergeant Bentz realized this and determined to switch over. All during the indoor period following the 1921 match, Sergeant Bentz practiced dry shooting in the squad room; he mastered the right hand operation of the bolt, and came to the try-out in 1922 shooting from the right shoulder. His shooting at the National Matches helped to put the Coast Artillery Team on the map, for not only did he make the team, but he won the National Individual Match against all comers; a most remarkable performance.

You may ask where you are to get this "proper coaching." The answer is: detail for this purpose the officers and men who have attended the try-outs. The Coast Artillery Corps has entered a team in the National Matches every year since 1919 and the officers and men who composed these teams are scattered throughout the Coast Defenses of the United States and the Insular Possessions and are qualified to carry on this instruction. At last year's try-out, one day was set aside to fire the Infantry Qualification Course and the 56 competitors fired through the course, all qualifying as Expert Riflemen. This shoot was held after about thirty days of practice and is an example of what can be accomplished by consistent daily practice. Incidentally, these 56 competitors will be awarded the qualification of Expert Rifleman, by Bulletin No. 1, W.D. 1923, a reward for their hard work. This should be an inducement to future candidates for it is probably the only way in which a Coast Artilleryman may qualify as expert on the infantry course unless he attend the National Matches.

Dry Shooting should be accompanied with all the precision of outdoor practice; every motion that one would actually make were he firing in the most important match of the season should be simulated; and nothing should be slighted, as it would be better not to fire at all than to do it in a haphazard manner. In the individual application of the program laid down here let us assume that the shooter has a thorough knowledge of the rifle and how to use it, as laid down in Rifle Marksmanship.

The JOURNAL is furnishing as a loose supplement to this issue a series of six groups of miniature targets. These groups are intended to be used at a distance of 25 feet from the eye. Placed at this distance they afford the proportions of rows of targets at the several ranges as follows:

Target A at 200 yards
Target A at 300 yards
Target B at 600 yards
Target C at 1000 yards
Target D at 200 yards
Target D at 300 yards

The purpose of furnishing these miniature targets in groups is to afford the opportunity for practice in keeping on the proper target. It is suggested that the targets be prepared for use by cutting them out with their numbers and then shellacking each group on an unpainted board.

Assign yourself a target and practice shooting on this one for a while; then take another; and as you proceed across the range, take different numbered targets. Fix the number in your mind and repeat it over to yourself just before firing. This may seem trivial but failure to do so has been the cause of much grief. Blacken your sight; see that it is properly set for the range upon which you are firing; and that the deflection, if any, is set in the proper direction. Failure to observe these simple rules has caused many a disaster. Adjust your sling. (You should have places marked on the strap to indicate the proper adjustment for slow fire and rapid fire as it is customary to use a slightly looser sling in rapid fire than in slow fire in order to give greater freedom of movement.) Identify your target, and get some identifying feature fixed in your mind. Take deliberate aim, not hurried nor too slow, but well timed and carefully considered. Hold your breath while you are s-q-u-e-e-z-i-n-g the trigger and, above all, HOLD, that is, get the sights aligned on the bulls eye and keep them there.

The best way to prepare your breathing for the holding and squeezing is to take one or two good breaths and exhale freely; then take a good breath, let about half of it out, and stop it by closing the throat, keeping a pressure there during the operation of aiming and firing. This method must be identified from the reverse method of closing the throat while inhaling or keeping the throat open. One should be able to complete the operation of aiming and firing in from 8 to 10 seconds as too much time taken in aiming is disastrous. Your pulse becomes abnormal, your eyes strained, your brain fogged, and you become very unsteady, a condition that you cannot readily overcome. If you find that you cannot get your shot away before the target begins to fade, or if you become uncomfortable, you should take the gun down, change your position, and try again.

Holding and Squeezing are really the most important things in shooting. The man that can *hold* will always bring back a good score even under the most trying conditions, and the team than can hold will bring back the trophy. Holding and squeezing are four-fifths of the battle and you must make up your mind in the beginning that you cannot

jazz with the rifle. It won't respond to that sort of treatment and will surely develop bad habits which are difficult to break. Make it your religion never to pull the trigger without carefully s-q-u-e-e-z-i-n-g and then only when you have a perfect hold.

Practice rapid fire until it becomes mechanical. You won't have time to think when it comes to the big match, so drill it until you have perfect rhythm; count your shots and keep track of the time. (The coach should call the time every ten seconds being careful not to confuse the shooter with the time 50 and 60. It is a good thing to call, 40, 45, 55, one minute, etc.) The same care must be taken in getting into comfortable position, checking your sights, aiming and s-q-u-e-e-z-i-n-g, and taking plenty of time for the first shot. The first shot should not be fired in less than 5 seconds; 8 is a good average.

Learn the elevation and deflection rules and apply fictitious corrections for varying conditions. This is not so easy to do but with study and concentration it can be accomplished with excellent results. Simulate hits on different parts of the target and then calculate the corrections necessary to bring you back to the bull's eye and make a record of it in your score book with an accurate plot of the shot from which the correction was made. Go over the score when it gets "cold" and see how often you are wrong, or what is worse, if you pulled a "bone head," and applied the correction in the wrong direction.

Make this your daily program, in the squad room, living room, or on the parade ground. In this connection it should be made an infallible rule to carry the rifle with the bolt open and to work the bolt back and forth several times before starting, in order to insure safety.

Keep a score book for every correction that you assume and become familiar with corresponding values for these corrections. For every shot "hold it and squeeze it" as though the whole National Team Match depended upon the outcome.

Now when you face the outdoor range you have something to build upon. Put the most practice on the 200 and 300 yard slow and rapid fire, then 300 slow fire prone. There is no better range upon which to prove one's ability to hold than this latter one.

To polish off, take any old telescope or field glass (if you have a good scope, 10-power say, so much the better) and fasten it to a solid support so that you can lie prone and watch the target. Obtain a clear focus upon the target at 600 or 1000 yards, as closely as you can estimate, then re-focus on an object about midway in a direct line, being careful to retain enough definition at the target to be able to distinguish a spotter (you should still be able to see the lines on the ordinary target). This will throw the target somewhat out of focus and will make it appear blurred which is precisely what you want, for then you are enabled to see the changes where they have the most effect upon the bullet, i.e., *between* you and the target.

The "dope," "conditions," and "mirage" are names which are familiar to most team shots. Everyone has at some time or other seen the heat waves, rising from the ground and being blown from side to side, by the wind. These heat waves, as seen thru a telescope which has been focussed as described above, furnish a very reliable indication of the wind conditions. The picture presented by the telescope is known as the "dope," the "mirage," or any old name you want to give to it.

Practice reading the "dope." First of all decide which way it is running, right, left, or up, then decide if it is steady or changing. This will require some practice but will soon become much easier. Give it a definite value; what you think it should be good for in minutes of elevation and quarter points in deflection. Get this value firmly fixed in your mind so you will give it the same value the next time you see it. It may not be exactly correct; the chances are it will not be, but that does not matter. Your first shot will prove that and then the necessary correction may be applied.

As you gain more experience you will be able to determine this value more accurately. The essential thing is to be on the alert for every possible change and to be able to call it about 10 seconds before it takes effect. You will invariably find a flurry or boiling condition in the mirage just before it switches from one side to the other and likewise you will see a very distinctive agitation just preceding a change in velocity. You must estimate the amount of change before it actually becomes visible, because if you wait until it occurs you will invariably be just a little behind.

Make it a rule never to be satisfied with a good score. Strive always for a "Possible," but if you make a poor shot, just bear in mind that a match is never won until the last shot is fired and go to the next one with the determination that it is going to be a "Pin Wheel."

THE COAST ARTILLERY RIFLE TEAM

1919	34TH PLACE
1920	10TH PLACE
1921	6TH PLACE
1922	**3RD PLACE**
1923	**?**

Our Military Policy Regarding the Training of Citizens

By Major Earl W. Thomson, C. A. R. C.

THAT important political personage, the average citizen, is by nature an optimist. Speak to him on the subject of military training and the need of a citizen soldiery in these United States and he disproves this need with the postulate that the test of a good military policy or of a well-balanced army is in the victories that it wins. And then he claims unblushingly that all our wars have been tremendous military victories. This logic is, of course, distinctly invalid. Victories are gained not only by an army, but by diplomacy, attrition of the enemy, and extraneous circumstances beyond the control of the contesting powers.

Such logic makes pessimists of the General Staff and all military men. They wonder what the future of a democracy will be whose people allow it to go unprepared, whose individual citizens lack military training even in the face of expanding responsibilities such as the last decade has given. In 1898 we reached across the Pacific and assumed the responsibility of insular possessions and alien tribes; in the interests of civilization and a uniting of our long coast line we built the Panama Canal; in the interests of the preservation of national honor and civilization we entered and brought to a close the World War. No longer can we escape our responsibilities in world affairs. With these responsibilities there must come to every citizen the knowledge that he is obligated to fulfill his part of our military policy.

PREVIOUS MILITARY HISTORY

From 1775 to 1781 our fathers fought and won the War for Independence. The rustic militia, with the help of Lafayette and the French Army, by means of the wonderful ability, daring and strategy of Washington, aided by the vacillation of Cornwallis, and relieved by European complications, emerged victorious.

But, to quote from General Greene: "In Washington's principal battles, Long Island, Brandywine and Germantown, he was either defeated or the result was inconclusive. This was not because they were badly planned, but because the soldiers by whom they were fought, while brave and patriotic, were deficient in training, experience and discipline,—were not as efficient instruments for accomplishing a specific purpose as were their opponents."

Our volunteer militia, based upon the idea that in time of war a trained, well-equipped force would spring into immediate existence, was as indigenously American as our representative form of government. But such a force, even in the Revolution, even with the inducements of bounties, land grants, and pensions, did not materialize; although the total enlistments approximated 400,000, the maximium army in the field never exceeded 35,000. Washington, granting always the patriotism and courage of his soldiers, pleaded after the Revolution for no more "raw and undisciplined recruits," but for veteran soldiers, a standing army, and a "well-regulated militia."

A sad commentary on our wasteful and expensive method of filibustering legislation is that Washington's policies were not carried into effect until the Militia Act of 1903, and the National Defense Acts of 1916 and 1920.

Except possibly in its results, the War of 1812 cannot be regarded as a military victory, even by the aforementioned average citizen. The military campaigns were one succession of failures due to the untrained, undisciplined troops, "suddenly assembled without organization." The naval victories, together with the absorbtion of the British in the Napoleonic Wars, brought the war to a finish, not with the help of, but in spite of, the inexperienced volunteer army. Employing a total of 460,000 men the army was out-guessed, out-manoeuvered, and outfought by a British Army which never totalled more than 17,000.

The Mexican War in 1847 proved conclusively the value of training. General Taylor had at his command regular troops and volunteers with nearly a year's training, and these experienced troops earned many victories against forces vastly superior in numbers.

At the beginning of the Civil War the regular army consisted of but 16,000 officers and men. With the exception of a few regiments of militia noted for their *esprit de corps*, our volunteer forces lacked training and discipline. Assuming that numbers meant victory, and that patriotism and courage were of more value than military education and discipline, the government made the mistake of seeking battle. The result was Bull Run, a defeat of disastous results. Our total lack of military preparation meant the continuance of the war for four bloody years, forcing the government to the limit in the conscription of men, money, and military resources, forcing our brothers of the Confederacy to accept defeat only after the grinding, wearing process of attrition.

In our own time, in the War with Spain, our dependence upon untrained troops has been again tested. In four months victory was secured, but at the expense of thousands sick and dying in the camps of Florida and Cuba, unused to the exigencies of camp life, removed from a sedentary, urban life to the active occupation of belated army training, and burdened with a lack of cooperation in the administration of the army. One benefit of the war with Spain was the adoption in

1903 of the Militia Act, directing that the organization, armament, and discipline of the National Guard should be the same as that of the regular army, and also providing for the amalgamation of these troops in time of emergency into one homogeneous army.

GENERAL LEONARD WOOD

From 1910 to 1914, Major General Leonard Wood was Chief of Staff of the Army. Because of his tremendous earnestness toward the matter of preparedness he has been known as America's prophet of preparedness, and as such for many years he assiduously preached in the wilderness. One of his first reports in 1911 was to plead for an adequate reserve, to ask for some means of raising a volunteer force quickly in time of emergency and to have this citizen soldiery trained before it was actually needed. In pleading also for short army enlistments and parole to the reserve he argued: "This is not only sound military policy, but sound economy, as it insures a reasonable preparedness for war, interferes to the least extent with the civil and industrial pursuits of the individual; in fact sends him back to civil life a more valuable industrial factor because of his better physique, his improved mental and physical discipline, and with greater respect for the flag, law and order and his superiors. It is in accord with our institutions and ideals, in that it gives us the trained citizen soldier with a minimum of time taken from his industrial career . . . . Our present condition, so far as the land force is concerned, is one of unpreparedness for war with any first-class power."

ESTIMATES OF THE NEED

In 1913 General Wood estimated that the regular army could supply only 6 per cent of the force necessary to fight a war with a first-class power, the National Guard an additional 19 per cent, leaving a balance of 75 per cent necessary to secure from citizen soldiery, volunteers, and a non-existent reserve. Secretary of War Stimson estimated at this time the need of 460,000 mobile troops and 42,000 Coast Artillery as the minimum number of first line troops necessary to repel an invasion, together with a second line of reserve of 300,000. He wrote: "The Constitution confers ample power upon Congress to raise citizen soldiery, other than militia, for general military purposes, and all of our successful wars have been carried through by the aid of such volunteer soldiery, raised and trained, under great disadvantage, after the outbreak of hostilities."

In 1913 Lindley M. Garrison, then Secretary of War wrote: "Much remains to be done, to popularize the Army and to fix it in its proper place in the estimation of the people . . . . The Army is not a luxury—it is a public necessity. The time has not yet come when a nation can wisely disarm or slacken its efforts for preparedness in case

of war . . . . It may truthfully be said that eternal vigilance is the price which must be paid in order to obtain the desirable things of life and to defend them."

General Hugh L. Scott later, as Chief of Staff, also pleaded for training for all the citizens who would certainly be called out in time of war: "To send men into battle who have not been given thorough military training and discipline is not only a useless waste of our resources in men, but, to anyone who understands anything about the realities of modern war, convicts the people of the country who are responsible for such proceeding of criminal neglect."

BEGINNINGS OF A RESERVE

Congress, in 1912, adopted a law allowing enlisted men of the regular army to be paroled into the reserve after three years of service. This law gave very poor results, as in 1914 the Reserve consisted of but 16 men and in 1915 of but 17. In his report for 1912 Secretary Stimson pointed out the need for a reserve for the regular army and asked for a reserve force of trained soldiers, which, at the outbreak of the war, could be called back from civil occupations to bring the army up to its full strength and to keep its ranks full during the inevitable losses of the first engagement.

Under the act of 1903 certificates were issued during the year 1914-15 to 37 persons who were found upon examination to be "specially qualified to hold commissions in any Volunteer force which may hereafter be called for and organized under the authority of Congress, other than a force comprised of organized militia." Fourteen hundred students in military schools, and 5000 civilians made application at this time for appointment as officers of Volunteers.

STUDENTS' MILITARY INSTRUCTION CAMPS

During the summer of 1913 two experimental military instruction camps of six weeks' duration were held for college students, one at Gettysburg, Pa., attended by 160 students, and one at the Presidio, Calif., attended by 85 students. These students represented 90 different institutions and were required to pay for their own transportation, subsistence and uniforms. The idea of such camps and their practical administration was so excellent that testimonials recommending their continuance were received from President Wilson, from ex-President Taft, and from the presidents of Harvard, Princeton, Yale, College of the City of New York, University of Michigan, University of Alabama, Virginia Military Institute and Lehigh. The students themselves, their parents, and the army officers in charge recognized these camps as a distinct military asset. This seems to be the first time in American history that a group of young men, not connected in any way with the army, except as citizens, were given training in army camps in time

of peace. It was in fact the pioneer of our present system of R. O. T. C. and C. M. T. C. camps.

During 1914, four of these Students' Military Instruction Camps were held, each of duration of four weeks, at Asheville, N. C., Burlington, Vt., Ludington, Mich., and Monterey, Calif.

During the summer of 1915, four more camps were held at military posts, one at Plattsburg, N. Y., one at Chicamauga Park, Tenn., one at Ludington, Mich., and one at the Presidio, Monterey.

In addition to the students' camps, there were held this year the first of the business mens' camps, at Plattsburg, Fort Sheridan, Ill., and the Presidio. These business men were so interested in preparedness that they asked the War Department for the opportunity to prepare themselves, so as to perform more efficiently their duties in case the country unfortunately should be involved in the Great War. The funds available for these camps were small and again all expenses had to be paid by the men attending.

During the summer of 1916, when Major General Wood was in command of the Eastern Department, he carried out a schedule of 14 camps in this department, four at Plattsburg, two at Oglethorpe, one at Fort Terry, and six at Fort Wadsworth. There was a total attendance of 12,200 enthusiastic business men and students at these camps. Two camps were also held at the Presidio, one at American Lake, Wash., and one at San Antonio. This plan of allowing men to pay their own expenses and receive military instruction at government camps, known as the Plattsburg plan, finally received recognition in Congress, and Congress for the proposed 1917 camps appropriated money for transportation and subsistence.

MILITARY INSTRUCTION IN COLLEGES AND SCHOOLS

Since 1862, when the Morrill Act was passed, allowing certain land and money for the endowment, support and maintenance of state universities and agricultural colleges where military instruction would be one of the subjects of instruction, Regular Army officers have been detailed to this duty under Section 1225 of the Revised Statutes. Until 1913 the enforcement of the military instruction requirement was under the Department of the Interior, and hence many abuses were propagated under the name of military training, the courses varying in quality from indifferent to excellent. In 1914 the War Department began coordinating the instruction at all these schools.

In 1915, Capt. E. Z. Steever developed a logical plan of training for high schools which was originally tried out in the schools of Wyoming and hence is known as the Wyoming plan. The plan embraced the preparation of the high school boy in military, moral, civic, business and educational equipment, depending for its functioning upon the instructive leadership among boys. This plan appears excellent because it

introduces the military as only one of the necessary qualities of citizenship. This plan has been developed since that date in the Junior R. O. T. C. and many of its recommendations should be adopted in the C. M. T. C. with the youths that some of these camps have recruited.

In 1912 and 1913 General Wood suggested that it would be practicable to select from the graduating classes of the military colleges where regular army officers were detailed at least 500 men each year as provisional second lieutenants for one year, providing thereby a reserve of officers. "One thing is certain: we shall require many thousands of officers, in addition to those of the regular establishment, as officers of volunteers and reserves in case of war, and steps should be taken to provide them in time of peace." The next year General Wood lowered his ante to 400 provisionals, and repeated his insistent demand for preparedness. He also recommended to the Militia that they should train an adequate militia reserve.

The number of students receiving military instruction in schools where officers were detailed grew from 17,835 in 1905 to 35,091 in 1916. In 1915, 32,000 were receiving instruction, and 5,200 completed the course of military training, out of a total of 170,000 students at these institutions. The total cost of training each student, ready for a potential reserve, did not exceed $1,000. In view of the advance that instruction in the colleges had made, the Act of March 17, 1916 authorized the foundation of the Reserve Officers' Training Corps at the colleges, universities and academies, throughout the country where military instruction was given. At the same time six weeks summer camps were contemplated, giving a fruitful source for the obtaining of an excellent civilian personnel for the Officers' Reserve Corps which was also founded under this act.

NATIONAL DEFENSE ACT OF 1916

In 1914, Congress, at the request of the War Department, passed a bill providing for the raising of volunteers in time of war.

But probably the greatest single advance in our military policy was in 1916, when Congress passed the National Defense Act of 1916. This act provided for four classes of soldiers in the United States, first, the Regular Army, second, the National Guard, third, the Enlisted Reserve Force, and fourth, the Volunteers in time of war. It also adopted General Wood's suggestion for the appointment of provisional second lieutenants for a period of two years, provided for an Officers' Reserve Corps, which could commission civilians, provided for the Reserve Officers' Training Corps and for an Enlisted Reserve from civilian life. It was this bill which was in effect, slightly modified, during the war period, giving excellent results in the raising of the officer personnel.

The General Staff had recommended that in this bill there be created a citizen volunteer army of 500,000 men with a minimum of nine months'

training in time of peace, and an additional three months' training in case of war, before they should be prepared for active service. This recommendation was not accepted by Congress, and was attacked as radical, unnecessary and impracticable. In lieu of this expansion of the Volunteer branch, the bill provided for the expansion of the Organized Militia, at the end of five years to consist of 17,000 officers and 440,000 men. General Hugh Scott attacked this provision on the ground that it did not require sufficient training for the National Guard, saying, "troops with less than twelve month's intensive training in peace times can not be considered dependable troops in time of war." The value of this legislation was seen, though, in 1917, when the National Guard was sworn into federal service, and was expanded to seventeen divisions, the 26th to the 42nd, all of which saw service in France. The tremendous expansibility of our militia was proven by the absorption and training of thousands of recruits during the summer and fall of 1917.

In 1915 the Regular Army and the National Guard were called out for active service along the Mexican border. Many of the units were below normal strength during the whole period although intensive recruiting campaigns were conducted. General Scott, as Chief of Staff, blamed the failure on our antiquated volunteer service: "The volunteer system, in this country, in view of the highly organized, trained and disciplined armies that our possible opponents possess, should be relegated to the past. The only democratic method is for every man in his youth to become trained in order that he may render efficient service if called upon in war. We have fallen away from the teachings of our Fathers, for there is no longer instilled into our people the fundamental doctrine that every man owes a military as well as a civil obligation to his country."

THE DECLARATION OF WAR

On the sixth day of April, 1917, Congress declared "That the state of war between the United States and the Imperial German Government which has been thrust upon the United States is hereby formally declared."

It can be said without fear of contradiction that this declaration found the United States unprepared from a military, industrial, and economic standpoint. Congress, knowing this, began consideration of plans for enlarging the military forces and the coordination of all the industrial strength of the nation. A national spirit was soon built up, thousands offering their services to the War Department immediately. Secretary of War Baker wrote: "Without distinction of age, sex or occupation, without distinction of geographical location or sectional difference, the people arose with but one thought in their mind, that of tendering themselves, their talents and their substance for the best use the country could make of them in the emergency."

SELECTIVE SERVICE LAW

As in our past history volunteer service had proved a failure, and as the British finally had to resort to conscription, the President recommended to Congress that an army be raised by means of a selective draft. This draft law, the most important single agency of the whole war was passed May 18, 1917, as "An Act to authorize the President to increase temporarily the Military Establishment of the United States." The advantages of this method were that it provided sufficient men for training and combatant forces, it selected those of suitable age and strength, it distributed the burden of defense in a most equitable and democratic manner, recognizing the principle of universal obligation, it accepted only those men who were not necessary for agriculture and essential industries, and it selected those whose home life was such that they would not leave dependents who would be a burden on the government.

Under this law the Regular Army could be expanded to 18,033 officers and 470,185 men, the National Guard to 13,377 officers and 456,800 men, and the law further provided for the raising of a National Army by the process of selective draft, at the call of the President. Actually twenty Regular Army divisions, numbered 1 to 20 were raised, seventeen National Guard divisions, numbered 26 to 42, and eighteen National Army divisions, numbered 76 to 93. On July 3, 1917 the President called the National Guard into service, and sixteen divisional camps were established for their mobilization and training.

This law provided for the draft for citizens between the ages of 21 and 30, proportional quotas of this citizen soldiery to be furnished by each state. On June 5, 1917, 9,587,000 male citizens registered for the draft. Then followed the operation of selection, examination and mobilization. An availability list was formed in each of the 4,557 registration districts, based upon a drawing of numbers on July 20. The draft was surrounded by assurances of fairness and equality so that throughout the whole country the attitude of the people was one of approval and confidence. The first draft sent 687,000 men into sixteen National Army cantonments from September 5, 1917 to the spring of 1918. Under the original and later acts 23,709,000 men between the ages of 18 and 45 were registered for selective draft, and 2,800,000 were inducted into the military service in a manner essentially fair to the individual. Of the total of 3,700,000 men in the service during the war, 76 per cent were inducted by means of the draft. At the signing of the armistice 25 per cent of the male population between the ages of 18 and 31 were in the military service.

GENERAL STAFF

Much of the credit for the efficient planning of the mobilization, plans of the war, and demobilization must be given the General Staff.

This body was created in 1903 and was expanded greatly during the war. Without this body, General Scott states: "the confusion, delays and disappointments of 1898 would have been repeated and magnified in 1917." In the reorganization the General Staff was divided into the War Plans branch, the Training and Instruction branch, the Legislation, Regulations, and Rules branch, and the Historical branch. Major General Hugh L. Scott, General Tasker H. Bliss, Major General John Biddle and General Peyton C. March each acted at various times during the war as Chief of Staff. It is from their reports that much of the material of this article has been gathered.

RESERVE OFFICERS' TRAINING CAMPS

The value of troops in battle depends to a large extent upon their training, and this in turn depends largely upon the character and training of the officers who instruct them and who lead them in battle. At the outbreak of the war there were a total of 17,750 available officers in the various branches of the army, 5,950 regular officers, of which 650 were provisionals, 3,200 National Guard officers and 3,150 officers of the Reserve Corps. These officers represented all kinds and conditions of training. At the end of the war there were about 200,000 officers, an expansion of 1100 per cent. Even with this tremendous increase the supply of officers always lagged behind the demand. It would be of interest to see the various agencies that were used in the training of these officers.

Using funds appropriated by Congress under the National Defense Act of 1916 for the enlargement of the Plattsburg movement, sixteen training camps were opened on May 15, 1917. Out of the 150,00 volunteers for this First R. O. T. Camp, 7,957 Reserve officers and 30,000 selected civilians were sent to the camp, and at the conclusion, August 15, 1917, 27,341 were granted commissions and directed to report to the places designated for the training of the new army. Of these men, two colonels, one lieutenant-colonel, 235 majors, 3,722 captains, 4,452 first lieutenants and 18,929 second lieutenants were commissioned. Those in charge did not believe that trained officers could be produced in three months' time, but that during this time some of the fundamentals could be taught and that the selection of those fitted best to train the army could be made. From the results obtained this belief is fully justified.

With the success of the First Camp in mind and with better rules for the selection and apportionment of candidates, a second series of Reserve Officers' Training Camps ran from August 27, 1917 to November 27, 1917. Out of the 72,914 who volunteered for these camps, 21,000 attended and 17,237 received commissions, the 59 highest being majors. Secretary of War Baker said of these camps: "It would be a national loss for me to fail to record a just estimate of the value to

this nation of these training camps for officers. They disclosed an unsuspected source of military strength . . . . These training camps have taught us that, given a relatively small body of professional soldiers, the Nation has at hand an apparently inexhaustible body of splendid material which can rapidly be made to supplement the regular soldiers . . . . When the first camp was opened, the colleges, military schools and high schools of the country poured out a stream of young men whose minds had been trained in the class room and whose bodies had been made supple and virile on the athletic field . . . . They have taken their places in the training camps and are daily demonstrating the value of their education and the wonderful adaptability of American youth."

An Officers' Training Camp was held for colored men at Fort Des Moines, Ia., from June 18 to October 18, 1917, and out of 1250 students there were granted 639 commissions.

A third series of Officers' Training Camps was in operation from January 5 to April 19, 1918, in which all applicants had to be enlisted men of the army. About 10 per cent of the men entered from civilian life, but they were of the draft age and had had previous military training. From these camps there were commissioned 11,657 second lieutenants on May 29th. From the first three camps in a year 57,307 officers had been commissioned.

The Coast Artillery had held a Third Camp at Fort Monroe from January 6 to March 27 and had commissioned 243 students, and this was followed by a Fourth Camp from April 6 to June 26, 1918 from which 464 students were graduated as second lieutenants. This totalled an increase in four camps of 2,770 commissions in the Coast Artillery.

CENTRAL OFFICERS' TRAINING SCHOOLS

A fourth series of Officers Training Schools started in twenty-four National Army and National Guard divisions in the United States as an integral part of the divisions, with an enrollment of 13,114, but in June 1918 these schools were superseded by Central Officers' Training Schools, at permanent replacement camps. The infantry had five such schools, at Camp Pike, Ark., Camp Lee, Va., Camp Grant, Ill., Camp MacArthur, Tex. and Camp Gordon, Ga. Each of these schools had a four month's course with a capacity of 5600 students, a monthly intake of 1400, and a monthly list of 1000 graduates. From these Infantry schools 9370 officers actually graduated before the armistice. At Camp Hancock, Ga. there was a machine gun school, with a capacity of 4000, a monthly intake of 1250 and a monthly graduation of 1000. From this school 2456 actually graduated before the armistice. The largest of these schools was the Field Artillery School at Camp Taylor, Ky., with a proposed intake of 5000 monthly, capacity of 13,000, and 8737 actual graduates. The Engineers had a school at Camp Humphreys,

Va., and the Cavalry at Leon Springs, Tex. The Coast Artillery was building up such a school at Fort Monroe, Va., having a three months' course, with a capacity of 2400, one company of 125 men to complete the course and graduate each week.

A total of 80,568 officers graduated from the four series of Officers' Training Camps and the Central Officers Training Schools.

STUDENTS' ARMY TRAINING CORPS

As the Training Schools kept graduating and absorbing all the available material for officers, there was felt the need of some schools to act as feeders for the Central Officers' Schools. In the spring of 1918 there were in 119 educational institutions a total enrollment of 36,000 in the Reserve Officers' Training Corps. From these schools in June 1918 there graduated 3,364, to go to training camps in the summer. In August these R. O. T. C. units were superseded by the newly organized Students' Army Training Corps, which grew to an enrollment of 158,000 at the various educational institutions throughout the country. The government in a mild way commandeered the colleges of the country and maintained the units at these colleges at government expense. All the men were on an active duty status and were housed, messed and instructed at government expense. These men were sent either to the Officers' camps as officer material, (11,000 having been sent before the armistice), or were sent out as non-commissioned officers or as privates. Besides the collegiate section there was maintained a vocational section for the training of specialists who had not had the college education, or were not eligible for it.

ARMY PLANS

The plans of the War Department called for 80 American divisions on the Western front by June 30, 1919 and for a reserve of 18 divisions at home, a total of 4,850,000 men. All of the plans for training were built on this scale and at the signing of the armistice on November 11th 1918 these plans were in full operation. On August 7, 1918 the distinguishing characteristics of the Regular Army, National Army and National Guard were discontinued and all the military forces of the Nation were united in the United States Army. In November America had 31 per cent of the Allied troops in France, Great Britain had 28 per cent and the French 41 per cent. The size of the Army had increased from 190,000 to 3,757,624 men, of which 2,086,000 reached France. In the Meuse-Argonne offensive 29 American divisions were in line, upholding the finest traditions of the service. The Coast Artillery had grown in this time from 21,000 men to 137,000 in November 1918.

DEMOBILIZATION

After nineeen months of concentration of all the national resources

and activities to the one end of upbuilding an effective war machine, to throw this machine immediately into reverse meant the solution of many vexing problems. Coordination with labor and the employment situation, securing of positions, prevention of congestion in the larger cities, and the disposal of surplus stocks and supplies, were some of these undertakings. As each division was really a cross-section of American life the best plan seemed to be the demobilization by military units. This plan was carried out so successfully that in a year from November 11, 1918 there had been discharged from the army 179,800 officers and 3,236,266 men.

Candidates in all the training schools were allowed to finish their courses leading toward a second lieutenant's commission in the Reserve, the S. A. T. C. was changed back to R. O. T. C. as fully as possible, so that by June 1919, 90,000 students were undergoing instruction in 191 Senior and 128 Junior R. O. T. C. units. Summer camps at which 3,400 students attended were held in 1919 at six cantonments and at the Coast Artillery School at Fort Monroe.

Thus the country returned to normalcy and the discussion of the triumphs and failures of the late, but not lamented, conflict.

LESSONS OF THE GREAT WAR

One of our national characteristics is that it takes experience to teach us anything, we never accept mere advice without the requisite experience. Out of the experiences of the Great War there should have come many ideas of worth for the conduct of national defense in the future.

Secretary of War Baker enumerated the lessons of the war as follows:

1. The necessity for General Staff control, in order to centralize the formation of a proper military program.

2. The necessity for a reserve of clothing and equipment. Such a lack slowed up mobilization, the striking case being the artillery regiment that proceeded to France after having simulated drill on a wooden log as a gun and an ash-cart as a carriage.

3. The necessity for the supply and training of officers and replacements. It was necessary to train 180,000 officers with but little previous military experience. 50,000 officers are necessary for each million men, and these should all be trained and organized as part of our peacetime duty.

4. Development of special services necessary: aeroplanes, tanks, motor transport, railroad artillery, caterpillars, trench mortars, machine guns, gas warfare, radio and sound flash ranging, and photography. These are all adjuncts to the infantry, and should be trained and made ready for use efficiently.

5. Necessity for combined training in large units.

Relative to training, Secretary Baker wrote: "Due to our lack of preparedness, the execution of our military program necessitated the sending to France and into battle of some organizations and replacements without proper training; undoubtedly the lack of proper equipment and instructors for training resulted, in some cases, in a loss of lives that might have been avoided with well trained and disciplined officers and men . . . . Only the determination, the valor, and the sacrifice of our allies throughout this terrible period of ordeal by battle made it possible for us to furnish the final reserve which, with its impetuous vigor, and its irresistible force, enabled the allied army to pass from the defensive to the offensive and made possible an early and a decisive victory."

Previous to this war the United States felt safe in her geographical isolation. The idea that 1,500,000 men could be transported across oceans and maintained there had been thought of as impossible, but we had accomplished this. General March says: "Reasonable provision and sound military policy demand that there shall be at all times available for immediate use a sufficiently trained and organized force to insure, in connection with our fixed coast defenses, that no probable or possible enemy can ever seize a great strategic base on our coast."

The country accepted the principle that the most equitable method of raising a large army was by means of the selective draft. Although Congress has not as yet agreed to this as a universal policy yet it is almost certain that any other large army will be raised by this most excellent method. The resources of the country had proved sufficient for ourselves, and in large part for our allies, but the mobilization of these resources had required nineteen months of intensive work on the part of the whole country. There could be no better argument for preparedness than this.

THE NATIONAL DEFENSE ACT OF 1920

These lessons of the war were incorporated into the amendments of the National Defense Act of 1916, which were passed on June 4, 1920. This Act of 1920 provided for a closer relationship between the Regular Army, the National Guard, and the Organized Reserves in the Officers' Reserve Corps, in that the National Guard officers should be Reserve Corps officers or vice-versa; it provided for a maximum Regular Army of 280,000 men and 17,717 officers; it provided that the Signal Corps, Quartermaster Corps and Ordnance Department be separate corps with their own permanent officers, and that officers be detailed by fitness to the General Staff, Inspector General's Department, Bureau of Insular Affairs, and the Militia Bureau; it provided for the grade of warrant officer and for the entire rearrangement of the grades of enlisted men; it provided for a War Council to consist of the Secretaries of War and Chief of Staff, and that the Assistant Secretary of War should have

charge of military supplies; it added the Air Service, Chemical Warfare Service and Finance Department to the Corps of the Army; it gave authority to the Army Nurse Corps; it made possible promotion of officers from a single list, not depending upon the corps that an officer is in; it provided for enlistment periods of one and three years; and it provided for the establishment of a Militia Bureau and that the federalization of the National Guard would not discharge men from their term of enlistment with the states.

Evidently Congress did not believe that the American people were ready for universal military training as this act did not provide either for universal training or for the application of the selective draft to future emergencies. Certainly it has been proven times without number that an adequate reserve is necessary for our national security, and without universal military training the maintenance and training of such a reserve is practically impossible. The expenditure during the war for the War Department was fourteen billion dollars, for the whole nation twenty-four billion dollars. Merely the interest from such a sum would insure us the security of a standing army as a nucleus with a system of universal military training to provide the reserve. This would train our young men for emergency, would Americanize the alien, educate the illiterate, and become a powerful factor in American life.

ACCOMPLISHMENTS OF THE DEFENSE ACT

The Defense Act, even with its acknowledged defects, has accomplished much toward clarifying our military policy. The old division of the country into territorial and geographical departments has been abandoned and the country has been divided into nine corps areas, each an administrative and tactical unit. The bill provides for the initial mobilization of approximately two million men organized in six field armies and appropriate corps, army and G.H.Q. units. From each corps area the Regular Army is expected to provide one division, the National Guard two divisions, and the Organized Reserve three divisions and the majority of special units. From the three separate units of the war one army has been formed, the Army of the United States, and the Regulars, the Guard, and the Reserves are all part of this one Army. The act has provided the framework, the skeleton on which to build, and when the handicap of decreased appropriations has been hurdled, we shall hope for tremendous advances. The only provisions for the training of citizens under this act have been those for the Reserve Officers' Training Corps, and Citizens' Military Training Camps, with some provision for the yearly training of a small percentage of the Reserve Officers. All these activities and the necessary training of the Regular Army itself have been hampered and minimized by the tremendous drive toward economy that the government has been making.

OFFICERS' RESERVE CORPS

Probably at no other period in the history of the United States have there been so many citizens connected with the Army of the United States. Most of these are members of the Officers' Reserve Corps, which in the World War and under the National Defense Act of 1920 has been organized as one of the components of the Army. The strength of this corps was 68,232 in 1920, 66,905 on June 30, 1921 and 67,309 on June 30, 1922. Of these, about 2900 in April, 1923, are Coast Artillery officers. This membership is made up of men who have seen real war experience, who are greedy for training and education in military affairs, and who are a group who can make or break the Army in the years to come. Through the Reserve Officers' Association they have already, in the 67th Congress, proven that they will stand behind the War Department in its requests before Congress, forming a liaison group between the professional citizen and the professional soldier.

The Defense Act has provided a framework of regiments and divisions with the reserve officers, but Congress has cut the necessary appropriation from year to year so that only a small percentage of these officers have had steady training. The science of war is developing and a few hours each month, and a few days each year in education, training and refresher courses are necessary and greatly appreciated by the reserve officer. The War Department, the officers detailed to this work from the regular army, and many of the members of Congress know the necessity for the advancement of this training. Unhappily, some of the members of the military committee of the House have been enemies, perhaps unwittingly, of the advancement of the reserve.

These reserve officers will be the instructors of the great mass of untrained, unorganized, civilians of the potential army, and hence must keep their own training fresh, accurate, complete and up-to-date. The reserve officer has adopted the army as an avocation, but he cannot feed his enthusiasm in the project from his own experience alone. He must have summer training, have contact with the regulars and the Guard, be recognized on an equal footing with them, he must accept the opportunities that are his in the way of correspondence courses, lectures and conferences. In these ways he will grow and prosper in military knowledge, instead of believing that the sum total of all knowledge and experience is already his,—that there is no more to learn. We can not afford to lose our reserve officers (7316 members of the Corps were separated from the service last year) because of lack of training, lack of interest or loss of contact. There is a moral in this for Congress, the War Department, the professional soldier, and the reserve officer himself, and it should not be hard to find.

For the next fiscal year the plans of the War Department for the training of the Organized Reserves call for 300 reserve officers for duty

with the Assistant Secretary of War with the industrial mobilization plan; for 100 officers for duty with divisions, bureaus and branches; for 450 officers for training at Corps Area Headquarters; for 1800 officers for training with the Regular Army and the National Guard when these units are undergoing intensive training; for 900 officers for duty with the Citizens' Military Training Camps; for 144 officers for duty at the special service schools; and for 9588 officers for fifteen days training at summer camps of instruction to be known as "Organized Reserve Camps."

In this way only 13,282 out of the 68,000 officers of the reserve would have received some type of training during the coming year, but even the appropriation for this was materially cut. It was the pleasure of the writer to be at Camp Meade, Md., last summer when the 79th and 80th Division officers were undergoing their fifteen day course. The tactical problems and exercises were excellent in showing the officers what should be done, how offensive and defensive tactics differed, where the various units were placed, and what the function of each officer was in his particular assignment. But one of the comments heard most often was, "We miss the soldier, the troops, the company,—we would rather be working this out ourselves, with our own soldiers, with help probably, than having the ideal shown us." But you say, "That would be impossible, nothing else can be done, the troops are not available." That's right, they are not. The reserve is merely a frame-work, a skeleton. We hope for better, more prosperous days, but in the meantime we hope to make the reserve a mighty lively skeleton.

CORRESPONDENCE COURSES

Supplementing the limited appropriations for training during the past year, the War Department has evolved a system of correspondence courses for the National Guard and the Reserve. These courses provide the theoretical training for an officer where field training can not be obtained, and thereby give some means for an officer to keep abreast of his subject. Courses have been built up for every branch of the service and for every grade of knowledge in that branch. Although an instructor in almost every subject at the Coast Artillery School during the war, the writer has found much of interest and worth in the elementary Coast Artillery Course "A" during the past winter. This course has covered matériel, elementary gunnery, drill and maintenance, administration, discipline and courtesies. The questions have been intriguing, and the collateral reading instructive. But to attempt to study by correspondence the functioning, for instance, of a machine gun, requires too much fourth dimensional knowledge of a two dimensional method. Without the necessary transits you can not properly teach surveying, without the necessary laboratories you can not teach science, and without the necessary guns you can not learn matériel.

Theoretical knowledge must have the practical applications, side by side, or it is of little value. One of our most brilliant instructors of the Department of Electrical Engineering at the Naval Academy has a sign on his front door, "Bell out of order. Knock." The Q.E.D. of this is merely that correspondence courses have their limits.

RESERVE OFFICERS' TRAINING CORPS

The Military Academy at West Point can supply only a small proportion of the necessary officers of the Army of the United States. Most of its graduates go directly into the Regular Army, hence the National Guard and the Organized Reserves must look elsewhere for the trained personnel to fill the ranks of the junior officers. The Reserve Officers' Training Corps has been reorganized since the war and has been successful not only in imparting military knowledge to the students of our secondary schools and colleges, but has been successful in graduating these men into the Reserve. Last June, 2,031 R.O.T.C. graduates were granted commissions in the Reserve, and 569, due to age or other reasons, were given certificates allowing them to apply for a commission within five years. The Coast Artillery received 235 out of this 2600 graduates. In 1922 there were 237 senior units with an enrollment of 51,742 and 106 junior units with an enrollment of 37,225, with 816 active and retired officers detailed to this work. The summer camps in 1922 were attended by 6,141 men for six weeks. The Coast Artillery was represented by 19 senior units, an enrollment of 3,244 students, and a summer camp attendance of 338 at Fort Monroe, Va., and Fort Casey, Wash.

It is from this R.O.T.C. that the major portion of the reserve officers in the future should come, college men, trained to think accurately and quickly, men who will wield the baton of influence in their communities in the next two decades, men whose minds are broader than Main Street, men whose interest and avocation would be the development of the Reserve. With the addition of the projected 5,000 graduates annually, the Reserve Corps should have no fear as to the excellence of its personnel.

CITIZENS' MILITARY TRAINING CAMPS

As a compromise for a national system of universal military training, Congress provided, under section 47d of the National Defense Act that: "The Secretary of War is authorized to maintain, upon military reservations, or elsewhere, schools or camps for the military instruction or training, with a view to their appointment as reserve officers or non-commissioned officers, of such warrant officers, enlisted men and civilians as may be selected upon their own application" to attend. The Secretary is further authorized to use equipment, to furnish uniforms, subsistence and transportation, to prescribe the courses of instruction, to

fix the periods, to prescribe the rules and regulations and to employ officers for the instruction and administration of these camps.

The first of these Citizens' Military Training Camps were held in 1921 at twelve different cantonments, each for a period of one month. Applications were received from 40,679 citizens, 11,202 were authorized to attend and 9,973 completed the course. These 1921 courses were "Red" or basic courses and included infantry drill, rifle marksmanship, guard duty, camping and marching, care of equipment, personal hygiene, military courtesy, athletic contests and military ceremonies.

Attendance, of course, is voluntary, each applicant taking only the oath "to support the Constitution of the United States, obey those in authority and follow the rules and regulations to the best of my ability." There has been until 1923 no obligation of any kind to continue in the military service after leaving the camp. However, from 1923 on, applicants for the advanced courses, the Whites and the Blues, will be placed under such obligation, "to indicate their willingness to serve, at some future time, an enlistment in the Army of the United States." This ruling does not apply to candidates for the Red course, nor to those who attended camp in 1921 or 1922.

This question of a lack of military status other than that of citizens, of the candidates, and the lack of ability to punish for violations of the Articles of War, may prove troublesome at some future camps, but so far has caused no friction. Candidates, upon becoming bored, or overworked by too much K.P., or from dissatisfaction with conditions have requested or been requested to depart from camp for the convenience of the government. Such cases have been few and have not exceeded more than 3 per cent of those in attendance, the great majority of the remainder being intensely enthusiastic about the work.

The average age of the men at the 1921 camps was 18½ years, and that of the 1922 camps 19 years. It is readily seen that the C.M.T.C. is building for the next two decades, and not necessarily for the present.

In the summer of 1922, 22,000 men attended these camps held at 29 different places during July and August. In the Third Corps Area camps were held at Camp Meade for the Infantry, Field Artillery, Cavalry and Medical Corps, at Camp Holabird for the Quartermaster Corps, at Camp Humphreys for the Engineers, at Langley Field for the Air Service and at Fort Monroe for the Coast Artillery.

At the close of the camp the Camp Meade regiment paraded up Pennsylvania Avenue in Washington and were reviewed and complimented by President Harding. The President has said regarding these camps, "I hope to see established during my administration a comprehensive system of volunteer military training for at least 100,000 men each year."

As a utilitarian measure it is hoped that many of the candidates will complete the Red, White and Blue courses and become candidates for

commissions in the Reserve. This offers an opportunity for men unable to attend the R.O.T.C., for financial or educational reasons, to become officers. This particular phase of the training should not be emphasized in the recruiting as it becomes embarrassing to refuse advancement to those candidates who have satisfactorily completed the course. Certainly, in the Coast Artillery, an officer must be a technician as well as a drill master, he must know the essentials of gunnery, orientation, matériel, adjustment of fire and tactics before he is qualified to accept a commission, and it would be almost impossible to include these subjects and train a man from a raw citizen to a finished soldier in three camps, each of one month. That is, a candidate must have more than the month's training in each of three years to be ready for a commission, he must have correspondence or extension courses in the theoretical subjects even before becoming an officer. The new lieutenants who have just been taken into the Regular Army have not been required to know these subjects, it is true, but they will receive this professional training immediately in some school, and will not have to wait, like the reserves, for the training to be given them piecemeal.

To obviate partially this difficulty, and to equalize more nearly the R.O.T.C. and C.M.T.C. courses, a Basic Red course will be given for all elementary candidates, regardless of choice of Corps, in 1923. This basic course will provide preliminary training, including physical development, athletics, school of the soldier, squad and company, rifle marksmanship, camp sanitation, personal hygiene, military courtesy, the meaning of discipline and studies in citizenship.

Next year, following this course, there will be an Advanced Red course in the different branches of the Army, the candidates to have as far as possible their choice of corps. Graduation from this course will mean that a man is qualified to perform the duties of a private in the reserve.

It should be emphasized that the C.M.T.C. must be democratic, it must be a cross-section of American life, to include all strata from the son of the coal miner of Mauch Chunk of the first generation, to the son of the twenty-fifth generation of F.F.V's of Richmond, of "which there is no other else but." True, all of these can not qualify for a commission through the C.M.T.C., and hence this phase should not be paramount. The C.M.T.C. is not to train officers, it is to train a complete citizen soldiery.

THE COAST ARTILLERY C.M.T.C.

During the summer of 1922 the Coast Artillery had its first experience with this new movement, the C.M.T.C. The Third Corps camp was held at Fort Monroe, Va., where 280 men were given the rudiments of infantry and artillery drill. It was the writer's privilege to have command of one of the three companies in the camp. Without any

idea of conceit or boasting it may be said that the results obtained were truly phenomenal. With but thirteen actual hours of big gun drill, a service target practice was fired, the first shot from one of the 12-inch guns knocking the target out of the water. On the mortar battery the eighteen year old Philadelphian who pulled the lanyard requested that his job be saved for him next year,—no fear there.

All this was accomplished by well laid plans of the staff, by hard work from 5:30 A.M. until 11:00 P.M. of all the officers, and by the wonderful enthusiasm of the men. In discipline they were sometimes mere boys, but in work they were men.

An excellent account of this camp was given in the October number of the COAST ARTILLERY JOURNAL.

Probably the following by the writer, a reprint from the Newport News *Daily Press* of August 11, will give some idea of the problems confronting a company commander of the first Coast Artillery C.M.T.C.:

"This is Saturday evening and the C.M.T.C. of the Coast Artillery at Fortress Monroe has been in operation for three days. It has been a busy three days of receiving candidates, as these patriotic young American citizens are officially called; of drawing all sorts and conditions of equipment; of attempting some sort of an organization, and of making everybody feel so much at home that he will want to stay at the camp for the full thirty days and then come back for more. It has been a cheerful three days, in spite of 20 hours work to each day, as the candidates have made it cheerful with their intense interest in matters military. It has been a three days in which civilians of all layers and employments have been thrown into the melting pot of the C.M.T.C. and have come out soldiers. These men are all young, many of them have still to cast their first vote, but they will all make good voters when they again become civilians at the end of the month's training, as they are rapidly becoming interested in true citizenship.

"Probably you would like to hear some of the things that I, as a company commander, have heard in the last three days. Maybe the popular idea is that all the men in camp before turning in at taps or tattoo have to be lined up to see that they are in the proper uniform, pajamas or "beeveedees." Maybe it isn't so. Anyway, last night in wandering around the barracks I was stopped by a newly arrived one who asked permission to sleep in his underclothes, as he had a very bad cold. No, the Army doesn't go quite as far as that, even in the C.M.T.C. And then of course we had the "boid from thoity-thoid street" who arrived in a very confidential mood, wandered into the orderly room without knocking, leaned on the desk where the captain was busily engaged in straightening out somebody else's record, and opened up his heavy artillery: "Say, captain, they've handed me a punk bunk, and I ain't had nothin' to eat since—", but that's as far as he got, and maybe he didn't collect a bawling out, all in a motherly tone of voice,—for all the sins on the calendar.

"We have a young farmer from away up in Pennsylvania who thinks that squads east and west are commands that should never be given in the Coast Artillery. Maybe he's right. And then we have the "Volunteer." So far in three days he has volunteered as swimming instructor, as a singer for a prospective glee club, as a "kitchen policeman" and as an umpire for an inter-company ball game of an impromptu nature. He was given the last job and when last seen was headed toward Buckroe Beach as fast as a good pair of legs and a trailing posse could make him move. But he's too good to waste, we'll have to bring him back unharmed and let him volunteer some more.

"And then we have the hombre from the "heart of Maryland" who lost his baggage, "one black suitcase, sir, and a musical instrument, for which I paid good money, which is in a box which looks like a hencoop." We looked for that baggage for hours, and finally heard a wailing that sounded like the last dying gasps of a champion bag-piper. No such luck. It was our candidate of the lost baggage, a mammoth accordion in a young hen-house. It is suggested that the Post Band, the reveille bugler, a trombonist who is learning the scales in the next barracks, and our accordionist, be allowed to rope off the arena on the sands of Fort Monroe and fight it out to a finish with their instruments, the winner to be given the green end of an "Eastern Sho' watermillion."

"But the duties of a company commander have their spare periods,—here it is only 11 o'clock, taps is blowing, and even I can quit for the day."

Among the items in which this camp specialized were inter-company meets in swimming, baseball and track, inter-company competitions in infantry and artillery drill, lectures on disease, health and personal hygiene (the latter was so successful that there was not a case of any "manly disease" in the whole camp), a camp paper called "K.P.", a vaudeville-musical-comedy-boxing show, a twelve mile hike through the back country which tested the ability of all the stickers and showed up all the "gold-bricks," demonstration of anti-aircraft and poisonous gases, and two trips each week to points of interest, the ship-yard, the Navy yard, Yorktown, Camp Eustis, Langley Field, and fishing. All the candidates were certainly kept interested and given plenty to do, making a highly successful camp.

PLANS FOR THE 1923 C.M.T. CAMPS

Congress has appropriated $2,000,000 for the summer C.M.T.C. of 1923. The War Department has announced that it will be able to train 30,000 candidates this year at an average cost of $78.21 per candidate. Under the appropriaton 3800 have been allotted to the Third Corps Area, with a basic camp and advanced camps in Infantry, Cavalry and Field Artillery for 3548 at Camp Meade, and a Coast Artillery camp at Fort Monroe for 252. All the other camps in the Corps Area have been abolished due to the increasing overhead with the multiplicity of camps. In the Third Corps these camps will start June 26, but the peak of C.M.T.C. work for the country will not be reached until August 1st. The upper age limit has been lowered to 24 years instead of 27, the Basic Red course has been established and candidates for the White and Blue courses will be required to indicate their willlngness to join the Reserve or National Guard after the camps.

Camps will be held at Camp Devens, Mass. in the First Corps Area; in the Second Corps Area at Madison Barracks, N. Y., Plattsburg Barracks, N. Y., Camp Vail, N. J., Fort Hancock, N. J., Fort DuPont, Del., and Porto Rico; in the Fourth Corps Area at Camp McClellan, Ala., Fort Barrancas, Fla., and Fort Bragg, N. C.; in the Fifth Corps Area at Camp Knox, Ky., and the rifle teams from all the other camps will be at Camp Perry, O.; in the Sixth Corps Area at Camp Custer,

Mich.; in the Seventh Corps Area at Fort Snelling, Minn.; Fort Des Moines, Iowa, Fort Leavenworth, Kas.; in the Eighth Corps Area at Camp Travis, Tex., Fort Sill, Okla., Fort Logan, Colo., and Fort Huachuca, Ariz.; and in the Ninth Corps Area at Del Monte, Calif., Camp Lewis, Wash., Fort Douglas, Utah, Fort Scott, Calif., and Fort Worden, Wash.

RECOMMENDATIONS

Among specific recommendations for the C. M. T. C. that the writer has made personally or has seen stated are:

1. That the course leading to a commission be lengthened. This is in order to equalize the requirements in the R.O.T.C. and the C.M.T.C. Most of this criticism comes from officers having experience with the R.O.T.C., as the trained college men feel rightly that anyone asking for a commission certainly should have as much training as themselves. Also, no man eligible for training in the R.O.T.C. should be given a commission from the C.M.T.C. previous to his graduation or severance from the college, as this creates inequalities and jealousies.

2. That the officers on recruiting duty for the C.M.T.C. should emphasize the serious side of Army camp life as well as the pleasurable side. There is plenty of pleasure, but the serious side is paramount.

3. That the candidates in the Blue course, when their numbers permit, be segregated and given more theoretical training, be made to study a longer period. When the Blues are with the Reds they are only super-Reds, and are satisfied with being merely better than the Reds. The Blues are candidates for commissions and should be given a course leading up to one, probably similar to the course given the candidates during the war, to include gunnery, orientation and kindred subjects.

4. That a normal program be adopted with a definite rest and sport period each afternoon from 3 to 5 o'clock, and that the program be followed absolutely with no "trick formations." Extra formations, at the behest of every known officer from a State Governor to the publicity officer, were the bane of a company commander's existence at Fort Monroe last summer. In this vein it might be stated that a fewer number of reviews might be appreciated.

5. That the normal program should include demonstrations by the Coast Artillery troops, a practice march by the whole camp, and target practice. These were beneficial to all concerned.

6. That the number of necessary subjects for the Whites be minimized and the course be intensified, definite problems being given for the study hour period each evening. The whole of the afternoon period, from 1 to 3, should be given for this White work, while the Reds are on the musketry work and elementary lectures which the Whites have had when they were Reds.

7. That emphasis be continued on the extra-curricula activities of athletics, camp paper, shows and candidate activities. This increases the morale and gives each company and each camp a company and camp morale that can not be excelled.

8. Finally, that completion of one course be not considered the *sine qua non* of promotion to the next course, but that the recommending authority also take into consideration a man's education, his rating on the Alpha test, his age, personality and knack of leadership in the camp. Probably some examinations, other than the Alpha test, could be used to rate the candidates in their acquired knowledge.

These recommendations are not complete, and all are open to argument. It is noted that the War Department has already adopted some of these subsequent to the Conference on Training for Citizenship and National Defense that was held in Washington last November.

BENEFITS FROM CAMP

The advantages and benefits from any R.O.T.C. or C.M.T.C. camp were ably summarized by General Leonard Wood in 1913:

"The physical benefits derived from the active, healthful, outdoor, life of a camp.

"The acquiring of habits of discipline, obedience, order, self-control and command, with their resultant gain in business efficiency.

"The training imparted to the young men in military manoeuvers, tactics, care of troops, camp sanitation, and rifle practice, resulting in their better preparation to discharge their military duty to their country should it ever have to call upon them in time of need, thereby saving the great waste in valuable lives and money which has always occurred at the beginning of previous wars due to the ignorance in such matters of the newly created officers and men.

"The benefit to the country in the fostering of a patriotic spirit without which a nation soon loses its virility and falls into decay, also the dissemination among the citizens of the country by the return of the students who attended the camp of a more thorough knowledge of military policy, the true military history of our country and its military needs, all necessary to the complete education of a well-equipped citizen in order that he may himself form just and true opinions on military topics.

"The result is not militarism, but to make provision in some degree to meet a vital need confronting us as a warlike, but unmilitary people, desiring peace, to the end that peace and prosperity may be preserved through the only safe precaution,—more thorough preparation and equipment to resist any effort to break such a peace."

CONCLUSION

If the previous pages have in any way clarified the history, development, results obtained or aspirations of the training of our citizen soldiery the "labor is not in vain." The need for Economy in the administration of our government is great, but the need for adequate training of our unlimited potential of citizen soldiery is greater; the need for the protection of our democracy is fundamental, but the adoption of a policy of universal military training is necessary.

Secretary of War Weeks in his 1922 report summed up the situation with the following:

"We threw our hearts and souls into the Conference for the Limitation of Armament,—but—in the meantime we can not blind ourselves to the interests of the American people and to the direction of the destiny which is theirs. Nothing has occurred to warrant that we should pay heed to the tempting advice which runs directly in opposition to the trusted advice of our own great leaders of the past. We intend, on no account, to permit our own peaceful desires to lead us into a trap of helplessness which would be fatal to the very peace that we wish for and intend to secure.

"The establishment of an intimate relationship between the Army and the people of the United States is in the highest degree desirable and the benefit to the Army of being understood can hardly be overestimated.

"Just as soon as the finances of the country make it feasible we should revert to a steady and uniform plan of development of the defense project as contemplated in the Defense Act of June 4, 1920."

This development should include an increase in the training of officers in all branches, an increase in the size of the standing army commensurable with the duties to be performed, and the enlargement and development of the Reserve Officers' Training Corps and the Citizens' Military Training Camps.

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The Cloke Plotting and Relocating Board

By 1st Lieutenant Joseph F. Stiley, C. A. C., of the Coast Artillery Board

THERE has been a long felt need in the Coast Artillery Corps for a plotting board on which base lines or base end stations could be changed easily, quickly and without interruption of firing. It was also desired that the board have rapid relocating ability. Simplicity, accuracy, speed of operation and ruggedness of construction were requisites. The assignment to Coast Artillery since the World War, of railway and certain tractor artillery units has accentuated this need of flexibility and the advent of fixed and mobile long range armament, has complicated it. Standardization of fire control methods and equipment has been rendered doubly necessary under the National Defense Act for the adequate training of Coast Artillery National Guard, Reserve and R. O. T. C. units, wherever situated.

It is the purpose of this article to describe to the service a plotting board which possesses all of the primary requisites mentioned above. The belief is held, and will be discussed subsequent to a description of the board, that it will fit into the eventual long range fire control policy, and that it will lend itself also, to standardization of methods and equipment for all of the far flung units of the Coast Artillery Corps of the Army of the United States.

The Cloke Plotting and Relocating Board was designed by Colonel Harold E. Cloke, C. A. C., in 1913, when that officer, then a Major, was stationed at Fort Flagler in the Coast Defenses of Puget Sound. He originally designed this board as a Fire Commander's Identification Board while at Fort Williams, Maine, in 1911.

DESCRIPTION AND OPERATION

The principle upon which the board is designed and operates is quite different from that of the generally known, manual plotting boards. The chief difference consists in making the target, the point about which the primary and secondary range arms pivot. If the reader will refer to Figure 1, which is a Whistler-Hearn board converted to the Cloke principle, and there visualize himself as an armsetter, the solution by this board of the various triangles, which contain for vertices, guns (or other points for which relocation is needed), base end stations, and target, can be more readily seen. The primary armsetter, as he sets,

the primary arm in a given azimuth from primary station to the target, is setting the fiducial edge of the primary arm as a ray from this point—as set on the azimuth circle, through the primary station's instrument, to the target. Figuratively, the armsetter is sitting far to the rear of the observing instrument and he moves on the arc of a circle until his eye is in a ray, from his eye through the axis of the observing instrument to the target. If the reader then will consider the setting of the secondary arm on an azimuth which represents an analogous ray from his eye through the axis of the secondary station's observing instrument to the target he will see that the board contains the two sides of a triangle which come from the target to the base end stations. The target

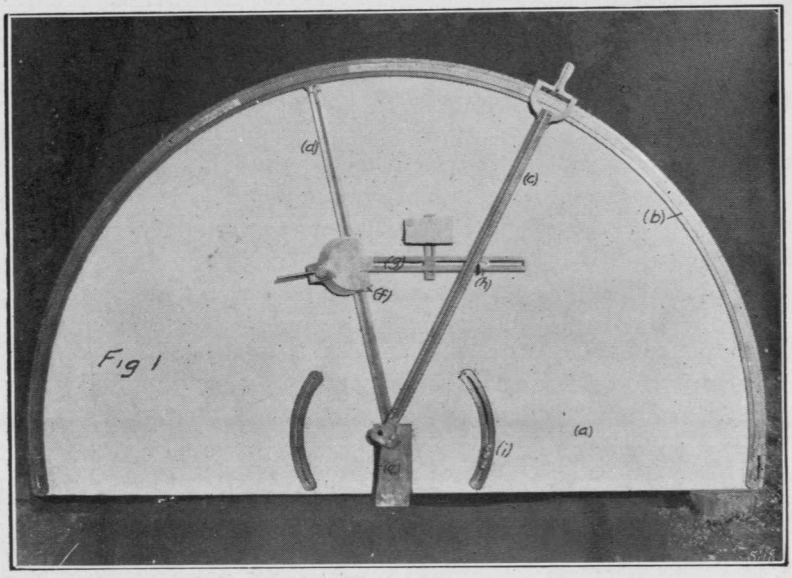

FIG. 1.

is the apex of this triangle and is represented by the point (at the bottom of the figure) about which the arms are pivoted. Since the arms are set on true azimuths one element of the triangle, to wit, the angle as if measured at the target between base end stations, is solved. As an aid to understanding this description consider that the platen (Fig. 3) which appears on the center of the board in Fig. 1 has not yet been placed in that position.

If a line whose true azimuth and length corresponds to that of the base line can be interposed between these two lines (or arms), which have just been set on the board, it can fit exactly in only one position. When that fit or position is obtained the triangle whose vertices are *target, primary station, secondary station,* is solved, and all the elements of the triangle, i.e., the three sides and three angles, are in plain view on the plotting board. Neglecting for the moment a description of

how the platen operates, notice in Fig. 1 the solution shown. The knife like edge of the master key, representing the vertical axis of the primary station's observing instrument, is shown cutting the fiducial edge of the primary arm; the distance from the target to the primary station is shown on the range scale of the primary arm opposite the vertical edge of the master key. The center of the fitting shown on the secondary arm (known as the sliding box) is the vertical axis of the secondary station's observing instrument; it is shown on the figure as a point rather than a master key and it is about this point that the platen pivots. The distance from this point, or secondary station, to the target is shown on the range scale which is imbedded along the middle line of the secondary arm. To allow for the dimensions of the sliding box the range scale is offset in the direction of prolongation of the arm through the azimuth circle, a distance equal to the distance from this point to the edge of the sliding box below which the range scale comes into view. Since the length of base line is known to be the distance between this center of the sliding box and the vertical edge of the master key, and, since the three interior angles are the azimuth differences between the base line and primary and secondary arm settings, all element of the basic triangles are solved.

The elements of all the triangles containing the base end stations and the points such as directing point, guns, lighthouses and what not, for which relocation is desired, are previously computed. These data are on record in practically every emplacement book. Their locations are accurately plotted on the platen with reference to the base line, usually by polar coordinates from the secondary station. When the basic triangle is solved on the board as previously described, then because the base end stations are properly located with respect to the target the points for which relocation is desired appear in their true positions with respect to the target also. Their relocation—range and azimuth to the target, is accomplished by placing an ordinary plotter's targ on the point desired, bringing up to the targ the fiducial edge of the primary arm and reading the range and azimuth shown on primary range scale and azimuth circle respectively.

Now, if a hole whose center is the plotted location of a gun or directing point, be drilled through the platen; and if a push button having a spring to keep the point of the push button off the table be inserted, a record of this relocation can be transferred to the paper surface of the plotting board by pressing the push button and obtaining a prick in the paper. Successive positions of these points, determined by the same method of tracking a target used on other boards, will represent a plot of the target's track in which successive positions of the gun with reference to the target are secured rather than successive positions of the target with reference to the gun. The course and speed of a moving target will be accurately represented; predicted and set forward points

located in the usual manner and firing data obtained by use of the primary arm and targ in exactly the same manner as on other boards except that one less arm will be required.

In Figures 1 and 2, the only differences are in types of platen, types of azimuth circles, and the size of the board. Figure 1 is a Whistler-Hearn Board converted to the Cloke principle. Figure 2 is a model of a Cloke board.

The essential parts of the board are marked on both the figures.

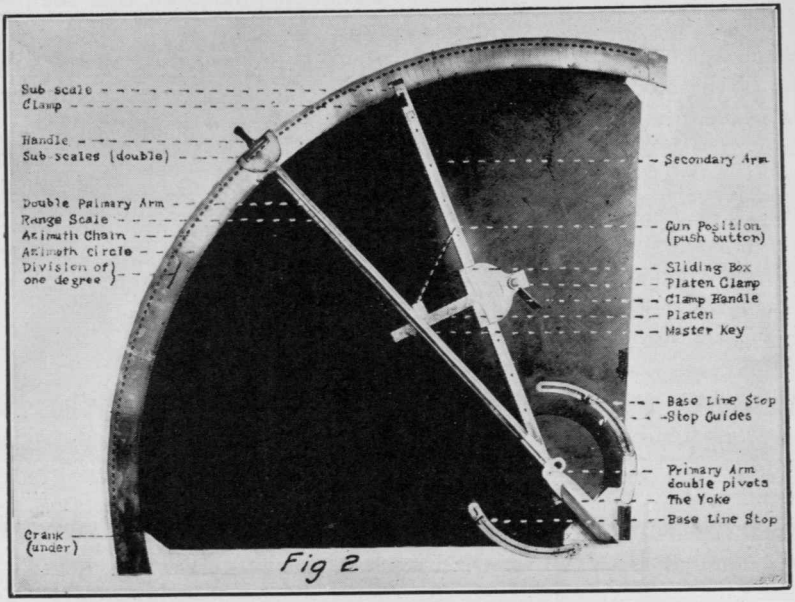

FIG 2

(a) The table
(b) The azimuth circle
(c) The primary arm
(d) The secondary arm
(e) The yoke
(f) The sliding box
(g) The platen
(h) The master key
(i) The base line stops and guides

Some of the theory of operation was indicated in the preceding discussion of the principles upon which the board depends. Of the parts just listed the table, azimuth circle, primary and secondary arms resemble those in use on any manual plotting board.

The table in Figure 1 is that of a Whistler-Hearn Board.

The table in Figure 2 is a segment of the field of fire. It subtends 120 degrees. A line bisecting the board is, in effect, a normal to the

base line through the field of fire. The board can of course be used for all around fire by changes in orientation as will appear later. The table shown in Figure 1 is believed to be the better.

There are two types of azimuth circles. That shown in Figure 1 is an ingenious and economical conversion of a Whistler-Hearn azimuth circle. The zinc azimuth circle of the Whistler-Hearn board was removed. About 36 brass plates were made. Each of these slid easily in the groove which formerly contained the zinc azimuth circle. About ten degrees appeared on each brass plate and the numbering on the plates was consecutive from 0 to 359. The board was thus equipped with a single continuous azimuth circle. It will be referred to hereafter as a sectional azimuth circle. The required sections are slid into one end of the azimuth circle groove; those not required are slipped out of the other end. The sections not in use are kept in their respective receptacles in the box shown in Figure 3. It should be noted that the actual position of the figures on the sections does not affect accuracy in plotting. The accuracy of a plot depends on the distance between the lines etched across the azimuth circle. These are permanent and must be exactly one degree apart. The figures so long as they are consecutive, are merely indices to the etched lines.

The azimuth circle in Figure 2 is known as the chain azimuth circle. The chain in the board shown is made from a standard bicycle chain. It is continuous, runs over sprocket wheels, and lies in two grooves beneath the table. These grooves lie beneath the azimuth circle plate at the outer circumscription of the field of fire, and continue under the left side of the board toward the pivot of the board—or the target. The extra length of the grooves is to allow the length required for an endless chain which would cover 360 degrees. The sprocket wheels are adjustable so that the chain can be tightened or slackened in the event of expansion or contraction of the table. The chain can be moved through 360 degrees in ten seconds by turning a crank which is attached to one of the sprocket wheels. There are 360 links and the numbers 0 to 359 inclusive are marked on the chain, one to each link. None of the parts are visible in Figure 2 except that on close inspection of Figure 2 the numbers on some of the links may be seen appearing in the holes of the azimuth circle plate.

The sectional azimuth circle is what will result where Whistler-Hearn boards are converted. Either type of azimuth circle lends itself to the flexibility of the Cloke design. The chain azimuth circle is a permanent fixture of the board. It cannot be lost unless the board is lost and the azimuth numbering is already in its proper order. The sectional azimuth circle must be guarded against loss and care exercised to see that the sections are fed into the azimuth circle groove in the right sequence. The chain azimuth circle is considered eminently satisfactory.

The primary arm in construction is a length of T-section metal.

The horizontal flanges of the tee are machined to fiducial edges and the vertical flange gives rigidity to the arm. Range graduations, 30 to the inch, are cut into each fiducial edge. Between the fiducial edges and the vertical flange, the horizontal flanges are slotted. Thin metal strips are made to fit each slot. Hundreds of yards of range are marked on the strips; they slide easily in or out of the slot, serve as indices to the range graduations and the scale of the board is altered by changing them as desired. A prolongation of each fiducial edge toward the azimuth circle passes through the zero of its respective subscale. Each subscale is marked for each five one-hundredth part of one degree by which the nearest hundredth may be interpolated so that the primary arm may be set in accurate azimuth and locked in that position by a suitable clamp. The subscale not in use can be blanked readily by the insertion of a small brass plate over its graduations. A prolongation of each fiducial edge toward the yoke passes through the center of its respective hole as drilled in a fitting attached to the end of the primary arm. When either hole is fitted to the pivot, which is a part of the upper prong of the yoke, a vertical line through the center of the pivot will pass through the corresponding pivot center of the secondary arm. This vertical line will pass through the center of the target, and will lie in the same plane as the fiducial edge being used. The mechanical accuracy of the board depends to a large extent upon this relation. Looking toward the azimuth circle the right fiducial edge of the primary arm is used for a right hand base line situation; the left edge for the left hand situation. It is these edges which are engaged by the master key or primary station. This arm then is universal and the only primary or gun arm required. A right hand situation is shown in Fig. 1. A left hand situation is shown in Fig. 2.

The secondary arm is a length of metal of rectangular cross section. It lies flat on the board. The edges of the arm which are perpendicular to the board must be machined to parallel planes; they form a track or guide for the sliding box and platen. The center line of the arm contains the ray from the secondary station to the target. Inlaid on this center line is a range scale similar to those on the primary arm. The center line passes through the zero of a similar subscale to those used on the primary arm. A suitable clamp permits an accurate setting of this arm in azimuth, and because both the arm and the clamp terminate at the inner side of the azimuth circle the primary arm will pass readily over the secondary arm when desired for relocation work. The center line passes through the center of a hole which fits over a pivot mounted on the lower prong of the yoke. (This pivot is not in view and comes from the under side of the table into the lower surface of the secondary arm.) Since the centers of the pivots of primary and secondary arms are in the same vertical line, it will be seen that this line represents the intersection of vertical planes containing the

fiducial edge of the primary arm and the center line of the secondary arm. The secondary arm terminates in a flange or stop against which the end of the sliding box comes to rest; the distance from this stop to the secondary arm pivot is equal to the distance from the center of the sliding box, to the edge of the sliding box which lies toward the target. The secondary arm is universal and the only secondary arm required by the board.

The yoke is a very heavy, U shaped metal casting bolted to a metal plate which is on the under surface of the table. The prongs of the U are set parallel to the plane of the table top. Near the end of each prong a pivot is fitted. The vertical line containing these pivot centers is a perpendicular to the table's surface and is the exact center of the azimuth circle of the plotting board.

The sliding box is rectangular in plan, is either built up or cast, and is channel shaped underneath. It fits over and slides along the secondary arm. To insure a perfect fit of the box to the paralleled edges of the secondary arm a metal strip or gib is inserted between one edge of the secondary arm and the respective flange of the channel recess. Adjusting screws run through the flange of the channel into the gib. The long axis of the sliding box is parallel to and lies in the same vertical plane as the center line of the secondary arm. On this axis at each edge of the upper surface of the sliding box is bevelled a fiducial edge for reading the range scale imbedded along the center line of the secondary arm. On the upper surface of the sliding box is a pivot the center of which lies on the long axis exactly halfway between the bevelled edges just mentioned. This point represents the secondary station. The platen pivots about this point. When the sliding box is withdrawn to the center of the board (the target position), and the edge of the box rests against the stop or flange in which the secondary arm terminates, then the center of the sliding box pivot must lie in the vertical line which contains the pivot centers of primary and secondary arms, because the distance at which the terminal flange is placed from the secondary arm pivot is equal to the distance from the box pivot center to the box fiducial edge which is resting against the flange. When the box is in this position the fiducial edge of the box which lies toward the azimuth circle will read zero range on the scale imbedded in the secondary arm. A very efficient clamp is a fitting on the box. By means of this clamp the platen's orientation is maintained while the box is being slid along the secondary arm. The position occupied by the sliding box and platen, in which the pivot center of the box lies at the target, or in the vertical line containing the pivot centers of the primary and secondary arms, will be referred to hereafter as "the orienting position." When the sliding box is in this position the motion of the secondary arm, as it is moved to various directions on the board in setting azimuths, will not affect the orientation of the platen so long

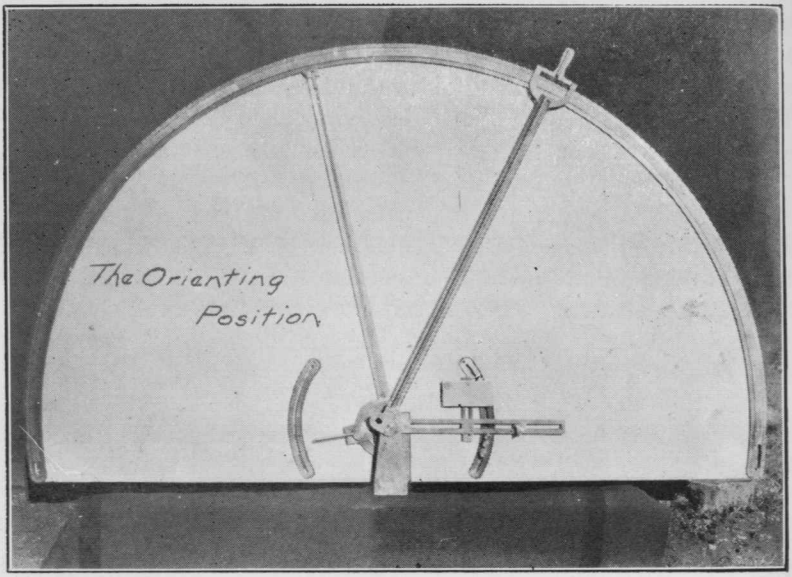

FIG. 5.

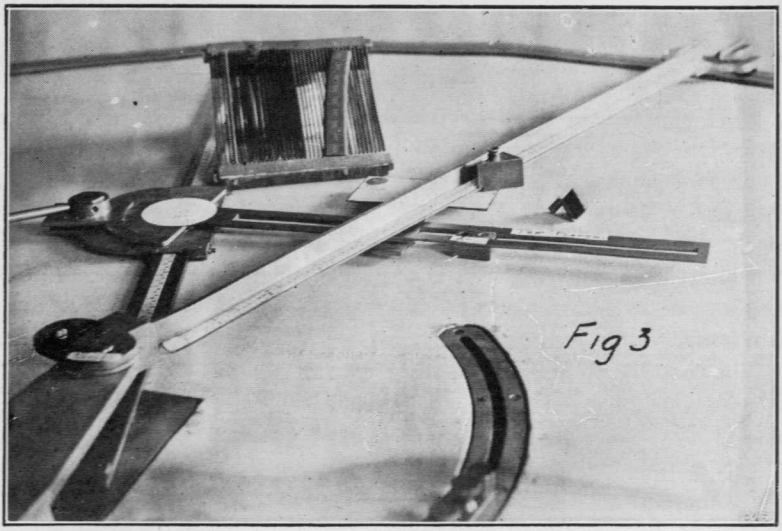

FIG. 3.

as the platen rotates freely about the sliding box pivot. The platen is clamped to the sliding box after the secondary armsetter calls "set." The sliding box can be changed from the right hand to the left hand situation by simply picking it up, reversing its long axis through 180 degrees, and then setting it down on the secondary arm again.

There are two types of platens. The universal platen is shown in Figure 3; it also appears in Figure 1. A fixed platen is shown in Figure 2. Another kind of fixed platen is shown in Figure 4. The universal platen is a permanent feature of all Cloke boards. The fixed platens are made up locally to fit particular situations. These situations can be set upon the universal platen also.

The universal platen is made from a flat sheet of metal as shown in Figure 3. One end of the platen is semicircular in shape. A hole is drilled at the center of this semicircle, or a recess is drilled in the under side of the plate at this point. When the platen is assembled to the sliding box this hole or recess fits over the pivot mentioned above and the secondary station is thus located on the platen. When a recess is used a punch mark is made on the top of the platen to indicate the exact position of the secondary station. A slot is cut to any convenient length out of the long axis of the platen. The edges of the slot are made parallel. A point moving on the center line of this slot,—or the long axis of the platen—will move in continuation of a straight line from the secondary station. This then is any battery base line. A fitting is inserted in the slot. By means of securing screws the fitting can be fastened at any desired position along the battery base line or long axis. A hole is drilled through the fitting having its center on the long axis or base line. Into this hole fits the master key representing the primary station. It should be apparent then that the length of any base line can be set to the scale of the board by a measurement of the distance between the pivot center of the platen (secondary station) to the center of the hole for the master key (primary station). There is another fitting with securing screws mounted in the slot of the long axis of the platen. Its purpose is that of a guide for a lateral slot which is set perpendicular to the slot of the long axis. Mounted in this lateral slot is a metal square called the gun plate. The metal plate has securing screws for fastening it to the lateral slot. The lateral slot then, can be moved in and out along a perpendicular to the long axis of the platen, and can also be moved (with its fitting in the long axis slot) along the long axis to any desired position. The gun plate can be moved to any desired position on the lateral slot. The position of each gun of a battery can be plotted by polar coordinates on the gun plate. In a corner of the gun plate a push button is fitted. This can be set, by use of polar coordinates, for the battery directing point. When the button is pushed a prick is made in the table surface. The receptacles for push button and master key are usually contained in metal blocks

whose depth equals that of the sliding box and is such that the surface of the platen will be parallel to the table surface. A three point support for the platen is thus secured—pivot, master key and push button.

The platen shown in Figure 2 is of the fixed type. To construct it the battery situation as to base end stations, guns, etc., is plotted to the desired scale on a sheet of paper. This is a pattern then for the platen. This plotted situation, or a part of a map on appropriate scale, is either pasted on a flat sheet of metal or the locations are transferred to the metal surface by punch marks. The metal plate is then cut away to the shape desired. A hole is drilled at the plotted position of the secondary. This is the platen pivot on the sliding box. A hole is drilled for the master key at the plotted position of the primary station. Another hole is drilled for the battery directing point, or gun if desired, and a push button fitted to obtain a track on the table for

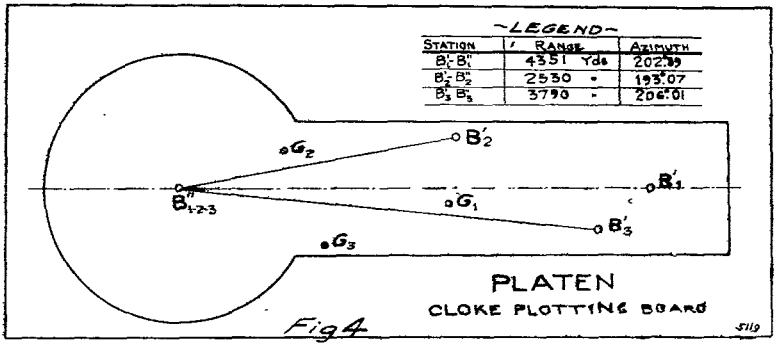

Fig 4

prediction purposes. Metal blocks of the necessary depth should be used at master key and push button to keep the platen surface parallel to the table surface.

Platens can be made for every situation as to battery base lines and guns, varying scales of the board, and may include adjoining battery base lines and guns on the same platen if desired. They can be filed away in a manner analagous to phonograph records and used at drill or service as needed. If, during drill or service, it becomes necessary to change platens, the change of platen and orientation can be made by a well drilled plotting section in less than 30 seconds and a continuous plot maintained, if the necessary communications to the changed base end stations are made available.

The platen in Figure 4 is a special type of fixed platen. It is a copy of a platen used in firing Battery Worth at Fort Casey, Washington, in 1919. The point G in each case is the same gun. The base lines change, but the point used on the platen to designate the various secondary stations remains the same. The actual locations of these stations in the field differ by hundreds of yards. The base line B'_1-B''_1 on the

long axis of the platen is the base line normally assigned to the battery. G_1 is the gun in its position relative to this base line. The base line of another battery, B'_2-B''_2 is shown in its proper relation, as to azimuth and length, to the first base line; G_2 represents the identical gun used with the first base line, and is shown in its proper position with respect to the second pair of base end stations. A similar situation is shown for a third base line B'_3-B''_3 (an emergency installation), and G_3 is the same gun in the same permanent emplacement as G_1 and G_2. If the board is oriented, the master key in B'_1, a push button in G_1 and observations taken from base end stations B'_1-B''_1 on a fixed point, the solution of this triangulation by the board will be shown by a prick in the table surface. If the orientation of the platen or board is not changed, the master key pulled out of B_1 and placed in B_2', and the push button changed from G_1 to G_2, the solution by the board of the observations from the second pair of base end stations on the same fixed point as before, will be identical with the first solution. The mark on the table surface for all three solutions will be the same point. This platen demands flexible communications, but when these are available the change in situation is accomplished on the board in about five seconds.

The use of platens of the fixed type is especially advantageous to fixed armament. When time is available, they can be used to advantage by railway artillery as well. The universal platen, a fixture of all Cloke plotting boards, can be used in fixed defenses for situations not considered by fixed platens but is especially advantageous to railway and tractor artillery whose battery positions are frequently changed.

The master key is cut from a piece of tool steel and fits snugly in the hole in a platen which designates the primary station. It is so designed that its knife like vertical edge is at the exact center of the hole and this edge then represents the vertical axis of the primary station's observing instrument. The key revolves freely about the vertical axis and is cut to quadrant shape so that only one point—on the vertical axis—can cut the fiducial edge of the primary arm. It may be fitted with a push button at its center if desired.

The base line stop is a block of metal provided with set screws and is designed to slide in the slots shown on the plotting boards as arcs of a circle. After the platen is oriented the base line stop is brought against an edge of the platen and clamped in place. It is a reference then to which the edge of the platen is brought when the platen is returned to the orienting position, after each plot.

To orient the board by any of the following methods, the master key must first be set in its proper position. On the fixed platens it is simply inserted in the hole for the primary station. On the universal platen, the key is placed in the fitting in the long axis of the platen. The platen is mounted on the sliding box and brought to the orienting position. The fiducial edge of the primary arm is brought against the

master key. The master key and its fitting are moved along the slot of the platen until the vertical edge of the master key is opposite the range graduation on the primary arm which equals the length of the base line. The fitting and master key are then locked in place by securing screws.

Any one of three methods can be followed to complete the orientation. The preferred method is:

1. For the left hand base line, turn the azimuth chain by means of a crank underneath the board until the number corresponding to the nearest whole degree of the base line azimuth appears in an opening in the azimuth circle plate near the left end of the board (to the left of a line from the yoke to the azimuth circle). Or, slide the sectional azimuth circle about in its groove until the desired degree number appears near the left end of the board.

2. Bring sliding box and platen to the orienting position and release the clamp mounted on the sliding box so that the platen can move freely about its pivot.

3. Set the left fiducial edge of the primary arm at the exact azimuth of the base line and clamp.

4. Swing the platen about its pivot until the vertical axis of the master key rests against the left fiducial edge of the primary arm. The edge of the sliding box must be against the stop or flange on the end of the secondary arm.

5. Slide the left hand base line stop in its slot or guide until it rests against the left edge of the platen and clamp it in that position. The board is now oriented.

For a right hand base line the method is similar. The right edge of the primary arm is used, the sliding box is reversed on its long axis 180 degrees from the position just described, the nearest whole degree of the base line azimuth appears at the right end of the board and the right hand base line stop is used. A left hand base line situation is shown in Figure 2.

The second method for orienting is as follows:

1. Set the chain azimuth circle, or sectional azimuth circle, about as before, but set it so that the normal to the base line will approximately bisect the board, for convenience in plotting.

2. Set the primary arm and secondary arm at the azimuths, from their respective observing stations to some datum point, and clamp.

3. With the platen mounted on the sliding box, but not clamped thereto, slide the box and platen along the secondary arm until the fiducial edge of the sliding box reads the known range from the secondary station to the datum. Holding the sliding box at this range revolve the platen about its pivot until the master key cuts the edge of the primary arm at the range from the primary station to the datum. It should be noted that the master key can cut the primary arm at two

places, but the place to be chosen must be that for which the range to the datum has been obtained. Trigonometrically; two sides, and the angle opposite one side, are given.

4. Clamp the platen to the sliding box.

5. Slide the platen and box back to the orienting position with the platen firmly clamped as in 4.

6. Bring the base line stop against the edge of the platen and clamp it firmly. The board is now oriented.

If the primary arm is now brought up to the edge of the master key it should read the azimuth of the base line.

The third method is a solution of an equilateral triangle.

1. Set the chain or sectional azimuth circle as in the first step of the second method.

2. Set and clamp the primary and secondary arms at azimuths which are exactly 60 degrees apart—or 30 degrees either side of the base line normal.

3. Move the sliding box and platen along the secondary arm to the range equalling the length of the base line. Holding the box in this position, revolve the platen about its pivot until the master key comes against the primary arm. The range thus intercepted on the primary arm should equal the base line's length.

4. Clamp the platen to the sliding box; withdraw platen and box to the orienting position.

5. Bring the base line stop to the edge of the platen and clamp firmly. The board is then oriented.

This indicated ease in orienting the plotting board lends itself to a method which will decrease the time, usually required, to begin fire with railway and tractor artillery occupying a new position. This method considers firing on moving targets rather than map firing. Accurate orientation, while desirable, is not an essential to accurate firing data. The essentials are: a meander line between base end stations, run while the second station is being selected and communications installed; a measurement of the base line to an accuracy of 1 foot in 2,000; and a measurement of the angles and distances from either base end station to the gun sights. A guess can be made as to the true azimuth of the base line. The observing instruments, gun sights, and Cloke board, can be set on azimuths corresponding to the assumed azimuth of the base line and accurate range and direction of fire obtained. Some time later, when accurate orientation data have been secured, the plotting board is reoriented by simply shifting the azimuth circle and base line stop, and the assumed orientation of gun sights and observing instruments is changed to conform. There is nothing inaccurate in this method and it is used frequently in transit traverses.

There are two methods used in plotting; the direct method and the offset method. Four men are required for service plotting, primary

armsetter, secondary armsetter, assistant plotter, plotter. The assistant plotter slides the platen to and fro along the secondary arm. The duties of the other men are practically the same as on other manual plotting boards. Assuming that the board has been oriented the direct method of plotting is accomplished in the following manner:

1. The arms are set at the azimuths sent from the respective observing stations at the usual time intervals. While the secondary arm is being set the sliding box and platen should be at the orienting position; the platen should not be clamped to the box and the edge of the platen should be against the base line stop.

2. After the secondary armsetter calls "set" the assistant plotter clamps the platen to the sliding box.

3. The assistant plotter slides the box and platen along the secondary arm until the vertical edge of the master key touches the primary arm.

4. The plotter pushes the button representing the gun or directing point.

5. The assistant plotter withdraws box and platen to the orienting position and releases the platen clamp.

6. The plotter obtains the positions of the predicted point and set-forward point in the usual manner; sets his targ on the point for which range and azimuth are desired; notifies the primary armsetter to bring his arm up to the targ and then calls out the range.

7. The primary armsetter reads and calls out the azimuth. When the time range and time azimuth prediction boards are used, the plotter places his targ on the point just plotted and obtains range and azimuth as before.

In the offset method of plotting the procedure is as before, except that the plotter does not push the button at the gun position, but sets his targ at the intersection of an edge of the sliding box and the secondary arm. Predictions are made on successive positions of this point. The targ is placed on the predicted—or set forward point; the secondary arm is brought against the targ; the sliding box and platen are brought against the targ, the primary arm is then brought over to the gun position, and the range and azimuth from the gun to the set forward or predicted point are obtained. Since these are similar triangles there is no inaccuracy in this method. Some plotters like it because it brings the plotted track into plain view and away from the working parts of the board.

For Vertical Base Secondary plotting, only the secondary arm is used in the operation of plotting. The primary arm is used as a gun arm to read ranges and azimuths from gun or directing point. As, in the offset method, the secondary arm is set in azimuth, and the sliding box moved to the proper range on that arm. Either the direct or offset method of plotting is followed from then on.

For Vertical Base Primary, the general method is the same as for Vertical Base Secondary. The designation right hand base line, left hand base line, primary station or secondary station is purely arbitrary and so are the definitions for these terms. The primary station is just as good a secondary station as the defined secondary station is. In this solution then, the primary station is placed at the pivot of the sliding box, the back azimuth of the horizontal base line is used, or for that matter an azimuth is assumed, the gun is located with respect to this horizontal base line and station, and, after orientation of the platen and board, plotting is done exactly as described for vertical base secondary.

It should be noted that a right hand base line can be made to appear on this plotting board as though it were a left hand base line. This is in accordance with the description for Vertical Base Primary. So far in this article, the generally known terms have been used and descriptions have been consistent with the definitions of those terms to avoid confusion. It is perfectly practicable, just as accurate, and many times preferable to place the primary station at the pivot on the secondary arm and, after setting the master key in the secondary station, locate the gun, etc., with respect to these locations of base end stations. The back azimuth of the base line is used, the board oriented, and plotting and relocating done as described up to this point. The azimuths being sent from the actual primary station are set on the secondary arm. Those from the secondary station are set on the primary arm.

A great many instances of special situations which have been solved by the board, could be described to prove more conclusively the board's accuracy, simplicity and complete flexibility. The foregoing description should clearly establish these points, however, and it is desired to discuss from now on the adaptability of the board to the missions of all coast artillery armament; its applicability to standardization of methods and training, especially for isolated National Guard, Reserve and R. O. T. C. units; its superiority to all other manual plotting boards; and the probability that it can be included successfully in the long range fire control solution.

ADAPTABILITY OF THE CLOKE BOARD

The term "Manual Plotting Board," as used herein, is assumed to define a board upon which successive positions of a moving target are obtained graphically. It is used in an effort to distinguish the 360 degree, 110 degree, Whistler-Hearn and Cloke plotting boards, from such agencies as the Ford battery computer, Ford range keeper and those of the coincidence type.

Whenever the term short range is used it applies to ranges up to 15,000 yards, medium range defines ranges between 15,000 and 25,000 yards and long range implies the use of ranges between 25,000 and 50,000 yards.

The normal missions of all Coast Artillery weapons except anti-aircraft and trench mortars include fire on waterborne targets. Such usage for fixed defense and railway artillery units is prescribed. That the 155-mm G.P.F., which is a short and medium range gun, can adopt this mission has been conclusively demonstrated at Fort Eustis and in Hawaii. Accounts of the Fort Eustis target practices were published in recent issues of the COAST ARTILLERY JOURNAL. A pilot mount of the 8-inch howitzer is being made on a modification of traversing ability which will probably permit the use of this cannon against naval targets at short range.

The devising of uniform methods for the training of Coast Artillery National Guard, Reserve, and R. O. T. C. units in conformance with the National Defense act has been difficult. This is especially so in the case of organizations at places remote from the seaboard and it is understood that 155-mm G.P.F's and certain items of fire control equipment will be issued to many of these units. This action will make for standardization of training methods and equipment. The assumption can therefore be made that in the near future all of the diverse units of Coast Artillery, with the exceptions noted, can be united in a system of fire control which will closely parallel that in use in fixed defenses at present.

The advent of long range armament has made necessary a fire control system adaptable to long ranges. It is the writer's belief that no sweeping change in our present fire control methods will be found necessary to accommodate the long range solution. It is conceivable that some modification in methods and equipment will be introduced but as far as can be foreseen the basis of our complete fire control system as it changes from long to medium to short range will be the system now used in fixed defenses.

It is proposed to show that the Cloke Plotting and Relocating Board possesses the flexibility necessary to attain a high degree of standardization and that it is a considerable improvement on all manual plotting boards now in use. Its adaptability to the following uses will be considered:

(A) Harbor Defense Artillery.
(B) Railway Artillery.
(C) Tractor Artillery.
(D) National Guard, Reserve and R. O. T. C. units.

(A) USE OF THE CLOKE PLOTTING AND RELOCATING BOARD IN FIXED DEFENSES

In this connection the present fire control plan is considered. Under this plan uncorrected firing data for primary armament are obtained by 110 degree plotting boards or those of the Whistler-Hearn type. That either of these boards will give a satisfactory and continuous plot of

the track of a moving target under certain conditions is admitted. These conditions are principally, visibility from terrestrial observing stations, the maintenance of communications with a given pair of horizontal base line stations and the emergency vertical base system.

No satisfactory substitute for visual observation from terrestrial stations has yet been devised and the prospect of such development, radio goniometric, sound ranging or other means, in the near future, is slight, although subaqueous sound ranging experiments are promising. Recent attempts at the control of long range firing problems from airplanes have resolved into position finding by the gun. An article in the January issue of the COAST ARTILLERY JOURNAL describes a recent problem on these lines. It is interesting to note that position finding by the gun is what our fixed defense fire control system will degenerate into, in the final stages of a drawn out engagement where communications have been destroyed. That is to say, the long range fire control conception now held is to substitute for visual observation from horizontal base line stations, when necessary, an agency giving the estimated direction and speed of a target from a point whose location is known. This principle is applied daily in every plotting room in locating a set forward point, the only difference being one of accuracy. The estimated course and speed is then corrected upon observation of fire by the same agency. When the target is visible and the movements of enemy vessels are not confined to a narrow channel, an emergency fire control in which the estimated course and speed of a target are obtained by the battery commander's observation of the fall of his shots with respect to the target, may be the only means left when communications are gone, and is a reversion to the fire control principles of the day of the wooden frigate, which may not be so bad after all.

No means are provided in the standard communication system whereby reassignment of base end stations can be made to meet the conditions obtaining in action, and it is probable that a fort's communications will be injured by hostile fire. The general system of having many primary and secondary stations grouped on the same cable is a glaring weakness in our fire control installation; but the practice is perhaps justifiable on the grounds of economy and the probability that this cable will be suppplemented by other systems when war is imminent. A continuous plot of a vessel's track cannot be made, nor can gun fire be efficiently maintained, unless the data being sent from base end stations which remain in service and are observing on the same target, can be utilized by a battery or plotting room which is crippled by the unserviceability of its assigned observing stations.

While it is apparent that any step toward a flexible plotting board must begin with a modification of fire control switchboards it is also evident that the desired flexibility of communications can be obtained. The target practice report of Battery Worth at Fort Casey in the Coast

Defenses of Puget Sound for the year 1919, contains an account of such procedure. Base end stations were changed at will, without reorientation of the board, and a continuous plot of the target's track was maintained during the practice. A Cloke Plotting Board and the platen of Fig. 4 above were used. Flexibility of communications was obtained by means of a temporary modification of the switchboard panels. A "jumper" was placed between the terminals of various lines and removed after the practice. A complete emergency telephone system, as a supplement to the cable on which observing stations were grouped, was also a feature of the practice. A jack board can be substituted for the "jumpers." The Commanding officer of the Coast Defenses of Puget Sound has stated that the Coast Defense Artillery Engineer who was there in 1916-17 recommended a modification of the fire control switchboards which consisted of adding two panels to each, using telephone material which could be bought locally. At the time the estimated cost of this modification was given as $500 per fort. It was claimed that such flexibility of communications would result, that full advantage could be taken of the flexibility of the Cloke Board, and any combination of stations thrown in on any battery or plotting room.

The absence of flexibility in the 110 degree and Whistler-Hearn boards is a well known defect. A continuous plot of a target's track cannot be made on these boards if a change in base end stations become necessary. This can be accomplished easily on the Cloke Board. For this reason, a large number of platens of the types shown in Figures 2 and 4 have been made in the Coast Defenses of Puget Sound for use with older models of the Cloke board. It is desired to comment again on the fact that the flexibility of the Cloke board is not dependent upon the local manufacture of special platens. The universal platen shown in Figure 3 is adaptable in itself to any situation, but both types of platens are advantageous to fixed defense and railway artillery problems.

Relocation cannot be had on the 110 degree or Whistler-Hearn types without considerable trouble. In some cases it is necessary to send the boards to an arsenal for modification and in the general case results in a multiplicity of arms and other attachments. Relocation can be accomplished with ease on the Cloke board for any number of points, and no additional arms nor special attachments are required. A special platen has been made for this board in the Coast Defenses of Cristobal by means of which it is possible to relocate every observing station, gun position, or light house, adjoining the battery or fire command for which the platen was designed. The necessity recently arose for relocating from data obtained on moving targets and referred to the directing point of Battery Parrott at Fort Monroe. Time was not available for the construction of a difference chart or the alteration of a Bowler spotting board. The 110 degree board, upon which the data were originally obtained, was not adaptable to ready relocation, and the

use of a Cloke board at Fort Eustis was necessary. Incident to the relocation, it was noticed that the first order of range differences in the targets' courses as obtained on the 110 degree board at Fort Monroe, was not so nearly constant as the differences on the same courses as plotted by the Cloke board at Fort Eustis.

Considering the mechanical operation of plotting boards the Cloke board is by far the simplest. It has but two arms, primary and secondary, which are adaptable to any changes in situation. It has one continuous, easily changed, azimuth circle. The confusion and interferences caused by the numerous arms, couplers, reading windows and superimposed azimuth circles on the 110 degree and Whistler-Hearn boards are well known. The absence of these defects in the Cloke board is apparent upon inspection of Figures 1 and 2. While all three boards possess the accuracy and speed needed to obtain firing data for the ranges ordinarily used, the Cloke board is capable of greater accuracy than the other types. An inspection of Figures 1 and 2 will indicate the reason for this increased accuracy. The graduations of the azimuth circle in Fig. 2 actually radiate from the point of intersection of the arms. These lines are but close approximations, practically accurate however, of true radial lines from the centers of the various arms in the case of other boards, and is the case in Fig. 1 which is a converted Whistler-Hearn Board.

An exhaustive, comparative test of Cloke and 110 degrees boards was made in the Panama Canal District in 1920. This test clearly established the superiority of the Cloke board both as to accuracy and speed of operation. The report on the test, by officers of long service, was an unqualified indorsement of the Cloke board. Its adoption was advocated for both fixed armament and railway artillery and the substitution in manufacture and installation of this type for the 110 degree board was urged.

The Commanding Officer of the Coast Defenses of Puget Sound has stated:

"The Cloke board is a simple accurate inexpensive plotting board that fills all the requirements even for flexibility that are mentioned as desirable for a short range fire control system. Six of these boards have been built locally and we have one or more in constant use at each fort. It is preferred to any other board."

This quotation is in effect a comparison with the Whistler-Hearn board which is standard in the Coast Defenses referred to. The six Cloke boards referred to are older models which are greatly improved in the design shown above.

The board appears adaptable to any situation requiring heavy artillery fire. Prior to 1917 a target practice was held in the Coast Defenses of Puget Sound in which mortars at Fort Worden fired over the Quimper Peninsula into Discovery Bay. The observing stations in this instance

were miles in advance of the firing battery. This means that it is possible with the board, if the necessary flexibility has been imparted to a communications system, to supply from one fort, accurate firing data to another fort which has lost its observing stations or cannot see the target from those it has.

An experiment is in progress in Panama with devices which attempt an instantaneous solution of the position finding problem. The consequent reduction of the predicting and set forward interval to the time of flight only, is a tremendous advantage to antiaircraft fire control which must reckon with three dimensions, but the need for this reduction, an admitted advantage, is not so apparent for fixed armament except at extreme ranges. The heavy cost of these devices as compared with any manual plotting board will be disregarded in this discussion, nor will a detailed description of the devices be possible. The basic principle however, is an estimation of the course and speed of a target. This can be simply an estimation, as is the case in naval usage of the devices, or it can be obtained accurately from successive triangulations. The only agencies, at present, which will supply data for an accurate solution, are terrestrial observing stations. The chances for errors then, are equal up to the point of setting the situation on the plotting board, or upon the computing devices. That there will be an advantage from that point on in the direction of accuracy and elimination of personnel errors in favor of the computing device is conceded. If the analogy be permitted, the writer has yet to meet a typist or adding machine operator who did not make mistakes.

If the situation be assumed that any target is moving at a fairly constant speed on a straight line course any manual plotting board is capable of sufficiently accurate results and there is not much gained by a reduction of the predicting interval.

It has been demonstrated, with certain types of armament, that firing data can be routed through a plotting room and set on the guns in less than 10 seconds. A 15 second predicting interval has been used successfully. The use of these intervals requires well drilled personnel and the tendency to hasten is a cause for personnel errors. The extension of the predicting interval to 30 or 60 seconds is born of this experience and is a compromise to obtain consistent accuracy. If there is sufficient need, the predicting interval now used in plotting can be reduced. A certain lapse of time is required for a chain of data to pass through a system which includes a computing device, and this time must represent a predicting interval. If it be ignored, then an error is introduced which must be compensated in fire adjustment. The errors caused by the tendency to hasten on manual plotting boards may be offset against this.

Nor is there as much gain in accuracy as there would seem in a reduction of the predicting interval where sinuous courses are consid-

ered. If, for the sake of illustration, the probability of a hit at a certain range is assumed to be 10%, it has been found that the reduction in this probability, due to plotter's errors, and the predicting interval, on sinuous courses amounted roughly to 25%. It is desired to emphasize that this probability is not the chance that the target will be in the 50% zone of dispersion, nor that the shot would fall more than one probable error from the target. The statements just advanced are conservative and will, so it is believed, obtain throughout short and medium ranges.

The writer is conversant with the general features of the plan which prompted the Panama experiment, and no attempt is being made herein to minimize the importance of the development of a long range fire control policy. The communications and fire control matériel of coast defenses must admit of their use at long range, as well as short, and it is realized that any advocated change in matériel, should be capable of incorporation in a long range fire control policy. A sweeping change in the standard system has been proposed to accommodate long ranges. This suggested change is, however, concerned primarily with certain principles of command, and the communications necessary for their functioning. It provides for the relocation of data referred to a common directing point. It does not preclude the adoption of the Cloke board, and the only device of which the writer has knowledge which possesses such flexibility as to be capable of use as a relocating device, under the proposed change, and be capable also of plotting as part of the present position finding system, if the need arises, is the Cloke plotting board.

It is not believed that any fire control policy should be adopted which does not provide a positive means for each *battery* in fixed defenses to do its own position finding in certain contingencies. Nor is it believed that any instruction policy is sound which does not finally equip a battery officer with the ability to fire his guns when the only means of position finding left to him are the guns themselves. *The Proceedings of the Joint Army and Navy Board* (*Joint Army and Navy Action in Coast Defense*) is established doctrine. In principle it requires a positive defense at short range, and its extension to the longer ranges. The installation of long range armament is in step with that doctrine, in that it precludes the probability of the leisurely attack of important centers, defended by present fixed defenses, by hostile vessels lying just out of range. It is therefore believed that a system of standard fire control, based upon manual plotting boards and terrestrial observing stations, is still sound in principle and necessary for training and service. The Cloke board is not only adaptable to this system but is an important improvement on the present equipment. It is not believed in view of the existence of the Cloke board that the plotting phase of the present fire control system in fixed defenses is sufficiently well cared for by the

types of boards now in use. The expense involved will probably limit the installation of Cloke boards to replacement purposes.

(B) Use of the Cloke Board by Railway Artillery

In the early part of December, 1922, the 8-inch rifles, railway, at Fort Eustis fired at a moving target on the water. The practice was very successful. A Cloke board as modified from a Whistler-Hearn board was used. The plotted target track and relocated data for four guns were obtained with ease and rapidity. The plotter and personnel using the board were enthusiastic about its mechanical operation. An examination of the board disclosed some mechanical defects but these were minor troubles, a result of local conversion and they are not present in the converted Whistler-Hearn board shown in Figure 1.

The gist of a report on this modified board, by the officers who fired the battery is:

(a) Accurate data were obtained for four guns.

(b) The board can be oriented for any situation and used for all-around fire. It can be reoriented quickly for fire in adjoining sectors, etc. Relocation is simply and speedily done.

(c) Twenty seconds appears to be the average time required to obtain data for one gun and forty seconds for four guns.

(d) Four men are required to operate the board.

(e) No mechanical difficulties were encountered in the operation of it.

(f) Recommendations for minor changes were made. These are accomplished in Figure 1.

(g) Using the offset method of plotting (as described above) some difficulty was encountered in obtaining the position of target and tug at the instant of splash. This difficulty was overcome.

(h) "It is believed that this board has many advantages over the Whistler-Hearn board. Among these are simplicity and ruggedness of construction with no small pinions and gears to wear, and facility and rapidity with which board can be changed from one situation to another. Another great advantage is that it does away with all relocation devices and the fact that separate data for at least four guns can be sent out every minute."

On January 30, 1923, a board of officers visited Fort Eustis for the purpose of inspecting the modified Whistler-Hearn board and reporting on its adaptability to the following missions of railway artillery:

(a) Railway artillery as a coast defense adjunct, operating from selected positions within the boundaries of a fort and using the fort's standard or emergency observing stations, and possibly its communications.

(b) Artillery operation in areas contiguous to forts where an independent fire control system will be necessary.

(c) Coastal operations where no fixed defense exist, and it is practicable to get railway artillery units into positions for seaward firing. That is to say, the use of railway artillery in accordance with the principles of W.P.D. Document No. 1 and the Joint Army and Navy Board on Seacoast Defense.

(d) Land operations with field armies, when railway artillery can be used against moving or fixed targets commensurable with the power of this class of artillery.

The theory and operation of the plotting board as set forth above were thoroughly explained to these officers. No mechanical interferences were found. It was apparent that more finished construction and elimination of some defects from a mechanical engineering viewpoint, would ensue if arsenal personnel made the drawings and parts, and this was arranged for. It was the opinion of all the officers present that this plotting board was thoroughly adaptable to all the missions of railway artillery, and that it met them better than any other type of manual plotting board.

When the mission of this artillery as an adjunct to fixed defenses is considered it is apparent that the arguments advanced for use of the Cloke board by fixed defenses will apply with equal force to railway units. Considering those missions which include operations coastwise, contiguous to forts, and with field armies, the need of this plotting board is more apparent. There will not be time available for arsenal or local machine shop alteration of a 110 degree or Whistler-Hearn board, and these units must be equipped with a flexible, manual plotting board.

(C) Tractor Artillery

The 155-mm G.P.F's at Fort Eustis will be fired this spring at moving targets. A Cloke Plotting Board will be used for the practices. When the mobility of this armament is considered, the need of a flexible plotting board, readily adaptable to quick changes in battery positions, is evident if these guns are to fire on naval targets; and the reasons which have been given for the adoption of the Cloke board by fixed and railway artillery are more cogent.

Some minor modifications of the board may be necessary to care completely for this problem. It is desirable to obtain firing azimuths in terms of the deflection angle as set on the panoramic sight and referred to the aiming point. The availability for issue of a large number of model 1918 azimuth instruments, graduated in mils, indicates that the Cloke board used by these units should possess a sectional, or chain,—azimuth circle graduated in mils. For the purpose of standardization however, it may be better if the board were modified to permit of plotting in degrees and hundredths, obtaining firing data in mils, and vice versa. While these modifications do not yet exist, they are planned,

and may be included in the board in the event of its issue as organization equipment. In the meantime these problems are handled by conversion of data in the plotting room.

(D) National Guard, Reserve and R. O. T. C. Units

In National Guard training, when armory facilities permitted the installation of standard fire control systems using manual plotting boards, Whistler-Hearn boards were provided. These had to be especially constructed as to azimuth circle, for the base lines in the particular armories concerned. This was expensive. Similar remarks apply to a larger extent where 110 degree boards were provided. Units were given armory instruction on the Whistler-Hearn boards, but during the annual 15 day service period, in many cases, they had to use 110 degree boards. They were thus trained on one board, under the usual difficult conditions of armory training, and were then required to use in service a board differing materially in construction and operation. Confusion resulted, and in a large measure the year's armory training was misapplied, because the units were confronted with mastering in a few days an entirely new device.

The issue for armory training of Cloke boards, either new or converted from the Whistler-Hearn and 110 degree types, will be less expensive than the issue of the other types, because the Cloke board does not have to be reconstructed for each local condition. During the armory training period the units can be instructed on the same type of board which will be used during the annual service period, for, if Cloke boards are not actually installed at the batteries to which these units are assigned, the situation can be met by simply transferring from the armory to the battery plotting room, the board on which the unit was trained at the armory.

Many Coast Artillery National Guard units are at isolated stations and no satisfactory system for armory training has been devised. The contemplated issue to these units of 155-mm G.P.F's should be accompanied by the issue of a Cloke board, necessary telephones and wiring, two azimuth instruments, a wind component indicator, a range correction board, a deflection board graduated in *degrees* and *mils*, and an inexpensive time interval apparatus of a type recently approved. With this equipment, these units can be well grounded in the fundamentals of the standard coast artillery fire control system, in the armory training. This equipment can not only be used in training, but can be taken in entirety and used during the annual 15 day service period, or in actual service.

The remarks concerning National Guard usage of the Cloke board apply with equal force to Reserve and R.O.T.C. units.

RESUME

In the fire control of long range batteries a relocating device may be necessary. The Cloke board is a suitable device. Within certain ranges this board will have an order of accuracy comparable with computing devices now undergoing test. Its use in long range fire control will permit the use of an ordinary manual plotting board in emergency.

The Cloke board is an improvement over any manual plotting board. It is simpler, more accurate, possesses a high degree of flexibility, is suitable for all types of artillery, and is cheaper to manufacture than 110 degree or Whistler-Hearn boards.

It may be made entirely new, or by conversion of Whistler-Hearn or 110 degree boards.

The efficiency of our present fire control system can be greatly increased by the adoption of the Cloke board, and this adoption will be an important step in the direction of increased flexibility and standardization.

National Guard, Reserve and R. O. T. C. training should be based primarily, on fire control methods using terrestrial observing stations and manual plotting boards.

For the present, considering the state of development of long range fire control, manual plotting boards in conjunction with terrestrial observing stations give an acceptable solution of the fire control problem for heavy artillery within the maximum limits of visibility. This system is acceptable in principle and its use in training gives an excellent foundation for artillery firing in action.

EDITORIAL

Again—The Work That Lies Ahead

THE Editorial in the January JOURNAL, *The Work That Lies Ahead*, has called forth some much appreciated comment from Coast Artillery officers, and in consonance with the conviction that certain considerations of importance to the Corps were touched on in that Editorial, it is desired to amplify the ideas therein set forth by some further consideration of the discussion which that editorial started.

In the first place, a Colonel of Coast Artillery, whose ability and ideas command profound respect, has taken issue with the idea advanced in January as to the outstanding privilege of service in the foreign garrisons of Coast Artillery in the next few years, in the following words:

"Before proceeding to the technical, I want to make the point that while foreign service gives our best chance for tactical and group training, the very conditions of our home service now permit all sorts of experiments in position finding and observation of fire. Moreover because of the danger that Coast Artillery troops in the United States may lose interest and become vegetables, original work of this kind is more than ever to be urged. I can't help feeling that your editorial tends to preach hopelessness and inaction in the home defenses and in this respect I hold you in the wrong."

A careful re-examination of what was said in January renders necessary the admisson that the criticism just quoted is sound. While of course the idea which was intended to be conveyed is limited to the conviction that for those elements of combined training and coordination of the larger units of Coast Artillery tactical command, the foreign service garrisons now afford the only practical laboratory for concrete experiment and experience, yet it was certainly not intended to infer that the function of independent and constructive thought need lie dormant in those serving in the United States, with regard to the development of Coast Artillery technique, any more than in the development of Anti-Aircraft Defense or of efficient administrative method. Emphatically, so long as we know that there are real Coast Artillery problems yet to be solved, every Coast Artilleryman, wherever he may

be serving, is confronted with the constant challenge for the exercise of constructive thought and painstaking effort.

As might have been expected, the comments on the January editorial bore heavily on what was said with regard to fire control and observation of fire. A Coast Artillery officer on R.O.T.C. duty has this to say:

"I wish to comment on one of those ideas. i.e., troubles in securing good observation of fire. As pointed out, the great concentration of fire necessary in the future increases the difficulties of observation of fire beyond anything which has been experienced by any of us in the service of Coast Artillery armament, and when I venture the opinion that they are, and always will be, extremely difficult at even moderate ranges and almost insuperable during fog and darkness I am not 'giving up' but merely attempting to state a fact. If we can accept that opinion as a probable fact then we had better direct our energies toward another form of solution.

"Someone said that 'an ounce of prevention is worth a pound of cure,' and may we not apply the thought towards overcoming our difficulties of observation of fire? If we knew beyond doubt that all of our shots would fall where we direct them then curiosity to observe the damage done would be the largest of the incentives for observation of fire, and the actual need for it would wholly cease. Would it not be more profitable to delve more deeply into the secrets of interior and exterior ballistics, to more accurately determine the characteristics of our powders, to better design the weapons and the projectiles which we use, since it is the defects in these which make observation of fire of such large importance to us? We cannot hope that all of these defects will ever be removed but the faith which we have in our technical men leads us to believe that they can remove many of them. Let them come to a full consciousness of the task, and the duty, before them and begin.

"Let us view observation of fire as an expedient necessary to compensate for the defects mentioned, and let us realize that the extent to which our technical men are successful in removing these defects will measure the extent to which we have accomplished permanent basic improvement in our system. I do not hold the belief that we can cease to observe fire nor that we should cease attempting to improve our methods, but do point a way for basic improvement which will minimize the need for observation, i.e., preventative rather than curative endeavor."

Other comment on observation and adjustment of fire emphasizes the limited time that will be afforded the coast guns to gain fire effect in certain forms of action which may be anticipated. The great speed of modern war vessels means that fire of the maximum volume and rate must under certain conditions be attained from the beginning of the action, and that if effect is to be obtained at all, this effect will be obtained in the first few minutes of action. A consideration of this fact, in elaboration of the idea set forth in the preceding quotation throws emphasis on the importance of the most accurate and careful initial preparation of fire, and the necessity for the reduction to a dependable minimum of both personnel and armament errors. For the reduction of armament errors below prevailing standards, we must look largely to the efforts of technical experts in the Ordnance Department. The elimination of personnel errors and the accurate preparation of fire is

our own concern. This re-emphasis on the importance of initial preparation of fire amounts to a very salutary harking back to the point of view prevailing in the Coast Artillery before the War. Even without observation, the Coast Artillery must not admit its inability to deliver fire which will be effective, at least in denying the use of channels passing a coast fort to a hostile naval force.

We are now sufficiently removed from the conditions immediately engendered by the World War to be able to recognize the following facts. Before the War Coast Artillery doctrine, with regard to the technique of fire, placed the primary emphasis and confidence in the necessity for careful initial preparation of fire, with the concrete belief that if the fire were prepared with sufficient accuracy, effect on the target would be bound to follow. On the contrary, the attitude engendered by War experience was to the effect that successful conduct of fire depended primarily upon effective observation and successful adjustment. There developed a marked tendency to repudiate the importance of ballistic corrections in the initial preparation of fire and at the same time the whole pre-war technical doctrine.

In this world, thought, like history, moves in cycles. We have now arrived at a point where we should be able to recognize and utilize the valuable elements of both pre-war thought and post-war thought. Having in mind the comment above quoted and a sound estimate of the tactical conditions which should determine our technical doctrine, is it not fair to say that we should have the utmost regard *both* for the most painstaking preparation of fire, with all that it includes in the analysis of all the former performance of a battery, the meticulous adjustment of all instruments and devices, the accurate determination of ballistic corrections, including firing of trial shots wherever possible, and as well, the subsequent control during the action of the center of impact by a simple and adequate method of fire adjustment? In order to open fire at the maximum rate and with maximum volume, careful preparation is necessary if effect is to be expected within the first few salvos. Moreover, effect on moving targets as a result of careful preparation is to be expected only within the first few salvos. Subsequently, when the great speed of the target has changed its range and azimuth so as to modify the original ballistic conditions, and when through the expected resort to a zig-zag course, unavoidable errors of prediction have operated to shift the center of impact off the target, the necessity for adjustment develops increasingly as the action continues. With such a point of view, may we not harmonize logically the doctrines prevailing in the Coast Artillery just before the War and just after the War?

In order to arrive at a practical solution of the problem of Coast Artillery fire in which we may have confidence, it is necessary that suggested methods should be tested under conditions involving the

travel of the target at twenty-five knots or more on a sinuous course and in all probable directions, including the direct approach to the battery firing. No such target has ever been available in the Coast Artillery, nor is it likely that it ever will be. Accordingly, the question arises whether the method suggested by Captain H. H. Blackwell in his Second Prize Essay, *Notes on Target Practice Methods* appearing in this issue of the JOURNAL, for a "targetless target practice" is not worthy of the most serious consideration. Indeed, it should be observed that at about the time Captain Blackwell was writing this paper in the Canal Zone, one coast defense commander in the United States was initiating preparation for the conduct of his target practices during the current year by this method. It is to be expected that the results of these experimental targetless target practices will later afford valuable data for subsequent use throughout the Coast Artillery in its experimental work. As is well known, one of the greatest problems confronting the Coast Artillery results from the ability and likelihood of a naval target proceeding on a sinuous course. The most complete discussion of this problem which has so far appeared was presented by Major (then Lieutenant Colonel) Roger B. Colton, in the November 1919 issue of the JOURNAL. Coast Artillery officers now disposed to attack this problem would find a careful perusal of Major Colton's discussion very profitable. By the resort to targetless target practice, including an extensive employment of the same idea in drills and experiments, we should be afforded the best opportunity for arriving at a workable solution in this problem.

With further reference to what was said in the January editorial and what has already been advanced in the present discussion with regard to *Fire Control* and *Observation of Fire*, it is pertinent again to call attention to Captain Blackwell's paper in the present issue of the JOURNAL. It will be seen that Captain Blackwell has raised the definite question as to whether or not in fire at a moving target there need be more than one method of fire adjustment. Is it too much to suggest that this idea is worthy of the most thorough theoretical and practical investigation? In this connection it is in order to remind the reader of a very real parallelism in viewpoint between Captain Blackwell's ideas and those of Major Quinn Gray embodied in his papers in the JOURNAL for May 1921, October 1921 and May 1922.

From one standpoint it is fair to assert that the use of trial shots is probably to be considered an element of the *preparation* of fire, rather than of *adjustment* of fire. Granting this distinction, an examination of the four methods of adjustment prescribed in Coast Artillery Memorandum No. 4 (revised) will reveal the fact that in any of these prescribed methods, the control of the center of impact is effected in substantially the same manner. As has been well remarked by a Colonel of the Coast Artillery, "You can't change human nature and in future

artillery action as in the past, raw human nature will be on exhibition." Would it not be a comforting thought for every battery commander, as well as for every fire and fort commander, to know that when for perhaps once in his lifetime a battery commander is called upon to engage an advancing hostile fleet, that the element of uncertainty in decision as to method and procedure would be boiled down to a minimum, and that through long experiment and practice in time of peace, the battery commander would have *one* simple and elastic method of adjustment to resort to? If it is not considered too fantastic to suppose that such a universal method of adjustment can be devised and experimentally confirmed, it is perhaps not out of place to outline the basic framework which should govern the development of such a method. It is suggested that the method should fulfill the following conditions:

1. It will enable use to be made of measured deviations of impacts, either from the target or from the set-forward point, when such a determination is available.

2. It will continue to function, maintaining continuous control of the center of impact and improvement of adjustment whenever measured deviations can no longer be determined, and only sensings can be obtained.

3. The method will be able to pick up the thread of adjustment and carry on after interruption of observation during which neither measured deviations nor sensings can be obtained.

4. The method will function whether one gun or eight are under the same fire direction.

5. The method will take full advantage of the most complete initial preparation of fire (including the firing of trial shots before action) and at the same time will quickly get control over the center of impact even if the initial preparation has been poor.

6. The method must not depend upon a regular interval between the firing of salvos.

7. The method must be such that corrections can be made without interrupting the firing, can be applied whenever they are determined, and must recognize that when the initial preparation of fire has been such as to justify the expectation that the target will be included within the zone of dispersion, rapid and continuous fire may be taken up from the opening of the action, without waiting for corrections from the observation of the first salvos.

8. The method should be one which will be applicable for use in target practice with its limited ammunition allowance, and equally so in action when economy of ammunition is not a primary consideration.

Perhaps one of the greatest difficulties in attempting such a solution of the fire control problem is presented by the last condition stated above. This difficulty may be lessened by considering as previously suggested

that the use of trial shots is to be considered strictly as an element of the preparation of fire and not of the adjustment of fire.

While we must never lose sight of the paramount importance in battle of opening and sustaining fire of the maximum rate and volume, without primary concern for economy of ammunition, yet we must recognize that in target practice we have to economize on ammunition, so that our target practice methods of fire should be such as will give us the greatest amount of experience in the conduct of fire with the ammunition allowance available, at the same time fitting into a system of fire which would be applicable in war, with the simple removal of the restrictions on the ammunition allowance. In war the firing of a series of trial shots at some suitable point in the field of fire should certainly be resorted to, not only immediately before action, but if action were imminent, perhaps at least once each day. Thus at the expense of an additional expenditure of ammunition, time in gaining effect would be saved through a better initial preparation, and the greater certitude that effect on the target would be obtained in the earlier salvos. On the other hand, in peace time target practice, we should be not so much concerned in using the available ammunition allowance to get the maximum number of hits on a hypothetical target from the number of shots expended, as to give the battery commander the greatest amount of experience in the control and adjustment of his fire from the number of shots at his disposal. Consequently, where the allowance of major caliber ammunition is so inadequate in peace, is there not more and better training to be had by the battery in using the shots which would otherwise be spent on trial shots, involving no strain on the judgment of the battery commander or on the endurance of the personnel, as a part of the series against a moving target? If the failure to use trial shots resulted in a less perfect initial preparation of the fire it would simply mean that there would be a greater demand upon the battery commander for the exercise of discretion and judgment in the use of whatever method of adjustment was being employed.

In addition to all the other comment which has been called forth by the January editorial, one officer has raised an issue, which while not hitherto unthought of nor wholly disregarded, is worth commenting on. In substance, he suggests that while it is of paramount importance that the regular Coast Artillery should maintain a certain fluidity of attitude and method at least until such time as our major problems have had a definite and satisfactory solution, yet there is a real necessity which should not be ignored that at the present time, and at all times, a complete and standardized procedure should be committed to paper, and should be instantly available for use in case of a sudden emergency for the training of Coast Artillery National Guard and Reserves and new and inexperienced regular officers and men. Of course, to a certain extent this need is now being met by the preparation and promulgation

of the series of Coast Artillery Training Regulations. However, there is a tendency to postpone the promulgation of methods until the time when an ideal solution has been reached. The point of view is well worth the attention of all of us that we should take a toe-hold at each step in our progress, there coordinating and standardizing sufficiently so that at whatever point in our progress an emergency may arise, we will at that point have a common doctrine generally accepted among ourselves and ready to disseminate rapidly among all the new Coast Artillery units which the emergency would demand.

Finally, in facing all of this *Work Which Lies Ahead*, we may be reminded that the very challenge of the problems to be solved in the wide field which confronts us is in itself enough to make us glad that we are Coast Artillerymen. Thank Heaven, we can not stop to stagnate!

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Major Boatwright Comments on Captain Phillips's Article

The following letter from Major Walter P. Boatwright, C. A. C., of the Office of the Chief of Coast Artillery, is published for the information of JOURNAL readers.

WAR DEPARTMENT
OFFICE OF THE CHIEF OF COAST ARTILLERY
Washington

March 29, 1923.

Subject: Article by Captain Phillips, C. A. C.

To: The Editor, Coast Artillery Journal, Fort Monroe, Va.

1. Without entering into a discussion of the many debatable questions presented in the article by Captain T. R. Phillips, C. A. C., in the March issue of the COAST ARTILLERY JOURNAL, I wish to invite attention to the following statements and to comment briefly with reference thereto. "We place our nation in a condition of great danger through our failure to appreciate the possibility of the airplane as a new offensive weapon in conjunction with the attacking navy" and "The sixteen-inch gun and howitzer program of Coast Artillery assures a land superiority for the next decade over naval attack. But these guns and emplacements have been constructed or are planned without protection from attack from the air." Throughout the article the writer implies that no serious study has been made of the possibilities of attack from the air and that the development of means to defeat such an attack has been neglected. If such an impression prevails throughout the service it is believed that an outline of the work which is being done should be published.

2. Development of Antiaircraft Artillery Defense.

The first antiaircraft guns constructed for issue to our service were the 3-inch M-1917 on fixed mounts. These guns were not all completed until after the World War. Other guns available for service are the 3-inch M-1918 on trailer mounts, and the 75-mm gun on truck mounts. All these guns and mounts were designed either before we possessed a definite conception of the requirements of Antiaircraft Artillery or during the war when speed in production took precedence

over the extensive experimental work necessary to perfect any new type of artillery. It is conceded that the existing antiaircraft artillery matériel, including guns, mounts, ammunition and fire control apparatus, is susceptible of great improvement. This fact was recognized during the war and early in 1919 the work of improving this matériel was initiated. Below is a brief summary of the progress to date.

a. Pilot models of 3-inch and 4.7-inch antiaircraft guns have been completed and tests carried far enough to determine that these models are superior to older matériel and that still further improvements could be realized. New designs are being made to incorporate the desirable changes. The 3-inch gun will be given the greatest mobility consistent with the limit of weight and the necessary stability when fired while the 4.7-inch gun will probably be movable rather than mobile.

b. Ammunition. The necessity for reducing the time of flight of antiaircraft projectiles is evident. This may be accomplished by high initial velocity and the correct design of the projectile. The latter offers no particular problem, but there are practical difficulties in securing a high muzzle velocity. The great angle of elevation, 80°, required by antiaircraft artillery necessitates high gun trunnions and consequently to secure the necessary stability the weight increases very rapidly with increase in velocity for a given weight of projectile. These problems can be solved and an initial velocity of 4000 f.s. or greater secured but the design of a fuse which will withstand the acceleration requisite for such a velocity and yet be seasonably accurate presents a problem which has not yet been solved notwithrtanding the fact that every effort has been made to develop such a fuse or to purchase the designs of one from some other country. An experimental lot of fuses which promise to meet our requirements has been ordered but definite conclusion as to the suitability of this type cannot be reached until after a thorough test.

c. Searchlights. The 60-inch searchlight with its power unit and transporting vehicle is satisfactory.

d. Sound Locating Apparatus. The difficulty of finding an airplane with a searchlight is so great that the necessity for some apparatus to locate the plane with sufficient accuracy to permit the light to pick it up has long been recognized. Such an apparatus will probably be based on sound location. Several such devices were in use during the World War and other types have been proposed since. So far as is known none of the existing devices are sufficiently accurate. Two Coast Artillery officers have been sent to a University to study this problem.

e. Fire Control. The present Antiaircraft Artillery fire control system is not satisfactory principally because of

(a) the time which is required to get data to the guns,
(b) the difficulty of identifying a target when firing on a large formation.
(c) too much delicate apparatus is required on the carriage, and
(d) it is not adapted to accurate night firing.

It appears that these difficulties can be overcome by an instrument which will require only one observer to follow the target and which will automatically compute firing data. Two types of instruments to accomplish this have been designed and will be manufactured for test. The latest models of antiaircraft guns are designed for normal use of Case III firing with a simple emergency system for use in case the central instrument cannot be operated.

f. Machine guns. Recognizing the limitations of the .30 caliber machine gun in attack of low flying planes a .50 caliber antiaircraft machine gun has been manufactured and is now undergoing service test. This gun is unquestionably more effective than the lighter type but the desirabliity of even a heavier gun is recognized and a 37-mm is proposed. This will be practically a machine gun but will use explosive tracer projectiles.

g. Antiaircraft Artillery Personnel. The personnel assigned to Antiaircraft Artillery is the maximum consistent with other requirements for Coast Artillery troops. In addition to the Regular Army antiaircraft units, 10 Antiaircraft Regiments are assigned to the National Guard.

h. Plans for Antiaircraft Defense. Plans for Antiaircraft defense are included in the defense plans prepared by Corps Area and Department Commanders. In general the development of antiaircraft artillery matériel, the training of personnel and preparation of plans for its employment are all being pushed energetically and progress is as rapid as considerations dictated by necessary eceonomy in funds and use of available personnel will permit.

3. The best defense of coast fortifications against aircraft attack lies in the employment of aircraft and antiaircraft artillery to prevent hostile planes reaching their objective. Further the type of fortifications should be that best adapted to minimize the effect of hits by bombs or high explosive projectiles. This was studied carefully when the question of the types of mounts and emplacements for the 16-inch guns was under consideration. Three types of emplacements were considered, turrets, the old type of seacoast fortifications in which all elements of the battery, except fire control stations, were concentrated and protected and the type which depends on dispersions and concealment of its elements for protection.

Turrets are not entirely proof against gun fire and while the turrets proper could probably be made safe against bomb attack the effect of a hit on the turret emplacement might be serious. One effective hit could put the entire battery out of action and in any case the cost is prohibitive. The following is the estimated cost of a two gun 16-inch turret:

Item.	*Cost.*
Guns	$ 500,000.00
Turret	2,275,000.00
Mounting	25,000.00
Turret Emplacement	925,000.00
Total	$3,725,000.00

The old type of major caliber seacoast emplacement is not satisfactory for 16-inch guns because

(1) it does not afford protection from modern ship's fire

(2) it is not protected from air attack and one effective hit might put the entire battery out of action, and

(3) the expense is too great.

The present type of emplacement for 16-inch guns was adopted because

(1) it minimizes the effect of a hit either by a high explosive projectile or a bomb.

(2) it is less conspicuous as a naval target than any other proposed type, and

(3) it is the most economical.

The average cost for a two-gun battery with this type of emplacement is estimated as follows:

Item.	*Cost.*
2 guns and mounts	$1,000,000.00
Emplacement and mounting	500,000.00
Total	$1,500,000.00

(Sgd) W. P. BOATWRIGHT,
Major, Coast Artillery Corps.

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."—

JOURNAL OF U. S. ARTILLERY, June, 1922.

Work of the Board for the Month of February 1923

1. Work on Training Regulations, "Service of the Piece for 12-inch Mortars" has been completed and the manuscript forwarded to Commanding Officer, Coast Artillery Training Center. Training Regulations, "The Battery Command" is being retyped for submission to Commanding Officer, Coast Artillery Training Center.

2. *New Projects received:*

a. Fire Control Installation for Battery Pennington (14-inch Howitzers) at Fort Story. The Coast Artillery Board is drawing up a fire control plan for this battery and incorporating therein the most recent development in fire control installations.

b. Deflection Board, Experimental for all Types of Artillery, Project No. 87.—This deflection device is designed to fulfill all present requirements for tractor artillery and for guns and mortars of fixed and railway artillery.

c. Issue of gun oil, Project No. 88.—Consideration is being given to a recommendation that gun oil for small arms and machine guns be automatically supplied as a part of the daily ration allowance when troops are in the field. If this recommendation be approved the necessary changes will be made in Tables of Basic Allowances governing the issue of gun oil.

d. Range Correction Ruler for 6-inch Guns, M.V. 2600 f/s., Project No. 89.—This device was submitted by Major Clifford Jones, C. A. C., and will be discussed in a later number of the COAST ARTILLERY JOURNAL.

3. *Projects Previously Submitted on Which Work Has Been Accomplished.*

a. Cullen Deflection Computer, Project No. 16.—This device has been before the Coast Artillery Board for several months. Its design and use is described in the June 1920 number of the JOURNAL. It is defective in that it can give a correct solution only when the azimuth of the aiming point is expressed in whole degrees (no hundredths). In any case where the azimuth of the aiming point contains "Hundredths" the solution given by the device is incorrect. This defect is due to an error in the mechanical design of the device and makes it useless as at present constructed, though the mathematical principle upon which it is based is correct. The Coast Artillery Board has decided to take no further steps toward the redesign of this computer to overcome the defects noted pending development of the deflection device mentioned above under Project No. 87.

b. Test of Tatelac Waterproofing Process, Project No. 70.—Twenty uniforms, blankets and shelter halves treated by the Tatelac Process have been received for test in comparison with twenty similar articles made of untreated cloth. The equipment and clothing has been issued to troops at Fort Monroe and Fort Eustus. Twenty men have received one treated and one untreated set. To give this clothing the necessary wear and usage it is anticipated that this test will run for about 6 months.

c. Range Table Correction for Rotation of the Earth, Project No. 81.—See Coast Artillery Board Notes in March issue of COAST ARTILLERY JOURNAL. The study on the rotation of the earth has been forwarded to the Chief of Coast Artillery.

The Chief of Coast Artillery approved the recommendation of the Board in favor of incorporating in the range tables the effects in range and deflection due to rotation of the earth instead of the various factors that make up the expressions used in determining these effects.

d. Study of the Rôle of Antiaircraft Defense together with Organization Equipment, and Methods, Project No. 83.—

(1) Training Regulations 435-30, "Tactical Employment of Antiaircraft Artillery," was submitted to the Coast Artillery Board, for comment, by the Commanding Officer, Coast Artillery Training Center. In commenting on these training regulations, the Coast Artillery Board recommended as follows:

(*a*) That the list of training regulations dealing with the tactical employment of the elements of antiaircraft defense be revised.

(*b*) That the revised list of training regulations provide for the publication first, of a training regulation, Coast Artillery Corps, on Tactics and Technique of Antiaircraft Defense to cover the following elements:

(I) Plans of antiaircraft defense including cooperation with Air Service.
(II) Antiaircraft artillery.
(III) Antiaircraft machine guns.
(IV) Searchlights and listening apparatus.
(V) Protective balloons.
(VI) Smoke screens and other methods of camouflage, warnings, dispersion of vulnerable elements to minimize danger, etc.
(VII) Lookout systems.

This training regulation to be sufficiently comprehensive to permit one to visualize our entire antiaircraft defense and to have a clear conception of the rôle of the Coast Artillery Corps therein.

(*c*) Additional training regulations on the various elements involved to be prepared where the tactics and technique of such elements are not dealt with in sufficient detail in the Training Regulations, Coast Artillery Corps, Tactics and Technique of Antiaircraft Defense. In these training regulations for tactics and technique of the various elements the following should be covered unless the general training regulations in (*b*) above cover them in sufficient detail.

(I) Training Regulations, Coast Artillery Corps, Tactics and Technique of Antiaircraft Artillery in Antiaircraft Defense.
(II) Training Regulations, Coast Artillery Corps, Tactics and Technique of Machine Guns in Antiaircraft Defense.
(III) Training Regulations, Coast Artillery Corps, Tactics and Technique of Searchlights and Listening Devices in Antiaircraft Defense.
(IV) Training Regulations, Coast Artillery Corps, Intelligence Service and Communication Nets in Antiaircraft Defense.
(V) Training Regulations, Coast Artillery Corps, Use of Obstructions, Dugouts and Camouflage in Antiaircraft Defense.

In the preparation of training regulations applicable to the various elements of antiaircraft defense mentioned above it was suggested that all such training regulations conform in plan and scope to Training Regulations No. 435-20, Emplacement and Tactical Employment of Coast Artillery in Harbor Defense, the presentation will be such as to permit proper visualization of the subjects.

(2) In a communication from the Chief of Coast Artillery, the Coast Artillery Board was called on to report on targets required and target matériel for antiaircraft organizations. The Coast Artillery Board recommended as follows:

(*a*) *Sleeve targets* (*towing sleeve*).—To be 20 feet long, color white, maximum diameter six feet. There is considerable doubt as to what color is most suitable. White has been recommended so that organizations may dye the sleeves any desired color and determine by test which is best. Annual allowance, 8 per regiment and 6 per separate battalion of antiaircraft artillery.

(*b*) *Towline.*—A Navy pilot tows with a 750 foot line for machine guns and a 2000 foot line for artillery. Towlines should be of minimum weight consistent with strength. No data are available on this here, but a flexible wire cable is believed desirable. Annual allowances: For each artillery regiment, 4 towlines 2000 feet long, for each separate battalion three 2000 feet towlines. The 2000 foot towlines can be used for machine guns.

(*c*) *a* and *b* above were recommended on the supposition that satisfactory arrangements can be made by the Chief of Coast Artillery with the Air Service for the towing of targets with lengths of towlines mentioned above.

(*d*) *Meteorological kites.*—Specifications to be obtained from the Signal Corps. Annual allowances, 3 per regiment and 2 per separate battalion. These will be valuable in fire control preliminary training.

(*e*) One reel cart, pack type, RL-16 S. C. (if not already a part of equipment), with 5000 yards of suitable wire, similar to piano wire, for flying and anchoring the kite recommended in (*d*) above. Allowances, one reel complete with wire per regiment and separate battalion.

(*f*) Six foot fabric balloons called by Air Service, barrage balloons. Black or red color preferred, although present standard color can be used. These to be used free, towed, or anchored. Annual allowance, 60 per regiment and 20 per separate battalion.

(*g*) *Rubber balloons.*—9-inch meteorological. Color black or red. Recommendations do not contemplate allowances for automatic rifle firing against aerial targets, (see paragraph (*m*) following).

(*h*) *Hydrogen tanks.*—Twelve per regiment and six per separate battalion. This allowance should be subject to increase where organization fires at considerable distance from filling stations.

(*i*) Hydrogen allowance, 21,000 cubic feet per regiment and 6000 feet per separate battalion.

(*j*) *Special target ammunition.*—Annual allowance of 120 rounds per regiment (3 gun batteries) and 40 rounds per separate battalion (1 gun battery) special target ammunition is recommended. This ammunition to have a smoke producing mixture which will cause a burst of distinctive color, such as would be obtained by use of brick dust.

(*k*) Assuming that target practice ammunition allowances for National Guard units, Reserve Officers, etc., are determined by consideration of their state of training, then their target material allowance should be computed on a percentage basis from the regular ammunition allowance.

(*l*) Considering the demands made on the 61st Artillery Battalion (AA) at Fort Monroe and experimental work carried on by it, following additional annual allowance was recommended for this organization:

20 Fabric Balloons (Item 1-*f* above.)
200 Rubber Balloons (Item 1-*g* above.)
6000 feet (cubic) hydrogen.

(*m*) The Coast Artillery Board has serious doubts as to the suitability of automatic rifles for fire against aerial targets. Furthermore, it is the understanding of the Board that in equipping antiaircraft units with automatic rifles it was intended that they be used in local defense against attacks from the ground. In the opinion of the Board the use of .30 caliber machine guns instead of automatic rifles would afford better defense against ground attack than will automatic rifles, and in addition such light machine guns can be used with far greater effect in repelling attacks from the air. Considerations of mobility and personnel required, seem to indicate that the automatic rifle has no marked advantages over the light machine gun, it being understood that automatic rifles are intended only for local defense and so move with their units. When the tests, now in progress, on front area sights are completed, specific recommendations relative to the use of the automatic rifle as standard equipment will be made. In view of these conditions no allowances of aerial targets have been recommended for organizations now equipped with automatic rifles, but it is recommended that the 61st Artillery Battalion (AA) be given a special annual allowance of 100 rubber balloons (Item 1-*g*) for use in determining what possibilities the automatic rifle has in firing against aerial targets. In this connection attention is invited to the fact that the belief of the Coast Artillery Board that automatic rifles are provided primarily for use against ground attacks does not appear to be the general belief throughout the service, the general belief seeming to be that these automatic rifles are intended for use against aerial attacks.

(*n*) A new type of target has been suggested by the 61st Artillery Battalion (AA). It was recommended that two experimental targets be furnished for test under direction of the Coast Artillery Board. (If this type of target is considered practicable a description will be published at a later date.)

(*3*) The Chief of Coast Artillery has called on the Coast Artillery Board for recommendations and comments in regard to the use and issue of mirror position finders to antiaircraft units. In this connection the Board recommended as follows:

(*a*) That sufficient sets of mirror position finders, complete, be obtained to issue one set for training purposes to each battalion and regiment of antiaircraft artillery, and that organizations at the conclusion of the drill season render reports thereon, together with recommendations as to future issue as articles of equipment, either for service or training purposes. Priority in issue to be given to the 61st Artillery Battalion (A.A.) and to the 62nd Artillery (A.A.)

(*b*) The above recommendation was based upon the following considerations: While the mirror position finder is not primarily a fire control instrument, it should find a practicable application in antiaircraft artillery service, particularly in training. In its present state, however, it is merely an instrument of great precision which can be used for making observations on bursts, targets and other objects and reading accurate data. Certain features of the apparatus indicate that it is not particularly desirable as an article of equipment of a mobile organization, unless it fills a requirement for which some simpler device is not adequate. In this connection the following was considered:

(I) Two stations, separated by a baseline three to four miles long, are required.

(II) The equipment for each station consists of a mirror about 2½ feet square on a large three leg table with levelling screws, as well as some other minor equipment.

(III) Its greatest use will be in training officers in fire control methods, while its value in training gunners, range details, etc., is problematical.

(4) The Coast Artillery Board made the following recommendations to the Chief of Coast Artillery in regard to meteorological instruments for antiaircraft units.

(*a*) The issue of a set of meteorological instruments to each regiment and separate battalion of antiaircraft troops. These instruments to be considered as being issued for service tests with a view to determining desirability of furnishing such instruments as a part of the equipment of each separate battalion or regiment. Detailed report on these instruments to be submitted by organization commanders to Chief of Coast Artillery after one season's training.

(5) Proposed drill regulations for the Corrector Brocq with Range Indicator were submitted to the Board for remark and recommendation. A careful study was made of these regulations and revised and corrected regulations were submitted to the Chief of Coast Artillery with the recommendation that they be published in a bulletin, Antiaircraft Series, O.C.C.A., as a guide for the use of the Brocq unit.

4. Reference is had to paragraph 4, *d*, of the Coast Artillery Board notes appearing in the January, 1923, issue of the COAST ARTILLERY JOURNAL in reference to recommendations submitted regarding range drum graduations. Problems have arisen incidental to the assignment of different types and weights of projectiles to batteries of the same caliber. In this connection the following was the recommendation of the Chief of Coast Artillery:

a. The Chief of Coast Artillery recommends the following policies in reference to range scale graduations on old types of armament. The range drums will be graduated with three scales wherever this is practicable:

1st.—Range scale for the standard weight of projectile with the graduations in yards:

2nd.—The subcaliber scale with the graduations in yards.

3rd.—The third scale should show elevation in multiples of 5° for clinometer checking.

The service range scale for the standard weight of projectile for any given caliber is to be retained on all guns in batteries where any high explosive ammunition has been allocated where there are standard weight projectiles in the same coast defense.

The method of using these standard range scale graduations when a lighter projectile, e.g., the high explosive shell, is to be fired, will be utilized a range relation table to be prepared by the Coast Artillery Board. (These tables will be furnished the batteries concerned as a matter of routine.)

b. The Ordnance Committee approved the recommendations of the Chief of Coast Artillery and proposed that the necessary steps be taken to carry the recommendations into effect at the earliest practicable date.

5. The Coast Artillery Board recommended to the Chief of Coast Artillery that paragraph 20 of Coast Artillery Memorandum No. 1, recently issued, be changed, the next time the memorandum is revised. This paragraph has reference to leaving pressure plugs in a gun or mortar during a series of shots. Repeated firings with a set of copper pressure cylinders ordinarily results in pressure indication which is higher than the maximum of the series. It was therefore suggested that when the memorandum is next revised that an explanatory note be added to this paragraph to the effect that leaving in of pressure plugs during a series of firings gives some indication of pressures but the pressure indicated cannot be taken as an essentially correct measure.

6. A target practice report, Battery "F," 52nd Artillery (Railway), C. A. C., 8-inch gun, Fort Eustis, was received for comment. The report was of particular interest in that it pertained to fire control equipment for railway and tractor artillery. It is considered extremely desirable that a standard fire control equipment be adopted for railway and mobile artillery.

a. Among other comments the following were made:

In the matter of telephones and communication systems it was reported that the present head-sets are not satisfactory and it was believed that a head-set which leaves one ear free with the transmitter attached to the operator's breast would be desirable. Such a transmitter will no doubt be more efficient than the old type.

Present indications are that for a service condition, over long lines of communication, a common battery telephone system will not be as satisfactory as a local battery system. Both types are being thoroughly investigated with a view of selecting the better type.

b. Cloke Plotting Board.—The Coast Artillery Board has recommended the adoption of this board for railway and tractor artillery as well as for certain other units. Definite action on this recommendation is expected at an early date.

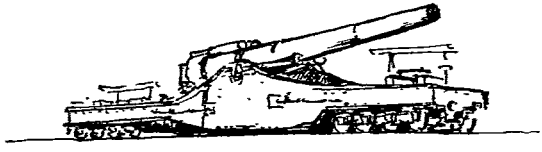
c. Set Forward Ruler and Prediction Scale.—The Coast Artillery Board has before it a mechanical prediction device applicable to guns and mortars. which will be sent to Fort Eustis for test at an early date. This device will, it is believed, accomplish the same result as at present, but with less work on the part of the plotter and assistant plotter and will, at the same time, lessen confusion and talk in the plotting room. The device possesses more advantages than the old pantograph predictor but has none of its disadvantages, and is handled very similarly to a prediction scale.

d. The development of a suitable deflection board for railway and tractor artillery units is being taken up by the Board as Project No. 87.

e. The range board, range correction board and slip-stick (for adjustment of fire) used in this firing appear to the Board to offer a satisfactory solution to the problems they are intended to solve and will be considered in detail later.

7. Based upon a previous recommendation of the Coast Artillery Board, circular range correction boards which work like circular slide rules are being manufactured at Frankford Arsenal. These boards are mechanical devices designed primarily to solve the firing data problems in the case of fixed targets and serve to give a quicker solution than by actual computation. The devices take into consideration variations in site, weight of projectile, air density, elasticity, wind, and velocity.

For the present these devices are being made for the 75-mm gun, the 155 G.P.F. and the 8-inch howitzer. It is very probable that similar devices will be made for other types and calibers of artillery, especially railroad artillery.



Employment of Heavy Artillery—Problem No. 9—A Solution

1st Requirement:

Maj A first makes a careful study of the map, from which he concludes that he will make a reconnaissance before the attack of the designated road as far as the present front line, taking with him his Bn Staff, Bn Agents, Scouts and Observers, the two Btry Commanders, the Commander of the Bn Comb Tn, and the Btry Agent and Scouts of the Btry selected for the forward displacement. He selects B Btry for the forward displacement due to the fact that if it should remain in position and fire while the other Btry was moving forward, the blast of its guns would interfere with the movement past MEYER. He tentatively selects a position for the forward Btry in the woods at 353.3-749 and just northwest of the unimproved road running through the woods. His tentative selection of this position is based on the belief that he should avoid putting the guns too close under WOLF HILL RIDGE as the reverse slopes of this RIDGE will probably be heavily shelled by the enemy after his withdrawal.

He then assembles the Bn Staff and Organization Commanders, shows them FO 9, Hdqrs 301st FA Brig, and issues the following verbal instructions:

(To the Bn Plans and Training Officer) "Prepare a firing schedule for the Bn in compliance with the Brig order, and have it ready for my approval when I return from my reconnaissance."

(To the assembled officers) "B Btry is selected as the btry for the forward displacement, and will cease firing at H+1 hr, form march order, and upon notification from me will proceed via SH-RJ 531-RJ M. RUDISH-RJ 529 to position at approximately 353.3-749, the exact position to be indicated to the Btry Commander by me on the ground. A combined Bn OP and Btry OP will be established on WOLF HILL.

"Organization of B Btry column in order, light column, heavy column, 2nd Platoon Bn Comb Tn.

"At H-2 hr the 2nd Platoon Bn Comb Tn will leave the rear echelon and proceed via RJ 615-CR 621 to B Btry position, and load surplus ammunition at B Btry position, completing its load if necessary from A Btry, and form for the march, head of column facing north on road leading south from B Btry position.

"Rations will be drawn as soon as D day is announced, so that on the morning of D day all organizations will have four reserve rations.

"The Bn Signal Officer will immediately lay wire from the present Bn CP

to TWO TAVERNS, and will connect there to the new Brig C P when established. After the advance of B Btry a new Bn CP will be established at the end of the road just east of WOLF HILL. The Bn Signal Officer will ascertain from Hdqrs 301st F A Brig as soon as possible the location of the Forward Communication Center on the Artillery Axis of Communication to be established on BALTIMORE TURNPIKE, and will tie in the new Bn CP to the FCC.

"The 2nd Platoon Bn Comb Tn after the advance will establish a new rear echelon in the ravine just southwest of RJ 452. The Bn Surgeon will be prepared to move the Bn Aid Station to this point. When I give orders for A Btry to cease firing and form march order, the remainder of the Bn Comb Tn and rear echelon will join A Btry's present position, load all ammunition and form march order head of column at RJ MEYER facing south just off the road in order, Bn Hdqrs, Bn Comb Tn, light column Btry A, heavy column Btry A.

"New Bn CP will open upon notification from me, the old Bn CP closing at the same time, communication from the old position to the new through the Artillery Axis of Communication."

Maj A then starts with the reconnaissance party above indicated, following the designated route as nearly as possible to the front line, noting necessary detours and arrangements that can be foreseen on account of the damaged condition of the road, and at each RJ and CR designating a Scout who on the day of the attack will be designated as a guide at that point for B Btry. Maj A and party then proceed to the Bn OP at 357.2-746.9, from which he can see all of the road beyond the front line and can indicate the proposed Btry position in the woods and the new OP and CP. Upon his return to the Bn CP he approves the firing schedule which appears below.

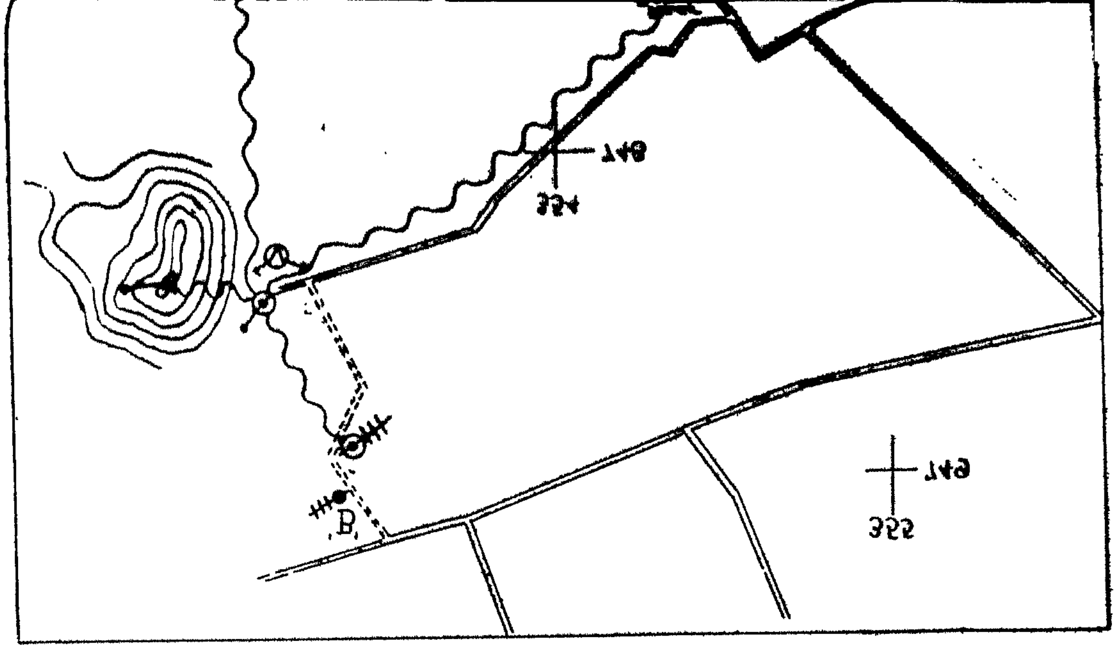
Firing Schedule No. 21
1st Bn 701st Art

Battery	*Target*	*Rate of Fire*	*Remarks*
A	V	1 Rd per gun per 2 Min	D Day H Hour until capture of WOLF HILL.
B	VII	1 Rd per gun per 2 min	D Day H Hour until capture of WOLF HILL.
A (2 Plat)	RJ 570	1 Rd per gun per 3 min	After capture WOLF HILL until further orders
A (1 Plat)	RJ EMMITTSBURG RD and BALT. TURNPIKE	1 Rd per gun per 3 min	

On the day of the attack, upon receipt of the message that WOLF HILL has been taken, he directs B Btry to proceed as rapidly as possible to the new position. He directs the Cpt of A Btry to take charge of the old Bn CP until his return or the new Bn CP is opened and then starts immediately with the Cpt of B Btry and Bn and Btry reconnaissance party over the road, leaving the designated guides, personally inspecting the new Btry position which he approves, establishing the new Bn CP and OP, and directing the orienteur officer to tie in the new Btry position. He then retraces the route of march until he meets the advancing Btry, accompanying it for the remainder of its march and being ready to meet any emergency conditions which obstruct its advance.

2nd Requirement:

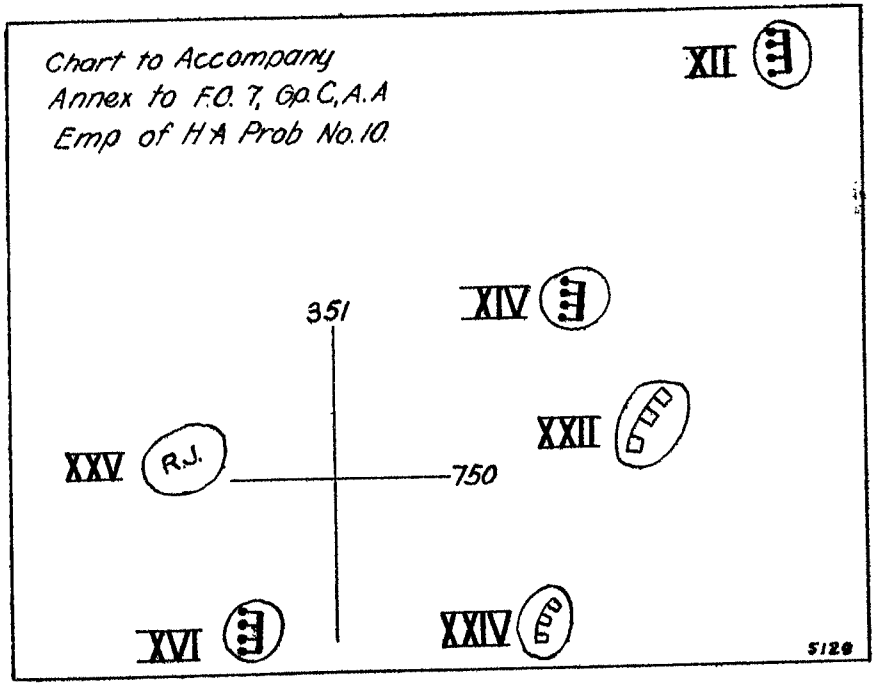
See attached sketch, to be placed over Gettysburg Sheet of 3-inch map.



Coast Artillery Journal, April, 1923. To face page 384.

Solution of 2d Requirement.
Problem No. 9.

5129



Employment of Heavy Artillery—Problem No. 10

General Situation:

In continuation of Problems 2, 4, 6, and 8.

The local attack of 17 April was successful in restoring our outpost zone along WHITE RUN. Shortly after this the 1st Bn 901st Art was relieved from the tactical control of the 3d Corps and was placed in Group C Army artillery (railway artillery) under command of Col C whose CP was at BERLIN JUNCTION 368.6-753.3. The period 17 April to 1 May was quiet on the front but heavy reinforcements of artillery from the GHQ reserves arrived and were emplaced and fresh divisions arrived and took over certain sectors of the front line.

Special Situation (Blue):

On 1 May the group order was received, extracts from which read as follows:

Field Orders
No. 7

Group C Army Artillery
BERLIN JUNCTION
1 May 22 10:00 AM

Maps. GETTYSBURG, General, 3-inch and 1-inch reduced from 12-inch War Game Map.

1. Reliable information has been received that enemy 2d Army is being concentrated about HARRISBURG.
   Our 3d Army is advancing on WESTMINSTER. Our 1st and 2d Armies will attack on D day at H hour turning hostile left and driving him westward. The 1st Army makes the frontal attack with the VIII, I, II, III, XII, and IV Corps in line from left to right.
2. This group supports the attack of the III, XII and IV Corps by firing distant interdiction and harrassing fires beyond the ranges of the Corps Artillery and by destruction fires on certain highly organized strong points.
3. a. .....
   b. .....
   c. The 1st Bn 901st Art will participate in the preliminary bombardment by firing concentrations indicated in Annex hereto. As soon as WOLF HILL and adjacent heights have been carried and on receipt of orders from these headquarters it will move forward to positions on the GRANITE HILL siding.
   x. Prior to H-6 hours, all reconnaissance of forward positions will be made by minimum parties. Forward positions prepared in advance of occupation will be carefully camouflaged.

* * * * *

Bln Co No 9 362.8-746.0 will observe for 1st Bn 901st Art.

* * * * *

ANNEX to F. O. 7, Gp C, AA.

* * * * *

	Targets	*Ammunition Allowance*	*Time*
1st Bn 901st Art	Btry XII	160	H−6 to H+1
	Btry XIV	160	
	Btry XVI	160	
	Strong Point XXII	160	H+1 to H+8
	Strong Point XXIV	160	
	RJ XXV	80	

* * * * *

On 5 May Maj A was informed that D day was 7 May, and H hour 5 AM.

1st Requirement:

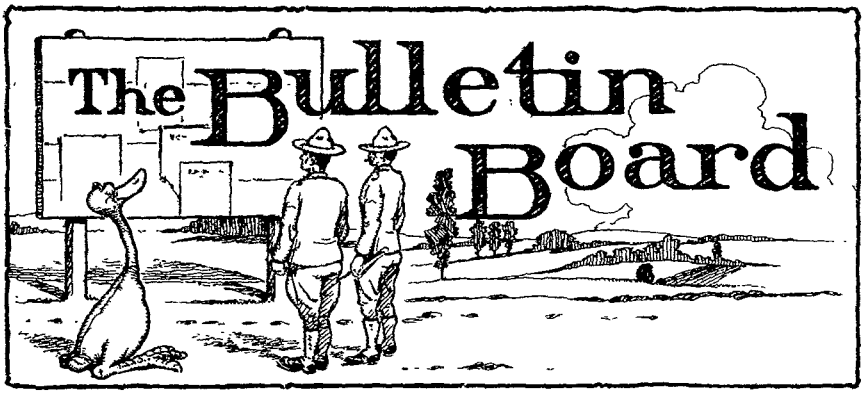
Maj A's actions and orders prior to D day, particularly with regard to preparations for the move forward. He finds that only 7 mortars can go into position on GRANITE HILL siding.

* * * * *

On D day at H-6 hours (11.00 PM 6 May) the Bn opened on its pre-arranged schedule and at 9.00 AM the balloon reported that our troops were on WOLF HILL. At 11:00 AM a message was received from Group Commander that WOLF HILL and the strong points to the north and south thereof were in our hands and directing the 1st Bn 901st Artillery to begin its forward movement at once.

2nd Requirement:

Major A's actions and orders.



Reference Remodeling Radio Sets

Since the appearance of the March issue of the JOURNAL, which contained Captain Pierce's interesting article "Remodeling an SCR-54-A Receiving Set" the Editor has been advised by Major Louis B. Bender of the Signal Corps that although the Signal Corps has sold a large number of the Radio sets referred to for $7.50, the supply has been completely exhausted for sometime and there is only a slight possibility that any more will be offered for sale. Major Bender also suggests that the user of one of these sets who modifies it in accordance with the suggestion of Captain Pierce, is liable to be involved in patent litigation unless he is licensed under the controlling patent.

Interpretation of Coast Artillery Memorandum No. 4

Paragraph 11, C.A.M. No. 4, Revised, dated War Department, January 15, 1923, refers to the use of the Successive Approximations Method of Adjustment and states that "this method is applicable for firing with major caliber guns." The method is equally applicable to firing with mortars and it was so intended.

Paragraph 12, of the same memorandum refers to the Salvo Center of Impact Method of Adjustment and states that "This method is a suitable one to use when firing batteries of four or more guns." This method is equally applicable to firing with mortars and it was so intended.

537 Art. A. A. Gets Together

A meeting of the officers of the 537th Artillery (A.A.) was held Saturday evening, March 3rd, 1923, at the Elk's Club, Minneapolis, Minn. Sixty per cent of the officers of that organization living in the City sat down to a big beefsteak dinner. Major Arthur H. Conary, C. A. O. R. C., commanding the Regiment, proved to be a very capable toastmaster. He gave a short talk on plans he has for the future of the 537th and what he expects of his officers.

Major Ivens Jones, F.A., gave a very excellent talk on the Reserve Corps, its purpose, functions, and the duties of Reserve officers in peace and war.

Major I. M. Madison, Inf., representing the 88th Division Staff, outlined in a very interesting manner, the Army Correspondence Courses, and the C.M.T.C. Camps.

Captain Vernon W. Hall, C.A.C., of the University of Minnesota, Military Dept., who has just recently come from Fort Monroe, presented in a most interesting manner some of the latest information on Anti-Aircraft.

A few of the Regimental Officers were called upon, and responses were made by Major Chas. Houston, Lt. Bacon, Chaplain, and Capt. R. J. Jordan, Adjutant.

Following the talks a letter from Lt. Col. Jno. R. Musgrave, formerly Executive Officer of the 537th, who was unable to attend the meeting, was read and heartily applauded. Resolutions were then passed regretting the relief of Lt. Col. Musgrave and requesting that an officer with Anti-Aircraft experience be assigned to this Regiment as Executive Officer.

It was voted by the officers to meet once a month for the furthering of the good work undertaken.

West Point Authors Note This

The Librarian of the United States Military Academy is attempting to secure for the Library a complete collection of the writings of all West Point graduates. It is earnestly requested that all graduates of the Military Academy who have entered or may venture into authorship, send a copy of each of the products of their fertile pen or Corona to the West Point Library.

BOOK REVIEWS

Automobile Blue Book, 1923. "Standard Road Guide of America." Volume Two. Automobile Blue Books, Inc. Chicago, 1923. 746 p. 9¼" x 5½". Flexible fabrikoid binding. Price, $3.00.

One of the surest signs of approaching spring is the arrival of a new edition of this valuable book. It brings the "Lure of the open road" to every one who glances over its pages, and a glance at the large map promises new trips over unknown roads, under its safe and sure guidance.

Close checking with the similar volume for the previous year reveals careful correction, re-editing, and revision. One important change, which is an improvement over the former system, has been the discontinuing of the "Places of Interest" section, in the center of the book, and the placing of that information as footnotes, immediately under the route in which each place is most prominently mentioned, with cross references from every other route which touches the place. Excellent city maps are placed in the same convenient manner. These are of value if it is desired to depart from the usual route thru a city, but are not necessary if one is passing thru on a trip, as the arrangement of the route instructions are such that one has only to take right and left turns as given to follow the most tortuous route thru the largest city, without the necessity of asking information from passers-by.

The make-up of the book is fully up to the standard. The paper is thin, but opaque, the 746 pages, with covers, measuring but 1½ inches in thickness, while the weight is less than two pounds. The publishers furnish a "Blue Book Holder" made to match the book, with a celluloid face, which is invaluable in wind and rain. The pages can be turned without removing the book from the holder, and it is so designed that it may be hung on the robe rail or laid on the driver's lap without holding.

All in all, if you have a car you must have the Blue Book to enjoy a trip or a tour to its fullest extent, and if you look over the book for any length of time you will not be satisfied until you have the car.

The Kaiser's Memoirs. By William II. Emperor of Germany. Harper and Brothers, New York. 1922. 5½″ x 9″. 366 pages. Price, $3.50.

This book is the ex-Kaiser's personal review of his career as emperor from 1888 to the end of the war and his abdication in 1918. He views the political conditions in Europe during the chancellorships of Bismark, Caprivi, Hohenlohe, Bulow and Bethmann; his relations with his co-workers in the administration; his attitude towards science and art, the church, the army and the navy; and the conditions that preceded the outbreak of the war. This book is throughout an attempt to justify himself and his country. Comparatively little is said of the war while in progress, but there is a brief chapter on its end and his abdication. A concluding chapter sums up the causes of the war, in the writer's estimation and absolves himself and Germany from guilt.

To the historian, the book is of little value. The omissions in the record are more glaring than the undue emphasis given to trivial incidents. However it is interesting and amusing to observe that despite the "divinity" of the royal author, he exhibits the very human trait of striving to shift his responsibilities to others. He begins the last chapter of his book with the words "I do not care what my foes think about me. I do not recognize them as my judges." But obviously he does care, otherwise the "Memoirs," which are nothing but an appeal to the people who were at war with Germany, would never have been written.

Why Wars Come. By Rear Admiral A. P. Niblack, U. S. Navy. The Stratford Company. Boston, Mass. 1922. 5″ x 7½″. 165 pp. Price, $1.50.

Wars result primarily from the conflicting interests and policies of states, but in the past, some imperfectly organized governments have plunged their countries into war. Accordingly it is of interest to examine the National policies of some of the leading powers, and their forms of Government. The author of this little volume discusses briefly the system of government and the National Policies of the United States, Great Britain, France, Italy, Japan, Germany, Spain and Central America. He shows the territorial gains made by the Allied Powers during the War, and shows briefly why the League of Nations cannot prevent wars.

The White Heart of Mojave. By Edna B. Perkins. Boni and Liveright. New York. 1922. 5¾″ x 9″. 229 pp. Price, $3.00.

The author, in *The White Heart of Mojave* describes in part her journey across Death Valley, "As we descended into the valley and came along the edge of the morass a feeling of deep lassitude and inertia gradually crept over us. It pressed upon us like a weight that never, never could be lifted. We stared down at the sand with unseeing eyes and went on because we were in the habit of going on."

And toward the end of her narrative she writes, "The desert shook us awake. We had come looking for mysteries and terrible fascinations and found only the mystery of the old outdoors. * * * Dust clouds roll over the edge of Mojave as America goes by. Some travelers look at her curiously, some look longingly, some shudder, some pass with the window shades pulled down. All the time she is singing on her rosy mountain-tops and in her deep, hot valleys where the blaze of the sun is white.

The White Heart of Mojave reads like fiction and yet is but the account of a journey of two women, not weather-wise explorers, but just folks who longed for something beyond the walls and solid roofs of houses. These two women journeyed not only through Mojave, and across Death Valley itself, but passed on up into the Panamints, these mountains "with their feet in the burning heat of Death Valley and their heads in the snow, awful, magnificent universe moving along, inexpressively fearful and beautiful."

Per La Verita. By General Luigi Capello. Fratelli Treves, Milan, Italy. 1920. 5″ x 7½″. 293 pp. Maps. Flexible Cloth.

General Capello was in command of the II Army during the great Austro-German offensive of October 1917, which resulted in the Italian catastrophe of Caporetto. Brought before a Board of Inquiry, the General was held responsible for the low morale of his troops; for failure to estimate promptly the threat endangering the extreme left wing of his Army; for not properly supporting the defensive ideas of the supreme Command, particularly as regards the posting of the Artillery and the dispositions for counter-preparation of fire.

These findings naturally reflected on his honor as a citizen and soldier and his dignity as a man and it was to vindicate himself that he wrote this book.

The 5 chapters of the book go into the technical details of his dispositions and the handling of his Army, his statements being generally supported by a very extensive appendix. In the concluding chapter the General expresses the positive statement that the Board was instructed to make him the scapegoat and he pleads for a trial by a competent court, where the charges may be properly considered and the guaranties of human justice duly safeguarded.

The Balkan Peninsula. By Ferdinand Schevill. Harcourt, Brace and Company. New York. 1922. 5½″ x 8½″. 558 pp. (with maps). Cloth. Price, $5.00.

This book deals with the history of the Balkan Peninsula, or Balkania as the author calls it for brevity, from the early migratory period to the present day.

Professor Schevill in preparing his book realizes that Balkania was the stage on which the World War was set, and that it may be the stage for other world wars if its present problems drift towards further disorder. It is an excellently prepared history of the conflict between European and Asiatic civilization.

A Neglected Era. By Edith Ross Braley. E. P. Dutton and Co. New York. 1922. 5¼″ x 7½″. 280 pp.

A Neglected Era is a concise historical sketch of the history of the Hebrew people covering more than four centuries from about 538 B.C. to the first century of the Christian Era. The treatment of the vicissitudes of the Jewish Race during this long period which intervenes between the accounts of the Old Testament and the New is divided into three parts, the Persian period from 538 to 333 B.C.; the Greek period from 333 to 160 B.C. and the Roman period from 160 B.C. to 70 A.D. During each of these periods the historical student is led to a clear conception of the very extensive interaction, that is generally little appreciated, between the influence of Hebrew Theology, Philosophy and Nationalism upon the other nations whose development is shown to have been definitely affected thereby, and likewise the very definite results in the successive modifications of the Jewish religion and national organization by the impact of the peoples surrounding them. The reader is bound to be much impressed by the very significant effects in the historical development of the Hebrews of the distinctive personalities who came to the front at successive intervals. The studies of Judas Maccabeus and his family and of Herod the Great afford vivid pictures of men who must be recognized as remarkable personalities, perhaps the equal of their better known contemporaries in Greek, Egyptian and Roman history.

Part IV, which is devoted to a survey of the developments of the Era under consideration, is particularly important in its illumination of the crystallization of Jewish characteristics, many of which have persisted even to this day among the members of the Hebrew race, scattered wherever they may be throughout the world.

In conformity with its contemplated use as a text book, the subject matter is supplemented by an appendix affording a detailed chronology, outline summaries and bibliographical references.

A distinctive value in the study of this book which can not be over-emphasized is its potential usefulness as a collateral reference in the study of the history of Persia, Egypt. Greece and Rome during the years paralleled by its contents.

Ancient Man. By Hendrik Van Loon. Boni and Liverright, Inc., New York. 1922. 4′¼″ x 6½″. 208 pages.

This little book, attractively bound in blue leather, with flexible covers, is dedicated to and intended for children about ten years old. It begins with a chapter on prehistoric man, and in its seventeen chapters traces briefly man's progress from his primitive beginning, up through the Stone Age, to the time of Rome and Greece. Space is devoted to Egypt, Assyria and Babylon, and the older civilizations, to some of the Old Testament heroes of the Bible, and to the early development of the written language. It is simply and attractively written and will be found entertaining by both young and old.

Beasts, Men and Gods. By Ferdinand Ossendowski. (Officier d'Academie Francaise). E. P. Dutton and Company. New York. 1922. 5½″ x 8¼″. 325 pp. Cloth. Price, $3.00.

Dr. Ossendowski, a Polish professor, was living in the town of Krasnoyarsk at the outbreak of the Russian Revolution. He is sought after by assassins and undertakes to get out of Russia by going overland to India. His plans are frustrated however and he only gets as far South as Tibet where he is forced to retrace his steps almost three-quarters of his entire journey and then flees East where he makes his escape into Manchuria.

This astounding Odyssey of wild adventure is told with deadly sincerity and modest precision. The adventures of fiction are flat and commonplace in comparison.

The Radio Pathfinder. By Richard H. Ranger. Doubleday, Page and Co. Garden City, N. Y. 1922. 5″ x 7″. 155 pp. Profusely Illustrated. Price, $1.50.

Of the popular sciences, psychoanalysis and radioitis are the most prevalent. For obvious reasons the radio fans are in the majority. In this group whose number is legion, are not a few inquiring minds. whose never fading hope is to find, in this ever flowing stream of publications on radio, the right kind of book.

The author of "The Radio Pathfinder" tells us his book is really the royal road to understanding of the basic principles of radio telegraphy and telephony. His purpose is to give the amateur radio enthusiast a fundamental knowledge of how radio works and why.

Mr. Ranger's little book contains the answers to the following questions: What is this radio broadcasting? What happens at the radio transmitting station? What happens at the receiving station? How does this sound get from the transmitting station to the receiving station? What equipment should I start with? How can I put up an aerial? What regulations must I observe? What are the various parts of the set and how do they work? These questions he answers in simple, layman's language, calling to his aid a vast army of genii, the little electrons—these willing messengers who do the necessary work at the radio transmitting station to start the music on its way, and which at the receiving station are ready to reproduce this into entertainment to be enjoyed by the radio-fan and his friends.

The Book of Radio. By Charles W. Taussig. D. Appleton and Co. New York. 1922. 5¾" x 8¾". 417 pp. 186 ill. Price, $3.50.

When the novelty of radio broadcasting has worn off, what? True it will have then lost its popular appeal but it will continue to be not the least contribution to science and business. A large element in our population is at present suffering from radio-phobia and many printing presses are turning out prescriptions in the form of popular books, and still more manufacturers, are making medicine in the form of new sets and accessories. And although folks generally may soon recover from this obsession, the radio amateur will still continue "puttering" and developing.

It is to meet the demands of this body of amateurs that "The Book of Radio" was written. The author is one of the pioneer radio amateurs of this country, and he continues to be as ardent a radio enthusiast as he was in the beginning. He is therefore peculiarly fitted to present the subject of popular radio, the information he gives being authentic and up to the minute. The book is all a radio amateur could desire.

Radio Phone Receiving. By Michael I. Pupin and 8 others. D. Van Nostrand Co. New York. 1922. 4¾" x 7½". 179 pp. Price, $1.50.

The radiophane anxious to fill his one-foot bookshelf will find it difficult to resist purchasing this practical book for everybody, written by specialists.

Professor M. I. Pupin writes the introduction; Dr. A. N. Goldsmith of the College of the City of New York, Chapter I, "How Radio Telephoning is Accomplished;" Dr. Erich Hausmann of the Polytechnic Institute of Brooklyn, Chapter II, "Tuning the Simple Receiving Circuit," F. E. Canavaciol, instructor in electrical engineering, also of the Polytechnic Institute of Brooklyn, Chapter III, "Receiving the Waves by Crystal Detectors," Professor J. N. Morecroft of Columbia University, Chapter IV, "The Vacuum Tube;" R. D. Gibson and P. C. Hoernel, engineers, Chapter V, "Amplifying the Music or Speech;" Professor L. A. Hazeltine of Stevens Institute of Technology, Chapter VI, "Regenerative and Heterodyne Reception;" and J. V. L. Hogan, engineer, Chapter VII, "Radio Telephone Broadcasting."

The authors have produced a satisfactory exposition of the operation of a transmitting and receiving system without the use of mathematical formulas and complicated physical concepts. By simple everyday analogies, with few technical words, and repetition of the more important ideas, the authors have succeeded in presenting a text that may be easily comprehended by the layman, the novice, and the amateur radio enthusiast.

Radio Reception. By H. J. Marx and A. Van Muffling. G. P. Putnam's Sons. New York. 1922. 5" x 7½". 241 pp. 130 Ill.

It is unfortunate that a number of the recent books on radio should either be so technical as to discourage the average reader or so elementary as to be of use only for children. The amateur would obtain more pleasure in operating a receiving set if he understood the how and why of the detector; whether to use crystal or vacuum tube; how the waves are sent out; what is meant by hugh frequency waves, radio, or audio frequency, or many of the other mysteries that make up the new popular recreation.

The authors of this book by reason of understandable writing, well prepared illustrations, and the seizing interest of the points selected to emphasize the subject, have succeeded in producing a simple and complete explanation of the principles of radio telephony, and a full exposition of the successful methods of radio reception.

Beginning with the elements of electricity and magnetism, covering the application of these elementary principles to radio reception, the reader is then made to understand how sounds can be reproduced at will at a receiving station thousands of miles away, by a study of wave motions and their characteristics. Having shown that the simplest method of transmitting electrical waves through the ether is by a high frequency alternating current, and the fact that this alternating current will not operate the phone receivers so as to give audible sound waves, the simplest form of apparatus for the rectification of this high frequency alternating current, namely the crystal detector, is explained. The electron theory is discussed as well as the principle of the operation of vacuum tube detectors. Then follow chapters on receivers and loud speakers, condensers and resistances, tuning and tuning apparatus, amplifying circuits, antenna and ground, batteries, miscellaneous apparatus, and don'ts. An appendix is devoted to radio formulae, calculation of tuning apparatus, and hook-up diagrams.

Traité de Nomographie. By Maurice D'Ocagne. Gauthier-Villars et Cie. Paris. 1921. 6½″ x 10″. 483 pp.

Professor D'Ocagne has recently published the second edition, revised and enlarged, of his work on Nomography.

Although nomograms are coming into more general use in engineering as well as in ballistics and gunnery, there are some who are not familiar with the general theory of this graphical representation of equations of any number of variables, the object being to replace certain numerical computations by readings made on scales.

The author devotes much space to the development of the theory of construction of nomograms, and illustrates his text with many practical applications from engineering and gunnery.

Professor D'Ocagne is recognized as being largely responsible for the present development of this labor saving device. His book may therefore be said to be the leading authority on this important subject.

An excellent work in English on alignment charts is Dr. Likpa's "Graphical and Mechanical Computations."

The 20th Century Guide for Diesel Operators. By Julius Rosenbloom and Orville R. Sawley. Western Technical Book Co. Seattle. 1922. 5¾″ x 9″. 637 pp. Price, $10.00.

In this important, because simply written and practical, guide the Diesel operator will find much that will help clear up many disputable points. Incidentally he will the better appreciate the growing importance of this comparatively new prime mover. The book is full of practical advice which up to recently had not been put in a form available for the use of the Diesel operator.

A glance at the headings of the sixteen chapters will suggest the authors' plan in preparing this text for the needs of those engaged in the operation of Diesel engines. Technical Terms as Applied to Diesel Machinery; Theory; Miscellaneous Formulas; Principles of Diesel Operation; Liquid Substances; Questions and Answers on Diesel Operation; Fuel Feed and Ignition; Principles of Construction; Auxiliary Machinery and Accessories; Detailed Description of Diesel Engines; Diesel Electric Propulsion; Low Compression Oil Engine; Compressors; Pumps; Batteries; U. S. Rules for Licensing of Engineers on Motorships, Lloyd's Rules, Extract from Rules American Bureau of Shipping.

The authors have not overlooked the little details in building up this treatise. Many elaborated points may seem unimportant, but the authors have held to their plan of a "Practical Book for operators, schools, libraries, and those inter-

ested in Diesel operation." The book fills a long felt want in this highly important field, especially for those who have wanted an American publication, written to meet the point of view of American operators.

Engines and Boilers. By Thomas T. Eyre. The Macmillan Co. New York. 1922. 5¾" x 8¾". 234 pp. Profusely illustrated.

This volume in the "Engineering Science Series," edited by Professors D. C. Jackson and E. R. Hedrick is intended for use in engineering schools which offer an elementary course in Heat Engines. The author makes no attempt to cover the more advanced work in Thermodynamics, or to give an exhaustive treatment of the subject of Heat Power.

The work includes chapters on the following: "Pressure, Temperature and Heat Units," "Fuel," "Steam," "Boilers," "Boiler Accessories and Auxiliaries," "The Steam Engine," "Common Types of Steam Engines," "Valves," "Governors," "Steam Turbines," and "Gas Engines." It is the result of the author's experience in teaching classes in Engines and Boilers and allied subjects.

One of the important features of the text is the use of illustrative examples. Whenever practicable the author amplifies his topic by means of a typical example and solution. At the end of the volume a list of 89 representative problems is given.

Wind and Weather. By Alexander McAdie. The Macmillan Co. New York. 1922. 4¾" x 7". 82 pp. 16 Ill. Price, $1,00.

Professor McAdie's *Wind and Weather* spans a long period in the history of meteorology, for he begins with a descriptive of the tower of winds in Athens, completed twenty centuries ago, and ends with a study of the path of the snow storm of January 1922, when 26 inches fell in the city of Washington, in a period of twenty hours.

This tower of winds built by the Greeks and still standing, served as a public time-piece and to tell the seasonal position of the sun, the eight walls of the temple being provided with dials, the position of the shadows of the marker indicating the seasonal advance or retreat of the sun as it moved north from the time of the winter solstice and then south after the summer solstice. These old Athenians did what we failed to do—gave distinctive names to the winds, representing figuratively the characteristics of the weather as the wind blew from each of the eight cardinal directions.

The author gives the general reader a brief description of the ten types of storms, classifying them according to the place of origin, discussing their paths and speed and disclosing the important fact that they all leave the United States in the vicinity of New England.

This little volume is not a treatise on meteorology nor a handbook of forecasting, but a popular exposition of some salient features of the weather map and the forecasting of storms.