No. 2, March-April, 1931

At the same time, while remedying these conditions as best we could (higher grades and ratings were given to the communications personnel), suitable detachments were provided in the battalion for liaison with the Infantry, a most vital problem, upon the proper solution of which depends much of the success of the Infantry-Field Artillery team.

e. Considerable progress has been made recently in sound and flash ranging, both of which are now performed by batteries of the Observation Battalion. The results both as regards speed and accuracy have been very promising. It is thought possible to use this method for the adjustment of our own long-range artillery, but the degree of practicability of this procedure has not yet been determined.

Training.—Field Artillery training must necessarily follow developments in matériel. The time remaining to Regular Field Artillery troops for their own training after their summer work with the civilian component, is too short to enable it to be spent on anything but absolutely necessary training and with the equipment actually in their hands. Any trial of new methods or verification of the sufficiency of any change in Field Artillery doctrine must be made at the Field Artillery School in connection with the work of that School, or by the Field Artillery Board.

Trends in training are along the following lines:

In firing,—a wider choice of targets and greater speed in firing; less of what is "bull's-eye practice" and more of shooting out an assumed situation from positions chosen in strict accord with tactical requirements. More firing with air observation, more firing at fast tanks, and more attention to defense of Field Artillery units against attack by low-flying aircraft.

Field Artillery gunnery technique has been considerably simplified since the War, based on its adaptation to our own particular problems, and on the necessity for economy in ammunition.

More comprehensive training is being given in Sound and Flash Ranging. Field Artillery officers are being specially trained in this work, as well as in automotive and electrical engineering, at the leading civilian institutions of learning specializing along those lines.

Left: MAJOR GENERAL WM. J. SNOW, Retired, Chief of F. A., Feb. 10, 1918-Dec. 19, 1927
Center: MAJOR GENERAL FRED T. AUSTIN, Retired, Chief of F. A., Dec. 22, 1927-Dec. 15, 1930
Right: MAJOR GENERAL HARRY G. BISHOP, Chief of F. A. Since March 10, 1930

THE FIELD ARTILLERY JOURNAL

VOL. XXI. MARCH-APRIL, 1931 No. 2

THE THREE CHIEFS

THE Field Artillery was organized as a separate arm of the service by act of Congress effective January 25, 1907.

From that date until February 10, 1918, the Field Artillery, although a separate arm, was run by committees of the General Staff.

As an example of how this arrangement worked, it is recalled that shortly after the United States entered the World War, and particularly when the 1st Field Artillery Brigade was being organized and equipped to go overseas, there was not a single Field Artilleryman on duty in the War Department.

On February 10, 1918, General Snow was appointed Chief of Field Artillery by direction of the President under the broad powers granted by Congress to the President for the war.

By the Army Reorganization Act of 1920, the Office of the Chief of Field Artillery was authorized by Congress and General Snow was appointed first statutory Chief. He was continually reappointed, but requested retirement before completion of his last detail.

The second Chief of Field Artillery, General Austin, was appointed for a term of four years. He did not complete his detail, however, but was forced to request retirement on account of poor health.

The third Chief, General Bishop, is the present incumbent.

To the efforts of these three Chiefs the Field Artillery owes much of its present state of efficiency.

THE TREND OF FIELD ARTILLERY

BY MAJOR GENERAL H. G. BISHOP. CHIEF OF FIELD ARTILLERY

(Extracts from a lecture recently delivered at the Army War College)

FROM many years' study of this subject, I am convinced that there has been no change in the trend since the first cannon was invented. For the last thousand years everybody has been trying to build a gun that will shoot farther and do more damage than any gun the other fellow can produce, and this still holds. However, I will attempt to give a little more detail.

The problem of artillery design properly begins at the objective.

What is your target? Is it animal or material? Do you want it just crippled (immobilized), or do you want it destroyed entirely? Where will it be? Behind a hill, hidden in the woods, in a hole in the ground or up in the air?

A consideration of objectives gives one a line on the size and character of the projectile required. From this, the characteristics of the gun and its carriage can be deduced, having due regard to mobility and weight.

Before going further, it will be well to get a correct conception of the classes of Field Artillery required and their missions, based upon a consideration of the objectives.

We are generally committed to three classes—Division, Corps and Army Artillery.

At the close of the World War, a board, generally known as the "Caliber Board" (or the Westervelt Board), was convened in the A. E. F. The report of this Board has since been the guide for our artillery design and organization. The missions, considerably abbreviated, of these three classes of Field Artillery, as given by the Caliber Board, are as follows:

Division Artillery.—Must have mobility permitting it to accompany the Infantry; its objective, primarily, the Infantry of the opposing division. It is, therefore, bound to its Infantry with the closest bonds; its tactical use cannot be separated from that of its Infantry. It must fire accordingly a man-killing

projectile, and be able to make quick changes of objective; must have great range because of echelonment in depth, both of our own and the opposing division; must constantly harass the enemy and destroy or immobilize him; on the defensive, must break up opposing Infantry formations by counter-offensive preparations and by annihilating fire on points whence attacks emerge, and, failing these, be prepared for barrage and close-range fire; on the offensive, must be prepared to cut wire, destroy machine-gun nests, gas and smoke areas, lay down concentrations and set up a deep barrage; must possess mobility for changes of position on the battlefield.

Corps Artillery.—Note that the Division Artillery mission does not include protection against enemy artillery. This counter-battery work is the principal mission of the Corps Artillery. It has also the mission of executing extensive harassing and interdicting fire along a front and in depth greater than the division, and of placing destructive fire on strong points, railroad facilities and supply points.

Army Artillery.—Missions of interdiction, neutralization and destruction, extending beyond the capabilities of the Corps. The Army must have a pool of light, medium and heavy artillery for any reinforcements that may be required; it should also contain artillery for special purposes such as pack artillery, trench artillery, and super-guns and howitzers.

As exemplifying this classification, the foregoing charts show the organization of the French, British, American and German Armies, first as they stood at the end of the World War and as they stand today.

Chart A shows the superb artillery organizations the French had actually put into effect on November 2, 1918. Particularly noteworthy in the organization is the amount of G. H. Q. artillery.

Few changes were made by the French in the organization of *Division* Artillery during the World War.

As a result of a shortage of horses, the lighter calibers of supporting artillery in Corps and higher organizations were made portée. With this increased long-distance mobility they

were so frequently used out of their Corps sectors that they were finally put into the General Artillery Reserve. No guns or howitzers in the Army Artillery. The Corps Artillery, both in this chart and at present has only guns.

Chart B shows the present French artillery organization.

Like ourselves, the French have many skeleton and inactive units. The French are prepared to expand to war strength divisions at short notice by calling to the colors the last three classes who were furloughed to the reserves.

It should be noted that the Division Artillery at war strength instead of being one regiment, consists of two regiments, one of 75s and one of 155 howitzers. It should also be noted that the Corps Artillery as at present organized is of medium caliber *guns*—no howitzers.

Chart C shows the British World War artillery organization.

Within the division the Great War brought about only minor changes in the organization of the command and staff of the artillery. It should be noted that 4-gun batteries were adopted for the new army, but before the end of the war the British had reverted to 6-gun batteries which they had in pre-war days.

It was not until the end of 1917 that organization of heavy artillery brigades* was taken in hand. It should be remembered that up to this point no system whatsoever of brigading batteries existed either in heavy or medium artillery. A certain number of "heavy artillery group headquarters" were placed temporarily in command of a number of batteries. The disadvantage of such a system became very apparent. Group headquarters were unable to take a permanent interest in batteries which were continually transferred from one group to another.

Toward the end of the war the British did what they could towards standardizing. They formed several type brigades such as mobile brigade (destined for general purposes), the Howitzer brigade (for barrage and bombardment) and mixed brigade (for counterbattery work).

The operations of May and June, 1915, showed to the British

*Here it should be noted that the British call a battalion of artillery a "brigade". When they say "regiment" they mean the whole artillery arm.

the necessity of coordination and control in the artillery beyond that of division and that the status of the artillery advisers and group headquarters were unsatisfactory and caused friction. It was with considerable opposition that the artillery adviser at corps headquarters became "General Officer Commanding the Royal Artillery of the Corps". This was effected in October, 1915. Turning to the Army headquarters we find that the status of the "Major General, Royal Artillery, attached to Army Headquarters" followed closely the fortunes of the "Brigadier General, Royal Artillery, attached to Corps Headquarters". His final status "General Officer Commanding the R. A. of the Army" and his functions (similar to those of the Corps Artillery Commander) were to keep the Artillery Commander informed of all matters connected with the artillery of the army and to take executive command of the whole or any part of the artillery with the army at the direction of the Army Commander. He was authorized to issue instructions direct to subordinate artillery organizations.

In the British Forces in France during the World War we find three separate armies starting with different organizations and following separate lines of evolution, yet all three arriving at a similar solution of factors affecting organization and command of artillery. The consensus of British opinion may be briefly classified as follows:

a. The necessity for strategic reserves of both heavy and light artillery. In this connection it should be realized that at the end of the World War the British had fifty-one army brigades of Field Artillery as strategic reserves, composed of 966 18-pdrs. and 540 4.5″ howitzers as opposed to sixty-one division artilleries with 2,196 18-pdrs. and 732 4.5″ howitzers.

b. The selection of the Corps as the most suitable organization for counterbattery control.

c. Selection of the Army for the control of guns with extreme ranges and best employed on strategic tasks.

d. Finally the necessity of centralization of artillery command during preparation and initial stages of attack followed by decentralization.

Chart D shows the present British artillery organization.

In the British Army there is no present organization for the corps and army. As regards the artillery, it should be noted that the British still cling to type battalions which they call heavy artillery brigades, medium artillery brigades, field brigades, light brigades, horse artillery brigades, etc. They also have a mixed battalion consisting of both gun and howitzer batteries. It appears that the British have given more attention to experimentation in new types of equipment and work along new tactical lines than to organization.

Chart E gives the German artillery organization at the end of the War.

During the World War one of Germany's most important problems was providing equipment for second-line divisions. They began during 1914 by reducing the 6-gun field batteries to 4-guns. This arrangement was retained to the end of the World War.

German G. H. Q. held on to a great part of non-division artillery throughout the war, abstaining from assigning it organically to armies and corps. By November 11, 1918, we find the divisions had 11,448 pieces of artillery assigned to them, the corps, only 480, and the General Artillery Reserves, 7,800.

No artillery command existed beyond the division until the Riga Offensive of 1917, when necessity for higher decentralization was realized. The change was apparently due to the successes which Colonel Bruchmueller had obtained. We find that in the Riga Offensive the whole of the artillery was placed directly under the orders of the army commander for the period of preparation and for the first few hours of the attack. As no artillery commander existed at army headquarters one had to be extemporized and we find the following system: "A commercial traveller, well versed in methods of massed artillery command, despatched to exercise his functions with the various armies concerned."

Chart F gives the present contemplated German artillery organization.

The problem of the Germans is very different from that of

the other great powers. Germany has practically no artillery on hand. Instead of planning and organizing to use what they have, having nothing, they are planning to use what they expect to make. Their organization naturally depends on how they expect to operate. In case of a war in the reasonably near future they would push forward their divisions as rapidly as possible, each division acting more or less independently and supported by its corps. We, therefore, see a great variety of types of artillery in the division. The division is fairly self-sustaining and can do some fairly heavy work with its artillery. On the other hand, the corps is prepared to reinforce the division with lighter calibers, and also to provide the heavier materiel needed in case the division is stopped.

It is of interest to note that this chart shows the German organization which the French are using at the Ecole de Guerre to represent the enemy organization in their map problems, etc. It also coincides with what our military attaches have learned as to German contemplated organization as set forth in latest German Field Service Regulations.

Chart G shows the organization which was contemplated for the artillery of the A. E. F. as shown in General Pershing's final report. The armistice came before the organization was entirely complete. This organization, perhaps better than any other, took into consideration all important factors as regards strategic reserves, allocation of proper materiel and functions to armies, corps and divisions and standardization of organizations.

Chart H shows the artillery organization of the American Army upon the completion of the fourth period of the Six Field Army mobilization plan. Much of the equipment for this organization is on hand—left over from the World War.

Returning to the subject of missions again, it should be noted that the Caliber Board did not include aerial targets, nor make mention specifically of tanks or other armored transport which, in the last few years, have become so important as to require that they be particularly noted in the division mission.

Based on the foregoing missions and resulting classification, the weapons recommended by the Board were as follows:

Division Artillery.—Ideal: a gun-howitzer capable of fulfilling all requirements, having all around fire and elevation up to 80°. Practical: a light field gun and a light field howitzer, with range not less than 11,000 yards.

Corps Artillery.—A gun and a howitzer, each having about 15,000 yards range, with carriage weight of about 11,000 pounds, both having all around fire and the gun with permissible elevation of 80″ and the howitzer 65″.

Army Artillery.—A gun of a range of approximately 25,000 yards and a howitzer with a range of about 18,000 yards, both with all around fire and elevation up to 65°.

In connection with division artillery, the Board discussed the accompanying gun question, stating that a solution by assignment of batteries of Field Artillery was not satisfactory as offering too vulnerable a target, difficulty of ammunition supply and not being sufficiently mobile. The missions of an accompanying gun are:

Neutralization of the fire of machine guns, Infantry mortars, anti-tank guns, and riflemen; disabling tanks and armored cars; support of tank attacks by physical accompaniment and by fire from supporting positions in rear; support of mechanized forces by physical accompaniment and by fire from supporting positions in rear.

One of its principal objectives is the wiping out of machine-gun nests. The Infantry alone can handle an isolated nest, but in the case of a line of nests a certain number must be destroyed in order that the Infantry may outmaneuver the others. The Board gave the following as the characteristics of an ideal gun for this purpose: caliber, about 2.5 inches; projectile, about 10 lbs; carriage permitting elevation from minus 5 to 50 degrees, so designed as to permit divisibility into loads of not over 100 lbs. each; total weight of gun and carriage not over 300 lbs. and so arranged as to be readily hauled by 2 men over sod; the complete equipment capable of being manhandled in trenches; the gun effective for direct fire at 2,500 yards.

New matériel.—The first noteworthy new item is the pack howitzer. This has proven to be an excellent weapon. With a gross weight of less than 1,400 pounds, we have a weapon

comparable in range to the 2,600-pound French 75. It is packed in 6 loads and is almost ideally designed as a pack transport weapon. The Phillips Pack Saddle, a new contrivance, replaces the standard aparejo.

In this weapon, it is possible that we have a solution of the accompanying gun problem. Tests to determine its suitability for this purpose are now under way.

For a long time every one shied away from the ideal divisional weapon, the gun-howitzer. In May, 1929, the subject was taken up with the Ordnance Department, and two carriages have been constructed for the 75mm. gun, M1, namely, the T2 and T3 mounts. The selected mount will probably conform to the 3 out-rigger design, embodying some of the features of the other. In traveling position the weight is about 5,900 pounds. Going a step further, we have now asked the Ordnance Department to build a gun-howitzer for this mount capable of aerial fire. The principal characteristics as agreed upon, will be caliber 90mm., firing a projectile for supercharge of 26 pounds, and for zoned charge of 22 pounds, with a maximum muzzle velocity of 1,900 feet per second and a maximum range of 14,500 yards.

A compromise had necessarily to be made between characteristics desirable for terrestrial targets and those for aerial targets, and this compromise occurred, principally, in the muzzle velocity. Two thousand one hundred feet per second is about the minimum desirable for aerial targets. The reduction to 1,900 feet per second will result in an increased time of flight of from 2 to 3 seconds per medium ranges over the regular antiaircraft gun, which reduces its efficiency somewhat as an antiaircraft weapon. This loss in efficiency will have to be made up by an increase in the volume of fire. A complete description of these carriages can be found in the May-June and July-August 1930 issues of the Field Artillery Journal.

There are also, in the study stage, plans for a new 155mm. gun—8-inch howitzer carriage. This also will be of the pedestal type. Weight reduction, possibility of greater traverse, speed and a spring carriage, are the objectives sought.

The foregoing constitute the principal changes now contemplated

in our guns and carriages. It may here be remarked, parenthetically, that both the British and the French are working on carriages similar to the T2 and T3 above mentioned. They are primarily for anti-aircraft use.

The present 75mm. gun, when equipped with the panoramic sight, is a suitable weapon for the attack of tanks and other armored vehicles, even when moving at some speed, and the proposed gun-howitzer should likewise be suitable. However, the increased speeds of both aerial and of some ground targets require improvement in our laying process. Our present method of computing data by pad and pencil, and transmitting it by voice, even over the telephone, is antiquated, considering advances in the transmission of stereotyped data in civil practice—witness, the dial telephone, stock quotations boards, etc. It is proposed to experiment with a mechanical computer and to transmit the data electro-mechanically to each gun of the battery, following the lines at present used with the anti-aircraft guns. This may be accomplished by a deflection and an elevation pointer, keeping each gun constantly advised of the proper direction and the proper elevation. The operators at the guns match these dials constantly by operating the traversing and the elevation mechanism. Likewise, a continuous fuze setter must be devised, if time fuzes are to be fired.

The present anti-aircraft protection of a division is that furnished by our own aircraft and by the special anti-aircraft artillery of the corps and the army; however, this is not sufficient and it is proposed to attempt to augment this by the anti-aircraft features of the division artillery itself, as previously stated. Protection against low-flying craft must, in addition, be furnished by each body of troops itself. Machine guns have been sufficiently tried out for this purpose to show that they are not satisfactory for Field Artillery troops in motion. The shoulder and the semi-automatic rifle, at the present time, seem to be our best bet. Pending development of another automatic, the Browning .30 caliber automatic rifle has been tentatively added to the equipment of selected Field Artillery units.

Prime Movers.—This is a term much used now, and as it pertains to Field Artillery, I would define it as the power unit

employed to move a section of Field Artillery. It may be animal or motor.

At the conclusion of the World War, with the exception of 50 per cent. of the 75mm. guns in a combat division, the motorization of all mobile artillery weapons was authorized and would have been put into effect had the war lasted a few months longer, and *sooner* if shipping had been available. This decision was influenced largely by the shortage of horses, and, by the existence of good roads in the theater of operations.

The artillery has experimented continuously since then with motor vehicles. The greatest stumbling block for ideal complete motorization of division artillery has always been the transportation needed for the establishment of communication lines and for reconnaissance.

With the types of motor vehicles now available, this objection, while not wholly removed, no longer presents such a serious obstacle. In some acute cases it might necessitate more walking and physical exertion on the part of the personnel concerned.

There is always some vehicle that is best suited to our purpose, but, unfortunately, it is almost invariably best suited to other arms as well, and the availability of supply enters largely into the problem. In other words, concurrent with tactical and strategical efficiency, availability enters. For example, right now every arm fixes on the 4-wheel drive truck as its prime mover. At the end of one year of war the Army's requirements for this vehicle would be to production as 6 is to 1. On the other hand, our animal population, available for withdrawal from commercial use, is 10 times our probable requirements. This answers the question as to whether or not the horse goes to war. The particular vehicle in which the artillery is now most interested, is the multi-wheel, multi-drive truck. Power goes to the 4 rear wheels. The Ordnance Department has devised a removable track for the two pairs of driven wheels. This is put on and taken off exactly as chains on an automobile by laying the track on the roadway, driving the vehicle on to it, folding over and connecting the two ends, all in four or five minutes. This gives a prime mover capable of high speed

without its track and, with its track, equal in cross-country mobility to a tractor. When at the selected position, the gun is lifted out by a boat crane, dropped in place and the truck is free to take shelter or go on some other mission. This truck appears to be well suited as a prime mover for both draft and portée artillery, as well as a cargo carrier. One of these trucks has been fitted to carry a T2 mount with a 75mm. gun.

There is nothing strikingly new in powder, projectiles and fuzes. The trend of development is, of course, constantly toward improvement.

The stream line Mark IV shell for the 75mm. gun has been found to give the best results as regards range, accuracy, and effect, and this type has been designated as standard for the 75mm. guns now in service. With slight modification this shell can also be used in the 75mm. gun, M-1, and the 75mm. pack howitzer. A shell of similar design, but heavier, is being developed for the two weapons last named, however. Shell of this general type are also under development for other new weapons.

A flashless, non-hygroscopic, smokeless powder has been adopted as the standard propellant for the light weapons, and tests of similar propellants for other calibers are now in progress. Tests are also being made of a powder charge for the inner zones of the 155mm. howitzer, M-1918, designed to give greater accuracy of fire in these zones.

The development is now practically complete of a selective super-quick and short-delay, bore-safe fuze for use with ammunition for the new weapons. The development of a time fuze for shell is also under study.

Communications.—Inasmuch as the supply of wire in combat is visualized to become much the same as that of ammunition in the future, an attempt is being made to standardize wire carrying equipment with the promise of considerable success. It is believed that all wire carrying agencies in the Field Artillery from man to truck can make use of a standard steel spool supplied by the manufacturer and carrying about ½ mile of the new type light wire. We now have 2 types—11 and 7 strand; the new light wire is 7 strand, stronger than the present 7 strand, and lighter than the 11 strand.

The development of radio equipment has progressed to a point where it can be foreseen that all Field Artillery agencies communicating by radio, will be equipped with continuous wave, hand generated, telegraph sets. The addition of three liaison sets in the battalion will go a long way towards solving the hitherto almost insoluble liaison problem. Satisfactory radio-telephone sets are an ideal which it does not appear will be attained in the near future.

Radio and command post wagons are a recent development which promises some increase in the operating efficiency of headquarters units.

New Manufacturing Processes.—This paper would not be complete without some mention of new methods and processes that have been developed by the Ordnance Department recently, which reflect to great advantage in construction of Field Artillery matériel. I want to call attention to the following:

Electric Welding.—This is largely replacing the old method of joining metal parts by bolts, screws and rivets. With a great reduction in weight, simplicity of manufacture, increased strength in the joints and saving of time, it gives a much better joint than the old method.

Cold Work or Auto-frettage.—This is a process of giving the required compression to the inner layers of metal of a gun tube by stress applied within the tube rather than without. The old method, as you all know, was to shrink jackets, sleeve and locking rings over the inner tube, making a built-up gun—a process that required careful microscopic turning and boring of the parts to be assembled. This is a laborious, costly and time-consuming process. The same results can be obtained by internal pressure, a fact long known and used. Formerly, it was accomplished by forcing a mandrel, slightly larger than the bore of the tube, through the tube, then another mandrel a little larger than the former was forced through and so on, until the tube received the desired compression. Some Austrian guns that we encountered during the War were treated this way. Now, the same result is obtained by our Ordnance Department by temporarily sealing both ends of the tube and subjecting the interior to water pressure. Another feature of Ordnance construction

and design is the use of articles of commercial manufacture, so far as can possibly be done, not only in their entirety, but in parts; for example, the use of automobile motor cylinders and pistons in recoil mechanism. Also, centrifugal casting, which in the case of gun tubes collects the good metal in the outer layer of the ingot, the inferior metal collecting in the center, where it is bored out.

Trend in Organization.—The trend is constantly toward simplification and standardization, and includes the adaptation of such of the latest methods and materiel as will best enable the Field Artillery to successfully perform its mission.

Some of the more important recent developments are:

a. Standardization of the various Ammunition Trains. Those of the Corps and Army are now being made up of components identical with certain of those in the new Ammunition Train of the Field Artillery Brigade of the Infantry Division.

b. A new organization for the Field Artillery Brigade Headquarters and Headquarters Battery, which when approved will be used for all types of brigades whether they be a part of the Infantry Division, Corps, or General Headquarters Reserve Artillery.

c. In the revision of other Tables of Organization, the same principles are being kept in mind with only such variations as are required by the types of weapon and transport.

d. An important development affecting particularly our active Regular Army units is the reorganization of the Field Artillery, which was effected last May, and which was made necessary:

(1) By reductions in enlisted strength for Air Corps increments.

(2) To remedy certain unsatisfactory conditions in the housing situation.

(3) To fill better the training needs of certain corps areas, particularly, for units equipped with howitzers.

(4) By reductions in animals for reasons of economy.

(5) To reduce overhead as much as possible in order to get greatest training value per man.

The Field Artillery School at Fort Sill continues to give to the graduates of its various courses a detailed knowledge of the technique and tactics of all Field Artillery units and tactical groupings, and a working familiarity with the technique and tactics of the associated arms. Its aim is to train Field Artillery officers to know their jobs, and never has that aim been so fully attained as at the present time. With present shortage of ammunition and of time for troop training, there is no other place where this aim can be fully attained. Any cut in either the scope or time allowed to any of these courses would be deplorable.

The Field Artillery tries to make its training all-embracing. We feel we must train our own motor mechanics, our own communication specialists, and our own horsemen—so that the Field Artillery will not have to pass the buck back to the Quartermaster or Ordnance Department, or to the Signal Corps or the Cavalry. We have the task—we welcome the responsibility, but we must have the tools and the training. We know better than anyone else what our training along our own lines should be, and we feel that, such being the case, we are more qualified than anyone else to undertake that training. We give expert training for our specialists that they may spread it throughout the Field Artillery arm.

There is probably no matter concerning Field Artillery that has received so much attention in recent years as that of motorization, particularly of the division artillery. Neither the French nor the Italians have committed themselves, and the British War Office is credited with the following recent statement: "A suitable type of mechanical vehicle for division artillery has not yet been developed, and no change will be made until a suitable type is developed, but more important, not until suitable field bridging is found." This subject is a most live one in our office, and we endeavor to keep in touch with the latest development in motor transport. It is my opinion that there are commercial types in existence which are suitable for most of our needs; however, considering the vast number of horses in the country, any final decision, which must, of course, be made by the War Department, must be based almost wholly upon the availability of the types required.

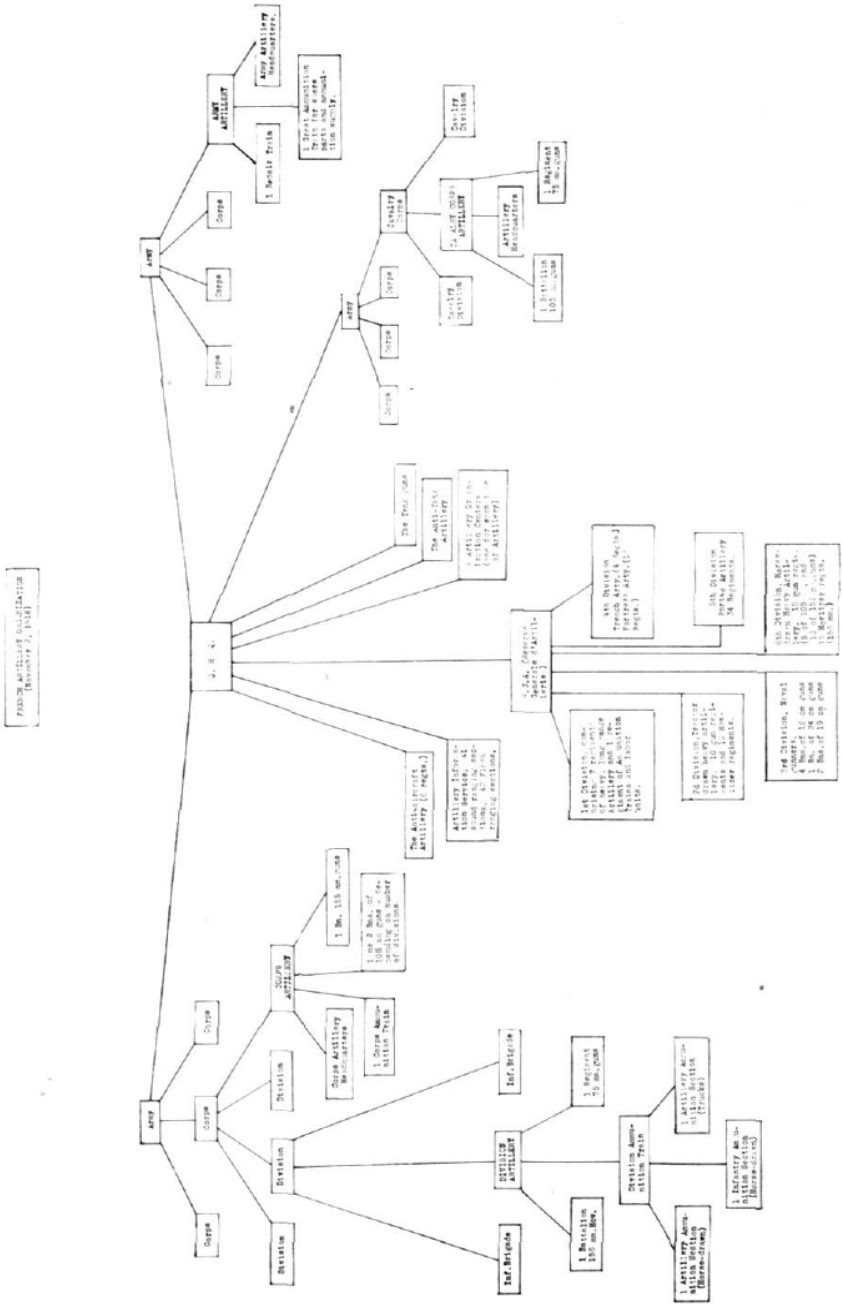


CHART A (For 1930 French Organization, See Page 138)

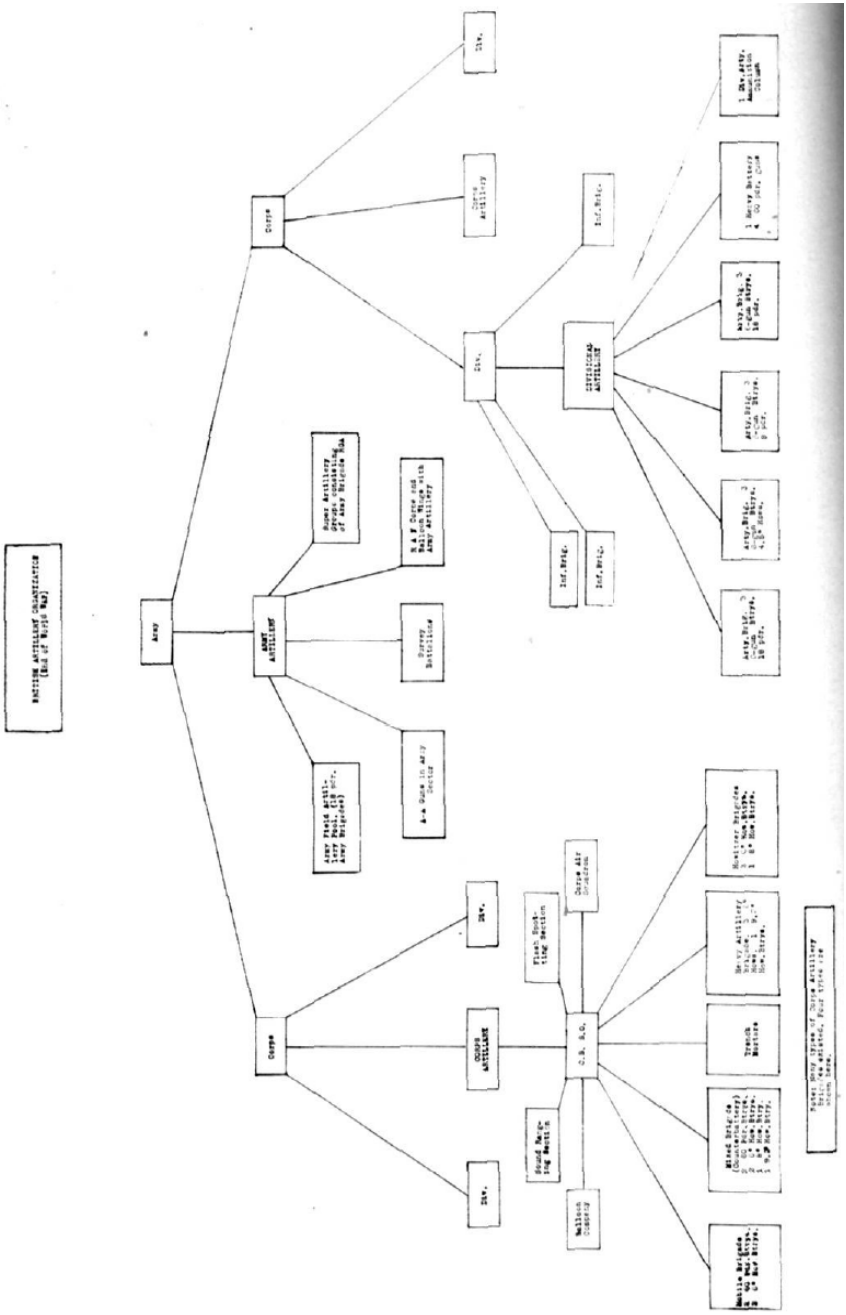


CHART C

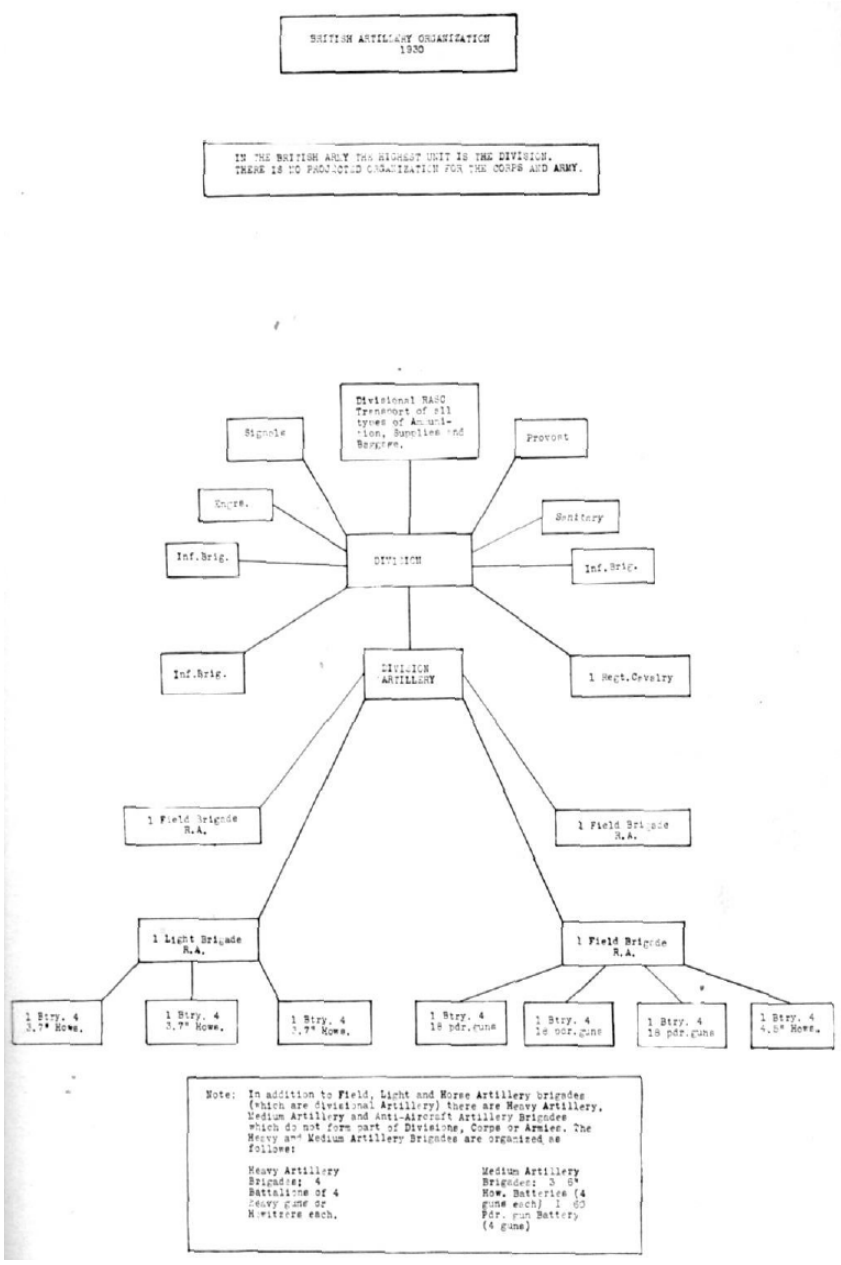

BRITISH ARTILLERY ORGANIZATION
1930
IN THE BRITISH ARMY THE HIGHEST UNIT IS THE DIVISION.
THERE IS NO PROJECTED ORGANIZATION FOR THE CORPS AND ARMY.
Divisional RASC Transport of all types of Ammunition, Supplies and Baggage.
Signals
Provost
Engrs.
Sanitary
Inf.Brig.
DIVISION
Inf.Brig.
Inf.Brig.
DIVISION ARTILLERY
1 Regt.Cavalry
1 Field Brigade R.A.
1 Field Brigade R.A.
1 Light Brigade R.A.
1 Field Brigade R.A.
1 Bty. 4 3.7" Howe.
1 Bty. 4 3.7" Howe.
1 Bty. 4 3.7" Howe.
1 Bty. 4 18 pdr.guns
1 Bty. 4 18 pdr.guns
1 Bty. 4 18 pdr.guns
1 Bty. 4 4.5" Howe.
Note: In addition to Field, Light and Horse Artillery brigades (which are divisional Artillery) there are Heavy Artillery, Medium Artillery and Anti-Aircraft Artillery Brigades which do not form part of Divisions, Corps or Armies. The Heavy and Medium Artillery Brigades are organized as follows:
Heavy Artillery Brigade: 4 Battalions of 4 Heavy guns or Howitzers each.
Medium Artillery Brigades: 3 6" Howe. Batteries (4 guns each) 1 60 Pdr. gun Battery (4 guns)

CHART D

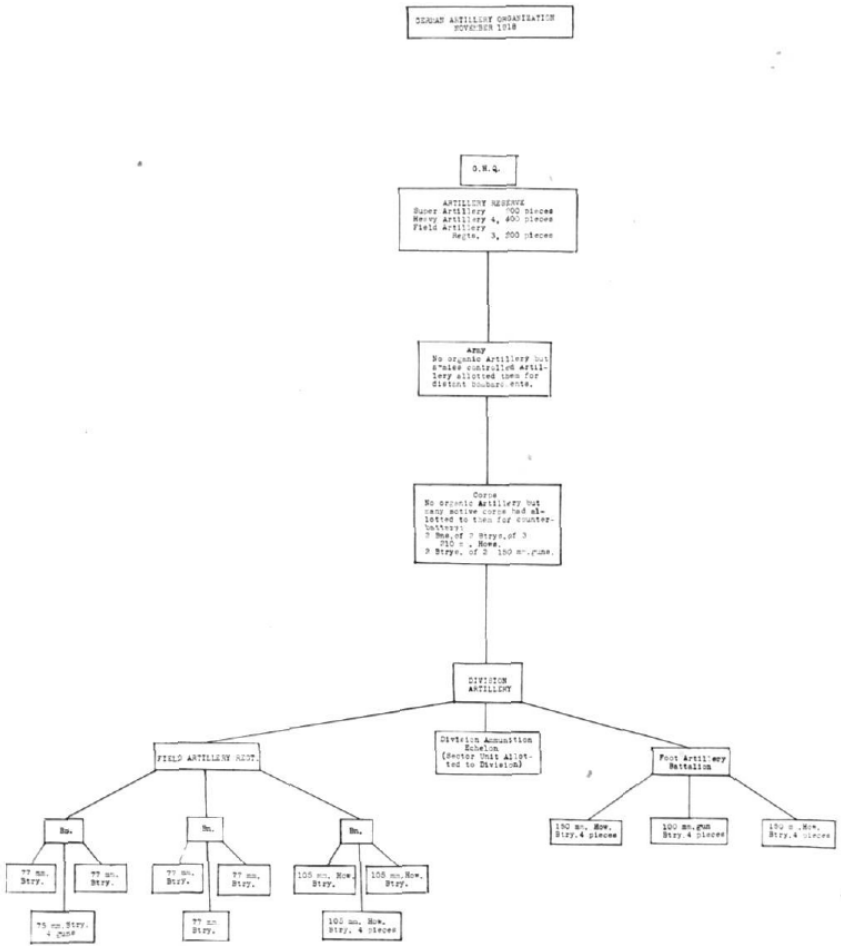

GERMAN ARTILLERY ORGANIZATION
NOVEMBER 1918
O.H.Q.
ARTILLERY RESERVE
Super Artillery 700 pieces
Heavy Artillery 4, 400 pieces
Field Artillery
Regts. 3, 000 pieces
Army
No organic Artillery but
Corps
No organic Artillery but
DIVISION
ARTILLERY
FIELD ARTILLERY REGT.
Division Ammunition
Echelon
(Sector Unit Allot-
ted to Division)
Foot Artillery
Battalion
Bn.
Bn.
Bn.
77 mm.
Btry.
77 mm.
Btry.
77 mm.
Btry.
77 mm.
Btry.
105 mm. How.
Btry.
105 mm. How.
Btry.
75 mm. Btry.
4 guns
77 mm.
Btry.
100 mm. How.
Btry. 4 pieces
150 m. How.
Btry. 4 pieces
100 mm. gun
Btry. 4 pieces

CHART E

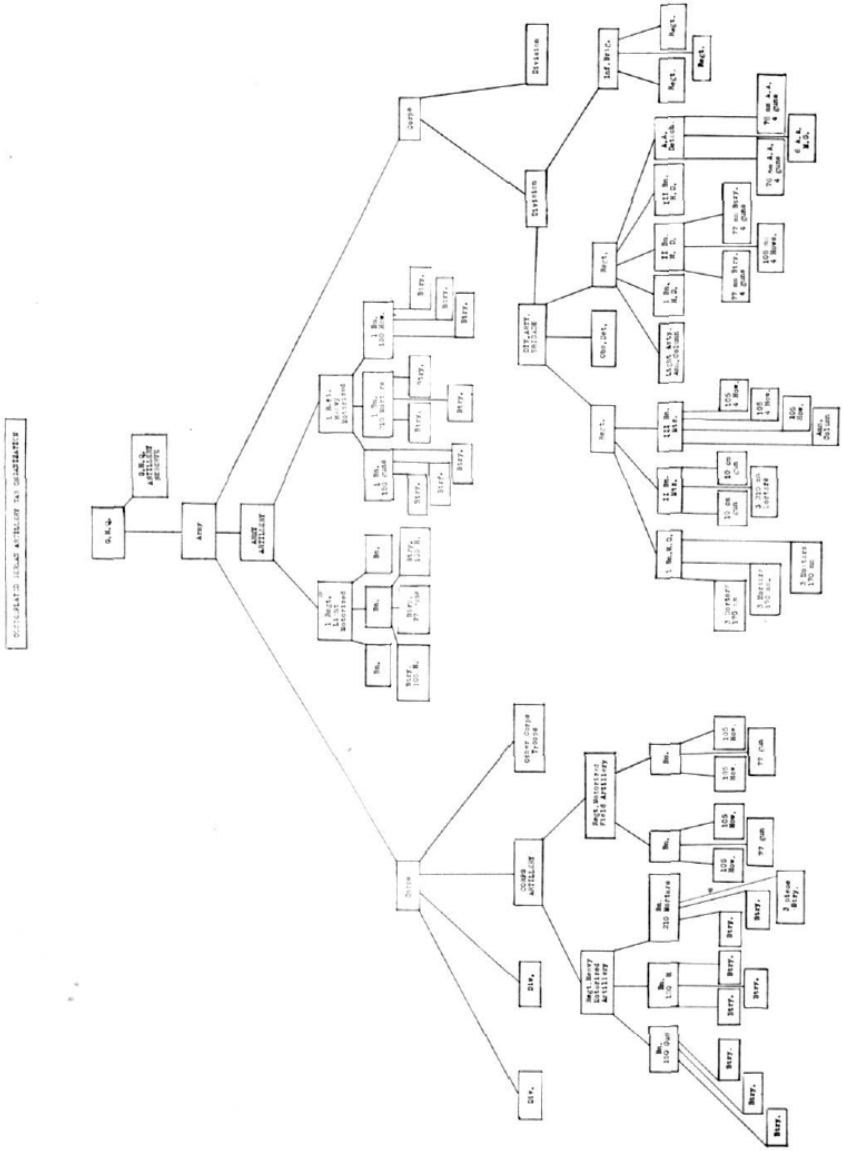


CHART F

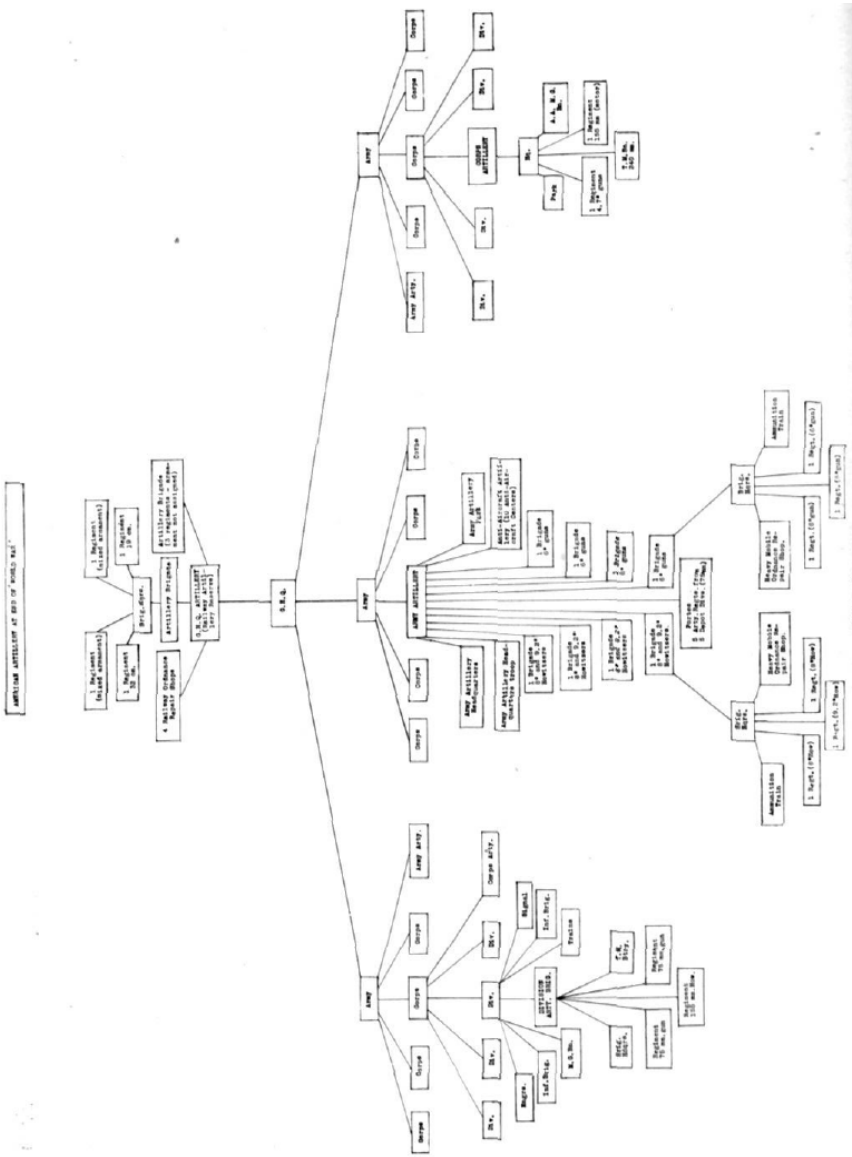


CHART G

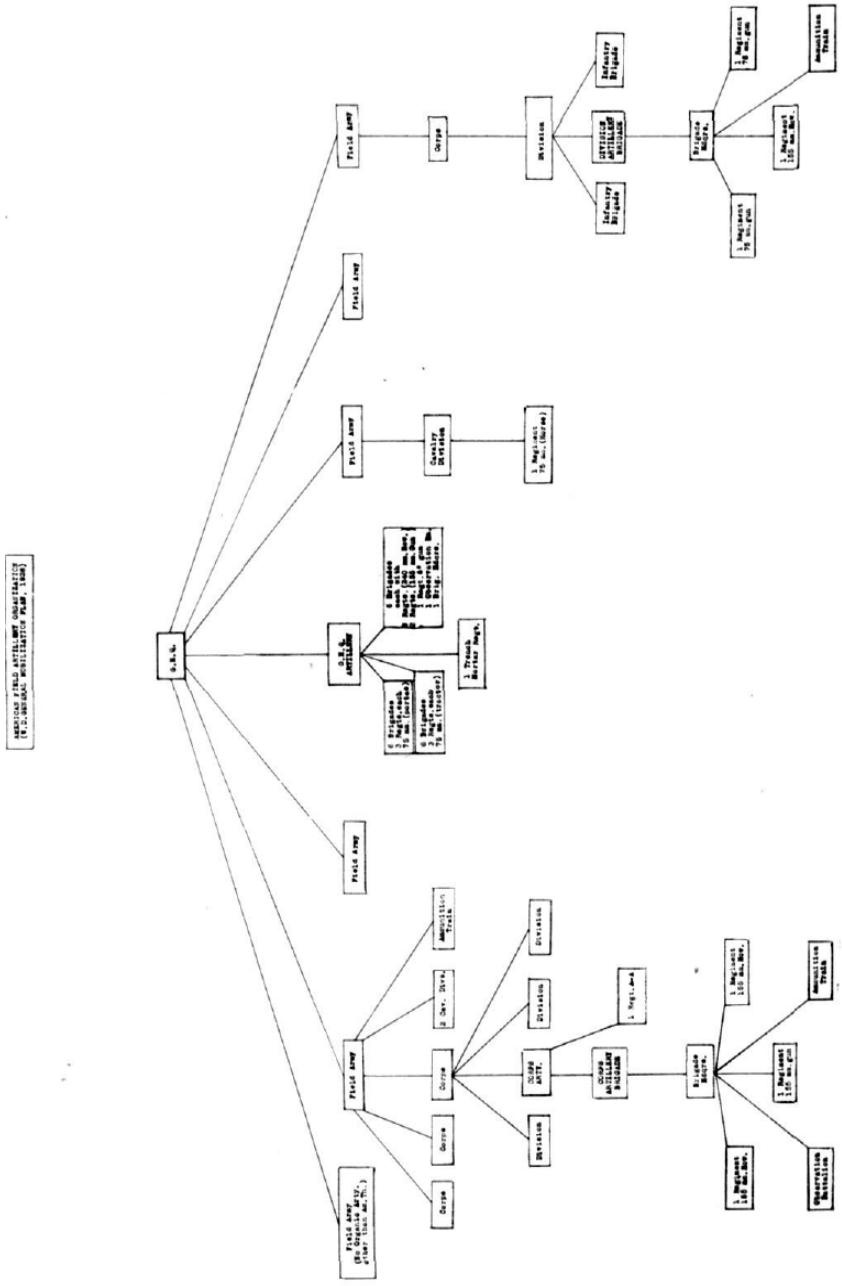


CHART H

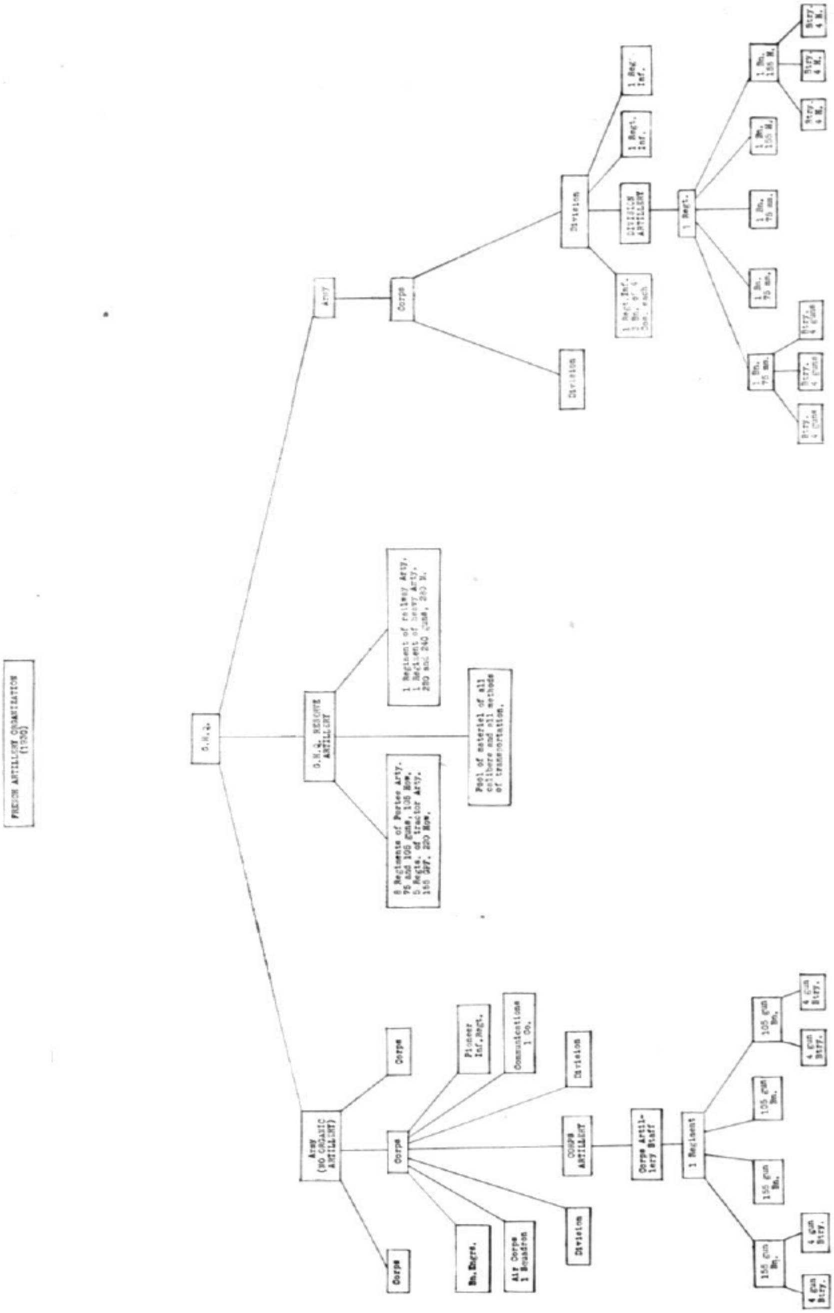

FRENCH ARTILLERY ORGANIZATION (1930)
G.H.Q.
Army (NO ORGANIC ARTILLERY)
Corps
Corps
Corps
Bn. Engrs.
Air Corps 1 Squadron
Pioneer Inf. Regt.
Communications 1 Co.
Division
CORPS ARTILLERY
Division
Corps Artillery Staff
1 Regiment
155 gun Bn.
155 gun Bn.
105 gun Bn.
105 gun Bn.
4 gun Btry.
4 gun Btry.
4 gun Btry.
4 gun Btry.
G.H.Q. RESERVE ARTILLERY
8 Regiments of Portee Arty. 75 and 105 guns, 105 How. 5 Regts. of tractor Arty. 155 GPF, 220 How.
1 Regiment of railway Arty. 1 Regiment of heavy Arty. 280 and 240 guns, 280 H.
Pool of materiel of all calibers and all methods of transportation.
Army
Corps
Division
Division
1 Regt. Inf. 3 Bn. of 4 Cos. each
DIVISION ARTILLERY
1 Regt. Inf.
1 Regt. Inf.
1 Regt.
1 Bn. 75 mm.
1 Bn. 75 mm.
1 Bn. 75 mm.
1 Bn. 155 H.
1 Bn. 155 H.
Btry. 4 guns
Btry. 4 guns
Btry. 4 guns
Btry. 4 H.
Btry. 4 H.
Btry. 4 H.

CHART B

GEORGE GRANT GATLEY

GENERAL GATLEY died at Letterman Hospital on January 8, 1931.

By his death the Field Artillery has lost more than an individual; it has lost an institution. He was known and loved not only throughout the Field Artillery, but throughout the entire Army. He typified the Old Army and was an outstanding exponent and a perpetual reminder of its best traditions. Those who have heard his stories and songs will always smile with a surge of pleasant reminiscence as thoughts of him come to mind. From Double Bottom badger fights, duck shooting with mountain guns in Mindanao, one armed flute players, Down East sea yarns, and imparting knowledge of the Spanish language to thirsty second lieutenants, down to more recent postwar times, he has ever striven to maintain esprit de corps and traditional good fellowship, and has steadfastly followed the Red Guidon. He taught those who were privileged to serve under him to make service a pleasure rather than a drudge. This was one side of his nature and yet it was always closely knit to the other side, for when occasion demanded he could be as inflexible in duty and as decisive in action as any man. He possessed that rare gift among soldiers—the ability to relax completely with his associates when off duty without the slightest sacrifice of the respect of those same associates when on duty. Men loved him and animals loved him. It is not hard to imagine old "Wop," the dog, and "Virginia" and the other horses waiting on the other side to welcome him as only dogs and horses can. His gruff exterior concealed a heart of gold. He never did any man an intentional injustice and he helped many a man out of a hole.

The Field Artillery has suffered a loss which time cannot heal or others replace. His passing marks the end of an epoch in our arm.

TYPE PROBLEMS

Precision Lateral Problem

(See Par. 86, TR 430-85, 1930 Edition)

Target Description: Machine gun emplacement. *Mission:* To destroy. *Matériel:* French 75 mm. gun, Model 1897. Visibility: Excellent. Wind Direction: Right to left. Initial data obtained: Deflection—Field glasses, Range Estimated. T = 190, R = 3800, r = 1900, s = 5, c = 5, r/R = .5, s/c = 1, F = 4. Battery on the right.

Initial Commands:

No. 1 Adjust
Base Deflection, left 150
Shell Mark I
Fuze short
No. 1
1 Round
Quadrant

OP

Target

Gun

Commands	Elev.	Rd. No.	Deviations	Sensings Rn.	Def.	Remarks
	120	1	20 right	doubtful		20×.5=Lt. 10 to get on line.
Lt. 10	120	2	5 left	over		s/d = 10/25 = 2/5, 5×2/5 = Rt. 2 to get on line. 16×1=Lt. 16 to stay on line ∴ Lt. 14.
Lt. 14	104	3	4 left	over		4×2/5=Rt. 2 to get on line. Lt. 14 to stay on line ∴ Lt. 12.
Lt. 12	88	4	4 right	short		$\frac{4\ \text{Rt.} + 4\ \text{L}}{2} = 0$
Rt. 6	96	5	line	short		
Rt. 4	100	6	2 right	short		
Rt. 2, 3 rds.	102	7	1 left	over		Range may be sensed on rule.
		8	2 left	over		
		9	1 right	over	over	Positive sensing on terrain.
Lt. 1, 2 rds.	100	10	target	target	target	Deflection is covered.
		11	2 right	short		Fork=4 2 shorts, 3 overs.
6 rds.	100.7		C. F. End of Problem			1/12 of 4=3, 101—.3 =100.7

Summary: Error in initial data: Deflection: 25 mils, Range: 359 yds. or 10.5%. Time from identification of target to announcement of first range: 2 min. 38 sec. Average sensing and command: 23 sec. Total time for problem: 12 min. 14 sec. Ammunition expended: 11 rounds. Classification: Satisfactory. General Comments: The problem was well handled. The officer firing used all available information, including terrain sensings.

Percussion Bracket Lateral Problem

(See Par. 87, TR 430-85, 1930 Edition)

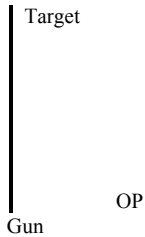
Target Description: Machine guns in the vicinity of bushes. *Mission:* To neutralize. *Matériel:* French 75 mm. gun, Model 1897. Visibility: Excellent. Wind Direction, right to left: Initial data obtained: Deflection—Compass, Range—Estimated.

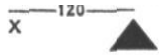
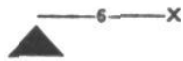
T=270, R=3000, r=2500

r/R=5/6=.8 s=27/3=9 OP on the right.

Initial commands

Compass 4850
Site plus 5
Shell Mk. I
Fuze long
No. 2
1 Rd.



Commands	Range	Sensings Deviations as viewed from OP but not announced	Rn.	Def.	Remarks
	3000		doubtful	doubtful	120×.8=96. Better to use nearest multiple of 5, *i.e.*, Rt. 95.
Rt. 95	3000		short	short	4×9=36. Better to use nearest multiple of 5, *i.e.*, Lt. 35.
Lt. 35	3400		lost	lost	(Behind a hill).
	3400		lost over	lost over	Slow in making sensings.
Rt. 18	3200		doubtful	doubtful	Battery should have been brought in 6×.8=5.
Lt. 5, Btry Rt.	3200		over		Should have fired battery left.
			over doubtful doubtful	over	
Rt. 10, Btry 1 Rd.	3200	Not fired			Did not open sheaf in passing to fire for effect. Should have opened 4 on No. 2.
	3100	Not fired			
	3000	Not fired			Better to start fire for effect at 3000 to obtain early verification of the short sensing at that range.
		C. F. End of Problem			BC not satisfied with Deflection so did not use zone fire.

Summary: Error in initial data: Deflection: 83 mils; Range 100 yards or 3.3%. Time from identification of target to announcement of first range: 3 min, 10 sec. Average sensing and command: 17 sec. Total time for problem: 8 min, 24 sec. Ammunition expended: 9 rounds. Classification: Unsatisfactory. General Comments: The error in initial deflection and the total time for the adjustment were excessive. The officer firing the problem demonstrated that he lacked a thorough knowledge of this type of fire.

Time Bracket Lateral Problem

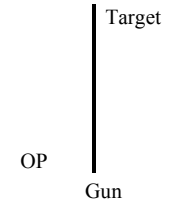
Target Description: Battery in position. *Mission:* To neutralize. *Matériel:* French 75 mm. guns. Model 1897. Visibility: Excellent. Wind Direction: Right to left. Initial data obtained: Deflection—BC telescope; Range, Estimated. BC on the left.

T=160, R=3200, r=2800, s=16/3.2=5

r/R=28/32=.9 BC on the left

Initial Commands:

Base deflection right 40
Site zero
Corrector 35
Battery right



Commands	Rn.	Sensings Deviations as viewed from OP but not announced	Rn.	Def.	Remarks
	3200		G short		
			G short	short	5×2=Rt. 10 to stay on line.
			A d'btful		
			G d'btful		
Rt. 10, U 5,	3400		G over		5×1=Lt. 5 to obtain a closer deflection.
			A d'btful	over	
			A d'btful		
			A d'btful		
Lt. 5, D 3,	3300		G short		
			A over	over	
			G short		
			A d'btful		
					Angle T is small, deflection bracket small, not necessary to open sheaf in fire for effect. Should have fired Btry., 2 Rds.
Lt. 3, Btry 1 Rd.	3300	C. F. End of Problem			

Summary: Error in initial data: Deflection: 2 mils; Range: 100 yds. or 3%. Time from identification of target to announcement of first range: 0 min. 31 sec. Average sensing and command 12 sec. Total time for problem: 4 min. 32 sec. Ammunition expended 12 rounds. Classification: Satisfactory. General Comments: A small shift of fire from the base point warranted the starting with the battery and the 200 yd. range bound. The method of fire for effect should have been two rounds. (Mixed salvo on a target calling for 100 yd. bracket).

Time Bracket Lateral Problem

Target Description: Machine guns in the vicinity of a tree. *Mission:* To neutralize. *Matériel:* French 75 mm. gun. Model 1897. Visibility: Very good. Wind Direction. Left to Right. Initial data obtained: Deflection—shift—BC scope; Range, estimated.

T=150, R=4800, r=3800

r/R=.8 S=15/4.8=3 (BC used 4) BC on the right.

Initial Commands:
Base deflection Left 45
Site plus 5
Corrector 35
No. 2
1 Rd.

Commands	Rn.	Sensings Deviations as viewed from OP but not announced	Rn.	Def.	**Remarks**
	4800	X—10—	G d'btful	d'btful	Corrector not changed. B C confident of his initial data.
Rt. 8	4800	—8—X	G over	over	8×.8=6=Lt. 6 to get on line. 4×4=16 = Rt. 16 to stay on line—Rt. 10 BC used Rt. 5
Rt. 5	4400	o	A d'btful	d'btful	Corrector dispersion.
	4400	o	A d'btful	d'btful	Air bursts approx. 5 high.
D 5	4400		G short	short	
Lt. 8, Up 3, Btry Lt.	4600	ooo X—6—	G d'btful A d'btful A d'btful A d'btful		6×.8=Rt. 5
Rt. 5, D2,	4600	x x oo	A d'btful A over G d'btful G d'btful	over	
On No. 3 Op 3, Up 3, Btry, 1 Rd. Zone 4600, 4400					

Summary: Error in initial data: Deflection, 12 mils; Range 300 yards or 6.7%. Time from identification of target to announcement of first range: 35 sec. Average sensing and command: 14 sec. Total time for problem: 5 min., 11 sec. Ammunition expended: 13 rounds. Classification: Satisfactory. General Comments: The error in determination of factors and an erratic corrector delay the adjustment in this problem. If available, shell is preferable at this range.

BATTERY "E" GOES TO WAR

BEING EXTRACTS FROM THE WARTIME DIARY OF
FIRST SERGEANT ANTHONY D. CONE,
Battery E, 15th F. A., Second Division

THIRD AND LAST INSTALLMENT

SEPTEMBER 21st we left the Bois De Boucq and hiked eighteen kilometers to Aulnois, arriving at 9:00 P. M. This town was seven kilometers from Commercy, where we were billeted and had quite a little rest, being able to buy beer and champagne. On September 26th the battery again took the road. We hiked sixteen kilometers to Dompierre where we entrained at 1:00 P. M. September 27th we detrained at 4:00 A. M. at Vitry Le Sec and hiked sixteen kilometers to Sorcey, where we were billeted. September 29th at 2:00 A. M., we left Sorcey and hiked ten kilometers to a woods near Courtisol. We arrived at 6:30 A. M. We had very bad weather on this march. It rained from the time we started until we reached our destination. We left at 7:30 P. M. the same day and arrived at Suippe at 4:00 A. M. This place was filled up with French cavalry and large caliber artillery. There were also a number of 14-inch guns mounted on flat cars. They kept up a continuous fire all night long and every time they fired they shook the earth. There was quite a heavy bombardment going on at the front, about four kilometers ahead of us. There was an observation tower from where we could see the flashes from hundreds of guns engaged in the battle at Argonne.

We were paid in the woods just before we left for the front and as the money was of no use to us, the men shot craps with it in their spare moments. October 1st, at 8:00 P. M., the firing battery moved forward and took up a gun position east of Somme-Py, where we arrived at 5:00 A. M. We hiked sixteen kilometers. On this trip we traveled roads that were torn up with shell holes. There was very heavy traffic and 75 mm. ammunition was piled up on both sides of the road. The road was under shell fire from the enemy's guns which made the hiking more difficult. We reached a town that had been destroyed and was still being shelled. Here the column was blocked and we had to stop about a half an hour. The Battery Commander gave orders to countermarch as the road ahead was blocked by some French outfit and we had to pass through a

stretch that was once No Man's Land. There were shell holes all around us, but it was a moonlight night and that helped us considerably. We only had one accident, that was when our ration cart slid into a big shell hole and we spent quite some time in getting it out. We then crossed a very narrow bridge and the drivers had to be on the alert to prevent going off. The pole on the first section carriage broke and that caused another delay while we fitted a new one. We then pulled into a valley where we established an echelon and the firing battery kept right on into the position.

We took up a position on a hill in plain view of the enemy, just at daybreak. There was a battalion of French infantry on the same hill in reserve. We went into position at a gallop, being exposed to the enemy machine guns. Directly in rear of us was a French tank which had been hit by a shell. We were so tired and hungry that we laid down to sleep after we had dug our gun pits and laid our guns. We slept in a big shell hole where there were two twelve-inch shells that had failed to explode.

On the morning of October 3rd, at daybreak, we began a rolling barrage which was part of the bombardment of the trenches, the big guns and machine guns all starting at the same time. This is one day that we will always remember, as the attack in the big drive from Italy to Holland began at the same time. When we ceased firing our guns were very hot. The attack was a success, the Infantry advanced and every one felt happy. We then received word that the Marines and Infantry had taken Medeah Farm and Mont Blanc, and when they had established a new position protected by our standing barrage we moved forward at 2:00 P. M., taking a position two kilometers north of Somme-Py, advancing four kilometers. On the road to Somme-Py we passed through the Hindenburg Line, where we saw some Austrian gun positions and plenty of the ammunition known as whiz-bangs, or 88's. There were also many dead along the road, French, Germans and Americans. We had to pass through Somme-Py at a gallop as there was an observation balloon up and the town was under shell fire. We passed two auto trucks that the Germans had burned up and, as we came near the other side of the town, the dead became more numerous.

We went into a position that was under indirect machine gun fire, laid our guns and began to fire barrages and zone fire. We stayed in this position five days because we had advanced too far and were flanked on both sides. The French on either side of us met very strong resistance and while it was no stronger than the resistance met by the Second Division, they did not succeed as well and we had to wait until they came up, firing night and day to keep our infantry from being shot to pieces. Our position was heavily shelled, as we were exposed to fire from three directions, North, East and West. On October 6th the line was established as the French succeeded in advancing on both flanks. We delivered a rolling barrage without any success as the Germans put up a strong counter barrage. On the morning of the 8th, we repeated our rolling barrage which was twice as strong as the one on the 6th and was a complete success, as our Infantry made the Boche retreat. While firing this barrage, we were under shell fire and one of the guns in F Battery which was on our right, blew up, killing three men. At the same time a Boche shell lit in front of the piece, bursting and seriously wounding eight men. We started to dig a few trenches for protection and just had them finished when we received a heavy shelling. We had to take one piece out of the barrage and bring it to the repair shop. All the roads were under constant shell fire.

The cook was coming up with our supper, when a shell exploded right in rear of the wagon, spilling the chow all over and making us go on short rations. Our position was right alongside of a cemetery where there were a number of Germans buried from the early days of the war in 1914. In rear of the cemetery there was a French dressing station crowded with wounded soldiers. There were also French soldiers burying their dead comrades in shell holes. We received word from the Chaplain that night, that the Germans were willing to come to President Wilson's terms of his speech of January 8th, 1918, but we did not take it seriously very long. We had a few casualties on this front while hauling ammunition under shell fire. Corporals Giles and Brindle were killed when a shell exploded between them and their caissons. While looking over the wires which connected our telephone with the front line, Charlie

Merrell was seriously wounded. We also had two runners who were in the front line and went over that morning with the Infantry. One of them, Roland Roeder, was reported missing in action (probably killed); the other, Private Stevens, was killed.

Our Liaison Officer, Lieutenant Vandergraef, while leading a battalion of Infantry (36th Texas Division) over the top was also wounded by machine-gun fire. We had nine men recommended for the Croix de Guerre who were later decorated in Germany. Private George, who was with Corporal Brindle, was also seriously wounded.*

After driving into this position until we were so far advanced that we were outflanked on both sides, the Germans sent in two of their best divisions to attack us, but we stood our ground until our own flanks were able to advance.

Just before going into the Champagne front, our battery commander, Captain McLane, who had relieved Captain Waters at Forfry, was taken sick with the Spanish influenza and Lieutenant Gore was given command of the battery.

After our division had got the Germans on the run, we were obliged to use high velocity or semi-steel shell in order to shoot our maximum range of 11,000 meters. The normal charge could not reach this long range.

October 10th, at 2:00 P. M., we left this position and moved forward, taking up a new position four and a half kilometers southeast of Mashault. We arrived at 6:30 P. M., advancing eight kilometers. Our forward echelon moved up also, billeting in some wooden shacks that were once a German camp. There were the remains of a German ammunition dump which had been blown up, scattering small and large shells, hand grenades

*"One of the unsung, uncited, undecorated heroes of the battle of Mont Blanc was Thomas Jeremiah, Private, Battery 'E,' 15th Field Artillery. 'Jerry' held down the lowly job of chauffeur on the water cart. But a man's value in this world lies, not in the position he holds so much as in how he performs his duties; and success all depends upon a man's goal. Jerry's job was to get water to the kitchen, and if there was water within miles he got it. When the guns went into position, the cannoneers dug in and either fired or rested. At least, they 'arrived.' When the echelon parked, they too were where they were going. But for Jerry it merely meant going back after water; back to town under shell fire, and over roads shell ridden. He filled all the containers at the kitchen and went back to re-fill his water cart and he did not confine his activities to his own Battery but to any unit of the Division. Jerry was happy to draw water. Into the front lines, went Jerry and his cart, to doughboys and Marines who hailed him as Heaven sent. He seemed to bear a charmed life and it was remarkable, for it was usually the man of most value to his mates, the man most liked and most essential to the scheme of things, who went first."—From "The History of E Battery," by Verne H. Torrance.

and bombs all over the fields. To the left of our position, was a large town which had been pretty well shot to pieces. Here we saw American infantrymen stretched out in shell holes as if waiting for the word to advance. One was looking at his wristwatch at the time he was killed. We were unable to fire from this position as the Germans were running so fast they were out of our range.

On October 11th we left this position, and took up a position two and a half kilometers north of Liffincourt, arriving at 2:30 P. M. We had advanced fifteen kilometers. On this hike we had to pass a road that had been torn up by bombs from our own bombing planes, dropped on the retreating Germans. We were also unable to fire from this position as the Germans had kept on going, so we laid our guns and fed the horses with some hay which we found at the position. It had once been a German echelon.

We were still overrun by those cooties and had no opportunity to get rid of the dirty pests as we were always on the go. We slept all night long without being interrupted. It was the first night in a long time that we had a whole night's rest.

On October 12th, the firing battery again advanced, leaving at 5:00 A.M., and taking up a position two kilometers south of Vaux Champagne, arriving at 6:15 A. M. We left our rear echelon near Leffincourt in an old German camp, where they had good stables and billets. In this position, which was on a large hill, we were right in plain view of the enemy, who had made a stand on the other side of the Aisne River, from which we were not very far. We fired quite a number of rounds from this position and were soon discovered and given a shelling from the German guns. On the 14th, the firing battery moved to a new position one kilometer East of Vaux Champagne, leaving at 8:30 A. M., and arriving at 9:30 A. M., traveling one and a half kilometers. We had our gun pits all dug and platforms made when we received orders to move for the position was claimed to be unsafe, and it caused us a lot of unnecessary work. This position was under close observation from the German observation balloon.

In the afternoon of the same day, we moved to a position a kilometer and a half East of Vaux Champagne. We stayed here

four days, doing very little firing. Our cook, Jerry Lynch, was on the job giving us three meals a day and plenty of it. We pitched pup tents here for the first time since leaving Chateau Thierry. Our forward echelon moved up in a large hollow about one kilometer in rear of us. Here we had a chance to shave and clean up. We were allowed to build fires during the day as it was very misty. There was plenty of water handy and Sergeant Cone built a shower bath by sawing a large barrel in half and setting it on three poles about ten feet high. We heated the water and poured it into the barrel. Every man in the firing battery took a bath, including the Battery Commander, and a few men from the forward echelon. We also changed clothes, which helped to reduce the cooties. Our sector here was very quiet, but at night there was always a heavy bombardment going on to our right towards Grand Pré. We were shelled once in a while, but not very heavily.

Our Regimental P. C. was in the town of Vaux Champagne and here one of our runners (Pvt. Gerald Johnson), was killed by a high explosive shell with time fuse. On October 19th, at 3:30 P. M., the entire battery left the front and hiked sixteen kilometers to an old German camp where an echelon was established two kilometers South of Mashault. We had pretty good quarters here in some wooden shacks with beds and stoves, and we also established a shower bath. We expected to stay here quite a while and rest up, but the night of the 21st we received orders to return at once to the front and relieve a French outfit which was very badly shot up. We left this camp at 9:00 P. M., and took up a position in the town of Marquiney, arriving at 2:00 A. M. We hiked sixteen kilometers. It was a very poor position, being muddy. There wasn't even a dry place to sleep, so after we laid our guns, which was very difficult because of the lack of lighting devices, we laid down in the mud and got a little sleep.

On October 22nd, we fired quite a few rounds and at dusk we moved to another position about two hundred yards to the left. It was a much better position, as it afforded good concealment for our guns and there was also a house and barn in which part of the firing battery slept. Our Marines and Infantry had been relieved and we were covering the Infantry from the 36th

Division. In this position we were getting very little to eat as they had changed cooks on us and the rear echelon was getting it all. There was a large turnip patch and also a cabbage patch and any time of the day or night the men could be seen there, eating turnips. When we fired at night, between intervals the men would run out to the patch and come back with an armful of turnips, eating them while working. We were shelled at this position, but most of them were over us. We were gassed pretty heavily for about three hours on the morning of the 25th. It was a very foggy morning and the smell of gas was very strong. At intervals they sent over a few high explosives. We had a good supply of gas shells on hand so we sent back a bigger dose and made them quiet down. We continued firing in all zones with rapid fire all the next day and night of the 26th.

On the 27th, at 4:00 P. M., we fired a rolling barrage for the 36th Division Infantry which lasted about two hours. We then began a standing barrage to protect the Infantry while they dug in their new positions. We had nothing left but shrapnel, so we finished our standing barrage with it. On October 28th, at 3:00 A. M., we were relieved by a French outfit and hiked to the rear echelon. Number of rounds fired on this front (Champagne), 8512 High Explosive, Gas and Shrapnel. (Also includes semi-steel.)

We arrived at the echelon at 6:00 A. M., hiking sixteen kilometers. While we were in position at Marquineg we heard that the Americans at Argonne Forest were meeting great resistance and all divisions engaged there were having heavy casualties and were calling for reinforcements. This was the reason we were taken from Champagne. Our Infantry and Marines were already on the way to Argonne. On October 29th the entire battery left the echelon and hiked thirty-eight kilometers to Cerna Dormois. We left at 8:00 A. M., and arrived at 4:35 P. M. We passed through Somme-Py again on this hike and the town was very quiet, a great difference from our first trip through there The weather was very warm for this time of the year. On the way to Cerna Dormois, we saw an aviator land in a field about three hundred yards from the road. He was waving his arms to attract our attention and some of the men galloped over to him and saw that he had been wounded by a machine gun bullet in

his right leg. They took him to a field hospital close by and left him there. We left Cerna Dormois at 1:30 P. M., October 30th, with the firing batteries in the lead and the three echelons of the battalion bringing up the rear, as a supply train. The echelon was established near Eglise Fontaine. The firing battery went into position at 9:00 P. M., a half kilometer Southeast of Fleville. We hiked twenty kilometers. The roads were crowded with troops going in two directions. The 42nd and 77th Divisions were coming back. There were also a number of auto trucks hauling ammunition. We left the main road and turned into a side road that had very deep mud, almost to the hubs of the wheels.

It was stiff pulling for the horses. We had a very small supply of rations, but our cook came upon a pile of rations which had been left by some outfit that was pulling out. We took up a position in a ravine and laid our guns, after which we rested, although the ground was muddy, and it was raining continuously. We rested all the next day and on the morning of November 1st we started a rapid zone barrage at 3:00 A. M. At 5:00 A. M., we began a rolling barrage that lasted two hours. This was a very hard front to advance on and there were thousands of guns there. The bombardment was terrible. The guns were mostly 75's although there were quite a number of large caliber guns from 155's to 16 inch. At intervals we could hear the big shells passing over us and also the rattle of machine guns, which kept up a terrible fire. While we were firing, our cook, Jerry Lynch, came up with a Boche wagon that he got at St. Mihiel, and we had our breakfast, one man from each gun at a time. This attack was successful and the heavy bombardment put the Germans on the run.

At 7:30 A. M., we moved up under the protection of a barrage that was still rolling and advanced eight kilometers, taking a position one kilometer South of Landres St. George, arriving at 10:00 A. M. We had to pass a road that was dotted with big shell holes and had it been at night we could never have made it. There was also barbed wire all along the road. We passed a trench that the Americans had held. There was a lot of equipment there, also some canned corned beef, which we took. In this position, which was on the side of a hill, we quickly

got the necessary data and picked up a barrage at 10:20 A. M. We continued to roll it until 3:00 P. M. At 4:00 P. M., we again advanced four kilometers and arrived at 5:00 P. M. in position Southeast of Landreville. When we were half way to the position, the Germans shelled us with gas and high explosives and we were ordered back about two hundred meters from the main road.

While we were moving into position, we were shelled pretty heavily and we moved forward without laying the guns and arrived in position at 5:00 P. M. We fired on a machine gun nest from this position with semi-steel shell.

On November 3rd, we fired a number of rounds, and at 2:00 P. M., we moved forward to a new position. We passed through Fosse and hiked about five hundred meters North of the town and were then ordered to return to our old position. On this trip the horses were very weak from lack of food and a wheel horse of the second section went down. The chief of section, Sgt. Cone, was forced to shoot him as he was no longer able to rise. The section caught up with the column and we reached the old position at 8:00 P. M. The reason we had to return to the old position was that the Infantry had not advanced. That evening from 8:00 to 11:00 we fired three hundred rounds of semisteel shell into Beaumont, a range of nearly 11,000 meters. November 4th we left this position and advanced eight kilometers and took up a new position five hundred meters East of La Forge Farm, arriving at 10:30 A. M. We fired at intervals most of the time we were here and one of the guns in Battery "D" blew up. Our battery had their guns in the open under a camouflage screen. The Germans were shelling the road continuously, which was close to our position but we remained undiscovered.

We left this position, east of La Forge Farm on November 5th. At 5:00 P. M. we advanced on the crossroads of the Southern edge of Beaumont and took a position a kilometer and a half South of Beaumont. On this hike it was very dark. It rained all night long and the mud was almost knee deep. The boys were in good spirits, singing songs and joking most of the way. We had to stop for two hours on this road as the traffic was very heavy. We finally started again and had to climb a

very steep hill. It was a severe strain on the horses and one of the sections had to stop quite often in order to give the horses a rest. The front line was close to Beaumont and it was so dark that it was impossible for a lead driver to see the road and it was necessary for someone to lead the horses. We could see the flash of the guns and just as we reached the crossroads, a flare rocket was sent up. It was what is known as a star shell and illuminated the place for a mile around. It was rumored that this rocket was sent up by a German soldier who was left behind when the rest of them retreated. Immediately after the rocket went up we were shelled by the Germans, with gas and high explosives. Although the gas was very strong none of the boys put their gas masks on and as a result there were a few of them gassed pretty badly. A high explosive hit right in front of the telephone wagon killing three horses, wounding one man, Pvt. Stone, who was brought to the rear, and turning over the wagon.

We were forced to abandon the telephone wagon for the time being but recovered it later the same night. The following is a piece from the Stars and Stripes which was received in Germany, April 11, 1919: "Through the pouring rain of that black night one battalion of the 9th Infantry marching in column of twos and "E" Battery of the 15th Field Artillery, with a company of Infantry a few hundred yards ahead as advance guard, moved rapidly up the single road, capturing German machine gunners asleep beside their pieces and other sleeping Germans at La Forge and La Tuliere Farms. Just before midnight, the Americans occupied strong natural positions in the neighborhood of La Tuliere Farm commanding Beaumont." We arrived in position at 10:00 P. M., on November 5th, hiking eight kilometers. We laid our guns and went to bed in the mud and rain with nothing to cover us but a tarpaulin. We got up in the morning and as we were almost barefooted and our socks were wet, we went out to look for some German boots and socks. We found plenty of boots and socks as the Germans left all kinds of equipment behind them.

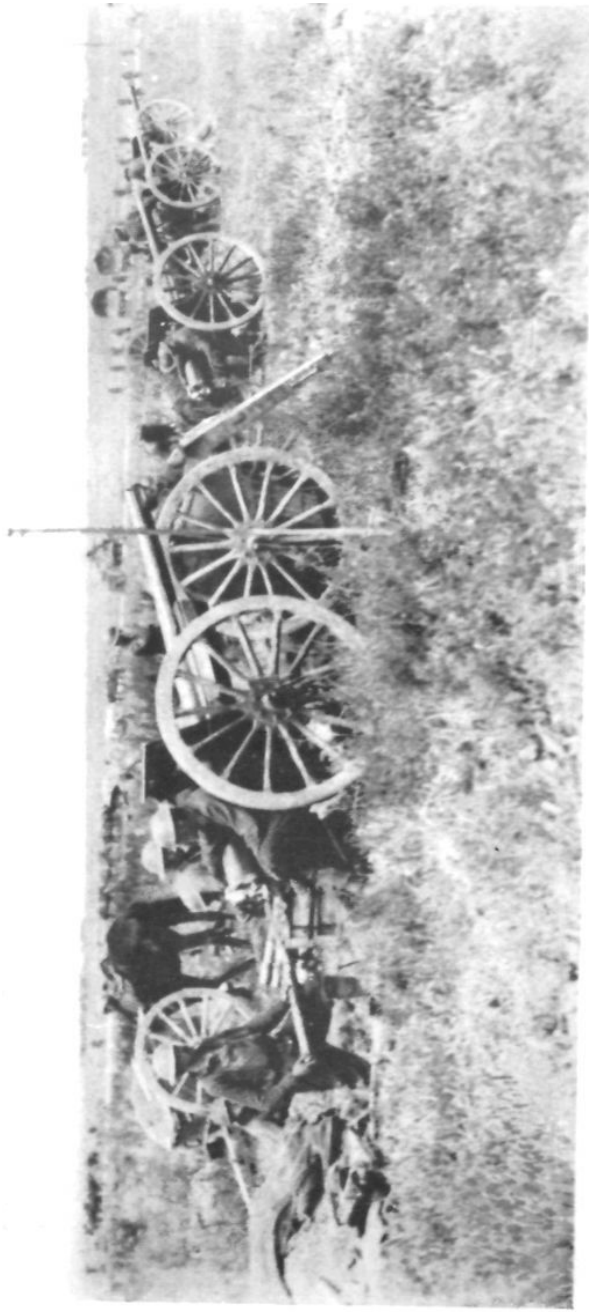
The night of November 10th we were shelled very heavily by some big caliber guns. It started about 5:00 P. M., and the shells were dropping all around our position. At 7:30 P. M., we fired a rolling barrage and rapid zone fire for the 2nd

Engineers and Marines who were forcing their way across the Meuse near Muzon. We stopped firing at 10:30 P. M. The Marines and Engineers met strong resistance but held their positions until the Armistice was signed on the 11th day and 11th hour and 11th month of the year 1918. On this front (Argonne-Meuse) we fired 5652 rounds of high explosive, shrapnel and semi-steel, also a few rounds of gas shell.

The battery fired their first shot at the enemy March 28th, 1918, at 12:00 Noon (Thursday), and fired their last shot at the enemy November 10th, 1918 (Sunday), at 10:30 P. M. The number of rounds fired by Battery "E", 15th Field Artillery, in the length of their engagement with the enemy were:

At Valdahon Target Practice	3112
Verdun Front	12484
Chateau Thierry Front	22700
Soissons Front	12500
St. Mihiel Front	3124
Champagne Front	8512
Meuse-Argonne Front	5652
Total Rounds	68084

When we heard that the Armistice had been signed we did not believe it, as there had been so many rumors going around about peace that we did not know whether to believe it or not. The Germans were firing right up to 10:47 and when everything became quiet at 11:00 A. M., we were still in doubt. You could see the boys listening for the sound of a gun, expecting to hear one every minute. Towards the afternoon we heard about the signing of the Armistice from every soldier we saw and were finally convinced. We then went out exploring and as we came to Muzon we could see the Germans on the banks of the Meuse waving their hands to us. We found a five gallon jug of schnapps and proceeded to celebrate. Some of the boys began to feel pretty good and started singing. Towards night it grew cold and we all built fires. It seemed funny to see so many fires now when twenty-four hours before we could not even strike a match.



E BATTERY IN POSITION AT SOISSONS

MODERN FIRE CONTROL FOR DIVISION ARTILLERY

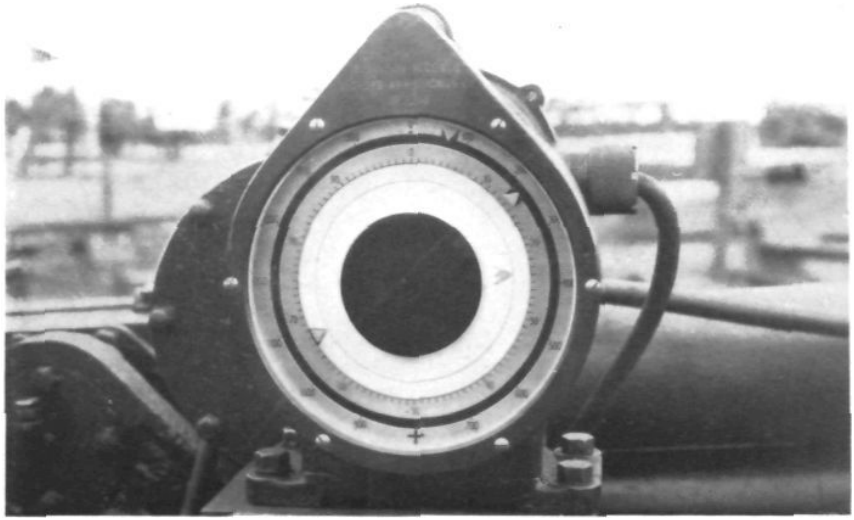
A DISCUSSION OF POSSIBLE APPLICATIONS OF MODERN ANTI-AIRCRAFT FIRE CONTROL TO FIELD ARTILLERY REQUIREMENTS

By CAPT. G. M. WELLS. O. D., CHIEF ANTI-AIRCRAFT SECTION, ARTILLERY DIVISION, OFFICE OF THE CHIEF OF ORDNANCE

A CONSIDERABLE difference of opinion seems to exist at the present time regarding the mission of division artillery in future wars. There seems to be no question, however, but what this mission has changed considerably since the World War, in that it must in the future include objectives such as high speed tanks, artillery prime movers, etc., in addition to stationary and slow-moving targets. There is also the somewhat controversial question concerning the secondary, or emergency, use of division guns as anti-aircraft artillery. A fire control system suitable for all these purposes will necessarily be somewhat elaborate and complicated if the matériel is expected to play an effective part in each role. The ultimate economy of proper fire control appears self-evident and, in the opinion of the writer, should require no discussion.

The deficiencies of the division weapons used in the World War have long been recognized and post-war developments have resulted in gradual improvements. Thus, the standard 75 mm. gun M1 presents noteworthy advances in range, elevation,

4 METER STEREOSCOPE HEIGHT AND RANGE FINDER



DIRECT CURRENT STEP-BY-STEP DATA RECEIVER

traverse, and many other important characteristics. It does not, however, present any radical innovations or departures from design practice of the previous decade. During its period of development the changing missions of the division weapons were not clearly defined and little cognizance could be taken of them in the design. The result must necessarily be regarded as a gun which would have been a superior weapon in the World War, but which is somewhat unsuited to the changed conditions of the present day. The carriage is deficient in amount and rapidity of elevation and traverse, and is entirely incapable of withstanding the effects of high speed transportation on its own wheels. The fire control is deficient in that it does not include means for predicting the future position of a moving target, nor does it facilitate the continuous laying of the gun on such a point.

In 1929 the Ordnance Department inaugurated the design of two new gun carriages differing radically from the conventional type. These mounts, the 75 mm. carriages T2 and T3 have been described respectively by Captain E. C. Goebert and Major G. M. Barnes in articles published in recent issues of this journal. Both designs, while differing in many respects,

DIRECTOR M2 MOUNTED ON INSTRUMENT TRAILER NOTE
POWER PLANT AND REELS FOR TRANSMISSION CABLES

DIRECTOR M2 IN OPERATION, IT CAN BE USED AGAINST EITHER CELESTIAL
OR TERRESTRIAL TARGETS

were intended to meet the same general requirements, namely, ability to fire at fast moving terrestrial or celestial targets and an under-carriage construction adapted to high speed truck or tractor draft on improved roads or across country. The first requirement of course implies such additional characteristics as 360° traverse, 80° elevation and a stable firing platform. Both carriages were completed last summer and have recently been subjected to preliminary tests at the Aberdeen Proving Ground. The tests demonstrated that the carriages could be used effectively against ground or airplane targets provided suitable instruments were available for computing the firing data and continuously transmitting them to the guns. Standard antiaircraft fire control instruments were used in the Proving Ground tests. These instruments were not, however, entirely suitable for Field Artillery purposes as will be explained later.

The development of modern anti-aircraft fire control really dates from 1925, although considerable study was devoted to the question in the years immediately following the World War. In the last five years the Ordnance Department, working in conjunction with instrument manufacturers at home and abroad, has developed and tested two satisfactory directors or computing instruments, several types of height and range finders, automatic electrical transmission systems and various allied instruments of lesser importance. It is important to note that these developments have been for the most part conducted with the anti-aircraft problem as the only objective. It is also of great interest and importance to note that much of this work on anti-aircraft fire closely parallels the requirements for similar instruments for ground fire.

Before proceeding with the discussion of anti-aircraft instruments and their application to division artillery it will be desirable to sketch briefly the fundamental information needed in computing the firing data for fast moving targets of all kinds. In the following summary it is interesting to note the similarity between the requirements for anti-aircraft and ground fire.

First—The present position of the target. For anti-aircraft targets, this position is defined by present azimuth, angular height and either altitude, slant range or horizontal range. For

ground targets, present azimuth, angular height (angle of site) and either slant range or horizontal range.

Second—Speed and course of the target. Having the present position of the target, its speed can be determined for anti-aircraft fire by measuring its vertical and lateral angular velocity with respect to the directing point of the battery. For ground fire, only the lateral velocity is necessary. The course is derived from successive, or continuous determinations of the target's present position.

Third—Ballistic information. The range table time of flight and fuze range to the future position of the target are required for both anti-aircraft and ground fire. Range table superelevation is an added requirement for anti-aircraft. The effect of wind, drift, non-standard atmospheric density and muzzle velocity must be determined for both kinds of fire.

The foregoing data must be supplied continuously with the possible exception of range or altitude which may be furnished at 2 or 3 second intervals without appreciably affecting the accuracy of fire. From these basic data, the fire control instruments must predict continuously the position of the target at the end of the time of flight of the projectile, together with the firing data to that point corrected for all abnormal ballistic effects. For indirect fire (Case III) the data supplied are range (or quadrant elevation), azimuth and fuze range. When the gun carriage is provided with sights and direct-fire methods are employed, vertical and lateral sight deflections may be substituted for quadrant elevation and azimuth.

Let us now define and sketch the functions of the important instruments in the modern anti-aircraft fire control system. They are briefly—

The Height or Range Finder. A self-contained optical instrument which can be used to measure either altitude, slant range, or horizontal range of the target. It is usually provided with electrical equipment for automatically transmitting the measured data to the computing instrument or director.

The Central Station Director. A rather elaborate computing machine which by means of two integral sighting telescopes is made to measure the present azimuth and angular height of

the target as well as its vertical and horizontal angular velocities. These data, together with altitudes or ranges received from the instrument previously mentioned, form the basis for continuously computing the present and future positions of the target. This machine also computes and applies the ballistic corrections. It is usually equipped with electrical transmitters for automatically transmitting the firing data to the guns.

The Electrical Transmission System. A combination of electrical elements designed to display continuously at one position the data determined at another position distant from the first. It consists of transmitter and receiver generators and motors, cables, junction boxes, etc. It may operate on either direct or alternating current.

Any automatic fire control system for use against fast moving targets, whether they be terrestrial, naval or air, will consist essentially of the three elements just described. There are, however, a number of possible variations, for example, a two-station system of range finding, a combination of optical range finder and computer on the same mount, substitution of telephone for automatic electrical transmission, etc., but the essential elements still remain. It is only necessary then to determine the form of the three elements which will be best suited to the special needs of the division artillery.

The requirements for low weight, ease of handling, rapidity of set-up for action and freedom from maintenance troubles, are of course fundamental and apply in greater force to division artillery than to anti-aircraft or seacoast weapons. Simplicity of design is desirable and has an important bearing on maintenance, but, as stated in an opening paragraph, is impracticable except in a relative sense.

The range finder for division artillery should unquestionably be a self-contained optical instrument. Two general types are available: the stereoscopic and the coincidence. The former is probably new to the Field Artillery, having been little used in this country until quite recently. Instruments of this type employ the well known function of stereoscopic vision, by virtue of which objects are seen in relief and in distinct relation to each other as to their respective distances from the observer. The

coincidence instruments make use of the familiar split-image principle. The accuracy of either type is in direct ratio to the length of base and to the magnifying power of the optical system. A height finder is essentially the same as the range finder in that it measures directly the slant range of the target, but has in addition a mechanism for converting slant range to altitude. This conversion mechanism adds very little to the weight of the instrument and does not appreciably detract from its accuracy as a range finder. The change from range to altitude measurement can be made almost instantly by throwing a lever.

Several types and sizes of both coincidence and stereoscopic height finders, representative of the latest developments at home and abroad, have been procured and tested in connection with the anti-aircraft program. The stereoscopic instruments have been found to be generally more accurate, at least against airplane and naval targets. They have the further advantage of permitting an accurate range sensing of the bursts with respect to the target. The greater accuracy is especially apparent under conditions of poor visibility. A very serious disadvantage lies in the difficulty in securing competent stereoscopic observers. Very few men are organically equipped for this work, and even when possessing a highly developed stereoscopic sense at least six months' initial training is required followed by refresher courses every year. On the other hand, any man possessing normal vision can be made a competent coincidence observer in a very short time. In spite of its disadvantages, the anti-aircraft and seacoast service have standardized the stereoscopic principle, believing that the greater accuracy combined with the ability to spot, more than compensate for the difficulty in training observers. This policy follows present practice in the leading countries on the Continent of Europe.

The type of range finder best suited to the requirements of division artillery can be selected by the Field Artillery from comparative tests of experimental instruments already procured for the anti-aircraft service. There are a considerable number and variety of both coincidence and stereoscopic height and range finders on hand, ranging in size from one to five meter

base. The writer personally believes that a three meter coincidence height and range finder will probably be found most suitable for an arm whose primary mission is certain to be terrestrial fire. Such an instrument will weigh about 250 pounds and can be broken up into two loads for transportation. It will be reasonably accurate up to ranges of 10-12,000 yards, and competent observers can be trained with little difficulty. It can be used with equal facility against either terrestrial or airplane targets.

The director, or automatic computer, is probably the most important and certainly the most interesting element of the fire control system. It is also logical to expect that it will offer the greatest difficulties in design and production. The computer for division artillery must first of all be of a size and weight which will permit of its being carried considerable distances by a limited number (not more than four) of men. Its size should be limited so that it can be camouflaged fairly readily when set up in the limited confines of an advanced O. P. The number of operators should be held to a minimum, probably four, and the operations required of the manning detail must be simple and quickly learned. If the possibility of an anti-aircraft mission be granted, then the computer must operate with equal efficiency against targets in the air or on the ground. Moreover, it should be possible to change from one class of fire to another instantaneously. It is extremely important that a parallax mechanism be incorporated such that the accuracy of the firing data will not be affected when the director is located in an O. P. distant from the guns. It should be possible to apply spotting corrections at the director, and have them included instantly in the firing data at the guns. The director should preferably compute indirect fire (Case III) data only, as a moving ground target will seldom be visible from the gun position. Provision for direct, in addition to indirect, firing data will add unnecessary mechanism and weight. Let us now examine these requirements in the light of our present accomplishments.

Two types of directors are now used by our anti-aircraft forces. The first, a machine designed and manufactured abroad, has been the standard until quite recently. This director is

quite satisfactory for anti-aircraft purposes, but has certain definite limitations which preclude its being used with division artillery. It can not be used against ground targets, and the absence of a parallax mechanism limits its use to the battery position. Moreover, it seems impracticable to modify the design to meet these important requirements. The second director, our present standard, was developed by the Ordnance Department in conjunction with a firm of instrument makers in this country. The design was predicated on the essential character of the ground fire mission, especially for anti-aircraft guns in coast defense. No pains were spared in this development to obtain a director of the greatest theoretical accuracy, both in the prediction of the target's future position and in the computation of the ballistic data. No approximations or empirical relations were permitted and the director gives, theoretically, an exact solution of the problem. The basic ballistic data are determined and corrected for all abnormal conditions of atmospheric density, muzzle velocity, wind, drift, etc., by means of three-dimensional cams which reproduce the firing tables with great exactness in a mechanically usable form. Considerable attention has been given to the adjustment of fire and the facilities provided for this purpose permit of a very rapid adjustment against targets maneuvering in any direction, including a dive. The director was tested quite extensively last summer, prior to standardization, and was found to perform equally well against either airplane or naval targets. The percentages of hits obtained against maneuvering airplane targets were better than ever before. It was possible to adjust the fire quickly and accurately. This director will do the greater part of the things required of a computer for modern division artillery, but considerations of weight, cost and size of manning detail will definitely preclude its being used for this purpose.

The question of a very much simplified computer has recently been receiving considerable study and the preliminary designs have now progressed to the point where a simplified machine incorporating all the important features of the anti-aircraft director seems entirely feasible. A number of refinements, such as the ballistic cam mechanism will have to be omitted, but the

remaining accuracy should be satisfactory for ordinary purposes. This is especially true in view of the fact that under field conditions the basic meteorological data on which the ballistic corrections are based are often seriously in error. A parallax mechanism will be included such that no error will be introduced in the computation of the firing data when the computer is located at a considerable distance from the battery position. The simplified computer will weigh not over 200 pounds and will be operated by four men. It will deliver a continuous flow of indirect fire data. A contract has been let for the development and the pilot machine will probably be completed in about one year.

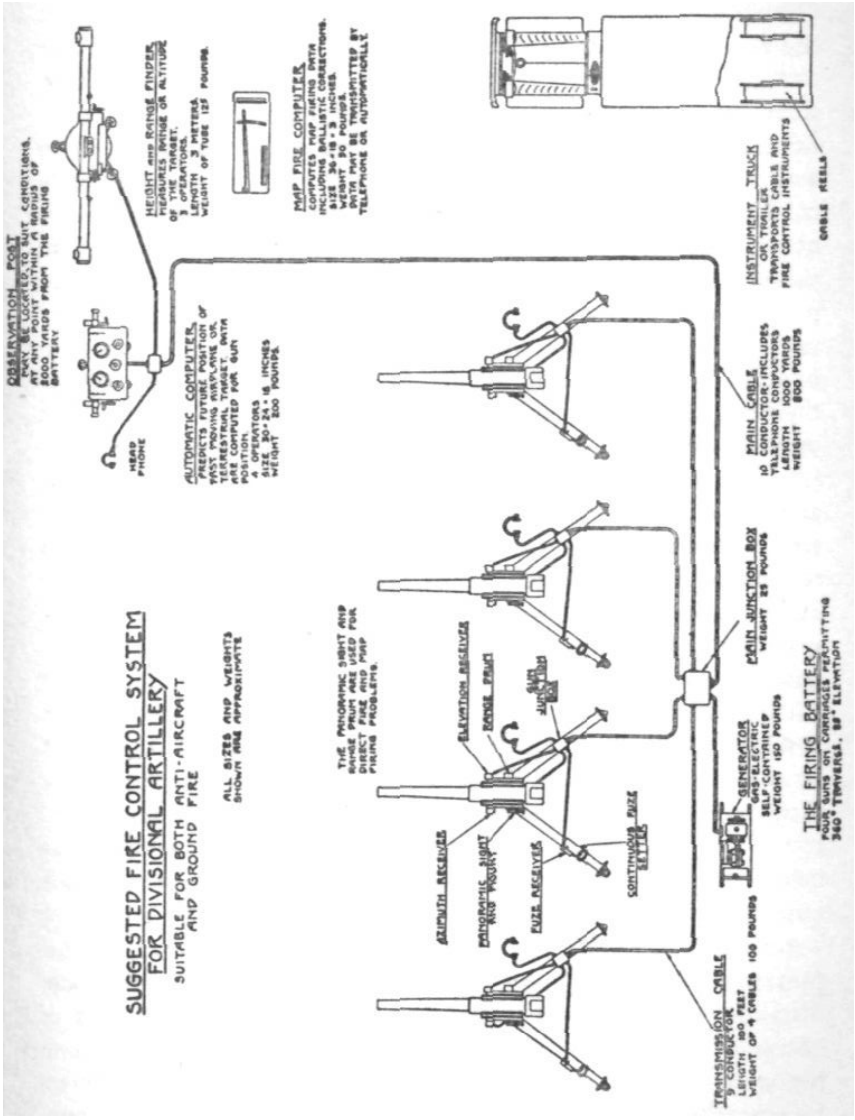
It would of course be possible to simplify the computer still further by eliminating the anti-aircraft features of the mechanism, and this would be the logical course to follow if it should be decided that division artillery will never be used against aircraft. The saving in cost and weight would not be as great as one would expect, probably amounting to not more than 25% in each case. The number of operators would remain the same and there would be very little gained from a standpoint of maintenance.

Automatic transmission is practically a necessity in a fire control system deriving indirect fire data for fast moving targets. Since the computer gives at every instant the future predicted position of the target, and since the time interval used in the prediction is the time of flight only, it is apparent that the guns must fire without appreciable delay. This means that the guns must be laid continuously in accordance with the instantaneous values of the data from the computer. When this is done the rate of fire and timing of the individual shots have no influence on the accuracy of fire. The only delay in the whole system is the very small time interval between the removal of the round from the continuous fuze setter and the firing of the round in the gun. This can be accounted for by an arbitrary "dead time" correction at the fuze setter. It is theoretically possible to incorporate a large "dead time" correction in all data, to transmit the data by telephone and to fire at the end of the dead time interval. But experience has shown that this method is very unsatisfactory

in that it retards the rate of fire very materially, and tends to cause an abundance of personnel errors.

Two types of automatic transmission have been developed for the anti-aircraft service, namely, the direct current step-by-step and the alternating current self-synchronous. The latter is now standard for our anti-aircraft materiel, but both systems offer important advantages. The D. C. system was the earlier type and is still used almost universally in foreign armies. The transmitters and receivers are less bulky than the self-synchronous type, fewer conductors are required in the transmission cables, and the voltage and current consumption are less, thus permitting the use of a small storage battery as a source of power. It has two serious disadvantages, the first and most important of which is lack of self-synchronization. This means that before the current is turned on the transmitter and receiver pointers must be set manually to the same reading. In the A. C. system, on the other hand, the pointers synchronize automatically. The second disadvantage of the step-by-step or D. C. system is the tendency of the receivers to fall out of step with the transmitters when either the rate or direction of angular movement is changed abruptly. The same condition in the A. C. system results in a momentary lag followed by automatic resynchronization. The self-synchronous system requires a source of 110 volt A. C. power. This is supplied for mobile anti-aircraft batteries by a small rotary converter driven by D. C. power from a storage battery. Since the current consumption is rather large, a gas-electric generator is furnished for charging the battery. The several elements of the power supply are permanently mounted on the trailer used to transport the director and other fire control instruments.

Neither the A. C. nor the D. C. system is suitable, in the present state of development, for transmission of data over long distances, say in excess of 1,000 feet. For greater distances it is necessary to resort to low resistance conductors and the cable becomes very heavy and bulky, and consequently difficult to transport and lay in the field. Experiments are now in progress which it is hoped will lead to the development of transmission apparatus, probably employing the step-by-step principle with


SUGGESTED FIRE CONTROL SYSTEM
FOR DIVISIONAL ARTILLERY
SUITABLE FOR BOTH ANTI-AIRCRAFT AND GROUND FIRE
ALL SIZES AND WEIGHTS SHOWN ARE APPROXIMATE
OBSERVATION POST
MAP FIRE COMPUTER
AUTOMATIC COMPUTER
HEIGHT and RANGE FINDER
HEAD PHONE
THE PANORAMIC SIGHT AND RANGE DRUM ARE USED FOR DIRECT FIRE AND MAP FIRING PROBLEMS
AZIMUTH RECEIVER
PANORAMIC SIGHT AND MOUNT
FUZE RECEIVER
ELEVATION RECEIVER
RANGE DRUM
CONTINUOUS FUZE SETTER
TRANSMISSION CABLE
GENERATOR
MAIN JUNCTION BOX
MAIN CABLE
INSTRUMENT TRUCK
THE FIRING BATTERY
CABLE REELS

important refinements, which will have very low current consumption and permit of using small, high resistance conductors. Needless to say, this development will have a very important bearing on the transmission problems of the division artillery.

Since the success of the long distance transmission project is, if not problematical, at least a matter of the future, let us see what can be done to adapt our present equipment to division artillery requirements. It appears to the writer that questions of size and, weight of receivers, transmitters and especially cables will restrict the choice to the step-by-step type. Three data receivers must be provided for each gun carriage, one displaying azimuth, a second quadrant elevation and the third fuze range. Each data receiver has two sets of concentric pointers; one driven electrically from the computer, and the other mechanically by the corresponding mechanism of the gun. The gun is kept laid continuously by the gunners on the future position data by matching pointers. Data receivers of this general type have been provided on the new division gun carriages mentioned above. The cables, junction boxes, etc., are shown schematically on a sketch which accompanies this article. The estimated weights of the several elements of the cable system are also given. Power will be supplied direct from a small portable gas-electric generator which will always be located at the battery position. The transmitters are a part of the mechanism of the computer. Telephone conductors are incorporated in the transmission cables with outlets at the junction boxes. Automatic transmission between the height-and-range finder and the computer is desirable but by no means essential, as these two instruments will ordinarily be located near each other. It is interesting to note that this transmission equipment would be the same if fire were restricted to ground targets.

The fire control system just described can be used only against fixed or moving targets within view of the O. P., or point where the computer and range finder are emplaced. It will be of no value in connection with map firing. The gun data receivers can not be used for direct fire missions, nor can they be used with map firing data unless the deflection is furnished in the form of azimuth and the range combined with the angle of site

correction and converted to quadrant elevation. The transmission equipment might be used in a makeshift fashion for map firing problems by transmitting whole numbers without reference to the units in which the instruments were graduated. If this were done, all guns would necessarily be fired on the same data uncorrected for parallax of the individual gun positions.

It will probably be desirable to provide an independent fire control system for map firing and for direct fire at targets visible from the battery. The "on carriage" equipment should therefore comprise a panoramic sight and range drum similar to the instruments now used by the Field Artillery.

If the gun carriage can not be leveled it will be necessary to connect the sights and data receivers so as to correct the indirect fire data for the out-of-level condition of the carriage. This scheme is used in one of the new division gun carriages.

The computation of map firing data can be simplified considerably by a special computing instrument designed only for this purpose. An instrument of this sort was issued recently to the Field Artillery for service test. It is so constructed that when placed on a map, the range and deflection can be read for each gun position without resetting. A simple mechanism is provided for computing the ballistic corrections. It is in reality a labor saving device and does in quick and simple fashion what is now done by rather laborious hand methods.

It is realized that experienced officers of the Field Artillery can not help but regard the size and complexity of this proposed fire control system with some alarm. Let us analyze just what it will mean in the way of adding to the responsibilities of the organization commander. Training difficulties will not be increased as the duties of the operators on all the instruments are extremely simple, generally a matter of keeping two pointers matched. A special truck or trailer can be provided for transporting the instruments, and it should be possible to move this vehicle to the gun position with no more difficulty than would be encountered with a gun carriage. More time will almost certainly be required in preparing the battery for action, especially if the nature of the terrain is such that the computer and range finder must be carried a considerable distance to the O. P.

by hand. Reel carts can be provided for laying the transmission cable to the O. P. and this operation should not be much more difficult than laying a telephone cable, if the terrain is not too unfavorable. The computer and guns must be oriented and the transmitters synchronized with the receivers. The first operation is fairly simple if a celestial body is visible or if datum points of known azimuth can be seen from both positions. Synchronization of the transmission system can be accomplished in a few seconds after the battery is oriented. Camouflage of the various positions, especially the O. P., will present added difficulties. The various instruments, while "fool-proof" in normal operation, must be handled with reasonable care in transportation and will undoubtedly be more difficult to maintain than the very simple equipment now in use. Unquestionably, the organization commander must assume new responsibilities and will encounter fresh difficulties. It remains then first to clearly define the missions of division artillery and then to determine whether or not the increase in fire efficiency is sufficient to justify such a radical departure from previous equipment and methods.

CURRENT FIELD ARTILLERY NOTES

Army Appropriations Bill

The Army Appropriations Bill for the fiscal year ending June 30, 1932, which has been passed by Congress and been signed by the President, contains the following provision:

"No appropriation for the pay of the Army shall be available for the pay of any officer or enlisted man on the active list of the Army who is engaged in any manner with any publication which is or may be issued by or for any branch or organization of the Army or military association in which officers or enlisted men have membership and which carries paid advertising of firms doing business with the Government; provided, however, that nothing herein contained shall be construed to prohibit officers from writing or disseminating articles in accordance with regulations issued by the Secretary of War."

In order to comply with the above legislation this issue of THE FIELD ARTILLERY JOURNAL contains no advertising. Thus THE FIELD ARTILLERY JOURNAL is strictly obeying the spirit as well as the word of the law.

The War Department has published the following in connection with the above provision:

"This restriction is viewed by the War Department as effective at once.

"It does not affect retired personnel.

"The expression 'engaged in any manner' with any publication described in the provision, applies to editing, directing, managing, or any other active business relation with any such publication, direct or supervisory, with or without compensation.

"The expression 'business with the Government' applies to business involving the expenditure of funds appropriated by Congress or the receipt of funds to be disposed of as directed by statute. This means all departments, bureaus and branches of the Government, not the Army alone."

This provision, in a somewhat modified form, first appeared as an amendment by the Appropriations Committee of the House of Representatives on the Army Appropriations Bill for

the fiscal year ending June 30, 1932. The amendment was the subject of considerable debate on the floor of the House on January 10, 1931, but was defeated by a vote of 55 to 38. The Army Appropriations Bill without this provision went to the Senate where it was referred to the Military Affairs Committee of the Senate. After consideration the Army Appropriations Bill was reported out of the Military Affairs Committee without the above proviso. However, when the Army Appropriations Bill was being discussed on the floor of the Senate, Senator Moses of New Hampshire introduced the amendment again, although in a somewhat modified form. It was then passed by the Senate, and the Army Appropriations Bill with this amendment was referred to conferees from the House and Senate. The Appropriations Bill was finally reported out of conference and passed by both House and Senate in the form given above. During the debate on the floors of the House and Senate the Field Artillery Association and Journal received some favorable comments as shown by the following extracts:

MR. REED*: Mr. President, there are certain conditions which undoubtedly ought to be corrected. It seems to me it is manifestly improper for an officer of the Corps of Engineers to solicit advertisements from people with whom he is transacting business in the letting of contracts. It is obviously improper for an officer of the Quartermaster's Department, for instance, to solicit advertisements from people who are bidding on Army supplies or are supplying articles to the Army. This is one side of the situation.

On the other side the technical advantages, both to the writers and the readers of the articles in such a magazine as THE FIELD ARTILLERY JOURNAL are very obvious and do not need to be expanded upon. It is very much to the good of the Army that professional information right up to date should be given by the current publication of the magazines.

I am hopeful, now that the matter has been brought to the attention of the Senate, that a regulation can be adopted by the Secretary of War which will have the effect of cutting out the abuses in this connection and of not depriving the Army at the

*Senator David A. Reed of Pennsylvania is Chairman of the Senate Military Affairs Committee.—EDITOR.

same time of the advantage of the technical information which is supplied by the magazines.

MR. WAINWRIGHT: . . . Among the journals affected would be the Infantry Journal, the Cavalry Journal, THE FIELD ARTILLERY JOURNAL, the Coast Artillery Journal, the Quartermaster Review and a number of other journals which those who have any familiarity with the Army, will recognize as most valuable and essential publications.

Now, what are the facts? There are eleven officers who give some of their time to the publication of these journals and twenty-two enlisted men; and of the officers who give any time to it, computing the time they do give to the work, for all these journals it would take not over the full time of three officers of the Army and eight non-commissioned officers.

If you want to deal a real blow and effect a real injury to the Army, you will let this go through. The journals manifestly can not exist or can not properly be managed and conducted without the active assistance of men who know most about the technical subjects involved.

MR. BACON: I challenge the statement that there ever has appeared in any single service journal a single criticism of any member of this House or of the body itself. The articles that appear in these service journals are entirely technical articles on the different branches of the service.

MR. WAINWRIGHT: I want to call attention to the statement before the committee in regard to these magazines. May I quote from the hearings before the committee:

"It is considered that each of these publications performs a very useful function in disseminating valuable information to the recipients, and that the high quality of the publications is best insured by the supervision of officers on active duty."

MR. HILL of Alabama: I believe if you will investigate this matter you will find that there is nothing in our Army, as constituted today, that does more to educate the officers of our Army or to build up the esprit de corps of the Army than the publication of these different branch journals (Applause).

I hope that the membership of this House will not today, by leaving this language in the bill, strike down and destroy these

journals. Let me say to the membership of the House if this is to be done it should be done not in an appropriation bill but after a bill for the particular purpose has been introduced, after hearings have been held on the bill, and a committee of the House has given full consideration to the matter. (Applause.)

MR. PARKS: . . . It seems to me that a terrible thing is about to happen. I do not know just what it is going to be. If this amendment is adopted, it is going to be an awful thing; and if it is not adopted, it is going to be a calamity. If they are going to take time to debate this amendment and destroy the publication of these magazines, I do not know how the Army is going to get along; and, on the other hand, if you do not adopt and you continue these magazines it looks to me like it is going to be a terrible calamity.

Here we are at 4:30 on Saturday afternoon, and whether that amendment is adopted or not, the flag will still fly over this Capitol and 5,000,000 men will still be out of work, begging for bread. Here we are at this time debating this matter while millions of people are appealing to this Congress for food and for relief. I am compelled to make a point of order that a quorum is not present.

Effect Upon the F. A. Association and Journal

The loss of income to the Field Artillery Association caused by this legislation is serious, but there appears to be no reason why the Field Artillery Association can not continue under its present constitution, and THE FIELD ARTILLERY JOURNAL continue to be published in approximately the same manner as heretofore, provided the membership and subscription list is increased and expenditures reduced. It may be necessary to cut down the expense of publishing the JOURNAL either by making it a quarterly instead of a bi-monthly, or by some other means. It is therefore exceedingly important at the present time that each member of the Association do everything in his power to increase the membership and that Field Artillery officers whether of the Regular Army, National Guard or Organized Reserves who are not already members join the Field Artillery Association.

The Field Artillery is a profession in itself, consisting of a great variety of activities, and it has been found through years of experience, not only in this country but also in leading foreign nations, that a professional journal is a necessity. Every Field Artilleryman who is interested in his profession should want to join the Association whose objects are according to the constitution:

The promotion of the efficiency of the Field Artillery by maintaining its best traditions; the publishing of a Journal for disseminating professional knowledge and furnishing information as to the Field Artillery's progress, development and best use in campaign; to cultivate, with the other arms, a common understanding of the powers and limitations of each; to foster a feeling of interdependence among the different arms and of hearty cooperation by all; and to promote understanding between the Regular Army, National Guard and Organized Reserves by a closer bond; all of which objects are worthy and contribute to the good of our country.

Motorization in the National Guard Field Artillery

The Secretary of War, Honorable Patrick J. Hurley, has approved the motorization of the 66th Field Artillery Brigade, Oregon, Washington and Idaho National Guard.

At present the two regiments of 75's are horse-drawn, while the howitzer regiment, the 218th Field Artillery, Oregon National Guard, is already motorized. The 146th and 148th Field Artillery (less 1st Battalion), Washington National Guard, will probably be motorized as rapidly as the necessary motors and other equipment can be supplied. The 1st Battalion of the 148th Field Artillery, Idaho National Guard, probably will not be motorized until after the summer training camp period.

This change was recommended by the Brigade Commander, Brigadier General Harry G. Winsor, Washington National Guard, and approved by the Adjutants General of Washington and Idaho, and Commanding General, Ninth Corps Area, and the Chief of the Militia Bureau. It is in accord with the tendency toward the gradual motorization of part of the National Guard Light Field Artillery.

In addition to the above, motorization of the following organizations has been accomplished:

59th Field Artillery Brigade, 34th Division, namely, the 125th and 151st Field Artillery, 75 mm. (Minnesota).

120th Field Artillery, 75 mm. (Wisconsin), 57th Field Artillery Brigade, 32nd Division.

In all of these projects the Militia Bureau has been able to supply tractors and 3-ton trucks in accordance with Tables of Training Allowances. The War Department supply of light trucks has been exhausted, and no passenger vehicles have been on hand for issue for several years.

Regulations provide for a small reimbursement to officers for the use of their own cars during the field training period.

The Militia Bureau is cognizant of the deficiency in light motor equipment and the need of modernizing the old equipment. Estimates are on hand for the remodeling of old trucks and procurement of additional new motor equipment. No information can be given as to when circumstances will permit the inclusion of these estimates in the National Guard budget.

Pack Artillery Notes

The Pack Artillery Board at Fort Robinson, Nebraska, has completed its test of four new drill cartridges for the 75 mm. pack Howitzer. These cartridges were found satisfactory and standardization was recommended.

The square cross section packing box containing four rounds of ammunition for the 75 mm. pack Howitzer has been selected as the best of the various types submitted. Hereafter ammunition will be packed in boxes of this type.

Morris Simpson Dead

On February 24 Morris S. Simpson, outstanding pioneer business man of Oklahoma, died at his home in Lawton. The name of Morris Simpson is almost a household word, as practically every home in Comanche County has had business or personal relations with him. Scores and scores of early settlers in this section purchased their first load of "goods" from the Simpson

store, and after thirty years are still dealing with the same business institution.

On a mountain top on the Fort Sill reservation a giant gun stands silent guard over peaceful underlying valleys, secured through the efforts of Mr. Simpson, and in his honor named and inscribed the "Simpson Gun." Thousands of people annually climb this mountain to inspect this giant emblem of war. It will stand for long as a monument to the memory of the man who has always been a true friend to the service.

When official news was received of Fort Sill having been designated as the permanent site for the Field Artillery School, the happiest man in Lawton was a dying man, Morris Simpson.

There are few civilians who have a more extensive acquaintance in the service, especially in the Field Artillery. Not only did Morris cherish his Army friends while they were at Sill, but he followed them ever afterward. He was a truly fine man, a devoted and generous friend; his loyalty to Fort Sill was striking in its unselfishness; he died as fearlessly as he lived.

The Foreign Legion

Organized by Louis Philippe of France, almost a hundred years ago (January 5, 1831 to be exact), the "Legion Etrangere" was modeled after the old Roman legions and various mercenary troops used in Europe at an earlier period.

Four years after its organization the Legion was "rented" by Isabella of Spain, and fought in the Bourbon—Carlist Struggle. The Crimea in '54 and Italy in '59 both saw the organization in action and shortly afterwards Maximilian took the Legion with him in his ill-fated effort to conquer Mexico. After Maximilian's death they returned to Africa, only to be called out again for service in the Franco-Prussian in '70. In '92 they fought in Dahomey, and six years later in Madagascar, with other units helping to keep peace in Indo-China. During the World War the Legion made a glorious record, and since that time has taken an active part in the pacifying of Morocco.

From certain standpoints, the Legion is an ideal organization. There are no embarrassing questions asked of its applicants—a man gives whatever name and nationality he pleases, and as a

consequence it offers a haven to political refugees and others with even shadier pasts.

After serving his five-year enlistment, the soldier is automatically given French citizenship if he wishes it, and many a man without a country has thus found one. The percentage of "foreigners" is very large. Germans who, before the World War composed approximately a fifth of its personnel, now number nearly half of its soldiers.

Aside from its splendid war record and its unique composition, its greatest feature is the unusual development of esprit de corps among its personnel.—*San Antonio Military Review*.

Fort Robinson Horse Show

Despite near-freezing temperature and overcast skies, the first annual Horse Show and Gymkhana recently held at Fort Robinson, Nebraska, was well attended and was considered an unqualified success. Officers were gratified by the response shown by people of the adjacent territory of northwest Nebraska, southern South Dakota and eastern Wyoming, feeling that the aim set for the show—the provoking of interest in good horses and horsemanship, thus laying a groundwork for a yearly affair—was fulfilled.

The show was held under the sponsorship of Col. Laurin L. Lawson, Field Artillery, commanding officer of post and Fourth Field Artillery, who is president of the recently formed Fort Robinson Horse Show Association. Major Sumner M. Williams, Q. M. C., commanding the Robinson Remount depot is vice-president of the organization and Major Orville M. Moore, Fourth Field Artillery, executive officer, directly in charge of arrangements.

The opening attraction of the horse show was a polo match held Sunday, October 19, in which the Seventy-sixth Field Artillery team of Fort Francis E. Warren, Wyo., defeated the Fort Robinson four 11 to 7. The visitors earned their victory by clever teamwork throughout the game, especially in the third period, when they ran five goals to one for Fort Robinson. Both teams rode hard and fast and were about on a par in hitting. The

Wyoming team, however, out-maneuvered the Fort Robinson riders who showed up weak on defense.

In connection with the horse show events, the yearly gymkhana, consisting of competitive events, mounted and dismounted, among the enlisted men of Fort Robinson was held.

The riding of Capt. and Mrs. Royal L. Gervais and the performances of their mounts, Eddie Cantor and Stonewall Jackson, featured the show events. Mrs. Gervais, who is one of the best horsewomen in the Army, was high individual winner, taking first in the ladies' saddle class, ladies' jumping, novelty jumping and pair jumping, and third in pair jumping. Captain Gervais, riding Eddie Cantor, won the important cup of the show, that awarded for first in the officers' charger class. Eddie Cantor was high point horse of the show.

Another experienced show mount which showed especially well was Coronado, eleven-year-old gelding owned by Capt. R. Van K. Harris, who won the open jumping class with him.

Dover, a 23-year-old black gelding attached to Battery D, Fourth Field Artillery, turned in several performances which were the more creditable because he is a cold-blooded horse, though he has had much show experience. He was ridden in the ladies' jumping class by Miss Lauriene Lawson, winning second, in the pair jumping by Mrs. Ruth Gervais, taking a third, and in the open and novelty jumping classes by Sgt. A. V. Fesperman, winning second place in both divisions.

Dover has been with Battery D continuously for 16 years, and has been constantly under the care of Sergeant Fesperman during that time. This long companionship of man and horse is to be broken soon by Sergeant Fesperman's transfer to Panama, however. Dover was on the border with the famous Squadron A of the New York National Guard during the Mexican trouble of 1916, being transferred to the Field Artillery organization when the squadron demobilized.

The Robinson Remount depot exhibit, arranged by Major Sumner M. Williams, commanding, was very comprehensive. The first animals led through the ring were six depot stallions, namely, Mentor, Mad River, Fitzgibbon, Southern Cross, Paavo and Mentata, all proven sires. Several of these horses

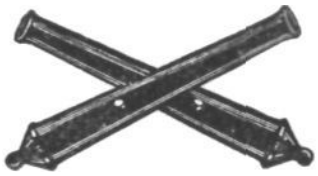
have fine track records, and all have proven their worth by their get, some of which formed later exhibits.

Six thoroughbred mares with foals at foot were next shown.

The yearling class was represented by nine stallions and three fillies, all registered thoroughbreds. Eight two-year-old stallions and four two-year-old fillies formed another exhibit.

Remount-Bred Horses

With a view to giving the maximum results in furnishing suitable horses to the service at large, the office of the Quarter-master General is desirous of obtaining information from Field Artillery organizations and schools on the performances and breeding of outstanding animals. Information concerning all remount-bred horses, and especially depot raised horses would be valuable. For example, if certain Olympic prospects proved outstanding in the trials this would be a guide to the conduct of depot breeding in that it would show that a particular sire was doing well or that a particular cross was satisfactory. The Quartermaster Corps is making an effort to have purchasing officers and depot commanders furnish complete information about the horses they put out, especially as regards depot raised horses. This should permit easy identification as pertains to the breeding of the horses. However, in order to obtain data on their performances it is necessary for officers in charge of these horses to submit information on how they are doing.



DIVISION ARTILLERY

THE ROLE OF THE BATTALION COMMANDER IN COMBAT*

BY E. RICARD, MAJOR OF ARTILLERY, FRENCH ARMY

> "The Battalion Commander prescribes the area in which each battery will reconnoiter for its exact position, organizes and exploits observation, distributes missions among the batteries, gives the orders for firing, coordinates and directs the fire and compiles information furnished by the batteries." (French Manuals for the 75 mm. and the 155 mm. Howitzer).

TAKING these duties as a basis, we shall attempt to deal specifically with the *nature* of the problems presented to the Battalion Commander:

I. Before the order for reconnaissance.
II. During and after reconnaissance.
III. Immediately before opening fire.
IV. During action.

It should be understood that the tasks required of the Battalion Commander in this connection constitute maximum requirements which, on account of the situation, he often may be unable to carry out in full, but which nevertheless, he should exert every effort to accomplish.

I. BEFORE THE ORDER FOR RECONNAISSANCE

A. MATERIEL

At the very beginning, it should be remarked that, in order to be able to coordinate fire during combat, the Battalion Commander will be required to prescribe a preparation of the matériel. This will be done prior to engaging in any operations, preferably in peace time, or else at the very beginning of moblization.

> *Note*. Eventually this work will be resumed during the course of operations on every occasion when the materiel is replaced, or whenever, after a long period of firing, there is sufficient time available for its resumption (rest periods, stabilization, etc.).

The purpose of this preparation is to obtain the most complete knowledge possible regarding the matériel of the battalion. Instructions relative thereto are contained in regulations:—comparison of bores, levels, laying devices, goniometers, etc.

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*Translated from the Revue d'Artillerie, with kind permission of its editor and the author.

We shall merely call attention to the fact that it is incumbent upon the Battalion Commander to distribute the pieces in such a manner to each battery that it will be equipped with tubes showing a comparable degree of wear, and moreover, that the records of the battalion should include the dV_o of the directing piece of each battery. A table showing the relative dV_o's once having been prepared, one of the batteries will be taken as the directing battery.

This information regarding the dV_o's may be obtained from data pertaining to wear of the forcing cone, contained in the gun books. Calibration firings executed in peace time or during operations may possibly lead to the adoption of a new value for dV_o.

Note. In order to make available promptly a new dV_o in proper form to be entered in the correction tables of the chiefs of section, it is advantageous to convert beforehand into minutes the corrections in meters given in the firing table for a dV_o of 10 meters.

For the 155, the correction table referred to is actually expressed in minutes.

For the 75, it likewise should be expressed in minutes, in view of the fact that shoots in which the gunners' quadrant is used are exactly those in which the greatest precision is necessary.

As the work involved in making this conversion is rather lengthy, it should be done in peace time.

The comparison of the matériel in use in the battalion may be made relatively rapidly. On the other hand, it is to be noted that the transfer of the results of this comparison to correction tables for use of the chiefs of section requires a great deal more time, and moreover, the use of the tables presupposes thorough instruction in their use. To place these tables in the hands of insufficiently instructed non-commissioned officers would result in larger errors than those which they are aimed to correct.

For all these reasons, the first comparison of matériel will be undertaken in peace time. It will be carried as far as possible along with the instruction of the non-commissioned officers in the use of correction tables.

Moreover, prior to engaging in tactical operations, but in this instance in the combat zone, the Battalion Commander will supervise the declination of the compass-goniometers of his battalion. If possible he will use a declinating station, obtaining

data relative thereto from the groupment. In the absence of such station, he will establish one for his battalion or will use, if one can be found in the area, a straight direction line 3 or 4 kilometers in length.

B. AMMUNITION

We shall depart slightly from the chronological order of the tasks to be performed by the Battalion Commander in order to consider at this time the question of ammunition, which is closely linked with the preceding one when we are dealing with the subject of coordination of fire. However, it should be understood that here we are dealing with a continuing question which will be presented during the entire course of operations.

Two words are sufficient to sum it up: *lots* and *weights*.

Sorting by Lots.

The application of the principles of sorting by lots, as set forth below, appears to meet most requirements:

1st. In case it is contemplated that the results to be obtained from the fire of the battalion shall not necessarily measure up to the accuracy of a given lot, an attempt should be made to obtain the same lot for all batteries of the battalion.

2nd. In the opposite case, a single lot must be assigned to a given battery.

3d. If the ammunition supplied contains mixed lots, these should be given to one battery, it being understood that this battery should, if possible, be assigned missions requiring the least accuracy in the event that there should be a considerable variation between the lots.

It should be remarked that the Battalion Commander does not control the assignment of lots to his batteries. This task devolves upon higher authorities, in principle upon the Chief of Artillery of the Army Corps. Nevertheless the Battalion Commander can and should influence this assignment of lots:

1st. By permanently keeping the authorities charged with ammunition distribution informed as to the lot situation, namely, by forwarding at the proper time, through channels, a "lot report," a copy of which may well be sent to the commander of

the distributing point upon whom generally devolves the duty of checking the ammunition.

This report differs from the "Ammunition Report" prepared at the end of the day, the latter only containing the number of rounds fired, kind of projectiles, etc., but never giving the lot numbers.

2nd. By prescribing a proper exchange of ammunition between his batteries with a view to approaching as far as possible the principles of distributing lots as stated above.

Sorting by Weight

After the ammunition has been supplied, the Battalion Commander will determine as soon as practicable the effect of variations in weight of projectiles.

If circumstances permit, the Battalion Commander will give orders to that effect; otherwise, the initiative in this matter will rest with the battery commanders. We shall see later how this effect is determined by firing.

It is merely to be noted here that weight effects and corrections are never conclusive, but that every adjustment and stripping indicates the possibility of effecting an improvement. On every possible occasion batteries will strip their adjustments. They will send to the battalion the results of this stripping, which results the Battalion Commander will consolidate in a table of weight effects in which the information will always relate to the directing battery.

II. DURING AND AFTER RECONNAISSANCE

As regards the order for reconnaissance, we have studied elsewhere (See Revue d'Artillerie, volume 104, July, 1929*), the preparatory work of the Battalion Commander and the general plan of reconnaissance.

Let us examine here the role of the Battalion Commander during his reconnaissance and the orders he issues after reconnaissance.

What should he have in mind from the very beginning?

In the very first place, matters affecting the entry of the battalion

* See page 715, *Field Artillery Journal*, November-December, 1929

into line, which is the immediate purpose of the reconnaissance: orders are issued and the officers of the battalion, having been oriented in a general way, set to work on the terrain. They will make their recommendations. The Battalion Commander will make the decision. But the entry of the battalion into line and the occupation of position are in themselves merely a means to an end, the ultimate purpose always being the accomplishment of the mission in the best possible manner. The accomplishment of this purpose leads the Battalion Commander to the following considerations:

1st. To prepare the fire missions from a study of the objectives.

2d. To take the fullest advantage of possibilities for observation in order to seek objectives, to direct and control the fire.

3d. To prepare for opening fire. Preliminary registrations.

4th. Reports to higher authority.

5th. (Finally) Orders for firing.

These considerations are not independent. We merely draw a distinction between them in order to facilitate the study of the Battalion Commander's work. Most of these considerations are not limited to the period when the battalion is going into action; they will appear again during the course of combat.

A. OBJECTIVES

During the preparatory work, this first consideration leads to a study of the map, information bulletins, aerial photographs, etc. This study will be continued during reconnaissance, at the observation post and in liaison with the infantry, with units already in the area and with the groupment, according to circumstances.

It will be materialized at first by a few notes or indications on the map, and, if the situation stabilizes, this document will become the basis for the record of objectives—maps and tables—which will be up to-date during the course of operations by entering thereon all information obtained (Observation, Artillery Information Service, Infantry, etc.).

For reconnaissance, the Battalion Commander, upon receiving from his batteries the tracings showing possibilities of fire, will use this document relating to objectives as a basis for prescribing certain fires to be prepared by the batteries and eventually for dividing up the zone of action of the battalion among the batteries (unless this division has been made previously).

> *Note*. In making this assignment, the Battalion Commander will from the very first keep in mind the ultimate fire maneuver, if the zone is narrow, he will assign the entire zone to each battery. If it is wide, he will divide it if possible between two batteries, superimposing the third upon the other two. He will avoid, if possible, assigning a separate zone to each battery.
>
> The same considerations will guide the Battalion Commander in his instructions as to the preparation of certain fires. We shall return to this subject later.

B. OBSERVATION

The matter of obtaining the best possible observation will lead to building up, during the reconnaissance, the ground work of a plan of observation.

Depending upon the time available, this plan will be more or less complete. In case ample time is available before opening fire, the plan will be more comprehensive from the beginning. Under other circumstances, its development will be progressive.

After his reconnaissance, the observer will submit to the Battalion Commander the list of OP's reconnoitered, and for each he will indicate the route by which it should be reached, visible and invisible areas, and eventually he will furnish a panoramic sketch. He will indicate the auxiliary targets identified from each OP and finally the degree of accuracy of their indication.

The Battalion Commander will determine the OP's to be permanently occupied, including a battalion OP, which may be used in conjunction with certain batteries.

He will not lose sight of the advantages of combined observation.

He will make the assignment of the OP's which are retained, prescribing even in certain cases the rank of the officer who will be stationed at each (1). He will keep a record of other OP's which may be occupied eventually.

In any event, the notes regarding OP's which have been reconnoitered, and the areas visible and invisible from each will finally serve as a basis for a record of OP's, to be kept by the battalion staff and to be completed as time becomes available.

Finally, when the situation warrants, for example, after having issued the initial orders for opening fire, the Battalion Commander will follow up the plan of observation with a plan for displacement of observation, aiming to regulate this displacement according to the requirements of events and prescribing in detail the plain. (Personnel, matériel, reassembly, bounds, liaison to be established, communications to be operated.)

C. PREPARATIONS FOR OPENING FIRE

The conditions for opening fire are functions both of the situation and the terrain.

Two cases are to be distinguished, according to whether fire is to be opened on the objective, or registration is possible. The second case implies generally that sufficient time is available to permit a deliberate preparation of fire.

The following situations may be presented:

Fire for registration is permitted without restriction, or, on the other hand, restrictions or even silence may be imposed.

Registrations will be made by day or by night.

The terrain does not offer a sufficient number of registration points.

Fire for effect may or may not immediately follow the adjustment, etc.

Each of these situations has its particular solution which must be sought by the Battalion Commander unless the solution

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(1) *Note*. These instructions will frequently be combined with a more general study, i. e. the employment of battery commanders.

Evidently, there are cases where full initiative will be left in this regard to the battery commanders.

In certain other cases,—for example, an attack pre-arranged in full detail,—an actual plan of employment is required.

For example: 1 Captain at the batteries.
1 Captain at an O.P. near the batteries.
1 Captain at a forward O.P.

It should be remembered that it is advantageous to have one Captain comparatively near the Battalion Commander.

is actually laid down for him. In either case during his reconnaissance he will study the means of putting the solution into effect.

Likewise, during his reconnaissance, the Battalion Commander will consider the possibilities of directing the fire of his batteries by terrestrial observation. To this end he will study the means of observation and communication involved in this question.

Therefore, we shall attempt to treat in a general way the subject of *fire direction by the Battalion Commander*.

This direction may be exercised in several forms:

Permanent control by firing bulletins;

Observation of the fires for the entire battalion;

Control of results obtained (aerial photographs, information gathered from the infantry);

Finally, preparation of orders prescribing *controlled fires* for the preparation or for the execution of fire for effect.

These controlled fires are observed by *aerial* or *terrestrial observation*.

In the case of aerial observation, we shall note that the adjustment of the three batteries lasts about 20 minutes, assuming that operations proceed normally (perfect fire discipline and communications). In principle, the battalion radio station functions as the directing station.

In the case of terrestrial observation, combined bilateral observation should be sought for the direction of fires upon an actual objective; the employment of the tangent reticule method for directing upon a fictitious objective. The adjustment of fire by the tangent reticule method pre-supposes that topographic locations are sufficiently accurate for carrying out this type of adjustment. The adjustment of the fire of a battery using this method lasts about one-half hour.

In regard to the choice of objectives, when it is a matter of directing the preparation of fire, we believe that there should be emphasized the advantage of giving the same registration point to the three batteries whenever possible. This type of control is in fact the best possible manner of preparing for concentrations which may come up eventually.

Regarding the orders relating to fire direction, reference is made to regulations setting forth the elaboration of the plans to be adopted.

D. REPORTS TO HIGHER AUTHORITY

We deal with this special topic, in order to insist upon the fact that the Battalion Commander, after reconnaissance, must not be satisfied with merely furnishing information regarding his own situation.

Without doubt he should transmit:

The location of his positions and his OP.

The tracing showing the possibilities of fire of his batteries.

The location of his OP's.

The tracing of areas visible from each OP.

The auxiliary targets he proposes to use.

His system of communications, etc.

Perhaps, after rendering this report, he will find, as a result, that his mission may be somewhat modified.

But, in addition, he should forward all results of his reconnaissance not utilized by him, but susceptible of use by others.

He will report in particular:

All suitable positions reconnoitered which he is not occupying.

All OP's which he is not using.

All auxiliary targets noted which he is not using.

E. ORDERS RELATING TO OPENING FIRE

If we except the case of opening fire upon the objective itself, the first shoots will, if possible, include fires for registration, controlled fires and, if necessary, calibration firing.

These three questions, registration, control and calibration, which we have previously distinguished for the purpose of study, will in general and when possible, be united. For this reason we are now treating them under a single heading.

The order for opening fire,—the first result of all the preliminary work of the Battalion Commander,—will aim if possible to carry out the three operations simultaneously, when they are required.

The form of this order will vary according to the situation. The simplest, corresponding to the greatest decentralization, will only indicate, for example, the time at which these initial fires will be completed and will leave full initiative to the battery commanders as to execution. The *most complex,* corresponding to the greatest degree of centralization, will constitute actually a plan of fire which may advantageously be presented to the batteries in the form of a work sheet, fixing time schedules, objectives, methods of fire and type of observation (terrestrial, aerial) and scheme of communications (necessary connections).

Finally the coordination of fire will be prearranged.

III. BEFORE OPENING FIRE

We ended the preceding paragraph with the word "coordination."

The matter of coordination, which is ever an important consideration, becomes at this time specially significant for the Battalion Commander.

Already, for the purpose of coordination, he has required his orientation officer to work for uniformity. Before opening fire he will obtain from him a *plot of locations of elements of the battalion,*—a large scale chart comparable in form to the chart of the battery position prescribed in Regulations. Only the directing piece of each battery will be indicated. The chart will be so constructed as to permit the ready measurement of corrections for parallax and planimetric corrections.

Undoubtedly, in certain situations this plot will perhaps show initially only three points on a map. But the orientation officer must not lose sight of the fact that his efforts must always lead to a progressive improvement of this battalion chart. There will be added to this chart, if necessary, a table of difference in altitude.

The first rounds are about to be fired. A final consideration arises for the Battalion Commander. In order to be able to coordinate the fire, he must transmit to the battery *the atmospheric conditions*,—furnish them with a meteorological message.

Usually, the matter of this meteorological message will be attended

to by higher authority, the Battalion Commander intervening only to inform the groupement of the hours at which he particularly desires this message and to transmit the message to the batteries.

If he has received no meteorological message, the Battalion Commander should furnish one to his batteries, making use of his thermometer and barometer and estimating the wind direction and velocity. It should be noted that certain reservations must be made if one of the batteries (especially 75's) is firing along a valley.

IV. DURING ACTION

We have come to the opening of fire. A uniform preparation having been carried out, the Battalion Commander will next undertake to coordinate the fire. This operation is not limited to the opening of fire. It will be taken up here in order to point out its importance.

COORDINATION

One of the first steps in obtaining coordination consists in disseminating throughout the battalion all results obtained during adjustment by any one of the batteries susceptible of use by the others,—dV_o's K's, correctors, etc.,—and in comparing the results of similar nature obtained by the several batteries of the battalion; in prescribing, finally, the adoption by the three batteries of the mean values resulting from this comparison.

But there exists another form of coordination, more direct, more immediate, so to speak. We shall examine how this problem is presented, how it is solved, and the degree of precision which is attainable.

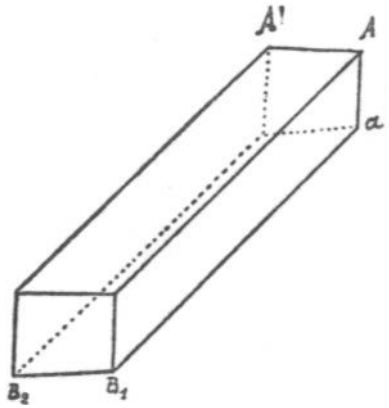
The problem is as follows: "The preparation having been uniform, if a battery B_1 has obtained data on a target, A, what steps must the Battalion Commander take to furnish immediately to B_2 and B_3 the data on A?

> *Note*. The advantages of this operation are evident: the possibility of registering the entire battalion on A, while B_1 alone fires on A; uniformly in concentrating the fire of the battalion; rapid coordination.

Evidently, if atmospheric conditions have changed since B_1 has fired on A, the data of the three batteries for A is in error. But this error is the same for the three batteries.

Finally, we shall remark that the procedure explained hereafter is applicable *under all conditions,* from the time when plot of the location of elements of the battalion is made available. This differs from the coordination obtained from dV_o or K which presuppose accurate topographic orientation, and for dV_o which moreover presupposes accurate meteorological data. The plot of locations of the battalion can be prepared rapidly. It is only essential that the directing pieces be plotted quite accurately in their *relative positions* and that the orientation be correct to within about 10 mils. It is sufficient to have the location of the pieces correct to within about 50 meters, but on the other hand, as has been stated, their relative positions should be exact.

The problem is *an inverse transfer of fire*. Referring to the figure below: *a* being the projection of the target A on the horizontal plane of B_1 and



B_1 B_2 being the line joining the two batteries (which may be at different altitudes), let us consider the parallepipedon of the figure *a*. It can easily be seen that:

B_2 A^1 = B_1 A and is parallel thereto.

The element of B_2 on A^1 are therefore identical with those of B_1 on A (corrected if necessary by the relative dV_o of B_2 in relation to B_1, a correction which can be made by B_2). Therefore if if B_2 knows the data of B_1 for A, B_2 has the proper data for A^1.

Note. The dV_o from calibration firing is used only if the batteries have the same lot of ammunition, otherwise the dV_o obtained from calibration and weight effect is used.

In order to obtain the data for A, the purpose of the problem, B_2 will only have to carry out a transfer of fire from A^1 to A. We may remark here that in most cases the transfer of fire may be carried out by the simplified method.

Note. This method is only inapplicable when the battalion is widely scattered, which condition should be avoided on account of the difficulties of command involved.

Thus, two operations devolve upon the Battalion Commander: 1st. Using the data of B_1, to furnish B_2 and B_3 with the information necessary to permit them to obtain their data for A^1. 2d. To furnish B_2 and B_3 with the data for their transfer of fire from A^1 to A. Here we may remark that the Battalion Commander may read these data from the plot of locations of the battalion and the table of differences in altitude.

The problem will thus be solved.

There remains to be stated a practical procedure for the solution. The inverse transfer of fire involves a certain number of calculations. Who will do them must be determined. The greater part may be assigned to the battery commanders on the ground that the Battalion Commander has other matters than coordination to attend to, and that often the latter's assistants will not be available to help him. On the other hand we may proceed on the theory that at the beginning of a war the battery commanders will lack training. In any case, there should be a fixed method within the battalion.

We shall now study the degree of accuracy which the Battalion Commander should expect to obtain from his coordination.

In the first place, as regards time fire, it is to be noted that coordination can only be attained in the initial elements of the adjustment.

Therefore, let us examine the accuracy attainable in percussion fire. It is a function of:

The value of the transfer of fire from A^1 to A (easily evaluated).

The value of the data of B_1, much more difficult to evaluate due to the fact that there are included as factors the accuracy of the observer. Whatever may be their values, the Battalion Commander should evaluate them. He will then have an idea of the exactness of the coordination.

If it is simply a matter of having B_2 and B_3 execute fire which it is possible to observe, the question of precision does not enter; an adjustment or registration will be carried out.

But if B_2 and B_3 must execute fire for effect which cannot be observed, the question presents itself in full. The Battalion Commander will solve it by prescribing the extent of the area to be covered (allowance) in relation to the accuracy which he expects.

And since for the first time we have used the word "allowance," let us insist upon it. This word should be written in capitals at the top of each page which follows. The Battalion Commander, is not an artillery physicist, he is an technician. An attempt by him to correct all minor errors would often be an impossible task, which in general would not pay. It is usually sufficient for him to appreciate the order of magnitude of these errors and to prescribe the useful allowance, it being understood that his attempt will always aim to prescribe only the *indispensable allowances*. It is not a question of firing "all over the landscape" under the pretext of hitting a target which happens to be somewhere.

To be able to prescribe allowances is difficult technique and an art, so that one might almost ask if the well known "artilleryman's intuition" is not in the final analysis a special aptitude in selecting judicious allowances.

Having dealt with the question of coordination with respect to the firing of the first rounds, we shall now continue the study of the role of the Battalion Commander during action.

The registration fires having been completed, after a time there will follow preparation fires or, at the very onset, fires in support of the attack.

In the case of a preparation, the scene will be laid in advance, the objectives being either selected by the Battalion Commander or indicated by him, or prescribed by higher authority. They will be assigned to batteries keeping in mind certain principles which we shall take up later. (Firing orders).

Let us now consider the role of the Battalion Commander during the course of the attack itself.

The employment of his batteries becomes his prime concern. To this end he must:

A. Know the objectives (Where to shoot?)
B. Give firing orders (What will shoot? Who will shoot? How to shoot?)
C. Prepare for displacements.

A. KNOWLEDGE OF OBJECTIVES

Two hypotheses are possible:

(a) The objectives are indicated by observers, of whose missions one is general surveillance.
(b) The objectives are prescribed by Higher Command. Under the first hypothesis, we shall distinguish two cases:

Either the Battalion Commander has complete initiative for firing within a zone, in which case he must judge the importance of the objective, taking into account the actual means for firing available within the battalion. If he decides to fire, he will define the objective and prescribe everything necessary as to the method of firing, particularly allowances (extent of area to be covered) and eventually the mechanism. After having issued the orders for firing, he must at times render a report.

Or on the other hand, the Battalion Commander has no initiative in firing. In this case, he will report (except in emergencies), but will also take all necessary measures to be able to intervene if the fire mission is assigned to him; that is to say, he will have his fires prepared.

Under the second hypothesis, the closest liaison will always be maintained with the groupement, whose intentions he must know in order that the unforeseen may be reduced to a minimum, since everything that is unforeseen causes a loss of time. Within the battalion, all measures will be taken to reduce this loss of time by a meticulous preparation for possible intervention (plans for transfers of fire, documents to be kept readily available). We shall return to this question when dealing with firing orders.

In the particular case of the battalion acting as part of a unit assigned to the support of the infantry, the liaison to be established is prescribed in regulations. We shall not stop to consider

this matter. This subject would require in itself a complete study.

B. ISSUE OF FIRING ORDERS

In the first place, it must be determined what will fire and who will fire, and then firing orders will be issued.

1. *What will fire? Who will fire?*

An objective having been determined and fire upon it being considered justified, the Battalion Commander, if the effect to be obtained has not been prescribed for him, will in the first place determine the effect desired, being guided by the principles of "Conduct of Fire" contained in Regulations. (Type and number of projectiles).

Taking into account delays involved in completing the fire mission and the moral effect to be produced, he will determine upon the number of batteries to be put into action. The question then presented will be "how to employ his batteries."

To solve this question he must keep constant track of the means at his disposal,—his situation. For this purpose, he will keep handy a chart showing him the situation at all times for his battalion, in the form of a work sheet of the batteries.

Moreover, he will keep in readiness another document showing the possibilities of employment of his batteries on given objectives, contained in the record of objectives. This document will show the fires which have been executed and also those which have been prepared, the latter having been prescribed beforehand according to a prearranged plan designed to facilitate the transfers of fire.

Let us go back to the employment of batteries as regards the assignment to them of objectives.

The two following principles seem to apply generally:

(a) *Always seek to conserve the means at hand.*

Already in the application of this principle we have studied the assignment of zones to batteries. This principle is linked with the corollary: *Always make the effort comparable with the mission;* that is to say, never use, for example, two batteries, where one is sufficient to obtain the desired material and moral

effect. Regulations state for each case the elements of the solution: number of projectiles required and permissible rates of fire.

(b) *In assigning an objective to a battery, seek the best conditions for engaging it* (nature of and time for intervening):

An objective will be attacked with greater effect if the battery has already fired on it, or in its vicinity, if the objective is taken in enfilade, etc.

An objective will be attacked with greater effect if the battery has calculated data for it or for a neighboring objective.

Note. We shall not attempt to specify the degree of propinquity inferred by the term "Neighboring" because in every case it is a function of the possibilities of the transfer of fire. For example, if we have all the dV_o's we may wish for, the degree has wider limits.

It is to be noted that if it is necessary to "surprise" a battery by assigning it a fire mission for which it is inadequately prepared, it should be furnished all the technical data obtainable as a result of coordination.

If it is necessary to fire, among others, a battery which has not adjusted on the objective in question, it will be furnished if necessary, every facility for observation, adequate means of communication being put at its disposal for this purpose.

We shall remark that at times these two principles are in conflict. Before reaching a decision, the Battalion Commander will weigh the importance of each in view of the situation of the moment.

2. *Assignment of Fire Missions*.

A battery having been designated to fire, its objective must be assigned to it.

Let us stop a moment on this subject to dwell on the procedure indicated in Regulations.

Every time the situation indicates, the Battalion Commander should endeavor to designate the objective by its coordinates. In order to do this readily he must practice himself and also his subordinates in reading the terrain. Moreover, in order to facilitate this reading, whenever observers are able to do so, they will

indicate on their panoramic sketches the greatest possible number of points by their coordinates, even though this be an approximation. Nor should we forget that the Battalion Commander has a telemeter. If he is able to use it, he can almost always obtain with certainty the desired precision for designating the objective by its coordinates.

As regards firing orders, we shall end with an important remark. Having designated an objective, the Battalion Commander must prescribe, if applicable, the extent of area to be covered (or the complete mechanism of fire).

C. PREPARATION FOR DISPLACEMENTS

With regard to observation, we have referred to the plan for displacement of observation; it is also important to regulate the displacement of the batteries. These two displacements are generally related. In most cases, they contemplate the employment of an advance reconnaissance detachment, a matter covered in a preceding study.

We shall not deal with its employment, but shall restrict ourselves to specifying the role of the Battalion Commander.

Sometimes, the Battalion Commander will have the initiative in making displacements, but more generally the whole matter will be regulated by the groupement. It will then be incumbent upon the Battalion Commander to put into operation the plan of displacement received from higher authority and in particular to organize the advance detachment, the reassembly and the initiation of the march. The mission will have been indicated to him and he will have charge of the means.

He must constantly strive to improve observation and in particular to enter promptly into action. He will do everything possible to avoid calling upon his batteries to occupy by night an incompletely reconnoitered position. Therefore, his advance detachment should always be prepared to act on his orders without prior warning. The Battalion Commander, imbued with his mission, familiar with the situation and knowing his terrain, will always be ready to give this detachment a definite order.

Let us recall that very often it will be necessary to send out a party to reconnoiter routes. Moreover it is not sufficient merely

to displace the batteries,—their supply must be attended to (orders to be given to the commander of the distributing point).

Finally, we must note that the Battalion Commander must give orders for the evacuation of the position itself. (Eventually, formation of the Column, designation of its commander, subdivisions, route, initial point, recovery of wire, perhaps evacuation of ammunition, etc.)

CONCLUSION

We have just followed the Battalion Commander through a complete cycle of operations. He has been confronted with many problems. We have considered it of less interest to seek the solution of each problem than to indicate the nature of the problems themselves. The solution is in fact a function of the situation. When the latter is well defined the solution is found in our regulations. But still it is important to foresee what problems will arise and when they will arise in order that preparations may be made to solve them at the proper time. This is what we have attempted to present.

FOREIGN MILITARY JOURNALS: A CURRENT RESUME

France—Revue D'Artillerie (November, 1930)

This number contains a complete translation, with illustrations, of the article by Major G. M. Barnes, Ordnance Department, on the 75 mm. gun with T3 mount which appeared in the May-June number of THE FIELD ARTILLERY JOURNAL.

Major C. Desrousseaux in this number presents an interesting article entitled **General Characteristics of Modern Artillery Materiél.** In speaking of the power of artillery he brings out the point that in the final analysis power depends upon other factors than caliber and weight; for example, in comparing the French 75 with the German 77, he shows that as far as concerns effect on the enemy, the French 75 is much more powerful because it carries 800 grams of explosive as against 150 grams* for the German 77. Furthermore, at medium ranges at least, the regularity of the bursts on ricochet of the 75 makes much more powerful effect than the bursts of the 77. Another example of the caliber and weight of weapons not producing the proper amount of power is the 210 mm. with delayed fuse which the Germans used so frequently against French artillery. Major Desrousseaux recalls that these big projectiles frequently fell all over the French battery positions burying themselves deep in the ground and barely puffing up the earth on explosion. He says it was only necessary for the French artillerymen to watch out that they did not actually land on them.

Major Desrousseaux points out the advantages of auto-frettage and states that not only is an auto-frettaged gun tube only about one-half the weight of the old type forged tube, but it has been found that auto-frettaged tubes last exceedingly well. He says the French Navy has a 14 cm. auto-frettaged tube which has been fired constantly since 1913 and is still in excellent condition. One point, however, should be remembered about auto-frettaged tubes. Being much lighter, the recoil of the gun on the carriage is much sharper since the power of recoil

*The German 77 mm. gun model 1915 used by the Germans extensively during the war carried 380 grams of explosives. [EDITOR.]

has only to overcome about one-half as much inertia. This sharper recoil, however, can be taken up easily by the recoil springs or recuperator. Many of the gun builders now, and particularly the Schneider works, use auto-frettage exclusively in the construction of their artillery.

Very encouraging results have been obtained by relining tubes; for example, a Schneider 85 mm. gun-howitzer has fired over 3,000 rounds, the tube in the meantime having been relined several times. The relining presented little difficulty except after an intensive fire of 500 rounds with high pressure when the relining process was noticed to be somewhat more difficult.

As regards design of projectiles the author points out the fact that in order to carry the same amount of explosive a highly stream-lined projectile must be longer than the old blunt-nosed type. With the same number of rotations per second a longer projectile is much less stable on its trajectory than the shorter projectile. If speed of rotation is increased (by giving greater angle to the lands and grooves) then the projectile has a tendency to keep its axis parallel to the line of departure which of course results in the projectile landing on its bottom instead of its nose. In order to have a modern stream-lined projectile travel correctly it has been found necessary to put the center of gravity of the projectile at a considerable distance from the center of air resistance (a point in the forward part of a projectile through which the resultant air resistance is exercised). This is done by screwing on a false ogive or elongated nose which brings the center of air resistance further forward.

As regards power in projectiles it may be stated that increased range and higher velocity are obtained by stream-lining to a certain extent, but at the expense of the amount of explosive which can be carried by the projectile.

With reference to traverse, the author states that the usefulness of all artillery weapons of greater caliber than 15 cm. is greatly impaired by smallness of traverse. In conclusion Major Desrousseaux states that artillery materiél of the future must have very large horizontal and vertical fields of fire along with the ability to fire rapidly and maneuver easily.

Revue D'Artillerie—December, 1930

General Estienne in his **Notes on the Effect of Long Range Artillery Fire on Tanks** says that nobody contests the great efficiency of direct fire of artillery at short range against tanks, but the effect of indirect fire at medium and great ranges is a matter for argument. Recent articles in French and other military reviews give contradictory opinions, some of these opinions backed up by calculations in which numerical values and theoretical factors are given weights which are doubtful. From April, 1917, to the Armistice the French had engaged 1,103 heavy tanks (Schneider and Saint-Chamond) and 3,282 light tanks (Renault). Of these, 324 heavy tanks, or 29.8 per cent, and 435 light tanks, or 13.2 per cent, were hit and immobilized by enemy fire of all kinds. Losses in different engagements ranged from a maximum of 43% to a minimum of 5%. The General says that the percentage of tanks destroyed grew steadily less and at the time of the Armistice was around 20% for heavy tanks and 10% for light tanks. He says that it can be shown that tanks can, without excessive loss, face long range artillery fire. As an example he shows that in General Mangin's memorable counter-offensive of January 11, 1918, 169 heavy tanks without any artillery preparation made an attack which cost 73 tanks, but saved Compiegne and perhaps Paris, and definitely put an end to German initiative in operations. This counter-attack was made at 11:00 a. m. in full view of the numerous enemy artillery and across a slope two kilometers deep. Although it is not possible to state how many French tanks were put out of action by the German artillery barrages, one can not forget that Ludendorf at the beginning of August, 1918, ordered the German artillery to abandon whatever mission it might be on in order to take under fire hostile tanks, because as he said, "If we stop the tanks we break the attack". General Estienne believes that indirect medium and long range artillery fire against tanks proved itself to be inefficient in view of the fact that notwithstanding the great number of mines and anti-tank weapons used by the Germans towards the end of the war in addition to their longer range artillery fire against tanks, the percentage of losses among the French tanks was constantly on the decline. He

states that it is his opinion that the most dangerous adversary for a tank is the cannon at short range, particularly if mounted on a tank. He says there is no doubt in his mind that if ten light tanks armed with 47 mm. guns should come up against five enemy heavy tanks armed with 77 mm. guns, the outcome of such a fight between weapons of different caliber would be no more doubtful on land than at sea: the only light tanks which would not be put out of action would be the ones which, like the German cruisers at Falkland, sought safety in flight. For lighter tanks to turn tail and run back through their infantry during an attack would have a most disorganizing effect.

Lt. Col. Vauthier's article on **new light artillery materiél** is of particular interest because this renowned French military author has many things to say about the American T2 and T3 guns described in the May-June and July-August numbers of the FIELD ARTILLERY JOURNAL. He says that from a technical artillery point of view the introduction of all-around fire as accomplished by the T2 and T3 mounts marks a memorable date in the history of artillery. He says that the necessity for traverse has always existed. The first feeble, although successful, attempt at obtaining it was in the French 75 (where the gun obtained some traverse by sliding on the axle). Other successful arrangements were the pivoting of a cradle on the center of the axle, and also the use of a split trail which enabled traverse to be obtained with some materiél up to 60° or 90°. Perfection in this connection has finally been reached with all-around traverse of T2 and T3 carriages. The solution by carrying an extra trail for the T2 and two extra trails for the T3 appears to the author to be "particularly elegant" and greatly preferable to the solution of obtaining all-around fire by use of platforms.

He states that the introduction of fire control by mechanical means for terrestrial use marks another important date in the history of light artillery. This system enables Field Artillery to utilize the progress and procedure made by naval and aircraft artillery. Col. Vauthier says that all-around fire and automatic calculation and transmission of firing data are particularly valuable qualities for division artillery in modern warfare of movement because so many important targets will be moving

very fast: armored cars, tanks and aircraft. Furthermore, the T2 and T3 mounts would help greatly in obtaining better observation because they are particularly suited to defend observation balloons. The author is particularly enthusiastic over the fact that mechanical transmission of data will do away with errors due to the telephone.

As regards employment, Colonel Vauthier says that the introduction of this new type of American Field Artillery materiél gives birth to a different conception of division artillery. He believes that division artillery of the future could consist of:

Light Howitzers—charged at all times and exclusively with direct support, and

Light Guns, American type—charged with firing on moving targets, long range fire, concentrations and reenforcing the light Howitzers in their mission of direct support.

Applying this idea to the French division organization, Colonel Vauthier states that he proposes an organization for French divisions of three regiments of Infantry per division, each regiment supported by a battalion of light Howitzers and in addition two battalions of light guns, American type, in the hands of the division commanders. The author does not believe the weight of the T2 and T3 to be excessive for modern division artillery. He says that the technical problem of adapting anti-aircraft systems and means to land artillery materiél is fairly simple but it is impossible to adapt terrestrial artillery means and systems to anti-aircraft fire.

In conclusion Colonel Vauthier states that the T2 and T3 studies have solved the problems which were holding up essential Field Artillery progress and he believes that all nations will sooner or later turn their steps along the road opened up by the artillery of the United States.

Revue Militaire Francaise—November and December, 1930

General J. Brossé introduces his article, "The Combination of Arms", as follows: "Among the great lessons of the last war, there is one upon which every one agrees: On the field of battle, the different arms, infantry, tanks, artillery, engineers, aviation, are not distinct forces, each fighting for its own benefit. On the contrary, they form an intimate combination, an amalgamation

of elements; and, by uniting their efforts, they furnish mutual support in the execution of common missions.

"The final goal of this complex activity, in the offensive, is that the infantry may install itself upon conquered ground."

In his chapter on the combination of infantry and the 75 he takes up the old question of fire and movement:

"In the first months of the war, we threw an unsupported infantry against continuous and organized defensive positions.

"The reasons for these rash attempts were various, but the principle reason was that in establishing our principles of warfare we relied upon speculation and theory rather than upon experience. If, by a deep study of the Russo-Japanese war, we had been convinced of the passive resistance of the machine gun combined with the trench and barbed wire, we would certainly have adopted other methods than those which were applied in August and September, 1914, and which proved to be so ill adapted to the fire power of modern weapons.

"The results of these attacks, unprepared and unsupported by artillery, were always the same: everywhere they led to complete checks and resulted in heavy losses.

"The machine gun presents an impassable wall. Men, however brave they may be, can do nothing against materiél; the combatant who advances, without any protection, can not overcome the resistance of a defensive system of automatic weapons unless his supporting materiél has first neutralized a large part of the enemy weapons."

General Brossé cites several examples of the last war illustrating good and poor liaison between infantry and light artillery. He emphasized the necessity of perfect co-ordination in the offensive.

"Thus the union of the 75 and the infantry should be the closest possible. The first infantry wave must be immediately behind the zone beaten by the artillery projectiles, to use an infantry expression: 'lean on the artillery shells, and march in their fire'.

"It is understood, of course, that all the machine guns will not be knocked out by the artillery. The artillery will turn over to the assaulting infantry an enemy zone of defense which

is partly disorganized. The infantry, by means of its own arms, must conquer scattered and isolated points of resistance."

After pointing out the inadaptability of the 75 against reverse slope targets, General Brossé studies the problem presented by targets which are not visible from normal artillery observation posts. He relates an incident of an attack of considerable depth against a series of successive trenches. The infantry support was assured by the fire of 75s lifted at fixed hours to the successive trenches, a time liaison. This gave excellent results at the initial phase of the attack. From that point on, the results were not at all uniform but depended upon the form of the terrain. In the sectors where the terrain was not seen from the artillery observation posts, the infantry found itself held up while the curtain of fire went on to the next objective. All efforts to regain contact with the artillery were in vain.

The results were far different in the sectors visible from the artillery observation posts. Here artillery observation could follow the progress of the infantry and readjust its fire to any departures from the pre-arranged time schedule.

The final results of this attack presented a very interesting development. The line reached by the French infantry in the different sectors corresponded almost exactly to the various points of contact with the ground of the visual rays tangent to the crests and leading to the artillery observation posts. In other words, corresponded to a visibility chart of the sector.

"Thus observation liaison of the 75s with the infantry is of enormous value. The importance of observing crests is evident: often the objective of attacks will be such crests.

"In spite of any progress that has been made in firing by map, the artillery must always take advantage of terrestrial observation facilities, using advance observation posts where the enemy infantry may be seen, as well as prominent and distant observation posts, which permit observation of the movement of enemy reserves."

In conclusion General Brossé reviews the previous chapters as follows:

"In combat, the light artillery destroys the barbed wire entanglements

that the infantryman has to cross, throws in front of him a curtain of projectiles in order to neutralize the machine guns which bar his advance; the tanks neutralize the machine guns which the artillery cannot reach, but should themselves be protected by the latter; the medium caliber artillery of the division shells the emplacements where other automatic weapons menace the infantryman and, farther back, the heavy artillery concentrates its fire on such organizations that cannot be reached by the 75. At the same time the corps artillery takes as targets the batteries which seek to stop the infantryman's advance; and still farther, the army artillery and the bombing planes attack the rear zones of the enemy, the depots, the railroads, in order to prevent the enemy from sending forward his supplies and reserves.

"Covered by the actions of these many forces and by his own means, the infantryman, at the price of exhausting efforts and terrible losses, seeks to accomplish his heavy task. Moreover, the infantry must know how to adapt its maneuver to the combined and complex efforts of so many friendly arms."

In the article, **"Military Effort of Great Britain, 1914-1918",** Captain Cammas describes the military organization of Great Britain at the beginning of the war, the initial effort of this organization in 1914 and the final development of British military power on the French front.

On August 5, 1914, Great Britain's military strength totaled 922,600 men. 468,700 of this total belonged to the territorial army and its reserves, but due to their unpreparedness as combat troops they could not be sent to the continent for several months.

453,900 constituted the regular army, 209,900 in the regular reserves and 244,000 in the active army. Of the latter number, 78,500 men were in India and 40,000 in other colonies.

In other words, Great Britain had available for immediate use 126,000 men of the regular army. 209,900 men of the regular army reserves were available after a short period of time. Due to the necessity of saving part of the regular army to train the reserves, territorials, and newly organized units, the combat strength of the regular army was further reduced. So, on August

5, England sent over 4 divisions of infantry of 20,000 men each and one division (9,000) of cavalry. With special troops this expeditionary force totaled 100,000 men. Two divisions of the regular army were held in England for home defense.

In the gradual development of power from 1914 to 1918, one of the most serious and delicate problems which the English had to solve was that of recruiting.

The English people and some of their political leaders were hostile, by sentiment and tradition, to compulsory service. Moreover, English industry, agriculture and commerce were likewise opposed to conscription, fearing it would disorganize England's system of production.

"These facts explain the slowness with which the government arrived at the eventual establishment of compulsory service. The various steps leading to this final policy were five in number: (1) August, 1914, to August, 1915, was the period of voluntary enlistments, encouraged by propaganda. (2) August, 1915, to December, 1915, was the period of attempted measures of persuasion and pressure to increase the number of voluntary enlistments. (3) 1916 was the period of partial compulsory service. (4) 1917 was the period of compulsory service, accompanied by numerous exemptions. (5) 1918 was the period of obligatory service for all.

"England found another difficult task in recruiting and training in a few months the commissioned personnel necessary for the instruction and command of 70 divisions. England tried to solve the problem by increasing the capacity of various existing training agencies such as: Sandhurst, Woolwich, and the Officers' Training Corps. In 1916 these organizations were considered insufficient and other training schools were organized, called "Cadet Units".

"They were finally able to furnish the necessary number of officers. The young men of middle class families, who were killed as privates in the first 'Kitchener' divisions, were a great loss; the system of voluntary enlistments had partly exhausted one of the best sources of officer material.

"The difficulty of training rapidly good officers for instruction and command of territorial units as well as for artillery

and special troops was the principal cause of the delay with which the territorial divisions were sent to the front."

Captain Cammas sums up England's military effort by quoting from an English war department document:

"It was only in the sixth month of the war that the regular army was able to furnish its maximum effort in France.

"The first line territorial divisions arrived in France during the seventh month and, consequently, could not support the regular army in its first engagements.

"Ten months were necessary to train the divisions raised at the beginning of the war.

"Thus the British effort on the French front, very feeble at first, grew progressively until March, 1917. There were, in France:

4 infantry divisions in August, 1914
9 infantry divisions in January, 1915
35 infantry divisions in January, 1916
52 infantry divisions in March, 1917

"This last figure was maintained until the end of 1917; and this period of nine months, from March to November, 1917, was the one when British forces in France were most numerous."

England—Journal of the Royal Artillery, January 1931

Captain J. N. Kennedy, M.C., R.A., p.s.c. in his article **Sidelights on Great Soldiers,** gives interesting information on the habits and characteristics of many great warriors. Let us follow, for example, what he says about the relations of some of history's greatest leaders with the horse:

"Hannibal, whom Wellington described as 'by many degrees the greatest soldier on record', was vigorous, athletic and hardy and excelled in all manly sports. He was noted for his horsemanship and 'his chief pride lay in the beauty of his arms and his steeds'.

"Caesar does not appear to have been a great hunter or sportsman, but he was an excellent swimmer and a good horseman. In his early years 'he brought his horsemanship to such perfection by practice that he could sit a horse at full speed with his hands behind him.' He dictated letters to his secretaries as he rode on horseback.

"Frederick the Great, in his youth, 'hated the hunt but loved the dance'. His is a curious case. His father brought him up with extreme rigour in the hope that he would become a hardy soldier and 'acquire thrift and frugality'. The result was just the opposite. He refused to ride or shoot, and generally indulged in frivolous and effeminate amusements.

"Until his later years, Napoleon lived a simple and active life and his physical matched his mental powers. Bourrienne notes 'that he could endure great fatigue, not only on horseback and on foot when with the army, but at all times; frequently walking five or six hours at a time without being aware of it. For the bath he had an absolute passion. . . . I have known him to remain there for two hours. During this time I read to him. . . . While he remained in the bath, he used to be continually turning on the warm water and, at times, would raise the temperature so that I have found myself enveloped in such a dense vapour that I could not see to read, and had to open the door'. During the Hundred Days his genius and physical powers were alike in profound decline.

"Neither was the Duke of Wellington an accomplished sportsman, but he certainly indulged in outdoor recreation to a greater extent than Napoleon. Lord Ellesmere says, 'The Duke rode good and safe horses, and I have seen him take good fences when needful'. It is well known that a pack of hounds was maintained with the army in the Peninsula and that the Duke hunted with it.

"Stonewall Jackson, whose campaigns have formed such a mine of instruction for soldiers, is an extreme example of a military hero to whom sport in all its forms was anathema. As a cadet at West Point, his only recreation seems to have been a rapid walk in the intervals between classes. Later, as a professor at the Virginia Military Institute, he joined in none of the outdoor recreations of the community. Colonel Henderson writes, 'Jackson found no pleasure in rod or gun; and although fond of riding and a good horseman, he never appears to have joined in any of these equestrian sports to which the Virginians were much addicted. He neither followed the hunt nor tilted at the ring'. But he kept himself physically fit, and his simple

and strict habits fitted him to endure the hardships of campaigning.

"Grant was the best horseman of his class at West Point, although not distinguished in studies. At 32 he resigned his commission and lived the life of a farmer for seven years until the Civil War broke out. He had the reputation of intemperate drinking. There is a well-known story of Lincoln's reply to a deputation which asked for Grant's removal on this account—'Find out the brand of whisky he drinks and I will send kegs of it to the other generals'. Grant's operations, though ultimately successful, incurred a terrible cost in human life. His strategy always reminds me of the story of Frederick the Great who, passing an old chateau in Silesia saw on the gate a crest in which two stags were fighting with horns interlocked. Underneath was the motto 'Le plus Obstiné l'emporte' (the most obstinate will win). 'That is the truest source of success' cried Frederick.

"Lord Roberts was a fine horseman. He loved a good horse all his life, and was especially fond of Arabs. When he was a horse artillery subaltern he used to try his hand at riding all the horses in his troop, which were not the quiet and well-broken animals of the present day; and he rode in the officers' team for the regimental brake. When on leave from India he hunted with the Curraghmore hounds. He was fond of pig-sticking, and he speaks in his autobiography of excellent sport with wild boar when he was sixty years of age. It was at that age that he speared a wounded boar in the nick of time, which was attacking Pertab Sing, who had been thrown from his horse.

"All his life Lord Kitchener was very fond of riding, and he cared a great deal for horses. As a junior subaltern he attained proficiency in tent-pegging. Whilst engaged on the survey of Cyprus, he acted as whip to a pack of hounds—but he could not be described as a keen hunting man. He distinguished himself 'across the sticks' by winning a steeplechase at the Nicosia meeting in 1882. This seems, however, to have been his sole exploit on the race course. Frederick the Great kept apes and other wild animals in his rooms, and his greyhounds slept in his bed. Lord Kitchener, the anithesis of Frederick in almost every phase of his personal character, apparently drew the line at

bears. A pet bear was one of the inmates of a house which Kitchener once shared with Lord John Kennedy, a young officer in the Cyprus Police. One night the bear took a plunge in Lord Kitchener's bath and then retired to his bed to dry himself among the blankets. Lord Kitchener insisted on its immediate expulsion from the establishment.

"Foch was not much interested in sport, and, although he loved a country life, his recreations lay mainly in the direction of a change in intellectual work. But Foch was a highly accomplished horseman and he was fond of shooting, and he was physically very strong and active. A British officer at his headquarters wrote of him 'In his habits the Marshal was quiet and unassuming. He used to ride or walk alone, or accompanied by one officer'. That Foch, at his age, stood the tremendous strain of the war so well must have been largely due to his simple and regular habits. He was anxiously cared for, too, by his personal staff, and is said to have slept out of bed on two nights only throughout the Great War".

In his article "Time Fuzes" Major O. F. G. Hogg, R.A., p.a.c. F.R.S.A., F.R.G.S., C.I.Mech.E., M.I.E.I., gives a fine history of fuzes from the earliest days to the present time. We quote as follows:

It seems to be a sine qua non that the ballistical progress reached in any age keeps just ahead of the requisite accuracy in fuze control.

The efficiency of a time fuze can only be guaranteed by an accurate method of measuring time and therefore the absence of reliable time recorders previous to the invention of the watch in 1674 did not conduce to much scientific attainment in this respect. Only subsequently to this great human achievement could progress in experience and knowledge become possible.

By the middle of the 18th century fuzes were made of beechwood, bored out and filled with powder, and cut to length according to the requisite time of burning. Bitter experience taught that there was, in practice, a limit below which it was not safe to cut the fuze; either a blind or a permature resulted.

The advantage a mechanical fuze offers is the abolition of most, if not all, of the difficulties inherent in the combustion

type. Physical and chemical factors disturb it not, age and climate almost pass it by. The mechanical time fuze has one outstanding merit; each individual fuze may be tested periodically for accurate time keeping without in the least destroying its usefulness. This is practically proof without destruction.

The disadvantages of mechanical fuzes are:

(1) Their present high cost of manufacture.

(2) Their possible loss of spring tension during storage. This is a point upon which a definite opinion cannot yet be pronounced. The Germans claimed to have experienced no loss of tension after ten years, and their mechanical time fuzes are certainly extraordinarily good. Should it be found that the clockwork develops a tendency towards unreliability after long storage, especially in bad climates, they may perhaps prove no better in the long run than the combustion type.

(3) A high rate of spin affects their mechanism to a certain extent.

(4) They may possibly suffer deformation in high velocity guns, but again no verdict can be definitely pronounced.

As the time to burst, after the fuze has been armed, is practically independent of the spin except at very high rates, the design can be used with nearly all equipment provided the time of flight be known, even though the range-table does not include a scale for the actual fuze. This is the great advantage of having the setting a linear function of the time.

There have been six mechanical time fuzes approved up to date in the British Army though none have yet been issued for service.

The essence of the mechanical time fuze is its main spring, and unless that component is correctly made and tempered trouble and inaccuracy will result.

The problem of fuzes still looms large upon the horizon and the evolution of science has only opened up further vistas undreamed of by the gunner of old. These must be faced with resolution, energy and perseverance if the technical side of artillery is to keep pace with its tactical employment.

THE ARMY POLO TEAM IN ARGENTINA

BY COL. W. V. MORRIS, G.S., IN CHARGE OF TEAM.

THE recent visit of an Army Polo Team to Argentina is of special interest by reason of the fact that it was the first foreign polo team to visit that country and the first polo team from North America or Europe to visit any South American country.

The Army Polo Team for this year was assembled at the Army Polo Center, Mitchel Field, Long Island, for participation in the Junior Championship matches. It consisted of Captain C. A. Wilkinson, QMC (Cav.), Captain P. P. Rodes, 16th Field Artillery, 1st Lieut. M. McD. Jones, Cavalry, and 1st Lieut. H. W. Kiefer, Field Artillery, with Captain Don M. Scott, 18th Infantry, as substitute. Its winning of the Junior Championship by the following record scores is a matter of polo history: July 19—Army 15, Elkwood 2; July 24—Army 19, Greentree 7; July 26—Army 17, Whippany River 7.

Early in July an invitation from the Argentine Polo Association was received by the United States Polo Association for the visit of an Army Polo Team to Argentina. After approval by the War Department the invitation was accepted. With a view to strengthening it Major C. C. Smith, 14th Cavalry, was added to the team.

Prior to departure for Buenos Aires a number of practice games were played, the most important of which were as follows:

Aug. 19—Army 11, Goulborn (Ashton Brothers) 5;
Aug. 22—Army 12, Hurlingham (British Reserves) 6;
Aug. 29—Army 9, Hurlingham (British Reserves) 7;
Sept. 1—Army 10, Old Aiken 4.

The Army team lined up with Lieut. Jones at No. 1, Captain Wilkinson, (team captain) at No. 2, Capt. Rodes at No. 3, and Major Smith at back.

The team, with Lieut. H. W. Kiefer as substitute and Colonel W. V. Morris in charge sailed from New York, September 12. Horse equipment was taken, but no mounts, as the arrangement with the Argentine Polo Association provided for ponies to be furnished by them.

On arrival at Rio de Janeiro, Brazil, on September 25th, the party was met by Captain E. C. Fleming, Field Artillery, Military Attaché, at Buenos Aires, who had come to Rio for that purpose and by members of our Naval Mission to Brazil. A very enjoyable day was spent including a trip to the top of the celebrated Sugar Loaf by aerial cable car and a visit to the Polo and Golf Club. A few of the unusual things learned and observed here were that men without coats are not permitted to ride on first-class street cars, that Rio is the cleanest city and its harbor the most beautiful that the members of the party had ever seen. The beautiful Avenida Rio Branco with its broad pavements of black and white mosaics in intricate patterns has to be seen to be appreciated.

Arriving the next morning at Santos, the great coffee port, the party motored about 50 miles over a most picturesque route, resembling the Bagiuo road in its steep and long ascent, to Sao Paulo the headquarters of the coffee industry of Brazil and a finely built, enterprising city of 585,000 people. Sao Paulo resembles a North American city more than any other of those we visited in South America. While Rio is the political capital, Sao Paulo is the economic and financial center of Brazil.

The members of the party were the guests here of the officials of General Motors Company who had generously furnished cars for the trip from Santos, as they had also done for our stay in Rio. While at Sao Paulo we visited the Polo Club and the celebrated snake farm of Butantan.

The police force of Sao Paulo is said to be the best and neatest uniformed and the most polite of any in the world.

We returned to Santos over a railroad (partially cable) that is a marvel of engineering skill, most of a drop of 3,000 feet being made within six miles and reputed to be the best equipped and most profitable railroad in the world. All profits in excess of fifteen per cent are required to be turned over to the Government, consequently much is spent on equipment. It is said that the only way to improve this road would be to gold plate the rails and gild the telegraph poles.

After a short stop at Montevideo we arrived at Buenos Aires,

September 30, where the party was met by a reception committee consisting of officials of the polo association, officers from the Ministry of War and the Cavalry School, and many others, some forty in all.

On October 3 the team visited the Los Nanduces Polo Club, about thirty kilometers from the city, which was to be its polo headquarters for the first month of its stay. Here it was received by the officials of the club and after a luncheon attended by forty-five polo enthusiasts all proceeded to the stables to inspect 48 Argentine polo ponies with their Gaucho attendants.

The ponies which were in charge of Mr. Ernest Grant, a fine horseman and trainer, were available through the generosity of some twenty-three Argentine sportsmen and polo players who were kind enough to place them at our disposal. On the day of our visit a practice game resulting in a score of 12 to 3 in our favor was played against a cut-in team of 14 to 15 goals handicap.

While the club had provided comfortable sleeping accommodations for six with a very good mess, a number of considerations, especially the many functions given for us in the city, made it desirable for members of the team to habitually live in Buenos Aires and go to Los Manduces by automobile or train for practice games and working ponies.

While the visit of Argentine polo teams to the United States had made us acquainted with the quality of polo played there, the extent to which the game was played was not realized. It was a surprise to learn that there are fifty-four active polo clubs in the country, and the interest in polo is increasing every year. It is also not generally known that polo was introduced into Argentina in 1875, one year before it was introduced into this country.

On October 7 was played the first real practice game against a cut-in 13 to 14 goal team. We won 12 to 2.

On October 9 a practice game at Las Tortugas Polo Club against a cut-in 14 to 16 goal team was not so good. Final score was 13 to 11 in our favor.

On October 11 in a practice game against a similar team at Los Indios Polo Club, we won by score of 13 to 4.

Other practice games on October 16th and 18th against low goal teams were won easily.

On October 21 at Los Tortugas our team had its first real test against Santa Ines, a 20-goal team. We won 8 to 5.

On October 27 was held our last practice game at Los Nanduces against a 11-goal team which we won 19 to 3.

Throughout practice games the team labored under the disadvantage of having no high goal teams against which to play. This was due to the presence of all the strong teams at the tournaments at Hurlingham, the big Polo and Country Club of Argentina. Our team was not entered in any of these tournaments and it is perhaps just as well, for the ponies were not ready for tournament polo, many of them being in need of considerable conditioning. For this reason the practice games against low goal teams were also probably a good thing.

On October 28 the ponies were brought in to Buenos Aires by road and lodged at the stables of the Live Stock Association, in readiness for the beginning of the Open Championship on November 1.

During this month's practice and conditioning of ponies the members of the party were well occupied with many official and social functions, Ambassador and Mrs. Robert Woods Bliss taking the lead in this respect with a luncheon in our honor on October 1.

Upon our arrival we had been informed that the principal clubs in the city, about eighteen, and a number of polo clubs, had either made us honorary members or had extended privileges for the duration of our stay. Soon after our arrival the team was received by Lieut. General Jose Francisco Uriburu, the President of the Republic, and by Major General Francisco Medina, the Minister of War.

Outstanding among the many semi-official and social functions attended were a luncheon by the Minister of War, a banquet given by the Circulo Militar and attended by about 100 officers and civilians, an outdoor luncheon by the Los Indios

Polo Club to about 65 guests, on which occasion a club membership medal was presented each member of the team, a reception and tea dance by Ambassador and Mrs. Bliss at the American Club, a dinner dance by the American Club, and a polo dinner at the Hurlingham Club.

On October 12 the party was privileged to witness from the official stand a parade through the streets of Buenos Aires of about 12,000 troops including the cadets of the Military and Naval Colleges, in honor of El Dia de la Raza (The Day of the Race). It was an interesting demonstration of well uniformed and equipped and excellently marching soldiers of all arms. At night the members of the party were guests of the Minister of War at a gala opera performance at the Teatro Colon.

An interesting event was our visit to Chapadmalal, a celebrated "estancia" 250 miles south of Buenos Aires. Through the kindness of the Minister of War a private car was placed at the disposal of the party for the railway trip. Chapadmala is owned by Mr. Miguel A. Martinez de Hoz, a well-known breeder of thoroughbred horses and cattle, and a fine gentleman of the old school. The party arrived on the morning of October 25 and spent a most enjoyable day there. Chapadmalal is a "show" place and has been visited by President Hoover, the Prince of Wales, General Pershing and other celebrities.

The visit to the Military College on October 30 was also an interesting occasion. After luncheon the entire afternoon was devoted to a tour of the college under the guidance of Colonel Francisco Reynolds, the Commandant, and witnessing special exercises held in honor of the party, culminating in the ceremonies of "Escort of the Color" and "Evening Parade".

Going back to polo the teams entered in the Open Championships were as follows:

SANTA INES			HURLINGHAM		
1 Daniel Kearney	6		1 Luis T. Nelson	5	
2 Andres Gaznotti	5		2 Luis Duggan	4	
3 Fermin Ramos	4		3 Leonardo Lacey	4	
4 Juan Kearney	5	20	4 Luis L. Lacey	10	23

LAS ROSAS		
1 Juan B. Miles	8	
2 Mauricio Kenny	4	
3 David B. Miles	7	
4 Carlos N. Land	6	25

LOS INDIOS		
1 Damase Del Campo	4	
2 Audilio Bonadeo Ayrolo	4	
3 Jose Luis Giribone	4	
4 Juan Carlos Giribone	4	

U. S. ARMY		
1 Lt. Morton McD. Jones	5	
2 Capt. C. A. Wilkinson	5	
3 Capt. Peter P. Rodes	6	
4 Major Charles C. Smith	5	21

LOS PINGUINOS		
1 Oscar Braun Menendez	3	
2 Alejandro Braun Menendez	4	
3 Carlos Braun Menendez	5	
4 E. Braun Menendez	4	16

VENADO TUERTO		
1 Tomas Moore	4	
2 Roberto H. Lambert	4	
3 Arturo Kenny	6	
4 Diego Cavanagh	6	20

SANTA PAULA		
1 Alfredo Harrington	6	
2 Juan C. Reynal	6	
3 Jose Reynal	8	
4 Manuel Andrada	8	28

HURLINGHAM B.		
1 Alfredo Benitz	4	
2 Luis T. Nelson	5	
3 Carlos Uranga	4	
4 Vicente Kenny	4	17

The results of the various games are given below:

Nov. 1—U. S. Army won from Los Pinguinos	13-5
Nov. 2—Santa Paula won from Venado Tuerto	19-7
Nov. 3—Hurlingham B won from Los Indios	9-8
Nov. 3—Santa Ines won from Hurlingham A	Default
Nov. 7—Las Rosas won from Hurlingham B	17-2
Nov. 8—Santa Paula won from Santa Ines	8-5
Nov. 9—U. S. Army won from Las Rosas	8-4
Nov. 11—Santa Paula won from U. S. Army	9-8

Games in Argentina are seven periods of 8 minutes each. These games were played on the Military polo fields in the Palermo District of Buenos Aires and opposite the celebrated Hippodrome of the Jockey Club. The fields were excellent.

The Pinguinos team against which we played in our first game, November 1, is composed of four brothers, with three other polo playing brothers available as substitutes. One of them, Armando Braun Menendez, went in when Alejandro was painfully injured in the third period by his horse's falling and rolling on him. This team was regarded as being about as well mounted as any in the tournament and as its rating was 16 goals, the score of 13 to 5 in our favor was very satisfactory.

Our second game which we won 8 to 4 against Los Rosas, a 25-goal team, with three players of international reputation, was remarkable in that our opponents earned but one goal, three of the four having been made from free shots from the 40-yard line as penalties for fouls called against members of our team.

The final of the Open Championship was played against Santa Paulo, a 28-goal team, on November 11 and was won by the latter by a score of 9 to 8. This is the same team that visited California last winter and departed with a clean score of victories.

In the fifth period the score was 8 to 3 in our favor but three free shots from the 40-yard line in the next two and a fraction periods, added to three earned goals without our scoring, enabled Santa Paula to win.

President Uriburu attended this game and Mrs. Robert Woods Bliss presented the trophies.

For the series of games with a team representing the Argentine Army, Ambassador Bliss offered a very handsome cup as a permanent trophy to be contested for each year or as often as possible by teams representing the United States and the Argentine Armies.

Our first match against the Argentine Army team which we won by a score of 10 to 7 was played November 15th. The line-up of the Argentine team was as follows:

No.	1—Sub. Lt. Matias Casares	3
	2—Capt. Juan Carlos Balbastro	3
	3—1st Lt. Pedro Cremona	4
Back	—1st Lt. Manuel G. Molinuevo	5
		—
		15

In the 6th period, Captain Balbastro suffered a fractured hand as a result of a blow by a mallet and had to withdraw, his place being taken by 1st Lieut. Alberto Paz.

On the morning of November 18 the party attended the graduating exercises at the Military College and in the afternoon played the final of the Military Matches which we won by a score of 16 to 1. Our team struck its stride at once and dominated the play from start to finish. Its hitting, passing and team play were excellent.

The trophy and individual cups were presented by President Uribru.

In these military matches, as in the others, the best of feeling existed between the two rival teams on and off the field. The military matches in this respect were somewhat like a match

between two squadrons of the same regiment, and the rival players almost walked off arm in arm.

The attendance at all games in which our Army team took part was exceptionally large—from 10,000 to 12,000. Ambassador and Mrs. Robert Woods Bliss attended all of our games as also did General Medina, the Minister of War. The President of the Republic attended the final game of the open championship and both of the military matches.

On the night of November 18 after the last military match the Polo Association gave its annual polo dinner to about 100 guests and at which the members of our team were guests of honor. This was a very enjoyable occasion.

On November 21 we gave a banquet to about 100 guests. The Minister of War was the guest of honor.

Lieut. Kiefer having left on November 9 and Major Smith and Captain Rodes on November 21, the balance of the party left Buenos Aires on November 23 by train, crossing the Argentine Pampas and the Andes to Santiago, Chile, where we were most hospitably received by the Army and officials of the Chilean Polo Association. An enjoyable two days was spent at Santiago and Vina del Mar including visits to two Cavalry regiments and one Field Artillery regiment and a dinner at the Cavalry School. The party sailed from Valparaiso on November 26, regretting that more time could not be spent with our Chilean friends.

Fourteen Peruvian Army officers of grades from Colonel to Major embarked at Mollendo, Peru, enroute to Lima from Arequipa, where they had been on temporary duty. Among them was Major Erasmo Reyna who had taken a course at the Massachusetts Institute of Technology and later at the Engineer School at Fort Humphries. These Peruvian officers were our guests at a social function before dinner and they reciprocated by having us as their guests before luncheon the next day. By the time we arrived at Callao, the "entente cordiale" was an established fact.

From the arrival of the team in Buenos Aires until its departure nearly two months later, everyone, including the President

of the Republic and members of the Government, appeared to be actuated by the desire to make our visit as pleasant and agreeable as possible. Through our close association with officers of the Army and those interested in polo, many valued friendships were made and it was with much regret that we said farewell to the hospitable people of Argentina.

In the interests of international understanding and friendship it is hoped that arrangements can be made for an interchange of visits by Army polo teams between Argentina and the United States as contemplated by Ambassador Robert Woods Bliss in his offering of a permanent trophy.