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APRIL-JUNE

**THE
FIELD ARTILLERY
JOURNAL**

EDITED BY

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**THE UNITED STATES FIELD ARTILLERY ASSOCIATION
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A DETACHMENT OF BRITISH TRENCH ARTILLERY

THE FIELD ARTILLERY JOURNAL

VOL. VII

APRIL-JUNE, 1917

NO. 2

Fontainebleau in War Time

LESSONS FROM THE FRENCH SCHOOL OF FIRE

BY COLONEL HENRY J. REILLY, 1ST ILLINOIS FIELD ARTILLERY¹

THE French believe so thoroughly in the school system that they have not only kept open all of their regular schools, but have established many new ones, principally just in rear of the armies in the field. The old schools, such as the one for artillery at Fontainebleau, have been considerably enlarged. In peace time Fontainebleau turned out about two hundred officers each year. In the two years and ten months of the war it has given to the arm which it represents ten thousand graduates.

The instructors are selected with great care from the officers at the front. They remain at the school, generally not more than three to four months, and then return to the front. In this way continual touch with all the latest developments on the line of contact is maintained. This is of the greatest importance, because new methods and new matériel are continually being introduced. Only a few officers, physically incapacitated, remain permanently at the school, and they are engaged in research work.

Anyone acquainted with French insignia can tell immediately on coming in contact with the officers that they are all veterans. Aside from the fact that many of them have the Croix de Guerre for bravery in battle, a considerable number

¹ Since the beginning of the war Colonel Reilly has been in Europe one and one-half years. He has had numerous trips to the various fronts as an American ambulance driver, and as a correspondent for the *Chicago Tribune* and *New York Herald*. The scope of this article is necessarily limited by the fact that details as to the organization of troops and the technique of fire are, at this time, regarded as confidential.

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have one or more gold chevrons on the right arm, each one of which indicates a wound received in action. They all have the gold chevrons on the left arm which indicate active service since the beginning of the war.

Though all French artillery officers belong to one corps, they specialize in different branches. Their artillery now consists of trench, light field, heavy field, anti-aircraft, and coast artillery. At Fontainebleau each officer instructs in detail pertaining to the branch in which he has been serving at the front. This not only insures the instruction being up to date, but also makes it more interesting, because all points made are supported by examples furnished in the battle experience of the instructor.

The pupils, who, at any one time, number about twenty-five hundred, come under one of the following classes:

- (a) The aspirant, or young student officer who has come from the Ecole Polytechnique.
- (b) Artillery noncommissioned officers recommended for commissions.
- (c) Cavalry officers who are preparing to transfer to the Artillery.

The noncommissioned officers have a ten-weeks' course; the others attend for three months. Like the instructors, all the students, with the exception of the aspirants, show, by their decorations and insignia, that they have had active service at the front, and, in many cases, have been wounded or have gained recognition for valor, or both.

The instruction is both theoretical and practical and includes, in addition to the work in the actual handling of the guns and control of fire of the various calibres, instruction in wireless, electricity, motors, ammunition of all types, with particular attention being paid to fuzes, topography, enemy matériel, and horsemanship. The school is kept supplied with all models of matériel, including those of latest manufacture, in sufficient quantities to facilitate instruction.

The target range is kept busy practically all day long and every day. At the far end are targets representing every object

FONTAINEBLEAU IN WAR TIME

on which artillery is obliged to fire in the field, except aircraft; there are trenches, hay-stacks, church steeples, houses, and various kinds of emplacements. Other than the trenches and emplacements, these targets are made of wood. In front of the trenches used for targets friendly trenches are constructed.

It is customary to fire a number of pieces at the same time, each piece having its fire regulated independently of the others by a different group of student observers stationed at some observation point just to the side of the range, or in the friendly trenches, in the same manner as would be done at the front. All of this regulation of fire is done by telephone, with the observers, as a rule, nearer the targets than to the guns. Fire is not interrupted nor postponed because of bad weather conditions. No one pays any attention whatsoever to being fired over, any more than would be the case at the front, which is not at all.

Firing data are primarily obtained from a map. A system of rectangular coördinates, based on a central point about one hundred kilometres north of a given location, is used to determine all places. By means of a protractor, the base of which is divided into units of the metric system, and the circumference of which is divided into mils for the light field artillery and decigrades² for the heavy field artillery, points are quickly located, angles read and distances determined.

Great attention is paid to accuracy. Corrections are made for barometric pressure, wind, and temperature. The students are also taught that the powder lots, projectile lots, and fuze lots must be taken into consideration. For barrage fire, the guns are laid for elevation by means of a quadrant placed on the breech.

The lessons of the field are brought into the school. Some of the points emphasized are outlined herein.

The closest liaison with the infantry is insisted upon. Every colonel of infantry has with him a lieutenant of the field artillery battalion which furnishes the barrage fire for his regiment. Every infantry battalion commander has a noncommissioned

² 4000 decigrades = 360°.

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officer from the battery which furnishes his barrage. The infantry and artillery are continually in close touch with each other, ordinarily by telephone. When the wires are cut, they keep in touch by means of messengers or airplanes. Visual signalling, while sometimes attempted, is not, as a rule, found effective. The great difficulty with liaison by airplane is for the infantry to communicate with the airplane itself. All artillery battalion and regimental headquarters are supplied with wireless receiving sets with which to receive messages from the airplanes. They send messages by means of pieces of cloth arranged in various ways on the ground.

The light field batteries respond immediately to any demand of the infantry for fire by day or night. The demand is made by telephone or by signal rockets. For example: if the enemy trench mortars become too obnoxious to the infantry, they will ask for what is called a fire of concentration. Immediately the batteries concerned will smother the district where the enemy trench mortars are with a number of shells. If a sentinel in the front line sees, or thinks he sees, the enemy infantry leaving their trenches, he sends up the rocket agreed upon and the batteries immediately respond with barrage fire. They then call up and ask if it is really necessary. The pieces are always left laid for barrage fire. As this fire is by piece, the gun crews commence firing immediately upon the signal being given, without waiting for command or for each other.

One of the principles most insisted upon is the prompt exploitation of any opportunity which presents itself for artillery fire. This means the most careful preparation of firing data for all possible cases which may arise; the most careful, continuous observation of all enemy territory, and the most perfect liaison between the observation stations and the batteries. This, so that immediately upon any target appearing it can be promptly and effectively fired upon.

The greatest attention is paid to concealment from view of the enemy. It is absolutely essential that no battery be seen approaching its position or going into action. When gun pits

FONTAINEBLEAU IN WAR TIME

are dug, the first step is to cover the working party with painted canvas or with chicken-wire fence with grass fastened to it, so that they may not be seen from above while working. The airplane is the bane of the existence of the artillery. The slightest movement may betray the position of a battery, with the inevitable result that the enemy will fire on it with guns, as a rule of heavier calibre. Cases have been known where the white faces of men looking up have come out in the photographs taken from a reconnoitering airplane. The position of many a battery has been disclosed by the fact that airplane photographs showed paths converging at a certain point. All personnel and carriages coming to a battery should be made to approach from one flank and leave by the other, so that there will be no convergence of paths or roads at the battery itself. The blast from the guns marks the ground, particularly when covered by snow, in a way which shows to a marked degree in aerial photographs. For this reason branches of trees or brush should be kept on the ground in front of the muzzle.

The artillery has now reached such a position of importance that successful attack or defense is impossible without it. However, its usefulness depends entirely upon its accuracy. Infantry officers do not hesitate to say that infantry should not leave its trenches until the artillery preparation has really smashed all targets, and, above all, the machine-gun emplacements. Also, the infantry can advance only as far as their artillery can escort them with fire. This fire, to be of any real value, must be so accurately delivered that the attacking infantry can keep close enough to it to get into the enemy's trenches before the hostile infantry has time to get out of the bomb-proofs and to receive them with rifle, portable machine-gun, and hand-grenade fire. The necessary accuracy can be obtained only by thoroughly trained gun crews and observers working under competent officers.

The French are of the opinion that the proper supply of competent officers can be obtained only by a thorough system of schooling carried on in rear of the army.

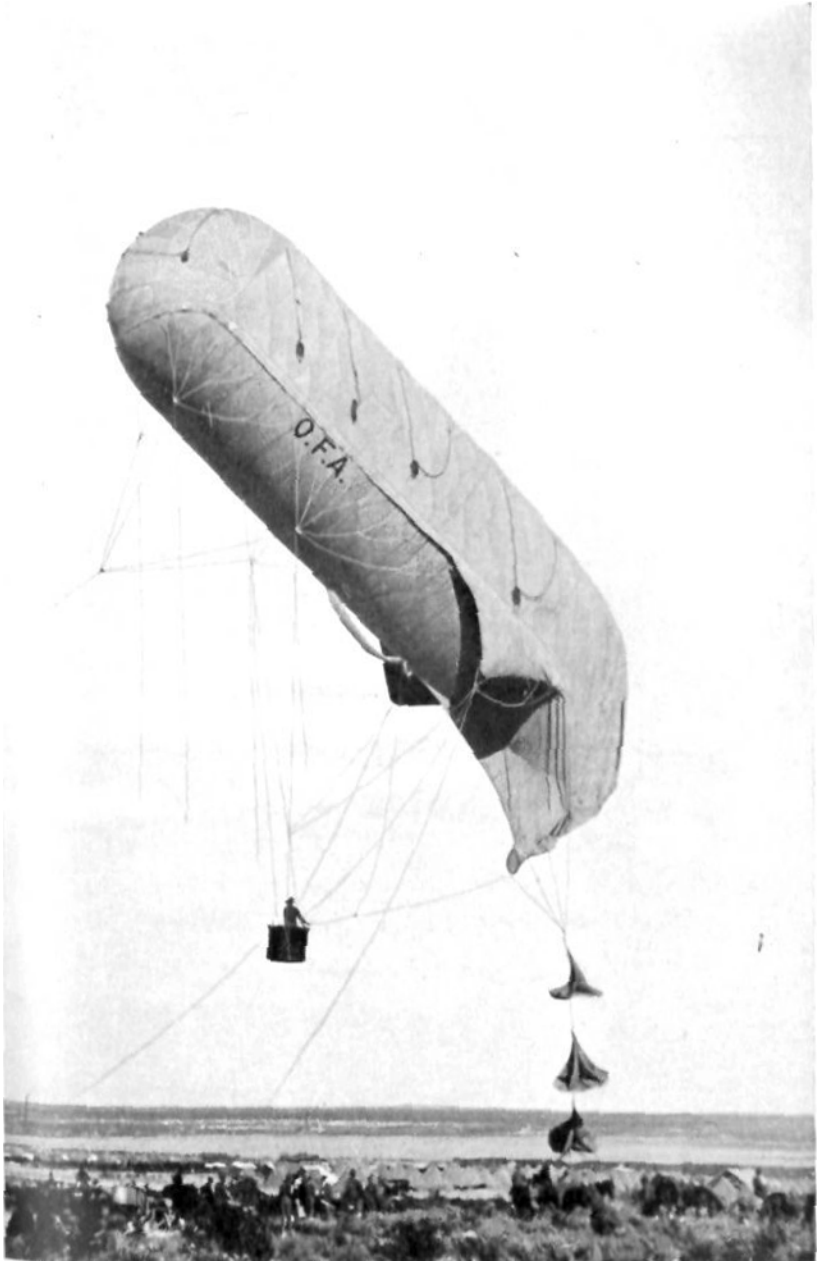
Observation Balloons for Field Artillery

Experiments at El Paso, Texas

BY CAPTAIN CLARENCE DEEMS, JR., U. S. FIELD ARTILLERY

EARLY in the fall of 1916 it was my fortune to receive orders to proceed to the border for temporary duty at El Paso, Texas. On approaching Fort Bliss from the north by train, the Pullman porter announced, "Befo' long we pass the Ahmy Camp where they mus' have a thousan' sojers—take a look, Boss." I did. The train passed acres of tents which at first interested me, knowing that this was to be my new "home"; but what demanded my undivided attention, from the moment I first saw it, was a straw-colored, cylindrical object, rounded at each end, which was at a considerable altitude, and seemed to be floating in the air at the approximate height of the lower peaks of the Franklin Mountains. It was an aircraft, but whether captive or dirigible I could not ascertain at that distance. While I knew that the mobilization of our troops, followed by their concentration on the Mexican border, had wrought wonders for our little army by obtaining for it motor transportation and some 'planes, the fact that we had such balloons was news to me, hence my particular interest.

An officer of the Michigan state troops courteously drove me in his machine from El Paso the six miles out to camp; on our approach to it I could see this balloon again, rising above the sea of tents and riding very steadily. It was evidently not a dirigible but a captive balloon, from the body of which swung a basket, and in that basket was some one in khaki. I questioned my guide and was informed, in effect, that, this being Sunday, Lieutenant Babbitt, of the Ohio Field Artillery, was working with the observation balloon belonging to this battalion. As I got nearer, in big letters of black on the under surface of the envelope I could read "O. F. A." Here, I thought, was



GOODYEAR KITE BALLOON JUST LEAVING THE GROUND

OBSERVATION BALLOONS FOR FIELD ARTILLERY

surely a progressive state and one that equipped its field artillery with the accessories that the warring European powers have found so necessary. But in this assumption I was wrong. Not by any state nor by the Federal Government had this artillery auxiliary been supplied; but, instead, it had been furnished through the courtesy, goodwill, and patriotic consideration of the Goodyear Tire and Rubber Company, of Akron, Ohio. That the battalion of field artillery from their state might be as well prepared in artillery accessories as their assistance could procure, they donated this observation balloon from private resources.

Shortly after arrival in camp I met Lieutenant Babbitt and the officers of the Ohio battalion again and resumed the pleasant relationship which had always existed during the preceding year or so while on duty with these troops as inspector-instructor. To his courtesy and willingness to give information I feel that I am indebted for most of the knowledge that I have been able to gather respecting technical details and the probable field artillery use to which such matériel may be advantageously put, and, through the same kind qualities, I was promised a trip in the air at the very first opportunity, which it was my very good fortune to secure.

It seems that Sergeant R. H. Upson, of Battery B of the Ohio Field Artillery, had initiated much pertaining to the handling and care of the balloon, and, naturally so, since in his capacity as an expert he had been abroad recently and visited foreign armies, where such balloons are in daily use, and where he had added materially to his fund of useful aerial military information. But, at this time, he had already left the border and was engaged elsewhere in aeronautics.

It developed that, due to the system of intensive training inaugurated for the National Guard troops on the border, there was no real time to devote to the balloon (since it was not an authorized unit) and to drill and train men and officers in its quick, efficient, and technical use; so only in spare moments (more particularly on Sunday afternoons) Lieutenant Babbitt

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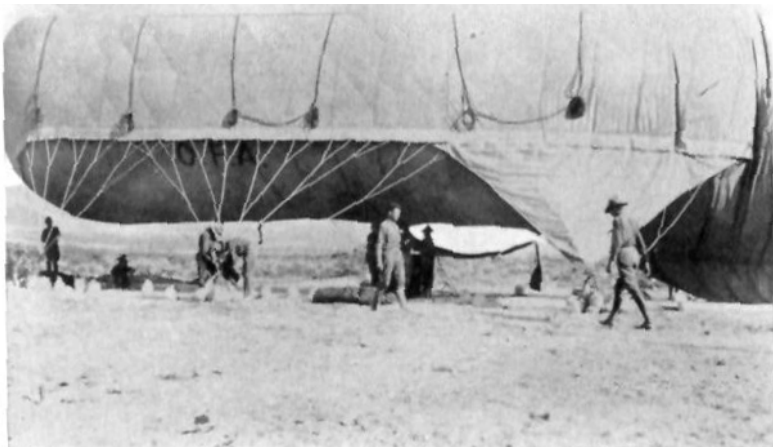
and a faithful detail of assistants would keep at work, caring for, experimenting with, and making frequent ascensions in the balloon.

This continued until about the 25th of October, when a storm wrecked the inflated balloon at its anchorage and put a stop to further procedure. As the life of such an envelope in daily use is comparatively short—say six months—it had been planned that, when the balloon became unsafe for ascensions, to then use it as a target at service practice, with a view to adding to the practical experience of the battery commanders. But no such opportunity developed. Target practice, an epidemic of inspections, and other disturbing features prevented aerial flights being taken up again. It would have been possible to patch up the envelope, but the filling of the balloon was surrounded with great inconvenience. The gas was obtained at El Paso, some six or seven miles away, and ordinarily brought up (for refilling) on a truck in a smaller gas-bag. The matter of obtaining transportation for the fresh charges of gas was attended with considerable difficulty. No funds were available for hiring it, and government transportation was unobtainable. To safely and conveniently inflate the balloon after repair would have practically necessitated having it filled in El Paso and towed by truck to the place of use. Then, too, the season of the year, with its storms, militated against safety. All these reasons, as well as other minor ones, indicated it to be better policy to defer further use of the balloon, and, much to the regret of all interested, the work was temporarily laid aside.

Necessity dictated a very poor place from which to conduct aeronautic experiments. For reasons of convenience, guard, and so on, the balloon was required to be kept in the immediate vicinity of camp. The camp-grounds were originally, in themselves, a forbidding bit of desert, boasting a crop of stones upon which were bunched patches of Texas vegetation, on the end of every leaf of which was a sharp thorn, ready to puncture anything that was not armor-plated. A fragile thing, such as a balloon, must of necessity be handled with care; so a patch of



SHOWING HOW THE BALLOON WAS ANCHORED WHEN NOT IN USE



PREPARING FOR AN ASCENSION

OBSERVATION BALLOONS FOR FIELD ARTILLERY

this land had been cleared off, and, upon a large canvas laid upon the ground, the partially inflated balloon was kept closely anchored when not in use.

For another reason the locality would have been ill-chosen had selection of the same been realized in these experiments. To begin with, the altitude (4000 feet) is such that the buoyancy of the aircraft is considerably reduced. Again, the camp is a mile or two east of the bottom slopes of the Franklin Mountains. Down these mountains draughts of air rush without warning, sometimes with great force, just as the squalls and thunderstorms race through the Highlands of the Hudson in the summer. A location out on the mesa a few miles to the east would have been very much more advantageous and perhaps would have meant missing the storm which produced a wreck and disappointment.

The type of balloon employed is what is known as a "kite" balloon, and is adopted because of its tendency to be steady and remain approximately at the same altitude. An observation balloon consisting of a spherical envelope filled with gas and attached to the ground by a cable of fixed length would, with each puff of wind differing in intensity, be blown varying distances toward the ground, thus making observation difficult and exposing the occupant of the basket to sea-sickness. A kite, properly adjusted, on the contrary, tends to rise higher with each increase of wind pressure. If, as in this case, the balloon be so constructed that the wind acting on its under surface produces an upward, or lifting, component at the same time that the pressure elsewhere tends to push it down toward the ground, a more or less stable state of the equilibrium of wind forces ensues, resulting in the neutralization of the vertical oscillation and obtaining thereby a reasonably steady platform from which to secure distant observation. To further assist in steadying the balloon, fins are attached thereto. To act as a brake on sudden movements, a string of large canvas tailcups depends from the end of the envelope farthest from the wind, and performs the same function as the tail of a kite. The kite

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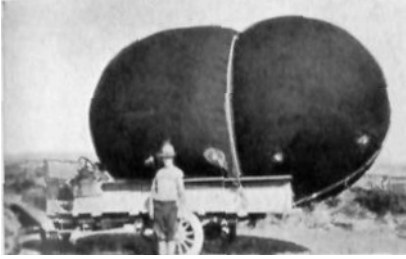
essentials extend still farther. As the small boy can alter the height at which his kite will ride by adjustments of the "bellyband," so the observer, to some extent, by shifting the position of the weight in the basket, may cause the balloon to rise somewhat higher or lower. Hence we see that this is well named a "kite" balloon.

This balloon is 82 feet long and 22 feet in diameter, having a capacity of 25,000 cubic feet, which is the volume of gas necessary to fill it. At this altitude (4000 feet) about 300 cubic feet of gas daily has been needed to keep it completely inflated. Due to the fact that high winds are almost constantly blowing in this locality, the daily gas renewal needed is probably considerably above normal. But, even then, when the extent of envelope surface of this aircraft is considered, the diffusion is in reality very small, for it amounts only to that leakage which would ensue through a 1/16-inch circular aperture, assuming the fabric to be totally impervious to the passage of gas contained therein.

Through the courtesy of the El Paso Refining Company the hydrogen for filling the balloon was secured, since in this case it is a by-product obtained from the manufacture of oxygen by the electrolytic method; and, further, this firm cheerfully furnished the gas whenever called for.

The balloon was originally filled at its plant, then pulled out to camp, and there the supply of gas was replenished as needed by means of a small balloon or container having a capacity of 600 cubic feet. This small balloon was transported on a Ford truck furnished by private enterprise, since no government trucks were available for this purpose. The gas is usually sold and transported in tanks at a pressure of 150 atmospheres. Purchased in this manner, the cost of transportation becomes the principal item, as the gas is usually a byproduct and firms are glad to be able, therefore, to get a nominal price for it. These tanks are made in different sizes, but the larger ones are best adapted for this use, weigh some 300 pounds, are about 20 inches in diameter and 5 feet long.

SHOWING METHOD OF KEEPING "KITE" BALLOON INFLATED



EVERY DAY OR TWO A SMALL CONTAINER BROUGHT 600 CUBIC FEET OF HYDROGEN FOR REFILLING



THIS WAS LIFTED FROM THE TRUCK AND PLACED OPPOSITE THE MIDDLE OF THE BALLOON



TO WHICH IT WAS ATTACHED BY A PIPE AND THEN THE GAS FORCED INTO THE BALLOON



THIS SHOWS THE CONNECTING PIPE NEAR THE LEG OF THE MAN IN THE MIDDLE OF THE PICTURE

OBSERVATION BALLOONS FOR FIELD ARTILLERY

This balloon was designed for two observers, and at Cleveland, Ohio, made several ascensions with three, but here (due to the altitude) it would not operate successfully for more than a single person. Lieutenant Babbitt (of light physique) alone was able to reach an altitude of 3700 feet above this level, and, had the wind pressure been greater, would have been able to go higher.

The cable used was 5000 feet in length, $\frac{1}{4}$ inch in diameter, and was about 500 pounds in weight. It was operated on a hoisting windlass which was direct-connected to a Ford automobile engine, the cable being run through a block fastened to the ground. In this manner the balloon was quickly raised and lowered.

To maintain the balloon at rest when inflated and not in use, sand-bag anchors are used. They weigh about 40 pounds apiece when filled. The night the balloon was wrecked it was held in place by one hundred of these bags and eight $\frac{1}{2}$ -inch guy ropes. This accident was caused by a wind blowing about sixty miles an hour, which resulted in a half a dozen rips in the envelope.

The balloon was originally designed for a thirty-mile wind, but it has been used in a forty-mile wind without its occupant experiencing any discomfort after reaching an altitude here of 2400 feet. Balloons for military use, it is believed, should be designed to comfortably stand a wind pressure of fifty miles an hour.

The balloon and its equipment do not require very much transportation. The weights are approximately as follows:

Balloon	600 pounds.
Basket and tail cups	80 pounds
Cable	500 pounds
Windlass	550 pounds

There is considerable room for improvement in the construction and weight of the windlass used. It is probable that the weight of the latter could be cut to 350 pounds.

The stress on the cable is not as great as might be expected from the kite action of the balloon. In a thirty-mile wind the pull is about 800 pounds.

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There are two principal parts to the balloon, the balloon proper and the ballonet. The latter is contained in the rear end of the envelope, and it encloses air under pressure. It is separated from the gas-bag by a diaphragm; or, rather, extending from the diaphragm to the rear, there is one balloon inside of another. When the balloon is filled with gas the diaphragm is pushed so far to the rear that there is no air in the ballonet. When the gas in the balloon proper contracts, air enters the ballonet through a funnel in the bottom of the vertical tail fin. The ballonet, when entirely filled, contains some 5000 cubic feet of air. While air can enter through the funnel in the rear fin, it cannot escape by the same route. In the bottom of the ballonet and envelope, above the fin, is an air safety-valve, which operates to release the pressure by the escape of air from the ballonet as the gas in the envelope expands. The function of the ballonet, therefore, is largely to keep the balloon in its proper shape and not permit it to lose its inflation to such a degree as to flap in the wind when lower temperature or greater pressure causes a contraction of the gas in the main envelope. About 1000 cubic feet of air should be left in the ballonet for each 1000 feet of altitude to be attained, as this allows for the expansion of the gas when the pressure is reduced at the higher altitudes.

Fastened to either extremity of the balloon, and running from end to end on the inside, is a cord which operates the safety-valve in the nose. When the gas expands too much, the lengthening of the diaphragm and balloon fabric to a position approximating maximum safe limits causes the cord to become tight and then to pull upon and open the safety-valve.

It was found that the operation of the tailcups was so satisfactory in a twenty-mile wind that excellent observation through field-glasses could be maintained in the clear air of Texas. A type EE field-glass disclosed a single man, mounted, from an elevation of 3000 feet and at a distance of 8000 yards from the balloon.

OBSERVATION BALLOONS FOR FIELD ARTILLERY

It is believed that, for experimental purposes, and until such balloons are adopted for our Field Artillery, the following outline should be reasonable upon which to form a tactical detachment for handling this auxiliary unit. For each balloon:

Two officers, one who commands the balloon, with its personnel, and his assistant; both to act as observers, relieving each other when necessary. One officer to be in charge on the ground when the other is in the air.

One sergeant, rated as engineer, to act as such, with *one mechanic* as assistant in charge of truck, engine, winch, and cable, and able to make all repairs on the same.

One sergeant, a balloon chief, in charge of the laying out, inflation, and handling of the balloon. He should be able to make all necessary repairs on the balloon, basket, manœuvring ropes and accessories. *One corporal*, his assistant.

Two signal corporals, one to work on the ground and the other in the air, to telephone or telegraph from the observer to the ground, and especially trained in the transmission and computation of firing data. In addition, they should send and receive sketches *via* the cable and be able to make balloon artillery panoramic sketches.

Twenty privates, who manage the manœuvring ropes in making the ascensions and landings.

The number of men outlined above seems to be a minimum for field work, and more men would be needed, probably, in a wind greater than ten or fifteen miles an hour. These men should belong to the headquarters company of a regiment and be additional to that number now authorized. The other men belonging to the headquarters company should receive balloon instruction so that they might be called upon to assist in a high wind, or to furnish relief for the regular detachment.

It was found that the old type of field artillery telephone operated perfectly at 2200 feet above ground, the cable being the only (single) conductor used, the air under the basket acting as the dielectric of a condenser. The new telephone should give much better results.

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The observation balloon is needed as a valuable auxiliary to the field artillery. We must secure some without delay and train our officers in their use. Artillery officers should handle them. They should be an integral part of a regiment of field artillery. From them the conduct of fire (which will demand the highest kind of training in artillery fire technique) will be controlled, and upon difficult targets the fire will actually be conducted from them. This being the case, there should be an artillery section formed at our Balloon School; or, far better yet, since the facilities at Fort Sill at the School of Fire are so advantageous for the conduct and observation of fire, a plant for the operation of not less than two of these balloons, for the training of field artillery officers, should be maintained at that station. Graduates of the School of Fire, or those positively known to be expert in the conduct of fire, should be chosen as students in this course. When the School of Fire is in session a supplementary course in balloon instruction should be given such graduates who may elect aerial experience and within the limited number that can be profitably accommodated by this branch of our School.

As to whether or not there should be more than a single balloon equipment for each regiment remains to be considered. It would seem that very properly an additional set of equipment for each regiment, together with a few trained men, could be kept with the artillery ammunition section of the ammunition train, so that, if needed, a balloon for each battalion could be put in use.

The experience of the French seems to indicate that where observation balloons are so handled as to not disclose their resting place on the ground, and where they are kept a mile or two in rear of the line of contact and at an altitude of some 3000 or 4000 feet, they are comparatively safe from hostile field-gun fire, due largely to their gradually shifting positions and to their altitude. For protection from hostile 'planes our own 'planes should be sufficient security, assisted in permanent

OBSERVATION BALLOONS FOR FIELD ARTILLERY

positions by anti-aircraft guns posted near the ground attachment of the cable.

The balloon should be transported by truck, which should contain a generating set for the manufacture of gas by the electrolytic method. The winch should be run by power applied from the truck. Emergency tanks for quick use filled with compressed gas should be carried on the truck. For this purpose a gas compressor will be needed.

Ahead of us, in this new field, artillery officers will have many matters of design to engage their attention. It is believed that simple vertical base range finders can be invented, so arranged as to be operated at any vertical height that the observation balloon occupies. On the ground we make, under certain conditions, absolute corrections in site, deflection and corrector. In the air, with a proper instrument, we can determine the absolute amount a projectile falls short or over a given target. Conduct of fire maintained from a balloon will then permit absolute changes in all elements of fire except the corrector, for which a bracketing method must be used.

As usual, our greatest need is for trained officers. It is believed that the greatest good for our service at the present time along this line of development would be attained by sending a field officer and several captains of field artillery for some weeks to the Goodyear Company and other concerns which manufacture balloons, and, under the advice of their experts, have them study the manufacture of balloons; at the same time they should learn what they could of the operation of these balloons at the testing grounds. A selected officer from this group should be sent as observer with the Allied Army. Then, fortified with this experience, they should be utilized as instructors in artillery aeronautics at our own School of Fire. The field (for us) in the artillery is new; the opportunity is great. How long will it be before we may profit by the experience of other nations along this line? Let us hope that we can quickly develop and improve this auxiliary.

Care of Guns in Operations

DUE to intense fire during some actions, guns may be fired for a long time without interruption. The excessive heating produced results in premature wearing of bores and the burning out of some recoil mechanism joints. While volleys can be fired with the greatest rapidity possible, there should be intervals sufficient to avoid excessive heating. Cooling can be hastened by the use of water either thrown on the outside of the gun or, preferably, used in washing the bore.

PRECAUTIONS

a. A receptacle full of water must be kept at each piece during firing.

b. During each interval in firing, even for a few minutes, wash and grease the bore without causing smoke. At the end of the day, or during long interruptions but not during short ones, the breech mechanism must be dismantled and cleaned. During prolonged firing, pieces and even platoons may cease firing to permit cooling, cleaning, and greasing.

c. Grease the rotating bands freely, leaving a certain amount of grease on the forward edge of the band.

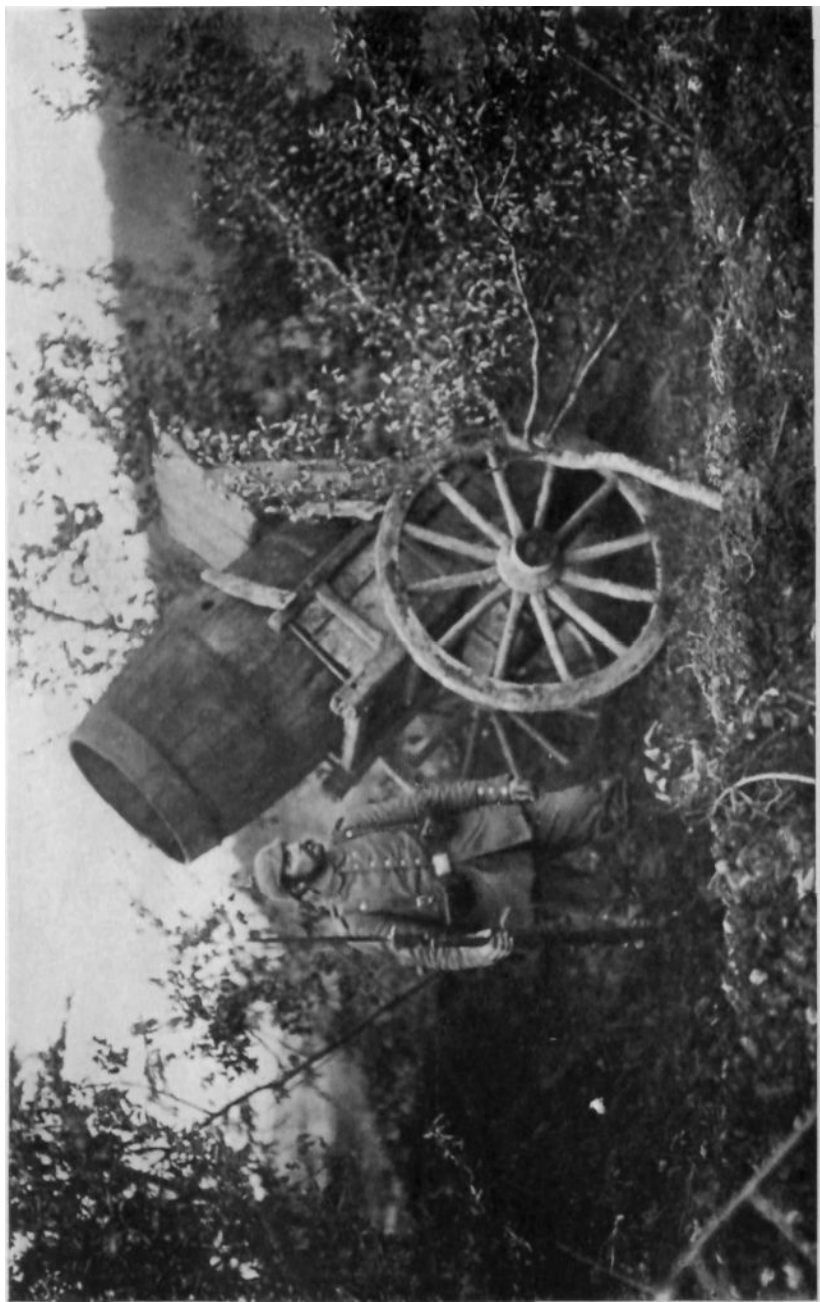
d. Whenever the rapidity of fire permits, make sure before each round that the bore is free from foreign bodies, such as pieces of cartridge cases or unburned powder.

e. If the fire has been intense enough to cause copper-fouling, remove the copper at the first opportunity.

After each day's firing the gun must be given a general examination. See whether any dangerous fault exists. Estimate the seriousness of each depreciation. Inform the proper authority. Make bold decisions and do not hesitate to keep the piece out of action provisionally, making report of the circumstances. The bore must be cleaned carefully with hot water



HOW THE ITALIANS LANDED MULES AT SALONIKI



DUMMY "42-CM." PLACED BY THE GERMANS IN THE ABGONNE FOREST

CARE OF GUNS IN OPERATIONS

and coal oil, if necessary, to remove caked grease in guns badly cared for. Examine both ends of the bore carefully. Provide light by candle, electric light, or sunlight reflected from white paper.

COMMON MANIFESTATIONS OF DETERIORATION

a. Erosion.—Large pitted areas close together in groups near the forcing cone or the beginning of the rifling. They are not dangerous unless they degenerate into fissures.

b. Indentations.—In the chamber and barrel recess, caused by rupture of cartridge cases and usually not deep or dangerous.

c. Fissures.—The beginnings of cracks in the tube appearing as fine lines usually parallel to the axis of the piece. Generally isolated and very deep. Differentiated from the scoring made by foreign bodies by their great depth. Rare, but very dangerous. Watch for deterioration of this nature that grows with further firing. Do not confuse with scars made by foreign bodies or tools.

d. Scars.—Made by hard bodies, they are frequent and may easily be mistaken for fissures. They are usually more continuous than fissures, long, shallow, and not necessarily parallel to the rifling. Not dangerous.

e. Scratches, Cuts and Dents.—Ordinarily caused by the presence of foreign bodies in the tube during firing. Of no importance unless they obstruct the passage of projectile. In such case, *retire the piece*; this is very important on account of the use of high explosive projectiles. Dents are frequent in guns using fixed ammunition. They are not deep. In spite of the gravity of their appearance, they are not serious unless their edges project into the bore.

f. Swellings.—Recognized from the appearance of the bore. *Retire the gun.* Record all marks of the ammunition that was used and report.

g. Copper Deposits.—Pay no attention to a tinge of copper appearing at the muzzles even after a few rounds. In case

of slight copper-fouling, remove the copper with ammonia solution. Deposits having the appearance of caked dirt may be removed only under expert direction.

h. Wear of Lands Near Their Origin.—Light guns can be submitted for condemnation when the wear exceeds 0.5 millimetre and, at the same time, dispersions over level ground of rounds of the same lot of ammunition equal *eight times the probable error*. The rule is the same for 4.7- and 6-inch cannon when the wear exceeds 1.0 mm.

i. Exterior Dents Caused by Hostile Hits.—Examine the bore. If swelling will oppose passage of projectile, *retire the piece*.

Each gun must have its record book in which are entered the rounds fired and an account of accidents and important incidents. It must be presented at all inspections of matériel. In it the inspector enters important information. It must remain always with the gun. It is not a battery record.

The adjustment of sights must be made daily or, even better, after each firing. Only simple field adjustments are required.

Assemblage of parts will not be made in the battery when forging, riveting, or filing of delicate parts is involved.

War experience shows that the wear of bores is not due alone to the number of rounds fired, but also to the way in which fire is conducted and to the methods of cleaning, cooling, and care.

Some light guns have become unfit for use after from 3000 to 6000 rounds, while others, after 20,000 rounds, are without copper-fouling or excessive wear. One battery is known to have fired nearly 1000 rounds per gun in 24 hours without wear, copper-fouling, or change in the bore. Pieces and platoons were fired alternately, the inactive pieces being cooled, cleaned, and greased.

Copper-fouling is one of the most frequent and important causes of trouble. Under the friction of the projectile light

CARE OF GUNS IN OPERATIONS

pieces of copper, liquefied by high temperature or flaked off by friction, are detached from the rotating bands and fixed to the surface of the bore, where they sometimes remain as though they were welded. The small projections thus formed increase the wear of subsequent rounds and the copper becomes more and more deeply embedded in the metal of the tube, especially if the temperature is greatly raised. Even if the fouling is removed by chemical means the surface remains rough and is liable to fouling again after even a few rounds.

For a given kind of copper the fouling depends upon:

a. The condition of the bore—whether smooth and polished, or rough; whether clean and lubricated, or dirty and full of powder residue; whether subjected to excessive heating, or cared for by rest and cooling; whether dry and clean, or seldom or rarely cleaned.

b. The action of the rifling on the rotating band—a function of the velocity of the projectile in the bore, its weight, and the inclination of the rifling. In cannon with constant rifling the fouling is chiefly at the beginning of the grooves; in those with increasing twist, nearer the muzzle. It does not occur with low-velocity guns if they are not badly cared for.

The change in the surface of the lands and grooves, particularly in the edges of the lands, is marked in cases of bad fouling. This is followed by changes in the rotating bands that explain some more or less erratic shooting.

Sometimes small flakes are nearly sheared off from the band, resulting in loss of powder pressure and irregularities of fire.

Sometimes larger bits are actually broken off and projectiles leave the muzzle with decreased rotational velocity that may be so low as to cause tumbling early in the trajectory, and that will frequently result in tumbling on the descending branch at long ranges.

Due to copper-fouling, great difficulties will therefore result from firing rapidly without proper precautions. But improper

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use also causes erosion and premature wear. These again increase the fouling. Thus the destruction of matériel and waste of ammunition are direct results of improper use and care.

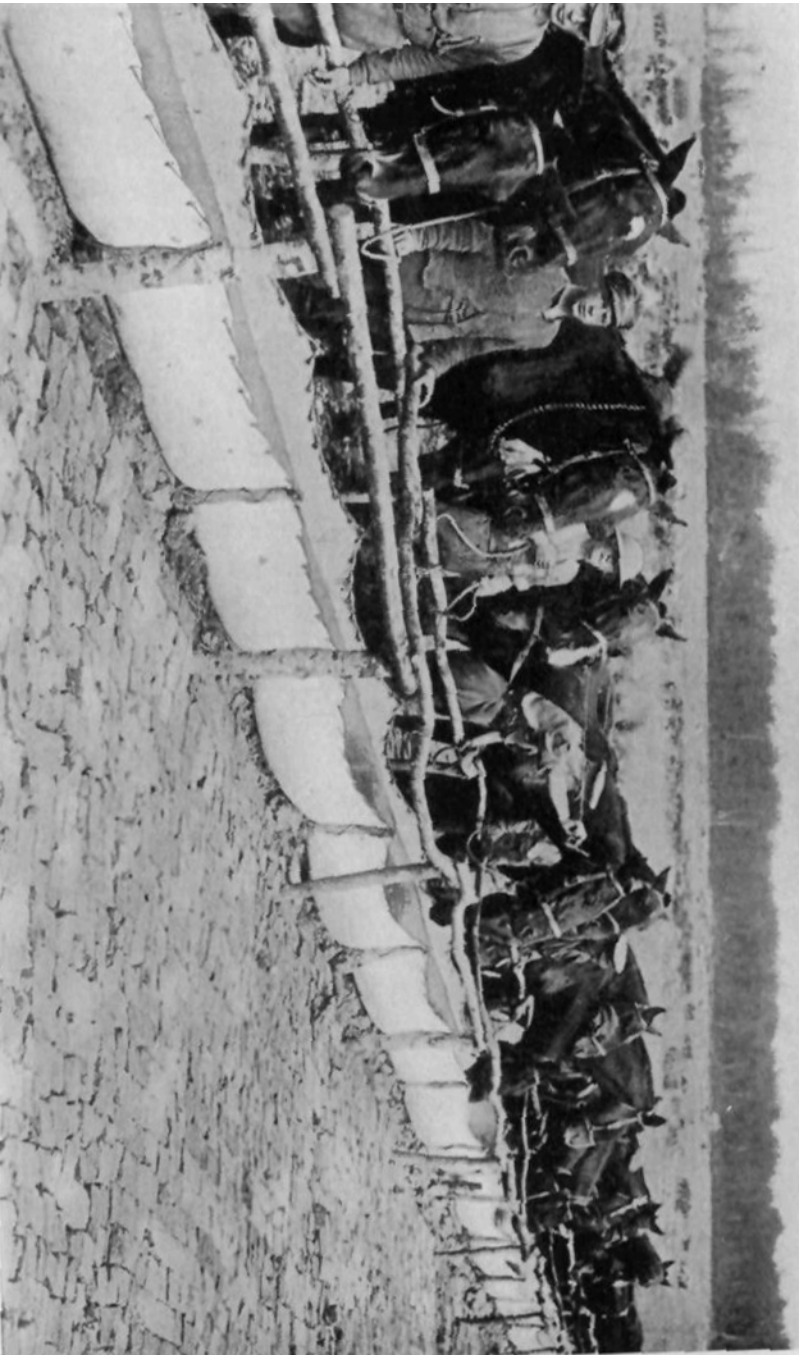
Tubes would be conserved longest by washing and greasing before each round.

Tactical and technical requirements of war make this ideal difficult to reach, but it must be sought. It is possible in some cases. The more nearly it is approached the greater will be the saving of life and matériel and the earlier will be victory.

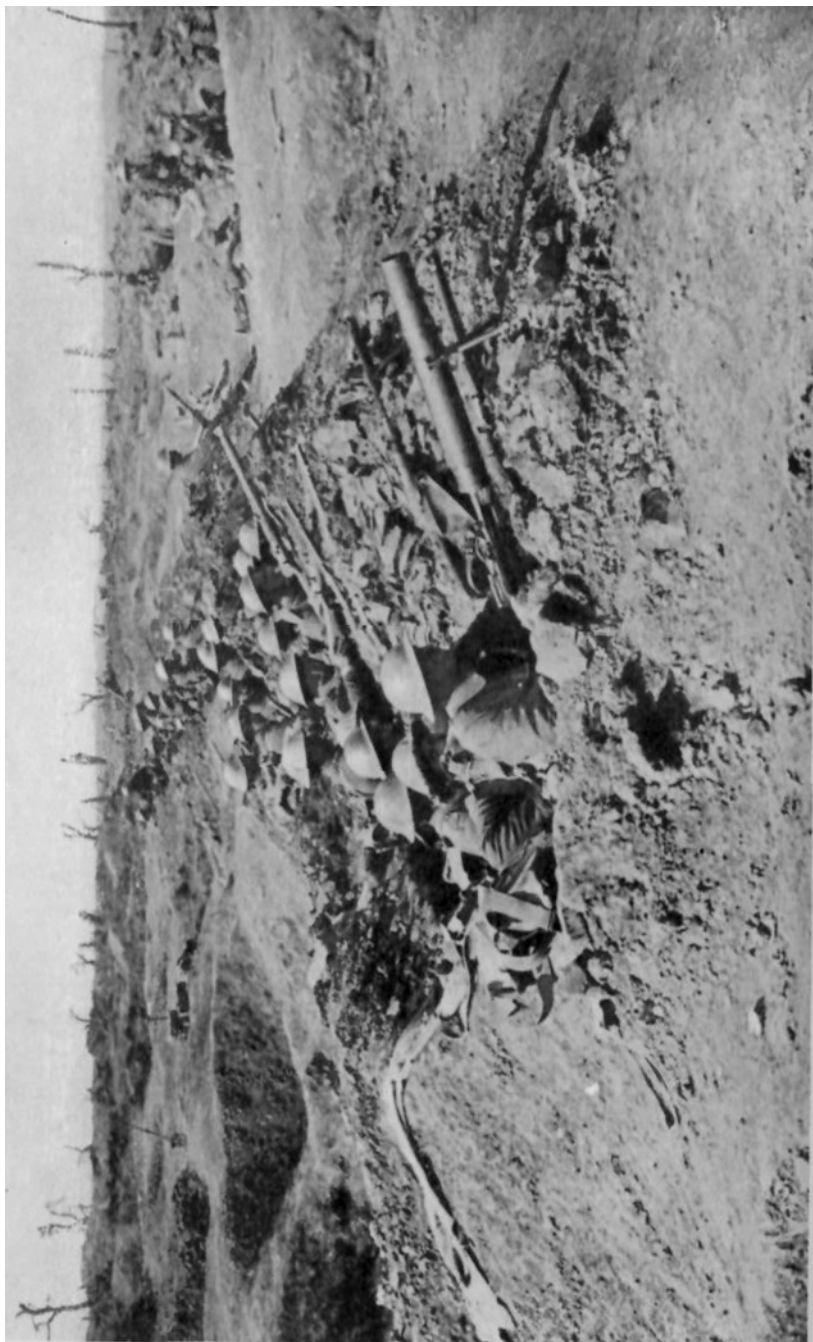
As the initial velocity and power of cannon increase, the greater is the necessity of special precautions. *During fire from the heavier guns, tubes should be greased at least every four rounds.*

Whenever the tactical situation demands it, the fire should certainly be as rapid as the matériel permits. But before such fire is ordered from large calibres it is essential that commanders should have examined the situation in all its particulars and have balanced the necessity of the moment against the probability of the partial or total destruction of some pieces.

From guns having variable charges the full charge should never be used except when the range or the nature of the target requires it. *One round fired with a full charge wears a gun as much as five rounds fired with a half charge.*



HOW THE ENGLISH WATER THEIR HORSES IN REAR OF THE BATTLE-FRONT



BRITISH TROOPS READY TO ATTACK OVER TERRAIN DEVASTATED BY ARTILLERY FIRE

How to Record Firing Data

Forms and Instructions for Use in the Field Artillery

BY CAPTAIN WILLIAM E. DUNN, FIELD ARTILLERY, D. O. L.

THE BATTERY RECORDER

A RECORD of the elements of firing data is kept set on the instruments at each piece by the gunner and number one and number three cannoneers. If errors never occurred, there would be no need at the firing battery of any record of firing data other than that kept set on the instruments themselves. The purpose of keeping a written record at the firing battery is to insure against mistakes, and to correct errors in settings on the various instruments.

How many copies of this record should be kept, and who should record them? We have tried the plan of having the four chiefs of section keep a written record of the data, each for his own section. While this gave a record immediately available at each piece, the plan did not produce the best results, for the reason that at the time his attention was required to watch the work in his section, the chief of section was busy writing down the elements of firing data in his book; in other words, attempting to act as recorder interfered with his duties as chief of section. This plan has very wisely been abandoned.

Are four copies of the record necessary? There are four pieces in the battery. With the exception of deflection, it is the usual case that the remaining elements of firing data are the same for all four pieces. One copy of the record will be sufficient, if kept in such form that any element of firing data can be immediately announced to the piece calling for it.

Should the executive attempt to keep the written record? There is no doubt that in order to supervise the work of the battery he must see what is going on in the different sections. He cannot, of course, attempt to see details and settings, but

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he must be able to locate any cause of confusion or delay as soon as it occurs, in order to keep the battery working efficiently. It is certain that he cannot see what is being done in the sections while he is engaged in writing down the record. This is the very time when his attention should be most keenly fixed on the work at the pieces. With training, the executive, and the chiefs of section as well, can acquire the ability to hold firing data in their minds, but it is not the part of efficiency for them to attempt to record it.

Recording the firing data at the battery should be the duty of a man especially trained to keep the record and to announce any element called for. Under our present organization this man is scout No. 1, working as assistant to operator No. 1. His designation should be changed by regulation from scout to battery recorder. Sufficient men should be trained for this duty to insure a trained recorder throughout the action, for a trained recorder enables the executive to speed up the battery on its rate of fire.

FORM OF THE RECORD

In order that the battery recorder may be ready to announce any element of firing data to the piece calling for it, the form of the record must be such as to call for few figures so arranged as to show at a glance any element desired. The number of figures must be few, in order that there be no delay in recording them. If a gunner calling for a deflection must wait for the recorder to complete a tabulation of figures, the system becomes a source of delay instead of a means of increasing the speed of the battery in firing. The form in which the record is kept should call for so few figures that they can be written down as fast as the data are announced to the battery.

But merely to note down the elements of firing data as announced will be of little use unless the form in which they are arranged will show at a glance the data for any piece. To accomplish this and at the same time to hold the number of

HOW TO RECORD FIRING DATA

figures to a minimum, use is made of a skeleton framework in which the data for any piece can be seen by inspection from the elements actually recorded. The blank spaces for each piece can be filled in between salvos and before the next change in data is announced.

The record should be kept in vertical columns so that the last number recorded shows the result of the last change announced. The form of deflection record for use with the 1915 model sight differs from the form for the 1902 model sight, due to the auxiliary deflection scale on the 1915 model.

The record is kept in a pocket note-book opening along the side, so that two pages, right and left, are presented when the book is opened. The left-hand page is used to keep the deflection record. For the 1915 model sight, this page is ruled in six vertical columns. The first four are headed "IV, III, II, I," from left to right, for the four pieces of the battery, the first piece being on the right. The next column, "DEF," contains the deflection for the upper scale on all four pieces. The last column, "DD," contains the deflection difference.

When the sight is used this form of record is devised to record the data in the following manner. All changes in deflection which affect all four pieces by the same amount are set off on the upper deflection scale. Deflection difference and individual changes affecting a particular piece are set off on the auxiliary scale. The main scale will therefore read the same for all four pieces.

A dash is used in the proper column to underline the directing piece. A circle indicates an individual change for a particular piece. As this change will affect all following settings on that sight, the numerical value of the change is written in the upper right-hand corner of the proper space and a circle drawn around it to attract attention to it. Thereafter the settings on the auxiliary scale of this piece will be out of their place, in the arithmetical progression across the battery, by the amount of this change. So long as no individual changes are

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ordered, the deflections on the auxiliary scales will form an arithmetical progression, differing from each other by the amount of the deflection difference. This principle affords one means of checking the correctness of the settings.

1915 Model Sight.
Left-hand page of record.

Commands:
(Given here for reference)

IV	III	II	I	DEF	DD
			0	1240	0 10
		<u>L 10</u>		1040	0 20
	<u>L 30</u>			1060	0 15
		R10			

Deflection 1240. On 1st piece open 10.
Right 200.
On 2d piece open 10.
Left 20.
On 3d piece close 5.
2d piece right 10.

Above filled in after each salvo.

L 30	L 20	L 10	<u>0</u>	1240	0 10
				1040	
L 50	L 30	<u>L 10</u>	R 10		0 20
				1060	
L 45	<u>L 30</u>	L 15	0		0 15
		R10			
		L 5			

Six columns are ruled for the right-hand page, as follows:

SITE	KR	M	RN	RN	RN

When a change in range is announced without a change in other elements of firing data, the additional columns for range can be employed.

HOW TO KEEP THE RECORD

On the left-hand pages the recorder notes down, as the commands are announced, only such figures in the skeleton framework as are necessary to indicate the directing piece, deflection, and deflection difference. Thus, in the data above, 1240 is written in the column "DEF," a dash is underlined in column

HOW TO RECORD FIRING DATA

"I" to indicate the directing piece, and 0.10 is written in the column "DD," at the announcement of the first command. From these figures, as arranged, the deflection for the auxiliary scale of any of the pieces can be seen at a glance. When opportunity offers, which is usually as soon as the pieces are laid, the recorder can fill in these deflections so as to be ready for the announcement of the next data. At the command, "Right 200," the number 1040 is written under the former deflection 1240. It is always the result of the change which is recorded. This saves both time and figures, and gives a clearer record, and one from which settings not yet written down can be more readily determined by inspection than if the value of the changes was recorded in figures.

"On 2d piece open 10." A dash is drawn in column II, and the DD is changed from 0 10 to 0 20, L 10 appears in column II as the deflection from the first salvo. The dash now placed in this column indicates the directing piece, so this deflection will be unchanged, and those for the other pieces will be opened from it by 20 mils. Fill them in after the salvo.

The command "Left 20" affects all pieces alike. Its result is recorded by changing 1040 to 1060 in column "DEF." "On 3d piece close 5." A dash is drawn in column III. The deflection for this piece on the 3d salvo was L 30, which remains unchanged for the directing piece. The DD becomes 0 15.

On the sixth salvo an individual change in deflection is ordered for the second piece. This value, R 10, is written in the upper right-hand corner and is enclosed by a circle, so that it can be readily seen. Thereafter it will affect the deflection recorded for the second piece.

HOW TO USE THE RECORD

Any gunner or cannoneer who does not hear a command, or who has the slightest doubt of what is his correct setting, is instructed to call for it, thus, "Deflection, 3d piece," "Corrector," "Range," etc.

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When an element of firing data is called for from any piece, the recorder announces it. In the case of deflections, he gives the number of the piece first and then announces the deflection; thus, "3d piece 1060 L 30," giving the deflection on the main and auxiliary scales.

A chief of section who observes any hesitation or delay on the part of a cannoneer in setting his instrument will require him to call for data. It makes for speed and accuracy to call for data about which there is the slightest doubt or suspicion of inaccuracy. It takes only a moment for the recorder to announce it, and then confidence replaces doubt.

CALLING A CHECK

When an interval between salvos presents an opportunity a quick check can be made across the battery. In order to avoid mistaking a check for announcement of new firing data it is indicated by the recorder calling "Check." For instance, after the 5th salvo in the above the recorder calls, "Check deflection. 1060. 0. L 15. L 30. L 45."

At the command "Check deflection" each gunner looks at his main scale. If not set at the correct setting, he changes it to the deflection announced, reporting this fact to his chief of section. In the same manner he makes certain that his auxiliary scale is set at the deflection announced for his piece. This check takes only the time for the recorder to call the list of numbers. One or more elements of firing data are checked as opportunity offers throughout the firing. An expert recorder can make frequent checks without interfering with the regular announcement of firing data.

The practice of calling a check gives every one concerned confidence in the accuracy of his work. It is believed that in action it will tend to prevent excitement and the resulting mistakes. It has been found, during instruction, that increased speed and accuracy result from the confidence and assurance that are gained by this method.

HOW TO RECORD FIRING DATA

It should be noted that this method of calling a check is entirely different from the old method of having each piece report in rotation its settings. This latter method was inefficient because of the waste of time consumed in making the check.

DRILL

The following method for drill has been found to work well with the above system. The recorder stands on the left of the executive. Each chief of section, gunner, number one and number three, report. The gunner has his sight, No. 1 has the quadrant, and No. 3 has the hand fuze setter. They arrange themselves by section, facing away from the executive officer. Each chief of section stands in rear of his group of three men and watches their work.

The executive has a set of commands prepared to illustrate the features he desires to take up in this drill. He announces the commands, allowing an interval between salvos. During the first part of the instruction he will have to make explanations and corrections; but, as the men become trained in the drill, he can begin to require speed as well as accuracy.

He has all the men where he can make explanations without the effort that is required to do so with the men at their pieces. This drill, conducted from fifteen to twenty minutes daily, will keep the men quick at setting data. Drill at the piece is also necessary for practice in laying.

Both at the above drill, and also at drill of the firing battery, the recorder should be practised in making frequent checks. Chiefs of section should be encouraged to call for data even when their men are getting it correctly, in order to practise the recorder, and also that the system may work smoothly and without confusing or interrupting the announcement of changes in data. It is best not to call for an element of data when another is being announced.

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1902 Model Sight.
Left-hand page of record.

Commands.
(Given for reference)

IV	III	II	I	DD	
			1240	0 10	
			1040		
		1050		0 20	
		1070			
	1090			0 15	
		R10			
		1065			

Deflection 1240. On 1st piece open 10.

Right 200.

On 2d piece open 10.

Left 20.

On 3d piece close 5.

2d piece right 10.

Above filled in after each salvo.

1270	1260	1250	1240	0 10	
1070	1060	1050	1040		
1090	1070	1050	1030	0 20	
1110	1090	1070	1050		
1105	1090	1075	1060	0 15	
		R10			
		1065			

Columns IV, III, II, and I contain the deflections for the four pieces. DD contains the deflection difference.



WITH THE SERVIANS, A TRENCH MORTAR EMPLACEMENT



BRITISH TROOPS LOADING A TRENCH MORTAR
Called by them "A Flying Pig"

Organization and Training of the New Armies

WAR COLLEGE DIVISION, GENERAL STAFF

(Continued from Page 65, January-March Number)

PAR. 6.—THE SUPPLY OF OFFICERS AND N. C. O.'S

The greatest difficulty which Great Britain had to surmount before being able to send out the large armies required to meet the well-trained and well-equipped German hosts arose from the depletion of cadres of officers fit to train these armies. The recruits came up fast enough, as we have seen elsewhere, and though their housing, clothing, equipping, and arming were for some time a subject of anxiety, these were difficulties which could be surmounted, sometimes in weeks, at most in months. But officers and noncommissioned officers fit to train recruits normally require a much longer period of training themselves than those whom they have to instruct. Seeing that before the war England's whole policy was directed to the end of having a small striking force of six divisions ready for duty overseas, and that the only other force contemplated was a comparatively small home defense force, and the garrisons in India and overseas, it is hardly surprising that the greatest difficulty was found in training the millions who came to take the place of hundreds of thousands.

To make matters worse, even the men, who in peace time had been allocated to the duties of training the special reserve and Territorials, were for the most part incorporated in the Expeditionary Force which sailed to Flanders in the early days of August, 1914. For example, most of the adjutants of the Territorial Force units and their regular noncommissioned establishment, often the only men in these units with any expert knowledge of military training, had to be sent abroad to take

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their place with their own regular units; in the Flying Corps the majority of officers were sent abroad, hardly any experienced pilots being left to teach the new recruits; nearly all the qualified instructors in physical training, both at the central school and in the commands, were sent off to rejoin their regiments at the front; even the Army School of Cookery was closed on mobilization and the instructors sent off to cook for headquarters in France, thus leaving no one to instruct the new armies in this very essential matter for the soldier's comfort and efficiency; and the same tale might be told of every branch of the service.

This departure to the front of almost every man fitted to train recruits² was a necessity due to the scheme of organization laid down for mobilizing the Expeditionary Force. This scheme was elaborated when no such vast increase of the army as actually took place was contemplated: in the circumstances it proved unfortunate. Indeed, even had it been possible to keep at home all the men previously engaged in training, their number would have been sadly inadequate to the new task devolving upon them. Still, they would have formed a valuable nucleus; as it was, there was hardly even a nucleus of experts to train the new armies. How great the dearth was may be imagined from the fact that at least one officer is required for 40 men, and that before the war barely 300,000 men were fully officered, and that the army was increased by that amount within little more than a month from August 4, 1914.

How was this dearth of training cadres met? Various expedients were adopted.

1. For the senior commands in the new service units:
 - (i) A nucleus of regular officers, left at the depots when the Expeditionary Force went overseas, proved of the utmost use in commanding new Service battalions. This nucleus was

² On the eve of sailing an order came to the Expeditionary Force from the War Office that every battalion should leave behind one captain and one subaltern to assist in training the new armies. These officers, of course, helped greatly.

ORGANIZATION AND TRAINING OF NEW ARMIES

spread out as thinly as possible so as to have at least one experienced man in every unit.

(ii) Some 200 officers of the Indian Army, home on leave, were retained for training purposes, and in the early days of the war materially helped this nucleus of regular officers in stiffening the officers' cadres in the Service battalions.

(iii) Retired officers ("dug-outs," as they were popularly called) were appointed in large numbers. Men who had thought their work in life was over, others who had left the army to take up more lucrative professions or to enjoy a life of greater independence or adventure, flocked back to their old profession of arms as soon as they saw the country might need them. In the great dearth of experienced men they were nearly all welcomed and given important duties in training the hosts of recruits. Most of them were invaluable to meet the pressing need, and many of them proved to be excellent officers in every respect, both at home and at the front. But this was not the case with all. Some were too old or otherwise physically unfit even at home, where long hours and strenuous exertion were almost as much needed as at the front. For example, the second in command of one battalion was discovered to be 55 years old, had to use a chair to mount his horse, and was physically unfit to ride any distance or to reconnoitre. But this officer was nevertheless as keen as any, and did good work in training his men, though he was not up to leading them at the front. Even in such cases, where the officer was fit to train but not to take his men abroad, after training them and getting to know their capabilities, it proved a considerable handicap to the men not to have been trained by the man who was to command them when their real work at the front began. Others were not up to date, and had not the capacity for making themselves so. This was a serious disability, since within the last ten years there had been drastic changes in the organization and drill of the army. The infantry drill had been altered, and the double company substituted for the old single company. In artillery the changes had been even more notable by the introduction

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and almost exclusive use of indirect laying, which required in artillery officers and noncommissioned officers faculties of rapid observation and calculation, impossible to obtain without severe study and application; again, the coöperation of artillery and aeroplanes was a closed book to all the old school of gunners; the use of telephones and signals had been developed in a manner unknown to quite recent generations of officers. Indeed, the whole art of tactics had been brought up to date and revived in those admirable manuals of military training, the Field Service Regulations, first issued in 1909, long after many of these men had quitted the army.

(iv) Many civilians over the age of 25 were given their first commissions as lieutenants or captains, especially in technical corps for which their previous pursuits had fitted them.

(v) After the first battles of the Expeditionary Force in Flanders, wounded officers from the front, not yet fit to rejoin their units, but recovered enough for training duties, were impressed for this service. These were of special use, since, in addition to their previous training, they had experience of the actual conditions of continental warfare.

2. For the junior ranks:

(i) The usual avenues for permanent commissions in the army before the war were through Woolwich and Sandhurst and the Special Reserve. For commissions in the old regular battalions this system was continued; but the supply of officers was greatly enlarged by increasing the establishments to 340 and 780 respectively; by considerably shortening the course at both places, at first from two years to six months at Woolwich, and from one year to three months at Sandhurst; and by raising the age limit for entry from 19½ to 25. Thus the yearly output of officers to replace casualties in the old regular battalions was quadrupled. The Royal Military College at Kingston, in Canada, and the training colleges, which took the place of the Staff College at Quetta and at Wellington, Madras, also supplied officers for permanent commissions, and a certain number of commissions were granted direct to

ORGANIZATION AND TRAINING OF NEW ARMIES

university candidates. As a general rule, however, these officers were not available for the new armies, being needed chiefly to fill gaps in the commissioned ranks of the old battalions.

(ii) A certain number of ex-warrant and noncommissioned officers were given commissions. All these men had, of course, a good grounding in methods of imparting discipline; but their suitability as officers varied according to the length of time since they had left the army. On the whole, these officers were exceedingly valuable, especially in the early stages of training, when a good grounding in discipline and a knowledge of drill were all-important. In many cases, too, either in the first instance or after a short interval, such officers obtained the rank of lieutenant or captain, and fully justified their promotion.

(iii) The junior commissions given to these first two classes were, as a rule, regular commissions for the army. But the first class provided hardly any officers for the new armies, while the second class was comparatively small. The great and immediate need was still to get officers for the thousands of recruits coming in daily to form the new Service battalions. To obtain the supply immediately in adequate numbers, it was necessary to waive the preliminary training, either at a military school or in the ranks required of officers taking regular commissions. It was decided, therefore, to give "temporary commissions" for the new battalions to young men otherwise suitable, but without the full training normally required.

At this juncture the wisdom of Lord Haldane in providing a method of rapidly expanding the commissioned ranks by means of the Officers' Training Corps became apparent. These corps are divided into two categories, senior and junior; the senior being Territorial units recruited at the universities and the Inns of Court;³ the junior cadet units composed of boys under education at the chief public and grammar schools of the country. Both senior and junior officers' training corps were thus chiefly composed of men or boys of the intellectual and moral

³ Since the war the Artists' Rifle Corps has also performed the functions of an O. T. C.

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attainments likely to fit them for the rank of officers, and in addition they had received a training, carefully designed to that end, especially in the senior corps. There were at the beginning of the war 22 senior officers' training corps and considerably over 100 of the junior division. Naturally there were differences in the quality of training given in the various corps, some being excellent, others poor; but, taken altogether, they could provide a very large number of young men with some training in the duties of command. For want of fully-trained officers they thus afforded the best material then available for forming the new officer cadres. Some of the best trained men from the senior corps were given regular commissions at once, and large numbers received "temporary commissions" for service with the new battalions. A great many senior boys from the cadet corps of the schools were also given temporary commissions. It is an indication of the value of these O. T. C.'s at a critical juncture of the war that within the first year of the war the Oxford University O. T. C. provided over 2500 officers for the army, the Cambridge O. T. C. provided over 2300, three of the smaller northern universities O. T. C.'s over 1000, and the Inns of Court O. T. C. over 2500. Thus the O. T. C.'s, as had been intended, proved admirable nurseries for officers on a sudden expansion of the army, and have fully justified the policy which called them into existence.

(iv) But even the O. T. C.'s, fruitful as they were, had not sufficient men to supply the need of officers. Junior "temporary" commissions were accordingly also given to a large number of university undergraduates and senior boys of public schools, who, though they had not had the O. T. C. training, seemed otherwise capable of command. In fact, before the end of 1914 there were hardly any students left at the larger universities, since nearly all had taken commissions or enlisted; and practically all youths from public schools have, since August, 1914, applied for commissions as soon as they reached the age limit.

(v) Some of the best junior officers came from among the

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young men who had already gone out to the Colonies or foreign countries to take up a life of adventure. As soon as the news of the war reached them, hundreds of these flocked back to offer their services to the Mother Country, and were gladly accepted. A file exists in the War Office showing the various places out of this country whence officers came to take up commissions. The tabulation is somewhat rough, but makes an imposing list, as showing the world-wide interests of Great Britain, and how men flocked home from the ends of the earth. In the list are to be found: Australia, Bermuda, Barbadoes, British Guiana, Burmah, British Honduras, Canada, Ceylon, the Channel Islands, British East Africa, the Falkland Islands, Fiji, Hong Kong, Halifax, Jamaica, the Leeward Islands, Mauritius, the Malay States, Nigeria, South Africa, the Straits Settlements, Sierra Leone, Trinidad, Buenos Ayres, Bangkok, Guatemala, Lisbon, Lima, Mexico, Montevideo, Madeira, Madrid, Manchuria, Nanking, Oporto, Peking, Rio de Janeiro, Rome, Singapore, Shanghai, Santiago, Teheran, Tokio, Washington. Other lists, even more comprehensive, could doubtless be prepared, and you could hardly now go into any regimental mess of the British Army without meeting young men able to tell you, from practical experience, of one or more distant parts of the globe. Certainly no young men made better officers than these, for all had taken some risks, they had been on their own responsibility, and had generally had men under them and experienced dangers by flood and field.

(vi) For the locally raised or "Pals" battalions considerable latitude was given to the raisers in the appointment of officers. As the ranks were filled with men all belonging to the same place or engaged in the same pursuits, the officers were, as much as possible, drawn from the same source. Thus for the "Pals" battalions of a town, the managers of commercial establishments, or perhaps foremen and chief clerks in the same place, or the sons of neighboring gentry, were chosen for commissions by the raisers, and almost invariably accepted by the War Office. The quality of these officers depended, of

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course, largely on the powers of discrimination and complete disinterestedness of the local raisers, who exercised their choice admirably in the overwhelming majority of instances. Nevertheless, as a whole the officers of local battalions were not up to the standard of the others, because the field of choice was necessarily more limited.

(vii) For officers of technical corps, such as the R. E., the A. S. C., the R. A. M. C., the Army Ordnance Corps, Pioneer Battalions, and to a certain extent the R. A., something more than the general education of a public school is required. On the whole, the supply of officers for such corps has been surprisingly adequate, owing to the trouble taken in their selection by the War Office, and its readiness to take advice from the heads of the corresponding civil professions as to the professional and moral capacities of the men recommended for commissions. For example, in the case of the R. E., officer candidates for field units were recommended by the President of the Institution of Civil Engineers and by the universities; for the railway companies candidates were nominated by the principal railway companies at home and abroad; tunnelling companies of the R. E. had their officers largely selected by the Mining Institutions of Great Britain; labor battalions obtained contractors and contractors' agents for their officers. In fact, it is reported that for the R. E. the supply of candidates with suitable technical qualifications had always exceeded the demand. For the A. S. C. the Institute of Chartered Accountants and of Civil Engineers and large business firms were asked to recommend candidates; and among those who received temporary commissions are to be found business men, chartered accountants, experts in provisions and forage, men with knowledge of horses and motors, and men used to controlling large bodies of workmen. For the R. A. M. C. there has never been any difficulty in obtaining the vastly increased personnel required since the war began, the medical officers being all drawn from the ranks of qualified medical practitioners in the United Kingdom and the Dominions; in addition to these,

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the War Office has obtained a large staff of specialists for work with troops; *e.g.*, bacteriologists, ophthalmologists, aurists, radiologists, dermatologists, experts in tropical diseases, etc.

On the whole, from these various sources the pick of officers for the first, and in a less degree for the second, new army was excellent. For the latter formations of the new armies the pick was perhaps not so good. The nucleus of regular officers, thinly spread over the first two armies, had been almost entirely used up; and the best of the young men available from the universities, the public schools, and the professions were no longer so easily obtained. One reason for the difficulty in obtaining such good men for commissions after the first three months was that many of the most suitable young men, unable to obtain commissions in the early days, would not wait in their ardor to fight, and enlisted in the ranks of the Artists' Rifles, the University and Public Schools' Brigade, and other similar corps. Afterward it sometimes became difficult to persuade commanding officers to part with such men from the ranks of their battalions when they were sorely needed to take up commissions. Eventually, however, most of them became officers, and, as will be described later, other means of finding excellent material for the officers' ranks were discovered.

It will be noticed, however, that a great many of these early-appointed officers, whose primary business was to train the raw recruits of the new armies, were themselves untrained to any military duties. At first some attempt at training was made. On August 12, 1914, classes for instruction of young officers were organized at six centres under senior officers of some of the Officers' Training Corps; to these centres the junior officers granted temporary commissions were sent for a month before taking up their duties. But even this short period of training was abolished by Lord Kitchener when he found that it entailed leaving new formations with hardly any subalterns; and during the remaining months of 1914 there was practically no special training given to infantry subalterns with temporary commissions. Early, however, in 1915 the system of a month's

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training for new officers was revived and extended, so that 2610 officers a month could get some instruction before joining their units. A month's instruction even to the most zealous subaltern is obviously very little; all that can be said is that at the time this was the best that could be given. Gradually, as the war progressed, opportunities for training officers became more ample.

For all practical purposes, therefore, most of the infantry subalterns of the new armies had to train themselves during the first five months of the war as best they could in the intervals of training their men.

If the officers were untrained, the noncommissioned officers of the new armies were in the main even less trained. The needs of the Expeditionary Force were, in this case also, considered paramount; consequently very few experienced noncommissioned officers were left in the country; and there was considerably less field for choice for noncommissioned officers than there was for officers in the first instance. To supply the need, the Army Council encouraged by every means in its power the reënlistment of ex-warrant and noncommissioned officers, as well as discharged soldiers up to the age of fifty, to help in the training of the new armies. A great many of them did reënlist, but some of the older ones, who had lost touch with the army and forgotten their drill, or had acquired unmilitary habits, proved worse than useless; the rest, however, were invaluable. But these reënlisted noncommissioned officers were a mere drop in the bucket, and the noncommissioned officer cadres had at first to be filled up at a venture from those recruits who seemed to give most promise of picking up the drill and discipline quickly. Many mistakes were made by choice of the wrong men as noncommissioned officers, and for a long time the good noncommissioned officer, who is much more a result of long training and good habits even than the good officer, was a comparatively rare phenomenon in the new battalions. This circumstance was undoubtedly a serious hindrance to training in the early stages, since a good grounding

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in drill and discipline depends more on the noncommissioned officer than on the officer. Any one who has had the opportunity of seeing a really good sergeant of the old school, with his mingled humor and severity, putting a squad of recruits through their paces, and contrasting him with some of the sergeants of August, 1914, at the same job will realize this. However, there was at least this good result of the weakness of the noncommissioned officers: that the officers themselves often had to do the noncommissioned officers' job as well as their own, and became thereby all the more proficient and understanding of their men.

PAR. 7.—ORGANIZATION OF THE NEW ARMIES

Before approaching the subject of the early stages of training it will be convenient to state shortly what organization was given to the new armies.

The first and second new armies were formed on the following basis: Each regiment of the British Army was given one new battalion composed of new recruits enlisted for the period of the war, the only exceptions being in the case of certain Irish and Fusilier regiments, where two new battalions were raised to form the Irish and Light Divisions. The third new army was formed of battalions raised in those areas where recruiting was best, chiefly in the Northern and Western Commands. After these three armies were completed, further recruits were posted to reserve battalions; as soon as any of these reserve battalions attained a strength of 2700 a new battalion was drawn from it, and these additional battalions were formed into a fourth new army. Later these fourth army battalions were reconverted into reserves, known as second reserve battalions, and used for drafting purposes; they thus no longer formed part of the fourth army. But a new fourth new army and a fifth were constituted about the middle of 1915 from the locally-raised battalions, which had hitherto been scattered about the country doing their training independently.

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The Territorial Force was also being expanded. The formation of the second line T. F. unit was authorized in the case of every original unit of which at least 60 per cent. of the strength volunteered for Imperial service. These second line units were first used to find drafts; later on the second line divisions were formed and a third line raised to supply drafts.

To make clear the system of organization, the battalions of the Manchester Regiment may be taken as an example. The 1st (63d Foot) and 2d (96th Foot) Manchesters are the old regular battalions. The 3d and 4th Manchesters, originally militia battalions, are the special reserve battalions, used for finding drafts for the 1st and 2d Battalions and for home-defense work. The 5th to the 10th Battalion (inclusive), each of which has a first, second, and third line unit, are Territorials raised in the Manchester regimental district. The remaining battalions have been raised since the war began. The 11th belonged to the first, the 12th to the second, the 13th to the third new army; the 16th to the 23d Battalion (inclusive) were all locally raised "Manchester City" battalions, and with the 24th, raised at Oldham, formed part of the second edition of the Fourth New Army; all these are technically called "Service" battalions. The 14th Battalion was in the original Fourth New Army as a Service battalion, but is now a reserve draft-producing battalion for the 11th, 12th, and 13th Battalions, while the 25th to the 27th "local reserve battalions" perform a similar function for the locally-raised battalions.

The system of organization adopted for the new armies is thus fairly simple, and had the great merit of continuing the former army organization. Thus, however, many units were created from the recruits that came pouring in, and they could all be attached to original regimental formations. In this way the proud traditions of almost every regiment in the British Army could be taken as the means of stimulating emulation in those newly attached to the regiment.

ORGANIZATION AND TRAINING OF NEW ARMIES

PAR. 8.—THE FIRST STAGE OF TRAINING

In previous sections some of the initial difficulties of training the new armies have been described. These difficulties were immensely accentuated by the rapidity with which the new formations had to be created. An Army Order of August 21, 1914, constitutes the First New Army, consisting of six divisions, or roughly 110,000 men. Three weeks later the Second, also of six divisions, was constituted, and only three days later the Third and the original Fourth New Army⁴ were officially established. Although the new Fourth and Fifth, composed of locally-raised battalions, were not created until after the middle of 1915, their constituent parts had been dotted about the country as separate units since the previous September, when authority had been given to raise these battalions, and required training as much as the regularly-raised units. Nor even do these five armies—or six, if the reserve battalions in the original Fourth New Army are reckoned—which amounted roughly to between 600,000 and 700,000 men, represent anything like the total amount of men under training in the United Kingdom in the first year of war, since the old and new Territorial units and other miscellaneous corps have also to be taken into account. During 1915 an average number of over a million troops were being trained in the United Kingdom, apart from the armies fighting on the different fronts. The training of the first three new armies had this advantage over that of the others: that from the first each of their divisions was concentrated on one training-ground. It was thus possible to secure uniformity of training, to economize in instructors, and to develop early the very important quality of *esprit de corps* for the division, which is the smallest self-contained unit in the British Army, and which has played a larger part on the imaginative side than in any previous war waged by us. Toward the end of the training all the divisions of one army would be brought together to one centre, so that they

⁴ See above "Organization."

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had the opportunity of combined training for a longer or shorter period before they were sent overseas.

The local battalions of the Fourth and Fifth Armies and the second line Territorial battalions, raised originally as draft-producing units for their first line battalions, were not so fortunate. For long periods these units had to do their training billeted in the districts where they were raised or in isolated camps, and were rarely collected into divisions until the first three armies had completed their training and left the country. For these men the training of the first year was an infinitely more difficult matter than for the first three armies. Being generally scattered about in billets, they took longer to learn discipline, and, as they often had to straggle individually to the drill-ground from considerable distances, the time available for drill was correspondingly limited. The equipment, arms, and clothing for the first three new armies was scarce enough, as has already been explained; for the remainder of the new armies it was generally a question of a long wait for every article obtained. Again, for the first three new armies some definite system of training could be elaborated, and it was possible to watch it as a whole and correct mistakes as they became apparent; for the others the training had to depend almost entirely on the idiosyncrasies of the commanding officers, and the units were so scattered that continuous supervision and control by headquarters' inspectors was almost impossible. The turn for systematic instruction for the Fourth and Fifth Armies and the Territorials came when the early armies had been dispatched abroad, but it must be borne in mind that throughout this first year these less fortunate units were acquiring what training they could under unexampled difficulties, and in some cases making themselves exceedingly proficient. The following description of the early stages of training is, however, mainly intended to show how the training proceeded when it was possible to bring it under some sort of system.

When the recruits were marched off from the recruiting stations or depots to the division to which they were assigned

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their first impression was that they were just units in a mere mob of men, the only resemblance of which to a military force was the presence of two or three regular officers and eight or ten noncommissioned officers per battalion. They and their fellow-soldiers were mostly in civilian dress; no rifles or equipment were at first available; the nominal rolls were not accurate, and it was difficult for the officers to keep tale of the men supposed to be under them; and the accommodation available for them was not in all cases sufficient and adequate as a protection against the weather.

Naturally it took some little time for such mobs to get a little sorted out, most of the men being entirely unknown to one another, ignorant of army methods, and with very few more enlightened to guide them. It was not so much like a crowd of new boys at school, but as if some big public school were being started with an entirely new set of boys and an inadequate staff of masters. But they were soon shaken down into some sort of order, helped very much by a peculiarity which is shared by almost every man when he first joins the army. On joining it, whatever his previous troubles may have been, whatever his personal or public anxieties, he almost invariably feels an immense relief at being no longer responsible for his way of life: however hard and uncomfortable his circumstances may be, he can at least luxuriate in the thought that the responsibility for it all is on some one else's shoulders, and that he need do nothing more than obey orders. Of course, with every soldier worth his salt this feeling soon passes, but while it lasts it is delicious, and has often proved an anodyne for the early hardships and troubles of the new recruit.

In an army order published shortly after the outbreak of war provision was made for the altered circumstances of training required by the necessity of getting men to the front at the earliest moment. For all arms courses of six months were laid down, three of these being for the recruit stage. The actual time devoted to training in different units varied very considerably, according to the facilities they had enjoyed, their

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readiness to learn, and the requirements of the front; but in no case were complete units of the armies sent out with less than nine months' training at home. The elaborate time-table for the six months' course could rarely be observed in all its details, but the following may be taken as a typical curriculum for one of the new army divisions:

1. The first step was to inculcate the elementary principles of drill, discipline, and personal cleanliness.

2. The second stage was marching, squad drill, physical training, bayonet and rifle exercises, and digging.

3. Then came company training and musketry; cooking in the field and in barracks was taught at this stage; also semaphore signalling, judging distance, and rapid loading.

4. The next stage introduced recruits to battalion training and life in billets. As more boots became available, more marching was possible. Digging in connection with tactical schemes was taught. Machine-gun training was taught with dummy guns. The trained soldiers' course of musketry was fired. Technical units, such as R. A., R. E., Signal Companies, and Ambulances, suffered from want of technical equipment at this stage, but had become well enough trained to make full use of it as it dribbled in. At this stage, too, divisional trains were distributed and the transport personnel of battalions was trained.

5. In the brigade and divisional training stage brigades and divisions went out for two or three days' marches, being fed by divisional trains, which drew food and forage from "refilling points." Night marching and digging and the relief and feeding of units in trenches were thoroughly taught.

6. The final stage brought the men to artillery practice in camp and rifled machine-gun practice on the ranges and to interdivisional training.

Such, roughly, was the normal course of training for the divisions of the first three new armies; for the rest, it only differed in that the early stages were much more protracted,

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and the final stage seemed never to approach. In all cases the training would have been more rapid had not the material aids—guns, rifles, proper hutting, good drill-grounds, and so on—been wanting. Some delays were caused also by the more or less frequent shiftings of quarters from one camp or billeting area to another, for no division was trained entirely in one place. Some divisions or individual units were seriously hampered by the number of short sojourns they made in different areas.

During this course of training—we are now speaking of the first year of the war—it was not possible to pay very special attention to the training of officers or noncommissioned officers: they had mostly to learn their business as best they could in camp with the men. Between September, 1914, and the beginning of 1915 even the short preliminary courses for second lieutenants on appointment had, as we have seen, been suspended. There were, however, a few short courses, to which a few officers and noncommissioned officers could be sent, in special subjects, such as signalling, musketry, and physical training; but the most useful special training was given by means of lectures and regimental tours under the direction of energetic and experienced seniors of the battalions. Officers of the more technical branches had rather better opportunities for preliminary training. Those newly appointed to the Royal Artillery, before joining their batteries, were generally sent to one of 12 reserve brigades established for training purposes, and then for a month's polish at Shoeburyness or Larkhill. But in the early days even this amount of preparation was not universal, and many had to join their batteries at once on appointment. Newly-appointed R. E. officers, whose work is nothing if not technical, were the most favored, since they were given a preliminary seven weeks' training at Chatham or another training centre in signalling or field work; but, even so, unless they were well qualified beforehand, as most of them, indeed, were, this training was very short for men supposed

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to know the use and repair of telephones and telegraphs or the way to build or destroy a bridge, or how to meet the countless other emergencies with which a sapper is called upon to deal.

Considering the great difficulties and the short period available for training, it is hardly surprising that many defects were noted by the inspectors of training in some of the new divisions. The most notable defects arose from inexperience and from the lack of equipment and the consequent want of practical skill at arms; restricted drill-grounds, where proper manœuvres or even trench work could not be carried out, was another cause of backwardness. Where the men were billeted near or in their homes cases of indiscipline and absenteeism were more frequent than in proper camps, but it is encouraging to note that faults of discipline were, on the whole, not common, and, as the training progressed, became very rare indeed. Of the various arms the most backward in proficiency seems to have been the artillery. Nor is this to be wondered at. The artillery, which needs its proper equipment and arms more than any other branch in order to understand its duties, was the least well provided for in this respect. Nevertheless, even here, when the time came for firing tests, a large number of the new batteries fired surprisingly well with the latest guns and live ammunition and dial sights, which some of them had hardly seen before.

On the other hand, the general results of this brief and disturbed training were wonderful. Only nine months after embodiment the First New Army was sent to the front, being closely followed by the Second and Third; even some divisions of the Fourth and Fifth, whose education had been still more scrappy, were fit to go to the front barely more than a year after they had been raised, and none of them gave a bad account of themselves. The secret of this great triumph over difficulties lies chiefly in the magnificent spirit of all ranks. In these great voluntary armies not a man held a commission or served in the ranks but that he felt it his duty to fight for a just cause and had a love for his country which spurred him on to fight worthily for her and that cause. They all meant to be soldiers and of

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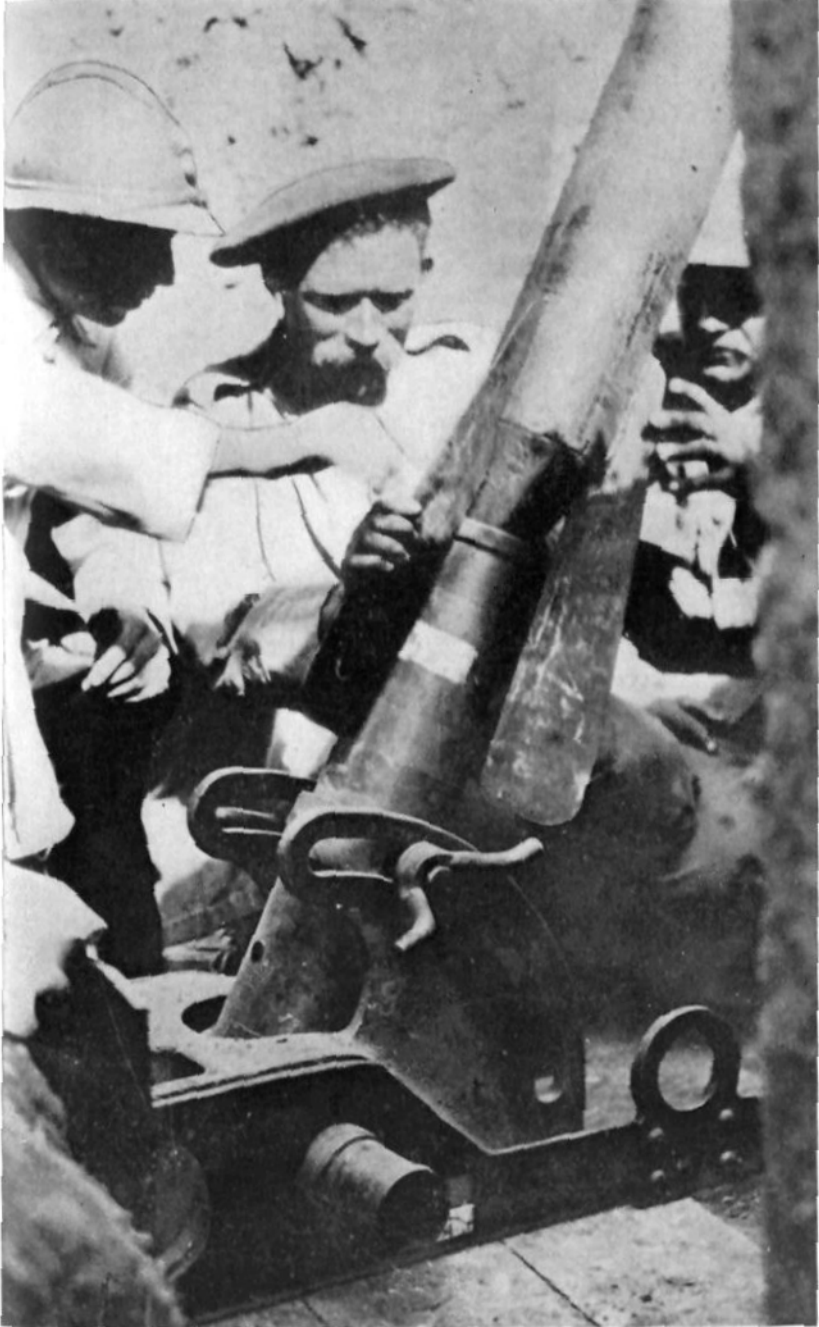
the best, such as their regiments and their army had sent forth in the past. If any special rank is to be picked out, it is undoubtedly true that the backbone of these new armies, especially in the earlier ones, was the junior subalterns. Mostly untrained, or half-trained, they came to learn their work with their men, and had no false shame in telling them so,—without any prejudice to discipline. Not content with the novel and exacting labors of the parade-ground, they sat up late preparing their work for next day, studying military text-books, and practising problems of strategy and tactics; at mess hardly any junior subaltern talked anything but "shop." They helped their noncommissioned officers, and were helped by them, and put posers to the major and the colonel, which these as willingly tackled. They were, in fact, all keen and on their mettle, and, as on the whole they had been well chosen for brain power and aptitude to command, they taught themselves and their men, too, as they went.

But, while this tribute is especially due to the junior subalterns, it is also applicable in a greater or less degree to all ranks. There was everywhere a jolly determination to overcome difficulties somehow and to get on with the work. In spite of the hardships, there was little grumbling and no serious crime; in fact, the reports on discipline after the first few months were almost invariably excellent. The health of the men, as is usually the case with those who put their whole soul into the work, was also very good, partly also owing to the good food, the regular, well-ordered life, and the splendid physical training, of which the standard was set by the Headquarters Gymnasium at Aldershot. Here, late in August, 1914, after the dispersal of the original army gymnasium establishment to the regiments at the front, a nucleus was again gathered together and proper instructors trained and sent out to the units. To the excellence of the physical training given through these instructors in improving the physique, quickening the brain, and giving push, confidence, discipline, and jump to the recruits, every observer has borne his tribute. But it was owing to the enterprise of

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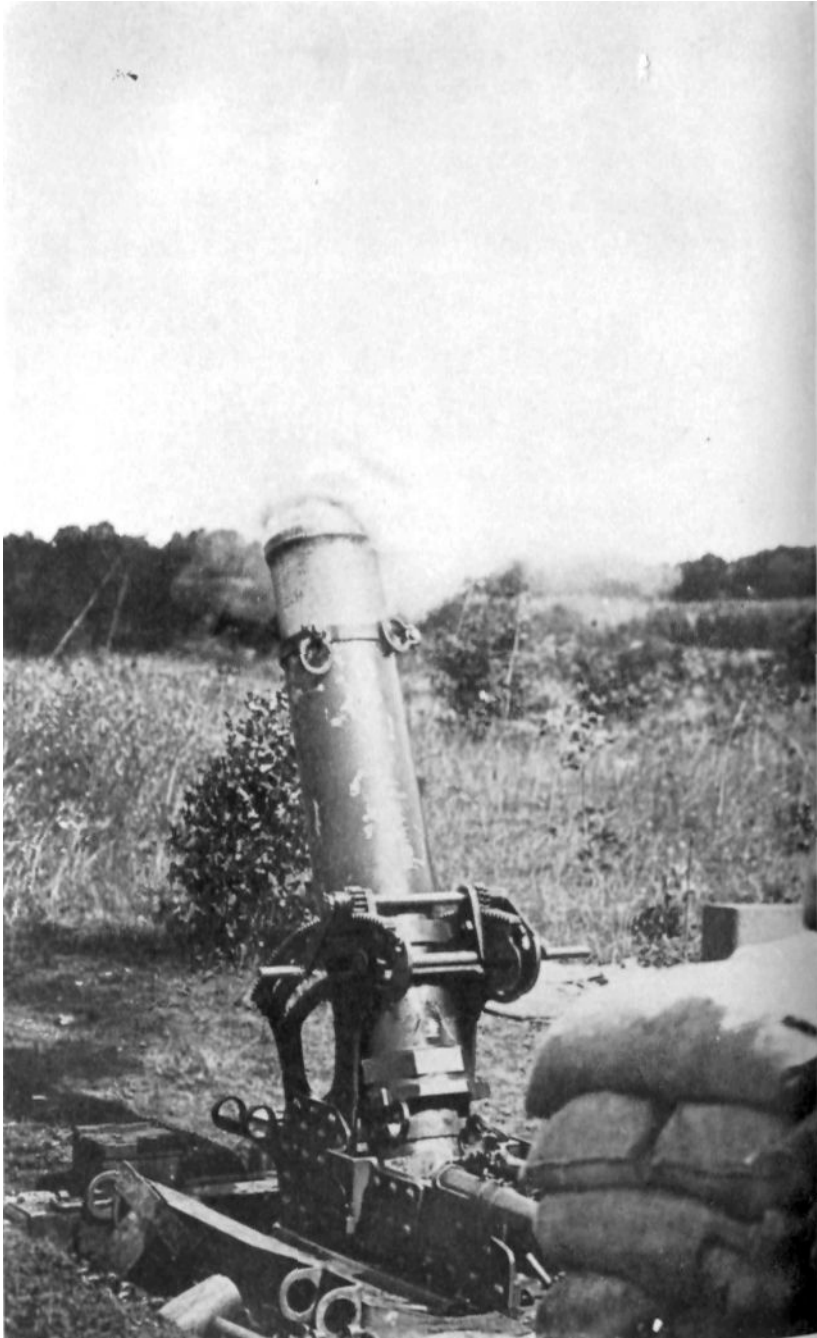
officers and men themselves that many of their difficulties were smoothed away. When equipment necessary for training could not be obtained from the hard-beset War Office, the new armies did not sit down helplessly and give it up: they set to work improvising, borrowing, or buying articles urgently required. Harness and saddlery would be lent by owners of stables in the neighborhood of a camp, dummy guns were made by a carpenter in the battery, rough dial sights were manufactured by ingenious subalterns, flags for semaphore work were made by the men themselves, the officers clubbed together to buy a telephone set or field-glasses or compasses or any rifles they could find on the market for their own and their men's instruction.

It would be difficult, perhaps, to convey a better idea of the spirit and training of the new armies than is to be found in Ian Hay's "The First Hundred Thousand." This intimate account, however, may be supplemented by the considered judgment of an experienced general who, speaking of the training at one of the chief army centres, recalled the old peace days, when two divisions less one brigade taxed the resources of the staff and the place to the full. Writing in April, 1915, he reported that there were five divisions in the same place, all working smoothly under no larger a staff and with less fuss made about all these divisions working in the field with their trains and ammunition columns than obtained before over an ordinary field day. The same authority, writing on the training of some of these new divisions, said that a mass of civilians had been transformed in less than eight months into an army which had more practical training for war than it had ever been possible to give to troops in England before. There was, he added, a feeling of confidence in all ranks, due partly to the organizing power of a short-handed staff, but chiefly to the keenness of all ranks to make themselves fit for the front.



FRENCHMAN INSTRUCTING SERVIAN IN USE OF TRENCH MORTAR

The shell weighs about 100 pounds



A BRITISH HEAVY TRENCH MORTAR
Picture taken immediately after firing

Buzzer Tests

BY SECOND LIEUTENANT JEWETT B. NEWTON, FIELD ARTILLERY, O. R. C.

HAVING spent more than two months in mastering the relatively simple field artillery buzzer, due largely to inability to secure complete information from any one source, and feeling that it is a proposition which, with proper data for ready reference, can be thoroughly absorbed in a few days, the writer submits a schedule of tests for the Buzzer in the hope that it may be of assistance to some one studying this question for the first time.

DESCRIPTION OF TESTS

100 Per Cent. Test

1. Short-circuit the two line terminals. The easiest way is to insert the small screw-driver, carried in the box, into the line plug socket and, pressing down the spring on the second terminal, slip the screw-driver over the end of the spring.

2. Throw the line switch on to *T*, hold receiver against the ear, hold the transmitter in a vertical position, button on top, and press the button or blow into transmitter, with button pressed. A click, or frying noise, in the receiver indicates the success of the test, and that your telephone is all right.

The line terminals can be short-circuited as above, or by leaving the connecting cords and the plugs in the instrument and clamping the line clamp on to the ground rod. This test, of course, includes the connecting cords, rod, clamp, and instrument. By cutting out the parts of the apparatus which test, the trouble is located in the remaining untested portions, and gradually located by the process of elimination.

LINE

GROUNDING OF LINE:

Bad Ground Near Instrument:

Indicated by noisy receiver and failure of telephone communication.

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Tested by weakening of buzzer tone when line is connected.

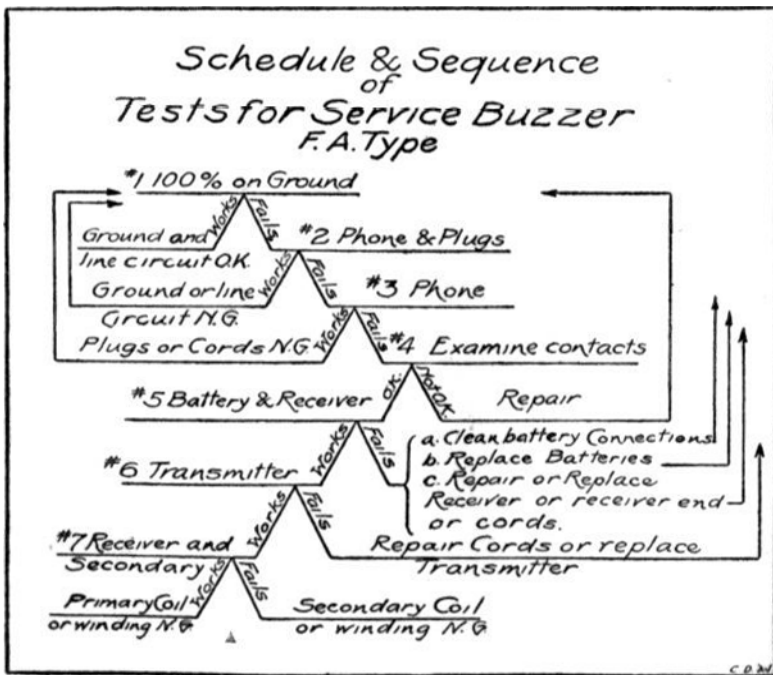
Located by sending a line guard to look for contacts of bare wire with the ground. If the soil is dry a ground is improbable if a small bare spot is touching the earth, and it is more likely a contact caused by pressure of a wheel or horse's hoof. If the soil is damp a ground can occur with a light contact.

Partial Ground:

Indicated by weakness or failure of telephone communication, although buzzer is unaffected.

Tested by making sure of your 100 per cent. test on instrument, including connection cords as hereafter described.

Located by examination of line as described above.



1. 100 Per Cent. Test on Ground

Indicated by failure of telephone communication and weakness in buzzer communication.

BUZZER TESTS

Test by applying 100 per cent. test on instrument, including connecting cords and line. The main binding post short-circuit consists of the line and ground connections, with the instrument on the other end.

Located by cutting in with extra instrument at intervals along the line, or by careful examination of line.

Works.—Ground and line connections and instrument all right.

Fails.—Instrument, line, or ground out of order. Apply test No. 2, "Phone and Plugs."

2. Phone and Plugs

Test.—Short-circuit ground rod and line clamp and apply 100 per cent. test.

Works.—Instrument and cords all right. Line out of order.

Fails.—Instrument or cords out of order.

Apply test No. 3, "Phone."

3. Phone

Test.—Apply 100 per cent. test to instrument.

Works.—Instrument all right, therefore cords out of order. Examine cords and plugs for loose or broken connections.

Fails.—Instrument out of order. Be sure that transmitter is in vertical position with button on top. Tap transmitter gently against knee or side of box and repeat test. Fails, proceed to No. 4.

4. Contacts

Examine contacts. If not in order, repair and apply 100 per cent. test as above. If all right, apply test No. 5, "Battery and Receiver."

5. Battery and Receiver

Test.—Short-circuit the transmitter terminal, labelled "T," and the centre terminal.

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Works.—Indicated by click in receiver, showing batteries and receiver are operating.

Fails.—Batteries or receiver, or both, out of order.

Batteries

Test.—Operate buzzer.

Fails.—Examine contacts for dirt and adjustment. Dirt is more likely to be the trouble. Contacts can be cleaned by drawing a thin strip of paper between the points. They should never be filed.

If contacts are in order.—Batteries are probably worn out, or there is improper connection between batteries and instrument. Test batteries by trying them in another instrument.

Receiver and Cords

If your batteries and contacts are all right, test receiver and cords.

Test.—Press upward on the buzzer key, thereby insuring a good contact on the point on the upper side of key; repeat 100 per cent. test. If no result is obtained, remove the receiver cords from their terminals and hook one on to the main line binding posts, throw the line switch on the "B," and press the buzzer key. Make contact between main binding post and loose cord.

Works.—Indicated by loud buzzing noise in the receiver. Receiver and cords operating. Apply test No. 6, "Transmitter test."

Fails.—Indicated by little or no sound in the receiver, and, if accompanied by diminution of sound of buzzer, cords are short-circuited. No change in sound in buzzer or signs in receiver indicates break in cords or defective receiver.

Receiver

Test.—Unscrew back of receiver, and make contacts directly between receiver screws and main binding posts.

Fails.—Receiver out of order. Examine back of receiver for loose connections, and unscrew front and examine diaphragm

BUZZER TESTS

and magnets for dirt. Dirt in the receiver is a common cause of trouble. Repair and apply 100 per cent. test as at beginning.

Works.—Receiver operating, therefore cords out of order. Test cords.

Receiver Cords

Break Test.—Connect up cords to main binding posts as before, and short-circuit other ends of cords. Leave one cord unhooked from the post. Keep buzzer key pressed down and make contact with loose receiver cord to binding post. Broken cord is indicated by no change in buzzer note and no noise in receiver. Keep key pressed down and work cords through the fingers in an attempt to bring possible broken wires together, and listen at receiver for signs of restored contact. Wherever your fingers are at time of sound in receiver shows where the break is in the cords. Repair break in cords and try 100 per cent. test as before.

Short-circuit in cords is indicated by diminution in sound of buzzer when contact is made, as described under "Receiver and Cords." Examine cords for short-circuit. Repair and repeat 100 per cent. test.

6. Transmitter and Cords

The transmitter is very delicate, and often tapping it gently against your knee will separate the little particles inside and cause it to work perfectly.

"A" Test.—Short-circuit terminal "T" and centre terminal.

Works.—Indicated by a click in the receiver and shows that the coils and receiver and contacts are operating, therefore transmitter or cords, or both, are out of order. Apply "B" Test.

Fails.—Nothing in regard to transmitter and cords is proved. Apply "C" Test.

"B" Test.—Remove back of transmitter and short-circuit ends of cords at transmitter binding screws.

Works.—Click in receiver. Cords all right, therefore transmitter

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out of order. Examine back of transmitter for loose connections, but do not take the front apart.

Fails.—Nothing in regard to transmitter or cords is proved. Apply "C" Test.

"C" Test.—Unscrew cords from terminals on instrument base and connect to main binding posts as described above for receiver. Keep buzzer key pressed down, and press transmitter button.

Works.—Indicated by diminution in sound of buzzer, cords, and transmitter operating. Apply test No. 7, "Receiver and Secondary."

Fails.—Transmitter or cords, or both, out of order. Test cords.

Transmitter Cords

Short-circuit test as for receiver cords. Change in buzzer shows short-circuit in cords.

Break Test.—Unscrew back of transmitter and, with buzzer key pressed down as before, short-circuit binding screws on back of transmitter and note diminution of buzzer sound.

Works.—Cords all right, therefore transmitter out of order. You have located the trouble in the transmitter and can do no more with it.

Fails.—Cords broken and can be detected and located, as described above for receiver. Repair cords.

7. Receiver and Secondary

If you still fail to get the 100 per cent. test and have proved the battery, receiver, transmitter, and connection are in order, test secondary coil.

Test.—Short-circuit the "R" and "T" terminals.

Works.—Indicated by click in receiver, therefore the primary coil is out of order, since you have tested everything else.

Fails.—Secondary coil is out of order, since you have already proved receiver to be all right. However, your primary coil

BUZZER TESTS

may be also out of order, but you have learned enough to know that the repair job is one for an expert.

You can do nothing about these coils beyond seeing if any visible connections are loose.

Miscellaneous

Batteries just beginning to wear out are indicated by weakening of the buzzer after some minutes' use. A sure sign of coming trouble is the cracking of the brown seal on the end of the batteries toward the door. That permits the moisture in the cells to escape and deadens the battery. It may be stimulated temporarily by dipping in water.

Improper connections with the contacts between the batteries and the battery door are due to the paper cell covering becoming pushed out too far or the bottom of the metal instrument box becoming bent in, through being knocked about. The remedy is to remove the instrument base and batteries from the box, and bend the box out to its proper shape, by tapping on a piece of wood held against the inside of the box. You can test your batteries by trying them in another instrument.

One battery, next to the hinge of the battery door, will run the telephone element, but both batteries are needed for the buzzer.

If the type "A" tungsten battery is not available, you can buy "Everready" tungsten batteries, which come commercially three cells in a roll. These cells are the proper size, and two of them make a battery exactly like the type "A" batteries issued.

Probably the commonest cause of trouble is the contact on the upper side of the buzzer key, and you should be sure that has a good contact, as described above under "Receiver Test." The pressure on this contact can be regulated by the spring under the key.

The commercial telegraph lines can be used as a part or whole of circuit for buzzer—telephone working without interfering with the use of the wire for Morse working, by throwing the condenser into the circuit.

Notes on Artillery

EXISTING ORGANIZATION

THE Field Artillery of an Army Corps of two or three divisions consists of:

The Divisional Artillery for each division (usually three groups of 75-mm. guns), commanded by a colonel or lieutenant colonel, who reports directly to the Division Commander.

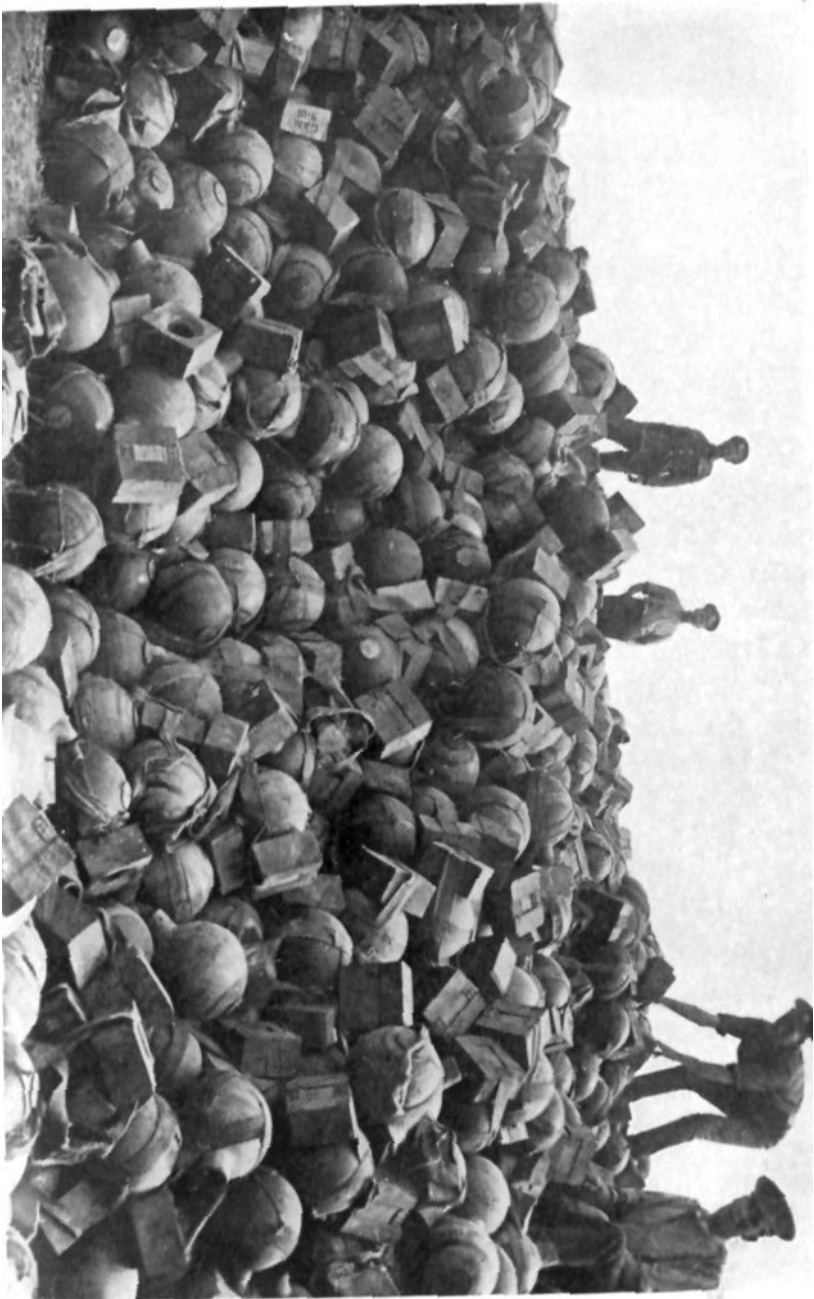
The Corps Field Artillery (usually four groups of 75-mm. guns), commanded by a colonel or lieutenant colonel, who reports directly to the general commanding the Artillery of the Army Corps.

An Artillery Park, consisting of two or three échelons, under the command of a colonel or a lieutenant colonel, who reports directly to the General commanding the Artillery of the Army Corps. Each échelon consists of ammunition sections for the Infantry, the 75-mm. guns, and the Heavy Artillery.

The Corps Commander apportions all or part of the Field and Heavy Artillery to the various divisions, depending upon the circumstances and the missions entrusted to them. In such cases artillery commands are created, which, according to their importance, are placed under the orders of colonels or generals.

The General commanding the Artillery in an Army Corps is in direct command of the Corps Light Artillery, the Heavy Artillery, the Artillery Park, and also of any Artillery command which may be assigned to him on the field of battle. He is also charged with the ammunition supply of the troops comprising the Army Corps.

In addition, for trench warfare a certain number of trench artillery batteries are attached to one of the Artillery Regiments of the Army Corps and distributed among the various sectors of the Corps.



TRENCH MORTAR AMMUNITION

NOTES ON ARTILLERY

TABLE SHOWING THE MATÉRIEL IN USE IN THE FRENCH AND GERMAN ARMIES

In general the guns and mortars of the German Army are of greater range than the French guns and mortars of the same calibre. They also fire heavier projectiles. This inferiority of the French matériel is fortunately compensated for in the French projectiles by a heavier bursting charge of high explosive. This is shown in the table below:

PROPORTION OF EXPLOSIVE

FRENCH PROJECTILES

Calibre	Percentage of Explosive
75-mm. Gun	16
155-mm. Gun	24
220-mm. Mortar	30

GERMAN PROJECTILES

77-mm. Gun	2
Other calibres	Between 2 and 14

Designation	FRENCH. Extreme Range, Metres	Weight of Shell, Kgs. Shrapnel H. E. Shell	
Field Guns:			
New models:			
65-mm. mountain, model 1906	5500	4.5	3.8
75-mm. cavalry gun, model 1912	6500	7.25	5.3
75-mm. gun, model 1897	6500 ¹	7.25	5.3
Old models:			
80-mm. mountain gun	3500	6	6
80-mm. cavalry gun	6500	6	6
90-mm. gun	7500	8.5	8.5

HEAVY ARTILLERY:

Guns:	
New models:	
105-mm. Schneider, model 1913	12,300 ² 16

¹ Ranges limited by carriage—gun will fire to 9000 metres.

² With "D" shells, range of nearly all guns is increased between 20 and 30 per cent.

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Designation	Extreme Range, Metres	Weight of Shell, Kgs. Shrapnel H. E. Shell	
155-mm., model 1877-1914, either tractor or horse drawn	11,000	40	43
147-mm. (in construction)	16,000		12
95-mm.	8,200		12
 Old models:			
100-mm. coast gun on 155-mm. carriage	12,000		13.5
120-mm.	10,000		20
155-mm.	11,000	40	43

GERMAN.

Designation	Extreme Range, Metres	Weight of Shell, Kgs.	
Field Guns:			
77-mm. cavalry, model 1896	8400		7
77-mm. field gun, model 1896	8400		7
105-mm. field howitzer	6300		15
90-mm., model 1873-1888	6500		7.5

HEAVY ARTILLERY:

Guns:			
105-mm., model 1904	10,300		18
130-mm.	14,400		40
150-mm. (149-mm.)	15,600		50
 Old models:			
120-mm.	7300		20
150-mm.	10,000		40

FRENCH.

Howitzers	Extreme Range	Weight of Shell Shrapnel H. E. Shell	
Old:			
120-mm., model 1890	5000		20
155-mm., models 1881, 1892 and 1881-1912	6300	40	43

NOTES ON ARTILLERY

Howitzers	Extreme Range		Weight of Shell Shrapnel H. E. Shell
New:			
120-mm. Schneider, model 1915	7100		20
155-mm. Riamilho	6300	40	43
155-mm. St. Chamond, model 1916	10,000		43
155-mm. Schneider	11,000		43
Mortars			
Old:			
220-mm. (Tractor)	5200		100
270-mm. (Siege)	7500		150
270-mm. (Coast)	10,000		250
New:			
280-mm. Schneider (tractor)	10,000		275
370-mm. Fillieux } platf	12,000		300
293-mm. Schneider } orm	8500		710
400-mm.	15,100		890

GERMAN.

Howitzers	Extreme Range		Weight of Shell
Old:			
150-mm. (149)	6000		40.5
New:			
150-mm. (149), model 1902	7400		40.5
150-mm. (149), model 1913	8500		40.5
Mortars			
Old:			
210-mm.	7200		119
New:			
210-mm., model 1910	8200		83
280-mm.	11,000		340
420-mm.	14,000		730

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French Artillery is divided into Field Artillery and Heavy Artillery.

Field Artillery comprises matériel smaller than 95 mm. Heavy Artillery comprises matériel larger than 95 mm. Heavy Artillery is divided into Heavy Field Artillery, which is drawn either by horses or tractors, and Artillery of Position or Siege Artillery.

All divisions of Artillery comprise both guns, howitzers, and mortars of both modern and ancient construction.

Heavy Siege Artillery is designated as follows: 1. *Fortress or Coast Artillery*.

2. *Special Heavy Artillery or High-powered Heavy Artillery* (designated as "A. L. G. P."—*Artillerie Lourde à Grande Puissance*).

The A. L. G. P. is subdivided as follows:

(a) Heavy Railway Artillery (designated as "A. L. V. F."—*Artillerie Lourde sur Voie Ferrée*). This is used either on standard or narrow-gauge tracks and fires from the truck.

This subdivision comprises old fortress, navy, or coast matériel, as follows: 190, 240, 320, 274, 395, 200, 95, 120, and 155 mm.

(b) High-powered Artillery which is transported by rail but which is dismounted and placed on a platform mount before firing.³

This subdivision comprises: 305- and 240-mm. rapid-fire, 340- and 293-mm. Schneider, 400-mm. howitzer and coast guns, 270- and 370-mm. Fillieux.

INDICATIONS

CHARACTERISTICS OF GERMAN BATTERIES IN ACTION

The employment of masked artillery positions has become a general rule. For this reason troops are ordinarily subjected to the effect of projectiles without knowing where they come from. If aerial reconnaissance is not available, it is very difficult

³ Observer's Note: This is not clearly stated. These guns fire on their trucks supported by platforms.

NOTES ON ARTILLERY

to discover the position of hostile batteries and to bring the fire of our own counter-batteries upon them.

In some cases a battery cannot be seen by the troops upon which it is firing, but may be seen by other troops. Certain indications permit an alert observer in some cases to reconnoiter the position of a hostile battery in action, although other observers see nothing.

Under modern conditions it is difficult to discover the positions of hostile batteries. For this reason officers of all arms should point out to our artillery all enemy battery positions which they can see which do not appear to be under counterbattery fire. Such positions may sometimes be indicated with an approximate accuracy sufficient for the initial elements of fire for adjustment and for the eventual delivery of effective fire for effect.

It is therefore necessary that all officers should be able to recognize the characteristic indications of German batteries in action by their flames, flashes, and smoke, and the different ways in which hostile projectiles of various calibres may be identified at the time they burst, so that not only the hostile battery positions may be signalled to the artillery but also the calibre of the guns.

1. CHARACTERISTIC INDICATIONS OF THE BATTERIES THEMSELVES

77-mm. Field Gun.—The flash is seldom seen. The flames when seen are short and of a pale-green, lurid color.

105-mm. Howitzer.—The flames are colored and a light vertical column of smoke is thrown up.

150-mm. and 210-mm. Howitzers.—The flashes are red and are mixed with a yellow smoke.

130-mm. Field Gun.—Each round fired gives a very vivid flash, much stronger than that of the other pieces.

False Mortars.—The Germans, not being able to do away with the columns of smoke from the 210-mm. mortars, have organized *false batteries* made of cone-shaped sheet-iron smokepots

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intended to imitate the smoke of the real mortars. It is necessary to avoid being deceived by these false batteries.

2. CHARACTERISTIC INDICATIONS OF VARIOUS PROJECTILES

These indications include the smoke made by the bursting of the projectile, the noise of the detonation, and the size of the craters. By these means experienced observers are able to determine with some degree of accuracy the calibres of the projectiles in question.

In hard ground with a non-delayed-action fuze the following craters are characteristic:

150-mm. Crater 2.5 to 3 metres in diameter and 1 metre deep.
210-mm. Crater 4 to 5 metres in diameter and 1.5 metres deep.

With delayed-action fuzes the craters are much larger, and exceed the figures given by about a third.

The 77-mm. projectiles are the easiest to distinguish, because they are by far the least powerful. But it should be remembered that the time-fuzed high-explosive shell and the unit-projectile give much more violent and destructive bursts than the 77-mm. shrapnel.

Firing by Salvos.—The 77-mm. and 105-mm. batteries are 6-gun batteries. Rapid fire for effect is usually delivered by salvos of either three or six guns.

The 105-mm. howitzer batteries are four-gun batteries and often deliver fire for effect by salvos of either two or four guns.

Difference in the Bursts.—The 150-mm. shells are equipped with non-delayed-action fuzes and their bursts are much more destructive than those of the 210-mm., which penetrate the earth with a muffled sound.

Whistling of the Shells.—The shells from the 100- and 130-mm. guns, which are fired at a high velocity, give a more strident whistle than the 150-mm. howitzers. The difference is even more marked in comparison with mortar shells. Moreover, in the case of shells fired from high-velocity guns, the

NOTES ON ARTILLERY

whistling is always very much like the noise produced by the "shock-wave" (*l'onde de choc*), analogous to the "crack" (*claquement*) of the infantry bullet. This "shock-wave" precedes the whistling and is often mistaken for the discharge of the gun itself.

All these indications are of relative value only. The only accurate indications are given by an examination of the fuzes and the fragments of the projectiles.

Shell Fragments.—In the case of steel shells only fragments of the base of ordinary shells and of the ogive of armor-piercing shells can be identified. The fragments of cast shells may be identified by their size. But the measurement of fragments, in order to give exact information, must be done with the greatest care and is a very delicate operation.

Examination of Fuzes.—The markings of fuzes give very definite information. They are especially definite in the case of time-fire, for they furnish information as to the range of the battery which fired them.

Markings.—The following marks are found on German fuzes and shell fragments. From them can be determined the calibre and the nature of the matériel, that is to say, whether it is a gun, a howitzer, or a mortar, viz.:

F. K. (*Feld Kanone*) field gun.

N. A. (*Neue Artillerie*) new model artillery.

L. F. H. (*Licht Feld Haubitze*) light field howitzer.

S. F. H. (*Schwere Feld Haubitze*) heavy field howitzer.

Mrs. (*Mörser*) mortar.

Kst. (*Küst Haubitze*) coast mortar.

12 K. (*12 Kanone*) 12-cm. gun.

13 K. (*13 Kanone*) 13-cm. gun.

15 Shr. (*15 Schrapnel*) 15-cm. shrapnel.

15 gr. (*15 granate*) 15-cm. high-explosive shell.

15 Brand gr. (incendiary shell).

Fuze Markings

M. V. (*mit Verzögerung*) delayed-action.

O. V. (*ohne Verzögerung*) non-delayed-action.

Nur Gr. Bz. (*nur granate Brennzünder*) high-explosive fuze for time shell.

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- D. Z. (*Doppelter Zünder*) combination fuze.
Gr. Z. (*granate Zünder*) percussion fuze.
Bdz. (*Bodenzünder 06*) base percussion fuze, 1906.

EXAMINATION OF THE POINTS OF FALL

The examination of the points of fall and of the whistling of projectiles, especially during fire for adjustment, often indicates the direction of fire and consequently the battery positions. These indications, combined with a study of the map, sometimes enable the battery position to be determined within 200 or 300 metres.

The Sound of the Gun.—In the case of guns with a flat trajectory, when the observer is in the vicinity of the trajectory, near the point of fall, three successive detonations may be heard:

1. The "shock-wave" which is produced, in the case of the infantry bullet, by the rolling (*roulement*) of the air. This "shock-wave" gives the impression of a cracking noise. In the case of guns it produces a sound which is analogous to that of the discharge of the gun itself.

2. The whistling of the projectile as it falls, if the observer is outside the trajectory, or the detonation of the projectile if the observer is very close.

3. The sound of the discharge of the gun.

In the case of howitzers and mortars, only the last two sounds are heard. In such cases the sound of the discharge of the gun may precede that made by the fall of the projectile.

TRENCH MATÉRIEL

For use at the short ranges which are often met with in trench and siege warfare, special artillery matériel is employed, which is served by artillery personnel, as well as bomb-throwers served by the infantry.

The flat-trajectory matériel of this nature includes revolver guns and rapid-fire guns of 37 mm. and 47 mm. On account of the flatness of their trajectories they are used as flanking

NOTES ON ARTILLERY

guns or for the purpose of supporting the infantry at the moment of the assault.

The other trench matériel—mortars, trench guns, and bomb-throwers—is used for vertical fire.

Smooth-bore Mortars.—Smooth-bore mortars, of very old model, were found among the armament of fortified places and were utilized at the beginning of trench warfare. They included mortars of 15, 22, 27, and 32 cm. They fired spherical bombs which could only bound and run along the ground. The weights and ranges are as follows:

Calibre, cm.	Weight, kg.	Extreme range in metres (approximate)
32	75	1500
27	51	1000
22	23	500
15	7	300

Unfortunately these mortars used black powder, which produced a great deal of smoke, and for this reason they were very easily registered by the enemy.

Trench Mortars.—Since the beginning of the war, in order to meet the powerful German *Minenwerfers*, new models of smooth-bore trench mortars have been built. These are muzzleloading, but they use B powder and have a much increased range. The weight of projectile for the 340-mm. trench mortar is 200 kilograms.

These projectiles, fired at a low velocity, contain large bursting charges. The 200-kilogram projectile contains a bursting charge of 100 kilograms.

The effect of such projectiles, which have been named aerial torpedoes, is very destructive.

In general, these mortars consist of a platform with two vertical cheeks which include trunnion beds and a guide-slot. The tube has two trunnions and two studs mounted on a collar. The studs work in the guide-slots and are held by two wing-nuts. By this device the desired elevation is given to the mortar (see Fig. 1).

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The following characteristics show the models of trench mortars in present use:

Calibre, mm.	Weight of projectile, kg.	Weight of bursting charge, kg.	Extreme range, metres
58 (No. 1)	16	6	400
58 (No. 2)	45	23	450
240 T	87	45	1000
340	200	100	2000

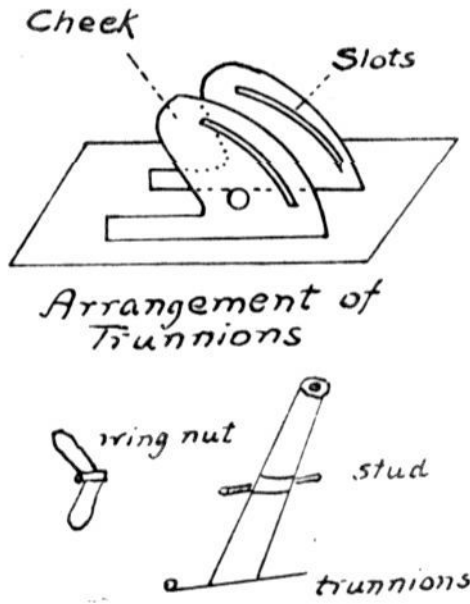


FIG. 1

Projectiles.—The projectiles are elongated. In order to steady them in their flight they are provided with vanes.

In the case of the 58-mm. trench mortar the projectile itself is not placed in the bore of the mortar, but only a cylindrical stud which projects to the rear, known as the "queue." In the case of the 240-mm. and 340-mm. the entire projectile is placed in the mortar.

NOTES ON ARTILLERY

Trench Batteries.—Trench artillery is organized into 6-gun batteries and is manned by a special personnel.

Each battery consists of 3 officers, 200 men, 120 horses (in round numbers), and 20 vehicles.

Bomb-Throwers.—Trench mortars and guns are very heavy matériel which it is difficult to move, but bomb-throwers are much lighter and are easily transportable. They are used to throw grenades to a certain range. These grenades are lighter than trench mortar projectiles and heavier than hand grenades.

There are several kinds of bomb-throwers. Some, such as the Aaren, use a small propelling charge of black powder; others use springs, either spiral or plate springs, and still others use compressed air.

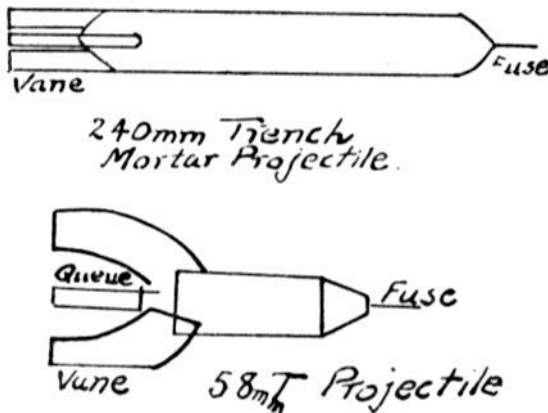


FIG. 2

THE INFANTRY CANNON OF THE FUTURE

In the attack of a position organized for defense, whether in trench warfare or the war of movement, troops which have taken the first enemy lines often hurl themselves against a second line, which, although it has also been demolished by the artillery, is still able to stop the infantry advance by means of machine guns. These machine guns, placed in hidden blockhouses, and having either escaped the fire for adjustment of the artillery or else been kept hidden with their gun crews in

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dugouts, are at the last moment placed in emplacements previously determined upon.

Against such machine guns the infantry can do nothing, and the artillery is so far away that there is no opportunity to ask for its fire. Communication with the artillery is, on account of the hostile curtain fire, so difficult that it is impossible to ask for accurate fire delivered rapidly. *It is necessary that means to destroy such machine guns shall be given to the infantry themselves.*

Bomb-throwers which are provided for trench warfare have so little accuracy that they cannot be used for this purpose. It would seem that if light pieces of artillery served by gun crews which can carry them forward are furnished, when the first waves of the assault have carried the first of the enemy's trenches, it will be possible to destroy those machine guns which have escaped the artillery preparation and which afterwards have disclosed their positions in the second line. For this reason several attempts have been made during large attacks to have the infantry accompanied by 37-mm. guns and 65-mm. and 80-mm. mountain guns.

The expected results have not been attained. These guns have a flat trajectory, especially the 37-mm. gun, at short ranges, and it is necessary to place them in uncovered positions outside of the trenches. The cannoneers make very visible targets, which are easy to hit. It has frequently happened that they have been put out of action before they have been able to open fire.

The 65-mm. and 80-mm. mountain guns present great difficulty on account of ammunition supply. In a terrain full of all kinds of obstacles one man can carry only one 80-mm. projectile weighing 8 to 9 kilograms, or one 65-mm. cartridge weighing 6 to 7 kilograms.

As an accompanying infantry gun there is required a very short, light howitzer which can be transported as easily as a machine gun, and can be fired from a trench or a shell hole or a ditch.

NOTES ON ARTILLERY

The 37-mm. and 47-mm. guns seem suitable as to calibre; and a careful study of the problem brings us to the conclusion that these are the calibres to be adopted. The 37-mm. fires a projectile weighing 0.5 to 0.8 kilogram, and the 47-mm. fires a projectile weighing from 1 kilogram to 1.5 kilograms. Such a gun should have a low initial velocity, because the pieces will be rifled howitzers which can fire a projectile with a very thin wall and a large percentage of explosive, 50 per cent. to 60 per cent. at the least.

These howitzers will be laid directly or by means of periscopes, and the powder charges will be varied so as to obtain ranges of between 200 metres and 1000 metres.

Ammunition supply will be easy, because one man can carry 15 to 20 37-mm. cartridges and 10 to 15 47-mm. cartridges. Two men carrying ammunition boxes can carry much more.

Such pieces may either be carried by hand, disassembled like machine guns, or, according to circumstances, they may be hauled on wheels. They may be fired either from tripods or from wheeled mounts. They must be arranged so that enough rapidity of fire may be obtained to compensate for the small calibre.

The gun crews organized from the artillery or the infantry should be so organized that the pieces may be marched either singly or in sections of two. They should be a part of the infantry regiment and be assigned one to a battalion in the same way that machine-gun crews are organized.

Use in the War of Movement.—Light howitzers will be of as much, if not more, value in the war of movement as in the war of trenches; for in the attack of positions the infantry will meet the same obstacles, and the artillery will have neither the time nor the means to prepare the attack as well as in trench warfare. The effect of the light howitzer will probably be more marked than in trench warfare, because the enemy will not have time generally to prepare casemates for his machine guns.

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EMPLOYMENT OF ARTILLERY

In the War of Movement.—The mission of the artillery comprises:

(a) To open the way for the infantry advance by firing on everything which impedes this advance and on every obstacle which the infantry meets.

(b) In case of need, to shelter its own infantry by stopping the advance of the hostile infantry.

Offensive Action.—In the offensive, the artillery supports the infantry of the advance guard in the capture of positions.

When contact has been gained, the artillery should profit by every opportunity to gain a material and moral superiority over the hostile artillery in order to put it out of action. But the artillery battle should never have any object except the support of the infantry.

If the attack succeeds, portions of the artillery (accompanying batteries) should take position in the captured territory as soon as possible in order to make sure of their conquest and assist the completion of the success.

Defensive Action.—In defensive action, the artillery becomes useful in interrupting the march of the hostile infantry. Fire is opened as soon as it can be effective. The artillery should avoid becoming absorbed in the artillery duel, because it should, *above all things*, make sure of the possibility of firing on the hostile infantry. When necessary, batteries or portions of batteries are hidden until the last moment in order to surprise the advancing enemy columns by a flanking fire.

Advance Guard Artillery.—Artillery is not assigned to an advance guard unless there is sufficient infantry to protect it, and unless, by means of its écheloning it in depth, it can be protected from being surprised by hostile artillery fire.

Before the present war it was assumed that artillery would not be assigned to an advance guard unless the advance guard was at least as large as a brigade.

In the future, on account of the increased range of artillery,

NOTES ON ARTILLERY

there is reason to believe that there will be a tendency in most cases not to assign any artillery to advance guards. Assigned a march position a little in advance of the main body, the artillery will be in a position to move forward rapidly for the support of the infantry of the advance guard.

Rear-Guard Artillery.—The protection of the main body is the first consideration. The artillery is the principal arm of the rear guard, and its proportion depends upon the strength of the infantry and also upon the terrain. The strength may be taken as one battalion (*groupe*) for each regiment of infantry.

Artillery with a Detachment.—If artillery is added to the strength of a detachment, it becomes the duty of the detachment to protect it. In each case it is thus necessary to come to a decision as to whether the advantage accruing from the addition of the artillery compensates for the inconveniences which are involved.

The proportion of artillery to be given to a detachment depends, as in the case of an advance guard, upon the infantry available to protect it during the march or during the battle. It should be noted that a detachment has only its own strength to rely upon, whereas an advance guard may, after a brief interval, depend upon the entrance of the main body into action.

The road space of artillery (300 metres for a battery, 1000 metres for a group) should always be taken into consideration.

In principle, not more than one battery should be assigned to a regiment, and a battalion (*groupe*) to a brigade.

Artillery in the War Position.—In the war position (more often referred to as "trench warfare") the entrenched troops increase in front and in depth the obstacles which impede the advance of the enemy infantry.

The rôle of the artillery remains the same as in open warfare, but assumes more importance.

Attack.—No attack is possible until after an intense and effective artillery preparation, which has for its objects:

- (a) To destroy the enemy's barbed wire;

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(b) To disintegrate and destroy enemy's trenches and dugouts, and to destroy or annihilate their defenders;

(c) To prevent, or at least to interfere with, hostile artillery action;

(d) To prevent the passage of the enemy's reserves by curtain (*barrage*) fire; and

(e) To destroy the machine guns wherever they can be located.

These results can be obtained only by methodical organization which requires much time and ammunition.

The various types of artillery—field artillery, heavy artillery, and trench artillery—receive different missions, depending upon their varying powers of destruction.

Field Artillery.—The mission of the field artillery is to make breaches in the barbed wire of the first line, to fire on all groups of the enemy who show themselves outside of their trenches, and to execute curtain (*barrage*) fire.

Short-Range Heavy Artillery.—The mission of the short-range heavy artillery (howitzers and mortars) is to destroy or to disintegrate the trenches and dugouts of the first line.

Long-Range Heavy Artillery.—The mission of the long-range heavy artillery (heavy howitzers and mortars) is to fire against the hostile artillery and to destroy or to disintegrate the trenches and dugouts of the second line.

Trench Artillery.—The mission of the trench artillery is to complete the action of the heavy artillery by disintegrating the first-line trenches and terrifying their defenders.

Accompanying Batteries.—If the attack succeeds, a certain number of the field and heavy batteries change position forward in order to assure the retention of the captured position and to prevent counter-attacks.

Defensive Action.—The experience gained in the French attacks in Artois and Champagne, and by the Germans in Russia, in the Balkans, and before Verdun, makes it possible to state to-day that an attack on a line of trenches should be

NOTES ON ARTILLERY

successful if it is well prepared by an artillery *which is unhampered by considerations of ammunition supply.*

Under the rain of projectiles of all calibres which disintegrate or destroy the trenches, the dugouts and the barbed wire, and which annihilate the defenders, the defense of a line which can be seen by the enemy becomes almost impossible. The attack can be easily delivered and the position where the enemy's trenches existed can be occupied almost without firing a rifle shot.

But the artillery of the defense can make the enemy pay very dearly for his success, even if it cannot make that success ephemeral.

During the preparation of the attack the artillery of the defense can, by well-adjusted fire, counter-batter the enemy's artillery, bombard the positions of the first and second lines, and fire upon the communicating trenches in order to prevent or interfere with the assembling and moving of the enemy troops.

When the enemy launches the attack, the artillery of the defense opens with curtain fire before the first and second lines of the enemy until the first-line trenches have been occupied. The curtain fire is then kept up before the first-line enemy position. Fire is also concentrated on the positions which have been lost in order to render them untenable and to permit the formation of a counter-attack.

In order to accomplish this, the defense should be in a position as in the attack, to reinforce the artillery already in position. If the attack has been secretly prepared, there will be little time to do this. For this reason the defense should at all times be ready to retaliate.

To this end, it is necessary at all times to study the front and the different hypotheses which may be made in regard to possible enemy attacks. In this way the rôle of the artillery of reënforcement may be deduced. There should be no delay in preparing battery positions for this purpose, as well as the organization of fire and communications.

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The High Command should have at all times ready a strong artillery reserve of all calibres which can be easily moved. This consists of the artillery reserves of armies and groups of armies, and is composed of 75-mm. guns on tractors, heavy batteries drawn by tractors, heavy railway batteries, and supplies in wagons, or on tractors and by rail. When an attack is anticipated, all the artillery in position should be reënforced. As soon as the sector of the attack is known, the artillery of that sector should be reënforced in order that the enemy may be replied to on an equal footing and the positions which he intends to occupy may be rendered untenable.

1. PROTECTION AGAINST THE FIRE OF ARTILLERY IN A WAR OF MOVEMENT AND IN A WAR OF POSITION

In Open-Warfare Employment of Lateral Movements.—A body of infantry taken under the fire of a rapid-fire battery can in a certain measure extricate itself momentarily from this fire by a rapid displacement, either to the right or to the left about 200 or 300 metres.

This displacement utilizes the difficulty which the artillery has in following with rapid-fire guns targets which move rapidly in a lateral direction.⁴ It is to be especially recommended to troops who, having crossed a crest, in sight of and fired on by artillery, arrive in a defiladed zone.

March under the Fire of Artillery.—It is by *concealing its movements from view* and in *progressing rapidly* that infantry escapes best under the artillery fire.

All formations (lines or columns) are vulnerable, certain ones less so than others, depending upon the nature of the shells

⁴ Rapid-fire guns are in effect fastened to the ground by their spades. Some, like the 75-mm., have besides zones immobilized by means of wheel shoes also furnished with spades. The lateral displacement of the gun is obtained then either by pivoting the carriage around the spade (this is the case with the 75-mm., whose carriage slides on the axle), or by pivoting the gun around a vertical axis supported by the carriage over the axle (this is the case with the German 77).

Thanks to the sliding of the carriage upon the axle, the 75 can execute a sweeping fire within a limit somewhat large. The German gun can do so only within very small limits.

With the 77, in order to follow an objective moving laterally, it is frequently necessary to displace the spade, which retards the fire.

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and the kind of fire, but what the infantry ought above all to seek are *formations which show the least and facilitate the least the regulation of fire.*

Lines of skirmishers generally make more visible targets for the artillery than small columns and are more easily adjusted upon. Whenever it is possible (that is to say, whenever they are not in a zone subjected to effective rifle fire) *infantry should march in small columns by échelon.*

In order to escape the observation of the artillery, these small columns should not hesitate to make detours *in order to take advantage of cover and of defiladed roads.* When it is necessary to cover open spaces it should be done at a single rush at a running step and *in good order.* Rushes should follow each other at irregular intervals.

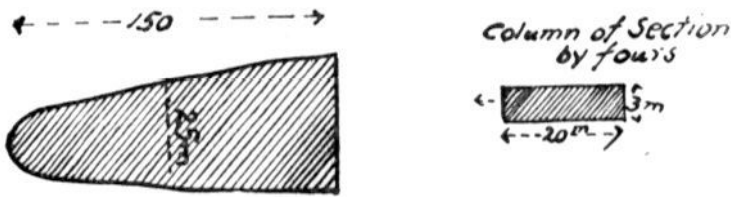


FIG. 3

Marching under Shrapnel and Shell Fire, Either Time or Instantaneous.—In order to avoid heavy losses, it is necessary to avoid altogether dense formations like section columns of fours. The formation in small columns with little depth or in small groups becomes necessary. Column of squads of half-sections by twos seems the best formation in which to march under shrapnel or time shell fire, or under percussion shell fire executed with non-delayed-action fuzes. Each file protects the neighboring files against the lateral fragments of high-explosive shells, just as the first rank protects the second rank to a certain degree against shrapnel balls. The rushes should be made between two salvos or two *rafales* (see Figs. 3 and 4). The intervals between columns should be at least 25 metres in order that one sheaf should not hit two columns.

Under Violent Rapid Fire.—Small formations which are unable to move rapidly to the right or left nor to advance should halt. If no natural cover is to be found, the groups should

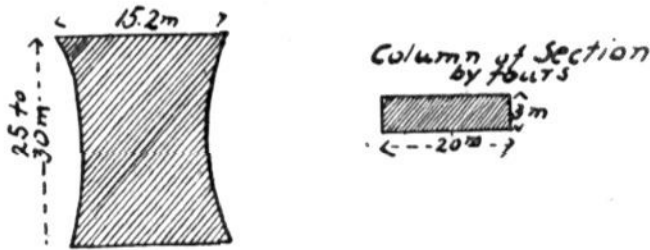


FIG. 4.—ZONE COVERED BY A 105-MM. TIME SHELL

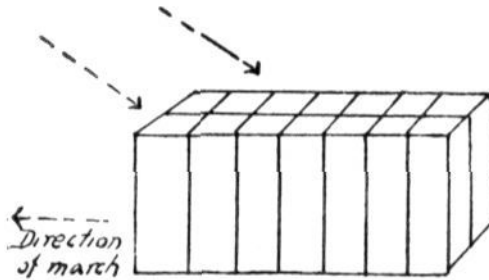


FIG. 5.—A COLUMN BY TWOS UNDER SHRAPNEL FIRE

huddle together. The men lie down close together, one against the other, under the cover of their packs, which, together with

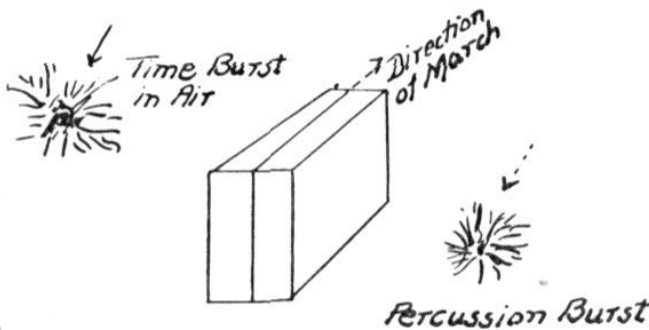


FIG. 6.—COLUMN BY TWOS UNDER HIGH-EXPLOSIVE SHELL FIRE

their steel helmets, form a protecting cover from the fragments. If this state of affairs continues for some time, the men can

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protect themselves by small mounds of earth thrown up at one side.

Advance under Large-Calibred Shell Fire.—In this case the shells produce their greatest effect by the explosion itself rather than by the fragments. The effect is like the explosion of a mine. The necessity of having thin formations takes precedence over the question of visibility. Columns by one (single file) or lines meet the required conditions, the line seeming preferable to the column on account of the moral effect which may be produced by a burst unluckily well placed.

Use of Forests.—Forests furnish no protection. On the contrary, they are very dangerous, because the tree trunks cause the detonations of high-explosive shells above the ground. But forests do serve a useful purpose as masks behind which the assembling or advance of infantry may be hidden.

In zones beaten by artillery fire it is necessary to avoid small



FIG. 7

clumps of trees, because they are easily registered by hostile batteries, and when the enemy sees troops entering them they overwhelm them with projectiles. Such small clumps of trees become veritable "projectile nests," which should be utilized only as masks behind which it is possible to hide momentarily.

Reserves.—The reserves are always posted in positions defiladed from the view of the enemy; but they are not for this reason any the less exposed to the zone fire of the hostile artillery.

Defiladed positions just behind crests are always dangerous, for it is easy for the hostile artillery to register on the crest. This is true except when 45-degree slopes are to be found, behind which one cannot be harmed except by vertical fire, or when veritable "pockets" are discovered, such as exist in some regions (see Fig. 7). For this reason it is better, when possible, to occupy the counter-slope, because the enemy, if he does not

suspect the existence of the second crest, will register on the first (see Fig. 8).

The Germans, in their zone fire, frequently sweep successive lateral zones, sometimes firing on one for a long time without modifying the deflection. Observation of the enemy's methods of fire may sometimes permit officers to make very advantageous dispositions of their troops.

When a zone already filled with shell craters is encountered, it is well to avoid it, for the Germans are in the habit of firing often on ground already registered.

Use of Natural Obstacles.—Ditches, slopes, and hedges form natural protections, cutting the terrain into small fields which can be taken advantage of in such a way as to obtain some protection against lateral shell fragments.

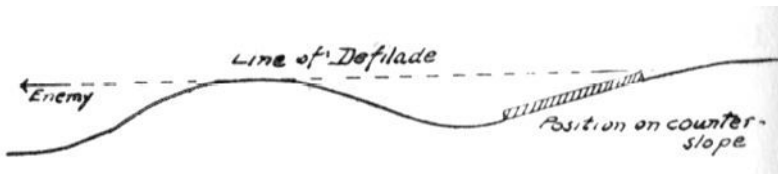


FIG. 8

In certain cases walls furnish protection; 77-mm. and 105-mm. shells penetrate walls unless they exceed 0.4 or 0.5 metre in thickness. Shells which go through such walls burst soon afterwards, and for this reason it is necessary not to protect oneself behind thin walls (see Fig. 9). But a succession of walls, such as are often met with in some parts of the country, may, if the angle of fall of the shells is not too great, make an excellent protection. These conditions are often found in the vicinity of farms; but it should not be forgotten that a *farm attracts the fire of the enemy*, which becomes, like a forest, a veritable "projectile nest."

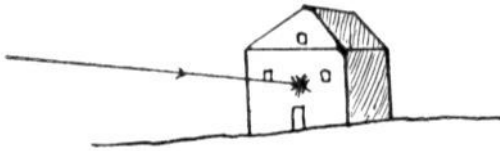
Against shell fragments, banks of earth 40 cm. in thickness, planks covered with 20 cm. of earth, and sand-bags furnish excellent protection.

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2. THE WAR OF POSITION

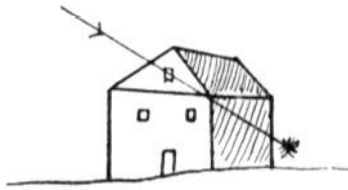
If a position is to be occupied for some time, protection against the heavy artillery must be provided. For this purpose the thickness of parapets is increased, the walls of trenches are consolidated, and the traverses are increased in number and in thickness.

The roofs of dugouts are thickened in order to resist the burst of a high-explosive shell, as follows:



A.

FIG. 9.—*A.* EXAMPLE OF HOUSE AS SHELTER FROM SHORT-RANGE FIRE



B.

B. EXAMPLE OF A HOUSE TO BE AVOIDED AS SHELTER FROM PLUNGING FIRE

Against the 77-mm., a bed of timbers from 20 to 25 cm. in diameter and 30 cm. of earth.

Against the 105-mm. and the 150-mm., two beds of timbers and two beds of earth.

Against the 210-mm., three beds of timbers 30 cm. in diameter and three beds of earth 30 cm. thick.

The beds of timbers may advantageously be replaced by a bed of railway iron and a bed of sacks of hardened cement.

The timbers and the rails should be securely fastened together. One of the beds of earth may well be replaced by a layer of stones, which gives a hard bursting surface.

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3. LIAISON BETWEEN THE INFANTRY AND THE ARTILLERY

In the present war the artillery has not always given the infantry the support which the infantry had a right to expect of it.

There have been many reasons for this. Among them are the insufficient quantity of telephonic matériel furnished the artillery, the lack of precision in the regulations on the subject of *liaison*, and, finally, insufficient preparation for the coöperation of the two arms and too few maneuvers executed in time of peace.

If the artillery officer can see the terrain well, if he can distinguish clearly between the friendly and the enemy infantry, and if he is acquainted with the formations and maneuvers of the infantry, he can support his infantry under good conditions. Sight *liaison* will in such cases be sufficient for him.

But under modern battle conditions the artillery officer can seldom see the enemy infantry. If he can see them, he is nearly always in difficulty on account of the new uniforms, which make it hard to distinguish his own troops. In addition, the infantry fire and the hostile artillery fire interfere with his judgment; and the movements of the lines of skirmishers reveal to him incidents concerning which he cannot generally understand the full import.

Moreover, infantry and artillery fire has become so powerful and so intense that the use of the terrain and field fortifications has become very important. For this reason it has become necessary for the artillery to support its infantry by fire directed on a precise spot at a precise time. Only the infantry can *actually know* these conditions. Often the artillery cannot know them, and often they *cannot even suspect them*.

Such conditions require that the most intimate *liaison* possible be established between the infantry and the artillery. The problems involved are important and are not easy to solve. Artillery and infantry officers must combine all their efforts and all the means at their disposal to solve them.

It is possible to sum up the problem as follows:

NOTES ON ARTILLERY

Problem of Liaison.—"A body of infantry (company, battalion or regiment) receives a definite mission, either offensive or defensive. It should be supported by artillery, either by batteries or battalions (*groupes*). How can the commanding officer of this body transmit to the artillery officer two or three kilometres in the rear the information that he is stopped by hostile machine-gun or rifle fire from a hedge at a certain point?

"It is, moreover, to be supposed that the terrain between the two commanders is under infantry or shell fire and that it is cut up by obstacles like barbed wire which are penetrable at certain points only."

Assuming that mounted orderlies or cyclists carrying messages would not be killed or wounded, the artillery commander will not receive the request from the infantry for 20 or 30 minutes after the departure of the message. During this time the situation may have changed. The artillery action requested may then be useless. Especially will this be true if, in the meantime, the infantry have taken the position occupied by the enemy. The action of the artillery will in this case be most unfortunate.

The problem is therefore complex, and no one can pretend to give a simple solution which will fit all cases.

The question is not new. It has been studied in time of peace. The solutions formerly adopted have not given good results, and it is necessary to continue to search for new solutions; and the experiences of actual war will always furnish the bases for new studies.

It can be stated with certainty that *liaison* will be assured under the following conditions:

1. When the artillery is furnished with powerful observing instruments and field glasses which make possible, under favorable conditions, the *liaison of sight*.

2. When the troops are furnished with numerous and rapid means of communication which enable them to establish easily *material liaison*.

3. When the two arms, convinced of the need for intimate and constant coöperation, have been prepared and trained by many combined exercises in order that there may be assured moral and *professional liaison*.

Liaison of Sight.—This is obtained by furnishing in ample quantities to all parts of the front powerful prism observing instruments which can be used as periscopes. Such instruments have already done excellent service.

Material Liaison.—It is necessary to develop and perfect this so that the infantry can transmit rapidly, or even instantaneously, the information necessary to bring effective fire to bear on the desired point at the desired instant.

The means of communication actually at the disposition of troops include:

Telephones;

Apparatus for optical telegraphy;

Signal Apparatus: Electric lamps, signal lanterns, and flags;

Smoke-bombs and devices to deceive the enemy;

Agents of communication on foot, mounted, on bicycles or motorcycles.

But, of all means of communication, none are perfect and none are sure.

Telephone wires are often cut in the course of action; signalling and optical telegraphing from the rear to the front are very delicate operations, and the movements of agents of communication are very doubtful under fire.

As a result, in order to have any chance for success, it is necessary to use as many means of communication as possible.

Conventional Signals.—The Morse alphabet is used in signalling apparatus and in the optical telegraph; and conventional signals are designed to increase the rapidity of transmission. The signals common to all arms are really too few to enable the infantry to designate a target or to ask for urgent support. For this reason it is necessary:

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(a) To establish a signal code which will complete the instructions of General Headquarters on the subject of *liaison* which were published in 1915.

(b) To make common various methods of designating targets.

Identification of Targets.—The designation of a target on which the infantry wishes the artillery to fire is an operation which is very simple in the war of position, but always much more difficult in the war of movement, in which it is necessary to make the designation rapidly and within certain limits of approximation over a terrain often not well known. It is for this reason necessary to have special means of designating targets and to employ very simple language in the communication between two arms.

Use of Reference Points.—Reference points which are very definite and very easily identified, either on the ground or on the map, should always be selected. After this has been done it is very easy to designate the target by referring it to one of the reference points agreed upon.

Example: "Battery in a field, 500 metres north, 300 metres east of Chateau X."

Squared Maps.—It is essential that the artillery and the infantry have exact copies of such maps.

A target is identified by coördinates and by reference to the junction of two lines of the squares. The lines of the squares are usually a kilometre apart and are numbered (see Fig. 10).

If squared maps are not available, existing maps may be enlarged and the squares applied in an improvised manner. This is recommended when on the defensive, so that the most advanced lines held by friendly troops may be clearly indicated to the artillery, so that, if an attack is made, the artillery may open fire without anxiety about the possibility of killing the friendly infantry.

Panoramic Sketches.—In principle a panoramic sketch assists in the designation of targets or of the places where they

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have been established, so that, if they are changed, the change will at once be apparent, because the country will not present the same aspect as when the sketch was made.

A panoramic sketch may be used to give a range to a battery at

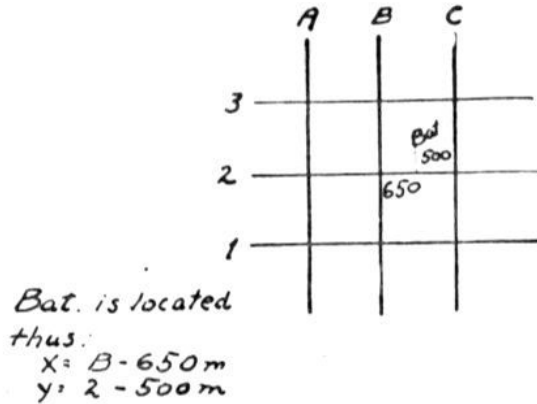


FIG. 10

B, if the point *A*, from which the information is given, can be exactly located on the General Staff map and if the angles are reported as being taken from a reference point *R*, which can also be identified on the map.

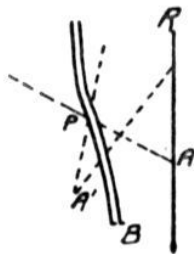


FIG. 11

If, in Fig. 11, the angle measured from the point *A* between the reference point *R* and the target near *P* is sent to the battery at *B*, the direction of *P* may be laid off on the map, and if the target can be described by its nature (such as bridge or a

NOTES ON ARTILLERY

road crossing), it will not be difficult to identify. It can be exactly determined if the distance AP can be accurately measured or if an auxiliary observer at A' can also measure the angle between P and R .

Material Liaison in Trench Warfare.—Telephonic *liaison* is at present established along the entire front. Sufficient time has elapsed to equip the troops fully with telephonic matériel.

Telephonic communication should be established as follows:

1. In the infantry, within the regiment by the telephonists of the corps.
2. In the artillery, within the battalion (*groupe*) by the telephonists of the battalion.
3. Between the artillery and the infantry by the infantry telephonists.
4. Between the infantry regiments and between adjoining artillery battalions, and between the artillery battalions and the artillery higher commands, by the engineer telephonists.

Fig. 12 shows diagrammatically the scheme of telephonic *liaison*.

In some very exposed sectors, company commanders may be connected directly to the batteries who are charged with their support. Battery commanders may arrange observing stations and battery commanders' stations at a distance from their batteries. Observation stations which are much exposed should be given duplicate lines.

Repetition of Messages.—During an attack or a severe bombardment telephone lines are generally cut. It is therefore necessary to repeat the messages sent by telephone by agents of communication and by messages sent by optical telegraph.

Moral and Professional Liaison.—In order to understand one another, artillery and infantry officers should know intimately the methods and the requirements of the two arms. *They should, above all things, speak the same language.* The instructions of officers and noncommissioned officers should, *especially in the artillery*, be carried on with this end in view,

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and frequent combined exercises should be worked out which have for their object the perfecting of this *liaison*.

In the field, higher commanders, generals commanding armies, army corps, divisions, and detachments of all arms should keep in close touch with the artillery commanders and keep them constantly informed as to the situation and their intentions. Living

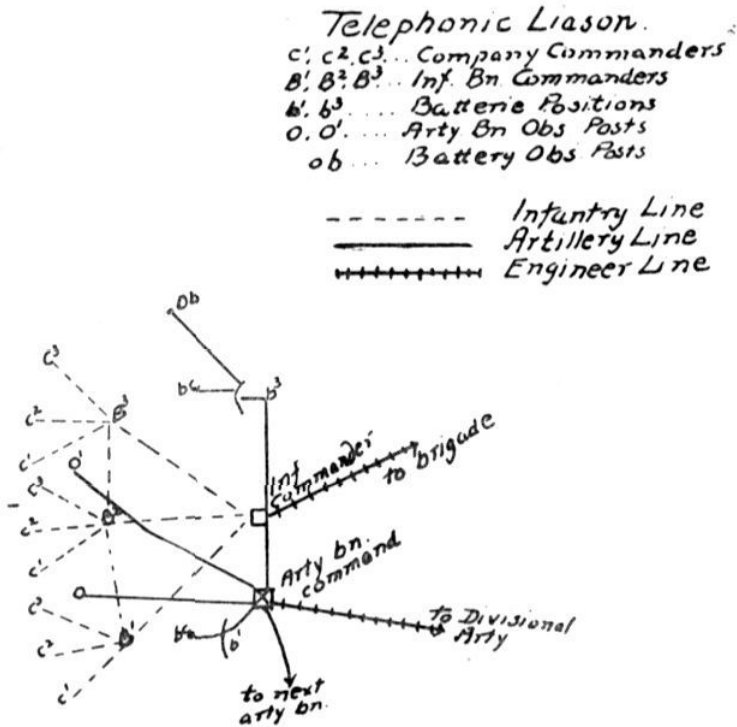


FIG. 12

together and speaking the same language, they establish what is sometimes called the "*upper liaison*."

On the field of battle, artillery commanders who are charged with the support of a body of infantry (brigade, regiment, battalion, or company) must at once put themselves in touch with the infantry commander, either directly or by the medium of an officer of *liaison*. In every case, in addition to this special *liaison*, the ordinary means should be established and used. The

NOTES ON ARTILLERY

orders and instructions received by both arms being understood, and the impressions and understandings between the higher and lower commands being made beyond the shadow of a doubt, the commanders concerned can come rapidly to a complete accord. This results in *professional liaison*.

One of the important factors resulting from this professional understanding is the mutual respect and comradeship which is brought about by common ideals of duty and hopes for final success and the utilization of every means for the common end. It is thus necessary, above all things, to obtain the *moral liaison*.

4. OBSERVATION OF ARTILLERY FIRE

The adjustment of fire is based on the observation of each round which can be observed. It is important to grasp clearly the methods by which accurate observations may be made.

1. *Direct Observation*.—For an observer stationed in the same horizontal plane as the target, if the smoke from a burst hides the target, the round is "short"; that is to say, it is between the gun and the target.

If the target is silhouetted by the smoke, the round is "over"; that is to say, it is beyond the target. What decision can be reached as to the range at which the round was fired? If time-fire is considered, the range which produced an "over" is too long a range to produce effect; but in the case of a round observed as "short" it is impossible to say whether the range is too short unless the height of burst is lower than 2 mils. A range too long may give the appearance of a "short" if the height of burst is above 2 mils, because the smoke ball may appear in front of the target. If the smoke is not seen, the dust and fragments may furnish information concerning the "sense" of the rounds.

On a horizontal terrain, rounds cannot be observed for range unless they are correct in direction; that is to say, unless the deflection is correct. If the deflection is not adjusted, such adjustment must first be made before the range is observed.

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2. *Adjustment of the Deflection.*—In order to adjust the deflection rapidly, it is necessary to measure the amount of the errors observed and change the deflection by corresponding amounts. Observers should report not only that bursts are "right" or "left" (that is to say, the "sense" of a burst), but should also measure the amount of the error in mils. This will be very easy for the observer and very useful for the officer conducting fire, if he knows the exact position of the observer.

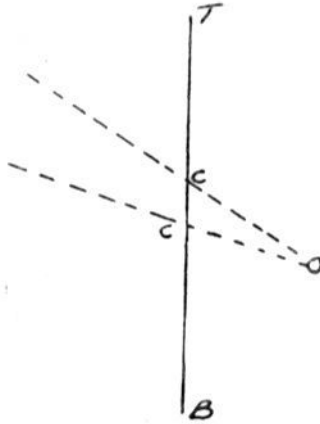


FIG. 13

On slope inclining toward the gun, the adjustment of the deflection will not have the same importance, for a burst seen above the target will correspond to an "over" and a burst below the target will correspond to a "short."

3. *Lateral Observation.*—For a lateral observer, a burst at *C* (Fig. 13), properly adjusted for deflection, which appears to the left, will correspond to a "short," but the observer cannot usually determine anything but the "sense" of the burst unless it is very close to the target.

There are three cases to be considered:

(a) The observer can be asked to adjust the fire along the line *OB*, but only an officer well informed as to the rules of fire and the orders to give can do satisfactory work.

(b) The observer can also be trained to measure the errors

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in deflection with respect to the line joining the battery and the target.

(c) The lateral observer will ordinarily report observed errors in deflection in mils; but when he judges that it is possible for him to do so, he will also report range errors in metres.

Lateral observation with a single post requires very well trained observers.

Ordinarily the observation will be given as follows (see Fig. 14):

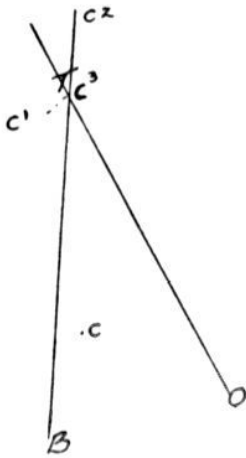


FIG. 14

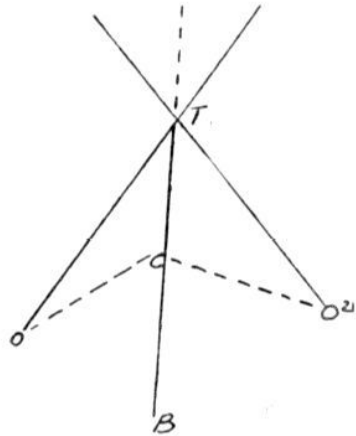


FIG. 15

For a burst at C: "Left, so many mils, very short."

For a burst at C^1 : "Left, so many mils, short."

For a burst at C^2 : "Right, so many mils over."

For a burst at C^3 : "Target."

4. *Bilateral Observation.*—Bilateral observation is carried on by two observers, one on each side of the plane of fire. It is more useful than single lateral observation. In order to give good results it is only necessary for the observers to give the measured errors in deflection. The battery commander, knowing the exact position of the observers, is able to plot the fall of the shots and to measure the errors in both range and deflection (Fig. 15).

Current Field Artillery Notes

TRENCH GUNNERY

ACCURACY OF FIRE

THE development of trench warfare in Europe has imposed upon the Field Artillery many requirements that were never contemplated or provided for in the doctrine hitherto inculcated, which is generally applicable only to field or maneuver warfare.

The matter of accuracy of fire has thus acquired special importance. The conditions frequently require the guns to be fired at an objective situated at a very short distance from the trenches occupied by friendly infantry, and the problem presents itself to the artillery commander as to whether it is safe, after a careful adjustment has been made, to continue the fire without having these trenches cleared, or whether there is a possibility of some of the projectiles or their fragments striking therein, requiring them to be vacated.

It is therefore clearly evident that the artillery officer must be thoroughly acquainted with the limitations and errors of the pieces under his charge, and that the matter of the accuracy of fire should be carefully considered by the higher artillery commanders in planning operations in support of their own infantry.

THE ERROR OF THE GUN. THE 50 PER CENT. ZONE

The errors of shots follow the law of errors. It is essential, therefore, to know the probable value for each of the various classes of errors. The probable value of a particular class of errors affecting a shot, such as the range error, is different under different conditions. Proving-ground errors are less than those of service firing. The errors of different guns or howitzers with different charges of powder and weights of projectile are naturally different. The errors likewise vary with the ranges.

The error of any gun or howitzer with a given charge and weight of projectile is generally measured by the 50 per cent. zone, which may be defined as the space in which 50 per cent. of the rounds fired at a given range (or deflection) should fall. For example, the 50 per cent. zone for range of the 3-inch field gun at 3500 yards is 56 yards; half the number of projectiles fired at that range should fall within

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a space of 56 yards, and if the mean of the rounds were exactly on the objective, 28 yards short of or over the target should be the greatest error of half the projectiles fired.

THE 100 PER CENT. ZONE

In solving the problem of whether he can fire safely over his own infantry, the artillery commander must, however, know the space in which all his projectiles will fall; that is, he must know the dimensions of the 100 per cent. zone. This zone is four times the dimensions of the 50 per cent. zone, so that in the above example all the shots would fall within a space of 224 yards, and we must be prepared to find a single shot falling 11 yards short of the objective if the fire has been properly adjusted.

It must be held in mind, however, that the values of the 50 per cent. zones have been arrived at through experimental firing under normal conditions of temperature, barometric pressure, wind, and that abnormal rounds have been rejected in the computations. Under the conditions of actual war abnormal conditions are to be expected, and the accuracy of experimental firing will rarely be attained.

The sights may be slightly out of adjustment; lost motion in the gears may produce error, and the personal errors of the members of the gun crew may be materially increased, due to the nervous strain of actual war. Due allowance must be made for such errors, and it is suggested that, in order to obtain reasonable safety, about 10 per cent. should be added to the tabular 50 per cent. zone or to the probable error, and that the 100 per cent. zone be taken as four times the increased amount.

To illustrate: A 3-inch battery has been ordered to fire upon a target 100 yards in front of our own trenches. The range is 3500 yards. The 50 per cent. zone is 56 yards, which, increased by 10 per cent., becomes 61.6 yards. The 100 per cent. zone is four times the 50 per cent. zone, or 246 yards, so that the shots may be expected to fall 123 yards short of the mean point of impact, and some of them will fall in our own trenches if the fire is accurately adjusted. The question arises, how will the battery commander perform his task without risk of firing upon his own infantry under the supposition that they cannot be withdrawn? He may proceed in one of two ways:

(a) He may so range on the target that the mean point of impact of his shots will lie 23 yards beyond the target, and the 100 per cent. zone of his fire will consequently lie beyond our own trenches. He must

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understand, however, that this method will give him a smaller percentage of hits with consequently greater expenditure of ammunition to attain his object.

(b) He may take advantage of the fact that the error in deflection is smaller than the error in range. The deflection error at 3500 yards is a little less than one-third of the range error. If, then, he can obtain a position from which he can deliver an oblique or enfilade fire, he can obtain many more hits and can attain his object with a much smaller expenditure of ammunition than from a merely frontal fire. The longer the range of the gun the greater are the possibilities for enfilade fire, since the normal errors of the gun will provide the necessary searching effect, while the comparatively small deflection error will ensure a large proportion of hits on the target.

From the foregoing it is evident that the relative values of various types of gun and howitzer vary directly as to their accuracy, as shown by their probability tables. It is also evident that all officers concerned with the preparation of plans of operations should have a clear idea of what these values are.

The error of the gun considered in the foregoing is a source of inaccuracy that cannot be eliminated. There are many other factors that materially affect the accuracy of fire, but these can generally be allowed for and their effects avoided through the application of proper methods. They will be considered in succession.

EFFECT OF ATMOSPHERIC CONDITIONS

The accuracy of fire is affected by the following atmospheric conditions:

- (a) Barometric pressure.
- (b) Temperature of the air.
- (c) Temperature of the powder charge.
- (d) Velocity and direction of the wind.

Corrections for all these elements of error must be made if great accuracy is to be attained. They may be computed from the data given in the complete range tables of the gun or howitzer, and in such cases these tables should be on hand and should be used. Also, whenever trench operations are being carried on, the necessary meteorological instruments—barometer, thermometer, and anemometer—should be obtained for each group of batteries.

Of these elements, the wind is the least constant; moreover, it will

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vary from the different altitudes. Its velocity and direction can best be obtained from observations taken in captive balloons or from the aero troops.

It is not only the accuracy of the fire that is affected by atmospheric conditions. The burning of time fuzes, on which the effectiveness of fire, and especially of shrapnel fire, depends, is materially affected by moisture. Unless artillery ammunition is adequately protected from the weather it may rapidly deteriorate. Fuzes and primers are especially susceptible to moisture, and should never be exposed to its influence more than is absolutely necessary.

The doors of limbers and caissons should be habitually kept closed.

When ammunition is taken from the caissons and stored in recesses in gun pits care should be taken that it is not exposed to the effects of weather.

The tin-foil cap should not be removed from either time or percussion fuzes until the ammunition is to be fired.

Only the closest supervision on the part of all officers and enlisted men will assure that the ammunition is kept in the best condition for use at all times.

EFFECT OF WEAR

After a large number of rounds has been fired from a gun the metal of the bore becomes eroded or worn away at the point where the rifling begins. This allows the projectile to be rammed home somewhat farther in those guns in which the projectile and charge are loaded separately, and causes a small space between the projectile and bore in those guns that use fixed ammunition.

A loss of velocity results, which affects the accuracy of the firing. In an advanced state of wear the projectile will be unsteady in flight and the accuracy will be materially reduced.

The state of wear of guns that have been in use for a long time should therefore be taken into consideration in assigning tasks that require special accuracy of fire. In computing the 100 per cent. zone, an allowance of about 30 per cent. should be made for those guns that are approaching the permissible limit of wear.

When the guns of a battery have been successively replaced, due to wear, it will naturally result that they will show varying amounts of wear, and that they will not shoot alike. This will affect the firing of the battery as a whole, and should be borne in mind when accurate shooting is required. It may even be necessary to obtain the error of each gun by calibration in order to obtain uniform results in firing.

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EFFECT OF VARIATIONS IN AMMUNITION

In the charge:

Slight variations in the manufacture of powder, resulting in corresponding variations in its quality, will give initial velocities that are slightly different. Likewise, different lots of powder will produce slightly different muzzle velocities. These variations from tabular velocities are easily compensated in ordinary field firing, but their correction in the accurate fire that is frequently required in trench warfare is a matter of importance.

In order to obtain as far as practicable a uniform degree of accuracy, care should be taken, whenever a task is undertaken by a battery that requires high accuracy fire, that the ammunition should comprise only rounds from a single lot. Mixed lots should never be used in the same series. For this reason various lots of ammunition should be kept separate as far as practicable.

In the weight of projectile:

A diminution in the weight of the projectile results in an increased muzzle velocity, with a consequent tendency to increase the range; at the same time the change in the ballistic coefficient of the lighter projectile tends to diminish the range, thus counteracting the effect of the higher initial velocity.

The resultant error varies inversely as the muzzle velocity; in consequence it is comparatively slight in the case of high-power guns and increases in importance as the lower velocities are attained, becoming appreciable in the case of howitzers and mortars.

In consequence it is desirable to group all howitzer projectiles according to weight.

RANGE TABLES

To enable the proper corrections to be made for securing the maximum of accuracy of artillery fire, the range tables supplied to batteries should be complete, showing the increments of elevation due to variations in the ammunition, ballistic coefficient, muzzle velocity, wind components, and should also include the dimensions of the 50 per cent. zones for range and deflection.

(Continued in July-September Number)

CURRENT FIELD ARTILLERY NOTES

CARE OF GUNS DURING PROLONGED BOMBARDMENT

1. *Every effort should be made to rest guns and allow them to cool.*

It is advisable to keep only three guns of a four-gun battery in action at the same time, to allow of guns resting and being thoroughly looked over so that necessary adjustments may be made.

2. *When a gun is resting, an officer should see that the following operations are strictly carried out:*

- (a) The bore, if overheated, is cooled by washing out.
- (b) Air is allowed to escape from the cylinder.
- (c) The cylinder is filled.
- (d) The glands are tightened if they show signs of leakage.

Under the conditions mentioned in paragraph I; if a fifteen-pounder battery fires three rounds per battery per minute and a four-gun six-inch howitzer battery fires one round per battery per three-quarter minute the guns will not become overheated and the use of water for washing out will not be necessary.

These instructions apply to all guns, but they are particularly important in the case of fifteen-pounders.

3. *Watch the recoil.*

On fifteen-pounder guns an indicator is fitted. When recoil is excessive, it generally means that the cylinder is not full, or the piston is worn. If long recoils are obtained with a full cylinder, send the gun to the nearest ordnance workshop.

4. A gun gets very hot after a rapid burst of fire. A slow rate of fire over a prolonged period will heat it almost as much as a short rapid burst.

5. The heat is communicated to the oil in the cylinder which—

- (a) becomes thin and is apt to leak through the glands,
- (b) expands and prevents gun recoiling fully.

6. The following points should be observed:

- (a) *A liberal supply of water should be kept at the battery and every opportunity should be taken of cooling the gun by washing out. Fifteen-pounders should not, if possible, fire more than 50 rounds at a time rapidly without sponging out thoroughly.*
- (b) *The hourly output from two guns firing rapid bursts alternately, and then being washed out, is probably greater than that of two guns used simultaneously.*

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- (c) *A hot gun should on no account be loaded until just before it is necessary to fire it.* A charge left loaded in such a gun may give a dangerous pressure. Also the rate of burning of a time fuze which has been loaded for a short time in a hot gun is probably affected.
- (d) *Tighten up gland packings when gun is hot.* They bed better then than when cold.
- (e) *It is necessary to release a little oil from the cylinders of the fifteen-pounder and sixty-pounder guns, when they get very hot, to enable the gun to recoil. This oil must be replaced when the gun is cold, or there will be trouble.*

EDITORIAL DEPARTMENT

A Word of Thanks

AGAIN the necessities of the military service have brought a change in the staff of our JOURNAL. This time Lieutenant-Colonel Dwight E. Aultman, who has been the editor for some time past, is obliged to relinquish that office, much to the regret of the Association. With him he carries the thanks of all for his labor of love, to which he so justly referred in his last issue. The personal time, thought, and effort so loyally given by him are thoroughly appreciated by the entire Association.

War Problems

Since the last issue of the JOURNAL we have seen our country, caught in the tide of battling nations, brought face to face with war. What, in the past, have been considered pressing necessities for us to adjust have now become of imperative and immediate moment. The crisis is upon us. All military problems now must receive some solution.

At present hundreds of young men, destined to become officers of our arm a few months hence, are receiving basic training in the camps. Our drill regulations will guide them in their preliminary work. But, before long, these officers will be called upon to fire batteries under conditions which demand the most accurate and rapid shooting, conditions such that the slightest kind of an error may deal death to our own troops and break their confidence in their officers. To do their duty properly these officers must be instructed until they are able to not only conduct battery fire systematically, accurately, and quickly, but they must acquire such confidence that, even under

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the stress of action, they can think quickly and initiate such acts as will permit them with surety to seize the golden moment of opportunity and crush the enemy, regardless of whether he plays according to rule or not. In order to secure such training the immediate resumption of our School of Fire seems to be indicated.

Some kind of an intensive course should be pursued by these gentlemen in which they could use, and see used daily, many rounds of ammunition, under all the field conditions of this war. This could well be undertaken at our School at Fort Sill, where suitable ranges and targets are to be obtained, and might immediately supplement their course in the training camps. Even if most of them be needed for use as instructors in the elementary training of the New Army, some at least could be spared to take this course with a view to making those who are competent regimental instructors of gunnery.

In time of peace, particularly, we should encourage original research, and, conditionally, authorize departure from established methods in search for those that are better; in time of war team play is the whole thing, and it is too late to experiment. We must have a thorough system; lacking it we will have chaos. This is no time for individuals to set forth in limited spheres their own particular hobbies. How are we to systematize the instruction of these gentlemen and acquire harmonious coördination? The answer seems to be that we need our own Field Artillery Board to supervise intimately our own School of Fire, and, also, to have the latter closely coöperate with our School of Musketry.

With war will come frequent changes in the commissioned personnel. If different systems in the conduct of fire are permitted to grow up in the various commands, chaotic conditions will, of course, be initiated, since an officer, no matter how able, will find himself seriously handicapped if required, in the battle zone, to go to another regiment which uniformly uses methods different from those of his own. Our officers, no matter what

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their grade, are leaders; without expert leaders, unembarrassed by confusion of methods, it would be impossible to secure a high degree of skill in the conduct of fire. The reopening of the School would serve to coördinate, perpetuate, and raise our standards. In the past it has been the most potent factor in the practical training of our Field Artillery; its potential value should be equally great for the future.

With our sudden expansion of the Regular Army, supplemented by the regiments of field artillery needed in the New Army, we have the great problems of matériel to solve. Granting their solution, together with that of supply, and assuming that our new regiments are armed and equipped, what method can we use for the coördination of instruction of such new units as may be assigned to our heavy calibres, or to the artillery trench mortars? If we use the drill regulations of the Allies, they must be adapted to our own organization. Again, we see the possible sphere of assistance and use of the combined operations of the Field Artillery Board and the School.

If, in time of war, extending over a period of years as this great European conflict has already done, we learn lessons of value in combat, then we must have some central body which is authorized specially to study such issues and to authoritatively promulgate data pertaining to them. During recent years of peace it is believed that if almost any field artilleryman had been asked the question, "What, in your opinion, has done the most for the advancement of our arm?" the question would have unhesitatingly been answered in substance, "The work of our School and our Board." Peace or war, our needs require these authoritative bodies to develop our strictly technical problems. The problems which confront us now are those inseparably connected with a crisis; their solutions are imperative. Let us hope for an immediate reorganization of our Board and our School, and, with them, early solutions of the war problems relating to Field Artillery.

Trench Artillery

In this number of the JOURNAL several illustrations appear which show types of trench mortars and their projectiles, which are now extensively used abroad. This is an arm for which we have no definite organization. Its general employment, under conditions that we will soon be obliged to face, demands an early and detailed knowledge of the handling of this weapon by our officers and men. We wait with interest the appearance of trench ordnance of our own design and the publication of our manuals of instruction which will pertain to this arm.

The Journal

In a previous number of the JOURNAL reference was made to the necessity of having suitable copy in order to keep the pages filled with up-to-date and interesting matter. Original articles are always desired. While much of real value can be obtained from reprints, those matters which relate strictly to our own interests carry with them an intimate association which attracts and holds the attention of our earnest artillerymen. Originality of thought, coupled with expression of opinion, teaches others and serves to keep the professional interest of all alive. By discussion, open, free, and limited only by the bounds of propriety, we can hope to obtain the best system for ourselves.

If what our daily papers chronicle be correct, then we may expect before long to have our Field Artillery, in part at least, on European battlefields; and, from that time on, there will be many narratives from both a lay and professional point of view which should be extremely interesting. Will not some of our members reduce their experiences to writing, and see that they get to us in proper form? It is true that the rules of censorship must be followed strictly; but, where articles are presented and passed, even with names and places deleted, the substance of the account itself should, in many cases, be of absorbing interest.

Equally as interesting as the narratives which record the

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experiences of our troops abroad, will be photographs showing them in their new surroundings, and the latter will, we hope, be authorized frequently for reproduction. Such pictures we will be glad to have sent to us by our contributors, after full authority for publication has been obtained.

And, before very many months have passed, probably some of our own artillerymen may be coming back. All will be anxious to hear from them the accounts of our efforts on the battlefield. Will they not be generous and give to us first-hand their experiences at the front? Before their arrival an ocean trip will give them the opportunity to place upon paper what they have to say.

No doubt the scarcity of original copy has been largely due to each person in our little force of officers, for months past, trying to do almost everywhere the labor of more than one, and conditions may become more and more exaggerated in the days to come. But, with ocean voyages ahead, and with long days of waiting in the trenches, we ask our members to try to give us a bit of their time in recording their experiences, and then to permit us to set them before the eager ones in this country who are anxiously waiting to profit by the solution of the difficulties met by those in the earlier expeditions.

BOOK REVIEWS

MILITARY TRAINING FOR BOYS. By Major James A. Moss and Major M. B. Stewart, U. S. Army. George Banta Publishing Company, Menasha, Wis. Price, 50 cents, postpaid. 230 pages.

At a most opportune moment this volume is placed in print. Enthusiastic loyal boys will welcome its appearance. It is written for them in direct, simple, appealing language.

To obtain anything approaching a military education for our boys, it is usually necessary to send them to special schools. Through the influence of an intelligent leader, this book makes it possible to give the boy such a training as will permit the latter, when mature, to be ready to step into his place as a soldier, and to do so with a very good idea of the more elementary duties which he must be ready to perform.

In the words of its author, included in its purposes, it is written, "To make clear to the American youth . . . that the lessons of patriotism, loyalty, discipline, frugality, physical and moral sturdiness, self-reliance, self-control, determination, and respect for the law, all of which enter into the training of a soldier, are qualities which help them to be better citizens and more successful men in every walk of life, and that they may, every day of their lives, while training themselves for their work in life, at the same time, train themselves in the qualities which the soldier must have."

It should be read with care by those of our boys who have never had the advantage of attending a military school. For elementary training, particularly in boys' camps, it should make a valuable text.

THE PLATTSBURGH MANUAL: A HANDBOOK FOR FEDERAL TRAINING CAMPS. By First Lieutenant O. O. Ellis, United States Infantry, and First Lieutenant E. B. Garey, United States Infantry. Foreword by Major-General Leonard Wood, United States Army. The Century Company, New York. 300 pages.

The authors have commanded companies at Plattsburgh, New York, and, noting the need of such a text, compiled their observations while there.

Every man who attends any Federal training camp can read this work with material advantage to himself. If he desires to go to such

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a camp, it tells him how to get authority to attend; if he goes, it tells him what to do, not only immediately on arrival, but outlines to him most completely the course that he must follow throughout his stay.

The advice given all through the text is sound and based upon experience.

One of the impressive features of the book is that of showing, by photographic reproductions, not only the correct methods of doing things, but, more than that, of going into illustrated details of the incorrect ways of prescribed military movements, showing, by comparison, the most common and glaring faults.

For those interested in the Officers' Reserve Corps, it outlines the method to pursue in order to secure a commission therein.

The book has a definite place in military literature and is recommended to all those for whom it was written; it should also be valuable as a guide for use in those schools where elementary military instruction is given.

OUR FLAG AND ITS MESSAGE. By Major James A. Moss and Major M. B. Stewart, both of the United States Army. J. B. Lippincott Company, Philadelphia, Pa. Price, 25 cents.

In a little booklet of thirty-one pages the authors assist the spirit of patriotism by giving the symbolism of the stars and stripes which go to form the emblem, explain the significance of the colors in it, and make clear the ideals for which the Flag stands.

The recent appeal of the President to the farmers and industrial forces of the nation to speak, act and serve together precedes that part relating to the Flag.

A final appeal to patriotic sentiment appears in the closing pages by presenting in type the words of "America" and "The Star Spangled Banner."

ARMY PAPERWORK. By Major James A. Moss, 29th Infantry, U. S. Army. George Banta Publishing Company, Menasha, Wis. 377 pages. Price, \$2.

At a time when our Army is struggling to absorb hundreds of untrained officers, this book appears. The matters of which it treats must be met daily, almost, by the commissioned personnel, whether the officers be new appointments or not. Its publication is timely; its opportunity for use is broad.

Administration is made easy by having it handy as a book of reference.

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It explains and amplifies matters in such a manner that a novice can clear up his papers with as much certainty as one of experience.

Unfortunately minor inaccuracies appear, such as are found on page 30, where a form letter is presumed to have been written by the Adjutant General of the Eastern Division. It is true that footnotes explain that different terms are used to-day, but it would have been much better had present designations been used in the illustrations.

In spite of such deviations from the forms strictly applicable to-day, the book should be found in the organization office of every unit of the National Guard that is called into Federal service; it should be studied by every officer of the New Army; it should be the close friend of every company clerk, sergeant major, and supply sergeant of both of these bodies of troops.

Whatever his rank or duty, the reading of this volume by every officer is recommended.

Index to Current Field Artillery Literature

Compiled from monthly list of military information carded from books, periodicals and other sources furnished by the War College Division, General Staff.

Officers requesting information will please give the number of the entry and the date of the list. For officers on duty in Washington, D. C., a formal call is not necessary; a telephone call will be sufficient. When a book is called for, the title and author will be given in the language in which it is printed. The material here listed is not available for general loan outside of the U. S. Army.

Aerial warfare—European war.—Destruction of captive balloons by means of aeroplanes. Illustrated. (Scientific American, January 27, 1917, p. 104.)

Aerial warfare—European war.—Notes on the aviation in the Serbian campaign. (Mitteilungen, Artillerie und Geniewesens (M. A. & G., No. 6, 1916, p. 927.)

Aeronautics—instruments.—Views of aeronautics: a drift set, incidence indicator and compass. (Scientific American, February 10, 1917, p. 156.)

Aeroplanes.—British procedure in testing aeroplane models. (Engineering, January 26, 1917, p. 69.)

Aeroplanes—Germany—European war.—Description in detail with diagrams of German types of biplanes. (L' Aerophile, November 1–15, 1916. Nos. 21–22, December 1–15, 1916. Nos. 23–24.)

Aeroplanes—Great Britain—European war.—Information on British success in construction of anti-Zeppelin aeroplanes. (Scientific American, January 20, 1917, p. 76.)

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Aeroplanes—U. S.—Progress of construction in the army, purposes, etc. (Congressional Record, January 29, 1917, p. 2461.)

Airships—European war.—Illustrations of an Italian dirigible. P. 54. (La Marina Italiana Nella Guerra Europea. No. 1.)

Anti-balloon gun fire.—Consideration of attack on aeroplanes and improvised mounts for field pieces. (Memorial de Artilleria, December, 1916, p. 747.)

Anti-balloon gun fire—U. S.—Approximate strength of the army under national defense act of June 3, 1916. (Filed Envelope Case—Armies—U. S.)

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Artillery—Austria-Hungary.—The evolution of the artillery during the past 10 years. Strength, types, etc. (Revista di Artiglieria e Genio, October, November, December, 1916, p. 124.)

Artillery—European war.—Caliber of guns employed. Tactics. Means of observation, etc. (La Guerra y su Preparacion, December, 1916, p. 799.)

Artillery fire.—Description and application of the goniometer for conducting indirect fire. With diagrams. (Revista di Artiglieria e Genio, October, November, December, 1916, p. 159.)

Artillery fire.—Effects of fire on forts and other structures. (Views filed in Map Room, Photos Nos. 4251, 4266, 3059, 2564–65.)

Artillery fire.—High angle fire at aircraft. (Aerial Age Weekly, January 29, 1917, p. 514.)

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- Balloons—European war.*—Picture of a French motor truck for transportation of a captive balloon. (Illustrated War News, January 24, 1917, p. 32.)
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- Coöperation of arms.*—Campaign of 1917. The massed formations of belligerents on the various fronts, January, 1917. (From Journal de Genève, January 11, 1917. (Filed Envelope Case—European war—Campaign of 1917.)
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- Coöperation of arms—Roumania—Bucharest.*—Description of the Fortress of Bucharest. (From the Neue Freie Presse, Vienna, December 7, 1916. (Filed Envelope Case—European war—Roumania—Bucharest.)
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- Moving pictures.*—Moving pictures proposed as a means for instructing troops. Outline of system. (Infantry Journal, January, 1917, p. 390.)
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- Munitions of war—U. S.—European war.*—French government in the market for 400,000 tons of shell steel for 1917. (Iron Age, February 8, 1917, p. 400.)
- Munitions of war manufactured—Canada.*—Amounts available for output of munitions in 1916. (Iron Age, January 4, 1917, p. 127.)
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- Munitions of war manufactured—European war.*—Increase of Great Britain product; time required for manufacture. British supply to her allies. (The Means of Victory. By Lord Montagu, London, 1916. UF535 G7 M75.)
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- Promotion—U. S. officers.*—A plan for separating promotion from organization. (Infantry Journal, January, 1917, p. 367.)
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- Seismograph.*—Notes on the application of the seismograph in observation on the British front. (La Guerra y su Preparacion, December, 1916, p. 809.)
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- Torpedoes—aerial—U. S.*—Sectional view of an aerial torpedo showing the time fuze and the contact detonator. (Scientific American, February 10, 1917, p. 156.)
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- Trench warfare—European war.*—Field works and heavy artillery. Diagrams of shelters and redoubts. (L'Illustration, January 13, 1917, p. 37.)
- Trench warfare—European war.*—French methods in trench warfare in 1916. (World's Work, February, 1917, p. 416.)
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* Publication suspended during the war.

Field Artillery Directory

REGULAR ARMY

FIRST FIELD ARTILLERY

(3-in. guns.)

Schofield Barracks, Hawaii

Colonel.

Berry, Lucien G. (D. O. L.)

Lieutenant Colonel.

Horn, Tiemann N.

Majors.

Austin, Fred T.

Lloyd, Charles R. (D. O. L.)

Chaplain.

Fealy, Ignatius (I. lieutenant.)

Captains.

McIntyre, Augustine

Currie, Dennis H.

Hoyle, René E. De R

Miles, Sherman.

McCleave, William

Daly, Charles D

First Lieutenants.

Stewart, Frederick W.

Ahern, Leo J.

Arnold, Archibald B.

Frankenberger, Bertram

Thurber, Philip L.

Erwin, Vincent P. (D. O. L.)

Andrus, Clift. (D. O. L.)

Greenwald, Karl C. (D. O. L.)

Eager, John M. (D. O. L.)

Second Lieutenants.

Heyser, Marvin C.

White, Arthur N.

Hoskins, John O.

Veterinarians.

Stokes, Wilfred J.

Haynes, James R.

SECOND FIELD ARTILLERY

(2.95-in. mountain.)

Philippine Islands.

Colonel.

Van Deusen, George W.

Lieutenant Colonel.

.....

Majors.

Spaulding, Oliver L., Jr.

Boiseau, Louis T. (D. O. L.)

Chaplain.

Houlihan, James F. (1 lieutenant.)

Captains.

Barnes, Joseph F

Fuger, Albert S.

SECOND FIELD ARTILLERY

Continued.

Captains—Continued

Baker, Scott

Pennell, Ralph McT. (att.)

Hall, Albert L.

Thorp, Frank, Jr., (att.)

Randol, Marshall G.

Mort, John E.

Higley, Harvey D.

King, Edward P., Jr.

McBride, Allan C.

Sparks, Leonard C. (att.)

Magruder, Marshall (att.)

Hopkins, Samuel R. (att.)

Allin, Geo. R. (D. O. L.)

First Lieutenants.

Hayden, Herbert B.

Johnson, Thomas J.

Hayes, Philip.

McDowell, John M.

Oliphant, Thos. G. M.

Brereton, Lewis H.

McConkey, Clyde J.

Anderson, Jonathan W.

Cole, Leon R.

Armstrong, Francis T.

Wallace, Fred C. (D. O. L.)

Wrona, William J. (D. O. L.)

Bloom, Frank. (D. O. L.)

Jones, Lloyd E. (D. O. L.)

Polk, Newton U. (D. O. L.)

Bailey, Wesley M. (D. O. L.)

Austin, Raymond B. (D. O. L.)

Second Lieutenants.

Kiser, Sherman L.

Yeager, Emer.

McCollister, John J.

Clarke, William

Ives, Albert R.

Sheridan, Joseph A.

Veterinarians.

Gage, Fred B.

Gould, John H.

THIRD FIELD ARTILLERY

(3-in. guns.)

Permanent Stations:

Hdqs. and 1 Battn., Ft. Sam
Houston, Tex.

2 Battn., Ft. Myer, Va.

Present Station:

Batty, D Eagle Pass, Tex.

Battys, E and F. Laredo, Tex.

Colonel.

Millar, Edward A.

Lieutenant Colonel.

McCloskey, Manus

THIRD FIELD ARTILLERY

Continued.

Majors.

Farrar, Henry B.

Herron, Charles D.

Apple, George M. (att.)

Chaplain.

Perry, Barton W. (maj.)

Captains.

Bunker, Charles M.

Jones, Clarence N.

Michel, William N

Jones, William F.

Mortimer, Charles G.

Margetts, Nelson E.

Smith, Edwin De L.

Lyerly, Ballard.

Lewis, Robert H.

Kirkwood, Robert G.

Brabson, Joe R.

Welsh, Robert S. (D. O. L.)

Burleson, Richard C. (D. O. L.)

First Lieutenants.

Watson, Edwin M.

Baehr, Carl A.

Odell, Herbert R.

Wycke, Ira T.

Millar, Edward A., Jr.

Malony, Harry J.

Waldron, Albert W.

Wallace, John H.

Hudnutt, Dean

Hibbs, Louis E.

Daly, Joseph O. (D. O. L.)

Harris, Arthur R. (D. O. L.)

Second Lieutenants.

Fibich, Michael J.

Brady, Sidney G.

Alexander, William D.

Hervey, Harcourt.

Bond, Oliver J., Jr.

Parker, Henry B.

Fielding-Reid, Francis.

Pitney, John B.

Jackson, William McK.

Knopf, Stacy.

Arthur, Louis C., Jr.

Veterinarians.

Griffin, Gerald E.

Mitchell, Aquila

FOURTH FIELD ARTILLERY

(2.95-in. mountain.)

Permanent stations:

Hdqs. and 1 Battn., Ft. D. A.

Russell, Wyo.

2 Battn., Corozal, Canal Zone.

Present Stations:

Hdqs. and 1 Battn., El Paso, Tex.

Batty D, Brownville, Tex.

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FIELD ARTILLERY DIRECTORY—Continued.

FOURTH FIELD ARTILLERY Continued.

Colonel.
Snow, William J.
Lieutenant Colonel.
Lyon, LeRoy S.

Majors.
Merrill, Thomas E.
Hall, Harrison.
McMaster, Richard H. (D. O. L.)

Chaplain.
Jones, Nathaniel A. (1 lieu.)

Captains.

Lawson, Laurin L.
Mason, Roger O.
Brewster, Alden F.
Wheeler, Ernest S.
McNair, Lesley J.
Kelly, John R.
Cubbison, Donald C.
Maul, John C.
Collins, Leroy P.
Rumbough, Joseph W.
Cruse, Fred T. (D. O. L.)

First Lieutenants.

Rogers, Joseph A.
Griffith, Charles T.
Lee, Raymond E.
Arnemann, George E.
Lang, Clarence D.
Hyatt, Robert F.
Parker, Edwin P., Jr.
Craig, Louis A.
Dunigan, Francis J.
Busbee, Charles M.
Maguire, Hamilton E.
Jones, Henry C.
Bateman, Harold H. (D. O. L.)
Eager, Howard (D. O. L.)

Second Lieutenants.

Pollin, George A.
Finkbiner David E.
Ennis, Robert H.
Ristine, Harold H.
Tate, Clifford H.
Minton, Hugh C.
Pope, David M.

Veterinarian.

Sproule, William A.

FIFTH FIELD ARTILLERY (4.7-in. guns, 6-in howitzers.)

Permanent station:
Ft. Sill, Okla.

Present stations:
Hdqrs. 1 Btn. and Batty, E. Camp Ft.
Bliss, Tex.
Batty, D. Ft. Ringgold, Tex.
Batty, F. Brownsville, Tex.

Colonel.

Menoher, Charles T.
Lieutenant Colonel.
Bowley, Albert J.

FIFTH FIELD ARTILLERY Continued.

Majors.
Smith, Wright
Moseley, George V. H.
Brooke, George M.
Lanza, Conrad H. (D. O. L.)

Chaplain.
Clemens, Joseph (capt.)

Captains.

Robinson, James P.
Wood, Norton E.
Davis, Robert
Glassford, Pelham D.
Davis, Joseph R.
Murray, Maxwell.
Capron, Webster A.
Perkins, Kenneth S.
Prince, Frederick A.
Booker, Philip W. (D. O. L.)

First Lieutenants.

Gay, George S.
Sandeford, Alvan C.
Templeton, Hamilton
Gruber, William R.
Spencer, Eugene T.
Lester, James A.
Struble, Herbert S.
Reinhart, Stanley E.
Woodward, William R.
Reynolds, Charles C. (D. O. L.)
Meyer, Vincent. (D. O. L.)
Barnes, Julian F. (D. O. L.)
Burr, John G. (D. O. L.)
Burr, William E. (D. O. L.)

Second Lieutenants.

Ruoff, Chauncey F.
Ruhberg, George N.
Bryan, Stanley F.
Jones, William J.
Carter, Benjamin E.
Edwards, Edmund B.
O'Donnell, Ottomar
Gallaher, Charles W.
Willenboucher, Eugene H.

Veterinarians.

Williams, Herbert S.
Power, Richard H.

SIXTH FIELD ARTILLERY (3-in. guns.)

Permanent station:
Ft. Riley, Kans.

Present stations:
Hdqrs. 1 Bttn. and Battys. E. and F.
Douglas, Ariz.
Batty, D. Nogales, Ariz.

Colonel.

McNair, William S.
Lieutenant Colonel.

Payne, Brooke
Majors.

Pulis, Charles C.
Bundel, Charles M.
Yule, Edgar H. (att.)

SIXTH FIELD ARTILLERY

Chaplain.

Dickson, Thomas J. (maj.).
Captains.

Birmie, Upton, jr.
Griffin, Francis W.
Myers, Joseph E.
Wood, William S.
Dodds, William H., Jr.
Bishop, Albert T.
Starkey, John R.
Marley, James P.
Martin, Truby C.

First Lieutenants

Beere, Donald M.
Miner, Harold E.
Conolly, Whitman R.
Zundel, Edwin A.
Marsh, Raymond
Rutherford, Ray C.
King, Alfred K.
Clarkson, Herbert S. (D. O. L.)
Anderson, John B. (D. O. L.)

Second Lieutenants

Davis, Erwin C. W.
Durant, Armand
Haines, Oliver L.
Vesely, Yarrow D.
Gruhn, Oscar L.
Winslow, John S.
Houston, Laurence V.
Hubbard, John F.

Veterinarians.

Hill, William P.
Mason, Alfred L. (att.)

SEVENTH FIELD ARTILLERY (3-in. guns.)

Permanent station:
Ft. Sam Houston, Tex.

Colonel.

Sturgis, Samuel D.

Lieutenant Colonel.

Farr, Otho W. B.

Majors.

Holbrook, Lucius R.
Faulkner, Albert U.

Chaplain.

Joyce, Francis P. (capt.)

Captains.

Landers, Howard L.
Howze, Marion W.
McKinlay, Louis H.
Mack, Jacob A.
Bailey, Benjamin M.
Sands, Alfred L. P.
Brunzell, Otto L.
Harlow, Charles W.
Greely, John N.
Barrows, Frederick M.
Parrott, Roger S.
Rogers, Wilbur (att.)
Dunn, William E. (D. O. L.)

FIELD ARTILLERY DIRECTORY

FIELD ARTILLERY DIRECTORY—Continued

SEVENTH FIELD ARTILLERY

First Lieutenants.

Kennedy, John T.
Turner, Frank A.
Lewis, Burton O.
Dawley, Ernest J.
Peyton, Bernard R.
Magruder, John
Franke, Gustav H.
Larned, William E.
Batson, Roscoe C.
Heard, Falkner
Tarpley, Jesse F.
Proctor, Mert. (D. O. L.)

Second Lieutenants.

De Coen, Emile G.
Roberts, Frank A.
Lee, Herbert L.
Daniels, Robert W.
Handy, Thomas T.
Gates, Oscar I.
Wrenn, Theodore W.
Echols, Oliver P.
Smith, Edward M.
Brigham, Arthur, Jr.
Shepherd, William E., Jr.

Veterinarians.

Foster, Frederick
Wight, Allan C.

EIGHTH FIELD ARTILLERY

(3.8-in. howitzers.)

Permanent Station:
Ft. Bliss, Tex.

Colonel.

March, Peyton C.

Lieutenant Colonel.

Bishop, Harry G.

Majors.

Hopkins, Frank E.
Lambdin, William McK.
Scott, Ernest D. (D. O. L.)

Chaplain.

Smith, Samuel J. (maj.)

EIGHTH FIELD ARTILLERY

Captains.

Westerfelt, William I.
Locke, Morris. E.
Bryson, James H.
Quinn, Leo P.
Neal, Carroll W.
Osborne, Thomas D.
Sturgill, Walter S.
Kieffer, Pierre V.
George, Charles P.
Shepard, William H.
Rucker, William H. (D. O. L.)
Gottschalk, Telesphor G. (D. O. L.)

First Lieutenants.

Bane, Thurman H.
Seaman, George G.
Austin, Jacob McV.
Byrne, Charles L.
Hobbs, Harvey M.
Spalding, Isaac.
Hochwalt, Earl B.
Swing, Joseph M.
McBride, Horace L.
Bradburn, Clarence E.
Goetz, Robt. C. F. (D. O. L.)
Morrow, Norman P. (D. O. L.)
Deshon, Percy. (D. O. L.)
vonHoltzendorff, John D. (D.O.L.)

Second Lieutenants.

McLendon, Idus R.
Marshall Richard J.
Heard, Ralph T.
Sheppard, Francis W.
Tipton, Frank B. Jr.
Brower, Gerald E.
Thomas, Charles B.
Rehm, Harold W.
Ripley Clement.
Garrett, James M., Jr.
Weston, Harry B.
Davison, F. McKenzie.

Veterinarian.

Dean, George H.

NINTH FIELD ARTILLERY

(4.7-in. guns, 6-in. howitzers,
motor.)

Permanent Station:
Schofield Barracks, Hawaii.

Colonel.

McMahon, John E.

Lieutenant Colonel.

Guignard, William S.

Majors.

Butner, Henry W.
Foy, Robert C.

Chaplain.

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Captains.

Kilbreth, John W., Jr.
Browning, William S.
Pratt, Raymond S.
Corey, John B. W.
Frankenberger, Samuel
Kilbourne, Henry S., Jr.
Paine, George H.

First Lieutenants.

Dickinson, Oliver A.
Erlenkotter, Herman
Devers, Jacob L.
Vanderveer, Harold C.
Wyeth, John C.
Selleck, Clyde A. (D. O. L.)
Cain, David E. (D. O. L.)
Hauser, John N. (D. O. L.)
Sedlacek, Ernst. (D. O. L.)

Second Lieutenants.

Lynch, Patrick L.
Bradley, Ivan N.

Veterinarian.

Nye, Elwood L.

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FIELD ARTILLERY DIRECTORY—Continued.

LINEAL RANK*

No. Name, rank, and date of rank.	No. Name, rank, and date of rank.	No. Name, rank, and date of rank.
<i>Colonels.</i>		
1 Van Deusen, G. W. 7 sept. 11	1 Westervelt, W. I. 25 jan. 07	69 Dodds, W. H., jr. 1 July,
2 Millar, E. A. 1 dec.	2 Birnie, U., Jr. 25 jan.	70 Hammond, J. S. 1 July,
3 Sturgis, S. D. 27 dec. 12	3 Deems, C., jr. 25 jan.	71 Bishop, A. T. 1 July,
4 Berry, L. G. 16 mar. 13	4 Doyle, F. C. 25 jan.	72 Prosser, W. E. 1 July,
5 McMahon, J. E. 3 June, 16	5 Robison, J. P. 25 jan.	73 Huntley, H. W. 1 July,
6 Menoher, C. T. 1 July,	6 McIntyre, A. 25 jan.	74 Smith, E. De L. 1 July,
7 Hinds, E. 1 July,	7 Greene, G. R. 25 jan.	75 Pennell, R. McT. 1 July,
8 March P. C. 1 July,	8 Briggs, R. W. 25 jan.	76 Sturgill, W. S. 1 July,
9 Kenly, W. L. 1 July,	9 Bunker, C. M. 25 jan.	77 Miles, S. 1 July,
10 McGlachlin E.F., Jr. 1 July,	10 Griffin, F. W. 25 jan.	78 Parker, C. 1 July,
11 Lassiter, W. 1 July,	11 Welsh, R. S. 25 jan.	79 Burleson, R. C. 1 July,
12 Irwin, G. Le R. 1 July,	12 Campbell, T. 25 jan.	80 Davis, J. R. 1 July,
13 McNair, W. S. 1 July,	13 Craig D. F. 25 jan.	81 Starkey, J. R. 1 July,
14 Snow, W. J. 1 July,	14 Warfield, A. B. 25 jan.	82 Hoyle, R. E. DeR. 1 July,
<i>Lieutenant Colonels.</i>		
1 Gatley, G. G. 12 June, 16	15 Landers, H. L. 25 jan.	83 Olmstead, D. 1 July,
2 Lyon, Le R. S. 1 July,	16 Burt, W. H. 12 June,	84 Maul, J. C. 1 July,
3 Horn, T. N. 1 July,	17 Jones, C. N. 25 Feb. 08	85 Hall, A. L. 1 July,
4 Sumnerall, C. P. 1 July,	18 Hennesy, F. B. 26 July, 07	86 Paine, G. H. 1 July,
5 Cruskshank, W. M. 1 July,	19 Lawson, L. L. 12 Aug.	87 Collins, L. P. 1 July,
6 Farr, O. W. B. 1 July,	20 Locke, M. E. 25 Aug. 08	88 Lyerly, B. 1 July,
7 Altman, D. E. 1 July,	21 Kilbreth, J. W., jr. 1. apr. 04	89 Lewis, R. H. 1 July,
8 Fleming, A. S. 1 July,	22 Bryson, J. H. 10 sept. 09	90 Booker, P. W. 1 July,
9 Payne, B. 1 July,	23 Mason, R. O. 30 sept.	91 Cruse, F. T. 1 July,
10 Guignard, W. S. 1 July,	24 Browning, W. S. 15 Nov. 10	92 Marley, J. P. 1 July,
11 Bowley, A. J. 1 July,	25 Barnes, J. F. 3 mar. 11	93 Potter, W. C. 1 July,
12 Bishop, H. G. 1 July,	26 Ennis, W. P. 11 mar.	94 Downer, J. W. 1 July,
13 Newbill, W. D. 26 July,	27 Currie, D. H. 11 mar.	95 Bailey, B. M. 1 July,
14 McCloskey, M. 26 July,	28 Browne, B. F. 11 mar. 11	96 Sharp, W. F. 1 July,
<i>Majors.</i>		
1 McMaster, R. H. 18 Nov. 14	29 Pratt, R. S. 11 mar.	97 Thorp, F., jr. 1 July,
2 Stephens, J. E. 3 June, 16	30 Brewster, A. F. 11 mar.	98 Tyndall, J. G. 1 July,
3 Merrill, T. E. 12 June,	31 De Armond, E. H. 11 mar.	99 Brunzell, O. L. 1 July,
4 Conner, F. 1 July,	32 Wood, N. E. 11 mar.	100 Kieffer, P. V. 1 July,
5 Butner, H. W. 1 July,	33 Fuger, A. S. 11 mar.	101 Murray, M. 1 July,
6 Newbold, H. L. 1 July,	34 Michel, W. N. 11 mar.	102 Sands, A. L. P. 1 July,
7 Scott, E. D. 1 July,	35 Wheeler, E. S. 11 mar.	103 George, C. P. 1 July,
8 Holbrook, L. R. 1 July,	36 Holiday, T. W. 11 mar.	104 Harlow, C. W. 1 July,
9 Hall, H. 1 July,	37 Corey, J. B. W. 13 Apr.	105 Rucker, W. H. 1 July,
10 Smith, W. 1 July,	38 Churchill, M. 13 Apr.	106 Shepherd, W. H. 1 July,
11 Starbird, A. A. 1 July,	39 Jones, W. F. 13 Apr.	107 Randol, M. G. 1 July,
12 Lloyd, C. R. 1 July,	40 Mortimer, C. G. 26 May,	108 Greely, J. N. 1 July,
13 Spaulding, O. L., Jr. 1 July,	41 Margetts, N. E. 26 May,	109 Capron, W. A. 1 July,
14 Lanza, C. H. 1 July,	42 Davis, R. 7 June,	110 Mort, J. E. 1 July,
15 Farrar, H. B. 1 July,	43 Myers, J. E. 7 sept.	111 Barrows, F. M. 1 July,
16 Granger, R. S. 1 July,	44 Wood, W. S. 8 sept.	112 Dunn, W. E. 1 July,
17 Moore, D. T. 1 July,	45 Frankenberger, S. 18 Oct.	113 Burns, J. H. 1 July,
18 Moseley, G. V. H. 1 July,	46 Morrison, W. F. 9 Feb. 12	114 Hughes E. S. 1 July,
19 Hopkins, F. E. 1 July,	47 Ferris, C. J. 26 Aug.	115 Smith T. J. 1 July,
20 Austin, F. T. 1 July,	48 Rehkopf, N. B. 11 July, 13	116 Parrott, R. S. 1 July,
21 Pulis, C. C. 1 July,	49 Baker, S. 9 Oct.	117 Gottschalk, T. G. 1 July,
22 Bundel, C. M. 1 July,	50 Howze, M. W. 24 Oct.	118 Higley, H. D. 1 July,
23 Herron, C. D. 1 July,	51 Kilbourne, H. S., jr. 22. Nov.	119 King, E. P., jr. 1 July,
24 Foy, R. C. 1 July,	52 McNair, L. J. 19 Apr. 14	120 Perkins, K. S. 1 July,
25 Boiseau, L. T. 1 July,	53 Allin, G. R. 13 June,	121 Kirkwood, R. G. 1 July,
26 Lambdin, W. McK. 1 July,	54 Kelly, J. R. 11 Nov.	122 Marr, H. E. 1 July,
27 Donnelly, E. T. 1 July,	55 Glassford, P. D. 18 Nov.	123 Rumbough, J. W. 1 July,
28 Brooke, G. M. 3 Aug.	56 Bryden W. 10 Jan. 15	124 McCleave, W. 1 July,
29 Williams, H. C. 22 Sept.	57 Honeycutt, F. W. 27 June,	125 McBride, A. C. 1 July,
30 Faulkner, A. U. 22 Sept.	58 Hand, D. W. 25 Jan. 07	126 Brabson, J. R. 1 July,
31 Apple, G. M. 26 Feb. 17	59 Blakely, C. S. 4 Nov. 15	127 Sparks, L. C. 1 July,
32 Yule, E. H. 21 Mar.	60 Smith, E. T. 3 June, 16	128 Crane, J. A. 1 July,
	61 Danford, R. M. 12 June,	129 Prince, F. A. 1 July,
	62 Quinn, L. P. 12 June,	130 Magruder, M. 1 July,
	63 Gruber, E. L. 1 July,	131 Martin, T. C. 1 July,
	64 Neal, C. W. 1 July,	132 Rogers, W. 2 July,
	65 Cubbison, D. C. 1 July,	133 Dougherty, L. R. 2 July,
	66 Mack, J. A. 1 July,	134 Hopkins, S. R. 7 July,
	67 McKinlay, L. H. 1 July,	135 Hollingsworth, C.P. 7 July,
	68 Osborne, T. D. 1 July,	136 Daly, C. D. 3 Aug.

*NOTE:—Names of officers detailed from the line for service in the staff departments under section 26, act of February 2, 1901, acts of March 2, 1903, June 25, 1906, March 2, 1907, March 23, 1910, or July 18, 1914 and officers detached from their proper commands under act of March 3, 1911, or July 18, 1914, are printed in italics.

FIELD ARTILLERY DIRECTORY

FIELD ARTILLERY DIRECTORY—Continued

No. Name, rank, and date of rank.	No. Name, rank, and date of rank.	No. Name, rank, and date of rank.
<i>First Lieutenants.</i>		
1 Bane, T. H. 23 sept.	74 Cole, L. R. 1 July	1 Kiser, S. L. 26 nov. 16
2 Palmer, A. K. C. 22 nov.	75 Ferron, P. L. 1 July	2 Yeager, E. 26 nov.
3 Dickinson, A. O. 5 June, 14	76 Deshon, P. 1 July	3 Heysler, M. C. 26 nov.
4 Stewart, F. W. 13 June, 14	77 Barnes, J. F. 1 July	4 McLendon, I. R. 26 nov.
5 Hayden, H. B. 18 nov.	78 Vanderveer, H. C. 1 July	5 Fibich, M. J. 26 nov.
6 Kennedy, J. T. 8 dec.	79 Andrus, C. 1 July	6 Brady, S. F. 26 nov.
7 Johnson, T. J. 8 dec.	80 Armemann, G. E. 1 July	7 Pollin, G. A. 26 nov.
8 Ahern, L. J. 10 Jan. 15	81 Lang, C. D. 1 July	8 Finkbiner, D. E. 26 nov.
9 Beere, D. M. 10 Jan.	82 Maxwell, R. L. 1 July	9 Ruoff, C. F. 26 nov.
10 Erlenkotter, H. 12 may.	83 Browne, C. J. 1 July	10 Davis, E. C. W. 26 nov.
11 Thummel, C. B. 15 may.	84 Hauser, J. N. 1 July	11 DeCoen, E. G. 25 nov.
12 Watson, E. M. 15 sept.	85 Greenwald, K. C. 1 July	12 White, A. N. 26 nov.
13 Miner, H. E. 4 nov.	86 Anderson, R. E. 1 July	13 Lynch, P. L. 26 nov.
14 Rogers, J. A. 22 Jan. 16	87 Gillespie, J. A. 1 July	14 Bradley, I. N. 26 nov.
15 Griffith, C. T. 21 feb.	88 Bailey, W. M. 1 July	15 McCollister, J. J. 27 nov.
16 Devers, J. L. 1 apr.	89 Spalding, I. 1 July	16 Roberts, F. A. 27 nov.
17 Taliatferro, L. H. 8 may.	90 Malony, H. J. 1 July	17 Alexander, W. D. 28 nov.
18 Bateman, H. H. 8 may.	91 Hyatt, R. F. 1 July	18 Lee, H. L. 28 nov.
19 Turner, F. A. 3 June.	92 Arnold, A. V. 1 July	19 Marshall, R. J. 28 nov.
20 Seaman, G. G. 12 June.	93 Hochwalt, E. B. 1 July	20 Heard, R. T. 28 nov.
21 Reynolds, C. C. 12 June.	94 vonHoltendorff, J. D. 1 July	21 Hervey, H. 29 nov.
22 Gay, G. S. 20 June.	95 Winton, W. F. 1 July	22 Sheppard, F. W. 29 nov.
23 Wallace, F. C. 20 June.	96 Armstrong, F. T. 1 July	23 Daniels, R. W. 29 nov.
24 Hayes, P. 1 July	97 Templeton, H. 1 July	24 Winslow, J. S. 30 nov.
25 Doniat, F. A. 1 July	98 Frankenberger, B. 1 July	25 Ruhberg, G. N. 30 nov.
26 Baehr, C. A. 1 July	99 Austin, R. B. 1 July	26 Durant, A. 30 nov.
27 McDowell, J. M. 1 July	100 Daly, J. O. 1 July	27 Handy, T. T. 30 nov.
28 Lee, R. E. 1 July	101 Parker, E. P., jr. 1 July	28 Tipton, F. B., jr. 30 nov.
29 Austin, J. McV. 1 July	102 Eager, J. M. 1 July	29 Bryan, S. F. 30 nov.
30 Lewis, B. O. 1 July	103 Gruber, W. R. 1 July	30 Haines, O. F. 30 nov.
31 Odell, H. R. 1 July	104 Scott R. C. 1 July	31 Gates, O. I. 30 nov.
32 Selleck, C. A. 1 July	105 Eager, H. 1 July	32 Brower, G. E. 30 nov.
33 Dawley, E. J. 1 July	106 Young, W. C. 1 July	33 Jones, W. J. 30 nov.
34 Beard, L. A. 1 July	107 Crane, W. C., jr. 1 July	34 Vesely, Y. D. 30 nov.
35 Jones, I. 1 July	108 Brewer, C. 1 July	35 Thomas, C. B. 30 nov.
36 Penleton, W. A. 1 July	109 Cain, D. E. 1 July	36 Bond, O. J., jr. 30 nov.
37 Goets, R. C. F. 1 July	110 Mc Mahon, J. E. jr. 1 July	37 Ennis, R. H. 30 nov.
38 Peyton, B. R. 1 July	111 Spencer, E. T. 1 July	38 Carter, B. E. 30 nov.
39 Magruder, J. 1 July	112 Heard, F. 1 July	39 Parker, H. B. 30 nov.
40 Conolly, W. R. 1 July	113 Clarkson, H. S. 1 July	40 Fielding-Reid, F. 30 nov.
41 Riggs, E. F. 1 July	114 Craig, L. A. 1 July	41 Ristine, H. H. 30 nov.
42 Nance, C. H. 1 July	115 Helmick, C. G. 1 July	42 Edwards, E. B. 30 nov.
43 Bowley, F. W. 1 July	116 Sedlacek, E. 1 July	43 Gruhn, O. L. 30 nov.
44 Franke, G. H. 1 July	117 Thurber, P. L. 1 July	44 Wrenn, T. W. 30 nov.
45 Beatty, J. C. 1 July	118 Houghton, W. C. 1 July	45 Rehm, H. W. 30 nov.
46 Stanton, H. G. 1 July	119 Wyeth, J. C. 1 July	46 Pitney, J. B. 30 nov.
47 Hatch, J. E. 1 July	120 Harris, A. R. 1 July	47 Tate, C. H. 30 nov.
48 Walker, C. A., jr. 1 July	121 Burr, J. G. 1 July	48 O'Donnell, O. 30 nov.
49 Simpson, B. W. 1 July	122 Anderson, J. B. 1 July	49 Echols, O. P. 30 nov.
50 Finch, N. B. 1 July	123 Burr, W. E. 1 July	50 Ripley, C. 30 nov.
51 Larned, W. E. 1 July	124 Lester, J. A. 1 July	51 Smith, E. M. 30 nov.
52 Byrne, C. L. 1 July	125 Beukema, H. 1 July	52 Hoskins, J. O. 19 mar. 17
53 Batson, R. C. 1 July	126 Strubble, H. S. 1 July	53 Clarke, W. 19 mar.
54 Standeford, A. C. 1 July	127 Dunigan, F. J. 1 July	54 Ives, A. R. 19 mar.
55 Wyche, I. T. 1 July	128 Zendel, E. A. 1 July	55 Brigham, A., Jr. 19 mar.
56 Hobbs, H. M. 1 July	129 Howard, C. W. 1 July	56 Jackson, W. M. 19 mar.
57 Andrews, J. 1 July	130 Busbee, C. M. 1 July	57 Sheridan, J. A. 19 mar.
58 Oliphant, T. G. M. 1 July	131 Waldron, A. W. 1 July	58 Minton, H. C. 21 mar.
59 Proctor, M. 1 July	132 Wallace, J. H. 1 July	59 Gallaher, C. W. 21 mar.
60 Wrona, W. J. 1 July	133 Marsh, R. 1 July	60 Houston, L. V. 21 mar.
61 Breton, L. H. 1 July	134 Swing, J. M. 1 July	61 Knopf, S. 22 mar.
62 Erwin, V. P. 1 July	135 Reinhart, S. E. 1 July	62 Garrett, J. M. 22 mar.
63 Bloom, F. 1 July	136 Hudnutt, D. 1 July	63 Pope, D. M. 22 mar.
64 Meyer, V. 1 July	137 Hibbs, L. E. 1 July	64 Weston, H. B. 22 mar.
65 Hicks, E. H. 1 July	138 Tarpley, J. F., jr. 1 July	65 Willenbacher, E. H. 22 mar.
66 Morrow, N. P. 1 July	139 McBride, H. L. 1 July	66 Arthur, L. C. Jr. 22 mar.
67 Jones, L. E. 1 July	140 Maguire, H. E. 1 July	67 Hubbard, J. F. 22 mar.
68 Polk, N. N. 1 July	141 Rutherford, R. C. 1 July	68 Davison, F. M. 22 mar.
69 Millar, E. A. jr. 1 July	142 Woodward, W. R. 1 July	69 Shepherd, W. E., Jr. 22 mar.
70 McConkey, C. J. 1 July	143 King, A. K. 1 July	
71 Bradley, F. 1 July	144 Jones, H. C. 1 July	
72 Anderson, R. E. 1 July	145 Bradburn, C. E. 17 aug.	
73 Oberly, R. S. 1 July		
<i>First Lieutenants—Continued</i>		
<i>Second Lieutenants.</i>		

THE FIELD ARTILLERY JOURNAL

FIELD ARTILLERY DIRECTORY—Continued NATIONAL GUARD

It is requested that changes be reported to the Secretary, United States Field Artillery Association, Washington, D. C.

FIRST INSPECTION DISTRICT

Capt. Ned B. Rehkopf and Capt. Harold E. Marr Inspectors,
Boston, Mass.

New Hampshire

BATTERY A, MANCHESTER

Capt. Edward L. Towle.
1st Lieut. Frank J. Abbott.
1st Lieut. Lucius E. Hill.
2nd Lieut. Walter B. Smith.
2nd Lieut. Harry G. Hall.

Massachusetts

FIRST REGIMENT

Headquarters, Boston

Col. John H. Sherburne.
Lieut.-Col. Thorndike D. Howe.
Maj. Richard K. Hale.
Maj. Frank S. Perkins.
Capt. Benjamin H. Ticknor, Adjutant.
Capt. Norton Wigglesworth, Battalion Adjutant.
Capt. John A. O'Keefe, Battalion Adjutant.
Chaplain Murray W. DeWart.

SUPPLY COMPANY

Capt. Henry P. Silsbee.
1st Lieut. Roger Sherman.

HEADQUARTERS COMPANY

Capt. Coburn Smith.
1st Lieut. Daniel Needham.

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1st Lieut. James F. Clarke.
1st Lieut.
2nd Lieut. Frederic C. Huntington.
2nd Lieut.

BATTERY B, WORCESTER

Capt. John F. J. Herbert.
1st Lieut. John B. Haliburton.
1st Lieut.
2nd Lieut. Milton J. Haynes.
2nd Lieut. Edward J. Gully.

BATTERY C, METHUEN

Capt. George A. Perker.
1st Lieut. Wayland M. Minot.
1st Lieut. Walter P. Tobey.
2nd Lieut. Isaac H. Angell.
2nd Lieut.

BATTERY D, SALEM

Capt. Harry E. Mitton.
1st Lieut. Thomas Sanders.
2nd Lieut. Nathaniel S. Simpkins, Jr.
2nd Lieut. Laurence K. Mansfield.

BATTERY E, SALEM

Capt. Ernest R. Redmond.
1st Lieut. George E. Burke.
1st Lieut. Arthur E. Johnson, Jr.
2nd Lieut. Harry E. Cahoon.
2nd Lieut. Willard B. Luther.

BATTERY F, SALEM

Capt. William B. Morgan.
1st Lieut. Frank L. Smith.
1st Lieut. Willis G. Dockum.
2nd Lieut. Herman A. MacDonald.
2nd Lieut. James E. Lovett.

SECOND REGIMENT

Headquarters, Boston

Col.
Lieut. Col.
Maj.
Maj.
Capt. Stuart McLeod, Adjutant.

SUPPLY COMPANY

Capt. Roland H. Choate.
1st Lieut.

HEADQUARTERS COMPANY

Capt. John Simpkins.
1st Lieut.

BATTERY A, HAVERHILL

Capt. Charles H. Morse.
1st Lieut. William H. Root.
1st Lieut.
2nd Lieut. Benjamin P. Harwood.
2nd Lieut. Ralph Bradley.

BATTERY B, LOWELL

Capt. Sumner H. Needham.
1st Lieut. Edward R. Watts.
1st Lieut. Winfred C. MacBrayne.
2nd Lieut. Lawrence B. Page.
2nd Lieut. George W. Emsley.

BATTERY C, METHUEN

Capt. Robert E. Goodwin.
1st Lieut. William B. Higgins.
1st Lieut. Roy A. Daniels.
2nd Lieut. Robert F. Hancock.
2nd Lieut. Bernard J. Lynch.

BATTERY D, NEW BEDFORD

Capt. Roger D. Swaim.
1st Lieut. Henderson Inches.
1st Lieut. Roger W. Eckfeldt.
2nd Lieut. Lester T. Lewis.
2nd Lieut. Harold Winslow.

BATTERY E, WORCESTER

Capt. Arthur P. Trombly.
1st Lieut. Romeo A. Gravel.
1st Lieut. John D. Power.
2nd Lieut. Andrew W. Thompson.
2nd Lieut. Winslow S. Lincoln.

BATTERY F, BOSTON

Capt. Erland F. Fish.
1st Lieut. Charles S. Weeks.
1st Lieut. Frank A. MacNamee, Jr.
2nd Lieut. Walter O. Luscombe, Jr.
2nd Lieut. Charles P. Reynolds, Jr.

Rhode Island

FIRST BATTALION

Headquarters, Providence

Maj. Ralph S. Hamilton, Jr.
Capt. Everitte S. Chaffee, Adjutant.
1st Lieut. Charles W. Bowen, Jr., Supply Officer.

FIELD ARTILLERY DIRECTORY

FIELD ARTILLERY DIRECTORY—Continued

BATTERY A, PROVIDENCE

Capt. Harold R. Barker.
1st Lieut. Joseph C. Davis.
1st Lieut. Harold P. Babcock.
2nd Lieut. Everett S. Hartwell.
2nd Lieut. Earl P. Luther.

BATTERY B, PROVIDENCE

Capt. Gerald T. Hanley.
1st Lieut. Norman D. MacLeod.
1st Lieut. Rush Sturges.
2nd Lieut. Duncan Langdon.
2nd Lieut. Ernest T. H. Metcalf.

BATTERY C, PROVIDENCE

Capt. Donald S. Babcock.
1st Lieut. Hendrik G. Nelson.
1st Lieut. G. Gordon MacLeod.
2nd Lieut. Stanley A. Ward.
2nd Lieut. Roy C. Stowe.

Connecticut

BATTERY E, BRANFORD

Capt. John J. Ahern.
1st Lieut. Ernest L. Averill.
2nd Lieut. John W. Newton.
2nd Lieut. Walter Green.
2nd Lieut. Joseph H. Driscoll.

BATTERY F, STAMFORD

Capt. John A. Twachtman.
1st Lieut. Melbert B. Cary, Jr.
1st Lieut. Stuart L. Bullivant.
2nd Lieut. Philip J. Clark.
2nd Lieut. Fred Auer.

SECOND INSPECTION DISTRICT

Capt. D. W. Hand, Capt. John S. Hammond, and Capt.
Dawson Olmstead, Inspectors, New York City

New Jersey

FIRST BATTALION

Headquarters, East Orange

Maj. Samuel G. Barnard.
Capt. Claude E. Lanterman, Adjutant.
Capt. Clarence A. Nordine, Supply Officer.

BATTERY A, EAST ORANGE

Capt. William F. Rothenburger.
1st Lieut. Tegwell L. Powell.
1st Lieut. Reginald T. Bennett.
2nd Lieut. Louis C. Geils.
2nd Lieut. Robert L. Simmonds.

BATTERY B, CAMDEN

Capt. John H. Dittess, Jr.
1st Lieut. Samuel R. English.
1st Lieut. Charles V. Dickinson.
2nd Lieut. John W. Hicks.
2nd Lieut. Charles S. Richards.

BATTERY C, EAST ORANGE

Capt. Edward C. James.
1st Lieut. Charles W. Fritz.
1st Lieut. Robert L. Eaton.
2nd Lieut. William F. Lind.
2nd Lieut. Richard A. Weibel.

New York

FIELD ARTILLERY BRIGADE

Brig.-Gen.
Maj. Leonard Bacon Smith, Adjutant General.

FIRST FIELD ARTILLERY

Headquarters, New York City

Col. Merritt H. Smith.
Lieut.-Col.
Maj. Charles R. Seymour.
Maj. James E. Austin.
Capt. Benjamin Van Raden, Battalion Adjutant.
Capt. John T. Delaney, Battalion Adjutant.
Chaplain Herbert Shipman.

HEADQUARTERS COMPANY

Capt. James H. Kenyon.
1st Lieut.

SUPPLY COMPANY

Capt. Clarence G. Michalis.
1st Lieut. William J. Volkland.

BATTERY A, SYRACUSE

Capt. Guido F. Verbeck.
1st Lieut. William H. Thomas.
1st Lieut.
2nd Lieut. Hamlin L. Aberdeen.
2nd Lieut. Irvine A. Williams.

BATTERY B, NEW YORK CITY

Capt. Walter C. McClure.
1st Lieut. James H. Giles.
1st Lieut. William P. Welsh.
2nd Lieut. Charles E. Dunlap.
2nd Lieut. Shippin.

BATTERY C, BINGHAMTON

Capt. Charles G. Blakeslee.
1st Lieut. Arthur E. Kaeppl.
1st Lieut. Albert J. Sinnock.
2nd Lieut.
2nd Lieut. Philip B. Weld.

BATTERY D, NEW YORK CITY

Capt. Sylvester Simpson.
1st Lieut. Clinton M. Lucas.
1st Lieut. Fred A. Petersen.
2nd Lieut. John Farr, Jr.
2nd Lieut. Henry B. Stimson.

BATTERY E, NEW YORK CITY

Capt. Robert L. Russell.
1st Lieut. Channing R. Toy.
1st Lieut. Steele Watkyns.
2nd Lieut. Harold LeR. Whitney.
2nd Lieut. John W. Pulleyn.

BATTERY F, NEW YORK CITY

Capt. George S. Gibbons.
1st Lieut. Arthur W. Hoffman.
1st Lieut.
2nd Lieut. Edwin S. Bettleheim, Jr.
2nd Lieut. James Park.

SECOND FIELD ARTILLERY

Headquarters, Brooklyn

Col. George A. Wingate.
Lieut.-Col. Frank H. Hines.
Maj. James B. Richardson.
Maj. DeWitt C. Weld, Jr.
Maj. Wilbur T. Wright.
Capt. Albert D. Washington.
Capt. Robert W. Marshall, Battalion Adjutant.
Capt. John D. Butt, Battalion Adjutant.

THE FIELD ARTILLERY JOURNAL

FIELD ARTILLERY DIRECTORY—Continued

HEADQUARTERS COMPANY

Capt. Frederick de Figaniers.
1st Lieut. Edward L. Brennan.

SUPPLY COMPANY

Capt. Louis F. Kuntz.
1st Lieut. Henry W. G. Cox.

BATTERY A, BROOKLYN

Capt. Walter P. Fox.
1st Lieut. Roger P. Clark.
1st Lieut. Thomas H. S. Andrews.
2nd Lieut. Clarence H. Higginson.
2nd Lieut. William E. Yeomans.

BATTERY B, BROOKLYN

Capt. Lester C. Fox.
1st Lieut. Walter H. Hereth.
1st Lieut. Harry C. Miller.
2nd Lieut. Arthur A. Farrell.
2nd Lieut. Charles E. Dunn.

BATTERY C, BROOKLYN

Capt. Albert S. Hamilton.
1st Lieut. Eugene A. Holmes.
1st Lieut. Edward O. Gilmore.
2nd Lieut. Arthur M. Floor.
2nd Lieut. James H. McSweeney.

BATTERY D, NEW YORK CITY

Capt. Howard E. Sullivan.
1st Lieut. Charles J. McGronan.
1st Lieut. George A. Sheddon.
2nd Lieut. George E. Fahys, Jr.
2nd Lieut. James H. Beard.

BATTERY E, NEW YORK CITY

Capt. Frank A. Spencer, Jr.
1st Lieut. Weyman D. Herbert.
1st Lieut. Cyril G. Ballin.
2nd Lieut. Alex. W. Chauncey.
2nd Lieut. Max L. Van Norden.

BATTERY F, NEW YORK CITY

Capt. William O. Richardson.
1st Lieut. Charles H. King.
1st Lieut. Raymond L. Hoffman.
2nd Lieut. Francis V. Hayes.
2nd Lieut. Albey E. Schaefer.

THIRD FIELD ARTILLERY

Headquarters, Buffalo

Col.
Lieut.-Col. John D. Howland.
Maj. Louis H. Eller.
Maj. James P. Fowler.
Capt. John D. Webber.
Capt. Bradley Goodyear, Battalion Adjutant
Capt. Thomas Marks, Battalion Adjutant.
Chaplain Walter Fornes.

HEADQUARTERS COMPANY

Capt. Wm. H. Kennedy.

SUPPLY COMPANY

Capt. Charles H. Williams

BATTERY A, BUFFALO

Capt. Chauncey J. Hamlin.
1st Lieut. Eben C. Sprague.
1st Lieut. Marvin M. Marcus, Jr.
2nd Lieut. Henry Schen.
2nd Lieut. Walter D. Parlour.

BATTERY B, BUFFALO

Capt. Patrick J. Keeler.
1st Lieut. Howard K. Parker.
1st Lieut. Jeremiah W. O'Mahoney.
2nd Lieut. John B. Howard.
2nd Lieut. William J. Gaskin.

BATTERY C, BUFFALO

Capt.
1st Lieut. Leonard S. Allen.
1st Lieut. Carleton B. Briggs.
2nd Lieut. Harold B. Honhart.
2nd Lieut. Theodore R. Farley.

BATTERY D, BUFFALO

Capt.
1st Lieut. John J. Curin.
1st Lieut. Edward L. Williams.
2nd Lieut. Edward C. Philips.
2nd Lieut.

BATTERY E, BUFFALO

Capt.
1st Lieut. Harry L. Gilchriese.
1st Lieut. Edwin C. Gutelius.
2nd Lieut. Louis Wojkoroski.
2nd Lieut.

BATTERY F, BUFFALO

Capt. William F. Schohl.
1st Lieut. Miles H. Merwin.
1st Lieut. Horace H. Burkhardt.
2nd Lieut. Paul F. Mann.
2nd Lieut. Harold H. Jones.

THIRD INSPECTION DISTRICT

Capt. Clarence Deems, Jr., Inspector,
Washington, D. C.

District of Columbia

BATTERY A, WASHINGTON, D. C.

Capt. Louis C. Vogt.
1st Lieut.
1st Lieut. Harry E. Shilling.
2nd Lieut. Homer M. Mohr.
2nd Lieut. Milton T. Noyes.

BATTERY B, WASHINGTON, D. C.

Capt.
1st Lieut. Ellwood S. Moorhead, Jr.
1st Lieut.
2nd Lieut. Charles L. Ladson.
2nd Lieut. Gerald G. McGrath.

FIELD ARTILLERY DIRECTORY

FIELD ARTILLERY DIRECTORY—Continued

Maryland

BATTERY A, BALTIMORE

Capt. James C. McLanahan.
1st Lieut. Gustavus Ober, Jr.
1st Lieut. A. Hunter Boyd, Jr.
2nd Lieut. Gresham H. Poe.
2nd Lieut. Edwin Warfield, Jr.

Virginia

FIRST BATTALION

Headquarters, Richmond

Major Thomas M. Wortham.
Capt. William W. LaPrade, Adjutant.
1st Lieut. Edward J. Keegan.

BATTERY A, RICHMOND

Capt. William M. Myers.
1st Lieut. Edward C. Rees.
1st Lieut. James C. Pollard.
2nd Lieut. John T. Wood.
2nd Lieut. George H. Myers.

BATTERY B, NORFOLK

Capt. Paul W. Kear.
1st Lieut. McChesney H. Jeffries.
1st Lieut. W. Carleton Jones.
2nd Lieut. John D. Thomas.
2nd Lieut. Cary A. Willcox.

BATTERY C, PORTSMOUTH

Capt. Ira Branch Johnson.
1st Lieut. Walter J. Tenment.
1st Lieut.
2nd Lieut. Irving L. Leafe.
2nd Lieut. Thomas S. Moseley.

SEPARATE BATTERY D, HAMPTON

Capt. Frank H. Couch.
1st Lieut. Thornton F. Jones.
1st Lieut. Robert G. Sugden.
2nd Lieut. Roland D. Cock.
2nd Lieut. James McMenamin.

STATE OF PENNSYLVANIA

Capt. W. F. Morrison, Lieut. H. E. Miner, and Lieut. R. C. F. Goetz, Inspectors.

FIRST FIELD ARTILLERY

Headquarters, Pittsburgh

Col. William S. McKee.
Lieut. Col. Albert V. Crookston.
Maj. Theodore R. McLain.
Maj. William T. Rees.
Capt. Josiah L. Reese, Adjutant.
Capt. James F. Kratzer, Battalion Adjutant.

HEADQUARTERS COMPANY, PITTSBURGH

Capt. Samuel D. Hollis.
1st Lieut. Edward A. Ohotnicky.

SUPPLY COMPANY, PITTSBURGH

Capt. Harry Howe.
1st Lieut. Walter P. King.

BATTERY A, SOUTH BETHLEHEM

Capt. Herbert M. Paul.
1st Lieut.
1st Lieut. Benjamin E. Cole.
2nd Lieut. Thomas P. Harris.
2nd Lieut.

BATTERY B, PITTSBURGH

Capt. Clinton T. Bundy.
1st Lieut. Chas. C. Williams.
1st Lieut. Anthony J. Leffler.
2nd Lieut.
2nd Lieut.

BATTERY C, PROENIXVILLE

Capt. Samuel A. Whitaker.
1st Lieut. Frederick S. Swier.
1st Lieut. John Nuckel.
2nd Lieut. John G. Failor.
2nd Lieut.

BATTERY D, WILLIAMSPORT

Capt. William B. Reilly.
1st Lieut. John D. Andrews.
1st Lieut. Garret Cochran.
2nd Lieut. John H. Ball.
2nd Lieut. Clyde R. Shelley.

BATTERY E, PITTSBURGH

Capt. Robert G. Snyder.
1st Lieut. William G. Fullman.
1st Lieut. Harry F. Plank.
2nd Lieut. Harry Bradley.
2nd Lieut.

BATTERY F, PITTSBURGH

Capt. John S. Purucker.
1st Lieut. Harry L. Probst.
1st Lieut. William K. Weaver, Jr.
2nd Lieut. Peter J. McGurk.
2nd Lieut. John M. Browning.

SECOND FIELD ARTILLERY

Headquarters, Philadelphia

Col. Hamilton D. Turner.
Lieut. Col. Thomas J. Ross.
Maj. John H. Hall.
Maj. E. St. J. Greble, Jr.
Capt. Stanley W. Root, Adjutant.
Capt. Andrew R. Lockhart, Battalion Adjutant.
Capt. Benjamin H. Whittaker, Battalion Adjutant.
1st Lieut. Robert J. McFetridge, Chaplain.

HEADQUARTERS COMPANY, PHILADELPHIA.

Capt. Romanus Fellman.
1st Lieut. Robert Morris.

SUPPLY COMPANY, PHILADELPHIA.

Capt. Jacob H. Geissel.
1st Lieut. Joseph Moorhead.

BATTERY A, PHILADELPHIA

Capt. J. Gobin Cranage.
1st Lieut. William A. Davis.
1st Lieut. James W. Duffy.
2nd Lieut. Edward M. Horter.
2nd Lieut. Hubert R. Southall.

BATTERY B, PHILADELPHIA

Capt. Joseph K. Fornance.
1st Lieut. Harry H. Ennis.
1st Lieut. Frederick J. Widman.
2nd Lieut. Victor Ballou.
2nd Lieut.

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FIELD ARTILLERY DIRECTORY—Continued

BATTERY C, PHILADELPHIA

Capt. William A. March.
1st Lieut. Alexander J. Maile.
1st Lieut. Robert W. King.
2nd Lieut. William E. Boeger.
2nd Lieut. Edward Hubbs.

BATTERY D, PHILADELPHIA

Capt. Robert G. MacKendrick.
1st Lieut. George S. Stewart.
1st Lieut. George E. Roth.
2nd Lieut. Erroll B. Hay.
2nd Lieut. Charles F. Jordan.

BATTERY E, PHILADELPHIA

Capt. Harold Hellyer.
1st Lieut. Charles C. Hicks 3rd.
1st Lieut. Clement Tingley.
2nd Lieut. William F. Brown, Jr.
2nd Lieut. Charles M. Ferat, Jr.

BATTERY F, PHILADELPHIA

Capt. Walton Clark, Jr.
1st Lieut. Charles D. Shaw, Jr.
1st Lieut. William F. Brothers.
2nd Lieut.
2nd Lieut.

THIRD FIELD ARTILLERY Headquarters, Wilkes-Barre

Col. Asher Miner.
Lieut.-Col.
Maj. James A. Dewey.
Maj. Olin F. Harvey, Jr.
Capt. Benjamin F. Evans, Adjutant.
Capt. George W. Coxé, Battalion Adjutant.
Capt. Stephen Elliott, Battalion Adjutant.
1st Lieut. James M. Farr, Chaplain.

HEADQUARTERS COMPANY, WILKES-BARRE

Capt. Neil Chrisman.
1st Lieut. David R. Palmer.

SUPPLY COMPANY, WILKES-BARRE

Capt. William S. McLean, Jr.
1st Lieut. George H. Rhinehart.

BATTERY A, HAZLETON

Capt. William I. Ravert.
1st Lieut. George N. Deitrich.
1st Lieut.
2nd Lieut. William S. James.
2nd Lieut.

BATTERY B, PITTSBURGH

Capt. Jacob A. Fleischer.
1st Lieut. William W. Lazarus.
1st Lieut.
2nd Lieut. Leo A. Tierney.
2nd Lieut.

BATTERY C, NANTICOKE AND PLYMOUTH

Capt. Robert F. Waters.
1st Lieut. Thomas J. Kniff.
1st Lieut. Adnah G. Kostenbauder.
2nd Lieut. William J. Spry.
2nd Lieut. Martin P. Hart.

BATTERY D, WILKES-BARRE

Capt. William H. Zierdt.
1st Lieut. Thomas H. Atherton, Jr.
1st Lieut. Robert C. Miner.
2nd Lieut. Edward Brown.
2nd Lieut.

BATTERY E, WILKES-BARRE

Capt. Alexander A. Mitchell.
1st Lieut. George N. Klein.
1st Lieut. William H. Smith.
2nd Lieut. Charles H. Zierdt.
2nd Lieut. Thomas N. Troxell.

BATTERY F, WILKES-BARRE

Capt. Gilbert G. Jacobosky.
1st Lieut. John W. Coover.
1st Lieut. William K. Russell, Jr.
2nd Lieut. Henry H. Dean.
2nd Lieut. Harold R. Mahoney.

FOURTH INSPECTION DISTRICT

Capt. Charles S. Blakely, Inspector, New Orleans, La.

Georgia

FIRST BATTALION

Headquarters, Savannah

Maj.

Capt. Joseph H. Thompson, Adjutant.
1st Lieut. Alan M. MacDonnell, Quartermaster and Commissary.

BATTERY A, SAVANNAH

Capt. Edward G. Thomson.
1st Lieut. Alexander R. MacDonell.
1st Lieut. Mathias M. Ray.
2nd Lieut. Joseph B. Buckner.
2nd Lieut. Joseph H. Comer.

BATTERY B, ATLANTA

Capt. Andrew J. McBride, Jr.
1st Lieut. Robert G. Mangum.
1st Lieut. Frank Boynton Tidwell.
2nd Lieut. John W. LeCraw.
2nd Lieut. Sidney F. Dunn.

BATTERY C, SAVANNAH

Capt. Edward G. Butler.
1st Lieut. Joseph E. Inglesby, Jr.
1st Lieut. R. F. Rumph.
2nd Lieut. Lewis H. Harper.
2nd Lieut. Alexander W. Lackey.

Louisiana

FIRST BATTALION

Headquarters, New Orleans

Maj. Allison Owen.

Capt. Stanley M. Lamarie, Adjutant.

BATTERY A, NEW ORLEANS

Capt. Schaumburg McGehee.
1st Lieut. Willis W. Hobson.
1st Lieut. Arthur C. Ball.
2nd Lieut. Cyril W. Bassich.
2nd Lieut.

BATTERY B, NEW ORLEANS

Capt. James E. Edmonds.
1st Lieut. Harold P. Nathan.
1st Lieut. Peter Hamilton.
2nd Lieut. Frederick G. Gassaway.
2nd Lieut.

FIELD ARTILLERY DIRECTORY

FIELD ARTILLERY DIRECTORY—Continued

BATTERY C, NEW ORLEANS

Capt. Bryan Black.
1st Lieut. Guy R. Molony.
1st Lieut. Walter J. Stauffer.
2nd Lieut. Louis S. Goldstein.
2nd Lieut. George S. Clarke.

FIFTH INSPECTION DISTRICT

Lieut. L. H. Taliaferro, Inspector, Indianapolis
Indiana

Indiana

FIRST REGIMENT

Headquarters, Indianapolis

Major Robert H. Tyndall, Commanding.
Capt. Guy A. Wainwright, Adjutant.

HEADQUARTERS COMPANY

Capt. Edwin Hofmann.
1st Lieut. Clarence E. Trotter.

SUPPLY COMPANY

Capt. Paul Fechtmann.
1st Lieut. Vernon Gasper.

FIRST BATTALION

Major Thomas S. Wilson.
Capt. Frank W. Buschmann, Adjutant.

BATTERY A, INDIANAPOLIS

Capt. Marlin A. Prather.
1st Lieut. Sidney S. Miller.
1st Lieut. Daniel I. Glossrenner.
2nd Lieut. Mark A. Dawson.
2nd Lieut. Carlos W. Bonham.

BATTERY B, FORT WAYNE

Capt.
1st Lieut. Leonard F. Wood.
1st Lieut. Lee Hensley.
2nd Lieut. Ferdinand H. Scheffer.
2nd Lieut. Henry C. Moriarty.

BATTERY C, LAFAYETTE

Capt. William F. Faylor.
1st Lieut. Luther H. Mertz.
1st Lieut. William C. Kashner.
2nd Lieut. Floyd W. Sense.
2nd Lieut. George R. Nixon.

BATTERY D, FORT WAYNE

Capt. John C. Scheffer.
1st Lieut.
1st Lieut.
2nd Lieut.
2nd Lieut.

BATTERY E, INDIANAPOLIS

Capt. Solon J. Carter.
1st Lieut. Frank L. Kelley.
1st Lieut. Carl Bloom.
2nd Lieut. Gilbert Inman.
2nd Lieut. Paul W. Bayard.

BATTERY F, BLOOMINGTON

Capt. Kenneth P. Williams.
1st Lieut. Humphrey Barbour.
1st Lieut. Clair H. Scott.
2nd Lieut. Earle E. Moore.
2nd Lieut. Allen V. Buskirk.

Michigan

FIRST BATTALION

Maj. Chester B. McCormick.
Capt. Earl H. Spencer, Adjutant.
1st Lieut. Gerald K. Wines, Supply Officer.

BATTERY A, LANSING

Capt. Fred G. Fuller.
1st Lieut. Edgar J. Learned.
1st Lieut. Glenn W. Carey.
2nd Lieut. Charles H. Donnelly.
2nd Lieut. Jay P. Sweeney.

BATTERY B, LANSING

Capt. Joseph H. Lewis.
1st Lieut. Chester E. Boelio.
1st Lieut. Harold H. Beltz.
2nd Lieut. Paul A. Applegate.
2nd Lieut. Robert F. Cuyler.

BATTERY C, LANSING

Capt. Amos H. Ashley.
1st Lieut. Frank G. Chaddock.
1st Lieut. Wayne A. Cochrane.
2nd Lieut. James F. Hammell.
2nd Lieut. Frank E. Van Halteren.

Ohio

FIRST BATTALION

Headquarters, Columbus

Maj. H. M. Bush.
Capt. Quida A. Kulish, Adjutant.
1st Lieut. John B. Morton, Battalion Quartermaster and
Commissary.

BATTERY A, CLEVELAND

Capt. Everette C. Williams.
1st Lieut. Robert K. Norton.
1st Lieut. John L. Sullivan.
2nd Lieut. Harold Matthys.
2nd Lieut. Charles S. Bailey.

BATTERY B, AKRON

Capt. Hurl J. Albrecht.
1st Lieut. Joseph J. Johnson.
1st Lieut. John F. Babbitt.
2nd Lieut. John R. Taylor.
2nd Lieut. Welton A. Snow.

BATTERY C, BRIGGSDALE (COLUMBUS)

Capt. Lawrence S. Schlegel.
1st Lieut. Vincent Welker.
1st Lieut. William D. Kinsell.
2nd Lieut. John H. Kline.
2nd Lieut. Russell G. Barkalow.

SIXTH INSPECTION DISTRICT

Lieut. Louis R. Dougherty, Inspector, Chicago

Illinois

FIRST REGIMENT

Headquarters, Chicago

Col. Henry J. Reilly.
Lieut.-Col.
Capt. Hugh C. Montgomery, Adjutant.

THE FIELD ARTILLERY JOURNAL

FIELD ARTILLERY DIRECTORY—Continued

FIRST BATTALION Headquarters, Waukegan

Major A. V. Smith.
Capt. Jacob McG. Dickinson, Adjutant.

HEADQUARTERS COMPANY

Capt.
1st Lieut. Howard R. Stone.
2nd Lieut. Guy L. Lawrence.

SUPPLY COMPANY

Capt.
1st Lieut. Robert A. N. Baltz.
2nd Lieut.

BATTERY A, DANVILLE

Capt. Curtis G. Redden.
1st Lieut. P. L. Wills.
1st Lieut. Thomas S. Hammond.
2nd Lieut. Fred C. Anderson.
2nd Lieut.

BATTERY B, CHICAGO

Capt. Frank M. Course.
1st Lieut. Max E. Payne.
1st Lieut. George H. Gould.
2nd Lieut. Walter Wolf.
2nd Lieut. Charles C. Kapschull.

BATTERY C, FORT SHERIDAN

Capt. Noble B. Judah, Jr.
1st Lieut. George Richardson.
1st Lieut. Lawrence B. Robbins.
2nd Lieut. Joseph Medill Patterson.
2nd Lieut. John C. Redington.

SECOND BATTALION

Headquarters, Chicago
Maj. Charles R. Vincent.

BATTERY D, CHICAGO

Capt. Leo T. Kelly.
1st Lieut. R. D. Bokum.
1st Lieut. Sterling B. Parkinson.
2nd Lieut. Arthur L. Sheying.
2nd Lieut. William R. Manson.

BATTERY E, CHICAGO

Capt.
1st Lieut. D. L. Smith.
1st Lieut. Irving Odell.
2nd Lieut. F. W. Waters.
2nd Lieut. T. W. Brewer.

BATTERY F, UNIVERSITY OF ILLINOIS, URBANA

Capt. Bruce W. Benedict.
1st Lieut. G. H. Doshier.
1st Lieut. Simon J. Neiburg.
2nd Lieut. Arthur D. Ruppel.
2nd Lieut. Frank E. Gould.

Wisconsin

BATTERY A, MILWAUKEE

Capt. Philip C. Westfahl.
1st Lieut. Alonso J. Comstock.
1st Lieut. John G. Reed.
2nd Lieut. William F. Fraedrich.
2nd Lieut. Alvin A. Kuechenmeister.

BATTERY B, GREEN BAY

Capt.
1st Lieut. Leland Wells.
1st Lieut.
2nd Lieut. Leroy Hoberg.
2nd Lieut.

BATTERY C, RACINE

Capt. George W. Rickeman.
1st Lieut. James W. Gilson.
1st Lieut. Richard Drake.
2nd Lieut. Richard C. Bryant.
2nd Lieut. Harry J. Sanders.

Iowa

FIRST BATTALION Headquarters, Clinton

Maj. Jacob E. Brandt.
Capt. James L. Oakes, Adjutant.
1st Lieut. Frank H. Hinricks, Quartermaster and
Commissary.

BATTERY A, CLINTON

Capt. Loren R. Brooks.
1st Lieut. Frank G. Luth.
1st Lieut.
2nd Lieut. Lloyd R. Kelsey.
2nd Lieut.

BATTERY B, DAVENPORT

Capt. Arthur M. Compton.
1st Lieut. Roland S. Truitt.
1st Lieut.
2nd Lieut. Edward McCoy.
2nd Lieut.

BATTERY C, MUSCATINE

Capt. Otto W. Mull.
1st Lieut. Edward A. Roach.
1st Lieut.
2nd Lieut. Charles Robinson.
2nd Lieut. C. Stewart Narvis.

BATTERY D, DAVENPORT

Capt.
1st Lieut. Harry Ward.
1st Lieut. Richard S. Gregg.
2nd Lieut. John H. Whitaker.
2nd Lieut. Herbert O. Koehler.

BATTERY E, CEDAR RAFTS

Capt. Ivan E. Ellwood.
1st Lieut. Frank K. Hahn.
1st Lieut.
2nd Lieut. John B. Madden.
2nd Lieut. William B. Doron.

BATTERY F, DES MOINES

Capt. George W. Dulaney.
1st Lieut. Fred W. Lehmann.
1st Lieut. James H. Wray.
2nd Lieut. Milton S. Denman.
2nd Lieut. Frederick W. Hubbell.

SEVENTH INSPECTION DISTRICT

Capt. W. F. Sharp, Inspector, Kansas City, Mo

Kansas

BATTERY A, TOPEKA

Capt. William P. MacLean.
1st Lieut. James C. Hughes.
1st Lieut. Richard B. Porter.
2nd Lieut. Paul T. McFarland.
2nd Lieut. Nels A. Anderson.

FIELD ARTILLERY DIRECTORY

FIELD ARTILLERY DIRECTORY—Continued

Missouri

FIRST BATTALION

Headquarters, Independence

Maj. Edward M. Stayton.
Capt. John H. Thacher, Adjutant.
1st Lieut. Charles C. Bundschu, Quartermaster and
Commissary.

BATTERY A, ST. LOUIS

Capt.
1st Lieut. Walter J. Warner.
1st Lieut. Robert C. Rutledge.
2nd Lieut. Daniel F. Jones.
2nd Lieut. Leon R. Sandford.

BATTERY B, KANSAS CITY

Capt. Arthur J. Elliott.
1st Lieut. Roy T. Olney.
1st Lieut. Fielding L. D. Carr.
2nd Lieut. Thomas S. McGee.
2nd Lieut. Marvin H. Gates.

BATTERY C, INDEPENDENCE

Capt. John L. Miles.
1st Lieut. Spencer Salisbury.
1st Lieut. Roger T. Sermon.
2nd Lieut. Kenneth V. Bostian.
2nd Lieut. Edgar G. Hinde.

Texas

BATTERY A, DALLAS

Capt. F. A. Logan.
1st Lieut. Ward C. Goessling.
1st Lieut. Willard G. Stanton.
2nd Lieut. Walter C. Lattimore.
2nd Lieut. Ben H. Smith.

BATTERY B, SAN ANTONIO

Capt. Claude V. Birkhead.
1st Lieut. Douglas Mackenzie.
1st Lieut. Raymond Phelps.
2nd Lieut. Michael H. Erskine.
2nd Lieut. George D. Dewees.

EIGHTH INSPECTION DISTRICT

..... Inspector, Denver, Colorado

Colorado

FIRST BATTALION

Headquarters, Denver

Maj.
Capt. Henry C. Nickerson, Adjutant.
1st Lieut. Lewis G. Carpenter, Quartermaster and
Commissary.

BATTERY A, FORT COLLINS

Capt. Roy G. Coffin.
1st Lieut. Charles M. Weller.
1st Lieut. A. W. Whitehouse.
2nd Lieut. Floyd Cross.
2nd Lieut. Paul G. Putty.

BATTERY B, DENVER

Capt. Guylan A. Blanchard.
1st Lieut. Canton O'Donnell.
1st Lieut. W. H. H. Cranmer.
2nd Lieut. Edward F. Hart.
2nd Lieut. Cyrus A. Hackstaff.

BATTERY C, COLORADO SPRINGS

Capt. Victor W. Hungerford.
1st Lieut. Daniel W. Knowlton.
1st Lieut. William H. Shade.
2nd Lieut. James H. Gowdy.
2nd Lieut. Horace Lunt.

New Mexico

BATTERY A, ROSWELL

Capt. Charles M. de Bremond.
1st Lieut. James C. Hamilton.
1st Lieut. Willard F. Hird.
2nd Lieut. George M. Williams.
2nd Lieut. Ranson B. Letcher.

Utah

1ST BATTERY, SALT LAKE CITY

Capt. William C. Webb.
1st Lieut.
1st Lieut.
2nd Lieut. Arthur Doran.
2nd Lieut. Irvin Offer.

NINTH INSPECTION DISTRICT

Capt. Emery T. Smith, Inspector, San Francisco,
Cal.

California

Headquarters, Oakland

Maj. Ralph J. Faneuf.
Capt. Frederick W. H. Peterson, Adjutant.

BATTERY A, LOS ANGELES

Capt. Jesse McComas.
1st Lieut. Harold G. Ferguson.
1st Lieut. Walter Lucer.
2nd Lieut. Robert W. Yates.
2nd Lieut. Frederick H. Hover.

BATTERY B, OAKLAND

Capt. Harry F. Huber.
1st Lieut. Edward E. Vicary.
1st Lieut.
2nd Lieut. Howard W. Enefer.
2nd Lieut. Clyde Alexander.

BATTERY C, STOCKTON

Capt. Edward Van Vranken.
1st Lieut. Otto E. Sandman.
1st Lieut.
2nd Lieut. Hunt A. Davidson.
2nd Lieut.

Oregon

BATTERY A, PORTLAND

Capt. Bert V. Clayton.
1st Lieut. Charles L. Johnson.
1st Lieut. Gilbert W. Stevens.
2nd Lieut. William D. Jackson.
2nd Lieut. Raymond E. Daniel.

STATE OF MINNESOTA

Capt. Geo. R. Greene, Inspector, Fort Snelling,
Minn.

FIRST FIELD ARTILLERY

Headquarters, St. Paul

Col. George E. Leach.
Lieut. Col. William J. Murphy.
Maj. William H. Donahue.
Maj. George T. Gorham.
Capt. Charles A. Green, Adjutant.
Capt. William Hoag, Quartermaster.
Capt. Joseph L. McKinney, Commissary.
Capt. Erwin H. Sherman, Battalion Adjutant.
1st Lieut. Fred M. Fuecker, Battalion Quartermaster and
Commissary.
1st Lieut. William J. Harrington, Chaplain.
1st Lieut. F. S. King, Supply Company.

FIELD ARTILLERY DIRECTORY

FIELD ARTILLERY DIRECTORY—Continued.

BATTERY A, ST. PAUL

Capt. Charles F. Baird.
1st Lieut. Levens D. Williams.
1st Lieut.
2nd Lieut. Garret B. Nash.
2nd Lieut. Harlon P. Neibling.

BATTERY B, ST. PAUL

Capt. William S. Jenkins.
1st Lieut. John Townsend, Jr.
1st Lieut. Oscar Shaw.
2nd Lieut. H. S. Johnson.
2nd Lieut. Wheelock Whitney.

BATTERY C, ST. PAUL

Capt. John H. McDonald.
1st Lieut. Philip J. McCauley.
1st Lieut. Henry A. Stempel.
2nd Lieut. Otto Seidel.
2nd Lieut. Thomas J. O'Leary.

BATTERY D, MINNEAPOLIS

Capt. Hugh H. Barber.
1st Lieut. Douglas G. Burrill.
1st Lieut.
2nd Lieut. Dana C. Schmahl.
2nd Lieut. John F. Robohm.

BATTERY E, MINNEAPOLIS

Capt. Jerome Jackman.
1st Lieut. William R. Cross.
1st Lieut. Claude H. Helgesen.
2nd Lieut. Hiram H. McLean.
2nd Lieut. Clifford J. Allen.

BATTERY F, MINNEAPOLIS

Capt. Arthur S. Gow.
1st Lieut. Oliver M. Michaels.
1st Lieut. George C. Ferch.
2nd Lieut. Howard W. McCoy.
2nd Lieut. Matthew W. Frederickson.