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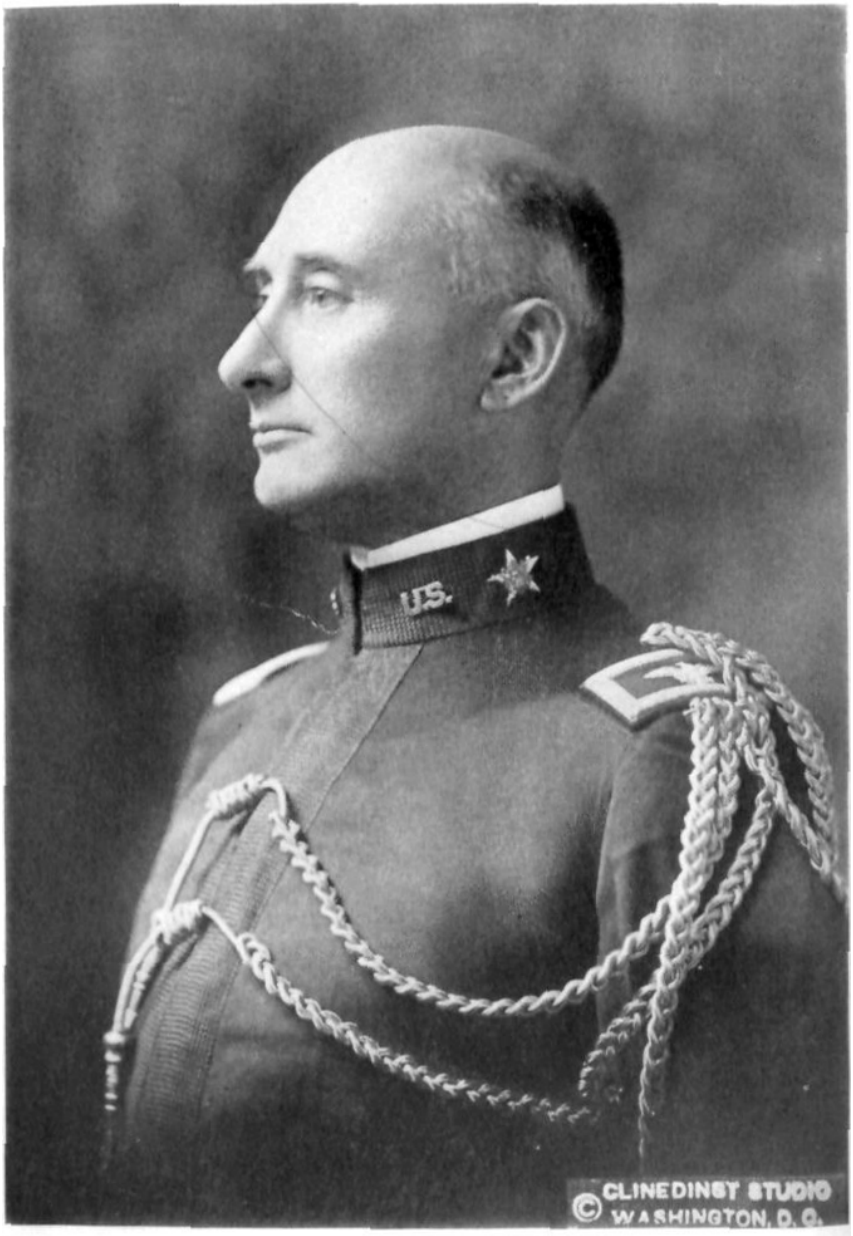

MAJOR GENERAL ERNEST HINDS

Chief of Artillery, American Expeditionary Force

THE FIELD ARTILLERY JOURNAL

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The Long Range Guns*

EXTRACTS FROM A LECTURE DELIVERED AT THE ROYAL ARTILLERY INSTITUTE BY MAJOR J. MAITLAND-ADDISON, R.A.

(Reprinted from the *Journal of the Royal Artillery, July*, 1918.)

MAJOR J. MAITLAND-ADDISON: General Stokes, Ladies and Gentlemen. We read that the German Long Range Gun has been aptly nick-named by the French "la Grosse Berthe." Two other appelations which I am told are used, one of which is very appropriate even if the other is a little more expressive, are "La Princesse Lointaine," after one of Rostand's plays, and "L'Imbécile." Our gallant French Ally would thus appear to be contemptuously indifferent towards the attentions of this monster weapon—the "Super Gun."

However, a marked advance has been made in artillery—for a projectile has been thrown a distance four times greater than has ever been previously attained. It is my purpose to explain in as simple a manner as I can, the various factors which coöperate towards this achievement—and further to point out that there is nothing about this gun which differs, except in degree, from the ordinary gun—that is to say, no new discovery has been made which, *per se*, has enabled the enemy to affect what he has just accomplished in this respect.

On the 23rd March—Palm Sunday—the Parisians were much astonished by a bombardment of Paris, which lasted throughout the day. At first it was thought that bombs were being dropped from enemy aeroplanes—but this idea was soon

*My acknowledgments are due to Captains L. Benke, and F. Hunt, of the Ordnance College, for their assistance in the calculations entailed, and in the preparation of the plates.

dismissed, for none were to be seen, although the bombardment continued. The conclusion was then arrived at, that such a range as the distance between the German front and Paris had been obtained by a powerful gun, but only by the projectile itself becoming a gun at some point of its trajectory, and ejecting a secondary shell to complete the great distance of 75 miles.

This, and many other quaint ideas were hazarded one after another, to be eventually dispelled by the more technical experts, who gave the real reasons which lead up to such a feat.

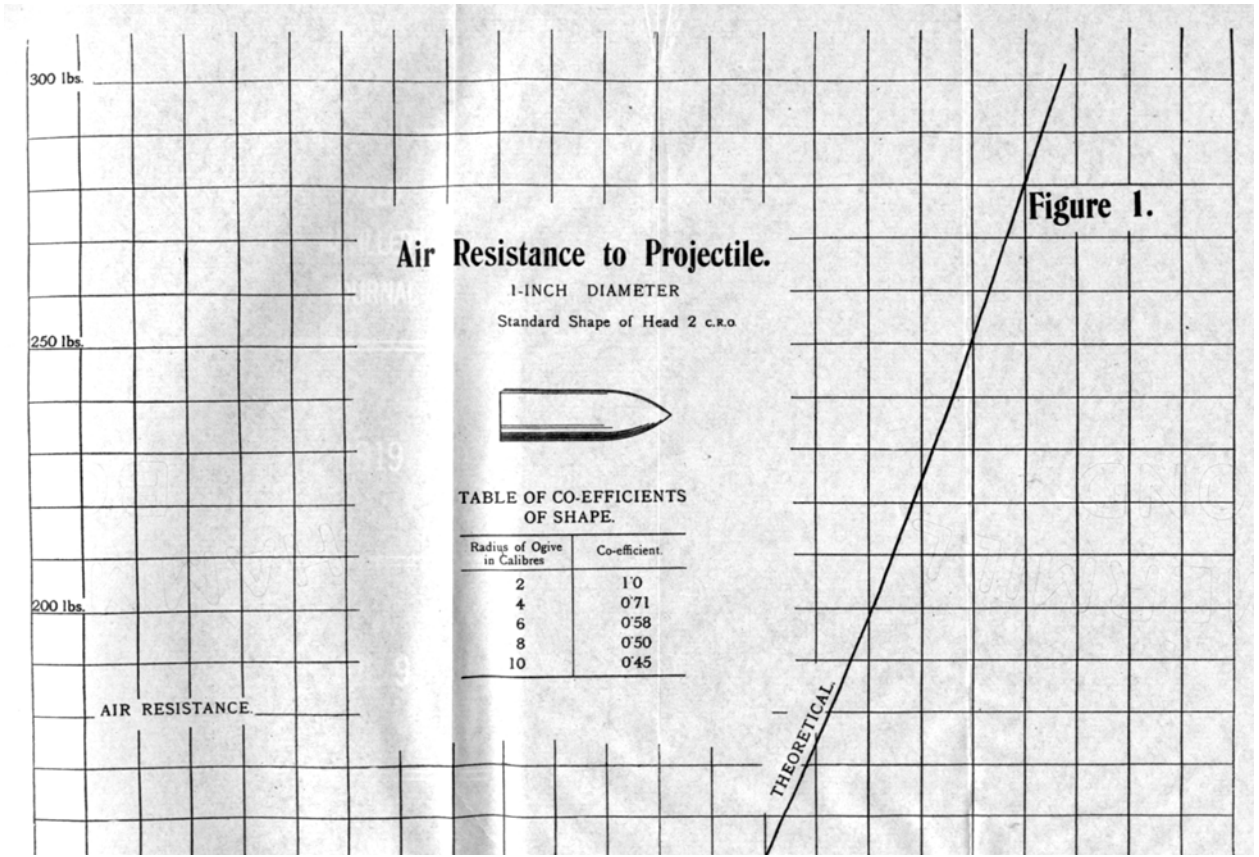
It must be remembered that in 1915, the Germans caused us no little surprise by firing shells into Dunkirk from Dixmude—a distance of 20 miles—and since then a considerable amount of long range firing has been carried on at the Front. But in 1918, the unprecedented range of 75 miles is an accomplished fact. This is only in keeping with the progress that has been made in artillery during the war. War makes for progress—and I will leave it to my audience to surmise what will be the extreme distance to which shell may possibly be projected in 1921, assuming the rate of increase to be, at least, uniform.

My lecture is what may be called pseudo-scientific-popular, because, although I mean it to be popular, it must be to a certain extent scientific; otherwise, I should have some difficulty in explaining the factors which conduce towards firing shells to such great distances.

I have divided it into the various subheads, which would appear to me to form the logical sequence of the subject.

THE AIR RESISTANCE TO PROJECTILES (FIG. 1.)

I must first introduce to you some conceptions of what an important factor the air resistance is to projectiles in retarding their motion. We all know something about the atmosphere and its resistance to motion, but I think that few of us have more than a very cursory knowledge of how resisting it is to projectiles moving at high velocities. There may be a few here who have at some time or another been whirled round the



Air Resistance to Projectile.

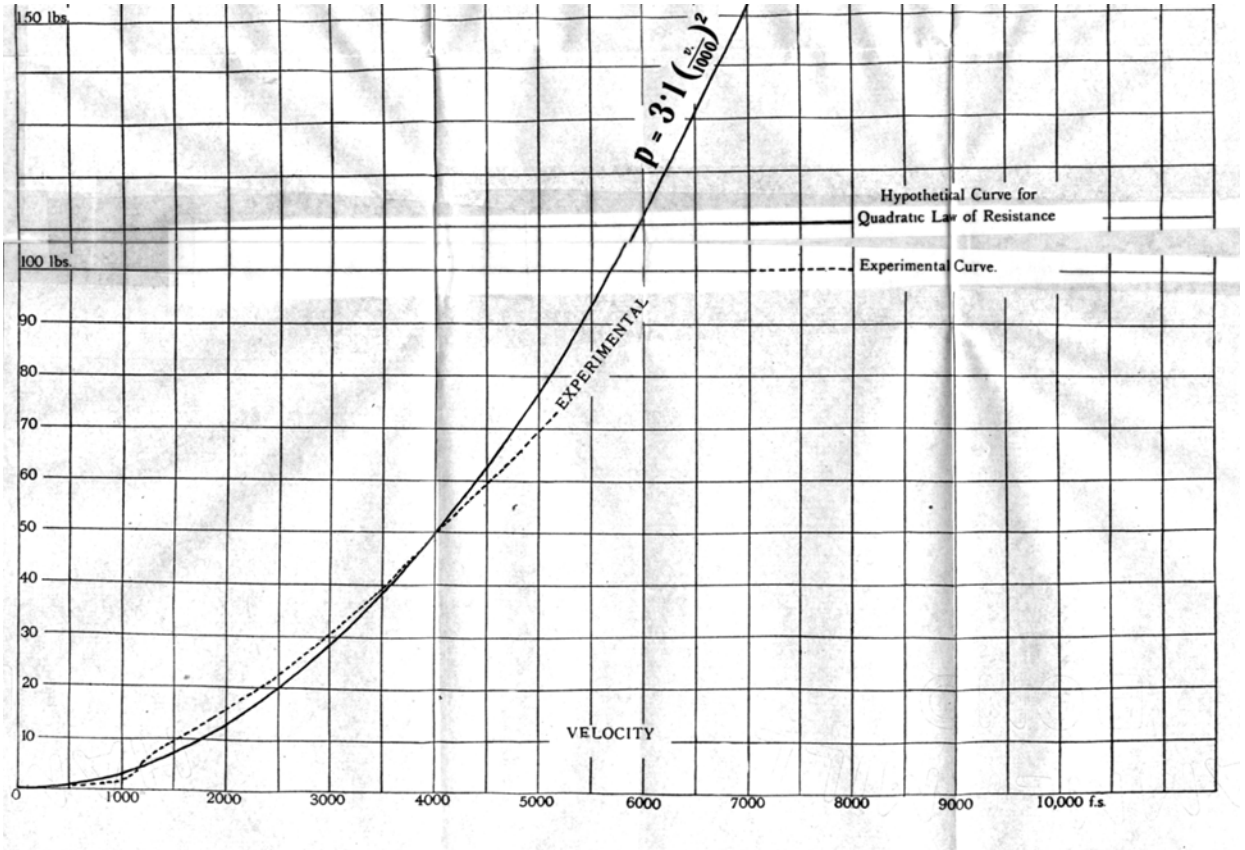
1-INCH DIAMETER

Standard Shape of Head 2 c.r.o.

TABLE OF CO-EFFICIENTS OF SHAPE.

Radius of Ogive in Calibres	Co-efficient.
2	1·0
4	0·71
6	0·58
8	0·50
10	0·45

Figure 1.


150 lbs.
100 lbs.
90
80
70
60
50
40
30
20
10
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10,000 f.s.
$P = 3{\cdot}1\left(\frac{v}{1000}\right)^2$
Hypothetical Curve for Quadratic Law of Resistance
Experimental Curve.
EXPERIMENTAL
VELOCITY

Brookland's Motor Track at speeds approaching to, but probably under, 100 miles per hour, and who consequently will have gained some experience of the pressure of the air as they rushed through it; and we know that racing cars are in some cases stream-lined in order to diminish the air resistance.

Also when travelling on the Paris Lyons et Méditerranée Railway to the South of France, many will have observed that the locomotives are fitted with "wind cutters" for the same purpose. The natural inference to be deduced is that, even at velocities of 100 miles per hour or under, the air offers such a great resistance that it is desirable to take advantage of such means as can be devised to reduce it, even if the reduction effected be small. Now these velocities are comparatively low ones. The projectile of to-day moves at high velocities. To illustrate the difference, the projectiles at present being fired from the German Long Range Gun commence their flight at about 1 mile per second, or 3600 miles per hour. Fig. 1 represents a hypothetical curve of the air resistance to what is termed the "Unit Projectile" of "Standard Shape"—that is, a projectile of 1-inch diameter with an ogival head of 2 calibres radius—for velocities up to 10,000 feet per second, or about 2 miles per second. This curve is based on what is called a "quadratic law" of resistance—that is to say, the resistance increasing as the square of the velocity.

Alongside it the dotted line represents our experimental knowledge of the air resistance to the same projectile. As you can see, this does not, at present, extend beyond velocities of 4000 feet per second. The two curves agree at two points only, and until we have experimented at higher velocities, thereby extending the knowledge that we possess, it is necessary, for the purpose of calculating these long-range trajectories of the future, to make use of a hypothetical curve similar to that illustrated, working on the principle that such a law is in conformity with the ways in which nature presents itself to us in other respects—these are well known to the scientific world. An examination of the curve shows that for the "unit" projectile moving

at 4000 f.s. the air resistance is about 50 pounds—or nearly 50 times the weight of the projectile, which is normally about 1 pound; for a velocity of 800 f.s. this resistance is increased to about 200 pounds, and so on.

To ascertain the resistance to any other projectile of different diameter and shape, we have to multiply the figures shown on the curve by the square of its diameter and by a suitable coefficient of shape.

Thus for a 10-inch shell of standard shape of head moving at 4000 f.s. the resistance is 5000 pounds, or only ten times the weight of the shell. If we give the shell a much more pointed head—that is to say, strike the curve of the head with a radius of, say 8 calibres—the resistance at the same velocity now becomes 2500 pounds, so that it has been reduced by 50 per cent. A table of such coefficients of shape is inset in Fig. 1. This pointing of the head corresponds to the "wind cutter" on the locomotive, and at such high velocities as projectiles move at it is mainly the shape of the head that is important.

DIMINUTION OF ATMOSPHERIC DENSITY AS THE ALTITUDE ABOVE THE EARTH'S SURFACE INCREASES

If the density of the air were uniform throughout, implying a total height of about 30,000 feet, the resistance to projectiles about which I have just been speaking would always be so great that such super-ranges as are now being obtained would be beyond all our efforts, even for very high velocities of projection. But it is a fact that the density diminishes very rapidly with the altitude above the ground and consequently the resistance offered by the air becomes so reduced that as the projectile ascends its motion becomes less and less affected, and so in the extreme case such as we are considering, it tends to travel as if in a vacuum.

At the ground the density is proportional to the pressure exerted by the weight of a vertical column of air reaching to the upper limit, which is equivalent to the weight of a column of

mercury 30 inches in height, the pressure being about 15 pounds to the inch—and the density is then about 534 grains to the cubic foot, or a little more than the fourteenth part of a pound avoirdupois. If we assume that the atmosphere expands upwards according to what is known as the Adiabatic Law, which allows for the diminution of temperature with altitude, we should arrive at the conclusion that it terminates somewhat abruptly at a height of 17 miles. On the other hand, assuming that the expansion follows an Isothermal Law—that is, expands at a uniform temperature—we are led to the consideration of an atmosphere of infinite height. But we are practically certain that there is a very much rarefied atmosphere at heights of 50 miles and more, as indicated by meteorites glowing redhot owing to the resistance to their motion—their velocity being very considerable. Equally well, our "physical" knowledge tells us that the height cannot be infinite. The present view is that the expansion follows the first law in the lower strata and tends towards the second in the higher and more rarefied region. Both laws do not differ much in the estimated density of the air up to a height of 30,000 feet or about 6 miles—moreover, up to this point theory has been largely confirmed by experiment. The air is then getting so rarefied that, as far as a projectile of reasonably high ballistic efficiency is concerned, it is not very material as to which of the two above-mentioned laws is nearer the reality.

I have followed the Isothermal Law in my calculations, as it does not favor the estimated range. On this law the density at 20,000 feet is about one-half its value at the ground, one-quarter at 40,000 feet, one-ninth at 60,000 feet, one-eighteenth at 80,000 feet, and at 100,000 feet or about 20 miles it is only one-thirty-sixth—so that at such a height each cubic foot should contain about 15 grains only of air, as compared with 534 grains at the ground.

This is illustrated in Fig. 3 by the shaded column. You will now appreciate how very much the resistance is diminished at such great heights. It is this diminution of density in the upper

regions of the atmosphere which alone allows the projectile to travel unimpeded, thus giving such a great range as 75 miles.

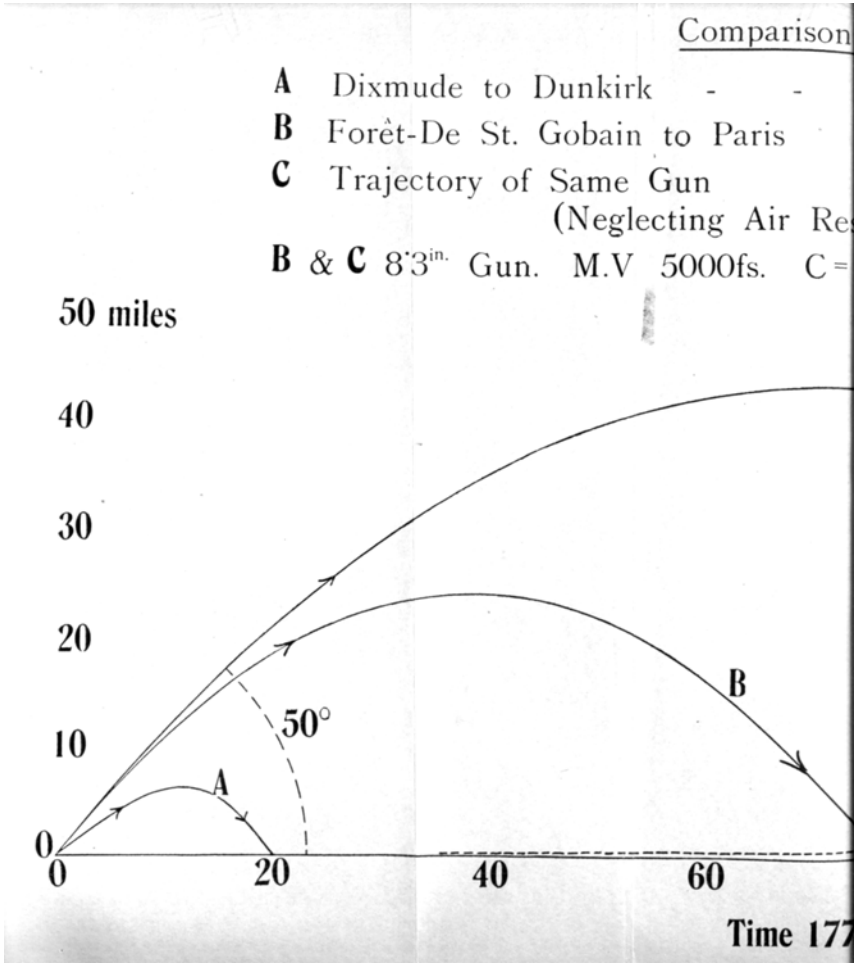
THE BALLISTIC EFFICIENCY OF A PROJECTILE

I must now mention an important feature in connection with projectiles—that is, their "ballistic efficiency," or what we call in Gunnery their "ballistic coefficient." If it were not for the atmosphere, a ping-pong ball would travel as far as the heaviest projectile, given the same initial velocity. But in an atmosphere this statement is far from the truth. A ping-pong ball would soon come to rest, and this is because it has poor ballistic efficiency—therefore no power to force a path for itself through the air on account of its bad shape and light weight for its size.

The modern elongated projectile, with its long tapering head, has great ballistic efficiency, because of its good shape and heavy weight for any given diameter.

Then, if we give it a sufficient initial velocity, and project it from a gun at a high angle of elevation, it will reach the upper strata of the atmosphere—and as the air becomes rarefied, so in proportion does the ballistic efficiency increase. For any given calibre of well-designed projectile, there is a certain height above the ground at which point the effect of the air resistance becomes negligible and the ballistic efficiency for all practical purposes infinite. The projectile will then travel in the parabolic curve first pointed out by Galileo about 1610. This is what is happening in the case of the German Long Range Gun, and throughout the major portion of the trajectory, the projectile is describing this path as an actuality for the first time.

One rather curious fact concerning the shape of the head of projectiles—important factor as it is, it has been generally neglected by all the artilleries of the world up to within the last 10 or 12 years, although the advantage of the long pointed head had been indicated from mathematical consideration with very fair accuracy many years previously.


Comparison
A Dixmude to Dunkirk - -
B Forêt-De St. Gobain to Paris
C Trajectory of Same Gun
(Neglecting Air Re
B & C 8·3in. Gun. M.V 5000fs. C=
50 miles
40
30
20
10
0
0
20
40
60
A
B
50°
Time 177

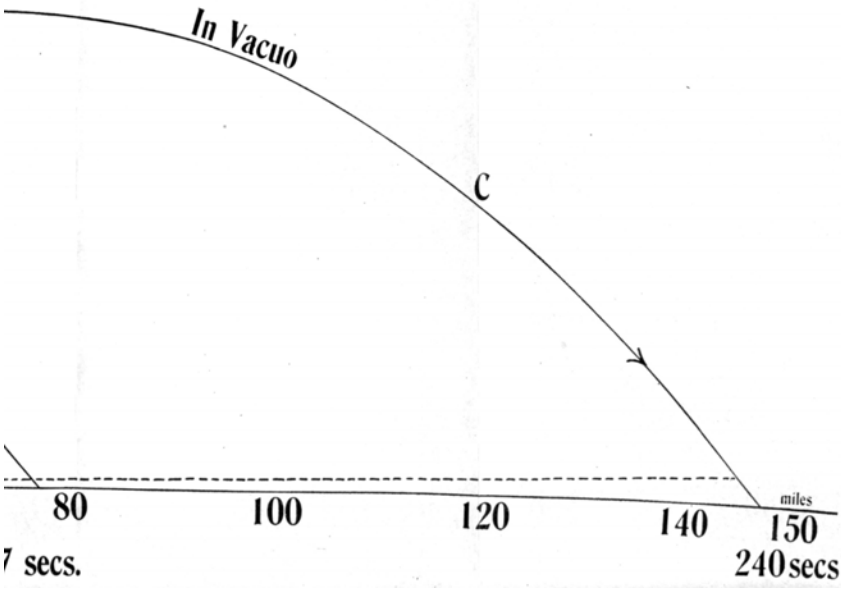
of Trajectories.

Figure 2.

- - - 20 miles - - 1915.
- - - 70 miles - - 1918.

sistance) - 145 miles

10. $\frac{\psi}{4}(\phi) = 50°$



COMPARISON OF LONG RANGE TRAJECTORIES (FIG. 2)

Fig. 2 represents the comparison of the 20-mile trajectory of 1915 with the 75 miles of 1918 of the latest Long Range Gun, also the limiting trajectory *in vacuo,* for the same velocity, and for the same angle of projection, as for the 75-mile trajectory. These two factors I have estimated to be 5000 feet per second and 50º. From what we learned about it at the time, the 20-mile trajectory from Dixmude to Dunkirk was accomplished with a large naval gun and with a much lower velocity than 5000 f.s. The ballistic efficiency of the projectiles at present fired into Paris is about 10 units, which is somewhat high for such a small calibre of gun as 210 mm. or 8.28 inches.* By employing guns for which the projectiles could have a greater ballistic efficiency, then with the same velocity ranges of more than 100 miles could be obtained. Proceeding in this way we could, for the same initial velocity, get nearer to the limiting trajectory of 146 miles—but never quite up to it. But by increasing both velocity and ballistic efficiency greater ranges than this even are obtainable.

Such a velocity as 5000 feet per second has not, to my knowledge, ever been obtained before. The greatest I know of is that of 4000 f.s. from a small gun at Shoeburyness in 1904, when the Ordnance Committee were redetermining the air resistance to projectiles. The late Sir Andrew Noble—some 30 to 40 years ago—obtained velocities of about 3200 f.s. out of a 6-inch gun, but this figure does not even compare with the high velocity of the German Gun. We therefore see how great is the advance that has recently been made in this respect.

THE TRAJECTORY OF THE LONG RANGE GUN (FIG. 3)

In Fig. 3 are shown the details of the trajectory for a range of 76 miles, which is slightly in excess of that from the Forêt de St. Gobain to Paris. The angle of projection has been taken at 50º, but more correctly I think it should be about 54º for this particular gun. The angle for maximum range—which is

* See additional data at end of article. (EDITOR.)

45º in vacuo—is greater in the case of these long-range guns, which have to force projectiles into the upper rarefied strata of the atmosphere. It varies according to the initial velocity and ballistic efficiency of the projectile, and tends to return to 45º as these two factors increase in magnitude—the principle involved being that it is necessary to get the projectile into the more rarefied region by the shortest path, and further, that the flight in this region should commence at about 45º.

As previously stated, the initial velocity is 5000 f.s. or just short of 1 mile per second. The projectile rises to a height of 12½ miles in 25 seconds—the inclination of the trajectory changing from 50º to 41º—the horizontal advance being also about 12½ miles. At this point the air density, as indicated by the shaded column, has diminished to about 1/10 of its value at the ground, and the ballistic efficiency of the projectile, which is 10 units at the ground, has, *vice versa*, been increased 10 times—that is to say, it is now 100 units. From this point the projectile practically ignores such slight air resistance as there may be in the region above it, and its motion becomes a parabolic to a point at the same level on the descending branch, the horizontal distance to which is about 65 miles from the gun. Thus 52½ miles or about 70 per cent. of the whole trajectory lies in what may be termed the Parabolic Region of Flight. The projectile passes through the vertex at a height of 23.9 miles, the horizontal distance to the vertex being about 39 miles, or just over one-half the range.

I might mention that in 1862 two celebrated and intrepid aeronauts, Coxswell and Glaisher, ascended in a balloon from Wolverhampton to a height of about 37,000 feet or 7 miles—the greatest known height ever reached by man—and narrowly escaped with their lives on this occasion. To Glaisher we owe much of our knowledge of the physical characteristics of the atmosphere, and his tables have been in use in the "Artillery" for many years. An aeroplane has never been higher than 4 miles, and Mount Everest, the highest point on the earth, has

Tra

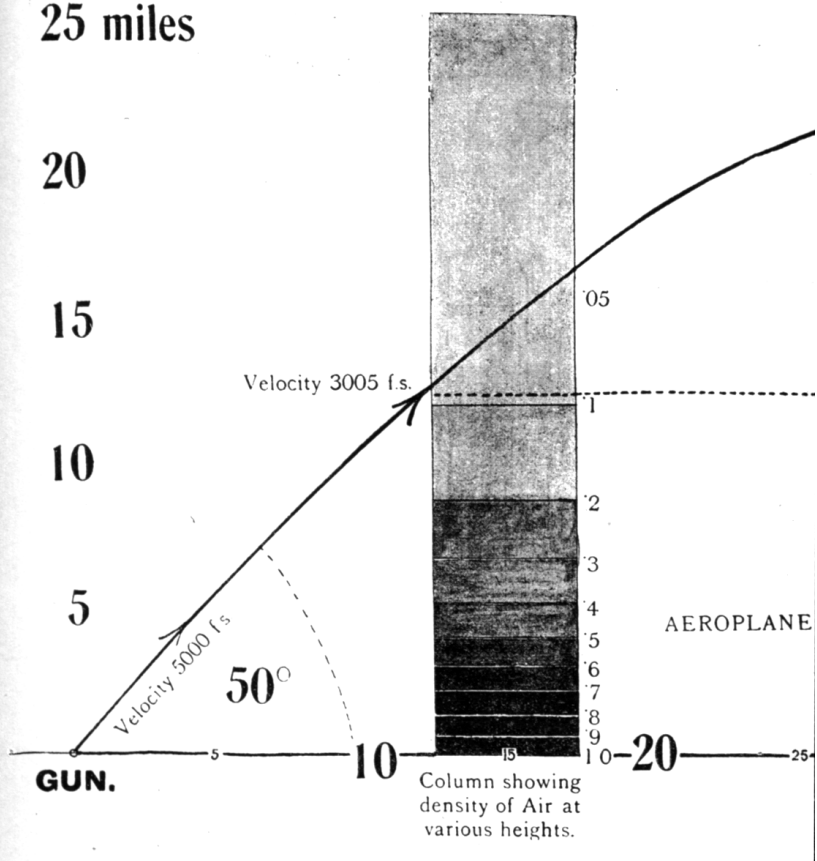
Range - - -

Maximum Height -

Time of Flight -

Angle o

Angle c

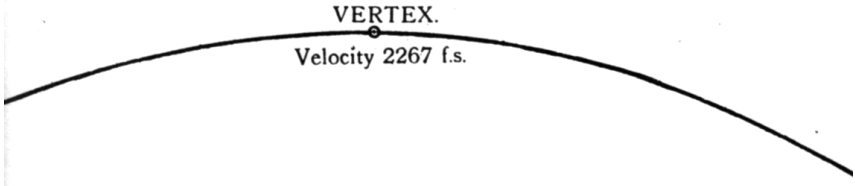


jectory of Long-Range German Gun.

-	- 76	miles.	Muzzle Velocity
-	- 23·9	miles.	Ballistic Coeff$^{t.}$ -
-	177	secs.	Remaining Velocity

Projection - - - - - 50°.

Descent - - - - - 54°.



Parabolic Region of Flight.

52½ miles

EARTH'S SURFACE SHOWING CURVATURE.

Figure 3.

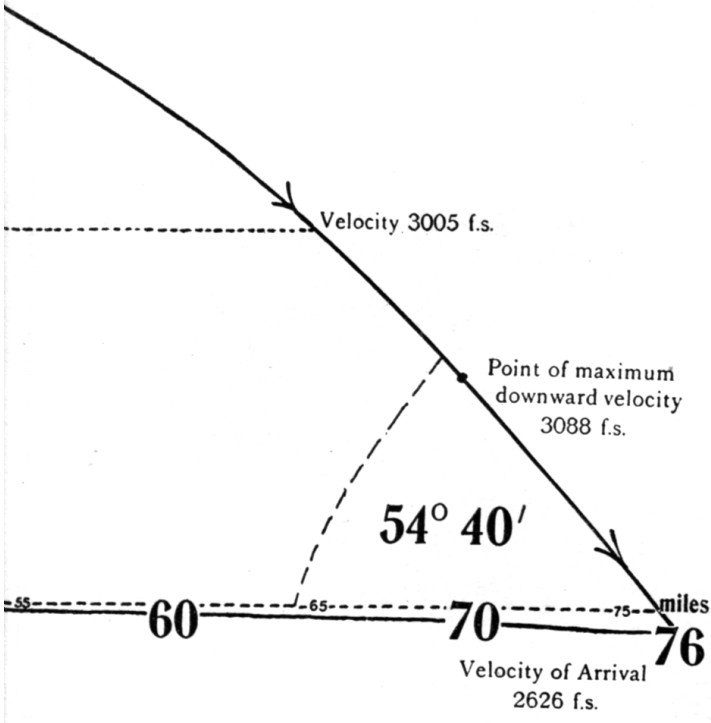
- - 5000$^{fs.}$

- - 10

- - 2626$^{fs.}$

^{o}.

^{o} 40′.



an altitude of 5½ miles, so that these comparisons will enable you to appreciate the great height attained by the projectile.

On the descending branch, the velocity, which is reduced to 2267 f.s. at the vertex, commences to increase rapidly, attaining its maximum of 3088 f.s. at 7½ miles from the ground, and at about 6 miles from the point of arrival. It then diminishes owing to the rapidly increasing air density, and the projectile finally reaches its destination at a velocity of 2626 f.s.—about 2½ times, the rate at which sound travels; there is, therefore, no possibility of any one hearing it coming, even for the fraction of a second. It will be seen, therefore, that in determining the trajectory, the air resistance has to be taken into account at the two ends only. To quote Sir George Greenhill, F.R.S., so long associated with the Royal Artillery in his capacity as Professor of Artillery and Mathematics at the Ordnance College, Woolwich, the trajectory may be considered as being on two stilts, and it is on these stilts that we have to give careful attention to the exactitude of our calculations. The angle of arrival on a tangent to the earth through the gun is about 54º 40′, which is only a little greater than the angle of departure—and allowing for the earth's curvature, which is considerable over a 76-mile trajectory, another 1º 6′ has to be deducted from this figure, so that actually it is about 53º 34′.

SUBSIDIARY PROBLEMS IN CONNECTION WITH THE TRAJECTORY

There are several subsidiary problems which I will briefly mention. Some of these—hitherto negligible—now assume importance in these long-range trajectories.

Earth's Curvature.—You will have noticed, for instance, in Fig. 3 that account has been taken of the earth's curvature, which in this case adds ½ mile to the range. This correction is now very much of account, as it varies as the square of the range.

Diminution of Gravity with Altitude.—For a trajectory

of the height in question; that is, 24 miles, the acceleration due to gravity at the vertex is diminished about 1 per cent. This would have to be allowed for in calculation were it not that an almost exact compensation is provided by ignoring another effect, namely, the convergence of the "parallels of gravity" towards the earth's centre.

Earth's Rotation.—This is also responsible for a correction to either the direction of the shooting—or to the range—or to both—according as the direction of the fire is from Pole to Pole—parallel to the Equator—inclined to both—also this correction is dependent on the latitude at which the firing is being carried out.

I have estimated that unless such a correction be applied in the case of the gun firing into Paris—the direction of fire being about southwest and the latitude 50º—there would be an excess of about 700 yards of range and a deviation to the right of the line of fire of about 400 yards.

Drift.—As artillerymen, we know what "Drift" is, but I will just mention that it is the deviation to the right from the vertical plane of departure due to the right-handed rotation of the projectile. I have not attempted to calculate how much this drift is, because it is a matter of great difficulty, and the result arrived at would be uncertain, but I will say this much about it: I think it is much less than a gunner might be predisposed to imagine, for the reason that 70 per cent. of the trajectory is accomplished practically in a vacuum where there is no appreciable atmosphere to cause it—and such "drift" as there may be is due to the comparatively small curvature of the trajectory in the two "stilts." If I were asked to hazard a guess as to its "How much," I would say that I think that it would be less than 1 mile of deviation in 100 miles of range. However, this is guesswork, and it is really a matter of experiment to ascertain its magnitude.

Accuracy of the Gun.—A small error in the elevation for maximum range would not appreciably affect the range, so that a little "jump" or "whip" of the gun is of no great importance.

But a varying error in the muzzle velocity from round to round, if it be large, vitally militates against the accuracy—and there is just a possibility that it may be difficult to maintain a constant M.V. in such a gun. For example, 100 f.s. or 2 per cent. change in M.V. alters the range in this case by over three miles.

Wind Effect.—Here again I have not made any estimate, but arguing on the same lines as for the "drift," I do not think it should be very great.

I will now pass on to some considerations of the projectile and the gun.

THE PROJECTILE (FIG. 4)

The shell presents features that are distinctly novel. In the first place it is built up, instead of being made as a whole; in this way manufacture and filling are much facilitated. Secondly, it is divided into two principal parts, entirely different in characteristics and functions. These are: (*a*) The body or shell proper; (*b*) the head.

The Body.—The walls of the shell are abnormally thick, tapering towards the front, where the danger of deformation due to "set back" diminishes. This is an indication that the pressure to which the gun is worked is in all probability greater than usual, but it also serves another purpose—one that is evident in the entire construction of the shell—and this I will refer to later. The function of the two copper bands AA is that of centering and steadying the shell in the bore and of effecting the gas seal. Since they take the rifling, they indirectly assist in rotating the shell, but this is not their "métier"; and to effect this the shell itself is rifled, which is a reversion to old practice. Rifled projectiles were used by ourselves many years ago, but the design was naturally more crude. The thrust of the rifling of the gun on the shell, in imparting the necessary rotation for stability of flight, is thereby much more evenly distributed along the shell, and failure to rotate, which

might result if the two copper bands were alone called upon to do this work, is thus eliminated.

Assuming a maximum working pressure of 21 tons/in^2, the acceleration of the projectile at the point of maximum pressure is about 250,000 feet per second, which is enormous, and consequently the "set back" pressure is unduly high.

The diaphragm B increases the strength of the shell, and by dividing the bursting charge into two parts, lessens any risks there might be due to the "set back" of the explosive towards the base. It is understood that it is also called upon to support an additional "impact" fuze inside the shell, which tends to obviate all possibility of "blinds," and serves to ensure the bursting of the forward compartment. It appears to me that this last-mentioned function is its real "raison d'être." The screwed socket C also holds a base impact fuze.

The capacity for high explosive is small, and the burster would weigh about 33 pounds, or 10 per cent. of the weight of the shell. With such thick walls and a small burster, the projectile would break up into a few large pieces, the resulting damage in all probability being small.

The Head.—A curious feature, although not entirely novel, is a false head, which is screwed on to the body or shell proper. It is a comparatively thin-pointed steel dome, and I should say is struck with a radius of about 10 calibres. I have assumed such a radius in estimating the ballistic efficiency of the projectile. I am not aware if the head has been "reconstructed" from parts which may have been found, so that this value is hypothetical, although a reasonable one. The function of this head is to diminish the air pressure, as I have previously explained, but it also serves another purpose—that is, to throw the centre of pressure well forward of the centre of gravity—a principle which, given the requisite twist of rotation for stability, increases the steadiness of the projectile during flight. The analogy of the peg top and the teetotum serves us here. Given the requisite spin, the peg top in which the C.G. is situated

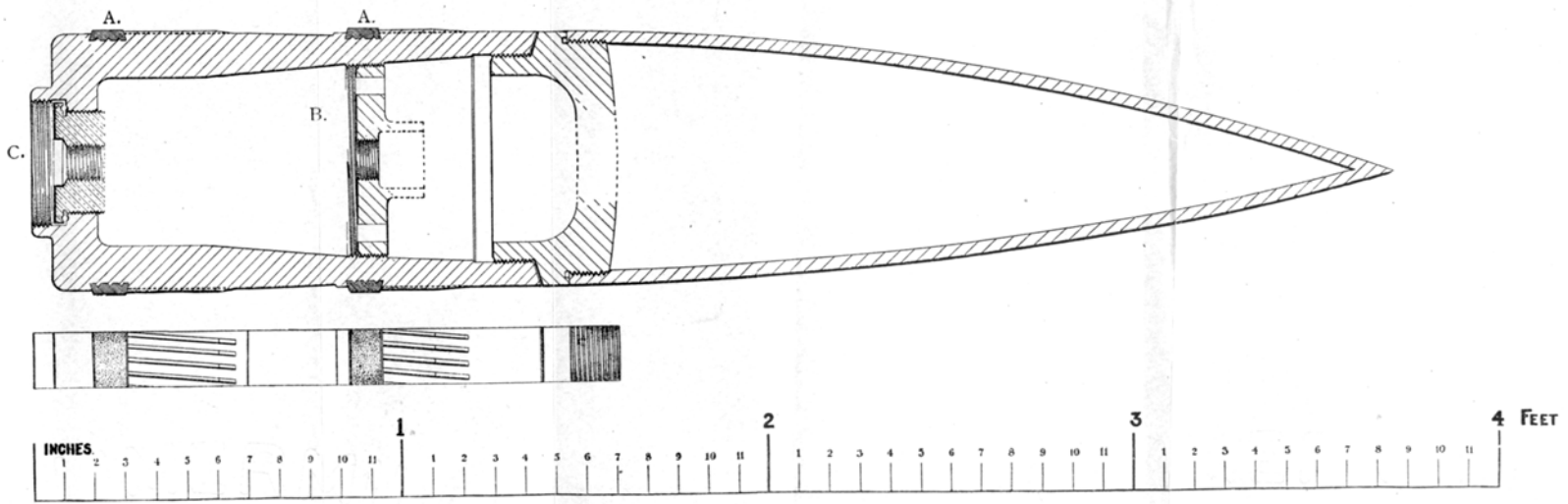
Figure 4.

210mm. (8·28 inches) Shell. Weight. 330 lbs.

FIRED ON PARIS

BY GERMAN LONG RANGE GUN.

1918.



high up, is much steadier and maintains its steadiness better than the teetotum in which the C.G. is low down near the point. The pressure on the head of the projectile when leaving the gun is about 1 ton, and the head must be strong enough to withstand this pressure. There is one more point which I might conveniently mention here—and that is this: In a vacuum, a rotated projectile would travel on its path in the same relative position to that at starting, and its axis would become more and more oblique to the trajectory. The presence of air resistance causes a rotated projectile to keep its point nearly in the trajectory. Hence, although the air must be very rarefied in the upper part of the trajectory which I have described, yet there must be sufficient resistance to keep the "yaw" within limits until on descending again into the denser strata the projectile becomes steadied, otherwise it would become quite unstable, the result being "blinds" and short ranging. This I believe not to be the actual case.

The rifling on the shell indicates a slope of 4º or a uniform rifling in the bore of 1 in 45 calibres. Such are the main features of the projectile.

THE GUN AND ITS MOUNTING

Now we know nothing of the type of gun the Germans are using, except its calibre; nor do we know how it is mounted for firing. But by employing another branch of artillery science called "Internal Ballistics" we are able to form a fairly accurate estimate of its length, charge, capacity, pressure, etc. The principles of gun construction can then be applied to determine a gun which will furnish the requisite strength, and we are then in a better position to deduce what type of mounting or carriage might be suitable and form a mental picture of the whole.

The Gun.—One or two of the illustrated journals have depicted in bold lines the gun on a railway mounting. An examination of these pictures shows clearly that they fail to

represent with any degree of accuracy what the dimensions of a gun must be that can discharge a projectile with a velocity of one mile per second. I have, therefore, worked out the ballistics and dimensions of a gun which would be equal to doing this—represented graphically to scale in Fig. 5. I have assumed a maximum working pressure of 21 tons to the inch, which is some two to three tons more than a gun is usually worked to. Supposing that it were possible to maintain a constant pressure of this magnitude, all the way down the bore, it is a matter of very elementary dynamics to estimate that the length of the shot travel alone—that is, of the rifled portion of the bore—would be 50 feet. Now no one has yet invented a system by which a constant pressure can be maintained, and as the gases of the charge expand the pressure drops considerably towards the muzzle—down to less than one-half of the maximum. I have estimated, by the more elaborate methods of "Internal Ballistics," that for such a maximum pressure as I am considering, the shot travel must be 75 feet, the average pressure being 15 tons, and that at the muzzle about 8 to 10 tons to the inch. Add to this figure a minimum length of chamber of about 15 feet necessary to hold the very large charge of propellant required, and the total length of the gun comes to 90 feet, or about 130 calibres of length—a length in calibres not previously approached except by Sir Andrew Noble's experimental 6-inch gun of 100 calibres. The weight of a gun is dependent on design, besides considerations of the requisite strength—but following the usual methods laid down for gun construction, it would work out at about 80 tons for such a gun.

The amount of propellant required is about 400 pounds, which is considerably in excess of the weight of the projectile, and if a cord propellant is used its diameter would be 0.6 inches. It is possible that some form of multitubular propellant may be employed by the Hun, which would tend more towards giving the constant pressure I have previously mentioned, and thereby slightly diminish the length of gun required, but this

THE GUN.

Calibre -	- 8·3 ins.
Length over all	- 90 ft.
Shot travel -	- 75 ft.
Capacity of Chamber	22,000 in.^{3}
„ „ Bore	- 70,700 in.^{3}
Weight of Charge	- 400 lbs. cord.
„ „ Projectile	- 330 lbs.
„ „ Gun	- 80 tons (approx.).
Muzzle velocity	- 5000 f.s. (about 1 mile per sec.)
Maximum pressure	- 21 tons/in.^{2}

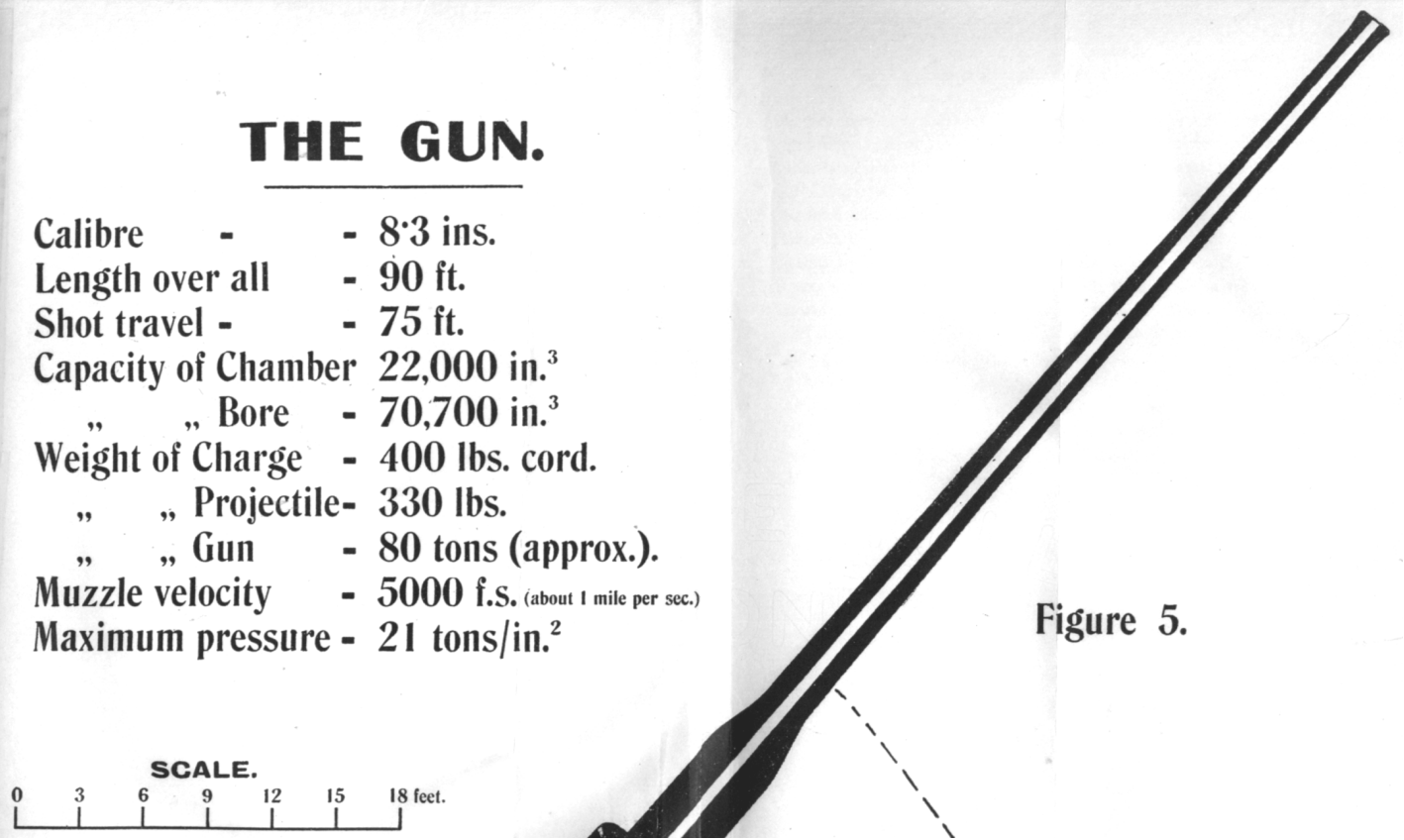
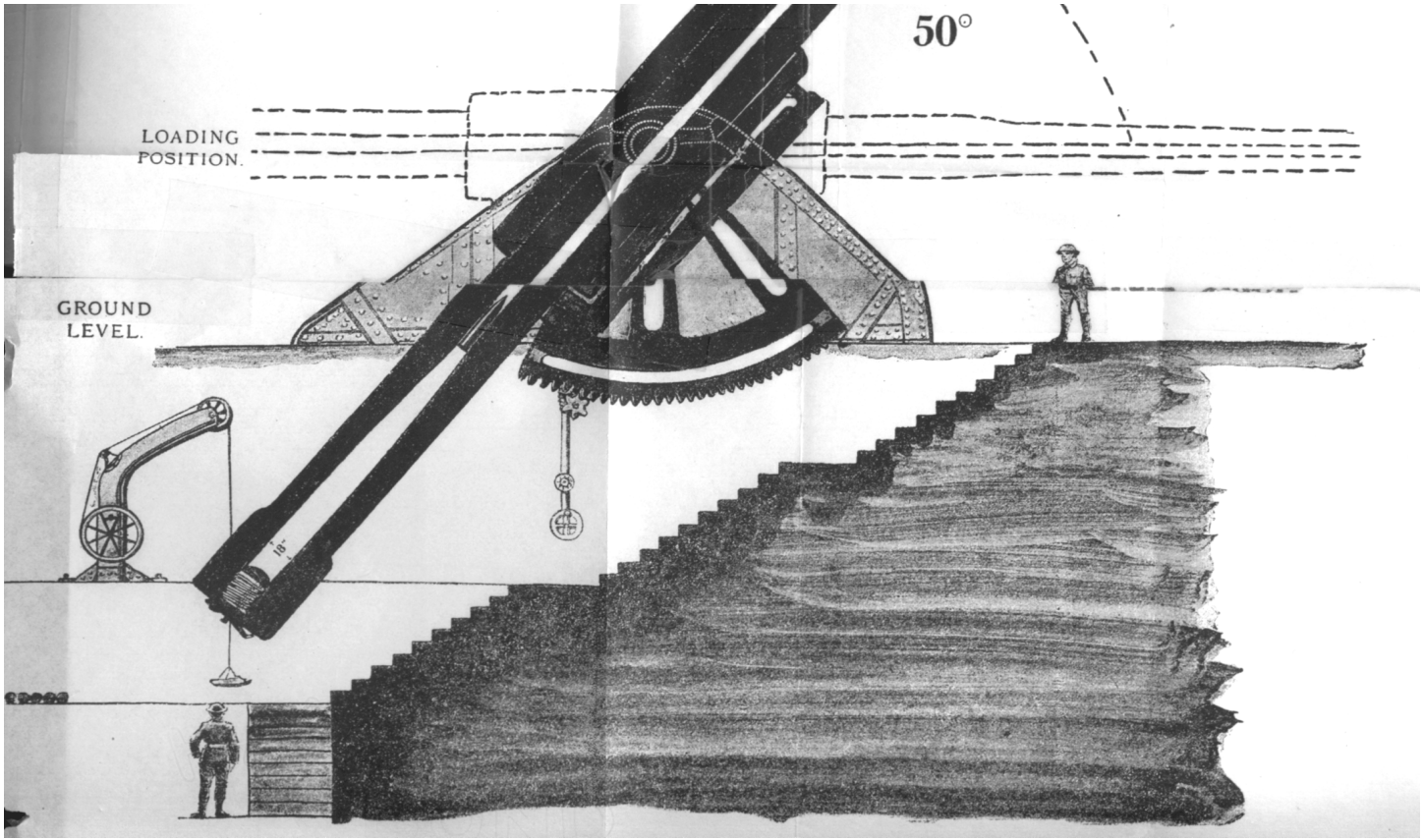


Figure 5.


50°
LOADING
POSITION.
GROUND
LEVEL.
15"

decrement would be very small. As regards the life of the gun, it has been said that such guns would be very soon worn out. I do not hold this view. With a working pressure very little above that normally used, the life of the inner tube should not be much short of the normal life of an ordinary gun of the same calibre, and I think it is quite possible that this particular calibre of gun may fire 600 to 700 rounds before requiring to be relined.

It has also been suggested the Hun may be using a big gun, lined up to a smaller calibre, to effect his purpose of shelling Paris. Such a measure would not give the ballistics for a 75-mile range—and I am inclined to the view that the gun has been specially constructed for the purpose. Manufacturing difficulties are to some extent increased; also special plant is required. These difficulties are not insuperable, as is evidenced, and although gun design has been very much standardized, it is quite possible that newer methods of construction will be evolved which will facilitate manufacture.

The Mounting.—I have pictured the gun as being mounted on a very ordinary type of standing carriage, erected over a deep excavation in the ground, for it is quite inconceivable that a gun of such length could be fired at the correct angle of elevation from any form of railway mounting or even from a long elevated bed of concrete, which has also been much discussed as being the only feasible arrangement.

The gun could be more easily transferred from its travelling position on railway trucks to this type of mounting. It is also practically certain that it has to be brought to the horizontal position for loading. It is not possible to say whether any arrangements exist for traversing. Having regard to the target at which the gun is being fired—also the range—very little traverse is required. One degree change in direction means a displacement of the point of impact of nearly one and a half miles right or left. At the same time, it would be feasible to arrange for a small degree of traverse, although possibly not an easy matter.

The Recoil.—The energy of recoil is greatly subnormal on account of the great weight of gun and recoiling parts relative to that of the shell. In this case the ratio is between 600 and 700 to 1 as compared with the more normal ratio of 120 to 1 in most guns. Therefore, the recoil arrangements do not call for any remarks.

THE ULTIMATE LIMIT OF VELOCITY (FIG. 6)

This illustration shows the effect of increasing the velocity up to what—for want of a better term—I call the "ultimate limit," which is to throw projectiles off the earth into space—such a feat as Jules Verne had in his mind when he wrote his book "De la Terre à la Lune." The requisite velocity is not so immeasurably higher than has already been achieved to-day. A velocity of a mile per second has been obtained. Assuming that some day we may be able to increase this to five miles per second (a velocity only five times greater), the projectile would then travel round the earth as a grazing satellite, completing its orbit between seventeen to eighteen times daily. And with a still higher velocity of about 7 miles a second, it would move off into space never to return. But it must not be presupposed that the dimensions of the gun are merely in simple proportion to the velocity it is required to produce. On the contrary, they increase as some power of the velocity. Nevertheless, it is a remarkable fact that such a velocity as one mile per second has been reached.

SUMMARY

To summarize what I have spoken about at some length, the factors which bring about such long ranges are—

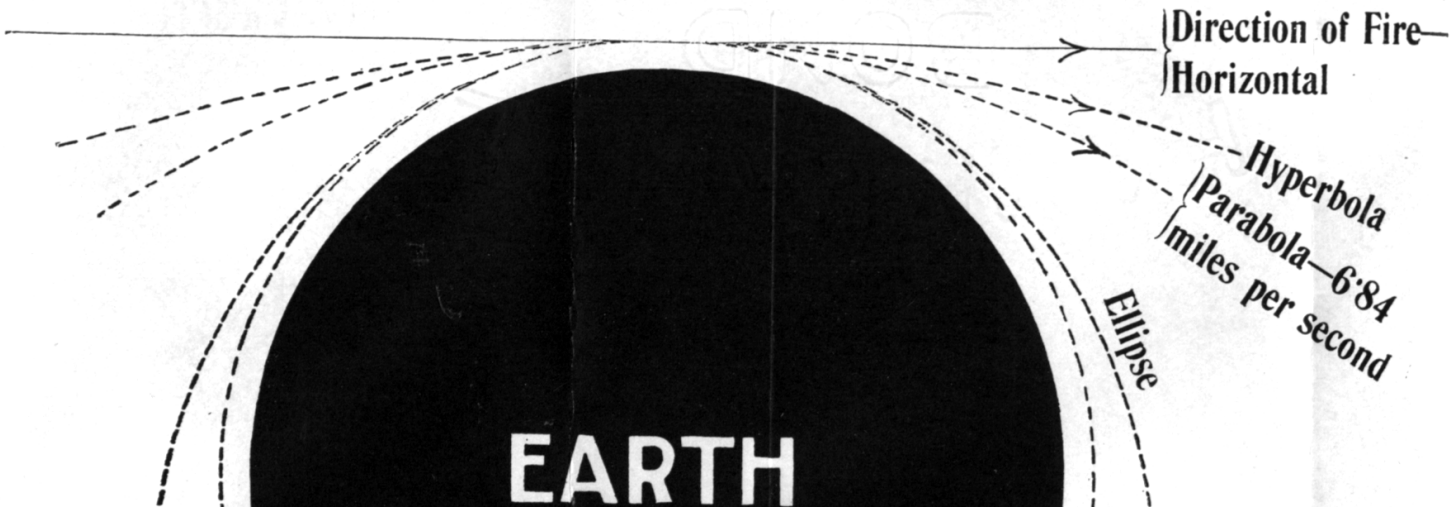
High ballistic efficiency of projectile.

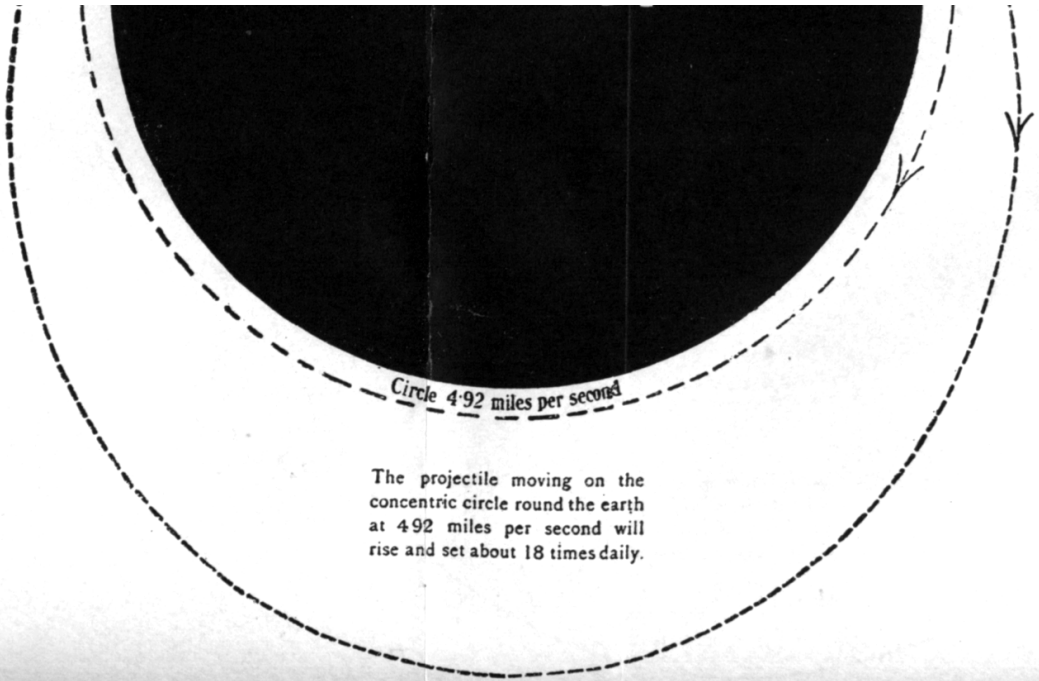
High velocity.

Velocity alone is useless without high ballistic efficiency of projectile, and the greater the calibre of gun we employ, the

Figure 6.

EFFECT OF VERY HIGH VELOCITIES
(ignoring the air resistance).





The projectile moving on the concentric circle round the earth at 4·92 miles per second will rise and set about 18 times daily.

greater will this efficiency be. Given both requisites, the rapidly diminishing air density with altitude does the rest.

The employment of a long and heavy gun is inevitable.

As regards the pressure to which these guns should be worked, the higher the pressure the shorter the gun within limits. But to use much higher pressures than those at present is not very feasible or desirable.

CONCLUSION

In conclusion, I want particularly to emphasize the fact that there is nothing abnormal about this gun the Hun is using, because all the points I have drawn your attention to in connection with it are points that have been known to us for many years. "Punch" has said, "The gunnery experts of the Allies say that we could have built guns of this nature, if only we had thought of it. Well, we did not think of it, but we must now take the Long Range Gun seriously. It has come to take its place amongst all the other weapons that are being used in the Great War. I do not say for a moment that the employment of such a gun would win the war; far from it, but it fulfils a mission, as does each engine of war devised. And these have been manifold in the last four years.

It will probably have a rapid development in the future—say in the next 20 years: Peace or war, it must be considered.

From such data as I have given you, it is patent that for still bigger guns and higher velocities, the engineering difficulties of construction will go up by leaps and bounds—and we shall have, in all probability, to acclimatize ourselves to a radical change in the scale of gun building. As regards the question—"What useful purpose will such a gun serve?" my reply is—Quite apart from any policy that may dictate its employment as a weapon of war, we should be able to add quite a lot of valuable information to our scientific knowledge of artillery by building a gun of this nature and carefully experimenting with it. Progress demands that we must always be marching

towards a further goal or higher limit, and in this respect artillery is no exception.

THE CHAIRMAN: Has any gentleman any question to ask the lecturer?

GENL. CLEEVE: Are there any data which have been found out from the French as to the fall of the projectiles in Paris?

MAJOR MAITLAND-ADDISON: Yes, sir, but they are confidential. I can hardly say anything as regards the accuracy except this, that I see no reason to suspect that it need be anything less than normal. The trajectory lies three-fourths *in vacuo* and can be affected only by the atmosphere on the two stilts, namely the upward stilt and the downward stilt; and so proportionately a gun which will fire 75 to 100 miles will in all probability be more accurate than are the smaller guns we have been using. I do not see any reason why the whole 100 per cent. of rounds should not be placed in a distance of well under a mile at 100 miles.

GENL. CLEEVE: That is what I wanted to find out.

MAJOR MAITLAND-ADDISON: Yes, sir; that is purely a conception of course; it is difficult to say what the accuracy is without knowing more.

BRIG. GENL. PERCEVAL: Would there be any difficulty about a traverse in the mounting, do you think?

MAJOR MAITLAND-ADDISON: I cannot myself see, sir, why there should be any very great difficulty. The gun is nothing more than the normal weight for a big gun, possibly some 70 or 80 tons, but apparently all the "experts" that exist at the present moment say it is probable that this German gun is directed on fixed lines. I think we ourselves would probably design a mounting to permit a traverse.

COL. BETHELL: About the weight of the gun, we are told that it would be about 80 to 90 tons, relying only upon the necessary strength to prevent it from bursting. Now it seems rather doubtful whether a gun of that length would not be so whippy as to require a very considerable increase of

weight to make it rigid; that is to say, the gun would have to be built primarily as a rigid girder and then, so to speak, have a hole made in it to make it into a gun. It would probably take the shape of a hollow tube built as a girder and enclosing the gun. Now if that were the case the 80 or 90 ton estimate of weight would be far below the reality, and I should like to know whether that point has been considered.

MAJOR MAITLAND-ADDISON: I have considered that point, sir. I really do not see that there is going to be any great "whip" in such a gun. A small amount of droop or whip is almost immaterial in such a problem as this long-range firing. Guns are very much more rigid than people would imagine them to be. If we take the normal 12-inch gun of 50 calibres in length there is not more than some seven or eight minutes of droop. There is a certain amount of whip, it is true, but I do not think those two factors would enter very largely into this gun. Of course, it would be possible to give it girder strength if necessary without vastly increasing its weight. The jacket, for example, of the gun might be made oval in shape with the thick part of the oval towards the top and the bottom, or it might be strutted to give it girder strength in the ordinary way that is done in bridge construction. But again, I see no great necessity for that. The gun I designed to show to you on the screen has a factor of safety of over 1½ and that is the usual factor of safety which we use in gun construction. Such a gun should be rigid enough.

AN OFFICER: Can you tell us how the shock of the recoil is taken up?

MAJOR MAITLAND-ADDISON: The shock of recoil could be taken up in the normal way. The recoil in this case would not be excessive, because the weight of the projectile is only 330 pounds for a gun of enormous weight; that is to say, a gun from 80 to 90 tons in weight. Therefore, nothing more than the ordinary recoil arrangements are required to absorb the recoil energy.

ADDITIONAL DATA ON LONG RANGE GUN

In connection with Major J. Maitland-Addison's lecture on the Long Range Gun, the following additional information has been received:

Up to date more than 100 shells calibre, 220 mm., have been fired. Each shell includes:

(*a*) A body proper, made of one piece, 500 mm. high, with 40 mm. base, and walls 40 mm. thick at the lower part and 25 mm. at the upper.

(*b*) A plug screwed on the body and bearing threads for screwing the dummy head of the shell.

(*c*) A diaphragm, 28 mm. thick, with 6 holes and, in the centre, a threaded opening 32 mm. diameter. This opening seems to be meant for a second fuze, which could be connected with first one by a tube containing the firing charge of H. E., which accounts for the very small number of non-bursts.

The base is provided with a screwed gaine and a fuze, which seems to be the regulation fuze for the 21-cm. marine shell.

The two relating bands are at 35 and 240 mm. from the base; one is 30 mm. wide, the other 25 mm.

Immediately above each rotating band, grooves have been made a swelled part of the body.

Depth of the grooves. .	2.5	in millimetres
Length	95 and 80	
Width	3	
Twist	4 degrees	

The upper rotating band seems to be provided with grooves to avoid the balloting of the projectile.

Weight	100 kgs.
H. E.	Tolite: 10-12 kgs.

Steel of the projectile: Great proportion of carbon with Ni and Cr.

Calculation gives:

M. V.	about 1700	m.
R. V.	about 700	m.
Maximum ordinate	38	km.
Time of flight	3	min.
Angle of departure	50	degrees
Angle of rail	60	degrees

The resistance of the air is reduced by using a high trajectory on account of the small density of the air in the high regions of the atmosphere. This question of the small density of air seems to be very important in ballistics when firing at long ranges. It is an obvious fact that it is easier to reach long ranges if the projectile travels during a great length of time in regions where the atmosphere delays or disturbs the projectile very little; the shell then travels almost as if it were *in vacuo*. If such is the case, it may be advisable to use an angle of departure a little greater than the angle which would correspond to the maximum range.

The rotation of the earth deviates the projectile a distance which may be 1 km. when the gun is fired from N.E. to S.W. at the latitude of Paris.

No information about the guns; they may be 280 mm. guns, brought to the calibre of 220, tubing them with tubes made of some special steel. The small twist of the grooves (4 degrees) shows that they are fired with a great M.V.

Observation Balloons

LIEUTENANT CRIVELLI, FRENCH AIR SERVICE

UNTIL this war started balloons had never been used for observation purposes as they are now; the part they were to play does not appear to have been very well defined, and few people who have not been at the actual fighting front know very much about them even to this day.

So indefinite was the part allotted to balloons that there were no trained observers, just anybody who felt like it could go up and look around, and he did not know exactly what to do when he got there. The generals in whose armies the balloons happened to be did not know to what use to put them, and rather considered them as units which encumbered the already overtaxed roads.

To such an extent was this true that after the first few weeks of fighting the balloon companies were all disbanded except one, and their men sent into the infantry.

This one balloon, then, may be considered as the beginning of what is now one of the most important services at the front. It was a spherical balloon which climbed painfully to the end of its cable and promptly sat down if the wind went any higher than 10 metres per second. Observation was difficult, if not impossible, owing to the way one got shaken up by the least wind, and communications with the ground were carried on generally by means of weighted messages, as the telephone was a primitive affair that was pretty to look at but of no use to speak through.

But one day our attention was called to the fact that the Germans not only had one or two balloons of the "drachen" type opposite, but they were getting more. We did not know how they used them exactly, but the fact was there, proving that they evidently found them useful, so we built some, too, to see what would happen.

Fortunately, the first one was put into the hands of a man who had plenty of imagination and all the qualities of a leader. When he saw how much steadier the balloon was he foresaw countless possibilities. He was well seconded by a boy who afterwards became first among French balloon observers. They not only saw things from the balloon, but they managed by endless efforts to communicate what they saw to the people interested. The method of procedure was extremely primitive and made good work difficult. The observer would see an enemy battery in action and would have to indicate its position on the map by means of a long explanation, as there were no coördinates at that time. This would be written while the basket would be swinging up and down and back and forth, and the paper, weighted by a bullet, would be dropped over the side, the attention of those on the ground being called to it by means of a blast on a tin trumpet.

Usually it fell in a wood or a river, and the man would take about 20 minutes finding it. He would then run off on a motorcycle to the nearest battery which would fire about 10 shots. We were optimistic in those days and we firmly believed that 10 shots of 75-mm. gun would put a battery out of action. Now we know that 800 of 155-mm. are necessary. Of course, at that time the guns were out in the open and all the men exposed.

During the whole of this time the observer had to watch the target, for having no communication with the battery he could not tell when it would fire, so that sometimes he might easily spend an hour watching for the shots. He would then mark the point of impact of as many as he could on a piece of paper, and send this by the same means as before to the battery. If the mean centre of impact was fair, the battery was considered as put out of action; otherwise ten more shots would be fired and the whole process gone through again.

Fortunately, the Germans were not doing much better with their balloons and so they considered us somewhat in the light of harmless mimics and only fired at us when they had

some spare ammunition and nothing better to do. In this way we only had the natural elements to contend with and were allowed to develop fairly freely. We had a little rattling steam windlass drawn by four horses, and we would camouflage it with the utmost care with branches and leaves so that enemy planes would not see it. Then, whenever a plane came along fearing it was about to attack the balloon, we would stoke up for all we were worth and start bringing down amid clouds of steam visible for miles. However, planes rarely ever had machine guns in those days and they would pass harmlessly by.

By means of hard and persistent work, by going up in almost impossible weather, by volunteering for work when the aviator was unable to go out, by making no guesswork and leaving nothing to chance, but only stating facts about which we were absolutely certain, and which were confirmed later on, the balloon began to attract attention to itself; credits were voted, men who were specialists and had been sent to the infantry at the outbreak of the war were recalled, new and improved material was studied, we had a telephone that would work almost always except when we particularly wanted it, and we had lines running directly to several batteries. The new maps were provided, we had good glasses and we began to work under more business-like conditions.

At this time balloon observation passed through its most critical period. People began to find us out, and so more balloon companies were formed and it was necessary to have more observers. Those already existing had become good through long practice and a liking for their work, which is passionately interesting, but there were only five or six such men along the whole front. Ballooning requires a rather special constitution if one is to avoid sea-sickness, so logically enough sailors were picked upon for the work, only, unfortunately, no attention was paid to any technical qualities they might require, with the result that we got lots of men who were not conscientious, who knew nothing about artillery fire, and who tried bluffing. At this time, too, our heavy artillery—a new toy—was in the

hands of men who did not know a very great deal about it and rather depended on the observer to adjust their fire; extraordinary as it may appear, in view of our present efficiency, there was time when a battery commander, after about six shots, would calmly ask the observer, who knew nothing whatever of the data, who had never heard of dispersion, and who knew as much about artillery as a Portuguese cat, if he considered his fire as efficiently adjusted, and the observer would just as calmly answer "yes" or "no," according to whether he had seen any of the shots anywhere near the target or not.

Needless to say, the result was disastrous. Our own trenches were fired upon as often as those of the Germans, and everyone tried to put the blame on everyone else. The same thing was happening in aviation and a general clean-up became an urgent necessity.

Schools were started in all branches, artillery, aviation, and balloon observation. The old observers were asked to propose a course, and suffering from a slight cast upon their service by young and inexperienced men, they had no tendency to make it too easy. Especial stress was laid upon the personal qualities of the men, and any man who seemed to be not quite dependable was ruthlessly dismissed, and the course was such that a man had to be keen on his work to go right through it.

Bit by bit, aerial observation began to rise again. Some men began to stand out strikingly by their initiative and the accuracy of their work. Roads were watched so carefully that circulation behind German lines was often practically stopped. Trains were smashed up, munition dumps exploded and the routine work of destructive fire on trenches was carried on in a quick and business-like manner, till finally the organization and work became as nearly perfect as could be, and in one attack on Verdun balloon observation reached a climax as will be shown by the following figures, so that new credits were voted, the matériel was again improved, things we had been requesting for months were at last given us, and we knew that now, whatever happened, balloons had come to stay.

From the 17th to the 22nd of August, 1915, when the weather was particularly favorable for balloon observation, during an attack at Verdun, the following results were obtained.

In the sector of one army there were:

Aviation: 8 squadrons adjusting for divisional artillery
12 squadrons adjusting for heavy artillery
2 squadrons adjusting for naval guns each squadron having from 8 to 15 observers.
8 balloons for divisional artillery
12 balloons for heavy artillery
2 balloons for naval guns
each balloon having from 2 to 4 observers.

AVIATION		BALLOONS	
German Batteries seen in action and located	Ranging for French Batteries	German Batteries seen in action	Ranging for French Batteries
521	690	1064	1078
Average per Observer 2.6	2.8	13.3	13.4

Of course, these figures must on no account be taken as an unfavorable criticism of aviation work. On other occasions when weather conditions were unfavorable for balloons most of the work fell to the aeroplanes, but they will serve to show what balloons can do, given fair conditions, and it is interesting to note how much cheaper one balloon company with one balloon and four observers is than one squadron with twelve planes and as many observers.

Strangely enough the Germans remained stationary for a long time, after having shown us the way they made little or no progress, and they probably thought the same of us, for we still enjoyed a relative peace, which permitted our uninterrupted development. We continued perfecting our matériel. Major Caquot discovered the present form of balloon; great strides were made in establishing communication with the artillery so that now the observer in the air can call up any battery along the front, and the telephone centrals are as complete as

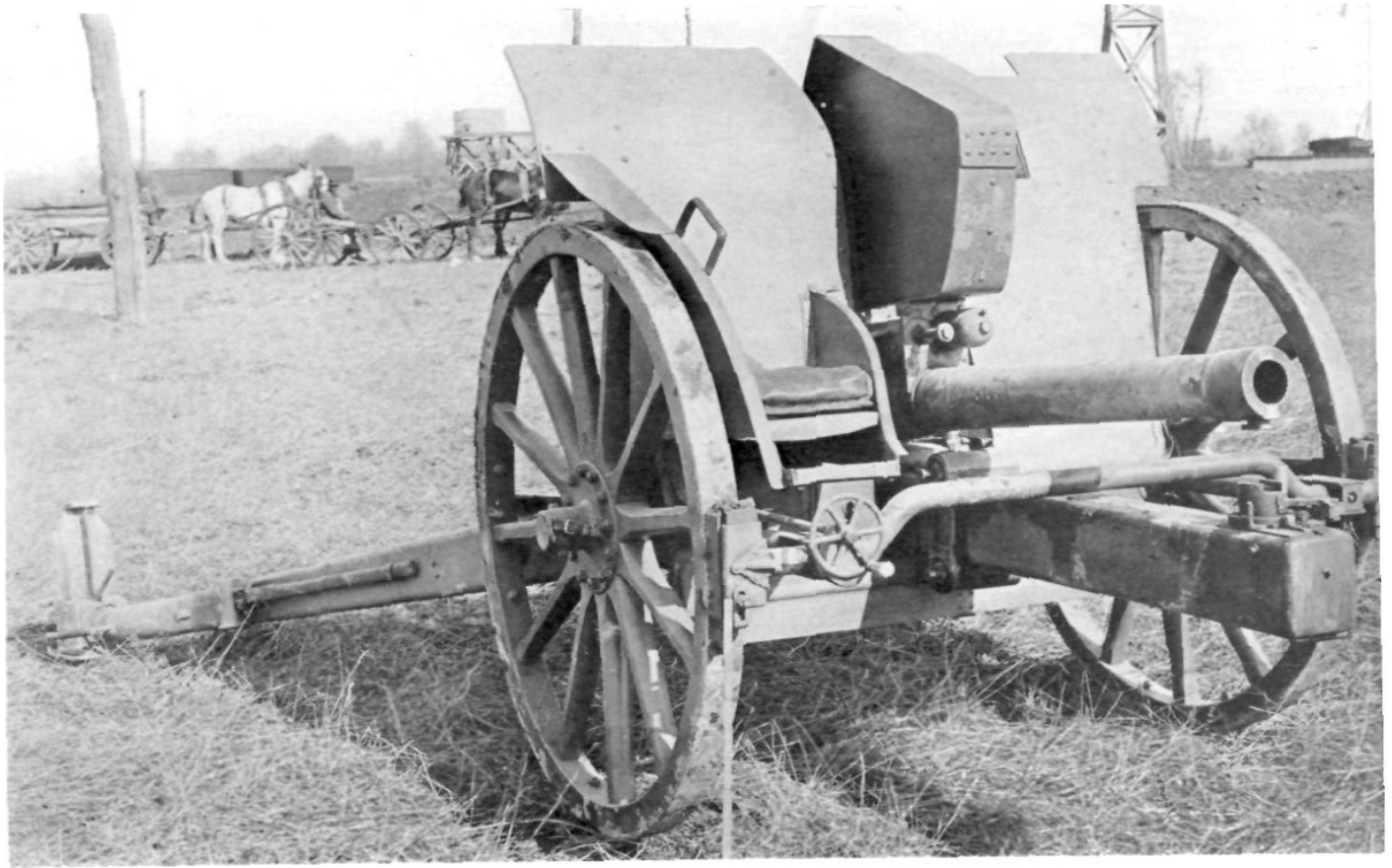
a city exchange. From his basket he can communicate instantly with the infantryman in his advanced trench or to the general in his office towards the rear. As soon as ever a German battery opens fire he can get our batteries to answer back so rapidly that in many cases the German soldiers have the impression that they are continually being watched and as soon as they become in the least aggressive they are sure to get a bad time. We have learned from prisoners that the mere fact of the balloon being in the air has often prevented batteries from firing.

War was first seriously declared on the balloons in 1916 in La Somme, when we opened up operations by sending out a fleet of battle planes who burned up 19 German balloons at one fell swoop. The result was very funny; for days afterwards they stayed miles to the rear of the lines, only peeping over hills from time to time and coming down with a run at the first sound of a French aeroplane; but naturally the Germans could not let such a thing pass, and as their battle planes at that time were quite inferior to ours both in speed and in numbers, they dared not attack us in this way, so they tried long-distance firing. We were in a sort of advanced pocket which allowed them to use bilateral observation, and they got extremely good at the game of potting balloons. They had a long gun which fired an elongated shell with a clock-work time fuze, and in five shots they would usually pepper one's balloon with splinters. Strangely enough, this was not very impressive. The shell would come at one like the "mewing" of a cat and burst with a sharp metallic "ring" quite different from the tearing, rending crash of high explosives with time fuzes which they now use. This shell had but a small charge of explosives and I never knew of any observers being hit, although one had his glasses smashed in his hands; personally, I was brought to the ground 5 days running, sometimes with as many as 300 holes in the balloon, but never had more than one or two in the basket and none in myself.

Later the methods of attack by aeroplane became perfected

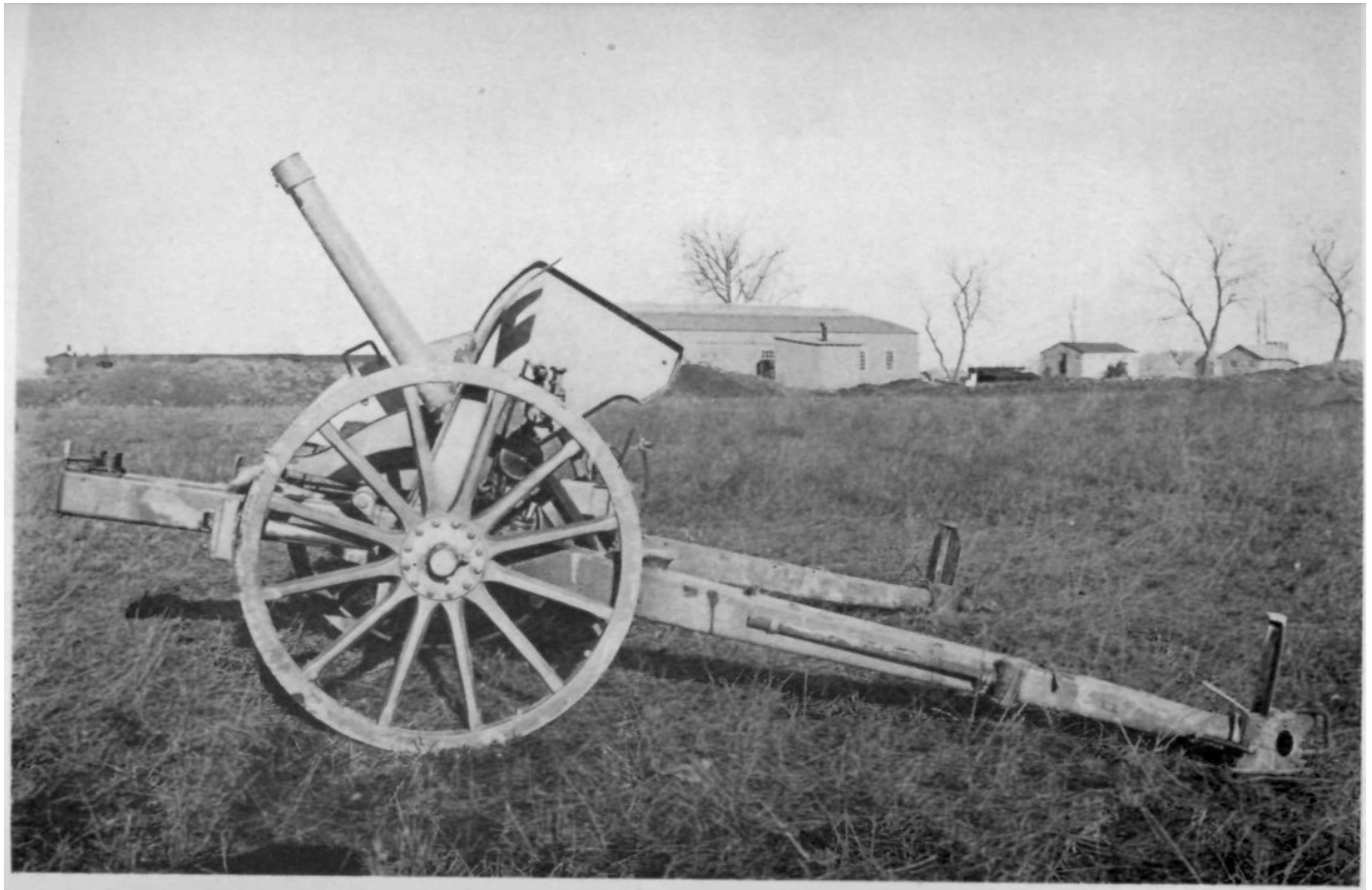
and incendiary bullets were used. These attacks are much more successful than the gun fire and almost always end in a 3500-foot jump with the parachute. Every clear day several balloons are brought down on both sides. However, the work is so interesting and the observer sees the good results he gets, and satisfies so well his ambition to "treat 'em rough," that any danger is fully compensated by having such a front seat in the biggest of world events.

The young American officers in the balloon service have started out right and they are of much better stuff for such work than the majority of men we now get in the French army, with our nerves more or less shattered as they are by four years' tête-à-tête with death. They are keen as mustard and have been subjected to the severest of tests before they are permitted to get anywhere near the front. But they lack that experience which only war can give, and, of course, they will make mistakes. But so will every officer in every other branch of service, and in this case it is the artillery officers' duty to help them out, not to cast the balloon aside as no good because he understands nothing about it. Shoots must be discussed in detail with the observer, anything the gunner dislikes about his method of work should be gone into, and thus with time, the artilleryman will help in getting for himself a tool that will increase the efficiency of his fire often as much as 80 per cent.



ITALIAN 75-MM. FIELD GUN

Front view, gun in firing position, showing cover afforded cannoneers and support for gun when locked in travelling position.



ITALIAN 75-MM. FIELD GUN
Side view showing maximum degree of elevation.

Artillery Information Service

EDITOR'S NOTE.—The long periods of stabilization which until recently have characterized the European war furnished opportunities hitherto unknown for the detailed study of maps and the terrain and for a continuous search for artillery targets. A highly-specialized, technical artillery information service has thus been evolved, the details of which were, until recently, almost unknown to our service.

The article which follows sketches the general principles upon which our own practice must necessarily be based; but it also goes into a certain amount of detail which our own regulations will undoubtedly modify to suit our organization and to the element of mobility which has happily been revived on the western front.

One basic principle is worthy of emphasis: the Artillery Information Service is a separate agency pertaining exclusively to the artillery. It coöperates with General Staff Intelligence, but is in no sense a part of it, and is entirely at the disposal and under the direction of the artillery commander. It is understood that this principle has been adopted in the American Expeditionary Forces.

It is also understood that another principle not referred to in the accompanying article has been adopted for our service in France—the Artillery Information Officer has become also the Counter-battery officer of his command. He not only finds targets, but takes immediate steps to plan for their destruction.

A. Rôle of Artillery Information Service

It is the duty of the Artillery Information Service:

1. To furnish the Artillery Commander and the units with all the *exact* information which they require for the accomplishment of the missions entrusted to them.

2. To coöperate with all other branches of the Intelligence Service with a view to furnishing the Commanding General the most accurate statement possible of what is known of the enemy's forces and his organizations for offense and defense.

With respect to the mission assigned to the Artillery, the

Artillery Information Service must make it possible for the Artillery Commander and those under his orders to obtain the best possible use of the guns and the maximum effectiveness of fire.

It is not sufficient to bring into position a great number of guns and to supply them with a considerable quantity of ammunition; it is also necessary to use them in an efficacious manner, at the same time avoiding waste of ammunition. It belongs to the Artillery Information Service to seek out objectives of prime importance.

It is necessary to locate these objectives to within about 25 metres.

The development of information with a view to the *accurate* determination of data required by the artillery for the carrying out of missions entrusted to it, is a *technical* rôle belonging exclusively to the Artillery Information Service, which gathers, coördinates, and ascertains all information received:

(*a*) From the observation means placed at the service of the Artillery or belonging properly to it.

From the air service.

From the ground observation sections.

From the sound-ranging sections.

(*b*) From the Intelligence Section of the General Staff.

After consideration of the information, the chief of the Artillery Information Service must deduce daily the position and activity of the enemy artillery.

The coöperation required of the Artillery Information Service places the chief of the Artillery Information Service in direct relation with the chief of the Intelligence Section of the General Staff.

The relation between the two should be close and constant. The method of determining the position of enemy artillery, the plan for searching out this artillery, the grouping of objectives to be covered by fire and the estimate of their importance should be discussed together by the chiefs of the Intelligence Section, General Staff, and the Artillery Information Section. They

will thus be able to submit a unanimous report to the Chief of Staff of the Army Corps, and to the general commanding the Army Corps, and, on the other hand, to the Chief of Artillery, whose duty it is to elaborate upon the information reported for the purpose of getting a working basis for his Artillery.

The Artillery Information Section furnishes the Intelligence Section, General Staff, with information other than technical information necessary for fire, and it receives from the Intelligence Section, General Staff, an entire file of information regarding the Artillery. The purpose of this information is to complete that which the various branches of the Artillery itself have been able to gather; that is:

Information furnished by the troops in the sector.

Information furnished by the prisoners.

Information furnished by the air service

insofar as this has not already been sent directly to the Artillery.

In the course of active operations, in cases of urgent necessity, the chief of the Artillery Information Service frequently receives directly, through the medium of the Infantry Divisions or from the Artillery of the Division, information obtained by Air Service units which he receives normally from the Intelligence Section, General Staff. He works it out personally. Then, as soon as possible, he comes to agreement with the chief of the Intelligence Section regarding the acceptation and interpretation of this information with a view to final revision.

What has just been said regarding the necessary close cooperation between the chief of the Intelligence Section, General Staff, and the chief of the Artillery Information Section shows how essential it is that these officers work side by side in the same place whenever possible. The chief of the Artillery Information Section has at its immediate service the information obtained by the Intelligence Section, General Staff, and *vice versa*. The entire Intelligence Service is the gainer by this.

B. Distinctive Characteristics of the Army Artillery Information Service and the Army Corps Artillery Information Service

An Information Service is organized in the Artillery Staff of large units (Army Corps and Army), but the respective missions of the two organizations are different.

The Artillery Information Section of the Army is more stable than that of the Army Corps, since it is not affected by the law of relief of troops. Among its duties is the organization of observation from the ground for the benefit of the Artillery, an organization made sure by a permanent personnel and adapted to the configuration of the ground and not according to the temporary distribution of the Army Corps or Infantry Divisions on the front. The branches of the service thus created (Terrestrial Observation Sections, and Sound-ranging Sections) are placed at the service of the Army Corps *for use*, in such a way as to avoid delay.

The Army Artillery Information Service has also among its duties the study of information about the enemy, but as it has no direct relations with the intelligence branches of the Army Corps and as it is too far away from them in action, its rôle consists chiefly in revising the various pieces of work carried out by the Artillery Information Sections of the Army Corps and in establishing harmony among them. Its duty is likewise to make these various bits of work accurate by combining them and by utilizing new elements which it obtains through the Intelligence Section of the Army General Staff, the Aeronautical Service, and the Army Survey Companies.

In this way there is prepared a map of batteries in coöperation with the Artillery Information Sections of the Army Corps and an Army general list of the batteries of which extracts are published periodically and distributed to the Army Corps.

The Artillery Information Section of the Army Corps not being entrusted with the organization of terrestrial observation, turns its efforts towards the seeking of information. Generally,

it receives this information with very little delay, if the information concerns the fire of the batteries, and distributes important parts of it at once.

In this case certain bits of information can be furnished provisionally until the Army Artillery Information Service, by the aid of photographic restitutions and other information determined by the *Army Survey Group,* can give complete and exact information (exact coördinates of batteries and definite location of objectives).

C. Means of Investigation of the Army Corps Artillery Information Service

We now come to a consideration of the means at the disposal of the Artillery Intelligence Section of the Army Corps:

(1) *Terrestrial Observation.*—The Heavy Artillery observation posts of the Army Corps and some others which are directly dependent on the Artillery Information Service concern themselves especially with the searching out of batteries by locating the direction of the flashes. Enemy batteries are sometimes located by a careful examination of results obtained at different stations at the same time. This is the least accurate mode of marking.

It goes without saying that although certain observation stations are more especially occupied with the spotting of enemy batteries, the Artillery Information Service does not neglect any of the information which it may receive from any other source. The advantage of the heavy artillery observation posts is that they can be permanently occupied (they are far enough away, and are shell-proof) and are provided with quite accurate aiming apparatus.

Furthermore, the Field Artillery and Infantry observation posts are sometimes capable of giving very useful information. Their information is communicated to the Artillery Information Service by Artillery Intelligence officers. An example occurred on the Aisne in 1917 between Froidmont Farm and the

Pantheon. The direction of flashes, which was carefully determined by Infantry Intelligence officers, was very valuable in directing investigations and confirming the vague lists of information about the new positions of enemy artillery, picked up during the first days after the advance. A battery drawn up in the quarries north of Chevrigny was spotted with great accuracy by an Intelligence sergeant.

(2) *Terrestrial Observation Sections*.—The function of these sections is nothing else but the methodical use of certain of the most favorably located heavy artillery observation posts.

A section consists as a rule of 4 observation posts connected one with the other through a telephone exchange under the direction of a specially trained officer. These four posts must look over the same sector where batteries are supposed to be. The same flash must be located at the same instant by several observation posts.

As soon as a post receives a flash it warns the exchange by an electric signal and the three other posts are immediately notified of the direction in which the first post has seen the flash. If other flashes are made again by the same battery, the three or four observation posts can get a line on it simultaneously. The battery can then be marked on the battle map by a very simple diagram. The best results are obtained from this system of marking in flat country, especially if one occupies a dominating position. Attention must be paid not to fall into a pitfall of mistaking false batteries for real ones, and not to mistake powder flashes from dummy batteries for flashes from real ones.

(3) *Sound-Ranging Sections*.—These sections are by far the most technical branch of the system of locating batteries. They are in possession of instruments which register the exact time of arrival of the same sound at several receiving stations. Imagine a certain number of microphones distributed over a front of several kilometres. They vibrate at all noises and transmit these vibrations by electric wire to a central exchange, where they are recorded on a strip of smoked paper or on a

moving-picture film. The reading of these records allows those who understand them to work out the position of enemy batteries and to locate them down to within a radius of 20 metres (by a solution of the intersections of 2 hyperboles).

(4) *Reconnoitring Work of Airplanes*.—In a fairly active sector the flashes of light made at twilight, a time when the light is most favorable for the work, give abundant opportunity for gathering information. The best results are obtained when the observer has previously studied the sector carefully.

(5) *Balloons*.—Balloons survey the ground from an altitude high enough to be able, where the ground is not hidden, to locate in general, with approximate precision, the flashes and their points of departure without having recourse to checking up. They can make permanent observations.

(6) *Aerial Photography*.—Photographs are documents of prime importance. The examination of tracks gives us an idea of the life of the Boches. Tracks start out generally from a supply centre, depot, railroad station, cantonment or bivouac and lead to places of assembly, centres of distribution and batteries. The tracks of liaison agents reveal particularly the emplacements of command posts and telephone exchanges. It has been possible at times by this method to make up groupings of enemy artillery, to make out the command posts of the infantry and artillery, to recognize the observation stations at the service of each artillery group.

(7) *Miscellaneous*.—Prisoners can sometimes give valuable information regarding batteries they have seen near the roads which they have followed. Documents found in advanced headquarters are sometimes of value. The listening antennæ for aeroplanes, the radio-goniometric posts (measurement of angles by wireless) give useful bits of information from time to time.

No detail, however small, is to be neglected; information which for the time seems unimportant afterwards becomes very interesting and important.

D. METHOD OF OPERATION OF THE ARTILLERY INFORMATION SECTION IN LIAISON WITH THE DIFFERENT BRANCHES OF THE ARMY CORPS INTELLIGENCE.

The Artillery Intelligence Section works in close liaison with the Intelligence Section of the General Staff, with the Topographical Section of the Army Corps, as well as with the Air Service and eventually with the Radio Intelligence Section. It works likewise in close liaison with the Artillery Information Services of the neighboring corps.

Its duty is to furnish information of a general nature, such as the importance of movements of enemy artillery opposite his units; the proportion of heavy batteries and field batteries and if this proportion corresponds to the normal strength or shows a reinforcement. It likewise gives to those in action the documents necessary for the accomplishment of their missions (battery maps, ideas as to the emplacement of batteries, etc.).

This intimate joint action of the Artillery Information Service with the Army Corps Intelligence is facilitated by the meetings of the Intelligence Section of the General Staff. When things are calm, these meetings can take place only once or twice weekly, especially on days when the Air Service can operate. It is advantageous to hold them on the landing field in order to have the observers who have seen the batteries establish accurately all the details and profit by the studies of officers interpreting the photographs. This is also the best way for the Artillery Information Service to tell observers, photograph interpreters and officers of the Army Corps Topographical Section definitely about obscure points which still remain to be cleared up.

During a period of activity these meetings necessarily take place every day in order to establish each evening the position of the enemy artillery.

At these meetings a comparison and criticism is made of information brought in: First, by the Information Officer of the Air Service; second, by the Artillery Information Service; third, by the Intelligence Section of the General Staff.

Before these meetings, whenever it is possible, the chief of the Artillery Information Service must receive a report of the results of the interpretation of photographs taken during the day, so that he can study out this work, check it up and have a well-founded estimate of these documents at the meetings of the Intelligence Section of the General Staff. The technical checking up of these interpretations is indispensable to avoiding of errors and incomplete returns.

At the meetings the chief of the Artillery Information Service finds all the information collected by the Air Service on the subject of Artillery carefully synthetized and coördinated. During the day the chief of the Air Information Service has gathered, compared and criticised the information of observers and has it definitely precised on the Trench Map. He then sees to it that the studies of the officers who make photograph restrictions are completed by the observers. He tries to clear up all the uncertain points or if an uncertainty cannot be eliminated, he brings out clearly the reasons for it.

By placing all this work alongside of the results of the investigations of the various branches which he has at his service (he may appeal directly to the observers and to the Army Corps Topographical Section if necessary) and by completing it all with the information reported by the Intelligence Section of the General Staff, it is possible at the end of the day to establish a situation map showing the enemy artillery accepted by all, which will show:

(*a*) The batteries seen in action during the day on the front of the Army Corps, distinguishing at the same time *new* batteries from batteries already *known*.

(*b*) The probable batteries whose presence it is necessary to *verify* by photography or by more accurate and direct observations.

(*c*) Information relative to enemy artillery (batteries caught under destructive fire—direction of fire—calibre of barrage-batteries—nature of casemates and observation posts marked out, etc.).

When an account has been taken of the results worked out,

the chief of the Intelligence Section of the General Staff will be able to determine the zone which there is reason to have photographed for the investigation of doubtful batteries and to prepare the order necessary for the photographic mission.

The chief of the Air Information Service will be able to point out to the observers the batteries which will have to be noted accurately by direct observation whether they have been revealed by their flashes or whether they have been reported by prisoners.

The situation of the Artillery established at these daily meetings includes the assignment of coördinates to each new battery. After careful selection these coördinates are adopted by the Intelligence Section of the General Staff and are made official for all concerned. But they are only provisional and will become permanent only when the batteries to which they are applied have been photographed and noted exactly by the Army Survey Company.

E. Transmission of Information

The information determined upon at these meetings tends towards fixing the daily position of enemy artillery which must be brought to the knowledge of the chief of Artillery and of commanders of active batteries.

The transmission of information takes place:

(*a*) either by information slip of the artillery Information Service;

(*b*) or by maps or sketches which show clearly the batteries already known and seen in action during the day or the period in question, the batteries known beforehand which have not fired, and the new batteries located and in action;

(*c*) or by sketches explanatory of commentary on photographs relative to details of organization of batteries. This commentary is based on the study of photographs made by the Artillery Information Service, the Army Corps Topographical Section or the Air Information Service.

From time to time the Artillery Information Service of the Army Corps may be called upon to furnish periodical reports of information.

The information is transmitted:

(*a*) To Artillery commanders down to the batteries.

(*b*) To the commanding generals of the Army Corps and the large subordinate units and to the different officers of their staffs, to the commanding officers of Infantry units and to their Intelligence officers, who might therefore easily bring about this close unity of action with the Artillery, which has already been emphasized as being absolutely indispensable to the efficient operation of the Intelligence Section.

(*c*) To neighboring Army Corps.

(*d*) To the Army which will make use of them, particularly to establish its battery map.

Besides the information which it has been possible to coordinate, select, and synthetize, the Artillery Information Service may gather during the day, either through the branches of investigation properly speaking, or through some of the branches of the Intelligence Service of the Army Corps, or from neighboring Army Corps or from the Army, information which can be immediately utilized by the Artillery (columns on the march—trains—batteries in action).

The chief of the Artillery Intelligence Service sends them immediately to the general in command of the Artillery or upon order of the latter directly to the Artillery groups concerned. He communicates immediately likewise:

To the Chief of the Intelligence Section of the General Staff.—The technical information which may immediately concern the High Command (movements of troops, convoys, trains, appearance of new Artillery groups).

To the Chief of the Air Information Service.—The information which may concern the Air Service.

CONCLUSION

The rôle, function and method of operation of the Artillery Intelligence Section have been described.

Practice will show that the operation of the Service is simple and that by active, deep and coördinate study of the manifestations of enemy artillery and its positions, it is possible to determine:

1. The importance, variations, changes of position and direction of activity of enemy artillery. This will give the command the opportunity of planning and acting.

2. The exact position, strength and detailed information of enemy positions and organizations, which will permit the wise distribution and efficiency of the Artillery.

APPENDIX A

The following list of documents does not take into consideration the C.S.T.S. files which, without being fundamental for the Artillery Information Service, must be referred to by its officers frequently:

A.—*Files and documents of current use:*

(1)—1/50,000 1/80,000 1/200,000 maps of the sector

A set of revised trench-maps of our own organizations 1/5,000 1/10,000 1/20,000

Sundry revised maps (road system, camps and cantonments, concealed routes)

Photographs of our own organizations (A set with connecting chart for classification)

(2)—*Observation posts:*

(*a*) General map showing *Observation Posts of command and of Artillery Information Service* (completed by indication of posts of sound-ranging sections and ground observation sections)

(*b*) *Album of panoramic views*

(*c*) Map of parts of ground concealed under direct observation.

B.—*Files and documents relating to Intelligence Service about the enemy.*

(1)—*German order of battle:*

Sketches from Army Corps (eventually Infantry divisions for particulars) with notes and connections, if any.

(2)—*Defences:*

(*a*) Set of successive revisions of trench-maps 1/5,000 1/10,000 1/20,000

(*b*) Revised trench-maps 1/5,000 1/10,000 1/20,000 and sundries.

(*c*) Set of Corps Topographical Section corrections.

(3)—*Enemy Artillery:*

(*a*) Map of batteries issued by Army

(*b*) Map of batteries issued by Corps

(*c*) Map of enemy artillery concentrations (batteries of each suspected group, ammunition shelters, tracks, observation posts, headquarters, telephone lines and exchanges, etc.

(*d*) Map of zones under fire

(i) Weekly document from Infantry divisions

(ii) Corps document

(*e*) Sundry notes (texts, graphics, etc.)

Artillery Information summaries:

daily

periodical.

List of battery positions (with indication of corresponding photographs), forming a very complete index, giving for each battery the date when it has been seen in action for the last time.

Periodical list of batteries having been submitted to counter-battery or destruction shoots.

Photographical Documents.

The Artillery Intelligence service must own two sets of all photographs so as to classify one for each reconnaissance—the numbers of the photos being in succession—and the other according to area or to counter-battery zone.

Explanatory notes on photographs.

Photographs must be commented upon directly if possible, in all cases must have attached a written commentary.

A photograph sent in without explanation to a combatant usually is not studied.

Graphics.

(i) Of comparative activity of our own and German artilleries.

(ii) Of the density of the German artillery.

N. B. The map of batteries issued by the Corps must mention all known zone of action and the chief objectives. It must be issued to all Battalions and counter-batteries to Observation Posts (Artillery Information Sections and ground observation sections) and regularly sent to Infantry Intelligence Officers in the line and to sound-ranging sections.

(4)—*Map of sensitive points, including:*

A 1/20,000 trench-map with outline of traffic in the enemy zone and indication of all vulnerable points.

Explanatory notes giving for each objective: its coördinates; its precise nature and importance; the calibre to be used against it, etc.

1/10,000 and eventually 1/5,000 complementary sketch for each objective of interest, with mention of the best photograph of this objective.

(5)—*Radio Service:*

(*a*) Map of Corps specialized receiving stations and radiogoniometric posts.

(*b*) Map showing location of identified enemy sending stations and zones of action of artillery registering aeroplanes.

(*c*) Classification in a special book of captured indicatives and of listening texts with their interpretation.

(6)—*Set of information bulletins from:*

(*a*) Army

(*b*) Corps; daily and periodical

(*c*) Corps in liaison

(*d*) Artillery Intelligence Service (Army Corps)

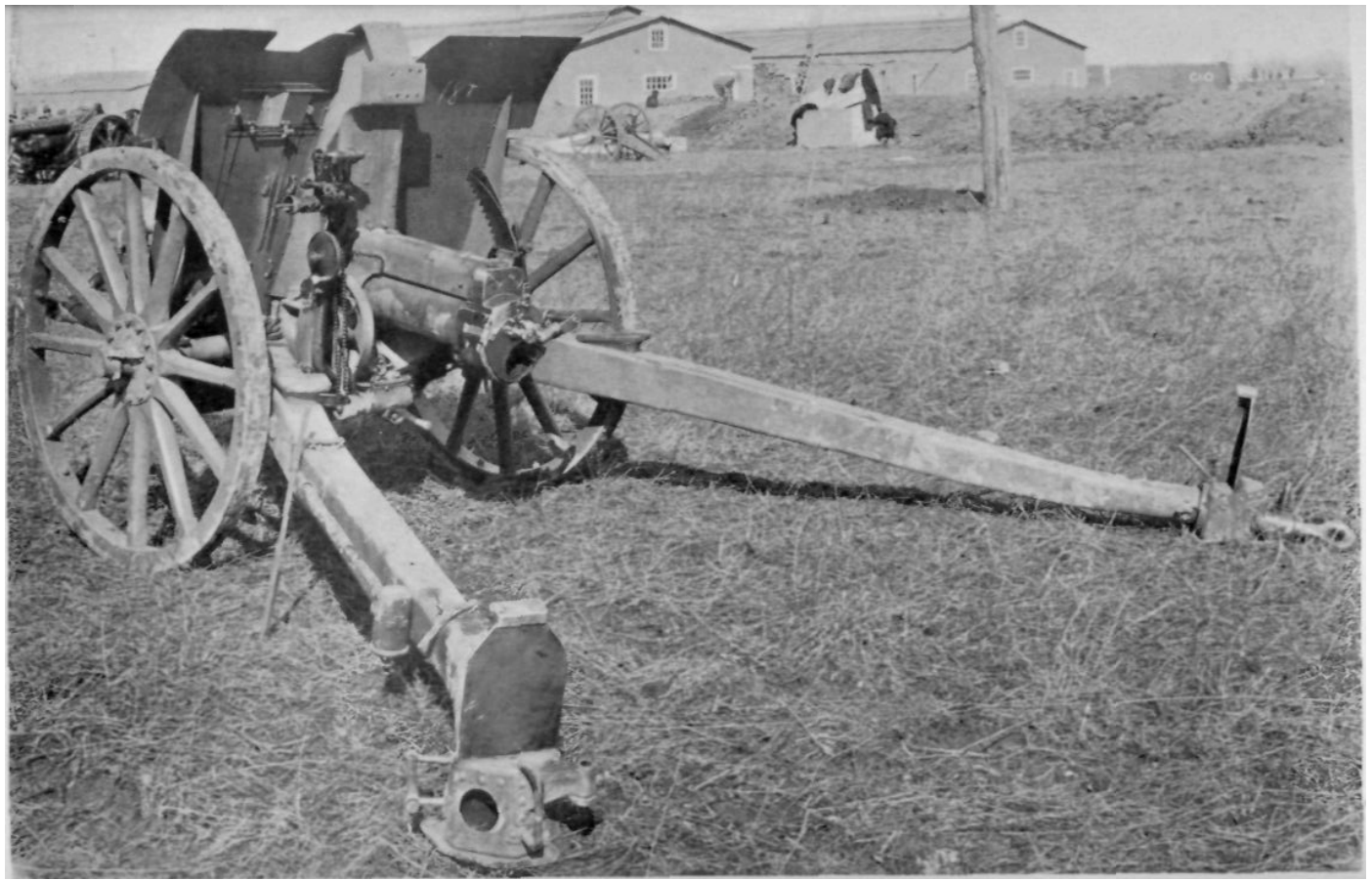
(*e*) Air Service (Army Corps)

(*f*) Daily summary from Sound-ranging Section

(*g*) Daily summary from Ground Observation Sections

(*h*) Daily report from Army Information Officers (divisional, Artillery, Corps Artillery, Heavy Artillery)

ITALIAN 75-MM. FIELD GUN
Right rear view showing range drum.



ITALIAN 75-MM. FIELD GUN
Left rear view showing sighting mechanism

American Drill Regulations and "Artillery Firing"

DEPARTMENT OF GUNNERY, SCHOOL OF FIRE FOR FIELD ARTILLERY, FORT SILL, OKLAHOMA

IN the Field Artillery Training Memorandum No. 2, issued April 18, 1918, the Chief of Field Artillery sought to disabuse the minds of Field Artillery Officers of the idea that changes have been made in the principles underlying methods taught in Volume III of our Drill and Service Regulations for Field Artillery, 1916; in other words, of the idea that our drill regulations are now obsolete on account of the peculiar conditions under which the present war is being fought.

For a further consideration of the points brought out in the above-mentioned memorandum, we must appreciate the different conditions under which the artillery works in "position" warfare and in "open" warfare. In position warfare, there is ample time to make use of every device which increases the accuracy of the work. Since friendly, as well as enemy troops, remain in place for long periods of time, accurate data concerning these positions can be procured. The element of time, so essential in open warfare, does not exist in such a positive sense in position warfare. Every means is furnished to aid the subordinate commanders in the conduct of fire. In other words, the fire of artillery in position warfare is precise on account of the greater facilities which are at hand. When open warfare is being fought, practically none of these refinements can be expected; and, in addition, time plays an important part. Therefore, we can say that, in position warfare, great accuracy is called for; and in open warfare, no such accuracy can be expected. Between these two extremes are found the many gradations through which open warfare merges into position warfare and in which the conductors of artillery fire must make the best use of the time and material available.

A very pertinent remark, made by a former director at the School of Fire, to a group of student officers is worthy of consideration. In discussing the merits of Volume III with reference to position warfare, he stated that any officer who has mastered open warfare as treated in Volume III, could get in a hole in the ground and take care of the situation at hand. But, an officer who is master of only the comparatively slow and very accurate methods of position warfare would be lost in open warfare.

A reading of publication No. 990 of the A. E. F., entitled "Artillery Firing," may give the reader the impression that the methods prescribed therein differ materially from those of our present drill regulations. A careful study of this book, however, and a thoughtful comparison of its provisions with those of the drill regulations will bring home the fact that there has been no change in the fundamental principles, and furthermore that such changes in details as the present war has brought about are only those which are logically indicated by the more deliberate nature of position warfare. A few examples in support of this statement will be drawn from that part of "Artillery Firing" which deals with the conduct of fire. Similar examples may readily be found in the methods of reconnaissance, and preparation for and observation of fire.

Consider first the terms used now, in comparison with those used in the drill regulations for the 3-inch gun. Our regulations have always used the word "bracket," qualifying it with "100-yard," "200-yard," etc., as the case called for. We have, in addition, thought of 100 yards as meaning, approximately, four field probable errors. In the terminology of "Artillery Firing" the word "bracket" is still used, but it is now qualified by the words "of so many forks." A one-fork bracket is synonymous to our old 100-yard bracket, a fork being exactly 4 field probable errors for that range. This exactness in using a variable fork is warranted on account of the fact that ranges may now be set off in degrees and minutes, or in twentieths of

degrees, these divisions allowing a range change of less than the minimum change of 25 yards formerly used.

In the process of ranging, the rules governing the range bounds to be used are the same in every respect. If the officer conducting the fire estimates the range, the range bound is four forks; if a range finder, or an accurate map is used, a range bound of two forks is called for; if corrections for the conditions of the moment have been made, a range bound of one fork, or less, is used. It will help those familiar with Volume III to think of these range bounds as approximately 400, 200 and 100 yards respectively.

The above is just one example of the similarity of meaning in different terms used. Another is "barrage." Suppose the word "barrage" had never been heard of, and an order was received to fire volley fire sweeping at a certain adjusted range and at the rate of a certain number of shots per minute. That would be a "standing barrage." If other ranges were used for specified periods of time, it would be a "rolling barrage." These are old methods refined for new conditions and are called by new names.

Before beginning any discussion showing the consistency of the old and the new methods, there are several points to be kept in mind. All fire on targets is divided into fire for adjustment and fire for effect. In the new methods as expressed in "Artillery Firing," fire for adjustment, as far as precision fire is concerned, is divided into two parts; namely, trial fire and improvement fire. Trial fire establishes a bracket which very probably includes the target in the zone of dispersion of its mid-range; improvement fire places the centre of impact on or near the target. Fire for adjustment may cease when the bracket has been established. This is called bracket adjustment. All of the old methods mentioned can be found in our 3-inch gun Drill Regulations; the new methods are in "Artillery Firing" and in "The Manual for the Battery Commander, Saumur."

First take up, in detail, the old method of fire for demolition in paragraph 1345 of Volume III. The initial range is

determined by the most accurate means at hand, and the ranging is started, taking the range bound called for by the problem. The battery is used as a whole from start to finish, but one round sensible for range is sufficient to permit a range change until the desired bracket is obtained—namely 100 yards (approximately 4 field probable errors). The 100-yard bracket is verified by at least four observations at each limit, and fire for effect is then started at the mean of the two elevations establishing the bracket. Fire is continued at this elevation as long as the number of shorts and overs observed are nearly equal. If at any time after 8 rounds are observed at this mid-range, a preponderance greater than 5 to 3 is established, the elevation is changed 25 yards in the appropriate sense, and fire effect is continued.

If, however, before the 100-yard bracket is established, a bracketing or mixed salvo is obtained, fire is continued at the bracketing (or mixed) range so long as the shorts and overs are nearly equal. As soon as a preponderance greater than 5 to 3 is obtained, the range is changed 50 yards in the appropriate sense.

The above method is accurate only when all the guns of the battery are shooting alike; that is, when they are all calibrated; and when the different elements of the target are at the same range and elevation with respect to the battery. It is very apparent that, unless these two conditions are fulfilled, each piece must have its individual adjusted elevation. If the above conditions are fulfilled, and the 100-yard bracket is established by 4 shorts and 4 overs, the probability that the target lies within the bracket is 96 per cent. Having obtained a preponderance greater than 5 to 3 at the mid-range, and having changed 25 yards in the proper direction, the target will lie within the 50 per cent. zone and can be destroyed. Because of the fact that changes smaller than 25 yards cannot be accurately made on the range scale of the 3-inch gun, the centre of impact cannot always be placed directly on the target. But the condition of having guns calibrated is very seldom, if ever,

accurately fulfilled, and the degree of certainty expressed by the above percentages cannot be depended upon. If a 100-yard bracket is obtained by an uncalibrated battery, the problem in figuring the probability that the target lies in that bracket is a complicated one; but the bracket for the battery can be considered as four separate brackets, one for each piece. This gives a 100-yard bracket for each piece established by one short and one over, and the probability that the target lies within the bracket of that piece is only 70 per cent. Again, when firing for preponderance, one gun may be giving shots entirely in one sense while the other three are giving about an equality of shorts and overs. Also two guns may give all overs and the other two all shorts, giving a result of equality at an ineffective range. The sum and total of the argument is that precision can be gotten best by single-piece adjustment.

This is exactly what the new method does; and, by a finer graduation on the range scale, enables the battery commander to put his centre of impact on the target, and does not permit him to be satisfied with merely having his target within the 50 per cent. zone.

The new method of fire for demolition or precision fire is as follows: Trial fire is carried on till a bracket of one fork is obtained, this bracket being verified by two observations at each of the limiting elevations. With this result, the probability that the target lies in the zone of dispersion of the mean of the two elevations, is over 99 per cent. Fire for improvement is then begun at the mean elevation where 6, 8 or 12 observations are sought, depending on circumstances. At this trial elevation a mixture of shorts and overs will usually be obtained, and from this mixture the preponderance in any direction is determined. The elevation is then changed by as many sixths, eighths, or twelfths, of a fork as are necessary to obtain equality of shorts and overs. This change will bring the centre of impact of that piece near the target; the centre being accurately placed during fire for effect. If the centre of impact is not on the target as a result of improvement fire, it can be

placed there as the result of further observation during fire for effect.

If during trial fire at any elevation a short and an over are observed, and this same result is obtained by a second group of two shots, fire for improvement is started at this elevation. If during improvement fire the first series gives shots all in one sense, the elevation is changed in the appropriate sense by one-half a fork and the second series fired. To compute the adjusted elevation all rounds of both series are considered as fired at the mean of the two elevations.

These two methods of fire are essentially the same in principle. The idea being to establish a bracket, fire at the mean range of this bracket, and then improve the adjustment by noting the observed number of overs and shorts. The essential difference in the two methods is that the American method makes an adjustment by battery, whereas the French method makes an adjustment by individual guns. There is no doubt but that the French method is the more accurate.

In firing through an area for effect, the new regulations require that a percussion bracket of the proper depth be obtained, and, in case of time fire, that the fire drop back to the nearer limit of the bracket and be held there while the height of burst is adjusted. However, air bursts *may* be used from the beginning whenever time is an important element or when percussion bursts cannot be observed. This reverses our method of procedure without altering the principle in the least. We have always adjusted our height of burst simultaneously with the range and direction adjustment, but we have had the alternative of using percussion bursts whenever the occasion demanded it. Formerly the French method was similar to our own. The reasons for the change are several, and are based on experience of the present war.

Every principle can be compared and found as sound as ever; and the conclusion to be drawn is that Volume III is not obsolete, but that it is quite up to date. This volume, supplemented by the French regulations and the *authorized* pamphlets,

ITALIAN 75-MM. FIELD GUN
Left side view showing gun locked in travelling position at muzzle

ITALIAN 75-MM. FIELD GUN
Right side view, showing gun locked in travelling position

should be thoroughly mastered by every field artillery officer, and every endeavor should be made to find similarities of principles in these volumes rather than to pick differences therein.

It must be remembered that the day will come when the trenches will be left for the open. When that day comes, the battle maps, the orienting lines and similar aids to precision will probably be left behind, and the field artilleryman will find himself equipped only with a pair of field glasses and a B. C. ruler.

On that day how will you feel; like the lost prairie dog looking for refuge in a hole, or the captive who has broken his bonds?

The Field Artillery Central Officers' Training School

WE reprint from the "Probable Era," the School paper, three articles which will be of interest to all field artillery officers who have not had the chance of knowing at first hand the great work being accomplished at the Field Artillery Central Officers' Training School at Camp Zachary Taylor, Kentucky. The task of training officers for the field artillery is a gigantic one; and how this is being done is best told by the men who are doing the work.

CENTURY OF WORK DONE IN THREE MONTHS

BY CANDIDATE ALFRED C. HOUSER

War is business—the biggest business in the world. Uncle Sam is admittedly the most successful and most canny business man in the world. Therefore, when it became necessary that he enter into the business of war he drew on his fund of commercial experience by adopting two basic principles—standardization and efficiency.

Typical and the newest example of standardization in the training of efficient commanders is the Field Artillery Central Officers' Training School at Camp Zachary Taylor, near Louisville, Ky. The public at large as yet knows little of what is being accomplished by this institution, but as time goes on there will be just cause for pride that such a gigantic task has been accomplished so quietly and so efficiently.

When did the school come into existence and who are the men who are running it? This is the natural query that the layman makes. The answer is illuminative and interesting.

The idea of centralized, standardized training for reserve artillery officers was conceived in the aggregate mind of the General Staff last spring. At that time artillery training schools were scattered throughout the country and as many different kinds of officers were turned out as there were camps. From now on every graduate will measure up to a fixed standard.

Maj. Gen. William J. Snow, Chief of Field Artillery, was the man on whom devolved the task of bringing the Central Officers' Training School into existence. First he needed a competent executive and thoroughly efficient military officer to assist him and take active charge. He

chose Col. Arthur H. Carter, then in the Ordnance Department. Col. Carter's qualifications were particularly adapted to the task he was required to undertake.

First of all he was a West Point graduate in the class of 1905 and had seen active service. He had served in the field artillery at Fort Leavenworth, Fort Meyer and in the Philippines on the staff of Brig. Gen. R. D. Potts, Commanding General of the Department of Luzon. Therefore Col. Carter had the military man's viewpoint.

Secondly, as a member of the Ordnance Department, he accomplished notable work in organizing sections of the administrative division. Therefore Col. Carter had demonstrated that he was a competent executive.

And last, but decidedly not least, Col. Carter's experience included work as inspector-instructor in field artillery for the National Guard in Minnesota, Wisconsin, Ohio and Pennsylvania. Therefore he possesses that most necessary of qualifications, the civilians' viewpoint, and can deal with it with sympathetic understanding. So much for the executive head of the school.

It is but natural that in looking about for a model on which to build the new institution Col. Carter should have chosen West Point and insofar as has been possible the methods in vogue at the national military academy have been adopted, with necessary modifications. For instance, the West Point honor system and the demerit system have been put into effect with complete success. The officer candidate who would cheat is not alone dealt with severely, but is hopelessly disgraced in the eyes of his fellows.

The Field Artillery Central Officers' Training School actually came into being June 20, the first roster of students being made up of candidates from scattered schools. The first class was graduated August 17, numbering approximately 1,100 men. A second class of 2,400 men was graduated in another two weeks, making a grand total larger than the number of officers which have been turned out of West Point since 1802, when the academy was founded. The first class of men to be trained from the beginning of the course will be graduated the latter part of October.

The course of study extends over twelve weeks, and in some cases a month or six weeks longer. The student candidate is given every chance, and if he does not make good it is deliberately his own fault or else he is hopelessly disqualified, in which case he goes to a replacement depot, where his services can be more effectively utilized in the service of his country.

Even when a candidate who seems to be disqualified has been called

before an informal investigating committee, which is headed by the executive officer, Licut. Col. A. C. Goodyear, his case is not hopeless. He may appeal to a formal board and present arguments to show that he is qualified to continue the course. But before a student's case reaches the court of last appeal he has been given every assistance possible. If he has failed in any subject in any week he is reported by his battery commander to the commandant and his case is made the subject of a careful investigation. If it is discovered that the candidate is merely a trifle slow, or "rusty" in certain subjects, he is sent back to an observation battery and given another chance.

The new student candidate on entering the school goes into what is called the observation area. Here for a period of from two to four weeks he is given the benefit of a course of intensive training in infantry drill, military dress and mathematics. During the period he is carefully studied by his battery officers so that when he is ready to go into the training school area proper he has been properly appraised.

For the man who comes from a military camp where he has had some previous military training the observation period of training is not unusually severe. But for the civilian, soft from the routine of his daily pursuits—oh my! At the end of the third day he is absolutely certain that he will never live to the end of the week. The fourth day he hopes he will not live that long. Every time an officer addresses him he quakes in his boots and morning inspections are a nightmare.

But curiously enough he does live to the end of the week and then comes his first Sunday and Saturday half holiday. He dons a white shirt and a stock, is given a pass to go outside of the camp, the soreness is beginning to leave his muscles and then he begins to note a curious phenomenon. He has a sneaking feeling of pride in his military bearing and when no one is looking struts a bit and executes a few "about faces" just for the fun of the thing. When he succeeds in clicking his heels he is like a boy with his first long pants.

The course of study, which embraces twenty-six scholastic subjects, is under the supervision of Lieut. Col. Frank H. Hicks, who was graduated from West Point in 1911. He served two years in the cavalry and then resigned to enter business. At the outbreak of the war he entered a training camp, just like an ordinary layman, and earned his commission all over again.

The course embraces forty-three hours of class work each week, eight hours a day except Saturday and Sunday and study periods of an hour and a half each evening.

The daily schedule for the first two or three weeks is as follows:

5:30 to 5:45 a.m.—Physical drill.
7 to 7:50 a.m.—Inspection.
7:50 to 8:40 a.m.—Mathematics, algebra and geometry.
9 to 9:50 a.m.—Dismounted drill and military courtesy.
9:50 to 10:40 a.m.—Mathematics, algebra and geometry.
10:40 to 11:10 a.m.—Physical drill.
1 to 1:50 p.m.—N. C. O. Manual.
1:50 to 2:40 p.m.—Dismounted drill and military courtesy.
3 to 3:50—Lecture subjects.
3:50 to 4:40—Military courtesy.

A typical daily schedule in the seventh week is as follows:

5:30 to 5:45 a.m.—Physical exercises.
7 to 8 a.m.—Firing battery drill.
8 to 9 a.m.—Driving drill and signals.
9:15 to 10:15 a.m.—Map reading and sketching.
10:15 to 11:15 a.m.—Use of battery commanders' instruments.
11:15 to 11:45 a.m.—Signalling.
1:15 to 2:15 p.m.—Protection for guns, ammunition, etc.
2:15 to 3:15 p.m.—Reconnaissance.
3:15 to 4:15 p.m.—Ballistics.
7 to 8:30 p.m.—Study period.

Candidate students are graded on technical subjects upon a basis of 100, with 75 as the lowest passing mark. Men are also appraised according to the Officers' Rating Scale. This embraces their measure on a scale of physical development, intelligence, leadership, personality and general value to the service. The scale was devised by Dr. Walter Dill Scott, director of the War Department's Committee on Classification of personnel in the army.

In determining the final grade of the candidate and his class standing the Officers' Rating Scale grade and the combined grades in technical subjects count one-half.

Lieut. Col. Hicks' staff of instructors consists of more than 200 Captains and Lieutenants, and their general policy, in accordance with instructions from Col. Carter, is that "there must be justice and sympathy with the viewpoint of the student."

With the completion of the enrollment now under way it is probable that within the next several weeks there will be in the neighborhood of 20,000 students in the school.

Officer candidates up to August 8 came from two sources—enlisted men in the army chosen as officer material and qualified civilians between

20 years and 8 months and 40 years. On the above date the Adjutant General ordered that no more civilian applications are to be received. Citizens are privileged, however, to apply to Maj. B. H. Dibblee, Assistant Adjutant of the Field Artillery Central Officers' Training School, for blanks to be filled out for consideration, if the present order is later withdrawn.

COLONEL CARTER EXPLAINS AIMS OF ARTILLERY SCHOOL

BY CANDIDATE JOHN KIRBY

On June 2 Maj. Gen. William A. Snow, Chief of Field Artillery, called Col. A. H. Carter into his office at the War Department and said to him in effect:

"Colonel, since you were assigned to the Ordnance Department you have repeatedly intimated that you desired more active service and that you were extremely anxious to return to the artillery, the branch in which you specialized since leaving 'The Point.' I have now found the job for you. It may not be the showiest post in the service, but it will give you all the hard work you want, and is second in importance to none held by an officer of your rank. You will organize a Central Officers' Training School at Camp Zachary Taylor. You will prepare plans immediately for a school large enough to train all the officers that will be needed, in addition to those already in the service. When the plans are approved by the Chief of Staff you will execute them without delay."

With a pencil and piece of paper as his only available material Col. Carter proceeded to execute his orders. Within a few days, on June 6, to be exact, his plans were completed, and on the same day they were laid before Gen. Peyton C. March, Chief of Staff of the army. Of all the men in America competent to pass judgment on such a plan none could be compared to the Chief of Staff, because it was Gen. March whom Gen. Pershing chose to be Chief of Artillery of the American Expeditionary Force, in which capacity he had unlimited opportunities of studying the French and British schools and systems before being recalled to America to take up his present duties.

It took Gen. March less than five minutes to satisfy himself that the plans made by Colonel Carter contained all the potentialities requisite for the organization of the greatest artillery school ever established in America—or, as far as we know, anywhere in the world. The plan gave in detail everything required to place the school on a working basis overnight.

Col. Carter accepted the detail with one proviso—that he be demoted to the rank of Lieutenant Colonel. The reason for the request was as

simple as it was magnanimous. When detailed to staff duty in the Ordnance Department he had been given an "eagle" so that he would have rank commensurate with his duties. When reassigned to the artillery branch Col. Carter found that he ranked many of the artillery officers who had been his classmates at West Point. He was unwilling to take this advantage and was demoted in accordance with his wishes.

Col. Carter, however, was destined to lay aside the "eagles" for a short while only. Before the school had been in operation many weeks he was again promoted to the rank which he had voluntarily given up.

That represents the plain, unvarnished story of the creation of the plans which led to the organization of the F. A. C. O. T. S. as it is to-day. The details of just how Col. Carter made his plans may be presented later. The story of the execution of those plans represents another chapter in the history of the school. It is a story of self-sacrifice, fidelity to duty and untiring labor, which, although of not nearly so picturesque a nature, will measure up well beside any episode on the firing line.

Before leaving Washington for Louisville Col. Carter was lucky enough to have Maj. A. C. Goodyear assigned to assist him. In choosing Maj. Goodyear as his assistant Col. Carter was actuated by a desire of having at his elbow an officer fresh from civil life, whose training would be invaluable in smoothing over the thousand and one difficulties which naturally arise when the military and civilian viewpoints come in contact. Immediately after Col. Carter reached Camp Zachary Taylor, 165 officers were assigned to assist him in executing the plans for the school organization and in putting them into operation.

Until they presented themselves for orders Col. Carter had never before laid eyes on a single one of the 165 officers who reported to him that day. In fact, he had never heard of most of them, and the only idea he had of their varying degrees of ability was based upon the fact that the War Department had chosen them for the work.

It is impossible to recount in detail the instructions given to these officers when they arrived to take up their new duties. The one fact that was impressed on each and every one of them was that the success of the great school would depend absolutely upon their diligence and devotion to duty coupled with the determination of each man to put every ounce of "pep" he possessed into his work every day of the week. Particular emphasis was laid upon the fact that under no circumstances should any officer indulge himself in the popular American practice of "knocking." Col. Carter explained that when an officer found things not to his liking the place to report the trouble was to his superior officer and to none other. So long as such reports were not

received at headquarters the commanding officer would assume that all was proceeding properly and that any officer making "informal" complaints, commonly known as "knocking," would be held to strict accountability.

The degree to which Col. Carter's demand for "team work" has been carried out is best evidenced by the inspiring manner in which officers of all grades have done their work with untiring good-nature and fidelity. It requires no comment here. The best method of estimating not only the success of the system but the improvement which has come to the various officers themselves, is shown in the list of promotions which have been made in the commissioned personnel since the school was opened. That every officer assigned to the organization since June has improved himself at least 20 per cent. has become camp axiom.

The "Probable Era" in this, its first edition, has the distinguished privilege of presenting its readers with Col. Carter's personal impressions of the school. While opposed to talking for publicity under ordinary circumstances, Col. Carter consented to discuss with a reporter for the "Probable Era" the development of the school, and to answer a few questions which have been uppermost in the minds of many of candidates.

"You have asked me to tell the readers of "The Probable Era" in a general way just how the decision was reached to organize the school upon its present lines," Col. Carter said, "That is not difficult. I immediately went back sixteen years or so ago to the days when I was a cadet at West Point. I decided that the only fundamental principles to build upon were those used so successfully at West Point, and that the ideal school, under the circumstances, would be based upon those principles adjusted to the difference in age and training of the men who could enter the school.

"Therefore, with the West Point curriculum in mind I immediately asked myself just what I could do at my present age, and decided that no man who entered the school would be required to do anything that I could not do. That is the basis upon which the school was planned, and that is the basis upon which it will be carried out. The degree to which the plan will prove to have been the wise one will be established eventually when there is an opportunity of estimating the degree to which the graduates succeed in the field. As far as it is possible to pass judgment at this time it appears that the plan was properly conceived.

"Everyone realizes that a man coming from civil life is somewhat shocked, at least in his mind, when he finds himself being trained physically and disciplined mentally under a military system. It is not an easy task to change over night the method of living, working and thinking to which a man has been accustomed. For this reason the observation

batteries were organized. The idea was to give the candidate an opportunity to reorganize himself during a course of a few weeks and to give his instructors an opportunity of estimating whether or not he was fit to become an officer. It is an excellent test. I think that any unbiased observer who has watched the military development of the men in this initial change will be pleasantly surprised if not actually astounded at the things that the American man can do when he puts his mind upon it.

"The first quota of men who entered the camp came from the ranks of those who had been drafted or had enlisted in the army. These men, having had some military training, went through the course remarkably well. Of the first class, which was graduated on August 17, 10 per cent. failed. These classes represented the picked men from the various batteries that entered school in June. The second graduation was held on August 31, and approximately 80 per cent. of those enrolled were commissioned.

"As soon as the school was in working order plans were prepared for accepting from civil life directly men not within the draft ages. The reasons for so doing appear to be self-evident. The method of selecting them remained to be solved. Of course, we wanted only the best type of men in the country. Various methods of examining them were adopted in the several sections of the country, and a thoroughgoing system of checking them up was worked out. In this first combing process we eliminated many men who for one reason or another appeared to be unsuitable. Of the men who finally reported here, virtually all were accepted, and there is little doubt that every one of them who does his very best from day to day will leave here with a commission or certified as eligible for a commission.

"Are you satisfied with the type of men who responded to the call, Colonel?"

"Satisfied," Col. Carter replied. "I am more than satisfied. I am delighted. I doubt if a finer class of men was ever gathered together at any time or place. The men represent the pick of America, and that means the pick of the world. The best evidence I can give of what I think of the candidates may be gathered from the answers which I gave people in Louisville when they asked me to select a list of candidates who could properly be invited to entertainments. I invariably replied that any hostess who desired to invite candidates need simply start at the A's and go right down to the Z's and she would make no mistake. There is no such thing as picking and choosing. All of the candidates are in virtually the same class—the best class. Of course, there may be a few here who have sowed a few wild oats or something of the

sort, but they will come out all right in short order if they will but do the work assigned to them and bury any inclinations that may arise to do otherwise.

"When we began to organize the curriculum one of the subjects which required much thought was mathematics. I realized readily that we could not expect men who had been out of school or college five, ten or fifteen years to be as fresh on these subjects as the lad who had just stepped out with a diploma or a degree. I realized also, however, that any man capable of holding a commission could readily freshen up on all the mathematics required in the course if he would only concentrate upon the work as hard as, in civil life, he would concentrate upon a business or professional subject which was important, if not vital, to success. Therefore we "skeletonized" a mathematics course that eliminated all that was unnecessary and emphasized all that was vital.

"The result has been that men are astounded by the ease with which the old rules and formulas come back to them and grasp it all readily, providing, of course, that they put their minds upon the subjects. Incidentally the mathematics work in the observation batteries helps men tremendously in rebuilding self-confidence for their new lives. The course not only assists the candidates in brushing up, but shows them, by sharpening their wits, how easy it is to grasp all the work in the course, providing they will work and try as hard as possible.

"The idea of this short, intensive course is twofold. The first is to make soldiers of the men. In order to make a soldier of a man discipline must be drilled into him twenty-four hours of the day. Without discipline you cannot have an army. Of all the branches of the service discipline is most necessary in the artillery. The slightest error on the part of an individual, no matter whether he be an officer or an enlisted man, may result in a catastrophe. Without the most refined teamwork from top to bottom you cannot have a good platoon, a good battery, a good regiment or a good brigade, and there is no place in the American army for anything except the very best.

"It is for this reason that we drill men night and day into the habit of discipline. We drive it in them in every possible way—into their heads, backs, shoulders, arms and feet. If I could find some way to inject it into the pores that would be done also. Of course, many of the tasks assigned to matured or maturing men appear on the surface to be trivial, but they are not. They are vital. The man who cannot or will not put his very best into every assignment is not fit to be an officer and will not be commissioned as long as I am here.

"No man is given a task that his officer cannot do and when the candidates leave here as commissioned officers they must follow the same

rule. They shall never ask an enlisted man to do anything that they cannot do.

"Having thoroughly drilled every candidate in the fundamentals that every soldier must know and practice, the second stage is entered, that of teaching the principles of artillery. The course was designed so that every candidate who leaves this school with a commission can immediately step into an artillery organization and function as an officer. If he has done his work properly here he need have no fears when he is assigned to an organization in the field. He can fit right in.

"Let no one imagine, however, that when he leaves this school he is a finished artilleryman. He is not. He is at the beginning only. But if he will persevere and continue his studies he can and will move toward the top. The highest command is the only limit. I am frequently asked what will become of the officers commissioned. They will move towards the battlefields just as rapidly as the War Department requires their services. Of course it is impossible to say definitely when any class will reach the front overseas, because it depends upon the developments of the war. But one thing is certain: unless there is an unexpected change in the situation they will be moving over seaward before very long.

"There are two rules which I believe will guide every candidate to success. The first is to concentrate and the second is to observe. Let each man constantly concentrate on what he is doing to the end that he will do it perfectly or as nearly perfect as possible. Let each man use every opportunity to observe the manner in which the officers at the school act. I am a great believer in the lessons of observation, and I know that each candidate who will avail himself of every opportunity to improve himself by observation will be surprised at the progress he makes."

In conclusion Col. Carter said that while there are now approximately 6,500 candidates at the school, he hopes before very long to increase the number to 14,000 so that six batteries or a total of 1,000 men may be graduated weekly.

THE NEW HOME OF THE F.A.C.O.T.S.

Additional plans now made public emphasize earlier announcements that the new plant of the Field Artillery Central Officers' Training School at Stithton, Kentucky, will be probably the largest and most complete plant of its kind in the world.

Following a visit of inspection to the site by Colonel Carter,

Lieutenant Colonel F. H. Hicks, Major Crane, and Architect Bennett, of Chicago, it was stated that work on the new buildings would begin this week. It is hoped to have the construction completed by December 15, at which date, if the building schedule is on time, the entire Field Artillery Central Officers' Training School will be moved from Camp Zachary Taylor to Stithton.

The new camp will be built around a huge cross-shaped drill field. Each of the four projections of the cross will be a drill field 400 yards by 200 yards.

The country is admirably adapted for artillery training, being rolling.

Candidates will be housed in barracks built on a new unit plan, each unit being a two-story building housing sixty men, there being four such buildings assigned to each battery. Another innovation will be the provision of one building to be used as a study hall by each battery.

General administration offices will be located on a knoll at the centre of the huge cross formed by the drill field. Besides these offices each battalion will be furnished with a headquarters of its own.

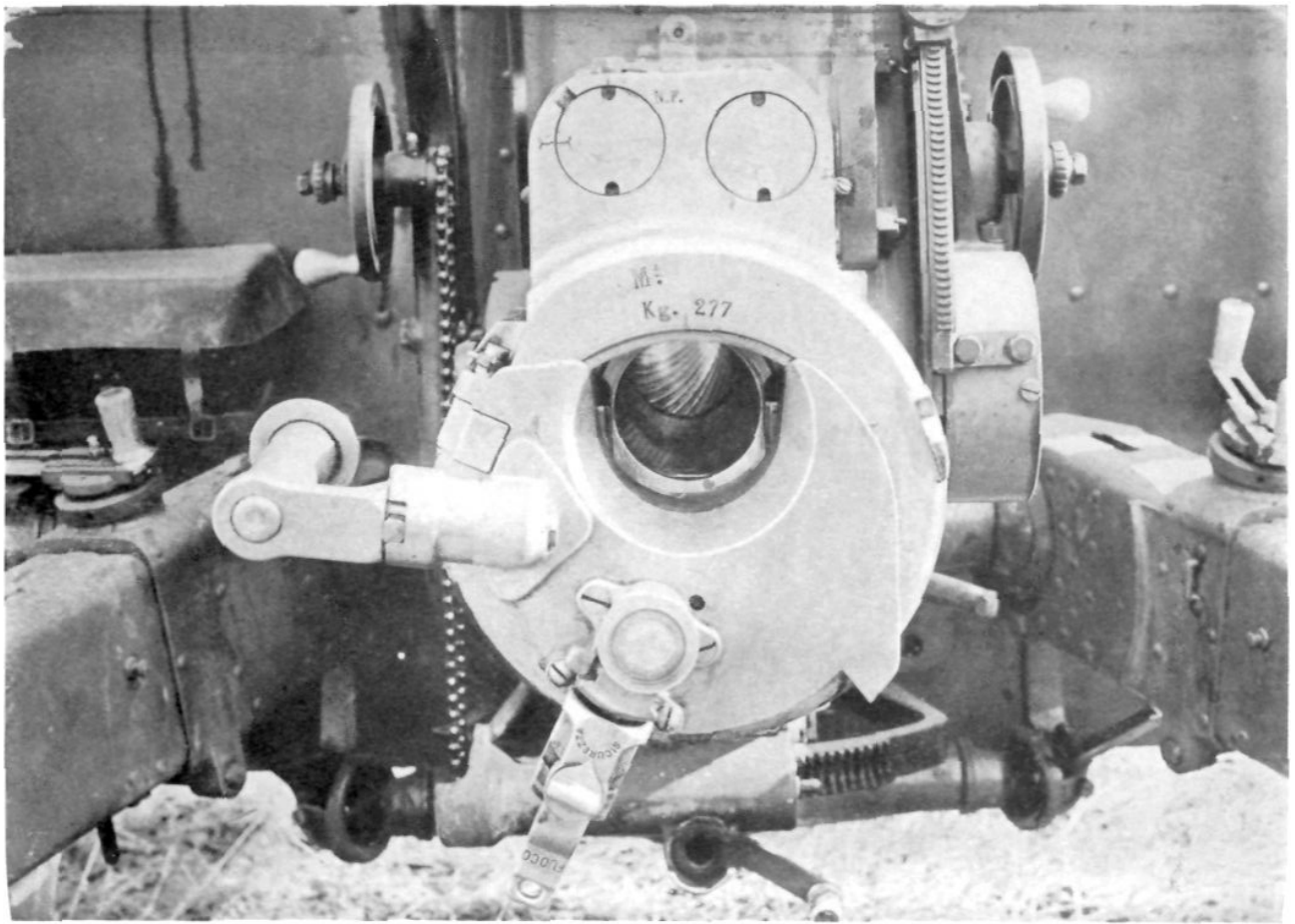
In order that inclement weather may not interfere with drill, a 300 by 600-foot drill hall will be constructed. Also, there will be an assembly hall seating 2,500.

Special provision will be made for the relatives and friends of officers and candidates visiting the camp. These visitors will be accommodated at a visitors' house, 60 by 30 feet.

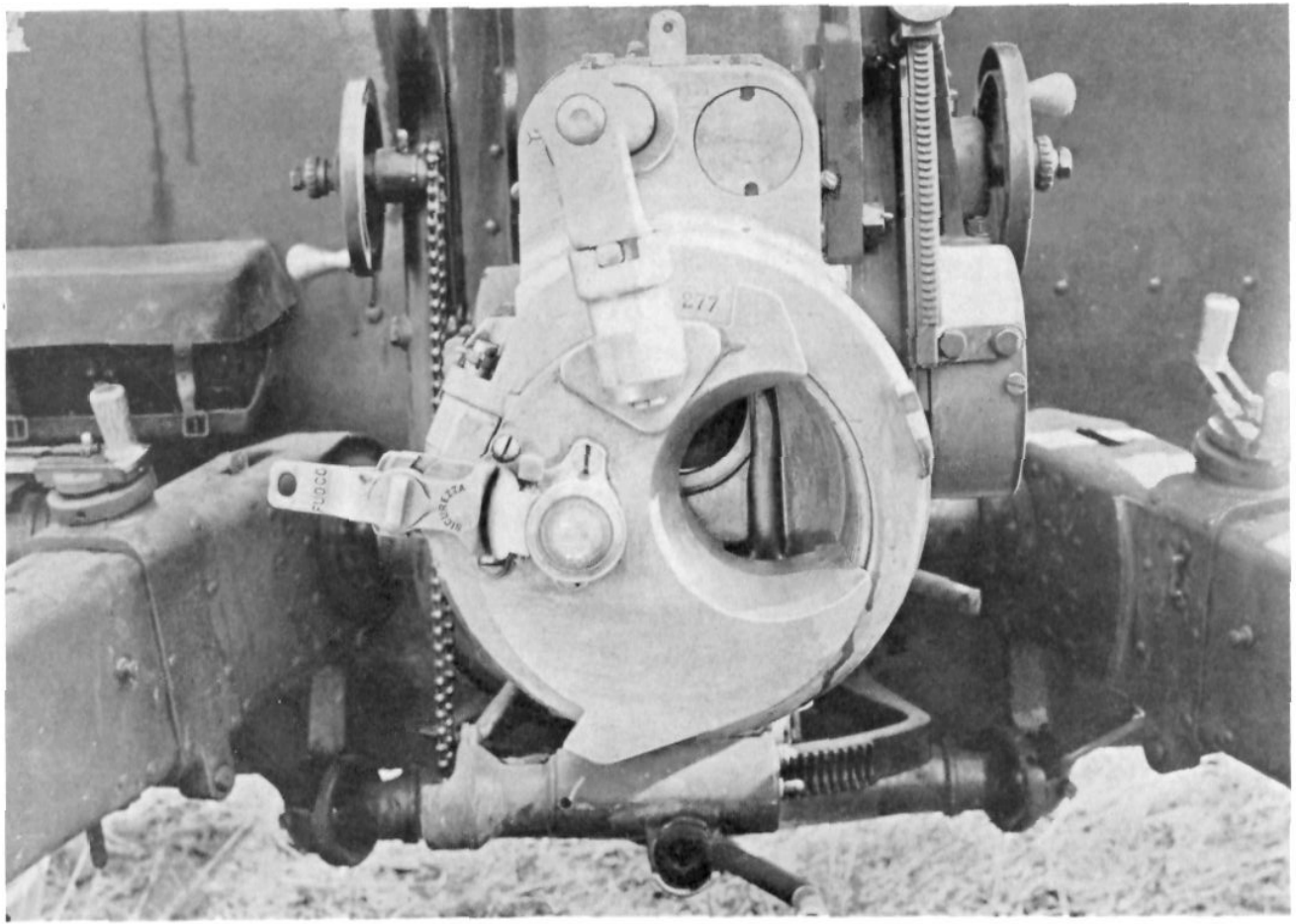
Some idea of the number of officers required to direct the activities of the huge artillery school may be gained from the fact that there will be four distinct officers' messes.

Within a few days an army of 4,500 men will be engaged in building the new school, and every effort will be made to rush it to quick completion.

On another part of the Stithton reservation a brigade training centre is being established. The plant will take care of four brigades at once. About half of the buildings have been completed.



ITALIAN 75-MM. FIELD GUN, BREECH MECHANISM, BREECH OPEN



ITALIAN 75-MM. FIELD GUN, BREECH MECHANISM, BREECH PARTIALLY CLOSED

Our Motorization Problem

PREPARED IN THE DEPARTMENT OF MATÉRIEL, SCHOOL OF FIRE FOR FIELD ARTILLERY, BY MAJOR JOSEPH W. KELLER, F. A.

DUE partly to lack of training, of matériel, and in many cases to a sense of false security based on personal experiences with their own cars, there has been noticed a decided tendency on the part of officers of motorized field artillery organizations to minimize the importance of the situation that confronts them. The problems attendant upon the organization, maintenance and use of a motorized outfit are not one bit less complex or technical than those of a horsed unit. With the conditions prevailing overseas, few commanders of horse artillery would care to take to Europe an organization which would have to receive all its training in equitation, draft, care of the horse, and other related phases after arrival in France. Yet many regiments of what will be motorized artillery have done just this thing. In none of these cases has the action been wholly justifiable. Much could have been done in this country with very limited equipment easily procurable at any camp or post. The temerity on the part of the commanders is doubtless due mostly to a lack of appreciation of the problem with which they will be confronted when motorized, and a belief that the average American is a natural mechanic, born with a wrench in one hand and a steering wheel in the other. They are due to be sadly disillusioned. Americans are mentally quick and have lived in a country where machinery plays a big rôle, but they are no more natural-born mechanics than they are natural-born soldiers. Up to date a limited supply of men who have had some previous experience in civil life with motor transport has been available. This is due to the large number of automobiles in this country, but even this class of men is limited and the future must be kept in mind. What then is a possible solution—what can be done?

Many officers have false ideas as to why so many of our regiments are motorized. Much valuable time has been wasted over useless discussions of whether the horse can do more than motors. All this is beside the point and serves only to further reveal a lack of appreciation of the situation.

Motors were not adopted because they could take guns where horses could not. In some cases horses can take light artillery where no motor can as yet follow, in other cases motors can take guns where horses cannot follow. Generally speaking, in light artillery, horses have the advantage in difficult terrain, motors in speed and field of operation. For heavy artillery, tractors undoubtedly are the logical means of transport.

Motorization for the present emergency is demanded for several reasons. Chief of these is economy of personnel, matériel, supplies and operation. In a motorized regiment of heavy field artillery a tractor driver takes the place of four horse drivers. This is an economy of men engaged in non-combatant work, and means fewer men on the echelon. One tractor takes the place of at least nine horses with their considerable equipment of saddlery, etc., which when we consider original cost, shipping charges, and other incidentals is a real money and space economy. There is no place where the economy is more apparent perhaps than in the question of supplies. When motors are not in use they use no gas, oils, or other supplies; horses must be fed constantly. When in use, mileage considered, there is no comparison between the amount of transport needed for forage constrasted with gasoline and oils. In operation, aside from economies previously mentioned, in the size of parks, amount of road space taken up on the march, speed, field of operations, and ease of concealment, the balance is all in favor of the motors. However, it is a decided mistake to believe that motors need less care or will in any way lighten the burden of those assigned to their upkeep or operation. Such a conception on the part of either officers or men is fatal to the maximum

efficiency of any motorized outfit. Another very important phase of the adoption of motors, lies in the fact that while our possible supply of horses is limited, our supply of mechanical draft knows no limit but the production of our mines and the size of our factories.

Any uncertainty as to details of his future equipment or lack of matériel furnishes no legitimate excuse to any officer for neglecting to institute at least elementary motor training in his command. There is little basic difference between a four-wheel or rear-wheel-drive truck, or between a 2½- or 10-ton caterpillar tractor. A soldier that can handle one can quickly learn the other. It is doubtful whether there is a camp in this country where several automobiles of some kind are not available at least part of the time for training purposes. Proportions and details of construction vary, but, from the cheapest of pleasure cars to the heaviest of trucks, the governing principles are the same. If you can grind a valve, adjust a bearing, or put a new porcelain in a spark plug of a Ford, you can do it to a F.W.D. 3-ton truck. Many of our camps are near cities of such size as to make either commercial Nash Quads or F. W. D. trucks available for instruction purposes even if they have to be hired. These trucks are substantially the same as the ordnance models. Moreover, the regular ordnance models are now in such production that it should in no case be difficult to obtain a few for training purposes. But get something. Start your training. Make it real, with the eye and hand confirming the brain.

The first and most important problem confronting an officer who is instituting motor training is the selection of the personnel to be trained. Look over the qualification cards of your command and consider first your engineers, machinists, and others of similar previous experience which would likely fit them for their new work. Don't give men definite jobs until you have tried them out. Finally ask for volunteers. The dreams of many a former clerk have been of gears and shafts and grease and waste. And that man generally makes a good man. Watch carefully the ex-chauffeur or repairman. When

applied to military work, you will often find this another case where "all is not gold that glitters."

Many good courses of training for the personnel of motorized organizations have been made up, so that we do not here intend to take up space by presenting our own "pet" theories. After you have chosen what seems to you a good course of training, watch your men. Some will display unusual aptitude in driving, the mechanical phase will appeal to others, while motorcycles will surmount all else in interest for still others. Here is the answer and guide to your selections. After certain basic training, your courses will begin to branch out and specialize. Have your drivers drive as much as possible, your mechanics repair, and your motorcyclists ride. Don't try to make every driver a mechanic. You have not the time and your men can't be masters of all trades. So far as your officers are concerned you will have to be judge of how much you wish them to know. Certain phases, such as care, road discipline, expedients of the march, and minor repairs, they must know to be efficient. Certain it is, the more they know, the more their men will know.

During the training of your men and thereafter, great stress must be laid not only on the operation but also on the care of the motorized equipment. There seems to exist among many the idea that metal is indestructible, that it suffers no deterioration when not in use and very little while in use, if liberally oiled. They believe wear so slight that frequent close adjustments are unnecessary and that external dirt means nothing to the interior of the mechanism. Nothing could be less true. Every motorized command should have "stables" as regularly as a horsed unit. If necessary, trucks and tractors should be "groomed by detail," cleaning, replenishing water and gas, lubricating, examining and adjusting being executed in the order named. This should be done under an officer who will verify the reports of work completed. Under ordinary conditions, "stables" should take not less than three-quarters of an hour daily, and no work should be regarded as complete until

the truck is in condition to take the road on a moment's notice.

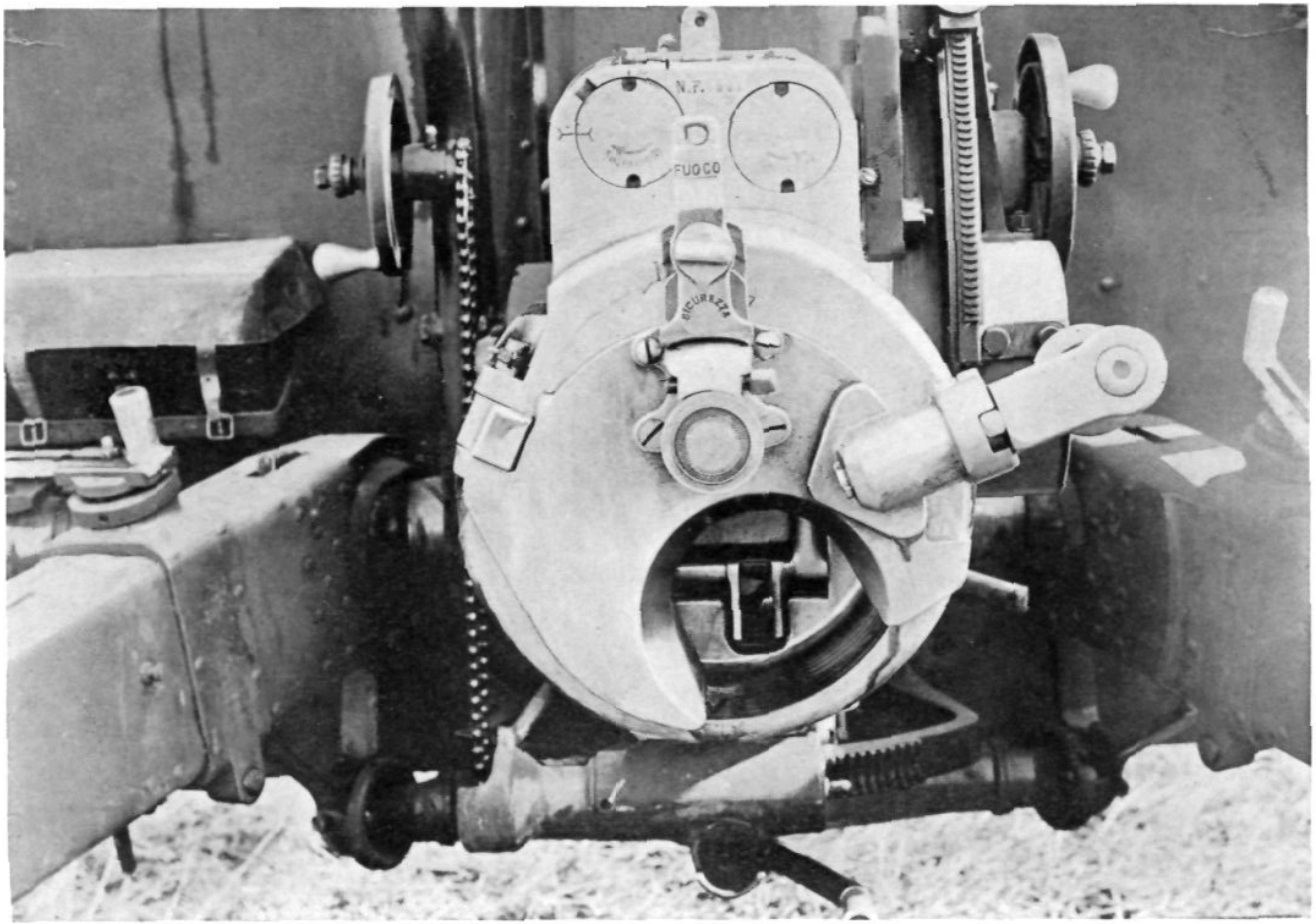
Careful records of mileage, gas and oil consumption of each truck must also be kept. In addition to the daily work a more detailed examination and lubrication of all equipment will be made weekly, and monthly a most exhaustive inspection of both shop and road should be made. Lubrication in every case should be on a time basis, not mileage. This is the result of actual military experience with motorized batteries. The average repairs can easily be made by your battery mechanics, more extensive and delicate repairs must be referred to the battalion or regimental repair trucks or to the ordnance repair shops. Magneto repairs especially must be referred to trained specialists and never attempted by drivers or the general run of battery mechanics. If there is one thing the average American possesses, it is self-confidence. This often results in drivers or battery mechanics—abetted by their commander's desire to have a record of keeping his trucks out of the shop—attempting repairs far beyond their capability to handle. Many times serious damage is done. If in doubt consult your experts; they are the "veterinarians" of your command.

As a logical sequence to care and maintenance in camp, there then follows the work of keeping the motors on the road. This involves two different problems; first emergency repairs to equipment, and second overcoming unfavorable road conditions. Very good results in teaching emergency repairs to matériel have been secured by an improvised game. Drivers and mechanics are assembled and the instructor asks questions in turn. For instance, "A shell fragment has torn off your left front wheel, the road is under fire, how are you going to get your truck out of the way?" Then make the man do it. The first thing you know you'll find the men thinking up possible accident and repairs you never thought of yourself. The instructors may have thrown at them questions that will make them scratch their heads, but that indicates a healthy condition for both. Overcoming unfavorable road conditions will bring some engineering into play. Shoring up bridges, rigging

up pulleys, preparing fords, buildings short passages over bad swamps or quicksands, all of these and a hundred other possible emergencies should be thought of and planned for before they are met.

The proper use of your equipment is, of course, the end toward which all effort is bent. Fortunately, the drill of motorized commands is very limited, quickly learned, and easily executed. Owing to the extreme variations of speeds and consequent difficulty of handling, small groups only will be handled as a rule. In march discipline, the utmost of careful training is necessary. Have you ever considered the importance of proper loading, or running distances in a motorized train? How would you keep control of a train on a dark night, when you can't use lights? Why and for how far must the head of a train run slowly after gaining the top or bottom of a hill? How many of your men can gauge a distance fairly accurately and maintain it in a column? And these are but some of the simpler problems of discipline. Can your sergeants read a simple road map, follow strange roads at night, take supplies to a battery, or take in and bring out a gun without getting lost, drawing fire, or leaving marks on the ground that will give valuable information to enemy planes when they take photographs the next morning? Can any one of your officers do it? There is no reason why you can't train them to do so *now,* instead of overseas when you have less time.

Have you thought of all these things and prepared for them? In this country you have perhaps lacked sufficient guns or ammunition for training in firing. Have you used that time that should normally have been spent there in teaching your men an equally important thing, how to transport the guns, get them into position, and supply them? Sit down, think it over, and see whether or not you have fully appreciated before one of the new phases of our new army, our motorization problem.



ITALIAN 75-MM, FIELD GUN, BREECH MECHANISM, BREECH CLOSED

Training Gun Crews

BY COLONEL RALPH McT, PENNELL, FIELD ARTILLERY, U.S. ARMY

1. This article is not intended to cover all the work of the gun crew, it is intended merely to cover certain points sometimes lost sight of. References are to the 3-inch gun, but any crew efficient in serving that excellent weapon will have little trouble in mastering any other.

2. All refinements taught have but one prime object, that is accuracy of fire. It is of no value to make atmospheric and velocity corrections if still greater variations are constantly introduced by poor service of the piece. The foundation of battery efficiency is well-trained gun crews. Officers may be able to lay out orienting lines with the greatest facility, may know the range tables in the dark, but it will avail little if they cannot train men to apply properly and accurately the data determined.

3. The safety of our own infantry and the effectiveness of our fire are absolutely dependent on the continuous training of gun crews, and the resultant precision and sureness with which they perform their work. This result can only be attained by constant drill from the day the recruit joins until the day of his discharge; not by long drills in which he grows tired and loses interest, but by short periods broken by instruction in other subjects; not by many hours one week and none the next, but by a short period every day of every week. The best of gunners grows rusty in a very few days; constant short drills will give results and are the secret of success. Every man must get instruction every day, be he raw recruit or expert gunner.

4. Cannoneers should be taught that the greatest crime that can be committed in laying the piece is to make an error—the only crime for which there is no punishment. An error or mistake in the correct service of the piece should not be punished, but it should be carefully explained how the efficiency

of the battery depends on each member, and to insure that crime is not committed again, additional hours of instruction beyond that required for the rest of the crew will be necessary.

5. Every man must be on his toes from the time he comes in sight of his gun, every movement at the piece must be at a run. Slow and sleepy motions of one man will kill all the snap and energy of every other member of the crew. Do not, however, confuse speed of performing any given motion with hurry in execution of detail. For example, the gunner must move with snap and energy in getting his eye back to the sight and his hand on the traversing handwheel after the piece is fired, but he must never be hurried in getting the vertical wire exactly on the aiming point, or in making the ordered changes in the deflection setting. Stop watches should not be used. They are a fruitful cause of errors. Speed comes from continual practice and it cannot be artificially attained by stop-watch timing. Do not understand that speed is not desirable, it is highly desirable, but practice alone will give it and it will nearly always be found that the best-trained crew is the fastest crew. Competitions between crews must be for accuracy, not speed. If every motion is made with a snap and at a run the results as regards speed will be satisfactory.

6. The accuracy of fire is affected by brakes not being adjusted for equal tension, by direction of recoil not being in line with the trail, by No. 2 sitting on the handspike and shifting his weight after the gunner has called "Ready"; by No. 1 jerking the firing handle; by the gunner not keeping his shoulder against the guard; by elevating cranks not being properly assembled; by sights and quadrants not being properly adjusted or locked with means provided (this subject deserves several pages); by variations in the amount of oil in the cylinder; by improper adjustment of the gland; by the gunner coming on to the aiming point sometimes from the right, sometimes from the left; by the No. 1 centering the bubble sometimes from front to rear, sometimes from rear to front.

7. You may have stood behind a battery firing and noticed

how one or two guns jump violently in recoil, while others would hardly disturb the proverbial glass of water on the top of the wheel, although all guns of equal service. This was due almost entirely to the lack of proper adjustment of some of the parts mentioned above.

8. Every member of the crew must know his duties so well as to make his motion automatic; the direction to turn the various handwheels, milled heads, and gears to obtain the desired result, and he must always do these things in the same way. The effect of small differences in laying may be graphically shown the gun crew by firing sub-calibre ammunition at a small arms steel target which rings a bell when a bull's-eye is made. Erratic shots mean poor adjustments of equipment or poor training of the gun crew. Pleas that worn matériel or lost motion, or defective ammunition are the causes of erratic shooting are largely excuses for ignorance, laziness, and lack of proper instruction. Worn matériel requires more makeshifts, takes longer to lay and more careful watching, so that fire cannot be so rapid, but except for wear in the bore of the gun it is possible to do almost as accurate shooting with worn matériel, especially if the new matériel has not been thoroughly worked in.

9. Among the more important duties of the men may be mentioned the following:

The Chief of Section.—Must teach his men to have pride in the gun they serve, and the reputation of the section. He shows each member how the accuracy of the firing is dependent on him, and that one man may ruin the best efforts of all the others. He must keep his matériel as clean as when it left the maker's hand, every part functioning properly, every screw and nut tightened, no burred nuts or bolts, or missing split pins. He helps each member to take a pride in keeping the part for which he is responsible as clean as a new pin and in perfect condition. He sees that the various canvas covers, and sponge and rammer never touch the ground where they will gather dirt. He knows the proper use of his tools, and the correct adjustment

of the firing mechanism. He must be able to assemble and disassemble blindfolded the firing lock and breach mechanism. In firing he knows the settings of all scales without reference to a data book.

The Gunner.—Knows that turning the levelling screw clockwise moves cross bubble to the right; that turning scroll gear clockwise increases the range; that turning the peep sight screw clockwise increases deflection, and so on with all handwheels, etc., that he operates and must know these things so well that he operates them in the proper direction automatically. Must always bring vertical wire on aiming point from the left to take up any play in traversing mechanism. He verifies that he is on the aiming point after the breech is closed and if there is any delay, again immediately before firing. He gets his eye back to the sight and relays *immediately* the gun returns to battery. He knows his scale readings at all times. He keeps his sight scrupulously clean, never permits his finger to touch the objective prism when turning the rotating head, nor wipes off eye piece with hand. He keeps his shoulder against the guard at all times.

The Number 1.—He knows his site and range scale readings without having to look at them. In centring the bubble he brings it always from front to rear to take up play in the elevating mechanism. He centres the bubble so accurately that it is not the thickness of a sheet of tissue paper nearer one graduation than the other, and what is most important he sees that it stays there until he fires the piece, when he promptly recentres it. (The latitude allowed in centring the bubble by our gunners' examination is responsible for 20 per cent. of our field probable error.) He must not fire the piece with a jerk but with a constant even pressure, else he may destroy all his accuracy of levelling. The same principle applies if he uses the lanyard. He keeps his quadrant free from any sign of dirt, and assures himself that it is in perfect condition. If the gunner fails to keep his shoulder against the guard when the piece is fired he reminds him of it. In centring the bubble or

setting the scales he gets his eye squarely opposite the scale or bubble.

The Number 2.—He knows the width of the spade, float, etc., in mils and is able to make any shift under two hundred mils within 5 mils. He shifts the trail so as to bring the direction of recoil in line with it (except for moving targets). In receiving empty cases he should not permit them to strike the trail or throw them against each other, as they must then be resized before they can be again used. If he sits on the handspike he must not shift his weight after the piece is laid.

The Number 3.—He knows that turning the corrector worm knob clockwise decreases the setting, turning the range worm crank clockwise increases the range. In making these settings he keeps his eye squarely over the scales. He knows his scale settings at all times. He is taught to keep his fuze setter and its cover clean, and is shown how a small pile of dirt or wax behind the stop pin or in the rotating pin notch can throw out his settings and ruin the reputation of his section. Gum from the fuze often collects in these places. The surest way is to keep a match stick handy and clean out these places whenever there is a lull in the firing.

The Number 4.—If necessary to reset the fuze he must turn the projectile until it brings up against the stop pin, then cease all turning movement and draw the projectile straight out of the fuze setter. If he continues the turning motion unconsciously he can easily alter the setting by a fifth of a second. In loading he is careful not to strike the fuze against the breech and so alter the fuze setting.

The Number 5.—He knows where the rotating pin notch is in the fuze setter, and where the corresponding pin is on the fuze. He places the fuze so that the pin is seated in the notch with little or no turning movement and turns rapidly but with no more force than required. He is careful to set all fuzes with the same force, that is, not turn one with a violent twist and the next barely up to the stop.

The Modern Attack on an Entrenched Position

BY COLONEL H. A. BETHELL, C.M.G., R.F.A.

(Reprinted from the *Journal of the Royal Artillery* for July, 1918.)

(This article is based on the published accounts of the German offensive of March 21-30, 1918. It is intended as a summary, in convenient form, of the latest German methods, especially with regard to the employment of Artillery. The information is taken from Sir Douglas Haig's despatches, and some of the details are from Mr. Hamilton Fyfe's correspondence.)

THE normal fighting strength of a German division is 12,000 rifles, 54 field guns, and 18 4.2-inch light field howitzers. It has been stated in the press that the infantry of a German division has recently been reduced from 12 to 9 battalions, or 9000 rifles at full strength. However, it seems probable that the effective strength on the 21st of March did not exceed 7200 rifles per division. This agrees with Sir D. Haig's estimate of 15,000 of all arms to a division.

The artillery is supposed to have been up to strength in guns, and in some cases to have been reinforced by Austrian batteries. (Sir D. Haig, March 22, 1918.) Counting a proportionate share of the Corps and Army Artillery, but not the Austrian batteries, the strength per German division on March 21, 1918, may be taken at: 7200 rifles, 54 field guns, 18 light field howitzers, 8 heavy (5.9-inch) field howitzers, 8 6-inch guns, 4 medium siege howitzers, 2 heavy (12-inch) siege howitzers. I think this estimate errs rather on the side of moderation. The German strength on the Western front is officially estimated at 200 divisions, of which 85 were in reserve. The attack on the 21st of March was delivered by 40 divisions (Sir D. Haig), reinforced on the 22nd by 33 divisions from reserve and on the 23rd by 21 divisions from reserve; total, 94 divisions. This left 31 divisions still in reserve. The original attack was on a 60-mile front (Vimy to La Fere), but after the

failure of the attack on Vimy and Arras it was continued on a 50-mile front, from Monchy to La Fere. Deducting, say 8 divisions, still left in the Vimy-Arras sector, we get a total of 86 divisions used on a 50-mile front in 10 days' fighting, with a general reserve of 31 divisions intact somewhere behind them, for use in case the attack succeeded in finally breaking through the Allied line. Some of these divisions were used three and four times. Dividing 86 by 50 we get an average of nearly 1 1/3 divisions per mile of front.

This gives the following average distribution:

Infantry:

6.6 rifles per yard of front.

Artillery:

1 field gun	per 19 yards of front.
1 light field howitzer	per 57 yards of front.
1 heavy field howitzer	per 128 yards of front.
1 6″ gun	per 128 yards of front.
1 medium siege howitzer	per 256 yards of front.
1 heavy siege howitzer	per 512 yards of front.

Since 33 + 21 divisions were put in as reinforcements, it is probable that their field guns and light field howitzers were not all in position for the week's bombardment which preceded the attack. But we may safely say that the whole of the heavy calibres took part in this bombardment. The difficulty in finding enough positions for them may be gathered from the figures given above.

In the accounts given by war correspondents we read that:

"On the front of one Corps there was a gun to every 15 yards." (Hamilton Fyfe, 22d March.)

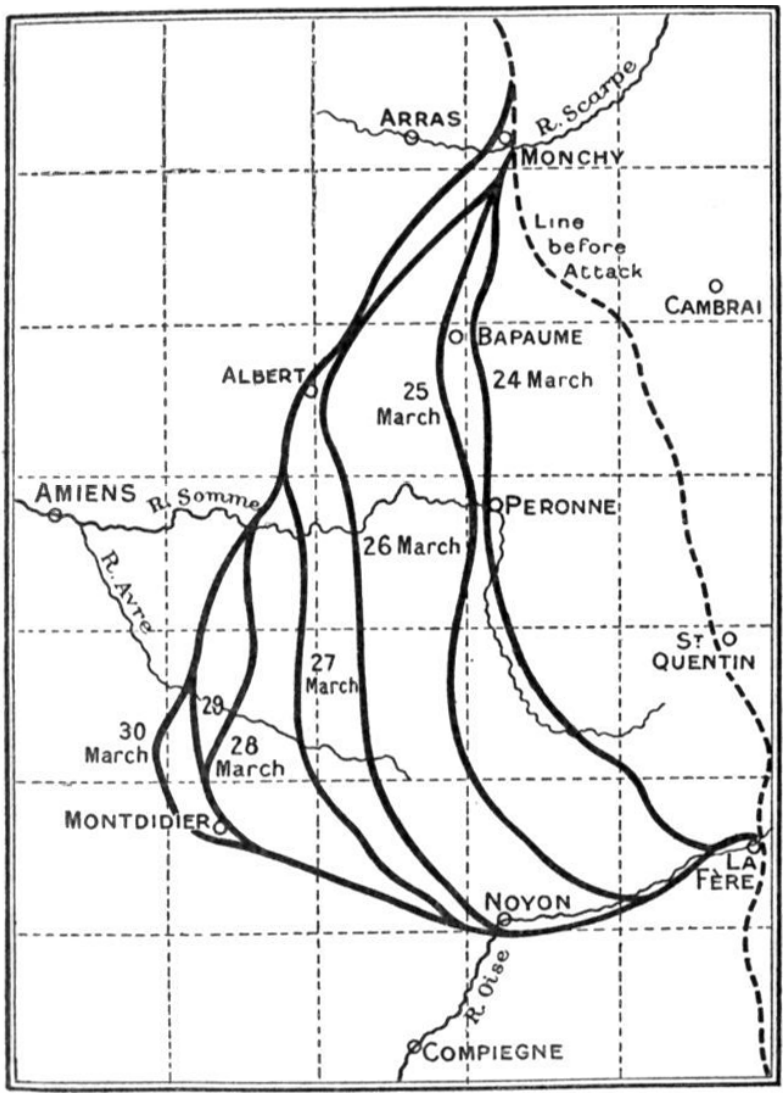
"On one Corps front of 2 divisions, the enemy used some 700 guns on the first day." (H. F., 23rd March.)

"Between Cambrai and Bullecourt the Germans had 8 divisions on a front of 10,000 yards," or 5.76 rifles per yard. (H. F., 23rd March.)

"The Germans had 14 divisions on the front between the Somme and Montdidier, on a front of 20 miles," or 3 rifles per yard. (H. F., 4th April.)

These quotations do not include divisions brought up on the following days as reinforcements.

It is presumed that, in accordance with modern practice, the guns were considered as belonging to the ground, not to the



GERMAN OFFENSIVE ON THE SOMME, MARCH 21 TO MARCH 30, 1918. TEN-MILE SQUARES

formations, and that they supported the attack of successive divisions advancing on the same front.

General Principles of the Attack

The attacking commander expects, or at least hopes, that the defender will keep his front trench, and his support trench one-half mile in rear, fully manned, as he does not know when the attack will be launched. The men in these trenches will suffer heavily, as both trenches will be practically obliterated by the bombardment. Therefore, the resistance experienced here should be slight.

Wherever the defender gives way, the attacking troops must follow him closely, in order to outflank and cut off the portions of the line which have not given way. The principle of limiting the depth of the objective does not apply to an attack in mass with large reserves behind it; on the contrary, it is desirable to push forward as far as possible wherever the defending line gives way, and to take the risk of the salients thus formed being cut off.

The attack must be pushed without intermission. The great force employed, probably at least 10 rifles per yard on the sector attacked (see below) admits of many successive waves being launched within one day. As each of the 3 divisions used on the same front secures its objective, the division in rear passes through it and captures the next line of trenches, and so on. The limit is the rate at which the guns, especially the heavies, can be pushed forward.

Thus the German official report of 24th March says:

"Light, heavy and the heaviest artillery and mine-throwers, unceasingly pushing onward over the crater-field, essentially contributed to the support of the infantry attack, which was continuously pressed forward."

This concurs with our own report:

"Another cause of their rapid progress is the rapidity with which they brought up their field guns." (H. F., 26th March.)

A captured German order directs that, in order to follow up the enemy closely, not only battalion and regimental commanders, but also generals commanding divisions, are to keep well forward.

PREPARATIONS FOR THE ATTACK

These involve a great deal of labor, mostly found by the divisions in reserve. The whole of the attacking force cannot be quartered immediately in rear of the fighting line; therefore railways must be made to bring up the infantry quickly. Roads must be made and repaired for the artillery to advance by. Battery positions must be dug and ammunition accumulated on a vast scale. Field hospitals and clearing stations must be prepared, and road metal, rations, and supplies of all kinds collected.

Thus our airmen reported that, "all the roads were made good for traffic right up to the front, in some cases to the support trench, and flanked by macadam tracks; they were repaired as fast as we filled them with holes."

German prisoners complained that before the battle they had been worked mercilessly at making roads and railways.

CONDUCT OF THE ATTACK

As we have seen, the troops employed on the 50-mile front averaged 1¾ divisions per mile. But the infantry attack was not pressed on every mile of the front. The German official report of 22nd March says, "We stormed the enemy's line in broad sectors." If we assume that the attack was pressed on alternate sectors of the front, leaving a holding attack on the intervening spaces, which seems a reasonable estimate, then we get 3 divisions per mile, or 11.3 rifles per yard, employed during the first three days' fighting on the sectors where the real attack was delivered. This would not affect the distribution of the artillery, which would want every yard of front that it could get, and would be equally distributed along the line and its fire concentrated on the real attack sectors.

The scheme then works out on the following lines:

Each division attacks on a front of one mile and penetrates one mile before it stops. It attacks in three lines; if each consists of 3 battalions, the front of a battalion is one-third mile.

Each battalion advances in two waves each of 2 companies, together 250 rifles (see below), thus on a front of one-third mile we get six successive waves of 250 men.

The 3 divisions are launched at intervals which may vary from one day down to six hours. At the latter rate there may be as many as 18 successive waves advancing on the same front of one-third mile within one day.

The whole of this is repeated 3 times, thus gaining a total depth of some nine miles.

Great use is made of machine guns and trench mortars pushed forward close behind the leading wave. Thus an eyewitness quoted in the press (Hamilton Fyfe's report, 23rd March) says:

> "The first wave to cross No Man's Land consisted of about 250 men with light machine guns, almost shoulder to shoulder. A hundred yards behind came another line of 250 men, then more machine guns. Next, after an interval of two to three hundred yards, came light trench mortars and the battalion staff. Again a space of two hundred yards, and then, from prepared exits from the trenches, the field artillery drove out into the open in column, forming line of batteries as soon as possible."

Reuter's correspondent with the French G.H.Q., writing on 26th March, says: "In these attacks the Germans are using a new type of low-built 3-inch field gun, which is as easily movable as a mountain gun, and which accompanies the infantry in its advance." This may be the Austrian field gun, which is known to be mounted on a special low narrow-gauge carriage for mountain work.

THE ARTILLERY PROGRAM

This is as follows: (1) All the heavy artillery, and the artillery of the divisions first put in, is got into position. If there is room, the artillery of the divisions which are to be put in later is also got into position.

(2) A week's general bombardment of the enemy's first, second and third lines: of all gun positions, roads, villages, railway

junctions, etc., up to some 10,000 yards in rear of his front line.

(3) Six hours' heavy bombardment of 1st, 2nd and 3rd lines and gun positions with H.E., shrapnel, and gas shell: wire-cutting up to a range of 2700 yards from gun positions.

(4) Rolling barrage from field guns, starting when infantry goes over the top and preceding them all the way.

(5) Bombardment of enemy's front trench, lifted on to his support trench when infantry goes over the top. This is repeated as each successive trench is taken.

(6) As soon as the front trench is taken, the field guns of one division advance to within wire-cutting distance (if possible within 1500 yards) of the next trench. This is repeated as each successive trench is taken.

(7) About one-sixth of the field guns are pushed forward to short range to knock out pill-boxes, machine-gun nests and the like.

As regards (1) it is uncertain whether the Germans put in the whole of the field artillery of the reserve divisions afterwards used, before the attack. Probably they put in as much of it as they could find room for.

As regards (3) it is recorded that in the later stages of the attack the Germans had to do a great deal of their wire-cutting by hand, covered by their advanced machine guns. It is not stated in any of the reports whether they used trench mortars for cutting wire beyond the original effective wire-cutting range of their field guns.

As regards (4), the rolling barrage preceding the infantry seems to be a regular feature of all attacks nowadays, except surprise attacks in a mist. The Germans call it the *Feuerwalze,* or "roller of fire."

As regards (7), the reports concur that field guns were regularly pushed forward in close support; this is provided for in the German Artillery Regulations, par. 471. We are not told what proportion were so used; the estimate of one-sixth given above is a mere surmise. Much would depend on the

ground. Par. 467 lays down that "Whenever there is a possibility of the situation developing so as to require quickness in opening fire, or rapid changes of target, the semi-covered or the open position must be used. As the infantry attack progresses, cover for the artillery becomes of minor importance." Accordingly, we read that: "Between Quéant and Pronville the German guns disdained all cover when the battle began." (H.F., 22nd March.)

EXPENDITURE OF ARTILLERY AMMUNITION

For every mile of the 50-mile front, the expenditure for a week's bombardment followed by a three days' attack may be estimated at:

Class:	Field Gun	Light Field howr.	Heavy (5′9″) field howr.	6″ gun	Medium Siege howr.	Heavy Siege howr.
Number:	95	32	14	14	7	3½
General bombardment of one week	100,000	10,000	10,000	5,000	2,500	500
Six hours' heavy bombardment	33.000	5,000	2,500	1,000	500	100
Rolling barrage	25,000	—	—	—	—	—
Bombardment during attack	—	5,000	2,500	1,000	500	100
Wire cutting	18,000	—	—	—	—	—
Close support	2,000	—	—	—	—	—
Total	178,000	20,000	15,000	7,000	3,500	700
Total per gun	1,873	625	1,071	500	500	200
Maximum rate of fire per hour per gun (during six hours' bombardment)	57	26	30	12	12	5

This estimate may seem high, but we must not be afraid of big figures if we want big results. In this connection a senior Staff Officer at G.H.Q. is reported to have remarked:

"The Boche is thorough. 'How much can we do with?' he asks himself. And when he has worked it out he orders just double the amount to make sure. That is what he did here."

It is assumed in the above table of ammunition that the whole of the field guns and light field howitzers of the 86 divisions were put in for the 6 hours' bombardment, as well as

the whole of the Heavies. If we accept the estimate of field gun and light field howitzer ammunition, then it follows that these pieces must have been put in, although 33 of the 86 divisions did not come in till the second day of the battle, and 21 did not come in till the third day. For the rate of fire, 57 rounds per gun per hour for 6 hours, and 26 for the howitzer, is already high, and must have been much higher if only the guns of the original divisions had been used. Perhaps this is the explanation of why the Austrian guns were required to supplement the divisional artillery.

GENERAL PRINCIPLES OF THE DEFENCE

The attacker hopes that the defender will keep his front trench, and his support trench one-half mile in rear, fully manned, to hold them against surprise attack in force. If he does so, the troops holding these trenches will suffer so heavily from the bombardment as to reduce their power of resistance to a very low level. Therefore, the defender should hold his front trench and his support trench lightly. He must then either reinforce them when the attack starts, an operation which is extremely difficult both to time and to execute; or else he must resign himself to lose these trenches temporarily if they are heavily attacked, and must hope to regain them by a counter-attack delivered under conditions favorable to his own troops. This includes both the general counter-attack delivered when the attacker's reserves are expended, and daily local counter-attacks.

The object of the defender is to get the enemy out of his (the enemy's) trenches and dug-outs into the open, and then to massacre his successive waves with fire from guns, machine guns and rifles. Even so the remnant of the attacking force will probably suffice to drive out the weak garrison from the almost obliterated front trench and support trench. These troops must retire, keeping touch with one another; if one battalion retires while the one next to it holds out, the latter will be outflanked and possibly cut off. Keeping up control and

communication from front to rear during a retirement is a very severe test of staff work, and keeping up lateral liaison is an equally difficult problem for unit commanders.

It is clear that when the attacker has gained the front trench he can begin again and apply the same procedure to the trenches in rear. But at each advance he must lose a heavy percentage of men, which have to be replaced from reserves, and it is the business of the defender to make this percentage so high as to exhaust the attacker's reserves while his own line, though drawn back, is still unbroken, and his own reserves intact. Then is the time for the defender to assume the offensive in his turn. If he has carried out his retirement from successive lines correctly, he will now enjoy a numerical superiority, and will have the advantage of fighting on his own familiar ground.

The above elementary theory of the defence may appear so obvious as to be hardly worth writing down. But it is desirable to state these principles clearly, because they govern the action of the artillery.

In considering this, it must be presumed that at the outset the attacker is in superior force, or at any rate that the defender does not elect to apply a force equal to that of the attack. If the opposing artillery forces were equal, and equally lavishly supplied with ammunition, then the defender would return shot for shot, bombardment for bombardment; the front and support trenches on both sides would be wiped out, and the hostile forces would finally be separated by a two-mile zone of destruction which no troops could cross. It would be a case of the Kilkenny Cats.

We will therefore consider the procedure when the defender elects to retire slowly from successive lines. It is unnecessary to dwell on the preliminary stages, when the artillery does all it can to inflict loss and damage on the enemy during the assembly of his men and guns.

The first thing that happens is the S.O.S. from the front trench when the first wave of the attack goes over the top. In response to this, a heavy barrage is put up over No Man's Land

by the field guns detailed for this purpose, while other field guns and field howitzers barrage the enemy's front trench and communication trenches. As the active defence of the front trench is assumed to be weak, the barrage alone will not stop the attack. But it will cause many casualties, which is the main object of the defender.

Simultaneously the whole of the Heavies of the defence open on the attacker's guns, which have just lifted on to the support trench. Observation of fire will be very difficult owing to the smoke of the barrages, even if good O.P.'s are still available behind the lines, and it will be necessary to trust to previous registration and to the aeroplane photos.

Next follows the stage when the defending troops retire, as per program, from the front trench. They are screened while retiring by a counter-barrage; that is to say, the defender's barrage is rolled back from No Man's Land, and is kept in front of the first wave of the attack and behind the last of the retiring defenders. (This is easier said than done, but this is the ideal to strive for.) The light field howitzers of the defence now turn on to the evacuated front trench; the Heavies continue to fire on the attacker's guns.

The same procedure is repeated in the defence of the support trench, one-half mile behind the front trench.

When the defenders retire from the support trench, the first wave of the attack will be getting within effective rifle range of the defender's field guns and light field howitzers. Now, the defender does not wish to sacrifice the whole of his field guns, but it is most desirable that some at least of these should remain in action till the attack is within 500 yards or less, even if they have at last to be abandoned. They will have a chance of putting in gun fire point blank at the enemy's masses, and will do more execution in a few minutes than in months of ordinary trench warfare. Moreover, if the attacker brings up light guns and tanks it will be absolutely necessary to have guns on the spot (not 2000 yards distant) to knock them out.

All the accounts from the front show that this is what we did during the recent German attack.

"The enemy's formations were split and rent again and again by two batteries of our field guns firing point-blank into the brown. Two of the guns were knocked out by direct hits, two had all their horses killed and were blown up. The rest got off." (Hamilton Fyfe, March 23d.)

"When you have a field battery firing for seven hours with open sights at large bodies of the enemy coming on steadily, not more than 1,200 and sometimes only 600 yards away, the numbers killed must be appalling." (H. F., April 4th.)

The best account which has been published of the handling of our guns during the retirement is in the April "Journal," and describes the action of four batteries of "An Old Regular Brigade," which all fought at short range in the open. Nearly every gun, except those smashed, got away safely. This was principally due to the effectiveness of their own fire.

Other accounts speak of guns which remained in action long after their infantry had retired past them. Even the Heavies enjoyed the novel experience of a scrap in the open. Thus a German newspaper, the "Kiel Neueste Nachrichten," says on 29th March:

"A heavy English battery continued to fire when our men were already within 100 yards of its guns. Finally the gun crews jumped to some machine guns which were in position for defence at close quarters, and blazed away till overcome by our storming columns."

If the retirement continues, even the Heavies will have to withdraw to fresh positions. And so the defence proceeds, taking heavy toll of the attack at each stage, till the attacker's reserves are exhausted, or till he has to pause to make fresh roads, bring up his heavy guns, and start afresh.

When, by the process of attrition of the attacking force, the defender becomes the stronger, he attacks in turn. This has happened before during the war, and will happen again.

Victory will be to the side that has the will-power to endure longest.

Notes on the New German Light Trench Mortar 7.6 cm. (3 inch)

LIGHT TRENCH MORTAR WITH NEW MOUNTING FOR FLAT TRAJECTORY FIRE.
SERVICE REGULATIONS FOR THE USE OF THE NEW LIGHT TRENCH MORTAR MOUNTED FOR FLAT TRAJECTORY FIRE

TABLE OF CONTENTS

I. General Remarks

(1) As a result of the adoption of the new carriage the light trench mortar may be very effectively employed for flat trajectory fire, without losing any of its peculiar qualities. Precision of fire is greatly increased; in particular, there is notably less lateral dispersion than in high-angle fire. The range is from 150 to 1100 metres (see Sec. V).

The light trench mortar mounted for flat trajectory fire may be employed with particular advantage as accompanying artillery. While more mobile than the Model 96 field gun (77 mm.) and therefore more easily maintained in liaison with the infantry, it is furthermore superior to the light trench mortar mounted on the ordinary carriage with respect to precision and the advantages resulting from a flat trajectory (shorter time of flight, greater accuracy of fire).

II. Use

(2) In attack, the light trench mortar mounted for flat trajectory fire will support its own infantry by means of direct fire in the assaults against hostile centres of resistance, flanking machine guns, tanks, and assist in repulsing counter-attacks.

(3) On the defensive, tanks, advancing infantry and machine

guns provide excellent targets for the light trench mortars mounted for flat trajectory fire.

(4) In a methodical attack, there is in the beginning sufficient time for reconnaissance, the occupation of positions, etc. But later, as the attack develops, it is important that the trench mortars follow closely behind the most advanced infantry with sufficient ammunition, and that they be able to go into action rapidly. A small number of well-placed shots during the course of the battle will frequently produce results which later, when the enemy has been given time, can only be obtained after long preparation.

(5) It is necessary, therefore, that the trench mortars used as accompanying artillery be made particularly mobile. For this purpose a certain number of infantry regiments will receive the following trench mortar equipment:

6 Light trench mortars for flat trajectory fire.

6 One-horse ammunition carts, each carrying 44 rounds.

3 Model '95 two-horse wagons, each carrying 80 rounds and the necessary accessories.

For marches over roads and in column, the light trench mortars are coupled to the ammunition carts; the model '95 wagons follow immediately and constitute the combat train.

On the battle field the trench mortars, coupled to the ammunition wagons, are drawn by horses in so far as the ground and hostile fire permit. The combat train follows by sections, according to the circumstances of the battle, the difficulties of the road and the ground. The commander of the combat train is responsible for liaison with the firing battery. During the fighting, if it is impossible to use horses, the pieces are pulled by men, and the ammunition carried by hand.

When an engagement takes place, it will generally be of advantage to assign two light trench mortars, with their ammunition carts and Model '95 wagons, to each infantry battalion.

(6) During the battle, there is no time for long reconnaissances and for taking preparatory measures. It is the duty

of the commander of the trench mortars to keep in touch with the situation by personal observation and by close contact with the commanders of the infantry forces. He must possess the indispensable qualities of rapid and accurate tactical deduction and decision.

The commander of the trench mortars must know how to recognize and rapidly occupy the positions made advantageous by the situation. The finding of cover is a secondary consideration. The observation posts are generally close beside the pieces.

It is not always possible to wait for the order to open fire. The commander of the trench mortars must frequently determine, and personally direct, the fire upon the objectives which the tactical situation renders most important. The better he succeeds in thus anticipating the needs of the infantry, the better will he fulfil his mission.

III. Description of the Carriage for Flat Trajectory Fire

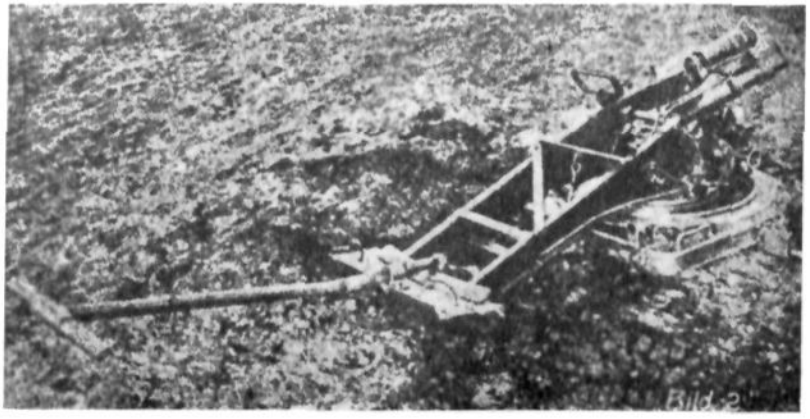
(7) For flat trajectory fire flasks provided with a trail spade are attached to the movable base plate in order to permit fire between the angles of zero and 27 degrees. Furthermore, it is possible to fire with this carriage at all angles between 45 and 60 degrees.

For fire mounted on wheels, see Par. 14.

(8) The flasks and their spade are fastened by means of a key bolt, which passes through the two rear nuts of the cradle and through the bearings of the flasks. The pull of a lever brings the piece into position for flat trajectory, or high-angle fire.

(9) At the lower end of the spade there is a traversing hand spike which permits the piece to be laid for direction by placing it in the holes provided below. (Extent of movement in each direction allowed by this lever: 12 graduations of the base plate.)

(10) The sights for flat trajectory fire consist of an arrangement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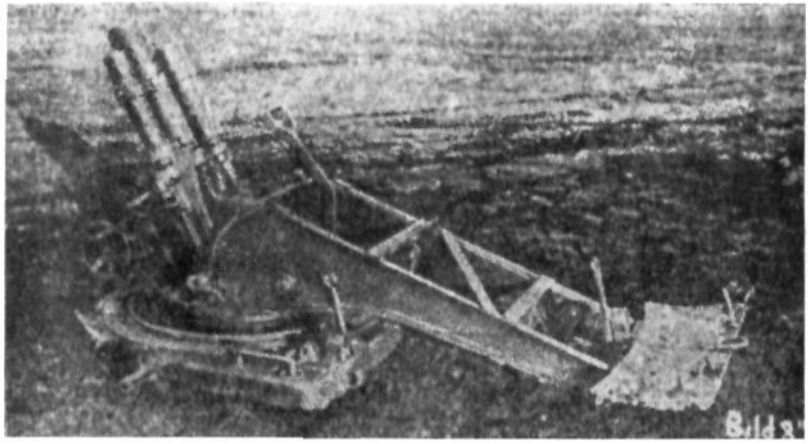
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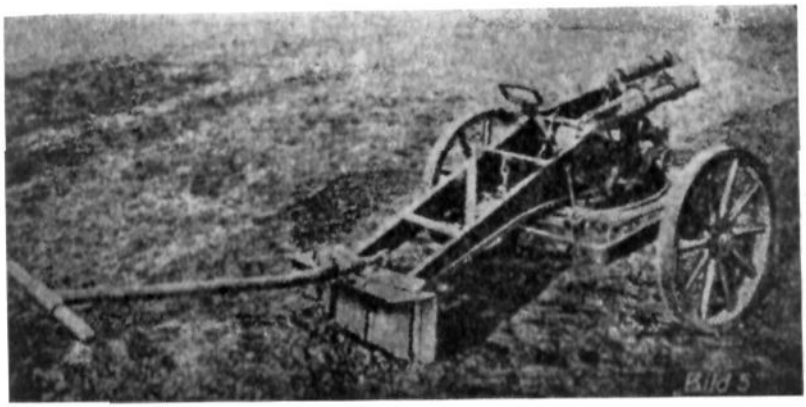
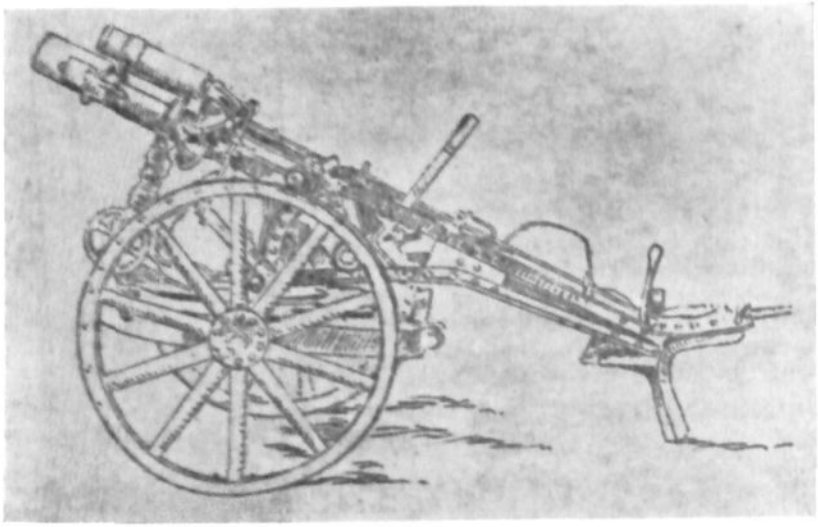




GERMAN TRENCH MORTAR FLAT TRAJECTORY CARRIAGE

In connection with the article on German Trench Mortars, the present sketch based on a photograph recently received is interesting. It has not been ascertained, however, whether the carriage shown in the sketch is the one now in general use.

attached to the rear of the cradle (in place of the elevating are) and of a front sight attached to the recoil cylinder. This sight is a graduated rod (up to 900 metres) with a sighting notch which is provided especially for flat trajectory fire. A new sight, graduated up to 1100 metres and permanently attached to the side of the elevating arc is under consideration; it will avoid changing the sight when passing from one kind of fire to another. This sight does not automatically correct for drift. The drift must, therefore, be corrected for, if necessary by an initial deflection to the left.

IV. SERVICE

(11) The service of the piece and the preparation of the projectiles requires a chief of piece and six men.

(12) For transportation on wheels the tube is placed in as nearly a vertical position as possible in order to take the strain off the elevating mechanism. The carriage is attached to the base plate by means of a bolt which is fastened to the ring, used for attaching the traces. The shafts are attached to the front handles of the platform and to the handles of the spade.

For transportation by hand, the pole is attached by three rings fastened to the end of the trail and the spade. Four men pull by means of breast straps, two of which are attached to the base-plate and two to the handles of the spade; two men push.

(13) In firing, it is important to enter into action with the least possible delay by immediately going into position. The wheels are usually removed for firing; the piece is placed in position without special preparation being made for the platform. The wheels, box of spare parts and shafts are taken off. The bolts fastening the gun carriage to the base plate are removed. Then by means of the lever the tube is placed in position for flat trajectory fire, the piece is laid in direction and the pole is removed. The spade is thrust into the ground. If the ground is too hard it must be loosened up.

(14) In order to profit by certain particularly favorable

opportunities which may arise in the course of battle, flat trajectory fire may be executed without removing the wheels. In this case, the bolts fastening the gun carriage to the platform are left in position; the pole is used as a trail hand spike. The minimum angle is 12 degrees. To fire with an elevation less than 12 degrees, it is necessary to lower the level of the wheels, for example, by digging them in, and by raising the level of the spade.

Fire from wheels is less accurate than fire from platform. Angles less than 12 degrees are impossible. A more vulnerable objective is offered the enemy. Therefore, as the wheels may be very rapidly removed after a little practice, it is preferable to fire from the platform.

(15) To point the piece, the pointer sets the range on the rear sight, gives the angle, and sets the front and rear sights to conform to it. The device for aiming in elevation is operated as usual. For aiming in direction, the set screw is loosened, the slide remaining always at the same distance from the sides of the fork. Large changes in deflection are effected by moving the spade, the laying being completed by the use of the spade lever or the deflection device. A white stripe painted in the centre of the recuperator cylinder permits rapid laying for direction.

(16) To load the mortar, the loader, grasping the lever with the left hand brings the tube into the vertical firing position, loads it with the right hand and puts the tube back into position for flat trajectory fire, by lowering the lever. Care must be taken not to bring the lever into its final position too violently, for too rapid a shock makes the projectile slide towards the mouth of the piece and the firing pin cannot reach the primer. It is then necessary to push back the projectile by using the rammer.

The other cannoneers are used in bringing up and preparing ammunition.

(17) To fire the piece, the lanyard is passed under the pintle bolt. The loader pulls the lanyard.

V. AMMUNITION

(18) For flat trajectory fire, use is made of the H. E. shell model '16 (Leichte Sprengmine 16) always with Charge No. 5, and if possible, with light trench mortar fuze No. 2 (Leichter Wurf Minenwerfer Zünder 2) (of manufacture later than January 11, 1917). The fuze cannot be used against vertical objectives at a distance of less than 150 metres, nor against horizontal objects situated at a distance of less than 220 metres. Up to those distances the projectiles do not explode on impact but only later, as a result of the operation of the timing apparatus. It is not possible to obtain air bursts at less than 800 metres.

With Fuze Az 16, a rather large number of misfires must be counted upon.

VI. BRIEF RANGE TABLE (CHARGE V)

Distance in Metres	Angle calculated in degrees and 1-16's of degree	Setting of fuze in Seconds	Distance in Metres	Angle calculated in degrees and 1-16's of degree	Setting of fuze in Seconds
150	2.7	7	650	12.10	7
200	3.5	7	700	13.14	7
250	4.3	7	750	15.4	8
300	5.2	7	800	16.11	8
350	6.1	7	850	18.3	9
400	7.1	7	900	19.12	9
450	8.1	7	950	21.6	10
500	9.2	7	1000	23.2	11
550	10.5	7	1050	25.	11
600	11.7	7	1100	27.2	12

Note:—From 910 to 1,100 metres, the range table is purely theoretical. The angles and especially the setting of the fuze are a first approximation.

Liaison in the German Army

The following is a translation of a German Document:

Part—Means of Communication and Regulations for Their Use in Position Warfare of All Arms:

(1) MEANS OF COMMUNICATION

The employment of a large variety of means of communication will guarantee that communications will be maintained under hostile fire in relatively short engagements only. In important combats of long duration, the repair work uses up the communication's personnel. The impossibility of controlling a complicated system renders its upkeep difficult and the lack of sufficient reserves excludes the possibility of timely replacement.

Telephone.—Under the artillery fire incident to violent fighting, the maintenance of telephone service cannot be counted on, even though there be two or three lines. Destruction and repair must be anticipated. Lines should be reduced to the smallest possible number and their repair made easier by carefully choosing the direction and increasing the number of buried terminal boxes. Only the requirements of the battle will determine the number of lines necessary. One line from each brigade forward is sufficient even for the most important tactical communications. If, during a quiet period, the use of the telephone increases, it simply shows that the rules limiting its use are not being observed. The number of telephone stations should be restricted as much as possible. It is particularly important to have a reserve supply of telephones and material on hand.

Visual Signalling Apparatus.—Visual signalling apparatus works slowly. It can give good results only if the nature of the installation simplifies the operating conditions. Intermediate

stations retard transmission and are the cause of numerous errors. They should only be used when absolutely necessary.

The tactical system of visual signalling should be limited to the requirements of the situation. These communications converge to central stations which are as close as possible to headquarters. Each central station must be in direct connection with its transmitting stations. It is preferable to have several central stations receiving direct communications than a single station working through intermediate stations. (See Sketch No. 1.)

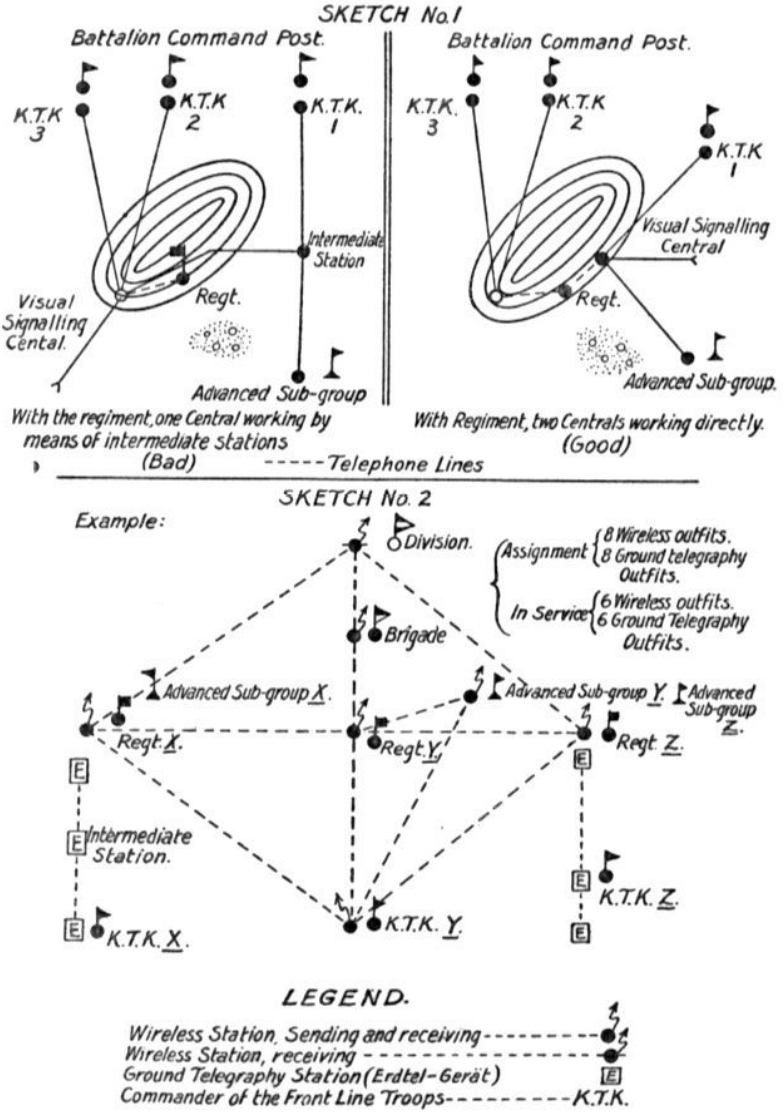
It is a mistake to include too many stations in the system for visual signalling. Messages sent by transverse lines require multiple transmissions. They become distorted, are delayed in the crowded stations or divert the apparatus from its proper functions. It is necessary in every case to ascertain which of the available means of visual signalling can be employed as reserve tactical lines.

A signal station cannot function as an intermediate telephone station. Messages must be infrequent and direct, transmission must be assured, and duties well defined.

The artillery signalling system must, as far as possible, be installed separately from all other systems in order to assure rapidity in transmission of its messages and in order to have stations more accustomed to the peculiarities of artillery transmissions. (See Par. 2, School of Fire.) Special stations should be provided for the observers.

Radio and Ground Telegraph Communication.—The new organization of the radio telegraph units which is about to be inaugurated will considerably reduce the number of the radio stations at the disposal of the divisions. It will be expedient to install communication from the Command Post (K. T. K.) through the regiment to the artillery by using either the radio telegraph alone or alternating the radio telegraph and the ground telegraph. The artillery, however, can no longer have its own sending system; it will have to use its receiving apparatus

and send through other radio stations. This again shows the necessity for close touch between artillery and infantry



headquarters. The first line will have a much-reduced number of radio stations at its disposal. The batteries delivering barrage fire will be equipped as far as possible with receiving

aerials and in any case will be directly connected by visual communication with the front-line command post or the regiments with which they are operating. It must be so arranged that the radio station at the command post is able to transmit the calls for barrage fire from all the sectors of the regiment without delay. (See Sketch No. 2 with legend and explanatory notes.)

Messenger Dogs, Trench Mortar Message Shells.—After the number of radio and ground telegraph stations have been reduced, communication between the front line and the command post will be carried on chiefly by means of messenger dogs and trench mortar message shells.

Carrier Pigeons.—The use of carrier pigeons by the companies must not lead them to think that their pigeons are a sure means of communication with the command post. It will always require considerable time for the message to reach the command post, so that it very often happens that urgent instructions relative to the battle have been rendered obsolete by the time they arrive. For communication between the companies and the command post other means of communication, such as runners, must therefore be given preference, if the circumstances permit.

Carrier pigeons are quite satisfactory for the transmission of reports at the close of operations, of sketches for the information of the regimental and higher command.

(2) ARTILLERY LIAISON

In large battles, the preservation of the artillery lines of communication cannot be relied upon. Consequently, during the less active periods, the artillery must learn to base its fire on control by radio telegraphy. For the transmission of ground observations it will be preferable to employ visual signalling. Aerial observation and the command will in general use radio telegraphy. Experience has demonstrated that communication between the balloon and artillery can be carried on

by direct signalling only on windless days. At other times the results are mediocre because of the vibrations. There is not always radio equipment available for use by the balloon. The best plan is to provide the balloon with a visual signalling post which will maintain telephone communication with the artillery. In any case, an effort must be made to establish communication between the balloon and some radio station.

Visual signalling and radio stations have a limited use. It is necessary by often repeated practice, to arrive at a clear understanding by means of very brief signs, in order to satisfy the enormous demands on the artillery in an important operation.

The unit commander must personally see to it that the fire is properly directed even when telephone communication is interrupted.

(3) SHELTERS

The care devoted to the system of communications will be valueless and fail in its purpose if the shelters reserved for the liaison service are not made strong enough to be shell-proof and offer assurance of being able to last through a large battle. Particular attention is called to the fact that the lamps employed in visual signalling are frequently still insufficiently protected. At least the lamp supports to the principal stations should be safeguarded against destruction. It should not be forgotten that during the most violent bombardment a lamp protected by a bomb-proof shelter still constitutes the most certain means of communication.

Every headquarters will see to it that its means of communication are in its immediate vicinity. It is absolutely essential that the difficulties of installation be surmounted. Posts separated from their command by a distance of 100 metres and heavily shelled cannot fulfil their mission completely, are the cause of futile losses and cannot take part in the liaison service. In a case where, for technical reasons, it is not possible to establish all means of communication in the immediate neighborhood

of headquarters, the command will, with the means at its disposal, make the liaison service as sure as possible by constructing boyaux or underground telephone lines up to the distant station. In selecting new positions the above considerations will always be taken into account.

(4) Lead Cables

The use of lead cables will be extended, as experience has shown that it is of great importance to keep the line dry. The deepest lines must be protected against outside moisture, such as rain and melted snow. An effort will be made to give sufficient fall to the conduits and to make drainage possible at all points where the grade changes. The most favorable routes are slopes which facilitate the drainage of water.

(5) Secrecy

The infantry telephone lines between the command post and the companies will be abolished. Only the observation lines used by officers are permitted to the front line. The transverse lines between the command post must not be constructed parallel to the position because such a disposition renders listening-in easier. They will be constructed in the form of large loops perpendicular to the front.

The lines leading from the infantry regiments toward the front will be connected in such a way as to make it impossible to overhear conversations with the rear. According to local conditions, these connections may be made at the local terminal boards or by means of special panels.

As far as artillery lines are concerned, it does not seem possible to obtain complete isolation on account of the requirements of fire direction. Communication over lines connecting advanced observation posts with the rear is only authorized for information having to do with the fire; all other conversation is forbidden.

(6) Principles for Applying the Means of Communication

Each headquarters will have exact knowledge of the means of communication at its disposal, how they are installed and how they are used. Concise wording of visual, radio and ground telegraph message is essential for the efficient operation of the system of communication during large battles.

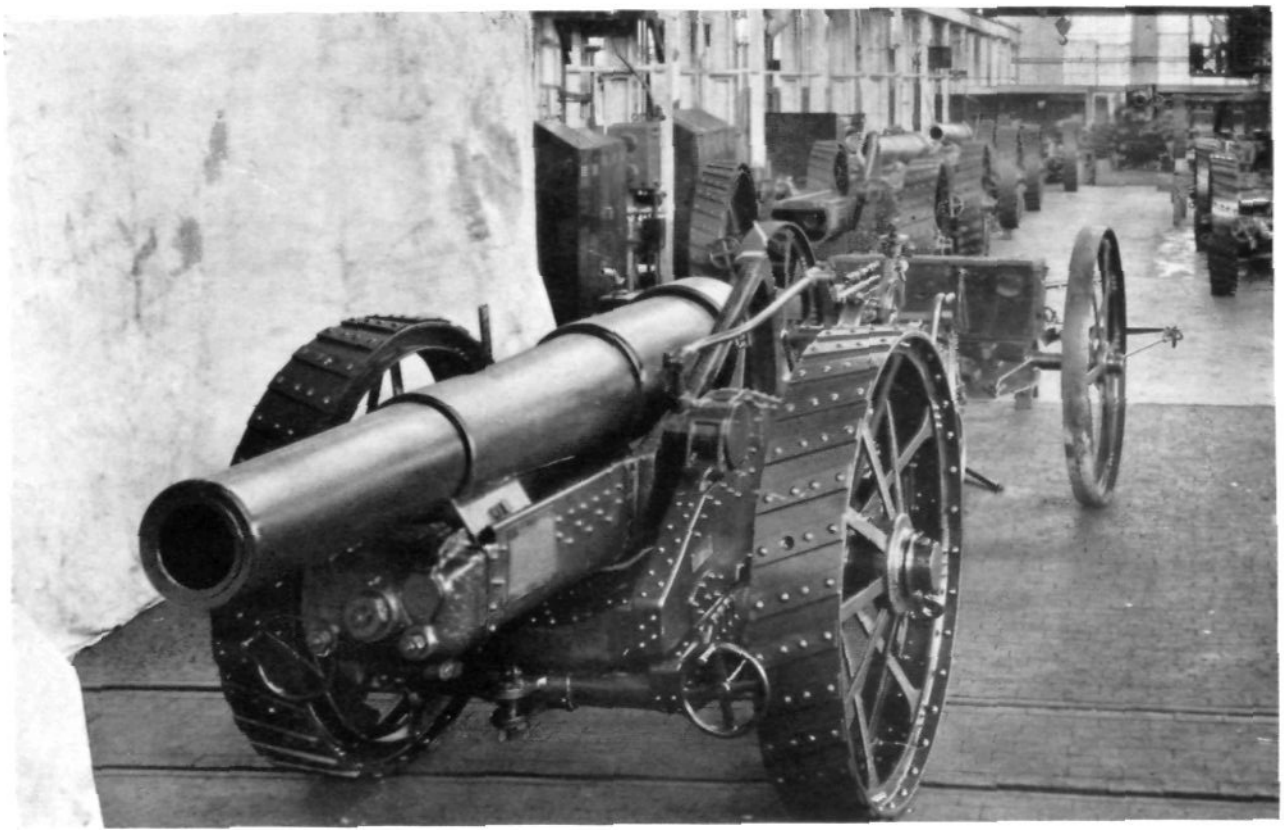
In spite of all notices issued, the use of (telegraphic style) has not yet become general.

All headquarters must thoroughly understand that the nearby radio and ground telegraph stations while they are operating depend upon each other and that the transmission of a long message paralyzes the rest of the system.

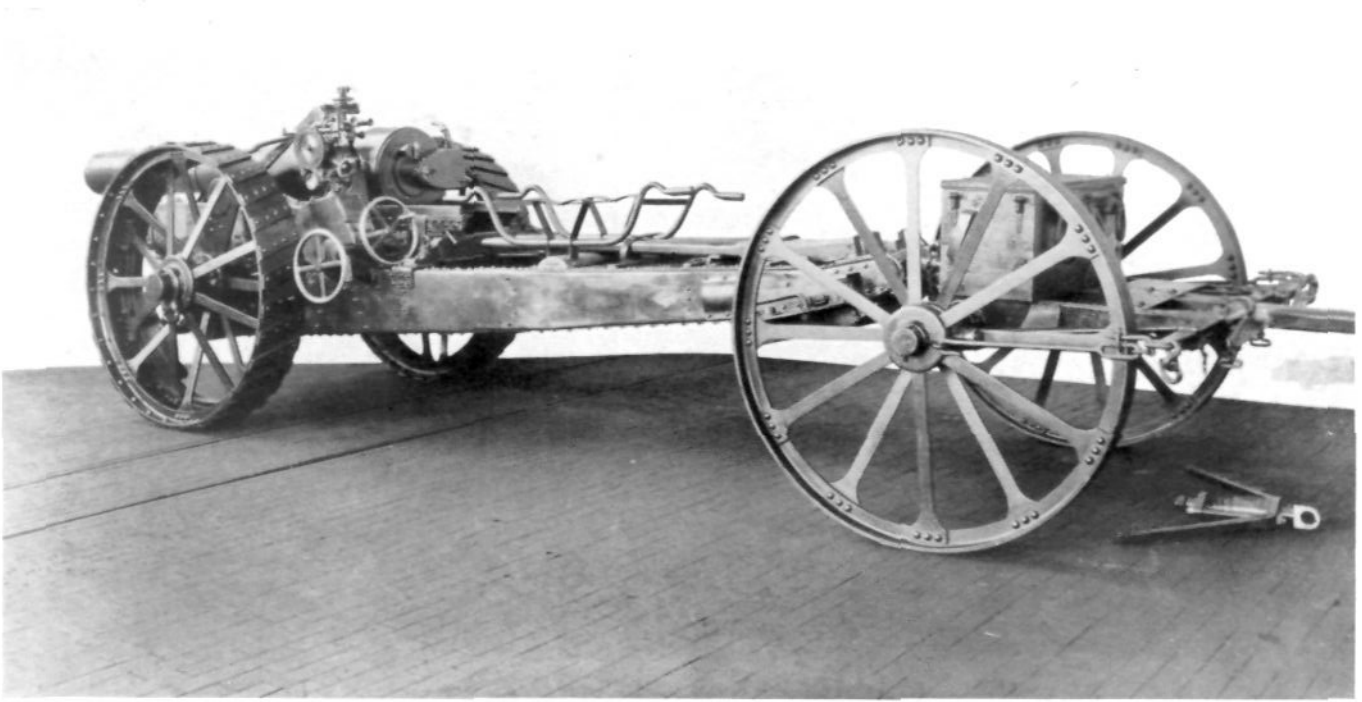
During the battle the radio and ground telegraph messages must contain in briefest form only that which is absolutely indispensable to the higher command.

For all expressions found in the code list or the code book transmission is shorter in code than in plain language. Every word not contained in these books assume three times its length when put into code. It must be possible to send the longest message in five minutes.

Battle reports (?), etc., must be transmitted by telephone, pigeons, dogs or couriers. All officers who have to send reports should be familiar with the functioning of every means of communication. This is the best method of teaching them to be brief.



VICKERS EIGHT-INCH HOWITZER, MODEL 1917



VICKERS EIGHT-INCH HOWITZER, MODEL 1917

Organization of a Rolling Barrage in the German Army

TRANSLATION OF A GERMAN DOCUMENT

THIS translation constitutes the most complete document that we have seen concerning the organization of the rolling barrage (Feuerwalze) in view of an offensive action.

It is to be noted that the mortars and medium and heavy trench mortars are not used for this purpose.

MEMORANDUM ON THE ROLLING BARRAGE

1. Object of the Rolling Barrage:

The object of the rolling barrage is to compel the enemy to keep under cover and to allow our infantry to take the adversary while he is in this situation. The rolling barrage must, then, paralyze the enemy, but it cannot annihilate him. Therefore, our infantry profits by it only if it takes advantage of the situation and follows very closely behind the barrage without fear of a few short bursts. A single hostile machine gun opening fire will cause more losses than the bursts of a few of our own shells.

2. Batteries Which Take Part in the Rolling Barrage:

All batteries which, during the attack, have no special mission (such as counter-battery fire, destruction of support points and rear lines, fire of "interdiction" and support of infantry) help to put down the rolling barrage. When assigning special missions to the artillery, the constant thought must be to obtain as heavy a rolling barrage as possible.

The rolling barrage proper is carried out only by field artillery, batteries of light and heavy howitzers and light trench mortars. On account of the large area of danger from the bursts, indirect mortar and heavy gun fire will be used especially against objectives which the rolling barrage cannot reach;

this fire is lifted and moved forward from line to line and from support point to support point, in front of the rolling barrage. The medium and heavy trench mortars do not fire.

3. *Opening of the Rolling Barrage Fire on the Points of Attack:*

The rolling barrage fire will be opened at the hour X + 300 minutes (the hour X is the time of the general opening of fire). The advance of the rolling barrage is timed. The time of flight of the projectiles must be taken into consideration. Watches will be compared.

4. *The Advance of the Rolling Barrage:*

The rolling barrage advances by being lifted from one target and put down on a more distant one. The distance of the first advance for light batteries (field guns and light howitzers) and for heavy batteries (heavy howitzers) is 300 metres. The distance of the subsequent advances of the light artillery batteries is 200 metres, and that of the heavy artillery is 400 metres, on account of its lesser rapidity of fire.

5. *Time Interval between the Advances of the Rolling Barrage:*

After the first advance, the light artillery hammers one spot for three minutes; the heavy artillery for two minutes only. After the subsequent advances, the light artillery fires on one spot four minutes, the heavy artillery eight minutes. In order that short bursts may not fall among our own advancing infantry, the heavy artillery will advance its barrage one minute sooner than the light artillery does.

6. *Stationary Periods of the Rolling Barrage:*

On some lines, and in case of necessity on the terrain between them (*e.g.,* on the rear lines of the first position, on the intermediary positions, on the outskirts of villages, on crests located between intermediary and secondary positions) the stationary period of the barrage will last longer. This is in order to compel the garrison to get well under cover before the arrival of our infantry, or to give our infantry the necessary time to catch up with the barrage, or to halt and get its wind.

7. Places and Length of the Stationary Periods of the Barrage:

Corps Commanders will give orders by means of a sketch covering this. (These sketches are always numbered 5, which number is used in the artillery fire orders. The sketch from the Army goes only to the Corps Commanders.) Corps Commanders agree among themselves upon the means for organizing the barrage within the limits of the attack zones in such a manner that the infantry will not be taken in flank by the enemy.

8. Advance of the Barrage after each Stationary Period:

The heavy batteries lift the barrage and put it down on the more distant target one minute sooner than the light batteries. The moment of lifting and not the length of the stationary period must be regulated.

9. Increase in the Rapidity of the Advance by Means of Signals:

In case it is desired to increase the rapidity of the advance, a luminous signal (increase the range) will be made use of. This signal will be given only at the order of battalion commanders and only well to the front. In this manner, there is brought about only a temporary increase in the rapidity of the advance of the infantry. The barrage takes up its former rate of advance if the signal is not repeated continuously. For the day of the attack, the signal will be either:

(*a*) Green rockets (stars or plain), or

(*b*) A succession of short vertical jets from light flame projectors.

At this signal, both light and heavy batteries will increase the range 200 metres. Before giving this signal, consideration must always be given the fact that the general order of the rolling barrage will be interrupted. Echelons of fire may thus be created which compromise the safety of that infantry which is moving faster (machine-gun enfilade fire).

10. Other Rolling Barrage Discipline:

The barrage is controlled by the watch and by signals. Our Artillery Commander and auxiliary observers moving forward

with the infantry may modify this control according to the situation and on their own responsibility, if they see the necessity from their own observation or from that of the means put at their disposal (airplanes, balloons, etc.). Constant supervision of the rolling barrage, by ground and aerial observation is of capital importance. It may occur that:

(1) The rolling barrage may have passed beyond certain support points or machine-gun nests without neutralizing them, and that the infantry may thus not be able to follow. The auxiliary observers or artillery liaison officers must then, if the infantry batteries and trench mortars cannot clear these points, inform the artillery commanders and cause the fire of certain batteries or groups coöperating with the barrage to be brought back on these targets. If the period of this fire has not been fixed, the above-mentioned batteries will continue it until they receive the signal to increase the range, either by telephone or visually. The batteries then take up the barrage fire at the proper range.

(2) Our infantry may already have passed the objects above mentioned without having taken them. In this case the infantry batteries and the trench mortars only will act against these points. The fire of batteries taking part in a rolling barrage must never be brought back through our infantry.

11. The Duration of the Rolling Barrage:

The duration of the rolling barrage depends on the range of the batteries which are putting it down. Our battery positions are located far enough to the front so that the barrage may be advanced beyond the second position. When this barrage passes the hostile battery positions, it is joined in by the fire of the batteries which until then were executing counter-battery fire. The same is true of the batteries which were destroying the second position when the barrage has passed that position. The various batteries cease their fire as they reach their maximum range and instead of a rolling barrage, it is no longer anything but the fire of several batteries.

12. Final Support by the Artillery:

The fire of heavy and high velocity batteries firing from their initial positions may still be effective for some time when the limits of rolling barrage have been passed. Preparation and cover by artillery fire must then be controlled. This is the function of individual initiatives and of the authority which gives orders to the artillery which has been pushed forward. This artillery must be put into position in time. Its liaison with the attacking infantry can never be too close.

By order of the General Commanding the Army,

The Chief of Staff,
von ———,
Major General.

Accompanying and Infantry Batteries

GERMAN ARMY

THE practice of sending artillery forward in close support of the infantry in attack seems to have come into fairly general use. The possibility of field guns actually accompanying the infantry instead of merely covering them from fixed positions in rear, was mentioned as far back as August, 1917. An order of that date, signed by General ———, states that "Mobile artillery which advances into the battle zone in close communication with the infantry and uses direct fire on visible targets is in better position to be used against hostile troops which have penetrated our lines than artillery in positions known to the enemy and therefore that counter-attack divisions must have mobile artillery in reserve in division sectors for local counter-attacks."

This principle seems to have been elaborated later, resulting in the employment of two different types, infantry batteries and accompanying batteries.

Infantry batteries are armed with 77's or with old guns of equivalent calibre. One gun is assigned to each first-line battalion of infantry in the attack and is directly under the command of the Infantry Battalion Commander. Their mission, as shown by a German order of March 30, giving lessons to be drawn from the attack of March 21, is to destroy nests of machine guns and other strong points impeding the advance of the infantry, which the artillery preparation has been unable to dispose of. For this purpose the guns follow the second wave of the infantry closely and use direct fire and ranges under 1000 metres. Horse-drawn guns were used in this way by the German —th Division in the attack of March 21, but the German regulations of 1917 state that these guns are moved by man power, and it is possible that the latter method is generally

used. The front-line battalions advancing in two waves, 50 metres between waves, were each supported also by two light trench mortars on wheeled flat trajectory mounts, which advanced 50 to 80 metres behind the second wave and whose mission was the same as that of the infantry guns. In addition to the orders quoted above, the following extract from a document issued by German General Headquarters, February —, 1918, shows that the general use of this method of attack is contemplated: "The barrage cannot save the infantry from the necessity for close combat with machine guns, rifle and bayonet grenades, light trench mortars and guns accompanying it. . . . . It is not only helped forward by the artillery in rear, by batteries accompanying the infantry and by light trench mortars, but principally by machine guns and infantry fire."

Accompanying batteries are assigned to regiments in an attack. To each infantry regiment of the front line is assigned a battery of 77's. These batteries follow the infantry at one or two kilometres. Their mission is to fire on the opposing infantry and to combat unexpected attacks or counter-attacks. The battery begins moving when the infantry lines start forward and keeps in close touch with the infantry regimental commander. Except in cases of unexpected emergency, its rôle begins when the fire of the artillery in fixed positions in rear begins to fail to accomplish its object.

In the attack on ——, April —, by the —th Division, each infantry regiment was supported by a regiment of 77's which detached one battery to accompany the infantry. This battery was strictly under the orders of the Infantry Regimental Commander and formed a kind of mixed group with that regiment. The same formation was used by the —th and —th Divisions on March —, the —th Division on March —, and the —th Division on April — at ———.

According to instructions issued by German General Headquarters, the accompanying batteries are not believed to be apt to suffer much from counter-battery fire (presumably

because they are covered by the fire of the batteries in position in rear) and therefore can be moved up close to the infantry.

A captured order of the —th Division for the attack on ———— , April —, states in substance:

"Each regiment of infantry will have assigned to it one company of 12 light trench mortars, two medium trench mortars from the divisional battery, one Field Artillery Battalion staff and two field gun batteries. The regiment in reserve is assigned one field gun battery. (These are the accompanying batteries.)

"Each regimental sector is assigned a battalion for close combat, under the immediate orders of the Artillery Commander. An artillery liaison officer from this battalion and the battalion staff referred to above, will remain near the Infantry Regimental Commander. The latter has the guns absolutely at his disposal.

"The light howitzers will take part in the preparation and barrage, and receive missions from the Infantry Regimental Commander only when the situation makes it necessary. The accompanying batteries will be pushed forward on the slopes south of —— and if possible to the south of——.

The following schedule of special training for accompanying batteries was obtained:

1st Month. School of the Soldier—All cannoneers receive general infantry instruction. In addition, a certain number are attached to an infantry unit and trained especially in the use of rifle and carbine, the throwing of grenade, etc.

2nd Month. School of Battery—Rapid accompanying position and conduct of fire.

3rd Month. Combined Manœuvres—Execution of manœuvres by four divisions.

In particular the following problems were given to the batteries:

(*a*) Follow the advance of the infantry and occupy a position rapidly, in rear of it.

(*b*) The guns are supposed to be destroyed; take the formation of an infantry company.

(It should be remembered that all batteries are provided

with two machine guns, principally for defense against aircraft and that the men are already trained in their use.)

ACCOMPANYING BATTERIES

Documents recently received give the following additional information on the use of accompanying batteries in the last offensive:

The mission of the accompanying batteries was in the main the same as in the March and April offensives, *i.e.,* reduction of machine-gun nests and strong points which had not been destroyed during the artillery preparation. In addition they were used to give general support to the infantry after the latter had begun to pass beyond the range of the creeping barrage.

During the March attacks the allotment of accompanying artillery was one battery to each infantry regiment. In the attack on ————, the latter part of April, a few regiments were assigned two batteries. In the offensive of May — and June —, the regular allotment seems to have been one battery for each regiment in the second line.

The batteries were furnished by the divisional artillery and were under the direct orders of the commander of the infantry unit to which they were assigned. Groups of mountain artillery, infantry guns and marine landing batteries were also assigned to infantry units in certain cases.

The necessity for a large supply of ammunition for these batteries is insisted upon. Each gun was assigned an additional caisson taken from the battalion combat train. Infantry battalion and regimental commanders under whose orders the batteries were placed were required to keep themselves informed of the ammunition supply in order that it might not be wasted in fire against targets of minor importance.

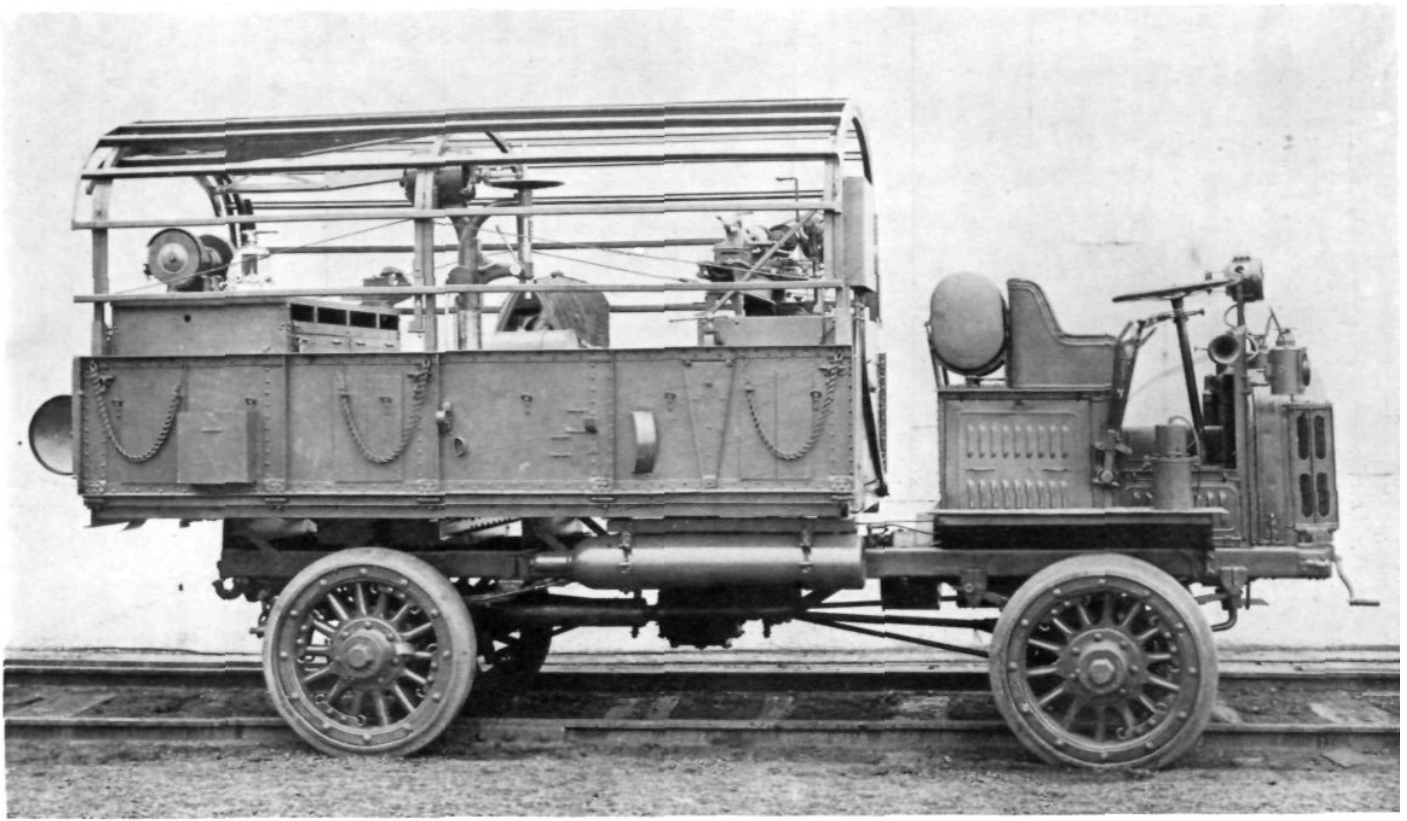
Batteries are instructed to advance by echelons of sections or double sections in order that there may always be guns in position ready to engage a target. All reserve troops, whether especially detailed for this purpose or not, must assist in moving guns and ammunition forward if required. The infantry

commander designates the targets, but the commander of a double section may open fire on any suitable targets on his own initiative. Direct fire from positions on a crest at short range is recommended. Fire against an isolated machine-gun nest should be executed by a single piece, and conducted by its chief. Instruction of section commanders in observation and conduct of fire, with this end in view, is especially emphasized.

Communication between the battery and the battalion which it supports is of vital importance. Artillery observers should accompany the first infantry line, and a liaison officer from the battery should be with the battalion commander. Several separate means of communication must be established in order that one at least may always be in operation.

When a number of field and heavy batteries have been brought up by orders of the division, additional artillery will become available for the engagement of machine-gun nests. Where the infantry advance is checked it is recommended that some of these batteries be assigned to infantry regimental commanders for use against these points.

An order of May — prescribes the use against centres of resistance of long H. E. shell or model 1916, H. E., half of which should be provided with delay fuze and armor piercing head if targets sufficiently protected are anticipated, and the other half with instantaneous fuze (EKZ). A certain number of Blue Cross gas shells should also be included. Smoke shells may be employed in case of need. Against visible machine guns in the open H. E. with instantaneous fuze should be used, or Blue Cross shell if the friendly infantry is not too near the objective. Against machine guns not accurately located, ricochet fire with delay fuze or salvos of Blue Cross are recommended.



U. S. ORDNANCE DEPARTMENT ARTILLERY REPAIR TRUCK

CURRENT NOTES

Field Artillery Training in the United States

THE following is a concise statement of the system or scheme of Field Artillery training in the United States:

1. The Field Artillery Central Officers' Training School at Camp Zachary Taylor, Kentucky.—This school is maintained for the purpose of producing officers for the Field Artillery, is organized with a headquarters personnel and ten batteries of school troops and receives candidates each week for a course of twelve weeks' instruction, at the end of which time the candidates are rated as officer-candidates with the rank of sergeants or commissioned second lieutenants of Field Artillery. Its present capacity is about 6000 officer-candidates, but it is hoped to increase this number to 10,000 within the next few weeks.

2. Two Field Artillery Replacement Depots—one at Camp Jackson, S. C., and one at Camp Taylor, Ky.—The officers or officer-candidates mentioned in paragraph 1 are sent to one of the two replacement depots, where they have an opportunity to make immediate use of some of the knowledge gained at the training school. Replacement depots are primarily for the training of drafted men for Field Artillery and are so organized as to instruct men in the essential duties of a soldier and the following specialties:

Auto mechanics
Chauffeurs
Motor cyclists
Motor truck drivers
Tractor drivers
Chief mechanics
Carpenters
Painters
Saddlers
Bandsmen
Buglers
Clerks
Horseshoers
Machine gunners
Mess sergeants
Cooks
Radio men
Stable sergeants
Farriers
Telephonists
Topographers and draughtsmen
Cannoneers
Drivers
Wagoners
Bakers
Cobblers
Tailors

The plan is to furnish all replacement troops sent out on calls from the A. E. F., from these two institutions, and to train non-commissioned officers, or candidates to become non-commissioned officers, and specialists for the organization of new brigades in this country. It is intended to have the capacity of these two depots reach 65,000.

3. The School of Fire at Ft. Sill, Okla.—This school is maintained for the purpose of giving officers an advanced course in artillery work and primarily for training battery commanders. At the present time it gives a ten weeks' course with a weekly intake of one hundred and twenty students, who, for the most part, are obtained from the Field Artillery Replacement Depots. In addition to the regular classes, a course covering a period of seven weeks for Aerial Observers, for both airplanes and balloons, is given to students detailed from the air service, the present weekly intake being fifty. While it is intended that the students at the School of Fire will come from replacement depots, there are classes organized from the recently converted cavalry regiments now undergoing instruction. It is intended to increase the capacity of the school to about two hundred per week beginning about October 1st.

4. Four Field Artillery Brigade Firing Centres.—Maintained for the purpose of organizing and training Field Artillery Brigades to such a point that the period of training abroad before going to the front will be reduced to a minimum. These centres are located at Ft. Sill, Okla.; Camp Knox, West Point, Ky.; Camp McClellan, Ala.; and Camp Jackson, S. C. It is proposed to give as many brigades as possible the course of training in these firing centres, and it is expected that the capacity of the four will aggregate eighteen brigades.

5. Ten officers selected from the classes graduating from the School of Fire each week are sent to the Radio Instruction School for Antennæ Officers at Columbia University, New York City, for a three weeks' course of instruction.

6. By arrangement with the Department of Military Aeronautics, which is in charge of all radio instruction in the Field

Artillery, a large number of enlisted men are being trained as radio operators in the training school at University of Texas, Austin, Texas. Classes are entering at the rate of fifty per week for a course of thirteen weeks' instruction.

7. An instruction school for fifty officers and five hundred enlisted men conducted by the Ordnance Department at Raritan, N. J., where a course of twenty-eight working days is given. On account of lack of facilities at the present time this course has been suspended.

8. The Committee on Classification and Education has authority to give instruction to about 250,000 men who have had at least a grammar school education and the Field Artillery has made requisition for about 75,000 of these with a view to their assignment to new organizations in this country at the completion of their course at the various training schools.

9. Officers are on duty at the Chemical Warfare Service Proving Grounds at Lakehurst, N. J., studying the tactical and technical relations of the Field Artillery to the Chemical Warfare Service, with a view to recommending a course of instruction for Field Artillery officers in that work.

Notes on Organization of German Divisional Field Artillery Information has been Received as follows:

THE —th Guard Field Artillery Regiment has the normal organization of three groups of three batteries of four pieces each. Instead of having two groups of 77-mm. guns and one of 105-mm. howitzers, however, the three groups are similarly organized, each comprising two batteries of 77-mm. guns and one of 105-mm. howitzers.

The organization of these mixed groups has already been reported. It seems, however, to have become fixed, at least in certain regiments.

Each battery consists of four guns, four caissons, one observation wagon carrying the telephone material and the baggage wagons. Each group furthermore has a field train and an ammunition train of 18 large ammunition wagons.

The batteries have a large complement of officers, three or four officers, besides the battery commander.

The strength of a battery is about 80 men with 100 to 118 horses. It is to be noted that the drivers are never instructed in the duties of cannoneers and are therefore not very useful for the replacement of the latter.

Since the offensive (March 21, 1918) each battery has for use against airplanes two machine guns, of which one remains with the battery and the other serves for the defence of the echelons.

These machine guns are served by gunners from the battery.

German Field Artillery Organization

THE artillery assigned to an active infantry division in 1914 consisted of one brigade of two regiments, one of which had two battalions of three 6-gun 77 mm. batteries each; the other one battalion of three 6-gun 77 mm. batteries and one battalion of three 4-gun 105 mm. howitzer batteries.

Each battalion had attached to it a (light ammunition column) or combat train consisting of:

24 caissons (4 horsed) carrying 2,154 rounds of 77-mm. ammunition, or 1,390 rounds of 105-mm. howitzer ammunition,

1 store wagon (4 horsed),

1 rolling kitchen (2 horsed).

The organization of both gun and howitzer batteries was:

1 Captain,
4 Lieutenants,
156 enlisted men,
137 horses,
6 guns (or 4 howitzers),
6 caissons (or 4),
1 observation wagon.

The reserve divisions on mobilization had only one 6-battery regiment.

In 1915 new divisions were organized. The divisional infantry was reduced from four regiments to three and all existing field batteries were correspondingly reduced to four guns, thus providing artillery material for the new divisions. The battery strength was reduced to four officers and 112 men.

The four-gun battery organization has been maintained up to date.

In the summer of 1916, when more new divisions were organized, the divisional artillery brigade was abandoned and one regiment of nine

batteries (two battalions of 77-mm. guns and one battalion of 105-mm. howitzers) was substituted. Some of the regiments taken from the old divisions were used in the new organizations, while the others were used to raise other regiments to the nine-battery strength. Some batteries not so utilized became independent and were later organized into independent field artillery regiments, composing a reserve placed at the disposal of an army headquarters or of General Headquarters, and used wherever needed. New independent regiments were organized in 1917. Some of these regiments appear to be armed entirely with 77-mm. guns, some with 105-mm. howitzers, and others to be mixed regiments. The raising of the regiments to nine batteries was done gradually and is thought to have been completed for all regiments on the Western Front at the beginning of the March, 1918, offensive.

The battery strength was increased in 1917 to six officers and 136 men. In the spring of that year it appeared from information received that the combat trains had been taken away from the battalions and placed under the command of the divisional train commander and that at the same time they were reduced from three to two.

According to information from various sources, some regiments, both divisional and independent, have been experimentally reorganized into three mixed battalions, each battalion consisting of two 77-mm. gun batteries and one 105-mm. howitzer battery. Reports were to be made on the advantages of this reorganization by the officers concerned, considering both position warfare and open warfare. According to information this reorganization was causing a great deal of discussion and difference of opinion among the officers. Prisoners of the —— Field Artillery Regiment recently captured stated that that regiment was now definitely reorganized in this manner.

The strength of the batteries was given as about 80 men and 100 to 118 horses, but this probably refers only to men immediately on duty with the battery proper, since information from numerous sources within the past few months places the normal strength of a field battery at 136 men.

In connection with this reorganization it should be noted that in several regiments lately identified, one battalion of 77-mm. guns has been replaced by the model 1916 77-mm. gun,* which is placed on a howitzer carriage, permitting an extreme elevation of 38 degrees against 16 degrees for the old model gun. It is not known how far this rearmament

* See notes on 77-mm. Field Gun, April-June number FIELD ARTILLERY JOURNAL. (EDITOR.)

has progressed nor to what extent it is proposed to carry it out.

A prisoner from the ——th Field Artillery regiment states that his battery has one motor car for the use of officers, and two motor trucks which are used for transportation of personnel or of ammunition or in case of need for moving the guns. Each truck carries 300 rounds of 77-mm. ammunition.

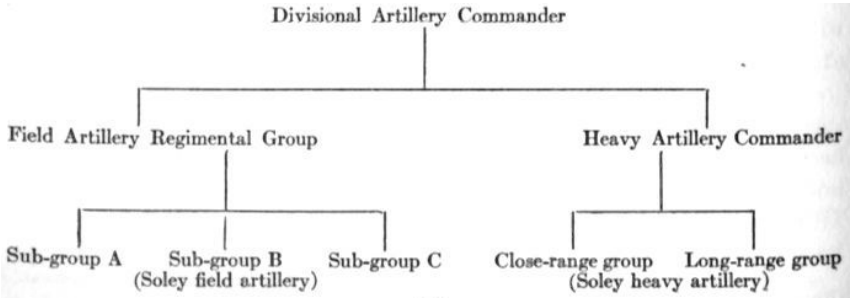
Prisoners have frequently mentioned a shortage of horses in the field artillery, and this use of trucks is possibly due to that reason. In some cases the guns have only two pairs each, and caissons one pair each. A prisoner of the ——th Reserve Artillery stated that when his division left the line one battalion had to leave their guns behind and turn over their horses to the other two battalions. One battalion of the 403 Field Artillery was obliged to send its horses to the Somme at the beginning of the offensive. An order issued April ——th, by General von ——, commanding the ——th and ——st Regions, prohibited the sale of horses in Bavaria, Saxony and Wurtemberg, on account of the shortage in the army.

Notes on Tactical Organization of German Artillery

A. IN DEFENCE

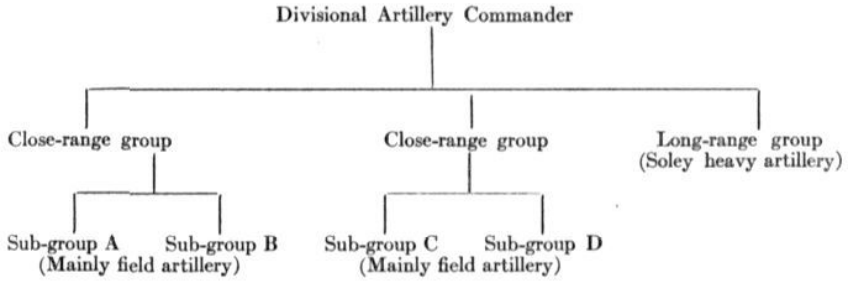
(1) Artillery allotted to the division.—According to documents received in 1917, the artillery under the divisional artillery commander in a defensive sector was divided into a field artillery group and a heavy artillery group. The former was usually divided into sub-groups, the latter into long-range groups. Thus:

Diagram of Old Organization



From a recently received map, which shows the disposition and organization of the artillery allotted to the—th Division in the —— sector, it appears that this organization has been changed. The field artillery group as such has disappeared, and the field artillery is formed into close-range groups, which include a small proportion of heavy artillery as previously. Thus:

Diagram of Present Organization



The functions of these groups presumably remain the same, *i.e.*, the close-range groups deal with forward areas and protective barrages, the long-range group with back areas and counter-battery work.

The artillery of the —th Division comprises two close-range groups, each subdivided into two sub-groups, and one long-range group. Each close-range group includes one battery of 15-cm. howitzers. The artillery allotment is as follows:

	Field Batteries		Heavy Batteries			Total
	7.7-cm. Gun	10.5-cm. Howitzer	10-cm. Gun	15-cm. Howitzer	21-cm. Howitzer	Batteries.
Northern Close-range Group.						
Sub-Group A	4	1	. .	. .	. .	5
Sub-Group B	4	. .	. .	1	. .	5
Southern Close-range Group.						
Sub-Group C	4	. .	. .	1	. .	5
Sub-Group D	2	3	. .	. .	. .	5
Long-range Group	. .	. .	3	3	1	7
Total	14	4	3	5	1	27

The map also shows four anti-tank guns, but there is nothing to indicate whether these are provided by the 7.7-cm. batteries allotted to the close-range groups or not.

The above apparent change in tactical organization is borne out by documents recently received by the ———, relating to the artillery organization of the —— Naval Division and the —— Division. In these cases, however, the long-range group is divided into sub-groups according to the type of weapon employed.

(2) Artillery under Group or Army H. Q.—Heavy flat trajectory guns are grouped under the command of Group (Corps) or Army Headquarters.

B. In Attack

There is very little evidence of the details of the tactical organization of the artillery for the offensive, but the artillery appears to be divided into two main groups:

(*a*) Artilleriekampfartillerie (Aka.), for counter-battery work, under the command of the Army or any lesser formation sive phases of the artillery battle.

(*b*) Infanteriekampfartillerie (Ika.), under the chief command during the preliminary bombardment, and finally passing to the command of the division. Its functions are barrage, harassing and destructive fire; in certain cases it is divided into sub-groups for these specific purposes.

These two main groups are not rigidly confined to the tasks specified above, but mutually assist each other in the succes- responsible for the whole attack.

Although this grouping corresponds roughly to that found in defensive warfare, the composition of the corresponding groups differs in that the Infanteriekampfartillerie has a larger portion of heavy artillery than the close-range group, while offensive conditions necessitate a different system of command.

In addition to these main groups are:

(*c*) Schwere Flachbahnartillerie (Schwefla), or heavy flat

trajectory guns, grouped under the command of Corps or Army Headquarters.

(*d*) Begleitbatterien, or batteries of 7.7-cm. field guns, specially detailed to accompany the infantry in the closest possible support; these are allotted on the scale of one four-gun battery per infantry regiment. Also see Notes on Light Trench Mortars.

German 15-cm. Yellow Cross Gas Shell

GENERAL DESCRIPTION

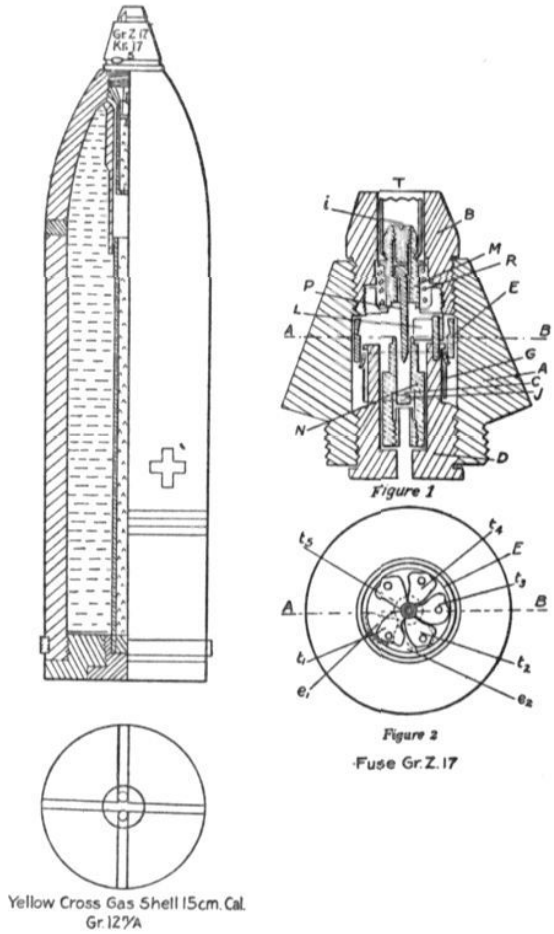
A YELLOW cross gas shell, 15-cm. calibre (see Sketch) was recently found at ———, in the sector of ———. It is identical with the green cross gas shell No. 2, 15-cm. calibre. As in the latter, the explosive is contained in a central tube, into the upper part of which is screwed a priming tube containing a detonator which operates independently of the fuze.

The shell is painted grey, with two blue bands indicative of the model; two yellow crosses are painted on opposite sides of the body and one yellow cross on the base.

Instead of the fuze Gr. Z. 92, which is used on the green cross shells No. 2, the shell under consideration has the new instantaneous fuze Gr. Z. 17, to which reference has been made in German documents but of which no description has so far been obtained; this fuze is entirely mechanical and may or may not be provided with a hollow stem (T) which in the present case was broken. The body (A) of the fuze is made of steel; into the upper part is screwed an aluminum plug (B) containing a plunger sleeve (M) holding the firing pin (P), the upper part of which (I) is constructed so as to receive the hollow stem (T). This plunger sleeve is kept in place by a spring (R).

A plug (D), also of aluminum, is screwed into the lower part of the fuze. This plug is bored out inside so as to receive the primer holder (N) which contains the fulminate (f). When not set, this primer holder is kept in place by means of

five cleats (t-1, t-2, t-3, t-4, and t-5), working independently and held in the position indicated in Fig. 2 by means of a ring (E) resting on the spurs of a circular spring (G). It is this position which is shown on Fig. 1.



Sketch of 15 Cm. Yellow Cross Gas Shell and Fuse Gr. Z. 17

METHOD OF WORKING

When discharged the ring (E) fits snugly into its seat by inertia and is held there by spurs of the circular spring (G) which insert themselves in the groove of the ring. On account

of the rotary movement of the projectile in flight the cleats are forced out of centre and thereby release the primer holder (N) which on impact strikes against the point of the firing pin. The hollow stem at the upper part of the fuze serves only to increase the instantaneous action of the latter.

The centrifugal safety device making use of cleats has already been used in the naval high explosive shell with cap and also in the use of anti-tank shells.

Artillery in Recent Attacks

THE present use of short, heavy artillery preparation had its first striking example in the German attack against the Russians at Riga on September 3, 1917. The methods used there, with some modifications, were the same as those used in the March, April and May offensives.

The element of surprise required the concentration of artillery as well as of other troops to be carried out with the utmost secrecy. Batteries moved in and constructed all emplacements at night. The adjustment was conducted by one battery at a time for several days before the attack, each battery firing not more than twenty or thirty shots a day; some batteries had no opportunity to adjust until the morning of the attack. The large number of trench mortars used was not placed in position until the night before the attack.

The artillery was separated into two distinct groups under separate command, a counter-battery group and an infantry support group. The trench mortars were also grouped under a separate command. This was the first time that this definite division had been made, counter-battery work previously having been considered one of the functions of the divisional artillery.

The preparation consisted of two hours neutralization of Russian batteries and important points with gas, followed by two hours and fifty minutes of gas and destruction fire on batteries, approaches, sensitive points and infantry positions;

heavy and medium trench mortars participated in the fire on the trenches. The last fifteen minutes of the preparation included rapid fire by all pieces.

The methods used in this battle had been only slightly modified in the Spring offensive of this year. Information at hand enables us to follow these modifications. The separation into counter-battery (Aka) and infantry support (Ika) groups has been regularly followed in all the large attacks. In some cases a third group of long-range guns for interdiction fire has been formed (FeKa).

The preparation for the attack of March 21 lasted for five hours, of which the first two hours consisted of gas and H. E. (with a large proportion of gas) on battery positions by all the available guns, followed by three hours continued neutralization by the counter-battery group and fire on infantry positions by the infantry support group. The heavy and medium trench mortars participated during the last hour and the light trench mortars during the last half hour.

In the subsequent attacks the preparatory fire was shortened:

A—, April .....2 hours 45 minutes preparation
M—, B—, April .....2 hours 30 minutes preparation
D—, April .....3 hours 30 minutes preparation

In each of these cases the first two hours consisted of a gas bombardment of battery positions.

The attack on the ———, May —, was preceded by two hours and forty minutes preparation, mostly with Blue Cross (sneezing) gas. In the ——— attack of June —, the preparation lasted four hours and twenty minutes with the same preliminary gas bombardment, and interdiction to a depth of 15 kilometres.

On June —, south of the XYZ River, this method was slightly varied. The gas bombardment lasted from 8 to 11 P.M., followed by a period of calm and a renewal of the preparation from 2.30 to 4.30 A.M.

Many of the batteries taking part in the preparation for

the recent attacks have not been well adjusted and the preparation was often insufficient, but always succeeded in destroying the means of communication. The object of the preparation seems to be not so much destruction, but simply sufficient neutralization to permit the infantry to advance.

BARRAGE

A memorandum from the —th German army dated March —, 1918, gives the following general instructions for barrage:

"The barrage should be made as heavy as possible. All batteries not otherwise assigned to special missions, take part in it. This includes, however, only the field artillery and the 150-mm. howitzers; heavy guns, on account of their dispersion, will not take part in the barrage.

"The creeping barrage will begin with an initial bound of 300 m. for all guns. Thereafter it will progress by bounds of 200 m. every four minutes for light artillery and 400 m. every eight minutes for heavy howitzers. The 150's will lift one minute ahead of the field guns on each bound. Counter-batteries (except heavy guns) will join the creeping barrage when it passes the battery positions on which they are firing. Batteries must be pushed forward to continue the support after the limiting range of the barrage is reached. The barrage must be conducted by a carefully worked out timetable, supplemented if necessary by signals from infantry battalions. These signals should be as simple as possible and should preferably include only 'halt' and 'lift.' In case the 'halt' signal is given the barrage will move on again at the normal rate after ten minutes' halt, unless the signal is repeated. The response to the 'lift' signal will be an immediate 200 m. bound followed by the normal progression. These signals should be rarely used, as they break the continuity of the barrage line and expose the troops to enfilade fire. Constant supervision by ground and aerial observation is necessary.

"In case the barrage passes strong points which hold up the infantry advance and which the accompanying batteries are unable to reduce, it may be brought back on demand of liaison officers or observers with the infantry."

The rules laid down in this memorandum seem to have been followed in the ——— attack. The creeping barrage

advanced at the prescribed rate of 50 m. per minute, stopping on various objectives of assault for periods of seven to twenty-five minutes. The total time of the barrage was two and a half hours, when it reached the limit of range. Thereafter the infantry was supported by batteries moved forward under the orders of the Division Commanders.

In later attacks the rate of advance was materially reduced. At ———, April —, it was 15 m. per minute. In the ——— attack, May —, the rate averaged 35 m. per minute for the six kilometres of the contemplated advance, except along the slope of the ———, where it was about 25 m. per minute. Barrage lines conformed to the ground and the rate of advance was not uniform.

Stops of from fifteen to thirty minutes on several objectives ranging from 500 to 1200 metres apart were provided for, in order to give time for the infantry assault and taking of the position. For the first and second objectives (a depth of 1700 metres), in addition to the creeping barrage, "a semi-rigid protective barrage" was prescribed. This seems to have been a standing barrage placed on the first objective until the creeping barrage reached it, and then moved to the second objective. The creeping barrage covered a total depth of 6100 m. in 5½ hours. In order to get this range, a number of guns were placed within 1000 or 1500 metres of the front line, several days before the attack. These formed the framework of the barrage group. Many of them were not defiladed and probably used direct fire during the preparation.

The same method of successive protective or box barrages on particular points of resistance was used by at least one division in the ——— attack of June —. For this purpose a special group of 77's was designated. These guns had a wide field of fire and swung from one point of resistance to another, according to a separate time table. At this point the creeping barrage advanced first by bounds of 125 m. every five minutes, then 125 m. every ten minutes and finally 250 m. every twenty minutes. The average rate throughout the June — attack

seems to have been about 12 to 15 m. per minute. The length of bounds was variable and in general the barrage was apparently less minutely timed than in previous attacks, and very much slower.

In an attack on a one-division front south of the ———, June —, a barrage chart was captured. This showed bounds of about 250 m. conforming to the contour of the ground. In general there was one bound every ten minutes, but several bounds were at fifteen-minute intervals. The total depth of the barrage was only 2½ kilometres, although the final objective was four kilometres distant.

EDITORIAL

Status of Amendments to the Constitution

THE attention of members of the Field Artillery Association is invited to the following War Department Order:

GENERAL ORDERS WAR DEPARTMENT,
No. 73. *Washington, August* 7, 1918.

1. This country has but one army—The United States Army. It includes all the land forces in the service of the United States. Those forces, however raised, lose their identity in that of the United States Army. Distinctive appellations, such as the Regular Army, Reserve Corps, National Guard, and National Army, heretofore employed in administration and command, will be discontinued, and the single term, The United States Army, will be exclusively used.

2. Orders having reference to the United States Army as divided into separate and component forces of distinct origin, or assuming or contemplating such a division, are to that extent revoked.

3. The insignia now prescribed for the Regular Army shall hereafter be worn by The United States Army.

4. All effective commissions purporting to be, and described therein as, commissions in the Regular Army, National Guard, National Army or the Reserve Corps shall hereafter be held to be, and regarded as, commissions in The United States Army—permanent, provisional or temporary, as fixed by the conditions of their issue; and all such commissions are hereby amended accordingly. Hereafter during the period of the existing emergency all commissions of officers shall be in The United States Army and in staff corps, departments and arms of the service thereof, and shall, as the law may provide be permanent, for a term, or for the period of the emergency. And hereafter during the period of the existing emergency provisional and temporary appointments in the grade of second lieutenant and temporary promotions in the Regular Army and appointments in the Reserve Corps will be discontinued.

5. While the number of commissions in each grade and in each staff corps, department and arm of the service shall be kept within the limits fixed by law, officers shall be assigned without reference to the term of their commissions solely in the interest of the service; and officers and

enlisted men will be transferred from one organization to another as the interests of the service may require.

6. Except as otherwise provided by law, promotion in The United States Army shall be by selection. Permanent promotions in the Regular Army will continue to be made as prescribed by law.

(320 A. G. O.)

BY ORDER OF THE SECRETARY OF WAR:

PEYTON C. MARCH,
General, Chief of Staff.

OFFICIAL:
H. P. McCAIN,
The Adjutant General.

In so far as this order concerns the Field Artillery Association, it would seem that the effect of the order being to abolish all distinction between classes of officers during the war, all such distinction as carried by our constitution is also waived or negative during this period.

From this it follows that during the present emergency a number of the proposed amendments to our constitution may be regarded as having already been adopted. They are, so to speak, adopted by order of the War Department. This interpretation is certainly in accordance with the spirit, if not the exact letter, of our constitution; for had the War Department maintained no distinction among officers at the time the constitution was adopted it is certain that none would have been written into that instrument.

The whole spirit of the constitution is to make as little distinction as possible between Regular and National Guard officers, and these were the only two classes of Field Artillery that existed at the time of the adoption of the constitution. The reserve officer and National Army officer came at a later date. So also during the continuance of the present emergency the Field Artillery has in addition to reserve and National Army officers added to its personnel Coast Artillerymen, Infantrymen and Cavalrymen, the latter in considerable numbers. The Field Artillery Association welcomes all these officers and

desires that no distinction be made among them. We ask only that they be good Field Artillery officers. They are all during the period of the war Field Artillery officers for all intents and purposes of the War Department and consequently they must be so regarded by the Field Artillery Association.

Considering now the specific amendments that have been proposed and accepting the above views as having disposed of all classification and membership questions, it follows that the only remaining ones of the proposed amendments not yet acted on are the following:

Article 6, Section 2, Par. 3—Question of changing the duties of the Secretary-Editor and the Secretary-Treasurer.

Article 6, Section 3, Par. 1—Revoking the requirement that the headquarters of the Association shall be in Washington, D.C.

Article 7, Section 1, Par. 1—Same question as preceding.

Article 7, Section 2—Procedure at meetings based upon a reassignment of the work between the Secretary-Treasurer and Editor.

Article 7, Section 3, Article 8, Article 9—The question previously treated of combining the duties of the Secretary and Treasurer instead as at the present Secretary-Editor.

These latter questions will all have to be voted upon at the annual meeting.

War Department

THE ADJUTANT GENERAL'S OFFICE

WASHINGTON

August 23, 1918.

From: The Adjutant General of the Army.

To: The Field Artillery Journal, War Dept., Washington, D. C.

Subject: Prohibition of publication of books not authorized by the War Department.

It is requested that you bring to the attention of your readers the following:

Paragraph IV, General Order No. 168, War Department, 1917, forbids the publication by members of the military service of any matter without previously submitting it to the War Department, for approval. Changes No. 6, Compilation of Orders, War Department, 1917, forbid the publication by members of the military service of any secret or confidential matter.

As cases have arisen in the past of violation of both of these orders, due to the inexperience or ignorance of the writers, which have resulted in disciplinary action being taken in the case of the writers and financial loss to the publishers, it is requested that the provsions of these orders should be given the widest publicity.

BY ORDER OF THE SECRETARY OF WAR:

F. W. LEWIS,
Adjutant General.

IV—1. Until further orders, officers, enlisted men, and other individual members of the service are prohibited from printing or distributing, through publishing houses or otherwise, any pamphlets or books not previously published or in process of being published on any military subject whatever, except as an approved Government publication or as authorized by the War Department. In order that there may not be duplication of effort in the preparation of publications, and in order that there may be proper supervision and collaboration in the use of information and available records, departments, bureaus, corps, schools, etc., will not prepare nor distribute any military pamphlet or book without first informing the Chief of the War College Division, General Staff, of the contemplated publication. Upon completion of the publication, three copies will be furnished to the Chief of the War College Division, General Staff.

2. The above will not be construed as interfering with the preparation and publication of such military books and pamphlets as may be authorized by the commanding general, American Expeditionary Forces, nor with the preparation and distribution of interpretative matter relative to authorized publications, nor with the preparation of articles for the service journals.

3. Members of the service having new ideas or information which they believe of value to the service in general may forward through military channels to The Adjutant General of the Army, for submission

to the General Staff, a brief outline of their ideas or the publication desired. If the ideas or information are desirable for publication, every facility will be given for perfecting the same and for presenting them to the service. Proper military recognition will be given to the individual concerned.

[000.7, A. G. O.]

BY ORDER OF THE SECRETARY OF WAR:

TASKER H. BLISS,
General, Chief of Staff.

OFFICIAL:
H. P. McCAIN,

The Adjutant General.

[451.9, A. G. O.]

176 (Page 407.) Documents and maps marked "Secret," "Confidential," or "For official use only."—1. A document or map marked "Secret" is for the personal information of the individual to whom it is officially entrusted and of those officers under him whose duties it affects. The officer to whom it is entrusted is personally responsible for its safe custody and that its contents are disclosed to those officers mentioned above, and to them only. The existence of such a document or map will not be disclosed by the officer to whom it is entrusted, nor by his officers without the sanction of superior military authority. No document or map marked "Secret" will be taken into the front line trenches in the theatre of war. A document or map marked "Secret," even though it may bear other classifying marks, such as "Confidential" or "For official use only," will, nevertheless, be regarded as "Secret" within the meaning of this paragraph.

2. A document or map marked "Confidential" is of less secret a nature than one marked "Secret," but its contents will be disclosed only to persons known to be authorized to receive them or when it is obviously in the interest of the public service that they receive them.

3. The information contained in a document or map marked "For official use only" will not be communicated to the public or to the press, but may be communicated to any person known to be in the service of the United States, simply by virtue of his official position.

4. Documents and maps classed as "Secret" or "Confidential" will not be referred to in any catalogue or publication which is not itself a document marked "Secret" or "Confidential," as the case may be. An officer or soldier who communicates information contained in a document or map marked "Secret" or "Confidential" or "For official use only" will at the same time inform the person or persons to whom he

communicates the information that is "Secret" or "Confidential" or "For official use only," as the case may be. The only legitimate use an officer or soldier may make of documents or information of which he becomes possessed in his official capacity is for the furtherance of the public service in the performance of his duty. Publishing official documents or information, or using them for personal controversy, or for any private purpose without due authority, will be treated as a breach of official trust, and may be punished under the Articles of War, or under section 1, Title I, of the espionage act approved June 15, 1917. (*Bulletin No. 43, War Department, 1917.*) (*C. C. of O. No. 6, Dec. 14, 1917.*)

BY ORDER OF THE SECRETARY OF WAR:

JOHN BIDDLE,
Major General, Acting Chief of Staff.

OFFICIAL:
H. P. McCAIN,
The Adjutant General.

THE bar has just been removed from literary effort by persons in the military service. Hitherto, General Order No, 1, January 2, 1918, forbade them to contribute to publications or to accept pay for their writings. This order has been amended by a new order, G. O. No. 89, dated W. D., October 2, 1918, and is quoted in full for the information of all concerned:

1. All persons in the military service, except those who are duly authorized, are forbidden to utter or publish, whether by speech, writing, print or picture, any true or false report likely to be of use to the enemy, or any criticism of persons in the Government service to the detriment of any department of the Government or to the successful prosecution of the war. This rule applies also to persons not in the military service who may be permitted to accompany any part of the army, save that it is not binding upon authorized correspondents for whose guidance special regulations are provided.

2. All persons in the military service are forbidden to act as regular correspondents or contributors of news or articles of an informational military nature to newspapers or other periodicals.

3. Except as above prohibited, and insofar as it does not interfere with the proper performance of military duty and the full observance of discipline, there is no objection to the publication, or to the

receipt of payment for fiction, verse, essays, letters, descriptive or technical articles, pamphlets, books, or illustrations, provided that such matter as relates to the military profession, the war or to current events is first submitted to and approved by the Chief Military Censor, Military Intelligence Division, General Staff.

4. In the case of troops in foreign territory, the Commanding General of such expeditionary force may establish such modifications or further regulations as the situation may seem to him to require.

The obect of this order is to satisfy, as far as is compatible with the protection of military interests, the natural desire of the people to keep in touch with their soldier representatives. It is, therefore, expected that all concerned will comply with both the letter and the spirit of its provisions.

None of the foregoing applies to press dispatches filed from cantonments or camps by regularly paid newspaper correspondents not in the military service. Their copy will not be censored by military authority, but the camp commander will instruct them that they must rigidly adhere to the requests for secrecy with respect to information of value to the enemy, as defined in the printed card sent out by the Committee on Public Information. On violation of these requests, the offending correspondent will be deprived of the privileges of the camp.

BY ORDER OF THE SECRETARY OF WAR:

PEYTON C. MARCH,
General, Chief of Staff.

OFFICIAL:
P. C. HARRIS,
Acting, The Adjutant General.

C'est dure mon Dieu, mais que voulez-vous c'est la guerre

WHILE the subscription list of the "Journal" has increased quite a bit from last December to date *i.e.,* from four thousand to eleven thousand, and we are financially on "easy street," there have been too many notices to "discontinue my subscription" coming in.

There are many and varied reasons given for such discontinuances. Some there are who have left the Artillery because, like Alexander, they sigh for new worlds to conquer; others have been transferred to different arms of the service where it is to be expected they will lavish all their affections on the new

love; still others are so continually on the move that they are afraid the Journal will not catch up with them at some future date no matter how often they inform us of their change of address; there are those who decline to renew their subscriptions because they have only received two numbers during the whole year; and finally there are the good people at home who do not think that it is worth while to continue the subscription for the coming year because the member of the family to whom the "Journal" is sent will not have time to read it.

It is with the last three classes we now propose to deal, and to them we would say:—First: We are loathe to believe that the Journal does not contain sufficient matter of interest, or that you can't afford to take a gamble on three dollars. Second: We have only the "Official Monthly List" published by the War Department and the last address you gave us upon which to depend. Now a man may be, in these quiet times, in several places during a month's time, and then again the "Monthly List" is only infallible with limits.

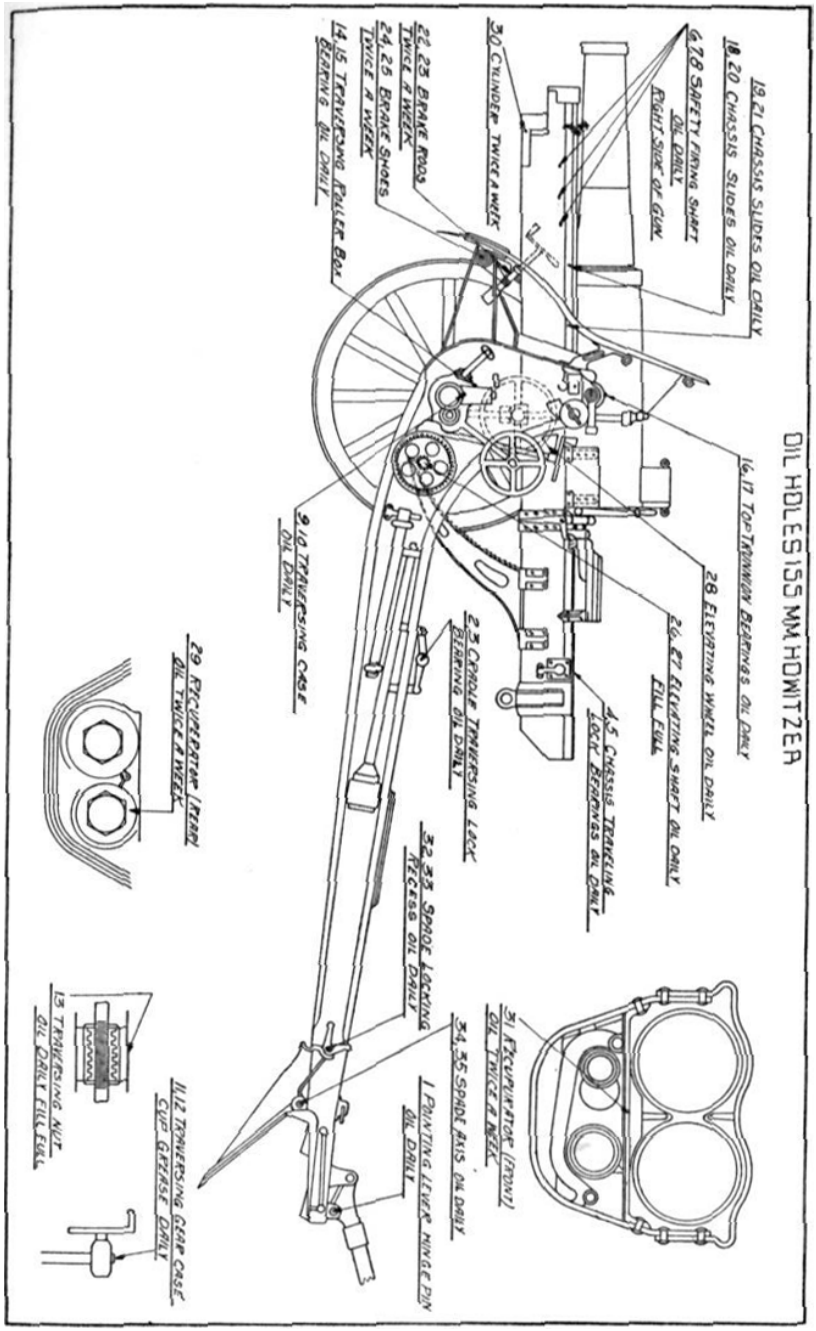
The envelopes in which the "Journal" is mailed, bear on the address side a plain notice to the postmaster that return postage will be sent in case of non-delivery. We frequently have copies of the Journal returned to us as a result; sometimes in bunches. This is because you, gentle reader, have failed to notify the postmaster at your former station (the address we have) of your new one. By postmaster is not meant the mail orderly—he either is relieved, if he is a good one, or dies the day after you leave; the Sergeant Major is otherwise occupied and the Adjutant don't care; he is probably glad to be rid of you. To those who have only received one or two copies during a whole year we would say that the above probably fits their case. There are some subscribers, however, who have evidently overlooked the fact that there are but four numbers a year and write in a peevish strain as if the "Journal" was a monthly.

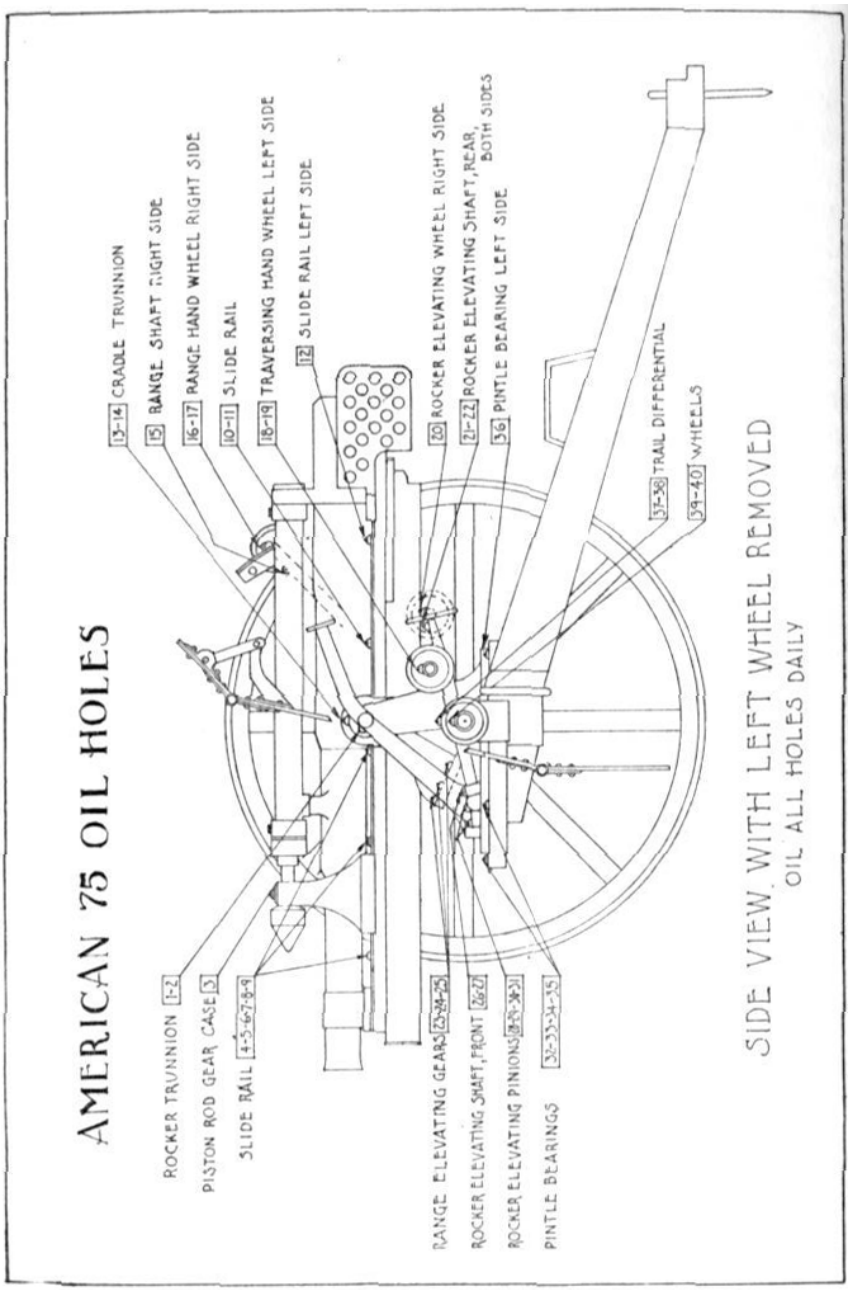
In this connection it may be pertinent to observe that some Sale Boche, Hun, Alien Enemy, or whatever you choose to

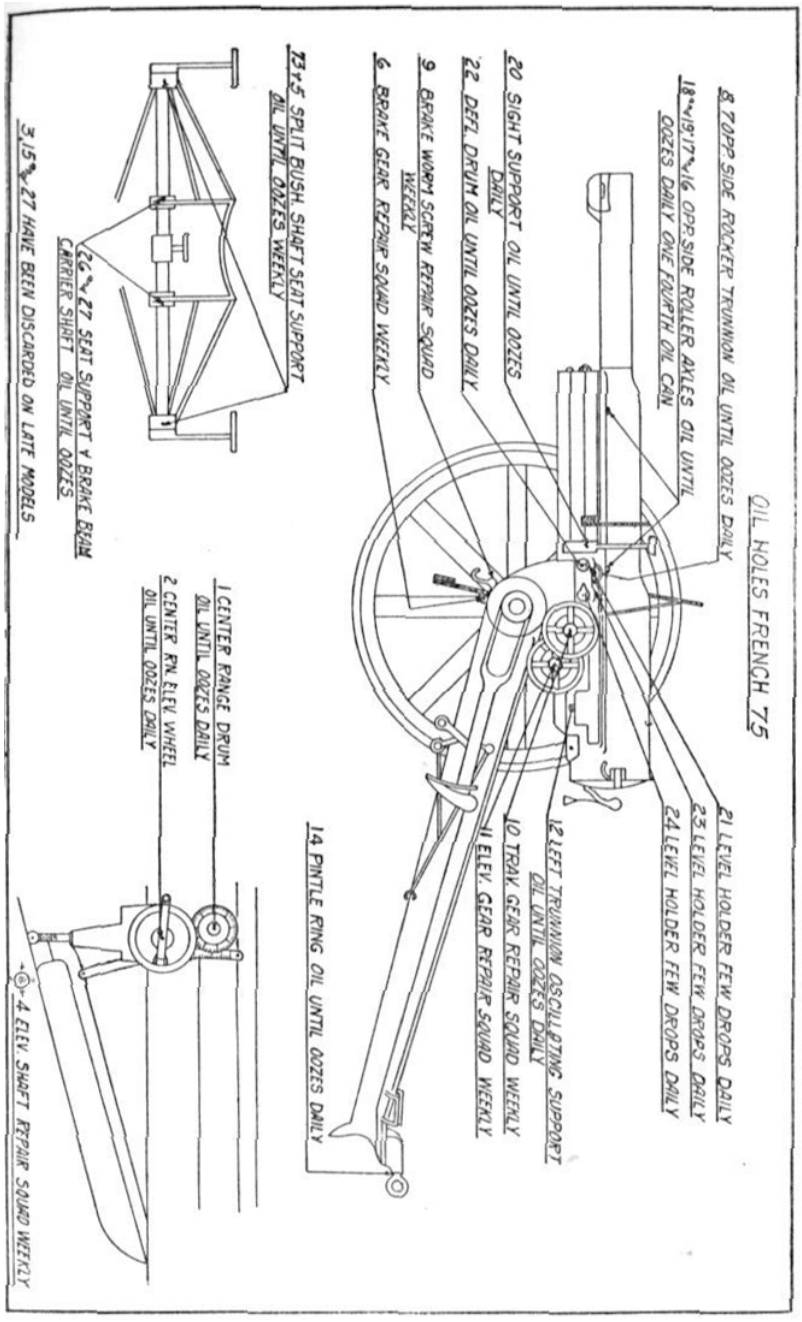
call it or them, has put down a standing, rolling, box or any old kind of barrage on the U. S. Mail, particularly, it would seem, in that part of the terrain occupied by the U. S. Army. The intensity of this fire is such that it is hard to get through it, but we are trying to do our best. All we ask is a little patience and plenty of kicks; we will get the Journal to you sometime if it takes a leg or a Repair Truck. The mail service overseas has *left a little to be desired,* but a letter has been written to the officer in charge explaining our troubles and asking for help. We hope for the best.

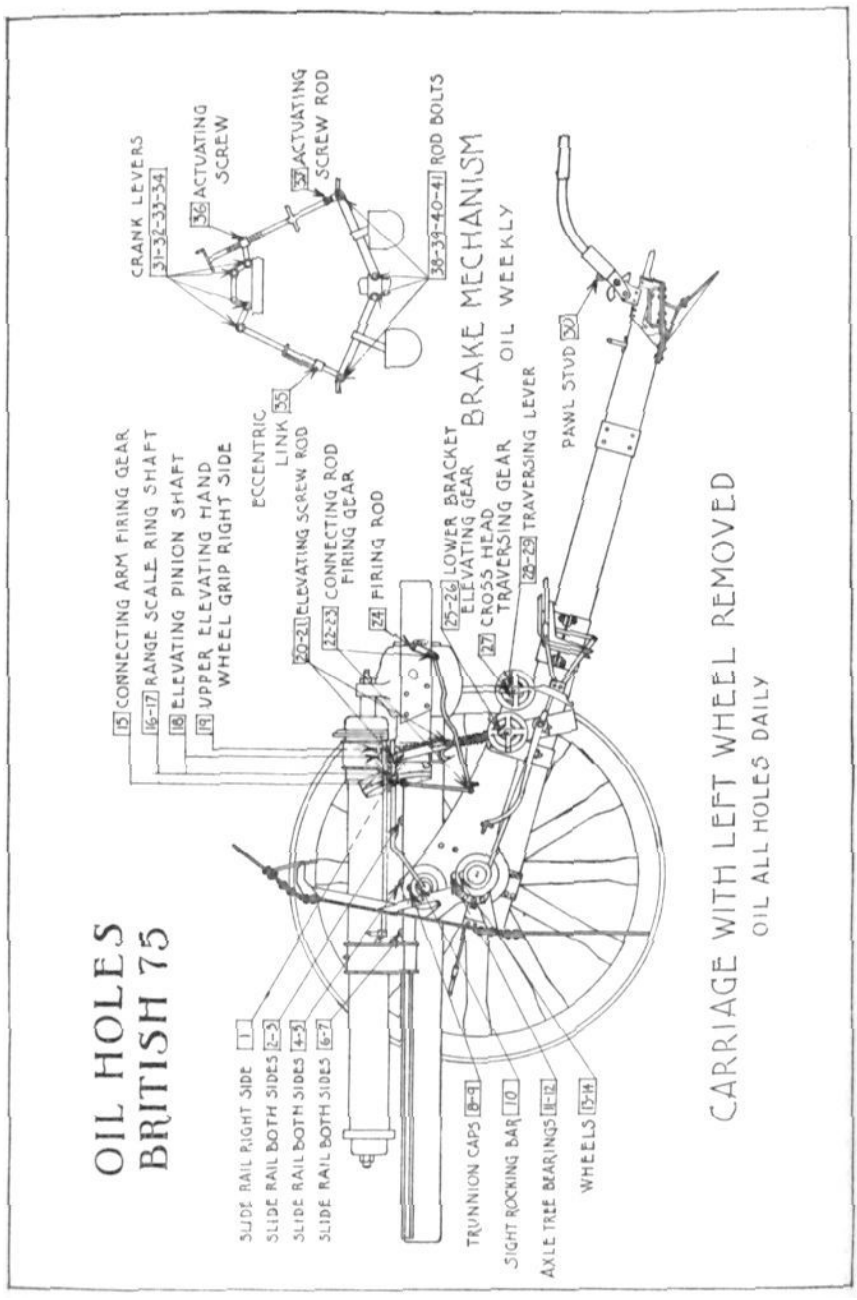
To the dear ones at home who don't think the boy will have time to read such trash because he is "Over There" we can only say—give him three dollars worth of a chance and anyway each number of the Journal contains lovely illustrations which are especially reproduced at great expense for those who cannot or will not read.

WE are all familiar with the tendency of uninstructed mechanics to paint over the oil holes. The Journal prints the following oil-hole diagrams, believing that their presentation at this time will help toward maintaining a high standard in the care and preservation of our matériel.


OIL HOLES 155 MM HOWITZER
19, 21 CHASSIS SLIDES OIL DAILY
18, 20 CHASSIS SLIDES OIL DAILY
6, 7, 8 SAFETY FIRING SHAFT OIL DAILY RIGHT SIDE OF GUN
30 CYLINDER TWICE A WEEK
22, 23 BRAKE RODS TWICE A WEEK
24, 25 BRAKE SHOES TWICE A WEEK
14, 15 TRAVERSING ROLLER BOX BEARING OIL DAILY
9, 10 TRAVERSING CASE OIL DAILY
29 RECUPERATOR (REAR) OIL TWICE A WEEK
13 TRAVERSING NUT OIL DAILY FILL FREE
W12 TRAVERSING GEAR CASE CUP GREASE DAILY
16, 17 TOP TRUNNION BEARINGS OIL DAILY
28 ELEVATING WHEEL OIL DAILY
26, 27 ELEVATING SHAFT OIL DAILY FILL FREE
4, 5 CHASSIS TRACKING LOCK BEARINGS OIL DAILY
2, 3 CRADLE TRAVERSING LOCK BEARING OIL DAILY
32, 33 SPADE LOCKING PIECES OIL DAILY
31 RECUPERATOR (FRONT) OIL TWICE A WEEK
34, 35 SPADE AXIS OIL DAILY
1 POINTING LEVER HINGE PIN OIL DAILY


AMERICAN 75 OIL HOLES
ROCKER TRUNNION 1-2
PISTON ROD GEAR CASE 3
SLIDE RAIL 4-5-6-7-8-9
RANGE ELEVATING GEARS 23-24-25
ROCKER ELEVATING SHAFT, FRONT 26-27
ROCKER ELEVATING PINIONS 28-29-30-31
PINTLE BEARINGS 32-33-34-35
13-14 CRADLE TRUNNION
15 RANGE SHAFT RIGHT SIDE
16-17 RANGE HAND WHEEL RIGHT SIDE
10-11 SLIDE RAIL
18-19 TRAVERSING HAND WHEEL LEFT SIDE
12 SLIDE RAIL LEFT SIDE
28 ROCKER ELEVATING WHEEL RIGHT SIDE
21-22 ROCKER ELEVATING SHAFT, REAR, BOTH SIDES
36 PINTLE BEARING LEFT SIDE
37-38 TRAIL DIFFERENTIAL
39-40 WHEELS
SIDE VIEW WITH LEFT WHEEL REMOVED
OIL ALL HOLES DAILY


OIL HOLES FRENCH 75
8 7OPP SIDE ROCKER TRUNNION OIL UNTIL OOZES DAILY
18 5/8 X 17 X 16 OPP SIDE ROLLER AXLES OIL UNTIL OOZES DAILY ONE FOURTH OIL CAN
20 SIGHT SUPPORT OIL UNTIL OOZES DAILY
22 DEFL DRUM OIL UNTIL OOZES DAILY
9 BRAKE WORM SCREW REPAIR SQUAD WEEKLY
6 BRAKE GEAR REPAIR SQUAD WEEKLY
23 X 5 SPLIT BUSH SHAFT SEAT SUPPORT OIL UNTIL OOZES WEEKLY
26 & 27 SEAT SUPPORT & BRAKE BEAM CARRIER SHAFT OIL UNTIL OOZES
3,15 & 27 HAVE BEEN DISCARDED ON LATE MODELS
1 CENTER RANGE DRUM OIL UNTIL OOZES DAILY
2 CENTER RN ELEV WHEEL OIL UNTIL OOZES DAILY
14 PINTLE RING OIL UNTIL OOZES DAILY
21 LEVEL HOLDER FEW DROPS DAILY
23 LEVEL HOLDER FEW DROPS DAILY
24 LEVEL HOLDER FEW DROPS DAILY
12 LEFT TRUNNION OSCILLATING SUPPORT OIL UNTIL OOZES DAILY
10 TRAK GEAR REPAIR SQUAD WEEKLY
11 ELEV GEAR REPAIR SQUAD WEEKLY
4 ELEV SHAFT REPAIR SQUAD WEEKLY


OIL HOLES
BRITISH 75
SLIDE RAIL RIGHT SIDE 1
SLIDE RAIL BOTH SIDES 2-3
SLIDE RAIL BOTH SIDES 4-5
SLIDE RAIL BOTH SIDES 6-7
TRUNNION CAPS 8-9
SIGHT ROCKING BAR 10
AXLE TREE BEARINGS 11-12
WHEELS 13-14
15 CONNECTING ARM FIRING GEAR
16-17 RANGE SCALE RING SHAFT
18 ELEVATING PINION SHAFT
19 UPPER ELEVATING HAND WHEEL GRIP RIGHT SIDE
20-21 ELEVATING SCREW ROD
22-23 CONNECTING ROD FIRING GEAR
24 FIRING ROD
25-26 LOWER BRACKET ELEVATING GEAR
27 CROSS HEAD TRAVERSING GEAR
28-29 TRAVERSING LEVER
30 PAWL STUD
31-32-33-34 CRANK LEVERS
35 ECCENTRIC LINK
36 ACTUATING SCREW
37 ACTUATING SCREW ROD
38-39-40-41 ROD BOLTS
BRAKE MECHANISM
OIL WEEKLY
CARRIAGE WITH LEFT WHEEL REMOVED
OIL ALL HOLES DAILY

Roll of Honor

PRO PATRIÂ

DEAD

SMITH.—Died of wounds received in action in France, June 6, 1918, Lieutenant Howard Lowell Smith, Field Artillery, United States Army.

MAYNOR.—Killed, result of aeroplane accident, in France, June 25, 1918, Second Lieutenant Eldridge W. Maynor, Field Artillery Reserve Corps, attached 90th Aero Squadron.

JONES.—Killed in action in France, July 4, 1918, Second Lieutenant Herbert C. Jones, Field Artillery Reserve Corps, attached Battery D, 6th Field Artillery.

COCHRAN.—Died on board U. S. S. Susquehanna, July 8, 1918, First Lieutenant Garrett Cochran, 107th Field Artillery.

DUBOIS.—Killed in action in France, July 11, 1918, Second Lieutenant Norman D. DuBois, Field Artillery Reserve Corps, attached Battery D, 149th Field Artillery.

BOOMA.—Killed in action in France, July 11, 1918, Second Lieutenant Frank Booma, Field Artillery Reserve Corps, attached Battery A, 151st Field Artillery.

HARRISON.—Died of wounds received in action in France, July 13, 1918, Captain Little Harrison, Field Artillery Reserve Corps, attached Battery E, 119th Field Artillery.

WOOD.—Killed in action in France, July 21, 1918, Captain Thurston E. Wood, National Army, Headquarters Company, 12th Field Artillery.

MEHL.—Killed in action in France, July 21, 1918, First Lieutenant Byron H. Mehl, Battery C, 12th Field Artillery.

MCCONNELL.—Killed in action in France, July 22, 1918, Second Lieutenant Frank J. McConnell, Battery E, 7th Field Artillery.

ANDERSON.—Killed in action in France, July 22, 1918, First Lieutenant George R. Anderson, Field Artillery Reserve Corps, attached Battery E, 102d Field Artillery.

HOOPES.—Died of wounds received in action in France, July 28, 1918, Second Lieutenant Joseph Hoopes, 12th Field Artillery.

MCCLENON.—Killed in action in France, August 11, 1918, First Lieutenant Joel H. McClenon, 101st Field Artillery.

PLUMMER.—Killed in action in France, August 11, 1918, Second Lieutenant Charles W. Plummer, 101st Field Artillery.

GRAHAM.—Killed in action in France, August 22, 1918, Second Lieutenant Edward F. Graham, 305th Field Artillery.

LEWIS.—Killed in action in France, August 28, 1918, First Lieutenant Samuel Lewis, attached 52d Field Artillery.

BEATON.—Killed in action in France, August 30, 1918, Second Lieutenant Lloyd C. Beaton, Headquarters Company, 119th Field Artillery.

MERSELIS.—Killed in action in France, September 1, 1918, First Lieutenant William S. Merselis, Headquarters Company, 16th Field Artillery.

PRITCHETT.—Died of wounds received in action in France, September 6, 1918, Second Lieutenant Frederick B. Pritchett, Battery A, 109th Field Artillery.

MCELDERRY.—Died of typhoid fever in France, September 7, 1918, Second Lieutenant August B. McElderry, Battery C, 120th Field Artillery.

HARVEY.—Killed in action in France, September 12, 1918, Major Harry A. Harvey, 103d Field Artillery.

DOUGLAS.—Killed in action in France, September 13, 1918, First Lieutenant Allan W. Douglas, Battery A, 113th Field Artillery.

CUNNINGHAM.—Killed in action in France, September 17, 1918, First Lieutenant Oliver B. Cunningham, Battery D, 15th Field Artillery.

GILLET.—Killed in aeroplane accident at Santa Gererudis Ranch, Texas, September 17, 1918, First Lieutenant Robert S. Gillet, Field Artillery, attached Air Service.

COCHRAN.—Died of pneumonia at El Paso, Texas, October 2, 1918, Captain Luckett Cochran, 6th Field Artillery.

ROWE.—Died of pneumonia at Camp Jackson, S. C., October 3, 1918, Second Lieutenant Louis H. Rowe, Field Artillery Replacement Depot.

NOTE.—It is intended to publish in each issue of the JOURNAL the names of those officers of Field Artillery who are killed in action, wounded, or died of wounds. Members of the Field Artillery Association will confer a favor on the JOURNAL if they will communicate any information they may have of casualties to officers of the Field Artillery, whether they are members of the Association or not. (EDITOR.)

BOOK REVIEWS

THE WARFARE OF TO-DAY. By Lieut. Col. Paul Azan, French Army. Houghton Mifflin Company, 4 Park Street, Boston, Mass. Illustrated. Price, $2.50 net.

Colonel Azan came to this country as senior officer of the Harvard University French Military Mission. This book, which is a compilation of a series of lectures delivered by Colonel Azan, is popular in form, and gives to the layman a clearly defined and intimate view of modern warfare as experienced by Colonel Azan on the Western front before coming to this country.

So general is the popular interest in war to-day that a publication of this sort, non-technical in tone, and reflecting on every page the personal angle of an officer who has taken part in the great struggle cannot but have a wide public.

FIELD ARTILLERY FIRING DATA AND NOTES. By Major K. S. Perkins, 5th Field Artillery, U. S. Army. George Banta Publishing Company, Menasha, Wisconsin. 1917.

This book, in pocket edition, contains complete instructions for computation of firing data by the methods previously used in the field artillery. This instruction is given with many diagrams and is easily understood. The book also contains considerable instruction for training battery details. It was prepared for the use of, and will be of advantage to, beginners in field artillery.

An interesting and compact little notebook is offered by the George Banta Publishing Company, Menasha, Wisconsin, under the title: "THE SQUAD LEADER'S NOTE BOOK, 1918." This volume is bound in linen of olive drab color and is of a size convenient for carrying in the field in a pocket.

The first 56 pages of the note book are of tough thin paper, and printed thereon in very small type are four chapters of brief, valuable extracts from Infantry Drill Regulations, covering Military Courtesy, School of the Soldier, School of the Squad, and School of the Company. Then follows a very comprehensive chapter on Signals (flag—hand—arm and sound) and Codes. The final chapter covers Guard Duty, Military Terms explained, and a résumé of Army Organization for Oversea Service.

Following the matter described above are two ruled but otherwise blank sheets for such permanent record as the squad leader may desire to keep. The foregoing is securely bound to the top cover of the note book. Attached to the back cover is a pocket in which is inserted a pad bound to a wedge-shaped card board which fits the pocket. This pad consists of twelve blank form pages for reports, followed by fifty pages ruled for the purpose of recording daily roll call.

This volume is handy in many ways for the squad leader, and will no doubt be valuable to new forces during the first two or three months of training, but for active field work its value is doubtful. In such a book the main things needed in the field are the blank message sheets, and the twelve blank sheets in this volume will hardly provide for the messages a squad leader might desire to send during one tour of outpost duty. The upkeep of the supply of extra pads has been found by actual experience to be a difficult matter. In actual field work, if the squad leader can be provided with the regulation Field Message Book, it will cover his needs far better than any of the prepared note books which are on the market. The carbon sheets of the Field Message Book, which permit of the retention of a copy of each message sent, together with the ruled squares on the back of the message sheets for the purpose of hasty sketching, offer features which were not considered by the author of the note book under discussion.

The author of this note book is to be complimented on the form and preparation of the volume which shows painstaking work.

TNT AND OTHER NITROTOLUENES. By G. Carlton Smith, Instructor in General Chemistry, School of Applied Science, Carnegie Institute of Technology, Pittsburgh, Pa., 1918. D. Van Nostrand Company, New York. 133 pages. Price, $2 net.

This little book appears at a time when the subject is of great interest to many manufacturers, chemists and engineers engaged in munitions work, as well as to the military service. While written in such a manner as to appeal to others than chemists, it constitutes an excellent discussion of the chemistry of the subject of nitrotoluenes.

The subject is treated under the following chapter headings: I. Introduction; II. Historical; III. Theory of Nitration of Toluene; IV. Manufacture of TNT; V. Purification; VI. Inspection and Testing; VII. Properties of the Trinitrotoluenes; VIII. Properties of Mono- and Dinitrotoluenes; IX. Accidents in TNT Plants; X. Diseases, References, and Index.

Items of special importance to those interested in manufacture are the emphasis placed on inherent dangers of the manufacturing process,

the discussion of methods of washing and purification, the treatment of the spent acids, and the dangers of the use of alkalies in purification.

The book contains eighty-four references to the literature of the subject, but it is noted that original references are not always given. Also, the numbering of references in the text is consecutive for each chapter only, necessitating a search for the number of the chapter before the list of references in the back of the book can be consulted. References in Chapter VII are numbered from 1 to 17, while the list shows only eleven references for this chapter.

The statement of page 66 that "refined TNT for exploders must melt from 80º to 81.5º C." is obviously an error, since figures for the m. p. of pure TNT given by the best authorities do not exceed 80.8º.

In connection with the description of tests in Chapter VI, it is not understood why the use of diphenylamine is prescribed for obtaining the correction for the exposed mercury column of the thermometer in the melting point determination (page 67). It would seem preferable to make use of the method generally adopted in all scientific work, where "N" in the formula is the number of degrees of exposed mercury column above the surface of the bath, and not above some arbitrarily determined point.

It is believed that the composition of the acid mixture quoted on page 34 as used in the mononitration of the two-stage process is incorrectly given, the nitric acid content being unusually high.

On the whole, the book should be of value to any one interested in the manufacture or technical application of TNT.

TROOPS ON RIOT DUTY. A Manual for the Use of the Armed Forces of the United States. By Major Richard Stocton, Jr., 317th Infantry, U. S. A., and Captain Sakett M. Dickinson, N. G. N. J., member of the New Jersey Bar. With plates by Jordon Homer Stover. Third edition, revised, 1918. George Banta Publishing Company, Menasha, Wis. Adopted by the War Department for issue on requisition to the United States Army.

In pocket edition, it shows careful study in preparation and is an excellent exposition of the subject.

MILITARY LAW—ITS PROCEDURE AND PRACTICE. By Lieut. Col. Sisson C. Pratt (late) Royal Artillery. Nineteenth edition, revised and corrected up to September, 1915. London: Kegan Paul, Trench, Trübner & Co., Ltd., Broadway House, 68-74 Carter Lane, E. C.—E. P. Dutton & Co., 681 Fifth avenue, New York, N. Y. Price, $2.25 net.

A complete compendium of the British military code, based on the Army Act, the Rules of Procedure, the King's Regulations, the various Army Orders, Royal Warrants and Orders in Council. Of interest to American officers only by way of comparison.

HOW TO OUT-THINK YOUR OPPONENT, OR T. N. TACTICS FOR CLOSE-IN FIGHTING. By Prof. Al. Williams (Humbert Cattaruzzi). John J. Newbegin, publisher, San Francisco, Cal., 1898.

A system of gymnastic exercises developed for the purpose of enabling an unarmed man familiar with the movements and holds to get the better of an opponent who is attacking with a fixed bayonet. The holds and locks are called T. N. Tactics, meaning thoroughly new tactics, and the system is known as the Arm and Rifle Interlocking System of Defense and Offense. The book is copiously illustrated, the illustrations being from life. The system is highly recommended by several army officers who have taken the course and used the system in the instruction of their commands.

FRENCH-ENGLISH DICTIONARY OF MACHINE GUN TERMS. By Major H. J. Maloney, 21st Field Artillery.; First Lieut. Frank Short, Ordnance Department; First Lieut. H. Morton, Ordnance Department, U. S. A. George Banta Publishing Company, Menasha, Wis.

A handy little dictionary in pocket pamphlet form of machine gun nomenclature. It should prove of assistance to any one having to do with that weapon.

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The United States Field Artillery Association

CONSTITUTION

ARTICLE I

Title

This Association shall be known as the "United States Field Artillery Association."

ARTICLE II

Objects

The objects of the Association shall be the promotion of the efficiency of the Field Artillery by maintaining its best traditions; the publishing of a journal for disseminating professional knowledge and furnishing information as to the field artillery's progress, development, and best use in campaign; to cultivate, with the other arms, a common understanding of the powers and limitations of each; to foster a feeling of interdependence among the different arms and of hearty coöperation by all; and to promote understanding between the regular and militia forces by a closer bond; all of which objects are worthy and contribute to the good of our country.

ARTICLE III

Membership and Eligibility

SECTION 1.—The Association shall consist of (1) active members and (2) associate members.

SEC. 2.—The following shall be eligible to active membership:

Commissioned officers on the active lists of the field artillery of the regular army and of the organized militia of the several states, territories, and District of Columbia; *Provided*, That officers of the regular army when separated from the field artillery, by promotion or detail

in staff departments, shall not thereby lose their status as active members.

SEC. 3.—The following shall be eligible to associate membership:

(*a*) Commissioned officers on the retired lists of the regular army and of the organized militia of the several states, territories, and District of Columbia.

(*b*) Those who, as commissioned officers, either regular, militia, or volunteer, have served with batteries or larger units of field artillery in time of war.

(*c*) Commissioned officers of the regular army and of the organized militia of the several states, territories, and District of Columbia, not now belonging to the field artillery, who have served at least one year as commissioned officers in field artillery.

(*d*) General officers of the regular army, except as provided in Section 2 of this article, and of the organized militia of the several states, territories, and District of Columbia.

(*e*) All commissioned officers and former officers of the United States Army, Navy, and Marine Corps, and of the organized militia in good standing, not included in the classification hereinabove set forth.

(*f*) Those in civil life whose applications are approved by the Executive Council hereinafter provided for.

ARTICLE IV

Applications for Membership; Withdrawals

SECTION 1.—Any person, eligible, under the foregoing article, to membership, may become a member by making written application to the Secretary and paying the first year's dues. The decision of the Executive Council as to eligibility of an applicant shall be final.

SEC. 2.—Any member may withdraw from the Association at any time by tendering his resignation in writing, but such resignation shall not take effect until such member has paid all indebtedness due the Association at the time of such resignation.

SEC. 3.—Any member may be dropped for cause by a majority vote of the Executive Council; but no member shall be so dropped without first previously notifying him, in writing, at his last known post-office address, of the proposal to so drop him, and waiting a reasonable time for his reply.

SEC. 4.—A member dropped under the foregoing section may be reinstated by a majority vote of the Executive Council, and by paying all sums, if any, due the Association.

ARTICLE V

Rights and Obligations of Members

SECTION 1.—Active members only shall be entitled to vote.

SEC. 2.—The annual dues of the Association shall be fixed by the Executive Council, but shall not exceed $4.00 per annum.

SEC. 3.—Active members shall be entitled to receive all publications issued by the Association without payment other than the annual dues.

SEC. 4.—Associate members shall be entitled to receive the JOURNAL without payment other than the annual dues.

ARTICLE VI

Executive Council; Officers

SECTION 1.—The Executive Council shall be composed of five active members, three of whom shall be officers of the regular army and two officers of the organized militia, to be elected biennially for a term of two years by a majority vote, in person or by written proxy of the active members. The Council shall hold its meetings at the headquarters of the Association, which shall be in the city of Washington.

SEC. 2.—The Executive Council shall appoint the following officers of the Association:

1. A President, to be selected from its own members, and who shall be an officer of the regular army.

2. A Vice-President, to be selected from among the active members of the Association.

3. A Secretary-Editor, to be selected from its own members, or other active members of the Association, and who shall be an officer of the regular army.

4. A Treasurer, to be selected from among the active members, and who shall be an officer stationed or residing in Washington, D. C.

These officers shall hold office at the pleasure of the Executive Council and shall perform the duties usually and customarily performed by like officers in civil associations.

SEC. 3.—The Executive Council shall meet from time to time, at the call of its senior member present in Washington. Three members shall constitute a quorum for the transaction of business.

SEC. 4.—The Executive Council shall have power to fill any vacancy in its own membership by temporary appointment from among the active members and subject to the requirements of Sections 1 and

2 of this article; *Provided,* That such temporary appointment shall not extend beyond the next annual meeting of the Association.

SEC. 5.—It shall require a majority vote of the members of the Council present at any meeting to carry any proposition.

SEC. 6.—The Executive Council shall be responsible for the administration of the affairs of the Association. To this end, they are empowered to carry out any measures whatsoever which, in their judgment, seem expedient to further the interests of the Association and to attain its ends and aims; *Provided*, Such measures are not in conflict with the rules, decisions, or practice of the War Department.

SEC. 7.—No contract involving expenditure of funds of the Association shall be made except pursuant to a general or special resolution of the Executive Council, duly recorded. The Executive Council shall have no power to place any personal liability on any member of the Association, and shall incur no obligations which cannot be met by the funds on hand in the treasury of the Association.

ARTICLE VII

Meetings and Elections

SECTION 1.—The regular meetings of the Association shall be held annually at Washington, D. C., or at such other place as may be designated by the Executive Council, who shall also prescribe the time of meeting, and at least thirty days' notice, by mail, must be given to each active member.

SEC. 2.—At regular meetings, any existing vacancies in the Executive Council shall be filled; the Treasurer's financial statements shall be submitted and his accounts audited; the Secretary-Editor shall submit a report on general affairs and progress of the Association and the conduct of the JOURNAL since the last regular meeting; and such other business shall be transacted as may come before the meeting.

SEC. 3.—Special meetings may be called by the Executive Council upon written request therefor signed by twenty members. At least thirty days' notice thereof shall be given, by mail, to active members. The object of the meeting shall be stated in the request and in the notice.

SEC. 4.—Fifty per cent. of the members in the United States, either present in person or represented by written proxy, shall constitute a quorum, except as provided in Article IX.

ARTICLE VIII

Adoption

SECTION 1.—This Constitution shall be considered as adopted and shall be of full effect when it shall have been accepted by eighty officers having the qualifications herein prescribed for active members, and when it shall have been subscribed to by the same officers, who shall then, and thereafter, be known as charter members of this Association.

SEC. 2.—Immediately after the adoption of this constitution, the charter members shall proceed to the election of the Executive Council. For this first election, those eligible to join the Association as active members, under Article III, Section 2, shall be eligible for election as members of the Executive Council, the same as if they had already signed the constitution as charter members; *Provided*, Officers so elected shall have the other qualifications provided for in Article VI, Section 1; but any officer so elected shall qualify as a member of this Association upon notice to him of his election, and before undertaking the duties of the office to which he is elected.

ARTICLE IX

Amendment

This Constitution may be amended or altered by a three-fifths vote of the active members, either in person or by proxies in writing. To secure consideration of a proposed change, application must be made to the Secretary, in writing, signed by not less than twenty-five active members, setting forth clearly the alterations desired and the principal reasons therefor. This application must be submitted at least six months prior to the time of the meeting. The Executive Council will direct the Secretary to give notice, by mail, to the members entitled to vote, so they may receive it at least ninety days prior to the meeting. The notice will contain the proposed amendment with the names of the proposers. The notice will also be published in all copies of the JOURNAL issued between the receipt of the application and the date of the meeting.

Proposed amendments to the Constitution will be voted on at annual meetings only.

Made effective June 7, 1910, at Fort Riley, Kansas, under the provisions of Article VII.

LIST OF CHARTER MEMBERS

Eli D. Hoyle,
Jno. E. McMahon,
P. C. March,
F. E. Stevenson,
C. F. Sargent,
T. M. Wortham,
J. B. Goodman, Jr.,
Wm. J. Snow,
W. S. McNair,
Chas. Rees Lloyd,
A. F. Cassels,
W. B. Carr,
J. W. Kilbreth, Jr.,
J. Edmond Hill,
Raymond W. Briggs,
C. M. Bunker,
D. F. Craig,
Chas. A. Salisbury,
Louis S. Cox,
Jos. A. Smith,
Quido A. Kulish,
J. S. White,
F. E. Hopkins,
John F. O'Ryan,
Robt. H. Tyndall,
Branch Johnson,
Edwin H. Tracy,
Wm. C. Webb,
Philip C. Westfahl,
Luther E. Gilmore,
D. S. Hanley,
Grant S. Taylor,
J. Ed. Eubanks,
Tilman Campbell,
S. G. Barnard,
D. H. Currie,
Chas. J. Ferris,
Courtlandt Parker,
John W. Downer
Wm. O. Richardson,
Jno. L. Thomas,
A. J. McBride, Jr.,
Frank H. Hines,
Wm. W. Mullen,
Frank H. Frisbie,
E. O. Sanguinet,
Beverly F. Browne,
Robt. M. Danford,
Chas. S. Mortimer,
Dawson Olmstead,
D. C. Cubbison,
Walter J. Cookson,
A. L. P. Sands,
Thos. D. Sloan,
J. W. Rumbough,
John J. Coates,
Thorndike D. Howe,
Marshall Magruder,
Saml. E. McRickard,
Harvey D. Higley,
H. M. Boyer,
T. W. Peck,
E. P. King, Jr.,
E. S. Steinel,
Paul C. Hunt,
A. C. Allen,
Roger D. Swaim,
O. W. Scharch,
John S. Williams,
Harvey W. Vint,
Ralph McT. Pennell,
Wm. G. Hinderer,
Alonzo J. Comstock,
Harry T. Speakman,
John S. Purucker,
Joseph A. Le Fever,
Henry C. Moriarity,
Robert H. Lewis,
Clinton T. Bundy,
Chester B. McCormick,
Chas. F. Nowell.

The first Executive Council of The U. S. Field Artillery Association was composed of:

Brig. Gen. Montgomery M. Macomb, U. S. Army.

Capt. Oliver L. Spaulding, Jr., 5th Field Artillery, U. S. Army.

Capt. Fox Conner, General Staff, U. S. Army.

Capt. John F. O'Ryan, 1st Battery, National Guard, State of New York.

Capt. Robert H. Tyndall, Battery A, National Guard, State of Indiana.

The first officers of the Association were:

President—Brig. Gen. Montgomery M. Macomb, U. S. Army.

Vice-President—Lieut. Col. E. St. J. Greble, General Staff, U. S. Army.

Secretary-Editor—Capt. Wm. J. Snow, 6th Field Artillery, U. S. Army.

Treasurer—Capt. Wm. J. Snow, 6th Field Artillery, U. S. Army.

Notice of Proposed Amendments to the Constitution as Required by Article IX

FORT SILL, OKLAHOMA,
APRIL 5TH, 1918.

THE SECRETARY,
Field Artillery Association,
Washington, D. C.

SIR:

1. As provided in Article IX of the Constitution of the Field Artillery Association application is hereby made to secure consideration of certain amendments and alterations to the Constitution as hereinafter set forth. The general idea of these changes is to remove the restriction placed on retired officers regarding active membership; to admit field artillery officers of the National Army and of the Officers' Reserve Corps to membership in the Association practically on the same terms as those of the organized militia, to separate the office of Editor from that of Secretary and to have a business manager or executive known as Secretary-Treasurer, and certain minor changes, as follows—article by article.

H. W. BUTNER, Colonel, 1st F. A.
OLIVER L. SPAULDING, JR., Col., 8th F. A.
A. S. FLEMING, Col., F. A.
R. S. PRATT, Lt. Col., 9th F. A.
RALPH MACT. PENNELL, Lt. Col., F. A.
R. E. D. HOYLE, Maj., 1st F. A.
M. MAGRUDER, Maj., F. A.
H. E. MARR, Maj., 301st F. A.
ROBERT G. KIRKWOOD, Maj., F. A. N. A.
H. E. MINER, Maj., 10th F. A.
WM. BRYDEN, Lt. Col., 329th F. A.
LAURIN L. LAWSON, Col., F. A.
W. R. ENNIS, Lt. Col., F. A.
NEWTON N. POLK, Capt., 13th F. A.
W. F. JONES, Lt. Col., F. A.
J. H. BAYGON, Lt. Col., 2nd F. A.
J. W. KILBRETH, JR., Col., F. A.
C. D. DALY, Maj., N. A.
THOMAS J. JOHNSON, Maj., N. A.
BALLARD LYERLY, Maj., 12th F. A.
T. W. HOLLYDAY, Lt. Col., 313th F. A.
LOUIS A. BEARD, Capt., 15th F. A.
D. M. BEERE, Maj., 321st F. A.
W. H. RUCKER, Maj., 16th F. A.
CLIFT ANDRUS, Capt., 14th F. A.
F. M. RUMBOLD, Col., 128th F. A.
ALBERT L. HALL, Maj., 2nd F. A.
W. F. MORRISON, Lt. Col., 322nd F. A.

PROPOSED AMENDMENTS TO THE ORIGINAL CONSTITUTION UNITED STATES FIELD ARTILLERY ASSOCIATION

ARTICLE II.—Objects: Insert after "militia forces" the words "and those of the National Army."

ARTICLE III.—Membership and Eligibility:

(*a*) It is believed that a great injustice has been done in providing that active members lose their status as such by retirement. Already

a number of the members who have devoted themselves to the interest of the JOURNAL have been affected, and as a result of this war many of our most competent *field artillery officers*, in full mental vigor and with experience gained in the trenches, will be cut off by retirement from active membership and ability to hold office. These are the men the JOURNAL most needs as active members. It is not only individually unjust but it is opposed to the best interest of the JOURNAL that active membership should be lost by retirement.

(*b*) Field Artillery officers of the National Army should be admitted to active membership. Therefore, the following amendments are proposed:

SECTION 2.—The following shall be eligible to active membership:

(*a*) Field Artillery officers of the regular army.

(*b*) Field Artillery officers of the organized militia.

(*c*) Field Artillery reserve officers in active service.

(*d*) Field Artillery officers of the National Army in active service. *Provided*, That officers of the regular army when separated from the field artillery by promotion, detail in Staff departments, or retirement shall not thereby lose their status as active members.

SECTION 3.—(*b*) Omit "either regular, militia or volunteer."

(*c*) Omit "of the regular army and of the organized militia of the several states, territories, and District of Columbia."

(*d*) Omit "except as provided in Section 2 of this article."

(*e*) All commissioned officers and former commissioned officers of the United States Army, Navy, Marine Corps, the organized militia and the National army not included in the classification hereinbefore set forth.

ARTICLE VI.—Executive Council; Officers:

SECTION 1.—It is believed the Council should have a representative from the National Army. Also that it should be authorized to designate the location of the headquarters of the Association. It may be necessary to change them some day. It is therefore recommended that Section 1 be amended as follows: (1) Substitute for the words "of the organized militia" the words "from other forces." (2) Substitute a comma for the period after "Washington" and add the words "or at such other place as the Council may designate."

SECTION 2.—(3) It is not good administration to combine the duties of Secretary and Editor. The Editor should be free to attend to his editorial work without being bothered by business correspondence. It would seem more logical to combine the duties of Secretary and Treasurer, thus constituting an executive officer. It is recommended that 3 be amended to read as follows: "3. A Secretary-Treasurer, to be selected

from its own active members, or other active members of the Association, and who shall be an officer of the Regular Army stationed or residing at the headquarters of the Association," and that 4 be amended to read as follows: "4. An Editor, to be selected from among the active members, and who shall be an officer of the Regular Army stationed or residing at the headquarters of the Association."

SECTION 3.—(1) For "in Washington" substitute "at the headquarters of the Association."

ARTICLE VII.—Meetings and Elections:

SECTION 1.—(1) Omit the words "at Washington, D. C.," "or" and "other." It is the duty of the Executive Council to designate the time and place of the annual meeting. The omitted words are redundant and without force.

SECTION 2.—It is recommended that this section read as follows: "Section 2. At regular meetings, any existing vacancies in the Executive Council shall be filled; the Secretary-Treasurer shall submit a report on the general affairs and progress of the Association, concluding with a financial statement, and his accounts shall be audited by a committee appointed by the presiding officer. The Editor shall submit a report upon the conduct of the JOURNAL since the last regular meeting, with recommendations for such changes as he may think necessary to make during the next year. Such other business shall be transacted as may come before the meeting."

SECTION 3.—It is recommended that the first sentence of this section read as follows: "A special meeting may be called by the Executive Council upon a written request submitted to the Secretary-Treasurer and signed by not less than twenty members."

ARTICLE VIII.—Adoption: No change.

ARTICLE IX.—Amendment: (1) Substitute "Secretary-Treasurer" for "Secretary" wherever it occurs.