VOLUME VIII NUMBER 2

APRIL-JUNE

THE FIELD ARTILLERY JOURNAL

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THE UNITED STATES FIELD ARTILLERY ASSOCIATION
WASHINGTON, D. C.

Contents

No. 2

GENERAL PEYTON C. MARCH, UNITED STATES ARMY

WAR DEPARTMENT.

General Orders
No. 53

WASHINGTON, May 27, 1918

1.—The following order is published for the information and guidance of all concerned:

WAR DEPARTMENT.

WASHINGTON: May 20, 1918.

By direction of the President, General Peyton C. March is detailed as Chief of Staff of the United States Army, to date May 20, 1918, relieving General Tasker H. Bliss. General Bliss will continue on his present duty with the brevet rank of General.

NEWTON D. BAKER,
Secretary of War.

(200.61, A.G.O.)

By Order of the Secretary of War:
PEYTON C. MARCH,
General, Chief of Staff.

Official:
H. P. MCCAIN,
The Adjutant General

THE FIELD ARTILLERY JOURNAL

VOL. VIII **APRIL-JUNE, 1918** **NO. 2**

General Comment on Anti-Aircraft Firing

BY LIEUTENANT COLONEL REILLE, HEAD OF ARTILLERY IN THE FRENCH MISSION

AT the beginning of the war it was almost impossible to foresee what would be the development of aviation in the army and what developments in the anti-aircraft artillery would of necessity follow.

The object of artillery against aircraft is above everything else to prevent the enemy machines from fulfilling their mission of observation. Although there are those who seem to think that the present and future rôle of aviation consists mainly in dropping bombs, it must be said that this is a decided error. The principal rôle of aviation is not in the dropping of bombs but in observation.

The flying machine should be considered less like one of the arms of the artillery and more as one of its eyes—and that eye the best one.

In fighting the enemy aircraft our guns fight the artillery of the enemy in its most vital part.

The artilleryman who fires, or orders firing, against aircraft should never forget the importance of his rôle, which is to render the artillery of the enemy practically useless, by blinding it.

At the outbreak of the war there were only a few types of anti-aircraft guns in our army, and as far as we know there was no special anti-aircraft gun in the German army.

On both sides, the aircraft war was considered as a supplementary duty for the field matériel and this duty had to be

fulfilled by whatever means could be improvised (burying the trail of the gun, etc.).

In proportion as the war developed the invention and extension of a special anti-aircraft matériel have taken on greater and greater importance in the armies of the Allies as well as in the German army, and this in proportion to the importance taken by the means employed for aerial observation.

The object of this lecture is not to study the improvements made in anti-aircraft matériel but to follow in its different stages and up to the point where it is, to-day, the study of the general problems which anti-aircraft war has presented to the minds of artillerymen.

I

As long as the objectives of artillery were terrestrial targets the interest in the study of the trajectory seemed to be limited:

(*a*) To the initial part of the ascending branch (angle of elevation, angle of jump, angle of projection or departure, clearing angle, etc., etc.).

The study of the initial part of the ascending branch was entirely oriented in the double problem of defilade and range.

(*b*) To the terminal part of the descending branch (angle of fall, angle of impact, angle of protection, angle of ricochet; the apparent elevation of the burst, etc.).

The study of the terminal part of the descending branch was entirely oriented in the problem of the vulnerability of the target according to its nature or its location.

When it was a question of firing at aerial targets the tendency at first was, and this is easily comprehensible, to argue in regard to these targets as if they were merely terrestrial targets raised to a very high angle of site.

One of the first results of this theory was to erroneously apply to these targets: first, the idea of a normal height of burst (hauteur type) above the target that would give the maximum effect. Second, the hypothesis of the rigidity of the trajectory.

In the same manner there was at first transferred to the sphere of firing against aerial targets the general principles of ranging (jump, bracket, etc.), which were in use in firing against terrestrial targets.

Finally, when it was a question not of firing at balloons but at flying machines, not of firing at fixed objects but at objects in motion, it was first thought that the methods of firing should be similar to those employed against marching troops, against a train, etc.

From this came the method of ranging called "de la tenaille"* and others of the same kind.

From this came, too, the considerable efforts made to employ the range finder and to make use of the data obtained through this instrument (that is to say, the actual distance of the target) in order to determine the fuze setting.

Gradually, experiences having demonstrated that this very simple method of transposing in the ballistic problems of space solutions which were only appropriate to the ballistic problems of terrain, only led to decided errors and to notorious inefficiency, the following general ideas were reached:

II

(*a*) A point in space taken as a target for a given gun is defined by:

1º—the azimuth in which it is located.

2º—the trajectory on which it is located in this azimuth, this trajectory being itself defined for the given gun by the angle of departure.

3º—the setting of the fuze which on the said trajectory will determine the burst at the said point.

If we draw on a vertical plane (Fig. 1) the locus of all points of burst obtained on the various trajectories by a given fuze setting, we shall then have a curve. This curve will be the locus of the points which the projectile reaches within a given

* Pinching.

time (time of fuze) if the fuze is a clock-fuze. For that reason it would be proper to call the curve an isochrone curve.

Now let us turn around in all the azimuths a vertical plane on which be drawn the diagram showing:

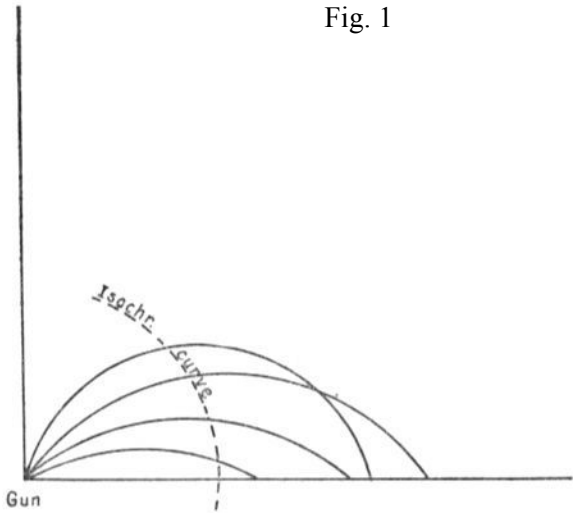
1º—the sheaf of the trajectories from degree to degree of angle of departure.

2º—the sheaf of the isochrone curves from second to second of the time of flight (this supposed to be equal to the time of fuze).

Thus, each trajectory will generate a surface of revolution determined by its angle of departure φ; we will call this surface "the surface Φ."

Each isochrone curve will generate a surface of revolution determined by its time of flight θ; we will call it the surface Θ.

Fig. 1

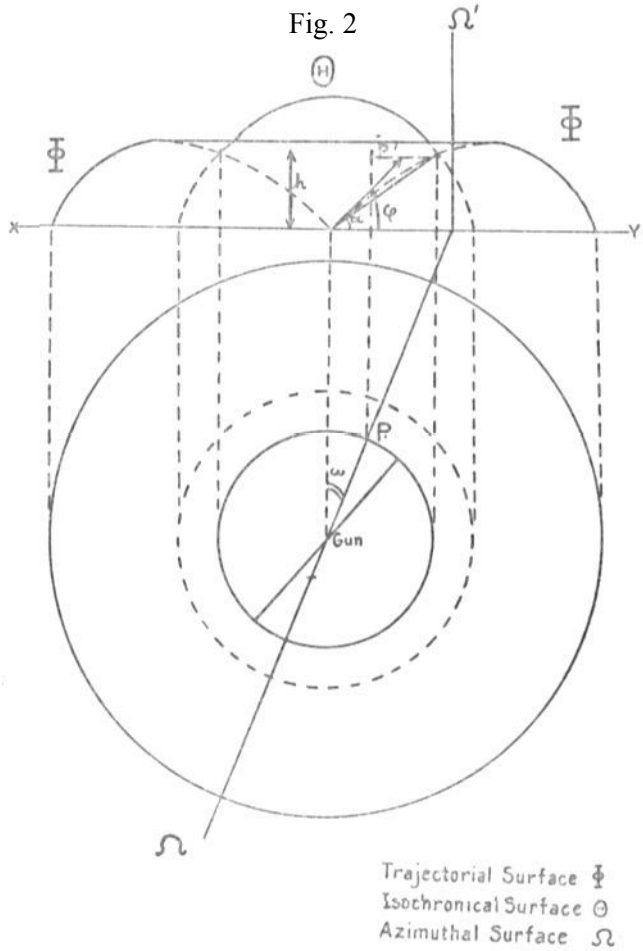


Any point in space will be determined by the intersection of three surfaces (Fig. 2): azimuthal plane, Ω; trajectorial surface, Φ; isochronical surface,Θ; and will have, as an aerial target, three ballistical co-ordinates: angle of azimuth, ω; angle of departure, φ, and time of flight (or of the fuze), θ.

Of these three ballistical co-ordinates of the point, the azimuth only is at the same time a geometrical one.

As the geometrical co-ordinates are the only ones that can be obtained by direct measure, notably by sighting, the ballistical co-ordinates φ and θ have to be obtained indirectly, by the following means, for instance:

Fig. 2



The target will be located in the azimuthal diagram by the measure of its altitude and of its angle of site (apparent elevation ∝) and, once it is thus located in the plane of the diagram, a simple reading will tell on which trajectory and on which isochrone it is.

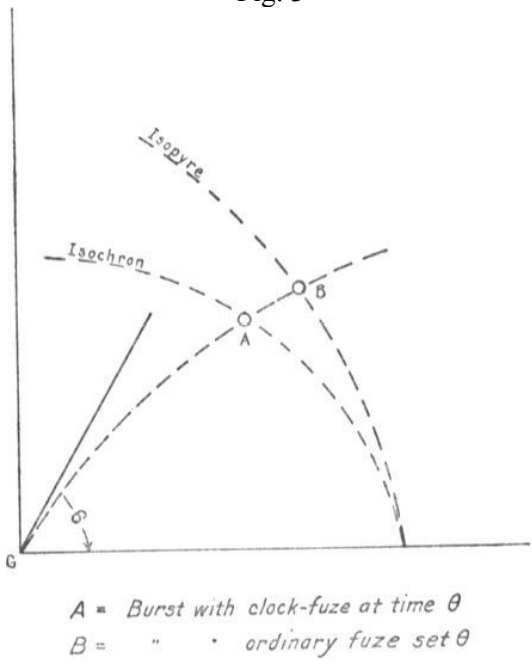
III

In the preceding paragraphs, we have taken for granted that the time at the end of which the shell bursts is equal, whatever may be its trajectory, to the time marked on the time-scale of the fuze.

This is true only for the clock-fuze.

For the ordinary fuze the time of bursting is determined by

Fig. 3



the duration of combustion of a certain length of communicating tube; this tube carries from length to length a time-scale which indicates the time which this combustion will take in the atmosphere near the earth.

For example, a fuze set at 10 seconds burns for 10 seconds before bursting, if the region in which the combustion takes place is normal. Transport the fuze to another place in which, for example, the air is more rare, that is to say, less dense, instead of lasting 10 seconds, the combustion will last eleven or twelve.

It follows from this, that the locus of the points of burst for a given fuze setting is not the isochrone curve corresponding to an equal time of flight.

In the high regions of atmosphere the combustion of the fuze is delayed by the dilution of the air, and the burst occurs not on the isochrone curve but further, on another curve which deviates in proportion to the time the projectile, before bursting, has been subjected to a lower barometric pressure.

This other curve, depending from a geometrical length of combustible tube and not from a chronometrical length of flight, is sometimes called the *"isopyre curve"* (Fig. 3).

Since the beginning of the war the empirical outlining of the isopyrical curves and of the trajectories for high altitudes have been the object of very careful work in which thousands and thousands of projectiles have been used.

A standard diagram has been established (Puteau-Arnouville, 1915–16) which, used as it is or more or less ingeniously transformed, constitutes the essential instrument of the methods of firing against aerial targets.

IV

Anti-aircraft firing does not merely consist in firing at aerial targets but in firing at aerial targets *in motion*. Moreover, these targets move with a certain speed which cannot be regarded as negligible with reference to the speed of the projectile designed to strike it.

With an average wind, the "observation machine" attains a speed of 35 meters per second (38.15 yards).

At ordinary firing ranges the time of flight of the projectile lasts 20 seconds.

It follows from this that, under normal conditions, the distance covered by the target, between the moment on which the projectile designed to strike it is fired and the moment at which it bursts, is about 700 meters.

What will be its course?

How can the gunner locate in advance the position in space where the target and the projectile will meet after both have followed their respective trajectories for the same length of time?

This is the problem sometimes called, especially by the British, the problem of *prediction*.

The target being an animated one and having, as may be said, its own will-power, it is *a priori* obvious that no absolute and definite solution can be applied to the problem.

During 20 seconds a flying machine has time to change its course in many sudden and various directions both in altitude and in orientation.

The problem has nevertheless a probable solution and this solution belongs to the domain of mathematical *extrapolation* based on the laws of continuity, to wit:

A moving body that has covered, with a uniform speed, a curve *a b* in space during a time *t* should, at the end of a total time *t+dt,* reach a point *c,* such that $\frac{bc}{ab} = \frac{dt}{t}$. This is nothing else but the equation of uniformity of speed.

If the curve of space *a b* is given in terms of the parameter *t* by the equations:

$$x = f_1(t)$$
$$y = f_2(t)$$
$$z = f_3(t)$$

the co-ordinates of the extrapolated point *c* will be given by the same equations by replacing *t* by *t+dt*.

If the curve *a b,* in the vicinity of *b,* has no pronounced curvature, the point *c* can be considered as located on the tangent to that curve drawn from point *b* in the direction of movement.

The problem of extrapolation with regard to the flying machines is (Fig. 4), with one dimension added, a problem quite similar to the ones commonly dealt with in the firing at sea moving-targets and which the Coast Artillery works out by the *plotting board:*

The positions s_1, s_2, s_3 of a ship are, by triangulation, registered on the plotting-board at the times t_1, t_2, t_3.

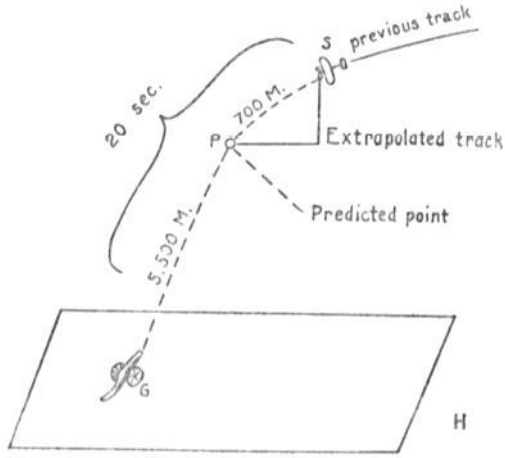
The point s_4 at which it is proper to aim in order to reach the ship at the time t_4 is given by a graphical extrapolation of the plotted track s_1, s_2, s_3.

The solutions which have been given to the same problem in space in view of anti-aircraft firing are of two general kinds:

1º—solution by measure of the angular velocity of the target.

2º—solution by measure of its linear velocity.

Fig. 4



G. Gun
S. Ship
H Horizontal plane

1º—the angular velocity of a flying machine in reference to the eye of the observer (or in reference to the position of the gun if observation be supposed to be made from this position) may be considered as being the resultant of two angular velocities measured, one in the plane of deflection, the other in the plane of site.

The instruments which have been invented in order to deal with the solution 1º, have been mostly based on this resolution of speed.

IMPORTANT REMARK

The angular velocity of a flying machine moving with a uniform linear velocity changes value every minute, except in very exceptional and very improbable cases; for example, the case of a flying machine which would happen to gravitate around a vertical passing through the eye of the observer.

Consequently, the measure of angular velocity taken at a given time can be considered as available only during a very short while.

Supposing even that the angular velocity measured at the very moment of the shot could be applied to extrapolate the point which the projectile ought to reach, and this is questionable owing to the relatively long duration of the flight, any measure taken at a moment somewhat prior to the firing of the shot is evidently out of date and has no value whatever regarding the wanted extrapolation.

This is the reason why, after the trials made with instruments capable of giving from time to time discontinuous measures of angular velocities, it has been felt necessary to substitute for them instruments of continuous measures, such as the galvanometric cinemometer.

This instrument is based on the following principle:

A steel armature which turns inside of a solenoid develops a current of induction, the intensity of which gives a measure of the velocity of rotation.

If the steel armature is secured on the axis of a sighting-telescope pointed at the flying machine, a galvanometer duly graduated will enable one to read constantly the angular velocity of the flying machine.

2º—the solutions of the second kind are based on the measure of the linear velocity. A very great majority of these solutions have admitted as an hypothesis that the measure of the

horizontal linear velocity was sufficient data for firing; that is to say, that it could generally be considered that the altitude of a flying machine did not alter much during the time of the flight of the projectile.

It goes without saying that these solutions also admit as an hypothesis that the speed of the flying machine in regard to the problem of firing can be considered as uniform.

This admitted, a measure of linear velocity taken at any moment, remains available.

All the instruments based on the solutions of the second kind have been based on the same principle as that of the *plotting-board*. Some of these have endeavored to draw automatically by simple sighting a continuous track of the course of the flying machine.

It seems that it is in line with this idea that the most handy and useful, if not the most complete, instruments will be found.

V

To sum up, the problem of anti-aircraft firing, after many experiments, is at present, if not solved, at least plainly laid out in the following way:

To be preliminarily measured: (*a*) altitude of the flying machine; (*b*) its orientation and its velocity (angular or linear); (*c*) extrapolation or prediction of the point to be aimed at; (*d*) wherefrom the knowledge of the azimuth of the said point; (*e*) wherefrom, too, in the azimuth the reading on a diagram of the ballistic co-ordinates of the said point (trajectory and isopyre) in functions of its geometrical co-ordinates (angle of site and altitude).

Finally, one word in regard to the means of measuring:

1º—the altitude (*h*) is measured by triangulation from a large observation base.

The flying machine is the summit of a pyramid of the space SsAB placed on the horizontal plane *H* (Fig. 5).

AB is the line of measure called horizontal base, at the two

extremities of which are two posts of observation, the distance between them being known.

s is the horizontal projection of the flying machine.

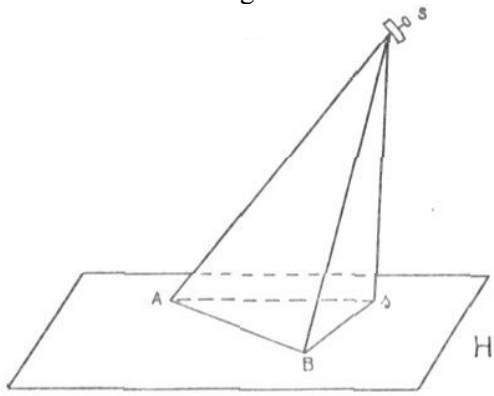
Any triangulation made in order to solve the pyramid will give the knowledge of the altitude *h*.

Among these methods the one to be pointed out in particular is the direct method which consists in the following:

The observer *B* announces simply by telephonic signal the successive passages of the flying machine in the azimuths 1, 2, 3—determined in advance, for example every ten degrees, starting from the true south.

The observer *A* moves on a plotting-board a vertical rule along the azimuth for which the first signal is expected and this in such

Fig. 5



a way as to sight the flying machine on the edge of this rule.

At the moment of the telephonic signal the altitude *h* of the machine is given by simply reading the height at which it appears on the rule; and its horizontal projection is given by the position from the lower end of the rule (Fig. 6). The board is supposed to be duly oriented and sealed; the rule to be accordingly scaled.

Remarks.—(*a*) This direct method permits the continuous tracking of the flight of the machine, once its altitude is known.

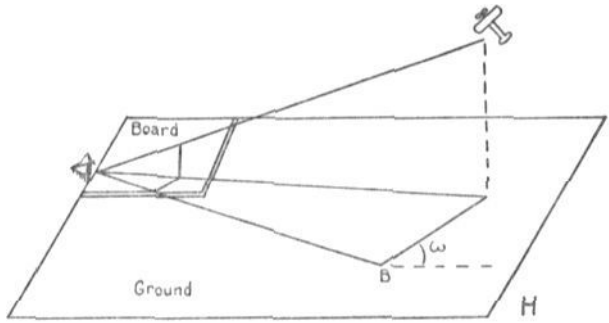
If, in fact, after the signal, the observer *A* keeps on moving

his vertical rule no longer along the azimuth but in such a way that the flying machine is maintained sighted at the same altitude *h* on the edge of the rule, the lower end of the rule will automatically track on the board the projection of the flight of the machine (taking for granted, of course, that the machine does not change its altitude).

(*b*) This same method permits one to control or rectify periodically the measure of the altitude.

In fact, the observer *A,* operating as has just been said, the signal of observer *B* announcing the passage of the machine in the next azimuth will be heard: either at the same time as the lower end of the rule crosses the mentioned azimuth drawn on

Fig. 6



the plotting-board, in which case the altitude has not changed; either before the reaching by the lower end of the rule of the azimuth, in which case the machine has gone higher; either after the passage of the lower end of the rule on the azimuth, in which case the machine has come down.

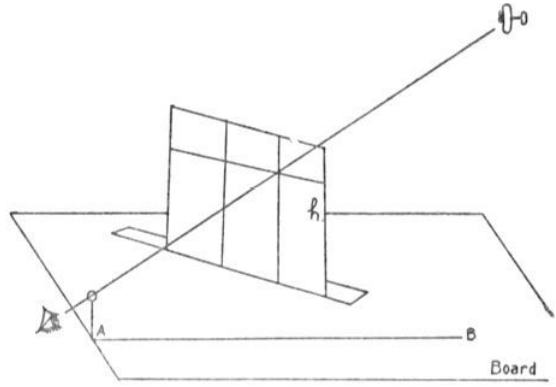
In the last two cases the observer *A*, as soon as he hears the signal, will recall or send back his rule along the sighting plane so as to replace it on the announced azimuth; from this will result the rectification of the reading of the altitude and also the rectification of the horizontal projection of the flying machine.

2º—the linear velocity may be measured in the following way (Fig. 7):

A given length of a horizontal wire, for instance, one centimetre representing 100 metres and thus corresponding to a scale of 1/10,000, is stretched across a vertical aperture at such a height above the plane of the board as to represent the altitude of the flying machine (for example, 20 centimetres representing 2 kilometres).

The observer *A,* after having trained the aperture in such a way that the machine aimed at appears as if following the wire,

Fig. 7



registers the time taken by the machine to cross the aperture from one side to another.

This time gives the measure of the horizontal linear velocity and the bearing of the plane of the aperture materializes the actual direction of the flying machine.

3º—the extrapolation or prediction results from the knowledge both of this actual direction and of the linear velocity.

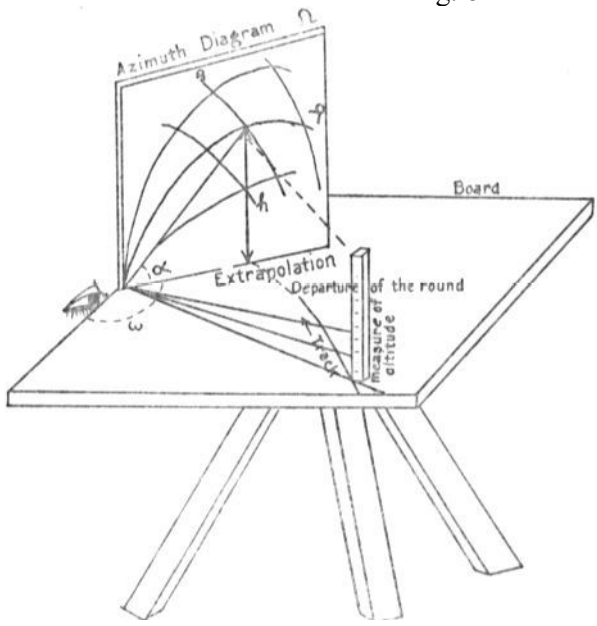
As has already been said, this extrapolation gives the azimuth of the point to be aimed at; and, in this azimuth, the angle of site (Fig. 8).

The altitude of the point to be aimed at in the extrapolated azimuth is supposed to be equal to the last altitude that has been measured. The angle of site results from the knowledge of the

altitude and of the abscissa; the latter is given by the intersection of the azimuth with the extrapolated horizontal direction.

4º—the ballistic co-ordinates (angle of departure, fuze-setting) are read on the diagram of the trajectorial and isopyrical curves; diagram on which the point to be aimed at has just been fixed by the very knowledge of its angle of site and of its altitude (or merely of its abscissa and ordinate).

Fig. 8



5º—if one proceeds by measure of angular velocities instead of by measures of linear velocities the instruments used are the continuous electric cinemometers already above mentioned, and then the extrapolation is determined as follows:

(*a*) *Azimuth*.—The extrapolated azimuth is obtained by the extrapolation of the horizontal angular velocity and this in starting from the last azimuth in which the flying machine has been observed prior to the firing of the shot.

(*b*) *Angle of Site*.—In the same way, the extrapolated

angle of site is obtained by the extrapolation of the angular velocity in the plane of site where the flying machine has been observed prior to the firing of the shot.

CONCLUSION

In ending this comment, which inevitably is of a very general character, it seems necessary to insist upon the great importance that should be attached to the fact that, as far as possible, the nature of the firing conditions should be such as not to disturb the continuity of the flight of the flying machine between the moment at which the measures that determine the firing data have been taken and the moment at which the shot reaches its destination.

It has been said that a flying machine covers about 700 metres during the flight of the projectile. During this period the match is most unequal.

On one hand, the projectile, just carrying away the measures and the intentions of the battery commander, is merely an inert instrument of a previous will. It clings helplessly to its trajectory and will inevitably burst once the combustion of its fuze has come to an end.

On the other hand, the aerial ship has maintained the full power of her free will, her trajectory is not compulsory and may be altered in accordance with her own desires.

Therefore, if she gets conscious that a projectile intended for her is on the way, she is in a position to baffle all the calculations of which this projectile is the unconscious carrier.

What, then, is any observation worth, even though it be minutely exact, that the gunner can figure out in regard to the deviations between his points of burst and the objective?

To what extent do these deviations indicate an error of firing which is subject to rectification? To what extent are they the effect of a modification to the continuity of the flight of the objective, voluntarily brought about by the pilot during the course of the projectile?

The first burst that will take place and which the pilot will see will give him the alarm and from this moment on, what craftiness, what feat of strength in case of need, will he make use of in order not to fall into the net of subsequent trajectories?

Are not these points of interrogation sufficient to make it clearly understood that the systems of anti-aircraft firing based solely on ranging must be condemned as being ineffective and excessively expensive?

Are they not sufficient to show that so long as there shall not have been found a gun of a fantastic muzzle velocity, capable of pouring into space projectiles of a speed infinitely superior to that of the flying machine, the gunner must concentrate all his attention and all his ingenuity in operating sudden and dense barrages on points of extrapolation silently determined by measures as accurate as they may be?

The Belgian Field Artillery In The Present War

BY LIEUTENANT E. VAN ERDE, OF THE BELGIAN ARMY

(Translation by George N. Tricoche, late officer, French Artillery)

(THE FIELD ARTILLERY JOURNAL has been most fortunate in securing the following article from the pen of the eminent Belgian officer who modestly hides himself behind the *nom de plume* of Lieutenant E. Van Erde. It is needless for us to dwell at length upon the interest and timeliness of this contribution, written at the front, by a man who has been valiantly playing his part, from the beginning, in the great war. We are much indebted to Lieutenant Van Erde for having complied with our request for an article at a time when he was just leaving a base hospital where his life had been, for many days, despaired of. The manuscript has been subjected to two handicaps of a rather serious nature. First, many technical details have been suppressed by the Belgian Army Censor; then the work had to be translated, and therefore lost much of its originality. Lieutenant Van Erde's style is distinctly individual; its brilliancy can be appreciated at its full value only in its French expression. The photographs that were spared by the Censor have been made by the Official Photographic Service of the Belgian Army.)

THIS article does not purport to be technical or didactic. We are writing here only some anecdotic pages, confining ourselves to an exposition of things seen during the course of the campaign. Therefore the reader should not be surprised at finding our essay somewhat lacking in method. Nor should he wonder at the fact that, deliberately, we have left out certain points which may be important: it is necessary for us to remain strictly within the limits of our original subject, and to speak only of things for the authenticity of which we can vouch. We trust the reader will be indulgent and see, in these lines, the token of good comradeship which was asked by THE FIELD ARTILLERY JOURNAL, and sent, most willingly, to the gallant American artillerymen by a Belgian soldier, from the little bit of land where his fellow-citizens are fighting for the very existence of his country.

It pleases us, moreover, to send you these pages. The United States, from the Belgian point of view, are surrounded by an aureola made of nobility, generosity, splendid moral grandeur. Since the time when Germany, betraying her word of honor, in contempt of anything that is loyal, threw herself upon Belgium, who was almost defenceless; pillaged her, ransacked her, profited by her, oppressed and tortured her; since Belgium, voluntarily, freely, proudly, sacrificed herself for Europe's salvation, and, above all, to keep her word and retain her honor as a nation; since then the Belgian people have always found, in the United States, words and acts full of encouragement, praise, and heartfelt sympathy that, to them, were particularly precious because they came from this great, powerful Republic, so far away. They found in the citizens of the United States, as well as in their government, true friends and sincere defenders. They will never forget the help, moral and material, that came to them from across the Atlantic; and their thankfulness shall never perish.

This is one more reason why one of Belgium's soldiers should heartily answer the call of THE FIELD ARTILLERY JOURNAL; come to speak to you about the Belgian Field Artillery, and endeavor to show you that the Belgian artillerist plays bravely his part in the great war, and also that the high military command has done its duty, fully and conscientiously, and in a way that was intelligent and perfectly appropriate to the existing conditions.

MATÉRIEL

What was the field artillery matériel at the beginning of the war? What is it at the present time? We are going to examine these points briefly.

1. *At the entrance of Belgium into the war*.

Before the war the Belgian nation was, generally speaking, anti-militarist. Why was it necessary to have soldiers and guns? Belgium was neutral, and this neutrality was guaranteed by the great powers. Who could have believed that one of the latter

would be dishonest and disloyal enough to allow its signature to be held as void? As soon as it became known through Belgium that Germany had made to the country this dishonorable proposal: to let the German Army, in order to invade France, pass over Belgian soil in consideration of some compensation, the whole Belgian people rose to defend its honor. Nobody, among us, entertained any illusion about our military weakness. But all declared: We would rather die than to permit ourselves to be dishonored! Within five days mobilization was completed; within five days 50,000 volunteers had offered to enlist. The recruiting offices were unable to cope with the work required of them. It was a sacrifice offered by free consent of all; a sacrifice indeed, because Belgium was weak, poorly armed, and in the middle of a period of military reorganization.

. . . *Suppressed by Censor* . . .

Her field artillery had only one type of gun: the Belgian 75-mm. rapid-fire. In principle it is the Krupp gun, but made in Belgium with some modifications for which patents were taken out in Belgium. We shall not go here into technical details of construction, but confine ourselves to the main characteristics of this piece.

(*a*) A system of breech closing consisting of a horizontal wedge, actioned by a screw with a very elongated pitch, and containing the firing apparatus, with firing pin and the usual safety devices.

(*b*) A modern aiming apparatus, with curved rear sight, panoramic sight of the Korrodi model; scale of deviations, enabling each piece to make corrections in traversing which are required by its particular conditions.

(*c*) A line of sight which is not independent (1); the same gunner consequently gives the range, the elevation, and attends to the level; hence some delay in the firing.

(*d*) Spring recuperator (1). Recoil brake actioned by glycerine: this apparatus has been much perfected (2), but it

would take up too much space in this paper to describe it more fully. The cradle contains the recoil brake and the recuperator.

(*e*) Light-weight piece (the gun with its limber weighs 1850 kilogrammes) (3), but it is solid and strong and it has withstood, better than could be expected, the almost incredible hardships undergone, especially during the war of movements and on the Yser.

The ammunition for the Belgian 75-mm. rapid-fire was a shrapnel with time fuze provided with disks.[1] A high explosive shell.[2] Each of these weighed 5.5 kilogrammes.[3] The charge of smokeless powder gave the projectile a muzzle velocity of 500 metres.[4] The caisson contained 101 rounds; the limber, 40. The piece was drawn by 6 horses; the caisson by 4. Both manœuvred easily at any gait and on all terrains. The range, theoretically, was 5600 metres.[5] But the Belgian artillerymen very cleverly contrived to increase it to , by means of a special device and without impairing the other firing qualities of the gun.

Summing up: An excellent gun, robust, simple, handy, easy to get into action and to maintain therein; it proved amazingly useful, and its qualities surpassed the most sanguine expectations. But these guns were too few, in consideration of the mass of artillery carried along by the German horde. Most of the time, during the first months of the war, the ratio of field guns in the contending armies was about 600 for the Germans, against less than 300 (on account of wear, losses, etc.) on the Belgian side. Moreover, what could be accomplished with a gun of this range and calibre against the pieces of all kinds, all sizes, guns, howitzers, mortars, with the fire of which the invader intended to "crush down" the Belgian Army? More ordnance and larger—such was our imperative need. But, how to do it? No more arsenals, no more matériel, no

[1] This, therefore, constitutes a marked difference with the French "75." (TRANSLATOR.)

[2] It is an improvement upon the similar part of the German "77." (TRANSLATOR.)

[3] 12.1 pounds.

[4] 545 yards (1635 foot-seconds).

[5] 6104 yards.

more factories, no more personnel; and, besides, on our rear, no more territory. The army was almost out of its own country. However, it did not want to be driven out entirely! And the Belgian soldier held out. Against all human expectation he kept the Yser line. And it will be to the everlasting honor of the high chiefs of the army not to have despaired of success in this inconceivable situation, to have gathered all the energies and dared to undertake a reorganization of the army, a reorganization of the artillery. Some matériel was taken from the enemy; some was bought; some was manufactured in plants hastily built; soon the Belgian soldier heard, behind him, the roars more and more numerous and stronger of more and bigger guns.

2. *During the siege of Antwerp*.

Some new heavy howitzers had been added to the field ordnance.

. . . *Suppressed by Censor* . . .

They were originally intended for the stationary defences of fortified positions. They were good guns, easy to handle.

. . . . . .

We cannot describe at length these pieces, nor those mentioned hereafter: this would lend us too far out of the limits allowed to this article.[6] Let us state, however, that one of these howitzers stands among the best of medium calibre created so far.

3. *After the retreat from Antwerp*.

Guns, howitzers and mortars of all sizes appear in the Belgian ordnance.

. . . *Suppressed by Censor* . . .[7]

These pieces are absolutely modern and provided with the latest improvements.

[6] Besides, the censorship would probably not allow any disclosure on that subject. However, from what we know of the condition of things at that time, it may be assumed that heavy guns of the French types were used by the Belgian Artillery. (TRANSLATOR.)

[7] Some information about the calibres will be found further in the paragraph entitled "The Artilleryman." But right here we may recall what was written in the issue of January, 1917, of the FIELD ARTILLERY JOURNAL, page 22 ("Contemporaneous Notes on Belgian Artillery"): "Not only the (Belgian) army, at the present time, is abundantly supplied with heavy guns—including the 380-mm.—but it has even created new types of guns . . ." (TRANSLATOR.)

Nothing will be said here about the field *auto-cannons*—these guns have been useful in Russia especially, and the Russian generals have warmly praised the personnel of these engines and valued very highly the services rendered by them under extremely critical circumstances.

. . . . . .

Let us notice that a great deal of the matériel used by the Belgians comes, either wholly or in part, from booty taken from the Germans. The fabrication or the arrangement and repairing of all this ordnance constitute a magnificent work of bold, persistent, tenacious initiative. The latter has worked miracles, and one cannot admire it enough if one knows under what trying circumstances Belgium effected it. He who wishes to make a special study of this admirable organization should read the beautiful book published by Major Willy Breton, one of King Albert's officers, under the title "Les Etablissements d'Artillerie Belges Pendant la Guerre."[8] This is a most interesting work, both from the military and from the documentary point of view. It splendidly sets forth the industrious, energetic, tenacious qualities of the Belgian people—workmen as well as soldiers.

Having become acquainted with the matériel at the disposal of the Belgian Field Artillery, let us try now to study its

PERSONNEL

Officers.

Before the war, all Belgian artillery officers came from the great "Ecole Militaire" of Brussels, the fame of which attracted, each year, many students from all the countries of the world. After his graduation the cadet officer went to the "Ecole d'Application"; finally he was mustered into the active *cadres*, often after a period of instruction at the "Ecole d'Equitation" of Ypres, which is considered a rival of the similar schools at Saumur and Turin. The war, of course, suppressed all this. Then, how can Belgium still train her sub-lieutenants of artillery?

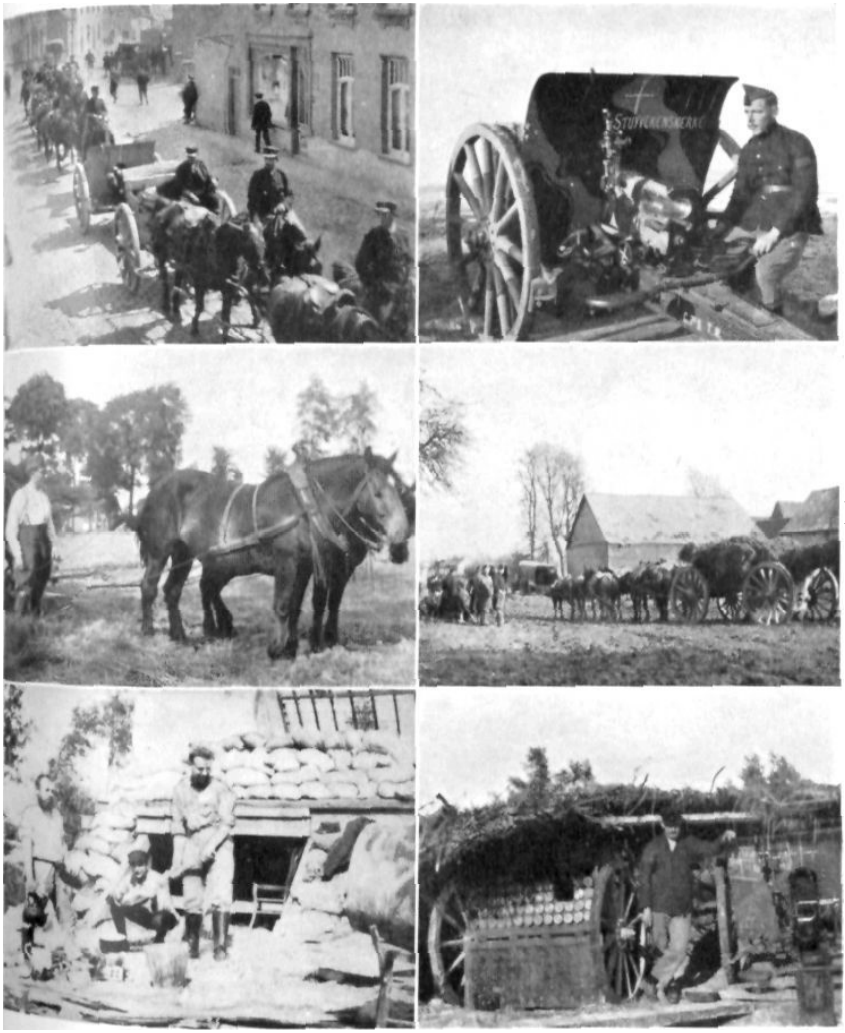
[8] Berger-Levrault, Paris, 1917.

She created, as soon as it was necessary—and this was very soon after the beginning of the war—a special school to train noncommissioned officers and even privates whose good behavior at the front, moral and intellectual qualities could give hope that they would be able to become quickly good chiefs of platoons. This school, called C.I.S.L.A.A. (*Centre d'Instruction pour les sous-lieutenants auxiliaires d'artillerie*), is, above all, a practical institution. Its aim is to impart, in a short time, to the young men admitted to it, notions, knowledge, and education which are needed to fulfil, in practice, the duties of the functions they seek to attain. They must be enabled to command, in front of the enemy, first a platoon (two pieces), then a battery. The course is a very full one; and they do work! No time is lost, I assure you. They get up early, retire late, and all give proofs of an eagerness to learn and a capacity for work truly remarkable. I shall not give here any details about the curriculum; but I wish to observe that almost all the work is done either around the gun, or in mounted drills, or else on the firing-grounds. Examinations are rigid and difficult. When graduated, the candidate returns to the front; he remains for some time *adjutant chef de section*[9]; then, after a few months, he may enter the normal hierarchy as sub-lieutenant. One may rest assured that these men know their business! One has only to ask, on this subject, the English, who have had with them, for a long time, a regiment of artillery loaned by Belgium, and read the praise they bestowed on these young officers and the regiment in general. One may also ask the French, who likewise borrowed some Belgian artillery for the battle of the Somme.

Nevertheless, the Belgian is not satisfied with himself. Such is his temperament that he always wants to better and perfect himself. And this is why Belgium has created for her artillery officers two new *Centres*—in reality, schools of improvement where chiefs of platoon and battery commanders, respectively, are enabled to study, theoretically as well as practically, the

[9] Sergeant major acting chief of platoon.

A B



C D

E F

A—BELGIAN BATTERY OF "75" PASSING THROUGH A FLEMISH VILLAGE
B—BELGIAN "75" POSITION OF TIREUR (NO. 1)
C—ARTILLERY TEAMS ARE USED FOR FARM WORK BACK OF THE TRENCHES
D—HEAVY GUN ON THE ROAD, SHOWING CAMOUFLAGE FOR THE MARCH
E—ARTILLERY OBSERVERS AND TELEPHONE OPERATORS NEAR THEIR STATION
F—BELGIAN "75" IN BATTERY (WITH TYPE OF CAMOUFLAGE)

ON THE BELGIAN FRONT. IN THE RECONQUERED LUYGHEM-MERCKEM DISTRICT. APPEARANCE OF THE GROUND AFTER THE PREPARATION OF ATTACK BY THE FRANCO-BELGIAN ARTILLERY. (OFFICIAL PHOTOGRAPH)

new technics, the latest matériel, the new-born methods, the innovations in manœuvring, and even the experiments. There they may attend lectures on the most recent events, on everything pertaining to the gun, ballistics, clastics, problems that have arisen during the latest operations, adaptations, engines, projectiles, instruments of all kinds put into use either by the Belgians and the Allies, or by the Germans. From there, without doubt, originated rough drafts, projected apparatus or ammunitions, and the interesting and efficient concepts which, at different times, have shown the inventive activity of Belgian officers during this war—and, among other things, to the influence of these schools are due new Artillery Regulations, very complete, modern, masterly, which are highly creditable to their authors. There are, besides, other special schools; for instance, that for *"Officers d'antennes"* (Signal Corps).[10] But we cannot undertake to give here particulars on, or even to quote all the manifestations of, that kind which denote the activity of the officers' body toward its own betterment, its improvement or renewal, its refreshment, so to speak—all of which were produced automatically. This would be an endless study. It is time for us to consider now:

The Noncommissioned Officers and Privates.

The artillery personnel was recruited to some extent by enlistments, but for the most part by levy from the annual contingent of the militia.[11] Men mustered in the artillery were chosen, either on account of their physical qualifications or because of their professional aptitudes.

The length of service under the colors was about 26 months. The first six months were devoted to the individual formation of the artilleryman: military discipline, school of the cannoneer,

[10] The word *antennes* (antenna) deserves notice, for it is certainly very descriptive when used in the factical meaning. (TRANSLATOR.)

[11] It may be interesting to remind the reader that, in Belgium, the army at large is called "Militia." The length of service is eight years in the active milltia, five in the reserve. The militia is recruited by enlistment and selective draft of men twenty years old. In practice, men remain under the colors, according to the arm or service, from one year and fifteen days to two years and a half. (TRANSLATOR.)

school of the piece, school of the mounted man, school of the driver. At the end of this first period, as the individual instruction seemed to be completed, it was possible to pass to battery mounted drills, then battalion drills, exercises on various kinds of terrain, the general manœuvres, and the firing practice. This second period aimed at developing and maintaining the military education of the soldier, out of whom it was intended to form an artilleryman able to adapt himself to all the requirements of war time. "Preparation for war is the goal which must be sought for by the whole instruction in time of peace"—thus spoke the "General Regulations for Field Artillery." As a principle, the reglementary prescriptions admit of a different course of instruction for the cannoneers and for the drivers. However, it is understood that the latter must be able to fill eventually the place of the former, at least for the most simple functions—those of *pourvoyeur*[12] and *chargeur*.[13] "The officers are answerable for the aptitude to the service of the soldiers who are intrusted to their care, as well as for their intellectual and moral development." As soon as they join their regiment, the most intelligent and best educated militiamen are subjected to an examination. If they pass, they are allowed to follow the courses of the corporals' school. There, while performing their duties as privates, they study for six months, most thoroughly, the elements of the "service intérieur,"[14] the matériel, etc. Later on, the best graduates of this course will be admitted at the noncommissioned officers' course,[15] which lasts about six months; at the expiration of the term they are appointed sergeants. Those among the latter who wish to adopt a military career may become successively; sergeants, first class; supply sergeants; first sergeants; first sergeants, first class; sergeants major; sergeants major chiefs of platoon (acting officers).

Lastly, some of the very best noncommissioned officers,

[12] Nos. 4 and 5 in the U. S. Field Artillery. (TRANSLATOR.)
[13] No. 2.
[14] This includes military discipline, guard duty, military courtesy, etc. (TRANSLATOR.)
[15] Corporals are not ranked as noncommissioned officers. (TRANSLATOR.)

conspicuous by their behavior, intellectual qualities, instruction, and education, were picked out by their chiefs and allowed to present themselves to the very hard examinations for commissioned officers.

During the war—this goes without saying—all this organization was upset by the natural trend of events. Every one knows what enormous difficulties the Belgian Army had to face in order to recruit new personnel, as all its normal reserves of men were in territory occupied by the enemy. Nevertheless, it was imperative to replace the artillerymen disabled since August, 1914, and also to obtain the necessary elements for the new units. To do this, the military authorities drew, mostly, from three different sources. First, they incorporated into the field army the fortress artillerymen, who had been released by the fall of the forts. Then they put into the field butteries men of older classes[16] called back to the colors by the new recruiting laws for the time of war. Finally, the Field Artillery received recuperated infantrymen, no longer able to serve in their own arm (on account of wounds, sickness, age, etc.). The men belonging to the first category could be sent without any especial preparation to the field batteries. The other ones, of necessity, had to follow a sort of training course before being mustered in their new units. The length of that course varied according to the more or less imperative requirements of the front. The course took place in a "Centre d'instruction d'Artillerie" (C.I.A.) created for that purpose, under officers of the arm, detailed in turn from the trenches, as instructors. At the C.I.A. the work is pushed very actively, and so arranged as to give the men in training, above all, the practical knowledge which is strictly needed. The program of studies is the same for all recruits. Each one of these must be able, when discharged from the Centre, to fulfil completely all duties pertaining to the working of a battery in the field.

[16] Or married and fathers of family. (AUTHOR.)

HORSES

We are coming now to a subject which keenly interests most artillerymen. However, we shall be brief thereupon, as this paper threatens, indeed, to outgrow its permissible size.

At the beginning of the war Belgian artillery, by virtue of its strength, was very well and abundantly mounted; its complement of horses enabled the arm to face almost entirely the requirements of the mobilization (except as regards certain requisitions, foreseen by the Regulations). The yield, altogether, was absolutely excellent; and often the artillerymen showed themselves proud of their faithful helps.

Belgian artillery was using animals of two different breeds. As a rule, for the saddle (and also as draught-horses in the horse artillery) it resorted to Irish mounts. For ordinary draught, the Ardennais were preferred—a local breed smaller, more thickly set, robust, and energetic, with a very sure footing.

At the time of the retreat from Antwerp toward the coast, the field artillery found itself in rather a predicament. The artillery, since August 5, had been subjected to an abnormally intensive and fatiguing work. Some horses had been wounded or killed. On the other hand, as we saw above, new batteries had been formed. The question was to meet these needs. Horses were requisitioned, and among them those splendid draught animals known all over Europe and which were the pride of the "Nations" at Antwerp. It was feared, to some extent, that such subjects, not trained for this new service, unused to the necessary irregularities of life in the field, or to the din of battle and reports of guns, might be a very poor help and cause much trouble. But it was not so, and the majority of requisition horses rendered just as good service as the others. Besides, the care, the kind attention of the Belgians toward these animals almost resemble those of a father for his child. Soldiers always keep their mounts in a state of absolute cleanliness; they take a pride bordering on vanity in the appearance of these horses, and often are more anxious for the welfare

of the latter than for their own. Thanks to this solicitude, they have lost, out of sickness or accident (not caused by the act of the enemy), a very small number of animals. For instance, it is surprising that there were no losses on that account during this long, trying retreat from Namur, in the course of which a number of batteries could not unhitch even once, or rest, in this enormous forced march, from the river Meuse to Rouen! The endurance of these horses has been truly admirable during all the war: at the beginning, when the fatigue, day and night, exceeded often the limits that one would have thought possible; later, when they were compelled to live continually upon the thick, miry soil of Flanders, in the everlasting and dense humidity of the atmosphere, in a country where flooding is normal, and from which salt water springs up at any time; where they stayed for ever so long, finding only emergency shelters, stables in ruin exposed to wind and rain, or else without any stables at all! But their drivers or riders were taking care of them; they cleaned and groomed them, kept them up, and not infrequently fed them—relatively speaking—better than themselves.

Yet, how many enemies had to be contended with! The chaps at the fetlock or under the fetlock which had to be healed up in spite of the salted mud and excessive work; the sores caused by harness that was never removed; parasites, such as itch, which had to be stamped out quickly; sand, which horses are always prone to lick up on seashore dunes and which too often causes colic and other intestinal troubles; water which had to be carefully selected or purified, because the water of the rivers, of the *vaarten,* and of the floods was contaminated with human blood and residue of putrefaction of the corpses accumulated everywhere.

. . . *Suppressed by Censor* . . .

Nowadays, things are in a far better condition. Horses are comfortably stabled. Well-fitted-up infirmaries receive the animals, which, in each division, are tired or slightly ill. A large

"Infirmerie Vétérinaire Centrale" cares for the horses which will not be soon available for active service or need special treatment. New harness is manufactured by the "Sellerie Centrale" (Central Saddle and Harness Workshop); this new harness is so designed as to permit of collar replacement by the *bricole* (breast collar) when the former threatens to cause sores.

However, it was necessary to make up for the losses in battle and the unavoidable deaths, and provide all the pieces and all the batteries newly created—and there were many!—and also their "accessory" formations and the "reserve" ones, with the many horses they needed. The resources of the New World were called upon to meet these requirements. Remount committees were sent to the republics of North, South, and Central America. And Belgian ships, armed by Belgians and manned by Belgian sailors, go to the other side of the Atlantic Ocean for cargoes of young horses. The latter, not yet fully developed, often too weak, undergo, yonder, back of the front, a course of training and education coupled with a treatment intended to strengthen, acclimatize, and enable them to do the required work.

The latter, however, is far less intense since the advent of the war of position. Formerly work was specialized. Six horses were hitched to the gun (75-mm.); four to each of the battery caissons (four of which were in reserve); four to each ration wagon (*fourragère*). To-day guns remain stable for weeks and months upon the same position. The horses are gathered at the *échelons,*[17] a few kilometres in the rear. All of them, in turn, share in the daily fatigue duties: they bring filled caissons to the firing battery and take away the empty ones; they carry rations, matériel, etc. Often they are even placed at the disposal of the engineers to bring forward all sorts of material needed for many kinds of work. However, when the batteries are relieved to go to the rear for a rest, the horses take up again their specialized work; and each artilleryman is glad to meet again his faithful helpmate.

[17] Combat trains. (TRANSLATOR.)

They are now somewhat different from what they were during the war of movement. At the beginning of the war the captain—who, as we saw heretofore, commands a battery of four guns—selects his position according to the directions given by the Brigade or Divisional Commander. He places his guns. Then, from the observing station which he has chosen with regard to the existing circumstances, he gives all the commands required for the firing (which is almost indirect in the present operations). Both officers (chiefs of platoon) remain near the pieces; they assure the execution of the orders, which they distribute to those concerned, and interpret them for the benefit of the noncommissioned officers (chiefs of section).

The latter command directly their respective six cannoneers, of whom three are at the gun—the *pointeur* (gunner) (often a corporal), a *chargeur* (No. 2), and a *tireur* (No. 1)—and three at the caisson—two *pourvoyeurs* (Nos. 4 and 5) and a *régleur* (No. 3).[18]

The gun is fed, first, from its caissons (as the rounds contained in the gun's limber constitute a reserve). As soon as a caisson is empty it goes, at a gallop, to replenish itself at the combat train, which, in turn, is replenished by the ammunition column belonging to the "Corps de Transport."

At the rear, with the *échelon* (combat train), are gathered the men who are not employed for the firing or the replenishment of munitions (men in reserve, cooks, etc.); the limbers, the teams and saddle horses not used for the service of the caissons. The whole is under the orders of the *chef de l'échelon*.[19] Often the different combat trains of the battalion are united under a commissioned officer.

At the outset of the war, the telephone outfits were scarce. Communication between the different elements and with the outside services was often difficult, and at times became quickly

[18] Called *déboucheur* in the French artillery. (TRANSLATOR.)

[19] Chief of the combat train. In France it is the first sergeant.

impossible. Nowadays the lines and apparatus are much more numerous and, consequently, telephone communications are much better assured.

. . . *Suppressed by Censor* . . .

Here would be the place for a study of the methods of observation which Belgian artillery has so completely and minutely developed. Yet we can only say a few words about them.

It is well known that artillery fighting, on the Belgian front, is incessant. On both sides, the *communiqués* (official reports) mention it daily. Observing stations have multiplied *ad infinitum*.[20] In the northern part of the Belgian sector, which is absolutely flat, without any cover, and which can be surveyed in its entirety by the Germans, real prodigies of ingenuity and patient labor were often needed to build or arrange observing stations in which it was possible to remain and to get a sufficient view of the hostile front. In the southern section, which is a little more undulating, with more cover, especially east of the Yser, where the Germans have much better means of hiding their movements, one had to face a different situation. Besides the ordinary observation methods, the observation by aeroplanes was, there, particularly precious and necessary. Therefore the Belgians made considerable efforts in that direction: creation of many aero squadrons, full of dash and well trained; formation of daring pilots and experienced observers; development and improvement of communications between the aeroplanes and the ground, and *vice versa*.

. . . *Suppressed by Censor* . . .[21]

No other country, moreover, is ahead of Belgium as regards the cleverness of the observer-photographers of her aviation

[20] Some of these Belgian artillery observatories have become famous among the Allied forces. Their names and location, of course, cannot be published in these columns. (TRANSLATOR.)

[21] We may add that credit must be given to the Belgians for the invention of several devices and apparatus which have been adopted since by their Allies. (TRANSLATOR.)

VIEW OF DEFENSIVE WORKS AMONG RUINS ON THE BELGIAN FRONT. (OFFICIAL PHOTOGRAPH)

A BELGIAN FIELD GUN IN ITS SHELTER. (OFFICIAL PHOTOGRAPH)

service and the excellent work done by her photographic section. The latter has been much admired by all visitors and military critics who have been permitted to study it *de visu*. No agency of that kind is more dexterous and better trained to reveal, in spite of the most patient camouflage, the batteries which are hidden with the greatest care by the Germans.

Lack of space prevents us from mentioning also many ultra modern processes of observation which Belgians have either invented or perfected, thanks to their constant craving for improvement. . . . In this field, like in a number of others, many innovations as regards methods or procedure are ascribable to Belgian artillerymen.

UNIFORM

Let us say a few words about the service uniform of the Belgian artilleryman.

Up to 1915 he kept his old uniform, of which he was very fond and which he did not discard without much grumbling. In fact, it was both handsome and sober; and we remember that, some time before the war, it was awarded the first prize in an international competition for military uniforms held at ——, Vienna! This uniform was altogether more practical than most of those of the Belgian Army at that time. It had a "smart" appearance, with its short tunic, royal blue and red trimmings; trousers of the same color, and red *fourragère*[22]; black leggings and astrakan cap. On horseback, a large cloak, with wide *pélerine,*[23] imparted to the whole a martial air, in which ease and strength mingled. As the Belgian artilleryman, in general, is very particular about the cleanliness and correctness of his uniform, the latter, which he wore in a befitting manner, and which was always kept in a first-class condition, could be said to be truly elegant, though very quiet. To-day, much to their chagrin, Belgian artillerymen wear the monotonous-looking khaki uniform, still more necessary on the vast plains

[22] A cord worn from left shoulder to middle of breast. (TRANSLATOR.)
[23] Rounded mantle. (TRANSLATOR.)

of Flanders than anywhere else. They are distinguished from the infantryman by the pipings, which are red—while the infantry's is royal blue—and by the collar device, which is royal blue—while the infantry's is red. For all, the number of the regiment is embroidered on the shoulder straps and also on the *bonnet de police*.[24] Artillerymen wear breeches and close-fitting leggins. The latter, like the shoes, are made of russet leather. The overcoat is the regular, large cavalry cloak, without rounded mantle, khaki colored.

Besides this uniform, the artilleryman possesses another one, made of cotton material. It is a summer suit, which, in fact, he wears in all seasons for fatigue duty, in order to save the field uniform.

The officer has the same uniform as the enlisted men, but made of special cloth; his insignia are gilded instead of bronzed or silvered. He wears a tan-colored belt with shoulder piece. Noncommissioned officers have the plain leather belt.[25]

THE ARTILLERYMAN

It is very difficult to analyze briefly a soldier, and to depict him so as to give a typical image of him, both true to life and complete. This is why we can only attempt, here, to make a mere sketch of the Belgian artilleryman—enlisted man or officer—by telling of some of his characteristics, without any pretension, except to sincerity.

People generally agree to acknowledge that the Belgian race possesses certain qualities which we shall find—with their inherent defects—in the soldier generally and, particularly, in the artilleryman. However, we want to look at these good and bad traits from the military standpoint only. Let us begin with the most delicate subject.

The Belgian artillerist seems to he the soldier of the army who is the least amenable to army discipline. He is prone to

[24] Fatigue cap. (TRANSLATOR.)

[25] Illustrations showing the insignia of Belgian Army are to be found in the October-December, 1917, number of THE FIELD ARTILLERY JOURNAL, page 450. (TRANSLATOR.)

find fault with everything. He rather dislikes restraint in things which do not pertain exactly to his service as an artilleryman. He does not observe the rules of military courtesy as rigidly as one might wish to have him do it. He readily makes a parade of easy bearing, and is very tenacious of a certain freedom of speech and manners. He ignores obedience in a way which is truly passive and void of understanding. He is fond of discussing orders, commenting upon them, and even getting angry at them. He seldom misses a chance of criticising the words and acts of his chiefs, especially when the latter belong to another branch of the service. And his commonsense is not infrequently pitiless. Does this mean that the artilleryman is unduly disobedient? Do not think so. There is no soldier more ready to follow punctiliously the directions given to him to assure the working of the service; there is none more careful than he is to fulfil exactly the expectations of his chief, and even to anticipate the latter's thoughts. But he wants to be commanded by his *own* chief, by the chief he knows, with whom he has already lived, of whose aptitudes he is well aware, whom he understands with few words, whose ideas he guesses, even when they are still absolutely unexpressed—the chief he loves, to use the proper word. For this is one of the characteristics of the Belgian artilleryman: he must be very fond of his chief. He hardly admits the ordinary relations between the one who commands and the one who obeys; he is anxious to understand what is required of him, why it is required; and this comprehension exists always, and in a natural way, if his superior officer is somewhat his comrade—a comrade higher in rank—more learned, older in the service; who is to be respected, of course, but who is also dear to the soldier's heart.

The Belgian soldier ignores the fetichism of rank. He does not subserve the insignia that adorn his chief's collar, or, at least, he does not do it willingly; on the other hand, he puts all his available physical, intellectual, or moral strength at the service of the officer whom he knows to be intelligent, brave, experienced, and just. Undoubtedly, from the point of view of

strict military discipline, one may think that this is a proof of a feeling of independence anything but classical; but it constitutes a trait of the Belgian character for which, perhaps, it would not be impossible to find some justification. At any rate, it is more deeply marked in the artilleryman than in the man of the infantry. And this is easily explained by the difference in military education—daily drills in close formation, such as are customary with infantry, finally break in the men and train them to formal discipline.

But, by way of compensation, what an obstinate devotion, carried as far as self-sacrifice; what a tenacious will power in the fulfilment of duty; what a deep attachment to the battery, to the "commandant"![26] How many beautiful qualities of the mind and of the heart, served by superb physical ones! A serious commonsense, somewhat heavy and slow at times, perhaps, but comprehensive and enlightened; a judgment both wise and well balanced, leading to solidly grounded decisions; quickness and accuracy in seizing the main points of things, enabling the soldier to unravel swiftly the component elements of intricate situations—and this often allows officers to rely upon their men in respect to certain manifestations of initiative, and to trust to their acts when it happens to be necessary to detail the soldiers from their unit and to take them away from the control of their chiefs.

Their moral qualities were plainly set forth—as well as their capacity for physical endurance—by the war they have kept up in such an amazing way—above all, during the period of mobile operations. Who will ever be able to tell the amount of self-denial, sturdy obstinacy, devotion, arduous strength of will that was needed to resist, in a manner which is still too little known, effectives ten times stronger, which were to crush them. Those who were the first to wonder at this, and to admit it, were the Germans themselves, whose boast was that they would "be through with this miserable little Belgium within five

[26] Battery commander. (TRANSLATOR.)

days": they find it still in front of them after more than three years of war and daily encounters!

Every day the Belgian artillerymen gave new proofs of these qualities and their indomitable gallantry in action. It may be said that the whole campaign is one uninterrupted proof of it. Shall we, nevertheless, gather from official statements, taken at random, a few testimonials referring to everyday deeds of the arm?

As early as the battle of Haelen, on August 12, 1914, we see three batteries, called into action, cover in four hours a distance of 25 kilometres, in a thick dust, under a burning sun; as soon as they reach the battlefield (1500 and 1000 metres only from the enemy), they silence the hostile artillery and mow down some German battalions of infantry which were marching. On that day the enemy fled beyond the banks of the river Gette. He had with him 36 field guns; the Belgian artillery had only 12 in the morning, 24 in all during the afternoon!

A few days after, at the gates of Tirlemont, a whole German army corps—the 10th—tries to crush down a Belgian brigade which stops it. For a full day that corps is held in check, so to speak, by one single regiment; and its 160 guns, among which are many howitzers, are subdued, for 12 hours, by a part only of the 36 light pieces of the 1st D. A.[27] In fact, the fight was kept up almost entirely against these 160 guns by 24 Belgian "75's"!

Shall I recall the battle of Quatrecht? Here, again, Belgian artillery—the very same batteries we saw at Haelen—against

[27] D. A. is a Belgian abbreviation for *Division d'Armée*. There were, at the beginning of the war, 6 infantry divisions and 1 cavalry division. The former, or D. A., consisted of two to four *Brigades Mixtes* (composite brigades), organized so as to be somewhat independent.

Composite Brigade
- 2 regiments of infantry.
- 3 field batteries = 12 guns.
- 1 machine gun company = 6 guns.
- 1 platoon *gendarmes*.

Besides the battalion of field artillery belonging to each of its brigades, the division had, among its divisional troops, one regiment of field artillery (12 guns, as only one out of the three battalions of that regiment had been organized). In all, including the batteries of the cavalry division, the Belgian Field Artillery, in August, 1914, had only 20 brigade battalions and 7 divisional battalions—a little less than 340 "75's." (TRANSLATOR.)

a double number of guns, resisted admirably and caused to the infantry and artillery of the Kaiser enormous losses. The daring and dash of the three batteries (7th, 8th, and 9th) were so brilliant that they roused the enthusiasm of the neighboring troops—Belgian volunteers and rifle companies of the French Navy. The latter, during the battle, stood up several times, waving their caps, and cheered the Belgian artillerists with shouts of victory, while the enemy was fleeing and abandoning its pieces. We could accumulate glorious narratives of heroic deeds by which, a thousand times in succession, under the most trying circumstances, the Belgian field batteries distinguished themselves. But this would take too much space; we had better give a general idea of the resistance opposed to the invaders by the artillerymen of Belgium.

From the very first, between the frontier and the Meuse, and especially in front of Liège, the artillery of the Third Division—which consisted of 60 guns of "75"[28]—faced, so long as it was necessary to cover the general concentration of the army, fractions of five German army corps, provided with 290 pieces of sundry calibres! The outcome of that struggle is well known. We hardly need to recall the fact that the Germans, absolutely broken up, fled, leaving around the positions of Barchon and Boncelles the best part of their attacking forces: they had lost 42,400 men, some flags and guns! Later, happened the fight on the Gette and on the Dyle; then the retreat, slow, absolutely orderly, toward the forts of Antwerp. From the 20th of August on, there were battles on the Ruppel, the Nethe, and the Escaut, with several sorties and offensives started from the fortified camp, either toward the German bases in Belgium, or toward their lines of communication; sorties of the 25th and 26th of August, during which a pretty large part of the hostile positions was taken; sortie of September 5, when Termonde was reoccupied by our troops; sortie from the 9th

[28] The Third D. A. (like the Fourth) had, exceptionally, four composite brigades—which gives a total of nine batteries, or 48 guns. These, added to the 12 guns of the divisional artillery proper, give a general total of 60 "75's." (TRANSLATOR.)

to the 13th, in the course of which strong hostile positions were conquered, Aershot retaken, the cities of Wesemeel and Louvain reached; there the Belgian Army, as it was admitted by the German critics themselves, had an enormous influence upon the outcome of the Battle of the Marne; special sortie of the 21st to the 23d of September, when the Antwerp garrison destroyed almost all the railroad communications of the invader in central Belgium; sortie of the 25th and 26th—the last one before the fall of Antwerp.

During the siege of Antwerp the Belgian Field Artillery coöperates with the batteries of the forts in the defence of the place and delays with all its might the advance of the German forces, covered by a tremendous mass of guns of all sizes and ranges up to the 420-mm.

Lastly took place the admirable retreat from Antwerp toward the seashore, and during which the whole field army retired surreptitiously from its risky position, and avoided so marvellously being encircled by the Germans, who thought their surrounding movement a matter of course (we all know that they had already announced at Berlin the capture of Antwerp *and* the whole Belgian Army). Here, also, the rôle of the artillery at the crossing of the Escaut, for the protection of the flank of the retreating troops, was difficult and successfully accomplished. One may refer, on this matter, to the affairs at Termonde, Schoonaerde, etc.

Finally, on October 15, the Belgians got ready to defend the last obstacle to which it was still possible to cling on national soil. The details of that desperate struggle have been often told. It is generally known that the Allies besought the Belgian general headquarters to hold out for 24 hours more. This was practically requiring a miracle from an army which, for over two months, had been fighting daily against forces sometimes tenfold larger. Yet the miracle was done. The Belgian resisted. He is resisting still.

He resisted, almost dying of fatigue, hunger, and thirst. He slept while marching; he woke up only to fight. I remember seeing soldiers fist one another, pinch one another in order to

keep awake. He resisted; not 24 or 48 hours, but *nine days,* alone.[29] On the tenth day, at last, a French division helped him in this stubborn resistance and superhuman struggle.

A superhuman struggle indeed: the Belgian Army, on October 14, numbered 48,000 rifles. The Fourth German Army, the three-fourths of which had been brought forward between Nieuport and Zousinghe, against the Belgians, consisted of one division of Ersatz, one brigade of landwehr, the Third Reserve Army Corps, plus four army corps composed of fresh troops—the Twenty-second, Twenty-third, Twenty-fourth, and Twenty-fifth—nearly 250,000 men in all.

A superhuman struggle: all the Belgian soldiers were on duty incessantly, without rest, in order to repel the onslaughts of hostile troops constantly renewed, refreshed—and these attacks were repeated as often as fifteen times a day upon a single point.

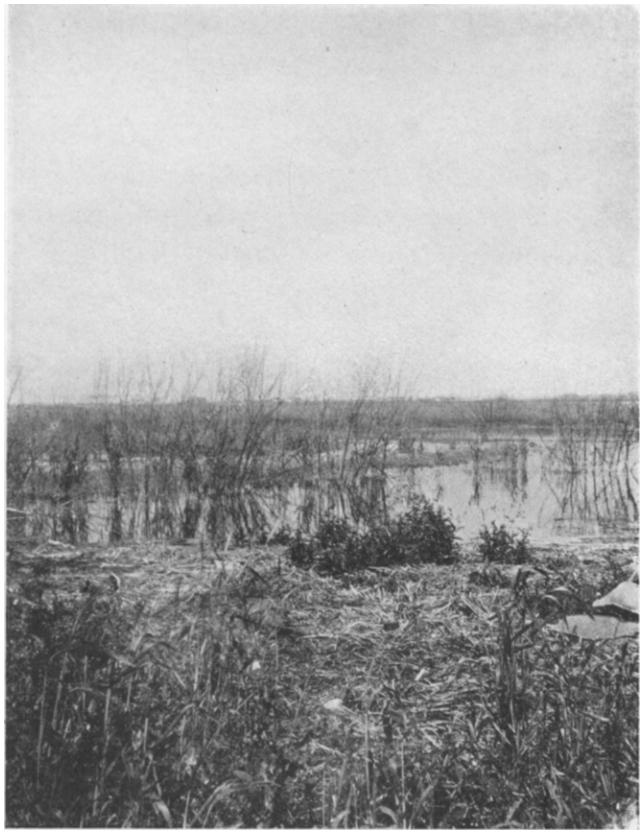
A superhuman struggle: all the pieces available for the Belgians were a certain number of "75's," worn out by daily firing for two months and a half, and some howitzers of 150-mm. calibre. The Germans were advancing with about 500 pieces of 77 mm.; 150 howitzers of 105 mm.; 75 howitzers of 149.7 mm.; a number—not stated—of guns of 105 mm. and 130 pieces of 210 mm., and even pieces of 380 mm.

A superhuman struggle: one single day, during this heroic resistance, cost the Belgian Army an enormous and precious part of its effectives. An official report states that this battle caused the Belgians to lose more than 14,000 men; that is to say, one-third of the 48,000 rifles brought to the Yser.

Superhuman struggle and admirable sacrifice which history shall record, and which shall be taken into account at the time of the final settlement.

The artillery, in that defence of the Yser, played a glorious part. There are a great many instances of batteries marked, on their way, by the Germans—who, from their stations, were able to see everything—bombarded heavily by long-range guns;

[29] Six thousand riflemen of the French navy were coöperating with the Belgians by defending one of the keys of the line: Dixmude. (AUTHOR.)



IN FRONT OF A BATTERY IN A FLOODED DISTRICT

reaching their own position piece after piece, caisson after caisson, and opening fire under a fierce shower of shells.

How often, because it is necessary to be everywhere at the same time, and because one cannot wait, batteries take an emergency position at a crossing of roads or in a meadow; fire furiously at the given objective; then limber up in a hurry and gallop off toward another spot where they are imperiously needed to fire on another target!

Day and night they are at work; they cease firing only to change stations; sometimes they stop galloping only to open fire. Day and night they are followed in their movements by many German guns which can work endlessly in relays. Shells of 77, 105, 180, 150, 210, and even 380 fall in large number close to the little Belgian "75's."

Cannoneers are wounded: they keep on firing until they drop, exhausted by the loss of blood, near their guns. Drivers and reserve men hurry to take the cannoneers' places. Officers fall; others come to replace them: they exert themselves to the utmost; noncommissioned officers do duty for disabled officers. Horses fall: emergency tractors are improvised, guns are moved by hand. When batteries are overwhelmed by hostile fire, they leave the position where it has become impossible to work any more; they move away, but toward the enemy. It then happens that pieces are placed, for hours, at 1000, 700, 500 metres only from the German infantry. The replenishing of ammunition is difficult in such conditions. Every one helps. They all drudge on stubbornly. Men and officers discard their blouses in order to work faster. It is a mad rush; the enthusiasm is marvellous. The artillerist forgets his traditional grumbling. One cannot question that, these days, a wind of magnificent madness was sweeping over the Belgian Army. The mere perusal of the cold official report of these battles cannot fail to rouse surprise and emotion.

All the batteries would deserve to be mentioned here. Have they not been, *all of them*, mentioned in the general orders of the day? Did they not *all* inscribe upon their shields the glorious names of Saint George, Nieuport, Ramscapelle, Pervyse,

Dixmude, Steenstraat? And are not already these names famous in the whole world? Individual instances? I do not know which ones to choose, for they are numberless.

Shall I tell you, at random, about the courage of these men of the 45th battery, who take position 250 metres from the Yser, and then, so as to fight their foe more easily, tear down their own mask and fire in the open? With men killed and wounded, horses lost, they nevertheless, for one day and a half, cling to their position, which they leave only upon the receipt of formal orders.

Shall I mention this battalion, which, subjected to the fire of *ten* German batteries of 77 and 130 and a battery of 210, does not cease firing for six days, moving only to go forward by hand, a few metres at a time, and to shell, in the open, the advancing German infantry? Ordered to retire, it goes back only a short distance and resumes its firing, which stops neither day nor night. On the tenth day it is rewarded by an especial mention in general orders. Its losses are one officer, one "commandant," some fifteen men, and twenty horses; two guns have been disabled by direct shots from the enemy; but the battalion never ceased firing for a single hour, and spent nearly 15,000 projectiles.

Shall I name another battery which enjoyed the uncommon honor of being praised by the Germans themselves? It has been in action since the 18th of October. A few days later an order of the German headquarters prescribes to silence it, because it is hindering the advance of the Fifth Landwehr Division.[30] Yet, on the 6th of November, the battery is still firing!

Shall I name also this battalion which remains fighting, 700 metres from the enemy? Ten out of its twelve guns are demolished: the last two continue to fire.

And this other battery, also of the First D. A., whose guns are destroyed one by one and which keeps firing until the last piece is disabled? And that other one in which the whole personnel of a gun is killed, which has 22 men *hors de combat,* 80 horses killed, and remains still in action?

[30] This order was found on a German prisoner. (AUTHOR.)

Shall I speak of that battery in position 800 metres from the enemy? It loses two pieces—personnel and matériel: to make up for it the remaining guns advance 400 metres toward the Germans! It would be an endless task to narrate these exploits. The most sanguine admirers of the Belgian artillerymen are the French and the English who have been able to judge them on the battlefield and who, more than once, were so enthusiastic about the bravery and the ardor of their comrades in arms that they have cheered them in the middle of a fight.

Here are some figures which bear witness of the Belgian batteries' activity on the Yser:

On October 22, 1914, returns from the Sixth Division announce that the latter has only 160 rounds left per piece. The Second Division has only 100; the Third: 90!

On November 1 most guns are out of commission, on account of excessive firing.[31] On November 4 the Second Division has only 15 pieces in condition to shoot; the Fourth, only 12.

A large volume would be necessary to mention the figures and facts that show the heroism of the Belgian artillery during this war. I have not said one word about the technical ability and the courage of officers. The former is amply proved by the statements made heretofore[32] concerning their works and inventions; as for their bravery and untiring efforts, they are fully equal to those of the enlisted men to whom they could always be set as an example. In short, the whole Belgian Field Artillery is worthy of that army which all the world, including its enemies, is admiring—not without amazement. Thanks to this army, France, first, then England, avoided the brutal stroke that was threatening them; thanks to it, liberty will continue to reign upon the world, in spite of the domineering ambition of Germany.

Thus the noble sacrifice of the Belgian nation will not be useless for humanity. It behooves mankind never to forget it.

[31] It must be observed that guns in that conditions are not necessarily unable to shoot; but the diminution in range caused by the wearing of the tube renders the piece practically useless under normal conditions. (TRANSLATOR.)

[32] Most of which, unfortunately, was suppressed by Censor. (TRANSLATOR.)

The Training of the Artillery Horse

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We reprint, as a timely contribution to field artillery literature, an article originally entitled "Breaking Artillery Horses," which first appeared in the October-December, 1915, number of the FIELD ARTILLERY JOURNAL, *now out of print. The author has elaborated the original article and gives us, under parts II and III, valuable additional information on the subject, gained as a result of his further experience. A limited number of copies of the article in its present form will be printed as a pamphlet, which may be obtained of the Field Artillery Association at a cost of 25 cents.*

No matter what conditions may bring about the organization of additional batteries of Field Artillery, each new battery will present to its Commander a definite and exceedingly difficult problem in horse-breaking and horse-training. Some batteries will receive partially trained horses, accustomed to draft on the farm or on the city street. Others will receive unbroken range horses.

The presentation of a detailed method of dealing with unbroken artillery horses is considered especially timely. Colonel Ennis tested his methods for three years at the Fort Reno Remount Depot. He put it into practice successfully when Battery A, First Field Artillery, received an entire remount in 1912.

PART I. TRAINING

It is probable that in the event of a sudden increase in the Field Artillery, many of the horses would come from the range, a large number of them not being even halter-broken. Under these conditions, the entire training would devolve upon the battery commanders.

PRELIMINARY STEPS

Before beginning the breaking, it is necessary to equip the horse with a halter and neck-rope, the latter of one-inch rope, with a length of about fifteen feet, in addition to the neck-loop, the end of the rope to pass through the chin-strap of the halter (Fig. 1). These can be adjusted by driving the horses singly into a chute. The operation being completed, the animals should be turned loose in a corral for about twenty-four hours, where, by constantly stepping on one another's neck-ropes, they do much towards halter-breaking themselves.

The following day by quiet work, the trainer can get hold of the halter-rope, and with the assistance of another man in rear of the animal to urge him forward, tie it securely to an unyielding object, the horse not being allowed more than two feet of rope (Fig 2.) A large rope is necessary in order to prevent all possibility of its being broken. The use of the rope for two months, or until the horse is thoroughly broken, eliminates all chances of a pull-back; indeed, it is wise to use it on all new horses, whether broken or unbroken, as there are always halter-pullers in every new consignment.

The horse being tied, the trainer, by very slow and careful movements, works up to the animal, at first feeding from the hand with a little hay or grass. Unless absolutely necessary for self-protection, no sudden movement should be executed while anywhere near the horse. In a short time, the man should be able to place his hand on the animal's head, then on his neck, and so on. After each step accomplished, the horse should be given something to eat, as a reward and as a means of gaining his confidence.

TEACHING TO LEAD

As soon as the horse allows his back to be rubbed, he should be taught to lead with the halter-rope. This not only gentles him, but is a great convenience in moving him about. It can be done in a few minutes by dropping a loop over the croup, the man carrying the end of the rope to the front and standing there

(Fig. 3). The end from the loop should not pass through the nose-piece of the halter. The trainer now pulls on the halter-rope. If the horse refuses to move, a jerk of the rope leading to the croup-loop will move him forward a step or two. This is repeated until the horse responds readily, which will generally be within five minutes.

HANDLING THE FEET

The gentling is now continued until all four feet can be easily handled. During this handling, the horse should always be securely tied with a short halter-rope, thereby avoiding much danger to the trainer. The safest method of working with the feet is to grasp a lock of the mane with the hand nearest the horse, using the other hand for the feet (Fig. 4). This does away with all chance of the trainer's being thrown to the ground by a quick move of the horse.

The trainer should keep his hand at the normal position of the leg even if the horse kicks. In this way the horse soon learns that kicking does not remove the hand, for he feels it on his leg again as soon as the leg is returned from the kick. Each leg will have to be gotten as if no other had been obtained.

MOUNTING AND BITTING

The horse, having become accustomed to the handling of his feet, must be taught to allow the man on his back. For this, the animal must be snubbed very close to an immovable object about five feet high. Under these conditions, it is impossible for him to buck. The trainer begins by getting a good grip of the mane with his left hand, places the right elbow across the horse's back, and leans on the horse. While gradually increasing the time of leaning, he also gradually gets a little farther up on the horse's back. When the horse quietly submits to this treatment, the trainer leaps entirely up and mounts. If the horse jumps at all, the rider must remain on the animal's back until the latter becomes quiet. The horse should be petted on neck and back and the rider's feet moved along his flanks, these motions being

FIG. 1

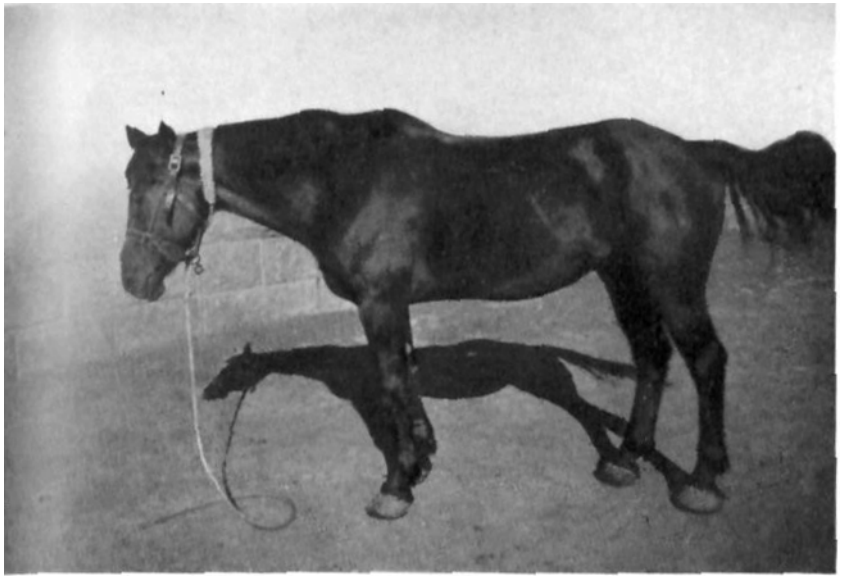


FIG. 2

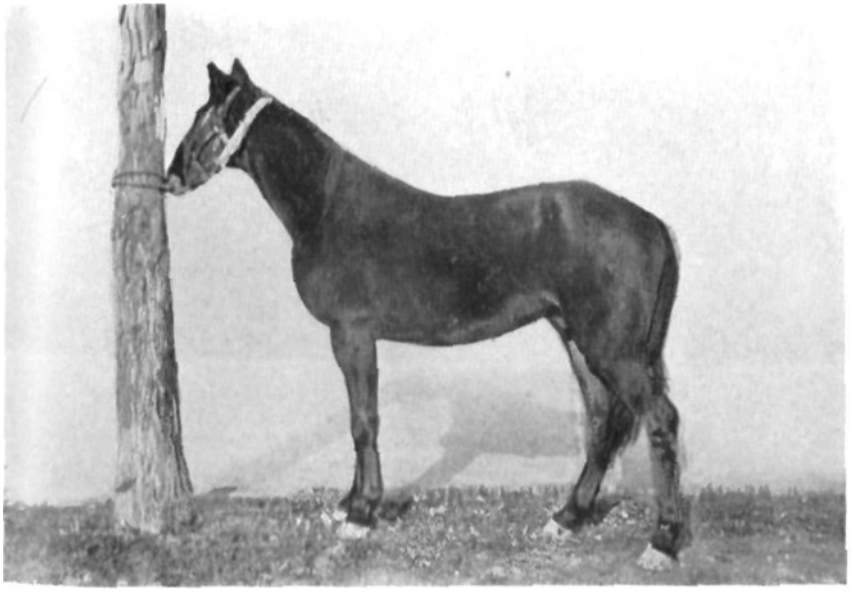


FIG. 3

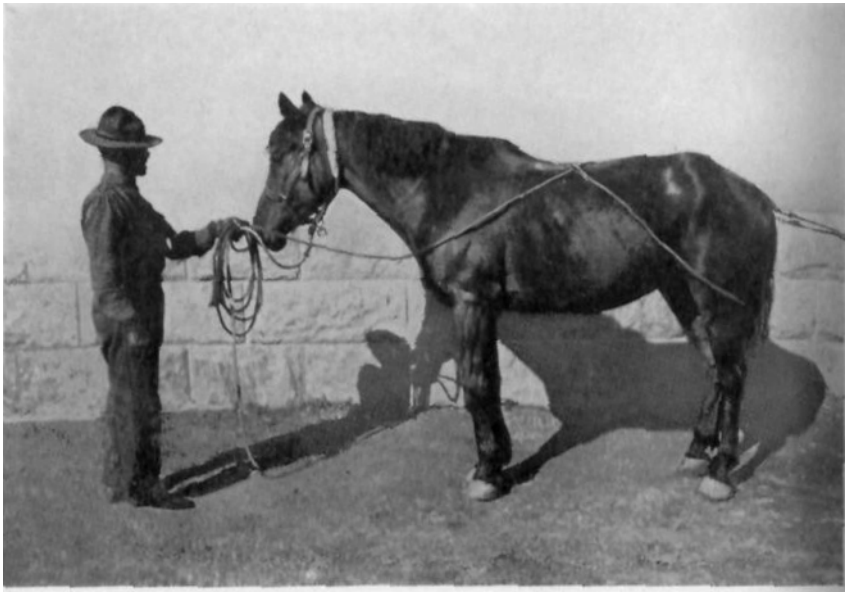
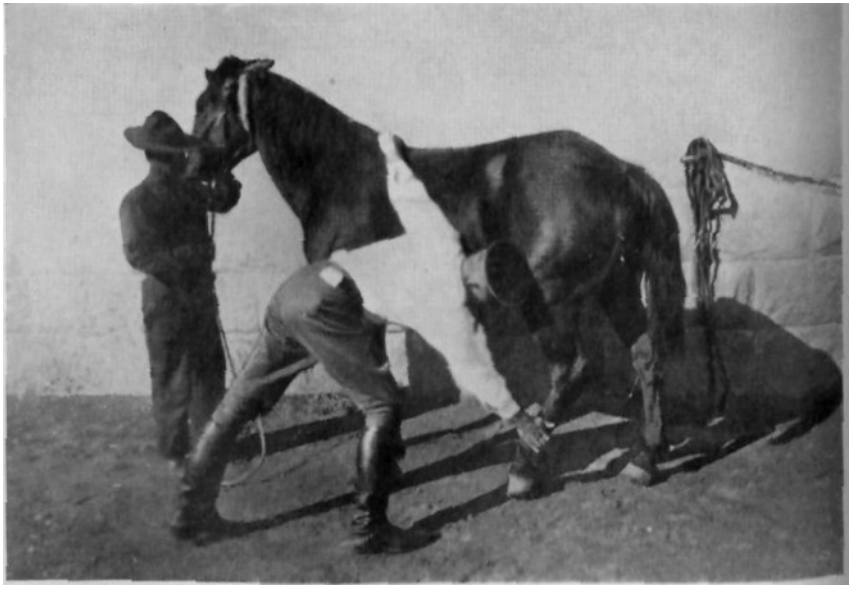


FIG. 4



continued until the animal ceases to show fear. This being accomplished, the trainer mounts and dismounts from both sides, repeating the action until the horse no longer objects to it. These steps, with the handling of the feet, grooming, hand-feeding, etc., should be continued until the horse accepts them quietly. During the last part of this period, a snaffle bridle without reins should be placed in the horse's mouth. The bit should never be forced into the animal's mouth, nor should the ears be handled roughly, as either of these things will produce head shyness which cannot be overcome for a long time. A little grain in the hand holding the bit will induce the horse to open his mouth, when the bit can be easily slipped into place.

At this point the horse can be mounted bareback, and the reins attached to the bit. An assistant next grasps the halter-rope and gradually starts the horse, then leads him about, starting and stopping him frequently. When the horse loses all fear, the rider alone can take him, always remembering that the least roughness in handling will probably lead to trouble.

SADDLING

As soon as the horse goes well at a walk, he can be saddled. To do this, snub him as before; very carefully put the blanket on and off several times; put on the saddle; fasten the girth loosely; rub the stirrups lightly against the sides of the animal, repeating each separate movement until the animal no longer shows fear. When the horse accepts all this without protest, the trainer should mount and move the stirrups freely with his feet, in order to accustom the animal to them. This result being achieved, the horse may be ridden with the saddle as in bareback. By gentle handling, he soon becomes bridle-wise.

HARNESSING

The next step is to harness. Snub the horse again, if necessary adjust a Scotch hobble fully described farther on in this article (Fig. 10). Place the blanket and saddle quietly on the horse's back; raise the tail and place the croupper in position

several times. Always fasten the girth lightly as soon as the saddle is in place, to prevent the latter from falling off and frightening the horse. Never throw the girth and off stirrup down, but lower them carefully so as not to startle the horse.

The collar is the next part of the harness to be put on and this requires more care than any other part. If a Scotch hobble is used in placing the croupper under the tail, remove it before putting on the collar. Unfasten the horse and have a reliable man hold him. A little carelessness or roughness may cause months of trouble, and even make it impossible ever to use a collar on this particular animal. The horse should be allowed to smell the collar, and the collar should be moved gradually close to the horse's neck and rubbed against him until it no longer alarms him. Then the collar should be placed around the neck (Fig. 5). With the aid of an assistant, the trainer gradually closes and buckles the collar and fastens the collar-strap to the saddle (Fig. 6). It is most important that neither man should release his hold on the collar until it is latched and the strap fastened, for if the hold is loosened and the horse jumps, the sharp part of the buckle will gouge the shoulders: and if the collar is latched, but the strap not fastened, the collar will hit the horse behind the ears and badly frighten him. Now lead the horse around. If he goes quietly, he should be unharnessed and harnessed several times. The neek-rope always being securely fastened to a secure object, and the same care exercised in unharnessing as in harnessing. If this can be accomplished without frightening the horse, there will be no further trouble in harnessing him.

Never leave the collar on a new horse without fastening the collar-strap to the saddle; therefore, never place the collar on the horse until the saddle has been put on and fastened.

TRACES

The traces are the next part to put on, and do so as follows: Tie the horse in a stall and fasten one trace to the collar. Snap a halter-rope to the end of the trace so that the trainer can be far enough away from the horse's heels to prevent being kicked,

FIG. 5

FIG. 6

FIG. 7

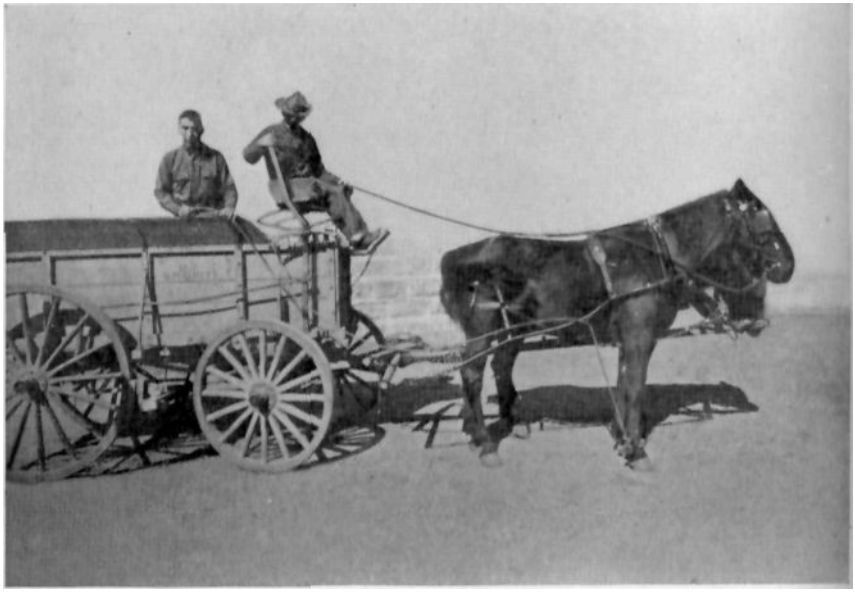


FIG. 8

The trainer, having the end of the halter-rope in his hand, gradually rubs the trace against the horse's leg and flank. Keep this up until the horse no longer objects to it. Increase the pressure and gradually pull the trace across the croup. When the horse no longer objects to the trace on the outside of the leg, try it between the legs and keep it up until the horse ceases to object to it. Then do the same with the other trace. Horses handled in this manner will never mind the traces or kick in harness.

THE TEAM

The first horses to be hitched should be the two wheel-horses which, up to this point, have shown the quietest dispositions. A field wagon with regular driving harness is the best vehicle to hitch to, but if this is not available, any of the carriages can be used, with driving reins of rope. A half-inch rope should run from the wagon, through a ring on the trace about two feet from the collar, to a strap around the fetlock of the outside foreleg of each horse (Fig 7). Each of these ropes should be held by a man on the wagon. If a horse misbehaves, the man holding the rope should pull hard on it, thereby raising the outer foot (Fig. 8). Deprived of the use of one leg, the most unruly horse cannot go far. As soon as the horse becomes quiet again, the tension is released and he is allowed to use the leg unless he again misbehaves. When one horse becomes tractable, he should be used under the saddle to break the off horses and the new near horses.

The lead horses should now be broken, the gentlest ones being tried first in the off wheel and then in the near lead. When the near leader works satisfactorily, the off leader can be easily broken in the off lead position.

If some of the horses refuse to move when first hitched, men should be ordered to lead them, getting them to move by gentle handling, and, if necessary, the carriage should be moved by hand until the horses are well started. Whipping or any kind of roughness should not be tolerated. Never forget that, if properly handled, about 99 per cent. of horses will willingly obey as soon as they understand what is desired.

Never let a horse lunge into a collar, as this bruises his shoulder and will probably make him fear the collar. Do not expect the young horse to pull immediately; if he will walk along quietly, it is all that can be expected. At the end of a week, the average horse will come to the collar nicely, a little encouragement being all that is required. Bear in mind that it is always easy to make a horse pull, but that it is very difficult to prevent a too-free horse from working too hard.

When the wheelers and leaders are working quietly, the swing animals can be hitched in the team, a near leader being used for a near swing until the near swing has been tried out in the off swing position and is working quietly. The most difficult horse should be the last one hitched, and should then be placed in the off swing with five reliable horses in the other positions. If he is a very fractious animal, the leg-rope should be used on him and the rope handled by a man on the carriage. A halter-rope from the halter of the off horse, fastened around the pummel of the near saddle, was found to be advantageous, in that it prevented the breaking of the coupling reins, and avoided injury to the mouths of obstreperous horses.

DRAFT

After all the horses are working well in the teams, they should be taught to pull on level ground by gradually applying the brakes. In the first part of draft training, care should be taken to avoid stalling the team, or tiring it by excessive pulling. If a team shows signs of stopping, the drivers should stop it immediately, so that the horses will not get the idea that the load stopped them. In the early stages of draft training, it is important, also, to avoid overloading, as at this point it is likely to produce balkers.

NECK-REINING

The horse can be trained to neck-rein by the following method: He should be taught first to turn on the forehand to right and to left, a light tap of a switch being used to augment

the pressure of the heel. When the horse will move his haunches by the application of the heel, the neck-reining proper should begin. Turning to the right is accomplished by carrying the left rein against the neck, the right rein being opened wide, the right heel tapping the right flank of the horse. If the horse fails to turn to the right, a slight jerk should be given to the right rein, and the action repeated until the horse obeys. Turning to the left is taught in the reverse manner.

BACKING

In teaching a horse to back, the trainer mounts and takes a rein in each hand, the hands being placed near the withers. While always keeping a light pressure on the bit, the pressure should be varied by rapid oscillations of the hands, the hands moving in unison so that there is no sawing of the mouth. The legs also should be closed on the horse, and light taps of the heel will be necessary if the animal fails to take a step backward by the end of a minute.

As soon as the horse takes a step release the reins and reward him, then try it again. When the horse readily responds to the application of the reins, the oscillations of the reins must be worked in unison with the movement of the forelegs, the force being applied just as the feet going to the rear touches the ground and the force is released as the front foot leaves the ground on its way to the rear.

When a horse becomes proficient in backing without being hitched, he should be hitched. He will probably refuse to back, due to the pressure of the breeching. Cannoneers should assist in backing the carriage and the horses gradually taught to do it.

RECRUITS

Recruits can be taught to ride by mounting them on the gentlest horses, and fastening the reins in the halter-squares instead of the bits. In this way, the horse's mouth will not be injured, and the animals will not resent so much having the recruits on their backs. The riding should take place in a corral,

which may be improvised with carriages. I believe that with a few experienced men to form a nucleus for the enlisted force, the horse part of a battery can be put in shape to travel on the ordinary road in a month.

In addition to the foregoing method of breaking ordinary horses, there are others that have been found greatly to expedite the work in difficult cases, and still others which my experience has shown to be decidedly harmful.

COLD-SHOULDERED HORSES

If a horse is just a little cold-shouldered, but will pull when once started, place a rope or a strap around the knees, as shown in Fig. 9, and pull straight to the front. This will cause the horse to move one of his forelegs and, consequently, bring all the tension of the rope on the rear one, which he will then move, and so on. This is generally sufficient for a horse of this kind.

BALKY HORSES

If the horse is a confirmed balker and throws himself, he should be hitched with a good pulling animal, and when down should be held down by putting two men on his head and neck. Get a bucket of water and pour a very small stream on his nose, occasionally allowing a little to fall into a nostril. He will struggle to rise, but should be held down for about two minutes, with water trickling on the muzzle all the time, and then allowed to get on his feet. If he goes down a second time, which he probably will do, repeat the treatment.

I have never known a horse to throw himself a third time. If he still refuses to move forward, a loop should be dropped over the croup, as in teaching to lead (Fig. 3), with the end of the rope running through the nose band of the halter and fastened to a good pulling animal. The horses should be started, the wagon being pulled by the mate of the balky horse, and the balky horse being pulled by the horse at the end of the rope. As soon as the balky horse shows an inclination to move by himself, the tension of the rope should be released, and tightened again

only when the balker hesitates or stops. A very few lessons of this kind will cure a balky horse. No punishment by whip should be used.

SCOTCH HOBBLE

To put a Scotch hobble on a fractious horse, place a fixed loop of one-inch rope around the horse's shoulders.

Take about forty feet of half-inch rope and make a loop of it by fastening one end to one ring of a leather anklet and allowing the other end to run freely through the other ring. Throw this loop on the ground beside the horse (Fig. 12). Move the horse sidewise until the desired foot is inside the loop (Fig. 12). Grasping the loop firmly to retain its size and keep it from slipping, suddenly jerk it upward so that it will go above the horse's hock. Pull the part of the rope marked 1 in Fig. 12 towards the right hand, paying out with the left hand until the anklet is near the right hand, in the position shown in Fig. 13. Untie the fastened end of the rope, still keeping it through the ring, but running freely like the other end. You are now holding four lengths of rope, two in each hand, a loop passing through each ring. The two inner lengths are our original loop, and the two outer lengths are the two ends of the rope (Fig. 13). Pull on the ropes in the left hand (marked 2 in Fig. 13) until the anklet is in position. Release the two inner ropes (our original loop) and pull quickly on the two outer or end parts. We now have a single rope running from the right hand through both rings of the anklet to the left hand. Allow the anklet to drop into place, as shown in Fig. 15. Fasten both ends of the rope to the shoulder-rope, and adjust the tension of the anklet-rope until the foot takes the position shown in Fig. 10. The hobbled foot should not be lifted more than enough to allow the toe just to touch the ground. This is most useful in harnessing new horses that kick, and in doctoring the hind legs. Except in shoeing, it should always be placed on the leg opposite the side on which you intend to work. A large neck-rope should always be placed on the horse before the Scotch hobble is put on.

LONG REINS

Haye's method of long reins as modified by Major Hardeman and formerly used at the Fort Reno Remount Depot, I consider the best means of teaching a horse to be bridle-wise, to move to the front, to back, and so forth. In addition, it does more to gentle a horse than any other method known to me. A horse handled with long reins will never object to being saddled or harnessed, nor will the traces ever frighten him. This method requires a special saddle which is not a commercial article (Fig. 16). In beginning, the reins are fastened to the halter or cavesson and are not attached to the bit until the horse understands their application. The secret of success with this method lies in gentleness and playing the reins, never in roughness or whipping. In this way, the horse's spirit of opposition is never aroused.

STALLED TEAMS

To make a stalled team pull, back up all the horses until the traces are as slack as possible, and pass the pairs well to the right or left. Start the leaders quietly, gradually moving them to the front at the same time. The swing driver should watch the lead traces, and when they begin to tighten he should move his team forward as the lead driver did. The wheel driver should move his team so that it will get in draft when the swing traces tighten. The instant the traces tighten, the horses should be required to give their maximum effort.

The advantages of this method can be briefly summarized:

Every horse moves one or more steps to the front before the traces tighten, thus giving him the idea that everything is all right. By moving sidewise at the same time, the tension in the traces is taken up gradually, without shock to the shoulders. It is much easier of accomplishment than is the moving of the whole team at once. The horse or horses of a stalled team should never be whipped.

FIG. 9

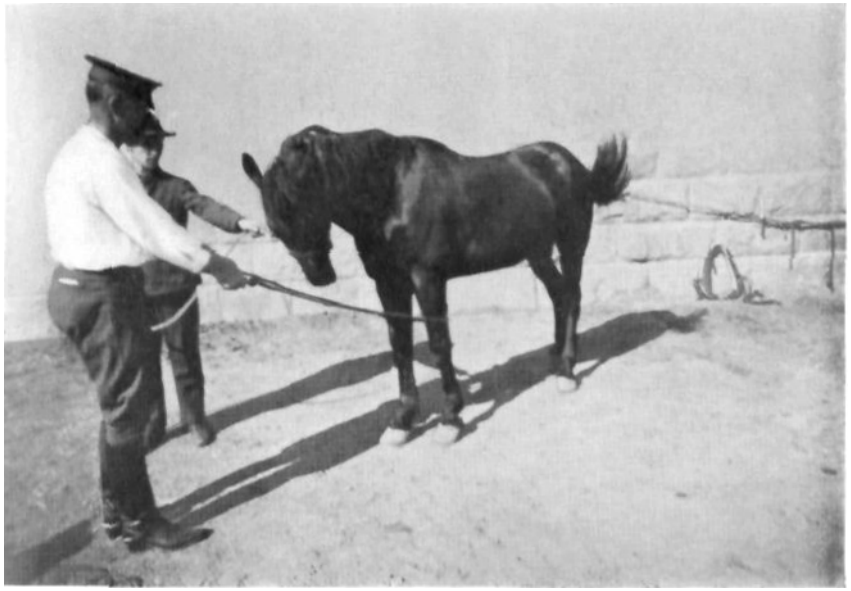


FIG. 10

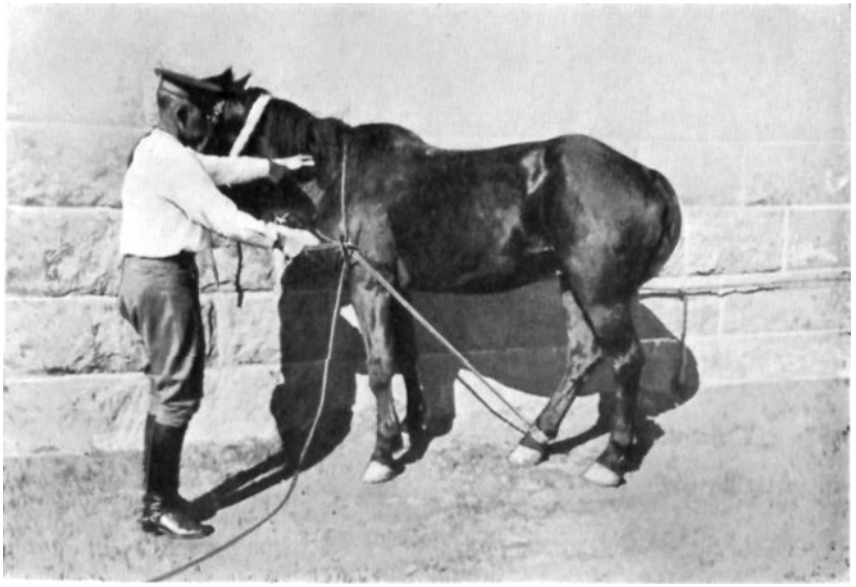


FIG. 11

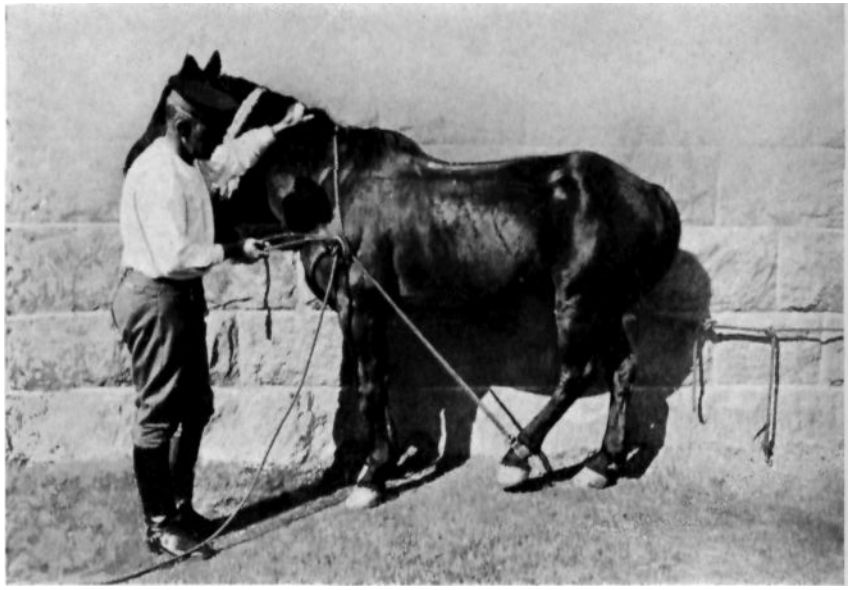


FIG. 12

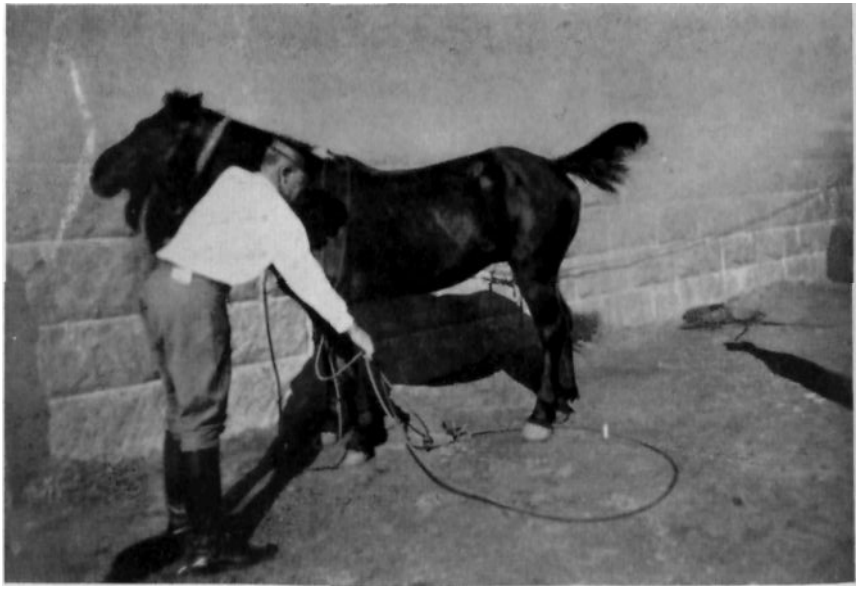


FIG. 13

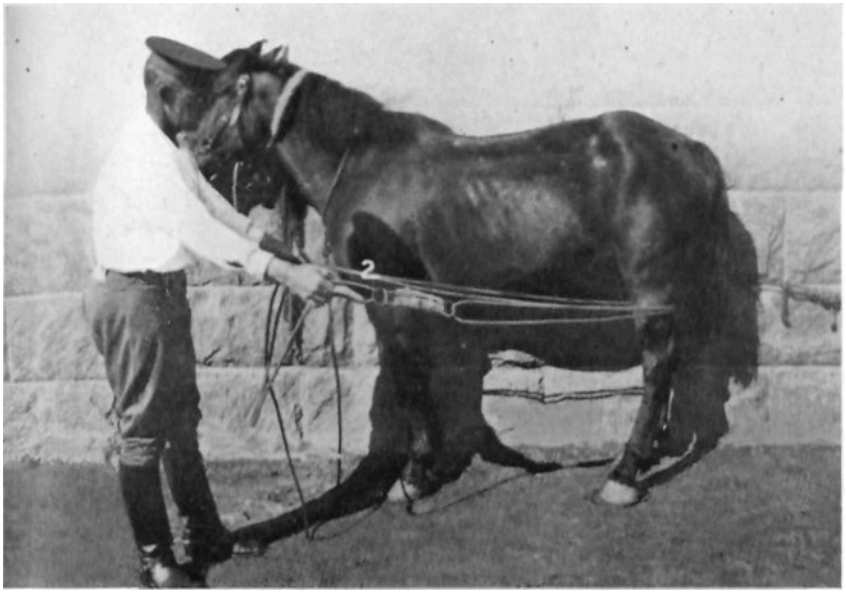


FIG. 14

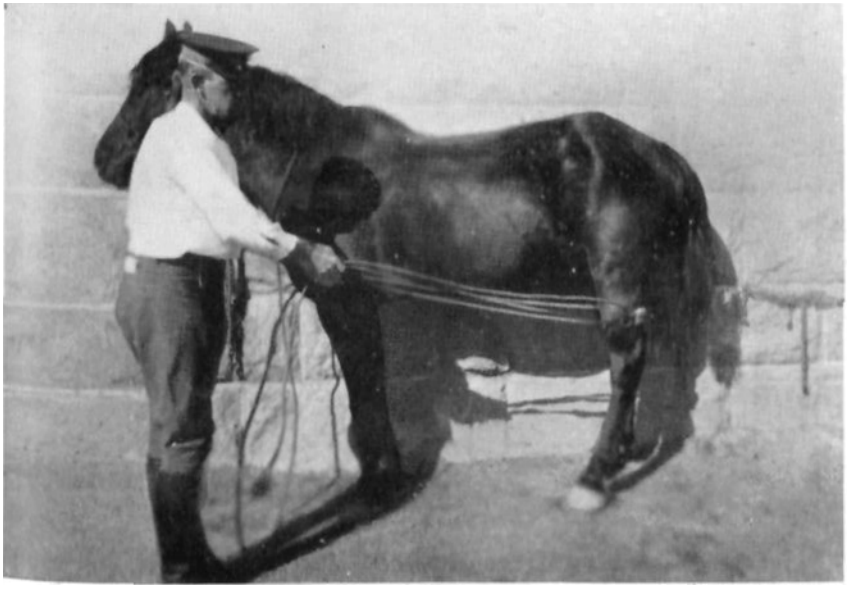
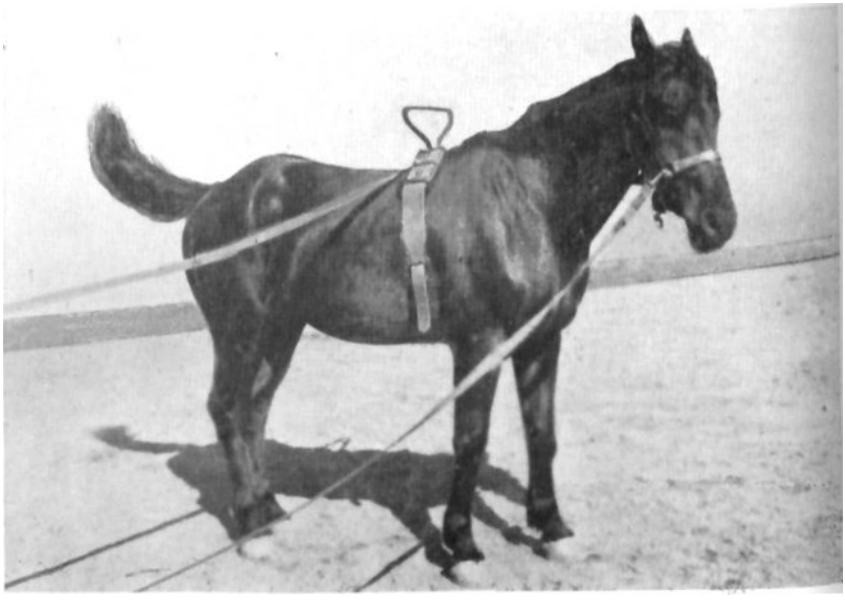


FIG. 15

FIG. 16



HARMFUL METHODS

Twitches.—Never allow a twitch to be used. It is absolutely unnecessary, brutal and ineffectual, and produces more headshyness than any other cause. I have had more than fifty range horses clipped without difficulty after having had them a month, and no twitches were used. Animals that had been considered too unmanageable to clip without a twitch, have been successfully clipped without one, and have stood more quietly than ever before. The next time you think you need a twitch, do without it, trying instead very quiet and gentle handling and, if necessary, placing your finger in the animal's mouth and holding it there. This will distract his attention sufficiently in all ordinary cases.

Stocks.—Never allow stocks to be used for shoeing, or for any, except veterinary, purposes. It never gentles a horse nor, in itself, teaches him to stand for shoeing. You cannot have it in the field, and, after all, efficiency in the field is the goal of all our training.

Whips, Spurs.—Do not allow whips or spurs to be used on new horses. Ignorant application of either will ruin more good horses than any other cause. If punishment is necessary, give it or supervise it yourself. About 99 per cent, of all horses will do their best for you if properly handled.

Drivers.—On a long, hard pull, if you are careful not to make your horses walk fast, they will not be winded or exhausted when they reach the top. Let them have their heads, as they know, better than you do, the most comfortable position for them. Never allow a team horse's head to be held to the side, as so many drivers do hold them through careless handling of the reins.

Finally, you must concede that your first duty is to get your battery to the required place at the required time. If, through neglect or ignorance in the care and training of your horses and drivers, you fail to accomplish this, your usefulness as a battery commander is negligible.

PART II. CARE OF THE HORSE

The horse is a creature of habit. Even in his native state, as well as when domesticated, if left to his own resources he forms habits that become more or less fixed and the matter of eating and drinking influence to a great extent his physical welfare. A sudden departure from his accustomed way of living will have a decidedly detrimental effect upon his health. These facts have been borne out by recent experiments by the Department of Agriculture and must be considered in the proper care and feeding of animals.

For the above reasons the method of feeding and water in garrison should be regular and as near to normal field conditions as possible.

STABLE MANAGEMENT

The officer in charge of Department "B" is in charge of the stable and is assisted by the stable sergeant, who in turn has a stable orderly to care for the sick and injured animals.

Daily a stable police of four to six men is detailed to perform the necessary work around the stable, such as feeding, watering and cleaning.

COURSE OF THE FOOD

We will trace briefly the course of the food from its source from the mouth to its final disposition.

Food is gathered by the lips and front teeth. It is worked around by the tongue and cheeks and by them carried to the back teeth, or molars, where it is ground and mixed with the saliva of the mouth.

When sufficiently ground it is carried by the tongue to the gullet (œsophagus) and then to the stomach.

By the muscles of the stomach the food is rolled around the stomach and mixed with the gastric juice. When sufficiently mixed in the stomach, it is passed into the small intestines, where it mixes with the secretions of the pancreas, liver and intestinal glands. The mixtures of all these juices prepare the food for absorption into the system.

The veins and lacteal absorbent vessels of the intestinal linings take up from the food its nutritive value.

The food then passes into the large intestines, where any remaining nutritive value is taken from it and the waste products of the body and food are passed through the anus as dung. The nutritive value of the food thus supplies the blood, which in turn nourishes the body.

COURSE OF WATER

The course of water through the body is somewhat different from that of food. Water does not stay in the stomach or small intestines, but passes rapidly through them into the cæcum or blind gut, which is one of the large intestines. From here it is absorbed by the veins as needed. It passes from the system through the lungs as vapor, through the sweat glands as perspiration, and in larger quantities through the kidneys as urine.

STOMACH

The stomach is small in comparison to the rest of the body and therefore holds only a limited amount of food. For this reason frequent feeding is desirable.

FEEDING

It has been found by experiments that feeding three times a day is sufficient. Oats should be divided into three equal parts and fed morning, noon and evening.

The time of feeding of hay should depend largely upon the work the horse is to do and the time he works. This matter for an army horse should be regulated by the conditions of field service. In the field the hay is delivered during the afternoon and could be fed partly at evening stables and partly in the early morning. It is believed the feeding of all hay at evening stables is the better plan, as the early morning feeding of hay would have to be done by the guard and very few guards in the dark without the presence of an officer would equally distribute the hay among the animals. A horse should never be worked

hard with a stomach full of hay. Horses on a picket line always paw the hay toward the rear in order to get the seed and tops. They eat the stalks later. Unless the sentry on the picket line continually pushes the hay back under the line, the horses will urinate upon it and spoil it for feed. This duty of the sentry is most important, as if not done from 25 per cent. to 50 per cent. of the hay is lost as feed.

WATERING

The ideal condition for watering would be to have water available for the horse to drink at all times. The objection to this method is that it is not a field condition and, as stated before, the horse is an animal of habit and a sudden change of method of watering or feeding is decidedly detrimental, especially so when combined with a change of life from garrison to the field.

Horses, as far as possible, should be watered three or more times a day and before feeding. The exception to this is the morning watering, which is given after feeding. This is due to the impracticability of watering before reveille. While on the march never pass a watering place after 9.30 A.M. without watering unless you know there is a place further on. While the regulations and most horse books state always to water before feeding, recent experiments held by the Agricultural Department have demonstrated that time of watering with respect to feeding has no effect, provided the same sequence is always used. Always let a horse have all the water he desires. Watering horses when warm does not hurt them provided it is not cold enough to chill them or that they are to be kept moving after drinking.

CLEANING

The stable and grounds should be kept clean at all times and no manure allowed to remain in the stables, corrals or picket line for more than 12 hours at a time. Floors of stalls and aisles should be thoroughly cleaned each morning and swept again after the noon feed. If the horses are on the picket line or in the stables during the day, the sentry or sentries should keep

the line or stalls clean at all times by removing droppings and sweeping urine to the rear. Watering troughs should be washed daily, feed boxes at least once a week and always after feeding a bran mash. Equal parts of water and vinegar should be used for this purpose. Corrals should be cleaned daily after the horses are tied in at evening stables. Keep stalls in repair at all times even if the rest of the stable is in bad condition.

VENTILATION

Fresh air, no matter how cold, does not hurt a horse, provided it is not caused by a draught. Foul air is most harmful. For this reason all properly built stables have ventilators at the ridge or highest point.

FORAGE

The forage furnished by the government consists of different kinds of hay, oats, corn, and bran.

The hays are timothy, blue joint, alfalfa, red top, orchard grass, clover, wheat and oat hay. Alfalfa contains the most nourishment. No. 1 timothy, or its equal, is generally called for by the government specifications. Red top, orchard grass, blue joint, and wheat and oat hay are all good hays. The value of a hay depends largely upon its growth at the time of cutting and upon the way it is cured. A grass that is in seed has lost a large part of its feeding value. The same happens to hay that is improperly cured.

Oats are considered the best grain for horses. While some other grains contain the same nutritive value oats seem to have the best effect. This is believed to be due largely to its ease of digestion. Corn is a good feed, but unless ground, fed on the cob, or fed with dry bran, horses will swallow a portion of it without grinding it. In this condition it will often pass through the horse. If fed with about one-sixth dry bran it cannot be swallowed without first becoming moistened by saliva and in doing this the horse crushes the corn. If a horse bolts his grain, mix dry bran as above and he cannot do so. Bran has practically

no nutritive value, but has a tendency to loosen the bowels when fed as a hot mash. It should never be fed as a mash unless it can be fed warm.

The hays furnish the bulk of the forage and by their bulk exercise and stimulate the stomach and intestines. The grains furnish the greater part of the nourishment.

INSPECTION

Hay may be divided into upland, lowland, and water meadow hay. Upland hay is the best and is recognized by the fineness and firmness of the stems and by the narrowness of the leaves. Lowland hay is known by the coarseness of the stalks and by the broad leaves of its grasses. It is not as firm and crisp as upland hay and is inferior to it as a feed. Water meadow grass is very inferior and should not be used as hay.

Good hay should be crisp, dry, greenish in color, sweet of smell, free from dust, dirt, weeds and foreign matter. It should contain the flowering heads in abundance but no seed. Two or more bales of each carload should be inspected by opening them and examining carefully for the above. If not up to contract specifications reject it. Never feed mouldy or musty hay.

OATS

Good oats are distinguished by being clean, hard, dry, sweet, heavy and plump and free from worms. The seed should be of the same size and have very few small or imperfect grains. The color of the oats is immaterial, but in general a white oat is called for by the specifications. Good oats should weigh forty pounds to the bushel. Poor oats weigh only 32 pounds.

CORN

Corn should be free from dirt, worms and foreign matter, should be sweet and dry and should weigh 56 pounds to the bushel. Bran should be free from foreign matter and dirt, and should be sweet of smell.

STORAGE

All forage should be stored in dry, well-ventilated buildings. It should never be stored when wet or even damp. Unless the floor is absolutely clean and dry the lower tier of forage should be raised by skids three or four inches from the floor. It should be inspected daily to see if there is any heating. This can be determined by feeling the bales or sacks. A complete record should be kept of all forage on hand and the amount fed each day. This record should be checked each day by the officer in charge of the stables. If stored in the open, the top of the pile should be finished off like a "V"-shaped roof and covered with paulins or loose hay racked in the direction of slope.

ALLOWANCES

Horses are allowed 12 pounds oats, 14 pounds hay, and 3⅓ pounds straw daily. Those weighing over 1300 pounds are allowed 2 pounds more of oats and 3 pounds more of hay.

Mules are allowed 9 pounds oats and 14 pounds hay. With the consent of the Post Commandant, substitutes may be made in the forage as follows: I pound of oats for 1½ pounds hay or 2 pounds straw.

Bran should be fed at the evening feed twice a week, generally Saturday and Sunday evenings. The bran is changed for oats pound for pound.

GROOMING

Grooming answers two principal and several subsidiary ends. First, it removes from the skin those particles of perspiration, dust and dirt which would otherwise impede the free action of the sweat and oil glands; second, it removes the scurf or worn-out cells which are no longer required on the surface of the skin and which would when cemented together by sweat add to the destruction of the glands. The subsidiary uses are for the glossiness of coat, shortness of hair, and as a general massage. The curry comb should be used only as a means of cleaning the brush and in very exceptional cases to loosen caked mud.

SICKNESS

The first sign a horse shows of being sick is a refusal to eat grain. For this reason the stable sergeant or stable orderly should inspect all food boxes one-half hour after feeding grain, and any horse that has failed to eat should have the grain removed and his temperature taken. If he shows a temperature the veterinarian should be called.

The common ailments among the battery horses are: Colic, thrush, distemper, influenza, scratches, nail pricks, founder, corns, and galls. With the exception of distemper, influenza, nail pricks, and occasional colic, all the above trouble can be prevented by proper care of the animals. Each organization commander should know the symptoms of the above diseases or injuries and the usual method of treatment. All new animals arriving at an organization should be quarantined for at least two weeks in order to prevent spread of any contagious disease that they might be carrying.

SHOEING

One of the most important duties of the battery commander is to see that his animals are correctly shod. To understand this properly he should be familiar with the structure of the foot and lower leg and should know the function performed by the main bones, tendons, and ligaments.

The junction of the lower cannon bone with the large pastern bone forms the fetlock joint. The junction of the upper and lower pastern bones forms the pastern joint, and the junction of the lower pastern and coffin bone forms the coffin joint. The navicular bone forms a roller for the flexor tendon. The joint is held in place by the ligaments and the movement of the joint is caused by contraction or extension of the tendons. The main tendons of the lower leg are the extensor tendon in front, which fastens to the extensor process at the top of the coffin bone, and the flexor tendon in rear, which fastens to the upper under surface of the coffin bone and pulls over the navicular bone.

The lower surface of the coffin bone is half-moon shape and convex upwards (see Fig. 17).

The elastic structure of the foot is composed of the lateral cartilage which fastens to wings of the upper part of the coffin bone and the plantar cushion which fills up the space between the lateral cartilages, the frog below and the part of the flexor tendon which is in the foot.

The sensitive laminæ (wall) covers and is firmly attached to the wall surface of the coffin bone and the lower surface of the lateral cartilages. It secretes the inner part of the wall. The coronary band at the top of the feet secretes the outer wall of the hoof. The sensitive sole covers the sole surface of the coffin bone and secretes the sole.

The sensitive frog covers the lower surface of the plantar cushion and secretes the frog.

The weight of the horse is supported principally by the wall of the hoof through the lateral cartilages to the coffin bone. The frog acts as an elastic cushion to prevent jar and also stimulates the circulation. The sole carries very little weight and is mostly a protection for the bones above. The outer or horny part of the foot is composed of the wall, sole and frog. In the healthy foot these parts are firmly united. The wall is divided into the toe, quarters, buttresses or heels and bars. The quarters extend from each side of the toe to the heel. The heel or buttress is that part of the wall where it bends inward and forms the bar. The sole is the lower surface of the foot between the walls and the frog (Fig. 18).

The wall is composed of fine fibres cemented together and grows downward similar to the growth of a finger-nail. It contains about ¼ water by weight and is covered on its outer surface by the periople which prevents evaporation. The sole and frog are not so covered, as they both scale off as they grow downward.

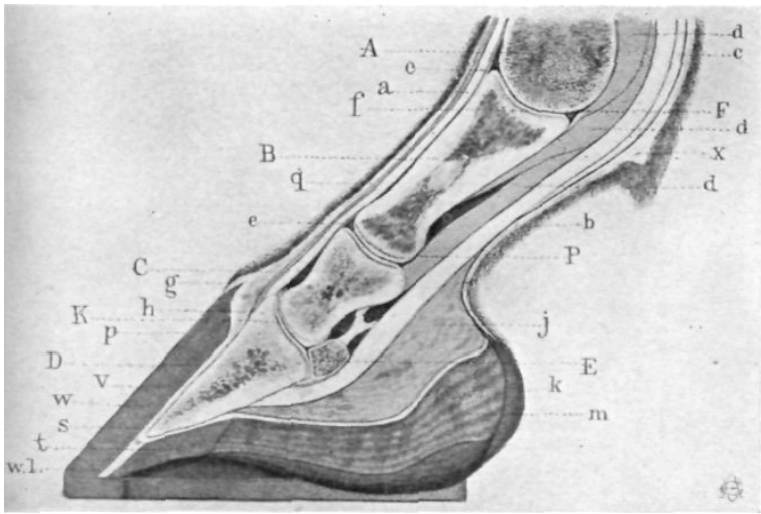
When the foot is placed on the ground, the frog is pressed upward and expands the plantar cushion latterly, thus causing the heel to expand. This expansion and contraction diminishes

the jar to the structure and acts as a pump for the blood circulation.

The necessity for a shoe arises from the unnatural conditions the hoof is submitted to in traveling on hard, gritty roads. This will wear down the foot faster than nature can grow it. In shoeing the foot of natural conformation, the nearer the conditions of nature are approached the better the job. Before preparing the foot for the shoe, a careful examination should be given the lower leg and hoof, both from the front and side. From the front to see if the horse is straight from fetlock joint to toe, or "toes in" or "toes out," or is "broken out" or "broken in." From the side to observe the slope of the pastern to see if the line of the front of the wall is parallel to the medium line of the pastern. There are three correct positions or slopes known as "regular," "sloping" and "stumpy" (Fig. 19).

There are two incorrect positions or slopes in which the line of the front of the wall is not parallel to the medium line of the pastern. These are known as "broken back" and "broken forward." The foot to be properly prepared for the shoe, should be so rasped that when looking at it from the front the median line of the toe and the pastern form one straight line, and from the side so that the line of the front of the wall is parallel to the median line of the pastern. The lower surface of the wall should be absolutely level, the sole convex upward and only short ⅛ inch bearing on the shoe. The bottom of the frog should be level with the lower surface of the shoe. The nails should enter the outside edge of the white line and come out about one inch above the lower edge of the wall. The nails should not be carried back to the quarters, as when driven near the quarters they prevent the normal expansion of the heel when the frog comes in contact with the ground. Nail heads should be countersunk in the shoe. The shoe should be shaped to fit the contour of the foot, absolutely level and the upper surface bevelled slightly downward from about ¼ inch inside of the nail holes. This is done to take the pressure from the sole. Clinches should

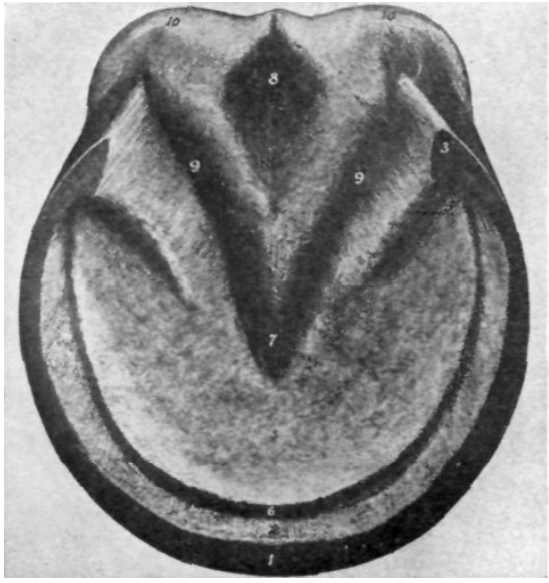
FIG. 17.



DIGITAL SECTION OF FOOT AND PASTERN

A, Cannon bone; B, os suffraginis; C, os coronæ; D, os pedis; E, os navicularis; F, fetlock joint; K, coffin joint, P, pastern joint; a, extensor pedis tendon; b, flexor pedis perforans tendon; c, flexor pedis perforatus tendon; d, sesamoidan ligament; e, capsular ligament; f, articular cartilage; g, perioplic ring; h, coronary band; j, plantar cushion; k, sensitive frog; m, horny frog; p, periople; q, skin; s, sensitive sole; t, horny sole; v, sensitive laminæ; w, horny wall; w. l, white line; x, ergot

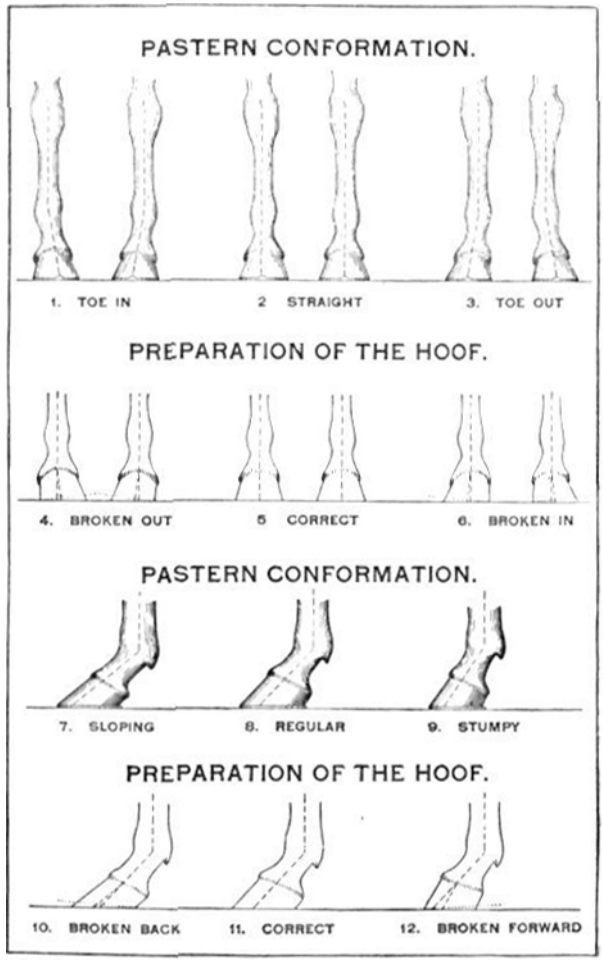
FIG. 18.



RIGHT FORE HOOF OF HORSE; GROUND SURFACE

1. Basal or ground border of wall; 2, laminæ of wall; 3, angle of wall; 4, bar; 5, sole; 5′, angle of sole; 6, white line (junction of wall and sole); 7, apex of frog; 8, central sulcus of frog; 9, 9, collateral sulci between frog and bars; 10, 10, bulbs of hoof

FIG. 19.



THE FOOT AXIS AND THE PASTERN AXIS

be of medium size, well turned and set in, and smoothed off with a rasp, care being taken not to rasp the wall to any extent.

In pulling off old shoes, all clinches should be cut, otherwise there is danger of tearing off sections of the wall.

PART III. ADJUSTMENT OF HARNESS

The importance of the proper adjustment of the artillery harness cannot be over-estimated, especially the collar. An artillery horse that cannot be used in draft, due to sore shoulders or neck, is of little value to the battery. The service is now receiving both breast and steel collars, and while the steel collar is decidedly the better draft implement if properly handled, it is believed the breast collar will give better satisfaction with the large number of inexperienced men now in the Field Artillery. It also has the advantage of being able to be adjusted to a horse within a few seconds, while the steel collar may require twenty minutes. A badly fitting steel collar can ruin a horse's shoulder in a few hours' hard draft, while the breast collar will probably cause less damage. There is, however, no excuse for sore shoulders or sore necks when using the steel collar, if the collar is properly handled and cared for.

In all the adjustment of harness, bear in mind that any improperly adjusted part will worry the horse and thus tend to wear him out and cause loss of flesh.

ADJUSTMENT OF COLLAR

Collars are issued in the following sizes: 2A, 2B, 4A, 4B, 5, 5A, 5B, 6, 6A, 7, 7A, 7B, 8A. The different sizes allow of the numerous adjustments, and practically any horse can be fitted.

The adjustment of Nos. 4A, 5 and 6 collars in inches is given below as a general example of how the different sizes run:

Size	Shortened	Extended	Top Construction Varies	Bottom Buckle Varies	Length Varies
				(3¾)	
4A	17½	20½	By ½ (3½)	By ¾ (4½)	By ¾ (3″)
5	19½	22½	By ½ (3½)	By ¾ (4½)	By ¾ (3″)
6	21	24	By ½ (3½)	By ¾ (4½)	By ¾ (3″)

The collars are issued as follows: 20 per cent. No. 4A, 30 per cent. No. 5, 40 per cent. No. 5A, 10 per cent. No. 6. If you cannot fit your horses properly with these sizes of collars (which you, in general, cannot), get permission to exchange them for smaller sizes. The length of the collar is measured from the under side of the pad to the top side of the throat of the collar.

If you have no collars for the purpose of determining the correct sizes needed for your battery, make a measuring device to determine the length of the shoulder from top of crest of horse to bottom of throat and send for sizes corresponding to these lengths. You should always have three extra sets of top connections and pads for use in fitting collars.

About 75 per cent. of the horses used in Field Artillery will use a No. 4, 4A, or 4B collar. The numbered collars, such as No. 5, have quite a curve outward as seen from the front and are used for horses with thick necks, the No. 5A collar is straighter than the No. 5 as seen from the front, and the No. 5B is practically straight and is used for ewe-necked animals. When the horse is in flesh the collar fitted to him should be the smallest size extended to its maximum. This allows the collar to be taken up and still made to fit the horse if the horse through any cause loses flesh. The collar should be adjusted so that when in place against the shoulders, the fingers of the hand can be placed between the inside of the collar and the neck and moved in their position from top to bottom of collar with considerable pressure upon the fingers. The throat of the collar should allow the fingers as far as the knuckles, back of the hand horizontal, to be placed between it and the throat of the horse without any pressure on the fingers. To accomplish the adjustment, the ordnance department issues seven sizes of top connections, numbered 0 to 6, and seven sizes of pads also numbered 0 to 6. There are also issued two sizes of buckles for latching the collar. Each collar allows of an increase of length of three inches by unbolting the sliding piece at the top of the sides, and a change of width at the bottom of about 3¾ inches by moving the latch bolt *and* knuckle bolt in different holes. You can also use a different size buckle and increase the width by 1 inch more.

ADJUSTMENT OF BREAST COLLAR

The breast collar should be adjusted as high as possible on the horse's chest without there being any tendency to choke him by pressing against the wind-pipe. This collar can be lowered or raised within narrow limits to relieve galls and sores that may occur on new horses when put in hard draft before the shoulders and breast have a chance to harden.

COLLAR STRAP

No adjustment, should be loose. It is only there to prevent the collar from striking the horse behind the ears when he lowers his head.

BLANKET

The blanket should be carefully folded and examined to see that there are no wrinkles or bunches in it. It should be equally divided on both sides of the horse and placed far enough forward so that when the saddle is in place, about one inch projects in rear of the rear end of the side bars of the saddle. All blankets have a tendency to work to the rear, so that after a short distance is travelled, blankets placed in this position will soon be evenly distributed under the saddle.

SADDLE

The saddle should be placed on the back so that the front ends of the side bars of the saddle are about the width of three fingers in rear of the top of the shoulder-blades. Before girthing, the blanket should be raised slightly over the withers to prevent pinching by the saddle at that point. In very high withered horses it is often advantageous to use two blankets under the saddle. The girth should never be very tight. After the horse has travelled a short distance the flat of the hand should easily be placed between the barrel of the horse and the safe of the cincha ring.

Backstrap.—The backstrap should be adjusted so that when the saddle and crouper are in their proper places, the flat of the

hand can be held vertically between the backbone and the backstrap.

Hip and Loin Straps for Lead and Swing.—The hip and loin straps on the lead and swing horses should be adjusted so that when the horses are in draft the trace loops will hang about ½ inch below the traces. Their function is to support the traces when the animals are not in draft.

Breeching.—The body strap of the breeching is adjusted so that the rear part (part below the tail) is about four inches below the point of the buttocks, the front part where the side straps fasten, is adjusted to hang at the height of the stifle. In other words, the body strap of the breeching slants down toward the front. The reason for this adjustment is so as to interfere as little as possible with the movement of the hind legs when the breeching comes in play. If the body strap is too low behind it gives a greater lever arm on the hind legs, and materially interferes with their movement. If too high most of the strain comes on the hip straps and not on the body strap. Also the side straps bear hard against the barrel of the horse and cause sores. If too low, the front hip strap is always slack and the body strap is entirely held up by the rear hip strap which is not strong enough to bear all the strain by itself.

Traces.—The traces of the lead and swing allow of small changes of length, but as a general proposition it is believed best to have all traces shortened as much as possible. This is the proper adjustment in all but exceptional cases (horses that are very long) and has the advantage of not having, through carelessness, traces of different lengths placed on the same horse. The average horse in a team can exert a pull on the traces of about 250 pounds. If no holding down straps are used, the traces pull in a nearly horizontal direction, while the shoulder of the average horse makes an angle of about 16º to the vertical. This means that without the holding down strap there is an upward pull on the collar in the direction of the shoulder of about 70 pounds. This pull with a properly fitted collar will choke any horse on a long hard pull.

The line of pull of the trace where it fastens to the collar should be perpendicular to the line of the shoulder (not to the front face of the collar). This is accomplished by putting the horse in draft and regulating the length of the "holding down strap" so that this direction is obtained. The wheel traces, due to the downward component of the pull of the swing traces, are pulling on the wheel collars at an angle below the perpendicular. This makes the wheel horses sustain considerable pressure on their necks when the team is in draft, besides the weight of the neck-yoke, collar and pole. The pressure due to the downward component of the pull of the swing and hind traces can be overcome as follows: Place an extra strap through the stirrup strap squares and the traces. Put the team in draft and adjust the length of this strap so that the tugs of the wheel collars are pulling in a direction perpendicular to the slope of the horse's shoulder. The extra pressure placed upon the saddle by this strap has never been known to produce sore backs and the pressure is only exerted when the lead and swing pairs are in draft. With breast collars no "holding down straps" are needed, and the direction of the pull of the trace takes care of itself.

Neck-yokes.—In the wheel pair holding up straps are needed and should be so adjusted that the chain from the trace to the breast collar pulls in a horizontal direction. This prevents any downward pull on the neck and prevents the breaking down of the breast collar which otherwise will occur.

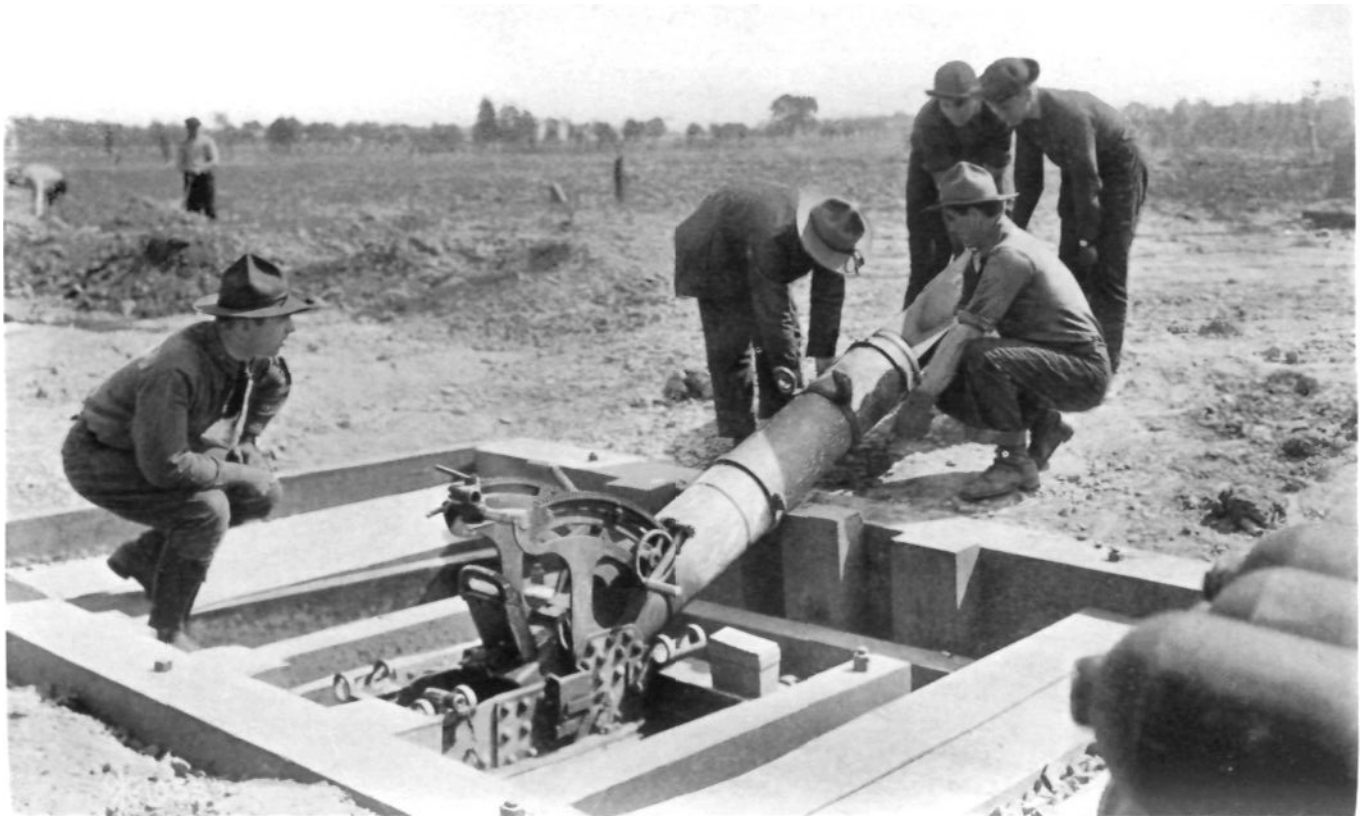
The breast straps should be so adjusted that the pole is carried horizontally. If too low, the pole has more tendency to thrash, if too high the martingale rubs between the forelegs and produces sores.

Side Straps.—The length of the martingale and side straps should be such that when the wheelers are in draft and at an extended trot, the breeching does not interfere with the movement of the hind legs. It should be as tight as possible under these conditions. The position of the safe above the ring in the martingale must be so adjusted that when the horse is

holding back, it will not come in contact with the loop on the cincha. This can be accomplished by the combined adjustment of the side straps and the martingale cincha strap. If not adjusted in this manner it will pull the girth forward and will also often catch in the cincha loop and cause constant pressure on the body strap of the breeching.

Bridle (*Snaffle Bit*).—The crown piece and brow band should be long enough to prevent chafing of the ears. It is often found that with large-headed horses these two pieces are not long enough and in that case new ones should be made. The cheek pieces should be so adjusted that the snaffle bit comes up in the corners of the horse's mouth, but does not wrinkle the lips. The throat latch should always be loose so that there is no danger of choking the horse. The coupling rein should be long enough so that when turning to the right, when the off horse is ahead of the near horse, there will be no tendency to pull the head sidewise.

Traces, Length.—There is no adjustment for length of wheel traces. The lead and swing traces allow of adjustment in length, but in order to prevent traces of different lengths being used on the same horse, it is found the best results are obtained by shortening all traces as much as possible.



240 MM. TRENCH MORTAR—MARK I. LOADING POSITION, SHELL BEING INSERTED AT MUZZLE

Notes on Target Practice of a Regiment of Field Artillery, National Army

BY COLONEL A. B. WARFIELD, FIELD ARTILLERY, NATIONAL ARMY

THE following is taken from official reports and personal notes on the target practice of a regiment of Field Artillery in the National Army stationed at a cantonment "Somewhere in the United States."

They are given in the hope that they may be of benefit to the National Army and that they may be of some general interest to the whole Field Artillery service.

The subject will be considered under the following sub-heads:

I. ALLOWANCE OF AMMUNITION

Allowance of ammunition is 1000 rounds per battery.

II. SELECTION AND CONSTRUCTION OF TARGET RANGE

On or about September 1, 1917, the Regimental Commander concerned was placed on a Board of Officers by the Division Commander with two other officers, one a Colonel of Infantry and one a Lieutenant-Colonel of Infantry; to investigate and report upon the entire matter of target ranges for this division, both for small arms and artillery firing.

The selection of a Small Arms Range was a comparatively simple matter and a suitable range was found within about three miles of the cantonment area.

The selection of an Artillery Range in this thickly settled section of the state was a more difficult matter; several weeks' time and many gallons of gasoline were expended in visiting nearly every square mile of ground within a thirty-mile radius of the cantonment before a site at all suitable could be located. The site finally reported to the Division Commander as suitable was so reported, not because it was a particularly good one, but

because it was the only one that could be found anywhere within the vicinity. The Division Commander had directed that the Range must be within a reasonable marching distance of the cantonment.

The site selected was some ten miles from the cantonment in a small sheltered valley. This valley was some three miles long by less than a mile broad at its widest point, with land of but little value and only a few scattered small farms. There was a well-defined stream with abundant and pure water supply flowing through the valley with plenty of downed, dead wood in the hills. A large hill, or, rather a small mountain, backed by a well-defined ridge furnished a most excellent firing butt at the far end of the valley.

A fairly large farmhouse, with a barn and out-buildings, at the lower end of the valley, furnished a suitable place for Range Headquarters, with an excellent, large room for holding critiques. Adjacent to this farmhouse was a level, well-drained meadow, near the creek, which furnished a most suitable place for erecting tents for the camp and stable covers for the animals. All details as to rental of ground and buildings were taken care of by an officer of the Quartermaster Department from the Headquarters of the Department in which this cantonment is situated.

On December 20, the Regimental Commander was informed that the Range had been rented by the Government and that his Regiment would be expected to start its target practice not later than January 15, 1918.

January 1, 1918, a detail of some 100 men made up proportionately from the three Regiments of this Artillery Brigade was sent to the Range under charge of a First Lieutenant of this Regiment—this officer was chosen because of his previous experience in construction and contracting work. This officer was detailed as permanent Range and Supply Officer and actually lived at the Range during all the time this Regiment was there. He took charge of all matters concerning the supply and upkeep

of the Range and conducted all arrangements necessary with the Quartermaster Department. Verbal instructions were given this officer to prepare the farmhouse for occupancy by Regimental Headquarters, officers of one Battalion detail, including Battalion Commander and his Adjutant, and to procure and erect sufficient tents, cook shacks, stable shelters, etc., to accommodate one full Battery of Artillery, a Battalion Headquarters and the necessary extra officers.

Pyramidal tents were permanently installed with tent floors and Sibley stoves. Cook houses were erected from lumber furnished by the Quartermaster Department. A well was driven, giving an abundant supply of excellent water (which was tested by the Medical Department) for cooking and drinking purposes. Stable shelters, made of poles and brush driven into the side of a bank and covered with tarpaulins, were erected. The Range Officer was directed to construct an artillery target range along the lines, as far as the topography of the ground would permit, as laid down in War Department Memorandum "Re-Construction of Target Range to Conform to Condition of Trench Warfare." This memorandum can be secured upon request from the office of the Chief of Field Artillery, Washington.

In connection with the above, the following should be noted:

1. Select as Range Supply Officer a competent, energetic officer, if possible, one who has had previous experience along construction lines, and give him concise, definite orders as to what you want done.

2. Give him the necessary commissioned officers as assistants (not more than two should be needed), furnish him with the necessary enlisted details for construction work, and then, though, of course, you supervise his work, do not bother him. Tell him you expect results, and leave him alone as much as possible.

It is believed that certain portions of the report of the Range, Supply and Mess Officers will be of interest as they furnish data for other Range, Supply and Mess Officers.

EXTRACT FROM REPORT OF RANGE SUPPLY OFFICER

"On the evening of December 30, 1917, the writer was ordered by the Regimental Commander to proceed to the Target Range and commence the construction of an Artillery Target Range for the use of the Artillery Brigade. A set of plans and specifications from the War Department was furnished and the range was to be completed by January 14, 1918."

"Monday, December 31, 1917, was spent in securing information as to leases, boundaries of the range and mapping out of general schedule of operation. The writer found that the Quartermaster Corps had covered the ground very thoroughly and had already made leases covering most of the property involved. Final settlements were made with the tenants during the ensuing week and the Range was cleared of inhabitants. On this date also requisition was made on the Quartermaster for tents, flooring and stoves."

"Tuesday, January 1, 1918, the writer, accompanied by a Captain of French Artillery, made a preliminary reconnaissance of the Range and tentative target and observation positions were gone over. On Wednesday, January 2, 1918, a visit was made to the Range by the Regimental Commander and the selection of the above positions was approved and final instructions given as to the conduct of the work."

"Thursday, January 3, 1918, a party of about twenty men, composed chiefly of mechanics from the three Artillery Regiments, moved out to the Range and established a temporary camp in an old schoolhouse. In addition to this party there were two officers and two enlisted men from the Engineers, who at once started to establish the axis or centre line of the range. The weather was very cold and most of Friday was spent in providing cover for the wagon teams. We also received on Friday afternoon six pyramidal tents and enough lumber to floor them from the Quartermaster Corps. Work was started on the erecting of these at once and Saturday the detail moved from the schoolhouse into the tents. The schoolhouse at the lower end of the range was re-floored Saturday and the furniture moved

from the schoolhouse near the target area, which was ordered abandoned."

"Sunday, January 6, 1918, the railroad placed a car of lumber from the Quartermaster on the siding, this being followed by a carload of tents and stoves on Monday. The work at the schoolhouse was completed and furniture placed on this date, but owing to the heavy rain no other work was done."

"Monday, January 7, 1918, found everything frozen up again. A Lieutenant of the Regiment came out with sixty-six men drawn equally from the regimental organizations of the Brigade. The Regimental Mess Officer also arrived and took charge of the messing of the detail. That afternoon a Lieutenant went up the range with about thirty men and established camp in the schoolhouse near the target area where the balance of the week was spent in constructing the German trenches and two observation posts."

"On Wednesday, January 9, 1918, a further detail of about fifty men was brought out from the Brigade and twenty-five of these were sent to the Lieutenant at the schoolhouse for work on the trenches. The German trenches and two observation posts were completed on the afternoon of January 13."

"During the week of January 7, forty-eight tents were floored and erected, kitchen built, two latrines erected and stable room for sixty head provided, and covered, under the hill just south of the tents. During this week, a Lieutenant of Headquarters Company laid wire from the forward observing posts to the gun positions and established telephone communication. The Engineer officers also completed their work, platted the axis line and other salient points on the range. Two families were also moved out by Government teams."

"On Monday, January 14, 1918, the range was ready for firing, but access to the camp was cut off by a heavy snowfall. The Regimental Commander with Headquarters Company and "D" Battery arrived on Thursday, January 17, and fired the first shots on January 18. No firing was done on Saturday or Sunday and the time was spent in clearing the trenches of

snow drifts which had completely obliterated them, and in constructing a third observation post on the top of Kaiser Hill. Firing was resumed on Monday, January 21."

"On January 23, 1918, a fatigue party of about forty-five men was brought out from the Regiment and on the 24th and 25th a system of front-line American trenches was put in about 300 yards from the German trenches. On the 28th and 29th two new observation posts were built, one behind the American front line and one on Crown Prince Hill. On February 7, another observation post was completed on the top of Crown Prince Hill, making six bomb-proof observation posts in all. All constructed in dead of winter with zero temperature and some foot and a half of snow. On the 7th and 8th, a barbed-wire entanglement was placed in front of the German first-line trenches. On February 10 an 85-foot well with excellent water was completed near the camp kitchen and at once put in operation. In addition to the tents and flooring, 250 canvas cots were furnished by the Quartermaster for the use of the men at the range."

"On February 14, 1918, bedding straw stored in one of the pyramidal tents caught fire from some unknown cause and the tent was destroyed."

"A brief recapitulation of the work done between January 3 and February 10, 1918, follows:

52 pyramidal tents floored and erected;
5 wall tents erected;
Stable room for seventy-five head provided;
System of German front line, support and communicating trenches dug;
System of American front line trenches dug;
Six bomb-proof observation posts built;
250 figure targets made, placed and maintained;
400-foot section of road built and small bridge thrown across stream;
Telephone communication established by Headquarters Company with all gun positions and observation posts;

85-foot well drilled by Quartermaster Corps;
Two families moved;
One schoolhouse refloored and school furniture moved in place;
House at Range Headquarters cleaned and repaired;
Stable at Headquarters house remodeled and capacity doubled;
Four latrines dug and erected;
Trees and brush cleared away at gun positions and observation posts;
Artillery Targets maintained and wire entanglements placed in front of German front line trenches."

EXTRACTS FROM REPORT OF REGIMENTAL MESS OFFICER

"Pursuant to Regimental Order of January 1, 1918, twenty-four men proceeded to the Artillery Range on January 2, as a working party.

"This number was increased daily until a maximum of 152 men were present. This number fluctuated daily. The working party remained until January 17. During this time, from January 2, 1918, to January 17, 1918, there was a total of 1484 men present. The ration saving of $35.34 was made on messes of these men with an additional $25.02 from officers who boarded with the mess. The transportation of supplies was particularly difficult at this time, owing to the snow, mud, frozen and slippery roads, but at no time was there any lack of food supplies at the target range; the transportation furnished by the Supply Officer of the Regiment was extremely efficient."

NOTE: By Regimental Commander.

The Supply Officer of the Regiment concerned is an Ex-Noncommissioned Officer of the regular service of nearly thirty years' service, some twenty years of which has been in the grade of Sergeant, First Sergeant and Regimental Supply Sergeant.

"On the 17th day of January the first battery of the Regiment arrived on the Range. The Headquarters Company of the Regiment kept a permanent detail there of some seventy men. These men, along with the working party, kept the

average of men at the Range up to about 250 men until the close of firing on February 21, 1918. The messing of the men was done by the Battery firing under the supervision of the Regimental Mess Officer, who also conducted an Officers' Mess for the permanent Staff Detail of some fifteen officers and also prepared one meal for the Regimental Officers who came out daily to witness the firing."

"Two army field ranges were set up on a raised platform in a permanent wooden kitchen, giving a continuous cooking service on the fire plate and also attachments. The service was sufficient for the preparation of food for 250 men, but the range was entirely too light in construction to sustain the weight of the food and the heat of the fire."

"An emergency supply of five days' rations was kept in storage at the range at all times in order to prepare for emergencies of winter, and breaking down of transportation."

"The cooks were efficient in cooking meals and prompt in preparation. This was due, no doubt, to the prior training the cooks had received in the Regimental School for Cooks and Bakers, which included outdoor cooking on the field ranges and improvised clay ovens and ranges, including cooking trenches, bean pits, etc."

NOTE: By Regimental Commander.

It is particularly necessary to train the battery cooks at as early a date as possible in all the expedients to be used in field cooking.

III. PRIMARY INSTRUCTION OF OFFICERS AND MEN LEADING UP TO ACTUAL SERVICE PRACTICE

Since November 9, 1917, when the receiving of men from the draft was completed in this regiment, a Regimental School of Fire has been conducted daily under the supervision of a Major of this Regiment, who is a graduate of the School of Fire at Fort Sill, Oklahoma, and a former instructor at that school. This school was for Battery Commanders and selected First Lieutenants. At this time, but at a different hour, a supplementary

School of Fire was held for all officers not in the first school. This school was also under the supervision of the Major above referred to, but was directly conducted by a Captain of this Regiment, who is a graduate of the Officers' Training Camp, and who had shown most satisfactory progress in the principles and preparation of firing data. These schools were carried on with indoor terrain board during bad weather and outdoor smoke bomb practice whenever the weather permitted. The officers were taught the principles of fire as taught at Fort Sill. These principles were later brought out in the CRITIQUES of the actual service firing, which were held daily on the target range during the afternoons following the morning firing.

It is absolutely necessary before officers be allowed to fire service ammunition that they be thoroughly ground in the principles of fire and this can be best accomplished by the methods above given. In addition to the above principles of fire, officers' schools in general artillery subjects were conducted for periods of not less than two hours daily in the evenings, covering in general the following subjects:

Manual for Battery Commanders;

Meteorological Elements Affecting Artillery:

Manual for Orientation Officer;

Lateral Observation;

Notes on Artillery Training; Working Formations of Battery Details; Dismounted Drill; Gun Drill; Visual Signaling; Cordage; Physical Drill; Property Accountability; Matériel; Preparation of Firing Data; Topography; Maps and Plan Directeur; Map Co-ordinates; Organization Tables; Fire Control Instruments; Harness Fitting and Draft; Telephone and Telegraphic Communication; Telegraphy with Service Buzzer; Range Tables; Corrections of the Moment; Including Wind and Atmospheric Corrections; Corrections for Muzzle Velocity; Temperature of Powder, etc.; Exterior Ballistics and Gunnery; Stable Management; Equitation; Camouflage; Anti-gas Instruction; Methods of Communicating with Air-Craft; from the Ground; Artillery Field Fortifications.

IV. EQUIPMENT

On November 5, 1917, two 3-inch American Guns were assigned to this Regiment and on January 1, 1918, two more guns which had been with the other Field Artillery Regiment of the Brigade were also turned over to me. The entire equipment for the Regiment consisted of four 3-inch model 1902 guns; 8 caissons, model 1902, with 12 limbers; 8 sets of wheel and 16 sets of lead and swing harness; 4 panoramic sights, complete; 6 bracket fuze setters; 1 B. C. instrument, old model 1905; 4 field artillery telephones, buzzer type; and approximately 4 miles of field wire and 1 mile of buzzer wire; 16 sets of semaphore flag sets; 2 megaphones; 15 pairs of field glasses, type EE.

The above matériel, forming four sections, was used by one battery for instruction purposes for an entire half day, commencing January 7. Drill periods were from 7.40 A.M. to 11.00 A.M. and from 12.50 P.M. to 3.00 P.M.

The Battery Commander personally commanded the mounted battery and took such steps as were necessary to insure taking advantage of the entire time allotted for battery drill and firing instruction. The entire commissioned and enlisted personnel to complete these sections came from the battery then using the matériel for drill. The following is some idea of the manner in which the matériel was used by the different batteries:

Battery "A"—Monday morning
Battery "B"—Monday afternoon
Battery "C"—Tuesday morning
Battery "D"—Tuesday afternoon
Battery "E"—Wednesday morning
Battery "F"—Wednesday afternoon

Battery "A"—Thursday morning
Battery "B"—Thursday afternoon
Battery "C"—Friday morning
Battery "D"—Friday afternoon
Battery "E"—Monday morning
Battery "F"—Monday afternoon

A First Lieutenant was placed directly in charge of the drill for the gun squads and the different squads were kept constantly

at drill from early in the morning until late at night, every available minute being made use of. In the evening, sights, quadrants, fuze setters, etc., were taken to the barracks and men drilled in their use and their uses explained to them by an officer for at least two hours. When outside duty, such as exterior or interior guard or division fatigue, prevented a battery from taking its proper place in the schedule, the next battery immediately took over the matériel.

Under this intensive training, the gun crews of the different batteries were fairly well grounded in their duties by the time they were required to fire on the range.

V. PRELIMINARY ARRANGEMENT

The following is an extract from a regimental order concerning preliminary arrangements and precautions for safety:

"All officers assigned or attached to batteries will attend target practice."

"Officers who are not assigned specific duties as enumerated in tables of organization will be attached to B. C. Detail. Officers will take bedding rolls, full field equipment; they will mess with the battery."

"The 2d Battalion Detail will accompany this battery and remain on target range during target practice of the 2d Battalion. Adjutant of the 2d Battalion will make necessary arrangements to insure his detail being equipped for target practice. The Battalion Detail will mess with the battery firing. The Major of the 2d Battalion will have general supervision of target practice of his Battalion. The Major of the 1st Battalion will have charge of all schools of the Regiment and be in command of the Regiment while the Regimental Commander is absent at the target range. *All officers of the Regiment, except one officer left with each battery, will report daily at the Target Range during days of actual firing, not later than 8.00 A.M.* Telephone information will be furnished from the target range to the Regimental Adjutant in time for him to notify all officers."

"The Regimental Supply Officer will furnish transportation

required in connection with batteries going to the target range. He will keep a reserve allowance of five days' rations for a complete battery, officers and enlisted men, on the target range at all times. He will keep a minimum allowance of two days' forage for the maximum number of animals on the range at all times."

"The Regimental Surgeon will detail one commissioned Medical Officer and necessary enlisted medical personnel, provided with medical supplies for permanent duty at the target range."

VI. SAFETY PRECAUTIONS

Second Lieutenant Blank, F. A., is detailed as Target Communications and Safety Officer of the Target Range during regimental target practice. He will establish such communication between the firing points, observation stations and range party as may be necessary and equipment will permit. After consulting with the officer in charge of the range, he will be responsible for the proper posting of the guards and safety signs and flags. Eleven posts will be established as indicated on the attached map in red. All of the above sentinels and guards will be posted by the Safety Officer each day before firing commences. Guards will be informed of the hours upon which firing will commence and cease.

The Safety Officer's attention is invited to paragraph 87, page 188, to paragraph 88, page 201, inclusive, Compilation of General Orders Circulars, and Bulletins of War Department, 1881–1915.

Each sentinel will have in his possession a typewritten copy of orders given him for his post and his particular duties. These instructions will cover in detail the following points:

(*a*) My post is No. —— and extends from —— to ——.

(*b*) My orders are to allow no civilians, stock or animals of any description to remain in or enter upon any portion of the target range while I am on post.

(*c*) To warn all civilians and soldiers against picking up or handling in any way any projectiles, shells or fuzes, explaining

to them that to do so may cause an explosion that may result in injury or may even cause death.

(*d*) To locate, as far as possible, any unexploded projectile and report same to the Range Officer.

A copy of this order and a copy of instructions given to all guards will be in the possession of Major —— and Lieutenant —— at all times and an additional copy of each of the above, with attached map, will be kept posted on bulletin board in the office of the Adjutant of the Range.

VII. SERVICE PRACTICE

The firing was commenced with "D" Battery of the Regiment on the 19th of January and continued daily, Saturdays, Sundays and holidays included, until February 20, being interrupted only by the necessary time taken up in changing batteries on the range, it being impracticable to keep more than one battery on duty there at a time. The Batteries proceeded to the target range under draft and complete field equipment, as far as equipment on hand would permit.

Roads were very slippery, covered with ice, and draft was very difficult. Road in several places so narrow as to be just wide enough for wheels of carriage, very careful driving was necessary. Two caissons loaded with ammunition turned completely over down an embankment but with no damage to matériel, men or animals.

Upon arrival at a point about two miles from the target range area, each battery commander was given a problem to solve, arranged by the Battalion Commander, requiring a march to, selection of, and occupation of a position in observation, ready to open fire. This included preparation of firing data, selection of objectives, registration points, auxiliary aiming points and positions for flank observers.

Due to the very deep mud that existed during the firing of several batteries, it was necessary to construct gun platforms; in most cases these were made of the trunks of small trees cut near the gun positions. The gun positions had to be drained

and in many cases the guns lifted up out of the mud on the above built-up platforms before they could be fired. Though the above was of a necessity very hard work, it furnished excellent instruction for the officers and men concerned.

A total of 121 problems were fired by the different officers of the Regiment.

The number of problems fired by officers of the Regiment follows:

Regimental Commander		1
Regimental Adjutant		1
Regimental Supply Officer		1
C. O., Headquarters Company		3
Battalion Adjutants		8
1 Captain, attached		2
Regimental Ordnance Officer		1
Regimental Mess Officer		1
Officers of Supply Company		2
Officers of Headquarters Company		15
Captains, commanding batteries	average	8 each
First Lieutenants, Executive and Reconnaissance Officers	average	2 each
All other officers		1 each

VIII. SERVICE PRACTICE, CONTINUED

The weather during most of the time of this target practice was extremely cold. Several problems were fired with the thermometer registering several degrees below zero. At another time several problems were fired in a blinding snow storm, and on other occasions, problems were fired in a driving rain.

Two night problems were fired with tracer ammunition, both shell and shrapnel, using a previously prepared barrage table obtained from data of previous firing, corrected for the moment. Signal for commencement of barrage fire given from F. O. P. in infantry first line by signal rockets. The battery answered at once by laying down a standing barrage on the German frontline trench. At the end of five minutes' firing, the barrage changed to a creeping barrage covering the ground from the

German front-line trench to German support line trench by jumps of 50 yards and ending on the German support trench.

Actual conditions as existing on the Western Front in the European War were simulated whenever possible. Trenches were dug representing American and German front lines, support and communication trenches. Machine-gun targets were constructed and placed in dug-outs, barbed-wire entanglements were built and fired at with shell. The allowance of shell, however, was so small as to produce but very little effect. Observation posts were constructed and used with both telephone and semaphore communication. Gun pits were dug for the guns and gun crews. Camouflage was constructed over the guns and on the last day of firing guns were pushed forward into direct fire positions and fired with extremely short ranges. The ranges used varied from the last day's firing, when the shortest range was 900 yards, up to approximately 5000 yards, which was the longest range available.

One daytime barrage problem was fired, with previously prepared firing data, corrected for the moment.

The first four rounds each day were fired at a designated trench as target, using the data from the previous day's firing, corrections for the moment having been applied for the temperature of the air, atmospheric pressure, hydrometric conditions, temperature of powder and the wind components.

Four forward observation posts were constructed in the area of the American front-line trenches and used by the Battery Commanders to conduct the fire of their batteries, using both telephone and semaphore signals. When the Battery commanders were in a position of observation near their batteries, these forward observation posts were used as positions for the forward observation officer, who telephoned information as to the necessary changes in firing data. One of these F. O. P.'s was directly in the line of fire, and, in one problem, two shrapnel burst directly on the roof of the dug-out, but did no damage to either the F. O. O. or to his recorder, telephone operator, or telephone connections.

Flank observers were used by the Battery Commanders whenever possible. They were particularly useful to give necessary changes in deflection when Battery Commander was in the F. O. P. near his target.

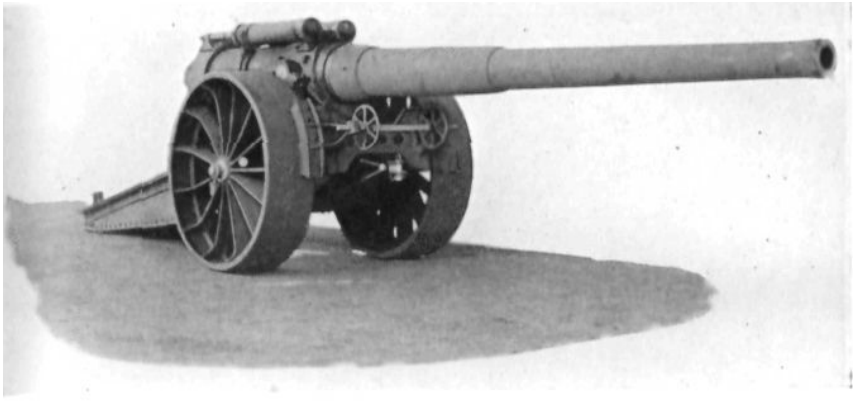
A progressive battle map was made during the continuance of the firing with the position of all gun emplacements, American and German first line, support and communicating trenches, F. O. P.'s., Range Officer's Dug-out, etc., shown on it, as well as all other targets fired upon.

The Range Officer, the Officer supervising the fire and *all Artillery Observers* kept an accurate account of every shot fired.

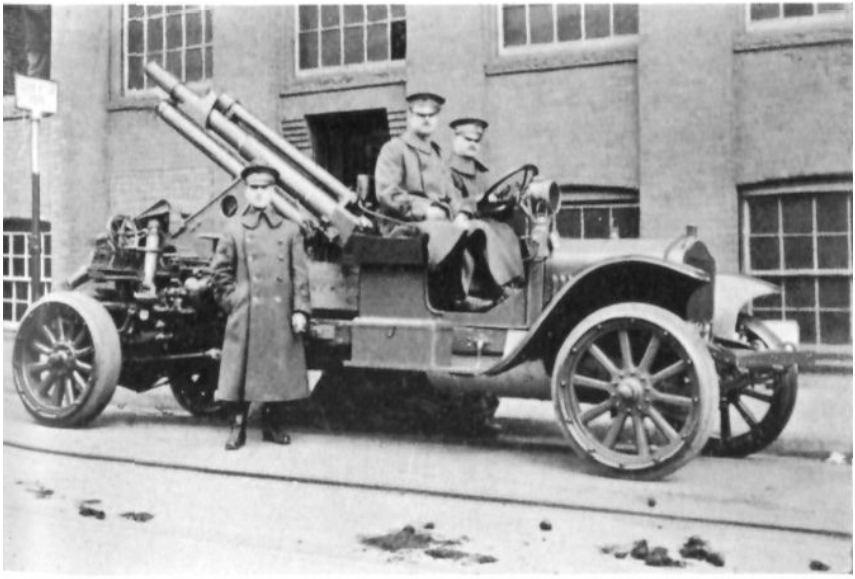
Blackboard Critiques were held immediately after the firing and all problems discussed and criticized under the personal supervision of the Regimental Commander, assisted by the Battalion Commanders.

The above notes were not written with any idea that they present anything remarkable or out of the ordinary. They are merely the result of one Regimental Commander's experience, given in the hope that they may be of some help to others confronted with similar or even greater difficulties, and who may not have the assistance of several excellent officers with Regular Artillery training. It is believed that the time is certainly coming when the Regimental Commander of the new National Army Field Artillery Regiments will have had but little actual experience other than that acquired at the Training Camp and at Fort Sill. If the above helps in solving in any little particular, any of the numerous problems that may come up, the end sought will have been obtained.

In the vocabulary of the Field Artilleryman, there are no such words as "It can't be done"; and also there should be no such words as "I will try." The only thing to do is to find out exactly what is wanted of you, be sure you understand your instructions, and then produce results quickly. Results are expected no matter what the conditions confronting you are. The only place where failure to produce results will be welcomed will be in the lines of the German forces confronting you.



IMPROVISED MOUNT, MODEL 1917. TYPE A. FOR 6″ SEACOAST GUN



ANTI-AIRCRAFT TRUCK MOUNT, MODEL 1917, FOR 75 MM. FIELD GUN, MODEL 1916

Notes on the 77-mm. Matériel and Ammunition

DURING 1916 the German ordnance service made important changes in the manufacture of the 77-mm. field gun to make it more effective. The improvements affected the following points:

1. The introduction of a long-range model 77-mm. gun characterized by a longer tube and a carriage of the light howitzer model, permitting of high-angle fire.

2. The adoption of a large-capacity, thin-walled, steel, elongated explosive shell of much higher effectiveness than the shells heretofore used by the Germans. The profile of this shell is also designed to give an increase in range.

77-mm. Gun, Model 1916.
Feldkanone 1916 (F. K. 16).

A 77-mm. gun of a new model was captured from the enemy, April 17, 1916. It is mounted on the 105-mm. howitzer carriage, model 1898–09, and bears the inscriptions:

No. 7246. Fr. KP.
Abg. 1916. G. g. 5 p.

The piece has 32 riflings of a uniform twist and with an inclination of 8 degrees 25 minutes. Its total length is 2.70 metres (35 calibres). The length of the rifled part is 2.27 metres (29 calibres). It has the ordinary 77-mm. breech.

The recuperator springs have a square cross-section and are naturally stronger than the old type. (*Note*.—It is said, but not confirmed with certainty, that there is also a model with air recuperator.) On the last spiral of the springs is the inscription: "K. i. H. L/35" ("Kanone in Haubitzaffete," 35-calibre gun on howitzer carriage).

The gun rests on a circular platform weighing 144 kilogrammes, which is intended to facilitate aiming in direction and to stabilize the piece during fire.

The information about the new matériel gathered from various sources makes it possible to give the following comparative table of the two 77-mm. pieces:

Piece	Weight in battery	Muzzle velocity, m/s	Vertical aiming field	Calibres. length of rifled part	Number of riflings	Inclination of the rifling
1916	1,300 kg. (*A*)	488	–10 to 38	29.5 (*B*)	32	8 25′
n/A	980	465	–12 to 16	21.2	32	7

(*A*) 75-mm. gun, model 97: 1140 kg.
(*B*) 75-mm. gun, model 97: 29.7 calibres.

We have no precise information on the maximum range of the new gun. It should apparently be as high as 10,000 metres. The extreme range for percussion fire of the old gun was 8400 metres.

77-MM. SHELLS

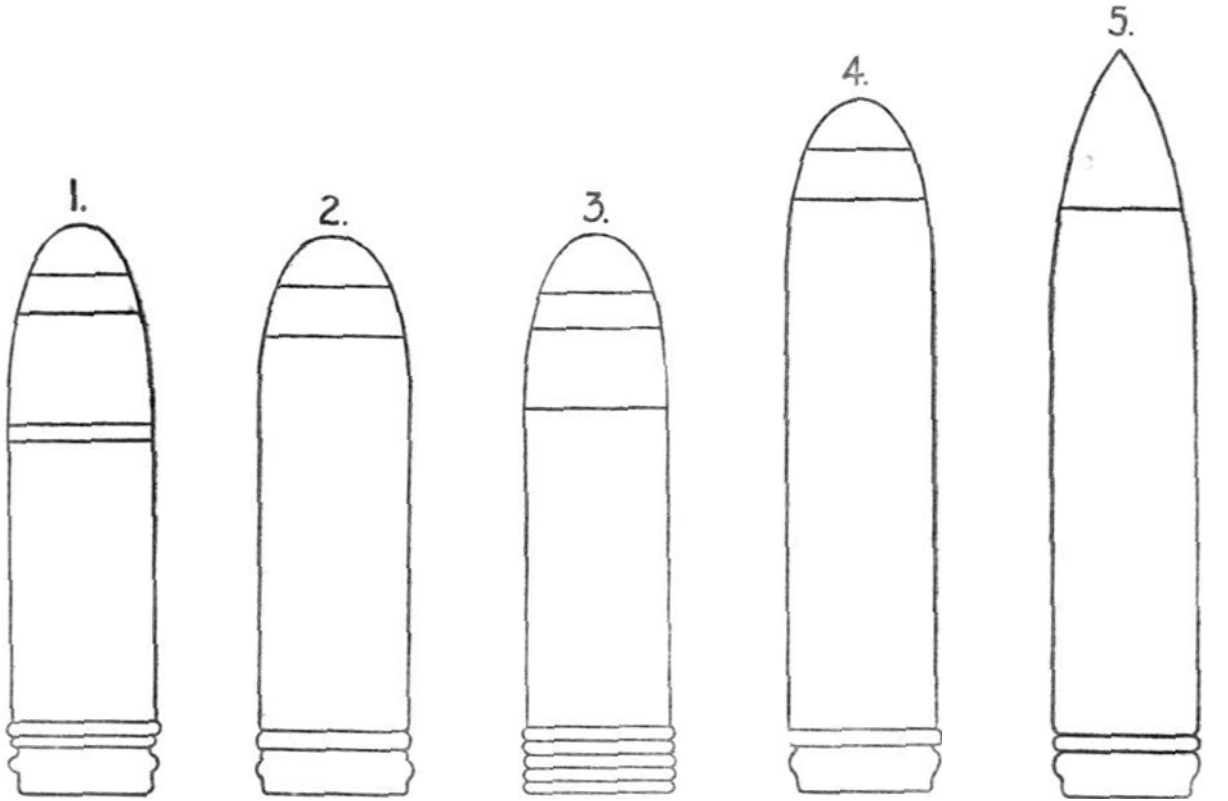
Before the war the Germans used three projectiles: a shrapnel (Schr. 96), a universal projectile (*Einheitsgeschoss*), and a shell (Gr. 96).

They have kept the shrapnel and abandoned the universal projectile (probably on account of manufacturing difficulties which were incompatible with intensive production).

In the matter of the shell, numerous models have successively been put into service since the war opened (see Fig. 1).

At first the regulation shell was the model 1896 (Gr. 96), of cast steel, of the general German type, with thick walls and small explosive charge, essentially different from the French type, with thin walls and maximum explosive charge.

(*Note*.—The study of projectiles in France and Germany developed from different definitions of effectiveness. A fragment was effective, according to French definitions, when it passed through a pine panel 41 mm. thick. In Germany the standard thickness was much less (about one-half). It will



Scale ¼

FIG. 1.—GERMAN 77-MM. SHELLS

easily be understood that different types of shell developed in the two countries.)

In September, 1914, when the original supply of ammunition had been much reduced, the Germans adopted an easily and quickly manufactured *semi-steel* shell, called the model 1914 (Gr. 14), and at the same time increased the quantity of explosive, as far as the poor quality of the metal permitted. (The explosive charge in the 1896 projectile was 165 grammes; in the 1914 projectile, 260 grammes.)

In 1915 they improved their field projectile and carried on simultaneous manufacture of the model 1914 and of the model 1915 (Gr. 15) *steel* shells (explosive charge 370 grammes).

Finally, in 1918, according to an official document of the German Ministry of War, the *semi-steel* shells are abolished after July 1. At the same time there appears a *new elongated steel shell* of large capacity, called "Lange Feldkanone Granate 16" (L. F. K. Gr. 16).

Since July 1, 1916, then, the only shells in service are:

The cast-steel shell, model 1915 (Gr. 15), and the elongated steel shell, model 1916 (L. F. K. Gr. 16).

(*Note*.—A document of October 31, 1916, declares, however, that the manufacture of the model 14 will be resumed in order to intensify production.)

The following table shows the principal characteristics of these different projectiles:

Model	Metal	Total weight	Weight of explosive	Proportion of weight of explosive to the total weight
Gr. 96.....	Cast steel	6,825 kgs.	0.165	2.41%
Gr. 14.....	Semi-steel	6.800 kgs.	0.260	3.82%
Gr. 15.....	Cast steel	6,850 kgs.	0.370	5.40%
L. F. K. Gr. 16.	Forged steel ..	7.175 kgs.	0.920	12.82%

(See sketch below.)

ELONGATED SHELL, MODEL 1916

There are two different forms of the elongated shell, depending on the type of fuze which is screwed in the top (Fig. 2); the uncapped shell, which can be used either for percussion or

Capped. Without cap.

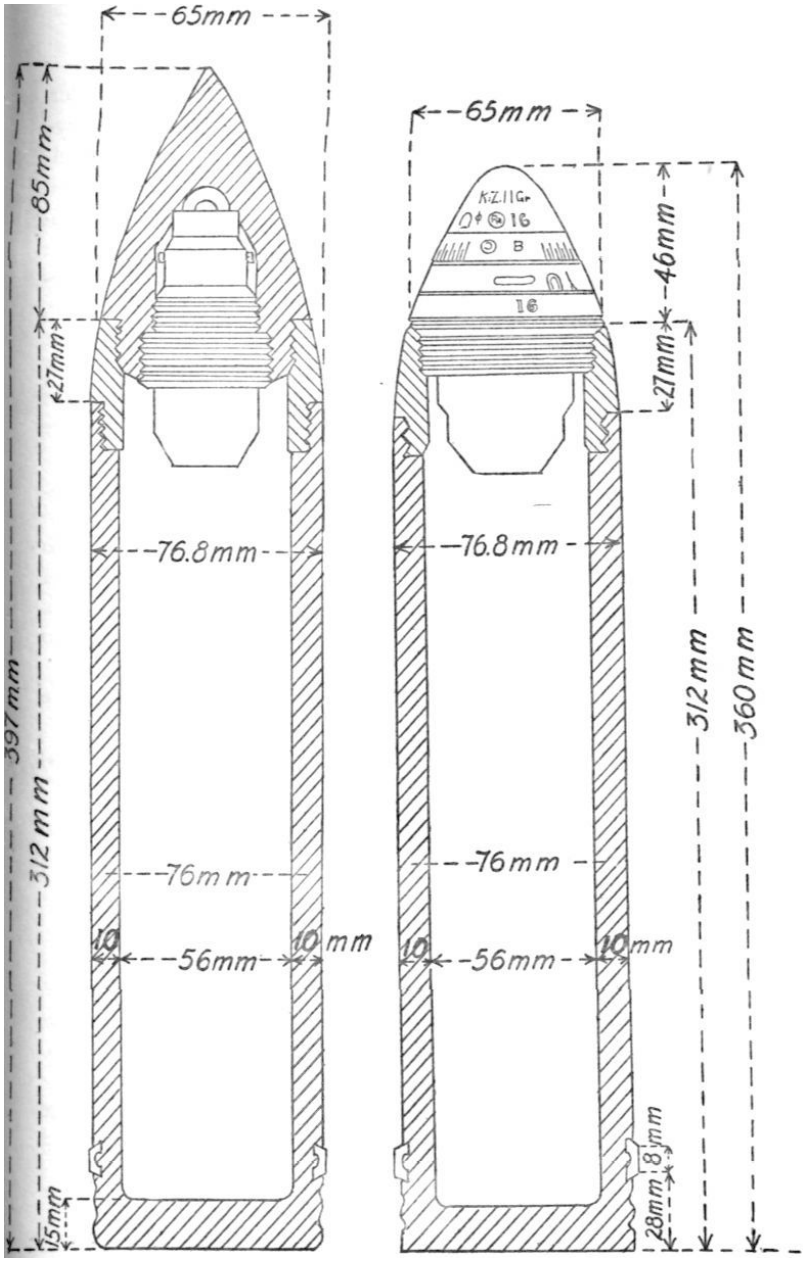


FIG. 2.—ELONGATED 77 M/M. SHELL

for time fire, and the capped shell, which can be used only for percussion fire. The shell body and obturation band, everything below the fuze-hole, are identical for both shells.

The bursting charge is of the well-known explosive mixture Fp. 60/40 ("Full pulver 60/40), which has 60 parts of trinitrotoluol and 40 parts of nitrate of ammonia. One-third of the shells put in service also have in their lower part a smoke-generating charge (about 90 per cent. red phosphorus or arsenic, 10 per cent. paraffin), which serves to heighten the visibility of the smoke of burst.

The shells which have no smoke-generating element are marked by a black stripe, 3 centimetres wide, running the entire length of the shell.

The numerical data given below are from analyses of heighten-visibility shells.

The explosive is poured directly into the shell, with no cardboard separating it from the metal. The inside walls of the shell are not varnished. (Trinitrotoluol does not attack metal, whereas melinite does, thereby requiring the walls to be tinned.)

The priming is by a detonator containing a charge of picric acid.

The metal of the shell body has the following composition:

Carbon	0.52 to 0.81 per cent.
Silicon	.03 to .28 per cent.
Phosphorus	.03 to .06 per cent.
Sulphur	.04 to .05 per cent.
Manganese	.50 to 1.13 per cent.

Ball tests have shown that the steel is not tempered.

Propelling Charge

The propelling charge is contained in a case which is sometimes separated from the projectile and sometimes attached to it to form a complete cartridge. We have no certain information concerning the use of the separate and fixed cartridge cases. It seems likely that the complete cartridge is reserved

for the model 1896 n/A gun, and the projectile with separate case for the 1916 gun. In that case the propelling charge could be increased for very long range fire, and anti-flash bags can be added when desired.

UNCAPPED SHELL

Length in calibres		3.85
Weight of the projectile	kilogrammes	7.175
Explosive Fp. 60/40	"	.920
Inside charge:		
Smoke-generating compound	"	.040
Priming explosive	"	.020
Total charge (including the smoke-generating compound)	"	.980

The following fuzes (described below) are used with this projectile: Combination fuzes K. Z. 11. Gr. and L. K. Z. 11. Gr.; instantaneous percussion fuzes E. K. Z. 16. Gr. and E. K. Z. 17. Gr.

CAPPED SHELL

The purpose of the cap is to facilitate ricochets in low-angle fire and thus permit of making good use of the superiority which the Germans recognize in ricochet fire.

The cap also increases the range. (According to a German document of August 17, 1916, the capped elongated shell has 350 metres longer range than the elongated shell equipped with K. Z. 11. Gr., K. Z. 11., or K. Z. 14. fuzes.)

The characteristics of the capped shell are the following:

Length in calibres		5.1
Weight of the projectile	kilogrammes	7.350
Explosive Fp. 60/40	"	.019[1]
Inside charge:		
Smoke-generating compound	"	.070
Priming explosive	"	.023
Total charge (including the smoke-generating compound)	"	1.000

[1] Note.—0.900 kilogramme of Fp. 60/40 according to German documents.

The following fuzes are used with this shell: L. K. Z. 16 o. V. non-retarded action (*ohne Verzogerung*) percussion fuze; L. K. Z. 16 m.V. retarded action (*mit Verzogerung*) percussion fuze.

The fuze screwed inside the cap is not visible.

Effectiveness

The new shell is notably more powerful than the old models 1896, 1914, and 1915. Tests of burst at rest recently made at Bourges show the progress made in this respect by the Germans since the beginning of the war.

On an enclosure of panels, the radius of which was 10 metres, the following number of perforations were registered:

	Perforations
Shell, model of 1896	37
Shell, model of 1914	34
Shell, model of 1915	49
Shell, model of 1916, uncapped	107
Shell, model of 1916, capped	121

It appears that the Germans were satisfied with results like these, and they have written the following eulogy of their new model projectile (translation of German document 11th Army, S. C. 4947):

"The elongated shell is much more effective than the other shells of our field gun, because of *its heavy charge* and of *the greater number of fragments* produced by its explosion. The detonation is like that of the French melinite shell. The smoke from the explosion is almost as heavy as that from the 105-mm. shell. In time fire the opening of the sheaf is more than 180 degrees. The mass of the fragments is very violently projected on the ground and to the sides. On the other hand, the action in depth is a minimum."

The above-mentioned tests included a comparative study of the German elongated shell and of the French model 1900 shell. For this purpose comparative explosions were made in an enclosure of 20 metres radius of uncapped elongated 77-mm.

shells and of model 1900 75-mm. shells *charged with cresylite*.

There were also exploded inside the 10-metre enclosure two shells of the German model charged with M. F. D. N. melinite in order to compare the results with those given by the same shell with its normal charge.

The results are given in the following tables:

1. ENCLOSURE OF 20 METRES RADIUS

	Number of perforations due to the shells				
	Uncapped elongated 77-mm. shell			Model 1900 75-mm. shell charged with cresylite	
	First shell	Second shell	Third shell	First shell	Second shell
Ogive sheaf	3	1	. .	2	. .
Lateral sheaf	22	26	31	22	23
Base sheaf	3	4	3	19	10
Totals	28	31	34	43	33
Average	31			38	

2. ENCLOSURE OF 10 METRES RADIUS

	Number of perforations due to uncapped elongated 77-mm. shells			
	Charged with M. F. D. N.		Normal charge of Fp. 60/40	
	First shell	Second shell	First shell	Second shell
Ogive sheaf	6	6	2	1
Lateral sheaf	81	98	63	73
Base sheaf	40	43	54	21
Totals	127	147	119	95
Average	137		107	

The new German shell is therefore less effective than the regulation French shell charged with cresylite. The German explosive is also inferior to the French mixture M. F. D. N.

ANTI-TANK SHELLS

The German shell does not pass through a plate of special steel 20 mm. thick. To fight tanks the Germans have therefore

developed a special projectile (Fig. 3). This projectile is derived from the model 1915 explosive shell (K. Gr. 15),

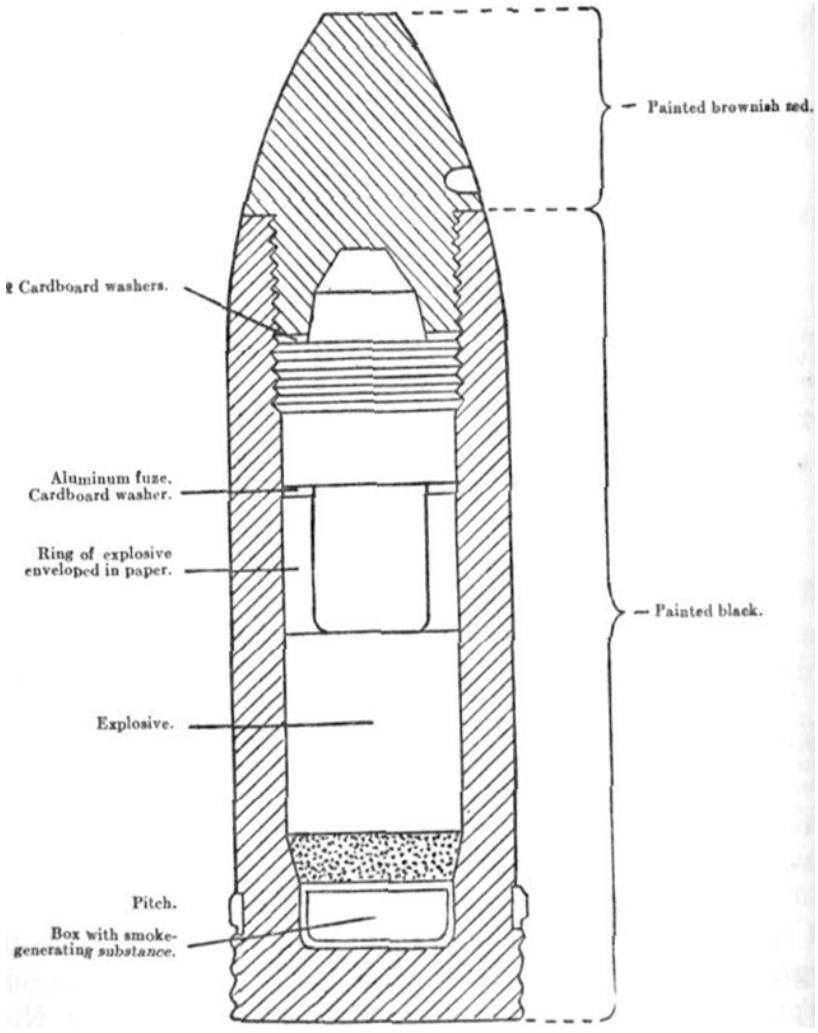


FIG. 3.—GERMAN 77 M/M. ARMOR-PIERCING (ANTI-TANK) SHELL. SCALE ½.
HEIGHT OF THE PROJECTILE: 266 M/M.

which has been transformed into a semi-armor-piercing shell. A massive ogive of hard steel is screwed on the shell body, which

has been duly adapted to receive it. The front of the ogive terminates in a flat nose 20 mm. in diameter. At the bottom of the cavity is a metal box containing a smoke-generating substance. This box is separated from the explosive by a layer of pitch. The characteristics of the shell are as follows:

Length in calibres		3.45
Weight of the projectile	kilogrammes	6.740
Explosive	"	.185
Inside charge:		
Smoke-generating compound and pitch	"	.060
Priming charge		?

A special aluminum percussion fuze without delayed action is used with this shell. It is placed inside the shell body below the ogive. This projectile is designated by the initials "K. Gr. 15. m. P." (*Kanone Granate mit Panzerkopf*). It is especially intended for the short-range batteries (*Nankampfbatterien*") for use in defence against tanks. These batteries are armed with the model 1896 n/A 77-mm. gun, which differs from the normal type only in having smaller carriage wheels. (A sketch of the projectile is given below.)

FUZES

The improvements made in the fuzes serve the following purposes:

1. To increase the range for time fire, which has been raised by successive stages from 5000 at the beginning of the war to 7000 and then 7200 metres, which is the range at present attained.

2. To create types of delayed-action fuzes for ricochet fire with shells.

3. To improve the instantaneity of the non-delayed-action

fuzes in order to obtain maximum surface effects in case of percussion fire.

4. To provide a safety device to delay the arming of the fuze at discharge so as to prevent bursts in the bore of the gun.

The different models of fuzes guaranteed against bursts in the bore, and which are intended to replace the models previously used, are the following (Fig. 4):

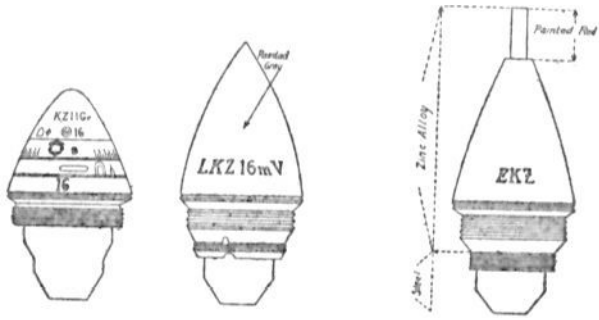


FIG. 4.—TYPES OF FUZES OF 77 M/M. SHELLS

L. K. Z. 11 Gr.	Combination fuze.
K. Z. 11 Gr.	Combination fuze.
L. K. Z. 16 o. V.	Percussion fuze without delayed action.
L. K. Z. 16 m. V.	Percussion fuze with delayed action.
E. K. Z. 16 Z. (*Empfindlicher Kanone Zunder*).	Instantaneous fuze.
E. K. Z. 17	Instantaneous fuze.

(*Note*.—Besides the models of fuzes guaranteed against bursts in the bore, and which arm only when they are 300 metres from the gun, the field artillery still uses for short-range fighting the fuzes of the older models, K. Z. 11 and K. Z. 14, which do not have this safety system.)

The characteristics and uses of the guaranteed fuzes are summarized in the following extracts from two German documents:

DOCUMENT OF AUGUST 9, 1916

Fuzes K. Z. 11 Gr. and L. K. Z. 16

Fuze	Maximum range	Use
K. Z. 11 Gr. combination fuze (brass or zine)	Percussion without delayed action 8400 metres[1]	Used like the fuze L. K. Z. 16 o. V. and when the latter is not available
	Time fire 7200 metres[1]. . .	For fire against live targets, especially when they are defiladed (batteries in action, protected battery emplacements, occupied trenches, reserves, targets situated behind houses)
L. K. Z. 16o. V. iron painted gray[2]	Percussion without delayed action 8400 metres[1]	For fire against all objectives whether defiladed or not. Destruction of strong obstacles, destruction of wire entanglements (used concurrently with delayed - action shells). Fire on localities, woods, bivouacs (used at the same time with delayed-action and time shells)
L. K. Z. 16m. V. iron painted gray with m. V. in black[2]	Percussion with delayed action 8400 metres[1]	(*a*) *Mining effects*. Destruction of strong targets for which it is necessary to obtain a mine effect (levelling trenches, demolition of battery emplacements, house shelters and constructions) (*b*) *Ricochet fire*. Bursts after ricochet will not be numerous enough except at ranges of less than 4000 metres[1] and on ground favorable for ricochets. Used against all live targets under cover or in the open as well as on targets defiladed behind small shelters

[1] All the ranges given are those obtained with the model n/A 77-mm. gun. With the new 35-calibre gun the range is higher.

[2] These fuzes are also used with the Gr. 15 shells, so that there are capped short shells.

DOCUMENT OF DECEMBER 7, 1916

INSTANTANEOUS FUZES

It has been decided to equip the field artillery with instantaneous fuzes:

Instantaneous fuze, model 16, for gun (E. K. Z. 16).
Instantaneous fuze, model 17, for gun (E. K. Z. 17).
Instantaneous fuze, model 17, for howitzer (E. H. Z. 17).

Instructions

The effects of burst of the projectiles are better than those obtained with the ordinary fuzes.

Instantaneous fuze shells are particularly effective at long and middle ranges. At short ranges frequent misfires are to be feared, and it is therefore preferable to use delayed-action percussion fuzes or time fuzes.

For transportation, the fuze is covered with a protecting envelope.

At the moment of firing, pull off the envelope and push in the striker the length of its unpainted part.

It is forbidden to transport shells of which the strikers have been pushed in.

CONCLUSION

To sum up, during 1916 the German artillery made considerable progress affecting both the range and the power of the projectile.

Concerning range, the advantage which the Germans have won can be recovered; concerning the power of the projectile, we still have with our model 1900 shell a very marked superiority over them.

240 MM. TRENCH MORTAR—MARK I—JUST AFTER FIRING

6″ TRENCH MORTAR—MARK I. (BRITISH) (NEWTON)

Notes On Flank Observation, Bilateral System

BY G. W. BLATTNER, FIRST LIEUTENANT 344TH FIELD ARTILLERY

COMBINING upon a plotting board observations made at two flank stations has long been a method of fire adjustment in the Coast Artillery. The system had been regarded as too cumbersome for Field Artillery use, but with the advent of stationary warfare and the long occupation of the same position by batteries of Field Artillery, the French have found the bilateral system applicable. No system of observation which can give accurate indication of the next proper step in the process of adjustment can be overlooked. That the bilateral method is capable of accomplishing this end under certain adverse circumstances is the justification of its existence.

The French, instead of using a plotting board, have reduced the method to an obvious and simply operating formula. What is set down below is partially but a clarification of what may be found in the French *Manual for the Battery Commander*. However, this has been amplified by results got from considerable empirical experimentation upon a plotting board; and results got from the actual firing of bilateral problems by the 344th F. A. at Leon Springs, Tex. These notes are offered here with the hope that our experimentation may be of some general value to the service.

The bilateral system of flank observation is based on making corrections for both range and deflection through algebraic combinations of the deflection sensings made at two flank stations.

If the right observer (Fig. 1) sees a shot right of the line RT, he senses it as plus (+) the number of mils right of the target as he sees it. If he sees it left of the line RT he senses it minus (—) the appropriate figure.

If the left observer sees the burst left of the line LT, the sensing is plus (+) the amount; if right minus (—). Thus if both observers sense a burst minus (—), it must be in the area,

Section 1 (Fig. 1), and is necessarily short of the target; if both plus (+) in Section II and over the target. If R senses plus (+) and L minus (—), the shot is in Section III and maybe either over or short but is necessarily off in deflection to the right. If

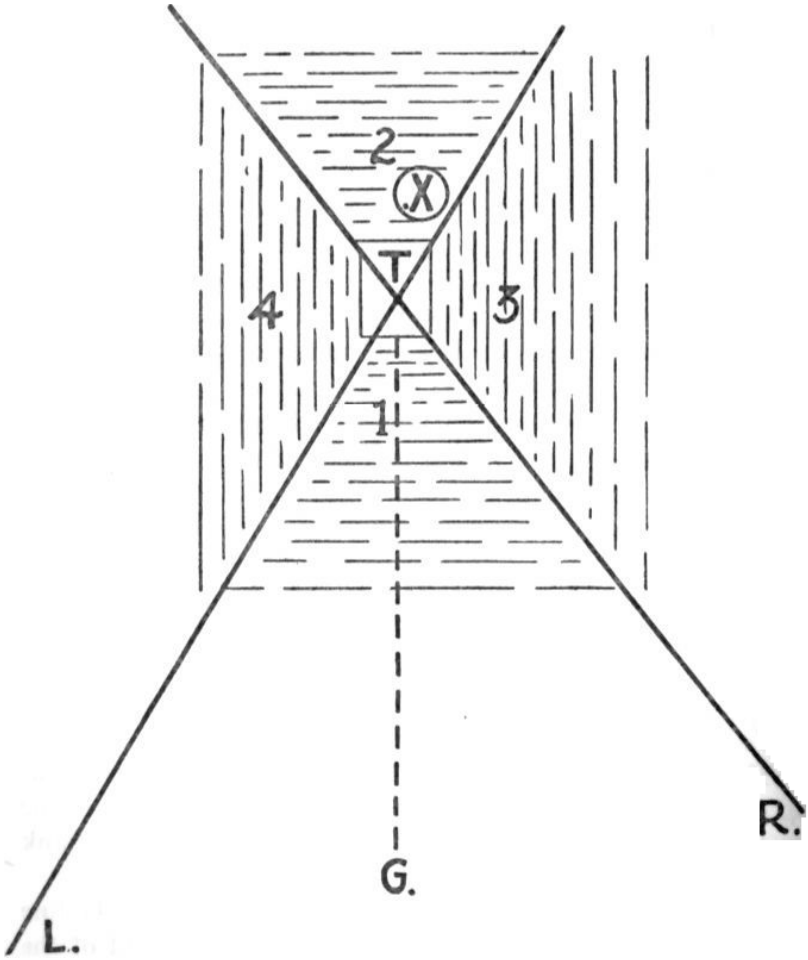


FIG. 1.—*G*, GUN POSITION; *T*, TARGET; *R*, RIGHT OBSERVER; *L*, LEFT OBSERVER

R senses minus (—) and L plus (+), the shot is in IV, over or short, and off to the left in deflection. Thus, if the sensings have different signs the deflection is off in the direction of the observer giving the plus sensing.

Each time a shot is fired both observers send in their sensings—a numerical amount either plus or minus. If either observer sees a shot on the line between him and the target he sends in zero.

The range sense is determined by taking the algebraic sum of the two sensings. If this sum bears a plus (+) sign, the round is over; if it bears a minus (—) sign, the round is short. This algebraic sum is called the index of the round.

To make deflection correction, subtract algebraically the sensing of the left observer from the sensing of the right observer with their respective signs; divide this difference by 2. If the sign of this difference be plus (+), the deflection shift is left the amount of the difference. If the sign is minus (—), the shift is right the amount.

Take as an example a simple case. Presume the point x (Fig. 1) as marking a burst. R senses plus (+) 20 (*i. e.,* right 20). L senses plus (+) 5 (*i. e.,* left 5). The algebraic sum is thus plus (+) 25, and the round is surely over. Subtracting algebraically the left observation from the right the result is (+) 15; dividing by 2, we obtain plus (+) 7. The next range should be short the appropriate bound and the deflection shift, left 10. A convenient table for recording and combining sensings is the following:

Deflection correction	Index round	Left observation	Right observation
2/15 +7 (left 7)	+25 (over)	+5	+20

If the positions of the observation stations are symmetrically placed in respect to the line of fire and are at about the same range from the target as the guns, the index of the round will give absolutely accurately the overs and shorts; the deflection shifts will always be in the proper direction and approximately the correct amount. When once the shot has been placed on the line G–T, it will stay there. A bracket of twenty-five yards can easily be obtained.

However, it is not necessary to have the observation stations symmetrically placed in respect to the line of fire or at the same range as the guns to get reasonably reliable results. If the two stations are at radically different distances from the target, in order to get the best results with the index and deflection, a ratio should be computed for each observation station—divide the range from the station to target by range from gun to target. Then, if the ratio be applied to all readings made from that station before they are used, the effect is to reduce the mil reading to its value at the guns. If readings from both stations are so reduced, they become comparable. Differences in range are thus neutralized. Let us apply this principle to the example taken above. Assume the following ranges: RT-1000, LT-3000, GT-2000. The ratio to be applied to the observations at the right station is thus 1000/2000=.5; at left station 3000/2000=1.5. Hence, instead of using plus (+) 20 for the right observation above, use 20×.5=plus (+) 10; for the left 5×1.5=plus (+) 7.

It has been found by empirical methods that the two stations may be off the line of fire up to 1000 mils without materially affecting the results. To the same degree the two stations may be differing amounts off the line. If a station be more than 100 mils off the line an adjustment for obliquity becomes necessary.

When the positions of observation stations are not symmetrically placed in regard to the line of fire and the guns, it will seldom be the case that the burst can be got on the line G-T and kept there, according to the algebraic differences. However, there are certain conditions that indicate when the bursts are near this line. One of these is when the deflection readings from the two stations are each time about the same amount and have the same sign. Another indication which amounts to the same thing is when the algebraic half difference is one time a few mils to the right, and the next time a few mils to the left of the line. When this condition prevails, fire for effect should be opened with a few mils sweeping, depending in amount upon the size of the variations noted. When the two stations are very

eccentrically located in respect to the line of fire, the indication of small indices are not too reliable. In such cases the range bracket accepted should be wide enough to dismiss all possibility of doubt.

Adjustment should be made with one gun on a particular part of the target. When this adjustment has been made, the other guns can be given their proper distribution. If more than one gun is used in the adjustment, observers will be confused by the different bursts and are apt to sense on the wrong part of the target unless the fire be converged.

The system has several apparent defects. In the first place the algebraic indices are never as satisfactory as direct sensings. Second, the degree of accuracy of the index of the round is wholly dependent upon the accurate mil readings of both observers. Necessarily these are varying quantities. Third, communication of first order is absolutely indispensable between the two stations and the guns. Failing this, the system collapses. Fourth, it entails at least two observers and a third person at the guns to combine the sensings from the two flanks and to give the proper commands to the guns. Such divided responsibility is not conducive to the highest efficiency in firing. However, when a single station near the line of fire cannot be had, the bilateral system offers a very satisfactory alternative. Assurance may be entertained that a reasonably narrow bracket, both range and deflection, may be obtained even under the most adverse circumstances in a surprisingly short time. When time is not the essence of the problem but rather perfect adjustment, the observations from the two flank stations can well be taken as a check upon observation made near the line of fire. The bilateral method has also been used for night firing with success when the targets had been located by deflection readings before dark.

In general, however, the system cannot be offered as an improvement on direct observation where the latter is possible. But where the possibility of direct observation be precluded by circumstances a workable substitute is at hand in the bilateral system.

Flank and Forward Observation of Fire

SCHOOL OF FIRE FOR FIELD ARTILLERY

FORT SILL, OKLAHOMA,
December 20, 1917.

DOCUMENT No. 46.

I. *Practical steps to be taken by observer*. (Demonstration follows table.)

1. Determine *T'*, *BT*, and *OT*.

2. *T'* < 800:–Determine the correction factor, which is the tabular factor *F* (see table below) multiplied by the ratio $\frac{OT}{BT}$ approximately determined.

3. Determine the deflection constant, which is *T'* multiplied by the tabular factor and divided by the gun range in hundreds of yards.

NOTE.—If more than one target is anticipated, take the above steps for each. The correction factor and deflection constant are constant for all shots at the same target, *thus obviating further calculations during firing*.

4. Measure the deviation (D_o) of the first shot in mils from the line *OT*. Bring the next shot to the line *OT* as follows:

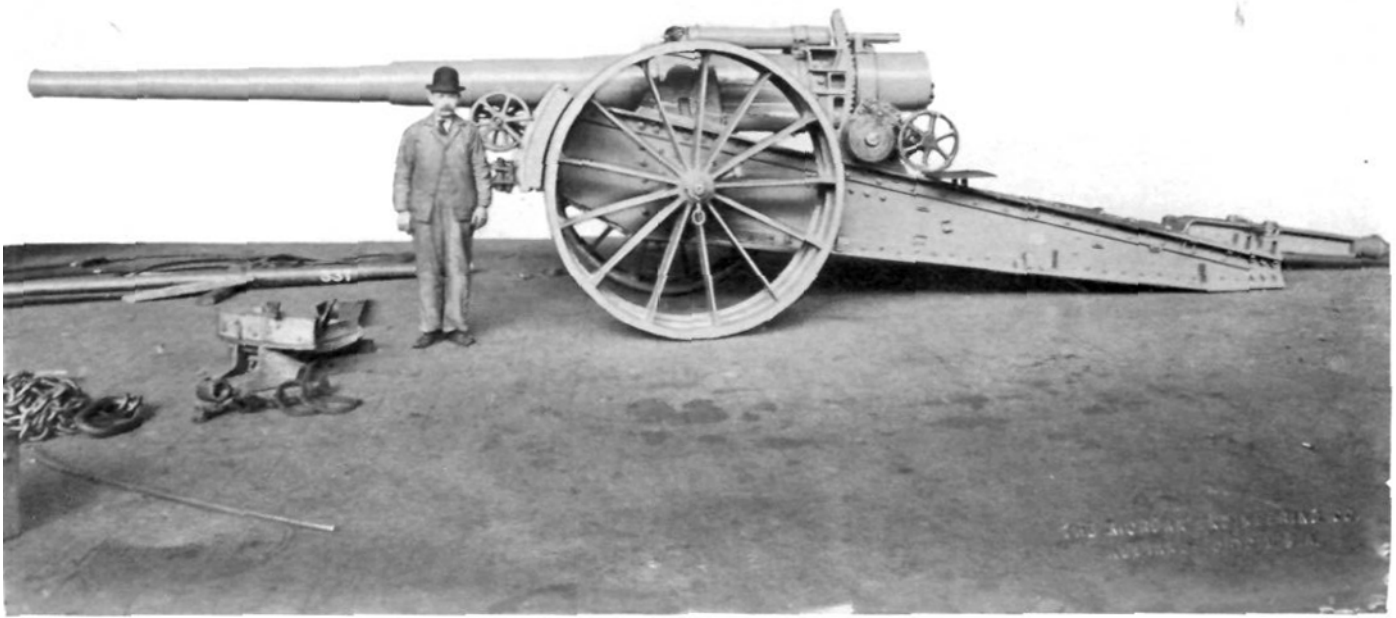
(*a*) *T'* < 800:—Multiply the observed deviation by the correction factor. Correct the deflection accordingly. Make no range change.

(*b*) *T'*> 800:—Bracket in range without deflection change. The range change may be taken as the next hundred above $\frac{OT}{1000}$ D_o.

5. The shot being on the line of observation, bracket the target *on this line,* changing the range in the usual way and the deflection by the deflection constant for each 100 yards change.

NOTES: 1. Do not expect a correction to put a shot exactly on the line *OT*; this is a method of successive approximations in order to get the shot sufficiently close to the line of observation to be observable.

2. Do not be misled by the fall of a single shot. If one falls



IMPROVISED MOUNT, MODEL 1917 FOR 6″ SEACOAST GUN

at an unexpected point, *repeat it, as the dispersion of the gun may be the answer*.

Flank and Forward Observer's Table.

(T' mils)	*0* to 400	600	800	1000	1200	1400
F	1.0	1.1	1.25	1.5	2.0	3.6

To put shot on *OT*:
- $T'<800$: $D_c=\left(F\,\frac{QT}{BT}\right)D_o$. No range change.
- $T'>800$: Bracket in range. No deflection change.

To keep shot on *OT*:
- Bracket in range; for each 100 yards range change,
- after deflection:— $D_k=100\,F\,\frac{T'}{R}$

II. *Discussion and demonstration*. This subject has been surrounded by mystery and difficulties which do not exist. The experienced observer needs neither mathematical device nor formula for adjusting fire from such observation points—the corrections leap from his subconsciousness. This ability is to be acquired from a thorough knowledge of the underlying principles which are set forth below for the mathematically inclined.

When observing from the immediate vicinity of the gun position the battery commander corrects his fire on the basis of what he sees. At flank and forward observation posts what is seen must be adapted for use. This system depends for its practical application upon the simple determination of two correction factors *prior* to firing, and thereafter on the simple multiplication of the observed deviation by one of these factors, *which are constant for any given gun position, observation station, and target*.

In the figures, *B* is the battery, *T* the target, *O* the observer, *T'* the angle in mils between the lines *OT* and *BT,* and *S* the point of impact.

In the general case, all that the observer can tell is that the point of fall is on the line *OX* (Fig. 1). He cannot determine whether the shot is short or over unless it falls on or very close to the line *OT* (the line of observation). Consequently, to bring it to the target he must do two things:

1. Bring the point of fall to the line *OT*.
2. Move the point of fall along the line *OT* until it reaches *T*. In practice, adjustment is often facilitated by special clues to the position of the shot, picked up by an experienced observer; but the problem is, in general, indeterminate; *i.e.,* the solution must be approximated, and the farther the shot falls from *T* the less accurate will be the approximation.

The point of fall may be brought to the line of observation by changing either the range or the deflection. An inspection of Fig. 2 will show the disadvantage of a range change when the angle *T′* is small, since a range approximately correct may be

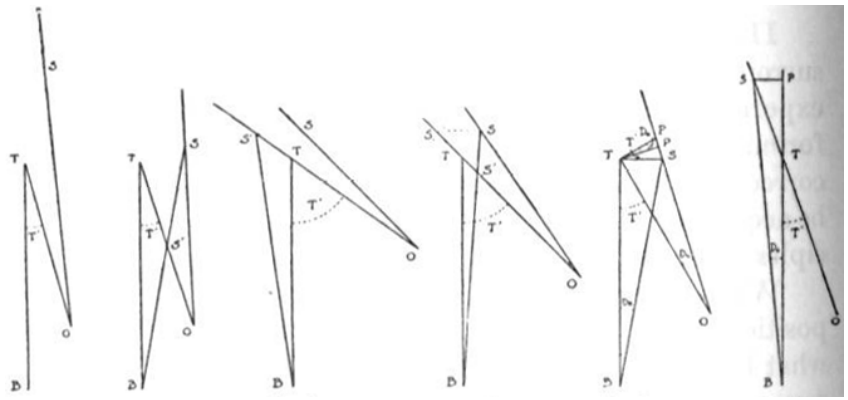


Fig 1 *Fig 2* *Fig 3* *Fig 4* *Fig 5* *Fig 6*

changed by a large percentage (*S* to *S′*), and subsequently delay adjustment along the line *OT*.

Conversely, when *T′* is large (Fig. 3), bringing the shot *S* (at the same observed deviation from *OT*) to the line *OT* by a deflection change causes a large deflection error (*S* to *S′*). When *T′* is near 800 mils (Fig. 4) it is immaterial, in principle, whether the shot be brought to *OT* by range or deflection change, since the *yards* of correction are practically the same for either method; *i.e., SS′* = *SSi* approximately.

Consequently it is concluded that when *T′* is less than 800 mils it is generally better to correct the deflection; when *T′* is greater than 800 mils a range correction is preferable.

Referring to Fig. 5,

$$\frac{\frac{PT}{OT}}{1000} = D_o; \quad \frac{\frac{ST}{BT}}{1000} = D_o.$$

$$\frac{P'T}{ST} = \cos(T' - D_o); \quad \frac{P'T}{PT} = \cos D_o.$$

which is the general equation for bringing the shot on the line of observation when T' is less than 800 mils.

From which

$$D_o = \frac{\cos Do}{\cos(OTB - Do)} \qquad \frac{D_o OT}{BT} \text{ .....} (1)$$

NOTE.—When the range of S differs from that of T the above relations will not be strictly correct, the error increasing as the range of shot departs from that of the target, but for practical purposes the degree of approximation is sufficiently accurate.

When T' exceeds 800 mils, bring the shot to the line OT by changing the range only.

As there is a criterion for this change, which may be very simply applied, it should be utilized. The distance from T to the line from the observer to point of fall, measured perpendicularly from OT, is $\frac{OT}{1000} D_o$. This range change will give close results when T is near 1600, otherwise its use will cause creeping. Generally the next larger hundred should give a bracketing range.

Assuming that the shot has been placed on the line OT, the next step is to keep it there while bringing it to T.

In Fig. 6—

$$\frac{\frac{SP}{PT}}{1000} = T'$$

Let $PT = 100$ yards; then $SP = \frac{T'}{10}$

Also $D_k = \frac{\frac{SP}{R}}{1000}$

Hence $D_k = 100 \frac{T'}{R}$ ..... (2)

If $PT = 200$ yards, $D_o = 200 \frac{T'}{R}$

As the angle T' increases, the above relation becomes less accurate, because of the assumption that when $PT = 100$, $SP = \frac{T'}{10}$, since the true value of SP is 100 *tan OTB*. Let F be the factor necessary to correct for this assumption, then $F \frac{T'}{10} = 100$ *tan OTB,* from which,

$$F = 1000 \frac{\tan OTB}{T'} \quad \ldots\ldots\ldots \quad (3)$$

The factors given in the table result from this equation. The same factors may be substituted for $\frac{\cos D_o}{\cos \ (OTB) \ - D_o}$ in *Eq*. (1) with sufficient resulting accuracy for all practical purposes within the limits of use of this equation (0 to 800 mils); especially in view of the probable error in measuring D_o, when large, of the error of the gun.

Approved:
A. S. FLEMING,
Colonel, 14th Field Artillery,
Commandant.

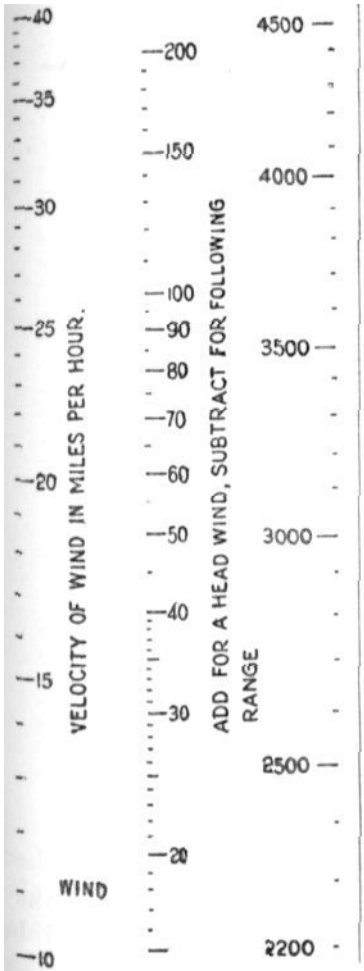
6″ TRENCH MORTAR—MARK I—(BRITISH) (NEWTON) SHOWING MORTAR WHICH HAS JUST BEEN FIRED; SHELL; GAS EJECTOR; AND CLINOMETER ATTACHED TO BARREL

240 MM. TRENCH MORTAR—MARK I. OPEN SIGHT ATTACHED. SHELL CARRYING CART—LOADED TOOL BOX AND ACCESSORIES

A Range Correction Device

BY CAPTAIN PETER H. OTTOSEN, C.A.C., U. S. ARMY

FOR close shooting in the field ballistic corrections must be made. This must be done quickly and in such a simple manner that a man of ordinary intelligence can actually do it in the



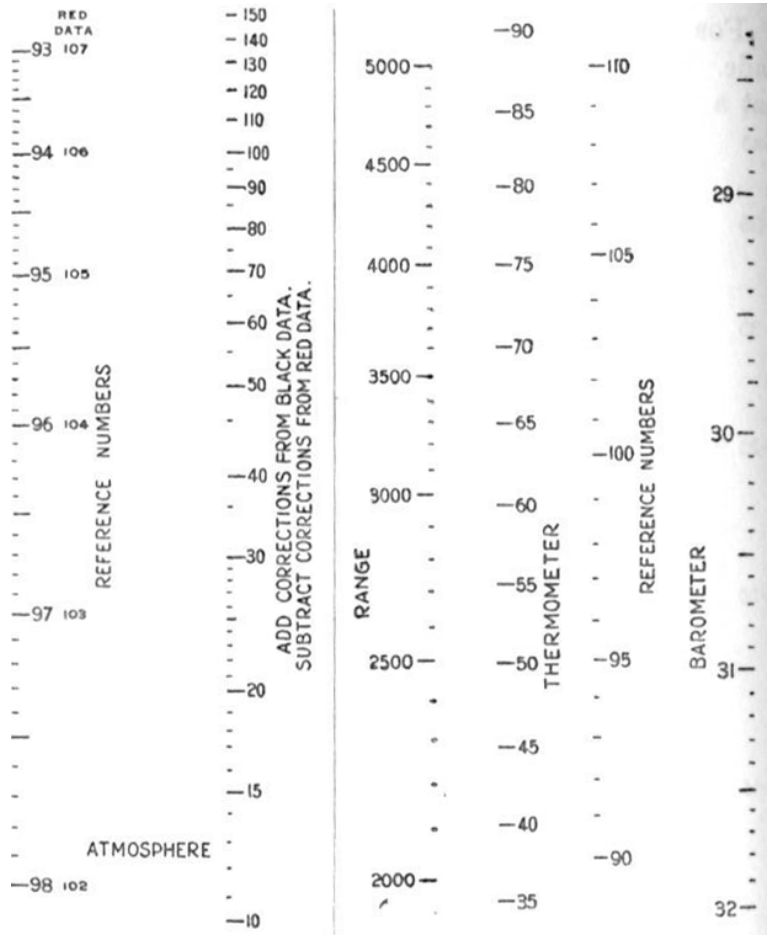
BOUFORT SCALE

NO.	SPEED M.P.H.	OBSERVATION	FLAG
0	0	SMOKE STRAIGHT UP	NO MOVEMENT
1	2	SMOKE SLANTS	NO MOVEMENT
2	5	FELT IN FACE	SLIGHT MOVEMENT
3	10	PAPER ETC. MOVED	¾ UP
4	15	BUSHES SWAY	UP AND FALLING
5	20	TREE TOPS SWAY WAVELETS ON WATER	UP AND FALLING LESS OFTEN
6	30	TREES SWAY AND WHISTLE	UP AND FLAPPING

THE BOUFORT FLAG IS OF LINEN ABOUT 5″×¾″

midst of confusion and excitement, without errors. This calls for a clear-cut portable device such as can be incorporated in a shirt-pocket note-book.

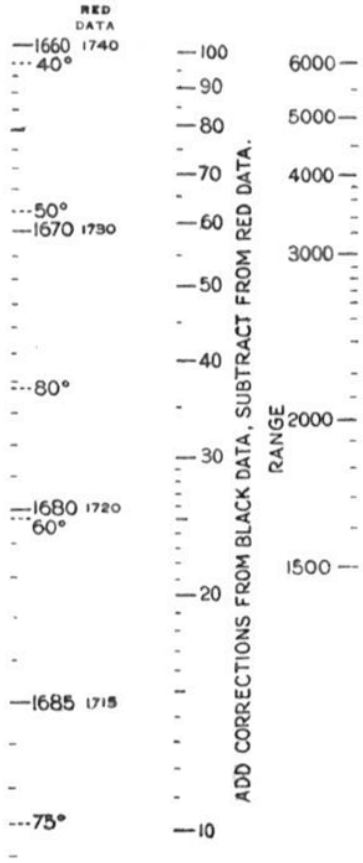
A series of diagrams are presented here that seem to meet the requirements fairly well. They are so simple that no explanation of their use is deemed necessary. Their



construction is explained, however, as the principles involved can be applied in making drawings for other guns than the 3-inch. As they are all similar in construction, only one diagram will be explained.

To construct in a note-book a diagram (wind correction, for instance), take a slide rule and range table and place the "C" scale of the slide rule along the right-hand edge of the

note-book. The range table gives 30.1[1] yards as the correction for a 10-mile wind at 3000-yard range. Opposite 30.1 on the slide rule make a short line in the note-book and mark it



"3000." Next, opposite 50.2, taken out of the range tables, make a line and mark it "4000." Proceed in this manner till the desired number of range divisions have been made along the right edge of the note-book.

Now place the same scale of the slide rule along the left-hand

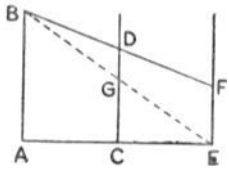
[1] Data from range table in 3-inch Handbook.

edge of the note-book and make short lines opposite each number of the rule. Mark 10 on the note-book opposite 1 on the slide rule; 20 opposite 2; 30 opposite 3, etc. These are velocities of the wind.

Connect "3000" on the right with "10" on the left by a straight line. Where this line crosses the centre line of the book is 30.1. Mark it so. Place the "B" scale of the slide rule along this centre line of the note-book and shift it so that 30.1 is opposite the mark 30.1 in the note-book. Now mark 10 in the note-book opposite 10 on the slide rule; 20 opposite 20 on the slide rule, etc. These divisions are the range corrections.

The diagram is now complete except for artistic finishing and a straight line from any range division on the right to any wind velocity on the left will intersect the corresponding range correction on the centre line. Of course, these are for the 3-inch, 15-pound, shrapnel only, but the same principles can be used for any range table published—the "75's," for instance.

A mathematical explanation is on one of the diagrams.



AB, CD, and *EF* are parallel and equidistant.

GD = ½ *EF*, for in Δ *BEF, GD* is parallel to *EF* and ½ dist. vertex-base.

Likewise *CG* = ½ *AB*.

Adding *CD* = ½ (*AB* + *EF*) or 2*CD* = *AB* + *EF*

Plotting logarithms along the three parallel lines, *AB, CD*, and *EF*, the above equation becomes

$$\overline{CD^2} = AB \times EF$$

If now the log scale used on *CD* is half the size of the log scale used on *AB* and *EF*, the equation is

$$CD = AB \times EF$$

or, in words, "The intersection on the centre line represents the product of the intersections on the outer two lines."

Notes Concerning Firing Exercises of Reduced Terrain

I—Object and Advantage of These Exercises

THE object of these firing exercises is to train the officers, the noncommissioned officers and the personnel of the communications in the preparation of fire, in observation of fire and in the employment of the rules of fire.

The method of instruction on the terrain to be described possesses over the methods already known (indoor firing, outdoor exercises on the field, etc.), the following advantages:

1. It places all those taking part under conditions as nearly real as possible.

2. It represents what happens near the targets and thus permits observation.

3. It gives as far as possible, to all the personnel of the communications (telephonic and others), the opportunity for work and training.

The remarkable results obtained by this method, applied for nearly one year at the Centre of Instruction at ——, justify its application in other Centres of Instruction.

II—Organization of the Firing Field

Generally the terrain is reduced to the scale of 1/100 (as explained later). It is therefore sufficient to have a field 50 metres long to execute fire at supposed ranges of 5000 m., 100 m. long for ranges of 10 kilom., etc. A field 150 m. to 200m. in its longest direction would therefore be sufficient to fulfil every condition in range. Such fields can be easily found in the immediate vicinity of all garrisons or cantonments[1] if the drill grounds or courtyards of the barracks do not suffice.

The sketch No. 1 shows the organization of the field on which is drawn a double system of lines, first, arcs of circles drawn with a common centre O, where the base piece of the battery is supposed to be (200 metres between ares); second, radii of these circles drawn each 50 decigrades. It is thus very easy for the men in charge of the targets to locate immediately any point of the terrain simply from the commands given by the B. C.

[1] If a field of this size cannot be obtained take a smaller field and change the scale of reduction, 1/150 or 1/200.

A firing map of the terrain is made, showing the emplacements of a certain number of fixed targets. New targets can, due to the system of lines, be placed and immediately designated by their co-ordinates.

This firing map, shown by sketch No. 2, is made to the scale 1/20000 and is provided with a system of checkered lines one kilometre apart. It is sufficient for the B. C.

III—Firing Exercises

For the battery:

The officer who conducts the fire is provided with a firing-board, on which is mounted a firing map, a protractor and the range table of the gun with which he fires. Generally he sees neither the target nor the points of impact and has, for executing his adjustment, only the information furnished by the observer or observers.

He receives:

(*a*) The co-ordinates of a marker situated on the terrain;

(*b*) The co-ordinates of the target and its altitude with respect to the battery;

(*c*) The data concerning the supposed atmospheric conditions: wind velocity and direction (given in a form as furnished by the balloon meteorological station); temperature and air pressure;

(*d*) From time to time the weight of the projectile, the fuzes used or any other necessary indication.

He announces the data loud enough to be heard by the officer stationed near the points of impact. This officer should be well trained.

For the officer in charge of the targets:

The system of lines on the ground enables the officer in charge of the points of impact to place immediately, with the aid of a ruler, the mean point corresponding to the commands given by the B. C.

The points of burst of the projectiles of each salvo (of 4, 2 or 1 round according to the calibre) are represented on the terrain by means of a small ball of cotton, mounted, if necessary, on a vertical wire which enables the heights of burst in time fuze fire to be represented in their true value.

This wire must be so fine that it cannot be used by the observer to figure the position of the burst with reference to the target.

To take account of the dispersion and let the change of the probable errors intervene as it would in real fire, a number drawn by chance indicates for each round the distance between the point of impact and the mean point. This places the point of impact.

In time fuze fire a second number is drawn which enables the probable error in height of burst to be taken into account.

With a detail with a little training and with accessories prepared in advance the time necessary to place the points of impact does not exceed the time of flight of the projectile and places the B. C. under conditions nearly identical to those of real fire.

Observation and communications:

The use of the reduced terrain permits also training the observers to observe with the naked eye or with measuring instruments (protractor mounted on a tripod, substituting the sighting triangle, B. C. telescope field glasses, etc.).

It permits, likewise, the training of the personnel of the communications.

The observers and agents of communication are trained to announce to the battery the errors as they would be made in real conditions. The transmission of information can be made by voice (due to the short distances) or by telephone.

In addition, in each observation post the height of the point of view can be varied in a proportion corresponding to the scale of reduction of the terrain.

All the methods of observation can also be realized (direct observation from the battery itself, combined observation, unilateral observation, or bilateral, made with the observers placed at various heights, etc.). Finally the methods of aerial observation, using wireless, may be employed.

IV—CONCLUSIONS

The advantage of this method, the ease of putting it into application, and, above all, the excellent results which it has given, are sufficient to recommend it to the Directors of the Centres of Instruction and to all the Depot Commanders.

A detailed annex hereto attached is designed to permit the organization and working of these exercises, even in a Centre or in a Depot where there is no one who has ever seen them work.

CHOICE AND ORGANIZATION OF THE TERRAIN

Choose a field sufficiently level and without grass, which, in consequence of the scale on which the terrain is constructed, could mask the bursts and prevent observation.

The scale of 1/100 being particularly suitable (1 cm. for 1 m.),

the length of the terrain will vary, according to the material in use, between 60 and 150 m., permitting firing up to 6000 or 15,000 m. The width will be about half its length.

To lay out the field: drive in the ground at one end of the field a stake which represents the piece which fires. Attach a cord to this stake. With the aid of the cord trace on the ground ares of circles with radii differing by 2 m. in length (representing difference of 200 m.). Mark out likewise, using the cord, radii 50 mils apart (or decigrades according to need) which should intercept on the ares described above, lengths which can be calculated, which permits verification of the execution of the tracing.

Next, outline on the field a landscape about to scale 1/100, showing roads, woods, trenches, villages, etc. To do this copy a portion of the firing map, for example. The roads will be represented by yellow sand, the trenches by earth, the woods by small branches of fir stuck in holes bored in boards,[2] finally the houses made of cardboard or wood, of convenient size (dimensions reduced to the scale chosen).

If it is desired to give a certain relief to the terrain it will be sufficient to have a few barrows of earth with which the accidents of the ground can be represented.

The observation posts are not specially marked out; the observer who is there has only to lie down on the ground in order to represent as much as possible the scale of the terrain with respect to the height of the eye above the ground.

MAPS TO CONSTRUCT

Make to the scale 1/200 a map of the terrain which has been constructed. Since the terrain is itself the reduction of 1/100 of the actual firing field, this map establishes a sketch of 1/20,000 of the actual firing field.

The position of the piece is marked on the map as well as the radii and ares of circles traced on the terrain. Checkered lines, one kilom. apart, are also made (sketch No. 1).

This map enables the co-ordinates of any point on the terrain to be rapidly determined: one marks on the ground the position occupied by this point in the curvilinear trapezium to which it belongs, which will permit its being located on the sketch by using the curvilinear trapeziums. Once the point is located it remains only to measure its co-ordinates from the kilometric axes.

[2] These boards permit only the edges of the wood to be represented.

The firing map of the firing field is likewise constructed, which will be given to the officer firing (sketch No. 2), reproducing only the ordinary indications of the firing maps published for the armies (checkered lines one kilom. apart—geographic north—bench marks—observatories—principal objectives).

NECESSARY MATERIAL

1. *For the officer who conducts the fire:*

1 board covered with a firing map.

1 protractor, with window (lacking this, a protractor without a window and a zinc square).

1 flat ruler.

1 range table.

2. *For the observers:*

Field glasses, or, better, field glasses mounted on a sighting circle, which can be placed on the ground and obliges the observer to place his eye at a short distance from the ground.

3. *For the personnel of the communications:*

The results of observation will generally be transmitted to the post of command of the captain by voice.[3] One can also, with the object of training the officers in the use of the portable projectors and signal lanterns, use these methods of visual signalling.

Finally, if you set up apparatus for sending and receiving wireless you will make use of it as was made at the Course of Fire of Heavy Artillery at ——, to send to the wireless officer the results of observation of an aviator (in this, the aerial observer walks around the field, he sends the indications of adjustment for the aerial observers, true value of errors being given 1 cm. = 1 m.).

If there is no wireless apparatus the officers will be trained by using the buzzer for simulating use of wireless.

4. *For the officer who places the points of impact:*

1 sketch No. 1.

1 range table.

1 note-book for recording commands sent to him.

1 2-metre rule.

[3] Post of Command not necessarily at position of the piece, on the contrary, preferably in a position to shelter the board from the rain and which by masking the targets from the officer conducting the fire will oblige him to use only the observations of the observers to adjust his fire.

1 bag with 12 small cardboard discs, each marked with one of the following inscriptions: 1– target, target, –½, +½, –1, +1, –1½, +1½, —2, +2, —3, +3.

1 double entry table indicating for all the circles traced on the terrain (radii differing by 200 m.) the lengths which, on each of them, correspond to changes in direction of the piece of 5 mils (from 0 to 45 mils).

A number of small balls of cotton fixed to small wire rods which are themselves fixed to the centres of wooden discs which will stand on the ground. The size of the balls of cotton is proportional to the cloud of smoke produced by the burst of the shell. The percussion bursts are represented in the same manner by a ball of cotton of desired form, fixed on the wooden disc.

COMPLETE EXAMPLE OF A FIRING EXERCISE

The directing officer of the firing exercise, who can also, if instructors are scarce, take charge of placing the points of impact, must move from place to place on the field, and gives to the officer conducting the fire the following information:

Co-ordinates and altitude of base piece.

Co-ordinates of the marker (or reference point).

Co-ordinates, altitude and nature of the target. (The co-ordinates are taken from sketch No. 1, the altitude, according to the desire of the director to require a positive or negative angle of site.)

Direction and velocity of wind.

Temperature.

Pressure. (The last three elements of information are given at the will of the instructor who can also assume a variation of weight of projectile, or a powder kept in a place of temperature T.)

Finally, the position or co-ordinate of the observatories used.

With the aid of these elements of information and a range table the B. C. prepares and executes his fire as he would in the field.

EXAMPLE

We take, for example, the fire of a 155-mm. howitzer, model 1915, Schneider, on a casemated enemy piece—adjustment by unilateral observation with O. A. shell.

PREPARATION OF FIRE

Conditions of fire:

Base piece { $x = 35{,}580$; $y = 71.700$; alt. = 88 } Aiming point (Steeple in X) { $x = 33{,}420$; $y = 75{,}380$ }

Target / Casemated piece { $x = 34{,}600$; $y = 75{,}830$; alt. = 175 } Observatory { $x = 33{,}330$; $y = 73{,}320$ }

Atmospheric conditions:

Wind { direction 16; velocity 10 } call it { longitudinal component 9 m. from rear.; lateral component 4 m. from right. }

(Supposing Y line coincident with true north.)

Temperature + 15º.

Pressure 740 mm.

Shell: O. A.; charge 2.

Measure on the plane table:

Topo range: 4240 Difference of altitude +87.

Angle—aiming point—piece—target: 295 mils.

Calculation of the initial elements (from the range table):

Direction	Deflection of the base piece	705
	Correction for drift	+8
	Correction for lateral wind	–2
	Deflection to command	711
Site	Angle of site	20 mils
	Complementary correction	2
	Total correction of site	22 mils
Range	Topo range	4240
	Correction for longitudinal wind	–50
	Correction for air pressure	–8
	Ballistic range	4180

Elevation, 379 twentieths.

Fork, about 100 m., 12 twentieths.

The captain first gives to the piece the deflection and the site; during the time assumed necessary for laying the piece in direction, the

B. C. makes the calculations for range and the graphical constructions necessary in using unilateral observation (page 104 of "Conferences on the Fire of Heavy Artillery," by Lt. Col. Spilleux).

In the example chosen, for $f = 100$ m., it is found that:

$\omega = 23$ mils and $\theta = 20$ mils, from which $f/\omega = 100$ m/23 = 4 m., or in twentieths $f/\omega = 12/23 = \frac{1}{2}$ twentieth.

Execution of fire:

Role of the officer charged with representing the points of impact.

During the preparation of fire the officer in charge of targets will note on a pad the value of corrections made by the B. C. on the topo range, in this case –60 m.

If it is admitted that the captain has taken accurate account of *all* the influences tending to modify the range, the officer in charge of targets will have only to add these 60 metres to each range commanded by the captain (range corresponding to the number of twentieths which he commands) to have the range corresponding to the mean point.[4]

But, in practice, this is not so (erroneous atmospheric conditions and angle of site, for example); therefore, the officer in charge of targets will always assume that the corrections made by the B. C. are a little too small or too great. In the example chosen, admitting that the corrections would amount to 40 m. plus,[5] he would add regularly *100 metres to all the elevations*.

Under these conditions, if the command is 4180, he marks on the corresponding radii of the terrain (or between 2 radii) the point situated 4280 m. from the battery; to do this he will use the double metre ruler to measure from the circle marked 4200 (each circle should be marked to facilitate this). This point is the mean point of a scale of dispersion in which it only remains to place the point of impact by drawing by chance one of the twelve probable error cardboard discs; the disc drawn gives, in probable errors,[6] the distance of the point of impact from the mean point.

If the captain commands 2 or 3 rounds the officer in charge of

[4] For, to say that the corrections are –60 amounts to saying that the variation of range due to external influences will be +60. It is necessary then to add these 60 metres to the elevation commanded by the B. C. to have the range of the projectile.

[5] Admitting an error whose value is equal to the sum of the correction made by the B. C.

[6] The officer in charge of targets finds the value of the probable error in metres from the range table.

targets draws 3 probable errors, taking care to replace the first one drawn before drawing the second, and so on.

Concerning the direction, two cases are to be distinguished.

1. *For the first round:*

The officer in charge of targets who knows the aiming point is content to verify, when the captain gives the deflection to the piece, that there is no gross error in laying the piece in direction. For this it is sufficient for him to estimate the angle between the aiming point and the target, using the radii traced on the sketch and on the terrain (sketch No. 1).

Moreover, even if the calculations of the B. C. are well made, the target officer always places the first plane of fire a number of mils to right or left of the target in order to necessitate an adjustment in direction.

2. *For the change in direction:*

The displacement of a point on the circle of radius R, corresponding to a change in direction of the piece of an angle α, will be found in the double entry table. There will be found in this table, by interpolating, if necessary,[7] the length which, on circle of radius R, corresponds to the angle α.

If the change in direction is accompanied by a change in elevation of the piece the mean point of the preceding round is first changed in direction which gives the new direction of fire on which is located the new mean point.[8]

For the B. C.:

The B. C. using only the indications furnished by the observer or observers proceeds to adjust his fire absolutely as if he were in campaign.

We give, as an example, the adjustment of fire for which we have made the preparation above.

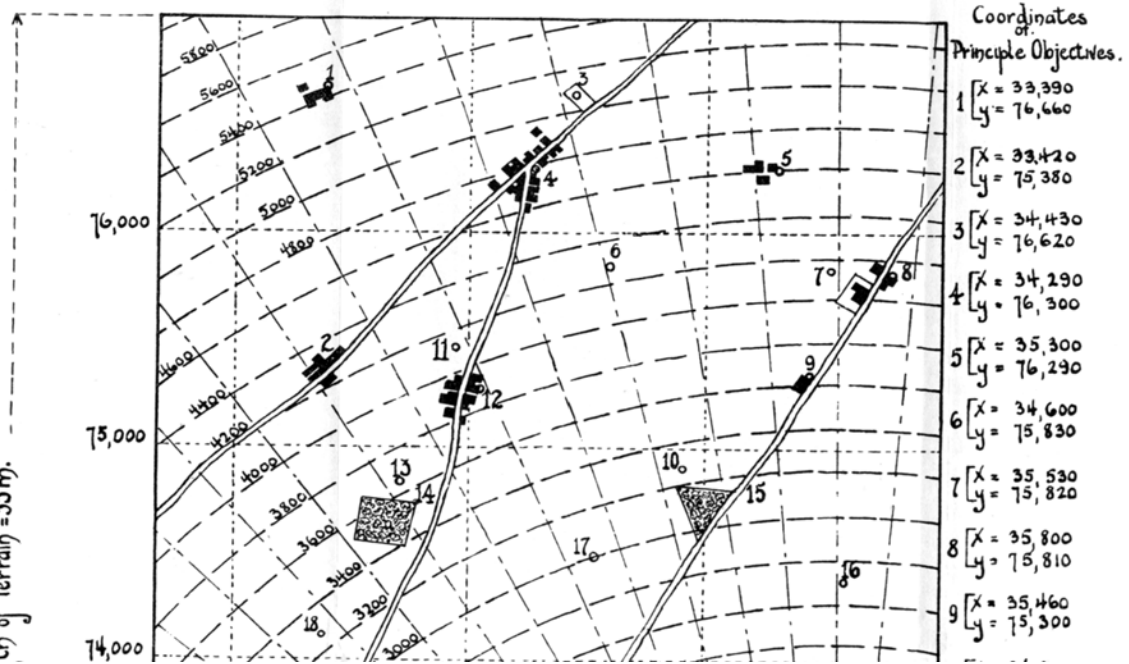
[7] In order that the changes in position of the points of impact may be rapidly made, it is well for the target officer to have an assistant who draws the probable errors and makes the interpolations (at command: "right 12, 6300," for example).

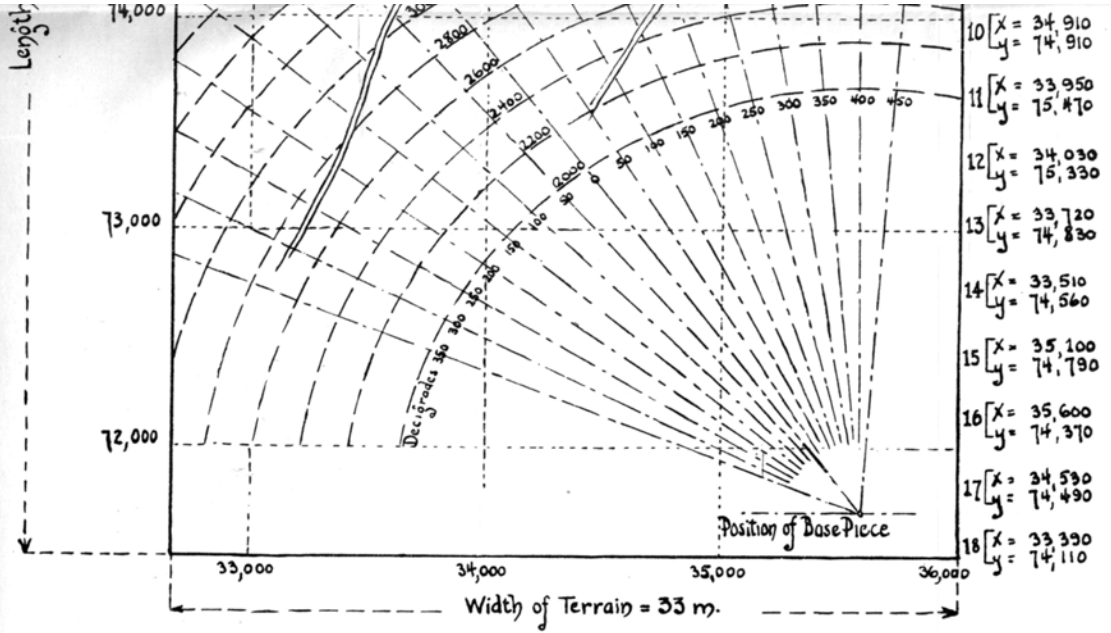
[8] After placing the first mean point it is advantageous in order not to have to add the same amount to all the elevations (here 100 m.) to place each of the other mean points with respect to the preceding by noting the differences of elevation and direction in passing from one to the other (115 m. over, 10 mils right).

Commands			No of rounds	Results of observation	Remarks and calculations
Shell charge	Direction	Range			
				Observer at left	
Shell O. A.	Deflection	2 rounds	1	Left 10	Mean of amt. left 14
Charge 2	711	379	2	Left 18	14×½ = 7 twentieths.
		372	3	Right 8 direction	Change range by 1 fork
			4	short	and deflection by φ.
	Right	384	5	Left 6	Mean to right 4
	20		6	Right 14	4×½ = 2 twentieths.
		386	7	Direction over	Trial fire complete.
			8	left 5	Provisional angle for fire for improvement $\frac{372+386}{2} = 379.$
	Left	3 rounds	9	Left 6 direction	Plane of fire to right; go
			10	over right 10	left 3 mils and
	10	379	11		decrease elevation by 3 twentieths.
	Left		12	Target	3 overs, 2 shorts, 1 target.
		376	13	Right 12	
	5		14	Left 6	Ranging angle: 376.

Sketch Nº 1

Firing Excercises On Reduced Terrain.





Scale of Reduction of Terrain 1/100

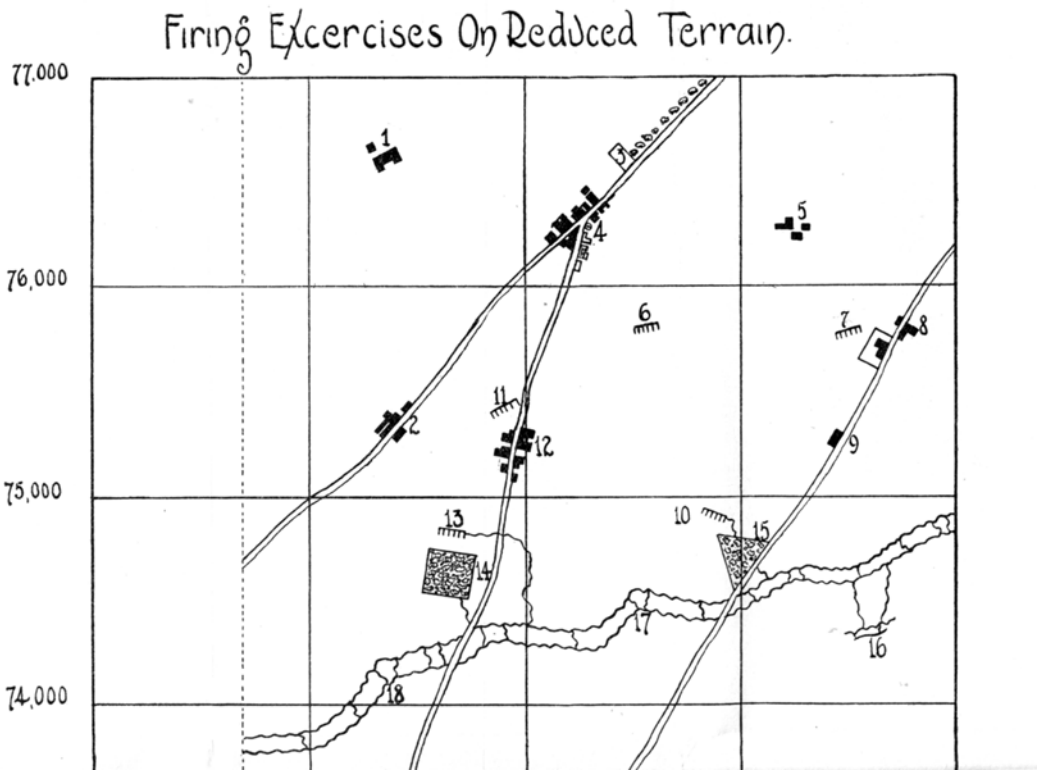
MAP OF REDUCED TERRAIN

On the prepared terrain will be represented in different colors, — for example:

In red { The figures. / The arc of circles represented by — — — —

In blue { The figures marking decigrades / The radii represented by — · — · — on the present sketch

Sketch No 2.


Firing Excercises On Reduced Terrain.
77.000
76,000
75,000
74,000
1
2
3
4
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9
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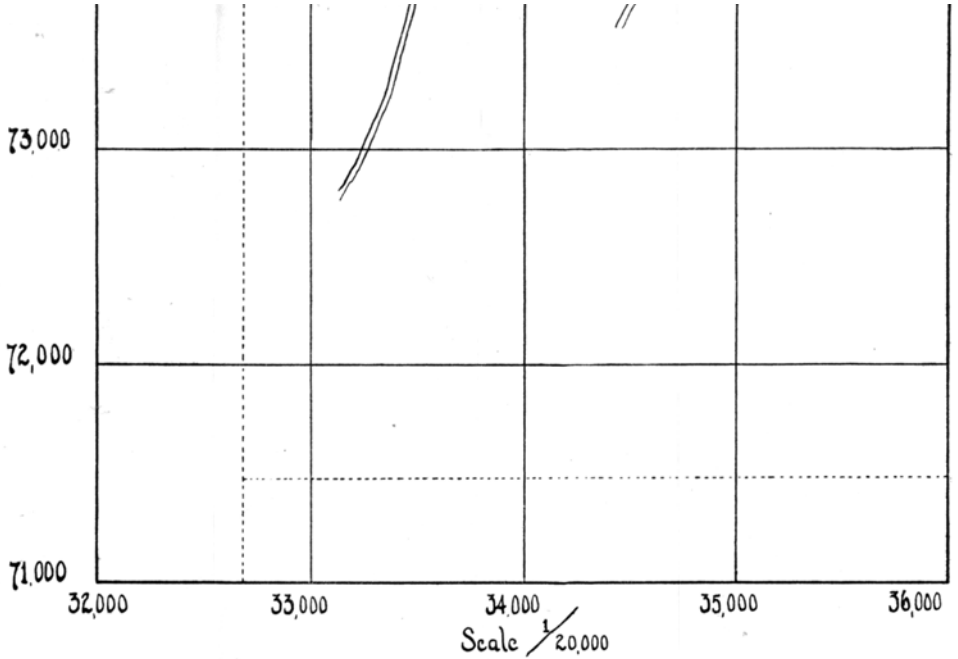


FIRING MAP.

Note: The drawings of the firing map will conform to those issued by the orienting groups to the armies.

CURRENT FIELD ARTILLERY NOTES

Wastage of German Artillery

A SECRET report issued recently from the office of the Chief of the German Staff, signed by Ludendorff himself, shows the alarming losses of German artillery. It takes the form of an argument in reply to domestic criticisms, and on the technical points raised the old warrior has no great difficulty in justifying himself.

For us the chief interest of the document lies in certain figures it contains. It stated that during grand operations the average number of guns lost by a single German army in a single month either by wear and tear or by enemy fire are to be found as follows: field guns, 870; heavy pieces, 585. This is a remarkable confession.

A great industrial strain is the necessary result. The arsenals and workshops have had to make or repair pieces to the extent of three-quarters of the whole artillery establishment merely in order to keep up the existing strength. The industrial strain of such efforts makes it easy to understand why Ludendorff found it necessary to answer his German critics. Further, we have valuable statistical proof of the efficacy of the allied counter-battery work. Of an average of 1455 guns put out of action, it appears that 655 were lost by wear and tear, and 800 by the allied bombardments. Ludendorff offers his critics this figure by way of reply to their contentions that fire against the enemy's batteries is relatively unimportant and that it is only the bombardment of infantry that seriously matters. The reply is decisive. (*The Canadian Military Gazette*, Ottawa, December 26, 1917.)

German Methods of Co-Operation Between Artillery and Aircraft

A NEW edition of S. S. 560 "The Employment and Duties of Artillery Aeroplanes in Position Warfare," is entitled "The Artillery Aeroplane and the Artillery Balloon" and was published by German G. H. Q. on October 1, 1917. It embodies certain ideas which are summarized below. Special attention is paid to battle conditions and moving warfare is considered though the principles of co-operation remain unaltered.

General:

(*a*) Full use must be made of aerial registration with a view to

(*i*) Economy of ammunition.

(*ii*) Registering over a more extended area than is possible with ground observation. An increased volume of fire for effect can thus be brought to bear when occasion arises. In such registration both offensive and defensive possibilities are to be kept in view.

(*b*) All squadrons and balloons must be able to co-operate with artillery.

(*c*) The aerodrome itself should be near Divisional Headquarters. Failing this there must be an intermediate landing ground in the vicinity, and the squadron must send to Divisional Headquarters a liaison officer (Fliegerverbindungsoffizier), who will be attached to the artillery commander.

(*d*) It is laid down that additional protection should be afforded to artillery aeroplanes by counter-battery work directed against antiaircraft guns.

In Battle:

The allotment of aeroplanes is slightly increased. The division has at least 6 to 9 machines, for both artillery and infantry work, and, in addition, the artillery commander has a few machines at his own disposal.

Special squadrons, fitted with combined receiving and transmitting wireless apparatus, will be allotted by the Army to super-heavy artillery as necessary.

Both field artillery and heavy artillery commanders are to make the greatest possible use of aerial observation for controlling fire both in the offensive and the defensive battle. Its value is particularly emphasized for:

(*a*) Bringing fire to bear on fleeting targets.

(*b*) Keeping a continuous watch (especially from balloons).

(*c*) Observation and correction of destructive and barrage fire, and of the general grouping of fire.

(*d*) Controlling and switching both artillery and Minenwerfer fire as occasion arises, especially in the defensive battles. This may be done by infantry aeroplanes (contact patrols) as well as by artillery machines.

Balloons:

The only feature of any interest is the suggested employment of balloons for the registration of heavy guns.

"Balloon registration of heavy flat-trajectory guns will be facilitated

by the employment of two balloons at a considerable distance from one another. One stationed in the line of fire observes for line; the other, stationed well to a flank, observes for range."

Telephone Equipment Allotted To Field Artillery

AN order of the German Ministry of War, dated August 2, 1917, prescribes the amount of telephone equipment for field artillery and cancels all previous allotments.

The following extracts of the table attached to this order appears particularly interesting:

EQUIPMENT	ALLOTMENT		REMARKS
	For each Bat. Hq.	For each Field Btry.	
Army telephones	4	6	Instead of the central switchboard with buzzer call (Summerschauzeichenschrank) there may be issued a switchboard shutter signal similar to that used by the Postal Department, Model O. B. 1915, with either buzzer or induction coil.
Spare microphones, in tin boxes	4	6	
Field batteries of 3 cells each, with carrying strap	4	6	
Spare field cells	3	3	
Cases of accessories for Army telephone equipment	1	4	
Central switch board (buzzer call)	1	. .	——
Army cable, pieces of 500 metres each	20	40	The cases of accessories can only be delivered after a certain period when all the Army General Staffs have been provided.
Cable reels	8	8	
Insulating material (Chatterton) on rolls of 16 metres, in boxes of 666	2	2	
Battery testers	1	1	
Regulations entitled "Telephone Equipment of Field Artillery" (Das Fernsprechgeraet der Feldartillerie)	3	3	
Terminal box, in case, with shutter and signal ball	4	6	(Vermittlungskaestchen).
Gloves	3	3	
Transmitters, in case	1	1	(Ubertragerkaestchen).

Communication In Defensive Combat

(*a*) The telephone, although frequently cut and destroyed in moments of great need, is nevertheless the best method of communication. The linemen must remain constantly at their work, even under the most violent fire.

(*b*) Wireless stations have only given results intermittently on account of jamming by aeroplanes.

(*c*) Ground telegraphy has given good results.

(*d*) Visual signalling works with difficulty in the first lines on account of smoke and dust. It has worked well in the rear lines.

(*e*) Runners and relays of runners have rendered excellent results.

(*f*) The divisional message centre has given excellent results. Liaison agents brought in information from their regiments which was transmitted to the higher commands by telephone, or in case of a break in the line, by mounted orderlies. This message center, as organized, was not able to supply the artillery and could not be used by it, a condition which had serious disadvantages and should be remedied later.

(*g*) Colored light signals used to request barrage fire or fire of annihilation were generally effective, but as the signals fired by the first line could not be seen by the artillery, signal pistols were supplied to the men of the relays of runners.

(*h*) Sirens used to request barrage fire could not be heard by the artillery. To obviate this disadvantage, two men provided with signal pistols were placed at the end of the series of sirens.

(*i*) To obtain close co-operation between the infantry and artillery when urgently needed, it is recommended that each regimental sector be equipped with a battery of light artillery which is to operate in immediate conjunction with the infantry in case of an attack or raid.

(*j*) An aeroplane landing ground or a collecting post for dropped messages with smoke cartridges established near the command post of the division have proved invaluable. Furthermore, there was with the command post of the division an aviation liaison officer in constant touch with the squadrons assigned to the division.

German Principles of Elastic Defence

TRANSLATION OF A CAPTURED GERMAN DOCUMENT

1. OUR methods of conducting at elastic defence, by distributing our forces in depth and fighting in a defensive zone organized in depth, are known both to the French and English. They have found no means of defeating it, and their great attacks, intended to break through, have failed in face of it. They now appear to attack with limited objectives, and by piecemeal battering, carried out, however, with a considerable expenditure of force, attempt to wear us down, to inflict losses on us, and gradually to press us back. We must, nevertheless, reckon with the possibility of their making a renewed attempt, at one or several points, to attain their final aim, namely, to break through on a large scale.

Our system of defence will also be able to cope with these tactics most successfully, if, in accordance with the experiences gained on all the battlefields of the Western front, the divisions employ their three regiments in line, side by side, within the relatively narrow divisional sectors, and distribute them in considerable depth. In this case, the actual divisions in line will usually be able to repulse attacks with limited objectives

by means of their own troops, without the assistance of elements of the counter-attack division. They must, at any rate, make an effort to do so. In any case, it will be very exceptional for the whole of the counter-attack division to be employed.

Holding a divisional sector with two regiments in line and a counterattack regiment in rear increases the difficulties of command in battle to a considerable extent, owing to the sectors held by the regiments in line being usually too broad and also on account of the fusion of units which quickly occurs during a hostile attack.

2. With regard to artillery tactics, *the engagement of the enemy's artillery* with observed destructive fire remains as before the chief method of affording relief to our infantry, and thus, indirectly, of depriving the enemy's infantry attack of its prospects of success. It thus forms the most effective support for the infantry, although they do not, for the most part, fully appreciate its value, and counter-battery work must be continued up to the moment of the assault. In addition, the enemy's infantry must be kept constantly under observation, in order that their preparations for the attack, and, in particular, the advance and assembly of the assaulting troops, may be detected *in time*. This is difficult, since only a relatively small number of troops are engaged in these limited attacks, but it cannot be dispensed with. It is essential for short, but heavy, bursts of annihilating fire to be opened immediately on all targets thus observed. This does *not* mean that bursts of fire should be opened on certain defined areas either according to some set scheme or in response to visual signals. On the contrary such fire must be controlled both as regards time and space, in accordance with the observed movements of the enemy. For this it is necessary that there should be very intimate and rapid co-operation between all units engaged on observation (especially aeroplane and balloon observers) and the artillery, and also that artillery commanders should make very quick decisions.

The more effective annihilating fire is, the more can barrage fire be dispensed with. In the case of the latter (in contrast to the procedure with annihilating fire), efforts must continually be made to ensure that fire is automatically opened in response to visual signals, that barrages are put down with as few gaps as possible, and that the barrage is kept as close to our front line as our artillery material will allow. An essential condition in this respect for all artillery units is the accurate determination of the position of the front line by every possible method; this must be continually checked by mutual co-operation between the two arms.

3. The "forward zone" must not be considered merely as the foreground of a defensive system. It is an integral part of the defence and

its front line must be held until orders to evacuate the whole zone are given by the Higher Command. This front line must be very clearly defined for the troops, particularly in view of the arrangements for barrage fire.

4. It is urgently necessary that all command posts should be so chosen that observation from them is possible over their own battle area, or at least over a section of it. In the case of divisions, this principle is limited by the necessity of always maintaining communications intact both with the Group and the neighboring divisions, etc., and of keeping the general system of communications working as far as possible. In the case of command posts of lower formations, this consideration must, however, give way to that of the possibility of actual observation of the progress of the fighting.

5. *The general distribution and grouping of the artillery of divisions in line*, and the correct employment of such artillery, must be the subject of clear orders issued by Army and Group H. Q. Divisions must put these orders into force, and supplement them where necessary in accordance with the situation. Only thus is it possible to ensure that the whole fighting power of the artillery is employed to the fullest extent, in accordance with the requirements of the general situation, which can only be fully appreciated at Group or Army H. Q.; this applies, especially, to the concentration of the artillery against decisive points.

6. High ground has not always the same importance in a battle on a large scale as is attached to it in quiet times. We have been unable to make up our minds to evacuate *unfavorable* positions on high ground; lest, we found suddenly that we could do without them. It was then clearly seen that, in the battle on a large scale, it was very difficult for the enemy's attacking waves to descend to lower ground from the heights we had lost, and that this gave us far more favorable conditions for fighting than the positions on the heights could have done. Other favorable positions on high ground, such as the Chemin-des-Dames Ridge, acquired great importance, mainly, of course, because in this case it was possible at the right time to pass successfully from the defensive to the offensive.

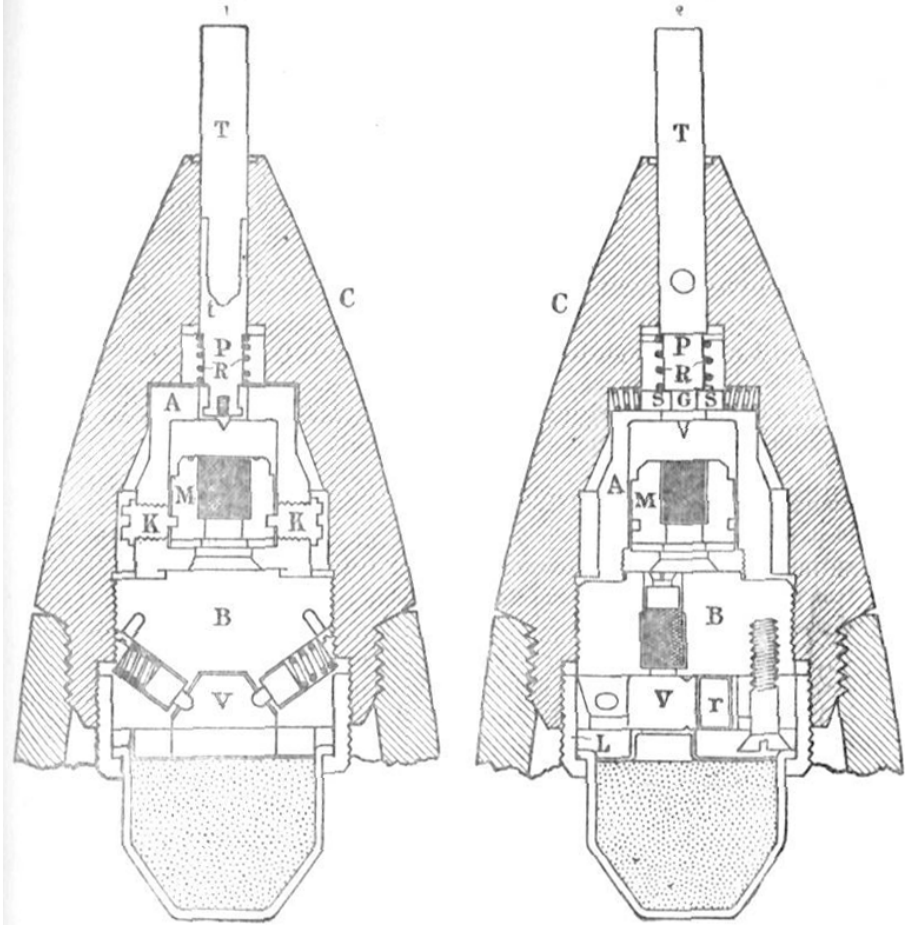
Essential considerations, when weighing the advantages of positions on heights, are whether they have a certain depth and whether they are exposed to an enveloping or flanking movement. Narrow ridges draw fire and are difficult to hold, as they cannot be organized in depth.

It is a difficult task for the Higher Command to estimate correctly the importance of high ground for the conduct of a battle on a large scale, and to make decisions in such cases unflinchingly, even during the actual progress of a battle.

(Signed) LUDENDORFF.

German Instantaneous Fuze

IN order to secure great surface action incident to the burst of high explosive and gas shell for field artillery, the Germans have for some time been employing types of instantaneous fuze variously designated as "E. K.



GERMAN INSTANTANEOUS FUZE E. K. Z. 16.
1. Section perpendicular to safety plunger lock. 2. Section along axis of safety plunger lock.

Z. 16 (or 17)," "E. H. Z. 16 (or 17)" and "E. K. Z. 16. C. ZI.," the abbreviations being for "Empfindlicher Kanonenzuender (Haubitzzunder)," meaning sensitive gun (howitzer) fuze; and the third indicating the fuze for the new stream line shell "C" Geschoss."

This type of fuze is employed in projectiles for the 77-mm. field gun and the 105-mm. light field howitzer, but its use in the field gun is limited to ranges superior to 5000 metres, since at lower ranges the angle of fall is such that the functioning of the percussion element is not to be depended upon.

The following brief description, together with two drawings, relates to the E. K. Z. 16, but the design and functioning of its percussion element is probably quite similar to that of its variations.

The fuze is screwed into a seat provided in the detachable head of the shell, from which an axial channel forming the plunger rod seat passes out at the point.

The fuze consists of a movable percussion plunger and firing pin P, a centrifugal plunger lock S, a plunger safety spring R, a housing A, containing the primer and primer block M, a safety block R, provided with an offset interrupted priming channel and a centrifugal connecting block V, retained by two centrifugal safety lock plungers. A fuze stock filled with a picric exploder is attached to the lower end of the fuze. Immediately before firing, a safety cover disc is removed from the point of the shell and a percussion plunger rod T is placed in its seat, with an annular groove at the inner end of the rod locks in a butterfly clip "t." After the projectile has acquired a given rate of rotation, the safety plungers S moves outward due to centrifugal force, unlocking the assembled percussion plunger which during flight is thus held safe by the spring R. In the same manner the block V is freed from its locking system, moves outward and connects the priming channel of the fuze and the explosive in the stock.

Upon impact the plunger rod and plunger are driven inward firing the primer which, acting through the priming channel and connecting charge in V, causes detonation of the fuze stock charge and consequently that of the bursting charge of the projectile.

Overseas Equipment.

IN view of the late limitations upon the baggage of officers going abroad for overseas service, it is impossible to take all of the articles enumerated in the official lists of what should be taken; furthermore, it is understood that at least some of the articles enumerated there can now be obtained in France. Among these are trench boots, rubber boots, Sam Browne belts, and overseas caps. The following list has been made out by an officer who has been abroad, and it is suggested as comprising the essential articles which can be carried within the limitations ordered:

LOCKER

Breeches (2 pairs).
Coat, service (1).
Drawers, wool (4).
Flashlight, with extra batteries.
Gloves, riding (pair).
Gloves, woolen (2 pairs).
Laces, shoes, extra (4 pairs).
Leggins, spiral.
Moccasins, to ankle, large.
Overshoes, arctic.
Shirts, O.D. (3).
Socks, heavy.
Tape (for identification tag), (1 yd.).
Undershirts, wool (4).
Watch, extra (1).

BEDDING ROLL

Basin, canvas.
Blanket.
Boots, leather (1 pair).
Bucket, canvas.
Canteen.
Sleeping bag, wool.
Sleeping bag, quilted.
Shoes (2 pairs).
Raincoat (?).
Sweater (?).
Hood, wool (?).
Muffler.
Overcoat, short, fur-lined (?).
Tub, rubber.
Spurs, extra (1).
Pillows, air (2).
Wristlets.
Ear Muffs.
Haversack.

HANDBAG

Roll of toilet articles.
Pajamas, heavy (2).
Drawers, cotton (6).
Undershirts, cotton (6).
Socks, light, wool (12).
Shirts, white (12).
Handkerchiefs (12).
Collars, white (12).
Towels, face (4).
Towels, bath (2).
Soiled clothes bag.
Portfolio, leather, with note paper and envelopes.
Housewife.
Shoe brush and polish (Lutetian cream, best).

SUPPLIES (TO BE CARRIED IN ABOVE)

Tobacco.
Soap.
Tooth powder.
Matches.

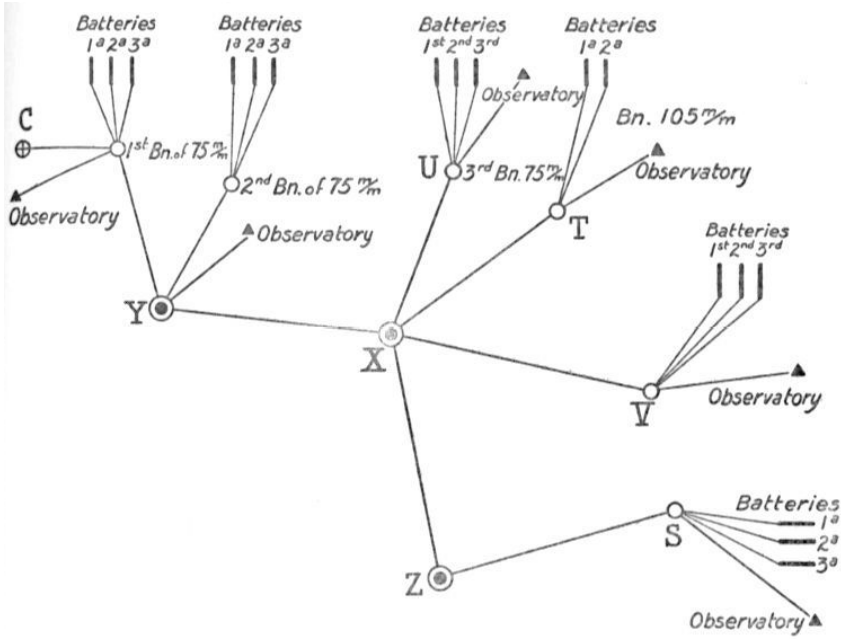
HORSE EQUIPMENT BOX

English saddle and pad.
Saddle bags.
Bridle.
File of official books.

ON PERSON

1 O.D. uniform, leather leggins.
1 overcoat.
1 cap, service.
1 field belt.
1 pistol.
1 first aid pouch.
magazines.
2 magazine carriers, with extra
1 field glass, with compass.
1 dispatch case, containing notebook and pencils, road runner.
2 identification tags.

Organization of Chain of Command



ORGANIZATION OF THE CHAIN OF COMMAND OF FRENCH ARTILLERY IN THE FIELD.

Z, Station of the Artillery Commander of the Sector; *S*, Station of the Chief of Group of 150 m/m guns; *X*, Station of the Artillery Commander of the Attack; *Y*, Station of the Commander of the Attack; *C*, Station of the Colonel of the 25th Right of Infantry; *U*, Station of the Chief of Group of 75 m/m guns; *T*, Station of the Chief of Group of 105 m/m guns; *V*, Station of the Chief of Group of Howitzers. (From *La Guerra y su Preparacion*. Madrid, July, 1917.)

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. BRYSON, 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 station 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.

EDITORIAL

The New Chief of Staff

WE publish in this number as its frontispiece a photograph of the new Chief of Staff, General Peyton Conway March, U. S. Army. The Field Artillery may well congratulate itself upon the selection of one of its members for this important position, and the service at large is to be congratulated upon the selection of such a man to handle the great problems of organization, training, supply and combat now facing us in this greatest of world wars.

At the age of fifty-three years, General March reaches the pinnacle of an officer's military career. At this age, an officer is ripe with experience, and still physically and mentally vigorous, and accordingly we may confidently expect General March to do his best work in the next four years.

To those who know General March, both as officer and man, and who have served with him both in garrison and in the field, any comment is superfluous. Few officers during the past thirty years have had a wider experience or been engaged upon more important duties. To those who have not had the good fortune to have had him as a comrade in arms, a brief account of his services is interesting, as showing how by the very nature of the varied duties to which he has been assigned, he is exceptionally well qualified to handle the arduous and responsible tasks of his office.

General March entered the United States Military Academy at West Point, New York, June 15, 1884, being appointed from Pennsylvania.

He was graduated June 11, 1888, as an additional second lieutenant and assigned to the 3rd U. S. Artillery, becoming a second lieutenant the following November. Lieutenant March was promoted to first lieutenant, 5th U. S. Artillery, October 25, 1894, in which grade he remained until the outbreak of the war with Spain, just prior to which he had been graduated from the Artillery School at Fort Monroe, Va.

When war was declared against Spain, Colonel J. J. Astor, of New York, patriotically purchased and presented to the United States Government a battery of mountain guns.

Lieutenant March was selected to organize and command this battery, which later under his command became the famous Astor Battery and rendered such good service in the Philippines. Upon its being mustered out of the service in New York in 1899, Lieutenant March returned to the Philippines, where he served as aide-de-camp upon the staff of Major-General MacArthur.

When the United States Volunteer Regiments were organized in June, 1899, Lieutenant March was commissioned a major in the 33rd United States Volunteer Infantry. With this regiment he saw a considerable amount of active service and commanded the American forces in the action at Tilad Pass, Luzon, P. I., December 2, 1899, in which General Gregorio del Pilar was killed. During the same expedition General Venancio Concepcion, Chief of Staff to Aguinaldo, surrendered to Major March, and General Aguinaldo's wife and her escort were captured.

Major March was promoted lieutenant colonel in the 33rd U. S. V. Infantry, June 9, 1900. From February to June, 1900, he was in charge of the civil and military government in the district of Lepanto-Bontoc and southern half of the province of Ilocus Sur, and the province of Abra to February, 1901. From February to June 30, 1901, the date he was honorably discharged from the volunteer service, he served as Commissary General of Prisoners in the Philippines. Colonel March was promoted to the grade of captain in the Artillery Corps, U. S. Army, February 2, 1901, and after his discharge from the volunteer service was assigned to command the 19th Battery Field Artillery. This battery he organized at the School of Application for Cavalry and Field Artillery, Fort Riley, Kansas, and commanded the same until June, 1903.

Upon the formation of the General Staff, Captain March

was selected for detail on it as a representative of the Field Artillery and thus became one of the original members of that body. He served in this capacity from 1903 to 1907, and while on this duty was detailed as Military Attaché to observe the operations of the Japanese Army in the Russo-Japanese War, February to November, 1904, during which time he was attached to General Kuroki's army and was with it on its great turning movement against the Russian left.

Captain March was promoted major in the 6th Field Artillery (Horse), January 25, 1907, and served with his regiment at Fort Riley, Kansas, until 1911. During this time, which may be said to have been a formative period for our Field Artillery, he was a member of the Field Artillery Board and acted as Chief Umpire of the Army Maneuvers held at Fort Riley during August and September, 1908.

Detailed to the Adjutant General's Department in April, 1911, he was assigned to duty as Adjutant General of the Department of the Missouri, September 2, 1911.

He was promoted Lieutenant Colonel 6th Field Artillery, February 8, 1912, and served with his regiment until again detailed as Adjutant General, August 26, 1912. Colonel March was on duty in the Adjutant General's Department at Washington, D. C., until his promotion to Colonel in June, 1916. He was assigned to command the 8th Field Artillery, which he organized and served with in Texas until June, 1917, when he was promoted to the grade of Brigadier General, U.S.A.

When General Pershing was ordered to France in command of the American Expeditionary Forces, Brigadier General March became Commander of the Artillery of the Army and while serving as such was promoted to the rank of Major General, National Army, in August, 1917. The following month, September 27, he was commissioned Major General United States Army, and continued on duty as Army Artillery Commander, American Expeditionary Forces until his return to the United States March 1, 1918, when he was detailed Acting Chief of Staff.

May 20, 1918, General March was commissioned General, United States Army, and detailed Chief of Staff.

During his service General March was nominated for the following brevets: Captain U.S.A. "for distinguished gallantry in action" near Manila, P. I., August 13, 1898; Lieutenant Colonel U.S.V. "for actions near Porac, September 28, and at San Jacinto, Luzon, November 11, 1899"; Colonel, U.S.V., "for actions at Tilad Pass, December 2, and at Cayan, Luzon, December 5, 1899."

General March holds the degrees of A.B. '84, A.M. '87 and LL.D. '18, Lafayette College, and LL.D., Union College, '18.

To those who know the man and have served with him the one expression which best describes him is a "strong man." Always keen on matters pertaining to his profession, and never letting anything interfere to prevent the prompt accomplishment of what he had to do, he brings to his high office and assignment as Chief of Staff, the confidence and respect of the Army. Verily under him we may feel *"On les aura."*

WE print in another part of this issue certain proposed changes in our constitution.

This instrument was drawn some years ago, and at a time when the present world war could not have been foreseen. With the enormous expansion of the Field Artillery, with the creation of the National Army, and with the service of our Field Artillery in so many widely scattered parts of the world, many new problems in the conduct of the affairs of the Field Artillery Association have arisen. The solution of these problems is rendered difficult under our inelastic constitution. It is accordingly proposed to so amend this instrument as to facilitate the management of the Association affairs.

Roughly speaking, the proposed changes come under the following classification: (*a*) questions affecting personnel; (*b*) questions of administration; (*c*) question as to the location of the Headquarters of the Association.

The constitution has served its purpose well, and, on the

whole, is a carefully drawn document. It is thought, however, that the adoption of the proposed amendments will improve it, and accordingly the attention of all members is invited to the proposed changes. Attention is also invited to the fact that the constitution is difficult to amend, and only a strong vote of the Association will accomplish this object.

IT was intended, as stated in the last number of the THE JOURNAL, to publish in each issue a "Roll of Honor," giving the names of the officers of Field Artillery who had been killed in action, wounded, or died of wounds. This we find it impossible to do except in a very imperfect way, as the War Department cannot furnish us with a list of casualties of Field Artillery officers. We can, therefore, publish only such information as may come to us from other sources from time to time.

Through error in the public prints we published in our last number as dead of wounds received in action in France the name of Captain John D. von Holtzendorff, Field Artillery, U. S. Army. We are glad to say that Captain von Holtzendorff, though severely wounded, did not die, and is now on the road to recovery.

WE publish by request of the American Library Association the following:

At the request of the War Department Commission on Training Camp Activities, the American Library Association has undertaken to supply reading matter to the men of our army and navy, wherever they may be.

This service extends to 39 large camps, to small camps and stations, to vessels, hospitals, transports, and overseas. It is the aim of the service to send books to every point where United States soldiers, sailors, and marines are stationed.

During the last seven months, the Library War Service Headquarters at Washington reports 1,271,800 books shipped to 39 large camps where there are trained librarians and 36 library buildings; 185,000 books to 211 small military camps, posts and stations; 130,000 books to 111 naval stations; 30,000

books to 111 vessels; 20,000 books distributed among 81 army and navy hospitals; 200,000 books shipped from dispatch offices for use on transports and overseas.

This distribution makes a total of approximately two million gift books in service through nearly 600 different agencies. In addition to these, 350,000 new books (largely technical) have been purchased and are in use.

Books and magazines of all kinds are available: good stories; technical books on military tactics, electricity, machine shop work, trench fighting, aeronautics, automobiles, gas and such subjects; poetry; biography; books about the war; in fact, all books that men like to read.

Books will be found in A. L. A. camp libraries, in Y. M. C. A. and K. of C. huts, in charge of Red Cross secretaries and chaplains, in hospitals, barracks, mess halls, on ships—wherever United States army and navy men are in service.

If there are no A. L. A. books in any place where men are stationed, all that is necessary to obtain them is to send the following data to the Library War Service Headquarters, Library of Congress, Washington, D. C.

Name and address of camp (or vessel).

Kind of camp (or vessel).

Approximate number of men in camp (or on board).

What agencies are supplying reading matter and to what extent.

What local library, if any, is co-operating.

How many and what kind of books are needed.

How many magazines are needed.

Where will reading matter be housed.

Who should be notified when books and magazines are shipped.

Will he arrange for the circulation of this reading matter throughout the entire camp (or vessel)?

There is no red tape about getting the books; men in charge will be asked to keep simple records, instructions for which are furnished with each library.

Roll of Honor

PRO PATRIÂ

DEAD

FEIGEL.—Killed in action in France, March 21st, 1918. Lieutenant Jefferson Feigel, 7th Field Artillery.

AYER.—Killed in action in France, April 20th, 1918, 2nd Lieutenant Laurence S. Ayer, 103rd Field Artillery.

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

MANUAL OF RECRUIT INSTRUCTION FOR FIELD ARTILLERY. By Major William E. Dunn, Field Artillery, National Army. Published by J. B. Lippincott Company, Philadelphia, Pa., 1918. Price, 75 cents.

This little manual in pocket size contains a course of instruction given to many successive classes of recruits and finally worked into shape to occupy one month of intensive training, by which time the recruit is ready to perform full duty with his section. The lessons are based on a progressive plan, and sufficient work is assigned to keep everybody busy every minute. The course has been carefully worked out, and should prove of help to officers having recruits to train in a limited time.

OFFENSIVE FIGHTING. By Major Donald M. McRae, M. C. Infantry Reserve Corps. (Formerly Major, Canadian Infantry.) Published by J. B. Lippincott Company, Philadelphia and London. Price, $2.00.

This book, in a pocket edition, contains valuable information on present-day methods of offensive warfare. It should be of great help to our officers, especially so to those who will be called upon to conduct operations in "No Man's Land," where a knowledge of how the game is played may be of vital importance to the lives of those under their command. The book is authorized for publication by the Secretary of War, upon recommendation of the General Staff, and a portion of Chapter V, entitled "Co-operation Between Infantry and Artillery," appeared in our last issue. The author says in his preface: "The object of this book is to place in the hands of the officers and men of our new Army some of the details of the work it took me months of labor and the probable sacrifice of lives to learn." Certainly, when it comes to fighting, there is no better school than the hard one of experience.

FIELD TRAINING—SIGNALLING. American Edition. Edited by Captain E. J. Solano. Published by George U. Harvey Publishing Co., New York City. Price, $1.00.

This book is by an author of experience in the first year of the present war. Field Training contains much valuable information, but is more adapted to British than American methods. Most of the information it contains is covered in official manuals issued for use of American

forces. This applies also to Signalling, which is excellent, but any attempt to introduce it in our training would result in serious confusion. The book may be recommended to those desiring to make a general study of training.

OUR ARMY IN A NUTSHELL. By George Nestler Tricoche. Published by George U. Harvey Publishing Co., 109 Lafayette St., New York City. Price, 60 cents.

The information contained in this pocket edition has been gathered principally from official government publications and arranged in a logical order and indexed to present, as the author states in his foreword, some elementary statistics and other condensed information about the United States Army. The book is of little value to the military man, but should be of special interest to the civilian interested in military matters.

TACTICS AND TECHNIQUE OF RIVER CROSSINGS. By Col. Mertens, Chief of Section in the Engineer Committee, German Army. Translation by Walter Kruger, Major and Assistant Chief of Staff, 84th Division, National Army. 105 illustrations and four maps. Published by D. Van Nostrand Co., 25 Park Place, New York City. Price, $2.50.

This book, written with all the thoroughness and attention to detail for which German military men are noted, is an excellent exposition of a very important phase of warfare. It is written in such a way that officers can gain a clear idea of the subject, and the author lays stress upon the importance of a thorough understanding and appreciation of the powers as well as the limitations of each arm of the service, in order that there may be the necessary coöperation which the problem of a river crossing demands. Major Kruger, who is well known as a translator of military works, has given us a valuable addition to an officer's military library.

SCIENTIFIC MANAGEMENT APPLIED TO INSTRUCTION AND TRAINING IN FIELD ARTILLERY. By Major William E. Dunn, Field Artillery, National Army. Published by J. B. Lippincott Company, Philadelphia, Pa. Price, 75 cents.

Index to Current Field Artillery Literature

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

Aerial warfare—France.—Plans for air war in France. Summer of 1918. (Motor Age, January 17, 1918, p. 12.)

Aerial warfare—Germany.—Our enemies in the air. How Germany is preparing to meet American and Allied air fleets. (Scientific American, February 9, 1918, p. 133.)

Aerial warfare—United States.—The problem of defeating Germany and how it can be solved. (Flying, February, 1918, p. 35.)

Aeroplanes—United States.—Types of military airplanes. U. S. A. types for standardization. (The Journal of the Society of Automotive Engineers, January, 1918, p. 24.)

Aeroplanes—European war.—Military aircraft and their armament. Illustrated article dealing with tactical and technical elements. (Aerial Age Weekly, March 4, 1918, p. 1114.)

Aeroplanes—European war.—Types of aircraft employed in European war. Every military aviator ought to know what his own and the enemy's machine can do and how they look. Plates with descriptions. (Aerial Age Weekly, March 18, 1918, p. 42.)

Aeroplanes—United States.—Characteristics of the leading American aeroplanes, hydroplanes, and flying boats, 1917–1918. Table giving names of makers, types of machines, wing spans, etc. Illustrations of many makes. (Aerial Age Weekly, March 18, 1918, pp. 36 and 40.)

Anti-balloon gun fire—European war.—Exhaustive article on artillery fire against aircraft. (Rivista di Artiglieria e Genio, October-November, 1917, p. 45.)

Ballistics.—Notes on Exterior Ballistics. High Angle Fire. Technical article by Major Alston Hamilton, C. A. C. Illustrative exercises and tables. (Journal of the United States Artillery, 1913, v. 40, p. 173.)

Battle tactics—European war.—The experience gained during the English-French offensive in the Spring of 1917. Translation of German document, 10th of June, 1917. The construction of field positions, the garrison, and the conduct of the battle. Illustrated. (Infantry Journal, February, 1918, p. 597.)

Browning, John.—Those Browning guns. (Coller's, May 30, 1918, p. 17.)

Camouflage—European war.—Series of illustrations showing methods in European war. (Everybody's Magazine, March, 1918, p. 45.)

Coöperation of arms—European war.—British Army experience with coöperation between infantry and artillery during European war. (Infantry Journal, March, 1918, p. 647.)

Coöperation—Great Britain.—British Army experience with coöperation between infantry and artillery during European war. (Infantry Journal, March, 1918, p. 647.)

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