

Contents, September-October, 1922

Riding Off	<i>Frontispiece</i>
What of the Future?	365
By Colonel H. G. Bishop, General Staff.	
The Development of Artillery Tactics—1914-1918. (Part I)	375
By Lieutenant-Colonel C. N. F. Broad, D.S.O., R.F.A.	
A Simplified War Game	397
By Major Sherman Miles, Field Artillery.	
Some Remarks on Mountain Artillery	411
By Captain of Artillery, A. Mortureux, French Army.	
The Development of the Austrian Field Artillery During the War..	430
French Artillery Doctrine	440
From the New Edition "Artillery Firing" 1922.	
Current Field Artillery Notes	445
Notes on Feeding Artillery Horses. Field Artillery School Book Department.	
Editorial	450
The Reserve Officers' Association of the United States. Tactics and Technique of Artillery.	



RIDING OFF
By Herbert Haseltine.

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WHAT OF THE FUTURE?

BY COLONEL H. G. BISHOP, GENERAL STAFF

THE object of this article is to attempt to indicate the lines along which the advances in science will affect weapons, matériel and equipment in a future war with a view to stimulating constructive effort on the part of those scientifically inclined and of inaugurating thought directed toward the consequent effect upon tactics and training as a result of such probable advances.

The importance of this matter cannot be overestimated. The World War was nearly lost in the beginning because a certain allied power failed to appreciate the fact that advances in science would enable its antagonists to produce a gun that would crack open their heavily armored turrets and fortifications, and which was mobile enough to keep up with their advance, and the allies had to mark time at a terrific cost to themselves until they could produce a weapon to combat it. Again the allies were caught napping when their antagonists sprung gas and liquid fire upon them. The possibilities of the use of these weapons could have been foreseen by unbiased scientific thought and the offensive and defensive machinery to combat them provided, or, at least planned and the necessary changes in tactics and training to abort the effect of such weapons made ready for use. As a result of this lack of foresight the allies again had to "lay-to" until the work could be done.

As a beginning, and for the purpose of directing our efforts along proper lines, the following analysis of characteristic methods developed during the World's War is submitted:

1. The preponderant rôle of machines.
2. In a majority of cases superior armament determined success.
3. Echelonment of an army in great depth.
4. Necessity for industrial mobilization.

The effect of the first characteristic was the substitution of a collective machine for the individual arm—machine gun for the rifle; the highly organized battery of a few guns provided with many auxiliaries for increasing the speed and accuracy of its fire rather than increase in the *bouches à feu* within the machine itself; the tank, the combat airplane, etc.

This transformation of armament into a series of collective machines had an immediate and direct influence upon the employment

THE FIELD ARTILLERY JOURNAL

of the personnel of the army, and the most striking effect was the increase in the relative number of individuals under immediate military control, *i.e.*, the increase in the number of men in uniform. Right here it must be emphasized that this is contrary to the layman's view and a point which the army must never fail to emphasize to the public. The public fondly imagines that the substitution of a tank for a platoon of infantry in the front line results in the sending home of this platoon, less the two or three men required to operate the tank. As a matter of fact this substitution requires more men than before—a larger number at the spot where it is to lay up, to clean, repair, and adjust its parts, to supply it with oil, gas and ammunition, and requires more men strung along its rear to bring up these supplies, to manufacture them and duplicates of the machine and its parts, even back to the steel mills and brass foundries and to the mines, fields and forests whence come its unformed elements. Unless this chain of repair, replacement and manufacture is controlled by the military there may come a crisis when the machine will fail to function and its engines of destruction droop and go silent. Therefore, the man who slits the throat of a hog at the Chicago stock-yards is, in time of war, practically as much a soldier as the man who buckles its pelt around the breech of his machine gun in the Argonne Forest.

Another tactical effect is this: Formerly it was the art of war to place all the effectives on the battle line. Caesar left only a comparative few in his camp to guard supplies and bring up food and water, every available effective was lined up to strike the enemy, but the comparative number thus put in the front line fell off from war to war and from century to century until today, on the contrary, there is placed in the front line only the personnel needed for the immediate service of the machines used by the combatant branches. Behind them, stretching clear back to the interior of the home country, are echelon after echelon connected with replacement, supply, repair and manufacture.

An interesting item connected with this matter is pointed out by General Debeney of the French army, and that is, that previous to the Great War belligerents in general have fought through a combat with the same armament with which they began. What has never been seen before is the transformation of armament in the middle of combat, the giving to it a concurrent extension, the waiting for a new weapon before starting an operation; in other words, the making of the question of armament into an element of strategy.

Another important feature connected with echelonment of an army in depth is the power which it gives the commander to select the organizations and individuals for front-line service and to

WHAT OF THE FUTURE?

promptly weed out inefficient for such duty and utilize their services in rear echelons. This is a well-known process established in the A.E.F. and had the war lasted would probably have almost reached perfection. The above are side issues, so to speak, to our subject, but are mentioned to show the intimate relation between tactics and strategy and armament.

Another primary characteristic of the recent war mentioned by General Debeney is the fact that "this material cannot be specially manufactured at military arsenals as was formerly the case. Its perfection and its variety are the result of collaboration of all civilian industries and of all scientific laboratories. In other words, the industries and laboratories of peace time must combine in war to supply the army. For the first time in history the process to be employed in order to put them rapidly at war work is understood. The time saved by such understanding, plus the technical progress which will have been realized by the next war, will insure machinery playing an even more preponderating part. There is no escaping the fact that the war arsenal of a nation consists of its peace-time laboratories and industries. This second characteristic is a very grave one. Whether we wish it or not, it is thus the whole country, both from the point of view of personnel and matériel, which must take part in war. The passage from a peace basis to a war one is only possible through some form of general mobilization of the whole nation. In the war of machinery, a nation which wishes to defend its independence must prepare, besides the mobilization of its man-power, the mobilization of its industry and that of all its economic and administrative elements. The time has come when the nation in arms is a verity." If this fact is accepted, how far back in these echelons should direct military control extend? Would it not be better to draft the entire man-power of the nation and put it on a military status, graded, rated and recompensed according to the work to which it is assigned?

But to return to our subject. It is evident that in the devising or selection of any arm, apparatus or element of defense or offense which goes to overcome difficulties of time, space, terrain and weather, to improve our own strength, morale, communication, supply and armament, and to inflict damage to the enemy along corresponding lines, some commercial product should be utilized, as far as possible, either in its commercial form or by adaptation made as simple as possible. If this is impossible, then its manufacture or production should be, if possible, by some simple adaptation of existing commercial plants. The plans for thus utilizing commercial plants for its production is second in importance only to devising the article itself.

Any apparatus or matériel for war purposes which requires a

THE FIELD ARTILLERY JOURNAL

special plant, special machinery, or special skill, unknown in civil pursuits, for its production, is almost hopelessly handicapped, especially if required in quantities.

The War Department has under way an exhaustive study of the influence that modern scientific development will have upon the technic of warfare, especially with regard to aviation, motor transportation and tanks. There is substantially unanimous agreement in the following conclusions made by the Department and these conclusions should be kept constantly in mind when new engines of war are proposed.

1. That man remains the fundamental instrument in battle and as such cannot be replaced by any imaginable instrument short of one more perfect than the human body, including the mind.

2. The man in the bulk—meaning the greater portion of armed forces—fights with greatest freedom of action and with greatest efficiency when on foot, not when on horseback, in a tank, in an airplane, in a fixed fortification, etc.; that to achieve action he is best armed with a rifle and bayonet; that man is rendered less vulnerable when merely clothed against the weather and armored with his own agility, with steel helmet.

3. That battle is normally determined by physical encounter with the bayonet or the fear thereof; all other agencies of destruction, as artillery, machine guns and aircraft are auxiliary in their effect, however potent, and serve to make possible the advance of the foot soldier to hand-to-hand encounter.

4. That infantry is the basic combatant arm upon whose success normally depends the success of the army; the primary duty of the other arms when associated with infantry is to assist the infantry to achieve its mission by protecting and aiding it in every way, and by destroying enemy resistance to its efforts.

5. That no arm except infantry can be expected, under normal conditions, to destroy an approximately equal force of enemy infantry armed with rifle and bayonet.

6. That while infantry is normally the basic arm in war, under certain conditions or during certain phases, cavalry may replace it as the basic arm; for example, in operating against mounted forces or against foot troops whose efficiency is below normal for any reason.

To the above may be added the fact that the increasing use of airplanes carrying bombs does not tend to obviate the necessity for the use of mobile field artillery on the battlefield, nor is there uniformity of agreement that the horse can be replaced for certain necessary military purposes by any form of machine; that motor traction has not yet reached such a stage of development as safely to permit the motorization of all field artillery. Similarly, that aviation

WHAT OF THE FUTURE?

supplements, but can never entirely replace cavalry in all forms of reconnaissance, the use of aircraft for this purpose being in general devoted to greater distance than it would be possible for cavalry to reach, and its efficiency for reconnaissance being also greatly affected by bad weather conditions.

The following is an estimate of scientific advance that may be applicable to war in the near future: A careful reading of these possible scientific advances is recommended, with a view not only to stimulating invention, but to determining how much, possible advances therein, will affect methods of combat, organization and tactics, with consequent effect on training. This matter has been obtained from a source which I am not permitted to disclose:

1. In the science of mechanics, chemistry, electricity, etc.

Photography: Photographic plates sensitive to infra-red rays have been developed which, by using selective ray filters, make it possible to photograph through fog and haze, with resulting increase of efficiency of aerial observation.

Fuel: By the "Trent Process" ash and foreign substances are removed from coal. The process includes a mixture of oil with the coal, so that in addition to the increase in efficiency by reason of the removal of the ash, there is also an increase due to the mixture of oil, amounting to about 66 per cent. over ordinary coal by volume.

The effect of this is to reduce transportation weights for the known deposits of coal and make available deposits of low-grade coals distributed throughout the country.

In a military way it will have application further and beyond the reduction of transportation weights, by increasing the radius of action of units limited to a certain weight of fuel supply, such as transports and naval vessels.

Glass: Improvements have been made in the manufacture of glass, particularly in the production of an elastic or tough glass, which may be used as a liner for projectiles carrying gas or other compounds which deteriorate through corrosive effect.

2. In small arms, machine guns, grenades, cannon, mounts, projectiles, tanks, etc.

Small arms: Successful development is promised of a suitable semi-automatic rifle to replace the present bolt action rifle.

Machine guns: Machine guns of fifty calibre for ground, air, and tank use, have been developed along the lines of the Browning gun.

Grenades: Combination hand and rifle grenades are being developed, giving increased range over present type.

Cannon: Cannon of larger calibre and increased range, penetration, and explosive effect are being developed for coast defenses

THE FIELD ARTILLERY JOURNAL

and naval use. Studies are in progress looking towards the successful development of an aircraft gun capable of firing an explosive projectile up to three inches.

A new method of construction of guns of medium calibre by radial expansion increases the possibility of rapid manufacture and low cost of production.

Mounts: Progress has been made in the development of self-propelled mounts capable of crossing streams, and moving independent of roads.

Projectiles: Improvements have been made in projectiles, giving greater range, penetration and explosive effect.

In the major calibres, projectiles capable of penetration of armor at oblique angles up to twenty-five degrees to normal have been developed.

Tanks: Improvements in tanks have been made, giving them increased fire effect by mounting larger calibres, increased mobility, and increased protection.

The use of tanks for transportation of infantry in attack is a development to be anticipated, as it does not present any unsurmountable difficulties.

Searchlights: Searchlight units of increased power and mobility are being developed for use in both coast defenses and field operations.

3. In Chemical Warfare: The trend of development is,

Offensively:

To increase the container capacity as well as the radius of action and projection; to improve the control of gases as to persistence and virulence; development of toxic and non-toxic smokes; make practical new features (such as inflammable gas); application to the warfare of manœuvre.

Defensively:

To improve gas masks and clothing as well as methods of neutralization.

4. In aerial torpedoes and ground-controlled weapons.

Aerial torpedoes: The launching of the smaller type torpedoes from airplanes at a height of twenty feet has been successfully accomplished. The successful launching of torpedoes of greater size and range is a development to be anticipated.

While this development has its principal application to naval warfare, it will also find application for coast defense.

Ground-controlled aerial weapons: Developments indicate probability of reasonable success in controlling torpedo, bomb, or explosive-carrying aircraft by both gyro and radio. It is believed that the inaccuracy of such weapons, even if developed fully, will always cause them to be classed as auxiliaries too unimportant to

WHAT OF THE FUTURE?

exert any decisive effect in operations of war, but they may be effectively used in furnishing realistic targets for training anti-aircraft batteries.

5. In aerial warfare.

The development of the airship with helium as a lifting gas, and of the mooring mast, is the greatest advance that will be made in the near future.

The development of *all-metal* airplanes, with greater speed and lifting power; increased engine efficiency by improvement in fuel; and greater horse-power per unit weight is steadily progressing.

The development of instruments that will facilitate and improve air navigation and that will improve shooting and bomb-dropping is making rapid progress.

Progress is also being made in the development of higher-powered aircraft guns, increased armor protection, tracer projectiles, and more efficient bombs.

In regard to the latter, various improved types are being developed looking towards their use:

- (1) For creating smoke screens.
- (2) In gas attacks.
- (3) In explosive effect.

6. In means and methods of communication.

Improvements have been made in existing methods and equipment for communication.

The greatest development has been in the use of radio energy looking toward the improvement in communication between front-line elements and their directing headquarters, and between aircraft and ground troops.

7. In means of transportation.

While improvements in the technical and mechanical details of the present means of transportation are continuous, and will promote efficient operation, it does not seem probable that science will produce any new means in the near future.

8. In quick construction and repair of roads and railroads.

Development has been made in self-propelled and tractor-drawn vehicles and road-making machinery which will materially increase the rate of construction of roadbeds.

Improved track-laying devices promise quicker provision of additional routes of transportation.

A better understanding of geology will have application in the selection of routes for use with reference to the location of construction materials.

9. Improvements in terrestrial and aerial observation with particular reference to aerial posts of command.

The more important developments in the near future will probably

THE FIELD ARTILLERY JOURNAL

be in aerial photography, in the more rapid and accurate transmission of information by radio, in the use of helium in balloons and dirigible and possibly in the helicopter.

Helium will probably make possible a considerable extension of the use of aerial posts of command. Airplanes have been used by commanders of railroad artillery units and of coast defenses, but a lighter-than-air vessel would be needed for a division or higher headquarters.

10. In camouflage and screening carried to the concealment of large units.

The developments of a fast-color dye to replace the heavy paint now used on nets and fabrics is in progress which will result in weight reduction. Smoke bombs or projectors may be developed to produce artificial fogs (not smoke screens); to conceal troops on the ground; or clouds, to hide airplanes.

11. In ranging devices.

Improvements in range-finding instruments are developing accuracy at great distances, and new methods are being perfected to determine ranges of targets hidden from visual observation.

The indicated improvements are:

- (1) In optical systems.
- (2) In methods from balloons at both ends of a long base line assisted by airplane spotting.
- (3) In sound-ranging devices, including subaqueous methods.
- (4) Quick-ranging devices for aircraft and anti-aircraft batteries.

The effect that these improvements in weapons and inventions will have upon strategy, tactics and training.

1. The trend of science and invention has been to improve the arms and equipment now in use rather than to develop new agencies. In general, the effect of these improvements is to add to the fire effect (or, effectiveness of weapons of war), to the means of communication, to the means and methods of gaining information, and to transportation as affecting the mobility of personnel and matériel.

2. Specifically the effects may be briefly stated as follows:

- (1) Increased fire effect due to improved range, penetration, volume and rapidity will increase the offensive power of infantry and artillery with a consequent effect on tactical formations toward greater dispersion.
- (2) Improved communications, with more accurate and complete information of the enemy, will result in simplification of methods of training and in better tactical control of dispersed formations.

WHAT OF THE FUTURE?

(3) The development of aircraft radio apparatus promises instantaneous communication from deep within the enemy's lines. The constant intercommunication between air and ground will permit improvement in aerial observation as the observer will be always in touch with the artillery or infantry or other airplanes. This will require greater dependence on airplane observation by ground troops, particularly the artillery, and emphasize the importance of combined training between the air service and ground troops and the possible extension of the ground radio nets.

(4) Self-propelled tractor mounts will make artillery and transport independent of the roads, and add to the capacity of roads for ammunition and supplies, and increase the efficiency of supply on the battlefield. This, with improved road construction methods and improved repair machinery, will result in increased tactical mobility. Development of the air service will permit the rapid movement of men, munitions and supplies to isolated or critical points which cannot be reached in any other way or to take advantage of fleeting strategic or tactical opportunities.

Lines of Future Fruitful Study and Experiment

Continued study and experiment is recommended to develop and improve all known types of weapons, matériels and equipment in the endeavor to obtain increased range and fire effect, mobility and speed, power of observation, concealment, and efficiency of communication.

Specifically the following are suggested as subjects of possible fruitful study:

1. Greater mobility of automatic arms, and their ammunition supply.
2. Increase in the security of handling and transportation of hand grenades.
3. Further development of smoke-producing bombs.
4. Defense against gases by civil populations as well as military forces.
5. Development of means for neutralizing effect of gases.
6. Construction of ships to minimize the effect of attack from overhead and under water and from gas attacks.
7. Development of means and methods for launching airplanes from all types of ships.
8. The extension of anti-aircraft equipment to all types of ships and important centres on land.
9. Development of armor-piercing bombs.

THE FIELD ARTILLERY JOURNAL

10. Development of ground-controlled aircraft for anti-aircraft target practice.

11. Further development of the auto-frettage system of gun construction.

12. Development of other sources of helium supply to replace natural gas when exhausted.

13. Extension of the use of buoyant tractors and waterproofed engines.

14. Continuation of studies already made in the development of radio communication, with particular reference to communication between and with front line troops and with aircraft.

15. The transportation of troops and supplies by aircraft.

16. The extension of the use of aerial posts of command.

17. Enemy means and methods of observation in order to develop means of counter-action by camouflage.

18. Means for delivering observed fire at extended ranges.

19. Battlefield communications between Infantry and Field Artillery.

THE DEVELOPMENT OF ARTILLERY TACTICS—1914—1918*

BY LIEUTENANT-COLONEL C.N.F. BROAD, D.S.O., R.F.A.

PART I

CHAPTER I. 1914

THE 72 field and 6 heavy batteries which accompanied the British Expeditionary Force to France in 1914, expanded, by November 11, 1918, to 568 field and 440 heavy and siege batteries.

The artillery also, in actual battle, increased in proportion to the other arms. It thus ceased to be a subsidiary arm and, in time, grew to such a proportion of the fighting forces, as to have a very vital bearing on the course of the war.

It is with the development of tactics due to these factors that the following chapters will deal.

Tactics before the war usually meant the fire and movement of infantry supported by such artillery as was available; one of the main essentials being a large infantry reserve. The battles of the Russo-Japanese War offer a very instructive study in this connection.

With certain modifications the same holds good today, either in the early stages of a big continental war, or in a campaign such as that in Palestine in 1918.

In the late war in France, tactics had, however, a different meaning.

It then meant, almost entirely, the fire power of artillery, machine guns, tanks and aeroplanes. The infantry, although no less essential than in 1914, being in comparatively small numbers. These small parties worked in coöperation in matters of minor tactics, but could not be influenced in their action from the rear, either by orders or by reinforcements.

The control of the commander lay almost entirely in the use he made of his fire power; although his measure of success often depended on the initiative displayed by junior infantry commanders in making use of the opportunities he had created.

This statement applies not only to the pitched battles of 1916–17 and 18, but also to the so-called open fighting shortly before the end. Towards the close of 1918, we had small glimpses of really open warfare when the enemy was retiring, but they were usually brought

* Reprint from *The Journal of the Royal Artillery*, May, 1922.

THE FIELD ARTILLERY JOURNAL

to a very abrupt conclusion once the enemy had established a new line. The tactics of "fire" had then to be again resorted to.

Therefore to the commander of the future, the study of artillery tactics is as important as those of his infantry, machine guns, tanks, etc.

Artillery tactics in principle do not differ from that of other arms.

There are perhaps three main things which the artillery tactician has to study.

- i. He requires a detailed knowledge of the organization, capabilities and limitation of the various arms.

There is perhaps more to learn about artillery, machine guns, tanks and the Royal Air Force, than there is about infantry; or perhaps one should say that the majority of people know more about the latter, than they do about the former.

You do not, of course, need to know the technical capabilities and limitations, but those concerning tactics. Technic cannot be entirely divorced from tactics in artillery, but you need only know such technic as bears directly on tactics.

For instance, you do not need to know the calculations which a battery commander makes when in action, but you do need to know that survey sections, meteor, thermometers, barometers, etc., are as essential, in certain cases, to effective fire, as shell to put into the gun and men to pull the lanyard; moreover for an intelligent application of this knowledge, the commander must know generally why these items are essential, just as much as common sense tells him that the guns will not go off unless there are shell to fire and men to work them.

- ii. He requires a good working knowledge of the organization, equipment and tactics of the enemy.

The main points which the artillery commanders studied in France were perhaps:

- (a) The German divisional organization; especially the changes in the strength of the field and heavy artillery included in the division; the organization of heavy artillery other than that in the division.
- (b) The hostile artillery tactics and tendencies in detail.
- (c) Machine-gun tactics and the distribution of the hostile machine guns on the battlefield.
- (d) The method by which the hostile infantry held the line and the use and location of infantry reserves and, in fact, reserves generally.

THE DEVELOPMENT OF ARTILLERY TACTICS

- iii. The third big point is the study of the mentality of the opposing commanders.

This is always difficult in artillery matters, as it is the custom in both our own and also the continental armies to conceal the identity of the artillery commanders under the signature of a general staff officer.

General Ludendorf was credited during the war with profound thought in artillery matters, but he was equally profound as regards infantry, engineers, machine guns, cavalry, etc., and if we are to go by his signature, he also had time to think out the daily situation report, which we received with unflinching regularity on our breakfast tables!

The late General Sixt von-Arnim was equally instructive and prolific, so that it was obviously waste of time to study these gentlemen, not as to their stuff, but as regards their mentality.

In matters changing so rapidly, as the artillery did in tactics, you really required to get at the brain which originated the thought and that, we rarely succeeded in doing. In default we could only study general tactics and tendencies, which, in an army so well organized and disciplined as the German, and moreover, with such a decentralized artillery command, to a certain extent made up the deficiency. It, however, made any attempt to forecast the probable trend of future developments, a matter of great difficulty. That, usually, was only obtained by battle fighting on a large scale. Even then one was completely ignorant concerning the training, education, experiences, and other characteristics of the brain which was leading any new development.

Before we proceed to a detailed consideration of the subject, I should like to summarize pre-war and 1918 artillery tactics, so that we can see at a glance the chief points of difference, *i.e.*, the subject we are really going to study.

As I have already pointed out, artillery before the war was a subsidiary arm, not only without any great power of its own, but very few people visualized its possibilities. There was a good deal of loose talk about the power of modern artillery but we, at least, did not take any definite steps to translate these words into deeds.

Very shortly before the war we were engaged in reducing a certain number of batteries, as these units were in excess of what was required for the Expeditionary Force organization and for finding the Indian and Colonial drafts. The possibilities of heavy artillery

THE FIELD ARTILLERY JOURNAL

in the field, barring the 60-pounder, were not seriously considered. The idea was held, I believe, that only artillery that could be landed on an open beach was permissible in a "Field Army." At any rate the 6" howitzer batteries, then in existence, did not form part of the Field Army as in the German service. It is interesting to point out that the Russo-Japanese War turned the attention of the gunners to the importance of heavy artillery; at least, that of the Royal Garrison Artillery branch. Nevertheless, regarding the 6" howitzer, Garrison Artillery Training, 1906, stated, that it was intended, in addition to being available for use in a siege, they should be utilized, if required, for use in the field.

In a lecture at the Royal Artillery Institution, in 1908, a Royal Garrison artillery officer stated that the uses of heavy artillery in the field were as follows:

- i. To silence at long range, hostile guns that may command lines of advance.
- ii. To search and enfilade points which the lighter guns can only reach with frontal fire.
- iii. To destroy villages and houses held by the enemy.
- iv. In the final stages of the attack, to support the firing line.
- v. In pursuit, for harrying the enemy's main body at long range.

The lecturer concluded by saying that he hoped that means would be found for associating these howitzers with the Field Army, so as to familiarize all ranks with their duties and to accustom generals and staff officers of other arms to their employment in the combined tactics of the battlefield.

The devastating power of quick-firing field artillery was realized, but somewhat exaggerated, as the ammunition problem was not seriously tackled. You cannot devastate if you are counting shell all the time. I do not know that we have advanced much, as our field artillery ammunition supply is now rather more meagre than it was in 1914. Full value will not, of course, be obtained from the artillery in open warfare until an adequate ammunition supply is provided.

Another great cry before the war, was mobility. In war time, people want shell power, in peace time, mobility. It has been the same since time immemorial.

In war, however, guns rarely trot.

Artillery tactics, therefore, consisted largely of manœuvre, designed to facilitate the projection of bursts of fire, as far as ammunition permitted, which were intended to assist the infantry in their fire fight with the enemy, and so facilitate their movement.

Now to turn to 1918. Let us examine the main features of artillery tactics at that time.

THE DEVELOPMENT OF ARTILLERY TACTICS

- i. The artillery and machine guns obtained fire superiority without a long and exhausting fire fight on the part of the infantry. The latter were thus enabled to penetrate several thousand yards into the enemy's position, at the same time preserving their energies and their ammunition for exploiting the advantages already gained.
- ii. Counter-battery work had evolved into an elaborate science, designed to obtain fire superiority over the enemy's artillery so that
 - (a) The barrage batteries could carry out their duties against the enemy's infantry and machine guns.
 - (b) The advance of our infantry was not made impossible or costly by the hostile artillery.
- iii. Bombardments of great intensity, either long or short, designed to destroy the enemy's infantry, artillery and machine guns, so that our infantry could pass through and reap the fruits of victory.
- iv. Continuous harassing fire, both by day and night, to prevent the movement of the enemy's reserves and replenishment of ammunition.
- v. Unlimited ammunition, and hence the dust and smoke of a modern battlefield, necessitating mechanical aids and increased science to replace terrestrial observation.
- vi. Finally surprise and deception, the really big thing in war, did not lie wholly in the placing and use of the "general Reserve" as contemplated in Field Service Regulations, Part I, 1912, but rather in the methods employed in the use of the artillery masses.

The chief points of difference between 1914 and 1918 may be summarized as follows:

- i. In large attacks the infantry in 1918 were not required to provide their own covering fire.
- ii. Artillery fire in 1918 battles, was largely unobserved on account of the dust and smoke.
- iii. Counter-battery work was almost impossible before the war as there was no aeroplane observation.
- iv. Continuous firing and the effect of harassing fire is a new feature in war.
- v. A commander by proper use of his artillery can both mystify and deceive the enemy.

I would now like to make my first point.

It is that modern grand tactics are largely a correct use of artillery; and furthermore, if we are to develop these tactics on the right lines in peace time, we must have a good knowledge of the various

THE FIELD ARTILLERY JOURNAL

forces and reactions which have brought us to our present state of evolution.

I propose to study each year of the war in detail. At present, of course, a lot of evidence remains to be sifted, but even so, a statement of the various situations that confronted us and the means taken to overcome them, made while the facts are still clear in ones memory is probably of value, as showing the tactical train of thought at the time, which must after all be our basis for future study.

Before the end of 1914 four big points had cropped up, these were:

- i. The introduction of the medium howitzer by the enemy and later by ourselves.
- ii. The real superiority of the 18-pounder, with all its faults, as a man killer over all other continental field gun equipments.
- iii. The introduction of universal night firing.
- iv. And last, but first in importance, the use of wire on a large scale.

These are all big points and each had an important bearing on the future course of artillery tactics.

To take them in order.

- i. The introduction of the 15-cm. howitzer as a horse-drawn field piece was a complete surprise to, at any rate, the mass of the army. It outranged everything we had, except the 60-pounder and could occupy positions safe from the fire of these guns on account of their flat trajectory. Its shell power was greater than anything we had expected to meet.

To my mind the enemy obtained a moral advantage at that time which remained with him until the end of the war, and which was chiefly due to the effect of the 15-cm. howitzer in 1914. I refer, of course, to the manner in which the enemy fought for observation right from the beginning and to the persistence with which our minds stuck to the idea, first germinated in 1914, of getting our most advanced lines on to reverse slopes and thus giving up all observation, and incidentally, very often gun positions as well.

The 1914 line, *i.e.*, the Ypres heights, Messines, Aubers Ridge, Notre Dame de Lorette, the Somme, etc., shows nearly all the dominating ground in the hands of the enemy; in some cases only obtained by hard fighting.

The result of this was that gun positions were exceedingly difficult to find, and later on our batteries went into

THE DEVELOPMENT OF ARTILLERY TACTICS

action (practically speaking) in the open, or huddled together in the few available valleys.

The Somme valleys in 1916 often held four tiers of field guns. In 1917 practically no flash cover was available in the Ypres salient at the commencement of the battle.

The moral effect of the 5.9" remained with us even in 1918. The trenches hurriedly dug across France in April and May of that year were often sited on reverse slopes; all observation being given up to the enemy.

These views first made their appearance in the war, in a pamphlet published on October 30, 1914. The author therein states:

"Your trenches must be sited on the backward slopes, and they must be concealed, not only from the artillery fire itself, but also if possible, from observation by the observers so that the artillery fire cannot be directed on them."

"Leave yourself anything over 100 yards field of fire."

The author is not very clear in his meaning as regards the artillery fire, but the moral effect of the 5.9" is very clear.

The reverse slope in 1914 was a tactical disadvantage forced upon us as a penalty for going to war with an artillery inferior in range and shell power to that of the enemy.

Although the artillery situation had been reversed long before 1918, the moral effect of our initial mistake remained with us up to that year.

- ii. The comparative failure, on the other hand, of the German 15-pounder field gun and the successes gained by the British 18-pounder had far-reaching results.

On certain occasions, during 1914 the line was held in places by the fire of 18-pounders, even after the infantry in front had all been placed "*hors de combat*."

The masses in which the enemy advanced, made themselves particularly vulnerable to shrapnel and firmly established the 18-pounder in its position.

This was a great advantage to us, as manufacture could proceed on a well-known and well-tested type of gun and no wastage or delay occurred through changes in construction.

The enemy, on the other hand, was inclined to develop along howitzer lines on account of the success of the 5.9"s. So that when the day arrived in which attacks were made under artillery covering fire alone, or barrages as we call them, the Germans suffered under the disadvantage of not being able to get close to their howitzer barrage. They had

THE FIELD ARTILLERY JOURNAL

field guns in the barrage but never enough to make field gun creeping barrages as we did.

iii. The introduction of night firing as a normal procedure was a new feature in warfare and from this evolved the following:

(a) Harassing fire.

(b) The S.O.S.

Both were going in a modified form in 1914. Harassing fire was carried out as far as ammunition permitted. Some of the approach trenches before Neuve Chappelle were dug under cover of specially ordered harassing fire or night bombardment; guns being placed in specially selected positions for the purpose. The S.O.S. was not known as such, but batteries were prepared to fire on night lines, if rifle fire broke out in an intense fashion from the front line.

The former developed into a very important tactical feature in all our battles and was of great assistance to us, but the later caused enormous waste of ammunition and in 1918 became a positive danger to us. I will deal with this at length later on.

iv. Finally we come to wire. Thick belts of wire were a new feature in field warfare, as it had been held that its use would be limited to what could be gathered locally. Its immediate effect was to stabilize the front. It had, however, a greater tactical effect even than that. For a long time strategical surprise was an impossibility. The wire had always to be cut before an attack, and since it could not be cut in a serious manner all along the front, the real zone of attack was fairly clearly defined.

The introduction of tanks again made the strategical surprise possible, and ended for us the era for wire. The Germans never suffered from our wire as we did from theirs. If they had, the tactics of their attacks in 1918 must have been very different to those employed. No infantry ever dared to attack successive belts of steel wire without either previous cutting or the aid of tanks.

Another effect the enemy wire had on us was over bombardment. So long as any wire showed on a photo, the artillery was kept on cutting. The size of the zones of the various wire cutting equipments was not so well known to the general staff in those days as they are today, otherwise possibly it would not have been done; but it grew into a habit and as it generally rained during battles, it produced the fifth element, mud; which offered a more effective resistance to our advance than anything the enemy ever did.

THE DEVELOPMENT OF ARTILLERY TACTICS

We are thus, by the end of 1914, beginning to see standing out some of the main factors on which our tactics developed.

- i. Our faith in the field gun.
- ii. The power of the enemy howitzers, and hence our counter by bigger and more numerous howitzers.
- iii. The power of wire and hence the introduction of the tank to make surprise possible.
- iv. Our bid for superiority in moral by the extended use of harassing fire and in fact the almost continuous artillery offensive right up to the end of the war.

CHAPTER II. 1915

1915 was a year of growth, training and experiment and laid the foundation of the tactics of later years.

Beginnings were made in many things such as attack barrages, counter-battery work, centralized artillery command, aeroplane coöperation, sound ranging and flash spotting, but neither the time nor the material was available in order to produce successful solutions to the artillery problems of that year. It is therefore not to be wondered at that the artillery and infantry coöperation, which was one of the great features of 1916, was largely absent during this year.

The attacks were very costly, as we all know, which fact can, I think, be ascribed to the endeavor to force a decision by man power without first obtaining superiority of fire.

Four points stand out in 1915 which had great influence on the development of our tactics.

- i. The power of the German machine gun.
- ii. The strength of the German artillery, which was still more powerful than our own.
- iii. Our divided system of artillery command.
- iv. The very limited ammunition supply.

The German machine guns swept away attack after attack and were as effective at Loos as in the earlier battles of the year. The field artillery covering fire lifted from trench to trench and through inexperience of map shooting sometimes missed the trench altogether.

This led to the creeping barrage which was used on at least one divisional front at Loos.

The "yards to the gun" varied a good deal during this year, which points to the fact that the artillery was still considered a subsidiary arm.

At Neuve Chapelle we had one 18-pounder every 6 yards; at Loos, one every 40 yards.

THE FIELD ARTILLERY JOURNAL

The difference in the casualties of the first attack in each case was what one would have expected in later years.

Counter-battery work in 1915 was in a very rudimentary state. It was carried out by the divisional artillery, various formations of heavy artillery, R.F.C. and field survey companies, all working on their own, without any appointed coördinating authority. Beginnings, however, were made, which evolved into the counter-battery staff officer of 1916.

The artillery organization at the battle of Loos was as follows:

- i. Field artillery under divisional control.
- ii. Brigades Royal Garrison Artillery (60-pounders and 6" howitzers) under corps control.
- iii. Heavy artillery reserve allotted by General Headquarters to Armies (6" guns and heavy howitzers).

There was no official appointment of a General Officer commanding Royal Artillery corps, or a corps heavy artillery commander. Consequently it was exceedingly difficult to coördinate the operations of the infantry,

Date	Battle	18-Pounder	6" Howitzer
Sept. 25th	Hooge, 1915	100 R.P.G.	.....
Sept. 22nd, } 23rd, 24th }	Hooge, 1915	33 R.P.G. per day	.....
Sept. 25th	Loos, 1915	.....	About 200 R.P.G. whole operation including 4 days' bombardment. 50 R.P.G.
Sept. 15th	Courcelette, 1916	235 R.P.G.	52 R.P.G. per day.
Sept. 15th, } 16th, 17th }	Courcelette, 1916	146 R.P.G. per day	185 R.P.G.
Nov. 13th	Beaumont Hamel, 1916	270 R.P.G.	116 R.P.G. per day.
Nov. 13th, } 14th, 15th }	Beaumont Hamel, 1916	216 R.P.G. per day	

field artillery and various forms of heavy artillery; or to insure that the counter-battery work carried out was that most calculated to assist either the infantry or the rest of the artillery in the actual battle.

The amount of ammunition expended in the battles of the year made the result almost a foregone conclusion when compared with what was required to achieve success in 1916.

The comparatively small expenditures were due to the fact that ammunition did not exist in sufficient quantities to achieve the object in view.

The lesson was therefore learnt that it is hopeless to engage infantry in battles unless the requisite amount of gun ammunition is available. If this amount is not in the country or through difficulties in transportation is not at the guns, then the battle must be postponed. In other words, it is just as important for a modern commander to count his shell as his bayonets.

The foregoing figures emphasize this point.

THE DEVELOPMENT OF ARTILLERY TACTICS

The quiet times of 1915 provided very favorable soil for the cultivation of the S.O.S. which in point of speed attained great proficiency.

Although extremely wasteful of ammunition and energy, this form of the S.O.S. in the great battles of 1916–17 at times achieved its object in withering local counter-attacks.

In the defensive battles of 1918 it was destined, however, to rob the artillery of all offensive power, since the presence of a German reconnoitring patrol, in those anxious times, was sufficient to cause the S.O.S. signal to be sent up.

The artillery, in consequence, was automatically taken from counter-preparation, *i.e.*, offensive action against the enemy's assembly, to carry out a useless ploughing up of "No Man's Land."

By the end of 1915 we had reached the following state of development:

- i. Artillery covering fire had practically replaced rifle covering fire. The infantry, however, had not learnt to hug the barrage or to form a tactical offensive with it.
- ii. Although the appointment of General Officer commanding Royal Artillery corps had been made, it was cancelled before the end of the year. The absolute necessity of some executive authority to control the various operations of the growing masses of artillery within the corps, made the return of the appointment a practical certainty.
- iii. The pre-war standard of so many guns to the 1000 infantry was being upset. We were beginning to look at the difficulties before us, and to calculate the fire power which was required to overcome these difficulties.

This gradually evolved, as regards the 18-pounder into the so many yards per gun standard.

There is, perhaps, nowadays a tendency to regard any chosen figure in that standard as a kind of Ju Ju to insure success, forgetting that it was never more than an average on a certain standard of defense, *i.e.*, the German in France.

- iv. Counter-battery work was recognized as a separate tactical operation of the artillery, requiring special organization. The way was thus cleared for the temporary organizations prepared for the Somme, which later consolidated in the creation of a regular counter-battery staff.

CHAPTER III. 1916

1916 was a year of great development. This was made possible by the experience gained in 1915 and by the increased resources in guns and ammunition.

The preparations for the Somme began in April. Elaborate but

THE FIELD ARTILLERY JOURNAL

unsuccessful attempts were made to keep it secret. The assembly of the artillery was made by night and fire was carefully regulated to cover the registration.

Elaborate measures were, however, taken to protect the batteries from the German artillery; overhead cover being constructed for even 60-pounders and 6-inch howitzers. This was due partly to the fear that the German artillery would interfere with our bombardment; partly to our lack of confidence in the real efficacy of counter-battery work, and also largely to the fact that many of our positions were devoid of flash cover. The latter was, of course, due to the fact that the enemy held all the high ground. This extensive protection fell into disuse later on, as it was found that it gave away the battery positions; and that it was better to depend upon camouflage of the actual position, combined with the provision of dug-outs in the vicinity. Elaborate arrangements were also made for the protection of observation posts and their telephonic communications. It was impossible to construct separate observation posts for all batteries, so that arrangements had to be made by the corps for batteries to be allotted to a certain observation post, and a certain battery to be made responsible for its maintenance. This practice was quite valuable in certain cases in bringing the heavy and field artillery together.

The difficulties in organizing the communications for all this artillery, without complete expert supervision was one of the chief causes which led to the provision of the various artillery signal units and to their eventual taking over by the Signal service. The heavy artillery communications for the Somme, were laid out entirely by artillery officers, except in those cases where good liaison had extracted an officer from the corps signal company.

The chief points in the artillery plan of attack were as follows:

- i. Five days' bombardment (increased to seven) in order to destroy machine guns and strong points, and to cut wire.
- ii. Counter-battery work of an intensive character during the bombardment.
- iii. Continuous harassing fire.

Arrangements have to be made in a bombardment of this nature for the hostile area to be divided into zones of a suitable size, say 500 yards \times 500 yards, according to the locality, range, etc., so that fire may be observed. These sub-areas are allotted to units at certain hours during which time all other batteries are warned off. The wire was cut by this means, but the bombardment by aerial observation was not entirely satisfactory. This was due partly to the lack of practice in observation on the part of observers but chiefly to lack of experience in the organization of this class of fighting.

THE DEVELOPMENT OF ARTILLERY TACTICS

This greatly improved in 1917 owing to more efficient staff work. These programmes require very good staff work, as they are long and full of detail, much of which has to be filled in for the next days' shooting after the effect of the preceding day's fire is known or can be judged. The work has therefore to be both quick and accurate.

Counter-battery work was carried out by means of shoots observed from the air. Failures due to lack of experience, bad staff work, and faults in wireless were fairly frequent, and the efficiency of the work varied a good deal. Howitzers were beginning to be used for this work but the 60-pounders were the rule for neutralization. Concentrations were also initiated.

Harassing fire was kept up really continuously for seven days and had an overpowering effect. The enemy were confined to their dug-outs, and it was only the magnificence of these, which saved them from annihilation. Battle harassing fire was successfully used on the day of attack. A case is on record of a certain German battalion which detrained one morning at Bapaume during the first few days of the Somme. During detrainment two carriages were hit by a 12-inch gun engaged in battle harassing fire. The battalion then advanced down the Bapaume—Pozières Road. Considerable losses were suffered during this advance, first by 6-inch guns, then by 60-pounders, and later by 18-pounder harassing fire. At Pozières the battalion took to the communication trenches and advanced towards Fricourt, losing men all the way. The commanding officer and the remains of his battalion—some forty men—were eventually captured about 4 P.M. the same day in Railway Wood, a short distance east of Fricourt.

The attack on July 1st was supported by an 18-pounder per 25 yards and a heavy gun or howitzer every 58 yards. It was therefore the first battle fought under modern conditions of size, frontage, number of troops employed, etc. Consequently the study of this battle produces many points which had a direct bearing on the future tactics of the campaign, and formed the real foundation, on which modern artillery tactics are built up.

The creeping or rolling barrage, as it was called at that time, came down in No Man's Land and then lifted on to the front line trench. The lifts were then made from trench to trench on a time table. If the space between the trenches was considerable the fire raked back at such a pace as would keep it in front of the infantry. The barrage was really made by the division, the corps laying down the times of the main lifts. This caused difficulties; as the corps, in laying down points of junction, had to consider the whole barrage; so that very shortly it became the custom for the corps to issue

THE FIELD ARTILLERY JOURNAL

complete barrage orders. Considerable difficulties were encountered at the flanks of corps, as corps were expected to agree amongst themselves as to their barrage lines. Later on this was overcome by the issue of Army barrage maps giving the main timings; but nothing of this kind had been started by July 1st. The heavy artillery during the barrage was employed in bombarding trench lines well behind the rolling barrage, and in neutralizing counter-battery work. This bombardment lifted back from trench to trench but had no idea of creeping about it.

Where failure occurred on July 1st, it was generally held to be due to one or more of the following three causes:

- i. Undamaged hostile machine guns in heavily concreted emplacements.
- ii. Hostile machine guns being unneutralized on account of the pace of the barrage being too fast. In certain cases the pace expected was very optimistic.
- iii. Ineffective counter-battery work during the bombardment period which occasioned very heavy losses amongst our infantry during their assembly.

The hostile machine guns were at first, of two types, but by September, 1916, three had appeared, *viz*:

- i. The machine gun in a heavily concreted emplacement.
- ii. The machine gun which waited in a deep dug-out till the barrage had passed and then appeared.
- iii. The machine gun placed in a shell hole outside the trench, at first solely with a view to avoiding our barrage and bombardment.

The first kind had been known in 1915 and organization existed for spotting it. With the influx of heavy howitzers we were well provided with the means of dealing with it. After July 1st they did not give much trouble on the Somme. The machine gun in a deep dug-out was a new proposition and led to the perfecting of our present method of attacking under a barrage. The infantry, at this time, were not imbued with the necessity of keeping close to the barrage. Special training was started for this purpose and also the form of the barrage was reviewed. It was necessary to keep the trench, about to be attacked, under fire along its whole length since it was not always certain, at that time, where the dug-outs were. We thus required an 18-pounder every 25 yards as this is the average spread of the bullets from one shell. Practice barrages could be indulged in, and the line of each gun was thereby established with great accuracy. This system further evolved into letting

THE DEVELOPMENT OF ARTILLERY TACTICS

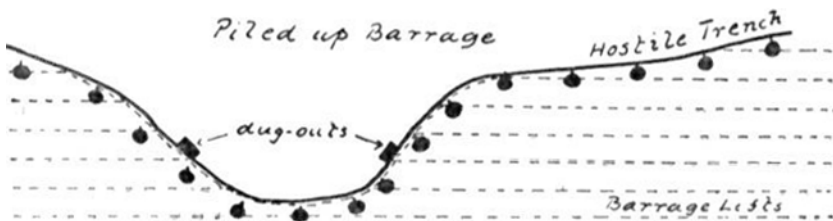
the infantry into the objective trench at the same time along its whole length for the following reasons:

When the barrage rolled straight back, it was found that some dug-outs were always in such a position that they were comparatively free from our



fire and yet unassaulted by our infantry. The enemy then manned their machine guns and by firing to a flank wiped out our advancing lines.

The barrage was piled up on the trench to be assaulted. Those infantry destined to assault the extreme salient, lay down until the whole trench line



was ready to be attacked. The whole trench was then assaulted at the same moment. All the hostile dug-outs were thus kept under fire until the last possible moment, and all attacked simultaneously.

The point to be noticed is that this piling up of the barrage on an objective was designed to meet the special form of fortification which was before us at that time and is no argument for barrage of this nature being required under other circumstances.

The actual moment of attack was concealed by care on the part of the infantry as regards noise, showing of bayonets, etc.; and on the part of the artillery by firing in such a manner as either not to alarm the enemy right up to zero, or else by a series of feints to deceive him into crying "Wolf." In this manner, towards the end of the Somme, it was possible to bring off small operations with no casualties outside the enemy's trenches.

The machine gun in the shell hole appeared towards the end of August, 1916. This led to the creeping barrage being established across the whole front as the normal method of attack and to the standardization of the 100 yards lift. It was impossible to locate these machine guns accurately, as they came out of the trenches to

THE FIELD ARTILLERY JOURNAL

avoid our bombardment of the latter. The enemy were also losing faith in the deep dug-out, as the close coöperation established between the infantry and the artillery by means of the piled up barrage merely made the dug-outs so many traps for the trench garrison. It was therefore necessary to sweep the whole ground both before and during an attack. This was done with shrapnel, as it was found that the bullets got down into the shell holes better than high explosive. It is interesting to note, that in 1917 the French in Flanders, came to use shrapnel for this purpose, in spite of the disadvantages of their equipment. I do not propose to enter further into the shrapnel and high explosive controversy, as each projectile has its special uses, and neither will fulfil all requirements.

A careful examination of the ground after certain attacks at this time, notably Courcellette, September 15, 1916, established the fact that 100-yard lifts at 100 yards in three minutes, were perfectly efficient in searching the whole terrain passed over. The enemy machine gunners were found dead in their shell holes, killed by shrapnel, and the cases were evenly distributed over the whole area in such a manner that the spread of the bullets must have searched every shell hole. From this time forward 100 yards became the normal lift in all attacks, except when it was necessary to pile up on the objective. Then, of course, the exact range had to be put on in order to get the mean point of impact onto the target.

Attacks at this time were commonly made at 100 yards in three minutes, becoming slower as the autumn advanced and the ground became more sodden. I do not think that they ever got slower than 100 yards in five minutes during this year.

This matter of pace is a very important one. Too fast a pace causes the barrage to run away from the infantry, and the automatic coöperation between the two arms ceases. Too slow a pace causes more ammunition to be fired than necessary. The battle may have been postponed 24 hours to collect this extra ammunition. This respite may very probably enable the enemy to resist an attack, under which he would have broken down 24 hours previously.

In 1917, as will be shown later, the increased slowness of our attacks enabled the enemy to evolve a system of counter-attack, which started automatically from our zero hour!

The whole question of barrages was thoroughly thrashed out this year.

The result may be summarized as follows:

- i. The corps must settle the main timings and lifts of the barrage. Within these limits, divisions settle their own details.

Any other system led to continual conferences and bickerings between divisions, with consequent loss of time.

THE DEVELOPMENT OF ARTILLERY TACTICS

- ii. The barrage map must be printed or hectographed by corps in sufficient numbers for all requiring it. This again is a time-saving device.
- iii. Before the corps can do the above, divisions must state their wishes regarding:
 - (a) The infantry forming up line.
 - (b) The pace of the barrage.
 - (c) The time they want to wait on the various objectives.

The corps commander gives a decision in any case of disagreement and the final decision on the above three points is given to the General Officer commanding Royal Artillery Corps. The barrage is then prepared and printed.

Matters did not go so smoothly as the above in 1916 for the following reasons:

- i. The infantry did not at first realize that slight alterations in the forming-up line, could throw out the whole barrage with consequent loss of efficiency.
- ii. The above three points were not always settled sufficiently early for the barrage orders to get to batteries in time for an efficient barrage to be prepared.
- iii. The infantry also did not realize that an overestimation of the speed of the attack, is worse than an underestimation from the point of view of accuracy of fire; since in the former case a few shells have to be added at the last moment to each lift.

The battles in the autumn (Beaumont Hamel) saw the introduction of the heavy artillery into the creeping barrage. Corps control was now a real factor. Coöperation in the attack between infantry and heavy artillery became a possibility so that from now onwards, we find the heavy artillery firing up lanes exactly in the same manner as the field artillery. The advantage of this lies in the fact that the objective is subjected to a much more prolonged and continuous fire than was the case formerly, when only the field artillery were used in the actual attack barrage.

During this time counter-battery work greatly improved and was established on modern lines. To get efficient work, you must have an office or headquarters whose definite responsibility lies in the defeat of the enemy's artillery; the C.B.S.O. therefore came into being. His headquarters must consist of two parts: the operations branch and the intelligence branch.

As I have pointed out before, we had various organizations studying the hostile artillery, with no real coördinating authority. About this time great advances were made.

- i. The Counter-battery Staff Officer made himself responsible for the enemy's artillery.

THE FIELD ARTILLERY JOURNAL

- ii. The headquarters of the sound ranging section and observation group were located either with or close to the Counter-battery Staff Officer, so that all their information was immediately available for the man who wanted to use it.
- iii. An artillery officer was sent to the Corps squadron Royal Flying Corps for the purpose of examining pilots and observers immediately after landing and for telephoning this information at once to the Counter-battery Staff Officer.
- iv. The artillery intelligence service started at corps and army headquarters in order to provide a coördinating centre for all this information and to make the required deductions from it.
- v. Trust was established in these various organizations by the fact that the General Officer Commanding Royal Artillery of the army made himself responsible for the various lists and maps, which were sent out. He was enabled to do this by his own "I" staff and that of the field survey company, working in the closest coöperation, often in the same building, although at this date he was not officially held responsible for having any cognizance of the fact that the hostile artillery existed.

Counter-battery work developed during the first battle of the Somme, into its present three main tactical divisions.

- i. Shoots for destruction with aeroplane observation. The German artillery was definitely mastered on the Somme by this means, and hostile counter-battery work practically ceased. Coöperation between the air and the guns was not, even in 1916, by any means perfect. It was not till the end of 1917 that the regulations existing at present had been fully worked out. We are nowadays in a very rudimentary state as regards counter-battery work in open warfare. The lesson of the Somme, in this respect, is that advances can only be made by the training of the air and the guns being made in the closest coöperation, and with actual shell.
- ii. Concentrations for destruction.

These concentrations were started in order to endeavor to destroy the enemy, when the observation from the air was either climatically impossible or machines were not available.

Methods were continually improved until this form of attack became very formidable. On one occasion in 1917 a village, filled with heavily concreted batteries, which all other methods had failed to subdue, was completely evacuated by the hostile artillery after a super-concentration.

Practically all the guns of two corps on a battle front,

THE DEVELOPMENT OF ARTILLERY TACTICS

bombarded the village for an hour. The concentrated concussions completely destroyed it.

iii. Neutralization.

This had commenced very early in the war. The improved methods of artillery intelligence now began to make battle neutralization a possibility. The enemy's barrage or other dangerous batteries were spotted and heavily attacked at zero hour.

The protection of the infantry assembly also began to be a counter-battery possibility on account of the improved intelligence at our disposal. The General Officer commanding Royal Artillery Corps thus began to coördinate the counter-battery work with the operations of the infantry, and was able to ensure that its activities were directed at the same objective as the rest of the forces of the corps.

The harassing fire carried out during the seven days' bombardment at the commencement of the Somme had been very successful. Two British soldiers, captured during this period, remained in a front line dug-out until the day of attack, as it was quite impossible to evacuate either them or their information.

During the battle, harassing fire was further developed, with the result that artillery and the intelligence branch of the staff came into very close touch. Special harassing fire maps, showing the localities where the best results might be expected from intelligent fire of this nature, were first printed at this period.

The state of the Somme battlefield when the enemy evacuated it the following spring conclusively proved the value of this form of fire, when there is ammunition to spare beyond that required for actual attacks. It was therefore continued and improved throughout 1917 and 1918. It was largely this form of fire, in 1918, which made the salient around Merville such a costly operation to the enemy.

Long-range gun fire was conducted without any definite battle policy at this period. The guns were used chiefly for harassing fire. On July the 1st, von Stein's Headquarters (XIV Corps) at Bapaume were hit by 12-inch shells and Corps Headquarters moved that day to Le Transloy. The move was discovered from a captured order and a long-range gun caused another move. The corps then retired beyond the range of our guns.

Considerable disorganization was caused by this success. Reinforcements, moving up to the battle, received no maps and no information, so that the confusion was considerable.

Nevertheless the long-range gun shelling of headquarters is of very doubtful value. It is extremely difficult to select the right moment for the shelling, and even then it is very fortunate if the

THE FIELD ARTILLERY JOURNAL

shelling is sufficiently accurate to cause a move such as that of the XIV German Corps.

These guns were not really brought into coöperation with the other arms till the following year.

All the above had of course great effect on infantry training and as usual, we went to extremes. The infantry learnt to follow the barrage with the greatest dash and often got in with a few or no casualties. The bomb then practically replaced the rifle, so that no exploitation took place beyond the range of the guns. This loss of musketry was to have a very serious effect later on. It was partly due no doubt to the losses we had suffered at Loos and on July 1st, which had reduced many battalions to a very low ebb as regards trained subaltern officers.

By the end of 1916 the following state of development had been reached:

- i. Before plans for a battle could be made, it was essential to know the minimum amount of artillery which would be available. This limited the scope of the operations. The artillery then formed the frame-work on which the proposed operations were built up. Simplicity in arrangement, observation facilities and telephonic communication was then the main point to be sought for. Enfilade fire in mass is thus unsuitable for major operations.
- ii. The destruction of the hostile communications is one of the chief objectives to be sought after in any bombardment.
- iii. Where German wire existed, no hurricane bombardment had been deemed sufficient preparation for an attack.
- iv. The necessity for a centralized artillery command was fully realized in order to:
 - (a) Control all the fire so that the element of surprise, so essential at zero, could be brought about by the action of the artillery.
 - (b) To coördinate all the artillery fire at zero so as to obtain the maximum effect in the attack from the infantry, field artillery and heavy artillery and to direct the counter-battery artillery so as to assist the operations to the utmost.
 - (c) To lay down a definite artillery policy between battles so as to cause the enemy the maximum number of casualties both by harassing fire and counter-battery work.
- v. The chief danger spot in any attack is the infantry forming up place. If surprise is achieved at zero, the hostile guns need not be feared till either a halt is made on an intermediate objective, or the final objective is reached.
- vi. Zero hour is the hour at which the artillery barrage opens.

THE DEVELOPMENT OF ARTILLERY TACTICS

- vii. The artillery undertook the duty of driving off the enemy's counter-attack within its range by means of the protective barrage, and to a limited extent during this year, by means of calls from the air.
- viii. The fact that the artillery provided the fire and the infantry the movement was almost a principle at the end of the Somme.
- ix. The number of shell you could put into the front line was as much a tactical matter of importance as the number of infantry. The fact of whether you could have a battle at all and always when you could have it, depended on ammunition supply. This will constantly recur, and staffs must be prepared to make estimates both as regards the total amounts required for a battle, and for the time it takes to collect it at the guns. With practice these estimates can be made to very close figures.
- x. It was apparent that ammunition expenditure always tended to increase—this went on through the whole war and during the mobile operations of 1918 was greatest of all.
- xi. It was also apparent that no roads could stand the ammunition transport and that light railways must largely replace roads in 1917.
- xii. Ordnance workshops—both as regards their output and location became a tactical matter, as it had a direct bearing on the efficiency of the barrage. Output had to be regulated so that the shops were as empty as possible on battle days, and time had therefore to be saved by their location as near to the fighting as it was possible to put them.
- xiii. Gas shell was beginning to be used, but the quantities available were not sufficient for any definite results to be achieved.
- xiv. Lack of information in battle still remained one of the greatest difficulties of the artillery. Liaison between the infantry and the artillery was still one-sided; more experience in battle was still required to make it a mutual affair.
- xv. Finally the German machine gun had appeared as our greatest enemy; and our minds were firmly fixed on it as our chief tactical objective.

The enemy appreciated the situation as follows during the winter 1916–1917.

- i. The effect of the British artillery fire had been overwhelming both as regards moral and in actual casualties. The tone of the people in Germany had been changed from the great optimism after Verdun to deep depression.

THE FIELD ARTILLERY JOURNAL

- ii. Their method of disputing each trench with strong garrisons had caused them great losses both in killed and prisoners.
- iii. There was little hope of competing with us in the supply of artillery matériel or of personnel to man the batteries if made, on account of the claims made by their Eastern and Western fronts.
- iv. The one bright spot was the German machine gun.
- v. Tactics must therefore be amended so as to nullify the effect of our artillery, both as regards the German infantry, machine guns and artillery; and to tempt our infantry beyond the support of our guns so as to place them on an equality with the German infantry.

This was of course unknown to us at the time and we had become stereotyped in our methods—the Germans had never changed their style all through the war and were considered to be very conservative. We had apparently found a method of war, which if correctly applied met with success. We therefore stuck to it, and in fact, forgot the old Chinese maxim "Once a strategem has been successful never repeat it."

(To be concluded.)

A SIMPLIFIED WAR GAME

BY MAJOR SHERMAN MILES, FIELD ARTILLERY

THIS is an attempt to devise a game based on the principles of war—a game, mind you, not a study. There must not be a single umpire about. The rules must cover all questions on what may or may not be done, and decide losses; and yet they must not be too long or too complicated. And the paraphernalia used in the game must be simple.

Obviously the minutiae of modern tactics cannot enter into such a game. Questions of the powers and limitations of the different arms, of the effects of fire, or terrain and of morale are too complicated to admit of any such simplification as this game involves. But the basic principles of strategy and of logistics, the fundamental principles of war, are now headed up under nine words. They lend themselves to sufficient simplification and conventionalization for our purposes.

Chess, in a sense, is a simplified war game. But chess stresses tactics—the powers and limitations of the different pieces—and tactics which have little relation to the complications of the modern battlefield.

Furthermore, chess forces a move on each player in turn, and that move is made against an immobilized enemy, one who cannot move while you are deciding upon and making your play. In war, on the contrary, you may move any or all or none of your forces, and your opponent may, and often does move while you are moving. The distinction is vital. For a decision based on the certainty that you have your enemy pinned to the ground until after you have shot your bolt is altogether different from one based on the assumption that your enemy is at the same time free to make and carry out a decision of his own.

Nevertheless there is in chess something which has given it life through many thousands of years and made it the most successful game ever devised. It enables a player to handle different forces by conventionalizing the powers and limitations of those forces. Take the knight, for instance. Why should not a knight who has rested a while on a certain square and is perfectly fresh, make a forced march and move, not two squares and one, but four squares and two? He might do it in war. Or why should not a good husky bishop, sliding along his diagonal, hop over a piece now and then? Divisions leap-frog each other. The answer is that, in conventionalizing the average moves of the pieces by a relatively small number of fixed

THE FIELD ARTILLERY JOURNAL

rules, you get a workable game, you get average forces simulating average conditions, and you make broad and basic principles, even though they be followed unconsciously, the only sure road to success.

So we imitate chess in conventionalizing the possibilities of war of movement into a relatively small number of rules, and in fixing on average powers, limitations and results. We depart from chess in that we neither force movement nor limit it by alternate plays. And then we let Nature, disguised as the nine basic principles of war, take its course.

THE GAME

The object of the game is the defeat of the enemy's main forces, a defeat which must be made evident by the capture and occupation of the enemy's capital. Should either side fail to guard his capital (which is also his base), his opponent may win the game by seizing the hostile capital and holding it for one day, even though a decision between the main opposing forces has not been reached.

Two players, whom we will call Black and White, sit down opposite each other, a conventionalized map of the theatre of war between them. This map is made by taking a square of cardboard, or anything else that lends itself to the support of pins, and marking on it roads and cross-roads practically at random (see the illustrations). There is no movement allowed in the game except by these roads, so they should be diversified. At opposite corners of the map are two capitals, or bases (in the illustrations they are marked 1 and 14, the upper left and the lower right hand corner).

At convenient points on the map are laid off a cavalry march (18 miles), an infantry march (12 miles), and "striking distance" (6 miles). The latter will be explained further on. (In the illustrations these scales show in the lower right hand corner, in the triangle 11, 12, 13.)

Each player has, say, 15 pins whose heads are colored black and white, respectively, and marked A, B, C, etc., and Z, Y, X, etc.—or else they are ordinary pins bearing black and white tags which are lettered to identify the different forces. A pair of dividers, a pencil and a notebook to each player completes the necessary paraphernalia.

Black and White agree on, say, 100,000 infantry, 30,000 cavalry and 30,000 artillery each. The artillery may march with either the infantry or the cavalry, but may not exceed 20 per cent. of any one force. To introduce a factor of surprise, and also to represent the great fire mobility of artillery, the battle strength of artillery is counted as double its actual strength. The battle strength of cavalry is taken as three-fifths its actual strength. The battle strength of infantry equals its actual strength.

Now comes the organization of the forces. The potential forces of

A SIMPLIFIED WAR GAME

Black and White are equal—100,000 infantry, 30,000 cavalry and 30,000 artillery each. But a factor of surprise must be introduced. So before the moves begin (but at no other time) both sides are allowed to convert their forces on the basis of 1 artillery equals 2 cavalry equals 2 infantry. For example. White can take 10,000 of his infantry and convert them into 10,000 cavalry. As cavalry they may march 18 miles a day instead of 12, but in battle they will count only as 6,000 men instead of 10,000. So one player may sacrifice battle strength to gain mobility while the other may sacrifice mobility to gain battle strength. And neither knows how his opponent has organized his forces until he feels him out in battle, as will appear later.

Logistics enter into the organization of the forces and rule that not more than 25,000 men, actual strength, may march along any one road on any one day. Hence there is no use of having any one mobile force of over 25,000 men.

On the basis of the above, and remembering that the artillery component of any force cannot exceed one-fifth its total actual strength, we will suppose that Black and White organize as follows:

BLACK (110,000 inf., 20,000 cav. and 30,000 arty.)			WHITE (90,000 inf., 40,000 cav. and 30,000 arty.)		
Forces	Actual Strength	Battle Strength	Forces	Actual Strength	Battle Strength
O	20,000 inf. 5,000 arty.	30,000	A	20,000 cav. 5,000 arty.	22,000
T	20,000 inf. 5,000 arty.	30,000	B	20,000 inf. 5,000 arty.	30,000
U	20,000 inf. 5,000 arty.	30,000	C	20,000 inf. 5,000 arty.	30,000
V	15,000 inf. 3,000 arty.	21,000	D	20,000 inf. 5,000 arty.	30,000
X	20,000 cav. 5,000 arty.	22,000	F	20,000 cav. 5,000 arty.	22,000
Y	20,000 inf. 5,000 arty.	30,000	K	10,000 inf. 1,000 arty.	12,000
Z	15,000 inf. 2,000 arty.	19,000	L	20,000 inf. 4,000 arty.	28,000
Total battle strength		182,000	Total battle strength		174,000

Each player enters in his notebook his own organization.

Then both players, simultaneously, concentrate their forces as they see fit, along lines previously agreed upon. We will say these lines are: Black—4-31-82-70-18, White—10-42-44-51-65-22. The concentration may then be as shown in Fig. 1.

Now the moves begin. Each move corresponds to a day's march.

THE FIELD ARTILLERY JOURNAL

In each move both players simultaneously, may move any or all of their forces, all or any part of the day's march laid down for that force, or they may move none of their forces. This liberty of action is, however, conditioned by certain rules of logistics, such as those which forbid the crossing of forces on the march and the march of more than 25,000 men along any one road on any one day; it is also, of course, conditioned by what the enemy may do.

Starting with the concentration, Fig. 1, we will assume that it represents the dispositions at dawn on the first day, July 1st. Black's general plan is to

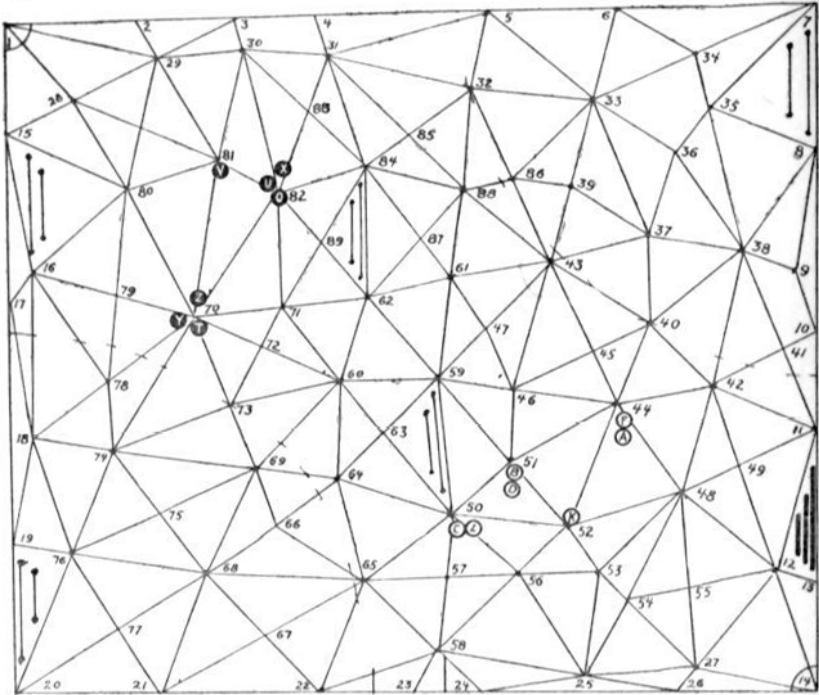


FIG. 1.—THE CONCENTRATION. DAWN, JULY 1ST.

advance in a compact mass to the line 62-60, with a flanking detachment at 87. From this line he hopes to be able to throw the bulk of his forces onto the enemy wherever he can engage the enemy's main forces to advantage. White's general plan is to use his strong cavalry divisions, A and F, to work around Black's left flank, by the roads 44-43-31 and 44-40-43-32-31, while he engages the attention of Black somewhere on the line 47-63. White may then either press A and F forward to capture Black's capital or recall A and F and force general battle after Black has sent off strong detachments to guard his capital. These general plans must be borne in mind in order to understand the moves that follow.

But before beginning the moves, let us see what information each side has. Take Black—he knows his own general plan and also the

A SIMPLIFIED WAR GAME

organization and disposition of his forces (which he presumably has shaped to his plan). He knows nothing of White's plans, so far, save what he may guess from White's dispositions, which are now laid out before him by the pins on the map. On White's organization and strength he has certain general indications, for he may ask White to state the battle strength of the White forces, and White must comply by giving the real battle strength of each force plus 5,000, or the real battle strength less 5,000, or any number between. For example, the weak White force K, actually 12,000 battle

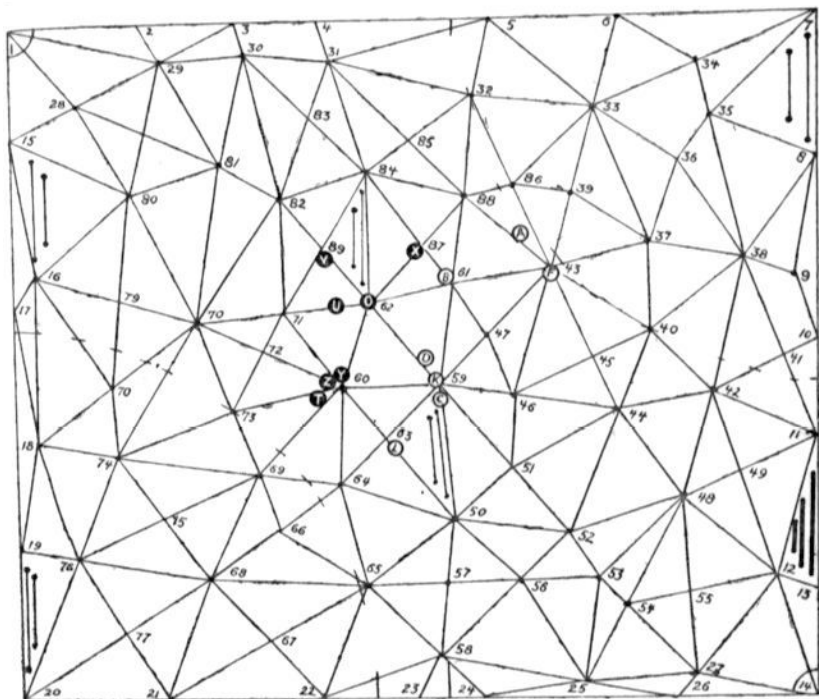


FIG. 2.—THE POSITIONS AT 2 P. M. JULY 3RD.

strength, cannot pose as more than 17,000 or less than 7,000. Black does not know which are White's mounted forces, nor will he know until White chooses to march them their full cavalry marches or until they are engaged in battle. In short, Black knows all about his own plans and forces, but has, so far, only vague indications of those of the enemy.

Now let us take the first move. Black and White write out their orders—a very simple process once their decisions are made. Each has in his notebook a page ruled in vertical columns. In the left hand column, one above the other, are the letters representing his forces—A, B, C, etc. In the next column, opposite the appropriate letter, he simply writes the number of the cross-road (or cross-roads) that force is to march on, indicating, if necessary, what part of a full day's

THE FIELD ARTILLERY JOURNAL

march the force is to make. And so on, in each succeeding column, for the successive moves.

The orders for the first move having been written, the players simultaneously execute their moves. And so on for successive moves. (NOTE: If the play is too slow, the players should agree on a time limit for each decision and move.)

Fig. 2 shows the opposing forces at the end of the third move, which we will call 2 P.M., July 3rd. Neither side has disclosed its mounted forces by moving them full cavalry marches. The intentions of the enemy are revealed to either side only by deductions from the enemy dispositions and the general directions of his moves. Black sees that the White A and F may well turn his left, particularly if they are cavalry. He decides to withdraw X and V to cover his capital while he presses forward with the remainder of his forces to break the centre and left of the White line at 59 and 63. White sees that his own left flank is somewhat threatened by the enemy concentrations at 60, and decides to shift B and C to the left. He is willing to risk battle on the line 47-59-63 if by so doing he can divert Black's attention from A and F. No hostile forces have yet come into contact.

Fig. 3 shows the positions after the 5th move, at 2 P.M., July 5th. Black has concentrated for battle at 59 and 63. White has unfortunately left B at 47, not being sure of his right flank. White A and F have pressed on, disclosing the fact that they are mounted forces by marching full cavalry distances. Black X and V have fallen back to check them.

Hostile forces are now in contact at 59 and 63. When two or more hostile forces are within 6 miles of each other at the end of a march, they are said to be within "striking distance," and may engage that day. Let us see what happens.

Black and White toss a coin for the initiative. White wins the toss. He may now attack with any one of his forces any one hostile force within striking distance. Black may then attack with any one of his forces not engaged. Then White may throw in another disengaged force, and so on until all hostile forces within striking distance of each other have been engaged or until both sides decline to engage any more forces.

What does White do? He believes that Black will attack him both at 59 and at 63, for Black can engage 5 of his forces to White's 4. C is White's "mass de manoeuvre"—it can be engaged either at 59 or 63. With C and L at 63, White might defeat Black's Y and T, if the latter are not full strength divisions. But then D and the weak K would certainly be defeated by U, O and Z, and would probably be thrown out of 59 (for hostile forces twice the strength of defeated

A SIMPLIFIED WAR GAME

forces may compel the latter to retreat). White concludes that it is better to risk being thrown back at 63 than at 59. He attacks Z with K at 59. Black attacks L with Y at 63. White throws C into the fight at 59, and so on until D, K and C have been engaged against U, O and Z at 59, and Y and T against L at 63.

There are now two fights to be decided before another move is made. The first fight is that at 59. White attacked there. He bids on that fight, very much as he would bid on a poker hand. He starts his bid at, say, 60,000. Black says "not enough," for Black actually has 79,000 (battle strength of O plus U plus Z). White raises his bid, step by step, but at each bid Black

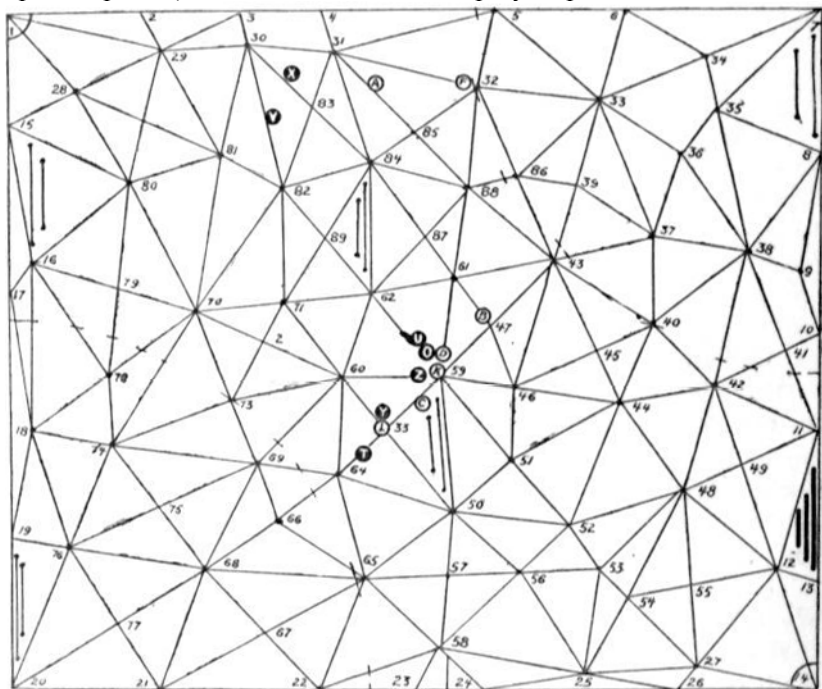


FIG. 3.—THE POSITION AT 2 P. M. JULY 5TH.

says "not enough." Finally White makes the highest bid he can, 72,000 (battle strength of D plus K plus C), and it is still "not enough." White admits defeat and loses 10 per cent. of his forces engaged, 7,000 men (calculated only to the nearest thousand), and deducts these losses from D, K and C. Black, the victor, loses nothing (this convention is in the interest of simplified calculation). White does not elect to retreat from 59, which as a defeated party he could do if he chose.

Black, the attacking side at 63, now bids on that fight. When his bid reaches 28,000 White says "enough," and is again defeated, losing this time 3,000 men. Black, knowing that his forces Y and T

THE FIELD ARTILLERY JOURNAL

together have at least double L's admitted strength, so declares, and L is forced to retreat from 63. A retreat, whether it is made voluntarily immediately after a defeat or whether it is forced by the enemy's development of double strength, must be made down the shortest road towards the capital and for a distance of 18 miles. (This is of course providing there is a road not blocked by enemy forces.) Such a retreat inhibits the retreating force or forces from making any move in a forward direction during the day following their retreat. So L goes back to 50, and cannot again advance until July 7th.

Both sides state the nature of the arms engaged in these actions (infantry and artillery in both cases). Each player enters in his notebook information on the enemy gained in these actions, and July 5th is over.

You will note that the scheme of bidding has enabled Black to disclose to his opponent only sufficient strength to carry his points—to win at 59 and 63 and to throw L back from 63—while White, the defeated side, has had to disclose his full strength of forces engaged in attempting to avoid defeat. The winner in a fight, therefore, not only causes his opponent losses, but gains more information than he himself discloses, and final victory in the game often falls to the side having the most accurate information of the opposing forces.

Before going on, let us look at the situation on the night of July 5th–6th. White has been defeated and his left has been thrown back. But he has forced Black to detach X and V to the defense of the Black capital. Following his original plan, White can now press A and F forward in the hopes of reaching the Black capital by ultimately reducing X and V to half the strength of A and F; or he can swing A and F down, through 85-84-62 and 32-88-61, and about July 8th hope to concentrate all of his 7 divisions against the 5 Black divisions U, O, Z, Y and T somewhere about 59, 61, 62 or 60. For it is obvious that X and V must continue their withdrawal on 3 and 30 on July 6th in order to cover their capital, and A and F could thus gain two days' march on them by swinging down towards 62 and 61.

Black's plans seem to be working out well on the night of July 5th–6th. He feels little anxiety for his capital, and White's determination to remain at 59 after his defeat presages more Black victories there or thereabouts. Black, following his plan, has met the main forces of the enemy, has defeated them, and has good hopes of continuing to defeat them. He probably sees that A and F could sweep down on his left flank some days before he could recall X and V, but there is time to meet that move after it begins.

Fig. 4 shows the situation at 2 P.M. July 7th. White has chosen to press forward on the Black capital with A and F rather than to

A SIMPLIFIED WAR GAME

try for a concentration of all his forces on a battlefield somewhere about 59. Black U, O, Z and Y have hammered at 59 on July 6th, causing White a further loss of 6,000 men (White did not engage B). L remained at 50 during July 6th, while T moved out about 5 miles from 63 down the road towards 50. Perhaps because of this move of T's, L remained at 50 on the 7th. On that day T doubled back through 63, and at 2 P.M. is within striking distance of the

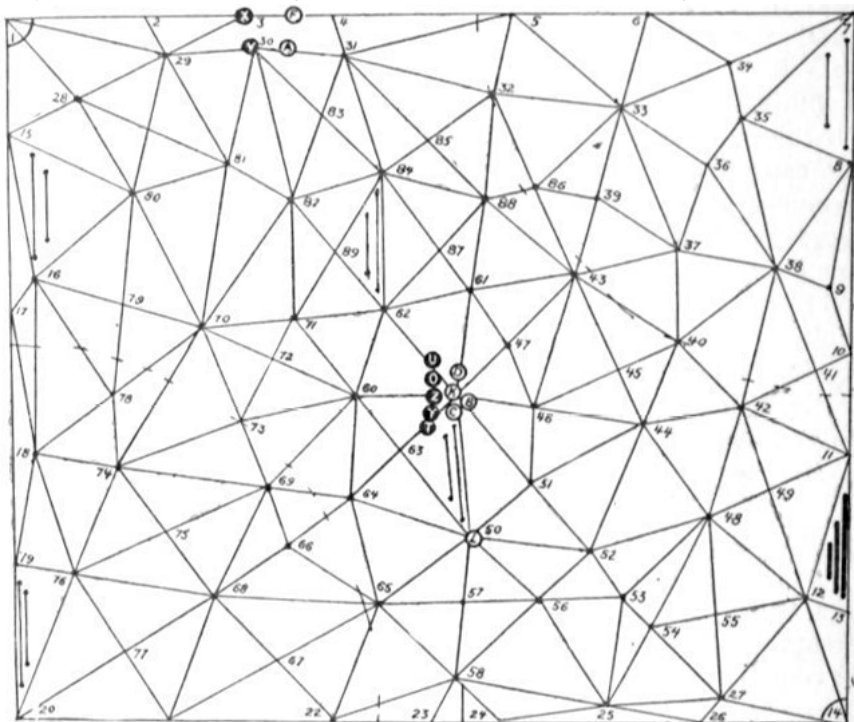


FIG. 4.—THE POSITIONS AT 2 P. M. JULY 7TH.

fight at 59. Again Black has concentrated 5 of his forces against 4 of White's, and the ensuing fight at 59 on this day (the 7th) will cost White at least 7,000 men (for even if he transfers some men from B to, say, K, and does not engage B, he must put in 75,000 men to be sure of holding 59).

At 30 White wins, and also at 3 if he is lucky enough to get the initiatives there. At any rate he develops the strength and composition of X and V, and he sees that, at best, it will take him 6 days more of fighting to reduce them to one-half the strength of A and F, and so force them back. But in 6 days U or O could reinforce the Black line at 3-30. It would therefore appear that the White raiding forces cannot capture the Black capital, and that White must use the mobility of A and F as best he may to balance his losses in battle.

THE FIELD ARTILLERY JOURNAL

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I have come to the end of my figures illustrating the successive moves of a hyperthetical game—a game by no means decided on its 7th move. But in these few moves I think the principles of war are fairly apparent. Black stuck to his objective, the defeat of the enemy's main forces, and to a large degree attained it. His offensive on July 5th at 59 and 63 illustrate both the principle of mass and the value of the offensive in forcing your will on the enemy. White's raid with A and F and Black's consequent detachment of X and V both illustrate the principle of economy of forces—were these detachments justified? This same manœuvre of White's around Black's left flank brought out the principle of movement in the strategic field, and its effect on the enemy. On July 5th and again on the 7th Black surprised White by effecting concentrations on the White positions which caught White incompletely concentrated. Black withdrew X and V on July 4th–7th because he thought his strategic security demanded it. Black's movements were more simple in plan and execution than those of White, and this difference would probably have been still more apparent had White attempted the pretty but complicated concentration of all of his forces on 61-62-59 which seemed open to him on July 5th. Lastly, it is evident that both players tried to make their different forces coöperate, both in marching and in fighting—the principle, in its strategic sense, is inherent in the play of the game.

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It will be seen that the amount of figuring of losses, etc., required of the players has been reduced to a minimum by taking round numbers, usually thousands. Losses may be deducted from the battle strength of the defeated forces, and need not be apportioned among the component arms.

Force	July 1st	July 2nd	July 3rd	July 4th	July 5th	July 6th	July 7th
O	62	62	0	59	59–	0	0
T	73	73/60	60	64	64/63	(5 miles) 50–	63/59
U	71	71–	62	62–	59	0	0
V	82	89	0	82	30	30	30–
X	84–	87–	87–	84/30	30	30/3–	0
Y	71	71/60	60–	0	63	59	0
Z	72	60	60–	59	59–	0	0

But how much note keeping has this game entailed? Let us again take Black as an example. He has put down the composition of his

A SIMPLIFIED WAR GAME

own forces. He has had to correct the battle strength of V (and perhaps of X) by deducting the losses of July 7th. Another page of his notebook shows his orders, thus (minus sign indicates less than a full day's march for the force concerned).

Black's notebook also should have contained a G-2 page, something like this (numerals in brackets indicating the day on which the information was obtained):

A—Called 25,000 (1st). Cav.? (3d). Cav. (4th). Is 22,000 (7th).

B—Called 25,000 (1st). Called 15,000, cannot exceed 13,000 (7th).

C—Called 25,000 (1st). Called 20,000 (7th). See below.

D—Called 25,000 (1st). Called 20,000 (7th). See below.

F—Called 25,000 (1st). Cav.? (3rd). Cav. (4th). Is 21,000 or 22,000 (7th).

K—Called 15,000 (1st). Called 20,000 (7th). See below.

L—Called 25,000 (1st). Is 25,000 (5th).

C plus D plus K are 65,000 (5th). (NOTE: It will be seen that after the 59,000 (6th) fights on the 7th Black had a pretty fair 68,000 (7th) idea of all the White forces.)

Lastly, Black's notebook may contain a list of losses:

<i>Black</i>	<i>White</i>
2,000 X (7th)	7,000 C plus D plus K. (5th).
2,000 V (7th)	6,000 C plus D plus K. (6th).
3,000 L (5th).	7,000 C plus D plus K. (7th).

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RULES OF THE GAME

Definitions.

I. A "force" is any separate unit, composed of one or more combatant arms, which is represented in the game by a pin bearing a distinctive letter.

II. The "battle strength" of infantry is its actual strength. The "battle strength" of cavalry is three-fifths its actual strength. The "battle strength" of artillery is double its actual strength. The "battle strength" of any force is the sum of the battle strengths of its component arms.

III. "Striking distance" is that distance, measured along roads, from the end of the day's march, within which a force may attack a hostile force. It is the same for all arms—6 miles.

Organization.

1. The total strength of each arm given each player will be decided by mutual agreement between the players.

2. Before the moves commence (but at no other time) a player may convert from one arm to another in the ratio:

1 artillery—2 cavalry—2 infantry.

THE FIELD ARTILLERY JOURNAL

3. The artillery component of any force may not be greater than one-fifth the actual strength of that force.

4. At any time during the game when requested to do so by his opponent, a player must declare the battle strength of any or all of his forces. The declaration made must be the real battle strength of the given force plus 5,000, or the real battle strength less 5,000, or any figures between these two.

5. No force of less than 5,000 battle strength shall be organized at the beginning of the game nor formed by detachment from another force during the game.

6. Transfer of troops may be made from one force to another provided one force passes the other during a march, or provided they are both together during a night. But they must be bona-fide transfers of troops, and not merely exchanges of letter designations of forces made to deceive the opponent.

Marching.

7. Cavalry and artillery may march 18 miles, infantry 12 miles, maximum, in a day's march.

8. Any force may march the whole or any part of the maximum march of its least mobile arm on any day (unless prevented from doing so by the enemy), or it may stand still.

9. All marches, advances to the attack or support, and all movements in retreat will be made over roads.

10. Not more than 25,000 men, actual strength, may be marched along any part of any road on the same day. *Exception:* This rule does not apply to forces retreating on the day of a battle in which they were defeated (see rules 17 and 21).

11. Any number of friendly forces may pass through the same cross-roads on the same day, provided that no columns cross each other.

12. Hostile forces which reach the same cross-road at the same time must fight for it, possession going to the victor. Otherwise the position of hostile forces which would, by their orders, pass or meet each other on the march is determined, for the end of the march, solely on their rates of march.

13. Marching orders usually designate a cross-road (or roads) towards which the march is to be made; and if it is not to be a full day's march that fact must be indicated. A force may, however, be ordered to follow a given hostile force if, in the course of its march, it runs onto the trail, made that day, of the hostile force. Marching orders having been written, they must be carried out as written to the full extent permitted by the enemy.

Combat.

14. After a march, if two or more hostile forces are within

A SIMPLIFIED WAR GAME

striking distance, a coin is tossed. The winner of the toss may take the initiative in attacking a given force with a given one of his forces within striking distance. Or he may "pass," and permit the initiative to pass to his opponent. The initiative passes from one player to the other in turn, each being permitted to throw in not more than one force at each turn, until both sides are satisfied. The first fight started is then decided, then the next fight, and so on until all are decided for that day. *Exception:* See rules 22 and 23.

15. The attacking force bids. He bids up until he reaches the limit of his battle strength engaged, or until the side attacked admits that the last bid is equal to or greater than his battle strength engaged.

16. The attack wins if he develops a battle strength equal to or greater than that of his opponent. Otherwise the defense wins.

17. Twice his battle strength, if declared, forces the loser to retreat towards his capital 18 miles, or so much of that distance as is not blocked by enemy forces. The day following such a forced retreat, the force or forces defeated and thrown back can neither advance towards the enemy's capital, nor attack the enemy nor support friendly troops engaged with the enemy. *Exception:* See rule 24.

18. Twice their battle strength brought against an enemy force or forces which cannot retreat, cause their immediate surrender. The same result is obtained, regardless of any possibilities of retreat, by developing against an enemy force or forces four times their battle strength.

19. The victor in a fight does not have to declare more battle strength than is necessary to win. Hence he is not required to force an enemy to retreat or surrender by declaring double or quadruple the enemy battle strength, under rule 17 or 18.

20. The loser in a fight, if not forced to surrender, loses 10 per cent. of his battle strength engaged, calculated to the nearest thousand. If the 10 per cent. involves a 500, a coin is tossed to determine whether the loss shall be the thousand above or below the actual value of the 10 per cent. *Exception:* Defeated forces of 5,000 battle strength or less, if not forced to surrender, lose 1,000.

21. Any defeated force, if not driven back or forced to surrender may, immediately after the fight, retreat towards its capital 18 miles, or so much of that distance as is not blocked by enemy forces. On the day following such a voluntary retreat, the force which has retreated is subject to the same limitations imposed on a force thrown back by the enemy under rule 17.

22. The "break-through." Any force or forces have the right to break through any hostile barrier of force, if they can do so under rule 17, and attack or get into a fight within striking distance of their respective positions at the end of the march. To do this, they must

THE FIELD ARTILLERY JOURNAL

declare intention of breaking through when they move to the attack; and ability or inability to break through must be determined before other fights are decided. If forced back on a break-through, the defeated forces may retreat under the provisions of rule 17, or they may fall back onto the forces to reach which the enemy made his break-through. In either case they lose 10 per cent. under rule 20. Those of the victorious forces which were within striking distance at the end of the day's march will then be pushed forward into the fight to reach which they made their break-through. (NOTE: This is the only case in which any force may be engaged in two fights on the same day.)

23. A force advancing on a hostile capital cannot attack a hostile force if, to do so, it must move through a cross-road which in the next march the hostile force would reach first, and thus, solely by the win of the toss, cut off the hostile force from its own capital; but this rule is applicable only when the advancing force actually threatens the capture of the hostile capital.

Capture of the Capital.

24. The capture and occupation of the enemy's capital results in the winning of the game, unless the invading forces are driven out on the day following the capture or occupation. In any attempt to recapture the capital, all the forces of the side whose capital is disputed, and which are or may get within striking distance, may be used in any fight connected with the attempted recapture, regardless of the fact that they may have retreated or have been forced out of their capital on the previous day.

Such are the outlines and rules of a simple little game which can be, and has been played with a certain amount of pleasure by men who are interested in such things. It can not be claimed that it is susceptible to rules so clear and comprehensive as to eliminate differences of opinion in the course of the play. But if approached in a broad spirit of generosity and fairplay, if a coin is kept conveniently to hand with which to settle questions of interpretation or honest differences of opinion, the game will not disrupt friendship.

For valuable suggestions in the evolution of this game, I am indebted to Lieutenant General N. A. Miles, retired; Majors H. W. Huntley and F. M. Barrows, F. A.; Lieutenant J. Stacey Brown, F. A. (deceased), and Eugene V. Hurd, late Captain, M. C.

SOME REMARKS ON MOUNTAIN ARTILLERY*†

BY CAPTAIN OF ARTILLERY, A. MORTUREUX, FRENCH ARMY.

CHAPTER IV¹

ORGANIZATION OF THE ARTILLERY SYSTEM AND OF THE MOUNTAIN GUNS

THE organization of the system of mountain artillery and of the guns is dependent on the limitations of the mountains and the problems of fire stated in the preceding chapters (I and III).

A complete mountain artillery system includes:

(a) Guns that can either be carried on pack animals or be transformed into guns with carriages, so as to be moved on wheels.

(b) Guns that cannot be carried on mule-back, but that can either be moved on wheels over the mountain roads or be broken up into parts that can be taken separately to positions that are inaccessible to vehicles, either by means of mechanical equipment accompanying the gun or by special mechanical engines such as special caterpillar tractors.²

(c) Guns built to move over the narrow-gauge mountain railroads and that can fire either from the track or from emplacements situated close to it.

The artillery system composed of guns of class *a* only will be considered.

Let us remember that the guns of such a system should satisfy numerous conditions, as follows:

1. *Manœuvring Qualities.*—Lightness, rapidity in going into battery and in being loaded on mule-back, wide horizontal field of fire.

2. *Ballistic Qualities.*—Precision, power (long range), efficiency,

* Translation of an article in *Revue d'Artillerie*, June, 1922. By courtesy of Military Intelligence Division, General Staff, U. S. Army.

† Continued from July-August, 1922 FIELD ARTILLERY JOURNAL.

¹ See *Revue d'Artillerie*, Vol. 89, April, 1922, p. 349.

² For example, caterpillar tractors of the "chenillette" type, plans for the construction of which are being worked out at the Saint-Chamond shops.

THE FIELD ARTILLERY JOURNAL

ability to strike dead angles and to fire at large angles of impact (large vertical field of fire).

3. *Qualities of Construction.*—Simplicity, robustness, perfect stability, ease in making repairs, slight wear under fire, suitability for movement on wheels and on the backs of animals.

Such conditions cannot be secured in a single gun, except by getting only an unsatisfactory compromise between all the requisite qualities.

Hence they imply, taken altogether, a system of *pack-saddle artillery*, in which a *long gun* and a howitzer would be coupled and used side by side in such a way as to complement each other.

If we take into account the present possibilities of construction it would appear that the organization resulting from such a system should have the following characteristics:

	LONG GUN	HOWITZER
Calibre.	mm. 75.	95 to 105.
Length in calibres.	17 to 18.	About 14.
Total weight in battery (maximum), without shields, kg.	500	700.
Number of loads.	5 for 5 mules at the maximum.	(7 at most).
Horizontal field of fire, deg.	About 40.	About 40.
Vertical field of fire, deg.	-10 to +42.	-10 to +60.
Stability.	Perfection at any inclination.	Perfect at any inclination, even with the largest charge.
Probable error.	1/100 of the range.	1/100 of the range.
Muzzle velocity (Vo.)	<i>Single, about 400 m.</i>	Four different graduated amounts.
Maximum range (with percussion fire) km.	10 to 12.	8 to 10.
Plaquettes. ³	Two types.	None.

³ A disk placed on a projectile to increase resistance thereby obtaining a greater angle of fall.—Ed.

SOME REMARKS ON MOUNTAIN ARTILLERY

Am mu niti on.	Nature.	Cartridge.	Shell and charge separate. The latter contained in a cartridge case.
	Charge.	Composed of rather quick burning powder (kind of attenuated ballistite).	Charge of quick-burning powder (ballistite). Divisible charge composed of a priming charge and 3 reduced charges, each reduced charge being secured by subtraction from the priming charge or the next larger charge.
	Projectile.	Weight from 6.5 to 7 kg. Explosive charge 1 kg. Types: Shrapnel, 30 per cent.; H.E. shell, 70 per cent.	About 15 kg. 2 kg. H. E. shell
	Fuse.	A universal fuse or, lacking this: (a) ordinary double action fuse; (b) a double action detonator fuse; (c) a percussion detonator fuse with instantaneous action or with short delay.	A universal fuse, or lacking this: (a) double action detonator fuse; (b) a percussion fuse with instantaneous action, with short delay and with long delay.
	System of aiming for elevation.	Independent sight by preference.	HOWITZER Angle of site and range setting given by the same device (single aiming sector).

THE FIELD ARTILLERY JOURNAL

Laying gear.	Panoramic device allowing aiming in complete azimuth and at great inclinations. Precision such that the tolerances in construction do not exceed <i>altogether</i> in elevation and deflection 5 sexagesimal minutes, or 1.5 mil. Device for correcting the inclination of the trunions.	Similar arrangement.
Time for going into battery.	About 3 minutes.	About 5 minutes.
Time for being put into traveling position.	About 4 minutes.	About 7 minutes.
Suitability for wheeled transportation.	Practical and easy hauling by the gun crew secured simply by adding joined shafts.	Similar arrangement.
Construction with view to repairs.	a Standardization of spare parts; pieces and parts that can be repaired on the spot, as far as possible, without the help of machining establishments.	Similar arrangements.
Transportation ammunition.	of 12 per mule. The cartridges being placed in boxes of 3 can be set vertically on the panels of the pack saddle. Special arrangements for keeping the ammunition exactly in place and for keeping it dry.	8 per mule. Similar arrangement.

SOME REMARKS ON MOUNTAIN ARTILLERY

An examination of the characteristics of such a system brings out the following advantages:

The selection of the seventy-five calibre for the long gun insures unity of calibre between the mountain gun and the field gun, hence the manufacture and supply of ammunition is facilitated. The projectile has the same power and the same effectiveness.

The 105 howitzer as defined above constitutes a gun that can be built, possessing, when viewed as a whole, the properties of the howitzer that a large number of artillerists and infantrymen claim for the short artillery of the divisions. That is to say, it could play its part just as well on the plains as in the mountains.

Taking into consideration the parts to be played by the howitzer and the long gun respectively, the power of the first as compared to that of the second, and the possibilities of supply, it appears that of n mountain guns put into line, the number of howitzers in relation to that of long guns should be in ratio of one to two.

With a view to insuring their close collaboration and their logical use, the best solution seems to be that of the *mixed group* (battalion), including one battery of howitzers and two batteries of long guns. Such a combination of guns would give mountain artillery extensive means: *range* and *destructive power*, possibility of bombarding ground *in dead angles*, etc.

It does not seem that the number of five mules for the gun itself could be exceeded without having a piece that is not easily handled on a mule path and in certain positions in the mountains.

As to the howitzers, we may assume, having given their number and their action, that they will have a rather long period of time at their disposal for going into battery; thus the number of seven mules becomes admissible for them, although it must result in a certain increase in the length of the columns.

The *shields*, the transportation of which requires an additional mule, may be done away with without any very serious wrong being done to the men, who can use earthen mērlons or trenches for protection.

A large *horizontal field of fire* is all the more advantageous for mountain guns in that the latter, often not very numerous in a given sector, must be in a position to bombard as large a front as possible (sweeping), and to participate very quickly in concentrations of fire, utilizing to the maximum the efficiency permitted by the rapidity of fire. It seems that an extent of forty degrees could be secured for both the long gun and the howitzer.

As far as concerns the *field of fire in elevation*, the angle of forty-two degrees for the long gun will enable it to secure the maximum

THE FIELD ARTILLERY JOURNAL

range of the tube; for a howitzer, the angle of sixty degrees is very advantageous, for it makes it suitable for high angle fire.

The ammunition *in cartridges* for the gun favors rapidity of fire, facilitates supply and the preservation of the charge from dampness. The plaquettes appear to be an advantageous corrective of the too flat

Model ⁴	Length of tube	Weight of projectile	Muzzle velocity	Weight of gun in battery		Kinetic energy of the projectile at the muzzle	Ballistic efficiency	Number of mules for transportation
				with shields	without shields			
1. Long guns	l	p	v	P	P ¹	T	R	
Models existing before 1914	in calibres	kg.	m.	kg.	kg.	metretons	$\frac{T}{P}$	
Mt. 65, 1906 model.....	18.6	3.81	330	.....	400	20	0.05	4
Italian mt. 65	17.5	4.27	343	556	.....	24.5	0.044	6
Ehrhar dt 75 L/16, 1911 model.....	16	6.5	380	461	.....	24.3	0.053	5
Japanese ⁵ 75, 1908 model.....	14.5	5.5	440	.....	.....	43.2	.....	6
Powerful Skoda 75, 1911 model....	15	6.5	320	498	.....	33.4	0.067	5
Krupp launch type, 75 L. 16	17	5.3	350	595	.....	40.6	0.0682	6
St. Chamond 75, T.R.P. 110/4.....	16.2	6.2	330	424	.....	29.4	0.0693	4
Schneider 75, M.P.D. 11.....	18	6.5	420	669	.....	57.3	0.0856	6
Guns built or improved since 1914.....	.....	.....	.....	.....	.....	.....	.....	.....
Skoda 75, M. 15 ⁶	15	6.5	350	620	.....	40.7	0.0656	6
American 75, mod. 1920 (pack howitzer).....	15.7	6.803	275	.....	375	25.7	0.0695	4
St. Chamond 75 ⁷ with large field of fire.....	21.5	6.5	430	760	375	62.1	0.0889	6 or 7
Schneider 75, mod. 1919	18.5	6.5	425	659	375	58.6	0.0889	7
2. Howitzers models prior to 1914								
Krupp 10 cm. L/12 howitzer.....	12	12	300	830	375	72	0.0867	6 or 7
Models created or improved since 1914.....								
Skoda 10 howitzer M. 16.....	19.3	16	340	1,235	375	92.4	0.0740	3 carriages not made to be packed
3.7 in. English howitzer (Vickers system), 1918 model.....	11.8	9	296	.....	728	40.7	0.0559	8
105 Schneider howitzer, model 1919.....	12.4	12	350	740	.....	75	0.1013	8

⁴For reference to this table see I. Ballistic Efficiency, page 418.

⁵Gun manufactured at the Creusot factory (Schneider).

⁶The three Italian mountain regiments have been armed since 1920 with the Skoda guns M. 13 and M. 15 (see the Bonomi Law of April 20, 1920). The Italian field regiments include four battalions of the Deport system 75 and one battalion of mountain sixty-fives.

⁷The gun is being built; its characteristics are to be those indicated.

trajectories of the long guns, especially if the latter are given a single cartridge (non-divisible charge).

For the long gun, the combined use of collars and of detonator fuses with double action, allowing time fire with high explosive shell will, in many cases, provide the means for effectively bombarding the ground in a dead angle.

To simplify fire and supply, the question of *fuses* would best be solved by a fuse of universal type, enabling us, by a simple initial adjustment, to secure time or percussion shots (instantaneous or delayed action).

SOME REMARKS ON MOUNTAIN ARTILLERY

As concerns movement on wheels, the minimum of weight and cumbersomeness can be secured, under the present conditions, by the use of jointed *shafts*, while permitting the transformation of the mounted gun into one on wheels. The important thing then is for the latter to be very well balanced on the axle.

As to the question of the *independent sight*, it is being much discussed at present.

Being based on the principle of the rigidity of the trajectory, the independent sight system allows the two operations of aiming in elevation to be separated; the angle of site and the elevation can be given simultaneously by two gunners instead of one, so that there is a saving of time, simplification of the operations that have to be performed by the pointer, a greater possible rapidity of fire, and diminution of the chances for error. Besides, in the operations of laying for time fire, a single command fixes the fuse setting and the range setting, which allows the bursts to be easily shifted along the plane of site and, when the range setting varies, to keep the bursts at the normal height without changing the corrector. These arrangements are particularly favorable in observed fire for the rapid opening of fire on a moving target and for a change of targets.

And yet the independent sight has lost many of its partisans today, because of the general use of multiple charges, the importance acquired by percussion fire in comparison to time fire, the frequent use of high angle fire, to which the principle of the rigidity of the trajectory is no longer applied, etc. Let us note that the independent sight complicates the calculations for the preparation of fire, and that it increases the weight of the gun, since the adoption of a single aiming sector enables us to do away with the cradle.⁸

Such are, taken as a whole, the characteristics and the advantages of a system of pack artillery (*artillerie de bât*) within the limits stated above.

We now propose to make a brief statement of the characteristics

⁸ We shall call attention to the fact that the saving in weight resulting from the replacing of the cradle by a single sector is not very great, for a mountain gun. Now the cradle appears advantageous for the long gun (not for the howitzer) for quickly taking advantage of opportunities for fire afforded by dominating positions in the mountains.

Besides, a cradle, being constructed for being brought to a constant angle and kept there, may constitute the longitudinal corrector for the terrain, without it being necessary to provide a more or less delicate mechanism on the laying gear itself to perform this office of corrector. The cradle is then the platform (identical for the four guns of a battery) which serves as the primary base for giving the angle of site and the elevation.

THE FIELD ARTILLERY JOURNAL

of the mountain artillery *guns*, and the different solutions that bestow on them the numerous qualities, often contradictory, that we have defined.

We shall consider these characteristic features of construction as they have been embodied by different makers and as they might be in the future.⁹

1. BALLISTIC EFFICIENCY

Being the relation between the two essential qualities, *power* and *weight*, the ballistic efficiency is at one and the same time the principal characteristic and the best expression of the value of a mountain artillery gun. Let T be the energy $\left(\frac{P}{2g} v_0^2\right)$ at the muzzle, expressed in metre tons, and P the weight of the gun in battery, in kilograms. The ballistic efficiency is $R = \frac{T}{P}$.

The foregoing table enables us to compare a number of mountain artillery guns of the most recent types, from this point of view.

The study of this table brings out the following facts:

Among the most powerful mountain guns that existed before 1914, those constructed by the Schneider and Saint-Chamond firms were very well planned in view of the part that they were intended to play; they were at the head in regard to ballistic efficiency. The powerful Saint-Chamond 75, model P/110/4, with its four mules and its ballistic efficiency of 0.0693, provided a gun that was at the same time both powerful and very light.

It is to be noted that the calibre that was most generally adopted is the 75, and that the length of the tube varies between fifteen and eighteen calibres.

Advances in construction were made also in the guns produced during and after the war, in particular a considerable increase in power, secured, however, at the expense of a slight augmentation in weight.

Thus it is that the latest gun put out by the Schneider firm, model 1919, has a kinetic energy at the muzzle and a ballistic efficiency that had never been secured in a mountain gun, and this without any violence having been done to the essential qualities that are to be respected. Transportation requires seven mules, but six would suffice if the shields were done away with.

The Saint-Chamond 75 gun with large field of fire that is now being built will perhaps surpass these results, to judge by the types constructed before the war. This firm, moreover, has undertaken studies with a view to producing guns based on principles the application

⁹ The details of these features of construction will be given further on in the special study of certain guns (5th part of this work).

SOME REMARKS ON MOUNTAIN ARTILLERY

of which to mountain artillery is still new, but will doubtless be most profitable.

2. CONSTRUCTION OF THE GUN

The different solutions secured are enumerated below, with a statement of the existing gun to which they have actually been applied.

Gun

- | | |
|--|--|
| Tube with breech forming a single part. | French mountain 65,
Italian mountain 65,
Saint-Chamond 70 P/96/4 and 75
T.R.P./110/4,
Skoda 75, M. 13 and M. 15. |
| Built-up tube connected to a housing bearing the breech. | Schneider guns,
Ehrhardt guns. ¹⁰ |
| Dismountable tube in two parts connected to each other by a joint. | English guns (Vickers 2.95 in. and 3.7 in., model 18),
Krupp guns,
Greek gun. |

Recoiling Body

- | | |
|---|--|
| Tube alone recoiling on the brake chassis. | American 75, model 1919. |
| Tube recoiling with a housing on the chassis bearing the recuperator brake. | Skoda 75, model 1915. |
| Tube recoiling with the slide containing brake and recuperator. | Italian mountain 65,
French mountain 65,
Schneider 75, model 11 and model 1919,
English 3.7 in. (94 mm.), model 1912. |

Connection of the Gun with the Chassis or Cradle

- | | |
|--|---|
| By bars at the front and rear, held in place by simple cam levers. | Mountain 65, model 1906. |
| By collars at the front and rear. | Japanese 75, model 1908 (Creusot system). |

¹⁰ In the Ehrhardt gun, the lower part of the housing is prolonged about 70 cm. toward the front by a rod, to the end of which the tube is fastened a second time by a catch.

THE FIELD ARTILLERY JOURNAL

- By short housing at the rear. Schneider 75, models 1911 and 1919.
- By housing at the rear and clip or key in front. Ehrhardt 75 L/19, model 1911.
- By long housing forming slide. Skoda 75, model 1915,
St. Chamond 70 (P/96/4),
St. Chamond 75 (P/110/4).

Construction of the Carriage

- Carriage in the form of a fork or Y and with a recess between the sheet steel cheeks.¹¹ French mountain 65,
Schneider guns,
Saint-Chamond guns,
Skoda guns,
Krupp guns,
American 75, model 1920.
- Cheeks replaced by tubes. Ehrhardt gun,
Japanese gun, model 1908.
- Carriage with split trail. English system 3.7 in. (94 mm.),
model 1918 (Vickers).
- Carriage with folding trail. French mountain 65.

Aiming in Direction

- Pivoting around the trail spade with sliding motion on the axle. French mountain 65,
Italian mountain 65,
American 75, model 20,
Skoda 75, model 1915,
English 2.95 in. (75),
Saint-Chamond guns,
Schneider guns.
- Rotation of the whole gun and cradle around a vertical axis. Krupp guns,
Japanese 75 (Creusot system),
model 1918,
English 3.7 in. (94 mm.) split-trail
howitzer.

Aiming in Elevation

Position of the trunnions:

- Rotation of the cradle around median trunnions or those carried very slightly to the rear. Schneider guns, models 1911 and 1919,
Some Krupp guns: 75 L/14 and L/16,¹²

¹¹ On certain guns the cheeks have openings in them, so as to save weight.

¹² The Krupp 75 guns, models L/14 and L/16, include: a 75 L/14 with straight or bent axle, a 75 L/16 with straight or bent axle.

SOME REMARKS ON MOUNTAIN ARTILLERY

- Rotation of the cradle around trunnions that have been carried to the rear. Vickers guns,
Japanese 75 (Creusot).
French mountain 65
Italian mountain 65,
Skoda guns,
Saint -Chamond 70 P/96/4 and 75
T.R.P/110/4.
- Rotation of the whole cradle (pivot) and axle with relation to the axle arms of the wheels. English 3.7 in. (94 mm.) guns,
model 1918.
- Equilibrators for aiming in elevation.* Krupp 75 guns, L/16,
Skoda 75 guns, 1915.

Extending the Vertical Field of Fire

- Burying the trail and raising the wheels on supports. (Makeshift processes.)
- Shortening the trail by means of an extension piece or a telescopic device. Vickers 75,
Ehrhardt 75,
Japanese 75, model 1908 (Creusot system).
- Dismountable pedestal for superelevation placed under the front of the gun and increasing the quadrant angle of elevation by a fixed amount. Krupp guns (75) equipped with a brake with constant recoil of about 1 m.
- Bent axle allowing the height of the trunnions above the ground to be increased for high angles of fire by rotation of 180 degrees around the axle arms, which are integral with the nave-boxes. Schneider 75 guns, M. P. D. 11 and model 1919.
Krupp guns (75 model L/14 and L/16).

Arrangements in Which the Brakes and Recuperators Are Separate

BRAKES

Hydraulic brake:

- Constant stress during the recoil and whatever be the inclination of the gun (constant long recoil). French mountain 65,
Italian mountain 65,
Schneider guns,
Saint-Chamond guns,
Skoda 75, launch type, model 1911,
Ehrhardt 75, model 1906,

THE FIELD ARTILLERY JOURNAL

	Krupp 75, models 14 and 16, 2nd type 75 L/18 and 10 cm. howitzer L/12.
Orifices varying with the inclination, either constant for one recoil or varying with the course of the recoil.	American 75, model 1920, English 3.7 in. (94 mm.) howitzer, model 1918, Krupp 75, models 14 and 16 (1st type), Krupp-Lycoudis 75, Greek 75, Skoda 75, model 1915, Ehrhardt 75 L/19.
<i>Recuperators:</i> With springs.	French mountain 65, Italian mountain 65, Saint-Chamond guns, Skoda 75 guns, model 15, American 75 gun, model 1920.
Pneumatic.	Schneider guns, model 1919, 3.7 in. (94 mm.) English model 1918, Vickers system.
	<i>Arrangements in Which Brakes and Recuperators are Integral</i>
Hydropneumatic.	Saint-Chamond 75 gun at present under construction.

Launching Systems

Deport 65 and 75, de Chatillon-Commentry.
French mountain 65.
Skoda 75, powerful 1911 model.

ADVANTAGES AND DRAWBACKS OF THE DIFFERENT SYSTEMS

In a general way, the constructors have merely applied to the mountain guns, in a more careful and reduced fashion, the solutions already worked out for field guns. These solutions have the following advantages and disadvantages.

Shifting the trunnions to the rear is particularly advantageous for giving increased elevation, provided that equilibrators are not required, the weight of which is quite considerable. The mechanism for aiming in elevation must therefore be adjusted accordingly, without the parts that compose it being too heavy. The system permits to a certain extent the use of the brake with long constant recoil.

The solution by the *bent axle* is ingenious, but time is lost in

SOME REMARKS ON MOUNTAIN ARTILLERY

changing from the low position to the high position, and in the latter it is difficult to secure stability with slight inclinations of the gun. This kind of arrangement was specially devised with a view to using a constant recoil brake on mountain guns without shifting the trunnions of the chassis all the way to the rear.

Laying in direction by *moving on the axle* limits the horizontal field of fire. The moving of the gun *around a pivot* is bound to be very limited, otherwise we will get off the target, unless the carriage is one with a split trail.

The system of a carriage with *split trail* has been applied only to one mountain gun (English 3.7 in. Vickers gun, model 1918); it appears very advantageous, if the constructor can remain within the admissible weight limits. The transportation of such a carriage is, in fact, very simple and when the gun is in battery it allows a wide scope both in elevation and direction. The *telescopic* carriage, or one provided with large tubes forming an extension, also seems capable of giving good results: saving in weight, augmentation of the vertical field of fire.

As concerns the *recuperators* and *brakes*, the advantages of the different systems have been very clearly brought out by the study by Major Graux that appeared in this publication.¹³ We shall limit ourselves here to recalling his conclusions, as far as they have to do with the construction of mountain guns.

1. *Recuperators*.—From the standpoint of weight, pneumatic recuperators are practically equivalent to recuperators with springs. In pneumatic recuperators, in fact, it is necessary to have thick walls to withstand pressure and tight joints to avoid escape of gas. They are harder to make, and it is not easy to *give a large capacity to the recuperator*: the suppleness of the system, and consequently the stability, suffers from this.

The gas never wears out, but it is sensitive to variations in temperature.

The recuperators with springs are easier to manufacture, to put in place and to replace. They do not require a very stout covering, and it may even have holes for making the part lighter, but they are not very supple and do wear out. Hence their handling varies with the degree of wear and the angle of fire.

2. *Brakes*.—The different arrangements may be characterized as follows:

(a) The brakes and the recuperator are separate and work independently of each other;

¹³ See the article entitled Comparative Study of Recuperators, *Revue d'Artillerie*, Vol. 86, December, 1920, and Vol. 87, January-February, 1921.

THE FIELD ARTILLERY JOURNAL

(b) The brake is connected to the recuperator and works in series with it (hydropneumatic brake);

(c) The recoil is long and approximately the same no matter what the inclination of the barrel is;

(d) The recoil is reduced in proportion to the inclination;

(e) The recoil takes place with orifices that are constant during the same course;

(f) The recoil takes place with orifices that vary during the same course.

Brakes of class *a* have a cumbersome construction and looking after them is exacting and careful work, for the volume of oil contained varies with the temperature. If this volume becomes too great the gun does not return to battery readily. The remedy is automatic filler, a supplementary part that occupies much space.

The system of class *b*, being less cumbersome, avoids this drawback; besides, if we compare it with the system of the separate recuperator, it shows the following advantage:

Let us take a brake such as that of the 75, model 1897, with its joint (free piston) between the recuperator and reserve oil. If there is a leak at one of the joints, the reserve oil (supercharge) can then be lost without trouble. As soon as the reserve is used up, the free piston strikes against its stop, the pressure on the oil becomes zero from this time on and the loss of liquid ceases, the operation of the brake remains normal.

On the contrary, in a recuperator in which the liquid remains constantly in contact with the compressed air, the pressure on the liquid remains practically constant and maintains any leakage that may occur at one of the joints.

The brakes with constant stress and long recoil (class *c*) are easier to construct and favor good stability; their use on guns in which the height of the trunnions above the ground is slight complicate the construction of the latter, for it is necessary to prevent the tube from striking against the ground at great inclinations.

Brakes with variable orifices (class *d*) are a little more complicated and produce more violent reactions on the carriage.

Recoil with orifices varying during the same course (class *f*) generally necessitates a *shock absorber* for returning to battery. One of the simplest and most powerful of these shock absorbers is that of the brake for the Saint-Chamond field gun, of recent type. The device consists of a long metal pin that is integral with the free piston; this pin forms a buffer in a special seat at the time of return to battery, and moreover gradually closes the opening for communication

SOME REMARKS ON MOUNTAIN ARTILLERY

between the cylinder of the recuperator and that of the brake piston.

Whatever the system of the brake or recuperator may be, it is of prime importance to keep its construction from being so complicated that it has to be sent to a machining establishment for the slightest break-down. Hence the constructor must be required to furnish simple and stout devices that *can be easily repaired by the units or repair squads by means of spare parts* (interchangeability and standardization). The Saint-Chamond firm has made very important advances along this line in its latest type of brake for the 75: each set of joints of the brake can easily be replaced even in the battery position.¹⁴

It remains for us to consider the *launching system*.

The "launching" system is very attractive and presents real advantages when it comes to constructing a mountain artillery gun that is at the same time powerful and *light*. We will call attention to the principle of it and will discuss rapidly its advantages and disadvantages.

(a) *Principle and Advantages*.—The gun must be made less than a certain weight, which itself depends on the energy developed.

Let R be the energy of recoil, P_t the total weight of the gun in battery, H the height from the ground of the centre of gravity of the recoiling part, L_t the horizontal distance from the centre of gravity of gun in battery to the vertical line passing through the trail-spade, f the force required to balance R , l the admissible length of recoil.

We know that stability is governed by the law $P_t L_t > RH$, that is to say, that the force of stabilizing couple $P_t L_t$ must constantly remain greater than the force of the upsetting couple.

It is not possible to make P_t and L_t large, for a mountain gun, and on the other hand we cannot diminish H below a certain limit, already low for such a gun. Therefore we must try to diminish R as much as possible.

On the other hand, we know that

$$R = f \times l \quad (1)$$

and

$$P_t = k \times R \quad (2)$$

¹⁴ Major Graux recommends (*Revue d'Artillerie*, Vol. 87, p. 80) another method, namely the formation of a small reserve of recuperator-brakes that will enable us to replace quickly all the damaged parts and to send them to the factory. In certain mountainous regions the application of this system would appear very difficult.

THE FIELD ARTILLERY JOURNAL

Hence the smaller R is, the smaller P_t , f and l will be.

Now $R = \frac{1}{2} mv^2$, m being the recoiling mass, or $(p/g) v$ being the velocity of recoil.

To diminish R , we can act on m or v .

The reduction of m is very limited (necessary thickness of the walls of the tube, length of the tube, breech, weight to be given m for stability, etc.).

v may be decreased directly by a simple hydropneumatic brake; its effects (reaction on the carriage) *may also be reduced by the application of the principle of the differential recoil.*

If the tube is moving forward with a certain velocity v , instead of being at rest, when the shot is fired, the real velocity of recoil to be absorbed will be the difference between the "launching" velocity v_1 and the velocity v .

Then we have:

$$R = \frac{1}{2} \times \frac{p}{g} (v_1 - v)^2 \quad (3)$$

In guns in which differential recoil was secured, v_1 was taken as equal to $\frac{v}{2}$, which gives

$$R = \frac{1}{2} \times \frac{p}{g} \times \frac{v^2}{4} \quad (4)$$

It follows from this that the length of recoil l and the weight P_t (equations 1 and 2) are reduced in the ratio of 1 to 4.

(b) *Description.*—In outline, the working of such a system is as follows:

The gun (Fig. 2), being provided with clasps g that make it integral with the recuperator R , can move on the slide face G . Let us suppose it to be first brought to the rear by compressing a spring of the recuperator and held in this position by a spring firing bolt V .

If this bolt is released, the gun is thrown forward by the tension of the spring.

At a certain point in its course the hammer lever M strikes a lug B (firing lug), which causes the ignition of the charge by means of a suitable device.

The explosion causes the gun to return to its original position, where it is held automatically by the bolt V .

(c) *Disadvantages.*—The system shows the following disadvantages:

1. Little simplicity, complicated parts.
2. Necessity of performing some manipulations for setting it for the first shot, hence loss of time.
3. Drawback of the failure to be caught by the hook after the

SOME REMARKS ON MOUNTAIN ARTILLERY

shot is fired. In fact, the gun strikes more or less violently against the front end of the slide face, which may cause jumping and loss of aim. Necessity for providing some kind of shock-absorber to overcome the results of this occurrence.

4. Serious danger of hanging fire; as the recoil occurs too late, the trajectory of the launch type gun is more extended than the trajectory expected. When the gun strikes against the front of the chassis, the shot is fired after aim is lost, and the projectile takes a direction that may be dangerous, particularly if the piece is behind a mask.

Hanging fire, of course, depends on the ammunition and should not occur with good charges and a firing device that is perfectly dependable.

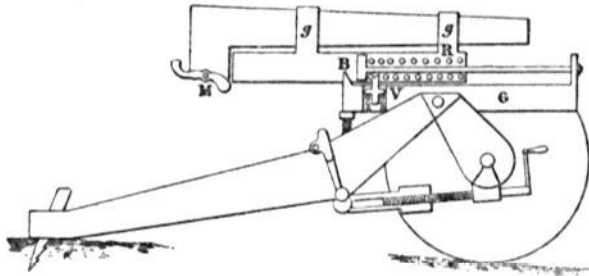


FIG. 1.—LAUNCH TYPE GUN.

During the years 1917 and 1918 this occurrence was repeated with regrettable frequency and cast a certain discredit on the gun,¹⁵ but the cause of this was pointed out by General Sainte-Claire Deville: in order to save copper, a material that had become scarce during the course of the war, the model 97 primer tube, which normally is used for the cartridge-case of the M 1906 65, had been replaced by a tube shortened by about half (2.7 gr. of powder instead of 4.4 gr.); hence ignition was defective. It was sufficient to return to the original model to do away with hanging fire.

5. A brake is necessary in spite of everything, although theoretically it had been hoped to dispense with it.

Some device is indispensable, in fact, to make the length of the recoil constant in spite of the variations in the angle of fire and to act as a shock absorber in case of hanging fire. Without this, the length of the recoil increases in proportion to the increase in the inclination of the gun; consequently the velocity and the length of the launching process must increase. At the next shot the velocity and the length of the recoil will be diminished by this and so on. Hence very

¹⁵ The consequences to the gun crew and the persons in the vicinity have often been unfortunate; in Morocco, in particular, General de Poemvrau was wounded by the bursting of a 65 shell caused by hanging fire.

THE FIELD ARTILLERY JOURNAL

irregular functioning and different conditions for slight or negative angles of fire.

Whatever these drawbacks may amount to, the "launching" system works admirably in the M 1906 65 gun, carefully planned¹⁶ and perfected by experience.

The brake and recuperator system gives entire satisfaction and requires repairs only at long intervals.

The different defects in operation are remedied very quickly either by the use of spare parts put in place by the battery squad or by having simple repairs or adjustments made by the repair squad of the mixed ammunition section.

It is extremely rare for a chassis brake to have to be sent to the constructing establishment because of a defect in operation that cannot be remedied in the units.

The launching system is therefore not to be condemned in principle, and it is certain that a large part of its drawbacks can be eliminated by adopting the system of partial launching, an improvement over the integral launching system that has just been described.

CONCLUSIONS

To sum up, no solution in itself and no known combination of devices gives perfect satisfaction in the construction of the mountain gun. The requirements of small height of the trunnions above the ground, light weight, and low degree of cumbersomeness greatly limit the benefit that the constructor can derive from the solutions applied to field guns up to the present.

However, the continuous advances made in metallurgy and in the manufacture of powder and explosives will doubtless allow the results achieved to be improved. New solutions, moreover, may spring from the use of the muzzle brake, the turbo gun, vaned projectiles, autofrettage, hauling guns on trucks or pulling them by small caterpillar tractors, etc.

If we give free play to our imagination, we may perhaps represent the mountain gun of the future in the following form: tube proper having maximum lightness by the use of suitable steel and autofrettage, breech made according to the turbo-cannon system, that is with successive ignition chambers and escape nozzles, reactions calculated so as to eliminate recoil, hence neither brake nor cradle, which would compensate for the increased weight of the breech with chambers, and lastly a central pivot held in place by a tripod mount. In such a system we shall doubtless not be able to serve the piece from the rear, because of the jet of gas when the shot is fired, but loading

¹⁶ The artillerists who have worked out this gun at Bourges construction shop bear the names of Baquet, Filloux and Ducrest.

SOME REMARKS ON MOUNTAIN ARTILLERY

will be done from the side, by means of a special device placed on top of the gun or to one side of it, and the gunners will be provided with a protective contrivance or will withdraw to a distance when the shot is fired.

If, on the other hand, we reduce to the minimum the weight of the mechanism for laying in elevation and direction, we shall perhaps finally get the powerful and light gun that mountain artillerists dream of, and that it is so hard to produce.

(To be continued.)

THE DEVELOPMENT OF THE AUSTRIAN FIELD ARTILLERY DURING THE WORLD WAR

TRANSLATION FURNISHED BY COURTESY OF MILITARY INTELLIGENCE
DIVISION, GENERAL STAFF, UNITED STATES ARMY

1. IN the last issue of the *Italian Revista di Artiglieria e Genio* considerable attention is given to an article printed in the *Technische Mitteilungen* by Lieutenant-Colonel Eimmansberger on the development of the Austro-Hungarian artillery during the World War. The Italians more than any other nation are interested in what the Austrians did during the war because, to a certain extent, Italy has become heir to that country's artillery. She had a better chance than any other country, except Russia, to study the efficiency of the Austrian artillery and after the Armistice received a large supply of artillery matériel, some of which was so excellent that it has been incorporated into the Italian army. The article by Lieutenant-Colonel Eimmansberger should be of considerable interest to our field artillery and should be obtainable through the Military Attaché at Vienna; nevertheless the following extracts from the article should also be interesting.

MATÉRIEL

2. The World War was the first series of campaigns in which the Austrian Army took part since general obligatory service was instituted in that country. An important factor in the Austrian Army was the fact that individuals drafted differed among themselves not only in intelligence, but also in racial characteristics and languages; this fact made it necessary to employ the drafted men from different regions according to their capabilities, which in turn resulted in a lack of homogeneity in the army, many regiments being in every way superior, or inferior, to others of the same arm.

3. In 1914 the following artillery matériel had been experimented upon and Austria was ready to produce same in large quantities:

75-mm. model 1915 mountain gun which could be split up into six loads for packing;

10-cm. model 1914 field howitzers;

15-cm. model 1914 heavy field howitzers;

10.4-cm. model 1915 gun.

The two howitzers and the 10.4-cm. gun were constructed in such a manner that they could easily be used in mountainous districts. Great weight was given to equipping the artillery for mountain warfare. Pieces capable of high-angle fire were most necessary both

DEVELOPMENT OF THE AUSTRIAN FIELD ARTILLERY

as to quality and quantity. The mountain gun, it should be noted, is also ballistically a howitzer. The author states that, with the exception of the 10.4 gun, this matériel still ranks among the best in the world, as do also the sights, etc., used therewith. For the heavy artillery the 30-cm. mortar had been studied between the years 1908 and 1912. This piece was designed for action against reinforced concrete emplacements and it was of such mobility that it could be carried on any roads which had good beds. The 24-cm. mortar, model 1898, was also considered an excellent piece.

4. In 1916 the infantry was equipped with 37-mm. infantry accompanying guns. As the campaign progressed there appeared a tendency to increase the power of artillery even at the expense of mobility and to this end a 8.35-cm. gun was studied. Construction of this model, however, was suspended on account of the difficulty of providing ammunition for same. In the same year the Austrians started mounting guns and howitzers on motor vehicles.

5. As regards heavy artillery it may be stated that in the spring of 1915, the 42-cm. howitzer arrived at the front. It had been constructed for the fortress of Pola, but was changed so as to make it a mobile piece. In 1916 the 30-cm. mortar was improved by increasing its range and traverse and in the same year the 24-cm. and 38-cm. guns were put into action, the latter having a range of 30 km. These pieces were transported in a very satisfactory manner by electric tractors with many wheels. The author states that with the exception of the 24-cm. gun these supercannon did not repay the efforts made in transporting them except in the matter of morale. The real strength of the artillery lay in its medium calibre and light pieces.

6. As to trench mortars, it should be noted that a great variety of them were used. They were the types offered by private concerns. It was not until 1918 that standard light, medium calibre and heavy trench mortars were adopted.

7. Artillery ammunition making was the most serious problem during the early part of the war. In the autumn of 1914, and until the spring of 1915, the scarcity of artillery ammunition in Austria was so great that it would have been disastrous except for the fact that all belligerents were suffering from the same evil. During this period an average of only ten rounds per gun per day was allowed. An example is given to show the great consumption of ammunition. In the Battle of the Isonzo, which took place between August 18 and September 6, 1917, 1454 cannon used 1,600,000 rounds, or 33,320 tons of ammunition. The Austro-Hungarian Monarchy produced about 83,000,000 artillery projectiles during the war. To provide explosives for so large a quantity of ammunition it was necessary to employ many makeshifts, for example, the trotyl charges

THE FIELD ARTILLERY JOURNAL

were diluted in sal nitrate of ammonia. Iron shrapnel balls were also used instead of hardened lead ones. However, in 1915, the industrial centres of the Monarchy began to supply large quantities of ammunition, which they continued to do until the end of the war.

8. As regards organization it should be noted that in 1916, the field artillery brigades of the regular army and the two Landwehrs, were supplied with uniform matériel. The field artillery regiments were reduced to four batteries and one anti-aircraft battery. The field howitzer regiments were also created and had four batteries, while the heavy field regiments had three batteries, two heavy howitzers and one 10-cm. gun battery. In the autumn of 1916 each infantry division was supplied with sixty-four pieces of artillery; at the same time the mountain and fortress batteries were supplied with new matériel.

9. In January, 1918, a second reorganization of the field artillery brigades were ordered. The brigade was made to consist of two field artillery regiments, each with two light gun batteries, three light howitzer batteries, and one special battery (anti-aircraft for one light regiment of the brigade and trench mortar for the other). The third regiment of the brigade was a six-battery heavy field regiment consisting of five heavy howitzer batteries and one 10-cm. gun battery. This reorganization was not completed until the end of the war on account of the tremendous consumption of 15-cm. howitzers, which were used generally for destructive fire.

10. In 1918 each field artillery brigade was given a group of mountain batteries consisting of two batteries of mountain guns and one of mountain howitzers, and all three mountain batteries were designated as infantry accompanying batteries; thus the number of guns per division was 100, or 10 guns per 1000 rifles.

11. In February, 1918, there was a reorganization of heavy artillery, which provided for fourteen regiments, three of which were to be used for coast defence. The others were as follows: Two very heavy regiments of 24-cm. guns and 38-cm. howitzers; five motor-drawn heavy regiments consisting of 30-cm. mortars and various howitzers and guns mounted on motor vehicles; and four heavy regiments, horse-drawn, consisting of 15-cm. howitzers and 10-cm. guns. Each regiment consisted of four groups of four batteries and two special batteries of which one was anti-aircraft and the other trench mortar.

12. At the same time all mountain artillery was organized into fourteen mountain artillery regiments, the heavy regiments and the mountain regiments remained under the command of General Headquarters and were used as reserve to reinforce important parts of the front.

13. The Austro-Hungarian artillery entered the war with 571

DEVELOPMENT OF THE AUSTRIAN FIELD ARTILLERY

batteries, which were manned by 206,000 men, including the men required for regular artillery services. In 1918 there were 1931 batteries.

THE TECHNICAL EMPLOYMENT OF MATÉRIEL

14. One of the first troubles which arose, due to the lack of knowledge of artillery by the persons entrusted with same, was the excessive wear and tear on the matériel. This was due in great part to rapidity of fire not warranted by most tactical situations. In 1917 a course of instruction in the use of matériel was started.

15. As regards accuracy of fire it has been the experience of the Austrian Army that firing, instead of improving during the long war, deteriorated. This was due in large part to the fact that trained artillery officers were no longer in positions requiring them to direct fire and also on account of the fact that fire control during great concentrations is impracticable. Furthermore, the idea which exists in peace times of obtaining the maximum effect in the maximum time and with the minimum expenditure of ammunition does not hold in war time. During the fighting the principal object is to obtain the effect desired, everything else is secondary, which means that nobody has time to attend to it. On the other hand, the influx of fortress artillery officers tended to make field artillery firing more precise.

THE EVENTS OF THE WAR

16. The autumn of 1914, with its bloody battles and its unheard of losses may be called the heroic period of the World War. The infantry, according to its training, had attacked hostile positions relying on nothing but itself and had conquered the enemy batteries by frontal attacks. During this period nobody wanted to hear anything of the artillery. The infantry felt that it was doing the fighting. From the first battle it was clear that the artillery was unable to silence the hostile batteries. Neither could it properly protect the advance of its own infantry, because when batteries were pushed forward for this purpose they were immediately suffocated by hostile fire. For this reason artillery soon learned to accompany the attack from covered positions and at this time the opinion was general that the hostile artillery was superior, either on account of its armament or its employment. The author declares this is not so. He says that as regards matériel the Austro-Hungarian field piece was by no means inferior to the Russian one. The explanation lies in the preponderance of hostile batteries and the fact that greater consideration was given to the damage caused by the enemy than by frontal artillery. As regards employment of artillery, the author admits that the ideas which were being carried out by the High Commands and by the infantry commands as regards artillery were delinquent

THE FIELD ARTILLERY JOURNAL

and in some cases delusions. The High Command had not yet grasped the idea of massing artillery on important parts of the front, taking some from quiet sections to do so. The same trouble existed in the divisions where artillery concentration was rarely ordered. The attack was often launched without waiting for results of artillery preparation and the artillery frequently was without orders to prepare the attack or to help push it through. Of course, some of the blame should be put on the artillery; it was new at this kind of warfare; its methods had to be changed and inefficiency was to be expected. However, in individual cases artillery commanders adopted procedures which were successful. For example, credit should be given to the artillery commander who, of his own initiative, laid down drum fire on a time schedule. This preparation allowed the Servian position at Paraznica to be taken without any losses. Such examples, however, were rare as a rule. The scanty artillery was not used to the best advantage and infantrymen paid the penalty.

17. Soon it was evident that this kind of fighting would lead to the country's bleeding to death and that a strong artillery with many howitzers and well supplied with shell was necessary. The experience thus far gained in the war, however, showed the absolute necessity of collaboration between the principal arms, and the artillery immediately became more effective.

18. At the end of the fall of 1914, long tracts of the front became stable. The rifle with its flat trajectory lost its importance. Hand grenades and bombs of all kinds came into vogue.

19. The artillery of the defence was given the task of preventing the enemy from reaching his infantry's trenches. At this period the individual commanders had to work up some method of interdiction fire. To do so it was necessary for them to have a perfect knowledge of their sectors and the precision of their fire was of great importance as were also liaison with the infantry and a rapid and efficacious fire, on account of the proximity of the hostile trenches.

20. The development of liaison was difficult. The infantry at first thought they had solved the problem in the best possible way by placing the battery observatory at the post of the commander of the trench system. This arrangement gave excellent results in quiet sectors, but when the enemy seriously attacked he would not only destroy the first line trenches, but incidentally also the battery commanders' stations just at the critical moment. These experiences, which were so costly in artillery officers and even more costly to the infantry who lost the fire of their own artillery, showed the necessity of putting artillery observing and command posts farther to the rear and of leaving only observers far to the front who, however, should be supplied with all possible means of liaison.

21. The placing of pieces far to the front in order to obtain

DEVELOPMENT OF THE AUSTRIAN FIELD ARTILLERY

flanking fire was also abandoned because these pieces were habitually destroyed by the enemy and also because machine guns could serve this purpose.

22. At the same time the firing trenches were echeloned in depth according to the Russian system and well protected by wire, machine guns, etc. To attack such positions, massing of artillery was necessary. Divisional artillery was not sufficient on account of the smallness of its calibres and the length of bombardment required previous to an attack. It now became necessary to have weeks of preparation prior to an attack in order that same should be successful; even so, when the infantry went over, they often found much bloody work still to be done. An example of such an attack was the operations at Gorlice on May 2, 1915. The area of penetration here corresponded exactly to the area of the principal artillery concentration. Other examples of it are the taking of Belgrade on October 24, 1915, and the breaking of the Austrian lines at Luck by the Russians on June 4, 1916.

23. In these cases, however, after the infantry had penetrated, it met the enemy in secondary positions beyond the range of friendly artillery. A classical example of this was the so-called Tyrol offensive against Italy in the summer of 1916. The Italians had been surprised on the 15th of May, 1916, and had lost their first defence system. The Austrians, however, were unable to drive them down into the plain, as they had reinforcements in the rear beyond the range of the Austrian artillery. A better employment of mountain artillery might have avoided this situation. On the other hand, the mountainous nature of the country and the great amount of artillery and munitions, which would have had to be brought up by the Austrians, was beneficial to Italy.

24. The Allied attack on the Somme in 1916 proved to the German General Headquarters, that a rigid line of defence was no longer possible because the Allies now had enough guns and munitions to destroy any kind of defensive organization. Therefore, in December, 1916, "Rules for the conduct of defensive battles" were issued. These prescribed an active and elastic defence method. These rules were of great value to both sides in the latter part of the war and the author remarks that these methods were especially helpful to the Allies in the Austro-German attacks of 1918.

25. On the Austrian front the elastic defence system could only be applied partially "because of scarcity of troops and matériel as well as the special situation in these areas." The Isonzo front which the Italians tried to smash in June, 1915, by heavy concentrations on restricted sectors became a kind of high school in defence methods for the Austrian artillery because here defensive methods quite different from those on the western front were necessary.

THE FIELD ARTILLERY JOURNAL

26. Here the lines were in the calcareous Carso region which made conditions very different from those in France, where the attack tried to gain possession of hostile trenches and then hostile zones. On the Carso, on the other hand, which consisted of many natural or artificial caves, the attackers had to concentrate their efforts upon capturing these caves. Here nuclei of defenders made it impossible to hold any zone until the caves had all been taken; for this reason an elastic defence could not be applied. Further, the mountainous character of the front enabled observation to be made from lateral positions as well as enfilading fire. On the Carso more than anywhere else liaison between command and troops was necessary. It was extremely difficult for the artillery to follow the advance of the infantry on account of the rock fragments and dust which enveloped the fighting areas; on the other hand, lateral and distant observing stations were better developed on the Carso than elsewhere. The author states that in France divisional artillery almost always fired frontally at the enemy's lines facing it; whereas, on the Carso the Austrians were able to make great use of cross-fire with divisional artillery.

27. The Danubian Monarchy's difficulties in obtaining replacements of all kinds kept increasing throughout the war. In the winter of 1916-17 there was great mortality among horses due to starvation. In August of 1917 the number of horses in the army was reduced by one-third, in order that the rest could be fed. The author states that in many items the Austro-Hungarians were far behind the Italians. For example, in aviation, mechanical transport, funicular railroads, locomotives, etc. Industries were greatly handicapped on account of lack of coal.

28. In the fall of 1917 it was evident that Austria could not continue to hold the Isonzo front by simple defensive methods. As it was necessary to hold this front, an attack was decided upon. The attacking forces between Plesso and Telmino were under German orders. The means of attack of the two allies were about the same. The result of the attack on the 24th of October is well known; the Italians were driven to the Tagliamento at the first onrush and, after short resistance there, they withdrew to the Piave. This attack, which the Austrians call the twelfth battle of the Isonzo (the Allies called it Caporetto), is the turning point in the employment of artillery, because here for the first time gas was used by the Austrians on an Austrian front to any considerable extent. The author states that he does not wish to belittle the work of the Austrian High Command and the troops on this occasion, nevertheless Italian abandonment of positions and very strong defensive systems, which were occupied by abundant troops and reserves, he claims can only be explained by the fact that there was a general panic, due to the effect

DEVELOPMENT OF THE AUSTRIAN FIELD ARTILLERY

on the Italians of firing gas shells. In this sector the lines had been stable since the beginning of the war. The Italian defences consisted of trenches with wire, positions prepared to the rear, support points and intermediary positions. A considerable amount of Italian light artillery could fire from positions in caves. The important heights which dominated roads had artillery emplacements which could not be hit by the Austrian artillery except from the front, due to the fact that the artillery was mostly in caves. Even large calibre Austrian guns could not damage these caves by flanking fire. Gas had not been used by either belligerent to any appreciable extent on this front. The author states that gas was used by the Austrians on the Carso in 1916, but this was only an experiment, and was not followed up by an attack. The Italians take exception to this statement in a footnote to the effect that in the attack referred to the Austrians not only used gas, but inflicted considerable losses upon the Italians by following it up with an advance of a new division which had just arrived in the line and which was equipped with clubs which had metal spikes on them.

29. In the fall of 1917 the Italians had a type of gas mask which was inadequate both as to quantity and quality. On the 24th of October, at 2:00 A.M., while it was still completely dark, of course, a four-hour bombardment was started by the Germans with poisonous and lachrymogenous gases. The Austrian pieces also fired gas projectiles, but in small quantities. Yellow cross (iprite), however, was not used. All battery positions of the enemy, as well as cantonments, bivouacs, dugouts and road crossings were thoroughly bombarded with gas shells. The effect was not purely one of morale, because after the lines were broken many Italians were found dead as a result of gas. During the attack of the infantry the Italian artillery fire was insignificant and their batteries in the caves did not shoot. The author claims that the battle of the Isonzo was the only great operation in the World War where one army was able to beat the other because of perfect gas technic against improper gas protection. This gas attack was the turning point in the progress of artillery, especially as regards counter-battery work. The author claims that gas projectiles eliminate the necessity of all refinements in calculating firing data because the gas spreads no matter whether the shell hits the target or not. The necessity for the enemy to serve his pieces with gas masks and the difficulty for him to transmit orders under these conditions are apparent. Neutralization of hostile batteries requires a tremendous expenditure of ammunition under ordinary circumstances, whereas it is comparatively simple when using gas shells.

30. The twelfth battle of the Isonzo, it is claimed, showed the German superiority in armament of all kinds. The author claims

THE FIELD ARTILLERY JOURNAL

that the 14th German army on this front did some mapping with airplanes by means of cameras which had one-metre focal range. These planes flew at 5000 m. and accomplished as much in a few days without any losses as the Austrian aviators with their less perfect photographic apparatus were able to do in months flying at 2500 m.

31. During the winter of 1917-18, the Piave zone was organized according to the German system and the Austrian artillery was given new duties to perform. The elastic defence required this. On the other hand, in the mountainous sections the old defensive tactics were still kept. It is to be noted that the cessation of hostilities on the Russian front permitted considerable reinforcement on the other fronts. It was due to this that for the first time it became possible to withdraw batteries from the war zone and teach them in rear areas how properly to accompany the infantry.

32. In the spring of 1918 preparations were started for the great offensive which Austria was to make against the Italians. This offensive was to be actuated at the same time as the German offensive on the western front. The attack was planned according to the German system. After an adequate artillery preparation the infantry and accompanying batteries were to break through the enemy's positions. The infantry, which had been studying hard how it should attack at this time, gained considerable morale, strength of esprit like that existing in 1914. The failure of the attack certainly is not chargeable to the infantry.

33. In looking back over the events of this period one becomes convinced that the Austro-Hungarian army was behind in the competition of technical progress. The eyes of the army had become weak. After the arrival of the entente divisions in northern Italy the possession of the air had passed to the Allies, who were thus enabled to carry on methodical reconnaissance by means of their aircraft and at the same time prevent the Austro-Hungarian aviators from obtaining results. In the telemetric and photometric systems Austro-Hungary had always lagged behind the entente as regards number of organizations and quantity of instruments. It was only in 1918 that the Austro-Hungarian Supreme Command decided that the artillery telemetric companies should follow their brigades instead of remaining permanently assigned to a sector. The work of the Austrian telemetrists was also frequently poor.

34. The Austrian attack met very strong resistance from the Italians, for the latter after Caporetto had provided themselves with an English type of mask and had organized defence in depth wherever it was practicable to do so. The Austro-Hungarian infantry, which was so full of confidence in itself and trust in the efficiency

DEVELOPMENT OF THE AUSTRIAN FIELD ARTILLERY

of its artillery, was disappointed in this attack, and it became necessary to go back to defensive warfare.

THE END OF THE WAR

35. After July, on account of the melting away of Russia, it was possible to organize strong reserves of artillery and infantry behind the lines with an idea of getting ready for warfare of movement. The number of quadrupeds available seemed to increase and the shortage of ammunition was not noticeable. Austria had never been as strong either as regards matériel or number of troops, but it was too late. In the middle of September the Balkan front crumbled and on the 29th of September, Bulgaria signed the Armistice. The attack of the Italians against the mountainous front between the Brenta and the Piave on the 24th of October was repulsed in the usual manner. Then occurred the dissolution of the Austro-Hungarian army which the writer claims was more due to internal political reasons than to the Italian feats of arms. The author claims that the two great groups of adversaries in the spring of 1918 were thoroughly worn out and only kept fighting as a result of their great will power. But at this moment a miracle happened to save the entente. This was the transfusion of new blood from the American forces. The Central Empires who received no such assistance, and who were under the pressure of a blockade, which constantly increased in severity, were submitted to catastrophe.

FRENCH ARTILLERY DOCTRINE

(FROM THE NEW EDITION "ARTILLERY FIRING" 1922)

[EDITOR'S NOTE.—*By courtesy of the Military Intelligence Division, General Staff, U. S. Army, we publish the following report received from our Military Attaché, Paris, entitled "French Artillery Doctrine." In transmitting the report the Military Attaché makes the following comment:*

"This is a translation from the introduction to the recently published 'Artillery Firing,' which is the basic artillery instruction manual in the French Army. This introduction expresses so well the fundamental principles of French artillery doctrine that it is my opinion it cannot fail to interest American artillery officers, and I therefore recommend that it be transmitted to both the FIELD ARTILLERY and 'Coast Artillery' Journals for publication."]

American artillery officers will recall the handbook entitled "Artillery Firing" published in March, 1918, by the headquarters of the A. E. F. as a translation from the French edition of November, 1917. For many months an artillery commission has been engaged on the revision of this document which forms the basis of artillery instruction in the French Army. The finally approved "General Instructions on Artillery Firing" dated March 20, 1922, has just been published and represents a valuable contribution to artillery literature.

The introduction to this book is of particular interest, as it lays down the fundamental principles of French Artillery doctrine. Its translation follows:

I.

"The doctrine of artillery fire is the same for all units of the arm. Its fundamental principles are the following:

A. *The weapon of the artillery is the projectile.*

The power of a deployed artillery is not only measured by the number, the calibre, the rapidity of fire of the matériel in line, it depends especially on the ammunition supply available with the guns and the conditions in which this supply can be renewed.

B. By means of its projectiles *the artillery seeks to destroy*, and by destruction is meant a *sudden, complete and brutal* destruction. When circumstances do not allow the artillery to undertake destruction, its use is to embarrass the enemy in accomplishing his missions. It tries to paralyze him, at least momentarily, by threatening his destruction. The action corresponding to this latter situation is generally called "neutralization."

C. *To be effective artillery fire must be regulated.*

FRENCH ARTILLERY DOCTRINE

Artillery fire is regulated by *preparation* and by *adjustment*. By "preparation" the artilleryman tries to eliminate errors *a priori*; by "adjustment" the artilleryman verifies the errors and corrects them by successive approximations. Preparation and adjustment complete each other. As a general rule firing is prepared as if it were not to be adjusted, and it is adjusted as if it had not been prepared. But occasionally firing must take place without preparation; occasionally firing must take place without adjustment; occasionally a superficial preparation and incomplete adjustment must suffice.

D. *In order to be effective artillery fire must be opened at the right moment.*

E. *In order to be effective artillery fire must utilize the right projectiles, the right fuses and the right powder charges, depending on the nature and the situation of the target.*

F. *To be effective artillery fire must be dense.* The artilleryman brackets the target with a sheaf of trajectories more or less dense according to the nature of the target and the effect desired. The possibility of hitting with a single shot, as a matter of fact, is practically zero, and is small in case of firing comparatively few shots. Even when adjusted firing remains the slave of dispersion.

G. *In order to be effective artillery fire must be carried out rapidly.* From the point of view of moral, the losses which fire inflicts on the enemy are more effective when they surprise him and when they are produced in a short period of time. Moreover, the time may allow a moving target to withdraw from the material effects of the projectile, either by sheltering itself or by taking up another position.

Any slowness in carrying out fire decreases the value of means of observation. Time changes certain firing conditions and makes the centre of impact capricious. Time is adverse to fire adjustment.

The artilleryman consequently will economize time as much as is compatible with proper service and the care and upkeep of his guns.

H. *Since artillery fire must be both dense and rapid, the best chances of effective fire are obtained if a large number of guns participate in the firing.*

Instead of attacking simultaneously several targets with several batteries, it is better, from the point of view of efficiency and if other considerations do not intervene, to concentrate the fire of all the batteries successively on the various targets.

Concentration of artillery firing is consequently sought for as a general rule. The commanding officer who organizes it takes into consideration the aptitude of changing target by the guns which he controls. He regulates the quantity of ammunition to be fired according to the result desired, independent of the number of guns put into

THE FIELD ARTILLERY JOURNAL

play. Concentration, which is one way of economizing time, must not lead to a waste of ammunition.

I. *Observation renders the most valuable services to the artillery.*

The observation service is always on guard and is a source of information.

Observation permits the adjustment and control of fire. In this way it completes or corrects the preparation of fire. The artilleryman never makes too great an effort to observe, but he does not always succeed. As a matter of fact:

Terrestrial observation stations are occasionally difficult to find, to join up with the batteries, and they may be entirely lacking.

Aerial observation is not assured under all circumstances.

Observation, difficult at night, becomes impracticable in foggy weather or during an intense artillery action.

In such a case the consumption of ammunition increases; the efficiency of the artillery becomes more a question of chance. Deprived of observation, firing is impaired. As a general rule it is not prevented. Except in exceptional cases observation is not indispensable to artillery firing, and the lack of observation does not justify the inactivity of this arm.

II.

In its most general form firing includes the following operations:

During preparation,

By means of instruments and topographic processes the artilleryman determines the relative position of the target and the battery;

From this he deduces, in consulting the firing tables, first of all the elements of the normal trajectory, *i.e.*, the trajectory of the battery to the target under the basic condition of the tables. Then the corrections for the conditions of the moment are applied insofar as the basic elements are effected.

He makes these corrections and in this way obtains the initial firing data (more or less approximate) to open fire.

During the adjustment of fire,

The artilleryman tries out these elements:

He improves them by displacing his fire according to the errors which observation reveals to him; in this way he obtains a bracket on the target.

He immediately carries out fire for effect apportionate to the target engaged.

The problem of fire becomes complicated on the battlefield.

It frequently happens that the artilleryman is poorly supplied, his instruments are poor, he is badly oriented, his information concerning the target or concerning the position of the battery, or concerning the multiple influences which affect trajectory is poor.

FRENCH ARTILLERY DOCTRINE

Often the conditions in which he operates are little favorable to the accuracy of his measurements and calculations.

Finally an obligation is imposed on the artilleryman:

He must conform either to the orders of his commanding officer or, in case such orders are lacking, to the intentions which this officer has manifested or to the exigencies of the situation. The artilleryman is generally not master of his time.

As a result it may happen that he is forced to open fire without making measurements and without calculation, to fire for effect before being certain that he has bracketed the target. On other occasions no adjustment is possible. He commences at once fire for effect in order to obtain the surprise desired by headquarters.

In order to obtain in such varied situations the highest efficiency from his ammunition, the artilleryman must have a profound knowledge of the various methods of fire and the way they should be used.

In studying profoundly a great number of particular cases he will have acquired the notion of the sense and the amount of the various corrections of which circumstances do not always permit the exact calculation. Prepared in this way, he will be in a position to improve the results of simplified operations without loss of time. He will moreover be guaranteed against serious errors in calculations, errors to which complete operations are always exposed.

Finally, the artilleryman must be able to estimate a situation, to adapt to the conditions and circumstances of the moment the methods of preparation, of observation, and of execution of fire which are furnished by the present instructions on artillery firing. A sure judgment is the first quality of the artilleryman. This judgment is formed not only by the study of text-books but better still on the ground under the direction of the commanding officer and the instructor.

III.

For the reasons indicated above the general instructions on artillery firing could not have the character of an imperative regulation. It sets forth processes, justifies them, shows their advantages and disadvantages, defines their conditions of use. It seeks to treat each question in such a way as to make it easily understood. It is this latter consideration which has regulated the development given to the various methods and not their chances, more or less good, of being used, chances, moreover, which it should be imprudent to define.

The general instruction on artillery firing is no other than the instructions of August 26, 1920, made over. In this new edition the majority of the observations and desires formulated during the period of examination of the earlier text have been taken into consideration.

THE FIELD ARTILLERY JOURNAL

The general instructions on artillery firing include seven sections and a supplement. The seven sections are for the use of all artillery officers. They treat:

Section 1.—Ballistics and dispersion.

Section 2.—The effects of projectiles and their conditions of use.

Section 3.—The preparation of fire.

Section 4.—The rules of fire.

Section 5.—Observation.

Section 6.—High burst ranging.

Section 7.—The conduct of fire.

The supplement consists of fourteen annexes in which are set forth demonstrations, presented as far as possible in a simple way, explanations and supplementary information and methods that are not frequently used.

The general instruction on artillery firing treats neither questions of topography nor firing with the use of an aerial observation which represent special information to be inserted in the artillery drill regulations."

CURRENT FIELD ARTILLERY NOTES

Notes on Feeding Artillery Horses

BY LIEUTENANT-COLONEL C. F. MORSE, MEDICAL CORPS,
U. S. ARMY, DIRECTOR, VETERINARY CORPS.

THE forage ration of 14 pounds of hay and 12 pounds of oats, corn or barley, increased for a Field Artillery horse of the heavy draft type weighing 1300 pounds or over to 17 pounds of hay and 14 pounds of oats, corn or barley; and for a mule of 14 pounds of hay and 9 pounds of oats, corn, or barley (par. 1077, AR 1913), was established by practical experiments in the Army after taking into consideration all the basic feeding principles involved and checking by feeding experiments at various state experiment stations. The results were verified in particular by the feeding experiment conducted under the auspices of the Kansas State Agricultural College, Manhattan, Kansas, at Fort Riley, Kansas.

In arriving at sound conclusions in this matter certain natural laws must be taken into consideration. These laws need not be discussed at length in this place, but attention is invited to a few basic facts in order that the conclusions reached may be understood. The accepted authority, "Feeds and Feeding," by Henry & Morrison, is quoted freely.

First, the necessary maintenance ration for the horse at rest, computed in net nutrients, must be determined. Second, the additional ration in net nutrients required for the work demanded must be determined and in this connection the influence of speed on the consumption of nutrients in the animal body plays a very important part. A maintenance ration is one that furnishes enough, but no more, of each and all of the several nutrients required to maintain a given resting animal, so that it will neither gain nor lose in weight. The method of determining the maintenance requirements of a horse at rest is to feed a ration sufficient to maintain its weight and then after a time to decrease gradually the supply of nutrients until it begins to lose weight. Using this method the weight of horses getting walking exercise for one-half hour daily was maintained on a ration of 17.6 pounds meadow hay which supplied 7 pounds of digestive nutrients per thousand pounds live weight.

To determine the nutrients necessary for work in addition to the maintenance requirements, consideration must be given the various kinds of work which the animal performs, consisting of more or less complex combination of the following simple types:

- (1) Locomotion, or merely travelling along a level course with no load.

THE FIELD ARTILLERY JOURNAL

- (2) Raising the body, with or without a load, against the force of gravity in ascending a grade.
- (3) Carrying a load.
- (4) Draft, or hauling a load.

In the case of an animal drawing a load up a hill, we find all of these types combined. The animal is (1) advancing, and at the same time (2) raising its body. It is also (3) carrying the harness and (4) hauling the load. When it descends the hill it will even perform a fifth type of labor in bracing itself so as not to be forced down the hill too rapidly.

Based on the foregoing, the net nutrients required for a horse for various kinds of work have been determined as follows:

	Net nutrients required Lbs.
Travelling without load, 1 mile on the level at a walking speed of 2.5 miles per hour.....	0.134
At a walking speed of 3.5 miles per hour.....	0.169
At a trotting speed of 6.6 to 7.6 miles per hour.....	0.254
Travelling 1 mile on the level when carrying a load of 220 lbs. at walking speed of 3.4 miles per hour	0.210
Trotting speed of 6.9 miles per hour	0.323
Raising the body 100 feet, in climbing incline of 10.7 per cent.	0.060
Lowering body 100 feet on a road with a 5 per cent. dip, compared with travelling on the level, saves.....	0.025
Draft on level per 1000 feet—tons, not including locomotion of body	1.157

Influence of Speed.—It will be noted from the table that 26 per cent. more net nutrients are required when the horse walks a mile at a speed of 3.5 miles per hour than 2.5 miles. When its gait is hastened to a trot, nearly twice as much food is required per mile of travel as at the slower walk. Among the reasons why rapid labor generally consumes more power than slow motion, even when the distance travelled and the actual work done are the same, are the following: When a horse is walking at a rapid speed the work of the heart is greatly increased. In trotting or galloping the rise and fall of the body is much greater than in walking, and therefore a smaller part of the energy expended is available for onward movement. The temperature also rises, and much heat is lost by the evaporation of water through the skin and lungs. The proportion of food producing heat is thus increased, while that appearing as work is diminished.

CURRENT FIELD ARTILLERY NOTES

Fourier found that the horse was at its best for drawing loads when moving at a rate of 2 to 2.5 miles per hour. When held down to a slower speed, and likewise as the rate of speed was increased beyond this figure, its efficiency decreased. At length, when a speed of 11.25 miles per hour was reached, less than one-tenth the maximum amount of work was accomplished. Grandeau states that a horse walking 12.5 miles per day was kept in condition on a daily allowance of 19.4 pounds of hay, while a ration of 24 pounds was insufficient when the same distance was covered at a trot. A horse hauling a load 12.5 miles daily, the draft performed being equivalent to 1943 feet—tons, was sufficiently nourished by a ration of 24.6 pounds of hay, while a ration of 36.2 pounds—all the horse would eat—was not enough to maintain its weight when the same amount of work was done at a trot.

When it is necessary to develop maximum power continuously at a considerable speed, the number of horses required for a specific work must always be greatly increased. Thus when horses were used on mail coaches, even on the admirable highways of Great Britain, the proprietors maintained one horse per mile of route for each coach, each horse travelling only eight miles and working an hour or less per day on the average, four horses drawing the loaded coach which weighed two tons. Draft horses moving 2.5 miles an hour are expected to do seven times the work of coach horses moving 10 miles per hour.

With running horses, the requirement of speed reduces the work performed (carrying the rider) to the smallest amount possible. Low writes: "When it is considered that an ounce of additional loading to the same horse may make the difference of a yard or more in half a mile of running, it will be seen how greatly the weight borne may affect the issue in the case of horses of equal powers."

Formerly the Germany army horse was fed only 11 pounds of oats, 5.5 pounds of hay, and some cut straw during the manœuvres, when often travelling over 40 miles a day, covering about equal distances at the walk, trot, and gallop. It is not surprising that on this ration, containing only about 8.8 pounds of digestible nutrients, the horses, which performed about 11,900 feet—tons of work daily, lost heavily in weight, and that many were unfitted for further military service.

The daily food requirements of an animal are therefore based on certain well-defined scientific principles. An animal of a given weight must have a certain quantity of forage in order to perform its full duty and to keep in normal condition. The ration allowances now prescribed in Army Regulations are devised to meet these requirements exactly. If additional work is required, the allowances

THE FIELD ARTILLERY JOURNAL

must be increased. On the other hand, if the allowances are reduced, it is inevitable that the physical condition of the animal must deteriorate, such deterioration being measured by the degree of reduction and the amount of work demanded. Obviously therefore any reduction of the forage allowance should be accompanied by a proportionate reduction in the work required in order that the physical deterioration which is bound to occur shall be as little as possible.

In view of these facts, it is impossible to approve the reduction of the ration for animals required to do a full day's work below the authorized allowances. If any reduction is permitted, ability to perform work should be conserved by reverting to the method of conserving the animal strength which was adopted by officers commanding cavalry and artillery organizations in the days of Indian warfare when, due to the inability to transport a full ration, it was necessary to perform all evolutions and marchings at a walk.

The following conclusions are believed warranted and action indicated along these lines is recommended:

(a) Conservation of the forage ration and its feeding in the manner most favorable to assimilation by the individual will utilize its elements to the best advantage, but cannot operate to increase its net nutrient value.

(b) Neither the present reduced ration, nor any modification thereof, contains the net nutrients required to enable the animal to render full duty and to maintain it in fit condition for immediate field service.

(c) The arbitrary reduction of the forage ration for all animals irrespective of the work required, is an unsound economic procedure.

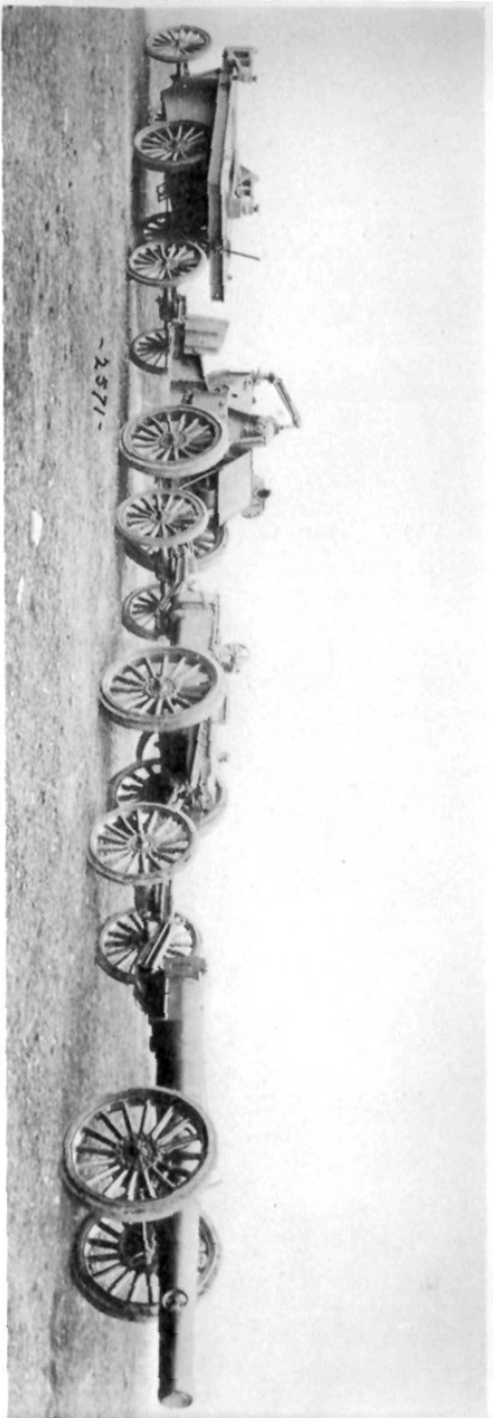
(d) It were better to sell animals for which there are no funds to buy forage than to reduce the forage or increase the work to a degree which permits excessive loss of condition, emaciation, impaired health and diminished resistance to disease.

(e) All animals required to perform full duty at service schools or at any other station should be allowed the full forage ration.

(f) Animals wherever located whose day's work may be materially reduced, might, without harmful effects, undergo a reduction in the forage allowance of not to exceed three pounds of grain.

(g) It must be understood that the animals included under subparagraph (e) above will not be in a fit condition to perform active field duty without undergoing conditioning on full forage for a period of from six weeks to three months.

(h) If sufficient saving cannot be effected under the operation of subparagraphs (e) and (f), a necessary number of the less essential animals which the Government cannot afford to feed under the circumstances should be sold.



240-MM. HOWITZER IN TRAVELLING POSITION
Right rear view. From left to right: Platform, Top Carriage, Cradle, and Howitzer. Each vehicle is drawn by one ten-ton tractor. For description of this weapon see July-August, 1922.
FIELD ARTILLERY JOURNAL, page 363.



240-MM. HOWITZER IN TRAVELLING POSITION
Left front view.

CURRENT FIELD ARTILLERY NOTES

Field Artillery School Book Department

THE Field Artillery School, Fort Sill, Oklahoma, announces the establishment of a Book Department to serve the officers and enlisted men of the Field Artillery.

The Book Department will furnish any book on any subject at retail prices listed by its publishers. It will also furnish at cost all Publications printed at the Field Artillery School in the various courses.

Officers and enlisted men of the Field Artillery are urged to take advantage of this service for not only will they receive books at minimum cost, but the Book Department will derive a small commission from the publishers on commercial books. The revenue obtained will be utilized to further lessen the cost of production of textbooks.

The Book Department will be conducted on a cash basis and whenever prices are known orders should be accompanied by check or money order.

Price Lists of the texts on hand may be obtained upon request.

Address all correspondence to Book Department, Field Artillery School, Fort Sill, Oklahoma.

EDITORIAL

AN important convention was held in Washington, D. C., on October 2nd, 3rd and 4th last. It was a convention of Reserve Officers representing the different parts of the United States, and was convened for the purpose of creating a national organization.

Full accounts of the sessions were given out to the Associated Press and therefore few details need be mentioned here.

General Pershing, General Harbord and other officers addressed the convention and their remarks were thoroughly approved and appreciated. General Harbord in particular made a hit by discussing the entire preparedness situation in commercial and every-day business terms.

The general purpose of the association is given in the constitution adopted, as "the object of this association shall be to support and assist in the development and execution of a military policy for the United States which shall provide adequate defense."

Heretofore the Regular Army and the National Guard have each been represented by an organization which was able to make their situation and needs known. But the only mouthpiece for the Reserve has been the Regular Army. As the Reserve now comprises about eighty thousand members, it is fitting that it also should have an independent spokesman. Each of the three components of the Army of the United States thus has a suitable vehicle for making known its needs, progress and development.

The Field Artillery Association congratulates the Reserve Corps upon the organization of its association and welcomes it as a new member of the family of military associations.

The full constitution adopted is as follows:

The Reserve Officers' Association of the United States

Report of Committee on Constitution

Washington, D. C.
October 4, 1922.

ARTICLE I

Name: This Association shall be known as THE RESERVE OFFICERS' ASSOCIATION OF THE UNITED STATES.

ARTICLE II

Object: The object of this Association shall be to support and assist in the development and execution of a military policy for the United States which shall provide adequate national defense.

EDITORIAL

ARTICLE III

Membership: Section I. *Active Membership.* Any person holding a commission in the Officers' Reserve Corps of the Army of the United States shall be eligible for active membership in this Association; provided that officers holding active commissions in other components of the armed forces of the country in addition to their reserve commissions shall not be eligible to vote or hold office in this Association.

Section II. *Associate Membership.* Any active member of this Association who, under honorable circumstances, ceases to be a Reserve Officer may remain in the Association as an Associate Member, with all privileges of Active Membership except those of voting and holding office in the Association.

ARTICLE IV

Organization: Section I. The Association shall consist of the national organization in which shall be vested its final and controlling authority and which shall consist of the entire membership represented as hereinafter provided. The membership of the national organization, for purposes of administration, shall be divided into state associations, subdivided as the state associations may prescribe.

Section II. State associations may organize in any manner not inconsistent with the provisions of this constitution which may be acceptable to their membership.

Section III. For purposes of the selection of delegates to the National Conventions only, the membership shall be organized into Corps Area Chapters.

Section IV. A national council composed of twenty-seven members, three elected by the delegation of each corps area at annual National convention to serve for one year or until their successors are elected, shall be the governing body of the association and shall be vested with complete authority to represent and act for the Association at all times between National Conventions of the Association.

The national council shall elect from its members an executive committee of nine and such other committees as it may decide to be necessary to whom it may delegate any or all of its powers.

Section V. Charters for all Corps Area Chapters and state associations shall be issued by the executive committee of the national council in the following manner:

A. To Corps Area Chapters: Upon the written application of not less than one hundred reserve officers, resident in the corps area, accompanied by a certificate of the Chief-of-Staff of the corps area that to the best of his knowledge and belief notice of the proposed organization meeting was given to all reserve officers in the area a reasonable time prior to the organization meeting from which the said application issued.

B. To the State Associations: Upon the written application of not less than twenty-five reserve corps officers, resident in the state, accompanied by a certificate of the Chief-of-Staff of the corps area that to the best of his knowledge and belief notice of the proposed organization meeting

THE FIELD ARTILLERY JOURNAL

was given to all reserve officers in the state a reasonable time prior to the organization meeting from which the said application issued.

C. To Subdivisions of State Associations: By the executives of the state associations under such rules and regulations, not in conflict with this constitution, as may be adopted by the state associations.

ARTICLE V

Officers: Section I. The officers of the national organization shall be a president, three vice-presidents, one from each army area, a secretary and a treasurer, to be elected by the annual national convention from the membership at large of the association to take office immediately upon election and to serve for one year or until their successors are duly elected and qualify.

Section II. The above mentioned officers shall perform the usual duties pertaining to their several offices and, *ex-officio* shall be members of the national council and executive committee thereof.

ARTICLE VI

Meetings and Representation: Section I. There shall be an annual convention of the association held in the month of October of each year, at such place as shall be determined by the next preceding annual convention. The annual convention shall have the complete legislative authority of the association.

Section II. The basis of representation for the annual national convention of 1923 shall be the same as that at the first national convention of 1922, namely, five delegates from each division and non-divisional group, selected by the corps area annual chapter convention provided for in section three of this article.

In the event of the Corps Area Chapter meeting failing to designate a full quota of delegates as provided herein the Chief-of-Staff of the corps area shall designate members to fill the vacancy. Thereafter the basis of representation at annual national conventions shall be that determined by the annual national convention of 1923 in the form of amendment to this constitution or otherwise.

Section III. *Corps Area Chapter Meetings:* There shall be in each corps area an annual chapter convention to be held not less than thirty or more than sixty days before the annual national convention of that year for the purpose of electing the corps area delegates to the annual national convention at such place as may be determined by a meeting of that chapter, and thereafter by each annual chapter convention for each next succeeding chapter convention. The basis of representation for the annual chapter convention for 1923 shall be prescribed by the national council at its first meeting, and thereafter the basis of representation shall be such as may be prescribed by the annual national convention in the form of an amendment to this constitution or otherwise.

Section IV. A meeting of the national council shall be held immediately after the first and each succeeding annual national convention, and also at such other times as it may be determined by the executive committee

EDITORIAL

of the national council. Other meetings may be called on not less than fifteen days' notice by the president of the national organization, or in his absence or inability to act by the national vice-presidents in order of seniority or in turn by the national secretary.

ARTICLE VII

Dues: Section I. The treasurers of the national organization and the various chapters and associations shall be the custodians of the funds of their respective organizations and no treasurer shall receive funds until he first shall have qualified under a bond as shall be prescribed by the governing committee of his organization.

Section II. The annual dues of members shall be one dollar (\$1.00) payable to local treasurers October 1st of each year, one-half of which shall be payable to the national treasury and transmitted to the national treasurer immediately upon receipt by the treasurer collecting same.

Section III. The remaining half of the annual dues shall be distributed to the state and local associations as may be prescribed in the rules of the state associations.

Section IV. The dues for the year ending September 30, 1923, shall be collected upon the organization of each state or local association and the fifty cents (50c.) payable to the national treasurer shall be transmitted when and as collected.

Section V. Local associations may levy and collect such additional dues as may be determined by their own organizations for their own purposes.

ARTICLE VIII

Amendments: Section I. This constitution may be amended at any national convention by a two-thirds of the vote of such convention, provided the amendment is proposed, considered and voted on in accordance with the order of business adopted by such convention.

Tactics and Technique of Artillery

THERE have recently appeared from The General Service Schools Press, Fort Leavenworth, Kansas, two volumes of the above text. This is a most important book for any student of Field Artillery, and is especially useful to any officer preparing himself for entrance into the School.

The Preface states that the work is intended "to present a sufficient knowledge of artillery units and their employment to prepare for the solution of problems in combined arms." The main part of volume one treats of division artillery. Certain other artillery is in part treated of in volume two. This includes: Corps and Army Artillery, Coast and Harbor Defense, Submarine Mine Defense, Railway Artillery and Anti-aircraft Defense.

Volume one was originally designed for the use of the Line Class and volume two for the Staff Class.

"Artillery reached the climax of its modern development in the

THE FIELD ARTILLERY JOURNAL

World War. In numbers of guns, rapidity of fire, complexity of internal management, intricacy of external control, and quantity of ammunition expended, heights of development were reached which, in pre-war days, had not even been seriously contemplated. The stabilized situations of the fields of France and Italy lent themselves admirably to complications of technique as well as to unbalanced tactical notions."

The present work, "Tactics and Technique of Artillery," is a change from the point of view of stabilized warfare to the principles of open warfare. The latter is distinctly American and in consonance with the essential nature and ultimate characteristics of our race."

Ever since the Office of Chief of Field Artillery was established in February, 1918, insistence has been placed on the principles of so-called open warfare.

This work, while originally prepared at the General Service Schools, was carefully gone over in the Office of the Chief of Field Artillery, while in manuscript form, and such changes made (except in Coast Artillery subjects) as were necessary to bring it up to date with late developments in Field Artillery and in harmony with the doctrine as promulgated by the Chief's office. The Chief of Field Artillery and an assistant from his office then personally visited Fort Leavenworth, and went over the entire matter with the Commandant and the Field Artillery faculty. This method of coöperation has resulted in the promulgation of an excellent text.

It is the opinion of the Chief of Field Artillery that this work should form a part of the military library of *every field artilleryman*.