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THE DEVELOPMENT AND TACTICAL EMPLOYMENT OF PORTÉE ARTILLERY

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BEFORE any discussion can be taken up on the subject of portée artillery, it is desirable to know the reasons for its birth and the circumstances of its development. Portée artillery is the French term used for artillery having automotive transport and is distinct from all other types of artillery having automotive power. From experience and mechanical limitations, it is practically limited to guns of a caliber inferior to 155 mm., but, with improvement in trucks and roads, larger guns may also be satisfactorily handled.

There were many causes that brought about a crisis in horseflesh to the Allied armies during the last war. Specially was the animal shortage acute with the artillery, and particularly with the 75 mm. One of the principal causes was the demand for an increase in artillery masses and artillery fire, and this became greater at each new development of artillery tactics. Munitions were being consumed in enormous quantities, and the resultant effect was not only to use the reduced supply of animal transport to its extreme limit of physical endurance but also to cause the temporary separation of artillery brigades from their respective divisions. There was also a serious forage shortage. It was very natural, therefore, to consider a system of transport for the light artillery by some means other than animal transport. As an experiment, in August, 1917, the French Army decided to organize a field artillery regiment (the 213th) with truck transportation for its matériel. Only sufficient trucks were issued to transport one battalion, the regiment being thus forced to make its displacements with only one battalion at a time. In case of a long move, it was assisted by trucks from the motor transport service. The regiment on arrival at position was told to depend on assistance in going into position by animals borrowed from artillery already in that vicinity. In spite of all

their difficulties, this regiment proved to be of tremendous value almost at once. This in spite of much opposition by those who could see nothing but heresy in such a type of field artillery.

At first it was considered an experiment of a temporary nature and only for a rapid movement of small units, such as a battery or a battalion, capable of keeping up with a rapid movement of infantry. It was not foreseen at this time that whole regiments would ever be thus organized. The arrival of the American forces in the war was considered by many as a time when the animal and forage shortage would soon end and then these converted units of field artillery would again become orthodoxly horse-drawn. Towards the close of 1917, with the rapid arrival of these forces, it became more and more apparent that the arrival of these new units would not ameliorate the animal situation, but would actually gravely increase the shortage. The American divisions, in accord with the Allied shipping plan, were not to bring animals with the troops, but were to get them from the Allies in Europe. By January, 1918, the first experiments in portée had proved so successful that, with the increased French and American automotive equipment, each battalion of portée was issued its own motor equipment. At this time a battery had four Jeffery (four-wheel drive) tractors and six trucks.

The artillery that was transferred to portée was mainly made from the corps light artillery regiments (the French had since 1915 regiments of 75 mm. in the corps artillery), which were composed of three battalions of three batteries each. In this new form, the corps light artillery showed increased ability at once by its rapid and extensive displacements. By the time the German offensive broke out in March, 1918, there existed nine regiments of portée artillery in the French Army. These regiments played a most important part in the war of movement resulting from these violent German attacks at numerous places on the front. So successful, in fact, did these few regiments show themselves as forming a powerful mobile artillery reserve, able to be rushed to all points threatened, that twenty new portée regiments were ordered formed at once. The newly formed portée regiments soon lost all connection with their former corps organization and became a reserve field artillery for the High Command. By June, 1918, they had become such an important part of the artillery arm that they were officially

created into the 5th Division of the R. G. A. (Reserve General d'Artillerie) or the G. H. Q. Reserve, where they have since continued. By September, the 5th Division was composed of thirty-two regiments of three battalions of three batteries. The program at the time of the Armistice was for forty regiments, but at that date only thirty-seven were completed, or a total of 1,332 guns. Thus it is seen, in brief, how rapidly this organization, altogether new and frankly born of necessity, grew in just a year's time. In addition it had developed itself into a remarkable strategical instrument of the High Command. This is especially significant as occurring during the period of greatest activity of the entire war and when warfare of movement was absolutely essential. It took part in all defensive and all offensive actions, becoming, before the end of the war, a vital part of the G. H. Q. artillery.

Since the war our army has, at various times, undertaken the study of portée batteries at different stations, and results have been beneficial in advancing our knowledge of this subject. At the present time in our service, a portée battery has the following matériel (T.O. 528 W):*

4 guns, 75 mm.
1 three-ton tractor (caterpillar).
9 F.W.D. trucks, used as follows: 4 for guns, 1 for tractor, 1 for baggage and rations, 1 for gasoline and wire, 1 for personnel, 1 for spare parts, supplies, personnel.
4 motorcycles.
1 reconnaissance car.
1 five-passenger car.

The battery carries in addition 240 rounds in the gun trucks. There are no caissons or reel cart in the battery. The battalion is composed of three batteries and Headquarters, but has no Combat Train. The regiment has two battalions and a Headquarters and a Service Battery. The brigade has three regiments and a Headquarters, but no Ammunition Train.

Without going into a technical discussion of the practicability of the present tables, it is apparent that not enough trucks are available to carry sufficient ammunition for any unit. It is believed that

*In Panama and Hawaii portée units have a special organization, the principal difference being an increase in the number of tractors.—EDITOR.

ammunition should be carried and supplied by the portée units themselves, as this proved so satisfactory by actual war experience. In view of the fact that the brigade (or regiment) is the usual tactical unit, it would be necessary to add to the present tables the trucks lacking (4 per battery from what the war batteries had) for incorporation into regimental ammunition units. This would give a rolling reserve of about the same size as the present motor section of our Brigade Ammunition Train. At the end of the war it was found a regiment (9 batteries) had 203 vehicles (including side cars) in all.

In the consideration of the employment of portée artillery, it will only be worth while to discuss those features in which it differs from horse-drawn artillery of the same caliber. Some parts of the tactics of portée artillery are the same as animal-drawn artillery, but also much of it is different. First, it is to be recognized that the two are not the same and are best used one to support and supplement the other. Portée artillery is preeminently an instrument of the Tactics of Maneuver. Being part of the G. H. Q. Reserve, it is used by the High Command for the rapid entry into action of large masses of artillery.

Two of the greatest objects to be obtained in the handling of large groups of artillery are: surprise and crushing power. Surprise is of two kinds: first, strategical surprise; and second, tactical surprise. Strategical surprise consists in absolute secrecy of all measures taken, installations made, and the assembly of matériel in the firing positions. This, as is well known, is very difficult to obtain due to the amount of artillery needed and the many resources of modern intelligence. Without question, the greatest aid for retaining secrecy is by speed of entry into position. By keeping the reenforcing artillery as far distant as possible, it is available for use over widely separated operations at short intervals. It must be able quickly and quietly to execute long marches. Horse-drawn artillery can never accomplish this mission except when used as local reserves. At other times, it must wait for railroad transportation and all the limitations that it imposes.

Tactical surprise is obtained by not allowing your enemy to know the location of your main blow or strength. It is best obtained by the infantry attacking without artillery preparation, or, if one must be used, a short, intense one. This can be accomplished

by using the artillery in mass; also by rapidity of fire and short overwhelming concentrations, thus giving the desired crushing power. It is absolutely necessary that your artillery reserves be not displayed until the very last moment, when they must be used with all possible speed and with their maximum power. This rôle is one for which portée artillery is particularly fitted.

The method for the tactical use of portée artillery as part of the G. H. Q. Reserve is as follows: The portée units should be held at a distance from the front line and moved only just previous to the operation and then with all possible secrecy and rapidity. They are usually attached to an army by brigades which, in turn, pass them down by regiments or brigades to the corps. There they may be held or perhaps may be given further missions to support divisions or even regiments of divisional artillery. They usually revert to the army (or the corps) as soon as reaching the limit of their range or when forced to move from initial positions. All movements are done under cover of darkness, the reconnaissance parties and headquarters personnel usually "going in" the night before, with the guns coming in the last night before the operation commences. The reconnaissance parties are thus able to have an entire day to become acquainted with the situation by personal contact and inspection. Parties locate their positions which are staked out, observation posts and command posts established, data calculated, and wires laid. Guides are then instructed where they will meet their units so they can easily and quickly lead them on their arrival at night to their respective installations. The commanding officers should arrange all details with supported artillery commanders, the details including the scheme of maneuver, boundaries, lines of departure or defense lines, schedules of fire, liaison, etc. Much time can be saved by utilization, as far as possible, of existing installations of artillery already present, which will generally be the supported unit. There is practically no occasion when fire should be allowed before the preparation. It is well to note here that map firing is the general practice, due to the requirements of the tactical situation. This makes it necessary, for a campaign where the G. H. Q. artillery is to be used, in countries of which reliable maps are not available, that the air service furnish accurate aerial photographs.

The location of the battery positions is usually on or near

roads, but positions may be occupied at any distance therefrom by the use of the battery tractor. However, positions can usually be obtained near roads for batteries which come in just prior to an attack or defense, because these positions would not be possible to be occupied by other artillery which had to remain more than a day in one position. In portée artillery, a position easily accessible for supply and ease of entry is much more to be desired than a so-called "good battery position," from the tactical point of view, but difficult of approach by reason of a long or poor route from the main roads. The battery positions in an attack should be pushed as far forward as the enemy situation will allow, so as to permit long range, and also to continue firing when the organic artillery is on the move forward, care being taken not to get the motors so near that they can be heard by enemy posts. It will be noted that trucks can always approach much closer than tractor-drawn artillery.

The most important consideration is the same for portée as for all artillery—ammunition supply. In the handling of ammunition, every effort must be made to reduce the labor of your personnel, for the greatest wear on the men is in transferring ammunition from the trucks to the gun positions. A good position near roads greatly reduces the labor involved. A small ammunition cart, built on the style of a motorcycle's side car, capable of carrying some 35 rounds, is used with great success by the French to transport ammunition from the trucks to the position. A great saving of man power is obtained by using trucks instead of caissons for transporting ammunition, one truck driven by a single man being equal in hauling capacity to over two caissons with a personnel of at least seven men. Again at the distributing point, five trucks occupy only the loading space of three caissons, which aids materially the speed of loading. On account of the speed of the trucks, the distance of haul can be greater for portée units. All in all, the saving in time and labor for the portée units is considerable. During the war, the French regiments furnished their own personnel for handling their ammunition. As most of the hauling will be done while no firing is going on, it is believed that this arrangement will be the normal one and that no additional personnel will be needed other than the regular battery personnel.

In planning the use of portée artillery, consideration should be given to its ability of displacement over great distances when railroads

are not available or when they are taxed to the limit with troops or supplies. It is here that the tactics of maneuver are demonstrated. Small portée units are able to march from 70 to 100 miles per day, depending upon traffic and road conditions. Larger units, such as brigades, however, can only be counted on for about 60 miles per day in the battle zone. All units should be routed over roads reserved for truck traffic whenever possible. An interesting example of a movement made under war conditions is that of the 49th R. A. C. P. (French) which occurred March 25, 1918. The movement was made through the road congestion existing behind a broken front and by night marching. This regiment of three battalions left Bulligny (12 kilometers south of Toul) and marched to support the defense of the English army near Amiens. In five nights and four days it traveled 492 kilometers and was the first of all French reenforcements to arrive in support of the defense. It is remarkable that every vehicle completed this march except a light telephone truck. This tends to prove that with all artillery units, motor or horse, maintenance of transportation is the secret of success. It is well to note at this point that small portée units cannot be used for a long time away from their regiments, on account of their inability to maintain themselves due to the lack of sufficient trained repair personnel and spare parts. The number of trained motor mechanics necessary for the maintenance of the vehicles is seldom available in units smaller than the regiment. The parcelling out of small units of portée artillery is a most frequent mistake of superior commanders. Staff officers, in planning the use of this type of artillery, should keep this in mind. Of course, a careful study of routes and road conditions previous to the beginning of the movement must be made so as to assure the uninterrupted march of the different columns, which naturally must be arranged by the respective speeds of the vehicles. This rapidity of displacement is one of the greatest assets of the High Command in any phase of war.

All wars will, no doubt, cause shortages in the number of cannon available, due to the long time needed for the manufacture of new matériel. Again there is also the never ending demand for greater numbers of guns per thousand men. It is the portée batteries whose guns will remain the fewest hours out of action while marching on roads. As far as the enemy's point of view is concerned, batteries on the road and out of action are "neutralized" and, therefore, any

means by which this time may be reduced is of the highest importance to all armies. In the World War, after over four years duration when every effort of the various nations had been made to increase the quantity of artillery matériel, there was still a large shortage of cannon in 1918. The division and corps batteries were overworked to such an extent that their efficiency was seriously affected both in ability to maneuver and in firing efficiency. The portée units were then indispensable to any plan of the High Command, as their guns could be used at many points with the least possible time out of action on the march. As an example of this flexible and powerful reserve, take the case of a regiment which in September, 1918, was engaged in supporting the fronts of thirty-two divisions belonging to the French, American, English and Italian armies. Such use by any other types of artillery is manifestly impossible. In spite of this incessant activity, this regiment was not fatigued to the exhausting point; in fact, their morale was excellent as they developed a high esprit as "artillery shock troops." This method of employment was typical of most of the portée regiments in the latter phases of the war. No big engagement was launched until their arrival, and by their ready and constant activity they proved that their potential fire power per gun was far greater than other regiments of the same caliber not having this type of transportation. This potential fire power per gun was said, by one of the leading authorities on portée artillery of the French Army, at the Center of Artillery Tactical Studies at Metz to be four to one in favor of the portée units over horse-drawn units. This increase in potential gun power is, of course, of immense importance to the High Command.

The principles of artillery tactics require surprise attacks and the predominance of neutralization by fires of great density. It is apparent that animal-drawn artillery cannot be held at any great distance from the front and be in position at the crucial hour. Even tractor-drawn artillery will find it most difficult to arrive at the time desired from a sufficient distance so that enemy intelligence will be unaware of the scheme of maneuver of our force until it is too late for adequate counter-action. However, portée artillery can, as has been shown, most successfully accomplish both of these missions.

During an operation, good troops can be accustomed to continuous

artillery fire of light density from which they can escape by leaving the zone or seeking shelter. However, no troops can become habituated to a deluge of shells suddenly arriving from several directions at the same time, leaving them no time to take shelter. Portée artillery used in large units is able to smother its targets in an avalanche of projectiles, thus causing an acute disorganization lasting for a considerable period of time. Portée artillery is the only artillery able to expend these large quantities of ammunition in short periods, owing to the fact it has no problem of conservation due to its ability rapidly and adequately to supply itself by means of its own vehicles. Occasions occurred during the World War where portée units were not only able to supply all their own needs but, in addition, furnished ammunition to horse outfits which were unable to supply themselves. The ability of a regiment to supply itself with ammunition is illustrated by the case of the 49th French Regiment which in a period of less than seven months in 1918 fired over 800,000 rounds of 75-mm. ammunition.

What, then, appears to be the future of portée artillery? It is obviously not a substitute for animal-drawn artillery, for neither one nor the other is sufficiently able to fulfill completely all the tasks of the lighter guns. But must be used at times or in combination. Its rôle is not in the meeting engagement or in support of small troop bodies. But portée artillery will go anywhere that trucks will go, which means anywhere an army will go.

Portée artillery, by reason of its simpler organization and rapid mobilization, seems adaptable especially for our National Guard. Also its economy of upkeep and the requirement of less expensive armories, when compared to horse-drawn units of the same fire power, commends itself to the maintenance of peace-time National Guard artillery. Experiments conducted in Hawaii and Panama since the war have proved this type of artillery has great advantages for the defense of those territories. With the enormous development of motor transportation in this country and the rapid expansion of the road system, it is inevitable that portée artillery will become increasingly valuable to our army and that it will have an important expansion in the future development of our artillery.

SIXTEENTH CENTURY GUNNERY

BY LIEUTENANT COLONEL K. P. WILLIAMS, F.A., INDIANA N. G., AND R. H. COON, ASSOCIATE PROFESSOR OF LATIN, INDIANA UNIVERSITY

THE UNCERTAINTY that obscures the circumstances and activities of the fourteenth, fifteenth, and sixteenth centuries naturally extends to artillery, and makes it difficult to trace its early history. From meager references to the *Wagenburg,* to the *cartes with gonnes,* to *master gunners,* and to *servitour gunners,* the story of the early stages must be imperfectly pieced together. Progress was steady, though, of course, slow in comparison with that which we at the present day associate new developments. The difficulties to be overcome were formidable. Chief among them were, of course, mobility and an understanding of the rôle the new weapon could play on the field of battle if skilfully employed.

One phase of the development of artillery can be traced with more completeness. It is that which pertains to the science of gunnery. This had to be initiated by some one who possessed a scientific instinct. The custom of scholars to develop their ideas in books, and their tendency to regard themselves as constituting a band irrespective of nationality and political allegiance, naturally resulted in leaving a record of the beginnings of the extensive science of gunnery and ballistics.

The first writer on the subject is generally conceded to have been Tartaglia. This quite renowned mathematician published a work, *Nuova Scienzia,* in Venice in 1537, a portion of which deals with the theory and practice of gunnery. Tartaglia's ideas concerning the simplest elements of kinematics were imperfect. It remained for the eminent Galileo to prove even the proposition that the path of a projectile is a parabola if the resistance of the air is neglected. This theorem seems now distinctly simple, but its proof requires an understanding of the method of combining velocities and a knowledge of the law of a freely falling body.

The present paper is devoted to an illustration of some of the ideas about gunnery as given by a writer who followed Tartaglia by a few years but who preceded Galileo.

Practically nothing seems to have been recorded concerning

Daniel Santbech. He lived in Nijmegen, Holland, and published at Basil in 1561 a folio work in Latin of 294 pages devoted to problems of astronomy and geometry. He also brought out an edition, presumably the same year, of the famous trigonometry of Regiomontanus. A section of the first work is devoted to problems of gunnery. It is well illustrated with wood cuts that are both quaint and amusing. There is no hint of either horror or confusion on the battlefields of Santbech. Clouds, birds, and trees are dominant parts of the landscape, and leave the impression that the activities of the artillerymen occur amid agreeable surroundings. The gunners reveal a very commendable coolness. In some instances they seem decidedly mature. This need occasion no surprise, for in the early days the artillery did not belong to the army, but the gunners owned their guns and sold their services to needy and belligerent princes. Some of the gunners that Elizabeth had in the tower are reported to have been ninety years old. At least with her gunners the maiden queen was not flirtatious. But senility is by no means a characteristic of all of Santbech's gunners, for many of them clearly combine agility with nonchalance.

However interesting the inferences one may draw from the illustrations concerning the matériel, the personnel, and the character of sixteenth century warfare, one examines the pages of Santbech primarily to discover his principles of gunnery. He states his problems in well-digested form. The spirit of Euclid is naturally present in his exposition, but the terseness of that great teacher often gives way to the extreme verbosity of the contemporary writer, and we find at times irksome repetition.

Santbech announces at the start the principle he will use for the solution of the problems of artillery. The principle amounts to assuming that the path of the projectile is a straight line until a point is reached where the original impulse has vanished, and the projectile falls to the ground in a second straight line. One is, of course, amazed at the naïve thinking which would accept as true anything so utterly at variance with the visible path of a stone thrown by the hand. Santbech is evidently led to think that in the case of a cannon the far greater velocity of projection completely alters the character of the phenomenon. It is also implied in his work that the distance the projectile travels in a straight line before starting its vertical drop is (for a given gun) a constant independent

of the angle of fire. He uses this assumed *range* in the solution of his problems, but nowhere enters into a discussion of how it can be obtained. He does, however, develop a rather complete method of setting a gun at a desired elevation, and the provision he makes for sights is quite surprising.

We give with certain omissions three of Santbech's propositions, the one that states his fundamental principle, and two showing its application.*

PROPOSITION CXIII

THE FUNDAMENTAL BASIS FOR THE FIRING OF CANNON BALLS

The following proposition of Euclid (in the sixth book of his Elements) is at the foundation of this whole treatise: The sides of

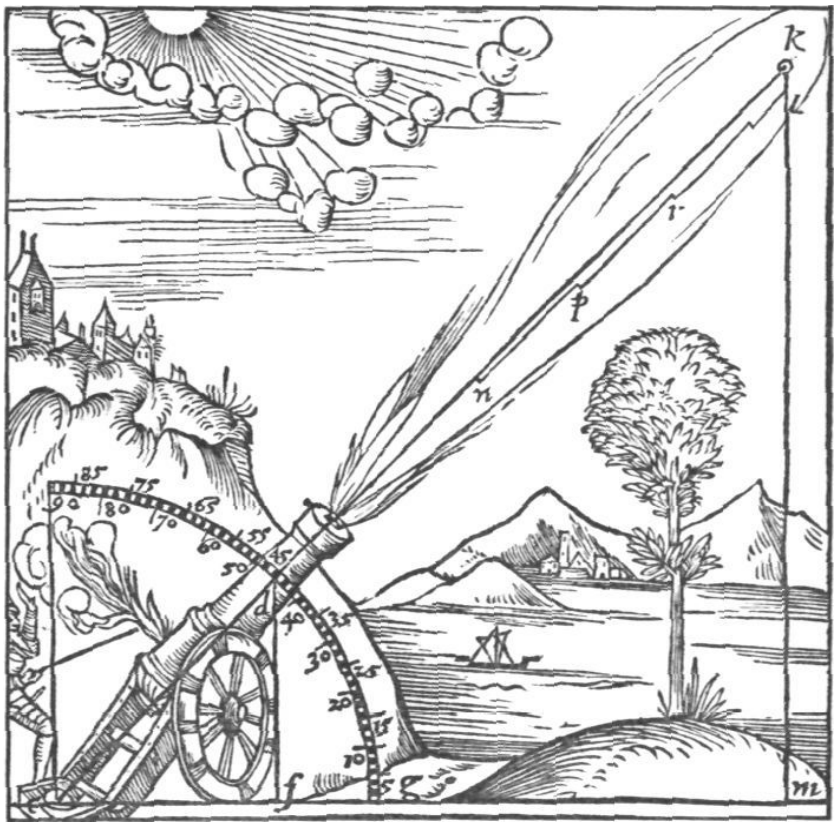


FIGURE 1

*No indication will be made of the portions of propositions omitted.

triangles with corresponding angles equal, that is, the sides which bound such angles and the sides which subtend them are proportional. Assume that we are to find two triangles of this kind in connection with the firing of cannon balls.* One of them is a right angle triangle, having three lines, the first of which is the hypotenuse of the cannon,† or the path which the ball traverses from its starting point, after being discharged with great force, to a point from which it turns and drops to the ground. We understand that this does not form an exact straight line, although the departure from the straight line is not great.

For the powerful force with which the ball is discharged is not broken in a moment so that the ball drops immediately from its high point to the ground, but on its way it gradually loses its force until finally at the end of its course it is exhausted. And on this account the ball, at the end of its path, does not exactly reach the intersection of the vertical line with the line formed from the elevation of the cannon, but it strikes the line a little below that point. Therefore, although the ball traverses a line which is not exactly straight, yet in determining the angle of elevation of the cannon we must assume the hypotenuse to be a straight line. The second line is the path which the ball traverses, when, after the failure of the projecting force, it is borne by force of gravity to the earth at right angles. The invariable experience of all time attests the fact that this line forms an exact vertical line of a right triangle.

PROPOSITION CXXIII

THE ANGLE ABOVE THE HORIZONTAL AT WHICH A CANNON MUST BE SET IN ORDER FOR A BALL TO DROP ON A FIXED POINT IN A VERTICAL LINE

Assume that a ball is to be fired from a cannon so as to drop on a point N (Fig. 2). First let us find from the lines NO and CO, which are known by observation, the line CN, which subtends the right angle CON: This is done according to the next to the last proposition of the first book of the Elements (of Euclid). It is

*The word used by Santbeck is *sphera*.

†The Latin word used is *tormentum,* which in classical Latin was used to denote any mechanical contrivance for hurling heavy projectiles such as stones. Santbech's use of the word *hypotenuse* in this connection is a good illustration of the deficiencies of an existing vocabulary for the needs of a new science.

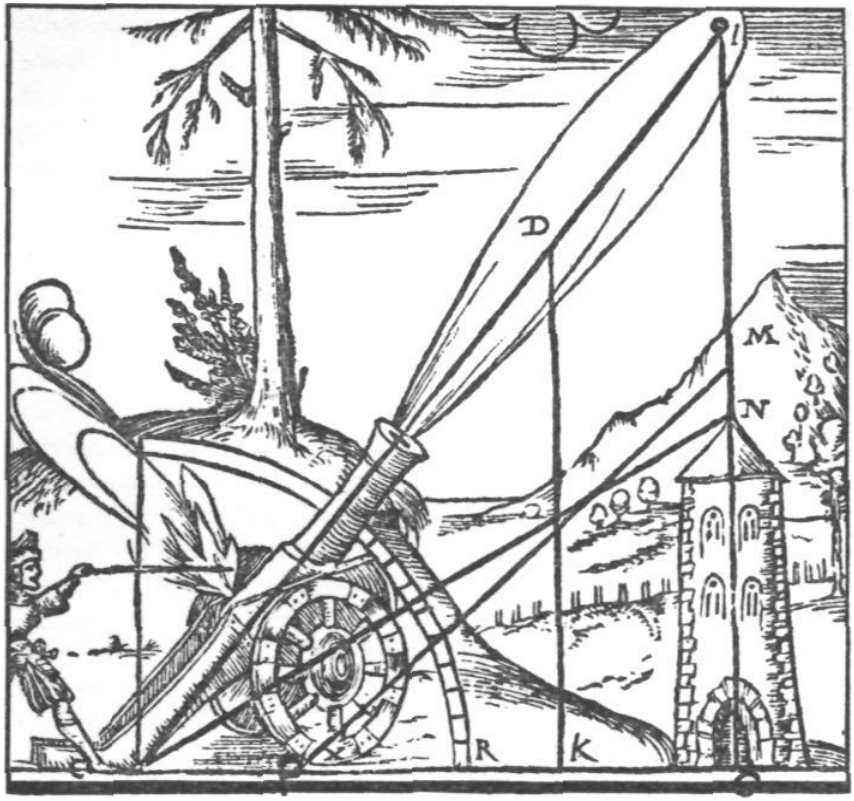


FIGURE 2

agreed that if a ball is to be fired from the point C so as to drop upon the point N, CL must be longer than CN, and that the angle LCO must be larger than NCO. For, since both COL and CON are right triangles, having the common base CO, and the vertical line LO is greater than NO, the square of LO will be greater than the square of NO. But the sum of the squares of CO and LO, according to the above-mentioned proposition of the Elements, equals the square of CL, and by the proposition the sum of the squares of CO and NO equals the square of CN, and the latter are smaller than the square of LC. Consequently the line LC is longer than the line NC. This is proved even more simply by the twenty-first proposition of the same book. According to it the two sides CN and NO are shorter than the two sides CL and LO, and the angle CNO is larger than the angle CLO. Therefore, since the two acute angles in a

right triangle equal a right angle, it must follow that the angle LCO is larger than the angle NCO. Clearly then if the cannon should fire the ball only to point D, since CD is shorter by hypothesis than CN, the cannon must be advanced closer. For otherwise the ball would not be carried to the fixed point but would drop to the plane below at the point K. But suppose the power of the cannon is sufficient to reach only as far as D. The nearest point must be gained in the plane CO from which the power of the cannon can project the ball to the vertical line LO. Assume some point in LO little above N, that is M, from which we draw a straight line MP to the plane below, which is equal to CD, and which strikes at the point P. The distance PO must then be found. In the right angle triangle PMO two sides are known, PM by hypothesis and MO by observation. The base OP then will be known according to the twenty-sixth proposition of the first book of Regiomontanus. And so, if the cannon were advanced to P, the ball would strike the vertical line at M. With these facts known, let us see how the thing may be explained

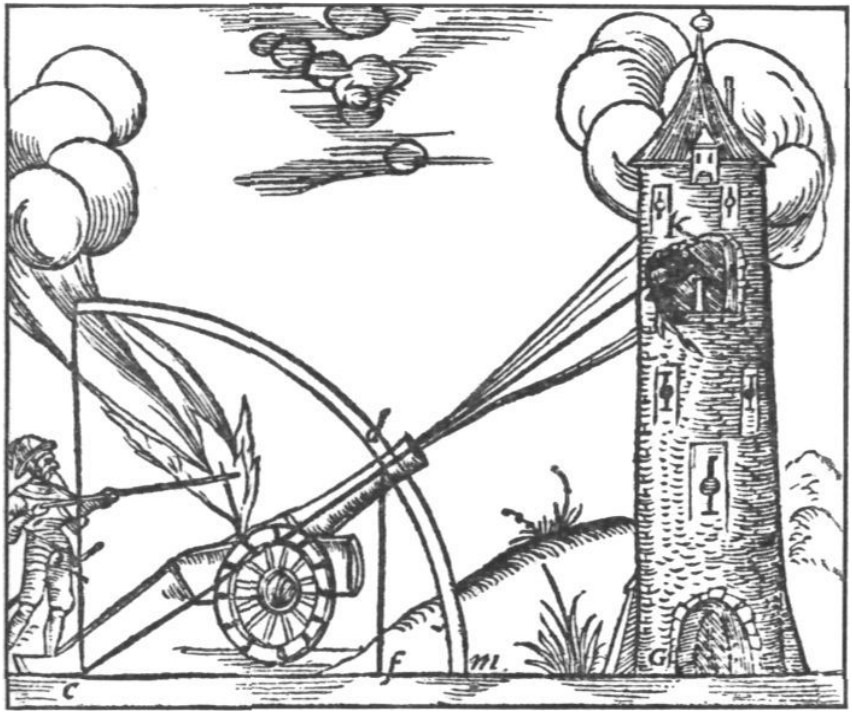


FIGURE 3

by a concrete example. Assume that the full force of the cannon can fire the ball along CL, which is 1,000 paces, while the distance CO is 600, and altitude NO is 100. The first question is whether the power of the cannon can fire the ball so far as to touch at some point the vertical line LN. First square CL, which gives 1,000,000, then square CO, which gives 360,000. Subtract the latter from the former and there remains 640,000, the square of the vertical line. The square root of this is 800 (the number of paces in the vertical line). Since this is greater than 100, there is no doubt of the result. By this demonstration, then, it is established that the ball drops about 700 paces in reaching the point N. Now we still have to investigate the angle of elevation of the cannon, a problem to be solved very easily by the table of the sines. (Santbech finds the elevation of the gun to be 53° 8′, which is the correct value of arc sin. 8000).

PROPOSITION CXXIIII

HOW A BALL SHOULD BE FIRED FROM A CANNON IN ORDER TO FOLLOW THE COURSE OF THE HYPOTENUSE TO A GIVEN POINT

The problem is to determine the angle of elevation of a cannon placed at point C of a plane CG so that it can fire a ball to the point K. By hypothesis we know nothing except the hypotenuse, but by measurement we can find the line KG, which is that of the altitude of the given point, and CG, that of the base of it from the cannon. Square both of these. From the sum of the squares we obtain the square of the line CK subtending the right angle CGK, the square root of which is the line CK. If this is found to be less than the hypotenuse, it is certain that the difficulty can be overcome. With these points determined we can proceed to the discovery of the circumference DM, which fixes the elevation of the axis CD of the cannon. Since DF is perpendicular to CG, as we pointed out at the start, according to the fourth proposition of the sixth book of the Elements (of Euclid), CK is to KG as CD is to DF, which line is the right sine subtending the proposed circumference. Three of these are known, CD, CK, KG. The fourth will be found from the rule of proportion, by which, from the tables and from the circumference, DM will be found. The following is a concrete example of this: Assume the hypotenuse to be 900 paces, the altitude CK to be 100, and the distance CG to be 300. The square of CK is 10,000, of CG is 90,000. Adding these, we obtain 100,000, the square root of which is 316 = CK. Therefore it is clear that the ball fired from C will strike K with very great force if the cannon is raised to the correct elevation. (From the table of sines Santbech finds the angle to be 18° 27′.) Such, then, is the angle of inclination of the cannon. But the gunners can see this without difficulty even with their own eyes.

The problems that Santbech deals with are quite varied, and some of them are rather complex. They deal entirely with the attack and defense of buildings and walled cities. There is nothing to indicate the use of artillery against infantry or personnel in the open. In some cases batteries of two or three guns are indicated, and one even sees the beginnings of the modern battery commander's detail.

REPULSE OF MEXICAN CAVALRY AT BUENA VISTA

METHOD OF MAINTAINING PISTOL COMPETITION AT THE UNIVERSITY OF MISSOURI

BY 1ST LIEUT. E. V. KERR, F.A., D.O.L.

ANY OFFICER who has ever served on R. O. T. C. duty knows the value of the pistol, rifle and polo competitions to the military instruction at the various institutions. In addition to the publicity that they give the Military Department and the school, they establish a personal contact with the student, arouse his interest and combat the discontent which some undergraduates feel at the compulsory feature of our military training in a way that nothing else can imitate. Almost all of the students, entering such activities as basics, continue into the Advance Course, and the schools where these activities are most widely developed have little or no trouble with anti-military training propaganda.

For years most of the Field Artillery R. O. T. C. units have maintained pistol teams and held annual intercollegiate pistol matches with one another. There has never been a specific allowance for such competitions, but the surplus from the normal allowance of 250 rounds per student more than covered the expenditure of ammunition for such purposes. A few years ago this allowance was cut to 100 rounds per student, last year it was cut to 90 rounds per advanced course student, and this year it was further limited to the first year advance course (Juniors) only, making a saving of enough ammunition to train a team or hold any matches almost an impossibility.

Having won the National Match sponsored by the Chief of Field Artillery last spring and desiring to retain possession of the cup this year, we have given a great amount of attention to the problem of maintaining a team in spite of the above handicap and have evolved a system by which we can do so. This scheme would work equally well at other institutions.

By using the cailber .22 for all of our practice and only allowing the five high men to practice a few periods prior to each competition, this amount of ammunition will suffice for eight or ten caliber .45 matches. By requiring the team members to trigger

squeeze with the heavier weapon each time they fire the lighter one, we find that their scores with the caliber .45 are not appreciably lowered by the shift. In all of our local matches and in all of our N. R. A. matches, except the Field Artillery R. O. T. C. match, we use the caliber .22 and hope to hold most of our interscholastic matches with the same weapon as soon as other schools adopt it.

After the original expenditure of $297, our system enables us to carry on our pistol practice and competition without any further expense to the Government or to the institution, as the club dues meet all expenses.

In response to eighteen challenges which we mailed this year, we have received one acceptance and four letters of inquiry as to our system of maintaining a team. The other schools are apparently holding up their answers to our challenge in the hopes of finding a solution to the problem.

Believing that all the Field Artillery R. O. T. C. can be reached through the FIELD ARTILLERY JOURNAL better than through any other channels, I am outlining the method we use in hopes that the other schools may read and adopt some similar plan that will enable us to continue our competitions as before. Unless this is done, it is my belief that interscholastic pistol competitions will have to be discontinued and one of the best morale builders of the Field Artillery R. O. T. C. will be lost.

At the University of Missouri, pistol competition is considered as a minor sport and under such a ruling sweaters and numerals are authorized for the Varsity and Freshman teams. In addition, the intercollegiate matches, the N. R. A. match for Field Artillery, R. O. T. C., the other N. R. A. individual and team matches, and shoulder to shoulder matches with nearby National Guard, Police and Reserve Officers' teams, provide considerable inducement to the students to compete therein.

Practice and competition in these events are limited to members of the University of Missouri Pistol Club. Costs of membership are $2.00 initiation fee and $1.00 per semester dues, a total of $4.00 per year.

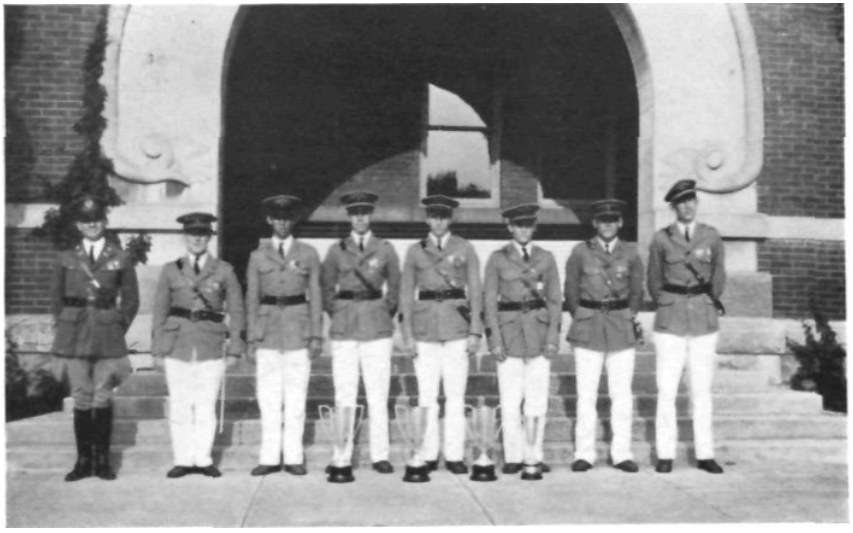
The equipment of the club consists of ninety Colt automatics, caliber .45; eight Colt automatics, caliber .22, Woodsman Model; an outdoor range and an indoor range (suitable for .22 caliber

only). The caliber .22 pistols were purchased last spring and the indoor range constructed this fall at a cost to the military fund of $297.00 ($85.00 for the range and $212.00 for the eight caliber .22 pistols). The .45 caliber pistols and the outdoor range are, of course, the regular government equipment of all Field Artillery R. O. T. C. Units.

We purchase our .22 caliber ammunition from the Ordnance Department at approximately $3.75 per thousand rounds, freight included. As every club member pays dues sufficient to purchase 1,000 rounds of ammunition, he is allowed that much firing. This amounts to twenty rounds per practice period, twice a week. Any club member desiring additional practice may purchase additional ammunition from the club, and, prior to each match, the better shots all do this. Quite a few of the club members become discouraged as the season progresses, leaving plenty of extra caliber .22 ammunition for special purposes.

We are authorized by AR 775-10 to expend ninety rounds of caliber .45 ammunition for every first year advance course student. By giving them their instructional practice with the .22 caliber pistols (150 rounds per man), we are able to qualify more of them and at the same time save about 45 rounds of caliber .45 per student. We are also authorized by 7th Corps Area Headquarters to expend 450 rounds per year for use in firing the N. R. A. match sponsored by the Chief of Field Artillery.

BATTLE OF SACRAMENTO



UNIVERSITY OF MISSOURI PISTOL TEAM, NATIONAL CHAMPIONS, 1928

Left to right: Lieut. E. V. Kerr, W. L. Sapper, G. L. Noland, C. R. Courtney, J. V. Elzea, J. C. Baker, O. H. Meyer, C. D. Gleason.

UNIVERSITY OF MISSOURI PISTOL CLUB.

"MY CENTER IS GIVING WAY, MY RIGHT IS RETIRING, IMPOSSIBLE TO MANOEUVRE, THE SITUATION IS EXCELLENT, I SHALL ATTACK." TELEGRAM FROM GEN. FOCH TO G. H. Q., SEPT. 9, 1914.

THE CONDUCT OF WAR

BY MARSHAL FERDINAND FOCH
AUTHOR OF "THE PRINCIPLES OF WAR"
TRANSLATED BY CAPTAIN W. F. KERNAN, FIELD ARTILLERY, U. S. ARMY

PREFACE TO THE FOURTH FRENCH EDITION

THIS book, published in 1903, was intended to perform somewhat the function of a beacon light that is set up on a dangerous coast for the guidance of the uncertain navigator. It was an elementary treatise; as such, it sought to establish certain truths regarding the conduct of war that are generally accepted as axiomatic, but whose application to concrete situations needed to be worked out in detail. Its plan was to lead the student towards the solution of ever-changing problems of war by intellectual exercises based on the study of history. In this manner, and by researches made into wars of the past, it was thought possible to discover the principles underlying the art of modern warfare.

In 1918, even without considering factors of *morale*—that outgrowth of modern warfare which has resulted in arousing national spirit to an unprecedented degree and in mobilizing the entire population—it is evident that with the growth of industry there has been a corresponding development of armament, and that the art of war has undergone very important transformations due to the introduction of new weapons. Machine guns and barbed wire, for example, now permit the rapid organization of defensive strong points, thus endowing trenches and natural obstacles with a solidity which permits a heretofore undreamed-of extension of defensive fronts. Accordingly large defensive areas may be quickly organized, and, once organized, they are exceedingly difficult to take by assault.

The offensive, confronted with these measures, has also resorted to new weapons. Machine guns and tanks have been added to the already formidable fire power of modern artillery which, together with the action of cannon mounted on self-propelled mounts and protected by armor, makes it possible for the attacking side to overcome the machine guns and barbed-wire entanglements of the enemy's defensive positions.

Along with the manufacture of cannon and munitions on an unprecedented scale there has grown up the necessity for other

machines of war. All of which demand for their production—steel. Thus it is that a nation may be enabled to launch an early offensive because of its highly developed industrial resources and, conversely, the lack of such resources may force a nation to assume the defensive in spite of the numerical strength of its armies.

Aviation, by means of its greatly improved technique, has opened the theater of the air. Air superiority, and consequently the superiority of all communications, will be gained by that adversary possessing the best and the most efficient aerial equipment. Here also we observe the appeal to industrial rivalry. The same thing is true of the manufacture of poison gas and of the many other materials of war which modern armies are coming to demand of their governments in ever-increasing amounts. The result is that our armies are more and more difficult to feed, to shelter, and to transport. Thus again the industrial capacity of a nation at war may be said to determine the striking power of its armies.

The above elements constitute new conditions in the art of war which, as we see, has already adopted new methods. We may as well say that war has become a new art altogether. How, therefore, can the principles of this new art be embodied in a work originally written in 1903?

The fundamental truths underlying the art of war remain unchanged. Just as the principles of mechanics govern in architecture whether the materials of construction be wood, stone, iron or reinforced concrete; just as the principles of harmony underlie all musical composition whatever the instrument may be, so it is always necessary that the principles of war be clearly established.

Because of new conditions, the men who will command troops must prepare themselves to face an ever-widening horizon, to deal with situations always more and more varied. It is only by developing through constant study the capacity of analysis and then of synthesis—that is to say, the ability to reach conclusions in a purely objective manner—that the military commander will gain the power of forming prompt and judicious decisions. Of even more importance, he will gain through the certainty of his convictions the confidence necessary to make such decisions on the field of battle. For this reason, and in order to avoid any possible deviation of mind, actual situations taken from history must be considered.

Thus it is hoped that the present work, although originally written in 1903, may still serve to assist in the education of future commanders, and that it may guide those who desire to study the fundamental principles of war.

Sept. 1, 1918. F. FOCH.

THE CONDUCT OF WAR

THE BATTLE OF MANŒUVRE

PART 1

THE PLAN OF WAR

CHAPTER I

THE PURPOSE OF WAR

Military science in past ages concerned itself primarily with the conservation of an army's strength. It usually attained its ends by ruses, by threats of battle, by negotiations, by maneuvers, by local combat, by the occupation of enemy territory, or by the capture of towns. Modern warfare, since Napoleon, uses freely all the means at its disposal without counting the cost. It recognizes but one argument—the act of force. It is only after having defeated the enemy in battle and exhausted him by a successful pursuit that it consents to negotiate with him.

Strategy demands, first of all, study and preparation in order to obtain the most favorable conditions for one outcome—battle, and, the first battle being won, commences its preparations for a second battle.

The rôle of tactics is to direct rationally the progress of these battles, and to accomplish the destruction of the enemy's forces through the application of the principles of mechanics and the laws of morale.

Although history shows these two divisions of military art were carried to different degrees of elaboration by a Napoleon or a Moltke, yet it is evident that both the strategy and the tactics of these generals were influenced by the same developments which confront us when we study the warfare of today, namely:

1. The nationalization of recruiting.
2. Greater numbers of combatants.
3. Perfection of armament.

The successful command of troops in war is becoming more and

more dependent on the ability to foresee and prepare for the *offensive battle* and, after this battle has begun, the ability to launch the *decisive attack*. Herein lies the master principle of all warfare. It must always be kept in mind if we would overcome the difficulties and hesitations which attend the formation of correct decisions. Let us remember the words of Napoleon:

> "It is difficult to appreciate what strength of mind is required to deliver—after having carefully considered the consequences—one of those great battles upon which the fate of an army, a nation or a throne depends. Generals who give battle willingly are not easy to find."

Nevertheless that is the big decision which must be made.

The study of history reveals a campaign as a series of strategic movements, each terminating in an important battle. Are these various movements connected only by chance, or at best by the unconscious genius of their originator? Or are they, on the other hand, the products of an irrefutable logic, which we can follow step by step? Can we study the relation of cause and effect underlying the movements of an army from the day it takes the field to the day it returns to its barracks after having dictated a victorious treaty of peace? This is the question which we must consider.

After studying war in detail we shall go further and consider its synthesis. Thus we shall attempt to discover the logical connection between its different operations and the point where it attains its end. Does war consist merely of the maneuvering of armies and their subsequent employment in battle? Or is there, in addition to this, a theory of war which will tell us what the goal of battle is? In what manner for example should strategy, foreseeing battle, seek to bring that battle about and pass on to a second or third battle? Finally; how can these battles be so planned as to fulfil the original purpose of the war?

To all such questions Napoleon has given us an answer. His attention being directed on one occasion to the expression "Methodical War" in a book, he exclaimed in exasperation:

> "Every well planned war is a methodical war . . . indeed it is inevitable that all war should be methodical, because war must be waged in accordance with the principles of military art and the laws of reason, in conformance to its purpose."

It follows therefore that a war is well or poorly waged precisely as there is, or is not, a logical connection of the ideas and methods of the Commander-in-Chief. The successful waging of war demands the correct adaptation of the rules of military art to the end pursued.

Napoleon adds:

> "Strategy is an art founded on certain simple and easily understood principles. The great generals of antiquity, as well as those of modern times who have followed worthily in their footsteps, achieved fame only because they mastered certain axioms of war. These are: *Correctness in combining factors, exactitude in estimating the means required, and the ability to overcome difficulties as they arise*.
>
> "They conquered, their most ambitious plans were carried out, their most difficult enterprises were successful because they assimilated these principles.
>
> "If they are now regarded as our models it is because they never ceased to make of war a true science, and if we would emulate them we can only do so by following where they have led."

War, then, rightly considered, is not a product of chance but a science, and as such can be studied and assimilated. Strategy has its principles, and these principles alone establish *correctness in combining factors, the exactitude in estimating the means required*.

In this connection Clausewitz says,

> "When we read the accounts of campaigns which have been left us by famous generals; when we consider how they set in motion hundreds of thousands of men as easily as they moved their own bodies; when we appreciate the fact that they deduced their decisions—which they put into execution so effectively—from the simplest principles (sometimes they even went so far as to attribute their actions to instinct), then at first sight nothing appears easier than the command of armies. War seems reduced to the proportions of a duel between individuals.
>
> "But when it comes to the formation of a *theory*, when it becomes necessary to view these events systematically and as a whole—assigning to each operation a sufficient and logical cause—the mind is in danger of becoming confused; and we feel the

irresistible fear of moving always in the lower depths of elementary ideas. We fear, in such moments, the inaccessibility of the higher regions of strategy, where a great general achieves the freedom necessary to control events, to embrace, as it were, a whole war in a single glance and to determine upon and follow a given course of action undeterred by the difficulties which confront him.

"However, we too can succeed if we will persevere in the direction indicated above (the analysis of facts, the study of history). Remember that whenever ideas unite and interpenetrate to form principles, theory alone can be our guide. And therefore we depend upon theory for the formulation of brilliant conceptions as well as for the fundamental principles of military art.

"But at this point theory ceases to lend its aid; for it can no more furnish the formulae for the solution of individual problems than it can indicate a particular line of action for us to take. After disclosing the mass of objectives and their relations it abandons us to our own initiative, and, whenever action is imperative, we must make our own decisions and dispositions within the scope of the means at hand and in accordance with the mental powers with which we are endowed.

"From this double equation we derive our insight into the situation confronting us and our estimate of the means to be employed. It is often true that our mental labors appear to have less influence on the result than the force of necessity and the perils with which we are faced."

To recapitulate—we study over and over the same lesson and arrive always at the same conclusion as regards war: all operations have their logical relations. These relations find their expression in the form of theory. The knowledge of this theory strengthens and moulds our spirit.

When we pass from theory to action we must rely upon our knowledge of facts, upon truth itself, upon our convictions—and character and strength of heart are derived from conviction—in order to find that freedom of action which is necessary to dominate the stubborn realities surrounding us.

Here is the double equation, one term of which the school

gives us, but it only indicates the other term to us. Thus the distance between the plan and its fulfillment, between theory and practice, is reduced but never entirely eliminated.

It is with this mental attitude that we would once more approach the study of the war of 1870; from this war, a war of yesterday, we shall attempt to discover the principles which govern modern warfare in general and the war of the future in particular. From these principles we shall develop a theory of the relations existing between the various phases of strategy.

Studying with particular care the first phase of strategy—that phase which leads up to the first battle—we shall seek to discover by analysis the purpose of the operations of which it is composed; we shall endeavor to forecast the part that these initial operations will play in future wars; and we shall outline the manner of conducting them which is most likely to be successful.

1. THE CAUSES OF WAR

Before determining whither war leads us, let us see how it comes about and where it comes from.

Moltke, in writing the history of the war of 1866, commences his account with this plain statement of a somewhat brutal frankness: "The war with Austria had become a necessity of history."

The war of 1870 was produced by similar causes; that is, it arose solely and exclusively because of Prussia's desire to wage it; and this desire itself was born of Prussian ambition and consciousness of power.

This point is unquestionable inasmuch as Prince Bismarck has taken it upon himself to give us the facts:

On the 13th of July, 1870, Moltke, Roon and Bismarck had luncheon together; they were speaking of the eagerly awaited war with France when a telegram from the King of Prussia of a tenor very hopeful of peace arrived for Bismarck. The Chancellor read it to his guests. He adds:

> "Moltke and Roon dropped their knives and forks in consternation. We were very much disappointed and had the feeling that the affair was being mismanaged.
>
> "Addressing Moltke, I put this question to him, 'Is our army really in sufficiently good condition for us to commence this war

with a reasonable certainty of victory?' 'Never better,' he replied.

"Roon, in whom I had, it must be confessed, less confidence, confirmed fully the words of Moltke.

"'Very well,' said I to my guests, 'you may continue your luncheon in peace.'

"Seating myself at a round marble table nearby, I read the telegram carefully and, taking a pencil, crossed out the passage which referred to Benedetti having demanded a second audience. The beginning and the end of the telegram I left intact.

"The message now had a totally different meaning, and when I read it to Moltke and Roon in the new form I had given to it they both exclaimed, 'Splendid, this is sure to have its effect.'

"We continued to eat with a better appetite. The result is a matter of common knowledge."

This account needs no commentary. 1866 had seen Austria, the powerful rival of Prussia, rejected from the Germanic Confederation. 1870 was to create Germanic unity for the benefit of the same Prussia.

What better cement for this union than German blood spilled in defending the fatherland against the hereditary enemy!

Any pretext is sufficient for war provided one of the two adversaries desires it; and before the strategic offensive there is always a historical or, better to say, a political offensive.

This desire for war to be justified must be accompanied by the development of power. Some nations go beyond the Latin proverb, *Sivis pacem, para bellum* (If you want peace, be prepared the fight). They prepare for war not so much to secure the blessings of peace as to be the first to launch an offensive against a potential enemy.

2. THE PURPOSE AND METHODS OF WAR

Were the consequences of this war, which Prussia started so deliberately, carefully considered? Were the plans prepared and critiqued in advance? To what lengths was the war to be pushed? What operations were projected to carry out its program?

Some years before, Clausewitz, Moltke's instructor in the art of war, who was always obsessed by the idea of a war with France, had written the following:

"Inasmuch as the power of a state lies in its army and its capital the plan of the Germanic Confederation should be:

"I. To defeat the French Army in one or more general battles.

"II. To take Paris, and finally—

"III. To throw back beyond the Loire the remains of the defeated French armies.

"The most vulnerable point for an attack on the French Monarchy lies between Paris and Brussels; here the capital is not more than 220 kilometers from the frontier. This is therefore the natural center for the operations of the Confederation, and it is in this region that the war will be fought.

"If France is sufficiently presumptuous to attempt again to oppress Europe, as she has done periodically during the past five hundred years, I am convinced that by proceeding against her as outlined above she can be quickly brought to her knees. But the war must be carried beyond Paris, to the Loire itself, if this haughty nation is to be defeated and forced to submit to the conditions which the peace of the world demands."

What prophecy was ever better fulfilled? What plan of war was ever more accurately carried out?

What was this plan?*

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* It was also Clausewitz who wrote concerning the invasion of France in 1814:

"The conquest of France cannot be the object of a strategic attack—because a country of such extent containing such a large and warlike population cannot be conquered, and furthermore the physical and moral forces of the Confederation are wholly inadequate for such a conquest.

"Generally speaking, the subjection of large states is only to be accomplished by means of political division, and this principle is particularly applicable to France. The capital of a state is a nucleus of political divisions, and this is more true of Paris than of any other capital in Europe.

"The object of the strategic attack must therefore be the absolute defeat of the hostile army and the reduction of the capital. To attain only one of these two objectives is not sufficient; both are necessary.

"Admitting that the losses of the French at Leipzig permitted the supposition that Bonaparte would fall back beyond Paris, this victory still gave no assurance of the capture of that city or the revolution which was destined to take place afterwards. It seemed indeed more probable that he would build up again a new and powerful army. It was therefore necessary to destroy the foundations of his political influence before counting on internal dissension to open the abyss in which his power was finally engulfed.

"The object of strategic attack in this case was the destruction of the army which had again united in France to form a principal mass of resistance, afterwards the reduction of Paris.

"Consequently it was necessary for the forces of the allies to unite and fight a second decisive battle. Having defeated the French, it was then possible to march on Paris with united forces or with a part of these forces.

"In the case under consideration here, the point of attack has been sufficiently emphasized by indicating the object of that attack—the French Army and Paris."

First of all battle—as many large battles as necessary; next the reduction of Paris, and the throwing back of the enemy beyond the Loire. Only by carrying out this program could France be driven to sue for peace.

Observe here how the careful determination of objectives become successful strategy, how *each phase* of war has its distinct purpose.

To have an end in view is a general rule, it is elementary, its observance is common enough in daily life; in tactics it becomes an axiom. The attainment of this predetermined end is the main objective of battle, and the main effort of every battle—the decisive attack—should be launched with this in view.

Why should it be otherwise in strategy? Are we able, in strategy any more than in tactics, to dispense with a fixed purpose, a plan, the salient points of which can be determined in times of peace? As Clausewitz points out, it is in times of peace that we must find the vital points of a prospective adversary—his centers of power—where, in time of war, we must strike to defeat him.

This is the conclusion that must be drawn from any *a priori* examination, and we reach the same result *a posteriori*. Is there for example a single campaign of Frederick, or Napoleon, or of Moltke in which from the outset a definite purpose cannot be observed by the student of military history?

"I shall be in Berlin before them," said Napoleon in the beginning of October, 1806, and it is in order to reach Berlin before the Prussian Army that he orients his strategy and plans the direction of his attacks. It is with this purpose in view that he holds the detachments of Bernadotte and Davout on the Saale, a decision otherwise difficult to justify by pure tactics.

Nor does he confine himself merely to the preparation of tomorrow's battle; his plans take in also that of the day after tomorrow. He desires, it is true, to wage a decisive battle. His tactics of combat neglect nothing that will bring him a victory over the main body of the enemy. But from the manner in which he makes his plans to cut the Prussian line of communications it is evident that he wishes to do more than win a tactical victory. In planning the first phase of the action he foresees also the carrying out of his program for the second phase: *To be in Berlin before them,* which

is the purpose of the war. He expects to find at Berlin a government without an army, a government without power, since at Jena and Auerstadt he would have cut off the army from the government, and consequently from its supplies, finances, replacements.

In studying the war of 1870 we observe this same relentless, if sometimes indirect, advance towards a predetermined goal; Moltke is carrying out the plan of Clausewitz when he attempts to cut off the French armies from Paris and the Loire by his strategic deployment, by his preparations for battle on the Saar (8th and 9th August), and by the maneuvers of Metz and Sedan.

It is therefore evident that when strategy demands as its first objective an advance on the main body of the enemy, followed by an offensive battle, it foresees something more than this advance and this battle. But no matter what further developments arise, no matter what intermediate ends are to be attained, the Commander-in-Chief should still form his first forward movement, have already determined the main purpose of the war in order that from the commencement of the first battle he may converge in that direction all the lines of action which he initiates.

War is absolute; it demands that every objective have its motive. Action follows action without intermission; and the various phases of combat get so intermingled that in actual warfare only one result is worthy of consideration, and that is the final result. A campaign must accomplish the desired effect or it has failed. Partial results have value only as they contribute towards the purpose of the war; i.e., the unconditional acceptance by the enemy of our terms. "Only the completed work is crowned with success" (Clausewitz).

And the first battle is subject to this condition in the same way as any other partial result of the war.

In the determination of the final purpose of a war, in the selection of a decisive objective for our strategy, we must turn to the political situation. Politics only can explain the reasons for a war, why we drop the pen and take up the sword. There is always some material reason. Should war be declared or negotiations continued? Our decision must in each case be based on the particular political situation with which we are confronted. We must be prepared to accept the principle that besides the capitals of

states there are other centers of national power, other organs necessary to the existence of a government, to the life of a people. Furthermore, differences in epochs as well as among individual nations must be considered. (The resistance of Austria would not be the same as that of Spain.) This principle represents the indispensable foundation which strategy receives from politics and history, and without this foundation it remains dangling in the air, groping blindly.

Inversely it is true that, once this principle is fixed for a given war, it determines the methods to be employed in waging war as well as the degree to which operations should be carried in exploiting victory.

Is it not evident that an error in the determination of his goal caused the reverses which Napoleon suffered in 1812? His mistake lay in assuming that the capture of Moscow and of half Russia would make certain the peace which he desired. In this connection also we recall his despair when, after being defeated at La Rothière, at Laon, and at Arcis, and resuming maneuvers against the enemy's line of communications he perceived that the Allies had not followed him and had continued their march on Paris. Their sovereigns also understood where the center of power lay; they knew that the Emperor could not long survive the defeated soldier, the general without an army. They knew that the empire was falling and that they could bring about its destruction not by pursuing this phantom of an army but by overturning the government in Paris. For, as long as the Empire existed, the army could always be reconstructed.

And again, the day after Waterloo, realizing the complete downfall of his military power, Napoleon exclaimed, "Louis XIV would have been able to save himself." Certainly he did not believe the *Roi Soleil* a greater general than himself. It was only that he was well aware of the different form of power which that monarch possessed and upon which he could depend to save himself even in the face of military disaster.

Still another proof of the existence of this principle is to be found in Napoleon's words to his countryman, Sebastiani, on the battlefield of Arcis-sur-Aube.

Sabastiani, astonished at the magnitude of the Emperor's plans

and the weakness of the army upon which he depended to carry them out, advised him to order a general conscription similar to that which was used to save France in 1793. The Emperor, with that greatness of soul and depth of vision which is to be found in all his words and deeds, and which lifts him unembittered above disaster, exclaimed: "You speak to me of conscription in a country where the revolution destroyed both priests and nobles and where the revolution itself was destroyed by me!"

It is true, then, that different nations have different forms of power; in one the king is the bulwark of the national strength, in another the aristocracy, in another it may be the church, or the revolutionary idea, or, as in the Spain of 1809 and 1810, and in the Germany of 1813, the national spirit itself may arise and overthrow the oppressor. These forces cannot be denied, and we must take them into account in determining the spot where a nation is most vulnerable in order to assign the proper direction and scope to our military operations.

This spot and this direction are in every case dependent on the particular situation. Our decision in determining them has this in common with all military decisions: it can never be general, absolute or *arbitrary*. It must be the result of careful study of the outstanding individual factors at a particular moment and also of the relative weight of the factors when viewed collectively.

If, for example, we make such a study of our neighbor to the East, we find at present an empire, but an empire composed of federated states, some of which lie North of the Main River, others South; indeed there are in reality two Germanies, North and South, differing in interests and temperament, yet both having the same capital, Berlin, in Prussia. Now the final blow of a war with Germany must be struck on Berlin, but is it possible first to cut the Empire in two parts by striking at Mainz, and therefore a rational plan of attack would consist of advancing on Berlin by way of Mainz, this not because the Rhine would thereby be opened to navigation, nor because the right bank dominates the left bank or *vice versa,* nor for any other reason that may be adduced by military theorists, but simply because at this point the interests of North and South Germany are united, and consequently may here be separated.

Our strategy, then, in seeking a decisive battle with the main body of the enemy would not cause us to maneuver vaguely to right or left, but would be to throw the German army off from the direction of Mainz in order later to cut it off from the road to Berlin.

Our strategy will dictate a victorious treaty of peace when it finds a government incapable of rejecting our terms, that is to say a government without an army, superior strategy having either destroyed it or cut it off from its capital.

Preparations made for war must always conform to the program laid down. Consideration should be given to the needs of combat, replacement, and occupation troops for the protection of the lines of communications. Thought must be given to proposed sieges, to railways and to the service of supply and administration. Modern war demands that consideration be given to all these things in advance.

In general it should be clear from what has already been said that strategy must not be towed along by geographical considerations, or even by conditions of terrain, in a search for advantageous positions and for the vulnerable points of a real or potential enemy. In waging war strategy must take into account both the material interests and the sources of power of the adversary.

When Moltke decided on Paris as his objective, it was evident that he viewed the power of France as centralized in its capital. When he proposed to gain a decision north of the Loire, he showed that he had studied history to some purpose. The destinies of Southern France have always been influenced by the decisions of Northern France both in foreign affairs and national politics. The Commander-in-Chief was thinking of something more than defeating the main body of the enemy; he understood very well that all strategy, all the science of war is not limited to the formula: *March immediately with all forces on the enemy's main body*. Something further is necessary to complete this important, but in itself insufficient operation, and though Moltke had this formula in mind, and had already determined upon his first objective—the French Army—yet looking beyond it he saw Paris and the Loire and selected his method of attacking his first objective accordingly.

His strategy consisted, then, of marching on Paris and the Loire and striking at a government without an army and therefore

powerless to negotiate. However, certain conditions had to be satisfied or his plan was worthless. The advance on Paris had to be made through Metz and Sedan, through Northern France, through all points where there were French armies to be defeated. The route of his invasion was determined accordingly.

The soundness of this theory is attested by history.

By the maneuvers which this strategy involved, by the sweeping victories of Metz and Sedan, unhoped for, yet in each case partially prepared, the German Commander-in-Chief had driven the entire French Army from the theater of opertaions, by the first of November.

After Metz and Sedan the French Army, properly speaking, had ceased to exist; yet in spite of this fact it was necessary to conduct an arduous campaign for four months longer before obtaining peace.

The organized armies (of Metz and Sedan) did not therefore represent the whole of the nation's strength. This is our first conclusion.

If the German High Command had achieved at Metz and at Sedan only the tactical results of victory; if, without separating our armies from our country, it had merely defeated them, can we foresee what the result would have been? It is evident that new armies built from the remains of the Metz and Sedan forces would have resumed the war at Paris and along the Loire. How long would such a war have lasted, a war which even without these resources prolonged itself for four months? What effect could the Prussian invasion have had on a government which, understanding the meaning of a national war, would have sought its defense in the armies of the provinces—that is to say, of France. Such a government, understanding the difference between the loss of Paris and the safety of the country, would have utilized all the resources of nature itself to resist the enemy; it would have made use of both land and sea to find arms, supplies, men and also the space necessary to maneuver against and to defeat the enemy.

Confronted with such a government, what course of action would have remained to our adversaries except to cross the Loire, and to undertake with their exhausted army a methodical conquest of the 600 kilometres of territory between Paris and the southern

boundary of France, and to pray fortune to remain propitious to them as far as the Pyrenees? This would, perhaps, have been asking too much of this already fatigued deity.

When one approaches a government that refuses to negotiate, there is indeed a point where final victory becomes obvious, where one can foresee the ruin of the country, a last frontier, which, when taken, leaves a beleaguered government without defense. This point, however, must be reached. Remember that the occupation of Moscow itself was not sufficient to conquer Russia in 1812. Moreover, it is still necessary to conquer thoroughly, to subjugate the evacuated territory. The invasion of Spain and the occupation of Madrid by Napoleon failed to guarantee the possession of that country to France.

History will always give Gambetta the glory for having understood that the power of a state rests not in its capital, but in the nation itself with its combined resources; that if, indeed, the capital with its two million inhabitants be surrounded by the enemy, the country, consisting of thirty-five millions of men, still is able to maneuver and to attack. It was on this foundation that he organized the national war of 1870—the war to a finish.

Unfortunately it is difficult even for the most intelligent persons to escape entirely from the influence of prevailing ideas. Gambetta failed to apply his theory to its fullest extent.

He organized national armies, but he failed to understand how a national war is waged. He was unable to get away from the idea that the destiny of a nation and the fate of its capital are inseparable.

To the armies which he created as though by magic he assigned the mission of the deliverance of Paris, thus exposing them to the attack from more numerous, better trained, and victorious troops. He commenced an offensive which was beyond their strength. He sought an immediate and final decision which his troops were incapable of obtaining. And finally he allowed his army to fight over terrain (that of Beauce) absolutely unfavorable to the maneuvering of young and inexperienced troops.

Altogether different would have been an extended program of national warfare including from the start a step by step defense of territory rich in natural resources, and afterwards the final deliverance

of the nation from its invaders. The execution of this plan would have permitted Gambetta at first to take the defensive, which is the only form of combat possible with troops recently recruited. He could have made use of space, time, and terrain and refused the decision by battle to an adversary who needed decisive victories in order to break down the resistance of the country before conquering it. In the end he would have been able to pass to the offensive, with his armies hardened and possessing more confidence; then he would have gone against an enemy whose front had been forcibly extended, an enemy dispersed, worn out by ineffectual efforts and suffering from shortage of supplies by reason of the length of his line of communications. These are the tactics which should have been used.

In his attempt, the great patriot and organizer suffered from lack of technique. Military laws and conceptions resemble all others in this, that they are ineffectual unless they rest on the secure foundation of special knowledge, in this case a thorough understanding of the nature of war and the command of armies. It was because Carnot understood both that in his day he could apply the principle of the general levy to attain victory for France.

STORMING OF CHURUBUSCO

RECONNAISSANCE; GIVE ME A HORSE

BY CAPTAIN C. G. BENHAM, F. A.

IF WAR came tomorrow, and found me in command of any unit of motorized artillery, I would try to take one or more horses with me.

Right here I suspect that the 100 per cent motorized man will say, "This fellow is either a fool or else doesn't know anything about artillery." Let's see about it.

At the end of the Pont-a-Mousson offensive, Major General McNair (an officer who has spent his entire service in the artillery), speaking of the need for greater artillery reconnaissance, said, "The horse, as always, proved to be the best means for artillery reconnaissance."

Of course fair play demands that it be admitted at the outset that motor vehicles have improved since those days; consider the 1916 Dodge touring cars still rolling around our army posts. However, there are more good officers' mounts on hand now than ever before in peace times, and in spite of gray hairs and bulging tummies our war-time captains (still captains) can do lots more of their stuff on them than as of yore.

So-called cross-country cars to the contrary notwithstanding, most officers agree that all four-wheeled motor vehicles must stick to a road of some kind (if they can in wet weather). In dry weather and where the ground is firm and fairly smooth, like the prairie around Sill, we all know that we can leave the roads to a certain extent, but then the pace is slow.

In general, where the road ends you start to walk. And how. Does anybody like that these days? Mr. Chug-chug doesn't like woods, thickets, ravines, ditches, streams much over a foot deep, or hardly anything except a good road. He cannot countermarch except where the road is wide. Heavy rains, long grass, mud and slop, or what have you, all cause him grief, disease, destruction, and death.

Another gloomy fear arises. Everything mechanical is subject to breakdown. As the Frigidaire people say: You will need "service" from time to time. The way they use the word "service" it covers a multitude of sins, and includes everything from spare

parts to skilled mechanics with special tools. Everybody knows how full the woods are of these items.

Due principally to its light weight, the motorcycle is better in some ways, for when it cannot carry you, you can carry it. Of course its use off the road is exceptional and for short distances as a rule. Sooner or later, as in the big brother car, you walk the rest of the way. Sometimes you walk back. You get the idea.

Old faithful Mr. Horse, in ninety-nine cases out of a hundred, will take you there and bring you back. That's moral certainty, and a lot better than fair weather speed.

A good horse, ridden by even a moderate horseman, can go practically anywhere a man can go, can go more rapidly, and without tiring his rider. And rapidly enough for any artillery reconnaissance, tractor or horse-drawn. The usual bounds from ridge to ridge can be made at the extended gallop, 16 miles per hour. Catch up!

But some man will say (they had doubting Thomas in Bible times), "Now tell me how in the world you can keep horses except in a mounted organization." "Well, can't hay and oats be carried in a truck as well as in an escort wagon? And won't the same water that fills radiators, boils the spuds, and goes under bridges, satisfy Mr. Horse? Hasn't this very point been tried out recently and found not wanting, and the horse proven so useful for column supervision alone that all field artillery officers are now authorized to be mounted?

Why not let the head save the heels? Our brigadiers learned during the war that a Cadillac and horses made a good combination. By having their mounts led in advance to rendezvous points on the road within their zones of action they were able to get a little more shuteye; then go forward in their cars, mount up, reconnoiter their areas, dismount, and hum back on the roads to the heads of their commands and personally direct their development.

Who can say but what it might prove beneficial for certain of our artillerymen to get "horsey" for a while, to follow the hounds in a pink coat; to become a polo fool; and even admit that a race horse is a thing of beauty, or whatever you like? Such goings-on have been known to change one's mental as well as physical characteristics.

Where is my horse?

SOME ASPECTS OF MECHANIZATION

BY COLONEL H. ROWAN-ROBINSON, C.M.G., D.S.O., p.s.c.

[This is the third installment of a short book which gives some very new and interesting British views on this important subject. The writer is a distinguished military author whose opinions are receiving great attention in England. The book is reproduced in serial form in the FIELD ARTILLERY JOURNAL through the courtesy of the publishers, William Clowes and Son, Limited, London.—EDITOR.]

CHAPTER III

THE DEFENSIVE IN MECHANICAL WARFARE

A STUDY of current military literature reveals a wonderment as to how a defensive position is to be held in these days of mechanical warfare. The infantry has no weapon of its own with which to deal with tanks, and is not expected, therefore, to stand against the latter except behind tank-obstacles. The only hope for a successful use of machine guns lies in careful camouflage, and in the possibility that they may escape observation until the tanks have passed and may then be able to open fire on the infantry. There is perpetual discussion as to how artillery shall be employed, and no wholly happy solution has been devised: single guns emplaced to fire over open sights, though effective when correctly sited, break up the organization and reduce the massed strength of the artillery; guns distributed in depth are of no value once the forward gun-line has been penetrated, for between attacking tanks and retiring teams or dragons and perhaps counter-attacking tanks, it will be impossible to distinguish friend from foe; no army can afford to carry ammunition in mobile warfare sufficient for barrage fire over a wide area; and, finally, the engagement by observation of a vast number of individual tanks from under cover presents no high prospects of success. Tanks in the defence can naturally not make use of their valuable fire-power to strengthen that of the other arms, for they normally employ direct-fire weapons, requiring for their use exposure in stationary positions to the fire of hostile artillery and tanks. Their rôle, therefore, is one of counter-attack either before or after penetration. The former, though apt to mask fire, is the more promising, as in a broken line where confusion reigns the situation becomes quickly obscure; and, even in case of success, it will be exceedingly difficult to restore the line. Finally, the ease with which encirclement can be effected by mechanical units

endangers not only the slow-moving arms, but also such tanks as are committed to the defence of a position.

It seems, then, that to no arm and to no weapon of a mechanized or partially mechanized army is the defensive position suited in mobile warfare. Hence a radical change in our defensive procedure appears necessary. Where rivers, swamps, mountains and other tank-obstacles exist, the age-old forms may persist; but, in the normal country which generally furnishes the battlefields of civilized warfare, we must seek new methods.

Information is as in the old days the primary requirement. Aeroplanes and ground patrols will furnish this up till dusk, and on it the commander will develop his plan. His main body will move as little as possible by day till the opportunity for striking arises, and at the halt it will remain well camouflaged. Only his light troops—motor cycles, light tanks, etc.—and his engineer tanks will be active; the former in observation far out on good roads which they will block when possible at suitable points in their front so as to have the lead in relative mobility; the latter preparing demolitions in rear with the object not only of delaying the enemy, but also confining his advance to particular approaches. At night the defender will manœuvre either to postpone the decision once more or to move to a striking position. These then are the principles on which to work: ceaseless reconnaisance, camouflage, retardation of the enemy's movements, postponement of a decision till the hour is ripe. They will not easily be followed. The fog of war, the forcible advance of a powerful enemy, ill-fortune, heavy casualties, the necessity of stopping the enemy in front of a certain line—any or all of these conditions may render the perfect execution of the task impossible; but, just as armies of to-day try to avoid being cooped up in a fortress when retreating, so must the mechanical army of the future avoid anything that savours of the occupation of a position. Except in this respect, the method of applying the principles of defensive action by the petrol-driven army does not run far counter to that employed by his muscle-driven forerunner. The one difference is, however, vital. For a mechanical force to take up a position is to discard hitting power, mobility and ability to manœuvre, and to invite envelopment and destruction. The function of the mechanized army, whether on the offensive or defensive, is to attack; only so can its essential qualities find expression.

If we could pass directly from the muscle-driven period to the petrol period no very serious difficulty would arise in the application of the principles of defensive action. It is the intermediate period, in the elementary stages of which we stand at present, that is so difficult. We have to try and combine two mutually antagonistic processes—the occupation of a defensive position by the muscle-driven portion of the force and the flat refusal to occupy any such position by the petrol-driven portion.

The solution, if there is a solution, appears to lie in the former only occupying positions which are largely impassable to tanks or which offer great chances to guns for the destruction of tanks; and in the latter recognizing such positions as pivots of manœuvre, but refusing to be tied to them in any way except in so far as to combine with the forces holding them, from however great a distance, in the bid for victory.

Strategically, with mechanized armies, the assumption of a defensive attitude may confer many advantages. Such a statement must not, however, be taken to imply that it will normally be the sound attitude to adopt. With ordinary armies it is the offensive that has as a rule achieved victory. Where defensive campaigns have been waged with success, the magic has lain in the imposition of the burden of maintenance and supply on the shoulders of the attacker. Fabius Cunctator, William the Silent, Kutusov in 1812, the Archduke Charles in his struggle with Moreau, Wellington drawing Masséna to the lines of Torres Vedras, all bear witness to the truth of this statement. Now these two factors of supply and maintenance are, with a mechanized army, of more importance than ever. Let the aggressor advance, exhausting himself at every step, and he will fall an easy prey to a force originally weaker that is ready to operate from a base, or, preferably, from alternative bases suitably situated with short lines of communications. Galliéni's stroke against von Kluck has been quoted in this connection. Had the German 1st Army and the Paris Group both been fully mechanized forces and had they acted, *mutatis mutandis*, as they did in the early days of September, 1914, then there is little doubt but that the French would have won an overwhelming victory. The moral is not, however, that the defensive is the stronger form of war but rather that the assailant needs to recognize the limitations

of mechanized forces and must organize his line of communications so as to create new jumping-off places as he advances.

Generally speaking, it may be said that the defensive, both tactical and strategic, will give the skilful commander greater opportunities than of old of displaying his ability and may enable him to obtain relatively quicker and more decisive successes.

CHAPTER IV

RECONNAISSANCE AND PROTECTION

Reconnaissance and protection are divided into two categories—"close" and "distant." Prior to the Great War these particular functions were exercised wholly by cavalry—independent cavalry for "distant" and divisional cavalry for "close" work. The aeroplane, on its advent, at once took over some of the "distant" reconnaissance, and the armoured car not long afterwards absorbed portions both of "distant" reconnaissance and "distant" protection. These weapon-carriers are suited to action both with mechanized and unmechanized forces. With the latter, cavalry is still available and is valuable for work both near and far. In its new, mildly mechanized form it has doubled in value.

The need for "close" reconnaissance and "close" protection for a tank-army, to enable it to fit into the battle-picture, was long realized but remained long unfulfilled. It appeared indeed that there could be no logical development of such an army unless this need were met. The essence of the problem was solved by the production of the Martel tank. The adaptation, by a process of trial and error, of this vehicle to the requirements mentioned is only a matter of time and continual experiment.

The technical and tactical details of reconnaissance and protection, both far and near, have yet to be elaborated—a duty that will fall to the Experimental Armoured Brigade. In this connection there are many points of consuming interest to be considered, some of them interdependent, and others dependent on the lines of the future development of mechanization.

In a previous chapter it was pointed out that armoured forces would have to be commanded from the air. The arguments adduced to indicate the truth of this proposition in the case of armies

apply with even greater force to the command of units and formations taking part in distant reconnaissance. And it would be clearly beyond the powers of one man, even when in the air, to command an army and at the same time control the activities of ground and aerial patrols. The armoured cars and aeroplanes employed on that duty must have their work closely coordinated and be directed in combination towards the required end. To effect this, communication between them by wireless must be perfected, and they must be under a single hand directly responsible to the Force Commander. Because of the distances involved both on the ground and in the air, because of the drawbacks incidental to a view from the ground, and because of the difficulty—and sometimes the impossibility—of passing quickly from flank to flank, the officer directing the reconnaissance, who may be chosen either from the Air Force or the Army, must be in the air.

The nature of distant protection will require much study and its control much practice. To take night protection first. The suddenness with which envelopment can be initiated and executed certainly prohibits the continuation of our existing standard methods of protection. Take any map and any example. A northern invading force occupies a town for convenience of billeting. Its outposts are placed on high ground some 3½ miles away to ensure freedom to the main body from artillery fire; they cover some 2 miles laterally to protect the approaches from the south, troops being entrenched and distributed in depth to ensure the necessary degree of resistance.

Roads probably converge from every direction on the town occupied by the main body. Hence the latter is open to surprise attack by mechanized units from any direction except the south. In the fight that ensues one-quarter of the force will be absent on outpost duty.

If we were to change the system and to adopt an all-round defence on the same lines, we should use up three-quarters of our force in protecting the fourth quarter. If we were to bring our outposts very close in, we could reduce their numbers, but we should render ourselves liable to effective area-attack by artillery fire.

What then is the solution of the problem of protection at rest in mechanical warfare?

Two solutions are suggested: the first, that the whole force, sufficiently disseminated to offer no target for artillery fire, occupies an area large enough to enable it to form for battle within its limits; that the force be divided into groups (normally the fighting or marching groups), each group being responsible for a proportion of the approaches, and all probable approaches being guarded. Each group would have to furnish its own outposts, but these need not be distant because the enemy is unlikely to waste artillery ammunition by firing into a large area; they need not be strong because they would often be mere guards to tank traps; and they would always contain anti-tank guns or tanks. If the troops in the area were grouped in diamond formation, groups not attacked could move at once to the counter-attack.

The second solution which the writer puts forward, is to quarter the main body as may be most convenient, and keep the light troops of the armoured force—silent motor cycles, two-man tanks, or armoured cars and mobile 3-pounder guns—far out on all possible approaches. The motor cyclist observation posts will fire combinations of Verey lights to indicate the arrival of the enemy and, to discourage rapidity of advance on his part, will cross the approach with a string of light tank mines. For night work a section of guns, or even a single gun, with a two-man tank, will afford adequate protection to each approach. By day, the main body will act as the situation demands; by night, it will make the necessary preparations for the delivery of the counter-attack at dawn.

These dispositions follow naturally from the method of movement by day of a wholly mechanized force whose main body advances normally in the midst of a protected area. The degree to which it can be made effective will depend largely on the degree of mechanization attained.

The main requirements of this latter method of outpost defence are: (1) the co-operation of aircraft along the principal approach in the event of probable attack; (2) a simple and complete system of signalling between the observation posts and the central body; (3) a very careful reconnaissance before dusk of all approaches open to the enemy and their neighbourhood with a view not only to the siting of anti-tank guns, but also for a possible manœuvre by the central body over that ground at dawn; (4) the utmost use of

natural tank-obstacles; and (5) the use of a simple and portable sound-ranging instrument between the observation groups, the aircraft being called upon to reconnoitre with flares in the event of definite indications as to the direction and the distance of attack being obtained.

Of the two solutions suggested the former is the more applicable to existing conditions and the latter to the time when mechanization shall have made considerable progress.

As regards protection in movement a moving guard will replace the stationary guard, and this will be particularly difficult to organize. It will, however, have the immense advantage of the assistance of aeroplanes.

Distant protection merges generally into distant reconnaissance and demands the same system of control. In fact, the same officer must direct both processes. He will be a very busy person. By night he will deal chiefly with protection, by day chiefly with reconnaissance; and, apart from the organization of these two duties, which will require physical and mental capacity of a high order, he will have the task of maintaining by means of workshops, and by supplies of food, petrol and spare parts, the mobility of a large number of isolated and far-ranging ground machines. Thus, unless endowed with the powers of a Marshal Ney, who for thirty-seven days in succession conducted the French rearguard in the retreat from Moscow, he will need constant relief.

Independent armoured forces acting, as did the independent cavalry formations of Stuart, Sheridan and Gourko, on raiding or outflanking operations, must of course be treated with regard to command just as the ordinary armoured army.

The control of bodies employed on close reconnoitring and protective duties requires separate and careful consideration. The aeroplanes thus engaged will undoubtedly operate directly under the force commander; but the ground machines will be under a subordinate leader, who according to existing war-routine would be the advanced guard commander. The latter is certain to ask for an air-view. That he should be allowed to have it is doubtful; for it is important to keep the number of commanders in the air as low as possible, and the wider range given to a force commander by the use of a 'plane will enable him to keep in touch with all the movements

of his force except those under the director of distant reconnaissance.

Out of this point several other points arise. The first is—will it really be necessary to have an advanced guard commander? It is often difficult enough to prevent the army commander on the ground from interfering unduly with his advanced guard commander. If both are in the air, or if the former is in the air and the latter on the ground, the greater temptation to interference and the greater ease with which it can be effected, are likely to deprive the unfortunate subordinate of any real control of his detachment; so, with an officious chief, he might just as well not be there except to act as a distributor of orders. It looks, indeed, as if the intimate view gained by a force commander from a 'plane may cause him to issue rigid and categorical orders to subordinate group-commanders and thus deprive the latter of a proper sense of responsibility. The balance, however, may be adjusted partly by the fact that even an air commander cannot be all pervading, and partly because sometimes he will be killed and the interval of replacement will certainly be appreciable.

Then again, will an advanced guard itself be necessary? Certainly not one of the type as we know it today. There is an impression abroad indeed that, because enemy armoured forces can travel 100 miles in a night, they may be expected to arrive any morning on the doorstep. Although there is no possibility of such an occurrence where distant protection is soundly organized, pictures are constantly drawn of mechanized advanced guards crawling slowly over the country examining every corpse and every quarry for the ambushed tank or gun. If this is done we shall make no advance in our present march-rates and daily march-performances, and mechanizations, except for body-protection, will be stultified. There must certainly, as for man-power armies, be close reconnaissance and close protection in and just before battle, when the distant protective bodies have been driven in; but, prior to the arrival of that stage, security will have to be considered as a whole and will have to be gained by four means: distant protection, power of changing direction, surprise, and speed. Rapidity of movement (and surprise, if effective) will deprive an opponent of the time needed for the preparation of ambushes or flank attacks; distant protection will

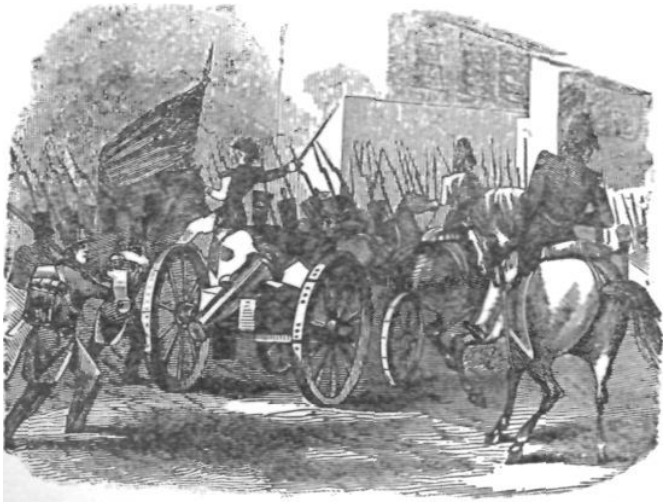
afford a moving manœuvre area from which to strike in any required direction. That is to say, if the army commander utilizes the inherent qualities of his land-fleet to the utmost he will be able to retain his speed and yet render it very nearly impossible for his opponent to surprise him. On the other hand, half-measures, meticulous quartering of the ground and transparency of purpose will very soon spell defeat.

The conclusions reached in this chapter may be summarized as follows:

All distant reconnoitring and protective detachments, whether belonging to air or ground forces, must be controlled by a single commander from the air.

The method of controlling near reconnoitring and protective detachments is less clear. Their immediate commander will probably be on the ground, and he may expect to have his liberty of action much restricted by categorical orders from the force commander.

It is not certain, however, that such detachments will be needed except in and immediately before battle. In fact, our ideas on the protection of armoured forces may have to be recast on the lines indicated above, which include the full exploitation of speed, surprise and cross-country mobility.



ENTERING MEXICO CITY

MOLLY PITCHER

THE FOLLOWING illustration and extracts from Lossing's "Field Book of the Revolution" (Harper Bros., 1855) should be of interest to all American Field Artillerymen.

THE FIELD OF MONMOUTH

From a Painting by George Washington Parke Custis, Esq.

This outline sketch is from a copy of the picture at Arlington House (the seat of Mr. Custis), made, by permission, in November, 1850, for the purpose of giving a specimen of pictorial composition upon an interesting historical subject from the pencil of the adopted son, and the only surviving executor of the will of the great Washington. The engraving was executed by Dr. Alexander Anderson, the pioneer wood-engraver in America, at the age of seventy-seven years. Both painter and engraver have passed several years beyond the age allotted to man.

In the picture here given, the Chief is seen most prominently on his white charger, with his general officers. Washington and Greene are in front; Knox on the right, upon the most prominent horse; and behind them are Hamilton, Cadwallader, etc. On the left is seen the group of artillery, with "Captain Molly" at the gun. In the distance is seen a portion of the British army, and Colonel Monckton falling from his horse. On the right, in the foreground, lying by a cannon, is Dickinson, of Virginia; and on the left, by a drum, Bonner, of Pennsylvania.

"Captain Molly was in Fort Clinton with her husband when it was attacked (Autumn of 1777). When the Americans retreated from the fort, as the enemy scaled the ramparts, her husband dropped his match and fled. Molly caught it up, touched off the piece, and then scampered off. It was the last gun fired by the Americans in the fort."

Captain Molly's fame, however, dates more particularly from the battle of Monmouth, June 28, 1778. To quote from Lossing: "It was during this part of the action that Molly, the wife of a cannonier, displayed great courage and presence of mind. We have already noticed her bravery in firing the last gun at Fort Clinton. She was a sturdy young camp-follower, only twenty-two years old, and, in her devotion to her husband, she illustrated the character of her countrywomen of the Emerald Isle. In the action in question, while her husband was managing one of the field-pieces, she constantly brought him water from a spring near by. A shot from the enemy killed him at his post; and the officer in command, having no one competent to fill his place, ordered the piece to be withdrawn. Molly saw her husband fall as she came from the spring, and also heard the order. She dropped her bucket, seized the rammer, and vowed that she would fill the place of her husband at the gun and avenge his death. She performed the duty with a skill and courage which attracted the attention of all who saw her. On the following morning, covered with dirt and blood, General Greene presented her to Washington, who, admiring her bravery, conferred upon her the commission of sergeant. By his recommendation, her name was placed upon the list of half-pay officers for life. She left the army soon after the battle of Monmouth and died near Fort Montgomery, among the Hudson Highlands. She usually went by the name of Captain Molly. The venerable widow of General Hamilton, who died in 1854, told me she had often seen Captain Molly. She described her as a stout, red-haired, freckle-faced young Irish woman, with a handsome piercing eye. The French officers, charmed by the story of her bravery, made her many presents. She would sometimes pass along the French lines with her cocked hat, and get it almost filled with crowns."

FOREIGN MILITARY JOURNALS: A CURRENT RÉSUMÉ

The Journal of the Royal Artillery, January, 1929

Tactics of Armoured Fighting Vehicles, by Colonel C. N. F. Broad, D. S. O.

This is an interesting article primarily on tanks by an officer who was formerly a Field Artilleryman and who therefore looks at this subject with something of the Field Artillery background.

In common, perhaps, with a great many officers who have associated themselves with Arms other than the Infantry, he desires an organization of tanks which will keep their control in the hands of a tank command at all times rather than associating tanks and Infantrymen in the same fighting unit. This attitude was made the subject of some implied criticism by Major General De Pree in the discussion which followed this lecture before the Royal Artillery Institution. General De Pree said, "It seems to me that what you propose may be the right tactics theoretically, but if you are going to get value out of the tanks in practice you must have a certain number of them working closely with the Infantry." Inasmuch as the subject of a mechanized force is of very present interest to our Army, a few extracts from Colonel Broad's lecture may be of interest:

> "As regards the details of tactics: tactical principles will always remain the same; it is only in methods that we have to make changes.
>
> "All the time you should think whether you are getting the best out of your special characteristics, i.e., your petrol and armour and the fire power which goes with it. If you exploit these three you are probably on the right lines in your tactics.
>
> "If you have to put out an advance guard, you use your light tanks and your mortars. You want your light tanks for your reconnaissance and your mortar for a bit of 'punch.' It may be that the enemy is holding a bridge, and a little 'H.E.' will shift him. Many of you have experiences of what 'H.E.' does to people who are retiring. If you bring out a big enough shell, bigger than he expects, he will go back. I have known several cases. If you can bring up a fat mortar with light

tanks probably you will get through, but in any case whether you use the gun or not, the great thing is not to sit down.

"Remember that you are a mobile force, you have the power of movement and fire power in movement, and directly you meet a block you can swing round on both sides. If you have got into such thick country that you cannot do this, then you are using the wrong kind of soldier and the infantry will do it quicker than the armoured people, but if you are able to swing round at once from the rear then the enemy must go. If you cannot swing round, it means that you are getting up against serious opposition, and you have to feel along the whole front and find out how strong it is.

"These little machines go in first to draw the fire and find out what is there; secondly, to look at the ground; and thirdly, to report where the ground is favourable for the heavier machines behind. They then have to find the flanks in the same way, and in all this your fire and armoured power will help you and if you keep in movement you should have the other fellow guessing. You do not want to look into every hole and corner, because you have gone round the flank and the enemy cannot be prepared everywhere. Everywhere you go you are going at great speed, comparatively speaking, and speed is your protection. If you have to look at every haystack and every cottage you will never get anywhere; you have to be bold, and, as I say, any obstruction can be got round and attacked from the sides.

* * *

"As regards the organization of the main body of the brigade we have in the medium tank battalion three companies, and our tactics, I hold, are built round these three companies.

"These companies are the units that are going to give the blow, and we have to arrange our local reconnaissance and covering fire round each company. Therefore, each company will have its light tanks and its mortars, and the brigade moves up organized into three small but complete fighting formations: possibly one behind the other or on a broader front according to the ground and circumstances. You must have small complete formations in a quick business like this, and the three components

must be trained to work automatically together. Thus when a medium company attacks, the covering fire and reconnaissance work automatically with it, something on the lines of horse artillery and cavalry. There is no time for detailed orders; it has got to function automatically according to your previous training.

"Now by this time the commander will have selected his objective which he is to attack. He has got to get this information back to the brigade which he has already directed to some rendezvous, and the only way he can do that, if voice control is not possible, would be by sending officers back. If you look into history you will see the same difficulty occurring. Napoleon used to send his A.D.C.'s to lead people in the right direction. It used to be the only way to direct mobile troops, and we shall probably have to do the same.

"The commander will then place himself in the middle of his brigade probably at the head of the last of the three groups. The place for every commander is at the head of his reserve.

"The two leading fighting groups then advance to attack; they use their mobility to get where the people in front say the softest spot is. They swing round comparatively rapidly to that place, and they then go straight in. You cannot wait about; the little machines in front find out the trouble, the accurate fire power from behind squashes it, and you go straight through. The commander at the head of his reserve can use that reserve to help you through, but the whole thing goes through as one formation until you get past the worst of the battle. Then the rally, of course, has always been a difficulty. That is what you have to train for; you have to train so that your people automatically rally as quickly as possible, and the man who can rally first wins.

"Now it is probably at this time that you find the greatest danger from the air. You will have to wait about to a certain extent to rally, and it is then that you will probably require an anti-aircraft gun to protect the rally. Having rallied, you attack again. That is the kind of operation, as I foresee it, for armoured fighting vehicles.

"Defence, of course, they cannot do. They can only attack.

If you have to defend a place you will require infantry to defend it. For the defensive-offensive style of battle, the armoured brigades can be used for the counter-attack while the infantry hold a position or pivot of maneuver."

The Real British Attitude towards Afghanistan by Lieut. General Sir George MacMunn, K.C.B., K.C.S.I., D.S.O.

While this article does not particularly concern Field Artillery, it is rather interesting in view of the present disturbance in Afghanistan. That country has always been of the keenest interest to Great Britain as furnishing an approach to India, and this historical review is of very present interest.

Racing and Training the Hunter, by "Pardon."

While our Army, together with other armies, may tend to more and more mechanization, the Field Artilleryman of this generation will always be interested in the horse. Association with the British Army generally brings with it the impression that we still have something to learn from them with regard to condition and care of horses. This article lays down a schedule for the care of a hunter in training for point to point races which would certainly be valuable to any officer whose interests lie along these lines.

This issue also contains the following:

"Does Radio Telephony Offer a Possible Solution to the Main Artillery Problem of the Day?"

"Battery Tactical Training."

"Louisbourg 1745 and 1758, and Historical Retrospect."

"Aeroplane Clock Code v. Observation."

"The Problem of Flank Observation." A translation from the German.

"Tank Problems Past and Future." A translation from the German.

"Campaign Summary and Notes on Horse Artillery and Sinai and Palestine."

This is a reprint from the *Field Artillery Journal* of an article by Lieut. E. L. Sibert, F. A.

"Yachting in Kashmir."

Revue Militaire Française, November, 1928

Colonel Grasset in his study, **"The Preparation of a Monograph on Combat,"** outlines a method for collecting, collating, and arranging the information necessary in ascertaining and reporting the facts of any particular combat or battle. The object in view in the preparation of such a document is always the same. It consists of obtaining from the various events of war, strategical or tactical, the maximum of instruction for the future. In order that the lesson may really be of value, the facts must be set forth as exactly and completely as possible.

The task is difficult and complicated. The study of a strategical situation or of the combined action of a large unit, such as an army, may be placed on a solid basis of fact by means of the authentic orders and reports having to do with the affair. A combat, however, filled with many and varied incidents in which the events constantly mix with and influence one another, requires a different treatment. The acts of the individual, though an infinitely small element of the whole, become of the greatest interest. The testimony of the participants, from as many and as diverse sources as possible, alone gives us an idea of the truth. "In the classification and use of such testimony may be found the only originality, if any exists, of the method proposed here."

The teachings and theories of schools do not always prevail on the field of battle. There the imponderables—the character of the leader, the spirit of the soldier, and many other things—become predominant. The conduct of a battle or any portion of it requires art, experience, and character; and even the most conscientious and thorough course of tactics can never go sufficiently into the details of combat. Of supreme value is the concrete, living fact. It alone is capable of showing how certain methods of war were applied in certain cases and whether they did, or did not, succeed; hence, the great value of studies which reconstitute the facts with as much accuracy as is humanly possible. For such a study three elements are essential: first, an interested worker; second, sufficient material; and third, plenty of time.

Any one may write or speak on questions of higher strategy; and many persons do, without shadow or substance of military training or experience. They even weigh and rate military commanders

in decisive terms, discussing and often condemning the greatest of captains. Those who essay to discuss the varying phases of combat are less numerous. When one approaches the realm of facts to maneuver in the mud with a section under fire or to struggle along with them over shell-torn and wire-strewn ground, it is necessary to have had some training for the sport, to know something of the habits of thought and manner of action of soldiers. Furthermore, the writer must be a specialist in the matter—infantry artillery, etc.—of which he writes. With this must be combined an excellent memory, an orderly mind, a critical spirit, and little or no creative imagination. Finally, it is of advantage if he is experienced in the classification and use of historical documents.

Lacking sufficient material to work with, nothing is possible. The documents required consist of official orders, reports, etc., and, more important, the testimony of participants. It is necessary to consult official documents in order to fix the general situation and, to a certain extent, the special situation of the unit under consideration. But documents must be accepted with caution and their degree of credibility carefully established. The circumstances under which orders were issued should be known and whether or not the orders were delivered or acted on. It is almost a rule that orders never reach the lower units on time and that the action of the enemy usually governs their conduct.

The testimony of participants presents a great mixture of good and bad. There are honest witnesses who see accurately; and others, equally honest, who see little, and that badly. The old proverb, "Testis unus, testis nullus," holds true. Two witnesses from different sources and without collaboration must be found to prove a fact. Many witnesses of many sorts give rise to much labor and study, but many are necessary to establish the facts. We must have the testimony of generals, of their staffs, and of troop commanders down to the smallest unit.

Hence the importance of the third factor—time. The writer is at the mercy of his documents. Witnesses must be found and corresponded with. Years are required to prepare the most modest phamphlet. The one on Verdun, for instance, was seven years in the making. The task cannot be hurried for fear of producing an inexact document, dangerous for use in instruction.

In order to get the most from the testimony received, the witness

must be led to make statements only about the facts that we desire to ascertain. Before any witness is consulted the combat must have been studied closely, utilizing all documents available. The general officers are then consulted. Thus we form a base of departure, true or false as may be. We then proceed to consult the lower commanders in turn, enlightening ourselves with the information derived from one group before proceeding to question the next.

How can this mass of material best be utilized? The one rule which must be rigorously observed is to have no preconceived ideas, no doctrine to attack or defend, nothing except a firm desire to obtain the facts. But from these facts, accumulated by the hundred, must be selected the ones pertaining to the characteristic and vital incidents of the affair. Then these must be classified and placed in their true relation to one another. A simple method of accomplishing this task is to prepare a table containing a separate column for each unit concerned. In each column the incidents pertaining to the unit are placed in chronological order. A final column contains the incidents of general application.

This is a long and tedious process, but it allows a grasp of the whole situation at a glance for any particular hour of the action and also a perception of the relation of the various events, large and small. The completion of the table marks the beginning of the end. The frame work is finished. There remains the task of editing and developing the subject as a whole. For this, a certain facility with the pen is essential. The style must be clear and concise but the picturization must be vivid. To achieve this, the writer should, as far as possible, seek to know the participants, to enter into their thought and to divine their character.

In conclusion, it may be said that the only method of producing a useful work of this nature is to subordinate everything to a scrupulous search for the truth, and to devote to this quest all the time required. Finally, the labor must be performed with willingness and pleasure, for in no other spirit can a vivid, living document be produced.

* * *

"Fire and Maneuver," a continued article by General de Barbeyrac de St. Maurice, begins with a discussion of the question

of liaison. The problem of liaison, in the author's opinion, is not exclusively a matter of communications, as is so often stated, but is more a question of fire—of means and methods for its use.

It is upon an apportionment of fire missions, upon liaison constantly directed and controlled, not by the infantry but by the general commanding, that real maneuver in combat is based. In this regard the infantry must consider itself primarily concerned with fire and it must develop the technique required for a proper utilization of the weapons that it possesses, and for the maneuver of the powerful volume of fire that these weapons can furnish.

The lack of an adequate solution to the problem of liaison has resulted not so much from lack of communications as from the fact that the only maneuverable and effective fire obtainable on the battlefield is that of the artillery; in consequence, this arm has been called upon to handle all questions of fire to such an extent that it is all too frequently faced with demands impossible of fulfilment. If maneuver on the field of battle is to be controlled, the use of fire must be brought to a higher degree of effectiveness by requiring the infantry to play the part of which it is technically capable when proper methods are used. In spite of the considerable development of its weapons, the infantry has not broken away from the elementary methods of fire that it has always used and it still regards itself as requiring effective artillery support in order to maneuver.

We hear on all sides, "The artillery exists only to aid the infantry." No one says to the infantry, "Begin to help yourselves a bit more with the formidable power of your own weapons before calling on Providence and the artillery for aid."

In practice, the problem concerns the infantry assault battalions. They occupy an area in combat about 1,000 meters wide and 1,200 to 1,500 meters deep. The enemy elements which cause them the most trouble are, for the most part, located within a zone extending 1,500 meters beyond their front lines. The limits of this zone are constantly changing in accordance with the movements of the two adversaries. Within this zone, the instantaneous application, cessation, and transport of sufficiently powerful fire will alone allow the infantry to advance without useless losses or without letting slip many favorable opportunities for successful action, either because the fire arrives too late or because it remains too long.

In the offensive, the infantry battalion is well echeloned in depth and only the small fractions in front are engaged in firing. The traditional firing line remains, because no other method of fire other than by direct aim from the shoulder is contemplated, except in certain rare cases. Consequently, the density of the fire can only be increased or massed by changes of front in the firing line. Such fire is confined to the direct front and can only be maneuvered or massed by changes of front on the part of the personnel—a practical impossibility. Moreover, the firing is mostly from the prone position which definitely limits the field of vision, resulting in a thin volume of short range fire. The machine guns are usually employed under similar conditions with a consequent lack of use of their tremendous fire power.

Hence, as soon as fire effect at greater than 400 or 500 meters is required, as soon as mass actions or transports of fire are desired, the artillery is called on, for it alone is trained to maneuver its fire in any direction. But it is often incapable of furnishing all the fire required, or of immediate response to the desires of the infantry.

In stabilized situations, an attack may be arranged by time schedule with limited objectives so that little is demanded of the infantry except to keep close to the artillery fire. But, once outside the fortified lines, the use of such a procedure in the moving zone of action may be termed *the method of lost opportunities*. In a moving situation, if the infantry can furnish only rudimentary fire action, the knell of maneuver is sounded.

Whenever the progress of the advance can not be planned according to a fixed time table, the old phrase, "on call from the infantry," appears. This manner of "passing the buck" à la Pontius Pilate carries no solution of the problem and usually means only, "Save your own skins." Those who are able to do so give loud praise to their supporting artillery, while those who are not so successful are equally loud in their blame. There is certainly a need for fire and the artillery attempts to meet all calls, though effective fire may often be impracticable. The most disconcerting feature of the whole affair is that the infantry demands for fire usually concern only enemy elements which are acting with the same sort of weapons, in no greater number, and which, for the most part,

are no better situated for effective action. In the moving zone of action, prompt fire is usually needed, maneuverable at will against targets which are often in the immediate vicinity. In such cases, the artillery alone cannot furnish all the fire required for maneuver throughout its zone of action. Under the conditions, we may indeed fear that maneuver will be sacrificed to a liaison that means nothing except the adjustment of infantry movement to artillery fire when it should mean the useful combination of artillery and infantry fire in order to allow movement.

No more is demanded of the infantry than is required in the defensive, where a rational combination of the fire of various weapons is planned and put into effect. Why is such an arrangement not planned for the offensive? The truth is that the infantry requires so much time to make its preparations, with the aid of stakes, plumb bobs, and other primitive accessories, that fire over its own troops or cross fires with its different weapons are usually considered academic and impracticable for the offensive. As a result, we have the old firing line with about a quarter, or less, of the fire power being utilized, and with most of the weapons trailing impotently along behind, under fire but unable to act.

To remedy this, the disposition of weapons in depth must be such that they may act throughout the advance, providing a maneuver of fire without requiring movement of personnel. There must be a methodical displacement, by unit or by weapon, from one firing position to another, and no weapon should use direct fire except those which cannot fire otherwise. Heavy machine guns and auxiliary weapons should be kept in hand for fire missions wherever the terrain allows and not be dispersed among the various units. The entire fire must be directed by the leaders, from the chiefs of platoons on up to the battalion commander.

For rapid and unexpected fire missions against targets which do not require destruction, at 500 to 700 meters or less, it would appear that the infantry is better able to act than the artillery. The present procedure of dealing with resistance (first, with a few rifles in the firing line; then, with the reinforcement of that line by rifles, machine guns, and auxiliary weapons which much push forward in order to fire; and then, the final call on the artillery) does not apply the principle of engaging the enemy with a maximum of fire

power and a minimum of personnel. With the infantry able to take care of itself against ordinary enemy resistance at close range, the artillery will be able to act effectively against objectives beyond the infantry limits, that is, beyond 1,200 meters, and on certain other points closer in where infantry fire may be unable to reach the target or may be of insufficient power to overcome it. The fires of infantry and artillery will then be maneuvered, separately or in combination as needed. The task demanded of the infantry is considerable, but not beyond its means; and it is not asked to shoulder the burden alone.

In the article, **"Plans for the Production of War Material,"** Major Oudet discusses the question of the parts to be played by the Government and by private industry in the planning and manufacture of matériel required for the army.

The manufacture of the tank presents practically all the difficulties that may be encountered and, for that reason, it is made the basis of this study. Tank armament calls for all the resources of the designer: a rapid fire cannon, small but powerful, capable of being handled in confined space by one man, must be provided; machine guns with a large field of fire and observation instruments with a large field of view, but with a minimum of vulnerability are required; and the armor must be light, but of exceptional strength.

The problem of motive power is no less difficult. The motor must be reliable, readily disassembled, and of superior flexibility and power. The transmission of power to the tracks must be at the same time of great strength and capable of being handled by one man. The tracks must anchor deep in the soil, but must not crush road surfaces. They must be light but resistant to shocks which increase as the cube of the speed.

In this machine must be carried several men with their equipment, a considerable store of gasoline and ammunition, and a radio apparatus whose operation is considerably affected by the material of which the tank is made. There must be an arrangement for its direction in fog or darkness although conditions are particularly unfavorable for either the ordinary or the gyro compass. For all this, the weight, length, and volume are strictly limited by reason of transport and hauling requirements. In addition, the matériel must

be sufficiently watertight to cross fords while it must at the same time be thoroughly ventilated; also, it must protect its personnel from gas. These conflicing requirements make the tank the most complex machine in war. For its study and development the Government must have recourse to private industry.

It is evident that the general directives concerning manufacture are the affair of the Command. However, this does not mean that they are studied without constant touch with the technical services, for the criticism, information, and advice of these services is necessary to prevent mishaps. The directives being issued, the technical services prepare a rough draft of the project. For tanks, this means the collaboration of practically all the services.

The rough draft may show the impossibility of certain conflicting requirements, in which case the Command must renounce or modify its demands. It must be realized that there are impossibilities in manufacture and one must not be too hasty in condemning a constructor who points them out. The impossible may be capable of achievement in the future, but immediate results are required.

There is a common belief that the best method for safeguarding the interests of the Government is to grant contracts to the lowest bidder. This may be true for equipment in common use, but for specialized construction more care must be used. Mistakes in this regard have resulted in years of delay, though the work might have been completed in a period of months by a more capable manufacturer whose prices were higher precisely for the reason that the difficulties involved were foreseen. In the case of the tank, the construction is too complex to be intrusted to a single firm. The technical services must handle the matter of allotting tasks to the various firms and of settling conflicting questions that arise—a difficult role, requiring much patience and tact.

Except in the case of guns and ammunition, it is not believed that the Government will find it either possible or advantageous, at the present time, to carry out the studies of a project down to the details of execution. It does not possess a separate bureau capable of combining all the special studies required in the construction of matériel such as the tank, for instance. If such an agency existed, it could hardly function independently of the various shops charged with executing its plans, as the difficulties between designer and

shop are often insurmountable, even in small establishments. Moreover, all responsibility and initiative in such work would be withdrawn from industry. This does not mean that the role of the technical services ceases when the plans are handed to the contractor. On the contrary, the work must be followed closely and the collaboration be continuous.

The matter of contracts is a delicate one and no set rule can be followed. In general, it may be said that for material in common use or differing little from former types, as well as for those mechanisms undertaken voluntarily by the manufacturer, a forfeiture clause should be included in the contract. On the other hand, all construction of new types required by the Government and all damage incurred in required tests should be paid for at a set rate. Whatever may be the desire of manufacturers to cooperate in National Defense, they cannot be expected to operate at a loss or to accept work which does not promise some immediate benefit, as is the case when contracts call for only one unit of a certain matériel which may not be desired in quantity for several years. It would be to the advantage of the Government as well as the manufacturer to have at least three units constructed in order to guard against delay in the tests and to obtain a proper basis of comparison.

Furthermore, industry desires continuity. It interests itself little in the study of new matériel if it knows that the staff of designers and engineers employed on such work must in a short time abandon it. To insure progress and continuity, a plan for new design must be established as part of the plan for armaments. For example, it might be decided to periodically design and study a new tank, always providing for a minimum of three test units. It would be impossible to frequently renew the entire number of tanks in the army; on the other hand, it is equally impossible to wait for perfection before putting any of the matériel in service. A certain diversity must, therefore, be accepted. If it is admitted, for example, that the entire armament must be renewed once in ten years, there should be three or four different types in service. Training may be more difficult; but without such a plan there will be no progress. There is nothing new about this, for all the navies of the world are constructed in a similar manner.

When the matériel is not in current construction or use (for

instance, the motor, transmission, and controls of the heavy tank), new types must be provided. In this, however, one must proceed with great caution. Nothing should be accepted that has not been tested under conditions very similar to those to be met in the actual use of the matériel. A mechanism that works perfectly in theory or in a small model often breaks down under the test of practical use. The effects of the forces of inertia, the resistance and elasticity of materials—all are more or less imponderable and cannot be definitely predicted.

The question of how far the Government should go in authorizing or subsidizing the experiments of inventors cannot be a matter of rule. The new mechanism must be indispensable, and the inventor must have pushed his experiments sufficiently far to guarantee some prospect of success, before the Government should take it up.

In time, the conditions should be similar to those which obtain in naval construction, where certain Government establishments carry out the complete study and construction of vessels and others are used as finishing or assembly plants, while only certain selected private concerns are given contracts for the entire planning and construction of units. By this method will be avoided the formation of powerful combinations of private industry which might impose on the Government not only their own prices, but also their technical direction, as well as demands for Government construction in time of industrial depression.

The article, **"Forced River Crossings,"** by Colonel Bailles, deals with the crossing of the Piave by the 24th Corps of the Austrian Army in June, 1918, during the attack on Montello. The Piave is from 250 to 320 meters wide.

At midnight, 15 June, the troops of the 17th, 13th, and 31st Divisions were in place ready for the crossing. A preparation fire using gas was put down at 3:00 a.m. At 5:00 a.m., the Italian counter-preparation began. The first troops were put across in boats and, thanks to the fog which did not lift until after 6:00 o'clock, their passage was rapidly and safely made.

On account of the enemy reaction all along the line, the first elements attacked prior to the hour set and soon took the Italian

front lines. At 10:00 a.m., the attack had progressed only about 2 kilometers. No artillery had been able to cross. At 2:40 p.m., only the 13th Division—the central one—had been able to get all its infantry across followed by three mountain batteries.

The Italian artillery and aviation had taken both boats and bridges under fire early in the day and caused considerable difficulty in the crossing. On the left of the 24th Corps, the 33d Division had all its means of crossing destroyed and the 58th Division was unable to get more than a few scattered detachments across.

Liaison was particularly difficult and was achieved only by means of carrier pigeons and airplanes. There was practically no liaison between infantry and artillery.

A combined attack ordered by the Corps for 3:00 p.m. could not be executed as there were not sufficient troops across. The attack was set forward to the 16th and the Corps was reinforced by two divisions, but the difficulties of crossing remained so great that it was impossible to bring over sufficient artillery to support the assault. However, all Italian counter-attacks were repulsed.

The night of 16-17 June was used to repair bridges, but the rise of the river rendered communication more and more difficult. In spite of this, the Italian second lines were taken and Austrian lines pushed forward on the 17th to about 4 kilometers from the river, which marked the final limit of the advance. Counter-attacks were beaten off on the 18th, 19th, and 20th. Practically no supplies of any sort could be brought across and, on June 20, a withdrawal was ordered.

The withdrawal was skillfully carried out during the nights of June 20, 21, and 22. The Italians showed no signs of being aware of it, and on the morning of the 23d all Austrian troops had reached the left bank.

Study of the technical operation involved in the crossing brings out the following points:

17th Division (*left*)

1. On account of fire from artillery and airplanes, although unobserved, daylight construction of bridges was impossible with a bridgehead only two or three kilometers in depth.
2. For the same reason, the use of boats was not successful.

3. The bridges were destroyed frequently at night by drifting wreckage carried down by the rapid current.

4. The division actually had in use only one pontoon bridge for a total of two hours' time during the whole six days of attack.

13th Division (*center*)

1. Fire from artillery and aviation, although unobserved, prevented the crossing of the Austrian artillery on the 15th.

2. The crossing of boats was seriously interfered with by the same fire on points of embarkation.

3. Bridges were destroyed by drifting wreckage, even in broad daylight, in spite of all efforts to protect them.

4. One pontoon bridge only was in use for a total of thirty or forty hours during the entire attack.

31st Division (*right*)

1. Artillery fire prevented any bridge construction by day but not by night. It also greatly hindered the crossing of boats.

2. A trestle bridge of 27 bays, 180 meters long, was constructed in one night in spite of the rapidity of the current. Its maintenance was extremely difficult and the rise of the river greatly interfered with its use. It suffered as much damage from drifting boats and wreckage as did the pontoon bridges.

3. The division had the use of a bridge for only twenty hours in the six days.

The following conclusions may be drawn from the study of this operation:

(*a*) The artillery preparation must provide for extensive counter battery action on the flanks. The flank division in this crossing suffered much more heavily from artillery fire than did the center divisions. The experience of the Germans at the Marne likewise bears this out.

(*b*) The attacker must have absolute superiority in artillery and aviation or he will find it practically impossible to bring over enough supplies to carry on his attack. Superiority in tanks will not alter the situation, for they require supplies also.

(*c*) The demands on engineer and pioneer troops in river crossings are such that one cannot be too careful in planning for their

reinforcement and relief, and for their use in the most economical fashion.

(*d*) When the current is rapid, the protection of bridges from drifting material is the most difficult problem encountered. However, rivers with such a current are the exception rather than the rule.

(*e*) The quantity of material needed for crossing a large stream is very great on account of the wide fronts and the steady flow of supplies required in modern battle. In the World War, river crossings made with an average of two bridges per kilometer were unsuccessful when opposed by a resolute and well-equipped enemy. This average is about the same as that employed in successful river crossings in the wars of Revolutionary and Napoleonic times. While very few forced crossings failed prior to 1914, we find that the principal crossings of the World War failed, in spite of the most careful preparation. Of the five crossings made, not considering those of 1918 executed on division fronts against the Germans in retreat, two—those at the Marne and the Piave—were unsuccessful.

Revue D'Artillerie, November, 1928

"The Combat on the Petit-Morin," by Colonel Valarche, which began in the August issue, is completed in this number. The author has made a most interesting and detailed study of the operation of the 10th Corps of the 5th Army on September 5, 6, 7, and 8, 1914. He has incorporated selected reports of the participants from corps staff down to company, battery, and section commanders, and has succeeded in presenting a clear and convincing picture of the entire operation. The dejection and weariness of the French soldier, worn and disheartened after fifteen days of fighting and seemingly needless retreat; the eagerness with which he turned to the attack against the Germans, equally weary but filled with enthusiasm by the advance and also, fortunately, by large quantities of the wine of Rheims, Moussy, and Epernay; the uncertainties of combat and liaison; the delay and failure in the delivery and execution of orders—all are brought out in masterly fashion.

Of particular interest to artillerymen are the accounts of battery operations. Nowhere are better illustrated the difficulty of obtaining targets, the uncertainty of the positions of one's own troops, the necessity for constant touch with the infantry, the

power and effectiveness of observed fire, and the great assistance rendered by the artillery in covering a withdrawal. On September 7, the Germans covered their retreat by concentrations of unobserved fire from the 150's on various points. The concentrations had no material effect, but they produced the impression that a counter-attack was being prepared and thereby succeeded in delaying the French advance sufficiently long to allow the unmolested retirement of the German infantry. On September 8, the fire of 77's, regulated from a balloon, held up the advance of the 19th Division for six hours. The neighboring division was practically stopped during the entire day by artillery fire alone.

In his article, **"The Origin of Railway Artillery,"** Colonel Appfel states that the idea was first advanced in 1826 by one de Marguery, an officer of the French navy, who proposed armored cars weighing 85 tons and carrying mortars which were to be steam operated. The first material realization of the idea was the 32-pounder ordered by General Lee for the Confederate Army in June, 1862, and completed during the same month. This gun was first used at Savage Station in the Seven Days Battle around Richmond and later in 1864 at the siege of Petersburg.

The Union forces also had railway artillery at Petersburg. The "Dictator," a 13-inch mortar, firing a projectile weighing 220 pounds with a range of 5 to 7 kilometers, was mounted on a single truck and was the first weapon to be fired from curved sections of track in order to facilitate changes of direction.

December, 1928

Major Camps introduces his article, **"The Artillery Armament of an Infantry Division,"** by a recapitulation of certain technical considerations:

1. The projectiles of any particular caliber may be fired by several types of weapon. Clearly the best weapon to use will be the one which gives the greatest range with the least weight. This leads to a comparison of the gun and the howitzer of the same caliber. As an approximation, it may be stated that the weight of a howitzer of average range as compared with the weight of a gun of average range is as 1 to 3, whereas the range is about as 2 to 3.

2. The usual calibers in the French and German artilleries increase

according to an empirical law in the relation of about 1 to 1.4 in consecutive calibers. Comparing different calibers, we find that, in general, the weight of a gun is about the same as that of the howitzer of the next superior caliber. The range of the gun is considerably greater.

3. These considerations suggest the possibility of using the same mount for either gun or howitzer. On account of the greater weight, it would be imprudent to place a howitzer on the mount designed for the gun of immediately inferior caliber. On the contrary, the howitzer mount could carry the next lower calibered gun if the gun had no unusually great initial velocity. The resistance of the recuperator and mount must be calculated for the howitzer. The resulting weight will be more than the gun would require, but, within limits, this weight may be utilized by increasing the power of the gun. During the war, the Germans placed the 77 and the light howitzer on the same modified light howitzer mount.

The specifications as to range, weight, destructive effect, and mobility are controlled by tactical requirements:

1. The maximum range for divisional artillery should not be less than 10 kilometers. The divisional artillery may occupy as much as 6 kilometers of front and an equal depth in many situations, depending on tactical requirements and on the terrain and the state of the roads. Such a distribution also lessens the effectiveness of the enemy counterbattery and allows space for reinforcing artillery. The necessary echelonment in depth, an important factor for safety, cannot be obtained without at least 10 kilometers of range.

2. In broken country and acting against an enemy provided with artillery, the minimum range of the 75, theoretically zero, is actually several kilometers. This is a grave defect and, for this reason alone, the 75 gun should be replaced by a howitzer.

3. In choosing the divisional artillery, a primary consideration is that it must have a mobility comparable to that of the infantry. It must also be capable of rapid emplacement and change of direction. The 155 howitzer does not meet these requirements.

The above considerations call for a piece weighing not more than 1,600 kg. (3,520) pounds, if provided with a box trail; or 1,750 kg. (3,850) pounds, if of the split trail type. The latter type is to be preferred.

The following armament for the French infantry division is proposed as conforming best to the technical and tactical requirements:

Two regiments of 2 battalions of 105 howitzer, split trail, maximum range greater than 10,000 meters.

Two mixed battalions of light artillery, attached to the two regiments; each with 3 batteries of 3 sections of 75 howitzers (maximum range 7,500-8,000 meters, 6,500 meters with the ordinary projectile) and one battery of six 45-mm. anti-tank guns, all on the same type of split trail mount. Six extra 45-mm. tubes per battery are to be provided to be substituted for the 75's in case the situation requires more anti-tank guns.

All divisional artillery to be horse drawn in principle, the light artillery to be capable of being handled by man power with drag ropes or shafts, or even broken up into loads of about 220 pounds. A unit of about 20 light tractors should be provided for hauling in exceptional cases.

The division should not be armed exclusively with the 105 howitzer, as this weapon is not sufficiently mobile to meet all situations. In addition, the 105-mm. ammunition is heavy (55 pounds per round), therefore difficult to transport and not as appropriate for zone fire and fire against unsheltered personnel.

The 75 howitzer, visualized as exceptionally mobile, drawn by horse, hand, or in pack loads, is provided to be employed either in the supporting artillery or as accompanying artillery attached to infantry regiments or brigades. The Germans have organized their light batteries for the latter task only, one battery of 3 sections being an organic part of each infantry regiment.

As the 75 howitzer will have only a limited value in action against tanks, a proper anti-tank gun is indispensable. A semiautomatic 45-mm. gun, 40 calibers long, interchangeable in mount with the 75-mm. howitzer, is believed to be a suitable weapon.

The corps artillery, according to Major Camps, should consist of one regiment of 4 battalions of 155-mm. (3 of howitzers and 1 of guns) and one regiment of 4 battalions of 105-mm. guns.

"The Regimental Telemetric Section," by Lieutenant Colonel Magnien, is a study of the use of such sections in high burst ranging. According to the regulations, the section comprises: 1 officer,

1 sergeant, 2 computers, 1 draftsman, 2 or 3 instrument corporals, 4 or 6 observers.

As visualized by the author, the rôle of the section in high burst ranging is limited to the determination of the three coordinates, x, y, and z, of the mean point of burst of a series of salvos fired at a point on the probable trajectory passing through the target or through the adjusting point.

For this determination, two or three observing stations and a central station must be installed, all connected by telephone with one another and with the various battalions which they serve. The central station is manned by the officer in charge, the sergeant, the draftsman, and the two computers. The observing stations are accurately located, and each one is manned by an instrument corporal and two observers.

As soon as any battery commander is given the coordinates of the mean point of burst, he determines the point of fall of the mean trajectory, makes the necessary corrections, and prepares his fire. The telemetric section has nothing to do with this.

The registration of a battalion is conducted as follows:

(*a*) The battalion commander selects a registration point for his three batteries somewhere near the center of his zone of action. He gives this point to the telemetric section and the batteries, and designates the projectile, charge, and fuse to be used.

(*b*) The batteries prepare their fire for the convergence of all pieces at the point selected. As soon as any battery is ready to fire, the battery commander selects a corrector setting which he believes will bring the burst within the field of view of the observers. Fire is then conducted by single rounds from the directing piece, raising the corrector until a burst is observed by all observers. The final corrector must be such that the corresponding dispersion will not give bursts that can not be observed.

(*c*) The observers center their instruments on the final burst and clamp them, making no change during the ensuing fire. The azimuths and sites read by each observer are transmitted to the central station.

(*d*) The battery then fires three or more salvos, using a ten-second interval. The number of each round and the corresponding deviations in direction and height of burst are telephoned to the central station where the coordinates of the mean point are calculated.

After observing the final round, the observers are immediately ready to proceed with the adjustment of the next battery.

In the problem of resuming fire on a target after registration on a high burst witness point, the error introduced by the substitution of shrapnel for shell in the witness firing is exactly compensated by the inverse operation of returning to fire for effect with the same shell and fuse. Also, the errors in the location and plotting of OPs, battery, and target are eliminated. Therefore the exact topographic determinations and the degree of accuracy of observation required for the regimental telemetric installation are not necessary for such work, which may be done by improvised battalion sections.

The resources of a battalion should enable it to man two posts. These posts can be rapidly located during the afternoon prior to going into position. During any particular shoot adjusted by airplane observation, for example a battalion concentration on an enemy battery, one piece could be withdrawn to fire on a witness target. Ten or fifteen minutes later, the coordinates of the mean point of burst of a series of 8 to 12 rounds fired at the witness point would be known for this piece and it could take up its former mission. Subsequent fires on the same enemy battery could be accurately delivered by a transport of fire from the mean point of burst so determined.

Colonel Sainctavit's article, **"The Employment of Lignites as a Source of Motor Fuel,"** gives an outline of the Houdry process which is now being applied commercially in France. The problem of producing a national combustile to replace imported gasoline has long been an important and serious one for the French from both an economic and a military point of view, and many efforts have been made to adapt various substances to this use. Gases from the distillation of wood have been used with some success, but the distillation of the lignites which occur in large quantities in France appears to offer the best solution.

The idea of distilling lignites is not at all modern. For more than a hundred years, they have been used as a source of coal tar and semi-coke. However, the temperatures used at the start in the ordinary processes have been too high to allow the separation of a satisfactory motor fuel.

The motor fuel obtained in the Houdry process contains a large proportion of the aromatic hydrocarbons. This renders it superior in power to the low grades of gasoline, susceptible of high compression, and capable of being mixed with methyl alcohol in equal proportions. The last quality is of particular interest in view of the development of methyl alcohol manufacture in France and the possibility of thus doubling the availability of a satisfactory national motor fuel. The presence of the aromatic hydrocarbons in quantity may also be a valuable national asset by furnishing the basic compounds (benzene, toluene, xylene) for the manufacture of explosives.

The by-products which appear in marketable quantities are principally semi-coke, sulphur, and heavy oil. There are also certain compounds of ammonia and some phenols.

During the first part of 1929, one factory will be in operation, handling 100 tons of lignite per day. The daily output will be about 8,000 liters of oil, of which 4,000 liters can be used for motor fuel. Other factories are to be constructed at the various lignite fields. These fields are sufficiently extensive in France to warrant an estimate of 100 years as the time during which they can furnish the total output of gasoline required.

STORMING OF CHAPULTEPEC

POLO

TOURNAMENT DATES, 1929

Midwick Country Club	Jan. 25th to Feb. 10th
San Antonio Club Eighth Corps Area	Jan. 13th to Feb. 25th
Flamingo Polo Club	Feb. 1st to Feb. 28th
Del Monte Polo Club	Feb. 2nd to Feb. 24th
Santa Barbara Polo Club	Feb. 15th to March 3rd
Camden Polo Club	March 1st to March 22nd
Aiken Polo Club	March 4th to March 16th
San Mateo Polo Club	March 29th to April 4th
Sandhill Polo Club (Invitation)	April 6th to April 20th
Boise Polo Club	May 11th to May 28th
Meadow Brook Club	June 8th to July 15th
Rockaway Hunting Club	June 22nd to July 13th
Broadmoor Polo Association	June 29th to July 13th
Point Judith Polo Club	July 13th to Aug. 31st
Suneagles Polo Club	July 20th to July 27th
Rumson Country Club	Aug. 3rd to Aug. 17th
Broadmoor Polo Association	Aug. 10th to Aug. 24th
Myopia Hunt Club and Dedham Country and Polo Club	Aug. 10th to Aug. 28th
Miami Valley Hunt and Polo Club	Aug. 24th to Aug. 30th
Onwentsia Polo Club	Aug. 31st to Sept. 14th
Bryn Mawr Polo Club	Sept. 2nd to Sept. 14th
Philadelphia Country Club	Sept. 16th to Sept. 28th
Oakbrook Polo Club	Sept. 22nd to Sept. 29th
Open Championship	August
Junior Championship	August
Inter-Circuit Championship	August
Twelve Goal Championship	September

EFFICIENCY OF ARTILLERY AMMUNITION

DISCUSSION OF SOME PROBLEMS CONNECTED THEREWITH

BY A. ADELMAN,* BY COURTESY OF "ARMY ORDNANCE"

FOR THE benefit of those who may have forgotten the relation between the artillery ammunition problem and some of the many other large problems of munitions supply, it is desired to repeat that about fifty-five cents of every dollar spent on ordnance matériel, or about sixteen cents of every dollar spent on all army activities by the American Government during the war, went for this type of munitions. The unprecedented use of artillery with the resultant requirements for artillery ammunition was one of the surprises of the war. This surprise resulted not from the fact that there was an increase as compared with earlier wars, but from the extent of the increase, which was far beyond anticipations.

Further increased demands, which it is fair to assume will be made in the event of another war, might well exceed the ability of industry to furnish, and failure to meet these demands might prove disastrous. It is therefore a problem of the ammunition engineer to determine to what extent these increased demands can be met by increasing the efficiency of the ammunition furnished.

If the efficiency can be increased so that 10 rounds will perform a mission which previously required 12, the requirements should be correspondingly reduced; or if the improved ammunition can be furnished without undue effort, the problem of increased demands will have been met to the extent indicated. A reduced number of rounds of better ammunition has further advantages in reduced gun wear, reduced transportation and handling, reduced raw material requirements, etc., even if requiring the same effort to produce.

The efficiency of ammunition can be increased in a number of ways, such as the acquiring of information which will permit more intelligent selection and use, improvements in the accuracy, and by increasing the effectiveness at the target. It is the purpose of this paper to outline some of the problems relating to these studies, rather than to cover in detail work being done in the solution thereof.

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The problem of selecting the most effective projectile for a given mission is more involved than merely determining as between the several well-known types, such as shrapnel, high explosive, smoke or gas shell. The effectiveness of each of these is dependent upon the method of fuzing, which determines the position of burst, and upon the method of projection, which determines to a great extent the angle and velocity at which the projectile approaches the target. This angle and velocity at which the projectile approaches the target are particularly important for high-explosive shell and for shrapnel, which projectiles are dependent upon fragments for their effect. The situation is complicated by the fact that the fragmentation effect of high-explosive shell is increased by a method of projection which results in steep angle of fall and low striking velocity, while similar conditions result in decreasing the efficiency of shrapnel. This results from the fact that the effective missiles from shrapnel are projected forward along the trajectory and depend for their effectiveness largely on the remaining velocity of the projectile at the time of burst, while most of the effective fragments from high-explosive shell come from the side walls and are projected laterally at a high velocity resulting from the effect of the bursting charge, and largely independent of the velocity of the projectile at the time of burst. Reduced linear velocity of the projectile is advantageous since less fragments are carried into the ground. Any method of projection therefore designed to increase the efficiency of one of these two common types of projectile, is liable to result in decreasing the effectiveness of the other.

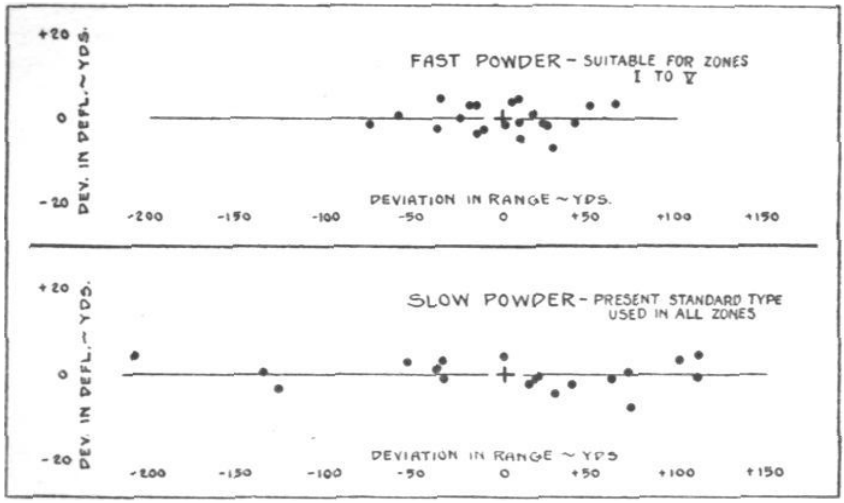
Among the specific problems which have been undertaken in connection with the establishment of more or less fundamental data bearing on the selection and use of ammunition are: (*a*) Shell-shrapnel tests which have for their purpose the determination of the more effective of these projectiles for given missions; (*b*) gun-howitzer tests by which it is proposed to determine the most suitable types of artillery weapons; (*c*) artillery fire on prepared targets such as trenches, dugouts, barbed wire, etc., to determine the expenditure of ammunition required to accomplish certain missions; (*d*) determination of the velocity and distribution of shell fragments.

With reference to the relative effectiveness of high-explosive shell and shrapnel, it would appear on first consideration that sufficient data should already be available. Many tests had been conducted and volumes written on this subject prior to the World War. The war, however, introduced at least two factors which make a restudy of the problem essential. First, greatly increased ranges were used, which resulted in increased angles of fall and made adjustment of time fuzes more difficult. This resulted in decreased shrapnel efficiency. Second, there was a marked increase in shell efficiency, resulting partially from the increased range which causes the projectile to strike more nearly vertical, thus giving better distribution to the shell fragments, but primarily from the use of a fuze which gives quicker action and bursts the shell above ground.

The gun-howitzer tests are closely related to the shell-shrapnel studies. The efficiency of high-explosive shell fire is further increased by the use of high-angle fire from 45 degrees up to 65, which brings the angle to fall still nearer the vertical. Howitzers used during the war generally were fired at angles below 45 degrees.

The tests to determine quantities of ammunition required for the destruction of different types of fortifications are essential in its efficient selection and use. Data are not available covering present day ammunition and modern defenses. These tests should cover not only the different types of projectiles, but different methods of firing, such as time, super-quick, and delay action.

A number of projects are under way with a view to increasing the efficiency of ammunition. In the tests referred to above of firing on prepared targets, there was indication that a great amount of ammunition might be wasted due to lack of accuracy which results in a large percentage of impacts being too far over or too far short to have any effect. The accuracy of most types of ammunition can be increased considerably but, in some, with resultant complication in manufacture and supply. Take, for example, howitzer ammunition for which the powder charge is adapted to zone fire. The chamber capacity is constant and therefore best adapted to a certain size of charge. At other velocities, particularly at the lower zone velocities where the density of loading becomes small, greater velocity dispersions resulting in increased range dispersions



COMPARISON OF DEVIATION IN RANGE AND DEFLECTION FROM CENTER OF IMPACT, USING FAST AND SLOW POWDERS.

Weapon: 155-mm. Howitzer, Model 1918. Ammunition: High Explosive Shell. Mark I, Zone II. Fuze: Short Delay, Mark IV. Range: Approximately 4,500 yards.

occur. This could be somewhat improved by the use of powder granulation best adapted to the conditions of loading. The best results would of course be obtained with a considerable number of granulations, perhaps a different one for each zone, but this would be impracticable from the standpoint of supply and use.

With one of the service howitzers a great reduction in range dispersion (see illustration page 195) has been obtained by using two powder granulations, one adapted to the first five zones, the other adapted to the two outer zones but usable also in the first five in case the charges particularly adapted to these zones are not available. One difficulty in connection with this problem is that it is difficult to estimate what added cost in the way of increased difficulty in production, supply and use, is justified for a certain percentage reduction in dispersion. The more accurate ammunition has its greatest value on certain types of targets, restricted in size and definitely located. On the basis that the more accurate ammunition should be decidedly more efficient for use against such targets, and at least equally efficient for others, certain problems have been undertaken with a view to increasing accuracy and otherwise improving the efficiency. Among these are:

(*a*) The 155-mm. howitzer probable error firings, in which

the probable error of present ammunition was determined in all zones by firing a large number of rounds and comparison made with the results obtained with experimental powder charges, which greatly increases the accuracy in the first five zones.

(*b*) A board known as the "Ignition Board," consisting of representatives from the Ordnance Department and from private powder manufacturers, is actively engaged on problems having for their purpose the improvement in ballistics by more efficient means of igniting the charge.

(*c*) Powders having non-hygroscopic characteristics and therefore less affected by adverse storage conditions are under development. Some of these are also flashless.

(*d*) In connection with the development of new powders and the study of ignition, powder compositions which ignite readily and which otherwise tend toward uniform ballistics, are receiving special consideration.

Projectile design is also being studied with a view to increasing the accuracy. Except in certain special cases, however, where particular types of projectiles are not well adapted to the rifling of the gun with which used, or in a few cases where there are readily correctable defects in details of the projectile design, the greatest range dispersion results from non-uniform velocity given by the propellent charge. The greatest improvement in range uniformity may therefore be expected from improvements in the propellent charges which will make more uniform the velocity of the projectile as it leaves the muzzle of the gun. Projectile design is also being studied with a view to obtaining maximum range consistent with accuracy and with manufacturing characteristics.

In addition to questions as to more intelligent selection and use, and improvements in range and accuracy, there are certain problems particularly related to increased effectiveness of an individual round, such as—

(*a*) Improvements in detonating trains which have for their purpose a reduction in the number of duds and low orders.

(*b*) Improvements in explosives or in methods of loading which have the same general purpose.

(*c*) Improvements in time fuzes with perhaps the adaption of time fuzes to high explosive shell with a view to obtaining increased effect.

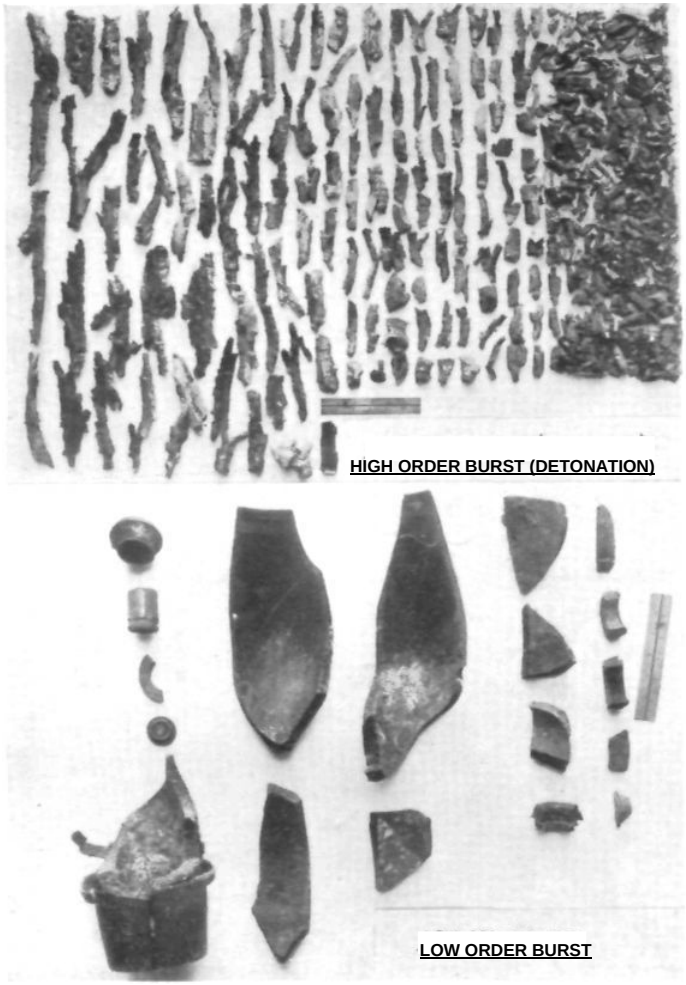
(*d*) Improvement in the fragmentation characteristics or the demolition characteristics of shell.

With reference to (*a*) and (*b*) above, any reduction which can be made in the percentage of duds will increase the effective ammunition supply by just that much and practically the same can be said relative to reduction in the percentage of low orders, since a low order burst of a high explosive shell is little better than a dud, producing neither effective demolition nor effective fragments. (See illustration, page 199.) The few fragments resulting from a low order have a low velocity and the burst is delayed until the shell has penetrated, so that the fragments are buried. Present ammunition is particularly defective in the high percentage of low orders. Development work has progressed sufficiently to indicate that this defect can be eliminated with changes in detonating train which will not greatly increase manufacturing difficulties.

As stated above, the effectiveness of high-explosive shell against personnel was greatly increased by the introduction during the World War of the superquick type of fuze by the French. The fuze bursts the shell almost instantly on impact, although many of the fragments are lost due to their forward velocity, resulting from the remaining velocity of the shell at the time of burst. The increased effect which would result if the burst could be raised a few feet is so great that a number of devices have been proposed to accomplish this. None of these suggested up to the present time appears to be practicable, so that consideration is being given to a time fuze with superquick impact element even though such a design may be somewhat complicated. It remains to be determined whether the increased effect would justify the increased effort required to produce such fuzes.

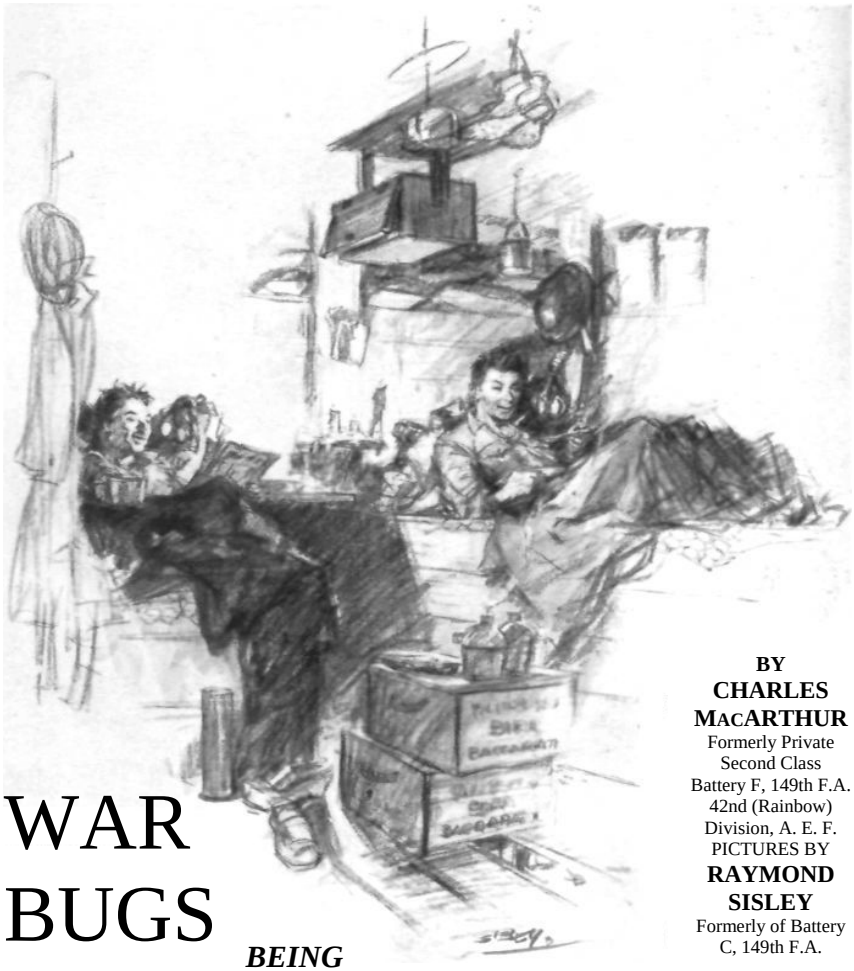
Improvements in the fragmentation qualities of shell having in view the further breaking up of some of the long fragments coming from the side walls of the shell, offer attractive fields for study, but the solutions offered thus far appear more complicated than the probable increased efficiency would warrant. Some solution of the problem may, however, be reached in time.

The problems outlined above, some of which are primarily Ordnance problems and others which pertain more directly to the artillery service, are nearly all interrelated. It is rarely practicable to



CHARACTERISTIC EFFECTS OF HIGH ORDER DETONATION AND LOW ORDER BURST—4.7-INCH HIGH EXPLOSIVE SHELL.

attain the desired increase in efficiency without some sacrifice in the ease of production or the simplicity of supply. It is therefore necessary to give careful consideration in each case to see that the increased efficiency attained fully justifies any increased effort required in the production. A satisfactory compromise between the various factors such as ease of production, maintenance, and supply, with the desired excellence of performance, is the most difficult part of these problems.



WAR BUGS

BY
CHARLES MACARTHUR
Formerly Private
Second Class
Battery F, 149th F.A.
42nd (Rainbow)
Division, A. E. F.
PICTURES BY
RAYMOND SISLEY
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BEING

A WORM'S-EYE VIEW OF THE WAR TO END WAR

BY COURTESY OF

LIBERTY MAGAZINE

PART TWO

IN FEBRUARY, 1918, it was against the law to leave for the front at a Christian hour, so reveille sounded at 2:30 in the morning. It was no hardship this time, because none of us had gone to bed Roll call and a last breakfast.

The little Greek cook was released from quarters, to which he had been confined for being caught redhanded swapping two satchels

of army flour for a lady's favor. In a burst of gratitude he cooked doughnuts.

Harness and hitch was accomplished in record time, in spite of officers. There was an epidemic of them that morning. All of them had a rush of orders to the mouth. Down the long hill to Guer, and horses and guns were loaded before you could say boo.

Twenty-six men piled into each box car: Y. M. C. A. officials put out coffee and sandwiches free (believe it or not); the trick engine giggled and let out a small squeal; and we were off for death and glory, God and country, Berlin or bust.

The first 100 miles were the hardest. Some mighty close harmony going on and it was pretty terrible. Matters were adjusted by moving the glee clubs into separate box cars, which made the rest available for some quiet gambling.

Three days of this nonsense, with the train sneaking up on Paris

and all the big cities late at night, so that our heads wouldn't be turned by strange sights. Now and then we heard the rumble of guns far away and conversation would turn to war.

But the most important issues touched on how long the Bull Durham would hold out, why they called it Sunny France, and where in hell did those dizzy new shavetails come from. Every Frenchman along the long, long trail got three rousing cheers, and when that form of fun wore out we took to shying beer bottles at cows, Savon Cadum signs, and stray gendarmes—thereby creating another bond between the rooster and the eagle.

When spirits drooped through sheer cramp and confinement. Danny Elwell felt moved to slice adjacent eardrums with, "Are we happy?" at the top of his leather lungs. Supposedly the answer was a concerted "Yes!" but the boys (even the university contingent) were getting pretty sick of the rah-rah stuff and we began to throw things.

Elwell took all the sounds and songs of his alma mater a bit seriously. At the drop of a hat he would start up the Illinois Loyalty Song, demanding that the noncollegiate section of the battery likewise stand and uncover. As First Sergeant he got away with this sort of hooey at first, but not now. The first note of Loyalty became the signal for a bitter razz.

Three days out, the train shuddered and stopped, and we were rolled out with the announcement that we had hit the war zone. A constant rumble formerly attributed to the flat wheels of the train now became a roar, and from the doors of the box cars we could see an airplane high above, peppered with white puffs.

Signs of death and glory littered the landscape. A shattered French plane stood on its ear near the roadbed. Shell craters, old and new, stared rudely. Hundreds of graves, eloquently grouped in threes and tens and twenties. Evidently the Germans weren't kidding.

We lay on a siding, 40 miles from Lunéville, our destination. All the unpleasant manifestations of dirty work revived our officers' happy hunches that (*a*) we would detrain under shellfire (*b*) we would detrain in a cloud of poison gas; and (c) we wouldn't detrain at all, as the Germans would see us first and send us sky high with few well directed 42s. It was all very discouraging.

Nothing happened for hours, during which we loafed up and down the tracks and attempted conversation with a bunch of Italian soldiers who were guzzling garlic, salami sausage, and odds and ends of horse, boiled over a bonfire. They had run on the Piave and were doing manual labor for punishment. Yacullo and Bagnuola, our battery Garibaldis, spoke to them and reported some bitterness. They implied that war wasn't any good and advised us to pick up our marbles and go home.

At last the train crawled forward. Late in the afternoon we reached Lunéville, where we unloaded horses, wagons, and guns, and sneaked up a side street to the Château Stanislas, an enormous castle in the center of town, built by King Stanislas after he had been shagged out of Poland some time before.

The fact that Stan settled his court in Lunéville establishes him as a maniac, but there was plenty of other evidence to the same effect in and around the chateâu. It was a regular Katzenjammer castle. We were assigned to the attic, six stories up, where there wasn't a board that wouldn't tip at a touch, revealing a nice long drop of 150 feet.

It made disposition of bottles, corpses, and so forth, rather convenient; but little feet had to be careful where they led us after a quart of grape juice and six or eight *bières terribles*. The latter consisted of large goldfish globes, mounted on glass legs and filled with the old suds. (A gent had to dive inside for the last quart.) They were discovered eight minutes after the first passes were issued.

"Looneyville was a dull town by day, but grand at night. There were interesting social centers that we could visit, provided we wore French uniforms. Consequently, impoverished poilus did a thriving business in the rental of blue helmets and overcoats. Fee, two francs an hour; three francs for two hours; and ten for the evening. Our own coats and helmets were kept for security.

It was depressing how lightly the inhabitants of Lunéville took the war. On Sundays they walked in the park and threw bread to the swans, quite oblivious to airplane duels overhead; and three times a week the rubes came in from the country with vegetables and souvenirs to sell, as if nothing was going on. That meant we

had to scrub stables and park the horses in the courtyard until marketing was over.

We did most of the marketing ourselves, loading up on Swiss cheese, Basque berets, bum jackknives, et cetera, like halfwits. Items of female apparel got the best play, being suitable for souvenirs. Many a nice girl in the States received pale purple bloomers embroidered with the crossed flags of the Allies.

Meanwhile the war waited and we began to get restless. In this period of marking time, Porch Climber MacMillan discovered 200 feather beds in the chapel of the château—more than enough to go around.

Early the next morning there was a terrific hullabaloo in the courtyard. The French officers of the area, who had imported the mattresses from Paris, now discovered their loss. They went through the château like bloodhounds, following the trail of feathers until they reached our humble sixth floor quarters. One look at their property and they began yelling their hearts out.

Brick Bristol told a glittering colonel to button his nose, an unfortunate crack that didn't help matters any.

In the end the Frogs called our officers and bellyached so loudly that we had to carry the feather beds back.

The next important event was Lieutenant Pappy Le Prohon's transfer to the horseshoeing department—a matter of discipline. Being a French Canuck, Pappy spoke the lingo fairly well and had employed this talent in making friends with the women in town.

The colonel heard about it, bawled hell out of him, and put him shoeing mules. Pappy had bawled out so many of us for so much less that it seemed like poetic justice.

Finally, a week after our arrival, Lieutenant Stone was ordered to the front to pick out a battery position, and everything became mysterious once more. We packed all over again, shedding more and more of our fancy equipment. Pneumatic mattresses, portable typewriters, and canned delicacies are all right until you have to carry them. Solemn letters were written and surreptitiously handed to the chaplain for transmission in case of sudden death.

Four gun crews and a battery commander's detail were selected to accompany Lieutenant Stone to the front, and there were many touching farewells. The first ones slated to go got real snooty about it and said good-bye as if we were already their widows. There was a final inspection of equipment, especially identification tags. Lieutenant Stone spoke morbidly of their use, and toward noon the firing battery marched off. Four hours later the guns were installed in La Neuveville aux Bois, a seedy collection of busted brick houses 4,000 yards from the front line.

The village was dirty, lousy, dilapidated, and full of rats the size of St. Bernards. Fortunately, the chicken wire cots were a good two feet off the floor, but lay a shoe down by the side of the bed and the rats tore into it like lettuce.

Near by was a French Pinard station, from which Buck Somers promoted several cans of strong drink. Thus equipped, we spread blankets and rolled out the bones. At the first pass a shell screamed over the tar paper roof and caved in an adjacent bungalow. A dozen more zipped over—77s to judge by the scream and smack.

In a minute they were falling like meteors. Most of us were the sons God-fearing parents, and you can't go to heaven with

a pair of dice in your hand. Nor would it do to get right with God on the spot, in front of everybody. So we played on, shaking the dice without any muscular effort of our own and calling on Little Joe to be a man and come out.

Toward morning the bombardment died down and we started digging gun pits. The position Lieutenant Stone picked out had been abandoned the week before by a French battery—nobody knew why until we started to work. *All* the French aren't nuts. When they walk out on a digging job, it's because there's something pretty sour about it.

In this case it was the mud. After three days of heavy bailing it was only waist deep—and then it rained. And how! In four hours the country was a duck pond. Faithful to our homes, our oath, and the Constitution, we bailed on and on, up to our necks, with Danny Elwell, perched in a tree, bawling, "Are we happy?"

The answering chorus was contrary but impressive.

To rub it in, the little Greek, warm and safe and armorously engaged in Lunéville, shipped us a sack of soap instead of beef, proof of his activities in the department of Romance. We knew where that beef had gone. And the engineers dumped several tons of concrete blocks and steel beams in a mud lake 500 yards from the so-called battery position. All of it had to be moved by hand.

It quit raining only to snow, and stopped snowing only to hail. Every pup tent was an igloo.

The uselessness of going on became apparent even to the officers, so we wheeled our guns to the Forest of Parroy and placed them on the fringe nearest the German lines. Our new position was as visible as the Woolworth Building, but fairly dry;meaning that the mud was only two feet deep. And anybody would rather die from shellfire than drowning.

Five dire days had passed to no purpose, and the entries in the battery diaries were slightly pro-German. Apparently the war wasn't all it was cracked up to be.

The French furnished a little excitement by slinging some shells at the Germans before we got our protecting sandbags up. The Germans came back handsomely. Evidently now that we had arrived, there was going to be no more clap in, clap out or ring around the rosy.

From midnight till dawn the guns were cracking on every side. The ground rocked with explosions. The air sizzled with shells. A thousand jumping flashes threw their reflections on the low clouds for miles. Toward sunrise the show died down, with only an occasional burst like the sound of a steel shutter landing on a concrete floor, far, far away.

Shells had landed all around us, confirming our hunch that the Germans had our names, telephone numbers, and street addresses,

but we remained in strange safety, although C Battery had the hell shot out of them and lost heavily in killed and wounded. So did a company of New York doughboys.

There was a letup in the shooting and twelve cannoneers were assigned to adjacent French batteries for firing practice. Under the supervision of the veterans of Verdun we were permitted to pink a few shells at registration marks and battle over who would be first to fire.

The French were swell. We were the first American *soldats* they had seen, and their hospitality was sincere and elegant. Corporal Leon Canis, a charming character who had been a croupier at Monte Carlo, introduced us to all the worthwhile boys and saw to it that we had free and frequent access to the Pinard supply. A toothless gentleman by the name of Pierre turned out to be excellent company until one of our gang cabbaged an entire suitcase full of liquor he had brought back from leave in Paris.

The French greatly admired the way we worked the guns. Verdun and the Marne had taught them to flop when they fired, whereas we sat on the side saddles and took the jolt like cowboys. Cush Pryor amazed them by snapping the firing pin with his fingers when one of the lanyards broke during a barrage.

Between pot shots we sat around and listened to hair raising stories of Verdun: how our boy friends had fired into masses of German infantry at 100 meters distance, how every gun blew up, and a lot of other hows that made Lorraine look like a basket lunch.

It *was* pretty soft, at that, compared to all the fun that followed. Both the French and German divisions had come south for a rest and, except for occasional parties, were on terms of love and kisses. Whenever a smart American lieutenant intentionally missed a registration point and pegged a shell into a German kitchen, there was hell to pay for a week.

The Germans would retaliate by bouncing a few 6-inchers into French posts of command, and the French would complain bitterly to the Americans for starting it all. Consequently it was no fair to shoot Germans, although they paraded openly on their side of the line, making rude faces and noises at us.

Some Iowa boys took picks on a couple of them one day, with the result that the Germans sneaked over that night and stole a

side of beef from an Iowa kitchen. They dragged a kitchen policeman along to carry it, what's more.

As this sort of feeling progressed, the doughboys had to borrow French helmets and overcoats before they could venture out in No Man's Land. If an American helmet popped over the parapet it was a sieve in no time.

The attack came off March 7, and was the first in which the battery participated as a whole. All the men at the front ganged around the gun pits to see Battery F's first official shell pegged into the German lines.

The shell was tenderly kissed all around, somebody spit on it for luck, and when it was fired the case was seized and set aside for future presentation to the University of Illinois. Thereafter we pumped over 100 shots, rapid fire, and the order came down to call it a day.

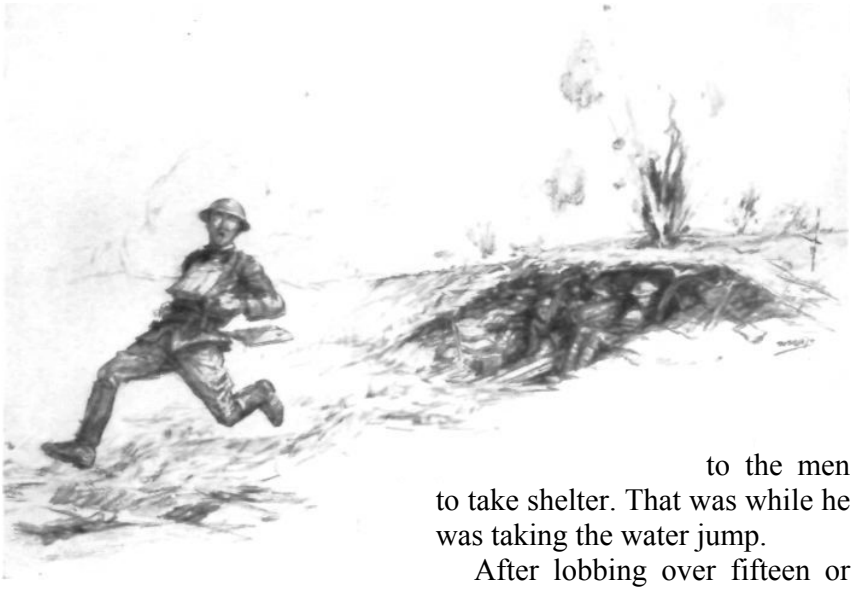
For fifteen minutes we sat around congratulating ourselves. In our exposed positions, we had gloomily imagined the first shot fired would bring a million tons of dynamite on our defenseless heads. Instead, the Germans cowered—silent, and doubtless scared to death. We began to feel sorry for such tame foes, when suddently, rudely, there was a—s-s-s-s-s BONG!!!!!

The first shell landed 15 feet in front of the battery. It was followed by another, and another, and another, each one jump ahead of its little pals, and coming like kangaroos. Everybody flattened out in the gun pits and kept very quiet.

Between shells we peeked cautiously over the sandbags. Clouds of black smoke drifted from a dozen fresh craters and the air was acrid with high explosive. Bang! Bang! Two shells wheeled in 20 feet ahead. The joke was over.

Lieutenant Such-a-One was in charge of the battery. At the first shell he manifested signs of uneasiness. At the second he seemed to be having some trouble with the trees. But if he could have been entered in the Olympic games at the precise second the last two hit, he would have won a bosomful of medals and demolished all worlds records.

He did the 100 yards from the battery to the *echelon* in nothing flat. Once in midair, he made a megaphone of his hands and yelled



to the men to take shelter. That was while he was taking the water jump.

After lobbing over fifteen or twenty shells, the Heinies quit work and it became apparent that they weren't shooting at us, anyway. They were after a narrow gauge railroad 100 yards to the left. Lieutenant Such-a-One, considerably bushed, returned to the battery in time to censor all accounts of the matter in our letters home. He made out that if we wrote anything about it the Germans would find out where we were and raise hell.

It was dig, dig, dig for several days. Not so boring, now that we had missed a few hot ones. From time to time we were visited by Colonel Reilly, and panic ensued as we rushed about looking for blouses and steel helmets. The colonel was a great guy, but a bit fussy on the subject of helmets.

We were similarly bothered by high French officers, who were fond of calling every other day to look at our new dugouts. A lot of Gloomy Gusses they were, too, shaking their heads sadly and indicating by pantomime and much "boom, boom, booming" that the first shell landing on top of the *abri* would kill everybody in it.

Telephones connecting the position with headquarters were installed and the telephone detail, Coe, Bailey, and Westbrook, became Ruth, Fanny, and Pearl in consequence. It was particularly tough on Westbrook, whose monicker hithering had become a sky.

The telephone system introduced more applesauce. Elaborate codes were invented to fool the Germans, who were supposed to have every wire well tapped. Thus, "Can I borrow a chew of tobacco?" meant that Gun Number One was on the bum, and the obliging adjutant would usually attend to this disaster by sending over a chew of tobacco.

As more days passed and nothing happened, the doughboys began to get skittish. Some of the Alabama outfit sought to relieve their boredom by pitching hand grenades into the New York trenches—all in good, clean fun, of course.

Another way to get kick was to crawl out in No Man's Land and then go "BOO!" at the sentries coming back. Alabama went in for that, too. Those babies couldn't get enough.

What stories went around about them! As for example:

One of them lost his temper in a crap game—every dugout on the line was a miniature Monte Carlo—so he decided to get even. With ten francs he promoted a bottle of cognac and meditated darkly for a while. Then he rejoined the game and announced that it was over. The game, that is.

The Alabama boys were easy going, but they took their gambling seriously. Somebody told Bitter Bill to go outside and button his nose. He was firm and suggested a second time that the game be adjourned.

There were no soft answers in the war. A dozen gamblers told Bitter Bill where he could go and what he could do when he got there. He stood like a statue of Horatius and said he would give them one more chance. A movement to throw him out on his ear was started. He was notified.

"All right," said the immortal calmly. "Fade this!"

And he tossed a hand grenade into the middle of the pot. The dugout was wrecked. Twelve were killed, including himself.

The general staff wisely courtmartialed his remains and dishonorably discharged his ghost. At least, that was how we heard it all. Tough babies, those Alabamans, and their reputations didn't suffer a bit with us, even if the yarns about them were hair raisers.

One day, early in March, it stopped raining and simultaneously it was rumored that we were in for some war. The Germans were

destroying the barbed wire along the Paris-Strasbourg railway, and the dope was that the uhlans would be popping through any minute to make marmalade of all the Americans they could find.

Machine guns were hurriedly set up along the roads and we sat at our guns for three solid days and nights. Again no luck. It was reported that the German general learned whom he was up against and faked the measles.

More rumors. John Snowhook had it right from the feed box that we were going back to the States *toot sweet* to teach the Young Idea how to shoot. All of us to be commissioned, of course.

Whenever the war got good and tough later on, and we needed a belly laugh, this particular rumor was repainted and put back in circulation. The first time, however, it worked and made up for all our troubles. The mud, the work, the boredom were getting on our nerves.

The little Greek had gone woman crazy, and we were forced to drag him to the front to protect our rations, which he would trade recklessly at the sight of a skirt. Cooped up in the battery position, he now began experimenting with food.

One day he loaded the stew with raw ginger. We promptly withdrew the fifty dollars a month bonus we had been chipping in over and above his salary (on the assumption that he *was* a cook), and he threatened to go on strike.

Whenever we had a minute to ourselves, the officers bethought themselves of the old field artillery recreation of hauling 2,000 heavy shells, three at a time, 900 yards, simply to haul them back again the next day. That was intended to keep us out of mischief.

All of a sudden, toward the middle of March, things began to liven up. Half a dozen French *Croix de Guerre* regiments moved in. Some big guns were wheeled up, some of them 12-inch rifles, and the word went out that we were going to knock the Germans loose from their underwear on J Day, H hour; which designated any day and hour our generals thought best.

Everything became tense and significant. There was one of those spy scares, with no stone or bush unturned. Ammunition piled up beside the guns. Our officers gumshoed here and there, skittish as sorority girls, whispering and adding up long columns of figures.

A few minutes after midnight on the morning of March 20 the alarm came down. We dove into our clothes and slopped down to the gun pits on the double. Five hours went by. Another false alarm.

At 7 o'clock that night Lieutenant Stone pounced out of his dugout and gave us another: "Battery, attention!" A bit dramatically, he announced that it was finally J Day and would be H hour in forty-five minutes.

In ten seconds we were all set. Shells were arranged in layers, fuses laid out at a safe distance from the high explosive, gas masks were adjusted, helmets nervously patted down so that more protection was afforded the right eye.

For a crowded half hour we patted the guns, fussed with the levels and aiming stakes, and guessed at the bloody consequences.

Seven forty-five.

"Fire!" yelled Lieutenant Stone. Simultaneously the air was ripped by terrific explosions from cannon all around us. Our own guns sounded like cap pistols in a boiler factory. Everything was racket, riot, and confusion.

The officers ran up and down the pits shrieking futile orders above the thunder of the guns. The men yelled back without hearing what was said—it had nothing to do with the firing data, of course. Shells stuck in the bores and had to be delicately tapped out, expert and nerve racking work, since that's how guns blow up.

The violent concussion knocked over the first piece aiming stake. Cush Pryor hopped out of the gun pit and held a pocket flash in its place, with our own shells screaming past his ears. More and more guns began to open up and every crack and cranny of sound was filled with the clatter of machine gun and rifle fire.

After the first ten minutes of fire the battery worked like a charm, every man on the job, every man part of the gun. The officers, with less to do and more responsibility for what was going on, were more excited. They began screaming orders that had been executed from the very start, and jumped in the pits to hold big powwows and get in everybody's way. Sample:

"Is there [*BANG!*] a shell [*BANG-BANG!*] in that gun?"—"Yes, sir!"(*Blankety—BANG!*)—"Well, put one in!" (*BANG!*) Now, you know that’s silly. And stuff like:

"For God's sake, Nahowski [*Crack! BANG!*], why don't you fire?"—"My aiming stake is out."—"Well, fire anyhow!" (*BOOM!*)—"Oh, get the hell out of here, will you—sir?"

Nearly an hour of this and our ranges were up 2,000 meters—sure proof that the doughboys had reached the enemy trenches and were sitting pretty—when the telephone rang and somebody came charging down to the gun pits with orders for a new barrage, to the right. Guns were relaid in a second and we dumped it over, wondering what the hell was up.

It's fascinating to work a 75 and guess at what's going on a couple of thousand yards ahead by the changes in your deflection and range. The range went up, 100 meters at a time. Q. E. D., the Germans were on the run.

Worry began to center on the guns, which were white hot and getting hotter—promising any number of blowups and short cuts to heaven.

When the paint began to roll off the tubes. Lieutenant Stone ordered everybody but gunners and Number One men from the pits. Worrisome, but the added work mercifully kept the mind off possibilities.

In the nick of time "Cease firing" came down. We swabbed out the guns with hard grease and cold water, and went to bed in our new dugouts—for the first and last time.

Just before daylight the Germans counterattacked, and we had to peg another barrage; but we were veterans then. No sooner had we finished than, abruptly and for no good reason, we were ordered to pack and beat it back to Lunéville. The old rumor of rest camps, delousing, new uniforms, and seven day leaves reared its pretty head and we hiked back from the front whistling Madelon and The Old Gray Mare.

The attack had been a great success—plenty of prisoners, *beaucoup* lines of trench.

Our box fire had slaughtered a division.

We were all together, safe and sound, and bound for a rest camp.

(*To be continued*)

NATIONAL GUARD NOTES

Service Practice in National Guard Field Artillery

THE Militia Bureau receives annually reports of target practice from all Field Artillery organizations of the National Guard which contain much valuable information. In reviewing the reports received for the calendar year 1928, a number of interesting facts have been presented which, with accompanying comments, it is believed should prove of interest to the Field Artillery of the National Guard. Since little or no information on this subject has been presented during past years, the FIELD ARTILLERY JOURNAL obtained permission from the Chief, Militia Bureau, to publish the following data.

On February 15, 1929, the Militia Bureau had received target practice reports from 40 Regiments, 2 Separate Battalions and 1 Separate Battery of the National Guard Field Artillery, for the calendar year 1928. Reports from 12 Regiments and 2 Separate Battalions have not yet been received.

Referring back to the years 1926 and 1927, the comments of officers visiting National Guard Field Training Camps, as well as the target practice reports, showed a number of Field Artillery organizations, after several years of training, were still occupying the same gun positions, and firing problems with no variation, from observation points located very close to gun positions. It was also noticeable in most cases that only the rapid parallel methods of calculating firing data were used, little or no attention being given to the topographical and compass methods. Consequently, the maximum instruction was not being obtained from the ammunition expended. Lastly, target practice reports in many instances were poorly prepared or not submitted at all.

Deficiencies noted in the firing reports of 1927 were brought to the attention of the organization commanders concerned with the result that those for 1928 indicate that, in a large number of regiments, an earnest effort has been made to improve service practice. In a majority of the organizations advancement was made in the type of problems fired, especially those involving lateral observation, which method of observation is of course very important

and should be understood by all Field Artillery officers. However, there still exists a tendency to neglect the use of various methods which should be employed in preparation of fire, particularly laying by means of the compass.

Comments of officers critiquing and supervising target practice are, in general, satisfactory and indicate that increased interest is being taken to obtain the maximum benefit from ammunition expended during service practice. It has been observed, from remarks made in critiques of problems, that in some instances officers are permitted to fire who have had little or no instruction in the preparation or conduct of fire. This practice results in the use of too much ammunition and a waste of valuable time at the firing point. Every effort should be made during the armory training period to instruct officers in these subjects, and no officer should be allowed to fire until he has been found proficient in the preparation and conduct of fire. This matter will necessarily have to be given careful consideration in the future due to reduction in ammunition allowances.

Reports indicate that the Field Artillery ammunition allowances for 1928 were satisfactory and, in the majority of cases, amounts expended were justified by the number of officers firing and the average number of rounds used per problem. This is a marked improvement over records of 1927.

Of the 43 organizations from which reports have been received, 34 averaged 25 rounds or less per problem, which is satisfactory and indicates profitable use of ammunition. The other 9 organizations exceeded 25 rounds per problem, one regiment averaging as high as 41 rounds, which is excessive and can hardly be considered as a justifiable expenditure. Taking the average of all reports received, the number of rounds fired per problem by 155-mm. howitzer regiments was 19 rounds, and for 75-mm. gun organizations 22 rounds. Reports from ten 155-mm. howitzer regiments show that 8,800 rounds were fired, the total authorized allowance being 9,200 rounds. Thirty-three 75-mm. gun regiments expended 51,405 rounds for which the total allowance authorized was 53,700 rounds. This shows that the majority of the National Guard Field Artillery regiments are expending their full

allowance of ammunition and are obtaining profitable instruction and training in Field Artillery firing.

Beginning with 1929, Field Artillery ammunition allowances for the National Guard will be based on the individual officer rather than on firing batteries as has been the practice in past years; the basic allowance for 75-mm. organizations being 30 rounds (24 shrapnel and 6 shell) and for 155-mm. howitzer and gun regiments 15 rounds (12 shrapnel and 3 shell) per officer of battery grade. While this reduces the allowance for a separate firing battery, it keeps the allowance for a battalion, regiment or brigade about the same as in past years. This system has the advantage of giving each officer entitled to fire his own allowance rather than requiring him to take it from a firing battery.

It is interesting to note also that during the past year several National Guard Field Artillery regiments fired problems using aerial observation, airplanes for this work being furnished by the National Guard Air Corps squadrons. In camps where such squadrons are available, advantage should be taken of the opportunity to conduct joint instruction.

One other interesting feature in connection with this phase of training is the attachment of Reserve officers to National Guard organizations. This was done in a number of instances during the past year with very good results. Field Artillery Reserve officers attached to National Guard organizations are authorized an allowance of ammunition, and commanders concerned should see that this ammunition is provided. The firing of this extra ammunition affords additional training for the personnel of the firing batteries which should be very advantageous to all organizations concerned.

A PROFITABLE METHOD FOR CONDUCTING A COMMAND POST EXERCISE

During the recent field training of one National Guard Field Artillery regiment, an original and interesting example of staff training by the use of Command Post Exercises was successfully demonstrated. This exercise was held for three days during the first week of the encampment and involved situations occurring during each twenty-four hours. Although the entire commissioned personnel of the regiment was engaged in the exercise, it did not

interfere with the regularly scheduled instruction. During the entire period of the exercise no one was required to go beyond the limits of the regimental camp area or neglect any normal duties. In addition to the officers, the communications and other personnel of each command post were actually engaged in the performance of duties incident to the maintenance of communications, and the operation of such posts.

The operation of the exercise was simple and required little time on the part of those engaged, except the enlisted personnel who were used throughout the day. Prior to the commencement of the exercise, a wire net was laid with a switchboard in regimental headquarters. From there lines were laid to switchboards at each battalion commander's headquarters (CP). Maps of the camp area were used, two sets being required for the exercise. The first, or control maps, were maintained by the instructors in their quarters. The second set was for regimental, battalion and battery command posts, in such numbers as were necessary. During the day the instructors sent information slips, in the form of messages, setting up different situations for all hours of the day and night. These messages were sent to the command posts concerned by wire or runner. Necessary action by the officers of each headquarters was taken upon return to C. P. from scheduled duties and during off hours. If sent by wire, the written message was later forwarded as a confirmation copy of the instructions transmitted. These situations were sufficiently varied to test the knowledge of the officers in the performance of their respective duties. A written solution to each situation, in the form of a message, was required in each case. These were sent either by telephone or runner, the written copy always being forwarded for confirmation purposes.

The problem was progressive in nature, and involved the use of a 75-mm. artillery regiment as part of a division in attack. A critique was conducted by the instructors at 7:30 p. m. each evening, when the various situations for each twenty-four-hour period were discussed and explained. At each critique brief talks were made by the instructors on the preparation of field orders, written messages, tactical principles, etc.

CURRENT FIELD ARTILLERY NOTES

Assignment of M. A. Graduates to the F. A.

Of the class of 1928, U. S. Military Academy, forty-eight were assigned to the Field Artillery of whom sixteen took detail to the Air Corps, the remaining thirty-two being assigned as follows:

8 to Hawaiian Department.
5 to Philippine Department.
4 to Fort Lewis, Washington.
6 to Fort Hoyle, Maryland.
5 to Fort Bliss, Texas.
4 to Fort Sam Houston, Texas.

Of the sixteen detailed to the Air Corps, none have yet "washed out."

Fifty-three of the 1929 U. S. M. A. class will be assigned to Field Artillery, of whom approximately twenty will doubtless request detail to the Air Corps. Stations for the others will include the Philippine Department, the Hawaiian Department, Fort Hoyle, Fort Bragg, Fort Myer, Fort Sam Houston, Presidio of Monterey, California, and Fort Lewis. Graduates of the Class of 1929, which it is estimated will number 300, will be assigned to branches of the service in the following proportions:

Infantry	44⅔%	134
Cavalry	9⅔%	29
Field Artillery	17⅔%	53
Coast Artillery Corps	12⅔%	38
Corps of Engineers	8⅔%	26
Signal Corps	3⅓%	10
Quartermaster Corps	3⅓%	10
		300

However, assignments to the Quartermaster Corps will be made only from cadets who have chosen such assignments. In the event that no cadets or a less number than its quota choose assignment to that branch, the remaining unfilled allotted assignments will revert to the line branches according to the percentages given above.

No graduates of this class will be assigned to the Air Corps directly upon graduation because of the provisions of the Air Corps Act of July 2, 1926, which limits non-flyers in each grade to 10 per cent. Details to the Air Corps for flying training with the view to eventual transfer will be unlimited.

Expectations for Largest C. M. T. C. Year

With the receipt of a number of applications for C. M. T. C. training at the various Corps Area Headquarters the procurement campaign for the authorized quota for the coming summer is now under way. It is estimated that a total of 37,500 young men will be trained at the 52 camps to be held during the months of June, July, and August. This is 2,500 more than the objective of previous years. Of these approximately 9,000 students will attend the June camps.

Since the establishment of these camps it has been possible each year to make progress, both in the number of trainees and in the number of camps. This has been due to the value of experience in organization and training gained at these camps by both Regular and Reserve personnel. Means for even greater expansion may be found in recent War Department steps to increase the availability of Reserve officers at the camps. By a directive to Corps Area Commanders it is provided that at some of the camps there will be combined training for the students and officers of Reserve units. This directive is in conformity with General Pershing's idea on a national training system as explained to the Appropriations Committee of the House of Representatives in 1922, when he said:

> "The full development of this system as planned cannot be carried out by the Regular Army alone, even at its present size, nor is it advisable that all instruction be given by Regular personnel. The assistance of Reserve officers must be invoked, and it is advantageous to do so. Whenever we employ a Reserve officer, even temporarily, to perform those duties, we not only decrease the peace cost, but we increase the efficiency of Reserve personnel that much. So we are able to deduce another principle, which can be stated as follows:
>
> "In training the citizen army we should employ as many Reserve officers and noncommissioned officers as possible as student instructors and staff personnel in our training camps and other training establishments.
>
> "In developing the National Guard and Organized Reserves, the professional soldier is indispensable, but his employment should be such as to encourage the initiative and self-reliance of the officers of those organizations. The details of

a system based upon the above principles must be carefully worked out and of necessity will have to be gradually applied."

In the development of this plan, for some years past, Reserve officers as individuals have been put on active duty in Citizens' Military Training Camps to assist in the training. As a further development the idea was conceived of having Reserve officers participate by organization and function as cohesive units in the performance of duties exactly comparable to those which would confront them in the event of an emergency. Accordingly, during the past summer, training at certain Citizens' Military Training Camps was conducted partially by Reserve regiments, acting successively for fifteen days each. The results obtained warranted an extension of this idea. Corps Area Commanders have been directed to adopt this method in at least one camp in each corps area, and also in as many more camps as, in the opinion of the Corps Area Commanders, available funds and qualified Reserve organizations render such training practicable. The Reserve organizations which will be used will be those selected by the Corps Area Commanders as best qualified. As heretofore, all camps will be commanded and closely supervised by officers of the Regular Army.

Charlie Wing

When Charlie Wing worked for the officers of the Fourth Field Artillery some twenty years ago he made friendships that time and distance cannot erase.

Charlie is blind now, or nearly so, and ekes out an existence down in Hop Alley, Denver's Chinatown, with the help of the Colorado Home for the Blind, and the friendships which were welded with Charlie's own potent mixtures.

There were many young officers in the Fourth Field Artillery when Charlie mixed and served. But now Wing is sixty-five and the "boys" he served have become majors and colonels. One is a brigadier general.

They all remember Charlie, and most of them remember his prowess with the shaker. It was Colonel Laurin L. Lawson of Sioux City, Iowa, who thought to ask how Charlie, his Chinese friend of younger days, might be.

Charlie replied in characteristic Oriental fashion: "No eyes, no shirt, no money, no nothing," he wrote. Colonel Lawson told

other officers of the old Fourth Field Artillery, and help and cheer have since been pouring in for Charlie from the Philippine Islands, the Canal Zone and dozens of army posts throughout the country.

There have been five packages of shirts, sweaters and other clothing, and no small number of personal checks—remembrances from the "boys" of the Fourth Artillery for old Charlie Wing.

"I no cookee, I shakee," the aging Chinese fairly snorted when he was asked if he was a messman.

The Newton D. Baker Trophy for Gunnery

In a recent letter addressed to the commanding officer of the 135th Field Artillery, Ohio National Guard, the Hon. Newton D. Baker provided a trophy which will do much for training in that regiment. Since the withdrawal of the appropriation providing extra pay for men qualifying as gunners, it has been difficult to interest them in preparing for and taking the examination. As a result, gunnery has waned in efficiency to an appreciable extent.

The award, to be known as "The Newton D. Baker Trophy for Gunnery," will be placed in annual competition among the units of the regiment. The rules provide that, during the month of June each year, examinations will be held at the home stations of the batteries under the supervision of the regular army personnel on duty with the regiment. Points will be awarded to the units as follows:

For each second class gunner	1 point
For each first class gunner	5 points
For each expert gunner	10 points

The unit with the highest total will be given the trophy for one year.

The wide difference in the number of points for each class exists because it was felt that every section chief and gunner could qualify as second class gunner without preparation, but qualification in the higher grades will entail a certain amount of study. T. R. 430-175 authorizes examinations which are more applicable to the National Guard than were formerly provided.

As a result of the interest aroused by the presentation of this trophy, the 73rd Infantry Brigade, which is supported in action by the 135th Field Artillery, has provided three medals, gold, silver and bronze to give to the enlisted man who shall, during the

annual examination receive the highest grade as expert, first class and second class gunner. To return the compliment, the 135th Field Artillery will present corresponding medals to the men of the 73rd Brigade who achieve the highest marks in rifle competition.

It is believed that gunnery will be greatly improved by this added incentive and that better liaison between the two arms will be effected through the exchange of medals. The presentation of both trophy and medals will be made at the close of the field training period.

McClellan Saddle to be Changed

In the interest of improved appearance and greater comfort to horse and rider, a modified type of McClellan saddle has been adopted as standard for *cavalry* organizations. The McClellan saddle probably has been in use in the Army longer than any other article of equipment. Developed by Major General George B. McClellan, prior to the Civil War while he was a captain, it since has been in continuous service with very few changes.

The modification in general consists of the substitution of a saddle girth for the present hair cincha and the use of a leather skirt and stirrup straps similar to those used on training saddles.

The Field Artillery Board at Fort Bragg has tested the modified McClellan saddle, and at present 180 are being prepared at the Jeffersonville Quartermaster Depot for extended service tests by the Field Artillery. These tests will probably be at Fort Bragg and Fort Sill. In addition to the modifications described above for the Cavalry, the Field Artillery McClellan saddle will have a "D" ring on the rear of the cantle for attaching the back strap, and other "D" rings on the girths for attaching saddle pocket straps.

Reenlistments Increased 21 Per Cent in the Past Five Years

Figures compiled in the War Department indicate that reenlistments in the Army have increased 21 per cent in the past five years. The following is the technical reenlistment rate. This is obtained by comparing the number of men reenlisting within three months of discharge to the number of men discharged by expiration term of service: 1924, 48.04%; 1925, 55.47%; 1926, 64.53%; 1927, 64.10%; 1928, 69.65%.

PROCESSING

BY COLONEL HARRY G. BISHOP, 6TH F. A.

PROCESSING is the term applied to the induction of a civilian into the military service and includes:

Reception: (*a*) Transportation from point of arrival to the processing area; (*b*) temporary disposition of any personal baggage; (*c*) attending to trainees' immediate physical wants, if any, such as food, toilet, medical assistance.

Personnel Examination: (*a*) Identification, including an examination of the trainees' draft papers, induction papers, or orders, and the initiation of the trainees' personal records; (*b*) disposition of rejects, as a result of personnel disqualification; (*c*) collection and safeguarding of any valuables which the trainee wishes to deposit.

Physical Examination: (*a*) Stripping and temporary disposition of civilian clothes; (*b*) physical examination; (*c*) disposition of rejects as a result of physical disqualification.

Issue of Clothing: (*a*) Measurements; (*b*) clothing issue; (*c*) shoe fitting; (*d*) check of clothing issued.

Adjustment of Uniform: (*a*) Dressing in uniform; (*b*) inspection of fitting; (*c*) correction of defects in fitting.

Finance: Payment of travel and other allowances.

Disposition of Civilian Clothing: Reception and storage of civilian effects and personal baggage.

Quartering: Transfer of trainee to his proper organization and quarters.

Equipment: Issue of arms and equipment, both personal and pertaining to his quarters.

Speed and accuracy are essential to processing, the necessary orders therefore must be carefully drawn up, all physical arrangements made well in advance, and the scheme tested by a preliminary rehearsal. At Fort Hoyle this year some 600 trainees were processed between 8:00 a. m. and 5:00 p. m. of one day. The speediest time noted, from the instant a trainee presented his orders until he arrived naked at the dressing tent to put on his uniform, was 35 minutes, the average being about 45 minutes. A careful inspection of the fit of the shoes and uniform at the time of dressing is very important. Music during the process is a great help, and numerous clearly lettered signs and M. P.'s must be employed to keep the column moving in the right direction and to prevent "skylarking" and other slowing up occurrences. The following is the substance of orders issued for the 1928 Fort Hoyle processing:

PROCESSING

1. The processing will be divided into eight stages with an officer in charge and a mission for each stage.

2. All stages will be in readiness to begin functioning at 7:30 a. m., July 6, and will be continued similarly at 7:30 a. m., July 7, until closed by the control officer. For late arrivals—after July 7, when all formal processing has ceased—candidates will be sent to Camp Headquarters and thence directly to their respective batteries, where the battery commanders will make the necessary arrangements with the Medical Officer, Finance Officer, and the Quartermaster, for their processing. Any candidate arriving after Stage II has been closed on the 6th of July will be sent directly to the C. M. T. C. Headquarters Building to be quartered by the Camp Adjutant in tents set aside for that purpose. He will then send them to Stage II on July 7 for processing.

3. (*a*) The Control Officer, Major Frank Thorp, Jr., 6th F. A., will be responsible for the proper functioning and coordination of all stages. He will take the necessary action to eliminate all friction and delays during the processing periods specified. Messages to the Control Officer will be sent to Stage III.

(*b*) The Assistant Control Officer, First Lieutenant Arthur E. King, will be in charge of all transportation. He will take the necessary steps to get an adequate number of trucks to be used in transporting the candidates. He will arrange with the Executive Officer, Edgewood Arsenal, concerning the use of the Electric Road, and with the Post Quartermaster concerning the use of the Steam Train to Fort Hoyle hay shed. He will make all arrangements concerning the division of available transportation.

(*c*) The officer in charge of each stage will be responsible for the efficient operation of his organization in coordination with other interlocking stages.

4. General instructions: (*a*) Those concerned with processing will cause all arriving candidates to report, first, at the Receiving Station, Stage II.

(*b*) Each officer in charge of the stage is responsible that he gets the necessary equipment and property to make his stage function.

(*c*) All officers and enlisted men connected with the processing will bear in mind that the candidates are unfamiliar with Army customs and will govern themselves accordingly. All their intercourse with candidates must be characterized by kindness and courtesy.

STAGE I

The officer in charge is First Lieutenant H. W. Kiefer, 6th F. A. Two noncommissioned officers and eight privates will be detailed as his assistants.

The personnel at Stage I will

1. Meet all trains arriving in Edgewood, Magnolia, Van Bibber, Union Station, Baltimore, and Mount Royal Station, Baltimore. All candidates arriving at Union Station, and Mount Royal Station, Baltimore, will be directed to Edgewood, Maryland.

2. Wear a white brassard on the left arm midway between the elbow and shoulder, bearing the stamped caption: "CMTC."

3. Dress neatly and act alertly.

The officer in charge will make all arrangements necessary for the transportation, messing, and relief of his personnel.

STAGE II

The officer in charge is First Lieutenant J. M. Lentz, 6th F. A. Three noncommissioned officers and nine privates will be assigned to him.

The mission of Stage II is to receive all C. M. T. C. candidates and to facilitate their passage through Stages III, IV, V, and VI to Stage VII.

The stage is divided into three phases—*reception, identification,* and *guiding*.

(*a*) The reception will strive to place the arriving candidates in a comfortable frame of mind. Refreshments (light food and cold drink), latrine facilities, and place to wash up (basin, soap, and towels). Second Lieutenant B. A. Holtzworth will have charge of the refreshments.

(*b*) The guiding will consist in taking the candidates, after they have been identified (in Stage III) to Stages IV, V, and VI, entrucking them to Stage VII (QM. Warehouse, C. M. T. Camp). The guides are responsible that discipline is maintained during truck movements.

4. He will erect a dressing tent. Care will be taken to have latrine and kitchen at a considerable distance apart.

STAGE III

The officer in charge is Captain William J. Jones, 6th F. A. One Reserve Officer, two noncommissioned officers, and five privates (clerks) will be assigned to him.

The mission of this stage is:

1. To check each candidate's orders and supply him with the necessary C. M. T. C. records.

2. To handle all rejected candidates.

The following list of records will normally be in the hands of a candidate after he passes through this stage: (*a*) Record Card (bearing Battery assignment); (*b*) Form 122, A. G. O. (Record of Enrollment, C. M. T. C.); (*c*) Travel Orders, Third Corps Area; (*d*) Individual Clothing Lists.

All rejected candidates will be reported to the Control Officer at Stage III, who will obtain the decision of the Commanding Officer as to their rejection; after which, the rejected candidates will be conducted to the Finance Officer, where they will draw their return travel pay. Each candidate will then be notified as to the time he can get a train from Edgewood to his home. He will be taken by a guide to the railroad station.

Candidates who have reported either without orders, or with improper orders, will be listed (with corrections that are necessary).

The Camp Supply Officer will have an agent at this stage to receive valuables from candidates, giving them a receipt for same. He will store same in a safe.

The Camp Supply Officer will have a man to issue a paper bag, *bearing candidate's name,* so that candidate can carry civilian clothes after undressing.

The Camp Supply Officer will also have about 250 sheets for use of candidates (to wrap around themselves) in case of a wet or cold day.

STAGE IV

The officer in charge is Major W. A. Hagins, M. C. Four enlisted men, other than his Medical Department personnel, will be assigned to him.

The mission of Stage IV is to make the prescribed physical examination of C. M. T. C. candidates, as follows:

The candidates will strip. They will then form in a double column with the records and their bag of civilian clothing in their hands.

Form 122, A. G. O., will be executed.

The officer in charge will cause entries as follows to be made upon their record card of each candidate:

1. A large penciled "A" encircling the Battery assignment for accepted candidates.
2. All rejected candidates to be sent to the Control Officer at Stage III for decision by the Commanding Officer as to their rejection.

DETAILS OF MEDICAL EXAMINATION

This work took place in a section of a well-lighted and ventilated warehouse, 70 feet square, from which most of the property had been moved, leaving a clear passage about 12 feet wide. The floor of concrete was covered with canvas.

Undressed, carrying in one hand a paper bag containing his civilian clothing, and in the other the physical examination form and other papers, the trainees entered the door.

At "A," four enlisted men of the Medical Corps, with two sets of physicians' scales and tape measures, recorded the color of the eyes and hair, the complexion, height, weight, and chest measurements.

At "B," one Medical Officer and a Medical Corps noncommissioned officer took groups of six to ten trainees at a time, and made and recorded the general examination (physique, skin, head, chest, abdomen, and extremities), general surgical conditions (bones, joints, muscles, tendons), and genito-urinary system.

At "C," a Dental Surgeon examined the teeth, mouth, and gums.

At "D," a Medical Officer examined the heart and lungs.

At "E," a Medical Officer examined the eyes, ears, nose, and throat.

At "F," a noncommissioned officer of the Medical Department recorded the vision, using a Snellings test set.

At "G," the trainee's vaccination record was checked by an enlisted man of the Medical Department and vaccination against smallpox and typhoid began, if needed.

At "H," a Medical Officer checked the entire paper, watched for neuro-psychiatric conditions and collected the physical examination record. Rejected candidates were held in the vicinity of "H" and were seen by the Surgeon, and finally by the Commanding Officer of the Camp.

STAGE V

The officer in charge is First Lieutenant J. C. Browne, Q. M. C. Two officers and twelve enlisted men, other than Quartermaster Corps personnel, will be assigned to him.

The mission of this stage is to equip the C. M. T. C. candidates with their prescribed allowance of clothing.

The stage will consist of four phases: *Measurements, clothing issue, shoe fitting, and checking.*

The measurements will be noted on the forms furnished by the Quartermaster. The courses (Basic, Red, White, and Blue) and the branch of service will be noted at the top of the form. The shoe fitting will be done with the Roscoe device as provided for in Special Regulations No. 28. An officer will personally see that each candidate is correctly fitted with shoes.

The checking details will be stationed at the exits, will make a verification of clothing issued to each candidate as he leaves the building, and will check on each record card the fact of a correct issue of clothing.

One special guide will be furnished by the officer in charge of Stage II to assist in moving candidates.

An officer from each C. M. T. C. Battery will make a settlement

by memorandum receipt to the Camp Supply Officer for all clothing and equipment issued, pertaining to their respective batteries.

Attention of the officer in charge of this stage is particularly invited to the instructions for Stages III and VII in order that proper cooperation may be obtained.

A receipt, in duplicate, will be taken from each candidate on "Individual Clothing Lists." After the issue is made, a memorandum receipt, in duplicate, will be prepared by the Camp Supply Officer, covering the total clothing and equipment issued to the candidates *by organization*. These receipts, supported by each candidate's signed individual receipt, will be signed by organization commanders.

Candidates will dress (in military clothing) in tent so marked.

Note: Clothing was arranged on tables or in bins according to sizes in the following order: Barrack bag; socks; shoes; gymnasium shoes, service; shirts, O. D.; cravat; belts, waist; ornaments, F. A., ornaments, C. M. T. C., badges, breast, collar patch, all in one package; trousers, fatigue; coats, fatigue; breeches, cotton; leggins, mounted; raincoat, mounted; hat, service; cord, hat.

A sufficient number of enlisted men were in charge of clothing to make prompt issue.

STAGE VI

The officer in charge is Captain F. C. Beebee, Finance Department.

The mission of this stage is to make the prescribed financial adjustments with C. M. T. C. candidates.

The work will be done by three stations, as follows: (1) Travel pay to accepted candidates; (2) reimbursement to accepted candidates; (3) travel pay to rejected candidates.

One special guide will be furnished by the officer in charge of Stage II to assist in moving candidates through Stage VI.

STAGE VII

The officer in charge is First Lieutenant T. F. Keefe. 6th F. A.

The mission of this stage is to receive and store the civilian clothes and baggage of the candidates and to give a receipt therefor; also to issue the necessary equipment to the candidates and obtain a receipt therefor from the candidates.

In order to make and enforce proper provisions to protect private property of candidates, the following is ordered:

> "At Stage VII, candidates will be instructed that their private property which will not be used in camp, must be stored with the *Camp Supply Officer,* at Stage VII. All small articles

of value will be stored in a safe provided at Stage III by the *Camp Supply Officer*. The *Camp Supply Officer* will be custodian of this safe. Should any candidates be unwilling to so store his personal belongings, he will be required to sign a statement releasing the government of all responsibilities in the event of loss in any manner."

At this stage the trainee is fully dressed in uniform. His civilian clothing and valuables, for which he holds claim checks, are in storage.

STAGE VIII

The officer in charge is each C. M. T. C. Battery Commander.

The mission is to complete the processing of the accepted candidates.

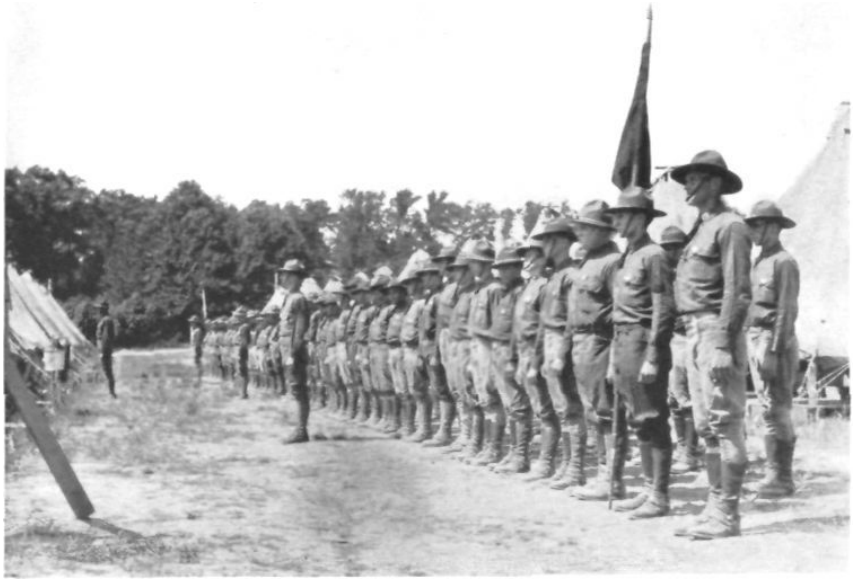
The Battery Commander or an assistant, with sufficient personnel, will always be present at Stage VII to receive his candidates for the start of Stage VIII. The battery officers will collect the complete file of individual records consisting of (*a*) Record Card (bearing battery assignment); (*b*) Form 122, A. G. O.; (*c*) Travel Orders, carried by the arriving candidates, and will submit them intact, less baggage tags, to Headquarters, with the morning report *on the morning following their receipt,* with platoon and tent assignment filled in on each card. *Extreme care must be exercised to avoid loss of records*.

Note: Upon arrival at his battery, each candidate was assigned to a numbered bunk in a numbered tent, where he found on his bunk mattress, pillow, bed linen, blankets, mosquito bar, belt, canteen, and spurs.

DEPROCESSING

This is the reverse of processing and must also be conducted following a carefully thought-out plan complete in all its details.

It is particularly important to see that each trainee after receiving his travel pay *buys a ticket home* and that *he gets on the train homeward bound,* otherwise he is likely to fritter away the money or even redeem a ticket and become a public charge of the locality. For this reason arrangements were not only made for special trains, but railroad passenger agents were present alongside the paymaster and an officer was present to see that every trainee who couldn't produce satisfactory evidence that he had other transportation such as automobile was required to buy a ticket and that he went to and got on his proper train. The following is the substance of orders issued for the Fort Hoyle deprocessing:



A PITTSBURGH C. M. T. C. BATTERY

A C. M. T. C. BATTERY—EARLY STAGE OF INSTRUCTION

1. The deprocessing will be divided into seven stages as follows:
   Stage I.—Drawing civilian clothing.
   Stage II.—Turning in equipment and military clothing.
   Stage III.—Medical examination.
   Stage IV.—Travel pay.
   Stage V.—Purchase of tickets.
   Stage VI.—Transportation to station.
   Stage VII.—Entraining.

2. *Responsibility*. (*a*) The Control Officer is responsible for the proper functioning and coordination of all stages. He will take the necessary action to eliminate all friction and delays during the deprocessing periods specified. Messages to the Control Officer will be sent to Camp Headquarters.

(*b*) The officer in charge of each stage is responsible for the efficient operation of his organization in coordination with the other interlocking stages.

STAGE I

The officer in charge is 1st Lieutenant T. F. Keefe, F. A.: three noncommissioned officers and six privates will be detailed as assistants.

The mission of this stage is: (1) Return to the C. M. T. C. trainees all valuables that were turned in to the Camp Supply Officer. (2) To turn over to the trainees all civilian clothing and hand bags stored by the trainees with the Quartermaster.

In order to carry out this mission, batteries will be marched to the C. M. T. C. Quartermaster Warehouse on August 3, 1928, as per schedule (omitted).

Each trainee will change to civilian clothing from military clothing immediately after he has drawn his civilian clothing.

STAGE II

The officer in charge is each C. M. T. C. Battery Commander.

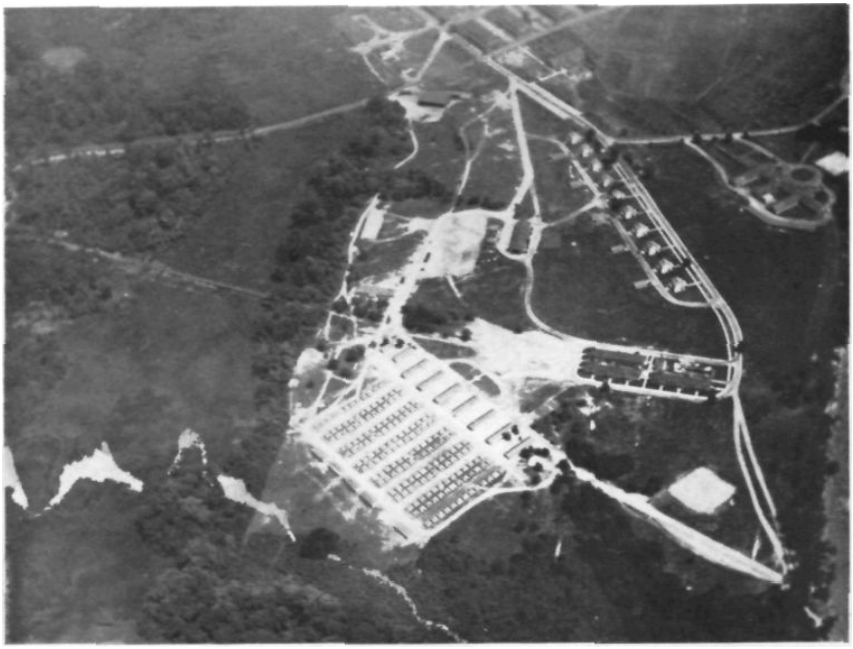
The mission is the return to the Post Quartermaster of all military clothing and equipment issued to the C. M. T. C. trainees.

In order to carry out this mission, the Battery Commanders will:

1. Immediately after the trainees have changed into civilian clothing on the afternoon of August 3, collect two pairs of cotton O. D. breeches and two woolen O. D. shirts. Battery Commanders will turn this clothing over immediately to a representative of the Camp Supply Officer, who will give a receipt therefor. The clothing will be sent at once to the Post Laundry.

2. Immediately after breakfast, August 4, have the mess halls thoroughly policed, dishes washed, tables and stools stacked against the south wall. This must be completed by 7:30 a. m.

ABOUT TO PUT ON THE UNIFORM



FORT HOYLE C. M. T. C. CAMP SHOWING MESSES, TENTS AND SHOWERS

3. Then have all remaining articles of clothing and equipme?? the hands of trainees (except bunks) turned in at the mess ?? where they will be sorted into serviceable and unserviceable ?? Both the serviceable and unserviceable piles will be subdivided into piles of ten. This must be completed by 8:00 a. m. A careful record of any shortages will be made.

4. Have battery streets policed.

5. Then make arrangements with the Quartermaster to take over this clothing and equipage; this must be accomplished by Retreat, August 4, 1928. *(Note:* Military equipage includes mattresses and pillows.)

STAGE III

The officer in charge is Major W. A. Hagins, M. C.

The mission of Stage III is to make the prescribed physical examination for trainees at the termination of camp.

In order to carry out this mission: (*a*) Blue and White Trainees will be reported to the Camp Recreation Hall at 1:00 p. m., August 2, 1928, for physical examination.

(*b*) Red and Basic trainees will be examined in their tents by medical officers on August 3, as per schedule (omitted).

Form 122, W. D., A. G. O., will be executed and forwarded to Headquarters.

STAGE IV

The officer in charge is Captain F. C. Beebee, F. D.

The mission of this stage is to make the prescribed financial adjustments with C. M. T. C. trainees.

Trainees will be marched to the door on the west side of the Recreation Hall, on August 4, 1928, as per schedule (omitted), where they will draw their travel pay.

STAGE V

The officer in charge is First Lieutenant J. M. Lentz, 6th F. A.

The mission of this stage is to assure that trainees have some form of transportation to their homes.

Immediately after each trainee is paid, he will be directed to the Ticket Desk in the Camp Recreation Hall. Battery Commanders will furnish the officer in charge of Stage V a list of those trainees who have automobile transportation to their homes. These trainees will not be required to purchase railroad tickets.

The Camp Mess Officer will have a lunch that may be taken by trainees in the Recreation Hall at this time (for noon lunch).

STAGE VI

The officer in charge is First Lietenant A. E. King, 6th F. A. and ten enlisted men.

REFRESHMENT TENT—STAGE 2

COMPLETELY EQUIPPED—OUT OF STAGE 5

The mission of this stage is to get the trainees from the camp to the railway stations at Edgewood and Van Bibber.

In order to carry out this mission, Lieutenant King will confer with Mr. Garrett of the P. R. R. concerning the time that the trains leave Edgewood.

He will arrange with Edgewood Arsenal for the use of the Electric Train ("Toonerville") to take trainees to the Edgewood railroad station.

Trainees will be loaded on trucks as soon as Stage V is completed.

STAGE VII

The officer in charge is First Lieutenant H. W. Kiefer, 6th F. A.; three enlisted men will be detailed as his assistants.

The mission of this stage is to see that trainees entrain in an orderly manner at the Edgewood railroad station; also to see that all trainees leave Edgewood and Magnolia either by train or automobile, and not by walking.

In order to carry out this mission, he will station one enlisted man at the Magnolia gate, another near the Edgewood Garage, and another at the Edgewood railroad station.

Credit is due Major E. W. Wildrick, 6th F. A., and Captain W. J. Jones, 6th F. A., for working out the details of this system.

An interesting feature in connection with this work is the fact that the execution of the processing described above was carried out by the 313th Field Artillery (Colonel L. T. Herron, F. A. Res., commanding). Great praise is due this Reserve Corps Unit for actually taking over the duties indicated above for the various regular officers, and for the skillful accomplishment of the Fort Hoyle processing.