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THE FIELD ARTILLERY JOURNAL

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Contents

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THE FIELD ARTILLERY JOURNAL

VOL. VIII **OCTOBER-DECEMBER, 1919** **NO. 4**

Field Artillery—A Retrospect

BY MAJOR GENERAL WILLIAM J. SNOW, UNITED STATES ARMY, CHIEF OF FIELD ARTILLERY

[*Ignorance of the eternal principles of tactics in open warfare has resulted in heavy losses on several occasions when operations temporarily assumed the character of open warfare, and for such ignorance a heavy responsibility rests with those—usually junior officers—who consider a study of tactics unnecessary to their work in this war.—Introduction, by Major J. de Morinni, to "The Principles of War," by General (now Marshal) Foch.*]

THE above criticism forcibly strikes an officer when looking back over the World War, and considering our army. The enormous expansion that was necessary in the officer personnel, particularly in the Field Artillery, when passing from our small peace basis to our large war status, required the rapid commissioning of officers in such numbers and with such limited training as to make impossible any thorough course of instruction. The whole problem was reduced to furnishing the new officer with the minimum training necessary to enable him to start his career, and to laying a foundation upon which he could build, with the hope that he would "train on."

That sounds simple enough but in practice difficulties at once arose. It must be borne in mind that at the time we entered the war the opposing armies were engaged in the so-called "trench warfare," entirely to the exclusion of open warfare. The urgent need for officers in our Field Artillery was so great that they of necessity had to be taught the thing they would have to use first. We knew that trench warfare immediately confronted

them. Open warfare might, or might not, confront them later. It is not to be wondered at, then, that the methods of trench warfare immediately assumed commanding importance in the minds of many officers. The newly-commissioned officers—ignorant alike of open and of trench warfare, their ears ringing with ideas concerning the latter enunciated on all sides—naturally considered trench warfare of paramount importance. The older field-artillery officers, likewise hearing trench-warfare talk on all sides, to the exclusion of open warfare, were naturally prone to believe that they had wasted years in learning something which was obsolete in so far as this war was concerned. The state of mind of both classes of officers was natural, but unfortunate.

Another factor introduced at this time was the innovation of instructors from foreign armies. They had recently come from the battle front and were saturated with trench warfare. These officers rendered us valuable assistance, and there is no desire on my part to belittle their services; but they undoubtedly added to the strength of the trench-warfare camp. Coming as they did from Europe, where even in time of peace there is a strong military atmosphere, it was impossible for them, immediately upon reaching our country, to realize that our newly commissioned officers had no military training of any kind to build on; hence, before they could specialize, it was necessary to lay some sort of military foundation. This could be laid only by inculcating the doctrines of open warfare. The trouble lay in the fact that officers of all ranks forgot the principles set forth in the quotation at the head of this article.

Certain of the older officers in our service realized from the start that the foundation of all field-artillery training lies in open warfare, and that the so-called trench warfare is merely an application of the eternal principles of open warfare to a peculiar case. The writer was firmly convinced of this; and, in planning the course at the School of Fire, which he had just been directed by the War Department to re-establish, he determined that open warfare should be made the basis of all instruction.

For this he was criticized at the time. When turning over the position of commandant to Colonel (now Brigadier-General) A. S. Fleming, who succeeded him, a request was made that the basis of the course be not changed. General Fleming agreed absolutely in these ideas; and to his clear perception on this question, and the unswerving determination of his assistants not to be driven into false doctrines, the Field Artillery is greatly indebted. General Fleming and the school authorities met with considerable criticism for teaching "pre-war stuff" instead of what some people called "modern artillery." He saw clearly what many people overlooked—that with a good knowledge of open warfare the students found no difficulty in acquiring the few additions required in corrections of the moment, in using the fixed base line, in map firing, etc. He saw equally clearly that if the close and accurate shooting methods of trench warfare with fixed base lines were adopted and taught exclusively, it was hopeless ever to expect to turn out field artillerymen. In other words, he was sound on the principles enunciated in our opening quotation.

Our present chief of staff, when chief of artillery in the American Expeditionary Forces, was also a tower of strength on this question. In a letter he stated: "The training of organizations now in France is being retarded by the presence in field-artillery regiments of a considerable number of officers who are not familiar with the provisions of Volume 3, Field Artillery Drill Regulations (Firing Instruction), and who are not experienced in the conduct of fire. This lack of training of officers in the application of our own firing regulations has proven in France a greater obstacle to rapid preparation of organizations for their duties at the front than has the necessity for the special training required under the conditions of present warfare. * * * It cannot be too strongly impressed upon all ranks that the principles laid down in Volume 3, Field Artillery Drill Regulations, are as absolutely sound to-day as when they were written. They constitute the groundwork upon which the special methods necessitated by the conditions of

trench warfare are built. In effect, the latter are but special cases of the principles of our drill regulations.

"A field-artillery officer must be thoroughly grounded in these principles and their application. The necessity for this is greater now than ever before. Any officer so grounded can be taught the special methods now in use in a very short time. If, however, he is not so grounded, education in France must begin with the basic principles, and must continue over months, to obtain in the end an indifferent result. In the event of a break in the trench lines and the resumption of open warfare, the special methods and refinements now in use must of necessity largely disappear. It cannot safely be said that one single paragraph of our present Field Artillery Drill Regulations is obsolete."

Notwithstanding these statements of principles, however, by such high authority, sound training was constantly attacked. It was continually said, among other things, that the Field Artillery should go to the fire control methods of the Coast, and that our old methods were obsolete. Manœuvre was neglected. To combat erroneous fire ideas, the chief of Field Artillery issued the following circular:

"Trench warfare is not a distinct procedure from open warfare, with a sharp line of demarcation between the two. On the contrary, it being entirely a question of movement, one shades into the other. We should try at all times to get the maximum effect from our guns. When they remain in position for long periods of time, and the enemy does the same, we may introduce every refinement we know to secure efficiency. This is the so-called 'trench warfare.' If we change position several times daily, and if our targets are fleeting, no refinements can be applied. We must get rapidity of action, and so only rough methods are suitable. This is so-called 'open warfare.' Between these two lie all other cases. Some of them, where there is little movement, will resemble trench warfare more closely than open, and the reverse of conditions will produce the opposite effect. Applying the foregoing remarks to

our Field Artillery Drill Regulations, we find that they have to be considered as the basis of all our instruction. Volume 3 is of especial importance and must be thoroughly mastered."

The chief of Field Artillery has never wavered from his stand that the foundation of all field-artillery training lies in the teachings of open warfare, and that the few new developments of the war calling for close shooting and trench-warfare methods were but a passing phase, easily acquired by any field-artillery officer possessing sound open-warfare knowledge. Accordingly, training in the United States was maintained by him on these lines in so far as he could control it. Many officers, and among them some Field Artillery officers of experience, however, always had a suspicion that their theory and practice were obsolete, and consequently there was always a disposition on their part to slip in an excess of trench warfare and coast-artillery methods at the expense of field-artillery methods. The claim is still quite frequently made that in this war the Field Artillery has abandoned its fire control system, and adopted that of the Coast. Nothing could be farther from the truth. In fact, the constant tendency to overlook the principles set forth in the quotation at the head of this article, and the constant creeping of coast-artillery methods into our field-artillery instruction has militated seriously against our efficiency. It has been a material handicap in securing sound training. The plan followed has been to try to instill open-warfare principles in officers in this country with only a brief application of trench-warfare training, leaving the further development of this latter to the additional training which brigades received in France.

A recent letter from one of our best known field-artillery generals in France, who has been continually in a position to know whereof he speaks, contains some words that are most illuminating on this subject. He says: "The recent operations have brought to light many interesting things in regard to Artillery. It is undoubtedly a fact that the Artillery has developed deficiencies in close coöperation with the Infantry. These are due in general to the fact that the Artillery is being taught along

the lines of trench warfare, instead of along the lines we have always considered as sound. * * * The Artillery is 'dippy' on the subject of map shooting and barrage. They seem to have forgotten that there is such a thing as observed fire, and consequently they do not fire, as General Percin once put it, 'on the proper target at the proper time.' * * * From what I can learn of brigades recently arriving, the instruction in the States is along proper lines. In learning the trench-warfare methods which are of course necessary under certain conditions, the young officers become imbued with the idea that all they have learned in the States was out of date, and that the trench warfare stuff is the real thing."

It would seem, therefore, that there is but little doubt that those officers who claim that our pre-war methods have been superseded by the later and better methods taken from the Coast Artillery, are mistaken and are chasing a "will o' the wisp."

The point never to be lost sight of is that only in a war of movement can sound tactical principles be learned, and that principles are eternal while their application varies with every particular situation confronting us. Each situation calls for its own solution, and trench warfare is but one phase of any war. No man can be fully or properly trained by continual harping on one phase, to the almost total exclusion of others. When lines confront each other in trench warfare, sooner or later the line must be broken, and open warfare resorted to, if a decision is to be obtained. Artillery trained for open warfare can readily adapt itself to trench warfare, but if trained only for trench warfare, it is hopeless and helpless after the break-through occurs. Its elaborate system of base lines, maps, coördinates, etc., is not then available. Rougher methods, coupled with observation of fire, must be resorted to. Instruments upon which absolute reliance has been placed are no longer available. It is too late then to take up the general training so necessary. Open warfare requires an officer to make quick decisions. Trench warfare involves plenty of time. We may

even on occasions rehearse the attack. It follows then that the officer who is trained to make the quick decisions involved in open warfare will have no difficulty in making more deliberate ones where time and opportunity permit.

This is the whole case in a nutshell, in so far as firing is concerned. In so far as manœuvre is concerned, there is none in trench warfare, and, accordingly, there can be none of this necessary training under the conditions of such warfare. Failing to manœuvre, there can be no tactical instruction, and failing tactical instruction in any arm, that arm simply is not trained. All Field Artillerymen should then take to heart the quotation at head of this article.

The Field Artillery Central Officers' Training School

A SKETCH OF ITS SCOPE AND ACHIEVEMENTS

By CAPTAIN RAYMOND WALTERS, A. G. D. REGISTRAR F. A. C. O. T. S.

EDITOR'S NOTE

[*Among the remarkable achievements of this war, the Field Artillery General Officers' Training School stands forth in the first rank. Shortly after the appointment of a Chief of Field Artillery, in February, last, and as soon as he had examined into the field artillery situation, it became apparent to him that such a school was an absolute necessity. There was a prospect of an early shortage of officers, those that were being trained in the numerous divisional camps were not being trained according to any one standard, and many officers held commissions in this arm with only a negligible amount of training. There was a shortage of equipment and consequent training facilities in all divisions, a shortage of instructors, and generally unsatisfactory conditions in field artillery commissioned personnel. As one of the fixed ideas of the chief was standardization and quantity production in this war, he at once proposed this central school. It is interesting to note that it was not until after we had been at war for over a year that he was finally able to secure the adoption of the plan. Once started, its success became early apparent, and it grew by leaps and bounds. Probably no school in the country has been the subject of more favorable commendation. It was just coming into quantity production when the armistice was signed*.—THE EDITOR.]

As the present number of THE FIELD ARTILLERY JOURNAL is issued there is drawing to its close the existence of an institution which has achieved distinction in six points of special interest to members of the United States Field Artillery Association. The institution referred to is the Field Artillery Central Officers' Training School. Its six achievements are as follows:

(1) It became the largest school in the world, with an enrollment reaching a maximum of fourteen thousand students, and a total attendance in six months of twenty thousand.

(2) As a corollary of the preceding point, this school, through its thousands of students and their thousands of friends, has widened to a remarkable degree popular understanding of the Field Artillery's purpose and importance.

(3) The Field Artillery Central Officers' Training School represents a proof of the value of Major-General Snow's principles of standardization and of emphasis upon fundamentals.

(4) Colonel Carter's working out of these principles constitutes a triumph of organization and furnishes a basis for future activities and progress.

(5) In the development of its course, the Field Artillery Central Officers' Training School has produced a book, "Field Artillery Instruction Memoranda," which constitutes a valuable contribution to the literature of the Field Artillery.

(6) The Field Artillery Central Officers' Training School, in common with other central officers' training schools, gave evidence of how American manhood responds to the most rigorous demands.

THE LARGEST SCHOOL IN THE WORLD

As the present writer remarked in an article in the *New York Times*, the F. A. C. O. T. S. is a school which, under the nurture of necessity, attained in three months' enrollment proportions that it has taken Columbia, Harvard, and Yale a century and a half or more to reach.

Size, of course, is not important, merely as size. But in a world war, in which the magnitude of armies exceeded anything in history, it was merely "in scale" to have an officers' training school so huge. Beyond this, there was a purpose in deciding to forego certain advantages which smaller educational units ordinarily possess; among them the advantage of independent experiment.

One of the points upon which the late Imperial German Government was pleased to discount America's entry into the war was her supposed incapacity to produce officers to command a large army. The central officers' training schools were

devised by the General Staff as America's answer upon this particular point.

In regard to training Field Artillery officers, it was determined to replace the several divisional schools first started with one school for the standardized production of second lieutenants capable of taking their place in units training directly for service overseas and capable of post-graduate study in the School of Fire at Fort Sill.

This circumstance is set forth to show that the great size of the F. A. C. O. T. S. was due to the desire for unity of aim and execution.

ADVERTISING VALUE FOR THE FIELD ARTILLERY ARM

It developed that a single large institution attracted a measure of public attention that a number of small schools would probably have failed to win. In other words, the newspaper advertising value of having "the biggest school in the world," together with the personal advertising done by the thousands of students and their thousands of friends, resulted in what the constitution of the Field Artillery Association denominates as one of the Association's objects: "Furnishing information as to the Field Artillery's progress, development, and best use in campaign." Popular understanding of the purpose and importance of the Field Artillery is certainly among objects which "are worthy and contribute to the good of our country."

THE PURPOSE OF THE F. A. C. O. T. S.

In a Field Artillery memorandum issued on April 18, 1918, Major-General William J. Snow, Chief of Field Artillery, declared that, despite changes in application, "the war has brought forth no change in the principles underlying the use of field artillery." It was upon this basis that Colonel Arthur H. Carter, Commandant of the F. A. C. O. T. S., attacked the problem of organizing the school at Camp Taylor. The course Colonel Carter laid out, in the words of his preliminary

report, "follows in general the course outlined in Special Regulations, No. 49, and the report of General Summerall on his observations abroad." Tribute to the skill with which these elements are compounded in the F. A. C. O. T. S. schedule has been paid by Field Artillery officers who have examined it and observed its operation.

QUALITY AND QUANTITY OUTPUT

The object of the F. A. C. O. T. S. was large-scale production of competent second lieutenants to meet the tremendous demand that existed in the Field Artillery last summer. Reports from regiments to which certain graduates of the school were assigned for duty, and from the School of Fire at Fort Sill, to which others were assigned for post-graduate study, show the success of the F. A. C. O. T. S. in regard to quality.

Evidence as to the quantity output is contained in the records of the school, which show sixty-eight hundred graduates commissioned from August 17, 1918, to December 11, 1918. When the armistice was signed, the school machinery was handling the largest student enrollment in the world, and was "tuned up" to graduate each week one thousand candidates having the qualifications designated for second lieutenants of Field Artillery.

It is not extravagant to assert that the handling and training of candidate officer material by the F. A. C. O. T. S. was an achievement in organization, and that the educational methods and system evolved will furnish a valuable resource for a possible similar war crisis or for universal military training, should it be established.

In common with other central officers' training schools, the F. A. C. O. T. S. has demonstrated how American manhood responds to the most rigorous demands. With full allowance for the patriotic motivation of this response, the training schools seem to afford a lesson to the colleges of the country as to the higher energizing levels of which students are capable, both mentally and physically.

SCHEME OF ORGANIZATION

The earliest memorandum of Colonel Carter for the Chief of Field Artillery (June 6, 1918) contemplated "(1) Permanent administrative personnel; (2) permanent training personnel; (3) variable corps of instructors." This outline was followed in the organization later developed.

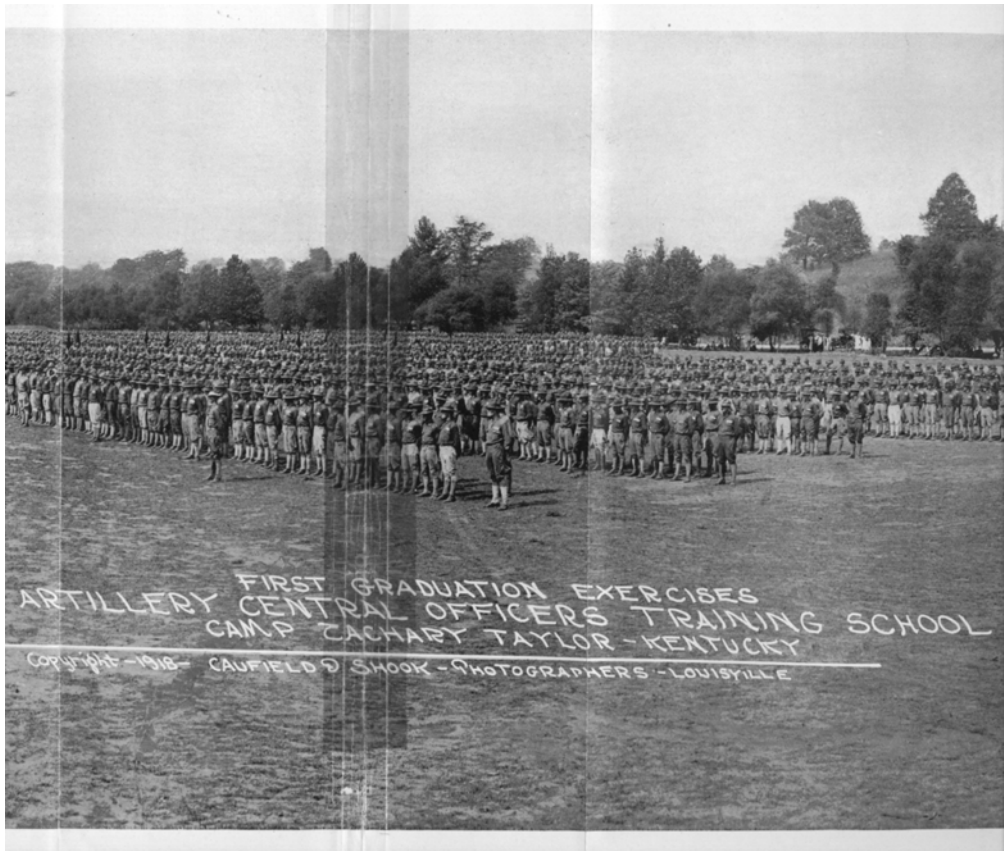
At the head of the school was the commandant, and next were the executive officer, the senior instructor, and the adjutant.

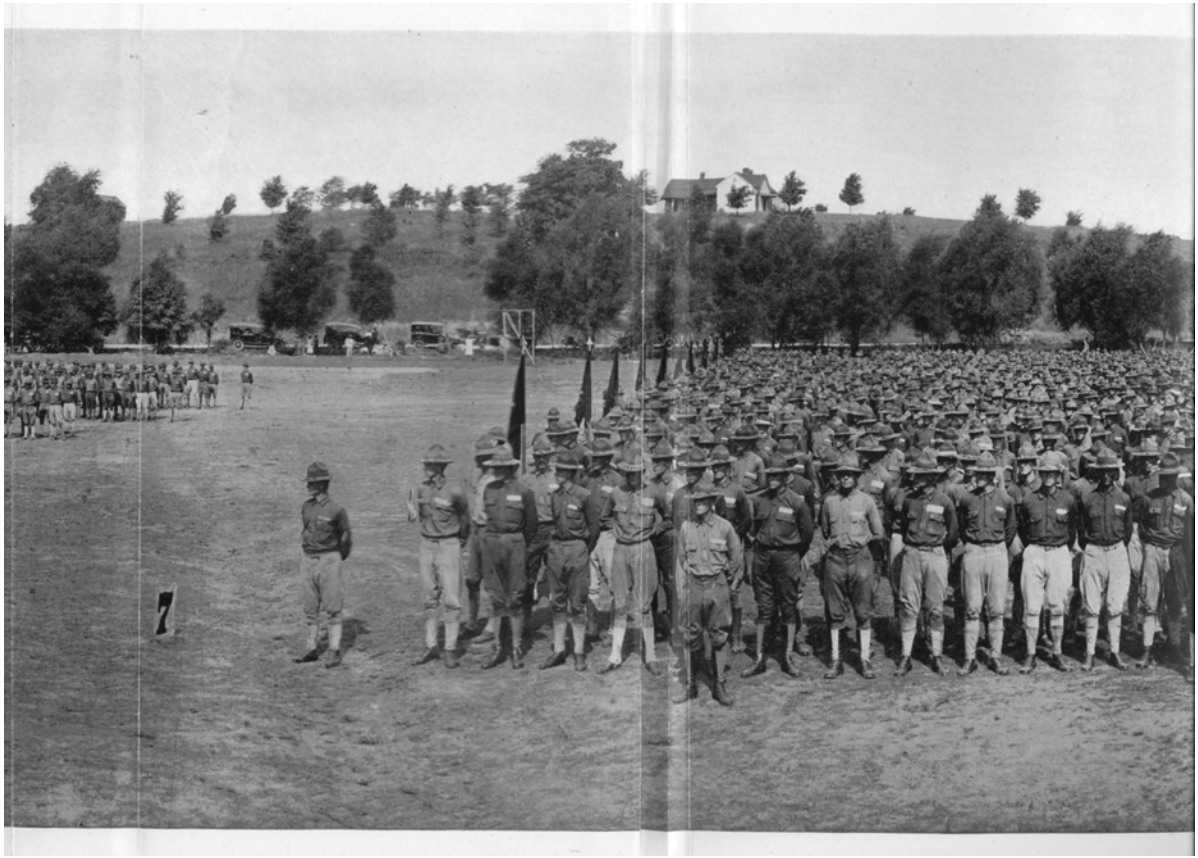
The school was organized under the three main heads of instruction, administration, and supply. Under instruction there were five departments: (1) fire discipline—including drill of the gun squad, nomenclature of matériel and drill of the firing battery; (2) gunnery—including field gunnery, conduct of fire, and computation of firing data; (3) mounted instruction—including riding and driving; (4) reconnaissance—including communication, topography, and reconnaissance; (5) miscellaneous—including subjects of the schedule not included in the other departments. There were also supervising departments of the senior instructor of motors and the senior signal instructor. The directors of the various departments had supervision of instruction in the training batteries and they also conducted schools for officers in which the instructors had a normal course in the subjects they were teaching. The observation batteries were under the supervision of a commanding officer responsible to the senior instructor.

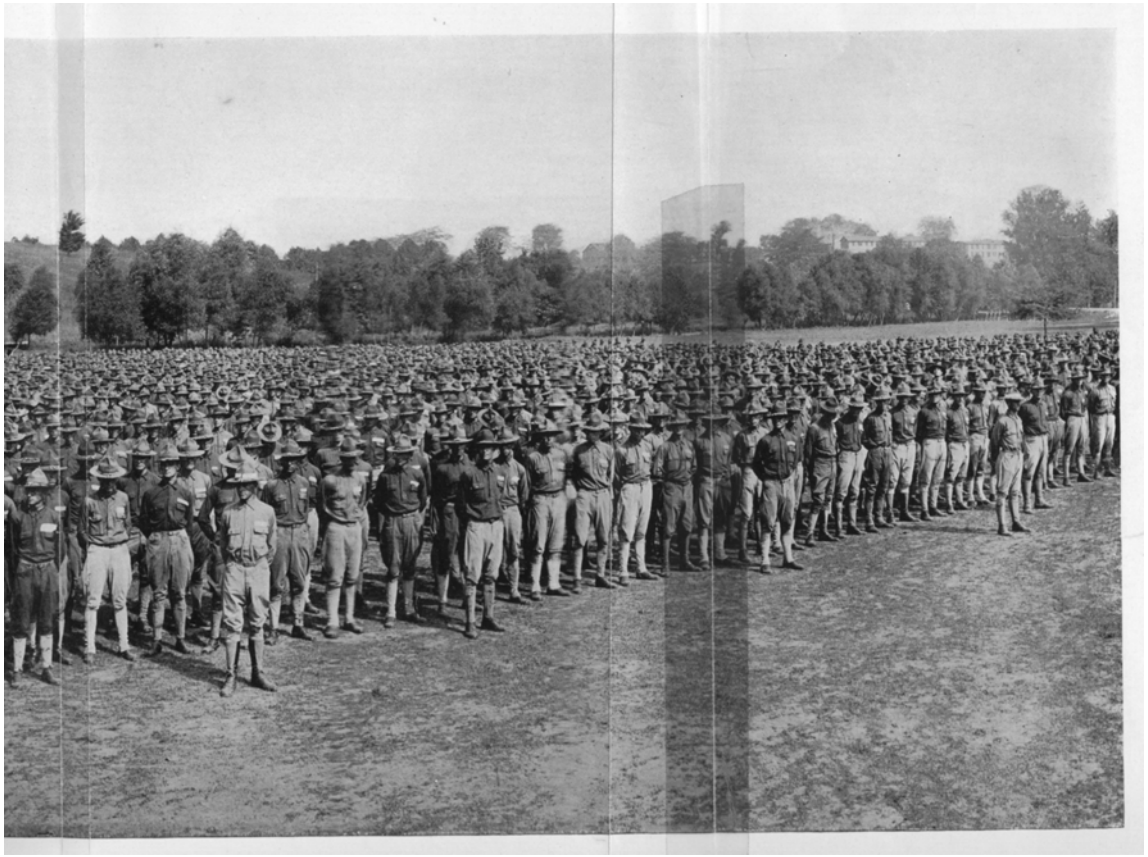
The administrative branch of the school was headed by the adjutant. Under it were the civilian application office, the surgeon's office, the personnel office, the inspection department, the post exchange officer, and the police officer. This branch also included the school troops, consisting of six light batteries and four heavy batteries, three headquarters companies, and two supply companies.

The administrative unit of the school was the battalion, which was made up of three batteries of two hundred candidates each.


FIELD


FIRST GRADUATION EXERCISES
ARTILLERY CENTRAL OFFICERS TRAINING SCHOOL
CAMP ZACHARY TAYLOR - KENTUCKY
COPYRIGHT - 1918 - CAUFIELD & SHOOK - PHOTOGRAPHERS - LOUISVILLE





Under the department of supply were the ordnance and quartermaster divisions of mess, utilities, finance, transportation, and issues. The registrar's office and the department of intelligence reported to the commandant directly.

The constant effort in the school was an administration that would relieve the battery officers as much as possible of the details of paper work, the recording of grades, the handling of mess, clothing and equipment, and thus permit them to devote themselves to their main function—teaching.

PERMANENT TRAINING PERSONNEL

The permanent training personnel, commonly known as the "school troops," was an important feature of the school. It included two battalions of light batteries, and two battalions of heavy batteries, with a mounted detachment, whose duties were the furnishing of details, the care of horses and matériel, and work in general that would relieve the candidates of everything not pertinent to their training as Field Artillery officers. These enlisted men incidentally obtained training for the Field Artillery, and made good progress in preparation for overseas duty.

The clerical force of the school was included in the headquarters companies.

THE OBSERVATION BATTERIES

As an outcome of the experience of the earliest weeks of the school, a preparatory department was organized to fit candidates for the work of the main course.

Within an hour or two after his arrival the rookie candidate was equipped with a uniform, assigned to a bunk, and provided with a seat in the mess hall. As a member of an observation battery he began at once to learn the fundamentals of dismounted drill and military courtesy. Instruction was given in guard duty, so that, at the end of a week, the candidate

was able to serve as a sentinel on post. Precision and brisk action were insisted upon. It was rigorous work. However, the physical condition of the individual, particularly of the older man, was taken into consideration, so that the training was not unduly strenuous. Those who showed themselves qualified at the end of a week were placed in the advanced platoon, where they utilized their knowledge and learned power of command by helping to instruct newly arrived candidates. They here had a chance to perform some of the duties of non-commissioned and commissioned officers of a battery.

Two hours daily were devoted in the observation area to instruction in mathematics essential for the Field Artillery. To qualify for the advanced platoon, candidates were required to demonstrate accuracy and rapidity in handling certain parts of arithmetic, algebra, and geometry. They then had instruction in trigonometry, approximate methods, coördinates, hasty calculations, and the elements of probability.

A third branch of the course of the observation batteries was a series of lectures by officers upon the purpose of the school, honor, loyalty, leadership, and the importance of discipline, voice, and carriage.

To graduate from the observation area into the training batteries of the school, candidates had to obtain a satisfactory rating in the five essential qualities of an officer, on the Scott scale, and also to meet the mathematics requirement. Exceptional men, or those with considerable military experience, could qualify to "cross the valley" in one week. Candidates were allowed four weeks for development. Those who at the end of that period had not shown themselves to be promising officer material were permitted to resign or had the option of appearing before an elimination board.

In the two-fold work of preparation of suitable candidates and elimination of those not suited for Field Artillery, the observation batteries were a most valuable department of the F. A. C. O. T. S.

THE GRAY-HORSE BATTERY OF THE TRAINING SCHOOL

A BATTERY OF CANDIDATE OFFICERS IN LINE

SCOPE AND DETAILS OF THE TRAINING COURSE

In organizing the Field Artillery Central Officers' Training School, West Point was followed as a model, as far as was feasible. The regulations of the military academy were adopted, and likewise the West Point honor system and demerit system.

There is, of course, no claim that this intensive training did more than approximate, in this one specialized branch of service, the all-round military education given at West Point.

Just what, in brief, was the scope of the Field Artillery Central Officers' Training School? Its schedule, beginning with the preliminary period just described, covered twelve weeks' intensive training in heavy and light artillery. There were fifteen technical subjects. The course called for forty-three hours of class-work each week, eight hours daily, except Saturday, with supervised study periods of two hours each evening. The twelfth week was spent in the field, with no routine classes.

A typical schedule for a day in the seventh week follows:

6:45– 7:45 A. M.	conduct of fire
7:45– 8:45 A. M.	driving
8:45– 9:45 A. M.	fire discipline
9:45–10:45 A. M.	topography
10:45–11:15 A. M.	physical drill
12:30– 1:30 P. M.	care and training of horses
1:30– 2:30 P. M.	communication
2:30– 3:30 P. M.	field gunnery
3:30– 4:30 P. M.	reconnaissance
7:00– 9:00 P. M.	study period (supervised)

For reference purposes there is given herewith a list of the subjects in the F. A. C. O. T. S. course, showing just what graduates have covered and should know:

(1) *Administration* (10 hours).—Army regulations. Battery administration and paper-work. Manual of courts-martial. Field service regulations.

(2) *Anti-Gas* (12 hours).—Inspection and drill with respirators. Disinfection of respirators. Adjustment of horse mask. Passing through gas trenches and gas house.

(3) *Care and Training of Horses* (37 hours).—The nomenclature of the horse. Ordinary diseases of the horse. Types of artillery horses. Rules for the care of horses. Shoeing. Construction of picket line. Simple cordage. Grooming. Soundness and common medicines. Care and policing of stables. Stable administration. Entraining and detraining horses.

(4) *Communication* (45 hours).—Semaphore (40 characters a minute, method of teaching). International Morse code, buzzer, and wig-wag (method of teaching). Elementary electricity. Local battery telephone (theoretical wiring and location of faults). Operation of four drop monocord switchboard. Projector (nomenclature and adjustment).

(5) *Conduct of Fire* (69 hours).—Computation of firing data. Mask clearance. Minimum range. Fundamentals of fire for adjustment. Fundamentals of fire for effect. Appropriate brackets. Blackboard, terrain board, miniature range, and smoke-bomb firing. Observation of service firing. Nomenclature, care, and use of fire control instruments. Simple derivation of firing data from map. Compass laying.

(6) *Dismounted Drill and Military Courtesies* (16 hours).—Dismounted formations of the battery. Commands. Saluting. Military courtesies and customs of the service.

(7) *Driving* (51 hours).—Rolling drivers' rolls and packing same. Nomenclature and use of the various parts of the harness, both breast and steel collar harness. Proper adjustment of all parts of the artillery harness and tests for the same. Harnessing and unharnessing in the field and in garrison. Management of the pair and the team. Battery drill mounted to include all movements: limbering and unlimbering, driving over difficult and varied ground—to include ditches, hills, woods, and varied terrain. How to get out of difficult places and to start a stalled team. One week of field instruction on

camps, including marches, occupation of positions, and the feeding, watering, and care of horses in the field and on the march.

(8) *Field Gunnery* (27 hours).—Simple definitions. Paragraph 1044, "Field Artillery Drill Regulations." Elements of rigidity and manipulation of the trajectory. Range tables. Three-inch field gun. Atmospheric effects on the trajectory. Dispersion. Probable error, to include three dimension problems. Practical application of principles to drill regulations.

(9) *Gun Squad Drill* (12 hours).—Complete the gun squad drill for three-inch gun and British 75-mm. matériel.

(10) *Drill of the Firing Battery* (69 hours).—Complete paragraphs 833–1043 of the D. & S. R. F. A. for the three-inch gun and British 75-mm. matériel (9 weeks on three-inch gun; 2 weeks on British 75-mm. gun).

(11) *Matériel* (40 hours).—Description and nomenclature of the wheeled matériel. Dismantling and assembling traversing and elevation apparatus. Mounting and dismounting the gun and recoil mechanism, three-inch and British 75-mm. gun matériel. Ammunition and fuzes—American common shrapnel; 21 seconds and both percussion fuzes. Entraining and detraining matériel—loading one flat car and chocking same. Cleaning harness, pitching shelter tents, rolling rolls and packing same on the carriages.

(12) *Physical Training* (33 hours).—As prescribed in the "Manual of Physical Training."

(13) *Pistol Drill and Guard Duty* (14 hours).—Manual of interior guard duty. Practical application on guard. Manual of the pistol. Position and aiming drills. Pistol firing.

(14) *Reconnaissance* (45 hours).—The battery detail, the formation. Route marking. Horse holding. Gun marking. The duties of the executive. The establishment of communication. Target designation. Agents. Sending and delivering messages. Scouts. Road reports. Reconnaissance of

route. The gun position. The desirable and undesirable features.

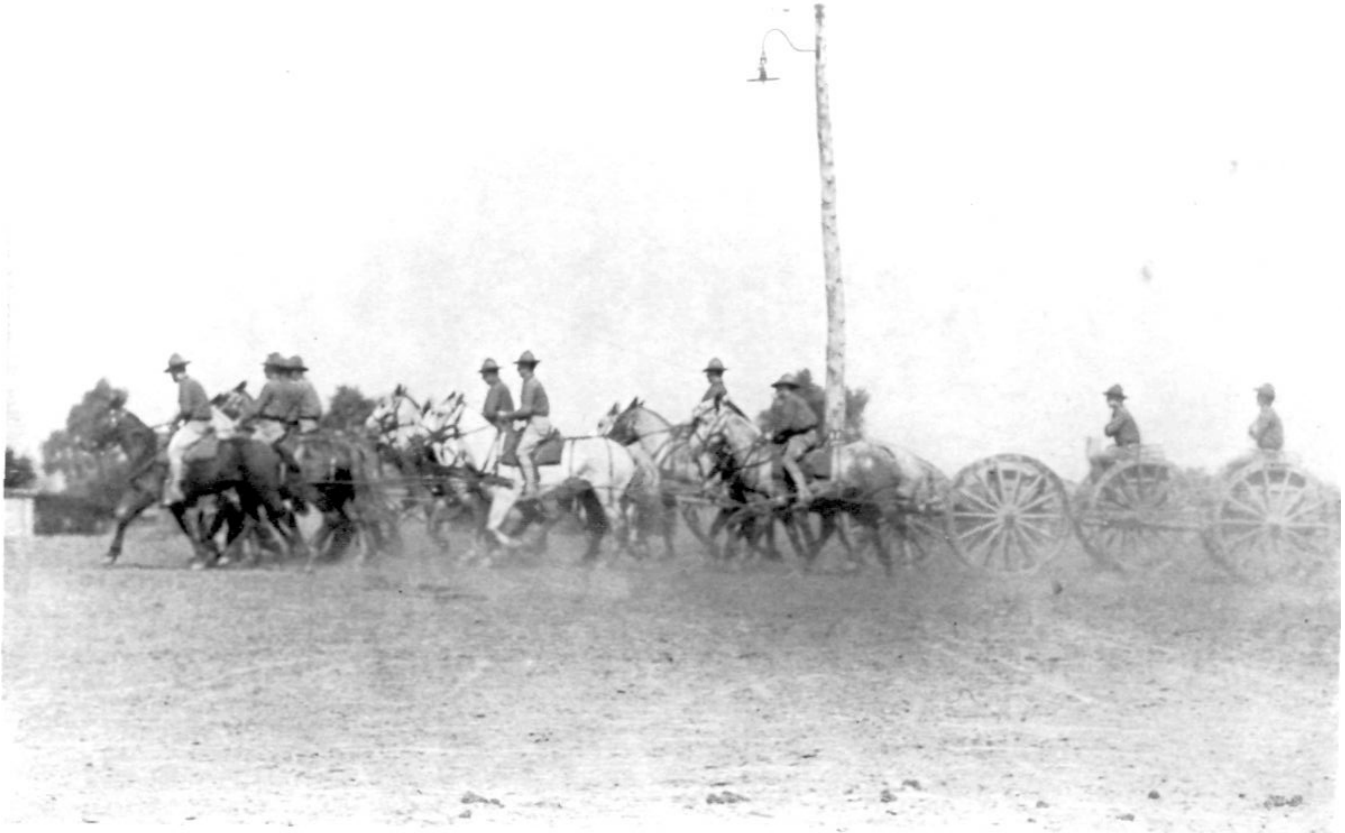
(15) *Riding* (17 hours).—Nomenclature and use of various parts of the horse equipment. To fold the blanket, to saddle and unsaddle, to fit both the double and snaffle bridles. To handle the reins properly, and the proper position of the soldier mounted. The suppling exercises and the purpose of the same. The ordinary aids used in controlling the horse and their proper use. How to gather the horse, to halt and back him, to take the gallop with the proper lead and the principles of posting—emphasizing the necessity of posting as much on one diagonal as the other. The principles of jumping—using very small hurdles. The ordinary gaits, and the care of the horse on the road.

(16) *Topography* (50 hours).—Pace scales, their construction and use. Simple traverse. Intersection and resection. Logical contouring. Visibility (profile method). Panoramic sketching. The French coördinate system (Lambert and Bonne projections not touched upon). Hidden and visible area. Computation of dead area from the map. Methods of determining the exact position of the directing piece. Area sketch.

(17) *Field Instruction in Camp* (twelfth week).—The last week of the course was spent in camp. The candidates performed all duties, no enlisted men but cooks being present. The drills consisted of firing battery, driving drill, care and use of field equipment, driving over varied and difficult ground, work of the B. C. detail, reconnaissance and occupation of position, service firing, and conduct and observation of fire.

PROBLEMS OF INSTRUCTION

Among the administrative problems of the senior instructor's office was the most advantageous utilization of the limited amount of matériel and the limited number of horses. The first scheme of assigning matériel and horses by battalions was soon replaced by a procedure that proved simple and adequate.



"THOSE CAISSONS GO ROLLING ALONG"

FIRING BATTERY DRILL OF CANDIDATE OFFICERS

Under this procedure the guns were kept in central matériel sheds and the battalions used them in rotation. Similarly the three hundred horses available for riding were kept at main stables to which both the training batteries and school troops reported for their turn in riding them.

An ingenious device to make up for the lack of sufficient animals was the use of wooden horses. These were built by the utilities department of the camp. They furnished a basis for instruction in the application of horse equipment, artillery harness, draft, and preliminary details of mounted instruction. Adopted as a substitute, these wooden horses really proved better for this preliminary work than live horses. The candidate had only his exercise to think about, and he was enabled to learn the application of these subjects thoroughly before having to worry about the eccentricities of the school's "bullring steeds."

Another feature was the normal course for instructors. Classes were conducted by the department directors and by officers who were experts in their respective lines. Classes were held five hours a week, at first at different times of the day, and later at the noon hour during the candidates' physical instruction period.

Talks on teaching methods were given and instructors were supplied with detailed directions for conducting recitations. It was emphasized that discipline must be the fundamental basis for military training and that personal example is the strongest means an instructor has for teaching impressionable candidates fresh from civil life.

Daily bulletins were issued from the senior instructor's office relating to instruction and organization matters. Weekly examination papers were supplied to all batteries, and the grading of papers was supervised by the department directors.

Throughout the course music was utilized to improve morale. As they marched to classes in the morning and at noon, the batteries sang popular songs, led by candidates having the vim of college cheer leaders. This practice was promoted by the

simple expedient of not requiring candidates to march at attention when they sang. In addition occasional periods were devoted to battery singing. There was no study period on Wednesday evenings, and instrumental music and singing had a prominent place in the programs of these "stunt nights."

"FIELD ARTILLERY INSTRUCTION MEMORANDA"

The earliest bulletins were put forth in mimeographed form. After revision in the light of three months' teaching experience they were issued as a printed, loose-leaf volume, "Field Artillery Instruction Memoranda." It was an encyclopedic text book, composed of contributions on the various subjects made by the department directors and by other officers. This book of composite authorship and compilation proved a practical teaching manual. Embracing late developments in the application of Field Artillery principles and giving a clear, full compendium of the fundamentals, it has won note in the Field Artillery as a contribution to the literature of the arm. It is hoped that "Field Artillery Instruction Memoranda" may be published later for general circulation.

GRADING SYSTEM OF THE F. A. C. O. T. S.

Much thought was given to the problem of grading candidates in the Field Artillery Central Officers' Training School, and a system was worked out which proved comprehensive, accurate, and simple.

The main points of the system were as follows: Each candidate was graded weekly on technical subjects upon a percentage basis of 100, with 75 as a weekly passing mark, and 70 as a minimum average for the course for graduation. Each candidate was judged monthly under the Scott rating scale upon the five essential qualities of an officer. The minimum rating for graduation was 50. The relative numerical rank of a graduate in the entire school was based upon the average of his technical subjects grade and his essential qualities rating.

A scheme for giving weight to each of the fifteen technical subjects was devised to be applied in computing the candidate's rating for graduation. This was fixed primarily upon the number of hours devoted to the subject, with modifications dictated by considerations as to the relative importance of the subjects as Field Artillery essentials. Upon a basis of 100 the weight of each was as follows: Administration 2, care and training of horses 5, communication 6, conduct of fire 12, dismounted drill 4, driving 6, field gunnery 10, fire discipline 10, gun squad drill 2, matériel 7, pistol drill and guard duty 2, reconnaissance 10, re-drill 12, riding 2, topography and artillery boards 10.

Each week battery commanders delivered to the office of the registrar grades for sections of twenty-five candidates in all subjects for that week. Grades and ratings were presented on pocket sheets carried in oil board covers. By means of a loose-leaf and cut-leaf combination these sheets could be used for entering grades immediately upon recitation and they could then be turned in without recopying.

The work of recording instructors' grades upon final record cards was performed in the office of the registrar. This office compiled two deficiency lists for battery commanders which showed candidates whose average for the week was below 75, and a second (without specific grades) for posting on battery bulletin boards.

Charts were prepared each week on each of the fifteen technical subjects, showing, by graphical representation, the percentage of candidates in each battery having grades between 60 and 75 and the percentage of those below 60. A general report upon technical grades and essential qualities ratings of the entire school was presented to the commandant each week.

During the twelfth week of the course, which was devoted to practical work in the field, no grades were given in technical subjects. Candidates were then rated according to the essential qualities scale, and this final rating was taken as the candidates' measure of value. Earlier ratings were disregarded.

The computing of individual ratings of graduating candidates and their relative standing for submission to an appointed board of officers and the commandant was done in the office of the registrar.

To afford a basis for judging the most valuable sources of candidate officer material for the Field Artillery, a study is being made in the registrar's office of the final ratings of all graduates of the F. A. C. O. T. S. This will analyze the graduates who had ratings from 85–90, 80–85, 75–80, 70–75, 65–70, and 60–65, to determine their ages, education, vocations, and previous military training.

Reference Library and Publication Section

There was a publication section, which embraced the preparation and the editing of material going out from the school and the supervision of all printing jobs.

An officers' reference library was provided, in which material from other central officers' training schools, and books and pamphlets relating to all subjects of the F. A. C. O. T. S. course, were available for instructors. The publication section and the reference library were under the direction of the registrar.

Personnel Office

It has been estimated that the volume and scope of the work handled in the personnel office of the F. A. C. O. T. S. were not exceeded by any unit personnel organization in the army. This was due, not alone to the size of the school, but to the fact that the personnel office here took over all paper-work of the batteries with the exception of strictly administrative records—such as the duty roster, the sick report, and the morning report. The aim was to leave the officer instructors free to attend to their primary function, the teaching of candidates.

Under the supervision of the school personnel adjutant, the various units (one personnel adjutant for every six batteries)

were centralized in a main building opposite headquarters. There all service records were kept, necessary rosters and strength reports were furnished, pay-rolls were prepared, morning reports were checked, and reports of organization changes were made up. This central office produced a coördination of the work of the battery personnel adjutants.

From a personnel viewpoint the paper-work was unusually complicated, due to the fact that the candidates included soldiers transferred to the school from organizations in other camps, soldiers of grades from privates to chief musicians and regimental sergeants-major. The location of every officer and candidate was available at this office in a directory card index file.

Especial interest was attached to the qualification card section. The cards here, of the regular form prepared by the Committee on Classification of Personnel in the Army, told a story of all sorts and conditions of men. The candidates whose histories were epitomized in these qualification cards, with the vari-colored tabs, ranged from barbers, clerks, and butchers to college professors, professional men, and bankers. Every state in the Union was represented.

Because of its organization to handle paper-work it was upon the personnel office that the great task of discharging candidates and officers of the F. A. C. O. T. S. devolved. This huge operation has been well performed.

THE SUPPLY DEPARTMENT

The supply department of the F. A. C. O. T. S. served as high as eighty-eight organizations at one time—a unit as large as four artillery brigades. But it was the extent to which these organizations of training and observation batteries and school troops were served that made the situation exceptional as a supply proposition. Large numbers of candidates arrived each week, and regularly within twenty-four hours the enlisted men from other camps were equipped, and the civilian recruits were both clothed and equipped. A notable record of the F. A. C.

O. T. S. supply office in this respect was 1165 men equipped in one day.

In the usual organization the supply office issues clothing and equipment, and its work in this respect ends there. In this school, with its shifting personnel, the task was to issue, and then, when the successive classes were graduated, to receive and check clothing and equipment and issue them over again.

Rations for the entire school were handled by the supply office, and the delivery of rations and of forage for the horses every day was no small undertaking. Here the fine coöperation of the Camp Taylor School for Cooks and Bakers proved an immense help, the messes they conducted being a model for the candidate officers as to the possibilities in this line.

Desks and other equipment for the various offices of the school—matériel not available from the quartermaster—were purchased by the supply officer from outside sources.

Transportation was furnished for the policing of the school and for taking one battalion each week to the range at West Point, Ky., and bringing one battalion back to Camp Taylor each week.

Under the heading of the supply department there was represented the quartermaster corps, ordnance department, signal corps, and engineer corps.

THE MEDICAL DEPARTMENT

The large number of candidates in the school from civilian sources made unusual demands upon the medical department, inasmuch as all candidates coming in from civil life had to undergo a physical examination before admission. A well organized procedure was developed for handling the continuous turnover of candidates.

During the epidemic of influenza, for a period of about one month, every candidate entering the school from the enlisted personnel, as well as from civilian sources, was examined. The medical department throughout the epidemic made two examinations

daily of the candidates in every battery, and likewise the school troops.

CIVILIAN APPLICATION OFFICE

From the outset the F. A. C. O. T. S. had a civilian application office devoted to recruiting candidates of a special type. Upon first thought it would appear that the great selective draft army could itself supply officer material to command within its own ranks. The combing of the enlisted personnel with this purpose did produce some excellent material for junior officers, and these enlisted men, sent to the officers' training camps prior to the middle of last July, acquitted themselves well.

On July 16, General Snow wrote: "It has been found that this source is not sufficient to supply the tremendous need for officers which now exists in the Field Artillery, especially the need of older men beyond the draft age." This statement was contained in a request of General Snow for help in securing the "type of men the Field Artillery requires," addressed to the Military Training Camps Association, an organization that had done work of the highest importance in the preparedness movement by furthering the summer training camps idea for college students and business men from 1913 (prior to the start of the European War) to date. This invitation to help was reinforced by the commandant of the F. A. C. O. T. S. The Military Training Camps Association promptly accepted the invitation, and sustained its record of efficient service by obtaining valuable publicity for the school. This was accomplished through branches of the association located in practically all large cities of the country and in many smaller cities.

The scope of this work was soon extended from publicity to selection. Extreme care had to be exercised in admitting only men of the highest type to the F. A. C. O. T. S. because, to meet the officer demands at the outset, a large percentage of the candidates admitted would have to be commissioned. Special regulations of the War Department provided that applicants

for the central officers' training schools were to be examined and passed on by army officers on duty at various educational institutions as professors of military science and tactics. To assist in the work of selection, civilian committees were organized, with the coöperation of the Military Training Camps Association, in all cities of fifty thousand or more, and in a few instances in smaller communities. These civilian committees gave time, energy, and enthusiasm to the enterprise.

An hiatus in the work of the civilian application office existed from August 8th to September 20th, when, pending the passage of the new draft law, the enlisting of civilians for officers' training camps was suspended by the War Department.

As to the success of these candidates obtained through civilian sources, the feeling is general at the F. A. C. O. T. S. that the results repaid the effort.

An examination of the deficiency lists of all training batteries in the school for the week ending October 26, 1918, showed that 18 per cent. of the candidates from civilian sources were deficient in technical subjects as compared with 23 per cent. for candidates from the enlisted personnel. The figures for essential qualities ratings were 22 per cent. deficient of candidates from civilian sources, and 24 per cent. deficient candidates from the enlisted personnel. A study now being made in the office of the registrar of the school as to high grades at graduation should furnish significant evidence as to the relative merits of these two sources of Field Artillery candidate officers.

THE SPIRIT OF THE SCHOOL

During the entire existence of the Field Artillery Central Officers' Training School there was not a candidate in the guard-house and not one tried by a summary court-martial.

The spirit manifested everywhere, from observation area to graduating batteries, was superb in its devotion to duty, in its acceptance of discipline, and in its enthusiasm for the service. There were many older men in every battery—men who had left business and family because of patriotic feeling; and these

EXPLAINING THE PROJECTILE TO A CLASS OF CANDIDATE OFFICERS

candidates supplied solidity of purpose and persistence of application in the student body. To these qualities of maturity the younger candidates added the zest and daring of youth. It was a fusion that produced exceptional results. Drudgery, drill, and discipline were triumphantly met. The late "sinister masters of Germany" overlooked these qualities in American manhood when they belittled the capacity of the United States to create armies and to train officers.

While they took their work very seriously, these candidates of the F. A. C. O. T. S. did not take themselves too seriously. They sang and joked and made merry at battery feasts that were a duplication of the banquets of their college days. All of the human aspects of the school—particularly its humor—were mirrored on the pages of *The Probable Error,* a weekly newspaper written and edited by the candidates without censorship or official influence. This paper leaped at once to the forefront of soldier journals. Its weekly cross-section of the life of the candidates constitutes a record of significance in any study of the school.

Now, to commemorate their days at Camp Taylor, the graduates and former students have formed an Alumni Association—a spontaneous, flourishing organization which already has a membership of more than ten thousand, and is growing fast. The F. A. C. O. T. S. Alumni Association will doubtless prove an important adjunct in the work of the United States Field Artillery Association. These former civilians, who are civilians again, have, thanks to their training and absorption of soldierly traditions at the Field Artillery Central Officers' Training School, become a valuable asset for the Field Artillery as a champion of this arm of the service.

Measures Taken by the German Artillery

TO CARRY OUT PREPARATIONS FOR ATTACK WITHOUT BETRAYING THE INTENTIONS OF THE COMMAND

THE following study sets forth in detail the measures by which German artillery has succeeded in the recent operations in deploying secretly an important mass of batteries and in effecting by surprise a violent and sudden entry into action, at the same time sufficiently well adjusted for good effect.

The memoranda of September 12, 1917, of October 11, 1917, and of December 14, 1917, lay stress upon the importance of the rapid entrance into action of the artillery, and enumerate the characteristics of this mode of intervention. The memorandum of December 29, 1917, states that preparation for the rapid entrance of the artillery into action is possible without preliminary adjustment by a directing piece of each battery.

The memorandum of February 6, 1918, dealing with the battle of Cambrai, sets forth in detail the measures taken by the British artillery for the purpose of dispensing with all fire for adjustment before the attack by means of a scientific preparation fire.*

Note 1.—The preparation was carried out successfully by the British at Cambrai, although they omitted to test the muzzle velocity of their powder, an operation which would have been easy to execute in the back areas.

The conclusion of this memorandum stipulates (section 4) that "it is worth while to shorten the duration of the destructive fire of the artillery and to compensate for the unexecuted destruction by intense neutralization and interdiction fire with a very extensive employment of special shells." We experimented

*July, 1918.

successfully with the same tactics in the operations of Ervantes-Rechicourt and of LaGaloche. A memorandum of March 21, 1918, dealing with the first of these operations, says that "rapid installation of the battery and opening of fire are to be practiced on every occasion, even if only as a training for extensive operations in the future."

In the same way, with a view to future extensive operations of our own, the armies may study with profit in the following document the German application to concrete cases of principles which we ourselves are already acquainted with.

All the great offensives of the Germans since the summer of 1917 (Galician counter-offensive, the Riga manœuvre, the spring operations of 1918 on the Somme, Lys, Aisne, and the Montdidier-Noyon Front) were characterized by a very vigorous action of a powerful force of artillery which came into line without giving any indication of the fact. Information received has enabled us to reconstruct the method of employing this mass of artillery and to establish the fact that the task of each battery was fixed with such minuteness that it seems, at first glance, impossible that firing began without adjustments. But in no one of the great offensives specified did the German artillery reveal its presence by preliminary adjustments.

On the Eastern Front where the observation, aviation, and, in general, the various means of investigation were rather rudimentary, the surprise is still explicable; but on well equipped fronts, where the troops are on the alert, the realization of the factor of surprise necessitated the use of methods which are interesting to study. These involved putting the guns in position and, above all, their adjustment. So far as the emplacements of the batteries were concerned, the methods were revealed to us by captured documents and statements of prisoners. These involved the fullest possible employment of the precautions already known and show the enemy's extreme march discipline.

Note 2.—On the Aisne, in particular, batteries were gradually emplaced; there were night marches; there was perfect emplacement of

cover, obliteration of tracks, absolute avoidance of new excavations and of all useless circulation, utilization of abandoned positions, camouflage, etc. Infinite precautions were taken to avoid every sound—horses' hoofs and wheels were wrapped in cloth or straw, equipment likely to make a noise were very tightly fastened, etc. It is to be noted, however, that despite these precautions certain sounds were heard. In some cases, as at ——, June —, the Germans operated in broad day. Time was wanting for the taking of the precautions specified.

In the matter of adjustment of fire we have found no document or prisoner's statement leading to the supposition that the enemy employed new methods.

Finally, after a very careful study of the nature of the fire to be carried out, the battery emplacements occupied, and known methods for executing fire for adjustment without attracting attention, the conclusion is reached that in most cases the greater part of the German batteries would not encounter insurmountable obstacles in carrying out their missions. It appears clear that in some cases their missions were far from being perfectly carried out.

NATURE OF THE FIRING TO BE DONE

Not all the batteries taking part in the preparation of an attack are obliged to use precision fire.

(1) The counter battery in these operations did not involve the methodical destruction of hostile batteries, but rather the neutralization of their activity by means of gas shells (blue-cross shells with a certain explosive power). Now this fire may without serious inconvenience be directed merely against a certain area—which does not require a precise adjustment.

(2) Destruction fire on the first trench—that is, such trenches as it is particularly important to destroy altogether—was executed, as a general rule, by trench mortars alone.

Note 3.—The artillery carried these out only when the distance was too great (for instance, on part of the Ailette Front), but in this case the artillery had a sufficient margin of safety.

(3) The creeping barrages regulated very precisely on the map are fired according to a pre-arranged scheme, so that precision of adjustment is not indispensable.

Note 4.—We captured several maps for creeping barrages—the —— division for the A—— attack, the —— division for the attack of June — in the —— sector. These are generally charts on which the fronts to be reached by the barrage are indicated at about five-minute intervals. The outlines upon the map do not in general correspond to any obvious point, and it is impossible to identify them on the ground. It is not necessary to find there more than an indication—there is, properly speaking, no designation of successive objectives.

(4) The destructive fire to be executed on lines other than the front lines theoretically involves precision fire, but it is to be noted that initial errors cannot endanger the German infantry and that systematic destruction is not anticipated. The duration of the preparation fire is very brief and the accompanying artillery has specifically the task of breaking down the centres of resistance which the manœuvre brings to light.

Note 5.—Unfortunately, it is difficult to say whether this mission was effectively executed by the batteries of accompaniment. Several prisoners have declared that they were badly supported; and, furthermore, it has been discovered that some of the accompanying batteries suffered very heavy losses; but it is not necessarily true that the Command in general made miscalculations.

In the eyes of the command the essential point, as was particularly clear on the ——, is the neutralization of these positions (note 6). With the density of artillery (note 7) and very heavy supplies of munitions available (note 8) this result is almost inevitably obtained even if the limits set for the systematic fire are large.

Note 6.—Orders to the ——th Army preparatory to the attack of May 27.

Note 7.—On the —— the von —— group (three divisions), which attacked from A—— to C——, had available 165 batteries of *I. Ka.* (artillery supporting infantry) and 60 batteries of *A. Ka.* (counter-battery artillery) (document). The *Fe. Ka.* (long-range artillery)

in action on this front may be estimated at 60 batteries, including some pieces of *Schwfla* (very long range artillery). As the front was approximately nine kilometres and 500 metres, the density per kilometre of front attack was 30 batteries, 15 or 16 of them heavy artillery. This number is clearly superior to that attained in preceding operations.

Note 8.—On the ——: Per battery of 77's, 2750 shots; per battery of howitzers 105, 2200 shots; per battery of howitzers 150, 1100 shots; per battery of 10-cm. guns, 1200 shots (about); per battery of 21-cm. mortars, 600 shots (about).

Per piece of long-range heavy artillery, 250 shots (about).

On the M——N—— Front, according to statements of prisoners, there were 2400 shots from a 77 battery and 2000 from a 105 howitzer battery; furthermore, the order from the —— reserve division indicates a maximum consumption per battery per hour of 400 for 77's, 300 for 105's, 180 for 15-cm. howitzers, and 75 for 21-cm mortars.

(5) In long range fire certain batteries with restricted objectives (necessary thoroughfares, command posts, distant observatories, etc.) have need of precise firing data, but those that bombard villages, camps, and bivouacs, may content themselves with a preparation of fire from the map. Finally, those firing on balloons find no difficulty in adjusting their fire even on the day of the attack.

BATTERY EMPLACEMENTS

The German Command has apparently divided the tasks as follows, taking account chiefly of the emplacement to be occupied by each battery:

(1) The batteries in sector all have the necessary firing data. They can, therefore, fire with great precision and this without having to execute adjustment fire action.

(2) The batteries that have just taken up emplacements already existing, and which are provided with firing notes, are in a situation almost as advantageous; and it is possible without serious inconvenience to assign them tasks similar to the preceding, at the same time forbidding preliminary fire. These emplacements in general are very numerous and on an average are six to a kilometre.

Note 9.—On the A—— Front of attack we located, between May — and —, 273 known battery emplacements from which firing was done. Moreover, a considerable number of unoccupied emplacements was known for which the gathering of firing data might have been done within a more or less distant date.

On the M——N—— Front 460 emplacements were known on June 9. From May — to — only 180 of these had been observed to be occupied. There remained, therefore, at least 280 possible reinforcement emplacements, for out of 180 which had been discovered a number must have been occupied by "nomad" pieces.

(3) Batteries intended for counter-battery work, which do not have to execute fire of precision, can occupy new emplacements established with a very great degree of accuracy by topographical methods, and can fire from these emplacements after a simple preparation on the map. (A number of documents insist on the use of the deflection bar, Planchette, on the importance of atmospheric correction, etc., which leaves no doubt on the use made by the Germans of this sort of fire.)

(4) Finally, it has been proved that part of the reinforcing batteries take up their position a long time in advance. (For the attack of May — orders prove that the emplacement of batteries began on April —.) If the batteries already in the sector systematically cease firing, these batteries can execute a small amount of fire for adjustment without increasing the average activity of artillery.

Note 10.—On the —— there was even an impression of decreased activity.

The Germans frequently change positions and use "nomad" pieces, and as a result our locating organization may conclude that they have to do with the artillery of the sector and not with fresh batteries.

(5) On fronts perfectly equipped, the number of emplacements of long range heavy artillery, already existing and provided with firing data, may permit the assignment of batteries which have fire of precision to carry out on condition that the firing data are kept for them.

METHODS OF ADJUSTMENT

Apart from the fact that batteries with firing data are systematically requested not to execute any but indispensable fire and to minimize all fire for adjustment, so that the artillery activity remains exactly as it was before the beginning of the preparation, adjustments regarded as necessary are carried out with numerous precautions.

(1) The fire for adjustments observed from observation posts or from airplanes is executed with the greatest discretion. It is reduced to a strictly indispensable number of shots after a minute preparation. It frequently accompanies firing carried out by a neighboring battery already known so that it passes unnoticed.

Note 11.—On the ——, in particular, it appears that these adjustments were often reduced to simple "brackets" (orders of the —— th Army).

(2) It has been clearly established that adjustment by high bursts, which is often employed, is to a certain degree camouflaged by making the bursts appear to be fire for effect, a few shots only in the whole total being actually observed for the adjustment.

Note 12.—Fire for Adjustment and Fire for Effect: It has repeatedly been observed in the region south of M——, that the enemy was adopting a new method for carrying out fire for effect following his adjusting fire, evidently in order to attain greater surprise effect. The procedure is as follows:

(*a*) When the adjustment is to be made by the methods of high bursts, the enemy fires high and low air bursts and percussion bursts for 30 minutes or an hour, instead of firing as heretofore 12 to 20 rounds at regular and short intervals in the neighborhood of the required plane of fire passing through the objective (above and slightly in front of the objective). In the course of this firing a series of 12 to 15 high bursts, at regular intervals, forming the true adjustment, may be observed. A second fire similar to the first is often carried out by the enemy to conceal the character of the first.

The enemy in general does not begin fire for effect until one or two hours after his adjustment; it is then carried out either by two series, at several hours' interval, of about 200 rounds each, or by four or five

concentrations of 60 to 100 rounds each, lasting about 15 minutes and at intervals of 45 minutes to one hour.

(*b*) When the adjustment is by airplane, fire for effect rarely follows the adjustment fire. Most frequently one hour elapses between the two fires, and the fire for effect is then carried out in the same way as with adjustment by high bursts. Fire for effect is rarely controlled by airplane.

It appears from the above that, with careful observation of the enemy's artillery activity, fire of destruction may be foreseen and the personnel not required for duty near the guns put under shelter.

Furthermore, when the enemy's consumption of ammunition does not reach 400 rounds during an adjustment, a repetition of the fire for effect may be expected after a fairly brief interval.

(3) Several attempts at adjustment by airplane have been discovered by night. It is possible that in certain special cases this procedure was effectively employed under cover of harassing fire.

Note 13.—Fire on villages, camps, bivouacs, railroad stations, and, in general, on every objective visible at night. No adjustment on the fronts of the great offensives by methodic wireless adjustments was observed, but fire control may well have been obtained in this way.

(4) Adjustments established several weeks before the attack were possibly not noticed even when they had a direct relation with the attack.

(5) Finally, when the need of fire for adjustment is felt, the Germans do not hesitate to carry it out. Thus before the attack of June — in the S—— region, the terrain being new and it being of less importance to maintain secrecy, and because of lack of time to calculate firing data, the Germans made the largest possible number of adjustments, trying to operate from the —th to the —th in spite of unfavorable weather. The minimum number of adjustments needed was without doubt executed.

EXECUTION OF FIRE IN PREPARATION FOR AN ATTACK

The execution of fire for effect on the day of the attack has in general been such that the preparations indicated its imminence.

(1) If the first line suffered heavily from trench mortar fire, the following line and especially the barbed wire were not destroyed in the greater number of cases (complete destruction was, moreover, not aimed at).

(2) In the case of artillery neutralization which does not demand great precision, and which was carried out, at least at the beginning of the action, by a concentration of fire (2 or 3 batteries per battery to be neutralized), the effect was not always sufficient to prevent our own batteries firing.

CONCLUSION

The following conclusions may be drawn:

(1) A minute division of tasks and of battery emplacements permitted the execution of precision fire by batteries already adjusted.

(2) The German artillery, moreover, executed all the adjustments compatible with the maintenance of secrecy, and observed extreme discretion.

(3) The use of considerable masses of artillery, copiously supplied, made it possible to ignore in large measure the precision of fire.

(4) The German infantry had to advance in spite of the deliberately incomplete destruction, contenting itself with the support of accompanying artillery. It succeeded in this, owing to manœuvre and an intensive preliminary training.

The Tendency of Design in Modern Field Artillery

LIEUTENANT COLONEL CHARLES J. BROWNE, ORDNANCE DEPARTMENT, U. S. ARMY

FROM the discovery of gunpowder by the English monk Bacon in 1248, sixty-five years elapsed before a Franciscan monk produced the first gun in Germany, about 1313. The first guns were of a small breech-loading type, supported in front by crossed sticks and anchored by a spike at the breech. Later these guns were fastened to cradles, the latter being mounted on sleighs, and finally, in 1376, the Venetians produced the first wheel mounts, which had become common by 1453, when the Turks took Constantinople.

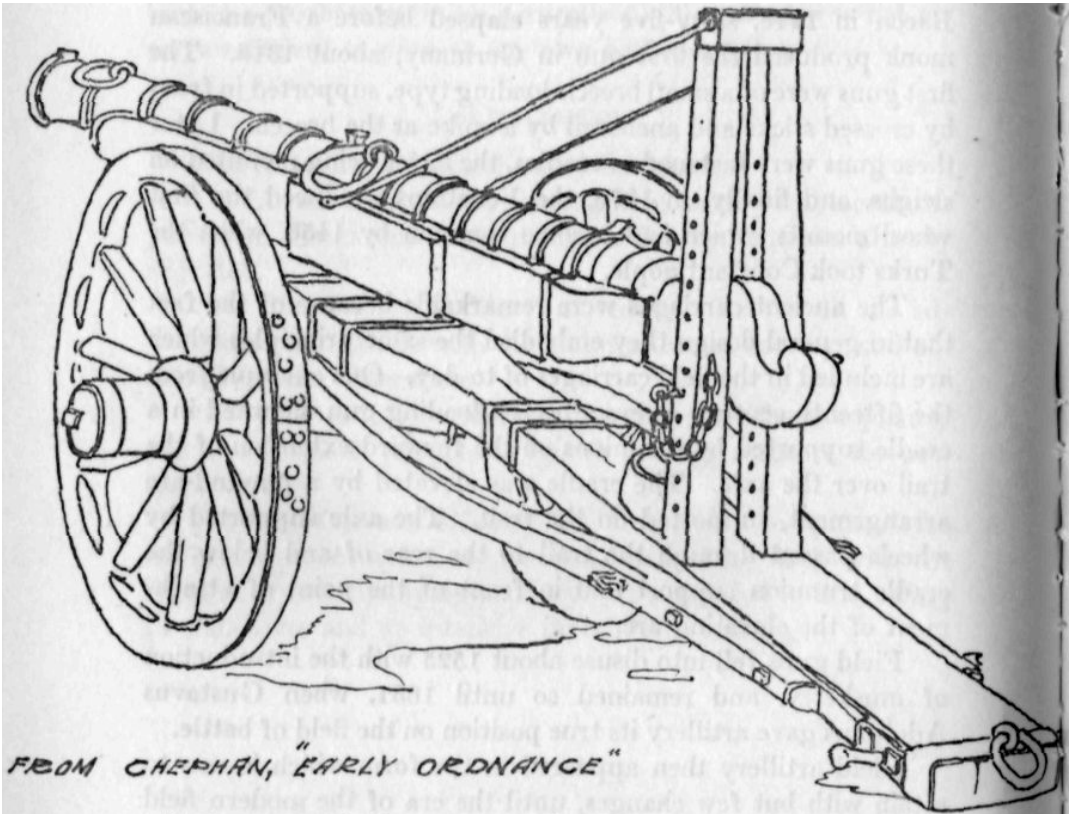
The ancient carriages were remarkable because of the fact that in general design they embodied the same principles which are included in the field carriages of to-day. One example from the fifteenth century shows a breech-loading gun mounted in a cradle supported by trunnions on the forward extension of the trail over the axle. The cradle was elevated by a pin-and-arc arrangement, supported on the trail. The axle supported by wheels passed through the trail to the rear of and below the cradle trunnion support and in front of the point of attachment of the elevating arc.

Field guns fell into disuse about 1525 with the introduction of musketry, and remained so until 1631, when Gustavus Adolphus gave artillery its true position on the field of battle.

Field artillery then appeared in the form which it was to retain with but few changes, until the era of the modern field carriage. The cradle disappeared, muzzle-loading guns cast with trunnions taking its place, and a stepped wedge resting on the trail superseded the pin and arc. With the exception of the gun, most parts of these carriages were of wood and were to remain so until 1870, when metal carriages came into general use. Muzzle-loading guns had supplanted breech-loaders

because of the poor obturation and the many accidents resulting from use of the latter type. Although numerous experiments were made, breech-loading guns did not come into vogue again until 1850, when the experiments of Major Cavalli (1845), the Walnendorff gun (1846) and the Armstrong gun (1854), produced satisfactory types.

Coincident with the reintroduction of breech-loading guns,



rifled guns and elongated projectiles came into general use, although rifling had been cognized as early as 1520, when the principle was set forth by Kotter.

Reactionary tendencies prevented the adoption of the rifled breech-loading gun at this time, the cast-iron smoothbore still being maintained. The latter type, however, was shortly modified

by the insertion of a rifled steel liner, and finally in 1880 the rifled breech-loading built-up steel cannon came into being.

During these centuries no recoil mechanism nor traversing device was ever introduced on the carriage, other than that chocks or wedges were used behind the wheels and ingenious rope devices were employed to return the carriage to battery. The carriage not remaining fixed, a traversing mechanism was not essential, and—with the crude sighting apparatus which, until the introduction of the tangent sight in 1829, consisted only of the line of metal—was probably not missed. The screw type of elevating mechanism had become common, however, by the middle of the nineteenth century, supplanting the cumbersome wedge or pin-and-arc type.

Thus the art stood at the introduction of the modern field carriage, commonly called the rapid or quick-fire field gun, on account of its having a recoil mechanism on the carriage permitting the carriage to remain stationary and therefore requiring little or no movement in order to relay the gun on the target.

The first of the modern carriages which were produced in the early nineties should be classified as semi-rapid fire carriages, as the recoil brakes were so abrupt that the carriage was not stable and jumped considerably, gaining for the type the sobriquet of "grasshopper guns."

In 1897 the immortal French "75" was born—the pioneer of all modern quick-firing equipments; which still maintains its superiority in many respects over later designs.

In 1902 our own 3-inch field gun was produced and still finds favor among many of our field artillery officers, even over the French "75."

The Deport carriage brought to this country in 1912 introduced to us the split trail, high angle of fire, wide traversing type of field gun carriage. This carriage was extensively tested by the Ordnance Department; by the Field Artillery Board at Fort Riley, Kansas; and by the School of Fire for Field Artillery, at Fort Sill, Oklahoma. The Field Artillery Board unqualifiedly approved of the Deport carriage and recommended that

it be adopted. The School of Fire for Field Artillery also approved of the type. Objection, however, was generally raised that it lacked power, and for this and other reasons it was not adopted. The French Government, to which it was originally presented, did not adopt it on account of financial and military reasons. It was, however, adopted by the Italian Government after exhaustive tests, and is now giving excellent service.

The limiting feature in weight of all light field artillery has been the draft power of the horse, which is from five hundred to eight hundred pounds per horse, varying with the size of horse found in the different countries. The second limiting feature is the weight of gun and carriage that can be manhandled by from five to seven men, it being held that the ratio is about four hundred pounds per man.

The elimination of the ammunition in the limber for the gun carriage permits of two types of light field guns, a high- and a low-powered type. Up to the present, the low-powered type has predominated.

The two foregoing features attended by their inevitable attributes go through very distinct cycles. During periods of peace the shooting quality of the weapons is lost sight of, more emphasis being laid on draft; and during war periods the draft becomes of secondary consideration, and the accuracy and hitting power predominate.

The following situation then confronted the American Army in the year 1912. The vital feature of range demanded a high-powered gun, capable of firing up to at least 45 degrees elevation with as wide a traverse as possible. Our artillery service at that time was dominated by the English school of artillery as witnessed by our having howitzers of less than 6-inch calibre, *i.e.*, 8.8-inch and 4.7-inch. The School of Fire for Field Artillery was under the régime of officers instructed in German artillery schools. Several individual officers of rank had studied in France. The English influence, since a high angle of fire field gun would probably supplant the intermediate calibre howitzers, demanded that the angle of elevation be equal

to that of the howitzers. The German and British influence demanded that it be a shrapnel gun, against the French influence that it be a shell gun. The French and British influence demanded that it have an independent line of sight. (It is interesting to note in this respect that the French no longer hold this feature to be requisite.)*

Figures given are, for obvious reasons, not strictly accurate.

	Austria, 1905	France, 1897	Germany, 1906	Great Britain, 1917	Italy, 1912	Russia, 1903	United States, 1902	United States, 1916
Calibre, inches	3.01	2.95	3.03	3.3	2.95	3	3	2.95
Weight of shrapnel, lbs	14.72	16.00	15.00	18.00	14.3	14.41	15.00	16.00
Muzzle velocity, f. s.	1640	1750	1760	1680	1510	1930	1700	1680
Muzzle energy, ft. tons	275	335	242	340	224	373	300	311
Weight of gun, lbs	700	1000	766	880	690	785	710	765
Weight of gun and carriage	2000	2650	1860	2600	2260	2075	2230	3000
Weight of gun and carriage and lumber	3750	4150	4200	4100	3350	3850	3730	4400
Maximum elevation	18	18	16	33	65	16¾	16	53
Total traverse, degrees	8	6	8	8	52	5½	8	45
Length of recoil, inches	51.5	47	44	28–48	18–53	42.5	50	18–46
Height of wheels, ft.	4′3″	4′	4′5½″	4′3″	4′3½″	4′4″	4′8″	4′8″
Independent line of sight	No	Yes	No	Yes	Yes	No	No	Yes
Sights, goniometric, telescopic, panoramic, ordinary	P.	G.	T. G.	O. P.	T. P.	O. P.	O. P.	O. P.
Breech block, wedge swinging, eccentric screw	W.	E. S.	W.	S.	W.	S. B.	S. B.	W.
Traverse, axle or pintle	P.	A.	P.	A.	P.	A.	P.	P.
Recuperation, spring or hydro-pneumatic	S.	H.	S.	H.	H.	S.	S.	S.
Length of gun, calibres	30	36	27.3	28.0	30	30	29.2	30.8
Width of tract, in	60	60	60	66	58	60	60	60
Range, maximum	6400	7550	7600	9000	8850	7800	6500	9650

From the foregoing table the requisites of a field gun, obtained from universal experience, may be drawn:

GUN.—Calibre, 2.95-inch to 3.3-inch; weight, 690 to 1000 pounds; length, 27 to 36 calibres; breech block, all types; velocity, 1510 f. s. to 1930 f. s.; recoil, 42.5 to 53 inch at 0 degree elevation; weight of projectile, 12 to 18 pounds; range, as great as possible.

CARRIAGE.—Weight with gun, 2000 to 3000 pounds; weight with gun limber and ammunition, 3350 to 4400 pounds; elevation,

* This question is open to discussion. [Editor.]

10 to 65 degrees; traverse, 6 to 52 degrees; height of wheels, 4 feet to 4 feet 8 inches; independent line of site, optional; sights, ordinary and panoramic; clearance, 13 to 18 inches; stability, 0 to 15 degrees.

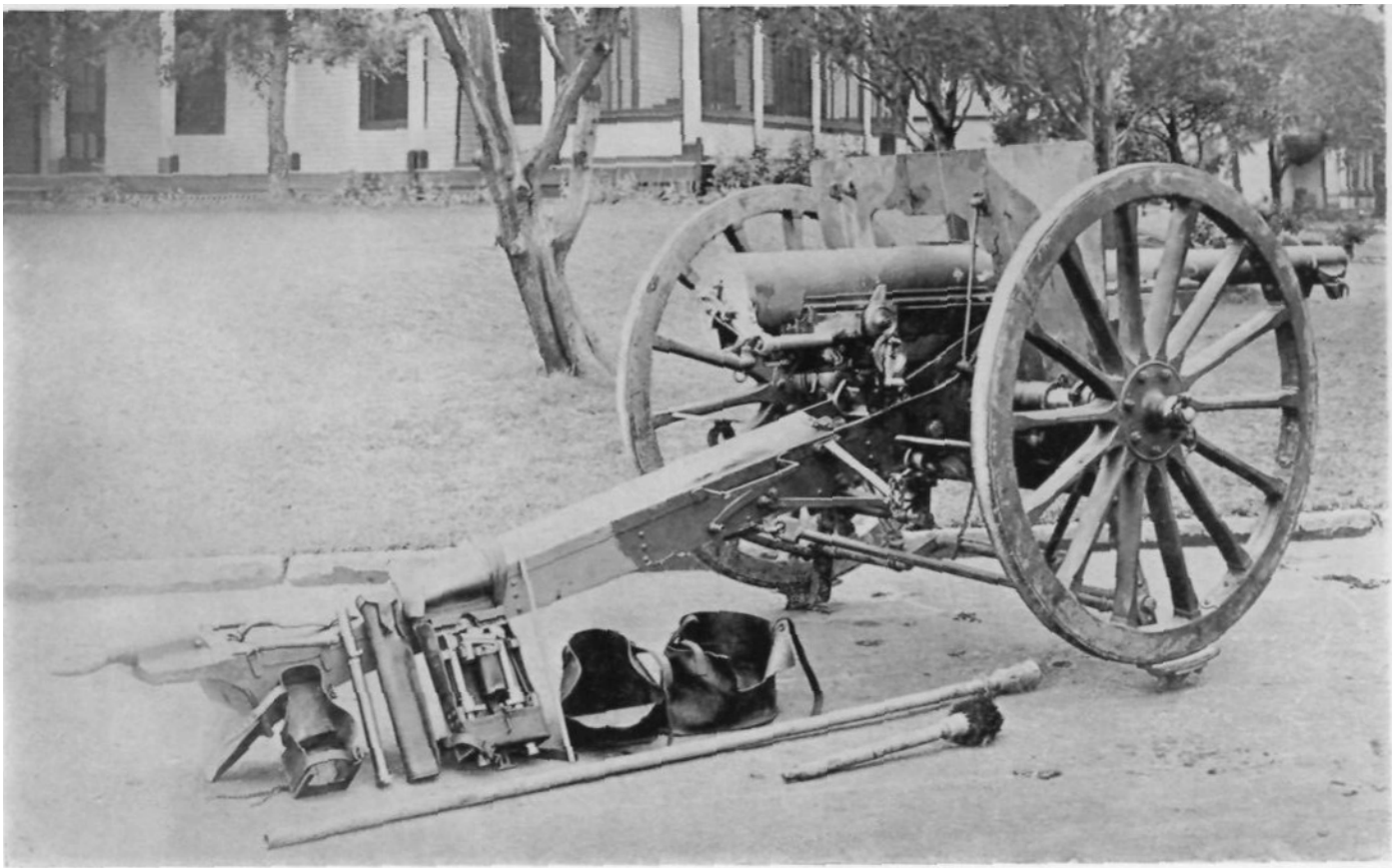
Considering the gun alone the greatest range is obtained at an angle of about 43 degrees from that gun which fires the heaviest projectile with the greatest velocity. The calibre being limited to from 2.95-inch to 3.3-inch, the projectile is limited in weight to from 12 to 18 pounds. The weight of the gun is limited to between 700 and 1000 pounds and in length to between 27 and 36 calibres. The longer the gun, the greater the weight and velocity from the same charge of powder. A pressure of 33,000 pounds per square inch with a corresponding velocity of 1700 f. s. has been found to be as high a pressure and velocity as are desirable for a reasonable length of life for a field gun, the average life of which is 10,000 accurate rounds.

Under the French school of artillery, which dominates our service at present, our bore is 75 mm., the weight of our shell 12 pounds, our shrapnel 16 pounds, the velocity for the one 1750 f. s. and for the other 1680 f. s.

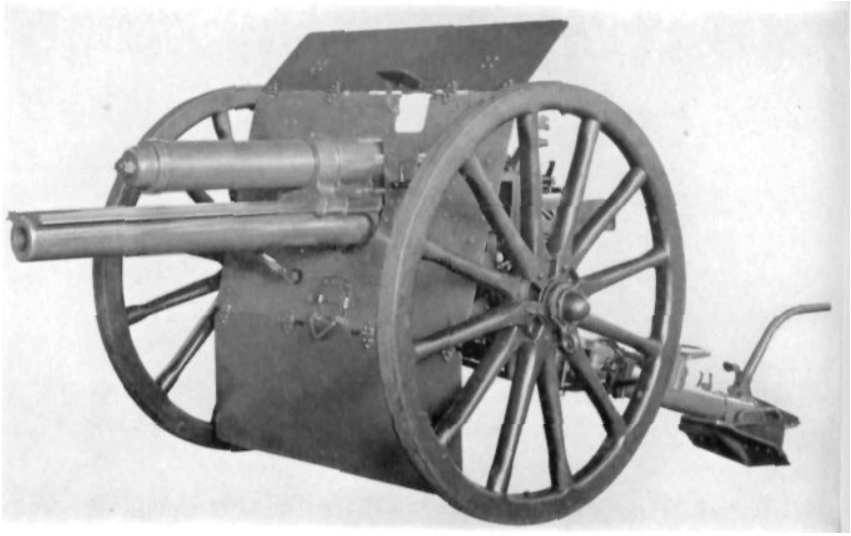
The breech block appears in four distinct types. Our own service has for years used the swinging interrupted screw breech block which in the 1905 model is the equal of any of that type in existence. The swinging block has serious disadvantages for high-angle fire in that it requires an excessive amount of room to operate and is difficult to load at high elevations.

The Italians have introduced a new breech block in one of their recent guns, consisting of a half cylinder with a superimposed spherical face on its cylindrical surface rotating vertically about a horizontal axis perpendicular to the axis of the bore. The gun is loaded through a groove in the breech block when the latter is in its horizontal position. The block, which is semi-automatic, is very satisfactory. It is adapted to high-angle fire.

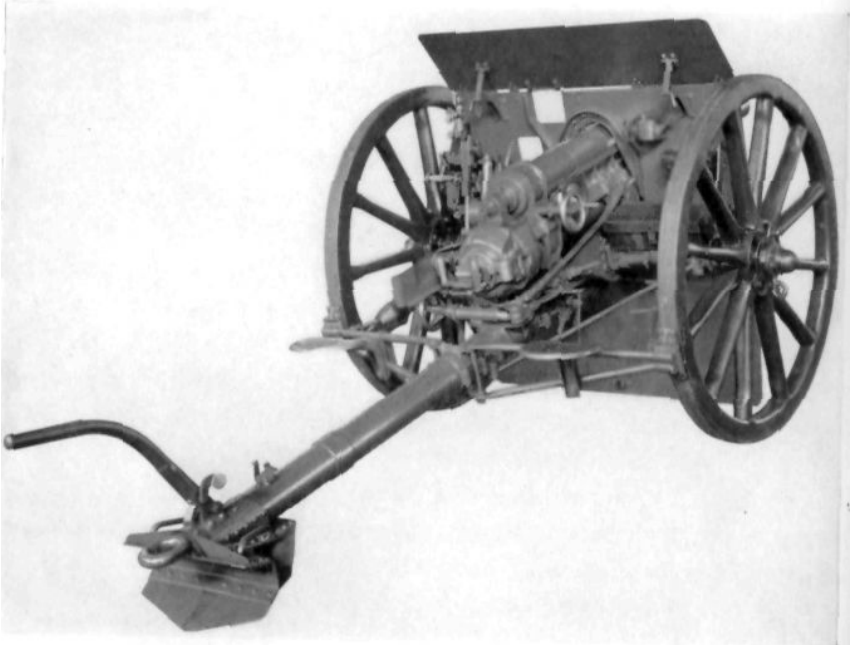
The French in their "75" have used the eccentric screw



FRENCH 75-MM. GUN
No. 2. Gun unlimbered and in firing position



75-MM. FIELD GUN, MODEL 1917 (BRITISH), GUN IN FIRING POSITION



75-MM. FIELD GUN, MODEL 1917 (BRITISH), GUN IN FIRING POSITION

type, which is rapid in movement and lends itself fairly well to high-angle fire. It is completely enclosed and of rugged construction.

The Germans have used the sliding wedge type of block, moving in a horizontal direction, which does not lend itself to high-angle fire.

The United States in its recent field carriage adopted the sliding wedge type in a vertical plane on account of its manifest superiority in fire at high angles. This block is rather difficult to manufacture and the type has a tendency to stick. The automatic closing necessitates a strong closing spring which fatigues the block operator, No. 1 in the gun squad. It is interesting to note that in a prospective new design for the 1916 gun carriage the American Ordnance Department adopted the French breech block; and the St. Chamond Company, designing for the American Expeditionary Forces, adopted the American drop block.

The height of the wheels affects the draft, weight, clearance and stability of the carriage both as to road stability—*i.e.,* low centre of gravity; and firing stability—*i.e.,* the overturning movement about the end of the trail. It is now believed that entirely too much stress has been laid on road clearance. Reducing the height of wheel reduces the weight and road clearance, lowers the centre of gravity and increases the firing stability; but it also reduces the angle of gun elevation unless the trail is shortened. Firing stability in general is increased by adding to the weight of the gun, lengthening the recoil, slinging the gun as low as possible and lengthening the trail. The less the height of the wheel exceeds four feet the better, despite the poor draft feature, which is compensated for to some extent by a reduction in weight and turning radius.

Axles are straight or of the offset drop type. The straight axle is stronger for its weight. The drop axle allows the centre of gravity to be lowered.

Most modern trails are of sectional built-up type. Some, however, are of tubular steel and telescopic. The most variable

portion of the trail is the spade. It consists of two parts, the spade proper and the float. The former prevents recoil, the latter the burying of the trail. The spades proper are of three types: the fixed, as in the French 75-mm.; semi-fixed, as in the 155 howitzer; and driven, as in the Deport and American 1916 75-mm. Each has advantages and disadvantages. The driven spade is considered essential for the split trail carriage, as the latter has no means of seating itself; and should one spade take, and not the other, the carriage might be damaged when the gun is fired at extreme traverse.

Split trails introduced a novelty in field gun carriages, in that a compensating device became necessary to adjust for the difference in ground level of the two spades.

Traverse is accomplished by two systems, axle and pivot. Axle traverse is steadier and permits the recoil to be always in line with the trail, but must be of very limited extent due to the width of track of 60 inches permitted. It is also objectionable in that it reduces the protection afforded the gun crew by the shield. Pivot traverse alone permits of a wide field of fire. Wide traverse and high elevation together can only be accomplished by a split trail carriage or by a knuckle-jointed axle with a U-shaped trail, traversed about the point of the spade by rolling the wheels as typified by some of the early type balloon guns. Pivot traversing is one of three types—pintle and cradle, pintle and yoke, and top carriage. Rotation is accomplished by means of a train of bevelled gears acting on a pinion meshed in an are or by a worm and are. Traverse on the axle type is accomplished by means of a pinion acting in a rack cut in the axle. Of the three types of pivot traverse no one is preëminently superior, the general configuration of the carriage and manufacturing considerations determining which is used.

Elevation is accomplished by telescoping screws, by circular racks and pinions, and by worms and ares. Telescoping screws are good for from 15 to 20 degrees in elevation only, as for greater angles they become rather too large and cumbersome. The elevating are is attached on the top, on the bottom or on the

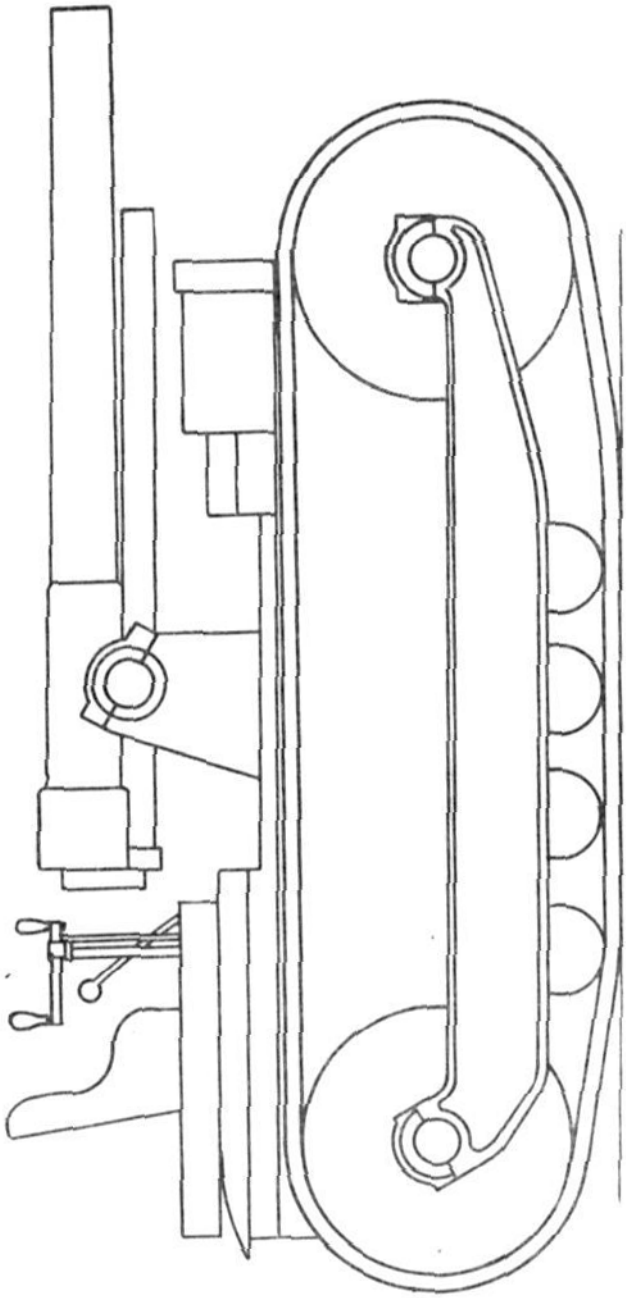
side of the cradle and, if possible, at its centre. When the latter is not possible, two ares are generally used to prevent torsional strains developing. Top racks are exposed to fire, side circular racks or ares interfere with the traverse, with the placing of the sights, and with the general handling of the carriage. The bottom of the cradle is perhaps the best location for the rack. As in the traversing mechanism, a train of bevelled gears transmits the power from the hand wheel to the elevating mechanism.

In both the traversing and elevating mechanism, strength, simplicity, power, accessibility, non-interference and absence of lost motion are the features sought. To secure these is one of the most difficult things in gun-carriage design; for, since the traversing and elevating mechanism are the last two elements considered, they must, therefore, be the ground for modification and the means of adapting the great main elements—namely, wheels, axle, trail, recoil mechanism and gun—into a unit.

The recoil mechanism is a study in itself, of which there are two schools—the advocates of the spring and of the air recuperators. Great Britain, Germany and the United States have been the advocates of spring recuperation and France of air recuperation. Great Britain and the United States were of the spring school, undoubtedly, because of the lack of a satisfactory air recuperating system; which is rather strikingly proven by the fact that both countries have adopted air recuperation since they have procured or developed satisfactory types.

Both schools have grounds for their position, however. The spring school has in its favor simplicity of design and manufacture and ease of replacement, which can be done in the field. On the other hand, spring recoils have many breakages and greater weight combined with a high replacement of weakened springs, the life varying from three thousand to eight thousand rounds.

The air school has in its favor a high order of efficiency, smoother action, general all-around efficiency and less weight.



SELF-PROPELLED CATERPILLAR MOUNT FOR FIELD ARTILLERY OF THE FUTURE
Calibre 3.3 to 4.7 mounted on caterpillar tractor. Total weight, 10,000 pounds. Speed, cross-county, 16 miles an hour

But the air recuperator is difficult to manufacture, costly, and when damaged must go to the rear to be repaired; which, however, it seldom needs.

In mounting the spring recuperator, the most recent practice has separated the recoil mechanism from the springs in order to distribute the piston rod pull, thus preventing whip and allowing easy access to the various parts for replacement, refilling and repairs. In order to lower the centre of gravity, the gun is slung under the recoil cylinder with the two spring recuperators below and on either side.

Air recuperators are invariably located below the gun for protection and because of their large size and shape, which adapt them for attaching the elevating mechanism.

In either system, the recoil is taken up by means of oil or glycerine and water passing through an orifice created by a slotted piston passing over ribs of varying height, or through a valve on the pressure side of the piston, or by a solid or perforated piston passing through a perforated intermediate cylinder.

The latter type is particularly adapted to variable recoil guns, as the intermediate cylinder can be rotated, thus throwing varying orifices into position for the flow of oil.

Counter recoil is accomplished by the springs or by the air pressure in the hydropneumatic system, in which the air pressure is sufficient to hold the gun in battery at all elevations and is built up at recoil.

In all counter-recoil systems, it is necessary to insert a buffer to take up the remaining energy of the springs or air pressure so as to bring the gun into battery without appreciable jar. Numerous types have been developed and perfected.

Although cover for the cannoneers had been used off and on since the invention of guns, it had fallen into disuse until it was firmly established as an essential feature by the French on their 75-mm. in 1897. All modern field guns have such protection both for the cannoneers and for the delicate parts of the matériel which would be damaged by shrapnel balls or shell fragments.

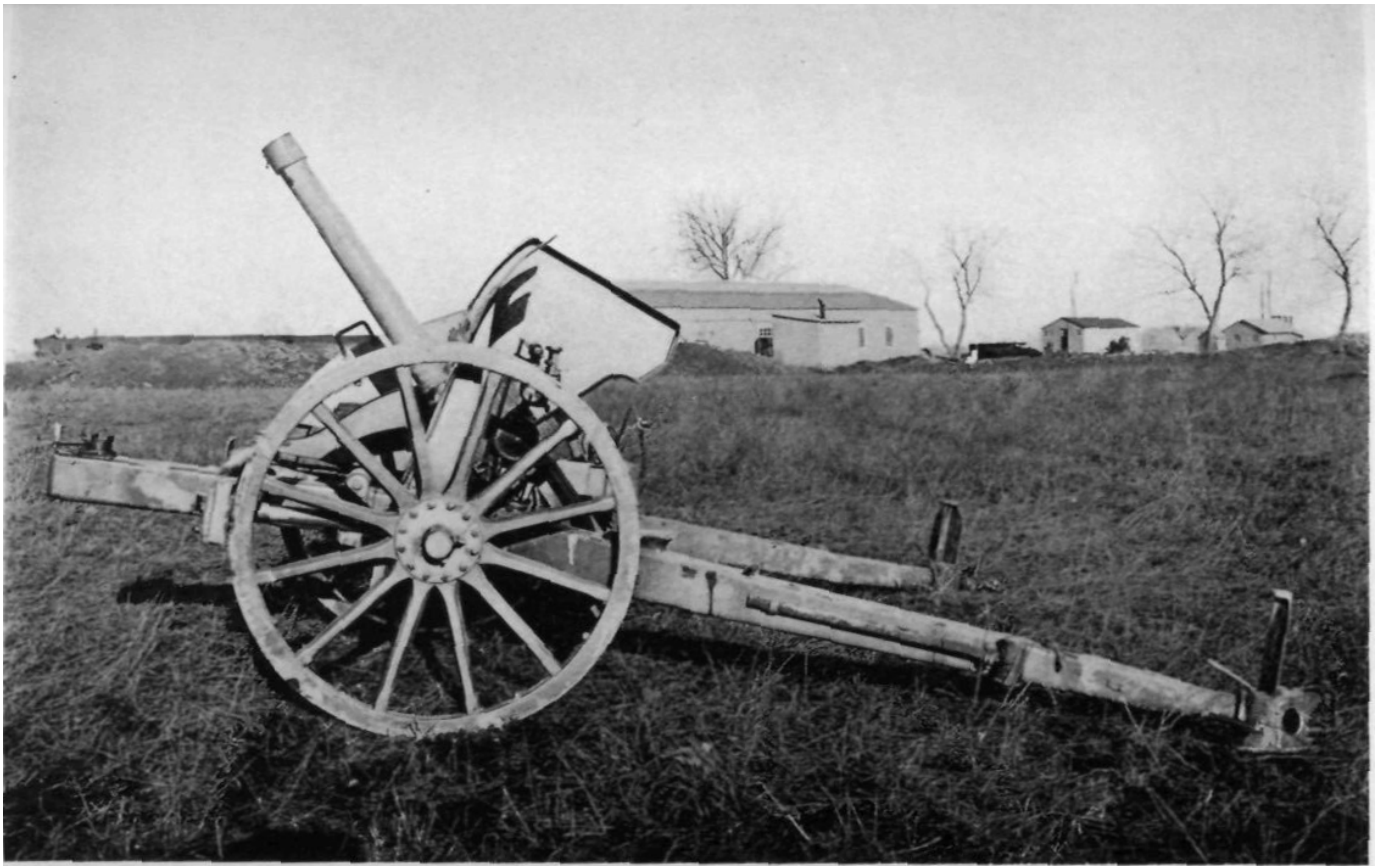
The shield is made of hardened steel capable of withstanding the impact of a bullet from the service rifle at 100 yards range with standard velocity. For convenience the shield is divided into three parts—known as the top shield, main shield and apron; with suitable ports equipped with shutters for the line of vision from the sights. The main shield is fastened to the axle and is rigid. The apron is hinged to the main shield or axle, swinging forward for the travelling position. The top shield is fastened to the main shield by hinges, and swings forward and downward for the travelling position.

The sights serve three important functions: They improve the vision of the gunner and lay the gun in elevation and direction. The simplest sight is the one over the line of metal, which lays for direction only. The second is the tangent sight, mounted on a range arc centred on the axis of rotation in elevation, usually having a deflection scale to correct for drift and to lead a moving target. The unit lays for range and direction. The last sight is a telescopic or panoramic sight, which is mounted on a range arc and lays for direction only, the unit in direct fire laying for range and direction and markedly improving the vision of the gunner. The latest model American panoramic sight is superior to any in existence.

For precision and indirect fire, practically all carriages are equipped with some form of range quadrant, containing a means of setting off the angle of site and the range angle. All instruments are equipped to compensate for difference in wheel level. The British carriage automatically corrects for deviation, simplifying the firing data by that element.

The American Field Artillery Service now has before it four types of field gun carriage—namely, our 3-inch model of 1902; the French 75-mm., model of 1897; the British 18-pounder, model of 1905 converted to a 75-mm. (known as the model of 1917); and our 1916 model of split trail carriage. Shortly there will be produced an improved model of 1916 75-mm. carriage on which the St. Chamond recuperator, adopted jointly by the French and American governments, will be substituted for the

75-MM. GUN, U. S. ORDNANCE DEPARTMENT, MODEL 1916
No. 1 Gun in firing position



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

spring recuperators; and the French 75-mm. cannon will be substituted for our shorter calibred type. From these types one must be selected. An intelligent selection involves a consideration of what may be expected in the future in order that it may best fit in with the new types yet to be evolved.

For horsed artillery—and horsed artillery will be with us for some years to come—the limiting features of draft and man power will still pertain.

For tractor-drawn mobile artillery, the limiting feature is the tractive power of the tractor with relation to the weight of gun and carriage, the unit being physically limited in weight by the supporting power of a pontoon bridge which is about ten thousand pounds per vehicle.

For caterpillar artillery—and by that is meant guns mounted on caterpillar tractors—the limiting features are power and weight, coupled with the weight limitation of the pontoon bridge. To circumvent the question of weight, the load may be divided by mounting the motor with an electric generator on one caterpillar and the gun with an electric motor on the other, a transmission cable connecting the two vehicles.

The limitations for automobile artillery—and by that is meant guns mounted on automobile truck chassis—are power and weight, with consideration of the supporting power of the pontoon bridge.

The foregoing covers in a general way the possible characteristics for the future development of light artillery. Which type or types will survive is difficult to say, the element of terrain playing such an important part.

The following characteristics will probably be extant:

Type A Gun.—Calibre 75-mm., weight 1000 pounds, length 36 calibres, drop block, firing a 16-pound projectile with a velocity of 1760 f.s., at a range of 10,000 yards.

Carriage, Horse-drawn.—Split trail, driven on fixed spades, 4-foot wheels, 45 degrees traverse on pintle, elevation 5 to 55 degrees, independent line of sight optional. Hydropneumatic

variable recoil recuperator, ordinary and panoramic sights, weighing with gun 2800 pounds and with limber carrying ammunition 4000 pounds.

Carriage, Automobile Artillery.—Three-and-a-half-ton truck chassis, all-around fire, top carriage traverse elevation 0 to 85 degrees, hydropneumatic variable recoil recuperator, ordinary, panoramic and anti-aircraft sights.

Type B Gun.—Calibre 3.3-inch, weight 1500 pounds, length 40 calibres, drop block, firing an 18-pound projectile at 2000 f. s. at a range of 15,000 yards.

Carriage, Tractor-drawn.—Split trail, 4-foot wheels, 30 degrees traverse on pintle, elevation 5 to 40 degrees, St. Chamond variable recoil recuperator, ordinary and panoramic sights, weighing with gun 3800 pounds and with limber 4800 pounds.

When drawn by automobile tractors, rubber-tired wheels will be used; when drawn by caterpillar tractors, caterpillar wheels may be substituted.

Carriage, Caterpillar Artillery.—Three-ton caterpillar tractor, 30 degrees traverse, 0 to 40 degrees elevation, St. Chamond variable recoil recuperator, ordinary and panoramic sights, weighing with gun 10,000 pounds.

The Scientific Preparation of Fire in the German Artillery

(Information Received September —, 1918)

THE progress made by the enemy in the scientific preparation of fire has permitted him completely to revise his tactical methods. This method, which appears to have been almost a complete revolution for the German artillery, is due, it appears, to Captain P——, and was not put into complete operation, at least on the western front, until about the end of February, 1918, as the following document shows:

CHIEF OF THE GENERAL STAFF.

February, 1918.

To the Army Group of ——;

Herewith is a schedule drawn up by the Inspector-General of the Schools of Fire relating to the simplification of adjustment through calculation of allowance for atmospheric influences. I desire you to commence immediately a test of the method, make a report on the result, and submit an appreciation of it. General Headquarters will reserve its decision until the arrival of these reports. But, in view of the practices carried out at M—— in February and prior tests, I specially call attention to the great importance which must be attributed under all conditions to the determination of calibration correction and to the calculation of atmospheric corrections.

(Signed) LUDENDORFF.

The schedule above referred to bears the following still more explicit title: "Schedule of Tests with a view to determining whether the data of the firing board (range and direction) corrected for the conditions of the moment (individual gun and atmospheric conditions) are sufficient to serve as a basis for preparatory fire (*Sturmreifsmachen*) on an infantry position, and whether, consequently, it is possible to do away with fire for adjustment."

The schedule comprises three firings of a duration of twenty-five minutes each on a narrow zone (100 metres with jumps of 25 metres) and on a regimental front (700 metres) executed by three batteries of 77 mm., three of 105 mm., three of 150 mm. and one of 210 mm. at ranges varying from 3 km. to 4.5 km.

The numerous documents captured by the army enable us to determine some of the mechanical methods employed by the enemy in the scientific preparation of fire. Some of them are only the improvement of former methods which had been already employed by him at Verdun in 1916. Others appear to be very recent and are still in process of evolution; thus the last edition of the regulations relative to the corrections of the moment were not distributed to the troops until the later days of August.

These methods are characterized by highly intensive division of labor and the constant endeavor to supply the troops with very simple implements and methods which require only mechanical operations and reduce calculations to a minimum. Results thus obtained by the enemy, though not entirely accurate, have at least enabled him to attain the moral effect which is placed above everything else by his regulations. The German artillery is certainly deeply indoctrined with these methods (*voellig in Fleisch und Blut uebergegangen*), and we must expect to see them employed in preference to the former systems of direct adjustment whenever the situation and especially the state of the topographical work on the front permit it. The consequence, moreover, is that artillery observers, partly freed from their task, will become available for a more strict observation of the battle-field and a closer liaison with the infantry.

TOPOGRAPHICAL PREPARATION OF FIRE

Installation of the Base Piece.—The topographical operations preparatory to the occupation of positions are, as a general rule, executed by specialists (*Vermessungstrupp*). These preparations are often the only ones made, to the exclusion of

any work on shelters or gun emplacements. The position thus prepared is called the surveyed position (*Vermessene Stellung*).

These operations have as their object:

1. The determination of the coördinates of the base piece.

2. The determination and location on the ground by means of stakes of the principal orienting line (*Grundrichtung*), which permits of the laying in direction of the base piece (*Grundgeshuetz*).[1]

Formation of the Sheaf.—Formation of the sheaf is generally carried out by pointing on the theodolite.[2]

Calculation of the Elements of Fire.—The following instruments are in service for facilitating the topographical preparation of fire:

1. The protractor (*Kartenwinckelmesser*) fastened to the battery board, its zero corresponding with the orienting line, gives immediately the elements of fire.

2. The position card (*Stellungsmessblatt*) is designed to facilitate the calculations in the direction of fire selected and the deflection differences to be applied to other pieces than the base piece.

[1] The following procedure, outlined by the firing instruction of December 1, 1917, and referred to in several documents which have come into our hands, permits of the elimination of errors resulting from the fact that the sight of the gun is not exactly located over the gun stake either at first laying of the piece or in course of the fire; an intermediate stake is placed in the middle of the line gun stake—aiming stake; if the pointer does not see the two stakes in the same alignment, he aims on the aiming stake, refers the piece on the immediate stake, and repoints with this new deflection on the aiming stake. (Firing Regulations, December 1, 1917.)

[2] The following method (called the Weber system) is recommended by an order of the H—— Corps, August 1, 1918:

(a) Place the base piece over the gun stake. It suffices if the axle is over the stake.

(b) Point this gun with the tube horizontal, with a deflection which is a multiple of 100, in such a way that it is generally perpendicular to the battery front.

(c) Transfer this direction to the other guns of the battery by the theodolite, the theodolite being placed with the limb horizontal at least 100 metres from the gun. Repeat the operation in order to eliminate errors of parallax.

(d) Set on the sights of the guns the deflection with which the base piece is pointed in the principal direction and place the aiming stakes in the direction of the cross lines of the sight.

(e) In this way the parallelism of the planes of fire is assured. All the guns of the same battery are laid with the same deflection on the same objective. All calculation is eliminated for the battery commander, and the control by chiefs of sections and officers is facilitated.

Distribution of Work.—As a rule, the operations relating to the formation of the sheaf and the calculation of the elements of fire are made by the battery commander. However, at the time of the offensives carried out by the VIIth Army, the artillery plans of action (position and objectives) having been established in minute detail by the army, the elements of fire were calculated and furnished to the batteries for all the objectives upon which they were to fire during the action by special units (range-finding sections, topographical detachments). Numerous cards of the following model fell into our hands:

RANGE-FINDING SECTION NO. ——,

Position No. ..... Directing Piece: -th Piece

Phase	Map range	Deflection	Elevation of battery	Elevation of objective	Site	Remarks
X						
AX						

The formation of the sheaf was in this case the only preparation carried out by the battery. No operation required the prior presence nor a special installation for the battery commander, and the occupation of the position could be executed in many cases during the night D-1 to D a very short time before opening fire.

Ballistic Corrections (Corrections of the moment).—Ballistic corrections due to the gun and to atmospheric influences have in recent months taken on a considerable importance and have undergone modifications due to the generalization of Captain P——'s methods.

The table of corrections, forming part of the firing tables, has been replaced by correction boards (*Tageseinflusskaesten*), formed by a panel on which are written the ordinates of the ranges.

The corresponding corrections in range for each gun for the density of the air and for the wind are read on strips of cardboard placed in the grooves of the board; they can be changed as

soon as the base coefficient has been determined (*Grundstufe*). For the density of the air, for example, there are thirty-six cards giving the corrections for densities varying from 1.10 to 1.45; it is only necessary at the moment of firing to slip in the groove the card corresponding to the density of the moment.

Calibration of Guns (Besondere Einfluesse).—This operation is carried out by firing *(Ershiessen der grunstufe oder erschiessen der Spalte).*

Since January, 1918, the attention of the German Command has been preoccupied with this question.

EXTRACT OF AN ORDER DATED JANUARY —, 1918, FROM THE GENERAL HEADQUARTERS TO THE ARMY GROUPS

An increase in the effectiveness of our artillery is of decisive importance for the success of the operations contemplated this spring. While the instruction of officers and men must be developed to the maximum, it is especially important that the battery commanders and their officers acquire precise knowledge of the ballistic qualities of the guns of their batteries. (Corrections to be made in the theoretical range.)

1. All field and heavy artillery battery commanders will determine during the winter by special firings the characteristics of their guns, in order to reduce them to a common basis. (Calibration corrections.)
2. This operation must be repeated on the receipt of every new gun.
3. It is of special importance to put in the same battery similar guns—*i. e.*, those having practically the same correction.

A note of General Headquarters, dated March, 1918, prescribes the conditions under which calibration firings should take place (selection of target range, inspection of guns and ammunition, ammunition, charge and range to be used). Finally, the following document, originating with the —th Army at the beginning of August, 1918, shows the importance which this organization has acquired.

INSTALLATION OF TARGET RANGE

1. The experimental calibration of the gun must be constantly continued by the Artillery by means of actual firings. This must include

all guns. It will take place on target ranges in rear of the front for heavy and light artillery guns, and on the front itself for high-power heavy artillery.

Calibration firing must be executed in conformity to the instruction, "The Influence of Atmospheric Conditions on Artillery Fire" (part 2, page 3).

2. This operation will be carried out by the army corps for all units attached to them. The ——th Army Corps is charged with the execution of this order in the zone of communications.

3. The reserves of guns of the artillery depot are placed at the disposition of army corps as may be required for initial adjustment.

The guns of the artillery of army corps parks should be subjected to trial adjustments under the supervision of army corps themselves.

4. Calibration firing to be so supervised that in an offensive battle the batteries can at any time apply the P—— system.

As a result of the calibration firing, pieces having the same ballistic characteristics should be assembled in the same battery.

5. The W—— Army Corps has established a target range for calibration near A——C——. For the time being this range will also be used by other army corps in line, who will arrange for their firing with the W—— Army Corps at least five days before the date of the firing.

6. The S——, H—— and S—— Army Corps will each reconnoitre for a target range in their respective army corps areas. They will render a report on August — to the Army, with a sketch showing the results of their investigations. The selection of the target range will be in conformity with the instruction, "The Influence of Atmospheric Conditions on Artillery Fire" (part 2, page 3).

The ——th Army Corps will confer with the inspector of the line of communications No. — with reference to the assignment of suitable locations.

7. The heavy flat-trajectory guns (13 to 15 cm.) will use the H—— range for calibration. A previous request will be submitted to the Commander of the ——th Army.

8. Estimate of ammunition required:

Field gun, H. E. shell, model '15, eight rounds per gun.

Field gun, long shell, eight rounds per battery.

Light field howitzer, H. E. shell, model '15, eight rounds per howitzer.

Light field howitzer, long shell, eight rounds per battery.

Ten-centimetre gun, H. E. shell, model '15, eight rounds per gun.

Ten-centimetre gun, long shell, eight rounds per battery.
Heavy field howitzer, H. E. shell, model '12, eight rounds per howitzer.
Heavy field howitzer, H. E. shell, model '14, eight rounds per battery.
Mortar, H. E. shell, model '14, eight rounds per mortar.
Mortar, H. E. shell, model '96, eight rounds per battery.
Thirteen-centimetre flat-nosed shell, eight rounds per battery.
Fifteen-centimetre Otto and Nathan shell, eight rounds per piece.
Fifteen-centimetre soft-nosed shell, eight rounds per battery.

9. Target ranges constitute a permanent part of army organization. They will be kept up by army corps. They will be used as may be required. The permanent personnel of a target range comprises one officer and one non-commissioned officer as observers, and two telephonists. The relief of the personnel should be provided for, but it should not be changed. Attention is invited to the necessity of a good liaison with the forward meteorological stations and that of the army.

ATMOSPHERIC CORRECTIONS

The data necessary for the use of the correction board (ballistic density of the air and ballistic wind coefficient) are not given as functions of the ordinate of the trajectory, but as functions of the time of flight (from which is derived the name *Gallistiche Tageseinfluesse Gestaffelt nach Flugzeit sekunden;* abbreviated, *Baltasekunden*).

The different documents originating in the German General Headquarters with reference to *Baltasekunden* were published between March and July, 1918.[3]

They comprise:

1. A preliminary instruction.

2. A regulation in four parts, entitled "Correction of the Moment in Artillery Firing" (*Die Tageseinflusse beim Schuessen der Artillerie*).

Part one defines the method; part two discusses the determination of the calibration correction; part three, the organization of the meteorological service; part four gives in addition

[3] All these documents were received in July and August.

some data on particular points, the method of transmission of meteorological messages.

The meteorological service is carried on by aërial meteorological posts, army stations and advanced posts. The army station is, as a general rule, charged with calculating the ballistic elements. It appears that transmission by wire, in spite of the priority which the regulations on operations gives it, has proved insufficient, and since July 10 data has been transmitted directly to the artillery antennæ by radio.

A large number of special instructions issued by army corps and armies show the difficulty which has been encountered in carrying out this transmission.

CONCLUSION

While the enemy at first adopted indirect fire for field artillery and later ballistic corrections with reluctance, he has for the past year been making a considerable effort in this direction. The P—— system, in spite of the opposition which it has undoubtedly encountered, has placed in the hands of the German Command a new method of combat which has permitted him to effect surprise complete in all respects. The care which the enemy devoted to improving the details of the method and homogeneity in matériel, without which the system would not have been practicable, have been the principal factors in its success.

German Artillery Equipment

The following statistics were compiled from documents and the statements of prisoners captured since July —. They are based on information concerning more than three hundred field batteries and one hundred active and reserve heavy batteries. All the artillery battalions, with the exception of one Landwehr battalion, were provided with means of transportation.

MATÉRIEL

Field Artillery

Howitzers, 37 per cent.; guns, 63 per cent.

Of the guns:

30 per cent. are model '16 field guns (F. K. '16).

70 per cent. are new field guns, model '96 (F. K. '96).

Of the howitzers:

38 per cent. are model '98/09 light field howitzers (1 F. H. 98/09).

42 per cent. are Krupp light field howitzers (1 F. K. Krupp).

20 per cent. are light field howitzers, model '16 (C. F. H. '16).

Heavy Artillery

Guns, 25 per cent.; howitzers and mortars, 75 per cent.

8 per cent. of the batteries are equipped with captured guns.

Twenty-one centimetre mortars: 12 batteries; eleven are equipped with long mortars and one with old-style mortars.

Fifteen-centimetre howitzers:

50 per cent. are model '13 heavy field howitzers (S. F. H. 13).

24 per cent. are model '02 heavy field howitzers (S. F. H. '02).

26 per cent. are model '13 long, heavy field howitzers (lg. S. F. H. '13).

Ten-centimetre guns:

50 per cent. are model '04 ('10 K. '04).

35 per cent. are Model '14 ('10 K. '14).

15 per cent. are old model ('10 K.).

Fifteen-centimetre guns: No old model 15-cm. gun has been identified.

Composition of Field Artillery Regiments

The composition is still very irregular. The proportion of one-third howitzers is generally respected; otherwise, there is no general rule. The use of the model '16 field gun, in spite of its long range, does not apparently tend to increase. This is due to the fact that the gun fires very slowly, and to the dispersion and slight capacity of its projectiles.

The average effective strength of the batteries is at the present time three officers, fifteen non-commissioned officers, ninety-three men, seventy-seven horses.

Composition of Heavy Artillery Battalions

The composition of all of the battalions identified (with the exception of the Landwehr battalion) is three batteries.

Seventy per cent. of the batteries are of mixed composition (two batteries of short guns and one battery of long guns).

The effective strength varies greatly, especially of the officers, the number of which is from two to five. These variations are attributable to losses.

ALLOTMENT OF AMMUNITION FOR TRENCH MORTARS

(Translation of a German Document)

CHIEF OF STAFF OF THE ARMIES,

General Headquarters, July —, 1918.

There is felt to be a need of establishing a basis for the allotment of trench-mortar ammunition, as already exists in the artillery. If, on the one hand, too large a supply of bombs near the firing position entails useless and excessive losses due to enemy artillery fire and to atmospheric conditions, it is necessary, on the other hand, to keep an emergency supply to be used in case of surprise attacks by the enemy.

In the latter case the trench mortars must have a supply which will be sufficient to enable them to take under annihilating fire enemy attack preparations which are observed, and an additional supply for the light trench mortars, only so that they may participate in the barrage fire.

From experience it is possible to fix allotment as follows:

For the heavy trench mortar, or one firing winged bombs, 20 rounds;

for the medium trench mortar, 40 rounds; for the light trench mortar, 120 rounds.

In trench warfare it will be sufficient to establish at the firing position a supply corresponding to this regulation allotment. In the alternative positions (Part 7 of the Rules for Trench Warfare, No. 28), only a part of this supply will be maintained (from about one-quarter to one-half). In ascertaining whether it is necessary to establish intermediate dumps between the firing positions and the divisional bomb dumps, the distances and character of the ground will be taken into consideration. As a general rule, these intermediate dumps will be provided with a half or a complete allotment.

In the divisional bomb dumps (whether intermediate dumps exist or not) there will always be stored a complete allotment or a complete allotment and a half per gun; in the corps dumps, a complete allotment. The pioneer ammunition parks of the Army will maintain a supply equal to one-quarter the regulation allotment.

In their requisitions for bombs the armies will, therefore, during a period of quiet, have to establish a supply equal to four times the regulation allotment—that is to say:

Per gun:

80 heavy or winged bombs.
160 medium calibre bombs.
480 small calibre bombs.

When it is a question of an attack by us, it is impossible to fix definitely the allotment for the preparation fire and the fire to complete the preparation for the assault (*Sturmreifmachen*) upon the first lines of the enemy's position. The necessary number of bombs will be calculated for each particular case according to the number of trench mortars available, according to the front and number of objectives to be destroyed as well as the length of the preparation fire. As a basis for these calculations, use may be made of the remarks concerning the rapidity of fire contained in the table, page 3, part 7, of the Rules for Trench Warfare.

These rules allow an hourly expenditure of:

Twenty bombs for heavy trench mortars and those firing the winged bombs; thirty to thirty-five bombs for medium trench mortars, and as high as 120 bombs for light trench mortars.

In open warfare the supply of ammunition to be carried along is regulated according to the capacity of the wagons of the light and medium trench mortar units. With the regulation number of wagons, 84 rounds per piece may be reckoned for the light trench mortars and 40 rounds per gun for the medium trench mortars. The reserve supply

is carried by the ammunition column for trench weapons. It depends upon the nature and number of wagons available. To assure the replenishments being brought up in time, use will be made of automobile trucks, drawing upon the depots in the rear (intermediate, divisional, and army dumps) or those in abandoned positions.

As concerns the allotment of special ammunition (gas and smoke bombs), it is impossible to give exact figures. This supply must be regulated according to the tactical situation and, consequently, according to the missions of the particular units.

(Signed) LUDENDORFF.

CONVENTIONAL NAMES FOR GERMAN GUNS AND AMMUNITION

Information received gives the following list of conventional names and their abbreviations:

Matériel	Abbreviation	Conventional Name (used over telephone)
Infantry S. ammunition	is.	Isidor
Armor-piercing ammunition (S. M. K.)	is.m.k.	Isidor M.K.
88 ammunition	i. 88	Isidor 88
71 ammunition	i. 71	Isidor 71
F. K. 96 (field gun, model '96)	A	Albert
F. K. 16 (field gun, model '16)	Aa	Anna
L. F. H. 98/09 (light field howitzer, model '98/09)	b	Berta
I. F. H. 16 (light field howitzer, model '16)	ba	Barbara
l. F. H. Kp. (light field howitzer, Krupp model)	bak	Barbara Krupp
s. F. H. (in general) (heavy field howitzer)	c	Cæsar
s. F. H. 02 and 13 (heavy field howitzer '02 and '03)	ci	Cicero
s. F. H. (heavy field howitzer, old model)	ca	Camille
lg. S. F. H. (long, heavy field howitzer)	clg	Caligula
Mrs. (Mortar)	eh	Eberhard
21 cm. Mrs. (21 cm. mortar)	en	Emanuel
13 cm. K. (13 cm. gun)	f	Friedrich
lg. 15 cm. K. (15 cm. long gun)	g	Gustav
15 cm. K. i. S. L. (15 cm. gun with overhead shield)	h	Heinrich

(Courtesy of The New York Times)

THE GUN WHICH FIRED THE FIRST AMERICAN SHOT IN THE WORLD WAR IN ITS ORIGINAL POSITION NEAR THE VILLAGE OF B——, LORRAINE, OCTOBER 23, 1917, AT 7 A.M.

Standing before the gun are: Captain Idus R. McLendon, Commanding Battery C, Sixth U. S. Field Artillery; and on the right, the Chief of the section, Sergeant Arch

(From a photograph taken under the supervision of Colonel Roger Villers, French Army, Artillery Commander of that sector and now a member of the French Military Mission to the United States.)

s. 12 cm. K. (12 cm. heavy gun)	K	Karl
15 cm. R. K. (gun with chase rings)	1	Ludwig
s. 15 cm.K. (15 cm. heavy gun)	n	Nathan
15 cm. V. K. (15 cm. short gun)	o	Otto
21 cm. K. (21 cm. gun)	p	Paul
Flak. 7.62 cm. (anti-aircraft gun)	rafl	russ. Albert Flak
Flak. 7.7 cm. (anti-aircraft gun)	afl	Albert Flak
russ. 8169 cm. (Russian 8.69 cm. gun)	ri	russ. Ivan
Inf. Gesch. 7.62 cm. (converted Russian field gun)	risa	russ. Isabella
russ. 5.7 cm. Ka. P. K. (fortress gun) . .	ry	russ. Ypsilon
37 cm. Sturm K. (siege gun)	stx	Sturm Xerxes
24 cm. K. (24 cm. gun)	t	Theodor
38 cm. K. (38 cm. gun)	kw	Kaiser Wilhelm

PREPARATION FOR ARTILLERY DEPLOYMENT AFTER BREAKING THE ENEMY LINE

Extracts from *Artilleristiche Mitteilungen No. 3,* dated July 15, 1918:

The Chief of the General Staff has issued the following instructions:

In position warfare, maps, accurate methods and calculations, a trained range-finding service and an aërial observation service thoroughly familiar with the sector are available. The zone of the objectives has been exhaustively studied, the meteorological service carefully organized, and other measures prepared long in advance. Defiladed objectives can thus be spotted and fired on at any moment, and accurate fire by night is possible. Conditions, however, change rapidly when an advance begins. The artillery is at first almost entirely reduced to terrestrial and direct observation.

Although direct observation must never be neglected, it is by no means sufficient even in such a case. Many objectives can only be reached by indirect fire. Unless a new organization of fire and observation can be effected, the artillery is compelled to resort to ineffective zone fire.

This organization is particularly important when, after the attack has been temporarily checked, a new deployment of artillery must be made before the enemy has the time to consolidate his line of resistance. In such a case, success essentially depends on the rapidity and accuracy of the work of organizing fire and observation.

This work comprises the following operations:

1. Reconnoitre and spotting front infantry lines, as well as the hostile infantry and artillery positions, observation posts, camps, etc.

(*a*) By directing in time the reconnaissances which must be carried out by the troops and by rapidly assembling and coördinating the information obtained by them.

(*b*) Send to the front in good time the range-finding sections and the topographical parties, so that they may be made use of immediately.

2. Reconnoitre our own artillery and minenwerfer emplacements, including observation posts, the P. C.'s, the liaison system, etc.

3. Establish the battery plane tables, locate the coördinates of the posts of the range-finding section, battery positions, ranging points, and objectives.

4. Organize the artillery meteorological service.

5. When a new methodical attack is to be made, prepare the orders relating to the deployment and advance of the batteries, to the ammunition supply, the firing missions, the firing data note-books, etc.

The necessary labor is detailed by the divisions in compliance with the orders of the higher échelons and in accordance with a preliminary study made before the break through. The work must be energetically carried out as soon as the infantry advance has halted, without waiting either for the results of the reconnaissance or the decision of the High Command as to the continuation of the operations.

If, however, the distribution of the artillery is modified by a new advance or by a suspension of offensive operation, and the preparations for observation, etc., thus rendered premature or useless, little harm is done. On the other hand, delay in making such preparations would be fatal to success.

The following details of the instructions must be carried out:

(*a*) *Air observation*.—For batteries connected with balloons, and for the employment of artillery airplanes, reference is made to the regulations of June 9, 1918.

In addition, airplane photographs must be taken and the results of their examination quickly applied. The photographic service must coöperate with the spotting and topographical sections.

(*b*) It is desirable that each attacking division be allotted one mobile sound-ranging section and one mobile ground observation information section. The sound-ranging sections which function night and day are quite as important as the latter, whose service is chiefly done at night. Both services should be placed under one command. The sections must not be kept in the Army Corps Reserve, but sent ahead by the divisions to avoid all delay in reconnaissance and installation.

Previous experience has shown that it takes from three to six hours to install these sections. Aside from the skill of the personnel, who are trained for the purpose, this period depends upon the transportation facilities (horses and vehicles for reconnaissance and transportation of matériel) and the rapidity with which the liaisons have been established. In the interest of the Command and of the troops, all possible assistance must be given to the range-finding sections to hasten their work of installation and to keep the wires in working order. This work must not be left to specialists; it concerns the artillery in general, and is a particularly important duty of the Divisional Command and of the officers in the higher échelons who are responsible for artillery.

Each division should work with its own section, independently of the neighboring section. The High Command must delimit the observation zones. When they are too narrow, the fields of the sections extend beyond the limits of the division. When a rapid advance is under way, only such part of the personnel will be used at the same time as may be necessary, and the section will go forward by échelons. Even when the zones of operation are narrow and partly overlap, the range-finding sections can do much locating of objectives and ranging of such fire as is particularly important. It is recommended in this connection that a direct liaison, permanent or temporary, be established between the sections and certain batteries, similar to that existing between batteries and balloons. The sections of two divisions can be combined under certain circumstances and an arrangement of successive échelons organized, particularly if means of transport and personnel is lacking. One of the neighboring sections can work while the other is moving to a new position. This plan allows an observation section, which eventually has to be moved, to function where it is up to the last minute. This scheme may, however, make close coöperation difficult. When two neighboring divisions are thus using the same observation system, the division whose own section is not in line must prepare its ranging data and quickly establish the necessary telephonic liaison.

Civilian Officers in the Field Artillery

By LIEUTENANT COLONEL ROBERT E. COULSON, FIELD ARTILLERY, U. S. ARMY

THE Army List and Directory of May 20, 1917, which includes all officers in the service at the time war was declared, lists four hundred and ten regular army field artillerymen. When the armistice was signed the Field Artillery had approximately twenty thousand officers in service, and but for the cessation of hostilities the Field Artillery Central Officers' Training School would have added approximately twenty-five thousand officers to the list by July 1, 1919.

This means that practically all the officers in the Field Artillery to-day, up to and including the rank of captain, were civilians at the beginning of the war.

The battery commander, with his rank of captain, has one of the most difficult jobs, and certainly the most satisfactory, in the field artillery arm.

The light battery, for instance, with its four guns, one hundred and ninety-four enlisted men and one hundred and sixty-four horses, is a real unit, with an intricate internal organization, and over this unit the battery commander has complete control. To be a good battery commander one must be a good artilleryman, and there is every evidence that our present battery commanders are efficient.

Some notion of the extent of the problem of rapid production of field artillery officers may be gained by scanning the following summary of "What Every Field Artillery Officer Should Know," which was issued by the office of the Chief of Field Artillery last spring:

> Below is stated what constitutes proficiency in each subject:
>
> 1. DISMOUNTED DRILL: Officer must be able to drill and instruct a gun squad, platoon or battery, dismounted marching; must be able to instruct in inspection, muster, guard mounting, and in the duties of the different members of the guard.

2. GUN DRILL: Must be able to perform the duties of every member in a gun squad; must be word-perfect in the sequence of commands; must have a thorough knowledge of the sights, quadrant and fuse setter of the field gun, and the methods of testing and adjusting these instruments, and must be a good layer with the different instruments.

3. VISUAL SIGNALLING: Must be capable of receiving and sending messages by International Morse Code at the rate of at least six words a minute.

4. CORDAGE: Must have a good knowledge of all knots, lashings and splices in general use in the artillery, and their application to military needs. (*Engineers' Field Manual*.)

5. PHYSICAL TRAINING: Must be capable of supervising instruction in this subject and of commanding units while giving instruction personally; must be able to detect faults of position and correct them, and know whether instruction being given by non-commissioned officers is along correct lines.

6. PROPERTY: Must be thoroughly conversant with the equipment used by officers and enlisted men of his regiment, and must understand the methods of cleaning, repairing, preserving, and accounting for the same.

7. MATÉRIEL: Must be able to mount and assemble all parts of the 3-inch gun, breech mechanism and carriage, and have detailed knowledge of the care, cleaning and preservation of matériel.

8. FIRING DATA: Must be able to calculate quickly the firing data for any assumed target and aiming point, using rough methods available in the absence of the B. C. telescope.

9. INDOOR FIRING: Must have a thorough knowledge of the principles and adjustment of fire and the various methods of applying them; must be able to adjust the sheaf in blackboard firing.

10. TOPOGRAPHY, MAPS AND "PLAN DIRECTEUR": Must be able to make a rough panoramic sketch of locality, including targets located therein. Must have a thorough knowledge of map reading and the use of the compass and the metric scale; must be able to determine a point on the map by co-ordinates and intersection and resection, and be able to solve problems on the map involving the location of batteries, aiming points, observation stations, targets, etc., and must understand the construction and use of the "Plan Directeur"; the use of datum and registration points; in addition, all duties of the orienting officer.

11. ORGANIZATION, ETC.: Must understand the organization of the different arms, up to the regiment.

12. INSTRUMENTS: Must be able to use the battery commander's instruments, including the range finder, B. C. telescope and aiming circle; be able to adjust them and to determine the firing data with facility and accuracy by means of their use.

13. FLANK OBSERVATION: Must be able to adjust fire from advance and flank or lateral observation stations.

14. HARNESS FITTING AND DRAFT: Must be able to adjust the harness, especially collars and breeching; must understand the principles of traction and the useful and harmful components of line traction, the causes of saddle and harness sores, and the means of avoiding and curing the same.

15. TELEPHONE: Must have a practical knowledge of the principles, construction and operation of telephones, telephone lines; must be able to test for telephone faults and line trouble, make repairs; must have a detailed knowledge of the receiver, transmitter, circuits and care of the telephone.

16. RANGE TABLES, "CORRECTIONS OF THE MOMENT," INCLUDING: Determination of wind, drift and atmospheric corrections, corrections for muzzle velocity, temperature of powder, variation in weight of projectile, and, in general, complete use of range tables.

17. BALLISTICS, GUNNERY, ETC.: Must understand powders, quick and slow; kinds of projectiles and fuses and their action and effects; probabilities of fire and their application; the laws of dispersion and their application to fire; trajectories, the trajectory in vacuo, resistance to air, effect of gravity, application to problems of defilade, and angle of site, direct and curved fire.

18. STABLE MANAGEMENT: Must understand theoretically the duties of stable management, and practically so far as facilities permit; must know the principles of hygiene and food for horses, how to keep horses in condition, to restore condition of debilitated horses, the prevention and cure of parasitic diseases and precaution to prevent their spread, the treatment of accident and simple injury, care of the feet, and training of the horses for draft and riding.

19. EXECUTIVE OFFICER: Must be able to perform properly and fully all the duties of executive officer in the firing battery.

20. EQUITATION: Must be capable of riding sufficiently well to command a mounted organization, to give instruction in riding,

to correct obvious faults in position, and to control the horse at all gaits with ease.

21. DRIVING DRILL: Must be capable of driving in any position in a gun team, and have a thorough knowledge of arm signals.

22. RECONNAISSANCE AND OCCUPATION OF POSITION: Must understand the general requirements of an artillery position and the application to specific missions of the battery; must be able to select positions, act as reconnaissance officer, locate the various échelons of a battery, locate observation posts of a battery command and posts of forward and flank observers; must be able to establish communication between all parts, provide for the security and cover of matériel, ammunition and personnel, and be able to prepare for battery movements from a position.

23. CAMOUFLAGE: Must have a practical knowledge of how to conceal batteries and how to construct protection from hostile fire; must understand the use of camouflage emplacements, ammunition pockets, dug-outs for personnel and telephone stations, construction of observation stations, and so on.

24. ENTRAINING: Must know the method of loading and unloading horses, matériel and men; arrangements during the journey, feeding, watering and messing *en route;* guards, and general care of horses and men.

25. SUB-CALIBER PRACTICE: Must be able to conduct sub-caliber practice and be able to use and explain the various mechanisms of fire.

26. SMOKE BOMB PRACTICE: Must be able to conduct smoke bomb practice, both at the firing point and at the target.

27. ANTI-GAS: Must understand the care, fitting and use of helmets, respirators, breathing exercises, and must be able to give commands and orders while wearing the mask.

28. FIRST AID TO INJURED AND PERSONAL HYGIENE: Must be thoroughly familiar with these and must be able to give instruction therein.

29. CODE, and method of communication with aircraft.

30. MINIATURE RANGE: Must be familiar with conduct of fire on miniature range, with special reference to flank observation of fire.

31. FIRING: Must be able to conduct the actual firing of a battery against various targets, such as guns, wire entanglements, communication trenches, headquarters establishments, machine-gun emplacements, and must be able to shift the sheaf quickly from one target to another; must understand how to make barrage

tables and maps; must be able to select projectiles and fuses according to the target, and be able to adjust fire from advance and flank observation stations; must be able to adjust a single gun on a target, making all the necessary corrections for temperature of air and powder, wind and barometric pressure, and, in general, conduct of fire for accuracy.

32. PISTOL PRACTICE: Must understand the care, action and use of the automatic pistol, and must fire the prescribed courses and be capable of instructing enlisted men.

33. NIGHT MOVEMENTS: Must be able to conduct a battery without lights to a designated position, and properly and quickly install the different échelons therein.

34. COMMUNICATIONS: Must be familiar with artillery information and communication service, and with system of liaison.

35. FIELD FORTIFICATIONS: Must be able to construct and conceal gun pits, shelters, emplacements and dug-outs.

36. RIFLE PRACTICE: Must be familiar with so much of the course of firing as pertains to his regiment, and capable of instructing therein; must be able to dissemble and assemble the rifle and understand its care, cleaning and preservation. Must have the same knowledge relative to the type of machine guns furnished his regiment (if any).

37. VOL. III, F. A. S. and D. R.

A great many factors co-operated to make possible the rapid development of civilians into competent artillery officers. One was the retention in this country of more than a third of our regular army field artillery officers for the whole period of war for use largely in training officers; and probably at least as many more of those who did get to France were held in schools there as instructors. It is a conservative statement that less than half of the four hundred and ten regular army field artillery officers mentioned above have seen combatant service in this war.

Another important factor was the building up in this country and in France of machinery for the intensive training of officers, which was both well designed and efficient. The early local officers' training camps were replaced by the Field Artillery Central Officers Training School, at Camp Zachary Taylor, Ky., with co-ordinated instruction and adequate matériel and instructors for that purpose. At the time the armistice was

signed, the weekly intake of this school was twelve hundred candidates. The preliminary training in this school was supplemented by work in the war course at the School of Fire for Field Artillery at Fort Sill, Oklahoma, and in the numerous courses for officers maintained at the brigade training centers in this country. Then, when the units got across, the instruction of officers was continued in the schools maintained in France.

Another factor of great importance was the closer co-ordination of field artillery training generally through the activity of the Chief of Field Artillery. The battery commander receives more help and guidance to-day than he did in the old days, and there is greater uniformity in training of our batteries than ever before.

The fact, moreover, that the civilians who entered training as field artillery officers brought to the service, in the main, good educations, often extensive mathematical training and much experience in the handling of men and controlling of organizations acquired in civilian occupations was, of course, essential to the development which has taken place.

To-day, however, we are in the period of demobilization, and more important than the question of what the civilians who came into the Field Artillery brought with them, or how they were trained, is the question of what they will take back to civil life with them.

While many of the civilian officers have seen active service at the front and have learned the lessons that actual warfare gives, all the officers have assisted in the training of batteries which, but for the unexpected collapse of the German resistance, would have taken part in the fighting. And all the officers who have shared the common experience of working with troops in the camps have acquired in common fundamental notions, which they will take back to civil life with them.

Certain of these are worthy of particular mention:

In the first place, every civilian officer who has worked with troops has gained a deep-seated optimism and faith in the economic and social possibilities of the American people from

observation of the rapid development of the drafted man, as an individual and as a part of a specialized organization, under the intensive methods of training employed in the army.

No doubt many a battery commander had a feeling of despair as he watched his draft men slouch into camp—coming as they did from every stratum of the economic and social structure, from the farms, the mines, the villages and the towns, and, worst of all, the slums of the cities—and thought of the work these men must be trained to do as artillerymen, some working with delicate instruments and all held to a standard of precision and accuracy not common in industrial operations.

Yet these men were made into artillerymen, and good artillerymen, with a speed that was surprising to the civilian accustomed to the slow training of skilled labor in civilian life. Many of the draft men were for the first time in their lives called upon for genuine intellectual effort. In many cases the draft men were completely illiterate, and had to be taught to read and write while their training as soldiers was in process. There are men in the army to-day who learned their semaphore and wig-wag alphabet before they learned to read printed letters.

No man could look at a draft battery as it was at the start, and again after three months' training, without being deeply inpressed by the possibility of improvement in the average American under proper methods of training. The men were markedly and obviously more alert, physically and mentally, and more effective.

It is safe to say that all civilian officers who return to their business upon the completion of the war will carry back a firm belief in the possibility of greatly increasing the efficiency of the average man by proper methods of training and a desire to apply more effective methods of training than those formerly current in civil life.

The second big lesson which the civilian officer has learned in his army experience is the value of military discipline as an aid in the training of men. The battery organization requires all sorts of enlisted specialists; men who do the work of a surveyor,

men who make maps, men who use fire-control instruments as complicated as the level and the transit, carpenters, blacksmiths, farriers, mechanics, clerks and the like. These men were well trained and quickly trained largely because they lived in an atmosphere of military discipline. These men learned to perform their varied duties accurately and well because they were first trained to be precise by the discipline under which they were placed.

Military discipline means precision; it means that detailed directions are to be carried out, not approximately, but exactly. This is one of the first lessons the recruit learns in his training as a soldier. But this, after all, constitutes but the rudiments of discipline, as we have come to know it. The discipline of the French, English and American soldier is much more; it is a loyal, intelligent and exact carrying out of the expressed desires of one's leader.

Marshal Foch says of the disciplined man in his book, "The Principles of War" (Major J. De Morinni's translation):

> He must, with the means at his disposal, *interpret* the thought of his superior, and therefore understand it first, then make of his means *the most suitable* use under circumstances of which he is the sole judge.
>
> To the strict, passive obedience of former centuries we shall therefore always oppose *active obedience*, necessary consequence of the appeal always made to the initiative, and of the tactical use of small, independent masses.
>
> And that notion of freedom of action which we find appearing as a protection to our spirit of active discipline, which comes from the necessity of assuring the action of the whole through the combined actions of all participants, we find becoming, like the principle of economy of forces, one of the fundamental rules of war.

Discipline in this sense is not the cold, teutonic thing the civilian conceived it to be before the war—an unthinking obedience; but is a necessary principle of effective co-operation among individuals in war or peace, and as valuable in industry or other social effort as in operations on the battlefield.

It is safe to say that practically all the civilian officers of the Field Artillery will go back to civil life with an earnest desire to make permanent in our education system the benefits of the methods used in military training. In other words, the great majority of them will advocate and support a proposal, in one form or another, to give every boy in this country, as he reaches an appropriate age, a year of education and training under military discipline.

This does not mean that they will want this country to be a permanent armed camp, nor does it mean that they are going back to civil life as advocates of a policy of militarism.

As a matter of fact, this war has done much to clarify our ideas of what militarism means. We had thought of militarism as a state of mind produced by undue emphasis on military preparation. Now we think of it as a national philosophy which seeks to justify the application of force in working the will of the stronger upon the weaker. We have come to realize that France, which for forty years before the war had had compulsory and universal military service, in a one hundred per cent. sense, was not a militaristic nation; while Germany, with compulsory but not universal training, in that it called to the colors each year only about fifty per cent. of the men coming of military age, was militaristic in the most absolute sense. And we have little fear, while the American character remains what it has so recently shown itself to be, that we shall as a nation develop a militaristic attitude toward smaller nations.

In fact, it is not, to any considerable extent, the military advantages of universal training that give rise to its support by our civilian soldiers; it is the economic and social advantages as made obvious by our experience under the Selective Service Act.

The proposal for universal training which meets with the most favor may be briefly outlined as follows:

1. That our compulsory education system be put on a Federal basis, to the extent of requiring from each boy in the country, as a preparation for citizenship, one year to be spent in great national schools (using the physical plants now existing in the

cantonments); these schools to be under military discipline, but the instruction to be primarily general education for citizenship and vocational training rather than military instruction.

2. That this educational requirement be made universal in the most strict sense, and include every boy of seventeen or eighteen, as may be decided, irrespective of his fitness, mentally or physically, for military service.

3. That special emphasis be placed upon instruction in personal and social hygiene and in the duties of citizenship.

It is obvious that such a plan would go far to place us in an impregnable position, from a military sense, as against the future aggressions of any nation or group of nations, since the soldier to-day is no more or less than a disciplined specialist; and, now that the selective-service principle has become a part of our national policy, we should have a tremendous store of disciplined specialists upon which to draw. Such a plan would eliminate the necessity for any large professional or standing army.

But, after all, we hope to live at peace with the world for many years, and the real justification for a demand for universal training for citizenship is not on account of its military advantages but on account of its economic and social advantages.

Think what it would mean on the economic side if every young man coming into industry had had the advantage of one year's real discipline and special instruction to prepare him for his life-work. Our economic machinery would work with a precision and efficiency unknown before the war. The plan would pay for itself many times over.

And on the social side, think what it would mean to take every young man, whatever his economic or social status, remove him from the environment which may be smothering his normal development, and put him in these big schools where he would rub elbows with other men from other social and economic strata and learn what discipline means, learn something of personal and social hygiene and something of ideals of citizenship. Think what it would mean when those boys went back home to the

farm, the village or the slums of the city. It would assure us a genuine democracy, and would be the foundation stone of a true national unity—or, perhaps better, it would be a wise building upon the foundation stone which our common effort in this war has furnished.

To-day we have the physical equipment and the organization to inaugurate cheaply and efficiently such a system of education for citizenship. If the opportunity is allowed to pass it may never recur. He who fears that such a plan conceals the germ of militarism has failed to appreciate the American character and lacks that complete faith in the average American which has come to those of us who have watched him at work as a soldier during the past year and a half.

German Precautions to Disguise Intentions

THE measure of secrecy used by the Germans in their preparation for recent offensives necessitated counter-precautions. The following is a summary of the methods by which the enemy attempts to hide his intentions.

SECRECY ORGANIZATION

Army Security Officer.—In order to study the necessary measures to insure the secrecy of operations and to supervise the execution of these measures, the ——th German Army (in orders dated April —, 1918, ——) appointed a general staff officer as the "army security officer" (*Sicherungsoffizier*), at the head of section —— of the army staff.

Group and Divisional Security Officers.—In the same orders it was laid down that a general staff officer should be detailed in each group and division to perform similar duties.

Regimental Security Officer.—From information received of the ——th infantry regiment, ——th division, dated June —, 1918, it appears that, in infantry regiments, an officer is detailed to carry out the duties of "regimental security officer."

Supervising Officers.—The same information also states that the sector of the ——th division was divided into four security zones, to each of which was allotted a "supervising officer." The duty of these officers was "to satisfy themselves personally that measures of security were taken in their area." They were "responsible that all new constructions, which could be observed by hostile air reconnaissance, should, both while under construction and afterwards, be continually camouflaged against air observations."

Zone of Observation.—In the orders of the ——nd German Army, dated January —, 1918, extracts from which were

given in ——, it was laid down that, in order to conceal movements, groups were to divide the forward area into zones of observation as follows: (I) The zone under enemy observation from the ground. (II) The zone under enemy observation from balloons.

Certain restrictions of movement by day in these zones were laid down, the strength of parties and the interval between them being limited, according to conditions of visibility.

Similar restrictions are still in force, probably universally, as shown by a map of the H—— sector, dated May —, 1918, and orders of the ——th infantry regiment, ——th division, on the —— front, dated June —, 1918, in which two zones of observation are clearly laid down, together with orders restricting movement in these zones.

ORGANIZATION OF TERRAIN

As a general rule camouflage is erected before new work is started. Mortar is plastered on the surface of wet concrete work, and into this moss, roots and weeds are stamped. Otherwise, the concrete is painted in large irregular patches of different colors. In constructing new trenches and excavations, short angles, steep slopes and exposure of new soil is avoided as much as possible. New communication trenches for common use are either tunnelled at fifteen or twenty feet below the surface, or disguised by covering them with netting on which straw and branches are placed. The whole is then covered with sods or sprinkled with earth. Emplacements are constructed so as to arrange gun pits at irregular intervals. These pits are connected by trenches which are continued well out on either flank to give them as much as possible the appearance of the ordinary trench. Another practice is to make conspicuous tracks of dummy gun positions near occupied emplacements. Great care is taken to conceal gun pits for new batteries while under construction; and, if no screen or netting is actually erected over the gun, screens or brush wood are kept close at hand to

throw over the new work upon the approach of Allied observers. When gun pits are made in woods there is little clearing, and wires with branches of small fir trees attached are hung over the gun.

MOVEMENT

By Day.—This has been restricted to small bodies. Unnecessary circulation has been forbidden, and guns, caissons and wagons are parked under cover. Camouflaged tops are provided for such vehicles as it is necessary to move. Visible roads in forward areas, where daylight movement is attempted, are masked by screens of camouflage. Dummy screens are erected at varying distances from the road to deceive artillery observers.

By Night.—All movements of large bodies are effected at night. Unnecessary noise, lights and fires are forbidden. Troops are instructed to halt and remain motionless if Allied aviators drop parachute flares.

INFANTRY

Assaulting troops are not necessarily placed in the front line previous to the attack. They move up during the night preceding, and pass through the sector troops to the attack.

ARTILLERY

Larger masses of artillery have been used than before, but the increase has not been revealed prior to the attack. To gain surprise, the preparation has been much shortened. Secrecy in the concentration and preparation of the artillery for their tasks is obtained by two principal methods: (1) Movement and occupation at night with strictest march discipline. (2) Minimum preliminary adjusting fire.

Occupation.—Little or no work is done on new emplacements. Careful movement begins some days or even weeks before the attack and batteries are put in old positions, of which there are generally a large number. If these new batteries are

located, they are apt to be mistaken for nomad pieces from old batteries. The remaining artillery is kept well hidden in rear and brought up at the last moment to occupy open positions. When necessary to construct new protected positions, the greatest care is used to camouflage them and they are not occupied until absolutely necessary.

Adjustments.—Neutralization is substituted for destruction wherever possible, and gas is largely used. This enables much of the work to be done without preliminary adjustment. Tasks are minutely divided; those requiring precision fire are assigned to batteries already in the sector. The absolutely necessary adjustment of new batteries is accomplished very carefully, other batteries ceasing fire so that no increase is noted. Neutralization of battery positions, villages, camps, etc., by gas does not require precision fire. On certain points precision is compensated for by volume of fire. Destruction of front line positions is accomplished by trench mortars. The accompanying batteries destroy strong points with direct fire at short range during the infantry advance. Sufficient data are obtained by new batteries occupying old positions from notes of those positions. For new positions, where absolute precision is not required, the map gives sufficient data. Batteries in open positions, brought up just before the attack, can use direct fire.

In the days immediately preceding the attack, there has been a noticeable decrease in artillery activity. Anti-aircraft fire is increased.

SIGNAL COMMUNICATION

Radio-telegraphy.—Radio activity is carefully controlled so as to give an indication of changes in troops. Before the March offensive there was greatly increased activity in certain areas, while in others radio communication practically ceased. Along the front actually attacked, the number of messages exchanged per day was kept normal. Other attacks have occurred, some following a period of great radio activity, others after radio activity has appeared to cease entirely.

Most stations change their call signs daily, and frequently make use of two or more call signs on the same day, so that the number of stations in an area may be increased or decreased without apparent change in the number of calls. Some cases have been reported in which the enemy appeared to move his radio stations from place to place during the day, at the same time changing the call letters, the wave length and the tone. These instances have, however, been few and have not been definitely confirmed.

Earth-telegraphy.—This means of communication is used only near the front line. Messages are few in number, except in certain areas where activity has been increased for short periods, evidently for the purpose of attracting attention to those areas.

Telephone.—Elaborate precautions are taken to prevent the interception of telephone conversation. No lines, except those to observation posts, are permitted in advance of battalion headquarters. Lines connecting adjoining battalions are required to run well to the rear in the form of a letter V or U. When regiments use the telephone to the rear, all lines running to the front are required to be disconnected.

Use of Code and Cipher.—Orders respecting the use of code and cipher cover the most minute details. No message sent by radio- or earth-telegraphy is permitted to contain any words in clear. It is ordered that messages sent in one code must never be repeated in any other code, or in clear. The sending of form reports is prohibited. If similar messages are required to be sent, the forms of the sentences must be made different in each. Many meaningless code groups are inserted at random. The use of unnecessary words is forbidden. Many messages are so condensed that, even when correctly decoded, they convey information only to one familiar with the circumstances and with what has gone before. Great importance is attached to the proper use of code. An officer appears to be attached to each divisional or corps area, for the purpose of checking any indiscretions.

AIRCRAFT

Balloons.—The crews of additional balloons assigned to an offensive front receive their training by ascending from the beds of balloons known to the sector.

Pursuit.—This class of airplane has usually not made its appearance until a few days before an offensive. They have then generally established a defensive barrage for the purpose of preventing Allied reconnaissances. Just preceding the attack they may become very aggressive, and are especially active against balloons.

Reconnaissances.—There have usually been a number of deep reconnaissances two or three weeks preceding an offensive. These are made by single machines. Adjustments, as already noted, have been very limited.

Bombing.—These units have usually operated in back areas during all favorable nights of the week preceding an offensive. Their objectives have been billets, dumps and transportation centres.

COUNTER PRECAUTIONS

The precautions of the enemy, as outlined above, make increased vigilance on the part of the observers necessary. There remain plenty of indications to be properly observed and reported. Among the methods of obtaining these may be mentioned:

Organization of Terrain.—Location of working parties and comparison of photographs. Increases in dumps, airdromes and hospitals in forward areas are especially significant. Increase in number of anti-aircraft guns is also usually an indication.

Movement.—Careful observation and recording of train movements, making airplane reconnaissances by night and at dawn and sunset.

Infantry.—Frequent raids, interrogation of prisoners as to occupancy of back areas, and visual observation of rear billeting areas.

Artillery.—Observation and thorough recording of information on batteries in action, suspected emplacements and coördination of shelling with appearance of hostile airplane. Vicinity of emplacements should be watched for increases in munition dumps. Anti-aircraft fire increases before an offensive.

Signal Communication.—Location of radio stations by observers or photographs. Location of telegraph and telephone line from photographs.

Aircraft.—Observation of routes and attitude of hostile aircraft, especial attention being given to routes of long-distance reconnaissances and hostile bombing objectives.

Details of Construction and Operation of the Miniature Ranges

FIELD ARTILLERY BRIGADE FIRING CENTRE, CAMP McCLELLAN, ALA.

PURPOSE

THE value of any type of miniature range in connection with the training of artillerymen is well known. Obviously the nearest approach to actual field conditions is the ideal to be sought.

ROLLING BRIDGE TYPE

The rolling bridge type of miniature range has been found to be very satisfactory both as to simplicity of construction and operation. The miniature ranges described herein are of this type as actually in use at the Field Artillery Brigade Firing Centre, Camp McClellan. The first ranges of similar type were constructed during the winter of 1917–1918 at Camp Funston, Kansas, for use in the Eighty-ninth Division.

Briefly, this type of range is contained in a building of convenient dimensions, in a portion of which the terrain is represented in miniature, the remainder being left open and free from obstructions to facilitate observation. A rolling bridge or travelling crane is constructed and operated over the terrain; the bursts may be placed at any point on the terrain by moving the bridge for changes in range and by moving right and left on the bridge for deflection changes, all in accordance with accurate scales in both directions, and in obedience to the commands of the officer firing.

In comparison with other types of miniature ranges, the following advantages may be claimed for the rolling bridge type:

1. Being indoors permits constant use, day and night and in all weather.

2. There is absolutely no obstruction to hinder observation. The operators are never in view, and consequently no unwarranted

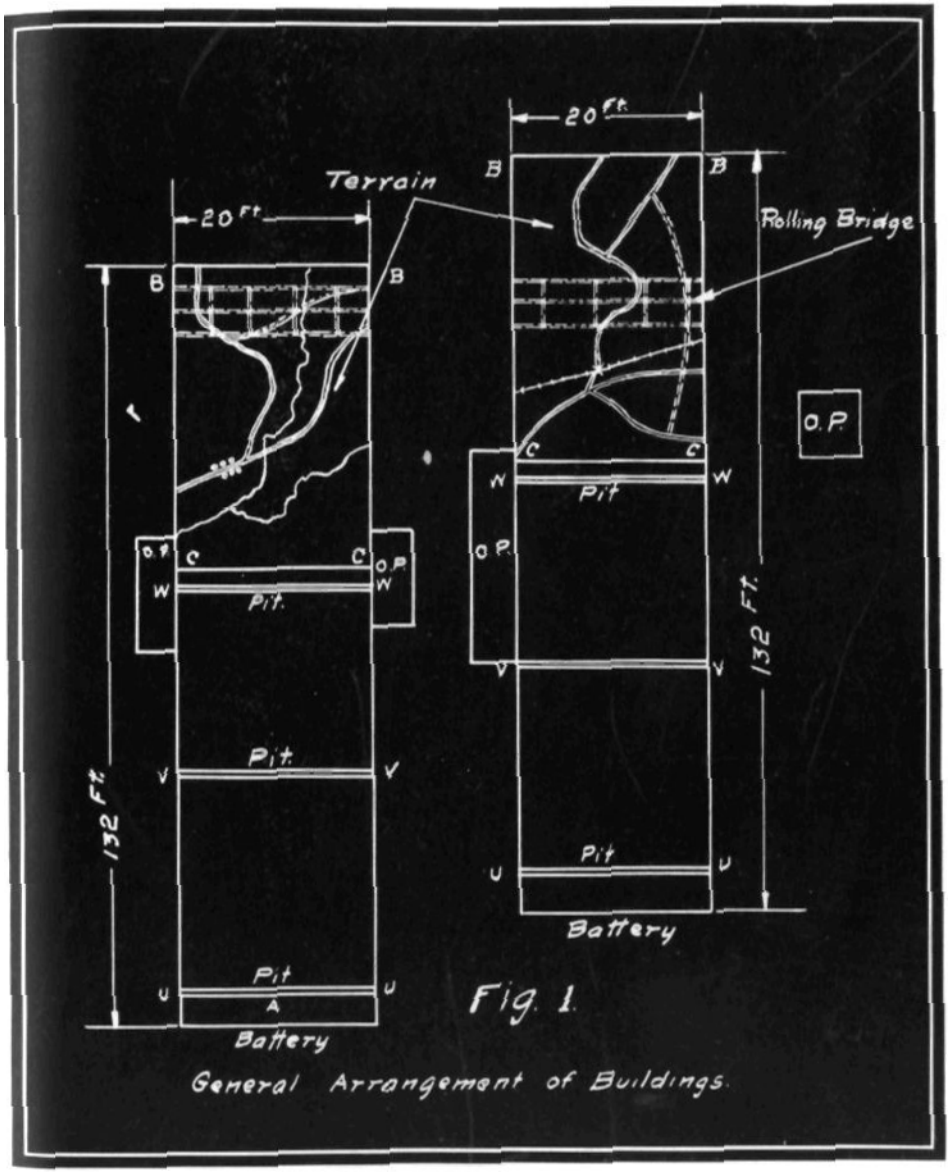
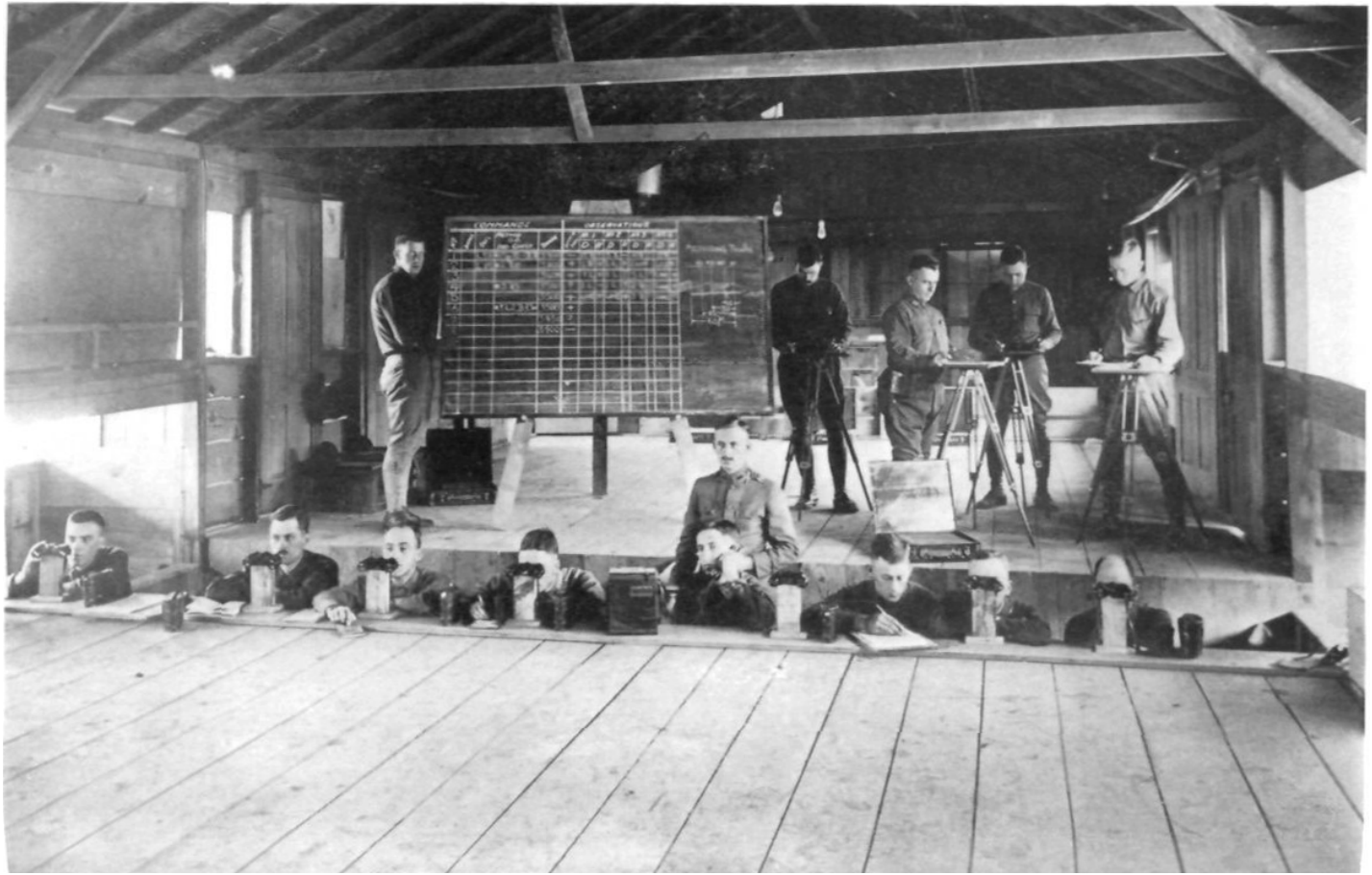


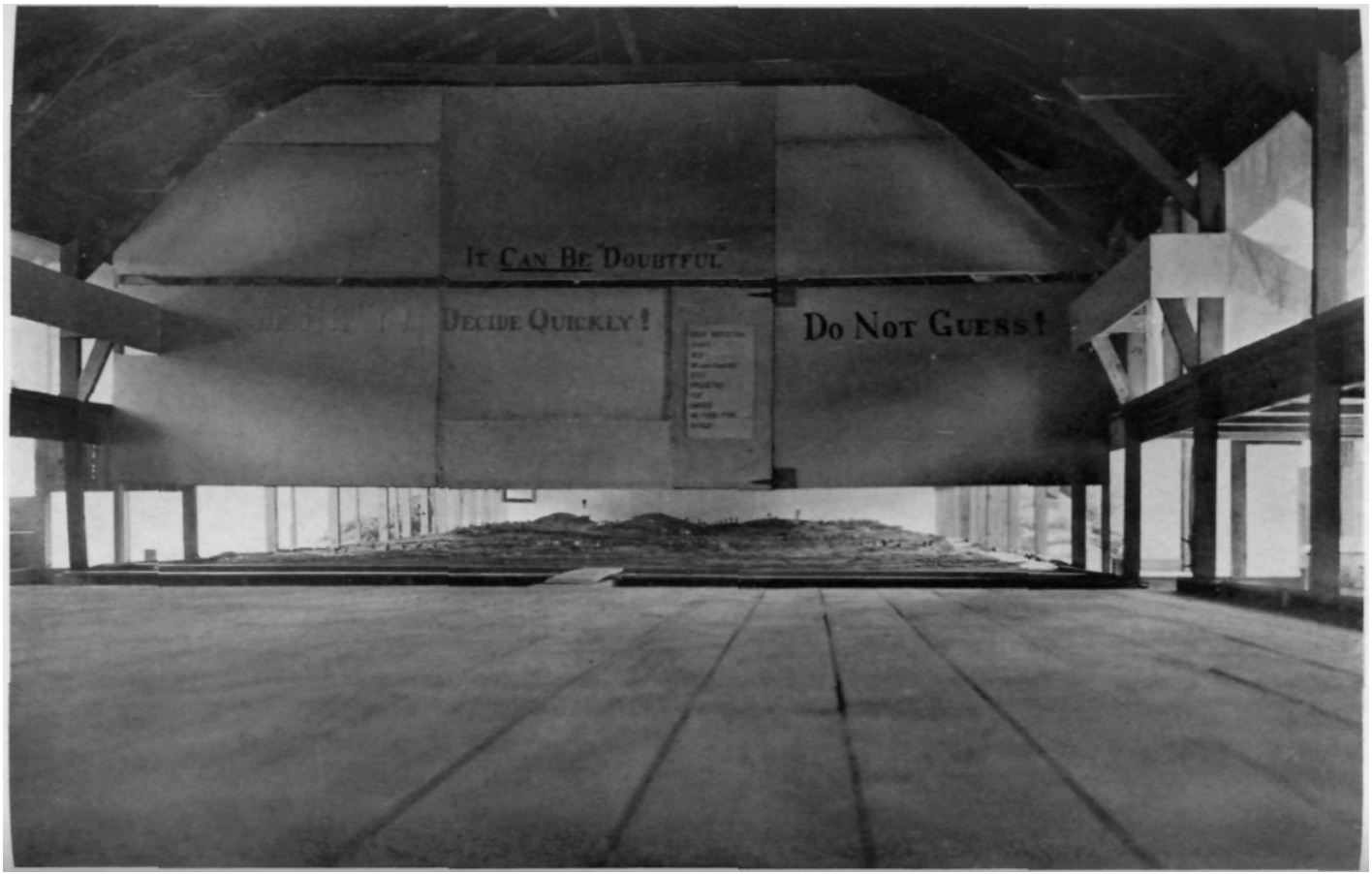
Fig. 1.

General Arrangement of Buildings.

PHOTOGRAPH 1



PHOTOGRAPH 2



PHOTOGRAPH 3

advance indication of the probable point of burst is possible until the burst itself appears.

3. The firing of one, two, three or four guns by volley or salvo may be simulated, and there is no limit to the variety of problems except those dependent upon the physical presence of the guns.

4. The measurements for range and deflection and the dispersion of the bursts are made automatically with great rapidity.

5. The speed of fire is practically the same as in service firing, and a large class may be instructed.

CONSTRUCTION

Fig. 1 indicates' the dimensions of the buildings and the general appearance of the interior. The terrain was built on the scale of 1/100, which allowed the construction of a terrain 600 metres wide, 200 metres long, and ranges up to 4000 metres. The terrain was constructed in the rectangle B-B, C-C. Pits were let down in the floor at U-U, V-V and W-W, in order to place the observers conveniently at the proper level with the terrain; and also allow all degrees of direct axial, forward, lateral and bilateral observation.

Photograph No. 1 shows the buildings used for the miniature ranges, and on the side of the building numbered 5, in the photograph, may be seen the small extension which is used for lateral or flank observation. Through special windows, observation from the adjacent buildings is also made possible.

Photograph No. 2 shows one of the observation posts, and photograph No. 3, shown on the following page, was taken from this observation post. The two succeeding photographs, Nos. 4 and 5, show the terrain as seen from the forward observation post.

The battery is assumed to be either inside or outside of the building. A scale graduated for both range and range setting (metres and degrees) runs along the side of the building, as shown in photographs Nos. 4, 5, 6 and 7.

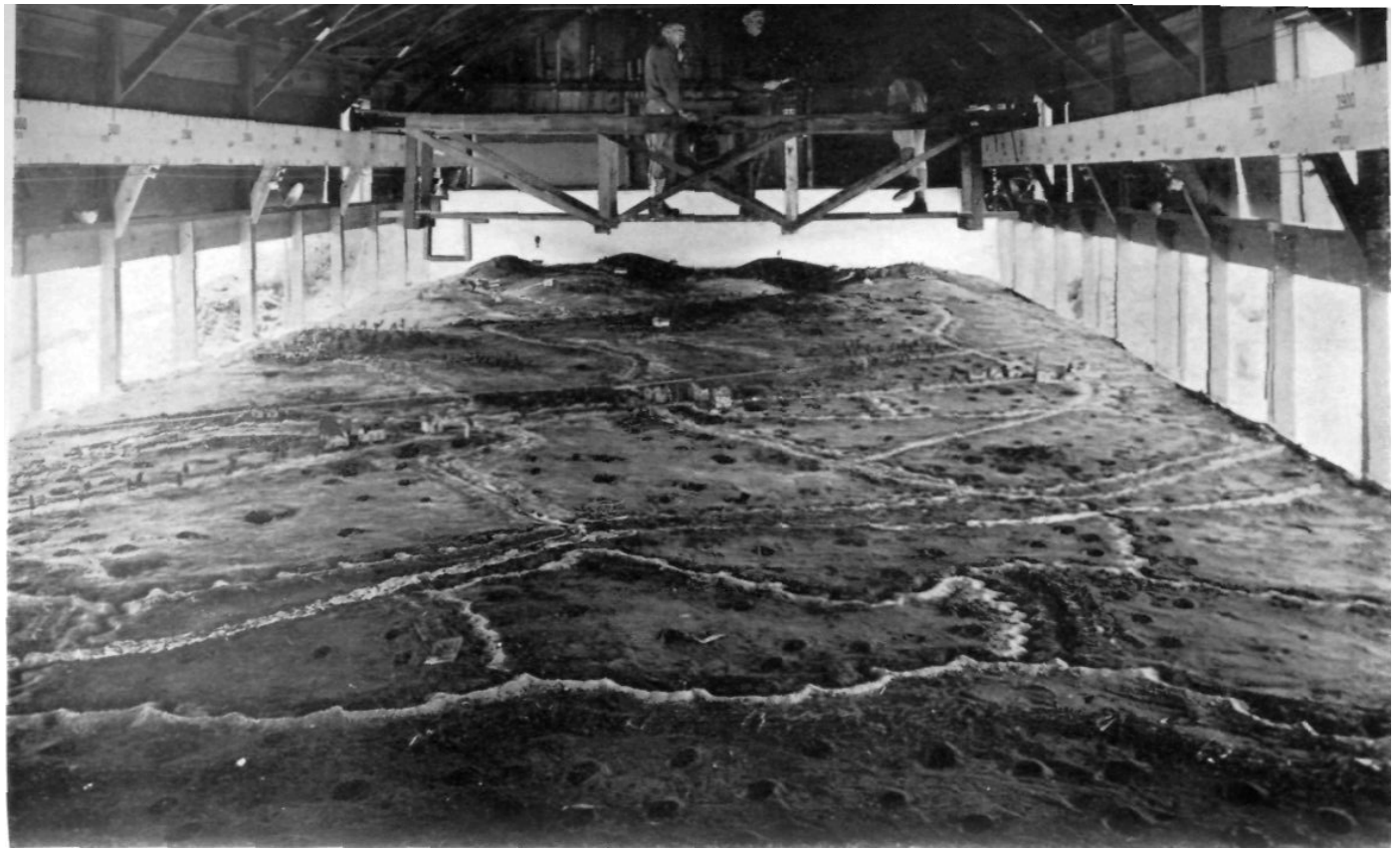
Assuming that the battery position remains always at the same point, there would be an error in deflection and range due to the fact that change in deflection is measured along a straight line and not on the arc of a circle. This error, though very small, may be easily avoided by assuming that the battery is on the perpendicular to the bridge passing through the target, Thus a line of ideal battery positions is obtained at the origin of the scale and running parallel to the bridge. This consideration is important, first, for the nature of the observation (axial or lateral); and, second, in the preparation of fire with the battle map.

It is readily appreciated that communication between various parts of the building, by telephone, buzzer or voice, offers no particular difficulties.

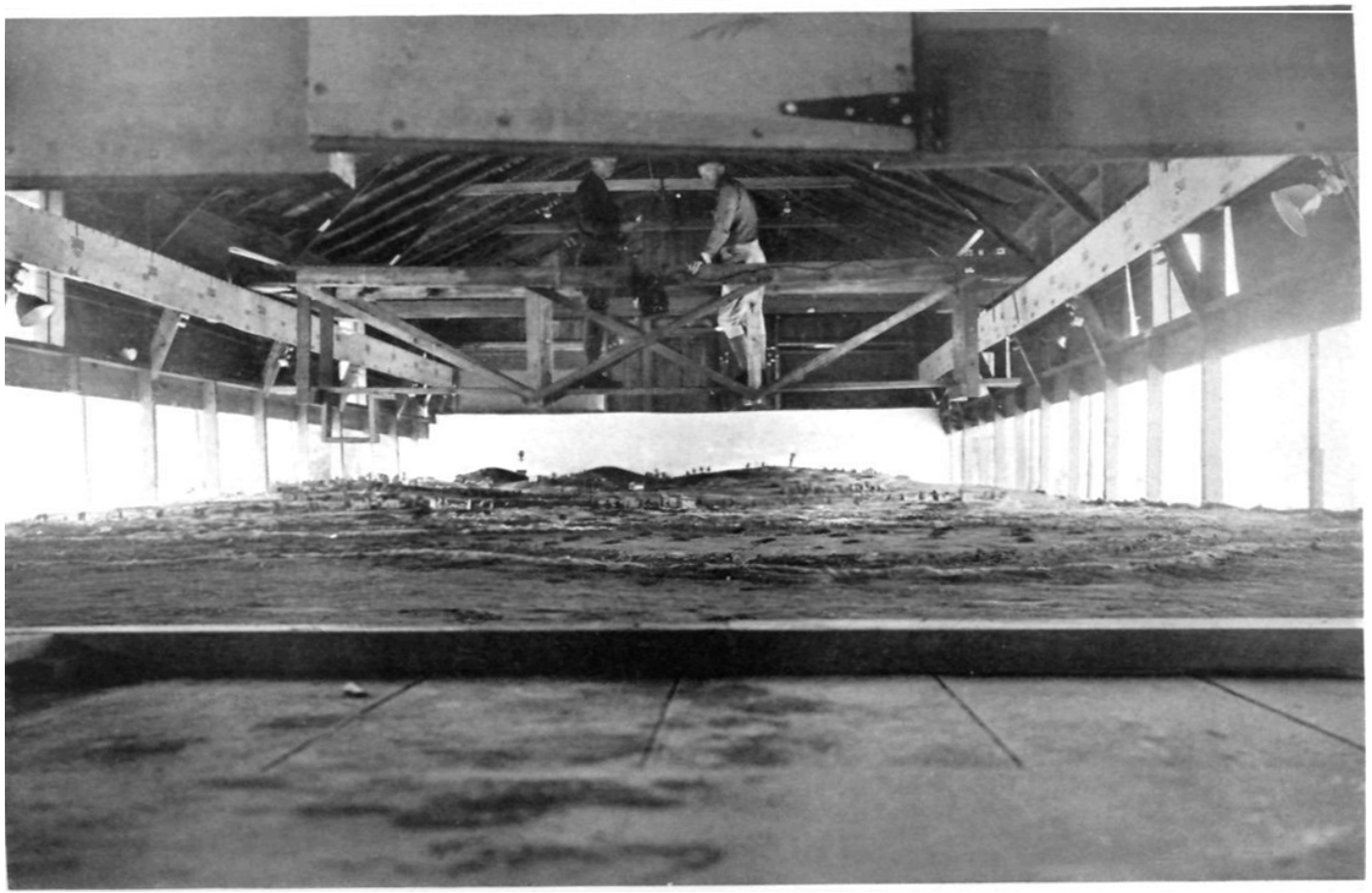
The detailed construction of the bridge and its appurtenances is shown in Fig. 2 and in photographs Nos. 5, 6 and 7.

The frame (A) is built to span the width of the terrain, and is fitted with wheels rolling on the side rails (I) fastened to the sides of the building. The range scale (B) is suitably graduated and nailed to these side rails. A pointer (D) is set at a distance equal to four field probable errors from the rear gauge (g). A slat or ruler (G) on which the field probable errors in range are marked off to scale in metres, at the range and for the projectile and charge specified, is operated across the space between the gauges (F). A variable deflection scale (C) is set transversely across the bridge.

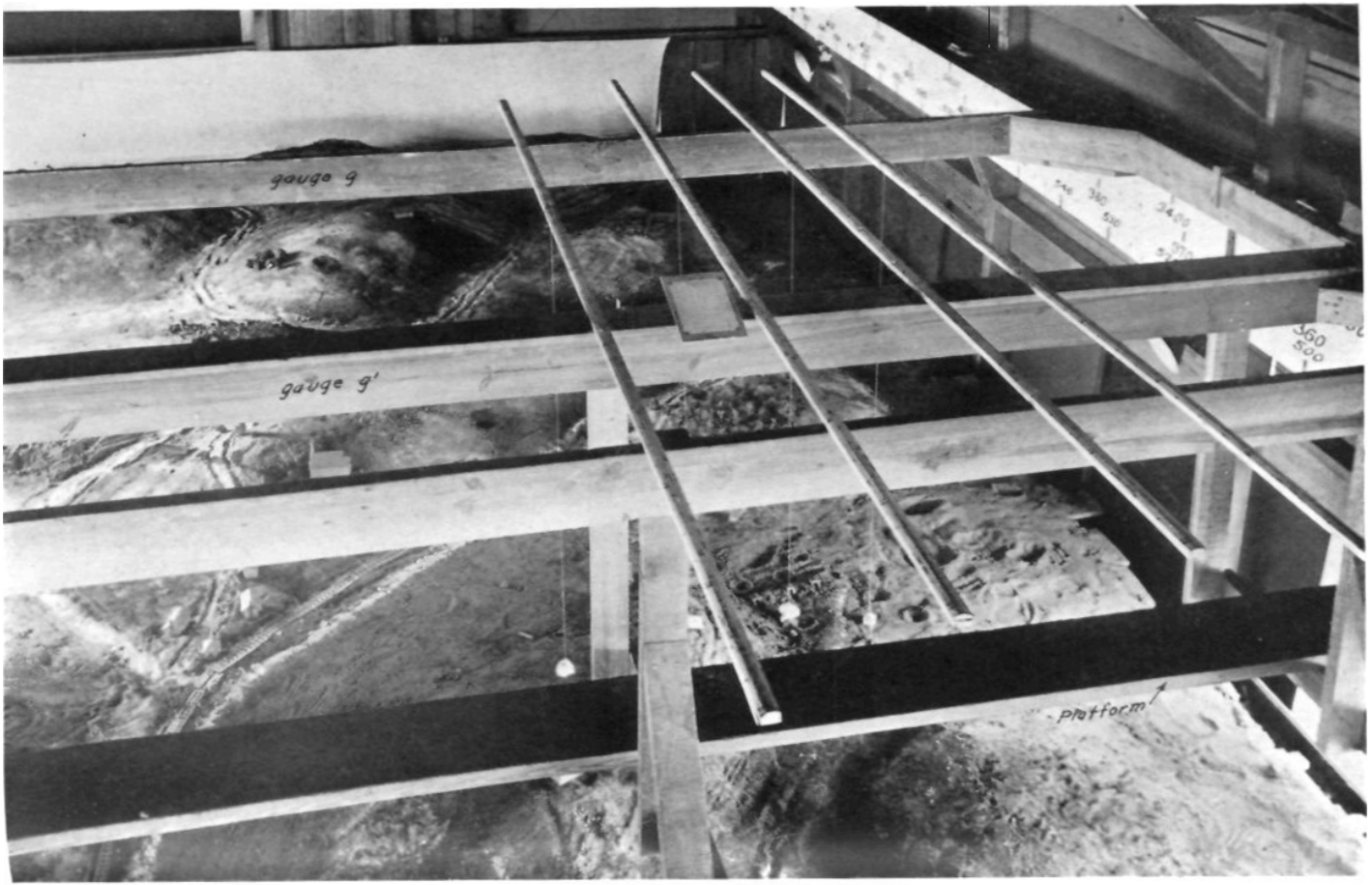
A set of four rulers is prepared for each charge and projectile intended to be used. A moulding of the section shown in Fig. 3 permits the probable errors for each charge and projectile to be measured off in three different sizes so as to take care of the varying size of the zones of dispersion at different ranges. The top of the ruler has three sides, on each side of which is a special graduation in probable errors, one used for ranges 2400 to 3000, another from 3000 to 3500, and the third from 3500 to 4000. Each scale is exact for the mean elevation of each group of ranges. The amount of probable error of the



PHOTOGRAPH 4



PHOTOGRAPH 5



PHOTOGRAPH 6

PHOTOGRAPH 7

round is determined by taking a marble out of a sack at random. This sack contains 100 marbles numbered 0, or –¼, or –½, or –¾, or –1, etc., up to –4, and the corresponding numbered plus errors. Each number represents the amount of field probable errors of the round. The number of marbles bearing a given figure can be easily calculated, as the scale of dispersion is known. The ruler is divided into 8 probable errors.

The wire clips (A) and (C) are simply handy contrivances for tripping and guiding the line suspending the burst. By moving the anchor clip (D) along the slot toward either end the height at which the "burst" will be stopped above the terrain may be regulated, thus simulating the manipulation of the corrector for air bursts. The zero point (or correcter 30) in this operation will be different, of course, for points on the terrain differing in altitude.

The ball of cotton is attached to a string fixed at point D, running through a trigger clip A-B and from there to a guide C. To fire a burst, the trigger clip A is released. The ball is given weight by lead shot sewn in it.

The deflection scale (C in Fig. 2) is graduated to show the average measure of mils in metres between certain ranges in a manner similar to that employed in measuring probable errors on the rulers. The scale is fixed on the setting wheel D. Four graduations in mils are set off along the scale, one on each side. The same scale is used between two ranges differing by 400 metres. The terrain runs from 2400 to 4000, for example. The same scale is used between 2400 and 2800, graduated in mils for the mean range 2600. When the carriage arrives at 2800, a stop automatically turns the setting wheel D and a new face is presented, giving the graduations in mils for the next 400 metres. We have then a systematic error in deflection, calculation of which proves it to be negligible.

The guages g and g′ are striped in colors in order to facilitate the movement of the rulers perpendicular to them. In order that the pointer D may always be 4 probable errors from the guage g′, a setting wheel (not represented in Fig 2) is

fixed on the pointer and operates in the same manner as the setting wheel of the deflection scale. A systematic error is then made because of the assumption that the probable errors are the same between certain limits. As above, calculation proves this negligible.

Photograph No. 8 shows map used for "map firing" on miniature ranges. The terrains are constructed exactly to scale, both as to planimetry and altimetry, in accordance with the map.

OPERATION

Range: For instance, command 3400 is given. The operator moves the carriage until the pointer is opposite 3400. As there are several scales along the terrain (range, range setting, different charges, etc.), a special pointer may be placed for each different case, a distinctive color being used.

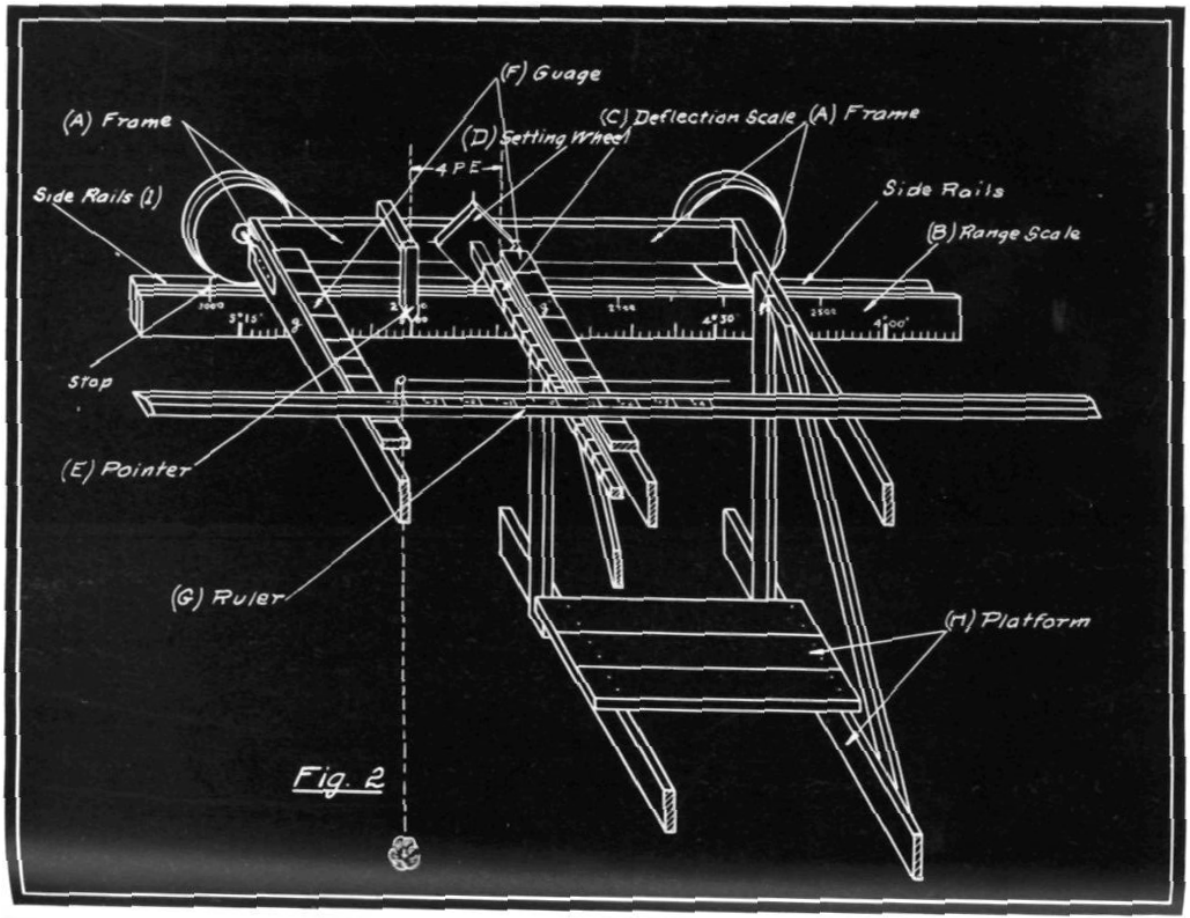
Assuming that there is no dispersion, the line running through the pointer perpendicular to the ruler will be on the desired range.

Deflection: At the command: "Right 20, on No. 1, open 5," the operator moves all rulers in accordance with the command, and draws a marble for each gun from the sack, sets the scale of the rulers so that the figures corresponding to the numbers on the marbles are at the gauge g′, trips the trigger clips in the order required, and the cotton balls appear on the terrain dispersed according to the commands and probabilities indicated.

The dispersion in deflection has been found to be less than that caused by the displacement of the ball of cotton in dropping to the terrain. Hence, it is practically negligible.

CONCLUSION

It is readily appreciated that a great variety of problems may be employed, and that telephonists, recorders, observers, and instrument operators may receive training at the same time and in coördination with the instruction in conduct of fire.


(F) Guage
(A) Frame
(C) Deflection Scale
(A) Frame
(D) Setting Wheel
4 P E
Side Rails (1)
Side Rails
(B) Range Scale
Stop
(E) Pointer
(G) Ruler
(H) Platform
Fig. 2

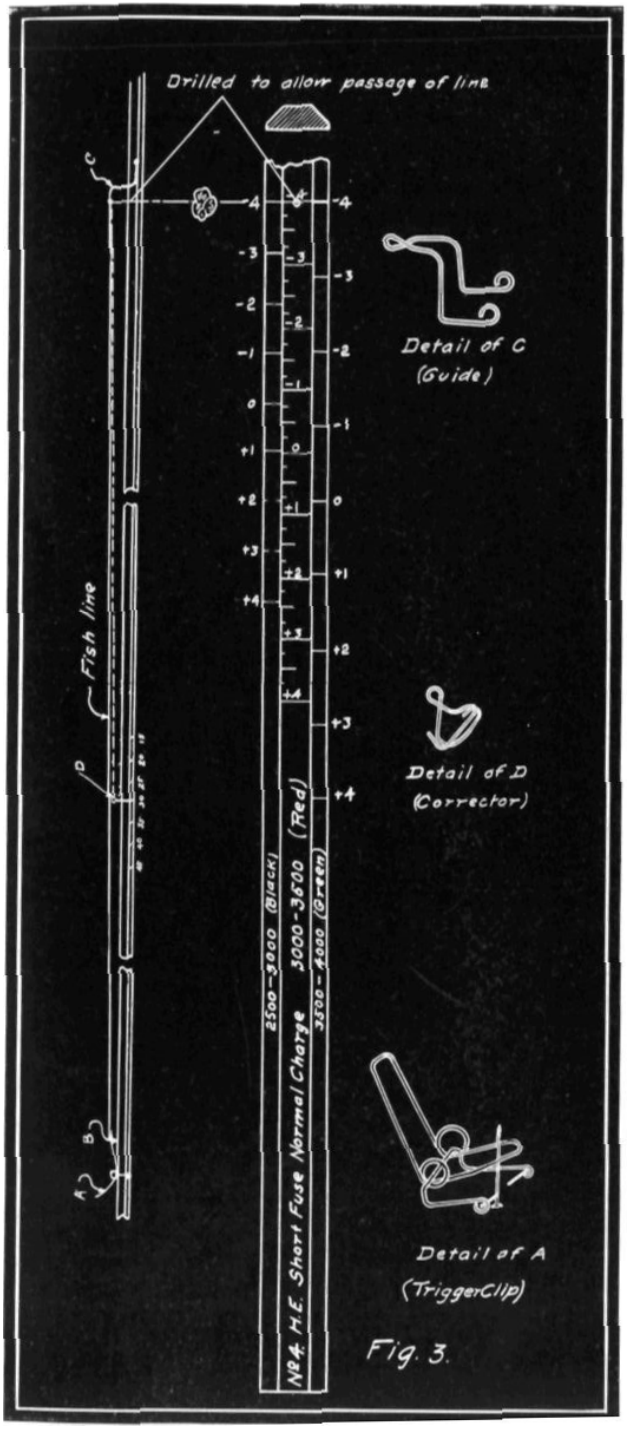
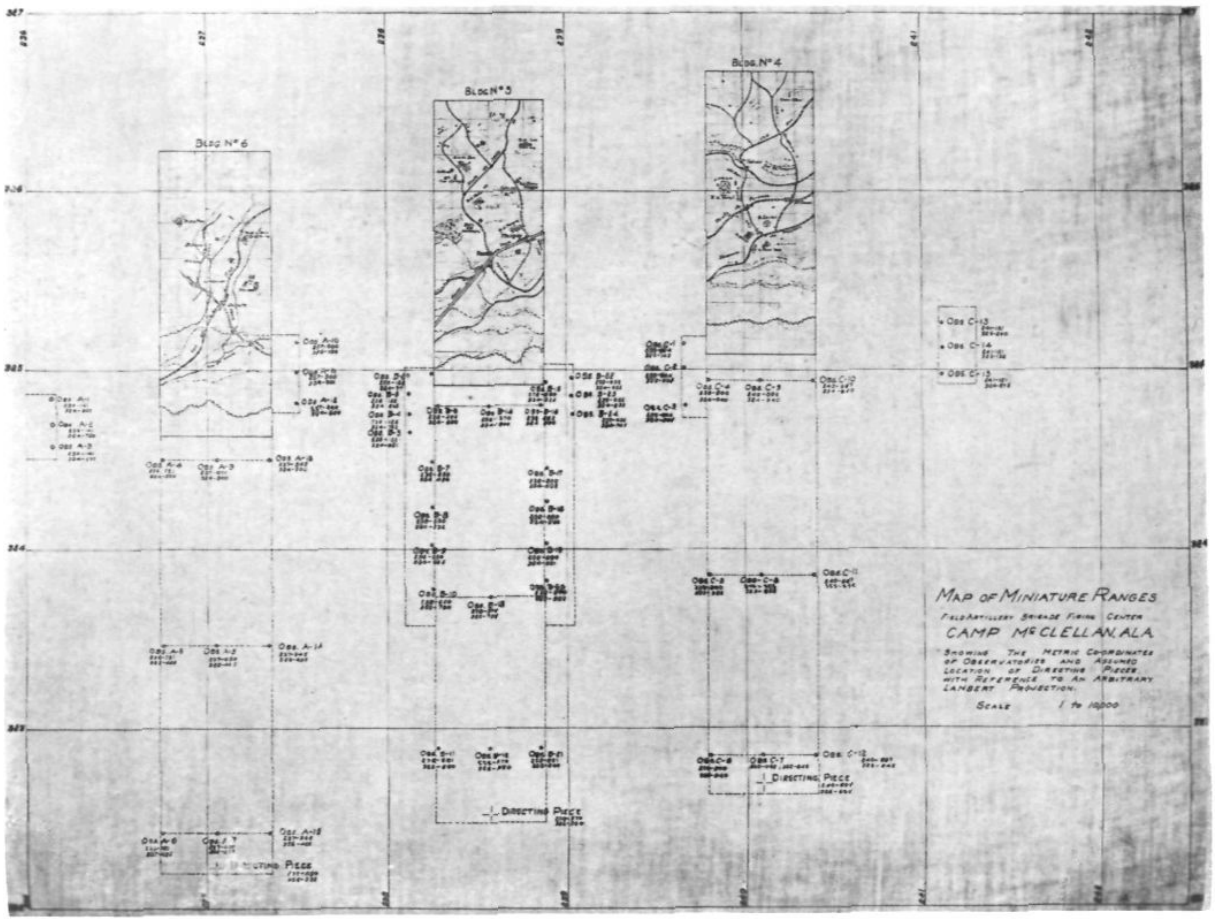

Drilled to allow passage of line
C
-4
-3
-2
-1
0
+1
+2
+3
+4
Fish line
D
B
A
2500-3000 (Black)
3000-3600 (Red)
3500-4000 (Green)
No4. H.E. Short Fuse Normal Charge
Detail of C
(Guide)
Detail of D
(Corrector)
Detail of A
(TriggerClip)

Fig. 3.



PHOTOGRAPH 8.

Problems involving corrections of the moment, transport of fire and calibration can be successfully undertaken in connection with firing from the map. Students are given the coördinates of the auxiliary target, eventual target, O. P. and directing plane, in connection with certain meteorological data. They are then required to prepare the fire on the plane table, obtain adjustment on the auxiliary target, and execute a transport of fire. In order to better illustrate actual conditions in such problems, the coördinates of the points are altered to fit the changes resulting from the meteorological assumptions. The same methods are employed with problems in calibration by simply adding or subtracting a prearranged amount from range commands for each gun; thus the field gun ranges after adjustment would differ by the amount added or deducted and actual possibilities of calibration simulated.

Employed at the Field Artillery Brigade Firing Centre, Camp McClellan, in the most business-like way, untrained officers, after one month of daily training on the miniature range, proved most satisfactory in actual target practice.

Plan of Defense of a Divisional Sector

(Translation of a German Document, August 30, 1918.)

A document, entitled "Orders for the Conduct of Battle in the Defensive," has been received. It is dated July 31, 1918, and was issued by the —— German Division. It is an exposition of the defensive measures taken by this division, which held the sector south of M——, to repulse a French attack. These measures are presented as the result of the lessons of recent great battles. They are based on memoranda of the ——th Army, dated July 20, and of the ——th Army Corps, dated July 24; they therefore represent the present ideas of the German Command.

I. Organization of the Positions

1. The units responsible for this organization are:

For the outpost zone, the infantry regiments in their sector, the artillery commander for the batteries and observatories.

For the battle zone (*Grosskampfzone*), the division (commander of pioneers and the artillery munitions officer for artillery works).

For the rear combat zone (*Hinterkampfzone*), the army corps.

2. The necessity for properly established P. C.'s.

3. *Infantry*.—First of all, the organization of the principal line of resistance, and the zones of depth connected to it by machine-gun nests (dug-outs and wire entanglements). First, continuous wiring and then connected trenches. Irregular distribution of machine guns in the zone of depth. Reciprocal flanking.

For each regimental sector, at least one approach to the principal line of resistance, protected from ground and balloon observation.

In the outpost zone, numerous strong points with wire entanglements. Utilization of shell holes.

4. *Artillery*.—The most important requisite is the establishment of observatories. The observatories for each sub-group will always be occupied by an officer. For each battery, a principal observatory, constantly to be occupied by an officer; there will always be an observatory near the battery; auxiliary observatories if necessary. All calculations for each battery must be prepared. The gun emplacements must permit an arc of fire of at least 120 degrees. Ammunition must be carefully protected.

All batteries must be surrounded by wire entanglements and must be organized for close fighting. Anti-aircraft machine guns and grenades. Demolition charges for all batteries of the outpost zone.

II. OCCUPATION

A. *Infantry*.—1. Combat battalion, support battalion, reserve battalion.

2. The first-mentioned two battalions are écheloned as follows:

(a) Outpost zone.—Advance posts, which may be composed of as many as two companies, under one commander.

(b) Principal line of resistance—three companies.

(c) Directly behind the principal line of resistance, for the counterattack—one to two companies.

(d) In and behind the principal line of resistance and in the zone of depth—two machine gun companies.

(e) Security garrison on the line of artillery protection—one company.

(f) Zone of depth in rear of the advance zone—one company for the divisional sector.

(g) Security garrison on the line of resistance of the battle zone—one company and two heavy machine-gun companies, besides one marksman M. G. company and the unassigned company.

3. For combat liaison with the division on the right, the regiment on the right will furnish one company (*Nahtkompagnie*).* Contact with the division on the left is assured by one company of that division.

4. The machine guns of the two advanced battalions, reinforced by the machine guns of position, must be écheloned in depth both on the principal line of resistance and in its rear. Seek to obtain dominating positions and flanking effect.

5. All minenwerfer must be so placed in the zone of depth of the advanced zone that they can execute barrage fire or fire of destruction in front of the principal line of resistance.

6. The reserve battalions are in rest billets. In case of alarm they will be brought up.

B. *Artillery*.—1. The close-combat grouping and the long-range combat grouping. The close-combat grouping is divided into three subgroups, each one of which is charged with the protection of an infantry regiment. The commander of the sub-group is with the regimental commander.

2. The mass of the batteries are behind the principal line of resistance of the battle zone. The surveillance batteries of the outpost zone

* Seam or connecting company.

are in the zone of depth in the rear of the advanced zone. The antitank guns and the close-combat guns are in position immediately behind the principal line of resistance of the advanced zone. For special purposes, certain batteries may be moved forward for a certain period. Use must be made of alternative positions, to which, in order to deceive the enemy, one gun or section will be assigned.

3. The mobile artillery reserves of the army corps are composed of three light batteries and one heavy battery.

III. ARTILLERY PROTECTION

1. Good observation, particularly of the ground in front of the line of resistance, is a basic requisite.

2. The surest means of defense is fire of destruction that is well directed and launched at the right moment. It is very important that every officer and non-commissioned officer should realize that fire of destruction must be launched at the enemy *before* his attack, and not a barrage *at the moment* of attack.

A severe bombardment which presages preparations for attack must be answered by rafales of annihilating fire. This fire must be directed by observation as much as possible. But as the enemy's departure positions more often than not are invisible, and as the arrival of troops in these positions always takes place at night, blind fire is inevitable.

There is a distinction between:

(a) Fire of destruction on the entire front.

(b) Fire of destruction, Roon, Friedrich, Doenhoff, which is concentrated before the front of one regiment.

Only officers may request such fire, and this by means of rockets, wireless, ground telegraphy and the telephone.

The annihilating fire lasts for ten minutes.

3. If we have not succeeded in breaking up the enemy's attack during its preparation, or if the attack is unexpectedly launched, barrage fire may be used. The barrage is placed on the edge of the outpost zone. With the means at our disposal it is not possible to distribute the barrage equally along the entire front. At sensitive points and on those which cannot be covered by the infantry it should be dense (two hundred metres per battery). On the remainder of the front it may be less dense; there the defense must be the task of infantry weapons: light and heavy machine guns and light minenwerfer.

4. As soon as the enemy has penetrated into the outpost zone he must be taken under annihilating fire. This is done by the surveillance batteries of the outpost zone. Each battery is responsible for one sector

in this zone. The choice of observatories is here of controlling importance.

5. Great care must be exercised in bringing back the barrage from the forward edge of the outpost zone to the principal line of resistance, in order to avoid endangering our own infantry. At first the barrage is placed on the forward edge of the outpost zone. When it is again requested, the third rafale is automatically put down in front of the barrier line (*Rueckhaltlinie*)* of the outpost zone. A greater shortening of the barrage is done in one shift and only by order. This order is given by the P. C. of the combat (front line) battalion (K. T. K.), which should be able to overlook the outpost zone.

As light signals may easily be mistaken, do not use them in asking for the shortening of the barrage until all other means (telephone, wireless, ground telegraphy, visual signal) have been exhausted.

IV. TWO DEGREES OF READINESS

1. *Battle Readiness*.—As soon as indications of a hostile attack are noticed, the battle alarm is given (*erhoehte Gefechtbereitschaft*). This order may be given by any unit commander (including a company commander) in his own sector; he informs his immediate superior and also the neighboring companies.

The following measures are taken when the battle alarm is given:

(a) The combat battalions and the support battalions are held in readiness for battle. Special-duty men take to arms.

(b) All observers are at their observation posts.

(c) Work ceases in the battle zone.

(d) Men temporarily detached rejoin their units.

(e) Troops at rest get ready; wagons are loaded; horses are saddled and harnessed, but not hooked up; telephones are manned by officers.

(f) All means of liaison are verified.

2. *Attack Readiness*.—When an attack seems imminent, the division may order the "attack alarm." This alarm (*Angriffsbereitschaft*) calls for the following measures:

(a) Resting battalions are brought up behind their regimental sector on the principal line of resistance of the battle zone.

(b) The unassigned companies will take position in the principal line of resistance of the battle zone.

(c) The limbers of batteries in front of the principal line of resistance of the battle zone must be sent forward to positions previously reconnoitred, so as to be at hand in case a change of position is necessary.

* Support line.

V. CONDUCT OF BATTLE

1. The first requisite is that everyone must know exactly what he is to do; this cannot be overemphasized.

Close and permanent co-operation between the artillery and the infantry is indispensable. Artillery officers must know the advanced infantry positions through personal observation; infantry officers must be minutely informed as to the location of the batteries and observatories, as well as the plan of artillery fire in their sector.

Every commander must know what observatories cover his sector.

Full value from the observations made by all agencies of the information service can only be derived by immediate transmission.

2. The division must hold the principal line of resistance of the outpost zone.

3. A deep outpost zone has the following advantages:

(a) The enemy will have a large distance to cover before reaching our principal line of resistance, during which he is under the combined fire of our artillery, machine guns and minenwerfer.

(b) The losses caused by the enemy's fire of preparation are decreased.

4. Troops in the outpost zone must make reconnaissances and repulse hostile patrols; they withdraw in case of an attack.

5. Our patrols must dominate the ground in front of the outpost zone. Prussian infantry superiority must always manifest itself, even during quiet periods; prisoners must be taken.

6. Patrols and advanced posts must positively withdraw in case of an attack, at the same time asking for barrage fire; if only a hostile raid develops it will be repulsed at the barrier line of the outpost zone.

If the attack is more serious, the garrison will retire fighting to the principal line of resistance. Support from the rear must not be counted on. When it is known that the enemy is going to attack, the division may order the methodical evacuation of the outpost zone.

7. The withdrawal of outpost troops behind the —— stream must be carefully prepared. Crossings will be prepared and everyone informed of their location. Points of support for the rear guards must be arranged for.

8. Each element which withdraws must inform the neighboring elements in time, so that they may likewise withdraw or protect their flanks by échelonment.

9. As soon as the enemy is repulsed, or has ceased to pursue, contact must be regained by means of strong patrols, and, if possible, the outpost zone must be retaken.

If the enemy is definitely established in the outpost zone, the division will decide what must be done.

10. If everyone has carried out his mission, and if in particular the annihilating fire has been well directed, the enemy will not reach the principal line of resistance without having suffered crushing losses.

In the struggle for the principal line of resistance the artillery, the close-combat weapons, the machine guns and the minenwerfer must be used to their maximum efficiency.

In case the enemy succeeds in breaking through portions of the principal line of resistance, a counter-attack will immediately be launched with all available units, while the artillery and machine guns check the hostile attack.

11. All enemy attacks must be checked in the zone of depth of the machine guns (intermediate zone), at the latest. At this moment of enemy weakness a successful counter-attack is generally feasible. A well-led squad may obtain a great success. But the counter-attack must be made immediately. If the enemy has had time to organize, a methodical counter-preparation ordered by the division will be necessary. Counter-attacks which are launched too late are doomed to failure. They are forbidden.

Security garrisons will not take part in the counter-attacks.

12. The sudden appearance of a great number of tanks must be reckoned with. Artillery groups and sub-groups are charged with immediately combating them in the zones which have been assigned to them. The defense is further aided by anti-tank weapons, light minenwerfer with carriage for flat-trajectory fire and machine guns with S. M. K. ammunition; keep reinforced grenade charges in readiness.

The crossing of the —— can only be accomplished by means of foot-bridges.

VI. SPECIAL DISPOSITIONS

1. *Fog Alarm*.—In foggy or murky weather this alarm should be given by every first-line commander down to the company commander. Inform immediate superior and neighboring units.

The occupation will be strengthened. Special posts with signal horn will be installed. Special alert for all T. S. posts.

The request for barrage will be made by horns and by violent rifle and machine-gun fire.

2. *Gas Alarm*.—In the gas alert zone everyone must always have his mask with him.

Horses must carry their masks attached to their harness. Those which have no mask must have a sack filled with moss or wet shavings around the neck.

Notes on 155-mm. Howitzer Matériel

By FIRST LIEUTENANT MILTON HARRIS, 9TH FIELD ARTILLERY, U. S. ARMY.

OF all the varied artillery employed in this war, there is one gun of undoubted interest to the American artilleryman; and that is the famous French 155-mm howitzer (Schnieder). Its fame is justly won, for its long life, accuracy, and splendid recoil system have led to its complete adoption by the United States Army as the premier medium heavy howitzer.

We will assume that our reader is familiar in a general way with this piece; for ready reference he is directed to Document No. 1851, Government Printing Office. Herein will be found a translation of the French 155 handbook and some splendid drawings of the gun and carriage. However, every piece of machinery has its peculiarities, familiarity with which makes for better and more accurate handling. It is the purpose of these notes to assist in gaining an insight into the practical use of items about this piece that are not found detailed in drill regulations nor in handbooks.

We will first turn to the carriage. We find that the wheels are made of smaller members than those that we are accustomed to see in our own matériel. It must be remembered, however, that the French designed their wheels for much better roads than ours; and, in comparison with our matériel throughout, this fact must be borne in mind. The wheels must be carefully watched, especially through the dry weather, for they tend to check and crack. Remedies are tire shrinking and soaking in water over night, followed by a thorough and careful application of linseed oil. Fast travel, as when the piece is coupled to a truck, must be avoided if the life of the carriage is to be assured.

To dismount the tube from the recoil mechanism, or sledge as it is denoted, a suitably strong overhead beam is selected and the carriage run beneath it. Mount two one-ton duplex blocks

on the beam over either end of the tube and thread the bore with a half-inch wire cable sling, in such a manner so as to leave a bight at both muzzle and breech ends. Into these loops the hooks of the blocks catch. Gunny sacks form a suitable packing at the muzzle and breech to prevent the cable damaging these parts of the tube. Provide several blocks of two by four or four by four stuff, to block up the sledge as it is moved to the rear—as we shall soon see that it does. Remove the locking hoop by knocking out the retaining bolts, and also remove the cradle bolts from their housings on the cradle. This will allow the sledge to move to the rear of the cradle. Take a strain on the blocks and carefully move the sledge back over the trail until the recoil lug key (locking the recoil lug to the sledge) clears the end of the cradle. Remove the set screw from the bottom of the sledge which locks the tapered key in place, and proceed to drive the key out with a sledge hammer and a block of wood. During this operation the rear of the sledge must be blocked up on the trail in order to take the strain off of the cradle rails. After the key is cleared, the tube may be raised by means of the two blocks, care being taken to make the lift vertical, otherwise the slots and grooves just in front of the breech will jam and be damaged. Remove the carriage and lower the tube on to blocks. The process of mounting is just the reverse of the above.

The elevating and traversing mechanism gives little trouble, if all gear cases are kept packed in grease. It is extremely important that, in laying for elevation with this piece, the final turns of the handwheel should bring the gun into correct position by raising the breech and *not* by lowering it. In this way all backlash is taken out of the gearing and the howitzer rests solidly for firing. The gunner may easily be taught to remember this by always having him bring the range bubble to the *front* of the glass and then slowly elevate the breech, bringing the bubble *to* him.

The traversing mechanism moves the whole carriage, including gun, along the axle, about the spade as the centre of rotation.

The traversing screw moves the carriage by being rotated through a nut set solidly in the axle. The axle and nut are stationary and the screw moves laterally by means of the traversing handwheel. Hence the carriage, being attached to the screw, must move when the screw moves. Inasmuch as the axle is straight, it must accommodate itself to the arc of the circle described about the spade as the centre. It does so by moving tangent to the arc, and consequently one end moves to the front and the other end moves to the rear, carrying the wheels with them. From this it will be seen that before attempting to traverse the piece, the brake must be "off." The movement of the wheels may be easily seen, if a pencil line be drawn across the tire just above the brake shoe and then the piece traversed. The line will be seen either to raise or lower according to whether the piece be traversed to the right or left.

According to the French drill of the gun squads, in going into action, the piece is first unlimbered and the trail is then laid on the ground, and the cannoneers change posts to the extent of the gunner going to his position by his sight; while the remaining cannoneers lift the trail again and set the spade. This is slow and cumbersome work. Much better results may be obtained by setting the spade at the time that the piece is unlimbered, without moving the cannoneers from their posts.

Taking up the recoil system of this piece, we come to one of its main features. While not taking up the actual operation of the recoil, we will give several practical "kinks" that will help in caring for this feature. The executive should be perfectly familiar with the working of the recoil and know when to put a gun out of action due to faulty recoil. The length of the recoil should be such that the end of the gun slides do not recoil over the end of the cradle rails. In counter-recoil, the sledge should be perceptibly slowed down at a point about ten centimetres from the front of the cradle, and from there on should ease gently into battery without a sound or shock. Strict watch should be kept to see that no excessive leakage takes place through the stuffing-boxes, the valve in the

gauge adapter, or the oil hole in the cylinder end nut. Slight leakage can hardly be helped, as one of the stuffing-boxes is under more than four hundred pounds pressure per square inch when the gun is at rest, and three or four times that amount when the gun is in full recoil. However, if a pool of liquid is found after the gun has been standing all night, it is time to report the matter and have the packings replaced. The gun must be dismounted, the stuffing-box repacked, and the dermatine inspected. The dermatine packing is a compound resembling rubber, but it has the quality of resisting any chemical action that the liquid may set up in the recuperator. A worn dermatine packing may be replaced by the simple expedient of turning it wrong side out and then using it again as before. This has actually been tried and found to give good results. Another temporary repair was effected by cutting a ring from a solid truck tire and using it in the place of the dermatine, until a packing of the latter could be obtained.

The French obtain a very tight fit in their stuffing-boxes by the peculiar design that allows the liquid pressure to actuate a strong spring which in turn expands the packing against the rod or cylinder wall, making an exceedingly tight fit. Leakage through the recuperator stuffing-box will be noticed by the liquid coming out of the oil hole in the right-hand cylinder end nut.

In dismounting French matériel, care must be used to replace the same nuts on the bolts from which they were taken. Threads are not standardized as to diameter; hence, trouble is likely to occur when remounting.

In filling the "brake" or recoil cylinder, good results have been obtained by merely levelling the gun and filling the brake cylinder until full. Trying to pour out one hundred cubic centimetres of the liquid, after the brake is full, as the French drill regulations lay down, is almost impossible; and no bad effects will be noticed provided the gun does not become excessively warm during the firing. If it should become warmed

up sufficiently to affect the recoil, level the gun, unscrew filling plug to release the pressure, rescrew, and continue the fire. In using the manometer gauge, to measure the pressure and height of liquid in the recuperator, it will be found that the valve in the gauge adapter will sometimes stick open to the extent of letting out all the air in the recuperator tanks. The only sure remedy for this is entirely to dismount the gun, remove the adapter, and replace its valve packing, which no doubt will be found to be worn and frayed, or else some foreign substance will be discovered lying between it and its seat. The gauges should be tested about once in three months by means of a standard steam gauge testing apparatus, making the appropriate transformations if the tester be graduated to pounds per square inch as most steam gauge testers are. It will be found that the maximum steam pressures used are rather lower than these gauges read, hence only the lower readings may ordinarily be tested.

To set the pointer to the correct pressure reading, pull the pointer loose and apply a known pressure to the gauge. Set the pointer at the corresponding reading on the manometer and press it on tightly. In general, this is sufficient for practical work.

Taking up the breech of the 155 howitzer, we find here a simple mechanism much resembling our own coast artillery block. After each firing this breech block should be entirely dismounted and each part washed in a caustic soda solution and then stippled with oil before reassembling.

The primer sledge ordinarily furnished is fitted for percussion primers; but, if the old-time friction primers are issued for use, a special form of primer sledge must be made and a bushing be provided for the vent tube of such a size as to take the smaller diametered friction primer. The best bushings may be made from an old percussion primer case, drilled out to receive the friction primers. The gun mechanic may easily make this sledge and bushing.

The French are no doubt a bit ahead of us in the matter of cleaning matériel, going to extremes that appear unnecessary to us. However, the prolongation of the life of their gun more than repays for the extra work. *We* clean *our* matériel like we clean a stable—merely brush it out; whereas the French take that care of their matériel that we would bestow on a telescope. Herein lies, in good part, the superiority in the action of their matériel, combined with careful hand-fitted machine work on all moving parts.

German Artillery

BATTERIES OF INFANTRY GUNS

A Ludendorff instruction concerning batteries of infantry guns has recently fallen into our hands. A complete translation of the document is given below, but attention is called to the following points:

1. Batteries of infantry guns, in spite of their name, do not form special accompanying matériel of infantry belonging to the infantry like the light minenwerfers or like our accompanying 37-mm. guns and mortars.

They are made up of available matériel of different types (7.7 cm. on low wheels, 7.62 cm. Russian, 7.7 cm. or 7.5 cm. mountain guns, 5.7 cm. naval guns).

Their numbers are not high. Up to now no battery number above 45 has been identified.

It is also to be noted that in several documents the use, as infantry batteries, of ordinary 77-mm. batteries, divided into sections or pieces, is advocated.

2. Infantry guns are used in the course of an engagement only to lend close support to the infantry, to overcome local resistance, and to put hostile tanks out of action. They are returned to the rear after the combat. In short, they are used for the same purpose as our tanks. But it is evident that they are much inferior to the tanks as an accompanying arm of the infantry.

The German infantry gun furnishes an indifferent solution of the problem of accompanying artillery, as it is necessarily difficult to move by hand and to keep it supplied with ammunition because of the weight of the latter. It is also very vulnerable, because it has to occupy emplacements in the combat zone of the infantry that are completely exposed or offer little protection.

REGULATIONS FOR THE INSTRUCTION OF BATTERIES OF INFANTRY GUNS

(Translation of a German Document)

Chief of the General Staff of the ——th General Headquarters,
Army in the Field. July —, 1918.

In General

In contrast to the artillery, which fires from a considerable distance, batteries of infantry guns are used, like accompanying infantry batteries, in close and personal liaison with the infantry on the terrain.* They produce thus a considerable material and moral effect.

Accompanying batteries are indispensable to the attack, both at moment of changing from a war of position to a war of movement and in the latter. For a fixed position of defense they have little value, but they can be usefully employed in a mobile and aggressive defense.

Organization

Batteries of infantry guns are special mobile batteries, assigned according to need, to infantry regiments for mixed missions—for example, for an offensive or a raid. The assignment must be made soon enough so that the battery of infantry guns can be in close touch with its infantry and take part in the preparations. In order to reconstitute and train the batteries of infantry guns, they will be sent from time to time to their centres of instruction.

Principles for the Employment of these Batteries

(1) Missions.—The infantry guns must engage at short range the enemy with whom the infantry is fighting at close

* In addition to the batteries of infantry guns, a certain number of field artillery batteries (especially field guns, F.K. 96 n/A) receive instruction in the divisions as batteries for accompanying infantry. For their tactical use the same principles apply as for the batteries of infantry guns.

The expression, shock battery (*Stossbatterie*), will no longer be used. It is not necessary to give a special name to artillery (apart from accompanying batteries), which in some circumstances is put under the orders of the infantry for distant fighting (*Fernkanpf*).

quarters. By reason of their proximity to the infantry, they can more easily than the artillery in the rear be fired at the right moment and on the right target. Also, being at close range, they can fire on the objectives which cannot be observed from the rear. Finally, as the dispersion at short range is slight, they can fire at close proximity to their own infantry, and even often fire by placing themselves in the spaces left between isolated groups. Particular attention must be paid to the following: To gain success, the deciding factor is not the number of rounds fired, but the accuracy of each one, and, in an attack, the immediate advantage taken by the infantry of the results obtained by the guns. The machine guns and tanks are nearly always the most important targets for infantry guns. The training must be conducted with this especially in view. Other objectives: enemy snipers in open country or in prepared positions; nearby combat artillery and trench mortars; troops in reserve near the first lines. More distant targets—for example, the enemy artillery—will be fired on by the infantry guns only in exceptional cases.

The infantry guns will be rarely used as a complete battery. As a general rule, single pieces or sections will be assigned to battalions by the commanding officer of the infantry regiment, or sent out on fixed missions under orders of the regimental commander.

(2) Mobility—Positions.—Mobility is the principle to be chiefly considered in the use of infantry guns. There is never a question of a fixed position prepared for a given time.

There will be frequent drilling in obtaining mobility on broken ground, moving the guns by hand, utilization of the terrain for moving the pieces and going into position, reconnaissance, and in rapid and careful occupation of protected or open positions.

To hesitate in the course of operations, even where a certain prudence is permissible, is a fault. A prompt, bold decision generally avoids loss and brings success.

Often in the course of a combat it is quite possible to place a

battery well out in the open without much danger; it is often necessary to do this to obtain quick results.

Always, wherever it is possible, seek for protection, at least against aërial observation.

The most favorable positions are those immediately in rear of coverts (positions at the edge of woods), which allow the gunner standing on the trail to give the direction of the target or of an auxiliary target situated in front. Another advantage is that the piece can be quickly drawn into the open to deliver direct fire against tanks or other mobile objectives.

It is exceptional to place infantry guns at a position protected against the fire of small and medium calibres. It is, however, important to protect them as quickly as possible against the observation of airplanes, balloons and terrestrial observation posts.

(3) Opening of Fire—Method of Fire.—Infantry guns are easily observed by the enemy. In consequence, unless they are established in a chosen position (paragraph 5), it is of the first importance to open fire rapidly, and to deliver effective fire as quickly as possible.

Fire by the whole battery is exceptional; for the most part, platoons or single pieces will fire.

Frequent training must be given in firing at small targets (machine guns, in quick observation, and in the bringing under fire objectives that appear suddenly (tanks). Only in exceptional cases will the infantry have to deliver harassing fire, zone barrage fire, and fire by night.

(4) Ammunition.—The following ammunition can be employed with good effect by the infantry guns:

(a) Explosive shell (*Brisanzgranate*), very effective, can be fired with delayed-action fuses (M. V.) or instantaneous fuses (E. K.).

The delayed-action fuse is used whenever it is wished to obtain by ricochet an effect similar to that of a time-fuse shell (*Bz.*) against open targets, such as tanks, house walls, etc.;

against objectives which have a particularly high resisting power, armor-piercing shell (*Panzerkopf*) is to be used.

Ricochets are obtained under certain conditions (great remaining velocity, slight angle of fall, favorable terrain at the point of fall). In all other cases use the instantaneous fuse (E. Z.).

At the present time a fuse is being perfected which can be used either as an instantaneous fuse or as a delayed-action fuse.

Time fuses for explosive fire, as well as shrapnel, must be given up, so as not to complicate the supply of ammunition.

(b) Blue-Cross explosive shell (*Blaukreuzbrisanzgeschoss*).

The bursting of shells which are merely explosives and of small calibre, except in the case of a direct hit, often does not have sufficient moral and material effect to force the enemy even to entrench. The cloud of Blue-Cross gas which forms in the neighborhood of the objective can put the enemy out of action, or at least force him to wear his mask. In addition, the Blue-Cross shells have serious destructive effects. At present there exist supplies of Blue-Cross shells only for the 77's (F. K. 96 n/A).

(c) Smoke-producing shells will soon be put in service. Their purpose is momentarily to blind the enemy and to facilitate the progress of our infantry, thus hidden from the enemy's observation.

The proportion to be used of each one of these shells will be decided by the mission in battle and the nature of the terrain. No fixed allowance of each will be prescribed.

In general, it is the division which has the responsibility of seeing that a sufficient quantity of ammunition is provided (assignments of supplementary transportation, ammunition depots).

(5) Liaison with the Infantry.—The work of the batteries of infantry guns depends on their close coöperation with the infantry. That is why these batteries are under the orders not of the artillery commander, but of the commander of the infantry regiment.

The regimental infantry commander, or in certain cases the battalion commander, gives to the battery its mission. The carrying out of this mission is the duty of the artillery officer.

Must the liaison with the regimental infantry commander before and during the action be carried on by the battery commander himself, or by a liaison officer or non-commissioned officer? Is it sufficient merely to receive reports and orders? This question will be decided by the circumstances of each case.

In general, the battery commander ought to receive in person the order to engage his battery, so that he can discuss, if necessary, the conditions under which the action is to take place. If the battery is apportioned among several units, the post of the battery commander will be, as a general rule, with the regimental commander. However, he must not consider himself as closely bound to this post; on the contrary, according to circumstances, he will move about and go to one or another of his sections where his presence may be most needed.

It is rarely necessary that an artillery officer of the battery of infantry guns be constantly with the regimental staff. These officers ought to be with their sections or pieces; they reconnoitre the emplacements or direct the ammunition supply; by being able to take immediate action at these different points, they will be incomparably more useful. This does not exclude the assignment, according to developments, of officers and non-commissioned officers of the battery of infantry guns by the regimental infantry commander: for example, he can assign them to take charge of the ammunition supply. Liaison officers who have no means of transmitting orders are of no use.

The above is true with respect to the liaison between the detached sections, or pieces, and their battalion, except that, as in this case the organization is smaller and less extended, it will be less necessary for a liaison officer to be constantly with the staff. As a rule, one or several runners are sufficient.

What is more important than liaison with the staff is coöperation with the troops of the unit. This coöperation will become closer if the training is done in conjunction with them and

an exchange of views is encouraged; if the officers and men come to know each other in the course of the work and outside. Also, assignments should be changed as little as possible. For certain operations it is possible to confer beforehand; in other cases only the seizing of a favorable opportunity revealed in the course of the action will bring success. It is not possible to establish fixed rules.

(6) Breaking the Front and War of Movement.—In general, a battery will not take part in the preparatory bombardment or in the rolling barrage. On the contrary, it will be kept ready hitched up in the neighborhood of the advanced infantry line, so as to follow as soon as possible the advancing infantry; or, in other cases, the single pieces will be placed in observation positions far up in order to be able immediately to overcome by direct hits the resistance which will develop after the first few steps of the infantry. These pieces must be ready to be hitched up immediately. It is important to have protection from the observation of airplanes. Retreat before the enemy fire will be carried out as the situation requires.

The advance will be conducted in general by échelon from position to position, in such a way that the advancing infantry may always have support from the fire of a few pieces. Reconnaissance units must be sent frequently to the farthest advanced infantry elements.

For the advance, pioneers or infantry, according to the circumstances, will be sent to the pieces to enable them to cross difficult terrain (shell holes, trenches, watercourses).

Ammunition must not be used beyond the limits of possibility of supply. Above all, avoid waste. Keep the infantry commander accurately informed as to the proportion of ammunition used and on hand.

If the attack can go no further, the batteries of infantry guns need give the infantry the support of their fire only until the artillery coming from the rear in sufficient force is able to give this support.

If the halt of the attack becomes extended, the batteries of

infantry guns will be taken to the rear, where use will be made of their mobility; or else they will be completely withdrawn from the front for use in other missions.

(7) War of Position.—The battery of infantry guns will be engaged in attack in local actions; in the defense its mobility will be used. Its principal mission, each day more important, as enemy tanks become more and more effective is for defense against tanks. Bring up boldly a few pieces, open fire rapidly and by surprise, and success is certain. In other cases use the principles set forth above as a basis for your action.

These batteries are not meant to stay long in one position. On the contrary, where they are not to be used in special missions, it is well to withdraw them and to continue their instruction with the infantry in combination with which later on they will be engaged.

(Signed) LUDENDORFF.

Notes on the Tactical Employment of Field Artillery

AMERICAN EXPEDITIONARY FORCES IN FRANCE
Extracts from Doc. 1348, A. E. F. (Confidential), Sept. 5, 1918.*

11. *Artillery*.—The division artillery, for open warfare, is divided into two classes: (1) that retained by the division commander under the command of the artillery brigade commander and (2) that assigned to infantry units under the command of the infantry commanders.

The proportions to be assigned to these two classes depend on the following considerations:

The retention of a large proportion under the division commander permits rapid and powerful concentration on decisive points anywhere on the division front. But, unless communications are perfect and information complete, it renders the close support of local actions difficult.

The assignment of artillery to infantry units binds such artillery closely to the infantry it is supporting, and gives the infantry commander a powerful combination of arms with which to handle local situations without loss of time. On the other hand, it tends to lessen the power of artillery concentration of the division as a whole, and may render the infantry unit clumsy and immobile. Moreover, it demands a high degree of decision and initiative on the part of both infantry and artillery commanders immediately involved.

In whatever manner the artillery is assigned, close and direct liaison between the artillery and the infantry which it is supporting must be maintained.

A suitable proportion of artillery for assignment under infantry commanders is, as a rule, one battalion of light artillery to each infantry brigade. With respect to its mission and employment, this artillery is divided into two classes: (1) Infantry Batteries and (2) Accompanying Guns. If a battalion is assigned to each infantry brigade, a suitable disposition will frequently be to use two batteries as infantry batteries and to break up one battery for use as accompanying guns. Infantry batteries should be fought as batteries; accompanying guns always by piece—each under an officer when practicable.

12. *Infantry Batteries*.—With two infantry batteries per infantry

* Publication in THE FIELD ARTILLERY JOURNAL authorized.

brigade, they may either be assigned one under each infantry regimental commander, or both held under the infantry brigade commander. The former disposition is ordinarily preferable when regiments are deployed abreast.

With both infantry batteries held under the infantry brigade commander, the artillery battalion commander commands these batteries, ordinarily remaining with the infantry brigade commander or in close communication with him. When the infantry batteries are assigned to infantry regiments, the artillery battalion commander supervises the employment of his batteries, as well as the replacement of personnel, matériel, and ammunition.

The missions of infantry batteries include the attack of the stronger points of resistance, defense against local counter-attacks, and firing on hostile reserves.

Fire is habitually by direct observation from near the battery positions on specific objectives. The range finder should be at hand and used when accurate map ranges are not available, and for moving objectives. Free use must be made of scouts for securing information and for protection against surprise. Visual communications are important. Positions should be forward, well reconnoitered, but occupied with rapidity and boldness.

13. *Accompanying Guns*.—These are assigned first line infantry battalions and placed under the command of the infantry majors. The proportion may be one or even two per battalion, depending on the front covered.

Accompanying guns attack hostile machine guns, tanks, and strong points.

Fire is direct in the case of clearly visible or moving objectives; otherwise indirect with flash défilade and observation at the piece. The range should be from 500 to 1500 metres. Ranges are ordinarily estimated. A wide bracket of (say) four hundred metres is quickly obtained and searched. Ineffective ranges are eliminated during fire for effect.

The pieces are ordinarily moved horsed, unlimbered under cover, and run forward by hand. Caissons are brought as near the pieces as conditions permit. Accompanying guns find their protection principally in the small target presented, in concealment by natural features, and in their mobility. Two or more caissons should be assigned for the ammunition supply of each piece.

Captains of batteries broken up for accompanying guns may devote their attention to superintending ammunition supply and replacement of matériel and personnel, or they may assign lieutenants to this duty and themselves command pieces.

Nearby infantry reserves should be called upon to assist in ammunition supply and in the movement of the piece when necessary.

A portion of the battery personnel for information and communication should be assigned to each piece. This personnel is pushed forward to secure information and locate objectives, to reconnoiter positions and to secure liaison with the infantry commander and the ammunition supply.

14. *Infantry Commanders*.—The functions of infantry commanders having either infantry batteries or accompanying guns under their command generally consist in the indication of missions and the supplying of information as to enemy and friendly dispositions. Technical details and methods should be left as far as possible to the artillery commander. However, in the absence of a specific mission, the artillery commander should, on his own initiative, use the means at his disposal to locate and attack suitable objectives.

In general, the artillery commander is responsible for the development and aggressive use of the full power of his weapons. The infantry commander must apply his power where it will best assist his infantry.

15. *Division Trench Mortars*.—The six-inch Newton trench mortar, while developed primarily for position warfare, is capable of utilization in open warfare. Its motor transport enables it to follow the advance and assures ammunition supply. If conditions render it necessary, a portion of the mortars may be left behind. This affords a reserve of personnel and transport for ammunition supply to hasten the occupation of a position and to replace casualties promptly.

16. *Division Trench Mortar Battery*.—The mission of the division trench mortar battery in open warfare is solely a close support of infantry in overcoming strong points which are holding up the advance. Except when the attack is at dawn of days succeeding the first day of the advance, the position warfare conception of elaborate prepared emplacements must be entirely abandoned. It requires too much time. For missions undertaken and executed by day, the rapid occupation of a position and opening of fire is essential to success.

17. *Nature of the Action*.—When the nature of the action is such that the mission of the trench mortar battery can be anticipated, it should preferably be attached to the infantry regiment or brigade which it will be required to support. When its mission cannot be foreseen, it must be held subject to orders of the division or brigade in such a way that its prompt assignment to any mission arising during the action can be effected. Its assignment to the division infantry reserve is feasible when this will not result in its being held too far to the rear for prompt entry into action. Whatever be the tactical assignment of the

battery, the battery commander must take all possible measures to push his unit forward in order to hasten its entry into action when called for.

18. *Mission of Infantry Commanders*.—Infantry commanders assigning a mission to the battery should state definitely the locality to be fired upon and the position of friendly troops. The selection of positions should be left, within rather large limits, to the battery commander. The time of attack should be arranged after consulting the battery commander as to the time necessary for the latter to go into battery.

19. *Assignment of a Mission*.—Up to the time of the assignment of a mission, the battery commander remains with, or in close liaison with, the infantry commander to whom attached. When assigned a mission the battery commander hastens to join the infantry commander whose unit he is to support. After obtaining the necessary information as to the operation contemplated, he makes a rapid reconnaissance of position and meets the battery on arrival in the vicinity or sends an agent to conduct it to the position. The position selected should be at as short a range as is possible, consistent with proper concealment and ammunition supply.

20. *Visual Concealment in Position*.—This must be had, but protection must be limited ordinarily to that afforded by the natural features of the position selected. The construction of emplacements is carried only as far as is absolutely necessary to fire. Previously prepared sand bags are necessary. Protection for the cannoneers must not be allowed to delay the opening of fire. The deep défilade possible with this piece is ample protection against hostile fire under open warfare conditions. The moral and material effect of a rapid fire, promptly delivered, is great. But if the fire is delayed, the enemy is allowed to perfect his dispositions, all the while inflicting losses on our infantry.

Extract from "Notes on Recent Operations" by Brigadier General Leslie J. McNair

INFORMATION BULLETIN, NO. 13, G. H. Q. A. E. F.

The recent operations in the St. Mihiel salient, while entirely successful in that they accomplished the mission assigned, developed defects which must be corrected in similar operations in the future.

The conditions, in detail, responsible for this general condition, may be stated as follows:

(*c*) Inefficient traffic regulation.

(*d*) Attempt to move too much artillery forward, not initiating

the movement soon enough, and unfavorable initial disposition of our artillery.

Traffic Regulation.—The difficulties were due to lack of organization in detail and lack of road discipline on the part of the troops. There were two few officers of rank and experience in personal charge at important points. In areas where traffic is dependent upon construction and repair, the engineer officer in charge of construction should control the traffic. Vehicles must be kept in column; and damaged, broken down, or stalled vehicles must be promptly thrown off the road. The movement of traffic was not begun early enough on the day of the attack. A distribution of traffic in point of time would have saved much congestion. The roads were used relatively little during the early morning of the first day. Thereafter, and especially in the night, they were jammed with a tangled mass of traffic, which scarcely moved at all, on account of poor distribution and condition of the roads.

Movement of Artillery.—While the plans contemplated the rapid and successive movement of the artillery with open-warfare methods, after crossing the trench system, the actual execution of this movement bore a close resemblance to trench-warfare methods throughout the operation. The faults were particularly due to a lack of promptness in starting the artillery movement and in attempting to move forward too much artillery. The result was that, during the afternoon of the first day, and throughout the following night, the roads were jammed with a mass of immobilized artillery, which was obviously not effective as such, which prevented other traffic, and which afforded a perfect target for harassing fire.

In surprise attacks of this kind a sufficient artillery concentration is made to dominate the hostile artillery and afford the infantry a powerful support in overcoming the enemy trench system. Both this operation and that of July 18th show that, concealment before the attack being maintained, the artillery has practically complete freedom of initial disposition, and complete freedom of movement so far as the enemy is concerned after the attack begins. These facts point to placing practically all the artillery well forward before the attack and moving it very promptly. The accompanying guns, for example, could readily have been concealed the night before the attack just in the rear of the enemy barrage line. The road reconnaissance could have followed the first infantry waves and the trenches crossed immediately after the necessary repairs had been completed. As it was, the infantry outstripped the accompanying guns and rendered them ineffective as such.

A similar procedure could have been followed in the case of infantry

batteries. They could have fired or not in the trench attack, depending upon circumstances. If they fired the objectives should have been the first captured. Reconnaissance should be made and firing cease as soon as it is possible to cross the trench system. Such batteries should move as complete fighting units with caissons and combat trains.

Thereafter the movement of artillery should be continuous and independent of the ammunition dumps of position warfare. Ammunition supply should be as provided for in regulations.

Whether it will be possible to move all of the tabular quota of artillery forward the first day of such operations depends upon the terrain. It should be possible in nearly all cases, however, to advance at least one regiment of light artillery with combat trains in continuous support of the infantry. Before moving forward more light artillery than this, one or, preferably, two battalions of division howitzers should be advanced.

The effectiveness of the artillery support given the infantry during the trench attack was not tested by a stiff resistance, but there is every reason to believe that it would have been equal to any emergency. There was no preliminary adjustment of fire, so that map firing was initially necessary. The accompanying fire took the form of a barrage in some cases, and in others of a progressive fire on carefully selected points. Unless the artillery is so powerful as to permit the barrage to be everywhere thoroughly effective, the latter method is preferable. The accompanying fire in crossing trenches was of necessity based on a time schedule. In view, however, of the slight resistance actually encountered, it proved to be too slow in its progression and hampered the infantry advance. This suggests the advisability of prearranged signals, or other means by which the accompanying fire may be either hastened or ceased altogether and reliance placed solely on the accompanying guns and infantry batteries.

After the trench system had been crossed and artillery advanced, the difficulty of moving forward ammunition made it by all means necessary to cease the extravagant methods of map firing and utilize direct observation. The terrain afforded excellent observation posts and battery positions. Observed fire was used rarely—if at all. It must be inferred either that artillery commanders do not appreciate the immense advantage of adjusted fire, and the waste and loss of effectiveness in searching areas, or that they lack confidence in the ability of their battery commanders in the rapid preparation and conduct of observed fire. It is conservatively estimated that of the ammunition fired during the first two days of this operation, 50 per cent. was wasted.

Aside from the difficulty of moving the artillery forward, the positions selected after the advance were in some cases too retired, considering the offensive nature of the operations. For example, in one division, at the end of the second day, the light artillery was all practically in line, about five kilometres in rear of the front line. The 155 howitzers were not yet in position. Instances have been reported where general instructions have been issued that the artillery should not be advanced closer than a certain distance from the front line. Such instructions induce timidity, are not sound in offensive preparations, and will be revoked at once. Guns if captured during counter-attacks will well pay for themselves in losses saved our infantry and inflicted on the enemy.

The use of smoke to mask likely sites for machine guns proved very effective in spite of a strong lateral wind.

There was some tendency to use the division howitzers for distant harassing fire. Their mission lies first in the stronger obstacles immediately impeding the infantry advance, unless the operation has passed beyond the range of the corps and army artillery.

Some division headquarters were too far back and too immobile after the operation had progressed.

The mounted men proved to be, as always, the best means of reconnaissance.

Diagrams for Obtaining Data

CAPTAIN K. P. WILLIAMS, 150TH FIELD ARTILLERY

IN order to obtain the data necessary in the execution of accurate firing, considerable care and careful preparation are essential. This sometimes requires arithmetical processes that may consume an undesirable amount of time. It is therefore of importance to have, if possible, means of reducing such procedures to a minimum. Charts and diagrams can be made beforehand that will allow the required quantity to be read from them. Many diagrams can often be made to serve the same purpose. Their usefulness is in proportion to their simplicity. A diagram that has upon it many lines and curves and is likely, in a hurry, to be used in an erroneous way, and is confusing, has obviously little advantage over an actual arithmetical process.

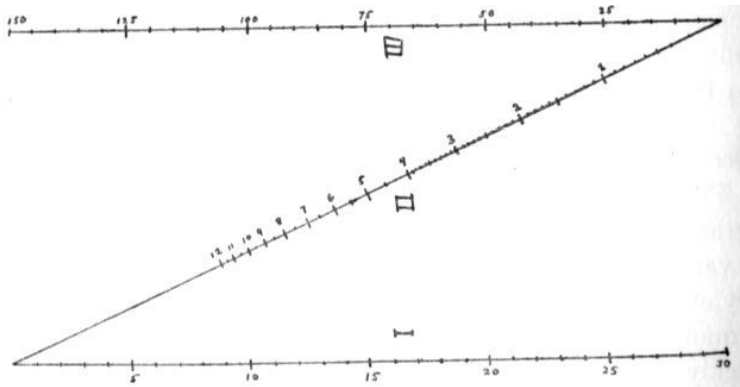
The diagrams that one often sees are in reality nothing but a graphical representation of the quantity under consideration for various values of the arguments involved, and sometimes are very elaborate. If a quantity to be found is merely the product or quotient of three known numbers, it can always be found quickly from an abacus made of three straight lines, graduated in the proper way. A straight edge, laid across these lines, performs the required multiplication and division by a principle of geometry. Diagrams of the sort are very easy to construct and quickly used without much chance for error.

We shall show how to make such a diagram, supposing that for a certain purpose we desire to multiply a number that we shall call A, ranging in value from 1 to 30, by a second number, B, varying from 1 to 10, each number being expressed to a tenth. Products of this sort occur in making a correction in range for a longitudinal wind, for instance.

Fig. 1.—We draw the parallel lines I and III and the line II (Fig. 1). The line I is graduated to represent the values of

A, and in the present instance the line III is graduated to take half the values that the product of A and B can take. The line II will be made into a scale for the number B. It remains only to put the graduations in the proper place. This is very easily and quickly done. For instance, to find where to put the graduation corresponding to the value 2 for B we join the values 25 on scale I to 50 (25 × 2) on scale III and mark the point where the line cuts II, and number it 2. We would find the same point on joining any number on I to twice that number on III. Likewise we join 25 on I to 75 on III and put the number 3 on the place where the line cuts

FIG. 1.



II. The particular numbers that we choose on I and III, in order to find the location of a certain value on II, should be so selected that the line joining them does not give too oblique an intersection with II.

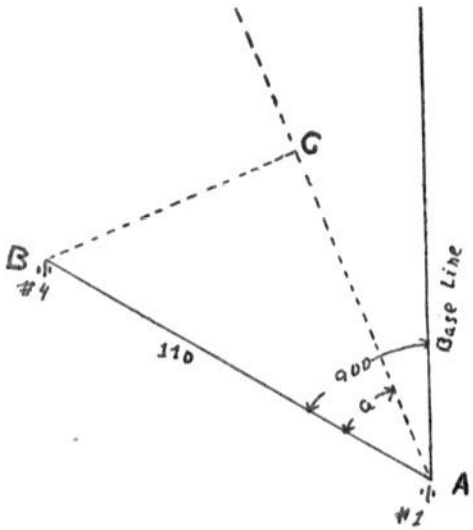
As, an example, we find the product of 18.7 and 3.8. We hold one point of a string at 18.7 on scale I, and pass the string through 3.8 on II and read the product 71 from scale III. The answer is obtained to the nearest unit. If it is desired to multiply a number greater than 15 by a number much greater than 5, it may be necessary to take one-half of one of them. The difficulty would be avoided if the scale III had been graduated from 0 to 300, and products still

could be read fairly accurately to a unit. It is evident that a number on III joined to I gives on II the quotient of the first by the second.

A diagram of the kind just made, when graduated with reference to certain problems, gives products and quotients as rapidly as a slide rule, and can be pasted in a range table.

We will next show how to make a diagram which will give very rapidly data that is necessary when we have the four guns of a battery distributed irregularly at considerable intervals. It is

FIG. 2.



necessary then to have a table that will allow us to converge the fire of all guns on the base piece, and also to correct for range difference, which with a wide field of fire, can by no means be neglected. The results can of course be obtained directly from a measurement made on a large scale map of the battery position. We will show how a diagram of the sort we are considering can be very useful in this connection.

Fig. 2.—We know the positions of the guns with respect to the base line. Suppose the positions of No. 1, 4, and the base line are shown.

We desire to fire in the direction AC. To converge the 4th gun on the 1st we divide B C by the range.

We know:

$$B\,C = A\,B \sin a.$$

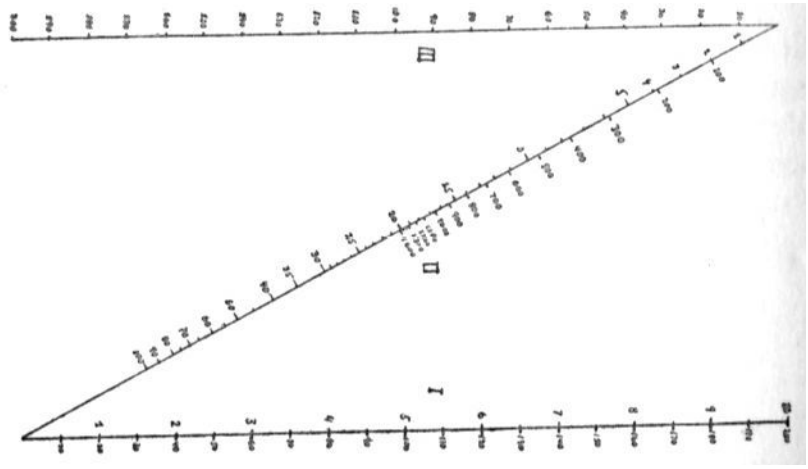
If A C is 300 mils to the left of the base line we would have

$$B\,C = 110 \sin 600 \text{ mils.}$$

And the range difference would be

$$A\,C = 110 \cos. 600 = 110 \sin 1000$$

FIG. 3.



In order completely to solve the problem we merely need a diagram to give the products of numbers, say, between 0 and 200 by the sine of angles between 0 and 1600 mils. The diagram is made as we described above. It is extended by adding a second scale on lines I and II so as to obtain directly the angle by which it is necessary to converge, which is merely the quotient of B C by the range in kilometres.

Fig. 3.—To explain the use of the diagram we take the case we had before. From the direction of fire with reference to the base line, find the angle *a* that it makes with the line joining the first to the fourth gun. Hold a string on the scale on the right of I at the point that corresponds to the distance between the guns. Make the string pass through the point that

gives the angle *a* on the scale on the right of II. Pivoting at this point, cause the string to pass through the graduation on the scale on the left of I that gives the range in kilometres, and read where the string crosses II on the scale on the left. The number found is the number of mils by which we must close the fourth piece on the first.

For the guns and base lines as given, and a direction of fire 300 mils to the left of the base line, we have $a = 600$. For a range of 4000 we find the required angle to be 15, so the 4th piece would need to close that amount.

To find the range difference we proceed in the same way, but make the string pass through the point that represents the angle (1600 - *a*) on the scale on the right of II and read the value from scale III. The answer is the amount the range is shortened. In the problem considered we join 110 on the right to angle 900 on II and read 83 from III.

We give a table for different direction of fire and ranges.

DISTRIBUTION CORRECTION

Range Shift	1000	2000	3000	4000	5000	6000	Range Correction
Right 600	108	55	36	27	22	18	12
Right 400	105	52	35	26	21	18	32
Right 200	98	49	32	24	20	16	52
Zero	86	43	28	21	17	14	69
Left 200.....	68	35	23	17	14	12	85
Left 400.....	52	26	17	13	10	9	97
Left 600	32	16	11	8	6	5	105

In this way a table for the four guns can be made very rapidly. The range corrections, of course, would be taken only to the nearest 10 metres.

The chart can also be used in the parallel method of computing firing data. Here we desire the perpendicular distances from the B C station on to the gun-target line, and the gun-aiming point line. If the guns are visible from the B C station we can obtain, by pacing or estimating, the distance to them, and we can measure the angle between the lines B C station-gun and

B C station-target. The chart will then give us the angle at the target between the line gun-target and the line B C station-target. Similarly we can get the corresponding angle at the aiming point. The results would be more accurate than those obtained by estimating the offsets.

In the same way a diagram can be made to give the deflection change that should accompany a certain range change in lateral observation, as well as the angular value of the range change as seen by the observer. For if we represent the range change by f, the gun range by R, the observer distance by r, the angle between gun-target and observer target line by D, and let ϕ be the change in deflection to accompany a range change of f in order to keep shots on the observer target line, and ω the angular value of the range change f, as seen by the observer, we have

$$\phi = \frac{f \times \tan D}{R} \quad \omega = \frac{f \times \sin D}{r}$$

and the diagram can be made in a manner similar to the last.

Contoured Trajectory Scales*

A QUICK and simple method of determining the height of the trajectory at any point is often required in order to ascertain:

(*a*) Whether fire can be directed with safety over the heads of our own infantry.

(*b*) Whether a certain trajectory will clear a crest, or row of trees, or other obstacle.

This requirement can be met, in the case of flat trajectory guns, by contoured trajectory scales.

These scales can be made for any gun, but are especially useful in the case of the eighteen-pounder quick-firing gun.

TO MAKE THE SCALES.—The scales are made as follows:

1. The trajectory for any quadrant angle is plotted to a scale of 1/10,000 by means of the formula† h equals ½ g t (T - t), where

h equals height in feet.

T equals time of flight to the moment when the shell meets the horizontal plane passing through the gun.

t equals time of flight to required point.

Note.—Below the horizontal plane t will be greater than T, and the formula will consequently give negative values for h. For use with maps contoured in metres, h is converted into metres (1 metre equals 40 inches).

2. A series of horizontal lines, ten metres apart, are drawn. The intersections of these lines with the trajectory form a scale of contours for the trajectory.

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* Reprint from *Monthly Summary of Artillery Information*, General Staff, British Army.

† Or more accurately, from the formula

$$y \text{ (feet) equals } \frac{(A - a) \text{ minutes X yards}}{1146}$$

where y equals height in feet of the trajectory at any point P.

x equals horizontal distance in yards from gun to P.

A equals angle of elevation in minutes for the whole range.

a equals angle of elevation in minutes for the distance gun to P.

This formula holds true for all cases, and can be applied to our guns by substituting the authorized units used in our service. (Editor.)

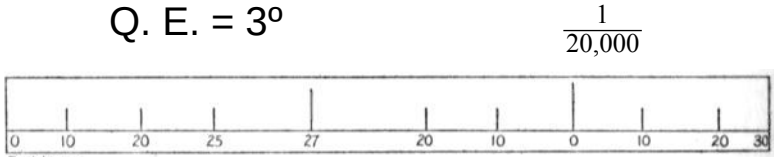
3. The above procedure is carried out for as many quadrant angles as are required.

One scale for eighteen-pounder quick-firing gun is shown below, representing in plan the trajectory for a quadrant elevation of three degrees.

The graduations between the zeros indicates the height of the shell above the horizontal plane of the gun at any point along the trajectory.

The graduations at the right-hand end of the scale indicate the course of the trajectory below the horizontal plane of the gun.

TO USE THE SCALES.—To use the scales, it is necessary to convert the required range into the angle of elevation, then add or



(This scale has been drawn to a scale of $^{1}/_{20,000}$ for simplicity in printing.)

subtract the angle of sight from it and so obtain the quadrant angle. Take the scale for the quadrant angle and place it along the line of fire on the map with the "O" marked "Battery position" on the site of the battery. Note the contour height of the latter, add it to the height shown on the scale and compare the result with the height of the ground as indicated by the contours immediately below the scale.

EXAMPLE:

Contour height of the battery equals 120 metres.

Height on scale ..... equals 30 metres.

Map contour 140 is immediately below the 40-metre mark on the scale.

The height of the shell above the sea level is therefore 30 plus 120 equals 150 metres, and the height of the ground above sea level is 140 metres, therefore the shell is 10 metres above the ground at this point.

CONTOURED TRAJECTORY SCALES

When studying a map with a view to siting a battery or of ascertaining the possibility of covering difficult slopes, a general comparison of trajectories and ground can be arrived at by trying various scales in succession. The scale for any quadrant angle can be placed on the map with the "O" marked "Battery position" on any selected point, and by comparing the graduations on the scale with the contours on the map it can quickly be ascertained where the shell will strike the ground for the quadrant elevation used. Should this point be beyond or short of the position it is required to hit, a scale for a smaller or larger quadrant angle can be tried, and a general idea of the course of the trajectory as compared with the ground will be obtained.

CURRENT NOTES

The Suppression of Barrage Fire and the Assignment of Sections of Artillery to First-Line Troops and to Support Troops

Translation of German Documents, September, 1918.

THE two recent orders given below are very interesting as showing a change in German artillery tactics. Several German orders captured on our front indicated the approaching suppression of barrage fire considered "as a necessary evil." It is interesting to see how it is replaced.

Of importance also is the assignment of sections of artillery to battalions in the front line, in support and in reserve for defense against tanks. It is clear how keenly the question of anti-tank defense preoccupies the German command.

I.

DIVISIONAL ORDER

——st Infantry Division. Division Headquarters,
September ——, 1918.

1. *Assignment of Artillery to Battalions in Line, in Support and in Reserve for Defense Against Tanks.*

(a) The Artillery Commander will immediately assign to each battalion in line one section of field artillery. This section will be placed sufficiently close to the front-line troops to give the latter effective control of the section even during a battle (liaison by telephone, visual signal and runners).

Independently of defense against tanks, these pieces directly intervene in the infantry combat and are under the exclusive orders of the front-line troops, who should not use these pieces for any other mission. The pieces do not take part in annihilating fire or in the accomplishment of artillery missions.

(b) For each battalion in support, a section of a battery will be assigned, which is now in position. These pieces will be employed in the missions indicated in paragraph *a*, but they will participate upon the orders of the Artillery Commander in the accomplishment of artillery

missions just as other batteries. The liaison with the support troops will be carried out by the means indicated in paragraph *a*.

(*c*) The assignment of artillery to battalions in reserve will not take place at present. The Artillery Commander will designate a battery which can on a divisional order be rapidly drawn out of its shelter and which can immediately go into action. The team will have its shelter in the vicinity of the battery. The Artillery Commander will be held responsible for the carrying out of the present order by September ——, 1918.

2. *Dispositions to Bring Annihilating Fire back from the Line of Outposts on the First Line of the Advanced Zone of the Position and on the Main Line of Resistance of that Position*.

For the present, fire will be brought back on these lines only on the signal of the first-line troops to the chiefs of the sub-groups of artillery, with whom liaison ought to be maintained under all circumstances, or on a divisional order.

The signal "shorten the fire" will not be provisionally employed until the army corps has definitely settled this question. The artillery will not obey a signal of this kind.

Annihilating fire will remain directed in front of the line of outposts until the order is given.

3. (a) The schematic barrage fire employed up till now which was not directed on any specific objective, and which was placed in case of an imminent enemy attack as a screen of fire in front of certain lines occupied by our infantry, is suppressed by an order of the Chief of the General Staff of the Field Army, dated August —, 1918.

(b) The protection of the infantry in the presence of an enemy attack by artillery fire will in the future be carried out only as annihilating fire, which will be directed (in the event of an enemy attack impending or actually in progress) either against the enemy himself when he is observed, or against the presumed positions in which the enemy is making his preparations for the attack or over which he will pass during the course of the attack.

(c) The signal "barrage fire" will not be used.

(Signed) —— —— ——.

II

PROTECTION OF INFANTRY BY ARTILLERY FIRE

Artillery Headquarters No. ——. September ——, 1918.

1 and 2. Reproduction of paragraph three of the preceding order.

3. To organize annihiliating fire against the enemy positions in

which he is supposed to be making his preparations in front of our first line of outposts, these positions are distributed between the different batteries according to the attached plan. The batteries immediately direct their fire on these objectives. A withering fire is opened, upon an order or upon the appearance of the signals in force (actually, red with a parachute or a double red star), in such a way that each battery fires a rafale of annihilation at first on its objective in Position I, then in the same way in Position II. These rafales, alternating between Positions I and II, are repeated as often as the light signals reappear in the air. By a rafale of annihilation is meant: Twelve rounds of a field gun, eight rounds of a light field howitzer, six rounds of the 10cm., four rounds of the heavy field howitzer, for each piece for each rafale.

The existing regulations will be terminated September ——; the new distribution of objectives will be in force on September ——, at six o'clock in the morning.

4. In the same way batteries will direct their fire, according to the attached plan, on the objectives assigned for concentration of fire in front of the line of the outposts. Fire concentrations will be laid down in case the preparations for the attack against our outposts are presumed or reported, or when counter-battery work with observation is not possible.

5. In connection with annihilating fire on the positions of our covering zone in which the enemy is presumed to be advancing to attack our main line of resistance, all batteries will accurately calculate the firing data in order to secure direct hits on the objectives indicated in the plans which will be distributed to-morrow. The emission of annihilating rafales on these objectives ought to be prepared in such accurate detail that, immediately following in order, a light signal or a demand by radio (T. S. F.) or earth telegraphy (T. P. S.), the fire of all the batteries can be suddenly laid down with startling effect. A special light signal will be arranged to bring down the fire on these objectives; signals by radio (T. F. S.) and earth telegraphy (T. P. S.) will likewise be arranged. During the wait the fire will be shortened only on the order of groups or subgroups.

6. Likewise, the batteries, according to a special plan, will accurately calculate the firing data in order to secure hits on the objectives assigned to protective fire in front of the main line of resistance. These batteries must equally be prepared to execute annihilating fire by rafale on these objectives. Until further notice protective fire will be laid down only by order.

7. To facilitate the rapid designation of objectives upon which

concentrated annihilating fire or harassing fire is to be directed, a plan is issued entitled: "Permanent Classification of Objectives." This plan must be followed, on and after September ——, for the purpose of designating in daily orders the objectives for harassing fire.

8. A copy of the order of the General Staff of the ——th Reserve Corps, as a supplement, as well as a copy of the plan of the ——d Bavarian Artillery Headquarters, will be sent to all groups. Further orders will follow to put into effect this plan for the more rapid designation of objectives.

(Signed) ——.

Artillery in Open Warfare*

ACCOMPANYING BATTERIES

THE accompanying battery is under the orders of the commander of the infantry regiment until the battery has received its combat mission.

Mixed Groupings of Artillery at the Disposal of Infantry Regiments.—The allotment of two or three groups of field artillery (in addition to the shock batteries) to each division is insufficient in most cases for the missions required of the light artillery. The assignment of a group of field artillery to each infantry regiment would be desirable. But it has not been possible to carry this desire into effect, as the divisional artillery commander would not then have a sufficient number of batteries to execute the required missions outside the combat zone of the infantry regiments (counter-battery, distant objectives, interdiction fire on bridges and defiles).

On the other hand, it is very desirable, when the necessity arises, to assign to the infantry regiments, in addition to the accompanying batteries, a supplementary reinforcement of artillery intended for the direct support of their action in the zone of combat to which they are assigned.

The problem will be solved in the future in the following manner (it is the division in question which speaks): Artillery group or battalion staffs will be assigned to the infantry regiments

* From the report of a division of the German Army on experiences during the offensive in Picardy, March and April, 1918.

and will have charge of the artillery groupings which, according to the situation, will comprise a variable number of batteries or sections of light and heavy artillery.

From a tactical point of view there is no comparison between the staff of a group of field artillery or battalion of foot artillery with the staff of the infantry battalion which constantly has its five companies at its disposal.

The staffs of the artillery groups and battalions must give up the idea that they are only to take part in the combat with the light or heavy batteries which are organically assigned to them. They must be ready to meet the most varied tactical requirements. It is expected from their experience in artillery combat and as a result of their mixed groupings that they will support the infantry attack in close liaison with the regimental commanders.

To fulfil these missions, the group and battalion staffs in charge of mixed groupings will move ahead, without stopping at the firing positions of their batteries, to a point from which they can distinctly follow the phases of the infantry battle. In most cases, the commander of the infantry regiment will be able to direct the combat of his unit from the place which the commander of the artillery group (who will have preceded him) shall have selected for his P. C. The personal coöperation of the two leaders will in this way be better assured.

HEAVY ARTILLERY

An extraordinarily effective support may upon occasion be given to the infantry attack by only a small number of rounds of large calibre. On this account, it may be necessary to assign a few batteries or sections of heavy field howitzers, commanded by carefully selected leaders, to the mixed groupings mentioned above.

Otherwise the main force of the heavy artillery remains, as a general rule, under direct control of its commanding officers. It pushes its observers far ahead over the battle-field, and, while remaining in close liaison with the infantry brigades and regiments,

receives missions from the divisional artillery commander only.

EQUIPMENT OF ARMY FIELD ARTILLERY REGIMENTS WITH MOTOR TRANSPORT

An order, issued by Crown Prince Rupprecht's Group of Armies to the —— German Army, dated June ——, 1918, states that a beginning has been made in the equipment of army field artillery regiments with motor transport, to facilitate their rapid transference independently of the railways. The —— Field Artillery Regiment has already been thus equipped, in combination with the —— Motor Transport Echelon (*Kraft-wagen-Staffel*). The details of organization are as follows:

1. The regiment consists of three *Abteilungen*, each of three four-gun batteries, without ammunition wagons or light ammunition columns.

2. The regiment has in charge seventeen motor vehicles for personnel and twenty-seven motor lorries for the conveyance of the various staffs and for the transport of ammunition and supplies. It is forbidden to place these vehicles at the disposal of any other formation.

3. The Motor Transport Échelon consists of a headquarters and three sections. Each section is intended for the conveyance of a field artillery *Abteilung* and consists of thirty-five lorries plus the necessary motor vehicles for personnel. The échelon is, if necessary, to be used for the conveyance of several regiments in succession.

Should it not be used for this purpose, in accordance with orders from General Headquarters, it is placed at the disposal of the army to which the field artillery regiment equipped with motor transport has been transferred, and will be used for purposes of ammunition supply. The special equipment of the vehicles must not suffer thereby.

4. Battery positions should be selected for the regiment in the vicinity of good roads, so as to make the fullest use of the motor transport. Horses and teams must be provided as required for the reconnaissance and occupation of positions.

Further orders show that each corps in the Second Army was to reconnoitre positions in its sector for one such field artillery regiment, and, in the LIst Corps, positions for one *Abteilung* were to be reconnoitred in each divisional sector.

Positions were to be selected with a view to defense.

German Artillery Firing Manual

THE Artillery Firing Manual of December 1, 1917, recently came into our hands. This manual replaces Bulletin No. 3 of the Manual on Field Artillery Training (preparation and conduct of fire) as well as the Manual for Foot Artillery of November 19, 1908.

These new regulations have two main objects in view:

1. The adoption of uniform regulations for the light and heavy artilleries, these terms replacing from now on the terms "field artillery" and "foot artillery."

2. The insertion into the regulations of new provisions resulting from recent experience in present warfare.

ADOPTION OF UNIFORM REGULATIONS FOR THE LIGHT AND HEAVY ARTILLERIES

The regulations comprise four main parts: The first two relate to the methods of fire and laying, and apply with only slight differences to both artilleries, the aiming devices of which have now been made uniform. The third part treats of firing methods for light artillery, and the fourth of those used by the heavy artillery.

PRINCIPAL CHANGES IN FORMER REGULATIONS AND NEW REGULATIONS

1. Changes in the old regulations:

(a) Up to the present it was generally accepted that the effect of H. E. shell and long shell was felt to the rear on the line of flight of the shell; experience has proved that the effect is felt mainly forwards and to the sides.

(b) While the old manual required, in the case of light artillery, that time fire for effect should begin at the effective range (*i.e.*, the range which in adjustment gave an equal number of overs and shorts) diminished by 100 metres for shrapnel and by 50 metres for H. E. shell, the new regulations require

it to begin at the shorter limit of the bracket (the bracket is 50 metres if the adjustment has been carried out with percussion fire, and 100 metres if with time fire), keeping the same corrector as during adjustment—that is to say, the corrector which gave an equal number of grazes and bursts in air.*

(c) In the case of heavy artillery the determination of the site is absolutely necessary in the case of indirect fire; the verification of the limits of the bracket is required in the case of fire on a zone of 100 metres deep.

(d) The former regulations for both artilleries relating to fire in mountainous country are not repeated. The question is pending until it has been fully developed by the trials now in progress at the Mountain Artillery School at Southofen.

2. New regulations. The following chapters have been introduced into the new regulations:

Fire on a zone within narrow limits.

Fire observed by balloon or airplane (duty of the radio officer).

Fire observed by ground observation stations (particularly adjustment by high bursts) and sound-ranging.

Fire from a défiladed position against captive balloons.

The determination of corrections for atmospheric conditions has an important place.

Volley fire has been introduced into the new regulations for the purpose of facilitating adjustment when conditions for observation are unfavorable. By this method it is possible to distinguish the shots of a particular battery when several batteries are firing on the same objective, and it also becomes possible to use it in fire for effect.

Finally, part five of the new regulations outlines briefly the duties of the commanders of units higher than the battery (battalion or subgroup, regiment or group, divisional artillery).

Generally speaking, the new artillery manual seems to be

* Note the death of the "drop back." Some of our readers will remember this "drop back" as far back as 1911. [The Editor.]

a considerable advance over former regulations. It makes the methods of laying and of fire for the light and heavy artilleries uniform, bringing together the several methods of fire and taking the recent experiences in the war into account.

The regulations are presented in a methodical manner which render them clear and easy to consult.

Certain questions, however, have not yet been settled and are reserved for more complete study.

Dispersion of German Artillery Fire*

March 15, 1918.

From Chief of the General Staff
to the War Ministry:

I have the following comment to make relative to the "Memorandum on Dispersion" published by order of the Minister of War, February 4, 1918.

The statement that a triple dispersion is still admissible (paragraph 4), that this dispersion increases when the range is lengthened (paragraph 5), and that it is further increased by errors in laying (paragraph 6) has apparently greatly reduced the confidence of other arms in the artillery.

When, for example, the 77-mm. gun, model 1916, is fired at a range of 6000 metres (K. Gr. 15, charge 2), the average dispersion of the battery is given as 162 metres and the total dispersion 648 metres. With the 10-cm. gun, model 1914 (10-cm. Gr. 15, heavy charge), at a range of 10,000 metres, the average dispersion of the battery may reach 285 metres and the total dispersion 1140 metres. With these figures the word precision ceases to exist; the memorandum is a license for the artillery to fire anywhere.

I consider the term "battle-field dispersion" to be ill chosen. "Dispersion," according to the Firing Instructions, Article 28, is the phenomenon in consequence of which shots fired under as nearly identical conditions as possible do not fall upon the same spot. It may be granted, for psychological reasons, that in war fire is more scattered than in peace times; but the term "battle-field dispersion" gives rise to the idea that this dispersion is inevitable. Defectve guns and ammunition may be found a little more frequently than in peace time and may slightly increase the dispersion, but there is no reason for

* Translation of a German document, September, 1918.

bringing out that fact in the memorandum. Furthermore, if these deficiencies were as important as the memorandum indicates, the matériel and ammunition might as well be considered useless. We cannot apply the word dispersion to errors due to mistakes on the part of artillerymen, who may frequently be held responsible.

It is not admissible to adopt as a definite rule the multiplication of the dispersion of a gun by the coëfficient 1.5, in order to abtain that of the battery (paragraph 3). If the individual corrections have been properly made, or if the fire is observed after each gun has been registered, there is no reason why technical considerations should cause the dispersion to increase in this proportion. I consider the question of dispersion raised by the memorandum as seriously reflecting upon the prestige of the artillery. We are making every effort, and I believe successfully, to obtain effective fire from the artillery. If official documents contain statements such as those referred to above—statements which, moreover, are debatable—our efforts are condemned to failure. Every tactical use of the artillery is brought into question. I direct, therefore, that the "Memorandum" be recalled from the front, immediately if possible.

Copies to Army Groups and Armies.

(Signed) LUDENDORFF.

USE OF BALLOONS TO INSURE THE RAPID OPENING OF ARTILLERY FIRE ON FLEETING TARGETS

German Document

An order from the artillery of the First Guard Division of July 13, 1918, describes the following method of securing the opening of fire on batteries in action or on fleeting targets in the shortest possible time.

A balloon grouping is formed, comprising several batteries to which a balloon is attached. These batteries go into action without consulting anyone, firing on the objectives indicated by the balloon observer.

1. Mission.—To open fire immediately on its own initiative upon targets located by the balloon observer, especially enemy batteries, troops in motion, villages, etc.

2. Composition.—Three or four batteries under the orders

of the same staff (10-cm. guns, heavy, long howitzers, model 1913, long mortars); one battery of 15-cm. guns, model 1916, is attached.

3. The choice of targets and the order in which they will be fired upon is left as far as possible to the balloon observer. The essential thing is to open fire upon the targets quickly.

4. The commander of the balloon grouping insures that a part of the grouping is always ready to fire, positions being changed by sections or by guns.

5. Positions should be chosen as far as possible along the road which the balloon will follow, so as to shorten the lines of communication. The balloon should be able to adjust the fire at all times, even while changing positions.

6. All batteries near the balloon should be connected by telephone with the point of ascension, near which the group commander's P. C. should, as a general rule, be located.

Use of Anti-Flash Packets by the German Artillery

WE learn from documents received and other sources of information that anti-flash packets (*Kartuschvorlage*) are commonly used by all German artillery, except the 77 gun.

These packets are made of chlorate of potash (*Duneberg-Salz*) in the form of round, flat additional charges. They are introduced into the shell case on top of the powder just before firing (the lid of the shell case, which has been removed, being immediately replaced).

They are packed in tin boxes. The prescribed allowance is one-third of the number of rounds authorized from March to November and half the number of rounds from December to February.

The following regulations are issued for their use: "The anti-flash packets increase the dispersion. They must, therefore, be used only when tactical, local or atmospheric circumstances require it. Damp packets must never be used. Damp packets can be used after thorough drying and pulverization of

their contents. Anti-flash packets have the greatest effect on small charges."

The decrease in initial velocity and range caused by the use of these packets is shown in tables. The 10-cm. gun shows a loss in initial velocity of four metres with the heavy charge and of eight metres with the light charge. The corresponding losses in range are forty-five metres and one hundred and fifty-five metres at eight thousand metres. The figures are correct for a used bore and must be reduced by half in the case of a new bore. It is said that the use of these packets does not cause noticeably more smoke than ordinary charges.

It would seem that the use of these packets is one of the causes of the increasing difficulties encountered by our observation service in obtaining intersections of batteries, even when these do not attempt to secure very deep défilade.

GERMAN PRECAUTIONS RELATIVE TO YPERITE

Troops should be instructed to leave yellow-cross shell No. 1 and smoke shell exposed to the rays of the sun as little as possible. It is not yet known whether heat produces a decomposition or expansion of the gas liquid, but prudence should be observed (Order of ——th Army, June 24th).

In spite of regulations to the contrary, gas-shell dumps are often too large and improperly located, as, for example, on the edge of roads. After the explosion of yellow-cross shell, caused by hostile bombardment or fire, it must be expected that the immediate surroundings (roads, battery emplacements and munition dumps) will be impracticable for a considerable period, eight days or more. Yellow-cross shell must be dumped, when possible, in places free from vegetation. If this is not done, the splashes of liquid gas will be scattered over trees, thickets, wheat and grass and will make it very difficult to clear the ground and do other work. Attention is also called to the necessity for establishing dumps of chloride of lime as soon as practicable (Order of the ——th Army, May 29, 1918).

GERMAN REGULATIONS FOR BATTERY EMPLACEMENTS SHELLED BY YPERITE

——th Army.

Ia. General of Artillery. General Headquarters, July ——, 1918.

Gas Officer No.——.

1. Under the condition that the emplacements must be occupied or can be abandoned for a short period only:

Gun emplacements are particularly dangerous when shelled with yellow-cross gas, and the persistence of this danger is increased by the fact that the construction and the camouflage of emplacements are unfavorable for ventilation. In addition, it is hard to see the splashes on bushes, camouflage and the guns. Keep the mask on and remove the camouflage with long poles (gun sponges, or better, poles already prepared and kept under cover; sprinkle with chloride of lime if there is danger from splashes). The chief of section must examine his piece for splashes. Pieces which have been in contact with yperite will be cleaned in the following manner: sprinkle with chloride of lime; rub with a wet object—a broom or similar implement; wash freely with water. Restore the camouflage (after leaving the piece exposed to the sun and air as long as possible) with branches taken from an unshelled area. Shell holes in the neighborhood of the position will be disinfected, whenever they can be reached, with a layer of chloride of lime (among bushes, in fields of wheat, etc., this cannot be done), then concealed from airplane observation by a layer of earth. Instead of the ammunition which was near at hand, ammunition which was well covered and protected from splashes will be used as far as possible.

2. When an alternative position is to be occupied:

Clean the piece, as in the first case. When withdrawing the guns from the shelled position, avoid passing through bushes, wheat and high grass, and anything on which splashes may have fallen, even at a distance from the position. Always keep on the mask, even if the withdrawal takes considerable time. The eyes of horses cannot be protected; horses, therefore, cannot be used until the shelled area has been cleared.

Everything which is not indispensable is left in the shelled position. Ammunition for the alternative position will, as far as possible, be brought up from the rear.

3. The position must not again be occupied until the Divisional Gas Officer has declared it safe. Disinfection is only possible where the ground bears no vegetation and where the gas shells have not fallen thickly.

Chloride of lime must always be on hand, in well-closed receptacles and protected from dampness (about 10 kg. for each piece, in small dumps of about 2 kg. each), if for no other reason than that we must reckon with our own yellow-cross shells and our own gas bombardments.

Gas Shell Firing in the German Army

The following table, taken from a German document, indicates the various methods of gas shell firing and the conditions of employment.

(*a*) BURSTS OF FIRE (*Gas Ueberfall*)

Objectives	Method of Firing	Occasion	Ammunition		Rapidity of Fire	Atmospheric Conditions
			Kind	Amount		
Small targets, for example: occupied battery positions, points where work is being done, etc.	Several batteries execute a burst of fire after the exact range has been ascertained with H. E.	When it is certain that enemy is being surprised and is not wearing gas mask.	Green or Yellow Cross, or, if necessary. Yellow Cross H. E.	For each burst: at least 100 rounds from field guns, or 50 rounds from light howitzers (or 10-cm. guns), or 25 rounds from heavy howitzers, or 10 rounds from mortars.	Start with a general salvo or with rapid fire.	Even during unfavorable weather, for example: especially by day and with a wind blowing as high as 3 metres per second.
		When there is no effort at surprise.	Blue Cross, followed by Green or Yellow Cross.	As above. As much as can be fired in a period of some minutes.	Start as above. Continue with several minutes of rapid fire.	

(*b*) ZONE CONCENTRATIONS (*Verseuchungaschiessen*)

Section of terrain which it is important for the enemy to occupy permanently.	Surface of target is divided into hectare squares. Several hectares are assigned to each battery. H. E. is used for ranging.		Yellow Cross percussion shells generally only on marshy ground. Yellow Cross time fuse or Yellow Cross percussion H. E.	Per hour on each hectare, at least: 100 rounds from field guns, or 50 rounds from light howitzers (or 10-cm. guns), or 25 rounds from heavy howitzers (150 mm.), or 10 rounds from mortars. Take into account dispersion in	Steady, well-regulated fire for several hours. Repeat the following days.	Even during unfavorable weather (wind up to 5 metres per second)

(*c*) SHEET FIRING (*Schwadenschiessen*)

Extensive areas containing living objectives.	Area to be shelled is divided into several sections, each of which is assigned to a battery. The area of each section is one or more hectares, according to the dimensions of the zone of dispersion of the various calibres shelling each of these sections. Ranging on the centre of each section with H. E. All firing is executed with the elevation thus obtained. Continuous firing.	The effect is secured from the density and long duration of the gas. In order to rapidly effect a dense concentration on certain points, all the batteries may be concentrated on each area at the same time.	Blue and Green Cross Shell. Blue Cross No. 1 (if necessary) or Yellow Cross in equal proportions.	For each hectare of surface at least 100 rounds from field guns or 50 rounds from light howitzers (10 cm. guns), or 25 rounds from heavy howitzers (or 15 cm. gun); 10 rounds from mortars.	Start with bursts of fire and follow with rapid fire. Duration one to two hours. Strong repetition after short interval.	Only in favorable weather. The wind must not exceed 1½ metres per second.
			When the nature of the terrain is favorable, this fire may be continued in the form of:			
			All kinds of gas shell, preferably Green Cross No. 1. Blue Cross is least suitable.	For each hectare only ½ or $^{1}/_{10}$ the amount employed per hour in sheet firing.	Steady fire throughout the day.	

(*d*) FIRE WITH H. E. GAS SHELL

All kinds of moving objectives.	H. E. gas shell are mixed irregularly with H. E. or replace it entirely if the enemy does not have bomb-proof shelters.		Blue Cross H. E. or Yellow Cross H.E.	Several groupings against one objective, for example: 12 groupings of field guns or 3 groupings of heavy howitzers, etc.	Always several groupings in rotation, firing as rapidly as possible.	In all weather.

H. E. GAS SHELL IN USE

	7 mm.	105 mm.	15 cm.	21 cm.	
Blue Cross	Yes	Yes	Yes	In preparation	Contents about: ¾ explosive. ¼ gas.
Yellow Cross	No	In preparation.	In preparation.	In preparation.	

Yellow Cross shell will not be used in open warfare, because this gas remains active too long a time.

In case of a gas bombardment preceding an attack by us, some smoke shells will be mixed in with the last gas shells, as the gas will no longer be effective after the smoke has dissipated.

The firing of a few isolated rounds of gas shell is ineffective and always forbidden.

Proposed Schedule of Instruction for Field Artillery Operations Officers

BY
LIEUTENANT COLONEL MERT PROCTER, FIELD ARTILLERY, U. S. ARMY

		2-hour period	2-hour period		2-hour period	2-hour period
1st week	Monday	Explanation of course, school regulations, assignment to sections	Issue of equipment		Study of terrain map and field	
	Tuesday	Lecture: tactical principles modern warfare; organization of the division; tactical disposition of infantry and artillery	General explanation of maps, charts, tables, pertaining to divisional operations		Preparation of maps and charts; general outline of a divisional sector	
	Wednesday	Conference: tactical organization of divisional artillery	Preparation of table of organization of command; brigade		Preparation of a battalion battle map	Preparation of a regimental battle map
	Thursday	Conference: liaison; artillery and infantry	Preparation of liaison plan and chart		Conference: artillery intelligence	Preparation of intelligence maps, bulletins, and files
	Friday	Conference: organization of observation system; terrestrial and aërial	Panoramic sketch; identification of terrestrial objects on the map		Preparation of maps and charts, records and reports for observation system	
	Saturday	Conference and special instruction on week's work				
2nd week	Monday	Conference: artillery missions	Preparation of plan of defensive barrage, with maps and		Conference: counter-offensive preparation	Preparation of plan of C. O. P. with maps and charts
	Tuesday	Conference: interdiction, harassing, concentration, reprisal, counter-battery, retaliation	Preparation of interdiction chart and table		Preparation of maps, charts, and tables for harassing, concentration, reprisal, retaliation, and counter-battery. Preparation of daily firing schedule	

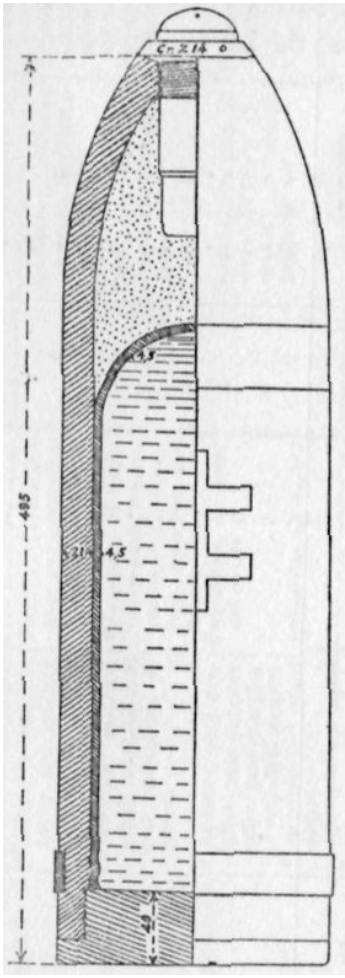
PROPOSED SCHEDULE OF INSTRUCTION FOR FIELD ARTILLEY OPERATIONS OFFICERS—*Continued*.

		2-hour period	2-hour period		2-hour period	2-hour period
	Wednesday	Conference: raids; infantry and artillery coöperation	Preparation of box barrage and neutralization fire; time table and operations orders		Conference: offensive barrage; neutralization fire	Preparation of barrage ladder; neutralization schedule; time table; operations orders
	Thursday	Conference: munition supply; establishment and functioning of system	Preparation of munition records, reports, and requisitions; battery, regiment, and brigade		Conference: provisioning and traffic regulations	Preparation of traffic charts and orders
	Friday	Conference: plan of reinforcement and alternative positions; plan of reciprocal support	Preparation of maps and orders		Conference: plan of defense for withdrawal or second positions	Preparation of maps, charts, and orders
	Saturday	Conference and special instruction on week's work				
3d week	Monday	Conference: outline of week's work; mission of division; organization of reconnaissance	Preparation of map reconnaissance and preliminary operation orders		Field reconnaissance for brigade problem; brigade, regiment, battalion, battery	
	Tuesday	Conference: preparation of operations maps	Preparation of battery, battalion; battle map; operations orders		Preparation of regimental and brigade battle map, operations orders	
	Wednesday	Conference: organization of the artillery command	Preparation of table of organization		Conference: plan of defense; assignment of missions	Preparation of maps, tables, orders, and charts for artillery; plan of defense
	Thursday	Preparation of maps, tables, and charts for artillery plan of defense continued			Conference: service of information plan of observation	Preparation of maps, tables, charts, and orders for plan of observation
	Friday	Conference: service of information; plan of liaison	Preparation of charts, tables, and orders for system of liaison		Conference: supply and traffic, munitions, provisioning	Preparation of maps, tables, orders for supply and traffic
	Saturday	Conference: coördination of staffs	Special instruction on week's work			

4th week	Monday	Conference: outline of week's work; mission of division; organization of reconnaissance	Preparation of map reconnaissance; preliminary operations orders		Field reconnaissance for brigade problem; brigade, regiment, battalion, battery	
	Tuesday	Conference: plan of action of the division, infantry, artillery, tanks, machine guns, engineers, etc.	Conference: plan of action of the artillery; organization of command		Preparation of table of organization; attack orders	
	Wednesday	Conference: assignment of missions	Preparation of maps, charts, table, and orders for preparation fire, neutralization fire, rolling barrage, counter-battery, special missions, forward movement, and defensive barrage			
	Thursday	Conference: service of information; plan of observation	Preparation of maps, charts, and orders for plan of observation		Conference: service of information; plan of liasion	Preparation of maps, charts, and orders for plan of liaison
	Friday	Conference: supply, munitions, provisions, traffic	Preparation of charts, schedules, and orders for supply and traffic		Conference: coördination of staff and special situation in attack	Conference: special instruction on week's work
	Saturday	Conference: special instruction on whole course	Property clearance			

New German 15-cm. Yellow Cross Shell

DURING the gas bombardment of June, 1918, in the attack upon R——, the enemy used a new 15-cm. yellow cross shell which has the following characteristics:



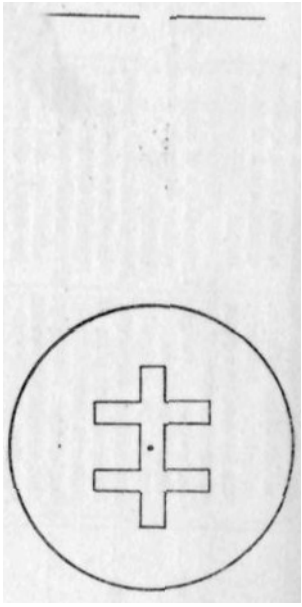
NEW GERMAN 15 Cm (5.9")

YELLOW CROSS SHELL

POWERFUL BURSTING CHARGE

SHELL PAINTED BLACK

CROSS YELLOW



Scale 1/4 Size

Length without fuse—495 mm. (19.49 inches).

Body of the shell painted black.

Mark—A double yellow cross, with one upright bar and two cross bars (Lorraine Cross).

Total weight—40.3 kgs. (88.86 lbs.).

Charge—Bursting charge, 1200 gr. Fp. 60/40* (2.6 lbs.); poison gas, 2250 cu. cms. of yperite (2 quarts).

The yperite is compressed into a container of sheet iron from four to five mm. thick, without a bottom, probably filled by a compressing machine, and closed at the bottom by the threaded base of the projectile, which is covered on its upper surface with cement.

The projectile seems to have the following advantages:

It has an appreciable demolition effect. The enemy's troops do not take it for a gas shell. The yperite is more thoroughly pulverized.

The same projectile is noted in information of July 5, which describes its bursting effect as almost as strong as that of the 15-cm. H. E. shell recently studied by the French.

The British, July 10, report a similar shell armed with Gr. Z. 14 (non-delay action).

* Fullpulver—*i.e.,* Amatol 40 per cent. ammonium nitrate and 60 per cent. T. N. T.

The United States Field Artillery Association

THE annual meeting of the Association was held at the Army and Navy Club in Washington at 4 o'clock P.M., December 14, 1918, with the President, Major-General Wm. J. Snow, in the chair. The secretary presented written proxies which, with the members present in person, constituted a quorum for the transaction of business. The minutes of the last meeting, as published in THE FIELD ARTILLERY JOURNAL, were approved. The financial statements of the treasurer were submitted, and his accounts were audited and found correct.

The secretary presented notice of proposed amendments to the constitution of the Association, given in accordance with the provisions of Article IX of the constitution and twice published in THE FIELD ARTILLERY JOURNAL. He reported that one hundred and forty-six members had voted for the amendments and that he held the proxies of one hundred and forty-three other members; but, as this number did not constitute the required three-fifths vote of the active members, the proposed amendments had failed of adoption.

The secretary-editor submitted his annual report, as follows:

Again during the fiscal year ended November 30, 1918, there was a very large increase in the business of the Association. The total cash income, exclusive of the amount on hand at the beginning of the year, was $23,654.06, which, with the bills receivable but not yet collected when the Treasurer's books were closed for the year, $1248.11, made the total amount of the year's business $24,902.17, or considerably more than double the business of the preceding fiscal year. There was, of course, a very considerable increase in the expenses of the Association, the total expenditures amounting to $11,933.28; but the ratio of expenditures to income during the preceding fiscal year was nearly maintained during the past year. The sources of income and purposes of expenditures are given in detail below:

U. S. FIELD ARTILLERY ASSOCIATION

RECEIPTS

Balance on hand December 1, 1917	$7,967.25	
Subscriptions to THE FIELD ARTILLERY JOURNAL	19,419.91	
Advertisements	3,804.37	
Sales of copies of the "Journal"	27.35	
Sales of pamphlets published	240.56	
Cancelled checks	23.00	
Interests on deposits	132.37	
Miscellaneous receipts	6.50	
		$31,621.31

EXPENDITURES

Publishing THE FIELD ARTILLERY JOURNAL	$7,977.57	
Printing pamphlets	473.12	
Miscellaneous printing	117.47	
Postage	240.95	
Telegrams	4.33	
Personal services	1,134.40	
Office supplies, stationery, etc.	111.41	
Refunds	18.85	
Bad checks (later redeemed, except $12.00)	128.00	
Commissions on advertising business	1,626.48	
Commissions on subscriptions	38.40	
Miscellaneous expenses	62.30	
Certificates of deposit purchased	18,000.00	
		29,933.28
Balance on hand November 30, 1918		$1,688.03
Interest-bearing certificates of deposit		18,000.00
Bills receivable		1,248.11
Total assets		$20,936.14

During the year the number of members of the Association and subscribers to THE FIELD ARTILLERY JOURNAL more than doubled, increasing from 4430 to 10,261. This showing would have been even better had there not be a serious failure of the mails to effect delivery of the periodical and bills for renewal of subscriptions to members of the Association on duty in France.

Last year the Secretary, in his annual report, stated that as more than half of the increase in the business occurred during the last half

of the year, and as therefore the consequent increased cost of operations would have to be borne in part during the following year, it would not be possible to maintain the great difference between income and expenses. The same condition confronts the Association this year, and while the management has succeeded during the past year in maintaining about the same ratio of expenses to income which appeared in the business of the preceding year, it would be unsafe to predict that this will be done during the coming year. An earnest attempt will, however, be made to do so.

The thanks of the management and of the entire Association are due to the instructors of field artillery at training camps and to the commanding officers of regiments of field artillery for the assistance they have rendered in introducing THE FIELD ARTILLERY JOURNAL, and particularly to the commandant and officers on duty at the Field Artillery Central Officers' Training School at Camp Zachary Taylor, Kentucky, for the splendid work there accomplished in behalf of this periodical.

Appreciation is here expressed of the many kind words of encouragement received during the year, of a nature and from sources which justify us in the statement that THE FIELD ARTILLERY JOURNAL has a rightful place in the military service and is of real and lasting benefit to the service.

The meeting proceeded to the election of members of the Executive Council. Major-General Wm. J. Snow, Brigadier-General Edward H. De Armond, Colonel Francis W. Honeycutt, Lieutenant-Colonel J. Craig McLanahan, and Lieutenant Colonel Robert E. Coulson were declared elected.

There followed an informal discussion of the affairs of the Association, after which the meeting adjourned.

EDITORIAL

Wanted—A Permanent Chief of Field Artillery

IN our January-March number we asked the Field Artillery and the service generally to rejoice with us over the appointment of a Chief of Field Artillery for the Army. Since the creation of the office last February, as an emergency war measure, it has accomplished so much by increasing and maintaining the efficiency of our Field Artillery as to prove the wisdom of making it a permanent feature in any new military establishment Congress may authorize as a result of the lessons of the great war. In this connection the Secretary of War in his annual report for the current years says: "The Department will present to the Congress a plan for the maintenance of a Regular Army which shall continue as a nucleus of any future military establishment, pending the time when the experience through which we have gone can be digested and the future needs of the nation maturely considered."

The promised plan is understood to be in preparation by the General Staff. It is expected to embody such improvements in the organization of our Army as the experience of this war indicate should be made to give us a land force sufficient not only for defense but also strong enough to back up our national policies and ideals. We stand for government of the people, by the people, for the people, and believe in fair play for all nations, weak as well as strong. Our guiding policies, namely, avoidance of entangling alliances, the Monroe Doctrine and Pan-Americanism, cannot be maintained by words alone. If we really believe in these principles and policies we must be prepared to back them with "force, force to the utmost, force without stint or limit." This force for the present and for many years to come must be physical. This does not mean militarism but organization of all our resources including man power so that they can be quickly mobilized. It does not mean the maintenance

of a large standing army, but one sound in all its parts and capable of quick expansion. Quick expansion requires a thoroughly trained corps of regular officers backed by a large officers' reserve well versed in the rudiments of the military art.

We may safely assume that the General Staff plan will provide for the training of officers of all arms and that it will insist upon the retention, as a permanent feature in our service, of the best of the great training schools and camps. We have now facilities for training our field artillery that have never before been available. That this was finally accomplished is due to the efforts of the Chief of Field Artillery, and we believe the continuance of this office in peace as well as war absolutely essential to the efficiency of that arm in the Army of the future. That is why we hope that Congress will be asked to make the office permanent and will not be persuaded to merge it with that of Chief of Coast Artillery. Moreover, it will be evident from what follows that these two arms came into being due to conditions existing in the past, and which will continue to exist in the future—that they are radically different and never could be made efficient under a single head. To attempt this in the face of our past experience would be a most unfortunate step backward. We should never forget that from 1901 to 1907 our Artillery under a Chief of Artillery constituted a single Corps comprised of two branches—the coast artillery and the field artillery, and that this combination proved so unsatisfactory that Congress was urged to dissolve what was plainly a most unnatural union. The reasons for this step were clearly and logically presented by the Chief of the Corps, who concluded his argument with these words: "The combination of the Coast and Field Artillery into a corps as is now done is not only unsound as a military principle, but the frequent interchange of officers between these tactically unrelated arms is considered detrimental to the efficiency of both." His conclusions were concurred in by the Secretary of War, the Chief of Staff, and the General Staff as a whole. Thus unanimity of opinion resulted in the Act of January 25, 1907, "To reorganize and

increase the efficiency of the artillery of the United States Army." Under the terms of this act the coast artillery and field artillery were *"permanently separated,"* and thereafter constituted two distinct arms of the service. Their functions were definitely defined as follows:

> Sec. 3.—That the Coast Artillery is the artillery charged with the care and use of fixed and movable elements of land and coast fortifications, including the submarine mine and torpedo defences.
>
> Sec. 4.—That the Field Artillery is the artillery which accompanies an army in the field, and includes light artillery, horse artillery, siege artillery and mountain artillery.

Thus, under the law, the Coast Artillery "constitutes in reality a passive defensive force which has no tactical relation whatever with the active forces of infantry, cavalry or field artillery, the three fighting elements of a mobile army." The law also provides "that on and after July 1, 1908, the Chief of Artillery shall cease to exercise supervision over the field artillery and shall hereafter be designated as the Chief of Coast Artillery."

Accordingly on that date the Field Artillery, which had been reorganized into six regiments, was left without any chief, and thereafter, together with the infantry and cavalry to which it was tactically related, constituted what came to be called collectively the "Mobile Army" in contradistinction to the Coast Artillery. It was unfortunate that the Act of 1907 failed to provide a chief for the field artillery, for although under the regimental organization the arm became more efficient than it was before the separation, its progress was not so rapid as that of the Coast Artillery under its chief, who was, *ex-officio,* a member of the general staff and stationed in Washington, where he could and did look out for the interests of his corps.

Conditions remained unchanged until June 3, 1916, when the reorganization of the Army was begun under the provision of the National Defense Act. The Field Artillery was to be increased by fifteen regiments in five equal annual increments. Accordingly, three new regiments had been added. Thus, when

the United States entered the great war in April, 1917, the regular Field Artillery consisted of nine regiments, three of which were brand-new.* The emergency required the immediate expansion of this little regular force to the full number of twenty-one regiments authorized by the new law. This was in itself no easy task and the difficulties were enormously increased by the necessity of quickly organizing and equipping sixteen Field Artillery Brigades (48 regiments) for the so-called National Army, each of which required a certain leaven of regular Field Artillery officers. In addition to this there was a call for a certain proportion of these officers for duty in the Staff Departments.

The enormous expansion of the Field Artillery† gave great opportunities for promotion in which the officers of all arms were eager to share, and many were appointed in all grades, including that of Brigadier General. A number of Cavalry regiments were taken over bodily and converted into Field Artillery.‡ All of this new personnel required intensive training to fit it for its new duties. The officers especially needed instruction to fit them for command. Skilled French officers fresh from the experience of the European battlefields were sent over to assist in this work. They were assigned to the various Divisional Camps. But as there was no Chief of Field Artillery appointed to bring order out of chaos, there was no uniformity in the instruction. There was also a deplorable lack of matériel. Then again the Divisional Schools had no permanency as they ceased to function as soon as the Division was sent overseas. The need of a great central school § was now evident to everyone, and the School of Fire at Fort Sill, which had been closed in 1916 at the outbreak of our Mexican trouble, was

* The approximate strength of the Field Artillery, with these three new regiments, was 479 officers (70 of these had not had a year's service on July 1, 1917), and 11,000 enlisted men, 50 per cent. of whom had had less than a year's training.

† The Field Artillery was expanded to nearly 25,000 officers and 400,000 enlisted men.

‡ A total of twenty-three cavalry regiments were thus converted, eight of which were from the Regular Army and fifteen from the National Army. The eight Regular regiments formed eight regiments of artillery, and the fifteen National regiments formed thirty regiments of field artillery and fifteen trench mortar batteries.

§ See article on Field Artillery Central Officers' Training School in this number.

finally reopened in July, 1917. General Snow, who was then Commandant, prepared a comprehensive plan for its enlargement which was approved in September. By March, 1918, it was graduating 100 officers per week, by November, 1918, 200 per week, and was being enlarged to graduate 300 per week, well grounded in the elements of their duties and able to instruct their units on joining. The teaching at Fort Sill was sound. The faculty were never led astray by the fetishes of "map firing" and "trench fighting." The principles of handling light artillery in open warfare, with "observation of fire," formed the basis of the instruction of all officers. Officers had an opportunity to handle our 3-inch and 4.7-inch guns, the French 75's as well as their 155-mm. guns and howitzers. They were instructed in the use of the horse and the tractor. Having mastered the basic principles with the light guns, those destined for service with units armed with the heavier calibres specialized accordingly. It is not to be inferred that the methods of trench fighting were neglected. On the contrary, French instructors from the Western Front, illustrating their lectures with actual battle maps, taught all officers the principles of firing by such maps, as well as laying barrages. Later problems along these lines were solved on the Fort Sill terrain. These methods seemed to have a peculiar fascination for some officers, especially those from the Coast Artillery, who found them akin to those of their own arm. They were inclined to pooh-pooh the basic field artillery procedure as out of date and to prefer the other in all cases. Every effort was made to correct such unsound ideas, but possibly without success in some cases. The correct view as to the training of field artillery is practically this: The artillery must be able to work with the infantry both in the war of positions and in the war of movement. In the former the first step is to dislodge an intrenched enemy. This requires the artillery to resort to firing by the map, with accurately determined ranges, "corrections of the moment," and all the other refinements necessary. The infantry advances under its protection, and assuming the attack to be finally successful,

the enemy is forced to retire. The war of positions now becomes a war of movement. The field artillery must now come up in close support of the advancing infantry even at the risk of its guns. Its commander must be in close touch with the infantry commander. He now needs all his courage, initiative and quickness of eye. He must be complete master of his guns under these new conditions. He must reconnoiter quickly and locate the centres of resistance that are delaying the advance. By the use of observed fire the centres of resistance may be overcome and hours or even days of delay saved the infantry, as well as many lives. Field artillery that is not thoroughly trained along these lines but is skilled only in "map firing" and laying a barrage will be practically useless in such cases. It will not be able to give the advancing infantry the support it requires and will end by forcing it to clean up the machine-gun resistance unaided and at a tremendous sacrifice. One-sided training is sure in the end to bring discredit upon the artillery. Efficiency in open fighting is harder to secure than in trench warfare and makes greater calls upon the courage, initiative, and "coup d'oeil" of the artillery commander.

It is understood from remarks made by officers coming from the front that at first the instruction given our artillery arriving in France was necessarily along the lines of trench warfare and that many of our officers, young and old, became imbued with the idea that these were the only methods worth knowing. They became so fascinated with the barrage as a means of infantry support as to wish to apply it in all operations, trench or open. They seemed to forget (if they ever knew) that there is such a thing as observed fire, and consequently they did not fire, as General Percin once put it, "on the proper target, at the proper time." Such ideas are dangerous. Unless cured of such heresy our artillery commanders will be timid about getting the guns forward and into the fight when the war of movement begins, and consequently will not give the infantry the support it has a right to expect.

All this is a question of proper training, and we firmly believe

the only way to insure this is to provide for a permanent Chief of Field Artillery who will see that the training in peace will be in harmony with what the artillery is expected to do in war. And now, a few words as to the matériel. In our army the term Field Artillery has a much broader significance than it has in Europe. In the latter case (as in France) the term includes only the smaller calibres like the 75 and others of approximately the same mobility. As previously noted, we have by law extended the scope and application of the term to include *all the artillery that accompanies an army in the field*. With us it is not a question of calibre but of mobility that determines the armament of our Field Artillery. The motorization of guns has been so greatly developed that very heavy calibres may now accompany an army in the field. In general, therefore, it may be stated that with us, under the law, Field Artillery includes all guns and howitzers irrespective of their calibres, provided they are always ready to move without having to provide special means of transportation, and to fire without having to prepare special emplacements. Therefore, the Field Artillery of the United States Army properly includes light artillery, horse artillery, mountain artillery, heavy artillery and caterpillar artillery. It does not include railway artillery, which properly pertains to coast artillery and should be developed by that arm as an addition to our coast defense armament—with an eye to its temporary use with a mobile army should conditions require it.

It is a pleasure to say in conclusion that the closing days of the great war find us in a position to give our army something it has heretofore never had, namely, an adequate, properly organized, fully equipped force of modern field artillery. In the first place the personnel of the future will have, as mentors, in the higher grades, veterans with the ripe experience of actual war. In the second place, we will bring home from France a huge number of 75's as well as 155-mm. howitzers and guns manufactured there for the use of our armies, to say nothing of other modern artillery material. In this country we have facilities

for training that never before existed. To utilize all these factors of efficiency to the best advantage requires a permanent directing head at the War Department. For this reason we again express the hope that the forthcoming plan of reorganization will provide for *one* responsible official whose function it will be to form from these elements a really effective fighting force. This desirable result will be assured by giving the Field Artillery a permanent chief, the lack of which in the past has continually militated against its progress.

Shall We Take the Backward Step?

THERE seems to be much unofficial activity in some quarters to secure a reversal of the decision and law of 1907, that "The combination of the Coast and Field Artillery into a Corps is an unsound military principle." Have the principles of warfare been changed by this greatest of all wars? By no manner of means. Why, then, is such a step considered for a single moment, and who is seeking to bring it about?

The arguments for this "about face" which have thus far come to our attention are:

(1) No absolutely clear line of demarcation between the two arms.

(2) Coast Artillery and Field Artillery methods are asserted to be practically the same.

(3) The two were in effect united in this war and probably will be in every war to come, hence should be under one head.

(4) Equalization of promotion.

(1) To Field Artillerymen the line of demarcation is clear and distinct. Every gun, no matter what its calibre, that accompanies an army in the field—division, corps, army—is *Field* Artillery. The introduction and use of the tractor and caterpillar have given mobility to heavier guns—extended the range of Field Artillery, given it greater power, and given the mobile army, therefore, greater effectiveness in offense and defense. The introduction of these devices, however, has not converted coast defense, mine planters, and casemates into Field Artillery.

It is a sound principle that in time of peace those arms should function together that will necessarily serve together in war. In our future mobile army the principal combatant arms will undoubtedly be the Infantry, the Field Artillery, the Cavalry, and the Air Service. In addition there are many important auxiliaries. All of these must be ready at the outbreak of war for either offensive or defensive combat. Their training must accordingly be both technical and tactical. Tactical training can be learned in one school only, that of open warfare—the war of manœuvre. There is no manœuvre, and consequently, no tactical training, in Coast Artillery proper. The function of a mobile army is to move; the function of the Coast Artillery (more properly termed Coast Defense) is to stand fast, defending a limited area only; that is, a restricted area in defensive warfare. The training is technical only. How can the Coast Artillery get the tactical training in peace which is necessary for the artillery of a mobile army, unless it leaves its coast defense guns, abandons them, and goes off with a mobile force, in which case it ceases to be Coast Artillery proper? The basic training of Coast and Field Artillery is, then, entirely different. The former is for defensive warfare in a restricted area; the latter, for offensive or defensive war anywhere. The former training does not fit officers or men for the latter. Moreover, the requirements of technical training are so diversified and so great in each arm as to preclude an officer from becoming a master of both. We cannot make of each officer a "Jack of all trades." More and more the scientific warfare of the present day requires us to develop highly specialized officers.

(2) That Coast Defense methods and Field Artillery methods are practically the same is a popular heresy, as dangerous as it is untrue. The unfortunate tying of Field Artillery to Coast Defense methods by officers of Coast Defense experience and by officers who were not trained Field Artillerymen has in this war cost us many precious lives. Dugout shooting, map shooting, shooting without eyes, and shooting with complicated mathematical formulas for corrections of the moment

are necessary in the particular but unusual kind of combat termed "trench warfare," but artillery limited to this phase of fighting in effect deserts its infantry when the line begins to move—when the guns must go either forward or backward. Coast Defense combat is a warfare of science. Field Artillery combat is a warfare of science, skill and art.

(3) Coast Artillery and Field Artillery were in effect united in this war purely through dire necessity. A pre-war Field Artillery so insignificant in size that it had to be expanded over seventy-one hundred per cent. in commissioned personnel would have been open to the severest censure and blame had it not utilized every regular army officer it could get, irrespective of the branch to which he belonged, and for which he had been specialized. Moreover, with our coasts secure from attack and with many officers of Coast Artillery who had seen service in the Field Artillery prior to 1907, it was but logical that the Coast Artillery should furnish an unusual number of its officers for service in the mobile artillery. The fact that Coast Artillery, due to an emergency, has manned heavy guns with the mobile artillery on the Western Front is no more argument for continuing the practice than that the Navy should continue to man railroad artillery because it did so on the same front. Each was a measure of great emergency. The same procedure may again be necessary in time of war; but this is not a sound principle upon which to organize and train in time of peace. Combining two arms so radically different in their reasons for existence as our Coast Defense and Field Artillery cannot but result in each interfering with the development of the other. There is far more reason to combine the Field Artillery and Infantry, since these two arms must fight together in any campaign, and neither one can know too much about the other. The fact is that the Coast Artillery in its organization (which is in varying sized units so as to man different coast commands) and in its training (with stationary guns, submarine mines, water transportation, etc.) has absolutely nothing in common

with the mobile army. It is a specialized branch by itself, more or less closely related to the Navy.

(4) Equalization of promotion. Enough said. The kernel of the nut is reached. After many years of observation we have reached the conclusion that most men, ourselves included, are influenced, first, last and all the time, by their own selfish interests—many unconsciously, perhaps. In the first place, they naturally see and emphasize the reasons which tend to guard their own interests. As they think these over their importance is magnified, and the opposing reasons are minimized, until a final conviction in harmony with their *personal* interests is reached.

With the advent of the aeroplane and with guns of larger calibre becoming mobilized, the defense of our coast is becoming more and more a task for the Navy and for the mobile army combined. The signs of the times point to a Coast Artillery of lesser importance, and a Field Artillery of greater importance. This looks as if there were more promotion in prospect in the Field than in the Coast; and irrespective of promotion, many Coast Artillery officers now serving as Field Artillerymen prefer the latter service, and think the only way of continuing it is to re-combine the two arms.

Promotion—the root of all service jealousies, intrigues and heart burnings—can and must be settled on a basis that is fair and just to all, and not in such a way as to sacrifice efficiency or violate sound military principles. Any reorganization of the army on the great scale that undoubtedly will soon become necessary should be based upon a reassignment of regular officers, so that the proportion in each arm is approximately the same. An expanded Field Artillery wants, and should have, the officers of the other arms who have been serving with it during the war; and it wants and should have its proper strength and proportion of other regular officers, be they Coast Artillery, Cavalry or Infantry, provided they are anxious or willing to transfer to it. The policy must be to take these officers without unjust discrimination and without loss of relative rank.

After that a single list for promotion, line and staff, with perhaps the pace set by the main fighting branch, the Infantry, could, we believe, settle all promotion worries and fears in time of peace, and permit all officers to see military problems in their true perspective.

All Field Artillery officers know that progress in the Field Artillery dates from 1907, the year in which occurred its separation from the Coast, with the corresponding certainty of specialization. To a man they will resist re-combination with all the strength and energy they possess. Re-combination agitation comes from Coast Artillery quarters. The line is sharply drawn. Is there to be a quarrel? We hope not—there will not be unless it is forced upon us; unless effort is made to compel us to adopt a principle that we know to be unsound in theory and destructive in practice. Of all times, this is the one when Regular officers should work together in utmost harmony and accord.

With countless other problems that are big, far-reaching and important, a family quarrel is distinctly out of place, and should be studiously avoided. We ask our Coast Artillery friends speedily to bury this bone of contention so that all of us may turn our attention to the big questions that concern the entire service.

An Editorial Appeal

IT would seem, in view of the decidedly prominent part field artillery has played in the world war, that there should be available for publication a vast deal of interesting information pertaining to this arm; in fact, we hear on all sides that there ought to be any quantity of material for THE FIELD ARTILLERY JOURNAL. We hear about it, but don't see it in the form of manuscript.

The idea that a so-called technical or professional journal is the result of one man's efforts to dig up things, and that its success is measured by his ability to keep on digging, is erroneous.

We know that the members of our Association are always

busy, both on this side and over there; but we feel that, now the armistice has been signed, there must be a few moments each day one could jot down ideas or impressions gained, especially by those who were so fortunate as to see active service.

In this connection, we would remind our readers that there are several thousand members of the Association who did not see foreign service, and who would, it is believed, be glad to hear from those of us who have had experience with their arm in battle. During the earlier part of the war a translation was made of a series of articles written by a major of German field artillery, and published in the JOURNAL. This was an account of the actual everyday events that fell to the lot of an officer in campaign. They were of great interest to us as field artillerymen, in that they brought out all the little things that go to make up the day's work. Surely, there must be some among us who can equal if not surpass his accounts.

We have increased our subscription list considerably during the past year and hope to maintain this increase. But if we are to keep up the interest of a large number of our members, more than half of whom have already gone or will shortly go back into civil life, we must furnish them with information as to what the field artillery has done in this war. Let us try to put before them something of the "personal touch" side of the game.

Don't be afraid to send in your literary effusions, because most of us are just common or garden clay, and those who are not, or who are inclined to be critical, don't count in the long run, anyway.

To those who are now overseas we would say, take a little time off from the Mignons in the Chateaux and the Big Berthas in the Schlossen.

To those who have been over there and are back again, there is no excuse unless their brains have become ossified.

This is in the nature of a personal appeal. *This means you if the shoe pinches*. In the words of the good old Caisson Song: "Keep them rolling."

Roll of Honor

PRO PATRIÂ

DEAD

ADAMS.—Died of pneumonia at Camp McClellan, Ala., October 21, 1918, Second Lieutenant Milton Wesley Adams, Field Artillery.

ANDERSON.—Killed in action in France, November 1, 1918, Captain George W. Anderson, Jr., 313th Field Artillery.

BASH.—Reported missing in action in France, October 21, 1918, First Lieutenant Henry E. Bash, Field Artillery, attached 91st Aëro Squadron.

BERRY.—Died of pneumonia at Youngstown, Ohio, October 29, 1918, First Lieutenant Edward Hall Berry, 8th Field Artillery Brigade.

BOARDMAN.—Died of pneumonia at Camp Zachary Taylor, Ky., October 22, 1918, Second Lieutenant T. Bradford Boardman, Field Artillery.

BROGAN.—Died of pneumonia in France, November 14, 1918, First Lieutenant Lawrence E. Brogan, 349th Field Artillery.

BROWN.—Killed in action in France, November 3, 1918, Second Lieutenant Hilton U. Brown, Jr., 7th Field Artillery.

BUBBS.—Killed in action in France, October 2, 1918, Second Lieutenant L. T. Bubbs, Battery F, 107th Field Artillery.

BURT.—Died of pneumonia at Camp Lewis, Washington, October 26, 1918, Second Lieutenant Ray Albert Burt, Battery D, 38th Field Artillery.

CAMERON.—Killed in action in France, November 3, 1918, First Lieutenant Douglas Tilford Cameron, Battery D, 7th Field Artillery.

COWING.—Died of disease in France, September 29, 1918, Second Lieutenant Lawrence Cowing, 144th Field Artillery.

EDMON.—Died of pneumonia at Fort Sill, Okla., November 5, 1918, Second Lieutenant John M. Edmon, 46th Field Artillery.

WALLACE.—Died of pneumonia in France, September 13, 1918, First Lieutenant Edward Wallace, 146th Field Artillery.

WELSH.—Killed in action in France, November 5, 1918, Colonel Robert S. Welsh, 314th Field Artillery.

WYMAN.—Died of influenza in France, September 9, 1918, First Lieutenant Horace Wyman, Battery C, 303d Field Artillery.

WOUNDED

GESELL.—Severely wounded in action in France, August 12, 1918, Second Lieutenant Walter Bertram Gesell, Battery A, 16th Field Artillery.

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

EDWARDS.—Died from injury at Camp Custer, Mich., November 27, 1918, Second Lieutenant William E. Edwards, 41st Field Artillery.

FARNSWORTH.—Died of pneumonia at Camp Zachary Taylor, Ky., October 6, 1918, Second Lieutenant John Farnsworth, 23d Training Battery, F. A. C. O. T. S.

FERGUSON.—Died of pneumonia at Camp Zachary Taylor, Ky., October 13, 1918, Second Lieutenant Thomas T. Ferguson, Battery E, 70th Field Artillery.

FULTON.—Killed in action in France, October 4, 1918, First Lieutenant Hugh Fulton, 12th Field Artillery.

GARNSEY.—Killed in action in France, September 30, 1918, Second Lieutenant Cyrus Garnsey, 3d Field Artillery.

GELFELT.—Died of wounds received in action in France, October 3, 1918, Second Lieutenant George R. Gelfelt, 130th Field Artillery.

GROSSIUS.—Died of influenza at Camp Zachary Taylor, Ky., October 26, 1918, Second Lieutenant William Henry Grossius, Field Artillery.

HARGETT.—Died of wounds received in action in France, September 30, 1918, First Lieutenant Earlston L. Hargett, Battery B, 150th Field Artillery.

HARRINGTON.—Killed in action in France, August 9, 1918, First Lieutenant William J. Harrington, Chaplain, 151st Field Artillery.

HITES.—Died of wounds received in action in France, September 28, 1918, Second Lieutenant Edward E. Hites, 6th Field Artillery.

HOBBS.—Died of wounds received in France, November 21, 1918, First Lieutenant Joseph C. Hobbs, Field Artillery, 113th Supply Train.

HOUSTON.—Died of pneumonia at Camp Kearney, Cal., December 5, 1918, Captain George T. Houston, Jr., Field Artillery.

HOUSTON.—Died of wounds received in action in France, August 19, 1918, Second Lieutenant Henry H. Houston, 53d Field Artillery Brigade.

HUGHES.—Died of tubercular meningitis at Fort McPherson, Ga., October 20, 1918, Second Lieutenant Lester H. Hughes, Field Artillery.

KEEFE.—Died of pneumonia at Camp Zachary Taylor, Ky., October 26, 1918, Second Lieutenant Thomas Victor Keefe, Battery D, 1st Regiment, Field Artillery.

KILLOUGH.—Died of pneumonia at New York, N. Y., October 30, 1918, First Lieutenant Joseph E. Killough, Field Artillery.

KING.—Killed in action in France, November 9, 1918, Major Alfred K. King, Field Artillery, Headquarters 5th Army Corps.

KRAUS.—Died of pneumonia at Camp Zachary Taylor, Ky., October 12, 1918, Second Lieutenant Elmer L. Kraus, Field Artillery.

LARSON.—Died of pneumonia at Green Bay, Wis., October 25, 1918, First Lieutenant Peter D. Larson, 82d Field Artillery.

LATHROP.—Died of tuberculosis in England, March 17, 1918, Second Lieutenant Lewis L. Lathrop, 21st Field Artillery.

LINDLEY.—Died of pneumonia at Jackson Barracks, La., November 14, 1918, Second Lieutenant John H. Lindley, 63d Field Artillery.

LOCKERMAN.—Died of empyema at Camp Zachary Taylor, Ky., November 21, 1918, Second Lieutenant Haywood Lockerman, 4th Observation Battalion, F. A. C. O. T. S.

MCCLURE.—Died of pneumonia at Camp Jackson, S. C., October 23, 1918, Second Lieutenant Craig McClure, Jr., Field Artillery.

MONTAGUE.—Died of pneumonia in France, November 5, 1918, First Lieutenant Danforth Montague, Headquarters Company, 305th Field Artillery.

PETTIT.—Killed in action in France, November 10, 1918, Captain William S. Pettit, Battery B, 14th Field Artillery.

POTTER.—Died of pneumonia at Camp Zachary Taylor, Ky., October 17, 1918, Second Lieutenant Sanford Hubbell Potter, Field Artillery.

PUTNAM.—Died of wounds received in action in France, October 20, 1918, First Lieutenant Winfield Putnam, Headquarters Company, 16th Field Artillery.

REDNER.—Died of pneumonia in France, September 25, 1918, Second Lieutenant Joseph Howard Redner, Headquarters Company, 119th Field Artillery.

RODHOUSE.—Died of pneumonia at Camp Zachary Taylor, Ky., October 14, 1918, Second Lieutenant Frank Rodhouse, School Battery, F. A. C. O. T. S.

RORICK.—Died of acute neuritis at Fairfield, Ia., November 17, 1918, First Lieutenant Elroy E. Rorick, 54th Field Artillery.

ROTHFUSS.—Died of pneumonia at Camp Zachary Taylor, Ky., October 5, 1918, Second Lieutenant Ruber S. Rothfuss, attached 37th Training Battery, F. A. C. O. T. S.

ROWE.—Died of pneumonia at Camp Jackson, S. C., October 3, 1918, Second Lieutenant Louis H. Rowe, Battery F, 13th Field Artillery.

SARGEANT.—Died of wounds received in action in France, October 28, 1918, Second Lieutenant Bradley V. Sargeant, Jr., 11th Field Artillery.

SHEPPARD.—Died of pneumonia at Camp Zachary Taylor, Ky., October 11, 1918, Second Lieutenant Andrew J. Sheppard, 36th Training Battery, F. A. C. O. T. S.

SISTARE.—Died of influenza at New London, Conn., November 29, 1918, Captain William M. Sistare, Field Artillery.

SIVLEY.—Died of injuries received in an aëroplane accident at Selfridge Field, Mount Clemens, Mich., October 29, 1918, Second Lieutenant Andrew H. Sivley, Jr., Field Artillery.

SLADE.—Died of pneumonia in France, September 17, 1918, Second Lieutenant John Slade, Battery D, 121st Field Artillery.

SMITH.—Killed in action in France, October 30, 1918, Second Lieutenant John H. Smith, Battery C, 107th Field Artillery.

SMITH.—Killed in action in France, October 2, 1918, Second Lieutenant Lester M. Smith, Battery C, 7th Field Artillery.

STRACK.—Died of pneumonia at Camp Zachary Taylor, Ky., October 8, 1918, Second Lieutenant John J. Strack, 10th Battalion, Field Artillery Replacement Depot.

TOWNE.—Died of pneumonia at Camp Jackson, S. C., October 6, 1918, Second Lieutenant Nathan Clarence Towne, 137th Field Artillery Replacement Depot.

TUCKER.—Believed to have been drowned near Selfridge Field, Mount Clemens, Mich., October 6, 1918, Second Lieutenant Dixie B. Tucker, Field Artillery.

VANSICKLE.—Killed in action in France, March 1, 1918, Captain Karl G. Vansickle, 308th Field Artillery.

VON SALTZA.—Reported missing in action in France, September 30, 1918, First Lieutenant Philip W. Von Saltza, Headquarters Company, 306th Field Artillery.

BOOK REVIEWS

THE SUBMARINE IN WAR AND PEACE. By Simon Lake, M.I.N.A. 71 illustrations. J. B. Lippincott Co., Philadelphia, Pa. Price, decorative cloth, $3.00 net.

The author, who has achieved international fame as an inventor, especially along submarine lines, gives to the layman a comprehensive exposition of the subject. While not, properly speaking, a subject with which field artillery officers are concerned, it is one of such general interest and has played such an important part in the war, to say nothing of the future, as to make this a valuable book to anyone who desires to increase his knowledge of the submarine.

THE ENGLISH OF MILITARY COMMUNICATIONS. By William A. Ganoe, Major of Infantry, U. S. Army, Assistant Professor of English, U. S. Military Academy. George Banta Publishing Co., Menasha, Wis., 1918.

Received too late for review.

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AERIAL WARFARE.—European War: "Long-distance Bombardment from Airplanes, and American Aviation." (*The Living Age*, Nov. 9, 1918, p. 327.)

AERIAL WARFARE.—Types of airplanes and qualities required for air war. (*Air Service Journal*, August 22, 1918, p. 262.)

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AEROPLANES.—European War: "Bombing Planes and Their Targets." Description of; results and methods. (*Scientific American*, August 3, 1918, p. 86.)

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ARTILLERY.—Belgium: Artillery matériel, and personnel of the Belgian army during European War, 1914. (*Revue Militaire Suisse*, June, 1918, p. 228.)

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