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THE TRUCK-DRAWN 75mm BATTERY

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TEST OF THE TRUCK-DRAWN 75MM BATTERY

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MR. O. F. HIPKINS, of Port Deposit, Maryland, spent several years working on a means for increasing the traction of Ford and Chevrolet trucks on muddy roads and across country. In the fall of 1931 he demonstrated his truck to Major General Harry G. Bishop, Chief of Field Artillery. A light commercial 4 × 2 truck, with a sub-transmission and with Hipkins' traction devices on the dual rear wheels, towed a French 75mm gun over the difficult courses at Aberdeen Proving Ground. This performance fired General Bishop's imagination. It satisfied him that not only was he on the right track in his stand taken previously that Field Artillery vehicles should include commercial types wherever possible, but that there were untried possibilities in the lightest and commonest of these types.

He determined to get started on this line and secured a single truck and a set of traction devices for test by the Field Artillery Board. Based upon the Board's satisfactory findings, and assisted by the Quartermaster General, he secured a battery equipped throughout with Ford trucks.

This battery was assigned to Battery D, 17th Field Artillery, command by Captain Alan Campbell, at Fort Bragg, N. C., and was tested by the Field Artillery Board from May 7, 1932, to March 1, 1933. The directive for this test was, in general, to determine the capabilities and limitations of light trucks as prime movers and accompanying vehicles for a battery of light field artillery, the possible and practical modifications of the vehicles to improve their capabilities, and the proper personnel organization to insure the functioning of the battery as an efficient field artillery unit.

EQUIPMENT

The motor vehicle equipment furnished included the following vehicles, all of Ford manufacture, of the 1932 series:

Five station wagons, six-passenger type.

Five 1½-ton trucks, 4 wheel, rear-wheel drive.

Five 1½-ton trucks, 4-wheel, rear-wheel drive, with Warford auxiliary transmissions.

One 2½-ton truck, 6-wheel drive, with Warford auxiliary transmission.

Although the development of a high speed gun carriage had not been completed at that time, the Ordnance Department furnished four guns known as the 75mm gun M1897 M1E3, which were satisfactory from the standpoint of mobility, but had certain defects in firing that have been corrected in later designs.

There were attached to the battery for comparative test with the above vehicles:

One pick-up truck, Ford, ¾-ton.

One 1½-ton truck, Chevrolet, 6 wheel, 4-wheel drive.

1½-ton truck Ford, 6 wheel, (middle axle) drive.

THE TEST OF THE BATTERY

On receipt of the experimental equipment for the battery, a period of approximately one month was set aside for instruction of personnel in the operation and maintenance of the materiel. This preliminary training period was followed by a period of about two months which was utilized for training of the battery as a unit in marches on roads of varying types, on cross country movements, and in the reconnaissance and occupation of positions involved in execution of various tactical missions. During the second period, firing tests of the experimental carriages were conducted.

After completion of the battery training and the tests of the Ordnance materiel, the battery was required to execute a series of tactical missions presented in problems selected by the Board. These problems were drawn up with the object of determining the ability of the battery to function as a tactical unit of light field artillery, under all conditions of terrain and weather existing at Fort Bragg. Several problems involved movement on poor

roads and across country at night, without lights, followed by occupation of position and the complete establishment of observation, fire control and communication equipment of the battery. Normal loads, to simulate ammunition weight, were carried in vehicles during tests.

The final test given the light truck-drawn battery by the Board was a march to Fort Ethan Allen, Vermont, and return to Fort Bragg, involving operation at the northern post during the month of January to determine the ability of the motor vehicle equipment to function under winter conditions in a cold climate. Advantage was taken of the opportunity to test the equipment on the Fort Meade and Fort Humphreys reservations during an enforced stop-over at Fort Myer, caused by an outbreak of influenza in the personnel of the battery.

AT FORT BRAGG

At Fort Bragg the battery was given a series of eight tactical exercises involving reconnaissance and occupation of positions in a variety of assumed situations. The exercises covered the following:

(1) The battery, as part of a small force, advanced to and occupied a position appropriate to the accomplishment of certain given fire missions. This was followed by a situation involving the selection, displacement to and occupation of a position to the rear, to be executed under cover from designated observation. The exercise was accomplished without incident. The rear displacement was about 3,500 yards and was effected in 35 minutes. Part of the route involved driving through closely set trees, off the road.

(2) The battery, as a part of an attacking force in a meeting engagement, was required to advance to, select and occupy a position suitable for the support of the attack. This was a simple problem and was accomplished without incident.

(3) The battery, as a part of the artillery with an advance guard, was required to select and occupy successive supporting positions. The advance from the first position to the second was made over some extremely bad stretches of road. The road distance was approximately five miles and was covered by the firing

THE HIPKINS TRACKS THAT ADAPT THE LIGHT TRUCK TO CROSS COUNTRY TOWING

battery in 1 hour and 3 minutes. The going was dry, but rough and sandy. The transportation of the battery commander's party in two station wagons materially reduced the flexibility of this unit and added to the difficulties of reconnaissance and route marking.

(4) The battery as part of an attacking force selected and occupied its attack position. The situations given involved two forward displacements, the first along an inferior road and the second partly across country. The displacement across country was slowed up to some extent, due to the necessity for having men on foot precede the vehicles for the purpose of locating stumps. No other difficulties were encountered.

(5) The battery, as part of a delaying force operating in front of a defensive line, occupied its position. The situation involved a daylight reconnaissance of a position within the defensive lines, followed by the withdrawal to that position after dark. The moon was bright and the displacement of the battery was made at a rate of approximately eight miles per hour by the leading vehicle. Although this vehicle halted several times to permit the column

to close up, the fact that any halt had been made was not apparent to observers in a Board vehicle which was following the column closely. Even with a bright moon, it is believed to have been demonstrated that a speed of from three to four miles per hour is the maximum which should be expected of this transportation at night, without lights on poor roads.

(6) The battery, as a part of a force charged with the defense of a river line, occupied its position in readiness. A daylight reconnaissance of the appropriate front was made and tentative positions selected. After dark a situation was given the battery commander which involved the movement to and prompt occupation of one of these positions. The move was about three and one-half miles over fair and poor roads. No difficulties were encountered.

(7) The battery was assumed to be a part of the artillery reenforcing a force which was to attack at daylight of the following day. The route and position were reconnoitered during the afternoon. About half of the route assigned to the battery was unfamiliar to any of its personnel. It led across a small stream and about thirty feet of very soft going. In making the reconnaissance both station wagons were stuck at this point, but were pushed through by the personnel assigned to ride in them. Twenty minutes were required to make this crossing. Immediately afterwards, the Franklin engined 4 × 4 truck crossed without assistance but with some difficulty. Before dark, a detail from the battery was brought up to this crossing in the six-wheeler which crossed with little difficulty. Some pioneer work was then done on the crossing, mostly corduroying. The firing battery moved forward after dark with tracks on most of the vehicles. The battery reached the crossing at 8:30 p.m. The first gun was crossed over at 9:00 p.m. and the crossing was completed at 9:55 p.m. It was necessary to pull all vehicles with the six-wheeler. After the completion of the crossing, the remaining distance to the position, slightly over one mile, was covered in twenty minutes. The route beyond the crossing was fair to poor and it was found necessary to have each vehicle preceded by a man on foot, wearing a white shirt. This problem was carried out on an extremely dark night.

(8) The battery was assumed to form part of the artillery of a division contemplating a night withdrawal. This exercise involved firing in the initial position, the concurrent reconnaissance of a rear position and the withdrawal to the latter under cover of darkness. The route selected for the displacement, part of which was off the roads, was about five miles long and was effected in approximately two hours. Again it was found to be necessary to have a man clad in a white undershirt precede each vehicle and frequent halts were necessary to keep the column closed up. The night was fairly dark, there being no moon, but some light was afforded by the stars.

CONCLUSIONS

1. On roads the battery possesses a high degree of strategical mobility.
2. In dry or sandy country, that is in terrain approximating that of Fort Bragg, the battery possesses a satisfactory degree of tactical mobility. With the exception of crossing the swamp land, the battery was able to negotiate any part of the reservation without unusual difficulty. Due to the non-availability of suitable terrain for a test, the mobility of the battery through sticky mud has not been determined. This question can be answered after a test at Fort Sill.
3. Two wire trucks are required.
4. An assistant driver on each vehicle is essential.
5. Except on good roads, the battery cannot be expected to move at night, without lights, at a faster pace than that of a marching man. It is essential that on poor roads and across country a dismounted man precede each vehicle on foot.
6. A test should be made of a suitable light vehicle, capable of messenger service, such as a three-wheeled motorcycle, for purposes of communication between the advanced elements and the battery.

TRIP TO FORT ETHAN ALLEN

On the trip north, the battery remained at Fort Myer for several days. On one day the battery went to Fort Meade, staged a tactical problem which involved movement in a flank guard action, through small trees and cane-brake. The ability of the

trucks to move through small trees and thorny underbush without damage was surprising.

Following this, the battery was taken across the tank test course. At the start of this course the Ford and Chevrolet 6-wheel, 4-wheel drive truck, with traction devices arranged as half-tracks over the pair of driving wheels, crossed a swamp in which the 4 × 2 trucks were mired. However, the latter, with the assistance of the cannoneers, were able to get through. The desirability of light vehicles that can be materially assisted by man-power was evident here. In ascending a sandy hill-side, it was found difficult to steer the 6 × 4 trucks, since the tracks took control and resisted any effort to change direction. This had been observed before and had given rise to requests for a front driving unit, and for a 6 × 2 truck which is more flexible under such conditions.

At Fort Humphreys the battery was taken through a narrow, winding, heavy clay road in the woods. This wet clay presented difficult operating conditions much different from those met in the sandy soil at Fort Bragg. However, the battery negotiated its march without serious delay, turned about by moving into spaces between trees on the sides of the road, and returned to Fort Myer.

During the stay at Fort Ethan Allen, all vehicles were parked out of doors to simulate field conditions as to protection of vehicles, and in order to further simulate field conditions, running gear was allowed to remain covered with mud on return from daily operation, in order to ascertain the effect of freezing mud on brake mechanisms and other exposed moving parts. Antifreeze solution (Prestone) was used in cooling systems, and winter grade of lubricants in motors and chassis. Blanket lined radiator and hood covers were made for all vehicles, with adjustable openings over the radiators.

An excellent opportunity was offered to test the efficiency of the vehicles in cold weather, and on extremely varied conditions of road and terrain, by the trip to Fort Ethan Allen. Road conditions encountered varied from solid ice, on steep winding grades, with other roads, deeply rutted and frozen hard, with and without snow, to clay roads with surface made slippery by rain and thawing. The terrain over which the battery operated on tactical

problems at this post is very hilly and broken, with many stone walls, and typical small mountain streams, partly ice covered, in the valleys. Ground surface was at times frozen, without snow, at other times very slippery from effect of thaws on heavy frost. Tests were also made in snow about twelve inches in depth. Vehicles were tested in their ability to cross a small river, with very stony bottom, and with smooth ice on ascent from the deepest part of the stream, and they successfully crossed this obstacle.

The tactical problems presented at Fort Ethan Allen involved occupation of positions, selected as the most difficult for occupation by divisional artillery, the displacement of the battery across country over ground broken by steep hills and ravines, rocks, and scattered trees, and its movement over very steep and rocky trails crossed by streams. After a very fine dry snow had fallen to a depth of about ten inches, the battery executed a cross country move over terrain which had been previously traversed without snow, with a thawed surface and frozen subsoil, to determine the comparison of its performance under very different conditions.

DISCUSSION

The tests determined that the light truck-drawn battery has satisfactory mobility on any road with a reasonable traction surface. On first class roads, it has excellent mobility, and can steadily maintain an average mileage of from 15 to 20 miles per hour, including necessary halts, with remarkable fuel economy. On very soft and dry sand roads, with no firm subsurface, the vehicles have difficulty, and, except the six-wheeled truck, equipped with traction devices, will have to be assisted at times, especially on up grades. The six-wheeled truck, on traction devices, performs well in sand and retains its tractive power. On wet clay roads, the vehicles, with chains and traction devices, give a satisfactory performance, and make consistent progress at reduced speed. Unless such a road is exceptionally bad, the light truck-drawn battery should be able to average five miles per hour. During the march to Fort Ethan Allen, a stretch of twelve miles of mountain road, with steep grades and sharp curves, with the surface entirely covered with smooth ice, and made slippery by a steady rain,

was traversed in a most creditable performance. The condition of the road was such that civilian traffic was practically suspended at the time. In a number of instances, the battery was required to traverse deeply rutted frozen roads during the tests in the vicinity of Fort Ethan Allen, and also over the same roads after the surface had thawed to an extent which made the road surface very slippery. This type of road was negotiated without difficulty and an average speed of ten to fifteen miles per hour maintained. On one day's run, on a very poor road, partly through woods, with several steep grades, the road surface was rendered extremely slippery by a rain and thaw, which softened the clay surface while the soil underneath was solidly frozen. Using chains and traction devices the battery completed its move over this road without difficulty, while vehicles without chains were promptly stalled by slippage of the wheels.

The hill climbing ability of the vehicles is excellent, whenever traction can be obtained. With firm footing the steepest grades encountered on the Fort Bragg reservation were climbed without difficulty. Several of the positions chosen for occupancy at Fort Ethan Allen were selected because of the extremely steep approaches, but all of the moves into these positions were accomplished without delay.

Deep dry sand, however, is a serious obstacle if encountered on an up grade, and, with such road conditions, it may be necessary to assist the vehicle.

The cross country mobility of the unit is surprisingly good. It is possible to stall the vehicles in marshy ground, and a stream, with muddy banks and a soft bottom, is a serious obstacle which will require pioneer work to permit passage of the vehicles. The stream fording ability of the vehicles is limited. To insure successful fording of a stream without delay, the bottom must be firm enough to support the vehicles and depth of stream not over eighteen inches, with reasonable approaches or banks. The vehicles have no trench crossing ability. However, on reasonably firm ground, and over ordinary terrain, the vehicles can make steady progress across country at the rate of five miles per hour, and at higher speed under favorable terrain conditions. In all problems given the battery on the varied terrain at Fort Bragg,

Fort Meade, and at Fort Ethan Allen, the battery successfully accomplished the occupation of designated battery positions, by day and night, without undue delays and in a manner satisfactory to the Board. Displacements across country, simulating changes of position in action, were made at the speed attained by the dismounted men making the immediate reconnissance in front of the vehicles.

On reasonably level ground, with a surface not obstructed by rocks or trees, and ordinary soil such as commonly found in pastures or hay fields, the unit can move for short distances at fifteen miles per hour on tracks. It is not advisable to anticipate this speed on tracks for long distances, due to possible damage to the tires or traction devices.

No opportunity has been offered to test the mobility of the unit in freshly plowed ground, but the performance of the vehicles, with tracks installed, on varied types of difficult terrain leads to the belief that, except in extremely sandy or muddy fields, the vehicles will operate without difficulty.

The turning radius of the trucks is such that the vehicles lack the extreme maneuverability of tractors, or animal-drawn artillery carriages. This is noticeable in the difficulty encountered in reversing the direction of the column in a narrow defile, or in maneuvering on heavily wooded terrain. The six-wheeled truck is more difficult to maneuver than the four-wheeled trucks.

The protection afforded by the brush guards, and the power of the vehicles, is such that the trucks will make steady progress through thorny brush and scrub which would be impassable for animals without pioneer work.

Extreme care is necessary in movement of vehicles across country at night without vehicle lights, to prevent damage to vehicles through striking obstructions, or attempting passage of ditches, marshy ground, etc., liable to cause delay. However, by using dismounted men, wearing white cloth markers or carrying screened lights, to precede vehicles as guides, and to mark bad spots on poor roads, the unit successfully accomplished all night movements in a very satisfactory manner.

The test at Fort Ethan Allen demonstrated the ability of the battery to retain its mobility under reasonably severe winter conditions.

THE REEL RL-26 MAY BE USED IN ANY TRUCK OF THE BATTERY

Frozen ground, and hard frozen roads, offered no serious difficulty. Ice covered roads slowed up progress, but, even when extremely difficult, were successfully negotiated. Snow, of over one foot depth, is an obstacle, and, under certain conditions, will give trouble by "balling up" on the tracks, but the battery is able to make satisfactory progress on broken, snow covered ground.

Modern commercial anti-freeze solutions offer satisfactory protection to motors exposed to cold weather, and should be supplied for winter work. Extreme care is necessary to prevent accumulation

of water in gas lines and consequent freezing in cold weather. Except when caused by frozen gas lines, no difficulty was experienced in starting vehicles. The accumulations of mud and ice on brake parts, steering mechanisms, and wheels, which, in order to simulate field conditions, was not removed from vehicles on return to park, did not interfere with proper functioning.

The light truck-drawn battery has demonstrated a combination of strategic and tactical mobility which surpassed the anticipations of the Board. In a large measure, the success attained with this unit was due to intelligent operation and constant attention to details of maintenance by the personnel of the unit. While the material is rugged, efficient, and has given an excellent mechanical performance, the characteristics of motor vehicles are such that damage and probable disabling results will follow reckless or careless handling, or neglect of a rigid maintenance routine.

For these reasons the remarkably successful performance by this battery is not necessarily an indication or a guarantee that the same degree of success may be anticipated with every unit to be equipped with similar material.

The use of light commercial trucks as transport for light field artillery offers many advantages over animal transport, but the complete replacement of animal transport by motor vehicles brings up the possibility of many difficulties with the transport in field operations, and in the provisions of transportation for individual personnel required by reconnaissance, communications, and column control missions. The advantages of the extreme strategic mobility of the motor vehicle, and its superiority as a means of transportation of supplies over considerable distances, are obvious.

The use of comparatively inexpensive motor vehicle equipment results in a large economy in cost of equipment per unit, as compared to the cost of animal transport. Due to reduction in bulk of supplies required, as compared to supplies for animals, a reduction in cargo space required in unit trains seems probable. Practically no supplies are consumed, except during actual operation of the vehicles. The motor vehicle, properly maintained and operated, has ability for continuous work not possible with animals.

The time required for training is reduced, and the training of personnel is simplified, in case of general mobilization, under present occupational vocations of the civilian population. Further, a reduction in personnel of units is made possible by use of motor vehicle transport.

On the other hand, each motor vehicle must be considered as a potential cause of serious difficulty, and subject to being easily disabled. The operator of the motor vehicle, however, cannot rely on any assistance from instinctive action on the part of his machine, and a moment's inattention, carelessness, or an error in judgment on his part may result in disabling his own vehicle and in the delay of many others. An animal quickly forms a habit of following closely behind a vehicle preceding him, and avoids colliding with it should it stop. The motor vehicle will neither follow nor avoid a collision except in response to the control of its operator.

The road control and supervision of a column of fast moving motor vehicles is far more difficult than the control and supervision of an animal-drawn column. This difficulty of column control is emphasized as the speed is increased.

There is a general impression that adoption of motor vehicles as transportation for light field artillery will bring a relief from the constant care required by animal transportation. This is true only to a very limited extent. There is a relief in that the motor vehicles, when not in operation, require much less attention than animals. Motor vehicles may be stored for considerable periods without serious deterioration. While actually operating, however, the successful use of motor transportation by large units requires constant attention, careful judgment, and strict supervision to a greater degree than animal transport. The maintenance work following any operation, the check of condition and readiness for further operation, must be as systematic and thorough, and is often more essential than the care given an animal after work.

CONCLUSIONS

It was concluded by the Board that:

a. The light truck-drawn battery had demonstrated a highly satisfactory combination of strategic and tactical mobility. Its

satisfactory operation requires a high degree of training and discipline in the enlisted personnel, and good judgment, close supervision, and constant attention on the part of its commissioned officers.

b. The performance of the light truck-drawn battery determined that it is an efficient light artillery unit and that light artillery so equipped is especially well adapted to function as the light artillery of GHQ reserve. It should replace the tractor-drawn and portee organizations of 75mm guns now included in plans for mobilization as GHQ reserve units.

c. The light regiments of the brigade of the Hawaiian Division would be more efficient with this equipment, than with their present equipment, in so far as their primary mission is concerned.

d. An extended test of a battalion equipped throughout with light commercial trucks, and light vehicles having mechanical characteristics similar to the trucks, should be made in direct comparison with a battalion of animal-drawn light field artillery. This test should be made at a station where the maximum activity of artillery units would be required in all phases of tactical work, and should extend over a period of at least one year. The observations made during this test should form the basis of the final decision as to the suitability of the light motor truck transport as a replacement for animal transport in divisional light field artillery.

e. The peace strength of batteries of light truck-drawn field artillery should be 4 officers and 100 enlisted men. One station wagon or similar vehicle should be added to the present equipment, giving a total of six vehicles of this type instead of the five now issued. (NOTE: Based upon the test of the pick-up truck, it was decided by the Chief of Field Artillery to add one to each battery for column control, messenger service, etc.)

f. The equipment used during the tests proved extremely efficient and reliable. It is simple, markedly free from mechanical weaknesses, and very economical in operation.

g. Certain requirements may be set down as necessary specifications for the vehicle equipment which must be fulfilled to insure satisfactory performance by light truck-drawn field artillery

units. These requirements cover types of vehicles, and also certain modifications which must be made in the usual standard commercial vehicles to adapt them for use by light field artillery.

The light vehicles for transportation of personnel and light equipment should be of the station wagon or similar type.

In two batteries of the battalion to be organized for further test the trucks used as prime movers and general cargo carriers should be of approximately 1½ tons pay load capacity, of the four-wheel, rear drive type, with dual rear wheels. All 1½-ton trucks in the organization should be identical, to facilitate their usefulness in any capacity in the unit.

One six-wheel, four-wheel drive truck, with dual rear wheels of approximately 2½-tons pay load capacity should be included in the vehicle equipment of this battery, as a vehicle for transporting heavy supplies, and as a means for assisting other vehicles which may be in difficulty.

h. The third battery, to be operated in the same battalion with the batteries equipped as specified in the preceding paragraph, should be equipped with five six-wheel, four-wheel drive trucks, to serve as prime movers and for transport of heavy supplies, with six 1½-ton, four-wheel rear drive trucks identical with those described above. This battery should be tested to determine the relative efficiency of the six-wheel type prime movers as compared to the four-wheel type in the other batteries. (NOTE: It was later recommended by the Board that 6-wheel, 2-wheel-drive trucks be tested as prime movers in one battery.)

i. All vehicles should have the following:
   Identical motors.
   Identical transmissions.
   Windshields which may be adjusted to give unobstructed vision to the front.
   Brush guards.
   Tow hooks.
   Small reserve fuel tanks with gravity feed line.
   Rugged bumpers, without springs, front and rear.
   Suitable tire chain equipment.
   Puncture proof inner tubes.

j. The general purpose, (1½-ton), trucks in the unit should all have the following characteristics:

Light vehicle weight for pay load capacity.

Lowest commercial standard rear axle ratio.

Rugged two-speed auxiliary transmissions, with direct and low range only.

Oversize radiators, to insure adequate cooling at low vehicle speed.

Folding top over driver's seat.

Steel express bodies, with folding longtitudinal seats.

Suitable pintles at maximum height and with minimum overhang at rear.

Tires of same dimensions on all wheels.

A suitable form of traction device, of Hipkins or similar type.

Simple accessible mechanisms, with provision for quickly draining fuel lines.

k. The light vehicles, of station wagon type, should have four speed transmissions to give a low gear reduction permitting operation in column with trucks at extremely low vehicle speeds.

RECOMMENDATIONS

The Board recommended:

a. That a battalion of light truck-drawn field artillery be organized as described in the conclusions expressed above, and given a service test as an active unit in direct comparison with horse-drawn divisional field artillery. One battery of this battalion to be equipped with six wheeled, four-wheel drive trucks as prime movers.

b. That commercial motor vehicles, modified in accordance with the requirements expressed in pars. i, j and k (Conclusions) above, be procured as the equipment of the battalion recommended in the preceding paragraph.

c. That final decision as to the suitability of light commercial motor vehicles as transport for divisional light field artillery be made after test of the complete battalion.

d. That the two light regiments of the Hawaiian Division be equipped as light truck-drawn artillery.

e. That all tractor-drawn light field artillery and portee light field artillery organizations, now contemplated for mobilization as GHQ reserve light artillery, be replaced in mobilization plans by light truck-drawn field artillery units.

f. That a study be made considering the complete replacement of animal-drawn units in service batteries, combat trains and ammunition trains by suitable light motor truck units.

EFFECT UPON THE NATIONAL GUARD

Major General George Leach, Chief of the Militia Bureau, followed the test of this battery with increasing interest. After observing it in Washington en route to Fort Ethan Allen he initiated arrangements for a demonstration at Fort Bragg about February 23rd. This demonstration was witnessed by commanders of nearly all the brigades and regiments of light artillery in the National Guard. From a standpoint of economical maintenance and of the requirements for peace-time training he decided that approximately half of the 75mm gun regiments of the National Guard should have this equipment substituted for animal-drawn equipment immediately. He succeeded in launching this project and such re-equipment will be accomplished during the summer of 1933.

TRANSFER TO FORT SILL

As originally contemplated by General Bishop, the equipment of this battery was transferred to the Field Artillery School at Fort Sill in March 1933. A detachment of Battery D, 17th Field Artillery took the equipment overland stopping at Fort Benning where it was examined by the officers of the Infantry School.

The Commanding General, Eighth Corps Area, had the battery ordered to Fort Sam Houston for a few days. A large number of officers in the vicinity of San Antonio took advantage of the opportunity to observe the two demonstrations there. It was the general impression there that such a battery is superior to portee but that further experiment was necessary before conclusions could be drawn as to its use as divison artillery.

AT FORT SILL

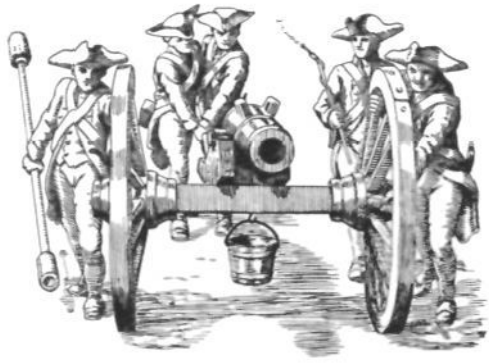
Upon arrival at Fort Sill the equipment was turned over to Battery A, 1st Field Artillery commanded by Captain Ward C.

THE 75mm GUN M1897-M1E7 ADOPTED FOR THE TRUCK-DRAWN BATTALION

Goessling. Captain Campbell, Lieutenant Enslow, and their drivers and non-commissioned officers remained with the battery for a few days to give the benefit of their experience to the new personnel. The battery participated in the motorized battalion march in the spring schedule of the School and demonstrated that the gas and oil consumption of the entire battery was about equivalent to that of one tractor. Due to the early closing of the School and to the activities of the post in caring for the Civilian Conservation Corps it was necessary to postpone further tests of the battery for about two months.

After more than 8,000 miles of operation, much of which was in the lower gears, with traction devices on the wheels, it appeared advisable to give the equipment a complete overhaul. This should be completed in July and the battery will be ready to take its place in the experimental battalion. The vehicles for the other two batteries as recommended by the Board, and those for the battalion headquarters were shipped on June 23rd. The new gun carriages known as 75mm 1897-M1E7 being provided by the Ordinance Department will reach the battalion about August first.

Whatever the final conclusion may be it is certain that, through having observed these tests and learned the use of a simple auxiliary transmission, and of tracks on the wheels, the field artillery is much better able to exploit the possibilities of light trucks and that it will see trucks replace its animals to a large extent in future operations.



WHY THE 75?

BY COLONEL ALLEN J. GREER, FIELD ARTILLERY

THE November-December, 1932, issue of THE FIELD ARTILLERY JOURNAL contained an article by Colonel Conrad H. Lanza entitled "What the Artillery Accomplished at St. Mihiel."

This article is a volume of information presented in such a logical manner that it is a classic in its line, and should be carefully studied by all Field Artillery Officers. One paragraph has started a train of thought in the mind of the writer. This paragraph is quoted:

"The 75 guns used slightly over one day's fire. The guns which individually fired more than any others were the French 120mm. These were mobile, easy to handle, *and fired a shell sufficiently large to give good neutralization effect, which the 75mm guns did not do."*

For many years a gun of approximately three inches in caliber has been the principal light artillery weapon. The adoption of such a weapon was dictated largely by the element of mobility, since a team of six horses could haul efficiently a load of slightly over 4,000 pounds, and this in round numbers was about the weight of the three inch gun and limber. Such a gun could also be manhandled and shifted in its position by the gun crew. The French 75mm gun model of 1897, possessing the above characteristics of caliber and weight, when it appeared, of course completely revolutionized artillery doctrines of fire and tactics. All of us are familiar with the French belief that the fire of these guns would be the decisive artillery feature in battle, and not until active hostilities and the appearance of the mass of German heavier artillery was this doctrine altered. During the war we abandoned our own three inch gun and adopted the French 75mm. It is still the prncipal light artillery weapon of our own and several other countries besides France.

The Caliber Board of 1919 among other things recommended for our light artillery a gun of about three inches and a howitzer of 105mm in caliber with interchangeable carriages. Since that date our Ordnance Department has manufactured several pilot weapons of these types, namely a 75mm gun and a 105mm howitzer.

There is a very general tendency among military students to assume that the stabilization which occurred in France during the World War was the result of the narrow front, flanked on one side by Switzerland and on the other by the sea. However, history shows that stabilization has resulted in all protracted modern campaigns, where there has been anywhere near an equality of the contending forces. Take our own Civil War for example. During the latter part of the campaign in Northern Virginia both armies continually entrenched, and in whatever direction the Union Armies maneuvered, they found in front of them the Confederate entrenchments. A similar situation developed during Sherman's campaign against Atlanta. In both cases there was a period of maneuvers alternating with a period of stabilization, with both forces entrenched. During the Russo-Japanese War the same state of affairs occurred, and during the Balkan Wars this was also true.

It is believed that in all future conflicts between modern armies of nearly equal strength, there will be periods of maneuvers followed by stabilization during which preparations will be made for the next offensive. The cause of this stabilization and stagnation is the ever increasing power of infantry fire on the defensive.

In our Army we have been most reluctant to come to the doctrine that the individual infantryman with his rifle and bayonet is merely an adjunct to the powerful automatic weapons with which modern infantry is equipped. Germany toward the end of the war more and more developed the theory that the Machine Gun was the Infantry. That it still is so considered is shown by their present Infantry organization. Their battalion, in addition to a section of anti-tank guns, consists of a machine gun company and three rifle companies, each organized into nine squads of twelve men, each squad having a light machine gun. The Machine Gun Company has twelve heavy guns.

It becomes necessary to ask the following questions: 1. Is our army prepared to contend with a foe equipped as is the German Army and other modern forces? 2. If not, then what should be done to alter our organization and armament?

This article proposes to deal with only one phase: the organization

and equipment of divisional artillery. An article on organization prepared by the present writer appeared in the September-October, 1932, issue of THE FIELD ARTILLERY JOURNAL. So far as the proposal that the Divisional Artillery consist of three regiments of three battalions each, with the battalion containing four batteries, no modification is recommended. However, it is most earnestly believed that our opinions on armament should be altered.

Weapons in warfare should be suited to the operations. The defensive will invariably resort to entrenching, manning the fortifications with automatic weapons. The completeness of the defensive works will depend upon time available. For a successful attack against a force thoroughly entrenched, and well equipped with large numbers of machine guns, the offensive must have a preponderance of artillery fire. In such a situation the 75mm gun has little effect. It has approximately a thirteen pound projectile, which of course does a small amount of damage, the flat trajectory causes many dead spaces, and the angle of fall being slight the shell fragments produce a small number of casualties only.

In 1923-1924 the Field Artillery Board at Fort Bragg under the direction of Colonel Wright Smith made some extremely interesting and valuable experiments on the effect of projectiles detonated at various angles of fall from 0 to 90 degrees. Major Keith Adamson, Ordnance Department, was on this Board and acknowledgment is made to him for much of the data that follows. The principal fire mission of light artillery will be against personnel, and the long fuze with instantaneous burst upon impact is used to produce the maximum effect. Very often, however, the division artillery must be assigned the task of cutting wire to provide lanes of passage for the attacking infantry.

A shell upon detonation sends its fragments to the side, front and rear. The nose and base sprays have little casualty producing effects, and only the side spray gives appreciable results. Consequently a projectile with a small angle of fall, that is one fired from a gun with a flat trajectory, loses a large portion of its fragments by shooting them directly into the ground or up into the air. On the contrary, a shell detonated at 90 degrees

sends its spray of fragments in all directions. Therefore a general rule may be given: The greater the angle of fall of a projectile, the greater the number of casualty producing fragments upon detonation.

As a tactical proposition we may assume 4,000 yards as a frequent and normal range for light artillery, and the following table gives some figures compiled for that range showing the weapons and the angle of fall on impact of the projectile. Other ranges would of course produce relatively the same results:

French 75mm gun		7°
New American 75mm gun	Supercharge	5°
	Normal Charge	10°
75mm Howitzer Pack—Zone	2	23°
	3	16°
	4	11°
New 105mm Howitzer—Zone	2	32° & 62°
	3	24°
	4	16°
	5	13°
	6	10°
	7	9°

Taking these angles of fall in order and interpolating from a chart furnished by Major Adamson, the following list shows the number of fragments, capable of producing casualties, which a 75mm shell produced upon detonation: 7°—30, 5°—29, 10°—32, 23°—41, 16°—36, 11°—33; (32°—49, 62°—78), 24°—42, 16°—36, 13°—34, 10°—32 and 9°—31.

Therefore contrasting the French 75mm gun and our new 75mm pack howitzer using zone 2 at a 4,000 yard range we find the latter produces eleven, or about one third more casualty causing fragments. At an angle of 32°, one of the two elevations at which the 105mm howitzer can be fired, the resulting fragmentation of a 75mm shell is 49 or about one and two thirds times the number that the French gun would give, while at 62°, which the 105mm howitzer can also use with charge 2, there would be 78 fragments, or about two and two thirds times that of the French gun. Disregarding then the dead spaces which the flat trajectory of the gun fails to cover, and which howitzer fire will reach, and other features such as the ability of a howitzer to go into position

behind a mask too high for the gun to fire over, we find a striking superiority of the howitzer over the gun in casualty effecting fragmentation.

The following rule may be stated:

Two pieces of artillery vary in efficiency:

1st In their accuracy or inversely as to probable error;

2nd Distribution of shell fragments due to angle of fall;

3rd Number and size of effective fragments due to mass of projectile.

In round numbers we will assume that the shell projectile for the 75mm gun weighs 13 pounds and for the 105mm howitzer 34 pounds. Taking our previous figures for angle of fall, and assuming the number of fragments will vary as does the size of the projectile, which is approximately true, we find the 105mm howitzer at 4,000 yards using zone 7 with about the same angle of fall as our new 75mm gun at the same range will produce about 2.7 times the number of effective fragments as does the 75, while using 32° at 4,000 yards it will produce four times the number, and using 62° elevation, which can also be done, almost 6 2/3 times the number of effective fragments will be caused.

It is of course well established that a gun is more suitable for shrapnel firing than is a howitzer. All of us are familiar with the difficulties of producing great volumes of shrapnel ammunition such as war demands and securing accuracy in timing the train. This and the difficulties of training officers to adjust shrapnel fire were primary causes in relegating it to an insignificant position during the World War. Its prime purpose is against troops in the open and not for trench warfare. Its moral effect cannot compare with that of shells bursting among the troops. In addition many experiments tend to show it does not actually produce the casualties which shells do, particularly when the latter have a considerable angle of fall. Without going deeply into the problem which the writer considers practical conditions during the World War actually solved, this article is going to assume that shrapnel in great wars has become obsolescent, and arguments given herein are entirely based on shell fire.

While light artillery is to be used principally against personnel, there are many cases where it must be employed against wire entanglements.

Here again the angle of fall and the mass of metal of the projectile give the advantage to the howitzer. While the 75 will cut wire, it does little damage to the posts and the entanglement remains almost as effective. The howitzer projectile, with its greater angle of fall and mass of metal, will not only cut more wire, but demolish the posts as well, thus making a much more effective opening. For demolition, which is an occasional mission of light artillery, the angle of fall and mass of metal produce the same relative effect on explosion as has previously been stated in discussing fragmentation.

Let us now consider the question of range. We find the maximum ranges for our light cannon in yards to be as follows:

French 75mm gun	12,780
New American 75mm gun	14,880
Pack 75mm howitzer	9,200
New American 105mm howitzer	11,960

While the gun has a superiority in range there are many officers who seriously doubt the advantage of great range for light supporting artillery. A very natural tendency will be for the artillery to take advantage of this long range and not remain in intimate liaison with the infantry it is supporting. Also unless the observation post is well to the front, observation of long range fire is very difficult, particularly for the small 75mm projectile.

In draft the weights of our light cannon are as follows:

French 75mm gun	4,586	pounds
New American 75mm gun	4,650	"
Pack 75mm howitzer	1,446	"
New American 105mm howitzer	5,275	"

If we take into consideration the fact that all our artillery will be motorized, and the light artillery will almost certainly have carriages with pneumatic tires, the extra weight of the howitzer is no serious disadvantage. It can be manhandled into and out of position without much greater difficulty.

The extra weight of the howitzer ammunition is a difficulty in supply that motor transport can be expected to overcome. The howitzer with its semi-fixed ammunition arranged for zone fire cannot maintain the rate of fire of which the gun is capable. It seems to the writer that the most reasonable solution for this is to have only two types of fire for the howitzer, and to have fixed

ammunition using what is now the zone 2 charge for one and the zone 7 charge in the other. The nature of the operation will determine the proportion of ammunition of each type.

The foregoing arguments point to the conclusion that in the majority of situations the 105mm howitzer possesses great advantages over the 75mm gun as a divisional artillery weapon. In a few instances only is the gun superior. As stated earlier in this article, we may expect all future great campaigns to have periods of stabilization followed by preparations for the offensive. Equipping our Army with the weapons best suited to provide for these contingencies means changing our light artillery's principal weapon from a gun to a howitzer.

While the missions of counter battery, counter preparation and long range fire will ordinarily be assigned to Corps Artillery, there will be numerous occasions when a certain amount of divisional artillery must be allotted to this purpose. Hence one of the three regiments should be equipped with the 155mm or medium caliber howitzers.

Notwithstanding all the study given to the question of organization and equipment by our General Staff and the War College, it seems to the writer that we have a division with an obsolete infantry organization and armament, and an artillery inadequate in numbers and type of weapon. While it is realized that during times of peace we cannot hope to have artillery regiments of twelve batteries, we should recognize the fact that our present War Tables do not give the infantry sufficient supporting artillery to make offensive operations a success, and they should be changed to do so.

Not long ago Mr. Owen Young made the statement that one of the principal reasons for the present world financial difficulty was the demand of the United States for payment in gold of its war debts. Certainly a number of our European debtors have claimed if they could pay us with goods and not gold they would willingly do so. Therefore, why should we not offer some of these European nations the opportunity to manufacture for us sufficient 105mm howitzers to equip our Regular Army and National Guard? In this manner a portion of the war debts could be paid in goods without disturbing the gold balances of those countries, and at the same time providing us with modern equipment.

WHAT CAN A NATIONAL GUARD BATTERY ACCOMPLISH IN A YEAR—AND WHY?

(THE STORY OF BATTERY A, 101ST FIELD ARTILLERY, MASSACHUSETTS NATIONAL GUARD, AND THE YEAR 1931-1932)

By 1ST SERGEANT FREDERICK L. FISH

THE question is a broad one and the answer a simple one. Any National Guard battery can accomplish exactly what it sets out to do, providing it has proper leadership, the will to do spirit and the love of artillery for the fun of the thing. Below you will read of the year 1931-1932, that is from September, 1931, until the end of Summer Camp, August 6, 1932, of Battery A, 101st Field Artillery, Massachusetts National Guard, commonly known as Battery "A" of Boston. During that year the Battery—

Won the Major's Cup (best all around battery in the battalion).

Won the Marne Trophy (best in service practice gunnery in regiment).

Won the Knox Trophy (best all around battery for year in brigade).

Received a mark of "Excellent" in the State Inspection.

Received a mark of "Satisfactory" in the Federal Inspection.

Won the major event—Section Stake Driving Contest—Mounted Service Night.

Won the Class B championship and Estes Cup—Indoor Polo League.

Defeated First Corps of Cadets of Boston, ancient rival in football, 13-0.

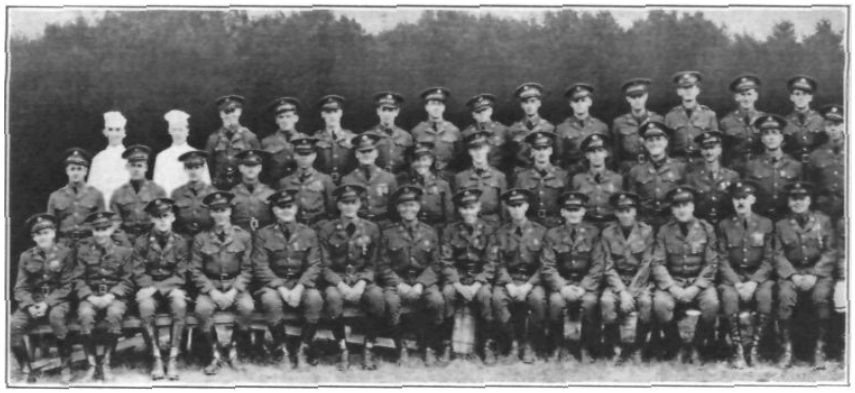
What was the reason for this success? There were several reasons and in order to get a true picture they must be considered separately.

AN OUTLINE OF OUR DISCUSSION

That this accomplishment was possible with but one drill a week during the year and fifteen days' Summer Camp would seem to be incredible until we consider the reasons behind it. These reasons will be our discussion because they were our spark plugs and made a real difference. During the discussion you will note:

We kept active (men like to be associated with action).

We had lots of fun (the best adult fun is doing work well).



BATTERY A, 101ST FIELD ARTILLERY

We made the most of our equipment.

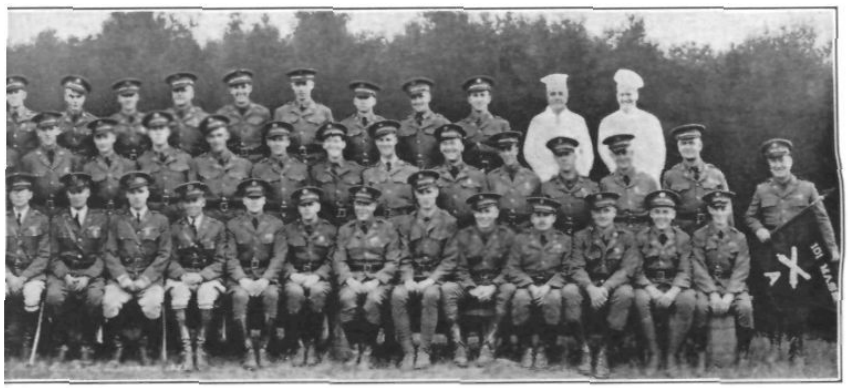
Our schedule was complete and progressive (always something more to learn).

Men were encouraged to use their initiative.

An example of this latter point might well come here. The only competition which the Battery did not win in 1931-1932 was a battalion four team pistol match. The Battery finished third because of lack of ammunition which would have permitted the forming of an expert pistol team. This defeat was such a disappointment to a certain corporal that he has gathered together a team, raised funds and purchased ammunition, bought new Colt pistols and has his team practicing at least once a week. It's hard to beat men like that. (Since this was written the corporal and his team have won this year's battalion four team pistol match with a lead of about 100 points.)

THE BACKGROUND

The history of Battery A, 101st Field Artillery, can be traced back to the forming of the Boston Light Artillery Company in 1853. Modern use of Field Artillery started at the close of the 19th century and it is from 1895 when Captain William D. Ewing started his battery that we look for the beginning of that training and background which kept things going ever more efficiently until the World War found the Battery ready. One of the most interesting events of this period was the encampment at Manassas,



MASSACHUSETTS NATIONAL GUARD

Virginia, during the first week in September, 1904, when maneuvers were held with the Regular Army and the militia of the various states. The report of the Regular Army inspector stated: "I can say unhesitatingly that this is the best militia field battery I have ever observed." To tell of the events between this encampment and the World War would take several volumes and so we pass to February 5, 1918. We are in the Chemin-des-Dames sector near the ruins of what was once the Village of Ostel. The Battery prepares to fire, guns laid on Moulin Rouge. The guidon is hung in the first section gun pit. A message to Kaiser Bill is chalked on a shell. Other section gun crews gather around the first section to watch history being made. Suddenly the command "fire"; the first shot fired in action by National Guard Field Artillery is on its way. Besides this the Battery was the first National Guard Battery to land in Europe, and fired in the first Rolling Barrage of American Forces against the Germans (February 23, 1918). It occupied 32 different positions and spent 223 days on the front. It was in foreign service 18 months and 21 days, fired 52,295 rounds, the third section alone firing 14,005 rounds. Chemin-des-Dames, Toul, Chateau Thierry, St. Mihiel and Verdun are all names famous in Battery history. That, in brief, is the history and background which has inspired the postwar Battery in its efforts to push ahead and be prepared.

THE EQUIPMENT

Battery A is part of a French 75mm horse-drawn regiment (101st F. A.) and brigade (51st F. A. Brigade) and has full

peace time equipment. By proper care it is kept in good shape and the question of equipment does not bother. During the winter there are enough horses for one battery to drill mounted at a time. At Summer Camp each battery has its own. Likewise we are fortunate in being quartered at the Commonwealth Armory in Allston (Boston), Mass. This Mounted Service Armory is the home of many units, the principal ones being the 1st Battalion of the 101st Field Artillery and the 110th Cavalry. The armory contains a large indoor riding ring (suitable for even a fast mounted drill), a small ring for single mount work and a large yard for outdoor riding and mounted drills. The quarters of the Battery include an office for the captain and 1st sergeant, an officers' locker room, sergeants' locker room, large enlisted men's locker room, library, gun shed, saddle room, mechanics' work room, supply room and special detail equipment room. There is also a large basement storeroom. In the sub-basement there is a pistol range.

THE OFFICERS

In the success of Battery A during the season 1931-1932, intelligent leadership, as it always does, accounted for at least 75% of the efficiency. This was due to: long service with same outfit; well rounded experience; careful handling of men, especially as to initiative and self government.

For example, Captain Theodore L. Storer has been connected with the Battery since June, 1915, when he enlisted as a private. The captain with two of the three remaining officers had a good deal of experience during the War although he was the only one with the Battery. As is natural, the majority of the ideas used by the Battery during 1931-1932 originated with the officers. In most cases, however, they were not communicated directly to the men but were suggested to leading non-commissioned officers. Perhaps merely a hint was passed. Nevertheless, the seed was thus planted and the idea grew under the leadership of some officer who remained in the background. Thus a natural growth of ideas sprang up—each sure that it would be heard before being discarded. To this degree, the Battery ran itself and the officers had more time to give individual instruction.

THE BATTERY OF 1931-1932

No battery of National Guard troops stands still even in membership.

Changes are constant. A man's time runs out, he changes his occupation, moves away, is transferred to another city, etc. The first step is to increase a man's interest by presenting a more interesting and varied program, by appealing to the idea that artillery is a man's game and time must be spent to learn it. Merely place the chance to learn more about his job before any member of the Battery and he'll respond. The longer a man has been in the "game" the more use he is to you. At the State Inspection on January 29, 1932, it was found that the following years of service were represented:

Enlisted strength	**80 men**	**%**
Over 3 years' service	30 men	37½%
Two to three years	16 men	20 %
One to two years	14 men	17½%
Six months to 1 year	11 men	13¾%
Recruits (less than 6 months)	9 men	11¼%
	80 men	100%

Only four enlisted men had had war service although three of the four officers had been in the World War. A comparison of these figures with those of some years back would show a distinct increase in years of service—an advantage to any outfit.

OUR ENLISTED MAN

Being in Boston, a college and educational center, the temptation to get college men to enlist is great. They are a clean cut type, about the right age, healthy, strong, intelligent and supposedly hard workers. But there's the catch—they are hard workers but they have too many other interests. There is always the baseball team, football or crew, or perhaps examinations or vacations. Good attendance is impossible and in a few years they are gone—scattered to the four corners of the earth—and you begin again with a new lot. Experience has shown us that the best type of man for our Battery is the young broker, lawyer, real estate or professional man, or the young executive. This type has all the qualifications of the other group and in addition is looking for a hobby, for more exercise, the chance to ride, the opportunity to shoot.

THE MEMBERSHIP COMMITTEE

Recruits were not hard to find and during a good part of 1931-1932

there were eight to ten on the waiting list at all times. The men were encouraged to bring their friends to watch the drills and to discuss membership. After seeing one good mounted drill, the rest was easy. Each new man filled out an application, met the membership committee, which consisted of the first sergeant, a chief-of-section, and a corporal, and the matter was frankly discussed. Applicants who were not strong, who seemed rather young and those who could not go to Summer Camp were discouraged for their own good. After accepting a man and enlisting him the committee saw that he got started right. He was assigned to a section, introduced to the other members of that section and of the Battery and was not allowed to feel he was not wanted. A certificate was presented to each man upon formally enlisting.

HOW WE HANDLED RECRUITS

The recruits we got were handled like those of many other National Guard outfits. When a man enlisted he was assigned to a section and worked out his own salvation. There were several reasons why this was necessary. Men did not enlist at the same time, peace time strength required them in the sections, the year's work had to progress without taking non-commissioned officers out for artillery recruit instruction, etc. But as you may have noticed in the preceding paragraph we did not stop here, rather we made the men feel at home in a definite section, and section pride fostered by good non-coms, did the rest. What was not learned at Battery drills was passed on by the older men in the section. Then we placed in the recruit's hands drill manuals and TR's covering his job and these were usually eaten up by his initial enthusiasm. During the winter and whenever else needed we required all the recruits to attend drill half to three quarters of an hour earlier and a recruit school on such items as military courtesy, guard duty, close order drill, etc., was conducted by an experienced sergeant and an alert and capable corporal.

THE DRILL SCHEDULE OF 1931-1932

September, 1931—Warming up

October, 1931—Winter Training—Instruction by non-coms.—pistol

November, 1931—Winter Training—Instruction by non-coms.—pistol

December, 1931—Winter Training—Preparation for Federal and State Inspection
January, 1932—Winter Training—Preparation for Federal and State Inspection
February, 1932—Winter Training—Correction of errors noted at Inspection
March, 1932—Winter Training—Correction of errors noted at Inspection
April, 1932—Preparation for Summer Camp
May, 1932—Preparation for Summer Camp—overnight turnout
June, 1932—Preparation for Summer Camp
July, 1932—Preparation for Summer Camp
July 23rd to August 6th—Summer Camp (Fort Devens, Mass.)

The schedule was progressive, seeking to bring the Battery to a peak at State and Federal Inspections and again at Summer Camp. Because more subjects, such as rolling rolls, packing equipment, etc., had to be covered to put the Battery in an efficient condition for field work than for indoor inspection the above schedule was timed to permit proper instruction for both objectives. Again, there are no short cuts to a well trained battery. It's good hard work which we tried to make enjoyable. The Battery Commander felt that a chain was as strong as its weakest link and insisted that all do their own job well.

SYSTEM OF INSTRUCTION BY NON-COMMISSIONED OFFICERS

In the Fall of 1931 a new system of instruction by non-commissioned officers was tried for the first time. Each drill night was divided into two sessions and the members of the Battery into two groups. Each group was assigned an active period and a lecture period each drill. A complete schedule covering October and November was made up in advance and a non-com. was assigned to take care of each of the four periods each drill night. An assistant was also assigned to each period. The Captain assigned the non-com. in charge of a subject but outside of that it was up to him. The instructions read: "The Non-Commissioned Officer in charge of a session will be expected to take full responsibility for making his period interesting and instructive. He will have complete charge to do what he desires. The chapters (in the TR's) referred to are only a general guide. Any other information

may be made use of." For the Assistant they read: "The Assistant Non-Commissioned Officer can be called upon by the Non-Com. in charge. He will write a full report for the period and turn it in within 24 hours to the Battery Commander. He will see that the period starts and ends on time, and will be responsible for maintenance of proper discipline." Some of the subjects covered were: pistol instruction; matériel, including 15 min. gun drill; pair driving; harnessing for speed; nomenclature of harness; equitation; special detail instruments; signal equipment, its care and use; scouting, carrying messages, map reading; foot drill and calisthenics.

The result was better non-commissioned officers both as to knowledge of their job and ability to command their little group. Those who had been shy or backward seemed encouraged by this system. The privates came to know their non-coms. in a bit different way and seemed to have more respect for their position and followed their instructions more closely ever after. It put the non-coms, across and made them a definite part of the Battery. There was, because of this system, more study than ever before, for the officers had to be prepared, the non-com, in charge could call on the assistant, the assistant's report kept the former on his toes and the privates tried their best to trip up their non-com. friends. Weaknesses revealed were corrected in due course.

PISTOL PRACTICE

The Battery is armed with the .45 cal. Model 1911 automatic pistol. As previously noted, we have the use of a fine pistol range where both practice and record courses are fired. During the non-commissioned officer instruction, preliminary pistol instruction is included. This covers the parts of the pistol, the function of each part, how the pistol is sighted and how fired. Experience has taught us that it is best to hold the practice and record firings on week-ends in order to save time. On such week-ends both Saturday afternoon and Sunday morning are divided into hour and one-half periods and one non-commissioned officer and 12 men are handled each period. This allows the officer in charge time to devote to each person firing. Lack of ammunition keeps the results at a low figure, they being as follows in 1931:

Expert	7	
Sharpshooter	3	Out of 80 men and 4 officers this
Marksman	40	was about 60%.
Total	50	

A new pistol team is in the making and is meeting with fair success. (Since this was written the Battery pistol team has won two matches, including the Jones Cup for the best pistol team in the 1st Battalion. 101st Field Artillery, Mass. N. G.)

SPECIAL LECTURES

On the theory that a man enjoys his work if he understands his part in it and something of the problems that have faced his brother-in-arms both in the past and present, special lectures are included in the year's work. Some in the 1931-1932 season were: "Principles of Artillery Employment in Warfare," "Parts and Care of the Horse," "History of Artillery," "Modern Fire Control Instruments," "Mechanization of Field Artillery," "Gas Defense," "The Artillery of the Battle of Gettysburg."

With the exception of the "Care of the Horse," all these were handled by members of the Battery, in three cases by privates of the B. C. Detail.

DRIVER OR CANNONEER? OR B. C. DETAIL?

To make a man a driver or cannoneer, that is the question. Or should he be in the detail? In the National Guard we've found you've got to put him in the best place according to his abilities but you've also got to interest and train him in all three. The day will come when you'll need him in some other position and you must keep after him to be sure he's learning all he can about the whole game.

TRAINING THE DRIVERS

We started, as you do, with a mixed group of men, some trained, some new, horses, equipment and the TR's. It was a question of getting the best in the shortest possible time. You have already seen that at the beginning of the year (in this case 1931) we instilled interest in the men and urged the non-coms. to be on the job, so we began with interested men and up-and-coming non-coms. The new men were separated and given instruction in equitation only, receiving their other mounted instruction in their sections. As far as time allowed we gave proper instruction

to all the drivers in equitation, the artillery driver, management of the pair, and draft. The artillery horse, harnessing and care of equipment were all included as single mount bareback and single mount with saddle rides, pair driving and fast mounted drills were worked into the drill schedule. Rules were stressed continually. Whether a drill, hike or parade, draft, proper management, distance, interval were all insisted upon every minute by everyone from the captain down. A man learned to drive by driving.

TRAINING THE CANNONEERS

The problem here was the same—new men, old men, equipment and TR's. The difference between a cannoneer and a real good cannoneer is plenty of work—and individual instruction. Usually you'll find that the cannoneers are left over drivers. Some will be real glad, as they dislike the horses anyway, but others will be most unhappy, even sore about it all. The answer to developing good gun crews is, or was in 1931-1932, good gunner corporals, for they sensed the thrill and seemed to catch the spirit of it all. The cannoneers of 1931-1932 enjoyed their work because they had lots of good fun besides. Ever had a "prepare for action" or "march order" race, or breech block races between No. 1 and No. 2 of each section, etc.? These added to the joy of the work well done and showed where individual instruction was needed. The theory was also stressed as the paragraph on the gunner's exam, points out. To sum up, we took our book in hand and made sure every cannoneer knew his job before he reached camp. After that, the men seldom failed.

TRAINING THE B. C. DETAIL

It's the easiest thing in the world to forget the B. C. detail until you need it and then wonder why it isn't ready. And, in turn, the B. C. detail often finds such things as excessive equitation much more interesting than their real work. It isn't so much a problem of getting the right man for the job as getting the man to take an interest in his job. We found the secret of success to be plenty of opportunity for the detail to drill alone under expert leadership, for after all, the TR's have all the details.

STATE AND FEDERAL INSPECTIONS

We have been used to having these inspections on the same night but in the 1931-1932 season, State Inspection came on January

29th and Federal Inspection one week later. These inspections are the winter check-ups by the State and Federal governments to observe the progress of the training, the state of efficiency, the condition of equipment, and the handling of the paperwork. At each inspection the inspecting officer checked the paperwork and the equipment in the afternoon and inspected the men in the evening. The latter formation started in each case with a personal inspection of each man at which questions on military organization, courtesy, guard and riot duty, general orders for the guard, etc., were asked. Then followed dismounted drill, calisthenics, guard duty, riot duty, mounted drill and B. C. detail work. During all the practical work, questions were asked. Parts of harness, horse, gun, detail instruments, telephones, etc., all came in for attention. The check-up is always a complete one and 1932 was no exception. The highest grade in the State Inspection is "Excellent" and in the Federal "Satisfactory." We are proud to say we received these marks for 1932 and have for some years.

SPRING SECTION COMPETITION

After the above mentioned inspections there are often weak spots to be ironed out and there are still February and March in which to do it. Then with Spring comes the thought of outdoor work and Summer Camp. April 1, 1932, found the winter's training about done and it was decided to have a Battery Competition. Usually we side away from section competitions as we like to stress a one-Battery spirit but this time we weakened. The competition took place on April 21st and the events were:

1. Prepare for Action and March Order Race
   (Chief of section and complete gun crew)
   Each gun crew takes post carriages unlimbered in March Order. At the command "Prepare for Action" the movement is executed against time and every error counts. Then, on command, back to March Order in the same manner against time.
2. Breech Block Race
   (2 men from each gun crew)
   At the command "go" one man takes block down, steps aside and the second man puts it together again, total time to count.

3. Harnessing and Hitching (Not the usual race)
   (1 sergeant, 3 drivers)
   The horses are gathered together at one end of the ring without halters. The carriages (one for each section) are at the other. The four men from each section line up by their carriage, halters in hand. At a signal the four men from each section run towards the horses, which are let loose. The drivers must catch, harness and hitch their horses and drive the length of the hall back to a starting line.
4. Stake Driving
   (1 sergeant, 3 drivers)
   Move over a figure 8 course, driving between stakes at walk and trot. Count stakes touched.
5. 10 rounds
   (Chief of section and complete gun crew)
   A dummy shell is placed in fuse setter. The gun crews are at posts in carriages unlimbered, prepared for action. At the command "fire," the shell is cut, placed in gun and supposedly "fired," extracted, placed in fuse setter, etc., until 10 rounds have been "fired." Deflection, range and fuse setter are changed between each shot. At the end of last round, the dummy is placed on the footboard of caisson, the squad falls in "rear of pieces" at attention.
6. Equitation
   (4 men from each section)
   Walk, trot and canter.

The result was a lot of fun and those who lost saw to it that their faults were soon corrected.

ANNUAL SPRING TURNOUT

For years one of the popular features and a good training bet for Summer Camp has been the Annual Spring Turnout. When you're sure Winter's over, you feel like getting out in the woods on a horse. We are no exception and so again last May we started on a Saturday afternoon with full equipment, went about 5 or 6 miles, established camp, and returned Sunday afternoon. This allowed plenty of time on Saturday to get back the hang of rolling rolls and packing equipment, and gave a full Sunday morning for a good workout by driving through the woods, over hill

and dale, taking positions one after another and having snappy gun drills. Then a level field was found and a fast mounted drill in the clear cool air added the final touch. For the new men especially, and for the old ones too, it more than proved its worth in 1931-1932.

SPECIAL TURNOUTS

We tried to keep active and interested. For example, on March 17, 1932, the Battery took part in the Evacuation Day Parade in South Boston. What a day! Rain, sleet, cold, ice! Up hill and down hill with the only way to keep a carriage in check being to keep one wheel against the curbstone so that it would act as a brake. Horses down, up and down again. Everyone chilled clear through. At last it was successfully completed. Would the men go again? You bet!

SPORTS—FOOTBALL

It's football all Fall for a very good reason. Since 1905 the Battery has played the First Corps of Cadets of Boston on Thanksgiving and the feeling runs high. So each year the men dig out the old pigskin and get busy. Once upon a time a man was enlisted because he was a good football player. Those days are gone, for unless he wants to stay with the Battery and play artillery as hard as he plays football, he doesn't even get in. However, we never lose sight of the fact that some of our best men came to the Battery because they knew we played football. Every precaution is taken to guard against football interfering with drill and each football man attends drill even if he has just had a hard practice. They practice twice a week and have a few games before the one mentioned above. The idea is to have a good time and they do—but for some years they've won, the score on Thanksgiving, 1931, being Battery A, 13; 1st Corps, 0. In fact, during the past twelve years only three games have been lost. (Since this was written the Battery won the Thanksgiving, 1932, game, 12-0.)

POLO

Each winter for several years the Battery has entered a team of enlisted men in the Class B section of the Indoor Polo League of Boston. Games are played at the Commonwealth Armory. On March 13, 1932, this team won the game that gave them the title in the Class B and won for the Battery the Estes Cup. Two of

the three men on the team had never played polo before joining the Battery but good coaching and fine mounts were available. The other teams in the League were far from soft opponents, many of their members having played together for some time. It was a common opinion that the Battery team could have defeated many of the Class A teams.

OTHER ACTIVITIES

Active? Progressive? Have a program? Yes, indeed, for other activities include: Football smoker. Annual dinner dance, Annual Battery banquet (with the Veterans), *The Rangefinder* (an eight page and cover paper), Battery plays (two in last four years).

Both *The Rangefinder*, the Battery Quarterly paper, and the Battery plays have caused very favorable comment.

EXAMINATION FOR GUNNERS (TR 430-175—JAN. 2, 1932)

The final touch to the year's training in preparation for Summer Camp was added by the use of TR 430-175 (1/2/32). Under paragraph 10, Section II, the commanding officer selected the following subjects for members of the Battery other than the B. C. Detail:

	Points
Duties of the Cannoneer	20
Material	15
Driving	15
Animal management	20
Total	70

For the members of the B. C. Detail were prescribed:

Firing data	20
System of Communication	20

in place of Duties of Cannoneer (20) and Animal Management (20).

The reason for selecting these subjects is best described by quoting from the same section and paragraph, as follows: "Prescribing certain subjects by the Battery Commander is designed to further the general training of the battery by requiring individuals to gain proficiency in certain necessary duties incident to the functioning of a symmetrically trained battery." Every National Guard battery has to guard against being short handed and

as far as possible this means that every man must be prepared to handle as many different jobs as may be necessary. With but a few exceptions every man was required to take the exam. For that reason it wasn't long before the dust was knocked off the TR's as everyone began to study. The subjects were discussed by the officers during drill and suggestions as to what would be expected in each subject were given. As time before Summer Camp was short, the first actual exam, to be given was oral. It was on two prescribed subjects and one optional, namely, Duties of the Cannoneers, Material and Powder, Projectiles and Fuzes. The actual questions were asked by the officers and first sergeant under the direction of the Battery Commander. During Summer Camp and after more study on the part of all, a surprise written exam, held in the mess hall of the wooden quarters at Camp (now Fort) Devens was given in Driving, Maneuvers Limbered, Animal Management, Firing Data, System of Communication, Instruments and Map Reading. Later additional subjects were given and the results just released show:

Experts	28	
1st Class	23	About 75%
2nd Class	8	
	59	

These results should be considered successful as cooks, etc., were not interested and lower the average. Moreover, one man hated to be outdone by his friend (or his enemy) and as non-commissioned officers were continually being asked questions by their men, the same happy situation arose as in the non-commissioned officer instruction—everyone bucked up. Once a man got into it, he began to think of things which had never occurred to him before and his job and all artillery took on a new interest.

SUMMER CAMP

The Battery as part of the 101st Field Artillery has trained at Camp (now Fort) Devens for nine years. Our camp of 1932 was perhaps the best of these. Like a football team that has a good day, everything clicked. If the foregoing has suggested any reasons for this, we will be sure you appreciate that to take the field successfully, the home work in preparation must be done

well. At the end of this two weeks of camp we found that our work had earned us the Marne Trophy given each year by Colonel Robert E. Goodwin, the war-time commander of the 101st Field Artillery, to that battery of the present regiment which excels in firing during the annual service practice. This trophy is given to perpetuate the memory of the excellent gunnery of the regiment during the Second Battle of the Marne in July and August, 1918. During our service practice we used at times a 37mm clamped on the barrel of the French 75mm. The usual gun drill was but slightly changed. No. 1 faced to the rear with his left hand on the shield, his right on the snap trigger of the 37mm and from that position fired. The only other change was No. 2, who received the shell between the wheels of the gun and caisson from No. 4, loaded and faced to the front, his back against the caisson body.

AGAIN WINNER OF THE KNOX TROPHY

Word has just come that the work of the year 1931-1932 has again merited the Knox Trophy, awarded to the Battery in the 51st Field Artillery Brigade being most proficient in gunnery and all around artillery. The Battery has previously won this trophy in 1916, 1922, 1923, 1926, 1928 and 1930. The trophy is, of course, a gift of the Society of the Sons of the Revolution of the Commonwealth of Massachusetts in honor of General Henry Knox, the father of American Artillery. Every outfit in the 51st Field Artillery Brigade is after this each year and competition is very keen. Careful continuous checks are made by the Federal Instructors and Inspectors and an outfit to win must be on its toes.

SUMMARY

No new ideas have been advanced here. They're merely adoptions of old ones. Again we say that a battery that keeps active, progressive, and interested will, like the corporal and his pistol shooting, be unbeatable. Each year is a new adventure but live wide-awake batteries, like wide-awake men, go on to greater things.

TRANSPORTING THE 75MM HOWITZERS BY PLANE

BY CAPTAIN WILLIAM P. MERRY, F.A. (ORC)

GOOD BYE mules. . . . .

This was the cry of the cannoneers of the 2nd Field Artillery as the mules were left behind and the 75mm mountain artillery howitzers were disassembled and placed with their accessories in bombing planes which were supplied by the air forces of France Field and Albrook Field. These bombing planes, protected by twenty-nine pursuits and twelve observation planes after being loaded with howitzers and personnel, sped to their destination at a speed of one hundred miles per hour, while mules loaded down with these howitzers would have averaged less than three and one half miles per hour.

This innovation of transportation of this type of howitzers of the 2nd Field Artillery by aeroplanes was conceived and executed by Major General Preston Brown, Commanding General of the Panama Canal Department, during the department annual maneuvers, February, 1933.

The year of 1931 saw Battery "B" 2nd Field Artillery use this same method of transportation during an experiment, but

this is the first time in history that a battalion of field artillery, pilgrimaged through the air by planes, accomplished a mission.

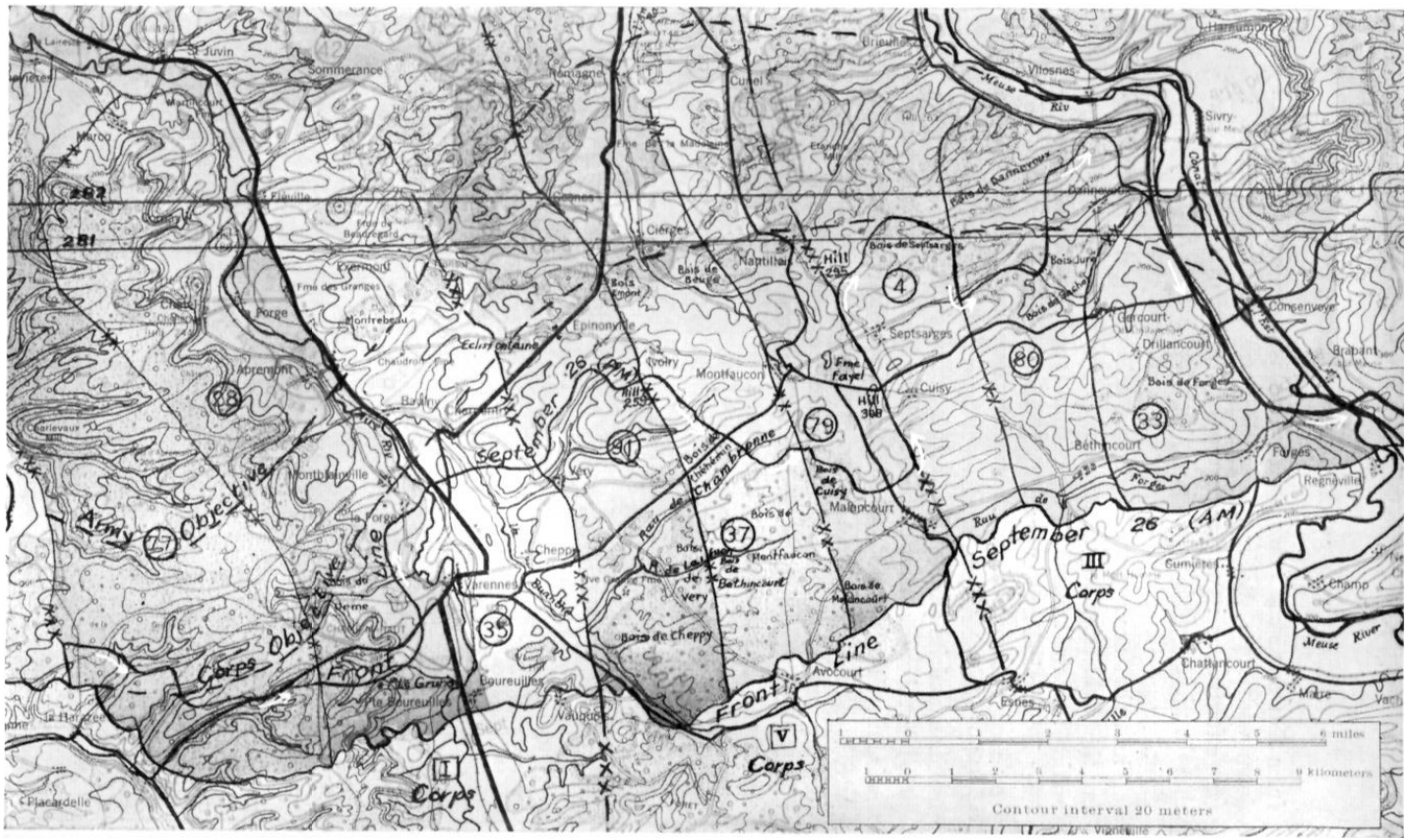
The 2nd Field Artillery commanded by Lt. Colonel E. L. Gruber, consisting of Batteries A, B, C and Headquarters sent approximately five officers and twenty men from each battery and a total of twelve howitzers with communications and fire control equipment to be loaded in bombing and observation planes at the landing field near the town of Bejuca, Republic of Panama. After being loaded and everything in order, the big bombers roared down the field and took off without a mishap, the observation and pursuit planes following behind. The destination of the planes was the coast of Chorrera, Republic of Panama, a distance of approximately thirty miles. Here the planes made a landing, howitzers were taken out, assembled, dragged by hand about four hundred yards to the firing position and were ready to fire thirty nine minutes after Bejuca was left behind. After completing the fire mission at Chorrera, they were withdrawn from position and again loaded in the afternoon for transport by air to Albrook Field, a distance of thirty miles, where they were put in trucks and moved to camp at Fort Clayton. In six hours the battalion therefore made two changes of position going thirty miles each and was able to execute a fire mission at each position.

Time during this problem was of secondary importance, the real purpose was to demonstrate that it is practical to move a regiment of field artillery equipped with the 75mm mountain artillery howitzer through the air by planes. That it was practical was proven by the success of this experiment. In the first place this is an ideal weapon to be transported by plane as it can be disassembled and assembled by a trained gun crew in less than three minutes. Disassembled it consists of the following parts, top sleigh, breech, tube, bottom sleigh, cradle, wheels, axle, front and rear trails. Stripped, the 75mm howitzer weighs in the neighborhood of twelve hundred and sixty pounds, the heaviest part being the front trail weighing two hundred and thirty-five pounds, which can be very easily handled by four men. It fires a projectile weighing approximately twelve pounds and has a range of nine thousand yards. The bombing planes have a platform constructed in their bombing racks and it is on this platform

that this small howitzer was placed disassembled and lashed down with rope. While this method was crude nevertheless it was effective, as it was consensus of opinion of the cannoneers that the piece lashed down did not shift an inch during the entire flight.

The writer accompanied Battery "A" 2nd Field Artillery during the flight as a Sergeant and can state from first hand information that the transportation of this type of field artillery howitzer is practical and every consideration should be given to this angle of transportation. A special plane could be built or a bombing plane be remodelled to carry, in addition to the 75mm howitzer and its ammunition, a gun crew of at least seven men.

While this movement of field artillery howitzers by plane is in its infancy, there is no doubt in the minds of those who participated in this mission, that the transportation of the smaller type of field artillery will eventually be a common occurrence. When this happens it will be good bye to the horses and mules who served the field artillery in the past.



MAP SHOWING: FRONT LINES, SEPTEMBER 26 (AM) AND SEPTEMBER 26 (PM) (INDICATED THROUGHOUT BY WHITE ARROWS): BOUNDARIES BETWEEN CORPS AND DIVISIONS: CORPS OBJECTIVE: ARMY OBJECTIVE

THE END OF THE BATTLE OF MONTFAUCON

BY COLONEL CONRAD H. LANZA, FIELD ARTILLERY

SEPTEMBER 27TH, 1918; THE AMERICANS

ON THE EVENING of September 26th, 1918, the Summary of Intelligence, First Army, announced that all objectives of that day's fighting had been reached, and gave the enemy front line as just beyond the Corps Objective (see map). At 10.00 P. M., the First Army issued a field order, directing that at 5.30 A. M. the next morning an advance be made to the Army Objective: a line through Apremont, Romagne-sous-Montfaucon and Brieulles. No artillery barrage or supporting fires were provided for, and the army artillery was prohibited from firing inside of a line, in general about 5 kilometers beyond the Army Objective. The order stated that the enemy was offering "no serious infantry or artillery resistance . . . on our whole front."

During the night of the 26th-27th, the 75mm batteries were advanced well forward, with OP's near our front, ready to support the infantry at daybreak. Corps and army artillery had not yet advanced. The corps artillery was ready to fire, but was not in a position to respond promptly to events at the front, due to its distance therefrom.

Of the nine divisions in the battle only the three on the right were near the Corps Objective. The remaining six were from 1 to 6 kilometers short of this line. But like good soldiers they jumped off at 5.30 A. M., in darkness, fog and heavy rain. The center of our line had been arrested the day before by the enemy holding the line Ivoiry-Montfaucon. Here our 37th and 79th Divisions were almost immediately stopped by wire, an artillery barrage and machine guns. In the fog, nothing could be seen, and our artillery had no apparent effect. By 7.30 A. M., this attack had ended, with requests for assistance from corps and army artillery to overcome the enemy's resistance.

On the right the III Corps attempted to advance, especially on Nantillois. In addition to the enemy in front, the troops had to meet an enfilade fire of artillery and machine guns from across the Meuse. As the position of Nantillois was of course accurately known, our artillery fire here was effective, but the 75mm

guns, alone available, were unable to drive the enemy out of his position, and our attacks failed. After long delay word came back to the corps and army, requesting support from the heavy artillery for a new attack. Late in the morning the corps and army fired a general preparation covering Nantillois and adjacent areas. When the fire lifted the 4th Division occupied the town, only to lose it later. Early in the afternoon the weather was clear, and the enemy in turn started an artillery preparation on Nantillois, and followed it with a counterattack. The division light batteries replied to the enemy, but 12 batteries of 75s were insufficient for the task in hand. Due to lack of liaison between the front and the corps and army, the heavy artillery knew nothing about the counterattack, and it was impossible to warn them in time. Nantillois was lost to us for that day.

After the failure of the early morning attack by the V Corps in the center, corps and army artillery fired a general preparation against the line, Ivoiry-Montfaucon, and completed it by 11.30 A. M. By noon, our infantry was in possession of this line. Attacks by the 91st Division west of Ivoiry broke down under severe losses from machine gun and artillery fire. On the left, our I Corps, with enemy in front, and enfilade fire east from the Argonne, failed to secure any substantial advance.

Late in the morning, visibility became good, and air observation commenced. From this source, and from delayed reports from the front, it became evident about noon, at division and higher CPs, that the front was not advancing to the Army Objective. It was decided to use artillery to push our troops forward. From reports at hand, estimates were made as to the enemy's positions, and heavy concentrations were fired in front of the V Corps, on towns, woods, etc., which it was assumed would be the probable positions of the enemy. It was impossible to notify the infantry as to when the artillery fire would be lifted, or advanced. We had to trust that their officers would observe the fire, and would lead their men forward at the proper time. This failed to occur. The infantry were not always ready to advance when the artillery program called for it; and in other cases they failed to appreciate the necessity for advancing *immediately* behind the artillery supporting fire.

Time elapsed after the artillery supporting fire ceased, before the first infantry attack, with tanks, was launched at 4.00 P. M., against the Bois de Beuge. The enemy had reestablished himself. Due to this, and to the further fact that it was now found that the enemy also had locations scattered in an irregular manner in the open, where no artillery fire had fallen, the attack failed under hostile artillery and machine gun fire. The positions in the open, which were occupied by machine guns, were unknown to the artillery and to the infantry until they ran into them. The fire of the artillery had been limited to critical points, in those days called "sensitive" areas, where the enemy should have been, according to texts on "Occupation of Positions." Another attack at 5.30 P. M. had no better success. A third attack, made after 7.00 P. M., similarly supported by tanks, and stated in German reports to have been the strongest attack of all, also failed, with the loss of three tanks.

We had some success against the Bois Emont. Here our infantry seized the south part of the wood and all of the Bois Communal de Cierges.* On the left the 28th Division advanced and occupied Montblainville.

After the failure of the last attack on the Bois de Beuge, it was realized that lack of success here endangered the entire program, and the artillery was called upon to solve the problem. It did; it gassed the Bois de Beuge, during the night, with toxic shell, and the next morning the 79th Division occupied the wood.

Little counter-battery was undertaken during the 27th, due to the inability to locate hostile batteries. The division artillery and some of the corps and army artillery were brought up close to the front, and OPs provided. The line reached at the close of the day's battle was Montblainville-Charpentry-Epinonville (all incl.)-Bois Emont (in part)-Bois de Beuge (excl.)—thence as before. The net result was the wiping out of the salient which had extended into the front of our V Corps, caused by the enemy holding the line Ivoiry-Montfaucon, at the beginning of the day.

SEPTEMBER 27TH: THE GERMANS

Five German divisions, which had commenced to enter the line the day before, completed the movement this day, and gave the

*Just west of Bois Emont. Shown, but not named, on map.

equivalent of nine divisions in line. This was the same number that we had, but German divisions were only about one third the strength of ours. Special attention was given, by suitable instructions, to obtaining enfilade fire from the east edge of the Argonne, over ground east of the Aire. Positions were vigorously defended. With the infantry nearly all equipped with machine guns or automatic rifles, and artillery defensive barrages available, the line was held everywhere during the morning.

At 9.00 A. M., the Fifth Army ordered the front withdrawn from the line Ivoiry-Montfaucon to the line Bois Emont-Bois de Beuge-north of Nantillois-hill 281*—south of Brieulles. Preparations having already been made, and the telephone net working satisfactorily, withdrawal began at once. Due to fog and mist, it was not observed by us, and was accomplished in an orderly manner. When our artillery preparation fell upon the line Ivoiry-Montfaucon, this had already been evacuated, except for stragglers and minor infantry elements. When we occupied this line, the visibility had become good, we were observed, and taken under artillery fire.

German aviation was active during the afternoon, and made photographic flights over the American lines. Their photographs show an extraordinary number of targets, artillery, tanks, rolling kitchens, wagons, trucks, infantry, etc., with almost complete absence of camouflage on our part. The German artillery had some wonderful shoots.

During the afternoon, Nantillois having been lost about noon, an artillery preparation was fired, after which a counterattack was launched, and Nantillois was temporarily reoccupied. The Bois Emont was lost at about the same time. This was a day of reorganizations.

COMMENTS ON SEPTEMBER 27TH

Our plan was based upon an assumption that the enemy was weak and offering no serious resistance. A retreat on his part was expected. An advance, without artillery supporting fires, was indicated as the proper action for us.

Information as to what was happening at the front was slow in arriving at Division CPs. Liaison was by messenger, through

*About 2 kilometers south of Brieulles, shown on map, without number.

shell swept zones, via numerous intermediate CPs, over jammed and almost impassable roads. Officers at the front lacked the time or the energy to write messages, draw sketches, and describe conditions. Absorbed by the terrific impressions of the battle, many sent no messages, others too brief ones; nearly all started with great delay. In consequence, divisions did not know, in some cases, within several kilometers where the front was.

The division artillery, alone, was nowhere able either to advance its own infantry or to stop counterattacks. In both cases heavy artillery from the corps or army was required for success, while the latter, due to its distance from the front, was unable to correctly locate the enemy positions. Places marked on the map were easily brought under fire, but for other positions coordinates were needed, and these were not to be had. In the absence of this information, only a general fire of neutralization covering entire areas would bring results. Maybe this should have been done, but it was not thought of at the time. One lesson of this battle was, that prominent places were avoided by troops on the defensive.

SEPTEMBER 28 TH: THE AMERICANS

Marshal Foch sent a letter on the 27th, to General Pershing, discussing methods of advance. In part, it read:

". . . The prolonged attacks which we launch against the enemy, oblige him to defend himself to the utmost . . . in other words prevent him altogether from conducting an important battle, even a defensive one. Consequently, if we do not give the enemy time to recover, we will everywhere find him disorganized, units mixed, or at least with extemporized organizations.

"Numerous machine guns may. undoubtedly, mark or cover the enemy's retreat. These are insufficient for a solid system, and by maneuvering, small units will especially permit, in all cases, of counter measures.

"Under these conditions, attacks must be incessantly sought to produce break-throughs, organizing for this purpose groups of infantry and artillery directed toward objectives, the possession of which will guarantee the crumbling of the enemy front. It is therefore necessary: in army corps—to select and assign distant and important objectives; in divisions—to select intermediate objectives; and, in small units (regiments or battalions)—to maneuver, rapidly and decisively, against machine gun posts which temporarily delay them. From now on, the fate of the battle

rests on the decision of corps commanders, and on the initiative and energy of division commanders.

"Once again, the activity of leaders, and the endurance of the troops, which latter never fails provided they are appealed to, will decide the results of the battle."

General Pershing followed this letter with one of his own, addressed to the corps commanders, stating:

"The enemy is in retreat, or holding lightly in places. Advance elements of several divisions are already on the Army Objective, and there should be no hesitancy or delay in going forward.

"Detachments of sufficient size will be left behind to take strong points, which will be turned. They will not be allowed to delay, or hold up, entire Brigades or Divisions. All commanders will push units with all possible energy."

At 11.00 P. M., on the 27th, the First Army issued a short field order, directing that at 7.00 A. M., the next morning, an advance be made to the line, north edge Argonne Forest-St. Juvin-St. Georges-Bantheville*-Brieulles. all inclusive. This line was about 5 kilometers beyond the Army Objective on the west, gradually closing in on it at the east limit. Army artillery was forbidden to fire within this line, substituting Dun-sur-Meuse** for Brieulles, except by agreement with Corps.

Liaison between division CPs and the front was still bad. Due to terrific traffic jams, only a small part of the corps and army artillery had arrived close to the front. With the division artillery, they had OPs well forward. The infantry in the front line was now worn by two days and nights of continuous fighting. Yet it advanced as ordered. Fog and rain again prevented all observation. Every effort to advance met with severe opposition from machine gun and artillery fire, and the enemy counterattacked frequently.

Around 5.30 A. M., before daylight, the III Corps felt nervous as to counterattacks from across the Meuse, and from north of Dannevoux. This corps ordered its corps artillery to place defensive barrages in front of the threatened area, and asked for army artillery counter-preparation fire. This was furnished; no counterattacks developed here. An attack was now made by the

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*Bantheville is not shown on map; it is about 2 kilometers north of Romagnesous-Montfaucon.

**Dun-sur-Meuse, not shown on map, is on the Meuse River about 5 kilometers north of north edge.

80th Division into the Bois de la Cote Lemont, which was partially successful; but an attempted advance beyond broke down under tremendous machine gun and artillery fire from the front and the right flank.

Nantillois was attacked; but not until noon did it come into possession of elements of the 4th and 79th Divisions. The 37th Division attempted to take Cierges. On the right the infantry advanced beyond Cierges, and that town itself was entered, but not held. The advance was stopped by hostile machine guns. As soon as our line was immobilized, the German artillery began a systematic fire, bracketing positions and sweeping through. It caused terrific losses, in men and morale, and the line went back. An attack by the 91st Division succeeded in taking Epinonville. The I Corps made a slight advance. Apremont and Montrebeau were taken and retaken in very severe fighting.

Toward the middle of the day, the fog and rain disappeared, and from air observation, and usual long delayed reports from the front, it was clear at division and higher CPs that the army objective was not being reached. It was decided to assist the infantry by an artillery preparation, to start as soon as firing data could be prepared, and to be fired by the army artillery, which had about sixty batteries of 155mm GPFs available. By order of the Army, at 2.30 P. M., the enemy line from Fléville through Romagne-sous-Montfaucon to Brieulles, which was a line mostly of wooded hills, was shelled. The fire was of great intensity, but it failed to advance our infantry. Two German counterattacks, one near Cierges and the other near Nantillois, occurred during this fire. At 6.00 P. M., this fire was lifted from Romagne, on request of the III Corps, which believed they had troops about to enter that area. The fire ceased at dark, but at 10.00 P. M. was renewed in part, again at the request of the III Corps, who reported they needed counter-battery fire badly.

On this day, General Pershing visited the 28th Division command post. He was informed that it was not known where the front line was. It was explained that this was due to lack of trained brigade commanders. The brigade commanders for the infantry were immediately relieved, and General Pershing left two of his staff (General Nolan and Colonel Conger) to replace

them. On a visit at the 35th Division Command Post, General Pershing was again unable to find out where the front was, due to absence of liaison with the front line. On a visit to the III Corps headquarters, he was assured that the troops were doing well. The inspection having shown poor control of circulation on roads, with much jamming, orders were issued regulating traffic. As there seemed to be a possibility of shortage of ammunition, the use of corps ammunition, without authority of the army, was prohibited. It having been ascertained that divisions were urgently in need of more artillery supporting fire, the corps were directed "to maintain liaison, so that artillery of divisions can be used to assist adjacent divisions."

The line reached this day was from Champ Mahaut (incl.)-1 kilometer north of Montblainville-Montrebeau (in part)-Epinonville (incl.)-Cierges (excl.)-Nantillois (incl.)-Bois de la Cote Lemont (in part). The advance made averaged about 1 kilometer.

SEPTEMBER 28TH: THE GERMANS

The Germans received some reenforcements, but as they withdrew troops, their strength remained as about equivalent to nine divisions. They had reorganized, and had decided to actively resist every advance. To this end, the Fifth Army had ordered on the 27th:

"The situation requires that the artillery on both banks of the Meuse River be under one control. Effective 28 September, General M ——— will assume command of all this artillery under direct orders of the Army.

"The period, while the enemy has little artillery and munitions available in face of our Meuse West Group (XXI Corps). is to be profitably employed by our artillery. Hostile batteries will be counter-batteried: hostile camps and dug-outs will be gassed. Interdiction fire will be laid on Bois d'Avocourt-Malancourt-Montfaucon roads: Bethincourt; Cuisy and Septsarges."

Special attention was given to breaking attacks by artillery fire.

By daybreak, the reorganization was about completed, and batteries were ready to fire. Due to rain and fog, there was no visibility during the morning, and the artillery was limited to map firing and defensive barrages. About 11.00 A. M., it became possible to control fire through the air service, balloons and OPs. A large number of targets were discovered, and fire was

directed against the flanks and rear of American troops, columns marching on roads, camps, woods showing occupation and towns.

Counterattacks were ordered. The first was launched at 12.00 noon, the 115th Division attacking south from Romagne. The artillery of this division was east of the Meuse. Together with all other batteries east of the river, and capable of firing west of it, the Fifth Army, at 12.30 P. M., ordered all of them to concentrate their fire on infantry and artillery targets. These batteries fired from the right rear of the Americans, while others fired from their front. By 1.00 P. M., elements of the American 37th Division had been driven out of Cierges, and the American attack stopped. Under concentrated artillery fire, the Americans were forced back.

About 3.00 P. M., a Bavarian regiment attacked south from the Bois des Ogons (1.2 kilometers north of Nantillois). This met an American attack, supported by tanks, moving north. Here was an unexpected meeting engagement. Both attacks promptly broke down. A little later, the 4th Guard Infantry, with elements of the 2nd Landwehr Division, counterattacked in the Aire valley, supported by artillery fire, east from the Argonne, and south from the main line, and retook Apremont from the 28th Division. A group of 13 batteries in the Argonne fired heavily against our 28th and 35th Divisions, and reported having shot down 30 tanks in the Montblainville-Chaudron Fme areas.

The 150th Infantry, 37th Division, held a 3 kilometer line from north of Cierges to north of Nantillois. They repulsed all attacks by our 37th and 79th Divisions, due to the assistance of over 60 batteries, some of which were east of the Meuse. Discussing this fight, the Fifth Army in its report, made on the 29th, stated:

"The American Infantry is very unskillful in the attack. It attacks in thick columns, in numerous waves echeloned in depth, and preceded by tanks. This kind of attack offers excellent targets for the fire of our artillery, infantry and machine guns.

"Provided the infantry does not allow itself to be intimidated by the advancing masses but remains calm, it can make excellent use of its weapons, and the American attacks fail with the heaviest losses. For example, the 150th Infantry, 37th Division, yesterday repelled ten American attacks, and today three, without

losing any ground, and with relatively light losses."

Our heavy artillery fire on the Fléville-Romagne-sous-Montfaucon line caused almost no damage. This line was parallel to the front, but in general, 3,000 meters beyond it. The range was short of the artillery line, only a few batteries suffering casualties. Naturally the front was not affected, and the fire was mostly useless.

SEPTEMBER 28TH: COMMENTS

On the American side decentralization of command was in force. The battle was turned over to the divisions, under an assumption that the enemy was in retreat, protected only by strong points of machine guns, sufficiently far apart as to admit of passing between them and capturing them by turning movements, while not interrupting the pursuit of the German main body. To overcome these strong points divisions were authorized to call upon the corps, or the army, artillery if necessary; but to avoid the main pursuit being slowed up by heavy artillery firing in the front, such firing was prohibited unless specifically requested.

There was no difficulty in liaison between the CPs of division, corps and the army. This worked beautifully; messages received at one of them were quickly available to the others. But there was extraordinary delay in information from the front reaching division CPs, which were the nerve centers of the attacks, and without whose cooperation little could be accomplished. In the fog, nothing could be seen, the OPs were of no use, and the infantry could not determine where hostile fire was coming from. In some cases they sent in no reports, and in other cases the reports arrived with such delay that no one could tell whether the facts stated as of the time of sending were still true.

Division and higher CPs made assumptions as to the progress of the battle, and the position of the enemy and of our own front. It is now clear that these assumptions were quite wrong, and that artillery fire was consequently directed miles beyond where the targets were. At the time nothing was known about this, and it was believed that our artillery fire had a material effect in stopping enemy counterattacks. We know now that these counterattacks escaped our fire, due to gross errors in assumptions as to range.

On the German side, their Fifth Army concentrated artillery command. Even divisions lost control of their artillery, which were not necessarily posted in their own division zones of action. The pooling of all the artillery, the fact that our divisions attacked at different hours, and that counterattacks were similarly staggered, enabled powerful concentrations of fire to be made successively by the artillery. Other favorable circumstances were enfilade fire by batteries east of the Meuse, into our right rear, and from other batteries in the Argonne firing into our left rear. Being on the defensive, there were no problems as to advancing artillery, stores, and ammunition, over shell swept, devastated terrain, such as we had.

SEPTEMBER 29TH: THE AMERICANS

Between 6.00 and 8.00 P. M. of the 28th, the First Army made the following estimate of the situation:

"Reports from the III Corps during the day indicate a rapid and easy advance up to 5.00 P. M. to points only slightly south of the Army Objective. The Corps met little resistance, and reports at 5.30 P. M. show evidence of disorganized flight in its front.

"The V Corps reports, up to 5.00 P. M., that Cierges was taken and lost this morning, and retaken again, since which time the advance has continued rapidly. The road leading north from Cierges has been reported full of American troops this afternoon by aviators.*

"There is nothing at hand to indicate that the advance has not gone well with the I Corps. Apremont has been reported taken and mopped up (1.30 P. M., 28th Division).

"It thus appears that, although we have identified five new divisions in our front since the battle began, they have exercised but slight influence on the course of events. This has apparently not come about through lack of contact, as all of these divisions have been identified by our troops.

"There have been but two counterattacks pulled off by our enemy—one yesterday against the V Corps and one today against the V Corps.

"I estimate that the enemy is doing what he can to stop our advance. Reconnaissance to date reports nothing in his rear but retreating small columns and artillery. That the enemy will offer

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*NOTE: After an examination of American and German reports. I can find no evidence that this road was "full of troops" at any time this day. The German 115th Division was deployed before it moved south from Romagne, and never had troops in columns according to their reports.—C. H. L.

a strong resistance somewhere, if he can, goes without saying. The situation is not sufficiently congealed yet to say where this will be, but from a small amount of fragmentary evidence received in connection with the digging of a defensive line in rear, I have been of the opinion that his final defensive line west of the Meuse would run from Stenay northwest."

The following General Order was issued on the 28th by General Pershing:

"The Allied troops are now engaged all along the Western front in the largest combined movement of the war. It is of extreme importance that the First American Army drive forward with all possible force.

"There is evidence that the enemy is retiring from our own front. Our success must be followed up with the utmost energy, and pursuit continued to bring about confusion and demoralization, and to prevent the enemy from forming his shattered forces.

"I am counting on the splendid spirit, dash and courage of our Army to overcome all opposition. Our country expects nothing else."

The First Army, at 11.50 P. M. of the 28th, issued the following field order for the 29th:

"1. (a) The enemy is resisting on the heights of the Bois de Romagne, and east of Romagne-sous-Montfaucon. This resistance consists mainly of artillery and machine gun fire. Movements of convoys indicate a retirement to the north.

(b) The attack of the Fourth French Army to our left continues to advance.

"2. The First American Army will continue the attack.

"3. (a) The III. V and I Corps will advance within their zones of action as specified in Field Orders No. 20, without regard to objectives. The hours of attack will be designated by corps commanders, but will not be later than 7.00 A. M., September 29. These Corps will especially drive the enemy from the following points:

III Corps: Heights 2 km. northeast of Cunel.

V Corps: Heights in Bois de Gesnes.*

I Corps: Main crest of Foret d'Argonne south of an east and west line through Apremont.

(b) Army Artillery will not fire south of the line Dunsur-Meuse-Aincreville-Bantheville-Landres-et-St. Georges, thence along Combined Army First Phase Line, except by arrangement with Corps."

At 12.45 A. M., 29 September, the Army ordered the Army

Artillery to deliver a heavy preparation on the heights 2 kilometers north of Cunel; Bois de Gesnes*; hills near Chatel; Montrefagne and woods along the line indicated by these points. These objectives were divided among the brigades of the army artillery, with instructions to start the fire as soon as firing data was computed, without regard to other batteries. The corps artilleries were requested to assist in this preparation, by superimposing their fire on that of the army. At 1.55 A. M., the I Corps telephoned that they knew nothing about any attack, but in view of the request, the corps artillery would fire as desired.

At 1.30 A. M., two officers from the Army G-3 Section came to the Army Artillery CP, and stated that we had lost over 5,000 men the day before, from hostile shell fire alone, and that it was imperative to have more artillery assistance. It was explained to these officers that the fighting was way south of the line within which the mass of the artillery was prohibited from firing by formal written orders, and that there were no targets beyond this line. Attention was invited to the fact that although the corps were auhorized to ask for assistance of army artillery, they seldom did so.

The V Corps was thereupon instructed by telephone to use their artillery, especially gas shell, to a greater extent. In a supplementary letter sent to that Corps, the Army directed:

"Your two right divisions (are) apparently held up by hostile artillery in Bois de Cunel, Bois de Valoup** and along Romagne-Cunel road. Gas should be used to neutralize batteries in these positions while our troops advance. The Army Commander desires this means of overcoming opposition and delay utilized whenever possible.

"If your artillery hasn't the necessary ammunition within reach, call on Commanding General. Aire Group. Army Artillery, for help, indicating exact targets for his fire. Use of No. 5 shell (non persistent gas) is suggested, as our troops can, if desired, occupy bombarded places within one hour after (fire) ceases, except in woods and ravines, when three hours should elapse.

"No. 20 shell (mustard gas) should be used especially for obstinate points, but bombarded places should not be occupied afterwards. Safety in calm of down wind for our own troops:

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*Northwest of Gesnes: shown on map, but not named. Gesnes is 2½ kilometers northwest of Cierges.

**1.4 kilometers southwest of Romagne; shown on map, but not named.

1,000 to 1,500 meters for No. 5 shell
2,000 to 2,500 meters for No. 20 shell.

If the wind is blowing steadily away from our troops, they will be reasonably safe beyond 400 meters from fall of shells. Hostile infantry concentrations sufficiently in advance of our troops should be bombarded with short intensive bursts of No. 5 shell."

To prevent loss of ground captured, such as the loss of Nantillois on the 27th by counterattack, due to absence of defensive barrages, orders were issued prescribing:

". . . Immediately after receipt of information, from any reliable source, as to the line held by our troops, grouping commanders (army and corps) will give the necessary directions to their units to prepare data for counter-offensive preparation, so as to cover the front within their normal sectors. All arrangements will be made to start counter-offensive preparations at once, as soon as need therefore is indicated. The data for this purpose will be corrected during the day, as often as necessary, to enable this method of fire to be promptly and effectively given."

The 29th opened with fog, mist and light rains. It did not clear until about 10.30 A. M. Due to the instructions issued and the fact that a large part of the army and corps artillery was now well forward, with established OPs, where the front could be overlooked, artillery activity increased this day.

On our right, the 80th Division was withdrawn, and its zone of action taken over by the 33rd Division. Attacks launched by the latter from the Bois de Dannevoux towards the Bois de la Cote Lemont broke down under direct fire and enfilade fire from across the Meuse.

In the center, the 37th, 91st and 35th Divisions attacked about 7.00 A. M. The 37th Division had no success, but the other two divisions made progress forward, and by 10.00 A. M., tanks had penetrated the enemy line at Gesnes and at Exermont, both of which towns were entered by our infantry. Severe losses now occurred, when, due to improved visibility, enemy artillery in the Argonne enfiladed our lines with gas and HE shell. As early as 8.15 A. M., the commander of the 35th Division had ordered his division artillery to counter-battery and stop this fire. An attempt was made to do so, but it was without effect. It was impossible to locate the enemy artillery. The I and V Corps artillery undertook to help out in counter-battery by firing at coordinates

obtained from air reconnaissances and presumed locations. But the enemy artillery never stopped his shelling.

On the extreme left our artillery fire on hills near Cornay seemed to be effective, but the infantry attacks were not coordinated with the artillery, and the attacks succeeded only in retaking Apremont.

At 10.30 A. M., our troops held the line Apremont-Exermont-Gesnes. On the right of Gesnes, the 37th Division was stopped by severe artillery fire. If the enemy artillery was destructive in the early morning it became intolerable as soon as visibility had become good. As usual, in the early afternoon, the Germans started their counterattacks. One went south astride the Aire against our 35th and 28th Divisions. It had terrific artillery support. An eyewitness stated that the fire from the east edge of the Argonne was so rapid that he thought that the Germans had invented a new gun, so thick was the fall of shells among our ranks. The 35th Division was forced back, losing all the ground it had gained in the morning, and some more. The 28th Division was forced out of Apremont, the enemy advancing about 2 kilometers along the Aire. While two of our divisions were retreating, the 91st Division advanced to beyond Gesnes. This afternoon fight was very severe and mixed, both Americans and Germans advancing or withdrawing at the same time in adjacent parts of the battlefield. The 91st Division finally found itself on a line beyond Gesnes, with the enemy on their right holding Cierges, and on their left advancing towards Eclisfontaine. With both flanks uncovered, they discontinued their advance, and fell back to a position in line with troops on their right and left.

When the division CPs received word as to the enemy counterattack along the Aire, the First Army urgently ordered defensive barrages to protect the 35th Division and the V Corps. It went down quickly, and soon after the counterattack was reported stopped.

It being evident that possession of the high ground on the east edge of the Argonne gave the enemy a considerable tactical advantage, the Army ordered a study made as to the possibility of driving the enemy out of the Argonne by gas shelling. The study indicated that 30 batteries of 75mm guns could be made available

and moved to the left rear of our army, to gas the west edge of the Argonne, to enable our troops to enter by that route; while the east edge could be gassed at any time by batteries already in position. Gas shells in quantities were started forward, but the Army failed to order this gassing.

At 6.40 P. M., reports arrived that the enemy was starting new counterattacks in the I Corps area, while the V Corps reported urgent assistance needed around Gesnes. The army and corps artillery again placed defensive barrages down over the whole front from Exermont to Gesnes. All these defensive fires came down this day within about 20 minutes from the time the Army ordered them.

At 8.30 P. M., the First Army's estimate of the situation stated:

"All day long on the 29th, the enemy has maintained himself by means of machine gun fire, artillery and counter attacks. . . . It is becoming quite obvious that his intention is to hold this ridge (Apremont-Exermont-Cierges-Brieulles line) as long as he can do so. It may be the strength of the position that has influenced him to attempt this; it may be the dilatory nature of our advance for the past two days; or it may be the incomplete condition of his positions in rear.

"As an indication of these intentions the town of Cierges has been taken and lost by us at least twice, and we are not now apparently in possession of it. Similarly we have approached the town of Exermont and been driven back. It appears that the enemy has attacked twice today opposite Exermont. His last counterattack was very heavy, was delivered late this afternoon, and succeeded in driving back our troops to quite a considerable distance. According to last reports (6.00 P. M.) we have restored our position, and arrived again at the south bank of the little stream flowing past Exermont.

"I believe that the Germans were overwhelmed by our original advance, but that the advance has been so mismanaged and has been so dilatory as to enable them to recover from their first surprise, to readjust and establish themselves in a defensive position, to bring up several reserve divisions and to commence a very much stronger defense than they were able to conduct at the start. We can expect, I think, no further withdrawal under present conditions. The great success of the French Fourth Army (on our left) will possibly attract some of the troops in our front to the

front of that army, unless we continue to hammer at the enemy. However, on the other side, it seems that our proper action would be to cease this hammering, to reorganize our advance, and to renew our attack in an orderly manner with fresh troops."

The conclusions of this report were adopted. At 11.00 P. M., orders issued providing for a line of resistance, while reorganizing for a further attack.

The line held at the end of this day was Apremont (incl.)-Chaudron Fme-Cierges (excl.)-Nantillois (incl.)-Bois de la Cote Lemont (incl.). This line, in the center, corresponded substantially with the Corps Objective indicated for the initial attack on the 26th; on the flanks this line had been passed by 1 to 2.3 kilometers.

The question of supply was serious. There was only one axial road in each Corps area. Destructions by the enemy, constant enemy interdiction fire, and heavy rains had made these few roads difficult. Partial lack of traffic control had impeded what progress was possible; supplies at the front were short. Above all the troops in line were exhausted after four days and nights of hard and continuous fighting.

General Pershing this day attempted to reach the front. He personally conducted M. Clemenceau, the French premier, towards Montfaucon. Due to road conditions, this party never reached Montfaucon.

Our losses in killed and wounded for this period, for combat troops only, and excluding losses of our French allies were:

September 26	3,835
September 27	3,757
September 28	5,353
September 29	6,280
Total	19,225

In addition, our losses from diseases, mostly flu and pneumonia, were nearly as large.

SEPTEMBER 29TH: THE GERMANS

Two new divisions, the 236th and elements of the 53rd Reserve, entered the line this day, replacing the 117th and elements of the 1st Guard Divisions which were withdrawn. The divisions in line remained as about equivalent to nine. The plan of battle was to strenuously resist on the front, counterattacking

hostile troops entering the position. All artillery remained pooled in the Fifth Army, which held the territory, east of a north and south line through Gesnes.

German artillery was especially active. They continued to have partial enfilade fire over our lines, east from the Argonne and west from east of the Meuse. OPs in the Argonne were in tops of tall trees, inside the forest, safe from fire directed against the edge of the woods. Battery CPs were at the foot of the trees. There were a few camouflaged towers, one of which was in the center of Montrebeau woods. Neither this tower, nor other battery OPs, showed after the battle any traces indicating that our artillery fire had reached them.

The American infantry is reported to have attacked without much artillery support and to have been generally shot down by fire. The attack of our III Corps on Bois de la Cote Lemont was stopped by artillery fire from east of the Meuse. Our own supporting fire was reported as falling about 2,000 meters over the front line. The Germans had no strong points, but did have a large number of single machine guns, manned in many cases by only one man. Their XXI Corps (Bois de la Cote Lemont) reported:

"The troops must be impressed with the hollowness of the American attacks. The denser the advancing masses, the more they are hampered in an advance, and the greater the losses caused by the fire of the defenders. Single machine guns, on several occasions, have compelled entire attacking companies to flee in disorder."

The diary of a German division artillery commander, east of the Meuse, reads:

"29 September: Fired with balloon and plane observation. Fired on Etanche Mill, Nantillois, Bois de Beuge, on woods, and south of Brieulles. Drove the Americans out of the Bois de la Cote Lemont; Americans followed up by our trench mortar fire from south of Brieulles. Northwest part of the Bois de la Cote Lemont remained in German hands. Fired on columns on roads, and on 6 batteries (of which 3 were in the Bois d'en Dela* and 2 in the Bois de Septsarges). Strong fire by us on the Bois Juré and roads in vicinity.

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*Near the Bois de Sachet.

"Night 29-30 September: Fired heavily on roads, villages, camps and woods."

The 37th Division held their positions about Cierges all day, although three attacks were made against them. Neither the division commander nor his artillery commander report any of our artillery fire as on their front line. To the west Gesnes was lost in the morning, the Americans penetrating the German line. Gesnes was on the boundary between the Fifth Army (east) and the Third Army (west). There were no reserves on this boundary, and the local commander was unable to secure any from the XXI Corps. Fifth Army. There was great fear that the Americans would exploit this success, as there was nothing but batteries north of the point of penetration and appeals were made to the LVIII Corps, to the west, for assistance. The LVIII Corps was engaged at the time in counterattacks in the Aire valley, but it sent one regiment of infantry to close the gap in the line. In the afternoon, this regiment attacked, and the Americans withdrew to south of Gesnes.

The Third Army, about noon, delivered a heavy counterattack south along the Aire valley, to recover the Montrebeau woods lost in the morning. Their report states:

"A counterattack by the 52nd Division, against a tank attack near Exermont, drove the enemy back. Two Guard Divisions* (later) marched forward. The entire American front between the Aire and our left Army boundary was forced back. Our artillery fired annihilating fire into the retreating enemy. In a short time the enemy brought up strong reserves, to a line east of Apremont and south of Montrebeau woods. About this time the 2nd Landwehr Division captured Apremont. Several enemy tanks were destroyed. The enemy losses . . . were heavy."

Encouraged by the success of the Third Army, the Fifth Army ordered a counterattack by the 236th Division at 7.30 P. M., south of Nantillois. Reports received indicated that so much artillery firing had taken place that there was a shortage of ammunition. The order for the counterattack was countermanded, and instead the front was withdrawn to a line Gesnes-Fme de la Madeleine-Bois des Ogons. This resulted in abandoning about 2 kilometers near Cierges and about 400 meters near Gesnes.

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*The 5th Guard Division and elements of the 1st Guard Division. The latter division was withdrawn at the end of this day.

West of Gesnes, the withdrawal was slight; from and west of Montrebeau, there was no withdrawal. To the east the line was advanced about 1 kilometer along the Meuse.

Batteries suffered little from our counter-battery. The XXI Corps had 50 batteries in the zone between a line through Cierges and the Meuse. Our artillery in this area fired on the heights 2 kilometers north of Cunel (Bois de Cunel) and the road from Romagne to Cunel, on an assumption that this was where the enemy artillery was. After checking the coordinates at which this fire was directed, none corresponded with the reported positions of the German batteries, but six positions fired at were within 100 meters of a battery. The remaining 44 German batteries in this area did not have fire fall near them, being mostly, but not entirely, beyond the area fired at. All German batteries were defiladed from our OPs and balloons, but many were in the open and apparently should have been discovered by the Air Service. Ten of the 44 batteries were grouped together in an open draw without cover except camouflage nets. They were not fired at. Our preparatory artillery fire in the early morning of this day was, in general, about 3,000 meters over the infantry line and from 1,000 to 2,000 meters short of the artillery line. The German counterattacks started within the line of our artillery fire and were not interfered with at the start. Our later defensive fires south of Exermont and north of Gesnes did fall on German infantry, caused losses, and stopped attacks in these localities.

SEPTEMBER 29TH: COMMENTS

Counter-battery produced no results. There was no interruption to the activity of either artillery by the fire of the other that was serious. This was due to the impossibility of locating hostile batteries. Exceptions were some of our batteries east of the Aire, which were defiladed from hostile OPs on their front, but not from those in the Argonne. Similarly some of our batteries near the Meuse were defiladed from one set of enemy batteries, usually in their front, but not from the other set east of the Meuse. But even these constituted but a small percentage of the hundreds of batteries present in this battle.

Locating hostile infantry and machine guns was equally difficult. We fired at where we supposed they were. Checking, as

far as records show, our reports of fire against German reports as to where their infantry was, thousands of rounds were daily fired at what now appears was empty terrain. In some cases our errors amounted to several thousands of meters. This was caused by,

a. lack of information from the front;
b. assumptions that enemy elements would occupy military crests, edges of woods, high ground, and other similar critical lines.

Nothing can correct absence of information. The enemy avoided occupying positions which could be observed from OPs or located by adjacent landmarks. They did not have a "line" of defense, but had machine guns and automatic rifles, disposed in depth, irregularly spaced, and at wide intervals. When fighting was severe, as on this day, this area became two or more kilometers deep, in which small groups and single men of both sides were mixed. They extended through woods, not along edges; across country, not along ridge or stream lines; through or around towns. They were a hard target, due to the extraordinary number of small indistinguishable units. The OPs found they could seldom distinguish individual men with an automatic rifle, concealed in holes or in the grass. And it was difficult for light artillery, with the small danger area of a 75mm burst, to drive out such a small target after it was located.

In no case was the artillery of a division on either side able alone to secure an advance of its infantry. It was always necessary to have assistance from medium and heavy artillery. On the American side division fronts averaged 3,000 meters approximately. This gave for the organic artillery of a division one battery for every 167 meters front, or not quite one gun per 40 meters front. This was never enough, neither on the defensive nor on the offensive. The army commander retained under his direct orders a large mass of long range guns, with a view of intervening in the battle to secure fire superiority where and when needed. This power he used. The 29th was the first day this system secured decisive results in stopping counterattacks. On other occasions it obtained but slight results, not because of the system, or efficiency of the batteries, but because of the erroneous information or assumptions based on which the fire was ordered.

CONTROL OF THE FIRE OF A BATTALION BY A SINGLE FORWARD OBSERVER

BY FIRST LIEUTENANT C. C. BLANCHARD, FIELD ARTILLERY

THIS narrative of an exercise conducted at the Field Artillery School, May 13, 1933, illustrates a method of artillery support by a 75mm. gun battalion in a moving situation where no maps or aerial photographs are available and observation is impossible except from an OP well forward.

When the exercise begins, the artillery is disposed as follows: The two liaison officers are with the infantry commander, one of them for the primary purpose of acting as forward observer. The battalion and battery parties are halted on the road 3,000 yards to the rear. The gun batteries are on the road 1,000 yards farther to rear. Each of the liaison officers has an SCR-161 set; the battalion party, 2 sets. The forward observer has been instructed in the general procedure to be followed, F.A.S. Notes, G-43 an A-277. The exercise has not been rehearsed, at least Bn. S-3 is in the dark.

The Bn. C receives the following message from the forward observer, "Require artillery support. Can observer on reference point." The Bn. C decides to establish the Bn. CP 50 yards to the right of the road; one radio for work with the observer, at the CP; the second radio for work with the other Ln. O, 50 yards in rear of the Bn. CP; the battery CP's with battalion; direct lines from batteries to Bn. CP. He selects positions for the batteries on fairly level ground to the right front, in the order, left to right, C—B—A.

As finally organized, the CP consist of the following, roughly on a circle: Bn. C, S-3 with a plane table, each B.C. and his telephone operator, a radio and its operators. All other personnel and impedimenta are cleared away.

To the first B.C. reporting his battery in position (B.C. of Battery B), the S-3 issues following instructions: "The forward observer will adjust your battery on a base point, precision adjustment with No. 1 piece, 6 rounds for effect, compass 600 (general direction of the advance), site 0, range setting 5,000 (sufficiently great to surely clear our front lines). Use high

shrapnel bursts for the initial rounds. Move your phone over to the radio operator and work directly with him."

The adjustment of Battery B follows:

COMMAND: COMPASS 600, SI+30, KR 30, No. 1, 1 RD, AT MY COMMAND, 5,000.
RADIO: Battery ready.
OBSERVER: Fire.
COMMAND: FIRE.
OBSERVER: 400 left, 600 over.
COMMAND: R 80 (400/5), SI O, SH MI, FL, No. 1, 1 RD, 4,400 (5,000-600).
OBSERVER: 100 left, 300 over.
COMMAND: R 25 (100/4), 4,100 (4,400-300).
OBSERVER: 50 left, over.
COMMAND: R 13 (50/4), 4,000.
OBSERVER: Short.
COMMAND: 3 RDS, 4,050.
OBSERVER: 10 left, mixed over.
COMMAND: R 2, 4,050.
OBSERVER: Mixed over.
COMMAND: RECORD BASE DEFLECTION.

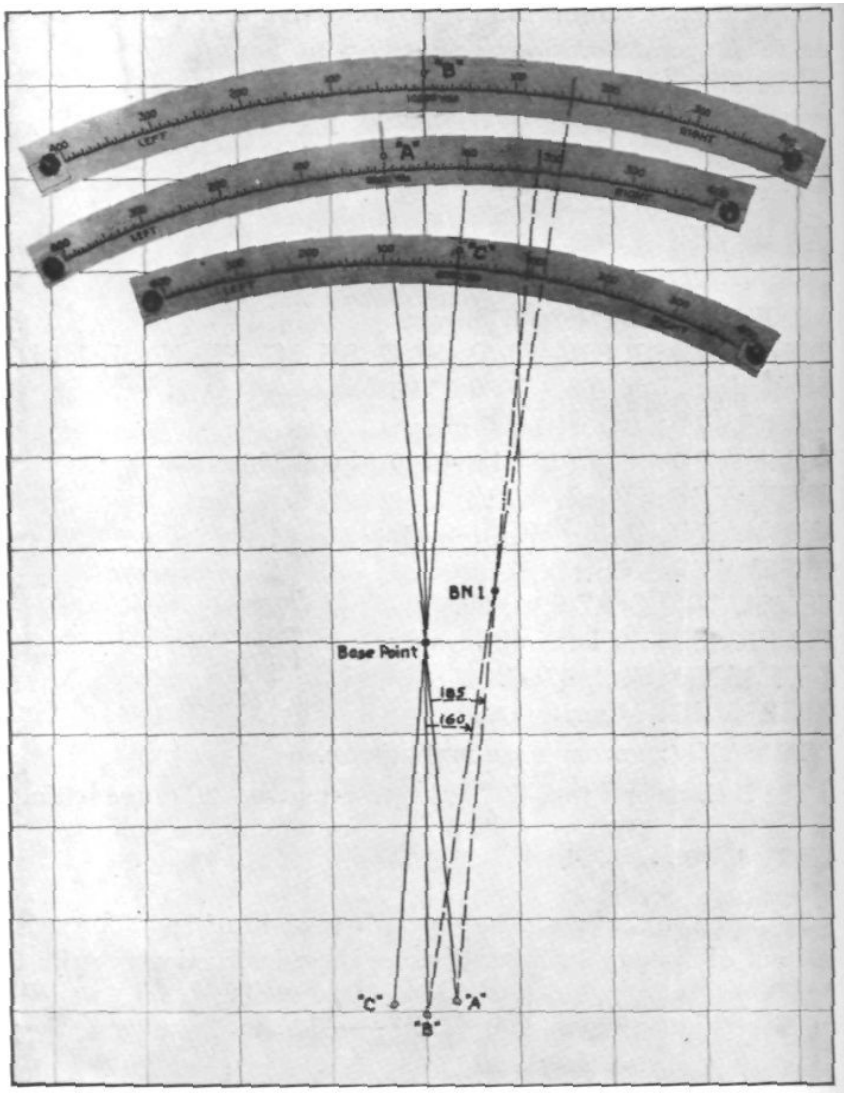
The B.C. reports to S-3, "Adjusted compass 720, range setting 4,033 ($4{,}050 - \frac{100}{6}$)".

To Battery A, in position 400 yards to right of and 200 yards in front of Battery B, the S-3 issues these instructions, "Adjust on base point, compass 620 ($720 - \frac{400}{4}$), site 0, range setting 3,800 (4,033-200). Fire 3 rounds to give the observer your line."

Battery A adjusts and reports, "Adjusted compass 640, range setting 3,900."

Similarly, Battery C adjusts and reports, "Adjusted compass 810, range setting 3,950."

Meanwhile, the S-3 has built up a fire direction chart (See plate). He assumed a convenient grid intersection as the *Base Point*, a grid line as the *B Base Line*, and using adjusted range of



FIRE DIRECTION CHART CONSTRUCTED BY BATTALION S-3

Battery B, plots the *B Base Piece*. He has three protractor arcs for use with radii of 8,000, 9,000, and 10,000 yards. He fastens one of these astride the *B Base Line* at the proper distance from *B Base Piece*. When Battery A reports adjusted compass, the S-3 lays off from *B Base Line* to the right an angle of 80 mils

(720-640), plots *A Base Piece* and fastens an arc astride the *A Base Line*. He plots the data of Battery C in similar manner.

Immediately after adjustment of Battery C, the forward observer locates and reports a target:

"Enemy strong point, reference point 600 left, 400 short."

The Bn. C. considering the nature and importance of the target and the accuracy of his data, decides to adjust each battery in turn and to fire a concentration of 60 shell, fuze long, per battery.

The S-3 plots the target roughly, and tells Battery B, "Adjust on Bn. 1, base point 600 left, 400 short."

As this adjustment is proceeding, he gives Batteries A and C approximate shifts and ranges to expedite their initial laying.

On completion of Battery B adjustment, the B.C. reports, "adjusted deflection, BDR 160, 200 yard sheaf, range setting 4,650."

S-3 plots the target from these data, determines shift, "Btry. A, adjust BDR 185, 200 yard sheaf, range setting 4,450."

The observer reports the first salvo, "100 right, range correct."

S-3, having meanwhile given Battery C its initial data, orders: "Battery C adjust."

Meanwhile, the BC's of Batteries A and B have given their commands for zone fire, that of Battery B, for example, being: "B 3 RDS. SWEEPING, 3 TURNS, AT MY COMMAND, ZONE 4,550, 4,750."

The observer reports initial salvo of Battery B, "100 short."

S-3 immediately orders, "Fire for effect on Bn 1" and each battery fires through its zone as rapidly as possible.

At the conclusion, the observer reports "Fire effective."

Actually, each battery fired one salvo at the mid range of its zone, the observer reporting each salvo effective.

The total time from designation of target until fire for effect was 8 minutes.

THE USE OF CHEMICAL AGENTS BY THE FIELD ARTILLERY IN FUTURE WARFARE

BY MAJOR J. M. EAGER, 1ST F. A. BRIGADE

AT PRESENT our ideas about the use of chemical agents by the Field Artillery are based upon firing these agents from the guns and howitzers which were left over from the World War. Undoubtedly any war in which we might become involved in a not too remote future would start with our Field Artillery using the matériel salvaged from the Warld War. We cannot expect our government in times of peace to go to the expense of rearming the bulk of its fighting forces, viz.: the ground troops, with newly developed weapons. After all, the World War guns and howitzers we have on hand are still very respectable artillery and about as good as the armament of the other nations.

However, our government will have to start making more artillery weapons at the outbreak of another major war. Surely these new weapons will not be copies of more or less obsolete World War models; they will be of more modern types, designed so as to utilize the lessons of the World War and of post war development.

Our ideas concerning the use of chemical agents by the Field Artillery using World War materiel, organization and tactics are now fairly well standardized and are set forth in regulations and the teachings of the Service Schools. However, there is a large almost untouched field for thought and speculation concerning the use of chemical agents with guns and howitzers of new design. Furthermore, new weapons will affect organization and tactics.

What lessons did we learn from the World War about the use of chemical agents which will be applicable in another war? We learned that—

1. The Field Artillery projectile is the most reliable means of reaching an enemy with chemical agents, because it is not dependent on wind, weather, daylight or darkness and its long range enables a large amount of chemical agents to be concentrated on any desired area.

2. Practically all types and calibers of Field Artillery can be used to great advantage in shooting chemical shell.

3. The action of chemical shell supplements the action of high explosive or shrapnel in an ideal manner, because:

a. The gas reaches places and personnel which cannot be reached by high explosive or shrapnel;

b. The gasses can be fired to greatest advantage at night or in fogs when H. E. shell or shrapnel is least effective. In this connection General Gilchrist during the war obtained data from 6,980 patients to the effect that over 72.1% were gassed at night.

c. Chemical agents can be used to better advantage on targets in the woods than in the open, whereas the opposite is true with H. E. and shrapnel.

d. Observation of fire is less important when using chemical shell than when using high explosive or shrapnel.

4. An advantage of using artillery to deliver the gas or smoke is that by doing so it is not necessary to send the chemical agents with the personnel and weapons to shoot them, up to the very forward areas where movement, personnel and equipment should be kept at a minimum.

5. The effectiveness of chemical agents when used by the Field Artillery is well established. In this connection the following quotation from Lieutenant Colonel B. C. Goss, Chief Gas Officer, 1st Corps, A. E. F., is convincing:

"The importance of this method of gas attack may be estimated from the fact that 90% of the total gas casualties in the British Army was caused by enemy artillery shell, and this in spite of the tremendous casualties incurred by the first unexpected use of cloud gas from cylinders in 1915 against troops wholly unprepared. Casualties in the British Army due to gas artillery shell reached the appalling total of 170,000." (Later statistics show British gas casualties to have been 180,981.)

As an example of the effect of hostile artillery gas shells on our troops in the World War the following is quoted from a report dated June 25, 1918, made by Paul B. Malone, then commanding the 23rd Infantry:

"The number of shells fired by the artillery support of this regiment has been approximately 3,000 per day. The enemy has not fired as great a number, but his fire of all kinds has produced in this regiment a total of about 855 casualties since June 1st. Of these 334 were produced by gas. The 334 casualties were produced by firing not more than 4,000 gas shells. It would therefore

appear, roughly speaking, that the 4,000 gas shells had produced 334 casualties while approximately 116,000 shells of other varieties, machine gun fire, etc., had produced the remaining 521 casualties. From the foregoing it would appear that, expressed in number of shell only, the gas shell has been approximately *nine* times as effective as the other forms of projectiles in producing casualties. Of the casualties produced, however, few are fatal. The vast majority will return to the line, but so far as the fighting strength of this regiment is concerned, the men are lost and will not return for perhaps two or three weeks. So far as our ability to resist attack is concerned, these casualties are as serious as those produced by bullets."

During the World War the A. E. F. suffered a loss on the battlefield of 258,338 men, exclusive of the Marines. Of this number, 34,249, or 13.3%, were killed outright or died on the field before they could be removed. Only 200 of these were gas deaths. The remainder were hospitalized. Of the hospitalized cases, 70,552 or 27.3% were suffering from the effects of gas, and of this number 1,221 or 1.73% died. Of the remaining 153,537, or 59.4% of casualties, suffering from wounds produced by weapons other than gas, 12,470 or 8.1% died.

It is interesting to note that of the 70,552 gas casualties suffered by the A. E. F. the average number of days lost per casualty, dependent on the kind of gas, were as follows:

Kind of gas	*Average days lost per man*
Mustard	46.
Phosgene	45.6
Chlorine	60.
Unknown	37.3

Another proof of the effectiveness of the Field Artillery in using gas is the fact that during the latter stages of the World War frequently areas had to be vacated by both Allies and Germans solely due to the fact that enemy artillery had so impregnated them with gas that it was impossible for troops to stay in them. It often happens in warfare that by causing the evacuation of a locality by the enemy the same advantage is gained as if the area were actually captured and occupied.

The proportion of chemical shell used by the Germans and Allies kept increasing until the Armistice. At that time the Germans

were using chemicals in more than 30% of their artillery shell and the American Army's ratio was fixed at 20%, which was to be increased on January 1, 1919, to 25%.

During the World War the proportion of gas shell employed depended more upon amounts available or procurable than on ideal ratios, as is shown by the following extracts from the 1st Division Gas Officer's report to the Chief of Chemical Warfare Service dated February 15, 1919:

"Very satisfactory results were obtained from the extensive use of gas shell. In fact its value was considered so great that ammunition of this nature was in continual demand and was never supplied in the quantities desired. This was especially true before the Argonne-Meuse Offensive. The proportions were governed by the supply, not by the rules of the occasion. For rapid neutralization of enemy batteries, for harrassing fire, for use against enemy in probable assembly points during periods when attack by the enemy is imminent, extensive employment of gas concentrations constitutes a means of injuring the enemy which should never be disregarded. During the German May, 1918, offensives, they used shell in the following proportions:

"Counter battery fire:	
HE shell	20%
Phosgene shell (blue cross)	70%
Diphosgene shell (green cross)	10%
"Creeping Barrage against Infantry:	
HE shell	60%
Phosgene shell	30%
Diphosgene shell	10%"

At this point it is proper to consider whether the use of gasses will be permitted in another great war. Attempts have been made by some individuals and nations to outlaw gas warfare. They contend that gas is inhumane. Their belief is to a great extent the result of war-time propaganda and the lack of available statistics on the subject which existed at that time. Since the World War much serious thought has been given to the humaneness of gas and valuable statistics have been carefully compiled. The following quotations from "A Comparative Study of World War Casualties from Gas and Other Weapons," an official document, should be conclusive:

"Both experience and statistics of the World War indicate that

gas is the most humane method of warfare ever applied on the battlefield.

"The measure of humaneness for any form of warfare is the comparison of the degree of suffering at the time of injury, their permanent after effects, and the percentage of deaths to the total number injured by the particular methods of warfare under consideration.

"If a man becomes a casualty from gas, his sufferings are less severe and of shorter duration than if wounded with other weapons. With the lung irritants, the man exposed is fairly out of danger at the end of 48 hours. The burns produced by mustard are not painful immediately upon exposure, and are not painful after the first 24 hours, although prolonged hospitalization is usually necessary. As to the wounds produced by bayonet thrusts through the abdomen, gunshot wounds affecting any of the important organs, the results of high explosives in which bodies are torn and mangled, the loss of limbs, etc., comment seems unnecessary."

The following Table will show the percentage of deaths from gas and from all other weapons in the A. E. F., British and German Armies:

	Gas Casualties	% of deaths from gas	All other casualties	% of deaths from all other casualties
A. E. F.	70,752	2	187,586	24
British	180,981	3.3	1,908,810	36.6
German	78,663	2.9	4,168,116	43

The popular opinion that gas casualties are particularly liable to tuberculosis is erroneous. Strange as it may seem, the contrary is true. The number of cases of tuberculosis for each 1,000 men gassed in the A. E. F. is 2.45. The general rate of tuberculosis in the A. E. F. in 1918 was 3.50 per 1.000 and in 1919 it was 4.30 per 1.000. This shows that the gassing was either somewhat of a deterrent to tuberculosis or the gassed men under hospital care were less subject to tuberculosis than were their comrades in the field.

As regards the contention of certain nations that gas warfare should be outlawed, it is believed that their reason for making this contention is their fear that through lack of chemical materials, plants, knowledge or proximity of potential enemies, they would be in a position of inferiority as compared to their rivals in gas warfare.

The potentialities of the United States in regard to chemical materials, means of production and technical personnel are now unexcelled by any other nation. In the 1899 Hague Conference, the United States was the only power present which would not adhere to a provision to outlaw the use of asphyxiating gas from warfare. Although the matter has been brought up in many later international conferences, the United States has never ratified any agreement to outlaw gas warfare. It is believed that the American people are gradually beginning to realize that gas warfare is more humane than bullets and explosives. There have been many examples of its use on our own people in the last few years to prevent or break up civilian disturbances, and completely satisfactory results have been accomplished without any permanent injury: to accomplish the same results with clubs and bullets the bloodshed, maiming and killing would have been calamitous. It is believed that in case of a great national emergency, the men on whom would rest the responsibility of deciding to use or not to use chemical agents would decide to use gas, not only on account of its military efficiency, but also for the very reason that it is far more humane than the other means of warfare.

So, assuming that in another great war we will be using gas again, it is important that we prepare ourselves to use it to the best advantage. The use of gas by the Field Artillery during the World War, effective as it was, was nevertheless a conglomeration of improvised arrangements. In the first place no American gas shell reached our artillery in France before the Armistice. We got what chemical shell the French could let us have, and some of it was not much good. Our artillery personnel, like everybody else, had very meager knowledge of the characteristics and proper methods of employment of the various chemical agents they were firing, so much of the firing was bound to be ineffective. The artillery gas projectile itself was just an improvisation, an H. E. shell filled with some sort of chemical agent which was fired with H. E. range tables regardless of its altered ballistic qualities. It appears that not much has been done since the war to improve these conditions.

At the beginning of the next war we probably will be using the same old French 75's and 155's and the same old improvised gas

shell. But if the war is hard and long enough, and they often are, we will soon get something better.

Let us try to determine what new types of artillery weapons will be manufactured for another war. Post war development should indicate the trend of new design. However, we must not base our conclusions entirely upon what we have seen or heard concerning pilot models. Much of the work of development is in the nature of experimentation. When it comes to re-arming the Field Artillery with new weapons the knowledge gained in this experimentation will be of great value, but it is believed that tactical employment will govern in determining the specifications and quantities of any new Field Artillery armament.

In post war development much has been done towards obtaining greater ranges, traverse and mobility as well as improvements in processes of construction. All these factors will enhance the value of Field Artillery as a conveyor of chemical agents. Probably the thing that will increase the efficiency of Field Artillery more than anything else that has happened since the World War is the great development of the pneumatic tire in the last few years. Road and cross country mobility has been tremendously increased. If the consumption of artillery ammunition was appalling during the World War when ammunition had to be gotten to the front in wagons, caissons and hard tired trucks, what will it be in another war when it can be delivered rapidly on dual balloon tired vehicles of almost any size or number of wheels?

The idea of General Headquarters reinforcing artillery for offensives, which worked so well towards the end of the war and which should be still more important in another war when cargo mobility will be greater, should favor the more extensive use of gas by the Field Artillery.

The old gun vs. howitzer argument has been going on through decades, but everybody seems to agree now that a light howitzer is needed as a divisional artillery close support weapon, possibly with an all purpose gun such as the T2 or T3 gun for general support of the division. The effect of this on the use of gas by the Field Artillery would be:

(1) light howitzers, having larger projectiles and slower muzzle velocities than light guns, will carry more gas filler.

(2) light howitzers being able to get nearer the front and use defilade to better advantage than light guns, will be able to fire gas and smoke missions formerly assigned to 4″ mortars.

There is apparently no reason why light howitzers could not be used with mortar type ammunition by locking the breech block and putting in the rear end of the chamber a wooden or metal drum with a spike sticking to the front so that mortar shells of the type of the 4.2″ chemical mortar or 75mm Stokes Brand mortar could be dropped in at the muzzle in rapid succession. The howitzer's rifling could be utilized to give rotation to the mortar type projectile by means of a base rotating plate similar to that provided for the 4.2″ chemical mortar.

It is believed that the Field Artillery should insist on chemical ammunition of design to carry the maximum amount of chemical agent. If we are to shoot chemicals we want to obtain the maximum effects.

As far as is known nothing has been accomplished since the war to increase the ballistic efficiency of the artillery gas shell. The 75mm gas shell with a mustard filling weighs about 13 pounds, of which there is only 1.35 pounds of mustard, or an efficiency of about 10%. The 155mm shell is not much more efficient, its ratio being 95 pounds: 11.3 pounds, or about 12%. These efficiencies compare very poorly with that of the 4.2″ chemical shell which was designed especially to carry chemical agents. Figured the same way, its efficiency is 30%.

Next in importance is rate of fire. Volume of gas at the target area is what is needed even more than range or accuracy. It is believed that by using mortar type ammunition in light howitzers and even in light guns a rate of fire of 20 rounds per minute could be easily attained. There seems to be an idea that chemical shell for artillery should be as much like H. E. as possible so as to avoid complications in range tables, fuzes, corrections, etc. We should break away from that idea. Chemical shell and H. E. shell should be designed with a view to obtaining the maximum effect for each, not with a view to making the projectiles similar to one another. A lot of metal is desirable for H. E.; the smallest possible amount for chemical shell. Great accuracy is needed for H. E. shell; accuracy is not nearly as important as

large content for chemical shell. Great range is desirable for H. E.; it is not as important as volume of fire for chemical shell. If great range is desired in shooting chemicals it can best be attained by Corps and Army artillery, or the Air Corps.

No study of Field Artillery for future warfare is complete without at least a reference to the possibilities of rockets as a method of conveying high explosives or chemical agents to the target. Considerable work is being done on rockets by civilians both in this country and abroad, and progress is being made, particularly as regards rocket airplanes and automobiles. It is not believed that the Army has done anything constructive along these lines, although from an artillery point of view the problem should be relatively simple due to the possibility of confining it to rather narrow limits. From information obtained from Professor Goddard, who has been working with rockets since 1909 and is now provided with generous funds by the Guggenheim Foundation, it appears that for a rocket shell shooting at 20,000 yards, the propellant would be 28% of the weight, the rocket 14%, and 58% pay load, i. e., explosive or chemical agent with its container. The most astonishing point about rockets, however, is there seems to be practically no limit to the size and range they can attain.

In conclusion it is well to point out that the Field Artillery is the main using service for chemical agents and it is our problem to get the maximum benefit from them, not only by obtaining ammunition and weapons of proper design to use them efficiency, but also by making ourselves thoroughly familiar with the possibilities and limitations of Chemical Warfare.

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AUSTRIAN MEDIEVAL ARTILLERY

THROUGH THE COURTESY OF COLONEL ROBERT R. McCORMICK, THE CHICAGO TRIBUNE

AUSTRIAN artillery was for almost six centuries the ordnance of the Holy Roman Empire. Its origins go back to the fourteenth century. The Vienna Arsenal still possesses a huge mortar from the year 1350 which was cast in Steyr, later to become the seat of Austrian munitions manufacture. It was captured by the Turks in 1529 and spiked because they could not take it away.

The Bohemian Hussites were the first members of the Holy Roman Empire who used artillery in mass and according to plan. Their great leader, Ziska, employed the bronze pieces of his time with great skill in the wars of the first half of the fifteenth century. The siege of castle Karlstein near Prague by the Hussites in 1422 was a singular example of the use of artillery in this period.

Some 24,000 Hussites laid siege to the fortress, defended by the Imperial troops, and placed in position before it 5 catapults, 46 small cannon and 5 large ones. The marble pillars of the Prague churches were used to make cannonballs. The heavy pieces discharged from one to two shots daily, the lighter from six to twelve. The catapults were used principally to hurl rotting carcasses and other filth into the castle confines, in the hope of causing disease. The defenders countered this by covering the discharges with lime and arsenic. After a month the Hussites were forced to raise the siege but not before they had fired 10,930 cannonballs, 932 stone fragments, 13 fire barrels and 1,822 tons of filth into the fortress.

In the fourteenth century a cannoneer who could fire five or six shots from a large gun was counted highly skilled in his craft.

The special privileges of the artillery in the Imperial Army, which held good for hundreds of years, were granted first by Emperor Frederick the Third in 1444. Artillery, it was early admitted, was a mysterious science which required brains as well as discipline. Artillery was an art like alchemy, its adepts were more or less sorcerers and the gunner did his best to weave a veil about his craft by preserving its secrecies. Artillerymen were not

loved in the army, but they were feared. They were no happy warriors, neither drinkers nor plunderers, and kept themselves very much to themselves.

The gunner, drawn mostly from the bourgeois or artisan class, was a member of a guild and not merely one of a wild soldiery. The knights hated him, the cavalry also. This man shunned hand to hand conflict but killed from afar. His activities had already put a period to the depredations of the robber barons. This resentment endured until the World War. The German and Austrian artillery was a corps d'elite. The descendants of the robber knights served, however, in the cavalry and had little esteem for their brothers of the artillery.

It was part of the privilege granted by Emperor Frederick to the artilleryman that his monthly pay was reckoned anew from the day when a fortress was captured or siege repelled. No provost-marshal had the right to judge him; that was the prerogative only of his own superiors. His wife and child stayed with him, not with the general baggage train. When food was distributed he did not have to stand in line with the other soldiers, but need only raise his fire stick to be served immediately. He did not need to plunder since by right all the churchbells of captured cities and all captured artillery belonged to him and must be purchased from him by his field-marshal with money. When a foot soldier chased by the military police could gain the artillery train and lay his hand on a gun, his pursuers could not touch him and this right of asylum lasted three days.

The real founder of the Imperial artillery was Emperor Maximilian the First, the "last knight," who was a passionate artillerist himself. He brought this branch of the service to a high pitch of perfection and made it a pattern for the whole continent. He invented new quadrants, sights and methods of fire. He also improved munitions. His biographer remarked "he had made use of only a hundredth part of his inventions. The rest he kept to himself, out of pity for mankind and for the good of his soul."

He erected many artillery depots and the inventories—splendid colored drawings of the guns and gunners—are valuable sources for the history of artillery in the early sixteenth century.

Maximilian's artillery can be estimated at several thousand pieces. It is difficult to derive an idea of the manner in which his

artillery was organized since, like the artillery of the whole sixteenth century, there was no proper differentiation in nomenclature between the different pieces.

The investment of Padua by Emperor Maximilian in 1509 was a good example of the use of artillery in the sixteenth century. Padua was defended by 15,000 Venetians against 24,000 Imperial soldiers. The Emperor brought 136 heavy guns from the Tyrol across the Alps to Padua. Land and river transport were called into service. The heaviest piece was "Pretty Katherine," which weighed about ten tons. She was brought with great trouble almost to Padua, but there changed her mind with feminine inconsistency and dived into the river Bachiglione from the raft on which she was being ferried. She was never recovered. The siege was conducted with all the refinements of the sappers art, which had already a high state of development, but it failed.

Until the Thirty Years' War the artilleryman's duty ended with the war in which he was engaged. When it was over he was dismissed from service and the guns were deposited in depots. This rule changed with the Thirty Years' War, which had few breathing spaces. The artillery was permanently engaged. Both Wallenstein and his opponent, King Gustavus Adolphus of Sweden, valued artillery highly and greatly increased its strength. This produced a shortage of professional artillerymen and ordinary foot soldiers, after short instruction were added to their ranks.

The aura of mystery which had hung over the gunner's art began to disappear and the improvement in muskets and musketry pressed his slow firing weapons into the background. Wallenstein's efforts, however, were responsible for an increase in the rapidity with which the pieces could be discharged and a consequent heightening of their fire effect. This was brought about by the invention of shells and grapeshot, by the construction of lighter guns of smaller calibre and improvement in loading methods. The betterment of the Imperial ordnance, however, did not keep step with that of the Swedish King's artillery, which was distinguished by a mobility almost unbelievable for that period.

The Austrian army paid more and more attention to sapping and mining methods of warfare and its rawly trained gunners grew less and less able to hit their targets. The honor and reputation of the gunner in the Austrian army, after all, depended on

the success of his aim and often this was also true of his life. He was allowed only three ranging shots with a new piece, even though it were of a make unknown to him. The fourth shot must hit the target, and no joke. "Hit it, you beast, or I will hang you," cried Wallenstein to an artilleryman at the siege of Stralsund. Archduke Ferdinand hanged a gunner at the siege of Regensburg in 1634 because he twice missed his aim.

It was hardly to be wondered at in such circumstances that experienced artillerists could work wonders with their crude pieces. At the investment of Prague one of them shot at a distance of 400 paces the "ears" from which the alarm bell of the fortress was suspended and thus prevented the news of the attack from being heralded. At the siege of Ostend another Imperial gunner cut the anchor chain of an enemy ship.

The bronze pieces which they fired could be discharged a hundred times daily if they were of light calibre, perhaps only thirty times if they were heavy. Their calibre varied from one to eight inches.

The proportion of artillery to other troops also varied greatly. At the battle of Noerdlingen 60,000 men had 116 guns; eight years later at Breitenfeld 40,000 men had only 46 pieces. It was at this time that a distinction was made between field and siege artillery in order to increase the mobility of armies. The Thirty Years' War saw the transformation of armies formed of German mercenary foot soldiers into something resembling the standing armies of today. The artillery also became permanent.

During the Turkish wars which followed, Field Marshal Count Montecuccoli reorganized the artillery, allowing one field piece to every thousand men. He also organized a siege train which in 1684 comprised 87 light and 36 heavy guns. The Imperial gunners won many laurels under Prince Eugene of Savoy in the Turkish wars. The conquest of Ofen and Belgrade are glorious pages in their history. In the Vienna Arsenal today may still be seen a mortar with an inscription setting forth how a shot from it exploded the Belgrade powder magazine in 1717 and caused the death of 3,000 Turks.

In the eighteenth century artillery manufacturers became more or less standardized. The weight of gun barrels did not greatly diminish since lighter construction was balanced by longer barrels.

In 1722 the War Ministry in Vienna ordered all old cannons to be recast according to new patterns. The range of artillery of this date was short. Five hundred paces was almost the maximum. The munition supply was organized on a basis of 500 shots for each gun. At the siege of Temesvar in 1717, 9,248 shots were fired from 52 field pieces and 19,372 from 87 siege guns.

With the introduction of standing armies the artillery had seen many of its ancient privileges fade. Saint Barbara, however, patron of gunners since time immemorial, was still revered as of yore and her picture was to be found engraved on most Austrian cannons.

The eighteenth century found the Austrian artillery, despite their success in the Turk and Spanish wars, far below the level of the rest of Europe. Lack of uniformity and slowness of fire were their principal defects. The wars against Frederick the Great brought about fundamental changes and Prince Liechtenstein, artillery commandant from 1744 to 1776, thoroughly reorganized his department. When war broke out in 1742 the Imperial artillery was scattered over an area from Belgium to Transylvania and from Naples to the Saxonian borders. Only eighteen guns supported the Austrian army in its first battle against Frederick in Mollwitz. The guild feeling of the Austrian gunner which he had retained long after his comrades in the rest of Europe had lost it, was the greatest obstacle to the modernization of his service. He lacked scientific training and hated rather than greeted progress.

Liechtenstein proceeded to change all this. He summoned experts from all over Europe. He established a field artillery corps of three brigades with separate supply and transport. His main efforts, however, were directed toward modernizing the training of officers and men. The officers were schooled not only in exercises, but also in ballistics and tactics. Special attention was paid to the mobility of the field artillery. Finally all special privileges of the artillery were abolished and all means were used to make soldiers out of the guildsmen.

Liechtenstein's efforts bore fruit in the later wars against Frederick, when the Prussian monarch complained bitterly of the "frightful fire" of the Austrian artillery in the battles of Kolin

and Hochkirch. Mathematics had become now the favorite science of the young Austrian artillery officers, until finally their ranks produced a Vega, one of the country's greatest mathematicians.

Liechtenstein's scientific methods also found expression in gunpowder manufacture, which had been surrounded up to this time with almost superstitious mystery. He was the first in Austria who tried by exact methods to improve powder mixtures. He also introduced the use of cartridges.

The Napoleonic wars saw many changes in the organization and arming of the Austrian artillery and also a permanent improvement in its scientific equipment. The tendency to form strong field batteries continually had to be checked and the importance of smaller batteries insisted upon.

Four guns were apportioned to each thousand men in 1813. Field artillery had improved greatly as regards both mobility and rapidity of fire. Siege artillery—because so seldom employed—had not made the same progress. The defense of Fort Malborgeth on the Italian frontier in 1809 against some 40,000 French troops was one of the most brilliant pages in the history of the Austrian artillery. It proved that artillery skilfully directed and served by resolute hearts, could discount all cut and dried calculations of the infantry and cavalry. The defenders of Malborgeth died at their posts, but not before they had greatly delayed the French invasion of Austria.

The wars of the nineteenth century against Italy, France and Prussia gave new grounds for the claim of the Austrian artillery to be the army's corps d'elite. Its finest performance was at the battle of Koeniggraetz in 1866, where three hundred Austrian guns covered the retreat of the whole Austrian army almost without infantry support. It was a successful example of those tactics which called for the advance of batteries close to the enemy line into which they fired round after round to cover retreats or changes of front by infantry. Such tactics cost much in life and material but saved many a threatening situation.

The present German president, Hindenburg, then a young lieutenant, was wounded in attacking the Austrian "battery of the dead" near Chlum in the battle of Koeniggraetz. Its guns, almost buried by the corpses of their crews, were fired to the last man.

The high reputation which the Austrian artillery won in these wars lasted until the World War. In the last quarter of the nineteenth century the Austrian field pieces were modernized but until the World War they fired from bronze gunbarrels. At the beginning of this century rapid fire guns were introduced. The number of pieces fell far short of the army's requirements owing to the difficult financial position of the Hapsburg Empire.

Due to the topography of many parts of the Empire special care was devoted to mountain artillery and its transport in high Alpine districts. The siege guns, however, were antiquated when the World War broke out. Weapons of the year 1860 were still in use and ammunition left much to be desired. The theoretical training of the officers was perhaps too intensive in relation to tactical instruction and practical technique. The old offensive tradition of the artillery, which scorned protected positions, caused heavy losses in men and guns against the Russians, who had learned better tactics in the Japanese war.

Despite the financial situation Austria-Hungary had secretly constructed as early as 1912 heavy motorized mortars of 30½ centimeters calibre, which, together with the German 42 centimeter howitzers, obtained surprisingly good results at the siege of the Belgian fortresses in 1914.

The Austrian artillery which entered the world war with about 400 batteries numbered over 1,500 in 1918, despite heavy losses. The lack of bronze forced the field artillery to be satisfied with steel barrels but the Skoda works, the Krupp of Austria, supplied a whole series of special pieces. Fire tactics, however, were adopted largely from the Germans.

The Treaty of Trianon wrote the finishing chapter to the long history of Austrian artillery. A small country of 6,000,000 could not have afforded much in the way of ordnance anyway. But the Allies made sure. They prohibited all heavy artillery and allowed just enough light pieces to allow Austria's tiny army of 30,000 men to carry out manoeuvres.

By the terms of the treaty, Austria is permitted three field or mountain guns per thousand men. Some of these are howitzers. The treaty also allows two light and two medium trench mortars per thousand men. That is all. This branch of the service is dead.

Pictorial Map, Fort Sill:

A pictorial map of the Fort Sill Military Reservation, showing features of terrain and general interest. It is in full colors, highly humorous, decorative; a souvenir and reminder for those who have been stationed at Fort Sill. It never fails to produce a chuckle. The map is adapted for framing and use as a wall hanging. Size 28 inches by 34 inches. Price, postpaid, $1.00.

The map was drawn by Lieutenant Frank Dorn and can be ordered from the U. S. Field Artillery Association.

Truck-Drawn National Guard Field Artillery Units:

Authority has recently been granted for the conversion of certain tractor-drawn and horse-drawn Field Artillery units into truck-drawn Field Artillery units. This is a result of the tests recently made by Battery D, 17th Field Artillery at Fort Bragg, North Carolina, under the direction of the Field Artillery Board. Some of these units have already received their equipment while others are in the process of reorganization:

117th F. A. (H. D.) Ala. N. G.

119th F. A. (H. D.) Mich. N. G.

59th F. A. Brig. (T. D.) less 185th F. A. (155mm. How.) Minn. N. G.

143rd F. A. (H. D.) Calif. N. G.

145th F. A. (H. D.) Utah, N. G.

51st F. A. Brig., 26th Div. Mass.

68th F. A. Brig., less Hq. Btry., 43rd Div., R. I. and Me.

60th F. A. Brig., 35th Div., Kans.

61st F. A. Brig., 36th Div., Texas.

70th F. A. Brig., 45th Div., Okla., New Mexico and Ariz.

104th F. A., Hq. and Hq. Btry., 52nd F. A. Brig., New York.

116th F. A., 56th F. A. Brig., Fla.

Hq. and Hq. Btry. 56th F. A. Brig., Fla.

Hq. and Hq. Btry. 55th F. A. Brig. and 115th F. A., Tenn., and S. C.

Graduates—Army War College—Army Industrial College—Naval War College—and Their Future Assignments:

ARMY WAR COLLEGE

Lt. Col. W. R. Henry—detailed to I.G.D., Hq. 9th C.A., San Francisco, Calif.

Lt. Col. W. H. Dodds, Jr.—Instructor Army War College.

Major C. Brewer—ROTC Purdue University.

Major B. R. Peyton—Instructor Cavalry School.

Major G. A. Pollin—OR duty, Oklahoma City.

Major F. B. Prickett—War Department General Staff.

Major C. G. Helmick—13th Field Artillery Brigade, Fort Bragg, N. C.

Major J. L. Devers—1st Field Artillery Brigade, Fort Hoyle, Md.

Major J. B. Wogan—War Department General Staff.

Major F. T. Armstrong—Office Assistant Secretary of War.

ARMY INDUSTRIAL COLLEGE

Major R. Hospital—NG duty Trenton, N. J.

Capt. C. R. Toy—2nd Division Artillery, Fort Sam Houston, Tex.

NAVAL WAR COLLEGE

Lt. Col. M. Magruder—17th F. A., Fort Bragg, N. C.

Results of Field Artillery R. O. T. C. Pistol Competition for 1933:

The winner of the annual Field Artillery R.O.T.C. 22 Caliber Pistol Competition for 1933 is the *University of Oklahoma* with a score of 1,387.

The five teams next in order of scores are as follows:

2.	Colorado Agricultural College	1,380
3.	University of Missouri	1,379
4.	Cornell University	1,365
5.	Iowa State University	1,351
6.	Purdue University	1,348

The scores of each member of the teams having the three highest scores follow:

UNIVERSITY OF OKLAHOMA—SILVER MEDALS

Name	Slow	Rapid	Timed	Total
Mayrath, Thomas	92	93	96	281
Mayrath, Robert L.	90	93	95	278
Smith, Winfred W.	90	94	91	275
Blake, Homer C.	87	95	94	276
Cox, Mark S.	89	92	96	277
Total				1,387

COLORADO AGRICULTURAL COLLEGE—BRONZE MEDALS

Name	Slow	Rapid	Timed	Total
Congdon, Wilfred H.	91	97	97	285
Hamilton, Fred B.	87	99	97	283
Hochmuth, Harold R.	84	94	95	273
Thomsic, Mike F.	91	94	91	276
Price, Wm. P., Jr.	83	94	86	263
Total				1,380

UNIVERSITY OF MISSOURI—BRONZE MEDALS

Name	Slow	Rapid	Timed	Total
Parman, Kenneth C.	91	98	96	285
McQueen, Donald M.	88	97	96	281
Gorelick, David F.	87	95	97	279
Smarr, Lawrence K.	88	97	89	274
Callison, Charles H.	80	90	90	260
Total				1,379

The highest individual score in the match, 285, was made by each of the following:

1. Congdon, Wilfred H., Colorado Agricultural College.
2. Parman, Kenneth C., University of Missouri.
3. Jordan, Albert, Iowa State College.

Since the inauguration of the Field Artillery R.O.T.C. 22 Caliber Pistol Competition, it has been won by the following institutions:

1930—Purdue University.
1931—Princeton University.
1932—University of Missouri.

The P. M. S. & T., University of Missouri, will forward the Challenge Cup to the P. M. S. & T., University of Oklahoma. The latter will have it suitably engraved and furnish the Secretary of the National Rifle Association with a voucher covering the cost.

Individual medals for members of the teams winning places in the competition will be forwarded by the office of the Chief of Field Artillery as soon as received from the National Rifle Association.

Graduates U.S.M.C., 1933, Assigned to the Field Artillery

The appointment as second lieutenants in the Regular Army of the United States, with rank from June 13, 1933, and the assignment to arms of service of the following-named cadets, graduates of the United States Military Academy, class of 1933, are announced:

FIELD ARTILLERY

19. John Thomas Honeycutt
20. William Allen Harris.
23. John Gardner Shinkle.
35. Walter Adonis Downing, Jr.
36. Guy Cecil Lothrop.
*42. Thomas Samuel Moorman, Jr.
47. Herbert George Sparrow.
49. Robert Wolcott Meals.
*51. Winton Summers Graham.
*53. William Livingston Travis.
54. Thomas Burns Hall.
*55. Chalmer Kirk McCelland, Jr.
*57. David Nicholas Crickette.
58. John Denton Armitage.
61. Paul Elton LaDue.
*62. Edward Joseph Hale.
*63. William Joseph Daniel.
67. Tayloe Stephen Pollock.
*70. William York Frentzel.
74. Samuel Edward Otto.
79. Gerald Chapmen.
82. Daniel Parker, Jr.
90. Robert Beall Franklin.
94. Paul Rudolf Walters.
*95. Vernon Cleveland Smith.
*102. Francis Hill.
103. Herbert Charles Plapp.
*104. Lassiter Albert Mason.
109. Francis Iden Pohl.
122. Harrison King.
124. Richard Park, Jr.
125. Beverly DeWitt Jones.
126. William Hadley Richardson, Jr.
*127. Frank Patterson Hunter, Jr.
128. Richard Channing Moore.
131. John Roosevelt Brindley.
134. Marcus Tague.
135. Joseph Leonard Cowhey.
138. Newell Charles James.
141. John William Ferris.
142. Robert Penn Thompson.
145. Neil Merton Wallace.
146. William Paul Whelihan.
148. Robin George Speiser.
149. William James Given, Jr.
*151. Avery John Cooper, Jr.
*152. Lawrence Browning Kelley.
*156. Cam Longley, Jr.
*157. Carlyle Walton Phillips.
158. Robert Benton Neely.
*159. Phillip Henshaw Pope.
*160. William John Ledward.
*166. George Allen Carver.
171. James Monroe Royal, Jr.
172. Robert Totten.
*173. Douglas Moore Cairns.
177. William Orlando Darby.
178. Daniel Light Hine.
181. George Thomas Powers, 3d.
182. Frank James Carson, Jr.
183. Joshua Robert Messersmith.
186. William Francis Ryan.
188. James Henry Skinner.
*191. Richard John Meyer.
*192. Randolph Whiting Fletter.
194. Horace Benjamin Thompson, Jr.
196. Humbert Joseph Versace.
*197. Milton Frederick Summerfelt.
*198. Franklin Guest Smith.
*200. Gabriel Poillon Disosway.
201. James Pugh Pearson, Jr.
204. Emile Jeantet Greco.

Class rank is shown by the number in front of each officer's name. Those officers whose names are marked with an asterisk (*) will be detailed to the air corps.

The Field Artillery Journal:

THE FIELD ARTILLERY JOURNAL desires to call the attention of its readers to the new formal which was adopted beginning with the January-February, 1933, number. In contrasting the size of the present JOURNAL with its 60-pound English finish paper with former JOURNALS printed on the bulking book paper it would appear to be about one-half the thickness of the previous format. This is due to the thickness of the paper rather than to the number of printed sheets. Previous JOURNALS normally contained 96 pages exclusive of pictures, as it was necessary to put the pictures on finished rather than rough paper. The present JOURNAL normally contains 96 pages including pictures, as pictures can now be printed on any page of the JOURNAL. While there has been no adverse comment on this matter, the Executive Council believed that the above facts should be pointed out to JOURNAL readers.