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**THE  
FIELD ARTILLERY  
JOURNAL**

**EDITED BY**

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**LIEUTENANT-COLONEL (FIELD ARTILLERY), UNITED STATES ARMY, RETIRED**

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

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## THE FIELD ARTILLERY JOURNAL

Edited by

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## Ordnance Motor Equipment for Artillery Transport

BY MAJOR WEBSTER A. CAPRON, ORDNANCE DEPARTMENT, U. S. A.

[AUTHOR'S NOTE.—*The greater part of this article is taken from a paper prepared by the writer, under direction of the Chief of Ordnance, for use by the General Staff. This paper varies greatly from the original and should in no way be considered as an official publication. The subject of tanks has been omitted as well as most of the data on self-propelled mounts. Any conclusions or principles presented herewith are solely the opinion of the writer.*]

1. This paper deals with vehicles of the track-laying type, which constitute the cross-country Combat Transport of the Army. Such transport should not be confounded with that peculiar to the Supply Departments or that of the Service of Supply, which, being confined to good roads, presents a simple problem and one already solved in the commercial world by the use of trailers and motor-propelled vehicles of the wheeled type.

2. While most of the track-laying vehicles developed by the Ordnance Department were originally intended to fulfill the needs of the Artillery, the success of these mechanisms has been so marked that, without question, their use may be extended to a broader field; *viz.*, that presented by the needs of the entire Army.

3. With respect to type, track-laying vehicles may be classified as:

- I. Artillery Tractors.
- II. Tanks.

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- III. Tractor Caissons.
  - (a) Draw-bar Tractor Caissons.
  - (b) Reconnaissance Tractor.
- IV. Trailer Caisson.
  - (a) Artillery Repair Trailer Caisson.
  - (b) Artillery Supply Trailer Caisson.
  - (c) Three-ton Shop Trailer Caisson.
  - (d) Four-ton Shop Trailer Caisson.
  - (e) Power Trailer Caisson.
- V. Tractor Cart.
  - (a) Tractor Hand Cart.
  - (b) Tractor Power Cart.
- VI. Trailer Gun Mount, Track-Laying.
- VII. Self-Propelled (S.P.) Gun Mounts.
- VIII. Caterpillar Adapters.

4. The various types listed above are defined as follows (this list is the official nomenclature for such vehicles):

A. ARTILLERY TRACTOR.—A vehicle of the track-laying type, with power plant self-contained, used for hauling artillery carriages. The pay load (useful load) is always pulled as a draw-bar load, the tractor being the prime mover.

B. TANK.—An offensive combat vehicle of the track-laying type, equipped with armor and armament, and capable of crossing the worst terrain expected on the battlefield.

C. TRACTOR CAISSON.—A vehicle of the track-laying type with self-contained power plant, having a body primarily intended for the transport of artillery ammunition, but useful for carrying other material when special circumstances require the use of such transport. Primarily suitable for transport attached to combat troops requiring the mobility of tanks and artillery tractors.

D. DRAW-BAR TRACTOR CAISSON.—A track-laying vehicle fulfilling the functions of both tractor caisson and artillery tractor, either separately or simultaneously.

E. RECONNAISSANCE TRACTOR.<sup>1</sup>—A small high-speed

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<sup>1</sup> The so-called "Iron Horse."—EDITOR.

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vehicle of the track-laying type with a pay load (useful load) capacity of approximately 600 pounds. The basic use of this vehicle is to replace the horse of the individually mounted man in Mobile Artillery organizations. It may also constitute the mechanical transport for the infantry howitzer, wire reels, machine guns, etc.

F. TRAILER CAISSON.—A trailer of the track-laying type, primarily intended for the transport of artillery ammunition. The vehicle has no power plant and is intended for towing behind artillery tractors.

G. The bodies with loads and equipment of the Artillery Repair Truck, Artillery Supply Truck, the 4-ton Shop Trailer, etc., when removed from the wheeled truck chassis and placed on the appropriate trailer caisson chassis, are termed respectively:

Artillery Repair Trailer Caisson.

Artillery Supply Trailer Caisson.

Four-ton Shop Trailer Caisson.

Three-ton Shop Trailer Caisson.

H. POWER TRAILER CAISSON.—A track-laying vehicle which is normally a trailer caisson but which has such a coupling that, if desired, power may be transmitted mechanically from the prime mover to the tracks of the trailer. This necessitates a power take-off attachment on the prime mover.

I. TRACTOR CART.—A small vehicle of the track-laying type whose control is such that the operator normally walks upon the ground. These are usually machine gun or ammunition carriers of small capacity.

K. TRACTOR HAND CART.—A tractor cart, without power plant, *i.e.*, one pulled or pushed by man power. There is usually an attachment for securing great mechanical advantage, such as ratchet action, etc., for negotiating difficult terrain.

L. TRACTOR POWER CART.—A tractor cart with power plant, *i.e.*, internal combustion engine, transmission, etc.

M. TRAILER GUN MOUNT, TRACK-LAYING.—A trailer of the track-laying type upon which a gun is mounted as a superimposed

load. The gun mount, etc., is an inherent part of the trailer.

N. S.P. CATERPILLAR GUN MOUNT.—A self-propelled (S.P.) vehicle of the track-laying type, upon which a gun is mounted as a super-imposed load for transport and firing. The gun mount, power plant, etc., are inherent parts of the construction of the vehicle. Travelling and firing position for the weapon are the same; *i.e.*, to fire no preparation other than bringing the vehicle to rest, placing outriggers (in some cases), and unlocking the traversing and elevating lock. The engine may run during firing of the weapon. This is the general case; in some instances (where the gasoline electric system is employed) the gun mount is supplied electric power from a separate prime mover.

O. CATERPILLAR ADAPTERS FOR GUNS AND HOWITZERS.<sup>2</sup>—Caterpillar tracks similar to those used on trailer caissons, replacing the road wheels on gun carriages. The adapters are attached to the carriage axle, the purpose being to greatly decrease unit ground pressure. The adapter should not be confused with bands consisting of wood, or metal shoes, which are sometimes placed over gun-carriage wheels to decrease unit ground pressure.

P. COMBINATION TRACTORS (TRACTOR CAISSON, TANK, ETC.) WITH SELF-CONTAINED POWER WHEELS.—An Artillery tractor, tractor caisson, or tank, which is normally of the track-laying type, for travelling over bad terrain, but is capable of being quickly converted into a power-driven wheeled vehicle for rapid movement over good roads. The same power plant drives both the tracks and wheels. The several members to afford such a combination are an inherent part of the vehicle. The necessary conversion either way usually requires 10 minutes by two men with such special tools as are readily carried on the vehicle.

Q. COMBINATION TRACTOR (TRACTOR, CAISSON, TANK, OR TRAILER CAISSON, ETC.) WITH SELF-CONTAINED TRAILER

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<sup>2</sup> See article on Notes on Report of Demonstration and Tests, etc., this number.—EDITOR.

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WHEELS.—An artillery tractor, tractor caisson, etc., which is normally of the track-laying type, for travelling over bad terrain, but which is capable of being quickly converted into a wheeled trailer to be towed rapidly on good roads. The remarks under "Self-Contained Power Wheels" regarding all the mechanism necessary for conversion apply also in this case.

### RATINGS OR CAPACITIES

5. The designation of several sizes of the different types is as follows:

I. ARTILLERY TRACTORS.—The gross weight in tons of the tractor indicates its size. This is also about the weight that it will pull over the worse terrain the tractor is expected to negotiate, *i.e.*, 5-ton Artillery Tractor.

II. TANKS.—The gross weight of the tank in tons; *i.e.*, 6-ton tank. Tanks of English or English-American design are known as Mark IV, Mark V, Mark VIII, etc.

III. TRACTOR CAISSON.—The weight of the pay load (useful load) carried; *i.e.*, 3½-ton Tractor Caisson.

IV. TRAILER CAISSON.—The weight of the pay load (useful load) carried; *i.e.*, 1½-ton Trailer Caisson.

IVa. Special applications should take the appropriate descriptive nomenclature as:

Trailer caisson, artillery repair.

Trailer caisson, artillery supply.

V. TRACTOR CARTS.—The weight of the pay load carried; *i.e.*,

Tractor hand cart, 200 pounds.

Tractor power cart, 300 pounds.

VI and VII. Trailer and self-propelled gun mounts are described by the calibre of gun carried; *i.e.*,

Self-propelled caterpillar mount, Mark II, for 155-mm. gun MI (Filloux).

VIII. Caterpillar adapters are known by suitable descriptive nomenclature; *i.e.*,

Caterpillar adapter for 155-mm. gun, G.P.F., Model 1918.

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6. The vehicles under discussion may be divided as follows:
- (a) *Standard Vehicles* or those which have been definitely adapted as articles of issue to the Army.
  - (b) *Experimental Vehicles* or those whose development is such that actual working models or samples are either produced or being produced.
  - (c) *Possible Studies* or vehicles which may be considered both from the technical and tactical viewpoint, the experimental design would be based upon the results of such consideration and study.
  - (d) *Miscellaneous Projects* or projects which do not contemplate the development or design of a whole vehicle but include only a portion of a whole vehicle, such as an engine of a particular type or the application of a new mechanism, the result of which may materially affect the vehicle as a whole; *i.e.*, projects whose successful result when applied to a vehicle will greatly increase its sphere of military usefulness.

### 7. Standard vehicles.

#### (a) The 5-ton Artillery Tractor.

Weight 10,500 lbs.	Road speed at 1280 R.P.M. of engine.
Length over-all armored, 133½".	Low 2.08 M.P.H.
Width over-all 63".	High 7.87 M.P.H.
Draw-bar pull 8100 lbs.	By over-speeding engine can attain 10 M.P.H.
B.H.P. of engine 57.	

This tractor replaces the eight-horse team and constitutes the transport of medium heavy field artillery; *e.g.*, the 155-mm. howitzer, 4.7" gun, etc. It is also used on very heavy weapons which break up into several transport loads. In general, for pulling draw-bar loads not exceeding 5 to 6 tons in weight over difficult terrain. It is armored to resist shrapnel.

Technical Advantages: Unlimited production; indefinite storage at very small cost; no fuel consumption when idle; less training required for personnel; increased mobility; more economical; presents no sanitation problem; can be greatly overloaded; few personnel necessary; less fatiguing to personnel;



PHOTOGRAPH NO. 1. ARTILLERY TRACTOR.  
(See paragraph 4-a.)



PHOTOGRAPH NO. 2. TANK.  
(See pfragraph 4-b.)





PHOTOGRAPH NO. 3. TRACTOR CAISSON.  
(See paragraph 4-c.)



PHOTOGRAPH NO. 4. RECONNAISSANCE TRACTOR.  
(See paragraph 4-e.)

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can be efficiently used in tandem; sustain speed for long periods; cannot be gassed; less vulnerable; presents simple transport problem; *e.g.*, requires no personnel, care, watering, feeding and occupies less space; not subject to disease or exhaustion; not affected by climatic conditions; fuels, oils, etc., require less transportation space than forage; can be salvaged; does not require exercise, watering and feeding when idle; can be used for convoy purposes on good roads; can cross railroad bridges without flooring.

Technical Disadvantages: Noise; cannot ford streams over two feet in depth; occasional visibility of exhaust; must have fuel to run; *i.e.*, cannot live on the country as grazing horses, etc.; poor operation on hard, slippery surfaces; *i.e.*, icy, slippery pavement, etc.; centre of gravity too high; subject to mechanical faults and derangement.

General Military Uses: In conjunction with the 3-ton trailer caisson for the transport of ammunition and other combat matériel; as a substitute for the 2½-ton Artillery Tractor in the motorization of the 75-mm. gun and light field howitzer; transported on a 5-ton truck in truck trains (one per train) for salvage purposes and aiding the train over difficult stretches of road; the motorization of Engineer Pontoon trains; in depots and docks for shifting large boxes, pulling cars, towing canal boats, for hoisting (when equipped with a capstan) and moving all classes of wheeled material; when equipped with belt pulley, to drive other machinery; when equipped with a capstan, one tractor greatly increases the mobility and scope of manœuvre of the organization to which attached.

### (b) The 10-ton Artillery Tractor.<sup>3</sup>

Weight 21,500 lbs.	Road speed at 600 R.P.M. of engine.
Length over-all, armored 162".	
Width over-all 76".	Low 1.47 M.P.H.
Draw-bar pull 13,650 lbs.	High 4.19 M.P.H.
B.H.P. of engine 67.	By over-speeding engine can attain 6.5 M.P.H.

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<sup>3</sup> See F. A. JOURNAL, July-August, 1919, for photograph of this type of tractor.—  
EDITOR.

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This tractor is the prime mover of the 155-mm. gun (G.P.F.), 8" howitzer and other heavy weapons. In general, it handles draw-bar loads not exceeding 10 to 12 tons in weight over difficult terrain. It is armored to resist shrapnel.

Technical Advantages: See Technical Advantages under 5-ton Artillery Tractor.

Technical Disadvantages: Noise, cannot ford streams over 2½ feet deep; occasional visibility of exhaust; cannot run with fuel; subject to mechanical faults and derangements.

General Military Uses: For convoy work over roads, one tractor can pull a long train of vehicles weighing 20 to 36 tons; for salvage purposes; at depots and docks as shown for the 5-ton artillery tractor; when equipped with special track shoe or grouser can operate on Standard gauge railroad for freight and yard work; logging operations; bridge building; road building; construction work; towing canal boats; when equipped with belt pulley, for driving machinery; when equipped with capstan for hoisting, salvage and increasing mobility of unit to which assigned.

### (c) Repair Facilities.

While Mobile Ordnance repair facilities do not properly come under the head of "Track-Laying Vehicles," their importance with relation to combat mechanical transport and other combat matériel is such that it is thought pertinent to give a brief description of such repair vehicles and their general function. It will be noted that all the repair vehicles excepting the Light Repair Truck may be mounted on trailer caisson (track-laying) chassis, which, when pulled by artillery tractors will possess the same mobility as the motorized units to which assigned.

#### (c-1) The Light Repair Truck.

One to each motorized battery and each ammunition truck company. The function of the Light Repair Truck is that of a trouble wagon, the tool equipment being such as to facilitate hasty roadside and light emergency repairs. Owing to its speed, mobility and large radius of operation, it is the connecting link between the battery and the Artillery Repair Truck in

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the Battalion or Regimental Supply Company. Examples of repairs by this vehicle are:

Replace damaged machine gun in organization.

Repair water pump, repack.

Adjust clutches.

Replace breaker points and adjust magneto.

Make temporary repairs to radiator.

Replace or repair ignition wiring.

Carry repair parts and personnel to isolated or abandoned vehicles from the Battalion Repair Unit.

Carry inspector from shop to damaged cannon.

(c-2) Artillery Repair Truck.

One assigned to each motorized Battalion of Artillery. This vehicle is a complete self-contained machine shop, whose scope of work is limited by the sizes of its lathe (13") and the element of time. The body is of steel with drop sides, extension roof, with a top capable of raising or lowering. The machine tools are driven by a gasoline electric set. A very complete set of gauges, micrometers, hand tools, etc., is carried.

Examples of usual repairs by this vehicle are:

Adjust gun sights.

Remove carbon and grind valves.

Adjust recuperators.

Take up main and connecting-rod bearings.

Star gauge guns.

Replace piston rings.

Welding work.

Repair or replace fan bracket and belt.

Repair and overhaul steering clutch.

Riveting work.

Replace disc or discs of steering clutch.

Apply all spare parts.

Replace shifter fork.

Replace radiator tube or section.

Adjust elevating and traversing mechanisms.

(c-3) Artillery Supply Truck.

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In each motorized Battery, Battalion and Regiment. While this vehicle with its several different loads cannot be termed an active repair facility, it is used only for carrying spare parts and other matériel to be used in repair and maintenance. In general, the Supply Truck has various uses depending upon the load carried. "A" Load is for use in motorized batteries where it replaces the vehicle known in horse batteries as the Battery and Store Wagon. "B" Load consists of spare parts for the gasoline engine propelled vehicles in the organizations together with lubricating oils, greases, etc., and is usually attached at the rate of one per battalion. "C" Load consists in spare parts for optical instruments, telephone and fire control equipment and camouflage paint, etc. "D" Load consists of the forge and raw matériel such as bar stock, etc., for use by the Artillery Repair Truck. The Artillery Repair Truck is always accompanied by a Supply Truck with "D" Load. Load "E" is practically an empty Supply Truck issued to certain heavy batteries for the purpose of carrying special tools, pertaining to the gun matériel. It will be noted that the old Supply Truck body has been replaced by the Repair body with suitable racks and chests for carrying various loads. It will further be noted that whenever an Artillery Repair Truck is assigned to a motorized organization it is accompanied by a Supply Truck Load "B" and a Supply Truck Load "D."

### (c-4) Heavy Mobile Ordnance Repair Shop (H.M.O.R.S.)

This unit is a group of trucks and trailers so arranged and carrying such loads as to form a complete machine shop of high mobility with a very complete tool and machine-tool equipment for the repair of gun matériel, tank matériel, and mechanical transport equipment in heavy mobile gun organizations. One shop is composed of two identical sections which are intended to operate independently of each other as complete repair units. One section contains approximately 15 shop trucks, mounted on F.W.D. chassis and 13 shop trailers in addition to the incidental light vehicles for passenger transport, motorcycles for messenger service, etc. It will be noted that it is possible to mount the bodies with their loads on trailer caisson chassis and



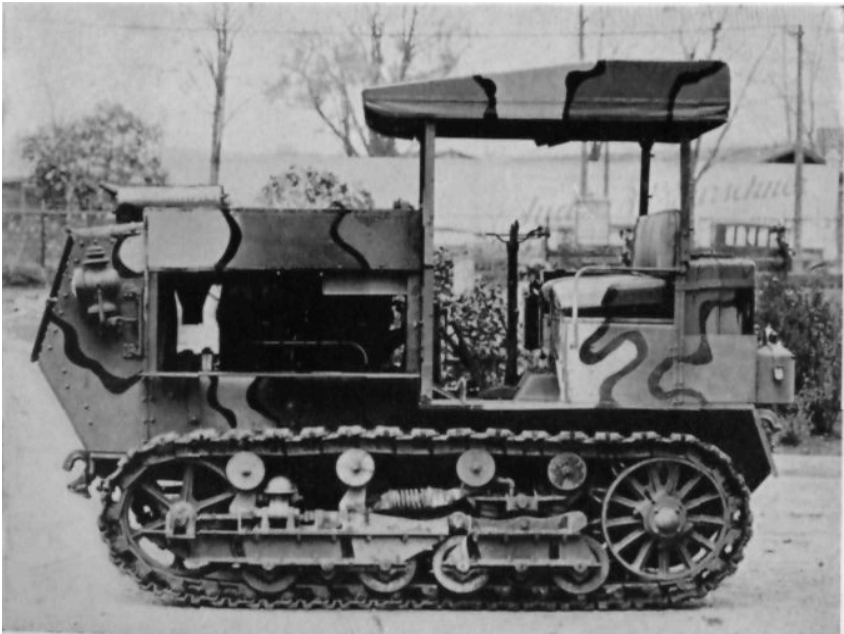
PHOTOGRAPH NO. 5. ARTILLERY REPAIR TRAILER CAISSON.  
(See paragraph 4-g.)



PHOTOGRAPH NO. 6. TRACTOR POWER CART.  
(See paragraph 4-l.)



PHOTOGRAPH NO. 7. SELF-PROPELLED (S.P.) CATERPILLAR GUN MOUNT.  
(See paragraph 4-n)



PHOTOGRAPH NO. 8. 5-TON ARTILLERY TRACTOR.  
(See paragraph 7 Standard Vehicles.)

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the whole pulled by artillery tractors. The extent of repair handled by this shop will generally be governed by the time available. Examples of repair in active service are:

- Replace engines.
- Repair or replace cracked crank case.
- Replace gun tubes.
- Replace wrist pin and bushing.
- Make special tools required for emergency use.
- Repair, weld or replace cracked cylinders.
- Salvage abandoned guns and motor vehicles.
- Overhaul tanks after action.

### (c-5) Divisional Artillery Repair Shop.

No such unit actually exists, but the Artillery Equipment Board (paragraph 142, S.O., W.D., 289-290, 1918) contemplated the assignment of a separate Mobile Shop to the Divisional Artillery Brigade (paragraph 114-E of this Board's report) as distinct from the so-called Divisional Mobile Ordnance Repair Shop (M.O.R.S.), which is a duplicate of the repair facilities already assigned to each Motorized Regiment. It is suggested that the most appropriate vehicles be selected from the Heavy Mobile Ordnance Repair Shop to form a repair unit for the Divisional Artillery under the command of the Artillery Brigade Commander. Such a shop composed of the tool-room truck, air-compressor truck, saw-mill truck, lathe trailer, generator trailer, drill-press trailer, welding trailer, when mounted on trailer-caisson chassis, would have the mobility of the divisional weapons, and could readily handle repair work far beyond the scope of the Artillery Repair trucks already assigned to the regiments. Several 2½-, 5- and 10-ton Artillery tractors for salvage and replacement purposes would also be of value. The repairs handled might be:

- Repair, replace or weld transmission case.
- Overhaul or repair differential.
- Replace armor.
- Replace or repair track rollers, idlers and sprockets.

Generally speaking, whole units, such as engines, transmissions, etc., will be carried in this shop for replacement purposes,



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as time will not always be available to immediately do the repair work, whereas a whole unit may be changed and the broken one retained to be repaired when possible.

### 8. Experimental Vehicles.

#### I. Artillery Tractors.

##### (a) 2½-ton Artillery Tractor, Model 1918.

Weight 7700 lbs.	Road speed at 1500 R.P.M. of engine.
Length over-all 120".	
Width over-all 58".	Low 3 M.P.H.
Draw-bar pull 4000 lbs.	Intermediate 7 M.P.H.
Brake H.P. of engine at 2600 R.P.M. 70.	High 9 M.P.H.

12 miles per hour obtainable for reasonable distances at 2000 R.P.M.

This tractor was designed late in the war with a view of motorizing.

75-mm. Artillery organizations, reel carts and the caisson companies of the Divisional Ammunition Train.

While this vehicle is in the experimental class, it has been considered sufficiently satisfactory to equip organizations with a view of obtaining more definite information on the tactical requirements of a high-speed tractor for 75-mm. gun matériel.

Technical Disadvantages: This tractor being the first model produced is not considered of sufficient merit to warrant adoption as a standard vehicle principally for the reason that it is too heavy for the work it does; is rather delicate mechanically; cannot cross water of a depth that can be easily forded by a horse and the gear reduction on low is not as great as desirable.

##### (b) 2½-ton Artillery Tractor, Model 1920.

Weight 6000 lbs.	B.H.P. of engine 50.
Length over-all, armored, 142.5".	Road speed at 1600 R.P.M. of engine.
Width over-all 58".	Low 1 M.P.H.
Draw-bar pull 5500 lbs.	High 12 M.P.H.
	By over-speeding engine can attain 15 M.P.H.

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This is a much improved tractor as compared with the model of 1918, the principal improvements over the latter being: Better design, lighter weight, better location of centre of gravity, lower unit ground pressure, less noisy, more rugged engine, four speeds, ability to cross water at least four feet deep, more resilient construction and a type of track requiring but few grousers. Two experimental models are now under preliminary test.

### (b-2) Modified Commercial Model.

A commercial tractor is also being modified to comply with the requirements for a divisional tractor. The design appears reasonably promising and will probably be ready for test some time during this year.

This type of tractor replaces the six-horse team in the motorization of the 75-mm. gun and light field howitzer, pulls the battery, battalion and regimental reel cart in all motorized organizations and, in conjunction with the 1½-ton trailer caisson, replaces wheeled caissons of the divisional Artillery, in the battery, and in the caisson companies of the ammunition train. In general, pulling draw-bar loads not exceeding two and one-half to three and one-half tons in weight over the most difficult terrain. It is armored to resist shrapnel.

Technical Advantages: Unlimited production; indefinite storage at very small cost; no fuel consumption when idle; less training required for personnel; increased mobility; more economical; presents no sanitation problem; can be greatly overloaded; fewer personnel necessary; less fatiguing to personnel; can be efficiently used in tandem; sustain speed for long periods; cannot be gassed; less vulnerable; presents simple transport problem; *e.g.*, requires no personnel, care, watering, feeding and occupies less space; not subject to disease or exhaustion; not affected by climatic conditions; fuels; oils, etc., require less transportation space than forage; can be salvaged; does not require exercise, watering and feeding when idle; can be used for convoy purposes on good roads; can cross railroad bridges without flooring.

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Technical Disadvantages: Cannot run without fuel; cannot ford streams over four feet in depth; subject to mechanical derangements. (These have been reduced to a minimum.)

General Military Uses: Use on aviation fields for towing purposes; in conjunction with the 1½-ton or ¾-ton trailer caisson can replace limbered combat wagon of the Infantry; carried on a 3-ton truck (one per truck company) to aid stalled wheeled vehicles and pull trucks over bad stretches of road.

### (c) The 7-ton Artillery Tractor.

Weight 14,000 lbs.	Road speed.
Draw-bar pull 10,000 lbs.	Low 1 M.P.H.
B.H.P. of engine 85 to 95.	High 15-18 M.P.H.

Gun and howitzer development has been such that it has become more practical to have three sizes of draw-bar prime movers instead of four sizes. The weapons on hand in quantity today demand a series of tractor weights as follows 2½, 5, 10 and 15 tons, while the gun and howitzer program as indicated by the Westervelt board report can be fully covered as follows:

2½ (3) tons for the Division.	15 tons for the Army.
7 tons for the Corps, and	

In carrying out this new program the present 5- and 10-ton tractors on hand will be fully maintained and such alterations as are deemed necessary for their successful operation in the field will be made, but no attempt at complete redesign as formally contemplated will be made.

### (d) The 15-ton Artillery Tractor.

Weight 30,000 lbs.	Road speed at 1000 R.P.M. of engine.
Length over-all 193.5".	Low 1 M.P.H.
Width over-all 102".	High 8 M.P.H.
Draw-bar pull 25,000 lbs.	Studies being made to increase speed to 12 M.P.H.
B.H.P. of engine 150.	

This tractor is for the transport of very heavy weapons of the Army Artillery, such as the 194-mm. gun and in general for pulling loads not exceeding 18 tons.

Two sizes of heavy tractors, 15- and 20-ton weight, were

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used during the World War for pulling heavy gun matériel. These were commercial farm tractors, which, though having slow speed, short tracks and greatly hampered by a steering wheel at the front, did effective work. There are uses, therefore, for a properly designed heavy tractor which for the most part are confined to salvaging operations or to operations well to the rear of the front line; *i.e.*, pulling heavy weapons which do not break up into several transport loads, general work at bases and depots, forestry operations, construction, etc.

A satisfactory design has been completed and construction of experimental vehicles will be undertaken in the near future. The photograph shows a modified commercial tractor, the appearance of which is not far different from that of the new 15-ton tractor.

### II. Tractor Caissons.

#### (a) 1½-ton Tractor Caissons.

Weight 4000 lbs.	Road speed at 1000 R.P.M. of engine.
Length over-all 136".	Low 1 M.P.H.
Width over-all 74".	High 12 M.P.H.
Pay (useful) load capacity 3000 lbs.	By over-speeding engine can attain 15 M.P.H.
B.H.P. of engine 32.	

This vehicle is an ammunition carrier or caisson for use with the 75-mm. gun and the light field howitzer (105-mm.) on self-propelled (S.P.) mounts; it has "Self-Contained Power Wheels" for use on good roads where its maximum speed is 18 miles an hour.

The use of rubber-tired wheels for high-speed operation on good roads eliminates shock and vibration to which the track-laying vehicle is subject when running on hard surfaces.

#### (b) 3½-ton Tractor Caisson.

Weight 9000 lbs.	Road speed at 1000 R.P.H. of engine.
Length over-all 184".	Low 1 M.P.H.
Width over-all 76".	High 6 M.P.H.
Pay (useful) load 7000 lbs.	By over-speeding engine can attain 8 M.P.H.
B.H.P. of engine 50.	

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This vehicle is an ammunition carrier for the 4.7" gun, 155-mm. howitzer, 155-mm. gun and 8" howitzer, all on self-propelled gun mounts. It has "Self-Contained Power Wheels," whose use on good roads make possible a speed of 12 to 15 miles per hour.

### (c) The Mark VII Tractor Caisson.

Weight 19,460 lbs.	Road speed at 1280 R.P.M. of engine.
Length over-all 180.75".	Low 1.04 M.P.H.
Width over-all 85".	High 7.87 M.P.H.
Pay (useful) load capacity 6000 lbs.	By over-speeding engine can attain 9 M.P.H.
B.H.P. of engine 56.	

This tractor caisson was designed during June, 1918, and is based on the Standard 5-ton Artillery tractor, using the same engine, transmission, track and track mechanism, etc., as the latter vehicle. While the normal cargo capacity is 3 tons, it can transport 5 tons over favorable terrain. It was originally intended as an ammunition carrier for the first models of 8" howitzer and 240-mm. howitzer on self-propelled mounts.

This vehicle is equipped with a capstan to assist in manœuvre of itself and the weapons it serves. This tractor caisson has proven very rugged and stable in negotiating difficult terrain and in general has given excellent service, but due to excessive weight has not the extensive application of the lighter vehicles of this class; *i.e.*, it could not cross the average country road bridge, a requirement very necessary for combat matériel in the United States. However, it is more mobile than the heavy army artillery which it normally accompanies.

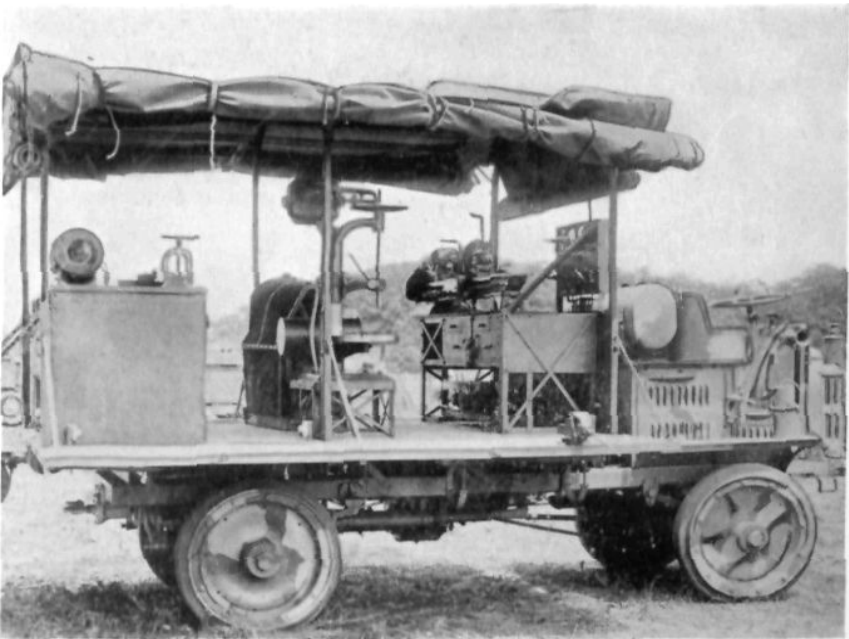
### (d) The Reconnaissance Tractor.

Weight 1000 lbs.	Road speed at 1600 R.P.M.
Length over-all 104".	Low 1.5 M.P.H.
Width over-all 44".	High 20 M.P.H.
Cargo capacity 500 lbs.	By over-speeding engine can attain 30 M.P.H.
B.H.P. of engine 15.	

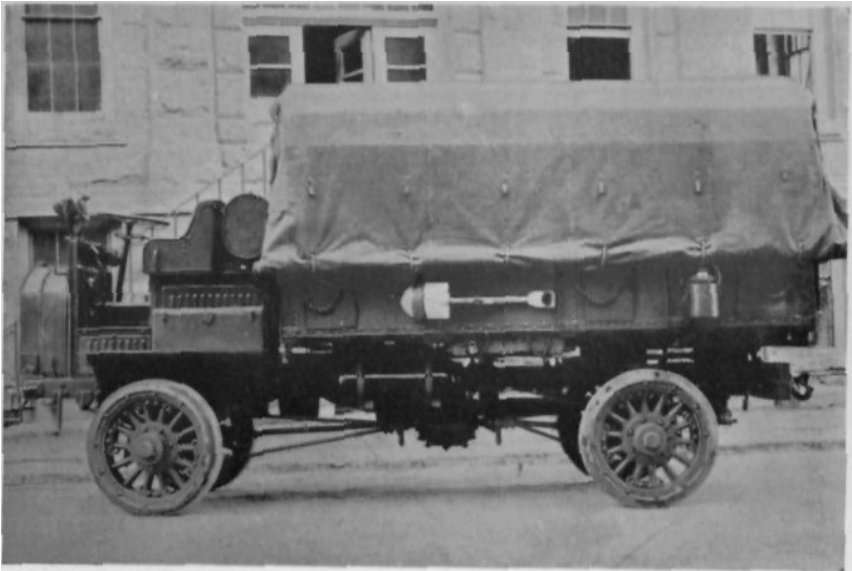
This vehicle replaces the horse of the individual mounted man in motorized artillery. It is well known that the transport



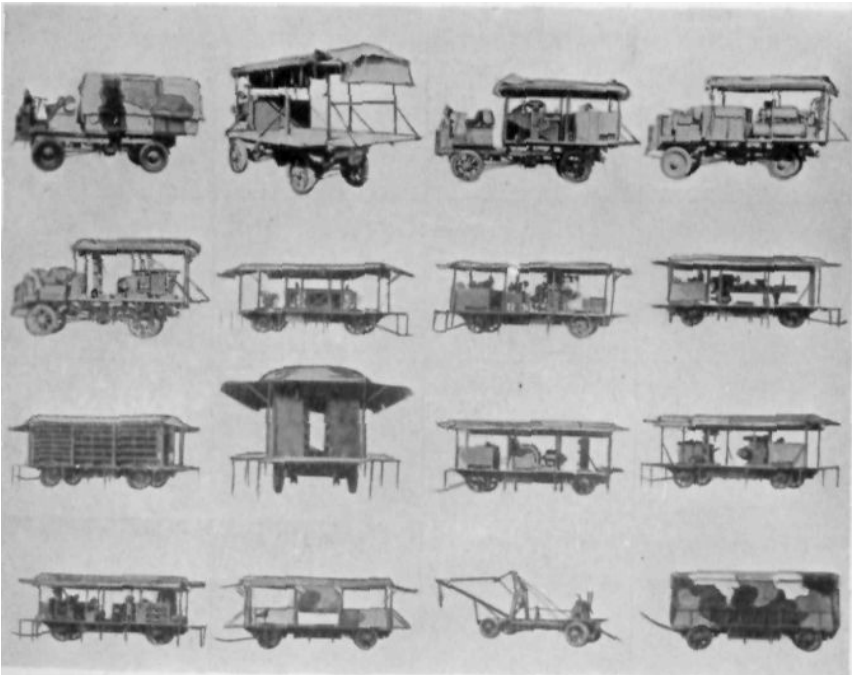
PHOTOGRAPH NO. 9. LIGHT REPAIR TRUCK.  
(See paragraph 7 (c-1))



PHOTOGRAPH NO. 10. ARTILLERY REPAIR TRUCK.  
(See paragraph 7 (c-2).)



PHOTOGRAPH NO. 11. ARTILLERY SUPPLY TRUCK.  
(See paragraph 7 (c-3).)



PHOTOGRAPH NO. 12. HEAVY MOBILE ORDNANCE REPAIR SHOP.  
(See paragraph 7 (c-4).)

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for the B.C. detail, officers, scouts, signal men, agents, etc., has been one of the most difficult problems since the advent of mechanical transport for artillery. The first method employed was the use of motorcycles, which, however, failed due to the inability of such vehicles to negotiate cross-country terrain. It was then decided to retain the horse, but combined motor and animal transport was highly unsatisfactory. The next step was employing specially constructed high-speed wheeled motor cars, which, while efficient where fair roads existed, were therefore suitable for army and possibly corps weapons, but required reconnaissance on foot for the mobile artillery man; it remained to develop a mechanically operated structure which approximated the capabilities of the saddle horse. While the first experimental model may not equal the performance of the horse, it will be the forerunner of a motor-propelled vehicle which will far surpass the horse in artillery reconnaissance. With the use of a capstan this vehicle is expected to negotiate the most difficult terrain.

The particular experimental model shown herein while not fully conforming to specifications of the ideal vehicle of this type has shown a truly remarkable performance, the unit ground pressure is so small as to admit of crossing marshes where a man on foot cannot walk—the vehicle runs directly off of land into water, where, by the addition of a small propeller operated by a power take-off from the transmission, and properly housed to prevent damage during land operation it can navigate as a small powerboat. The track mechanism represents what is thought to be the greatest development in track construction ever attained, and may revolutionize high-speed track design particularly for lighter vehicles. The track weighs approximately only 38 pounds to a side and is of such flexibility as to allow of sustained speeds up to 30 miles per hour on hard roads. The track is essentially two special endless belts tied together by metal cross pieces which not only afford a channel for the driving wheel, idler and idler wheels but constitute



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the lines of ground contact on hard road surfaces, relieving any wear on the belts; at about one-fourth to one-half inch penetration on soft ground the belts offer a large area of contact. The first experimental model carries four to five men both on land and water and weighs 1600 pounds; with the proper body modifications in shape, size and decking toward the bow, together with the addition of a capstan either hand or power driven, and a propeller with a view to transporting 500 pounds (two men and instruments) it is believed that the mechanical approximation of the capabilities of a single horse will be more than realized.

Technical Advantages: Capability of floating and manœuvring on reasonably smooth water; not injured by wire fences; unlimited production; indefinite storage at very small cost; no fuel consumption when idle; less training required for personnel; increased mobility; more economical; presents no sanitation problem; can be greatly overloaded; less fatiguing to personnel; sustain speed for long periods; cannot be gassed; less vulnerable; presents simple transport problem; *e.g.*, requires no personnel, care, watering, feeding and occupies less space; not subject to disease or exhaustion; not affected by climatic conditions; fuels, oils, etc., requires less transportation space than forage; can be salvaged; does not require exercise, watering and feeding when idle; can cross railroad bridges without flooring.

Technical Disadvantages: Cannot operate without fuel; cannot pick its own way along trails; cannot jump high walls; cannot pass through spaces less than 41 inches wide.

General Military Uses: Miscellaneous pack transportation; carrying wounded; the infantry howitzer; wire reels; heavy machine guns; mounted infantry and cavalry (in certain cases); mountain guns; Engineer pontoon bridge building; equipped with special shoe or grouser for use on Standard narrow gauge railroad.

### III. Trailer Caisson.

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### (a) $\frac{3}{4}$ -ton Trailer Caisson.

Weight 1500 lbs.	Body dimensions.
Length over-all 96".	Length 96".
Width over-all 72".	Width 47".
Load capacity 1500 lbs.	Height 16".

This trailer represents the application of the principle of multiple loads to increase mobility; *i.e.*, two such units have the same cargo capacity on the  $1\frac{1}{2}$ -ton trailer caisson and constitute the normal load of a  $2\frac{1}{2}$ -ton tractor for operation over fairly difficult terrain. When, however, extremely difficult terrain is encountered, one trailer may be pulled forward at a time. This method approximates using two tractors in tandem but is not so efficient. The limit of load division of trailed loads is that condition where the useful cargo capacity is so small that the cargo can be more efficiently transported on the prime mover. This limit has, as yet, not been established. The  $\frac{3}{4}$ -ton trailer would be used in conjunction with the  $2\frac{1}{2}$ -ton Artillery tractor as the Battery Ammunition transport of the Divisional Artillery.

This vehicle will possibly incorporate the fabric track as described under the Reconnaissance Tractor. Such an application of this type of track to a vehicle of this size is considered the second great step toward the solution of the problem presented by the heavy high-speed track layers.

### (b) $1\frac{1}{2}$ -ton Trailer Caisson.

Weight 3000 lbs.	Body dimensions.
Length over-all 110".	Length 110".
Width over-all 79".	Width: 48" bottom, 59" top.
Useful load capacity 3000 lbs.	Height 24".

This trailer replaces wheeled caissons in 75-mm. gun and 105-mm. howitzer batteries and also in what was the horsed section of the ammunition train. Its normal prime mover is the  $2\frac{1}{2}$ -ton Artillery tractor.

There are two types of body suspension, the two point or cart type, and the four point or wagon type. The essential

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difference is that the cart type must be supported upon a jack or prop when unlimbered but is more adapted to crossing difficult terrain than the wagon type. It is believed that the cart principle lending increased mobility should apply to the 1½-ton and smaller trailer caisson and the wagon type, whose body is supported horizontally on the chassis should be used for large capacity trailers.

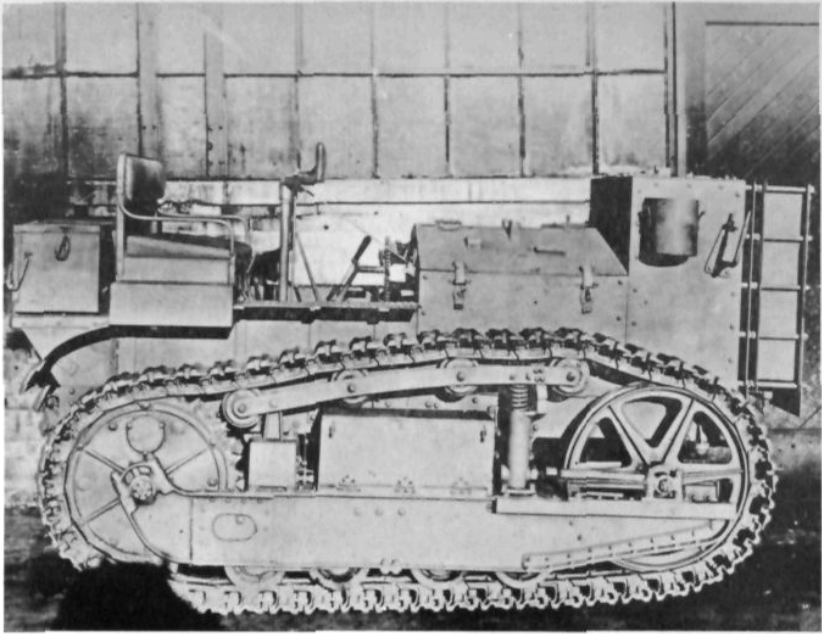
Trailer caisson pulled by tractors have far greater mobility than wheeled caissons pulled by the same agency due to capability of the long track to negotiate obstacles and the low unit ground pressure in crossing soft terrain. Also a power vehicle can handle a greater draw-bar load than one carried on its back; when very bad terrain is encountered, trailers may be dropped off, but the tractor caisson has practically the same load under all conditions. When the trailer is idle, the power unit may be employed for other useful work, such as towing guns, etc., but with the tractor caisson, if the nature of its cargo enforces idleness, the use of an effective power plant is totally lost. The trailer caisson, while primarily intended for ammunition transport, has such a body that cargo of any nature may be carried.

### (c) 3-ton Trailer Caisson.

Weight 6000 lbs.	Body dimensions.
Length over-all 124".	Length 124".
Width over-all 85".	Width 48" bottom, top 58.5".
Useful load capacity 6000 lbs.	Height 36".

This trailer caisson replaces wheeled caissons in 4.7" gun, and 155-mm. howitzer batteries. Its normal prime mover is the 5-ton artillery tractor. This vehicle is being developed in both the cart and wagon types. The wagon type is to have "combination trailer wheels," forming the vehicle into a cart-type wheeled trailer, in order to adapt it to rapid towing over good roads. The mobility and flexibility of this caisson with its prime mover is much greater than the tractor caisson of the same capacity. The general remarks under the 1½-ton vehicle are also applicable in this case.

A particular trailer now under construction, is of the Christie



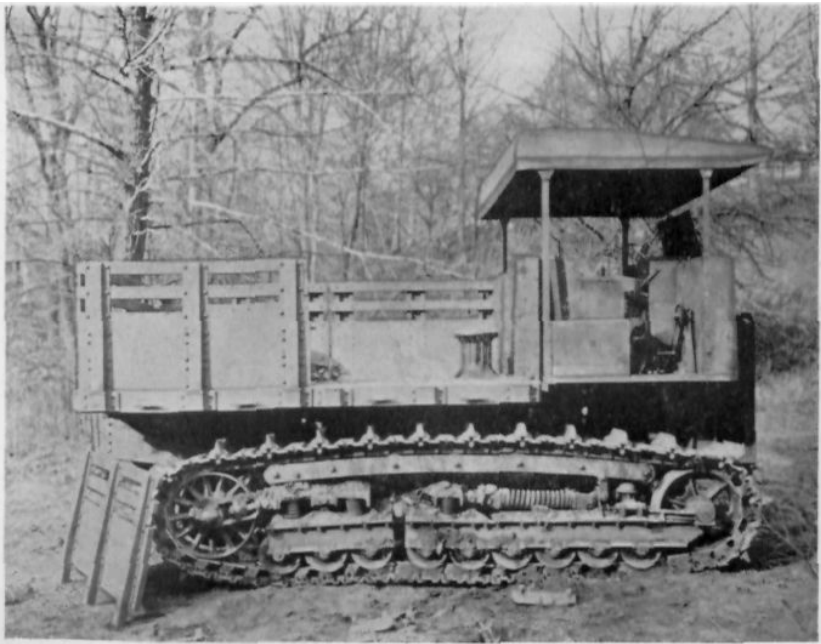
PHOTOGRAPH NO. 13. 2½-TON ARTILLERY TRACTOR MODEL 1918.  
(See paragraph 8-a Experimental Vehicles.)



PHOTOGRAPH NO. 14. 2½-TON ARTILLERY TRACTOR MODEL 1920.  
(See paragraph 8-b.)



PHOTOGRAPH NO. 15. THE 15-TON ARTILLERY TRACTOR.  
(See paragraph 8-d.)



PHOTOGRAPH NO. 16. THE MARK VII TRACTOR CAISSON.  
(See paragraph II Tractor Caissons (c).)

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type, of 6000 pounds pay-load capacity for use with the latest experimental model of the S.P. (self-propelled) mount for the 75-mm. gun. "Christie" is the name of the designer and builder of a special type of track-laying vehicles, including tanks, S.P. gun mounts, and in this case trailers—all the vehicles of Mr. Christie's design have either "self-contained power wheels" on the prime mover or "self-contained trailer wheels" on the trailer, and represent one particular type of design. It may be said that Mr. Christie brought out the first self-propelled track-laying gun mount, which, with the tracks removed could travel at comparative high speeds on rubber-tired wheels on good roads.

### (d) The Artillery Repair Trailer Caisson.

Weight 11,900 lbs.

Width over-all 85".

Length over-all 136".

This vehicle is composed of the 3-ton wagon type trailer caisson chassis and the Artillery Repair truck body with load and equipment. The normal prime mover is the 5-ton Artillery tractor. The Mobile Ordnance Repair facilities, being mounted on wheeled trucks, do not possess the mobility of the tractor drawn weapons to which assigned. It is, therefore, intended to replace the wheeled chassis by track-laying chassis in all cases, using the appropriate artillery tractor as a prime mover. Other bodies to be mounted as above will be those of the Artillery Supply truck, 3-ton Shop truck, and the 4-ton Shop trailer.

### IV. Tractor Carts.

#### (a) Tractor Hand Cart.

Weight 125 lbs.

Body dimensions.

Length over-all 36".

Length 36".

Width over-all 24".

Width 24".

Useful load capacity 300 lbs.

Height 15".

This vehicle is intended as an ammunition carrier for use in stabilized warfare or for carrying other miscellaneous stores which would, due to local conditions, have to be transported by men on foot. The old two-wheeled hand pushcart of the Quartermaster

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Corps is to good flat terrain what the tractor hand cart is to difficult terrain. The width and length of track producing very low unit ground pressure permits operation over very soft ground, while the great mechanical advantage afforded the operating handle by ratchet or similar action in driving the tracks makes it possible for one man to work the vehicle over steep slopes and in and out of shell holes; on good going the cart is drawn by the operating handle or tongue. The gross weight is such that it is possible to manhandle the cart over obstacles. It is so constructed as to float, thereby lending itself to operations which necessitate fording streams, keeping the cargo dry, and protecting the operators. This cart has great possibilities as a trailer for use with the reconnaissance tractor for Infantry purposes.

The photograph shows the best preliminary experimental model thus far produced.\* It incorporates a track construction similar to that of the reconnaissance tractor described on page 32. The performance has been excellent, but the vehicle has been designed for too great an overload and is consequently slightly heavy. In principle, however, it has more than fulfilled expectations and the slight excess of weight can be readily eliminated.

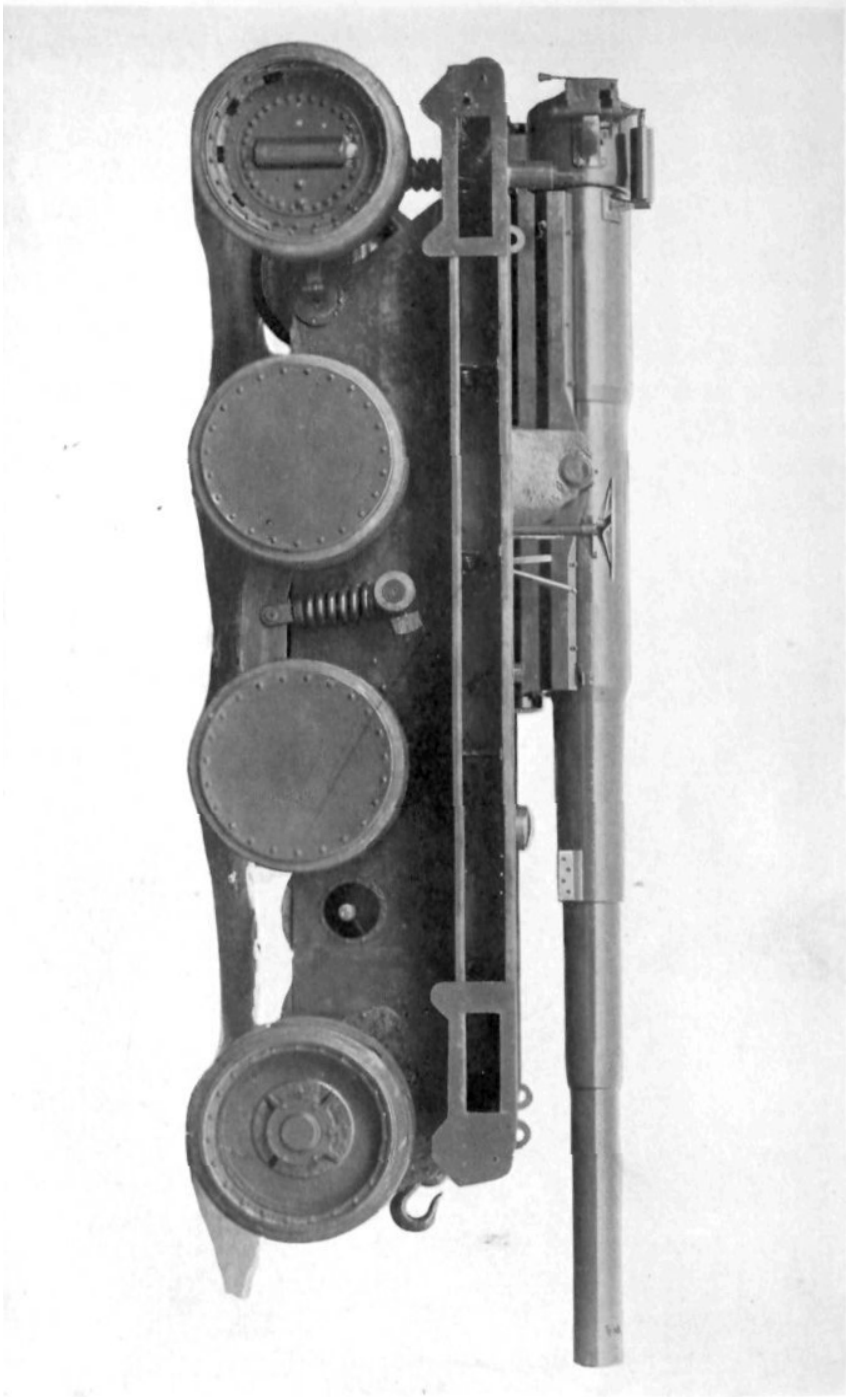
### (b) Tractor Power Cart.

Weight 600 lbs.	Low 1½ M.P.H.
Length over-all 83.5".	High 6 M.P.H.
Width over-all 46".	By over-speeding engine can attain 7.9
Useful load capacity 300 lbs.	M.P.H.
B.H.P. of engine 5.	Body dimensions.
Length 48".	Width.
Height 19".	Top 34".
Road speed at 2500 R.P.M. of engine.	Bottom 28".

The tractor power cart is intended to transport wire reels (laying wire), divisional Artillery ammunition, small arms ammunition, machine guns, the infantry howitzer, wounded,

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\* Photograph not shown in this article, but will be shown in a subsequent issue of the JOURNAL.—EDITOR.



PHOTOGRAPH NO. 17. LATEST MODEL OF SELF-PROPELLED WHEELED CATERPILLAR (CHRISTIE) FOR 155MM. GUN, MODEL 1918 MI (FILLoux).



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food, water and other miscellaneous matériel under conditions which normally require transportation by men on foot. This vehicle can operate over the most difficult terrain, causing no fatigue to the operator other than that incidental to walking. The low unit ground pressure allows operation over marshy surfaces which will scarcely support a man on foot. It is of such weight as to be readily manhandled over ditches and other obstacles. This cart will float in water, a capability which greatly increases its mobility and usefulness.

The model shown above is equipped with a track mechanism similar to that of the reconnaissance tractor and is considered to be highly successful.\* The addition of a step or foot board for the operator to ride upon when conditions permit will greatly add to the ease of operation. This preliminary model handles a large overload on land and water and is therefore slightly overweight. The excess weight can easily be removed.

### V. Self-Propelled Caterpillar Mounts.

Great progress has been made in the development of self-propelled gun mounts as indicated by the difference between the Mark I for 8" howitzer Mark VIII½ British finished during August or September, 1918, and the latest type of Christie gun mount to be completed during November, 1920.

The Mark I weighs 58,000 pounds with speed ranges between .93 M.P.H. and 4.05 M.P.H., while the weight of the latest mount is 35,000 with speed ranges between 2 M.P.H. and 18 M.P.H.

Regarding the ultimate possibilities of the self-propelled gun mount, the following is quoted from the Report of the Westervelt Board:

"While improving the caterpillar truck tractor, gun design will also progress; but with the weapon upon its wheeled carriage, a point will soon be reached where no improvement is possible. In all probability such a weapon and carriage will embody the split-trail feature, large angles of elevation and

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\* Photograph not shown, but will be in a subsequent issue of the JOURNAL.—  
EDITOR.

traverse, lightness coupled with stability and high power, but such a unit is not the limit of progress, for we have the broad field presented by the possibilities of the gun mounted directly upon a self-propelled vehicle. Already, the self-propelled caterpillar gun mount is well along in the experimental stage and has passed to fact from fancy, and while the weights are excessive, the gun traverse limited, and slight relaying necessary, the results arrived at indicate final success in the near future. This success will be realized in a gun using, possibly, a pedestal mount, possessing perfect stability, all round fire, 90 degrees elevation, mounted upon a caterpillar truck tractor." (Self-propelled gun mount with self-contained power wheels, the Christie design is of this type.)<sup>4</sup>

VI. The S.P. (Self-Propelled) System versus the D.B. (Draw-Bar System).

(a) Light Weapons.

Advantages of the S.P. system:

Less cargo space in rail and sea shipment.

Less road space.

Rapidity of going into position.

Rapidity of withdrawing from position.

No digging necessary for trail spade.

Ability to obtain quickly all-around fire by moving whole mount.

Disadvantages of the S.P. System.

More difficult to camouflage or conceal.

One direct hit disables both gun and its transport.

Mechanical faults or derangements on either gun or mount destroys the usefulness of the whole unit.

When in firing position the mount with its power plant cannot be employed for other useful purposes; the seriousness of this condition is more apparent when considering the extensive use of the S.P. system in persistent stabilized warfare.

Less mobile on difficult terrain, due to concentration of

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<sup>4</sup> See November-December, 1919, F. A. JOURNAL, for photograph of this type.—  
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weight, the S.P. mount is inherently encumbered with its gun load, whereas the D.B. tractor does not carry or lift the total weight of its trailed load, which may be dropped or split in emergency, the tractor proceed over a difficult stretch, pass a cable to the load and continue the march.

Weight concentration prevents the S.P. mount from crossing country road bridges, and hastily constructed engineer bridges.

Cannot be used in tandem with that efficiency possible with the D.B. tractor.

It is believed that in the general case light weapons on self-propelled mounts will never replace those on wheeled or other carriages pulled by the draw-bar tractor. The lighter weapons, however, especially the 75-mm. gun and 105 howitzer on S.P. mounts lend themselves ideally to reinforcement purposes; by being grouped in rear, they can be rushed forward on their wheels at high speed and upon leaving the good roads proceed as track layers to the firing point.

A limited number of these weapons may also prove highly effective for use with the infantry as accompanying guns.

### (b) Heavy Weapons.

Weapons of great weight must possess a certain degree of mobility when transported as concentrated loads, in order to go around culverts and small bridges which their weight would destroy.

The same weapon using the D.B. System usually comprises several transport loads. These when pulled by draw-bar tractors of about the same weight possess good mobility but require a comparatively long time to go in and out of position. With the heavy weapon using the S.P. System, the principal feature is the facility of going into action, opening fire, and moving to another position.

General Remarks: With respect to mobility and flexibility of manœuvre, experience indicates the principle of employing multiple loads with a corresponding number of light prime movers, rather than a few concentrated loads pulled by heavy

prime movers; certainly this principle is violated in the use of the tractor caisson and the S.P. Mount.

Tractor-drawn artillery organizations may use tandem operation in negotiating difficult terrain, but, while the D.B. tractor can greatly assist the S.P. Mount, it is seldom present with such organizations, being replaced for ammunition purposes by the tractor caisson. It would seem better practice to replace the tractor caisson by the D.B. tractor, especially those with capstans, for ammunition transport in S.P. Mount organizations, if high mobility is desired, because the tractor caisson with its cargo presents the one great fault of the S.P. Mount; *viz.*, excessive concentration of weight.

#### VII. Caterpillar Adapters.

(a) Caterpillar Adapters for 8" howitzer carriage, Mark VI and VII.

The application of the adapter to this weapon requires a slight alteration in the wheeled carriage; *i.e.*, wheels and adapters are not entirely interchangeable. The unit ground pressure of this weapon on the wheeled carriage is 321 pounds per square inch. By using the adapter this is reduced to 12 pounds with the corresponding increase in mobility.

(b) Caterpillar Adapter for 155-mm. gun G.P.F. Model 1918.<sup>5</sup>

The adapters and wheels of this gun carriage are interchangeable. The unit ground pressure using wheels is 41 pounds per square inch; that with the adapters—10 pounds.

The principal difficulty in manhandling the Infantry howitzer over soft and rugged terrain would appear to be due to the high unit ground pressure offered by the carriage wheels.

It would seem perfectly possible and practicable to eliminate this impediment to mobility of manœuvre by replacing the wheels with caterpillar adapters of the same design of track and track mechanism as is on the Tractor Hand Cart. Furthermore, to further increase manœuvring ability, the ratchet mechanism could also be employed. It is thought if this were

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<sup>5</sup> See article on Tests in September-October, 1920, F. A. JOURNAL.—EDITOR.

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carried out that two men, with no difficulty whatever, could handle this weapon over the most abnormally difficult ground.

### 9. Possible Studies.

#### (a) 1½ Power Trailer Caisson.

Weight 3500 lbs.

Length over-all 110".

Width over-all 79".

Useful load capacity 3000 lbs.

Body dimensions:

Length 110".

Width: 48" bottom, top 59".

Height 24".

The basis of this vehicle would be the 1½-ton trailer caisson to which is added the necessary shafts, differentials and final drive to allow power to be transmitted mechanically from the draw-bar tractor through the medium of a coupling or flexible shaft to the tracks of the trailer. The power shaft is taken off the transmission of the prime mover on the engine side of the steering mechanism. The coupling or connection between tractor and trailer is such as to operate through a maximum angular displacement of 60°, allowing the trailer to push the tractor as well as the tractor to pull the trailer. The purpose is to insure continuity of movement over difficult terrain, better control of movement up and down steep inclines and a better distribution of tractive effort. A favorable comparison of this unit to the ordinary trailer caisson pulled by an Artillery tractor is that of the four-wheel drive truck to the ordinary two-wheel drive truck.

#### (b) Draw-bar Tractor Caissons.

These vehicles have "Self-contained Power Wheels" with an allowance of time for conversion of 5 minutes. The purpose of this project is to secure one unit in each class of Artillery draw-bar work which may be used as a tractor to pull gun matériel and a tractor caisson for cargo carrying, both capable of rapid operation on good roads using the wheel feature, and high mobility over difficult terrain using the track-laying feature.

If such a unit is practicable, the use of but one vehicle will be necessary in motorized artillery for transport purposes, a condition which will lend to quantity production, simplify

repair and maintenance, and greatly reduce the spare parts supply problem.

10. Miscellaneous Projects.

(a) Water-proofing of Gasoline Engines.\*

The purpose of this project is to overcome the principal disadvantage of motor-propelled vehicles for cross-country transport; *i.e.*, the lack of stream-fording ability. While the lighter vehicles may be constructed so as to float, those weighing over two tons require such displacement that in the general case this is not practicable. It is necessary, therefore, to use construction that allows submerged operation. The most simple method is housing the engine in a water-tight compartment provided with the necessary extension tube for carburetion, exhaust and breathing, but this prevents accessibility, a necessary military requirement. It was thought the best method was employing engines especially designed for this purpose, but tests have been recently conducted by the Ordnance Department, which indicate that water-proofing is not so difficult or complicated as formerly believed. These tests carried out on a self-propelled gun mount, S.P. caterpillar, Mark VI for 75-mm. gun, using a commercial pleasure car engine showed that not only was a special design unnecessary but that very little equipment or fittings, etc., would allow operation completely submerged in water at 32° F. Under-water operation would occur only during a small part of the life of a vehicle, the means of accomplishing such operation should not, therefore, destroy its efficiency through the greater part of its service. It is now believed that water-proofing is not only possible but highly practicable and can be applied to most of the engines now in service.

(b) Floating.

To increase the mobility of the smaller track-laying vehicles, especially the cargo-carriers, it is intended to provide sufficient body displacement to float them, allowing a factor of safety to permit self-propulsion in water. In cases where large steel

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\* See articles in March-April and May-June, 1920, FIELD ARTILLERY JOURNAL.—  
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bodies are not desirable for normal use, it may be possible to employ collapsible canvas or fabric sides which are stowed away or broken out as the case demands. In some special tactical situation, if it be desirable to float certain vehicles, air flasks may be provided which will readily be attached and cast off when necessary.

### (c) Track Construction.

Modern military practice demands high speed for cross-country transport and to meet the requirements it is necessary to reduce weight and eliminate vibration, especially in the track mechanism of this class of vehicles. Two different methods of the solution of this problem are under consideration: first, construction by which the vehicle is a track layer for operation over difficult terrain and by removal of the track it becomes a rubber-tired wheeled vehicle for high-speed travel on good roads; second, construction allowing the track to always remain on the vehicle both during cross-country manœuvre and for good road high-speed operation. At first glance the first method appears the most feasible, because to date, travel under each condition has been separately solved by the tractor on one hand and the rubber-tired wheeled truck on the other, the answer is obvious, *i.e.*, produce a composite vehicle capable of fulfilling the functions of a tractor and a truck—this has been done with astonishing success, but it is well to consider other methods before concentrating entirely upon the combination vehicle, remembering that in order to function under both conditions a great sacrifice is necessary in the capability of operation under each particular condition. A parallel to this composite vehicle is the universal projectile which could be used as H.E. shell and as shrapnel, but each use sacrificed so much to produce the composite that neither function was quite fulfilled.

The second method involves great difficulty and presents a vast problem to the engineer, but recent Ordnance development indicates that it may be possible of solution. Only four years ago two miles an hour was the safe maximum continuous speed on hard roads, to-day the latest experimental model of tractor

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weighing approximately 5600 pounds has attained 18 miles an hour for periods of an hour or more, while one of a much lighter class has reached 30 miles per hour during short periods and maintained a rate of 15 to 20 miles for two hours. The problem may be briefly stated as follows: Eliminate road shock and vibration, particularly in the track mechanism, but generally throughout the whole structure. This involves generally: springing the vehicle to the greatest extent.

Using resilient members such as rubber-tired rollers or rubber-cored rollers.

Reducing to a minimum the weight of unsprung parts, and parts moving at high speed.

Presenting an approximate jointless rail to roller, sprocket and idler.

Effecting favorable angles of approach of the track to front idler and rear sprocket.

In connection with these features several projects are under way, among which are the "Chase" track, comprising two endless rubber or fabric belts separated by metal cross straps which are so formed as to produce a channel for the drive wheel rollers and idlers and whose outer surface is in contact with the hard road surface, this track is very light, presents only low joints to the track rollers and is resilient within itself. The use of metal rollers with rubber cores as being used on the new 15-ton Artillery tractor. The use of springs on the chassis and roller supporting members together with light-weight track of special shoe and rail forms and special metal, as on the new 2½-ton Artillery tractor. The use of cable suspension for that portion of the tractor above the running gear, a system which consists of a steel wire cable working on sheaves or rollers in conjunction with a spring attached to one or both ends of the cable.

This system of suspension is in a highly experimental stage, but it is hoped that by its use heavier loads may be sprung with greater efficiency, simplicity, ruggedness and longer life. The



## ORDNANCE MOTOR EQUIPMENT

sprung load when the vehicle is moving rapidly over rough ground appears to actually float on the running gear.

Toward developing high speed with true track-laying vehicles of reasonable weight it is intended to apply the "Chase" track as already developed under direction of the Ordnance Department for the tractor carts and the Reconnaissance tractor, to standard chassis, such as the Ford, Dodge, the F.W.D. truck and the Standard Ordnance four-wheel drive truck (Militor). If these experiments are successful, not only can the same highly efficient system be applied to draw-bar tractors of similar and greater weight but also the ultimate with regard to the proper use of track-laying vehicles for all purposes in artillery motorization may be expected, that is, by economical conversion to track layers, vehicles of the wheeled type can be wholly eliminated, a condition which has been sought since the advent of the track-laying prime mover for artillery carriages. The wheeled motor propelled vehicle has no more place in motorized mobile artillery than has the horse.

It is believed that the ultimate high-speed artillery tractor will not be a convertible vehicle but will be of the track-laying type for use both on and off good roads.

### (d) Cooling systems.

The Ordnance Department has initiated the development of air-cooled engines over the whole range of sizes now in use or expected to be in use. The object is elimination of water-cooling troubles, principal among which being those due to operation in low temperatures. Already one cylinder developing approximately 14 H.P. at about 1300 R.P.M. as the basis of a four-cylinder engine, has given excellent results.

A study is being made of a heater to be applied to the water-cooled engines now in use on the standard Artillery tractors in service (5- and 10-ton), by which the troubles due to freezing may be prevented and ease of starting in cold weather may be assured. A review of the practice in Russia, the worst known condition where water-cooled engines are used to a great extent, indicates that the use of alcohol in large proportions is the principal

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method of securing cold weather operation. The following proportions are quoted from a report on this subject:

PER CENT. BY VOLUME OF DENATURED ALCOHOL	9.1	23.1	33.3	44.5	50	54.5	60
SPECIFIC GRAVITY	.988	.973	.962	.945	.935	.927	.914
QUARTS OF DENATURED ALCOHOL ADDED TO 10 QUARTS OF WATER	1	3	5	8	10	12	15
TEMPERATURE AT WHICH MIXTURE WILL FREEZE	plus 25.4°	plus 13.8°	plus 1°	minus 14.5°	minus 23.5°	minus 31.5°	minus 40
TEMPERATURE AT WHICH INSTRUCTIONS SPECIFY MIXTURE TO BE USED	plus 32	plus 20	plus 10	0	minus 10	minus 20	minus 30

The above figures represent the result of an investigation in the Chemical Laboratory of Columbia University and are believed to be dependable.

When using mixtures containing high percentages of alcohol it might be practicable to employ on each radiator a small condenser to prevent wastage of alcohol due to vaporization when heated.

(e) *Use of Diesel or Similar Types of Engines in Tanks and Tractors.*—The use of such engines greatly facilitates water-proofing as the electric ignition system and carburetor are not used. The efficiency is higher and fuel of low gravity can be employed. A 5-ton Artillery tractor engine was altered so as to operate on low gravity fuels using high compression for ignition purposes with the fuel feed under atmospheric pressure. Combustion timing varied as the flash points of the several fuels used, and therefore could not be regulated over a large range of fuels. It remained to select *one* fuel and adapt the engine to that one in particular to the exclusion of all others. Before selecting this one fuel, it was necessary to review the whole oil and refining situation in this country. A careful survey and study is now under way by the Ordnance Department and until definite results are obtained, no further progress can be made. The use of the Diesel principle where the fuel is injected under high air pressure and hence subject to regulation

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was thought impracticable because of the complication and weight of such engines.

However, a new engine of the Diesel type which is compounded and generally similar to a compound steam engine, is now under development by a prominent company. There are three cylinders, the two outside being high pressure while the middle one is the low pressure.

One such unit suitable in horse power for a 15-ton tractor is now actually running, while the small one of almost 1/10 that power will be in operation in the near future.

In general these engines may develop the same power as a simple Diesel engine of twice the weight and represent considerable advance in the application of the Diesel principle to automotive work. The Ordnance Department is closely following this particular development.

### (f) The hydraulic clutch and transmission.

The subject of hydraulic clutches and hydraulic transmissions has been under tentative consideration by the Ordnance Department for some time, but just recently the subject has become more active. The transmission certainly presents a most attractive proposition. If sufficiently efficient, the use of such a member in conjunction with an internal combustion engine, especially in the heavier vehicles, will give a flexibility approximating that of steam, without the objectionable features of the steam installation in military vehicles. The hydraulic clutch appears to be very promising and will in all probability be the first of these two flexible units to be in practicable use and may in the very near future find a place in the power installation of the heavy military prime mover.

### (g) Use of Engine Fuel for other purposes.

A study might well be initiated to investigate the practicability of using gasoline or other military motor vehicle fuel for heating, cooking and lighting purposes, for troops in the field, replacing wood, coal and other fuels. The object sought is economy and simplification of supply.

# Questions Affecting Artillery\*

LECTURE BY GENERAL LE GALLAIS TO THE OFFICERS OF THE SIXTEENTH  
INFANTRY DIVISION, FRENCH ARMY

## Part II (Continued).

### III. *Position Warfare.*

1. *Proportion of Artillery.*—I must here necessarily enter much more deeply into the subject. A period of trench warfare of three years and a half was not foreseen, and could not have been foreseen, by anyone; a multitude of new problems suddenly presented themselves—new calibers, new classes of artillery were brought into action.

The number of batteries brought into combat increased in a formidable manner, never before imagined.

Were there not seen, in a certain battle around Verdun, more artillery batteries than there were units of infantry?

Were there not seen, on the Somme, at Malmaison, and perhaps elsewhere, proportions of artillery that exceeded all limits:

A field piece for every ten meters of front attacked;

A piece of trench artillery for every ten or twelve meters;

A piece of short heavy artillery for every fifteen meters;

A piece of long heavy artillery for every twelve meters, not including high-powered heavy artillery;

Making a total something like:

One piece for every three or four meters of the front attacked?

These unforeseen proportions, if they have not in any way upset the logical use of artillery, have undeniably brought about errors in the beginning, faulty methods of use; it is important to draw conclusions and bring matters into order.

In position warfare, as well during the period of an offensive as in the sectors where an attack is being withstood, we find

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\* Translated from *The Revue Militaire Générale*, November, 1919.

## QUESTIONS AFFECTING ARTILLERY

ourselves in the presence of a certain number of general basic principles that are applicable in all cases, and which it is essential to summarize at the outset.

The superiority of artillery is—as we said at the beginning of our study—one of the essential causes of success.

In position warfare, on the offensive side, this factor becomes of first importance.

Far be it from me to maintain that it is the only factor. Other factors, also, are required for success; they are:

The conception of the commander;

The mastery of the air;

The systematic "mopping up" of boyaux, shelters, etc.;

The use of fresh and spirited troops for the attack;

An assured supply of ammunition;

Last, and most important of all, the morale of the troops and the will to succeed.

Attacking infantry, however brave they may be, can not cross barbed-wire entanglements in face of an intact body of infantry, unweakened by the hammering of artillery, in the presence of even inferior artillery which has preserved its freedom of action by means of hidden and uncounter-battered batteries.

In order to accomplish these different tasks—destruction, at least partial destruction, of passive obstacles, lowering of the morale of the infantry by losses or at least by physical depression, silencing of the greater part of the enemy batteries—a decidedly overwhelming artillery is needed for the attack.

2. *The Rôle of the Artillery.*—The rôle of the artillery is to attain one sole and only object—to enable the infantry to penetrate the line in the offensive, to resist in the defensive.

This object is accomplished by the triple action of the artillery:

(a) Barrage fire and counter-preparation fire;

(b) Destruction fire (obstacles, trenches, communications);

(c) Destruction fire against the artillery, or at least, neutralization fire, counter-battery fire.

These actions become sufficiently powerful only when they

can produce a desired effect within a given time. The result is attained only by a sufficient density, that is to say, by a concentration of fire, all the more necessary when the guns are of slow fire; a concentration obtained, according to the circumstances and the needs, either by reduction of the front of the objectives assigned to each battery, or by superposition of the fire.

This is another principle which was denied by many, at the time the 75 appeared, and which the experience of the war has again demonstrated to be indisputable.

(a) Barrage fire in the mass may be divided into the following classes:

- Barrage fire proper (defensive);
- Rolling barrage (offensive);
- Counter-preparation fire (defensive).

The first mentioned of the three classes (in which the barrage is shifted upon lines fixed beforehand, according to the estimated advance of the enemy) is necessarily of a defensive character. The enemy attacks; he is barred; we must stop him from advancing.

It is necessary, therefore, to employ for this purpose all the artillery available, in concentrated fire as dense as possible, for time at our disposal is short and the terrain over which the enemy passes is of limited extent. Here we have our first important conclusion with regard to the necessity of preparation and concentration of fire under an artillery commander.

In the presence of enemy artillery of greatly superior strength, placed in position for the projected attack, we cannot hope to silence this artillery; it is necessary, then, that all our artillery that is capable of acting should take as its objective that which is most dangerous at the moment of attack, that is to say, the enemy infantry.

We see, then, the utility, the necessity, of the barrage, in great attacks, against the enemy infantry and their assembly trenches.

It is also necessary that a barrage be possible, that is to say, that the distance between our lines and those of the enemy be

## QUESTIONS AFFECTING ARTILLERY

sufficient to allow artillery fire without danger to our troops and to give it the necessary time to act.

The barrages, then, should be placed, at the nearest, about 100 or 150 meters from our first occupied lines that are to be defended. If these conditions are not fulfilled and the enemy's proximity to our first lines is such that barrage is impossible in the time and space allowed, the position is bad. Such a position is inconceivable for a defensive; it must be changed; it is better to abandon a piece of terrain that will, besides, be made difficult for the enemy to hold, than to risk a defense in a bad position, where the infantry, pounded by artillery fire, must fight alone against both enemy artillery and enemy infantry, and must finally be captured or destroyed.

This sacrifice, painful to amour-propre, but enjoined by good sense, was, unfortunately, not understood to be necessary during long months of the period of stabilization. Certain commanders would have believed themselves dishonored by ordering such retirements.

Ideas have changed, and during the last months of defensive warfare, instructions from the high command were issued, giving us freedom of manœuvre, prescribing systematic giving up of ground in case of threatened attack on a large scale, no longer merely of some unimportant parcels of ground of small extent, but along an entire deep zone within the limits exposed to destructive fire and susceptible of being cleaned out by light artillery or trench artillery fire.

The enemy attacked empty space; his attack, disorganized before reaching our real lines of defense, was foiled.

He was beaten—that is the history of the last defensive battle of Champagne, which marked the beginning of a new era of offensive at all points—the beginning of the enemy's ruin.

This conclusion drawn from the experience of war is of capital importance and will hold good. Untenable positions are not to be defended except in case of absolute impossibility of doing otherwise. The course to be pursued is to manœuvre and to oblige the enemy to lose precious time, by forcing him

to change the position of the mass of his batteries, if he has obtained knowledge of the manœuvre.

Time is gained, that is, equilibrium is reestablished by the arrival of powerful reinforcements—infantry and artillery—and we fight in the position that suits us, upon terrain chosen by us, and not by the enemy.

This giving up of terrain is not always possible, whether because the ground is of essential importance, as observation terrain, or because its loss would have an effect upon the morale which must not be disregarded.

The instance of Verdun is a typical example of this. In such a case, it is necessary to stand, to hold on, until the rapid, uninterrupted arrival of powerful reinforcements shall enable us to repulse the enemy, in the first place, and afterwards to resume the offensive.

The class of artillery fire called rolling barrage is, in effect, a moving barrage accompanying the attacking troops who follow close behind and profit by the fact of the enemy being forced to take shelter in their earthworks from the artillery fire, to gain ground and hold it.

We are familiar with both of the principal types of rolling barrage.

The first, which regulates, from beginning to end of the attack, the speed, the rushes, and the successive halts.

The second, which proceeds by stages of definite depth, with halts of indeterminate duration upon certain lines of terrain, and resumption of movement under the orders of the commander, who is supplied with information.

Both systems have advantages and disadvantages, partisans and detractors.

Those who have had success with one of them consider it perfect. The first of the two, much simpler in theory, is at the mercy of serious accidents which may cause loss of contact between infantry and artillery, and lead to certain and bloody failure.

By a serious accident, I mean, for instance, a great hidden



## QUESTIONS AFFECTING ARTILLERY

and unforeseen center of resistance, which the infantry cannot reduce unaided, and which requires the use of artillery.

Now, in a concerted plan of action, regulated like the movement of a clock, it is impossible, absolutely impossible, to change at a moment's notice all the pre-arranged dispositions of a mass of artillery. The liaisons are never perfect at this point; both time and means are wanting.

These serious accidents may occur; we had an unhappy experience of one in the Grille woods.

Provided with manifestly insufficient artillery, the attack, launched under cover of night and in a snow storm, found itself, in part, under the fire of German infantry, forewarned and not surprised, and under the fire of a powerful body of artillery which had remained silent and uncounter-battered up to that moment; it was confronted, in the midst of the wood, by a powerful organization that had not been revealed by any photographs. In short the advance of a part of the attacking troops was halted. The others carried on the attack magnificently, but, completely overwhelmed and surrounded by fresh troops, they had to fall back on the first lines taken, and if they were able to hold them for days and nights, in spite of being decimated and exhausted, it was solely due to their magnificent valor and to their high morale.

The conclusion that I draw from this is that decided preference should be given to the second method, which, besides, gives an opportunity for the possible action of the commander.

In the first case, it is non-existent; it counts the minutes, and that is all.

The third of the classes of fire grouped under the general heading of "barrage fire" is fire of counter-preparation.

This, in brief, is a preventive fire, used in the defensive, against an imminent, or supposedly imminent, enemy offensive, with the view of counteracting it before it gets started.

Here again, we see the necessity of a heavy, concentrated surprise fire upon the enemy's departure trenches if there is reason to believe that he is in them.

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Fire may also be directed upon our own trenches or in their vicinity, if, having evacuated them under orders, we have reason to suppose that the enemy has advanced into that area, in preparation for the moment of attack.

A remarkable example of fire of this kind is the counter-preparation effected on the night of July 14-15, 1918. Knowing by concordant intelligence from different sources that the German attack was to be launched at H hour, our counter-preparation fire was suddenly opened, along the whole front, at H5'.

The Germans were taken completely by surprise, with the final result that you know.

I must not conclude this discussion of barrage fire without pointing out an error too often committed in the defensive, and indicating the practical lesson to be learned from it.

In position warfare, as in open warfare, one cannot be uniformly strong everywhere. That would be to be weak everywhere.

Forces must be concentrated, both infantry and artillery, at points where there is reason to prepare an offensive or to fear an offensive of the enemy.

The remainder of the terrain should be held with the indispensable minimum of forces; this is one of the oldest and most infallible principles of warfare. As a result, in these less important sectors, the infantry is far from being dense, and the artillery is still less concentrated.

To wish to have artillery barrages prepared along the whole front is nonsense; it is dispersion, and nothing else.

It is necessary to concentrate, or at least to prepare the concentration of the fire, on the delicate points, those most exposed, the points of friction. For the rest, nothing—no barrage; the infantry, if it is attacked, defends itself unaided; if it loses a bit of ground for the time, it endeavors to retake it.

We must get it thoroughly into our heads that a barrage laid down by one battery on a front of 200 meters is not a barrage at all.

## QUESTIONS AFFECTING ARTILLERY

Calculate and you will see how inappreciable is the damage on such a front, with a rate of fire of five shots per piece per minute, with explosive projectiles having a danger zone of about 25 square meters, and with probable errors in range of 35 to 40 meters even for pieces not much worn, but shooting at night. You will see, I say, how many men will be lost by an infantry company attacking on such a front in small columns, and taking two minutes to cross the most dangerous zone. (Two probable errors, one on each side of the point of impact.)

You will be astonished at the result, for you will find that, unless there is some lucky shot falling directly on a group, the losses will be negligible and will by no means prevent the enemy from advancing.

This fully justifies the conclusions that we have already drawn and that I cannot repeat too often.

Raising artillery dust doesn't get us anything.

Thin barrages are not barrages at all; they are dangerous because they give to a not well-advised infantry the unfounded confidence that it can count on the barrages, when it ought to count on itself.

(b) The second mode of action of the artillery is destruction fire.

First, daily destruction in the regular course of sector operations, directed upon specially troublesome objectives, as machine guns, mines, etc.

The experience of the war shows us that the only difficulty is the precise designation by the infantry on the terrain of the objective to be demolished.

That the great mistake to be avoided is the systematic sending over daily, on the mere chance of some result, of a few projectiles on a badly defined objective, just to satisfy the infantry.

This is a waste and an error.

If it is not possible to reduce the objective because it is poorly defined, the offensive must be taken by destroying something that is clearly seen and is important to the enemy.

What one must do is to give tit for tat, to defend one's self

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by attacking, but it is necessary to have plenty of ammunition and to use it lavishly. I cannot insist too strongly on the principle of no small parcels, no mere raising of artillery dust.

The destructive fire used in preparing an attack on a large scale is of an entirely different order.

The calibers used are as follows:

Against the wire, trenches, and shelters of the first lines:

Trench guns;  
75-mm. field pieces.

Against more distant organizations:

Howitzers, 155 (short);  
75-mm. guns.

For still greater distance:

Long-range guns with special objectives.

Against certain strong shelters:

Heavy mortars.

All this is simple in theory, and is easy as far as the first lines are concerned, because observation is easy. The difficulty increases with the distance, because the surest mode of observation, terrestrial observation, becomes increasingly difficult, and observation by aeroplane is often impossible or imperfect.

But, in fine, with time and effort, success may be attained.

The essential points of the lessons taught us by the experience of the war are as follows:

The destruction can never be total, complete, whatever may be the length and perfection of the preparation. Certain points, certain organizations will escape destruction, and the infantry must not expect to walk over at their ease.

They should be thoroughly convinced that they will have to fight at such and such a point, and to reduce by their own efforts the small centers of resistance not completely wiped out.

In certain local attacks, and even in certain attacks on a large front, it was possible to accumulate such a great quantity of artillery that everything was indeed destroyed or overcome, and certain regiments were able to advance one, two, or three kilometers without having a single man killed.

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I am tempted to say that these extraordinary circumstances were almost a misfortune, for the idea was quickly diffused and received that it ought to be so always.

We have come back to the sensible doctrine, which is to have the artillery as strong as possible, to require of it the greatest possible amount of destruction, in selected zones of action, and to say to the infantry, the way is prepared, you may advance without fear, but not without some fighting.

(c) Counter-battery.

The third mode of action of artillery, that is, counter-battery, remains to be discussed.

It may be said that in position warfare, the batteries which reveal themselves by their fire must be masked and sheltered, under penalty of rapid destruction, or at least neutralization at the moment of an attack.

Can the destruction be complete? Evidently not.

Can it be efficacious? The conclusion is not doubtful; we must answer, yes.

Counter-battery work, however, is not the affair of a moment, but requires time; it must be pursued continuously, methodically, and with perseverance. Firing a few shots every day at such and such a battery, to satisfy the infantry, is a waste of ammunition which must at all costs be avoided.

We must economize until we are sure that the emplacement is occupied, and until we are certain of having at our disposal a sufficient quantity of ammunition, and then we must send over a fire heavy enough to be effective. Two or three hundred shots at least will be required, of small, medium, or large caliber, depending on the defilement and the protection.

It is above all necessary that this "fire of effectiveness," that is to say, of destruction, should immediately follow the ranging observations, on pain of attacking empty space on the morrow, that is, firing at emplacements evacuated during the night.

Unfortunately, errors have been continually committed in

this respect, due to mistakes of the aviation observation, as well as to the inexperience of certain artillerymen.

The commander, divisional general, or general commanding the artillery should intervene energetically.

And this is another reason justifying the necessity of providing the division with a flight squadron for range finding and general utility. Good work cannot be done while the flight squadrons remain casual, variable, independent of the commander who uses them.

In large attacks, the assailant brings up a great number of new batteries, and he strives, by every possible ruse, to mask their presence until the moment fixed for suddenly opening his preparation fire.

It is not possible for the artillery of the defense to reduce the enemy's artillery; in the first place, because it is very inferior, and in the second, because it has not sufficient time and because sound ranging is of no avail in the tumult of battle.

All that can be done is to try to neutralize a part of the enemy's batteries by appropriate shell fire—shrapnel if the batteries are unmasked, high explosives or poison-gas shells in other cases.

From this summary of conditions, you may conclude that the defense artillery finds itself in a critical situation at the moment of crisis, since, on the one hand, it is very inferior and, on the other, all its usual firing emplacements have been located and will be singled out for attack.

For a long time we were unable to find a remedy for this unfavorable situation, but nevertheless there is a remedy, or rather, two remedies, which are as follows:

1. To prepare a large number of battery emplacements, as many as possible, and to occupy them temporarily and successively with migrating pieces. This has a double advantage; the fire may be minutely prepared, and the enemy is left in uncertainty as to the emplacements really occupied at the moment of the attack and is obliged to disperse his efforts.

2. To make extensive use of mute batteries. I will explain:

## QUESTIONS AFFECTING ARTILLERY

Emplacements completely hidden from the view of aviators should be chosen, and the fire should be minutely prepared on the map. We may arrive at absolute precision in this respect. No earthworks should be made that might reveal the presence of these emplacements which are to be kept hidden. Only some ammunition dumps, some narrow trenches, deep and masked.

All these batteries are echeloned in depth and, as a rule, farther to the rear than the batteries necessary for the daily operations; they are not meant to shoot far beyond the enemy's first lines, but on his lines of departure, and even within our own lines.

As soon as the attack appears imminent, these emplacements are occupied by a part of our batteries, withdrawn from the advance zone, or by new batteries, if there has been time to bring them up.

The absolute rule is to leave them silent until the moment when the commander gives them liberty of action. Their security is, so to speak, absolute; it is due to their silence before the attack and to the completeness with which they are concealed by avoiding all work and all indications that might reveal their presence before the proper time.

This conclusion regarding the use of silent artillery, in attack as well as in defense, is essential; it is sanctioned by the experience of the war. We have had proof of its effectiveness many times—once, for example, to our detriment: In the battle of the 17th of April, 1917, the German artillery, which showed but little activity during our preparation, revealed a large number of mute batteries during the attack; they could not be counter-battered, and they did us great injury.

Another time, to our advantage: Battle of Champagne, July 15, 1918. The German attack was anticipated, and more than half the artillery withdrew to silent emplacements. It did most excellent work at the moment of the German attack.

It may have had a few wounded—I do not remember certainly—but I believe there were none. On the other hand, a group of 75's which had not been displaced because it was

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necessary where it was and a battery of 155 (short) which had not until then been fired on by the enemy, but which had previously revealed itself by its fire, suffered extremely heavy losses.

It is, then, a thing well proved.

And I will add that the principle remains the same in open warfare—with different methods of application, of course.

Mobility, natural concealment, change of position, even though slight (when the battery is caught under accurately ranged fire), by taking advantage of a lull, these play the same rôle in open warfare as do the mute emplacements and the numerous emplacements prepared beforehand in warfare of position.

*(To be concluded.)*



# Being a Tactical Study of the Field Artillery Group in Retreat.\*

BY LT.-COL. W. H. F. WEBER, C.M.G., D.S.O. P.S.C., R.F.A.

(In three parts; Part I, March, 1918; Part II, April, 1918; Part III, Conclusion and some Platitudes.)

[EDITOR'S NOTE.—*This study of Field Artillery in retreat contains much of interest to our Field Artillerymen, as it will call to mind some of their own difficulties in transportation and with communications, though fortunately we were never in a retreat.*

*A few notes on the latest British Field Artillery organization are given as an aid to the reader, as their organization differs materially from ours.*

*Batteries are commanded by majors, each with a captain, second in command, and have six guns, except heavy field batteries, which have only four.*

*Brigades, commanded by lieutenant-colonels, usually have three batteries, though horse artillery and howitzer brigades have only two batteries. Heavy gun batteries are not brigaded.*

*The Divisional Artillery (D.A.), commanded by a general officer, contains four brigades (one equipped with howitzers) and one heavy gun battery. Howitzer brigades are now being increased to three batteries, which will give seventy-six guns and howitzers to a division.*

*A cavalry division has two brigades, with a total of twenty-four guns.*

*In this article, the writer's Second Brigade, R.F.A., had four batteries (three guns and one howitzer).*

*The term "group" refers to a convenient grouping of batteries, varying in number, to cover an area. At first the writer had three batteries in his right group, while later he had seven.*

*The "bury" so frequently mentioned is a buried telephone cable.*

*As this study will appear in serial form, it is suggested that numbers of the JOURNAL containing the different installments of the "Study" be preserved in order that the whole may be read when leisure permits. Back numbers of the JOURNAL are not always on hand.]*

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\* Reprint from *The Journal of the Royal Artillery*, January, 1919.

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### Part I (Continued).

#### CHAPTER VI.

22.00 March 21st to 02.30 March 23rd.—The Renewed Assault.

IN the hope of hearing something definite from the infantry as to the morrow's doings, the Group Commander waited several hours at Headquarters; in the meantime there was established at position 128 (I 14 a) a signal-distributing station to the battery-positions and a line was commenced to 128 from Group Headquarters with what wire could be collected on the spot.<sup>1</sup> At 03.00 hours on 22nd, nothing having transpired, he left in moonlight and quiet to visit the batteries in their new positions; he found 42nd, 53rd, and 87th batteries (or what remained of them) in position and engaged according to orders in harassing fire; the distributing station was in working order, but as yet the line from Group Headquarters was not "through." He lost his way to A & C/110 and, wishing not to be absent too long, returned to Group Headquarters in time to attend an informal conference of B.G.C. 18th I.B., B.G.C. 14th I.B. (25th Div.), and B.G.C. of the neighboring brigade on our right (51st Div.) with his group commander. B.G.C. 18 I.B. was still in charge, but only relies of his brigade existed any longer and, in practice, B.G.C. 74 I.B. (25th Div.) directed operations on the 22nd. The Group Commander considered it advisable under the circumstances to be with his batteries rather than with the infantry (i). At 06.00 hours, it being still quiet (but as misty as it had been 24 hours previously), he visited A & C/110 and found them efficient. The efforts of the previous day had not increased the efficiency of the 42nd, 53rd, and 87th Batteries and there was much to be done there (ii). At position 128 he found the promised 21st Battery, but as it consisted of only one officer and a handful of men, conditions were not improved by their arrival. The line was now "through"

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<sup>1</sup> Shortage of wire is more felt during a withdrawal than during an advance because the enemy captures so much. The provision of spare wire is a necessary part of preparations for withdrawal.

## TACTICAL STUDY OF F. A. GROUP

to Infantry Brigade Headquarters and information was received that the two Brigadiers would be at Fremicourt. With their concurrence, the writer stopped at 128 and sent as liaison his own Adjutant who had just received permission to rejoin from D. A.

An enemy barrage, which had commenced soon after 06.00 on the Brown (now our front) Line, gradually extended westwards until the Green Line became unhealthy; it interfered with digging which had been going on all night. It was already obvious that the five battery positions (42, 53, 87, A/110, C/110) were sited with an obstacle (the Green Line wire) behind them (iii). Two F.O.O.'s and battalion liaison were established, the F.O.O.'s being particularly instructed to watch the flanks. At 10.40 there was a report that the enemy were in Mariecourt Wood (I 4 b and d) on our side of the Brown Line and at 11.31 the Left Group could be seen withdrawing guns; on the right it was quiet. Orders were therefore sent to A & C/110 on the threatened flank to withdraw behind the Green Line when necessary, an operation which was well carried out<sup>2</sup> at the psychological moments selected by the battery commanders concerned. At 11.40 74 I.B. protested against this withdrawal saying that the enemy had been driven back, but the Group order only anticipated a definite order from 6th D.A. to this effect which was received at 12 noon, having been written at 10.40. The D.A. order gave liberty as regards withdrawing 42nd, 53rd, and 87th batteries; these batteries moved successively back through the wire into position along the bank in which lay position 128 (now Group Headquarters). During the morning Lieut.-Colonel B. arrived (preceding a written order) to command a sub-group consisting of C/236, D/236 (his own brigade), and A and C/110. The Right Group now consisted of 7 batteries (5 18 pdr. and 2 4.5", totalling 29 guns in action) all within easy distance and in view of Group Headquarters; the line laid to the infantry at Fremicourt was working

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<sup>2</sup> Under machine gun fire. But see Maj.-Genl. Uniacke's article on this incident on page 136 of Vol. I, No. 4 of "The Gunner," July, 1919.

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well; the sun was shining brilliantly, casualties were few, and conditions were actually pleasant. Information, however, came in very badly, and a succession of S.O.S. calls for fire along the Morchies-Mariecourt Wood road<sup>3</sup> told its tale (iv).

During the afternoon the enemy captured Vaultx and the Left Group was heavily engaged. Right Group offered its assistance, but the enemy's efforts to debouch from Vaultx had already failed with loss. The Favreuil area was reconnoitred by all batteries in case of withdrawal. Arrangements with 74.I B for an S.O.S. line showed that whereas the enemy was close enough to the Green Line on the left, on the right he had not yet reached the Brown Line beyond Beugny—in fact, had not advanced at all along the north side of the Bapaume-Cambrai road.

At 20.30 the D.R. brought a set of orders timed 18.05. As these orders were subsequently modified in certain details, and so to avoid confusion, it will be sufficient to state that they arranged for the reconstitution after withdrawal of the 2nd Brigade by amalgamation with the other brigade of the 6th D.A. (which had previously formed the nucleus of the Left Group). They allotted the Green Line Positions (see Defence Scheme, Chapter II) to various brigades, ordering the reconstituted 2nd Brigade to occupy positions 141-143.<sup>4</sup> Lieut.-Colonel B's sub-group was to reconnoitre others. The Right Group, consisting of 2nd Brigade R.F.A. and Lieut.-Col. B's sub-group (A/110, C/110, C/236, D/236), was to continue under the same command.

This operation order was accompanied by a message timed 18.30 which announced that the infantry to hold the line would be 123 I.B. of 41st Div. and that all Infantry and Artillery Headquarters would be in certain dug-outs near Favreuil "where ample accommodation exists."

At 21.45 a conference was held at Right Group Headquarters attended by Lieut.-Colonel B. and all B.C's. It was

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<sup>3</sup> By telephone from 74. I. B (25th Div.).

<sup>4</sup> See map No. 3, attached to Defence Scheme, Chapter II.

## TACTICAL STUDY OF F. A. GROUP

explained how our line now ran with a marked salient round Beugny; the 2nd Brigade from its new positions 141-143 could only just cover the left or northern portion; Lieut-Col. B's Brigade must therefore find positions about I. 19 d. or H. 23. c. whence it would be possible to cover the right or Southern portion of our line (v).

Immediately after the conference Lieut.-Col. B, started to conduct a reconnaissance of the areas selected—probably A & C/110 in I, 19 d, and C & D/236 in H. 23. c—sub-group Headquarters at Favreuil. The batteries of 2nd Brigade moved off without delay, as they had to reconstitute. The withdrawal was covered by Lieut.-Col. B's batteries, of which A & C/110 moved back at 23.30 and C & D/236 were not to move until 00.30 on 23rd. Group Headquarters remained in position until 23.30 then withdrew, leaving the senior officer of 236 at position 128. All batteries were given their S.O.S. lines before starting.

On the way to Favreuil the Group Commander visited positions 141-143 and found the reconstituted 2nd Brigade getting into position (42nd reinforced to 6 guns, 53rd reinforced to 6 guns, 87th 3 4.5" Hows. and 112th 6 guns). It was another moonlight night and fairly quiet.

On arrival at Favreuil dug-outs, there were lines to lay out, group headquarters to accommodate, and people to locate. It was found that there were trying to "squeeze" into the dugouts 3 Infantry Brigade Headquarters, 2 Group Headquarters and 6 Field Artillery Brigade Headquarters—it was excruciatingly cold. It was 02.30 on 23rd before the writer located 123 Infantry Brigade (41st Div.) where he learned that the battalions of this Brigade were in the act of relieving 7th I.B. of 25th Div. The relics of the 6th Div. were to pull out as best they could.

As Major-General Sir Thomas (then Colonel) Capper had said in a lecture at Camberley, "It looks, gentlemen, as if in future wars the night would be a period, not of rest, but of increased activity."

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### COMMENTS.

(i) *Location of Headquarters.* In such a state of affairs Infantry Brigade Headquarters was likely to get but poor information, while the group commander had every reason for wishing to be near his batteries. As it was thought (and actually proved) possible to get communication by telephone between Group and I.B., the group commander decided<sup>5</sup> to separate himself from the Infantry Brigadier. The value of the two commanders being together is, as a rule, inestimable, and it was commonly felt by the artillery that in choosing headquarters, the importance of artillery communications was not always realized by the infantry. In one division, the divisional operation orders usually contained a paragraph to the effect that infantry and artillery headquarters would be at such and such a place; it is the surest road by which the General Staff can initiate coöperation.

(ii) *Change of Position.* It is said that the best way to obtain good work is to issue clear orders; this is based on experience that in the absence of clear orders, good work is *not* obtained. Give a battery a clear order to move to such and such a position and the move is well enough done; but it is what the battery does after getting into the new position that makes it a factor in the battle. The procedure to be adopted should be drilled into all ranks until it is a habit; it is for that reason that some sort of standing orders for positions and emplacements are valuable. Efficiency is not always achieved at the earliest possible moment after change of position, and this is more so in a withdrawal than in an advance; in an advance the spirits are elated—in a withdrawal there is present the sense that one has escaped a danger and can rest awhile. Even *potential* power does not exist until certain procedure has been carried out. Immediately on arrival each gun must be emplaced, ammunition sorted, aiming point selected, camouflage erected; the B.C. must work out his lines, see to communications, arrange observation,

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<sup>5</sup> (With permission from the Infantry).

## TACTICAL STUDY OF F. A. GROUP

and "shoot himself in"—some of which requires daylight. If a battery has been fighting all day and moving all night, to obtain efficiency in the early hours of the morning requires an unusually fine B.C.; to order heavy counter preparation at dawn is to *ask for* short shooting, especially in cold weather with salvaged ammunition—a thing which a man fighting by the map has a tendency to forget.

(iii) Here was an instance of siting rearward positions with a defile behind them.

(iv) All ranks were still suffering from the settled habits induced by trench warfare; observation has to be improvised; information can often be obtained only by violent methods, and is *even then of no use unless communicated*. Officers were still slow to obtain the information, and the group not yet insistent enough on getting it, getting it accurate, and getting it early. It is useless to expect it to fall like manna—a commander must obtain it with means at his disposal. Much of the trouble here was due to lack of wire.

(v) The Green Line positions were only suitable for covering the Green Line; on the right our infantry were still in the Brown Line; here is a typical example of the advantages of grouping rearward positions in depth instead of on a linear basis. Even 141-143 was not perfectly suitable, being at a very long range; Lieut.-Col. B's batteries had to be obliquely advanced.

(vi) March 22nd was perhaps the most interesting day in this period of fighting—for the artillery; for once one could see what was happening. The tactical problem presented by the forcing of the Brown Line in the morning and the evening's loss of Vaulx had to be dealt with by those on the spot at once. For the mixed-up infantry of the 6th and 25th Divisions the day must have been terribly trying; on the right it seemed easier. Our wagon lines as usual spent the day moving and the 42nd Battery was again unlucky.

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### CHAPTER VII.

#### From 02.30 on 23rd until 02.00 on 25th.—The Turning Movement.

IN the very early hours of daylight, the enemy forced the Green Line away to our left and captured the village of Mory which increased the salient nature of our Beugny position; for a time the state of affairs was critical, but he did not improve his advantage; he also made an effort to force the Green Line on our own front but completely failed.

As the C.R.A. 6th Division remained in charge, the command of the Right Group was unchanged and was later increased by another sub-group—the 187th Brigade, R.F.A. of 41st D.A., in position N. of Favreuil.

The Group S.O.S. line had been arranged from a point just N. of Chauffour's Wood (I 12a 5/4), where it met the S.O.S. line of 51 D.A., via Morchies along the Vaulx road to I 2 c 4/5, where it met Left Group.

The relief of the troops holding the Green Line by the 123rd I.B. of 41st Division was not successful; two battalions of 123 I.B. took over the front line on the right as far North as I 9 central, but the third battalion failed to relieve 7th I.B. (25th Div.) whose right was in the Green Line at I 15 a 0/0. Between I 9 central and I 15 a 0/0 there was a gap, the effect of this gap as with all such gaps<sup>1</sup> was very serious; further than this, it was not for a considerable time understood that the Right Group was covering two Infantry Brigades *both* of which retained responsibility for holding the line.

Liaison was maintained by the Group at Headquarters 7th I.B. (presumed to be under the Brigadier of 123) and with two battalions in the front line, but was far from successful in so much as concerned information. Each sub-group maintained its own observation; the 2nd Brigade had out two F.O.O's. A

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<sup>1</sup> A French divisional commander on the Somme had cried to writer "I hate gaps."



## TACTICAL STUDY OF F. A. GROUP

report from one (I 14 c, timed 11.40) received at 12.45, stated that our fire at 11.05 was most successful. The reports of F.O.O. No. 2 merit study later.

Throughout the day attention was being directed to enemy movement about Vaultx; S.O.S. on the line I 8 a 6/6—I 9 a 6/6 was asked for at 10.50, 13.30 and 15.45. The Left Group was constantly shooting on the southern exits from Vaultx and batteries of the Right Group joined in as required; so pressing was the attention directed to this area that the quieter right was less considered; the F.O.O. (No. 2), specially detailed to watch this flank, was himself drawn to the left where the principal fighting was apparently taking place.

At 14.45 a Group message was issued which announced capture by the enemy of Lebuquiere, our right being thus threatened; it became necessary to withdraw Lieut.-Colonel B's batteries in I 19 to the area H 23; successful repulse of the enemy efforts about Vaultx was also announced in this message. At 15.05 an untimed message from F.O.O. No. 2 was received reporting that our infantry were retiring in I 14; this was thought by 123 I.B. to be part of the relief of 7th I.B.; it may have been so,<sup>2</sup> for a later message timed 3 P.M. and received via 53rd Battery at 15.10 reported our line in I 7, 8, and 14 as "still holding." A written report from the same F.O.O. reached Group Headquarters at 18.05 saying our line in I 7 and 8 was correct, but not otherwise optimistic; this officer visited Group Headquarters about 22.00—his attention had been entirely taken up by events on the left. About 21.00 a report from quite another officer (2nd Brigade) announced that Beugny was in enemy hands but that we held the Green Line west of it. It was not until much later that a wounded infantry officer reported personally that the two infantry battalions of 123 I.B. which had completed their relief last night had been captured almost en masse, a condition of affairs entirely unsuspected at I.B. Headquarters and which accounted for the silence of our

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<sup>2</sup> More likely, it was connected with the capture of the two battalions of 123 I.B., see below.

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liaison officer with those battalions. It appears <sup>3</sup> that the enemy got in during the early afternoon from the Beet Factory in I 17 and through the gap between the 123 and 7 Infantry Brigade; by this concentric advance they cut off the salient holding the two battalions of the 123 I.B.

At Group Headquarters there was much to attend to besides this. A section of one of Lieut.-Colonel B's advanced batteries which had got into position by moonlight found themselves in the morning in full view and had to shift under heavy fire. On news being received of the capture of Beugny the advanced batteries had to be withdrawn—the whole sub-group being collected into the area H 29—H 35 by 21.10.

6th D.A. ordered 187th Brigade out of its positions N. of Favreuil in the morning into positions about the Monument (H 15) to cover a possible retirement; once there, they came (about 19.00) into the Right Group.

Rearward positions had to be allotted and reconnoitred by everyone; as regards 2nd Brigade the area G 18a, E. of Bihucourt, was reconnoitred by the Brigade Orderly Officer.

An officer of rank arrived during the morning at Favreuil with instructions to arrange for all transport to get west of the defile formed by the Achiet le Grand—Bapaume railway. It was desired by him to move *all* battery wagons, but the Group Commander declined to part with his firing-battery wagons, for rearward positions stocked with ammunition no longer existed. An officer was detailed to conduct the reconnaissance and guide all the wagon-lines back; fortunately the wagon-lines (except 2nd Brigade Headquarters Staff) kept liaison with their gun-lines.

The batteries of the reconstituted 2nd Brigade along the Bapaume-Favreuil had suffered fairly severely from shellfire directed against that road, especially 112th. Communications were difficult to maintain in consequence. Some "short shooting" S. of Vault occasioned worry during the day.

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<sup>3</sup> From a letter written after peace by that liaison officer who was captured about 15.00 in the original (March 21) 18 I.B. Headquarters.

## TACTICAL STUDY OF F. A. GROUP

Orders had to be issued for observation and liaison for the 24th; a new S.O.S. line had to be traced to meet the altered situation on our right. It was past mid-night before the Group Commander was able to leave his Headquarters and visit his batteries.

At dawn on the 24th our infantry, consisting of 123 I.B. reinforced by sundry units of 41st Division to make up for the two battalions lost on the 23rd, were holding the Green Line from northwest of Beugny to near Vaulx (as before). By order of higher authority counter-preparation was fired at 05.00 and 06.15; as short shooting still took place, all batteries were ordered to register their lines at stated times; the result was reported as satisfactory; the origin of the short fire was not traced—salved ammunition and intense cold was the most probable cause, but the coordinates of the Green Line were perhaps still inaccurate, though an official tracing had been sent round late on 23rd. Liaison was working satisfactory on the right; there was also an experienced artillery officer at Headquarters 7th I.B.; the adjutant of the 2nd Brigade R.F.A. (available again on return from Fremicourt) went at 11.00 to 7 I.B. and thence to a battalion in the front line where he was dangerously wounded while assisting to bring up machine guns.

At 10.40, the C.R.A. 41st Division having taken over the artillery defence, the Right Group passed to Lieut.-Colonel L. commanding 187th Brigade, the writer remaining with 2nd Brigade.

The same officer who had sent in the good information on 23rd<sup>4</sup> was again doing F.O.O. He verified S.O.S. fire at 11.00. At 11.55 a message came from him asking for fire on enemy infantry in I 2d and I 3c. At 15.25 he reported line in I 7 and 8 holding well; I 14 was not so satisfactory. He visited a battalion commander at I 14a 1/6, and was on his way to the right about 16.00 when he saw our infantry retiring there; a heavy hostile bombardment was in progress; moving back north towards the left he was hit by a German machine gun firing from

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<sup>4</sup> Spoken of above as F.O.O., No. 2.

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the battalion headquarters he had left about 15.00. After lying in the open for 24 hours he was picked up by the enemy (and was well enough treated during captivity).<sup>5</sup>

In the meantime bad news was coming in from another F.O.O. further right; it was reported at 12.40 that hostile infantry were massing in I 21 and 22; at 15.05 we had a report of our infantry retiring "wholesale in I 14b and d and I 21c, with the enemy close behind"; the last message from this front asked for a barrage all over I 21, I 27b and I 28. The 2nd Brigade was chiefly engaged in helping the Left Group in the area I 2d and I 3d.

From other sources news came in of the breaking of the Green Line south of Beugny and of enemy occupation of Fremicourt, and by 15.00 Lieut.-Col. B's brigade in H 23 and H 35 had been withdrawn and moved back towards G 14a and G 23b. There was no liaison whatever with the troops on our right and it is obvious that the enemy, having got in S. of Beugny and captured Fremicourt, was sweeping north.

During the morning a representative party from all batteries, led by the Brigade Orderly Officer, had reconnoitred the G 18a position in detail.

The difficulty was now to extricate the 2nd Brigade without stopping fire too suddenly. Orders were sent (by telephone) to batteries to withdraw one section each to the G 18a position directly Colonel B's brigade had passed. It was not then known at Group Headquarters that several guns were out of action; the B.C.'s all decided to send two *useful* guns back and to send as well all guns temporarily out of action.<sup>6</sup>

At 17.30 123 I.B. Headquarters with the Group Commander withdrew to Bihucourt. Just after the last battery had received the order to send back a section, the telephone lines broke; it was no longer of any use to remain in Favreuil and the

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<sup>5</sup> For his excellent work with the forward section of 53rd on 21st and for his work on 23rd and 24th, he received notice.

<sup>6</sup> It looked as if casualties to guns occurred through trying to fire the guns with the "safety catch" on—orders as to use of this safety catch were issued later by higher authority.

## TACTICAL STUDY OF F. A. GROUP

brigade commander,<sup>7</sup> considering it his place to remain in action with his brigade, proceeded thither at 18.30 (under revolver fire from an agitated infantry officer).

He took up his post with the 87th (Howitzer) Battery and saw the last of the leading sections go by; he then ordered away the remaining gun of the 87th as unsuitable to the close combat, after which he went along, well behind the gun-line to avoid the road, to order back the rest of the 42nd Battery as being on the dangerous flank. Coming *back* along the gun-line to 53rd, where he expected to find four guns, he discovered an error had occurred in one message—53rd was not to be seen, having already withdrawn complete (instead of only sending one section); expecting to find four guns of 112th, he found only two (owing to guns out of action); of these one got hit soon after; instructions were given to the officer commanding to withdraw the last at 19.30 if nothing further transpired, which order was well carried out at the time stated, under rifle fire but no severe pressure. The brigade commander then walked towards Bihucourt and at G 18a the 2nd Brigade was duly found getting into action; the batteries had by his order avoided Bapaume during the withdrawal, as being too near the point of danger and, until quite recently, too much shelled; they had reached G 18a unmolested.

Preparations were being made to achieve efficiency, but at 21.30 the Group Commander arrived with orders to withdraw still further. The new position was reconnoitred by moonlight and the 2nd Brigade got into action west of the railway and south of Achiet le Grand at about 02.00 hours on the 25th.

Many things needful for comfort were by now missing, but there was ample whiskey in this neighborhood. This was the sixth brigade-position taken up since the morning of the 21st. That something had "gone" on the right was obvious to all, but the retreat of the Fifth Army was not known except to a few. Behind us were some very active 60-pdrs., welcome company for all their noise.

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<sup>7</sup> 2nd Bde., R.F.A.

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### COMMENTS.

(i) *Artillery protects its own front.* The general liaison of these two days' fighting seems to be a verification in a new form of Prince Kraft's conclusion that *Artillery can only protect its own front.* In spite of troops inexperienced in the war of movement, in spite of heart-breaking failure in communications, in spite of increased gunnery difficulties and consequent short shells, the Right and Left Groups did materially assist in a successful defence of our front within their own zones of responsibility; but they could not seriously affect enemy action coming from a flank. What happened to the artillery covering the troops south of the Bapaume-Cambrai road the writer does not know; the last touch he had with his neighboring Group Commander was in settling the junction point of the S.O.S. Line on the evening of the 22nd; by wire through D.A., and by orderly, and through the infantry, efforts were made to get liaison on 23rd, but without success; doubtless the neighbor made similar efforts.

(ii) *The troubles of a salient.* The capture of the battalions in the Beugny salient was a minor disaster which it does not appear that the supporting artillery could have prevented. The enemy's points of entry were (a) from beyond our extreme flank, (b) through a gap known to exist, but which could not be properly barraged because the left of 123 I.B. was beyond the gap and the right of 7 I.B. was this side of the gap; machine guns are the weapons to meet such an eventuality. The incident illustrates the objectionable points of there being a gap at all and the disadvantages of a salient in a withdrawal. Further, the existence of a salient renders the distribution of artillery very difficult.

(iii) *Flank patrols.* More, and earlier, information might have been obtained by employing flank patrols, but horses are hard to get at, casualties lessen the number of men available, and above all some of us had half forgotten (and still more had never known) the war of movement.

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(iv) *Groups*. The habit had arisen of forming large groups of artillery under the senior Brigade Commander without consideration for the means of "running" such a group. Such a thing can be done with impunity in position warfare where there is little movement and all ranks get warning of each event; even then three brigades are about as much as one brigade-staff can manage. In an advancing battle, it can be done, because mistakes made have a less serious result with a beaten enemy in front; the writer had five complete brigades under him on October 17, 1918. But in a battle of withdrawal, the command of a group is difficult. Either one has to steal the Brigade-Staff to run the Group and leave the Brigade to improvise a staff, or one has to command several sub-groups and several batteries as well. Groups must be formed, to give each infantry brigadier his local artillery commander, but they need special organization of a staff to meet the purpose;<sup>8</sup> it is a point that wants consideration at the time that they come into existence. The alternative of keeping group-staffs going in quieter times has great disadvantages, but so far as work goes, the group-commander's time would be well occupied in doing liaison, cooperating with the heavy artillery, visiting neighbors, and supervising T.M's. If the F.A. Brigade Commander does all these he has little enough time for wagon-lines and administration.

## CHAPTER VIII.

From 02.00 25th until 12.00 26th.—The Pursuit.

It was difficult to "get going" on the morning of the 25th, no one had much sleep since midnight 20/21. Two officers were out by 07.00 for observation and liaison. A succession of orders were received, the first affair being trouble near Saignies said to have been caused by an enemy agent within our lines; the real trouble lay, as before, to our right (South). At 09.15 a set of orders (based on a message from the Group Commander) was issued to batteries which gave our front line as

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<sup>8</sup> A Group certainly needs at least one D.R.

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from Grevillers to Sapignies, and a provisional S.O.S. line was traced. Ammunition supply was now according to F.A.T.; the position of 41st D.A.C. was known, but not yet that of the 6th D.A.C. Wagon-lines had split on 23rd into two echelons—the firing battery and the rest; the firing battery wagon-lines were maintained henceforth as close as possible to the guns.<sup>1</sup> The enemy artillery was as yet quiet, but our batteries had begun registration when at 10.00 an abrupt order was received to "clear out at once owing to a break-through on our right," a rendezvous with the 41st D.A. Staff being appointed to L 11 b.

As it was not known how pressing the need might be, the guns were withdrawn directly horses could be procured, some wagon-bodies being left on the position; all these "bodies" were fetched later, however.<sup>2</sup> The only road lay through Achiet Le Petit and was blocked; later, but not until the brigade had passed, this road was shelled by the enemy with all too good effect.

Between Achiet Le Petit and Bucquoy the block was worse; no touch could be obtained with 41st D.A.; the countryside was, however, dry, and the Brigade Commander formed up the 2nd Brigade off the road, fell out the battery staffs and reconnoitred a position as in pre-war days. An almost ideal "half-covered" position was found; its left lay not far from Bucquoy and it ran nearly due N. and S.; in front lay a well-wired (old German) trench containing quite a number of filthy but well-constructed dug-outs; this trench had been for the Germans on the reverse slope and was therefore for us on the forward slope and provided excellent O.P.'s almost within sound of voice of the guns. The whole country from Logeast Wood to Achiet Le Grand and Le Petit was in full view. The "half-covered" position seems to be the secret of support in a running fight. The danger was to the south, but from the right-hand gun of the right right-hand battery there was a grand view of the low ground towards the Butte De Warlancourt, High Wood, and

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<sup>1</sup> Nobody knew where the Brigade Staff wagon-lines were.

<sup>2</sup> Enemy artillery already active and enemy machine-guns not far off.



## TACTICAL STUDY OF F. A. GROUP

Martinpuich; though flank patrols were not sent out, the nature of the ground permitted us to watch this danger area—empty of troops, British and German, so far as could be seen, but with the dry grass burning in a hundred places. We were now off the last 1/20,000 map and felt lucky to get a few copies of the 1/40,000.

During the critical moments previous to taking up this position there arrived a low-flying German plane, which was successfully brought down by the Lewis Gun of the 42nd Battery.

At 14.30 the O.C. 2nd Brigade was again put in charge of the Right Group and told to obtain touch at once at a certain place with the Brigadier of the 186 I.B. of 62nd Division—the Fourth Division to support since 21st March. The Brigadier was not there and it was 17.00 before he was found but a few hundred yards away from Group Headquarters. There was now considerable shelling, and the journey in search of 186 I.B. was both wearisome and depressing. The infantry were manning a line round Achiet Le Petit with detachments of unknown strength and composition some distance in front; it was still impossible, therefore, for us to shoot—or indeed to make any definite arrangement, for it had not yet been decided whether we were to hold on to Achiet Le Grand. The loss of our vehicles<sup>3</sup> was becoming something of an incubus; our very last one (the telephone wagon) had but just escaped destruction from a chance shell, leaving Achiet Le Grand; and our dinner this night consisted of a tin of pork and beans from an abandoned dump, eaten off an envelope with a pen-knife.

Returning to Group Headquarters at 18.00 hours, the writer gained touch with 62nd D.A. and issued such orders as were possible to 2nd, 187th, and Lieut.-Col. B's brigades. A small visual party was left at Headquarters 186 I.B. and visual kept up until nearly midnight; the Group Commander himself intended to reach 186 I.B. again by 03.00 on 26th. The two officers sent out at 07.00 rejoined in the evening with a considerable

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<sup>3</sup> Brigade Staff Wagon Lines.

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amount of information as to the day's doings and after fairly exciting experiences.

At approximately 02.00 on 26th, an order was received from 62nd D.A. that 2nd Brigade R.F.A. was to move at once out of the battle to Souastre; that the O.C. 2nd Brigade was to retain charge of the Group; that 187 and Lieut.-Colonel B's brigades were to withdraw and come into action in certain named squares east of Hannescamps (our old front line before the war) where we should find 310 Brigade R.F.A. of 62 D.A. already in position. Again luck was with us and the improvised telephone-lines "held" to the two other artillery brigades; it was even possible to talk through the 62 D.A. to 186 I.B., but unfortunately not possible to get out of the latter where 186 I.B. would have its headquarters next morning; this was a misfortune. The visual station left at 186 I.B. had suddenly ceased to function—we never saw the men again, but heard of them months later as prisoners of war in Germany.

At 04.30 on 26th every battery had gone and Group Headquarters moved (walked—no touch with wagon-lines yet obtained) through Essarts to Hannescamps. 310 Brigade was found and its position generally inspected; 187 and Lieut.-Col. B. were also found, positions inspected, and orders issued verbally as regards liaison, observation, etc., so far as could be done. A Group signal-distributing station was established in a convenient place. A personal inspection of his position is an absolute *sine qua non* for an Artillery Commander (i). The impression gained by this tour was that either the artillery position had been chosen in connection with some definite purpose strategic plan,<sup>4</sup> or else the batteries had been sent unduly far back. The position was at least 8000  $\times$  behind the infantry line.

It was a mistake not to borrow horses at this point, but one had little idea where to find 186 I.B. and the country was cut up and wired over by the old German trench system. A new but not less weary journey commenced at 08.00 and took us through strange sights and places; in at least one place it was necessary

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<sup>4</sup> The imagination flew to Austerlitz and Bull Run.

## TACTICAL STUDY OF F. A. GROUP

to retire with more speed than dignity, but a little before 10.00 the Brigadier was found just west of Bucquoy. The problem was now how to control fire; there was no wire to be got until some could be picked up from the countryside; visual was impossible; for a time one could rely only on mounted orderlies (ii).

The news at 186 I.B. was not too satisfactory; machine gun fire was already being directed on these headquarters; there was a rumor that the enemy had reached Hebuterne, the neighborhood of which was visibly being shelled by British guns; a huge snake of men of unknown nationality<sup>5</sup> was trailing about the hilltops to the south like the "useless months" of the Green Curve; there was no communication with anyone and S.O.S. calls were already beginning.

About 12 noon the writer was relieved of the command of the Group and sent in pursuit of his brigade. It was past dark by the time he had reached a place called Gaudiempre and extracted his batteries from the since famous battle of Souastre.<sup>6</sup>

Next day after gathering into the fold the 21st Battery, we marched north towards Part II of this little history.

The 2nd Brigade had lost 18 Officers (including three B.C's and the Adjutant), 106 men and 106 horses—the last named as usual came first in the animal-loving adjutant's lists.

\* \* \* \* \*

### COMMENTS.

(i) *Personal acquaintance with terrain.* An Artillery Commander fighting his batteries without having seen them in position will be putting himself to a great disadvantage; what would one think of a man trying to arrange a day's cover shoot off a map without visiting the woods? The only time to carry out this tour in a withdrawal is after the batteries have reached their new position but before the new battle has begun. A motor-bicycle with a sidecar combined with (not instead of) his

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<sup>5</sup> Proved to be stragglers of many Divisions.

<sup>6</sup> Caused by a rumor spread by a strange individual (wearing general's badges) that the German Cavalry had passed Hebuterne. This battle boasts of many varied and stirring incidents, including a ride to Doullens by a modern John Gilpin in search of eggs.

horses would enable a commander to do this. The writer has enough doubts in his mind as to some of his conclusions—but on the question of personal acquaintance with the gun-positions he is as confident as he is on the question of frequent visits to personnel.

(ii) *Infantry Brigade Headquarters, and the best method of maintaining coöperation in the retreat.* Here is an example of the difficulty of combining the functions of command with the functions of liaison. Command without communications is practically impossible; liaison without knowledge of the capability of the gun position is equally so; the combination of communications and presence at infantry headquarters was not possible in this case unless the brigadier so placed himself as to meet the needs of the artillery. The writer does not forget his sense of depression when after extricating a big group from the clutches of battle, seeing them in their new position with his own eyes, and at last finding infantry headquarters in a position singularly unsuitable to the artillery, a senior officer of fresh appearance addressed him as follows: "You Group Commanders must keep touch with your batteries."

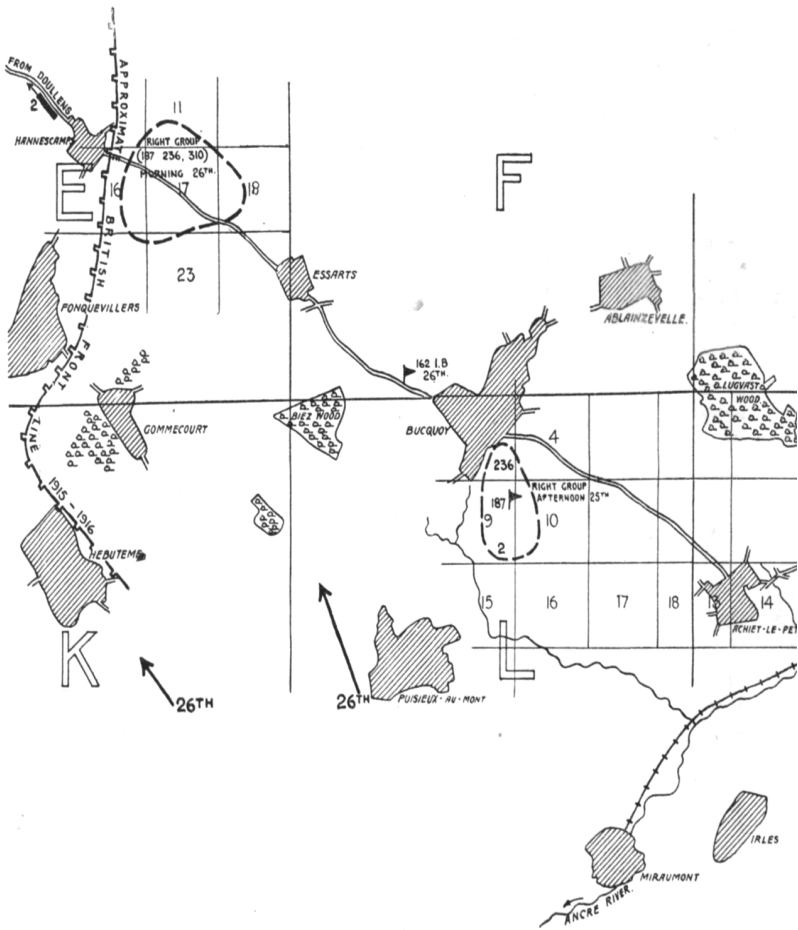
The question is—in a very rapid withdrawal such as this had become, is it not better to establish the bulk of the guns well back, thus gaining time to organize an efficient artillery defence, and to entrust to a detachment the duty of providing immediate support to the rearmost infantry? An account of an action of this nature, fought by a French battery detailed for the purpose, appeared in the February, 1916, number of the *R. A. Journal*.<sup>7</sup>

In this case the retiring infantry stopped (for many months) where they were at 06.00 on 26th, and the guns had to advance from the position to which they had been ordered.

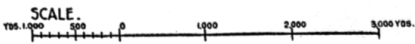
(iii) This phase of the withdrawal is negligible as regards fighting lessons, but full of instructive situations affecting the art of extricating artillery while still retaining its power to support the infantry—though doubtless not to compare with 1914 experiences.

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<sup>7</sup> An abridged translation from the German by Brig.-Genl. H. A. Bethell.



# MAP TO ILLUSTRATE PART I CHAPTERS VI TO VIII



REFERENCE.

ROADS OR TRACKS  
 BRITISH LINES  
 HEADQUARTERS

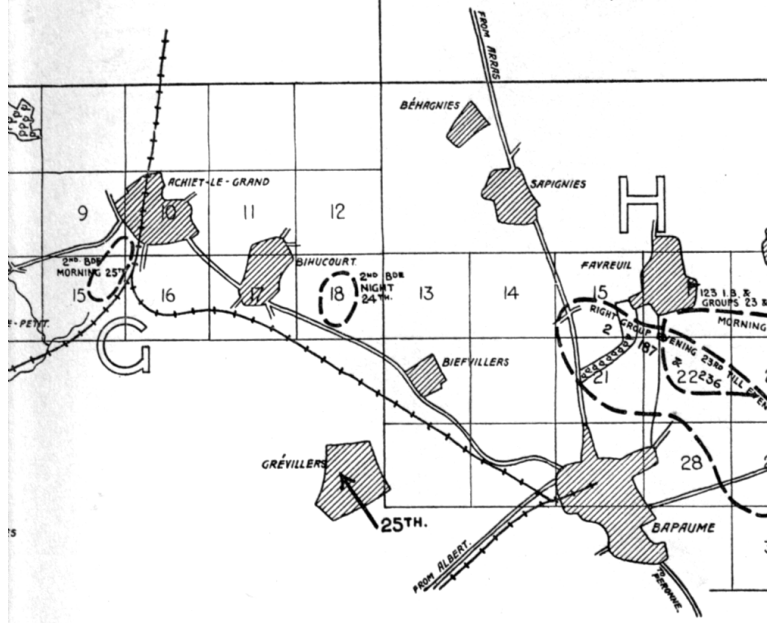
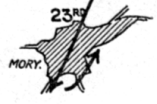
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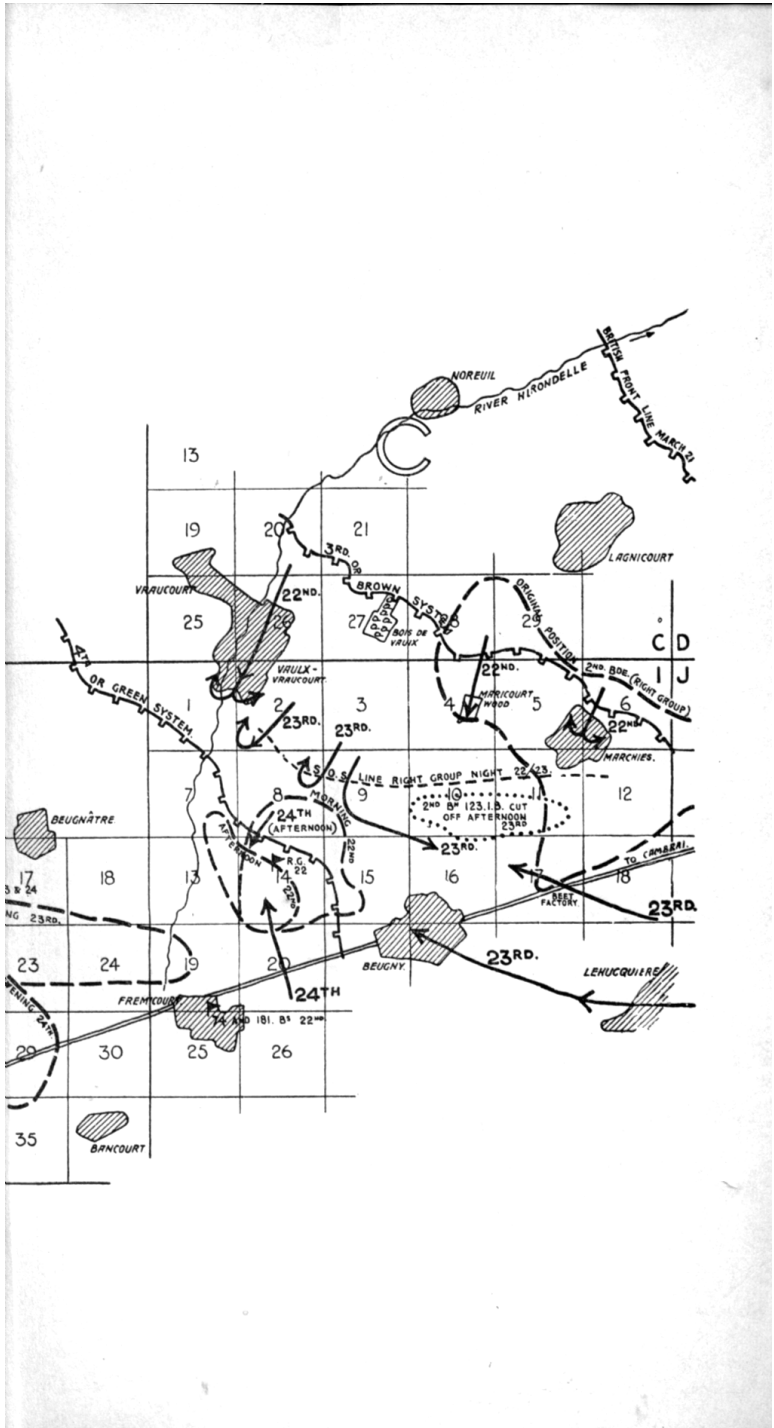
POSITIONS OCCUPIED BY  
 RIGHT GROUP.

APPROXIMATE DIRECTION  
 OF ATTACKS.



B





## TACTICAL STUDY OF F. A. GROUP

The movements and experiences of the wagon-lines since March 21st would take more space to describe than can be granted here.

Though guns, men, and horses had been lost and though no one had had rest, there existed in the batteries a certain sense of elation. Someone meeting them remarked contemplatively, "You ought to be feeling 'down' after a retreat!" The answer lies perhaps in Rudyard Kipling's conditional, "If you can meet with Triumph and Disaster, and treat these two *Impostors* just the same."

With regard to our German criticism,<sup>8</sup> there can be little doubt as to the British Artillery's "splendid service." As to its "bad direction"? After the 21st March there was nothing for the Directorate to do but punctuate the withdrawal and leave the rest to the gods and the men on the spot; the criticism affects, therefore, only the pre-battle ordinances. "Direction" includes the issue *and application* of instructions. There was little enough fault to find with the January Instructions (see Chapter I), except perhaps as regards not laying down an S.O.S. policy; it is when one gets nearer the fighting-man that troubles begin—in other words, it is the carrying into effect of changes in policy, which calls for so much training and character, knowledge of the soldier, sacrifice of advertisement, and concentration on essentials; in the difficulty of application all formations have their share, from even the very formation-commander who has issued instructions to the No. 1 in charge of the gun. The student must judge for himself how far "direction" had shown itself at fault; it is easier to be wise now.

End of Part I.—(To be continued.)

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<sup>8</sup> See Heading, Part I.



# Notes on Report of Demonstration and Test of Ordnance Tractors for 8-inch Howitzer and 155-mm. G. P. F. Gun Equipped with Caterpillar Attachment Units.

BY CAPTAIN G. B. ALLEN, ORDNANCE DEPARTMENT, U. S. A.

THE purpose of the test was to show the relative advantage of the manœuvring ability of the 8-inch howitzer and 155 G.P.F. gun when equipped with caterpillar attachment units over soft, swampy ground.

The test was held on a selected terrain in France during the early part of 1919, in the presence of a board of officers representing the Field Artillery, Coast Artillery and Ordnance Department.

*The following artillery matériel was used for the test:*

- 1 20-ton Artillery Tractor (Holt 120 H.P.).
- 2 10-ton Artillery Tractors (With Armor).
- 1 5-ton Artillery Tractor (With Armor).
- 1 Ordnance Truck Tractor (Militor).
- 1 Nash Quad Truck.
- 1 8-inch Howitzer (equipped with Caterpillar attachment units).
- 1 8-inch Howitzer (with Standard wheels).
- 1 155-mm. G.P.F. Gun (equipped with Caterpillar attachment units).
- 1 3-ton Special Caterpillar Trailer.

## *Description of Tests.*

A number of preliminary tests were made previous to February 24, 1919, and several photographs were taken to illustrate the conditions. Both the 8-inch howitzer and 155-mm.

## TESTS OF ORDNANCE TRACTORS

G.P.F. gun with caterpillar units were pulled by a 10-ton artillery tractor in high gear on hard ground at a maximum speed of six miles per hour, no trouble being experienced in making short turns with the caterpillar units. The guns were taken to the test field and manœuvred over swampy ground without difficulty. One noticeable fact observed proved that the 10-ton artillery tractor is sufficient to pull both guns in difficult places. The 8-inch howitzer, however, requires less effort to trail than the 155-mm. G.P.F. gun.

This perhaps is most noticeable on a steep grade. It was demonstrated that the 8-inch howitzer with caterpillar attachment units was drawn up a short grade of approximately 30 degrees with one 10-ton artillery tractor. Photographs show the howitzer at bottom of grade and at top. Also, a photograph shows the 155-mm. G.P.F. gun at bottom of same grade and a 10-ton artillery tractor attached, unable to proceed further. Two 10-ton artillery tractors attached in parallel by use of chains easily pulled the G.P.F. gun up this grade. It should be noticed from photograph that the line of draw-bar pull does not pass through the mass of weight to be drawn up grade. This is a rather freakish condition, which increases the necessary draw-bar pull greatly; a matter of triangular solution to note the extra draw-bar pull required and increased weight on front wheels. Further tests were conducted by trailing guns through a stream of rather muddy banks with one 10-ton artillery tractor. One photograph taken with enlisted man standing in the stream in front of 155-mm. G.P.F. gun illustrates a position in which the 20-ton tractor was unable to proceed further, due to the inability of the tractor to climb the opposite bank. The gun was uncoupled and the 20-ton tractor pulled from the stream with a 10-ton artillery tractor. By a chain connection the gun was pulled across stream with the 10-ton artillery tractor. Perhaps the most interesting test shown was in trailing guns across a very narrow bridge. The tracks on the 8-inch howitzer extending over each edge about ten inches. Some

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difficulty was experienced in taking the 155-mm. G.P.F. gun across the bridge, as the caterpillar brake-wheel and bracket interfered with a tree, and it was necessary to cut the tree down.<sup>1</sup>

On February 24, 1919, the first operation of test consisted in taking the 155-mm. G.P.F. gun and 8-inch howitzer to test field; both being equipped with caterpillar attachment units and the G.P.F. gun with caterpillar band shoes (cingoli) attached to front wheels, as considerable load rested on wheels, due to weight of trail spades and hydraulic jacks. Each gun was pulled with one 10-ton artillery tractor. It should be noted that after several months of continuous rain the ground was very soft and extremely suitable for caterpillar tests. The howitzer and gun were trailed easily with one 10-ton tractor without making appreciable mark or track over the pasture ground. To show comparative advantages, an 8-inch howitzer with standard wheels was drawn to test the terrain by means of a 20-ton tractor; the howitzer wheels sinking into the pasture ground about eight inches, and tractor operating in low gear. Now a 10-ton artillery tractor was hooked to howitzer with standard wheels, pulling the howitzer about sixty feet. Here, near the stream bank, the howitzer wheels sank in the soft ground until the axle dragged the ground and the tractor was unable to proceed further. As the other 10-ton tractor had developed mechanical trouble, the 20-ton tractor by means of a chain was hooked ahead of the 10-ton tractor, and practically with maximum effort the two tractors hooked in tandem pulled the 8-inch howitzer some one hundred feet, with howitzer axle dragging the ground. Now the 8-inch howitzer with caterpillar attachment units was taken over the same soft ground, following often in the same tracks made by the howitzer with wheels with one 10-ton artillery tractor. This was a very conclusive advantage shown for the caterpillar attachment units.

The next operation of test was to show the manœuvring ability of four wheel-drive trucks. Neither the Nash Quad

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<sup>1</sup> Alterations will probably be made so that the track will be the outermost part of the unit.—EDITOR.



8-INCH HOWITZER, WITH CATERPILLAR ATTACHMENT UNITS, BEING PULLED UP SHORT GRADE OF APPROXIMATELY 30° WITH ONE 10-TON ARTILLERY TRACTOR-HOWITZER AT BOTTOM OF GRADE.



8-INCH HOWITZER AT TOP OF GRADE.



155 MM. G. P. F. GUN, WITH ONE 10-TON ARTILLERY TRACTOR ATTACHED, AT BOTTOM OF 30° GRADE UNABLE TO PROCEED FURTHER. TWO 10-TON ARTILLERY TRACTORS HITCHED IN PARALLEL PULLED GUN UP GRADE.



155 G. P. F. GUN IN A POSITION FROM WHICH 20-TON TRACTOR WAS UNABLE TO PROCEED FURTHER DUE TO INABILITY OF TRACTOR TO CLIMB OPPOSITE BANK. PHOTOGRAPH ALSO SHOWS CHAIN CONNECTION BY WHICH GUN WAS PULLED ACROSS STREAM WITH 10-TON ARTILLERY TRACTOR ON OPPOSITE BANK.

## TESTS OF ORDNANCE TRACTORS

nor Ordnance truck-tractor (Militor) without load were able to proceed through the soft terrain, as the wheels soon sank to axle, retarding further progress of the trucks. The Nash Quad was able to go further, perhaps, due to lighter weight. Both trucks were pulled out with the 5-ton artillery tractor.

The 5-ton artillery tractor was now hooked up to the 2½-ton caterpillar trailer, with approximately one-ton load, and manœuvred through the soft terrain without difficulty, this showing a distinct advantage for hauling ammunition in very soft places in which it is entirely impossible for trucks to operate at all.

In all the tests only one 10-ton artillery tractor was necessary to pull the 8-inch howitzer or 155 G.P.F. gun, except on a very steep grade.

### *Mechanical Discussion.*

(a) 155 G.P.F. gun:

Approximate weight of gun .....	28,000 lbs.
Approximate weight of caterpillar units.	10,000 lbs.
Approximate weight of wheels and brakes removed (—) .....	2000 lbs.
Total weight of gun with caterpillar units .....	
	36,000 lbs.

(b) 8-inch howitzer:

Approximate weight of howitzer with wheels and limber .....	21,000 lbs.
Approximate weight of caterpillar units.	10,000 lbs.
Approximate weight of wheels and brakes removed (—) .....	5000 lbs.
Total weight of howitzer with caterpillar units .....	
	26,000 lbs. <sup>2</sup>

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<sup>2</sup> Certain modifications will probably be made as a result of the test, but all are of minor importance.—EDITOR.

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### *Summary of Tests*

(a) The 8-inch howitzer with caterpillar attachment units has far greater manœuvring ability over soft, swampy ground, and the speed over hard roads may be maintained as formerly. The 10-ton artillery tractor will practically pull the howitzer through any reasonable condition of terrain. It is believed that the additional weight of approximately 5000 lbs. may be somewhat decreased. The unit ground pressure per square inch may not be but slightly less than unit pressure on tractor.

(b) The 155 G.P.F. gun with caterpillar attachment units has greater manœuvring ability over swampy terrain, and was pulled successfully with one 10-ton artillery tractor except on steep grades. It seems that the addition of approximately 8000 lbs., to relieve only the rear end of the gun, is excessive, and if more weight of tube and cradle could be shifted to the rear axle the advantages of caterpillar attachment units would be greater.

The chief advantage, at present, is due to the fact that the caterpillar units prevent the rear axle from sinking into the mud, which formerly made the gun very difficult to pull through soft ground. The gun may be pulled on hard roads at six miles per hour with a 10-ton artillery tractor. With caterpillar attachment units, test shows that the 155-mm. G.P.F. gun required more draw-bar to pull than 8-inch howitzer, and undoubtedly is due to the greater weight.

Caterpillar attachment units by test have been shown to be a great improvement over the standard wheels, but further tests and development should be conducted before finally approved.



TRAILING 8-INCH HOWITZER ACROSS VERY NARROW BRIDGE, SHOWING TRACKS ON HOWITZER EXTENDING OVER EACH EDGE ABOUT 10 INCHES.



155 MM. G. P. F. GUN EQUIPPED WITH CATERPILLAR ATTACHMENT UNITS AND CATERPILLAR BAND SHOES (CINGOLI) ATTACHED TO FRONT WHEELS TO SUPPORT WEIGHT OF TRAIL SPADES AND HYDRAULIC JACKS.



# "The German and French Field Artillery at the Beginning of the War."

BY MAJOR GENERAL ISBERT, RETIRED.\*

THE recent publication under the title of "Die Schlacht bei Longwy" (The Battle of Longwy) of Part III of the work "Der grosse Krieg in Einzeldarstellungen" (The Great War in Monographs) gives me an opportunity to define my position in regard to the question whether, as was said in the essay of Lieut. General Rohne, in the May–June number of the *Artilleristische Monatshefte*, the war has clearly shown that the French Field Artillery was really "markedly superior to the German, not only in armament, but also, which is much more important, in the use of the armament." This "fact" is acknowledged by unprejudiced officers without any hesitation.

The fact that one may be unprejudiced, and yet hold an entirely different opinion, has already been shown by the arguments of the author of "Rückblicke" (Retrospect), which was published in the September number of the *Artilleristische Monatshefte*, and is well known to all readers of this periodical. I, too, have tried, on the basis of my personal experiences, to form as unprejudiced an opinion as possible concerning the question brought up here. I must, however, frankly confess that I cannot consider myself qualified, on the basis of these experiences alone, to express an opinion of such import as the one contained in the sentence quoted above, even if I understand as included in my personal experiences not only what I myself have experienced, but also what I have heard from associates capable of forming a judgment. I have, on the contrary, reached the conclusion that all the circumstances are not yet sufficiently cleared up for us to be able to speak of a "proved fact."

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\* Translation from *Artilleristische Monatshefte*, February, 1920.

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First of all, the question of armament. It cannot be denied that the French field gun was superior in regard to ballistics to our 1896 n.A. field gun. Now, of all the field guns with which I have become familiar, the 1902 Russian field gun undoubtedly has the best ballistic results to show. In spite of this, however, I have never yet heard, and indeed hardly any one will wish to assert, that the Russian field gun was superior to the German or the French. The value of a field gun is, in fact, not to be judged entirely by its ballistic efficiency. But it would unquestionably have been easy for our highly developed industry to have provided the German Field Artillery with a gun which need not have been inferior to either the French or the Russian guns in regard to range and accuracy of fire. There is no question, however, that, according to the views which prevailed before the war among the higher officers, as well as among the troops, a field gun which would have made possible an increase in range of about 2 kilometres at the expense of an increase in weight of 100 to 150 kilograms, would have been unconditionally rejected.<sup>1</sup> In the manœuvres of 1911 I was obliged to experience personally how little value was placed at that time on the long ranges of the field artillery even by the Command. When I, with my mounted group, shelled at that time the main body of the enemy in column of march from about 4000 m, I was blamed for this in the criticism of the commanding general, with the remark that I should use the ammunition to better advantage by shooting from distances of less than 3500 metres.

The fact that the 1896 n.A. field gun did not have a sufficiently long range was, moreover, a defect, which, in the main,

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<sup>1</sup> The author admits here that a mistaken opinion prevailed among the higher officers as well as among the troops. Mobility was too highly valued at the expense of effectiveness, as I have already emphasized in a previous number. A grave mistake which was soon recognized, but, unfortunately, too late! For the light field howitzer (which is only two years younger, and on the mobility of which the same demands have to be made as on that of the 1896 field gun) is, in firing position, 145kg, and equipped for the march, as much as 210 kilograms heavier than the field gun. I do not doubt in the least that German private industry would have constructed a field gun just as effective as the French 75 mm. gun if such a mistaken limitation in regard to weight had not been imposed upon it.—THE EDITOR.

## GERMAN AND FRENCH FIELD ARTILLERY

first became apparent in trench warfare,<sup>2</sup> and which so far as I know, was never brought out by criticism before the war. In other respects, however, the 1896 n.A. field gun proved itself entirely satisfactory. In the first period of the war, especially in the battles which lasted for months at a time without interruption, this gun had necessarily to be exposed to and endure treatment which in peace times would never have been considered as even approaching a possibility. Mr. M., in the essay mentioned above, has already emphasized the fact that we had in our armament many better guns than the French had, above all the excellent light 1898/09 field howitzers to which the French had, in general, nothing of equal value to oppose.

A comparison of the field guns on both sides, which would be free from objections to some extent, would, in my opinion, only be possible in the main, if these guns could be tested for effectiveness by an impartial commission, under conditions as nearly as possible the same, corresponding to the purpose for which they were to be used. But even then I believe opinions in this commission would differ very much as to which gun deserved the preference.

I had the pleasure of including Mr. M. among my subordinates during the first two years of the war. He was in command first of a battery and then of a group (Abteilung) of my regiment. The regiment was stationed in the front line, almost without any interruption whatever during these two years. During this long time I learned to know and value Mr. M. as an unusually skillful artillery officer who was quite equal to any situation, no matter how critical. I need say nothing to the readers of the *Artilleristische Monatshefte* in praise of his knowledge and his ability to form judgments. Now, when an artillery officer, so highly trained in the very best sense, both theoretically and practically, and such an excellent authority on the German and French artillery matériel, says, on the

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<sup>2</sup> The fact that the short range of the German field gun was found to be a disadvantage, even in open warfare, is shown very clearly in the essays of Major Seeger concerning the activity of the 15th (Field Artillery) Regiment which are published in this number, and are to be published in the following numbers.—EDITOR.

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basis of more than four years' experience in the war on the various western and eastern fronts, that, if he had a choice of going into the field with the German 1896 n.A. gun or with the French M 97 field gun, he would always give the preference to the former, this gives us much ground for thought.

I cannot, in any event, regard it as a proved fact that the French Field Artillery was at all superior to the German in regard to armament, not to say markedly superior.

Now, as to the question of use.

If two wrestlers are wrestling together, an impartial spectator can certainly judge pretty accurately which of the two is the better, provided he sees that both are wrestling under the same conditions, although even then a momentary indisposition on the part of the inferior one may have led to an accidental result. In a battle, however, if one artillery silences the other, we can only express an opinion, possibly correct to some extent, concerning the question whether the artillery which was victorious in that instance, is really superior, provided we have an exact knowledge of, and can accurately weigh, the situation of the enemy's forces, as well as the manifold other conditions under which the battle took place. But we lack for the present, in my opinion, the most important and indispensable foundations for expressing such a judgment that the French Field Artillery was markedly superior to the German at the beginning of the war.

Part III, concerning the battle at Longwy, mentioned above, which was edited from official sources, that is, from the best information available at the present time, does not by any means indicate any superiority of the French Field Artillery. The reader may judge for himself from the following literal extracts from this work:

Page 33, VI Army Corps.—"Major von Mellenthin, with the 1st Battalion of the 6th Regiment, the 2nd battery of which, under Lieutenant Hiltrop, especially distinguished itself here, was able, indeed, to cover the enemy's batteries at Mesnil from a position at Ansart in such a way that 36 guns were put out of

## GERMAN AND FRENCH FIELD ARTILLERY

commission, and he thus afforded great relief also to the 12th Infantry Division." . . . "Guns of the Schönfelder Battery of the 42nd Field Artillery Regiment were drawn up to the Infantry front line (Schützenlinien)." . . . "The attempt of the enemy to outflank us was frustrated chiefly by the Materne Battery of the 42nd Field Artillery Regiment, which had a wide field of fire. Thrown into disorder, the attacking force passed through towards the east in confusion."

Page 28, V Army Corps.—"The battle, with its many fluctuations, had also cost the artillery many losses. . . . The 56th as well as the 20th Regiment, heavily shelled in an exposed position, yet did very effective work. The silencing of the enemy's batteries proved this. Munition trains which were forced to halt the other day on the road from Ethe to Gomery had leisure enough to closely examine the effect produced by our artillery. Guns and wagons shot to pieces lay between great heaps of dead horses. . . . It had been a sudden annihilation, like a stroke."

Page 36, XVI Army Corps.—"Before the assault of the von Estorff Brigade, under the accurate fire of the 1st Battalion of the 69th Regiment, the enemy evacuated the heights east of Joppecourt."

Page 40, VI Army Corps.—"In Rossignol the artillery, which had been shot to pieces, blocked the southern end of the road and caused considerable delay."

Page 42, XIII Army Corps.—"The fire of the artillery set Montigny-sur-Chiers in flames, and was then concentrated on the hostile positions on the southern bank of the Chiers. The enemy retreated, forced to give way by the annihilating effect of the fire."

Page 50.—"As new batteries of the V Reserve Corps, springing up, opened a flanking fire on the village from Bois de Serupt, the enemy began to give ground."

Page 52.—XVI Army Corps.—"The German Artillery was more carefully concealed in the terrain than formerly. It opened fire several hours before the infantry attack. The

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enemy returned the fire, but hit nothing. . . . The hostile batteries were at least partly silenced by the concentrated fire of our batteries. The artillery vied with the infantry in willingness to sacrifice themselves. The 1st Battalion of the 33rd Regiment met with heavy losses when, in answer to urgent appeals from the Infantry, it supported the advance of the Infantry from an exposed position. At Bois Reverdel the 67th Regiment had to repulse a strong French attack. There Lieutenant Colonel Isbert moved forward three batteries of his 69th Artillery Regiment to an exposed position and brought the enemy's attack to nought."

Page 53.—"Continued pressure on Nouillon Pont called forth a French relief attack from the direction of Spincourt. Once again Lt. Colonel Isbert brought against them, in the quickest way and with the most favorable effect, the first batteries he could procure, this time those of the 9th Reserve Field Regiment."

Page 59.—34th Infantry Division: "As now, south of this place, the enemy began to weaken under the excellent effect of the artillery, and finally fled in disorder."

Page 67.—"About 7 A.M. the support given by the artillery of the 13th Army Corps became noticeable. The enemy was completely dominated."

The fact that the good effect produced by the French artillery is repeatedly mentioned in this work is a proof of the impartiality with which it was written, yet, as every reader of the book will be convinced, it does not in any way shift the picture to the disadvantage of the German Field Artillery.

More than five German army corps from the most diverse regions of our Fatherland took part in this momentous battle, which, in the words of Part III, decided the question that France, not Germany, was to be the future theatre of operations. According to the results obtained in this battle, we cannot really say that the German Field Artillery was inferior to the French in the use made of the guns. We might rather adopt the opposite view, especially if we were of the opinion that the

## GERMAN AND FRENCH FIELD ARTILLERY

French had better guns and ammunition, and if we took into consideration the fact that they had the advantages of being on the defensive and of fighting in their own familiar country. Nevertheless, I do not think of considering such an opinion even partially justified, chiefly because the condition of the enemy's forces has not been clearly established, and also because in every military success all kinds of accidental occurrences ("luck") play an important rôle.

To take only one example at random: What would have happened if my enterprise mentioned on p. 6 had miscarried, if the batteries necessarily coming into action in exposed positions had been shot to pieces while doing so? Then the case would probably have been cited as another proof of the "fact" that even with us the use of artillery had not yet been perfected, and that it was too dangerous a hazard to go into action against such artillery as the French in such a careless way. The regimental commander who did this would perhaps gain the reputation of a man who took chances ("Hazardeur").

The opinion that the French Field Artillery is markedly superior to the German in the use of the matériel has clearly resulted from the fact that the French artillery was, as a general thing, completely masked, and therefore we often had great trouble, and frequently did not succeed in discovering it and engaging with it. Now, if it were really established that the French artillery from its masked positions produced the required effect at the right time against the right objective, then one could at most, conclude from this that good use had been made of it. Yet even then we could only conclude that the use the French made of their guns was superior to ours, if it were established that ours was faulty in the majority of cases. In this connection it would always have to be taken into consideration that the French, as I have already mentioned, usually had certain advantages over us, which are not at all to be underestimated.

Now, if, especially at the beginning of the war, German Field Artillery was repeatedly stationed in exposed positions

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opposite masked French batteries, and repeatedly met with heavy losses, who can say, however, that this is to be traced in the majority of cases to wrong or even to faulty use of the guns? If on August 22nd the batteries of the 56th and 20th Regiments were heavily shelled in exposed positions and suffered heavy losses (and, nevertheless, did such excellent work), who can term it a mistake in the use of the guns that they were, in general, moved into exposed positions?

In his essay in the September number Mr. M. mentions how on September 1st, 1914 (not on September 2nd as was said there), during the crossing of the Meuse, the twenty-three field artillery batteries of the XVI Army Corps were obliged to move into positions, exposed for the most part, in the face of hostile batteries, stationed in masked positions directly in front of a narrow passage, through which all the batteries had to pass one after another. We were driven there to tactics of the most primitive kind. The rounds of the enemy's artillery came from the west, south and east. It was impossible to move into a position behind the narrow passage; in front our infantry was in danger of bleeding to death, so there was nothing else to do but to lead our batteries through the opening, and to set them up like mushrooms, as well or as poorly as might be. It was a hazardous exploit, which in manoeuvres would have led to the exclusion from battle of the whole field artillery of the XVI Army Corps, without any hope of rescue. No umpire could have decided otherwise. But in the situation, as it was at that time, it was entirely out of the question to do otherwise. Mr. M. has already related how well this manoeuvre succeeded. If, however, it had failed, then the statistics concerning the faulty use of the German Field Artillery would doubtless have been enriched by an especially gross case.

I do not know how all the other cases may have occurred which have given rise to the opinion of the marked superiority of the French Field Artillery in regard to use. I am convinced, however, that many of them might be explained and justified in a manner similar to the case mentioned here. In saying this



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I, as a matter of course, do not wish to deny that mistakes have also often been made. Mr. M., however, has already mentioned in his essay, that, even with the French, catastrophes occurred with artillery in exposed positions, and in Part III this is shown above all by the results obtained by the von Millenthin group (p. 4) and the effective fire of the 56th and 20th Regiments, described on p. 5.

In all comparisons between the performances of our artillery and the enemy's, one must always think of the saying of Napoleon: "We always see our own misfortunes, but hardly ever those of the enemy." If infantry has to suffer heavily under hostile artillery fire, they will always reproach their own artillery because they have not protected them better, and they will consider the enemy's artillery superior. This is but conceivably human. In my opinion, however, one could speak of a superiority, which has been actually proved, only when one could form a positive judgment concerning the situation and the condition of the forces on both sides.

Mr. M. has already mentioned, moreover, that the French artillery, in spite of its alleged superiority, had to endure the bitterest reproaches. I might here recall once more the reproaches which the Frenchman Hervé uttered in the *Victoire* of June 17, 1917, which he dared to utter in a country where the censorship was managed with severity, such as we did not even approach:

"It is also especially regrettable that since the last offensive at Craonne the complaints of the Infantry concerning the Artillery have again (!) noticeably increased. These complaints are so numerous, clear, and determined that the High Command would do well to start an investigation. It would then hear the same statement from all sides—that our Artillery, in spite of all liaison signals, has continually shelled our own Infantry."

In conclusion, a few more words concerning the shooting of the German Field Artillery. With regard to this also very unfavorable opinions have been expressed. Among the infantry, especially, it is almost an article of faith that the French shot

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far better than we did (compare in regard to this the above statement of Hervé).

It is, therefore, doubly gratifying that in Part III, on the basis of official reports, indisputable instances of the remarkably good shooting of the German artillery, and, specifically, the Field Artillery, have so frequently been brought forward, shooting which often had a determining influence upon the result. In this regard I refer once more expressly to the extracts from Part III made by me, and thereby I wish to underline, besides the achievements of the active regiments, especially those of the batteries of the 9th Reserve Field Artillery Regiment. If one considers that this was the first battle in which all these batteries took part, and that their commanders therefore could not have acquired their marksmanship through their own war experience, but owed it, in the last analysis, to their peace training, we are forced to the conclusion that the German method of training in shooting cannot be so behind the times as has often been asserted, and also that our last gunnery regulations do not deserve the harsh judgment which has recently been passed upon them in this periodical.

To sum up: The German Field Artillery may look back with just pride on its achievements in the Battle of Longwy, so momentous for the course of the war.

It showed in this battle that it need not avoid comparison with the French Field Artillery in any respect, either in regard to the use of the guns or the shooting.

### [LIEUT. GEN. ROHNE'S COMMENT.]

I wish particularly to establish the fact that in my essay, which led to these replies, only the defective scientific training of the officers of the German Field Artillery was discussed, and that no fault whatever was found with the behavior of the troops in the face of the enemy. Indeed, I expressly emphasized the fact that it only redounded to the honor of the arm to have held its own in the war, in spite of this, and to have learned much under difficult circumstances. But it is evident to me that

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with better artillery training of the officers, much better results would have been obtained. This deficiency, however, is the fault, not of the officers, but of the system.

The Higher Command is principally responsible for the mistakes in the use of the artillery. It often did not trust the artillery enough; certainly not without fault on the part of the artillery, to which I referred in my comments on the second essay of Mr. M. It is extremely difficult, perhaps even impossible, to lay down definite rules in peace which must be unconditionally followed in war. In every war things have appeared which could not have been anticipated and which force us to deviate from the regulations. The only thing that can be settled is, what must not be done in battle under any circumstances. For example, in the French artillery the principle was established that exposed battery positions were only to be chosen when the mission in question could not be accomplished from a masked position. Consequently, the French artillery was thoroughly trained in occupying masked positions, and in the measures required for opening fire. In our great troop exercises masked battery positions were often taken, it is true, but on account of the rapid course of the battle in these exercises it was seldom possible to make the preparations as thoroughly as the real case would have required. The "courage to go slowly" was lacking (and the individual should not be reproached for this in the slightest). This was the courage that General Endres, the Bavarian liaison officer, who unfortunately died too soon, once demanded. The French artillery officers did not need it, for the Command always left the artillery the necessary time for reconnoitring and preparation. The German regulations (line 395) also required this, it is true, but it remained mostly on paper.

The author goes into details concerning the exposed positions occupied by his regiment. Naturally I cannot judge whether the missions might not have been accomplished as well from masked positions, but I shall be glad to assume that this was impossible. It remains surprising, however, that not only

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his regiment, but also the batteries of the 20th and 56th Regiments had to come into action in exposed positions, and thus suffer great losses. Here mistakes, not of the artillery, but of the infantry are apparently shown. The infantry in its would-be brilliancy of leadership rushed so far forward that only swift, not to say headlong, assistance could rescue it. Then even the leadership failed. Let us leave it undecided whether it was the fault of the Commander of the Division or of the Commander of the Artillery Brigade, who should have drawn attention to the fact that such a runaway infantry could not be properly supported by the artillery.

H. ROHNE.

# Operations of the Horse Battalion of the (German) 15th Field Artillery, Bapaume, Autumn of 1914.\*

BY MAJOR A. SEEGER.

AFTER the operations about Roye and Lassigny, our 7th Cavalry Division was ordered to move north, and, in conjunction with other cavalry forces which had arrived meanwhile, to cover the right flank of the army, which was exposed from Amiens northward. It was to be expected that we should encounter, not second-rate troops as heretofore, but solid French fighting forces, as well as the English troops which were reported as on the march. The next few weeks, then, were to prove as strenuous as the past ones, since the enemy's strength was constantly increasing.

On September 25th the 21st Army Corps relieved us at Ercheu, and we took leave of the comrades with whom we had participated in firing exercises at Hagenau just before the outbreak of the war. We were fortunate enough to come in touch briefly with our own regiment, which we had not seen since mobilization. How differently things had turned out, from what we had imagined on the little antiquated firing ground of our little Alsatian garrison! How infinitely stern was actual warfare, as compared to what our peace manoeuvres had taught us! How much greater were the ranges which we had to use, even from the first days! How full of surprises were our efforts at artillery reconnaissance; and how difficult was ranging, when only three months before one was seriously criticized if he did not get his bracket in six or eight shots! War is the best teacher; those officers who seriously meditated on the events of August, and tried to draw conclusions from them, were able to continue the training of their troops intelligently,

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\* Translated from the *Artilleristische Monatshefte*, April-May, 1920, by Lt. Col. O. L. Spaulding, G.S., U.S.A.

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and keep somewhere near the requirements made upon them. My horse batteries had rapidly acquired skill in the new situations, and enjoyed the full confidence of the division. But every day brought something new and unexpected, always requiring sound judgment, rapid decision and bold action.

We assembled that day at the little village of Esmery-Hallon, in Picardy, between Ham and Nesle. It was supposed that we were to make only an ordinary route march, a welcome relief after the daily battles. Our horses had already suffered, and we had lost many, especially of the new ones received from Lorraine on mobilization, which were not all of them up to the rapid movements of a cavalry division. But those that had come through so far were all reliable, for war soon separates the fit and the unfit.

But at the very outset we found that our endurance was to be tried, for we were to march in the main column of the division. This in itself troubled us somewhat, for cavalry, when it takes up the trot, expects the same rate of march of its artillery as of the cavalry regiments, even in broken country. Peronne, which we were to leave on our left, it being almost in the fighting zone, was plainly in view, lying peacefully in the beautiful Somme valley. We were to get across the main roads leading into it, especially the one from St. Quentin, as rapidly as possible, so as to leave them clear for the 1st Bavarian Corps, our comrades in the first actions in Lorraine.

Our first objective for the day was the vicinity of Bapaume, which we expected to reach late in the afternoon. But as usual, it happened otherwise; for instead of a long but unmolested route march we had a day of great excitement and hard fighting. Hardly had we come in sight of Peronne, when orders were received to turn at once toward the west, to protect the city from imminent danger from hostile flying columns of cyclists and cavalry. Since the main body of the Bavarian infantry could not come up in time, and its advance-guard was already heavily engaged, we were called upon, as usual, to fill the gap.

Our division, then, upon the appeal of another cavalry division

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already engaged, hastened to Flaucourt, about seven kilometres west of Peronne and south of the Somme. From here, our good glasses gave us our first view of the khaki-colored English, deployed north of the river and trying to advance against the Guard cavalry, which, with its artillery, was forming a barrier of fire. We were to fire into the flank of the hostile line; but it was evident that the range was too great, for the enemy just north of the Somme, at Curlu and Clery, was over 6000 metres distant. Under the scanty protection of a few friendly cavalry detachments, we were to approach nearer the river, for the first few shots from Flaucourt were lost in the deep, swampy valley.

Now it is a ticklish matter, even for horse artillery, to venture too far forward when hostile contact is expected, before a definite zone is reconnoitred and found clear; and unfortunately we could not count on all the cavalry regiments of the division to protect us against surprise in an exposed position. With some of them we knew we were safe, but others often sent reports which afterwards proved to be erroneous or exaggerated. One of my batteries worked forward Indian fashion, and perhaps too boldly, toward the village of Horbecourt, two kilometres to the north; hardly had it come into position, when the usual foam-covered horseman dashed up and reported that a hostile battalion had crossed the Somme hardly a thousand metres away, and was advancing against the battery deployed. Who was to be believed—one's own eyes and field-glasses, or a cavalryman without map or knowledge of the country, who reported having seen something indefinite somewhere or other? Not to be caught napping, the battery limbered up again, and under the protection of half a dozen Uhlans reestablished connection with the battalion, without gathering the laurels which seemed in its hands. Hardly had it reported back, when the original report was found by a reliable officer to be entirely false; and great was our anger at the constant repetition of this sort of thing. Again had a bit of initiative been rendered useless; this is what leads officers, only too easily, to wait for orders

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for everything, and to restrain their own initiative. But without this initiative neither cavalry nor the artillery assigned to it can get good results.

On this same day one of our best patrol leaders, a Würtemberg dragoon officer, had the misfortune to be cut off on the other side of the Somme, during this reconnaissance of the enemy's southern flank. All efforts to get back by detours failed, for all the bridges were in the hands of the enemy. He therefore decided to swim the Somme at night, which he succeeded in doing, leaving his horse behind. But when the exhausted and dripping swimmer reached the shore he was met by hostile outposts, which he could not escape. Four years' imprisonment on Corsica was the result of this experience, which falls only to the boldest.

The sun was already low in the sky when we made our way back to the division to receive the evening orders. My batteries were in position at wide intervals, firing at long range and without much effect. We could, however, observe very clearly the exposed flank of the enemy, almost from the rear, and see the impact of the shell and the smoke clouds of the shrapnel, which the batteries of the Guard Cavalry Division were firing at the enemy's cyclists. It was like lateral observation at firing practice, following the firing from a range tower; only, unfortunately, we had no telephone or visual signals to report the effect.

We had very soon discovered that the regulation allowance of wire, two kilometres for each battery and two for the battalion, was nowhere near enough for even the most urgent necessities. In peace time, with but few observation stations and those near at hand, it would serve; but not when, as army advance-guard, we had such distances to cover and such areas to control by fire. A great deal of wire was left behind every day, with or without fault of someone; much was cut up by our own or the enemy's fire, or was removed without authority. Soon we had nothing left but patched-up bits of cable. New supplies never came as quickly as they should, and this applied especially to the all-important telephone equipment, for which



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the demand was enormous even in 1914. The divisional telephone detachment gave us splendid assistance, working tirelessly and with the best of spirit; I am still grateful to them, even after six years. They not only repaired our wire, spliced on pieces, and repaired our telephone instruments, but they gave us everything that they could possibly spare to keep the battalion in fighting condition. We got from them very welcome supplies of so-called cavalry wire, single-strand, uncovered wire, insulated with some sort of varnish. It was easy to transport, and a considerable length could be carried by a single mounted man; in good weather it would last for weeks, and even in rain for several days. The best of it was, that when we were done with it we could leave it behind; it was too brittle to take up. We could lay many kilometres of it in a day, and so could develop a wide net of observation stations, just as we did later in position warfare, under different tactical conditions, and less efficiently. As we found out later from captured papers, and as we learned on the battlefield, the French artillery seems to have done more in this line than we in time of peace; for they habitually used more than one observation station for a battery, even in manoeuvre warfare, as we ourselves soon discovered to be necessary.

At Flaucourt, instead of orders to withdraw, we received a new and important task, which led us into the lines of the Bavarians, heavily engaged at Dompierre. Here the line was stretched so thin that there was danger of its breaking; and again the nearest cavalry had to help, since there was no infantry available. So our Uhlan brigade, and with it my battalion, were sent there in haste, although I pointed out that we could not get there before evening, and even so would probably be of no use. But the orders stood, and "we marched at a trot to the sound of the guns."

At Dompierre, the Bavarians were getting on very well, and said they could do without the assistance of the artillery if it was more needed elsewhere. As ill luck would have it, hardly an hour before a heavy shell had fallen in the courtyard of the

farm where artillery headquarters had been established and killed or wounded most of the officers there, including the brigade commander. The whole mechanism was thrown out of gear, and things looked discouraging until a new staff was organized and the chain of command reestablished. My batteries went into position along with the Bavarian guns; preparations were made to open fire in the morning, for it was already dark and we could accomplish nothing that day. I had forbidden my batteries, once and for all, to fire upon an area without a definite target, even if the infantry asked for the fire to steady their men; the ammunition supply did not permit it. It was often hard to tell what to do—our orders from the army and the wishes of the troops were often in contradiction.

Arrangements were soon made for the night. Both men and horses were exhausted from the heavy day's work, and the rich village furnished quarters, rations and forage for all. Then came new orders. We were to return to the division, ten kilometres away, which had itself just received a new task—to assemble on the main St. Quentin-Amiens road, withdraw from the territory of the Bavarian corps, and find quarters between Peronne and St. Quentin. This meant a night march of something like six hours, which seemed a physical impossibility with our tired-out horses. In vain I asked permission to remain for the night and rejoin in the morning; the order stood. The bivouac was broken, and the night march began—the worst I ever saw, unless it be one at the end of August, 1914, when we, lying before Epinal, had to make a night march by Luneville to the Rhine-Marne Canal. Night marches with infantry, either in peace or war, are never pleasant; with large bodies of cavalry they are simply hell.

Heavy supply trains were moving in the opposite direction, and blocking the roads. Our column, seven kilometres long, was being constantly broken, for men and horses were so tired that they fell asleep at the slightest halt, and could be kept going only by patrols, acting as shepherd dogs. We would make a short distance at a trot, then everything would stall; and

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the same thing was repeated innumerable times, until at four o'clock, absolutely exhausted, we reached the village of Vraignes, where we roused the inhabitants to make room for us for a short rest. In the morning we were almost immobilized; one battery had to leave behind thirty horses. I reported to the division that if this went on they would soon have no artillery, but headquarters entrenched itself behind orders from higher up, which is a very convenient scheme, but does not serve to keep up the efficiency of the troops.

The bounds of possibility had long been passed; a few days more, and I could not see how we could horse even the guns. Caissons were falling out all the time. Requisitioned horses from the country helped little; at this rate of travel they lasted hardly a day, not being accustomed to it. The losses in horses were soon enormous, new ones being requisitioned after great efforts, only to be left behind in a few hours. These days, moving up toward Bapaume, are the darkest in my memory; not even in Galicia did we have such marches to make, for by that time everyone had come to a slower rate. But in 1914 the cavalry was still "flying."

Unfortunately, although excusably, two of my batteries paid no further attention to the horses that fell out, following the saying of our hard-hearted General Staff officer, "What falls behind, stays behind." But the third, whose senior lieutenant was a fine horsemaster, and greatly attached to his old horses, which he had trained with such care for years, would not abandon one of them. He detached a reliable sergeant to look after them, giving him the simple order to follow as best he could when the horses could travel. After a few days, when we got a little rest, he brought most of them up again, in fair shape, and the battery nursed them back to condition again. It had its reward; the last of the old horses did not give out until the Roumanian campaign, when the guns had to be "horsed" with oxen, slow but sure, to get them over the Carpathians. There this officer himself fell—Captain Von Chappuis, well

known as a horseman both within and without Germany, a gallant soldier and a first-class artillerist.

At Cartigny, on the Cologne, seven kilometres east of Peronne, we assembled in the morning after only four hours' rest. The distance lost by the episode of the previous day had now to be made up by increased speed of marching; of course, to our great satisfaction. We were getting to prefer constant fighting, to this eternal marching, reconnoitring, going into action, limbering up again and moving on, giving special entertainments here and there, wherever we were called for.

Our way this day led us through the country which afterward acquired such bloody renown in the battle of the Somme. It was still unharmed and rich, like all of this well-cultivated Picardy country. We passed town after town, whose names will all live in German military history—Bouchavesnes, Moislains, Mannancourt, Sailly-Saillisel, and Etricourt. The sound of the guns grew louder; the division next to us, which included the splendid Danzig grey horse brigade commanded by the Crown Prince shortly before the war, had gone into action against French territorials, and was driving them. They generally put up little resistance, either against our artillery fire or against the attacks of our cyclists and riflemen, which were, almost without exception, fine troops. The more we had of these the better we liked it, for it is a joy to the artilleryman to go into action with reliable and enterprising troops, who are not always glancing back at their horses when things grow a bit hot. The action is more serious; one stays in position longer and does more effective shooting. When foot troops are once engaged, they generally carry the fight through to an end, while in the nature of things a cavalry action is more fleeting.

After another long march, it was getting toward sunset when we got our usual orders for action. Two of my batteries came into position on the edge of the village of Bus, ten kilometres southeast of Bapaume, and opened fire upon infantry on a broad front, falling back toward Bertincourt and Haplaincourt. Just at sunset we began to get effect upon them with

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shrapnel; then came orders to cease firing, for German reinforcements, the advance-guard of the Fourteenth Reserve Corps, were expected from Cambrai, and we did not want to impede their march by our fire. This was well meant, of course, but I felt it advisable to settle definitely with the enemy we had already engaged, whose red trousers were still clearly visible in spite of the dusk, and not give up advantage we had already won because friendly troops might turn up later in that direction. So, as usual in cases of doubt, I had a personal conference with the division commander, and got permission to continue the fire upon the red-legs as long as we could clearly see them. To be perfectly safe, I sent forward my adjutant, who quickly laid several kilometres of the cavalry wire, and directed our fire from an advanced station until it was dark, when he reported that the enemy had disappeared in Bertincourt. I then telephoned him to cease firing at once, for that town had been assigned to us for quarters that night. This sounds strange, but was correct. The order would have been thought impossible in peace manoeuvres; but we assumed that after their unsuccessful fight the French would continue the retreat. This was partly true. About ten o'clock we reached our quarters, which had been reported by patrols as clear of the enemy, but found a few stragglers there, who, for their own safety, tried to defend the village.

We finally got in, however, and took possession of the completely installed mess of a French battalion headquarters, which had been there the night before, and had evidently expected to return for that night. We were especially pleased to get their excellent canned goods, much better than ours, which all tasted alike. We also appreciated their neat little officers' trunks, although I would not allow the amount of our baggage to be increased. At that time commanding officers had to be constantly on the watch, or all sorts of useless things would be put on the wagons. At inspections of baggage we would find whole uniforms, such as those of the Spahis and Chasseurs d'Afrique,

which came from God knows where, and had to be instantly discarded.

The German troops reported on the main road from Cambrai had not yet put in an appearance that evening, so I could claim it as one of our achievements, that our fire had driven the enemy out of Bertincourt, our quarters for the night. Perhaps it was for this reason that the division commander had assigned us this prosperous village, where we secured ample supplies and enjoyed a much needed rest. We realized the truth of the proverb, that what one wins for himself gives more satisfaction than what comes without effort. The enemy remained close at hand, however, either for tactical reasons or because he was too tired to go farther, and the other troops did not all have so good luck with quarters. I still remember the malicious pleasure with which I heard an officer, returning from reconnaissance, say, "We can't get into Haplincourt, where we were to spend the night, for the enemy won't get out." This all goes to show that, under favorable circumstances, a handful of determined men can hold their ground against greatly superior numbers, so assuring safety and rest to their own troops, and avoiding the necessity of marching farther.

Such incidents are natural to rapid manoeuvres, especially with cavalry. A certain feeling of superiority and self-confidence also contributes to make one willing to risk taking quarters within rifle range of the enemy. One who is uncertain of the situation or of his own troops will prefer to drop back and get safer quarters, rather than take the risk of a night attack. But when one has fully sized up his opponent, he is entitled to take chances. We had little to fear from the old grizzled men, who seemed to have been collected as the last reserve of France. We felt that they were saying to us, "Let us alone to-night, and we'll do as much for you; you must want to eat and sleep, too!" And this was often the case, as prisoners told us the next day, when we finally came in sight of Bapaume and began the series of fights which finally brought the city into our hands.

# CURRENT FIELD ARTILLERY NOTES

## Light Field Howitzer in France

The question of the light field howitzer is being much discussed in the French Artillery at the present time. Notably at Metz, there were innumerable discussions which resulted in the almost unanimous opinion that a light field howitzer was necessary for divisional artillery, the principal reasons being:

1. The necessity for something lighter than the 155-mm. howitzer, which was frequently too expensive for the purposes of destruction which could be fulfilled by a lighter matériel.

2. The fact that a 75-mm. gun did not give a sufficient angle or fall, nor was its projectile sufficiently heavy to accomplish the desired destruction.

3. The greatly decreased consumption of powder in the case of a light howitzer which would be of ultimately very great importance considering the large amount of ammunition expended.

In the "France Militaire" of August 25, 1920, there is an article signed "Colonel O.B." entitled "Light Howitzer and Reduced Charge for the 75-mm. Gun," which is translated herewith. This information is forwarded in order that our Field Artillery and Ordnance may be kept in touch with the live problems which interest the French Artillery.

A translation of the article follows: "The adversaries of the light howitzer often support their arguments by suggesting the possibility of using the 75-mm. gun to execute curved fire with reduced powder charge. It is necessary to know what they mean by curved fire.

Generally such fire is defined as that giving an angle of fall of about 30 degrees, and it is that generally executed by a howitzer. Is this the case with our 75-gun with reduced charge? Certainly not. If we consult a range table we observe that

only beyond 5000 metres does the reduced charge (MV. 344 m.s. instead of 550 m.s.) really give curved fire; *viz.*, only 1000 metres nearer the gun than the full charge. Moreover, less direct fire being frequently advantageous, we are not completely opposed to the reduced charge for the 75 and, in any case, we think that as long as the light howitzer was lacking during the late war, it was an excellent plan to utilize the gun. We regret only that very good officers permit themselves to call firing with the 75 at reduced charges "curved fire," and this is not a simple discussion of words we are raising here, for we remember too well that it was by the same method that, formerly, opinion was lulled to sleep in assuming that the Malendrin disk would replace the light howitzer in a particularly economic way. It consequently appears prudent to avoid all that can lead us to proceed in these old errors. Meanwhile, the remarkable accuracy of the reduced charge for the 75 is highly praised, and, as a matter of fact, this precision for the same range is greater than that obtained with the full charge. But that does not prove that in firing at the same target with an equal angle of fall desirable for a good effectiveness, the 75 gun with reduced charge would be more accurate than the light howitzer.

An "artilleur," on the contrary, has shown in a former number of the "France Militaire" that for the same angle of fall, a howitzer is, in practice, more accurate than the gun even of the same calibre. As regards effectiveness, it is occasionally held that the 75 projectile is very capable of destroying trenches on the condition that a proper delay action fuse is used and that it is fired with a reduced charge giving a large angle of fall, 30 degrees for instance.

These conditions of firing correspond with the full charge firing a little beyond 6000 metres, and with the reduced charge, to firings a little over 5000 metres. For a given target at 5000 metres from the gun, precision and effectiveness are gained by firing with reduced charge, but still more would be gained with the howitzer.



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The advantage of the light howitzer is further shown from the point of view of economy of powder. To illustrate this the powerful 105-mm. Krupp howitzer used at the end of the war fired a much heavier projectile than our 75, and nevertheless its full charge (680 grammes) only exceeded by 80 grammes the full charge of the 75, and its reduced charge (202 grammes) was inferior to the reduced charge of the 75 (250 grammes).

From these considerations it appears logical to conclude that if the 75 with reduced charge was able to fill a gap temporarily, for the future we need a light howitzer.

## ÉDITORIAL

WITH this issue of the JOURNAL, we inaugurate an Annual Prize Essay Competition. The conditions governing this competition are set forth in the notice on the inside page of the back cover.

We particularly invite the attention of our readers to this competition. The Council of the Association has had this idea in mind for some time, but did not consider conditions to be ripe. Now, sufficient time has elapsed since the close of hostilities to enable officers to think over their experiences in the war, to separate the wheat from the chaff, to partially crystallize their opinion, and to enable conclusions to be reached. From the wealth of experience, it is confidently anticipated that valuable observations may be brought out, and that useful lessons may be deduced.

In the long interval of peace preceding this war there was no dearth of military literature—based, of necessity, upon theory. The time has now come to determine how theory agreed with actual experience during the war. Articles are now commencing to appear in considerable volume in foreign publications, and it would be easy for the Editor to fill the JOURNAL with translations. But what we want is American articles—articles written from *our point of view*, and based on *our own experience*. Foreign articles are valuable, and will continue to be published in the JOURNAL, but it must always be borne in mind that such articles are colored by the national viewpoint of the writer.

THE FIELD ARTILLERY JOURNAL was started as a medium of exchange for the views of Field Artillery officers, and no better way is known by which these views can be presented than by incorporating them in articles submitted under this competition. It is, therefore, urgently requested that the entries be numerous. The Field Artillery played a part in this

## EDITORIAL

war of which it is justly proud; so give us the benefit of your personal views, experiences and thoughts.

### **Membership in the U. S. Field Artillery Association**

THERE are far too many officers of Field Artillery belonging to the regular establishment who are not members of our "Association," and therefore subscribers to THE FIELD ARTILLERY JOURNAL.

This means you who read this and are not a member. You should become one. The expenditure of three dollars a year, which pays your dues to the Association and includes the subscription price of THE FIELD ARTILLERY JOURNAL, will be well spent if by so doing you join and coöperate to make the JOURNAL a better magazine and a help professionally to yourself and others.

If you are already a member, what is up to you? To impress upon some brother who has until now remained in darkness of the necessity of gaining the light.

Every National Guard Field Artillery officer is in the same boat with his brother in the regular establishment, and the foregoing remarks apply equally to him.

Officers of the Field Artillery Section of the Officers' Reserve Corps, are now eligible as subscribers to the JOURNAL, and at the next annual meeting, to be held December 14, 1920, will be made eligible to full active membership. They should, therefore, take these remarks to heart.

We believe that one of the best ways for the officer, be he Regular, Reserve or Guard, to keep pace with his profession is by joining the Field Artillery Association, and becoming a subscriber and contributor to its JOURNAL, thereby giving his arm the benefit of his support and experience. The JOURNAL is published in their interest, and should receive their support.

Communications should be addressed:

Secretary U. S. Field Artillery Association,  
War Department,  
Washington, D. C.

# The United States Field Artillery Association

PROPOSED AMENDMENTS TO THE CONSTITUTION

WASHINGTON, D. C.,

December 31, 1919.

The Secretary, United States Field Artillery Association,  
Washington, D. C.

SIR:

In conformity with Article IX of the Constitution of the United States Field Artillery Association, the undersigned, being active members of the Association, hereby propose certain changes in said Constitution for the following principal reasons:

(a) At the time of the adoption of the Constitution of the Association there were no officers of the Field Artillery Section of the Officers' Reserve Corps. There are now approximately eight thousand of these officers, all of whom were in the Field Artillery of the United States Army during the World War, and a considerable number of whom are subscribers to the FIELD ARTILLERY JOURNAL. It is believed that the service and interest of these officers merits the privilege of active membership in the United States Field Artillery Association, and representation upon the Executive Council of the Association.

(b) It is believed that the natural interest in Field Artillery matters of those persons who served in the Field Artillery of any of the United States forces during the World War should entitle them to the privilege of associate membership in the United States Field Artillery Association.

The proposed amendments to said Constitution are clearly set forth as follows:

1. It is proposed to amend Section 2, of Article III, by

## AMENDMENTS TO F. A. CONSTITUTION

inserting the words "and commissioned officers on the active list of the Field Artillery Section of the Officers' Reserve Corps" between the words "District of Columbia" and "provided" in line six of said Section, so that said Section shall read, when amended, as follows:

Sec. 2.—The following shall be eligible to active membership:

Commissioned officers on the active lists of the field artillery of the regular army and of the organized militia of the several states, territories and District of Columbia and commissioned officers on the active list of the Field Artillery Section of the Officers' Reserve Corps; provided, that officers of the regular army when separated from the field artillery, by promotion or detail in staff departments, shall not thereby lose their status as active members.

2. It is proposed to amend Section 3, Article III, by adding thereto the following sub-paragraph:

"(g) All persons who, in any war, served in any capacity in the Field Artillery of any of the forces of the United States Federal Government," so that said Section shall read, when amended, as follows:

Sec. 3.—The following shall be eligible to associate membership:

(a) Commissioned officers on the retired lists of the regular army and of the organized militia of the several states, territories and District of Columbia.

(b) Those who, as commissioned officers, either regular, militia, or volunteer have served with batteries or larger units of field artillery in time of war.

(c) Commissioned officers of the regular army and of the organized militia of the several states, territories and District of Columbia, not now belonging to the field artillery,

## THE FIELD ARTILLERY JOURNAL

who have served at least one year as commissioned officers in field artillery.

(d) General officers of the regular army, except as provided in Section 2 of this Article, and of the organized militia of the several states, territories and District of Columbia.

(e) All commissioned officers and former officers of the United States Army, Navy and Marine Corps, and of the organized militia in good standing, not included in the classification hereinabove set forth.

(f) Those in civil life, whose applications are approved by the Executive Council hereinafter provided for.

(g) All persons who, in any war, served in any capacity in the Field Artillery of any of the forces of the United States Federal Government.

3. It is proposed to amend Section 1 of Article VI by striking out the word "five" in line two of said Section and substituting therefor the word "nine"; by striking out the word "three" in line two of said Section and substituting therefor the word "five"; by inserting a comma after the word "army" in line three of said Section; by striking out the word "and" in line four of said Section; and by inserting the words "and two officers of the Field Artillery Section of the Officers' Reserve Corps" between the words "militia" and "to" in line four of said Section, so that said Section shall read, when amended, as follows:

Sec. 1.—The Executive Council shall be composed of nine active members, five of whom shall be officers of the regular army, two officers of the organized militia, and two officers of the Field Artillery Section of the Officers' Reserve Corps, to be elected biennially for a term of two years by a majority vote, in person or by written proxy of the active members. The Council shall hold its meetings at the headquarters of the Association, which shall be in the city of Washington.

AMENDMENTS TO F. A. CONSTITUTION

4. It is proposed to amend Section 3 of Article VI by striking out the word "Three" in line three of said section and substituting therefor the word "Five," so that said Section shall read, when amended, as follows:

Sec. 3.—The Executive Council shall meet from time to time, at the call of its senior member present in Washington. Five members shall constitute a quorum for the transaction of business.

Respectfully submitted,

E. P. KING, JR., Col., F.A.	C. P. GEORGE, Col., General Staff.
JOHN B. ANDERSON, Lt. Col., F.A.	J. F. BARNES, Major, G.S.
W. C. POTTER, Col., F.A.	CLIFT ANDRUS, Lt.-Col., F.A.
R. E. LEE, Col., F.A.	M. CHURCHILL, Brig.-Gen., G.S.
G. R. ALLIN, MAJOR, F.A..	D. F. CRAIG, Major, F.A.
T. W. WRENN, Major, F.A.	MANUS MCCLOSKEY, Col., F.A.
WILLIAM E. BURR, Lt. Col., F.A.	WM. BRYDEN, Major, G.S.C.
T. D. SLOAN, Col., F.A.	MAXWELL MURRAY, Col., F.A.
W. W. HESS, JR., Major, F.A.	WM. J. SNOW, Maj.-General.
C. S. BLAKELY, Major, F.A.	OLIVER L. SPAULDING, JR., Lt.-Col., F.A.
E. T. SMITH, Col., F.A.	J. N. GREELY, Col., F.A.
F. W. HONEYCUTT, Col., F.A.	H. W. BUTNER, Lt.-Col., F.A.
H. D. HIGLEY, Lt.-Col., F.A.	

WASHINGTON, D. C.  
December 31, 1919.

The Secretary, United States Field Artillery Association,  
Washington, D. C.

SIR:

In conformity with Article IX of the Constitution of the United States Field Artillery Association, the undersigned, being active members of the Association, hereby propose certain

## THE FIELD ARTILLERY JOURNAL

changes in said Constitution for the following principal reasons:

It is believed that no good reason exists for the requirement of the Constitution that the Secretary-Editor and the Treasurer of the Association shall be active members of the Association. Since the policy and records of the Association and the editorial policy of the FIELD ARTILLERY JOURNAL are under the close supervision of the Executive Council, the members of which are required by the Constitution to be active members of the Association, and since the Executive Council selects the Secretary-Editor and the Treasurer, it is desirable that the Constitution be amended so as to permit those offices to be held by retired officers. It is necessary that the Secretary-Editor and the Treasurer should be stationed in or reside in Washington. As officers on the active list are constantly changing station, the number of troublesome changes in the officers of the Association will probably be diminished by making retired officers eligible to hold these offices.

The proposed amendments to said Constitution are clearly set forth as follows:

1. It is proposed to amend paragraph number three, of Section 2, of Article VI, by inserting the words "or associate" between the words "active" and "members" in line two of said paragraph, so that said paragraph, when amended, shall read as follows:

3. A Secretary-Editor, to be selected from its own members, or other active or associate members of the Association, and who shall be an officer of the Regular Army.

2. It is proposed to amend paragraph number four, of Section 2, of Article VI, by inserting the words "or associate" between the words "active" and "members" in line two of said paragraph, so that said paragraph, when amended, shall read as follows:



AMENDMENTS TO F. A. CONSTITUTION

4. A Treasurer, to be selected from among the active or associate members, and who shall be an officer stationed or residing in Washington, D. C.

Respectfully submitted,

(Signed)

JOHN B. ANDERSON, Lt.-Col., F.A.	F. W. HONEYCUTT, Col., G.S. MAXWELL MURRAY, Col., F.A.
WILLIAM E. BURR, Lt.-Col.,	WM. J. SNOW, Maj.-General.
R. E. LEE, Col., F.A.	OLIVER L. SPAULDING, JR., Lt.- Col., F.A.
E. P. KING, JR., Col., F.A.	J. N. GREELY, Colonel, F.A.
T. D. SLOAN, Col., F.A.	W. S. BROWNING, Col., G.S.
W. C. POTTER, Col., F.A.	H. W. BUTNER, Lt.-Col.
T. W. WRENN, Major, F.A.	ALFRED A. STARBIRD, Lt.-Col., F.A.
CLIFT ANDRUS, Lt-Col., F.A.	DWIGHT E. AULTMAN, Col., F.A.
D. F. CRAIG, Major, F.A.	M. E. LOCKE, Major, F.A.
MANUS MCCLOSKEY, Col., F.A.	C. D. HERRON, Lt.-Col., F.A.
M. CHURCHILL, Brig.-Gen., G.S.	A. S. FLEMING, Col., F.A.
WM. BRYDEN, Major, G.S.C.	A. J. BOWLEY, Col., F.A.

## BOOK NOTICES

THE BATTLE OF THE MARNE. By George Herbert Perris, with 12 maps.  
John W. Luce and Company, Boston, Mass.

As correspondent with the French armies throughout the war, Mr. Perris had unique opportunities of information, and of discussing the greatest of historic battles with combatants of all ranks and arms. In this important volume he cites and weighs the opinions of experts, and exposes the errors of the Allied as well as of the German commands.

SNIPING IN FRANCE. By Major H. Hesketh-Prichard, D.S.O., MC.  
Illustrated. E. P. Dutton and Co., 681 Fifth Avenue, New York, N. Y.

Major Hesketh-Prichard was in command of the First Army School of Scouting, Observing and Sniping, which trained officers who in turn instructed at the Corps Schools, Brigades and Battalions throughout the British Army. It is not only a record of a successful system of training, valuable as such to soldiers, but is written in such informal narrative fashion that it will be full of interest to the general reader.

G.H.Q. (Montrenil-Sur-Mer). By "G.S.O.," with map and thirty-two illustrations. E. P. Dutton & Co., New York, N. Y., 1920. Price \$9.00 net.

A very interesting account of the daily life and work of the British General Headquarters at Montrenil, France, during the great war.

AMERICAN GUNS IN THE WAR WITH GERMANY. By Edward S. Farrow.  
Price \$2.50 net. E. P. Dutton & Co., New York, N. Y.

Here is the tale of one of the country's most remarkable war achievements in sudden efficiency and expansion in a field of the finest and most accurate science, told by an expert.

GAS WARFARE. By Edward S. Farrow. Price \$3.00 net.

This volume has been prepared by the author, who has had access to official records, to assist in educating our soldiery in the use of gas, both in defense and offense.

## Index to Current Field Artillery Literature

Compiled from monthly list of military information carded from books, periodicals, and other sources furnished by the War College Division, General Staff.

- AERIAL WARFARE.—Mobile artillery and aircraft. (*The Journal of the Royal Artillery*, June, 1920, p. 93.)
- AIR SERVICE.—United States. Our Army's Air Service. Being a sketch of the United States Air Service since beginning of the war; its present relative rank with other nations, and what is to be expected of it in the future, by Brig. Gen. William Mitchell, Chief of Training and Operations, United States Air Service. (*The American Review of Reviews*, September, 1920, p. 281.)
- AISNE.—From the Aisne to Ypres, 1914, by Brig. Gen. Walker. (*The Royal Engineers' Journal*, August, 1920, p. 69.)
- AMMUNITION SUPPLY.—American Expeditionary Forces. Ammunition service in the American Expeditionary Forces, by Col. Philip H. Worcester. (*Journal of the United States Artillery*, July, 1920, p. 9.)
- AMMUNITION SUPPLY.—France: The work of the 4th Army Bureau. Outline of work necessary to supply ammunition to troops at the front. Describes establishment of ammunition dumps; question of transportation discussed. (*Revue Militaire Generale*, April, 1920, p. 229.)
- ARTILLERY.—A history of artillery. Part I, Artillery before the regiment, by Ralph Flenley. (*The Journal of the Royal Artillery*, July, 1920, p. 156.)
- ARTILLERY.—Organization of the battery signallers in a separate section, by Maj. H. J. Humphreys. (*The Journal of the Royal Artillery*, July, 1920, p. 185.)
- ARTILLERY DRILL AND TACTICS.—Belgium: Organization and employment of the artillery in the Belgium Army during the war of 1914-1918. (*Revista Militar*, March, 1920, p. 425.)
- ARTILLERY DRILL AND TACTICS.—European War. The action of the 16th Divisional Artillery Group in the battle of April 4, 1918, in front of Amiens (British troops). (*The Journal of the Royal Artillery*, July, 1920, p. 187.)
- ARTILLERY DRILL AND TACTICS.—France: Defensive artillery, a cause of defeat in the Laon-Soissons-Reims region. French poorly supplied in men, rations, and ammunition. French batteries placed too near each other. (*Revue Militaire Generale*, April, 1920, p. 214.)
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- ARTILLERY DRILL AND TACTICS.—War experiences of French artillery. (*Artilleristische Monatshefte*, March, 1920, p. 73.)
- ARTILLERY FIRE.—Accuracy of fire at long ranges, by Chase. (*United States Naval Institute Proceedings*, August, 1920, p. 1175.)
- BAPAUME, BATTLE OF.—Two battles of Bapaume. The battle of Bapaume, January 2 and 3, 1871, and the battle of August 22-29, 1918. (*United Service Magazine*, June, 1920, p. 230.)
- BATTLE TACTICS.—Revolutionizing battle tactics by Col. Amos A. Fries, Chief of Chemical Warfare Service, U. S. Army. (*National Service*, July, 1920, p. 21.)
- BROWN, SEVELLON.—The story of Ordnance in the world war. Wash., James W. Bryan press. 1920, 184 p. Illus.
- CARTER, ARTHUR HAZLETON.—Field artillery instruction. New York, London, G. P. Putnam's Sons. 1920, 631 p.
- CENTRIFUGAL GUN.—The centrifugal gun. Description and fire control of. (*The Independent*, September 1, 1920, p. 284.)
- CHIEF OF FIELD ARTILLERY.—Field Artillery special service schools. Wash. Govt. Print. office. 1920. 11 p.
- COÖPERATION OF ARMIES.—The liaison between the infantry and the artillery. (*Revue d'Artillerie*, July, 1920, p. 57.)
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- EUROPEAN WAR.—How the war ended. Article dealing with the German offensive of 1918, describing their advances on Paris which were checked by Foch and the drive of the Allies which forced the enemy to beg for a cessation of hostilities. (*Revue des Deux Mondes*, June 1, 1920, p. 481.)
- FIELD ARTILLERY REPLACEMENT DEPOT.—Specialists' schools of the fourth brigade. Columbia, S. C. Camp Printing Office. 1918. 353 p.
- FIELD ARTILLERY REPLACEMENT DEPOT, CAMP JACKSON, S. C.—Training regulations and outline of instruction. Columbia, S. C. Camp Print. Office, 1918. 199 p.
- GAS WARFARE.—Revolutionizing battle tactics (tests of gas), by Amos A. Fries. (*National Service*, August, 1920, p. 81.)
- GEORGE, ALBERT E.—Pictorial history of the 26th Division, U. S. A. Boston, Ball Pub. Co. 320 p. Illus. D. 609.
- HARLOW, REX F.—Trail of the 61st. A history of the 61st field artillery brigade, 1917-1919. Oklahoma City, Harlow Pub. Co. 1919. 231 p. Illus. D 609 U 58 61st Brigade.
- HEAVY GUNS.—Germany: The German long-range gun. (*Engineering*, July 2, 1920, p. 30.)
- HORSES.—Germany: German and Austrian supplies of effective horsepower. (*Revue D'Artilerie*, March, 1920, p. 205.)
- MACHINE GUN DRILL AND TACTICS.—European war. Machine guns of the Fourth Brigade, by Maj. L. W. T. Waller, jr. (*The Marine Corps Gazette*, March, 1920, p. 1.)
- MANEUVERS.—The maneuvers of the future and the general principles on which higher peace training should be conducted in view of the lessons of the late war, by Lieut. Col. G. W. Haslehurst. (*The Journal of the United Service Institution of India*, April, 1920, p. 50.)
- MAP MAKING.—The tri-lens camera in aerial photography and photographic mapping, by J. W. Bagley. (*The Military Engineer*, July-August, 1920, p. 358.)
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- RIFLES, AUTOMATIC.—The Browning guns. The Browning automatic rifle. (*United Service Magazine*, June, 1920, p. 230.)
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- ST. MIHIEL.—One day's work at St. Mihiel. The first complete story of our combat operations. (*The Independent*, June 19 and 26, 1920, p. 390.)
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- TANK WARFARE.—Anti-tank defence, by Major A. K. Hay. (*The Journal of the Royal Artillery*, June, 1920, p. 109.)
- TANKS.—The future tanks, by Capt. Martel. (*The Royal Engineers Journal*, August, 1920, p. 49.)
- TRANSPORT CORPS.—American Expeditionary Forces. Transport Corps of the American Expeditionary Forces, by Brig. Gen. Frank T. Hines. (*National Service*, August, 1920, p. 82.)
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