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MANUAL

FOR

TRENCH ARTILLERY

UNITED STATES ARMY

(PROVISIONAL)

Part IV

240 mm. Trench Mortar

Reprint of pamphlet prepared at Headquarters American Expeditionary Forces, France, March, 1918

WAR PLANS DIVISION
JULY, 1918

WAR DEPARTMENT Document No. 820
A. E. F. 519
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WAR DEPARTMENT,

WASHINGTON, *July 5, 1918.*

The following pamphlet, entitled "Manual for Trench Artillery, United States Army (Provisional)—Part IV—240 mm. Trench Mortar," is published for the information and guidance of all concerned.

(062.1 A. G. O.)

BY ORDER OF THE SECRETARY OF WAR.

PEYTON C. MARCH,
General, Chief of Staff.

OFFICIAL:

H. P. MCCAIN,
The Adjutant General.

MANUAL

FOR

TRENCH ARTILLERY

UNITED STATES ARMY

(Provisional)

PART I.—Trench artillery.
PART II.—Formations and Maneuvers.
PART III.—6″ Newton trench mortar (English).
PART IV.—240 mm. trench mortar (French).
PART V.—58 mm. No. 2 trench mortar (French).

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PART IV

240 mm. TRENCH MORTAR

CHAPTER I

DESCRIPTION OF MATERIEL

The Piece.

The piece is divided into four main parts: The mortar proper, the carriage, the metal bed and the platform. Fig. 1 shows the assembled piece.

The Mortar Proper.

The main parts of the mortar proper are (*a*) the barrel, a steel tube slightly thinner at the muzzle than near the breech, with a smooth bore of 240.3 mm. (9.45 inches) and octagonal in shape at the breech end, (*b*) the breech, a steel plug bored out to form a chamber for the charge.

The front end of the breech is threaded externally and screwed into the breech end of the barrel. The rear end is provided with trunnions. The breech is slotted to receive a steel breech block raised or lowered by hand in a plane perpendicular to the axis of the bore by means of a handle at the top, and held up or down by a safety latch. A hole is bored through the breech block and tapped to receive the firing mechanism shown in Fig. 2.

Around the barrel, slightly below the middle, is bolted an elevating band carrying an elevating and clamping mechanism consisting of a shaft with two pinions and two cranks, and a spindle with a hand-wheel for clamping the mortar in elevation. Two transportation collars (near the breech and muzzle), with rings to receive porter bars, are bolted around the barrel. A groove is cut into the top of the barrel, midway between breech and muzzle, for the quadrant and above this is a support screwed underneath the barrel to hold the goniometer mirror. Aiming lines are cut on top of the breech and muzzle ends of the barrel.

The Carriage.

The steel carriage is designed to permit firing the mortar between 45° and 75° elevation. At the center of the bottom plate is a hole which fits over the pivot of the bed. To the underside of the bottom plate are riveted two segments, forming the upper racer which rests and slides on the racer of the bed. These segments carry lugs which engage under the locking ring on the bed, thus joining the carriage and bed.

A traversing clamp screw passes through the bottom plate at the rear. A steel covering plate is secured to the carriage on each side to protect the lower racers.

When in position, the mortar trunnions are held in the trunnion beds, on the side-plates, by cap squares operated by levers on the outside of the beds. Stops are fitted to limit the movement of the levers. The side-plates, braced by a plate at their front ends, are each provided, front and rear, with sockets to receive socket bars. The elevating pinions engage in two racks at the top of the sideplates and the clamping spindle slides in curved slots immediately below the racks.

The Metal Bed.

The steel bed, rectangular in shape, consists of a floor plate to the center of which is riveted a pivot, the pintle center of the piece. Under the floor plate are riveted six flanges, two overlapping the front and rear and the other four fitting between the upper sleepers of the platform. On the floor plate is a circular racer on which the carriage slides, the locking ring with which the lugs of the carriage engage, and a metal ring graduated in grades, which in conjunction with an index mark on the carriage is used for giving direction to the piece. The locking ring is cut away for mounting and dismounting the carriage, an arrow head being chiselled at the left front so that when the index on the carriage is opposite the arrow, the carriage can be lowered into position. The bed is fitted with four sockets and ten angle irons, the latter for securing the bed to the upper platform.

The Platform.

The wooden platform is composed of a rigid frame made of timbers held together by means of rods and channel irons, which, being sunk into the ground and held firmly by jacks, forms a bed on which the mortar is placed (see Figs. 4, 5 and 6). The principal parts of the platform are:

(1) The five under sleepers (C).

(2) The frame, composed of the two front and rear base timbers (A) and the two lower side timbers (B). The under sleepers and the frame are firmly held together by means of the four channel irons (D) and (E), the eight tie rods (G), the four upper channel iron bolts (J) and ten lower channel-iron bolts.

(3) The five upper sleepers, on which the metal bed is placed, are fixed to the under-sleepers by means of the two upper side timbers (T), which are fastened to the base timbers (A) by the four vertical bolts (S).

(4) The front and rear kicking beams, each formed of four kicking timbers. Between the frame and the rear beam are three vertical blocks (Q), and between the frame and the front beam are four vertical blocks and four 20-ton jacks which keep the whole platform in place.

Weights

Part	Weight	
	Kilograms	Pounds
Mortar (barrel and breech)	314	690
Carriage	203	448
Metallic bed	345	764
Wooden platform	2600	5720
Total (approx.)	3500	7700

Bombs.

Only one size of bombs is used with the 240 mortar.

Bomb	Weight		Length	Explosive		
				Weight		Kind
	Kilos	Pounds	Meters	Kilos	Pounds	
Model 1916, type T	83	183	1.02	42	93	S

Bomb, Model 1916, Type T.

Fig. 7 shows a longitudinal section of a loaded bomb. The two main parts of the bomb are the body and the four vanes. The body, of steel, consists of three parts welded together, (1) the rounded nose, (2) the main cylindrical shell, and (3) the base to which the vanes are welded. The nose is threaded for the retaining plug which is screwed in after loading and which is internally threaded to receive the fuse. The walls of the bomb are 8 mm. thick. The four vanes, at right angles to each other, are reinforced by four angle irons strongly riveted. The space between the vanes forms a portion of the gas chamber when the bomb is in the barrel.

Loading of Bombs.

Fig. 7 also shows the manner of loading the bomb. The interior of the body is first painted carefully with tar to prevent contact of explosive with metal. The explosive is then rammed in with a wooden tamp and mallet until very closely packed. A hole is bored in the explosive, along the axis of the shell, for the exploder, a cardboard cartridge 47 mm. in diameter and 48 cm. long, containing one kg. (2.2 lbs.) of melted melinite. The retaining plug, with a cup containing 25 grams of pulverized and compressed melinite, is then screwed in and seated in trotol at the top of the exploder cartridge. This cup receives the fuse. When the bomb is not fused a small cap is screwed in the fuse socket to keep out dirt.

Marking of Bombs.

Data relating to the manufacture of the bomb itself are stamped in the metal near the nose of the bomb, usually as follows:

(1) Initials of the contractor.
(2) Number of the order on which bomb was furnished.
(3) Initials of intermediate contractor, if any.
(4) Lot number.
(5) Last two figures of the number of the year in which bomb was manufactured.

On one vane, in white paint, are given the data relating to the manufacture of the explosive as follows: (*a*) letter showing kind of explosive, (*b*) intitial of place where explosive was manufactured, (*c*) figures showing day, month and year of manufacture.

On another vane in white paint are given data as to the loading of the bomb as follows: (*a*) initials of place where loaded, (*b*) figures showing month and year of loading. On the reverse side of the same vane in white paint is the weight in kilograms. Bombs loaded with special liquids are painted green and have the number of the liquid indicated in white paint.

Propelling Charges.

The propelling explosive used is "Balistite" with an additional igniter charge of "F-3," or black powder. Two charges are used as follows:

	BALISTITE	F-3	RANGE
Charge No. 1	1250 grams	15 grams	1100 to 2200 meters.
Charge No. 2	800 grams	15 grams	750 to 1400 meters.

These charges are in brass cartridge cases similar to the French 155 C. T. R. (6 inch) gun cartridges and are exploded by a percussion primer in the base. Ten charges are packed in one case.

As shown in Fig. 8, between the charge of balistite and the bottom of the brass cartridge case, there is a small air space. On top of the balistite is placed a wad of cardboard. Above this wad is an expansion chamber topped by another wad with a layer of felt. The whole is sealed in the case with thick varnish. In the center of the balistite a hole is made to receive the black powder, which is also topped by a felt wad. A brass cylinder in the base of the cartridge holds the percussion (fulminate of mercury) primer. The brass cartridge cases must be carefully preserved, as they are reloaded.

Fuses.

The only fuse used is the 24/31 P. R., model 1916, 1/10 of a second delay action fuse. It requires nearly normal acceleration to arm, this characteristic greatly reducing the danger of premature explosion.

The action of the P. R. fuse is shown by Figs. 9 and 10. Fig. 9 shows the fuse unarmed. Fig. 10*a* shows the inertia plunger, the safety block and boss in detail before arming. In this position the percussion cap, which is on the end of the spindle of which the boss is a part, cannot touch the firing pin because of the fingers of the safety block. As the bomb accelerates when the mortar is fired, the inertia plunger, due to its weight, moves down the spindle (Fig. 10*b*) until the fingers of the inertia plunger are disengaged from those of the safety block. The safety spring then forces the safety block down the spindle, rotating it slightly at the same time, until the head of the safety block is against the boss, as shown in Fig. 10*c*. The spindle with the percussion cap can now move a distance equal to the length of a finger of the safety block. When the bomb strikes, the spindle, inertia plunger and safety block as a unit are thrown forward by inertia, causing the percussion cap to strike the firing pin. The delay action is given by the time train as shown in Fig. 9.

CHAPTER II

A.—Installation of Platform and Mortar

(*a*) **Preparation of ground.**—The wooden platform is placed in an excavation of the dimensions shown in Fig. 3. The front and rear walls must be vertical and smooth. Special care should be taken with the rear wall which should be virgin ground strongly tamped. The bottom of the excavation must also be prepared. If the ground is of good ordinary earth it will simply be tamped and made plane with an inclination of 1 degree towards the front. If the ground is rocky the excavation is to be deepened by at least 25 cm. (10 inches) and a bed of stones covered with a layer of gravel made up to the correct depth of the excavation.

(*b*) **Installation of front and rear kicking beams.**—The lower timber of the rear beam, with the three bolts, is placed in its excavation. The other three timbers are placed upon it one at a time and the nuts tightened. If possible, concrete should be placed in the interval between the rear wall and the rear beam. If concrete cannot be secured, wet sand should be used in order that the rear beam may directly transmit the pressure to the wall. The front beam is installed in the same manner. The four vertical blocks are then put in place against the rear beam.

The bottom of the excavation is now covered with sand to a depth of about 5 cm. (2 inches). If sand cannot be procured, soft earth, free from stones and well tamped, may be used.

(*c*) **Installation of the under sleepers.**—At the proper distance apart in the sand bed are placed the two lower channel-irons, each equipped with five bolts as shown in Fig. 4. These channel irons, flat surface uppermost, are pressed into the sand bed until the flat surface is flush with the levelled sand. The rear bolt of the channel iron should be 53 cm. (21 inches) from the rear beam. The five under sleepers (Fig. 5) are then put in place, the front one being installed first. At the front and rear of these sleepers is put in another 5 cm. (2 inches) of sand which, on being levelled, will support the timbers A (Fig. 5).

(*d*) **Assembling and installing the frame.**—The frame is assembled outside of the excavation. The two base timbers A, each provided with its two upper channel-iron bolts J (Fig. 5) and its two upper side timber bolts S (Fig. 6), each held in place by a nut at the top, are placed at the proper distance apart. The eight tie rods G (Fig. 5), each held by a nut, are put in. A porter bar is passed through each of the lifting eye-bolts N (Fig. 5) and this assembled part of the

frame lowered into position. The nuts of the rods G must be toward the front of the emplacement, so that they may be tightened until the timbers A come into light contact with the under sleepers C. The sides B (Fig. 5) of the frame are placed in position, the nuts of the vertical bolts (J) unscrewed and the upper channel irons E (Fig. 5) and the washers put in place. The nuts and lock-nuts of the bolts (J) are screwed on and tightened. The nuts on the rods G are tightened little by little, alternately, until they are firm. The lock nuts are then screwed on and tightened. The nuts and lock nuts of the bolts (J) and (H) are tightened as far as possible.

(*e*) **Installation of the jacks.**—The four front vertical blocks and the jacks are put in place as shown in Fig. 6. The two outside jacks are placed at the top of the outside blocks and the two inner jacks at the bottom of their corresponding blocks. They are tightened little by little and alternately until the whole frame is firmly held.

(*f*) **Installation of the five upper sleepers.**—The five upper sleepers are placed inside the frame in order, as numbered, number one being at the front. The letter G stamped on each indicates the left and aids in installing the sleepers always in the same way.

B.—Installation of the Bed.

(*a*) **Unloading the bed cart.**—The horse is unhitched and the shafts removed. The pins holding the bed to the cart are withdrawn, the body of the cart tilted toward the rear and the bed slid carefully to the ground.

(*b*) **Mounting the bed.**—The clamps on the five upper sleepers are opened. With the socket bars the bed is placed on the sleepers so that the mounting arrow is at the left front of the emplacement, taking care that the flanges of the bed pass between the sleepers and that the lugs fit into the clamps, which are then fastened by hand.

C.—Installation of the Carriage.

(*a*) **Unloading the carriage cart.**—The horse is unhitched and the shafts removed. The socket bars are put in place, the lock holding the carriage to the cart raised, the carriage lifted and the cart moved away.

(*b*) **Mounting the carriage.**—With the traversing clamp screw loosened the carriage is placed upon the bed with the rear of the carriage toward the front of the bed, the pivot fitting through the pivot hole. The carriage is traversed until the index on the carriage is opposite the arrow on the bed, when the locking lugs under the carriage drop through the cut-away portion of the locking ring. The carriage is then traversed until the rear is again toward the front of the bed.

The traversing clamp screw is tightened and the cap square levers are raised.

D.—Mounting the Mortar Proper.

(*a*) **Unloading the mortar cart.**—The horse is unhitched, the shafts removed and the short iron tongue put in place. The elevation clamping handwheel is unscrewed and withdrawn. The breech-lock is pulled out. The retaining collars are opened by unscrewing the wing-nuts, and a porter bar passed through the rings of both transportation collars. Two men at each porter bar raise the mortar, move it to one side of the cart and lift it over the wheel to the ground, another man holding the tongue of the cart to maintain its balance. As early as possible, during this operation, two other men assist in lifting with a porter bar under the middle of the mortar.

(*b*) **Mounting the mortar.**—It is now necessary to turn the mortar over. This is best done by raising it to a vertical position on the breech end and lowering it again with the elevating pinions underneath. The mortar is then raised by six men, two at each porter bar, and carried to the front of the platform with the breech end toward the carriage. The porter bar at the breech end is placed on the low sides of the carriage and the muzzle raised, using the porter bar at the breech as an axis, until the trunnions slip into their beds. The elevating pinions are engaged symmetrically with the racks. The porter bar at the breech end is removed, and the spindle with the washers of the clamping mechanism put through its guides, starting at the left. The handwheel is tightened, the cap-squares locked and the porter bar at the muzzle removed. The carriage is traversed through 180 degrees and the mortar depressed to the loading position. The breech-block is replaced and lowered. The upper side timbers T (Fig. 6) are then put in place and the nuts and lock-nuts are tightened. If these timbers are in their proper position a small space exists between the bottom of their extremities and the front and rear base timbers A. Between the front of the metal bed and the wooden frame are then placed the two pair of wooden wedges, one against each side of the frame. When firing, the nuts, lock-nuts, wedges and jacks must be kept firmly tightened in order that the platform will be a rigid body, displacement of any part of the platform being detrimental to the platform itself and to the metallic parts of the piece. If firing with a deflection differing greatly from the zero line of fire, stones should be placed between the lateral walls of the excavation and the lower side timbers of the frame so that the platform cannot move to one side or the other, and a small timber should be placed between the side timbers of the frame and the upper sleepers to prevent the tie rods from being bent.

E.—Dismounting the Mortar and Platform and Loading of the Carts.

The reverse of the procedure given above is followed.

CHAPTER III

TRANSPORTATION

The piece.—On the road each separate part of the piece (mortar, carriage and bed) is transported on a separate cart (see Figs. 11, 12, 13). Each cart is normally drawn by one horse, but over rough ground, man power may be used, in which case four towing ropes and a towing bar passed through a towing tongue are utilized. The wooden platform and the service bar and accessories, as far as possible, are carried on two escort wagons. Hand transportation of the mortar from the carts to the emplacement is necessary. In this case six men carry the barrel, two porter bars being run through the transportation rings, and another bar under the barrel at the middle. Four men with bars carry the carriage and four men the bed.

Bombs.—On the road bombs may be carried on escort wagons, 15 bombs to a wagon. By fitting special bodies with bomb racks to small mortar carts, four bombs, as well as the charge cases, may be carried on each cart (see Fig. 14). For keeping the battery supplied with bombs, they are normally brought from the main ammunition dump in escort wagons to an intermediate battery depot, at a point beyond which these wagons cannot pass. From these intermediate depots the bombs are carried by bomb carts as near as possible to the emplacements.

For carrying by hand, two men are necessary for each bomb. A bomb carrier is provided consisting of a metal collar to which are attached four chains connected to two rings. The bomb is set upright on its vanes, and after clamping the collar around the bomb a porter bar is run through both rings which are held at the center of the bar by the pins and each of the men carries one end of the bar on his shoulder. If it is necessary to carry the bomb a long distance, especially in the trenches, a relief of two extra men will be necessary. In this case one of the relief walks ahead of the porters and the other behind the porters.

CHAPTER IV

CARE OF MATERIEL

Small repairs or replacements of damaged parts may be made by the battery. Repairs necessitating filing, forgework, riveting or disassembling the instruments used for laying, or their supports, must be made at the repair station.

Daily care.—After firing, the bore should be thoroughly washed with water, carefully dried with rags and a light coat of grease applied. The breech-block is withdrawn and cleaned, the slot cleaned and both greased lightly. The bed racers are cleaned and greased. The firing mechanism must be cleaned. Heavy grease should not be used, but the separate parts should be wiped with a greased rag or a few drops of oil applied. Candle grease is put on the short lanyard where it rubs against the metal. Lastly, the sponge is placed inside the barrel and the cover put on muzzle.

Inspection of the Materiel.

At least once a week, and oftener if possible, and after heavy firing, the battery commander should thoroughly inspect the mortars, wooden platforms, accessories, and wagons. For this inspection the materiel should be completely cleaned and dismounted. A battery should never have more than one piece dismounted at any one time. Inspect the bore, the breech and the firing mechanism. See that the elevation and traversing clamps hold the mortar firmly. See that the locking ring and bed flanges are in good order and that the base of the carriage is not warped.

The different parts of the wooden platform must be inspected with great care and repaired, if necessary. The bolts and the jacks must be tightened to prevent any play between the various members. Any fault, especially deformation of the barrel, liable to cause irregularity of fire, must be immediately reported. While the piece is dismounted for inspection, the damaged parts should be replaced and the following carefully greased:

Elevating racks and pinions,
Guide slots for elevation locking mechanism.
Threads of elevating locking mechanism,
Swivels of transportation rings,
Trunnions, trunnion beds, and cap squares,
Pivot racers and locking ring,
Threads of traversing clamp screw,
Threads of jacks.

CHAPTER V

SERVICE OF THE PIECE

Owing to the conditions under which the mortar is usually fired, slight variations from the drill may be necessary. This is particularly true in the method of laying and inserting the bomb.

240 TRENCH MORTAR DRILL.

The mortar section consists of a chief of section, a mortar detachment, an ammunition detachment and a driver's detachment.

Each mortar detachment consists of a chief of section, a gunner and 5 cannoneers, numbered from 1 to 5 inclusive.

Each ammunition detachment consists of an ammunition corporal and 8 ammunition carriers, numbered from 6 to 13 inclusive, two of whom serve bombs and six of whom are in reserve.

To post the mortar and ammunition detachments.—The chief of section commands DETAILS POST, after the battery commander has commanded SECTIONS POST. The details take post as prescribed in the drill.

After the details have reached their posts, the chief of section then commands PREPARE FOR ACTION.

To call off.—The battery commander may at any time give the command CALL OFF. This command is repeated by the chief of section, and the cannoneers and ammunition carriers, beginning at No. 1, call off their numbers.

To load and fire.—The battery commander gives the line, elevation, charge, and fuse. The chief of section repeats the commands of the battery commander and commands LOAD. The battery commander may give the command, LOAD, in which case the chief of section repeats the command. When the mortar is loaded and laid, the chief of section commands TAKE COVER, and reports No. . . . READY and pulls the lanyard when the command COMMENCE FIRING is given by the battery commander.

When the battery commander commands FIRE—ROUNDS, COMMENCE FIRING; or FIRE—SHOTS, COMMENCE FIRING; the chief of section commands LOAD before each shot of a series, and at the end of the series reports No . . FIRED . . ROUND(S) or SHOT(S).

When the number of rounds is not specified, the battery commander commands CEASE FIRING, or SUSPEND FIRING and the chief of section repeats the command.

To suspend firing.—The chief of sections repeats the command SUSPEND FIRING given by the battery commander. If the mortar is loaded or being loaded, the cannoneers stand by to resume firing at any instant. If, however, the mortar has just been fired, it is depressed to the loading position, the breech is opened, and the cartridge case is extracted, and the cannoneers stand by for further orders.

To cease firing.—The chief of section repeats the command CEASE FIRING and command REPLACE EQUIPMENT, when the battery commander commands DISMISSED.

Misfire.—In case of a misfire, the chief of section reports, No. . .MISFIRE, and after waiting 1 minute, a second trial of the primer will be made. If this also fails, the cannoneers will remain under cover for 2 minutes. The mortar is depressed to the loading position, No. 5 unscrews the fuse, and No. 1 withdraws the cartridge case. If the cartridge case cannot be withdrawn, No. 5 inserts the bomb extractor and, assisted by Nos. 2, 3 and 4, extracts the bomb. The cartridge case is then withdrawn by No. 1.

THE FOLLOWING DRILL IS PRESCRIBED:

DETAILS	AT COMMAND DETAILS POST	AT COMMAND PREPARE FOR ACTION	AT COMMAND LOAD
Chief of section (N. C. O.).	Commands DETAILS POST and supervises the procuring of equipment and implements.	Commands PREPARE FOR ACTION, and makes a general inspection of mortar, carriage and base. He then reports to commander No. — IN ORDER, after receiving the reports of the chiefs of details.	Commands LOAD and supervises the work of his section. Inserts the fuse after the bomb is seated. He verifies the clinometer, goniometer and index setting and if correct, inserts firing mechanism and commands TAKE COVER. He takes cover and reports No. — READY. At the command COMMENCE FIRING, he pulls the lanyard with a steady pull and reports No. — FIRED — ROUNDS, or No. — MISFIRED.
Gunner (N. C. O.).	Procures firing mechanism, lanyard clinometer, goniometer and mirror, and places them convenient to his post. He takes post 1 yard from clinometer seat, on the side of the mortar and facing it.	Inspects, cleans and oils firing mechanism. Tests and coils lanyard and places it convenient to the breech. Tests clinometer and supervises the installing of the goniometer rest. Tests and inspects the traversing and elevating mechanism.	The mortar is traversed approximately to the zero line and the gunner commands ELEVATE after the bomb is seated, directs the elevation setting by clinometer and commands CLAMP. He then lays the mortar in direction, commands CLAMP, removes goniometer and mirror, and takes cover.

THE FOLLOWING DRILL IS PRESCRIBED:—Continued.

DETAILS.	AT COMMAND DETAILS POST.	AT COMMAND PREPARE FOR ACTION.	AT COMMAND LOAD.
No. 1. TRAVERSING DETAIL.	Procures a socket-bar handspike and T wrench. Takes post one yard in rear of left edge of bed.	Inspects breech block and inserts socket bar in left rear socket. Loosens clamp screw and tests traversing of piece. Removes muzzle cover and bore sponge, and examines bore. Reports to gunner.	Repeats deflection data. Assists No. 4 to insert cartridge. Traverses piece at command of gunner, clamps handwheel, when elevation is set, and tightens traversing clamp screw when deflection is set and takes cover. After firing assists Nos. 2 and 3 to depress muzzle.
No. 2. Elevating detail.	Procures oil can, waste and sledge. Takes post one yard to left of muzzle facing it.	Erects goniometer seat. Tests elevating, cleans and oils gears and racks. Reports to gunner.	Assist No. 1 to traverse piece. At command ELEVATE, they elevate piece and, as soon as it is clamped, take cover. After each round, they depress piece and assist No. 1 in traversing to loading position. No. 2 ejects cartridge case. No. 3 sponges out bore and chamber.
No. 3. Elevating detail.	Procures goniometer support and stakes. Takes position one yard to right of muzzle facing it.		

No. 4. Charge detail.	Procures chamber sponge and places it conveniently for No. 3. Takes post in charge recess.	Inspects charges and fuses. Reports to chief of section.	Repeats charge and fuse data. Hands fuse to chief of section. Brings up and inserts cartridge in breech and takes cover.
No. 5.	Reserve.	Reserve.	Reserve.
Ammunition Corporal	Takes post at ammunition shelter.	Inspects bomb and accessories and reports condition to chief of section.	Supervises ammunition detail and prepares bombs.
Nos. 6 and 7. Ammunition detail.	No. 6 procures bomb tray. No. 7 procures bomb extractor, file and wire brush. Take post at ammunition recess.	Load a tray with bomb.	Carry up bomb, No. 6 in front, No. 7 in rear. No. 6 assists chief of section to slip bomb tray over muzzle, pushes bomb into bore, removes tray and returns it to bomb shelter. No. 7 assists Nos. 2 and 3 to elevate piece and then takes cover.

CHAPTER VI

AIMING AND LAYING

ELEVATION.

The gun commander sets the quadrant at the angle ordered, holds it on the barrel in the groove provided, with the arrow pointing in the direction of the target, gives the necessary directions to the cannoneer to elevate or depress the muzzle so as to center the bubble of the level between its two indices and orders "Clamp." The gun is clamped by means of the elevation clamping mechanism and the gun commander removes the quadrant after making sure that the elevation has not been changed in the process of clamping. After giving direction to the piece the elevation must again be checked.

DIRECTION.

(*a*) **Plumb bob method.**—The target being indicated by a stake on the trench, or seen with the eye, the gun commander, holding a plumb line, stands behind the mortar in the vertical plane of the axis of the bore. No. 1, at the socket lever at the rear of the gun, stands ready to traverse the muzzle right or left. The gun commander holds the plumb line to the height of his eye and directs the piece to be moved so as to bring the target (or stake), the axis of the bore and the plumb line in coincidence with his line of vision. This being accomplished, No. 1 locks the clamp screw at the command of the gun commander. The gun commander verifies this laying. After pointing the piece he notes the reading of the goniometer as explained in (*f*). In case the target cannot be seen from the position, one of the following methods may be used, which necessitates the employment of certain topographical instruments.

(*b*) **By means of a compass**[1].—The location to be occupied by the mortar is marked on the battle map with letter B and the position of the target—T. The magnetic meridian BM is drawn through B, with a protractor and the angle TBM is measured on the battle map. At the location to be occupied by the mortar the magnetic line BM and the line to the target BT are staked out, making an angle equal to TMB measured on the battle map. The compass must not

[1] Ordinarily the needle of the compass does not lie in the meridian, i. e., in the true north and south line. Its angle of deviation from that line is called the *magnetic declination*.

The magnetic declination varies (at a given time) from place to place, and (at a given place) from time to time. The change in declination, from place to place, or from time to time, is called *magnetic variation*.

The magnetic declination in northern France is *west* of *north*.

be used within about 40 meters of the mortar because its readings would be influenced by the steel. Steel shells in the ground may also influence the compass.

The mortar is then mounted and laid for direction on the stake T and the goniometer reading is noted. This method is only approximate on account of the difficulty of accurately laying off the angles on the ground.

(*c*) **By means of an aiming point.**—If there is an aiming point visible from the position and accurately located on the battle map, the angle between the gun-aiming point line and the gun-target line is measured on the map. The gun is laid on the aiming point by the plumb-bob method and the goniometer reading is noted. The gun is then traversed in the proper direction by the amount of the angle measured on the map by means of the goniometer, as explained below.

(*d*) **Changing the target.**—Fire having been adjusted upon one objective O, and the goniometer reading for this noted, to lay the mortar upon another target O′, on the battle map, the angle O gun O′ is measured, the goniometer reading changed in the proper direction by this amount and the piece laid by means of the goniometer as described below.

(*e*) **By means of the goniometer mirror.**—The piece is pointed by placing the goniometer support either in front of the mortar or at the side. The support must be placed at a distance of about one meter from the mirror when on the barrel. If in front of the gun, perpendicular to the zero line, and if at the side, parallel to the zero line. The stakes must be driven vertically, the goniometer rest placed accurately horizontal, using the quadrant, and the set screws tightened.

The elevation of the piece being correct, No. 5 attaches the mirror to the barrel and brings the bubble to the center of the level by means of the adjusting screws. The gun commander sets off the given reading on the goniometer and placing himself behind the crossbar, facing the piece, slides the goniometer along the groove until he is able to see the image of the goniometer in the mirror. To accomplish this he directs No. 5 to tilt the mirror to the proper position. The gun commander then looks through the eyepiece of the goniometer and directs the cannoneers to traverse the gun in the proper direction until the slit in the eye-piece coincides with the reflection in the mirror of the white line of the goniometer screen. During this operation No. 5 should be careful to maintain the mirror level as indicated by the bubble. The gun being laid, the gun commander orders "Clamp" and No. 1 tightens the traversing clamping screw. The mirror is then removed and placed in the service box.

(*f*) **To find the goniometer reading corresponding to a given direction of the mortar.**—No 5 attaches the mirror and levels it. The gun commander sets the goniometer at zero and placing himself behind the cross-bar, facing the piece, slides the goniometer along the groove until he is able

to see the image of the goniometer in the mirror. To accomplish this he directs No. 5 to tilt the mirror to the proper position. Holding the goniometer perpendicular to the groove with the left hand, with the right hand he presses down the rod of the instrument and turns it until he can see, through the eye-piece, the slit in the eye-piece near the image of the white line of the screen in the mirror. He then turns the drum until the two exactly coincide, locks the drum with the set screw and checks the setting after locking. He then calls out and records the goniometer reading. The mirror is then removed and placed in the service box.

CHAPTER VII

IRREGULARITIES OF FIRE

The most frequent irregularities are:

Misfires,
Hangfires,
Abnormal shots,
Premature bursts,
Failures to burst.

Misfires.—Misfires may be due to failure of either the firing mechanism or the charge. In case of a misfire, the gunner reports "Misfire," waits one minute and then hooks the lanyard and tries again. If another misfire occurs, the position of the breech block is checked. If the breech block is in its proper place the firing mechanism is removed and closely examined. If it appears perfect, the charge is taken out without unloading the gun, if possible to do it in that manner. If it is necessary to unload the gun the fuse is carefully unscrewed, the bomb taken out by means of the bomb extractor and the charge pushed back by quickly ramming the charge down the barrel. The gun is reloaded with a new charge and fired. If a misfire occurs once more, it is probably due to the firing mechanism which should be changed and the faulty one sent for repair.

Hangfires.—Hangfires are caused by faulty ignition. In such cases the pressure developed in the gas chamber is below normal and the bomb falls short, sometimes not more distant than the trench parapet.

Abnormal shots.—In trench artillery terms, an abnormal shot is said to have occurred when the projectile reaches less than 2/3 of the distance indicated by the range table. Occasionally it happens that a bomb falls too far from the line of direction. Abnormal shots are generally caused by:

(*a*) Hangfires.
(*b*) Tumbling of the bomb due to a bent vane.
(*c*) Unsteady platform.
(*d*) The bomb not being properly seated.
(*e*) Strong wind. This has great effect on the range, especially when firing at the higher elevations.

Premature bursts.—Premature bursts may be caused by:
(*a*) Premature functioning of the fuse. A fuse in good condition may work prematurely because of a sudden change in the velocity of the bomb due to dirt in the bore.

(*b*) The bomb hitting the trench wall. This may be due to hangfires, or to the elevating handles not being clamped securely, causing the dropping of the barrel on firing; or to

failure to check the angle of elevation to see that the projectile has free passage over the parapet.

(c) Spontaneous detonation of the bursting charge, which is very sensitive to friction, may occur if the bursting charge rubs against the inner surface of the bomb: (a) if the explosive is not well rammed, or (b) if an abnormal pressure is exerted on the bomb when fired.

Failures to burst.—Failure to burst may be due to:

(a) Failure of the fuse to function.

(b) The fuse not striking the ground on account of the bomb tumbling in its flight or falling on a slope or ground upturned by shells.

(c) Poor condition of exploder.

Besides these principal irregularities of fire, the following may occur:

(c) **Defective operation of the breech block.**—In this case the breech block is unscrewed, inspected and cleaned. If necessary the spring or the whole block is changed.

(b) **Difficulties with the breech block.**—If the breech block is hard to move up and down it should be pulled out and it and the slot inspected for roughness. If either is damaged it should be sent away for repairs.

(c) **Difficulty in loading the gun. It is absolutely forbidden to force the bomb into the barrel.**—A bomb which cannot be easily put into the barrel is to be taken out with the bomb extractor, cleaned and inspected for roughness and bent vanes. If necessary, the roughness is removed with a file and the vanes straightened.

(d) **Difficulties with the platform.**—If the platform jumps when firing, or is abnormally displaced, it should be replaced and the jacks and bolts tightened and the orientation checked.

Detailed Report.

Every irregularity of fire should be reported by the battery commander to the commander of the artillery, through channels. This report should state:

(a) Model and number of mortar.
(b) Kind of bomb and fuse used.
(c) The markings of the bomb.
(d) The charge used and the angle of fire.
(e) Approximate range attained.
(f) Damage to materiel caused by accident.

If a report refers to a case of a failure to burst, it should also state:

(a) Kind of ground.
(b) Slope of ground at point of impact.

Precautions to be Taken for Preventing Accidents.

Transportation of ammunition on railroad cars and on wagons.

Bombs must be transported in crates.—Crates should stand on end so that the tail of the bomb is downward. *This precaution is imperative.* Do not put bombs in the same wagon with charges and fuses if it can be avoided. If this must be done, a layer of straw must be used to prevent relative movement of bombs, charges and fuses during transportation. Bombs should be carried in cases as near as possible to the front line. In railroad transportation one ten-ton car carries 90 bombs.

Care of Ammunition.

Bombs.—When stored in ammunition magazines or shelters, uncrated bombs must never be stood on the tail. Officers should superintend the storing of all ammunition and personally see that the vanes are in good condition. Bombs must not be exposed to the sun as the heat melts the parafine and vaseline composition of the explosive and renders it unstable. Bombs should be arranged according to weight.

Charges and fuses.—Charge cases and fuse boxes should be sheltered from rain and dampness and opened only at the time of firing, one case at a time. Cases and boxes should be closed when firing is over. In storage, charges with the same arsenal lot number should be kept together.

Inspection of Materiel.

Materiel must be carefully inspected frequently and especially after periods of intensive firing. Any mortar, the bore of which is wearing out or shows cracks, should be sent back for repairs or renewal. The same precaution is to be taken with firing mechanism.

Precautions While Firing.

The gunner should:

(1) Check the position of the bomb in the barrel by means of the gauge.

(2) Verify the position of the platform after each round and see that the wedges are always driven home, the jacks and the nuts tightened.

No. 4 should see that the charge is in good order. A charge showing signs of dampness will not be used.

No. 5 sees that the bomb is clean and presents no erosion and that the vanes are straight and in good condition.

It is forbidden to tear off the felt washer of the fuse or to attempt to screw or unscrew the fuse socket of the bomb.

If firing in rainy weather, care must be taken that charges and fuses are protected from dampness. The sponge must also be kept dry.

The battery commander takes all necessary measures to prevent accidents to the personnel. *He compels cannoneers* to take shelter while each shot is fired. In all cases he will keep in touch with the infantry commander to have the zone in front of the position evacuated by the infantry during periods of firing.

CHAPTER VIII

TARGETS AND METHODS OF ATTACK

When fires for effect does not immediately follow, the adjustment of fire is verified before firing for effect. This is because atmospheric conditions and the state of the ground on which the piece stands may have changed. During the fire for effect all rounds are observed so as to allow the corrections necessary to make the fire more effective to be made.

Dispositions should be made to insure a continuation of the firing, whatever may be the difficulties in the transmission of orders.

It is advisable to give the chief of section written orders, the nature of which is shown in par. 108 of Part II.

When the target is small the direction and elevation for its center is used.

When the target is large, fire is conducted with elevations successively increased by half the value of the bracketing angle and in directions varying successively by 10 decigrades This is to cover the target in the most effective manner.

Night Firing.

At night, except under particularly favorable circumstances (when searchlights or lighting rockets are used), it is impossible to observe the points of impact of the projectiles. Night firing, therefore, can only be fire for effect, when fire adjustment has been executed during the day, either upon the objective or upon an auxiliary target. The data for this fire for effect having been previously established will be sent in writing to each position commander. If, in an exceptional case, it is possible to observe shots with certainty they should be recorded for the correction of fire.

Effects of the Projectiles of the 240 (long) Mortar.

Craters.—The 240 (long) projectile with a delay action fuse, in a hard clay soil, produces a crater:

D = diameter at top = 6 to 10 meters.

d = diameter at top of globe of compression = 2 to 3 meters.

h = depth = 1.5 meters.

Effects on trenches.—A bomb falling in the trench or within 3 meters of the sides of it will wreck it for a length of 6 to 8 meters, depending upon the nature of the soil. The 240 (long) bomb is not normally used for destruction of barbed wire as it upturns the ground too much for an easy advance of the infantry.

Blockhouses, observation posts, machine gun shelters, minenwerfer emplacements, sap heads, organized houses, etc.—Against these small targets firing should be with a single elevation and direction. For demolishing a blockhouse (4 m. by 4 m.) 30 to 40 bombs are required.

Portion of trench or communication trench.—Enfilade fire is very advantageous on account of the greater precision in direction of the mortar.

(*a*) **Enfilade fire.**—The portion AB (fig. 15) of the trench is to be destroyed. If elevations corresponding to points A and B do not differ in value by more than one fork, all the bombs should be fired with an elevation and direction corresponding to the middle (M) of the portion to be destroyed. If elevations corresponding to A and B differ by more than the value of one fork, fire should be executed on points M_1 and M_2 so located that $AM_1 = BM_2 = 1/4$ AB.

The levelling of an enfiladed trench for a length of 100 meters, at a range of 1500 meters, will require from 40 to 50 bombs.

(*b*) **Frontal firing.**—The target is divided into sections of 10 decigrades in width. Fire for effect is executed on the centers of these sections. In many cases the enemy trenches are doubled by a circulation trench parallel to the front trench and about 20 yards to the rear. If the firing is frontal, it will be satisfactory to conduct fire for effect on a point situated midway between the two trenches. If the firing is enfilade it is conducted for effect on each of the trenches separately. For such firing the number of bombs required is the same whether the firing is frontal or enfilade.

Salient.—The salient shown in fig. 16, 100 meters square, at a range of 1600 meters, is to be destroyed.

1. **Adjustment fire on a point distinctly visible.**—If possible, a point is chosen upon which the fire for adjustment may produce a useful effect, as for example the head of the sap A. It is assumed that the data for this target is found to be elevation 63° and deflection 3950 (with the goniometer).

2. **Distribution of projectiles over the whole target.**

(*a*) **In direction.**—The fire for effect should be carried out by changes in direction of 10 decigrades at a time. If the distance AM corresponds to 25 decigrades, the directions to use will be 3970, 3960, 3950 and 3940.

(*b*) **In range.**—The elevation corresponding to the point A has been found to be 63° which corresponds to a range of 1570 meters (one fork = 3°). If the near edge of the salient MN is 35 meters from A, as shown by the map, the elevations corresponding to AN and to PQ will be, respectively:

MN (1535) 63½°
PQ (1635) 61¾°.

The difference in elevation being $1\frac{3}{4}°$, which is less than one fork (3°) the fire for effect should be carried out with a single elevation namely, that of the mean point, or at an elevation of $62\frac{1}{2}°$. If 200 bombs are considered necessary for the destruction of the target, the fire would be conducted as follows:

50 bombs,	elevation	$62\frac{1}{2}°$;	direction	3970
50	—	$62\frac{1}{2}°$	—	3960
50	—	$62\frac{1}{2}°$	—	3950
50	—	$62\frac{1}{2}°$	—	3940

If the firing is to be carried out by more than one mortar it is necessary to adjust the fire of each separately and then to divide the work between them.

APPENDICES

APPENDIX A.

Range Table—240 (L) Trench Mortar.

Bomb T.—83 kilos (183 lbs.).

Charge No. 2.—800 grams balistite 1×10×10 Grams F3 powder:

Range in Meters	Elevation in degrees	Fork in degrees	Range in Meters	Elevation in degrees	Fork in degrees
740 m.	65°	2°	1100 m.	64¾°	5°
760	74½°	"	1120	64°	6°
780	74°	"	1140	63¼°	"
800	73½°	"	1160	62½°	"
820	73°	"	1180	61¾°	7°
840	72½°	"	1200	61°	"
860	72°	"	1220	60¼°	"
880	71¼°	2½°	1240	59½°	8°
900	70¾°	"	1260	58½°	"
920	70¼°	"	1280	57¾°	"
940	69¾°	3°	1300	56¾°	"
960	69°	"	1320	55½°	"
980	68½°	"	1340	54½°	10°
1000	68°	"	1360	53°	"
1020	67¼°	"	1380	51¾°	11°
1040	67¾°	"	1400	49¾°	13°
1060	66°	5°	1420	45°	15°
1080	65¼°				

Table of Values of ⅙ of a Fork.

F	⅙ F	⅓ F	½ F
2½°	½°	¾°	1¼°
3°	½°	1°	1½°
4°	¾°	1¼°	2°
5°	¾°	1¾°	2½°
6°	1°	2°	3°
7°	1¼°	2¼°	3½°
8°	1¼°	2¾°	4°
9°	1½°	3°	4½°
10°	1¾°	3¾°	5°
11°	1¾°	3¾°	5½°
13°	2¼°	4¼°	6½°
15°	2½°	5°	7½°

Range Table.—240 (L) Trench Mortar.

Bomb T.—83 kilos (183 lbs.).

Charge No. 1.—1250 grams balistite 1×10×10 grams F3 powder.

Range in Meters	Elevation in degrees	Fork in degrees	Range in Meters	Elevation in degrees	Fork in degrees
1100 m.	75°	2½°	1680 m.	64°	2½°
1120	74¾°	d°	1700	63½°	d°
1140	74¼°	d°	1720	63°	d°
1160	74°	d°	1740	62¾°	d°
1180	73½°	d°	1760	62¼°	d°
1200	73¼°	d°	1780	61¾°	d°
1220	73°	d°	1800	61¼°	d°
1240	72½°	d°	1820	60¾°	d°
1260	72¼°	d°	1840	60¼°	d°
1280	71¾°	d°	1860	59¾°	d°
1300	71½°	d°	1880	59¼°	d°
1320	71¼°	d°	1900	58¾°	d°
1340	70¾°	d°	1920	58¼°	d°
1360	70½°	d°	1940	57¾°	3°
1380	70¼°	d°	1960	57¼°	d°
1400	69¾°	d°	1980	56½°	d°
1420	69½°	d°	2000	55¾°	d°
1440	69°	d°	2020	55°	d°
1460	68¾°	d°	2040	54¼°	4°
1480	68¼°	d°	2060	53½°	d°
1500	67¾°	d°	2080	52¾°	d°
1520	67½°	d°	2100	52°	5°
1540	67°	d°	2120	51°	d°
1560	66¾°	d°	2140	50°	6°
1580	66¼°	d°	2160	48½°	d°
1600	65¾°	d°	2180	47°	7°
1620	65¼°	d°	2200	45°	8°
1640	65°	d°	"	"	"
1660	64½°	d°			

APPENDIX B

MATERIEL

List of materiel used in a Trench 240 mm. battery (Long).

A

6 pieces 240 mm., each composed of:
- 1 mortar,
- 1 carriage,
- 1 metal bed,
- 1 platform composed of:
  - 2 base timbers,
  - 5 under sleepers,
  - 8 tie rods,
  - 2 lower side timbers,
  - 2 lower channel irons,
  - 2 upper channel irons,
  - 4 upper channel-iron bolts,
  - 4 rear kicking timbers,
  - 4 front kicking timbers,
  - 7 vertical blocks,
  - 2 upper side timbers,
  - 4 twenty-ton jacks,
  - 5 upper sleepers,
  - 4 upper side timber bolts,
  - 6 kicking timber bolts.

B

18 mortar carts.

C

14 G. S. wagons. Two are assigned to each piece and carry:
- (*a*) platform,
- (*b*) one service box containing:
  - 2 padlocks,
  - 1 bomb extractor,
  - 1 scraper,
  - 1 wooden mallet,
  - 1 hammer,
  - 1 screw driver,
  - 1 three-cornered file,
  - 1 half round file,
  - 1 rat tail file,
  - 1 monkey wrench,
  - 1 large double ended socket wrench,
  - 1 grease brush,
  - ½ kg. (1 lb.) can of grease,
  - 1 cleaning brush.
  - 1 pair pliers,

1 sledge hammer,
1 cold chisel,
1 canvas bucket,
1 plumb line,
3 kilograms (6.6 lbs.) rags,
1 alligator wrench,
1 hand spike for jacks,
1 bore sponge,
1 chamber sponge,
1 T wrench,
1 rope sling,
2 large sponge covers,
3 small sponge covers,
1 goniometer mirror and support,
1 siege goniometer,
1 siege goniometer screen,
1 quadrant,
1 firing mechanism,
1 breech lock,
1 breech lock spring,
1 canvas bag,
1 long lanyard,
1 tarpaulin, 3 by 4 meters,
1 carpenter's pencil,
1 percussion plug,
1 firing pin extras,
1 safety spring,
1 short lanyard,
1 percussion plug wrench,
½ meter emery cloth,
¼ kilogram (½ lb.) string,
1 flashlight,
1 candle lantern,
1 bomb tray,
6 bomb carriers,
1 ten meter towing rope,
6 cart shafts (spares),
3 converting frames for carts,
1 goniometer support consisting of:
1 iron cross piece,
2 iron pickets.

1 G. S. wagon, carrying:
(*a*) Extra equipment,
1 No. 1 rear wheel for G. S. wagon,
1 No. 5 front wheel for G. S. wagon,
12 shovel handles,
6 pick handles,
1 bomb tray,
6 shafts for mortar carts,
3 single trees for mortar carts,
3 towing tongues for mortar carts,
12 towing ropes for mortar carts,
12 axle pins for mortar carts,
1 spare wheel for mortar carts,

1 upper channel-iron,
1 lower channel-iron,
2 face plates for tie-rods,
4 upper side timber bolts,
6 lower channel-iron bolts,
4 face plates for base timbering ring bolts,
200 wood screws,
5 channel-iron washers,
2 20-ton jacks,
4 upper channel-iron bolts,
4 face plates for base timbers,
8 handles for under sleepers,
4 kicking timber bolts,
4 kicking timber slotted face-plates,
4 kicking timber face-plates.

(*b*) Box of spare parts:
2 pad-locks,
3 transportation rings,
3 washers for elevation hand-wheel,
4 transportation collars, muzzle end,
4 transportation collars, breech end,
1 traversing clamp screws,
2 cap square levers,
6 elevating rack bolts,
1 punch,
6 socket-bar pins with chains and rings,
6 staples or chains,
1 hand vise,
12 D-handles for upper sleepers,
12 clamps for upper sleepers,
1 set of sponges,
1 chamber bore sponge in two sections,
3 large and 3 small sheepskin covers,
1 canvas cover for bore sponge,
1 canvas cover for chamber sponge,
1 quadrant,
2 scrapers, each in two parts,
2 complete firing mechanisms.

1 canvas bag containing:
2 firing-pins,
2 safety springs,
2 striker springs,
2 breech latches (in canvas bag),
2 breech bolt springs,
2 breech bolt screws,
2 firing-pin liners,
1 striker,
1 wrench for firing mechanism,
2 short lanyards,
1 goniometer mirror and support.

(*c*) Fire control materiel as follows (in 3 wooden packing boxes):
1 plane table,
1 plane table tripod,

1 box of accessories containing:
1 Peigné compass,
1 declinator,
2 screws for declinator,
1 levelling alidade,
6 sheets drawing paper,
12 sheets tracing paper,
1 box assorted colored pencils,
1 box thumb tacks,
1 eraser,
3 hard pencils,
1 decimeter rule,
1 straight edge,
1 square,
1 pair drawing compasses,
1 compass extension arm,
1 drafting pen,
1 bottle India ink,
1 bottle blue ink,
1 bottle red ink,
2 zinc protractors,
1 artillery board,
1 firing chart pasted on zinc, cross sectioned in kilometers,
1 periscopic alidade,
1 periscopic goniometer,
20 kerosene lanterns,
1 box of instruments containing:
2 extra mirrors,
1 box for extra mirrors,
1 siege goniometer screen,
1 siege goniometer with sight,
2 extra goniometer screws,
2 extra goniometer mirror screws,
1 pair of field glasses,
1 padlock,
1 case goniometer accessories,
2 A2 telephone sets, each containing:
1-4 way switch board,
4000 meters light wire (in eight spools),
1 breast reel,
2 forked poles in two pieces,
3 grounding stakes,
3 pamphlets on telephone materiel.

3 field telephones each containing:
2 tool bags each containing:
1 hammer,
1 pocket knife,
tarred cord,
1 pair pliers,
iron wire,
1 rubber tube,
1 roll rubber tape,

1 roll friction tape,
20 wall pins.

1 G. S. wagon containing:

(*a*) Blacksmith's equipment,
1 field anvil,
1 field anvil block,
1 vise,
1 box horse shoe nails,
1 square setter,
1 round setter,
2 horse shoe swages,
1 smith's sledge,
1 farrier's hammer, fitting,
1 farrier's hammer, forging,
1 small hammer,
1 riveting hammer,
1 sprinkling brush,
1 palette,
2 punches,
1 hand punch,
1 round punch,
1 hot caulk punch,
1 cold caulk punch,
1 smith's tool scraper,
6 taps,
3 forge tongs,
3 wide jawed tongs,
1 poker,
2 hardies,
1 paring knife,

(*b*) Miscellaneous:
1 monkey wrench,
1 pair pliers,
1 screw driver,
2 cold chisels,
2 locksmith's chisels,
2 joiners' chisels,
1 iron try square,
1 plane,
4 screw driver bits,
3 bastard files,
2 half smooth files,
6 file handles,
1 riveting hammer,
4 bits,
1 spoke shave,
1 farrier's punch,
1 small hand saw,
1 key-hole saw,
1 buck saw,
3 twist-drills, Nos. 32, 20, 14,
1 brace,
1 steel meter rule,

1 picketing outfit including:
1 picket rope,
1 picket sledge,
2 large pickets,
2 small pickets,
1 spare wagon pole,
2 axle pins,
1 wagon paulin,
2 lashing ropes,
2 spare traces,
1 spare trace bag,
2 padlocks,
1 padlock key,
1 water pail,
1 shovel,
1 pick,
50 axle pin thongs,
1 kilogram rags,
6 sickles,
1 scythe blade,
1 scythe ring,
1 scythe wedge,
1 scythe handle,
1 small anvil,
1 hammer,
1 whet stone,
1 whet stone sheath,
1 scythe belt.

E

3 covered wagons,
Wagon No. 1, containing:
Baggage,
Battery records.
Wagon No. 2 containing:
Reserve rations.
Wagon No. 3 containing:
Daily rations.

The following accessories are distributed among the three wagons:

1 spare wagon pole,
3 axle pins,
6 spare traces,
3 spare trace bags,
1 large grease pail,
1 spade,
1 pick,
2.5 kilos heavy grease.

F

1 rolling kitchen.

G

14 spare wagon poles (one at the left side of each wagon),

5 No. 1 axle pins, 5 No. 2 axle pins, 7 shoulder washers (5 No. 1 and 2 No. 2), 7 friction washers (5 No. 1 and 2 No. 2), 7 stud washers (5 No. 1 and 2 No. 2),	On wagon carrying blacksmith equipment.

28 spare traces,

14 spare trace bags (1 under the seat of each wagon).

H

Engineer and Battery tools (distributed among the 12 G. S. wagons):

1 large cleaning brush,
1 large grease brush,
4 two-men cross cut saws,
4 sheaths for two-man cross cut saws,
2 wire cutters,
2 leather cases for wire cutters,
4 axes,
8 spades,
40 shovels,
6 intrenching tools with cases,
6 rock picks,
20 pick axes,
4 bolos,
2 wire cutters,
2 hand axes.

L

ACCESSORIES.

1 muzzle cover, on the mortar,
1 canvas-leather breech cover, on the mortar,
1 rammer, in the mortar,
12 picketing outfits (one in each of the 12 park wagons), each outfit consisting of:
1 picket rope,
1 picket sledge,
2 large pickets,
2 small pickets,
7 bicycle oil cans (one in each alternate G. S. wagon on inside of left door of underslung box),
12 lashing ropes, for battery bags,
14 grease pails (one hooked between front wheels of each G. S. wagon),
1 3-liter can of kerosene (in G. S. wagon containing the accessories),
7 No. 7 and No. 5 cans of oil (on inside left door of underslung box on each odd-numbered G. S. wagon),

31 padlock keys,
14 water pails (one on each front axle of G. S. wagon),
12 candle lanterns (in covered wagon No. 2),
12 65-kilogram battery bags (in covered wagon No. 2),
1 20-ton jack with hand spike (in wagon carrying blacksmith's tools).

Provisions and miscellaneous objects:
100 kilograms forge coal (in blacksmith's wagon),
10 kilograms 4 mm. wire,
10 kilograms 70 mm. nails,
5 kilograms candles (in each G. S. wagon),
42 kilograms heavy grease (3 kg. in each grease pail),
7 kilograms sperm oil (1 kg. in each No.7 and No. 5 can),
5 liters kerosene,
1 set of account books, pamphlets, etc.

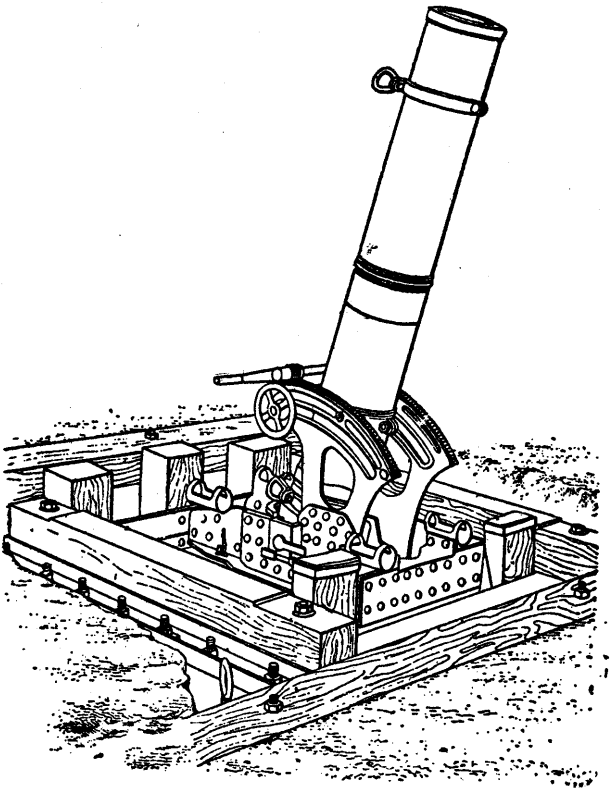

Fig. 1. — The 240 mm. (long) trench mortar.

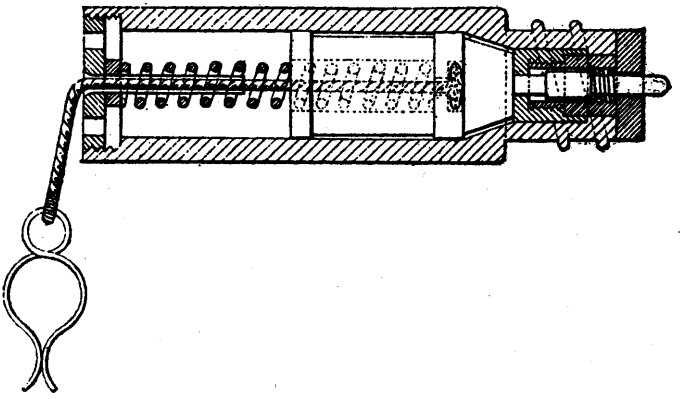

FIG. 2. — Firing mechanism.

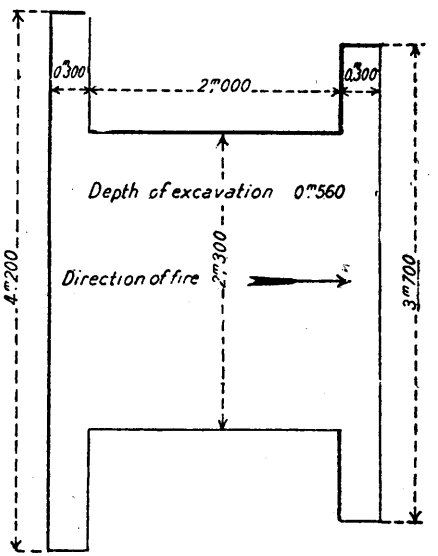

FIG. 3. — Excavation for platform.

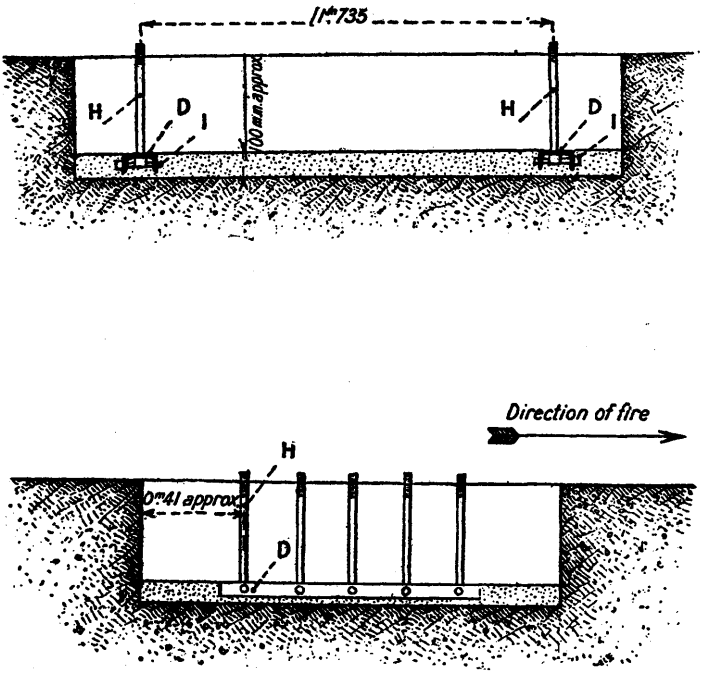

Fig. 4. — Setting of lower channel-irons.

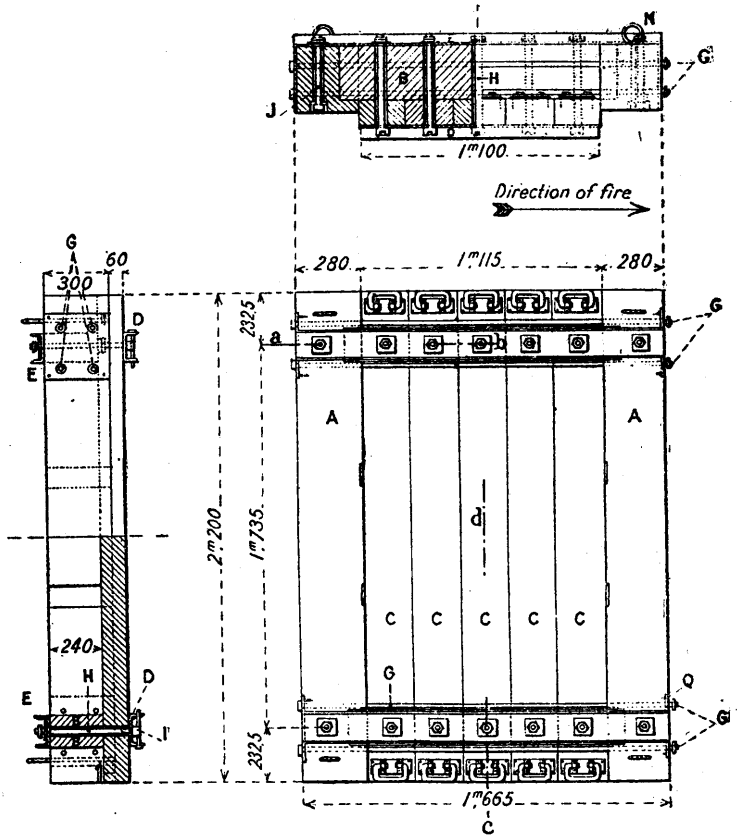

FIG. 5. — Frame and lower sleepers assembled.

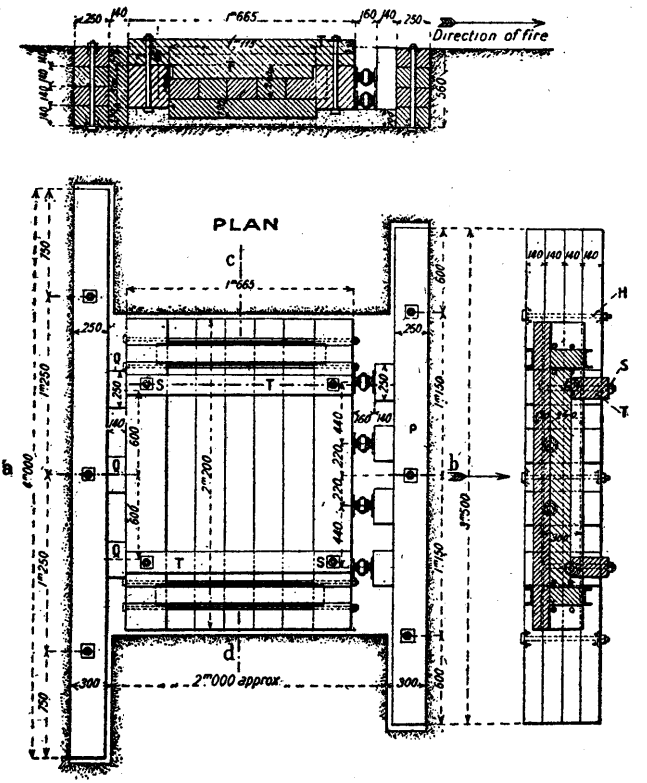

FIG. 6. — Assembled platform.

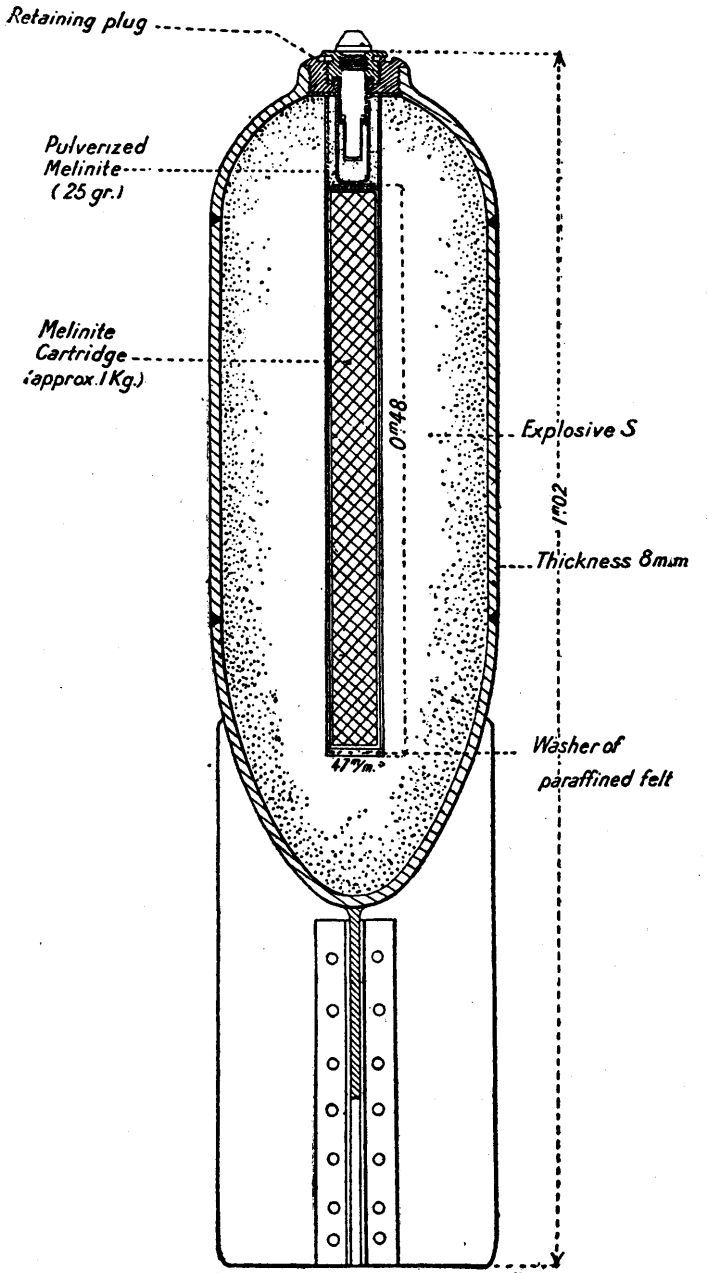

Fig. 7—Bomb, Model 1916, type T, Longitudinal section.

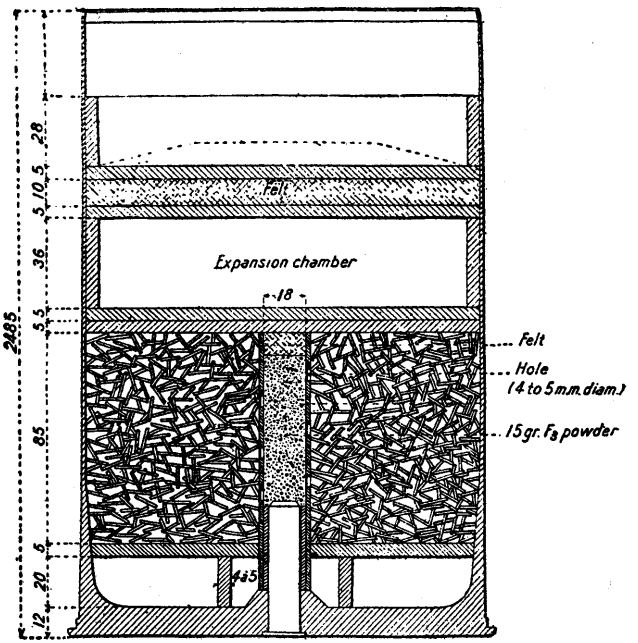

FIG. 8. — Propelling charge.

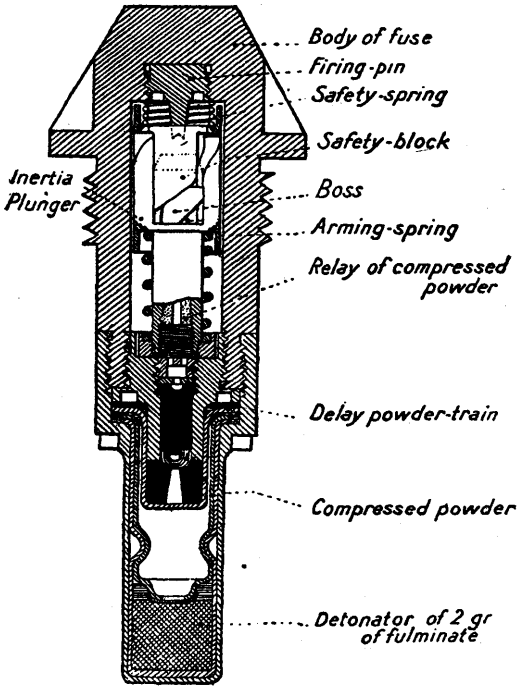

FIG. 9. — 24/31 P. R. Model 1916 delay fuse (Fuse unarmed).

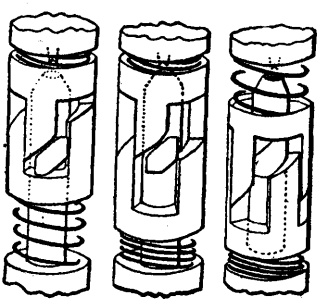

FIG. 10. — Details of fuse.

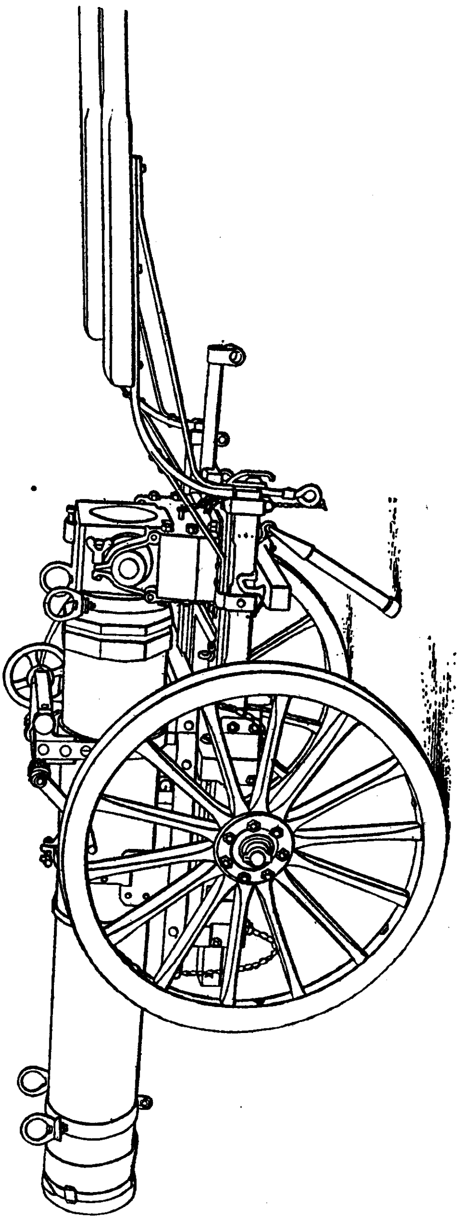

Fig. 11. — Mortar-cart.

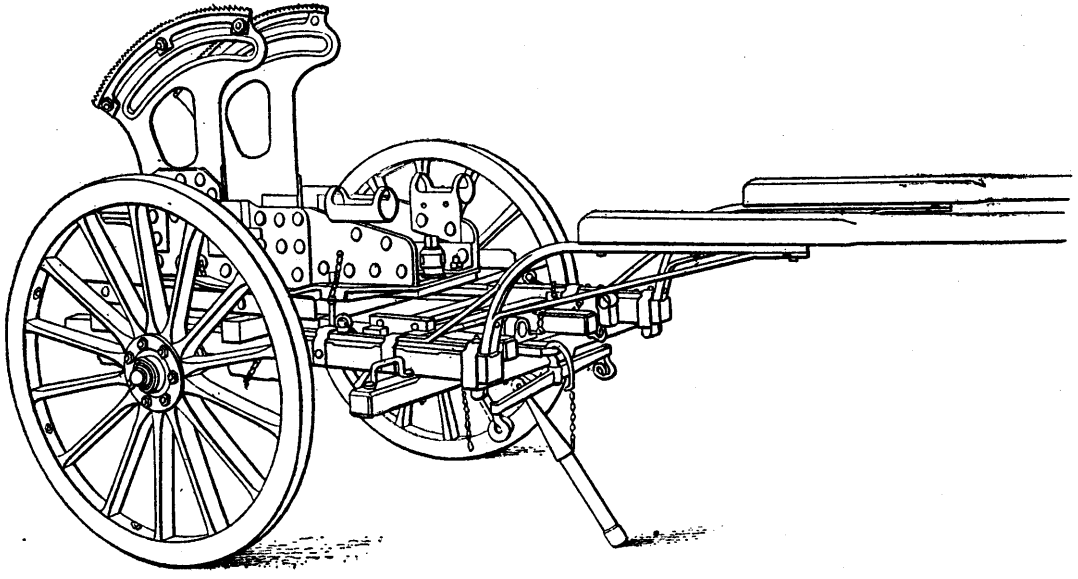

FIG. 12. — Carriage-cart.

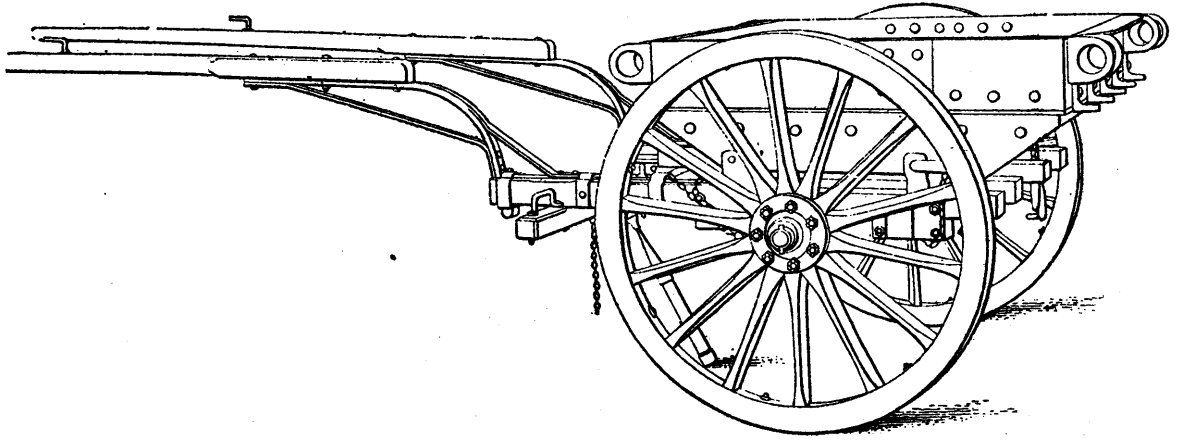

FIG. 13. — Bed-cart.

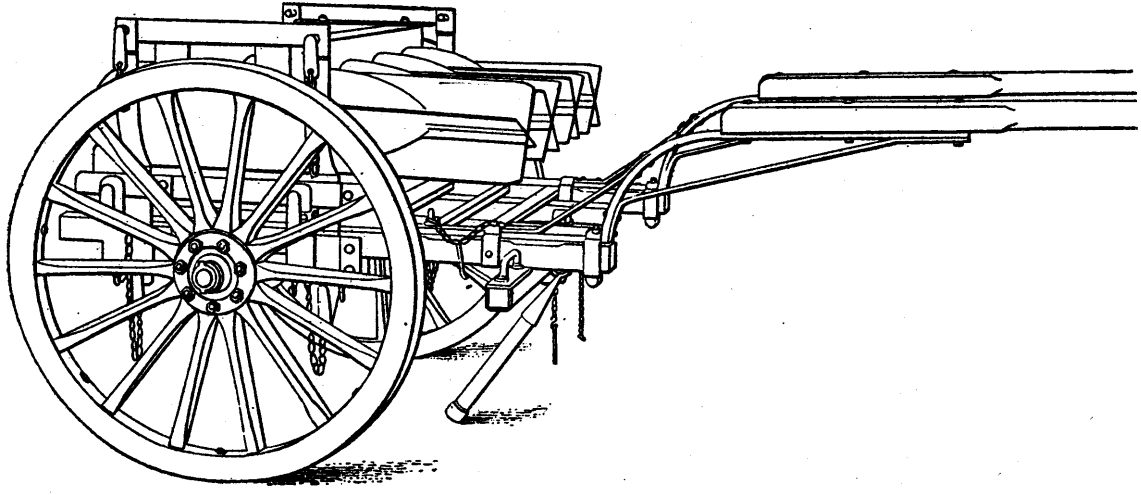

FIG. 14. — Bomb-cart.

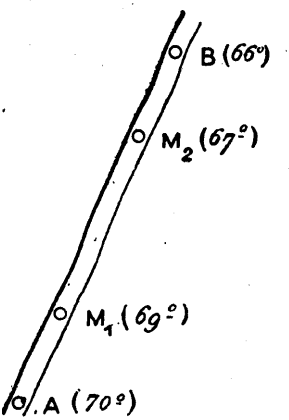

Fig. 15. — Enfiladed trench.

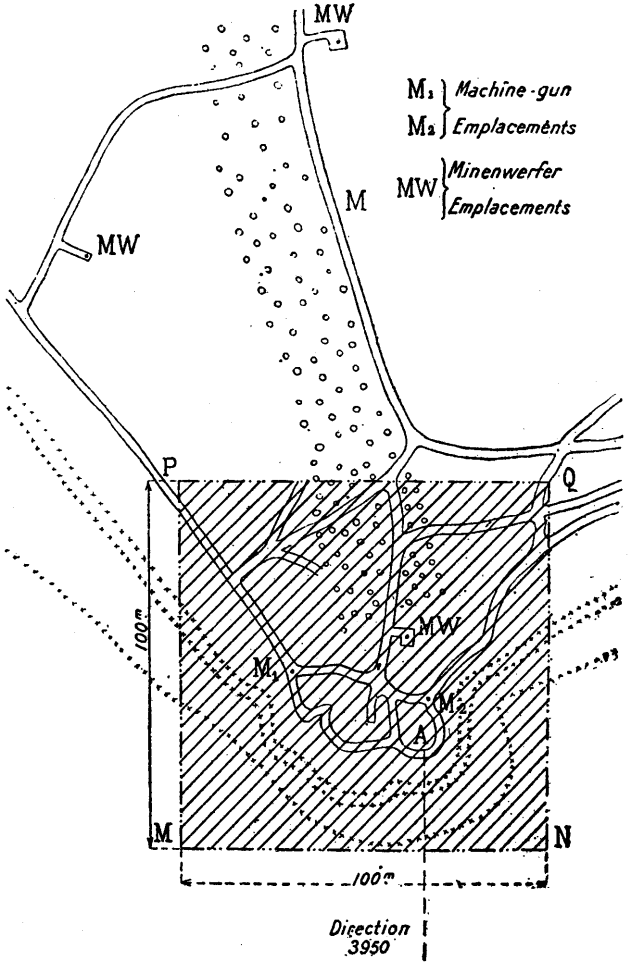

Fig. 16. — Salient.