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LECTURE ON

HIGH-POWERED HEAVY ARTILLERY

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WAR DEPARTMENT,
WASHINGTON, *October 11, 1917.*

The following pamphlet, "Lecture on High Powered Heavy Artillery," is published for the information of all concerned.

[062.22, A. G. O.]

BY ORDER OF THE SECRETARY OF WAR.

TASKER H. BLISS,
General, Chief of Staff.

OFFICIAL:

H. P. McCAIN,
The Adjutant General.

WAR DEPARTMENT,
THE ADJUTANT GENERAL'S OFFICE,
Washington, June 19, 1917.

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PART ONE.

GENERAL ORGANIZATION AND USE OF THE HIGH-POWERED HEAVY ARTILLERY.

Documents.—The general organization of the high-powered heavy artillery was determined by the Decisions of the Commander-in-Chief of February 7 and March 28, 1916.

Tables B and C of the Appendix to the Instruction of December 13, 1915, on the Use of Heavy Artillery contain the ballistic data on a certain number of high-powered heavy artillery pieces.

A Note of December 13, 1915, determines the conditions for the use of the high-powered heavy artillery in the Armies.

History of the origins of the high-powered heavy artillery.—From the beginning of the campaign an effort was made to reenforce the heavy artillery by bringing into service at the front naval and coast defense matériel suitable for that purpose.

In this way there were successively brought into use—

14 and 16 cm. guns manned by Navy gunners.

19 and 24 cm. coast-defense guns mounted on railway trucks.

305 mm. guns, with chassis mounted on bogy trucks.

240 mm. guns on bracket mounts (affuts à échantignolles).

Thanks to cooperation on the part of manufacturers, it was possible to improvise a high-powered heavy artillery, the general mission of which may be defined as follows:

To combat or destroy targets which other artilleries can not engage, either because their projectiles are not sufficiently powerful or because their range is too short.

The pieces obtained by the realization of the present program are, for the most part, nothing more than adaptations of naval and coast defense matériel to land warfare. Some pieces have been obtained by using guns ordered in our shops by foreign countries; others are existing guns transformed by reboring; some have been constructed entire.

This whole collection, comprising nearly 20 types, is classified into *mortars, howitzers,* and *guns,* a certain number of which are *of very long range.*

The increased range of these pieces has been obtained by combining higher angles of fire than usual with the use of special devices (false ogives in shells) and the adoption of more powerful charges, to which recourse has been possible, thanks to the excess strength which is available, in particular, in the Bange artillery.

Rôle of the high-powered heavy artillery.—In the form in which it has been constituted, the high-powered heavy artillery forms *a special artillery reserve* at the disposal of the commander-in-chief. *It is put temporarily at the disposal of the armies to execute définite missions.* As a rule, it is withdrawn when its mission is completed.

Organization of the high-powered heavy artillery.—Placed under the authority of a general belonging to the general headquarters, the high-powered heavy artillery comprises a certain number of battalions of two or three batteries of guns and such special formations as the following:

(*a*) The standard-gauge railway construction companies; the companies of laborers for the construction of the platforms of 60 cm. gauge track, who execute the necessary work for preparing the gun emplacements and the tracks leading to them.

(*b*) The munitions transportation sections and the tractor sections, which in certain circumstances supplement insufficient normal means existing in the armies.

The high-powered heavy artillery also comprises two parks, some park companies, some repair sections, some topographic detachments, and a section of automobile signal searchlights, necessary for its special service, as well as an automobile service and a matériel-inspection service.

Part of these units form three commands, each associated with one of the Army groups. The others, which serve as *general reserve*, constitute four other commands, as follows: The mortar and howitzer command; the sliding-carriage gun command; the very long range gun command; the river gunboat command.

Each of these commands is under a field officer who has the rank and emoluments of an Army corps commander. The commanders of high-powered heavy artillery commands associated with the Army groups are at the orders of the commander of the Army group for all missions concerning the use of high-powered heavy artillery pieces, and conduct the reconnaissances relative to these missions.

MISSIONS OF THE HIGH-POWERED HEAVY ARTILLERY MATÉRIEL.

During the *period of stationary warfare*, the batteries of high-powered heavy artillery may be given special missions, which are almost always confined to long-distance action on points of a certain military importance.

For these missions use is made of the 14 cm., 16 cm., 240 mm., 274 mm., 305 mm., and 340 mm. pieces, and also of the 19 cm. and 24 cm. on railway trucks.

But the great purpose of the high-powered heavy artillery is to serve as an offensive weapon which shall play an important rôle in *general actions*.

The following is a classification of the missions which this arm may be given, arranged in the order of their importance:

1. To crush strong points of resistance against which the heavy artillery has not been considered sufficiently powerful or which are not in range from the positions which the heavy artillery can occupy.

This rôle was in evidence as early as the Champagne offensive, and its success was fully established in the battle of the Somme.

This mission devolves on the mortars and howitzers of the high-powered heavy artillery. The 270 mm. and 370 mm. mortars and the 293 mm. howitzers are used for this purpose, firing shells containing from 35 to 150 kilograms of explosive at ranges verying between 5,000 and 12,000 meters. The 200 mm. howitzers on trucks also give good results up to 10,000 meters. The 400 mm. and 370 mm. howitzers fire shells containing from 55 to 90 kilograms of explosives to distances varying between 7,000 and 15,000 meters. Steel shells of larger capacity will carry 140 to 180 kilograms of explosive 16,000 meters.

These pieces execute plunging or vertical fire, depending on the projectiles; the howitzers execute vertical fire exclusively (angle of elevation from 45 to 65 degrees).

They use several service charges and shells with or without delayed-action fuzes.

The sliding-carriage 32-cm. guns may be used as auxiliaries for these missions on account of their powerful shells, which now contain 35 or 36 kilograms of explosive, and of their range, which for one model varies between 13 and 20 kilometers, and for the other between 10 and 16.

2. To act as powerful long-range counter batteries called on to make up for the insufficient action of the heavy artillery due either to their range or to the effect of their projectiles.

To counter batter targets, which often will not be revealed until the action is in progress, the artillery to which these missions are assigned must be able to act in a wide sector of fire or must be capable of rapidly changing the orientation of their lines of direction.

The following guns may be used:

16-cm. guns moving over roads or on 60-cm. gauge track; 19-cm. and 24-cm. guns on railway trucks.

240-mm. rapid-fire guns, 240-mm. guns on bracket mounts and, later, tractor drawn.

240-mm. guns (cariage is being perfected).

32-cm. and 274-mm. guns on sliding carriages.

The 240-mm. guns fire shells containing from 15 to 34 kilograms of explosive to distances of 6,000 to 16,500 meters. The 274-mm. and 32-cm. guns fire shells which now contain 20 to 40 kilograms of explosive to distances as high as 26,000 meters.

The 19-cm. and 24-cm. pieces on railway trucks can cover 180 degrees on either side of the track; the rapid-fire 240's and the sliding-carriage pieces are capable of changing rather quickly the orientation of the axis of their sector of fire when the dimensions of the socket or the development of the firing siding are favorable.

3. To execute long-range bombardments in the course of a general action on targets of military importance, such as cantonments; supply stations, centers, and roads; junctions of communications; matériel and ammunition parks.

For these missions it is advisable to give preference to the use of—

The 14-cm. and 16-cm. Navy guns on stationary platforms, and also the 14-cm. and 100-mm. rapid-fire pieces on gunboats.

The 19-cm. and 24-cm. guns on railway trucks.

The 305's, 274's, and 340's (but the 340's only in exceptional cases since they are so few and wear so fast).

The Navy 14's and 16's fire shells containing from 3 to 5 kilograms of explosive to distances as high as 17,400 and even 18,000 meters for the 14's with superelevated carriage.

The 19-cm. and 24-cm. pieces on railroad trucks fire shells containing from 8 to 16 kilograms of explosive; their range is from 7,000 to 15,600 meters.

With the 305's and 340's the extreme ranges of 27 to 32 kilometers may be attained.

4. Special missions which may comprise either fire on an establishment of military importance or reprisal fire on localities occupied by the enemy. Very long range fire of a piece on an isolated piece is contemplated only in exceptional instances, as there is too little probability of hitting so small a target.

Such fire is assigned only to very long range pieces, the 274's and 305's on sliding carriages and the 340's. Complete preparation is required and such fire is executed only when conditions are favorable for observation and adjustment of fire.

OPERATION OF THE HIGH-POWERED HEAVY ARTILLERY IN BATTLE.

We will next consider the operation of the high-powered heavy artillery during a general action. This may best be considered under four heads:

(*a*) The study and preparation of gun positions.

(*b*) The tactical organization of the command.

(*c*) The means of communication and of observing the fire.

(*d*) The ammunition supply and the repair and inspection service.

(a) The study and preparation of gun positions.—The studies relative to the bringing into action of the high-powered heavy artillery batteries which have been put at the disposal of an Army group for a general action are made and directed by the officer commanding the high-powered heavy artillery command of that Army group.

The object of these preparatory studies is to determine what existing railroad tracks to use, what spurs and firing sidings to build, and where to organize sidings for this artillery at some distance behind the gun positions, and also to decide on *the location of the special ammunition and matériel depots for this artillery.*

When possible, it is well to provide several positions to be occupied successively so that it will be possible to keep up with the progress of the attack.

The theoretical procedure is for the companies of railway sappers to lay track up to the turnouts of the firing sidings; these sidings themselves are built by the standard-gauge railway construction companies of the high-powered heavy artillery.

In almost every individual case, however, the total work is divided between the two organizations by a special agreement.

(b) **The tactical organization of the command.**—From the tactical point of view the control of the high-powered heavy artillery mortars, while cooperating in the preparations for an attack, is generally delegated to the Army corps in the zone where the mortars are installed. Their missions are subject to the approval of the Army (instruction of Dec. 15, 1915).

All the other high-powered heavy artillery pieces which are put temporarily at the disposal of an Army group form in each Army a command under charge of a field officer of the high-powered heavy artillery who for this purpose is placed on duty with the general commanding the Artillery of the Army.

(c) **The means of communcation and of observing the fire.**—In the matter of telephone communications, more than one solution is possible. The high-powered heavy artillery batteries may be connected with the nearest artillery and staff centrals or they may have a special system of wires of their own which connects with chosen artillery and staff centrals. No absolute rules have yet been laid down on this point.

The mortars of the high-powered heavy artillery most often use the means of observation of the Army corps. The other pieces have their own individual means of observation such as squadrons of airplanes equipped with long-range wireless apparatus, which are put at the special disposal of the high-powered heavy artillery; and specialized balloons, the first duty of which is to observe their fire. They also use the other balloons of the armies when they are available, and terrestrial observation when circumstances make it advisable.

The personnel of the high-powered heavy artillery furnishes a certain number of officers to act as observers from airplanes. The central aviation and wireless services each detail an officer to act as technical assistant to the general commanding the high-powered heavy artillery. The duty of this officer is to insure the liaison with his branch in the Army. For this purpose the general may post him with a high-powered heavy artillery command.

(d) **The ammunition supply and the repair and inspection service.**—Ammunition is routed from the interior either to the heavy-artillery parks or to the special depots of the high-powered heavy artillery organized for each Army and served by its personnel.

These latter depots are provided with suitable loading equipment. From them the ammunitions are sent to the battery positions in carload lots for pieces on the railway and by trucks for the other pieces. This latter service is ordinarily provided by the Army with the assistance, when possible, of the transport sections of the high-powered heavy artillery.

Repairs to matériel which do not require it to be returned to shops are made by repair sections with an equipment of tools in auto trucks. These repair sections are quartered near the high-powered heavy-artillery depots. An inspection service operating within the high-powered heavy artillery insures expert supervision of the maintenance of matériel and of the work of the repair sections.

PART TWO.

DETAIL AND ORGANIZATION OF THE MATÉRIEL OF THE HIGH-POWERED HEAVY ARTILLERY.

The high-powered heavy artillery was formed by taking the available coast defense and naval pieces and adapting them to the present warfare. This necessity of using existing pieces, together with the necessity of working quickly, involved the adoption of many different expedients. All these expedients, however, are well adapted to the requirements of the present warfare, and in spite of their variety they present some common characteristics which makes it possible to classify them.

Up to the present time the normal means of moving the pieces is the railway (whether standard or 60-cm. gauge). The installation for firing may be made either on standard-gauge track or independent of this track.

We shall discuss successively—

First. Pieces moving freely and firing on standard-gauge track with no preparation. Among these we shall distinguish:

(*a*) The pieces which can fire on any operating track (19's, 200-mm. howitzers, 24's) railways trucks.

(*b*) The pieces which require the construction of a firing siding, either by reason of the direction to be given the fire or by reason of the strength of the roadbed (cradle-mounted 274's and pieces on sliding carriages).

For all this class the whole reaction of the firing is transmitted in one way or another to the track.

Second. Pieces moving on standard-gauge track and firing on a special platform, the construction of which also requires the construction of a firing siding.

For these pieces almost the whole reaction of the firing is transmitted directly to the ground by the platform, and a very small part to the track by the bogy trucks on which the pieces rest while firing.

Third. Pieces normally transported on standard-guage trucks but which can also move on 60-cm. gauge track and (only exceptionally, at least up the the present) on roads.

(NOTE.—Tractor-drawn pieces are being perfected and should soon be ready.)

Following is a rapid survey of the characteristics of some of these pieces:

1. PIECES FIRING ON STANDARD-GAUGE TRACK WITH NO PREPARATION.

(A) PIECES WHICH CAN FIRE ON ANY STANDARD-GAUGE TRACK.

These are what are called railway trucks or armored trains, although some of them have no protection for the personnel.

1870–1893 model 19's.—This is the coast-defense piece mounted on its center-pintle carriage which gives it a horizontal field of fire of 360 degrees.

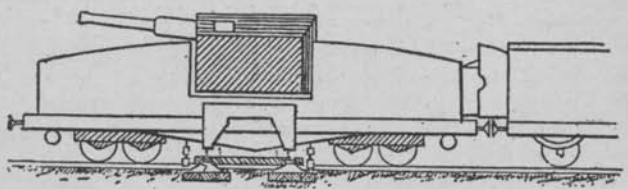


FIG. 1.—19-cm. gun, 1870–1893 model.

Arrangement on truck.—The complete carriage has been mounted on a standard-gauge railway truck having two 4-wheeled bogies. The truck is completely armored and the movable part is a revolving turret.

Arrangement for firing.—The bearing on the rails is secured by two beams parallel to them. These are carried between the bogies of the truck and lowered into contact with the rail by means of screw jacks.

To resist the lifting effort of the carriage parallel to the rails the car is fastened to the rail by clamps which close on the web of the rail above the base. To resist the lifting effort perpendicular to the track jacks are let down outside the rails to bear on wooden wedges resting on wide sills which lie on the ballast.

Ammunition supply.—An ammunition car is coupled to the turret car. During fire, the cars are connected by a loading

chute. The gun must be brought back to the center line of the track, after each round, to receive the next charge.

200-mm. howitzer.—The arrangement for firing is very similar to that just described.

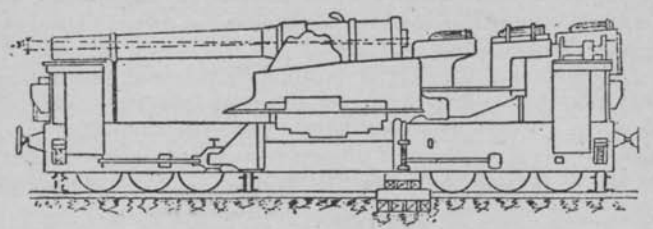


FIG. 2.—1870–1887 model 24-cm. gun on Batignolles truck mount. Fire in direction of the track (gun in loading position).

1870–1887 model 24-cm. gun.—This is the coast-defense gun mounted on the 1888 model center-pintle carriage, which gives it a field of fire of 360°.

Arrangement on truck.—The complete carriage has been mounted on a special standard-gauge truck having two 3-wheel trucks. It has no armor protection.

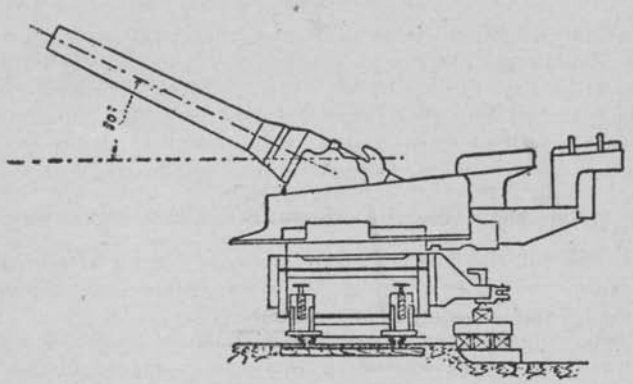


FIG. 3.—Fire in the direction perpendicular to the track. (Gun at the maximum angle of which it is capable, +30°.)

Arrangement for firing.—The bearing on the rail is obtained by means of four beams perpendicular to the track. They are let down simultaneously by means of jacks and fastened by

clamps on their underside, which are tightened on the web of the rail.

Resistance to the lifting effort in the direction perpendicular to the track is provided by letting down lateral jacks mounted on hinged shutters which hang down along the car when it is in motion and are raised to the horizontal for firing. This gives a much larger bearing surface.

Ammunition supply.—The projectiles are passed from the ammunition car by a hoist on the gun truck which can take five shells at a time. The hoist is then raised to the height of the back of the carriage, which has first been placed on the center line of the track, and the projectiles are put on a holder attached to the carriage. It is thus possible to fire five rounds before bringing the carriage back to the center line of the track.

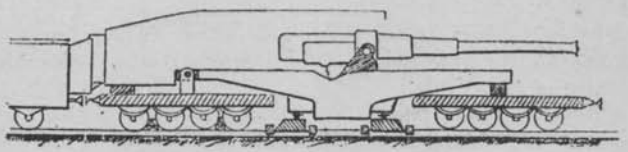


FIG. 4.—274-mm. gun.

Remarks.—For all these pieces the truck is symmetrical and the ammunition car can be coupled at either end. It is thus possible always to have the ammunition car on the side toward which the breech will be turned during fire. This precaution is indispensable not only for the advantage of rapid fire but to prevent the demolition of the ammunition car by the blast.

(B) PIECES REQUIRING THE CONSTRUCTION OF A FIRING SIDING.

In general, the horizontal field of fire of these pieces is zero or very small (not over 2°). They use as an aiming circle a curved siding of standard-gauge track.

This siding is planned so that the tangent at one or more points of the siding is directed toward the target or targets to be fired on. The minimum radius of curvature is 150 meters. Under these conditions a displacement of about 3 meters on the rail corresponds to an angular displacement of 1° for the tangent.

Cradle-mounted 27½-mm. gun.—This gun marks the transition from the pieces already discussed, which are fastened to the track, to the pieces on sliding carriages, of which the horizontal

field of fire is zero. It is the 1893–1896 model 274 with its cradle mount.

Arrangement on truck.—The trunnions of the cradle are supported on a mount formed of a sheet-iron girder, the ends of which rest on the king-pins of two 8-wheeled standard-gauge bogies. The back part of the gun is inclosed in an armored firing chamber. By means of an endless screw on the king-pin of the rear truck it is possible to swivel the front truck so as to give the gun a field of 1° on either side of the center line of the track.

Arrangement for firing.—Stability on the rail is obtained by friction afforded by two long crossbeams, one before and the other behind the bottom of the girder mount. Each of these crossbeams has two friction clamps each side of the mount, which are tightened on the vertical web of the rail. Two other oak crossties are laid on the rails between the wheels of the

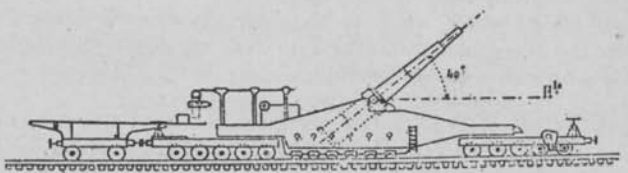


FIG 5.—Sliding-carriage pieces, 32-caliber gun.

rear truck, but not fastened. All these crossbeams are lowered down with jacks.

No support outside the track is necessary or is provided since the recoil is always practically along the axis of the mount.

The thrust of the recoil is thus absorbed in part by the brakes of the cradle and in part by the devices for securing friction and pressure on the track. The track is laid on ordinary ties spaced more closely than for ordinary track. Special fishplates are used for the rail joints in the part of the track used for firing.

Ammunition supply.—The projectile is brought from the ammunition car to the back part of the mount on a rolling platform, from which it is lifted by a traveling crane and put on the loading car.

The 274, 305, and model 32 gun.—The 274, the 1893–1896 model 305, and the 1870–1884 or 1870–1881 model 32 all have identical arrangements. The following is a description of the 1870–1884 model 32:

Arrangement on truck.—The mount is formed of a sheet-iron girder resting on two 10-wheel bogies. There is no device for lateral aiming.

Arrangement for firing.—The firing track really forms a platform. It consists of very heavy rail laid on special ties, which are spaced more closely than for ordinary track. On each side of each rail two sheet-iron stringers are spiked to the ties. For fire six crossbeams are lowered to rest on the stringers. Their friction alone absorbs the whole thrust of the recoil. The rear truck also has two crossbeams, which are lowered by jacks.

Ammunition supply.—It is impossible to have an ammunition car in contact with the piece, as is the practice with guns which are fastened to the track. A carrier car is put between them to bring projectiles under a beam on the rear frame of the gun mount. A hoist working along this beam takes the projectile from the carrier car to the loading car.

All pieces which we have thus far discussed are equipped with the Navy metal obturator (except the 200-mm. howitzer, which uses obturating cartridge cases).

2. PIECES MOVING ON STANDARD-GAUGE TRACK BUT FIRING ON A SPECIAL PLATFORM.

These pieces move on standard-gauge track to the firing emplacement, where the track is reinforced, and rests on a platform which serves to transmit the firing reactions to the ground.

305-chassis guns.—This is the 1893–1896 model 305 on an 1889 model center-pintle chassis mount. The breech has the Navy type metal obturator.

Arrangement on truck.—The whole piece is carried by a truck formed of a sheet-iron bridge, the ends of which rest on the king-pins of two 12-wheel standard-gauge bogies. In front, in back, and on each side of this bridge are four jointed struts with collars to serve as jacks. When the car is in motion the struts are turned up along the car. When in the firing position they are held in place by connecting rods.

Arrangement for firing—(a) Platform.—The platform comprises a double flooring of crossed timbers resting on a bed of sand. To this flooring are spiked the rails and two edge stringers of oak.

(*b*) *Mounting.*—The mount rests on the platform by means of blocking built between the edge stringers and the lower part

of the sheet-iron bridge. The blocking is built just high enough to lift the weight from the springs of the railway trucks. The horizontal thrust of the recoil and the reaction from it are taken care of by being transmitted through the above-mentioned props to wooden frames bedded in the ground. The bearing surface on the edge stringers is increased by four hydraulic jacks set on them which are also useful in arranging the blocking. The whole central shock of the discharge is transmitted to the platform.

Ammunition supply.—A traveling crane lifts the projectiles vertically from the ammunition car and sets them on the loading tray.

Cradle-mounted 305.—The arrangement is in general identical with the 370 howitzer, which is discussed below.

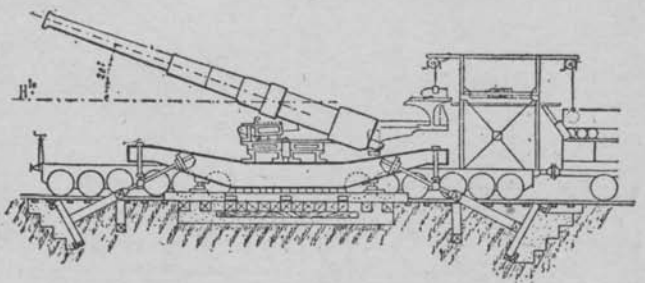


FIG. 6.—305-mm. gun on railway truck mount.

The 340-mm. gun.—This is the 45-caliber 1912 model gun with its cradle and its air buffer. The breech is equipped with the plastic obturator.

Arrangement on the truck.—The trunnions of the cradle are supported by a mount formed of two sheet-iron girders, the ends of which rest on the king-pins of 12-wheeled bogies. A caisson almost directly below the trunnions is attached to the lower part of the mount. Inside this caisson is a vertical shaft which serves as pivot in the firing position.

Arrangement for firing—(*a*) *Platform.*—In the center is a pit in which a socket is supported on two layers of thick planks laid on a bed of sand. Another pit behind receives the breech while aiming and on recoil. The back of this pit is lined with planks against which the socket is braced by wooden stringers. A bed of planks is built front and back under the ends of the mount.

(*b*) *Mounting.*—The mount is moved over the platform and the center pivot is let down into its socket. It is this pivot which must take all the reactions of the discharge. Four jacks are now placed on the plank beds at either end of the mount, and the whole mount and gun are lifted clear of the trucks, which are taken entirely out of the way for firing. The jacks are then lowered until the gun rests on the pivot. The jacks are taken out and four sills put in their place on the planks in such a way that they can slide to the side on the planks when the gun is turned on its pivot. This gives a horizontal field of fire of 5° on each side of the center line. This movement is controlled

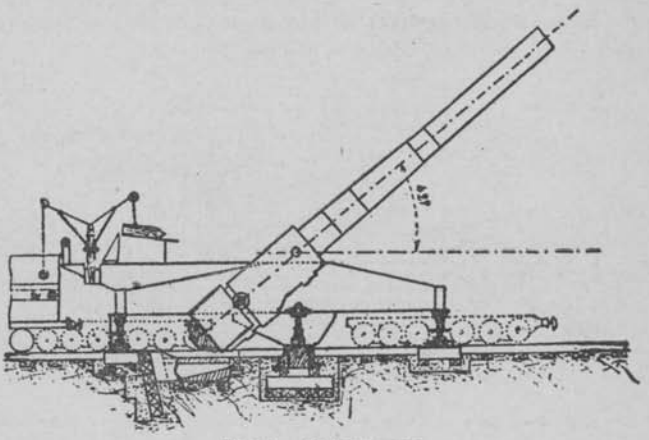


FIG. 7.—340-mm. gun.

by a horizontal screw working in a nut on the lower part of the back of the mount.

The horizontal reaction of the discharge is thus entirely absorbed by the vertical pivot; the vertical reaction is divided between the pivot and the four sills.

Ammunition supply.—A slewing crane on the mount lifts the projectile across the roof of the ammunition car to the loading tray.

370-mm. howitzer.—This 26-caliber howitzer is made by reboring 305-mm tubes. The breech is fitted with the plastic obturator.

Arrangement on truck.—The gun with its cradle is on a mount placed on a sheet-iron bridge with a pivot toward its front, which

gives it a field of fire of 6° on each side of the center line. The sheet-iron bridge forms a chassis resting on two 8-wheeled bogies of normal gauge.

Arrangement for firing—(*a*) *Platform.*—The platform is prepared and taken down into six parts ready for laying, which are transported on a special car. Each part comprises a length of reenforced track on its ties, with two parallel stringers binding the ties, and a trail spade. The car has a special winch with which to put each of the parts in its proper place. The platform is completed by merely putting the fishplates in place on the rails and joining the stringer lengths by bolting splice plates. When assembled the platform forms a kind of wide rigid bridge floor anchored to the ground by metal spades.

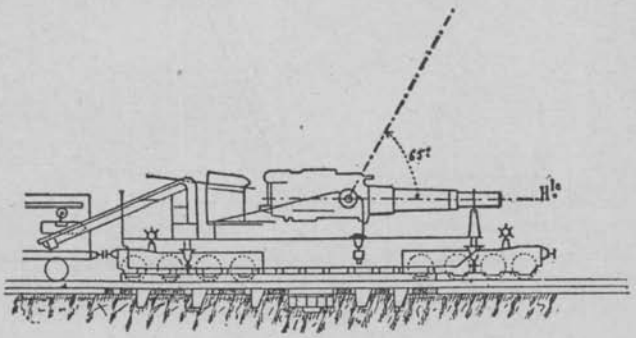


FIG. 8.—370-mm. howitzer.

(*b*) *Mounting.*—The connection of the chassis with the platform is obtained by means of blocking put between the platform stringers and the bottom of the chassis. The blocking is tied with angle irons to prevent side slipping and block completely both horizontal and vertical thrusts.

Ammunition supply.—Two inclined rails are used as a runway for a hoist which raises the projectile from the ammunition car to the top of the gun mount where the projectile is put on the loading car. The gun has to be brought back to the center line of the track for each charge.

400-mm. howitzer.—This 26-caliber howitzer is made by reboring 340 mm. guns. It is equipped with the plastic obturator.

Arrangement on car.—The cradle is supported by its trunnions on a mount turning on a forward pivot on a sheet-iron

chassis. The chassis rests on two standard-gauge bogies (a 12-wheel bogy in front and an 8-wheel bogy behind).

Arrangement for firing.—(*a*) *Platform.* The platform is made of two layers of thick planks in front and in back of a central pit which gives clearance for the breech for aiming and on recoil. Beside the roadbed at the back of the platform, two wooden frames are buried firmly in the ground.

(*b*) *Mounting.*—The chassis is supported by four screw jacks placed on the outside and rear planks, and is also braced against the buried frames through threaded articulated props like those of the chassis-mounted 305's. Against the horizontal thrust it

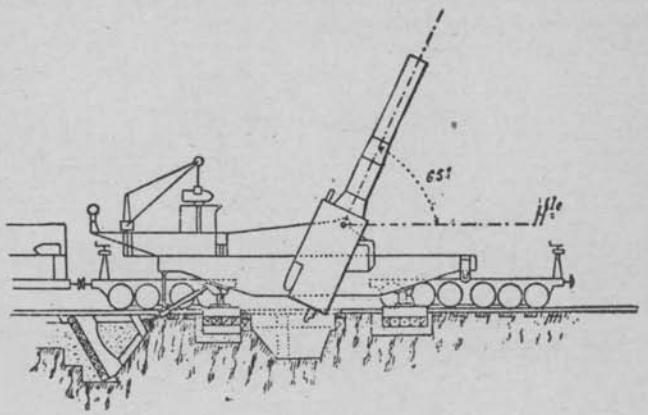


FIG. 9.—400-mm. howitzer.

is braced in front by buffers on the crosstie and in back by the props.

Ammunition supply.—The arrangement is similar to that of the 340.

Remarks.—For the three pieces last described (the 340, 370, and 400), it is necessary to remove the rails where the central pit is dug in order to leave room for recoil when firing obliquely to the track. A break is therefore made in the track during fire and the gun can not leave the position until the track is restored. The rail taken out can be put on a metal beam which can slide into the central pit and lie against the side walls. (For the 370, this operation takes less than 2 minutes.)

3. PIECES WHICH FIRE INDEPENDENTLY OF THE STANDARD-GAUGE TRACK.

Rapid-fire 240-mm. gun.—This is the cradle-mounted 1903 model rapid-fire 240-mm. coast-defense gun, with concentric-groove breech plug and cartridge case obturation.

Arrangement on truck.—On a chassis which is fastened to the car floor the mount is provided with rollers which can move on inclined planes. Under the chassis and connected with it by a pivot near the front is a metal base plate. Four rollers on the frame assist the movement about the pivot. The hydraulic brake rod is attached to the front of the mount and the body of the pump to the front of the truck.

The truck has two standard-gauge axles which can be raised. Under each end it carries a 60-cm. gauge car, which can be

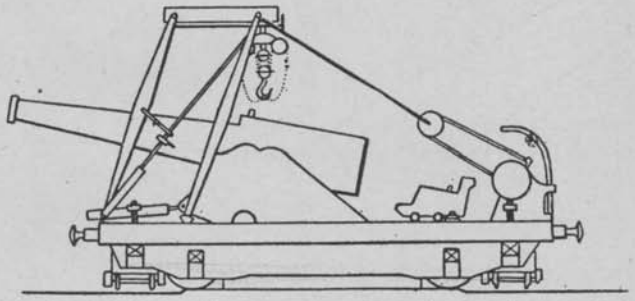


FIG. 10.—Rapid-fire 240-mm. gun on railway truck—Firing position.

turned on a vertical shaft and can be let down by a hand-wheel when the car is to run on a 60-cm. gauge track.

For transportation, the gun is separated from the mount and loaded on two 60-cm. gauge cars, which are carried on a standard-gauge flat car.

Arrangement for firing.—(*a*) *Platform.* The firing emplacement is formed of a horizontal platform of dry earth or sand, rammed as tight as possible, constructed over the track (standard or 60-cm. gauge) by which the gun is brought up. Wheel grooves are cut through the platform to allow the passage of the matériel.

(*b*) *Mounting.*—The truck is brought over the platform and jacked up. The standard-gauge trucks and the 60-cm. gauge cars are taken off and the bedplate is lowered until it rests on

the platform. The gun is then put in place on the mount by means of the special gin. The bedplate is anchored to a buried sleeper, which, together with the friction, serves to prevent recoil on the platform.

The frame has a movement of 7° on each side of the center line of the platform. This horizontal field of fire can be increased by raising the frame on jacks and changing the position of the bedplate with relation to it. The gain by each such operation is about 8°.

Ammunition supply.—Projectiles brought from the magazine by handbarrow or small car are put in the chamber by a loading car which is brought near the breech.

(NOTE.—The matériel can also be transported by railway trains of cars with removable wheels.)

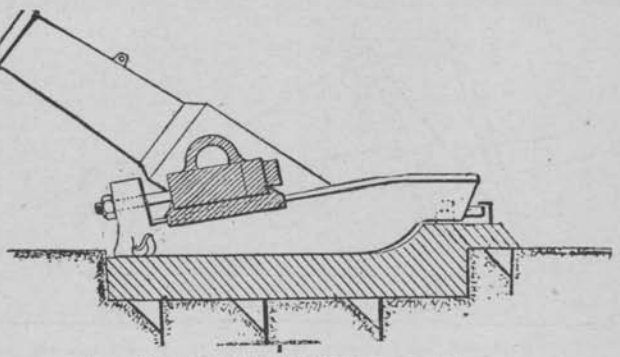


FIG. 11.—Filloux 370-mm. mortar.

293-mm. howitzer.—The arrangements are the same as those just described, except that there is no brake connecting the car and the mount. This howitzer also has the peculiarity of automatic loading at an angle of 45°.

Bracket-mounted 1884 model 240-mm. gun.—This is the 1884 model 240 on a mount made of wood bound with iron hoops. It is taken apart for transportation by rail or wagon and use is made of 60-cm. gauge track material in setting it up.

For fire, the mount is put on a wooden platform made flush with the ground. For return into battery, which is effected by tackle, the mount is put on a swan-neck device similar to that of the 155.

Coast-defense 270-mm. mortar.—This is the mortar with mount as used in the coast-defense batteries but with some detail modifications.

For transportation by rail or wagon it is taken down into three loads, comprising the mortar with mount, the chassis, and

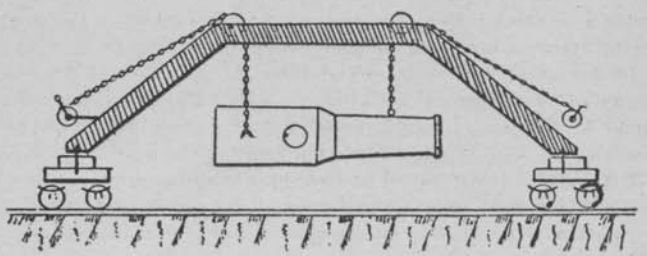


FIG. 12.—Carrier.

the bedplate bolted to a wooden platform. For fire, the ground is cut away to receive this platform and the parts are reassembled by means of gins mounted on 60-cm. gauge rolling stock.

Filloux 370-mm. mortar.—This 8-caliber piece is equipped with a threaded breech plug, which has a short steel sleeve to

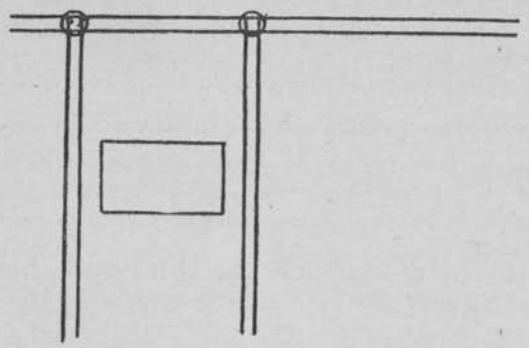


FIG. 13.—Entry into battery.

secure obturation. It rests by its trunnions on a small mount which is joined to the chassis by two hydraulic brakes. This chassis has inclined slideways for the recoil. It rests on three rollers on a cast-steel platform which is flush with the ground.

Arrangements for transportation.—Transportation is by three loads, comprising the mortar, the chassis with mount, and the platform.

Each part is suspended from what is known as a transporter, which is a metal frame, like a traveling crane, the ends of which rest on two 1888 model small cars on which the transporter can pivot. For transportation over highways the same arrangement is used, supplemented by wagon trains.

Arrangement for firing.—The piece is put into battery by means of transporters working on two parallel 60-cm. gauge tracks laid 7 meters apart, perpendicular to the line of fire and passing each side of the excavation dug for the platform. Each of these tracks is connected by turntable with the approach track so that the transporter can bring each part successively over the excavation, where it is a simple matter to lower it into place.

Ammunition supply.—The projectile is put on a loading car, which is brought to the rear of the platform by a special 60-cm. gauge car, from which it is passed to the breech along rails which run over a movable bridge to the ends of the recoil slideways on the platform.

4. NAVAL PIECES.

The naval guns which have been adapted to land warfare form part of the high-powered heavy artillery. They are manned by navy gunners. They comprise two categories: First, pieces which fire from stationary platforms, and, second, river gunboats.

(1) PIECES WHICH FIRE FROM STATIONARY PLATFORMS.

These are the 1910 model 14, the 1893 model 16, and the 1891–1912 model 16. All have center-pintle mounts, giving a possible angle of fire of 36°. For a certain number of 14's this has been increased to 43°.

Arrangement for transportation.—One of the devices used for the transportation of this matériel is to suspend the complete piece between two 9-ton 60-cm. gauge cars. In this way it can move over 60-cm. gauge track, or the cars and suspended piece can be loaded on a 20-ton standard-gauge flat car by means of a special movable ramp which is carried with the piece.

A similar arrangement can be used on 1-meter gauge track or on highways by the use of especially designed cars or wagons. By making three loads, comprising the gun, the mount with base plate, and the shield, the weight per unit is reduced, but much

more time is required to set the piece up, and this is not permissible for mobile artillery.

Arrangement for firing.—For comparatively permanent installations concrete platforms may be provided, especially when the field of fire is wider than 90°. In that case a shellproof casemate is provided to protect the piece.

In other cases a wooden platform is used or preferably a demountable sheet-iron caisson made of two or three parts, which bolt together, and to which the base plate is bolted through a wooden stringpiece.

(2) RIVER GUNBOATS.

The pieces on river gunboats use navigable waters just as the high-powered heavy artillery uses railways. There are two types of gunboat:

(a) The 14-cm. gunboats.—Their characteristics are: Displacement, 110 tons; length, 28 meters; width, 5 meters; draft, 1.80 meters.

Armament: One 1891–1893 model 14-cm. gun; two 47-mm. guns.

Power: Two 100-horsepower motors, giving a possible speed of 9 or 10 knots.

(b) The 10-cm. gunboats.—Their characteristics are: Displacement, 180 tons; length, 38 meters; width, 5 meters; draft, 1.80 meters.

Armament: Two 1891–1893 model rapid-fire 100-mm. guns; two 47-mm. guns.

Power: A 300-horsepower engine, giving 12 knots speed.

Arrangement for firing.—The 14-cm. and 100-mm. pieces are on the navy chassis mount modified to give an angle of fire of 36°. The horizontal field of fire is 270°.

For firing, the gunboat is moored to the river bank. To increase stability and rapidly dampen the oscillations due to the reactions from firing, an outrigger is attached similar to that of a canoe. It consists of a float rigidly attached to the hull and about 3 meters from it. With this it is possible to stop oscillation within 10 seconds of the discharge.

Ammunition supply.—A certain number of pinnaces are attached to each squadron to handle ammunition.

CALIBER, RANGE, AND ANGLE OF FIRE.

Caliber.	Arrangement.	Horizontal field of fire.	Weight of projectile.	Charge of explosive.	Minimum angle of fire.	Range at minimum angle.	Maximum angle of fire.	Range at maximum angle.
		°	*Kilos.*	*Kilos.*	°		°	
10, 1891–1893 model gun.	On gunboats	360 to 270	14	1	5		36 to 40	14,300 to 14,800
14, 1891 model gun.	1893 model platform chassis; superelevated trunnions.		30	0.5 to 5			30	13,100 to 15,200
14, 1890 model gun.	Superelevated trunnions; fires on inclined platform of concrete or metal.		30 to 36	2.6 to 5.3			35.5	13,000 to 17,600
16, gun	Platform of metal, concrete or wood (cradle), concrete or wood (chassis).		50	0.97 to 4.45			34 to 36	15,100 14,000 to 17,400
19, gun	Fires on standard-gauge track with no preparation of the track.	360	80	5.3 to 16	10	6,000 to 8,900	30	11,800 to 16,500
200, howitzer	do	360	100	9			60	9,050 to 11,490
24, 1870–1887 model gun.	do	360	153 to 161	15 to 34	10 to 15	6,200 to 10,500	30	12,200 to 16,300
240, 1903 model rapid-fire gun.	Fires on platform covering standard or 60 cm. gauge track.	[1] 70	123 to 161	9 to 34	11 to 15	7,200 to 10,900	35	14,900 to 17,250
240, 1884 model gun.	Fires from a wooden platform sunk flush with the ground.	[1] 170	123 to 161	9 to 34	15	9,000 to 10,900	37	15,200 to 17,500
24, 1893 model gun.	do		161 to 170	10 to 16	15	12,100	37	16,900 to 22,900
270, coast mortar	do	36	152 to 232	29 to 66	7		27 to 60	5,000 to 10,400
274, cradle-mount gun.	Fires on standard-gauge siding without platform.	[1] 10	216 to 260	19 to 35	10	10,100 to 13,200	25	15,300 to 22,000
274, sliding-carriage gun.	Fires on standard-gauge siding; requires metal platform (4 rows of beams on which piece slides).		216 to 260	19 to 35	22	14,400 to 20,800	40	18,400 to 26,900

293, howitzer...	Fires on platform covering standard or 60 cm. gauge track.	[1] 70	225 to 300	34	to 63	45	6,900 to 11,300	65	4,900 to 7,900
305, chassis gun.	Fires on special platform built on the track, the piece being braced by props against wooden frames bedded in the ground.	[1] 10	321 to 351	29	to 31	10	10,100 to 13,400	20	15,200 to 22,000
305, cradle gun.	Fires on special platform built on the track and anchored to the ground by spades.	[1] 50	321 to 351	29	to 31	15	13,000 to 17,000	38	20,600 to 30,600
305, sliding-carriage gun.	Fires on standard-gauge siding. Requires a metal platform on which the gun recoils.	.....	321 to 351	29	to 31	22	16,000 to 23,300	40	20,900 to 31,130
32, sliding-carriage gun, 25 calibers.	.....do.....	.....	338 to 506	35	to 70	22	9,500 to 12,175	40	12,900 to 16,400
32, sliding-carriage gun, 30 calibers.	.....do.....	.....	338 to 506	35	to 70	22	11,000 to 15,600	40	14,250 to 20,500
340, gun.....	Fires on special platform built on the track, the railway trucks removed.	[1] 5	465 and 540	21	and 52	15	12,200 to 20,000	42	20,200 to 31,300
370, mortar.....	Fires on a platform fitted into a pit dug in the ground.	12	407 and 500	97	to 150	16 to 20	3,450 to 6,000	60 to 65	6,500 to 8,150
370, howitzer...	Fires on special platform built on the track and anchored by spades.	[2] 6	516 and 710	58	to 143	45	9,400 to 16,400	65	6,800 to 12,200
400, howitzer. .	Fires on special platform built on the track, the piece being braced by props against wooden frames bedded in the ground.	[2] 6	640 to 900	90	to 180	15	7,000 to 11,200	65	9,500 to 15,000

[1] Each side of the center line.

[2] Each side.