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FM 4–40

WAR DEPARTMENT

COAST ARTILLERY FIELD MANUAL

SEACOAST ARTILLERY

SERVICE OF THE PIECE

12-INCH MORTAR, RAILWAY ARTILLERY

FM 4-40

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SERVICE OF THE PIECE

12-INCH MORTAR, RAILWAY ARTILLERY

Prepared under direction of the
Chief of Coast Artillery

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BY ORDER OF THE SECRETARY OF WAR:

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Chief of Staff.

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Major General,
The Adjutant General.

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SERVICE OF THE PIECE

12-INCH MORTAR, RAILWAY ARTILLERY

(The matter contained herein supersedes TR 435–230, February 14, 1927.)

SECTION I

GENERAL

■ 1. SCOPE.—*a*. This manual prescribes the service of the piece for the 12-inch mortar, railway artillery. It is applicable to the M1890 or M1890MI mortar, mounted on an M1918 carriage, and an M1918MI or MII car. The duties of the members of the gun section in the service of the piece are contained in section III and in the drill table in section X.

b. The service of the piece is based on the use of an overhead loading device and a gravity loading tray (pars. 24 and 25). If this equipment is not available, loading is accomplished as described in paragraph 26.

c. The service of the piece described herein is intended as a guide for the battery commander. Changes in the details of the service of the piece may be made to meet local conditions.

■ 2. REFERENCES.—The references listed in the Appendix should be consulted, especially those pertaining to ammunition and to the operation, care, and maintenance of matériel.

SECTION II

ORGANIZATION

■ 3. COMPOSITION.—Each railway mortar with its ammunition cars is manned by a gun section consisting of a mortar

squad and an ammunition squad. The war strength of the gun section is 26 enlisted men; the peace strength is 24 enlisted men (T/O 4–47).

■ 4. MORTAR SQUAD.—*a.* At war strength each mortar squad (20 enlisted men) consists of a gun commander (chief of section), a gun pointer, an elevation setter, an aiming rule operator, an azimuth display board operator, an elevation display board operator, a chief of breech, and 13 cannoneers numbered from 1 to 13, inclusive. Men are assigned to permanent positions according to their aptitude but will be interchanged frequently in drill positions to develop flexibility and to facilitate replacement.

b. At peace strength the mortar squad is reduced to 18 men, cannoneers Nos. 7 and 13 being eliminated.

■ 5. AMMUNITION SQUAD.—At both peace and war strength, the ammunition squad (6 enlisted men) consists of a chief of ammunition and 5 cannoneers numbered from 14 to 18, inclusive. This squad is divided by its chief into details for the service of powder and projectiles.

■ 6. FORMATION.—Each section assembles in two ranks with 4 inches between files and 40 inches between ranks. The post of the chief of section (gun commander) is in the front rank 1 pace to the right of his section (fig. 1).

SECTION III

DUTIES OF PERSONNEL

■ 7. BATTERY EXECUTIVE.—*a.* The battery executive commands the firing section of the battery. He is responsible to the battery commander for the—

(1) Technical handling of the mortars.

(2) Training and efficiency of the firing section.

(3) Condition of the matériel under his charge.

(4) Observance of all safety precautions pertaining to the service of the piece.

b. He supervises the emplacement of the mortars and their preparation for firing.

c. He selects positions for and supervises the emplacement and employment of the machine guns of the firing section.

d. He receives the reports of the assistant battery executives and reports to the battery commander, "Sir, firing section in order," or reports any defects which he is unable to remedy without delay.

e. At the conclusion of drill or firing, the battery executive commands: REPLACE EQUIPMENT, inspects the mortar po-

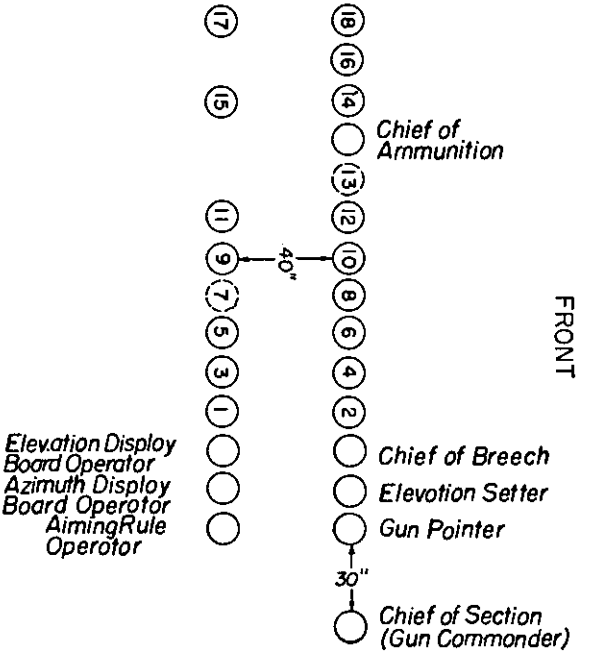

FIGURE 1.—Formation of gun section.

NOTE.—Nos. 7 and 13 are not included in peace-strength organization.

sitions, and reports to the battery commander. In case the mortars are to be withdrawn from position he gives the necessary commands and supervises the preparation for withdrawal.

f. As battery railway officer he is responsible for the condition and maintenance of the railway matériel assigned to his battery.

■ 8. ASSISTANT BATTERY EXECUTIVES.—*a.* Each assistant battery executive commands a platoon (two mortars). He is responsible to the battery executive for the—

(1) Technical handling of the mortars.

(2) Efficiency of the gun sections of his platoon.

(3) Condition of the matériel under his charge.

(4) Observance of all safety precautions pertaining to the service of the piece and to the handling and care of ammunition.

b. He supervises the emplacement of his mortars and their preparation for firing.

c. He inspects the matériel of his platoon and personally verifies the adjustment of all pointing devices as frequently as necessary to insure accuracy. He tests all firing devices before each drill or firing, paying special attention to the safety features. He checks the air and liquid pressures of the recuperators and the adjustment of the breechblocks before firing.

d. He receives the reports of the chiefs of section and reports to the battery executive, "Sir, No. (Nos.) ——— in order," or reports any defects which he is unable to remedy without delay.

e. He exercises general supervision over the loading and pointing. If for any reason he desires to hold fire for one firing interval, he commands: RE-LAY, and reports his action to the battery executive.

■ 9. CHIEF OF SECTION.—*a.* The chief of section (gun commander), a noncommissioned officer, is in command of the gun section and is also chief of the mortar squad. He is responsible to the assistant battery executive of his platoon for the—

(1) Training and efficiency of the personnel of his section.

(2) Care of the matériel.

(3) Emplacement of the piece and its preparation for firing, including bore sighting.

(4) Camouflage discipline and gas discipline, when necessary.

(5) Firing of the piece.

(6) Observance of all safety precautions at his emplacement.

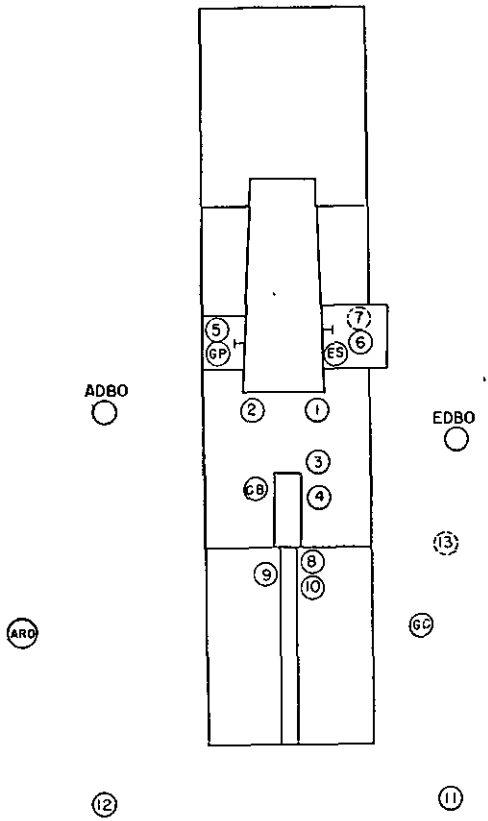

FIGURE 2.—DETAILS, POSTS.

(7) Police of the emplacement.

b. He supervises the preparation of the track for the firing position, the emplacing of the mortar, the removing of the mortar from the firing position, the loading of equipment, and the service of the piece.

c. The mortar being emplaced for firing, he commands: 1. DETAILS, 2. POSTS, and supervises the procuring of equipment. After all details have reached their posts (fig. 2), he commands: EXAMINE GUN. He then makes an inspection of the piece, carriage, and cars, paying special attention to the following: recoil cylinders, recuperator pressures (both air and liquid), the firing mechanism, the oiling of the various bearings, safety devices, and the condition of the track, H-beams, cross ties, outriggers, and floats. He receives the reports of the chief of ammunition and of the various details of the gun squad and reports to the assistant battery executive, "Sir, No. ——— in order," or reports any defects that he is unable to remedy without delay.

d. When necessary to verify the section, he commands: CALL OFF. The cannoneers of the section call off their titles or numbers in succession, beginning with the unnumbered members of the section, followed by the numbered members in order.

e. He informs the chief of ammunition as to the projectile, fuze, and powder charge to be used.

f. At the command LOAD, he repeats the command and supervises the loading. After the piece is loaded and laid, he calls, "No. ——— ready." He also commands: LOAD, before each shot of a series. The piece is not fired, however, until the command COMMENCE FIRING is given and the proper firing signal received.

g. At the command COMMENCE FIRING, if the piece is unloaded, he commands: LOAD, and supervises the work of his section. Upon receipt of the firing signal, he commands: FIRE.

h. He commands: CEASE FIRING, when the number of shots specified has been fired. He repeats the command CEASE FIRING when it is received. At the conclusion of a series of shots, he reports, "Sir, No. ———, ——— (so many) rounds" When dummy ammunition is used, he supervises the unloading.

i. During firing, he carefully observes the action of the piece in recoil and counterrecoil. He pays particular attention to the recuperator piston rod, noting from time to time the distance between the rear face of the washer on the front

end of the piston rod and the front end of the small stuffing box gland. When this distance is as great as 4 inches, the proper relation between the air and liquid pressures no longer exists. In such case, it is necessary that firing be suspended so that the proper relation between the pressures may be reestablished.

j. He is responsible for the observance of all safety precautions at his emplacement. Under no circumstances will he permit his piece to be fired prior to the receipt of the command COMMENCE FIRING.

k. He commands: RE-LAY, in case his mortar is not ready to fire when the firing signal sounds. He also repeats this command when it is given.

l. In case of a misfire, he calls, "No. ——— misfire." He sees that the precautions described in paragraph 41 are observed.

m. At the command REPLACE EQUIPMENT, he supervises the replacing of equipment, sees that all matériel is properly secured and the ground around the mortar and cars properly policed, and then unless otherwise directed forms his section.

n. He keeps a record of the number of rounds fired by his gun during a practice or action, showing the date, approximate time, and any unusual action of the ammunition. He keeps the gun book posted accurately and up to date.

■ 10. GUN POINTER.—The gun pointer (noncommissioned officer) is charged with the duty of laying the piece in direction. He is responsible to the gun commander for the proper operation, care, and adjustment of the sight, azimuth circle, and traversing mechanism, and for the supervision of the aiming rule operator. For detailed duties of the gun pointer, see drill table, section X.

■ 11. ELEVATION SETTER.—The elevation setter is charged with the duty of laying the piece in elevation. He is responsible to the gun commander for the proper operation, care, and adjustment of the elevation quadrant and elevating mechanism. For detailed duties of the elevation setter, see drill table, section X.

■ 12. CHIEF OF BREECH.—The chief of breech (noncommissioned officer) is responsible to the gun commander for the condition and serviceability of the breech mechanism, breech-

block, breech recess, firing mechanism, chamber, and bore. He is also responsible for the efficiency of the breech detail and for the observance of safety precautions insofar as they pertain to his detail. For detailed duties of the chief of breech, see drill table, section X.

■ 13. AZIMUTH DISPLAY BOARD OPERATOR.—*a.* The azimuth display board operator is charged with the duty of receiving and recording in legible figures on his display board all azimuths sent from the fire control car. He repeats all messages received from the fire control car, making sure that they are received by the person for whom they are intended.

b. At the command DETAILS, POSTS, he gets the azimuth display board, chalk, a blackboard eraser, a telephone with head set, a pencil, and paper forms for recording azimuths. He takes post at the place designated by the gun commander.

c. At the command EXAMINE GUN, he sets up his display board, connects his telephone, and tests the line to the fire control car. He reports to the gun commander, "Azimuth telephone in order," or any defects that he is unable to remedy without delay.

d. At the command TARGET, he repeats in a loud voice the azimuth received from the fire control car, posts it in legible figures on his display board, and records it. As soon as he receives new data, he erases the old data from the board and repeats the procedure with the new data. He continues this procedure as long as data are being transmitted or until the command CEASE TRACKING is received.

■ 14. ELEVATION DISPLAY BOARD OPERATOR.—*a.* The elevation display board operator is charged with the duty of receiving and recording in legible figures on his display board all zones and elevations sent from the fire control car.

b. At the command DETAILS, POSTS, he gets the elevation display board, chalk, a blackboard eraser, a telephone with head set, a pencil, and paper forms for recording elevations. He takes post at the place designated by the gun commander.

c. At the command EXAMINE GUN, he sets up his display board, connects his telephone, and tests the line to the fire control car. He reports to the gun commander, "Elevation telephone in order," or any defects that he is unable to remedy without delay.

d. At the command TARGET, he repeats in a loud voice the zone and elevation received from the fire control car, posts it in legible figures on his display board, and records it on the proper form. As soon as he receives new data, he erases the old data from the board and repeats the procedure with the new data. Whenever there is a change in zone he calls, "Change to zone ———," and makes certain that the chief of the ammunition squad is notified. He continues this procedure as long as data are being transmitted or until the command CEASE TRACKING is received.

■ 15. AIMING RULE OPERATOR.—*a.* The aiming rule operator is responsible to the gun pointer for the operation, care, and adjustment of the aiming rule and its sight.

b. At the command DETAILS, POSTS, he gets the aiming rule sight and crossbar, places them near the aiming rule stakes, and takes post behind the aiming rule stakes, facing the piece.

c. At the command EXAMINE GUN, he places the aiming rule crossbar in position on the stakes, sets the data determined during orientation of the aiming rule on his sight, and moves the sight along the bar until the vertical cross hair is exactly on the mortar sight. He reports to the gun commander, "Aiming rule in order," or any defects he is unable to remedy without delay.

d. At the command TARGET, he keeps the vertical cross hair of his sight exactly on the mortar sight by sliding his sight along the crossbar. Unless otherwise ordered he does not change the initial setting of his sight. He continues this procedure as long as data are being transmitted or until the command CEASE TRACKING is received.

■ 16. CHIEF OF AMMUNITION.—*a.* The chief of ammunition (noncommissioned officer) is responsible to the chief of section for the—

(1) Efficiency of the personnel under his charge.

(2) Care and preservation of the ammunition, ammunition car, and its equipment.

(3) Camouflage discipline at the ammunition cars.

(4) Correct recording of projectile and powder data.

(5) Observance of all safety precautions in the care and service of ammunition.

(6) Protection of the ammunition against water, dampness, fire, and the direct rays of the sun.

(7) Police of the ammunition cars.

(8) Uninterrupted service of ammunition during action.

b. He keeps a record of all ammunition received and that used by his gun, exercising particular care that projectiles and fuzes are listed under proper name and type.

c. He checks the weights of projectiles to be used and reports the results to the chief of section.

d. He keeps the chief of section informed regarding ammunition on hand and reports any defects found.

e. He keeps a thermometer in a selected powder container and records the temperature of the powder when called for by the executive.

f. At the command DETAILS, POSTS, he opens the ammunition car and posts the members of his squad.

g. At the command EXAMINE GUN, he inspects the ammunition and ammunition car equipment, and gives the necessary instructions for preparing both ammunition and equipment for service or drill. He then reports to the chief of section, "Ammunition service in order," or reports any defects that he is unable to remedy without delay.

h. At the command LOAD, he directs and supervises the service of ammunition.

i. At the command CEASE FIRING, when dummy ammunition is used, he causes the dummy projectile and dummy powder charge to be put in their proper places in the ammunition car.

j. At the command REPLACE EQUIPMENT, he supervises the replacing of equipment, sees that all ammunition, ammunition handling apparatus, and the ammunition car are properly secured, forms his squad, and reports to the chief of section.

■ 17. POWDER DETAIL.—*a.* At the command DETAILS, POSTS, members of the powder detail take posts in the ammunition car as directed by the chief of ammunition.

b. At the command EXAMINE GUN, they prepare the powder charges for service as directed by the chief of ammunition.

c. At the command LOAD, they open a powder container, remove the charge, prepare it for the proper zone, and deliver it to No. 2 at the mortar.

d. At the command RE-LAY, they have no duties unless the command WITHDRAW POWDER CHARGE is given, in which case

the new charge is carried to No. 2 and the old charge is returned to the ammunition car.

e. At the command CEASE FIRING, when dummy ammunition is used, they receive the dummy powder charge from No. 2 and put it in its proper place in the ammunition car.

■ 18. PROJECTILE DETAIL.—*a.* At the command DETAILS, POSTS, members of the projectile detail take posts in the ammunition car as directed by the chief of ammunition.

b. At the command EXAMINE GUN, they test, clean, and oil the ammunition car equipment under the supervision of the chief of ammunition. They extend the trolley beam through the end door and lock it in position. They prepare projectiles for service.

c. At the command LOAD, they place a projectile on the truck by means of the triplex block and trolley beam.

d. At the command RE-LAY, they continue handling projectiles.

e. At the command CEASE FIRING, when dummy ammunition is used, they receive the dummy projectile from the truck detail and put it in the designated place.

f. At the command REPLACE EQUIPMENT, they draw the trolley beam inside the car and lock it in position.

■ 19. ARTILLERY MECHANICS.—The artillery mechanics are members of the executive officer's detail. Assisted by members of the gun sections, they make such minor repairs and adjustments as can be made with the means available. The chief artillery mechanic is the custodian of the supplies pertaining to the emplacements to which his battery is assigned. He is responsible for the condition of the supply cars pertaining to the emplacements and the supplies contained therein. The chief mechanic or his assistant issues such equipment, tools, oils, paints, and cleaning materials to the members of the gun sections as may be necessary for the service and care of the mortars and accessories.

SECTION IV

NOTES ON THE SERVICE OF THE PIECE

■ 20. GENERAL.—The service of the piece will be conducted with dispatch and precision and with as few orders as

possible. Commands will be given in the prescribed form. Signals may be substituted for commands whenever practicable. Except for the necessary orders, reports, and instructions, no talking will be permitted. Cannoneers will change positions at a run. Loading with dummy ammunition and pointing the piece as for actual firing is the normal practice at drill.

■ 21. THE COMMAND STAND FAST.—If it is desired to halt all movements of matériel and personnel, the officer in charge of the emplacement or the chief of section commands: STAND FAST.

■ 22. PRECAUTIONS IN ELEVATING.—The mortar is held in battery by the air pressure in the recuperator only, no clamp or lock being provided. Therefore, it is essential that the recuperator pressures be checked before elevating for the first time on any day that the piece is to be operated. Care should be taken not to elevate or depress the mortar against the stops with a jar.

■ 23. OPERATION OF BREECH.—*a. To open.*—No. 1 pulls out the rotating crank lock and turns the rotating crank three times in the direction indicated by the arrow marked "open." He then turns the translating crank counterclockwise, ending with a quick motion in order to bring the breechblock to its final position in the tray with a jar sufficient to release the tray latch. No. 1 then grasps the tray handle and assisted by No. 2 swings the block until the tray back latch engages in its catch.

b. To close.—No. 2 releases the tray back latch with the left hand by raising the handle. He then grasps the tray handle and assisted by No. 1 swings the tray until it brings up against the face of the breech. No. 2 then turns the translating crank with the right hand three times in a clockwise direction, grasps the rotating crank handle with the left hand, and turns the crank in a clockwise direction until the rotating crank lock engages. While No. 2 is rotating the breechblock, No. 1 removes the translating crank from the roller and hands it to No. 2.

■ 24. SPECIAL LOADING DEVICES.—*a.* Overhead loading devices and gravity loading trays have been added to some mortars now in service. This equipment makes it possible to supply projectiles to the mortar without traversing the piece and to load them without using a rammer. The drill in this manual is based on the use of this equipment, which is as a rule made locally and which is illustrated in figures 3 to 7, inclusive. The principal changes in the drill for mortars not so equipped involve ramming, which is covered in paragraph 26.

b. The gravity loading tray consists essentially of an angle iron frame and a pivoted shell tray so balanced that when the lever is released it tilts 5°.

c. The overhead loading device consists essentially of an A-frame, with angle iron standards, and a top girder, mounted midway on the rear platform over the shell track. A long I-beam carrying a triplex block rides in a pivoted sleeve on the top girder of the A-frame. The front end of the I-beam is swiveled to a rigid davit made of a bent 60-pound rail, which is bolted to either side of the loading platform and overhangs the loading tray. The rear end of the I-beam is fitted with a stop to prevent it from leaving the sleeve at the limit of traverse. As the mortar is traversed the I-beam slides in the pivoted sleeve.

d. When the mortar is in position ready to fire, and action is imminent, one projectile should be placed on the gravity loading tray and another on the truck.

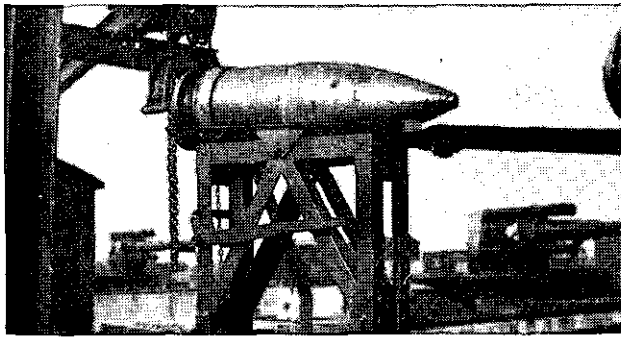

FIGURE 3.—Gravity loading tray.

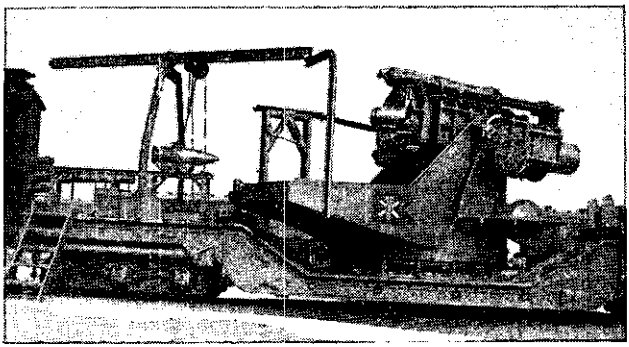

FIGURE 4.—Overhead loading device and gravity loading tray.

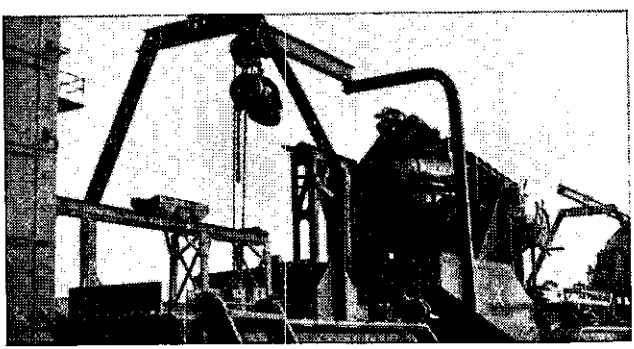

FIGURE 5.—Overhead loading device, rear view.

FIGURE 6.—Loading projectile, showing position of No. 4.

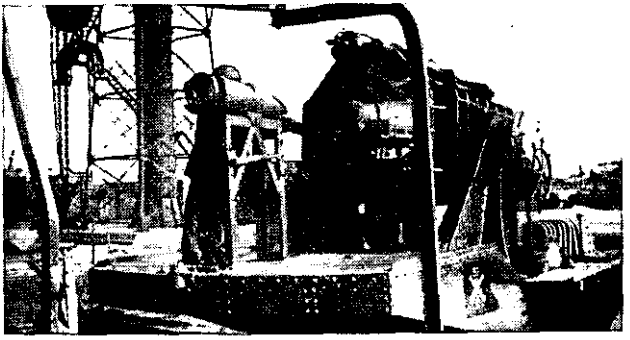

FIGURE 7.—Loading projectile, showing position of chief of breech.

■ 25. LOADING WITH SPECIAL LOADING DEVICES.—At the command LOAD, given by the gun commander, No. 1 opens the breech. The chief of breech places the shell trough in position in the breech, being careful not to damage the threads in the breech or on the breechblock. A projectile being in position on the gravity loading tray, the chief of breech commands: HOME RAM. No 4 releases the tripping lever and assisted by the chief of breech rams the projectile by hand (figs. 6 and 7). No rammer is used. Perfect seating of the projectile results from the velocity it has acquired before it strikes home. The shell trough must be smooth, free from paint, and well lubricated with graphite. Immediately after the projectile is rammed, the powder detail passes the powder charge to No. 2. No. 2 then places the charge in the chamber with the igniter to the rear. When the powder charge is inserted, it should be pushed into the powder chamber to such a distance that the breechblock in closing will give the charge a final push into the chamber. No. 2 releases the tray back latch and assists No. 1 in closing the breechblock. After the breechblock has been fully rotated and locked, the chief of breech commands: ELEVATE, and No. 3 inserts the primer while the piece is being elevated. After the piece has been elevated to about 25° (minimum 20°), No. 3 lowers the firing leaf and hooks the lanyard. Nos. 1 and 2 then turn back the folding platform. No. 3 takes position on the ground, straightens the lanyard, and stands facing the gun commander awaiting the command or signal FIRE.

■ 26. LOADING WITH RAMMER.—If for any reason it is found necessary to use a rammer in order to get proper seating of the projectile, the following procedure is recommended: In manning the rammer the men take their places in the following order: Nos. 1, 6, and 7 on the right and No. 2, chief of breech, and No. 8 on the left, each grasping the rammer with both hands, and as near the outer end of the rammer stave as possible. The projectile is then rammed with all possible force, the speed of the rush being increased so that the maximum force is exerted as the projectile seats. If the rammer is used, the piece will not be traversed while ramming.

■ 27. DRILL WITH DUMMY AMMUNITION.—*a.* For simulated fire using dummy ammunition, the following procedure is recommended:

(1) For the first and succeeding odd-numbered rounds, the operations of loading, pointing, and firing are as given for service ammunition.

(2) For the second and succeeding even-numbered rounds, the operations of sponging and loading are omitted, and the operation of unloading is substituted therefor. As soon as the projectile is removed, No. 1 (assisted by No. 2) closes the breech, and the operations of pointing and firing proceed as for service ammunition.

b. Unusual events, such as misfires, which may occur during actual firing, will be simulated during the drill. They should be called by the executive, without prior information to the mortar squad, in such a manner as to inject realism into the drill.

■ 28. FUZES, PRIMERS, AND POWDER CHARGES.—*a. Fuzes.*— When using point detonating fuzes, the fuzes must be handled with the greatest care. Projectiles are fuzed only as required and in accordance with the following procedure: The adapter plug is unscrewed from the fuze socket and the fuze, *fitted with its felt* or *rubber washer,* is inserted. The fuze is screwed home by hand, the final seating being accomplished with the fuze wrench but without the use of any great force. If there is any difficulty in screwing the fuze home, the fuze should be removed and another inserted. If the same trouble is experienced with the second fuze, the shell should be rejected.

b. Primers.—Prior to firing, the *primer pouch* should be examined to make certain that it contains live primers only. Fired primers should be discarded as soon as they are removed from the firing mechanism.

c. Powder charges.—(1) All members of the gun section should be familiar with the appearance of equal section and base and increment propelling charges for all zones, with particular attention to the difference between the igniter end and the front end of the charge. A misfire or hangfire may occur if the powder charge is loaded with the igniter against the projectile.

(2) When the powder charge is inserted, it should be pushed into the powder chamber to such a distance that the breechblock in closing will give the charge a final push into the chamber.

(3) Powder charges should be removed from their containers only as they are needed. For any given round, the powder charge must not be brought near the breech until the preceding round has been fired, the chamber sponged, and the mushroom head wiped.

■ 29. POINTING AND FIRING.—*a.* (1) For case III firing (the normal method), the gun pointer, assisted by No. 5, lays the piece at the azimuth posted on the display board. No. 5 operates the sight bracket leveling screws, keeping the cross level bubbles centered while the gun pointer is getting the vertical cross hair centered on the aiming point or aiming rule sight. Concurrently, the elevation setter, having set on the quadrant the elevation posted on the display board, elevates the piece, assisted by Nos. 6 and 7, until the bubbles of the quadrant cross levels are centered. He then calls "Elevation set" to the gun pointer. As soon as the piece is accurately laid in direction and after he has heard the elevation setter call "Elevation set," the gun pointer calls in a loud voice to the gun commander, "Azimuth set." When the piece is ready to fire the gun commander calls "No. ——— ready." The gun commander commands: FIRE, upon receipt of the firing signal.

(2) For case II firing, the procedure in (1) above is modified as follows: The gun pointer continues to track the target, and all bubbles on the sight and quadrant are kept centered, until the piece is fired.

b. At the command or signal FIRE, No. 3 pulls the lanyard. After the piece has been fired, Nos. 1 and 2 let down the folding platform while the elevating detail depresses the mortar to the loading position. No. 2 unhooks the lanyard, giving it to No. 3, and removes the fired primer. As soon as the piece reaches the horizontal position, No. 1 opens the breechblock and wipes off the mushroom head; the chief of breech, assisted by No. 2, sponges the powder chamber; and No. 3 clears the vent and cleans the primer

seat. All members of the gun section stand ready for the next round.

■ 30. BUTTERFLY NET.—The butterfly net is not an article of issue. One may be readily constructed by a variety of methods. One method is to take a long-handled landing net or a crab net, replace the netting with burlap, and fasten a heavy hook of small diameter to the handle and within the hoop in such fashion that the hook may be used to unlatch the firing mechanism and cause the primer to drop into the net.

SECTION V

SAFETY PRECAUTIONS

■ 31. GENERAL.—*a.* The following safety precautions are prescribed for peacetime conditions. They indicate, as well, the general principles to be followed in war service conditions.

b. Further instructions concerning safety precautions will be found in AR 750–10 and FM 4–20.

■ 32. THE COMMAND CEASE FIRING.—*a.* Any individual in the military service will command or signal CEASE FIRING if he observes any condition which makes it unsafe to fire.

b. At the command CEASE FIRING, given when the piece is loaded, the lanyard will be detached.

■ 33. FIRING MECHANISM.—*a.* The firing mechanism will be inspected and tested frequently, and immediately before firing, to insure proper operation and functioning of the safety features.

b. To test the proper functioning of the safety features of the mechanism, a friction primer will be inserted before the breechblock is rotated. A strong pull will be exerted on the lanyard while the block is rotated to ascertain if it is possible to fire the primer before the breech is locked.

c. Previous to firing, all primers to be used will be inserted in the primer seat, and the firing leaf and slide will be lowered to their firing positions in order to verify the proper functioning of these parts with each primer.

■ 34. LANYARD.—The lanyard will not be attached to the firing mechanism until the mortar has been elevated to about 25° (minimum safe firing elevation is 20°) and will be detached when the mortar is depressed to about 25°. If the mortar is *loaded* and a butterfly net is available, it is advisable to remove the primer by means of the net before the lanyard is detached. The lanyard will be pulled with a quick, strong pull (not a jerk) from a position on the ground and as near the rear of the piece as is convenient.

■ 35. PRIMERS.—Precautions to be taken in the care and handling of primers are as follows:

a. Prior to firing, the primer pouch will be examined to make certain that it contains live primers only.

b. Care will be taken not to drop primers.

c. Primers will not be inserted until after the breechblock has been locked in its recess, except for the purpose referred to in paragraph 33*b*.

d. Primers will not be inserted or removed by means of the button or wire.

e. The greatest care will be exercised in lowering the leaf of the firing mechanism.

f. The firing leaf will not be lowered on the primer until the piece has been elevated to about 25°.

g. Necessary precautions will be taken to prevent any attempt to use a primer that has failed.

h. Any primer removed after an attempt to fire will be handled with great care due to the possibility of a primer hangfire.

■ 36. FUZES.—Projectiles equipped with base detonating fuzes are received properly fuzed for firing. Projectiles equipped with point detonating fuzes are received unfuzed and will be fuzed as required. (See par. 28*a*.)

■ 37. SERVICE OF POWDER CHARGES.—In the ammunition car all powder charges will be kept in their containers except the charge which is to be served to the piece for the next succeeding round. The powder charge for any given round will not be brought near the breech until the preceding round has been fired, the powder chamber sponged, and the face of the mushroom head wiped.

■ 38. SPONGING POWDER CHAMBER.—After each shot the powder chamber will be sponged and the face of the mushroom head wiped with the liquid provided for the purpose. (See par. 44.)

■ 39. COVER FOR GUN SECTION.—When firing high explosive ammunition and cover is prescribed, each member of the gun section will be required to take adequate shelter each time the piece is fired. (See AR 750–10.)

■ 40. POOR VISIBILITY.—During target practice, firing will be stopped at once if visibility becomes so poor as to endanger the tug or shipping in the field of fire.

■ 41. MISFIRES.—*a. General.*—A misfire occurs if the piece fails to fire when desired. Failure of the piece to fire is due to one of two causes, failure of the primer to fire or failure of the propelling charge to ignite. In case of a misfire, all persons will remain clear of the path of recoil, and the piece will be kept pointed at the target or at a safe place in the field of fire.

b. Primer heard to fire.—If the primer is heard to fire, it will *not* be removed nor the breechblock opened until 10 minutes have elapsed after the firing of the primer.

c. *Primer not heard to fire.*—If the primer is not heard to fire, at least three attempts will be made to fire it. If a special device, by which the primer can be removed by an individual standing clear of the path of recoil (see par. 30), is available, the primer may be removed and examined 2 minutes after the last attempt to fire. If the primer has not fired, a new one may be inserted and firing continued. If the primer *has fired,* a new primer will not be inserted nor the breechblock opened until at least 10 minutes have elapsed from the last attempt to fire. If such a special device is not available, the primer will not be removed nor the breechblock opened until 10 minutes have elapsed from the last attempt to fire. (See FM 4–20.)

■ 42. GENERAL PRECAUTIONS TO BE OBSERVED BEFORE FIRING.—*a.* A check should be made of the *recoil and counterrecoil systems* to see that—

(1) Recuperator pressures are correct and the air and liquid valves are closed.

(2) Recoil cylinders are properly filled.

b. A check of the *ground platform and running gear* should be made to see that the—

(1) Underframing of the car has a uniform bearing on the crossties and the H-beams.

(2) Outriggers are set securely.

(3) Brakes are released.

NOTE.—The gun section will "stand clear" for the first round fired after emplacement and also for the first round fired after a long period (more than 24 hours) during which no action occurs.

c. The mortar should be elevated and traversed through the entire operating range to see that all parts work freely.

d. The slip friction device should be tested. (See par. 53.)

SECTION VI

CARE AND ADJUSTMENT OF MATÉRIEL

■ 43. RECOIL AND RECUPERATOR LIQUID.—*a.* A glycerin water mixture is used in the recoil and recuperator mechanisms. Its formula is as follows:

Glycerin, grade A, U. S. P., 50 parts by volume.
Distilled water, 50 parts by volume (or filtered rain water in emergencies).

To each 5 gallons of the mixture add 4 ounces of sodium hydroxide CP (NaOH), sticks or pellets.

NOTE.—Caustic soda (lye) must not be used.

b. Excess of sodium hydroxide will cause disintegration of packings and corrosion of bronze surfaces in the mechanisms. After the sodium hydroxide is thoroughly dissolved and well stirred in, the alkalinity of the solution may be tested by inserting a piece of red litmus paper which should turn blue.

■ 44. SPONGING SOLUTION.—*a.* The purpose of this solution is to provide a sponging liquid which will extinguish burning residue in the chamber of the mortar and also serve to lubricate the breech recess. It is preferred to plain water and will be used in place of compounds previously issued. Water only may be used when the soap solution is not available.

b. The solution is prepared by dissolving 1 pound of castile soap in 4 gallons of water. Yellow soaps should not be used

as they are liable to leave a gummy deposit in the breech recess.

(1) The soap should be shaved from the bar to facilitate dissolving. It should then be added to the water and the water heated until the soap is dissolved. The water should be stirred with as little agitation as possible to prevent foaming.

(2) To avoid the necessity of handling large receptacles, as much soap as is required for the water to be used can be dissolved in one bucket of water. This concentrated soap solution can then be added to water in other receptacles in the prescribed proportions.

■ 45. CARE OF BORE.—*a*. As soon as possible after any period of firing, the bore of the gun will be cleaned to remove all residue of powder and then thoroughly oiled. The cleaning solution is made by dissolving ½ to 1 pound (depending on the strength desired) of soda ash in each gallon of boiling water. The bore is washed with this solution, using a bore sponge around which burlap has been wrapped. A sponge wrapped with dry burlap is used to wipe the bore thoroughly dry. Then the bore is coated with rust-preventive compound, medium or heavy, depending on local conditions. Daily cleanings for a period of from 1 to 2 weeks are usually necessary.

b. Care must be exercised to prevent staves of the sponges, slush and cleaning brushes from rubbing against the lower portion of the bore, as excessive wear of the lands will result from such practice.

■ 46. CARE OF RECUPERATOR.—The recuperator cylinder and plunger should be emptied and refilled once every 3 months and thoroughly cleaned once every 6 months or more often if conditions require it. The liquid used in the plunger is the same as that used in the recoil cylinders. (See par. 43.) The air and liquid pressure gage calibration corrections should be known. (See par. 47.) The pull rod bearings in the cradle should always be kept well lubricated.

■ 47. TO FILL RECUPERATOR.—*a*. In filling the recuperator, unless only a small amount of liquid or air is to be put into the plunger or recuperator, both operations should be done

at the same time in order to keep a balanced pressure in the cylinder.

(1) To fill the *plunger*, pour the liquid (see par. 43) into the reservoir until it is filled. Open the liquid valve. By means of the pump, force liquid into the plunger until the gage shows 1,500 pounds of pressure per square inch. Close the liquid valve. A check on this pressure is to see that the distance between the rear face of the washer on the front end of the piston rod and the front face of the stuffing-box gland is approximately 3 inches. If this distance is more than 4 inches or less than 2 inches, proper relation between the liquid and air pressure does not exist. When it is approximately 5.75 inches the piston is resting against the plunger, and serious damage will result if the mortar is fired.

(2) To fill the *recuperator cylinder*, connect the air tank to the air tank connection by means of the copper tubing, open the valve on the tank, then open the valve on the air cylinder. When the pressure on the gage shows 1,370 pounds, close the valves on the air tank and the recuperator and remove the copper tubing and air tank. Two tanks are usually sufficient to run the air pressure up from 0 pounds per square inch to the proper amount, 1,370 pounds per square inch.

b. Pressure gages should be calibrated with a master gage obtained from the Ordnance Department. If calibration corrections are necessary, the gage readings that indicate correct recuperator pressures should be painted on the inside of the gage covers.

■ 48. To FILL RECOIL CYLINDERS.—*a.* Set the mortar at 45° elevation with rear yoke against stops on cradle and remove filling plugs. Insert spout of filling funnel and fill to overflowing with solution of glycerin and water (see par. 43.) Depress to 0° and refill, allow all air to escape, refill again, remove funnel, and screw filling plugs tight.

b. The filling ports are so located that they are difficult of access, filling, and inspection. Therefore, particular care must be exercised to see that they are properly filled. A funnel with a flexible hose and a special L-shaped spout is required. The best method to check for proper filling is to let the fluid overflow. On some carriages, part of each

side frame has been cut away to facilitate filling and inspection. Each cylinder holds 5.75 gallons of fluid.

■ 49. To DRAIN RECOIL CYLINDERS.—Depress the mortar to —5° (loading position) and remove the drain plug at the bottom of the front end of each cylinder. The recoil cylinders should be emptied and refilled once every 3 months and thoroughly cleaned once every 6 months or more frequently if conditions require it.

■ 50. ASSEMBLING AND ADJUSTING OBTURATOR.—*a.* With the breechblock in the loading position (open), the spindle, with split rings (front, rear, and small), gas check pad, and filling-in disk upon it, is inserted into the block. Special care must be taken that the front and rear split rings are not interchanged. The 4 obturator spindle washers (2 bronze and 2 steel) are assembled upon the rear end of the spindle projecting through the block, with a bronze washer in front and the others alternating steel and bronze. The spindle is then secured by screwing up the obturator nut by hand. The breechblock is then translated and rotated half-way into the firing position. The split nut is then screwed up as tightly as possible with the wrenches provided for that purpose and locked in place by the clamping screw. The spindle is properly adjusted if, while it has no play longitudinally, it can be turned around freely by taking hold of the mushroom head with both hands.

b. If after firing a few rounds the spindle is found to have longitudinal play, the adjusting operation described above is repeated.

c. The proper adjustment of the obturator is of great importance. It should not be made with the breechblock open due to the possibility of forcing the gas check pad out beyond the split rings and the resulting injury to the pad by being pressed backward over the rear split ring when the block is seated.

d. The obturator nut should never be removed while the breechblock is locked.

■ 51. FIRING MECHANISM.—*a. Care.*—While this mechanism forms part of a heavy gun, the parts are very closely adjusted

and the clearances very small. *The greatest care must be exercised, therefore, in keeping the mechanism well oiled and free from rust and dirt.* It should not be left on the gun when not in use, but should be kept in the small box provided for it and stored in the armament chest.

b. (1) *To assemble.*—(*a*) Clasp the hinged collar over the end of the spindle with the two ribs of the collar engaging in the corresponding grooves of the spindle, keeping the hinge at the top.

(*b*) Take the mechanism in the right hand, holding the collar with the left, and put the mechanism over the end of the collar. Screw the collar to the left until the catch on the under side of the mechanism engages and locks in position. While doing this, see that the guide bar which projects from the right side of the mechanism enters the groove cut for it in the breechblock, and that the pin on the safety bar slide (which is attached to the mortar) enters the hole in the outer end of the safety bar of the mechanism. *Do not attempt to use the mechanism until it is absolutely certain that the collar has been screwed entirely home and locked.*

(c) After the primer has been inserted, lower the slide until the catch engages in the notch of the housing. *Be sure the slide is entirely down before attempting to fire the piece,* otherwise the primer may be blown to the rear, endangering members of the gun squad.

(2) *To disassemble.*—(*a*) To remove the mechanism from the spindle, draw the collar catch to the rear and unscrew the hinged collar.

(*b*) To remove the slide from the housing, draw the slide stop out to the left as far as it will go. The slide may then be lifted from the housing.

(*c*) To remove the firing leaf and slide catch from the slide, start the split pin which passes through the leaf pivot by pressing upon it and then draw it out. The pivot is then free to be removed, and its removal frees the leaf and slide catch from the slide.

(*d*) The collar catch may be removed by unscrewing the screw at the lower edge of the housing.

(*e*) The slide stop may be removed by unscrewing it from the housing with the wrench provided for that purpose. The

slide stop should not be removed except when necessary to repair it or to replace a broken spring.

(*f*) The contact clip may be removed from the leaf by unscrewing the nut on the under side of the leaf.

c. Safety features.—(1) (*a*) There is a safety lug on the right side of the housing which prevents the firing leaf from being drawn back until the slide is all the way down.

(*b*) There is also a safety bar which holds the firing leaf until it is withdrawn by the safety bar slide, actuated by the rotation of the block.

(2) A firing mechanism which has been tried and is known to function satisfactorily in a particular gun will be stamped with the serial number of that gun, and will be used with that gun in order to insure proper functioning.

■ 52. OIL HOLES.—Oil holes must be cleaned frequently to keep them free from sand, grit, and dirt, and will be kept closed with screw plugs or countersunk screws where provided. Before oiling, wipe off carefully all dirt or grit near the opening that might be carried down into the bearing by the oil. All oil plugs, screws, covers, and grease cups should be painted red in order that their location may be easily determined. Fittings which cannot be painted should have a red ring painted around them.

■ 53. TEST OF SLIP FRICTION ADJUSTMENT.—*a. Modified carriage* (antifriction trunnion bearings and 3 to 1 gear ratio).—When the carriage has been modified according to FSMWO E29–W12, the slip friction device will be tested as follows: Place a wrench on the hexagonal section of the vertical shaft with an extension to give a length of 40 inches from the center of the shaft to the end of the extension. The maximum effort of one man applied at the end of the extension should slip the friction device.

b. Unmodified carriage.—The modification mentioned in *a* above is standard. If for any reason an unmodified carriage must be used, information as to the proper adjustment of the slip friction device should be obtained from the Ordnance Department.

■ 54. EXERCISING RECOIL MECHANISM.—*a. General.*—If firing is not conducted, the recoil and counterrecoil mechanisms will be exercised at intervals of approximately 6 months.

b. Procedure.—With recuperator fully charged, recoil cylinders filled, mortar well lubricated in the cradle, the mortar is set at maximum elevation (against the stops). By opening the air valve on the recuperator cylinder the air in the recuperator is allowed to escape, the air pressure gage indicating the existing pressure. When the air pressure has dropped sufficiently, the mortar will slide back a short distance, being stopped by the building up of air pressure in the recuperator. By successive movements the mortar comes to the full recoil position, when the air valve should be closed. Condition of the rods and under side of the mortar can then be ascertained. To return the mortar to battery, fully charged air cylinders should be used and the recuperator charged in the usual way. When the cradle has been re-

to service pressure.

turned to zero elevation, the air pressure should be reduced

SECTION VII

RAILWAY OPERATING EQUIPMENT

■ 55. GENERAL.—This section is intended to serve as a guide to battery commanders in the care and maintenance of railway operating equipment, its preparation for movement, and in emergencies which may arise during movement. In time of peace, Interstate Commerce Commission and local railway regulations will govern. Equipment which is accepted by one railroad may not be acceptable to another. Therefore the battery commander must familiarize himself with the regulations of the railroad companies over which his equipment will be moved.

■ 56. ASSOCIATION OF AMERICAN RAILROADS CODE OF RULES.—*a.* Railroad companies will not accept railway equipment for movement or interchange which does not conform with the Association of American Railroads Code of Rules concerning the care and upkeep of running gear, air-brake equipment, and other strictly railway operating features.

b. Copies of these rules should be in the files of all ordnance officers charged with the maintenance of railway matériel. They can be obtained by application, through channels, to the Commanding Officer, Raritan Arsenal, Metuchen, N. J.

■ 57. BRAKES.—Each truck is equipped with both hand and air brakes, the hand brake being so arranged that it operates through the same system as the air brake. The air-brake equipment is standard equipment. Local railway officials are usually very willing to cooperate by instructing a limited number of men in the care and maintenance of air-brake equipment in the railway repair shops. This instruction should be utilized whenever practicable.

■ 58. INSTALLING JOURNAL BEARINGS.—The journal box bearing, a babbitt lined bronze casting, is held in place in the journal box support by the journal. Before being installed it must be thoroughly clean, must have a smooth bearing surface, free from irregularities, and a proper bearing. Sandpaper, emery paper, or emery cloth should never be used for the purpose of removing irregularities from the bearing surface. A half-round file or scraper should be used. Care must be taken that the wedge has a good contact on the crown of the journal bearing. When installing a journal bearing, a coat of lubricating oil must be applied to the bearing surface. Never wipe the bearing surface of a journal bearing with waste.

■ 59. PACKING JOURNAL BOXES.—*a. Inner.—In packing a* journal box, twist somewhat tightly a rope of packing and place it in the extreme back part of the box. Make sure that it is well up against the journal so as to lubricate the fillet on the journal properly and keep out the dust.

b. Main.—Apply sufficient packing (preferably in one piece) to fill the remaining space out to the axle collar. Take care to have this packing bear evenly along full length of the lower half of the journal. The packing should not be too tight but should be tight enough to overcome any tendency to settle away from the journal. The packing should extend to approximately the center line of the journal but not above

it at any point, and should be pressed down evenly at the sides so that no loose ends may work up under the journal bearings.

c. Outer.—Apply a third piece of firmly twisted packing and pack tightly in order to prevent displacement of the main packing. There should be no loose ends hanging out of the box as they tend to draw out the oil.

■ 60. COMPOSITE CLEARANCE DIAGRAM.—*a.* The composite clearance diagram (fig. 8) includes all coastal lines, Mexican border lines, some transcontinental lines, and a few central,

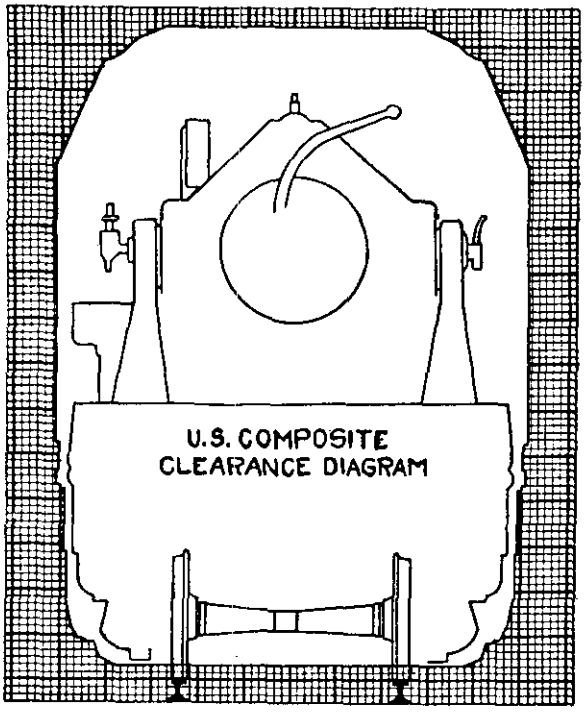

FIGURE 8.—Composite clearance diagram.
NOTE.—Large squares, 1 foot; small, 2 inches.

north, and south lines. It allows 4 inches' clearance between actual obstructions and the outline. As it makes no allowance for curves, the overhang of the mount in rounding curves must be considered. It is safe to assume a maximum curve of 17°—337 feet radius on main lines. The amount of overhang on certain curves is given in the following table:

OVERHANG ON CURVES

Degree curve	3	6	9	12	15
Overhang, inches	¾	1½	2 5/16	3	3 5/16

b. The Corps of Engineers maintains a complete and up-to-date record showing clearances, strength of bridges, and other pertinent data on all railway lines.

■ 61. WEIGHT.—The weight of the mount is just as important as clearance in determining where and how it may be transported. The total weight of this mount on the rails is 177,000 pounds. Before moving it, the strength of all bridges, trestles, and culverts to be crossed should be checked either from data obtained from the Chief of Engineers or from the officials of the railroad.

■ 62. REQUIREMENTS OF GOOD TRACK.—A good track must be regular in alinement and profile and without kinks or sharp bends. In going over the line to verify the profile from time to time, place the eye close to the rails, looking along the track as far as possible. The ends of the rails must not touch each other, as sufficient space for expansion is required between them. Each joint must be made with 2 splice plates fastened with 4 bolts (6 bolts for heavy work). Every bent or broken rail must be replaced. Loose ties (insufficiently tamped) must be made solid by tamping. Broken and rotted ties which depress under the passing of trains must be replaced. The ballast must be porous and firm. If the base is wet or muddy it lacks resistance and must be drained or the track will not retain its profile.

■ 63. MOVEMENT OF EXPLOSIVES.—The movement of explosives by rail is covered by regulations of the Interstate Commerce Commission and also by the municipal ordinances of various cities. Local railway officials should be consulted in reference to these regulations.

■ 64. MISCELLANEOUS PREPARATIONS.—The following suggestions are given to assist the battery commander in training his organization and preparing his matériel for railway movements:

a. Instruct the individual in charge of a rail movement in the procedure to be followed if repair work on the road becomes necessary, such as the supply department to which bills are to be sent, limitations on the cost of repairs he may authorize, and necessary forms and reports to be accomplished.

b. Have personnel trained and equipment available for packing journal boxes and replacing bearings. At each stop all journals should be inspected for overheating.

c. Arrange for a preliminary inspection of running gear by the receiving railway officials.

d. Exercise the running gear whenever possible. Equipment should be moved a sufficient distance so that the journals will become warmed up.

e. Have spare air hoses available.

f. Be sure "explosive" labels are placed on ammunition cars.

g. Have sandbags and marlin available for revetments in case heavy rains threaten washouts on a firing spur.

SECTION VIII

EMPLACEMENT FOR FIRING

■ 65. SITE.—Select a position on a straight level track with the level of the ground not much below the level of the ties. Deep ditches and sandy, swampy, or extremely rocky soil should be avoided when possible.

■ 66. PROCEDURE.—The following detailed procedure is given as a guide in emplacing the mortar:

a. Prepare the track. Replace defective ties or any that do not give a good bearing surface outside the rails. Level the

track both longitudinally and laterally. Tamp ballast well under the ties. Spike rails to ties if necessary.

b. Move the car to the firing position.

c. Unfasten the beam lashing from the side clip angle by unbolting the end from the wire clamps. (The clamps should be kept attached to the lashing for safekeeping and the latter swung out of the way but still attached to the loading track.) Remove the jack beams from the top of the H-beams and place to one side on the car platform.

d. All odd-numbered cannoneers, under the direction of the elevation setter, throw off two H-beams. These they place on the right side of the position, end to end, and parallel with and outside of the rails, with the junction of the two beams opposite the center of the firing position. After the H-beams are properly placed, they are joined together with two fish or connection plates with twelve 0.75- by 2.75-inch bolts. All even-numbered cannoneers, under the direction of the gun pointer, place the remaining two H-beams In a similar manner on the left.

e. Line up the H-beams so that they will be parallel to the track, will be an equal distance from the center line of the track, and so that their *center lines* will be 6 feet 10 inches apart. The beams should also be placed so that the ends of the two lines of beams will be directly opposite each other.

f. Under the direction of the elevation setter, Nos. 11, 12, and 13 unload and place a jack beam under the two forward screw jacks. Under the direction of the gun pointer, Nos. 15, 16, and 17 place a jack beam under the two rear screw jacks. Nos. 6, 7, 8, and 9 throw off the crossties. Nos. 1 to 9, inclusive, dig pits for the floats.

g. Nos. 11 and 13 take post at the right front jack, Nos. 15 and 17 at the right rear, Nos. 10 and 12 at the left front, and Nos. 14 and 16 at the left rear jack, with ratchet levers and cranks. The gun commander personally directs the jacking up of the car. He coordinates the work of the four details so that the jacks are operated together.

h. Nos. 11 to 17, inclusive, place the crossties under the car.

i. The same details that raised the car now lower it until the jacks are clear of the jack beams. The gun commander coordinates the operation in the same manner as he did in raising the car.

j. Nos. 11 to 17, inclusive, unload the floats and shoes and place them in position. No. 4 mans the traversing handwheel, No. 6 the davit, Nos. 3 and 8 take post on the car, and Nos. 1, 2, 5, 7, and 9 handle the equipment on the ground.

k. More detailed instructions on emplacing the piece may be found in Ordnance Document No. 2024.

■ 67. JACKS.—*a.* Four screw jacks are provided, so placed that they are directly above the rails when the car is being used on standard gage track. The jacks are usually operated by crank handles which are fastened with split pins to the square ends of the shaft projecting through the side sills. When not in use, these handles are taken off and fastened to the sloping part of the floor plates by means of crank hooks provided. The jacks can also be operated by ratchet wrenches. When operating the jacks, no more than two threads should be exposed below the transom, as further extension of the jack may damage it.

b. In order to oil the jacks conveniently, four holes with caps are provided in the floor plates over each jack. The hole nearest the center of the car is directly over the jackscrew, and oil poured into it will lubricate both the jackscrew and the worm wheel. The center hole of the other three holes on each jack comes directly over the worm and is used to oil the teeth of the worm and wheel. The remaining oil holes are used to oil the worm bushings.

c. There are two jack beams 8 inches wide, 6 inches high, and 5 feet 8 inches long provided with each car. These beams have bearings for the jacks. In order to raise the car, the jack beams are placed across the rails so that the two jackscrews of each shaft will rest upon the bearing plates.

d. Four 20-inch, 40-ton auxiliary jacks, having a total rise of 9 inches, are carried on each railway car. They weigh approximately 106 pounds each. They are for use in case of an emergency or in case the regular car jacks are out of order. Seats are provided on the end outrigger socket castings for these jacks when they are used to raise the car.

■ 68. OUTRIGGERS.—*a.* There are eight outriggers furnished with each car. These are used to prevent the car from tipping over or sliding on the ground platform when the gun is fired.

When emplacing the mortar for firing at naval targets all outriggers should be used.

b. When the mortar is emplaced the four end outriggers, which are permanently fastened in sockets on the side of the car, are swung out so that they make an angle of 30° with the side of the car body. They have a fixed ball fitted to one end and an adjusting screw and ball fitted to the other end. The adjusting screw is operated with a steel rod (tommy bar) which fits into holes provided next to the ball.

c. When the mortar is emplaced the four side outriggers are placed perpendicular to the side of the car body. They are made similar to the end outriggers except that they have tie rods extending from the adjusting screw nut to the lower part of the outrigger beam. The upper end of each of these outriggers has an eye instead of a ball and is fastened by means of a 2.5-inch pin to the upper part of the outrigger beam.

d. Outrigger float pits should, in general, be dug so that the ball end of each outrigger will be on a level with the bottom of the *track* crossties. These pits should be close enough to the car so that they will fit the outriggers when adjusted to minimum length. The bearing surfaces of the pits should be perpendicular to the outriggers and should be smooth in order to give uniform bearing for the floats. A mound of earth should be built behind the exposed part of the float. All loose earth should be well tamped. (See fig. 9.)

■ 69. RAILWAY CAR, M1918MI.—This railway car is of lighter construction than the MII car, and the weight of the mortar carriage causes a deflection of about 1 inch in the underframe. In emplacing a mortar mounted on this car, it is usually necessary to lift the car with the auxiliary jacks in order to get sufficient clearance for the standard jack beams to be inserted.

■ 70. ASSIGNMENT OF DUTIES.—For purposes of explanation, duties in emplacing have been assigned to men by their numbers in the gun section (war strength). In actual practice, the chief of section may find it necessary to reassign duties in accordance with the physical qualifications of the men. At peace strength there are no Nos. 7 and 13, and where mentioned they must be replaced by other available men.

SECTION IX

WITHDRAWAL FROM POSITION AND PREPARATION FOR RAILROAD TRAVEL

■ 71. GENERAL.—It may be stated as a general rule that the members of the gun section handle the same elements of matériel in preparing the mortar for railroad travel as they handle in preparing it for firing. Float holes should be filled and the roadbed and track left in good condition.

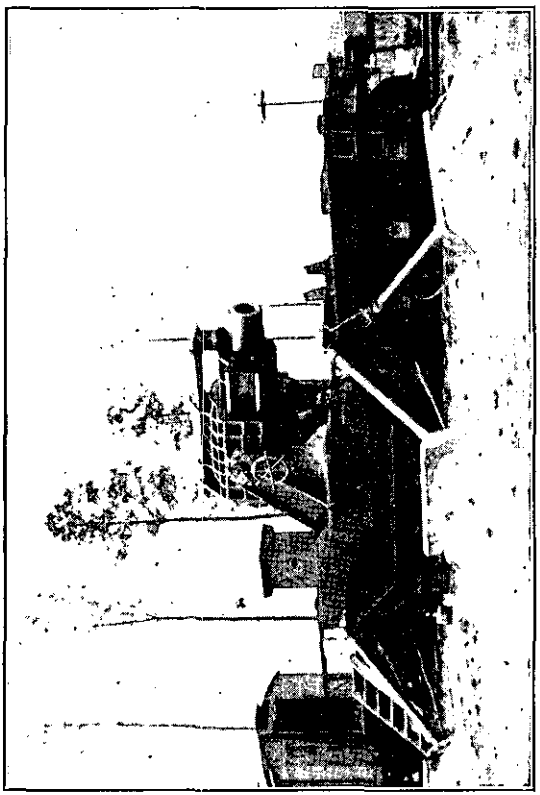

FIGURE 8.—Mortar emplaced.

■ 72. LOADING AND SECURING EQUIPMENT.—*a.* Six of the floats, all the footplates, and all the side outrigger struts are placed on the car platform on the end opposite the loading track. The floats are piled in an inclined position with guide angles horizontal against the two float loading brackets attached to the outrigger beam. The first float is placed with its lower surface against the float brackets. The second float is placed in a similar manner against the first float and so on. The footplates are piled between the tool chests in front of and leaning against the floats. The float lashing is put in place with the longer strand against the lower float angle and the shorter one against the upper angle. The footplate lashing (attached to the longer strand of the float lashing) is put in place and the lock bar locked. Then the whole lashing is pulled up tight with the turnbuckle. The other two floats are placed in the drop section of the car. They are at the same end of the car as the other floats on the M1918MI car. On the M1918MII car there is one at each end.

b. The side outrigger struts and tie rods are placed between the clip angles on the platform at diagonally opposite corners of the car. The strut pins are inserted in holes in the clip angles and through the eyes in one end of the outriggers. The other ends of the outriggers are held in place by toggle pins which are inserted in holes in the clip angles. The rods, pinned to these struts, are fastened by clamps attached to the strut so that they will not move about. The toggle pins in the end ladder hanger brackets are removed, the ladders swung up, and the end struts swung around and hung in their brackets under the side sills of the car. The ladders are then swung back and fastened.

c. The tie supporting brackets are bolted across the floor plates with 0.75- by 1.5-inch bolts and lock washers. The six crossties are placed on these brackets with clip angles vertical. (On the M1918MII car these clips must be removed.) The ends of the crossties should butt against the outrigger beams at one end. Two H-beams, with webs horizontal, are placed alongside the loading track on the opposite side of the car from the crossties. The remaining two H-beams are placed on top of the first two, with flanges staggered. The

jack blocks are laid on the webs of the top H-beams. The beam lashing, which is attached to the loading track at one end, is pulled over the beams; the end of the lashing is pushed through clip angles on the edge of the car, pulled tight, and fastened with wire rope clamps.

d. The storage platform is disassembled and stowed away between the supports of the loading track.

e. The traversing handwheel and the elevating handwheel handle are taken off. The traversing and elevating platforms are swung up and fastened in a vertical position.

f. The mortar is secured in the traveling position with the traveling lock pin (traversing) and the lock stirrup and lock screw (elevation).

■ 73. INSPECTION.—The gun commander inspects to see that all equipment is properly secured and that it does not project from the side of the car. He inspects the journal boxes for proper lubrication. He inspects the mortar position for proper police and to see that all tools and equipment have been loaded. He checks to see that the mortar is locked in the traveling position. He tests the brakes (hand and air) or makes sure that they are tested before the mortar is hauled from the position.

DRILL TABLE

Service of the piece, 12-inch mortar, railway artillery

Details	DETAILS, POSTS	(*a*) EXAMINE GUN (*b*) REPORT	TARGET	LOAD	CEASE FIRING
Gun pointer	If sight is to be used, gets panoramic sight, assisted by No. 5, places it in position on sight standard, and takes position on traversing platform in rear of sight, facing it. If azimuth circle is to be used, takes position where he can best see azimuth pointer.	(*a*) Assisted by No. 5, examines and tests panoramic sight, sight bracket, level bubbles, traversing mechanism, and azimuth pointer. (*b*) Reports to gun commander, "Sight and traversing mechanism in order," or any defects that he is unable to remedy without delay.	See note 3	Assisted by No. 5, lays piece at azimuth posted on display board. As soon as piece is accurately laid in direction and he has heard elevation setter call "Elevation set," he calls "Azimuth set."	Continues to lay piece at azimuth posted on azimuth display board.
Elevation setter	Takes post on elevation platform, facing quadrant.	(*a*) Assisted by Nos. 6 and 7, examines and tests quadrant and elevating mechanism. (*b*) Reports to gun commander, "Quadrant and elevating mechanism in order," or any defects that he is unable to remedy without delay.	See note 3	Sets on quadrant the elevation posted on display board, and at command or signal ELEVATE, given by chief of breech, causes piece to be elevated until bubbles of quadrant cross levels are centered. He then calls "Elevation set." As soon as piece has been fired, he causes it to be depressed as rapidly as possible to loading position.	Continues to lay piece at elevation posted on display board. When dummy ammunition is used, causes piece to be depressed to loading position.
Chief of breech	Posts his detail after assuring himself that they have procured the necessary cleaning material and equipment; takes post on loading platform 4 feet to rear and 2 feet to left of breech, facing it.	(*a*) Examines breechblock, breech mechanism, firing mechanism, breech recess, chamber, and bore (paying special attention to safety devices), and gives the necessary instructions for cleaning and putting them into condition for service, and supervises this operation. (*b*) Reports to gun commander, "Breech in order," or any defects that he is unable to remedy without delay.	No duties	Supervises work of his detail; places shell trough in position; assists Nos. 8 and 4 in placing shell on loading tray; commands: HOME RAM, and assists No. 4 in ramming projectile. After powder charge has been inserted in breech, removes shell trough and, as soon as breechblock has been rotated and locked, commands: ELEVATE. As soon as breech has been opened, assists No. 4 in sponging powder chamber.	When dummy ammunition is being used, receives hand extractor from No. 9. Engages head of extractor in dummy projectile and supervises work of unloading.
No. 1 (breech detail)	Gets cotton waste, translating roller crank, and can containing lubricating oil; places them convenient to the breech; takes post 1 foot to rear and 2 feet to right of breech, facing it.	(*a*) Removes breech cover and places it on drop platform, cleans and oils breechblock. (*b*) No duties.	No duties	Releases rotating crank latch, rotates and translates breechblock, and swings it open until it is engaged by securing latch; after piece is loaded, assisted by No. 2, swings breechblock until tray latch engages. While No. 2 is rotating breechblock, removes translating crank from roller and then hands it to No. 2. With No. 2, turns back folding platform. After piece has been fired, with No. 2 lets down platform. As soon as piece is depressed to horizontal position, opens breech and wipes off mushroom head.	When dummy ammunition is used, opens breech and assists in withdrawing dummy projectile.
No. 2 (breech detail)	Gets cotton waste and shell trough; places them convenient to breech and taken post on loading platform 1 foot in rear and 2 feet to left of breech, facing it.	(*a*) Cleans and oils breech recess and gas check seat. (*b*) No duties.	No duties	Receives powder charge from No. 14 or No. 15 and inserts it in powder chamber until its base barely clears gas check seat, releases securing latch, and assists No. 1 in swinging breechblock until it is engaged by tray latch. Translates and rotates breechblock and assists No. 1 in turning back folding platform. After piece has been fired, unhooks lanyard and removes fired primer; assists No. 1 in letting down folding platform. Places translating crank on roller. When breech has been opened, assists chief of breech in sponging powder chamber. He wipes out breech recess and cleans gas check seat.	When dummy ammunition is used, removes dummy powder charge and passes it back to No. 14. Assists in withdrawing dummy projectile.
No. 3 (breech detail)	Gets cotton waste, lanyard, primers, primer pouch, drill, reamer, and firing mechanism; takes post on loading platform 2 feet in rear of No. 1, facing breech.	(*a*) Examines firing mechanism and places it on obturator spindle, clears vent, cleans primer seat, examines lanyard, and places it in convenient position. (*b*) No duties.	No duties	After breechblock has been fully rotated and locked, inserts primer. After piece has been elevated to 25°, lowers firing leaf and hooks lanyard. Then takes position on ground, straightens lanyard, and stands ready for firing. Fires piece by quick, strong pull (not jerk) on lanyard. As soon as breech has been opened, clears vent, and cleans primer seat.	No duties.
No. 4 (ramming detail)	Assists No. 13 in getting sponging tub and chamber sponge; takes post on right side of loading platform opposite chief of breech, facing breech.	(*a*) Examines gravity loading device; cleans and oils tripping lever. (*b*) No duties.	No duties	Assists No. 8 and chief of breech in placing shell on loading tray; removes shot tongs; at preparatory command HOME, releases tripping lever; at command RAM, assists chief of breech in ramming. After breech has been opened, receives sponge from No. 13 and assisted by chief of breech sponges chamber; passes sponge back to No. 13; levels loading tray.	No duties.
No. 5 (traversing detail)	Gets hand extractor and places it beside left truck rail support; mounts to traversing platform and assists gun pointer in placing sight in position; takes post in front of traversing handwheel, facing to rear.	(*a*) Removes muzzle cover and places it in designated place; assists gun pointer in examining and testing sight and traversing mechanism. (*b*) No duties.	No duties	Traverses piece as directed; when panoramic sight is being used, operates sight bracket leveling screws, keeping cross level bubbles centered.	Continues to traverse piece as directed.
No. 6 (elevating detail)	Takes post on elevating platform beside elevating handwheel, facing front.	(*a*) Assists elevation setter in examining and testing quadrant and elevating mechanism. (*b*) No duties.	No duties	At command ELEVATE, assisted by No. 7, elevates piece approximately as indicated on display board; as soon as piece is fired, depresses it to loading position.	Depresses piece to loading position. If piece is loaded with service ammunition, no duties.
No. 7 (elevating detail) (see note 4).	Takes post on elevating platform beside elevating handwheel, facing rear, being in front of and facing No. 6.	(*a*) Assists elevation setter in examining and testing quadrant and elevating mechanism. (*b*) No duties.	No duties	At command ELEVATE, assists No. 6 in elevating piece approximately as indicated on display board; as soon as piece is fired, assists No. 6 in depressing piece to loading position.	Assists No. 6 in depressing piece to loading position. If piece is loaded with service ammunition, no duties.
No. 8 (hoisting detail)	Takes post on rear platform on right side of truck, facing front.	(*a*) Examines and tests chain block and overhead loading device. (*b*) Reports to gun commander, "Hoisting mechanism in order," or any defects that he is unable to remedy without delay.	No duties	At command LOAD, hoists projectile from truck to loading tray; returns empty shot tongs to No. 9.	When dummy ammunition is used, lowers dummy projectile from loading tray to truck.
No. 9 (truck detail)	Assisted by No. 10, gets truck rail extension and support and places truck on rails; takes post on left side of truck rails opposite No. 10, facing front.	(*a*) Assisted by No. 10, assembles truck rail extension; examines truck rails and stop, and cleans and oils truck; reports any defects he is unable to remedy. (*b*) No duties.	No duties	Assisted by No. 10, receives projectile from ammunition car, sees that it is properly placed on truck, and pushes truck up to stop; sees that shot tongs are locked around projectile and hooks tongs to hoisting apparatus; receives empty shot tongs from No. 8.	When dummy ammunition is used, with No. 10 assists No. 8 in lowering dummy projectile; assisted by No. 10, places dummy projectile on truck and pushes it back to ammunition car; passes hand extractor to chief of breech.
No. 10 (truck detail)	Assists No. 9 with truck rail extension and in placing truck on rails; takes post on rear platform 2 feet behind No. 8, facing front.	(*a*) Assists No. 9 with truck rail extension and truck. (*b*) No duties.	No duties	Assists No. 9 in serving projectile; steadies and guides projectile while No. 8 hoists; alternates with No. 8 in hoisting.	When dummy ammunition is used, assists No. 9 in handling dummy projectile.
No. 11 (outrigger detail) (see note 4).	Gets tommy bar and filling plug wrench; takes post on ground near outer end of right rear outrigger, facing front.	(*a*) Removes filling plug from right recoil cylinder and replaces it at direction of gun commander; examines all right outriggers and tightens up adjusting screws; sees that earth is firmly packed behind each float; reports any defects he is unable to remedy. (*b*) No duties.	No duties	As soon as piece is fired, inspects all right outriggers and sees that all have tight bearing on footplates.	No duties.
No. 12 (outrigger detail)	Gets tommy bar and filling plug wrench; takes post on ground near outer end of left rear outrigger facing to front.	(*a*) Removes filling plug from left recoil cylinder and replaces it at direction of gun commander; examines all left outriggers and tightens up adjusting screws; sees that earth is firmly packed behind each float; reports any defects he is unable to remedy. (*b*) No duties.	No duties	As soon as piece is fired, inspects all left outriggers and sees that all have tight bearing on footplates.	No duties.
No. 13 (sponge detail) (see note 4).	Assisted by No. 4, gets sponging tub and chamber sponge; places sponge in tub containing sponging liquid; takes post near sponging tub as directed by gun commander.	(*a*) Sees that tub is filled with sponging liquid. (*b*) No duties.	No duties	After piece is fired, passes wet sponge to No. 4; receives sponge from No. 4, and places it in sponging solution; sees that sponge is completely covered by solution, and allows excess liquid to run off.	No duties.

NOTES

1. At command RE-LAY, No. 3 slacks lanyard, and gun section perform such of their duties at command LOAD as may be necessary to lay mortar on new data. If new data involve change in zone, command WITHDRAW POWDER CHARGE is given by gun commander, gun section proceed as for command LOAD except that No. 3 unhooks lanyard and removes primer before piece is depressed below 20° and No. 2 withdraws old powder charge and passes it to No. 14 who takes it to ammunition car.
2. At command CEASE FIRING, given when piece is loaded with service ammunition, lanyard is detached and gun section stand clear until further orders are given.
3. As soon after command TARGET is given as data are received, gun pointer and elevation setter set data on panoramic sight (if used) and quadrant, respectively. These data are posted by display board operators.
4. At peace strength, there are no Nos. 7 and 13. No. 11, in addition to his other duties, performs duties of No. 13; elevating detail does not receive any replacement for No. 7.

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APPENDIX

LIST OF REFERENCES

Ammunition car	Ord. Doc. 2026.
Ammunition, general	TM 9–905 (now published as TR 1370–A).
Camouflage, cover, protection against air and chemical attacks, local security, machine gun defense	FM 4–5.
Care and maintenance of matériel	TM 9–850 (now published as TR 1395–A). FM 4–20.
Commands	FM 4–5.
Drill ammunition	TM 9–905 (now published as TR 1370–D).
Examination for gunners	FM 4–150.
Fire control and position finding	FM 4–15.
Firing tables:	
Deck piercing, equal section (aliquot) charge	FT 12–A–4.
Deck piercing, base increment charge	FT 12–G–1.
700 lb. HE shell, Mk. VI and Mk. VIa, base increment charge	FT 12–I–1.
Gunnery	FM 4–10.
Mortar matériel, including mortar, carriage, and firing mechanism	Ord. Docs. 1820 and 1987.
Organization of the battery	FM 4–5. T/O 4–47.
Railway cars, 1918MI and MII, including details on emplacement	Ord. Doc. 2024.
Reconnaissance, selection, and occupation of positions	FM 4–5.
Safety precautions in firing	AR 750–10. FM 4–20.