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**FM 4-85**

**WAR DEPARTMENT**

**COAST ARTILLERY  
FIELD MANUAL**



**SEACOAST ARTILLERY  
SERVICE OF THE PIECE  
16-INCH GUN AND HOWITZER**

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**FM 4-85**

# **COAST ARTILLERY FIELD MANUAL**



## **SEACOAST ARTILLERY SERVICE OF THE PIECE 16-INCH GUN AND HOWITZER**

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**Prepared under direction of the  
Chief of Coast Artillery**



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BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,  
*Chief of Staff.*

OFFICIAL:

E. S. ADAMS,  
*Major General,*  
*The Adjutant General.*

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# COAST ARTILLERY FIELD MANUAL

## SEACOAST ARTILLERY

### SERVICE OF THE PIECE

#### 16-INCH GUN AND HOWITZER

(The matter contained herein supersedes TR 435-275,  
March 20, 1933)

#### SECTION I

##### GENERAL

■ 1. SCOPE.—*a.* The service of the piece prescribed in this manual is for 16-inch guns, M1919MII and M1919MIII, mounted on 16-inch barbette carriage, M1919; 16-inch gun, Mk. II Mod. 1, Navy, mounted on 16-inch barbette carriage, M1919MI; and 16-inch howitzer, M1920, mounted on 16-inch howitzer barbette carriage, M1920. It is intended as a guide only. Minor changes to meet local conditions and matériel may be made by the battery commander.

*b.* The duties of the members of the gun section in the service of the piece, which are not covered in the body of the text, are shown in the drill table in section VII.

■ 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 OF THE GUN SECTION

■ 3. COMPOSITION.—*a.* Each emplacement of one gun is manned by a gun section consisting of a chief of section, a gun squad, and an ammunition squad.

b. Under war strength organization, the gun section consists of 42 enlisted men. Under peace strength organization, it consists of 38 enlisted men.

■ 4. GUN SQUAD.—The gun squad under both peace and war strength organization (20 enlisted men) consists of the gun commander, the gun pointer, the range setter, 2 display board operators, 2 recorders, the chief of breech, the air-pressure operator, and 11 cannoneers, numbered from 1 to 11, inclusive.

■ 5. AMMUNITION SQUAD.—a. Under war strength organization, the ammunition squad (21 enlisted men) consists of the chief of ammunition and 20 cannoneers, numbered from 12 to 31, inclusive.

b. Under peace strength organization, the squad (17 enlisted men) consists of the chief of ammunition and 16 cannoneers, numbered from 12 to 27, inclusive.

■ 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 is in the front rank, 1 pace to the right of his section. The artillery mechanics who are members of the maintenance section normally form with the firing sections, and take posts in the front rank on the left of the first and last gun sections. (See fig. 1.)

### SECTION III

#### DUTIES OF PERSONNEL

■ 7. BATTERY EXECUTIVE.—a. The battery executive commands the firing section of the battery and is in charge of the gun emplacements and accessories.

b. He is responsible to the battery commander for the training and efficiency of the personnel of the firing section, for the condition of the matériel under his charge, for the observance of all safety precautions pertaining to the service of the piece, and for the police of the emplacements.

c. Before each drill or firing, he verifies the air pressure; checks the amount of liquid in the recuperator cylinders; checks the filling of the recoil cylinders; and tests all elec-

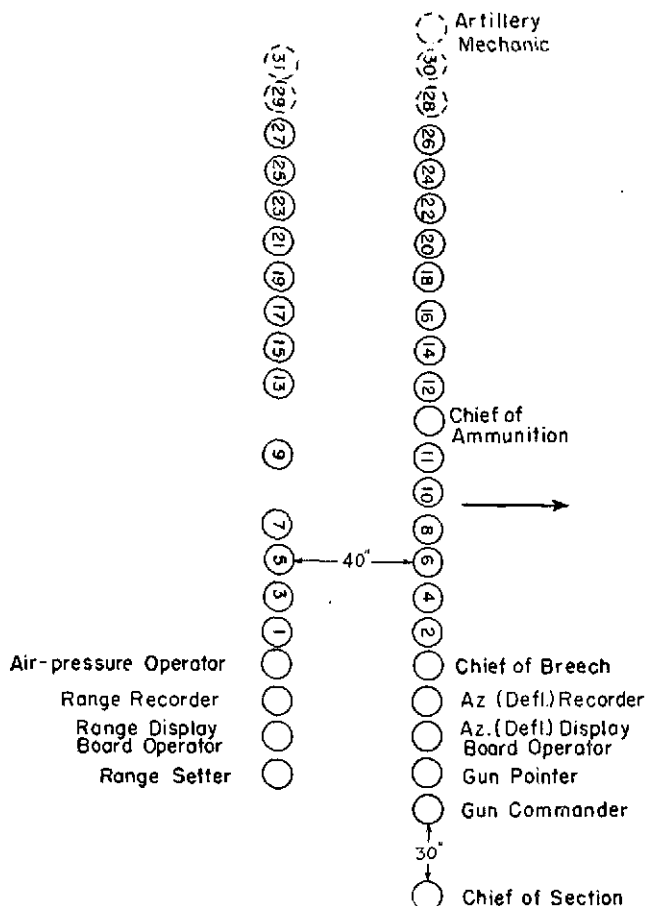


FIGURE 1.—Formation of the gun section.

NOTE.—Cannoneers Nos. 28 to 31, inclusive, are included in the war strength organization only.



trical operating circuits, firing circuits, and firing devices, paying special attention to the safety features. Before firing, he verifies that the recoil parts lock has been removed, and checks that it has been replaced immediately upon completion of firing.

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

*e.* When firing on time interval signal, he is responsible that the guns are fired immediately upon receipt of the proper firing signal, safety precautions permitting. If it becomes necessary to suspend fire for a time interval, he commands: **RE-LAY**, and reports his action to the battery commander.

*f.* At the conclusion of drill or firing, the battery executive commands: **REPLACE EQUIPMENT**, inspects the emplacements, and reports to the battery commander.

■ **8. ASSISTANT BATTERY EXECUTIVE.**—The assistant battery executive performs the duties of the battery executive insofar as they pertain to the emplacement to which he is assigned.

■ **9. CHIEF OF SECTION.**—*a.* The chief of section (noncommissioned officer) is in command of the gun section. He supervises the service of the piece and the service of ammunition, and personally directs the work of care and preservation at the emplacement to which his section is assigned. He is responsible to the officer in charge of the emplacement for the training and efficiency of the personnel of his section, for the condition of the matériel under his charge, for the observance of all safety precautions at the emplacement, and for the police of the emplacement.

*b.* When his section arrives at the emplacement he commands: **1. DETAILS, 2. POSTS**, and supervises the procurement of equipment. After all details have reached their posts (fig. 2), he commands: **EXAMINE GUN**. He then makes an inspection of the gun, carriage, and other matériel.

*c.* He receives the reports of the gun commander and the chief of ammunition and reports to the officer in charge of

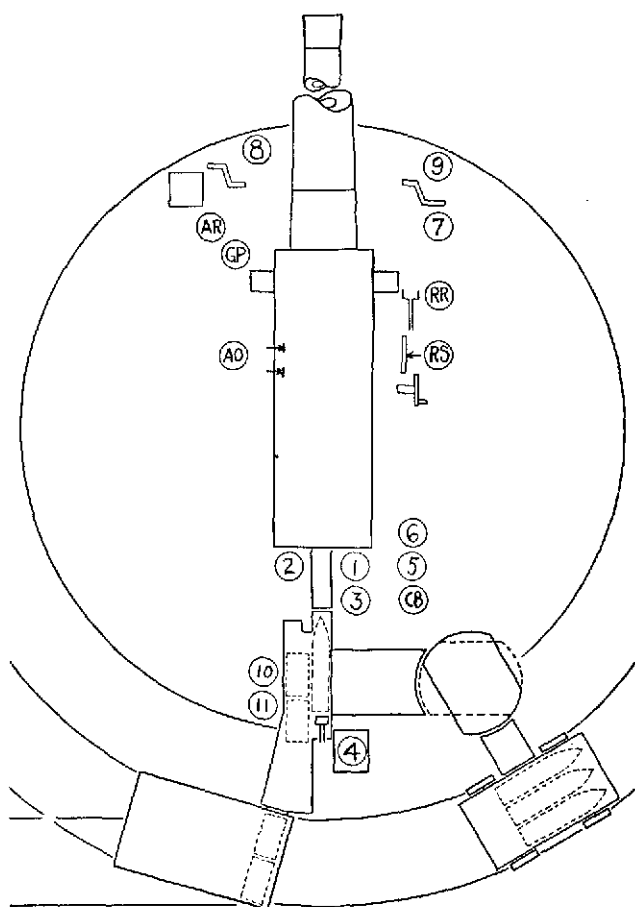


FIGURE 2.—Details, posts.

the emplacement, "Sir, No. ——— in order," or any defects 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. At the command **TARGET**, he repeats the command and target designation. As soon as the gun pointer is on target, the chief of section reports or signals to the officer in charge of the emplacement, "Sir, No. ——— on target."

f. He informs the chief of ammunition what projectiles and powder to serve.

g. At the command **LOAD**, the chief of section repeats the command and supervises the loading. Under no circumstances will he permit his gun to be fired prior to the receipt of the command **COMMENCE FIRING** from the battery commander.

h. At the command **COMMENCE FIRING**, if the piece is unloaded, the chief of section commands: **LOAD**. He also commands: **LOAD** before each shot.

i. He commands: **CEASE FIRING** when the number of shots specified has been fired. When the number of shots has not been specified, the chief of section repeats the command **CEASE FIRING** when it is received from the battery commander.

j. When firing on time interval signal, he is responsible to the officer in charge of the emplacement that the piece is fired immediately upon the proper signal, safety precautions permitting. He repeats the command **RE-LAY** when it is received.

k. In case of a *misfire*, he reports to the officer in charge of the emplacement, "No. ——— misfire," and requires the observance of the precautions described in paragraph 37.

l. He keeps a record of the number of rounds fired by his gun, showing the date and approximate time, in order that the emplacement book may be kept posted accurately and up to date.

m. At the command **REPLACE EQUIPMENT**, the chief of section supervises the replacing of equipment, the securing of

all matériel, and the policing of the emplacement, and then, unless otherwise directed, forms his section, and reports to the officer in charge of the emplacement.

■ 10. GUN COMMANDER.—*a.* The gun commander (noncommissioned officer) is in command of the gun squad. He is responsible to the chief of section for the efficiency of the personnel of his squad, for the condition of the matériel under his charge, for the observance of all safety precautions pertaining to his gun, and for the police of the emplacement.

*b.* At the command **EXAMINE GUN** given by the chief of section, he personally makes an inspection of the gun, carriage, and other matériel, paying special attention to the recoil and recuperator cylinders, the air system for operating the breechblock, the firing mechanism, safety devices, and the lubrication of all moving parts. He is responsible that the recoil parts lock is removed before firing and that it is replaced immediately upon completion of firing.

*c.* He receives the reports of the various details of the gun squad and reports to the chief of section, "No. ——— in order," or any defects he is unable to remedy without delay.

*d.* At the command **LOAD**, he supervises the work of his squad.

*e.* In case II firing, after receiving the report, "Elevation set" from the range setter, the gun commander calls and signals, "Ready," indicating to the gun pointer that the piece is ready to fire.

*f.* In case III firing, after receiving the reports, "Elevation set" and "Azimuth set" from the range setter and gun pointer, respectively, he calls and signals, "No. ——— ready," indicating that the piece is ready to fire. At the sounding of the proper time interval signal, he commands and signals: **FIRE**.

*g.* When firing on time interval signal, he is responsible to the chief of section that the piece is fired immediately upon the proper signal, safety precautions permitting. He commands: **RE-LAY**, in case his gun is not ready to fire when the time interval signal sounds. He repeats the command **RE-LAY** when it is given by the chief of section.

*h.* In case of a *misfire*, he calls, "No. ——— misfire," and requires the observance of the precautions described in paragraph 37.

*i.* At the command **CEASE FIRING**, when dummy ammunition is used, he supervises the unloading.

*j.* At the command **REPLACE EQUIPMENT**, the gun commander supervises the replacing of equipment and the securing of all matériel, and then, unless otherwise directed, forms his squad and reports to the chief of section.

■ **11. GUN POINTER.**—The gun pointer (noncommissioned officer) is charged with the duty of pointing the piece in direction. He is responsible to the gun commander for the proper operation, care, and adjustment of the sight, sighting apparatus, azimuth index, azimuth indicator of the electrical data transmission system (if so equipped), traversing mechanism, and electric firing circuit. For detailed duties, see drill table, section VII.

■ **12. RANGE SETTER.**—The range setter is charged with the laying of the piece in range (elevation). He is responsible to the gun commander for the proper operation, care, and adjustment of the quadrant, range disk, elevation indicator of the electrical data transmission system (if so equipped), and elevating mechanism. For detailed duties, see drill table, section VII.

■ **13. CHIEF OF BREECH.**—The chief of breech (noncommissioned officer) is responsible to the gun commander for the efficiency of the personnel of the breech detail, and for the condition and serviceability of the breech mechanism, breech recess, firing mechanism, chamber, and bore. He is specially charged with the observance of safety precautions insofar as they pertain to his detail. In firing, he listens for the explosion of the primer which may be audible if the powder charge fails to explode. For detailed duties, see drill table, section VII.

■ **14. AIR-PRESSURE OPERATOR.**—The air-pressure operator is responsible to the gun commander for the condition and serviceability of the air-pressure mechanism, the breech operating air system, and the recuperator system. He should

be carefully selected as the safety of the personnel and matériel depends upon his attention to duty. For detailed duties, see drill table, section VII.

■ 15. DISPLAY BOARD OPERATORS.—*a.* The azimuth (deflection) and range (elevation) display board operators are responsible to the gun commander for the proper operation of the display boards and for the recording of all data received from the plotting room.

*b.* At the command DETAILS, POSTS, they procure chalk, blackboard erasers, pencils, forms for recording data, and telephones, and take post at the display boards.

*c.* At the command EXAMINE GUN, they clean the display boards, if necessary, put on the telephone headsets, test the telephones to the plotting room, and report to the gun commander, "Azimuth (deflection) display board in order" and "Range (elevation) display board in order," or report any defects they are unable to remedy without delay.

*d.* At the command TARGET, they receive azimuths (deflections) and ranges (elevations) from the plotting room, post them on the display boards, and record them on the data forms.

*e.* At the command CEASE FIRING, they continue posting and recording data as long as data are being received from the plotting room.

■ 16. AZIMUTH (DEFLECTION) RECORDER.—*a.* The azimuth (deflection) recorder is responsible for the checking and recording of all azimuths (deflections) set on the gun.

*b.* At the command DETAILS, POSTS, he procures a pencil and form for recording data. When traversing is by power, he takes post convenient to the gun pointer; when traversing is by hand, he takes post at the left traversing crank, facing the muzzle, and assists in the traversing.

*c.* At the command EXAMINE GUN, he assists the gun pointer in examining, cleaning, and adjusting the azimuth index and sight.

*d.* At the command TARGET, he keeps a continuous record of the data at which the piece is set, being especially careful to record, check, and identify the data at which the piece is actually fired. In case II firing, he receives the deflections

from the gun pointer. In case III firing, as soon as the gun pointer has completed the laying of the piece, the azimuth recorder checks and records the setting; if firing electrically, he fires the gun on the firing signal. However, the gun pointer fires the howitzer when firing electrically.

e. At the command **CEASE FIRING**, he continues to record data as long as data are being set on the piece.

■ **17. RANGE RECORDER.**—*a.* The range recorder is responsible for the checking and recording of all ranges (elevations) set on the piece, and for the operation of the elevation brake levers.

b. At the command **DETAILS, POSTS**, he procures a pencil and form for recording data and takes post at the elevation brake levers, facing the range setter.

c. At the command **EXAMINE GUN**, he operates the elevation brake levers when necessary, and assists the range setter in examining and adjusting the quadrant and range disk.

d. At the command **TARGET**, he keeps a continuous record of the data at which the piece is set, being especially careful to record, check, and identify the data at which the piece is actually fired. He raises the elevation brake levers to their full extent whenever the piece is elevated or depressed.

e. At the command **CEASE FIRING**, he continues to record data as long as data are being set on the piece, and operates the elevation brake levers as required.

■ **18. CHIEF OF AMMUNITION.**—*a.* The chief of ammunition (noncommissioned officer) is responsible to the chief of section for the efficiency of the personnel of his squad, for the care of the ammunition and ammunition-handling apparatus, for the observance of all safety precautions in the care and handling of ammunition, for the recording of data pertaining to the storage of ammunition, and for the police of the magazines and galleries under his charge. He sees that all projectile cars are loaded and powder charges ready for firing, and that the service of ammunition is uninterrupted during firing. He keeps the chief of section informed regarding the amount and condition of ammunition on hand and reports any defects found.

b. At the command **DETAILS, POSTS**, he opens the projectile and powder magazines and posts the members of the ammunition squad.

c. At the command **EXAMINE GUN**, he inspects the matériel under his charge, gives instructions for preparing ammunition for firing or drill, and reports to the gun commander, "Ammunition service in order," or reports any defects he is unable to remedy without delay.

d. At the command **TARGET**, he directs and supervises the delivery of ammunition to the gun squad.

e. At the command **CEASE FIRING**, when dummy ammunition is used, he causes the dummy projectiles and powder charges to be put in their proper places.

f. At the command **REPLACE EQUIPMENT**, he supervises the replacing of the ammunition-handling equipment and the securing of all ammunition, forms his squad, and reports to the chief of section.

■ 19. **AMMUNITION SQUAD.**—*a. Rail tractor operators (Nos. 12 and 14).*—(1) These men are responsible to the chief of ammunition for the condition and serviceability of the rail tractors employed in ammunition delivery, for the care of switches and tracks, and for the continuous supply of projectiles and powder to the gun.

(2) At the command **DETAILS, POSTS**, they proceed to the rail tractors and run them to the designated positions.

(3) At the command **EXAMINE GUN**, they examine, clean, and oil the rail tractors. No. 12 reports to the chief of ammunition, "Rail tractors in order," or reports any defects he is unable to remedy without delay.

(4) They alternate in the delivery of ammunition trains to the gun in such manner as to assure a continuous supply of powder and projectiles at the breech.

*b. Projectile detail (Nos. 16, 18, 20, and 22).*—(1) The detail, No. 16 in charge, is responsible to the chief of ammunition for the condition, serviceability, and operation of the projectile cars.

(2) At the command **DETAILS, POSTS**, the detail proceeds to the projectile cars and places them in readiness for service at the designated positions.



(3) At the command **EXAMINE GUN**, the detail examines, cleans, and oils the projectile cars. No. 16 reports to the chief of ammunition, "Projectile cars in order," or reports any defects he is unable to remedy without delay.

(4) Nos. 16 and 18 on one train and Nos. 20 and 22 on the other assist in loading the projectiles onto the cars at the projectile room and deliver them from the cars to the revolving projectile table.

*c. Powder detail (Nos. 13, 15, 17, and 19).—*(1) The detail, No. 13 in charge, is responsible to the chief of ammunition for the condition, serviceability, and operation of the powder cars.

(2) At the command **DETAILS, POSTS**, the detail proceeds to the powder cars and places them in readiness for service at the designated positions.

(3) At the command **EXAMINE GUN**, the detail examines, cleans, and oils the powder cars. No. 13 reports to the chief of ammunition, "Powder cars in order," or reports any defects he is unable to remedy without delay.

(4) Nos. 13 and 15 on one train and Nos. 17 and 19 on the other assist in loading the powder charges onto the cars at the magazine and deliver the charges as required to the powder tray at the gun. Nos. 13 and 17 are responsible that the powder section containing the igniter is properly placed on the tray for each charge.

(5) At the command **CEASE FIRING** when dummy ammunition is used, Nos. 13 and 15, or Nos. 17 and 19, receive the dummy powder charges and put them in their proper place.

*d. Projectile room detail (Nos. 24, 26, 28, and 30).—*(1) The detail, No. 24 in charge, is stationed in the projectile room to receive, care for, store, and deliver projectiles. It is responsible to the chief of ammunition for the projectile room record books, and for the uncrating and proper storage of the projectiles.

(2) At the command **DETAILS, POSTS**, the detail proceeds to the designated projectile room.

(3) At the command **EXAMINE GUN**, the detail inspects the projectile room and prepares projectiles for delivery, as directed. No. 24 reports to the chief of ammunition, "Projec-

tile room in order," or reports any defects he is unable to remedy without delay.

(4) The detail uncrates and prepares projectiles for firing as required, assists in loading projectiles on the projectile cars, and assures a continuous delivery of projectiles to the ammunition trains.

*e. Powder magazine detail (Nos. 21, 23, 25, 27, 29, and 31).—*(1) The detail, No. 21 in charge, is stationed in the powder magazine to receive, care for, store, and deliver powder charges. It is responsible to the chief of ammunition for the condition of the powder magazines, for the care of the powder charges, for the proper keeping of the powder magazine record books, and for the uncrating and opening of powder charge containers.

(2) At the command **DETAILS, POSTS**, the detail proceeds to the designated powder magazine.

(3) At the command **EXAMINE GUN**, the detail inspects the powder magazine and prepares powder charges as directed. No. 21 reports to the chief of ammunition, "powder magazine in order," or reports any defects he is unable to remedy without delay.

(4) The detail uncrates and opens powder containers as required, loads the powder charges onto the powder cars, and assures a continuous delivery of powder to the ammunition trains.

■ **20. ARTILLERY MECHANICS.**—The artillery mechanics, assisted by members of the gun sections, 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 gun emplacements to which his battery is assigned. He is responsible for the condition of the storerooms pertaining to the gun emplacements and the supplies contained therein. The chief mechanic or his assistant issues such equipment, tools, oil, paints, and cleaning materials to the members of the gun sections as are necessary for the service and care of the guns and accessories.

## SECTION IV

## NOTES ON SERVICE OF THE PIECE

■ 21. GENERAL.—The service of the piece should be conducted with dispatch and precision, and with as few orders as possible. Loading with dummy ammunition and pointing the piece as for firing are normal practices at drill. Drill should be conducted without power during part of every drill period. Cannoneers change position at a run. Except for the necessary orders, reports, and instructions, no talking should be permitted. Commands should be given in the prescribed forms. Signals may be substituted for commands whenever desirable. (See FM 4-5 and FM 4-20.)

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

■ 23. THE COMMAND RE-LAY.—At the command RE-LAY, the display board operators post the new data on the display boards, the gun pointer and range setter continue to point the gun in direction and elevation according to the new data, and No. 3 slacks the lanyard (if used).

■ 24. FIRING LOCK.—*a.* No. 3 attaches the assembled firing lock to the obturator spindle by pushing it over the end of the spindle and giving it a quarter turn to the locked position.

*b.* The piece may be fired by lanyard or electrically as the firing lock is designed to be used with combination percussion—electric primers.

*c.* In lanyard firing, No. 3 attaches the lanyard to the cocking lever of the firing lock, and walks to the rear through the passage between the powder tray and the left side of the carriage, uncoiling the lanyard as he goes and takes post on the outer edge of the gun platform in rear of the breech. At the command FIRE, he fires the piece by a quick, strong pull (not a jerk) on the lanyard.

*d.* Due to occasional failures of the fired primer to fully eject when the breech is opened, the firing lock may be

damaged by closing the lock on the partly extracted primer. To prevent this, one of the following precautions should be adopted:

(1) After the breechblock is open, and while loading is taking place, No. 3 reaches under the breechblock and makes sure the old primer has been extracted.

(2) Before the breech is opened, No. 3 opens the firing lock by hand and removes the fired primer.

■ 25. OPERATION OF BREECH.—*a. To open the breech*, No. 2 pushes the salvo latch in the upper cam until it is retained by the salvo latch catch. He raises the operating lever latch disengaging it from the operating lever latch catch, and pulls the operating lever down until the breechblock is disengaged from the threads in the breech recess. Nos. 1 and 2 grasp the breechblock handle and pull the breechblock downward to the full open position where it is brought to rest on the carrier buffers. On the Mk. II, Mod. 1, Navy gun, the breechblock is held down by the holding down latch.

*b. To close the breech by hand*, Nos. 1 and 2 grasp the breechblock handle and raise the breechblock into the breech recess. No. 2 pushes the operating lever upward until the operating lever catch locks the lever in position. On the Mk. II, Mod. 1, Navy gun, No. 1 releases the holding down latch before raising the breechblock.

*c. To close the breech by air pressure*, No. 1 or 2, depending on the position of the closing valve, pulls outward on the closing valve handle. The air pressure acting on the pistons of the closing mechanism forces the spring rods to the rear, raising the breechblock into the breech recess. The rotating cam rollers attached to the breechblock sharply strike the paths in the upper and lower rotating cams located on the breech face, giving the breechblock its initial rotation and guiding it to the point of engaging the threads in the breech recess. The momentum of the breechblock acting through a rotating link whips the operating lever upward, rotating and completely closing the breechblock. No. 2 keeps clear of the operating lever as it is driven upward with terrific force into its closed position. The shock of the blow is absorbed by the operating lever plunger housed in the upper

cam. No. 2 pushes the operating lever home if the force of closing has not caused the operating lever catch to lock the lever in the closed position. On the Mk. II, Mod. 1, Navy gun, No. 1 releases the holding down latch before the closing valve is opened.

■ 26. **LOADING.**—There is a tendency to load the guns and howitzers at a greater angle than that specified because the breechblock then opens with less effort. The specified angle must be strictly observed. At a higher elevation the front end of the spanning tray is not supported in the breech recess and the whole weight of the projectile is borne by the front tray arm which is liable to break. The correct loading angle is indicated when the brass plate on the face of the range disk comes under the pointer. If the breechblock, when open, should rise slightly above its lowest position due to the action of the balance springs, the front end of the spanning tray should be pressed down upon the breechblock until the spanning tray is properly supported by the breech recess. When the spanning tray is being returned from the loading position, care must be taken to bring it gently against the stop. Continuous striking of the stop with undue force will break it or damage the rammer mechanism housing.

■ 27. **RAMMING.**—*a.* At the command **TARGET**, No. 5 moves the rammer control handle to the "On" position and stands ready to assist No. 4. At the command **LOAD**, No. 4 operates the feed lever of the projectile parking table, placing one projectile on the rammer tray. As soon as the spanner tray is in position and all is clear, he throws the rammer speed lever over toward "Ram," and as the projectile gains velocity, increases the speed so that the maximum will be attained at the moment of seating the projectile. He will be careful that the projectile is not rammed so hard that the ramming chain "buckles" or "jumps." He then throws the speed lever over to "Withdraw" and as rapidly as practicable withdraws the rammer. As soon as the first two sections of the powder charge are in position on the rammer tray, he operates the rammer and pushes these sections forward sufficiently to clear space for the next two sections. He then withdraws

the rammer. When the last two powder sections are on the rammer tray, he rams all four sections forward but in such manner that a final forward movement will be given by the mushroom head when the breechblock is closed. This will require training and the use of appropriate marks on the rammer links. At all times he exercises caution in ramming the powder sections to prevent jamming or bursting the sections. When using the howitzer charge or fractional charges, the ramming of the powder sections is modified as circumstances indicate.

b. In withdrawing the dummy projectile, the projectile will be slowed up with the hand extractor and brought to rest without striking the rammer chain head. A practice of giving the projectile as great a rearward velocity as possible and permitting it to coast down the incline without check until it is stopped violently by the head of the rammer chain will result in seriously damaging the rammer chain hydraulic head and the "B" end of the rammer speed gear.

c. When the rammer chain is run forward by power without a projectile or powder charge being rammed, No. 4 exercises care to reverse the lever and stop the chain several feet before it has reached its limit of travel. Failure to do this will cause the stop lugs on the last link of the rammer chain to jam violently into the sprocket teeth and injure the gearing. The rammer head must not be allowed to reach the rifled section of the bore, otherwise the rifling will be damaged.

d. In *hand ramming*, No. 4 supervises the work of the men on the rammer hand cranks. No. 5 disengages the rammer clutch from power operation. Nos. 5, 10, and 11, and the nearest man from the powder car, man the left rammer hand crank. One man from the powder car and two men from the projectile car man the right rammer hand crank.

■ 28. RECOIL PARTS LOCK.—The recoil parts lock has been provided to prevent the gun from sliding to the rear when in an elevated position, in case there should be insufficient air pressure in the recuperator cylinders. Before firing or exercising the gun, the air-pressure operator by direction of the gun commander removes the recoil parts lock nut from its bolt, and replaces it immediately upon completion

of the firing or exercising. Under no circumstances will the gun be elevated until it is ascertained either that the recoil parts lock is locked, or that there is sufficient air pressure in the recuperator cylinders.

■ 29. MOTORS.—To start a motor, *gradually* move the controller handle of the controller drum pertaining to that motor from the "Off" position around to the full running position, pausing long enough on each point to allow the motor to pick up speed. Upon an overload or no-voltage condition, the magnetic switches will open and it will be necessary to return the controller handle to the starting position before the motor can be restarted. The motor may be operated at reduced speed by permitting the controller handle to remain in one of the intermediate positions. To shut down the motor, return the controller handle to the "Off" position.

## SECTION V

### SAFETY PRECAUTIONS

■ 30. GENERAL.—*a.* The following safety precautions are prescribed for peacetime conditions. They indicate as well the principles to be followed in war service conditions, but should be interpreted by the personnel concerned according to the circumstances existing at the time of any particular emergency.

*b.* Further instructions concerning safety precautions to be followed will be found in AR 750-10 and FM 4-20.

■ 31. THE COMMAND CEASE FIRING.—Any individual in the military service will command or signal CEASE FIRING if he observes any condition which makes it unsafe to fire. At the command CEASE FIRING, the lanyard will be detached if firing by lanyard, or the gun pointer or the azimuth recorder will take his hand off the firing magneto handle if firing electrically.

■ 32. PRIMERS.—Precautions in the care and handling of primers will be observed as follows:

*a.* Before 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. Except when testing safety devices, primers will not be inserted until after the breechblock has been closed and locked.

d. Fired primers will be discarded as soon as they are removed from the firing lock.

e. Precautions will be taken to prevent any attempt to use primers that have failed. They will be handled with great care due to the possibility of a primer hangfire. These primers will be turned in to the ordnance officer for inspection.

■ 33. POWDER CHARGES.—The powder charge for any given round will be kept on the powder car until after the preceding round has been fired, the powder chamber blown out with compressed air or sponged, the face of the mushroom head wiped, and the bore announced clear.

■ 34. POWDER CHAMBER.—After firing, the gases are automatically blown out of the chamber and bore by compressed air when the breechblock is opened. No. 1 inspects the bore and chamber before reloading to see that the chamber is clear of smoldering fragments; that by day, he can see daylight through the bore; and that by night, the entire bore is clear from flame or luminous gas. He then announces, "Bore clear." In case of failure of the air supply, the chamber will be sponged after each shot with the liquid provided for this purpose.

■ 35. COVER FOR GUN SECTION.—When firing high-explosive shells 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.)

■ 36. POOR VISIBILITY.—During target practice, firing will be stopped at once if visibility becomes so poor that safety measures taken to protect the tug and shipping in the field of fire become inoperative.

■ 37. MISFIRES.—*a. In case the discharge of the primer is heard, at least 10 minutes must elapse after the firing of the primer before the old primer is removed or the breechblock*



is opened. During this period all persons will stand clear of the breech. The piece will be kept directed on the target or on a safe place in the field of fire.

*b. In case the discharge of the primer is not heard*, if a special device is available which permits removal of the primer by a person entirely clear of the path of recoil, the primer may be removed after 2 minutes have elapsed since the last attempt to fire. If, after removal, it is found that the primer actually failed to fire, no further wait is necessary before inserting a new primer or opening the breech. If, on the other hand, examination shows that the primer has fired, the precautions prescribed in *a* above will be observed. If no special device can be employed for the removal of the primer the precautions prescribed in *a* above will be observed.

## SECTION VI

### CARE AND ADJUSTMENT OF MATÉRIEL

■ 38. GENERAL.—*a.* Officers will be held strictly responsible for the proper care and preservation of all artillery matériel in their charge.

*b.* The methods prescribed for the operation, care, and preservation of matériel are those described herein and in other publications issued by the War Department, a thorough understanding of which is required of all officers and others having matériel in their charge.

*c.* Cleaning and preserving materials will be used in strict compliance with ordnance regulations.

*d.* Such repairs as may be handled by the battery personnel will be undertaken only under the supervision of an officer or chief artillery mechanic. In all cases where the nature of the repair or adjustment is beyond the scope of the enlisted personnel, the ordnance officer will upon request provide trained ordnance personnel for the work.

■ 39. FIRING LOCK.—*a.* 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 will be removed from the gun when not in use, kept in the small box provided for it, and stored in the armament chest.

b. Examination should be made for the condition of the annular grooves, the guides in the housing, and the guides on the slide; for a broken extractor, worn extractor cam, and broken or weakened extractor cam spring; for the condition of the primer retaining catch and spring, firing lock hammer, firing lock hammer catch and its spring, and operating surface of the cocking lever; and for a broken or weakened firing spring, scores on the hammer thrust pin, deformed firing pin, and broken or weakened firing pin spring.

c. Fouling of the firing pin and the use of thicker oil than authorized will cause the mechanism to absorb the blow of the firing lock hammer and result in misfires.

d. The combination percussion-electric primer is used with the firing lock.

e. The slightest withdrawal of the slide from the closed position should remove the firing pin from the percussion cap of the primer and preclude firing either electrically or by percussion.

f. A firing lock which has been tried and is known to function satisfactorily in a particular gun will always be used with that gun in order to insure proper functioning.

■ 40. OBTURATOR.—a. The primer seat and vent hole in the obturator spindle will be washed or brushed as required to remove every trace of powder fouling or gummy oil, wiped dry, and then oiled. In cleaning, use the reamer, brush, and vent cleaning tools provided for this purpose. The slightest accumulation of fouling in the primer seat will cause the primer to enter with difficulty, and like difficulty will be experienced in extracting the primer, with the possibility of breakage of parts.

b. The mushroom head, obturator spindle, and split rings require continual care to prevent rusting and pitting. The gas check pad when removed from the gun will be inclosed in the container provided for it to preserve it from deformation or contact with moisture. The gas check pad con-

ainer must always be opened with the ordnance tool provided, in order to prevent possible injury to the pad.

■ 41. BREECH AIR PRESSURE.—*a.* To adjust the breech closing air pressure, the reducing valve on the breech is adjusted to an operating pressure just sufficient to close and lock the breechblock. This pressure varies according to temperature, closing cylinder springs, and the condition of the breech mechanisms. Too high a pressure unnecessarily slams the mechanism into the breech recess.

*b.* The gas ejector valve is tripped and opened when the breechblock is rotated from its closed position. This valve admits air to the chamber and bore, ejecting the residue and hot gases. No. 1 closes the gas ejector valve when he reaches for the breechblock handle.

■ 42. AIR COMPRESSOR.—*a.* The air compressor is not designed for continuous service, and should not be run continuously for more than 1 hour. The air compressor should be run idle for a half hour each week whether the carriage is in use or not, in order that the motor may be dried out.

*b.* On a *water-cooled compressor*, oil is introduced through the oil filler on the lower part of the crankcase. The oil should be poured in until it flows out of the filling hole. There are also oil plugs on the end of the motor to take care of the armature shaft bearings.

*c.* On an *air-cooled compressor*, the oil pressure gage on the compressor should register from 15 to 25 pounds pressure. If no pressure is registered by the gage, the compressor must be shut down immediately, as its entire lubrication depends on the oil pressure. If the machine has been idle for some time, the oil pump may become dry so that it will not pick up oil from the crankcase. If this is the cause of no oil pressure, it will be necessary to prime the oil pump by removing the oil pressure gage and filling the pipe with oil. The crankcase does not hold a large quantity of oil, and as the high operating temperature of an air-cooled machine results in a rapid use of oil, it is necessary that the oil level gage of the compressor be watched and the proper quantity of oil kept in the crankcase. The oil should never be allowed to go below the middle of the gage glass.

■ 43. RANGE DISK.—To prevent damage to graduations, the range disk will be removed from the carriage when not in use, and placed in the range disk box. To remove the disk, remove the control handwheel, unscrew the disk clamp, and lift the disk off the elevating drum.

■ 44. ELEVATING BRAKE.—An elevating brake consisting of a brake drum and brake band is located on each side frame of the gun carriages and on the right side frame of the howitzer carriage. Each brake is normally set and must be released by lifting its brake lever before power is applied to the elevating mechanism. The brake stops the gun at any angle when power is shut off and prevents rotation of the tipping parts during recoil.

■ 45. ANTIFRICTION DEVICE.—a. The antifriction device is designed to reduce the effort required to elevate or depress the gun and to prevent the scoring of the trunnions and trunnion bearings during elevating and depressing. The weight of the tipping parts bears on this mechanism except at the time when the gun is fired, at which time the force of the gun in recoil compresses the Belleville springs of the mechanism, and the trunnions of the cradle seat themselves on the trunnion bearings of the side frames. After the effect of the recoil has been absorbed, the antifriction mechanism returns the cradle to its original position, where it again floats on the roller bearings.

b. Before any attempt is made to elevate or depress the gun, the setting of the antifriction device on each trunnion must be checked with the piece at 0° elevation by means of the special thickness gages provided, and any necessary adjustment made to insure that the trunnion is properly floated in its support. No reliance should be placed on the fact that this operation was performed a short time before. A slight sagging of the spring of the antifriction device would affect, and might nullify, any previous setting.

■ 46. RECOIL MECHANISM.—The recoil mechanism of the M1919 carriage consists of four recoil cylinders, one short and one long located at the top of the cradle and one short and one long at the bottom of the cradle. The recoil mech-

anism of the M1919MI carriage consists of one recoil cylinder located at the bottom of the cradle. The recoil mechanism of the M1920 carriage consists of four short recoil cylinders, two located at the top of the cradle and two located at the bottom of the cradle. The glycerin-water mixture described in paragraph 51 is used in all recoil cylinders.

*a. To fill the recoil cylinder M1919 and M1920 carriages.*—Set the gun or howitzer at 0° elevation, remove the cap from the filling connection directly under the expansion tank, and attach the filling funnel. Remove the vent plugs from the upper rear end of the upper and lower recoil cylinders on the side of the carriage to which the funnel is attached. Slowly pour the recoil liquid into the funnel until it runs out of the vents in the top of the rear end of each cylinder. Close the vents with the vent plugs, and replace the cap on the filling connection. Change the filling funnel to the other side of the carriage and fill the two remaining recoil cylinders. On the M1919 carriage, the capacity of each long recoil cylinder is 35 gallons, and of each short recoil cylinder is 17 gallons. On the M1920 carriage, the capacity of each recoil cylinder is 13.7 gallons.

*b. To fill the recoil cylinder, M1919MI carriage.*—Set the gun at 2° elevation, support the funnel end of the filling device on the bracket on the right side of the cradle and attach the lower end of the filling device to the filling valve of the recoil cylinder. Unscrew the valve plug of the filling valve about nine turns or approximately  $\frac{3}{4}$  of an inch. Remove the cap plug of the tee located on the pipe between the front end of the recoil cylinder and the expansion box. Pour liquid into the funnel until the liquid flows out of the tee. Close the valve plug of the filling valve and replace the cap plug of the tee. Remove the filling device. The capacity of the recoil cylinder is 73 gallons.

■ 47. RECUPERATOR SYSTEM.—The recuperator system (fig. 3) is hydropneumatic. On the M1919 carriage it consists of two recuperator cylinders, one at the top and one at the bottom of the cradle; on the M1919MI carriage, it consists of three recuperator cylinders located at the top of the cradle; and on the M1920 carriage it consists of one recuperator

cylinder located at the bottom center of the cradle. A floating piston separates the liquid from the gas in each cylinder. The liquid used in the recuperator system is the mixture of glycerin and water described in paragraph 51.

a. *To adjust the air pressure.*—The following are the prescribed air pressures:

	Pounds per square inch
Gun carriage M1919.....	1,770
Gun carriage M1919MI.....	1,700
Howitzer carriage M1920.....	2,000

The air pressure in any cylinder may be read on the air gage by opening the air valve on the air chamber of the recuperator cylinder. If the air pressure is lower than prescribed, additional air is supplied to the recuperator cylinder from a

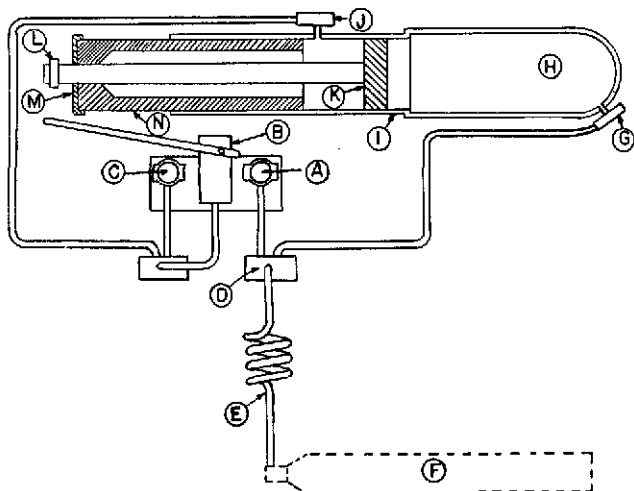


FIGURE 3.—Recuperator system (schematic).

A=Air gage  
B=Liquid pump  
C=Liquid gage  
D=Air pipe connection  
E=Connecting pipe  
F=Compressed gas cylinder  
G=Air valve

H=Air chamber  
I=Recuperator cylinder  
J=Liquid valve  
K=Floating piston  
L=Piston rod nut  
M=Small gland  
N=Recuperator plunger

compressed gas cylinder. To connect the compressed gas cylinder, close the air valve of the recuperator cylinder, remove the plug from the air pipe connection, and attach the upper end of the connecting pipe to the air pipe connection. Attach the lower end of the connecting pipe to the compressed gas cylinder which is laid along the left side of the carriage. Open the air valve of the recuperator cylinder, and then slowly open the valve on the compressed gas cylinder, allowing air to enter the cylinder. While air is entering the cylinder, the air gage on the side of the cradle should be watched. As soon as the hand of the air pressure gage comes to rest, showing that the pressures in the recuperator cylinder and in the compressed gas cylinder are equal, close the air valve on the recuperator cylinder. Close the valve on the compressed gas cylinder, remove the compressed gas cylinder, and replace with a full one. Continue charging the cylinder as before until the required pressure is obtained.

*b. To adjust the liquid pressure.*—The following are the prescribed liquid pressures:

	<i>Pounds per square inch</i>
Gun carriage M1919-----	1,950
Gun carriage M1919MI-----	1,842
Howitzer carriage M1920-----	2,190

The air pressure being as prescribed, open the liquid valve of the recuperator and check the liquid pressure indicated by the liquid gage. If the pressure is low, fill the reservoir of the liquid pump, and operate the pump until the prescribed pressure is reached; then close all valves.

*c.* The amount of space between the rear face of the piston rod nut and the face of the small gland on the forward end of the recuperator plunger indicates the amount the floating piston has moved toward the plunger due to leakage of liquid. This space will not be allowed to exceed 5 inches. The piston rod nut must not bear against the face of the small gland. The floating piston and piston rod will be in balance and have no tensile stress brought upon them when the space between the small gland and the piston rod nut is  $\frac{3}{8}$  of an inch on the M1919 and M1920 carriages,

or when the space between the small gland and the piston rod nut washer is  $\frac{1}{2}$  inch on the M1919MI carriage.

■ 48. CARRIAGE.—*a.* The carriage will be traversed and the gun elevated and depressed at least twice a month throughout their entire allowed movement. From time to time the azimuth at which the carriage stands should be changed to prevent uneven settling of the platform.

*b.* All parts of the carriage must be kept free from rust at all times. If rust is found it should be removed immediately. Its removal from all bearing parts, and especially piston rods, requires particular attention in order that clearances will not be unduly increased. The use of flint paper or emery cloth for this purpose by battery personnel is forbidden, and nothing more abrasive than crocus cloth may be used.

*c.* When the carriage is to be kept in readiness for service, all bearing parts must be kept thoroughly cleaned and lubricated. All the revolving parts of the carriage are lubricated through holes drilled in the bearings supporting the moving parts. The holes are closed by common brass oil plugs, compression grease cups, or pressure gun fittings in order to prevent dirt getting into the bearings. The sliding surfaces such as pull rods and piston rods should be oiled with light class D lubricating oil. When the carriage is in use for daily drills, a thorough lubrication twice each week should be sufficient for all but the most severely used parts.

■ 49. POWER RAMMER.—*a.* The power rammer should be kept well oiled and free from dirt, the rammer head cylinder filled with liquid at all times, and the stuffing box of the rammer head packed to prevent leakage.

*b.* To oil the rammer chain, open the breechblock and lower the spanner tray. Run the rammer chain out on the spanner tray until the rammer head comes to the rear end of the gun. With a small oilcan squirt oil on the inside of the chain rollers between the roller and the link, at the same revolving each roller by hand so as to work the oil around the roller and its pin. Oil all the rollers that can be reached in this position of the chain. Move the chain



ahead until the last link oiled is at the rear end of the gun, then oil the links and rollers as far back as they can be reached. Repeat this operation until all the rollers have been oiled. There are a few links on the end of the chain that cannot be reached in this manner. To oil them, remove the plate on the lower rib of the rammer frame near the front by removing the tap bolts and oil the inner end of the chain through this opening.

c. *To fill the rammer head cylinder*, remove the cover on top of the rammer head and the filling plug from the expansion box. Fill the cylinder to overflowing with the glycerin and water mixture described in paragraph 51. Replace the filling plug and cover.

■ 50. HYDRAULIC SPEED GEAR.—*To replenish the elevating, traversing, or rammer speed gear*, nothing but the special oil issued by the Ordnance Department for hydraulic speed gears will be used. Remove the expansion box cover of the expansion box. Pour oil into the expansion box slowly until the box is one-half full. Operate the speed gear by applying electric current to the motor for a period of 5 minutes for the purpose of allowing air to escape from the oil. Stop the mechanism and add more oil, if needed, to bring it to the half full level in the expansion box. Replace the expansion box cover.

■ 51. RECOIL AND RECUPERATOR LIQUID.—a. The glycerin-water mixture used in the recoil and recuperator cylinders will conform to the following:

Glycerine, grade A, USP, 50 parts by volume.

Distilled water, 50 parts by volume.

To each 5 gallons of the mixture add 4 ounces of sodium hydroxide, CP (NaOH) sticks or pellets (1 pound sodium hydroxide to 20 gallons).

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

b. Distilled water should be used when available. Pure water such as filtered rain water may be used when distilled water is not available.

c. Excess of sodium hydroxide will cause disintegration of the packings and corrosion of the bronze surfaces. 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.

d. The liquid should be strained through a clean piece of linen or muslin before using.

■ 52. SPONGING SOLUTION.—a. The sponging solution is a solution of water and castile soap. Its purpose is to provide a sponging liquid which will extinguish burning residue in the chamber of the gun and also serve to lubricate the breech recess. If the soap solution is not available, plain water may be used.

b. The preparation of the solution consists of dissolving 1 pound of castile soap in each 4 gallons of water. Yellow soaps should not be used as they are likely to leave a gummy deposit in the breech recess. The water should be stirred with as little agitation as possible to prevent foaming.

c. To avoid the necessity of handling large receptacles, as much soap as will be required may be dissolved in one bucket of water. This concentrated soap solution can then be added to water in other receptacles in the prescribed proportions.

■ 53. CARE OF BORE.—a. As soon as possible after any period of firing, and every day thereafter until all "sweating" has stopped, the bore of the gun will be cleaned, dried, and oiled. The cleaning solution is made by dissolving  $\frac{1}{2}$  pound of soda ash in each gallon of boiling water. Wash the bore with this solution using a bore sponge around which burlap has been wrapped. Then wash the bore with clear water to remove all solution. Wipe the bore thoroughly dry with new burlap. Finally, coat the bore with medium or heavy rust preventive compound, depending on local conditions. Care should be exercised to prevent entry of the soda ash solution to parts of the breech mechanism not easily accessible for cleaning.

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



SECTION VII  
DRILL TABLE  
*Service of the piece, 16-inch gun and howitzer*

Details	DETAILS, POSTS	(a) EXAMINE GUN (b) REPORT	TARGET	LOAD	CEASE FIRING
Gun pointer.....	When firing by case II, procures the sight and places it in its seat; takes post at the sight, facing the muzzle. When firing by case III, takes post facing the azimuth index on the left of the carriage.	(a) Examines and adjusts the sight (if used) and azimuth index; assisted by No. 8, examines, cleans, and oils the traversing mechanism; tests the electrical firing circuit and causes the firing circuit plug of the firing magneto not in use to be disconnected. (b) Reports to the gun commander, "Traversing in order," or any defects he is unable to remedy.	See note 1....	Keeps the piece pointed in direction. In case II firing, repeats to the deflection recorder the data he sets on the sight; fires the piece or commands: FIRE, as soon as the piece is pointed after the gun commander has called or signaled, "Ready." In case III firing, traverses the piece or directs the traversing so that the azimuth index is set to the displayed azimuth and calls, "Azimuth set;" when firing electrically, the gun pointer fires the howitzer, but the azimuth recorder fires the gun.	Keeps the piece pointed in direction until the command <b>CEASE TRACKING</b> is received.
Range setter.....	When firing by quadrant, takes post facing the quadrant on the right trunnion. When firing by range scale, procures the range disk, and places it on the elevation drum on the right side of the carriage; takes post facing the scale.	(a) Examines and adjusts the quadrant and range scale. Assisted by No. 6 cleans and oils the elevating mechanism. Before elevating the piece, obtains permission from the gun commander. (b) Reports to the gun commander, "Elevation in order," or defects he is unable to remedy.	See note 2....	When firing by quadrant, sets the quadrant to the displayed elevation; elevates the piece, assisted by No. 6 if necessary, at the command or signal of the chief of breech until the quadrant level bubble is centered; calls, "Elevation set." When firing by range scale, elevates the piece, assisted by No. 6 if necessary, at the command or signal of the chief of breech to the displayed range; calls, "Elevation set." After the piece has been fired, brings it rapidly to the loading position.	Keeps the piece laid in elevation until the command <b>CEASE TRACKING</b> is received. When dummy ammunition is used, brings the piece to the loading position.
Air-pressure operator.....	Procures the controller handle for the air-compressor controller box and places it on its seat. Assisted by Nos. 10 and 11, procures an air bottle for the recuperator system and places it in position on the left of the carriage. Procures tools to make air connections and adjustments. Takes post on the left side of the carriage facing the pressure gauges.	(a) Assisted by Nos. 10 and 11, examines and adjusts the air-pressure mechanism and the air and liquid pressures of the recuperator system. Assisted by No. 1, adjusts the breech air system. Removes the recoil parts lock when so directed by the gun commander. (b) Reports to the gun commander, "Air-pressure in order," or defects he is unable to remedy.	No duties....	During firing, observes the distance between the piston rod nut and the small gland on the front end of each recuperator plunger; observes the operation of the breech air system.	Corrects the air and liquid pressures of the recuperators and the air pressure of the breech closing mechanism as required. Replaces the recoil parts lock when so directed.
Chief of breech.....	Posts his detail after assuring himself that each man has procured the necessary cleaning material and equipment; takes post to the rear and right of the breech where he supervises the functioning of the breech detail.	(a) Examines the breech mechanism, firing mechanism, breech recess, chamber and bore, and gives the necessary orders for cleaning and putting them in condition for service. (b) Reports to the gun commander, "Breech in order," or defects he is unable to remedy.	No duties....	Supervises the details of loading. As soon as the primer has been inserted and all breech personnel are clear, calls or signals, "Elevate," to the range setter.	When dummy ammunition is used, supervises the withdrawal of the dummy powder charge and projectile.
No. 1 (breech detail).....	Procures cotton waste; takes post on the breech operating platform to the right and rear of and facing the breech-block.	(a) Assisted by Nos. 2 and 3, removes the breech cover. Examines, cleans, and oils the breech mechanism, and assists in cleaning or sponging the bore and chamber. Assists the air-pressure operator in adjusting the breech air system. (b) No duties.	No duties....	Assists No. 2 in opening the breechblock and lowering the spanner tray into the loading position. After the ramming of the projectile and powder is completed, assists No. 2 in withdrawing and raising the spanner tray; trips the closing valve if on the right side of the breech to close the breechblock. If the air pressure fails, assists No. 2 in closing and locking the breechblock by hand. Wipes off the mushroom head after each shot.	When dummy ammunition is used, assists No. 2 in opening the breech, inserting the spanner tray, passing the powder sections to Nos. 10 and 11, and extracting the projectile.
No. 2 (breech detail).....	Procures cotton waste, a wrench for pressure plugs, and a can of lubricating oil; takes post on the breech operating platform to the rear and left of and facing the breech-block.	(a) Assists No. 1 in removing the breech cover. Examines, cleans, and oils the breech recess and assists in cleaning or sponging the chamber and bore. (b) No duties.	No duties....	Assisted by No. 1, opens the breechblock and lowers the spanner tray into the loading position. Assists Nos. 10 and 11 in rolling the powder sections onto the rammer tray after the projectile has been rammed. After the powder has been rammed, unlatches the spanner tray and, assisted by No. 1, withdraws it to its raised position; trips the closing valve if on the left side of the breech to close the breechblock. If the air pressure fails, assisted by No. 1, closes and locks the breechblock by hand.	When dummy ammunition is used, assisted by No. 1, opens the breech after the primer has been withdrawn, inserts the spanner tray, receives the hand extractor or power extractor and wrench from Nos. 10 and 11 as required, withdraws the dummy powder sections and projectile.
No. 3 (breech detail).....	Procures the firing lock, lanyard, primers, primer pouch, drill, reamer, and cotton waste; takes post in front of the rammer motor, facing the breech.	(a) Examines, cleans, and oils the firing lock and attaches it to the obturator spindle; cleans the vent and primer seat; checks the condition of the lanyard. (b) No duties.	No duties....	After the breechblock has been closed and locked, inserts a primer into the primer seat and completely raises the slide. If firing by lanyard, attaches the lanyard and fires the piece at the command FIRE. When the piece has been brought to the loading position, coils and unhooks the lanyard (if used), withdraws the fired primer, clears the vent, and cleans the primer seat.	When dummy ammunition is used, unhooks the lanyard (if used), removes the primer, and stands clear of the breech operations.
No. 4 (rammer detail).....	Procures cotton waste and an oilcan; takes post on the rammer operating platform, facing the rammer control lever.	(a) Directs the examining, cleaning, and lubricating of the rammer mechanism, projectile parking table, and revolving projectile table. (b) Reports to the gun commander, "Rammer in order," or defects he is unable to remedy.	No duties....	Operates the feed lever of the projectile parking table, placing one projectile on the rammer tray. As soon as the spanner tray is in position and all is clear, rams the projectile and powder charge.	No duties.
No. 5 (rammer detail).....	Procures the controller handle for the rammer controller box and places it on its seat; takes post at the handle, facing No. 4.	(a) Assists No. 4 in examining, cleaning, and lubricating the rammer mechanism, projectile parking table, and revolving projectile table. (b) No duties.	See note 3....	Stands ready to assist No. 4. When projectiles are being delivered to the revolving projectile table, assists in operating the table.	No duties.
No. 6 (elevating detail).....	Procures the controller handle for the elevating controller box and places it on its seat; takes post thereby.	(a) Assists the range setter in examining, cleaning, and oiling the elevating mechanism. (b) No duties.	See notes 2 and 3.	If elevating is by power, operates the speed control when the quadrant is used. If elevating is by hand, assists in elevating the piece at the elevating handwheel or crank, under the direction of the range setter.	Assists the range setter.
Nos. 7, 8, and 9 (traversing detail).....	Nos. 7 and 9 procure the hand traversing cranks and place them in position; take post at the right traversing crank, No. 7 facing the muzzle and No. 9 facing No. 7. No. 8 procures the traversing controller box handle and places it on its seat; takes post thereby.	(a) Nos. 7 and 9 remove the muzzle cover. If the powder chamber and bore need cleaning, No. 7 procures the chamber sponge and No. 9 the bore sponge. Nos. 7 and 9 assist in the cleaning, then replace the sponges. Nos. 7 and 9 assist No. 4 in examining, cleaning, and lubricating the revolving projectile table. No. 8 assists the gun pointer in examining, cleaning, and oiling the traversing mechanism. (b) No duties.	See notes 1 and 3.	If traversing is by power, No. 8 moves the traversing clutch lever to power control; Nos. 7 and 9 assist in the delivery of projectiles to the revolving projectile table and in the operation of the table. If traversing is by hand, No. 8 moves the clutch lever to hand control; Nos. 7, 8, and 9 take posts at the hand traversing cranks, assisting in the traversing as directed.	No duties.
Nos. 10 and 11 (powder-serving detail).....	Assist the air-pressure operator in procuring a charged air bottle and placing it in position. No. 10 procures the hand extractor, and No. 11 the power extractor and wrench. They take post on the left of the powder tray.	(a) Assist the air-pressure operator in examining, cleaning, and adjusting the air-pressure mechanism, and in adjusting the air and liquid pressures of the recuperator system. (b) No duties.	No duties....	Assist in the delivery of powder charges from the powder cars to the powder tray; assisted by No. 2, roll the powder sections onto the rammer tray after the projectile has been rammed.	When dummy ammunition is used, pass the hand extractor or power extractor and wrench to No. 2 as required; assist in withdrawing the dummy powder charges and putting them on the powder cars.

NOTES

1. At the command **TARGET**, the gun pointer in case II firing sets on the sight the deflection posted on the display board; the gun pointer traverses the piece if by power, or the traversing detail under the direction of the gun pointer, traverses the piece by hand until the line of sight is on the target; the gun pointer calls, "On target"; the gun pointer continues to set the data posted on the display board, and assisted by the traversing detail, if necessary, follows the target. In case III firing, the gun pointer traverses the piece if by power, or the traversing detail, under the direction of the gun pointer, traverses the piece by hand until the azimuth index is set to the azimuth posted on the display board; the gun pointer calls, "Azimuth set"; the gun pointer assisted by the traversing detail, if necessary, continues to traverse the piece according to data posted on the display board.

2. At the command **TARGET**, the range setter and No. 6 stand ready to elevate the piece according to the displayed data.  
3. At the command **TARGET**, if ramming, elevating, and traversing is by power, Nos. 6, 6, and 8, respectively, start the ramming, elevating, and traversing motors.  
4. At the command **STAND FAST**, all movements of matériel and personnel cease.  
5. At the command **RE-LAY**, the display board operators post the new data on the displaying boards, the gun pointer and range setter continue to point the piece in direction and elevation according to the new data, and No. 3 slacks the lanyard (if used).

## APPENDIX

### LIST OF REFERENCES

Ammunition, general.....	TM 9-905 (now published as TR 1370-A).
Care and preservation of matériel.....	TM 4-245 (now published as TR 1160-20).
Cleaning and preserving materials.....	TM 9-850 (now published as TR 1395-A).
Coast artillery ammunition.....	TM 4-205.
Coast artillery weapons and matériel.....	TM 4-210.
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.
Formations, inspections, service, and care of matériel.....	FM 4-20.
Gunnery.....	FM 4-10.
Harbor defense and railway artillery ammunition (except antiaircraft).....	TM 9-905 (now published as TR 1370-A).
Organization and tactics.....	FM 4-5.
Organization of the battery.....	T/O 4-67.
Safety precautions.....	{ AR 750-10 FM 4-20.
Technical instructions issued by the Chief of Ordnance to each battery manning 16-inch guns or howitzers.	

