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TM 9-331B

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

155-mm HOWITZER M1 AND MOUNT M14

(MOUNTED ON 155-mm HOWITZER MOTOR CARRIAGE M41)

DEPARTMENT OF THE ARMY • MARCH 1953

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TM 9-331B

This manual, together with TM 9-331A, 28 January 1953, supersedes TM 9-331, 22 November 1943, including C 1, 17 March 1945 and C 2, 23 January 1947; TB 9-331-1, 5 June 1944; TB 9-331-2, 1 July 1949; TB 9-331-3, 7 April 1950; TB ORD FE 9, 2 August 1944; and those portions of TB ORD 263, 15 March 1945 and TB 9-2835-1, 18 December 1951, pertaining to the matériel covered herein.

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(MOUNTED ON 155-mm HOWITZER MOTOR CARRIAGE M41)

DEPARTMENT OF THE ARMY *MARCH 1953*

United States Government Printing Office
Washington : 1953

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This manual is correct to 13 October 1952

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *23 March 1953*

TM 9-331B is published for the information and guidance of all concerned.

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CONTENTS

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions are published for information and guidance of the personnel to whom this matériel is issued. They contain information on the operation and organizational maintenance of the 155-mm howitzer M1 and 155-mm howitzer mount M14 (mounted on 155-mm howitzer motor carriage M41) (figs. 1 and 2), ammunition, and associated on-carriage equipment.

Note.—A copy of this manual should accompany the howitzer at all times and may be stored in the gun book cover M539.

b. The appendix contains a list of current references, including supply catalogs, technical manuals, and other available publications applicable to the matériel.

2. Organizational Maintenance Allocation

In general, the prescribed organizational maintenance responsibilities will apply as reflected in the allocation of tools and spare parts in the appropriate columns of the current ORD 7 supply catalog pertaining to this howitzer and in accordance with the extent of disassembly prescribed in this manual for the purpose of cleaning, lubricating, or replacing authorized spare parts. In all cases whether the nature of repair, modification, or adjustment is beyond the scope or facilities of the using organization, the supporting ordnance maintenance unit should be informed in order that trained personnel with suitable tools and equipment may be provided or other proper instructions issued.

3. Forms, Records, and Reports

a. General. Responsibility for the proper execution of forms, records, and reports rests upon the officers of all units maintaining

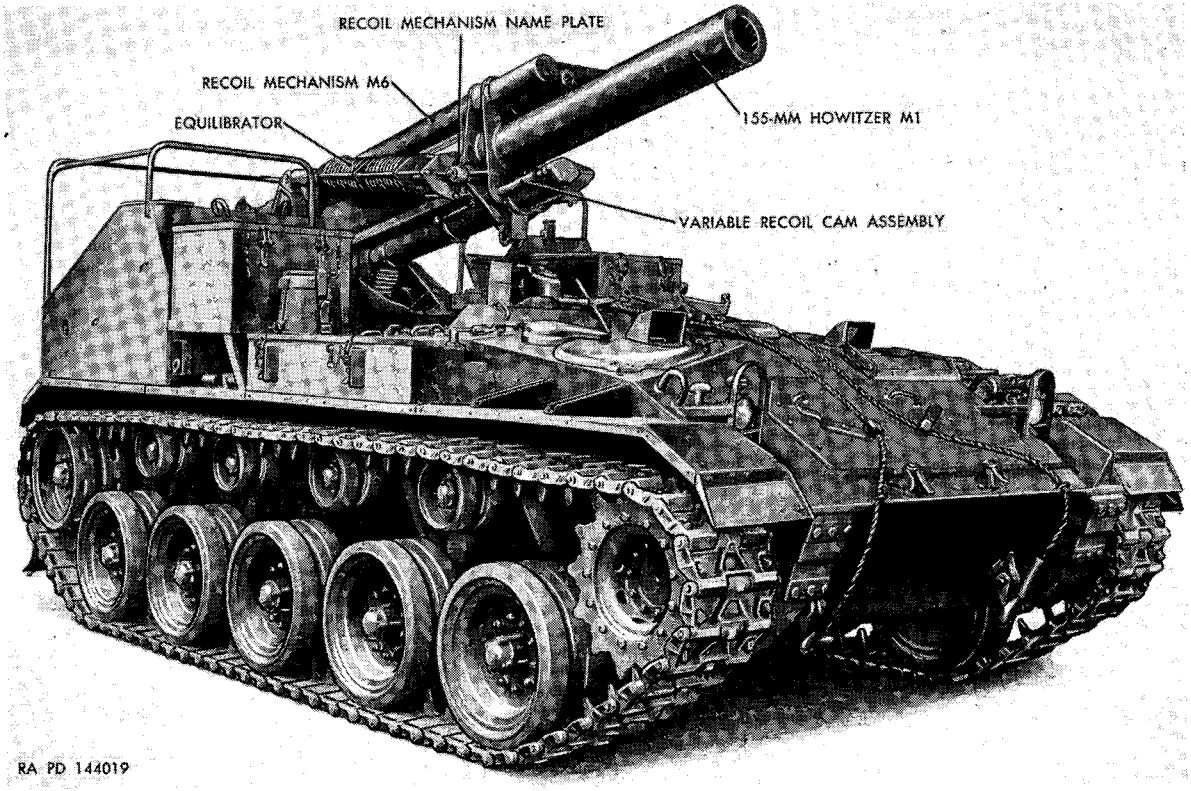

Figure 1. 155-mm howitzer M1 and 155-mm howitzer mount M14 on motor carriage M41—firing position—right front view.

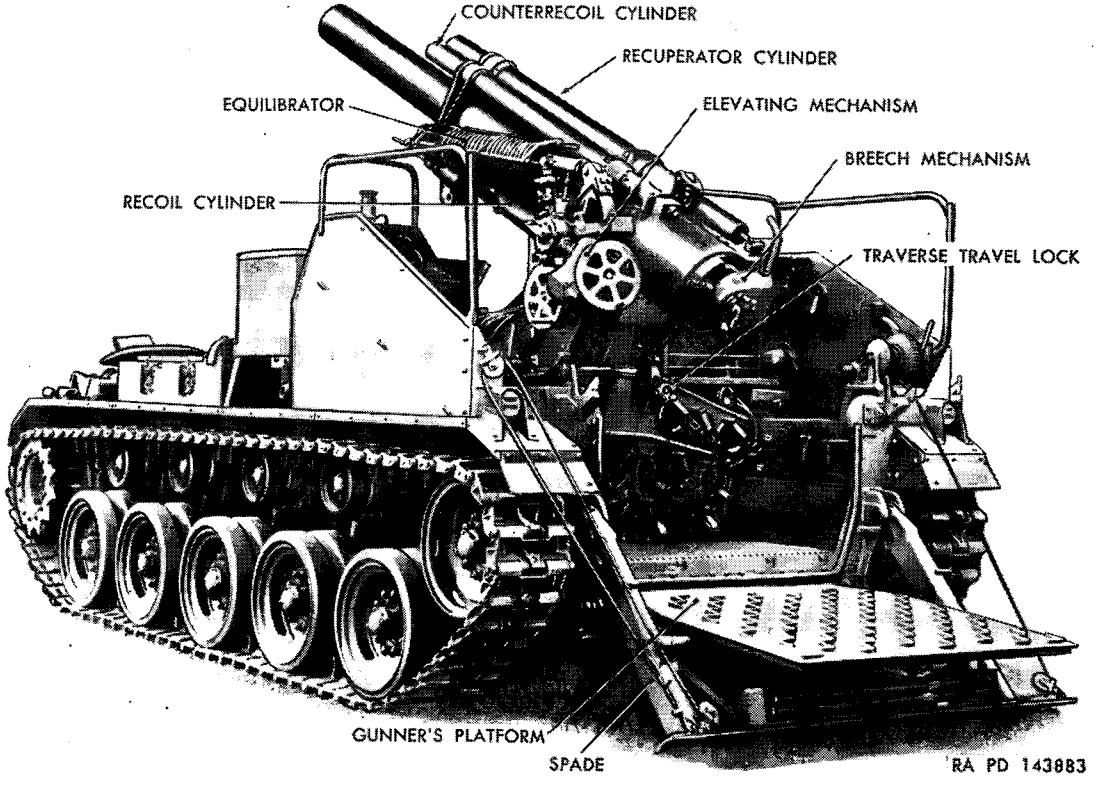

Figure 2. 155-mm howitzer M1 and 155-mm howitzer mount M14 on motor carriage M41—firing position—left rear view.

this equipment. However, the value of accurate records must be fully appreciated by all persons responsible for their compilation, maintenance, and use. Records, reports, and authorized forms are normally utilized to indicate the type, quantity, and condition of matériel to be inspected, to be repaired, or to be used in repair. Properly executed forms convey authorization and serve as records for repair or replacement of matériel in the hands of troops and for delivery of matériel requiring further repair to ordnance shops in arsenals, depots, etc. The forms, records, and reports establish the work required, the progress of the work within the shops, and the status of the matériel upon completion of its repair.

b. Authorized Forms. The forms generally applicable to using organizations are listed in the appendix. For a current and complete listing of all forms, see SR 310–20–6.

c. Artillery Gun Book.

(1) *General.* The Artillery Gun Book (OO Form 5825) (table I, par. 42) is used to keep an accurate record of the matériel. The gun book is stored in gun book cover M539 (fig. 27 and table I, par. 42). The book is divided as follows: record of assignment; battery commander's daily gun record; and the inspector's record of examination.

Note.—Record of assignment data must be removed and destroyed prior to entering combat.

These records are important for the following reasons:

(*a*) They inform the unit commander of the condition and serviceability of the weapons under his jurisdiction.

(*b*) They serve as the record of use and maintenance of the matériel and expedite effective maintenance.

(*c*) They serve as a source of technical data to the Ordnance Corps for the improvement of weapons, and furnish valuable design data for the development of new weapons.

(2) *Entries.* Complete instructions on how to make entries in the gun book are contained herein. *It is absolutely essential that the gun book be kept complete and up to date, and that the gun book accompany the matériel at all times regardless of where it may be sent.* In order to facilitate proper maintenance of the howitzer and its related matériel (i. e., carriage, subcaliber equipment, and associated sighting and fire control instruments), and to avoid unnecessary duplication of repairs and maintenance, the following additional entries in the gun book are prescribed:

(*a*) A record of complete modification work orders. The record will show the date completed and bear the initial of

the officer or mechanic responsible for completion of the modification.

(*b*) A record of any seasonal or periodic changes of lubricant and hydraulic fluid in sufficient detail to prevent duplication and afford proper identification by the inspector.

(*c*) The estimated accuracy life of the tube of this weapon is listed in paragraph 6. This number will be entered at the top of page 44 of the gun book. The gun book contains information on method of calculating full service rounds. The reference to OFSB 4–1 as the source of data for estimated accuracy of life in paragraph 6 of the gun book should be deleted.

(3) *Handling during shipment or transfer.* The following procedure is prescribed to insure that the gun book will always accompany the matériel whenever it is shipped or transferred from one organization to another:

(*a*) During transfer or shipment, the gun book will be kept in a waterproof envelope securely fastened to the matériel with waterproof tape.

(*b*) Under one of the wrappings of tape, one end of a small tab will be inserted reading "Gun Book Here."

(*c*) Field maintenance units and depot maintenance shops will insist that the gun book accompany each howitzer when it enters their shop for repairs or maintenance.

(4) *Completed gun book.* When a gun book is completely filled, an additional new gun book, requisitioned through normal ordnance supply channels ((5) below), will be added to it by stapling the covers together so that the two books will remain together as a single unit.

(5) *Lost gun book.* If a gun book is lost, it will be replaced at once and all available data will be entered in the new gun book. Additional copies of Artillery Gun Book (OO Form 5825, Federal Stock No. 28–F–67990) may be requisitioned through normal ordnance supply channels. A gun book which has become separated from the weapon to which it pertains and for which efforts to locate the weapon have failed, will be forwarded immediately to the Chief of Ordnance, Washington 25, D. C., ATTN: ORDFM—Weapons Section.

(6) *Disposal of gun book when howitzer is removed from service.* When the howitzer is condemned, destroyed, turned in for salvage, or otherwise lost from service, the gun book will be forwarded with proper notation to the Chief of Ordnance,

Washington 25, D. C., ATTN: ORDFM—Weapons Section. Information contained in the gun book which pertains to the carriage, recoil mechanism, or other weapon components being retained in service will be extracted and inserted in the gun book pertaining to the replacement howitzer.

d. Field Reports of Accidents.

(1) *Injury to personnel or damage to matériel.* The reports necessary to comply with the requirements of the Army safety program are prescribed in detail in the SR 385–10–40 series. These reports are required whenever accidents involving injury to personnel or damage to matériel occur.

(2) *Ammunition.* Whenever an accident or malfunction involving the use of ammunition occurs, firing of the lot which malfunctions will be immediately discontinued. In addition to any applicable reports required in (1) above, details of the accident or malfunction will be reported as prescribed in SR 385–310–1.

e. Report of Unsatisfactory Equipment or Materials. Any suggestions for improvement in design and maintenance of equipment, safety and efficiency of operation, or pertaining to the application of prescribed petroleum fuels, lubricants, and/or preserving materials, will be reported through technical channels as prescribed in SR 700–45–5 to the Chief of Ordnance, Washington 25, D. C., ATTN: ORDFM, using DA Form 468, Unsatisfactory Equipment Report. Such suggestions are encouraged in order that other organizations may benefit.

Note.—Do not report all failures that occur. Report only REPEATED or RECURRENT failures or malfunctions which indicate unsatisfactory design or material. However, reports will always be made in the event that exceptionally costly equipment is involved. See also SR 700–45–5 and the printed instructions on DA Form 468.

Section II. DESCRIPTION AND DATA

4. Description

a. Weapon.

(1) *Howitzer.* The 155-mm howitzer M1 (fig. 1) is a short-barreled weapon equipped with a manually operated breech mechanism (fig. 2) and a percussion type firing mechanism. The external surface of the howitzer is machined to form a bearing surface which slides in the cylinder yoke (fig. 3) and recoil mechanism cradle (figs. 4 and 64) during recoil and counter-recoil.

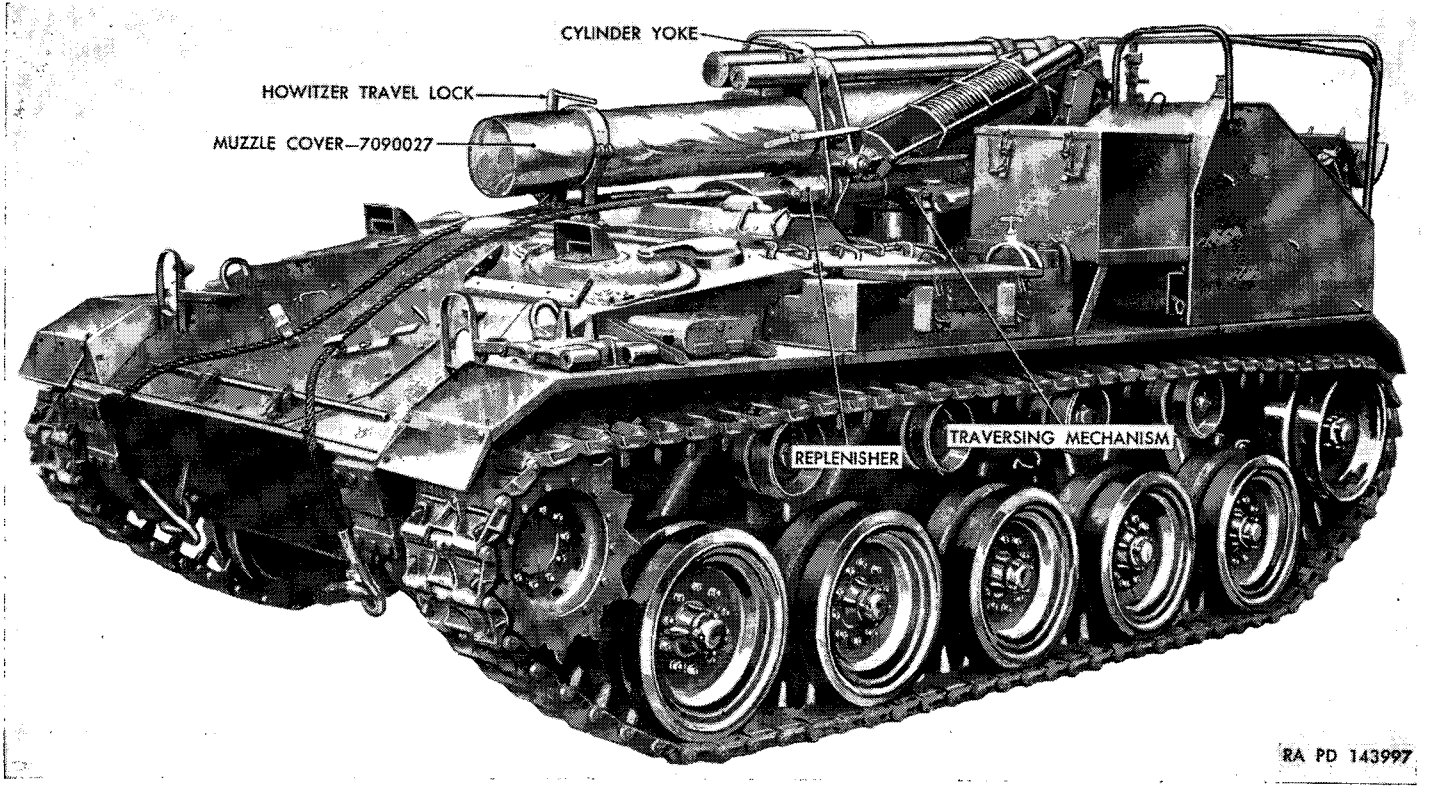

Figure 3. 155-mm howitzer M1 and 155-mm howitzer mount M14 on motor carriage M41—traveling position—left front view.

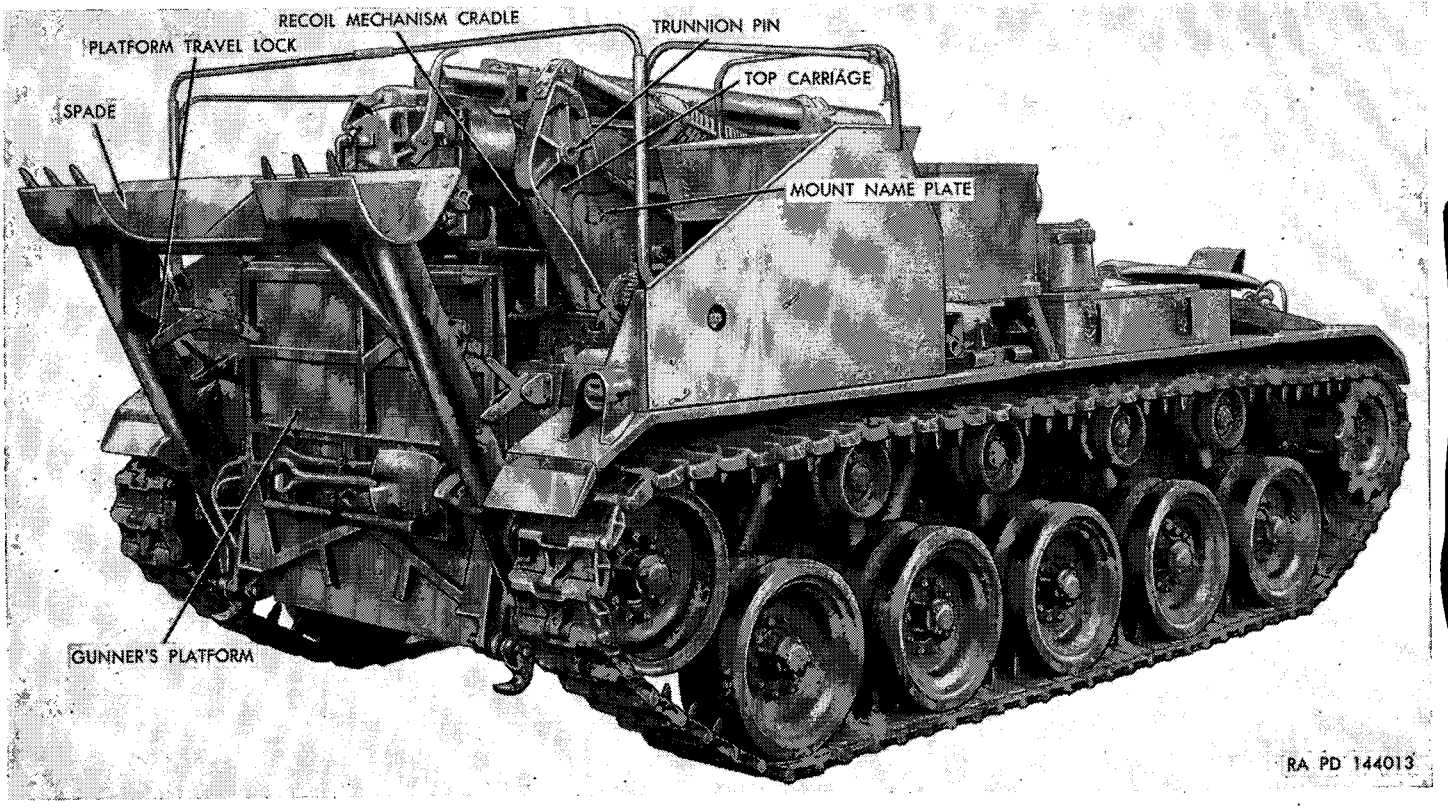

Figure 4. 155-mm howitzer M1 and 155-mm howitzer mount M 14 on motor carriage M41—traveling position—right rear view.

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(2) *Mount M14.* The 155-mm howitzer mount M14 is used with the motor carriage M41 (figs. 1 and 2) and incorporates recoil mechanism M6, M6A1, M6A2, M6B1, or M6B2 (fig. 1). It supports the weight of the howitzer and is supported by and rotates (within the limits of traverse) on the motor carriage. The major components of the mount M14 are the top carriage, equilibrators, elevating mechanism (fig. 2), and traversing mechanism (fig. 3). The top carriage (fig. 4) supports all the other units and rotates on the motor carriage; the elevating and traversing handwheels control movement of the howitzer in elevation and traverse. The muzzle-heavy weapon is balanced by spring-type equilibrators (figs. 1 and 2) to facilitate maneuvering the howitzer in elevation.

(3) *Recoil mechanism.* The 155-mm howitzer mount M14 is equipped with recoil mechanism M6, M6A1, M6A2, M6B1, or M6B2 (fig. 1). These mechanisms are of the hydropneumatic, variable recoil type. The recoil cylinder (fig. 2) controls the rearward movement of the howitzer when fired, and the counter-recoil and recuperator cylinders (fig. 2) return the weapon to battery after firing. The length of recoil varies with the elevation of the howitzer, and is controlled automatically by the variable recoil cam assembly (fig. 1).

b. Ammunition. Ammunition for the 155-mm howitzer M1 is of the separate loading type; a complete round consists of a projectile, a fuze, a propelling charge, and a primer.

c. Firing. The rear of the motor carriage M41 is equipped with a spade and gunner's platform (figs. 2 and 4) which serve as a tailgate when in traveling position and as an anchor and gunner's platform when in firing position (fig. 2). In firing position, the spade and platform is lowered and the vehicle is backed, partially burying the spade in the ground to prevent backward motion of the vehicle when the howitzer is fired. The firing stresses are transmitted through the recoil mechanism, top carriage, motor carriage, and spade to the ground.

d. Maneuvering. When traveling, the howitzer is prevented from tipping in the mount by the howitzer travel lock (fig. 3), and the mount is prevented from rotating on the motor carriage by the traverse travel locks (fig. 2), both of which are attached to the motor carriage. The gunner's platform and spade is raised to serve as a tailgate (fig. 4). The motor carriage M41 is capable of sustained speeds of 30 mph, will travel up or down a 60-percent grade, surmount a 40-inch vertical obstacle, cross a ditch 9 feet wide, and ford a river or operate in water up to 42 inches deep.

[redacted]

5. Name, Caution, and Instruction Plates

a. Howitzer. The howitzer designation, serial number, weight, name of manufacturer, and year of manufacture are stamped on the rear surface of the breech ring (fig. 13).

b. Mount M14.

(1) The recoil mechanism name plate (fig. 1) contains the recoil mechanism designation (M6, M6A1, M6A2, M6B1, or M6B2), serial number, name of manufacturer, and year of manufacture.

(2) The mount name plate (fig. 4) contains the mount designation, serial number, name of manufacturer, and year of manufacture.

6. Tabulated Data

a. Technical Data Pertaining to the 155-mm Howitzer M1.

Caliber	155-mm or 6.102 in
Type of breechblock	stepped-thread, interrupted-screw
Muzzle velocity	1,850 fps
Weight of projectile	94.80 lb
Weight of powder charge	13.91 lb
Maximum range with full charge	16,355 yd
Estimated life accuracy	15,000 rds
Rate of fire:	
Rapid bursts	3 rds per min
Prolonged firing	1 rd per min

b. Technical Data Pertaining to the Recoil Mechanism M6, M6A1, M6A2, M6B1, or M6B2.

Type	hydropneumatic
Recoil at maximum elevation	41 in
Recoil at minimum elevation	60 in

c. Technical Data Pertaining to the 155-mm Howitzer Mount M14.

Elevating mechanism:	
Range of elevation	−5° (89 mils) to +45° (800 mils—total 889 mils)
Rate of elevation per turn of handwheel	14.8 mils (50 min)

Note.—Maximum elevation and depression are dependent on emplacement of motor carriage.

Traversing mechanism:	
Range of traverse	666 mils (37½°)
Traverse to left of mid-position	302 mils (17°)
Traverse to right of mid-position	364 mils (20½°)
Rate of traverse per turn of handwheel	10.3 mils (34.7 min)

d. Matériel Used With Major Item.

(1) *On-carriage sighting and fire control instruments.* For addi-

tional information on on-carriage equipment, see paragraph 82–89.

LIGHT, instrument, M34.
MOUNT, telescope, M25.
PERISCOPE, M6, M13, or M13B1.
TELESCOPE, panoramic, M12A6 and M12A7G.

(2) *Off-carriage sighting and fire control equipment.* For coverage of off-carriage equipment, see list of pertinent publications in the appendix.

CASE, carrying, M55 or M66.
CHEST, packing, panoramic telescope, M27.
LIGHT, aiming post, M14.
POST, aiming, M1.
QUADRANT, gunner's, M1.
SETTER, fuze, M14, M22, M23, and M27.
THERMOMETER, powder, temperature, M1.
WATCH, wrist.

(3) *Subcaliber equipment.* For additional information on subcaliber equipment, see paragraphs 90–103.

GUN, 37-mm, M1916.
MECHANISM, recoil, 37-mm gun, M1916.
MOUNT, subcaliber, 37-mm, M13A1.

(4) *Ammunition.* See table X (par. 109).

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CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATÉRIEL

7. Purpose

a. When a new or reconditioned artillery piece is first received by the using organization, it is the responsibility of the officer in charge to determine whether the matériel has been properly prepared for service by the supplying organization and to be sure it is in condition to perform any mission to which it may be assigned when placed in service. For this purpose, inspect all assemblies, subassemblies, and accessories to be sure they are properly assembled, secure, clean, and correctly adjusted and/or lubricated. Check all tools and equipment against ORD 7 SNL G–236 to be sure every item is present and properly mounted or stowed. Stowage information is contained in FM 6–82. Determine that the tools and equipment are clean and in good condition.

b. Make a record of any missing parts and of any malfunctions. Correct any deficiencies as quickly as possible.

c. Pay especial attention to the small and minor parts as these are the more likely to become lost and may seriously affect the proper functioning of the matériel.

d. Whenever practicable, the operating section or crew will assist in the performance of these services.

8. New Matériel

a. Remove preservative compound as described in paragraph 48*b* (3).

b. Set up the matériel and check the operation of the following:

(1) Breech mechanism (par. 23).
(2) Percussion hammer (par. 28*c* and *d*).
(3) Elevating mechanism (par. 25).
(4) Traversing mechanism (par. 24).

c. Check general condition and appearance of matériel.

d. Lubricate the matériel (par. 43).

e. Check spare parts, tools, and equipment with Department of the Army Supply Catalog ORD 7 SNL G–236.

[redacted]

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f. Inspect equipment.

Caution: Initial issue and replacement cannon may be received with wooden filler blocks mounted on the obturator spindle. These blocks must be removed and the proper gas-check pad installed prior to loading the weapon.

9. Used Matériel

a. Used matériel requires the same inspection and service as prescribed for new matériel (par. 8), and in addition—

(1) Check all parts of the matériel for signs of excessive wear, damage, missing parts, or corrosion, and correct any deficiencies.

(2) When inspecting the howitzer tube, inspect the bore for wear on lands or deposits in grooves; raised, flattened, chipped, or stripped lands; gouges; or any other serious damage. Examine for evidence of powder fouling and rust. Do not confuse coppering of the bore with powder fouling.

Note.—Present regulations prohibit the removal of copper fouling by organizational personnel.

A clean bore is not necessarily a shiny bore and might frequently have a dull gray appearance. A shiny polished bore may indicate that abrasives have been used in cleaning operations (par. 50).

(3) Pay special attention to all latches, locks, and catches to see that they are functioning properly.

(4) Operate all controls (pars. 10–20) and check carefully for proper functioning.

b. If examination of the gun book (par. 3) indicates that the weapon has not been fired within 9 months, the recoil mechanism should be exercised. Notify ordnance maintenance personnel.

Section II. CONTROLS AND INSTRUMENTS

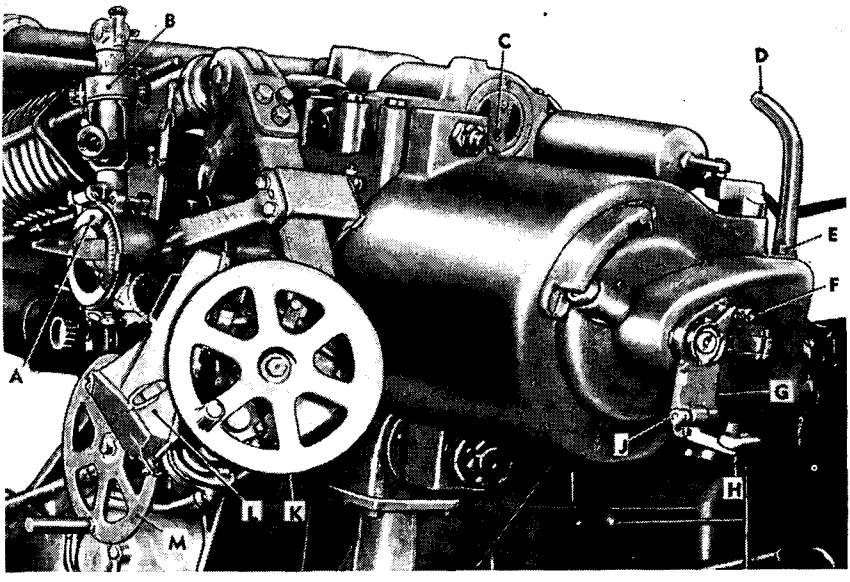
10. General

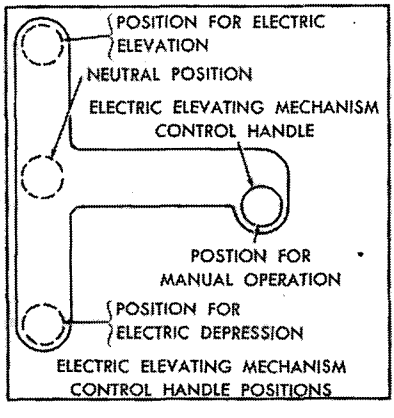
This section describes, locates, and illustrates all operating controls for the 155-mm howitzer M1 and the 155-mm howitzer mount M14. This section does not include information on the controls and instruments for sighting and fire control. Sighting and fire control equipment is covered in paragraphs 82–89.

11. Breechblock Operating Handle

After removing the firing mechanism, pull the breechblock operating handle (fig. 5) rearward and down to unlock the breech mecha-

nism. The breech is then opened by pushing the handle to the right and forward.





A—TELESCOPE MOUNT
B—PANORAMIC TELESCOPE
C—RECUPERATOR CYLINDER OIL INDEX
D—BREECHBLOCK OPERATING HANDLE
E—BREECHBLOCK OPERATING HANDLE LATCH
F—FIRING MECHANISM LOCKING PLUNGER HANDLE
G—FIRING MECHANISM HOUSING ADAPTER
H—PERCUSSION HAMMER
J—PERCUSSION HAMMER LOCKING PIN KNOB
K—ELECTRIC ELEVATING MECHANISM HANDWHEEL
L—ELECTRIC ELEVATING MECHANISM CONTROL BOX
M—TRAVERSING HANDWHEEL

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Figure 5. Operating controls.

12. Breechblock Operating Handle Latch

The breechblock operating handle latch (fig. 5) must be moved to the left to release the breechblock operating handle from its upright position. The operation of opening the breech is more fully covered in paragraph 23.

13. Firing Mechanism Locking Plunger Handle

The firing mechanism locking plunger handle (fig. 5) locks the firing mechanism in position and also serves as a handle to rotate the firing mechanism M1 when installing or removing it.

14. Percussion Hammer

The percussion hammer (fig. 5) swings from the breechblock carrier adapter. The lanyard is attached to the percussion hammer. To fire the piece, the lanyard is pulled with force sufficient to cause the percussion hammer to swing in an arc and strike the rear of the firing pin, which then detonates the primer.

15. Percussion Hammer Locking Pin Knob

In preparation for firing, the percussion hammer locking pin knob (fig. 5) is drawn to the left and turned to retain the knob in the locked-out position. This allows the percussion hammer to swing in an arc and strike the firing pin. With the hammer in the raised position, the knob can be turned to the locked-in position to hold the hammer upright and immobile. This is a safety feature which prevents accidental firing by inadvertent pulling of the lanyard.

16. Electric Elevating Mechanism Handwheel

The electric elevating mechanism handwheel (fig. 5) is used for final laying of the howitzer in elevation, and in case of failure of the electric elevating mechanism. The electric elevating mechanism control handle (par. 17) must be placed in the position for manual operation (fig. 5) to engage the handwheel and elevate or depress the howitzer manually. Turn the handwheel clockwise to elevate the howitzer and counterclockwise to depress it.

17. Electric Elevating Mechanism Control Handle

The electric elevating mechanism control handle is located in the electric elevating mechanism control box (fig. 5). Moving the control handle to the extreme "UP" position (fig. 5) elevates the howitzer by power. Moving the control handle to the extreme "DOWN" position depresses the howitzer by power. Moving the control handle to the extreme right and down engages the electric elevating mechanism handwheel (par. 16). The electric elevating control handle is used for approximate laying of the howitzer in elevation, the final setting being made with the electric elevating mechanism handwheel (par. 16).

[redacted]

18. Traversing Handwheel

Turn the traversing handwheel (fig. 5) clockwise to traverse the howitzer to the right. Turn the traversing handwheel counterclockwise to traverse howitzer to the left.

19. Replenisher Oil Gage

The replenisher (figs. 3 and 14) is located in the cylinder yoke. The position of the replenisher piston indicates the amount of oil reserve in the replenisher. Measure the position of the replenisher piston as described in paragraph 26*a*.

20. Recuperator Cylinder Oil Index

The position of the recuperator cylinder oil index (fig. 5), when withdrawn warns that a dangerously low oil reserve exists in the recuperator cylinder (par. 26*b*). When extended, the position of the oil index (fig. 5) indicates that some reserve is present in the recuperator cylinder (par. 26*b*) but does not indicate the amount. The index is actuated (withdrawn) when the reserve reduces to one-third, or less, of proper amount of reserve oil (par. 72*f*).

Section III. OPERATION UNDER USUAL CONDITIONS

21. General

This section contains instructions for the mechanical steps necessary to operate the 155-mm howitzer M1 and the 155-mm howitzer mount M14 under conditions of moderate temperatures and humidity. For operation under unusual conditions, refer to paragraphs 32–38. This section does not contain instructions for operation of the motor carriage M41. For information on the operation of the motor carriage, see TM 9–744.

22. To Place Weapon in Firing Position

a. Lower Gunner's Platform and Spade.

(1) Before firing the howitzer, it is necessary to lower the motor carriage spade and gunner's platform and partially bury the spade in the ground. The spade prevents the vehicle from moving backward during recoil of the weapon, and the gunner's platform serves as a loading platform on which the gunner stands.

Caution: All personnel must stand clear of the rear of the motor carriage while the spade and platform are being lowered.

[redacted]

(2) To lower the platform and spade, place the cranks (fig. 6) on the winch crankshaft. Release the winch locking pawl by swinging it upward and forward. Then tighten the cable by turning the crank until the spade travel locks (figs. 6 and 7) can be released by pushing their handles up.

Caution: Before releasing the spade travel locks, apply the winch brake firmly by pulling the brake handle (fig. 6) to the rear. Remove both cranks and lower the spade slightly by gradually releasing the winch brake.

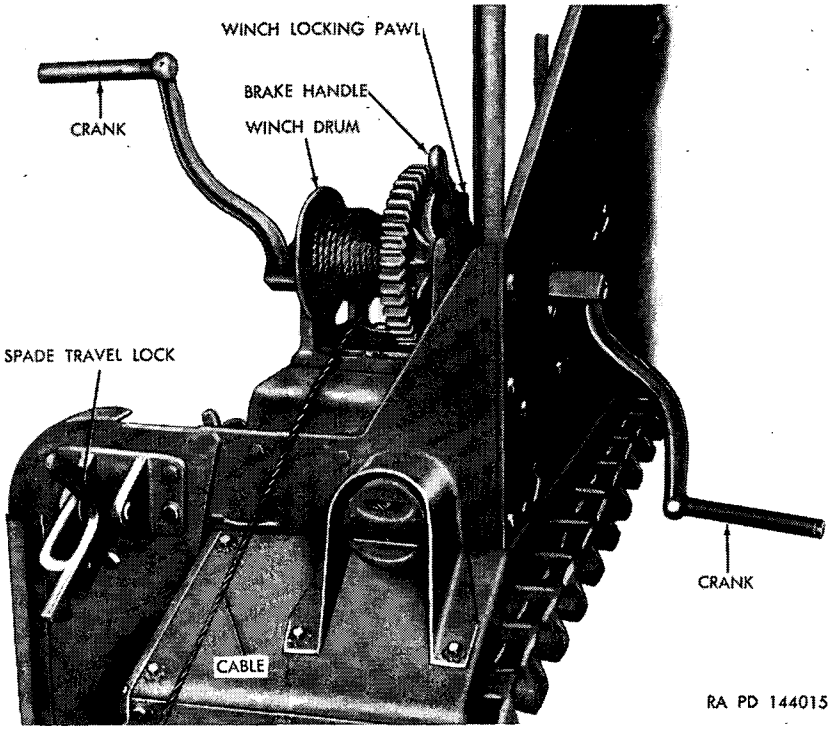

Figure 6. Spade winch and controls.

(3) Lower the spade about 6 inches, and then push the platform toward closed position to release the platform travel locks (fig. 4), which will automatically swing to released position. Then gradually release the winch brake and lower the spade and gunner's platform to the ground (fig. 7).

(4) With the spade and platform lowered, back the vehicle so that the spade buries itself well into the ground. The gunner's platform will then slant slightly toward the rear (fig. 2). Remove howitzer breech cover 7090014 (fig. 27 and table I, par. 42).

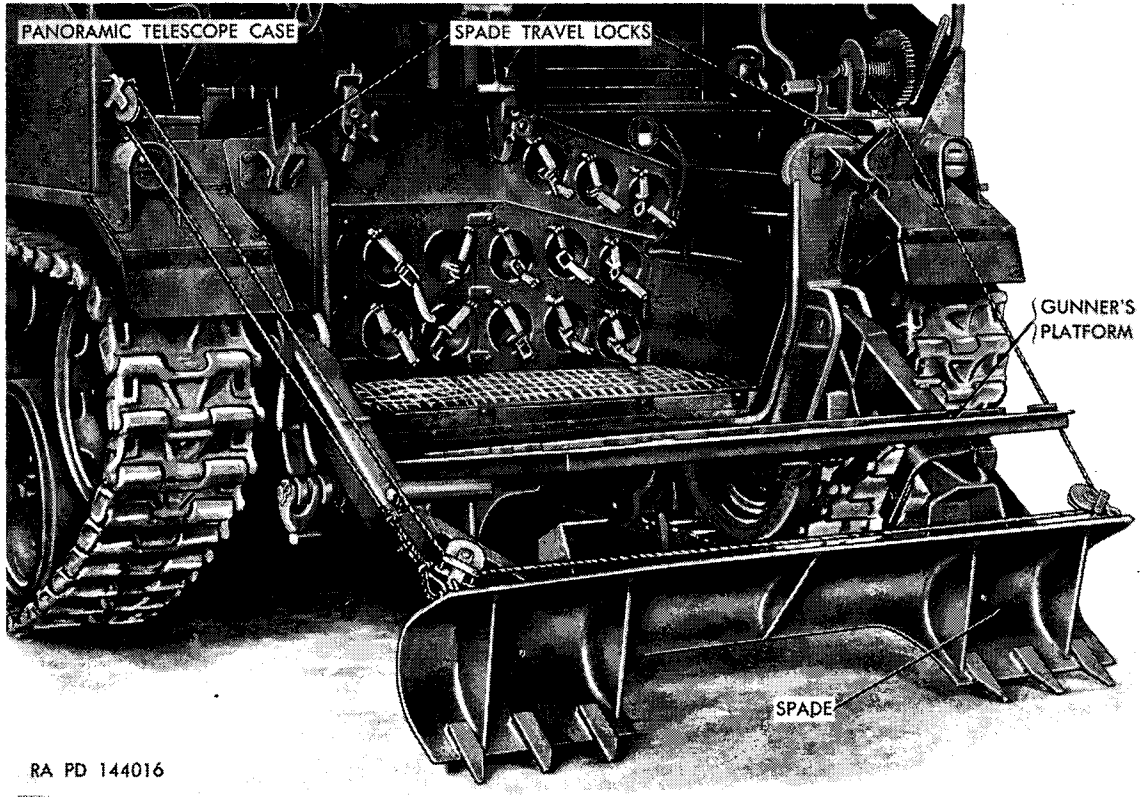

Figure 7. Spade and gunner's platform of motor carriage M41—lowered to ground.

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b. Release Travel Locks.

(1) Release the howitzer travel lock (figs. 3 and 8) by loosening the clamp sleeve until it can be swung away from the clamp.

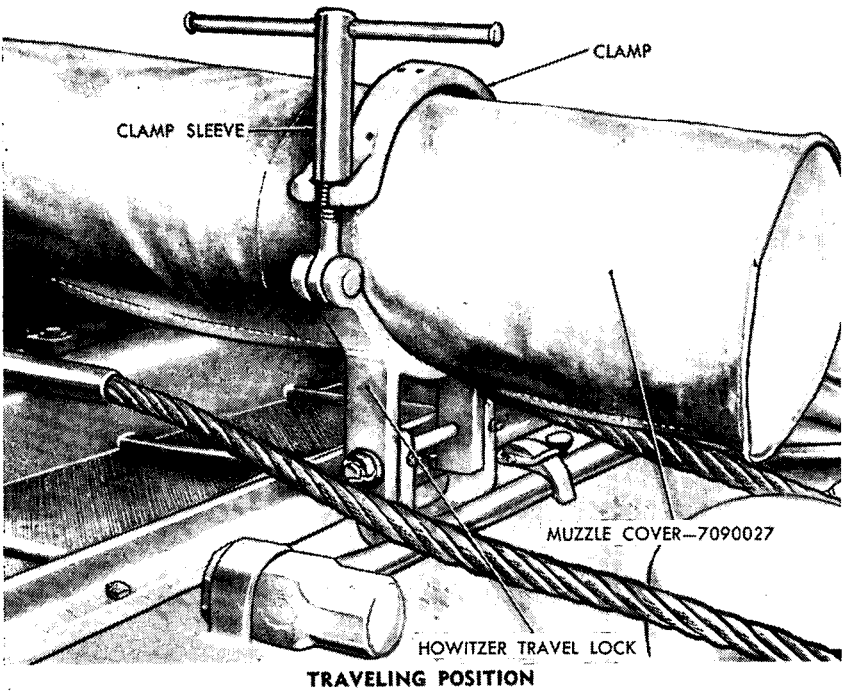

Figure 8. Howitzer travel lock on motor carriage M41.

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Then swing the clamp up and away from the howitzer muzzle. Elevate the howitzer (par. 25) enough to remove the muzzle cover 7090027 (figs. 3 and 27 and table I, par. 42).

(2) To release the traverse travel locks (figs. 2 and 9), loosen the traverse travel lock clamp nuts (fig. 9) until the traverse travel lock clamps can be swung free of the top carriage.

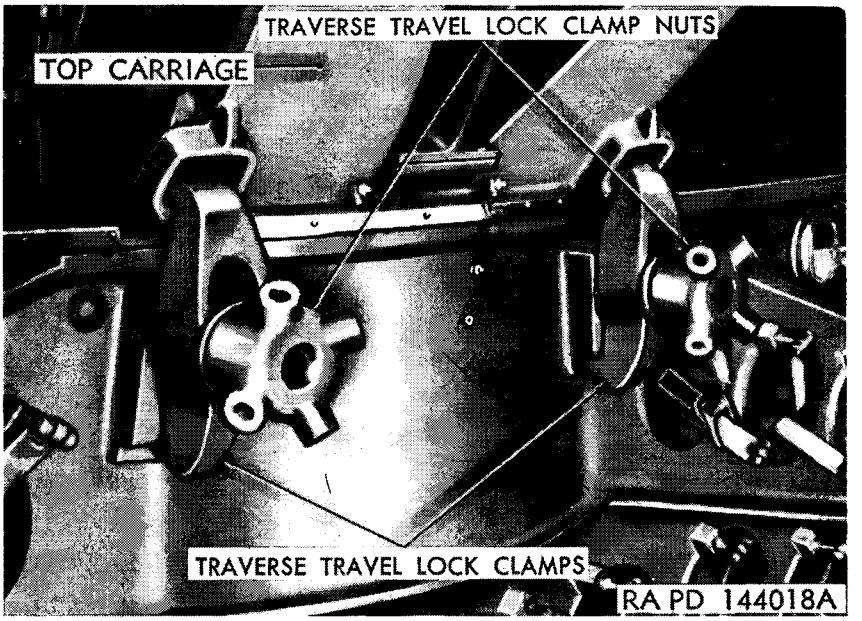

Figure 9. Howitzer mount traverse travel locks on motor carriage M41—traveling position.

23. To Operate Breech Mechanism

a. Open Breech. Pull the firing mechanism locking plunger handle to the rear to unlock the firing mechanism, rotate it *counterclockwise*, and then remove the firing mechanism M1 from the housing in the housing adapter (fig. 10). The firing mechanism safety latch (fig. 10) prevents the breech from being opened before the firing mechanism M1 has been unseated. It also prevents the firing mechanism from being seated before the breechblock is fully closed and locked.

Caution: Removal of firing mechanism safety latch plunger (fig. 48) and failure to assemble before firing, can cause the breechblock to blow, with resultant serious injury to personnel. This practice is strictly prohibited.

Move the breechblock operating handle latch to the left (fig. 11); pull the breechblock operating handle backward and rotate downward as far as it will go (fig. 12). Then swing the breechblock operating handle to the right to open the breech (fig. 13).

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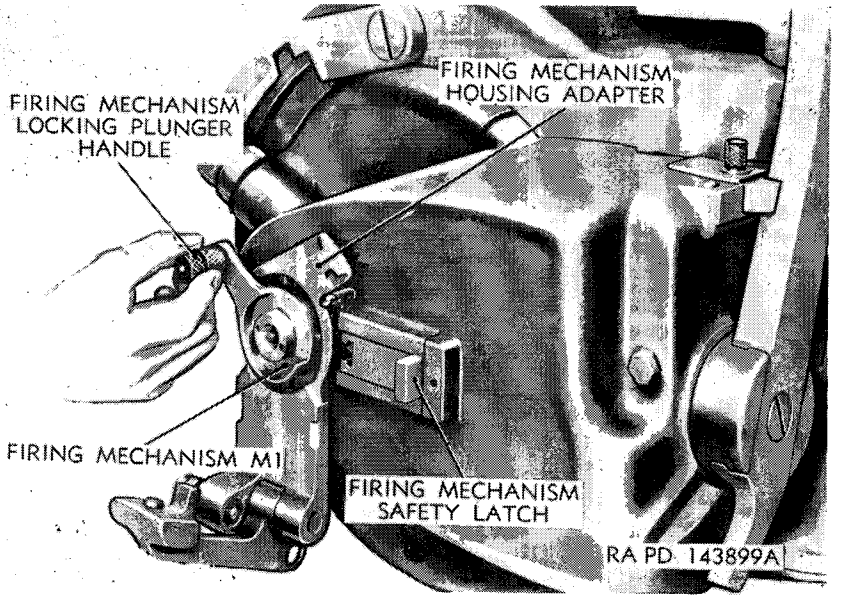

Figure 10. Removing firing mechanism M1 from firing mechanism housing adapter.

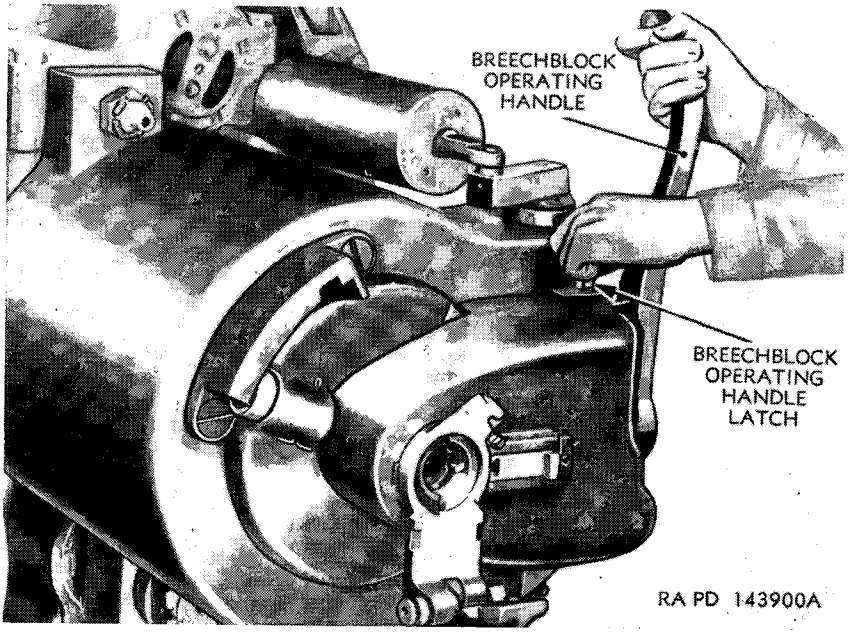

Figure 11. Releasing breechblock operating handle.

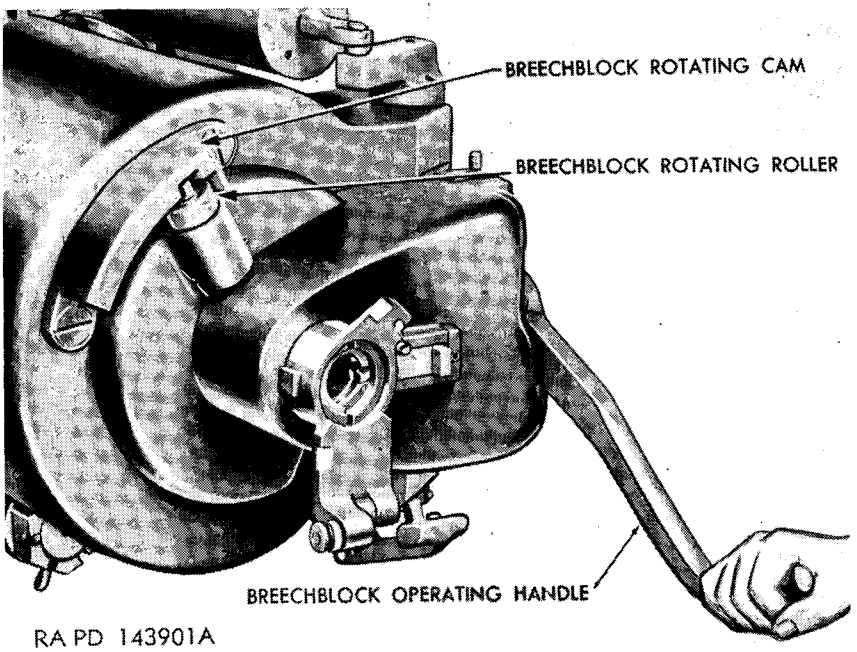

Figure 12. Opening breech.

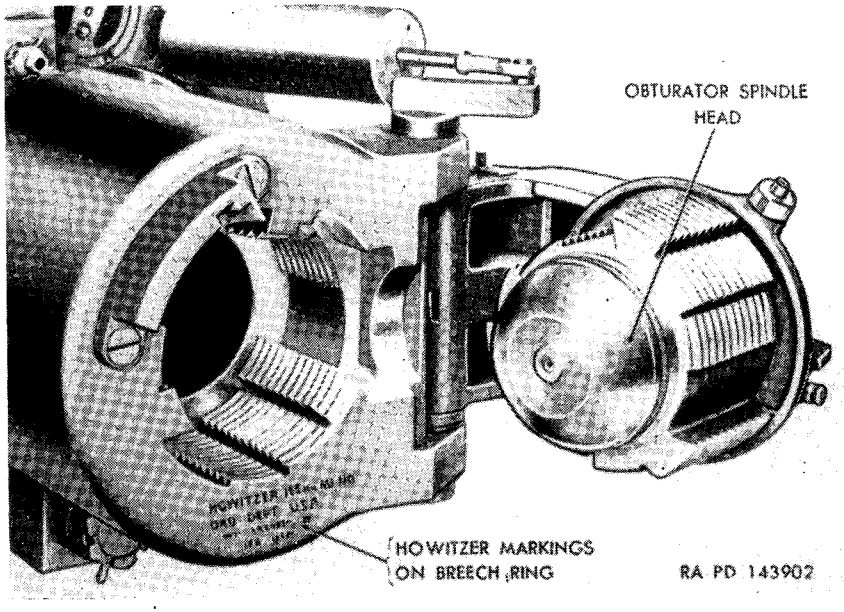

Figure 13. Breech open.

b. Close Breech. Swing the breechblock operating handle horizontally to the left. When the breechblock rotating roller enters the breechblock rotating cam (fig. 12), move the operating handle upward and forward until the operating handle latch locks the operating handle in its upright position (fig. 11).

24. To Traverse

a. The howitzer cannot be traversed on the motor carriage until the howitzer and traverse travel locks have been released (par. 22*b*).

b. Turn the traversing handwheel (fig. 5) clockwise to traverse the howitzer to the right. Turn the handwheel counterclockwise to traverse the howitzer to the left. Approximately 63 turns of the handwheel will traverse the weapon from one side to the other of its range of traverse.

25. To Elevate

a. General. Before the howitzer can be elevated, the howitzer travel lock must be released (par. 22*b*).

b. Electric Operation. Open the cover of the electric elevating mechanism control box (fig. 5). Place the electric elevating mechanism control handle in the extreme "UP" position to elevate the howitzer by power. Place the handle in the extreme "DOWN" position to depress the howitzer by power. Electric elevation or depression will stop automatically when the control handle is released to the neutral position.

Note.—The elevating mechanism control handle will not be used for final laying of the howitzer in elevation. Fine adjustments will be made by use of the electric elevating mechanism handwheel.

c. Manual Operation. To operate the elevating mechanism manually for fine adjustments or when the electric elevating mechanism is inoperative, move the electric elevating mechanism control handle to the extreme right and down (fig. 5). Turn the electric elevating mechanism handwheel clockwise to elevate the howitzer, and turn the handwheel counterclockwise to depress the howitzer.

26. To Prepare Weapon for Firing

a. Check Replenisher Oil Reserve.

(1) Pull the replenisher piston guide plug out of the rear of the replenisher (fig. 14). Insert a rule in the opening at the rear of the replenisher, and push it in as far as it will go. Read on the rule the graduation that is flush with the rear face of the replenisher.

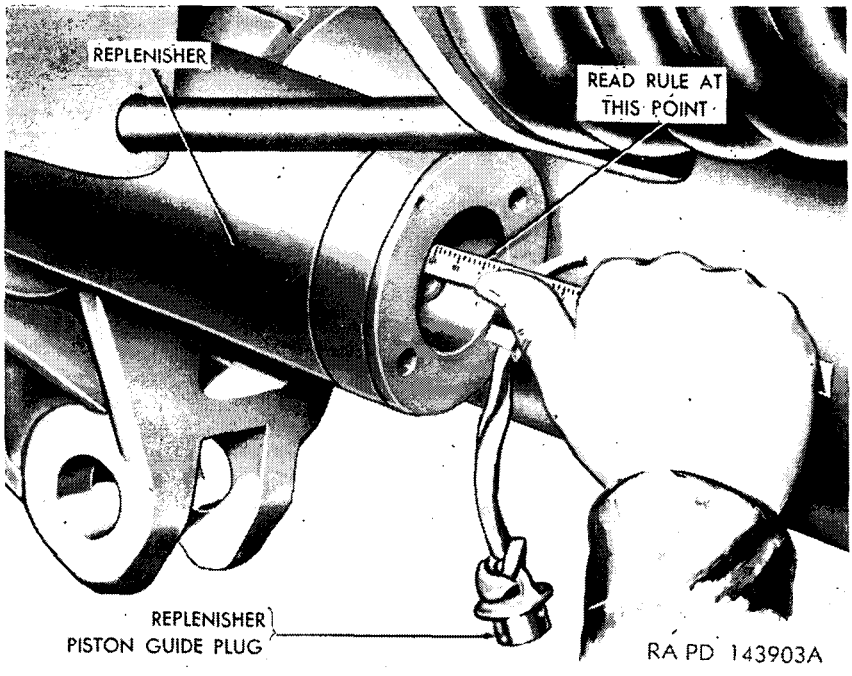

Figure 14. Measuring replenisher oil reserve.

(2) The normal position of the rear end of the extension on the replenisher piston is 5½ inches from the rear face of the replenisher. This position indicates a proper oil reserve in the replenisher.

(3) When the end of the piston is within 3½ inches of the rear face of the replenisher, it indicates too much reserve oil. Oil should be removed from the replenisher until the end of the piston is 5½ inches from the rear face of the replenisher before firing is commenced (par. 72*c*(1)).

(4) When the end of the piston is 7½ inches or more from the rear face of the replenisher, it indicates no reserve and sufficient oil should be added to establish the proper reserve (par. 72*d*).

Note.—When rapid fire is to take place, release oil from the replenisher until the rear end of the piston is 7½ inches from the rear of the replenisher. The heat of firing will expand the oil and bring the piston quickly to its normal position.

b. Check Recuperator Cylinder Oil Reserve.

(1) To judge the position of the recuperator cylinder oil index, hold one end of a rule firmly against the recuperator cylinder oil index housing with the edge of the rule parallel to and

close to the oil index (fig. 15). Note the graduation on the rule opposite the rear end of the oil index.

Note.—The scale is used to determine whether the oil index is at its maximum protrusion (par. 20) and not as a measure of reserve oil (par. 72*f*).

On recoil mechanisms of late manufacture, the maximum protrusion of the oil index is three-eighths of an inch.

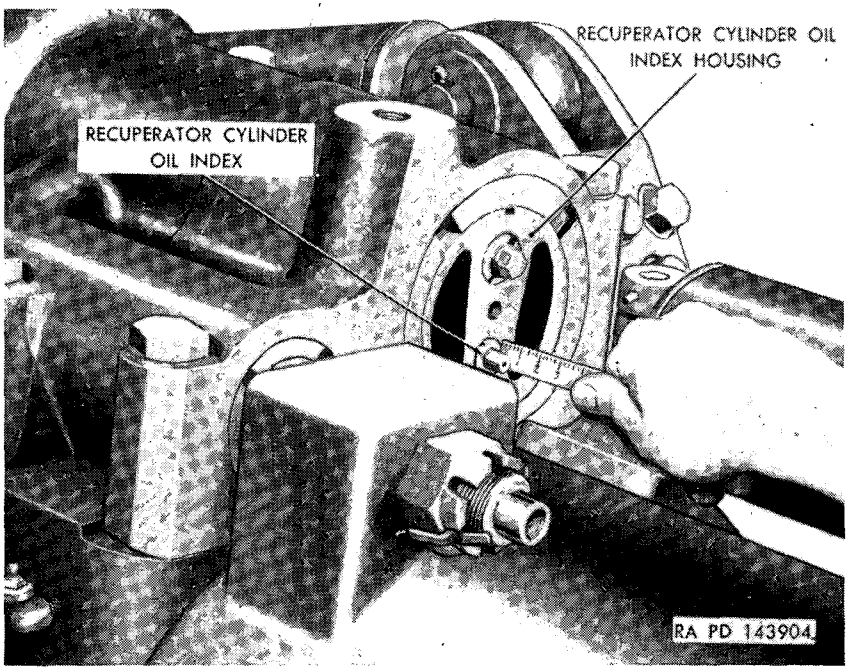

Figure 15. Checking recuperator cylinder oil reserve.

(2) If a reserve of oil is present, the oil index should protrude beyond the rear face of the housing. If the recuperator oil reserve is dangerously low (par. 20), the oil index should not protrude beyond the rear face of the housing at all. If the oil index is at less than maximum protrusion (par. 20) drain the oil reserve and establish the proper reserve (par. 72.*f*).

c. Inspect and Clean Bore, Breech, and Recoil Mechanism. Open the breech (par. 23*a*), and inspect the bore and breech for dirt or foreign matter; if any has accumulated, clean thoroughly and wipe dry (par. 50).

Caution: Be sure the proper gas-check pad is installed (pars. 8 and 63*h* (3)). Normally, the bore should be wiped or cleaned to remove the oil applied after the previous firing. Ream the primer seat with the

primer seat cleaning reamer 5012216 (figs. 16 and 26 and table I, par. 42). Clean the primer vent with the vent cleaning tool 6019667 (figs. 17 and 26). Inspect the recoil mechanism for oil leakage. Make certain that the external finished surface of the howitzer tube is clean and well lubricated.

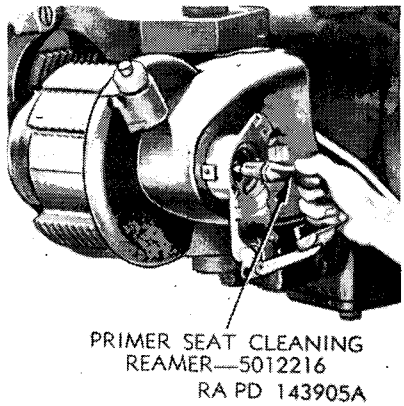

Figure 16. Reaming primer seat in obturator spindle plug.

Figure 17. Cleaning primer vent in obturator spindle.

27. To Load

a. Lower the weapon to an elevation suitable for loading (about 150 mils). Remove the firing mechanism M1 and open the breech (par. 23*a*). Lock the percussion hammer in the released "DOWN" position with the percussion hammer locking pin knob (par. 15).

Caution: Do not withdraw the percussion hammer locking pin knob until after the breech has been closed and locked and the piece is ready to be fired.

[redacted]

b. If a charge has been fired, swab the powder chamber and breech recess. Wipe the powder residue from the obturator spindle head (fig. 13) with a cloth dampened with water. Inspect the bore for burning fragments of powder bags or other objects and for bore injuries. Swab the bore with water to eliminate burning particles.

c. Prepare and fuze the projectile as prescribed in paragraphs 110 and 111.

d. Bring up the prepared projectile on the loading tray 5573641 (figs. 18 and 25 and table I, par. 42). When carrying the loading tray, grasp the handles firmly and raise it with the front slightly above the rear. Place the lip of the tray in the breech recess. Attach the loading rammer M13 7225236 (figs. 18 and 27) to the staff-section 5555199 or 7157648 (figs. 18 and 24), and place the head of the rammer squarely against the base of the projectile; push the projectile carefully until it has cleared the threads in the breech recess.

Caution: Exercise extreme care that the fuze does not strike against anything.

e. Ram the projectile into the breech with a powerful stroke. Successive projectiles must be rammed with the same force, since variations in ramming force will cause slight variations in range. Avoid damage to the rotating bands on the projectile, as such damage may cause erratic flight of the projectile.

f. Prepare the propelling charge for firing as prescribed in paragraph 110*c*.

g. Bring the prepared propelling charge up to the breech immediately after the projectile has been rammed.

Caution: An exposed propelling charge must not be near the weapon at any other time.

Place the propelling charge in the chamber (fig. 19) with the igniter end to the rear, and push it in until the base of the charge is three inches inside the rear end of the chamber.

Caution: Do not leave a propelling charge in the chamber for more than a few seconds before firing. Temperature changes affect the performance characteristics of a powder charge (par. 108*c*) and they occur very rapidly in the chamber.

h. Close the breech (par. 23*b*). To insure transmission of the flash from the primer to the charge, the obturator spindle head (fig. 13) should come in contact with the base of the charge when the breech is closed and must push the charge forward to its final position. A gap between obturator spindle head and the base of the charge can prevent the primer flash from setting off the charge.

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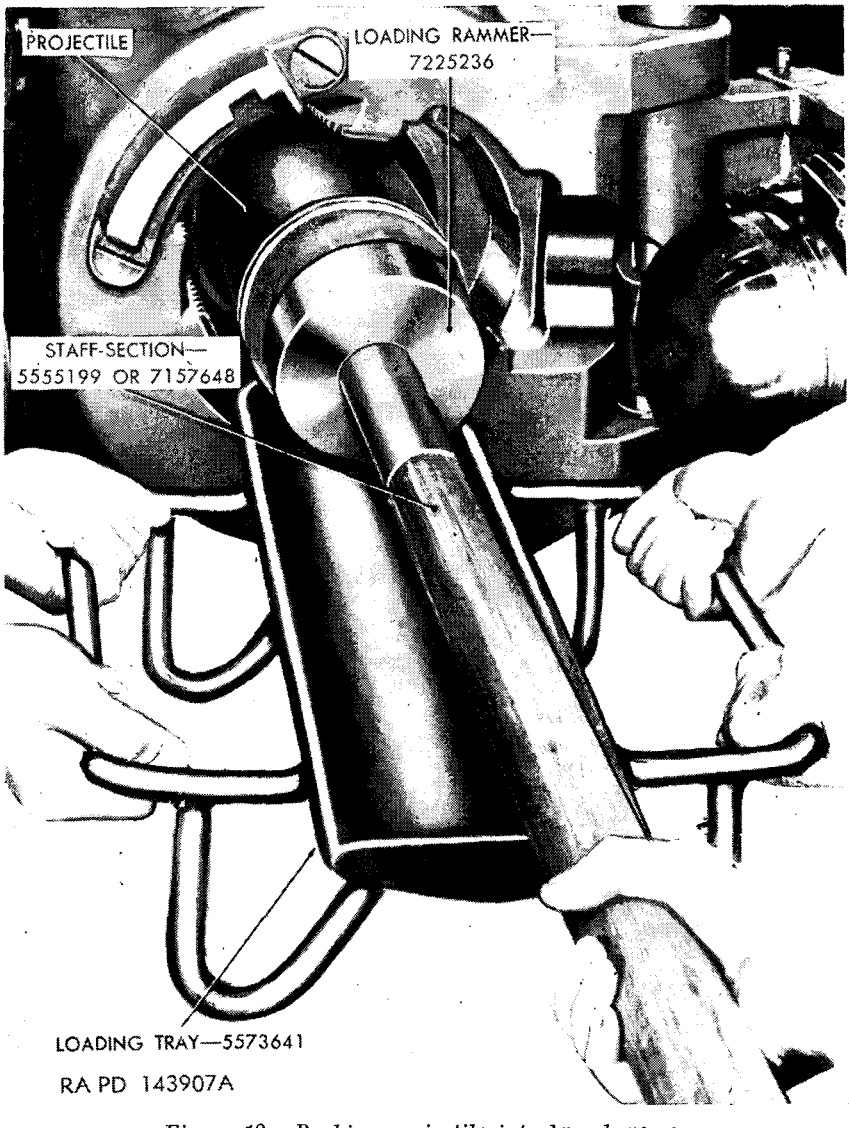


Figure 18. Pushing projectile into breech recess.

28. To Fire

a. Insert primer in firing mechanism M1 as follows:

(1) Hold the primer so that no part of the hand is in front of the tapered end of the primer, and insert the primer in the primer holder of firing mechanism M1 by pressing the flanged head of the primer firmly against the firing pin guide so that the rim of the primer slides under the edges of the primer

Figure 19. Loading propelling charge.

holder (fig. 20). The primer is then held in position by the pressure of the firing pin spring.

(2) Should the primer be slightly oversize or the primer holder dirty, the primer will stick before it is properly seated. Do not exert force to seat the primer. Remove the primer and clean the primer holder, or insert another primer.

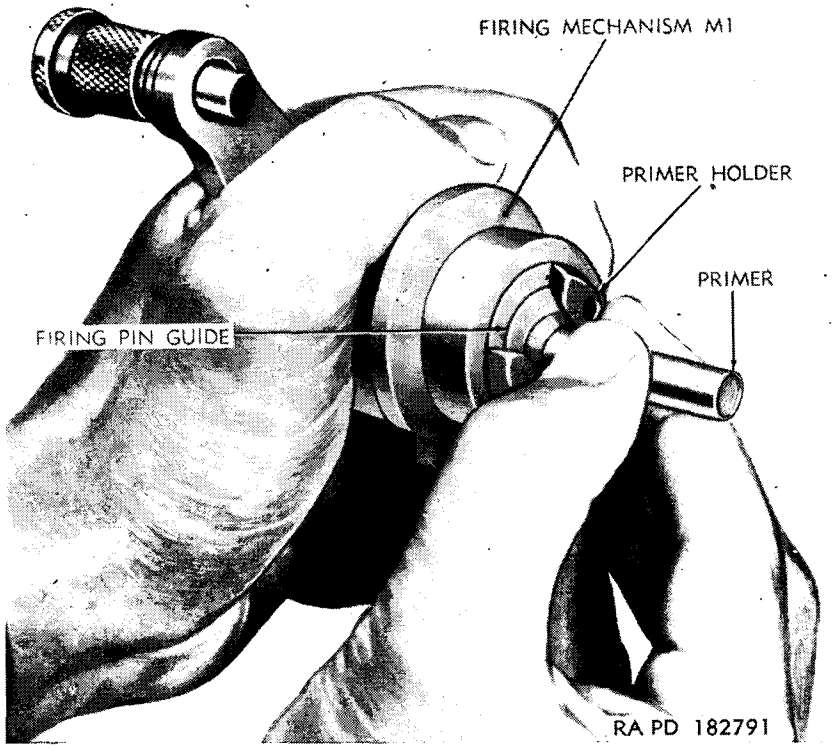


Figure 20. Inserting primer in firing mechanism M1.

b. Insert the firing mechanism in the firing mechanism housing (fig. 21), taking care that the front end of the primer has entered the obturator spindle plug (fig. 58). Seat the mechanism by turning it clockwise until it has contacted the firing mechanism stop stud (fig. 21) and the firing mechanism safety latch has moved to the right. If the mechanism will not set properly, the primer may be oversize, or its seat in the plug or in the primer holder may be dirty, or the breech may not be fully closed.

Caution: Make certain that the firing mechanism M1 is screwed against its stop stud and is latched in position.

c. Attach the firing lanyard 6195984 (figs. 22 and 25 and table I, par. 42) to the percussion hammer (fig. 22). Draw the percussion hammer locking pin knob to the left, and turn the knob to place it in the locked-out position (par.15).

d. Pull the lanyard from a position as near the rear of the piece as is convenient and sufficiently out of the line of recoil to insure safety. Grasp the handle of the lanyard with the right hand; without raising the hand, pull with a quick strong pull (not a jerk).

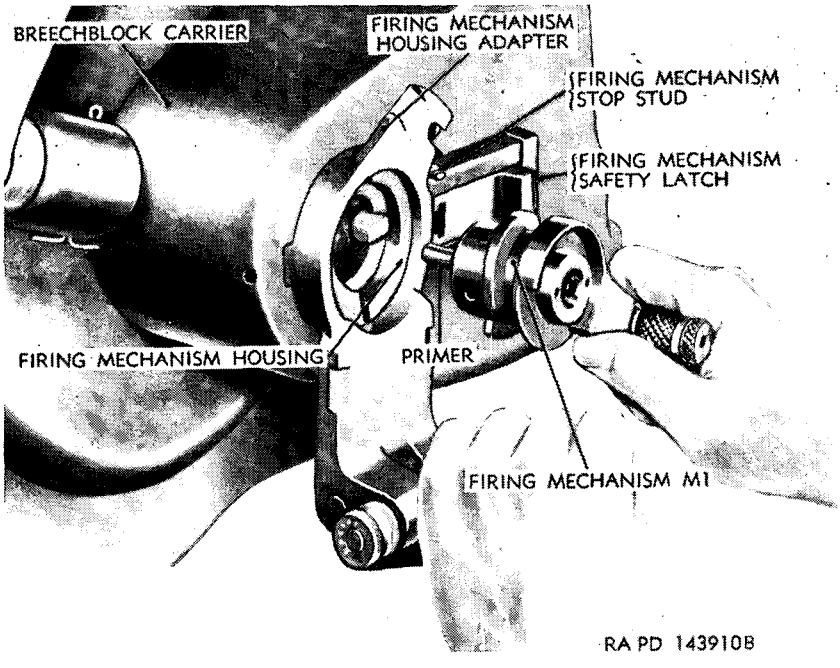


Figure 21. Inserting firing mechanism M1 in firing mechanism housing.

29. Observation During Firing

a. Observe the movement of the weapon in recoil. It should be smooth with uniformly decreasing velocity. The point of maximum recoil should be reached without shock. The weapon should return completely into battery without shock. If uneven jerky movement or shock is observed, or if the weapon will not return fully to battery, inspect the recoil mechanism to determine the cause (par. 57).

b. Check the recoil mechanism for any oil leakage. Check the oil reserve in the replenisher at intervals during firing. The temperature of (recoil) oil rises during firing and causes the oil to expand.

Note.—In an emergency, when it is necessary to continue firing without interruption, firing may be continued until the end of the replenisher piston is 2 inches (50-mm) from the rear face of the replenisher.

c. Measure the length of recoil for the first round and at intervals during firing when practical. To measure length of recoil, place a heavy smear of grease on the exposed portion of the howitzer tube extending from the tube wiper on the front of the cylinder yoke to the front end of the howitzer tube (fig. 23), or tie a piece of string around the howitzer tube in front of the wiper. After the weapon has fired and returned to battery, measure the distance between the

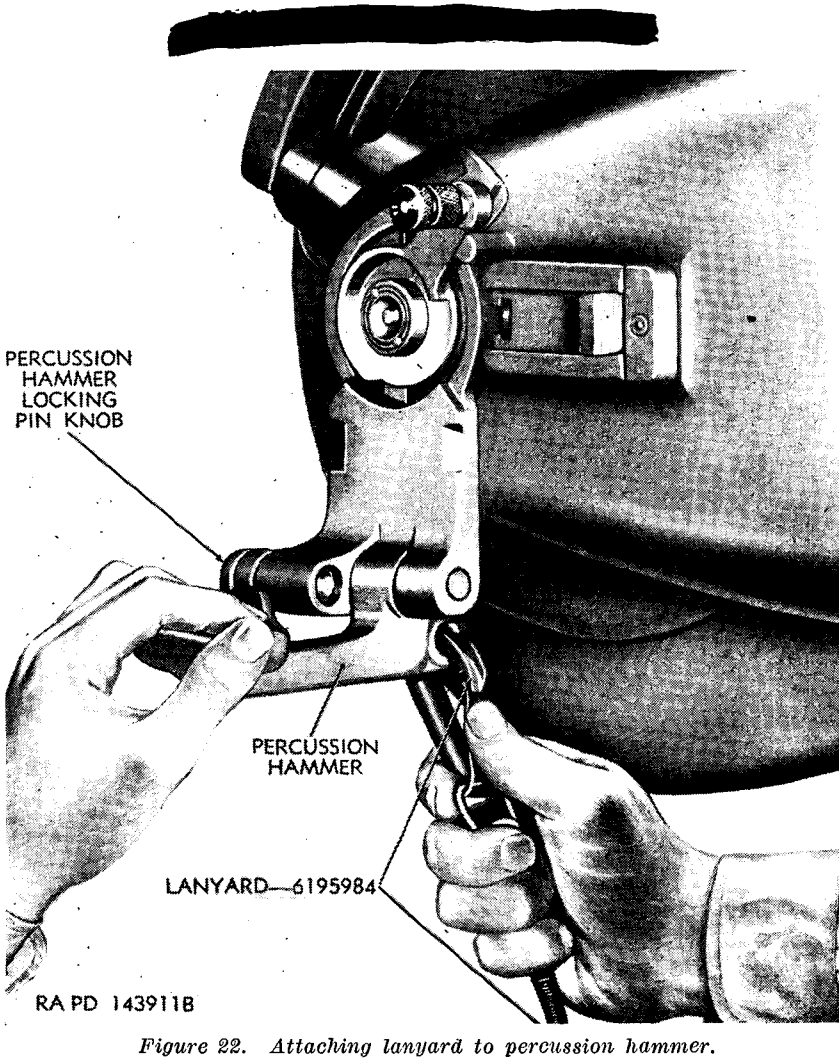


Figure 22. Attaching lanyard to percussion hammer.

wiper and the point to which the wiper has moved the grease or string. The normal length of recoil of the 155-mm howitzer M1 is 60 inches at 0° to 25° elevation and 41 inches at 40° to 65° elevation. If the length of recoil does not fall within the limits designated when the weapon is operating at normal temperature, check the oil reserves in the replenisher and recuperator cylinder immediately (par. 26*a* and *b*). If the oil reserves are abnormal, take the necessary corrective measures.

30. To Unload

Warning: In the event that the howitzer is loaded and firing ceases, the howitzer should be unloaded (par. 55*b*) or fired as soon as possible.

If the weapon has been fired a sufficient number of times to heat the tube, it is desirable to fire the weapon as soon as it is loaded (par. 27*g*). This will eliminate the danger of a "cook-off" (par. 55*b*) or excessive chamber pressure due to increased powder temperature (par. 108*c*). If it is not practical to fire the howitzer, unload as directed in *a* below. Personnel not needed in the unloading operation should be cleared from the vicinity.

a. Remove Propelling Charge and Projectile. The weapon will be unloaded under the direct supervision of an officer, except in combat. Remove the firing mechanism. Bring the weapon to a horizontal position. Open the breech and remove the powder charge. Place waste in powder chamber and close the breech. Inspect the cleaning

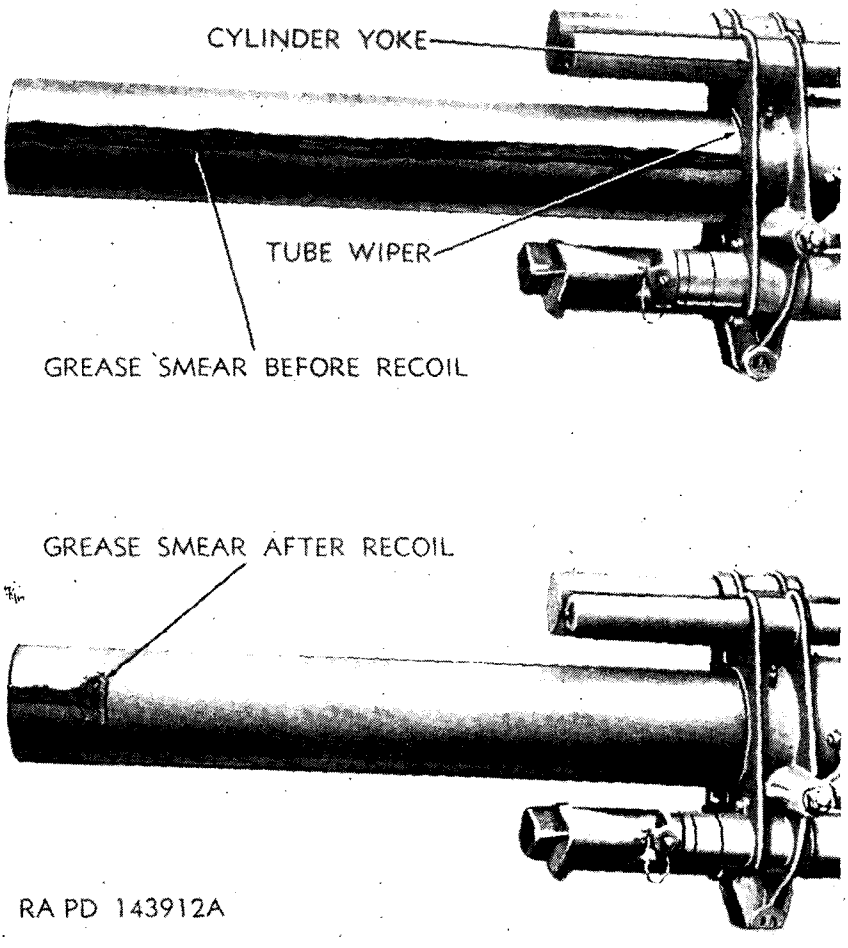


Figure 23. Measuring length of recoil.

and unloading rammer M7 5557112 to see that it is thoroughly clean. Attach the rammer to the assembled staff-section 5555199 or 7157648. Insert the rammer into the bore at the muzzle, and push it carefully until it incloses the fuze and comes in contact with the ogive of the projectile. It may be necessary to tap the end of the rammer staff with a wooden block in order to free the projectile from its seat in the bore. When projectile is freed from the bore, open the breech and remove the waste. Place the loading tray in position in the breech recess (par. 27*d*) and push the projectile slowly onto the loading tray with the cleaning and unloading rammer. Hold an extra rammer, if available, otherwise a pickaxe handle, firmly against the base of the projectile and steady its backward movement in the loading tray. Remove the loading tray and projectile from breech.

b. Defuze Projectile. Projectiles that have been fuzed and are not to be fired must have the fuzes restored to their original condition and removed. Eyebolt lifting plugs are installed and projectiles and fuzes are both repacked in appropriately marked containers (par. 110*a*).

31. To Place Weapon in Traveling Position

a. General. If the howitzer has been fired, clean, dry, and oil the bore and chamber. Disassemble the obturating parts from the breech-block carrier and clean and oil (par. 64*b*). Assemble the breech mechanism (par. 63), close the breech, and insert the firing mechanism in its housing (fig. 21). Lock the percussion hammer in the upright, immobile position (par. 15).

b. Engage Travel Locks.

(1) Traverse the howitzer to center position. Install the muzzle cover 7090027 (table I, par. 42) on the howitzer muzzle (figs. 3 and 27), and the breech cover 7090014 (fig. 27) on the howitzer breech. Hold the clamp of the howitzer travel lock (fig. 8) in an upright position and depress the howitzer until the muzzle rests snugly against the lower half of the clamp. Then position the upper half of the clamp over the barrel and secure the lock by tightening the clamp sleeve.

(2) Engage and fasten the traverse travel locks (fig. 9).

c. Raise Gunner's Platform and Spade.

(1) Drive the vehicle forward until the spade is level with the ground (fig. 7). Place both cranks (fig. 6) on the winch crankshaft and turn the cranks to tighten the cable and raise the platform and spade (fig. 7). When the spade is clear of the ground, brush off the dirt and mud, etc.

(2) Continue to raise the platform and spade until the spade is about 6 inches from closed position. Then push the plat-

form toward closed position and throw both platform travel locks (fig. 4) over to the locked position. Continue to raise the platform and spade to the closed position. Then pull down on the spade travel locks (figs. 6 and 7) so that they engage and hold the spade.

(3) Engage the winch locking pawl (fig. 6) and then remove both cranks. The weapon is now in traveling position.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

32. General Conditions

a. In addition to the normal operating procedures described for usual conditions, special instructions for operating and servicing the weapon under unusual conditions are contained as referred to herein. In addition to the normal preventive maintenance service, special care in cleaning and lubrication must be observed where extremes of temperature, humidity, and terrain conditions are present or anticipated. Proper cleaning, lubrication, and storage and handling of oils and lubricants not only insure proper operation and functioning but also guard against excessive wear of the working parts and deterioration of the matériel.

b. Refer to paragraph 45 for instructions on lubrication under unusual conditions, to the preventive maintenance schedules in table III, paragraph 52, and table IV, paragraph 53 for preventive maintenance checks to be made when the matériel is subjected to unusual conditions, and to paragraphs 79–81 for maintenance procedure applying to unusual conditions.

33. Cold Weather Operation

a. General Problems.

(1) Extensive preparation of matériel, schedules for operation in extreme cold weather, is necessary. Generally, extreme cold will cause lubricants to thicken or congeal, freeze batteries or prevent them from furnishing sufficient current for proper functioning, crack insulation and cause electrical short circuits, and will cause the various construction materials to become hard, brittle, and easily damaged or broken.

(2) For description of operations in extreme cold, refer to FM 31–70, FM 70–15, and TM 9–2855.

Caution: It is imperative that the approved practices and precautions be followed. TM 9–2855 contains general cold-weather information applicable to this matériel.

[redacted]

b. Handling and Storage of Lubricants and Special Oils.

(1) The operation of equipment at arctic temperatures will depend to a great extent upon the condition of the oils and lubricants used in the equipment. Immediate effects of careless handling of oils and lubricants are not always apparent, but any deviation from proper handling of these products is liable to bring trouble at the least expected times.

(2) In arctic operations, contamination with moisture is the source of many difficulties. Moisture can be the result of snow getting into the product, condensation due to "breathing" of a partially filled container, or moisture condensed in a partially filled container when a product is brought outdoors from room temperatures. Other impurities will also contaminate oils and lubricants so that their usefulness is impaired.

c. Preparation for Cold Weather Operation.

(1) When it is anticipated that the matériel will be operated in cold climates, it will be necessary to prepare the weapon for cold weather operation. Determine that the howitzer mount M14 is equipped with a winterized recoil mechanism (par. 70*b*). Refer to the lubrication order and TB ORD 193 for the lubricants prescribed under the expected temperature of operation. When it is necessary to change grades of lubricants or change to a more fluid lubricant, it is imperative that the parts receiving the lubrication be completely disassembled and cleaned bofore the new lubricant is applied.

(2) Cleanliness is imperative. Rust, dirt, gummed oil, or grease in bearing clearances interfere with proper distribution of lubricant thus causing stiff action, if not complete stoppage, in subzero weather. In preparing matériel for subzero operation, therefore, assemblies and mechanisms must be disassembled sufficiently to permit complete removal of heavy oil, grease, and foreign matter. Cleaning is most efficiently done by washing with dry-cleaning solvent or volatile mineral spirits and using brushes and scrapers where necessary. Care must be taken not to overlook cleaning small items which may look insignificant. Field experience has proved that careless repair, excessive lubrication, and thickening of lubricants in bearings and other similar parts may cause malfunctioning or failure of equipment in subzero weather.

d. Cold Weather Operating Instructions and Daily Care.

(1) In extreme cold weather, it can be expected that the counter-

[redacted]

recoil action will be slow for the first few rounds (until the oil warms up).

Caution: Do not remove recoil fluid to increase cyclic rate of fire.

(2) The recoil mechanism will be filled with the recoil fluid currently specified for cold-weather operation. The gas pressure will be adjusted by ordnance personnel.

(3) Do not let snow and ice collect on moving parts. Remove snow by vigorous brushing with a stiff bristle or wire brush before movement of the parts is attempted.

(4) Keep all parts clean. The mechanical procedure for cleaning the matériel is the same as for normal conditions. However, certain precautions concerning the use of rifle-bore cleaner when cleaning in extreme cold must be observed.

(*a*) Do not under any condition dilute rifle-bore cleaner.

(*b*) Do not add antifreeze to rifle-bore cleaner.

(*c*) Store rifle-bore cleaner in a warm place, if practicable and shake well before using.

(5) Leave no unpainted metal surfaces exposed without a protective film of lubricant.

(6) To prevent matériel from freezing to the ground, coat it with grease or any substance to which ice will not stick. Packing or carrying cases, etc., may be placed on straw, hay, brush, or waterproof paper such as tar or roofing paper.

(7) In addition to the procedures for traveling outlined in paragraph 31, particular attention will be given to the following:

(*a*) Make a thorough inspection and provide as much protection as possible for all parts. See that the covers are properly installed and securely fastened.

(*b*) Do not fold canvas when wet or frozen.

(8) When the matériel is protected with a canvas or other type of cover, moisture may form on the metal surfaces. To prevent rusting, the cover must be removed daily and all exposed surfaces inspected for the presence of moisture or ice. If moisture or ice is found, the surface must be thoroughly cleaned, dried, and coated sparingly with preservative lubricating oil.

(9) During extremely cold weather, the asbestos covering of Gerdom type gas-check pads tends to break away exposing the wire mesh. The exposed wire mesh will score and seriously damage the gas-check pad seat of the breech ring. Inspect the gas-check pad for exposed wire mesh and replace a damaged pad before firing.

(10) Cease firing, if cracks develop at muzzle or breech.

e. Preventive of Condensation.

(1) When the weapon, sighting and fire control equipment, parts, or assemblies are brought indoors after having been outside at low temperatures, vapor in the warm air will condense on and within the cold parts. If it is not dried off, this condensed moisture may cause rust and corrosion of the parts. In some cases drying without disassembly is practically impossible. If the matériel is operated indoors while this moisture is present, the moisture will form an emulsion with the grease used for lubrication. Such a condition will necessitate removing all the grease and relubricating. If the matériel is taken outside with this moisture present, the parts will become covered with frost and may not function.

(2) Do not bring any matériel indoors unless it is absolutely necessary. It is best to leave it outdoors, but covered to protect it from the snow. Snow-tight lockers which stay at outdoor temperatures are recommended as a place for keeping binoculars, telescopes, and other equipment.

(3) If it is necessary to bring instruments or other equipment from low temperatures to room temperature, "anticondensation" containers should be used. These containers can be specially made boxes, water cans, barracks bags, or any other fairly airtight containers with heat-conducting walls. Keep them outside so they will remain at prevailing temperatures until it is desired to bring an instrument indoors. Then put the instrument into a container, close the top, bring it indoors and let it come to room temperature. It can be put near a stove or on top of a stove to hasten the warming-up.

(4) The air in the container is cold dry air from the outdoors, so that when it is heated the air expands and breathing is outward; therefore, no warm humid air from the room comes in contact with the instrument and there is no condensation on it. When the instrument is at room temperature, the container can be opened and the instrument removed without condensation forming on it.

(5) It is possible for condensation to form on the inside of sealed optical instruments when they are taken outdoors into low temperature after having been assembled at room temperature. To avoid this possibility, the instrument should be finally sealed in a room that is kept at outdoor temperature.

f. Exercising. Exercise the various controls throughout their entire range at intervals as required to aid in keeping the controls from

freezing in place and to reduce the effort required to operate them.

g. Sighting and Fire Control Equipment.

(1) Sighting and fire control equipment will operate satisfactorily at subzero temperatures if it is properly winterized and certain adjustments are made.

(2) Ordnance maintenance of fire control equipment in cold weather where shop facilities are scarce will be difficult. Therefore, all equipment should be thoroughly inspected and winterized by ordnance maintenance personnel before the onset of cold weather.

34. Operation in Extremely High Temperatures

a. The bore of the weapon should be cleaned and oiled more frequently than usual when operating in hot climates. Temperature changes will cause condensation of moisture in the air on metal and cause rusting. If condensation occurs on other unpainted metal parts of the howitzer and mount, wipe them dry and coat with preservative lubricating oil as required to prevent rusting.

b. Constantly observe the operation of the recoil mechanism as prescribed in paragraph 29, to be sure that expansion of the oil due to the heat does not result in an excess oil reserve (par. 26*a* and *b*) with resultant damage to the recoil mechanism.

Note.—In locations subject to large variations between day and night temperatures, the quantity of oil drained from the recoil mechanism during the day must be restored to the recoil mechanism at night. Only perfectly clean oil may be used in filling the recoil mechanism. Drained hydraulic oil, if it is to be re-used in an emergency, must be strained through a clean, lintless cloth (preferably linen) to exclude foreign matter.

c. Since explosives are adversely affected by high temperatures, ammunition must be protected from sources of high temperatures including the direct rays of the sun. Elements in primers and fuzes are particularly sensitive to high temperature (par. 108*c*).

35. High Humidity

a. The amount of moisture in the atmosphere determines the rate of corrosion and rate of loss of protective quality by lubricant films used to prevent corrosion of metal surfaces, as the water will emulsify the lubricants and destroy their corrosion preventive qualities. Inspect parts frequently for corrosion. The more moisture present, the greater the tendencies for the matériel to corrode and deteriorate; therefore inspection, cleaning, and lubricating should be more frequently and carefully performed, depending upon the moisture present.

b. Keep the bore of the tube, the breech mechanism, and exposed unpainted surfaces coated with oil as prescribed on lubrication order. Watch for signs of rust.

c. Canvas covers and other items which may deteriorate from mildew or be attacked by insects or vermin will be inspected, cleaned, aired, and dried frequently.

d. Keep ammunition free from mud, corrosion, or foreign matter. Do not break moisture-resistant seal of ammunition container until ammunition is to be used.

e. In the tropics, many optical instruments are protected against fungus growth by the installation of fungicidal capsules. Notify ordnance maintenance personnel if there are indications of fungus growth in any optical instrument.

36. Salty Atmosphere

Salt in the air, such as occurs near salt water areas, adds to the corrosive activity of moisture. When operating in salty atmosphere, give extra attention to inspecting, cleaning, and lubricating the matériel.

37. Excessively Sandy or Dusty Conditions

a. When the weapon is active in dusty areas, remove lubricant from the elevating and traversing arcs and pinions, from the exterior surface of the howitzer tube, and from recoil mechanism piston rods before firing as they will pick up sand or dust, forming an abrasive which will cause rapid wear. Clean and lubricate parts after action.

b. Clean, inspect, and lubricate the matériel more frequently when operating in sandy areas.

c. Keep the matêriel covered as often as conditions permit.

38. Fording

a. Shallow-Water Fording.

(1) Cover the weapon carefully to protect it from water being splashed against the weapon.

(2) Watch carefully during the fording operation for the possibility of water seepage into the motor camage.

(3) If accidental complete submersion occurs, the weapon will be salvaged and treated as described in *c*(2) below.

b. Deep-Water Fording. Refer to TM 9–2853 for general information, descriptions, and methods of using deep-water fording kits.

c. After-Fording Operations.

(1) Immediately after weapon emerges from the water, if the tactical situation permits, perform the following services: Remove any accumulated water, clean, dry, and apply the

prescribed lubricant to all unpainted surfaces which were exposed to water, paying especial attention to the bore and chamber, the recoil slides, and the equilibrator rods.

(2) If parts of the weapon are accidentally submerged or badly splashed, apply temporary preservation (par. 45*f*) and notify ordnance maintenance personnel so that necessary complete disassembly, cleaning, and lubrication may be performed as soon as possible.

(3) Salt-water immersion greatly increases rusting and corrosion; especially on unpainted surfaces. It is most important to remove all traces of salt water and salt deposits from every part of the weapon. Apply temporary preservation as outlined in paragraph 45*f* and notify ordnance maintenance personnel so that necessary complete disassembly, cleaning, and lubrication may be performed as soon as possible.

[redacted]

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. PARTS, SPECIAL TOOLS, AND EQUIPMENT FOR OPERATION AND ORGANIZATIONAL MAINTENANCE

39. General

Tools, equipment, and spare parts are issued to the using organization for operating and maintaining the matériel. Tools and equipment should not be used for purposes other than prescribed and, when not in use, should be properly stored in the chest and/or roll provided for them.

40. Parts

Spare parts are supplied to the using organization for replacement of those parts most likely to become worn, broken, or otherwise unserviceable, providing such operations are within the scope of organizational maintenance functions. Spare parts, tools, and equipment supplied for the 155-mm howitzer M1 and 155-mm howitzer mount M14 are listed in Department of the Army Supply Catalog ORD 7 SNL G–236, which is the authority for requisitioning replacements.

41. Common Tools and Equipment

Standard and commonly used tools and equipment having general application to this matériel are listed for issue by the ORD 7 catalog and by T/A and T/O & E.

42. Special Tools and Equipment

All special tools and equipment designed for operation, organizational maintenance, repair, and general use with the matériel are listed in tables I and II for information only. This list is not to be used for requisitioning replacements.

[redacted]

Table 1.—Special Organizational Tools and Equipment for 155-MM Howitzer M1

Item	Identifying Number	References		Use
		Fig.	Par.	
BELT, primer, M8	7225490	25	109*e*	To hold primers.
BRUSH, bore, 155-mm, M13B1 (or)	7230870	24, 35	50*b*, *e*, and *f*	To swab howitzer bore.
BRUSH, channel type, 155-mm	5573734	24, 35	50*e* and *f*	To swab howitzer bore.
COVER, bore brush	5576513	24		
COVER, breech	7090014	27	22*a*(4), 31*b*(1)	
COVER, gun book, M539	7228906	27	3*c*	
COVER, muzzle	7090027	3, 27	22*b*(1), 31*b*(1)	
FORM, govt, War Dept, arty gun book, OO No. 5825.	28–F–67990	24	3*c*, 44*d*	
GAGE, head space, lgh overall 3.250 in	7225952 (41–G–200–700)	26, 59	64*c*(2)	To measure obturator spindle head space.
HOOK, lifting, shell w/4 in handle	41–H–2644–725	27		
LANYARD, firing, 47 in	6195984	22, 25	28*c*	To fire weapon.
PLUG, muzzle, M2	7237634			To protect howitzer bore during travel.
RAMMER, cleaning and unloading, M7	5557112	24	8*a*(4), 30*a*, 50*b* and *c*.	To clean howitzer bore and remove unfired projectile.
RAMMER, loading, M13	7225236	18, 27	27*d*	To ram projectile into breech.
REAMER, carb-S, hand primer seat cleaning, spiral flute, w/wood hdl, diam small end 0.321 in, diam large end 0.362 in, lgh overall 7 in.	5012216 (41–R–501–80)	16, 26	26*c*	To clean primer seat.
SIGHT, bore, breech	7238962 (41–S–3639–215)	24, 93, 99.	83*d*(3), 89*b*(5) and *d*.	To bore sight howitzer.

Table 1.—Special Organizational Tools and Equipment for 155-MM Howitzer M1—Continued

Item	Identifying Number	References		Use
		Fig.	Par.	
SIGHT, bore, muzzle	7238963 (41–S–3647–100)	24, 94, 99	83*d*(3), 89*b*(5), and *d*	To bore sight howitzer.
STAFF-SECTION	5555199	18, 24	8*a*(4), 27*d*, 30*a*, 50*b*, *c*, and *f*	To ram and clean.
(or)				
STAFF-SECTION (46½ in lg).	7175648	18	8*a*(4), 27*d*, 30*a*, 50*b*, *c* and *f*	To ram and clean.
TOOL, assembling, firing mechanism housing, thkns 0.24 in, lgh 5 in.	5207076 (41–T–3017–650)	27, 46	62*a*,*b*(6), 63*h*(4), 64*c*(5)	To install or remove firing mechanism housing.
TOOL, cleaning, vent, drill bit type, diam of bit 0.206 in.	6019667 (41–T–3081–120)	17, 26	26*c*, 64*b*(3)(*c*)	To clean and ream obturator spindle vent.
TRAY, loading	5573641	18, 25	27*d*, 30*a*	To load ammunition into breech.
WRENCH, ring, assembling (flat key face spanner, diam of circle 3⅝ in, lgh 8 in.)	7230275 (41–W–3255–426)		62*d*	To remove or install breechblock driver retaining ring.
WRENCH, firing mechanism	6167037 (41–W–3248–251)	26, 62	65*d*, 67*a* and *c*, 68*b* and *c*	To disassemble firing mechanism.
WRENCH, fuze, M16	7230851 (41–W–1496–115)	26	110*b*(2), (*b*) and (*c*)	To tighten fuze.
WRENCH, fuze, M18	7231161 (41–W–1496–135)	26	110*b*(1), (*c*) and (3)(*b*)	To tighten fuze.

[redacted]

Table II.—Special Organizational Tools and Equipment for 155-MM Howitzer Mount M14

Item	Identifying Number	References		Use
		Fig.	Par.	
TOOL, liquid releasing (for oil).	6103913 (41–T–3251–611).	27, 71, 72.	72c (1) and *f* (1) and (2).	To release replenisher and recuperator oil reserves.

Section II. LUBRICATION AND PAINTING

43. Lubrication Order

Lubrication Order 9–744 (figs. 28 and 29) prescribes cleaning and lubricating procedures as to locations, intervals, and the proper materials for this matériel. This order is issued with each weapon and must be carried with it at all times. In the event a weapon is received without copy, the using organization shall immediately requisition one. See SR 310–20–4 for lubrication order of current date. Lubrication which is to be performed by ordnance maintenance personnel is listed on the lubrication order in the NOTES.

44. General Lubrication Instructions

a. Usual Conditions. Service intervals specified on the lubrication order are for normal operation and where moderate temperature, humidity, and atmospheric conditions prevail.

b. Lubrication Equipment. The matériel is supplied with lubrication equipment adequate for its maintenance. This equipment will be cleaned both before and after use. Lubricating guns will be operated carefully, and in such a manner as to insure a proper distribution of the lubricant.

c. Points of Application.

(1) Lubricating fittings, grease cups, oilers, and oilholes are shown in figures 30 through 34 and are referenced on the lubrication order. Wipe these devices and the surrounding surfaces clean before lubricant is applied. If a fitting is missing, cover the hole with tape as a temporary expedient to prevent the entrance of dirt. A new fitting must be installed as soon as possible.

(2) A ¾-inch red circle should be painted around all lubricating fittings and oilholes.

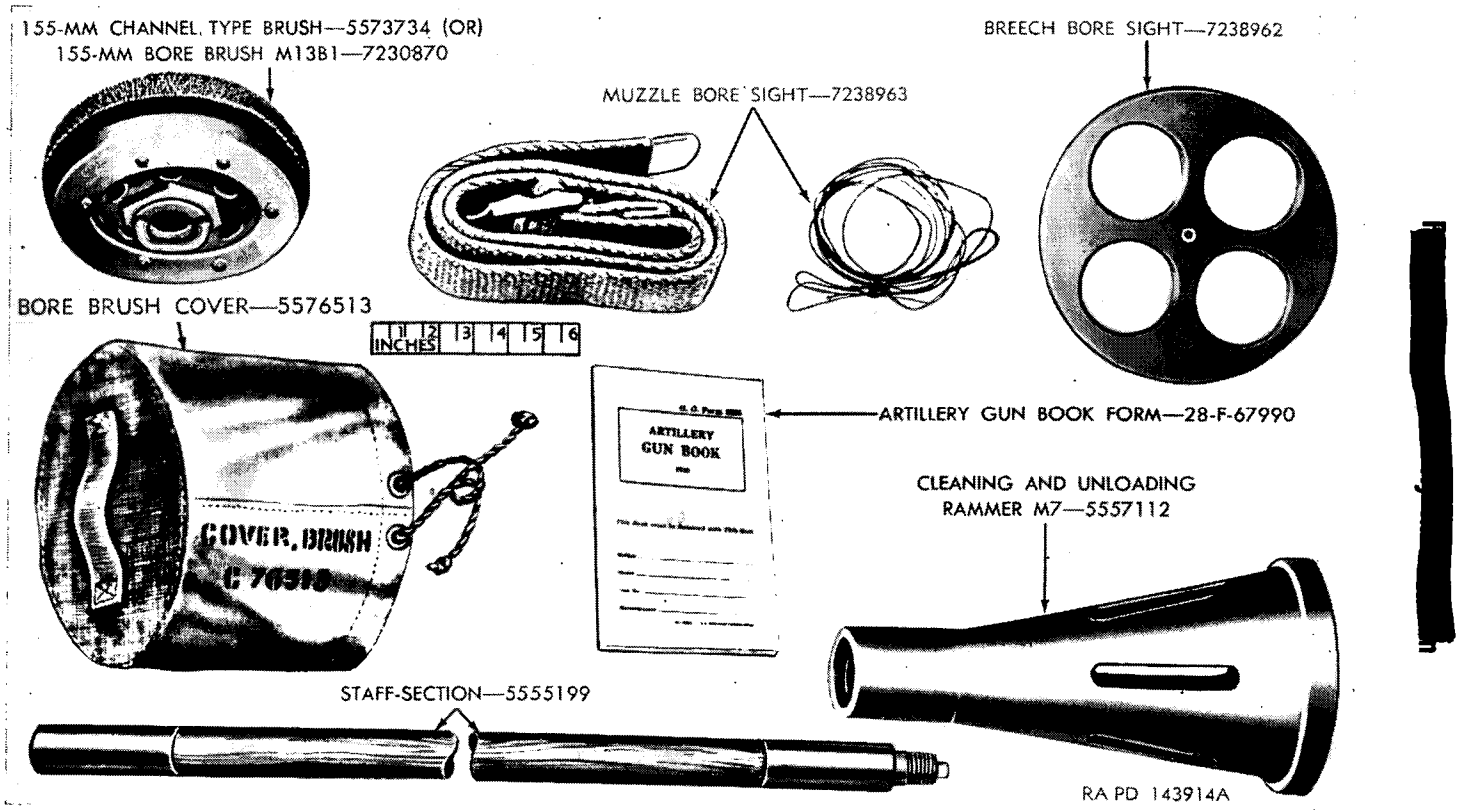


Figure 24. Equipment for 155-mm howitzer M1.

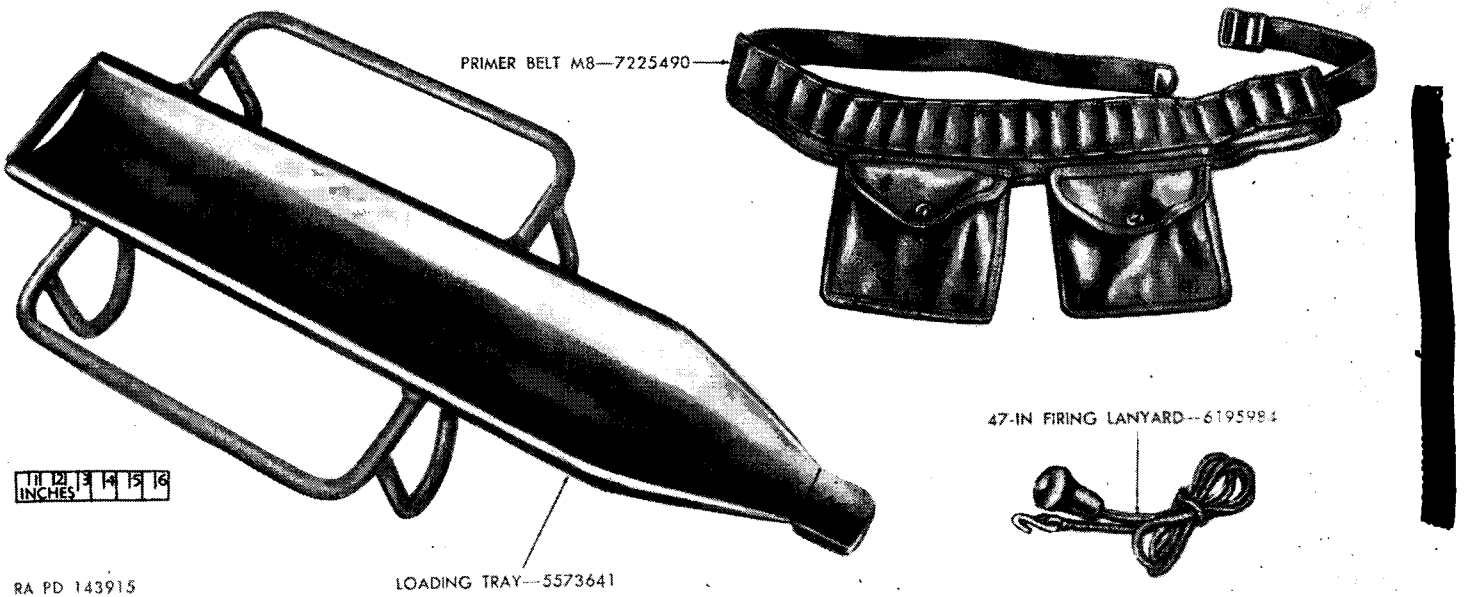


Figure 25. Equipment for 155-mm howitzer M1.

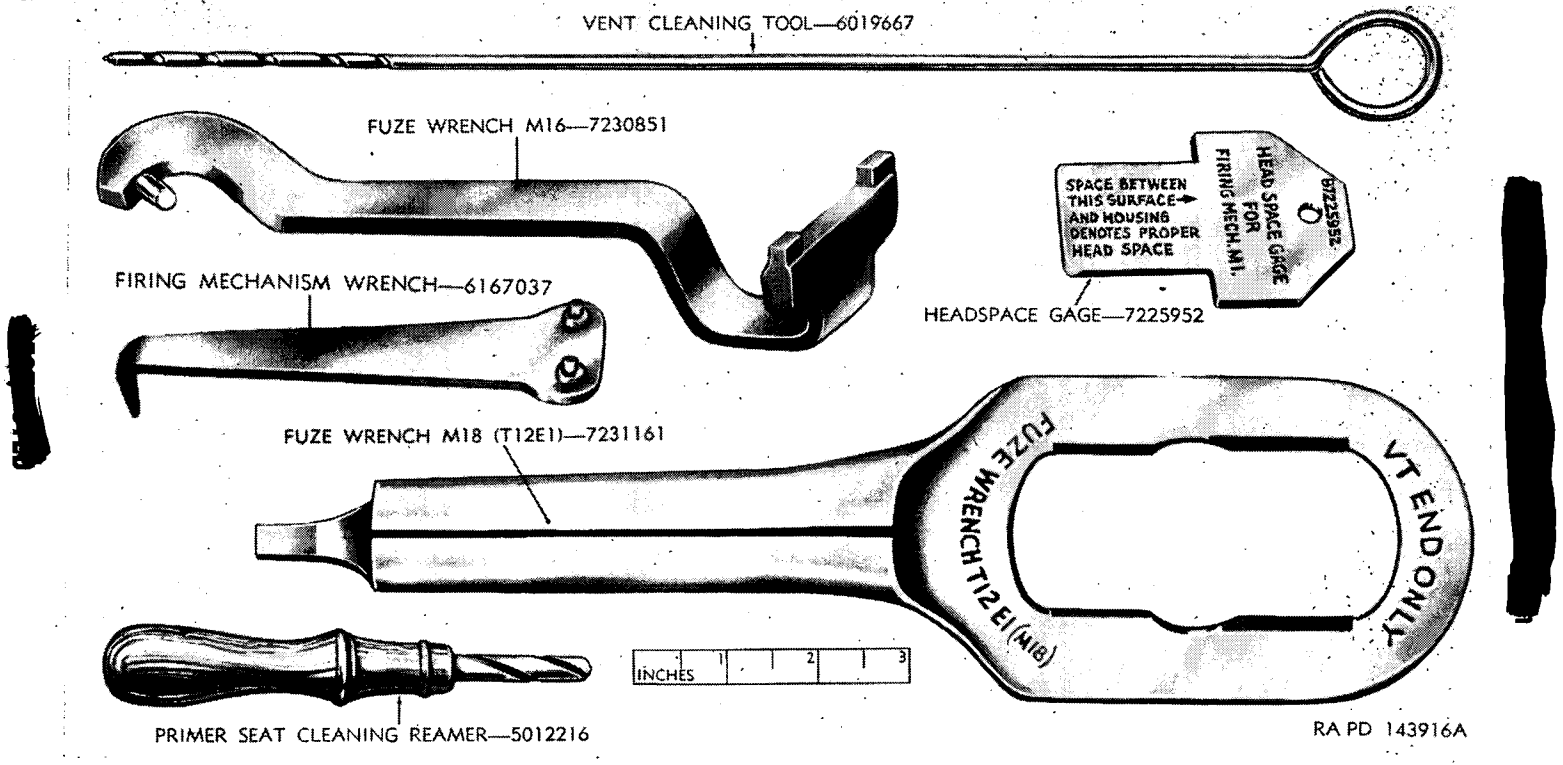


Figure 26. Equipment for 155-mm howitzer M1.

Figure 27. Equipment for 155-mm howitzer M1 and 155-mm howitzer mount M14.

(3) The filling plugs of recoil mechanisms filled with recoil oil special must be painted green. The filling plugs of recoil mechanisms filled with petroleum base hydraulic oil must be painted orange.

d. Reports and Records.

(1) Report unsatisfactory performance of matériel or defects in the application or effect of prescribed petroleum fuels, lubricants, and preserving materials in accordance with paragraph 3.

(2) Maintain a record of changes in grade of lubricant and hydraulic oil in OO Form 5825, Artillery Gun Book.

45. Lubrication Under Unusual Conditions

a. Service Intervals. Reduce service intervals specified on the lubrication order (i. e., lubricate more frequently) to compensate for abnormal operation and extreme conditions, such as high or low temperatures, prolonged periods of firing, continued firing in sand or dust, immersion in water, or exposure to moisture. Any one of these

LUBRICATION ORDER LO 9-744

15 March 1948 (Supersedes WDLO 9-744, 15 Aug 45)

CARRIAGE, MOTOR, 155-mm HOWITZER, M41

References: TM 9-744; ORD SNL G-236.

Intervals are based on normal operation. Reduce to compensate for abnormal operation and severe conditions. During inactive periods intervals may be extended commensurate with adequate preservation.
Relubricate after washing or fording.

Clean fittings before lubricating.

Clean parts with SOLVENT, dry cleaning. Dry before lubricating. (For exception, see ARMAMENT Note).

Lubricate dotted arrow points on both sides of the equipment.

Lubricant • Interval

Differential Drain (To reach, remove plate on hull) Remove oil pump and clean screen. Drain and refill. Cap. 20 qt. (See Note 5) — CG 6

Final Drive Drain (To reach, remove plate on hull) Drain and refill. Cap. 2 qt. each (See Note 5) — CG 6

Serviced From Driver's Compartment

Steering Brake Lever Shafts (Lubricate 6 points each side)	OE	1
Air Cleaner Check level (See Note 1)	OE	

Serviced From Engine Compartment

Fan Propeller Shaft Slip Joint	CG	1
Crankcase Fill and Level Check level (See Notes 2 & 3)	OE	
Transmission Fill and Level Check level	OE	¼
Crankcase Ventilator Air Cleaner Check level (See Note 1)	OE	
Fan Propeller Shaft Slip Joint	CG	1
Water Pump	CG	1

Serviced From Gun Platform

J, Fig 32	***Traversing Worm Gear Case Level*** Check level		M	
K, Fig 32	**Traversing Worm Gear Case Fill** (See Note 12)		PL	
L, Fig 32	**Traversing Pinion Bearing**	OG	M	
H, Fig 32	**Traversing Arc and Pinion** Clean and oil	PL	W	
F, Fig 31	**Elevating Worm Gear Case Fill**		PL	
P, Fig 33	***Elevating Worm Gear Case Level*** Check level		M	
N, Fig 33	***Elevating Worm Gear Case Drain*** Drain and refill		S	
A, Fig 30	**Traversing Gear Shaft Bushing**	OG	M	
C, Fig 30	***Electric Elevating Gear Case Drain*** Drain and refill		S	
B, Fig 30	**Electric Elevating Gear Case Fill and Level** Check level	PL	M	

Interval • Lubricant

Serviced From Driver's Compartment

¼	OE	**Differential Fill and Level** Check level
6	CG	**Speedometer Cable** Remove inner flexible shaft and coat lightly with CG 0
1	OE	**Transfer Unit Shift Lever**
¼	OE	**Transfer Unit Fill and Level** Check level
6		***Transfer Unit Drain*** (To reach, remove plate on hull) Drain and refill. Cap. 4½ qt. (See Note 5)
6		***Transmission Drain*** (To reach, remove large plates on hull) Drain and refill. Cap. 15 qt. (See Note 5)
1		***Crankcase Drain*** (To reach, remove round plate on hull) Drain and refill. Cap. 8 qt. each (See Notes 2 & 3)

Serviced From Engine Compartment

1	CG	**Distributor Shaft** Turn down cup one full turn, refill as required
6		**Distributor** (See Note 4)
6	CG	**Tachometer Cable** Remove inner flexible shaft and coat lightly with CG 0
1		***Oil Filter*** (See Note 8)

Serviced From Gun Platform

W	OG	**Traversing Arc Bearing Liner**		G, Fig 32
W	OG	**Carriage Support Liner** Lubricate 8 points (See Note 12)		M, Fig 33
M	OG	**Pintle Bearings**		D, Fig 31
W	PL	**Elevating Arc and Pinion** Clean and oil		E, Fig 31
M	OG	**Belleville Spring**		
1	CG	**Winch Shaft Bearings**		
¼	PL	**Winch Gear and Pinion** Clean and oil		
1	OE	**Winch Cable** Clean and oil (See Note 9)		
1	CG	**Platform Bearing**		

NOTES AND KEY

1. AIR CLEANERS AND BREATHERS—(Oil Bath Type) After every 8 hours of operation, replenish to bead level with OE. (For temperatures above 0°F., use crankcase grade; below 0°F., use 4 parts OE 10 with 1 part diluent. Diesel fuel, if available, is preferred as diluent but gasoline may be used.) Every 1,000 miles, disassemble, wash all parts, and refill with OE as above. For desert or similar sandy soil operation, disassemble, wash all parts and refill with OE as above every 4 hours or more frequently if required. (Mesh Type) For normal operation, wash and recoil at indicated intervals with OE as above. For desert or similar sandy soil operation, disassemble, wash all parts and recoil every 100 miles.

LUBRICANTS	EXPECTED TEMPERATURES			Below −40°F., See TB ORD 1264/193
	above +32°F.	+32°F. to 0°F.	0°F. to −40°F.	
OE—OIL, engine				
Crankcase	OE 30 or N.S. 9250	OE 10 or N.S. 9110	See Note 3	
Trans., Diff. and Final Drives	OE 30 or N.S. 9250	OE 10 or N.S. 9110	OE 10 or N.S. 9110	
Other Points	OE 30 or N.S. 9250	OE 10 or N.S. 9110	PL—Special or Navy Spec. OS 1361	
PL—OIL, lubricating, preservative Artillery and Small Arms	PL—Medium or Navy Spec. OS 1363	PL—Medium or Navy Spec. OS 1363	PL—Special or Navy Spec. OS 1361	
OG—GREASE, O.D.	OG 0 or Navy Spec. OS 1350	OG 00	OG 00	
CG—GREASE, general purpose	CG 1 or Navy Spec. 14L9	CG 0	CG 0	

LUBRICANTS	INTERVALS
RS—OIL, recoil, special	W—Weekly
GM—GREASE, special, high temperature	M—Monthly
CR—CLEANER, rifle bore	S—Semiannually (6 months)
WB—GREASE, general purpose, No. 2	¼—250 Miles
CW—LUBRICANT, chain, exposed gear and wire rope	1—1,000 Miles
	6—6,000 Miles

NOTE:

Wherever "**OG**—GREASE, Lubr Ord Dept" or "**CG**—GREASE, Lubr general purpose" are specified in LO 9-744, dated 15 March 1948, substitute "**GAA**—GREASE, automotive and artillery"

Wherever "**RS**—OIL, recoil, special" is specified in the Lubrication Order, substitute "**OH-A**—OIL, hydraulic, petroleum base"

The following KEY is substituted for the KEY included in the Lubrication Order

— KEY —

LUBRICANTS	EXPECTED TEMPERATURES			LUBRICANTS	INTERVALS
OE—OIL, engine **OES**—OIL, engine, sub-zero	above +32° F	+40° to −10° F	0° F to −65° F	**GAA**—GREASE, automotive and artillery	**D**—Daily **W**—Weekly **M**—Monthly **Q**—Quarterly **S**—Semiannually **1/4**—250 miles **1**—1,000 miles
Main engine crankcase	**OE** 50 or N.S. 9500	**OE** 10 or N.S. 9110	**OES**		
Final Drives	**OE** 50 or N.S. 9500	**OE** 10 or N.S. 9110	**OES**	**OHA**—OIL, hydraulic, Petroleum base, sub-zero	
Transmission	**OE** 10 or N.S. 9110	**OE** 10 or N.S. 9110	**OES**		
Auxiliary engine crankcase	**OE** 30 or N.S. 9250	**OE** 10 or N.S. 9110	**OES**	**CR**—CLEANER, rifle bore	
PL—OIL, lubr	**PL**—Medium	**PL**—Special	**PL**—Special		

RA PD 144021A

Figure 28. Lubrication order 9–744—155-mm howitzer mount M14.

Lubricant • Interval

SUSPENSION SYSTEM

Interval • Lubricant

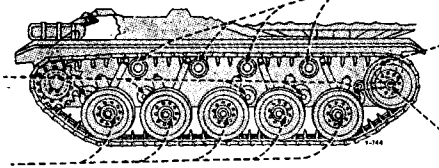
Torsion Arms CG 1/4

Track Wheels CG 1/4

1/4 CG Track Idlers

1/4 CG Support Arm

1/4 CG Compensating Wheel



HOWITZER, 155-mm, M1 — MOUNT, HOWITZER, 155-mm, M4

Lubricant • Interval

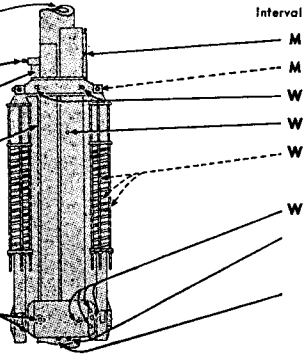
Howitzer Bore (See Note 6) PL W

C, Fig 34 → **Recoil Mechanism Replenisher** RS
Fill and drain. Cap. 33 pt.

A, Fig 34 → **Exposed Recoil Slide** OG W
Weekly and before firing, clean and coat

E, Fig 34 → ***Recoil Mechanism Replenisher Level***
Check daily and before firing

P, X, Fig 34 → **Cradle Liner** OG W



Interval • Lubricant

M OG **Variable Recoil Control** → K, Fig 34

M OG **Equilibrator End Bearing** → D, J, Fig 34

W OG **Cradle Liner** → B, H, Fig 34

W OG **Keyway** → G, Fig 34

W PL **Equilibrator Springs, Rods and Tubes** → F, Fig 34
Clean and oil

W OG **Cradle Liner** → N, P, X, Fig 34

RS **Recuperator and Counterrecoil** → L, Fig 34
Fill and drain valve. Cap. 16 pt.

Recuperator and Counterrecoil Oil Index → M, Fig 34
Check daily and before firing

FOLD

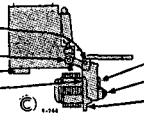
FOLD

R, Fig 34 — Breechblock Crankshaft Journal — PL W

Q, Fig 34 — Breechblock Hinge Pin — PL W

U, Fig 34 — Breechblock Rotating Cam — PL W

V, Fig 34 — Obturator Spindle — PL W



W PL Safety Latch — T, Fig 34

W PL Firing Mechanism (See Note 7) — S, Fig 34

W PL Breechblock Rotating Roller — W, Fig 34

2. CRANKCASES—Every 8 hours of operation, check level; add oil if necessary. *Drain only after operation.* Refill to FULL mark. Run engine a few minutes, recheck level.
3. ENGINE OIL BELOW 0°F.—If equipment such as winterization kit, stove kit or heated storage is available, use OE 10 undiluted. If dilution is required, gasoline or Diesel fuel may be used but gasoline, if available, must be used. Therefore, fill oil reservoir with OE 10 to normal FULL mark on dipstick. Add diluent to oil reservoir in ratio of 1½ qt. to each 5 qt. of reservoir capacity —approximately 2¼ qt. diluent to each engine. Run engines 5 to 10 minutes to mix the lubricant and diluent thoroughly. Stop engine and note the level of the diluted oil above the normal FULL mark on gage or stick. Mark level for future reference. Under operation, check oil level frequently. During operation add OE 10 if level drops below normal FULL mark. Upon shutdown of engine, add diluent to diluent FULL mark if anticipated shutdown time will be sufficient to cool engine oil.
4. DISTRIBUTOR—Every 6,000 miles, wipe breaker cam lightly with CG and lubricate breaker arm pivot and wick under rotor with 1 to 2 drops of OE.
5. GEAR CASES—Drain only after operation. (Final Drives) Fill to plug levels before operation and after draining. (Transfer Unit and Differential) Fill to level mark on gage. (Transmission) Check level immediately after engines have stopped. If vehicle has been standing, run engines for 5 minutes before checking level. To drain transmission, it is necessary to remove two drain plugs; one in the edge of the flywheel cover, and the other, marked "OIL," in the bottom of the transmission case. To reach drain plugs, remove hull floor plates under engines and flywheel covers. IMPORTANT: To fill transmissions, add 10 qt. oil, start engines and run 5 minutes to allow fluid couplings to fill. Then add oil to bring level to FULL mark.
6. ARMAMENT—After firing, and on 2 consecutive days thereafter, thoroughly clean the armament bore with CR, making sure that all surfaces including the rifling are well coated. Do not wipe dry. On the third day after firing, clean the bore with CR, wipe dry and lightly coat with PL. Weekly, thereafter, clean with CR, wipe dry, and recoil with PL. Clean all other exterior armament parts with CR before lubricating with PL. In humid and salt air areas, use PL Medium daily on external surfaces of armament.
7. BREECH AND FIRING MECHANISM—Immediately after firing, and on 3 consecutive days thereafter, disassemble the gas check pad from the obturator spindle and clean all parts of the breech and firing mechanism with CR. Wipe dry and lubricate with PL. Wipe the gas check pad with a dry cloth. Never use cleaner or lubricant on gas check. Weekly, during inactive periods, disassemble and clean all parts with CR. Wipe dry, recoil and reassemble. Wipe the gas check pad with a dry cloth.
8. OIL FILTERS—While crankcases are being drained, remove elements, clean inside of cases and install new elements.
9. WINCH CABLE—After each use, clean and oil with OE. Semiannually, if cable is not generally used, unwind entire cable, and coat, by means of a brush with PL Special. Wipe off excess and coat cable with CW. Coat winch drum also with CW before rewinding cable on drum.
10. OIL CAN POINTS—Weekly, lubricate Steering Brake Rod Clevises and Pins, Throttle Linkage, Cable Sheaves, Hinges and Latches, Elevating and Traversing Shaft Universal Joints, and Clevises with PL.
11. DO NOT LUBRICATE—Generators, Elevating Gear Drive Electric Motor.
12. DISASSEMBLED FOR LUBRICATION BY ORDNANCE PERSONNEL—Disassemble and lubricate at intervals with lubricants shown in parenthesis. Starter (Semiannually—GM), *Final Drive Universal Joints (Semiannually—CG), Propeller* Shaft and Fan Drive Universal Joints (Semiannually—CG), Cradle Trunnion Bearings (Semiannually—WB); Equilibrator End Bearings (Semiannually—OG), Carriage Support Liner (Semiannually—OG), Elevating Shaft Bearings (Semiannually—CG), Variable Recoil Gears (Semiannually—CG); Traversing Worm Gear Case and Elevating Worm Gear Case (Semiannually—PL), Hand Elevating and Traversing Gear Cases (Semiannually—OG), Electric Elevating Gear Case (Semiannually—PL).

Copy of this Lubrication Order will remain with the equipment at all times; instructions contained herein are mandatory and supersede all conflicting lubrication instructions dated prior to the date of this Lubrication Order.

BY ORDER OF THE SECRETARY OF THE ARMY:
OMAR N. BRADLEY
Chief of Staff, United States Army

OFFICIAL:
EDWARD F. WITSELL,
Major General,
The Adjutant General.

LO 9-744

DISTRIBUTION: Army Tech Sv (2); Arm & Sv Bd (1); AGF (2); OS Maj Comd (10); Base Comd (5); MDW (3); A (ZI) (18), (Overseas) (3); CHQ (2); D (2); R 9 (1); Bn 9 (1); C 9 (1); FC (1); Class II Instls 9 (3) except Curtis Bay Sub Dep (0); USMA (2); Sch (5); Gen Dep (Ord Sec) (2); Tng Ctr (2); PE (Ord O) (5); Dist 9 (3); T/O & E 6-125 (1); 6-127 (1); 6-129 (1); SPECIAL DISTRIBUTION. Air Force USAF (5); USAF Maj Comd (2).

RA PD 144022

Figure 29. Lubrication order 9-744—155-mm howitzer M1 and 155-mm howitzer mount M14.

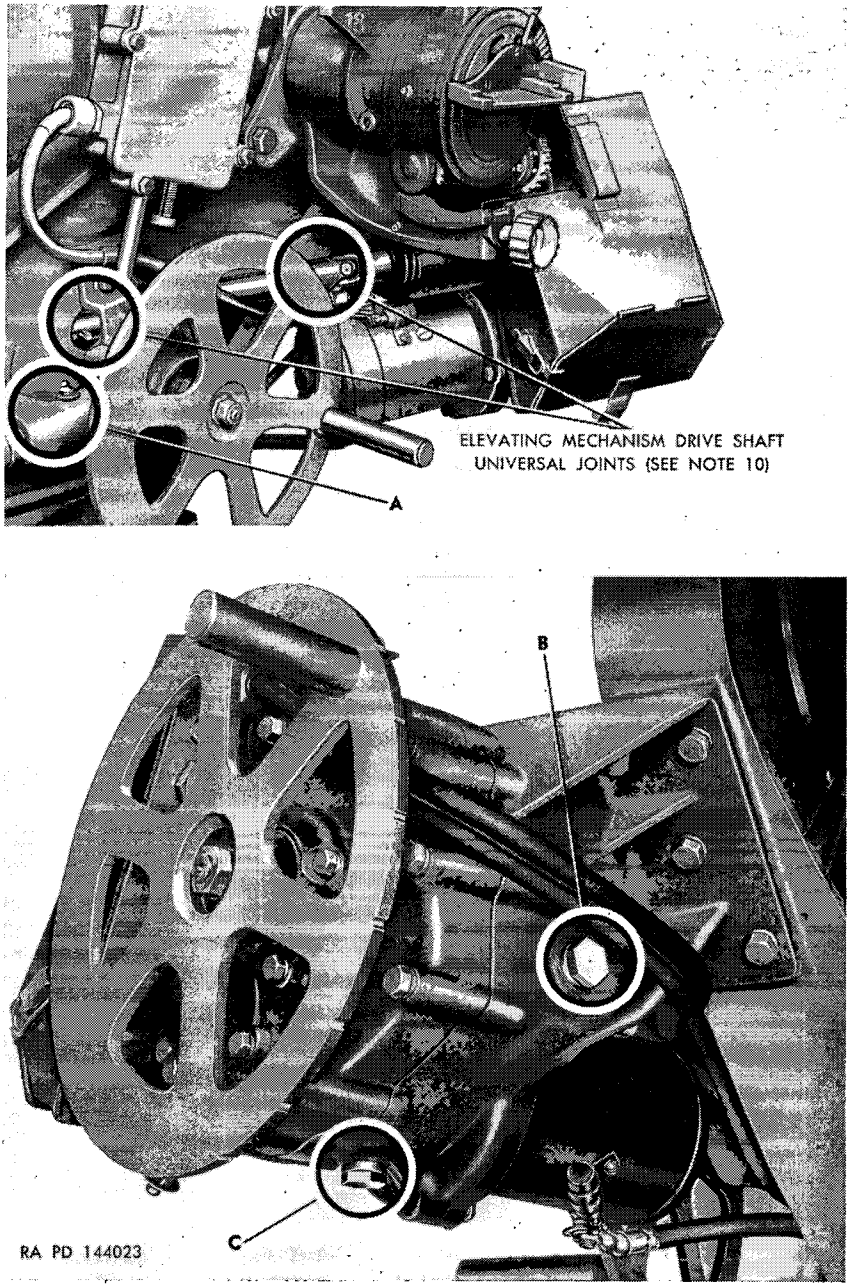


Figure 30. Localized lubrication points—155-mm howitzer mount M14.

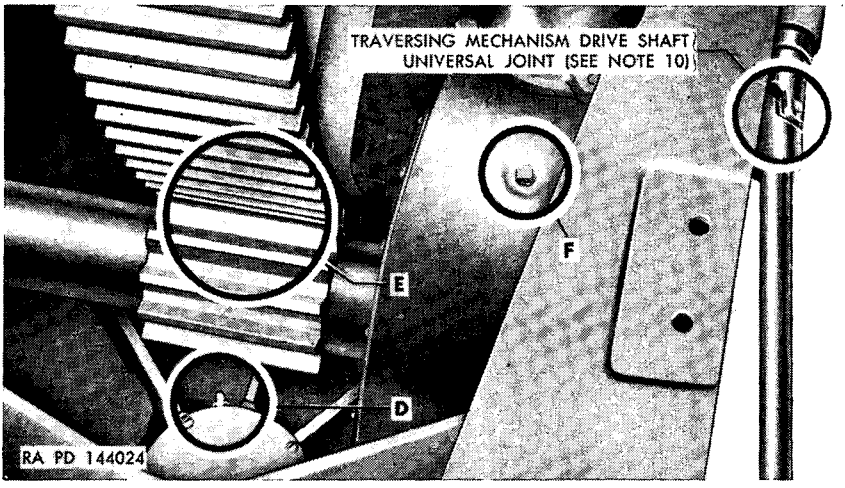


Figure 31. Localized lubrication points—155-mm howitzer mount M14—top carriage well.

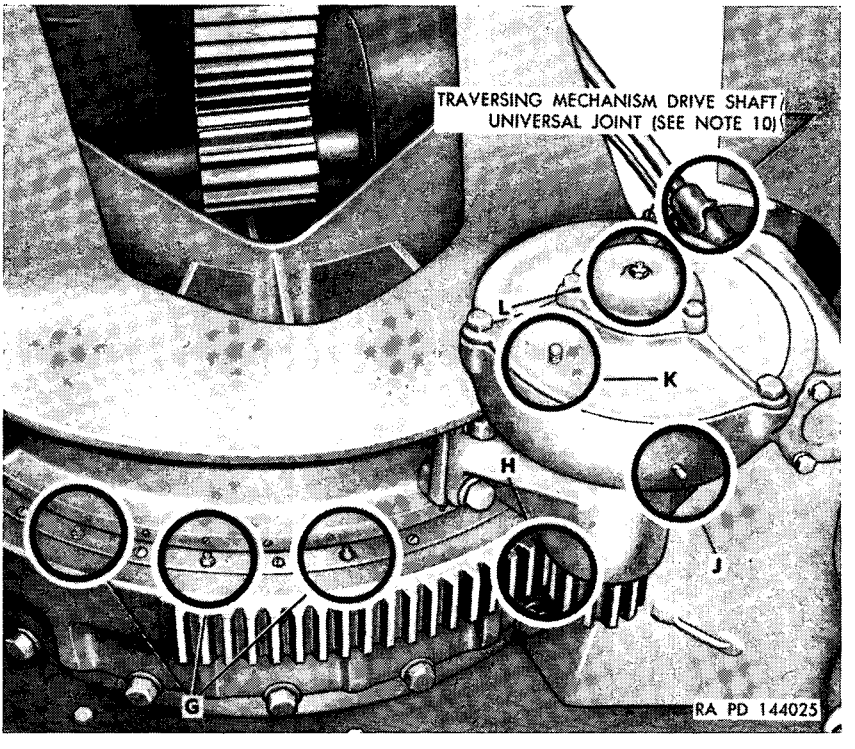


Figure 32. Localized lubrication points—155-mm howitzer mount M14.

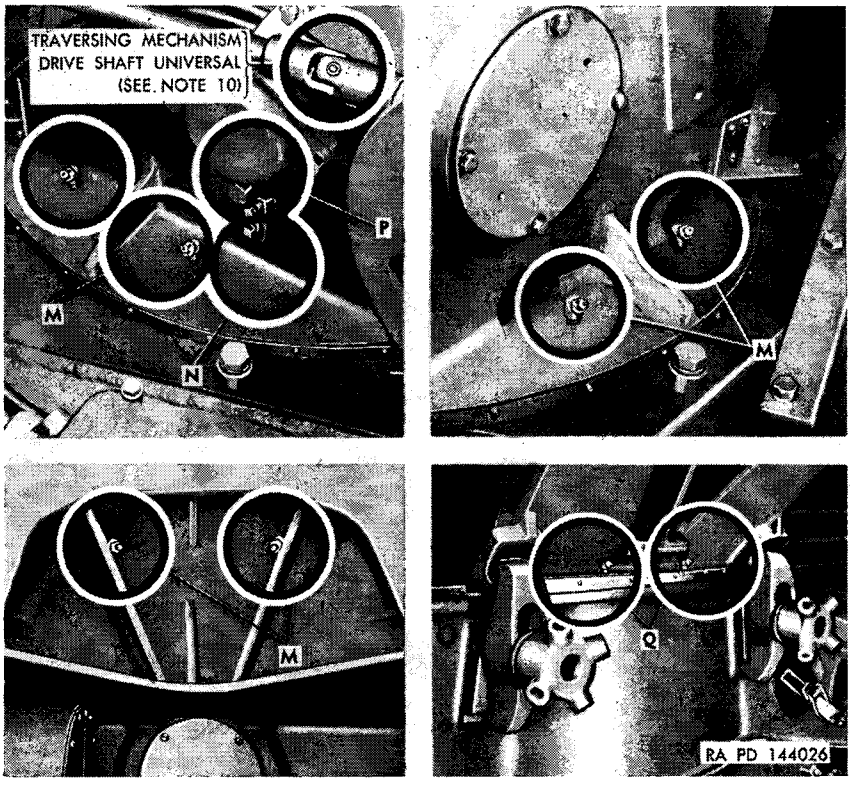


Figure 33. Localized lubrication points—155-mm howitzer mount M14.

operations or conditions may cause contamination and quickly destroy the protective properties of the lubricant. Intervals may be extended during inactive periods to the intervals required for adequate preservation.

b. Changing Grade of Lubricant. Lubricants are prescribed in the "KEY" in accordance with three temperature ranges; above +32° F., +40° F. to −10° F., and 0° F. to −65° F. Change the grade of lubricants whenever weather forecast data indicate that air temperatures will be consistently in the next higher or lower temperature range or when sluggish operation caused by thickening lubricant occurs. Normally, no change in grade will be made when a temporary change in temperature is encountered. However, if the operation of the matériel is encumbered by a drop in temperature, a change in grade of lubricant will be made to restore normal operation even if the drop in temperature is expected to be only temporary.

Note.—A record of changes in grade of lubricants and recoil fluids will be recorded in the artillery gun book (par. 3).

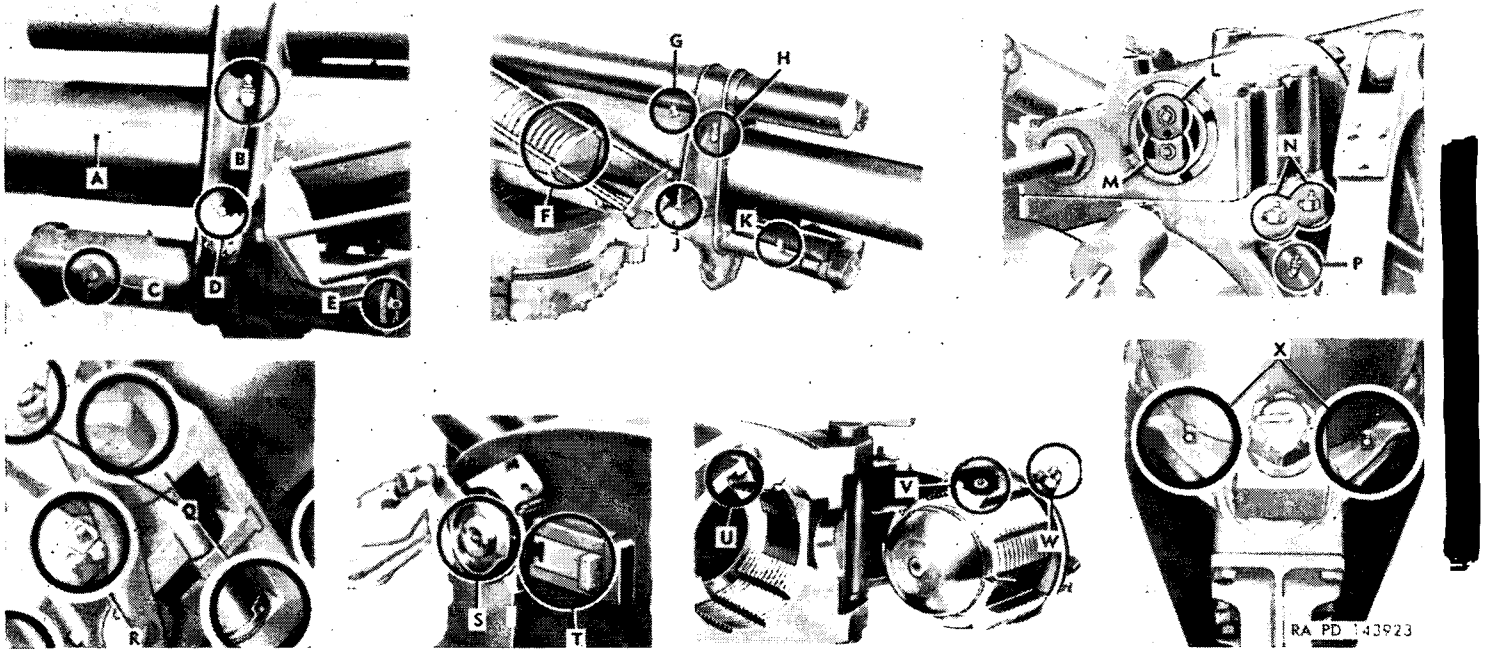


Figure 34. Localized lubrication points—howitzer and recoil mechanism.

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c. Extreme-Cold Weather Lubrication.

(1) In cold weather, apply lubricant sparingly and reduce lubrication intervals by one-half. Sighting and fire control equipment is normally lubricated for operation over a wide range of temperatures. This matériel should be exercised frequently during periods of low temperature to insure proper functioning. If any equipment does not function properly, notify ordnance maintenance personnel. Precautions to be observed and procedure when bringing sighting and fire control equipment indoors during freezing weather are prescribed in paragraph 33*e*.

(2) It is extremely important that all components (particularly antifriction bearings) be cleaned and washed thoroughly to remove all traces of previously used lubricants. Volatile mineral spirits or dry-cleaning solvents are suitable for cleaning. Disassembly is justified in order that all components are properly cleaned before lubricating. The proper lubricant is specified in the lubrication order (par. 43).

d. Extreme-Hot Weather Lubrication. Special lubricants will not ordinarily be required at extremely high temperatures, as lubricants prescribed for temperatures above 32° F. provide adequate protection. However, more frequent servicing than specified for usual conditions, in table III, paragraph 52 and table IV, paragraph 53, is necessary because the heat tends to dissipate the lubricants.

e. Lubrication For Humid- and Salt-Air Conditions. High humidity, moisture, or salt air tend to contaminate the lubricant, necessitating more frequent service than specified for usual conditions in table III, paragraph 52 and table IV, paragraph 53.

f. After-Fording Lubrication. After any fording operation, perform the maintenance described in paragraph 81, which covers maintenance operations after fording and includes special lubricating instructions.

g. Lubrication After Operation Under Dusty or Sandy Conditions. If firing or prolonged travel has occurred under dusty or sandy conditions, clean and inspect all points of lubrication for fouled lubricants. Lubricate as necessary.

Note.—A lubricant which is fouled by dust and sand makes an abrasive mixture that causes rapid wear of parts.

46. Painting

a. Instructions for the preparation of the matériel for painting, methods of painting, and materials to be used are contained in TM 9–2851. Camouflage painting information is contained in FM 5–20D.

[redacted]

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b. Do not paint over name plates or serial numbers or working surfaces which are lubricated in accordance with the lubrication order. Name plates will be kept coated with clear lacquer; if they have become rusty or corroded, they will first be carefully cleaned.

c. Sighting and fire control instruments will not be painted by the using organizations.

d. Materials for painting, prescribed for use by organizational personnel, are listed in ORD 7 SNL G–236.

Section III. PREVENTIVE MAINTENANCE SERVICES

47. General

a. Responsibility and Intervals. Preventive maintenance services are the responsibility of the using organization. Schedules of these services, which are to be performed by organizational mechanics and organizational crews at specified intervals, are included in this section. This section contains important general preventive maintenance procedure applying to the weapon as a whole and specific preventive maintenance of the various mechanisms and components of the weapon. Special maintenance procedure is referenced into the section pertaining to the mechanism where the procedure is covered in detail.

b. Definition of Terms. The general inspection of each item applies also to any supporting member or connection and is generally a check to see whether the item is in good condition, correctly assembled, secure, and not excessively worn.

(1) The inspection for "good condition" is usually an external visual inspection to determine whether the unit is damaged beyond safe or serviceable limits. The term "good condition" is explained further by the following: not bent or twisted, not chafed or burned, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, not deteriorated.

(2) The inspection of a unit to see that it is "correctly assembled" is usually an external visual inspection to see if it is in its normal assembled position on the weapon.

(3) Inspection of a unit to determine if it is "secure" is usually an external visual examination or a check by hand, wrench, or pry-bar for looseness. Such an inspection must include any brackets, lock washers, lock nuts, locking wires, or cotter pins used.

(4) By "excessively worn" is meant, worn beyond serviceable limits or to a point likely to result in failure in the immediate future.

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48. Cleaning and Care

a. General. Any special cleaning instructions required for specific mechanisms or parts are contained in the pertinent section. Procedure for cleaning the howitzer is outlined in paragraphs 50 and 51. General cleaning instructions are as follows:

b. Cleaning Instructions.

(1) *Powder-fouled parts.* Use rifle-bore cleaner to clean all parts which have been exposed to powder fouling during firing.

Note.—Rifle-bore cleaner is neither a lubricant nor a preservative. Parts which require lubrication or preservation will be wiped dry and oiled.

Do not use dry-cleaning solvent or volatile mineral spirits because these solvents will not readily dissolve the corrosive salts from powder and primer compositions.

(2) *General usage.* Use volatile mineral spirits or dry-cleaning solvent to clean or wash grease or oil from all parts of the howitzer and carriage.

(3) *Heavy accumulations.* Parts such as gear sectors or chassis, new matérial, matériel or component parts received from storage for immediate use may have heavy accumulations of grease or coatings of rust-preventive compound which may be protected by a tape covering. After removing the tape covering, the rust-preventive compound may be partly removed by scraping with sticks or other articles which will not damage parts. Remove the residue with waste, wiping cloths, or a brush saturated with volatile mineral spirits, dry-cleaning solvent, or with one part of grease-cleaning compound to four parts of dry-cleaning solvent or volatile mineral spirits. After cleaning, rinse off any remaining compound with cold water. The use of high pressure water, steam, or air for cleaning the weapon is prohibited. Dry and lubricate as specified in lubrication order (par. 43). Apply preservative lubricating oil to all nonpainted metal surfaces (other than optical instruments) to prevent rusting. Some new parts such as oil seals, etc., may require preparation prior to lubrication.

(4) *Optical surfaces.*

(*a*) To remove dust from lenses and windows, brush the glass lightly with a clean artist's camel's-hair brush, and rap the brush handle against a hard body to knock out the small particles. Repeat this operation until all dust is re-

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moved. Exercise particular care to keep optical parts free from oil and grease.

(*b*) To remove oil or grease from optical surfaces, apply liquid lens cleaning soap with a tuft of lens tissue paper and wipe gently with clean lens tissue paper. Under no circumstances will polishing liquids, pastes, or abrasives be used for polishing lenses and windows. Use only clean lens tissue paper for cleaning optical glass. Use of cleaning cloths is not permitted. If liquid soap is not available and if the temperature of the surrounding air is above 32° F., breathe heavily on the glass and wipe off with clean lens tissue paper. Repeat this operation until clean. The use of cleaning cloths is not permitted.

(*c*) If lenses become fogged, dry the instrument as prescribed in paragraph 84*c*(4).

(*d*) In cold weather, optical surfaces should be cleaned with lens tissue paper moistened with alcohol. If alcohol is not available, use dry lens tissue paper. Drops of alcohol should never be applied to the lens surfaces as any excess may injure the sealing compound. Do not breathe on the glass, since this would ice the surface.

c. General Precautions in Cleaning.

(1) Dry-cleaning solvent or volatile mineral spirits are inflammable and should not be used near an open flame. Fire extinguishers should be provided when these materials are used.

(2) Avoid getting petroleum products, such as dry-cleaning solvent or volatile mineral spirits or lubricants on rubber parts, as they will attack the rubber and destroy its characteristics.

(3) The use of Diesel fuel oil, gasoline, or benzene (benzol) for cleaning or the use of high pressure water, steam, or air for cleaning the weapon is prohibited.

(4) Under no circumstances will water, steam, or air from a hose be used in cleaning sighting equipment, fire control instruments, and portions of the mount. Before washing, take off removable sighting equipment from matériel to be cleaned.

(5) Under no circumstances will polishing liquids, pastes, or abrasives be used for polishing lenses and windows.

(6) In drying cleaned optical parts, heat from strongly concentrated sources should not be applied directly, as it may cause unequal expansion of parts, thereby resulting in damage to optical parts and inaccuracies of observation.

(7) In extreme cold, do not dilute rifle-bore cleaner. Do not add antifreeze. Store cleaners in a warm place if practical. Shake rifle-bore cleaner well before using.

d. Care in Handling Sighting and Fire Control Equipment.

(1) Sighting and fire control instruments are, in general, suitably designed for functional purposes. They will not, however, stand rough handling or abuse. Inaccuracy or malfunctioning will result from mistreatment.

(2) Any instrument which cannot be adjusted or corrected by the authorized procedure must be brought to the attention of ordnance maintenance personnel for necessary repairs. Adjustments other than those expressly authorized will not be performed by organizational maintenance personnel.

(3) Unnecessary turning of screws or other parts not incident to the use of the instruments is forbidden.

(4) Stops are provided on instruments to limit the travel of the moving parts. Do not attempt to force the rotation of any knob beyond the stop limit.

(5) Keep the instruments as clean and dry as possible. If an instrument is wet, dry it carefully before placing it in its carrying case.

(6) When not in use, keep the equipment covered and protected from dust and moisture, and keep the sights and telescopes in the cases which are provided.

(7) Care will be exercised when repainting sighting and fire control instruments to prevent paint from covering scales, lenses, bearing surfaces, telescope seats, etc. in order to maintain these and like surfaces in an efficient working condition; to this end, it may frequently be necessary to resort to masking techniques.

(8) Do not point any optical instrument directly at the sun unless a filter is used, as the heat of the focused rays may damage optical parts.

(9) Protect testing targets against dampness to prevent shrinkage.

(10) Keep the exposed surfaces of lenses and other parts clean and dry to prevent corrosion and etching of the surface of the glass.

e. Care of Canvas. To prevent formation of damaging mildew, shake out and air the canvas cover for several hours at frequent intervals. Repair without delay any loose grommets or rips in the canvas. Failure to make immediate repairs may allow a minor defect to develop into major damage. Mildewed canvas is best cleaned by

scrubbing with a dry brush. If water is necessary to remove dirt, it must not be used until mildew has been removed. If mildew was present, examine fabric carefully for evidence of rotting or weakening of fabric by stretching and pulling. If fabric shows indication of loss of tensile strength, it is probably not worth retreatment. If not damaged, retreat the canvas. Oil and grease can be removed by scrubbing with issue soap and warm water. Rinse well with clear water and dry.

Caution: At no time is gasoline or any solvent to be used to remove oil or grease spots from canvas.

Wet canvas should be dried thoroughly before folding.

f. Cleaning Under Unusual Climatic Conditions.

(1) Do *not* dilute rifle-bore cleaner or add an antifreeze.

(2) Store cleaners in a warm place, if practical. Shake rifle-bore cleaner well before using.

49. Basic Preventive Maintenance

Inspect and service the weapon as described in paragraphs 8 and 9 at least once every 6 months and after any extended travel, as the tactical situation permits.

a. Rust, dirt, grit, gummed oil, and water cause rapid deterioration of all parts of the weapon. Particular care should be taken to keep all bearing surfaces and exposed unpainted parts clean and properly lubricated. Wiping cloths, rifle-bore cleaner, dry-cleaning solvent or volatile mineral spirits, and lubricants are furnished for this purpose. Remove all traces of rust from finished surfaces with crocus cloth, which is the coarsest abrasive to be used by organizational personnel for this purpose. A coarser abrasive may be used on unfinished parts. Take care not to change the shape or dimensions of any part so that functioning will not be affected. Apply preservative lubricating oil with wiping cloth or paint surface as applicable.

b. Retouch painted surfaces as required to cover nicks, scratches, and worn spots that expose bare metal (par. 46). Complete repainting is not necessary.

c. Tighten loose parts, as necessary.

d. Each time a howitzer is disassembled for cleaning or repair, carefully inspect all parts for cracks, excessive wear, rust, and like defects which might cause malfunction of the howitzer. Refer to paragraphs 54–58 for information on trouble shooting. Certain parts which when worn, damaged, or improperly adjusted cause definite malfunctions. Thoroughly clean and properly lubricate all parts before assembly.

e. Use only tools that are provided and see that they fit properly. Tools that do not fit will fail and may cause damage to parts.

f. At least every 6 months, check the record in the gun book to see that all modification work orders have been applied. A list of current modification work orders is published in SR 310–20–4. If a modification has not been applied, the local armament officer will be notified promptly. No alteration or modification will be made by organizational personnel, except as authorized by official publications.

g. When the matériel is not in use, install the proper covers.

h. When a canvas or other type cover is used during periods of inactivity, moisture may form on metal surfaces by condensation. To prevent rusting, remove the covers at least weekly, and dry all surfaces thoroughly. Coat unpainted surfaces with the prescribed lubricant.

i. In cold weather, apply lubricant sparingly (par. 45*c*).

j. The surfaces of the leveling plates on the top of the howitzer breech ring should be protected from injury at all times. If these surfaces become damaged, necessary repairs must be made by ordnance maintenance personnel.

k. The recoil mechanism will normally be exercised by firing the howitzer. If the howitzer has not been fired for a period exceeding 9 months, notify ordnance maintenance personnel.

l. Promptly report unsatisfactory performance to the ordnance officer responsible for maintenance in accordance with AR 750–5 if correction is beyond the scope of organizational maintenance.

50. Howitzer Cleaning Procedure

a. This cleaning procedure should be followed at intervals specified by the officer in charge. The interval will be dependent upon atmospheric, traveling, or other conditions.

b. Lower the howitzer to 0° elevation and open the breech. Assemble the staff-section 5555199 or 7157648 (figs. 18 and 24), and attach the cleaning and unloading rammer M7—5557112 (fig. 24 and table I, par. 42). Wrap the rammer with pieces of burlap soaked in rifle-bore cleaner. With four or five men on the staff-section, work the rammer through the bore from the breech end, using a pushing and pulling action. Use bore brush M13B1—7230870 (figs. 24 and 35) after enough cleaner has been introduced. A man posted at the muzzle of the howitzer can indicate the progress of the rammer of bore brush in the bore and prevent its slipping from the muzzle. Inspect bore to be sure burlap which may be caught on a raised or stripped land is not left in the bore.

c. To clean the breech recess and powder chamber, use the cleaning and unloading rammer M7—5557112 on a single section of the staff-

section. Wrap the rammer with burlap soaked in the rifle-bore cleaner. Use one staff-section or an axe handle as a lever to hold the swab against the sides of the chamber. Pressure must be applied to clean thoroughly.

d. To dry the bore and breech recess, follow the same procedure as for cleaning, using the same accessories and method, but using dry instead of wet burlap.

e. If it has not already been done, the bore brush 7230870 or 5573734 (figs. 24 and 35 and Table I, par. 42) should be modified to improve the cleaning characteristics and lengthen service life as follows:

(1) Remove the six hex nuts, lock washers, and hex-head cap screws which secure the holding ring to the bore brush body, and dismount the holding ring from the brush body (fig. 35); then remove wire brush from the brush body.

(2) Separate the coils of the brush. Then use a pair of tinsmith shears to trim the bristles level with the steel channel on two full coils (one on each side of the middle coil) of the brush.

Note.—Do not cut or damage the steel channel.

(3) Assemble the wire brush to the brush body, and install the holding ring. Secure the holding ring in position with the six hex nuts, lock washers, and hex-head cap screws.

f. To oil the bore, assemble the bore brush 7230870 or 5573734 (figs. 24 and 35) to the staff-section 5555199 or 7157648 (figs. 18 and 24). Place the bore brush over a bucket to catch the oil that drips from the brush, and apply preservative lubricating oil (seasonal grade) to the bore brush with a paint brush. Apply a light coating of oil to the bore by working the brush through the bore as in *b* above.

51. Cleaning Howitzer After Firing

a. The bore and breech recess should be cleaned as soon as possible after firing to remove all powder fouling and all traces of residue and primer salts, and on subsequent days to remove all evidence of sweating. A clean bore has a uniform gray appearance; do not attempt to obtain a bright polished finish. Do not try to remove copper fouling.

b. After firing, when the tube has cooled sufficiently to touch with the bare hand, and on three consecutive days thereafter, clean with undiluted rifle-bore cleaner. Scrub all surfaces with a push-pull action from one end of the bore to the other (par. 50*b*). Make sure that all surfaces, including the rifling, are well coated. Do not wipe dry. On the third day after firing (a total of four cleanings), clean the bore and breech recess again with rifle-bore cleaner. If the

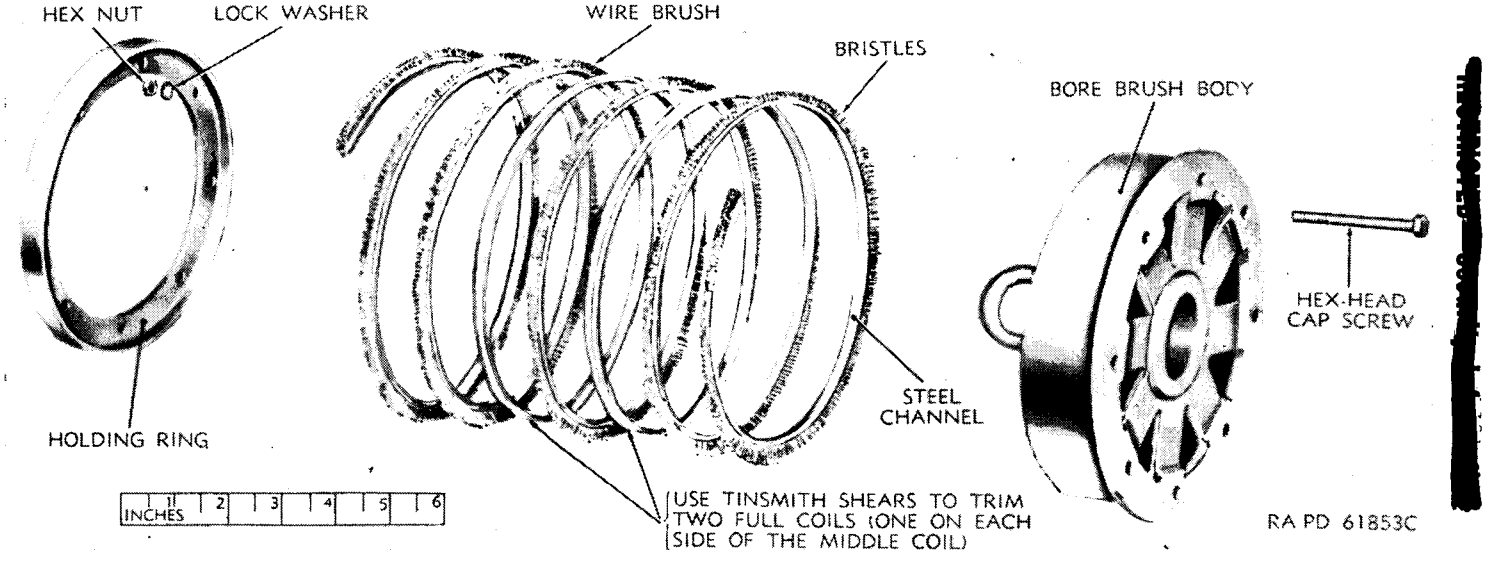

Figure 35. Modified bore brush—7230870 or 5573734.

weapon is to be fired within the next 48 hours, do not wipe dry; but if it will not be fired within that time, wipe dry and coat the bore with the prescribed oil (par. 50).

c. Rifle-bore cleaner does not inhibit rusting and daily cleaning of the bore is necessary when rifle-bore cleaner is left in the bore. The use of the prescribed preservative lubricating oil (par. 50) avoids the need of daily cleaning (except when sweating of the tube occurs). Weekly, clean the bore and breech recess with rifle-bore cleaner, wipe dry, and apply the prescribed preservative lubricating oil.

d. If sweating of the tube persists beyond the normal cleaning cycle of three days after firing, the tube will continue to be cleaned daily until all sweating stops.

52. Preventive Maintenance by the Operators (Gun Crew)

a. Promptly report unsatisfactory performance to the ordnance officer responsible for maintenance in accordance with AR 750–5, if correction is beyond the scope of organizational maintenance.

b. The preventive maintenance services (table III) include information on maintenance covering both usual (mild) and unusual (severe) conditions, for which the crew is responsible. The nature of the inspection and maintenance operations is outlined and reference is made to the actual detailed procedure, which appears elsewhere in the manual. The weekly intervals prescribed for usual conditions may be extended when the matériel is not in use.

Table III.—Operators Preventive Maintenance Services

Intervals						Procedure
Before-traveling	Before-firing	During-firing	After-firing	Weekly	Monthly	
						USUAL CONDITIONS
----	X	----	----	----	----	*Barrel assembly.* Dry all surfaces of the bore and chamber (par. 26*c*).
----	----	----	X	----	----	Clean bore and chamber after firing and daily for 3 days and oil as prescribed (par. 51*b*).
----	----	----	----	X	----	Examine bore and chamber for evidence of powder fouling or corrosion. Clean and oil (par. 50).
X	----	----	----	----	----	Check that percussion hammer is locked in upright position (par. 31*a*).
----	----	----	----	X	----	Examine threads, bearing surfaces of the breechblock or breech ring, and all recesses for scoring or other mutilation (par. 60*d*).

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Table III.—Operators Preventive Maintenance Services—Continued

Intervals						Procedure
Before-traveling	Before-firing	During-firing	After-firing	Weekly	Monthly	
						USUAL CONDITIONS—Continued
----	X	X	X	X	----	Clean and lubricate exterior of howitzer tube (par. 60*e*).
X	----	----	----	----	----	Check that muzzle and breech covers are installed and travel locks engaged (par. 31).
----	----	----	----	X	----	*Firing mechanism.* Check for proper functioning.
----	----	----	X	X	----	Clean and oil (par. 69*a*).
----	X	----	----	X	----	Check functioning of firing mechanism locking plunger (par. 69*c*).
----	X	----	----	----	----	*Breech mechanism.* Clean primer seat and vent (par. 26*c*).
----	----	----	X	X	----	Clean and lubricate obturating parts (par. 64*b*).
----	----	----	X	X	----	Disassemble, clean, and oil. Examine for evidence of corrosion or other damage (par. 64*a*).
----	----	----	----	X	----	Check primer seat in obturator plug (par. 64*b* (3)).
----	----	----	----	X	----	Test head space adjustment (par. 64*c*).
----	----	----	----	X	----	Lubricate breechlock hinge pin, rotating cam, crankshaft journal, and firing mechanism safety latch (par. 43).
----	X	----	----	X	----	*Recoil mechanism.* Check replenisher oil reserve (par. 26*a*).
----	X	----	----	X	----	Check recuperator cylinder oil reserve (par. 26*b*).
----	----	----	----	----	X	Exercise replenisher piston (par. 72*e*).
----	----	----	----	X	----	Lubricate yoke and cradle liners and howitzer recoil keyway (par. 43).
----	----	----	----	----	X	Lubricate variable recoil control—sparingly apply lubricant to fitting on variable recoil cam housing (par. 43).
----	X	X	----	X	----	Check for oil leakage (pars. 26*c* and 57*a*, *i*, *k*, and *l*).
----	----	X	----	----	----	Check for smooth operation, length of recoil, and return to battery without shock (par. 29).
----	----	----	----	X	----	Keep air holes open in replenisher piston guide (par. 72*a* (2)).
----	X	----	X	X	----	*Traversing mechanism.* Clean and oil pinion and arc (par. 76*b* and *c*).
----	----	----	----	----	X	Check level of lubricant in traversing worm gear case (par. 76*e*).
----	X	----	----	X	----	Check for smoothness of operation throughout entire sweep.
----	----	----	----	----	X	Lubricate traversing gear shaft bushing, pinion bearing, and pintle bushing (par. 43).

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Table III.—Operators Preventive Maintenance Services—Continued

Intervals						Procedure
Before-traveling	Before-firing	During-firing	After-firing	Weekly	Monthly	
						USUAL CONDITIONS—Continued
----	----	----	----	X	----	Check handwheel backlash (par. 76*a*).
----	----	----	----	X	----	*Equilibrator.* Clean and lubricate springs, rods, and tubes (par. 78*c*).
----	----	----	----	----	X	Lubricate equilibrator end bushing (par. 43).
----	----	----	----	X	----	Test adjustment (par. 78*a*).
----	X	----	X	X	----	*Elevating mechanism.* Clean and oil arc and pinion (par. 76*b* and *c*).
----	----	----	----	----	X	Check level of lubricant in elevating worm gear case (par. 76*e*).
----	X	----	----	X	----	Check for smoothness of operation throughout entire range.
----	----	----	----	X	----	Check handwheel backlash (par. 76*a*).
----	----	----	----	X	----	*Mount.* Check for cleanliness (par. 48), proper lubrication (par. 43), and condition of paint (par. 46).
----	----	----	----	X	----	Keep the four drain holes open (par. 74).
----	----	----	----	X	----	Lubricate bottom carriage liner and traversing arc bearing liner (par. 43).
----	----	----	----	X	----	*Covers.* Check for proper installation and condition of canvas (pars. 48*e* and 49*h*).
----	----	----	----	X	----	*Oil points.* Wipe clean and oil (par. 43).
----	----	----	X	----	----	*Howitzer matériel in general.* Inspect overall and correct any deficiencies (pars. 8, 9, and 49).
X	----	----	----	X	----	Check for loose bolts or parts.
----	----	----	----	X	----	*Fuze setters.* Clean with dry-cleaning solvent or volatile mineral spirits and dry thoroughly.
----	----	----	X	----	----	On fuze setters M22 or M23, tighten all exposed screws and nuts. Report missing parts. Verify overall accuracy by comparing the indicated settings at several points with those actually set on a fuze (par. 87*c*(3)). No adjustment by the using arm is permitted, but the use of the corrector scale may be adjusted to compensate for the error.
----	----	----	X	----	----	On fuze setters M22 or M23, turn corrector and setting knobs to move the setting rings through the entire length of scale readings. If there is any binding or sticking, notify ordnance maintenance personnel.

[redacted]

Table III.—Operators Preventive Maintenance Services—Continued

Intervals						Procedure
Before-travelling	Before-firing	During-firing	After-firing	Weekly	Monthly	
						USUAL CONDITIONS—Continued
----	----	----	----	----	X	*Telescope mount M25.* Apply a few drops of light lubricating oil to the cross-leveling knob felt washer.
----	----	----	----	----	X	Clean and apply aircraft instrument lubricating grease to machined surfaces of telescope socket.
----	----	----	----	----	X	*Panoramic telescope M12A6 and M12A7G.* Clean eyeshield with soap and water, dry, and dust with talcum.
						UNUSUAL CONDITIONS
						Preventive maintenance services for usual conditions will apply, with emphasis on servicing by the gun crew to combat the effects of extreme cold (par. 33), extreme heat (par. 34), and fording (par. 38). The special services described below are required to assure optimum results under unusual conditions.
						EXTREME COLD (par. 33)
X	----	----	X	----	----	*Covers.* Keep all covers securely in place to prevent ice and snow from entering working mechanisms.
----	X	----	----	----	X	*Clean.* Remove any moisture or snow from all parts, particularly from teeth of elevating and traversing gear sector and pinion (par. 33*d*(3)).
----	----	----	----	----	X	*Lubricate.* Lubricate items *sparingly* (pars.33*c*(2) and 45*c*).
----	X	----	----	----	----	*Gerdom type gas check pad.* Inspect for exposed wire mesh (par. 33*d*(9)).
----	X	X	X	----	----	*Barrel assembly.* Inspect muzzle end of tube and breech ring for cracks (par. 33*d*(10)).
----	----	X	----	----	X	*Recoil mechanism.* Check for oil leaks (par. 72).
----	----	X	----	----	----	*Flashlight.* Keep flashlight in pocket when not in use to protect battery against freezing.
----	----	----	----	X	----	*Freezing to ground.* Prepare footing to prevent matériel from freezing to ground (par. 33*d*(6)).
----	----	----	----	----	X	*Elevating and traversing mechanism.* Exercise.

[redacted]

Table III.—Operators Preventive Maintenance Services—Continued

Intervals						Procedure
Before-traveling	Before-firing	During-firing	After-firing	Weekly	Monthly	
						EXTREME COLD—Continued
		X				*Optical lenses.* Use face mask of chamois or cloth to keep operator's breath from eyepieces and avoid fogging. Change mask frequently to prevent freezing the face (TM 9–2855).
					X	*Sighting and fire control equipment.* Clean exposed optical surfaces (par. 48*b*(4)(*d*)).
					X	Check lighting devices (par. 83*b*(3)).
			X			Improvise cloth covers. Cloth covers with draw string or elastic to keep the opening closed, are superior protection for extreme cold to the leather covers furnished, in that the cloth permits breathing and so prevents fogging and icing of the lens when temperature drops (TM 9–2855).
						EXTREME HEAT (pars. 34, 35, and 36)
						Lubricate. Lubricate items as necessary (par. 45*d*).
	X					*Barrel assembly.* Wipe dry (par. 43).
			X		X	Clean and oil bore (pars. 34 and 35*b*).
	X				X	*Recoil mechanism.* Check for proper amount of recoil fluid (par. 72).
		X				*Rate of fire.* Avoid overheating the weapon.
					X	*Canvas covers.* Inspect for mildew (par. 35*c*).
					X	*Optical instruments.* Inspect for fungus (par. 35*e*).
						SANDY CONDITIONS (par. 37)
	X					*Exterior surface of howitzer tube and recoil mechanism piston rods.* On dusty and sandy terrain, clean but do not oil (par. 37*a*).
	X					*Elevating and traversing mechanisms.* Clean but do not oil pinion and arc (par. 76*c*).
						Sand-blasted surfaces. Touch up with paint. *Note.*—Do not paint sighting and fire control equipment.
						Clean. Remove water and sludge from all parts. If fording through salt water, wash with fresh water.
						Lubricate. Lubricate as necessary (par. 45).

[redacted]

53. Preventive Maintenance by Organizational Maintenance Mechanics

a. The battery mechanic is issued the necessary tools and either performs or supervises authorized disassembly, maintenance, or adjustments.

b. Service by battery mechanic includes a systematic check to see that all crew preventive maintenance (par. 52) has been properly performed at the prescribed intervals and that the matériel is in the best possible operating condition. The services set forth in table IV are to be performed or supervised by the battery mechanic at the designated intervals in addition to any maintenance required as a result of the checks and services by the crew. The frequency of the preventive maintenance services prescribed is considered a minimum requirement for operation of the matériel under usual (mild) conditions. However, when the matériel is not in use, the intervals pre-

Table IV.—Preventive Maintenance Services by Battery Mechanic

Intervals				Procedure
Weekly	Monthly (30 days)	Quarterly (3 months)	Semiannually (6 months)	
				USUAL CONDITIONS
----	X	----	----	*Before-firing inspection.* Perform this inspection as outlined in table III (par. 52).
X	----	----	----	*Barrel assembly.* Check for unusual wear, erosion, and damage in bore (par. 60).
X	----	----	----	Check for evidence of decoppering and use of unauthorized cleaning materials and methods.
X	----	----	----	Check external surface of howitzer tube for corrosion and damage. Lubricate (par. 43).
X	----	----	----	*Breechblock and components.* Check breechblock parts for wear, burs, and mutilation. Check springs for cracks and for set by comparing free length with spare ring. Check all cranks for wear, cracks, or mutilation.
X	----	----	----	*Breech ring and components.* Check all machined surfaces of breech ring for wear, burs, or mutilation.
X	----	----	----	*Recoil mechanism.* Check for leaks.
X	----	----	----	Check oil level (par. 26*a* and *b*).
X	----	----	----	Check piston rods for scoring or mutilation.
X	----	----	----	Check piston rods for corrosion and damage. Lubricate (par. 43).
----	X	----	----	Exercise replenisher piston (par. 72*e*).

[redacted]

Table IV.—Preventive Maintenance Services by Battery Mechanic—Continued

Intervals				Procedure
Weekly	Monthly (30 days)	Quarterly (3 months)	Semiannually (6 months)	
				USUAL CONDITIONS—Continued
X	----	----	----	*Elevating mechanism and equilibrators.* Check for proper operation (par. 78*a*).
X	----	----	----	Adjust equilibrators (par. 78*b*).
X	----	----	----	Check for excessive backlash (par. 76*a*).
----	----	X	----	Remove cover of elevating handwheel shaft bearing, clean, and repack with lubricant.
----	----	----	X	Remove cover of elevating bevel gear case, clean gears, and repack with lubricant.
----	----	----	X	Remove plug and drain elevating worm gear case and the electric elevating gear case. Refill and install plug (par. 76*f*).
X	----	----	----	*Traversing mechanism.* Check for proper operation (par. 75*b*).
X	----	----	----	Check for excessive backlash (par. 76*a*).
X	X	X	X	*Lubricate.* See that all items have been lubricated as prescribed (par. 43).
X	----	----	----	*Tools, equipment, and spare parts.* See that all tools, equipment, and spare parts for the gun, carriage, and fire control matériel are serviceable, clean, and properly stowed.
X	----	----	----	*Publications.* See that all manuals and lubrication orders are present, legible, and properly stowed.
----	X	----	----	*Level vials of telescope mount.* Check condition and adjustment of level vials (par. 86*c*(2)).
----	----	----	X	*Modifications.* Check artillery gun book to determine whether all modification work orders have been completed. A list of current modification work orders is contained in SR 310–20–4. Enter any modifications or major unit replacements made during this service in the artillery gun book.
				UNUSUAL CONDITIONS
				Maintenance operations, as prescribed under usual conditions, will apply under unusual conditions except for extreme-cold weather. Intervals are necessarily shortened in extreme-cold weather. Carriages subjected to salt-water immersion or complete submersion should be evacuated to an ordnance maintenance unit as soon as possible after exposure (par. 38*c*).

[redacted]

scribed for usual conditions may be extended. Under unusual operating conditions, such as extreme temperatures, dust or sand, extremely wet terrain, moist or salty atmosphere, or in rain or snow; it will be necessary to perform the maintenance services more frequently.

c. The crew should have the matériel in a reasonably clean condition for scheduled maintenance service by battery mechanic.

Section IV. TROUBLE SHOOTING

54. Scope

a. This section contains trouble shooting information and tests for locating and correcting some of the troubles which may develop in the 155-mm howitzer M1 and 155-mm howitzer mount M14. Trouble shooting is a systematic isolation of defective components by means of an analysis of the trouble symptoms, testing to determine the defective component, and applying the remedies. Each malfunction given for an individual unit or system is followed by the probable causes of the trouble and suggested procedures to be followed.

b. This manual cannot cover all possible malfunctions that may occur. Only the more common malfunctions are listed but similar methods of analyzing the difficulty and determining the defective component may be applied to any specific trouble which is not covered herein.

c. The tests and remedies provided in this section are governed by the scope of the organizational level of maintenance.

55. Failure to Fire

a. General Precautions.

(1) Keep the weapon trained on the target, and keep all personnel clear of the muzzle and path of recoil.

(2) Before removing firing mechanism M1 or unlocking or opening breech to remove round and reload, personnel not required for the operation will be cleared from the vicinity.

(3) After removal from the weapon, the primer and propelling charge will be kept separate from other primers and propelling charges until it has been determined whether the weapon, charge, or primer was defective. If the primer or propelling charge is found to be defective, continue to keep it separate until disposed of in accordance with instructions in TM 9–1900. If the weapon is found to be defective, the primer and charge may be reloaded after the defect in the weapon has been corrected.

b. Misfires and Cook-Offs.

Warning: In the event that the howitzer has been subjected to continuous fire for a considerable length of time before failure to fire, the tube will be hot and the heat of the howitzer can cause the fuze, projectile filler, or propellant to explode. An explosion under such circumstances is called a cook-off. If the tube is hot, play water on it until it is cool, then remove the round. If water is not available, all personnel must stand clear of the gun until it is cool. Then remove the round.

Make two more attempts to fire the primer. Wait 2 minutes. Remove the firing mechanism and examine the primer. If, upon examination, it is found that the primer is not fired, follow instructions in *c* below. If the primer has fired, a minimum of 10 minutes will be allowed before the breech may be opened and the faulty charge removed. The faulty charge must be stored separately from other charges.

c. Primer Fails to Fire. If the primer does not fire, examine the base of the primer.

(1) If the firing pin indent is sharp and well-formed, the primer is defective. Insert a new primer and continue firing. If a second primer is defective, causing either a hangfire (*e* below) or a misfire (*b* above), turn the lot of primers over to ordnance maintenance personnel.

(2) If the indent is shallow or if there is no indent at all and if the lanyard pull was normal (par. 28*d*), either the firing mechanism M1 was improperly seated (par. 66), is defective, or the percussion hammer is not functioning correctly. Examine the percussion hammer. The percussion hammer locking pin knob should be in the locked-out position (par. 15). If the operation of the percussion hammer is faulty, notify ordnance maintenance personnel. In most cases, shallow or no indent is caused by a defective or improperly seated firing mechanism and by heavy or gummed oil on firing mechanism. Disassemble the firing mechanism. Clean and inspect for broken or damaged parts. Replace any defective parts for which authorized replacements are available, lightly oil and assemble. When inserting, screw the firing mechanism all the way in until it rests against its stop stud and is fully latched (par. 66*c*).

d. Charge Fails to Fire. After the 10 minute wait described in *b* above, remove the faulty charge and examine it. Failure to fire may have been caused by one of the following:

(1) Missing, wet, or caked igniter. Replace charge.
(2) Igniter protective cap not removed. Remove cap.
(3) Charge inserted improperly (igniter end not against obturator spindle) or charge incorrectly assembled. Remove charge, assemble correctly (par. 110*c*), and insert in chamber so that the igniter pad is resting against the face of the obturator spindle (par. 27*h*).
(4) Primer vent hole fouled. Clean vent with vent cleaning tool.

e. Hangfire. If the howitzer fires during the waiting period described in *b* above, hangfire has occurred. The hangfire may be caused by a defective primer, propelling charge, or both. Examine the propelling charges and discard any that are wet. If hangfire occurs again, the primers are assumed to be defective. Turn the lot over to ordnance maintenance personnel.

56. Malfunctions of Breech Mechanism

a. Breech Will Not Open.
(1) The breech will not open if the firing mechanism M1 is in place. Remove firing mechanism M1.
(2) Although firing mechanism is removed, the firing mechanism safety latch may be stuck at right. Move safety latch to left. If necessary, disassemble and clean.
(3) Breechblock may be seized. Notify ordnance maintenance personnel.

b. Breech Mechanism Does Not Operate Smoothly.
(1) This condition may be caused by lack of lubrication. Disassemble breech mechanism, clean, and lubricate (par. 62).
(2) Scores on threads of breechblock or breech ring may cause binding. Notify ordnance maintenance personnel.

c. Threaded Sectors of Breechblock and Breech Ring Do Not Mate.
(1) The breech mechanism may have been assembled improperly. Disassemble breech mechanism and assemble properly (pars. 62 and 63).
(2) The breechblock control arc may be missing. Notify ordnance maintenance personnel.
(3) Parts of the breech mechanism may be broken or damaged. Notify ordnance maintenance personnel.

d. Obturating Parts Do Not Seal the Breech Properly (Powder Fouling on Breech Ring or Breechblock Threads).
(1) This condition may be caused by a bruised or burned gas-check pad, or by burred or ruptured split rings. Disassemble breech mechanism (par. 62) and replace damaged obturating parts.

(2) The obturator spindle spring may be weak or broken, causing looseness in the assembly of the obturating parts. Notify ordnance maintenance personnel.

e. Operating Handle Latch Does Not Latch Properly.

(1) This condition may be caused by lack of lubrication. Disassemble latch and lubricate (par. 62).

(2) A weak or broken operating handle latch spring or burs or roughness on latch or bearing surface may interfere with proper latching. Notify ordnance maintenance personnel.

57. Malfunction of Recoil Mechanism

a. Oil Leaks From Rear of Replenisher. If the weapon has been at 0° elevation for some time, oil may drip rapidly (or run in a stream) from the rear of the replenisher for several seconds when the howitzer is elevated. Neither this temporary leakage nor a drip at any packing, that does not exceed 3 drops per minute, are considered serious. If leakage at any packing exceeds 3 drops per minute, notify ordnance maintenance personnel.

b. Weapon Does Not Return to Battery.

(1) Too much oil in the replenisher may prevent howitzer from returning to battery. Reduce amount of oil in replenisher to normal (par. 72*d*).

(2) Insufficient reserve oil in recuperator cylinder may prevent complete counterrecoil. Drain off reserve oil and refill (par. 72*f*).

(3) The gas presure may not be sufficient to return the howitzer to battery. Notify ordnance maintenance personnel.

(4) Replenisher piston may be stuck. Exercise replenisher piston (par. 72*e*).

c. Weapon Returns to Battery With Too Much Shock.

(1) Insufficient oil in replenisher may interfere with cushioning. Refill replenisher to normal (par. 72*d*).

(2) Excess amount of reserve oil in recuperator may return howitzer to battery with too much force. Drain recuperator reserve oil and refill (par. 72*f*).

(3) The viscosity of oil may be affected by the heat resulting from sustained firing. Allow weapon to cool.

d. Weapon Slow to Return to Battery (Under Usual or Mild Climate Conditions) When Oil Indication is Normal. Insufficient gas pressure in the recuperator or too much friction at the packings may retard counterrecoil. Notify ordnance maintenance personnel.

e. Uneven or Jerky Counterrecoil. Tight, scored, or improperly lubricated howitzer bearing surfaces and foreign substances in oil can prevent smooth counterrecoil. Notify ordnance maintenance personnel.

f. Weapon Recoils Too Far. Insufficient gas pressure in the recuperator or a malfunction of the variable recoil mechanism may permit the weapon to recoil too far. Notify ordnance maintenance personnel.

g. Insufficient Recoil.

(1) High viscosity of oil due to low temperature may cause stiff recoil action. If this is the cause, the length of recoil will become normal after firing two or more rounds.

(2) Tight, scored, or improperly lubricated howitzer bearing surfaces or a malfunction of the variable recoil cam assembly may prevent normal recoil. Notify ordnance maintenance personnel.

h. No Hissing Sound of Escaping Air During Counterrecoil.

(1) Replenisher air holes may be stopped-up. Clean the air holes in the rear of the replenisher (par. 72*a*(2)).

(2) The counterrecoil respirator may be jammed. If during counterrecoil, air does not escape from respirator in the front of the counterrecoil cylinder, notify ordnance maintenance personnel.

i. Oil Leaks From Forward End of Counterrecoil Cylinder. The appearance of black oil in front of the counterrecoil cylinder is a normal condition due to lubrication. However, clear oil appearing at the front of the counterrecoil cylinder is an indication of leakage at the counterrecoil piston. Notify ordnance maintenance personnel of a leak of clear oil.

j. Oil Index Does Not Emerge When Oil is Pumped Into Recuperator Cylinder Against Evident Pressure. If the packing at the oil index is too tight, it may prevent the oil index from emerging as reserve oil is pumped into the recuperator cylinder. The oil index may be broken or it may be locked by some foreign substance. Drain off all recuperator cylinder oil reserve and refill (par 72*f*). While injecting oil, tap the oil index gently with each stroke of the pump. If the oil index fails to emerge after 67 full strokes of the oil pump, notify ordnance maintenance personnel.

k. Excessive Oil Leaks From Recuperator Filling Valve. A sticking filling valve or defective packing may cause leakage at the filling valve. Notify ordnance maintenance personnel.

l. Oil Leakage From Counterrecoil Piston Rod, Recoil Piston Rod, or Stuffing Boxes Necessitates Frequent Refilling. Notify ordnance maintenance personnel.

[redacted]

58. Malfunctions of Mount

a. Elevating Mechanism Jams. If the howitzer cannot be elevated to its maximum elevation, the variable recoil cam assembly may be jammed, there may be interference between tipping and nontipping parts, or the elevating mechanism may be defective. Notify ordnance maintenance personnel.

b. Excessive Backlash. If the backlash in the elevating or traversing mechanism exceeds one-sixteenth turn of the handwheel, notify ordnance maintenance personnel.

c. Excessive Handwheel Effort Required to Elevate or Depress Howitzer. Elevating or depressing the howitzer will be hindered when the equilibrators are out of adjustment or when the trunnions, elevating mechanism, or elevating arc and pinion lack lubrication. Test and adjust equilibrators if necessary (par. 78*a* and *b*) and lubricate the trunnions, the elevating mechanism, and the elevating arc and pinion. If elevating and depressing the howitzer still requires unusual effort, notify ordnance maintenance personnel.

Section V. 155-MM HOWITZER M1

59. General

a. The 155-mm howitzer M1 (fig. 36) consists of the breech ring, the breechblock, breech mechanism, and the barrel. The barrel is an alloy steel tube screwed into the front of the breech ring and locked into position with a locking screw.

b. The howitzer tube is machined to form a bearing surface which slides in the recoil mechanism cradle and cylinder yoke during recoil and counterrecoil. The forward section of this bearing surface is smaller in diameter than the rearward section due to a step (or shoulder) at approximately mid-tube. The tube is not tapered.

c. An integral recoil guide key (fig. 36) and a similarly shaped removable recoil guide key maintain the alinement of the howitzer tube in the recoil mechanism.

d. The rear end of the howitzer bore is tapered to form the powder chamber. From the powder chamber to the muzzle, the bore is rifled with 48 grooves with a uniform right-hand twist of one turn in 25 calibers.

60. Maintenance of Howitzer

a. Wear on cannon depends not only upon the the number of rounds fired but also upon the cooling periods permitted between rounds and

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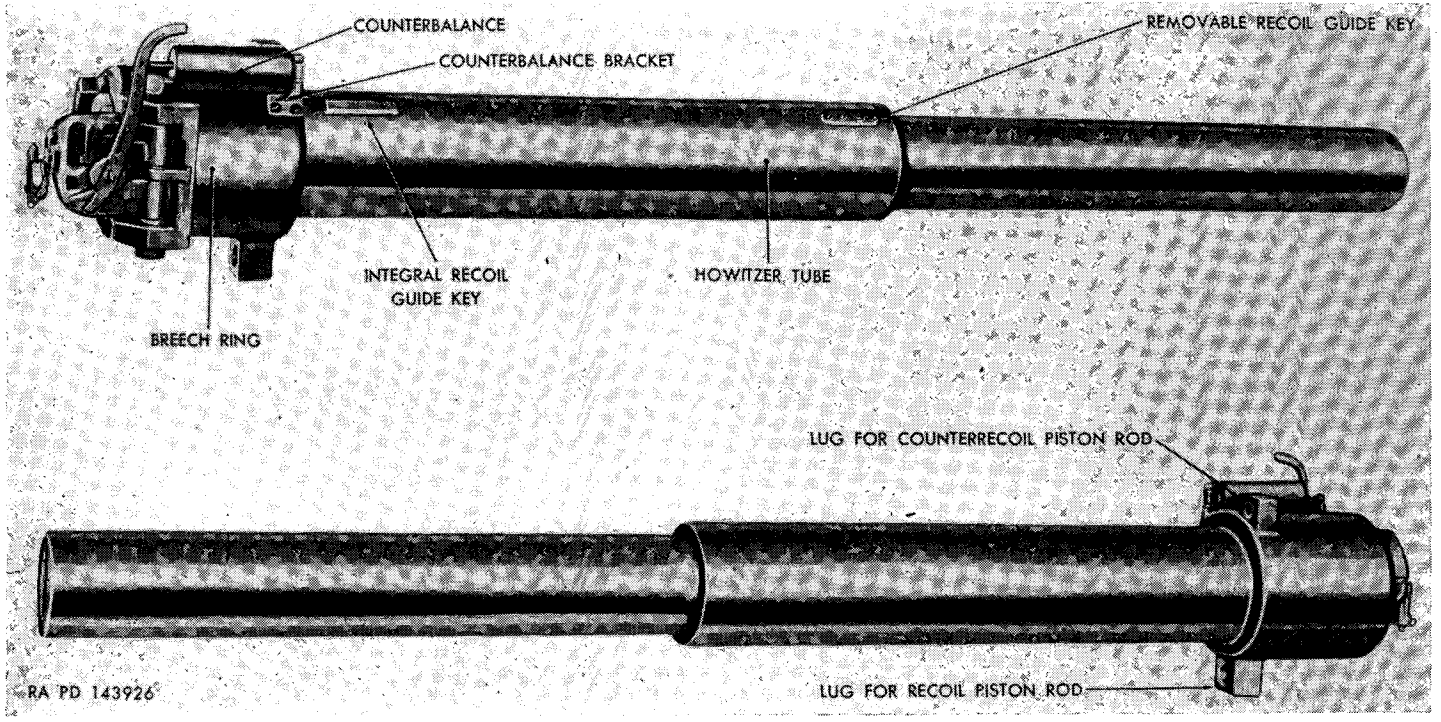

Figure 36. 155-mm howitzer M1.

upon the care of the weapon as regards a thorough cleaning and oiling schedule that is followed consistently (par. 50).

b. The howitzer bore should be cleaned before firing, whenever necessary (par. 26*c*). The gunner should inspect the bore frequently to make certain that it does not contain any foreign matter that might cause damage to the weapon.

c. The howitzer muzzle must be kept plugged when the weapon is not in action.

d. Report any cutting or abrasion of the threads or bearing surfaces of the breechblock or breech ring to ordnance maintenance personnel for correction.

e. Weekly clean the exposed exterior of the howitzer tube with dry-cleaning solvent or volatile mineral spirits, wipe dry, and lubricate as prescribed in LO 9–744 (fig. 29) (par. 43).

Section VI. BREECH MECHANISM

61. General

a. Counterbalance. The counterbalance (figs. 36 and 37) facilitates closing the breech when the howitzer is elevated, under which condition gravity opposes the swinging of the breechblock into the breech recess. It also tends to hold the breechblock carrier (fig. 37) in the open position when the counterbalance piston rod and the arm of the breechblock carrier hinge pin swing past dead-center position. The counterbalance is supported by and hinged on the counterbalance bracket (fig. 36) which is mounted on the forward right side of the breech ring. It is attached to the hinge pin body pin (fig. 37) on the hinge pin by means of the counterbalance piston rod. The piston rod end has an eye of keyhole shape to permit removal and replacement over the head of the hinge pin body pin.

b. Breechblock Carrier Hinge Pin. The breechblock carrier hinge pin (fig. 37) hinges the breechblock carrier and attached parts to the breech ring (fig. 41). The hinge pin body pin (fig. 37), extending from the top of the hinge pin, is provided for the attachment of the counterbalance piston rod. The hinge pin is retained in the breech ring by the hinge pin collar and detent. The breechblock carrier bearing washer provides a supporting bearing surface for the hinge pin and breechblock carrier.

c. Breechblock Operating Handle Latch. The breechblock operating handle latch (fig. 37) latches the breechblock operating handle in fully raised position, thereby locking the operating handle in closed position. The latch is spring-loaded to keep it extended until manually retracted.

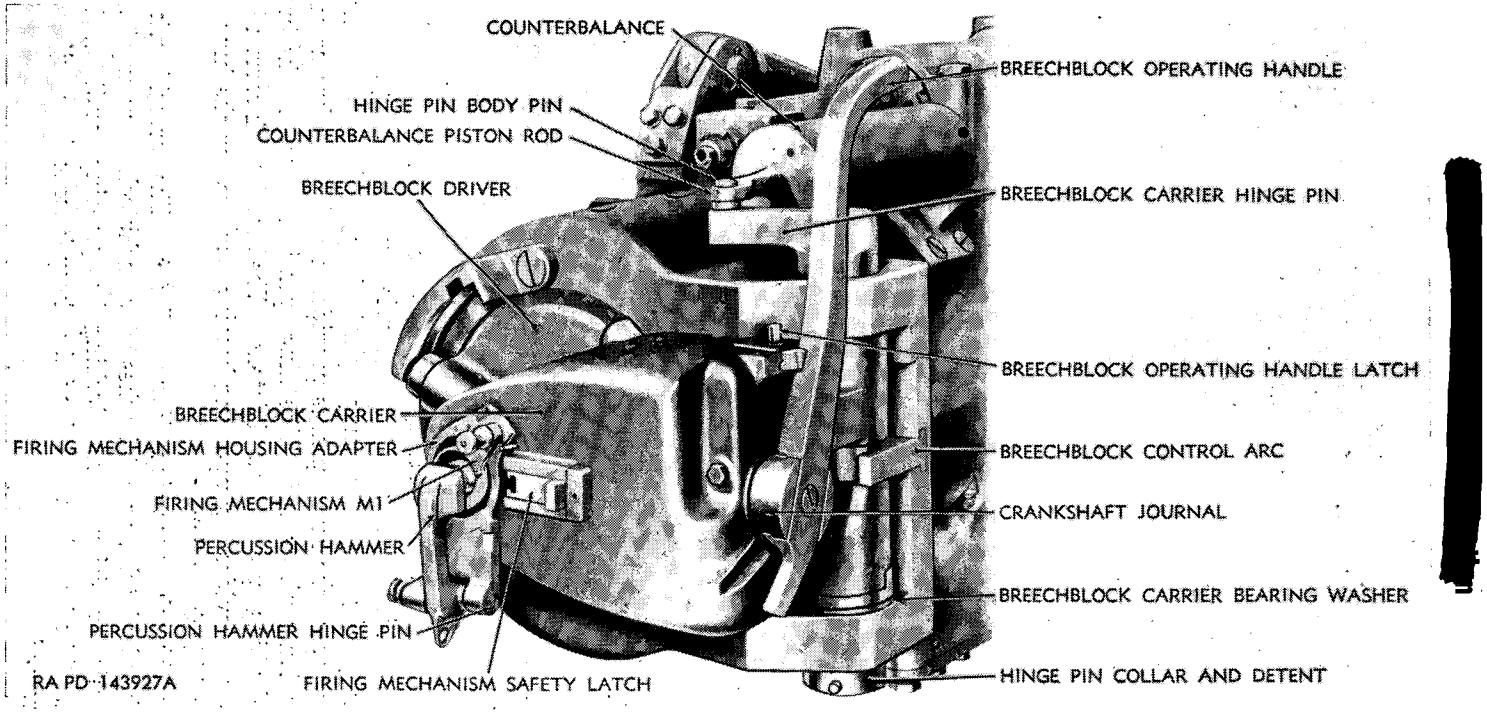

Figure 37. Breech mechanism—right rear view.

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d. Firing Mechanism Housing Adapter. The firing mechanism housing adapter (fig. 37) fits into the rear end of the bore of the breechblock carrier and into the rear of the breechblock. It has a rectangular lower arm which supports the percussion hammer. The adapter is retained in the carrier by the firing mechanism housing, which fits the interior of the adapter and screws onto the rear end of the obturator spindle. The firing mechanism is screwed into the firing mechanism housing before firing the howitzer (par. 28*b*).

e. Percussion Mechanism. The percussion mechanism consists of the percussion hammer, the percussion hammer hinge pin (fig. 37), and the percussion hammer locking pin knob (fig. 5). These are mounted on the lower arm of the breechblock carrier adapter. The lower portion of the percussion hammer is drilled for the attachment of the lanyard (fig. 22). The percussion hammer will not strike the firing pin in the firing mechanism unless the firing mechanism has been screwed fully into its housing (par. 28*b*).

f. Firing Mechanism Safety Latch. The firing mechanism safety latch (fig. 37) prevents the breech from being opened before the firing mechanism M1 has been removed. It also prevents the firing mechanism from being seated before the breechblock has been returned to closed and locked position.

g. Obturating Parts. The obturating parts (fig. 38) consist of the obturator spindle (with obturator spindle vent bushing, plug, and gasket), front and rear split rings, inner ring, gas-check pad, and gas-check pad disk. The rings, pad, and disk are assembled under the head of the obturator spindle against the front face of the breechblock. They seal the rear of the powder chamber against the rearward escape of powder gases when the howitzer is fired. The rear end of the obturator spindle is threaded externally to receive the firing mechanism housing, by which it is retained in the breechblock. The obturator spindle plug, which screws into the rear end of the spindle, is taper-bored to receive the primer.

h. Breechblock. The breechblock (fig. 39) is of the cylindrical, steeped-thread, interrupted-screw type. There are nine threaded sectors and three plain sectors. The arrangement of the threads permits the breechblock to be locked or unlocked by being rotated approximately one-tenth of a revolution. The breechblock has a central stepped bore from front to rear. The forward portion of this bore fits the obturator spindle. The central portion of the bore contains the breechblock bearing bushing (fig. 39), which forms the bearing surface on which the breechblock is carried on the hub of the breechblock carrier (fig. 40). The rear portion of the bore contains three wide splines which mate with three similar splines of the breechblock driver

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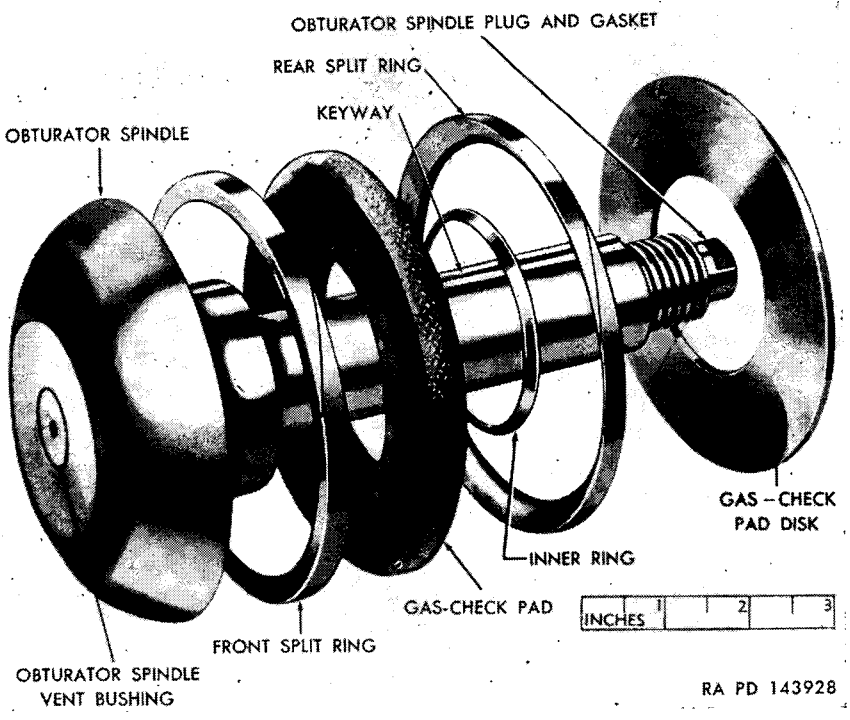

Figure 38. Breech obturating parts—removed from breechblock.

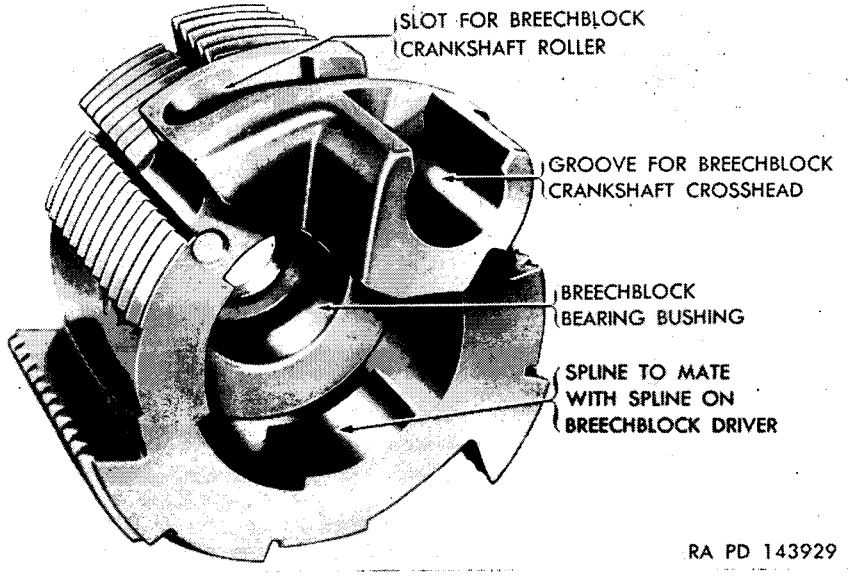

Figure 39. Breechblock.

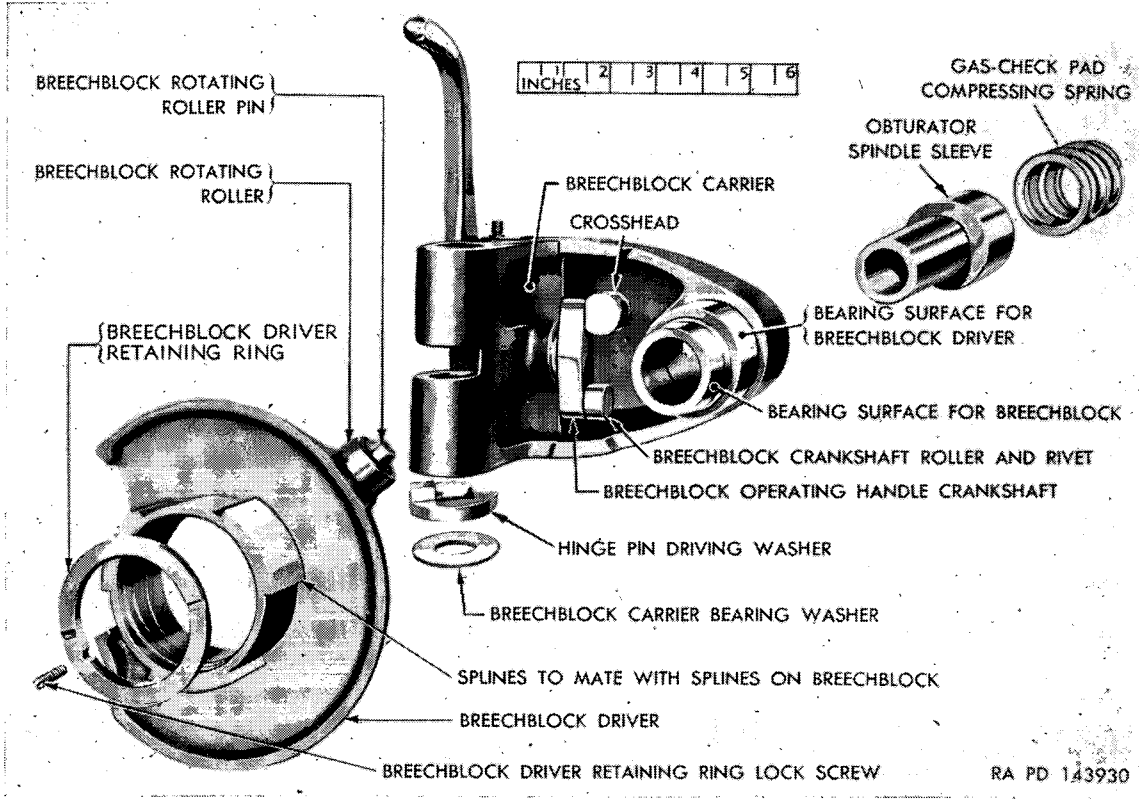

Figure 40. Breechblock carrier and breechblock actuating parts—exploded view.

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(fig. 39). They permit the breechblock to move freely backward and forward on the driver as the breechblock is being locked and unlocked, but constrain the breechblock to rotate with the driver.

i. Breechblock Carrier. The breechblock carrier (fig. 40) supports the breechblock and its actuating parts. The right end of the carrier is hinged on the breechblock carrier hinge pin (fig. 37). A cylindrical hub extends from the front of the carrier. The front surface of this hub provides a bearing surface for the breechblock while the rear surface forms a bearing surface for the breechblock driver (fig. 40). The forward end of the rear section is threaded to receive the breechblock driver retaining ring. A bore through the hub of the breechblock carrier receives the obturator spindle sleeve (fig. 40), obturator spindle (fig. 38), gas-check pad compressing spring (fig. 40), firing mechanism housing adapter (fig. 37), and firing mechanism housing (fig. 21). The carrier houses the operating handle crankshaft (fig. 40) and related breechblock actuating parts.

j. Breechblock Actuating Parts. The breechblock operating handle crankshaft (fig. 40) extends from the right side of the breechblock through the right wall of the carrier. The crankshaft has two crank arms at one end. One arm carries the crosshead and the other arm carries the breechblock crankshaft roller and rivet. The crosshead slides in a groove in the breechblock (fig. 39) and serves to rotate the breechblock in locking and unlocking. The breechblock crankshaft roller travels in a slot in the breechblock and moves the breechblock back and forth in its splined bearing on the breechblock driver. The crankshaft journal (fig. 37) supports the breechblock operating handle crankshaft (fig. 40) and fits the bore in the right side of the carrier. One end is slotted at right angles to the crankshaft to receive the breech operating handle (fig. 37). The breechblock driver (fig. 40) rotates on the hub of the breechblock carrier and is retained on the hub by the breechblock driver retaining ring and lock screw. The forward portion of the driver extends into the recess in the rear of the breechblock and is splined to the breechblock. The breechblock rotating roller is attached to the breechblock driver by the breechblock rotating roller pin. The breechblock control arc (fig. 37) is mounted in a slot in the breech ring (fig. 41). The lower end of the breech operating handle rides on the upper surface of the control arc to prevent rotation of the handle and crankshaft when the carrier is in open position.

k. Breech Ring. The exterior of the howitzer breech ring (fig. 41) is cylindrical in form. At the front end are lugs on the top and bottom for attachment of the howitzer to the counterrecoil and recoil piston rods (figs. 36 and 41). At the rear on the right side is the lug

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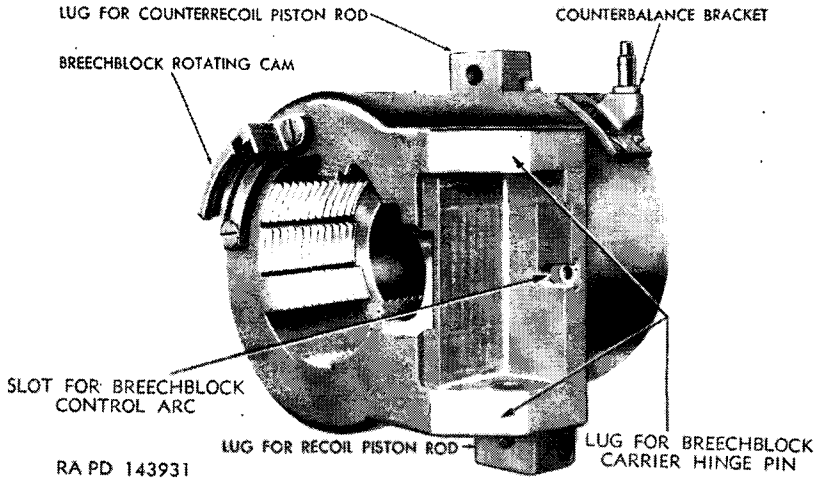

Figure 41. Breech ring—right rear view.

(fig. 41) for the breechblock carrier hinge pin. The counterbalance bracket is attached by four screws to the upper right side of the breech ring near the forward end (figs. 36 and 41). The breechblock rotating cam is attached to the upper left rear face of the breech ring (fig. 41). The forward portion of the breech ring is threaded internally to receive the howitzer tube. The rear portion of the bore forms the breech recess and is divided into nine stepped and threaded sectors to correspond with the exterior of the breechblock.

62. Disassembly of Breech Mechanism

a. Precautions.

(1) Never attempt to disassemble the breech mechanism with the breech partially or fully closed; otherwise, displacement of the split rings and the gas-check pad (fig. 38) and the dropping of the rings into the threads of the breech recess may occur. This may cause serious damage to the rings and threads and prevent either swinging of the breechblock out of the breech recess or returning of the breechblock to the closed position.

(2) Should the condition in (1) above occur, through accident or carelessness, do not force the breech mechanism.

(*a*) Remove the firing mechanism housing lock screw (fig. 44) and the socket-head cap screw (fig. 45) that holds the firing mechanism safety latch stop to the rear face of the breechblock carrier if not already removed. Retain the

stop and firing mechanism safety latch spring with the hand, when removing the screw.

(*b*) Move the safety latch to the extreme right.

(*c*) Unscrew and remove the firing mechanism housing (fig. 46) using the firing mechanism housing assembling tool 5207076. This releases the firing mechanism housing adapter, the obturator spindle with obturating parts, and the gas check pad compressing spring (fig. 47).

(*d*) Withdraw the firing mechanism housing adapter and the gas-check pad compressing spring from the rear of the breechblock carrier.

(*e*) Place a bronze drift or block of wood against the obturator spindle plug and drive the obturator spindle forward into the powder chamber with a bronze or hide faced hammer.

(*f*) The breechblock may now be opened without danger of damaging the obturating parts. The obturating spindle is free of the breechblock and will therefore remain in the breech recess when the block is opened and will permit the split rings and gas-check pad to remain in the breech recess when the block is opened.

b. Remove Firing Mechanism, Safety Latch, Firing Mechanism Housing, and Obturator Spindle.

(1) Remove the firing mechanism if in place by unscrewing it counterclockwise and removing it from its housing (fig. 10).

(2) Remove the breechblock control arc screw from the breech ring (fig. 42). Withdraw the control arc from the breech ring.

(3) Open the breech (par. 23*a*) and swing the breechblock operating handle to the right until a "U" block can be placed between the counterbalance piston rod end and the counterbalance cylinder head (fig. 43). Then swing the operating handle with the carrier to the left until the counterbalance piston rod end can be lifted over the head of the hinge pin body pin.

Caution: The counterbalance mechanism must be disconnected before removing the firing mechanism housing during disassembly of the breech mechanism in order to protect the personnel and the matériel from the results of accidental closing of the breech.

(4) Swing the breech fully open. Remove the firing mechanism housing lock screw (fig. 44) from the left side of the firing mechanism housing adapter. With the breech remaining open, lift the operating handle to the closed position.

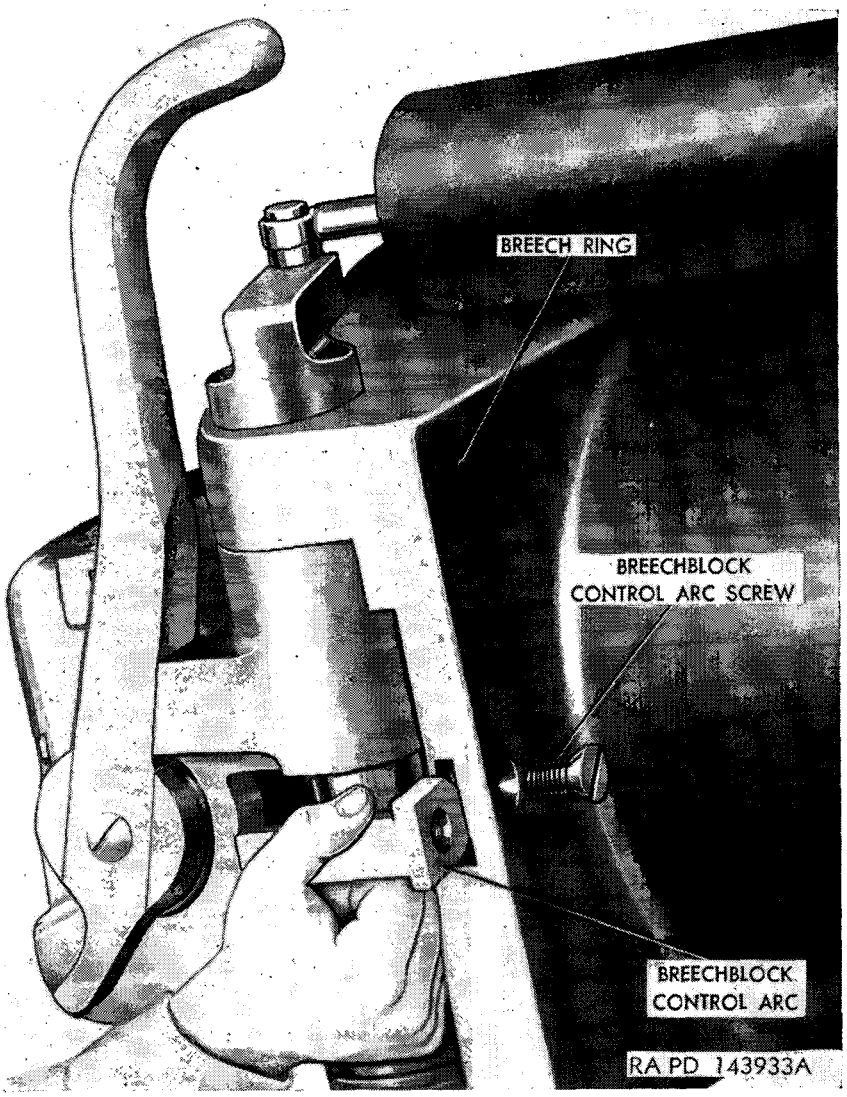

Figure 42. Removing or installing breechblock control arc.

(5) Remove the socket-head cap screw (fig. 45) holding the firing mechanism safety latch stop to the rear face of the breechblock carrier. The stop and firing mechanism safety latch spring may fly off when the screw is removed and should be retained by the hand and removed after the screw is out. Move the safety latch to the extreme right (fig. 46).

(6) Unscrew and remove the firing mechanism housing (fig. 46) using the firing mechanism housing assembling tool 5207076

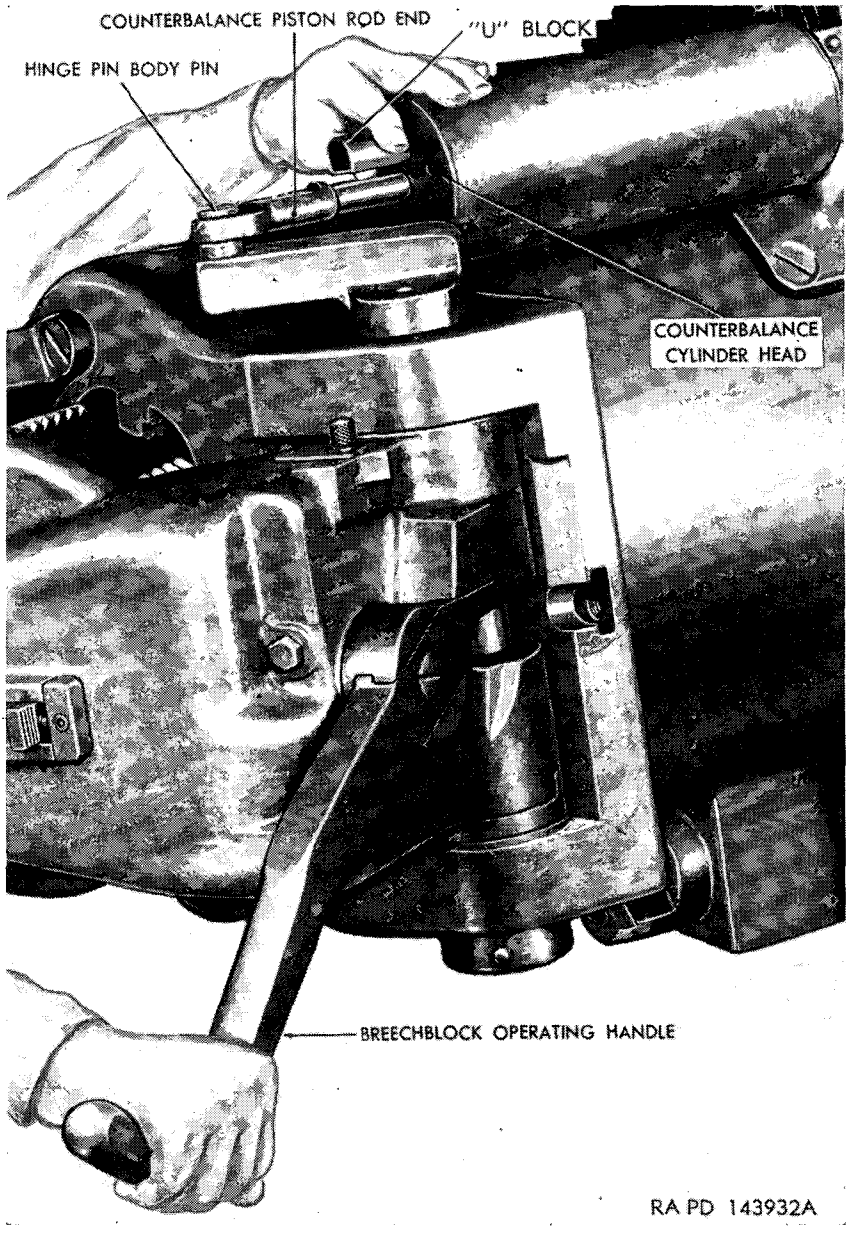

Figure 43. Installing or removing "U" block on counterbalance piston rod.

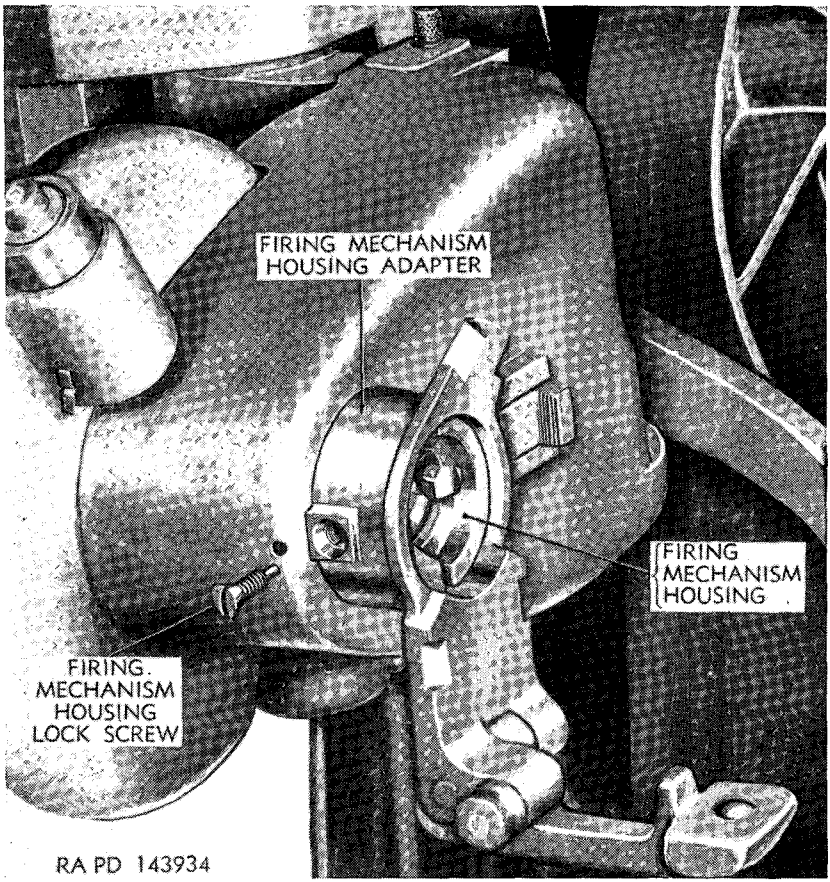

Figure 44. Unlocking firing mechanism housing.

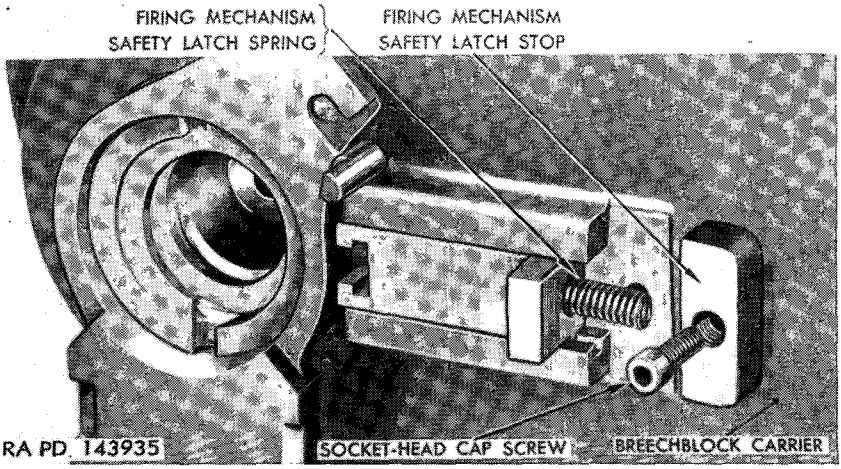

Figure 45. Removing or installing firing mechanism safety latch stop.

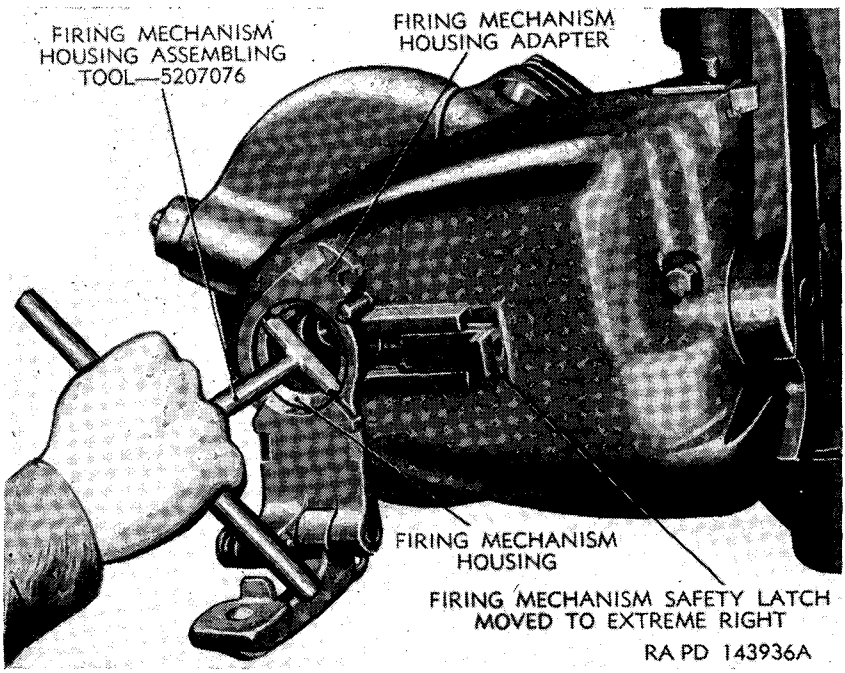

Figure 46. Removing or installing firing mechanism housing.

(figs. 27 and 46 and table I). This releases the firing mechanism housing adapter, the obturator spindle with obturating parts, and the gas-check pad compressing spring (fig. 47).

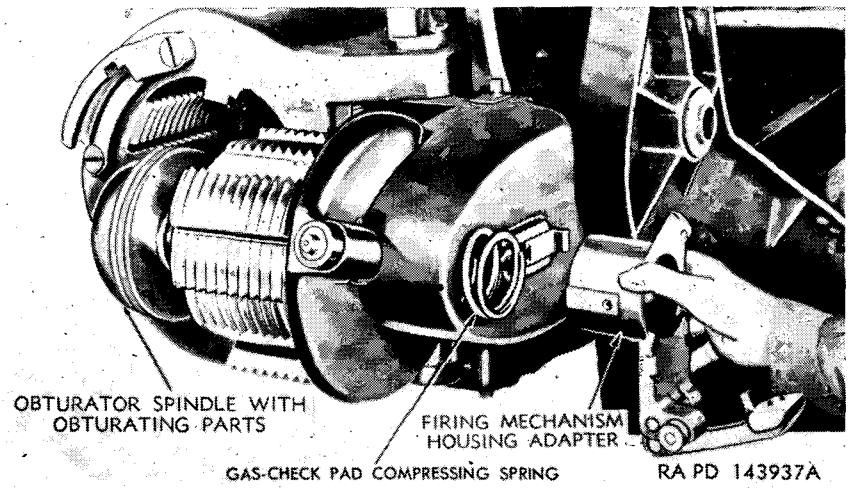

Figure 47. Removing or installing firing mechanism housing adapter, gas-check pad compressing spring, and obturating parts.

(7) Withdraw the firing mechanism housing adapter and the gas-check pad compressing spring from the rear of the carrier (fig. 47). Withdraw the obturator spindle from the front end of the breechblock, carrying with it the front split ring, the gas-check pad, the rear split ring, the inner ring, and the gas-check pad disk (figs 38 and 47).

(8) Slide the firing mechanism safety latch and plunger (fig. 48) to the left, and withdraw it from the breechblock carrier (fig. 40). Withdraw the obturator spindle sleeve rearward out of the breechblock carrier (figs. 48 and 49).

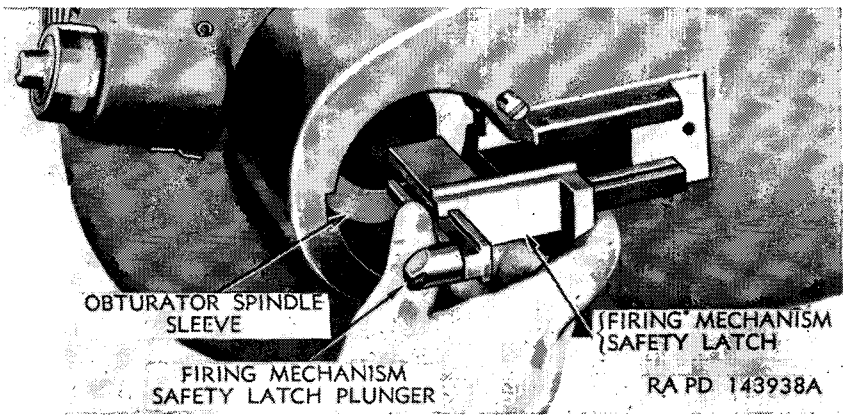

Figure 48. Removing or installing firing mechanism safety latch and plunger.

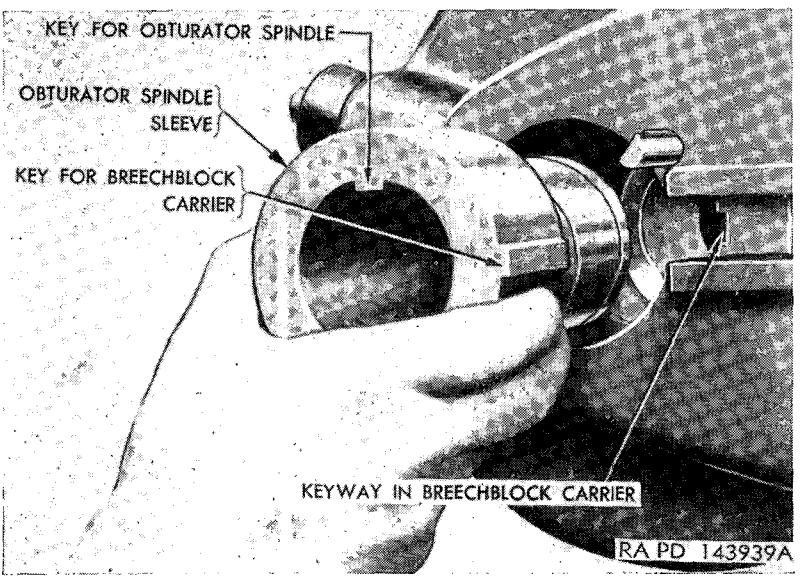

Figure 49. Removing or installing obturator spindle sleeve.

c. Remove Breechblock. Slide the breechblock forward off the breechblock driver (fig. 50). Rotate the breechblock by slightly manipulating the breech operating handle, if necessary, to free the breechblock crankshaft roller (fig. 40) from the breechblock. The breechblock driver should be held while the breechblock is being removed. To facilitate handling the breechblock during removal, insert cleaning staff, axe handle, or similar material through the bore of the breechblock.

d. Remove Breechblock Driver. Remove the breechblock driver retaining ring lock screw (fig. 40), which locks the breechblock driver retaining ring to the breechblock carrier at the forward end of the breechblock driver. Unscrew the retaining ring from the carrier, using the assembling ring wrench 7230275 (table I) or an adjustable spanner wrench (fig. 51). Slide the breechblock driver forward off its bearing surface on the breechblock carrier (fig. 40).

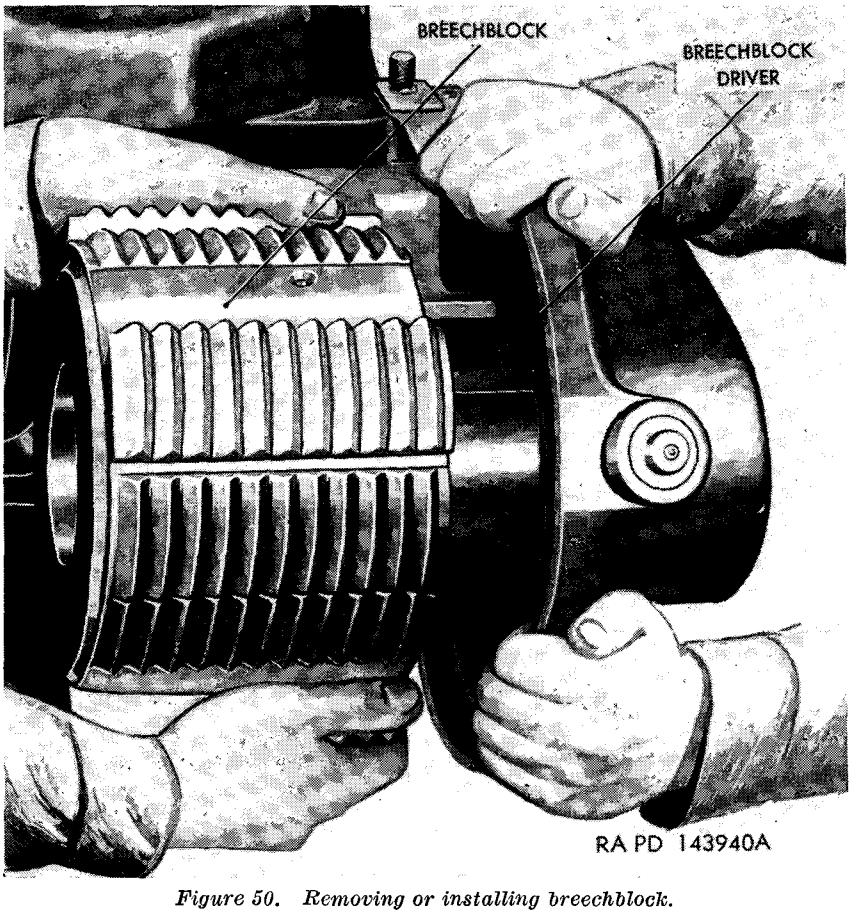

Figure 50. Removing or installing breechblock.

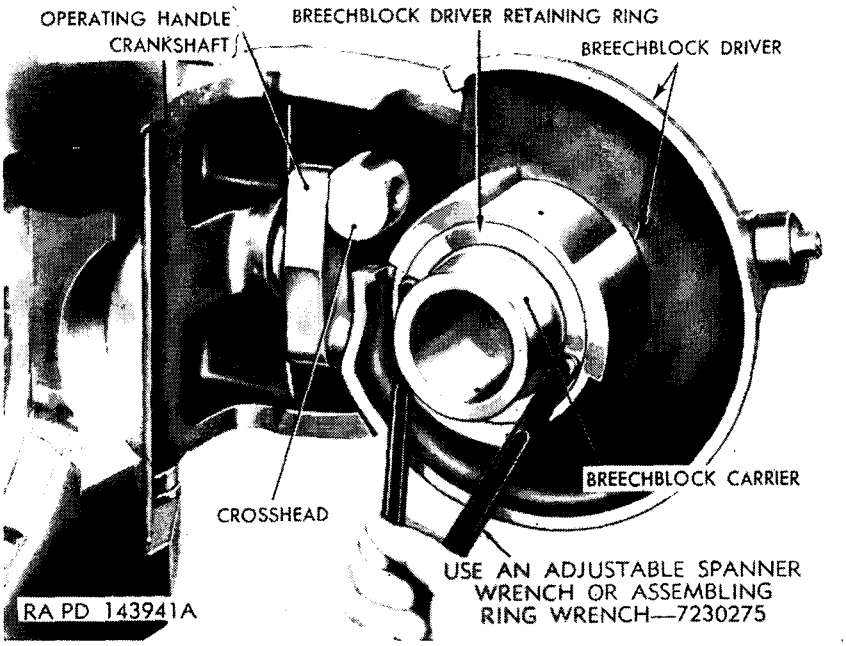

Figure 51. Removing or installing breechblock driver retaining ring.

e. Remove Breechblock Operating Handle. Remove the operating handle retaining screw (fig. 52), which holds the breechblock operating handle to the crankshaft journal. Withdraw the handle from the crankshaft journal. Unscrew and remove the crankshaft journal detent (figs. 52 and 53).

f. Remove Breechblock Operating Handle Crankshaft. Slide the crosshead (fig. 51) off the arm of the breechblock operating handle crankshaft (fig. 54). With the right hand, remove the crankshaft journal from the end of the crankshaft and withdraw it from the breechblock carrier (fig. 53), while with the left hand, remove the operating handle crankshaft through inside of the carrier (fig. 54).

g. Remove Hinge Pin. Drive the hinge pin collar detent out of the hinge pin collar on the lower end of the hinge pin (fig. 55). Remove the collar from the lower end of the hinge pin. While the breechblock carrier is being held, withdraw the hinge pin from the breech ring. A slight movement of the carrier may assist in the removal of the pin. Remove the carrier from the breech ring. The hinge pin driving washer (fig. 40) generally will adhere to the carrier and should not be permitted to fall. Remove the breechblock carrier bearing washer from the breech ring.

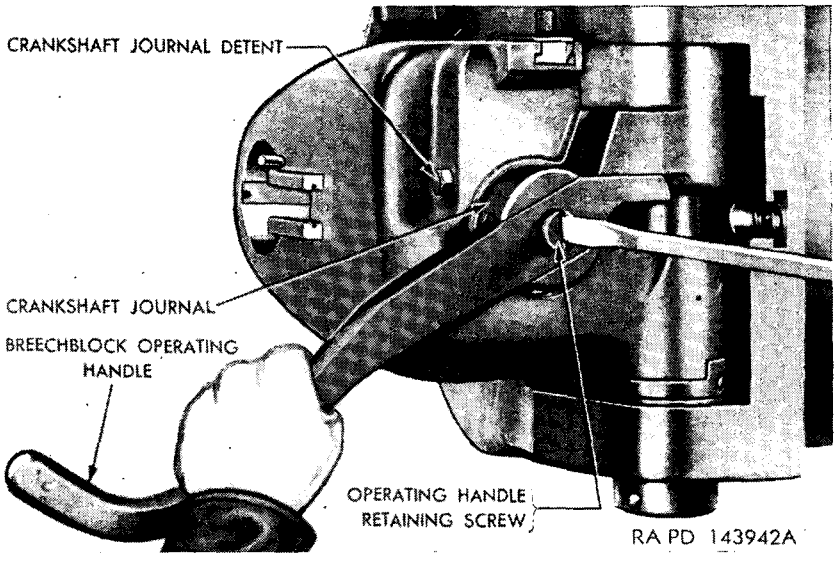

Figure 52. Removing or installing operating handle retaining screw.

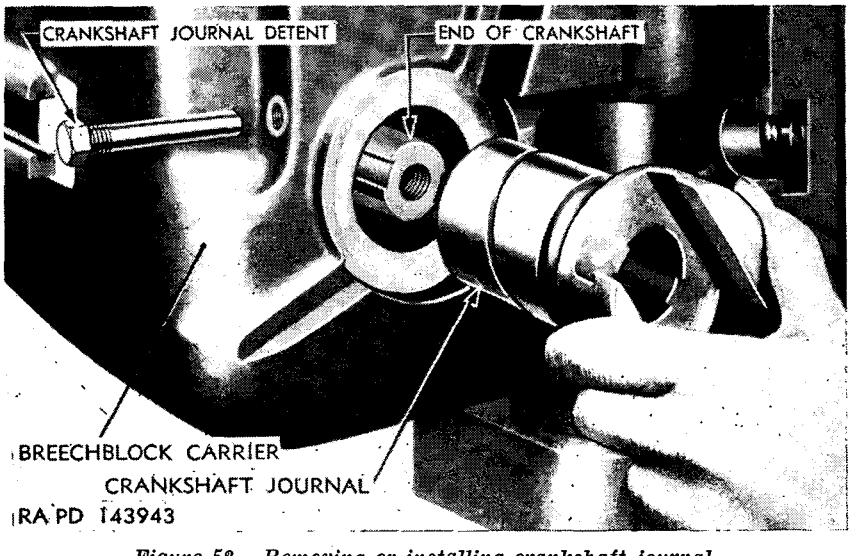

Figure 53. Removing or installing crankshaft journal.

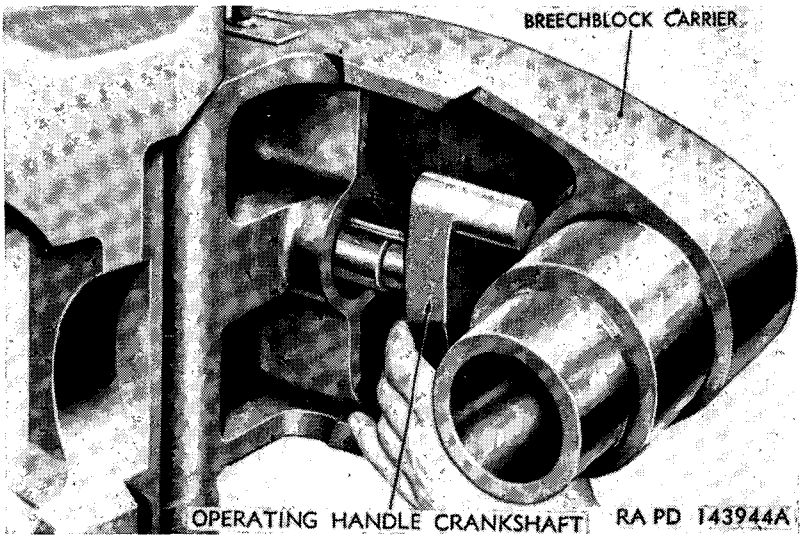

Figure 54. Removing or installing operating handle crankshaft.

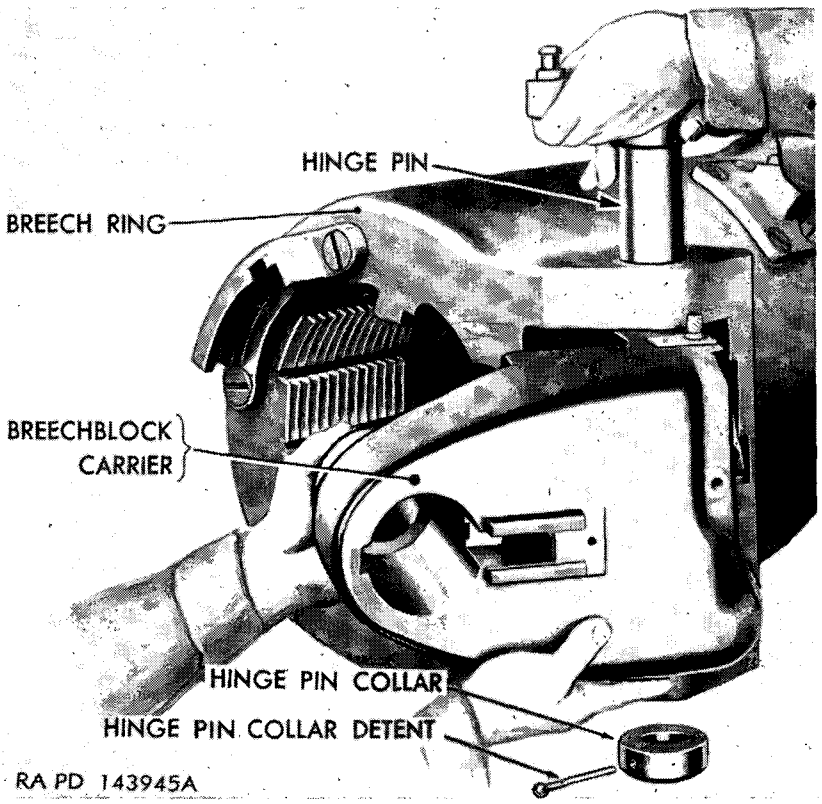

Figure 55. Removing or installing breechblock carrier and hinge pin.

h. Disassemble Operating Handle Latch. Unscrew the operating handle latch knob (fig. 56). The operating handle latch will then slide outward to the right under the tension of the operating handle latch spring.

i. Disassemble Breechblock Rotating Roller. Remove the cotter pin holding the breechblock rotating roller pivot pin to the breechblock driver (fig. 57). Withdraw the pivot pin from the driver to release and remove the breechblock rotating roller.

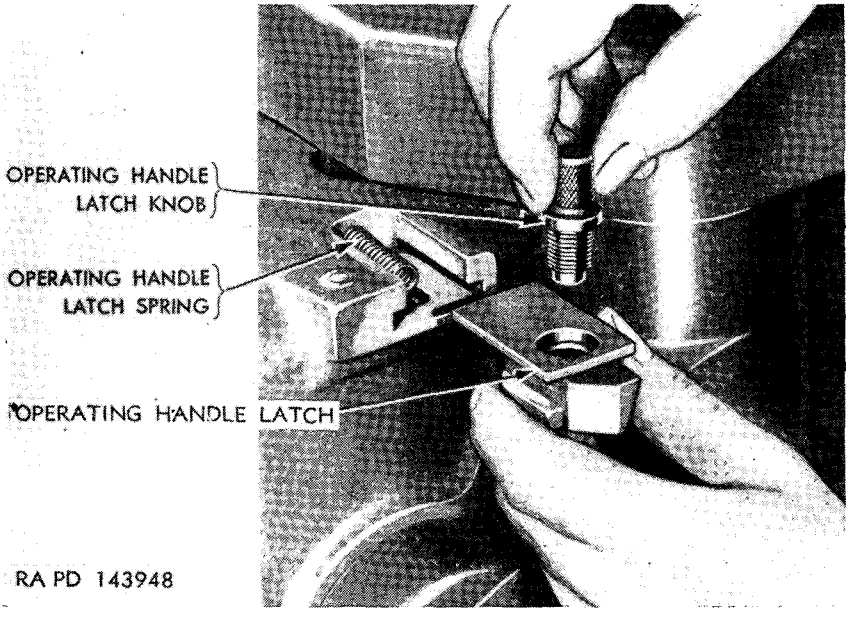

Figure 56. Removing or installing operating handle latch.

63. Assembly of Breech Mechanism

a. Assemble Breechblock Rotating Roller. Slide the breechblock rotating roller (fig. 57) onto the breechblock rotating roller pivot pin, and install the pin and roller in the breechblock driver. Aline the hole in the end of the pin with the holes in the breechblock driver, and install the cotter pin to secure the roller and pivot pin in position.

b. Assemble Operating Handle Latch. Place the operating handle latch spring (fig. 56) in position in the breechblock carrier. Slide the operating handle latch into position and push it in against the spring pressure. Install and tighten the operating handle latch knob.

c. Install Hinge Pin.

(1) Place the breechblock carrier bearing washer (fig. 40) on the lower hinge pin lug of the breech ring (fig. 41), fitting the small hole in the washer over the pin in the lug. Assemble

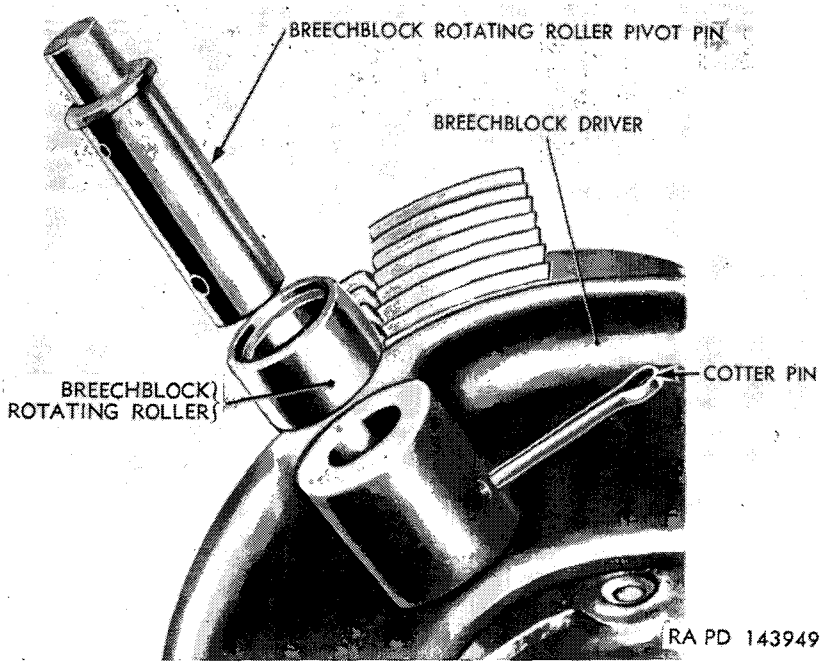

Figure 57. Breechblock rotating roller and pivot pin.

the hinge pin driving washer to the breechblock carrier (fig. 40), and place the carrier in position between the hinge pin lugs on the breech ring (fig. 55).

(2) While supporting the carrier, insert the hinge pin downward through the hinge pin lug and carrier (fig. 55). The squared lower end of the hinge pin must enter the square hole in the driving washer, with the arm of the hinge pin pointing toward the left end of the carrier. Place the hinge pin collar on the lower end of the hinge pin, alining the holes in the collar and hinge pin. Insert the hinge pin collar detent through the holes to secure the collar to the pin.

d. Install Operating Handle Crankshaft. From inside the carrier, insert the operating handle crankshaft into the right side of the carrier (fig. 54). Support the crankshaft inside the carrier, with the crosshead arm of the crankshaft uppermost. Start the small end of the crankshaft journal onto the outer end of the crankshaft from the outside of the carrier (fig. 53) and guide the journal into the bore in the right side of the carrier. Push the journal into the carrier as far as it will go.

e. Install Breechblock Operating Handle. Screw the crankshaft journal detent (figs. 52 and 53) into the carrier to secure the journal.

Insert the operating handle into the journal, handle upward, and secure the handle in place with the operating handle retaining screw (fig. 52). Place the crosshead on its pivot on the arm of the crankshaft (fig. 51).

f. Install Breechblock Driver. Slide the breechblock driver, flange rearward, onto the front of the carrier (fig. 40). Screw the breechblock driver retaining ring to the carrier to retain the driver (figs. 40 and 51). Lock the retaining ring in place with its lock screw. Position the crosshead horizontally near the top of its travel.

g. Install Breechblock. Start the breechblock onto the carrier (fig. 50), alining the breechblock so that the crosshead can be guided into its groove (fig. 39) in the breechblock while, at the same time, holding the breechblock driver in such a position that the large lug on the breechblock (which contains the crosshead groove), will enter the cut away portion at the flange of the driver (fig. 40). With the crosshead entered into its groove, slide the breechblock rearward onto the driver. Lift the breech operating handle to its upright position.

Caution: Never swing the breechblock into the breech recess until the obturator spindle, pad, rings, and disk (fig. 38) have been properly secured in position.

h. Install Safety Latch, Obturator Spindle, and Firing Mechanism.

(1) Insert the obturator spindle sleeve, smaller end first, into the rear of bore of breechblock carrier (fig. 49). Fit the key on the right side of the sleeve into the keyway in the breechblock carrier bore and push the sleeve forward as far as it will go.

(2) Slide the firing mechanism safety latch plunger into the safety latch (fig. 48). Start the firing mechanism safety latch and plunger into the carrier from the left. Push the plunger forward until its front end is approximately flush with the front end of the latch, then push the latch and plunger to the extreme right (fig. 46). The plunger will now clean the bore of the carrier and permit assembly of the firing mechanism housing adapter (fig. 47).

Warning: Failure to install the firing mechanism safety latch plunger will permit installation of the firing mechanism M1 before the breech is completely closed and locked. Firing the howitzer, with the breech not locked, will produce breech blow-back with possible serious injury to personnel. The practice of omitting the firing mechanism safety latch plunger during the assembly of the breech mechanism is strictly prohibited.

[redacted]

(3) Place the front split ring (smaller diameter), gas-check pad, rear split ring, inner ring, and gas-check pad disk in the order named on the rear of the head of the obturator spindle (fig. 38). Insert the spindle into the bore of the breechblock (fig. 47) and through the bore of the obturator spindle sleeve, fitting the keyway near the end of the spindle (fig. 38) on the key in the upper rear end of the bore of the sleeve (fig. 49).

Caution: Accidents resulting in serious injury to personnel and damage to artillery matériel have occurred because weapons have been fired without gas-check pads. Gas-check pads removed for cleaning must be installed as soon as cleaning has been accomplished.

(4) Place the gas-check pad compressing spring into the rear bore of the carrier (fig. 47) and press the firing mechanism housing adapter in behind the spring, fitting the key on the left side of the adapter in the keyway in the left wall of the carrier bore. Insert the firing mechanism housing into the adapter (fig. 46) and, while pressing forward on the adapter to compress the spring, screw the housing onto the rear end of the obturator spindle, using the firing mechanism housing assembling tool 5207076 (figs. 27 and 46 and table I). Check the split rings for proper position under the head of the obturator spindle.

(5) Screw the firing mechanism housing (fig. 46) onto the obturator spindle as far as it will go (aprx. seven full turns), and then back it off slightly to the nearest position in which the hole in the housing will aline with the safety latch plunger (fig. 48). This must be done to allow the plunger to enter the hole freely and to allow installation of the firing mechanism housing lock screw.

(6) Check and adjust headspace (par. 64*c*). When the headspace has been properly adjusted, install the firing mechanism housing lock screw in its hole in the firing mechanism housing adapter (fig. 44). The unthreaded end of the lock screw enters a slot in the side of the housing and can only be installed if the safety latch plunger is alined with its hole in the housing.

(7) Push the safety latch to the left, inserting the pointed end of the plunger (fig. 48) in the holes in the adapter and housing (fig. 44). Insert the firing mechanism safety latch spring (fig. 45) into the hole in the right end of the safety latch and

[redacted]

assemble the safety latch stop to the carrier with the socket-head cap screw.

(8) Lower the breechblock operating handle to its open position and swing the breechblock toward closed position until the counterbalance piston rod end can be placed over the hinge pin body pin (fig. 43). Then swing the breech open sufficiently to allow the "U" block to be removed.

(9) Carefully swing the carrier to closed position, easing the breechblock into the breech recess without permitting the edges of one part to strike those of another. Insert the breechblock control arc in the breech ring (fig. 42). Secure the arc in place with the breechblock control arc screw.

(10) Install firing mechanism by turning it clockwise into the firing mechanism housing (fig. 21).

64. Maintenance of Breech Mechanism

a. General.

(1) The breech mechanism is subject to contamination by powder residue working its way past the obturating parts and through the obturator spindle vent. For this reason, periodic disassembly of the breech mechanism (par. 62) is required in order that all parts may be properly cleaned and oiled. Intervals for disassembly for cleaning and oiling will be specified by the officer in charge, dependent upon the conditions of service.

(2) At disassembly, clean all parts (except the obturator gas-check pad) with rifle-bore cleaner. Be sure all powder stains, rust, burs, and roughness are removed, using crocus cloth if necessary. Wipe the surfaces dry and apply a coating of preservative lubricating oil, using clean wiping cloths.

(3) If the breech mechanism does not operate freely, disassemble the mechanism (par. 62) to determine the cause. Replacement of defective parts will be made by ordnance maintenance personnel, but improper assembly or lack of lubrication can be corrected by using arm.

b. Obturating Parts.

(1) After firing and on 3 consecutive days thereafter, disassemble the breech mechanism sufficiently to remove the obturator spindle and obturating parts (par. 62*b*(6) and (7)) from the breechblock carrier. Clean the gas-check pad disk, front and rear split rings, inner ring, and obturator spindle (fig. 38) with rifle-bore cleaner, wipe dry, and lubricate with

preservative lubricating oil. Wipe the gas-check pad (fig. 38) with a clean dry cloth.

Note.—Do not use dry-cleaning solvent, volatile mineral spirits, or rifle-bore cleaner to clean the gas-check pad, and do not apply oil to the pad.

(2) If the gas-check pad, gas-check pad disk, inner ring, front or rear split rings, or obturator spindle is damaged or worn so as to be unserviceable, replace the defective part, and assemble the parts (63*h*). A gas-check pad of the proper resiliency will yield slightly under heavy thumb pressure.

(3) When the obturator spindle is removed from the breechblock carrier ((1) above), check the obturator spindle plug for proper seating of the primer by inserting an unfired primer into the spindle plug (fig. 58), and pressing it in with thumb pressure. The flange of the primer should not be less than one-eighth inch from the rear face of the plug. If this distance is less than one-eighth inch, notify ordnance maintenance personnel.

c. Test and Adjustment of Head Space.

(1) The distance between the rear face of the firing mechanism housing and the end of the obturator spindle plug (fig. 59) is commonly called "head space." Excessive head space often results in primer blowback and resultant contamination of

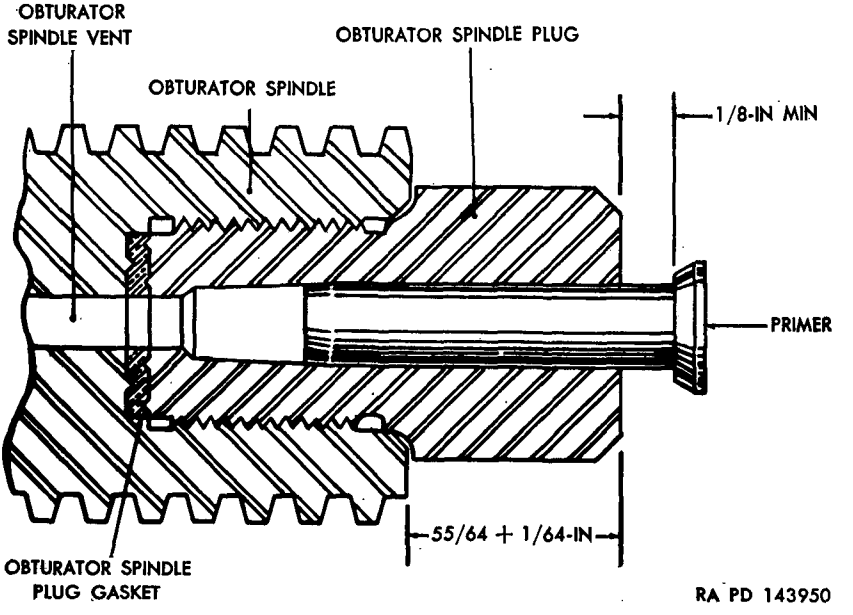

Figure 58. Checking primer seat in obturator spindle plug.

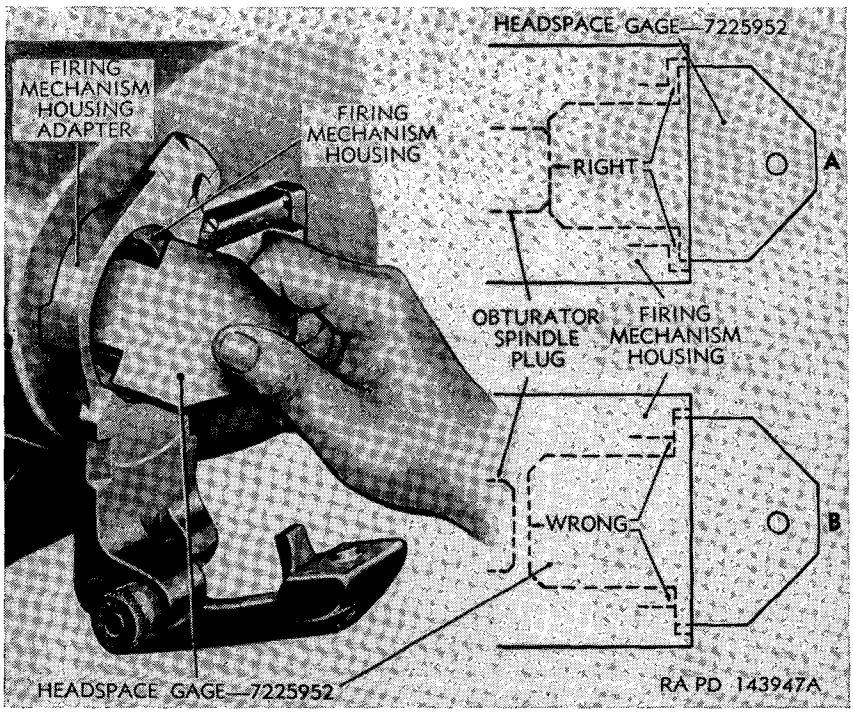

Figure 59. Checking head space.

the breech mechanism with powder residue, since the primer does not seat firmly in the end of the obturator spindle plug.

(2) To check head space, remove the firing mechanism M1 from the weapon, if in place. Insert head space gage 7225952 (figs. 26 and 59 and table I) in the firing mechanism housing (fig. 59).

(3) Space between the rear face of the housing and the shoulder of the gage (A, fig. 59) denotes proper assembly and no adjustment is required.

(4) If the shoulder of the gage rests on the rear face of the housing (B, fig. 59), excessive head space is indicated, and the head space must be adjusted.

(5) To adjust head space, the breech mechanism must be disassembled sufficiently to allow the firing mechanism housing to be screwed one or two complete turns onto the obturator spindle. This disassembly procedure is given in paragraph 62*b*(1) through (5). Use the firing mechanism housing assembling tool 5207076 (figs. 27 and 46 and table I) to turn the housing onto the obturator spindle (fig. 46).

(6) When the housing has been turned onto the obturator spindle one or two complete turns, check head space again. If it is correct (A, fig. 59), assemble breech mechanism (par. 63).

Note.—Any excessive head space (B, fig. 59) will result in primer blowback.

Section VII. FIRING MECHANISM M1

65. General

a. The firing mechanism M1 (figs. 60 and 61) consists of the firing mechanism housing assembly, firing pin, and related parts. The firing pin housing, firing pin guide, and the primer holder retain the firing pin in position. Safety set screws lock the firing pin housing and the primer holder in position. The firing mechanism M1 screws, as a unit, into the firing mechanism housing in the rear end of the breech-block carrier (fig. 37).

b. The firing mechanism housing assembly consists of a block to which is welded the locking plunger guide; the block is a cylinder with a safety rim extending around the major portion of the rear of the block. This rim prevents the percussion hammer from striking the firing pin (fig. 60) unless the firing mechanism M1 is screwed fully into the firing mechanism housing in the adapter with the locking plunger engaged.

c. The firing mechanism M1 is locked in position by the locking plunger, which extends through the firing mechanism handle guide and spring. The locking plunger is spring-loaded and fastened to the handle by a straight pin through plunger and handle.

d. The firing pin is held in the firing mechanism housing assembly by the firing pin housing at the rear and by the firing pin spring, firing pin guide, and primer holder at the front. The firing pin housing screws into the rear of the firing mechanism housing assembly and is locked by a safety set screw. A copper shoe is inserted ahead of the screw to prevent damage to the threads of the housing. The firing pin guide fits, closed end forward, in the forward end of the firing mechanism housing assembly. The firing pin spring is compressed between the guide and the firing pin. The primer holder screws into the front of the firing mechanism housing assembly, holding the guide and spring in place. Its flanged front has a "U" shaped slot (fig. 60) to receive the flanged end of the primer. The primer holder is locked in the firing mechanism housing assembly by a safety set screw (fig. 61). Holes are provided in the exposed heads of the holder and housing for insertion of the firing mechanism wrench 6167037 during assembly and disassembly.

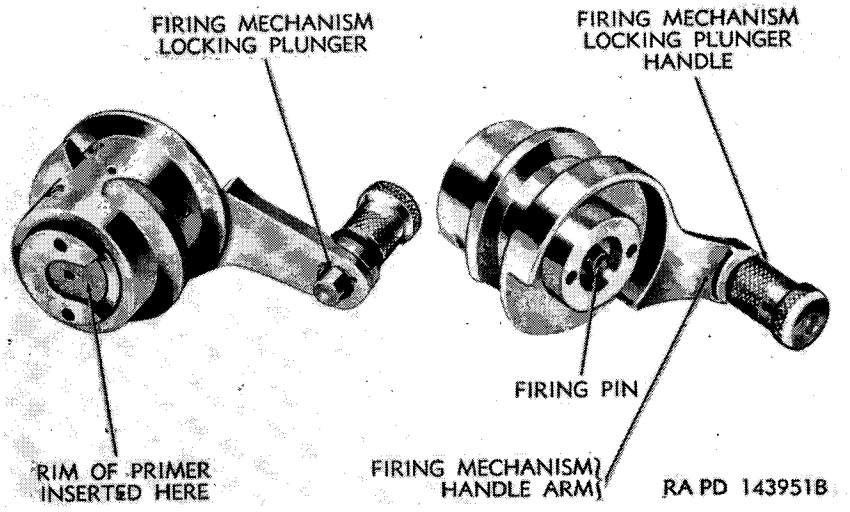

Figure 60. Firing mechanism M1—front and rear views.

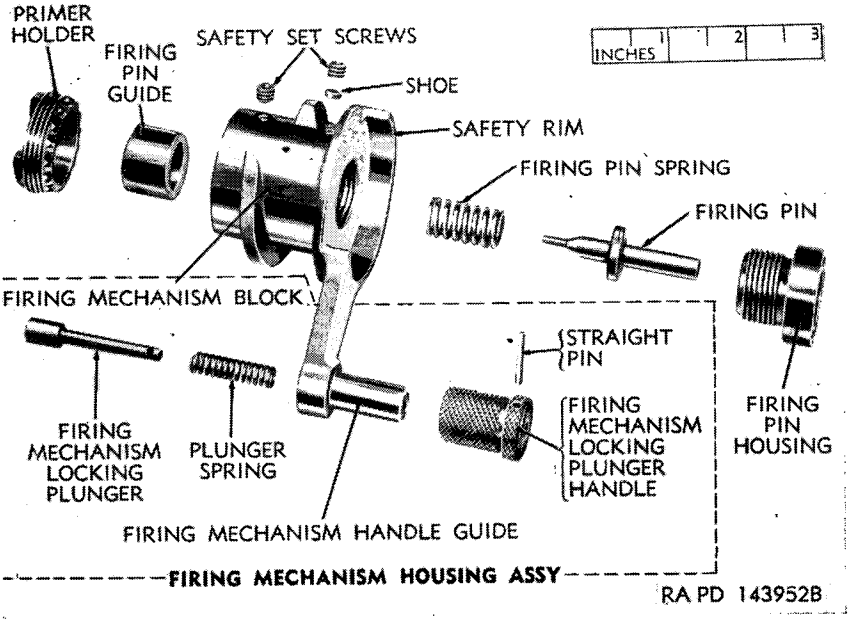

Figure 61. Firing mechanism M1—exploded view.

66. Removal and Installation of Firing Mechanism M1

a. The firing mechanism M1 is removed and installed in the firing mechanism housing at the rear of the breechblock carrier (fig. 37) between the firing of successive rounds.

b. To remove the firing mechanism, pull the firing mechanism locking plunger handle (fig. 60) to the rear against its spring pressure, and turn it counterclockwise to free the firing mechanism.

c. To install the firing mechanism in its housing, turn it clockwise into the housing until the firing mechanism locking plunger handle arm (fig. 60) contacts the firing mechanism stop stud at the rear of the breechblock carrier (fig. 21), and the firing mechanism safety latch moves to the right.

67. Disassembly of Firing Mechanism M1

a. Remove both safety set screws from the firing mechanism housing assembly (fig. 61). Do not loosen the shoe under the set screw for the firing pin housing. Unscrew (clockwise) the firing pin housing from the rear of the firing mechanism housing assembly, using the firing mechanism wrench 6167037 (figs. 26 and 62 and table I).

b. Remove the firing pin and the firing pin spring from the rear of the firing mechanism housing assembly (fig. 61). Push the copper shoe out of the set screw hole, if it has not already come out.

c. Unscrew (clockwise) the primer holder from the front of the firing mechanism housing assembly using the firing mechanism wrench 6167037 (figs. 26 and 62). Remove the firing pin guide (fig. 61).

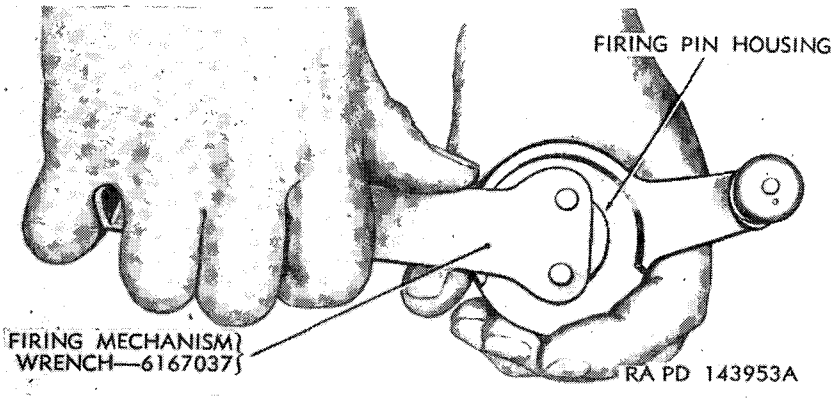

Figure 62. Disassembling or assembling firing mechanism M1

[redacted]

d. To remove the firing mechanism locking plunger, handle, and spring, drive out the straight pin holding the handle to the end of the locking plunger (fig. 61). When the pin is removed, the plunger and plunger spring may fly out of the handle guide, and should be retained by the hand and removed. Remove the handle from the handle guide.

68. Assembly of Firing Mechanism M1

a. Insert the firing mechanism locking plunger spring in the firing mechanism handle guide, from the front (fig. 61). Insert the small end of the locking plunger through the spring and guide and push it in against the spring pressure. Place the handle on the end of the plunger and aline the holes in the handle with the hole in the end of the plunger. Then install a $\frac{3}{32}$ x $1\frac{3}{16}$ straight pin to fasten the handle to the plunger.

b. Place the firing pin guide (fig. 61) in the forward end of the firing mechanism housing assembly with the hollow portion of the guide toward the rear of the housing assembly. Screw (counterclockwise) the primer holder into the forward end of the block, using the firing mechanism wrench 6167037 (figs. 26 and 62). Look in the set screw hole and aline the nearest notch in the rear edge of the holder with the set screw hole. Insert and tighten the set screw (fig. 61), using a socket-head wrench.

c. Insert the firing pin spring into the firing pin guide through the rear of the firing mechanism housing assembly. Insert the rounded end of the firing pin into the inner end of the firing pin housing (fig. 61), and screw (counterclockwise) the housing into the rear-end of the firing mechanism housing assembly using the firing mechanism wrench 6167037 (figs. 26 and 62). As the housing approaches its seat, it should be screwed carefully, making sure that the firing pin point properly enters its hole in the center of the guide (fig. 61). When the firing pin housing is firmly seated against the rear of the firing mechanism housing assembly, insert the copper shoe into the set screw hole to protect the threads of the firing pin housing. Screw in and tighten the set screw.

Caution: When the set screws are seated, they must be flush with or below the outside of the firing mechanism housing assembly.

69. Maintenance of Firing Mechanism

a. The firing mechanism should be frequently disassembled (par. 67) for cleaning and oiling. When the mechanism is disassembled for this purpose or for the replacement of defective parts, clean all

[redacted]

parts thoroughly with rifle-bore cleaner, wipe dry, and lubricate with preservative lubricating oil prior to assembly. Remove all burs or roughness with crocus cloth before applying oil to parts.

b. If the firing mechanism fails to function properly (par. 55), disassemble the mechanism (par. 67*a* through *c*) to determine the cause, and replace a defective primer holder, the firing pin guide, firing pin spring, or firing pin as required.

c. If the firing mechanism locking plunger is inoperative, the locking plunger spring may be broken. Disassemble the mechanism (par. 67*d*), and replace the locking plunger spring (fig. 61) if it is defective.

Section VIII. RECOIL MECHANISM M6, M6A1, M6A2, M6B1, OR M6B2

70. General

a. The 155-mm howitzer mount M14 is equipped with recoil mechanism M6, M6A1, M6A2, M6B1, or M6B2. These recoil mechanisms are similar in exterior appearance and all function and are serviced in the same manner.

b. Recoil energy is absorbed and the howitzer is returned to battery after firing by the recoil mechanism, which is of the hydropneumatic, variable recoil type. The recoil mechanism incorporates the cylinder yoke and cradle (figs. 63 and 64), which support the howitzer and in which the howitzer slides during recoil and counterrecoil. Its other components are the gun cover, the recoil cylinder, the variable recoil cam assembly, replenisher, counterrecoil cylinder, recuperator cylinder, counterrecoil and recuperator cylinder head stuffing box, elevating arc, and their assembled parts. Differences between recoil mechanisms are given in (1) through (5) below.

(1) *Recoil mechanism M6.* This early type mechanism was designed to give satisfactory performance in temperatures down to (aprx.) −20° F. and should not be used in colder climates. All existing stocks are to be modified for low temperature operation.

(2) *Recoil mechanism M6A1.* When mechanism M6 is modified to incorporate a spacer in the floating piston and low temperature type packing fillers, it is designated M6A1. Petroleum base hydraulic oil is used for recoil fluid. These modifications lower the operation temperature range to −65° F.

(3) *Recoil mechanism M6A2.* New manufacture M6 type mechanism will incorporate a one-piece floating piston, low temperature type packing fillers, and will use petroleum base hydraulic oil as recoil fluid; they are designated M6A2.

These mechanisms will use US standard or unified standard threads instead of metric threads. Designed to give satisfactory performance in temperatures down to −65° F.

(4) *Recoil mechanism M6B1.* This mechanism was an alternate of mechanism M6. All characteristics and performance of operation are similar to the M6.

(5) *Recoil mechanism M6B2.* When mechanism M6B1 is modified to incorporate the same improvements as for the M6A1 ((2) above), it is designated M6B2.

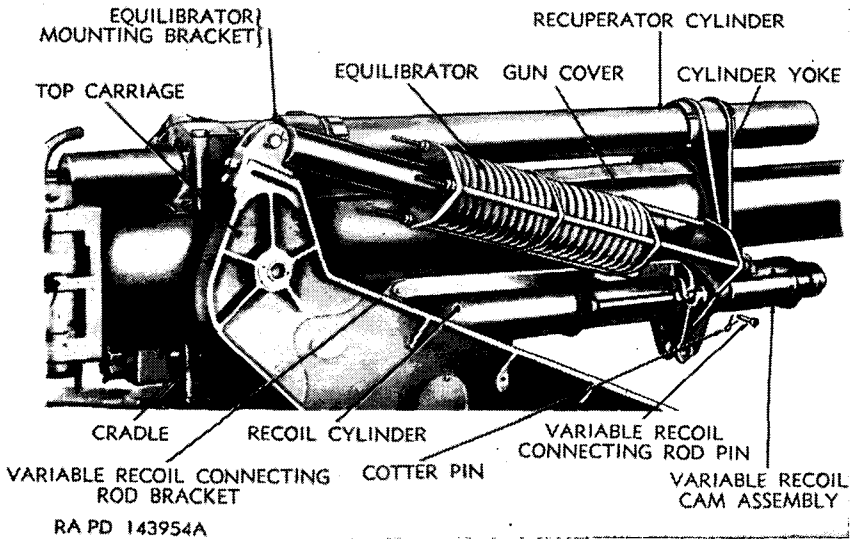

Figure 63. Recoil mechanism in place of mount—right side view.

c. The energy and shock of firing is absorbed by the recoil mechanism in gradually checking and stopping the rearward movement of the howitzer. The recoil mechanism returns the howitzer to battery position during counterrecoil and provides adequate buffing action to prevent "slamming" into battery. Compressed nitrogen in the recuperator cylinder supplies the force which returns the howitzer to battery and holds it in battery.

d. The recoil mechanism (figs. 63 and 64) is a hydropneumatic, variable recoil type and includes separate recoil and counterrecoil systems (figs. 69 and 70). The recoil system consists of the recoil cylinder, replenisher, and variable recoil cam assembly. The counterrecoil system consists of the recuperator cylinder (employing a floating piston to separate the oil from the compressed nitrogen), the counterrecoil cylinder and the counterrecoil and recuperator cylinder head stuffing box, which joins the two cylinders hydraulically. The recoil

and counterrecoil systems are not connected by oil passages. Both systems are installed in the cylinder yoke and cradle (figs. 63 and 64), which support the howitzer and in which the howitzer slides during recoil and counterrecoil. The gun cover connects the cylinder yoke and cradle and protects the bearing surface of the howitzer. An elevating arc is fastened at the bottom of the cradle.

71. Functioning

a. Recoil System.

(1) *Recoil cylinder.*

(*a*) The recoil rod stuffing box head seals the rear end of the recoil cylinder and forms a guide for the recoil piston rod. The front end is sealed by the recoil cylinder throttling rod packing head, which also forms the end bearing for the recoil throttling rod. The recoil cylinder houses the recoil piston and rod and the recoil throttling rod. All space in the recoil cylinder not occupied by the mechanism is filled with recoil fluid.

(*b*) The rear end of the recoil piston rod is connected to the lower lug on the breech ring and travels backward with the weapon during recoil. The piston and rod are drilled centrally to provide a bore in which the recoil throttling rod, which does not travel backward with the weapon during recoil, slides during the recoil movement. The bore of the piston rod is of smaller diameter at its rear end to form the buffer chamber ((*e*) below).

(*c*) The recoil throttling rod rotates in the bore of the recoil cylinder throttling rod packing head at the front end of the cylinder. A number of long grooves of varying depth are cut lengthwise in the surface of the throttling rod. In recoil, oil in the rear of the piston must pass through ports in the piston to these grooves and out in front of the piston. The restriction or throttling of this flow of oil opposes the movement of the piston (*c* (2) (*b*) below).

(*d*) The throttling rod is turned by the throttling rod gear sector (fig. 78) at its front end, which meshes with a similar sector actuated by the variable recoil cam ((2)(*b*) below).

(*e*) The rear end of the throttling rod is of smaller diameter and is provided with throttling grooves to form a spearhead type buffer. Near the end of the counterrecoil movement, this buffer enters the buffer chamber of the recoil piston rod. The oil trapped in the buffer chamber must

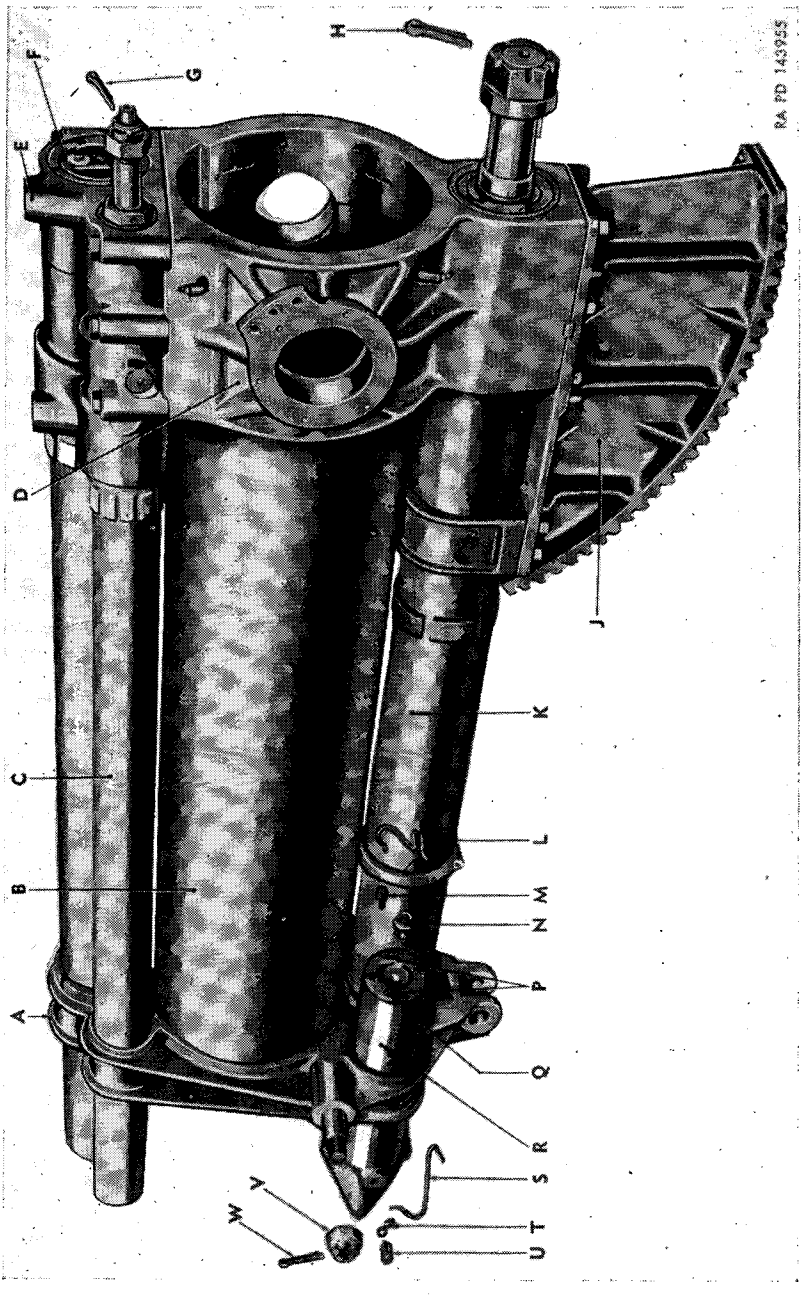

Figure 64. Recoil mechanism removed from mount—left side view.

A—CYLINDER YOKE
B—GUN COVER
C—COUNTERRECOIL CYLINDER
D—CRADLE
E—COUNTERRECOIL AND RECUPERATOR CYLINDER HEAD STUFFING BOX
F—RECUPERATOR CYLINDER OIL FILLING VALVE PLUG
G—COUNTERRECOIL PISTON ROD NUT AND COTTER PIN
H—RECOIL PISTON ROD NUT AND COTTER PIN
J—ELEVATING ARC
K—RECOIL CYLINDER
L—LEATHER THONG
M—REPLENISHER PISTON GUIDE AND PLUG BOLT
N—REPLENISHER PISTON GUIDE PLUG
P—AIR HOLES
Q—REPLENISHER PISTON GUIDE
M—REPLENISHER
S—LEATHER THONG
T—"S" HOOK
U—REPLENISHER OIL FILLING VALVE PLUG
V—CYLINDER YOKE PIN CASTLE NUT
W—CYLINDER YOKE PIN CASTLE NUT COTTER PIN

Figure 64. Recoil mechanism removed from mount—left side view.—Continued

escape through the grooves, which throttle its flow (*c*(3) (*c*) below).

(2) *Variable recoil cam assembly.*

(*a*) The variable recoil cam assembly (figs. 63 and 65) automatically reduces the length of recoil as the howitzer is elevated. The variable recoil cam housing mounted in and on the right side of the cylinder yoke near the front end of the recoil cylinder houses the tubular variable

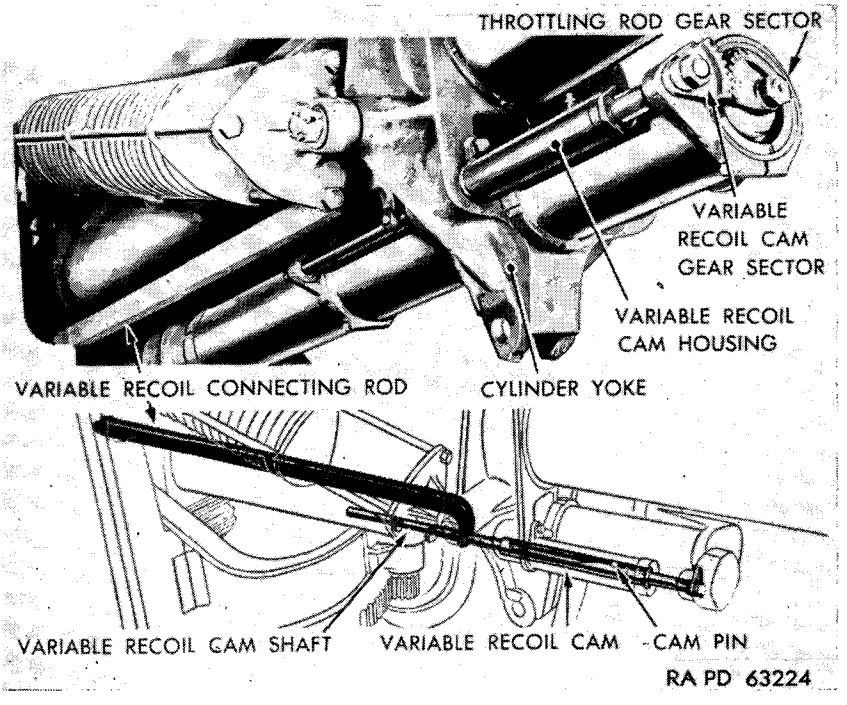

Figure 65. Variable recoil cam—assembled and phantom views.

recoil cam which is machined with a spiral slot. The variable recoil cam gear sector, mounted on the front end of the cam, engages a similar sector on the front end of the recoil throttling rod.

(*b*) The variable recoil cam shaft slides in the bore of the cam. This shaft is provided with a cam pin that engages the spiral slot in the cam (figs. 69 and 70). The shaft is connected to the top carriage by the variable recoil connecting rod. As the weapon is elevated or depressed, the connecting rod moves the shaft forward or backward. This causes the cam pin on the shaft to turn the cam and its

gear sector, which turns the gear sector on the throttling rod. The turning of the throttling rod regulates the opening of the oil passages in the recoil cylinder and determines the length of recoil.

(3) *Replenisher.*

(*a*) The replenisher (figs. 64 and 66) serves as an oil reservoir for the recoil cylinder. It stores excess oil forced from the recoil cylinder by expansion of the oil due to increased atmospheric temperature or to heat developed by firing.

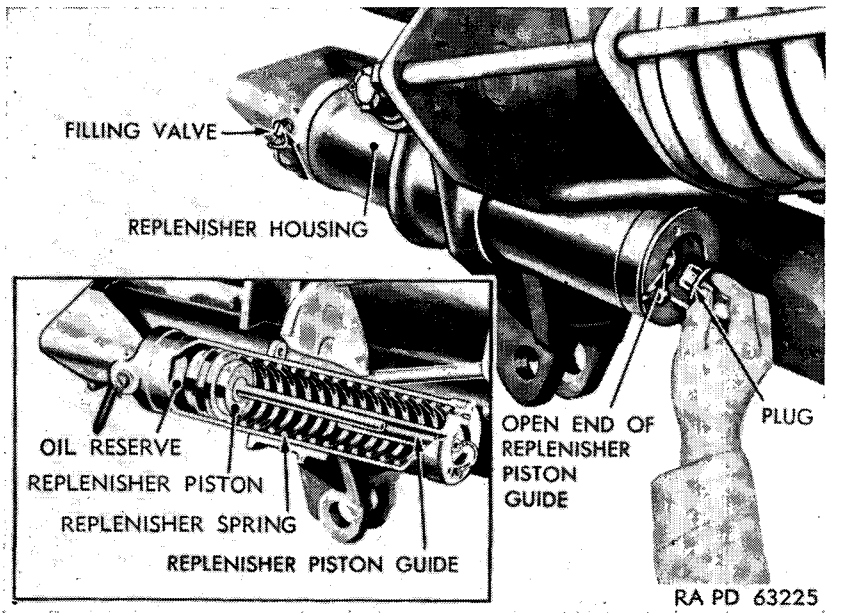

Figure 66. Replenisher—assembled and sectional views.

It supplies oil required to compensate for contraction of the oil due to low temperatures.

(*b*) The replenisher housing is mounted in a bore in the cylinder yoke at the left and near the front end of the recoil cylinder. A tube in the head of the replenisher connects the replenisher with the recoil cylinder. The replenisher is fitted with a spring-loaded piston. The piston, which has an oiltight packing arrangement, is forced rearward against spring pressure as oil enters the replenisher. The spring-loaded piston forces the oil into the recoil cylinder when oil is required.

(*c*) An extension on the rear of the piston slides in the replenisher piston guide, which closes the rear end of the re-

[redacted]

plenisher. The guide is open at the rear and provides a means for determining the amount of reserve oil in the replenisher. This reserve can be determined by inserting a rule in the open rear end of the guide and measuring the distance from the rear face of the guide to the rear end of the piston extension (par. 72*d*). The replenisher piston guide plug (fig. 66) is provided to protect the open end of the guide from dirt and other foreign matter.

b. Counterrecoil System.

(1) *Counterrecoil cylinder.*

(*a*) The counterrecoil cylinder (fig. 64) is the smaller of the two cylinders mounted above the howitzer. Its front end is closed by the respirator and is supported by, and is a slip fit in, a bore in the cylinder yoke. Its rear end is assembled in its bore in the counterrecoil and recuperator cylinder head box. The rear end of this bore is sealed by the counterrecoil rod stuffing box head through which the counterrecoil piston rod slides.

(*b*) The counterrecoil piston and piston rod reciprocate in the counterrecoil cylinder (fig. 70). This rod is connected to the top lug of the breech ring and travels backward with the weapon during recoil. The piston is fitted with an oiltight packing arrangement that permits it, when drawn backward in recoil, to force the oil in the cylinder to the rear and through the opening in the counterrecoil and recuperator cylinder head box into the recuperator cylinder.

(*c*) The counterrecoil respirator (fig. 67) in the front end of the counterrecoil cylinder is equipped with a spring-loaded ball check valve. Its purpose is to release any air pressure in front of the counterrecoil piston when the piston is moving forward during counterrecoil.

(2) *Recuperator cylinder.*

(*a*) The recuperator cylinder (fig. 64) is the larger of the two cylinders mounted above the weapon. Its front end is supported in a bore in the cylinder yoke and is locked by two nuts. Its rear end is assembled in the right bore of the counterrecoil and recuperator cylinder head box. The front end of the recuperator cylinder is sealed by the front recuperator cylinder head, which is equipped with the recuperator charging valve and protected by a cover (fig. 67). The rear end of the recuperator cylinder bore of the head box is sealed by the recuperator oil index housing. This housing is fitted with an oil filling valve and plug and the oil index (fig. 68).

[redacted]

(*b*) The recuperator cylinder houses the recuperator floating piston (figs. 69 and 70). The floating piston separates the oil at the rear end of this cylinder from the compressed nitrogen at the front end. This piston moves forward or backward, depending upon the direction from which the greater pressure comes.

Figure 67. Front ends of recuperator and counterrecoil cylinders.

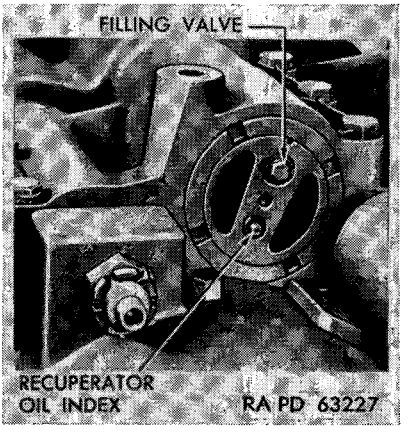

Figure 68. Rear ends of recuperator and counterrecoil cylinders.

(*c*) The counterrecoil regulator valve is housed in the recuperator cylinder bore of the head box. It permits free passage of oil from the counterrecoil cylinder to the recuperator cylinder during recoil of the howitzer but regulates the flow of oil back into the counterrecoil cylinder during counterrecoil.

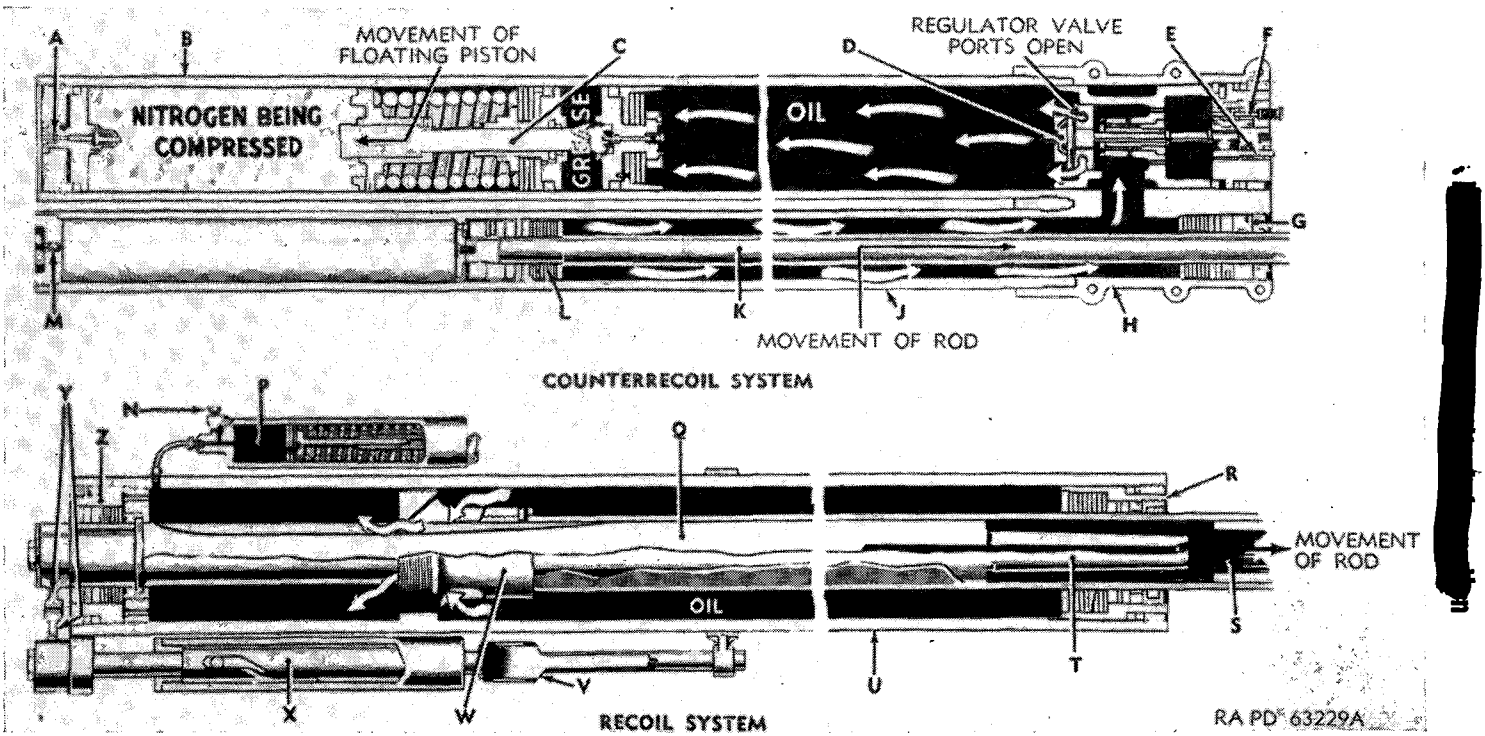

Figure 69. Recoil mechanism—recoil action.

A—RECUPERATOR CHARGING VALVE
B—RECUPERATOR CYLINDER
C—RECUPERATOR FLOATING PISTON
D—COUNTERRECOIL REGULATOR VALVE (SPRING-LOADED)
E—OIL INDEX
F—FILLING VALVE
G—COUNTERRECOIL ROD STUFFING BOX HEAD
H—COUNTERRECOIL AND RECUPERATOR CYLINDER HEAD BOX
J—COUNTERRECOIL CYLINDER
K—COUNTERRECOIL PISTON ROD
L—COUNTERRECOIL PISTON
M—COUNTERRECOIL CYLINDER RESPIRATOR
N—FILLING PLUG
P—OIL RESERVE IN REPLENISHER
Q—RECOIL THROTTLING ROD
R—RECOIL ROD STUFFING BOX HEAD
S—BUFFER CHAMBER IN BORE OF RECOIL PISTON AND ROD
T—BUFFER AND RECOIL THROTTLING ROD
U—RECOIL CYLINDER
V—VARIABLE RECOIL CONNECTING ROD
W—RECOIL PISTON AND ROD
X—VARIABLE RECOIL CAM
Y—GEAR SECTORS
Z—RECOIL CYLINDER THROTTLING ROD PACKING HEAD

Figure 69.—Recoil mechanism—recoil action.—Continued.

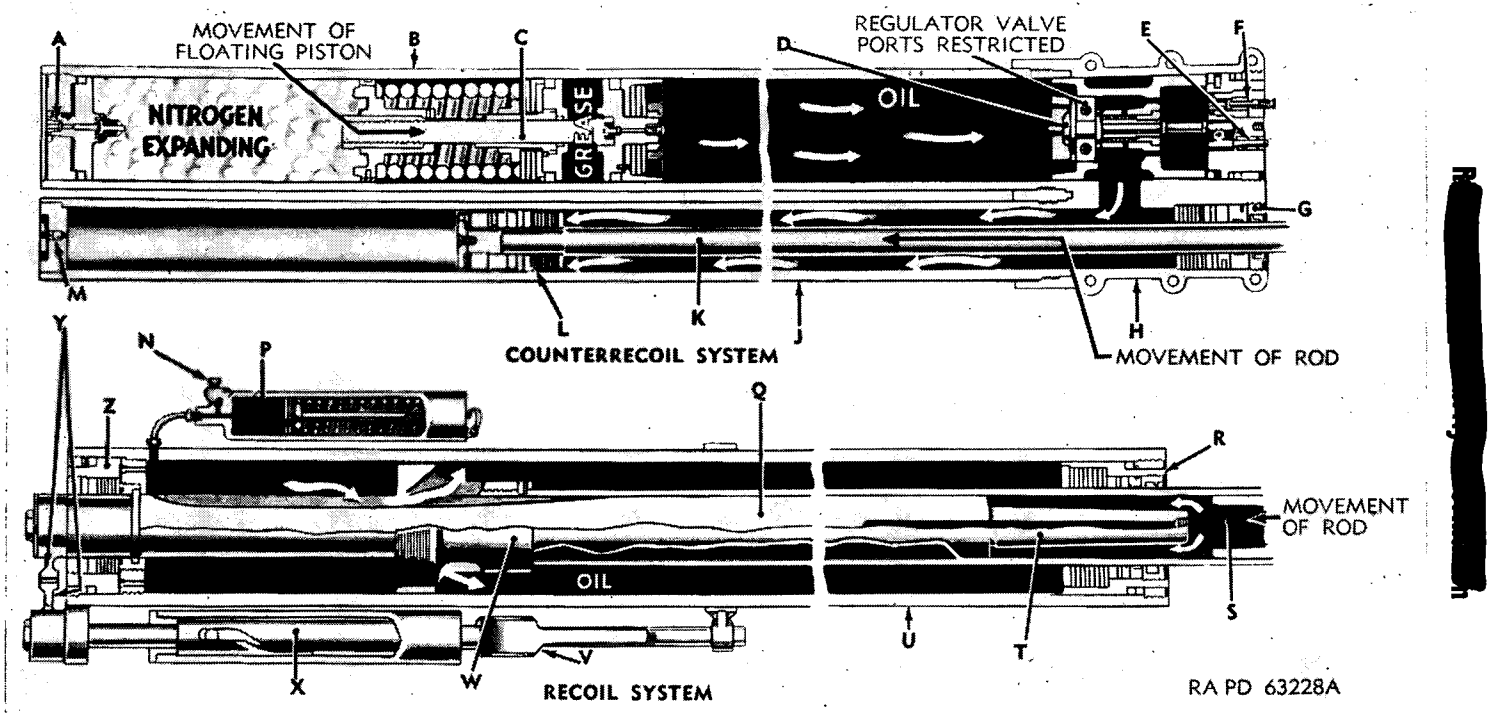

Figure 70.—Recoil mechanism—counterrecoil action.

A—RECUPERATOR CHARGING VALVE
B—RECUPERATOR CYLINDER
C—RECUPERATOR FLOATING PISTON
D—COUNTERRECOIL REGULATOR VALVE (SPRING-LOADED)
E—OIL INDEX
F—FILLING VALVE
G—COUNTERRECOIL ROD STUFFING BOX HEAD
H—COUNTERRECOIL AND RECUPERATOR CYLINDER HEAD BOX
J—COUNTERRECOIL CYLINDER
K—COUNTERRECOIL PISTON ROD
L—COUNTERRECOIL PISTON
M—COUNTERRECOIL CYLINDER RESPIRATOR
N—FILLING PLUG
P—OIL RESERVE IN REPLENISHER
Q—RECOIL THROTTLING ROD
R—RECOIL ROD STUFFING BOX HEAD
S—BUFFER CHAMBER IN BORE OF RECOIL PISTON AND ROD
T—BUFFER AND RECOIL THROTTLING ROD
U—RECOIL CYLINDER
V—VARIABLE RECOIL CONNECTING ROD
W—RECOIL PISTON AND ROD
X—VARIABLE RECOIL CAM
Y—GEAR SECTORS
Z—RECOIL CYLINDER THROTTLING ROD PACKING HEAD

Figure 70.—Recoil mechanism—counterrecoil action.—Continued.

[redacted]

(*d*) The recuperator oil index (fig. 68) indicates the presence or absence of an adequate oil reserve in the recuperator (par. 26*b*). Adequate oil reserve is necessary for proper functioning of the counterrecoil mechanism as the oil reserve locates the zone of movement of the floating piston. When dangerously low reserve is present, the rear end of the floating piston presses on the oil index actuating rod (figs. 69 and 70), which is racked through a gear to the oil index. This withdraws the oil index within the recuperator oil index housing.

Note.—The weapon should not be fired when the index is in this position.

c. Combined Functioning of the Recoil and Counterrecoil Systems.

(1) *General.* The recoil system, located below the howitzer, and the counterrecoil system, located above the howitzer, operate in conjunction with one another to control both the recoil and the counterrecoil of the weapon. The only direct connection between the two systems is the breech ring to which both are attached by their respective piston rods.

(2) *Recoil action.*

(*a*) When the howitzer is fired, the howitzer recoils in the cradle and the recoil and counterrecoil pistons are drawn backward through their cylinders by their piston rods, which are attached to the breech ring (fig. 69). The recoil throttling rod, which has been automatically adjusted to the elevation of the weapon, remains stationary in its bore in the recoil piston rod.

(*b*) The oil in the recoil cylinder in the path of the piston is forced through ports in the piston and through the grooves in the throttling rod to the other side of the piston. This has a throttling action on the oil, causing resistance which absorbs a great portion of the recoil energy.

(*c*) At the same time, the oil in the counterrecoil cylinder in the path of the counterrecoil piston is forced through the communicating opening in the counterrecoil and recuperator cylinder head box. This forces open the spring-loaded regulator valve, and the oil forces the floating piston forward, further compressing the nitrogen in the space ahead of the floating piston. The resistance encountered to increase the nitrogen pressure helps to oppose the movement in recoil of the weapon.

(*d*) The forces, produced by the throttling of the oil in the recoil cylinder, the increased nitrogen pressure in the re-

[redacted]

cuperator cylinder, and the combined friction of the packings of the recoil mechanism, bring the weapon to rest.

(3) *Counterrecoil action.*

(*a*) When the weapon has fully recoiled, the highly compressed nitrogen immediately begins to expand, forcing the floating piston, and the oil in back of it, in the opposite direction (fig. 70). The regulator valve is closed, and the oil is forced to return to the counterrecoil cylinder through the counterrecoil controlling parts in the regulator valve (*b*(2)(*c*) above).

(*b*) In the counterrecoil cylinder, the oil forces the piston forward, and the counterrecoil piston rod pulls the weapon into battery.

(*c*) The final movement of the howitzer into battery is cushioned by the throttling of the oil being forced from the buffer chamber (*a*(1)(*e*) above) in the bore of the recoil piston rod.

72. Maintenance of Recoil Mechanism

a. General.

(1) The recoil mechanism should be examined regularly for leakage of oil. There is no cause for concern should the oil drip rapidly, or even run in a stream, from the rear of the replenisher when the howitzer is elevated, provided that the weapon has been at 0° elevation for some time. This condition may exist in a normal replenisher. A leakage at any packing that does not require frequent refilling of the replenisher is not considered serious; if frequent replenishing is necessary, report the matter to ordnance maintenance personnel.

(2) Keep the air holes open in the rear of the replenisher piston guide (fig. 66). Use a wire to clean these openings.

(3) When the howitzer is not being fired, check the replenisher and recuperator cylinder oil reserves weekly (pars. 26 and 52). If the proper amount of reserve oil is not present, establish the proper reserve (*d* and *f* below).

(4) Failure of the weapon to return to battery or slow return to battery, indicates that the nitrogen pressure in the recuperator cylinder is too low. Notify ordnance maintenance personnel.

Note.—During cold weather, the counter-recoil action will be slow for the first few rounds (until the oil warms up).

[redacted]

b. Care of Recoil Fluid.

(1) Recoil oil (special) is used in recoil mechanisms M6 and M6B1. Recoil mechanism M6A1, M6A2, or M6B2 contain petroleum base hydraulic oil. Recoil oil (special) may be used in the recoil mechanisms M6 and M6B1 until recoil oil (special) is no longer available in the supply systems, then ordnance maintenance personnel will drain and refill with petroleum base hydraulic oil. Petroleum base hydraulic oil is an all temperature oil and will be used to replenish the oil in recoil mechanisms M6A1, M6A2, and M6B2.

(2) The oil filling valve plugs of the replenisher and recuperator of recoil mechanisms filled with recoil oil (special) are painted and circled with green. When the mechanism is filled with petroleum base hydraulic oil, these plugs are painted and circled with orange.

(3) Recoil fluid must not be put into any container not marked with the name of the fluid; left in open containers; be subjected to excessive heat; or mixed with any other type oil. The transfer of recoil fluid to a container not marked with the name of the fluid may result in the wrong oil getting into the recoil mechanism, or in the use of recoil fluid for lubricating purposes.

(4) When putting recoil fluid into the oil pump it should be filtered through a piece of clean cloth as well as through the wire strainer of the filling funnel. Every precaution must be taken to prevent the introduction of water or grit into the mechanism, either in the oil or through failure to clean thoroughly the connections and servicing equipment.

(5) Exposure of recoil fluid in an open can may result in the accumulation of moisture. Condensation in a container partly filled with oil, or the pouring of oil from one container to another which has moisture on its inner walls, results in moisture being carried along with the oil into the recoil mechanism.

(6) If there is a possibility that recoil fluid may contain water, it should be tested by one of the following methods:

(*a*) Fill a clean glass container of pint capacity with the recoil fluid. Permit the oil to settle. The water, if present, will sink to the bottom. With the container slightly tilted, drops or bubbles will form in the lower portion. Invert the container and hold it to the light. Drops or bubbles of water, if present, may be seen slowly sinking in the oil. If the oil has a cloudy appearance, the cloudiness may be assumed to be particles of water.

[redacted]

(*b*) Heat the oil in a shallow pan. Water in the oil will appear on the surface as minute bubbles. This test will disclose water not determinable by the settling test. Should either test show water, the oil on hand should be turned in.

c. Test Operation of Replenisher Piston.

(1) Remove the replenisher piston guide plug (fig. 14) from the rear of the replenisher, and insert a rule through the opening at the rear of the replenisher. Unscrew the replenisher oil filling valve plug from the front left side of the replenisher (figs. 64 and 71). Then release oil from the replenisher by screwing the liquid releasing tool 6103913 (figs. 27, 71, and 72 and table II) into the filling valve plug hole from which the plug was removed (fig. 71). If movement of the replenisher piston takes place as indicated by reading on rule, the replenisher piston is functioning.

(2) If the replenisher piston does not move, insert a block of hard wood through the opening at the rear of the replenisher and against the piston end and tap with a hammer. When the replenisher has not been exercised, the piston extension may become rusted in its guide. If a light tap will not free piston, notify ordnance maintenance personnel.

d. Establish Replenisher Oil Reserve.

(1) If the position of the replenisher piston extension indicates too much reserve oil (par. 26*a*(3)), release oil to establish the proper reserve.

(2) If the position of the replenisher piston extension indicates insufficient reserve oil (par. 26*a*(4)), establish the proper reserve by adding oil as follows:

(*a*) Attach the oil filling plug adapter (fig. 71) to one end of the oil hose and screw the adapter loosely into the filling hole on the replenisher. Attach the other end of the hose to the oil pump. Purge the tube and then tighten the adapter without the use of a wrench, except for the final tightening. Extreme care must be taken to prevent injury to the threads of the filling hole.

Note.—Purging means removing all air from the pump and hose before forcing oil into the recoil mechanism. This is accomplished by only partially screwing the adapter to the filling hole, operating the pump, and letting oil escape until no more bubbles appear at the connection; then tighten the adapter fully.

(*b*) Operate the pump until the rear end of the replenisher piston extension is 5½ inches from the rear face of the replenisher (par. 26*a*(2)).

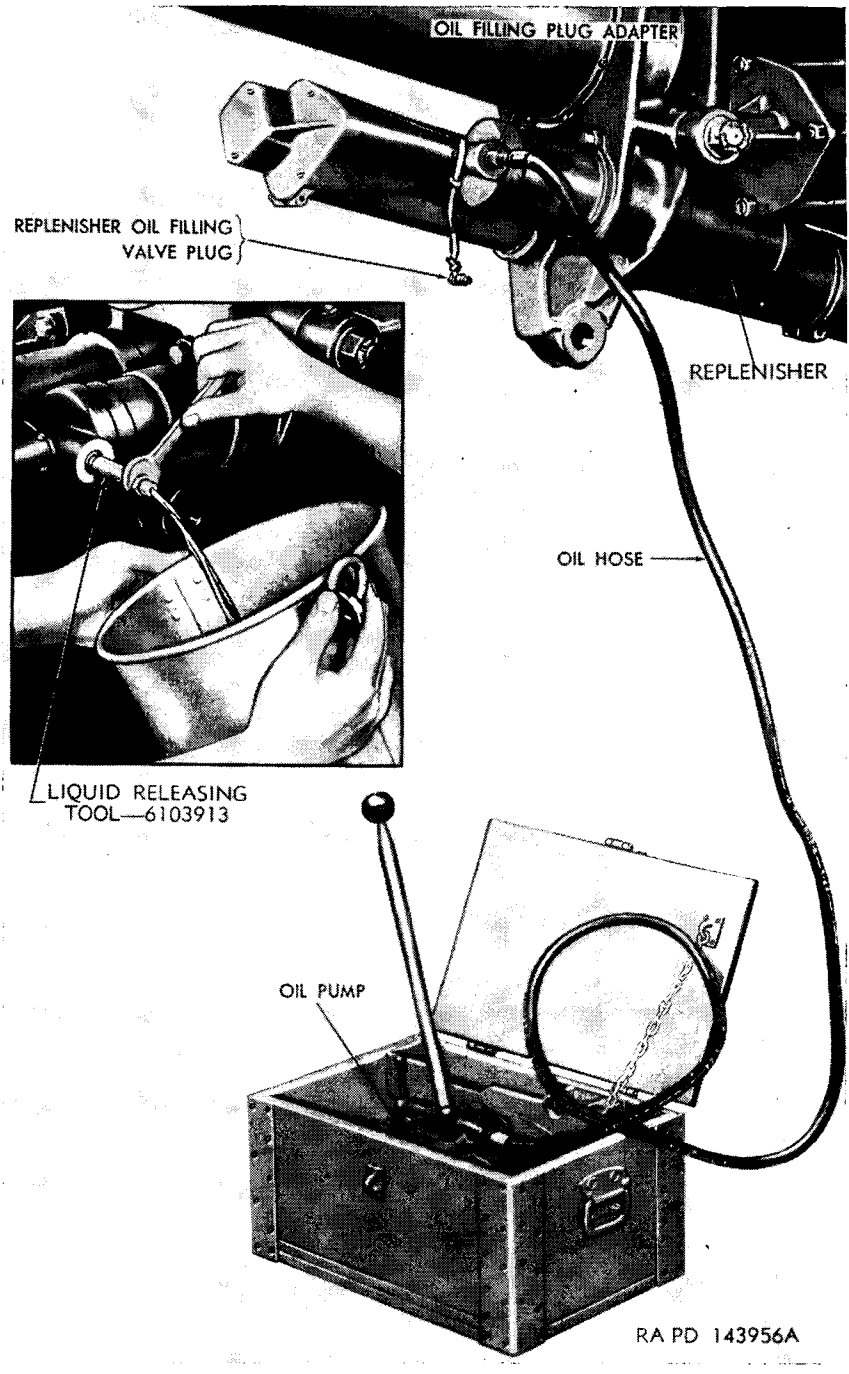

Figure 71. Draining and filling replenisher.

[redacted]

(*c*) Remove the adapter and hose and install the replenisher oil filling valve plug (fig. 71).

e. Exercise Replenisher Piston. The replenisher will be exercised monthly by pumping oil into the replenisher (*d* above) until the rear end of the piston extension projects to the rear of the replenisher. Any visible rust should be polished off the extension. Enough oil should then be withdrawn (*c*(1) above) to bring the piston back to normal position (par. 26*a*(2)).

f. Establish Recuperator Oil Reserve.

(1) The position of the oil index may indicate the oil reserve in the recuperator cylinder. If the position of the oil index warns that there is too small a quantity of oil in the recuperator (par. 26*b*(2)), drain off the reserve oil before refilling. This is accomplished by removing the recuperator cylinder oil filling valve plug (fig. 72) and installing the liquid releasing tool 6103913 (figs. 27, 71, and 72). Use a hollow tube or pipe to carry the oil from the liquid releasing tool to an appropriate container.

(2) The amount of reserve oil which will escape will be approximately 1 pint. The reserve oil will spurt out in a stream and suddenly drop to a trickle. At this point, the flow of oil should be stopped by unscrewing the liquid releasing tool 6103913 (figs. 27, 71, and 72). It will be noted that the oil index (fig. 72) has moved out of sight before all of the reserve oil has been released. If the oil index has not moved, tap it gently with a small piece of wood.

(3) To replenish the recuperator cylinder oil reserve, attach the oil filling plug adapter (fig. 72) to one end of the oil hose and screw the adapter loosely into the filling hole in the oil index housing. Attach the other end of the hose to the oil pump. Purge the pump, hose, and adapter (*d*(2) above), and tighten the adapter.

(4) Start working the oil pump while closely watching the oil index (fig. 72). As soon as the oil index starts to move to the rear begin counting the strokes of the pump handle. Count the number of strokes required to bring the oil index to its farthest outward position. Multiply the number of strokes required to accomplish this result by two. Add this number of strokes to the oil reserve. This will constitute a full reserve. Detach the adapter and install the filling valve plug.

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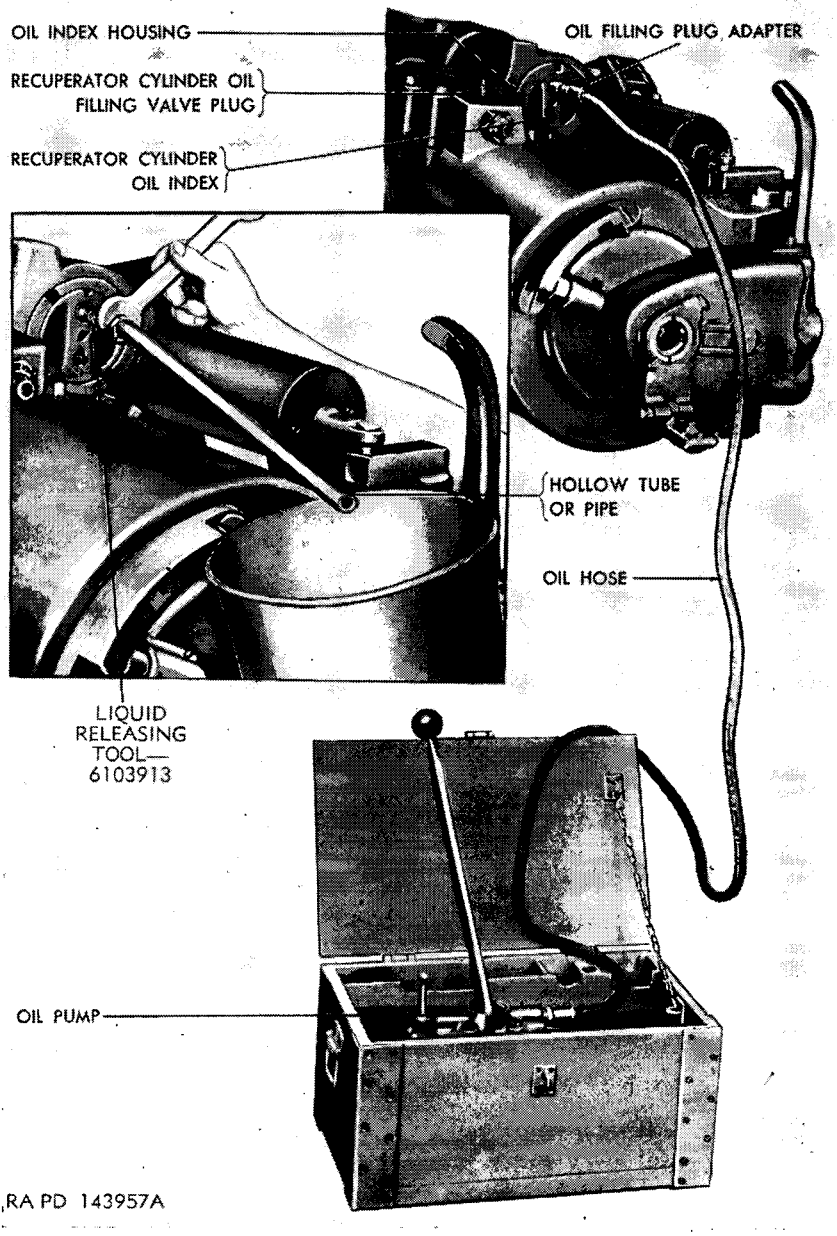

Figure 72. Draining and filling recuperator cylinder.

g. Replace Missing or Defective Parts.

(1) Operating personnel are authorized to replace the parts mentioned below if they become lost or damaged so as to be unserviceable. Any other repairs to the recoil mechanism must be performed by ordnance maintenance personnel.

(2) When the matériel is lubricated (par. 43), note whether any lubricating elbows, fittings, or nipples are missing. If any are missing, replace them.

(3) To replace the replenisher piston guide plug, remove it from the replenisher (fig. 64) and untie leather thong. Tie thong to new guide plug and install in replenisher guide.

(4) To replace the guide and plug bolt (fig. 64), untie the leather thong from the eye of the bolt. Unscrew and replace the bolt; tie the thong securely to the eye of the bolt.

(5) To replace the leather thong, remove it from the guide and plug bolt and guide plug as in (3) above and replace it with a new one.

(6) To replace the replenisher oil filling valve plug, unscrew it from the replenisher. Twist the "S" hook enough to remove it from the plug. Then twist the "S" hook into position on the new plug, and install the plug in the replenisher.

(7) To replace the "S" hook, remove the oil filling valve plug from the hook and then twist the smaller loop of the hook enough to remove the leather thong. Pass the smaller loop of the new "S" hook through the looped end of the thong and bend the hook closed. Then twist the larger loop of the hook onto the oil filling valve plug, and install the plug in the replenisher.

(8) Replace the recuperator cylinder oil filling valve plug (fig. 64), the recoil and counterrecoil piston rod nut cotter pins, the cylinder yoke pin castle nut and cylinder yoke pin castle nut cotter pin, and the variable recoil connecting rod pin (fig. 63), and variable recoil connecting rod pin cotter pin if they become lost or damaged.

Section IX. TOP CARRIAGE

73. General

The top carriage (fig. 4) is of welded steel construction. It supports the howitzer and recoil mechanism (fig. 1), the elevating mechanism (fig. 2), the traversing mechanism (fig. 3), and the telescope mount and panoramic telescope (fig. 5). It is supported by and rotates on the motor carriage M41 (fig. 1). Equilibrator mounting

brackets (fig. 63) for the rear ends of the equilibrators, and a bracket for the variable recoil connecting rod are provided on the top carriage.

74. Maintenance

There are two drain holes (fig. 67) in each side of the top carriage. Keep these holes open to prevent the accumulation of water in the top carriage and the resultant formation of rust. No other maintenance of the top carriage except cleaning (par. 48), painting (par. 46), and lubrication (par. 43) is prescribed for the using organization.

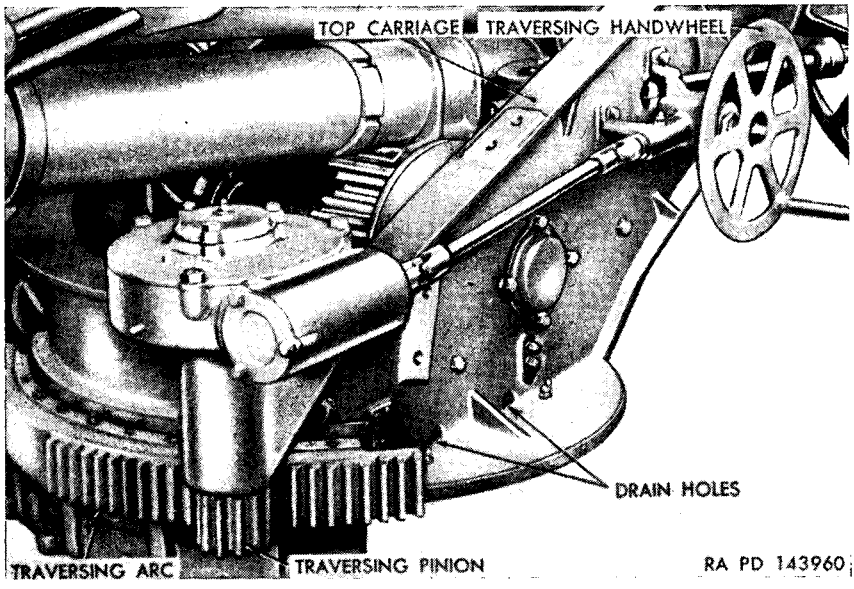

Figure 73. Traversing mechanism—left front view.

Section X. ELEVATING AND TRAVERSING MECHANISMS

75. General

a. Elevating Mechanism. The 155-mm howitzer mount M14 is equipped with an electric elevating mechanism (figs. 2 and 5) which controls the motion of the weapon in elevation by tipping the recoil mechanism and howitzer on the trunnion pins (fig. 4). Action of the mechanism is controlled by the electric elevating mechanism control handle (par. 17). An electric elevating mechanism handwheel is provided for manual operation for fine adjustments to elevation or when the electric mechanism is inoperative. Motion of the electric mechanism or the handwheel is transmitted through shafts, a flexible joint,

gears, worm, and a worm wheel to the elevating pinion which meshes with the elevating arc (E, fig. 31).

b. Traversing Mechanism. The traversing mechanism is secured to and rotates with the top carriage. It controls the movement of the weapon in azimuth (rotation) by means of the traversing pinion (fig. 73) which is rolled in the teeth of the stationary traversing arc. Motion of the traversing handwheel is transmitted through gears, flexible joints, a shaft, a worm, and a worm wheel to the traversing pinion which meshes with the traversing arc. The mechanism is mounted on the left to provide clearance for the weapon at minimum elevation.

76. Maintenance

a. By turning and stopping the elevating and traversing handwheels, check for backlash. Backlash exceeding one-sixteenth of a turn of the handwheel should be reported to ordnance maintenance personnel for correction. Backlash is an indication of wear or improper adjustment and will result in excessive muzzle whip and inaccuracies in firing.

b. The teeth of the elevating and traversing arcs and pinions must be covered with a thin coating of preservative lubricating oil as a protection against rust. Under normal conditions dust and grit will adhere to this film and cause wear; consequently, the teeth must be thoroughly cleaned and lubricated weekly.

c. If a considerable amount of dust or sand is present in the area of operation, the teeth should be wiped dry before the howitzer is operated (situation permitting) and then lubricated after the action is over. With the surfaces dry there is less wear than when they are coated with a lubricant contaminated with excessive dust or sand.

d. Vigilance must be exercised to detect any cutting or abrasion of the teeth of the elevating and traversing arcs and pinions. Report any deformation of this nature to ordnance maintenance personnel for correction. Rust must not be allowed to accumulate on these parts.

e. Monthly, check the level of the lubricant in the elevating and traversing worm gear cases and in the electric elevating gear case as prescribed in paragraph 43. Add the proper lubricant as required.

f. Semiannually drain the elevating worm gear case and the electric elevating gear case as prescribed in paragraph 43 and fill with the proper lubricant.

[redacted]

Section XI. EQUILIBRATORS

77. General

a. Two spring type equilibrators (fig. 63) are provided (one on each side of the howitzer), which function together to overcome the unbalanced weight of the weapon and to reduce the manual effort required to elevate it. The equilibrators connect the cylinder yoke with the equilibrator mounting brackets on the top carriage. The springs are compressed as the howitzer is depressed, counterbalancing the muzzle-heavy weight of the tipping parts and eliminating the need for manually braking their descent. The energy stored in the compressed springs is released as the howitzer is elevated; the springs tend to expand, thereby exerting an upward force on the weapon and assisting in elevating it.

b. The equilibrators are adjustable by means of three adjusting nuts (fig. 74) which screw onto the threaded ends of the three equilibrators rods and against the equilibrator spring seat to compress the equilibrator springs.

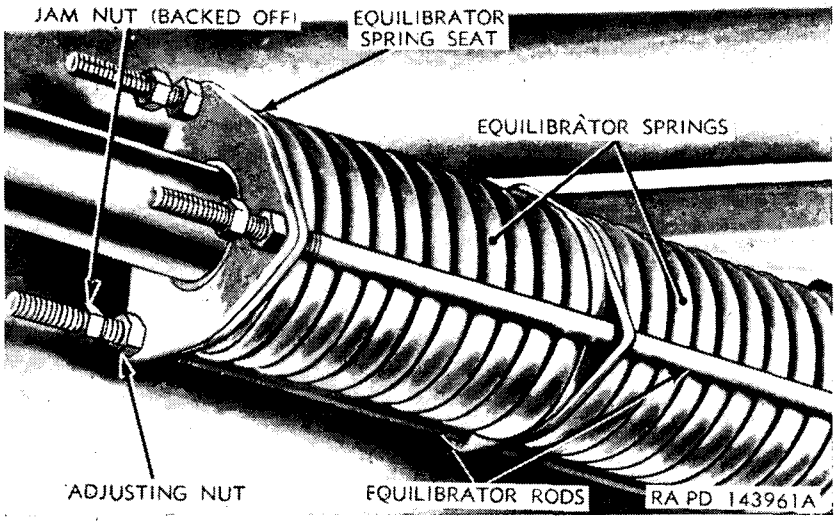

Figure 74. Adjusting equilibrator.

78. Maintenance

Warning: Under no circumstances will organizational maintenance personnel attempt to dismount the equilibrators from the top carriage or disassemble the equilibrators. The equilibrator springs are under very great compression, and failure to observe this warning may result in serious or fatal injury to personnel. Corrections of malfunctions

[redacted]

and adjustments other than described below must be performed by ordnance maintenance personnel.

a. Test Adjustment of Equilibrators.

(1) The equilibrators are properly adjusted when all of the following conditions are met:

(*a*) The howitzer is slightly muzzle-heavy when unloaded and slightly breech-heavy when loaded.

Note.—To effect smooth operation of the trunions, the motor carriage must be as level as possible.

(*b*) The three adjusting nuts of each equilibrator are equally distant from the ends of the equilibrator rods.

(*c*) The adjusting nuts of one equilibrator are the same distance from the ends of their equilibrator rods as those of the other equilibrator.

(2) Test the equilibrators for proper adjustment as follows:

(*a*) Drive motor carriage to level ground. Load approximately 54 pounds into the powder chamber to simulate half the weight of the projectile and powder charge. Elevate and depress the weapon throughout its full range of movement. If the weapon can be elevated and depressed at all degrees of elevation with approximately the same handwheel effort, the adjustment of the equilibrators is satisfactory with respect to the balance of the weapon.

(*b*) Measure the distance of each adjusting nut from the end of its equilibrator rod by removing the three jam nuts (fig. 74) and counting the threads on the equilibrator rod to each adjusting nut.

Caution: When removing the jam nuts be careful not to disturb the position of the adjusting nuts.

If all three adjusting nuts of each equilibrator are equidistant from the ends of the equilibrator rods, that equilibrator is properly adjusted with respect to equal adjustment of the adjusting nuts.

(*c*) Compare the distance of the adjusting nuts of one equilibrator from the ends of their rods with the adjustment of the adjusting nuts of the other equilibrator. If these distances are the same, both sets of equilibrator springs are under approximately the same compression, and the adjustment of the equilibrators is satisfactory with respect to each other.

Note.—Only ordnance maintenance personnel can measure the compression of the equilibrator springs so as to determine that both equilibrators are under equal compression.

[redacted]

b. Adjust Equilibrators.

(1) Before making any adjustments to the equilibrators, test them for proper adjustment as in *a* above.

(2) If all three adjusting nuts of each equilibrator are not the same distance from the ends of the equilibrator rods, tighten the nut or nuts nearest the ends of the rods until all three nuts on each equilibrator are the same distance from the ends of their rods.

(3) If the adjusting nuts of one equilibrator are nearer the ends of their rods than those of the other equilibrator, alternately tighten all three adjusting nuts of that equilibrator until the nuts of both equilibrators are the same distance from the ends of their rods.

Note.—Once the three adjusting nuts of each equilibrator have been adjusted with respect to each other, always turn each nut the same amount when making further adjustments to the equilibrators.

(4) If more handwheel effort is required to elevate than to depress the weapon, the adjusting nuts should be tightened on the rods (turned clockwise) to increase the spring compression. If more handwheel effort is required to depress than elevate the weapon, the adjusting nuts should be loosened (turned counterclockwise) to reduce the compression of the equilibrator springs. Turn all three adjusting nuts on each equilibrator an equal amount (one turn at a time) in the desired direction.

(5) Check the adjustment as in *a* above and tighten all jam nuts after the adjustment is satisfactory.

Note.—Take care to hold each adjusting nut stationary while tightening its jam nut.

Warning: Under no circumstances will the adjusting nuts be removed from the rods except by authorized ordnance maintenance personnel.

c. Clean and Lubricate Equilibrators. Weekly wipe the equilibrator springs, rods, and tubes clean with clean wiping cloths, and apply a coat of prescribed oil (par. 43) with oil-dampened wiping cloths.

Section XII. MAINTENANCE UNDER UNUSUAL CONDITIONS

79. Extreme-Cold Weather Maintenance

a. Thoroughly inspect matériel at every opportunity. Daily if possible.

b. Whenever possible, use covers and shelter.

c. Keep all parts thoroughly clean.

[redacted]

d. Lubricate sparingly. Reduce normal lubricating intervals by one half.

e. Do not let snow and ice collect on moving parts.

f. Leave no metal surface exposed without a protective film of lubricant.

g. Notify ordnance maintenance personnel if the recoil mechanism has not been winterized (pars. 70 and 72*b*(2)).

h. Refer to paragraph 33*d* for specific cold-weather operating procedures.

i. Refer to TM 9-2855 for a general discussion of maintenance problems, arctic-type lubrication, winterization, and dewinterization procedures.

80. Extreme-Hot Weather Maintenance

a. In hot, damp climates, corrosive action on all parts of the howitzer will occur and will be accelerated in areas of high humidity and during the rainy season. Evidences will appear in the form of rust and paint blisters on metal surfaces and mildew or fungi mold on fabrics and leather.

b. Protect all exposed exterior painted surfaces from the atmosphere by touch-up painting and protect unfinished exposed metal surfaces with preservative lubricating oil (medium). Cables and terminals will be protected by ignition insulation compound.

c. Make frequent inspections of inactive howitzer. Remove corrosion from exterior surfaces with crocus cloth and apply a protective coating of paint, oil, or suitable rust preventive.

81. Maintenance After Fording

a. General. During fording operations, water seepage to lubricated parts (such as the parts in a gear housing) will occur. It is advisable, therefore, that the following service be accomplished on all vehicles and howitzers which have been exposed to any depth of water or completely submerged, especially in salt water, and that precautions be taken as soon as practicable to halt deterioration and avoid damage before the vehicle is subjected to either extensive travel or the weapon to extensive firing. If a vehicle and howitzer which have been prepared for deep-water fording in accordance with TM 9-2853, have been in deep water for a considerable length of time, or if water seepage to lubricated parts may have occurred during shallow-water fording operation (due to accidental immersion or heavy splashing), precautions must be taken as soon as practicable to avoid damage to the matériel as follows:

(1) Perform complete lubrication service (par. 43).
(2) Assemblies which require disassembly for proper lubrication must be disassembled, dried, and lubricated as the situation permits.
(3) Regardless of temporary measures taken, notify ordnance maintenance personnel so that complete disassembly, cleaning, and lubrication can be accomplished as soon as practicable.

b. Cleaning and Lubrication. Drain or wipe dry all trapped moisture. Clean all exposed unpainted parts and coat with a film of preservative lubricating oil (special or medium) as prescribed for the ambient temperature in the lubrication order (par. 43).

(1) *Bore.* Wipe dry and oil with the lubricant prescribed in the lubrication order (par. 43). If any mud or grit has washed into the bore, clean with rifle-bore cleaner, wipe dry, and oil with the lubricant prescribed in the lubrication order.
(2) *Breech and firing mechanism.* Disassemble completely and clean all parts (except gas-check pads) with dry-cleaning solvent or volatile mineral spirits. Wipe dry and oil all parts (except gas-check pads) as prescribed in the lubrication order (par. 43). Wipe gas-check pad clean and dry.
Caution: Do not allow dry-cleaning solvent or volatile mineral spirits or rifle-bore cleaner to come in contact with gas-check pads.
(3) *External unpainted surfaces of howitzer tube and recoil mechanism.* Thoroughly clean and dry the rods, filling and drain valves, variable recoil cam, and external unpainted surfaces of the howitzer tube (recoil slide). Lubricate these parts as prescribed in the lubrication order (par. 43).
(4) *Elevating and traversing mechanism.*
(*a*) *Gear cases.* Drain and clean the elevating and traversing gear cases of lubricant and refill with lubricant specified in the lubrication order (par. 43).
(*b*) *Arcs, pinions, and handwheel shafts. Clean and dry.* Remove any rust with crocus cloth. Apply a thin film of lubricant prescribed in the lubrication order by wiping with a cloth that has been soaked in the lubricant and wrung out.
(5) *Equilibrators.* Wipe the equilibrator springs, rods, and tubes clean. Remove any rust spots with crocus cloth and apply a coat of the prescribed lubricant (par. 78*c*).
(6) *Top carriage.* Cleaning and lubrication of the pintle bushing and the cradle trunnion bearings will be accomplished

by ordnance maintenance personnel as soon as possible after immersion. A temporary expedient is to apply lubricant copiously to these bearings. Be sure the four drain holes are open (fig. 73).

(7) *Sighting and fire control equipment.* If sighting and fire control equipment becomes immersed in water, refer to ordnance maintenance personnel.

CHAPTER 4

MATÉRIEL USED IN CONJUNCTION WITH MAJOR ITEM

Section I. SIGHTING AND FIRE CONTROL INSTRUMENTS

82. General

This section contains information on the arrangement of the sighting and fire control equipment. It includes instructions for operation and maintenance of each item of on-carriage equipment. Instructions covering off-carriage equipment are not included in this manual, but a list of this equipment is contained in paragraph 6. The off-carriage equipment is covered in other technical manuals listed in the appendix.

83. Arrangement and Use

a. General. The sighting and fire control equipment for the 155-mm howitzer M1 is used for indirect or direct fire.

b. Indirect fire group.

(1) *Telescope mount M25.* The telescope mount M25 (figs. 5 and 75) is of the azimuth compensating type. It is bolted to the left side of the top carriage of the 155-mm howitzer mount M14, and is connected to the recoil mechanism cradle by means of the telescope mount actuating arm bracket and telescope mount actuating arm (fig. 75). It is used to mount panoramic telescopes M12A6 and M12A7G. By means of its elevating scale and longitudinal leveling micrometer, the telescope mount M25 serves to lay the 155-mm howitzer M1 in elevation.

(2) *Panoramic telescope M12A6 or M12A7G.* When in use the panoramic telescope M12A6 or M12A7G is mounted in the telescope mount M25 on the left side of the top carriage of the 155-mm howitzer mount M14 (fig. 75). It is used for laying the 155-mm howitzer M1 in azimuth. When not in use and carried with the weapon, the telescope is stowed in the panoramic telescope case (fig. 7) on the left side of the gunner's compartment of the motor carriage M41. When not in use and not carried with the weapon, the telescope is stowed in the panoramic telescope packing chest M27 (fig. 76).

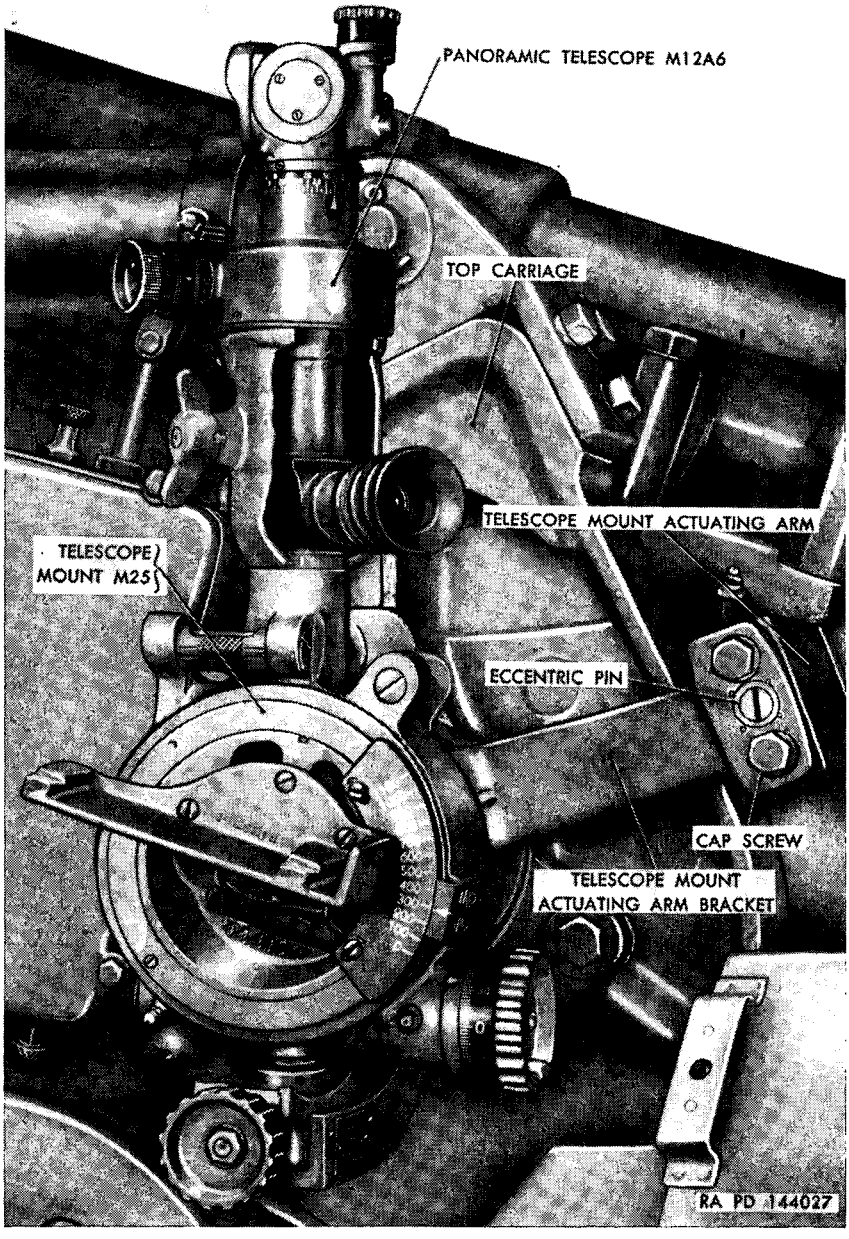

Figure 75. Telescope mount M25 with panoramic telescope M12A6 in place on Mount M14.

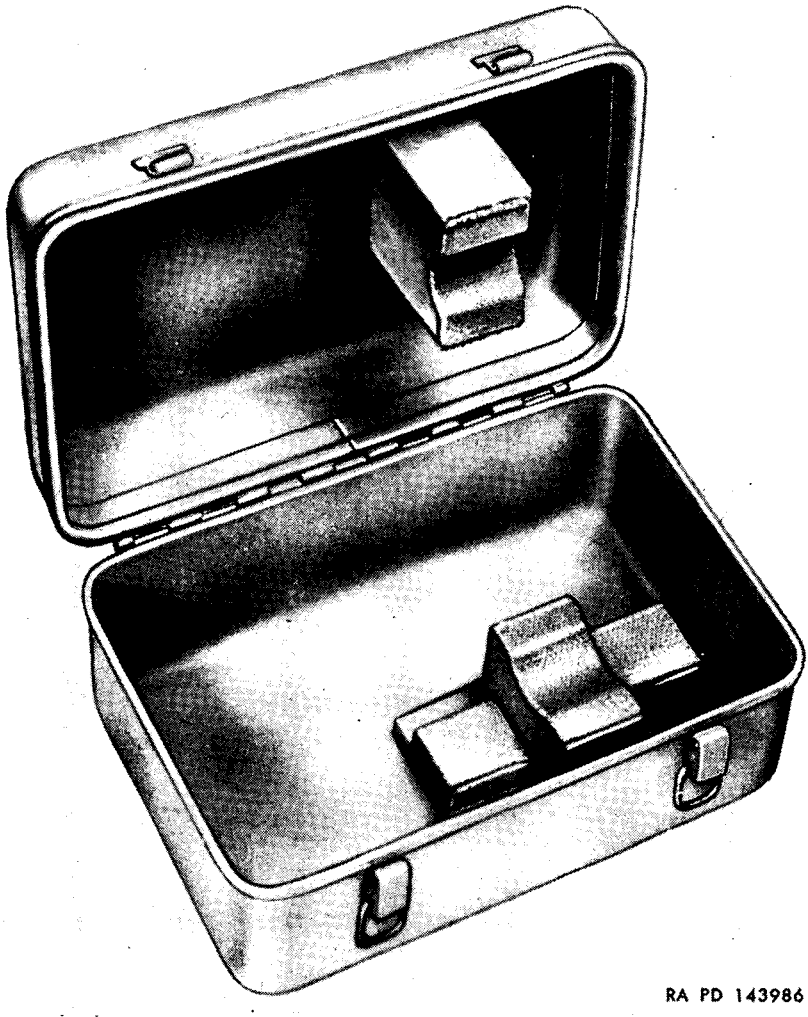

Figure 76. Panoramic telescope packing chest M27.

(3) *Instrument light M34.* The instrument light M34 (fig. 77) clamps to the telescope socket of the telescope mount M25, and is used for illuminating the reticle of the panoramic telescope M12A6 or M12A7G during night operation. A hand light is also provided for illumination of the scales on panoramic telescope mount.

c. Direct Fire Group. The telescope mount M25 (fig. 78), panoramic telescope M12A6 (fig. 79) or M12A7G (fig. 80) and instrument light M34 are also used for laying the howitzer for direct fire.

d. Miscellaneous Equipment.

(1) The fuze setters M22 (fig. 84), M23 (figs. 85 and 86), and M27 (fig. 87) are presently authorized for 155-mm howitzer motor carriage M41. They are hand-operated instruments used for setting time fuzes. When not in use, the fuze setter M22 or M23 is stored in fuze setter carrying case M55 or M66. No carrying case is provided for the fuze setter M14 or M27.

(2) The gunner's quadrant M1 is used for testing and adjusting the sighting equipment, and for laying the howitzer in elevation.

(3) The breech bore sight 7238962 (figs. 24 and 93) muzzle bore sight 7238963 (figs. 24 and 94) are used when bore sighting the howitzer (par. 89).

(4) The periscope M13, M13B1 or M6 are used by the driver and assistant driver for observation of the terrain from the interior of the motor carriage during travel.

84. Maintenance

a. General. Sighting and fire control matériel will be cleaned and lubricated in accordance with TB 9–2835–1. Intervals for servicing sighting and fire control equipment will be found in the preventive maintenance services (par. 52).

b. Care in Handling Sighting and Fire Control Instruments. Refer to paragraph 48*d*.

c. Care of Optical Parts.

(1) Do not touch lenses or windows with the fingers.

(2) Do not point any optical instrument directly at the sun, unless a filter is used, as the heat of the focused rays may damage optical parts.

(3) Exercise particular care to keep optical parts free from oil and grease.

(4) Moisture may condense on the optical parts of the instrument and cause fogging of lenses when the temperature of the parts is lower than that of the surrounding air. This moisture can be removed by placing the instrument in a warm place. Heat from strongly concentrated sources should not be applied directly, as it may cause unequal expansion of parts, thereby resulting in damage to optical parts and inaccuracies of observation.

5. Instructions for cleaning optical surfaces appear in paragraph 48*b*(4).

d. Batteries.

(1) Batteries will not be packed, stored, or shipped in equipment

[redacted]

in which they are used; the batteries are not part of the equipment but are used with it. Batteries used in the instrument light M34 should be removed whenever the lights are not in use. Chemical reaction set up in an exhausted battery will damage the tube.

(2) The batteries in the instrument light are installed as follows: Remove the cap on the battery tube. The cap is secured by pins in two bayonet slots and is removed by pressing the cap inward and then turning slightly until free. When installing the batteries in the body tube, be sure they go back in the same position as when removed. See that the pins in the cap engage the bayonet slots in the body to assure a tight contact with battery terminals.

e. Lubrication

(1) Lubrication of sighting and fire control matériel will be performed *only* by ordnance maintenance personnel, with the following exceptions which may be lubricated by the using organizations.

(*a*) External parts not readily lubricated with grease, such as handwheel knobs or cranks, hinges, stay brackets, cover fastening devices, and felt washers. Lubricate as required with aircraft instrument lubricating oil.

(*b*) Exposed bearing surfaces. Lubricate with a thin film of

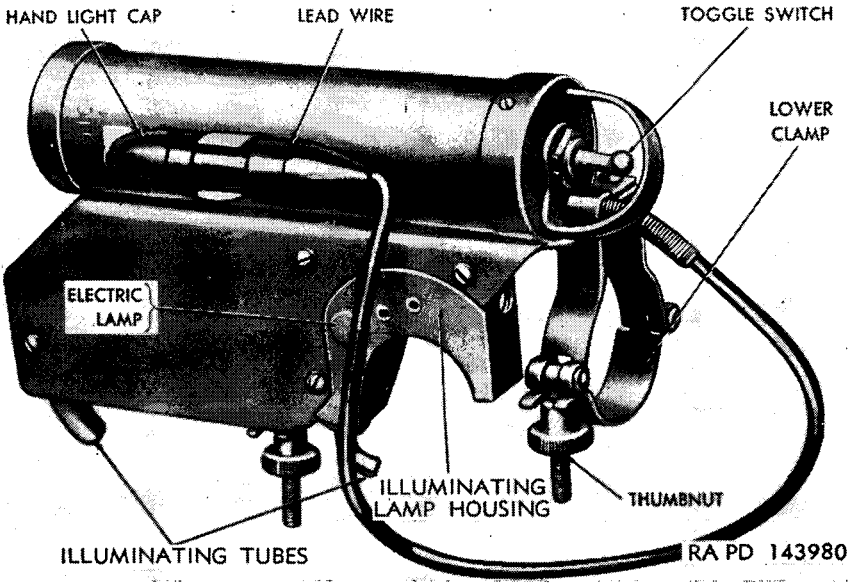

Figure 77. Instrument light M34.

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aircraft and instruments lubricating grease. This grease provides both lubrication and protection against corrosion.

(2) Lubricant will be applied sparingly particularly during periods of extreme cold to provide smooth and reasonably free movement. Lubricate when necessary and at time of repair and rebuild.

f. Replacement of Electric Lamps.

(1) To replace the electric lamp in the hand light of instrument light M34, unscrew the hand light cap from the lead wire (fig. 77). Unscrew the electric lamp from the lead wire and replace with a new lamp; then install the hand light cap.

(2) To replace the electric lamp which supplies light for the illuminating tubes, unscrew it from the illuminating lamp housing of instrument light M34, and replace with a new lamp (fig. 77).

g. Eyeshield. To replace the panoramic telescope eyeshield, twist it enough to remove it from the telescope eyepiece. The eyeshield is of soft rubber and slips easily on and off the telescope eyepiece.

85. Description

a. Telescope Mount M25

(1) The telescope mount M25 (fig. 78) contains longitudinal and cross-leveling mechanisms. The telescope socket at the top of the mount provides a means for mounting the panoramic telescope M12A6 or M12A7G and contains telescope locating slots and wing knob which is used to lock the telescope in position. The quadrant seat on the left side of the mount provides support for the gunner's quadrant M1.

(2) The cross-level vial is kept centered by operating the cross-leveling knob (fig. 78). The centering of the cross-level vial bubble automatically introduces an azimuth correction which compensates for any error produced when the howitzer is elevated with the trunnions out of level.

(3) The longitudinal level vial is operated by the elevation knob (fig. 78). The centering of the longitudinal level vial bubble places the azimuth scale of the telescope in a true horizontal plane when the cross-level vial bubble is centered, so that azimuth angles can be set accurately.

(4) The telescope mount is provided with an elevation scale (fig. 78) graduated and numbered in 100-mil intervals from 0 to 1,100 mils, and a longitudinal leveling micrometer (fig. 78) graduated in 1-mil intervals and numbered in 10-mil intervals from 0 to 100 mils. The elevation scale is read

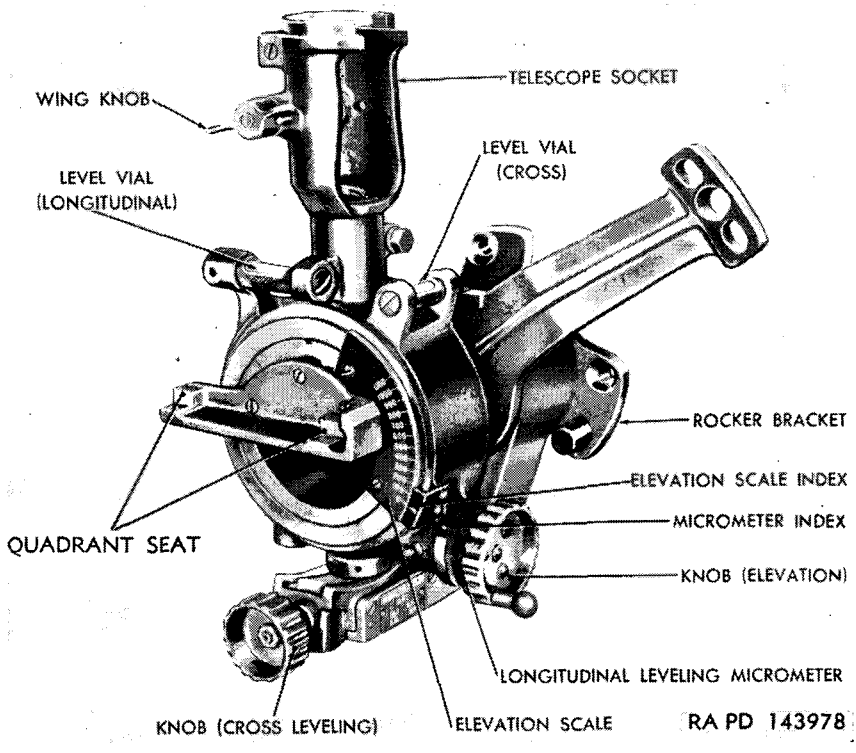


Figure 78. Telescope mount M25.

opposite the elevation scale index (fig. 78), and the longitudinal leveling micrometer is read opposite the micrometer index (fig. 78).

b. Panoramic Telescope M12A6.

(1) The panoramic telescope M12A6 (fig. 79) is a four-power instrument having a field of view of 10°, with the eyepiece offset 45° to permit the observer to stand clear of the howitzer. It has a cylindrical locating surface on the bottom and lugs on the rear for centering the telescope in its socket in the telescope mount M25.

(2) The line of sight of the telescope is elevated or depressed by the elevation knob (fig. 79) at the top of the telescope which turns the rotating head in a vertical plane; coarse and fine indexes (fig. 79) are provided for the normal (0 elevation) position.

(3) The telescope rotating head (fig. 79) is moved in azimuth by the azimuth worm knob (fig. 79) which has a throwout lever (fig. 81) to permit disengagement of the worm for

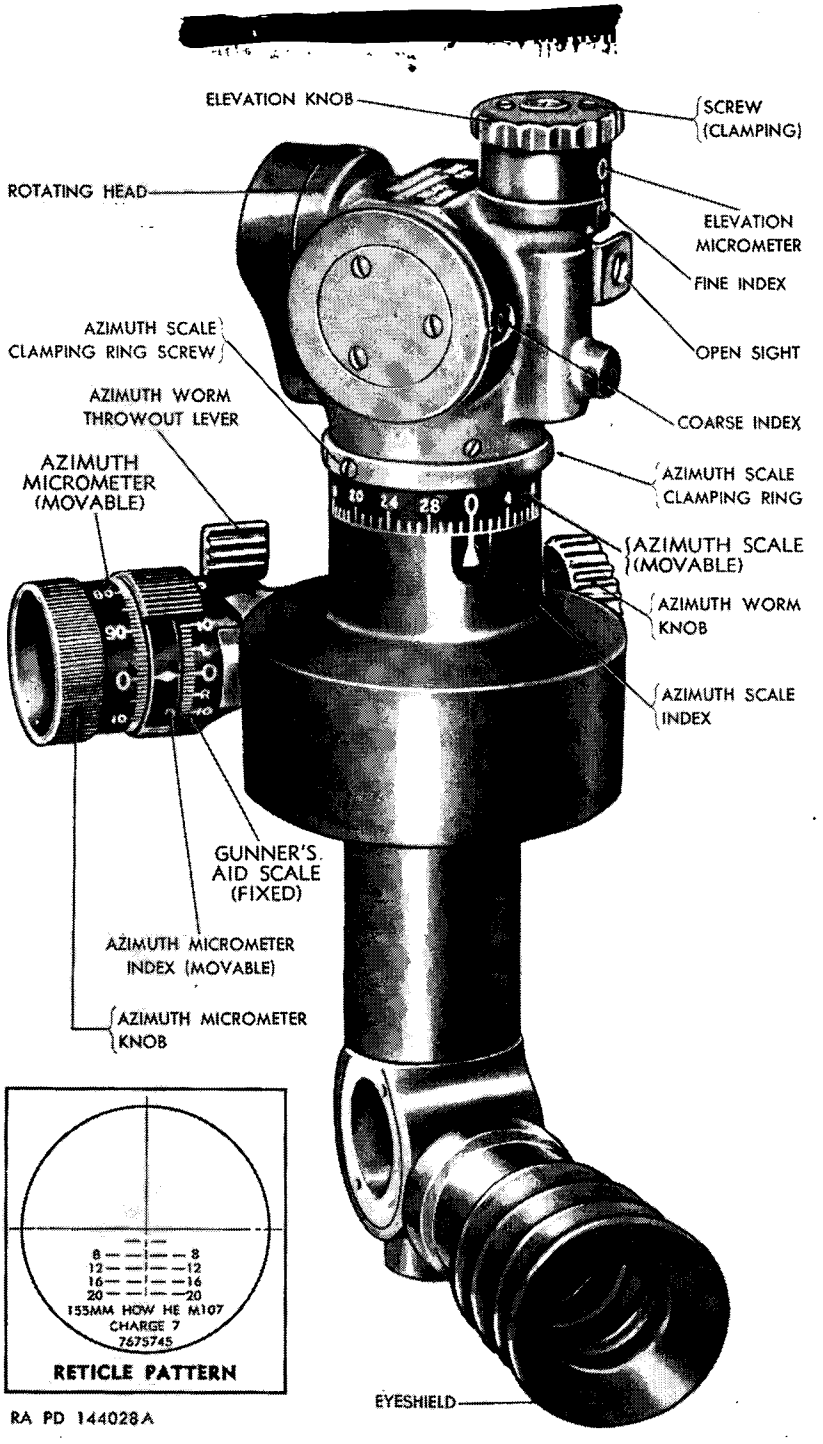


Figure 79. Panoramic telescope M12A6.

rapid motion when required. The azimuth scale (fig. 79) is graduated in 100-mil intervals and numbered at 400-mil intervals (scales of late manufacture are numbered at 200-mil intervals) and indicates progressively from 0 to 3,200 mils in two consecutive semicircles (6,400 mils all around). The azimuth micrometer (fig. 79) is graduated in 1-mil intervals and numbered at 10-mil intervals from 0 to 100 mils. The calibration on the azimuth scale, which is opposite the azimuth scale index (fig. 79), is the reading of the azimuth scale and the calibration on the azimuth micrometer, which is opposite the azimuth micrometer index (fig. 79) is the azimuth micrometer reading. A gunner's aid scale, graduated from 0 to 20 mils (right and left) in 1-mil intervals (fig. 79) is provided to set in the shift required for each howitzer when laying several weapons parallel from a distant aiming point (par. 87*a*). As the azimuth micrometer index is rotated, a detent clicks at each mil graduation.

(4) The reticle pattern for panoramic telescope M12A6 (insert of fig. 79) consists of a pair of cross lines representing zero range and zero deflections and is used for boresighting and indirect fire operation. Range graduations, provided for direct fire operation, are calibrated for 155-mm howitzer, HE shell M107 charge 7. Each part of the broken line extending downward below the horizontal cross line and each space between each part represents an interval of 100 yards range and serves as a guide when laying the gun for a range falling within a 400-yard range interval. The broken horizontal lines below the cross represent 400, 800, 1,200, 1,600, and 2,000 yards range and are numbered 8, 12, 16, 20. Each horizontal line or space represents a deflection of 5 mils. The telescope is provided with an open sight for rapid approximate aiming (fig. 79).

c. Panoramic Telescope M12A7G. The panoramic telescope M12A7G (fig. 80) is a modification of the panoramic telescope M12A6 and includes all its features plus the following features not found on the M12A6.

(1) A *slipping azimuth scale*, consisting of a circular ring graduated into 60 divisions, each of 100 mils, and numbered every 200 mils from 0 to 3,200 in two consecutive semicircles. When unlocked, this scale can be slipped freely to any deflection. Locked, the scale turns only with the rotating head as controlled by the azimuth micrometer knob and the throw-out lever.

(2) A *locking screw*, located on the circular ring (slipping azimuth scale): when tightened, it locks the slipping azimuth scale to the rotating head.

(3) An *azimuth scale* (nonslipping), graduated into divisions of 100 mils and with visible numbers every 200 mils. This scale turns only with the rotating head as controlled by the azimuth micrometer knob and the throw-out lever.

(4) A *door* that, when open, permits the reading of the azimuth scale (nonslipping). When closed, the door covers this scale and provides an index for the slipping azimuth scale.

(5) A *slipping azimuth micrometer scale*, graduated into 100 divisions of 1 mil each. When unlocked, this scale can be slipped freely to any setting. Locked, it moves only with the azimuth micrometer knob.

(6) A *locking nut*, located to the outside of the slipping azimuth micrometer scale. Tightened, it locks the slipping azimuth micrometer scale to the azimuth micrometer shaft.

(7) A *left index* (nonslipping) that is moved by turning the azimuth micrometer knob. At the time of modification, this index must be synchronized with the zero of the azimuth scale (nonslipping) and may not be adjusted by using troops.

d. Instrument Light M34.

(1) The instrument light M34 (fig. 77) is provided for lighting the telescope mount M25 and the panoramic telescope M12A6 or M12A7G, when night firing makes artificial illumination of the equipment necessary. The instrument light clamps to the telescope socket of the telescope mount.

(2) The instrument light consists of a case (for holding two dry cell batteries), two plastic illuminating tubes, a hand light and lead wire, a toggle switch, and two clamps for mounting the light.

(3) The light from the lamp (fig. 77) is directed to the panoramic telescope reticle and the cross-level vial bubble of the telescope mount. The illuminating tubes carry light from the lamp to the azimuth scale and micrometer of the telescope and the longitudinal level vial bubble of the mount. The hand light is used for illuminating the elevation scale and longitudinal leveling micrometer of the mount. The toggle switch, protected by a shield, controls the lamps.

e. Fuze Setters M14, M22, M23, and M27. Fuze setters M14, M22, M23, and M27 are hand-operated instruments for setting the following fuzes: time superquick M54 and M55A3, time mechanical M67A3, and mechanical time superquick M500 and M501 (par. 111).

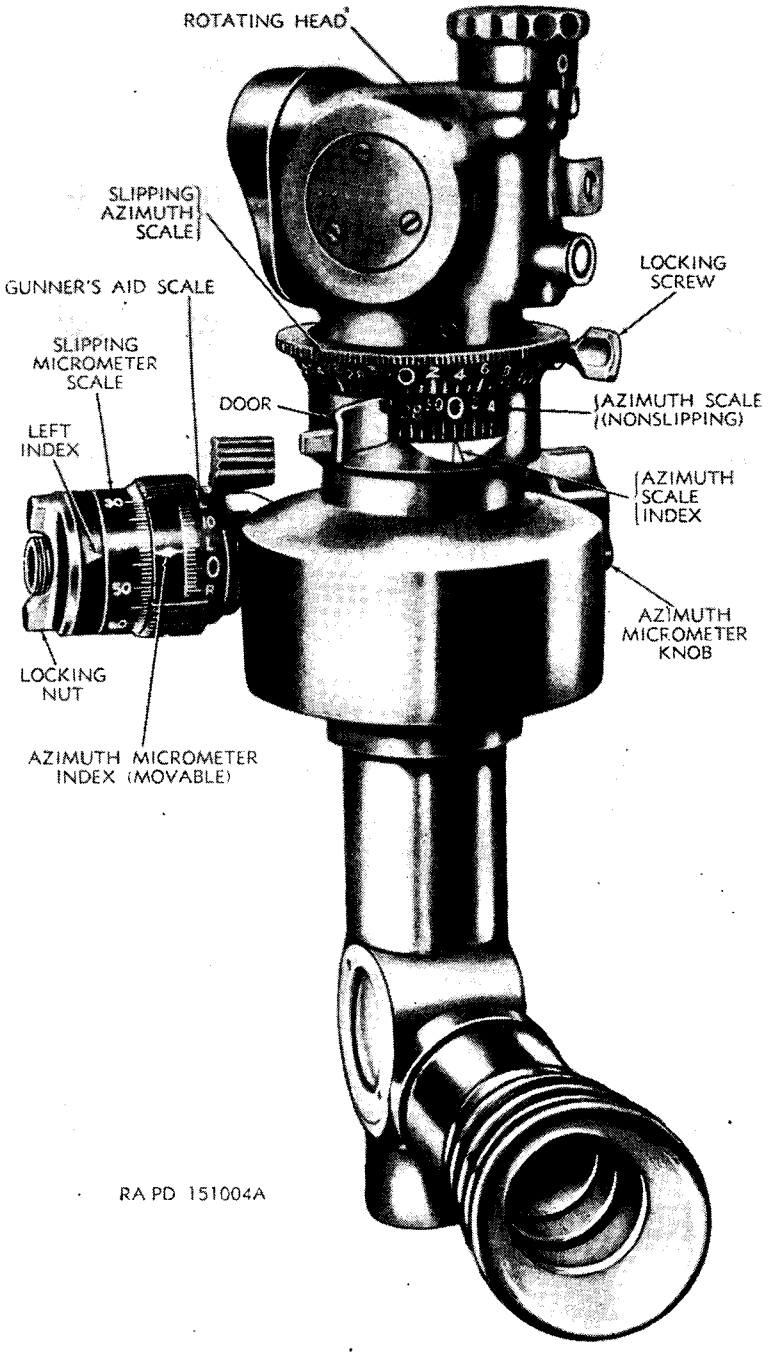


Figure 80. Panoramic telescope M12A7G.

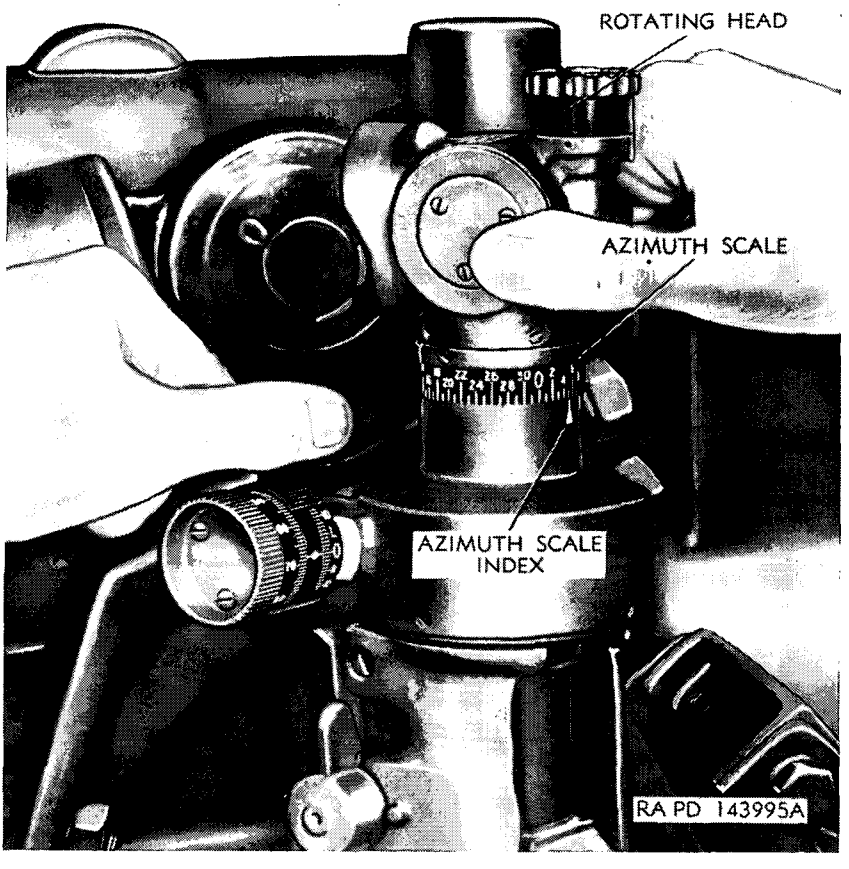


Figure 81. Rapid slewing of rotating head by use of azimuth worm throwout lever.

(1) The fuze setter M14 (fig. 83) is a solid wrench-type fuze setter with a key provided on the inner circumference to engage the notch on the setting ring of the fuze.

(2) The fuze setter M22 (fig. 84) has a stop pawl on the under surface to engage the notch on the setting ring of the fuze (fig. 85). A time scale and time corrector scale, with corresponding indexes (fig. 84), record the desired time of flight of the shell before bursting. The settings are held in place by two clamping screws to permit the setting of more than one fuze without slipping of the setting. The clamping screw on the time scale is marked "T," and the clamping screw on the time corrector scale is marked "C." The time scale is graduated in 0.1-second intervals from 0 to 25 seconds and indicates the desired fuze setting plus or minus the corrector

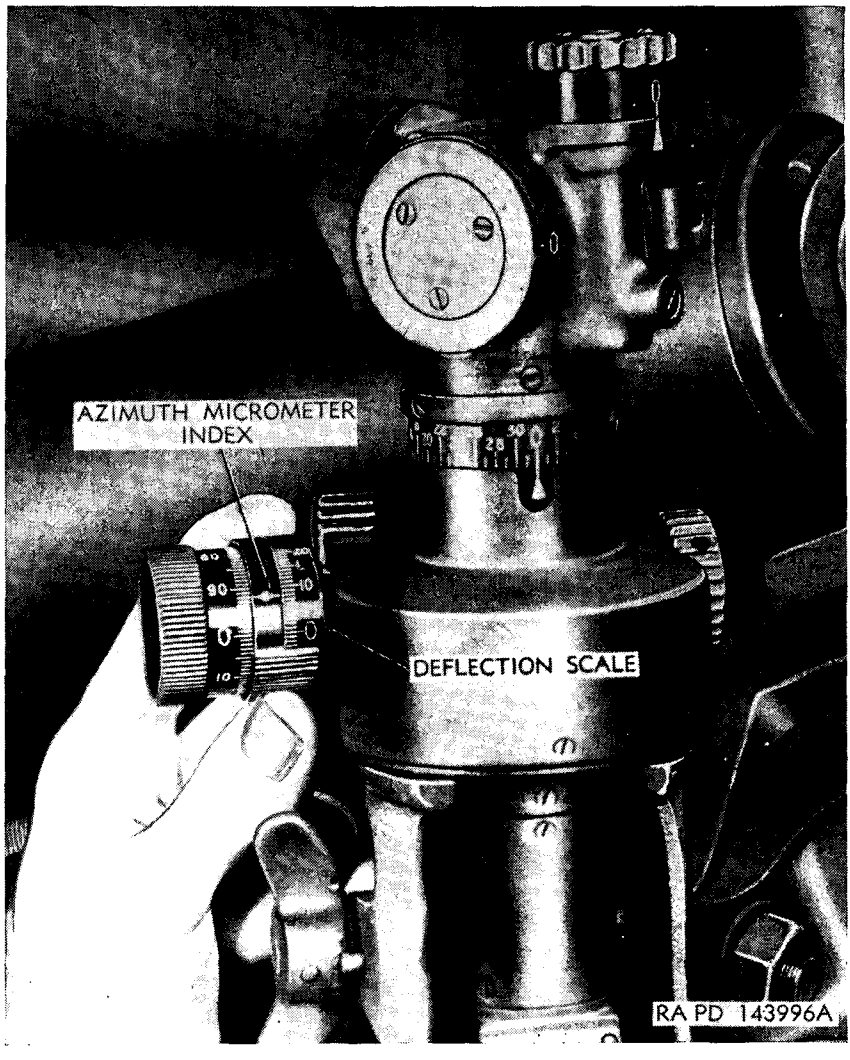


Figure 82. Turning movable azimuth micrometer index to set in constant azimuth deflection.

setting. The letter "S" on the time scale indicates the safe setting for the fuze. The time corrector scale is graduated in 1-point intervals from 0 to 60, with 30 as normal, and indicates the corrections in time from 0 to 3 seconds for increasing or decreasing the time of brust from the time indicated on the time scale.

(3) The fuze setter M23 (fig. 86) is similar in construction to the fuze setter M22, but the time scale is graduated in 0.2-second

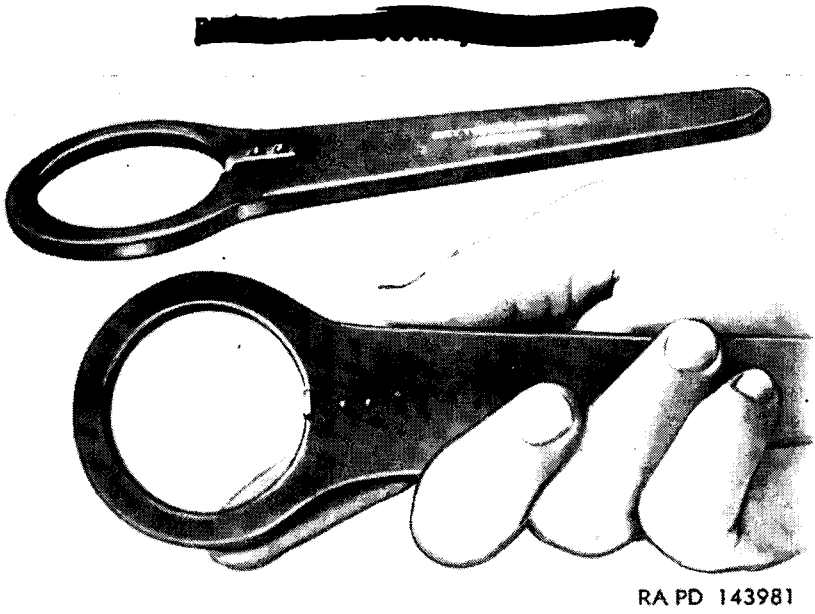


Figure 83. Fuze setter M14.

intervals from 3 to 75 seconds, and the time corrector scale is graduated in 2-point intervals. The zero graduation on the time scale is indicated but not identified by a "0."

(4) The fuze setter M27 (fig. 87) is a wrench-type fuze setter with a bell shaped portion in the center of the handle, which fits over the fuze. A key on the edge of the bell engages the slot on the fuze.

86. Preparation for Firing

a. Telescope Mount M25 and Panoramic Telescope M12A6 or M12A7G with Instrument light M34.

(1) Remove the padlock from the panoramic telescope case quick release lock and open the panoramic telescope case, located on the left side of the gunner's compartment of the motor carriage (fig. 7). To remove the telescope from its holder on the telescope case cover, turn the telescope holder wing knob against its spring pressure as far as it will go, and lift the panoramic telescope straight up and out of the holder (fig. 88).

(2) If the telescope has not been carried with the weapon, remove it from the packing chest M27 (fig. 76).

(3) To place the telescope in the telescope mount, turn the wing knob on the telescope socket against its spring pressure and place the telescope gently in the socket, taking care that the

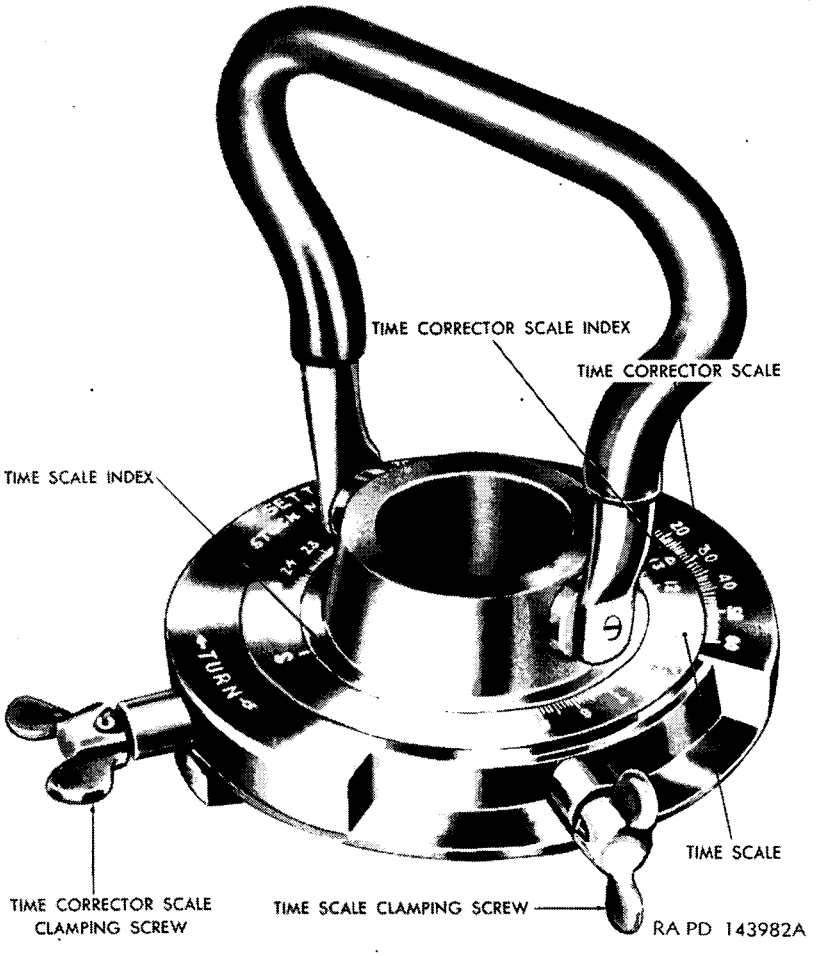


Figure 84. Fuze setter M22.

locating lug on the panoramic telescope enters the slot in the telescope socket (fig. 89). Release the wing knob and exert slight downward pressure to insure that the telescope is properly seated.

(4) Uncover the longitudinal level and cross level vials of the telescope mount (fig. 90) by turning the covers half a turn.

Caution: Keep level vials covered at all times when not in use.

(5) To install the instrument light M34 on the telescope socket of the telescope mount for night fire, carefully place the instrument light in position (fig. 91) and slip the clamps around the telescope socket. Swing the two thumb nuts into

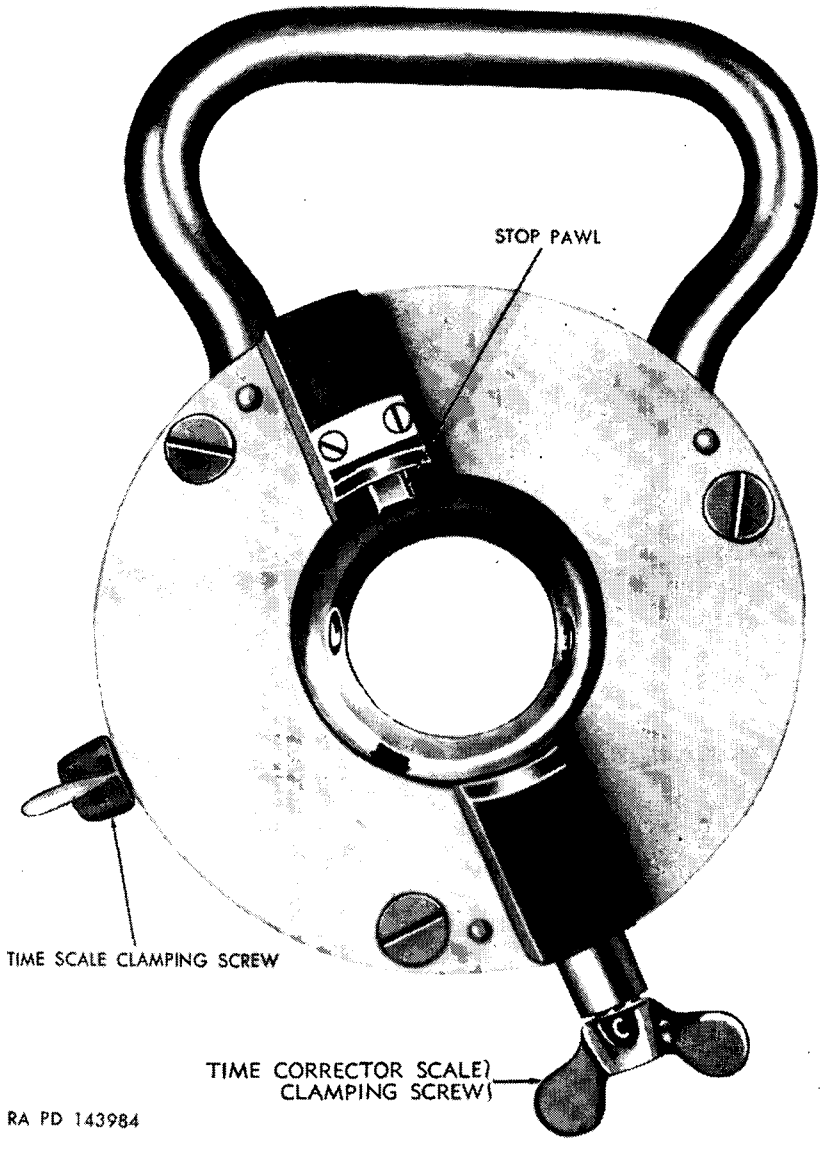


Figure 85. Fuze setter M22 or M23—bottom view.

their slots on the clamps and lock by tightening the thumb nuts (fig. 91). Snap on the toggle switch (fig. 77).

b. Fuze Setters M14, M22, M23, M27.

(1) Remove the fuze setter M22 or M23 from fuze setter carrying case M66 or M55 (fig. 92).

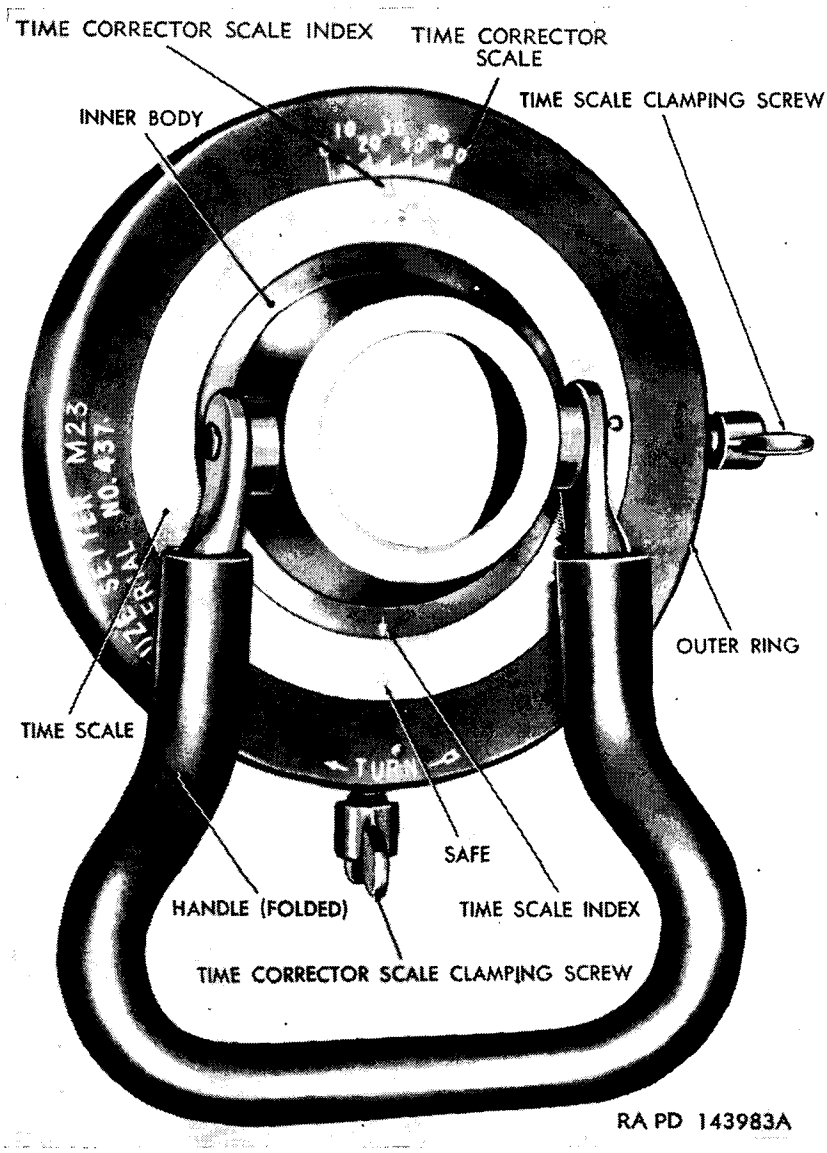


Figure 86. Fuze setter M23.

(2) To set the fuze setter M22 or M23, loosen the time corrector scale clamping screw marked "C" (figs. 84 and 86), grasp the handle, and turn the body and time scale until the time corrector scale index is opposite the announced corrector setting on the time corrector scale. Then clamp the corrector scale clamping screw, being careful not to disturb the corrector setting.

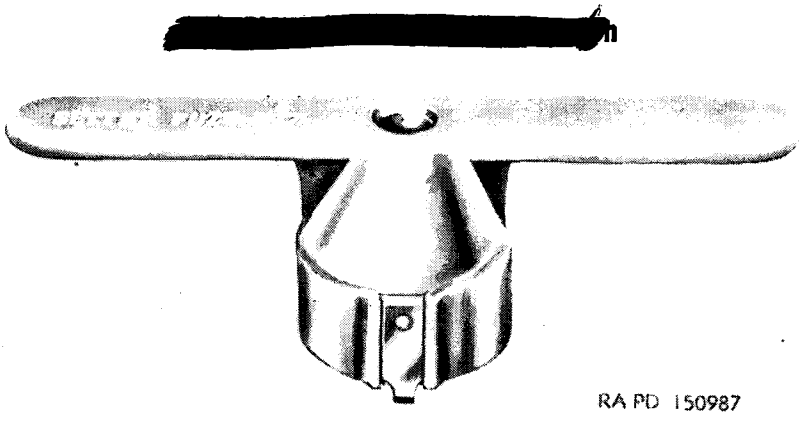


Figure 87. Fuze setter M27.

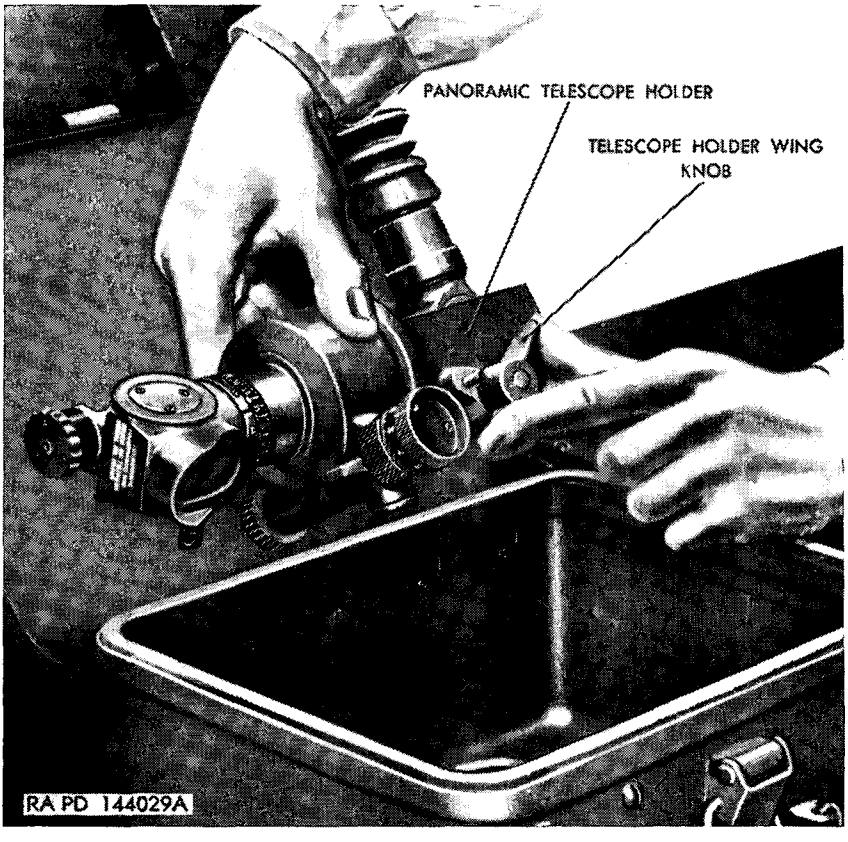


Figure 88. Removing or installing panoramic telescope M12A6 or M12A7G in telescope case.

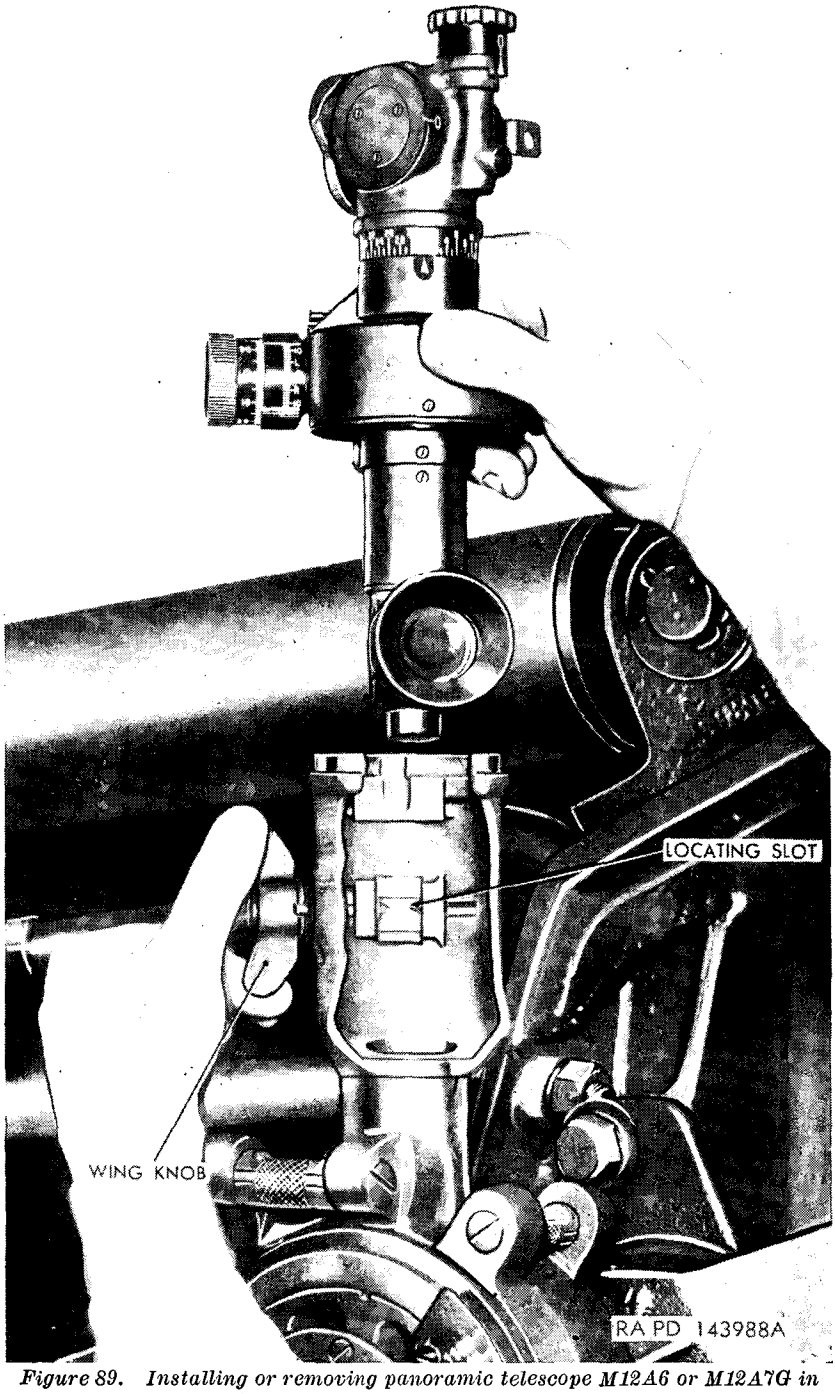


Figure 89. Installing or removing panoramic telescope M12A6 or M12A7G in telescope mount M25.

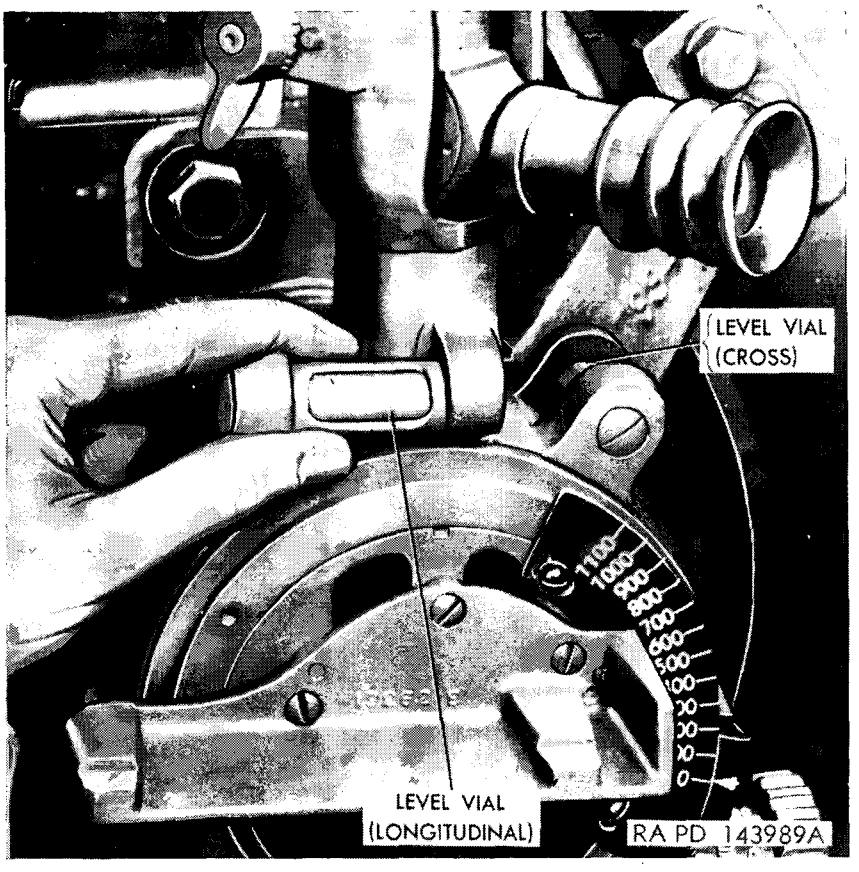


Figure 90. Uncovering longitudinal level vial.

(3) On fuze setter M22 or M23, release the time scale clamping screw marked "T" (figs. 84 and 86), grasp the handle, and turn the body until the time scale index on the body is opposite the announced time on the time scale. Clamp the time scale clamping screw, being careful not to disturb the setting.

Note.—For accuracy, look squarely at the scales and indexes each time a setting is made.

(4) Fuze setters M14 and M27 do not employ time or corrector scales (they are wrench types only), and therefore no preparations for firing are required.

c. Tests and Adjustments. Whenever inaccuracies, misadjustments, or any other conditions affecting serviceability are disclosed by the following tests, the equipment should be referred to authorized ordnance personnel for adjustment or correction.

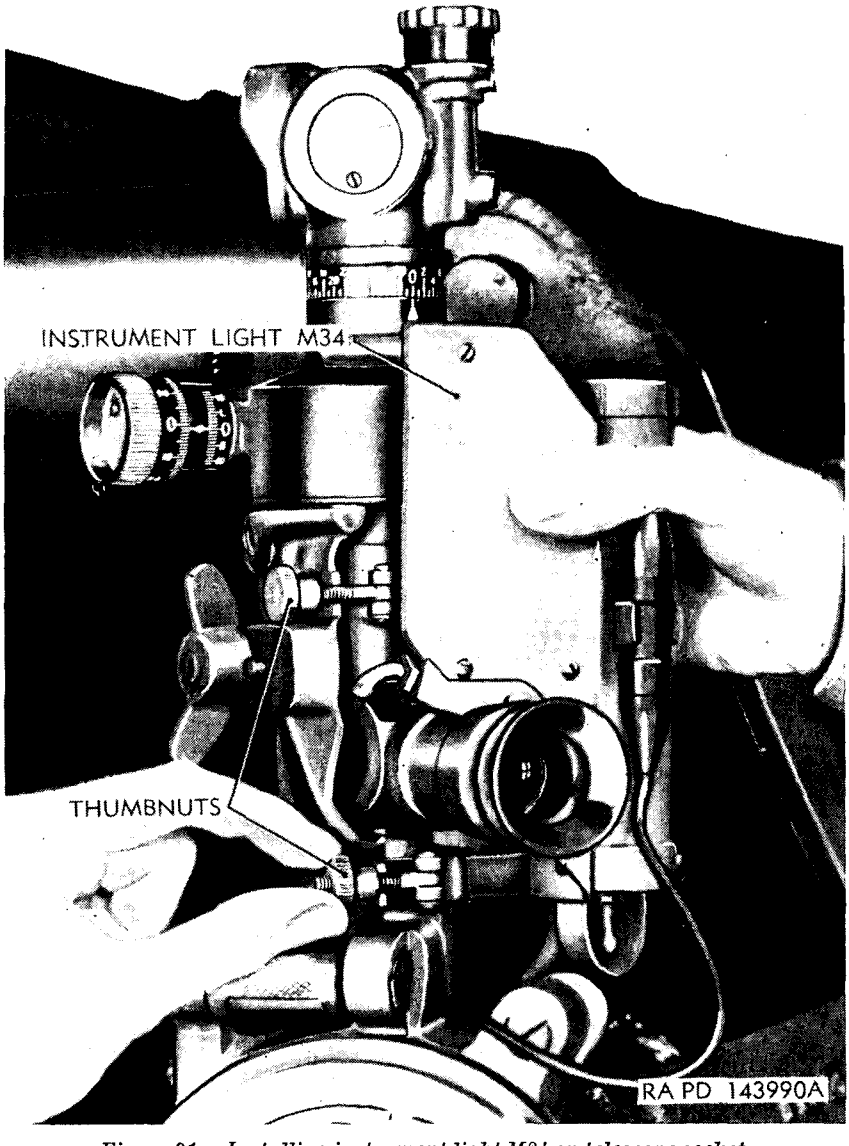


Figure 91. Installing instrument light M34 on telescope socket.

(1) *General.* Check the instruments for completeness and general appearance. The painted surfaces will not have bare spots, scratches exposing bare metal or chipped or loose paint. There will be no evidence of corrosion on any part.

(2) *Telescope mount M25.*

(*a*) The level vial covers will turn freely and snap into the

Figure 92. Fuze setter carrying case M66.

detent in the open and closed position. The level vials will not be cracked, broken, or loose in the holder or mount.

(*b*) Turn the wing knob (fig. 78) in the socket to the open position and release. The latch spring will be strong enough to snap the latch instantly into the locked position. It will clamp the panoramic telescope securely in the socket.

(*c*) The tangent adjusting screws (fig. 78) in the socket will be in proper adjustment; tight enough to prevent any lateral movement of the telescope, but not so tight as to cause wear when inserting or removing the telescope.

(*d*) Turn the elevation knob and the cross level knob (fig. 78) over their entire range of movement. The motion will be smooth and even. A wobbly knob or a movement that is alternately tight and loose at each half revolution usually indicates a bent worm shaft. Upon reversal of the worm knob, there will be no appreciable free movement of the worm without corresponding movement of the driven member.

(*e*) All graduations, lettering, and indexes will be clear and distinct.

(3) *Panoramic telescopes M12A6 and M12A7G.*

(*a*) When looking through the eyepiece and objective ends of the telescope, there will be no objectionable dirt, smears, scratches, digs, condensate, fungus growth, chips, fractures, or cement separations.

(*b*) The azimuth and elevation mechanism of the panoramic telescope will function without undue irregularities, friction, or looseness. The elevation knob will have a minimum movement of six complete turns between maximum depression and maximum elevation. The azimuth throw-out mechanism will operate so as to return the worm into mesh immediately upon release.

(*c*) The reticle illuminating windows will not be broken and will be sealed and fastened securely in the body of the telescope.

(*d*) Backlash in the azimuth mechanism of the panoramic telescope must not exceed three-quarters of a mil.

(4) *Instrument light M34.* Check for completeness, operation of switch and lamp, and condition of wiring. Ends of lucite rods must be clean to provide a maximum intensity of light. Case will not be dented nor will any other parts be bent or twisted. Clamp hinges and clamp nuts will turn freely. Inside of case will be clean and free of corrosion.

(5) *Tests for accuracy of performance.* It is not expected that organizational units will always have the necessary facilities available for performing these tests. However, because of their thoroughness, these tests should be performed whenever the situation permits.

Note.—Perform the tests in the following sequence:

(*a*) *Test preparation.*

1. Bore sight the weapon in accordance with paragraph 89.

2. Place the weapon on a site that is as near level as possible.

3. Accurately level the trunnions of the howitzer, using jacks if necessary, by tracking a plumb line with the bore sights of the tube. The plumb line should be suspended approximately 5 feet in front of the tube and should be long enough to permit maximum elevation of the tube while tracking the plumb line. The trunnions are level when the tube tracks the plumb line without deviating more than the thickness of the cord of the muzzle boresight throughout the entire range of elevation.

Note.—Do not disturb this setting and check it frequently, be-

cause accuracy of the following tests is dependent upon the trunnions being exactly leveled.

4. Prepare parallax shields for panoramic telescope M12A6 or M12A7G, as it will be necessary to eliminate parallax when viewing a plumb line or target at close range. The shield should be of the same diameter as the eyepiece lens housing. It should be made of stiff cardboard or brass shim stock and it should have a vertically and horizontally centered slot 1/16-inch wide by 1/4-inch long. The shield should be placed in front of the eyepiece with the slot in the vertical position (FM 6–40).
5. Check the accuracy of the gunner's quadrant in accordance with the procedure given in TM 9–575. Adjust the quadrant, if necessary, before proceeding with the test.

(*b*) *Check the telescope mount zero cross-level setting.*

1. Level the telescope mount in both directions by centering both level bubbles.
2. Place the intersection of the cross lines of the panoramic telescope reticle on any sharply defined distant aiming point.
3. Elevate the tube from zero to maximum elevation by 100-mil steps. At each 100-mil step, relevel the telescope mount in both directions and check for deviation of the line of sight from the aiming point.
4. If either the horizontal or vertical reticle line deviates from the aiming point by more than one-half mil at any of the elevation settings checked, the telescope mount is either misadjusted or improperly mounted on the howitzer. Refer the weapon to authorized ordnance maintenance personnel for adjustment or correction.

(*c*) *Check the telescope mount longitudinal level setting.*

1. Level the telescope mount in both directions.
2. Set the panoramic telescope azimuth scale and micrometer to 4,800 mils azimuth. Hang a plumb line and aline it with the intersection of the telescope reticle cross lines.
3. Sight through the telescope and rotate the telescope elevation knob through the extent of travel.
4. If the intersection point on the reticle deviates from the plumb line by more than one-half mil, the longitudinal level vial is incorrectly set. Refer the mount to authorized ordnance maintenance personnel for adjustment.

(*d*) *Check for alinement of telescope mount pivot and howitzer.*

1. Set the tube to exactly zero elevation using the gunner's quadrant on the leveling pads of the breech ring.
2. Check the adjustment of the quadrant seat as for bore sighting (par. 89*b* (2) and (3)).
3. Level the telescope mount in both directions and place the intersection of the telescope reticle cross lines on the plumb line at 4,800 mils azimuth.
4. Sight through the telescope and rotate the cross-level knob of the telescope mount through the extent of travel.
5. If the intersection point on the reticle deviates from the plumb line by more than one-half mil, the quadrant seat and actuating arm pivot are misalined in respect to the axis of the howitzer. Refer the mount to authorized ordnance maintenance personnel for correction.

(*e*) *Check telescope socket alinement.*

1. Set the panoramic telescope azimuth scale and micrometer to zero azimuth.
2. Keep the telescope mount cross-leveled and traverse the tube to the right to place the intersection of the telescope reticle cross on the plumb line target in front of the weapon.
3. Sight through the telescope and rotate the telescope elevation knob through the extent of travel.
4. If the intersection point on the reticle deviates from the plumb line by more than one-half mil, the telescope socket and mount are not correctly alined. Refer the mount to authorized ordnance maintenance personnel for correction.

87. Operation

a. Indirect Fire. Set the announced deflection on the azimuth scale and micrometer of the panoramic telescope. The gunner's aid can be used for setting in constant deflection (par. 85*b*(3)). Set the announced elevation on the elevation scale and micrometer of the telescope mount. Cross-level the mount and keep it cross-leveled during the remaining operations. Traverse the howitzer to bring the vertical cross line of the telescope reticle on the aiming point, or post, and elevate or depress the howitzer to center the longitudinal level bubble. (It may be necessary to turn the elevation knob on the panoramic telescope to bring the aiming point into the field of view. This operation is permissible in direct fire. However, the horizontal reticle line should be placed on the same point of the aiming post for all settings.) The howitzer is now laid for direction and elevation.

b. Direct Fire.

(1) Set the movable azimuth micrometer index of the panoramic telescope opposite the zero on the gunners aid scale. Set the azimuth scale and micrometer to zero. Set the elevation knob on the panoramic telescope to zero elevation by matching the coarse zero graduation and the micrometer zero graduation opposite their indexes (fig. 79). Set the elevation scale and micrometer of the telescope mount to zero (fig. 78). Retain these settings throughout the entire direct fire operation.

(2) Cross-level the telescope mount and keep it cross-leveled during the entire direct fire operation. Use the howitzer traversing and elevating mechanisms to make the target appear at the required range and deflection on the telescope reticle.

c. Fuze Setters M14, M22, M23, and M27.

(1) *Fuze setter M14.* Remove the safety wire from the fuze and engage the key on this wrench type fuze setter (fig. 83) in the notch on the setting ring on the fuze. Rotate the setting ring in a clockwise direction until the announced time setting is opposite the index on the fixed ring on the fuze.

(2) *Fuze setter M22 or M23.* After making the announced settings on the fuze setter (par. 86*b*), remove the safety wire from the fuze, and carefully place the fuze setter over the fuze. Turn the setter clockwise until the notch on the setting ring of the fuze engages the pawl on the undersurface of the fuze setter. Turn the handle to the horizontal position, push down on the fuze setter until the notch fully engages the pawl, and continue to turn it clockwise until the stop pawl in the adjusting ring assembly drops into the notch of the fixed fuze ring. This prevents further turning and indicates that the fuze is set. Carefully lift the fuze setter from the fuze without rotating it. A fuze which has been cut can be reset to the "Safe" position by setting the fuze setter time scale to "S" and the corrector scale to 30.

Caution: Rotate the fuze setters only in a clockwise direction. Ignore all other instructions or directional markings.

(3) *Test of fuze setter M22 or M23.* Test the fuze setter M22 or M23 on a dummy, inert, or a live fuze for correct cutting of the fuze and for smooth operation. Set the corrector scale to normal (30) and set in a time value on the time scale. Cut the fuze. The time setting of the fuze should agree with the setting on the fuze setter time scale. If the settings do not agree, repeat the operation with a different time value to make

sure there was no slippage. Note engagement with fuze and any tendency to stick or bind. If the fuze setter fails to operate properly, notify ordnance maintenance personnel.

Caution: When a live fuze is used, the precautions normally observed in handling ammunition must be followed. Remove the safety wire carefully for the test. After the test has been made, return the fuze setting to the "S" or safe setting and replace the safety wire. When checking the accuracy of the fuze setter by cutting trial fuzes, no fuze should be cut more than twice. The fuze from a dud must never be used. Further precautions are described in TM 9–1900.

88. Preparation for Traveling

a. Protect the longitudinal-level and cross-level vials on the telescope mount by closing their covers (fig. 90).

b. If the instrument light M34 has been used for night firing, remove the light from the telescope socket on the telescope mount by loosening the two thumb nuts and swinging open the clamps. Then carefully remove the light from the telescope socket. Make certain the toggle switch is in the "Off" position. Remove the batteries (par. 84*d*).

c. Turn the wing knob on the telescope socket of the telescope mount against its spring pressure as far as it will go, and lift the panoramic telescope from the socket (fig. 89).

d. Open the panoramic telescope case on the left side of the gunner's compartment at the rear of the motor carriage (fig. 7). Turn the wing knob of the telescope holder on the inside of the cover against its spring pressure as far as it will go, and place the telescope gently in its holder (fig. 88). Release the wing knob, and at the same time exert slight downward pressure to insure that the telescope is properly seated in the holder.

e. Swing the telescope case cover to its closed position and fasten with the quick-release lock. Then secure the padlock.

f. When the telescope is transported separate from the weapon, place it in packing chest M27 (fig. 76).

g. Place fuze setter M22 or M23 in carrying case M55 or M66 (fig. 92), and store the carrying case in the vehicle. No carrying case is provided for fuze setter M14 or M27.

89. Bore Sighting

a. General. Bore sighting is the process of alining the on-carriage sighting and fire control equipment so that the line of sight of the

telescope is parallel to the axis of the bore of the weapon. This is to insure accuracy in laying for elevation and direction. Bore sighting is conducted before firing and when necessary during lulls in firing. There are four general methods of bore sighting:

(1) Testing target method.
(2) Distant aiming point method.
(3) Aiming circle method.
(4) Standard angle method.

Only the first two methods will be described here. Refer to FM 6–140 for a description of the aiming circle and standard angle methods.

b. Testing Target Method. It is essential that the proper testing target is used for the weapon being bore sighted. If the proper testing target is not available, a substitute may be constructed in accordance with the dimensions shown in figure 95.

(1) Level the trunnions as accurately as possible. In no case should more than 20 mils cant be present.
(2) Set the howitzer to zero elevation using a gunner's quadrant on the leveling pads of the breech ring. Make certain that the shoes on the gunner's quadrant are positioned between the engraved lines on the leveling pads.
(3) Cross-level the telescope mount and place the gunner's quadrant on the quadrant seat attached to the front of the mount. The gunner's quadrant should register zero elevation with one-half mil. If it does not, loosen the two cap screws which retain the actuating arm bracket to the mounting bracket. Using a screw driver, turn the eccentric adjusting screw on the actuating arm bracket until the gunner's quadrant reads zero elevation. Tighten the cap screws and verify the adjustment.
(4) Center the longitudinal level vial by means of the elevation knob on the telescope mount. The elevation scale and micrometer should read zero. If they do not, loosen the two elevation scale retaining screws and the three screws on the elevation knob. Slide the elevation scale and micrometer to aline the zero gradations with their respective indexes. Tighten all screws and verify the adjustments (fig. 96).
(5) Place the breech and muzzle bore sights in their proper positions (figs. 93 and 94).

Note.—In the event that the bore sights are not available, provide strings as improvised cross hairs for the howitzer muzzle, and remove the firing mechanism from the howitzer (par. 23*a*). Close the breech and sight through the primer vent in the obturator spindle (fig. 93).

(6) Place the target (fig. 95) at least 50 yards in front of the

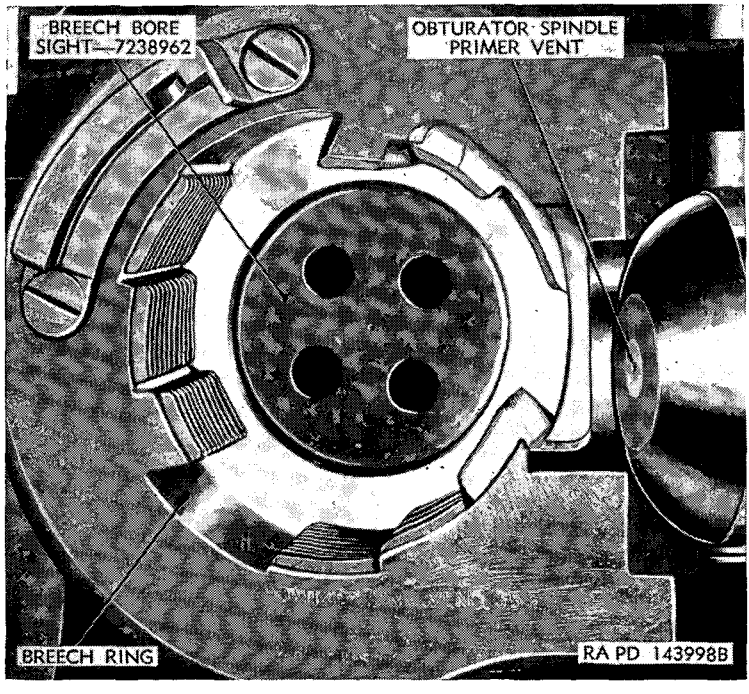


Figure 93. Breech bore sight installed in howitzer breech.

piece and aline the proper aiming diagram with the line of sight through the tube. Due to conditions of terrain, it may be found necessary to elevate or depress the tube slightly in order to make this alinement. If this is the case, *do not relevel the telescope mount longitudinally. Keep the elevation scale and micrometer set to zero at all times during the bore sighting operation.* If the tube and trunnions are level, the face of the target must be vertical and the horizontal center lines of the aiming diagrams must be level. If the trunnions are slightly canted, the target and the panoramic telescope mount must be canted an equal amount in the same direction. If the tube is not level, the face of the target must be tilted accordingly. In all cases, the face of the target must be positioned so that it is at right angles to the line of sight through the tube, and so that the horizontal center lines of the aiming diagrams are parallel to the axis of the trunnions. Precisely correct positioning of the target is readily determined when the howitzer and trunnions are accurately leveled ((1) and (2) above).

(7) Set the panoramic telescope azimuth scale and micrometer to

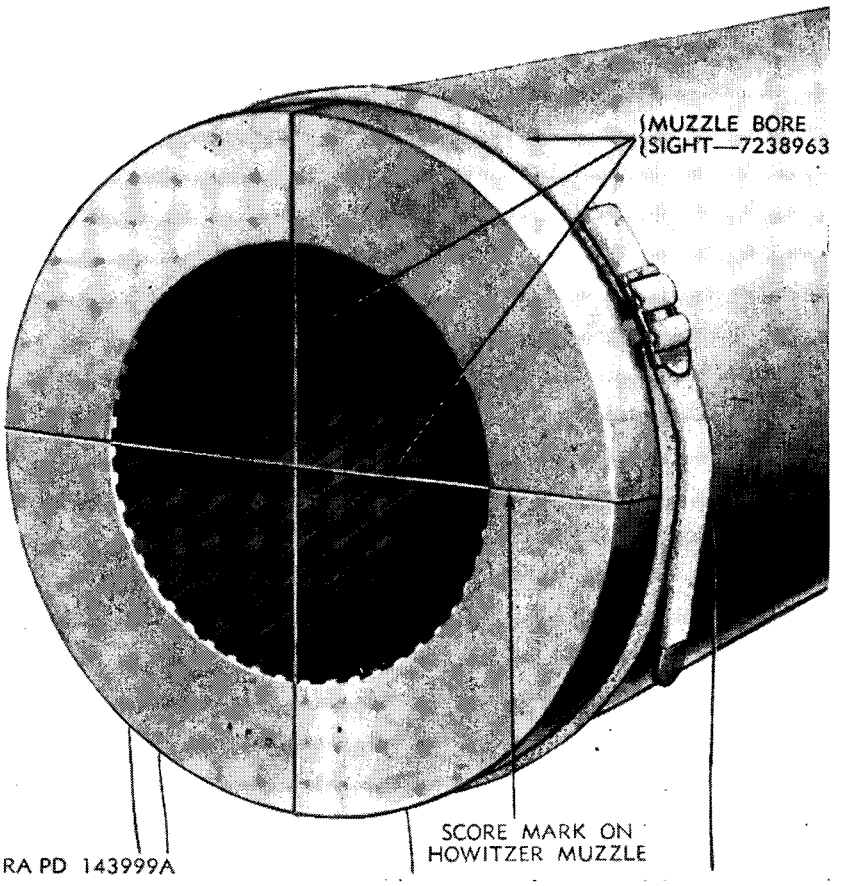


Figure 94. Muzzle bore sight in place on howitzer muzzle.

zero. Sight through the telescope. Turn the telescope elevation knob to aline the horizontal reticle line with the horizontal line of the aiming diagram for the panoramic telescope.

(8) If the coarse and fine elevation indexes of the panoramic telescope do not aline with the zeros, loosen the clamping screws on the elevation knob or elevation scale and shift the elevation micrometer or elevation scale to aline the zero with the fixed index (fig. 96). Tighten the screws and verify the adjustment. If the vertical reticle line is not alined with the vertical line of the aiming diagram, loosen the tangent locking screws in the telescope socket and adjust the tangent screws (fig. 97) until the vertical reticle line is properly alined. Tighten the locking screws and verify the adjust-

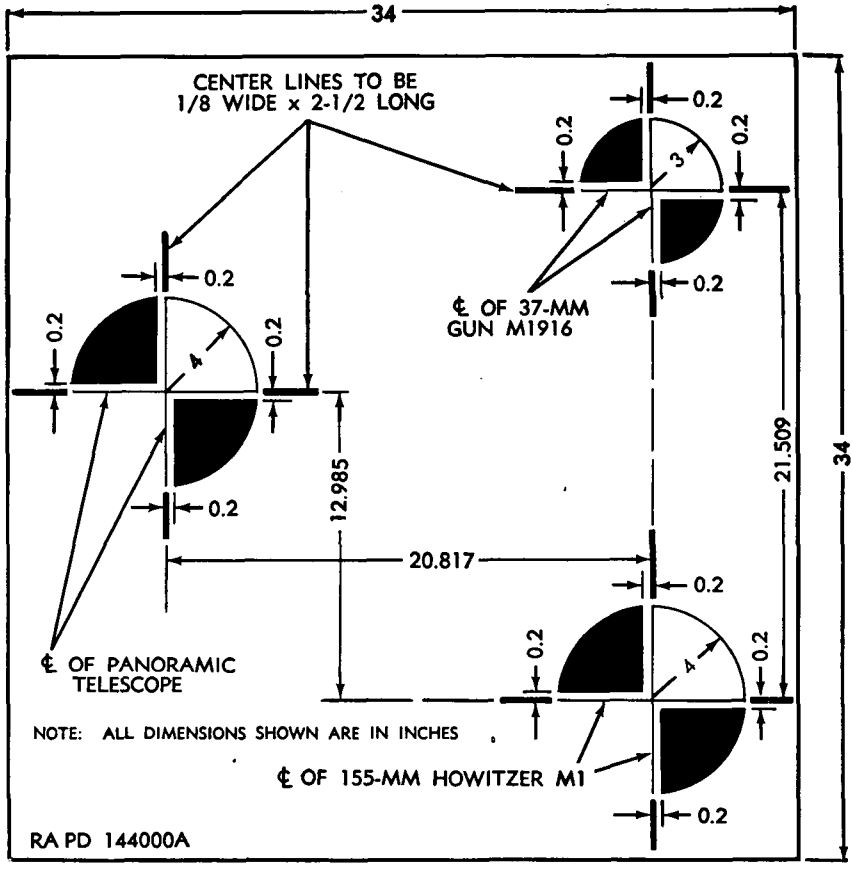


Figure 95. Testing target for boresighting 155-mm howitzer M1 and howitzer mount M14 mounted on motor carriage M41.

ment. Make sure the panoramic telescope fits snugly against the tangent adjusting screws without binding. If the limit of this adjustment is inadequate, refer the telescope and mount to the authorized ordnance maintenance personnel for correction. Never slip the azimuth scale.

c. Distant Aiming Point Method. A distant aiming point may be used instead of the testing target if the testing target is unavailable or if the tactical situation makes its use impracticable (fig. 98). The aiming point selected for this weapon should be a sharply defined point at least 2,500 yards from the weapon. All the steps prescribed for the testing target method apply except that the bore sights and optical sights are alined on the same point instead of on displaced points as on the testing target. Also, accurate leveling of the trunnions is unnecessary. It is improbable that the tube will be

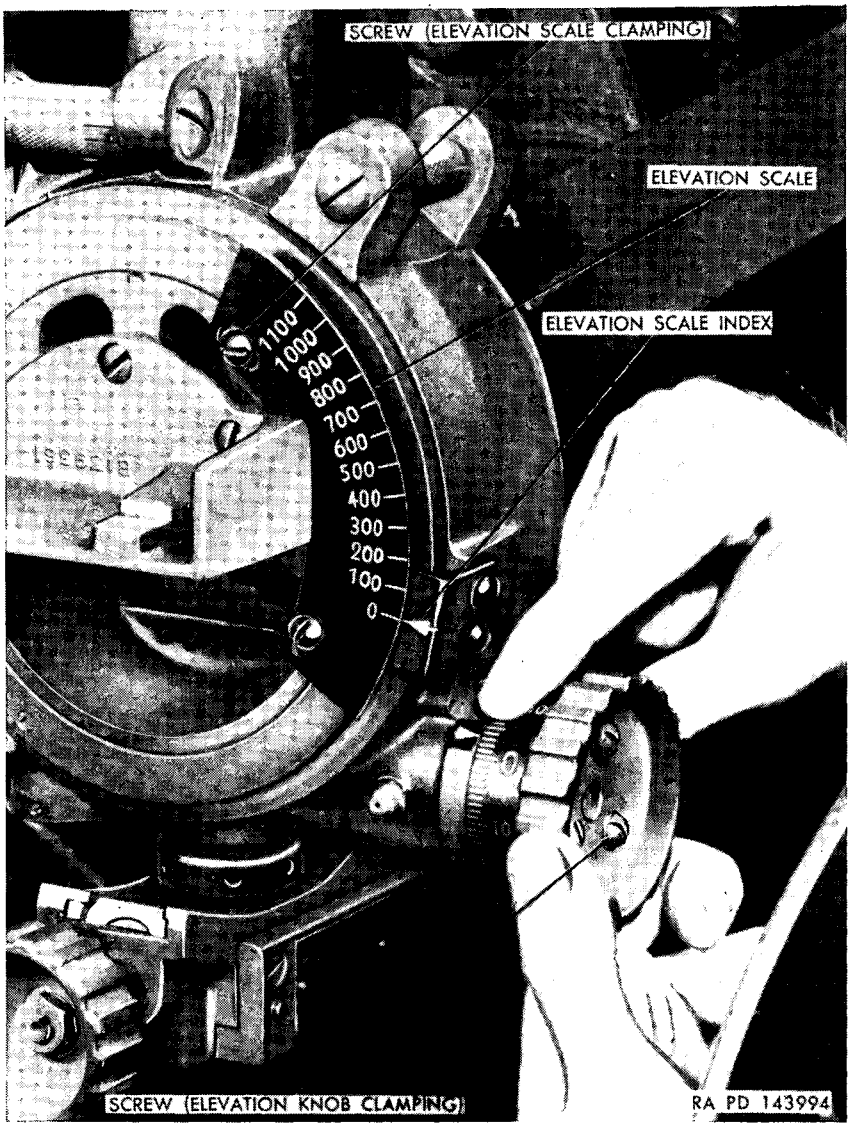


Figure 96. Adjusting longitudinal leveling micrometer to coincide with its index.

level. *Therefore, it is essential that the zero setting of the elevation scale and micrometer described in b (4) above, is maintained during the entire bore sighting operation.*

d. Bore Sighting the 37-mm Subcaliber Gun M1916.

(1) Mount the subcaliber gun in position on top of the howitzer recoil mechanism cradle (par. 95).

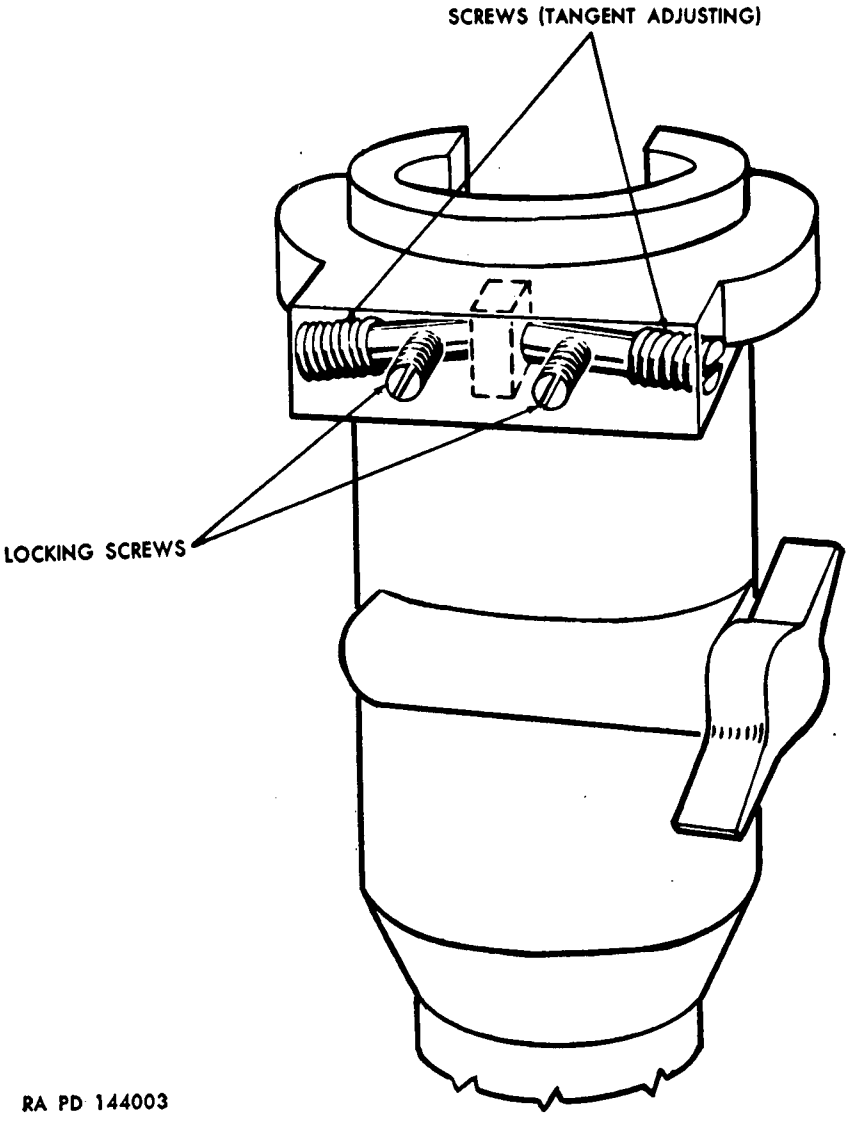
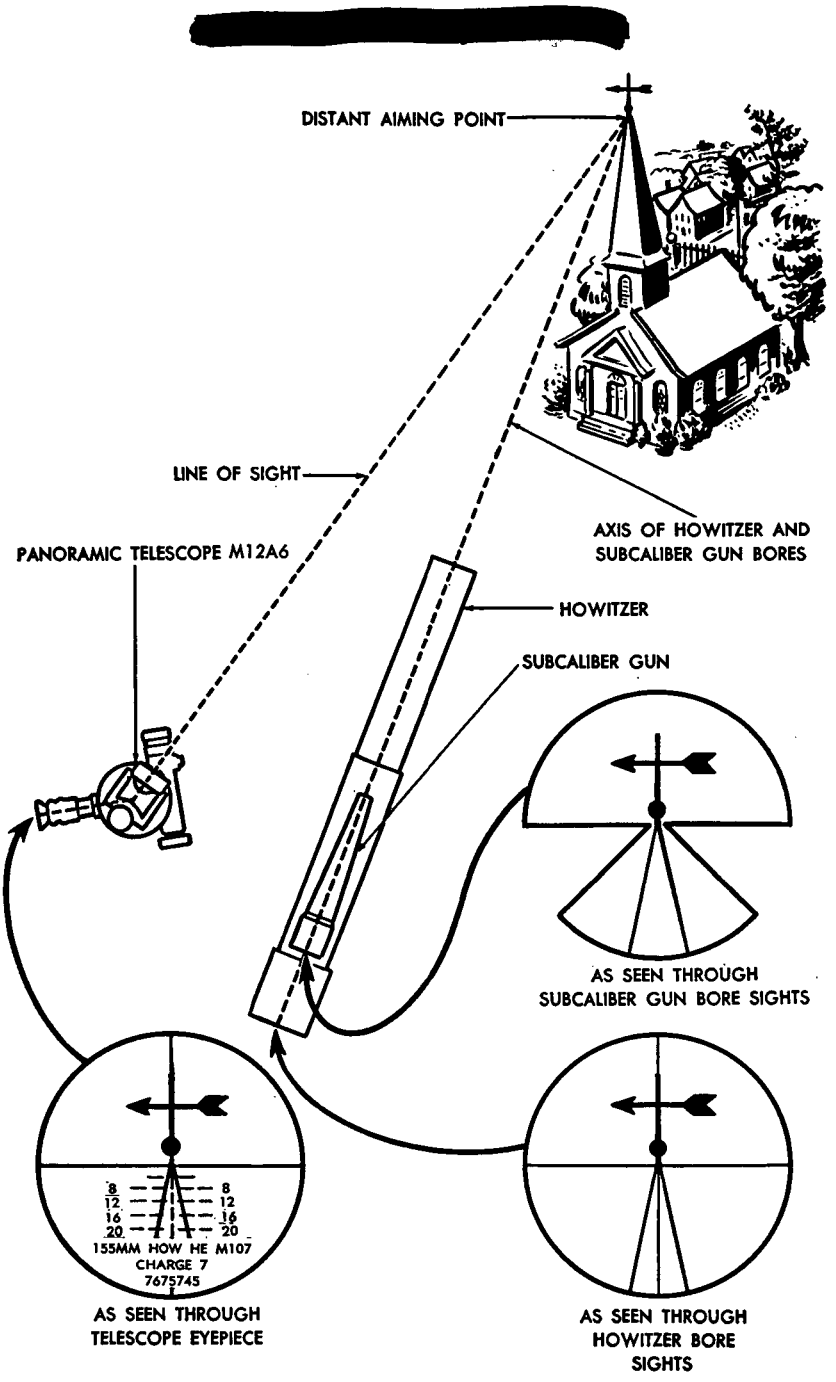


Figure 97. Tangent adjusting screws in telescope socket of telescope mount.

(2) Install the breech and muzzle bore sights (fig. 99) in the subcaliber gun.

(3) Aline the howitzer bore on the testing target (*b* above) or on the distant aiming point (*c* above).

(4) Aline the line of sight of the subcaliber gun with the proper horizontal and verticle lines of the testing target (or distant aiming point) by loosening the adjusting screw jam nuts



RA PD 144030A

Figure 98. Schematic view of distant aiming point method of boresighting.

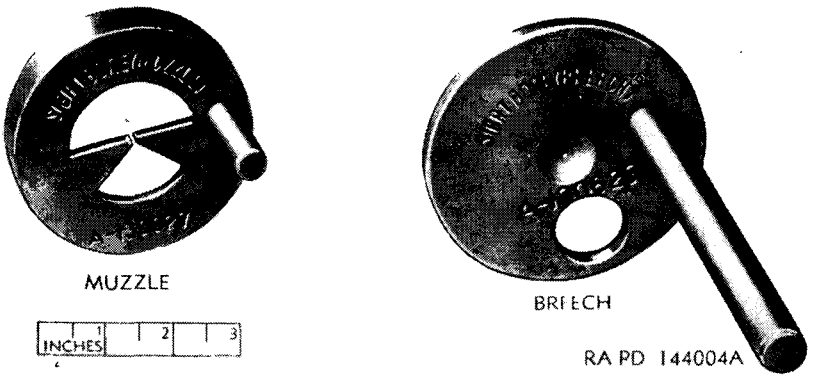


Figure 99. Boresights for 37-mm subcaliber gun M1916.

and trunnion cap screw jam nuts and turning the screws (par. 95*b*). When tightening the screws, do not overtighten to avoid putting any strain on the recoil cylinder of the subcaliber gun.

(5) When the bore of the subcaliber gun is properly alined on the testing target (or distant aiming point), fit the adjusting screw and trunnion cap screw jam nuts (fig. 106) up tight by tightening them alternately.

e. Bore Sighting the Caliber .22–.30 Rifle Subcaliber Equipment.

(1) Aline the howitzer bore on the testing target (*b* above) or on a distant aiming point (*c* above).

(2) Mount the caliber .22–.30 rifle subcaliber equipment in position on top of the howitzer recoil mechanism (par 95*a* and *c*).

(3) Remove bolt groups from caliber .22 rifle M2 (TM 9–280) or from caliber .30 rifle M1903A3 (TM 9–270).

(4) Sight through the bore of the caliber .22 or caliber .30 rifle and make the necessary horizontal and vertical adjustments, as described in *d* above, to aline the center of the rifle bore with the aiming point for the 37–mm subcaliber gun on the testing target (or with the distant aiming point used for howitzer.)

Section II. SUBCALIBER EQUIPMENT

90. Purpose

Subcaliber equipment, which is used for training purposes only, consists of the 37-mm gun and recoil mechanism M1916, 37-mm subcaliber mount M13A1, caliber .22–.30 rifle adapter M17, caliber .22 rifle M2 (without stock), and caliber .30 rifle M1903A3 (without

stock) and equipment. Subcaliber equipment is used to provide more extensive training in laying and firing the 155-mm howitzer matériel than would be permissible with the standard 155-mm ammunition. The use of small bore ammunition prevents wear on the regular piece during practice and is less costly. Although the actual handling, loading, and range obtained are different, the results in elevating, traversing, and similar operations are adequate for instructional purposes. The use of 155-mm drill ammunition provides training in handling and loading standard size ammunition. The following paragraphs pertain to the 37-mm gun and recoil mechanism M1916, with the exception of paragraphs 92*d*, 95*c*, 97*b*, and 98*b* which describe the installation and removal of the rifle adapter M17 onto and from the mount M13A1 and the installation and removal of the caliber .22–.30 rifles into and from the rifle adapter. Operation and maintenance of the caliber .22 rifle M2 are covered in TM 9–280. Operation and maintenance of the caliber .30 rifle M1903A4 is covered in TM 9–270 and caliber .30 rifle M1903 is covered in FM 23–10.

91. Data

Model of gun	M1916
Model of mount	M13A1
Weight of gun and mount	88 lb
Length of bore	29.13 in
Caliber	37-mm
Type of breechblock	eccentric screw
Type of firing mechanism	trigger
Recoil mechanism:	
Type of recoil	hydrospring
Type of counterrecoil	spring
Maximum allowable recoil	7 to 10 in
Ammunition—For complete data see chapter 5	
Maximum rate of fire	33 rds per min
Range	4,900 yd
Muzzle velocity	1,276 fps

92. Description and Functioning

a. The 37-mm gun (figs. 100 and 101) is a single-shot, hand-loaded weapon with a manually-operated eccentric-screw type breechblock.

b. The 37-mm gun recoil mechanism M1916 (fig. 100) is a hydrospring type and consists of the recoil mechanism, counterrecoil mechanism, and counterrecoil buffer contained in a single cylinder. The recoil mechanism controls the force created by firing and gradually

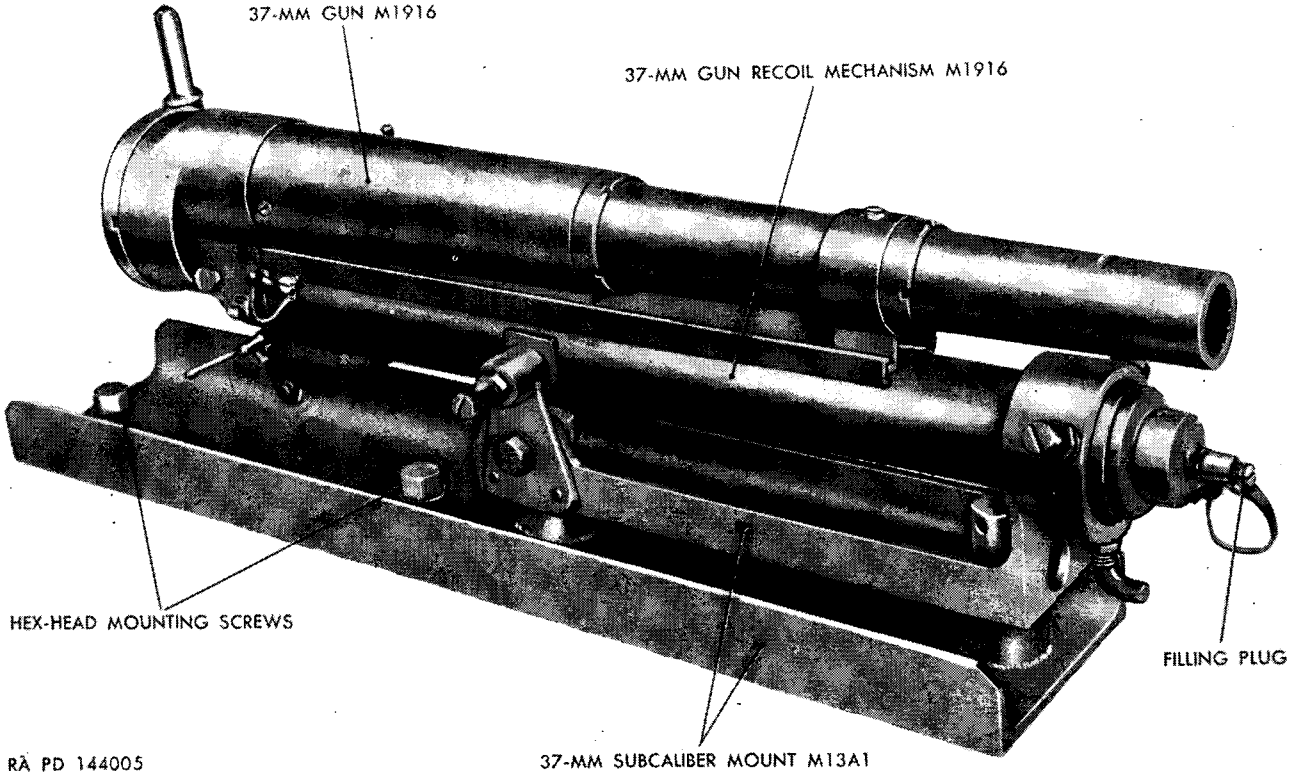


Figure 100. 37-mm subcaliber equipment for 155-mm howitzer.

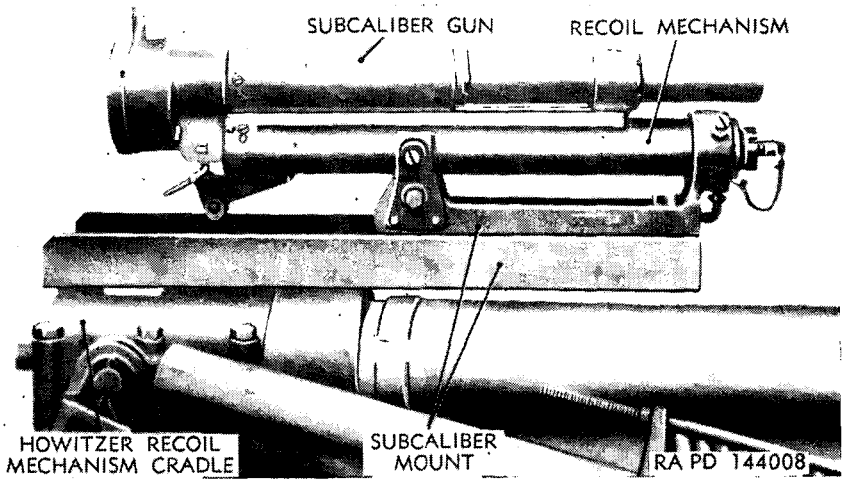


Figure 101. 37-mm subcaliber equipment mounted on howitzer.

retards the rearward movement of the gun. The counterrecoil mechanism returns the gun into battery. The counterrecoil buffer functions at the end of counterrecoil to cushion the return to battery.

c. The 37-mm subcaliber mount M13A1 (fig. 100) consists of a cradle mounting bracket to which the detachable right trunnion bearing bracket is fastened. The left trunnion bearing bracket is cast as an integral part of the cradle mounting bracket. Both trunnion bearings are equipped with cap screws and jam nuts (fig. 106), which not only retain the gun cradle in position but also provide a means of lateral adjustment. The collar at the front end of the cradle mounting bracket houses two side adjusting screws and one bottom adjusting screw and their jam nuts, which retain the front end of the recoil cylinder and also provide a means of vertical adjustment (par. 89*d*(4)).

d. The caliber .22–.30 rifle adapter M17 (fig. 107) is positioned in the subcaliber mount M13A1 (figs. 108 and 109). The rifle adapter mounts either the caliber .22 rifle M2 or the caliber .30 rifle M1903A3 with the stock removed.

93. Services

a. Cleaning. General cleaning instructions are outlined in paragraph 48.

b. Inspection Upon Receipt of New or Used Matériel. General inspection instructions are outlined in paragraphs 8 and 9.

c. Lubrication.

(1) Lubricate the matériel (par. 100).

(2) The recoil mechanism filling plug should be painted and circled green to indicate that the mechanism is filled with recoil oil (special) or orange to indicate that the mechanism is filled with petroleum base hydraulic oil.

(3) All lubricating fittings should be properly identified with red circles approximately ¾-inch in diameter, but the fittings themselves should not be painted.

d. Filling the Recoil Mechanism. The recoil mechanism requires 2¾ pints of oil. Only the prescribed recoil fluid (par. 100) is used. The filling procedure is as follows:

(1) Raise the rear end of the recoil mechanism of the 37-mm subcaliber gun higher than the front end, by using the elevating mechanism of the 155-mm howitzer. When filling a recoil mechanism that has been removed from the 37-mm subcaliber gun, position it as shown in figure 102.

(2) Fill and purge the oil gun. To fill oil gun, unscrew the nozzle of the oil gun, insert the end of the gun in the oil, and pull the plunger back. Fill the gun with the recoil fluid and install the nozzle. To purge the gun, push the plunger up gently. This forces out the air.

(3) Remove the filling plug in the front of the cradle (fig. 102).

(4) Screw the oil gun into the filling hole (fig. 102).

(5) Remove the drain plug in the right side of the cradle (fig. 102).

(6) Push the plunger of the oil gun in slowly, at the same time watching for the escape of oil from the drain hole. When the oil runs out free of air bubbles, the recoil mechanism is full.

(7) Remove the oil gun. Before installing the filling and drain plugs, let about 2 teaspoonsful of oil escape, then screw the two plugs in tightly. Permitting a little oil to escape gives some room for expansion, which is needed to accommodate the expansion of oil during prolonged fire and avoid interference with the complete return of gun to battery.

94. Controls

a. Breechblock and Breechblock Lever. The breechblock (fig. 103) is an eccentric type, which screws into the breech ring, and rotates through an angle of 156° about its axis. The axis of the breech recess is below the axis of the bore. The breechblock is operated by a breechblock lever assembly (fig. 103), which, when rotated counterclockwise, positions the eccentric opening in line with the bore. Opening the breech, operates the extractor, which extracts the cartridge case. When the lever is rotated clockwise, the breechblock closes the

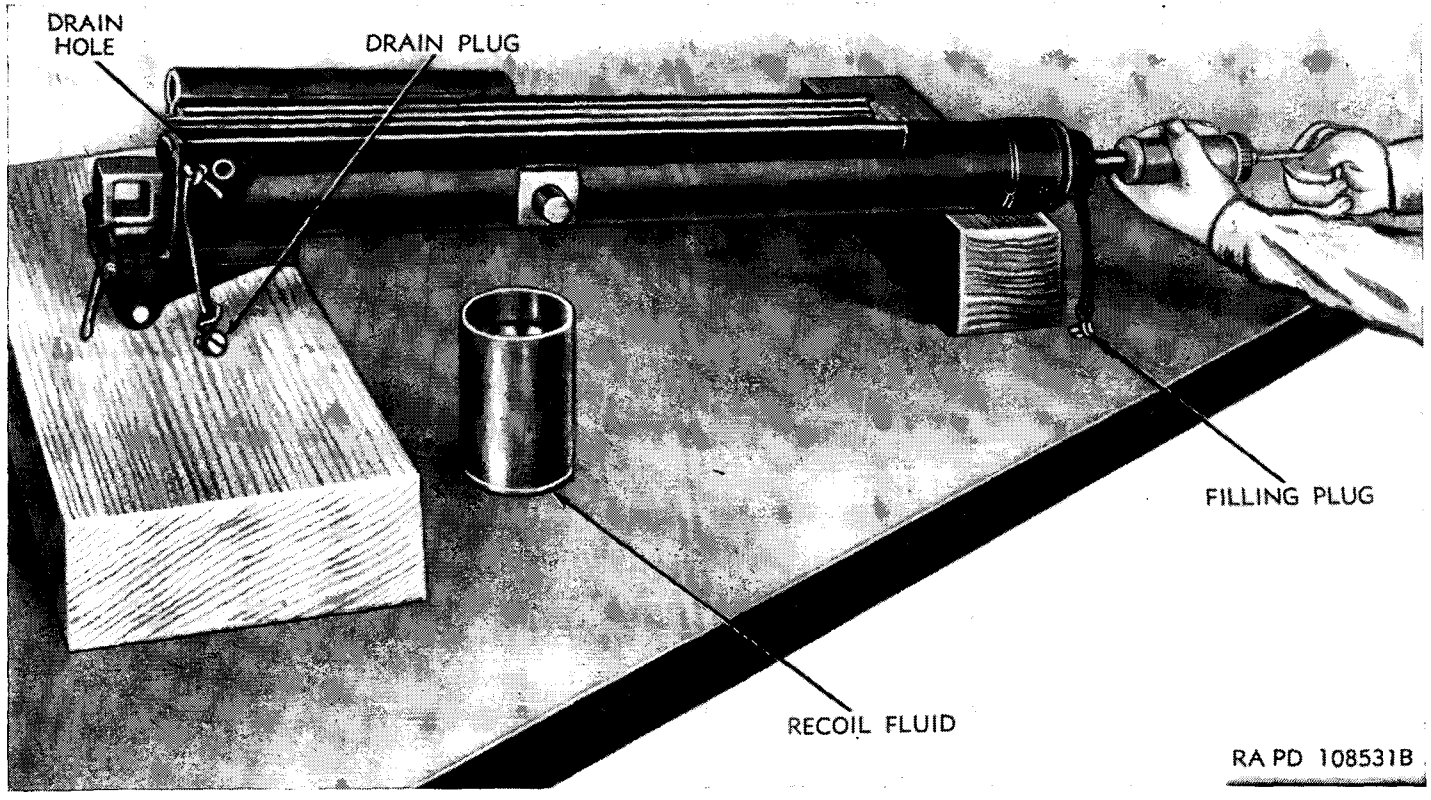


Figure 102. Filling the recoil mechanism.

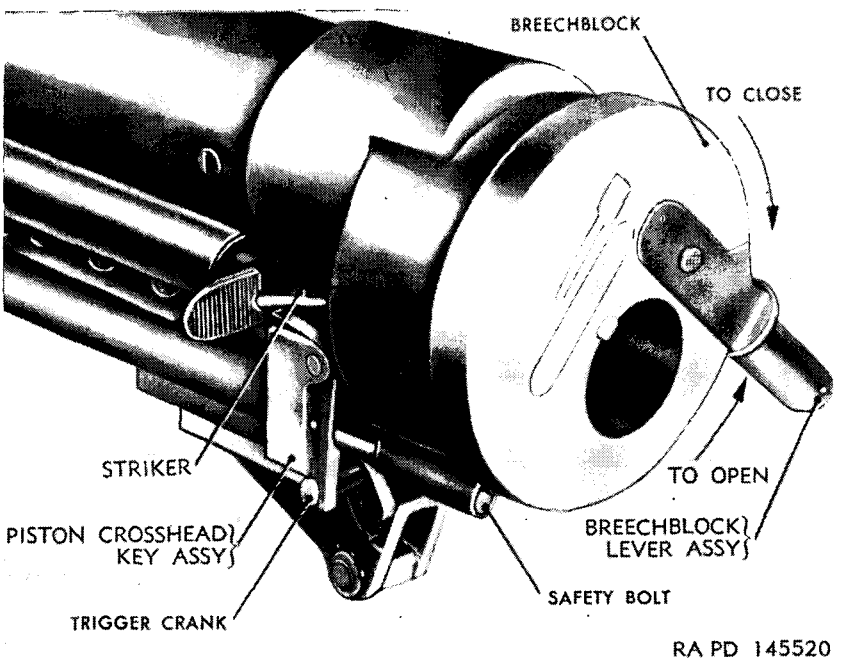


Figure 103. 37-mm gun breech.

breech, seats the cartridge, places the firing pin in line with the primer in the base of the cartridge case, and, at the same time, releases the safety bolt.

Note.—The breech cannot be opened if the firing mechanism is not cocked (*b* below).

b. Striker Cocking Handle. The striker cocking handle (fig. 104) is located on the left side of the gun near the breech. Before firing the first round or after a failure to fire, the gun must be manually cocked by pushing this handle forward with the palm of the hand until it latches.

c. Trigger Crank Actuating Lever. The trigger crank actuating lever (fig. 105) is located on the right side of the gun just below the breech. The gun is fired by pushing this lever down with the thumb.

95. Mounting Subcaliber Equipment

a. Install 37-mm Subcaliber Mount M13A1. To mount the 37-mm subcaliber mount M13A1, aline the holes on the bottom of the cradle mounting bracket with the holes in the 155-mm howitzer recoil mechanism cradle and secure the mount with the two hex-head mounting screws (fig. 100).

b. Install 37-mm Subcaliber Gun M1916. To mount the 37-mm

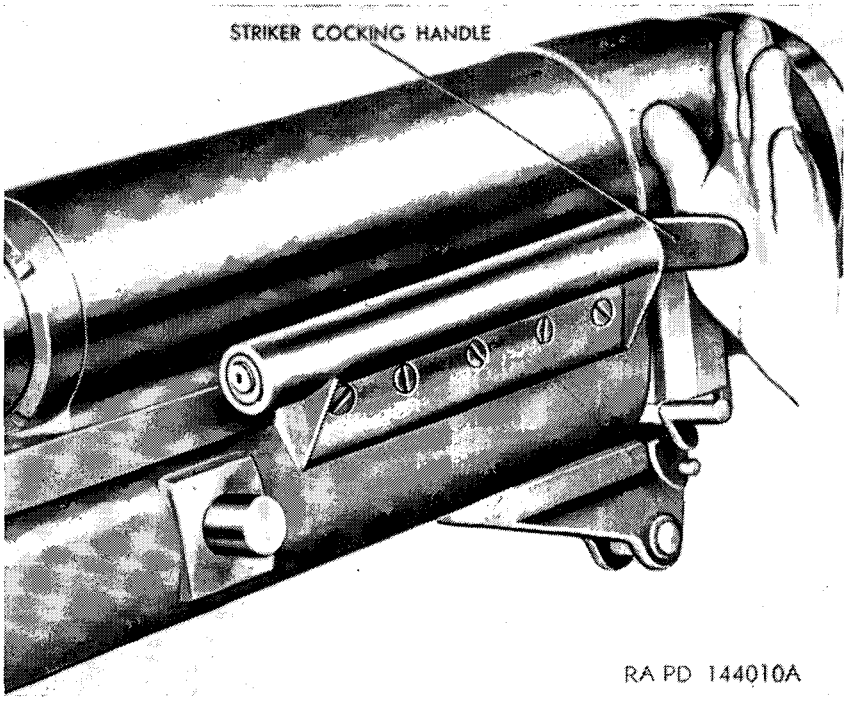


Figure 104. Cocking the 37-mm gun.

subcaliber gun M1916, loosen the three adjusting screws in the collar of the subcaliber mount (fig. 106). Remove the trunnion bearing bracket from the right side of the cradle mounting bracket, by removing the cap screw and lock washer which retain it in position. Lift the 37-mm gun with recoil mechanism to the top of the 155-mm howitzer and insert the front end of the recoil cylinder through the collar of the mount, while placing the trunnion of the recoil mechanism in the trunnion bearing on the left side of the cradle mounting bracket (fig. 106). Assemble the right trunnion bearing bracket to the cradle mounting bracket, making certain the trunnion on the recoil mechanism enters the bearing on the bracket, and secure the bracket with the cap screw and lock washer. Tighten the trunnion cap screws in the trunnion bearings and the three adjusting screws in the collar just enough to retain the 37-mm gun in position. Bore sight the gun (par. 89*d*).

c. Install Caliber .22 or .30 Rifle. To mount either a caliber .22 or .30 rifle, remove the stock from the rifle and mount the rifle in the rifle adapter M17 (figs. 107, 108, and 109). Loosen the three adjusting screws in the collar of the subcaliber mount. Remove the trunnion bearing bracket from the right side of the cradle mounting bracket

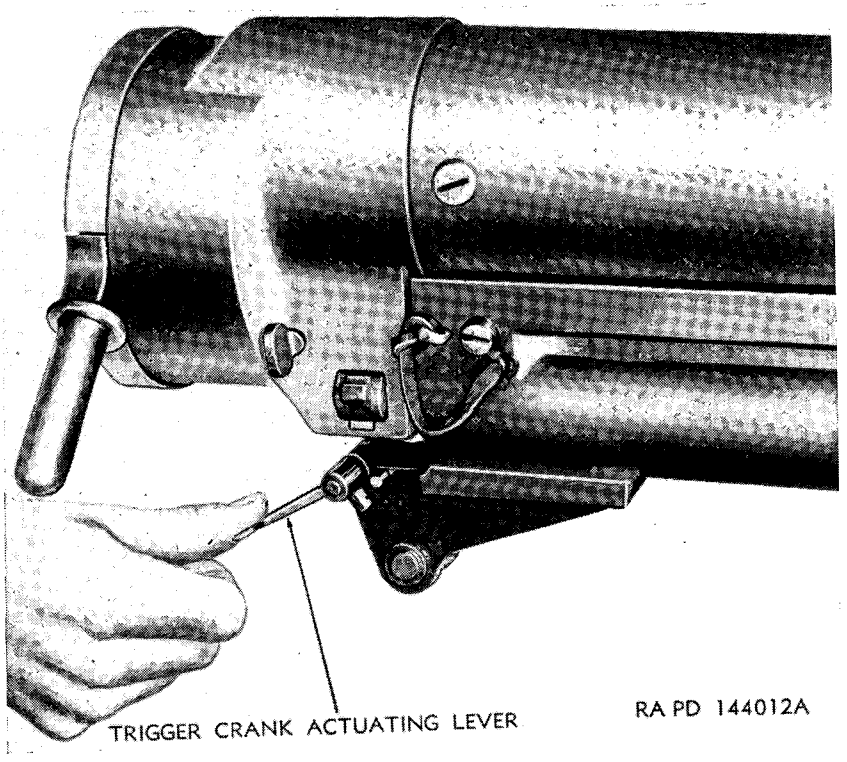


Figure 105. Depressing trigger crank actuating lever.

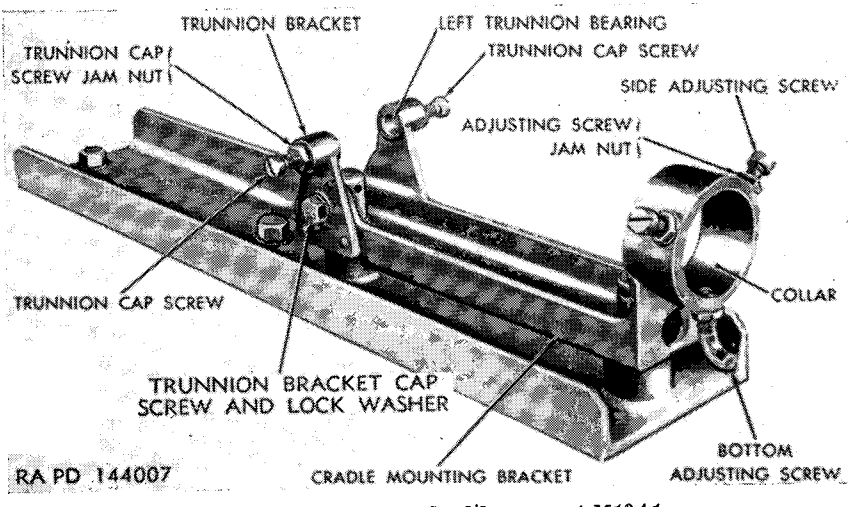


Figure 106. 37-mm subcaliber mount M13A1.

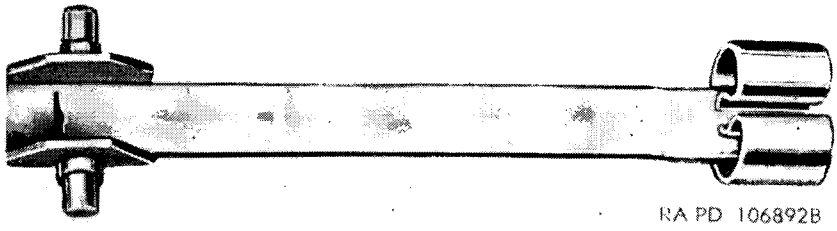


Figure 107. Caliber .22–.30 rifle adapter M17.

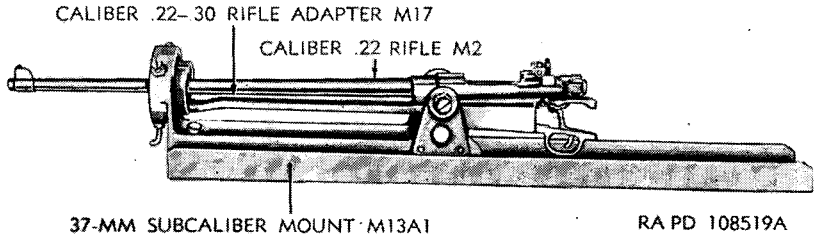


Figure 108. Caliber .22 subcaliber equipment.

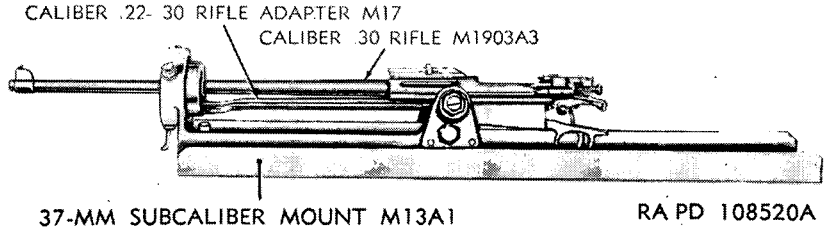


Figure 109. Caliber .30 subcaliber equipment.

(*b* above). With rifle mounted in the rifle adapter, insert the spring clip end of the rifle adapter through the collar of the mount, while placing the trunnion on the rifle adapter in the trunnion bearing on the left side of the cradle mounting bracket. Assemble the right trunnion bearing bracket to the cradle mount bracket, making certain that the trunnion on the rifle adapter enters the bearing on the bracket, and secure the bracket (*b* above). Tighten the trunnion cap screws in the trunnion bearings just enough to retain the rifle adapter in position. Bore sight the rifle (par. 89*e*).

96. Operation of Subcaliber Gun

a. Precautions Before Firing.

(1) Check to be sure that the bore is clean and dry, that the recoil mechanism is properly filled (par. 93*d*, that the mount is securely fastened to the 155-mm howitzer, and that both weapons are properly bore sighted (par. 89). Also check to see that all moving parts are oiled and that all moving parts are functioning properly.

(2) Avoid working the trigger mechanism when there is no round in the chamber. Do not attempt to force the trigger crank actuating lever when the breech is not completely closed. The sear is locked by the safety bolt and cannot move when the breech is open.

(3) The breechblock cannot be opened unless the firing mechanism is cocked. Caution is required on the first round or after a misfire when the gunner has to reach across the gun to cock the firing mechanism. Subsequent firing automatically recocks the firing mechanism.

b. Loading.

(1) The subcaliber gun should be loaded at approximately 150-mils elevation, since this elevation is used when loading the primary weapon (par. 27). However, it is possible to load the 37-mm gun at any elevation less than 65°. At low elevations, the gun is loaded by standing on the trails or bogie. At high elevations, the gun is loaded by standing on a board placed across the trails under the breechblock of the 155-mm howitzer.

(2) First cock the gun (par. 94*b*), if not already automatically recocked, and then open the breech (par. 94*a*).

(3) Place a round in the breech opening (fig. 110) and push it forward as far as allowed by the extractor. Rotate the breechblock lever to the right until the breech is fully closed (fig. 103). The gun is now ready to fire.

c. Firing. The normal position for operating the 37-mm gun is from the right side. Firing is accomplished by pressing the trigger crank actuating lever (par. 94*c*) and then releasing it promptly. Should the gun fail to fire, refer to paragraph 97.

d. Unloading. If a round has been loaded and is not to be fired, carefully rotate the breechblock lever counterclockwise until the cartridge extractor moves the round to the rear sufficiently for it to be removed by hand.

Caution: If an unfired projectile becomes separated from its car-

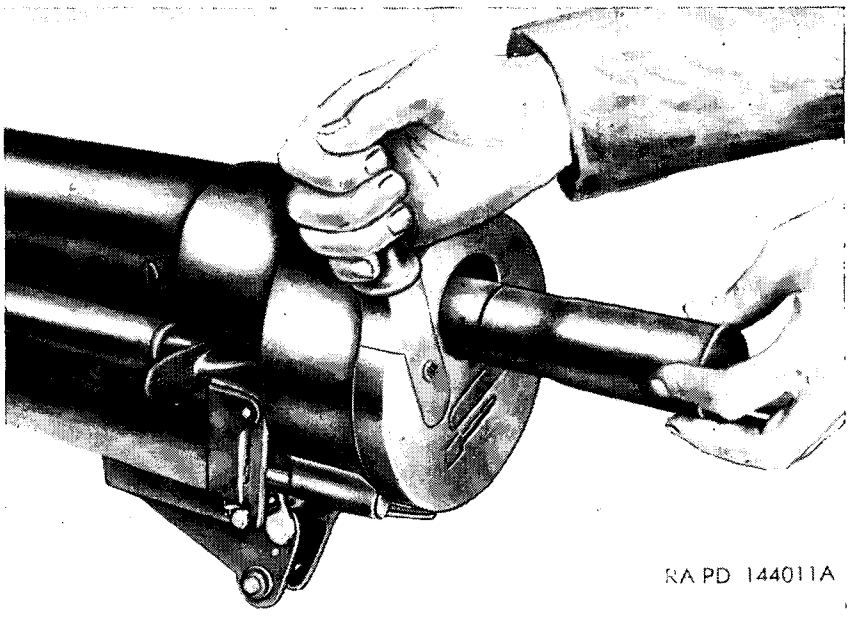


Figure 110. Loading the 37-mm gun.

tridge case while the round is being removed, notify ordnance maintenance personnel.

Note.—If the cartridge case of a fired round is ruptured so that only a portion of the cartridge case is extracted and the remaining portion cannot be removed, notify ordnance maintenance personnel. In the event that an unfired round becomes stuck in the chamber of the 37-mm subcaliber gun and cannot be removed as outlined above, notify ordnance maintenance personnel.

97. Failure to Fire

a. 37-mm Subcaliber Gun M1916.

(1) Failure of the gun to fire may be caused by defective ammunition or by a malfunction of the weapon.

(2) Upon the failure to fire, make two more attempts to fire (par. 96*c*), recocking manually (par. 94*b*) for each attempt.

(3) If the gun still does not fire, wait 1 minute from the time of the last attempt to fire and proceed as follows:

(*a*) Open the breech slowly and remove the round (par. 96*d*).

(*b*) Examine the primer for indent.

(c) If primer has a normal indent, the round is defective and should be turned over to ordance maintenance personnel. Resume firing.

(*d*) If primer has light or no indent at all, failure to fire was

caused by a malfunction of the gun. Refer to trouble shooting (par. 102) for correction procedure of malfunctions.

Caution: When a failure to fire occurs, keep all personnel clear of the line of fire and path of recoil of the weapon. Clear all personnel, not needed for the failure to fire procedure prescribed above, from the vicinity of the weapon.

b. Caliber .22–.30 rifles.

(1) If the rifle fails to fire, recock it and make another attempt to fire before opening the bolt. It is unsafe to open the bolt of a rifle for at least 10 seconds when a failure to fire occurs, since a misfire cannot immediately be distinguished from a hangfire.

(2) If the round was not defective, failure to fire was caused by malfunction of the rifle. Refer to the pertinent technical manual (par. 90) for correction of malfunction.

98. Removal of Subcaliber Equipment

a. Loosen the three adjusting screws in the collar of the mount. Remove the right trunnion bearing bracket from the cradle mounting bracket, by removing the cap screw and lockwasher which retain it, and remove the 37-mm subcaliber gun from the mount.

b. The rifle adapter is removed from the mount in the same manner as the 37-mm subcaliber gun (*a* above). Remove the caliber .22 or .30 rifle from the rifle adapter.

c. Remove the mount from the 155-mm howitzer recoil mechanism cradle, by unscrewing the two hex-head mounting screws (fig. 100) that secure the mount.

99. Organizational Spare Parts, Special Tools, and Equipment

a. Spare Parts. The spare parts issued with the subcaliber gun are replacements for those parts that are liable to fail and may readily be replaced by the using arm. These parts are specified in the Department of the Army Supply Catalog ORD 7 SNL C–33, Section 13, but are not specifically identified in this manual. No spare parts are issued with the 37-mm subcaliber mount M13A1.

b. Common Tools and Equipment. Standard and commonly used tools and equipment having general application to this material are authorized for issue by T/A and T/O & E.

c. Special Tools and Equipment. Certain special tools and equipment especially designed for operation, organizational maintenance,

repair, and general use with the material are listed in table V. This list is not to be used for requisitioning replacements. These tools and equipment for the 37-mm subcaliber gun and recoil mechanism M1916 and 37-mm subcaliber mount M13A1 are specified in the Department of the Army Catalogs ORD 7 SNL C–33, Section 13 and ORD 7 SNL C–33, Section 7, respectively.

Table V.—Special Tools and Equipment for Operation and Organizational Maintenance of 37-mm Subcaliber Gun M1916

Item	Identifying number	References		Use
		Fig.	Par.	
For GUN, 37-MM, M1916.				
BRUSH, bore, 37-mm M8.	6157305	111	101	Clean bore of gun.
EXTRACTOR, cartridge, hand.	41–E–520–80	111	102	To remove stuck or ruptured cartridge case from chamber of gun.
FORM, govt, War Dept, arty gun book, OO No. 5825.	28–F–67990	111	3, 115*f*	To record data on gun and recoil mechanism.
SIGHT, bore, breech (GUN, 37-mm, M1916).	41–S–3636	111	89	To bore sight gun.
SIGHT, bore, muzzle (GUN, 37-mm, M1916).	41–S–3645–50	111	89	To bore sight gun.
STAFF, cleaning, M7.	6104460	111	----------	Used with bore brush.
For MOUNT, Subcaliber, 37-MM, M10.				
ADAPTER, rifle, cal. .22–.30 M17.	7159300	107	92, 95, 97, 114	For mounting cal. .22–.30 rifles to parent weapon for subcaliber firing.

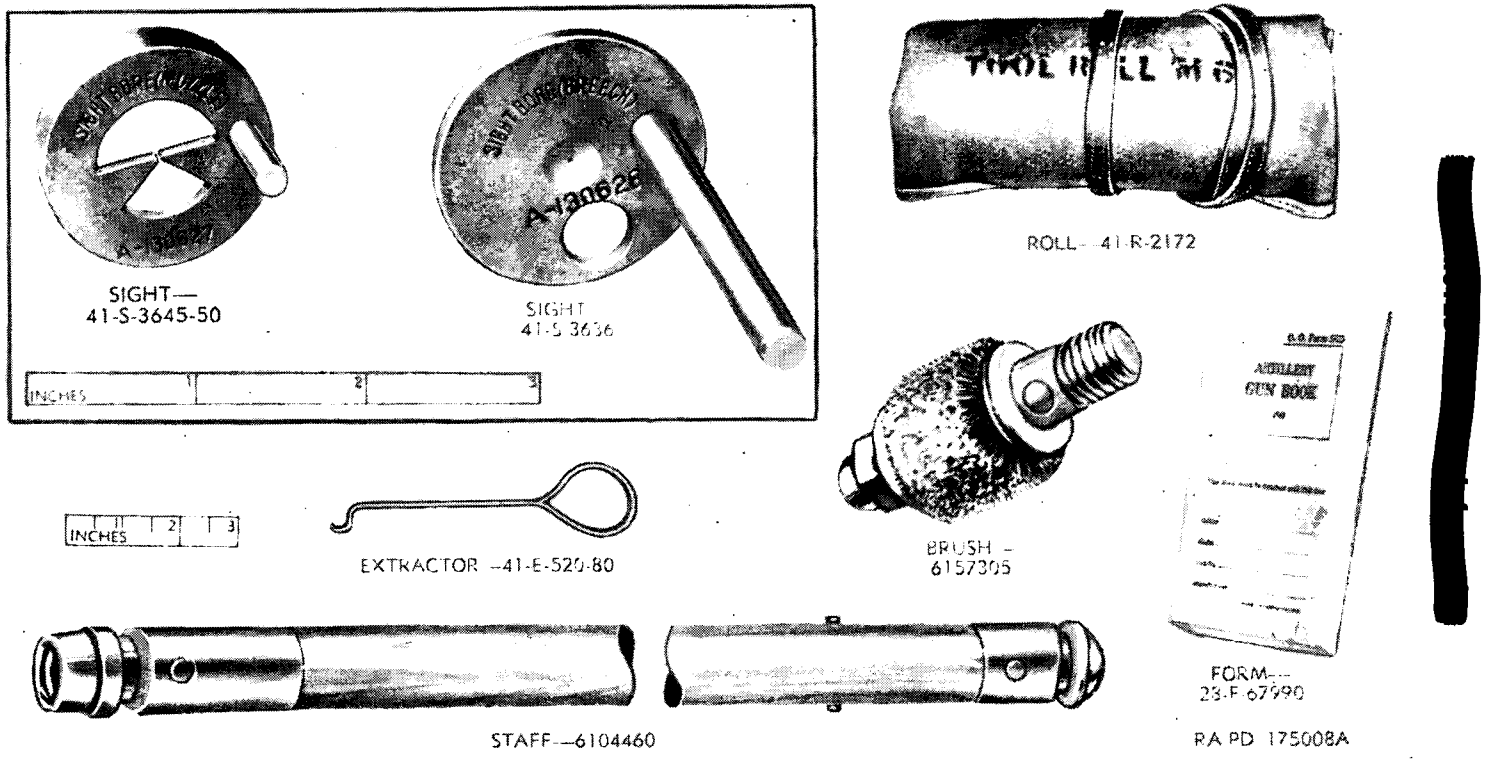


Figure 111. Special tools and equipment for 37-mm subcaliber gun M1916.

[redacted]

100. Lubrication

For lubrication of the subcaliber equipment see table VI.

Table VI.—Lubrication Guide, 37-mm Subcaliber Gun M1916

Part	Method	Remarks
Bore	Swab with bore brush moistened with CR. Dry and apply PL with jute burlap.	Clean and lubricate in the same manner as the 155-mm howitzer (pars. 50 and 51).
Breechblock	Apply PL to threads	Weekly. Unscrew breechblock (par. 103*b*(1)).
Firing pin	Apply a few drops PL at contact surfaces.	Weekly. While breechblock is dismounted (par. 103*b* (3)).
Extractor and extractor pin.	Apply a few drops PL at contact surfaces.	Weekly. While breechblock is dismounted (par. 103*b* (1)).
Safety bolt	Apply a few drops PL at ends of bracket.	Weekly. While breechblock is dismounted (par. 103*b* (1)).
Striker rod	Apply a few drops PL at ends of bracket.	Weekly. While breechblock is dismounted (par. 103*b* (1)).
Sear	Apply a few drops PL at bearing surface.	Weekly. While breechblock is dismounted (par. 103*b* (1)).
Piston crosshead key.	Apply a few drops PL at contact surfaces.	At assembly.
Striker spring	Slush with PL	At assembly.
Recoil mechanism	Check quantity of oil in recoil mechanism. Fill with OH–A as required.	Weekly (par. 93*d*).
Gun slides	Clean and coat bearing surfaces with GAA. Wipe off excess before firing.	Monthly. Dismount gun, clean, lubricate, and reassemble (pars. 103*a* and *e*).
Trigger crank	One drop PL at each end of bearing.	Weekly.

KEY

Lubricants	Expected temperatures		
	Above +32° F.	+40° to −10° F.	0° to −65° F.
PL—Oil, lubr, preservative	PL—Medium	PL—Special	PL—Special.
GAA—Grease, automotive and artillery.	GAA	GAA	GAA.
CR—Cleaner, rifle-bore	CR	CR	CR.
OH–A—Oil, hydraulic petroleum base.	OH–A	OH–A	OH–A.

[redacted]

[redacted]

101. Preventive Maintenance of Subcaliber Gun

a. The general instructions included in paragraphs 47 through 53 apply to the 37-mm subcaliber gun.

b. Table VII contains instructions designed to insure proper functioning of the 37-mm subcaliber matériel at all times. These instructions must be observed.

Table VII.—Organizational Preventive Maintenance Services

Intervals				Procedure
Before firing	During firing	After firing	Weekly	
X				*Mount.* Check to see that the mount is securely fastened to the parent weapon (par. 95*a*).
X				*Gun.* Check to see that the 37-mm subcaliber gun is properly installed in the mount (par. 95*b*).
X				Check to see that the subcaliber gun and parent weapon are properly bore sighted (par. 89).
			X	*Extractor.* Check operation of extractor (par. 96*d*), using an empty cartridge case.
			X	*Lubrication.* Lubricate (par. 100).
X				*Gun barrel.* Check to see that gun barrel is clean. Wipe dry.
			X	Examine bore for powder fouling. Clean with bore brush M8 (fig. 111) if necessary.
		X		*Clean.* The cleaning procedure outlined in paragraph 51 is generally applicable for the subcaliber gun. However, when cleaning, use the equipment specified for the subcaliber gun (par. 99).
			X	*Piston crosshead key.* Remove, inspect, clean, and lubricate. If the sear, sear spring, or sear plunger become worn, the entire key should be replaced (par 103*b*). Remove burs from the sear and sear notch with crocus cloth.
			X	Check the action of the sear plunger spring. The spring action must be such that it will hold the striker in a cocked position by means of the sear.
			X	*Jacket shoe and recoil ways.* Remove the piston crosshead key (par 103*b*) and slide the gun back. Check that the jacket shoe and recoil ways are free from burs. Remove burs with crocus cloth. If necessary, the gun can be removed from the recoil mechanism (par. 103*a*).
X				*Recoil mechanism.* Examine the front and rear cradle caps for oil leaks, and for leaks at the piston rod packing washer.
			X	Check the quantity of oil in recoil mechanism (par. 93*d*).

[redacted]

[redacted]

Table VII.—Organizational Preventive Maintenance Services—Continued

Intervals				Procedure
Before firing	During firing	After firing	Weekly	
----	----	----	X	Perform a retraction test. A simple retraction test (fig. 112) may be made by manually retracting the gun, blocking it with a piece of wood about 10 inches long, and then pulling out the block with a cord or wire. The gun should return to battery quickly, but without shock.
----	X	----	----	Check for proper functioning. The length of recoil should be measured for the first few rounds and then at regular intervals. Normal length of recoil is 7 to 10 inches.
X	----	----	----	*Breechblock.* Check for ease of rotation.
----	----	----	X	Remove the breechblock from the gun (par. 103*b*(1)). Inspect the firing pin hole in the face of the breechblock for foreign matter. Clean.
----	----	----	X	Test the tension at the breechblock lever latch spring by depressing the release pin cap in the breechblock lever assembly (fig. 114) and noting whether the spring returns the cap to the original position. If spring does not return the latch, notify ordnance maintenance personnel.
----	----	X	----	Disassemble (par. 103), clean, and lubricate (par. 100).
----	----	----	X	*Firing mechanism.* Remove the breechblock from the gun (par. 103*b*(1)). Depress the rocker plunger and measure the distance the firing pin protrudes from the face of the breechblock. This distance should measure approximately one-eighth of an inch. If the firing pin does not protrude approximately one-eighth of an inch, replace the firing pin (par. 103*b*(3)). After obtaining measurement, note whether the firing pin is fully retracted into the breechblock when the rocker plunger is released. If the firing pin does not return to its original position, replace the firing pin spring (par. 103*d*(2)).
----	----	----	X	*Trigger mechanism.* Test the action of the trigger crank adjusting lever. This lever should return to its original position after it has been depressed and released. If this lever does not return to its original position, it indicates that action of the trigger crank plunger spring is defective and does not hold the trigger crank plunger and trigger crank in place. Notify ordnance maintenance personnel for replacement of defective parts.
----	----	----	X	*Striker mechanism.* Check the action of the striker spring. The spring action must be such that when the striker is released it will deliver a sharp blow, which will be transmitted through the firing mechanism to the firing pin.

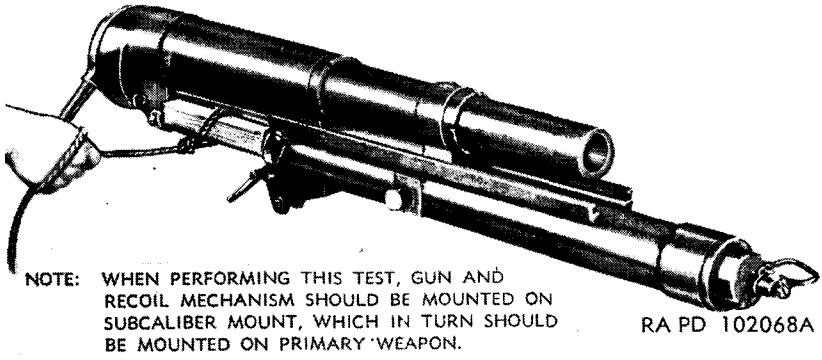


Figure 112. Retracting test, using block of wood.

102. Trouble Shooting

a. Scope. Trouble shooting is a systematic isolation of defective components. The more likely malfunctions, their causes, and corrections are listed in table VIII. The corrections provided in this paragraph are governed by the scope of the organizational level of maintenance.

b. Procedure. The procedure to follow in correcting a malfunction is to systematically isolate the cause and correct the malfunction in accordance with instructions contained in table VIII. If the correction is beyond the scope of organizational maintenance functions, refer the malfunction to ordnance maintenance personnel as indicated in the table.

Table VIII. Trouble Shooting

Malfunction	Cause	Correction
Failure to fire	Misfire	Check for defective round (par. 97).
	Firing pin recess dirty; heavy or gummed oil.	Disassemble firing mechanism (par. 103*b*(3)), clean and lubricate.
	Firing pin worn	Replace firing pin (par. 103*d* (2)).
	Rocker plunger and/or actuating rocket worn.	Replace rocker plunger and/or actuating rocker (par. 103*d* (2)).
	Striker spring defective	Replace striker spring (par. 103*d*(1)).
	Other causes	Notify ordnance maintenance personnel.

[redacted]

Table VIII. Trouble Shooting—Continued

Malfunction	Cause	Correction
Breech difficult to open.	Firing pin spring defective; does not retract firing pin.	Replace firing pin spring (par. 103*d*(2)). *Note.*—Firing pin will generally become damaged and should also be replaced.
	Other causes	Notify ordnance maintenance personnel.
Incomplete return to battery.	Too much oil in recoil mechanism.	Unscrew the drain plug on the right side of cradle (fig. 102). Allow a small quantity of oil to be run out and install the drain plug.
	Recoil guides burred or scratched.	Remove the gun from recoil mechanism (par. 103*a*). Remove burs and scratches from recoil guides with crocus cloth.
	Other causes	Notify ordnance maintenance personnel.
Gun does not cock automatically.	Incomplete return to battery.	Refer to *c* above.
	Sear plunger spring defective and/or sear worn or broken.	Replace the piston crosshead key (par. 103*e*(3)).
	Other causes	Notify ordnance maintenance personnel.
Return to battery with jarring impact.	Insufficient oil in recoil mechanism.	Add oil to recoil mechanism (par. 93*d*).
	Improper oil being used	Use correct oil (par. 93*d*).
	Other causes	Notify ordnance maintenance personnel.
Jammed trigger crank actuating lever.	Breech not fully closed	Rotate breechblock lever clockwise to fully close breech.
	Other causes	Notify ordnance maintenance personnel.
Cartridge case cannot be extracted by opening breech.	Cartridge case ruptured	Remove cartridge case with hand extractor.
	Broken extractor	Remove cartridge case with hand extractor 41–E–520–80 (fig. 111). Replace extractor (par. 103*e*(4)).
	Other causes	Notify ordnance maintenance personnel.

[redacted]

Table VIII. Trouble Shooting—Continued

Malfunction	Cause	Correction
Breech will not open.	Gun is not cocked	Manually cock the gun (par. 94*b*).
	Gunner has trigger crank actuating lever depressed.	Release trigger crank actuating lever. Manually cock the gun (par. 94*b*).
	Other causes	Notify ordnance maintenance personnel.

103. Organizational Maintenance of 37-mm Gun M1916

a. Removal. Remove the gun from the recoil mechanism as follows:

(1) To remove the gun, release the striker by pressing down on the trigger crank actuating lever (fig. 105), while applying pressure against the cocking handle (fig. 104), thus preventing too fast a movement of the striker (fig. 123). Remove the piston crosshead key assembly (fig. 118), by pressing its latch upward and pushing the key out to the left.

(2) Carefully draw the gun to the rear and off the cradle of the recoil mechanism (fig. 113).

b. Disassembly.

(1) *Breech mechanism.* To remove the breechblock when the subcaliber gun is installed on the recoil mechanism, cock the piece by means of the striker cocking handle (fig. 104). Remove the breechblock lever assembly (fig. 114), by grasping the handle with the fingers and pressing the lever release pin

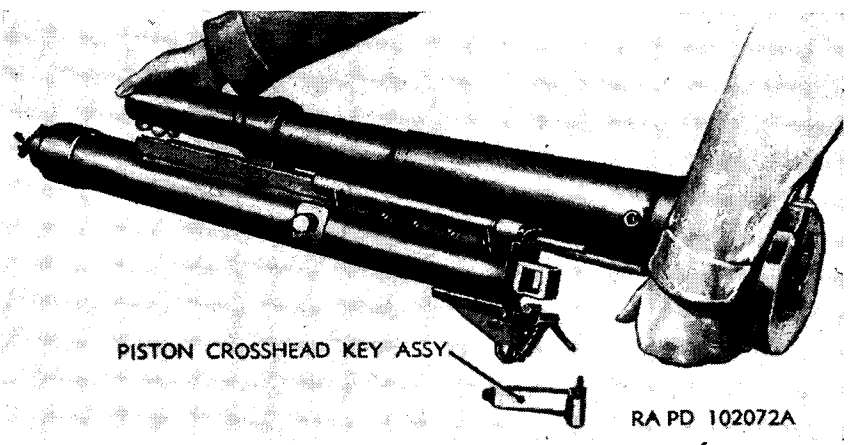


Figure 113. Removing subcaliber gun from recoil mechanism.

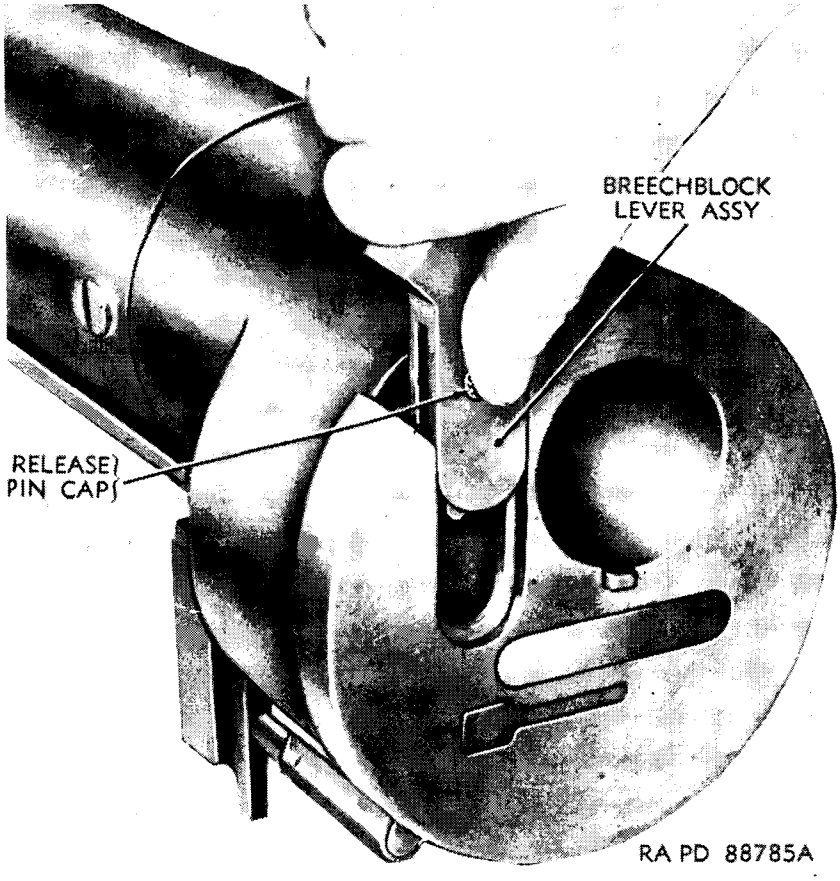


Figure 114. Removal of breechblock lever assembly.

cap with the thumb, and lift the breechblock lever assembly out of the breechblock. Take out the extractor pin assembly, by pressing the extractor pin latch (fig. 115) toward the breech with the forefinger and pulling it out to the right. The extractor will drop down until its heel clears the extractor cam (fig. 119). Then unscrew the breechblock (fig. 116) to the left, grasping it firmly in one hand and supporting it with the other hand.

(2) *Remove extractor.* Remove the breechblock ((1) above). Withdraw the extractor (fig. 146) from inside the breech by inserting a forefinger in the mortise in the base of the breech ring, slightly raising the extractor, and grasping it with thumb and finger of one hand.

(3) *Disassemble firing mechanism.* To disassemble firing mechanism, cock the gun or remove the breechblock ((1) above).

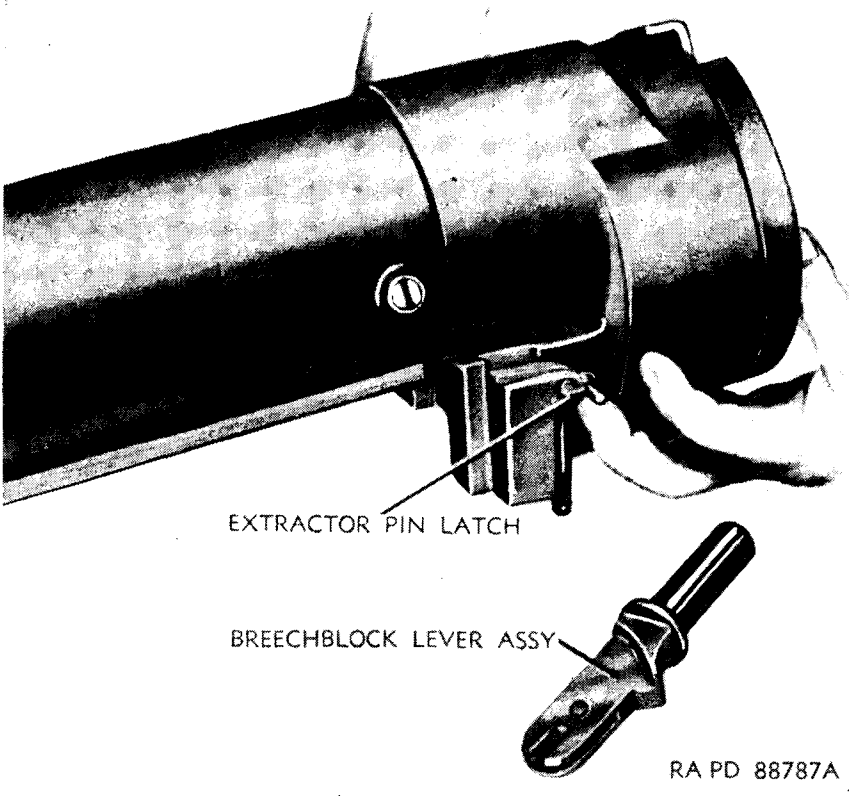


Figure 115. Depressing extractor pin latch.

In order to remove the firing pin, firing pin spring, rocker plunger, and firing pin actuating rocker, it is first necessary to remove the rocker retaining pin, which secures the firing mechanism. The rocker retaining pin is retained in its seat by the spring end (free end) of the rocker pin latch (fig. 119) entering the groove in the outer end of the rocker retaining pin. If this rocker pin latch becomes stuck with paint, free it by scraping the paint around the edge of the rocker pin latch before attempting to remove the rocker retaining pin. Remove the rocker retaining pin, by placing a small bronze drift against the projecting head of the rocker retaining pin and, with light taps, drive the pin up into the port (fig. 120). The firing pin actuating rocker is then free and, when removed (fig. 121), releases the firing pin (fig. 119) (which will be pushed out by its spring) and the rocker plunger (which may then be dropped out by tipping the breechblock).

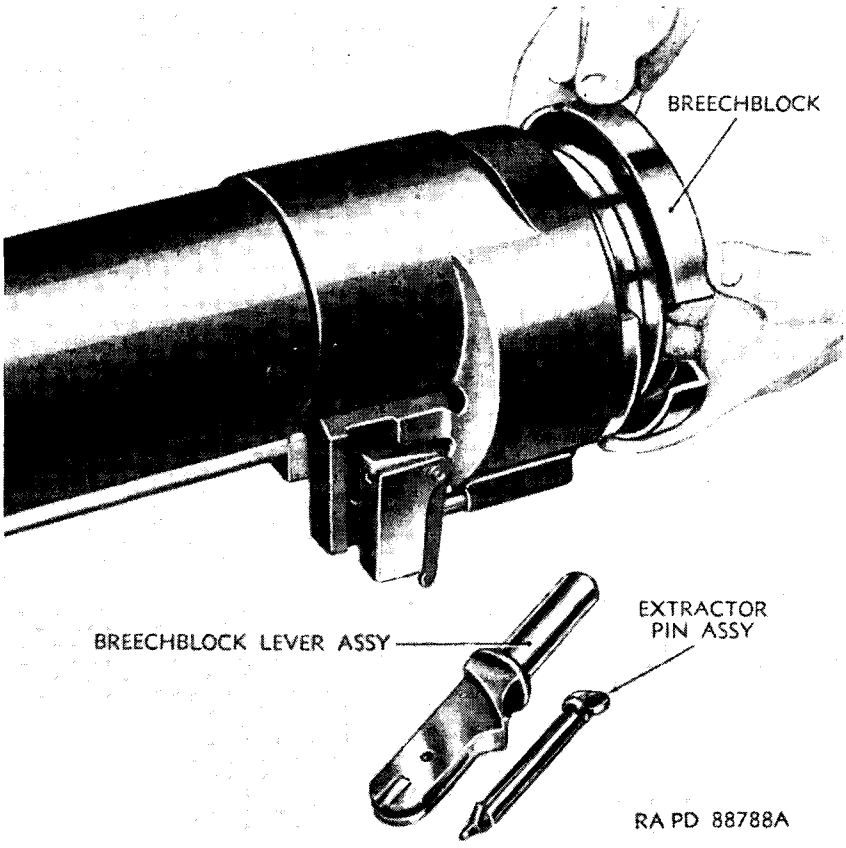


Figure 116. Removal of breechblock.

(4) *Remove piston crosshead key assembly.* Remove the piston crosshead key assembly (fig. 118), by pressing its latch upward and pushing the key out to the left.

(5) *Disassemble striker mechanism.* To dissassemble striker mechanism, remove the piston crosshead key assembly ((4) above). Draw gun back about 8 inches, push the striker to its extreme forward position, loosen the striker rod nut setscrew, and unscrew and remove the striker rod nut (fig. 122). Allow the spring to expand slowly, push the striker rod out, and remove the striker spring (fig. 123).

(6) *Recoil mechanism.* Disassembly of the recoil mechanism by the using arm is not permitted. The using arm may only fill or drain the recoil mechanism, replace the filling and drain plug assemblies, replace the drain plug and filling plug gaskets, and replace the striker spring.

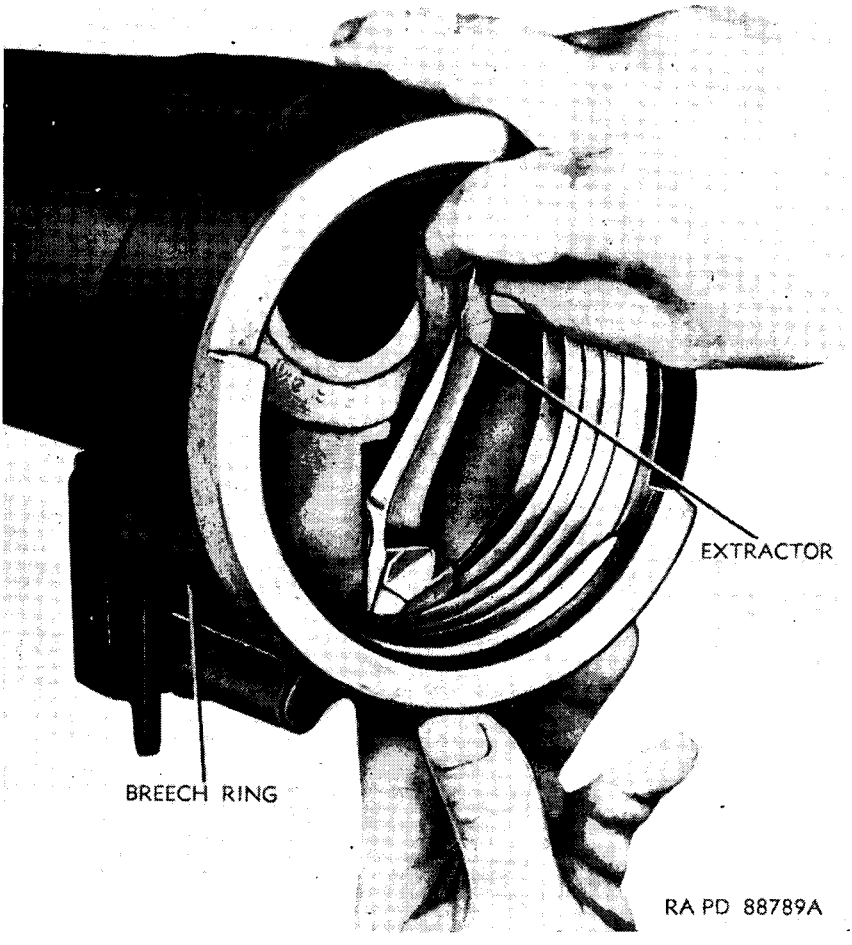


Figure 117. Withdrawing the extractor.

c. Inspection Before Assembly.

(1) *Breech mechanism and breechblock.*

(*a*) Inspect the extractor and extractor pin for cracks or burs. Remove burs with crocus cloth. Replace the extractor and extractor pin if cracked or broken.

(*b*) Inspect the breechblock lever assembly for cracks and burs. Replace if cracked or broken. Remove burs with crocus cloth.

(2) *Firing mechanism.*

(*a*) Inspect the firing pin spring for elongation and breaks. The free length of the firing pin spring should measure twenty-five thirty-seconds of an inch. Replace the firing pin spring if it is defective.

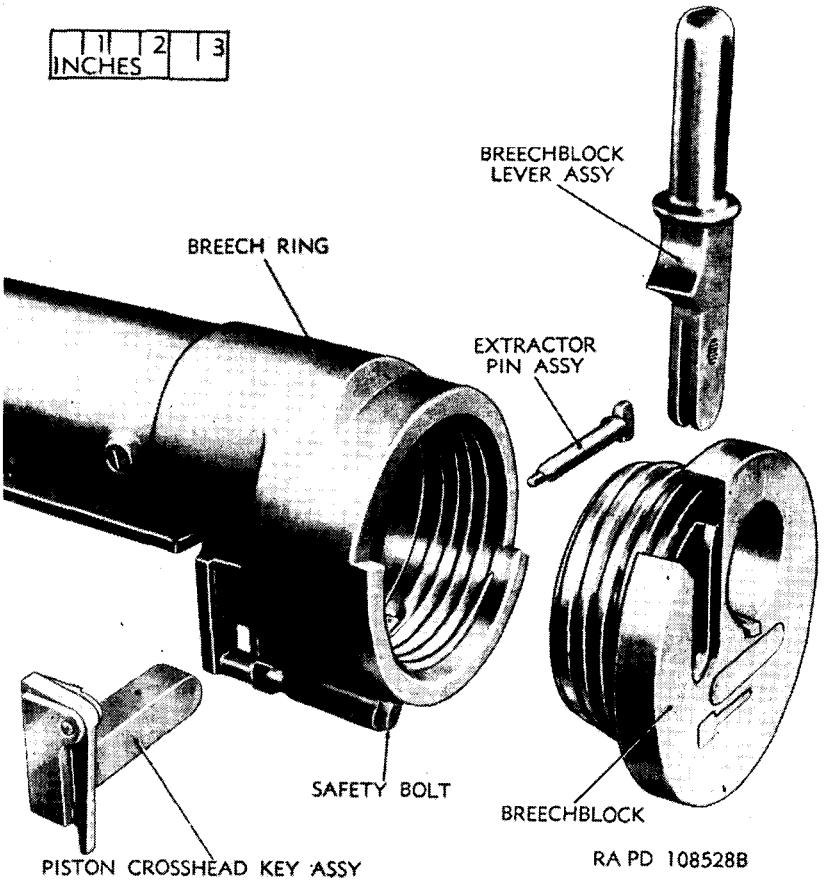


Figure 118. Breechblock—exploded view.

(*b*) Inspect the firing pin, rocker retaining pin, firing pin actuating rocker, rocker plunger, and breechblock for burs and cracks. Remove burs with crocus cloth. Replace parts that are badly worn, cracked, or broken.

(3) *Piston crosshead key assembly.* Depress the sear in the piston crosshead key assembly, release the sear, and note if the spring returns the sear to its original position. Replace the piston crosshead key assembly if the spring is defective. Replace the piston crosshead key assembly if any portion is cracked or broken. Remove burs with crocus cloth.

(4) *Striker mechanism.* Organizational maintenance is limited to the replacement of the striker spring. The free height of the striker spring should measure 6.81 inches. If the spring

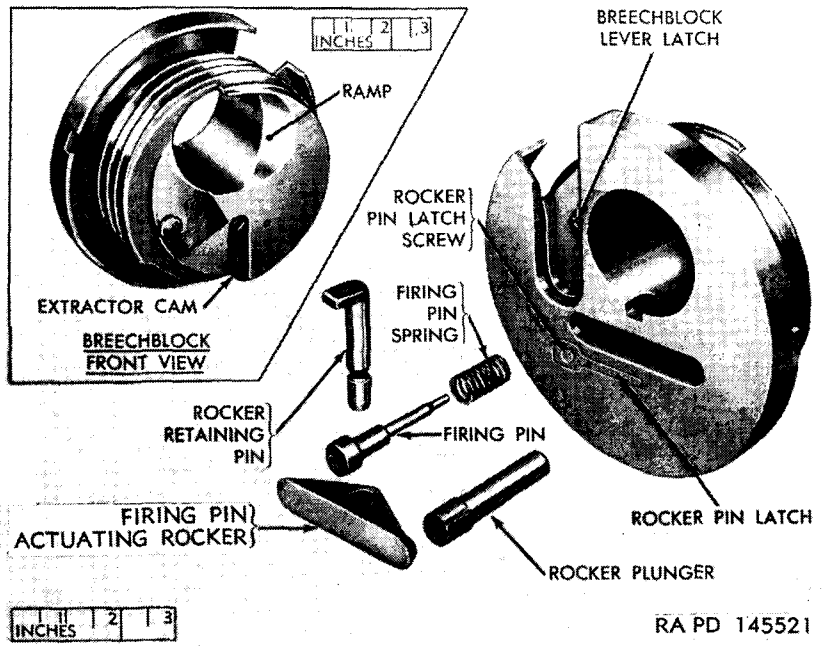


Figure 119. Breech mechanism—exploded view.

measures 0.5 inch less than 6.81 inches, replace the striker spring.

(5) *Recoil mechanism.*

(*a*) Replace the filling and drain plug gaskets if they are damaged.

(*b*) Inspect the threads on the filling and drain plugs. If threads are damaged, "chase" or replace the filling and drain plugs.

d. Assembly.

(1) *Assemble striker mechanism.* Prior to assembling the striker mechanism, oil the striker spring and striker rod. Place the striker spring over the rod and insert both in the striker housing (fig. 123). Push the striker to the extreme forward position and turn the striker rod nut (fig. 122) until the front edge of the nut is about flush with the front end of the striker rod, taking care that the striker rod nut set screw (fig. 122) comes opposite its keyway in the striker housing. The stroke of the striker rod may be lengthened by unscrewing the striker rod nut a few turns. The set screw

Figure 120. Removing rocker retaining pin.

must not be omitted and must be set so that it does not strike the bottom of the keyway.

(2) *Assemble firing mechanism.* Prior to assembling the firing mechanism, clean and lubricate all parts. Insert the rocker plunger, firing pin spring, and firing pin into position in the breechblock (fig. 119). Position the rocker retaining pin and firing pin actuating rocker in position. Hold the rocker retaining pin down with the thumb, while exerting pressure against the firing pin actuating rocker (fig. 124), until the rocker retaining pin can be started through the firing pin actuating rocker. Push this pin in until the rocker pin latch spring enters the groove in the rocker retaining pin.

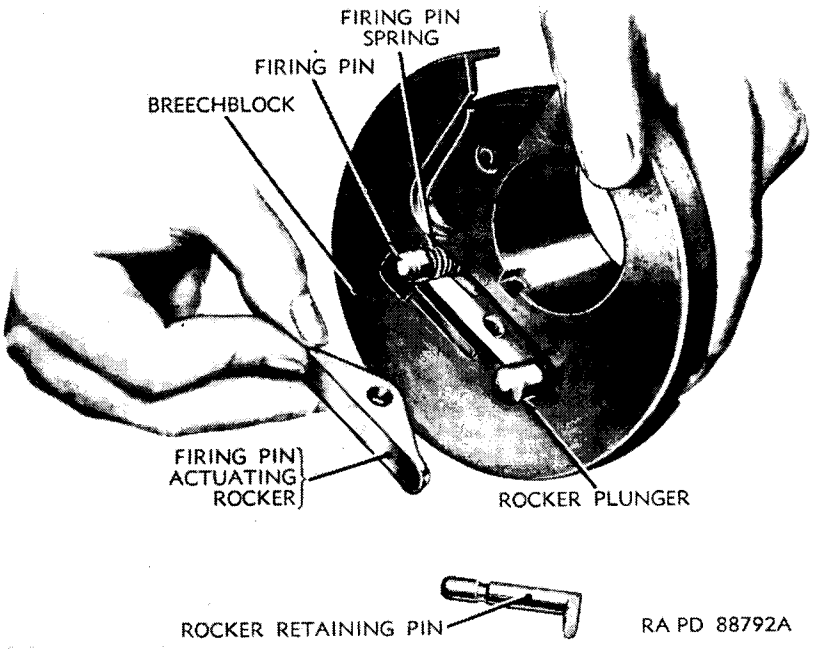


Figure 121. Removing firing pin actuating rocker.

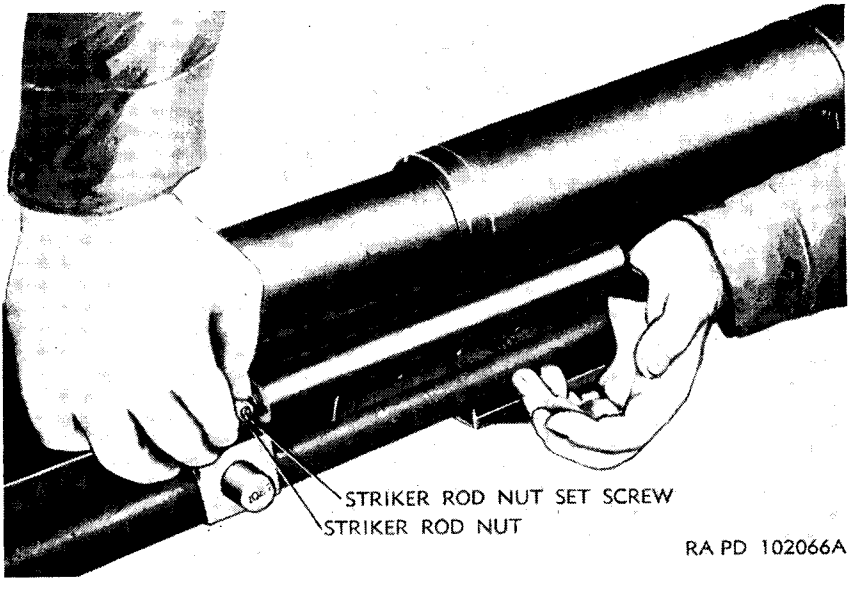


Figure 122. Removing striker rod nut setscrew and nut.

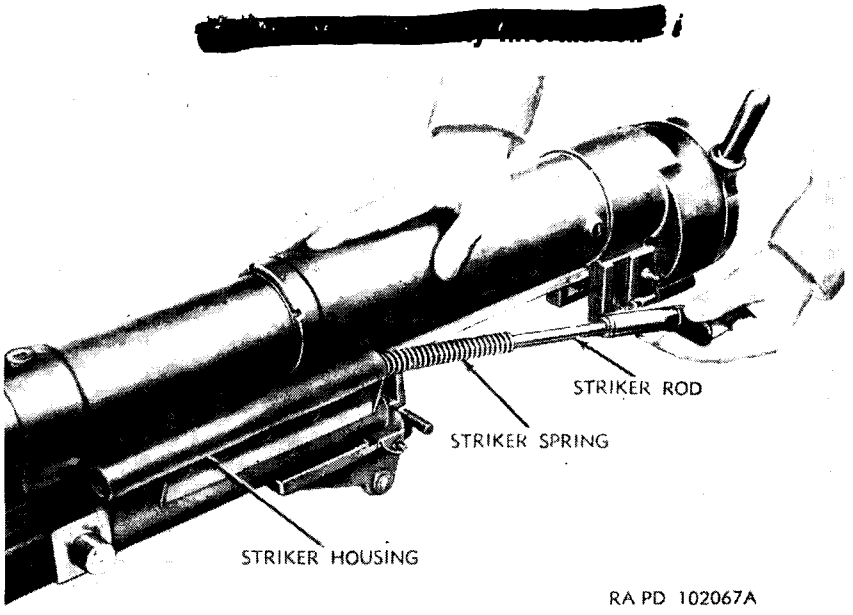


Figure 123. Removing striker rod and spring.

e. Installation. Install the gun in the recoil mechanism as follows:

Note.—The subcaliber gun must be bore sighted (par. 89*d* or *e*), before use whenever the recoil mechanism has been removed from the mount, the subcaliber gun removed from the recoil mechanism, or if the adjustment of the adjusting screws or trunnion cap screws have been disturbed.

(1) Prior to installation of the gun, clean and lubricate the gun slides and piston crosshead.

(2) Grasp the gun muzzle with one hand and the breech with the other and insert the gun onto the recoil mechanism, being careful to maintain alinement to avoid jamming or damaging the gun slides.

(3) Lubricate the parts and install the piston crosshead key assembly (fig. 118). Push the piston crosshead key assembly in place so that the trigger crank of the trigger mechanism is located in front of the long arm of the sear. See that the safety bolt properly engages the descending arm of the sear before the piston crosshead key is pushed fully home. Failure to have the safety bolt in the proper position will prevent the crosshead key from being fully pushed in and an attempt to force it will cause damage to the sear.

(4) Prior to installing the breechblock, first see that the breech recess, the extractor, and the threads of the breechblock are thoroughly cleaned and lightly oiled. Then set the extractor (fig. 117), in its seat but do not insert the extractor pin.

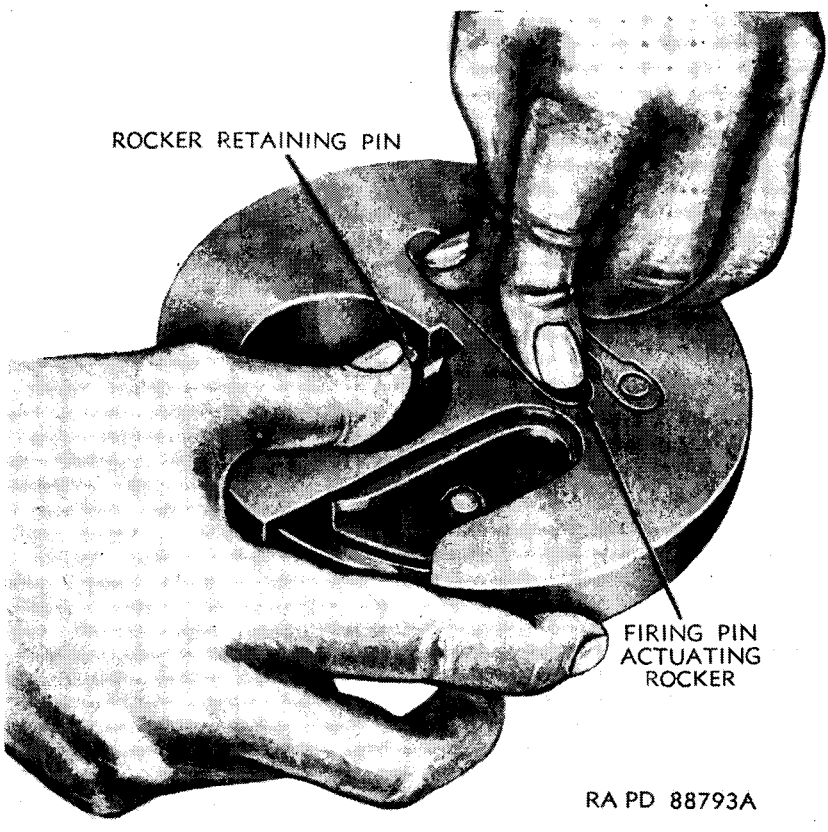


Figure 124. Installing rocker retaining pin.

Next, cock the striker mechanism, screw the breechblock home (fig. 116), and set the breechblock lever assembly in place (fig. 114). Raise the extractor by pushing upward on its heel from under the block and insert the extractor pin from the right until the extractor pin latch springs out and secures the pin. Unclock the striker mechanism by pressing down on the trigger lever with the right thumb while applying pressure against the cocking handle with the left hand, to prevent too fast a movement of the striker.

Note.—Do not attempt to screw the breechblock into position with the extractor pin in place.

f. Oil Guns (Recoil).

(1) Oil gun 41–G–1362–15 will be issued for use in filling the recoil mechanism of the 37-mm gun M1916 in lieu of oil gun 15–18–83, which is no longer being produced (fig. 125).

(2) The oil gun 41–G–1362–15 is not adapted for the recoil mech-

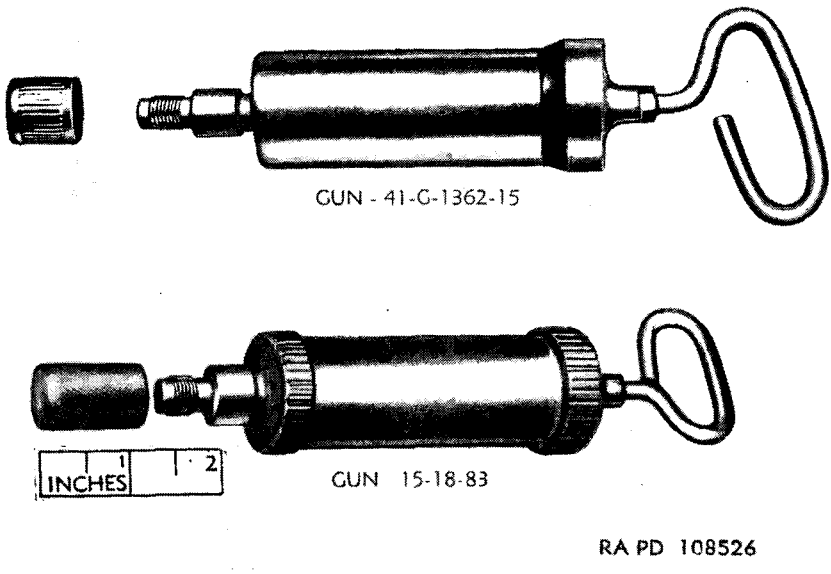


Figure 125. Oil guns (recoil).

anism M1916 because the nozzle of the gun is ½-inch diameter with standard thread, whereas the end cap of the recoil mechanism is adapted for a metric threaded nozzle of 12-mm diameter. To use this substitute oil gun, an adapter, two gaskets, plug, and link must be manufactured locally as shown in figures 126 and 127. The adapter must be assembled to the recoil mechanism and cap whenever it becomes necessary to replace the oil gun 15–18–83 with the gun 41–G–1362–15.

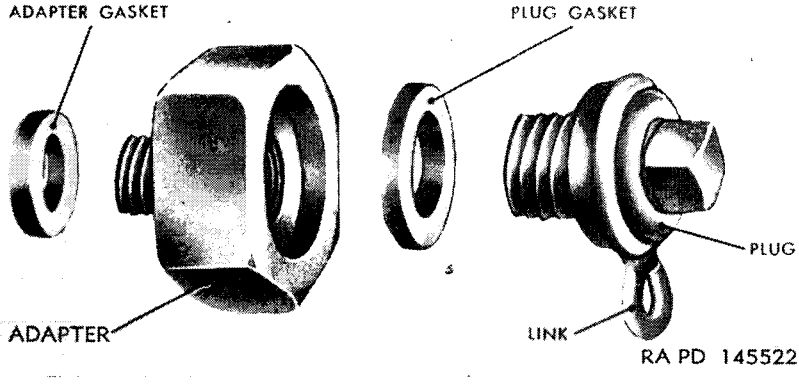


Figure 126. Adapter and components—exploded view.

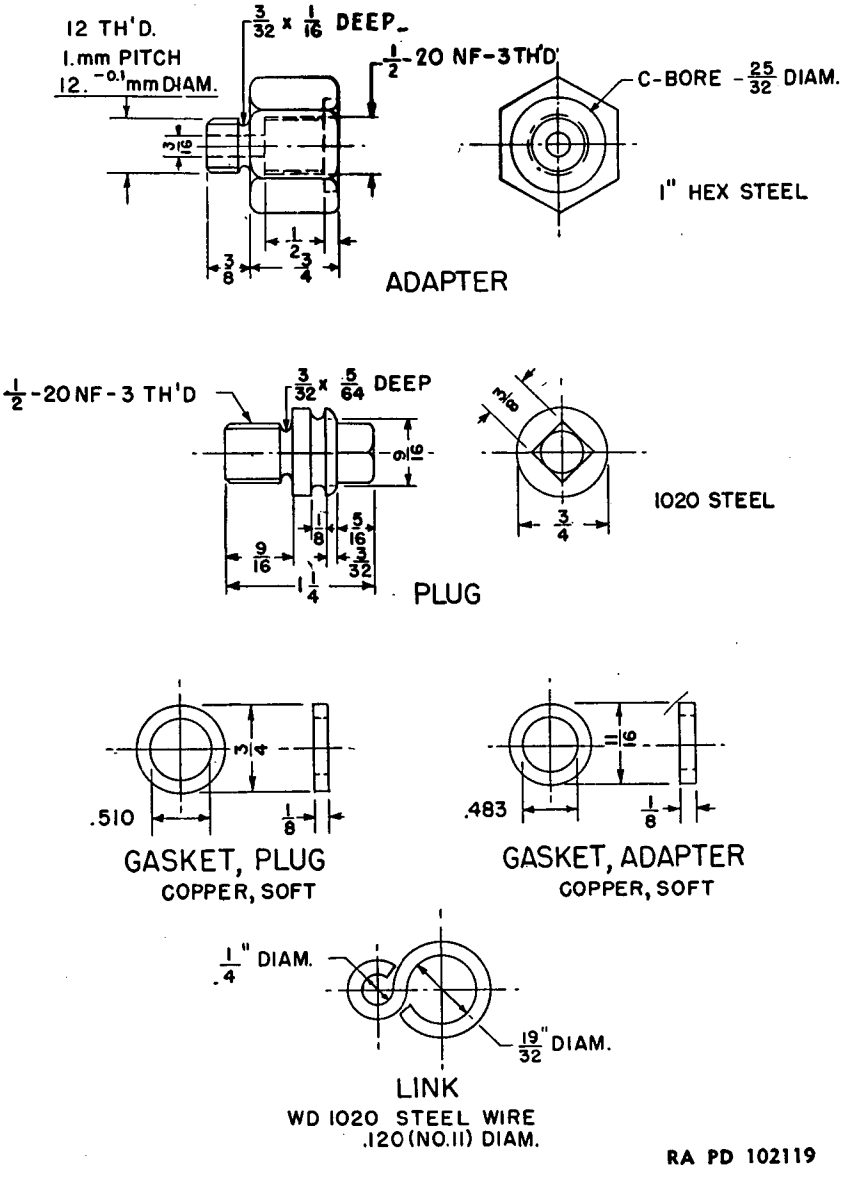


Figure 127. Adapter and components—exploded view.

CHAPTER 5

AMMUNITION

104. General

Ammunition for the 155-mm howitzer M1 is of the separate-loading type. The complete round is loaded into the weapon in three operations—loading the projectile, the propelling charge, and the primer. The components of a complete round (projectile, propelling charge, primer, and fuze) are shipped separately. As issued, the projectile is fitted with an eyebolt lifting plug in lieu of a fuze. The fuze is assembled to the projectile just prior to loading and firing.

105. Firing Tables

Firing data for rounds for this howitzer are published in FT 155-Q-2 and TjC 155-Q-2 (A through G). See SR 310-20-3 for an index of current firing tables.

106. Classification

a. The ammunition authorized for use in this howitzer is classified as high-explosive, chemical, illuminating, or dummy (drill), depending upon the type of projectile.

b. High-explosive projectiles are comparatively thin-walled projectiles containing a high-explosive bursting charge. They are intended principally for fragmentation, mining, or blast effect.

c. Chemical projectiles contain a chemical filler for producing either a toxic or irritating physiological effect, an incendiary action, a screening smoke, a colored smoke used for target or battery identification, or any combination of these. The HC and colored smoke projectiles are base ejection types, which when functioned by the fuze, ignites and ejects four smoke canisters. Maximum emission of smoke occurs in about 1 minute, although an effective smoke develops in 30 seconds.

d. Illuminating shell consists of an illuminating candle attached to a parachute unit and an expelling charge, all encased in a steel shell. A time fuze ignites the expelling charge which ejects the burning candle suspended from the parachute and illuminates a desired point or area.

e. Dummy (drill) projectiles, which are completely inert, are intended for practice in loading and handling.

107. Identification

a. General. Ammunition and ammunition components are completely identified by painting and marking (including an ammunition lot number) on the ammunition items and on original packing containers. The components of various types of rounds may be identified by the marking thereon and by the color scheme (when employed) as indicated in table IX and in figures 128 through 138 inclusive.

b. Model. To identify a particular design, a model designation is assigned at the time the item is classified as an adopted type. This model designation becomes an essential part of the standard nomenclature and is included in the marking on the item. The present method of model designation consists of the letter "M" followed by an Arabic numeral. Modifications are indicated by adding the letter "A" and appropriate Arabic numeral. Thus, "M107A1," indicates the first modification of an item for which the original designation was "M107."

c. Ammunition Lot Number. When ammunition is manufactured, an ammunition lot number, which becomes an essential part of the marking, is assigned in accordance with pertinent specifications. This lot number is stamped or marked on each projectile, propelling charge, and on all packing containers. It is required for all purposes of record, including reports on condition, functioning, and accidents in which the ammunition may be involved. In any one lot of projectiles or propelling charges, the components used in the assembly are manufactured under as nearly identical conditions as practicable. To obtain the greatest accuracy when firing, successive rounds should consist of projectiles of one ammunition lot number and propelling charges of one ammunition lot number whenever practicable.

d. Weight-Zone Marking. When it is not practicable to manufacture projectiles within the narrow weight limits necessary for the required accuracy of fire, they are grouped into weight zones in order that appropriate ballistic corrections, as shown on firing tables, may be applied. The weight zones are indicated on the projectile by means of squares with a prick-punch mark in the center of each. Where applicable, there are from one to seven punch marks on the 155-mm howitzer projectile, depending upon the weight and type of projectile.

Table IX.—Painting and Marking Ammunition

Type	MARKING							COLOR		Other distinguishing characteristics	Fig. No.
	Weight zone	Caliber	Kind of filler	Ammunition lot No.	Model	AIC symbol	Action	Body	Marking		
PROJECTILES											
HE	X	X	X	X	X	X	—	Olive-drab	Yellow	Marking may also include: "W/ SUPPL CHG," or "FOR FUZE T76E6."	128, 129
FS or WP smoke	X	X	X	X	X	X	—	Gray	Yellow	One yellow band painted around body of shell.	
HC or colored smoke	—	X	X	X	X	X	—	Gray	Yellow	One yellow band painted around body of shell. "RED," "GREEN," "YELLOW," or "VIOLET" is stenciled (in yellow) to indicate color of smoke filler.	131
Illuminating	X	X	X	X	X	X	—	Gray	White	One white band painted around body of shell.	132
H	X	X	X	X	X	X	—	Gray	Green	Two green bands painted around body of shell.	130
CNS	X	X	X	X	X	X	—	Gray	Red	Two red bands painted around body of shell.	
Dummy	—	—	—	—	—	—	—	Black		One red band painted around shell at its center of gravity.	133

Table IX.—Painting and Marking Ammunition—Continued

Type	MARKING							COLOR		Other distinguishing characteristics	Fig. No.
	Weight zone	Caliber	Kind of filler	Ammunition lot No.	Model	AIC symbol	Action	Body	Marking		
PROPELLING CHARGES											
Base and increment	—	X	—	X	X	—	—	Green	Black	Igniter end is dyed red and marked in black. Increments are numbered on topside.	134A
Base and increment	—	X	—	X	X	—	—	White	Black	Igniter end is dyed red and marked in black. Increments are numbered on topside.	134B
FUZES											
SQ or delay and CP	—	—	—	X	X	—	X			The nose of the nondelay CP fuze is painted white.	137, 138
Mechanical time super-quick.	—	—	—	X	X	—	X			Graduated time ring	138
Mechanical time	—	—	—	X	X	—	X			Graduated time ring	138
VT	—	—	—	X	X	—	—				135

Percussion	—	—	—	X	X	—	—		None	136

X —Indicates presence of markings shown in the heading.
Dash (—)—Indicates the absence of the item.
AIC —Ammunition Identification Code
CNS —chloracetophenone in chlorpicrin-chloroform solution
CP —concrete-piercing
FS —sulfur trioxide in chlorsulfonic acid
H —mustard gas
HC —hexachlorethane-zinc mixture
HE —high-explosive
SQ —superquick
suppl chg—supplementary charge
VT —proximity
w/ —with
WP —white phosphorus

108. Care, Handling, and Preservation

a. Ammunition components are packed to withstand conditions ordinarily encountered in the field. As shipped, the projectiles, except dummy, are provided with grommets to protect the rotating bands and, in addition, are fitted with eye bolt lifting plugs. Dummy projectiles are crated for shipment. Propelling charges, fuzes, and primers are packed in moisture-resistant or waterproof containers. Care must be observed to keep packings from becoming broken or damaged. All broken packings must be repaired immediately and careful attention given to the transfer of original markings to the repaired packings.

b. When it is necessary to leave ammunition in the open, raise it on dunnage at least 6 inches from the ground and cover it with a double thickness of paulin, leaving enough space for the circulation of air. Where practicable, dunnage strips should be placed under each layer of projectiles, propelling charges, and other ammunition components. Suitable trenches should be dug to prevent water from running under the pile.

c. Since explosives are adversely affected by moisture and high temperature, due consideration should be given to the following:

(1) Do not break the moisture-resistant seal until ammunition is to be used.

(2) Protect ammunition, particularly fuzes, from high-temperature and direct rays of the sun. More uniform firing is obtained if the rounds are at the same temperature. Fire promptly after loading the propelling charge into a hot weapon (par. 27*g*).

d. Do not attempt to disassemble any fuze.

e. Do not remove the eye bolt lifting plug from unfuzed rounds until the fuze is to be assembled thereto.

f. Explosive ammunition must be handled with care at all times. The explosive elements in primers and fuzes are particularly sensitive to undue shock and high temperature.

g. Do not handle duds. Because their fuzes may be armed, duds are extremely dangerous. They will not be moved or turned, but will be destroyed in place in accordance with TM 9–1900. Unlike other fuzes, VT fuzes may be considered safe for handling 24 hours after the projectile has been fired, but they should be handled with care since they contain an unignited powder train and booster charge.

h. The following pertains to the storage and handling of VT fuzes:

(1) In addition to the usual care in handling explosive ammunition, VT fuzes and VT fuzed rounds should be protected

from long exposure to high humidity, temperatures below −20° and above +130° F., and excessive jolting and shocks, which may result in improper fuze action.

(2) In temperate climates, the fuzes may be expected to remain serviceable for 6 months after removal from their original sealed containers. The fuzes should not be removed from their original sealed containers, particularly in tropical climates, until just before use. Exposure to rain or immersion in water will result in accelerated deterioration.

(3) VT fuzes will withstand normal handling without danger of detonation or damage when in their original packing containers or when assembled to projectiles. However, care should be taken not to strike or drop fuzes or fuzed rounds as these actions may increase the number of duds. A drop of 4 feet may cause the electrolyte vial in the fuze battery to break thus creating a dud. Excessive rough handling will not decrease fuze safety but may increase the number of duds.

(4) Supplementary charges which have been removed from shell, prior to assembling VT fuzes, will be packed in the containers from which the VT fuzes have been removed. The containers should be properly marked and returned to ordnance personnel for disposition.

(5) VT-fuzed ammunition may be safely transported short distances, with normal care and handling. However, when such ammunition is to be transported considerable distances, it is advisable to remove the fuze from the shell and return the fuze to its original marked container. The supple-

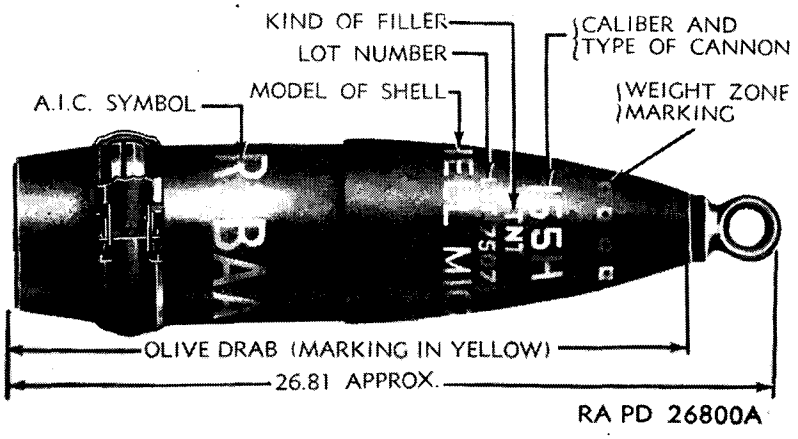


Figure 128. HE shell, M107.

A - WEIGHT ZONE MARKING
B - CALIBER AND TYPE OF WEAPON
C - KIND OF FILLER
D - LOT NUMBER OF LOADED SHELL
E - TYPE AND MODEL OF SHELL
F - FOR DEEP-CAVITY SHELL CONTAINING SUPPLEMENTARY CHARGE.
FOR DEEP-CAVITY SHELL W/O SUPPLEMENTARY CHARGE, "FOR VT FUZE" OR "FOR FUZE, M
G - AMMUNITION IDENTIFICATION CODE (AIC)
H - STAMPED IN THE METAL UNDER THE PAINT: LOT NUMBER OF EMPTY SHELL, YEAR OF MANUFACTURE, CALIBER AND DESIGNATION OF SHELL

RA PD 97757B

Figure 129. Marking of deep-cavity HE shell.

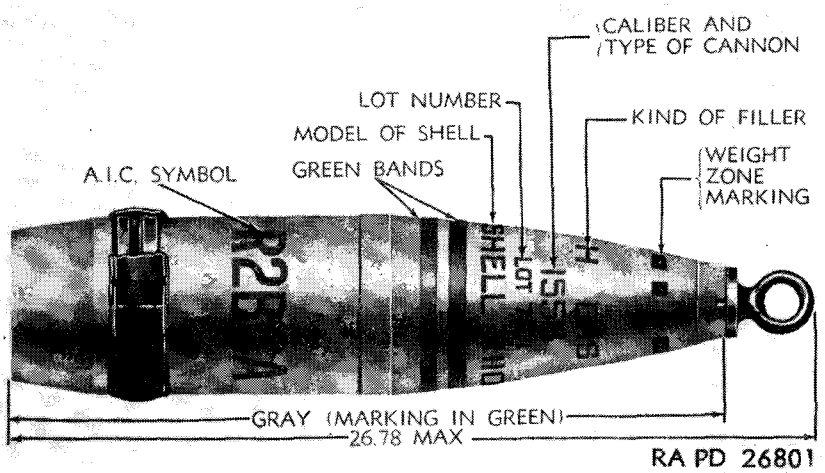


Figure 130. H gas shell, M110.

mentary charge and eye bolt lifting plug should be reassembled to the shell, making certain that the supplementary charge is properly inserted (felt-pad end innermost).

(6) VT fuzes of certain lots, as issued, have a wax coating on the plastic ogive. This wax coating is necessary for the proper functioning of the fuzes of such lots. Removal of this coating will usually result in malfunctioning of the fuze. VT fuzes should be used as issued; that is, with the wax coating on the plastic ogive if so issued or without a wax coating if issued without the coating.

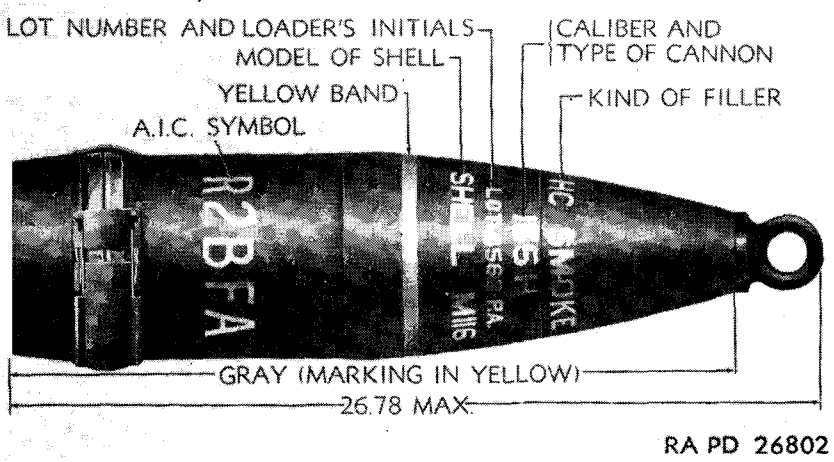


Figure 131. HC smoke shell, M116.

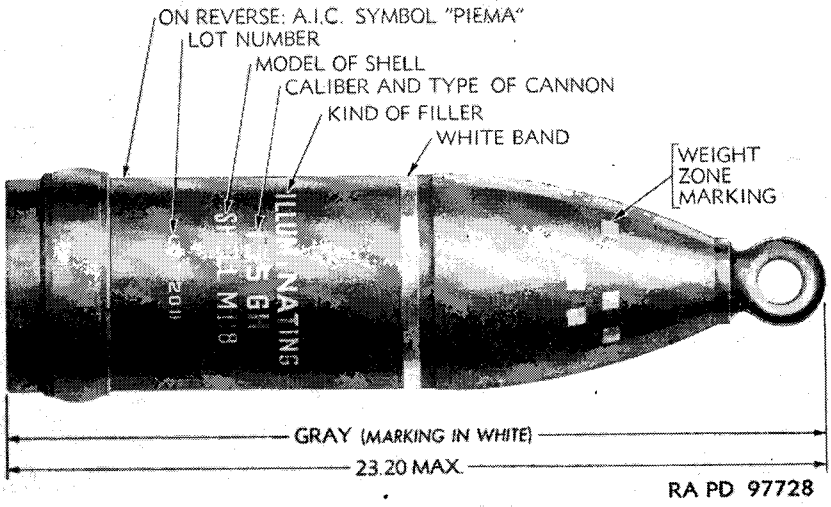


Figure 132. Illuminating shell, M118.

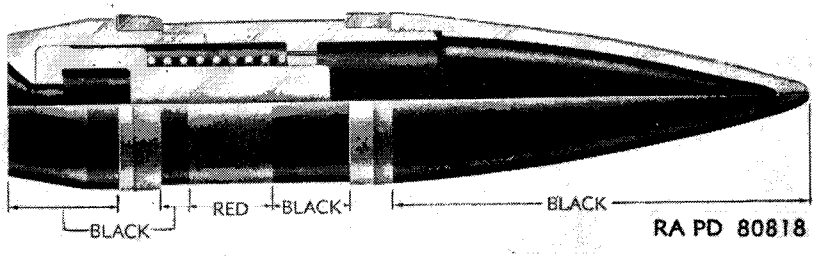
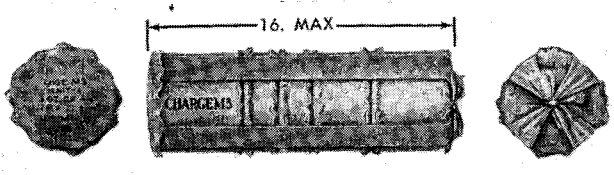
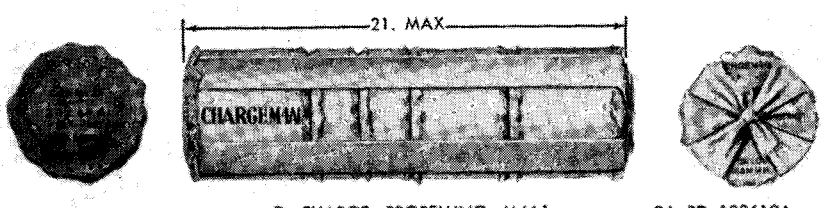


Figure 133. Dummy projectile, M7.



A—CHARGE, PROPELLING, M3



B—CHARGE, PROPELLING, M4A1 RA PD 108619A

Figure 134. 155-mm howitzer propelling charges.

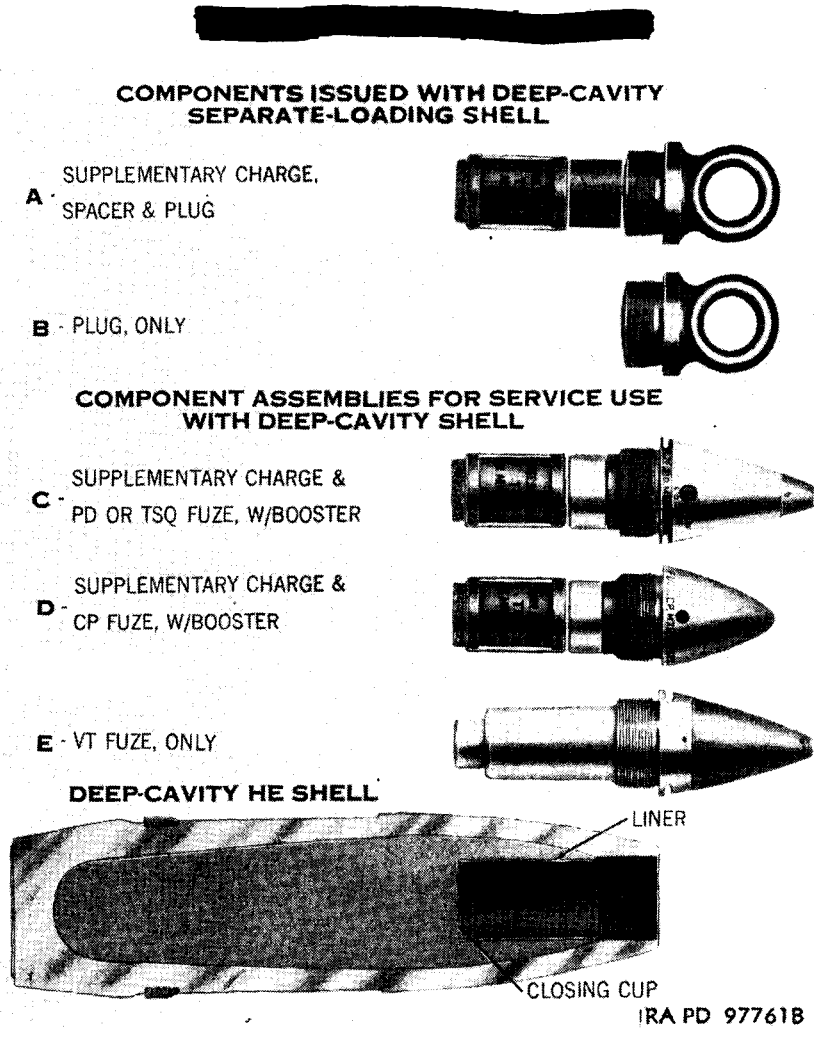


Figure 135. Components used with deep-cavity HE shell.

109. Authorized Rounds

a. General.

(1) The ammunition authorized for use in the 155-mm howitzer M1 is listed in table X. Standard nomenclature, which is used in the listing, completely identifies the ammunition except for lot number.

(2) High-explosive projectile M107 is manufactured with either of two types of cavities—normal-cavity or deep-cavity. The projectile is fitted with an eye bolt lifting plug. Deep-cavity projectiles contain a supplementary charge of TNT and are marked "W/SUPPL CHG." Deep-cavity rounds of

earlier manufacture were assembled without a supplementary charge and are marked "FOR FUZE T76E6."

b. Projectiles. Characteristics of the various projectiles used in this weapon are given in table XI.

c. Propelling Charges.

(1) *Service charges.* The propelling charges authorized for use in the 155-mm howitzer M1 (fig. 134) are divided into a base section and unequally sized increments to provide for zone firing. The service propelling charges consist of smokeless powder in green or white cloth bags to which is attached the igniter charge of black powder contained in an igniter cloth bag (igniter or igniter pad). An igniter pad is sewed to the rear end (breech end) of the base section. The cloth of the igniter pad is dyed red for identification and to indicate the presence of black powder. An igniter protector cap is placed over the exposed igniter to protect it during shipment and storage. Four tying straps (sewed to the base section) are provided as the means of securing increments to the base section. Sections of green bag charges will never be mixed with sections of white bag charges, as the latter contain powder which has a slower burning rate. *The use of charges having increments of more than one color is, therefore, prohibited.*

(2) *Flash reducer M2.* The flash reducer M2 is a square pad of red cloth containing 1½ ounces of a mixture of potassium sulfate and black powder. One flash reducer is used between each increment of the M4 or M4A1 propelling charges during night firings to reduce muzzle flash. These flash reducers have been developed as an expedient, until such time as a flashless propellant is produced for use in this weapon.

(3) *Dummy charges.* Dummy propelling charges simulate the service propelling charges and are inert. They have a base section and six increments made up of lead-weighted wood cylinders covered with white cotton duck. There is no igniter pad as such; however, the rear end of the base section is marked with the word "IGNITER." A cotton-webbing handle is fastened to the rear end of the base section for convenience in handling and extraction.

(4) *Characteristics of propelling charges.* The characteristics of service and dummy propelling charges are listed in table XII.

d. Fuzes. See paragraph 111.

e. Primer. The Mk 2A4 primer (fig. 136) used with this weapon

consists of a brass case containing a percussion element and approximately 19 grains of black powder. The percussion element in the head of the primer contains a sensitive explosive, hence, should be protected from any blows which might cause accidental functioning. A conical gas-check device prevents the passage of any propellent gas to the rear into the percussion element assembly. The function of the primer is to fire the igniter charge which is attached to the service propelling charge. In order that primers may be readily accessible at firing positions, they are carried by cannoneers in canvas belts—primer belt M8 7225490 (fig. 25 and table I).

Table X.—Authorized Rounds for 155-mm Howitzer M1

Projectile	Fuze for which adapted	Propelling charge
SERVICE AMMUNITION		
GAS:		
SHELL, gas, persistent, CNS, M110, for 155-mm howitzer.	FUZE, PD, M51A5 or M51A4.[1] FUZE, time, mechanical, M67A3.	CHARGE, propelling, M3, for 155-mm howitzer or
SHELL, gas, persistent, H, M110, for 155-mm howitzer.	FUZE, TSQ, M55A3___	CHARGE, propelling, M4 or M4A1, for 155-mm howitzer.
HIGH-EXPLOSIVE:		
SHELL, HE, M102, for 155-mm howitzer.[7]	FUZE, PD, M51A5 or M51A4.[1]	CHARGE, propelling, M3, for 155-mm howitzer.[2]
SHELL, HE, M107, for 155-mm howitzer.	FUZE, MTSQ, M500__ FUZE, CP, M78 (all mods and delays). FUZE, TSQ, M55A3___	CHARGE, propelling, M3, for 155-mm howitzer or
SHELL, HE, M107, w/ suppl chg, for 155-mm howitzer.[3]	FUZE, time, mechanical, M67A3.	CHARGE, propelling, M4 or M4A1, for 155-mm howitzer.
SHELL, HE, M107, for VT fuze, for 155-mm howitzer.[4]	FUZE, VT, M96[5]_____	CHARGE, propelling, M4A1, for 155-mm howitzer.[6]
ILLUMINATING:		
SHELL, illuminating, M118, for 155-mm gun and howitzer.	FUZE, MTSQ, M501__ FUZE, TSQ, M54_____	CHARGE, propelling, M3, for 155-mm howitzer.
SMOKE:		
SHELL, smoke, FS, M105, for 155-mm howitzer.[7]	FUZE, PD, M51A5 or M51A4.[1] FUZE, time, mechanical, M67A3.	CHARGE, propelling, M3, M4, and M4A1 for 155-mm howitzer.[2]
SHELL, smoke, WP, M105, for 155-mm howitzer.[7]	FUZE, TSQ, M55A3___	

See footnotes at end of table.

[redacted]

Table X.—Authorized Rounds for 155-mm Howitzer M1—Continued

Projectile	Fuze for which adapted	Propelling charge
SERVICE AMMUNITION		
SHELL, smoke, FS, M110, for 155-mm howitzer.	----------	CHARGE, propelling, M3, for 155-mm howitzer. or CHARGE, propelling, M4 or M4A1, for 155-mm howitzer.
SHELL, smoke, WP, M110, for 155-mm howitzer.	----------	
SHELL, smoke, green, BE, M116, for 155-mm howitzer.	FUZE, MTSQ, M501 FUZE, TSQ, M54	CHARGE, propelling, M3, for 155-mm howitzer. or CHARGE, propelling, M4 or M4A1, for 155-mm howitzer.
SHELL, smoke, HC, BE, M116, for 155-mm howitzer.	----------	
SHELL, smoke, red, BE, M116, for 155-mm howitzer.	----------	
SHELL, smoke, violet, BE, M116, for 155-mm howitzer.[8]	----------	
SHELL, smoke, yellow, BE, M116, for 155-mm howitzer.	----------	
DRILL AMMUNITION		
PROJECTILE, dummy, Mk 1, for 155-mm howitzer.	None	CHARGE, propelling, dummy, M2, for 155-mm howitzer.
PROJECTILE, dummy, M7, for 155-mm howitzer.	----------	

BE —base ejection
chg —charge
CP —concrete-piercing
CNS —chloracetophenone in chlorpicrin-chloroform solution
FS —sulfur trioxide in chlorsulfonic acid
H —mustard gas
HC —hexachlorethane-zinc mixture
HE —high-explosive
MTSQ—mechanical time superquick
PD —point detonating
suppl —supplementary
TSQ —time and superquick
VT —proximity
w/ —with
WP —white phosphorus

[1] When set "DELAY" and fired with charge 1 or 2 in the 155-mm howitzer, an appreciable percentage of duds may be expected. However, when set "SQ" (superquick), normal functioning may be expected in all zones.

[2] For training purposes only with SHELL, HE, M102 and SHELL, smoke, M105.

[3] Without supplementary charge the shell is adapted for FUZE, VT, M96.

[4] Some shell on hand, adapted for FUZE, VT, M96, are stenciled "FOR FUZE T76E6."

[5] With supplementary charge in place shell is adapted for FUZE, PD, M51A5 or M51A4; FUZE, time, mechanical, M67A3; FUZE, TSQ, M55A3; FUZE, CP, M78A1 and booster M25 or M78 and booster M25; FUZE, MTSQ, M500.

[6] This round is to be fired ONLY with charges 5, 6, or 7.

[7] Limited standard for use in 155-mm howitzer M1, and for training purposes only.

[8] For training and demonstration purposes only.

[redacted]

[redacted]

Table XI.—Characteristics of Projectiles

Type of projectile	Model	Weight as fired (lb)	Filler		Length as shipped (in.)
			Kind	Weight (lb)	
HE	M102	95. 09	TNT	15. 56	26. 78
HE	M107	94. 80	TNT	15. 13	26. 81
HE w/suppl chg	M107	94. 83	TNT	14. 87	26. 81
HE for VT fuze*	M107	95. 08	TNT	14. 61	26. 81
Illuminating	M118	103. 10	Illuminant candles	8. 92	23. 20
Gas	M110	97. 11	CNS	13. 81	26. 78
Gas (persistent)	M110	95. 00	H	11. 70	26. 78
Smoke	M105	99. 52	FS	16. 90	26. 78
Smoke	M110	100. 20	FS	16. 90	26. 78
Smoke (base ejection)	M116	95. 10	HC	25. 84	26. 41
Smoke (colored, base ejection).	M116	86. 45	(**)	17. 19	26. 41
Smoke (phosphorus)	M105	98. 22	WP	15. 60	26. 78
Smoke (phosphorus)	M110	98. 40	WP	15. 60	26. 78
Dummy	M7	95. 00	None		27. 56

*Also known as deep-cavity shell, the fuze cavity in this shell being 2.75 inches deeper than standard fuze cavities.

**The filler consists of four canisters of smoke mixture designed to produce a colored smoke. The colored smoke shell are marked "RED," "YELLOW," "GREEN," or "VIOLET" to indicate the color of smoke produced.

Table XII.—Characteristics of Propelling Charges

Type and model	Length		Max diam (in.)	Weight		Components	Authorized for firing the following charges
	Min (in.)	Max (in.)		Complete charge (lb)	Black powder in igniter (oz)		
M3	14	16	5	5. 94	3	Base charge and 4 increment charges.	1 to 5 incl.
M4	19	21	5. 8	13. 87	3	Base charge and 2 increment charges.	5 to 7 incl.
M4A1	19	21	5. 8	13. 91	3	Base charge and 4 increment charges.	3 to 7 incl.
Mk 1 DUMMY				8. 00		Base charge and 6 increment charges.	
M2 DUMMY		11	6	7. 37		Base charge and 6 increment charges.	

[redacted]

110. Preparation for Firing

a. General. Rounds for the 155-mm howitzer M1 require preparation of projectile, propelling charge, and primer as described in *b*, *c*, and *e* below. Rounds and their components prepared for firing but not fired (par. 30*b*) will be returned to their original condition and packings and be appropriately marked. Such rounds and components will be used first in subsequent firings in order that stocks of opened packings may be kept to a minimum.

b. Projectile.

(1) *With normal-cavity and standard contour point fuze.*

(*a*) Remove the grommet and eye bolt lifting plug from the projectile.

(*b*) Inspect the nose threads and fuze threads.

(*c*) Assemble the required point fuze (booster attached) to the projectile by hand. Insert fuze wrench M18 7231161 (fig. 26 and table I) in the fuze slots and tighten the fuze securely. Make sure the fuze shoulder seats firmly against the nose of the shell. There should be no space between the fuze shoulder and the shell. Do not stake the fuze to the shell. ("Stake" means the use of a blunt chisel or punch to force the metal of one piece to indent the other piece and so lock the thread that fastens the two pieces.)

(2) *With normal-cavity and CP fuze.*

(*a*) Perform operations as indicated in (1) (*a*) and (*b*) above.

(*b*) Remove the safety pin from booster M25 and screw the booster into the booster cavity of the projectile. Tighten the booster firmly with the booster end of fuze wrench M16 7230851 (fig. 26 and table I). Boosters which are issued without safety pins should not be used.

(*c*) Screw the CP fuze M78 or M78A1 into fuze cavity and tighten it securely with fuze wrench M16 7230851 (fig. 26). Make sure the fuze shoulder seats firmly against the nose of the projectile. There should be no space between the fuze shoulder and the projectile. Do not stake the fuze to the projectile ((1) (*c*) above).

(3) *With deep-cavity and standard contour fuze.*

(*a*) Perform operations as indicated in (1) (*a*) and (*b*) above.

(*b*) With supplementary charge in place, screw the fuze (booster attached) into the fuze cavity and tighten it securely with fuze wrench M18 7231161.

(4) *With deep-cavity and CP fuze.* Perform operations as indicated in (2) (*a*), (*b*), and (*c*) above, making certain sup-

plementary charge is in place prior to assembly of booster to the projectile.

(5) *With deep-cavity and VT fuze.*

(*a*) Perform the operations as indicated in (1) (*a*) and (*b*) above.

(*b*) Remove the supplementary charge, by means of its cloth tape loop, if one is present.

(*c*) Inspect the cavity for damage. Remove any loose material from the cavity. If the HE filler around the cavity appears to have been broken, reject the projectile. If any HE is found adhering to the threaded portion of the shell throat, remove it with a pointed instrument made of wood or a nonferrous metal.

(*d*) Screw in the VT fuze by hand. If binding occurs, inspect the fuze cavity and threads of both fuze and projectile. Reject the component at fault.

(*e*) Tighten the fuze to the projectile with the fuze wrench M18, issued with boxes of VT fuzes. Use only such force as can be applied by hand to the fuze wrench handle. If the fuze cannot be tightened to form a good seat between the shell and the fuze, reject the component at fault. *Do not hammer on the wrench or use an extension handle. Do not stake the fuze to the shell under any circumstances* (*(1) (c) above*).

c. Propelling Charge.

(1) *Preparation.* The igniter protector cap must be removed prior to using the propelling charge. To adjust for charge other than full charge, proceed as follows:

(*a*) Loosen the tying straps.

(*b*) Remove and discard those increments higher than the charge to be fired.

(*c*) Refasten the tying straps over the remaining increments.

(2) *Flash reducer M2.* To reduce muzzle flash during night firing when using the M4A1 propelling charge, insert one REDUCER, flash, M2 between each increment of the charge.

d. Fuze. The fuzes are prepared for firing as described in paragraph 111.

e. Primer. Primers are ready for firing when removed from packings and need only be inserted into the firing mechanism of the howitzer.

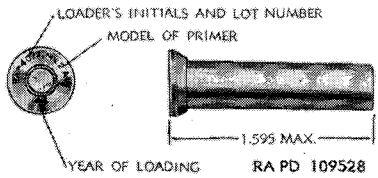


Figure 136. Percussion primer, Mk2A4.

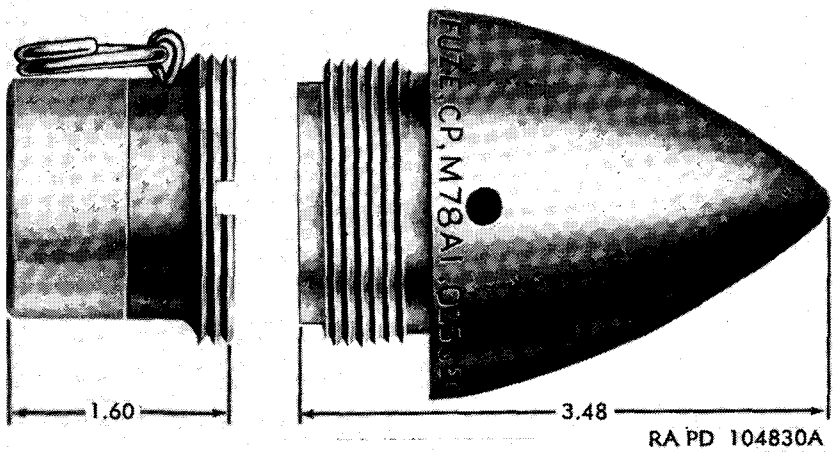


Figure 137. Fuze, CP, M78A1, and Booster, M25.

111. Fuzes

a. General. A fuze is a device used with a projectile to explode it at the time and under the circumstances required.

b. Classification. Fuzes are classified according to their manner of functioning as "time and impact," "time," or "impact." Impact fuzes function upon striking a resistant object. They are classified, according to the time of functioning after impact, as superquick, nondelay, or delay. Point detonating (PD) and base detonating (BD) fuzes, which are impact fuzes, are so called because of their location on a projectile. Time fuzes are designed to function primarily while the projectile is still in flight; certain time fuzes are also provided with an impact element. These time or airburst fuzes are of three types, mechanical time, powder train time, and VT. Powder train time fuzes differ essentially from mechanical time fuzes in that the former uses a compressed black powder time train to delay functioning for a preset length of time whereas the mechanical time fuze uses a clock-work mechanism to achieve the same result. VT fuzes are radio-actuated point fuzes which function on approach to the target.

c. Boresafe and Nonboresafe. A boresafe (detonator-safe) fuze is one in which the explosive train is so interrupted that, while the projectile is still in the bore of the weapon, premature action of the bursting charge is prevented should any of the more sensitive elements (primer or detonator) function. The fuzes used with the ammunition described herein are considered boresafe.

Caution: Fuzes will not be disassembled. Any attempt to disassemble fuzes in the field is dangerous and is prohibited except under specific directions from the Chief of Ordnance.

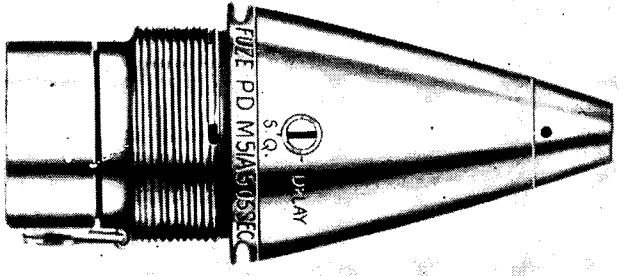
d. FUZE, PD, M51A5, 0.05-Second Delay.

(1) *Description.* The fuze (fig. 138) is an impact type which may be adjusted prior to firing to function with superquick action or with a delay action of 0.05 second. The delay is marked on the fuze. It should be noted that if the fuze is set for superquick action, and this action fails, the projectile will be detonated with delay action rather than become a dud. The fuze is fitted with the booster M21A4, which is a component of the fuze, at the time of manufacture. As shipped, the fuze is set for superquick action; that is, the slot in the head of the setting sleeve is parallel to the vertical axis of the fuze and is alined with the index mark for superquick "SQ" as shown in figure 138. For precautions in firing this fuze, see paragraph 112.

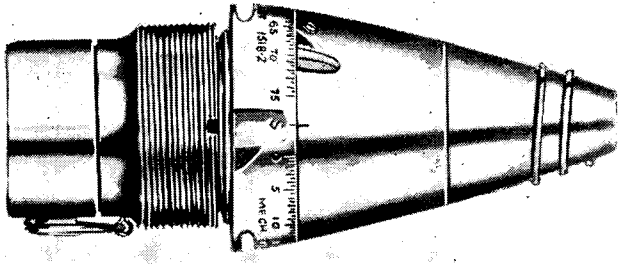
(2) *Setting.* To set the fuze for delay action, it is only necessary to turn the slot 90° to aline with the index mark for delay "DELAY". The setting may be changed at will (with the screw driver end of fuze wrench M18 or a similar tool) at any time before firing; this can be done even in the dark by feeling the position of the slot.

e. FUZE, TSQ, M55A3.

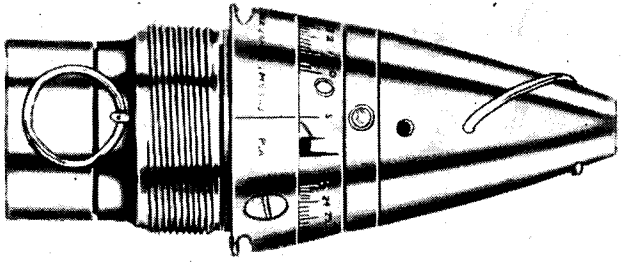
(1) *Description.* This fuze (fig. 138), which is classified as limited standard, is a combination time and superquick type. It is a unit assembly consisting of an M54 fuze and an M21A4 booster. A safety pull wire extends through the fuze to secure the plunger during shipment and handling. The fuze contains two actions, time and superquick. The superquick action is always operative and will function on impact unless prior functioning has been caused by time action; therefore, to set the fuze for superquick action, it is required that the time action be set either at "S" (safe) or for a time longer than the expected time of flight. The time ring is graduated for 25 seconds and contains a compressed black powder time train. To offset extremely rapid action, an



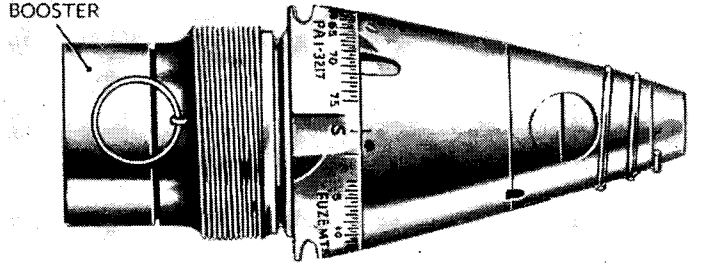
M51A5 PD FUZE .05 SEC DELAY



M67A3 MECHANICAL TIME FUZE



M55A3 TSQ FUZE



M500 MECHANICAL TIME SUPERQUICK FUZE

NOTE: M501 MECHANICAL TIME SUPERQUICK FUZE IS SAME AS M500 WITHOUT BOOSTER

RA PD 175002

Figure 138. Fuze (M51A5, M55A3, M67A3, M500, and M501).

internal safety feature prevents the time action from functioning should the fuze be set for less than 0.4 second; therefore, when setting for time action, the setting should always be greater than 0.4 second. The fuze, as shipped, is set safe "S".

(2) *Setting.* Remove the safety wire from the fuze and set the fuze to the desired time, using the fuze setter M22, M14, or M27.

f. FUZE, Mechanical Time Superquick, M500.

(1) *Description.* The M500 fuze was designed to replace both the M67A3 and M55A3 fuzes and is ballistically interchangeable with these fuzes. It is authorized for use with the M102 and M107 high-explosive shell. The time action of the M500 is based on a clockwork principle which permits the fuze to be set for any time up to 75 seconds. A safety leaf prevents functioning of the fuze at less than 1.5 seconds time of flight. A minimum calibration setting of 3 seconds is provided. The fuze is graduated in ½-second intervals up to 75 seconds. The M500 contains an impact element similar to that of the M51A5 fuze. The fuze is set safe as shipped. A safety wire extends through the fuze body and the set back pin, providing positive safety during shipment and handling. This wire is removed just before setting the fuze.

(2) *Setting.* Remove the safety wire from the fuze and set the fuze to the desired time, using the fuze setter M23, M14, or M27.

Note.—If, after setting the fuze preparatory to firing, the round is not fired, the fuze will be reset "SAFE" and the safety wire replaced in its proper position before the round is unfuzed and the components returned to their packing containers.

g. FUZE, Mechanical Time and Superquick, M501.

(1) *Description.* This fuze is similar to the M500 described in *f* above except that it has no booster. The M501 fuze is authorized for use with the M116 smoke shell and the M118 illuminating shell.

(2) *Setting.* Remove the safety wire from the fuze and set the fuze to the desired time, using the fuze setter M23, M14, or M17.

h. FUZE, CP, M78A1 (T105) and Booster M25 (T1E1).

(1) *Description.* The concrete-piercing fuze M78A1 (T105) and booster M25 (T1E1) (fig. 137) are used to convert HE shell M102 and M107 into projectiles capable of penetrating or severely damaging concrete or other heavy targets. Both

the fuze and booster are shipped as separate components in the same container. The fuze is a solid hardened steel nose plug which contains a detonator and delay plunger assembly in its base. It is shorter and heavier than the standard type impact fuzes. The CP fuze M78A1 is fitted with either a nonadjustable 0.025-second delay or a nondelay plunger assembly; the amount of delay is stamped on the fuze. As an aid in identification, 1 inch of the nose of the nondelay fuze is painted white. CP fuzes T105, as originally designed and manufactured, were assembled with 0.05-second delay plunger assemblies. The M78A1 is not issued with this delay. Nondelay fuzes are used primarily for spotting purposes. Fuzes with 0.025-second delay plunger assemblies are used when firing for effect. Booster M25 (T1E1) is a modified M21A4 booster having three rather than six external threads. A cotter pin with pull ring is located in the booster body and must be removed prior to assembly of the booster to the shell. This booster is intended for use only with CP fuze M78A1 (T105). FUZE, CP, M78 is limited standard.

(2) *Setting.* This fuze requires no setting.

i. FUZE, VT, M96.

(1) *Description.* The M96 is a proximity fuze (see VT fuze, E, fig. 135) and is provided for use in terrestrial fire with deep-cavity high-explosive shell (w/o suppl chg). It is essentially a self-powered radio transmitting and receiving unit. In flight, the armed fuze transmits radio waves. When any part of the radio wave front is reflected back from the target, it interacts with the transmitted wave. The ripple of beat caused by this interaction trips a switch which closes an electric circuit and initiates detonation of the fuze explosive train when at optimum distance from target. Bore safety is provided by an arming switch which delays arming of the fuze for approximately 5 seconds. When armed, the fuze will function on close approach to any object capable of reflecting the transmitted waves.

(2) *Setting.* No. setting is required. Any attempt to set the fuze may result in a malfunction.

j. FUZE, Time, Mechanical, M67A3.

(1) *Description.* This fuze is identical to the M500 fuze described in *f* above except that it has no impact element. The time calibration is from 0 to 75 seconds. The fuze will not function at less than 1.5 seconds of flight.

(2) *Setting.* Remove the safety wire from the fuze and set the

fuze to the desired time, using the fuze setter M23, M14, or M27.

112. Precautions in Firing

The following precautions should be closely observed in order to prevent injury to personnel or damage to matériel.

a. If the PD fuzes M51A4, M51A5, the TSQ fuze M55A3, the MTSQ fuzes M500, or M501 are fired during extremely heavy rainfall, premature functioning may occur. The rainfall necessary to cause malfunctioning is comparable to the exceedingly heavy downpours which occur during summer thundershowers. In the case of the M51A4 and M51A5, such prematures may be prevented by setting the fuze for delay action, thus making the "SQ" action inoperative. However, no corresponding change can be made in the case of the M55A3, M550, or M501 fuzes since the "SQ" action is always operative.

b. Do not remove safety devices from fuzes until just before use.

c. Before loading into the weapon, the ammunition should be free of sand, mud, moisture, frost, snow, ice, grease, or other foreign matter.

d. Exercise care when loading to avoid striking the fuze. Keep the shell out of the path of recoil.

e. If a round is in the chamber of a hot weapon, when firing is interrupted, the round should be removed promptly (par. 30) to prevent the possibility of a cook-off (par. 55*b*).

f. Failure to fire will be handled as indicated in paragraph 55 and SR 385–310–1.

g. Be sure that propelling charge is correctly loaded into breech (par. 27*g* and *h*).

113. Packing and Marking

a. Packing.

(1) Service projectiles for the 155-mm howitzer M1 are shipped uncrated.

(2) Dummy projectiles for drill use are shipped in wooden crates.

(3) Dummy propelling charges are packed in suitable wooden boxes as required.

(4) CHARGE, propelling, M3 is packed (for domestic shipments) two charges per fiber container, M68A1, two fiber containers M68A1 per wooden box, three containers per bundle; (for oversea shipments) one bundle per crate, or one charge per cartridge storage case.

(5) CHARGE, propelling, M4 or M4A1, is packed (for domestic shipments) one charge per fiber container M69A1, two fiber

containers M69A1 per wooden box, three containers per bundle; (for oversea shipments) one bundle per crate, or one charge per cartridge storage case.

(6) Complete data are published in Department of the Army Supply Catalogs ORD 3 SNL R–2 and ORD 3 SNL R–6.

b. Marking.

(1) Projectiles are marked as indicated in figures 128 through 139 and table X and XI, par. 109.

(2) The following information is marked in yellow on packing boxes and cartridge storage cases of propelling charges and in black on packing boxes of primers, for the 155-mm howitzer M1:

(*a*) Interstate Commerce Commission (ICC) shipping designation.
(*b*) Ammunition Identification Code (AIC) symbol.
(*c*) Ammunition lot number.
(*d*) Gross weight of packing box and contents.
(*e*) Cubical displacement of packing box.
(*f*) Type of powder (where applicable).
(*g*) Date manufactured.
(*h*) Descriptive nomenclature of packed item.
(*i*) Caliber and weapon designation.
(*j*) Ordnance insignia.
(*k*) Manufacturer's initial.
(*l*) Inspector's stamp.

(3) The cartridge storage case is encircled by the following: a band of green to indicate CHARGE, propelling, M3; a band of white to indicate CHARGE, propelling, M4 or M4A1.

114. Subcaliber Ammunition

a. General. The 155-mm howitzer M1 on 155-mm howitzer mount M14 employs the 37-mm gun M1916 and subcaliber mount M13A1 as a subcaliber weapon. Ammunition for this subcaliber weapon is described in *b* below. When the adapter M17 (fig. 107) is used in conjunction with the subcaliber mount M13A1, the caliber .22 rifle M2 (without stock) or the caliber .30 rifle M1903A3 (without stock) may be used as a subcaliber weapon. Ammunition for these rifles is listed in *c* and *d* below.

b. For 37-mm Gun M1916.

(1) *Authorized rounds.* SHELL, fixed, TP, M92, w/fuze, PD, M74, for 37-mm subcaliber guns and SHELL, fixed, TP, M63 Mod 1 (fig. 139), for 37-mm subcaliber guns are authorized for use in the 37-mm gun M1916. This ammuni-

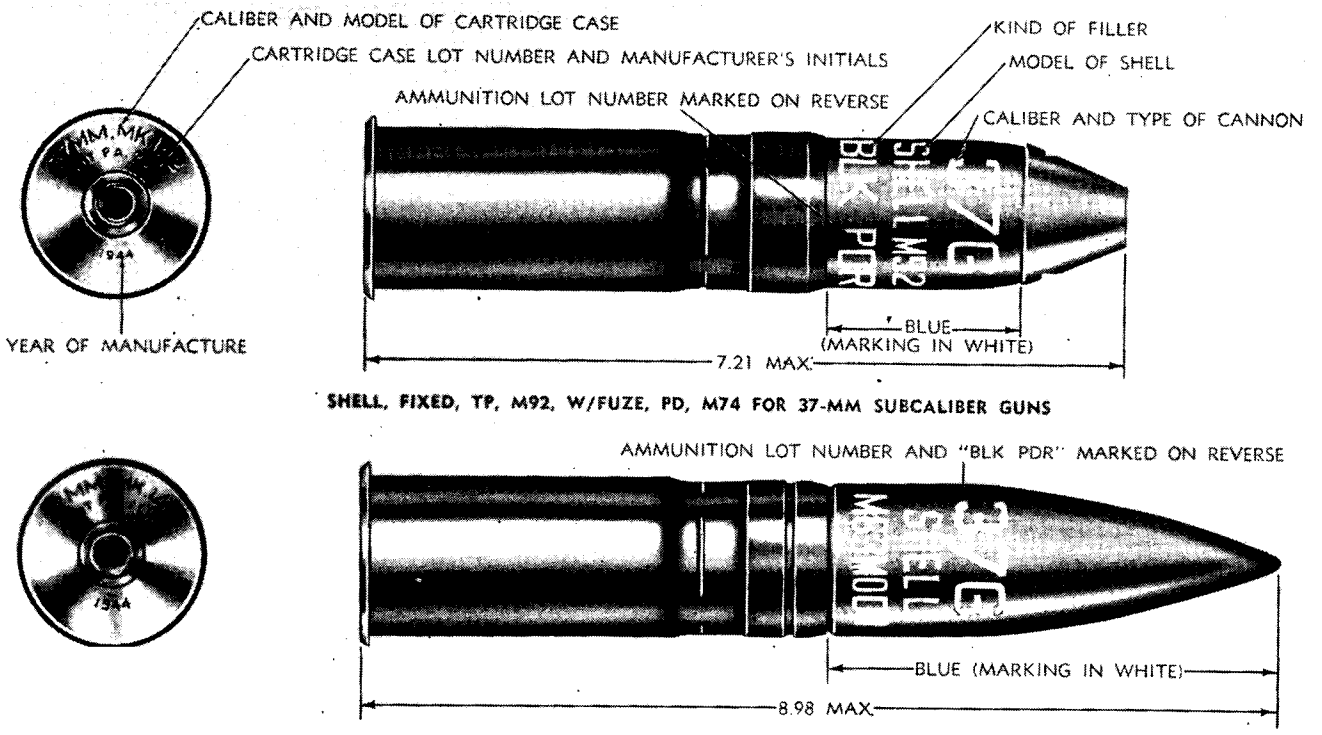


Figure 139. Ammunition for 37-mm gun M1916.

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tion is issued in the form of fixed complete rounds, with a low-explosive filler of black powder for spotting purposes. The cartridge case may be of brass or steel. The M63 Mod 1 is fitted with FUZE, base-detonating (BD), M58, practice.

(2) *BD practice fuze M58.* This fuze consists of a brass or steel body containing a detonator and a direct-action firing pin. Since the flash of the detonator is sufficient to ignite the black powder spotting charge, no booster is required or fitted to this fuze. There are no boresafety features incorporated in the design. Prior to firing, the firing pin is held in the unarmed position by a spring and resistance ring. Upon firing, setback force arms the fuze. Upon impact, the firing pin, acting against its spring, travels forward and strikes the detonator.

(3) *PD fuze M74.* The M74 is an impact type point-detonating fuze (shown fitted to the shell M92 in fig. 139) containing a direct-action firing pin and a Semple-type rotor which acts as the interrupter. It is used to ignite the black powder spotting charge and does not require or have a booster. This fuze is considered boresafe.

(4) *Packing.* The following packing data are representative for estimating weight and volume requirements. Complete packing data are published in Department of the Army Supply Catalog ORD 3 SNL R–1.

	Weight (lb)	*Volume (cu ft)*
TP shell M92 without packing material	2. 01	-----
Packed 1 round per fiber container, 40 containers (40 rd) per box	93. 3	1. 5
Over-all dimension of box (in.): 19⅝ x 12 x 10⅞.		
TP shell M63 Mod 1 without packing material	1. 65	-----
Packed 1 round per fiber container, 40 containers (40 rd) per box	75. 7	1. 2
Over-all dimension of box (in.): 18⅛ x 11⅞ x 11.		

c. For cal. .22 Rifle M2. CARTRIDGE, ball, cal. .22, long rifle is authorized for use in the caliber .22 rifle M2. The cartridges are packed in quantities of either 6,000 or 10,000 rounds in paper cartons; the cartons are packed in metal-lined or unlined wooden packing boxes. Packing boxes are marked with the manufacturer's name and lot number, the quantity and type of ammunition, the weight, cube, ICC shipping name, and generally the type of powder used. The dimensions (in.) of the 6,000 round box of ammunition are 15 x 11¾ x 7¼; the volume is 0.74 cubic feet; the weight (with 6,000 rounds) is

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85 pounds. Complete data are published in Department of the Army Supply Catalog ORD 3 SNL T–1.

d. For cal. .30 Rifle M1903A3. CARTRIDGE, ball, cal. .30, M2 is authorized for use in the caliber .30 rifle M1903A3. The cartridges are packed in quantities of 480, 880, 960, 1,040, or 1,500 rounds in paper cartons; the cartons are packed in either metal boxes or waxed cartons which are overpacked in wirebound crates or wooden boxes. Packing boxes are marked to indicate the quantity, caliber and type of ammunition, the method of packing, the AIC symbol, weight, cube, ammunition lot number, and ICC shipping name. The dimensions (in.) of the 1,040 round box of ammunition are 15⅛ x 13¼ x 11⅛; the volume is 1.28 cubic feet; the weight (with 1,040 rounds) is 84.0 pounds. Complete data are published in Department of the Army Supply Catalog ORD 3 SNL T–1.

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CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DESTRUCTION OF MATÉRIEL TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

115. Domestic Shipping Instructions

a. Preparation for Shipment in Zone of Interior. When shipping the 155-mm howitzer M1 matériel interstate or within the zone of interior, the officer in charge of preparing the shipment *will be responsible* for furnishing weapons to the carriers for transport in a *serviceable* condition, properly cleaned, preserved, painted, and lubricated as prescribed in SB 9–4.

Note.—For loading and blocking instructions for associated matériel used with these weapons on freight cars, refer to paragraph 117.

b. Preparation for Shipment to Ports.

(1) *Inspection.* All used weapons destined for oversea use will be inspected prior to shipment in accordance with TB ORD 385.

(2) *Processing for shipment to ports.* All weapons destined to ports of embarkation for oversea shipment will be further processed in accordance with SB 9–4. On-vehicle matériel (OVM) containers will be marked as outlined in SR 746–30–5. In addition, the nomenclature of the major item that the on-vehicle matériel (OVM) containers are related to, will be stenciled on each container, including on-vehicle matériel (OVM) containers received from other services (for example, Signal Corps matériel).

Note.—Ports of embarkation will supplement any necessary or previously omitted processing upon receipt of weapons.

c. Removal of Preservatives for Shipment. Personnel withdrawing weapons from a limited storage status for domestic shipment *must not remove preservatives*, other than to insure that the weapons are complete and serviceable. If it has been determined that preservatives have been removed, they must be restored prior to domestic shipment. The removal of preservatives is the responsibility of depots, ports, or field installations (posts, camps, and stations) receiving the shipments.

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d. Army Shipping Documents. Prepare all Army shipping documents accompaning freight in accordance with TM 38–705.

e. Deep-Water Fording. If during the course of shipment, operations embrace deep-water fording, prepare weapons in accordance with TM 9–2853.

f. Artillery Gun Book. During transfer or shipment place the artillery gun book in the gun book envelope and secure to the top of the breech mechanism with water-resistant pressure-sensitive adhesive tape. Under one of the wrappings of tape insert one end of a tab reading "GUN BOOK HERE."

116. Limited Storage Instructions

a. General.

(1) Weapons received already processed for domestic shipment need not be reprocessed unless the inspection performed on receipt of weapons, reveals corrosion, deterioration, etc.

(2) Completely process weapons if the processing data recorded on the tag attached to weapon indicates that such has been rendered ineffective by operation, freight shipping damage, or upon receipt of weapons directly from manufacturing facilities.

(3) Weapons to be prepared for limited storage must be given a limited technical inspection and processed as prescribed in TB ORD 408.

b. Receiving Inspections.

(1) Report of weapons received for storage in a damaged condition or improperly prepared for shipment will be reported on Report of Damaged or Improper Shipment DD Form 6 in accordance with SR 745–45–5. Report of weapons received in an unsatisfactory condition (chronic failure or malfunction of the weapon or equipment) will be reported on DA Form 468 in accordance with SR 700–45–5 (par. 3*e*).

(2) When weapons are inactivated, they are to be stored in a limited storage status for periods not to exceed 90 days. Stand-by storage for the 155-mm howitzer M1 and Mount M14 for periods in excess of 90 days will be accomplished as prescribed in TB ORD 408 by ordnance maintenance personnel only.

(3) Immediately upon receipt of weapons, they must be inspected and serviced as prescribed in paragraphs 7 through 9. Perform a systematic inspection and replace or repair all missing or broken parts. If repairs are beyond the scope of the unit, and the weapon will be out of service for an appreciable

length of time, store them in a limited storage status and attach a tag to the weapons specifying the repairs needed. The report of these conditions will be submitted by the unit commander for action by ordnance maintenance unit.

c. Inspection During Storage. Perform a visual inspection periodically to determine general condition as prescribed in TB ORD 408. If corrosion is found on any part, remove the rust spots, clean, paint, and treat with the prescribed preservatives.

Note.—Touch-up painting will be in accordance with TM 9–2851.

d. Removal From Limited Storage.

(1) If the weapon is not shipped or issued upon expiration of the limited storage period, it may be processed for another limited storage period or it must be further treated for stand-by storage (weapons out of use for periods in excess of 90 days up to 3 years) by ordnance maintenance personnel.

(2) If the weapons to be shipped will reach their destination within the scope of the limited storage period, they need not be reprocessed upon removal from storage, unless inspection reveals it to be necessary according to anticipated in-transit weather conditions.

Note.—All weapons being reissued through the depot supply system to troops within the continental limits of the United States must meet the requirements of TB ORD 385. This is NOT required for so-called reissues, exchanges or redistribution among troop units, where the depot supply system is not involved.

(3) Deprocess weapons when it has been ascertained that they are to be placed into immediate service. Remove all rust preventive compounds and lubricate as prescribed in paragraphs 43 through 46.

(4) Repair and/or replace all items tagged in accordance with *b*(3) above.

e. Storage Site. The preferred type of storage for the weapons is under cover in open sheds or warehouses whenever possible. Where it is found necessary to store weapons outdoors, they must be protected against the elements as prescribed in TB ORD 379. For storage under unusual weather and terrain conditions see paragraphs 32 through 38.

117. Loading and Blocking Instructions for Associated Matériel on Railroad Cars

For loading and blocking instructions for the 155-mm howitzer motor carriage M41 for rail shipment, refer to TM 9–744.

Section II. DESTRUCTION OF MATÉRIEL TO PREVENT ENEMY USE

118. General

Destruction of the 155-mm howitzer M1 and 155-mm howitzer mount M14, when subject to capture or abandonment in the combat zone, will be undertaken by the using arm only when, in the judgment of the unit commander concerned, such action is necessary in accordance with orders of, or policy established by, the army commander.

119. Method of Destruction

Destruction of the howitzer, mount, and related matériel, if directed, may be accomplished by one of the methods described in TM 9–744.

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APPENDIX

REFERENCES

1. Publication Indexes

The following publication indexes and lists of current issue should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to matériel covered in this manual:

Index of Administrative Publications ---------- SR 310–20–5
Index of Army Motion Pictures and Film Strips and Kinescope Recordings ---------- SR 110–1–1
Index of Training Publications ---------- SR 310–20–3
Index of Blank Forms and Army Personnel Classification Tests ---------- SR 310–20–6
Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders ---------- SR 310–20–4
Index to Tables of Organization and Equipment, Reduction Tables, Tables of Organization, Tables of Equipment, and Tables of Allowances ---- SR 310–20–7
Introduction and Index (supply catalogs) ---------- ORD 1
Military Training Aids ---------- FM 21–8
Ordnance Major Items and Combinations and Pertinent Publications ---------- SB 9–1

2. Supply Catalogs

The following catalogs of the Department of the Army Supply Catalog pertain to this matériel:

a. Ammunition.

Ammunition, Fixed and Semifixed, including Subcaliber, for Pack, Light and Medium Field, Aircraft, Tank, and Antitank Artillery, including Complete Round Data ---------- ORD 3 SNL R–1
Ammunition Instruction Matérial for Pack, Light and Medium Field, Aircraft, Tank, and Antitank Artillery ---------- ORD 3 SNL R–6
Ammunition, Rifle, Carbine, and Automatic Gun ---------- ORD 3 SNL T–1

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Land Mines and Fuzes, Demolition Explosives and Related Items; and Ammunition for Simulated Artillery, Booby Trap Hand Grenade, and Land Mine Fire ---------- ORD 3 SNL R–7

Projectiles and Propelling Charges, Separate Loading, for Medium Field Artillery, including Complete Round Data ---------- ORD 3 SNL R–2

Service Fuzes and Primers for Pack, Light, and Medium Field, Aircraft, Tank, and Antitank Artillery ---------- ORD 3 SNL R–3

b. Gun Matériel.

Gun, 37-mm. M1916 ---------- ORD (*) SNL C–33, Section 13

Howitzer, 155-mm, M1; Carriage, Howitzer, 155-mm, M1, M1A1, and M1A2; Mount, Howitzer, 155-mm, M14 (T19) ---------- ORD (*) SNL C–39

Mount, Subcaliber, 37-mm, M13A1 ORD (*) SNL C–33, Section 7

c. Maintenance and Repair.

Cleaners, Preservatives, Lubricants, Recoil Fluids, Special Oils, and Related Maintenance Matériels ORD 3 SNL K–1

Lubricating Equipment, Accessories, and Related Dispensers ---------- ORD (*) SNL K–3

Lubricating Fittings, Oil Filters, and Oil Filter Elements ---------- ORD 5 SNL H–16

d. Sighting and Fire Control Equipment.

Binocular, M13A1 ---------- ORD (*) SNL F–210

Binocular, M17A1 ---------- ORD (*) SNL F–238

Board, Plotting, M10 ---------- ORD (*) SNL F–314

Circle, Aiming M1 ---------- ORD (*) SNL F–160

Compass, M2 ---------- ORD (*) SNL F–219

Light, Aiming Post, M14; Light, Instrument, M34 ---------- ORD (*) SNL F–205

Mount, Telescope, M25 ---------- ORD (*) SNL F–216

Periscope, M6 ---------- ORD (*) SNL F–235, Volume 2

Periscope, M13 and M13B1 -- ORD (*) SNL F–235, Volume 5

Quadrant, Gunner's, M1 (mils) ---------- ORD (*) SNL F–140

Setter, Fuze, M22 and M23 ---------- ORD (*) SNL F–293

Telescope, BC, M65 ---------- ORD (*) SNL F–259

Telescope, Panoramic, M12A6 ---------- ORD (*) SNL F–214

Thermometer, Powder Temperature, M1 -- ORD (*) SNL F–346

Watch, Stop ---------- ORD (*) SNL F–36

*See ORD 1 for published catalogs of the Ordnance section of the Department of the Army Supply Catalog.

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3. Forms

The following forms pertain to this matériel:
DA Form 468, Unsatisfactory Equipment Report.
DD Form 6, Report of Damages or Improper Shipment.
OO Form 5825, Artillery Gun Book.

4. Other Publications

The following explanatory publications contain information pertinent to this matériel and associated equipment:

a. Ammunition.
Ammunition, General ---------- TM 9–1900
Ammunition Inspection Guide ---------- TM 9–1904
Artillery Ammunition ---------- TM 9–1901
Ballistic Data, Performance of Ammunition ---------- TM 9–1907
Qualification in Arms and Ammunition Training Allowances ---------- AR 775–10
Regulations for Firing Ammunition for Training, Target Practice, and Combat ---------- AR 385–310–1

b. Camouflage.
Camouflage, Basic Principles ---------- FM 5–20
Camouflage of Field Artillery ---------- FM 5–20D

c. Decontamination.
Decontamination ---------- TM 3–220
Defense Against Chemical Attack ---------- FM 21–40

d. Destruction to Prevent Enemy Use.
Explosives and Demolitions ---------- FM 5–25

e. Gun Matériel.
Service of the Piece, 155-mm Howitzer Motor Carriage M41 ---------- FM 6–82

f. General.
Artillery Gun Book ---------- TB ORD 347
Field Artillery Gunnery ---------- FM 6–40
Fundamentals of Artillery Weapons ---------- TM 9–2305
Reports of Accident Experience ---------- SR 385–10–40
Supplies and Equipment: Unsatisfactory Equipment Report ---------- SR 700–45–5
Targets, Target Material, and Training Course Layouts ---------- TM 9–855
The Field Artillery Battery ---------- FM 6–140

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g. Maintenance and Repair.

Abrasive, Cleaning, Preserving, Sealing, Adhesive, and Related Materials Issued for Ordnance Matériel	TM 9–850
Cleaning, Lubrication, and Preservation of Artillery Matériel, 20-mm to 16-inch, Inclusive	TB ORD 340
Cold Weather Lubrication: Operation and Maintenance Artillery and Sighting and Fire Control Matériel	TB ORD 193
Fire Control Matériel: Lubrication	TB 9–2835–1
Instruction Guide: Operation and Maintenance of Ordnance Matériel in Extreme Cold (0 to −65° F.)	TM 9–2855
Lubrication	TM 9–2835
Lubrication Order	LO 9–744
Maintenance of Supplies and Equipment: Maintenance Responsibilities and Shop Operation	AR 750–5
Maintenance and Care of Hand Tools	TM 9–867
Operations in the Arctic	FM 31–71
Painting Instructions for Field Use	TM 9–2851
Preparation of Ordnance Matériel for Deep Water Fording	TM 9–2853

h. Shipment and Storage.

Army Shipping Document	TM 38–705
Instruction Guide: Ordnance Packing and Shipping (Posts, Camps, and Stations)	TM 9–2854
Marking and Packing of Supplies and Equipment: Marking of Oversea Supply	SR 746–30–5
Military Standard—Marking of Shipments	MIL–STD–129*
Ordnance Storage and Shipment Chart—Group C	TB 9–OSSC–C
Preparation for and Maintenance in Storage of Combat Vehicular Armament	TB ORD 408
Preparation of Supplies and Equipment for Shipment: Processing of Unboxed and Uncrated Equipment for Oversea Shipment	AR 747–30
Processing of Motor Vehicles and Related Unboxed Matériel for Shipment and Storage	SB 9–4
Preservation, Packaging, and Packing of Military Supplies and Equipment	TM 38–230

*Copies may be obtained from Aberdeen Proving Ground, Aberdeen, Md.

Protection of Ordnance General Supplies in Open Storage	TB ORD 379
Shipment of Supplies and Equipment: Report of Damaged or Improper Shipment	SR 745–45–5
Standards for Oversea Shipments and Domestic Issue of Ordnance Matériel Other than Ammunition and Army Aircraft	TB ORD 385
i. Sighting and Fire Control Equipment.	
Auxiliary Sighting and Fire Control Equipment	TM 9–575
j. Subcaliber Equipment.	
Cal. .22 Rifles, All Types	TM 9–280
Local Manufacture of Adapter to Permit Use of Oil Gun CLAX7 with 37-mm Gun M1916 Recoil Mechanism	TB ORD FE 38
Service of the Piece, 155-mm Howitzer Motor Carriage M41	FM 6–82
U. S. Rifle, cal. .30, M1903	FM 23–10
U. S. Rifle, cal. .30, M1903A4 (Sniper's)	TM 9–270

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