- 1025-200-12

TM 9-1025-200-12

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR AND ORGANIZATIONAL MAINTENANCE MANUAL

HOWITZER, MEDIUM, TOWED: 155-MM, M114 AND M114A1

M114A2 (NSN 1025-01-025-9857)

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MARCH 1965

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WARNING

Do not chamber ammunition until immediately prior to firing.

Ammunition left too long in a hot weapon may result in hazardous conditions.

Fire or remove ammunition within 5 minutes after chambering. If you cannot fire, follow failure-to-fire procedures in paragraph 49 immediately.

Do not fire weapon with foreign object in cannon tube.

During unloading of unfired round, keep gun on target and personnel clear of muzzle and recoil path.

Never hammer a round while ramming it out. Keep clear of muzzle as much as possible. Do not reuse a rammed out projectile.

For failure-to-fire procedures, refer to pages 212.18 and 212.19.

WARNING
RADIOACTIVE MATERIAL



TRITIUM H 3

The reticle assembly of the M1A1 collimator contains radioisotope tritium (H 3). Rough handling can cause breakage of the radioactive element. If assembly appears to be damaged or does not illuminate, return to depot for replacement.

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A. RULES AND REGULATIONS: Copies of the following rules and regulations are maintained at HQ, AMCCOM, Rock Island, IL 61299-6000. Copies may be requested, or information pertinent to these rules and regulations obtained, by contacting the AMCCOM Radiological Protection Officer (RPO), AUTOVON 793-2964/2965, Commercial (309) 782-2964/2965.

(1) 10CFR Part 19 - Notices, Instructions and Reports to Workers; Inspections.

(2) 10CFR Part 20 - Standards for Protection Against Radiation.

(3) 10CFR Part 21 - Reporting of Defects and Noncompliance.

(4) NRC license, license conditions, and license application.

B. SAFETY PRECAUTIONS: The radioactive materials used in this instrument are tritium gas (H 3) sealed in pyrex tubes. They pose no significant hazard to the repairman when intact. These sources illuminate the instrumentation for night operations. Tampering with or removal of the sources in the field is prohibited by Federal law. In the event there is no illumination, notify the local Radiological Protection Officer. Do not attempt to repair or replace the instrument in the field! If skin contact is made with any area contaminated with tritium, immediately wash with nonabrasive soap and water.

C. IDENTIFICATION: Radioactive self-luminous sources are identified by means of radioactive warning labels (as above). These labels should not be defaced or removed and should be replaced immediately when necessary. Refer to the local RPO or the AMCCOM RPO for instructions on handling, storage, or disposal.

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TECHNICAL MANUAL
No. 9-1025-200-12

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *25 March 1965*

OPERATOR AND ORGANIZATIONAL MAINTENANCE MANUAL HOWITZER, MEDIUM, TOWED: 155—MM, M114 (NSN 1025-00-322-9755), M114A1 (NSN 1025-00-322-9768), AND M114A2 (NSN 1025-01-025-9857)

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*This manual supersedes TM 9-331A, 28 January 1953, including C1, 20 June 1953, C4, 25 July 1963; ORD 7 SNL C-33 section 13, 28 February 1945, including C1, 20 June 1950; ORD 7 SNL C-33 section 7, 20 June 1950; and TB 9-331A-1, 13 January 1953.

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual contains instructions for operation and organizational maintenance of the 155-mm towed medium howitzer M114 and M114A1, and the 155-mm auxiliary propelled towed medium howitzer M123A1 (figs. 1, 2, and 3). Organizational maintenance on the gasoline engine of the auxiliary propelled howitzer M123A1 is contained in TM 5-2805-204-14.

b. Appendix I contains a list of current references, including supply manuals, technical manuals, forms, and other publications pplicable to the howitzer.

c. Appendix II lists the basic issue items that are required by operational maintenance. It lists the quantities of operational maintenance accessories, attachments, component assemblies, tools and equipment, supplies, and repair parts accompanying the equipment. All these items constitute the major end item for issue to users.

d. Appendix III contains a maintenance allocation chart which lists the maintenance responsibilities allocated to each level of maintenance.

e. TM 9-1025-200-20P contains a list of repair parts and special tools and equipment required or authorized for organizational maintenance of the howitzer. For a list of repair parts and special tools applicable to the gasoline engine of the auxiliary propelled howitzer M123A1, refer to TM 5-2805-204-24P.

f. The direct reporting of errors, omissions, and recommendations for improving this technical manual by the individual user, is authorized and encouraged. DA Form 2028 will be used for reporting these improvements. This form may be completed using pencil, pen or typewriter. DA Forms 2028 will be completed by the individual using the manual and forwarded direct to:

Commanding General
Headquarters
U. S. Army Weapons Command
ATTN: AMSWE-SMM-P
Rock Island Arsenal
Rock Island, Illinois 61202

g. This manual differs from TM 9-331A, 28 January 1953; C1, 30 June 1953; C2, 20 February 1961; C3, 4 December 1961; and C4, 25 July 1963, as follows;

(1) Adds information on:
- (*a*) 115-mm auxiliary propelled towed medium howitzer M123A1.
- (*b*) The variable recoil connecting rod (long recoil).

(2) Revises information on:
- (*a*) Ammunition.
- (*b*) Organizational repair parts, tools, and equipment.
- (*c*) Boresighting.
- (*d*) Troubleshooting.
- (*e*) Preventive maintenance instructions.
- (*f*) Blackout light.

(3) Deletes information on M12 panoramic telescope; M14, M22, M23, and M27 fuze setters.
Artillery sled M6.
Caliber .22—.30 rifle adapter M17.
Caliber .22, .30 subcaliber equipment.

2. Organizational Maintenance Allocation

The prescribed maintenance responsibilties, as allocated in the maintenance allocation

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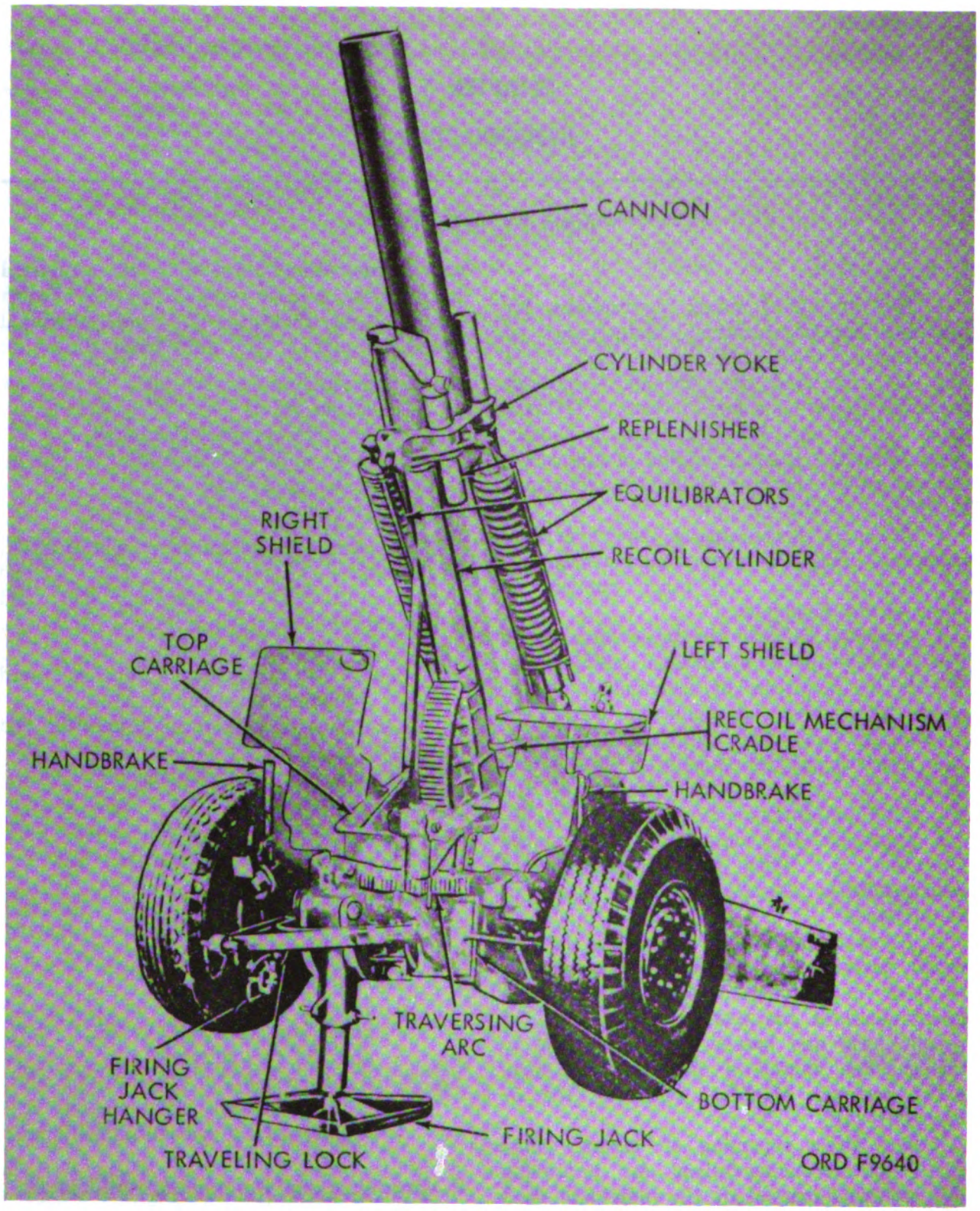


Figure 1. 155-mm cannon and 155-mm howitzer carriage M1A2—firing position, maximum elevation—left front view.

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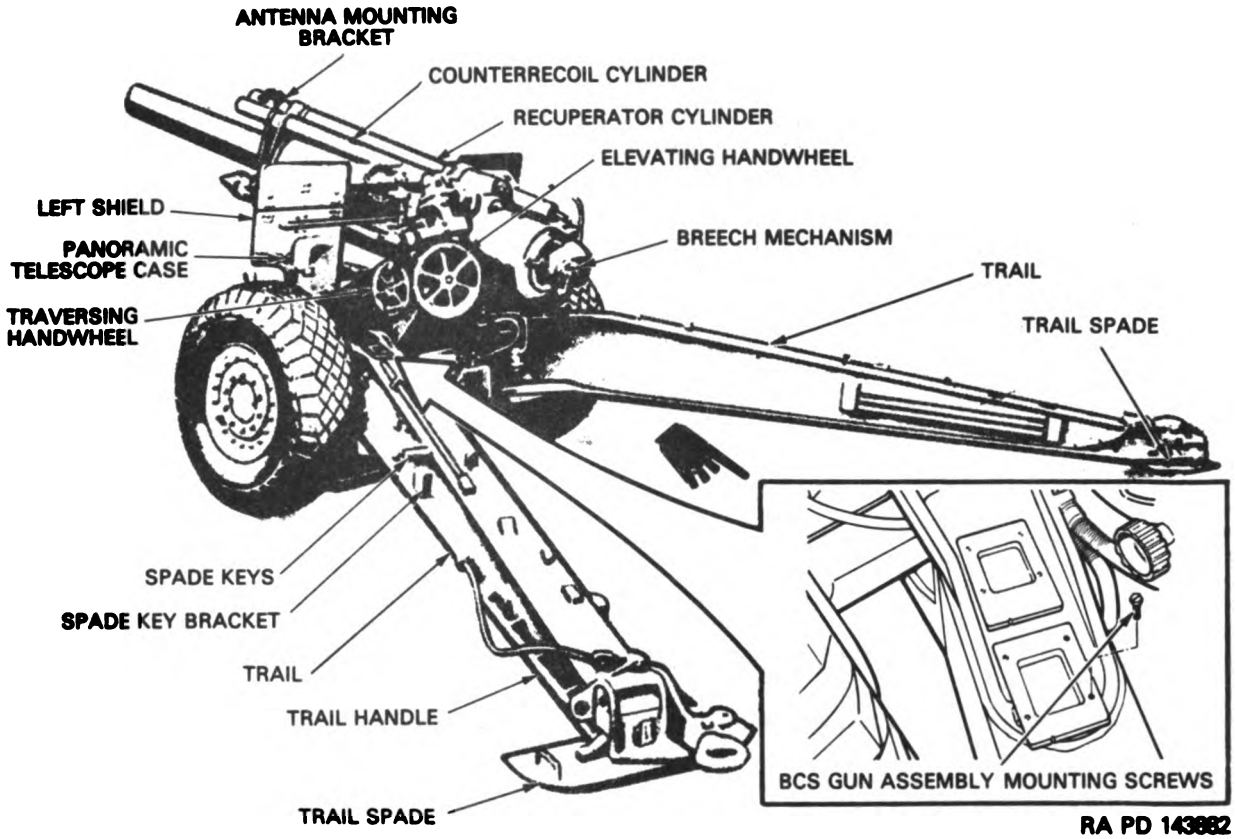


Figure 2. 155-mm cannon M1A1, M1A2, and 155-mm howitzer carriage M1A1—firing position—left rear view.

chart (app. III), are reflected in this manual. In all cases where the nature of repair, modification, or adjustment is beyond the scope or facilities of the operator, crew, or user, the supporting unit should be informed in order that trained personnel with suitable tools and equipment can be provided or other instructions issued.

3. Forms, Records, and Reports

a. General. Responsibility for the proper execution of forms, records, and reports rests upon the officer's of all units maintaining 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 materiel 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 materiel in the hands of troops and for delivery of depots, etc. The forms, records, and reports establish the work required, the progress of the work within the shops, and the status of the materiel upon completion of its repair.

b. Authorized Forms. The forms generally applicable to units operating this materiel are listed in appendix I. For instructions on use of these forms, refer to TM 38-750. For a listing of all forms, refer to current DA Pam 310-2.

c. Field Reports of Accidents.

(1) *Injury to personnel or damage to materiel.* The reports necessary to comply with the requirements of the Army safety program are prescribed in detail in AR 385-40.

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(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 AR 75-1.

d. Equipment Log Book. The equipment log book is a three ring binder with insert record forms to maintain a historical record for individual items of equipment. Included is TM 9-1025-200-ESC, which contains equipment serviceability criteria.

(1) *Purpose.* The equipment log book is used to keep an accurate record of receipt, operation, conditions, maintenance accomplished, modifications, and transfer of the equipment.

(a) It provides commanders with up-to-date knowledge of the materiel readiness of their equipment.

(b) It permits careful and accurate screening of equipment which requires the greatest amount of maintenance.

(c) It provides substantial guidance for the equipment as to the adequacy and length of service which can be readily determined by the evaluation of these records.

(d) It is permanently identified with applicable equipment and requisition or serial numbers.

(2) *Stowage.* The equipment log book will be stowed in the tool chest.

(3) *Procedure when equipment log book is lost or separated from weapon.* If the equipment log book is lost, it will be replaced immediately and all available data will be entered in the new book in accordance with TM 38-750.

e. Report of Unsatisfactory Equipment or Materials. Deficiencies detected in the equipment or materials should be reported immediately in accordance with TM 38-750.

3.1. Hand Receipts

Hand receipts for Basic Issue Items (B11) and Additional Authorized List (AAL) items are published in a Hand Receipt Manual. The hand receipt manual numerical designation is the same as the related technical manual with the letters HR added to the number. These manuals are published to aid in property accountability and are available through: Commander, US Army Adjutant General Publication Center, ATTN: AGDL-OD, 1655 Woodson Road, St. Louis, MO 63114.

Section II. DESCRIPTION AND DATA

4. Description

a. Weapon.

(1) *Howitzer.*

(a) M114, M114A1 and M114A2 howitzer. The 155-mm howitzer M114 and M114A1 consist of a M1 or M1A1 cannon, M114A2 consist of a M1A2 cannon (figs. 1 and 2), M6, M6A1, M6A2, M6B1, or M6B2 recoil mechanism, a M1A1 or M1A2 carriage, a M25 telescope mount (fig. 10) and a M12A7C panoramic telescope (M114) or a M12A27Q (M114A1) (fig. 11).

(b) Deleted.

(2) *Cannon.* The 155-mm cannon M1 (fig. 1) and M1A1 (fig. 3) is a short-barreled weapon equipped with a manually-operated breech mechanism and a percussion type firing mechanism. The external surface of the cannon is machined to form a bearing surface which slides in the recoil mechanism cradle and cylinder yoke (fig. 3) during recoil and counterrecoil.

Figure 4. (deleted)

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32. Deleted.

33. Deleted.

34. Blackout Light Assembly

The blackout light assembly (fig. 31) is installed on the weapon for night travel.

35. Gun Recoil Hydraulic Oil Pump Kit

The gun recoil hydraulic oil pump kit (figs. 32 and 33) is used to purge and refill the replenisher tube with recoil fluid.

36. Deleted.

36.1. M90 Chronograph

Refer to TM 9-1290-359-12&P for description of the M90 chronograph.

36.2 BCS Gun Assembly

Refer to TM 11-7440-283-12-1, TM 11-7440-283-12-2, and TM 11-5820-882-10 for description of the BCS gun assembly.

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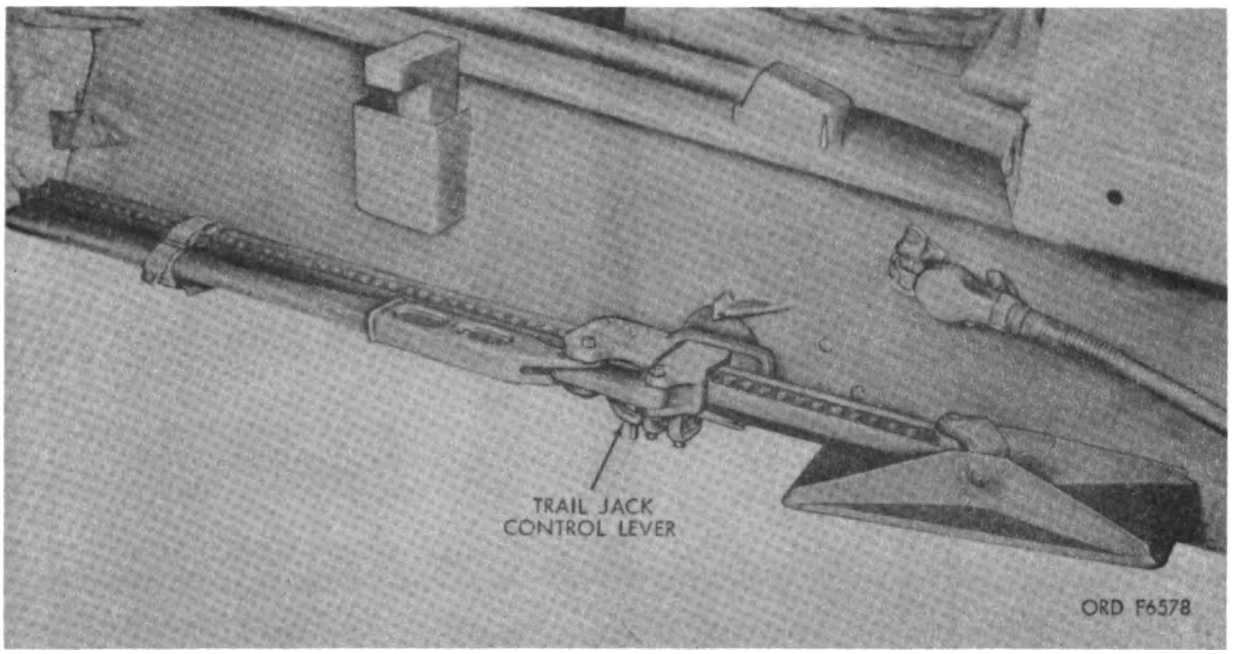


Figure 30. Trail jack assembly in stowed position.

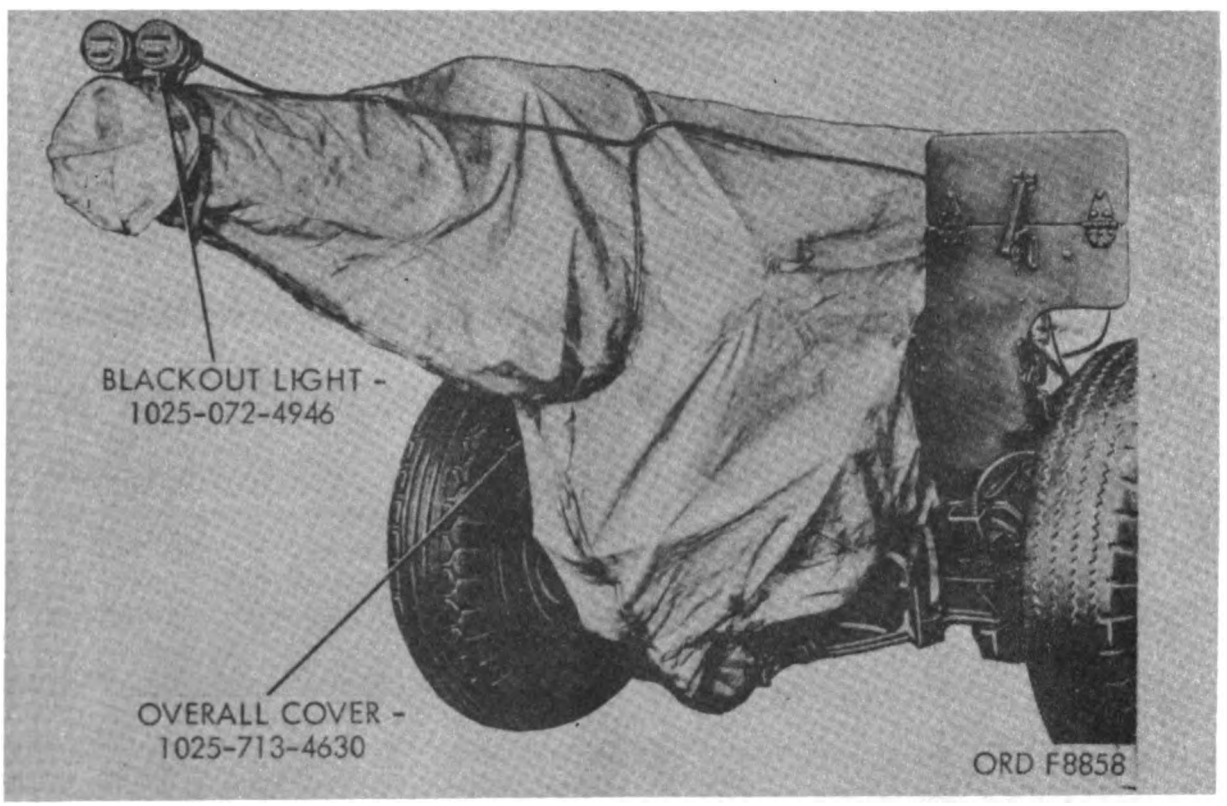


Figure 31. Over–all cover and blackout light system in place.

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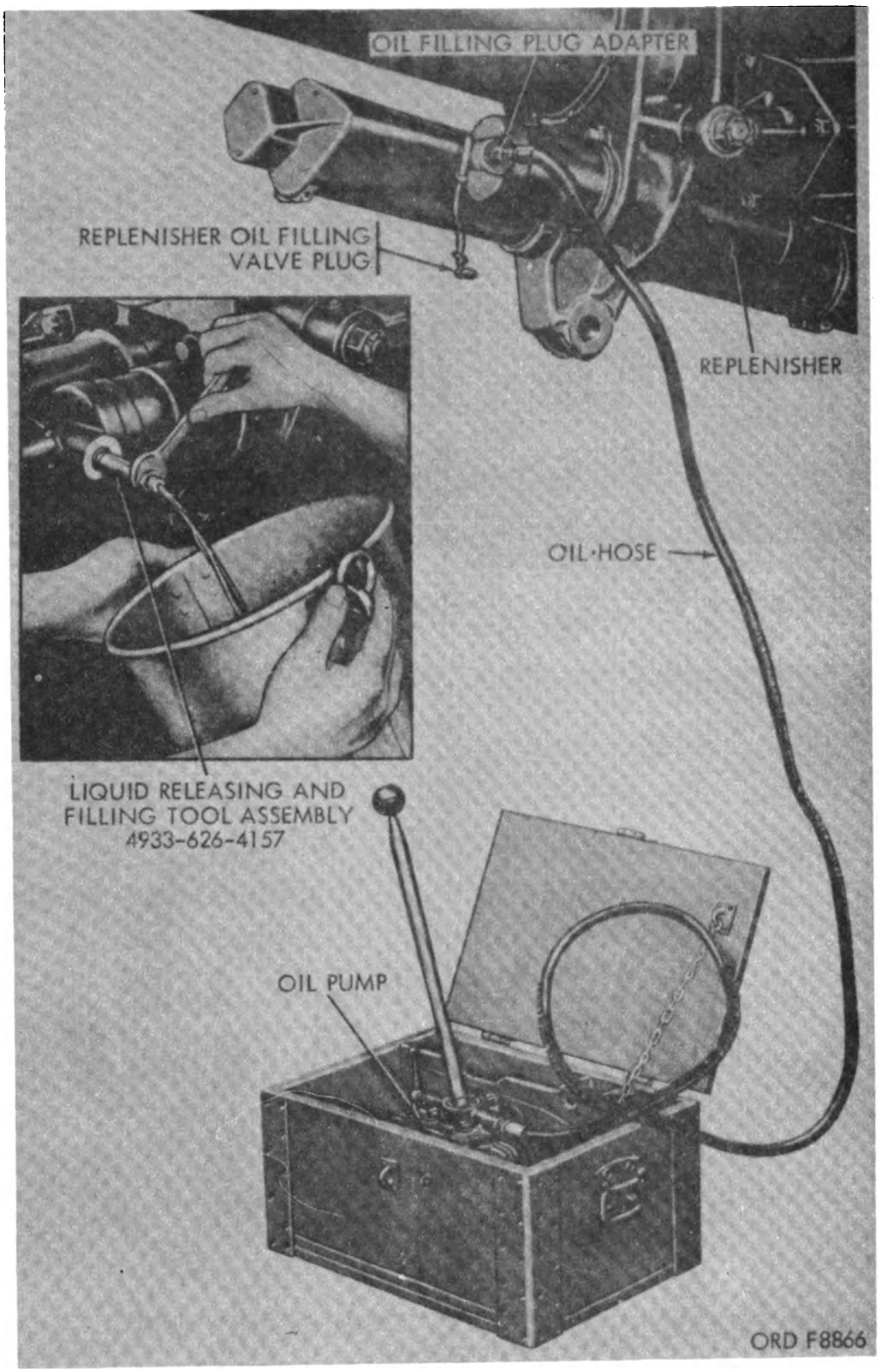


Figure 32. Draining and filling replenisher.

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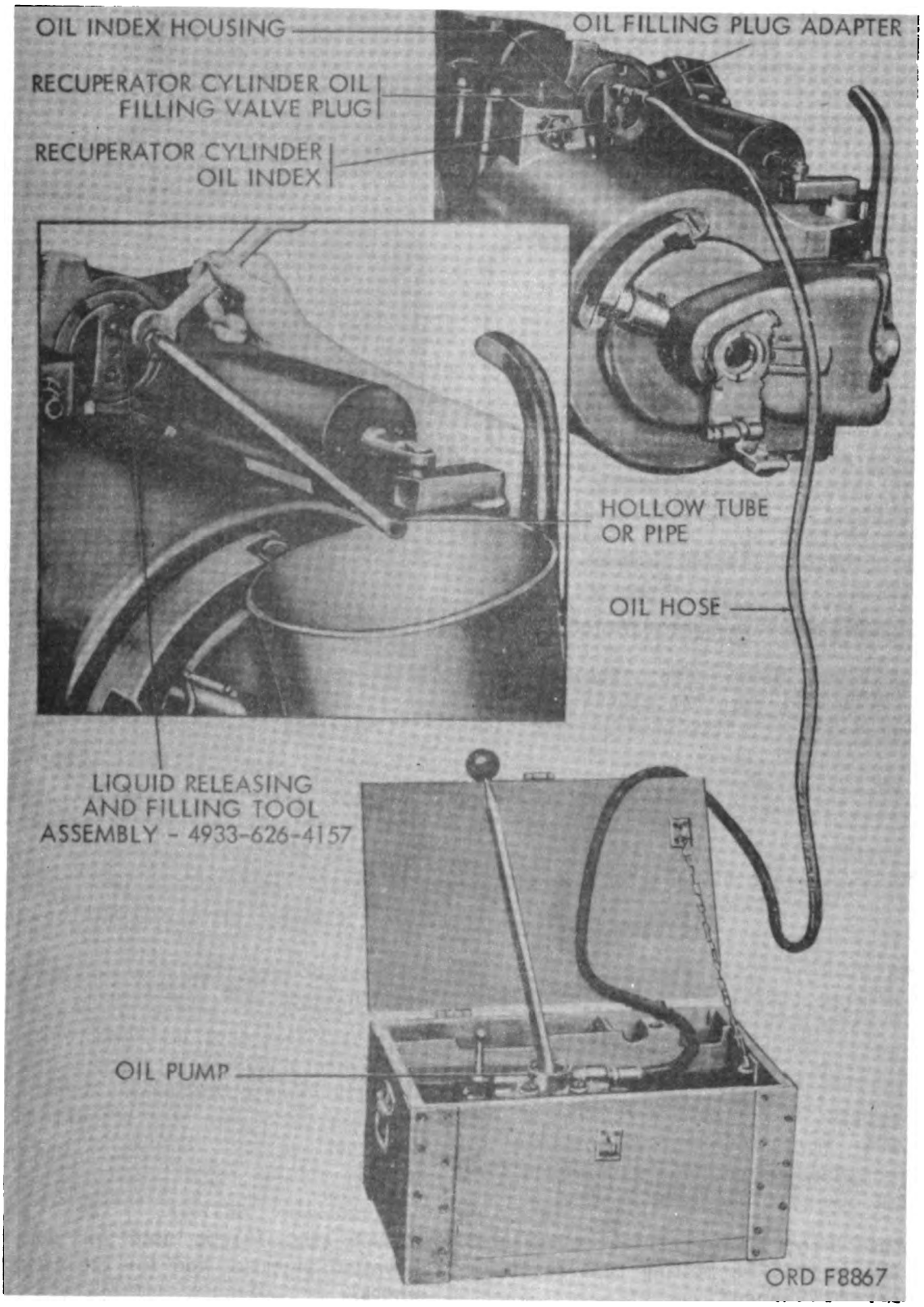


Figure 33. Draining and filling recuperator cylinder.

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Figure 34. Gasoline blowtorch.

37. Sighting and Fire–Control Materiel

a. Telescope Mount M25. The telescope mount M25 (10, fig. 23) provides a base for mounting the panoramic telescope M12A7C and also serves to lay the 155–mm howitzer cannon M1 or M1A1 in elevation for direct or indirect firing.

b. Panoramic Telescope M12A7C. The panoramic telescope M12A7C (1, fig. 23) is used to lay the 155–mm howitzer cannon M1 or M1A1 in azimuth for direct or indirect firing.

c. Instrument Light M34. The instrument light M34 (fig. 35) is used for illuminating the reticle of the panoramic telescope M12A7C during night operation.

d. Aiming Post Light M14. The aiming post light M14 (fig. 13) which clamps to the aiming post, is used for illumination during night operation.

e. Fuze Setter M26. The fuze setter M26 (fig. 14) is used for setting time fuzes for fire–control equipment.

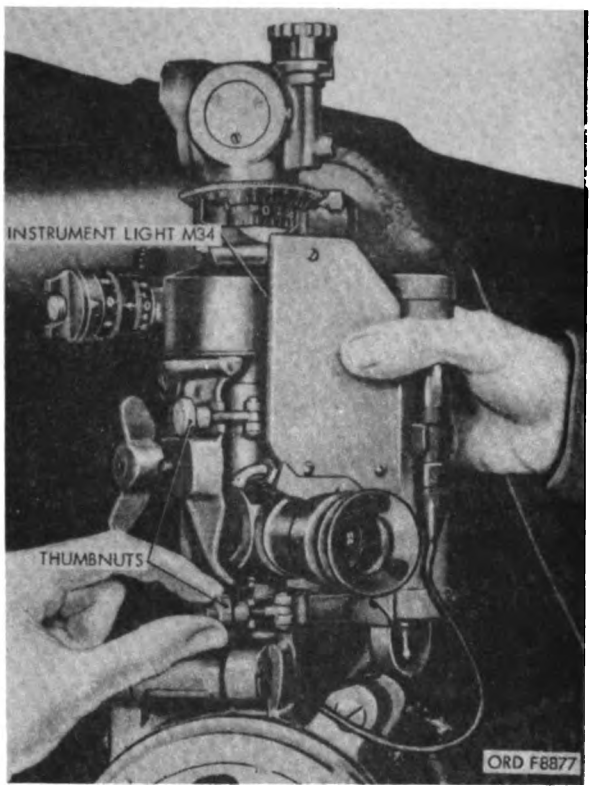


Figure 35. Installing instrument light M34 on telescope socket.

f. Fuze Setter M28. The fuze setter M28 (fig. 16) is used for setting clockwise time fuzes in fire–control equipment.

g. Aiming Post M1A2. The aiming post M1A2 (fig. 17) is used with most field artillery weapons to provide a suitable reference or zero point when laying the weapon during indirect fire operations.

h. Fire Control Quadrant M1A1. The fire control quadrant M1A1 (fig. 18) is used for testing and adjusting the sighting equipment and for laying the howitzer in elevation when a high degree of accuracy is required.

i. Binocular M17A1. The binocular M17A1 (fig. 19) is used for general observation purposes and for estimating small angles.

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Section III. OPERATION UNDER USUAL CONDITIONS

38. General

This section contains instructions for the mechanical steps necessary to operate the 155-mm towed medium howitzer M114 and M114A1 and the 155-mm auxiliary propelled towed medium howitzer M123A1 under conditions of moderate temperatures and humidity. For operation under unusual conditions refer to section IV.

39. Preparation of Weapon for Firing

Note. Examine the equipment logbook to make sure the weapon has been fired or the recoil exercised within the past 6 months. If weapon has not been fired or exercised within the past 6 months, notify ordnance personnel before proceeding with preparation of weapon for firing.

a. Removing the Howitzer from the Prime Mover.

(1) After the howitzer has been towed into the firing area by the prime mover, set the mechanical handbrakes on the carriage (fig. 3).

(2) Close the service and emergency air line cutout cocks on the tail end of the prime mover (fig. 36). Uncouple the service and emergency air brake hose couplings from the prime mover air hose coupling.

(3) Lock the air brake hose couplings in the dummy couplings on the sides of the trails (fig. 37). Remove the overall cover and the canvas firing jack cover, if in place. Remove the muzzle cover from cannon muzzle. Open the drain cock on the air tank (fig. 38).

(4) Remove cover and unstrap the trail jack assembly (M123A1 howitzer) (fig. 30) from the left trail and lift the trails with the jack (fig. 39); disconnect the lunette (fig. 36) from the prime mover. To remove howitzer M114 or M114A1 from prime mover, three men will lift each of the trails by the trail handles

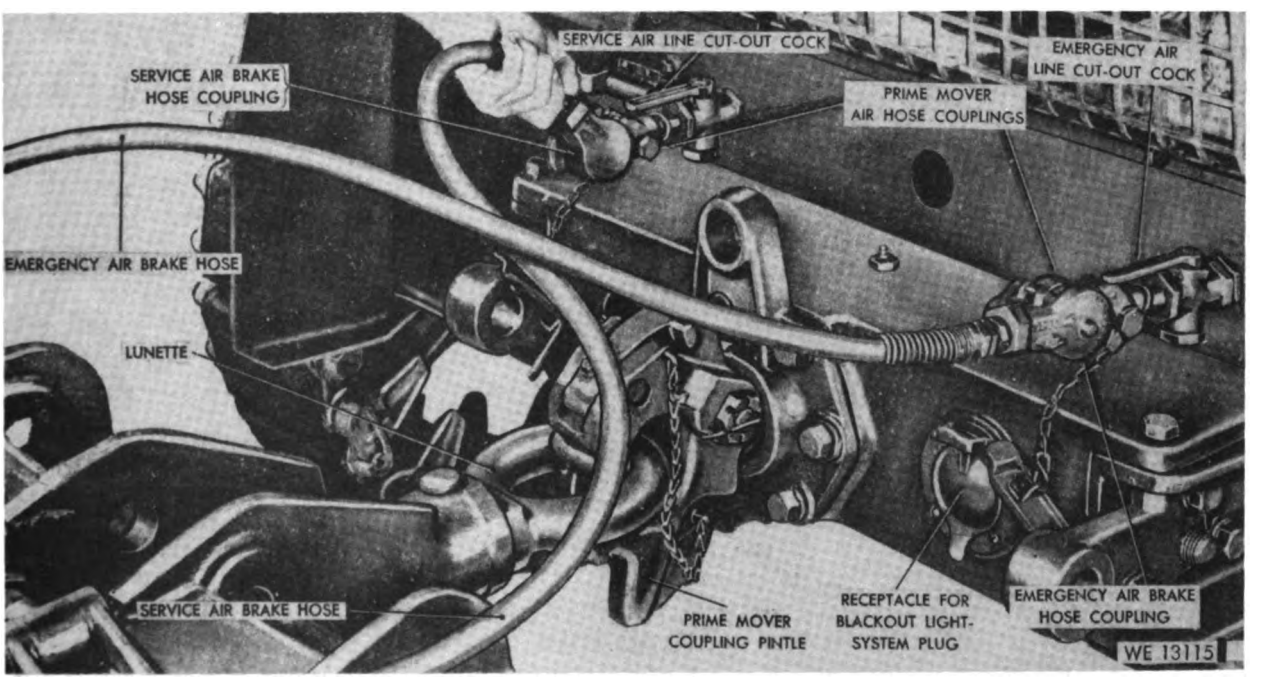


Figure 36. Uncoupling air brake hose from prime mover.

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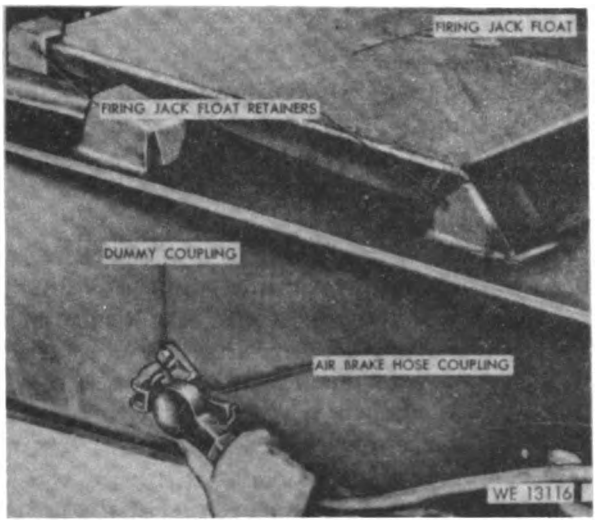


Figure 37. Attaching air brake hose coupling to dummy coupling on trail.

(fig. 2), disconnect the lunette from the prime mover coupling pintle (fig. 36), and lower the trails to the ground. Unload the primer mover and move it from the vicinity of the weapon.

Note. The M114 and M114A1 howitzer will be maneuvered into position by hand. When maneuvering the M123A1 howitzer proceed as in *b* through *d* below.

b. Installing the Caster Assembly and Drive Ring Assembly (M123A1 Howitzer).

(1) Remove the spade key with thumb knob and eye bolt from the spade key bracket (fig. 2), and lay it on top and near the end of the left trail. Remove caster assembly from prime mover and position caster assembly so the lug (fig. 40) fits into the spade slot provided on the bottom of the left trail with the

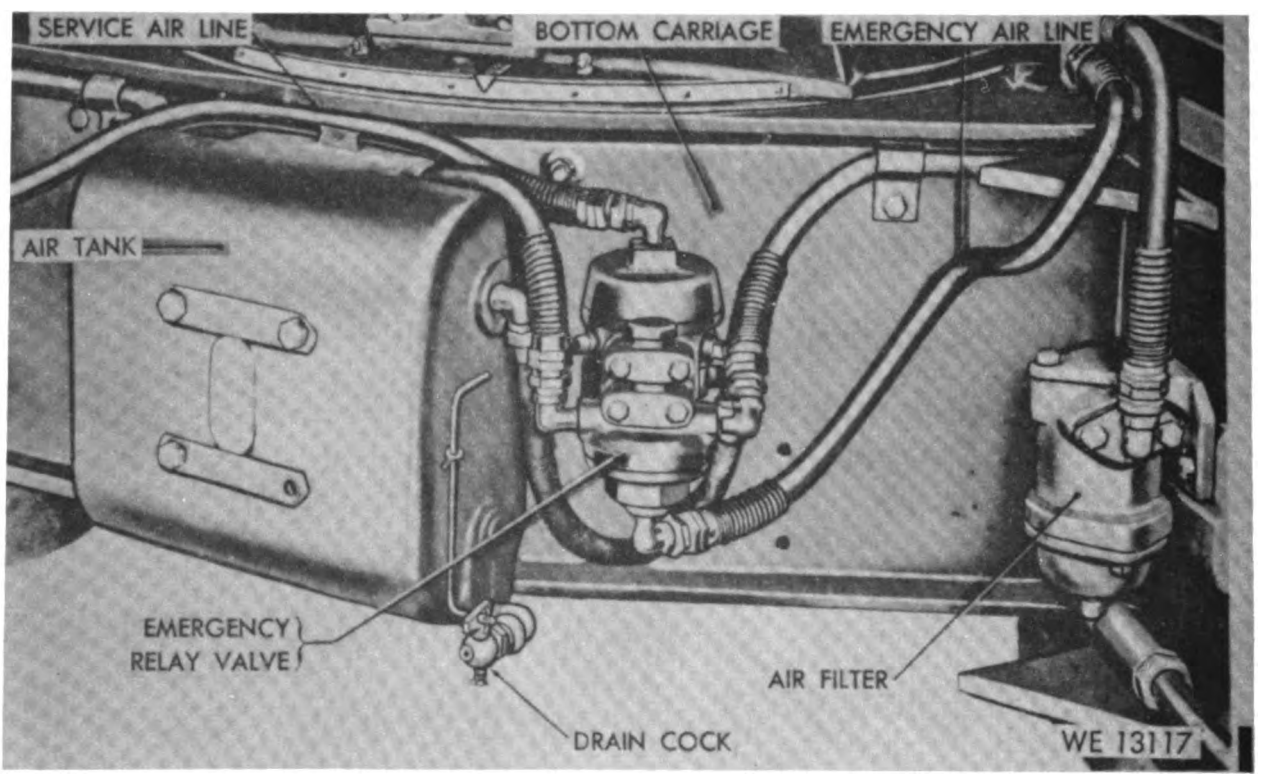


Figure 38. Emergency relay valve and air tank (guard removed).

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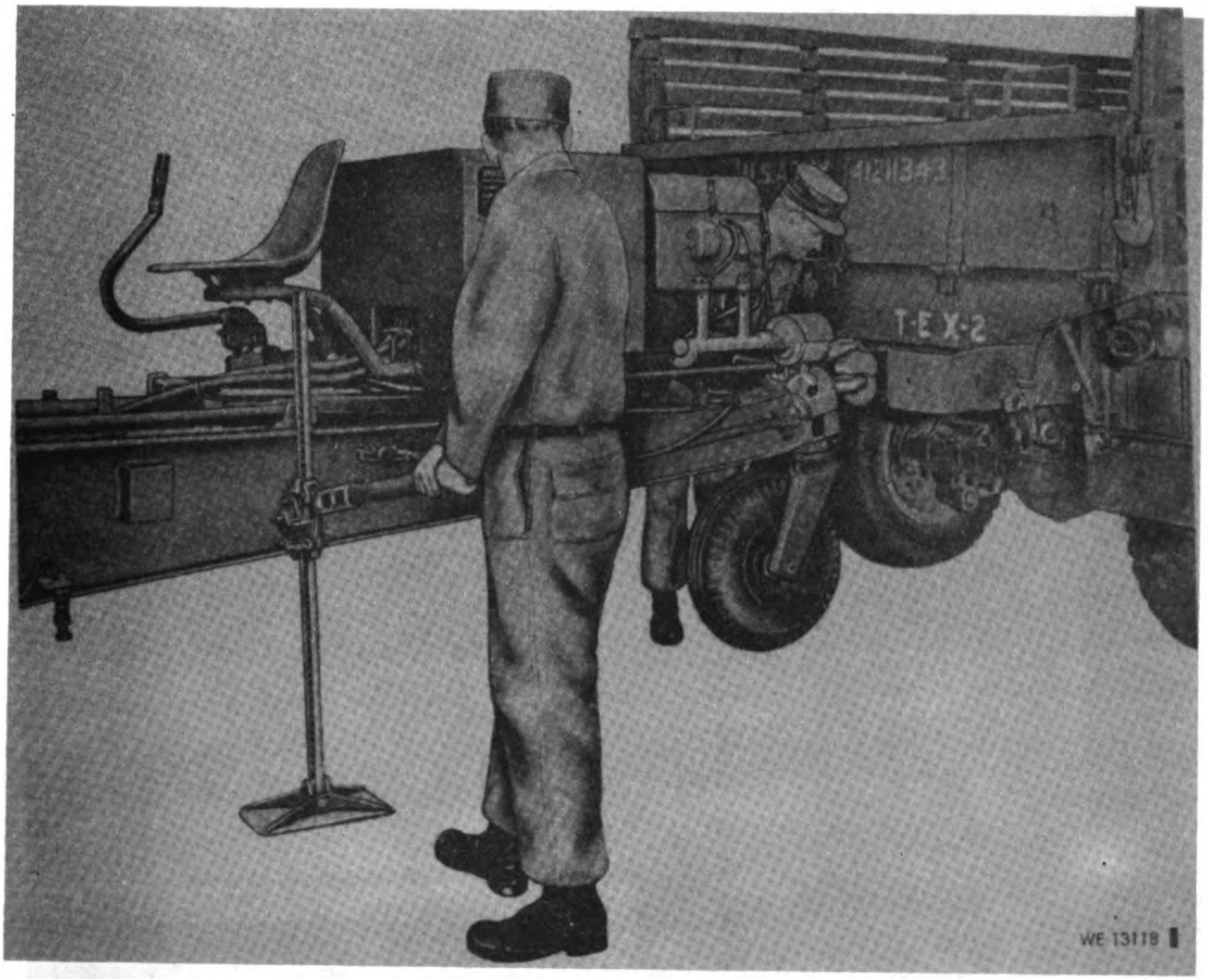


Figure 39. Removing or attaching howitzer from or to prime mover.

thickest part of the bracket to the rear; lock it in place with the spade key and knob on the eye bolt (fig. 41).

(2) Lower the trails with the trail jack until the caster assembly carries the weight of the trails. Place the jack in traveling position (fig. 30) and secure with the strap assembly.

(3) Inspect between the wheel drive unit and carriage wheel. If gear teeth are exposed, the drive ring assembly has been removed and must be installed before using auxiliary propulsion. For installation of the drive ring assembly, refer to paragraph 52*a*.

c. Using Auxiliary Propelled System to Place M123A1 Howitzer in Firing Position.

(1) *General.* The M123A1 howitzer is operated by a driver seated in front of the hydraulic power unit (fig. 4). A control stick, located directly in front of the driver's seat, allows the driver to regulate the pressure and flow of the hydraulic fluid from the pumps to the motors. A pair of foot rests on top of the trails supports the driver's feet. The engine is operated at full throttle with the governor set for a speed of approximately 3600 rpm.

Warning: Never operate the engine in an enclosed area unless

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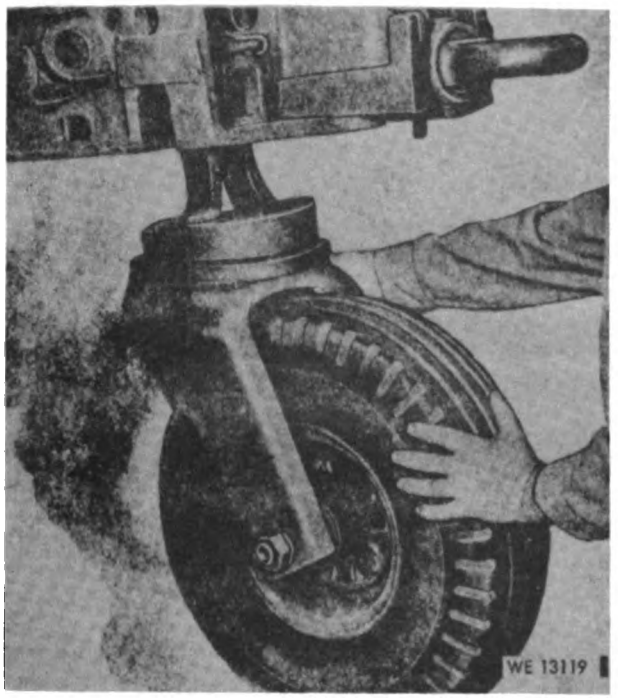


Figure 40. Installing or removing caster assembly.

the exhaust fumes are piped outside. Engine exhaust contains carbon monoxide and is deadly poisonous.

Caution: Do not operate engine with the governor disconnected or when it becomes inoperative as overspeeding will damage the engine. If the engine appears to be overspeeding, it must be stopped immediately. Also do not permit dirt to accumulate on the engine as dirt restricts the circulation of cooling air and will result in overheating.

(2) *Start engine* (above minus 25° F.).

(a) Release the four latches (fig. 42) and remove the hydraulic power (fig. 43).

Caution: Care must be exercised when removing cover to prevent damage to control linkages.

(b) Check fluid level of engine, transfer case, wheel drive units, and hydraulic tank assembly (paras 64 and 65).

(c) Check all oil drain plugs to be sure they are tightened securely.

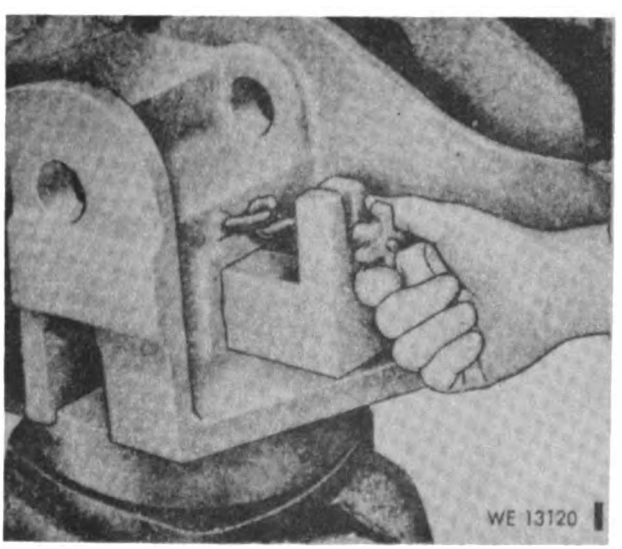


Figure 41. Securing or releasing spade key holding caster assembly.

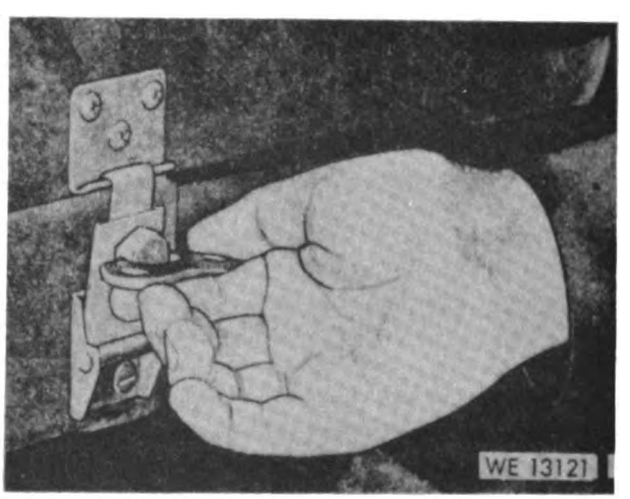


Figure 42. Releasing or fastening power unit cover fastener locks.

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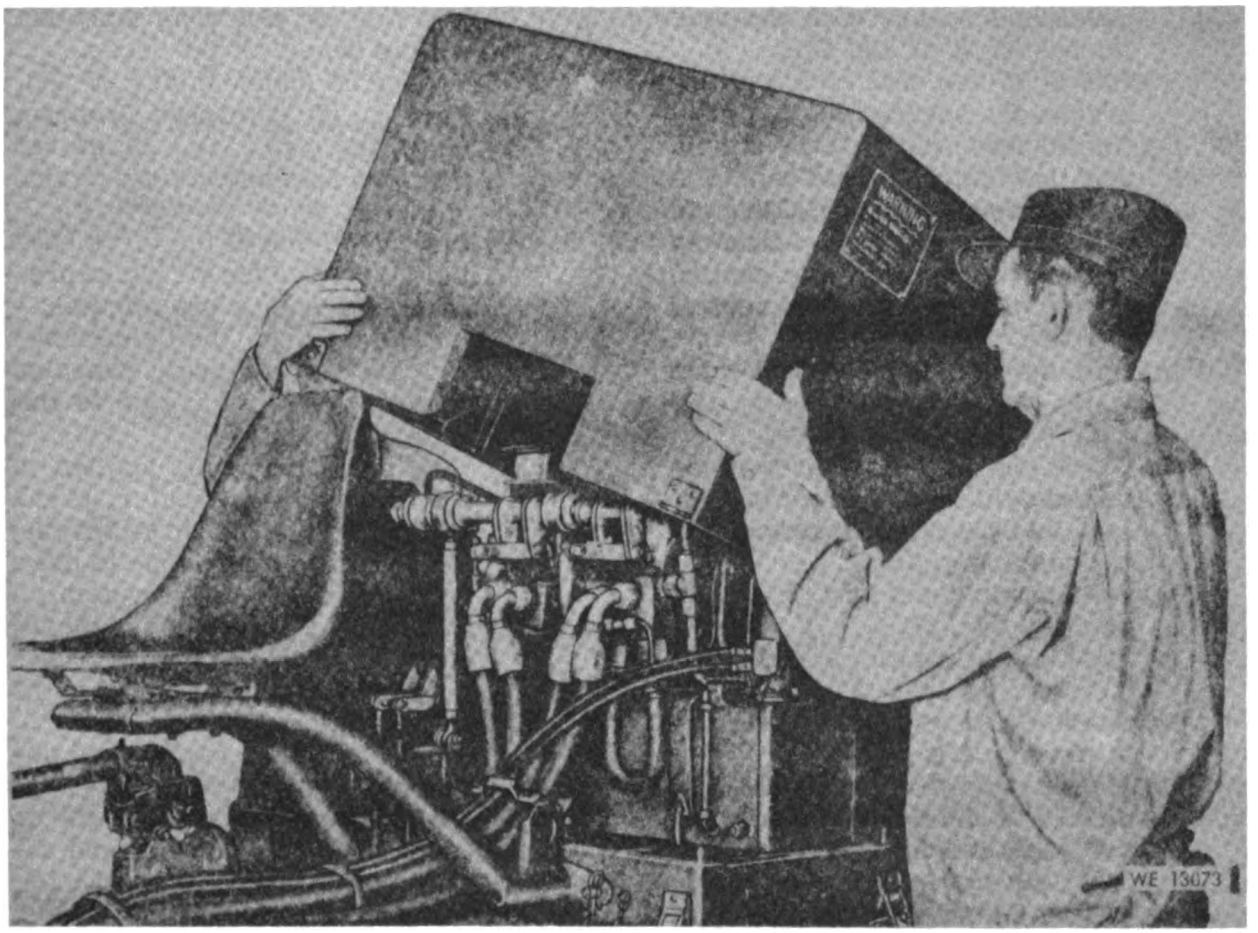


Figure 43. Removing or installing hydraulic power unit cover.

(d) Remove the gasoline suction pipe assembly from the gasoline can (fig. 44) and stow in the gasoline suction pipe assembly holder. Check fuel supply. If necessary, replace with a full can of gasoline. Replace the suction pipe assembly. Be sure gasoline is reaching the engine.

(e) Check air cleaner intake shutter on air cleaner for proper position (WINTER or SUMMER) (fig. 8).

(f) Check engine cover to be sure all latches are securely engaged (fig. 29).

(g) Check oil pan baffle rod for proper position (fig. 27).

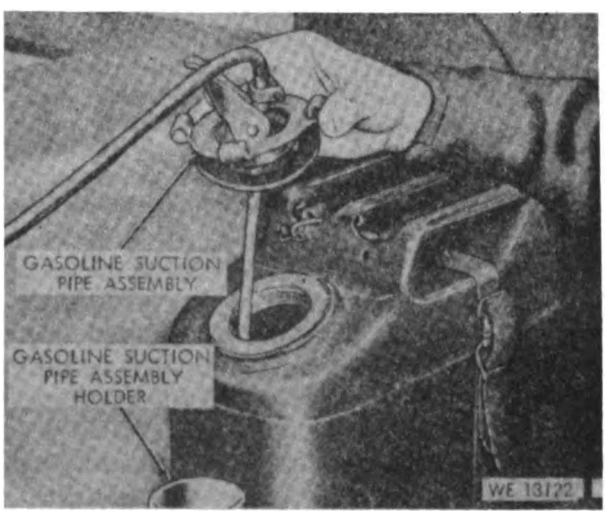


Figure 44. Removing or installing gasoline suction pipe assembly.

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(h) Replace the hydraulic power unit cover and secure with the four latches (figs. 42 and 43).

(i) Check to see that both parking brakes are set (fig. 3).

(j) Check each wheel drive unit to see that clutch control handle is in tow position (fig. 25). This will prevent the weapon from runaway on start-up should the control servo valve be out of its neutral position.

(k) Pull out the choke control cable which closes the choke valve (fig. 26).

(l) Crank engine two or three revolutions with the pull rope to draw fuel into the intake manifold and cylinders (fig. 45).

(m) Position to reset knob in the ON position (fig. 28).

(n) Position the ignition switch in the RUN position (fig. 22).

(o) Reduce choke to half-closed position (fig. 26).

(p) Position governor control on START & IDLE position and secure with locking screw (fig. 26).

(q) Start the engine by cranking with a firm steady pull on the pull rope (fig. 45). Do not use excessive force.

Note. Continuous cranking of the engine with the choke closed will flood the intake manifold and cylinders with gasoline. Under this condition it will be necessary to remove all spark plugs, dry, and replace them. A flooded condition is usually indicated by the presence of gasoline in the exhaust and by strong gasoline odors around the engine.

(r) After the engine starts running and as it warms up, reduce the amount of choke by pushing in on the choke control until it is fully closed. Also move the governor control (fig. 26) to GOVERN position and secure the locking screw.

(s) Apply the load after engine warms up and runs smoothly without benefit of the choke.

(3) *Start engine* (below minus 25° F.).

(a) Perform (2)(a) through (l) above.

(b) Ignite the gasoline blowtorch (fig. 34). See instructions on side of torch.

(c) Play the flame of the torch back and forth over the air intake preheater for one or two minutes.

Caution: Keep the flame moving. Do not overheat. Exercise care to avoid damage to the materiel.

(d) With heat still being applied to the air intake preheater, crank the engine two or three revolutions with the pull rope to draw fuel into the induction system.

(e) Position the reset knob in the ON position (fig. 28).

(f) Position the ignition switch in the RUN position (fig. 22).

(g) Reduce choke to half-closed position (fig. 26).

(h) Position governor control on START & IDLE position and secure with locking screw (fig. 26).

(i) Start the engine by cranking with a firm steady pull on the pull

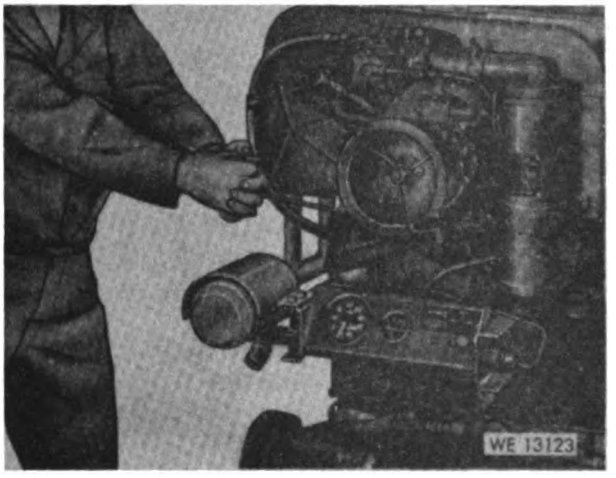


Figure 45. Starting gasoline engine with pull rope.

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rope (fig. 45). Do not use excessive force.

Note. If engine fails to start after several tires, apply heat to drive end of magneto and to the exposed surface of the oil pan for approximately five minutes. This will aid starting, particularly in extreme low temperatures. Also, continuous cranking will flood the intake manifold and cylinders with gasoline. See note (2) (q) above.

(*j*) When engine starts, remove heat and reduce amount of choke as engine warms up. Move governor control (fig. 26) to GOVERN position and secure with locking screw.

(*k*) Apply load after engine warms up and runs smoothly without benefit of the choke.

(4) *Driving the M123A1 howitzer.*

(*a*) Position each wheel drive unit clutch handle in DRIVE position (fig. 25). Clutch handle pin should spring into drive position in index hole. If pin does not engage proceed as follows:

1. Leave handle in drive position and rotate the wheel drive unit back and forth several times until engagement occurs.
2. If operation in (*a*) above does not engage pin, it will be necessary to obtain some slight movement of the gear train relative to the disengaged spur gear. This is accomplished by a small movement of the control stick in a turn position. The clutch handle is spring loaded and engagement will occur as soon as the gear teeth can mesh.

Note. In utilizing the above procedure, extreme care must be taken in applying a very small amount of movement with the control stick to minimize the possibility of gear clash.

(*b*) After both wheel drive unit clutch handles have been placed in drive position, howitzer can be driven.

(*c*) Release both handbrakes, depress the control stick hook (fig. 24), and lower the control stick; assume driving position and pull control stick upward to reengage stick.

(*d*) To move the howitzer forward, push the control stick forward (away from the driver) (fig. 46) and to move it backward, pull the stick back (towards the driver).

(*e*) To turn right while moving forward, push the control stick towards the right wheel. To turn left while moving forward, push the stick towards the left wheel (fig. 46). To pivot the weapon in a clockwise direction, move the control stick in a lateral direction to the right and to pivot it counterclockwise, move the stick laterally to the left.

Warning: **Only authorized personnel permitted to operate propulsion unit. Reduce speed when driving forward or backward down slopes to the extent that stability in steering is sensed by the operator. Weapon should be driven backward down slopes of 15 percent or more. Brake the weapon on slopes by moving the control stick in a direction opposite to motion of weapon. The control stick must be actuated with a smooth gradual motion.**

(*f*) Maneuver the howitzer into the desired firing position.

(*g*) Set the handbrakes (fig. 3).

(5) *Stop the engine.* To stop the engine, place the throttle control in the START & IDLE position and move the ignition switch to the OFF position (down).

d. Emplacement of M123A1 Howitzer.

(1) Remove the trail spades from the trail spade brackets on the trails (fig. 47) and place them on the ground near the positions they will occupy. Remove the remaining

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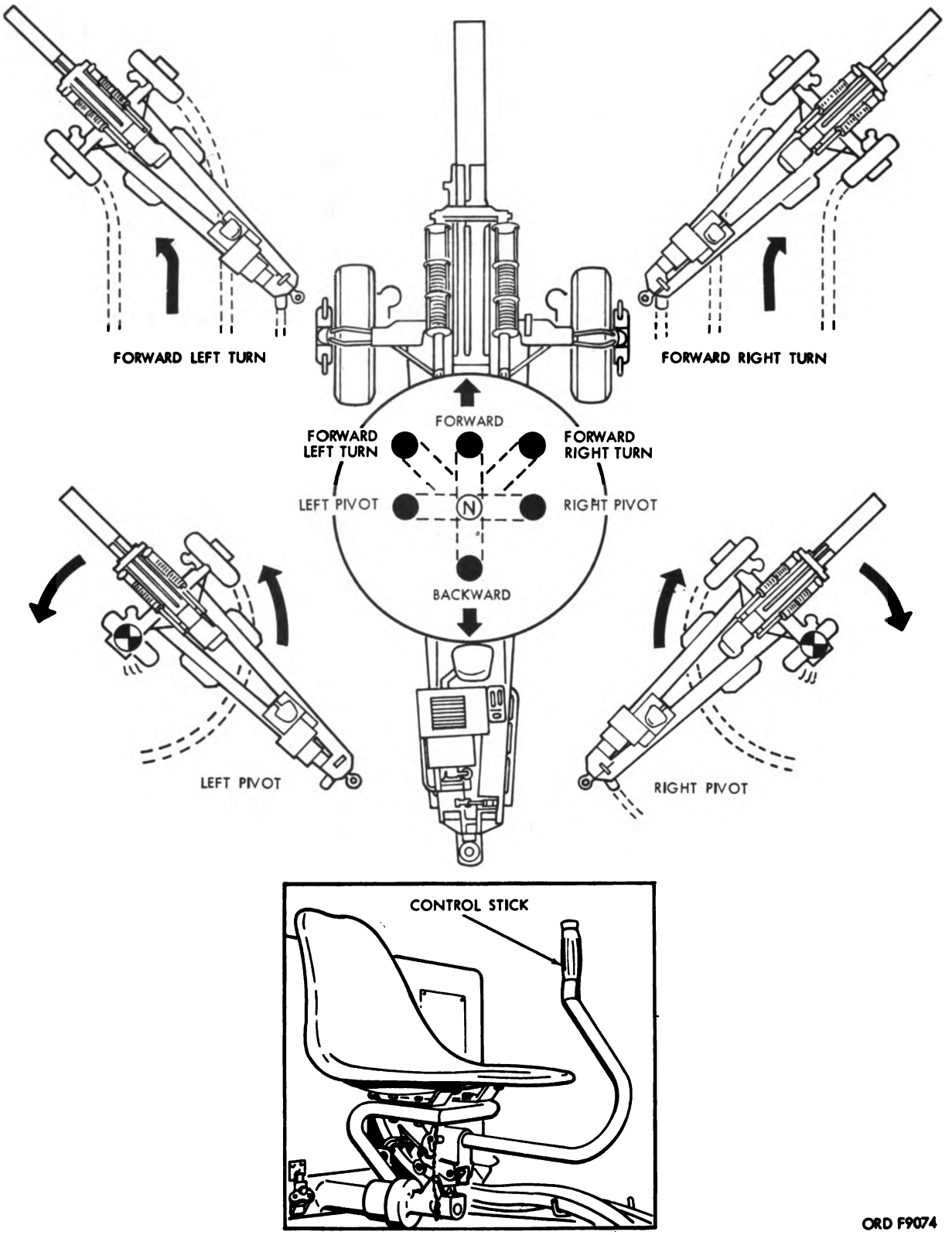


Figure 46. Howitzer driving control diagram.

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spade key from the spade key bracket (fig. 2) and lay it on top and near the end of the right trail. Remove the trail locking retainer pin and release the trail lock hook from the trail lock link by swinging the trail lock handle up (fig. 48).

Caution: **Do not allow the trail lock handle to swing past the vertical position (M32 only). (It will damage the air filter housing.)**

(2) Remove the weapons handling bars from their supports on top of the trails (fig. 47) and insert them in the weapons handling bar sockets (fig. 48) in the end of the trails. Break the trails and spread them sufficiently to remove the firing jack float (fig. 37) from retainers. In some cases, it will be necessary to place the end of the weapons handling bar between the ends of the trail and use it as a lever to break the trails apart. Place the firing jack float in front of the weapon. Spread the trails to their fully open position (fig. 49).

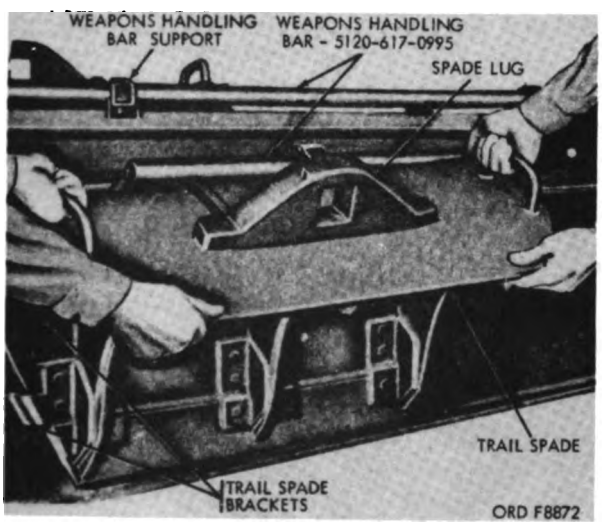


Figure 47. Removing trail spade from brackets on side of trail.

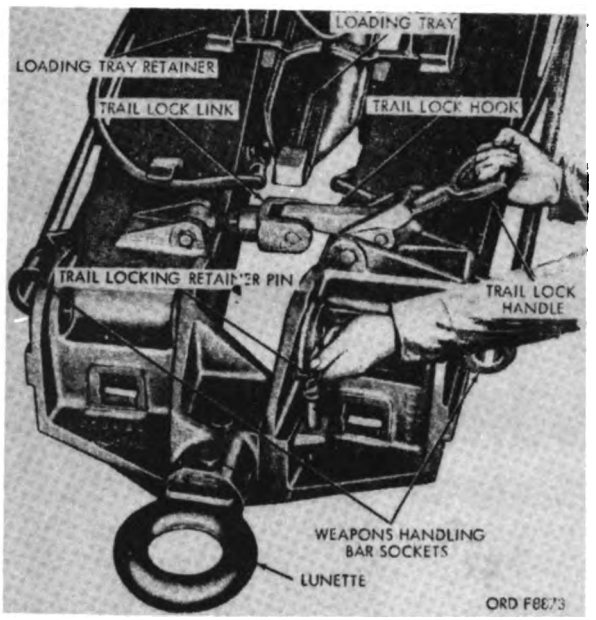


Figure 48. Releasing trail lock and removing trail locking retainer pin.

(3) Release the trail jack assembly from the strap on the left trail (fig. 30), swing it into position, and raise the trails until the caster assembly clears the ground (fig. 50). Release the knob and eye bolt and remove the spade key (fig. 41) and caster assembly (fig. 40) from the trail. Stow the caster assembly in the prime mover.

(4) Position the trail spade for each trail so that the spade lug (fig. 47) fits into the slot provided on the bottom of each trail and lock them in place with the spade keys (fig. 51). Mark the outlines of the pits for the trail spades and dig the pits.

(5) Using the trail jack assembly. lower the trail spades into the pits. Secure the jack assembly to the rail (fig. 30).

Note. **The horizontal floats of the trail spades (fig. 51) should be level with the top of the ground.**

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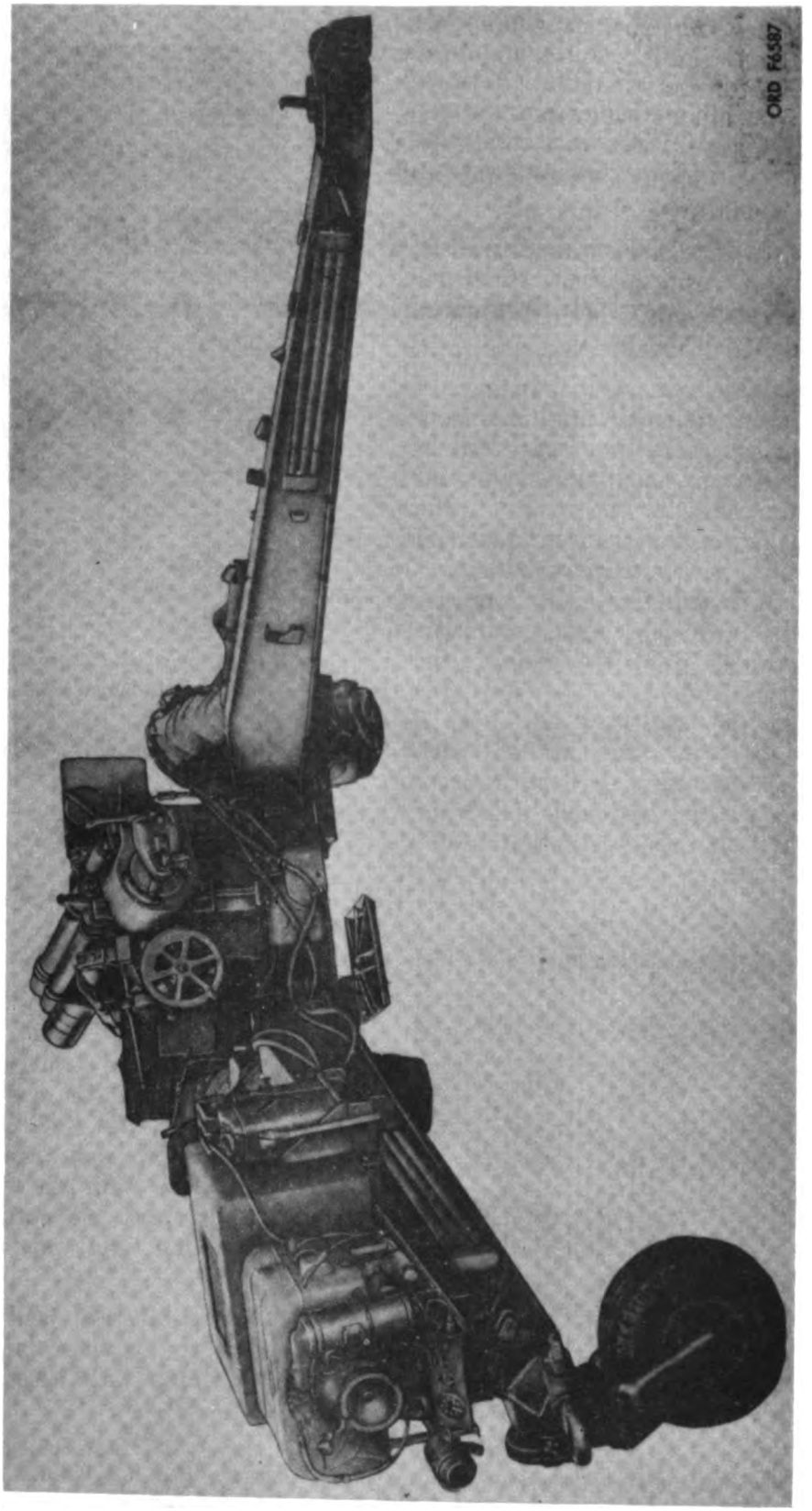


Figure 19. Howitzer with trails spread.

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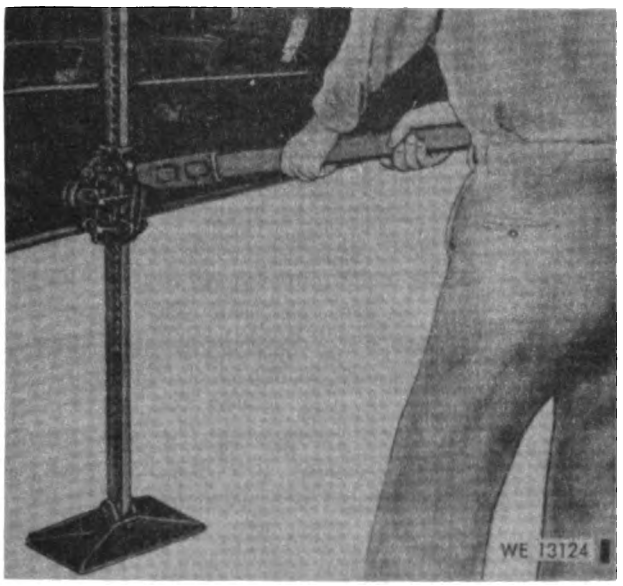


Figure 50. Raising the trails with trail jack assembly.

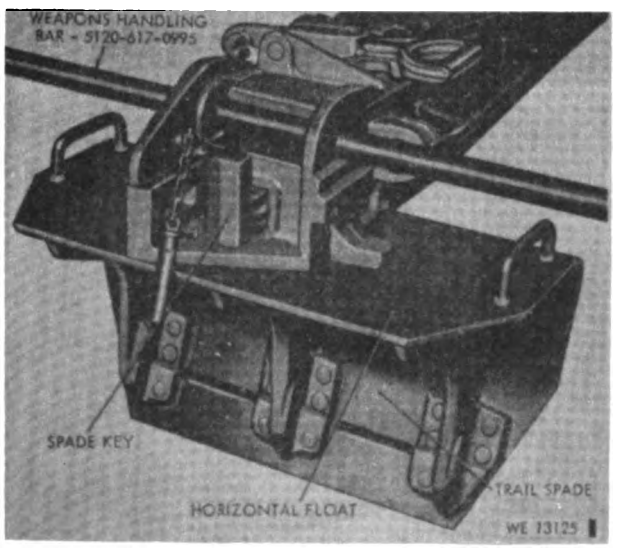


Figure 51. Trail spade installed on end of trail.

(6) Remove the ball locking pin securing the control stick in the socket assembly of the control linkage, and remove stick and stow in prime mover (fig. 52).

(7) Remove the lockpin securing the driver's seat to the power unit frame, and remove the seat and stow in the prime mover (fig. 53).

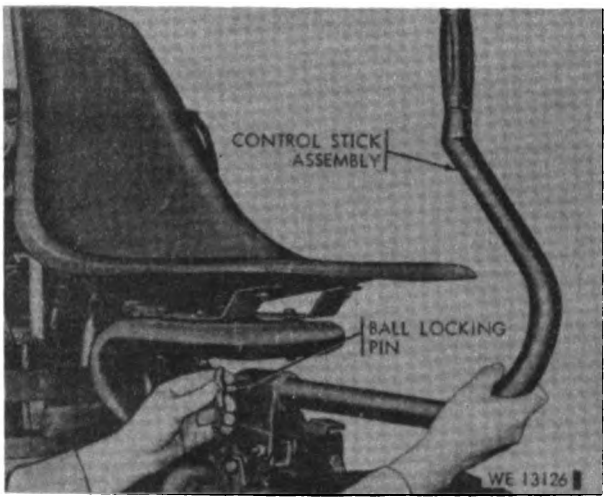


Figure 52. Removing or installing the control stick assembly.

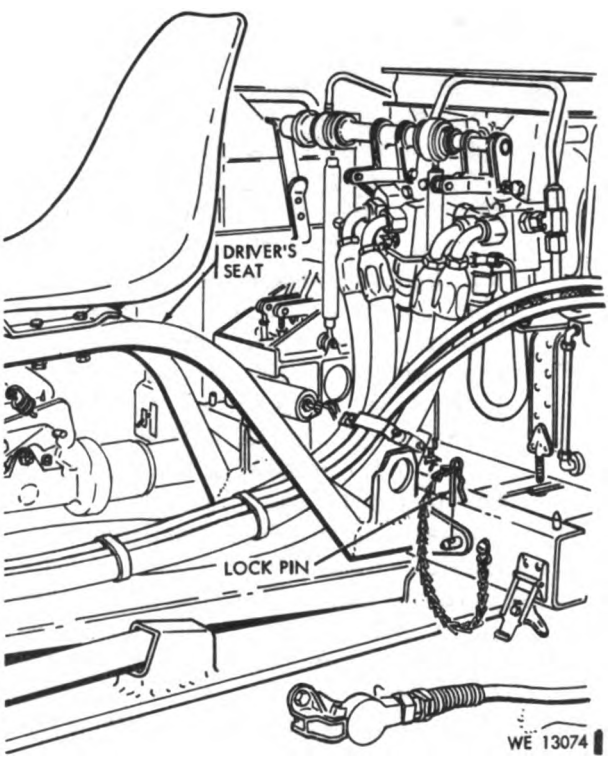


Figure 53. Removal or installation of driver's seat.

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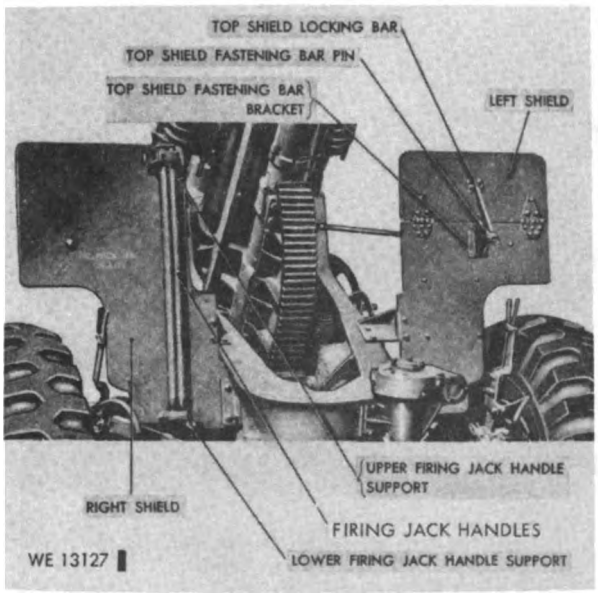


Figure 54. Right and left shields.

(8) Remove the telescope from the panoramic telescope case on the rear of the left shield and lock it in position in its mount (para 41*a*(1) and (2) and *b*(1)). Release the top shield locking bar from the top shield fastening bar bracket (fig. 54) by removing the top shield fastening bar pin. Then lower the top portion of the left shield, and lock it in the lowered position by reinserting the fastening bar pin through the holes in the fastening bar bracket and locking bar.

(9) Raise carriage M1A2 and M32 firing jack as follows:

(a) Release the firing jack bracket pin safety snap from the firing jack bracket pin and remove the pin from the firing jack bracket (fig. 55). With two men lifting the firing jack body handles, withdraw the traveling lock and firing jack locking pin and raise the firing jack hanger to unlatch it.

(b) Swing the firing jack down to the limit of its travel. Insert the bracket pin in the holes in the firing jack bracket and firing jack rear lug (fig. 55) and turn the pin one-quarter turn to lock it in place. Snap the safety snap to the bracket pin to keep the pin in its locked position. Insert the traveling lock and firing jack locking pin in the firing jack hanger. Place the firing jack float under the firing jack.

(c) Release and lower the traveling lock by releasing the traveling lock locking pin safety snap, removing the traveling lock locking pin (fig. 55), and elevating the weapon (para 17).

(d) Move the firing jack ratchet pin (fig. 56) toward the firing jack

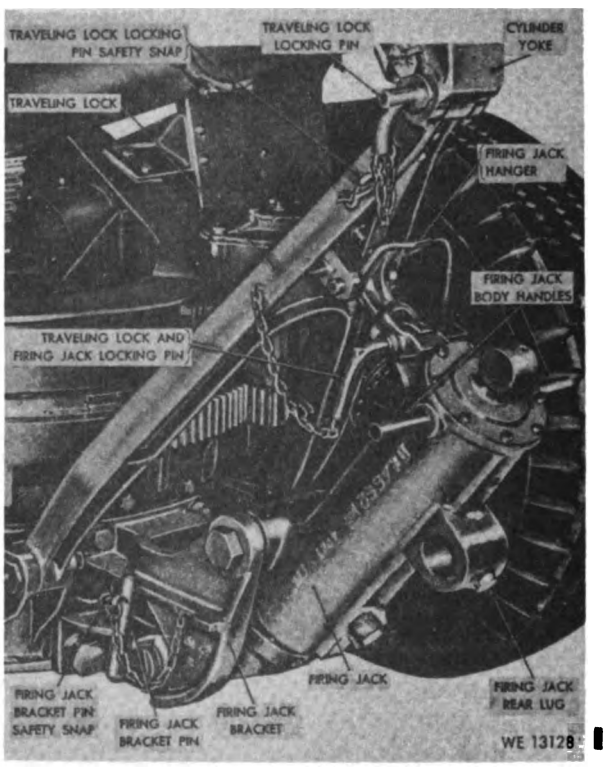


Figure 55. Carriage M1A2 and M32 firing jack and traveling lock—traveling position.

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ratchet plunger as far as it will go. Rotate the firing jack ratchet body clockwise to lower the firing jack ratchet plunger under the flat side ball at its lower end is a few inches above the socket in the center of the firing jack float (fig. 57). Lift the float into position on the lower end of the firing jack plunger, and lock it in place by rotating the float one-quarter turn.

(e) Remove the firing jack handles from the upper and lower firing jack handle supports on the front of the right shield (fig. 54), and insert them in the firing jack handle sockets in the ratchet body (fig. 56). Operate the firing jack handles horizontally until the tires clear the ground.

CAUTION

If the firing jack plunger reaches the fully extended position, care must be exercised to avoid breakage of the firing jack stop.

(f) Aline the firing jack ratchet plunger directly over the firing jack plunger stop (fig. 56) by moving the ratchet body counter-clockwise, and depress the ratchet plunger to engage the stop (fig. 57).

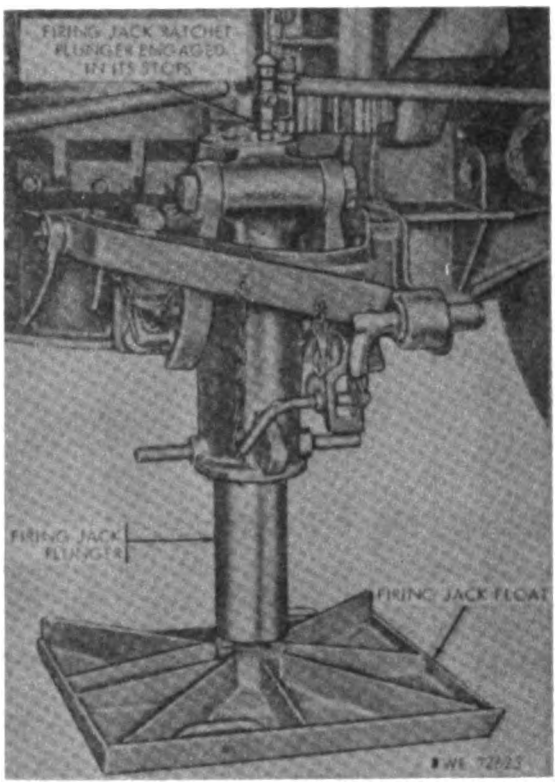


Figure 57. Carriage M1A2 and M32 firing jack and traveling lock—firing position.

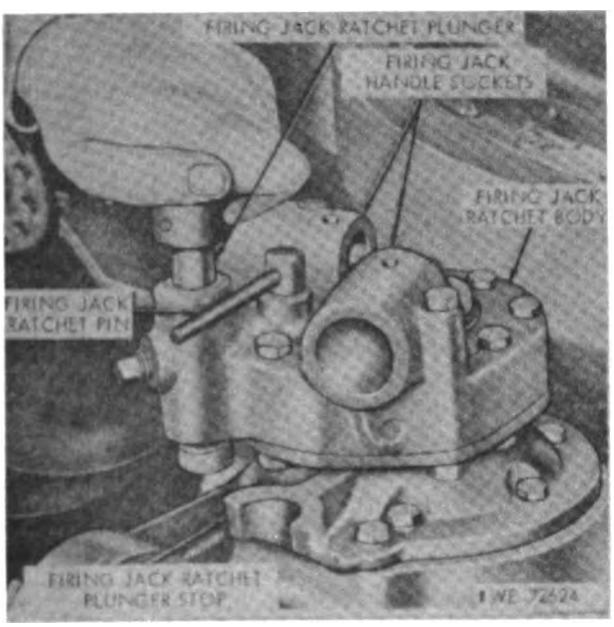


Figure 56. Rotating carriage M1A2 and M32 firing jack ratchet body.

CAUTION

The firing jack ratchet pin must be in its position nearest to the firing jack ratchet plunger, with the ratchet plunger engaged in its stop, in order to lock the firing jack in firing position.

(g) The weapon is then in firing position (fig. 57).

(10) Raise carriage M1A1 on firing jack as follows:

(a) Turn the two firing jack ratchet plunger handles (fig. 21 and 58) until the arrows inscribed upon them are pointed downward. Release the firing plunger locking lever by removing the safety snap on the locking lever chain from the hasp staple welded to the left firing jack keyway cover (fig. 58). Remove the locking lever from the firing jack housing, and install the safety

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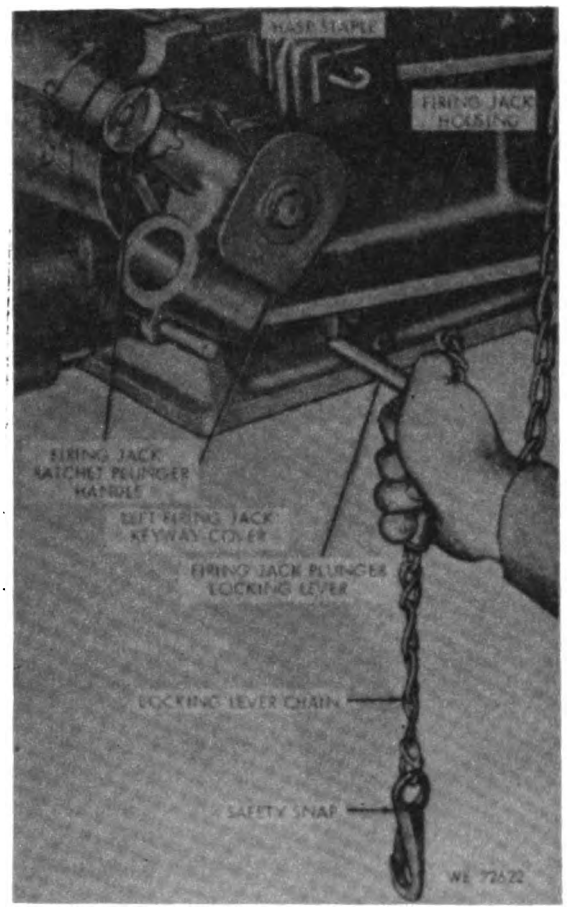


Figure 58. Carriage M1A1 firing jack—firing jack plunger locking lever.

snap on the hasp staple. By means of the firing jack ratchet case handles (fig. 59), lower the firing jack rack plunger (fig. 21), and remove the firing jack housing bottom cover from the ball on the end of the rack plunger by turning the cover one-quarter turn.

(b) Place the firing jack float (fig. 60) under the firing jack rack plunger and continue lowering the rack plunger until the flatsided ball on its lower end is a few inches above the socket in the center of the firing jack float. Lift the float into position on the lower end of the rack plunger, and lock it in place by rotating the float one-quarter turn.

(c) Remove the firing jack handles (fig. 54) from the upper and lower firing jack handle supports on the front of the right shield, and insert them in the firing jack ratchet case sockets (fig. 21). Operate the firing jack handles vertically to raise the carriage until the rack plunger is lowered to the limit of its travel.

WARNING

The firing jack handles may slip out of the sockets.

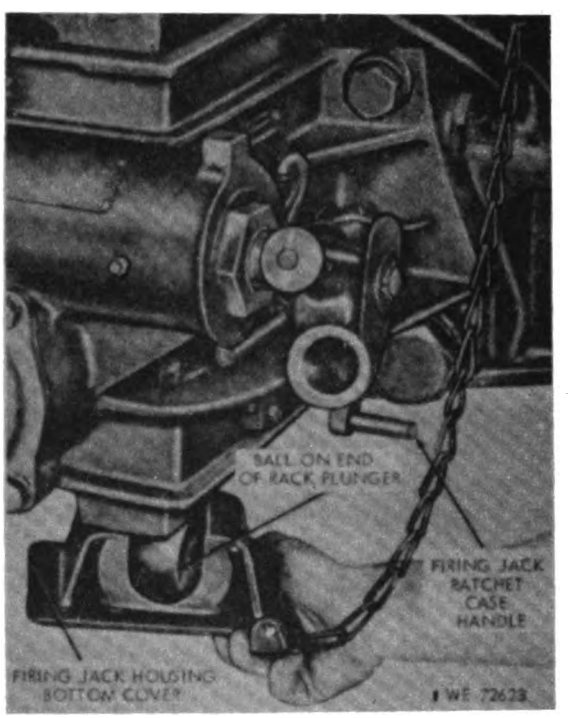


Figure 59. Carriage M1A1 firing jack—removing firing jack housing bottom cover.

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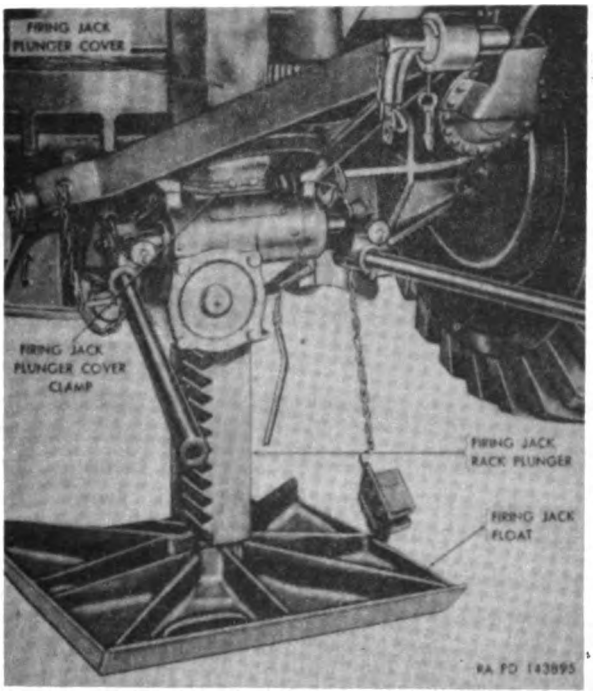


Figure 60. Carriage M1A1 firing jack and traveling lock—firing position.

(*d*) Remove the firing jack key from the firing jack key pocket (fig. 21), lift the spring-loaded firing jack keyway cover on the right side of the firing jack housing, and insert the key (fig. 61). Then turn the firing jack ratchet plunger handles until the arrows inscribed on them are pointed upward; lower the carriage (raise the rack plunger) until the top of the plunger contacts the firing jack key. This will take the weight of the weapon off the firing jack mechanism.

(*e*) Release and lower the traveling lock (fig. 21) by releasing the traveling lock locking pin safety snap, removing the traveling lock locking pin, and elevating the weapon (par. 17).

Note. The traveling lock should not be released until the weapon has been raised on the firing jack, as the lowered traveling lock will interfere with the jacking operation.

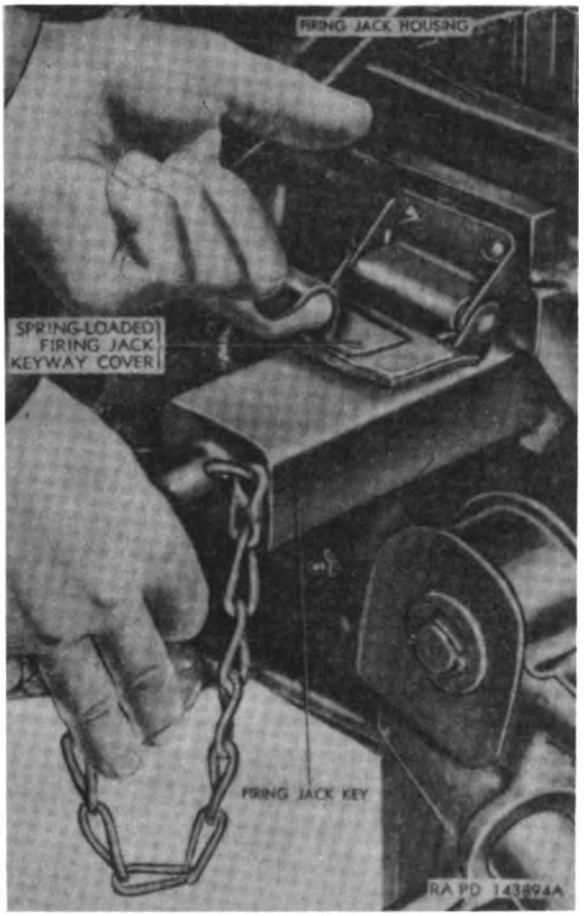


Figure 61. Carriage M1A1 firing Jack—inserting firing jack key.

(11) Remove the loading tray from the right shield (fig. 62) of the M123A1 howitzer.

e. Emplacement of M114 and M114A1 Howitzers.

(1) Remove the trail spades from the trail spade brackets on the trails (fig. 47) and place them on the ground near the positions they will occupy. Remove the spade keys from the spade key bracket (fig. 2) and lay them on top and near the ends of the trails. Remove the trail locking retainer pin and release the trail lock hook from the trail lock link by swinging the trail lock handle up (fig. 48).

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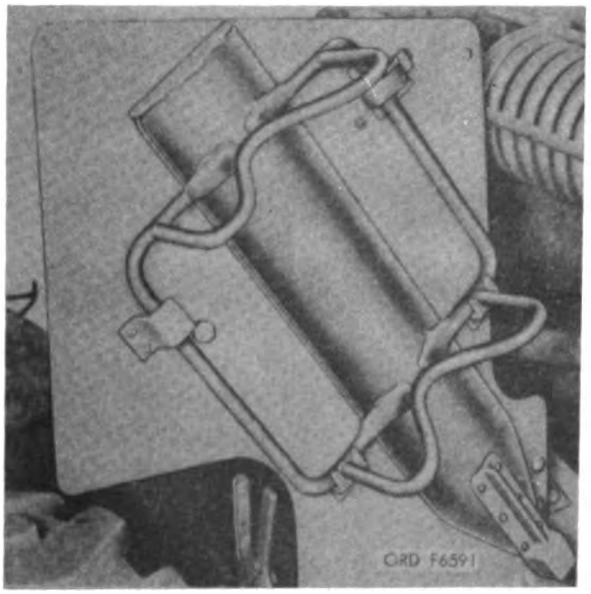


Figure 62. Loading tray stowed on right shield.

(2) Remove the weapons handling bars from their supports on the top of the trails (fig . 47) and insert them in the weapons handling bar sockets (fig. 48) in the end of the trails. Spread the trails sufficiently to remove the firing jack float (fig. 37) and loading tray (fig. 48) from between the trails. In some cases it may be necessary to pry the trails apart with the weapons handling bar. Place the firing jack float in front of the weapon. Spread the trails to their fully open position.

(3) Insert the handling bar horizontally through the two holes in the end of each trail (fig. 51). Lift the two trails simultaneously, position the trail spade for each trail so that the space lug (fig. 47) fits into the slot provided on the bottom of each trail, and lock them in place with the spade keys (fig. 51). Mark the outlines of the pits for the spades, close the trails sufficiently to clear the outlines, and dig the pits for the spades.

(4) Spread the trails simultaneously anc lower the spades into the pits. Remove the handling bar from the trails.

Note. The horizontal floats of the trail spades should be level with the top of the ground.

(5) Refer to 39*d*(9) and (10) above for remaining emplacement procedures.

f. To Operate Breech Mechanism..

(1) *Open breech.*

(*a*) Pull the firing mechanism locking plunger handle to the rear to unlock the firing mechanism, rotate *counterclockwise*, and remove the firing mechanism M1 from the housing in the housing adapter (fig. 63). The firing mechanism safety latch 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 breechlock is fully closed and locked.

Caution: **Removal of firing mechanism safety latch plunger (fig. 64) and failure to assemble before firing can cause the breechblock to blow open, with resultant serious injury to personnel. This practice is strictly prohibited.**

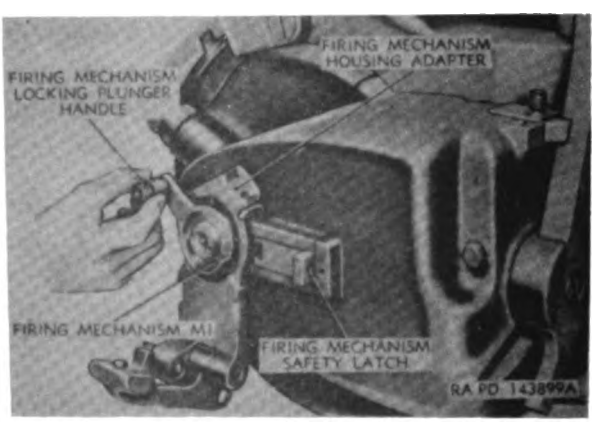


Figure 63. Removing firing mechanism M1 from firing mechanism housing adapter.

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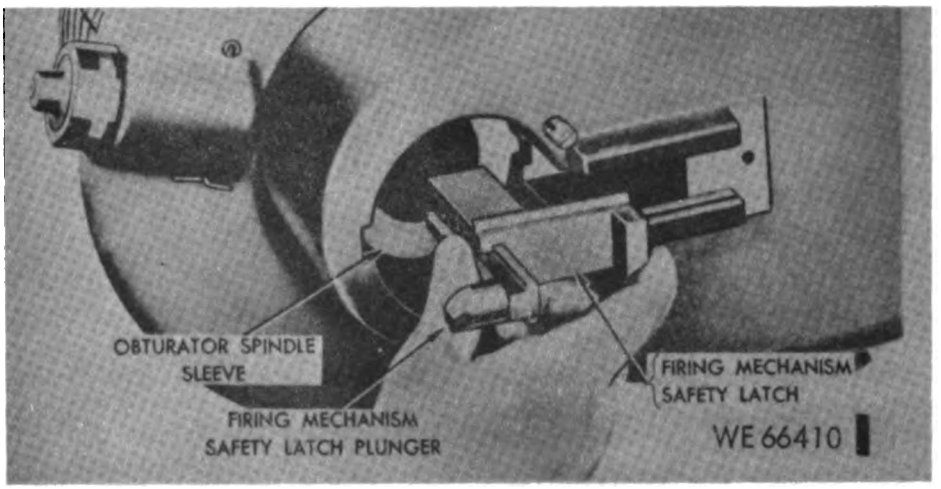


Figure 64. Removing or installing firing mechanism safety latch and plunger.

(b) With the left hand, move the breechblock operating handle latch to the left (fig. 65); with the right hand, pull the breechblock operating handle backward and rotate downward as far as it will go (fig. 66). Then swing the breechblock operating handle to the right to open the breech (figs. 20 and 66).

(2) *Close breech.* Swing the breechblock operating handle horizontally to the left. When the breechblock rotating roller enters the breechblock rotating cam (fig. 66), swing the operating handle upward and forward until the operating handle latch locks the operating handle in its upright position (fig. 65).

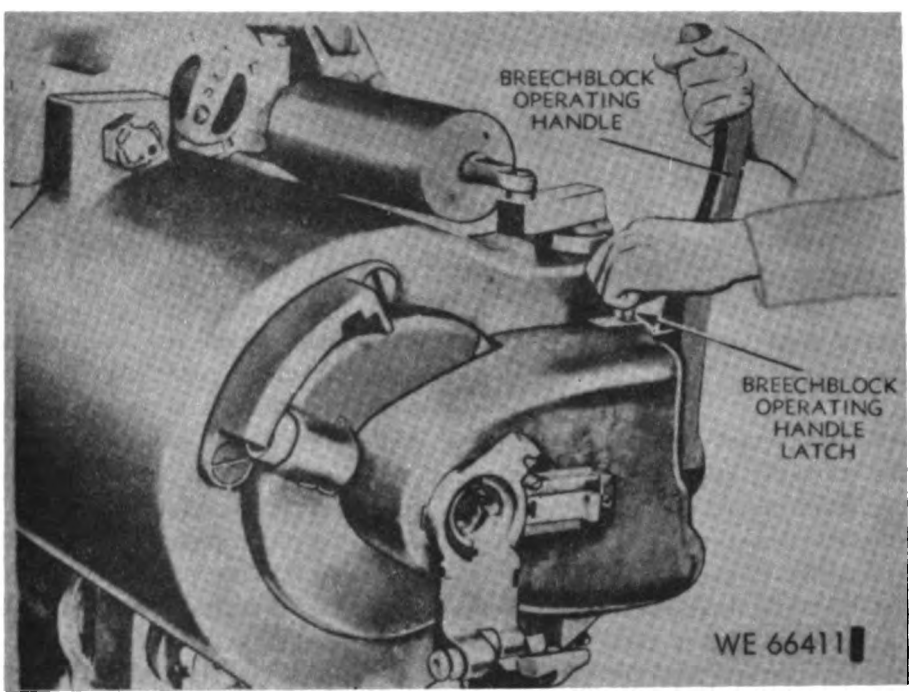


Figure 65. Releasing breechblock operating handle.

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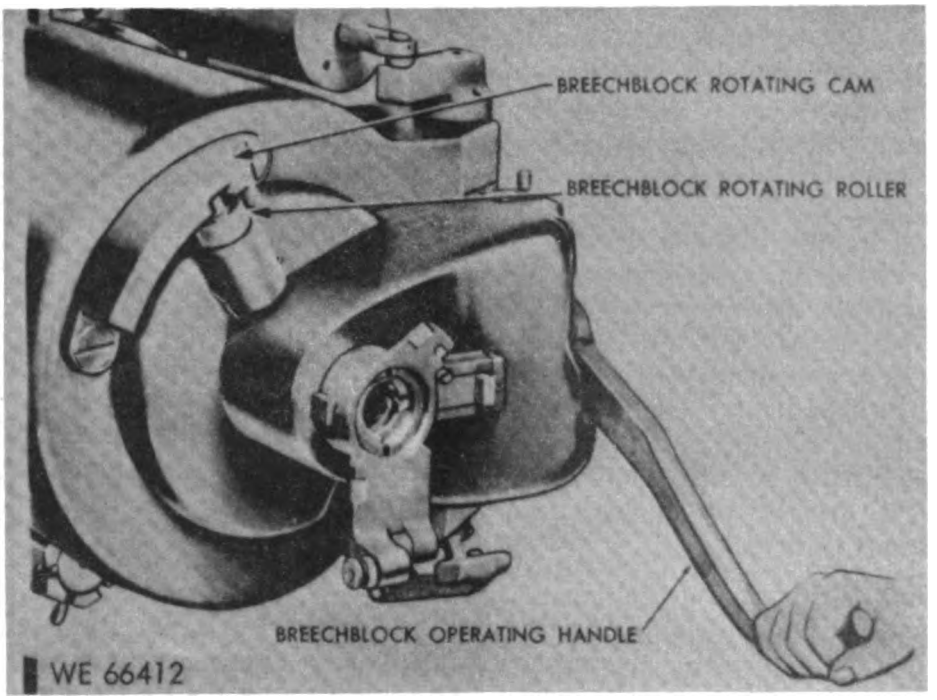


Figure 66. Opening breech.

g. To Traverse.

(1) The howitzer and top carriage cannot be traversed until the trails have been spread (*d*(2) above). Make no attempt to force the mechanism with the trails closed.

(2) Turn the traversing mechanism handwheel assembly (11, fig. 23) clockwise to traverse the cannon and top carriage to the right and turn the handwheel assembly counterclockwise to traverse the cannon and top carriage to the left. Approximately 84 turns of the handwheel assembly will traverse the weapon from one side to the other of its range of traverse.

h. To Elevate.

(1) The howitzer cannot be elevated or depressed until the traveling lock has been released (*d*(9) (*c*) above). Make no attempt to force the mechanism while the traveling lock is fastened to the cylinder yoke (figs. 21 and 55).

(2) Turn the elevating mechanism handwheel assembly (9, fig. 23) clockwise to elevate the cannon and recoil mechanism and turn the handwheel assembly counterclockwise to lower the cannon and recoil mechanism. Approximately 78 turns of the handwheel assembly will move the weapon through its range of elevation.

i. Prefiring Preparations.

(1) *Check replenisher hydraulic fluid reserve.*

(a) Pull the replenisher piston guide plug out of the rear of the replenisher (fig. 67). 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.

(b) 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 fluid reserve in the replenisher.

(c) When the end of the piston is within 3½ inches of the rear face of the replenisher, it indicates too much reserve fluid. Fluid 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.

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

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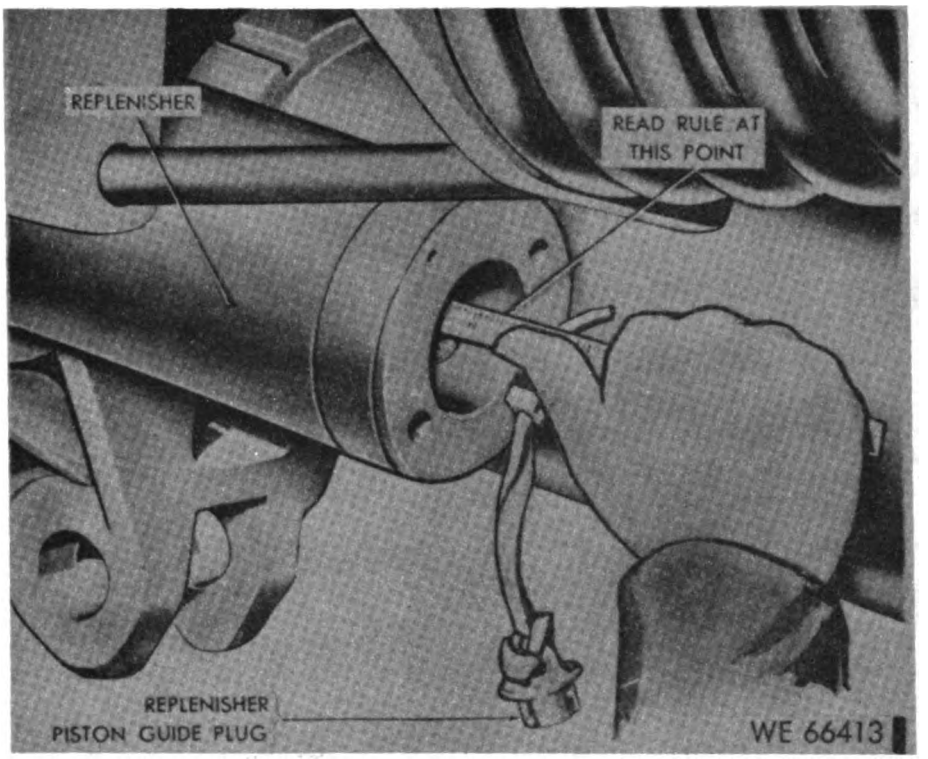


Figure 67. Measuring replenisher fluid reserve.

NOTE

When rapid fire is to take place, release fluid 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 fluid and bring the piston quickly to its normal position.

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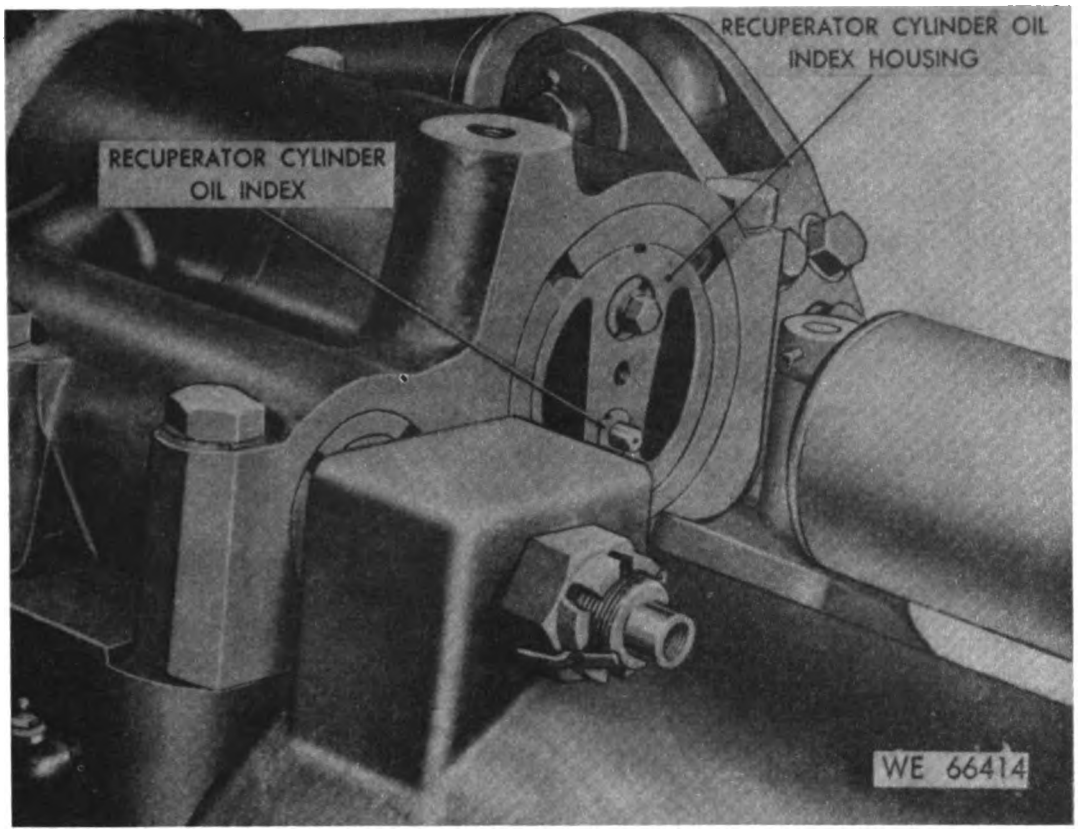


Figure 68. Recuperator cylinder.

(2) *Check recuperator cylinder hydraulic fluid reserve.*

(a) Drain and re-establish fluid reserve (para 94*f*), observing movement of oil index (fig. 68).

(b) If a reserve of fluid is present, the oil index will protrude between 1/4 and 3/8 inch beyond the rear face of the housing. The recuperator fluid reserve is dangerously low if the oil index is withdrawn to less than 1/4 inches beyond the rear face of the housing. If the oil index is at less than minimum protrusion, fluid should be added to establish the proper reserve (para 94*f*).

(3) *Check pins in variable recoil cam shaft.* The large ½-inch pin must be installed in the variable recoil connecting rod and variable recoil shaft at the forward (muzzle

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end) of the cam shaft (fig. 69). The smaller 1/4-inch pin must be installed in its bracket at the rear and below the variable recoil cam shaft.

Note. When firing M454 projectile, refer to paragraph 40 below.

Caution: **The weapon cannot be elevated with both large and small pins installed in the variable recoil cam shaft.**

(4) *Level trunnions.* When the weapon is in firing position, the trunnions of the howitzer must be approximately level as judged by eye. To level the trunnions, lower one or the other trail by digging the spade pit deeper and removing earth from under the end of the trail and the horizontal float of the spade, as required. If necessary, dig clearance for the wheels until both wheels are lifted free of the ground by the firing jack. The ground under the firing jack float must be made approximately level.

Note. Precise leveling of the trunnions is not essential. Any error due to a cant of the trunnions, which is so slight that it cannot be observed without instruments, will be within the limits of accuracy of fire.

40. Preparation of Weapon for Firing M454 Projectile

a. Proceed as directed in paragraphs 89*a* through *h* above.

b. To provide for firing the M454 projectile, proceed as follows:

(1) Dig a recoil pit dependent on traverse and elevation limits of weapon, to recoil 60 inches at all elevations.

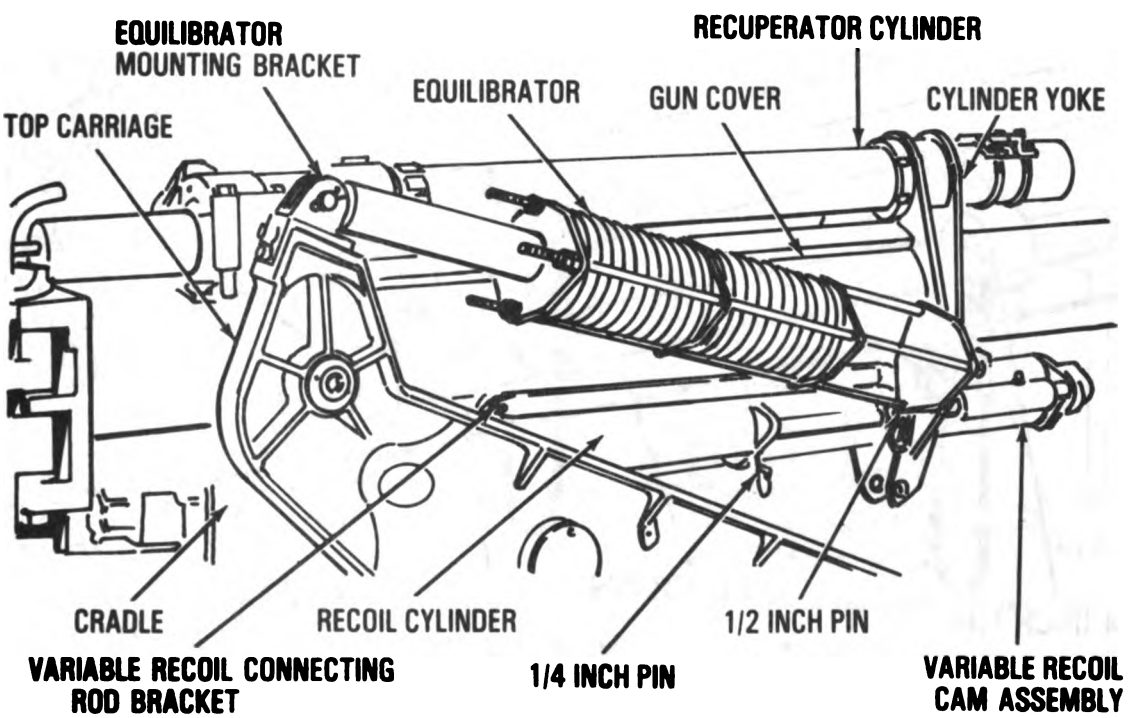


Figure 69. Recoil mechanism, mounted on carriage—right side view.

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(2) Bring the howitzer to 0° quadrant elevation and install the 1/4–inch pin in the drilled hole at the rear of the variable recoil cam shaft (fig. 70). Install the 1/2–inch pin in the bracket on the variable recoil connecting rod.

(3) The variable recoil is then locked out allowing maximum recoil at all degrees of elevation.

Note. To return recoil. mechanism to its normal recoil operating condition, position howitzer at 0° elevation and follow procedure in paragraph 39i(3) above.

40.1. Operation of M90 Chronograph

Refer to TM 9-1290-359-12&P.

40.2. Operation of BCS Gun Assembly

Refer to TM 11-7440-283-12-1, TM 11-7440-283-12-2, and TM 11-5820-882-10.

41. Preparation for Operation of Sighting and Fire-Control Materiel

a. Removal of Panoramic Telescope M12A7Q from Case.

(1) Open the panoramic telescope case, located on the back of the left shield of the howitzer carriage (fig. 2). To remove the telescope from its holder on the telescope cover, turn the telescope holder wing knob against its spring pressure as far as it will go and lift panoramic telescope straight up and out of the holder (fig. 71).

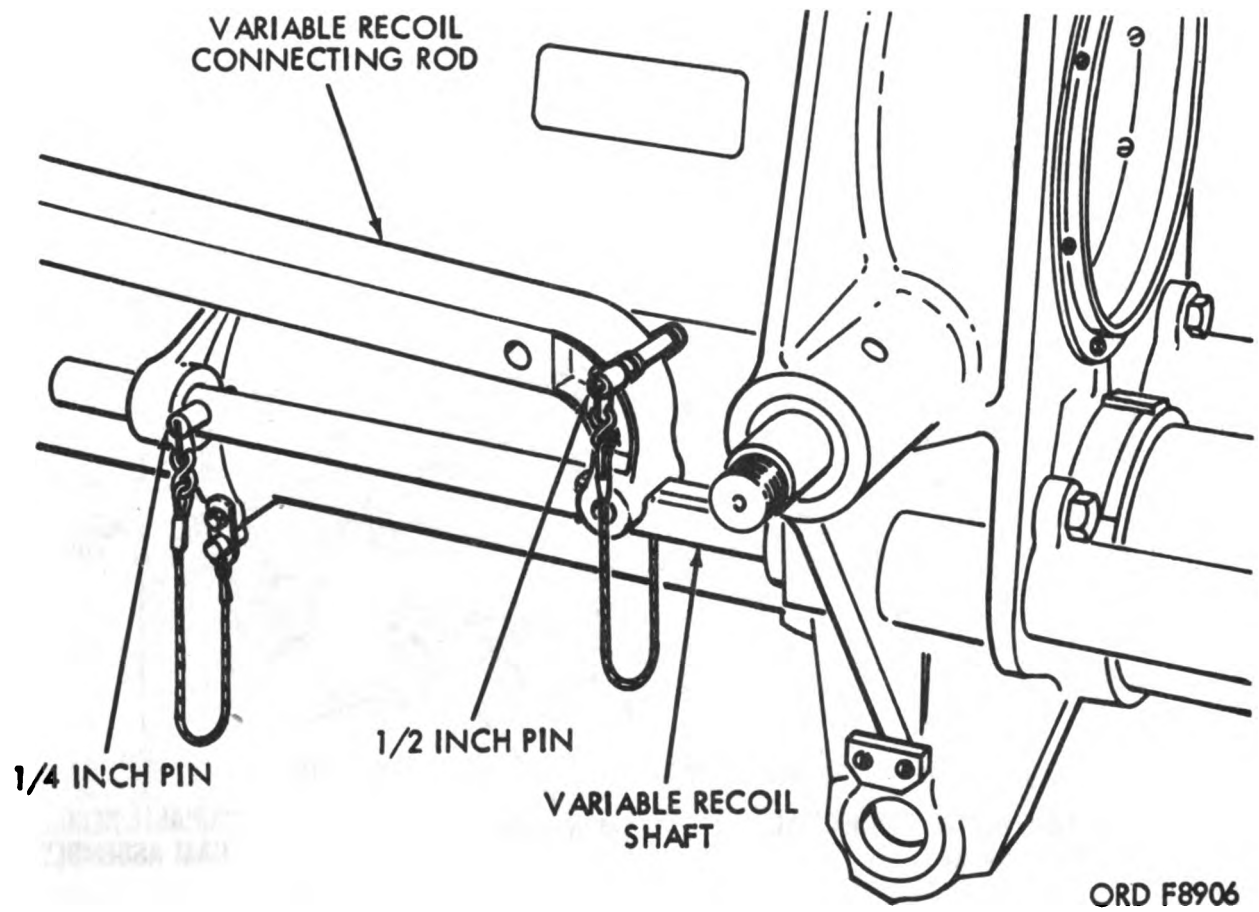


Figure 70. Positioning pin in variable recoil shaft for firing M454 projectile.

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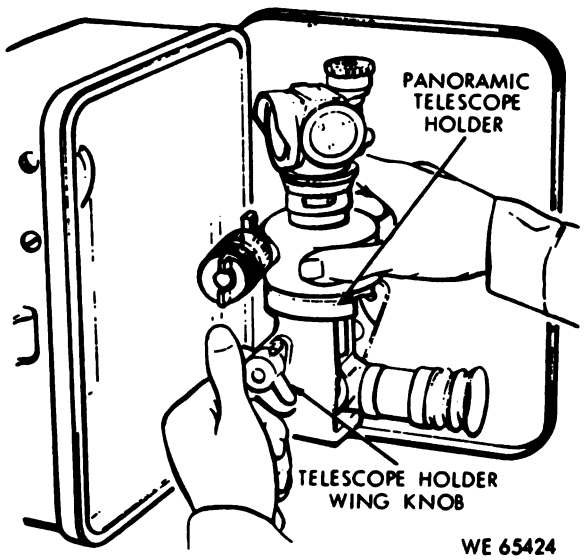


Figure 71. Removing or installing panoramic telescope M12A7C from or in telescope case on shield.

(2) If the telescope has not been carried with the weapon, remove it from the packing chest M27 (fig. 72).

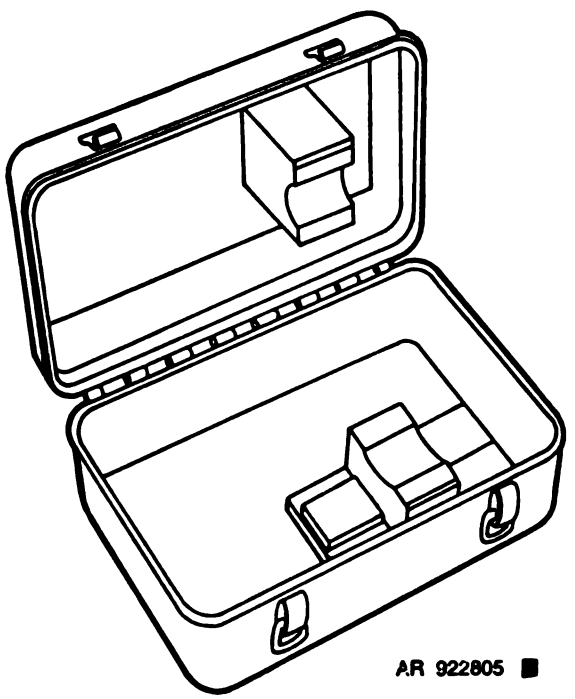


Figure 72. Panoramic telescope packing chest M27.

b Install Telescope on Telescope Mount M25.

(1) To install the telescope in the telescope mount, turn the wing knob on the telescope socket against its spring pressure and carefully place telescope in the socket, taking care that the locating lug on the panoramic telescope enters the slot in the telescope socket (fig. 73). Release the wing knob and exert slight downward pressure to insure that the telescope is properly seated.

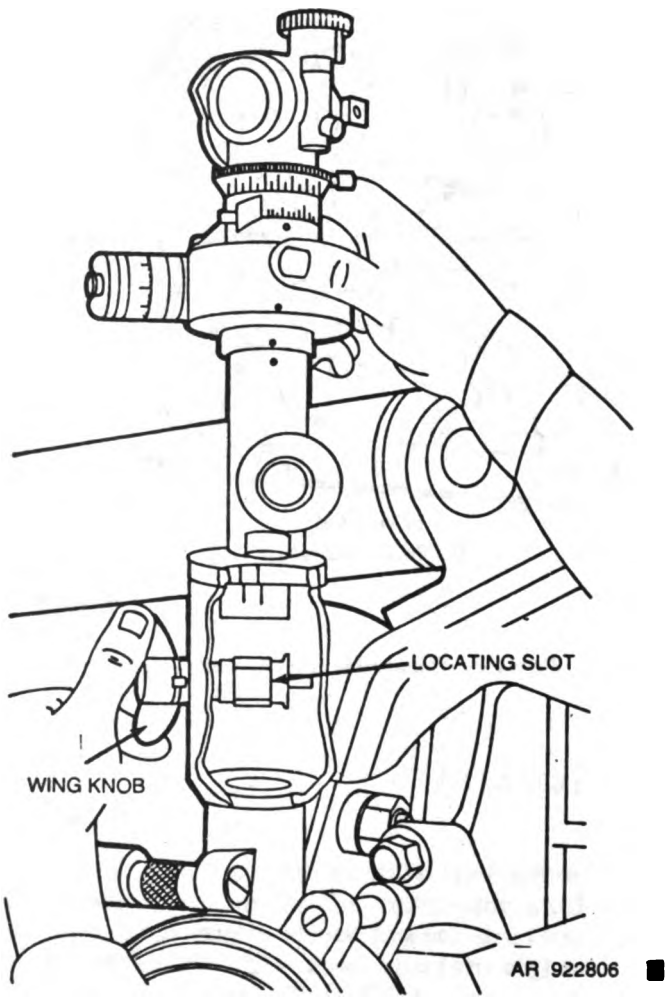


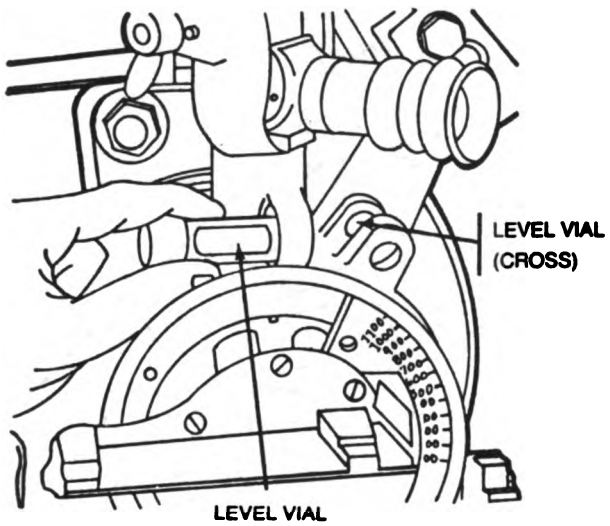
Figure 73. Installing or removing panoramic telescope M12A7C on or from telescope mount M25.

(2) Uncover the longitudinal and cross level vials of the telescope mount (fig. 74) by turning the covers half a turn.

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

c. Install Instrument Light M34 on Telescope Mount M25. 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. 35) and slip the clamps around the telescope socket. Swing the two thumbnuts into their slots on the clamps and lock by tightening the thumbnuts. Snap on the toggle switch of the instrument light (fig. 12).



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Figure 74. Uncovering (longitudinal) level vial.

d. Emplacement of Collimators M1 and M1A1

(1) *General.* The distance between the collimator and howitzer may vary between certain maximum and minimum values depending upon the offset distance of the telescope from the howitzer axis of rotation and the amount of traverse required. Location of the collimator (fig. 74.1) relative to the telescope is 20 to 47 feet and the maximum difference in height of collimator to telescope is 14 feet. Total howitzer traverse permitted is 120 degrees.

e. Preparation for Use.



Warning: **The M1A1 Collimator contains radioactive material (Tritium H 3). Care should be exercised to ensure glass vials are not broken. Refer to radiation hazard warning in front of manual for detailed procedures.**

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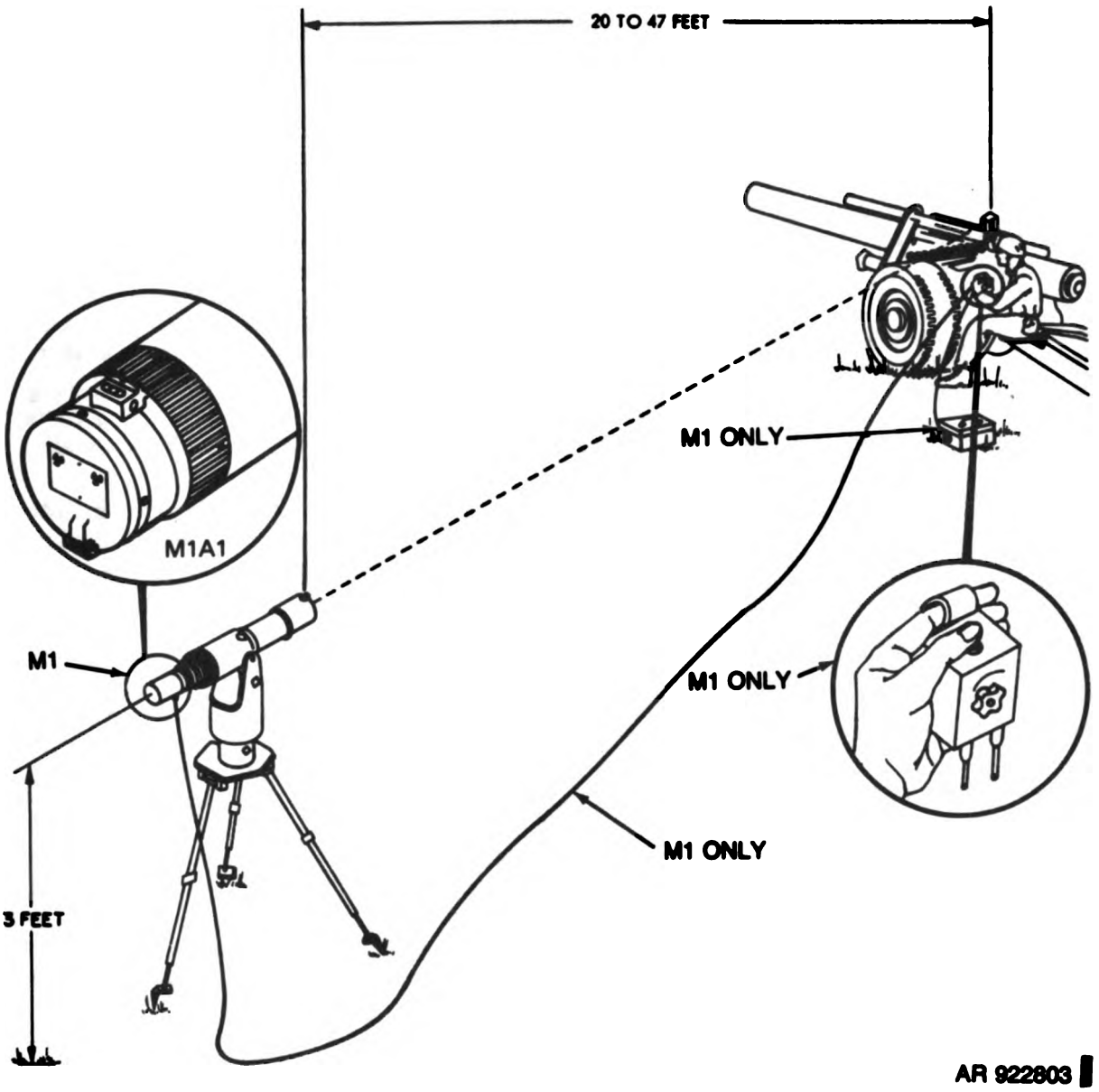


Figure 74.1 Location of collimator.

(1) *Setting up.*

(*a*) Loosen the strap on the instrument cover assembly and open the latches between the cover end and the collimator base. Remove the instrument cover and depress the tripod legs.

(*b*) Set the tripod into the ground as level and firmly as possible. Precise leveling is not necessary since the reticle can be cross-leveled separately.

(*c*) Release the azimuth and elevation clamps and move the collimator until the optical system is aimed toward the telescope M12A7C. The front and rear sights on the collimator will facilitate this operation.

(*d*) Release the collimator clamping knob and rotate the collimator about its axis until the reticle pattern is cross-leveled. The cylindrical level vial located on the collimator serves as a reference in cross-leveling.

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Note. The level bubble should be centered.

(*e*) (M1 only) Place the battery near the remote control unit, and attach the remote control power input cable securely to the battery receptacle.

(*f*) (M1 only) Install the 12-volt incandescent lamp into the collimator and connect the other remote control cable to the collimator. The collimator is now ready for illumination, final adjustment, and use.

(2) *Operation.* Lay the howitzer and aline the appropriate mil graduation of the telescope reticle with corresponding graduation on the collimator reticle. Whenever a new deflection is set into the scales of the telescope, traverse the howitzer until the reticle match is again achieved and the howitzer is properly deflected. In case of weapon jump during firing, simply traverse the howitzer until the reticle match is again obtained, and the howitzer is alined parallel to its original orientation.

42. Inspection Before Firing

Refer to before-firing services in table 3.

43. Bore Sighting

a. General. Bore sighting is the process of aligning 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) Distant aiming point method.

(2) Bore sighting target method.

(3) Aiming circle method.

(4) Standard angle method.

Note. Only the first two methods are described here. Refer to FM 6-140 for a description of the aiming circle and standard angle methods.

b. Distant Aiming Point Method (Preferred). A distant aiming point (fig. 75) is used if a bore sighting target is unavailable or if the tactical situation makes its use impracticable. The aiming point selected for this weapon should be a sharply defined point at least 1,500 meters from the weapon. An advantage of this method is that accurate leveling of the trunnions is unnecessary.

(1) Set the tube to zero elevation, using a gunner's quadrant on the leveling pads of the breech ring, and recheck the level of the quadrant seat (fig. 76).

(2) Level the telescope mount in both directions by centering both level bubbles.

(3) Place the breech and muzzle bore sights for the 155-mm cannon in their proper positions. Open the breech and insert the breech bore sight 4933-723-8962 (fig. 77) in the chamber of the tube. Improvise a muzzle bore sight (fig. 78) stretching a cord or string tightly across score marks on the muzzle and fasten in place. If the breech bore sight is not available, remove the firing mechanism (para 39*f*(1) (*a*)) and use the obturator vent hole as a peep sight.

(4) Looking through the breech bore sight, elevate and traverse the tube until the intersection of the crosslines of the muzzle bore sight is alined with the distant aiming point.

(5) Set the panoramic telescope to zero azimuth.

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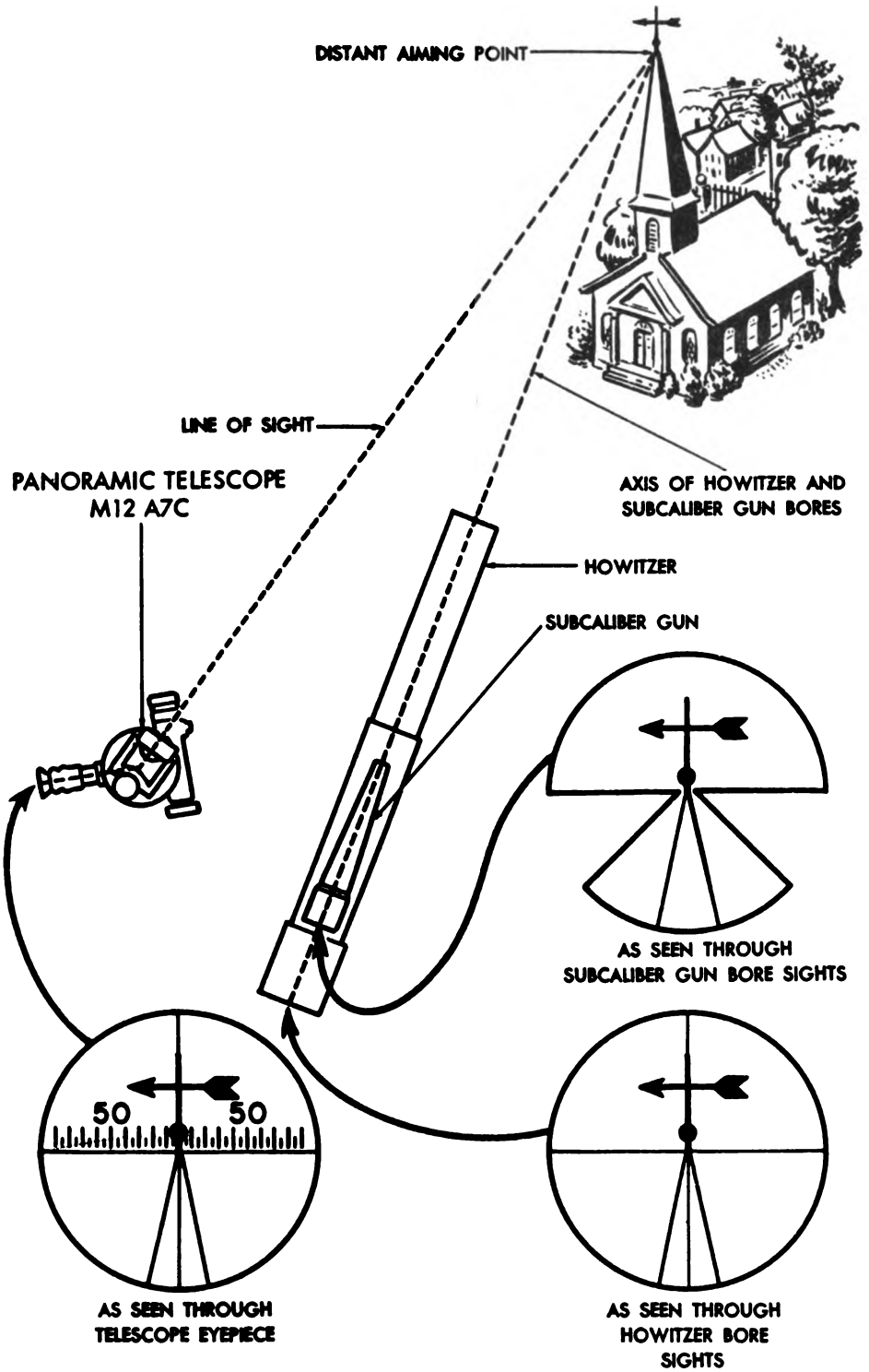


Figure 75. Schematic view of distant aiming point method of bore sighting.

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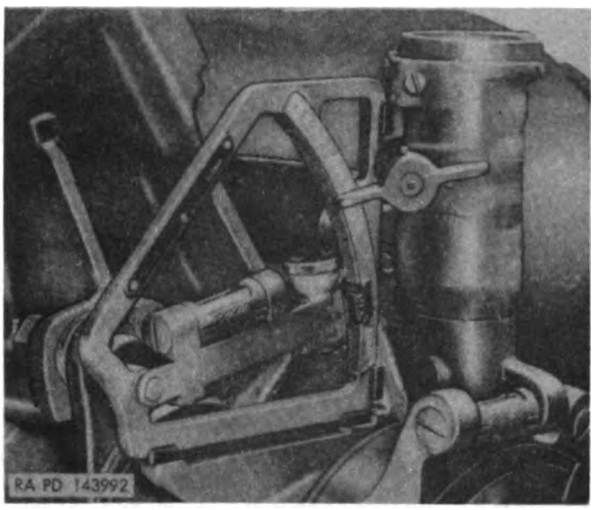


Figure 76. Checking adjustment of telescope mount actuating arm eccentric pin.

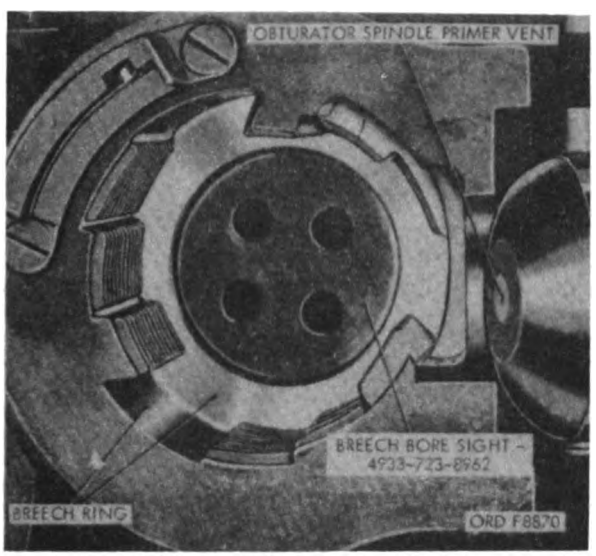


Figure 77. Breech bore sight installed in howitzer breech.

(*a*) Set the movable azimuth micrometer index (fig. 11) to coincide with the fixed zero on the deflection scale.

(*b*) If the zero on the slipping micrometer scale (fig. 11) is not in coincidence with the left index, loosen the locking nut and slip the slipping micrometer scale to aline the zero with the left index. Tighten the locking nut.

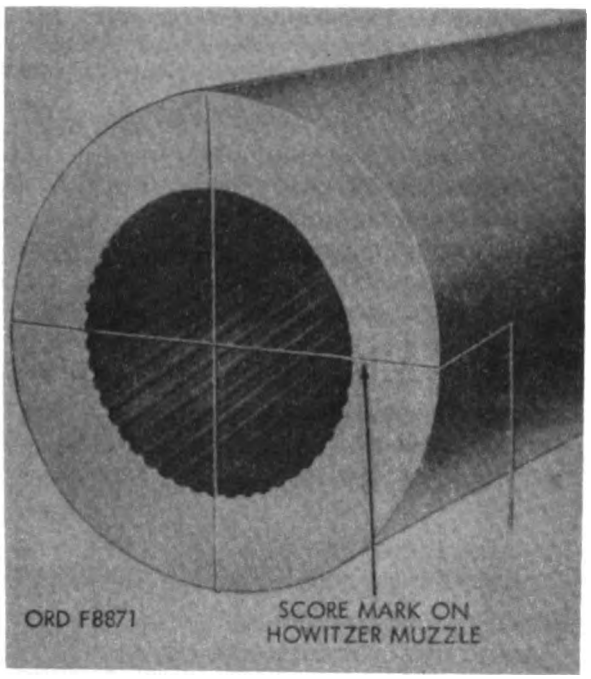


Figure 78. Muzzle bore sight in place on howitzer muzzle.

(*c*) Turn the azimuth micrometer knob (fig. 11) to aline the zero on the slipping micrometer scale with the azimuth micrometer index. The left index, the zero on the micrometer scale, the movable micrometer index, and the zero on the deflection scale should then be alined.

(*d*) Open the index door covering the nonslipping azimuth scale (fig. 11) and, while depressing the throw-out lever, turn the rotating head to set the nonslipping azimuth scale at zero.

(*e*) Close the index door, loosen the locking screw on the slipping azimuth scale (fig. 11), and move the scale until its zero coincides with the index on the outside of the door. Tighten the locking screw and verify the adjustments.

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(6) Sight through the telescope and turn the telescope elevation knob (fig. 11) to aline the horizontal reticle line with the distant aiming point.

(7) If the fine elevation indexes (fig. 11) of the panoramic telescope do not coincide, loosen the clamping screws on the elevation knob and shift the elevation micrometer to aline the zero with the fixed index. Tighten the screws and verify the adjustment. If the vertical reticle line is not alined with the distant aiming point, loosen the tangent screws (fig. 79) in the telescope socket and adjust the tangent screws until the vertical reticle line is properly alined. Tighten the locking screws and verify the adjustment. If the limit of this adjustment is inadequate, refer the telescope and mount to ordance maintenance personnel for correction.

Note. Never slip the fixed azimuth scales.

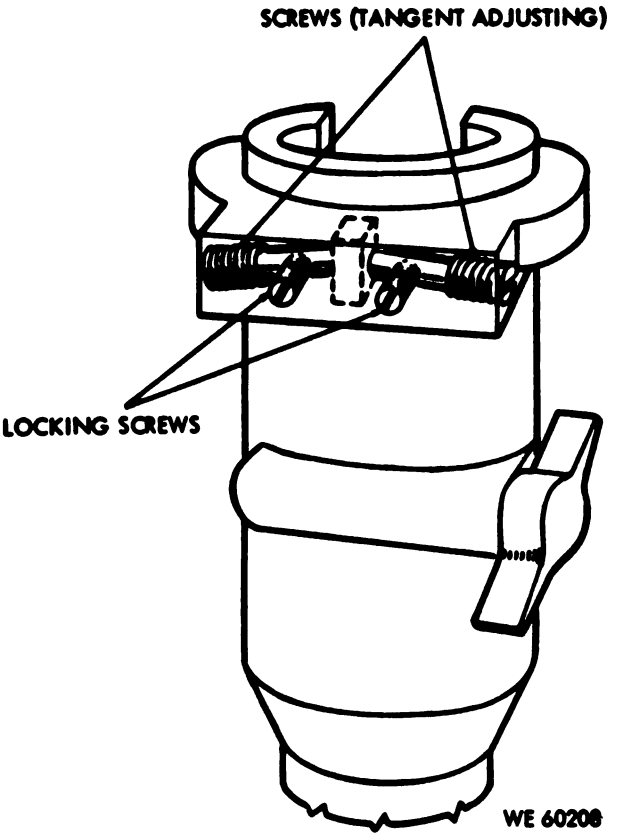


Figure 79. Tangent adjusting screws in telescope socket of telescope mount.

c. Bore Sighting Target Method. Where conditions of terrain or visibility are such that the distant aiming point method cannot be used, the weapon may be accurately bore sighted by using a bore sighting target (fig. 80). It is essential that the proper bore sighting target is used for the weapon being bore sighted. Use bore sighting target 6920-00-559-0598 for the 155-mm howitzer. With this method, it is necessary to level the trunnions of the howitzer by tracking a plumb line with the bore sights of the gun tube.

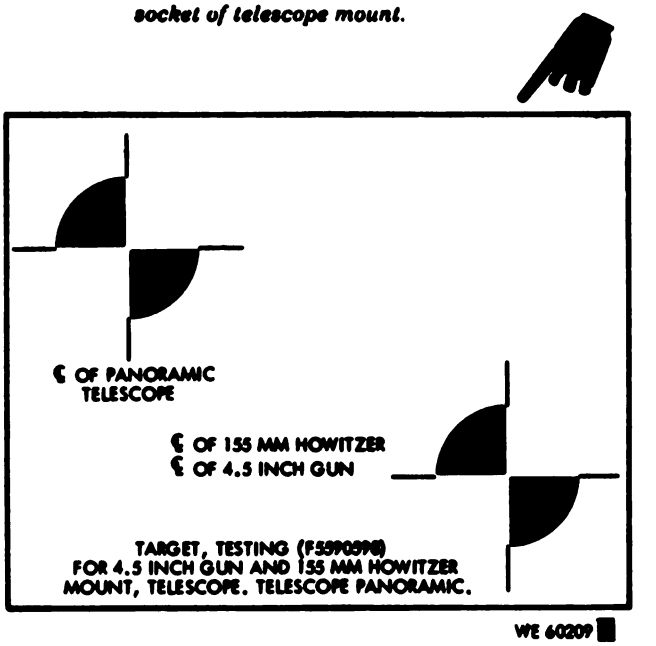


Figure 80. Bore sighting target for bore sighting 115-mm cannon on 115-mm howitzer carriage M1A1 or M1A2.

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(1) Positioning howitzer to plumb line and leveling trunnions.

(a) Suspend a plumb line approximately 1 foot or less in front of the muzzle. The plumb line must be 30 feet long to permit maximum elevation of the gun tube. Weight the plumb line with a heavy object. To prevent oscillation, the plumb line bob should be immersed in a bucket of oil.

Caution: The gun tube should remain at 350 mils during steps (b) thru (f).

(b) Visually aline the gun tube as close to the center of the plumb line as possible.

(c) Spread the trails to firing position (para 39e).

(d) Raise the trails and implace a planer jack (fig. 80.1) under each trail about 3 to 4 inches from the end. An alternative method consists of placing screw jacks (fig. 80.2) under the axle assembly as close to the wheels as possible.

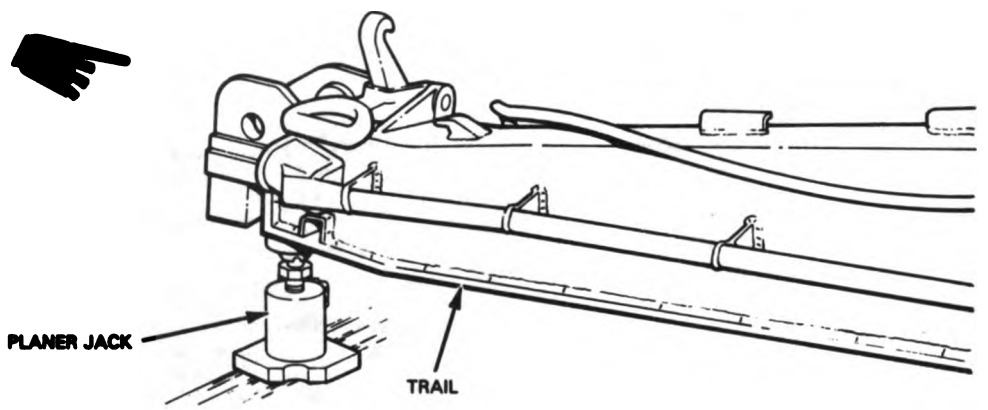


Figure 80.1. Planer jack implaced under trail.

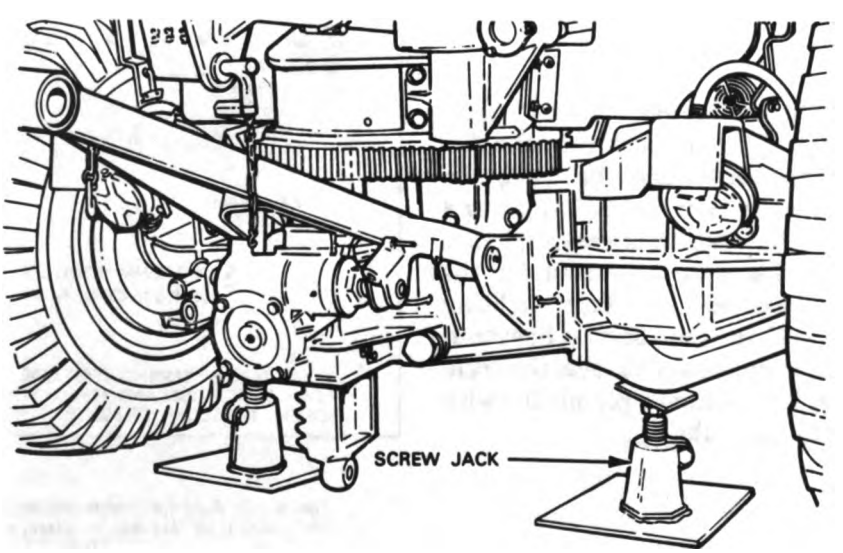


Figure 80.2. Screw jacks placed under axle assembly.

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Note. When using the alternative method, do not assemble the firing jack. Shim the trails if necessary to eliminate rocking, and proceed to step (f).

(e) Raise the carriage on the firing jack (para 39d (10)), with the firing jack lowered so that the tires have about 1 inch of floor clearance. If using alternative method, raise the howitzer with the screw jacks until both tires leave the ground.

(f) Depress the gun tube to 0 mil (fig. 80.3).

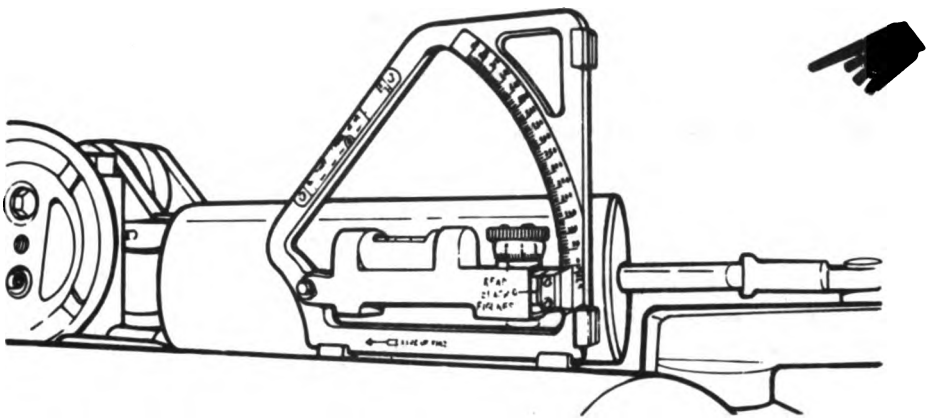


Figure 80.3. Gun tube depressed to 0 mil.

(g) Stretch a cord tightly across score marks (fig. 78) on howitzer muzzle to form crosshairs and fasten in place.

(h) Open the breech and install the breech bore sight (fig. 77).

(i) Traverse the gun tube until the vertical crosshair centers with the plumb line.

(j) Elevate the gun tube to 800 mils (fig. 80.4) and sight through the breech bore sight. The vertical crosshair should remain on the plumb line. If it does not, adjust as indicated in steps 1. thru 3. below.

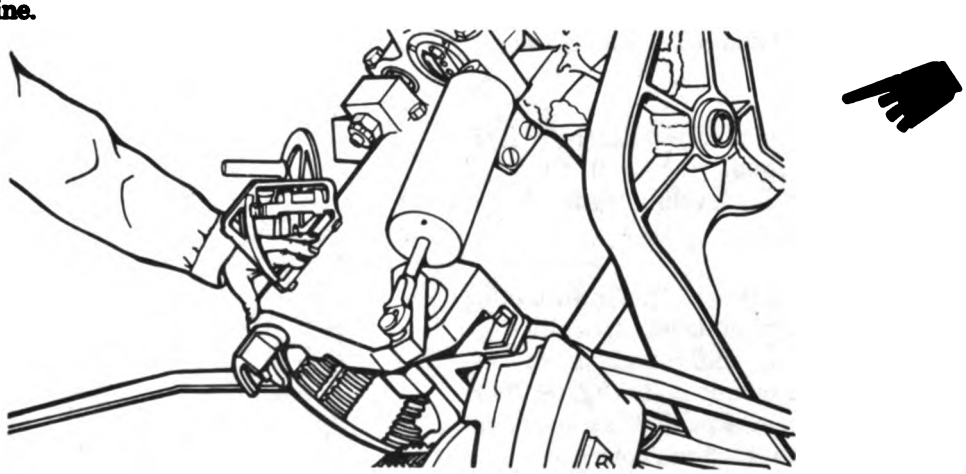


Figure 80.4. Gun tube elevated to 800 mils.

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1. At 800 mils, raise or lower one trail with planer jacks, or level the howitzer with screw jacks, until the crosshair centers on the plumb line.

2. Depress the gun tube to 0 mil and sight through the breech bore sight. If the crosshair fails to center with the plumb line, traverse the gun tube until they center.

Note. At 800 mils, use the planer jacks or screw jacks to center the crosshair. At 0 mil, traverse the gun tube to center the crosshair.

3. Elevate the gun tube to 800 mils and repeat steps 1. and 2. if necessary.

(l) Position the target (fig. 80) 50 yards from the end of the gun tube. Move the target until the bow-tie alines with the vertical crosshair and plumb line. Adjust target elevation with the gun tube at 0-mil elevation.

(2) Leveling telescope mount.

(a) Install the check gage (fig. 80.5) securely on the mounting pads of the howitzer carriage, using the mounting screws, washers, and nuts provided with the telescope mount.

(b) Level the gun tube with the M1A1 gunner's quadrant to 0 mil (fig. 80.3) on the leveling pads of the breech ring.

(c) Place the gunner's quadrant on the check gage and level vertically (fig. 80.6) within ±0.5 mil. Shim the telescope mount bolts (fig. 80.7) or file the mount pads if necessary to obtain the ±0.5-mil tolerance.

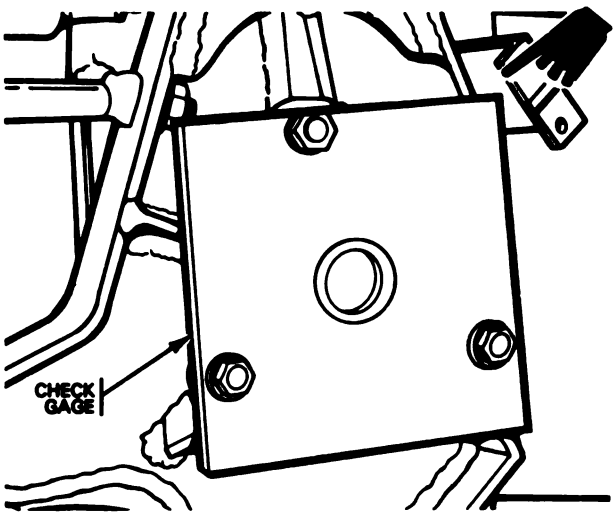


Figure 80.5. Check gage installed on mounting pads.

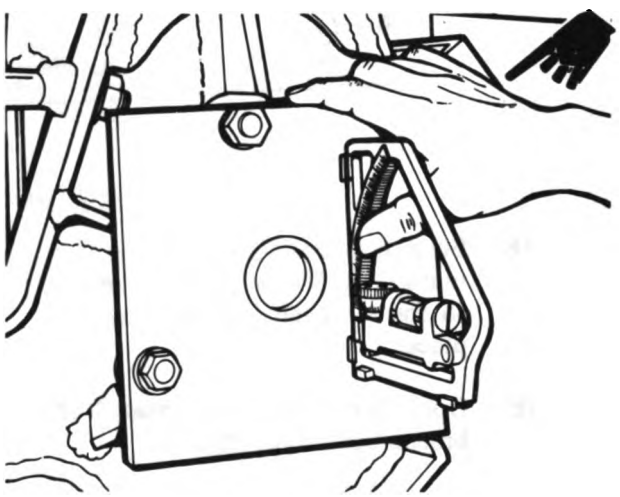


Figure 80.6. Leveling check gage vertically.

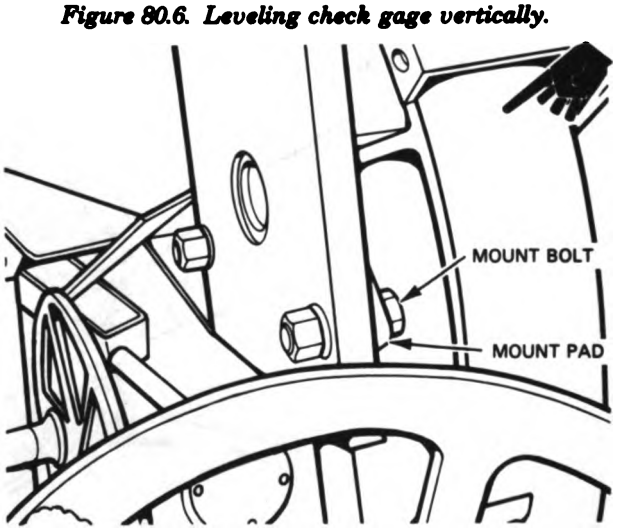


Figure 80.7. Telescope mount bolts and mount pads.

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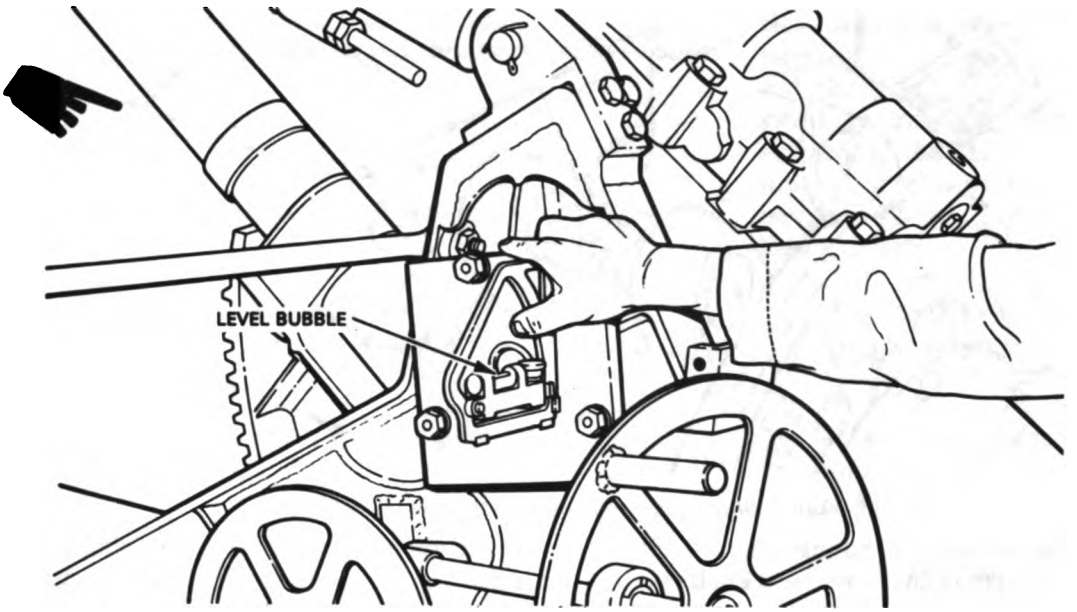


Figure 80.8. Level bubble on quadrant with gun tube at 800 mils.

(d) Elevate the gun tube to 800 mils and observe the level bubble (fig. 80.8) on the quadrant. If the quadrant bubble leaves the centering graduation marks on the vial, then make a note of the distance it traveled in grads at 800-mil elevation.

(e) Depress the gun tube to 0 mil and remove the check gage.

(f) Install the M25 telescope mount on the howitzer. Rotate the elevation knob in clockwise direction to set the telescope mount coarse elevation scale (fig. 80.9) and micrometer elevation scale to 0 mil. Center

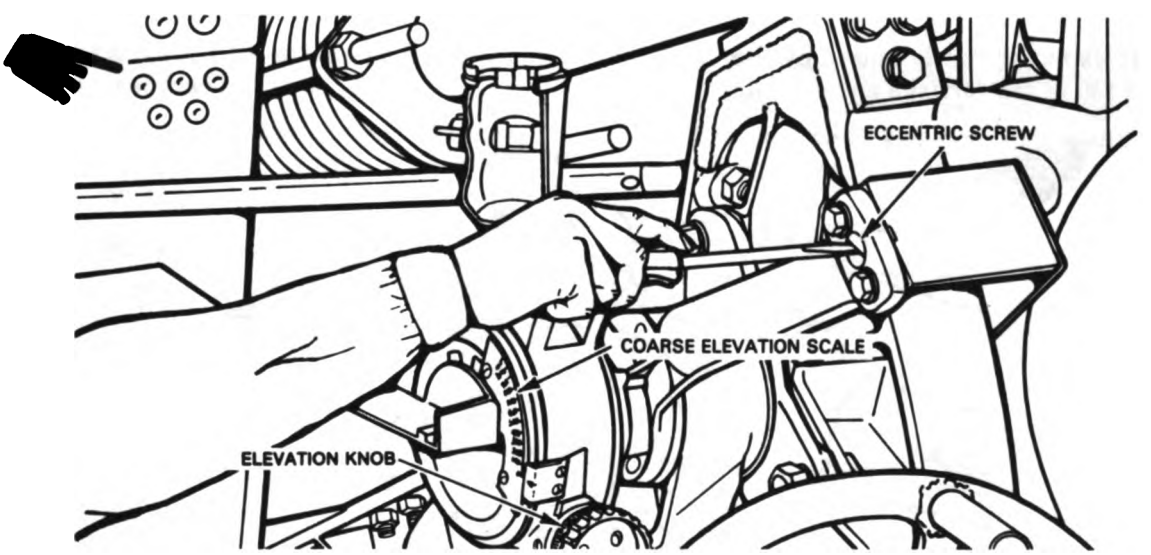


Figure 80.9. Leveling telescope mount with eccentric screw.

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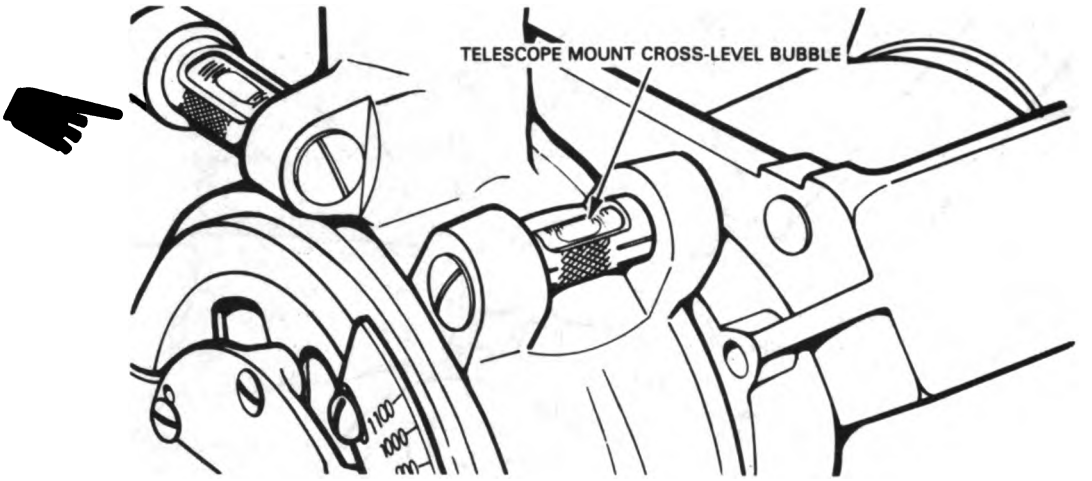


Figure 80.10. Telescope mount cross-level bubble.

the cross-level bubble (fig. 80.10) by turning the cross-level knob in a clockwise direction.

(g) Level the telescope mount to the gun tube with eccentric screw (fig. 80.9) on actuating arm.

(h) Elevate the gun tube to 800 mils and observe the cross-level vial. If the mount vial movement coincides with the cross-level bubble in step (2)(d) and the grad deviation at 800 mils is identical, then the mount is tracking parallel to the bore.

Note. Bubble movement is caused by flexing of the top of the carriage and a change in the center of mass when elevating to 800 mils. If the graduation movement is greater than the gunner quadrant reading in step (2)(d), there is excessive cross-level error in the mount.

(3) Adjusting M12A7Q panoramic telescope to target.

(a) Level the gun tube to 0 mil and cross level the mount vials.

Note. Check to ensure that muzzle crosshair is still alined on boresight target.

(b) Loosen locking screws (fig. 79).

(c) Loosen the adjusting screws (fig. 80.11) on the telescope mount.

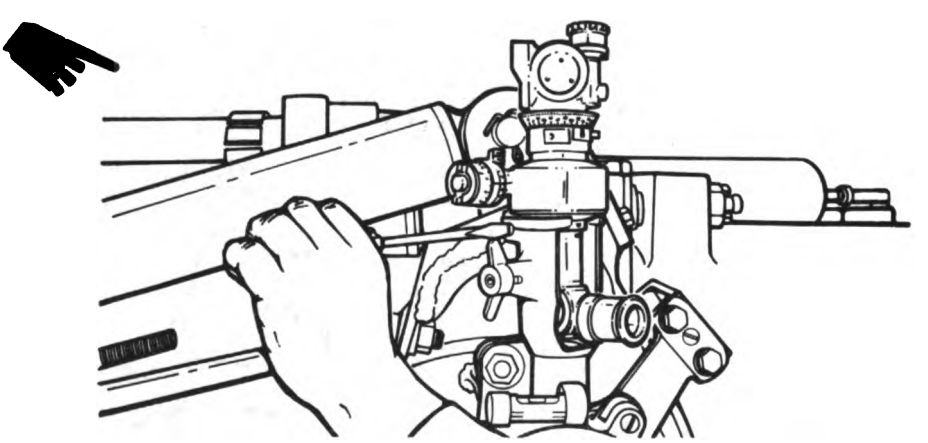


Figure 80.11. Loosening adjusting screws on telescope mount.

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(d) Hold the wing knob (fig. 73) open and place the telescope into the mount.

(e) Release the wing knob.

(f) Check that all telescope settings are on zero.

(g) Use the adjusting screws to center the telescope on the appropriate bow-tie target.

(4) Boresighting procedure and adjustment.

(a) Check the following:

1. The gun tube is at 0 mil.

2. The muzzle crosshairs are alined on the bow-tie target.

3. Both mount vials are level.

4. The telescope is on bow-tie target and all settings read zero.

(b) Elevate the gun tube to 1050 mils and depress the telescope mount to 1050 mils on the telescope mount scale.

(c) Cross level the telescope mount.

(d) Check that the vertical telescope reticle line is within ±0.5 mil of bow-tie target.

(e) Return the gun tube to 0 mil and cross level the mount. If the vertical telescope reticle line is centered on bow-tie target within ±0.5 mil, the telescope is parallel to the gun bore and the howitzer is bore sighted. If the M12A7Q telescope fails to track the bow-tie target within ±0.5 mil, perform steps 1. thru 5. below.

1. Elevate the gun tube to 1050 mils and depress the telescope mount to 1050 mils.

2. Aline the M12A7Q telescope reticle to the bow-tie target using the cross-level knob.

3. Lower the gun tube to 0 mil; raise the telescope mount to 0 mil with backlash eliminated. If not on target, adjust M12A7Q with mount tangent adjusting screws (fig. 79).

4. Adjust the telescope mount cross-level vials horizontally using cross-level vial jackscrews.

5. Repeat steps 1. thru 4. until the telescope tracks the plumb line.

Note. After completing bore sighting procedure, remove breech bore sight, close breech, and remove crosshairs from howitzer muzzle.

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45. Direct Fire Operation

a. The telescope mount M25, panoramic telescope M12A7Q, and instrument light M34 are used for laying the cannon for direct fire.

b. When using the panoramic telescope M12A7Q, setting the line of sight parallel to the axle of the bore depends upon the settings which have previously been made. The line of sight is set parallel to the axle of the bore as follows:

(1) If neither the slipping azimuth scale (fig. 11) nor slipping micrometer scale has been displaced from its true position, the line of sight is brought parallel to the axis of the bore.

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(2) If only the slipping azimuth scale (fig. 11) has been displaced from its true position, it is disregarded. The door covering the nonslipping azimuth scale is opened and the line of sight set to zero on this scale. The micrometer index and micrometer scale are brought to zero as in (1) above. The line of sight is now parallel to the bore.

(3) If both the slipping azimuth scale (fig. 11) and the slipping micrometer scale have been displaced from their true positions, it is necessary that the azimuth micrometer scales be zeroed (par. 43*b*(5)) and the nonslipping azimuth scale be zeroed as in (2) above.

c. Lay the howitzer in elevation as follows:

(1) Turn the elevation knob of the telescope mount (fig. 10) until the required quadrant elevation is read on the elevation scale and longitudinal level micrometer opposite their respective indexes. The final motion of the elevation knob should always be in the direction of increasing elevation.

(2) Turn the elevation mechanism handwheel assembly (par. 17) until the longitudinal level vial bubble (fig. 10) is centered. The last movement of the elevating mechanism handwheel assembly must be in the direction of the greater handwheel effort.

(3) When a high degree of accuracy is required, set the required quadrant elevation on the fire control quadrant M1A1 and place the quadrant on the telescope mount quadrant seat (fig. 10) with the inscribed arrow pointing toward the cannon muzzle.

(4) If the quadrant bubble centers, the piece is ready for firing.

(5) If the bubble of the quadrant does not center, elevate or depress the cannon until the bubble is centered, being careful that the final motion of the elevating mechanism handwheel assembly is in the direction of greatest handwheel effort.

d. If night operation is required, install the instrument light M34 (par. 41*c*) and snap on the toggle switch (fig. 12).

e. Track the target by turning the traversing mechanism handwheel assembly (par. 18) and simultaneously sighting through the telescope, keeping the vertical line of the reticle ahead of the target by the amount of the announced lead as measured on scale of the reticle (fig. 11).

f. At the same time, turn the telescope elevation knob (fig. 11) to keep the target in the field of view.

46. Indirect Fire Operation

The telescope mount M25, panoramic telescope M12A7C, and instrument light M34 are used for laying the howitzer in azimuth and in elevation for indirect fire.

a. Laying the Howitzer in Azimuth.

(1) When using the panoramic telescope to set off deflection angles, rotate the cross-leveling knob and the elevation knob of the telescope mount M25 (fig. 10) until the bubbles in the level vials are centered.

Note. It is essential that the telescope mount M25 be kept cross-leveled and longitudinally leveled at all times during operation; otherwise, the telescope mount will apply incorrct azimuth compensation, which will cause deflection errors in the firing.

(2) For rapid setting in large angles with the panoramic telescope M12A7C, push the azimuth worm throwout lever (fig. 11) against spring pressure as far as it will go. Hold the throwout lever in the disengaged position and turn the rotating head (fig. 81) until the proper 100-mil graduation on the azimuth scale appears opposite the azimuth scale index. Release the throwout lever.

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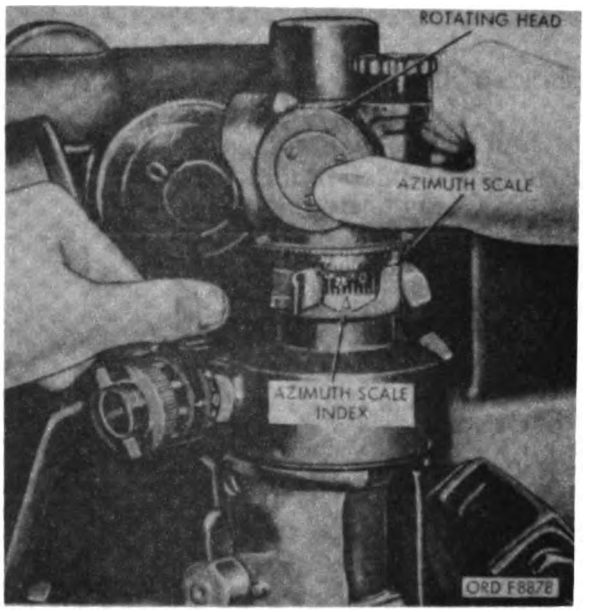


Figure 81. Slewing of the rotating head by use of azimuth worm throwout lever.

Caution: **When disengaging the azimuth mechanism of the panoramic telescope M12A7C, push the azimuth worm throwout lever outward as far as it will go to insure complete disengagement of the internal worm and worm gear. Do not allow the worm to drag over the worm gear teeth, as this will result in unnecessary wear of parts.**

(3) If the battery is laid on a common distant aiming point, the sheaf of the battery will not be parallel. To lay each weapon parallel, shifts of up to 20 mils right and left can be set on the deflection scale of the panoramic telescope M12A7C by moving the azimuth micrometer index (fig. 82) to desired shift, resetting the original setting of the azimuth micrometer opposite the micrometer index, and traversing the weapon to bring the line of sight back on the distant aiming point. (Refer to FM 6-140 for computation of shifts.) All weapons will then be parallel and read the same or common deflection on the azimuth scales of the panoramic telescope.

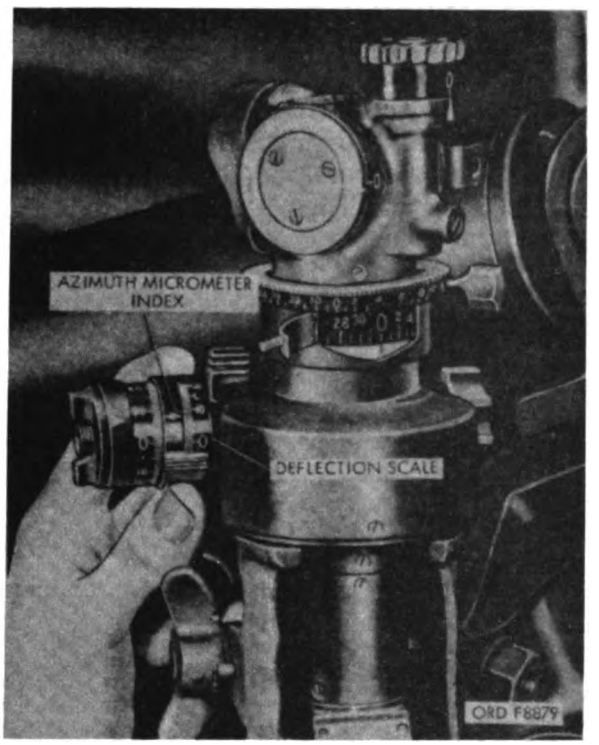


Figure 82. Turning movable azimuth micrometer index.

(4) If when laying the battery on aiming posts, some pieces in the battery cannot be set out at the common deflection because of obstructions, the aiming posts for these pieces are set out at some other multiple of 100 mils. The slipping azimuth scale of the panoramic telescope M12A7C is unlocked, turned to the common deflection, and locked in position when the line of sight is on the aiming point. The difference between the common deflection and the true deflection is recorded for use in cases when the true deflection must be known.

(5) To lay the howitzer on target, set the announced deflection on the slipping azimuth scale (fig. 11), if the zeros of the slipping and non-slipping scales are alined and if the aiming point is at the common deflection. If the zeros of the scale are

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not alined, the announced deflection is set on the slipping scale. If the aiming point is set at a deflection other than the common deflection, the nonslipping scale should have previously been set to read the common deflection, when the tube is parallel to the other tubes in the battery and when the line of sight is on the aiming point. The announced deflection in this case is set off on the slipping azimuth scale.

(6) Traverse the weapon until the vertical line on the reticle is centered on the aiming point. The gun is then laid in azimuth.

Note. A limited amount of elevation may be obtained to bring the aiming point into view by turning the elevation knob on the panoramic telescope M12A7C.

(7) Deflection corrections after the gun is laid in azimuth are set off on the graduated horizontal reticle line of the panoramic telescope.

(8) If for some reason it is desired to refer to a distant aiming point rather than to aiming posts set out at the common deflection, it is necessary to change the positions of both the slipping azimuth scale and the slipping azimuth micrometer scale of the panoramic telescope M12A7C. In such a case, the line of sight is set on the distant aiming point and the true referred deflection is recorded. The slipping azimuth scale is then unlocked, set at the common deflection, and locked in place. The slipping azimuth micrometer scale is unlocked, set at zero, and locked.

b. Laying the Howitzer in Elevation. Refer to paragraph 45*c*.

47. Loading the Howitzer

a. Lower the weapon to an elevation suitable for loading (about 150 mils). Remove the firing mechanism M1 and open the breech (para 39*f*(1)).

b. If a charge has been fired, inspect the bore for burning fragments of powder bags or other objects and for bore damage. Using the chamber swabbing sponge holder with five cellulose sponges clamped in holder in a star pattern, swab the bore with water to eliminate burning particles. Wipe the powder residue from the obturator spindle head (fig. 20) with a cloth dampened with water.

c. Prepare and fuze projectile as prescribed in paragraph 171.

d. Bring up the prepared projectile on the loading tray assembly (fig. 83). When carrying the loading tray assembly, 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 to the staff section, 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.

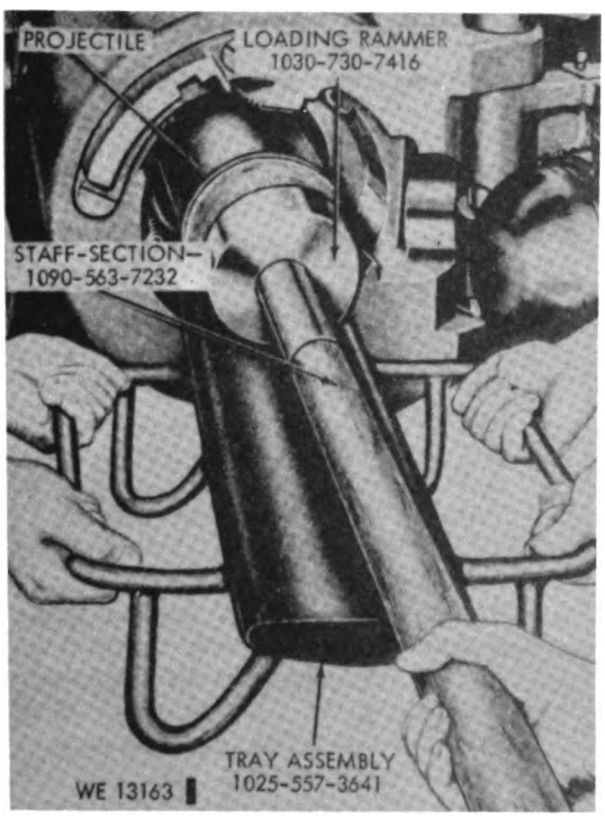


Figure 83. Pushing projectile into breech recess.

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Caution: Exercise 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 propelling charge for firing as prescribed in paragraph 170*c*.

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

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

Hold the obturator open (if obturator temperature permits) and place the propelling charge in the chamber (fig. 84) with the igniter end to the rear. Push the charge in until the base of the charge is approximately 3 inches in from 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 (para 169*c*). These changes occur very rapidly in the hot chamber.

h. Close the breech (para 39*f*(2)).

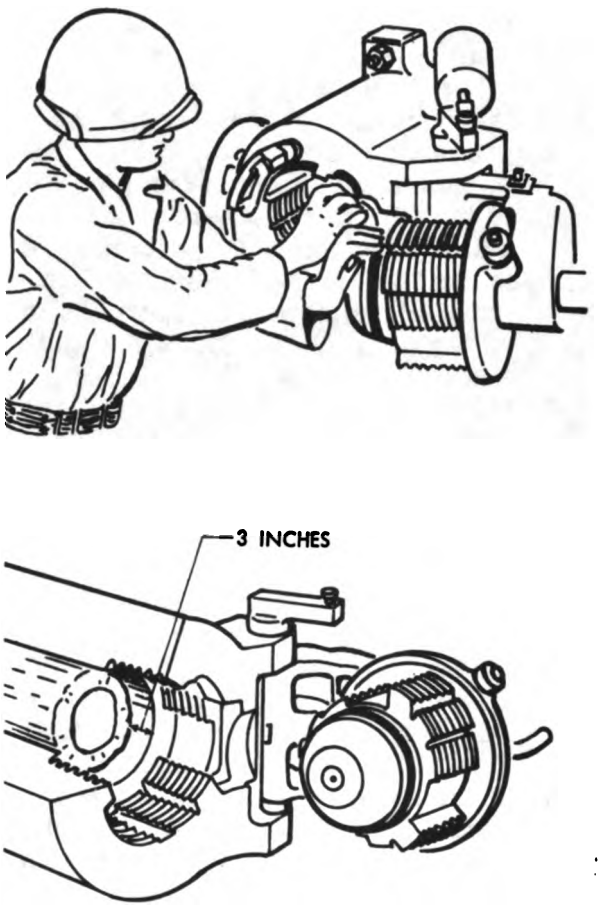


Figure 84. Loading propelling charge.

48. Firing the Howitzer

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 holder (fig. 85). The primer is then held in position by the pressure of the firing pin spring.

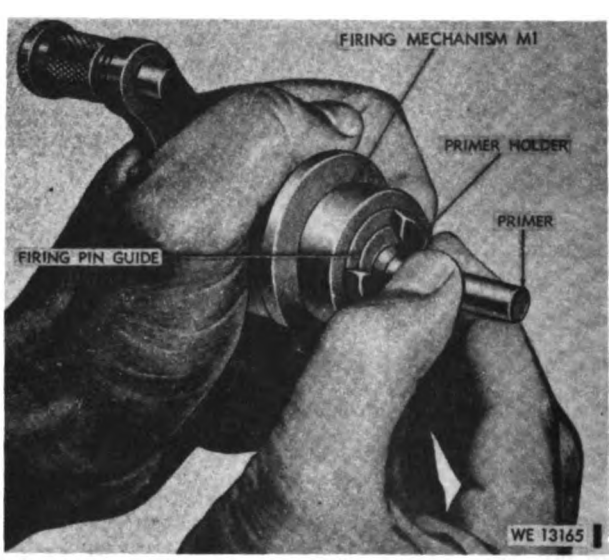


Figure 85. Inserting primer in firing mechanism M1.

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(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 holder. Remove the primer and clean the primer holder, or insert another primer.

b. Insert the firing mechanism in the firing mechanism housing (fig. 86), exercising care that the front end of the primer has entered the obturator spindle plug. Seat the mechanism by turning it clockwise until it has contacted the firing mechanism stop stud and the firing mechanism safety latch has moved to the right. If the mechanism will not seat properly, the primer may be oversize, 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. Place one hand over the striking portion of the hammer and attach the lanyard (fig. 87) to the percussion hammer. Draw the percussion hammer locking pin knob to the left and turn the knob to place it in the locked-out position (par. 16).

Caution: As a safety measure, attach lanyard in the manner stated in c above since a pull on the lanyard will cause the hammer to swing upward in an arc and strike the firing pin.

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).

e. 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. Then 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 (table 5).

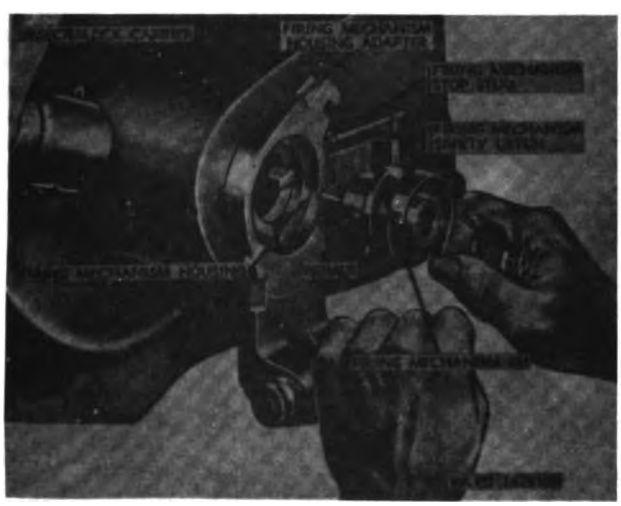


Figure 86. Inserting firing mechanism M1 in firing mechanism housing.

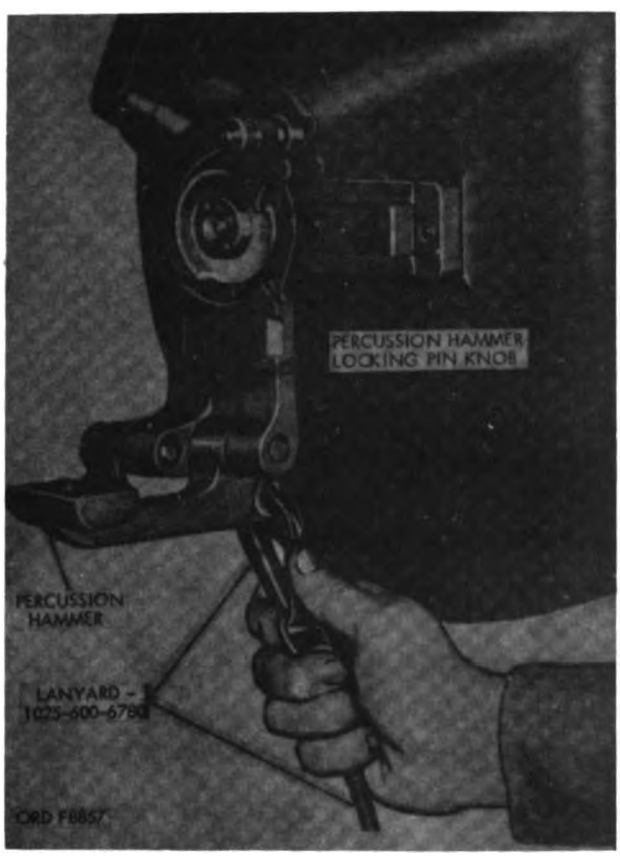


Figure 87. Attaching lanyard to percussion hammer.

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f. Check the recoil mechanism for any fluid leakage. Measure the fluid reserve in the replenisher and the recuperator cylinder at intervals during firing. The temperature of recoil fluid rises during firing and causes the fluid 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 two incres (50-mm) from the rear face of the replenisher.

g. 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 cannon tube extending from the tube wiper on the front end of the cylinder yoke to the front end of the cannon tube, or tie a piece of string around the cannon tube in front of the wiper. After the weapon has fired and returned to battery, measure the distance between the wiper and the point to which the wiper has moved the grease on string. The normal length of recoil of the 155-mm howitzer cannon 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 fluid reserve in the replenisher and recuperator cylinder. If the fluid reserve is abnormal, take the necessary corrective measures.

Warning: **If gun fails to fire, keep the weapon trained on the target and keep all personnel clear of the muzzle and path of recoil. Follow instructions in paragraph 49 below for cook-offs or hangfire.**

49. Misfire, Hangfire, and Cook-off

Warning No. 1: **Do not chamber a round in a weapon until immediately prior to firing.**

Warning No. 2: **A round that has been chambered in a weapon should be fired or removed from the weapon within five minutes.**

Warning No. 3: **Do not allow ammunition to remain in a hot weapon in excess of safety time indicated below; otherwise, cook-offs and other hazardous conditions may result.**

Warning No. 4: **Before removing firing mechanism M1 or unlocking** or opening breech to remove round and reload, personnel not required for this operation will be cleared from the area.

a. Removing firing mechanism, primer, and propelling charge from the weapon. The primer and propelling charge will be kept separate from other primers and propelling charges unti it has been determined whether weapon, propelling charge or primer is 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.

Warning: **In the event that the howitzer has been subjected to continuous fire for a considerable length of time before misfire, the tube will be hot and the heat 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 unavailable, all personnel must stand clear of the gun until it is cool. Then remove the round par. 50).**

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b. After gun is cool, two more attempts will be made to fire the primer before the firing mechanism may be removed and the primer examined. If upon examination it is found that the primer is not fired, follow instructions in table 5. If the primer has fired, a minimum of ten 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. If the gun fires during the waiting period described in *b* above, a 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.

50. Unloading an Unfired Round

WARNING

Projectiles and fuzes that have been rammed and then removed from the tube must not be reloaded and fired. They must be turned over to authorized personnel for destruction or demilitarization. Only an M712 Projectile (Copperhead) that has been rammed and extracted from a cold tube may be reused.

a. 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 the loading tray assembly in position in the breech recess (para 47*d*). Inspect the cleaning and unloading rammer (7, fig 216) to see that it is thoroughly clean. Attach the cleaning and unloading rammer to the assembled staff section. Insert the cleaning and unloading 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. Push the projectile slowly onto the loading tray. 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. Hold the loading rammer (8, fig 216) firmly against the base of the projectile and steady its backward movement until it comes to rest in the loading tray assembly. Remove the loading tray assembly and projectile from breech.

b. 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. This will eliminate the danger of a cook-off (pars 174.6 thru 174.9) or excessive chamber pressure due to increased powder temperature.

c. Remove the fuze of a projectile which has been fuzed but is not loaded into a weapon. Return projectile and fuze to their original condition and packing (par 173).

51. Inspection After Firing

a. Make certain that the weapon is not loaded and that the firing mechanism contains no primer. Lock the percusion hammer in the upright and immobile position (para 16).

b. Inspect the bore for stripped or torn lands. Check for cracks or gouges which might make the weapon unsafe for further firing.

c. Make certain the bore, chamber, and obturating parts have been cleaned, dried, and oiled (paras 71*c* and *d* and 85*a* and 85*b*).

d. After firing has been completed for the day enter the necessary firing information on DA Form 2408-4 in the equipment log book (para 51.1*c*).

51.1. Estimating Remaining Round Life of Howitzer Tubes

a. General.

(1) Each round of ammunition fired through a howitzer tube causes wear and erosion. In addition, each round reduces tube life due to metal fatigue, a process of weakening the material in the tube due to pressure generated by the expanding gases.

(2) The type of rounds to be fired vary in weight, type of projectile, and charge or zone. Each zone fired may have a different effect on the metal fatigue life of the tube. As a guide for estimating or determining these differences, the term "equivalent full charge" (EFC) was adopted. One round of the maximum charge or zone for each howitzer tube has been designated as an EFC round with a value of 1.00. Other charges or zones (1-6) have been assigned a value of 0.25. This value is based on the metal fatigue effect these zones exert on the howitzer bore relative to the EFC round (zone 7).

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(3) As an example of the effect of zones fired through a howitzer M1A1 tube, for which the tube life in based on metal fatigue (EFC rounds fired), zone 7 is the maximum zone with a value of 1.00. Zones 1 through 6 have been assigned an EFC value of 0.25. This means that it will require four rounds to be fired using zones 1 through 6 to cause the same metal fatigue as one round of zone 7.

b. Frequency of Inspection. As a minimum, howitzer tubes in the hands of using troops must be visually inspected with a borescope by technically trained personnel as specified below.

(1) Howitzer tubes will be inspected with a borescope within 90 days prior to the initial firing and within each 90-day interval when utilized for continuous or recurring firing.

(2) Howitzer tubes will be inspected with a borescope within 90 days prior to the initial firing and within 90 days prior to semiannual, annual, or other irregular firing interval.

c. Procedure.

(1) The method for determining remaining life for these tubes is to convert rounds fired to EFC rounds. To convert EFC rounds, multiply the quantity of rounds fired (by zone) times the EFC factor for that zone as indicated in table 1. Then subtract the EFC rounds fired from the remaining EFC rounds in column *g* of Weapon Record Data (DA Form 2408-4). Since the condemnation criteria as listed in table 1 is based on EFC rounds fired, the zone for each round fired must be entered on DA Form 2408-4, and the total rounds fired by zone must be carried forward to the new data card upon closeout and submission to the US Army Weapons Command.

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(2) The requirement to borescope these tubes still exists. Cracks, material defects, and other damage normally bear little relation of the age of the howitzer or to the number of rounds fired, although they may grow progressively worse through continued firing. For this reason a howitzer tube may be condemned even though the EFC condemnation limit for metal fatigue has not been reached.

(3) There is no direct correlation between wear measurements and metal fatigue so the remaining tube life should not be adjusted based on pullover gage readings.

(4) Data for determining remaining round life and criteria for condemnation is included in table 1.

Table 1. Condemnation Criteria for Tubes and Breech Assemblies

Howitzer caaaon	EFC life of tube	EFC factor	Breech life
M1	2000 rds	Zone 7 = 1.00 Zones 1-6 = 0.25	No retubing
M1A1	7500 rds	Zone 7 = 1.00 Zones 1-6 = 0.25	No retubing

Table 2 — deleted.

52. Preparation for Traveling

WARNING

Do not stow equipment of any kind inside the bore of the gun tube. Foreign objects inadvertently left in bore of gun tube prior to firing could cause premature explosion of round resulting in death or injury to personnel and extensive damage to equipment.

a. Sighting and Fire Control Instruments.

(1) Protect the level vials (longitudinal and cross) on the telescope mount by closing their covers (fig. 73).

(2) 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 thumbnuts and swinging open the clamps (fig. 12). Then carefully remove the light from the telescope socket. Make certain the toggle switch is in the "OFF" position. Remove the batteries. Place the instrument light in the tool chest.

(3) 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. 73).

(4) Open the panoramic telescope case on the back of the loft shield (fig. 2). 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 carefully in its holder (fig. 71). Then release the wing knob and, at the same time, exert slight downward pressure to insure that the telescope is properly seated in the holder.

(5) Swing the telescope case cover to its closed position and fasten with the quick-release lock.

(6) When the telescope is transported separate from the weapon, place it in packing chest M27 (fig. 72).

(7) Place fuse setters M26 or M28 in carrying cases (fig. 15) and store the carrying cases on the weapon.

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b. Place Firing Jack and Traveling Lock in Traveling Position (Carriage M1A1).

(1) Release the traveling lock locking pin safety snap and remove the traveling lock locking pin from the cylinder yoke (fig. 21). Raise the traveling lock and turn the elevating mechanism and traversing mechanism handwheel assemblies until the end of the traveling lock can be inserted in the bottom of the cylinder yoke. Insert the traveling lock locking pin and secure the safety snap to the locking pin.

(2) Turn the firing jack ratchet plunger handles (fig. 21) until the arrows inscribed on them are pointed down. Then raise the carriage slightly by operating the jack handles until the firing jack key can be removed from the right side of the firing jack housing (fig. 61). Turn the firing jack ratchet plunger handles until the arrows inscribed on them are pointed up, and operate the jack handles to lower the carriage until it rests on its wheels.

(3) Continue to raise the firing jack rack plunger until the firing jack float (fig. 60) is a few inches off the ground. Remove the float by turning it one-quarter turn. Then place the firing jack housing bottom cover on the flat-sided ball on the lower end of the rack plunger (fig. 59) and lock it in place by turning it one-quarter turn.

(4) Remove the firing jack ratchet plunger handles from the firing jack ratchet case sockets (fig. 21). Continue to raise the rack plunger as far as it will go by operating the firing jack ratchet case handles (fig. 59).

(5) Remove the firing jack plunger locking lever safety snap from the hasp staple welded to the left firing jack keyway cover (fig. 58) and insert the locking lever in the left side of the firing jack housing to lock the rack plunger in traveling position. Then install the safety snap on the hasp staple.

(6) Secure the firing jack handles to the upper and lower firing jack handle supports on the front of the right shield (fig. 54).

c. Place Firing Jack and Traveling Lock in Traveling Position (Carriages M1A2 and M32).

(1) Raise the firing jack ratchet plunger (fig. 56) to its free position. Move the firing jack ratchet pin away from the plunger as far as it will go and operate the jack handles horizontally to lower the carriage until it rests on its wheel.

(2) Continue to raise the firing jack plunger until the firing jack float (fig. 57) is a few inches off the ground. Remove the float by turning it one-quarter turn. Then remove the jack handles from the firing jack handle sockets in the firing jack ratchet body (fig. 56). Raise the ratchet plunger as far as it will go by rotating the ratchet body counterclockwise. Then engage the ratchet plunger in the ratchet plunger stop.

(3) Release the traveling lock locking pin safety snap and remove the traveling lock locking pin from the cylinder yoke (fig. 55). Raise the traveling lock and turn the elevating mechanism and traversing mechanism handwheel assemblies (fig. 23) until the end of the traveling lock can be inserted in the bottom of the cylinder yoke (fig. 55). Insert the traveling lock locking pin and secure the safety snap to the locking pin.

(4) Withdraw the traveling lock and firing jack locking pin from the firing jack hanger (fig. 55). Release the firing jack bracket pin safety snap and remove the firing jack bracket pin from the firing jack bracket; swing the jack forward and upward until it engages and is

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latched by the firing jack hanger. Lock the jack to the hanger by inserting the traveling lock and firing jack locking pin. Return the firing jack bracket pin to its position in the firing jack bracket and secure it in place with the safety snap.

(5) Secure the firing jack handles to the upper and lower firing jack handle supports on the front of the right shield (fig. 54).

d. Position Shields. Release the top shield locking bar from the top shield fastening bar bracket on the front of the left shield by removing the top shield fastening bar pin (fig. 54). Raise the top portion of the left shield to its upright position and lock it in place by inserting the fastening bar pin through the holes in the fastening bar bracket and locking bar.

e. Install Covers. Install the canvas firing jack cover, if it is to be used, and then install the overall cover (fig. 31).

f. Install Caster Assembly (M123A1 Only). Release the trail assembly from the strap on the left trail (fig. 30), swing it into position, and raise the trails until the caster assembly can be installed. Remove the spade keys, and remove the spades and place in their supports. Install the caster assembly on the left trail (fig. 40) and secure with spade key (fig. 41). Stow the remaining key in its bracket.

Caution: **Be sure the spades are uncovered and free and can be raised without undue strain on the trail jack assembly.**

g. Close the Trails (M123A1 Howitzer). Lower the jack and close the trails, placing the firing jack float in its retainers (fig. 37) before the trails are fully closed. Place the weapons handling bars in their retainers. Clamp the trails together by engaging the trail lock hook in the trail lock link (fig. 48); push the trail lock handle down, and insert the trail locking retainer pin. Install the muzzle plug M2 in the muzzle of the cannon. Install the loading tray on the right shield (fig. 62).

h. Install Driver's Seat and Control Stick Assembly (M123A1 Howitzer). Remove the driver's seat and control stick assembly from the prime mover and secure on power unit (figs. 52 and 53).

i. Check Hydraulic Hoses (M123A1 Howitzer). Check hydraulic hoses to make sure they are securely fastened.

j. Attaching M123A1 Howitzer to the Prime Mover. Raise the trails with the trail jack assembly and back up the prime mover until the lunette can be placed over the prime mover coupling pintle (fig. 39). Release the carriage handbrakes. Remove the air brake hose couplings from the dummy couplings on the trails (fig. 37). Cross the service and emergency air brakes hoses, as shown in figure 36, and connect them to the prime mover air hose couplings. Close the drain cock on the air tank. Open the air line cut-out cocks on the rear of the prime mover. For night travel, install the blackout light system (fig. 31). Insert the blackout light system plug in the receptacle at the rear of the prime mover (fig. 36).

Note. **If the howitzer is in an inaccessible position for the prime mover, it can be made accessible by moving with the auxiliary propulsion system. See paragraphs 39b and c.**

k. Remove Caster Assembly (M123A1 Howitzer). Remove the spade key and remove caster assembly. Stow caster assembly in the prime mover and the spade key in its holder on the trail. Lower trail jack assembly and secure it for traveling and install the cover. Release the handbrakes.

l. Close Trails (M114 and M114A1 Howitzer). Knock out the spade keys (fig. 51), lift the trails from the lugs on the tops of spades, and close the trails. Place the firing jack float and loading tray assembly in their retainers (figs. 37 and 48) before the trails are fully closed. Pry the spades out of the ground with the weapons handling bar. Place the spades, spade keys, and handling bar in their supports or brackets on the trails (figs. 2 and 47). Clamp the trail together by engaging the trail lock hook in the trail lock link (fig. 48), push the trail lock handle down, and insert the trail locking retainer pin. Install the muzzle plug M2 in the muzzle of the cannon.

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m. Attaching M114 and M114A1 Howitzer to the Prime Mover. Release the carriage handbrakes (fig. 1). Back up the prime mover until the lunette can be placed over the coupling pintle (fig. 36). Connect the service and emergency air brake hoses and blackout light system as detached in *j* above.

n. Brake Operation.

(1) The prime mover used with this materiel must be equipped for operating the air brakes with which the carriage is equipped.

Caution: To avoid injury to personnel, to insure safe road transportation, and to prevent "jackknifing" of the load, the driver should have the load under control at all times by avoiding any slack between the load and the prime mover. On down grades, curves, and rough or slippery roads, the speed should be held to approximately 10 mph.

(2) Before starting to tow the materiel, the air pressure must register at least 70 pounds on the dash gage of the prime mover in order that the braking system may be fully effective. Pressure should be checked occasionally while traveling. If the gage indicates a rapid falling off of pressure, stop the vehicle and check the air brake system to determine the cause of the falling pressure.

Note. Never use the emergency feature of the air brake system for parking purposes. Mechanical handbrakes are provided for this purpose.

(3) The best possible stop will be made when the first brake application is as hard as the speed of the vehicle and the condition of the road will permit and then reduced as the speed is reduced. Never apply the brakes lightly at first and then increase the pressure as the speed diminishes. Stops made in that manner require more time and the final high pressure produces a severe final stop.

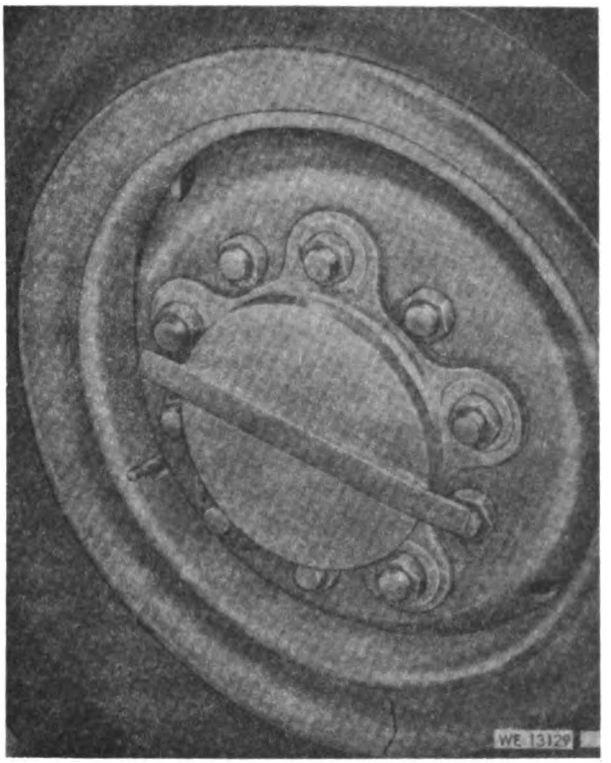


Figure 88. Axle hub cover assembly installed on carriage wheel.

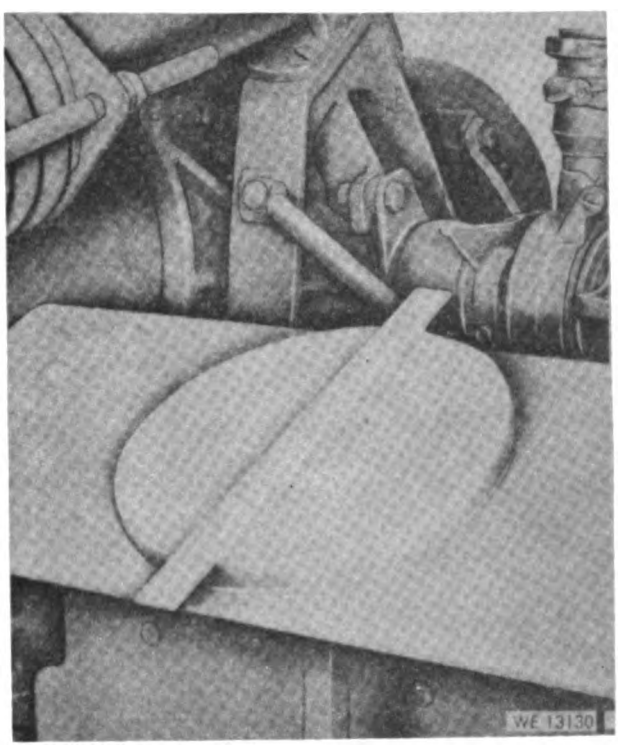


Figure 89. Axle hub assembly stowed on left shield.

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(4) Do not "fan" the brake pedal as this gives poor brake performance and wastes air pressure. "Fanning" does not increase the brake line pressure; instead, it decreases both air tank and brake line pressure.

(5) The air brake system is so designed that when the brake pedal is depressed to the limit of its stroke, an emergency application results which will apply the brakes in the hardest possible manner. Such application should be made only in an emergency and must not be employed in ordinary braking service.

o. Towing Speeds for the M114, M114A1 and M123A1. Refer to paragraph 7*f* and *g*.

Warning: Remove the M123A1 drive ring assembly 52 below) for towing speeds above 15 mph. Under no circumstances should the M123A1 be towed with the wheel drive units removed.

p. Remove the Drive Ring Assembly.

(1) Remove the wheel drive unit assembly (para 106*a*(1) and (2)).

(2) Remove the five wheel retaining nuts and drive ring adapters from the drive ring assembly (figs. 142 and 143).

(3) Remove the drive ring assembly (with gasket).

(4) Store the drive ring assembly in the prime mover until needed for auxiliary prepulsion.

(5) Install the five drive ring adapters and wheel retaining nuts on the wheel and tighten securely.

(6) Aline the splines on the wheel drive unit and carriage wheel, and push the wheel drive unit in place.

(7) Tighten the fastener pin assembly and lock the handle.

(8) Place the hydraulic motor on top of the wheel drive unit and secure with the fastener lock (fig. 136).

q. Installing the Drive Ring Assembly for Auxiliary Propulsion.

(1) Remove the wheel drive unit assembly (para 106*a*(1) and (2)).

(2) Remove the five wheel retaining nuts and drive ring adapters (used to secure the drive ring assembly) from the wheel.

(3) Clean and lubricate the mating gears on the wheel drive unit and wheel with GAA.

(4) Install the drive ring assembly (fig. 143).

(5) Install the wheel drive unit according to paragraph 106*b*(1).

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Section IV. OPERATION UNDER UNUSUAL CONDITIONS

53. General Conditions

a. In addition to normal operating procedures described for usual conditions, special instructions for operating and servicing the weapon under unusual conditions are contained or referred to herein. In addition to the normal preventive-maintenance service, special care in cleaning and lubrication must be observed where extremes of temperatures, 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 materiel.

b. Refer to paragraph 66 for instructions on lubrication under unusual conditions.

c. When chronic failure of materiel results from subjection to extreme conditions, report of such chronic failure should be made in accordance with instructions in paragraph 3*c*.

54. Extreme Cold-Weather Conditions

a. General Problems.

(1) Extensive preparation of materiel scheduled 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 operation in extreme cold, refer to FM 31-70, FM 31-71 and TM 9-207.

Caution: It is imperative that the approved practices and precautions be followed. TM 9-207 contains general cold-weather information applicable to this materiel as well as to all ordnance materiel. It must be considered an essential part of this technical manual, not merely an explanatory supplement to it.

b. Notify ordnance maintenance personnel if the recoil mechanism has not been winterized (para 92*a*).

c. Fire-Control Materiel. Avoid breathing on optical elements and causing condensation which might freeze. Cover ends of telescope when not in use to prevent accumulation of snow or ice. Avoid sudden temperature changes such as from a warm room to low temperature outdoors.

55. Operation in Extreme Hot-Weather Conditions

a. In hot climates, the film of oil necessary for operation and preservation will be quickly dissipated. Inspect the cannon and

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carriage daily, paying particular attention to hidden surfaces such as the bore and chamber, springs and spring seats, firing pin, and like places where corrosion might occur and not be quickly noticed.

b. Perspiration from the hands is a contributing factor to rusting because it contains acid. After handling, clean, wipe dry, and restore the oil film.

c. High temperature will cause the recoil fluid to expand.

(1) The expansion of the hydraulic fluid in the recuperator cylinder will cause excess reserve fluid. Excess reserve fluid can result in restricted recoil and shock at the end of counterrecoil. Drain off the reserve fluid and establish the correct reserve fluid (par. 94*f*).

(2) The expansion of the hydraulic fluid in the recoil cylinder will cause excess fluid in the replenisher. Drain off sufficient hydraulic fluid to establish the correct position of the replenisher piston (par. 89*i*(1).

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

(3) 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 temperatures (par. 169*c*).

(4) Whenever practicable, white phosphorous loaded smoke shell should be stored at temperatures below the melting point (105° F) of the white phosphorous filler. If not practicable, white phosphorous rounds should be stored on their bases so that, should the white phosphorous filler melt, it will resolidify with void spaces in normal position (in the nose of the shell) when the temperature falls below its melting point. Prematures have been caused by voids in the base end of the white phosphorous shell and erratic performance may result from voids in its side. Refer to paragraph 169*c* for precautions in handling ammunition in high temperatures.

(5) Keep tires covered with materials which may be available to protect them from the direct rays of the sun, to prevent excessive air pressure, and to prevent deterioration of rubber. Correct tire pressure is prescribed in paragraph 114*a*.

56. Operation in Hot, Dry Climate

When operating in hot climates and materiel is active, the bore of the howitzer should be cleaned and oiled daily. Temperature changes may cause condensation of moisture in the air on metal and cause rusting. If condensation occurs on unpainted metal parts of the weapon, wipe them dry and coat with the preservative lubricating oil (medium) as required to prevent rusting. Treat inactive materiel as prescribed in paragraph 57*e*.

57. Operation in Hot, Damp, and Salty Atmosphere

a. Materiel should be inspected daily when being operated in hot, moist, and salty areas.

b. When the materiel is active, clean and lubricate the bore and exposed metal surfaces daily.

c. Moist and salty atmospheres have a tendency to emulsify oils and greases and destroy their rust-preventive qualities. Inspect parts daily for corrosion. Keep covers in place as much of the time as firing conditions permit.

d. Inspect and care for canvas at frequent intervals. 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

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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, its 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.**

Note. **Wet canvas should be dried thoroughly before folding.**

e. When the materiel is inactive, the unpainted parts should be covered with a film of coil. All covers should be in place.

f. Do not break moisture–resistant seal of ammunition container until the ammunition is to be used.

g. Keep ammunition dry and free from mud, corrosion, or foreign matter. Provide proper drainage around the emplacement to keep it as dry as possible.

h. Special precautions must be taken to protect VT fuzes against dampness. Although the fuzes are nearly waterproof, any exposure to dampness may increase the number of duds. Contact with rain or immersion in water will hasten deterioration. Particularly in tropical climates, the storage time of unpacked fuzes should be kept to a minimum. Fuzes must be stored in their original sealed containers so far as practical.

i. 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.

j. In tropical climates, all electrical equipment must be checked frequently. Fungus growth attacks insulation and accelerates breakdown. Presence of moisture will contribute to voltage leaks.

58. Unusual Terrain Conditions

a. Soft or Rough Terrain. When traveling on soft or rough terrain such as much, sand, or snow, the auxiliary power on the M123A1 howitzer may be utilized to assist the prime mover or when a prime mover of adequate power is not available. Care must be exercised when backing weapon, while attached to prime mover.

Note. **Never emplace the weapon on soft ground or swamp.**

b. Snow or Ice.

(1) *Snow.* The many types of snow encountered make it impossible to establish firm rules for oversnow operations. Experience in particular areas is required for accurate predictions of snow trafficability. Reconnaissance must be made.

(2) *Ice and sleet.* When ice crossings are contemplated, inspect first for cracks, ridges, and thin spots. Ice must be in contact with the water beneath it, as suspended ice is not strong.

(3) *Side–hill travel.* Traveling along the side of a hill in snow, ice, or soft tundra must be avoided as the weapon will not track (i.e., follow in the path of the tractor or prime mover) properly.

c. Sand, Dust, and Dirt.

(1) *All models.* Inspect and lubricate the materiel more frequently when operating in sandy or unusually dusty areas. Exercise particular care to keep sand and dust out of the mechanisms and oil receptacles when carrying out inspecting and lubrication operations and when making adjustments and repairs. Keep all covers in place as much of the time as firing conditions permit. Shield parts from flying sand and dust with paulins or with the mount cover during disassembly and assembly operations. When commencing an action in sandy or dusty areas, remove lubricants from recoil slides and

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from elevating gear arcs and pinions or any other exposed lubricated parts, situation permitting, as they will pick up sand and dirt forming an abrasive which will cause rapid wear. With surfaces dry, there is less wear than when they are coated with lubricant contaminated with sand or dirt. Clean and lubricate all exposed parts after the action is over.

(2) *M123A1 Only.* Keep the gasoline engine as clean as possible. Wipe off dust, sand, and dirt; never allow such deposits to accumulate. Use particular care to keep the engine cooling fins clean and free of debris which could restrict the flow of cooling air. Service the air cleaner as frequently as required. Do not allow the air cleaner to become so filled with sand and dirt as to restrict the airflow to the carburetor. Keep reserve supplies of fuel and oil in airtight containers to prevent contamination with airborne dust, dirt, and sand. Keep the power unit hydraulic system cooler assembly free of dirt and debris which could restrict the flow of cooling air.

59. Fording

a. Shallow-Water Fording.

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

(2) Watch carefully during the fording operation for the possibility of water seepage into gear housings, trail pins, traversing pintle, or other parts which would contaminate the lubricant.

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

b. Deep-Water Fording. Refer to TM 9-288 for general information, descriptions, and methods of using deep-water fording kits.

Note. No attempt will be made to ford a stream or body of water with M123A1 howitzer that will submerge any part of the gasoline engine or hydraulic power unit.

c. After-Fording Operations.

(1) Immediately after weapon is towed from the water, if the tactical situations permits, perform the following services:

(*a*) Remove the wheel and hub assemblies and thoroughly clean and dry all working parts of the brakes and wheel bearings. Lubricate the assemblies in accordance with the lubrication order.

(*b*) Empty the materiel of any accumulated water, clean, dry, and apply the prescribed lubricant to all exposed unpainted surfaces, paying especial attention to the bore and chamber, the recoil slides, and the equilibrator rods.

(*c*) Remove drain plugs from the trails, allow trapped water to drain out, and install the drain plugs (par. 104*a*). See that the four drain holes in the top carriage (fig. 133) are open.

(2) If parts of the materiel are accidentally submerged or badly splashed, apply temporary preservation (par. 66*f*(2)) 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 cannon and carriage. Apply temporary preservation and notify ordnance maintenance personnel so that necessary complete disassembly, cleaning, and lubrication may be performed as soon as possible.

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CHAPTER 3

MAINTENANCE INSTRUCTIONS

Section I. SPECIAL ORGANIZATIONAL TOOLS AND EQUIPMENT

60. General

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

61. Parts

Repair parts are supplied to the using organization for replacement of those parts most likely to become worn, broken, or otherwise unserviceable, providing the replacement of these parts is within the scope of organizational maintenance functions. Repair parts supplied to the user for the 155-mm howitzer M114, M114A1, and M123A1 are listed in appendix II which is the authority for requisitioning replacements. Repair parts supplied to organizational maintenance are listed in TM 9-1025-200-20P.

62. Common Tools and Equipment

Standard or commonly used tools and equipment having general application to this materiel are authorized for issue by tables of allowances and tables of organization and equipment.

63. Special Tools and Equipment

a. Special tools and equipment designed for operation and organizational maintenance, repair, and general use with the materiel are listed in appendix II and TM 9-1025-200-20P, which is the authority for requisitioning replacements.

b. Description of Special Tools.

(1) Counterbalance cylinder spacer 4933-520-7129 is used to disconnect and connect counterblance piston end rod.

(2) Firing mechanism housing tool 4933-520-7076 is used to install or remove firing mechanism housing.

(3) Headspace gage 4933-722-5952 is used to measure the obturator spindle headspace.

(4) Liquid releasing and filling tool assembly 4933-626-4157 is used to drain or fill replenisher or recuperator cylinders.

(5) Spanner wrench 4933-616-7037 is used to unscrew (clockwise) or screw (counterclockwise) the firing pin housing from or onto the rear of the firing mechanism housing assembly.

(6) Non-adjustable spanner wrench 5120-723-0275 is used to remove or install the breechblock driver retaining ring from the breechblock carrier.

(7) Vent cleaning tool 4933-601-9667 is used to clean and ream the obturator spindle vent.

Section II. LUBRICATION

64. Lubrication Order (LO)

Lubrication order LO 9-1025-200-100 (figs. 90, 91, 92, and 93) and localized lubrication points (figs. 94, 95, 96, and 97) prescribes cleaning and lubrication procedures as to location of fittings and oil holes, and intervals and proper materials for lubrication of

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this weapon. This order is issued with the weapon and must be carried with it at all times. In the event a weapon is received without a lubrication order, the using organization shall immediately requisition one. Refer to DA Pam 310–4 for lubrication order of current date. Lubrication which is to be performed by ordnance personnel is included on the lubrication order in NOTES 9 and 10. TM 5–2805–204–14 covers lubrication of the gasoline engine by ordnance maintenance personnel at repair or overhaul.

65. General Lubrication Instructions Under Usual Conditions

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

b. Lubrication Equipment. Each weapon 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, so as to insure a proper distribution of lubricant.

c. Points of Application.

(1) *Grease and oil points.* Lubricating fittings, grease cups, and oil holes are shown in figures 94, 95, 96, and 97 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) *Wheel bearings.* Clean and lubricate wheel bearings as follows:

(*a*) Wash all of the old lubricant out of the bearings and from the inside of the hubs with volatile mineral spirits or dry-cleaning solvent and dry the parts thoroughly.

Caution: **Bearings must not be dried or spun with compressed air. See TM 9–214 for care and maintenance of bearings.**

(*b*) Pack the bearing by hand or with a mechanical packer introducing the lubricant carefully between the rollers. Do not smear grease only on the outside of the bearing and expect it to work in. Great care must be exercised to insure that dirt, grit, lint, or other contaminants are not introduced into the bearing. If the bearing is not to be installed immediately after repacking, it should be wrapped in clean oil–proof paper to protect it from contaminants.

(*c*) After the bearing is properly lubricated, pack the hub or wheel with a sufficient amount of lubricant to uniformly fill it to the inside diameter of the outer race (approximately one pound of grease). Coat the spindles and hub caps with a thin layer of lubricant (not over 1/16–inch) to prevent rusting. Do not fill the hub caps to serve as grease cups under any circumstances. They should be lightly coated, however, to prevent rusting.

(3) *Gasoline engine oil filter.* Remove the hexagon head screw and washer securing the oil filter shell to the oil filter cover (fig. 98). Remove and discard gasket and oil filter element. Clean the filter shell. Install a new filter using a new gasket.

Caution: **On reassembly, tighten the screw only enough to prevent leakage.**

(4) *Hydraulic unit transfer case.* When adding or refilling the transfer case with oil, remove the filter assembly next to the filler plug and clean or replace if necessary. Replace filler plug if damaged (fig. 94).

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LUBRICATION ORDER

LO9-1025-200-10

1 April 1966 (Supersedes LO 9-1025-200-10, 8 February 1965).

HOWITZER, MEDIUM, TOWED: 155-MM, M114 AND M114A1
AND
HOWITZER, MEDIUM, TOWED: AUXILIARY PROPELLED, 155-MM, M123A1

References: TM 9-1025-200-12)

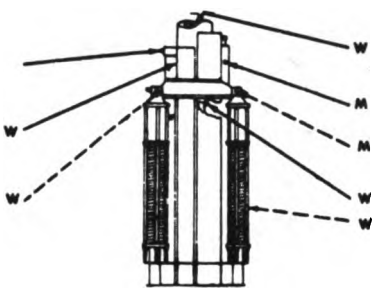
Lubrication will be performed only as prescribed by this lubrication order except as required under unusual conditions described in the referenced TM.

Clean fittings before lubricating. Clean parts with THINNER, PAINT, MINERAL SPIRITS, (TPM) or DRY CLEANING SOLVENT, (SD). Dry before lubricating (for exception see note 3). Lubricate dotted arrow points on both sides of equipment.

NOTE

CLP is the main lubricant for the oil can points and after cleaning. OL, RBC or CR may be used as an alternative unless specifically mentioned otherwise. GAA will be used as the main lubricant for organizational lubing of lube fittings.

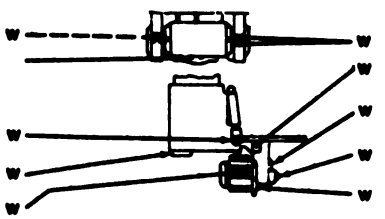
	LUBRICANT	INTERVAL
C, Fig. 96 →	Recoil Cylinder Replenisher Oil Filling Valve Plug (as required)	OHC
A, Fig. 96 →	Exposed Recoil Slide (Clean and coat with a thin film)	PL
B, Fig. 96 →	Yoke Liner	GAA



INTERVAL	LUBRICANT	
PL	Cannon Bore (Wipe clean before firing) (See note 3)	
GAA	Variable Recoil Cam Assembly (Sparingly)	← G, Fig. 96
GAA	Equilibrator Front End Sleeve Bearing	← D, Fig. 96
GAA	Cradle Keyway	← F, Fig. 96
PL	Equilibrator Springs, Rods and Tubes (Clean and oil)	← E, Fig. 96

FOLD

	LUBRICANT	INTERVAL
K, Fig. 96 →	Cradle Liner	GAA
H, Fig. 96 →	Recuperator Cylinder Oil Filling Valve Plug (Reestablish reserve before firing)	OHC
L, Fig. 96 →	Breech Mechanism Hinge Pin Assembly	PL
Q, Fig. 96 →	Breech Mechanism Rotating Cam	PL
R, Fig. 96 →	Obturator Spindle	PL



INTERVAL	LUBRICANT	
GAA	Cradle Keyway	← J, Fig. 96
PL	Breech Mechanism Crankshaft Journal	← M, Fig. 96
PL	Firing Mechanism Safety Latch	← P, Fig. 96
PL	Breech and Firing Mechanism (See note 2)	← N, Fig. 96
PL	Breechblock Rotating Roller	← S, Fig. 96

FOLD

CANNON AND RECOIL MECHANISM

- KEY -

LUBRICANTS	EXPECTED TEMPERATURES			INTERVALS
	Above +32°F	+40°F to -10°F	0°F to -65°F	
PE-1 - LUBRICATING OIL, INTERNAL COMBUSTION ENGINE:	PE-1	PE-1	OHC	A Annually
GAA - GREASE, AUTOMOTIVE AND ARTILLERY:	ALL TEMPERATURES			W - Weekly
PL - LUBRICATING OIL, GENERAL PURPOSE:	PL - (medium)	PL - (Special)	PL - (special)	M - Monthly
OHT - HYDRAULIC FLUID, PETROLEUM BASE:	ALL TEMPERATURES			S - Semiannually
M.S. 3042 - LUBRICATING OIL, GENERAL PURPOSE:	M.S. 3042	M. S. 3042	GOS	S - 5 Hours
GOS - LUBRICATING OIL, GEAR, SUB-ZERO:			GOS	50 - 50 Hours
OE - LUBRICATING OIL, INTERNAL COMBUSTION ENGINE:	OE 30 or M.S. 9250	OE 10 or M.S. 9110	OES	500 - 500 Hours
OES - LUBRICATING OIL, INTERNAL COMBUSTION ENGINE:			OES	
LCV-1 - LUBRICATING OIL, WEAPONS:	LCV-1	LCV-1		
GO80 - LUBRICATING OIL, GEAR, MULTI PURPOSE:	GO-80	GO-80	GOS	
CR - CLEANING COMPOUND, SOLVENT:	ALL TEMPERATURES			

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Figure 90. Lubrication order.

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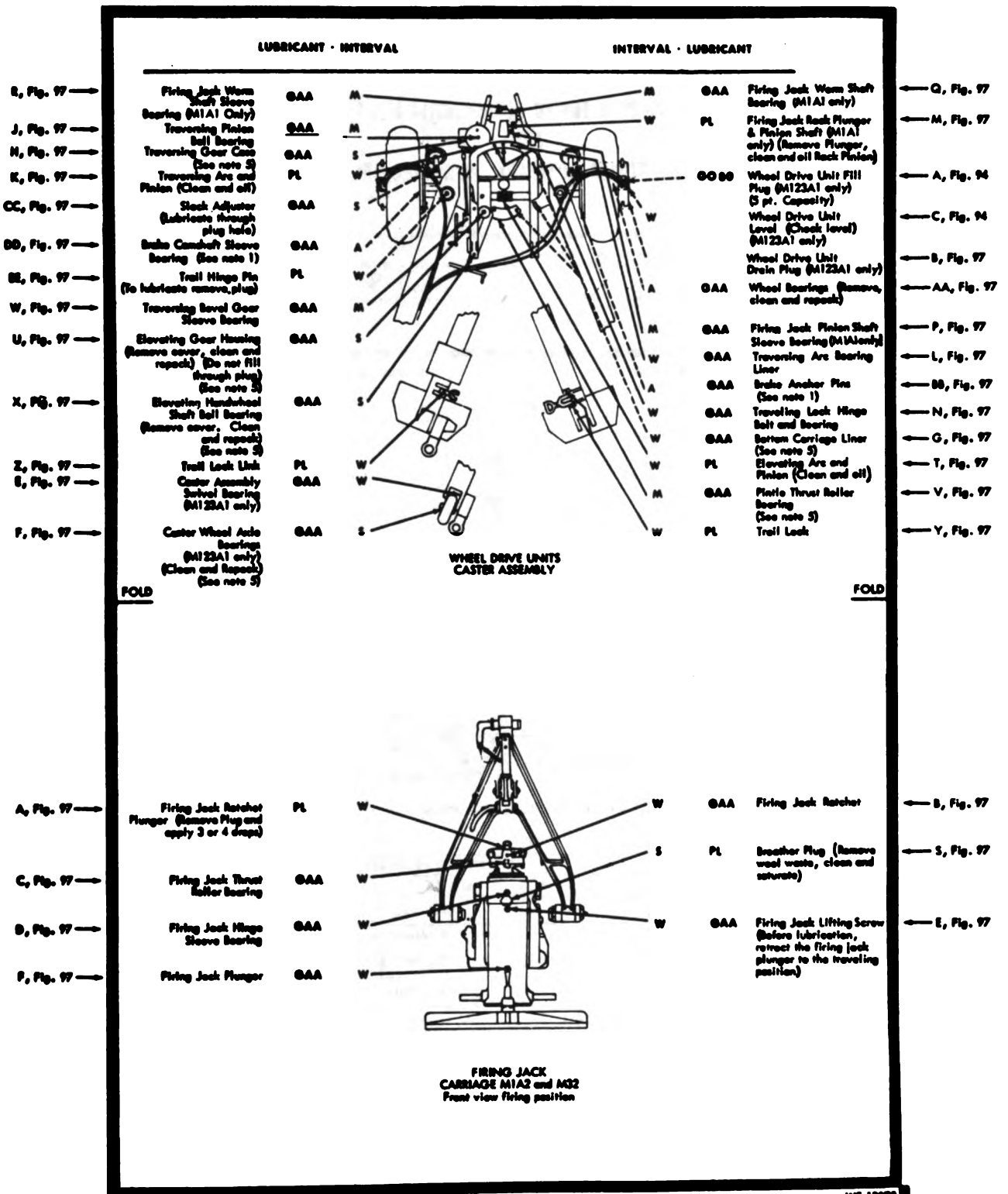


Figure 91. Lubrication order—Continued.

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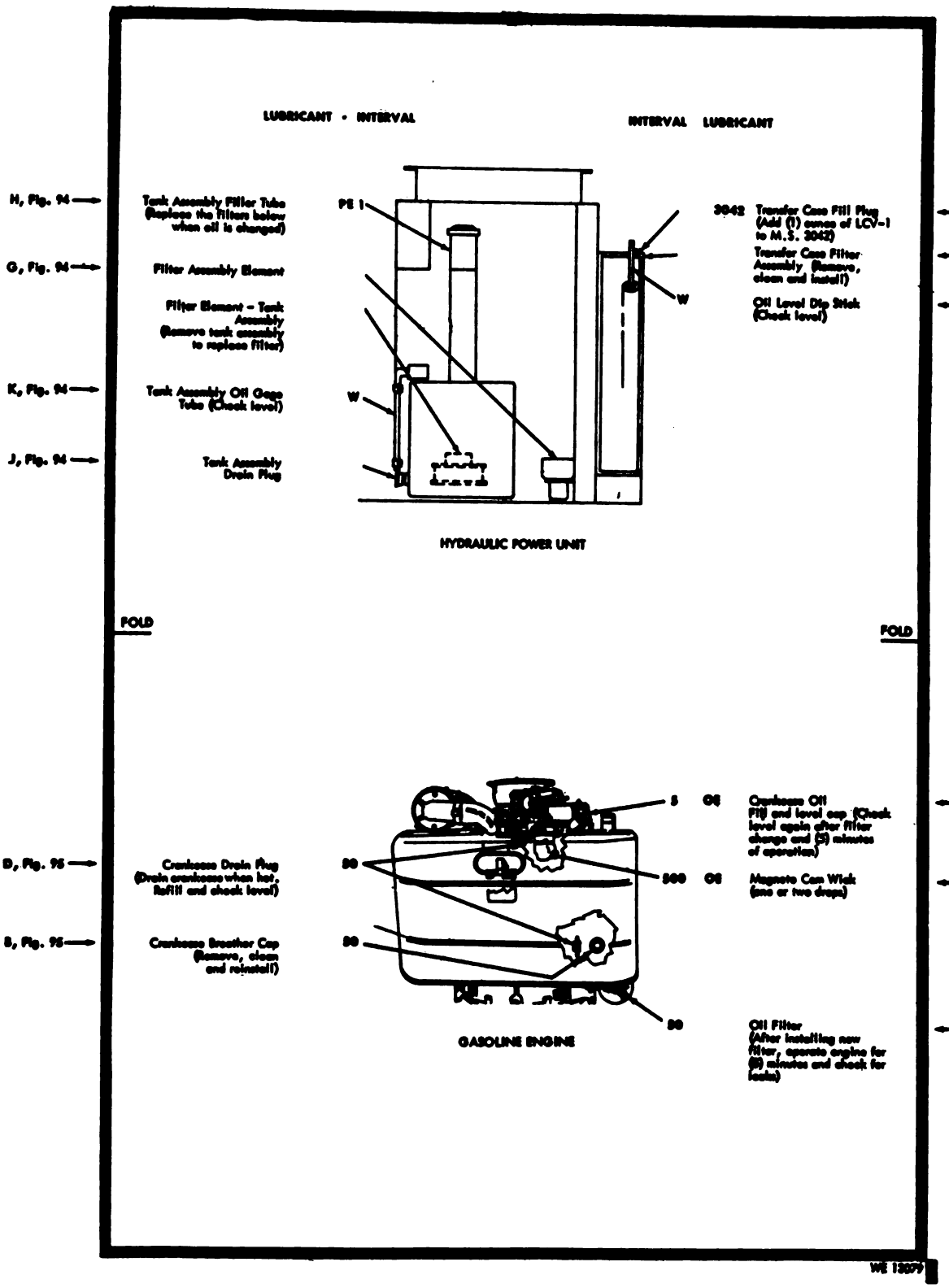


Figure 93. Lubrication order—Continued.

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– NOTES –

1. **BRAKE CAMSHAFT SLEEVE BEARING AND BRAKE ANCHOR PINS** - Lubricate at time of annual wheel bearing lubrication. Remove the plug, insert a fitting and sparingly lubricate; replace the plug after lubrication.

2. **BREECH AND FIRING MECHANISM** Lubricate all parts with PL (except the gas check pad) after firing. Repeat lubrication on the following two consecutive days after firing. Before lubricating, however, disassemble the gas check pad from the obturator spindle, clean all parts (except the gas check pad) with CR, wipe dry and oil with PL. Wipe the gas check pad with a dry cloth before assembly.

3. **CANNON BORE** - Clean with CR immediately after firing. Repeat the cleaning with CR on the following two consecutive days after firing. Make sure that all surfaces, including the rifling, are well coated. Do not wipe dry. On the third day after firing, clean with CR, wipe dry, and lightly coat with PL. From then on, weekly clean with CR, wipe dry, and recoil with PL.

4. **OIL CAN POINTS** - Lubricate weekly the following items with PL: handwheel handles, firing jack ratchets, plungers and keys, traveling lock pins, hand brake lever latches, hand brake lever release knob, firing jack ratchet knob (M1A2 and M32) latches, trail jack assembly (M123A1), and power unit control linkage (M123A1). Lubricate all exposed adjusting threads on the gasoline engine with OE every 25 hours.

5. **ITEMS LUBRICATED AT TIME OF DISASSEMBLY BY DS AND GS MAINTENANCE PERSONNEL** - Cradle, trunnion bearings, equilibrator and bearings, traversing handwheel gear case, traversing gear case, elevating pinion bearing, elevating handwheel shaft ball bearing, traversing worm gear, pintle thrust roller bearing, bottom carriage liner, firing jack, traversing worm gear case, elevating gear housing and caster wheel axle bearings.

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REPORTING OF EQUIPMENT LUBRICATION ORDER IMPROVEMENTS The direct reporting of errors, omissions, and recommendations for improving this lubrication order by the individual user is authorized and encouraged. DA Form 2028 will be completed and forwarded direct to: Commanding General, Headquarters U. S. Army Weapons Command, ATTN: AMSWE-SMM-P, Rock Island Arsenal, Rock Island, Illinois 61201.

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 the Lubrication Order.

By Order of the Secretary of the Army:

OFFICIAL:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff

WE 13080

Figure 93. Lubrication order—Continued.

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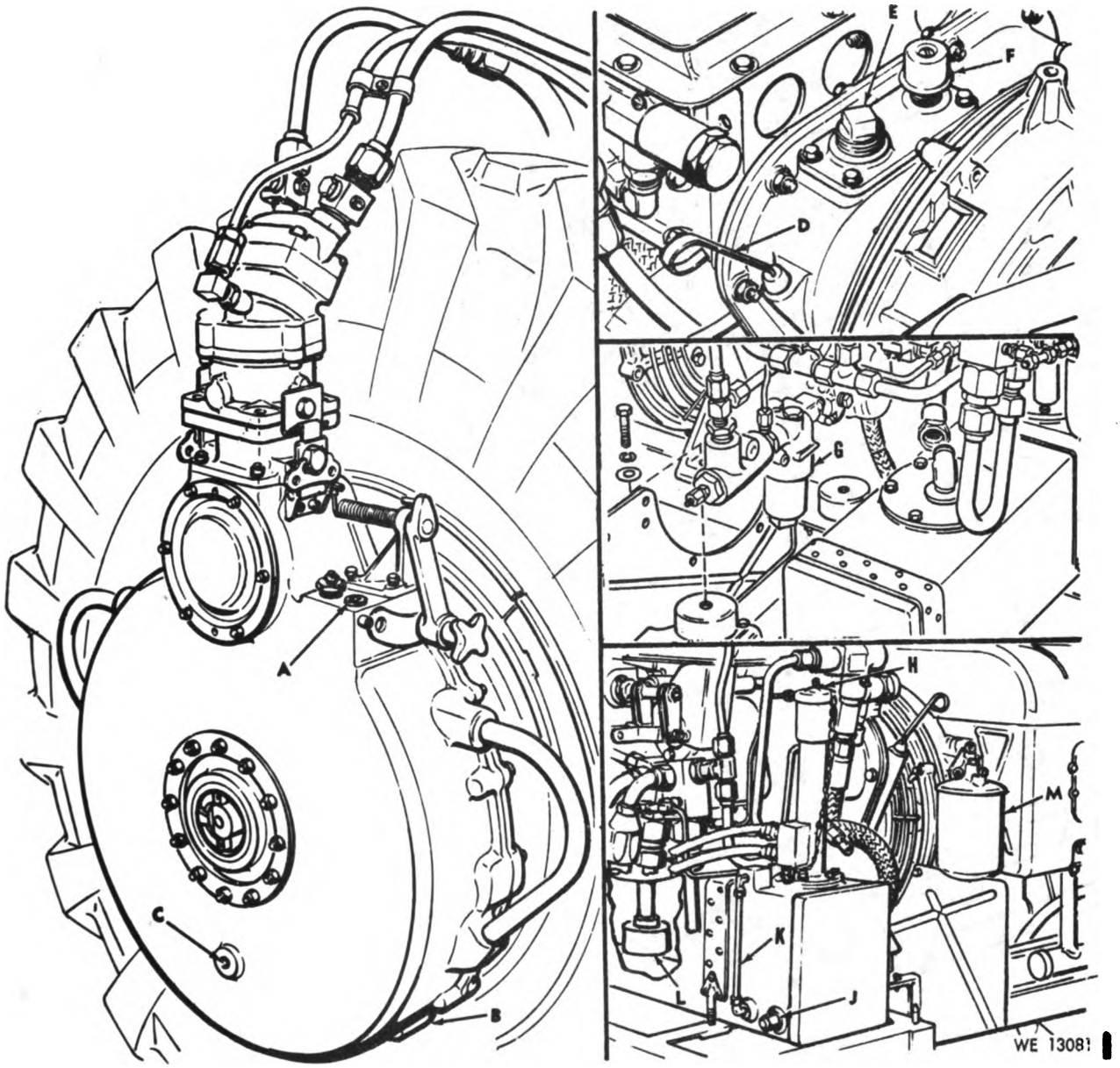


Figure 94. Localised lubrication points—carriage M32.

d. Reports and Records.

(1) Report unsatisfactory performance of prescribed petroleum fuels and lubricants or preserving materials in accordance with TM 38-750.

(2) Maintain a record of lubrication of the weapon on DA Form 2408-2 (Equipment Lubrication Record) in the equipment logbook.

66. General Lubrication Under Unusual Conditions

a. Service Intervals. Reduce service intervals specified on the lubrication

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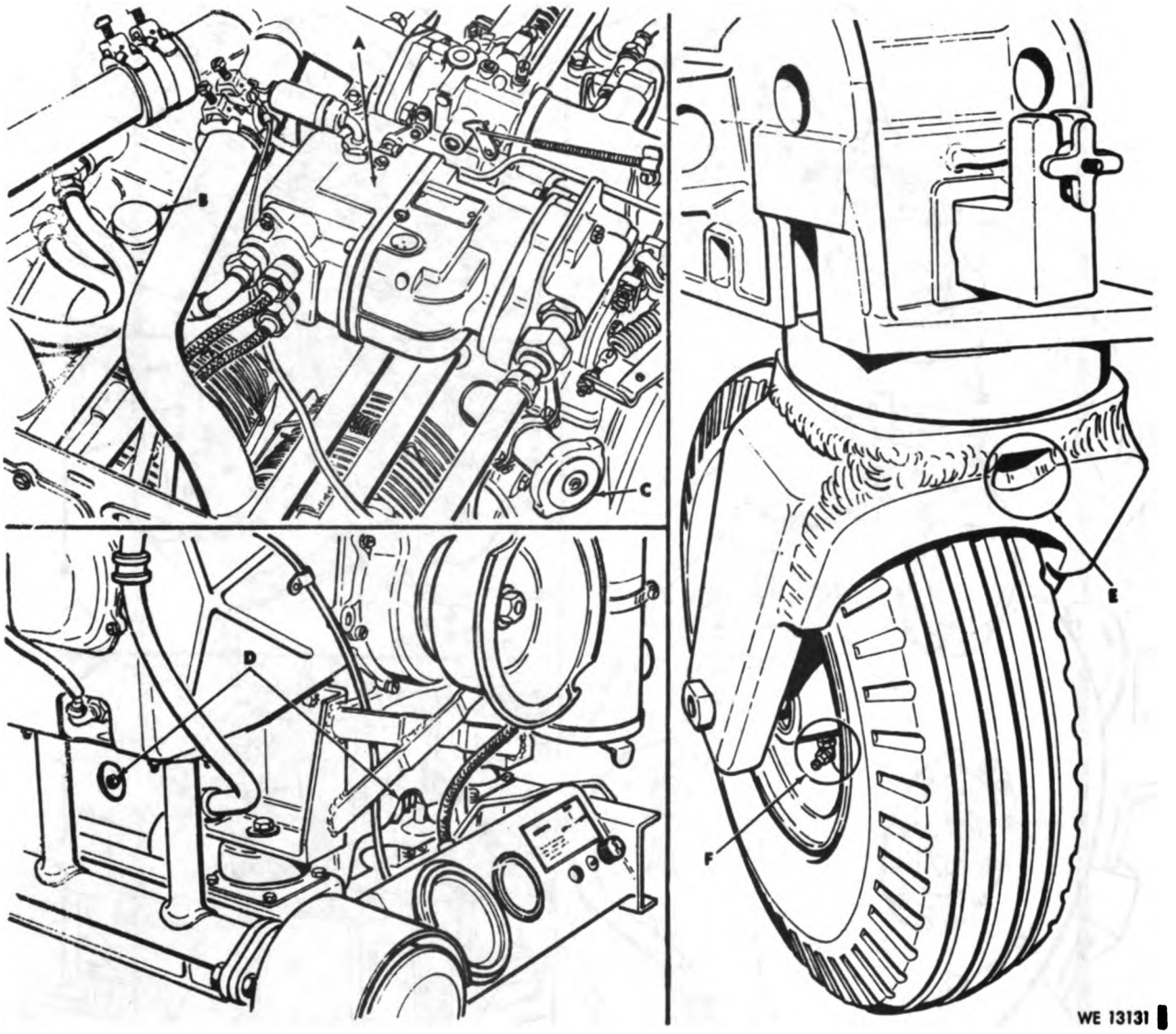


Figure 95. Localized lubrication points—carriage M32—Continued.

order to compensate for abnormal operation and extreme conditions such as high or low temperatures, prolonged periods of firing, continued operation in sand or dust, immersion in water, or exposure to moisture. Any one of these operations or conditions may cause contamination and quickly destroy the protective qualities 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 accordnance with three temperature ranges; above +32° F., +40° to -10° F., and 0° F. to -65° F. Change the grade of lubricants whenever weather forecast data indicate that air temperature 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

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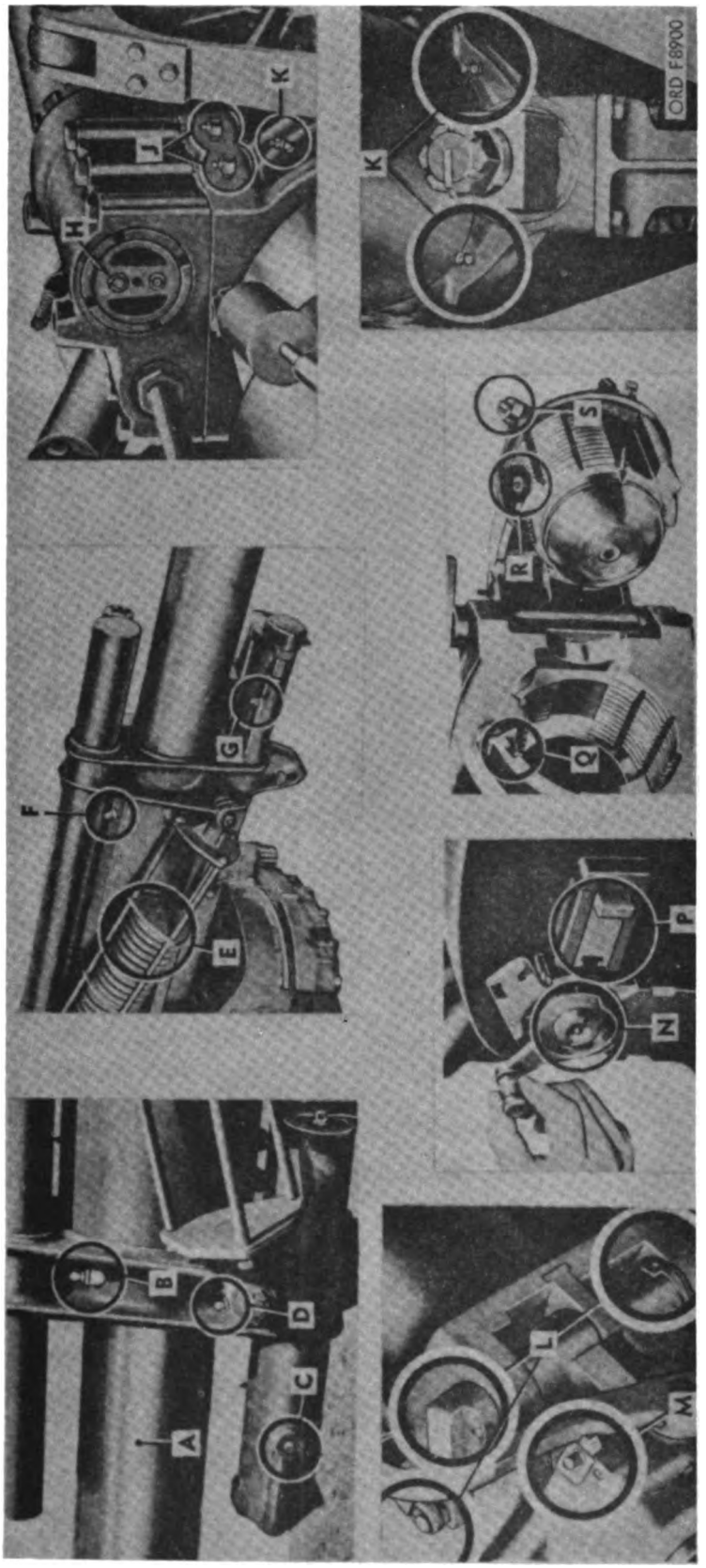


Figure 96. Localized lubrication points—howitzer and recoil mechanism.

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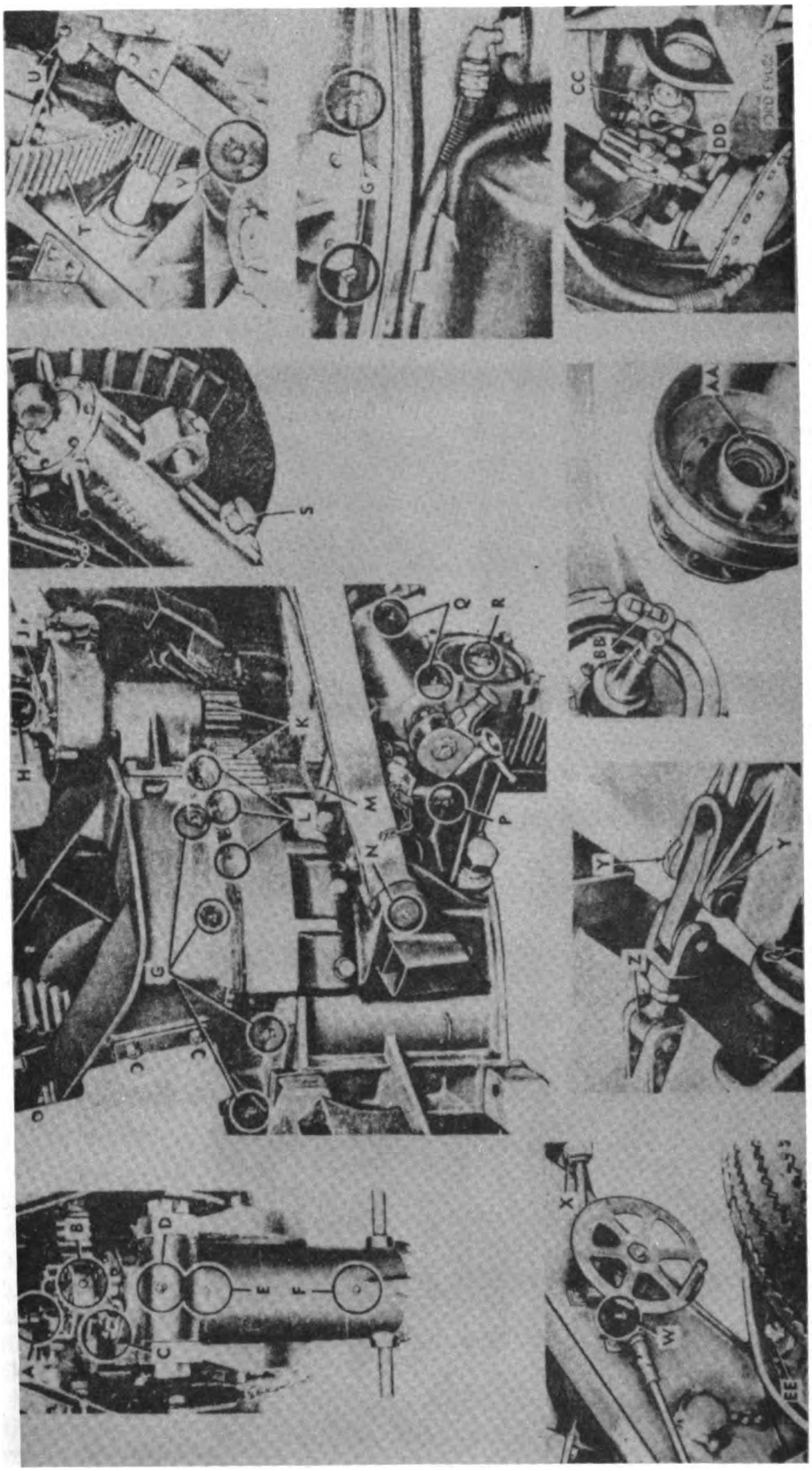


Figure 97. Localized lubrication points—carriages.

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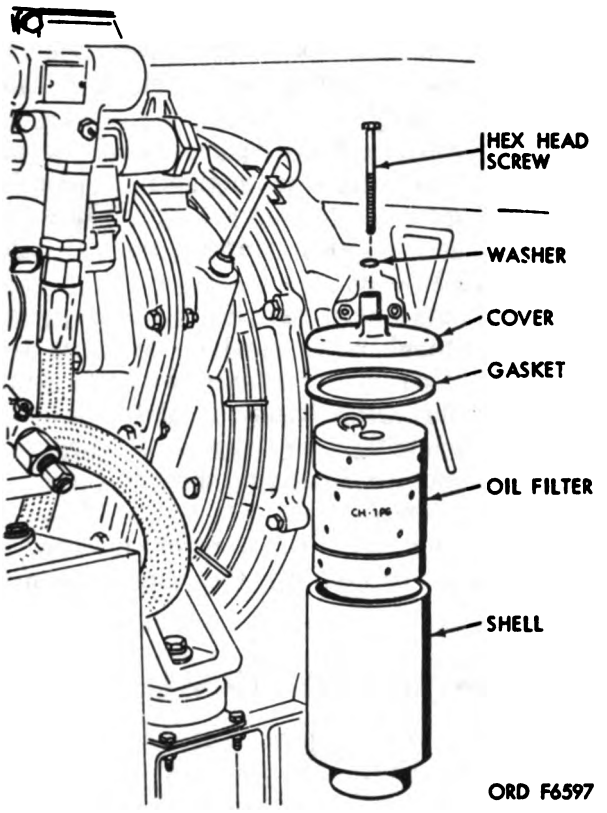


Figure 98. Installing oil filter.

in temperature is encountered. However, if the operation of the materiel is hampered 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.

c. Extreme Cold–Weather Lubrication. See TM 9–207 for instructions on necessary special preliminary lubrication of the weapon. Sighting and fire–control equipment is normally lubricated for operation over a wide range of temperatures. This materiel should be exercised frequently during periods of low temperature to insure proper functioning. If any of the equipment does not function properly, notify ordnance maintenance personnel. Precautions to be observed and procedure to be followed when bringing sighting and fire–control equipment indoors during freezing weather are prescribed in paragraph 54c and TM 9–207.

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 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.

f. After–Fording Lubrication.

(1) Immediately after weapon is towed from the water, if the tactical situation permits, perform the following services:

(*a*) Remove the wheels and hub assemblies and thoroughly clean and dry all working parts of the brakes and wheel bearings. Lubricate the assemblies in accordance with the lubrication order.

(*b*) Empty the materiel of any accumulated water, clean, dry, and apply the prescribed lubricant to all exposed unpainted surfaces, paying especial attention to the bore and chamber, the recoil slides, and the equilibrator rods.

(*c*) Remove drain plugs from the trails, allow trapped water to drain out, and install the drain plugs (par. 104*a*). See that the four drain holes in the top carriage (fig. 133) are open.

(2) If parts of the materiel are accidentally submerged or badly splashed, apply temporary preservation 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

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most important to remove all traces of salt water and salt deposits from every part of the cannon and carriage. Apply temporary preservation and notify ordnance maintenance personnel so that necessary complete disassembly, cleaning, and lubrication may be performed as soon as possible.

g. Lubrication After Operation Under Dusty or Sandy Conditions. If firing or prolonged travel has occured 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 mxiture that causes rapid wear of parts.

67. Painting

a. Materials for painting, prescribed for use by organizational personnel, are listed in appendix II.

b. Instructions for preparation of the materiel for painting and methods of painting are contained in TM 9–208–1 and TM 9–218. Camouflage painting information is contained in FM 5–20.

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

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

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

68. General

Preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain that it is in serviceable condition, prevent breakdowns, and assure maximum operational readiness. Operational preventive maintenance is accomplished by the equipment operator. The operator's role in the performance of preventive–maintenance services is:

a. To perform the daily service each day the equipment is operated.

b. To assist the organizational maintenance mechanics in the performance of any other scheduled periodic services specified by pertinent technical manuals.

c. To assist the organizational maintenance mechanics in the lubrication of the equipment in accordance with the pertinent lubrication order.

69. Responsibility

Operators are personally responsible for assigned weapons. Squad, section, and platoon leaders are charged with supervisory responsibility for weapons pertaining to their commands. Unit and organization commanders are required to insure that weapons issued or assigned to their command are properly maintained in a serviceable condition, and that they are properly cared for and used.

70. Recording Repairs

Repairs accomplished will be in accordance with procedures and standards prescribed in appropriate technical manuals. The equipment record system provides for recording repair required and accomplished on specific items of equipment. This will include, but is not limited to, adjusting, cleaning, and replacing. Deficiencies discovered before, during, and after operation that cannot be corrected by the operator will be entered on DA Form 2404. Deficiencies immediately corrected by the operator are not recorded, except when such corrections are made by replacing parts or which constitute repairs above operational maintenance. Such repairs will be recorded as organizational maintenance.

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71. General Procedures for All Services and Inspections

a. The following general procedures apply to operational maintenance preventive-maintenance services and all inspections, and are just as important as the specific procedures.

b. Inspections to see if items are in good condition, correctly assembled or stowed, secure, not excessively worn, not leaking, and adequately lubricated apply to most items in the preventive-maintenance inspection procedures. Any or all of these checks that are pertinent to any item (including supporting, attaching, or connecting members) will be performed automatically, as general procedures, in addition to any specific procedures given.

(1) Inspection for "good condition" is usually an external visual inspection to determine whether the unit is damaged beyond safe or serviceable limits. Good condition is explained further as meaning: not bent or twisted, not chafed or burred, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, and not deteriorated.

(2) Inspection of a unit to see that it is "correctly assembled" or stowed is usually a visual inspection to see if the unit is in its normal position in the equipment and if all its parts are present and in their correct relative position.

(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, locknuts, locking wires or cotter pins as well as any connecting tubes, hoses or wires.

(4) By "excessively worn" is meant worn beyond serviceable limits or to a point likely to result in failure if the unit is not replaced before the next scheduled inspection. Excessive wear of mating parts of linkage connection is usually evidenced by too much play (lash or lost motion). It includes illegibility as applied to markings, data and caution plates, and printed matter.

(5) Where the instruction "tighten" appears in the procedure, it means tighten with a wrench even if the item appears to be secure.

(6) Such expressions as "'adjust if necessary" or "replace if necessary" are not used in the specific procedures. It is understood that whenever inspection reveals the need of adjustment, repairs, or replacement, the necessary action will be taken.

c. Any special cleaning instructions required for specific mechanisms or parts are contained in the pertinent section. General cleaning instructions are as follows:

(1) Use dry-cleaning solvent or mineral spirits paint thinner to clean or wash grease or oil from all metal parts, except those exposed to powder fouling during firing. This solvent will not readily dissolve the corrosive salts from powder and primer compositions.

(2) Use rifle-bore cleaner to clean all armament parts which have been exposed to powder fouling during firing.

Note. Rifle-bore cleaner is not a lubricant. Parts which require lubrication will be wiped dry and oiled.

(3) After the parts are cleaned, rinse and dry them thoroughly. Apply a light grade of oil to all polished metal surfaces (other than optical instruments) to prevent rusting.

(4) When authorized to install new parts, remove any preservative materials, such as rust-preventive compound, protective grease, etc.; prepare parts as required (oil seals, etc.); and for those parts requiring lubrication, apply the lubricant prescribed in the lubrication order.

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d. General precautions in cleaning are as follows:

(1) Dry-cleaning solvent or mineral spirits paint thinner is flammable and should not be used near an open flame. Fire extinguishers should be provided when these materials are used. Use only in well-ventilated places.

(2) These cleaners evaporate quickly and have a drying effect on the skin. If used without gloves, they may cause cracks in the skin and, in the case of some individuals, a mild irritation or inflammation.

(3) Avoid getting petroleum products, such as dry-cleaning solvent, mineral spirits paint thinner, engine fuels, or lubricants, on rubber parts as they will deteriorate the rubber.

(4) The use of diesel fuel oil, gasoline, or benzene (benzol) for cleaning is prohibited.

e. To prevent formation of damaging mildew, shake out and air the canvas cover for several hours at frequent intervals. Have any loose grommets or rips in the canvas repaired without delay. 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 is 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, notify organizational maintenance personnel so that steps can be taken to have the canvas retreated. Oil and grease can be removed by scrubbing with issue soap and warm water. Rinse well with clear water and dry.

f. Identification plates, caution plates, and instruction plates found to be in a rusty condition should be thoroughly cleaned and heavily coated with clear lacquer.

72. Basic Preventive Maintenance

Inspect and service the weapon as described in paragraphs 9 and 10 at least once every six months and after any extended travel with the weapon, 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, mineral spirits paint thinner, and lubricants are furnished for this purpose. Remove all traces of rust from finished surface with crocus cloth, which is the coarsest abrasive to be used by organizational personnel. A coarser abrasive may be used on unfinished parts. Take care not to change the shape or dimensions of part.

b. Repaint painted surfaces as required to cover nicks, scratches, and worn spots which expose bare metal (par. 67). Complete repainting is not necessary.

c. Tighten loose parts, as necessary.

d. Each time a weapon 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. See table 5 on troubleshooting for information on 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 six months, check the equipment log book to see that all modification work orders have been applied. A list of current modification work orders is published in DA Pam 310-4. No alteration or modification will be made by organizational personnel, except as authorized by official publications.

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

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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. In cold weather, apply lubricant sparingly (par. 66*c*).

i. It is necessary to exercise the materiel in the hands of the troops, frequently. This means the working and operation of all moving parts, except the recoil mechanism, without actually firing the gun. Exercising the materiel should occur at least once a week in ordinary climates. If the weapon is not fired during a period of six months, notify ordnance personnel to exercise the recoil mechanism.

j. Promptly report unsatisfactory performances to ordnance office responsible for maintenance in accordance with AR 750-5, if correction is beyond the scope of organizational maintenance.

73. Preventive Maintenance by Operator(s)

a. Purpose. To assure maximum operational readiness, it is necessary that the equipment be systematically inspected at intervals every day it is operated, so defects may be discovered and corrected before they result in serious damage or failure. Certain scheduled maintenance services will be performed at these designated intervals. Any deficiencies discovered that cannot be corrected by the operator, or corrected by replacing parts will be reported on DA Form 2404.

b. Daily Preventive-Maintenance Service. Each piece of equipment will be inspected each day that it is operated.

74. Specific Procedures for Oporators

Table 8 gives specific procedures to be performed on the equipment by the operator for each daily service.

Table 8. Preventive Maintenance Checks and Services

Interval and [illegible] No.				Operational Daily Schedule		
Before travel	Before firing	During firing	After firing	Item to be inspected	Procedure	Paragraph reference
1	--	--	--	Equipment log book.	Insure it is present, complete, and cover is not torn; check for proper stowage.	8
--	10	--	18	Breech mechanism.	Open and close breech several times checking for smooth operation.	39*f*(1) (2)
					Check headspace adjustment.	85*c*
--	11	--	19	Firing mechanism.	Check to see that it is functioning properly and firing lock locks in both positions.	90
3	--	--	--	Tools.	Inspect for presence of all tools, condition, and proper stowage.	9, 62, 63
4	12	--	20	General condition.	Inspect for overall condition as follows: paint cracks, broken welds, rust, missing or damaged parts.	67, 71
--	13	--	21	Elevating and traversing mechanism.	Check for smooth operation of elevating and traversing mechanism making sure there is no binding or jerking motion and the handwheel backlash does not exceed 1/6 of a turn of handwheel.	98
--	15	17	23	Recoil mechanism.	Check air holes at rear of replenisher piston guide making sure they are not clogged.	94*a*
					Check for oil leakage.	
					Check for smooth operation and length of recoil.	
7	--	--	--	Firing jack.	Operate jack to check for smooth operation.	48*c*
9	--	--	--	Tires, wheel, and brakes.	Check tires for cuts, stones, nails and air pressure (correct pressure is 50 psi).	114

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Table 3. Preventive Maintenance Checks and Services—Continued.

Interval and Sequence No.				Operational		Daily Schedule
Before travel	Before firing	During firing	After firing	Item to be inspected	Procedure	Paragraph reference
					Check wheel retaining nuts and insure they are tight (use wrench).	114
					Check for moisture in air filters and air tank.	119, 122*c*
					Test air brakes for functioning and leaks.	122
					Apply handbrakes and see that they hold weapon securely in position.	89c, 119c 122*b*
--	16	--	--	Sighting and fire control instrument.	Visually check instruments for smears, dirt, and foreign objects on lens and windows. The controls must operate properly and instruments must be in serviceable condition.	146
24	--	--	--	Wheel drive unit (M123A1 only).	Inspect fastener pin assembly. It must be adjusted so that it holds the unit snugly against the carriage wheel.	106b
					Check lubricating fluid level.	39c
					Check drain and fill plugs to be sure they are tightened securely.	39c
					See that fastener locks hold the hydraulic motor to the drive units.	136
25	--	30	--	Hydraulic hose assemblies (M123A1 only).	Check hose assemblies for leakage at loose connections and condition of the hose clamps, supports, and brackets.	122
26	--	31	--	Hydraulic power unit (M123A1 only).	Check linkage for damaged or bent rods.	136h, i
					Check hydraulic tubing for loose connections and leakage.	136f
					Check hydraulic fluid level tube on reservoir tank and add oil as required.	39c
--	--	--	--	Hydraulic power unit (M123A1 only) continued.	Check lubricating oil in transfer case and add oil as required.	39c
					Inspect to see that all latches and fastening pins are properly engaged.	39c
--	27	--	--	Gasoline engine (M123A1 only).	Make a visual inspection of the engine for cracks, breaks, and loose or missing hardware. Inspect inside the shrouds for loose connections, damage, and signs of tampering. Look for fuel or oil leaks under and around the unit. Do not operate the engine until all deficiencies are corrected.	9, 10
					Check the engine oil level and add oil as required.	39c
					Clean dust and dirt from the engine shrouds, air intake housing, and cylinder cooling fins.	9, 10
--	--	32	--	Gasoline engine (M123A1 only)	Inspect the engine for unusual operation, such as overheating, excessive vibration, failure to deliver full power, and failure to respond to controls. If noises or irregularities are noticed, stop the engine at once and correct or report the deficiencies to organizational maintenance. Do not resume operation until the deficiencies have been corrected.	39c, 138
28	--	--	--	Trail jack (M123A1 only).	Check to see that trail jack assembly is secure in the left trail, operates freely, and does not slip.	39d, 132
--	29	--	--	Caster wheel (M123A1 only).	Inspect tire for cuts, stones, nails, and air pressure (correct pressure is 35 psi).	127
					Check to be sure that spade key holding the caster assembly is secure.	39b

*Missing sequence numbers purposely omitted.

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75. Preventive Maintenance by Organizational Mechanic

The following paragraphs prescribe and describe the quarterly inspections, tests, and adjustments that must be made in the performance of organizational preventive maintenance. The services performed and all deficiencies and shortcomings discovered during its performance will be recorded and reported as prescribed in Army Equipment Record Procedures, TM 38-750.

76. General

Preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain it in serviceable condition, prevent breakdown, and assure maximum operational readiness. Organizational preventive maintenance is accomplished by the organizational mechanics. Their role in the performance of preventive-maintenance services is:

a. To perform the monthly scheduled periodic services specified by pertinent technical manuals.

b. To lubricate the equipment in accordance with the pertinent lubrication order.

77. Recording Repairs

Repairs accomplished will be in accordance with procedures and standards prescribed in appropriate technical manuals. The equipment record system provides for recording repairs required and accomplished on specific items of equipment. This will include, but is not limited to, adjusting, cleaning, replacing, and straightening. Deficiencies and shortcomings not corrected by operators or crew, or those discovered during periodic inspections, will be corrected insofar as possible by organizational maintenance personnel. These repairs will be indicated on DA Form 2404 and recorded on the organizational maintenance record of the equipment log book.

78. General Procedures

a. Automatically Applied. All of the general procedures given in the operator's manual will be followed. Organizational mechanics must be so thoroughly trained in these procedures that they apply them automatically at all times in the performance of their duties.

b. Operator Participation. The driver or crew usually accompanies the equipment and assists the organizational mechanics in the performance of organizational periodic services.

c. Plates. Identification, caution, warning, and instruction plates made of steel rust very rapidly. When they are found to be in a rusty condition, they should be thoroughly cleaned and heavily coated with an application of lacquer. Refer to TM 9-213.

d. Services. Organizational services are defined by, and restricted to, the following general procedures unless approval has been given by the supporting ordnance organization.

(1) *Adjust.* Make all necessary adjustments in accordance with instructions contained in the pertinent section of this technical manual or applicable technical bulletins.

(2) *Clean.* Clean the unit as outlined in paragraph 71 to remove old lubricant, dirt, and other foreign material.

(3) *Special lubrication.* This applies either to lubrication operations that do not appear on the lubrication order or to items that do appear but which should be performed in connection with the maintenance operations.

(4) *Service.* This usually consists of performing special operations; such as draining and refilling units with fluid or oil, changing fluid or oil, cleaning the oil filter, air cleaner, or cartridges.

(5) *Tighten.* All tightening operations should be performed with sufficient wrench torque (force on the wrench handle) to tighten the unit according to good mechanical practice. Use a torque wrench where specified. Do not overtighten as this may strip threads or cause distortion. Tightening will always be understood to include the correct installation of lock

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washer, lock nuts, locking wire, or cotter pins to secure the tightened nut.

(6) *Modification work order application.* The owning organization will enter on DA Form 2408-5 all required modification work orders (MWO's) applicable to the equipment upon receipt of the official MWO, regardless of the level responsible for applying the modification.

e. Special Conditions. When conditions make it difficult to perform the complete preventive-maintenance procedures at one time, they can sometimes be handled in sections. Plan to complete all operations within the week, if possible. All available time at halts and in bivouac areas must be utilized, if necessary, to assure that maintenance operations are completed.

79. Specific Procedures for Organizational Maintenance Mechanics

Table 4 gives the specific procedures to be performed on the equipment by organizational personnel for each monthly service.

Table 4. Preventive Maintenance Checks and Services

Organisational		Monthly Schedule	
Sequence number	Item to be inspected	Procedure	Paragraph reference
1	Overall cover.	Remove cover and check for loose grommets, tears, or mildewing.	71e
2	Barrel assembly.	Check for unusual wear and damage in bore or corrosion and damage to external surface.	10, 82
3	Breech mechanism.	Open and close breech several times, checking for smooth operation.	39f(1) (2)
4	Firing mechanism.	Check to see that it is functioning properly and firing lock locks in both positions.	90
5	General condition.	Inspect for overall condition as follows: paint, cracks, broken welds, rust, and missing or damaged parts.	67, 72
6	Trails.	See that trail lock and trail locking retainer pin securely locks trails.	103b
		Inspect for trapped moisture.	104
7	Top and bottom carriage.	Check four drain holes, making sure they are not clogged.	96
		Check elevating and traversing mechanism for smoothness of operation.	98
		Inspect elevating and traversing arcs and pinions for burs, chips, and cracks.	98d
		Check handwheel backlash (must not exceed 1/6 of a turn of handwheel).	98
		Check adjustment of equilibrators. (Equilibrators are properly adjusted when the howitzer is slightly muzzle heavy when unloaded, and slightly breech heavy when loaded.)	100a, b
8	Recoil mechanism.	Check for fluid leakage.	94a
		Exercise replenisher making sure that the piston moves.	94c, e
		Check air holes at rear of replenisher piston guide making sure they are not clogged.	94a(2)
9	Firing jack and travel lock.	Check firing jack plunger cover for rips or mildewing (carriage M1A1 only).	71e
10	Tires, wheels, and brakes.	Check tires for cuts, stones, nails, and air pressure (correct pressure is 50 psi).	114
		Check wheel retaining nuts and insure they are tight.	114
		Check air filters and air tank for moisture.	119d, f
		Apply handbrakes and see that they hold weapon securely in position.	119i
		Test for leakage in air system.	122a

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Table 4. Preventive Maintenance Checks and Services—Continued

Organizational		Monthly schedule	
Sequence number	Item to be inspected	Procedure	Paragraph reference
		Road test the weapon and make the following checks: Apply air brakes several times to check proper operation. Note unusual side pull or drag. Adjust in accordance with paragraph 122. Test emergency brake application	122*e* 122*b*
		Check for unusual or excessive noises caused by improper adjustment, worn or loose parts, and lack of lubricant.	122*e*
		After road test, feel wheel hubs and brake drums for overheating.	
11	Equipment log book	Check to see that binder and cover are not torn or mutilated. Insure that all DA Forms required are present, legible and up-to-date.	TM 38-750
12	Panoramic telescope M12A7C.	Look through telescope. There will be no cracked elements, smears, scratches, condensation, or fungus on optics.	Table 6
		Rotate elevation and azimuth micrometer knob. There will be no irregular movement or backlash when rotation of knob is reversed.	
		Press throwout lever. Lever must release gearing when pressed and return the worm into mesh when released.	
		Ballistic reticle must illuminate when instrument light is turned on.	
13	Telescope mount M25	There will be no irregular movement or backlash when cross level and elevation knob are rotated.	Table 6
		Vials will not be cracked, broken, or loose in their mountings.	
		Tangent screws must not be damaged and must be free to move.	
		Locking screws will function properly.	
		Wing knob movement will be under spring tension, have a smooth movement, and will properly lock telescope in place.	
		Remove dirt, dents, nicks, burs, and paint from mounting surfaces.	
14	Instrument light M34 and aiming post light M14.	Check toggle switch and lamp, with batteries installed, and see if switch will function properly and the lamp will turn on and off.	Table 6
		Check for dents in case, and check to see if batteries will slide in and out of case. Parts should not be bent or missing.	
15	Fire control quadrant M1A1.	Visually check level vials to be sure they are not broken, cracked, or loose in mounting.	Table 6
		Check moveable parts to see if they function without undue irregularities, looseness, or tightness.	
		Also, be sure the plunger spring will have sufficient tension to maintain firm contact between plunger teeth and frame.	
		Visually examine frame shoes and segment teeth for nicks, burrs, dirt, or paint on these surfaces.	
16	Aiming post M1A2	Aiming post will be complete with cover and equipment.	Section XXIV
17	Fuse setters M26 and M28.	Scales and indexes are legible. Scales rotate freely when thumbscrew is loosened.	Section XXIV
18	Gasoline engine	Inspect spark plugs. Clean and regap to 0.030 inch. Replace damaged plugs.	TM5-2805-204-14.
19	Ignition switch	Inspect ignition switch for loose mounting and improper operation; the magneto ground lead for breakage and loose connection.	135*c*

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Table 4.1. Expendable and Consumable Supplies

FSN	Description	Symbol
8135-292-9728	BARRIER MATERIAL, GREASEPROOFED, WATER-PROOFED, FLEXIBLE: Moldable, self-adhering coating, hvy duty, 36 w, 100 yd roll MIL-B-121, amend 2, type II, grade C, class 2 (81349).	
7920-255-7536	BRUSH, CHASSIS AND RUNNING GEAR: 2 fiber clear of block, 2½ block w, w/handle, wood, ¾ dia, 2½ block w, 3½ block lg, 21¾ o/a lg H-B-181 (81348).	
7920-205-2401	BRUSH, CLEANING, TOOL AND PARTS: Chinese bristle, rd, brush part clear of block 2 lg, 1½ dia MS 16746-29 (96906)	
8020-242-7266	BRUSH, PAINT: fl, sq-edge, hog bristle, 3 w, 7/8 thk, 3 1/4 exposed lg, 3 in. size H-B-420, class 1, grade B (81348).	
	CHALK, MARKING: rd tapered, enameled, 4 lg SS-C-255 (81348).	
7510-223-6700	Blue (taper dia. 7/8)	
7510-223-6701	White (taper dia. 1 to 7/8)	
7930-227-1887	CLEANING COMPOUND, OPTICAL LENS: liquid, 1 qt cntr	
6850-753-4967	CLEANING COMPOUND, SOLVENT: powder 5 oz cntr 0-I-490 (81348).	
6850-224-6663	CLEANING COMPOUND, RIFLE BORE: solution type, 1 gal can MIL-C-372.	RBC
	CLOTH, ABRASIVE: al-oxide, jean-cloth-backing, closed-coat, 9X11 sheet, 50-sheet sleeve. P-C-451, type I, class 1 (81348).	
5350-192-5051	Grit no. 180 (gr 5/0)	
5350-192-5049	Grit no. 120 (gr 3/10)	
5350-192-5047	Grit no. 80 (gr 1/0)	
5350-221-0872	CLOTH, ABRASIVE: crocus, ferric-oxide and quartz, jean-cloth-backing, closed-coat, 9X11 sheet, 50-sheet sleeve P-C-458 (81348).	
8305-224-8286	CLOTH, BURLAP: jute, 9 oz per sq yd, natural color, 60 w CCC-C-467 (81348).	
8305-222-2423	CLOTH, CHEESECLOTH, COTTON: natural color, unshrunk, 1.60 oz per sq yd, 38½ w CCC-C-440 (81348).	
	CORROSION PREVENTIVE COMPOUND: Petrolatum, hot application, soft film MIL-C-11796A, class 3 (81349).	CL
8030-231-2353	5 lb can	
8030-231-2349	25 lb pail	
8010-297-2124	ENAMEL: olive drab, semigloss, 1 gal, color X24087 TT-E-485 (81348).	
6505-104-9000	ETHYL ALCOHOL, TECHNICAL: 95 percent, (for cleaning optics of sighting and fire-control equipment), 1 gal can JAN-A-463, grade 1 (81348).	
	GREASE, AUTOMOTIVE AND ARTILLERY: minus 65 deg to plus 125 deg F. efficient temp range MIL-G-10924 (81349).	GAA
9150-190-0905	5 lb can, type V, cl 2	
9150-190-0907	35 lb pail, type II	
	HYDRAULIC FLUID, PETROLEUM BASE: preservative, hyd equip MIL-H-6083 (81349).	OHC
9150-935-9807	1 qt can, type I	
9150-935-9808	1 gal can, type I	
9150-935-9809	5 gal pail, type I	
	LACQUER: brushing, nitrocellulose, quickdrying, clear.	
8010-166-1703	1 1 pt can, MIL-L-1118 (81349)	
8010-166-1688	1 qt can, TT-L-26 (81349)	
9150-111-3199	LUBRICATING OIL, ENGINE: 5 gal pail MIL-L-21260 (81349).	PE
9150-577-5841	LUBRICATING OIL, GEAR, MULTIPURPOSE: universal type use, 5 gal pail, grade 80 MIL-L-2105 (81349).	GO-80
	LUBRICATING OIL, GEAR, SUB-ZERO: 0 deg to minus 65 deg F. operating temp MIL-L-10324 (81349).	GOS
9150-261-7904	1 qt can	
9150-257-5440	5 gal drum	
	LUBRICATING OIL, GENERAL PURPOSE: non-corrosive, low temp VV-L-800 (81348).	PL-S
9150-231-6689	1 qt can, type V, cl 6	

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Table 4.1. Expendable and Consumable Supplies—Continued

FSN	Description	Symbol
9150-231-9062	5 gal pail, type I	
	LUBRICATING OIL, GENERAL PURPOSE: Noncorrosive MIL-L-3150 (81349).	PL-M
9150-231-2361	1 qt can, type V, cl 4	
9150-231-2356	5 gal pail, type I	
9150-985-7232	LUBRICATING OIL, GENERAL PURPOSE: 5.43 centistokes at 210 deg F. max viscosity, 5 gal pail, type 1 MIL-L-15016 (81349).	3042
	LUBRICATING OIL, INSTRUMENT: (For fire control instruments) MIL-L-6085 (81349).	OAI
9150-257-5449	4 oz can	
9150-223-4129	1 qt can	
	LUBRICATION OIL, INTERNAL COMBUSTION ENGINE: Above minus 20 deg F. operating temp, type 1 MIL-L-2104 (81349).	
9150-189-6927	1 qt can	OE-10
9150-186-6668	5 gal pail	
9150-186-6681	1 qt can	OE-30
9150-188-9858	5 gal pail	
	LUBRICATING OIL, INTERNAL COMBUSTION ENGINE: 0 deg to minus 65 deg F. operating temp MIL-L-10295 (81349).	
9150-402-4478	1 qt can, type I	OES
9150-242-7603	5 gal pail, type I	OES
9150-889-3523	LUBRICATING OIL, WEAPONS: preservative, vapor inhibited, general purpose, 1 qt can MIL-L-46002 (81349)	LCV-1
6640-663-0832	PAPER, LENS: tissue, sheet form, 5 lg, type I NNN-P-40 (81348).	
7920-205-1711	RAG, WIPING: cotton, bleached or unbleached, mixture of white or colored, designed for general purpose use, 50 lb bale DDD-R-30 (81348).	
7920-240-2559	SPONGE, CELLULOSE: rect, 3½ w X 4¾ lg X 1 7/8 thk LS-626 w	
8135-877-7502	TAPE, PRESSURE SENSITIVE: 60 yd roll, 1/4 w PPP-T-60 (81348).	
8135-269-8092	TAPE, PRESSURE SENSITIVE, ADHESIVE: Cloth backing, opaque, oil and water resistant, green color, 4 w, 60 yd roll PPP-T-60 (81348).	
8135-584-5785	TAPE, PRESSURE-SENSITIVE, ADHESIVE: black ¾ w, 60 yd roll PPP-T-97 (81348).	
	THINNER, PAINT, MINERAL SPIRITS: (Use in lieu of drycleaning solvent) TT-T-291, GR 1 (81348).	TPM
8010-242-2089	1 gal screw top can	
8010-558-7026	5 gal cylinder drum	
	THINNER, SYNTHETIC RESIN ENAMEL: TT-T-306 (81348).	
8010-160-5791	1 pt can	
8010-160-5794	1 gal can	
	1, 1, 1- TRICHLOROETHANE TECHNICAL: 0-T-620 (81348).	
6810-664-0387	1 gal	
6810-664-0388	5 gal	
6810-551-1487	55 gal	
4020-241-8875	TWINE, FIBROUS: fine India fin., 1 lb ball TT-911 (81348).	

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Section IV. TROUBLESHOOTING

80. Scope

a. This section contains troubleshooting information and tests for locating and correcting some of the troubles which may develop in the weapon. Troubleshooting 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.

Table 5. Troubleshooting

Malfunction	Probable cause	Corrective action
Failure to fire	Primer does not fire	Remove primer and replace
	Charge does not fire	After waiting 10 minutes, remove charge and replace.
Misfires and cookoffs	Weapon tube heats up after continuous firing and may cause fuze projectile filler or propellant to explode.	(See para 49).
Primer fails to fire	If firing pin indent is sharp and well-formed, primer is defective.	Insert a new primer. If second primer is defective, causing a hangfire or a misfire (para 49), turn the lot of primers over to ordnance maintenance personnel.
	If the primer indent is shallow or if there is no indent at all and if the lanyard pull was normal (para 48*d*, either the firing mechanism M1 was improperly seated (para 91*c*) or 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 (para 16). If the operation of the percussion hammer is faulty, notify ordnance maintenance personnel.

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Table 5. Troubleshooting—Continued.

Malfunction	Probable cause	Corrective action
Primer fails to fire—Continued.	In most cases, shallow or no indent is caused 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, oil lightly, and assemble. When inserting, screw the firing mechanism all the way in until it rests against its stop stud and is fully latched (par. 48b).
Charge fails to fire.	Missing, wet, or caked igniter.	Replace charge.
	Igniter protective cap not removed.	Remove cap.
	Charge inserted improperly (igniter end not against obturator spindle), or charge incorrectly assembled.	Remove charge, assembly correctly (par. 172c), and insert in chamber so that the igniter pad is resting against the face of the obturator spindle (par. 48b).
	Primer vent hole fouled.	Clean vent with vent cleaning tool.
Breech will not open.	Firing mechanism M1 is in place.	Remove firing mechanism M1.
Firing mechanism safety latch may be stuck right.		Move safety latch to left. If necessary, disassemble and clean.
Breechblock may be seized.		Notify ordnance maintenance personnel.
Breech mechanism does not operate smoothly.	May be caused by lack of lubrication. Scores on threads of breechblock or breech ring may cause binding.	Disassemble breech mechanism, clean, and lubricate (par. 84). Notify ordnance maintenance personnel.
Threaded sectors of breechblock and breech ring do not mate.	Breech mechanism may have been assembled improperly.	Disassemble breech mechanism and assemble properly (par. 84).
	Breechblock control arc may be missing.	Notify ordnance maintenance personnel.
Obturating parts do not seal the breech properly (powder fouling on breech ring or breechblock threads).	Bruised or burned gas-check pad, or burred or ruptured split rings.	Disassemble breech mechanism (par. 84) and replace damaged obturating parts.
	Obturator spindle spring may be weak or broken causing looseness in the assembly of the obturator parts.	Notify ordnance maintenance personnel.
Operating handle latch does not latch properly.	Lack of lubrication.	Disassemble latch and lubricate (par. 84).
	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.

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Table 5. Troubleshooting—Continued.

Malfunction	Probable cause	Corrective action
Stuck projectile.		Place the loading tray in position in the breech recess. Insert the rammer into the bore at the muzzle end and push it carefully until it incloses the fuze and comes in contact with the ogive of the projectile. Hold an extra rammer, pickax handle, or other wooden implement firmly against the base of the projectile to steady its backward movement. Tap the end of the rammer staff with a wooden block until the projectile comes to rest in the loading tray.
Fluid leaks from rear of replenisher.	If the weapon has been at 0-degree elevation for some time, fluid 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 three drops per minute are considered serious.	If leakage at any packing exceeds three drops per minute, notify ordnance maintenance personnel.
Weapon does not return to battery.	Too much fluid in the replenisher may prevent howitzer from returning to battery.	Reduce amount of fluid in replenisher to normal (pars. 39*i* and 93*a*(3)).
	Insufficient reserve fluid in recuperator cylinder may prevent complete counterrecoil.	Drain off reserve fluid and refill (pars. 39*i* and 93*a* (3)).
	The gas pressure may not be sufficient to return the howitzer to battery.	Notify ordnance maintenance personnel.
	Replenisher piston may be stuck.	Exercise replenisher piston (par. 94).
Weapon returns to battery with too much shock.	Insufficient fluid in replenisher may interfere with cushioning.	Refill replenisher to normal (par. 94).
	Excess amount of reserve fluid in recuperator may return howitzer to battery with too much force.	Drain recuperator reserve fluid and refill (94*f*).
	The viscosity of fluid may be affected by the heat resulting from sustained firing.	Allow weapon to cool.
Weapon slow to return to battery (under usual or mild climactic conditions) when fluid indication is normal.	Insufficient gas pressure in the recuperator or too much friction at the packings may retard counterrecoil.	Notify ordnance maintenance personnel.
Uneven or jerky counterrecoil.	Tight, scored, or improperly lubricated howitzer bearing srufaces and foreign substances in oil can prevent smooth counterrecoil.	Notify ordnance maintenance personnel.

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Table 5. Troubleshooting—Continued.

Malfunction	Probable cause	Corrective action
Weapon recoils too far	Insufficient gas pressure in the recuperator or a malfunction of the variable recoil mechanism may permit the weapon to recoil to far.	Notify ordnance maintenance personnel.
Insufficient recoil	High viscosity of fluid 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.
	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.
No hissing sound of escaping air during counterrecoil.	Replenisher air holes may be stopped-up.	Clean the air holes in the rear of the replenisher (para 94*a*(2).
	The counterrecoil respirator may be jammed.	Notify ordnance maintenance personnel.
Fluid leaks from forward end of counterrecoil cylinder.	The appearance of black fluid in front of the counterrecoil cylinder is a normal condition due to lubrication. If clear fluid appears at the front of the counterrecoil cylinder, it is an indication of leakage at the counterrecoil piston.	Notify ordnance maintenance personnel.
Oil index does not emerge when fluid 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 a reserve fluid 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 fluid reserve and refill (para 94). While injecting fluid, 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.
Fluid drips from counterrecoil piston rod, recoil piston rod, or stuffing boxes in excess of three drops per minute.		Notify ordnance maintenance personnel.
Elevating mechanism jams	Interference between tipping and nontipping parts or the elevating mechanism may be defective.	If the backlash in the elevating or traversing mechanism exceeds one-sixth turn of the handwheel, notify ordnance maintenance personnel.
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 (para 100*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.
Excessive tire wear	Misalinement of wheels resulting from bent wheel spindles.	Notify ordnance maintenance personnel.
	Loose bearings	Adjust wheel bearings (para 118*g*).
	Wheels are loose on their hubs	Tighten loose wheel retaining nut (para 111*b*).
	Bent wheels	Replace wheel and tire assembly (para 111).

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Table 5. Troubleshooting—Continued.

Malfunction	Probable cause	Corrective action
	Incorrect tire pressure	Inflat tires to the recommended pressure (para 114a).
Wheels contact ground during firing (carriage M1A2).	The wheels of carriage M1A2 may not be raised sufficiently by the firing jack to clear the ground during firing if the firing jack ratchet plunger is not engaged in its stop or if the firing jack ratchet pin is in wrong position.	Operate jack handles to extend jack plunger as far as it will go and engage the ratchet plunger in its stop (para 39(9) (d)).
Firing jack plunger cannot be extended or retracted (carriage M1A2).	A broken ratchet pawl spring may jam the mechaniam.	To retract plunger, insert finger in hole for pawl spring pin and press pin back to engage the pawl. Keep finger pressed against the pin while operating jack handles. To extend plunger, hold the ratchet pin toward the ratchet plunger while operating the jack handles. If the howitzer must be fired, tie the ratchet pin to the ratchet plunger to keep the firing jack locked during firing. Ordnance maintenance personnel must replace broken pawl spring at first opportunity.
Firing jack ratchet plunger will not hold its position (carriage M1A2).	Ratchet plunger lock spring is probably broken.	Notify ordnance maintenance personnel.
Intermittent braking or no braking.	A leak in air brake system ------	Test for air leaks with soap suds and remedy as prescribed in paragraph 122a.
	Moisture in air tank or air filters clogging the units.	Remove drain plugs, drain, and install plugs (para 122c). In cold weather, there may be ice in these units which must be melted to complete draining.
	Air filter strainer may be clogged	Remove strainer and clean (para 122d).
		If malfunction has not been corrected, notify ordnance maintenance personnel.
Weak braking ----------	Excessive travel of brake diaphragm push rods.	Adjust brakes (para 122e).
	Worn, glazed, or greasey brake lining.	Remove wheel hub and brake drum (para 116). Wash lining with drycleaning solvent or volatile mineral spirits. If brake linings are worn or glazed, notify ordnance maintenance personnel.

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Table 5. Troubleshooting—Continued

Malfunction	Probable cause	Corrective action
Grabbing brakes.	Insufficient air pressure at brakes	Notify ordnance maintenance personnel.
	Loose wheel bearings.	Adjust bearings (para 118*g*).
	Worn wheel bearings.	Notify ordnance maintenance personnel.
	Brakes are out of adjustment.	Adjust (para 122*e*).
Brakes are not applied automatically when emergency air line is disconnected.	Defective emergency relay valve.	Notify ordnance maintenance personnel.
Locked brakes.	Leaking emergency air hose connector.	Tighten or replace air hose coupling packing ring or connector gasket (para 122*a*).
	Leak in the emergency air line.	Notify ordnance maintenance personnel.
	The service and emergency air brake couplings are improperly attached to the prime mover.	Cross the service and emergency air brake hoses when coupling them to prime mover (para 52*j*)
Failure of clutch handle to engage (M123A1).		Perform operation in paragraph 39*c*(4) *(a)*2. If clutch handle still fails to engage after above operation, notify ordnance maintenance personnel.
Wheel drive unit does not hold snug position (M123A1).	A loose fit may be caused by a loose fastener pin assembly on the wheel spindle.	Tighten fastener pin assembly.
	Excessive play may be caused by worn, damaged, or missing dust seal.	Replace dust seal. If above corrective actions do not remove the difficulty, notify ordnance maintenance personnel.
One or both wheels creep (hydraulic power unit M123A1).	When engine in the hydraulic power unit is idling and one or both of the carriage wheels creep, perform corrective active as shown:	See paragraph 136*g*.
Howitzer has a tendency to drift (M123A1).		See paragraph 136*h*.
Malfunction of gasoline engine (M123A1).		Refer to TM 5-2805-204-14 for gasoline engine malfunctions.

Section V. CANNON TUBE

81. General

a. The 155-mm cannon (fig. 99) consists of the breech ring, the breechblock, breech mechanism, and 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 cannon 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 midtube. The tube is not tapered.

c. An integral recoil guide key (fig. 99) and similarly shaped removable recoil guide key maintain the alinement of the cannon tube in the recoil mechanism.

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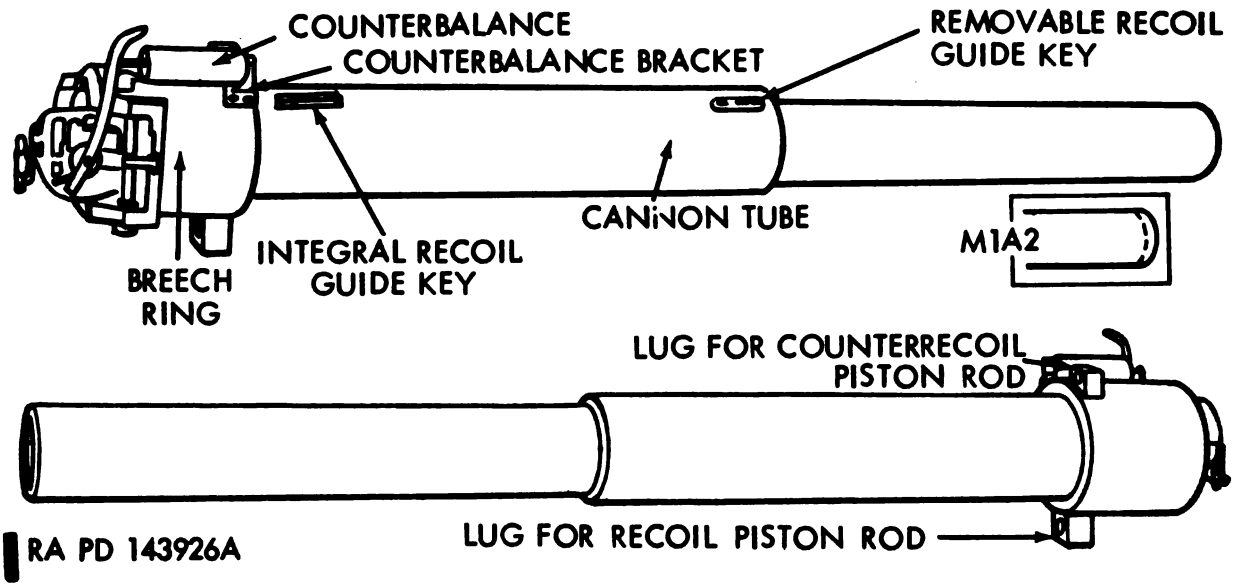


Figure 99. 155-mm cannon.

d. The rear end of the cannon 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 1 turn in 25 calibers.

e. The M1A2 is identified by ½-inch rounded groove encircling cannon 1¾.

82. Maintenance

a. Wear on cannon depends not only upon the number of rounds fired but also upon the cooling periods permitted between rounds and upon the care of the weapon as regards a thorough cleaning and oiling schedule that is followed consistently (para 71c).

b. The bore should be cleaned before firing (para 47*b*). The assitant 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 cannon 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 breechlock or breech ring to ordnance maintenance personnel for correction.

e. Weekly, clean the exposed exterior of the cannon tube with dry-cleaning solvent or volatile mineral spirits, wipe dry, and lubricate as prescribed in paragraph 65.

Section VI. BREECH MECHANISM

83. General

a. Counterbalance. The counterbalance (figs. 99 and 100) facilitates closing the breech when the cannon is elevated, under which condition gravity opposes the swinging of the breechblock into the breech recess. It also tends to hold the breechblock carrier in the open position when the counterbalance piston rod and the arm of the breechblock carrier thing pin swing past dead-center position. The counterbalance is

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supported by and hinged on the counter-balance bracket which is mounted on the forward right side of the breech ring. It is attached to 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. 100) hinges the breechblock carrier and attached parts to the breech ring. The hinge pin body pin, 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 supporting bearing surface for the hinge pin and breechblock carrier.

c. Breechblock Operating Handle Latch. The breechblock operating handle latch (fig. 100) 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.

d. Firing Mechanism Housing Adapter. The firing mechanism housing adapter (fig. 99) 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 screws into the firing mechanism housing, during firing of the howitzer (para 48*b*).

e. Percussion Mechanism. The percussion mechanism consists of the percussion hammer (fig. 100), the percussion hammer hinge pin, and the percussion hammer locking pin knob (fig. 23). 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. 87). The percussion hammer will not strike the firing pin in the firing mechanism unless the firing mechanism has been screwed fully into its housing (para 48*b*).

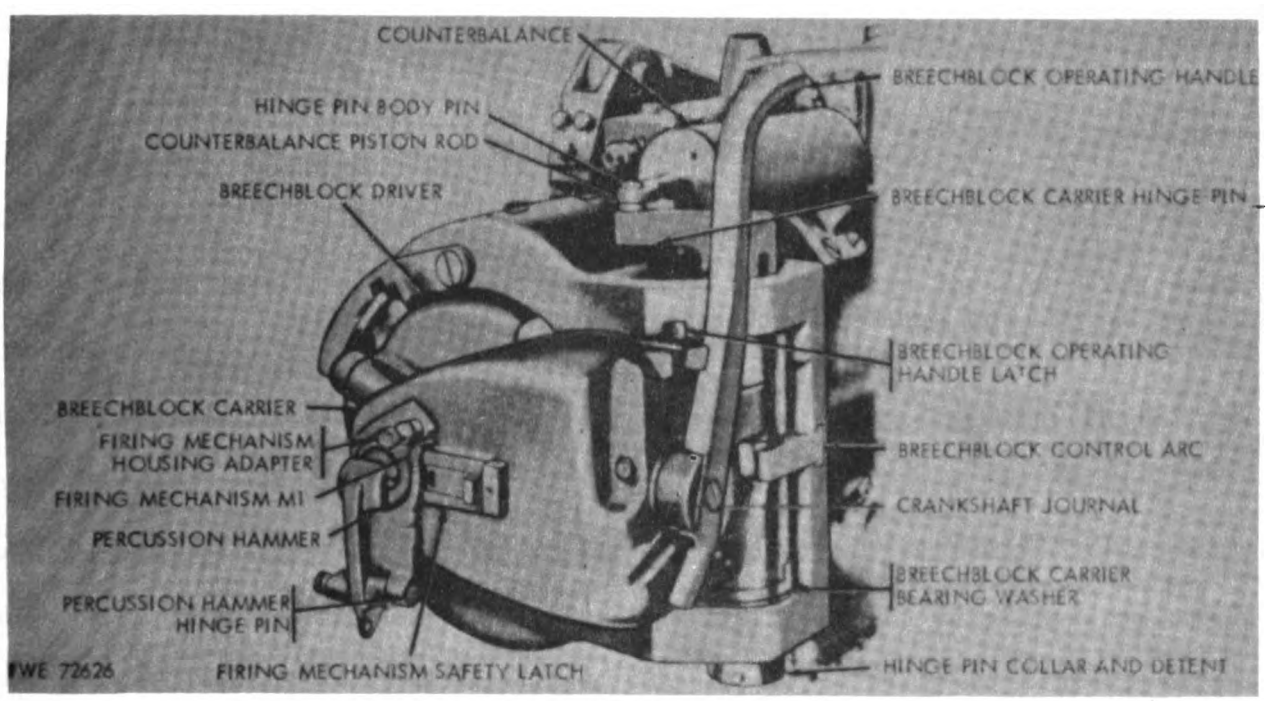


Figure 100. Breech mechanism—right rear view.

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f. Firing Mechanism Safety Latch. The firing mechanism safety latch (fig. 100) 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 the closed and locked position.

g. Obturator Parts. The obturating parts (fig. 101) consist of the obturator spindle (with 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 dle plug, which screws into the rear end of the spindle, is taper-bored to receive the primer.

h. Breechblock. The breechblock (fig. 102) is of the cylindrical, stepped-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, which forms the bearing surface on which the breechblock is carried on the hub of the breechblock carrier (figs. 100 and 101). The rear portion of the bore contains three wide splines which mate with three similar splines of the breechblock driver. They permit the breechblock to move backward and forward on the driver as the breechblock is being unlocked and locked, but constrain the breechlock to turn with the driver.

i. Breechblock Carrier. The breechblock carrier (fig. 103) supports the breechblock and its actuating parts. The right end of the carrier is hinged on the breechblock carrier hinge pin (fig. 100). 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 surface forms a bearing surface for the breechblock driver. 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, obturator spindle (fig. 101), gas-check pad compressing spring, firing mechanism housing

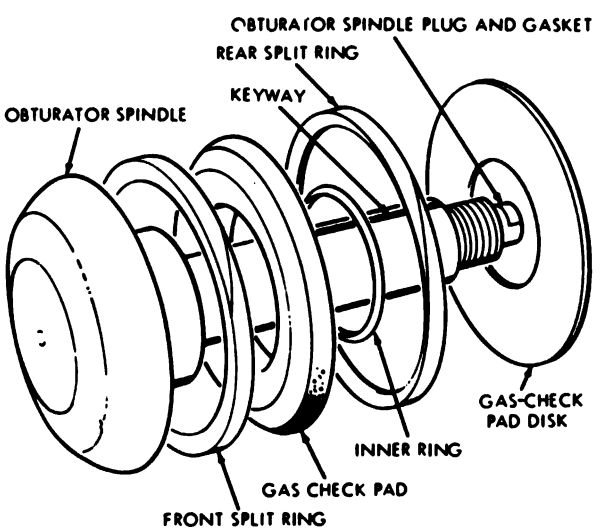


Figure 101. Breech obturating parts—removed from breechblock.

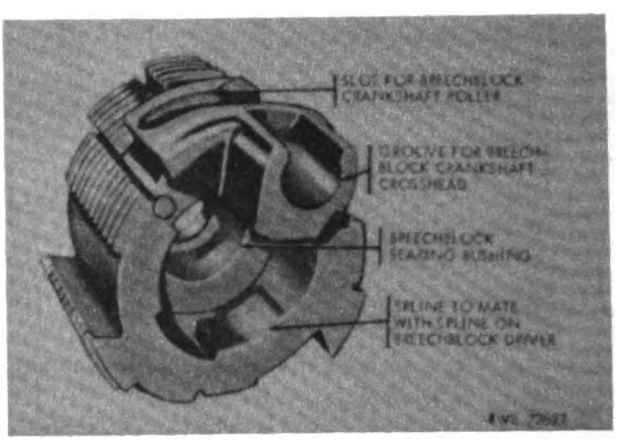


Figure 102. Breechblock.

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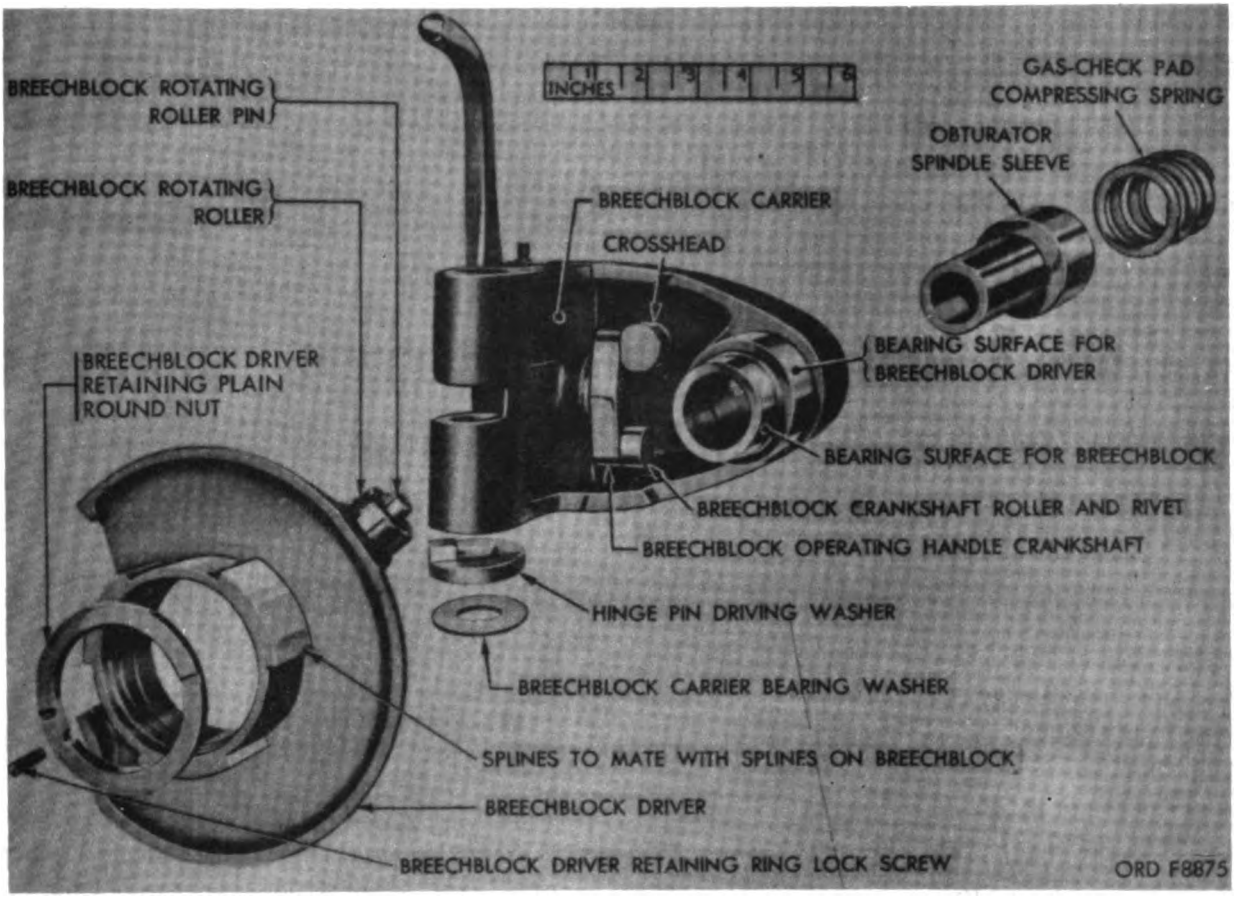


Figure 103. Breechblock carrier and breechblock actuating parts—exploded view.

adapter, and firing mechanism housing (fig. 86). The carrier houses the operating handle crankshaft and related breechblock actuating parts.

j. Breechblock Actuating Parts. The breechblock operating handle crankshaft (fig. 103) 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. 102) 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. 100) supports the breechblock operating handle crankshaft 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. The breechblock driver rotates on the hub of the breechblock carrier and is retained on the hub by the breechblock driver retaining ring and 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 is mounted in a slot in

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the breech ring (fig. 1.04). 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 cannon breech ring (fig. 104) is cylindrical in form. At the front end are lugs on the top and bottom for attachment of the cannon to the counterrecoil and recoil piston rods (fig. 99). At the rear on the right side is the lug 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. The breechblock rotating cam is attached to the upper left rear face of the breech ring. The forward portion of the breech ring is threaded internally to receive the cannon 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.

84. Disassembly

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. 101) 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 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. With the breechblock in the unlocked position, disconnect the counterbalance piston rod from the hinge pin (*b*(3) below) and remove the hinge pin (*g* below). Several men should carefully remove the complete breechblock carrier and breechblock assembly rearward from the weapon and then remove the obstructing parts remaining in the recess.

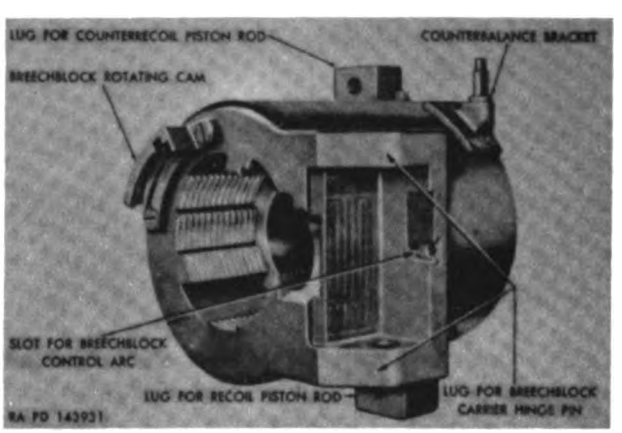


Figure 104. Breech ring—right rear view.

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

(1) Remove the firing mechanism if in place by unscrewing it counterclockwise and removing it from its housing (fig. 86).

(2) Remove the breechblock control arc screw from the breech ring (fig. 105), and withdraw the control arc from the breech ring.

(3) Open the breech (par. 39*f*(1)) and swing the breechblock operating handle to the right until the counterbalance cylinder spacer can be placed between the counterbalance piston rod end and the counterbalance cylinder head (fig. 106). 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 materiel from the results of accidental closing of the breech.**

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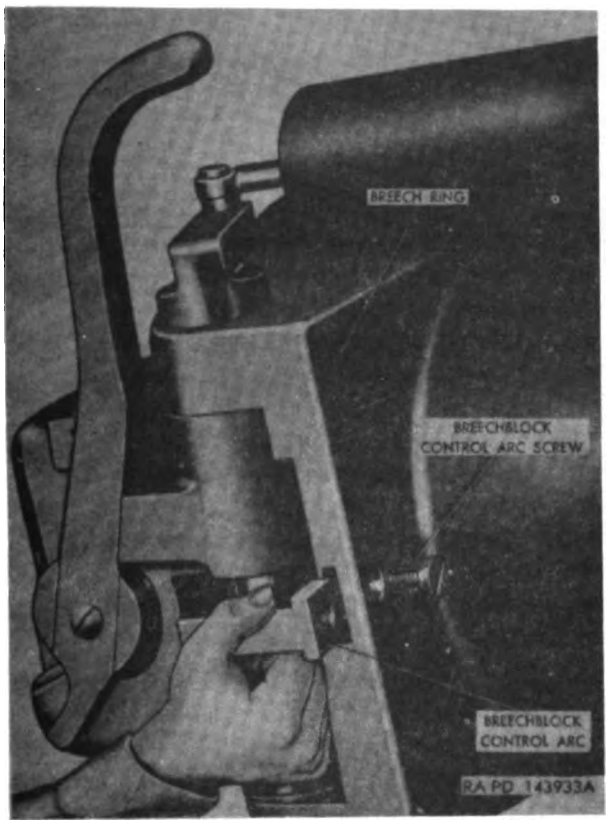


Figure 105. Removing or installing breechblock control arc.

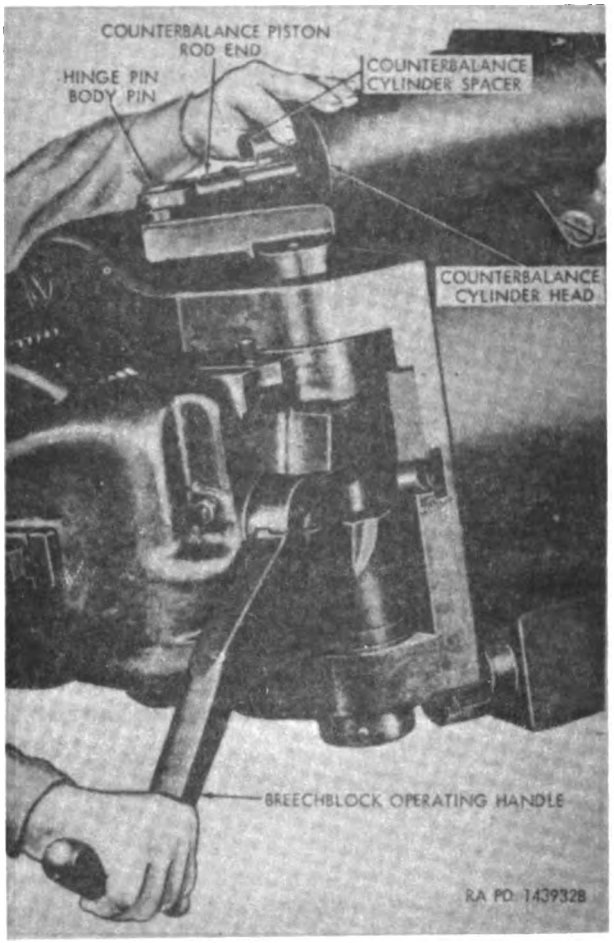


Figure 106. Installing or removing counterbalance cylinder spacer on or from counterbalance piston rod.

(4) Swing the breech fully open. Remove the firing mechanism housing lock screw (fig. 107) from the left side of the firing mechanism housing adapter. With the breech remaining open, lift the operating handle to the closed position.

(5) Remove the socket head cap screw (fig. 108) 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. 109).

(6) Unscrew and remove the firing mechanism housing (fig. 109), using the firing mechanism housing tool. This releases the firing mechanism housing adapter, the obturator spindle with obturating parts, and the gas-check pad compressing spring (fig. 110).

(7) Withdraw the firing mechanism housing adapter and the gas-check pad compressing spring from the rear of the carrier (fig. 110). 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,

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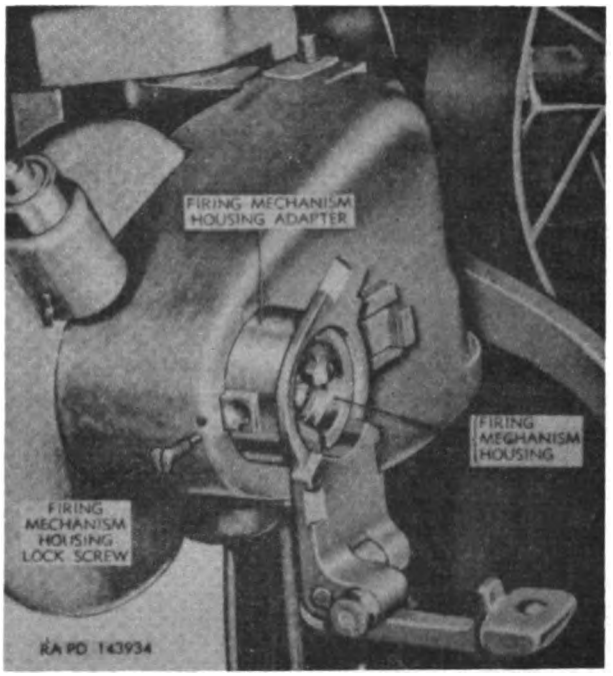


Figure 107. Unlocking firing mechanism housing.

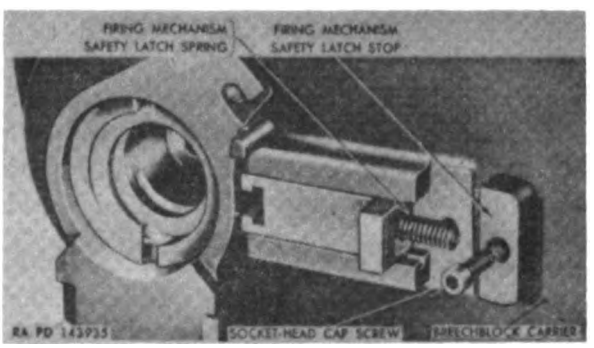


Figure 108. Removing or installing firing mechanism safety latch stop.

the inner ring, and the gas-check pad disk (figs. 101 and 110).

(8) Slide the firing mechanism safety latch and plunger (fig. 64) to the left, and withdraw it from the breechblock carrier. Withdraw the obturator spindle sleeve rearward out of the breechblock carrier (fig. 111).

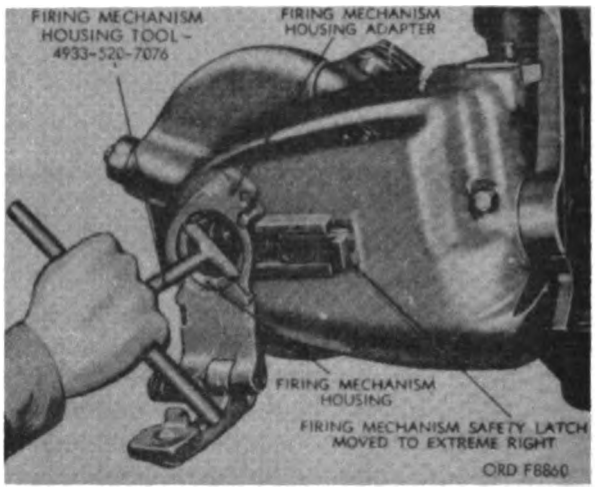


Figure 109. Removing or installing firing mechanism housing.

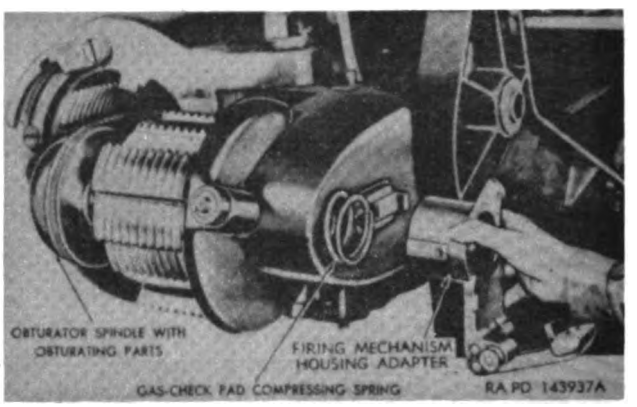


Figure 110. Removing or installing firing mechanism housing adapter, gas-check pad compressing spring, and obturating parts.

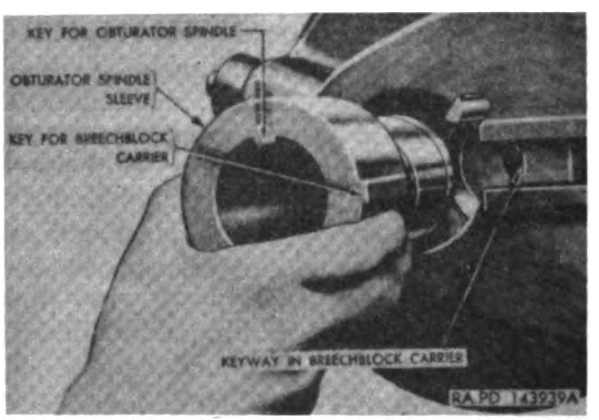


Figure 111. Removing or installing obturator spindle sleeve.

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c. Remove Breechblock. Slide the breechblock forward off the breechblock driver (fig. 112). Rotate the breechblock by slightly manipulating the breech operating handle, if necessary, to free the breechblock crankshaft roller (fig. 103) 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. 103) which locks the breechblock driver retaining plain round nut (fig. 113) to the breechblock carrier at the forward end of the breechblock driver. Unscrew the retaining plain round nut from the carrier, using non-adjustable spanner wrench. Slide the breechblock driver forward off its bearing surface on the breechblock carrier.

e. Remove Breechblock Operating Handle. Remove the operating handle retaining shoulder bolt (fig. 114), 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. 114 and 115).

f. Remove Breechblock Operating Handle Crankshaft. Slide the crosshead (fig. 113) off the arm of the breechblock operating handle crankshaft. With the right hand, remove the crankshaft journal from the end of the crankshaft and withdraw it from the breechblock carrier (fig. 115), while with the left hand, remove the operating handle crankshaft through the inside of the carrier (fig. 116).

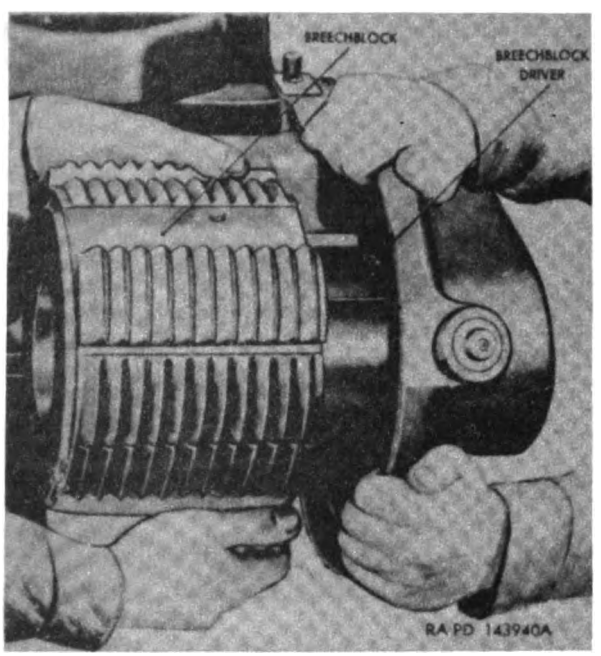


Figure 112. Removing or installing breechblock.

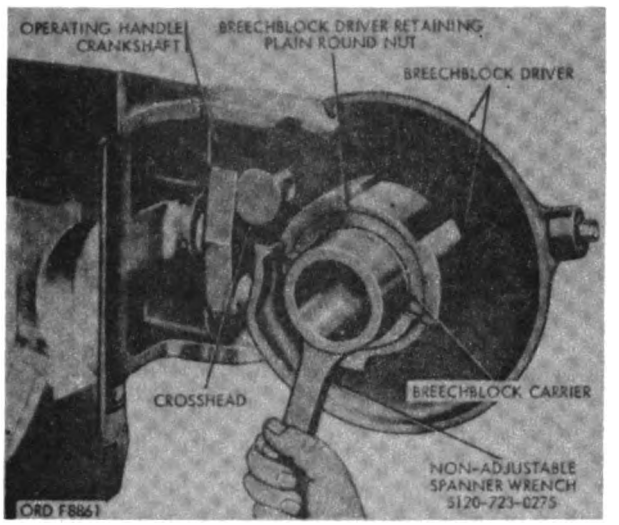


Figure 113. Removing or installing breechblock driver retaining plain round nut.

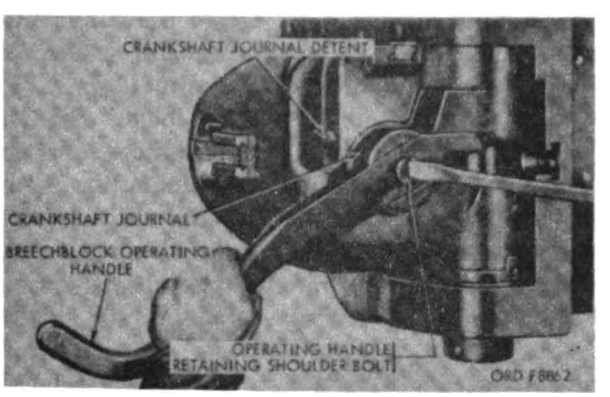


Figure 114. Removing or installing operating handle retaining shoulder bolt.

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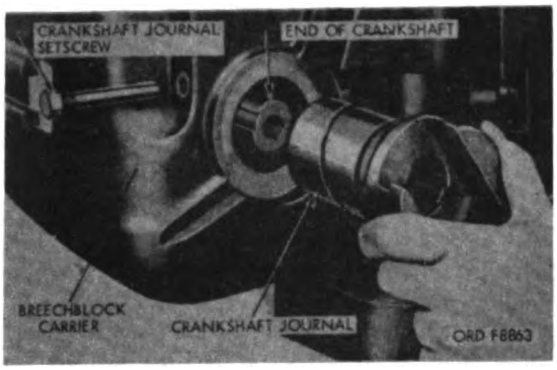


Figure 115. Removing or installing crankshaft journal.

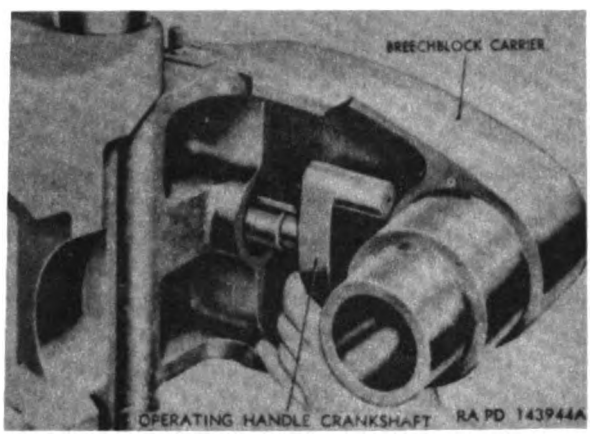


Figure 116. Removing or installing operating handle crankshaft.

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. 117). 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. 103) generally will adhere to the carrier and should not be permitted to fall. Remove the breechblock carrier bearing washer from the breech ring.

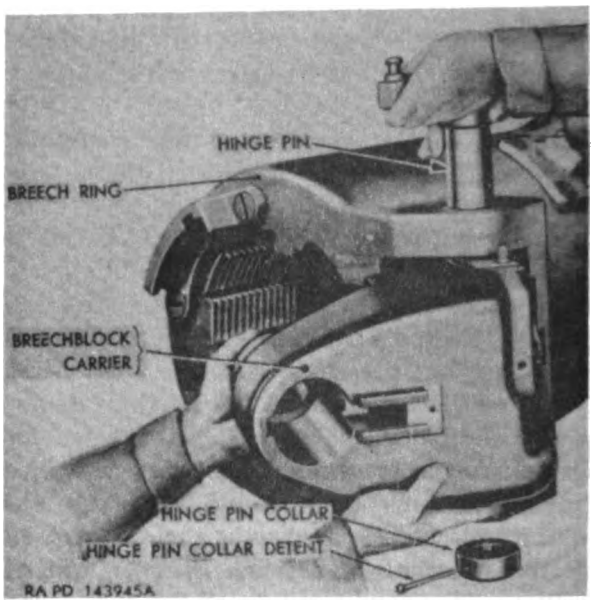


Figure 117. Removing or installing breechblock carrier and hinge pin.

h. Disassemble Operating Handle Latch. Unscrew the operating handle latch knob (fig. 118). 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

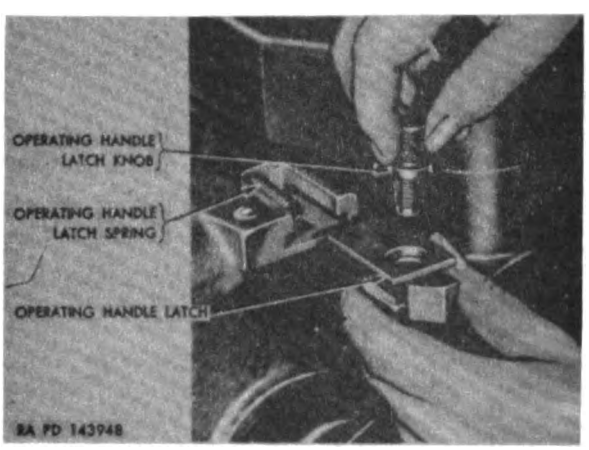


Figure 118. Removing or installing operating handle latch.

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breechblock driver (fig. 119). Withdraw the pivot pin from the driver to release and remove the breechblock rotating roller.

85. Maintenance

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 (para 84) 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 (para 72).

(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.

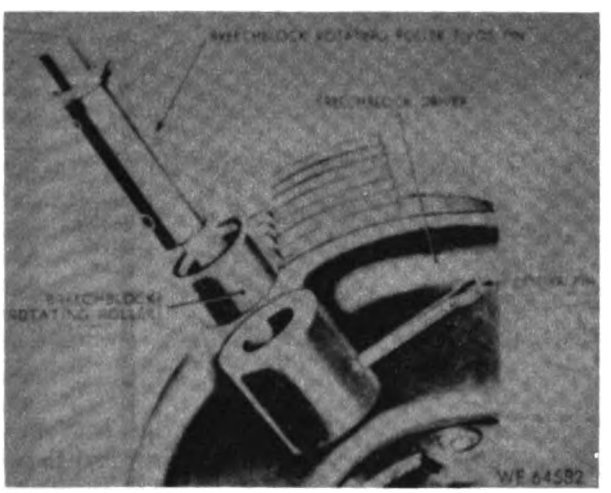


Figure 119. Breechblock rotating roller and pivot pin.

(3) If the breech mechanism does not operate freely, disassemble the mechanism (para 84) 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 the using arm. Serviceability of a breechblock driver should not be affected by small cracks or scratches unless cracks extend across the diameter of the face of the driver. Lesser cracks are not considered hazardous if the breech mechanism operates freely, opening and closing in a complete cycle of operation. If the breechblock closes and seats properly, there should be no danger of mechanism malfunction when firing. Inspect breech cam and roller surfaces to be sure they are in good operating condition.

b. Obturating Parts.

(1) After firing and on through consecutive days thereafter, disassemble the breech mechanism sufficiently to remove the obturator spindle and obturating parts (para 84*b*(6) and (7)) from the breechblock carrier. Clean the gas-chock pad disk, front and rear split rings, inner ring, and obturator spindle (fig. 101) with rifle-bore cleaner, wipe dry, and lubricate with preservative lubricating oil. Wipe the gas-check pad 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 (para 86*h*). A gas-check pad of the proper resiliency will yield slightly under heavy thumb pressure.

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(3) When the obturator spindle is removed from the breechblock carrier (*b*(1) above), check the obturator spindle plug for proper seating of the primer by inserting an unfired primer into the spindle plug (fig. 120) 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. Setting Headspace

(1) The distance between the rear face of the firing mechanism housing and the end of the obturator spindle (fig. 121) is commonly called headspace. Excessive headspace can result in a ruptured primer and early failure of the spindle due to gas erosion in the primer seat, commonly known as gas wash. Contamination of the breech mechanism with powder residue will also occur when the primer is not properly seated in the end of the obturator spindle.

(2) To check headspace, remove the firing mechanism M1 from the breech assembly. Insert the headspace gage into the firing mechanism housing (fig. 121).

CAUTION

Headspace gage should not be inserted so shoulders of gage enter the slots provided for firing of firing mechanism housing tool. This will give a false reading.

(3) When the headspace is adjusted correctly, there will be a space 1/16 inch between the rear face of the housing and the shoulder of the headspace gage (A, fig. 121).

(4) If the shoulder of the gage contacts the rear face of the housing (B, fig. 121), excessive headspace is indicated and headspace must be reset.

(5) To set headspace, dissamble the breech mechanism sufficiently to allow the firing mechanism housing to be screwed into the housing adapter. Screw the housing in until it seats against the obturator spindle, then back the housing off until the firing safety latch (fig. 109) and firing mechanism housing lock screw (fig. 107) can be inserted. See paragraph 84(1) through (5) for disassembly procedure.

(6) Recheck with headspace gage to assure proper headspace. When headspace is correct, assemble the breech mechanism (para 86*h*).

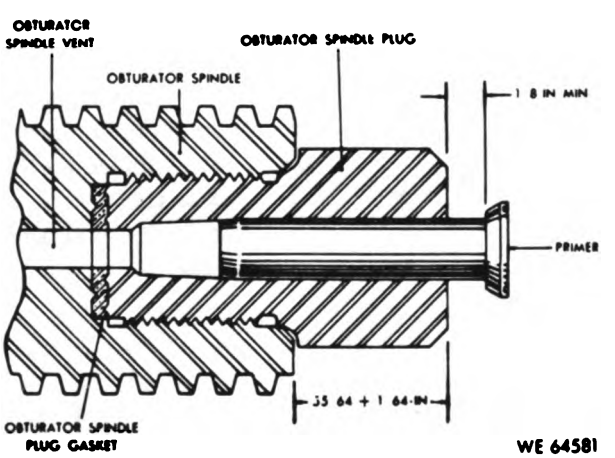


Figure 120. Checking primer seat in obturator spindle plug.

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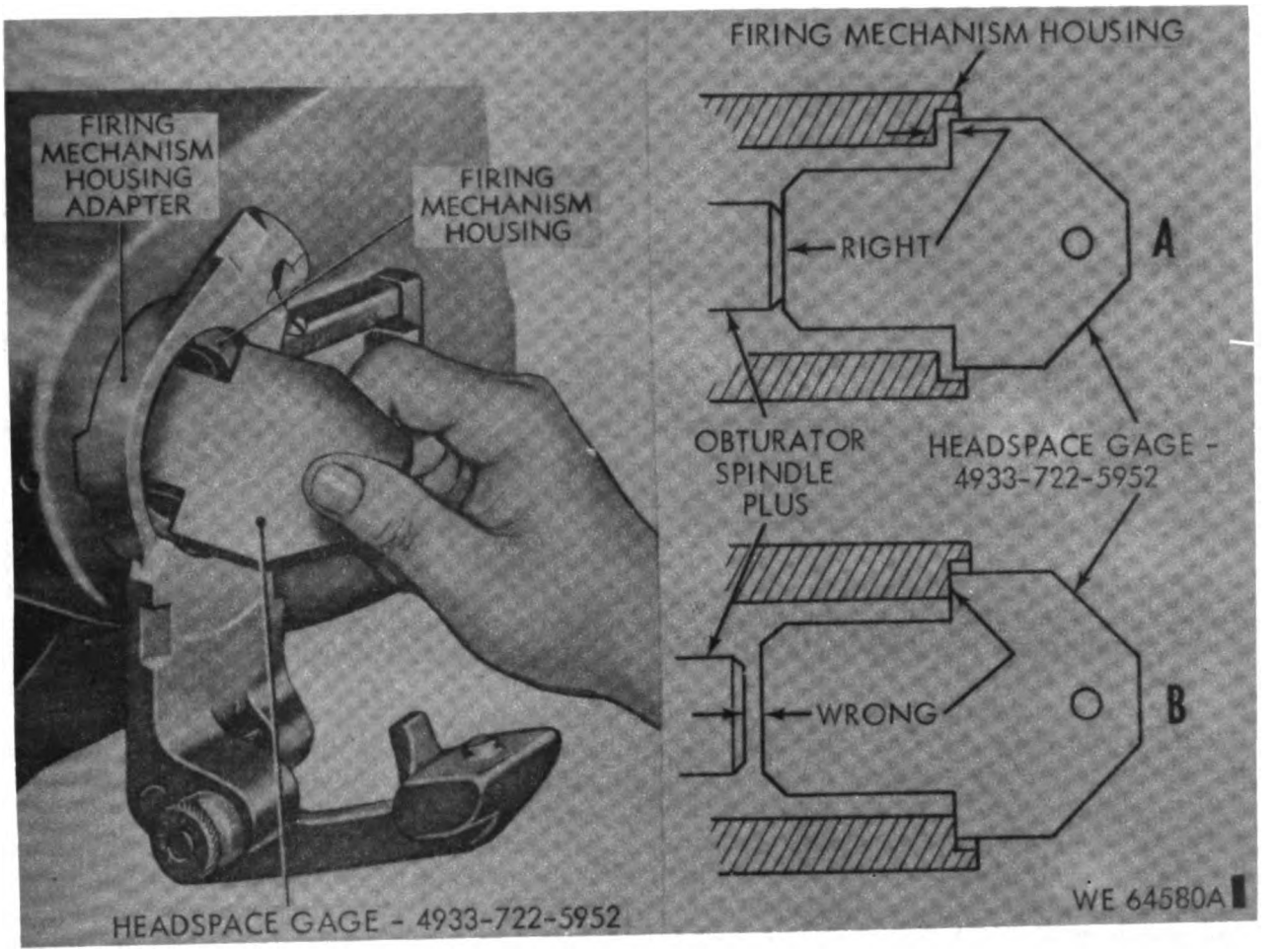


Figure 121. Checking headspace.

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86. Assembly

a. Assemble Breechblock Rotating Roller. Slide the breechblock rotating roler (fig. 119) onto the breechblock rotating roller pivot pin, and install the pin and roller in the breechblock driver. 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. 118) 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. 103) on the lower hinge pin lug of the breech ring (fig. 104), fitting the small hole in the washer over the pin in the lug. Assemble the hinge pin driving washer to the breechblock carrier and place the carrier in position between the hinge pin lugs on the breech ring (fig. 117).

(2) While supporting the carrier, insert the hinge pin downward through the hinge pin lug and carrier (fig. 117). 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. 116). 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. 115) 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. 114 and 115) 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 shoulder bolt. Place the crosshead on its pivot on the arm of the crankshaft (fig. 113).

f. Install Breechblock Driver. Slide the breechblock driver, flange rearward, onto the front of the carrier (fig. 103). Screw the breechblock driver retaining plain round nut to the carrier to retain the driver (fig. 103 and 113). Lock the retaining plain round nut 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. 112), alining the breechblock so that the crosshead can be guided into its groove (fig. 102) in the breechblock while, at the same time, holding breechblock drive in such a position that the large lug on the breechblock (which contains the cross head groove) will enter the cutaway portion at the flange of the driver (fig. 103). 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 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 the bore of the breechblock carrier (fig. 111). 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.

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(2) Slide the firing mechanism safety latch plunger into the safety latch (fig. 64). 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. 109). The plunger will now clear the bore of the carrier and permit assembly of the firing mechanism housing adapter.

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 assembly of the breech mechanism is strictly prohibited.**

(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. 101). Insert the spindle into the bore of the breechblock (fig. 110) and through the bore of obturator spindle sleeve, fitting the keyway near the end of the spindle on the key in the upper rear end of the bore of the sleeve (fig. 111).

Caution: **Accidents resulting in serious injury to personnel and damage to artillery materiel 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. 110) 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 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 tool (fig. 109). Check the split rings for proper position under the head of the obturator spindle.

(5) Screw the firing mechanism housing onto the obturator spindle (fig. 109).

Note. Set headspace as described in paragraph 85c(1) through (6) before proceeding to next step.

(6) Insert the firing mechanism safety latch spring (fig. 108) into the hole in the right end of the safety latch and assemble the safety latch stop to the carrier with the socket-head capscrew.

(7) Lower the breechblock operating handle to its open position and swing the breechblock toward closed position until the counter-balance piston rod end can be placed over the hinge pin body pin (fig. 106). Then swing the breech open sufficiently to allow the counterbalance cylinder spacer to be removed.

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(8) 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. 105). Secure the arc in place with the breechblock control arc screw.

(9) Check operation of breech mechanism and adjustment of counterbalance assembly. A properly adjusted counterbalance provides smooth and even operation of the breech mechanism. This makes slamming and the use of excessive force unnecessary in opening and closing actions. Malfunction and parts breakage caused by slamming and/or rough handling are greatly reduced when proper counterbalance adjustments are maintained. Contact Support Maintenance personnel for adjustment.

(10) Install firing mechanism by turning it clockwise into the firing mechanism housing (fig. 86).

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Section VII. FIRING MECHANISM M1

87. General

a. The firing mechanism M1 (figs. 122 and 123) 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 position. Safety setscrews 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 breechblock carrier (fig. 86).

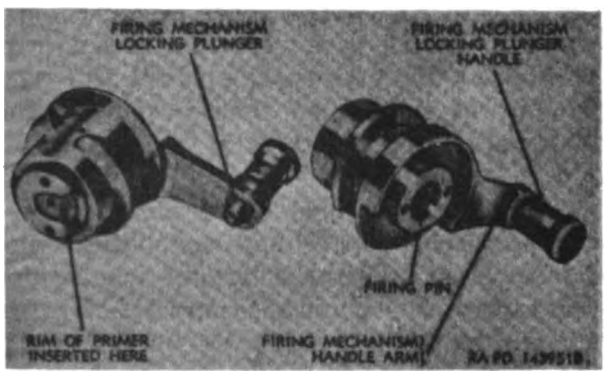


Figure 122. Firing mechanism M1—front and rear views.

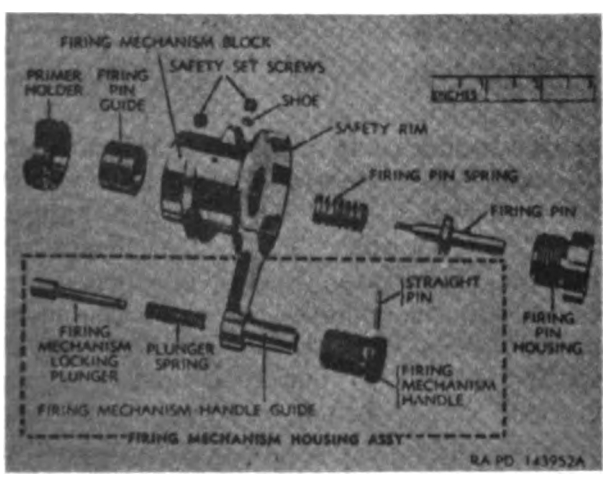


Figure 123. Firing mechanism M1—exploded view.

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. 122) 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 setscrew. 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. 122) to receive the flanged end of the primer. The primer holder is locked in the firing mechanism housing assembly by a safety setscrew (fig. 123). Holes are provided in the exposed heads of the holder and housing for insertion of the firing mechanism wrench during assembly and disassembly.

88. Removal and Installation

a. The firing mechanism M1 is removed and installed in the firing mechanism housing at the rear of the breechblock carrier

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(fig. 86) between the firing of successive rounds.

b. To remove the firing mechanism, pull the firing mechanism handle (fig. 122) 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 handle arm (fig. 122) contacts the firing mechanism stop stud at the rear of the breechblock carrier (fig. 86) and the firing mechanism safety latch moves to the right.

89. Disassembly

a. Remove both safety setscrews from the firing mechanism housing assembly (fig. 123). Do not loosen the shoe under the setscrew for the firing pin housing. Unscrew (clockwise) the firing pin housing from the rear of the firing mechanism housing assembly, using the firing mechanism spanner wrench (fig. 124).

b. Remove the firing pin and the firing pin spring from the rear of the firing mechanism housing assembly (fig. 123). Push the copper shoeout of the setscrew 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 spanner wrench. Remove the firing pin guide.

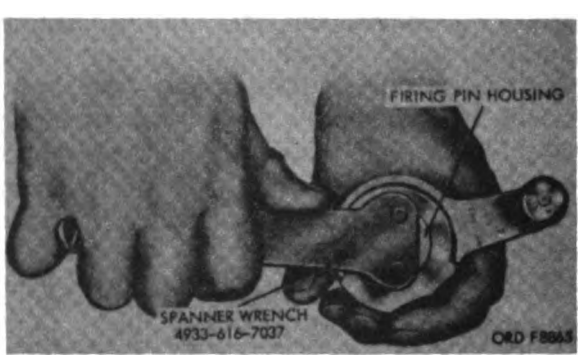


Figure 124. Disassembling or assembling firing mechanism M1.

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. 123). 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.

90. Maintenance

a. The firing mechanism should be frequently disassembled (par. 89) for cleaning and oiling. When the mechanism is disassembled for this purpose or for the replacement of defective parts, clean all 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 (table 5), disassemble the mechanism (par. 89) to determine the cause and replace a defective primer holder, 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. 89) and replace the locking plunger spring (fig. 123), if it is defective.

91. Assembly

a. Insert the firing mechanism locking plunger spring in the firing mechanism handle guide, from the front (fig. 123). 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 3/32 x 13/16 straight pin to fasten the handle to the plunger.

b. Place the firing pin guide (fig. 123) in the forward end of the firing mechanism housing assembly with the hollow portion of the guide toward the rear of the housing

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assembly. Screw (counterclockwise) the primer holder into the forward end of the block, using the firing mechanism spanner wrench. Look in the setscrew hole and aline the nearest notch in the rear edge of the holder with the setscrew hole. Insert and tighten the setscrew, 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. 123), and screw the housing (counterclockwise) into the rear end of the firing mechanism housing assembly, using the firing mechanism spanner wrench (fig. 124). 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. When the firing pin housing is firmly seated against the rear of the firing mechanism housing assembly, insert the copper shoe into the setscrew hole to protect the threads of the firing pin housing. Insert and tighten the setscrew.

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

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

92. General

a. The 155-mm howitzer carriages M1A1 and M1A2 are equipped with recoil mechanism M6, M6A1, M6A2, M6B1, or M6B2; the M32 carriage is equipped with recoil mechanisms M6, M6A2, or M6B1.

(1) The differences between recoil mechanisms M6, M6A1, M6A2, M6B1, or M6B2 are not apparent to the using arm and they function and are serviced in the same manner.

(2) The differences between the recoil mechanisms pertain to the floating piston and suitability for use in extreme climatic conditions.

Note. Recoil mechanisms M6, M6B1, and M6B2 will perform satisfactorily in temperatures down to -20°F. If lower temperatures are anticipated and the howitzer carriage is not equipped with either recoil mechanism M6A1 or M6A2, notify ordnance maintenance personnel.

b. The energy and shock of firing is absorbed by the recoil mechanism in gradually checking and stopping 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.

c. The recoil mechanism (figs. 69 and 125) is a hydropneumatic, variable recoil type and includes separate recoil and counterrecoil systems (figs. 126 and 127). The recoil system consists of the recoil cylinder, replenisher, and variable recoil cam. The counterrecoil system consists of the recuperator cylinder (employing a floating piston to separate the fluid from the compressed nitrogen), the counterrecoil cylinders, and the counterrecoil and recuperator cylinder head stuffing box which joins the two cylinders hydraulically. The recoil and counterrecoil systems are not connected by fluid passages. Both systems are installed in the cylinder yoke and cradle 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.

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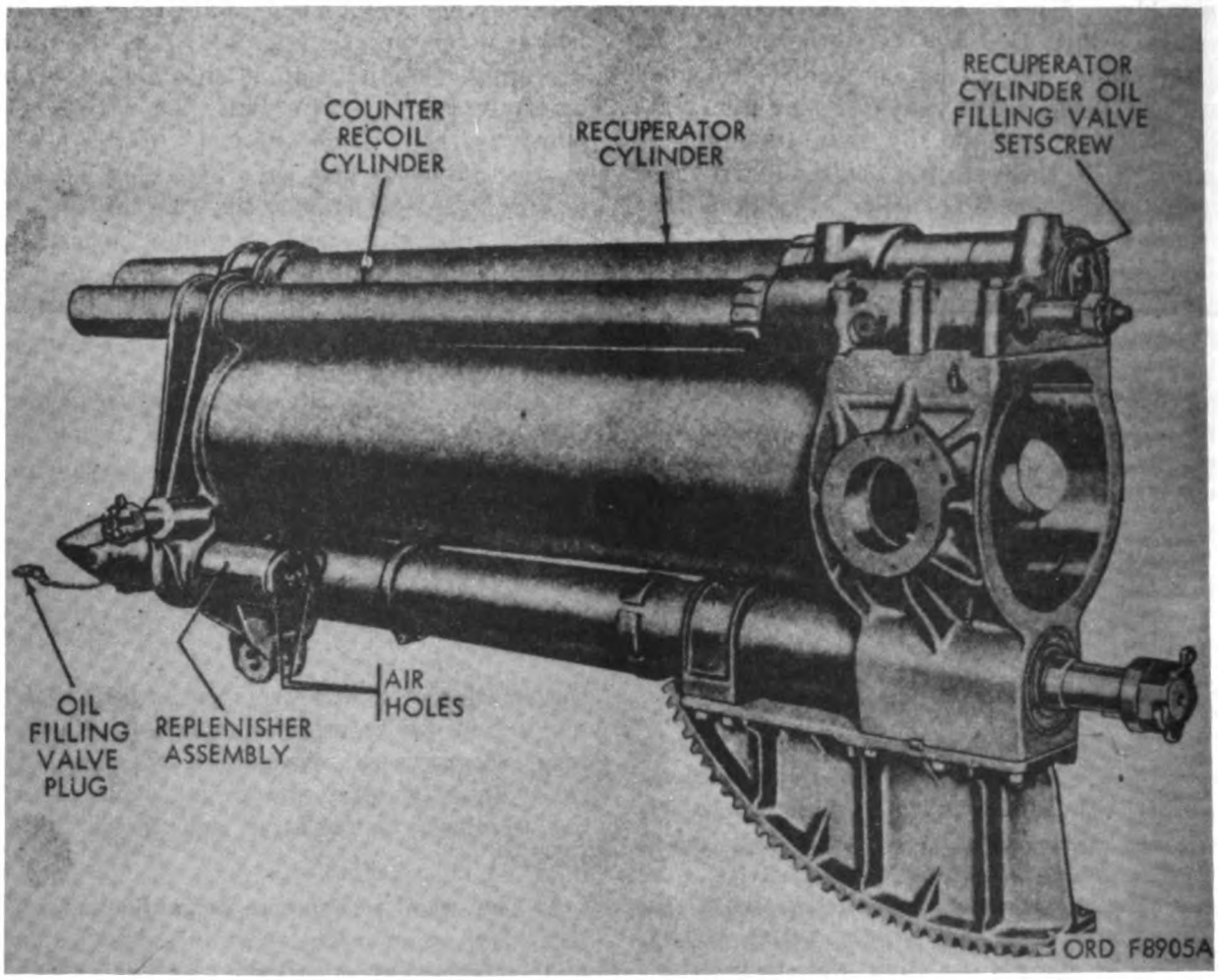


Figure 125. Recoil mechanism removed from carriage—left side view.

93. Functioning

a. Recoil System.

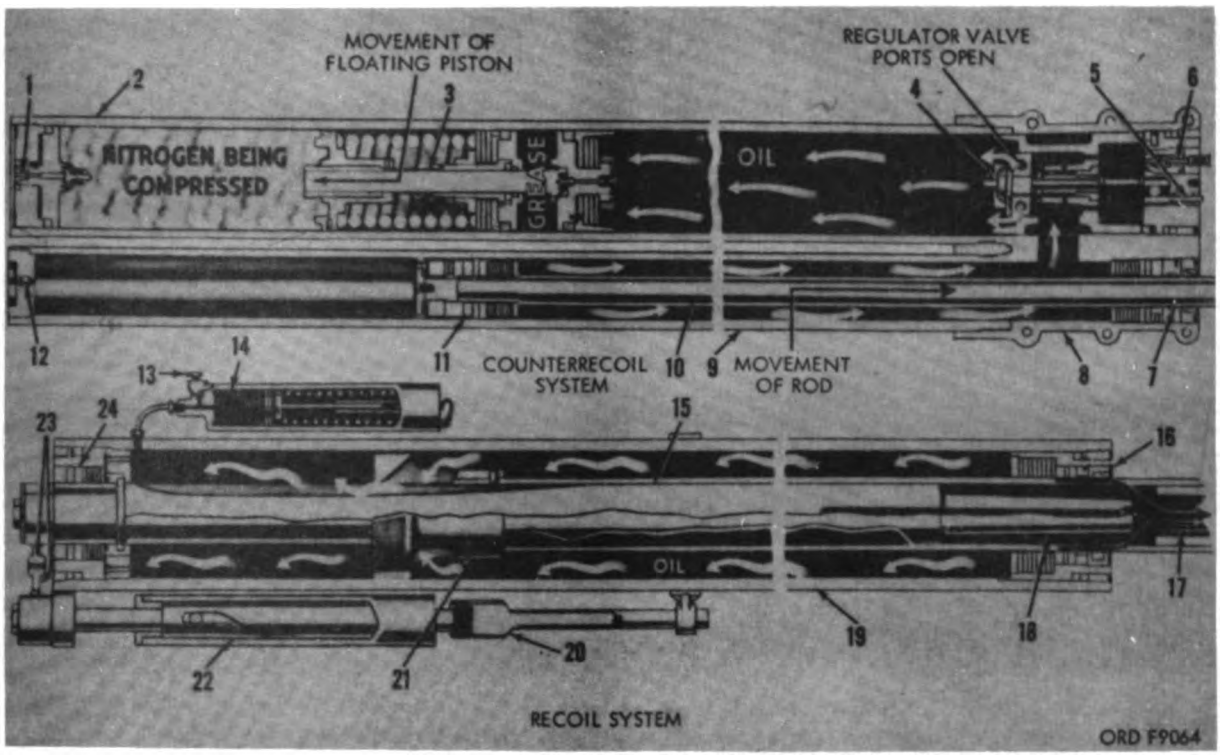
(1) *Recoil cylinder.*

Note: The key numbers shown below in parenthesis refer to figure 126, unless otherwise indicated.

(*a*) The recoil rod stuffing box head (16) seals the rear end of the recoil cylinder (19) and forms a guide for the recoil piston rod and liner assembly (21) The front end is sealed by the throttling rod packing head (24), which also forms the end bearing for the recoil throttling rod (18). The recoil cylinder (19) houses the recoil piston rod and liner assembly (21) and the recoil throttling rod (18). 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 and liner assembly (21) is connected to the lower lug on the breech ring and travels backward with the weapon during recoil. The piston rod and liner assembly is drilled centrally to provide a bore in which the recoil throttling rod which does not travel backward

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1—Recuperator charging valve 1025–615–5895
2—Recuperator cylinder 1025–653–7431 or 1025–712–2373
3—Recuperator floating piston 7148073
4—Recuperator cylinder regulator valve 1025–617–0980
5—Oil index 1025–619–2628
6—Recuperator cylinder filling valve 1025–501–9763
7—Counterrecoil rod stuffing box head 1025–519–1126
8—Counterrecoil and recuperator cylinder head stuffing box 7123445
9—Counterrecoil cylinder 1025–653–7429
10—Counterrecoil piston rod 1025–557–6100
11—Counterrecoil piston assembly 5574714
12—Counterrecoil cylinder respirator assembly 5574704
13—Replenisher oil filling valve plug 1025–617–1279
14—Oil reserve in replenisher
15—Recoil throttling rod 5773877
16—Recoil rod stuffing box head 1025–616–8280
17—Buffer chamber in bore of recoil piston rod and liner assembly
18—Recoil throttling rod 1025–711–7396
19—Recoil cylinder 1025–653–7430
20—Variable recoil cam shaft 1025–616–7202
21—Recoil piston and liner assembly 8410286
22—Variable recoil cam 1025–711–8010
23—Gear sectors 1025–616–7008 and 1025–616–7275
24—Throttling rod packing head 1025–616–8250

Figure 126. Recoil mechanism—recoil action.

with the weapon during recoil, slides during the recoil movement. The bore of the piston rod and liner assembly is of smaller diameter at its rear end to form the buffer chamber ((*e*) below).

(*c*) The recoil throttling rod (18) rotates in the bore of the throttling rod packing head (24) 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, fluid 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

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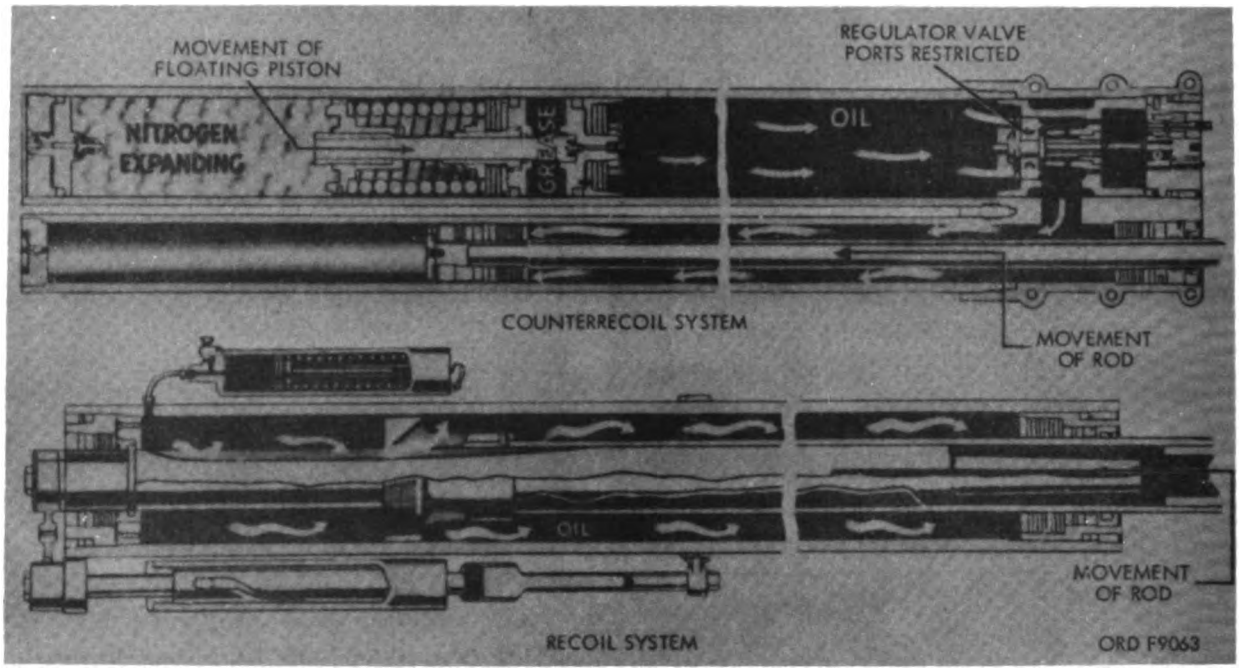


Figure 127. Recoil mechanism—counterrecoil action.

flow of fluid opposes the movement of the piston (*c*(2) (*b*) below).

(*d*) The throttling rod is turned by the throttling rod gear sector (fig. 128) 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 and liner assembly. The fluid trapped in the buffer chamber must escape through the grooves, which throttle its flow (*c*(3) (*c*) below).

(2) *Variable recoil cam assembly.*

(*a*) The variable recoil cam assembly (figs. 69 and 128) controls the length of recoil of the weapons at various elevations. The variable recoil cam housing is mounted in and on the right side of the cylinder yoke near the front end of the recoil cylinder. It houses the tubular variable 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 (20) slides in the bore of the cam. This shaft is provided with a cam pin that engages the spiral slot in the cam (figs. 126 and 127). 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,

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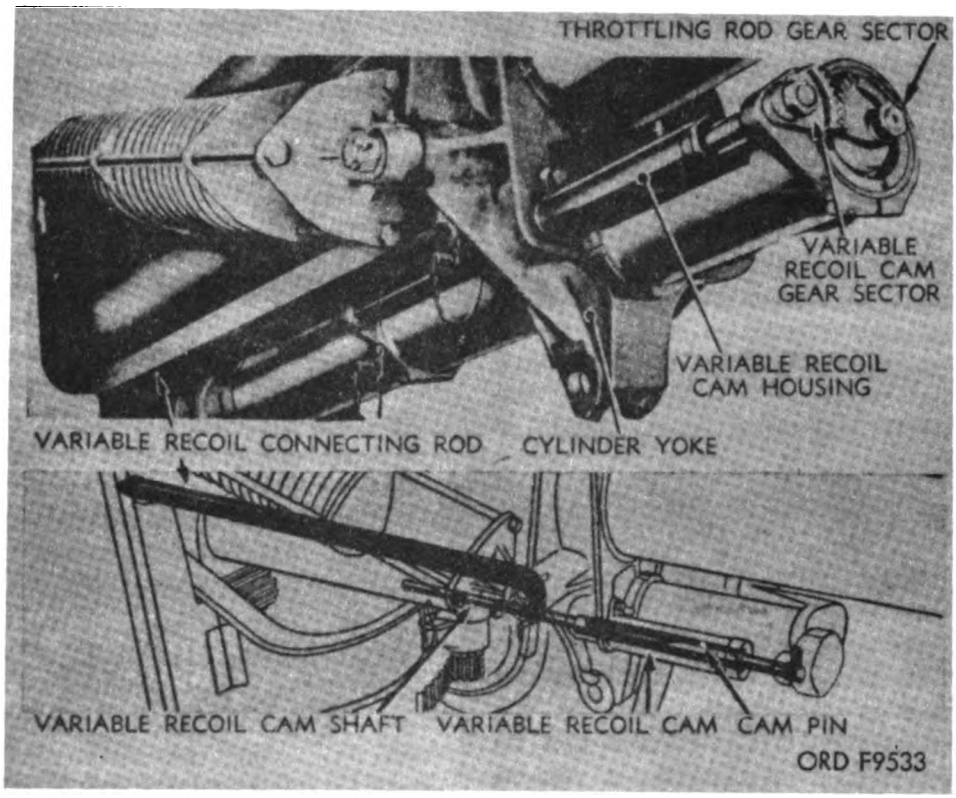


Figure 128. Variable recoil cam—assembled and phantom views.

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

(8) *Replenisher.*

(*a*) The replenisher (figs. 125 and 129) serves as a fluid reservoir for the recoil cylinder. It stores excess fluid forced from the recoil cylinder by expansion of the fluid due to increased atmospheric temperature or to heat developed by firing. It supplies fluid required to compensate for contraction of the fluid due to low temperatures.

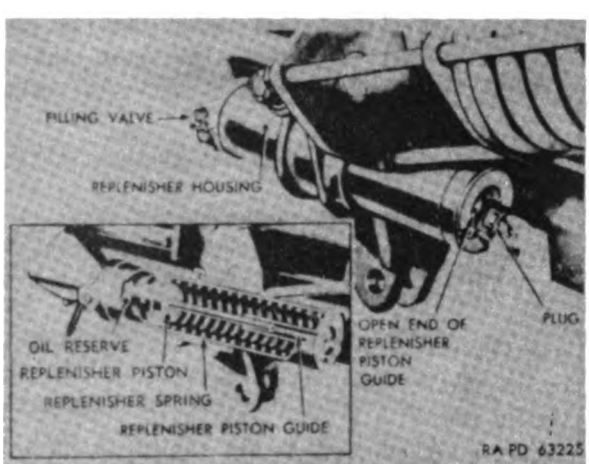


Figure 129. Replenisher—assembled and sectional views.

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(*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 fluid enters the replenisher. The spring-loaded piston forces the fluid into the recoil cylinder when fluid is required.

(*c*) An extension on the rear of the piston slides in the replenisher piston guide, which closes the rear end of the replenisher. The guide is open at the rear and provides a means for determining the amount of reserve fluid 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 (98*c* & *d*). The replenisher piston guide plug (fig. 129) 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. 125) 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 stuffing 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 assembly and piston rod reciprocate in the counterrecoil cylinder (fig. 127). 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 oil-tight packing arrangement that permits it, when drawn backward in recoil, to force the fluid in the cylinder to the rear and through the opening in the counterrecoil and recuperator cylinder head stuffing box into the recuperator cylinder.

(*c*) The counterrecoil respirator (fig. 130) 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 assembly when the piston is moving forward during counterrecoil.

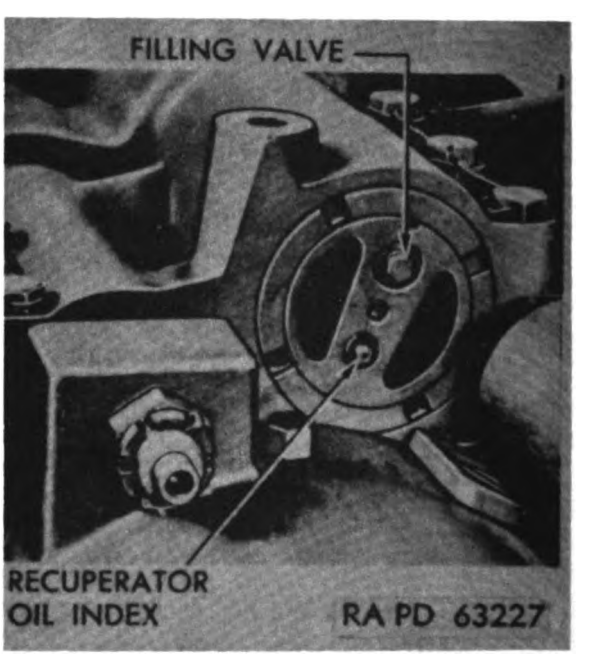


Figure 130. Front ends of recuperator and counterrecoil cylinders.

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(2) *Recuperator cylinder.*

(*a*) The recuperator cylinder (fig. 125) 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 stuffing 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. 131). The rear end of the recuperator cylinder bore of the head stuffing 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. 130).

(*b*) The recuperator cylinder houses the recuperator floating piston (figs. 126 and 127). 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.

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

(*d*) The recuperator oil index (fig. 130) indicates the presence or absence of an adequate fluid reserve in the recuperator (par. 39*i*(2)). Adequate fluid reserve is necessary for proper functioning of the counterrecoil mechanism, as the fluid 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. 126 and 127), 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.

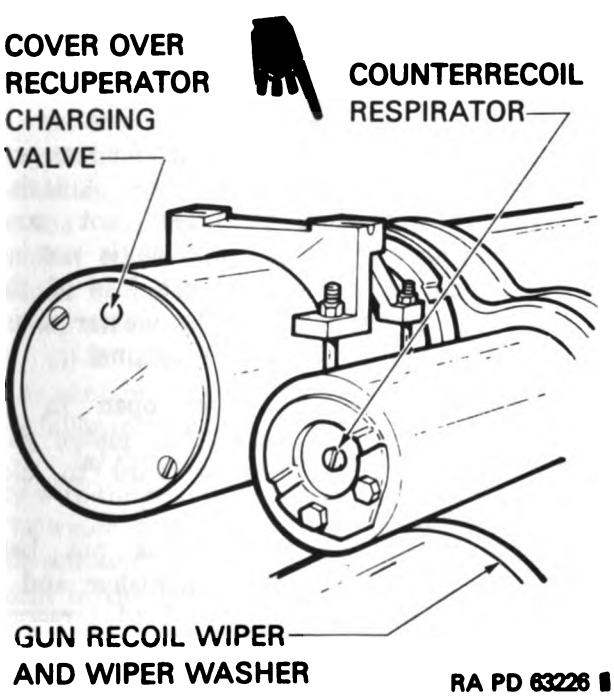


Figure 131. Rear ends of recuperator and counterrecoil cylinders.

c. Combined Functioning of the Recoil and Counterrecoil Systems.

(1) *General.* The recoil system, located below the cannon, and the counterrecoil system, located above the cannon, 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.

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(2) *Recoil action.*

(*a*) When the howitzer is fired, the cannon 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. 126). 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 and liner assembly.

(*b*) The fluid 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 fluid, causing resistance which absorbs a great portion of the recoil energy.

(*c*) At the same time, the fluid in the counterrecoil cylinder in the path of the counterrecoil piston assembly is forced through the communicating opening in the counterrecoil and recuperator cylinder head stuffing box. This forces open the spring-loaded regulator valve, and the fluid 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 fluid in the recoil cylinder, the increased nitrogen pressure in the recuperator 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 fluid in back of it in the opposite direction (fig. 129). The regulator valve is closed, and the fluid 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 fluid 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 fluid being forced from the buffer chamber (*a*(1)(*e*) above) in the bore of the recoil piston rod and liner assembly.

94. Maintenance

a. General.

(1) The recoil mechanism should be examined regularly for leakage of fluid. There is no cause for concern should the fluid drip rapidly, or even run 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 leak at any packing that does not exceed three drops per minute is not considered serious; if the loss of fluid is greater, report the matter to ordnance maintenance personnel.

(2) Keep the air holes open in the rear of the replenisher piston guide (fig. 125). Use a wire to clean these openings.

(3) When the howitzer is not being fired, check the replenisher and recuperator cylinder fluid reserves weekly (pars. 39*i*(1)(*a*), (2)(*a*)). If the proper amount of reserve fluid is not present, establish the proper reserve (*d* and *f* below).

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(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 counterrecoil action will be slow for the first few rounds (until the fluid warms up).

b. Care of Recoil Fluid.

(1) Petroleum base preservative hydraulic fluid (OHC) is an all temperature fluid and is used in all recoil mechanisms in all temperatures.

(2) 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 fluid or oil. The transfer of recoil fluid to a container not marked with the name of the fluid may result in the wrong fluid getting into the recoil mechanism or in the use of petroleum base hydraulic fluid for lubricating purposes.

(3) 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 fluid or through failure to clean thoroughly the connections and servicing equipment.

(4) Exposure of recoil fluid in an open can may result in the accumulation of moisture. Condensation in a container partly filled with fluid, or the pouring of fluid 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.

(5) 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 fluid 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.

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

c. Test Operation of Replenisher Piston.

(1) Remove the replenisher piston guide plug (fig. 67) 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. 32 and 125). Then release fluid from the replenisher by screwing the liquid releasing and filling tool assembly into the filling valve plug hole from which the plug was removed (fig. 32). 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 Fluid Reserve.

(1) If the position of the replenisher piston extension indicates too much reserve fluid (para 39*i* (1)), release fluid to establish the proper reserve.

(2) If the position of the replenisher piston extension indicates insufficient reserve fluid (para 39*i* (1) *(d)*), establish the proper reserve by adding fluid as follows:

(a) Attach the oil filling plug adapter (fig. 32) 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 fluid into the recoil mechanism. This is accomplished by only partially screwing the adapter

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to the filling hole, operating the pump, and letting air 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 (para 39*i* (1)*(b)*).

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

e. Exercise Replenisher Piston. The replenisher will be exercised monthly by pumping fluid 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 fluid should then be withdrawn (*c*(1) above) to bring the piston back to normal position (para 39*i*(1)*(c)*).

f. Establish Recuperator Fluid Reserve.

(1) The position of the oil index indicates the presence or absence of fluid reserve in the recuperator cylinder. When the position of the oil index warns that there is too small a quantity of fluid in the recuperator (para 39*i*(2)*(b)*), drain off the reserve fluid before refilling. This is accomplished by removing the recuperator cylinder oil filling valve plug (fig. 33) and installing the liquid releasing and filling tool assembly. Use a hollow tube or pipe to carry the fluid from the liquid releasing and filling tool assembly to an appropriate container.

(2) The amount of reserve fluid which will escape will be approximately one pint. The reserve fluid will spurt out in a stream and suddenly drop to a trickle. At this point, the flow of fluid should be stopped by unscrewing the liquid releasing and filling tool assembly (fig. 33). It will be noted that the oil index has moved out of sight before all of the reserve fluid 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 fluid reserve, attach the oil filling plug adapter (fig. 33) 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) Place a finger on oil index. Start working oil pump (fig. 33). When oil index moves to its farthest outward position, cease pumping and detach the adapter and install the filling valve plug. The correct amount of reserve is indicated by the position of the end of the oil index indication rod in relation to the face of the recuperator cylinder and will measure 3/8 inch.

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 materiel is lubricated (para 64), note whether any lubricating elbows, fittings or nipples are missing. If any are missing, notify ordnance personnel.

(3) To replace the replenisher oil filling valve plug (fig. 125), 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.

(4) Replace the recuperator cylinder oil filling valve plug (fig. 125) if it becomes lost or damaged.

SECTION IX. TOP AND BOTTOM CARRIAGES

95. General

a. Top Carriage.

(1) The top carriage (figs. 1 and 69) is of welded steel construction. It supports the howitzer and recoil mechanism (fig. 6), the elevating mechanism (fig. 132), the traversing mechanism, the right and left shields (fig. 1), the telescope mount, and panoramic telescope (fig. 23). It is supported by and rotates on the bottom carriage (fig. 1). Equilibrator mounting brackets for the rear ends of the equilibrators and the variable recoil connecting rod brackets are provided on the top carriage.

(2) The right and left shields (fig. 1) are bolted

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to the top carriage. The top portion of the left shield is hinged and may be secured in the raised or lowered position by the top shield locking bar (fig. 54). The panoramic telescope case (fig. 2), mounted on the back of the left shield, is for stowage of the panoramic telescope when the latter is not in use (para 52*a*(4)). The upper and lower firing jack handle supports on the front of the right shield retain the firing jack handles when they are not in use (para 52*b*(6)).

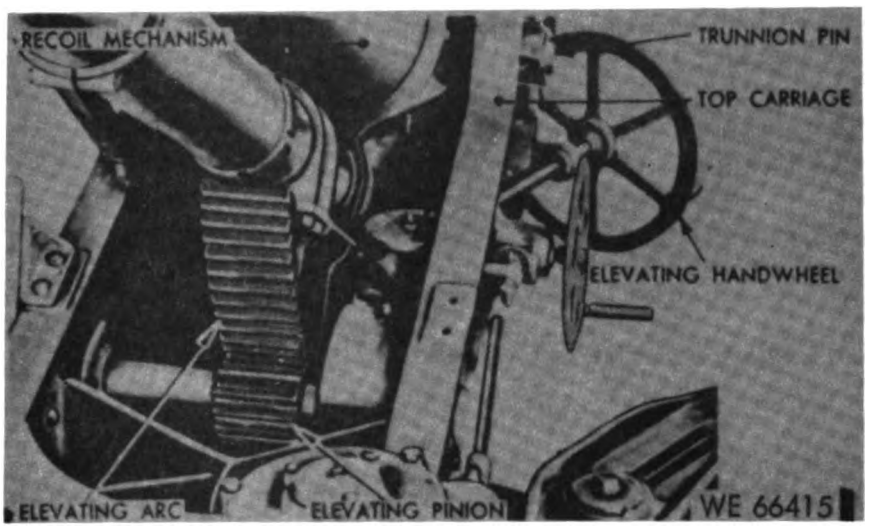


Figure 132. Elevating mechanism—left front view.

b. Bottom Carriage. The bottom carriage (fig. 1) is of welded steel construction. It supports the weight of the top carriage and weapon and transmits firing stresses to the firing jack and the trails. The firing jack, the traveling lock, and the traversing arc are mounted on the front of the bottom carriage. The trails (fig. 2) are hinged to each side of the bottom carriage, and the wheels and brake mechanisms are attached to each side. The air tank and emergency relay valve are secured to the rear of the bottom carriage.

96. Maintenance

There are two drain holes (fig. 133) in each side of the top carriage. Keep these holes open to prevent the accumulation of water and the resultant formation of rust. No other maintenance of the top and bottom carriages except normal cleaning (para 71*c*), painting (para 67*c* and *d*), and lubrication (para 64) is prescribed for the using organization.

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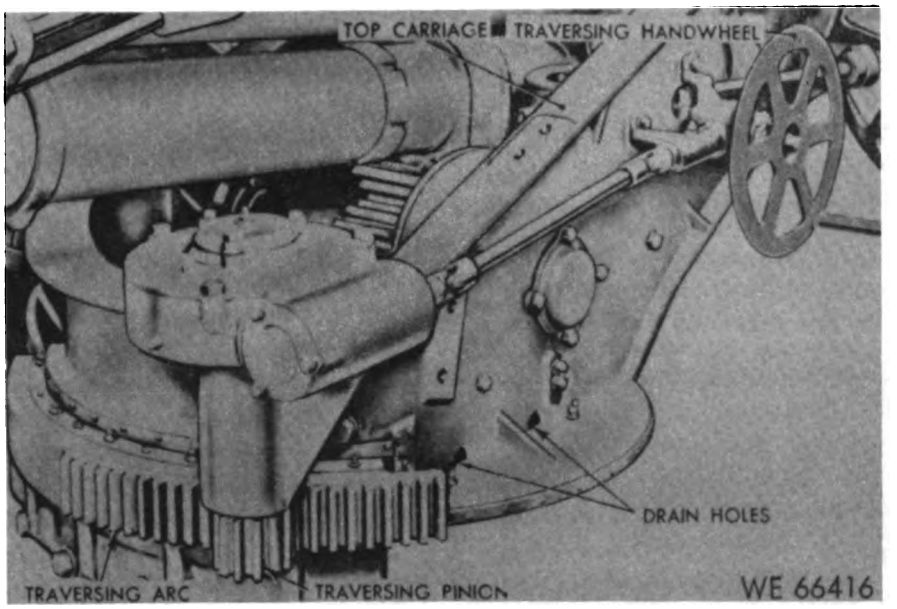


Figure 133. Traversing mechanism—left front view.

SECTION X. ELEVATING AND TRAVERSING MECHANISMS

97. General

a. Elevating Mechanism. The elevating mechanism controls the movement of the weapon in elevation and depression by tipping the recoil mechanism and cannon on the trunnion pins (fig. 132) secured in the top carriage. Motion of the elevating mechanism handwheel assembly is transmitted through shafts, a flexible joint, gears, a worm, and a worm wheel to the elevating pinion which meshes with the elevating arc, mounted on the underside of the recoil mechanism.

b. Traversing Mechanism. The traversing mechanism is secured to and rotates with the top carriage. It controls the movement of the weapon in azimuth by means of the traversing pinion (fig. 133), which is rolled in the teeth of the stationary traversing arc. Motion of the traversing mechanism handwheel assembly 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 of the top carriage to provide clearance for the weapon at minimum elevation.

98. Maintenance

a. By turning and stopping the elevating mechanism and traversing mechanism handwheel assemblies, check for backlash. Backlash exceeding one-sixth of a turn of the handwheel should be reported to the 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 teech 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 throughly 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 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.

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e. Semiannually, drain the elevating gear housing by removing the drain plug (fig. 97), and fill as prescribed in paragraph 64. Install plug. At the same interval, remove the elevating gear housing, clean gears, and pack with the proper lubricant as prescribed in paragraph 64.

Section XI. EQUILIBRATORS

99. General

a. Two spring-type equilibrators (fig. 69) 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. 134) which screw onto the threaded ends of the three equilibrator rods and against the equilibrator spring seat to compress the equilibrator springs.

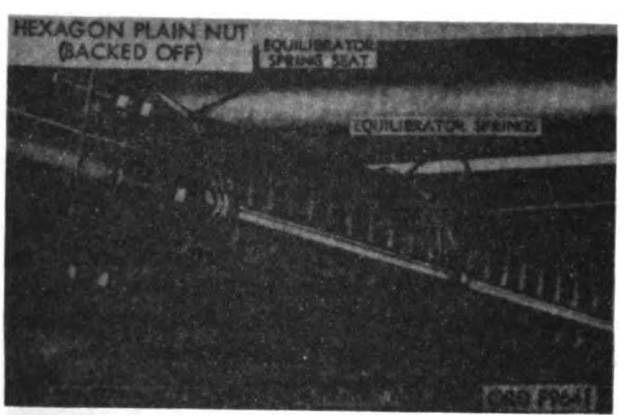


Figure 134. Adjusting equilibrator.

100. 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 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 trunnions, the carriage must be as level as possible (par. 89*i*(4)).

(*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*) Level the carriage (par. 89*i*(4)). 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

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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 balance of the weapon.

(*b*) Measure the distance of each adjusting nut from the end of its equilibrator rod by removing the three hexagon plain nuts (fig. 184) and counting the threads on the equilibrator rod to each adjusting nut.

Caution: **When removing the hexagon plain nuts, be careful not to disturb the position of the adjusting nuts. If all three adjusting nuts of each equilibrator are an equal distance from the ends of the equilibrator rods, the equilibrator is properly adjusted.**

(*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.

b. Adjust Equilibrators.

(1) Before making any adjustments to the equilibrators, test them for 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 nuts 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 to 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 hexagon plain nuts after the adjustment is satisfactory.

Note. Take care to hold each adjusting nut stationary while tightening its hexagon plain nut.

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

c. Clean Equilibrators. Weekly, wipe the equilibrator springs, rods, and tubes clean with clean wiping cloths and apply a coat of prescribed oil (par. 64) with oil dampened wiping cloths.

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Section XII. FIRING JACK AND TRAVELING LOCK

101. General

a. Carriage M1A1.

(1) The firing jack of carring M1A1 (fig. 21) is of the rack and pinion type and is bolted to the front of the bottom carriage to which it remains attached at all times. The firing jack rack plunger is protected from dirt, water, and foreign matter by the firing jack plunger cover which fits over the opening in the firing jack housing and is held in place by the firing jack plunger cover clamp. The plunger is raised and lowered by rotating either or both firing jack ratchet cases. When in the raised position, the lower end of the rack plunger is protected from dirt and foreign matter by installing the firing jack housing bottom cover (fig. 59), which is chained to the traveling lock and which also limits the upward travel of the plunger.

(2) The traveling lock (fig. 21) is a triangularly shaped casting, the two legs of which are hinged to the front of the bottom carriage. Its purpose is to anchor solidly the tipping parts of the weapon during travel (par. 52*b*(1)).

b. Carriages M1A2 and M82.

(1) The firing jack of carriages M1A2 and M82 is of the screw-type and is hinged to the firing jack bracket (fig. 55) at the front of the bottom carriage. The jack swings forward and upward and latches to the bottom of the traveling lock during travel (par. 52*c*). The firing jack ratchet controls the operation of the jack (par. 89*d*(9)(*d*)).

(2) The traveling lock (fig. 55) is a triangular casting, the two legs of which are hinged to the front of the bottom carriage. The firing jack hanger is fastened on the under surface of the traveling lock and supports the firing jack during travel (par. 52*c*(4)), when the traveling lock is attached to the cylinder yoke to anchor solidly the tipping parts of the weapon.

102. Maintenance

a. Carriage M1A1.

(1) The firing jack housing bottom cover (fig. 59) must be in place, except when the firing jack is in use; the canvas firing jack plunger cover and clamp (fig. 60) will be in place at all times, except when the firing jack plunger is removed for cleaning and lubrication.

(2) The firing jack rack plunger and pinion should be cleaned and oiled weekly as follows:

(*a*) Release the firing jack plunger cover clamp and remove the firing jack plunger cover (fig. 60). Release the rack plunger from traveling position by removing the firing jack plunger locking level (fig. 58); turn the ratchet plunger handles until the arrows on them are pointed down and lower the rack plunger by operating the jack ratchets sufficiently to remove the firing jack housing bottom cover by turning it one-quarter turn. Then turn the ratchet plunger handle arrows up (fig. 59) and raise the rack plunger to the limit of its upward movement, in which position the pinion no longer will engage the teeth on the rack plunger. Lift the rack plunger from the firing jack housing. Clean with dry-cleaning solvent or volatile mineral spirits and lubricate the rack plunger as prescribed in lubrication order (par. 64).

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(*b*) Reach down through the opening in the top of the firing jack housing and wipe the teeth of the pinion with clean wiping cloths, turning the ratchet case handles to expose the pinion teeth one after another. Lubricate the pinion in the same manner, using wiping cloths saturated with preservative lubricating oil.

(*c*) The rack plunger is installed simply by holding it in position in the upper opening of the housing and rotating the ratchet case (ratchet plunger handle arrows pointing down) until the teeth have meshed and the lower end of the rack plunger has been exposed below the bottom of the housing. Attach the firing jack housing bottom cover (fig. 59), turn the ratchet plunger handles until the arrows point up, raise the rack plunger to traveling position, and insert and secure the firing jack plunger locking lever (fig. 58). Install the firing jack plunger cover and clamp (fig. 60).

b. Carriages M1A2 and M32.

(1) No maintenance of the M1A2 and M32 firing jack and traveling lock other than prescribed below and normal cleaning (par. 71*c*), painting (par. 67), and lubrication (par. 64) is prescribed for the using organization.

(2) Every three months, remove the firing jack breather element (fig. 97) from the M1A2 and M32 firing jack, clean the element with dry-cleaning solvent or volatile mineral spirits, dry, and saturate with preservative lubricating oil as prescribed in lubrication order (par. 64).

Section XIII. TRAILS, TRAIL LOCK, AND TRAIL SPADES

103. General

a. Trails.

(1) The two trails (fig. 2) are tapered, welded steel, box-type girders hinged to the bottom carriage. In traveling position, the trails are closed and locked by the trail lock and the weapon is coupled to the pintle of the prime mover by the lunette (fig. 48). In firing position, the trails are unlocked and spread, trail spades are attached under the rear ends of the trails (fig. 51), and the spades are emplaced in pits dug in the ground. When fully spread, each trail forms an angle of 30° with the center of the carriage. Bottom carriage stops (fig. 135) are provided to limit the spread of the trails, and top carriage stops prevent traverse of the weapon during travel. Stops are also provided on the bottom carriage which causes the trails to be centered when closed and locked.

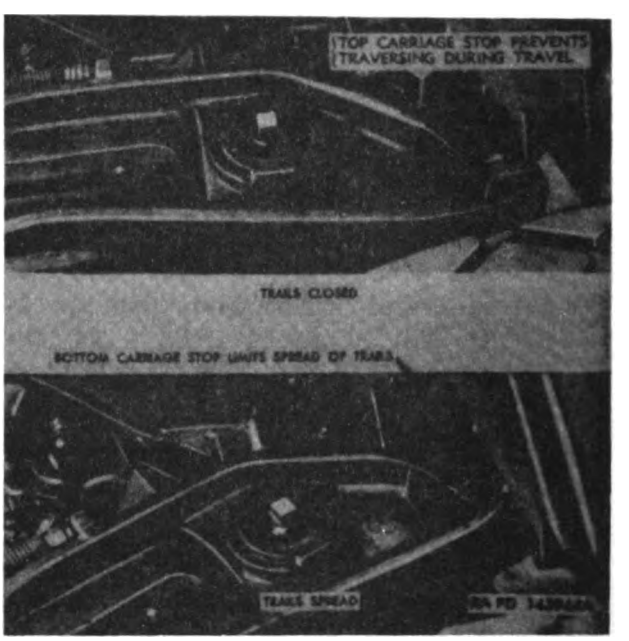


Figure 135. Stops to prevent top carriage traverse during travel and stops to limit spread of trails in firing position.

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(2) The rear end of the trails have smooth bottom surfaces with recesses for attaching lugs of the trail spades (fig. 51) and square holes in the rear for the insertion of the spade keys, which lock the spades in position. The recess for the trail spade lug on the left trail also accepts the caster assembly for the M123A1 howitzer and is locked in position with the spade key. They also have round holes through which the weapons handling bars are inserted for use as auxiliary lifting handles. Trail handles (fig. 2) are welded to the outer sides of both trails and a weapons handling bar socket (fig. 48) is provided at the rear end of each trail hahdle. On both trails, brackets are provided on the outer sides for the trail spades (fig. 47), retainers on the top for the firing jack float (fig. 37), supports on the top for the weapons handling bars, and supports on the inner sides for the sections of the rammer staff. Retainers are provided on the top for the loading tray on the M114 and M114A1. The spade key bracket (fig. 2) and the sledge carrier are welded to the outer and inner sides respectively of the left trail. The bottom carriage of the M123A1 howitzer has the loading tray stowed on the right shield. The left trail also has brackets to accept the hydraulic power unit.

b. Trail Lock. The trail lock is a clamping mechanism operated by the trail lock handle (fig. 48). The handle controls the action of the trail lock hook which engages the trail lock link. When the trails are closed, a projecting wedge on the left trail enters a mating hole in the right trail and is locked by the insertion of the trail locking retainer pin.

c. Trail Spades. The trail spaces (figs. 47 and 51) function as spades and floats and are equipped with lifting handles. The spade webs are rounded to provide better flotation when used with logs or timber or when the spades are not fully buried in the ground.

104. Maintenance

a. Accumulation of water in the trails can cause rupture of the welds upon freezing. Trapped water causes accelerated rusting and adds excess weight. If the trails are not provided with drain plugs, notify support maintenance personnel. When drain plugs are installed, the battery mechanic must remove the drain plugs each week, allow the trails to drain, and install the plugs.

b. No other maintenance of the trails, trail hinge pin, trail lock, and trail spades, except normal cleaning (para 71c), painting (para 67), and lubrication (para 64) is prescribed for the using organization.

Section XIV. WHEEL DRIVE UNIT (M123A1 ONLY)

105. General

Refer to paragraph 4*a*(7) for description.

106. Removal and Installation

a. Removal.

(1) Release the fastener lock securing the hydraulic motors to the wheel drive units and lift the motors from the units and lay them on the carriage tires (fig. 136).

(2) Lift the handle of the fastener pin in the center of the wheel drive unit, unscrew the assembly, and lift the unit away the wheel (fig. 137).

b. Installation.

(1) Position the wheel drive unit so the splines of the drive ring on the unit mates with the splines in drive ring on the carriage wheel hub, and the main shaft mates with the

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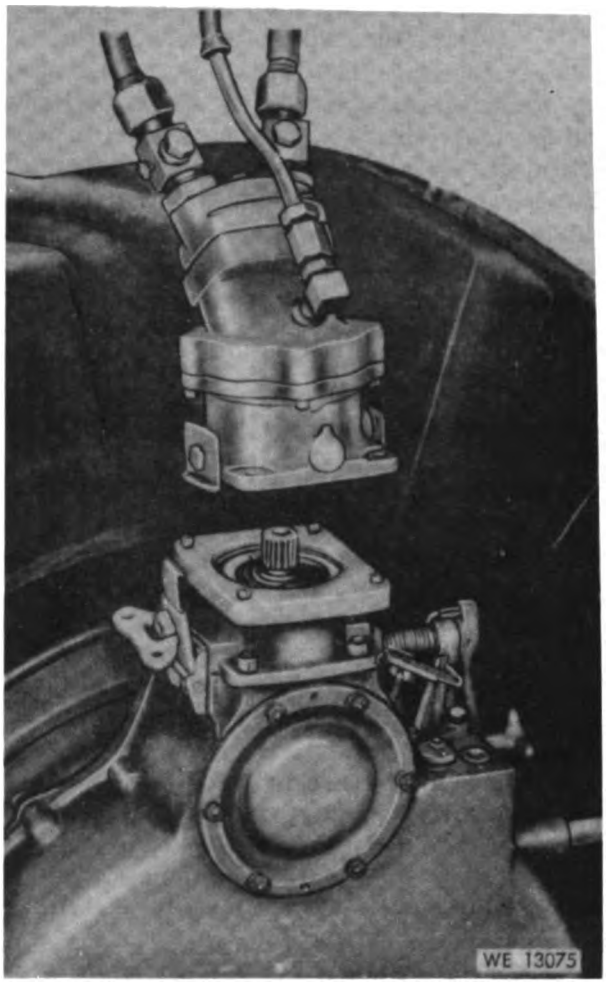


Figure 136. Hydraulic motor removed from wheel drive unit.

main shaft coupling with the hydraulic motor mounting on the top; push in place. Secure the fastener pin assembly to the wheel spindle (fig. 137). Raise the carriage wheels on the firing jack and rotate the wheel to test the freedom with which it turns, as the axle nut may have become tightened when the fastener lock was tightened. If such is the case, remove wheel drive unit and repeat bearing adjustment in paragraph 117*h*.

(2) Place they hydraulic motor on the top of the wheel drive unit and secure with the fastener lock (fig. 136).

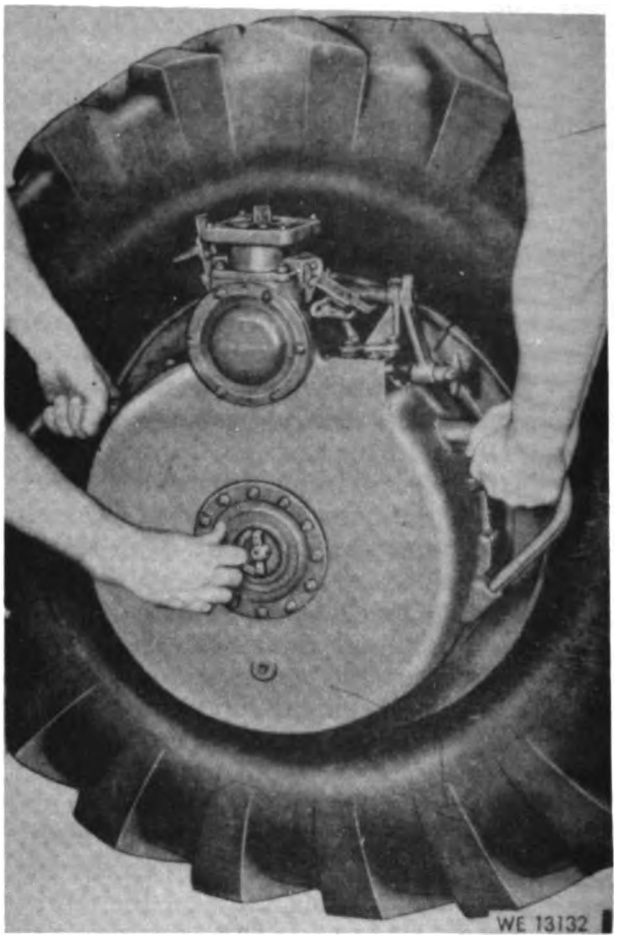


Figure 137. Removing or installing wheel drive unit.

107. Disassembly

a. Drive Unit Fastener Pin Assembly

(1) Remove the setscrew holding the fastener pin nut, unscrew the nut, and remove the fastener pin assembly from the center of the wheel drive unit.

(2) Remove the fastener pin plate from the fastener pin shaft.

(3) Remove the two spring pins from the fastener pin handle and remove the fastener pin handle pin, handle, bearing ball, and fastener pin handle spring from the shaft.

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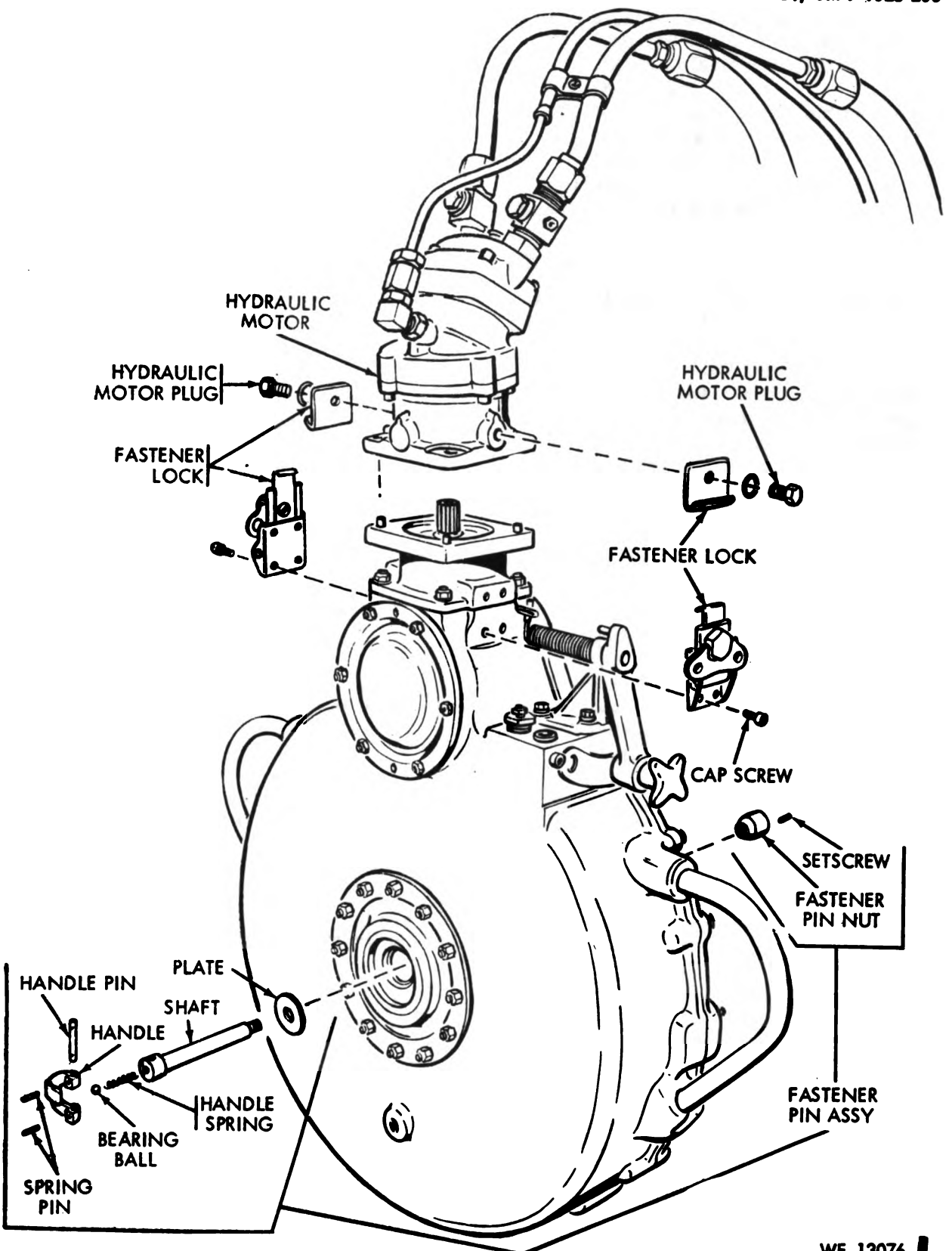


Figure 138. Removal or installation of fastener lock and lockpin.

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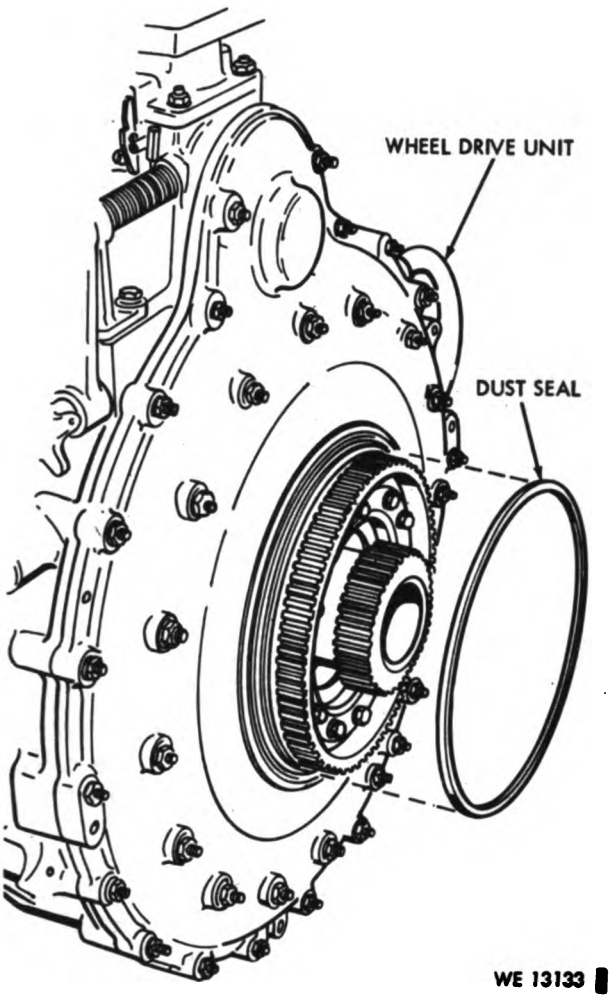


Figure 139. Removal or installation of dust seal.

b. Fastener Locks (fig. 138).

(1) Remove the four capscrews securing each fastener lock and remove the locks.

(2) Remove the plugs and remove the tops of the fastener locks and preformed packing.

c. Remove Dust Seal (fig. 139). Pry dust seal out of groove.

108. Assembly

a. Dust Seal. Install the dust seal in the groove provided (fig. 139).

b. Fastener Locks (fig. 138).

(1) Install the tops of the fastener locks on the hydraulic motor and secure with plugs and performed packings.

(2) Install each fastener lock on the wheel drive unit and secure with four 10 x 3/8 socket head capscrews.

c. Drive Unit Fastener Pin Assembly (fig. 138).

(1) Position the fastener pin handle on the fastener pin shaft, insert the fastener pin handle spring and bearing ball in the shaft, hold the ball and spring back and insert the fastener pin handle pin through the handle and shaft, with the slot in pin against the ball. Aline the pin holes and insert two 3/32 x 9/16 spring pins.

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(2) Slide the fastener pin plate on the shaft.

(3) Insert the fastener pin assembly through the center of the wheel drive unit and screw the fastener pin nut on the shaft. Aline the setscrew hole and install the No. 10 x 3/8 hexagon setscrew.

109. Maintenance

a. Lubricate the wheel drive unit in accordance with lubrication chart (para 64).

b. Inspect housing and cover for dents or cracks and refinish as required. Inspect for foreign matter lodged between the unit and carriage wheel.

c. Check the lifting handles to see that they are securely pinned and are not bent inward towards the carriage wheel.

d. Inspect the drive unit fastener lock assembly. If worn or inoperative, replace pin-assembly (para 107).

e. Examine the fastener locks which secure the hydraulic motors to the drive unit. Replace cracked or bent fastener locks (para 107).

f. Replace the dust seal which bears against the wheel hub, if damaged or worn (para 107).

g. Organizational maintenance of the wheel drive unit is limited to the maintenance covered herein. Notify ordnance maintenance for any other required maintenance.

Section XV. WHEEL AND TIRE ASSEMBLY

110. General

a. Wheels.

(1) The early model wheel in the M114, M114A1, and M123A1 howitzer consists of the wheel disk and rim, the wheel and hub ring, and 18 wheel ring retaining nuts (fig. 140). The wheel disk has a bead only at the rear. The front of the disk and rim bears 18 wheel disk rim studs. The wheel and hub ring is a separate piece which serves as the outer head for the tire. It is held to the disk and rim studs by the 18 wheel retaining nuts (figs. 140 and 141). The wheel disk rim is attached to the wheel hub by ten wheel retaining nuts.

(2) The later model wheel in the M114, M114A1, and M123A1 howitzer consists of the wheel disk and rim, and side rim. The wheel disk has a large bead at the rear and a small bead at the front. The side rim is a tension ring which locks behind the small front bead of the disk and acts as the outer bead for the tire. The wheel disk rim is attached to the wheel hub by ten wheel retaining nuts. Five of these nuts also retain the drive ring for the wheel drive unit (figs. 142 and 143).

b. Tire Assembly.

(1) The tire assemblies on the M114 and M114A1 howitzer consist of two 14.00 x 20 tires, two 14.00 x 20 tire tubes, and two tire bead locks.

(2) The tire assemblies on the M123A1 howitzer consists of two 14.00 x 20 directional traction (earth-mover) tires, two 14.00 x 20 tire tubes, two side rims, and two tire bead locks.

111. Removal and Installation

a. Remove Wheel and Tire Assembly.

(1) Spread the trails (para 39*d*(2)), set the carriage handbrakes, and raise the carriage on the firing jack (para 39*d*(9)) until the wheels are clear of the ground.

(2) Release the lock fasteners securing the hydraulic motor to the wheel drive unit (fig. 136) (M123A1 only).

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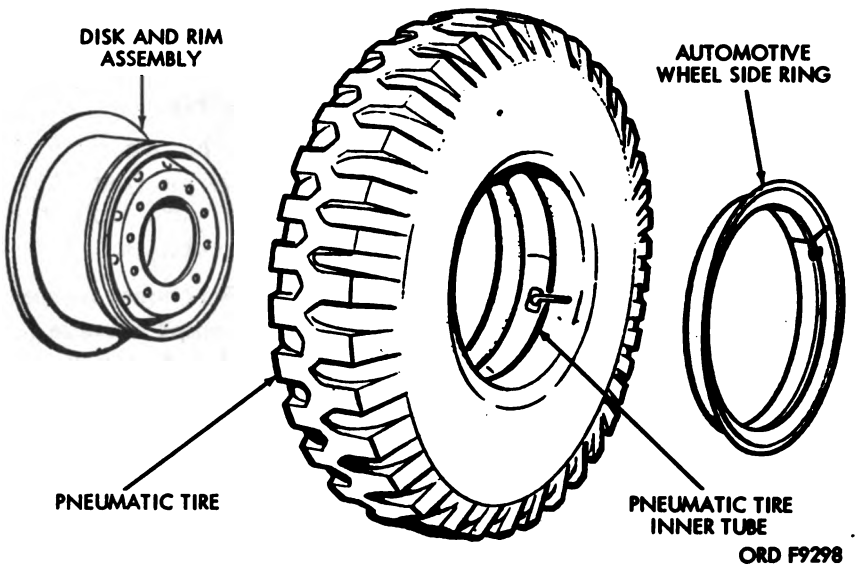


Figure 140. Wheel and tire—exploded view.

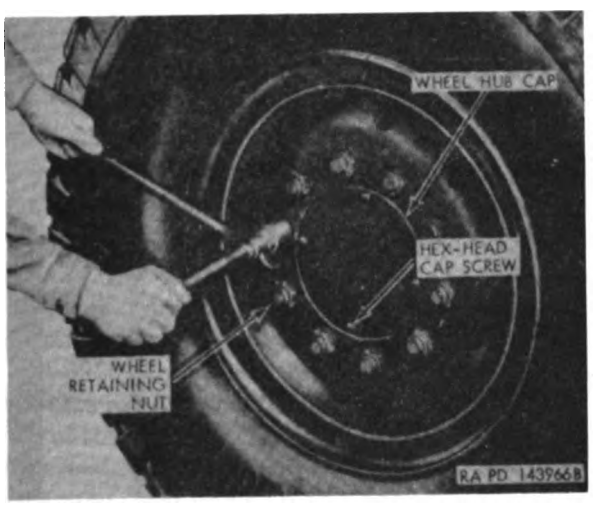


Figure 141. Removing or installing wheel retaining nuts.

(3) Pull the wheel drive unit lockpin and remove the wheel drive unit (fig. 137) (M123A1 only).

(4) Remove the ten wheel retaining nuts (figs. 141 and 142).

(5) Remove the drive ring and drive ring gasket (fig. 143) (M123A1 only).

(6) Tip out the top of the wheel and tire assembly to allow the wheel to clear the hub and roll the wheel and tire assembly out of the way.

Note. The wheel and tire assembly may be rolled easily if kept in an upright position.

b. Install Wheel and Tire Assembly.

(1) Roll the wheel and tire assembly into position and rock the wheel to

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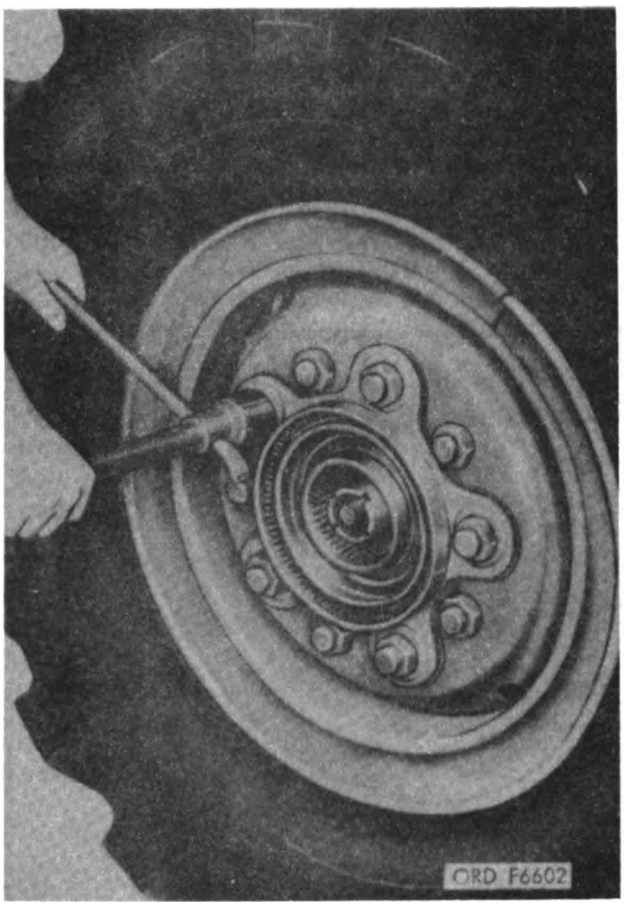


Figure 142. Removing or installing wheel retaining nuts.

get the lower portion under the hub. Release the carriage handbrake and turn the hub to aline the studs on the hub with the holes in the wheel disk and rim. Push the wheel and tire assembly into the hub and screw the wheel retaining nuts loosely into position. Apply the handbrake and tighten the wheel retaining nuts alternately until all nuts are tightened securely. On the M123A1 howitzer, install the drive ring gasket and drive ring on the longer studs (fig. 143) before installing retaining nuts.

(2) Lower the carriage to the ground (par. 52*b*(2)).

112. Disassembly

a. Remove the wheel and tire assembly from the carriage (par. 111*a*). Remove the cap and valve core from the tire valve and wait for tire to deflate.

Warning: **Tire must be completely deflated before any attempt is made to remove the side rims. An inflated tire may blow a partially removed side rim off the wheel disk and rim, and cause serious injury to personnel.**

b. When the tire is completely deflated, disassemble as shown in TM 9–1870–1.

113. Assembly

Assemble the tire as shown in TM 9–1870–1.

114. Maintenance

a. The pressure to be maintained in the tires is 50 pounds psi. To obtain maximum mileage, the air pressure should be checked prior to operations and weekly, and air added only if there is a loss of air pressure. Bleeding of air from the tires results in an increase in the flexing of the side walls, which increases the danger of failure.

b. Check for loose or missing nuts. Tighten or replace as necessary.

c. Replace wheel drive rings which are cracked or have damaged teeth. Clean outside threads on drive ring, lubricate lightly, and install hub cover when wheel drive unit is removed. Replace torn wheel drive ring gaskets (M123A1 only).

d. For maintenance and care of pneumatic tires, refer to TM 9–1870–1.

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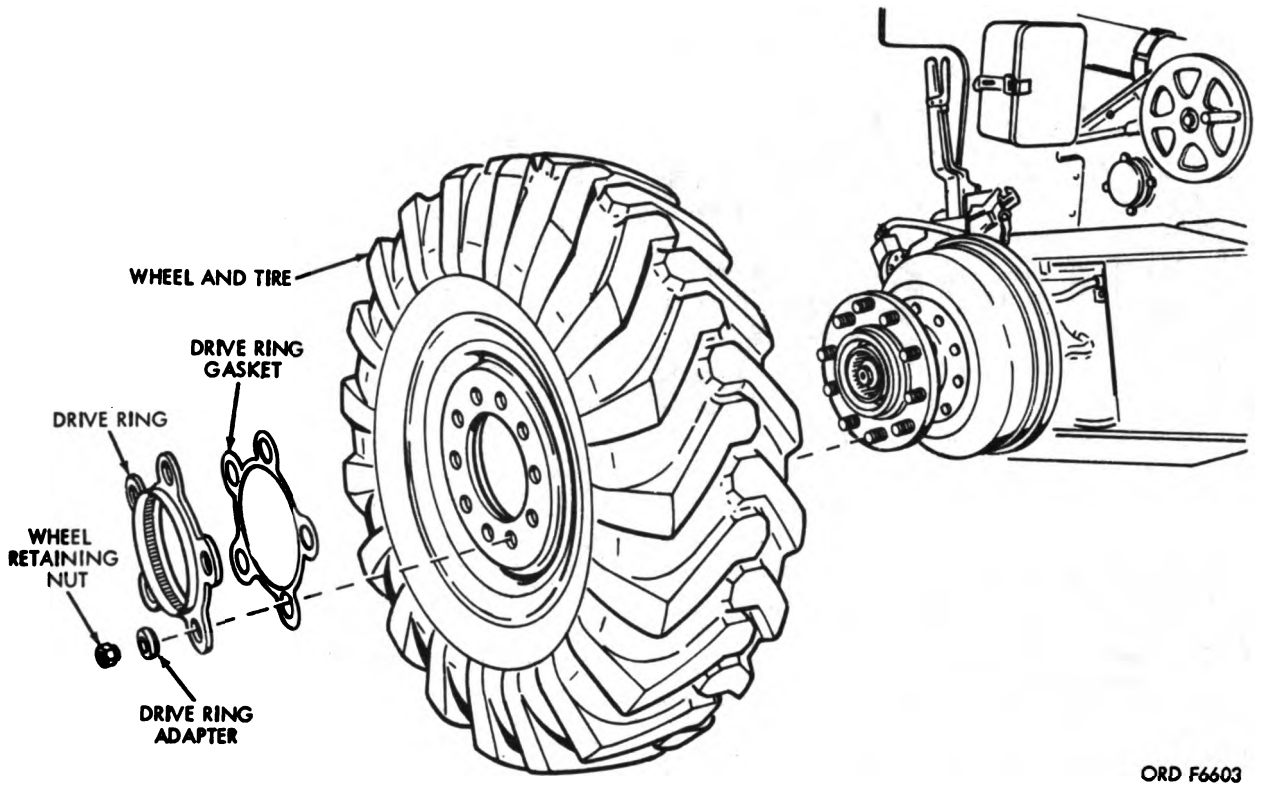


Figure 143. Removal or installation of drive ring group and wheel assembly.

Section XVI. WHEEL HUB AND BEARINGS GROUP

115. General

a. Wheel Hubs. The wheel hubs (fig. 144) are supported on the wheel spindles by the outer and inner wheel spindle roller bearings. The air brake drums are bolted to the inner flanges of the wheel hubs, and the wheels are fastened to the outer flanges of the wheel hubs by studs and nuts (par. 111).

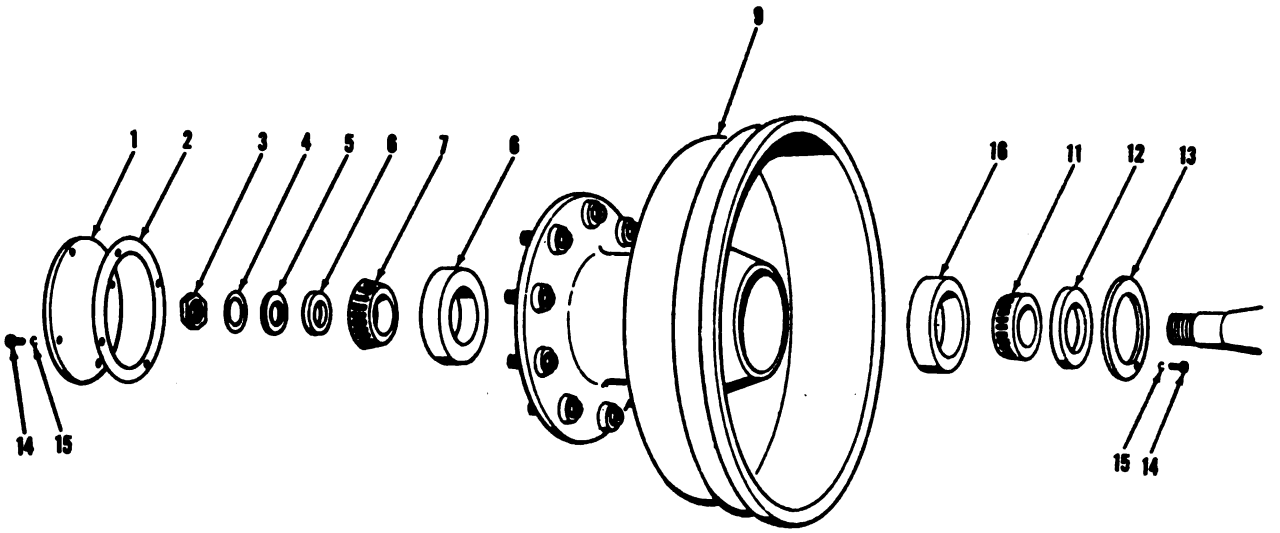
b. Wheel Spindle Roller Bearings. The inner wheel spindle roller bearings seats inside the wheel hub (fig. 144). This bearing and the oil seal are a drive fit in the hub and are secured in position by the oil seal retainer, which is bolted to the wheel hub. The wheel spindle roller bearings and the entire hub and drum group are secured to the wheel spindle and are adjusted by the wheel spindle nut and receiver assembly. A wheel hub seal is placed over the main shaft coupling and into the pilot ring which is fastened to the end of the hub by four hexagon socket shouldered cap screws. The seal protects the inside of the wheel hub against the entrance of dirt and other foreign matter.

116. Disassembly

a. Remove the wheel and tire assembly from the carriage (par. 111*a*).

b. Remove the four hexagon head cap screws and lock washers (fig. 141) holding the hub cap and paper gasket to the hub (fig. 144). Straighten the edge of the wheel lock which is bent over the wheel spindle hexagon plain nut. Using the combination

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1—Hub cap 1025-619-3420
2—Paper gasket 1025-619-3421
3—Hexagon plain nut 5310-617-1192
4—Wheel lock 2530-700-1705
5—Locking ring 1025-617-1190
6—Wheel bearing retaining nut assembly 1025-711-9545
7—Tapered roller bearing cone and rollers 3110-100-0268
8—Tapered roller bearing cup 3110-100-0327
9—Air brake drum
10—Tapered roller bearing cup 3110-100-0323
11—Tapered roller bearing cone and rollers 3110-151-8611
12—Encased plain seal 5330-171-8932
13—Packing retainer 1025-619-3422
14—Hexagon head cap screw 5305-068-0502
15—Lock washer 5310-013-1121

Figure 144. Wheel hub and drum and retaining parts—exploded view (M114 and M114A1).

wrench, unscrew and remove the hexagon plain nut (fig. 145). Remove the wheel lock and locking ring (fig. 144) from the spindle. Remove the wheel bearing retaining nut with combination wrench (fig. 164).

c. On the M123A1 howitzer, remove the axle nut (fig. 147) from the wheel spindle. Remove four shoulder screws securing the pilot ring to the hub and remove the pilot ring main shaft coupling and oil seal.

d. Slide the wheel hub and air brake drum (figs. 144 and 148) outwardly on the wheel spindle sufficiently to loosen and remove the cone and rollers. Two men should then remove the wheel hub and air brake drum from the wheel spindle, exercising care to prevent damage to the oil seal.

e. Remove the three hexagon head cap screws and lock washers that hold the packing retainer to the wheel hub (fig. 144). It will be necessary to reach inside the brake drum grease guard to loosen these screws. Tip the packing retainer at an angle (fig. 149). Using a brass drift, drive out the cone and rollers and the encased plain seal. Place the brass drift against the cone and rollers through the hub and tap it with a hammer. These parts are forced out evenly by tapping all around the edges of the cone.

Note. The tipped out packing retainer will permit the removal of the encased plain seal and cone and rollers without necessitating the removal of the grease guard from the air brake drum.

117. Assembly

a. Tip the packing retainer at an angle (fig. 149) to provide room to insert the cone and rollers in position in its cup in the hub. Insert the encased plain seal in the same manner. Install the cone and rollers and the encased plain seal by tapping the seal into position with a brass drift. Tap it evenly

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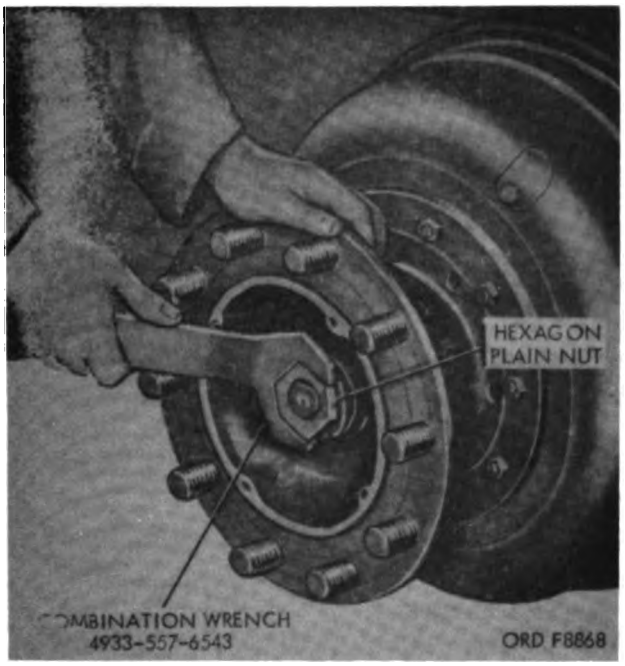


Figure 145. Removing or installing the wheel spindle hexagon plain nut.

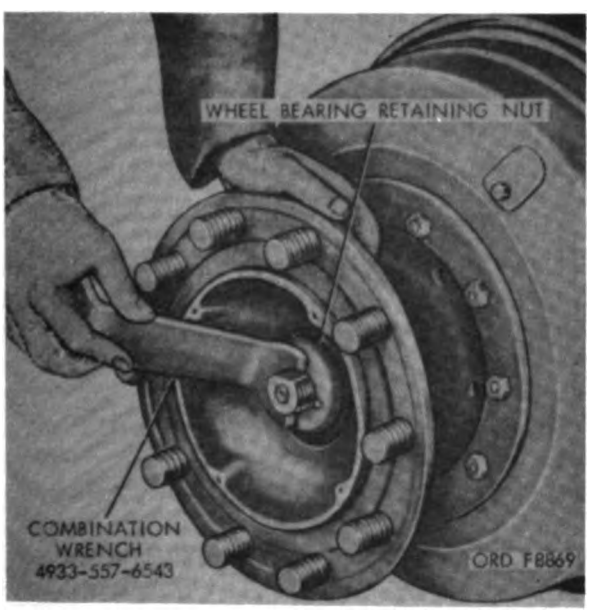


Figure 146. Removing or installing the wheel bearing retaining nut (M114 and M114A1).

so as not to bend it or get it out of shape. Make sure the seal is correctly positioned. Secure the packing retainer in position with its three hexagon head cap screws and lock washers (fig. 144).

b. Slide the wheel hub and air brake drum on the wheel spindle (figs. 144 and 148), keeping it straight with the wheel spindle to prevent damage to the oil seal. Install the cone and rollers of the outer wheel spindle roller bearing.

c. Install the wheel bearing retaining nut on the spindle with the combination wrench (fig. 146); tighten until the wheel hub and air brake drum cannot be turned without exerting considerable force. Then loosen the wheel bearing retaining nut about one-sixth turn. The adjustment is correct when the bearings have 0.005 to 0.010-inch end play, and the wheel hub can be rotated easily without binding.

d. Install the locking ring (fig. 144) with the pin on the retaining nut in one of the 12 holes in the locking ring.

Note. It may be necessary to turn the locking ring over, or turn the retaining nut one way or the other, to permit the pin to enter one of the holes in the locking ring. The bearing adjustment should not be changed farther than the next hole in the ring. Be sure the hub rotates easily.

e. Install the wheel lock (fig. 144) and hexagon plain nut on the spindle. Tighten the nut securely with the combination wrench (fig. 145), tapping the wrench sharply with a hammer to insure proper seating. Rotate the wheel hub to test the freedom with which it turns, as the retaining nut may have become tightened when the nut was tightened. If such is the case, remove hexagon nut and repeat bearing adjustment.

Caution: **Do not attempt to loosen or tighten the bearing adjustment by merely loosening or tightening the hexagon nut. This might permanently damage the bearings, wheel spindle, and hub.**

f. Place the paper gasket and hub cap (fig. 144) in position over the end of the wheel hub and secure with four 1/4 x 3/4

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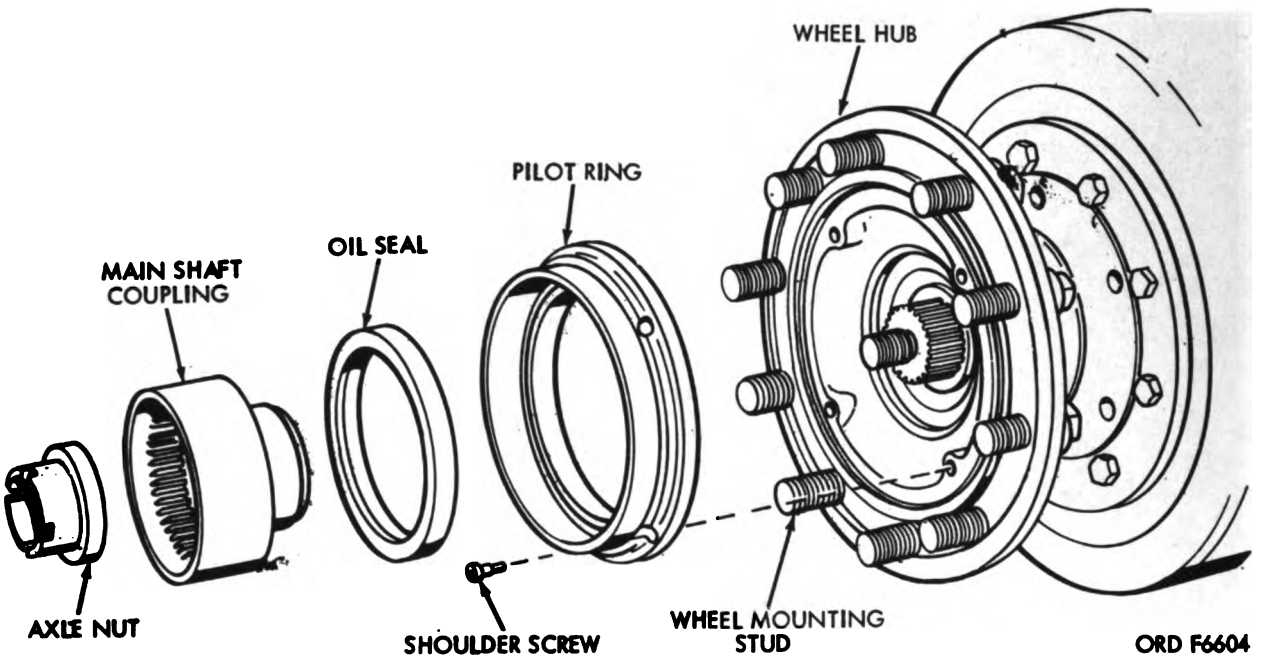


Figure 147. Removal or installation of wheel drive unit attaching parts (M123A1 only).

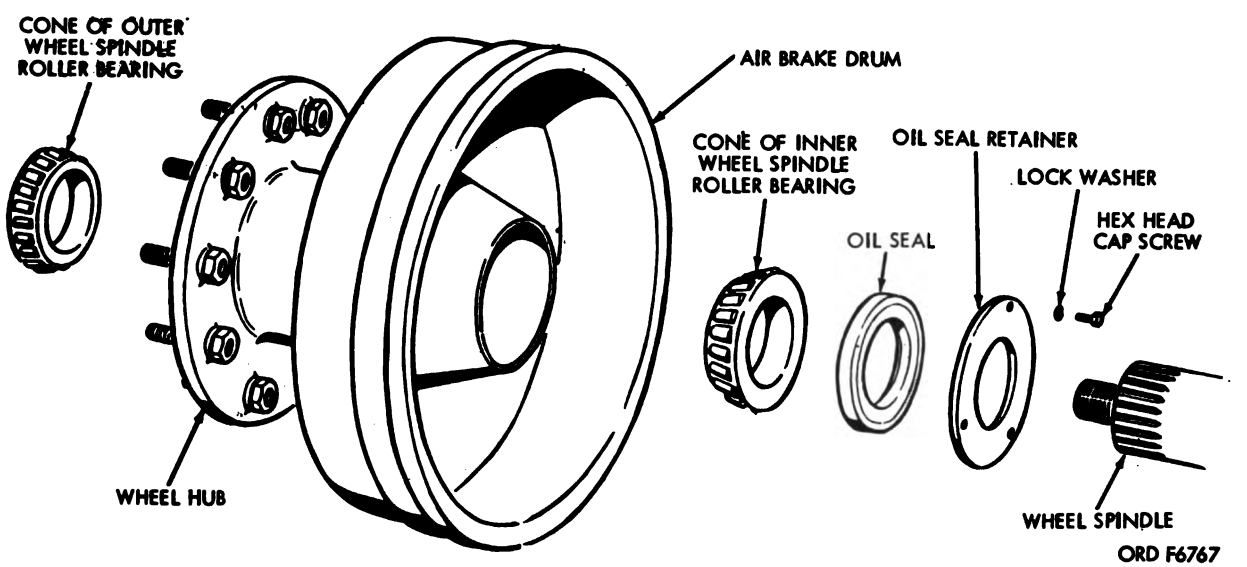


Figure 148. Wheel hub and drum—exploded view (M123A1 only).

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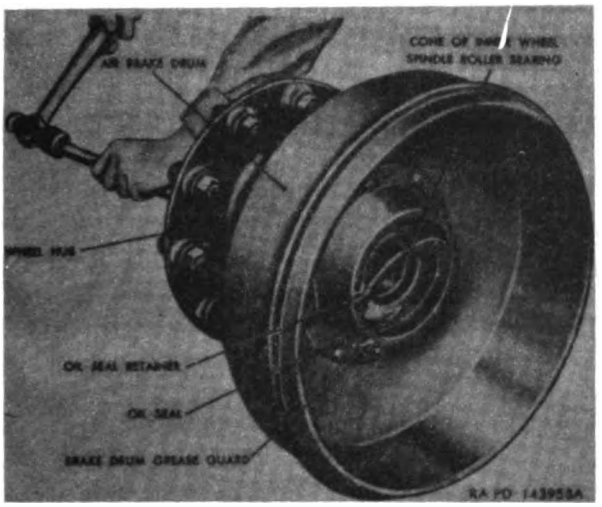


Figure 149. Removing cone of inner wheel spindle roller bearing.

hexagon head cap screws and 1/4-inch lock washers.

g. On the M123A1 howitzer, install the pilot ring (fig. 147) in hub and secure with four shoulder screws. Install the oil seal in the pilot ring and slide the main shaft coupling through the oil seal and onto the splines on the wheel spindle.

h. On the M123A1 howitzer, install the wheel axle nut on the wheel spindle; tighten until the wheel hub and air brake drum cannot be turned without exerting considerable force. Then loosen the wheel spindle nut about one-sixth turn. The adjustment is correct when the bearings have 0.005 to 0.010-inch end play, and the wheel hub can be rotated easily without binding.

i. Install the wheel and tire assembly on the hub (par. 110).

118. Maintenance

a. Disassemble the cones of the wheel spindle roller bearings from the wheel hubs annually for cleaning and lubrication, as prescribed in LO 9-1025-200-10 (figs. 90, 91, 92 and 93). Wash the bearing cones, wheel spindle, bearing cups (inside of wheel hub), and the brake drum with dry-cleaning solvent or volatile mineral spirits and dry thoroughly.

Note. Do not use compressed air to dry bearings. Coat the wheel spindle, pilot ring, main shaft coupling and inside of hub with automotive and artillery grease to retard rust. Lubricate the cones of the roller bearings with automotive and artillery grease with a packer or by hand, kneading lubrication into all spaces in the bearing. Use extreme care to protect the bearings from dirt, and immediately assemble and install wheel. Do not fill hub with lubricant, for the lubricant in the bearing is sufficient to provide lubrication until the next service period; any excess might result in leakage into the drum.

b. Inspect the main shaft coupling and wheel spindle for broken splines. Remove all burs.

c. Examine inside diameter of oil seal for worn, frayed, or damaged sealing member.

d. Inspect pilot ring for cracks or other damage.

e. Check receiver assembly for wear on the inside area where it receives the quick-release lockpin. Inspect the receiver for damaged threads.

f. Check the wheel spindle nut for damaged thread.

g. Adjust the wheel bearing as described in paragraph 117*c*.

h. Notify support maintenance for any further maintenance required.

Section XVII. AIR BRAKES

119. Scope

a. General. The brake mechanisms at the carriage wheels are actuated by compressed air furnished by an air compressor on the prime mover and conducted to the carriage by the service and emergency air brake hoses (fig. 36). The carriage brakes are applied

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by means of a control lever on the prime mover.

b. Principal Parts. The principal parts of the air brake system are the following: two air lines (service and emergency), two air filters, the emergency relay valve, the air tank, two air brake diaphragms, two slack adjusters, two handbrake levers, and two brake actuating mechanisms.

c. Air Lines. The air lines consist of air hoses and tubes interconnecting the various units of the brake system. The service air line leads from the prime mover to the top of the emergency relay valve (fig. 38), and controls all service brake applications. The emergency air line leads from the prime mover to the lower part of the emergency relay valve. Its purpose is to keep the air tank charged at all times. The tank, in turn, supplies the compressed air which actually makes all brake applications. Dummy couplings on the outer sides and near the rear ends of the trails are provided to retain the air brake hose couplings (fig. 37) and to exclude dirt when the couplings are not connected to the prime mover.

d. Air Filters. The air filters (figs. 38 and 150) are mounted on the trails and connected in the service and emergency air lines to filter water and dirt from the air before it enters the emergency relay valve. Drain plugs in the bottom of the filters permit draining accumulated water and dirt.

e. Emergency Relay Valve. The emergency relay valve (figs. 38 and 150) is mounted on the rear of the bottom carriage and is protected by a guard. The valve is a combined relay valve (which speeds up the brake action from the prime mover to the carriage) and emergency valve (which controls automatic brake application in the event of a break between the prime mover and carriage, or a ruptured air line).

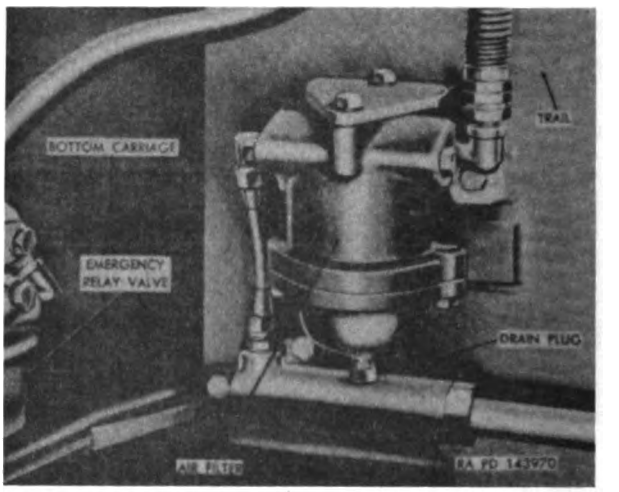


Figure 150. Air filter on right trail.

f. Air Tank. The air tank (fig. 38) is mounted on the rear of the bottom carriage and is equipped with a drain cock for the drainage of moisture and to relieve pressure prior to firing or when the brakes become locked. It stores air both for service and emergency brake applications.

g. Air Brake Diaphragms. Two air brake diaphragms (fig. 151), one for each brake, convert the energy of the compressed air into the mechanical force necessary to operate the brake mechanisms. The air hose connection is protected by the brake diaphragm guard.

h. Slack Adjusters. The slack adjusters (fig. 151) serve as levers to connect the brake mechanisms with the air brake diaphragms. They also provide a convenient method of brake adjustment (par. 122*e*). During braking, the slack adjusters rotate bodily with the brake camshafts (fig. 152) as the brakes are applied or released.

i. Handbrake Levers. A handbrake lever (fig. 151) is provided for each carriage brake. It is pivoted on the brake cam

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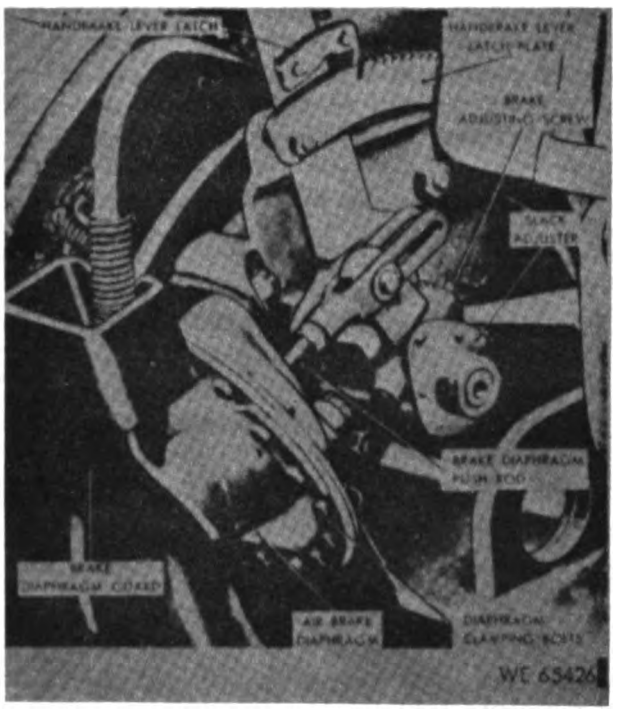


Figure 151. Air brake diaphragm and slack adjuster.

shaft just inside the wheel. The handbrake lever is positioned under the slack adjuster so that when the lever is pulled to the rear it lifts the slack adjuster, causing the brake camshaft to ratate and apply the brake. A handbrake lever latch (fig. 151), controlled by the spring-loaded hand grip lever, engages the teeth of the hanbrake lever latch plate and retains the handbrake lever in position when the handbrakes are applied. When handbrake latch is positioned in the third notch of rack, brake must be fully engaged.

j. Brake Actuating Mechanisms. Each brake actuating mechanism (fig. 144) consists principally of the brakeshoes, brake camshaft, and brakeshoe springs. The brakeshoes and camshaft are attached to the bottom carriage by means of the brake shield. Each brakeshoe pivots at one end of the brake anchor pin and both are expanded against the brake drum by the rotation of the camshaft when the brakes are applied. When the brakes are released, the camshaft release the shoes, which are then pulled away from drum by the brakeshoe springs.

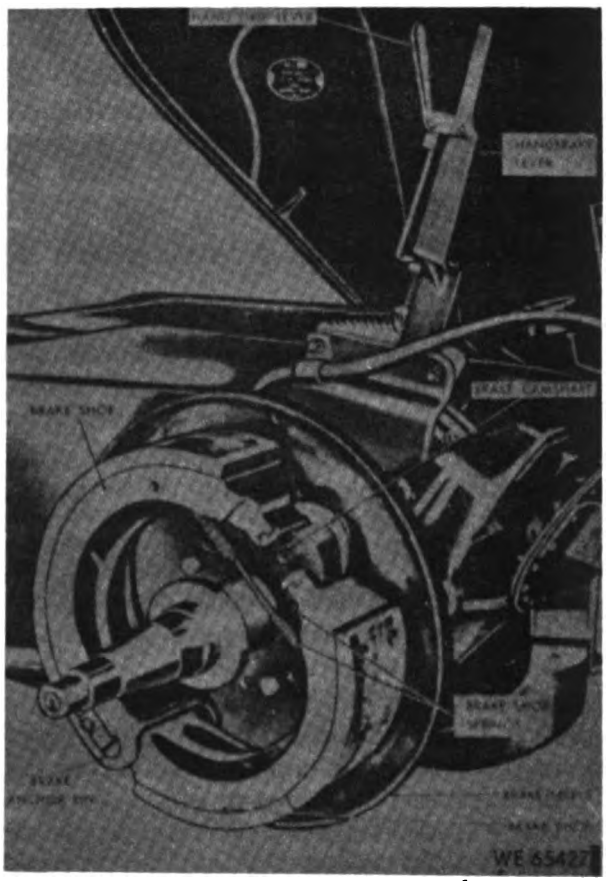


Figure 152. Brake actuating mechanism — internal parts.

120. Disassembly

a. Disassemble Air Filters.

Note. Air filters of two different designs are used on different carriages. While they work on the same principle, they differ slightly in appearance and construction. The air filter cover of one is connected to the air filter body by two screws; the cover of the other is connected to the body by four screws. Both employ the same strainer and strainer support.

To remove the air filter strainer (fig. 153) for cleaning, remove the hexagon head screws and lock washers connecting the air filter cover to the air filter body. Be careful not to lose or damage the air filter cover or the air filter body. Be careful not to lose or damage the air filter cover gasket. Draw the strainer from the body it it has not dropped out. Remove the strainer support from the cover.

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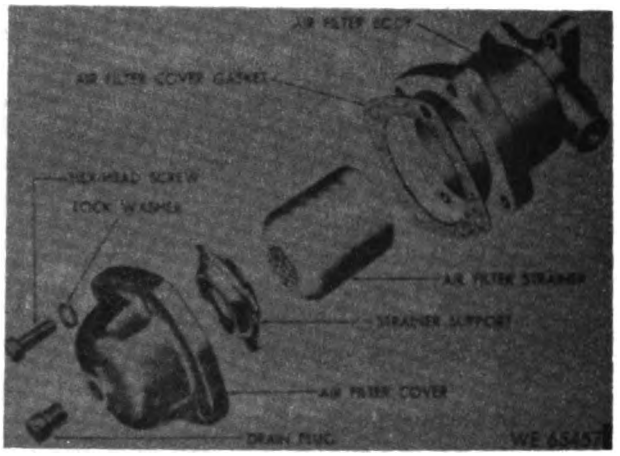


Figure 153. Air filter — exploded view.

b. Remove Air Brake Hose Coupling Packing Ring. The air brake hose coupling packing ring (fig. 154) is flexible and can be removed from the air brake hose coupling by twisting it sufficiently to free it.

121. Assembly

a. Install Air Brake Hose Coupling Packing Ring. Squeeze the flexible air brake hose coupling packing ring (fig. 154) sufficiently to force its flanged end into the air brake hose coupling. Be sure the packing ring seats securely in the recess in the hose coupling.

b. Assemble Air Filters. Install the strainer support in the air filter cover (fig. 153). Place the air filter strainer on the strainer support in the cover, and insert the strainer into the air filter body. Secure the filter cover to the body with the hexagon head screws and lock washers (two or four screws and washers, depending on design of filter) (para. 119*d*).

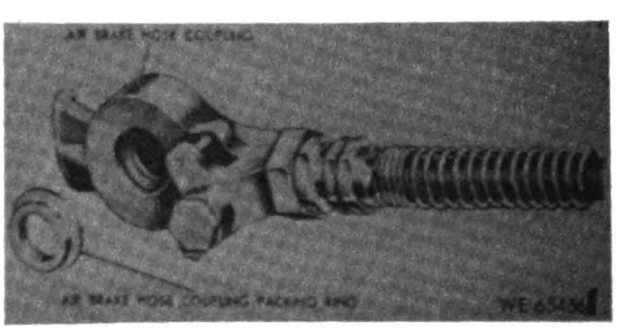


Figure 154. Air brake hose coupling and packing ring.

122. Maintenance

a. Test for Air Leakage.

(1) Test the entire air brake system for air leaks bimonthly, or when a leak is evidenced by weak or intermittent brakes, by applying soapsuds with the system under pressure to all air hoses, air brake hose connectors and other hose connections, air brake hose couplings, air filters, air brake diaphragms, and emergency valve and air tank. Any leak causing a soap bubble of 2-inch diameter in 5 seconds is considered serious; if it cannot be remedied by the methods herein outlined or if a leak is found in any air brake hose, notify ordance maintenance personnel.

(2) Apply soapsuds to the edges of the air brake diaphragms (fig. 151) and around all diaphragm clamping bolts. If a leakage of air is evidenced by the formation of a soap bubble, tighten all clamping bolts in such sequence that successively tightened bolts are positioned on the diaphragm as nearly diagonally from each other as possible. If this fails to stop the leak, notify ordance maintenance personnel.

(3) Test all air brake hose connectors for leakage. If a leak occurs at the joint between the connector body and connector nut, tighten the nut. If this does not correct the leak, notify ordance personnel.

(4) Apply soapsuds to the airbrake hose couplings. If a leak occurs at a coupling and it is securely in position, detach the coupling from the prime mover, remove the air brake hose coupling packing ring (para. 120*b*) and replace it with a new one.

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(5) Apply soapsuds to the joint between the air filter cover (fig. 153) and the air filter body. If a leak is evident, tighten the hexagon head screws holding the cover to the body. If this fails to stop the leak, notify ordnance maintenance personnel.

(6) Apply soapsuds to all joints and connections on the air tank and emergency relay valve. If any leakage is found, notify ordnance maintenance personnel.

b. Test Emergency Brake Application. Test the emergency brake application daily by closing the emergency air line cutout cock on the prime mover (fig. 36) and disconnecting the emergency air brake hose coupling from the prime mover, if the tactical situation permits coupling the weapon to the prime mover for this test. If the brakes do not apply automatically, notify ordnance maintenance personnel.

c. Drain Water From Air Filters and Air Tank.

(1) Drain accumulated water weekly from the air tank and air filters. In cold weather, drain these units every eight hours of continuous travel. If the water freezes in the unit, apply sufficient heat to melt the ice and drain the water, taking care not to damage the air brake hoses.

Note. Do not drain the air filters or air tank while the air brake system is under pressure. If draining is performed during travel, temporarily disconnect the air brake hose couplings from the prime mover (fig. 36).

(2) To drain the air filters, remove the drain plug from the bottom of the air filter cover (fig. 153), allow the water to drain, and install the plug.

(3) To drain the air tank, open the drain cock at the lower right of the air tank (fig. 38) long enough to expel all moisture and then close the drain cock.

d. Clean Air Filters. Clean the air filters bi-monthly by disassembling the filters (par. 120), brushing off accumulated foreign matter, and washing the air filter strainers (fig. 153) and air filter cover and strainer support with dry-cleaning solvent or volatile mineral spirits. Allow the parts to dry thoroughly and assemble the air filters (par. 121*b*).

Note. Do not use compressed air to dry the air filter strainer.

e. Adjust Air Brakes.

(1) Check the travel of the brake diaphragm push rods (fig. 151) monthly by measuring the distance each push rod extends from its air brake diaphragm with the brakes released and with the brakes applied. If the push rod travel is less than three-quarters of an inch, or more than one inch, adjust the brakes.

(2) Spread the trails to their fully open position (par. 39*d*(2)), and raise the carriage on the firing jack (par. 39*d*(10) carriage M1-A1; par 39*d*(9) carriage M1A2 and M32) until the wheels are clear of the ground. Release the carriage handbrakes (fig. 1).

(3) Rotate the wheel and, at the same time, turn the brake adjusting screw (fig. 151) on the slack adjuster until the brake stops the wheel from turning. Then back off the adjusting screw until the wheel turns freely.

(4) Remove the wheel and tire assembly (par 111*a*) and insert a thickness gage or feeler (fig. 155) through the inspection hole in the brake drum to check the clearance between the brake lining and the brake drum. Rotate the drum, taking care not to twist or damage the gage. The clearance between the lining and drum should not be less than 0.025-inch or greater than 0.050-inch. If it does not fall within these limits, readjust the brakes as in (3) above.

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(5) When the brakes are properly adjusted, install the wheel and tire assembly (par. 111*b*).

f. Lubricate. Lubricate as prescribed in the lubrication order (par 64).

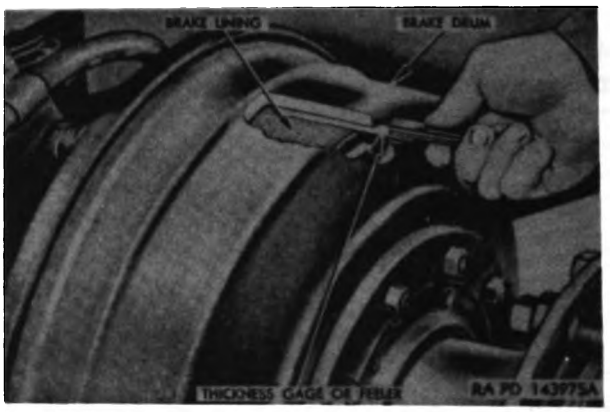


Figure 155. Checking clearance between brake lining and drum.

Section XVIII. CASTER ASSEMBLY (M123A1 ONLY)

123. General

Refer to paragraph 4*a*(8) for description of caster assembly.

124. Removal and Installation

a. Refer to paragraph 39*d*(3) for removal of caster assembly.

b. Refer to paragraph 52*f* for installation of caster assembly.

125. Disassembly (fig. 156)

a. Remove the hexagon plain nut and split lock washer from the caster axle and remove the axle, axle spacers, and wheel groups from the caster fork and bracket assembly group.

b. Remove the five hexagon plain nuts and split lock washers securing the caster hub and remove hub from caster wheel rim.

c. Make sure tire is deflated and remove eight hexagon plain nuts, eight split lockwashers, and eight hexagon head cap screws holding the two caster wheel rim halves together and remove the rim halves from the tire.

d. Remove the pneumatic tire inner tube from the pneumatic tire.

126. Assembly (fig. 156)

a. Insert the pneumatic tire inner tube in the pneumatic tire and inflate enough to keep the inner tube in the tire.

b. Insert the caster wheel rim halves in the tire with the valve stem in the hole provided and fasten the rim halves together with eight hexagon head cap screws, eight split lock washers, and eight hexagon plain nuts.

c. Insert the caster hub into the rim with hub flange on the opposite side from the valve stem and secure the five split lock washers and five hexagon plain nuts.

d. Position the wheel group in the caster fork and bracket assembly group with an axle spacer on each side, and insert the caster axle; secure with a split lock washer and hexagon plain nut.

e. Inflate the penumatic tire to 35 psi.

127. Maintenance

Lubricate in accordance with LO 9-1025-200-10 (figs. 90, 91, 92, and 93), and paint as necessary. Maintain tire pressure at 35 psi, to obtain maximum mileage. Check the air pressure weekly and before operating. Inadequate tire pressure results in an increase in the flexing of the side walls, which

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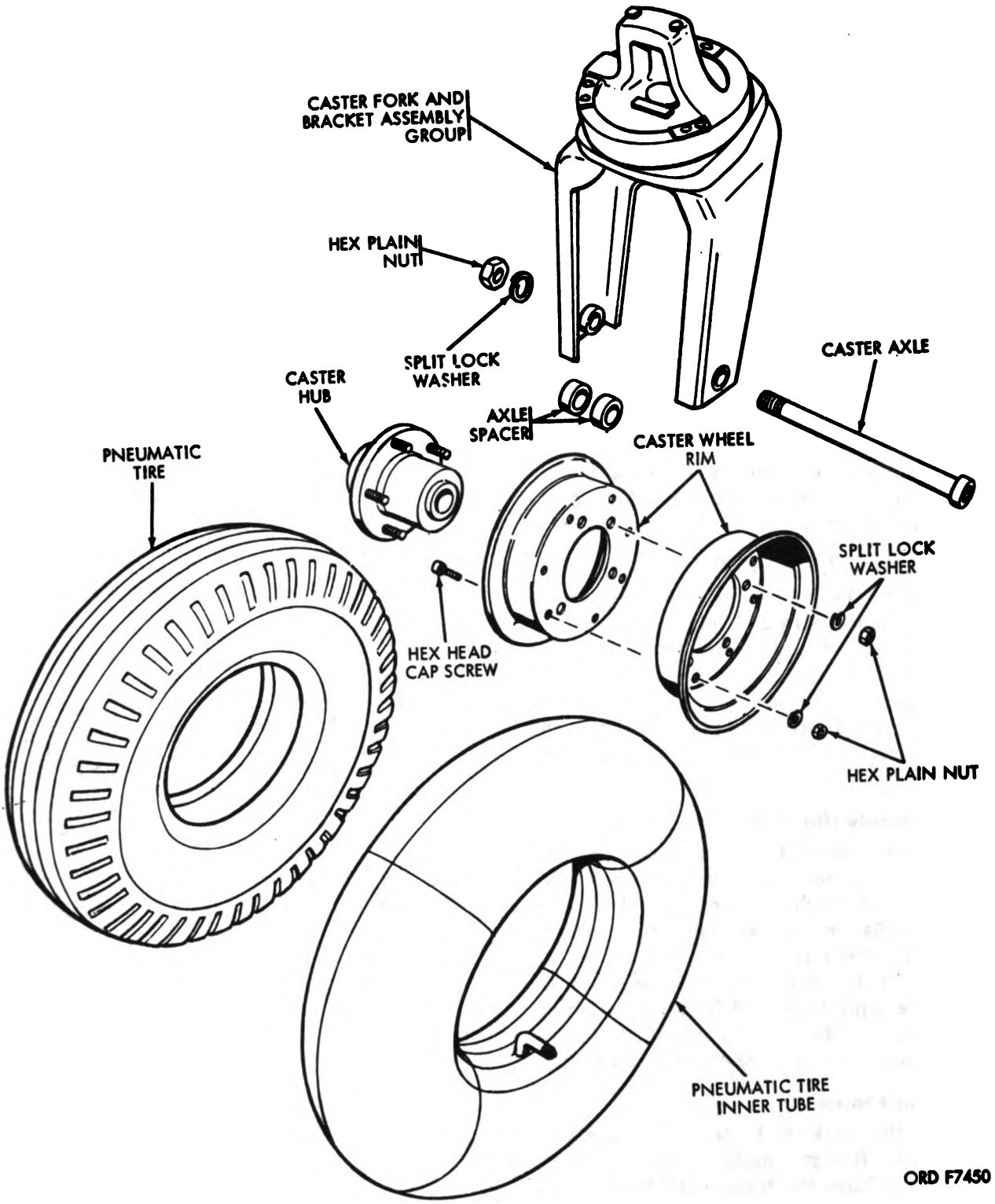


Figure 156. Caster assembly—partial exploded view.

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increases the danger of failure. Remove all foreign substance from the rubber, being especially careful to keep tire as free from oil and grease as possible. If inspection reevals damaged, worn, or flat tire, replace or repair. Repair of tire is covered in TM 9–1870–1. If inspection reveals damage other than tire, notify ordnance maintenance.

Section XIX. TRAIL JACK ASSEMBLY (M123A1 ONLY)

128. General

Refer to paragraph 4*a*(9) for description of trail jack assembly.

129. Removal and Installation

a. Removal (fig. 157). Remove the retaining ring securing the trail jack assembly to the left trail and remove the flat washer and jack assembly.

b. Installation (fig. 157). Insert the shaft on the trail jack assembly through the hole provided in the left trail and secure with a 1–3/4–inch flat washer and a 1–1/2–inch external retaining ring.

130. Disassembly (fig. 158)

a. Remove the cotter pin, two flat washers, and headed straight pin securing the trail jack base to the trail jack yoke and remove the base.

b. Remove the cotter pin, two flat washers, and headed straight pin securing the trail jack yoke to the trail jack assembly and remove the yoke.

131. Assembly (fig. 158)

a. Position the trail jack yoke on the trail jack assembly and secure with two 5/16–inch flat washers, one on each side, a 0.311 x 2.584 headed straight pin, and a 3/32 x 5/8 cotter pin.

b. Position the trail jack base on the yoke and secure with two 5/16–inch flat washers, one on each side, a 5/16 x 3.031 headed straight pin, and a 3/32 x 5/8 cotter pin.

132. Maintenance

Inspect the track in the trail jack assembly, remove any foreign matter, clean, and remove burs. Raise the trails with the jack assembly to make certain it operates freely and does not slip. Replace trail jack yoke if cracked or damaged. Replace trail jack assembly if inoperable or damaged.

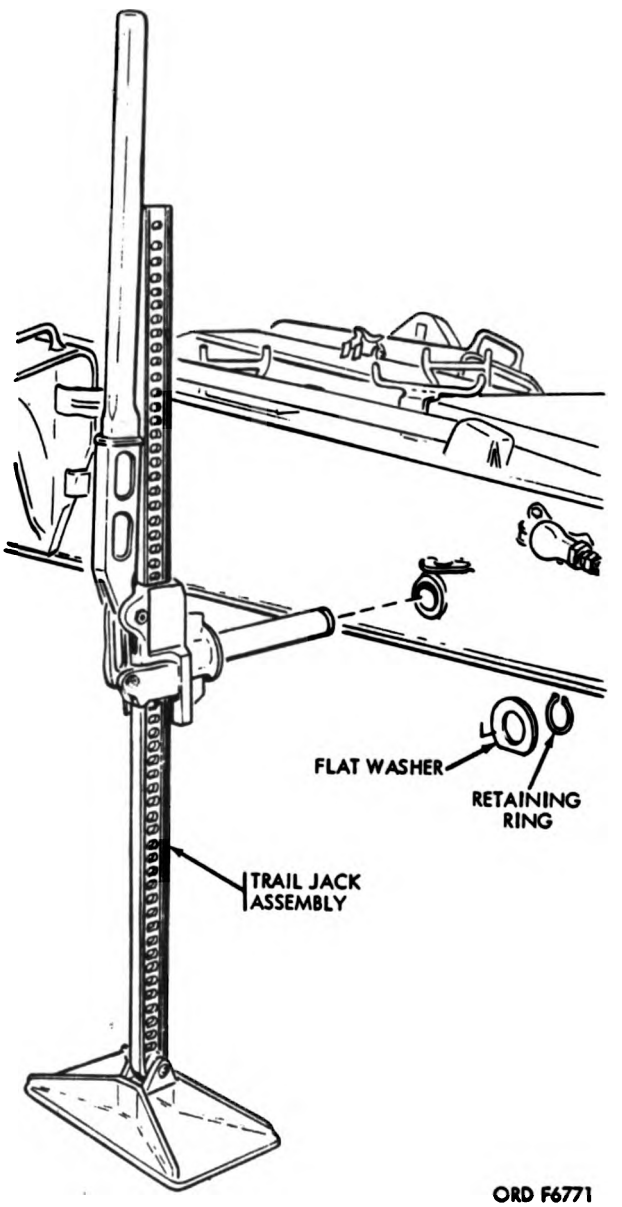


Figure 157. Removal or installation of trail jack assembly.

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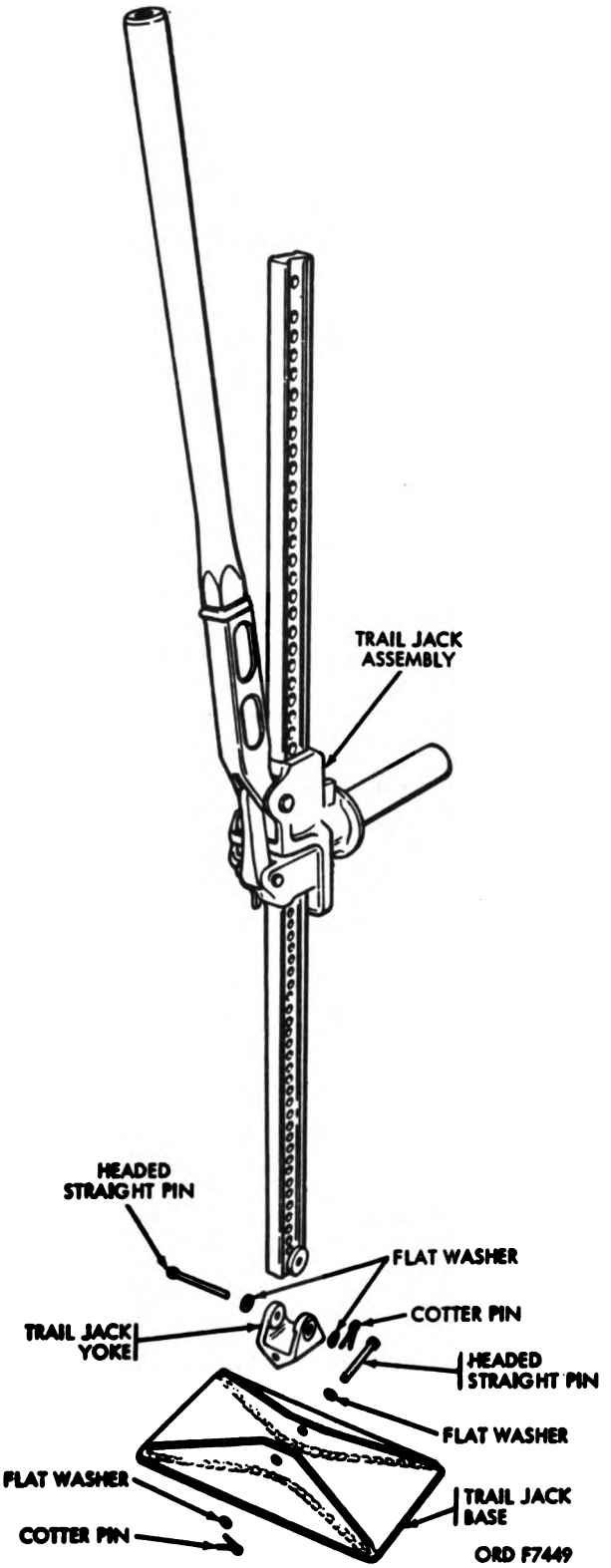


Figure 158. Trail jack assembly—partially exploded view.

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Section XX. HYDRAULIC POWER UNIT (M123A1 ONLY)

133. General

Refer to paragraph 4*a*(5) for description of hydraulic power unit.

134. Disassembly

a. Oil Pressure Gage Rubber Hose (fig. 159).

(1) Disconnect the coupling on the upper end of the oil pressure gage rubber hose from the hose adapter on the oil pressure line.

(2) Disconnect the coupling on the lower end of the hose from the 1/8-inch pipe to tube tee and remove the hose.

(3) Remove the tube assembly from the cut-off switch and pipe to the tube tee.

(4) Remove the 1/8-inch pipe to tube tee from the 1/8-inch pipe coupling in the oil pressure gage.

(5) Remove the 1/8-inch pipe coupling from the oil pressure gage.

b. Cut-off Switch Wire Assembly (fig. 159).

(1) Disconnect the upper end of the cut-off switch wire assembly from the capacitor terminal.

(2) Remove two hexagon plain nuts, two external teeth lock washers, and two pan-head machine screws securing two 1/4-inch loop clamps to the shroud and bracket.

(3) Pull the wire assembly through the rubber grommet in the shroud and remove the grommet and two loop clamps from the wire assembly.

(4) Remove the cover from the cut-off switch, disconnect the cut-off switch wire assembly, and remove the wire.

c. Ignition Switch Wire Assembly. (fig. 160).

(1) Remove the motor starter bolt securing the loop clamp to the motor starter casting.

(2) Remove the hydraulic power unit screw securing the loop clamp to the hydraulic power unit.

(3) Remove six hexagon plain nuts, six external teeth lock washers, six pan-head machine screws, and six 1/4-inch loop clamps securing the ignition switch wire to the frame assembly.

(4) Disconnect the ignition switch wire assembly from the capacitor terminal and the ignition switch and remove the wire.

(5) Remove one rubber grommet from the engine shroud, one from the frame assembly, and one from the ignition switch cover.

d. Gasoline Engine Muffler (fig. 161). Remove two hexagon plain nuts, two split lock washers, and two hexagon head cap screws securing gasoline engine muffler to the exhaust pipe and remove muffler.

e. Fastener Lock (fig. 162).

(1) Remove four hexagon plain nuts, four flat washers, and four pan-head machine screws securing the lower part of the fastener lock to the frame assembly.

(2) Remove three hexagon plain nuts, three flat washers, and three pan-head machine screws securing the upper part of the fastener lock to the hydraulic unit cover.

135. Assembly

a. Fastener (fig. 162).

(1) Install the upper part of the fastener lock on the hydraulic unit cover and secure with three no. 10 x 5/8 pan-head machine screws, three no. 10 flat washers, and three no. 10 hexagon plain nuts.

(2) Install the lower part of the fastener lock on the frame assembly and secure with four no. 10 x 5/8 pan-head machine screws, four no. 10 flat washers, and four no. 10 hexagon plain nuts.

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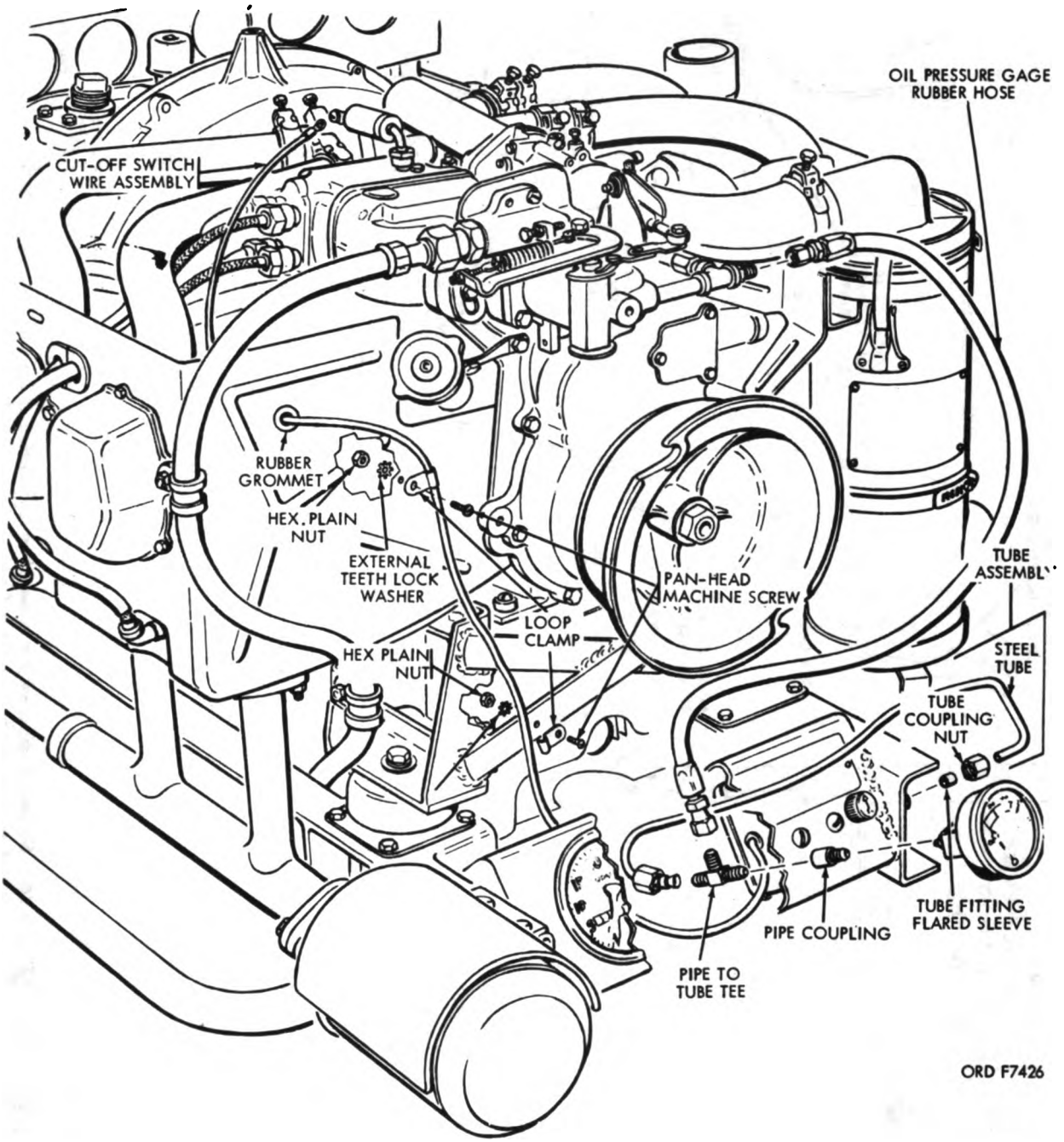


Figure 159. Removal or installation of oil pressure gage hose, tube assembly, and cut-off switch wire assembly.

b. Gasoline Engine Muffler (fig. 161). Install the gasoline engine muffler on the end of the exhaust pipe and secure with two 3/8-inch hexagon plain nuts, two 3/8-inch split lock washers, and two 3/8 x 1-1/4 hexagon head cap screws.

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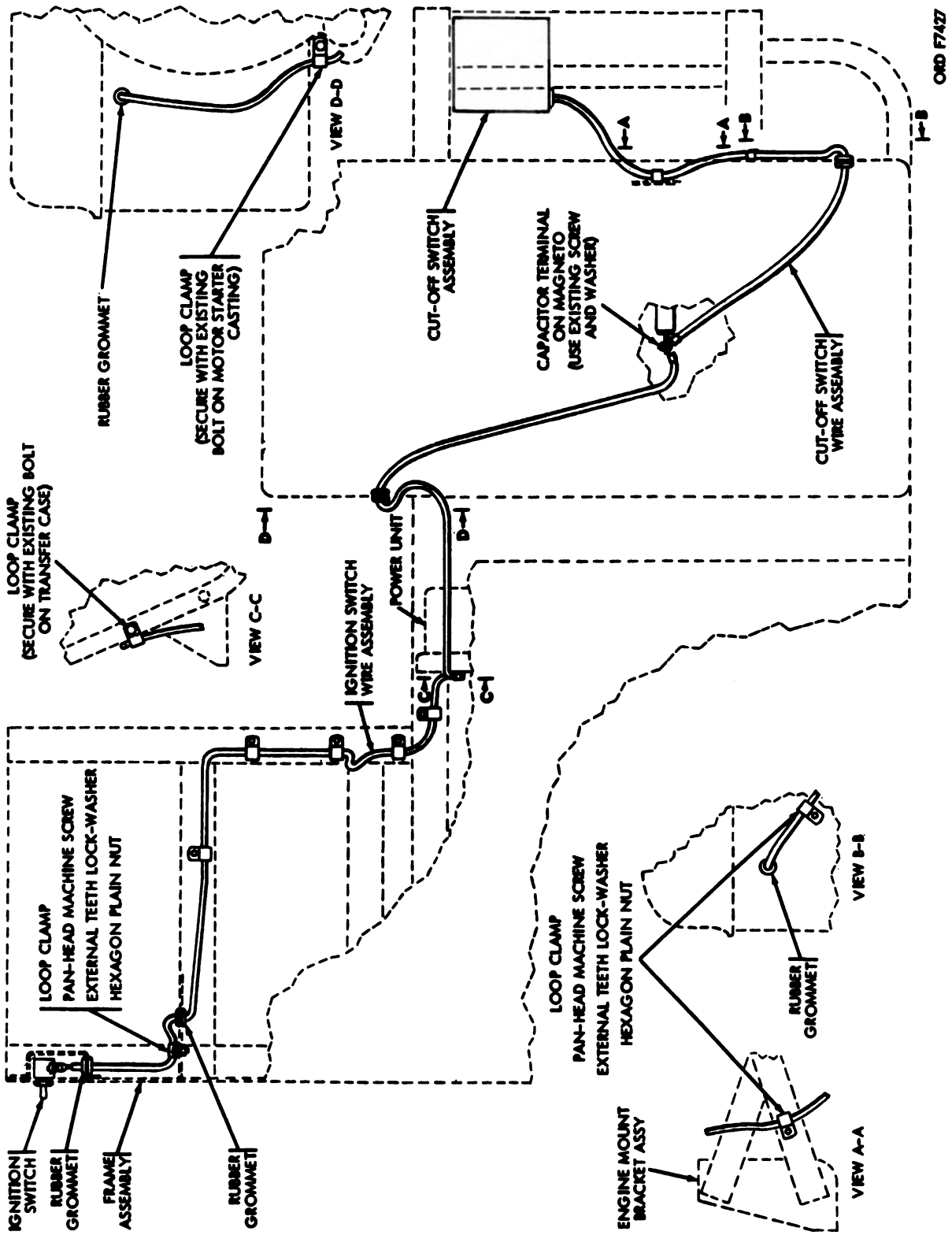


Figure 160. Schematic diagram for removal or installation of ignition switch wire assembly and cut-off switch wire assembly.

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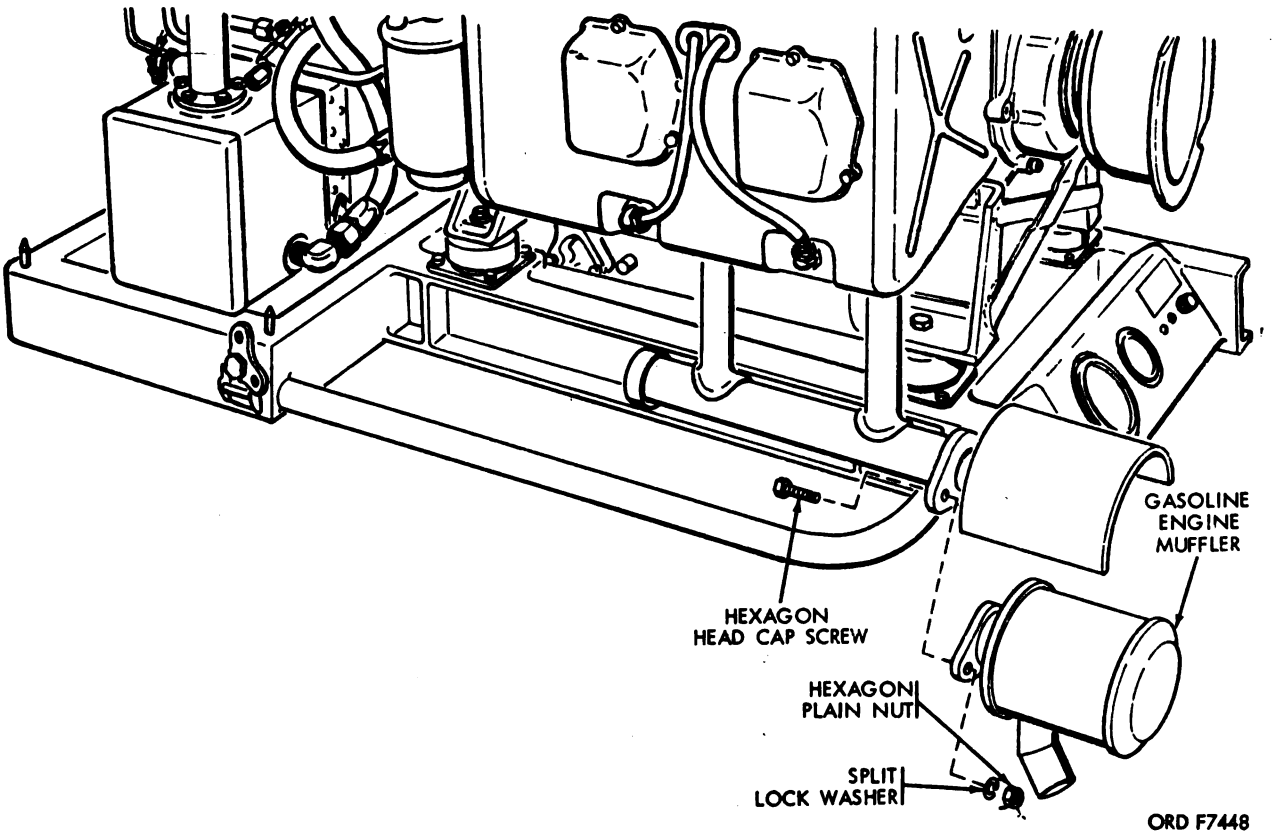


Figure 161. Removal or installation of gasoline engine muffler.

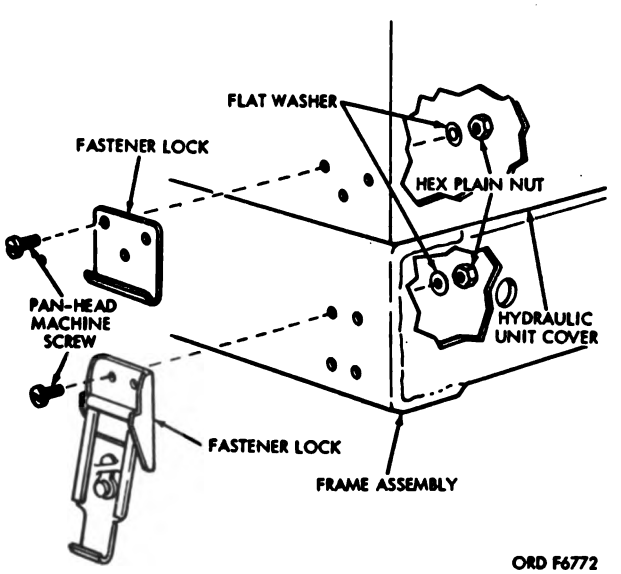


Figure 162. Removal or installation of fastener lock.

c. Ignition Switch Wire Assembly (fig. 160).

(1) Install one rubber grommet with a 1/16-inch groove in the front left side of the engine shroud, one in the ignition switch cover, and one with a 1/4-inch groove in the frame assembly.

(2) Install the ignition switch wire assembly and loop clamps as shown in figure 160. Connect one terminal to the ignition switch and one to the capacitor terminal on the magneto.

Note. The six loop clamps with the small mounting holes secure the wire assembly to the frame assembly and the two loop clamps with the larger holes secure the wire assembly to the hydraulic power unit and motor starter casting.

(3) Secure six 1/4-inch loop clamps to the frame assembly with six no. 10

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x 3/8 pan- head machine screws, six no. 10 external teeth lock washers, and six no. 10 hexagon plain nuts.

(4) Secure one 1/4-inch loop clamp to the hydraulic power unit with the existing hardware and one to the motor starter casting with the existing bolt.

d. Cut-off Switch Wire Assembly (fig. 159).

(1) Install a rubber grommet in the rear right corner of the engine shroud.

(2) Install the cut-off switch wire assembly and loop clamps as shown in figure 160. Connect one terminal to the red terminal in the cut-off switch and the other terminal to the capacitor terminal in the magneto. Install the cover on the cut-off switch.

(3) Secure the two loop clamps with two no. 10 x 3/8 pan-head machine screws, two no. 10 external teeth lock washers, and two no. 10 hexagon plain nuts as shown.

e. Oil Pressure Gage Rubber Hose (fig. 159).

(1) Install the 1/8-inch pipe coupling in the oil pressure gage.

(2) Install the 1/8-inch pipe to tube tee in the pipe coupling.

(3) Install the tube assembly on the cut-off switch and pipe to tube tee.

(4) Connect the oil pressure gage rubber hose to the adapter on the oil pressure line on the engine, and the pipe to tube tee in the oil pressure gage.

136. Maintenance

a. Inspect oil pressure gage rubber hose for severe cuts or leaks and replace if necessary (fig. 159)

b. Inspect tube assembly connecting the oil line with the cut-off switch for damage or leaking conditions (fig. 159). Fabricate new tube assembly, if necessary.

c. Inspect cut-off switch wire assembly and ignition switch wire assembly for broken insulation or other damage. If necessary to replace, fabricate new wire assemblies as shown in figure 168.

d. Check gasoline engine muffler for leaks and replace if necessary.

e. Inspect for inoperative or damaged fastener locks which secure the hydraulic power unit cover and replace if necessary.

f. Inspect the hydraulic hose assemblies for severe cuts and hydraulic tubing for dents, leaking connections, or other damage. Notify ordnance maintenance for repair.

g. Check carriage wheels for creeping action during idle or neutral position. If the wheels creep, follow the procedure outlined below.

(1) Raise the carriage wheels clear of the ground with the firing jack so they can rotate freely (par. 39*d*(9)).

(2) Remove hydraulic power unit cover and start engine (par. 39*c*(3)).

Caution: **Engine should not be run for extensive periods with cover removed.**

(3) With engine running, engage the clutch handle in the wheel drive unit and manipulate the control stick for forward, reverse, right turn, and left turn (fig. 46), observing the control linkage motion. With the control stick in the neutral position, observe which wheel creeps.

(4) If right wheel creeps, lengthen or shorten the inside override cylinder assembly (fig. 164) by removing one bolt, washer, and safety nut and loosen the lock nut on end rod. This allows the end rod to be turned in either direction to shorten or lengthen the cylinder assembly. Adjust the end rod in or out until the wheel stops turning when the linkage is reassembled. This will be its neutral position. Tighten the lock nut, assemble the linkage, and secure with hexagon head bolt, flat washer, and safety nut.

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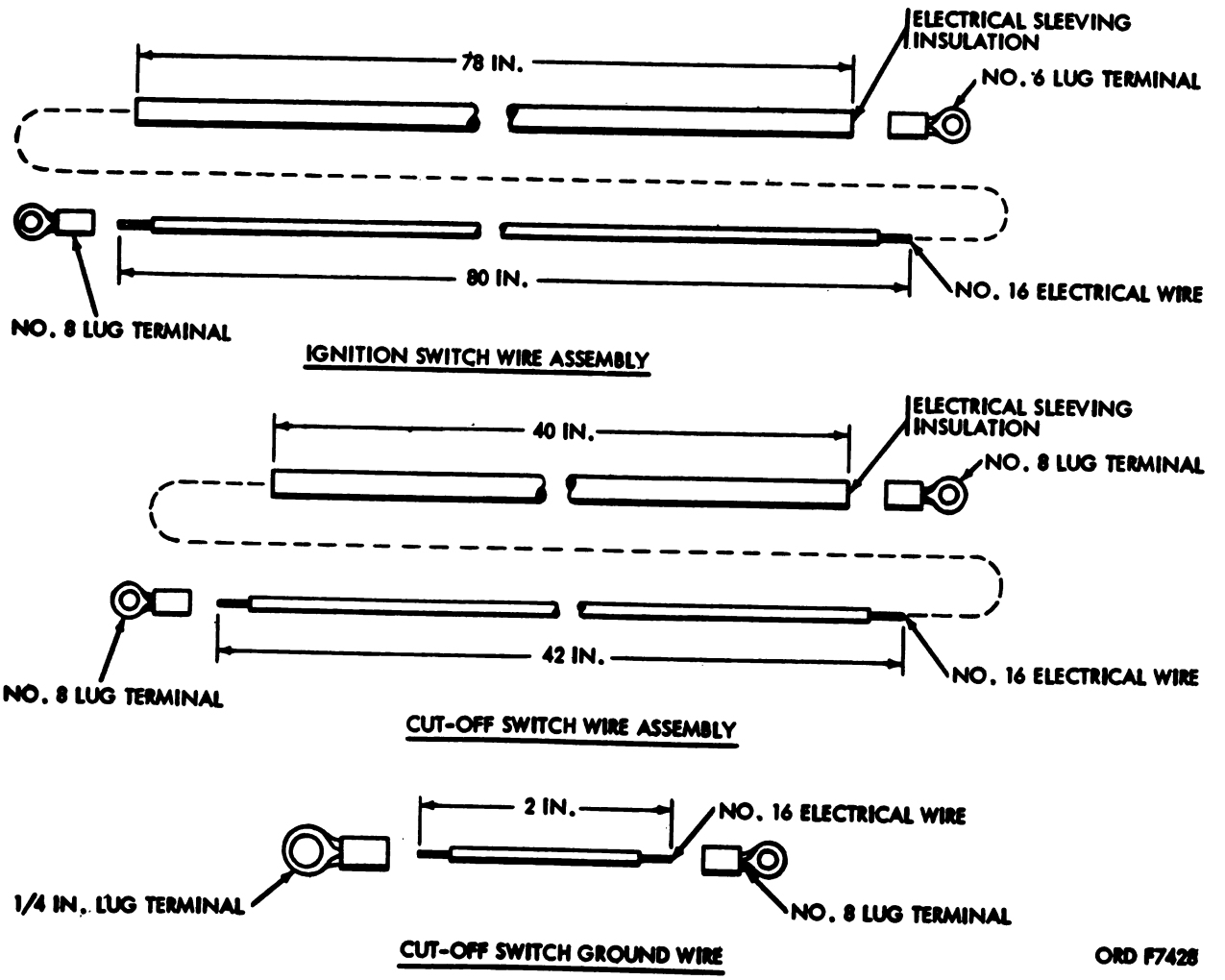


Figure 163. Wire assemblies—exploded view.

(5) Adjust the left wheel creep by lengthening or shortening the outside override cylinder assembly in the same manner as above.

h. Check howitzer for tendency to drift to the right or left and adjust as follows:

(1) Operate the howitzer forward (par. 89*c*(4)) on level ground to note any tendency to drift from a straight line.

(2) If the howitzer drifts to the left, more power is being delivered to the right wheel than to the left wheel. Adjust the right wheel by lengthening or shortening the inside end rods (fig. 165) as in *g*(4) above.

(3) If the howitzer drifts right, adjust the outside end rods (fig. 165).

i. Check control stick position and adjust as follows:

(1) If control stick moves too far forward or backward, lengthen or shorten control cylinder system assembly (fig. 164) as in *g*(4) above.

(2) If control stick moves too far to the right or left, lengthen or shorten control cylinder system assembly (fig. 165) as in *g*(4) above.

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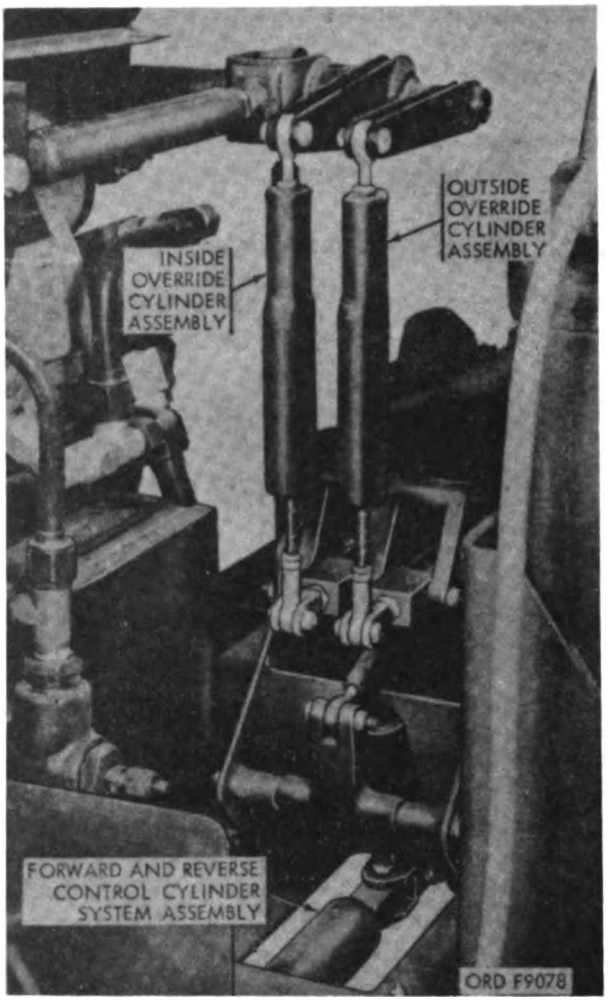


Figure 164. Override cylinder assemblies and control cylinder system assembly.

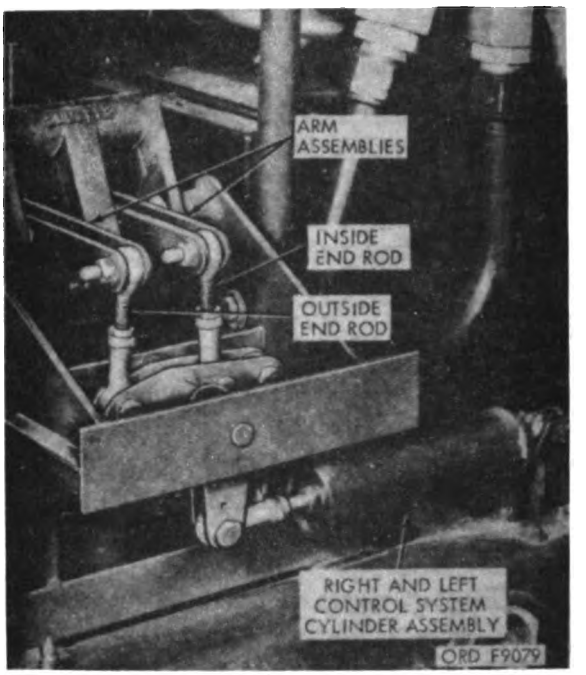


Figure 165. Arm assemblies, end rods, and control system cylinder assembly.

(8) After the control stick has been positioned, adjust the two hexagon head machine bolts control stick stops (fig. 24) on the turn control support assembly to stop the control stick just before it puts a strain on the linkage.

j. Organizational maintenance of the hydraulic power unit is limited to the operations covered herein. Notify ordnance maintenance personnel for further maintenance.

Section XXI. GASOLINE ENGINE (M123A1 ONLY)

137. General

Refer to paragraph 4*a*(6) for description of the gasoline engine.

138. Maintenance

a. Service Air Cleaner. Loosen the hose clamp and unhook the catch holding the air cleaner cover to the housing (fig. 166). Remove the element and blow it free of dust with low-pressure compressed air. Wash element with soap or detergent and water and dry thoroughly with low-pressure compressed air. Wipe out air cleaner housing. Insert cleaned element in housing and replace cover. Replace an excessively dirty or a defective element.

Caution: **Do not use gasoline or other solvents to clean element.**

b. Service Fuel Filter. Loosen the thumbscrew on the fuel filter bail and swing bail

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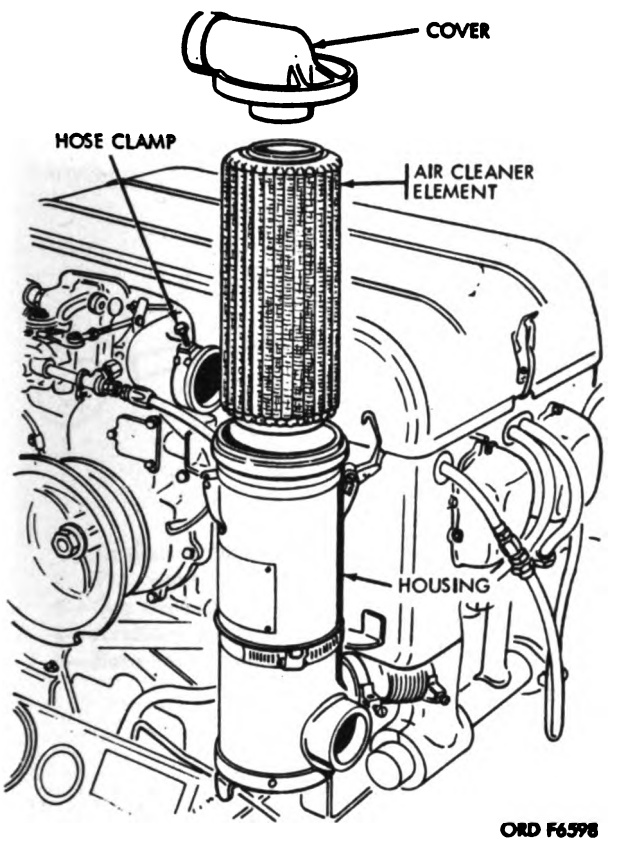


Figure 166. Air cleaner—exploded view.

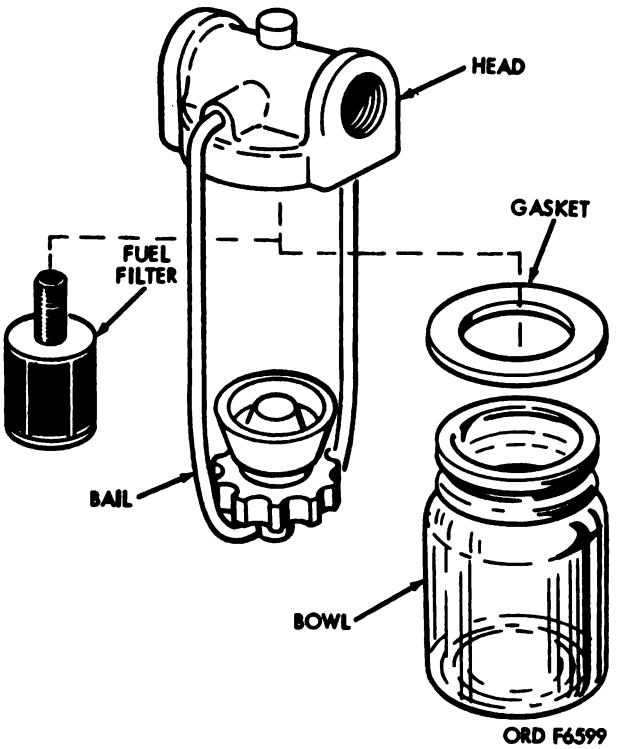


Figure 167. Fuel filter—exploded view.

to one side; remove the filter bowl (fig. 167). Clean the fuel filter and bowl. Install the fuel filter into the bowl and install the bowl in the fuel filter head using a new gasket and secure with the bail.

Section XXII. BLACKOUT LIGHT

139. Dissassembly

Remove the door assembly screws, door assemblies, and preformed packing (fig. 168).

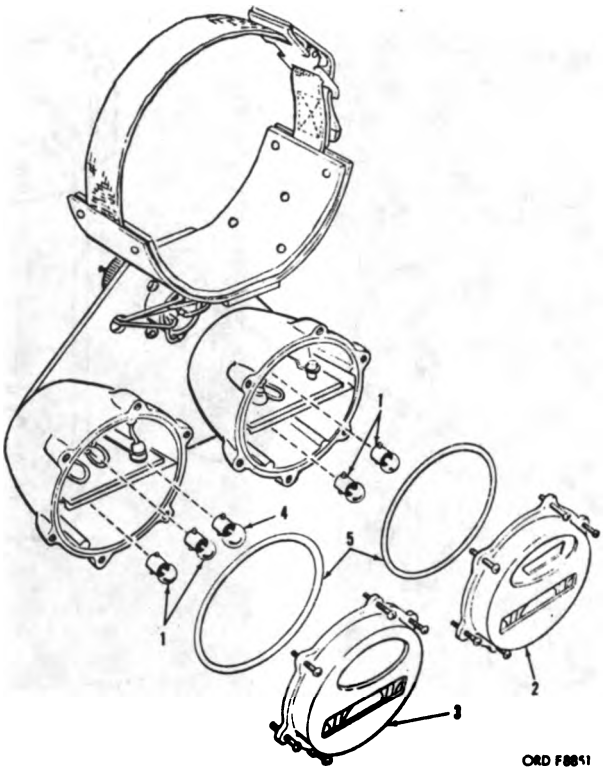
140. Assembly

Install packing and door assemblies and secure with screws.

141. Maintenance

Replace lamps if defective. Replace preformed packing. Replace door assemblies if broken or damaged.

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1—Incandescent lamp 6240-019-0877
2—Blackout tail and stop light door assembly 6220-752-6018
3—Blackout tail and service stoplight door assembly 6220-752-6020
4—Incandescent lamp 6240-044-6914
5—Preformed packing 5330-297-7106

Figure 168. Blackout light—partially exploded view.

Section XXIII. ARTILLERY CLEANING BRUSH

142. Disassembly

Note. The key numbers shown below in parenthesis refer to figure 169.

a. Remove hexagon plain nut (7), lock washer (8), machine screw (10), and flat washer (9) (fig. 169).

b. Drive spring pin (6) from bore brush adapter (5) and eyebolt (1). Remove bore brush adapter, flat washers (2), and eyebolt from caps (3) and artillery cleaning brush (4).

143. Assembly

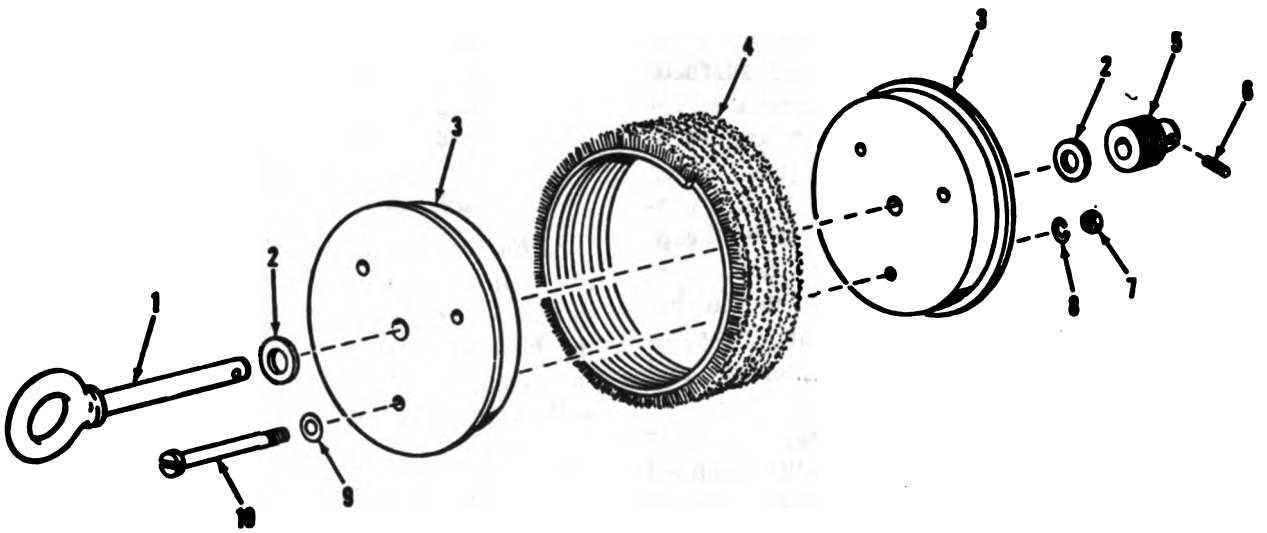
a. Fit caps (3) into brush (4) and install eyebolt (1), washers (2), and adapter (5). Line up eyebolt hole and adapter hole and secure with pin

b. Install machine screw (10), washers (8) and (9), and fasten with hexagon plain nut (7).

144. Maintenance

Replace worn or damaged parts as required.

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1—Eyebolt 8766031
2—Flat washer 5310-011-8777
3—Cap 8765993
4—Artillery cleaning brush section 1025-793-1990
5—Bore brush adapter 1030-711-8391
6—Spring pin 5315-682-2094
7—Hexagon plain nut 5310-655-9659
8—Lock washer 5310-274-8715
9—Flat washer 5310-543-5197
10—Machine screw 5305-682-5495

Figure 169. Artillery cleaning brush.

Section XXIV. MAINTENANCE OF SIGHTING AND FIRE-CONTROL MATERIEL

145. General

a. Care in Handling Sighting and Fire-Control Materiel.

(1) Sighting and fire-control materiel are, in general, rugged and suited for the designed purpose. They will not, however, stand rough handling or abuse. Inaccuracy or malfunctioning will result from mistreatment.

(2) Unnecessary turning of screws or other parts not required in the use of the instruments is forbidden.

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

(4) Keep the materiel as dry as possible. If an instrument is wet, dry it carefully before placing it in its carrying case.

(5) When not in use, instruments must be kept in the carrying cases provided, or covered and protected from dust and moisture.

(6) Any instruments that indicate incorrectly or fail to function properly are to be turned in for repair by support maintenance personnel. The authorized tests and adjustments (par. 147) are those for which tools and parts have been provided. Adjustments other than those expressly authorized are not the responsibility of the using arm personnel.

(7) Complete painting of the sighting and fire-control instrument by the using personnel is not permitted. Scratched, chipped, or worn surfaces exposing bare metal should be touched up to prevent rust or corrosion.

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

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b. Optical Parts.

(1) To obtain satisfactory vision, it is necessary that the exposed surfaces of the lenses and other parts are kept clean and dry. Corrosion and etching of the surface of the glass, which interfere with vision, can be prevented or greatly retarded by keeping the glass clean and dry.

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

(3) For wiping optical parts, use only lens tissue paper especially intended for cleaning optical glass. Use of cleaning cloths is not permitted. To remove dust, brush the glass lightly with a clean artist's camel's-hair brush. Rap the brush against a hard body to dislodge small particles of dust that cling to the hairs. Repeat this operation until all dust is removed.

(4) Exercise particular care to keep optical parts free from oil and grease. Do not touch the lenses or windows with the bare fingers. To remove oil or grease from optical surfaces, apply alcohol with lens tissue paper, and wipe gently with clean lens tissue paper. If alcohol is not available, and the temperature is above freezing, breathe heavily on the glass and wipe off with clean lens tissue paper. Repeat this operation until clean.

(5) 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. Wipe gently to avoid scratching or removing the coated surface of the optic.

(6) Because of condensation, moisture may collect on the optical parts of the instrument when the temperature of the parts is lower than that of the surrounding air. This moisture, if not excessive, can be removed by placing the instruments 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 function.

c. Batteries. Dry cell–type batteries are used in instrument lights and aiming post lights. The batteries should not be stored in the instruments when not in use. Chemical reaction set up in an exhausted battery will damage the battery tube.

d. Lubrication.

(1) Lubrication of sighting and fire–control materiel 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 should be lubricated as required with instrument lubricating oil.

(*b*) Lubricate exposed bearing surfaces with a thin film of aircraft and instrument grease. This grease provides both lubrication and protection against corrosion.

(2) Excessive lubricants should be wiped off to prevent the accumulation of dust and dirt.

(3) Lubrication of the internal worm mechanism on the telescope mount M25 is no longer authorized for organizational personnel. Lubrication fittings now provided on the mount are being removed and replaced with plugs.

146. Inspection of Sighting and Fire–Control Materiel

Whenever inaccuracies, maladjustment, or any other condition affecting serviceability are disclosed by the following inspections,

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the equipment should be referred to authorized ordnance maintenance personnel for adjustment or correction. All instruments should be checked for completeness and general appearance. The painted surfaces should not have worn spots, scratches exposing bare metal, or chipped or loose paint. All graduations, lettering, and indices will be clear and distinct. There must not be evidence of corrosion on any part. When looking into the eye-piece or objective ends of an optical instrument, there must be no objectionable dirt, smears, stains, scratches, digs, condensate, fungus growth, chips fractures, or cement separations visible. Table 6 lists the procedure and acceptable standard for each sighting and fire-control instrument used with the 155-mm howitzer.

Table 6. Inspection of Sighting and Fire-Control Materiel

Item	Procedure	Acceptable standard
1. Telescope mount M25 (fig. 10).	a. Turn level vial covers to open and closed position.	a. Covers must turn freely and snap into the detent in both positions.
	b. Turn the wing knob on the socket to the open position and release.	b. The latch spring must be firm enough to snap the latch instantly in the locked position.
	c. Install panoramic telescope.	c. The panoramic telescope must clamp securely in the socket.
	d. Turn the cross-leveling knob and longitudinal-leveling knob over the entire range of movement.	d. The motion must be smooth and even. A wobbly knob or a movement that is alternately tight and loose at each half revolution usually indicates a bent wormshaft. Upon reversal of the knob, there will be no appreciable movement of the knob without a corresponding movement of the driven member.
	e. Visually examine indexes.	e. Indexes must be clear and distinct.
	f. Tighten the elevation knob clamp.	f. The elvation knob will be held securely and will not turn.
2. Panoramic telescope M12A7C (fig. 11).	a. Rotate the elevation knob over the entire range of movement.	a. There should be a minimum of six complete turns from maximum depression. The motion must be smooth and even.
	b. Rotate the azimuth knob several turns.	b. The motion must be smooth and even. Backlash must not exceed 3/4 mil.
	c. Visually examine the reticle illuminating window.	c. The window will not be broken and will be securely sealed and fastened in the body of the telescope.
3. Fire-control quadrant M1A1 (fig. 18).	a. Turn level vial cover to open and closed positions.	a. Cover will turn freely and snap into the detent in both positions.

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Table 6. Inspection of Sighting and Fire-Control Materiel—Continued

Item	Procedure	Acceptable standard
	b. Turn the cross-leveling and elevation knob over the entire range of movement.	b. The motion will be smooth and even. Upon reversal of the knob, there will be no appreciable movement of the knob without corresponding movement of the driven member.
	c. Visually examine the scales and indexes.	c. All graduation lettering on scales and indexes will be clear and distinct.
4. Instrument light M34 (fig. 12).	a. Visually examine instrument light switch, lamps, wiring, clamp case, and lamp bracket.	a. Instrument lights will be complete. The case will not be dented, nor will any parts be broken or twisted. Inside of case will be free of corrosion. Clamp hinges and nuts will turn freely. Lamp brackets will be free of nicks or burs on the mating surfaces.
	b. Install batteries and turn both instrument lights on.	b. Lamps will light up.
5. Fuze setters M26 and M28 (figs. 14 and 16).	a. Examine scales and markings.	a. All lettering graduations and indexes will be clear and distinct.
	b. Tighten the clamping screws on the fuze setters.	b. The time scale clamping screw will securely clamp the time scale, and the corrector scale clamping screw will securely clamp the corrector scale.

147. Tests and Adjustments of Sighting and Fire-Control Materiel

Note. It is not expcted 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. Perform the tests in the following sequence.

a. Test Preparation.

(1) Bore sight the weapon in accordance with paragraph 43.

(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 five 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 bore sight throughout the entire range of elevation.

Note. Do not disturb this setting and check it frequently, because accuracy of the following tests are dependent upon the trunnions being exactly leveled.

(4) Prepare parallax shields for panoramic telescope M12A7C, 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

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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 6-81).

(5) Check the accuracy of the fire-control quadrant M1A1 in accordance with the procedure given in TM 9-575. Adjust the quadrant, if necessary, before proceeding with the test.

b. Actuating Eccentric Pin.

(1) Remove the telescope from the telescope mount by turning the wing knob on the telescope socket against its spring pressure as far as it will go, at the same time lifting the telescope straight up and out of the socket (fig. 72).

(2) Place the howitzer at any elevation, preferably not zero, by turning the elevating mechanism handwheel assembly (par. 39*h*). Then measure the elevation with the fire-control quadrant M1A1 seated on the leveling plates on the upper surface of the howitzer breech ring (fig. 18).

(3) Without disturbing the elevation of the howitzer or the setting on the fire-control quadrant, seat the quadrant on the telescope mount actuating arm bracket quadrant seat (fig. 10) (between the telescope mount and trunnions). If the quadrant level vial bubble centers, the actuating arm eccentric pin is in adjustment (fig. 75).

(4) If the quadrant level vial bubble does not center, loosen the two cap screws (fig. 170) (which fasten the actuating arm bracket of the telescope mount to the actuating arm on the cradle), and center the quadrant bubble by turning the eccentric pin.

(5) Tighten the cap screws, being careful to avoid throwing the quadrant bubble off center. Verify the adjustment by changing the elevation of the howitzer and repeating the test.

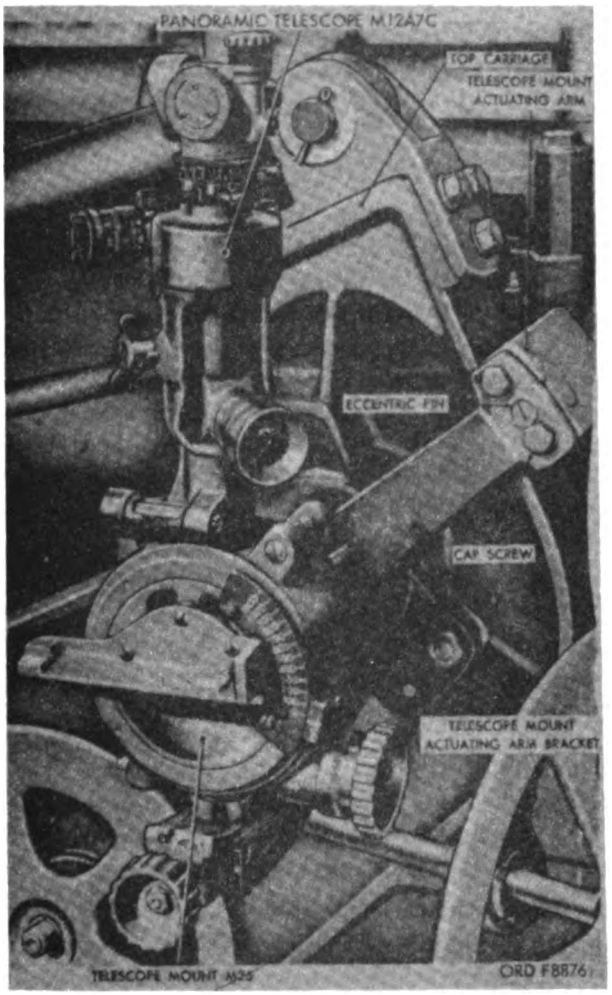


Figure 170. Telescope mount M25 with panoramic telescope M12A7C in place on carriage M1A1 or M1A2.

c. Elevating Settings.

(1) Place the howitzer at any elevation, preferably not zero, by turning the elevating mechanism handwheel assembly (par. 39*h*). Then measure the elevation with the fire-control quadrant seated on the leveling plates on the upper surface of the howitzer breech ring (fig. 18).

(2) Center the bubble in the cross level vial of the telescope mount M25 by turning the cross leveling

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knob (fig. 10), and center the bubble in the longitudinal level vial by turning the elevation knob.

(3) Check the reading on the elevation scale and micrometer of the telescope mount M25. If the reading on the elevation scale and micrometer of the telescope mount M25 does not agree with that of the fire-control quadrant ((1) above) within plus or minus one-half mil, the telescope mount must be referred to the authorized ordnance maintepersonnel for correction. However, if immediate repair is not possible, the telescope mount may be continued in use provided the necessary correction for error is applied to all future elevation settings made with the telescope mount.

d. Cross Level Setting.

(1) Level the telescope mount in both directions by centering both level bubbles.

(2) Place the line of sight of the panoramic telescope on any sharply defined distant target.

(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 the line of sight deviates from the target by more than one-half mil, adjustment of the cross level vial is necessary. This adjustment may be performed only by authorized ordnance maintenance personnel.

e. Longitudinal Level Setting.

(1) With the mount leveled in both directions, set the panoramic telescope, with parallax shield in place, to exactly 4,800-mils azimuth.

(2) Suspend a plumb line and place it to coincide with the vertical reticle line of the panoramic telescope.

(3) Turn the elevation knob of th panoramic telescope through the entire range of movement. If the telescope line of sight deviates from the plumb line target by more than one mil, adjustment of the longitudinal level vial is necessary. This adjustment may be performed only by authorized ordnance maintenance personnel.

f. Azimuth Compensating Mechanism.

(1) Set the tube to exactly 0 elevation and level the telescope mount in both directions.

(2) Set the panoramic telescope to 4,800-mils azimuth so that the vertical reticle line coincides with the previously situated plumb line target.

(3) Turn the cross leveling knob of the telescope mount through the entire range of movement. If the telescope line of sight deviates from the plumb line target by more than one-half mil, the telescope mount is improperly positioned on the trun nion. The misadjustment may be corrected only by authorized ordnance maintenance personnel.

g. Parallax. On the panoramic telescope M12A7C, there must be no parallax between the image and the center of the reticle when a target is viewed at a distance of 88 yards.

h. Plumb of Reticle. With the telescope mount M25 leveled in both directions and using a parallax shield, sight through the panoramic telescope M12A7C and place the intersection of the reticle lines of the plumb line target. The entire length of the vertical reticle line must coincide with the plumb line within 1.0-mil.

i. Zeroing Azimuth Micrometer of Panoramic Telescope M12A7C.

(1) Insure that the moveable azimuth micrometer index coincides with the right (fixed) zero on the deflection scale (fig. 11).

(2) Loosen the locking nut by holding the azimuth micrometer knob firmly

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in the right hand and turning the nut counterclockwise with the left hand.

(3) With the azimuth micrometer knob, turn the left index into coincidence with the right index.

(4) Slip the slipping azimuth micrometer scale to zero so that the left index, zero and the right index are alined.

(5) Tighten the locking nut and verify the alinement.

(6) Open the door and, with the azimuth micrometer knob or rotating head, set the azimuth scale at zero. Check to verify that the azimuth micrometer scales and indexes are still at zero.

j. Zeroing Slipping Azimuth Scale of Panoramic telescope M12A7C. Normally, the door (fig. 11) covering the nonslipping azimuth scale is kept closed and deflections are read from the slipping azimuth scale. This is to eliminate the possibility of errors caused by reading from the wrong azimuth scale. This requires that the slipping azimuth scale read zero when the line of sight is parallel to the gun bore or when the nonslipping azimuth scale reads zero. This is accomplished as follows:

(1) Open the door covering the nonslipping azimuth scale and set the scale to zero.

(2) Close the door covering the nonslipping scale, loosen the locking screw, and move the slipping azimuth scale until its zero coincides with the index on the outside of the door.

(3) Tighten the locking screw and verify the adjustment by checking both scales with their indices.

148. Replacement of Organizational Repair Parts for Sighting and Fire-Control Materiel

a. Panoramic Telescope M12A7C. To replace panoramic telescope M12A7C, refer to paragraph 41B(1).

b. Instrument Light M34. To replace instrument light M34, refer to paragraph 41c.

c. Eyeshield. Replace panoramic telescope eyeshield by twisting it enough to remove from telescope eyepiece (fig. 11).

d. Batteries.

(1) To replace batteries in the instrument light M34 remove cap on battery tube (fig. 171). The cap is secured by pins in two bayonet slots and is removed by pressing the cap inward and turning slightly until free. When installing the batteries in the bodytube, be sure they go back into 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.

(2) To replace batteries in the aiming post light M14 (fig. 172), remove cap from one end and cover from the opposite end of the case. Both the cap and cover are secured by bayonet pins and are removed by pressing the cap or cover inward and turning slightly until free.

e. Lamps. Replace incandescent lamp in either the hand light or illuminating lamp housing of the instrument light M34 and the aiming post light M14, if they fail to light and the batteries are known to be good.

(1) To remove a defective lamp in the hand light or lamp housing of the instrument light, refer to figure 171.

(2) To remove a defective lamp in aiming post light, refer to figure 172.

f. Reference collimator M1. Replace lamp in the lamp housing by releasing the bayonet mount and withdrawing the housing from the collimator (fig. 172.1). Remove and discard the old lamp. Insert new lamp and install housing in collimator.

Note. A spare lamp is stored in the base assembly of the collimator.

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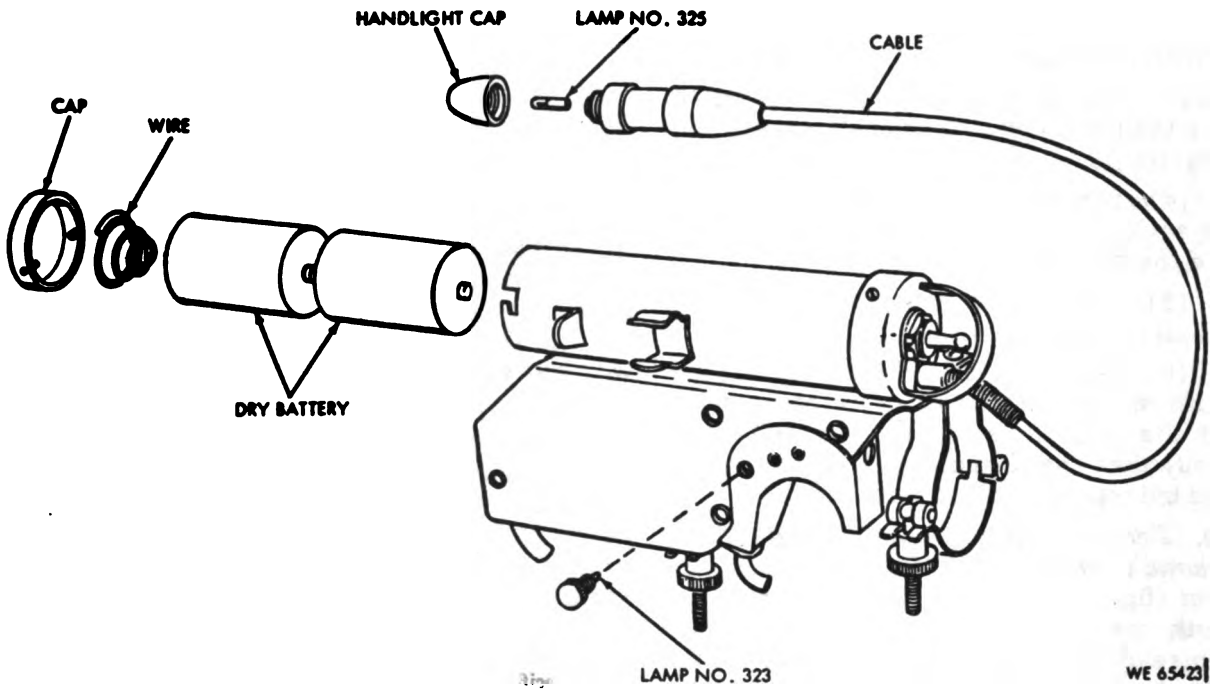


Figure 171. Instrument light M34 — partially exploded view.

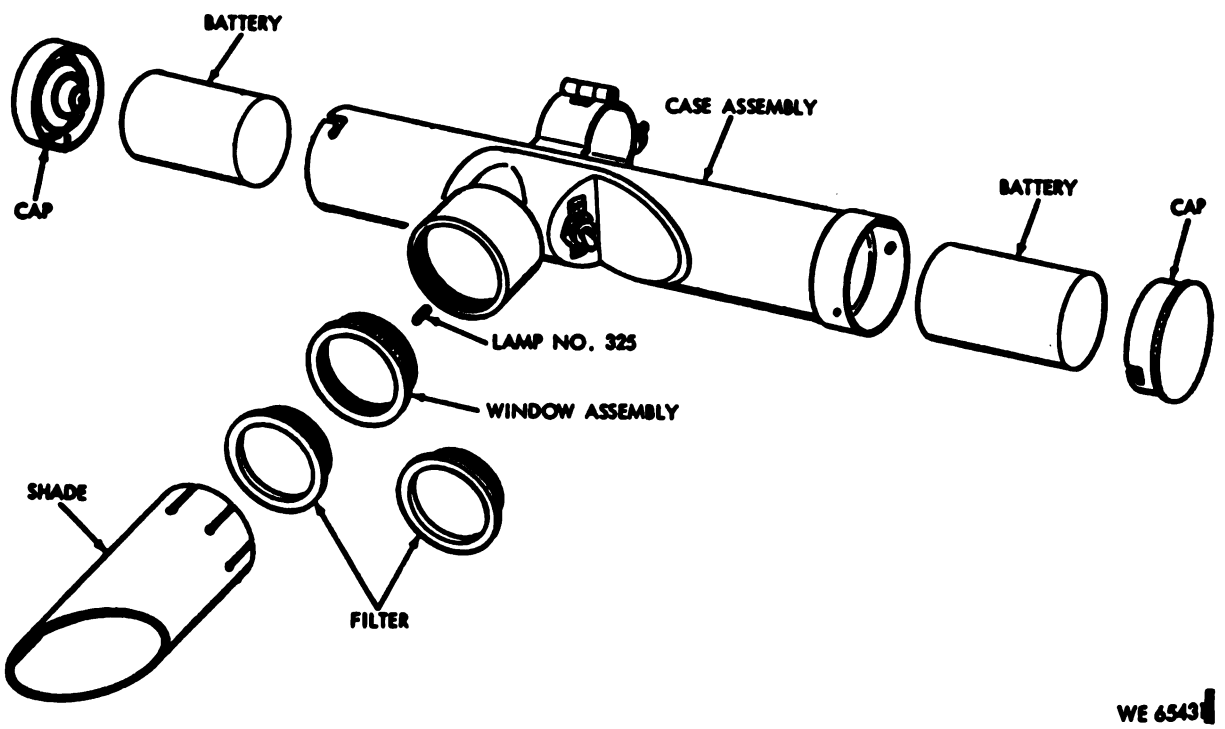


Figure 172. Aiming post light M14 — partially exploded view.

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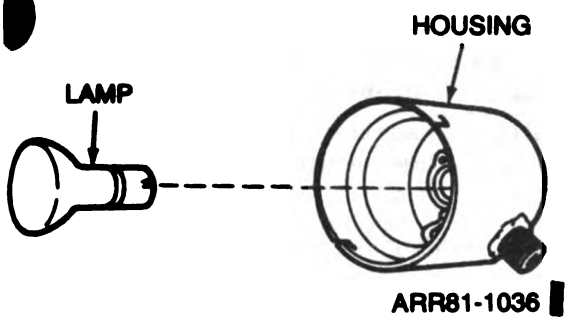


Figure 172.1. Collimator lamp and housing.

148.1 Purging and Charging of Fire Control Instruments.

a. Setup of Purging and Charging Equipment.

Note. The following setup procedure for purging and charging equipment is applicable to Organizational, Direct Support, and General Support maintenance.

(1) Obtain a tank of dry nitrogen (fig. 172.2) and remove threaded protective cover from the outlet of the tank. Open tank valve momentarily to rid valve seat of any foreign matter.

Warning: **Do not drop tank of compressed nitrogen gas, and when using in confined areas, use extreme care, gas could cause asphyxiation.**

(2) Securely attach regulator to tank valve using appropriate adapter supplied with purging kit.

Note. Two regulator assemblies are presently in use for purging and charging fire control materiel. The insert on figure 172.1 shows regulator 5580922 while the tank is shown with regulator 11729749.

(3) Securely attach hose assembly to the low pressure port.

Note. When using regulator 11729749, an adapter is required to connect hose assembly to low pressure port of regulator. Use a right or left-hand threaded (9/16 x 18) adapter, depending on the thread requirement of the hose assembly coupling.

(4) Rotate pressure regulator valve counterclockwise to the extreme closed position.

(5) Open the nitrogen tank valve slowly until the maximum tank pressure is registered on the high pressure gage.

Note. If pressure indicated is less than 100 psi, obtain and use replacement tank.

(6) Slowly rotate pressure regulator valve clockwise until approximately 5 psi is registered on the low pressure gage. Check for and eliminate any interference; close pressure regulator valve.

Caution: **Under no circumstances exceed the pressures indicated throughout the subsequent procedures.**

b. Typical Purging and Charging Procedure.

Note. The following steps present a typical purging and charging procedure which applies to most fire control instruments. This instrument procedure is in conjunction with specific procedures being followed when purging and charging fire control instruments.

(1) Remove entrance port valve caps or screws; exhaust port screw or plug; and accessory components such as gaskets, packings, washers, or nylon disks. Refer to specific instrument procedure for location of these components.

Note. On some instruments entrance ports are color coded gray and exhaust ports color coded yellow.

(2) Attach free end of hose assembly to entrance port of instrument. If an adapter is required for connection of hose assembly to entrance port, refer to specific instrument procedure.

(3) Open pressure regulator valve (fig. 172.2) until the required purging pressure is registered on the low pressure gage. Allow this pressure to purge through the instrument for the required purging time, or until all visible traces of moisture have been removed. Refer to specific instrument procedure for required purging pressure and time duration.

(4) If the instrument is to be charged rotate pressure regulator valve counterclockwise until it is closed. Install exhaust port screw or plug, and accessory components, using sealing compound,

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MIL-S-11031 (item 6, app IV) as applicable. Open pressure regulator valve until the low pressure gage reads 1 psi and charge the instrument at the charging pressure for the required time duration. Refer to specific instrument procedure for time duration.

Note. If exhaust port screw is LOST or DAMAGED, replace with appropriate machine screw as indicated in TM 9-1015-203-20P.

(5) After instrument is charged, close pressure regulator valve. Remove hose assembly and adapter, as applicable, from entrance port of instrument.

(6) Replace entrance port valve caps or screws. Apply sealing compound MIL-S-11031 (item 6, app IV) to entrance port screws. Do NOT apply sealing compound to valve caps.

(7) If no additional purging and charging procedures are to be conducted, close nitrogen tank valve.

c. Collimator, Infinity Aiming Reference M1/M1A1 (Fig. 172.3).

(1) Purge at 5 psi for 5 minutes.

(2) Charge collimators at 1 psi for 10 seconds.

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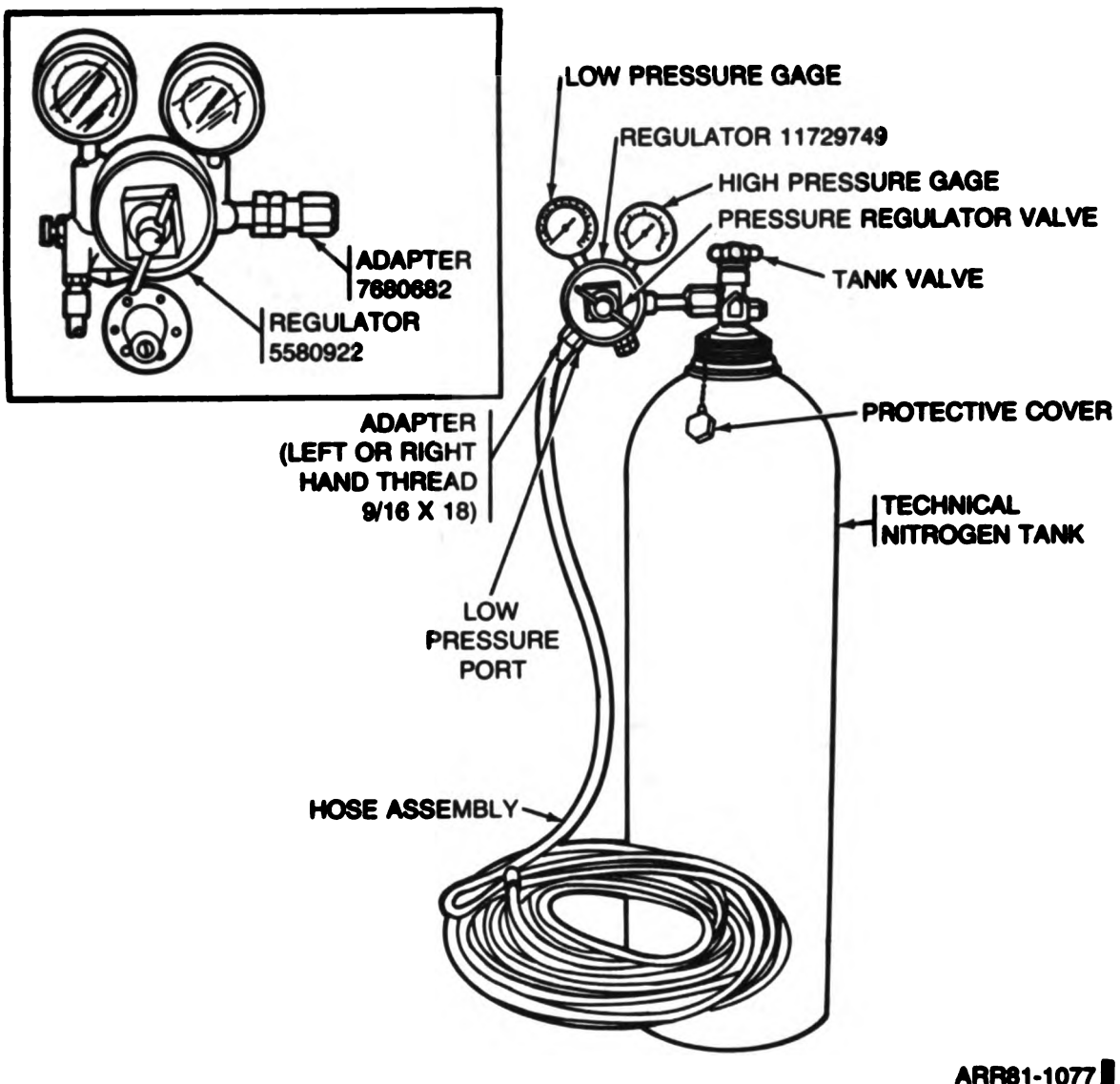
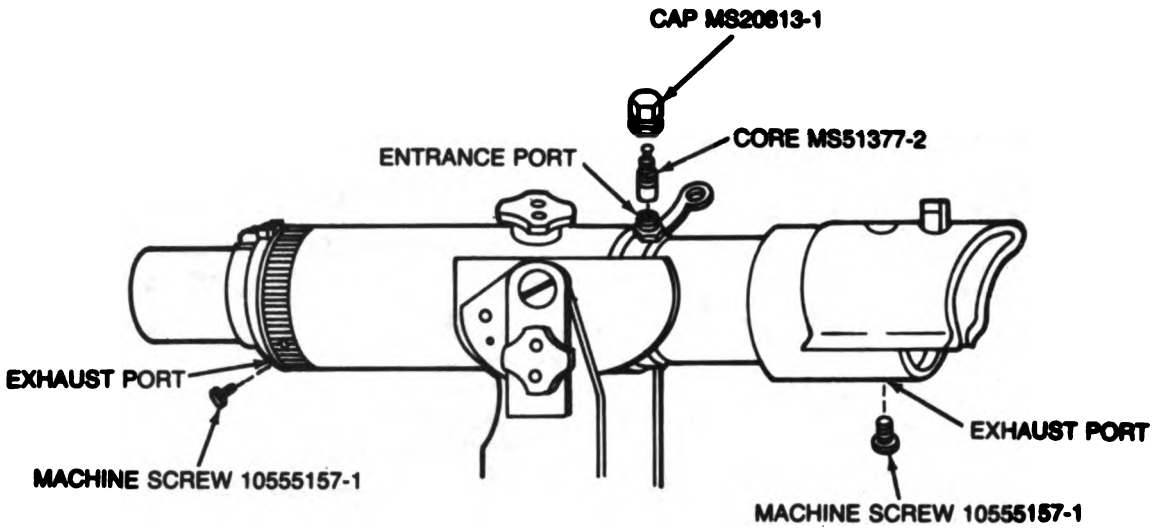
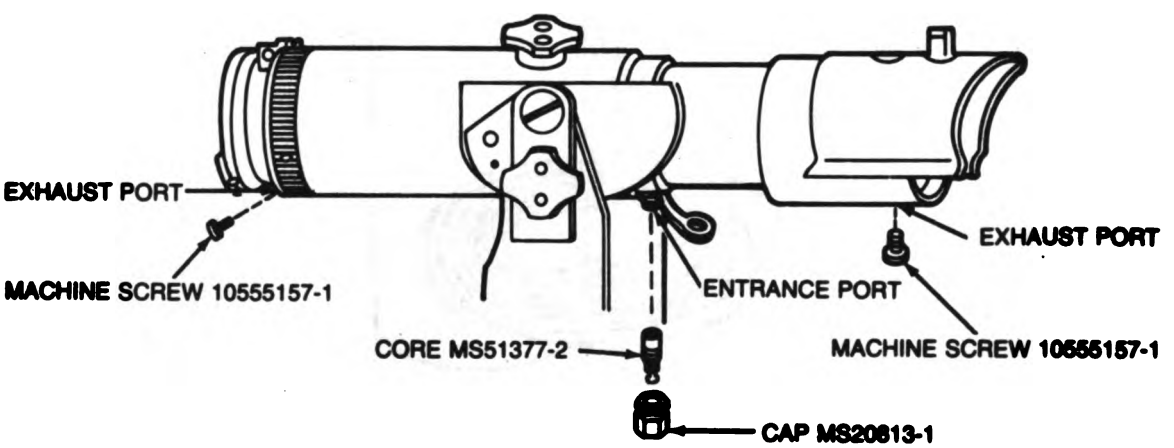


Figure 172.2. Setup of nitrogen tank and related equipment.

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A. INFINITY AIMING REFERENCE COLLIMATOR M1



B. INFINITY AIMING REFERENCE COLLIMATOR M1A1 (RADIOACTIVE)

ARR80-0090

Figure 172.3. Location of collimator extrance and exhaust ports.

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Section XXV. M90 CHRONOGRAPH ANTENNA MOUNTING BRACKET

148.2. Disassembly

a. Remove nuts on the four ends of two U bolts (fig. 172.3).

b. Remove four lockwashers and flat washers from U bolts.

c. Slide bracket off of U bolts. Remove U bolts from muzzle end of recuperator cylinder.

148.3. Assembly

a. Position two U bolts (fig. 172.3) on muzzle end of recuperator cylinder.

b. Slide bracket, with arrow pointing toward gun muzzle, over ends of U bolts.

c. Install a flat washer, lockwasher, and nut on each of four U bolts ends. Handtighten.

d. Rotats bracket until the antenna mounting surface is as horizontal as possible. Slide bracket completely to the rear and secure. Torque nuts to 20-23 ft-lb (27-31 N-m).

NOTE
Check mounting hardware periodically to be sure bracket is secure.

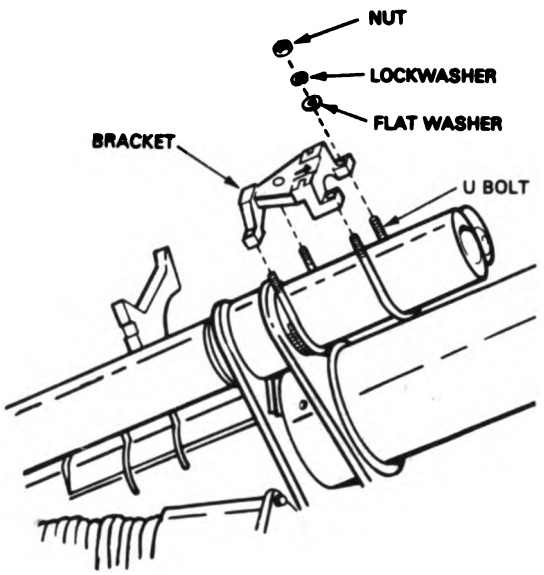


Figure 172.3. M90 chronograph antenna mounting brachet.

Section XXVI. BATTERY COMPUTER SYSTEM (BCS) MOUNTING SCREWS

148.4. Disassembly

Remove eight screws from two BCS mounting plates (fig. 172.4).

148.5. Assembly

Reverse disassembly procedure.

Note. These eight screws are used to attach BCS to mounting plates.

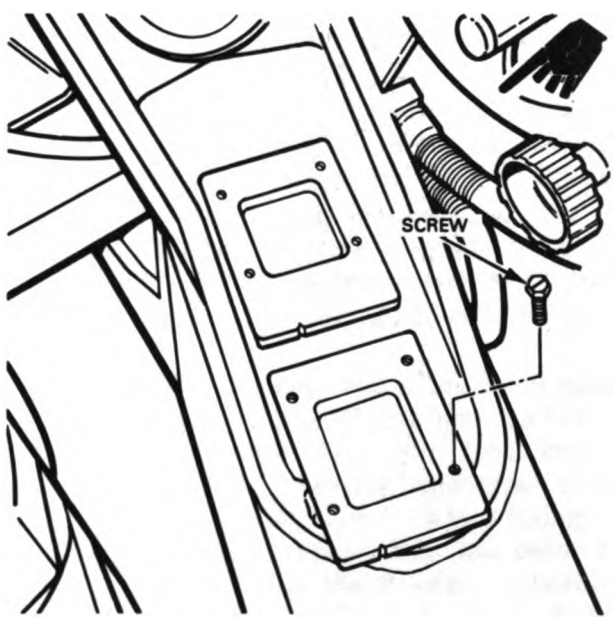


Figure 172.4. BCS mounting screws.

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CHAPTER 4

SUBCALIBER GUN AND MOUNT

149. Purpose

Subcaliber equipment, which is used for training purposes only, consists of the 37-mm gun and recoil mechanism M1916, 37-mm subcaliber gun mount M13A1, and equipment. Subcaliber equipment is used to provide more extensive training in laying and firing the 155-mm howitzer materiel 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 elevation, 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.

150. Tabulated 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 ..... percussion
Recoil mechanism:
  Type of recoil ..... hydrospring
  Maximum allowable recoil ..... 7 to 10 in.
Ammunition (for complete data, *see* chapter 5).
Maximum rate of fire ..... 35 rds per min
Range ..... 4,900 rd
Muzzle velocity ..... 1,275 fps

151. Description and Functioning

a. The 37-mm gun (figs. 173 and 174) is a single-shot, hand-loaded weapon with a manually-operated eccentric-screw type breechblock.

b. The 37-mm gun recoil mechanism M1916 (fig. 173) is a hydrospring type and consists of the recoil mechanism and counterrecoil buffer contained in a single cylinder. The recoil mechanism controls the force created by firing and gradually retards the rearward movement of the gun. The counterrecoil buffer functions at the end of the counterrecoil to cushion the return to battery.

c. The 37-mm subcaliber mount M13A1 (fig. 173) 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 fillister head machine screws and hexagon plain nuts, 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 machine screws and one bottom hook bolt and their hexagon plair nuts, which retain the front end of the recoil cylinder and also provide a means of vertical adjustment (par. 155*a*(1)).

152. Services

a. Cleaning. General cleaning instructions are outlined in paragraph 71*d*.

b. Inspection Upon Receipt of New or Used Materiel. General inspection instructions are outlined in paragraphs 9 and 10.

c. Filling the Recoil Mechanism. The recoil mechanism requires 2-3/4 pints of fluid. Only the prescribed recoil fluid (par. 158) 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 175. Attach adapter to gun.

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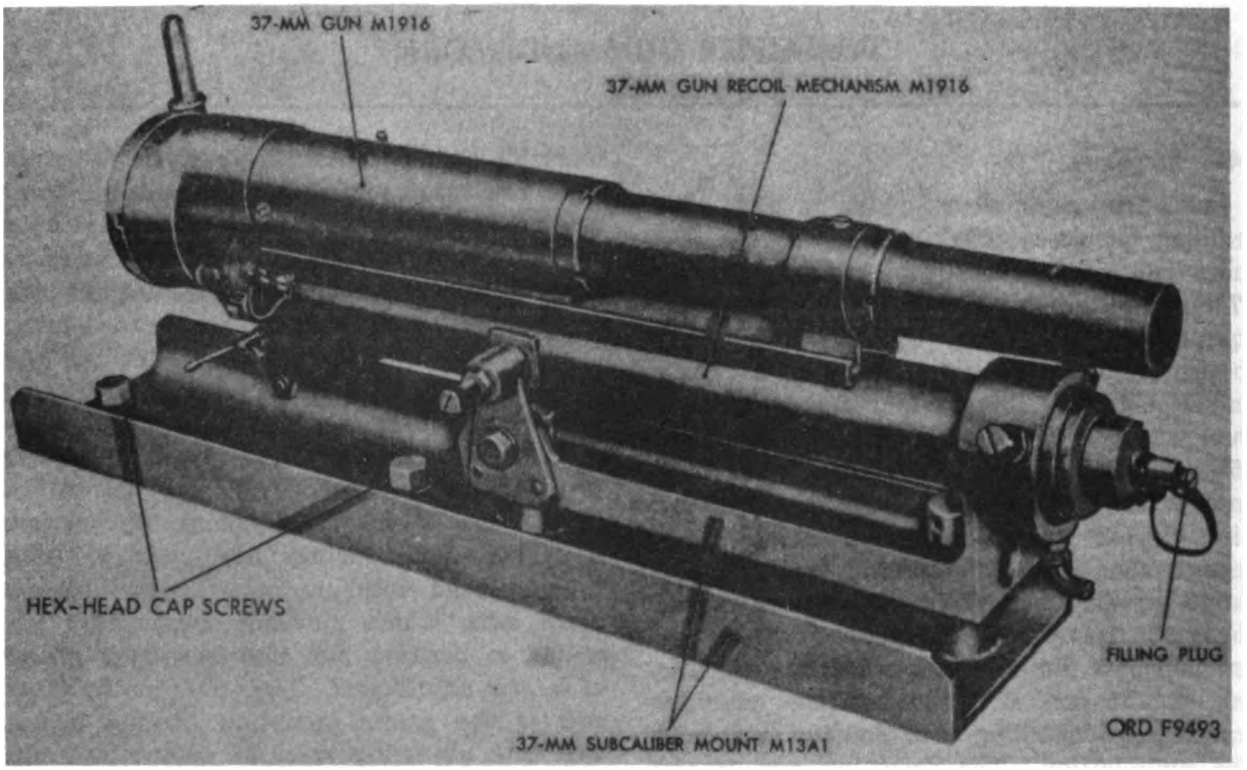


Figure 173. 37-mm subcaliber equipment for 155-mm howitzer.

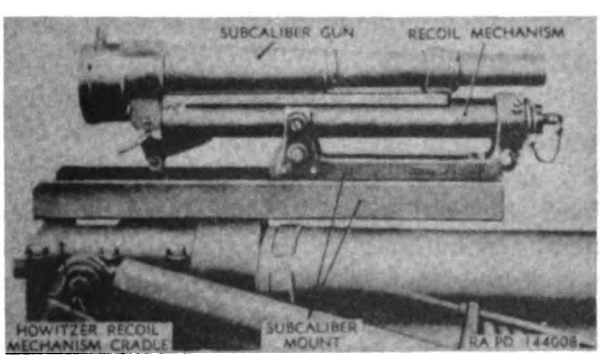


Figure 174. 37-mm subcaliber equipment mounted on howitzer.

(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 fluid 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. 175).

(4) Screw the oil gun into the adapter in the filling hole (fig. 175).

(5) Remove the drain plug in the right side of the cradle (fig. 175).

(6) Push the plunger of the oil gun in slowly, at the same time watching for the escape of fluid from the drain hole. When the fluid 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 two teaspoonfuls of fluid escape; then screw the two plugs in tightly. Permitting a little fluid to escape gives some room for expansion, which is needed to accomodate the expansion of fluid during prolonged fire and avoid interference with the complete return of gun to battery.

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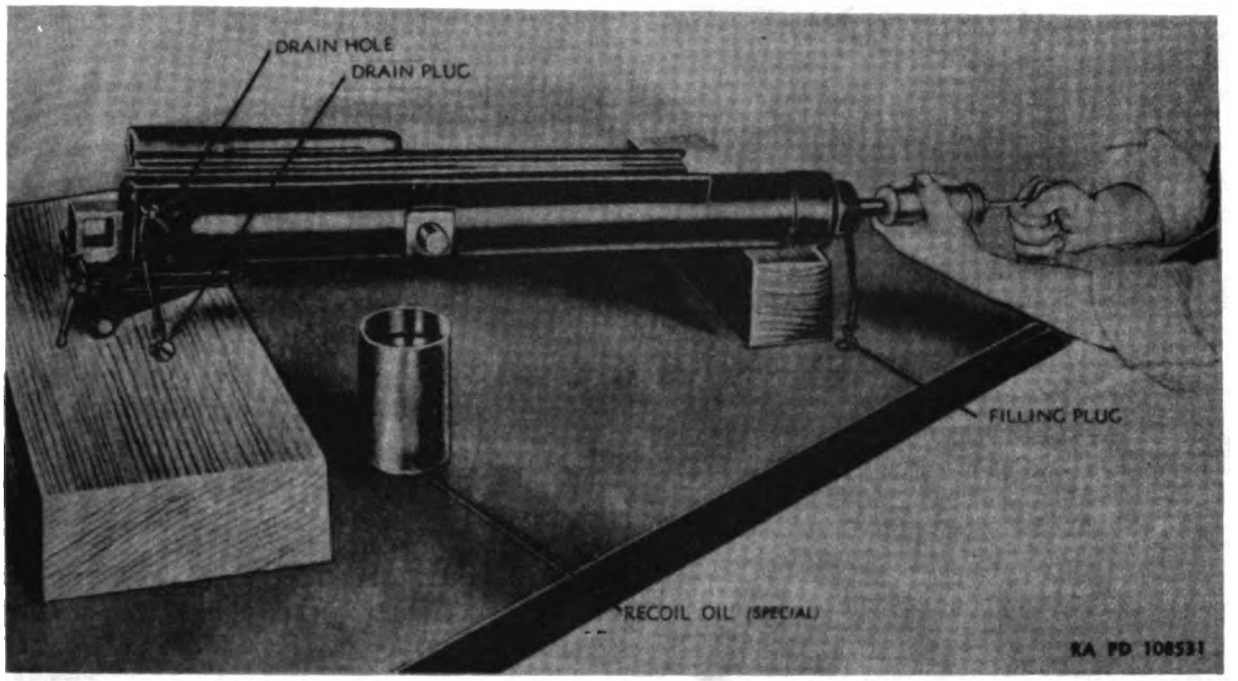


Figure 175. Filling the recoil mechanism.

153. Controls

a. Breechblock and Breechblock Lever. The breechblock (fig. 176) 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 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 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).

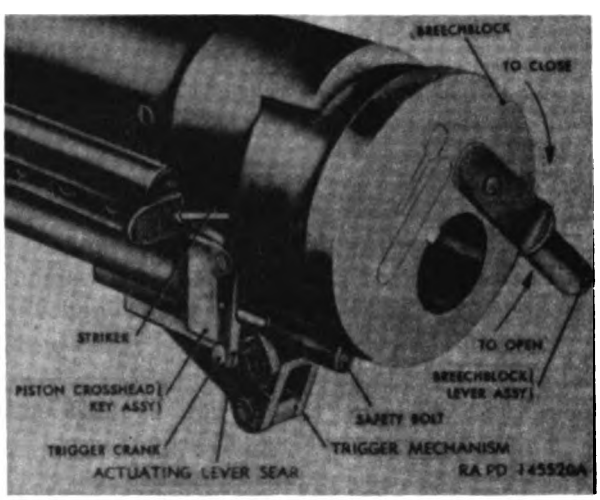


Figure 176. 37-mm gun breech.

b. Striker Cocking Handle. The striker cocking handle (fig. 177) 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. 178) 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.

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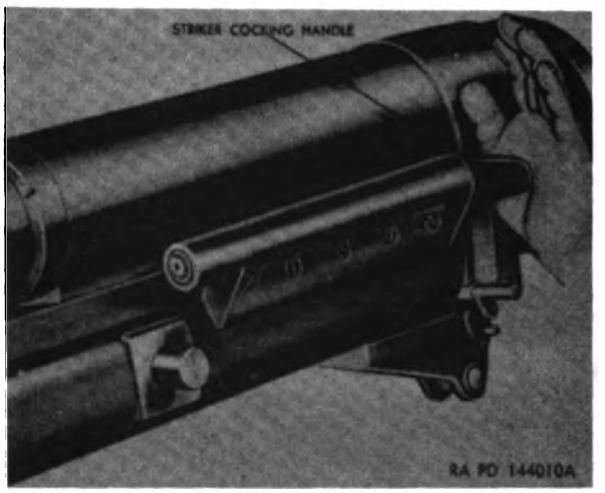


Figure 177. Cocking the 37-mm gun.

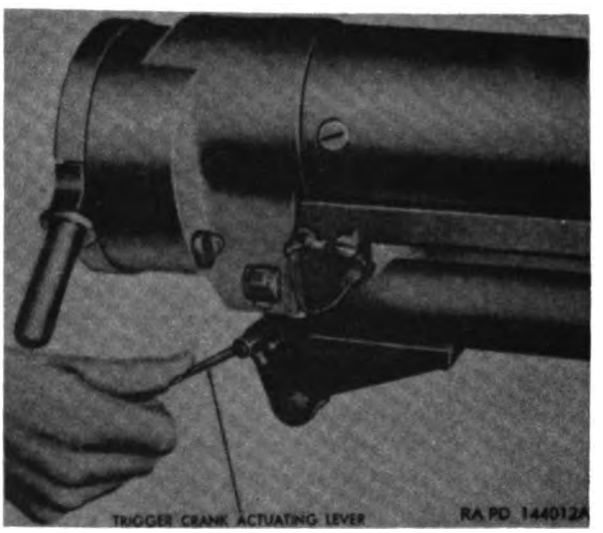


Figure 178. Depressing trigger crank actuating lever.

154. 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 mechnaism cradle and secure the mount with the two hexagon head mounting cap screws (fig. 173).

b. Install 37-mm Subcaliber Gun M1916. To mount the 37-mm subcaliber gun M1916, loosen the two side adjusting machine screws and the bottom adjusting hook bolt in the collar of the subcaliber mount (fig. 179). Remove the trunnion bearing bracket from the right side of the cradle mounting bracket by removing the hexagon head cap screw and lock washer that 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. 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 hexagon head cap screw and lock washer. Tighten the trunnion fillister-head machine screws in the trunnion bearings, the two side machine adjusting screws, and the bottom adjusting hook bolt in the collar just enough to retain the 37-mm gun in position. Bore sight the gun (par. 43).

155. 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. 158*c*), that the mount is securely fastened to the 155-mm howitzer, and that the 155-mm howitzer weapon is properly bore sighted (par. 43). Bore sight the 37-mm subcaliber equipment as follows: with the howitzer bore alined on the testing target or on a distant aiming point, refer to paragraph 43*b*. Mount the 37-mm subcaliber equipment in position on top of the howitzer recoil mechanism (par. 154*a* and *b*). Install the breech bore sight and muzzle bore sight in the subcaliber gun. Aline the line of sight at the subcaliber gun with the proper vertical lines of the testing target or vertically with distant aiming point

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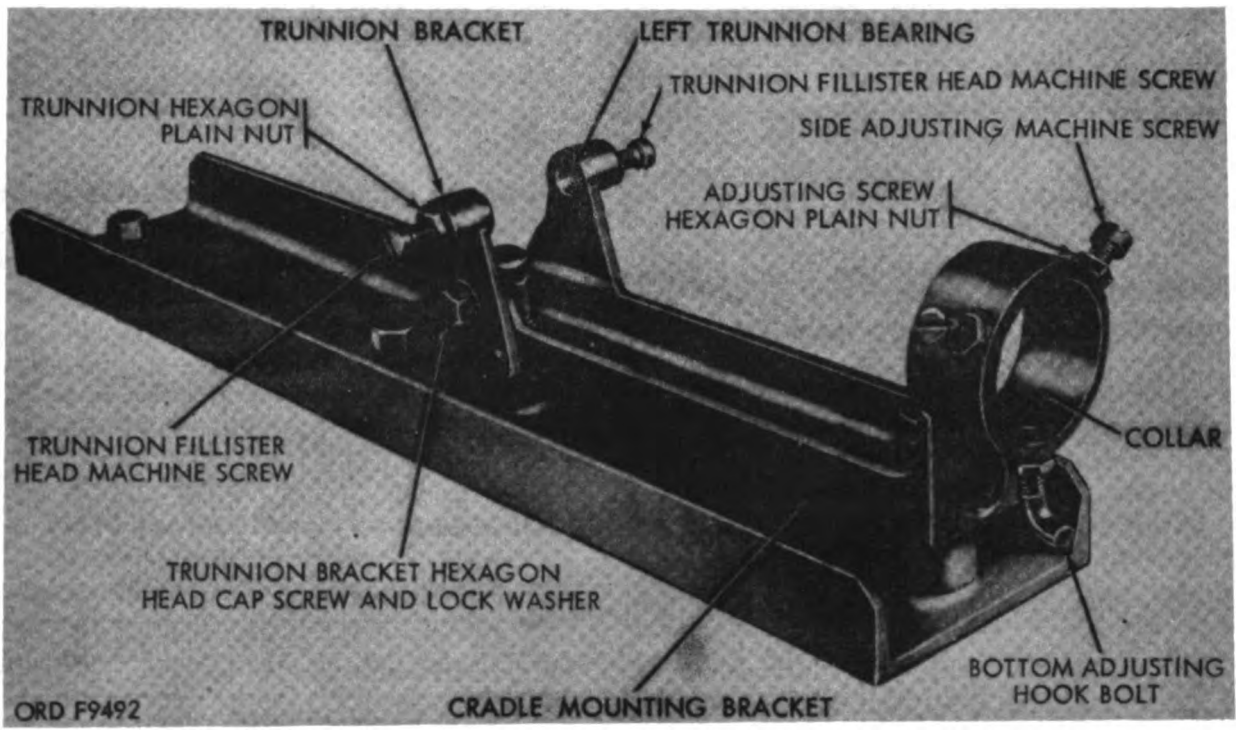


Figure 179. 37-mm subcaliber mount M13A1.

used for the howitzer bore by loosening the adjustment hexagon plain nuts and turning the adjusting machine screws in the collar of the subcaliber mount (fig. 179). When tightening the screws, do not overtighten. Overtightening the machine screws will produce a strain in the recoil cylinder of the subcaliber gun. Aline the line of sight of the subcaliber gun with the proper horizontal lines of the testing target (or horizontally with the distant aiming point used for the howitzer bore) by loosening the two trunnion hexagon plain nuts and turning the trunnion fillister-head machine screws so as to shift the gun laterally. When the adjustment is completed, both trunnion screws must be tight to hold the trunnions of the gun firmly between them. When the bore of the subcaliber is properly alined on the testing target (or distant aiming point), tighten the nuts of the adjusting screws and trunnion machine screws. Hold the screws firmly to prevent altering the adjustments when tightening the nuts. Also check to see that all moving parts are oiled and 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.

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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. 46). However, it is possible to load the 37-mm gun at any elevation less than 65°. At low elevation, the gun is loaded by standing on the trails or bogie. At high elevations, the gun is loaded by standing on the board placed across the trails under the breechblock of the 155-mm howitzer.

(2) First cock the gun (par. 153*b*) if not already automatically recocked, and then open the breech (par. 153).

(3) Place a round in the breech opening (fig. 180) 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. 176). 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. 153*c*) and then releasing it promptly. Should the gun fail to fire, refer to paragraph 156.

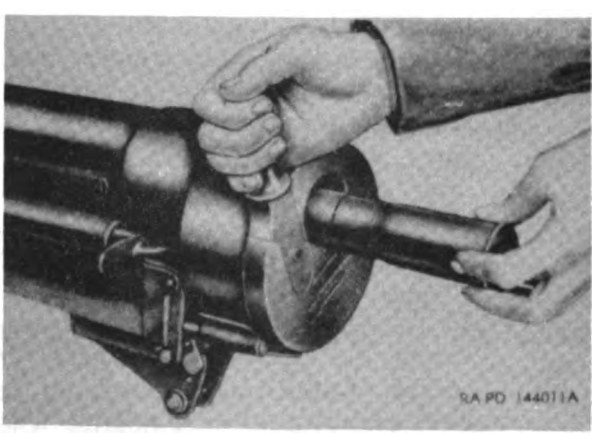


Figure 180. Loading the 37-mm gun.

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 cartridge 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 removed as outlined above, notify ordnance maintenance personnel.**

156. Failure to Fire

a. Failure of the gun to fire may be caused by defective ammunition or by a malfunction of the weapon.

b. Upon failure to fire, make two more attempts to fire (par. 153*b*), recocking manually (par. 153*b*) for each attempt.

c. If the gun still does not fire, wait one minute from the time of the last attempt to fire and proceed as follows:

(1) Open the breech slowly and remove the round (par. 155*d*).

(2) Examine the primer for indent.

(3) If primer has a normal indent, the round is defective and should be turned over to ordnance maintenance personnel. Resume firing.

(4) If primer has light or no indent at all, failure to fire was caused by a malfunction of the gun. Refer to troubleshooting (table 10) 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.**

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(5) After firing has been completed for the day, enter the number of rounds fired on DA Form 2408-4 for the subcaliber gun in the equipment log book. Each round fired will be rated as a full charge factor of one for each round (table 7). The round life of the cannon is estimated at 2,000 rounds based on the use of cartridges M92 and M68. Condemnation limits are determined by pullover gage readings taken by direct support unit, and not by rounds fired. Posting the rounds fired is only used for estimating life remaining in a cannon.

Table 7. Equivalent Full Charge Factor and Estimated Round Life of Cannon Tube Based on Specific Ammunition for 37-MM Gun.

Round				
Type	M-Model	Charge	Round life	EFC
LE	M92	Fixed	2,000	1.00
LE	M68 Mod 1	Fixed	2,000	1.00

157. Removal of Subcaliber Equipment

a. Loosen the three machine screws in the collar of the mount. Remove the right trunnion bearing bracket from the cradle mounting bracket by removing the machine screw and lock washer which retain it, and remove the 37-mm subcaliber gun from the mount.

b. Remove the mount from the 155-mm howitzer recoil mechanism cradle by unscrewing the two hexagon head cap mounting screws (fig. 173) that secure the mount.

158. Lubrication

a. Refer to lubrication chart (fig. 181) for lubrication of the subcaliber gun and mount.

b. Points of application for lubricating the subcaliber gun are shown in figure 182 and are referenced on the lubrication chart (fig. 181).

159. Preventive Maintenance of Subcaliber Gun and Mount

a. The general instructions included in paragraphs 68 through 73 apply to the 37-mm subcaliber gun.

b. Table 8 gives specific procedures to be performed on the subcaliber equipment by the operator for each daily service.

c. Table 9 gives the specific procedures to be performed on the subcaliber equipment by organizational maintenance personnel for each weekly service.

160. Troubleshooting

a. Scope. Troubleshooting is a systematic isolation of defective components. The more likely malfunctions, their causes, and corrections are listed in table 10. The corrections provided 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 10. If the correction is beyond the scope of organizational maintenance functions, refer the malfunction to ordnance maintenance personnel as indicated in the table.

161. 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. 178) while applying pressure against the cocking handle (fig. 177), thus preventing too fast a movement of the striker (fig. 184). Remove the piston crosshead key assembly (fig. 185) 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. 186).

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 stroker cocking handle (fig. 177). Remove the breechblock

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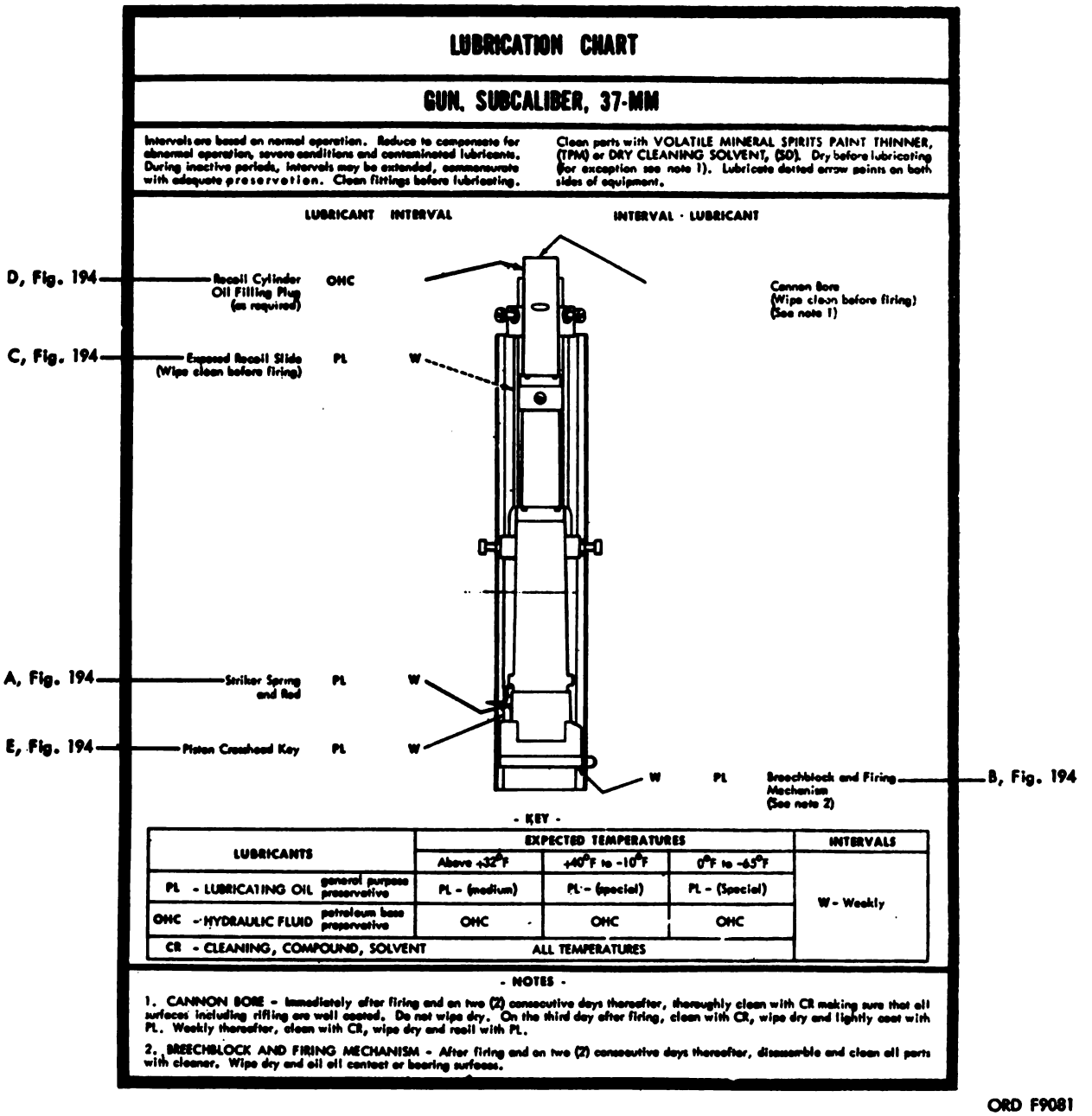


Figure 181. Lubrication chart—37-mm subcaliber gun.

lever assembly (fig. 187) by grasping the handle with the fingers and pressing the lever release pin cap with the thumb; lift the breechblock lever assembly out of the breechblock. Take out the extractor pin assembly by pressing the extractor pin latch (fig. 188) toward the breech with the forefinger and pulling it out to the right. The extractor will

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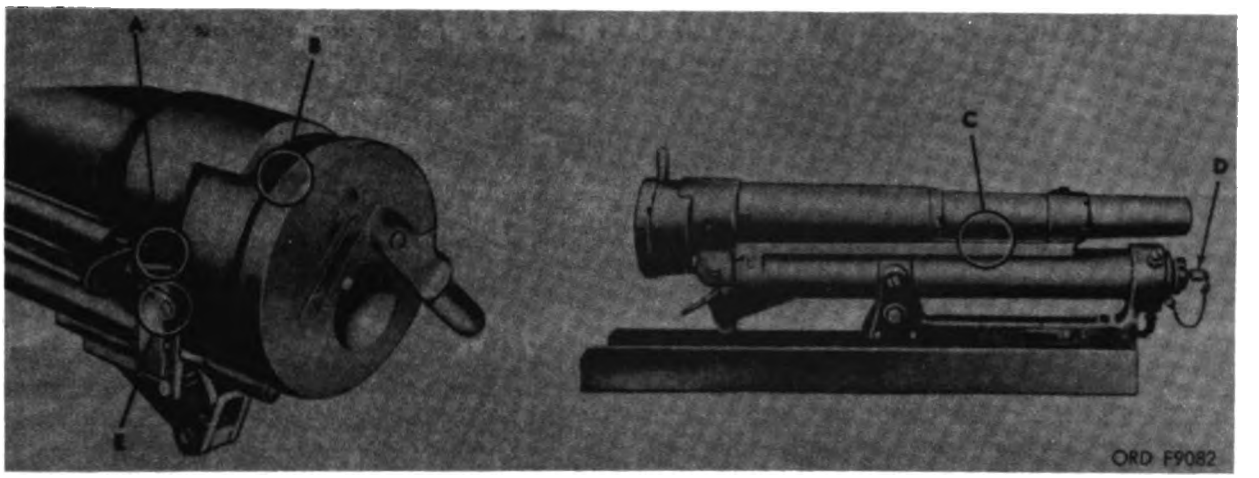


Figure 152. Localized lubrication points—37-mm subcaliber gun.

Table 8. Preventive Maintenance Checks and Services

Interval and Sequence No.				Operator Maintenance Category		Daily Schedule
Before travel	Before firing	During firing	After firing	Item to be inspected	Procedure	Paragraph reference
1	--	--	--	Equipment log book.	Check for presence of appropriate forms for maintaining weapon record data.	8
2	--	--	--	Tools.	Inspect for presence of all tools and equipment. Check proper stowage.	9, 62, 63
3	--	--	--	General condition.	Inspect weapon overall condition as follows: paint, cracks, broken welds, loose nuts, rust and missing or damaged parts.	67, 71
4	--	--	--		Check to see that mount is securely fastened to primary weapon and gun is properly installed in mount.	154
--	5	--	10	Barrel assembly	Check for unusual wear, damage, and powder fouling in bore.	155
--	6	--	--	Breech mechanism.	Open and close breechblock several times, checking for ease of operation and proper functioning of all components.	153*a*
--	7	--	--	Striker mechanism.	Check to see that striker cocking handle latches in cocked position.	153*b*
--	8	--	11	Recoil mechanism.	Check for fluid leakage and damaged filling and drain plugs.	152*c*
--	--	9	--		Check for smooth operation and length of recoil Normal length of recoil is 7 to 10 inches.	39*b*

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Figure 189. Retracting test, using wooden block.

drop down until its heel clears the extractor cam (fig. 189). Then unscrew the breechblock (fig. 190) 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. 191) from inside the breech by inserting a forefinger in the mortise in the base of the breech ring, slightly raising the

Table 9. Preventive Maintenance Checks and Services.

Organizational			Monthly Schedule
Sequence number	Item to be inspected	Procedure	Paragraph reference
1	Breechblock.	Remove the breechblock group. Inspect the breechblock and breechblock lever assembly for cracks, burs, corrosion or other damage. Inspect the firing pin hole in the face of the breechblock for foreign matter. Test the tension of the breechblock lever latch spring to return the release pin cap to the original position.	161*b*(1), 161*c*(1)
2	Firing mechanism.	Disassemble the firing mechanism parts. Inspect the firing pin spring for elongation and breaks. Check the firing pin, rocker retaining pin, firing pin actuating roller, and rocker plunger for burs and cracks. With the rocker plunger depressed, check firing pin protrusion for 1/8-inch from the face of the breechblock.	161*b*(3), 161*c*(2)
3	Extractor.	Inspect the extractor and extractor pin for cracks, burs, or other damage. Check operation of extractor using an empty cartridge case.	161*c*(1)
4	Piston crosshead key assembly.	Replace the piston crosshead key assembly if any portion is cracked or broken, or if the sear spring is defective. Remove all burs.	161*c*(3)
5	Striker mechanism.	Check ability of striker spring to deliver a sharp release. Free height of striker spring should not measure less than 6.81 inches.	161*c*(4)
6	Recoil mechanism.	Check recoil guides and cannon slides for burs. Check functioning of recoil mechanism by retracting the gun about 7 or 8 inches and letting the gun return to battery quickly, but without shock.	

Table 10. Troubleshooting

Malfunction	Probable cause	Corrective action
Failure to fire.	Misfire.	Chock for defective round (par. 156).
	Firing pin recess dirty; heavy or gummed oil.	Disassemble firing mechanism (par. 161*b*(3)), Clean and lubricate.
	Firing pin worn.	Replace firing pin (par. 161*d* (2)).

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Table 10. Troubleshooting—Continued.

Malfunction	Probable cause	Corrective action
	Rocker plunger and/or actuating rocker worn.	Replace rocker plunger and/or actuating rocker (par. 162*d*(2)).
	Striker spring defective.	Replace striker spring (par. 161*d*(1)).
	Other causes.	Notify ordnance maintenance personnel.
Breech difficult to open.	Firing spring defective; does not retract firing pin.	Replace firing pin spring (par. 161*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 fluid in recoil mechanism.	Unscrew the drain plug on the right side of cradle (fig. 175). Allow a small quantity of fluid to run out and install the drain plug.
	Recoil guides burred or scratched.	Remove the gun from recoil mechanism (par. 161*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 par. 153*b*.
	Sear plunger spring defective and/or sear worn or broken.	Replace the piston crosshead key assembly (par. 161*c*(3)).
	Other causes.	Notify ordnance maintenance personnel.
Gun does not cock automatically Return to battery with jarring impact.	Insufficient fluid in recoil mechanism.	Add fluid to recoil mechanism (par. 152*c*).
	Improper fluid being used.	Use correct fluid (par. 152*c*).
	Other causes.	Notify ordnance maintenance personnel.
Jammed trigger 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 w/hand extractor. Replace extractor (par. 161*c*).
	Other causes.	Notify ordnance maintenance personnel.
Breech will not open.	Gun is not cocked.	Manually cock the gun (par. 153*b*).
	Gunner has trigger crank actuating lever depressed.	Release trigger crank actuating lever. Manually cock the gun (par. 153*b*).
	Other causes.	Notify ordnance maintenance personnel.

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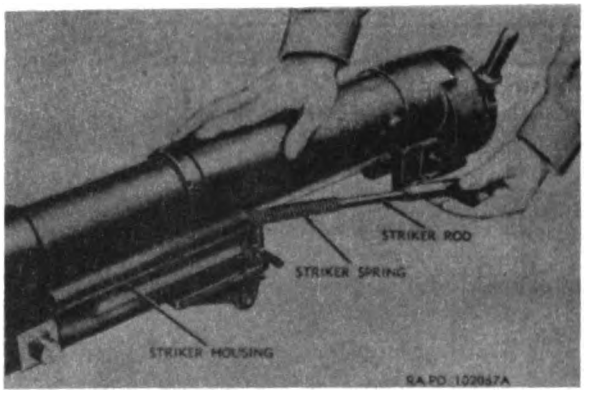


Figure 184. Removing striker rod and spring.

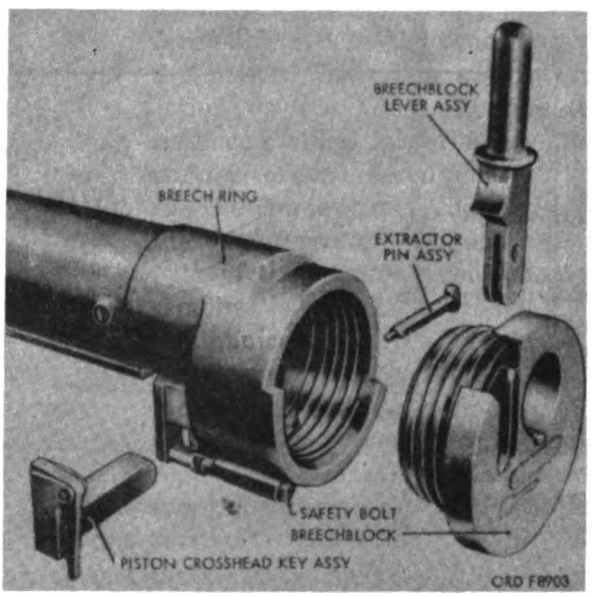
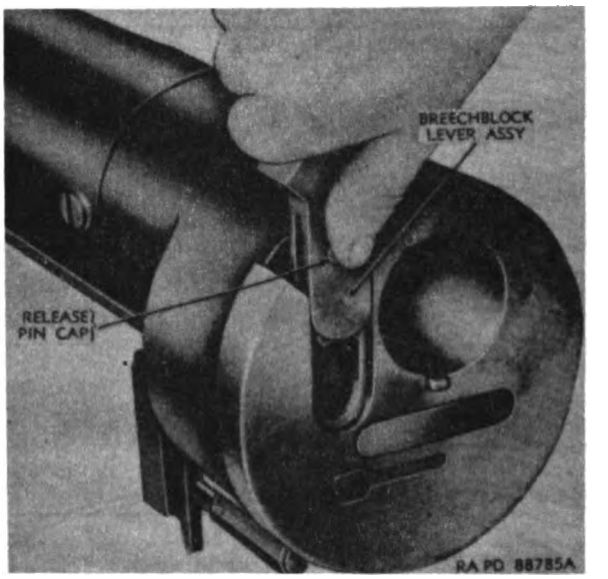


Figure 185. Breechblock—exploded view.



Figure 186. Removing subcaliber gun from recoil mechanism.



Fiigure 187. Removal of breechblock lever assembly

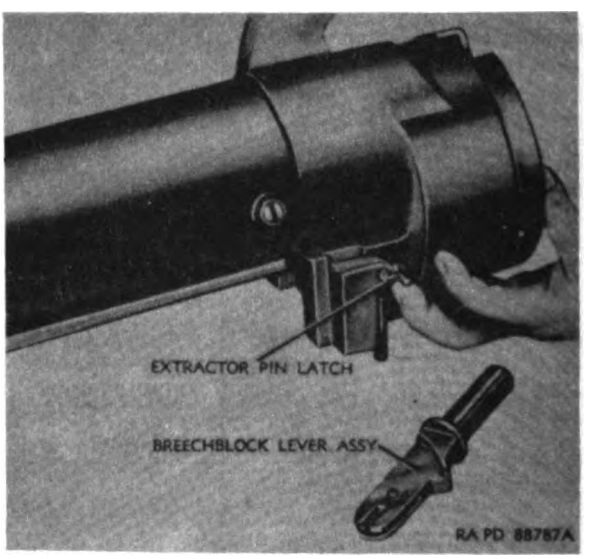


Figure 188. Depressing extractor pin latch.

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). In order to remove the firing pin, firing pin spring, rocker

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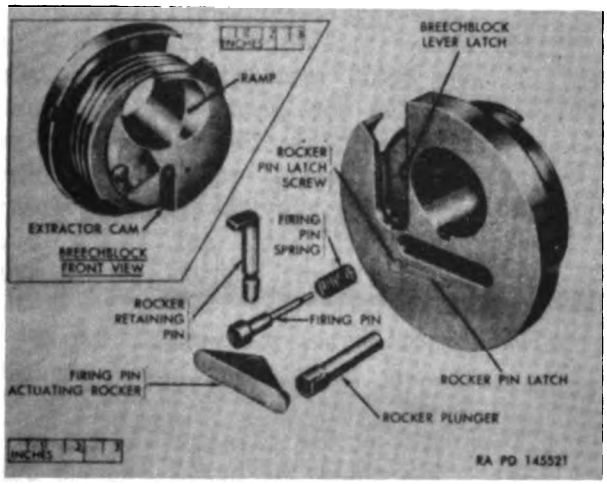


Figure 189. Breech mechanism—exploded view.

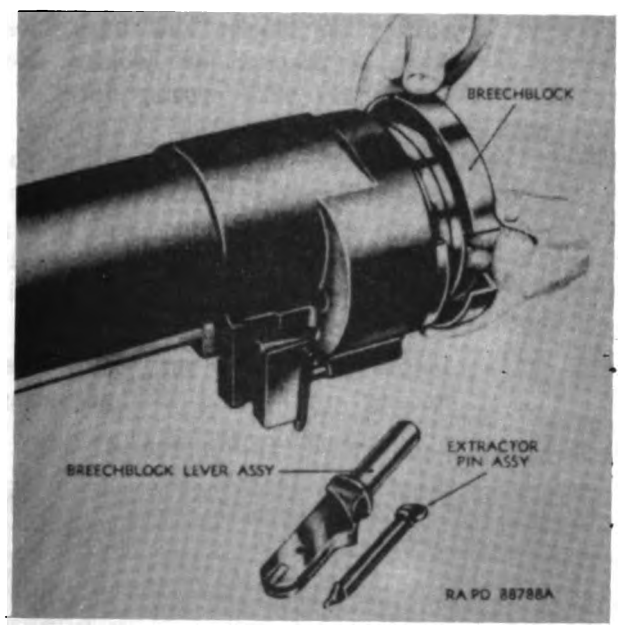


Figure 190. Removal of breechblock.

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. 189) entering the groove in the outer end of the rocker retaining pin. If this

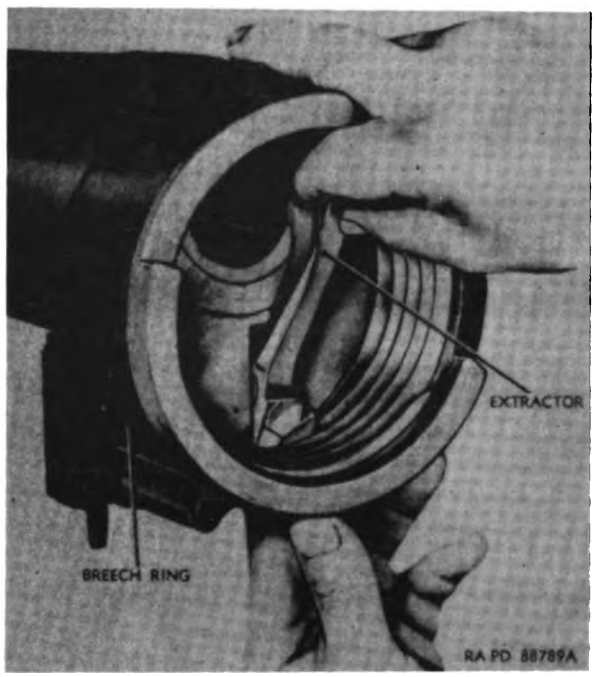


Figure 191. Withdrawing the extractor.

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. 192). The firing pin actuating rocker is then free and, when removed (fig. 193), releases the firing pin (fig. 189) (which will be pushed out by its spring) and the rocker plunger (which may then be dropped out by tipping the breechblock).

(4) *Remove piston crosshead key assembly.* Remove the piston crosshead key assembly (fig. 185) by pressing its latch upward and pushing the key out to the left.

(5) *Disassemble striker mechanism.* To disassemble striker mechanism, remove the piston crosshead key assembly ((4) above). Draw the gun

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Figure 192. Removing rocker retaining pin.

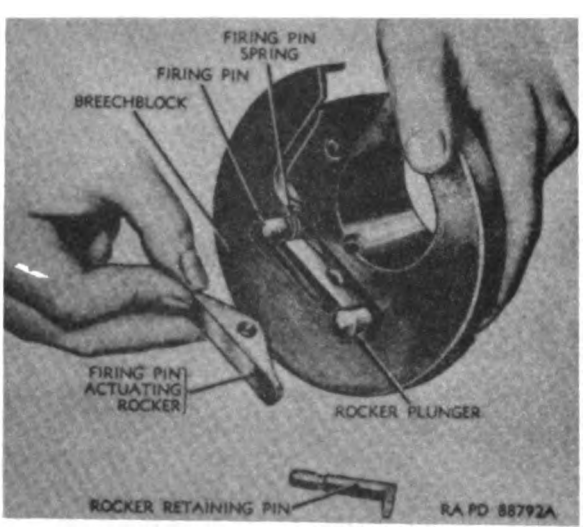


Figure 193. Removing firing pin actuating rocker.

back about eight inches, push the striker to its extreme forward position, loosen the striker rod nut setscrew, and unscrew and remove the striker rod nut (fig. 194). Allow the spring to expand slowly, push the striker rod out, and remove the striker spring (fig. 184).

(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.

c. *Inspection Before Assembly.*

(1) *Breech mechanism and breechblock.*

(*a*) Inspect the extractor and extractor 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 25/32 of an inch. Replace the firing pin spring if it is defective.

(*b*) Inspect the firing pin, rocker retaining pin, firing pin actuating

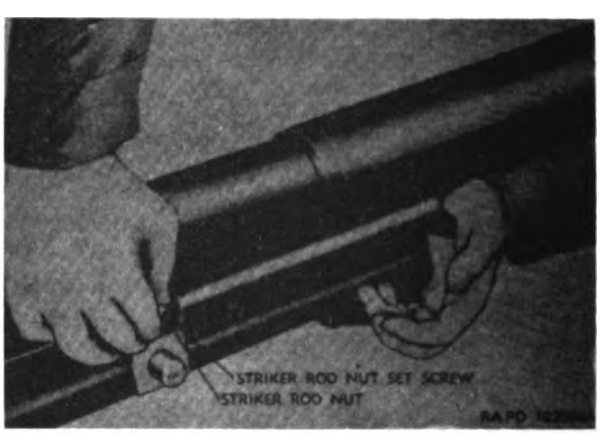


Figure 194. Removing striker rod nut setscrew and nut.

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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 measures 0.5 inch less than 6.81 inches, replace the striker spring.

(5) *Recoil mechanism.*

(*a*) Replace the filling and drain plug gaskets and thongs, 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. 184). Push the striker to the extreme forward position and turn the striker rod nut (fig. 194) 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 setscrew 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 setscrew 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. 189). 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. 195) 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.

e. Installation. Install the gun in the recoil mechanism as follows:

Note. The subcaliber gun must be bore sighted (par. 43) 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 machine screws or trunnion machine screws have been disturbed.

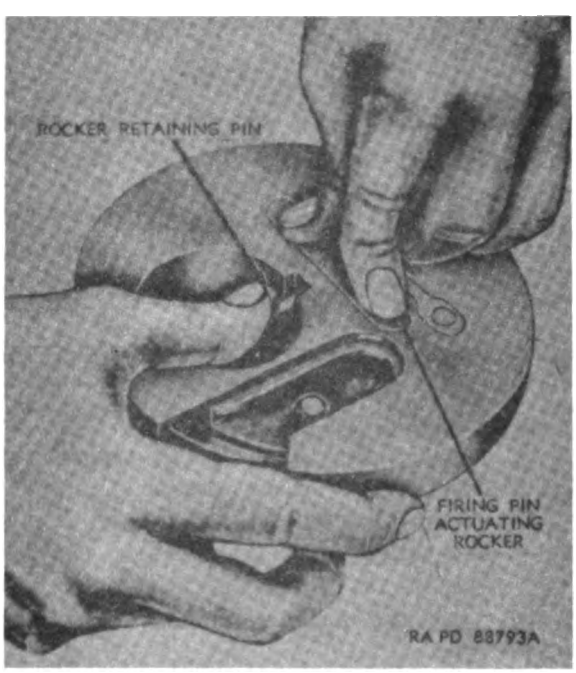


Figure 195. Installing rocker retaining pin.

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(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 into 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. 185). 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. 191) is its seat, but do not insert the extractor pin. Next, cock the striker mechanism, screw the breechblock home (fig. 190), and set the breechblock lever assembly in place (fig. 187). 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. Uncock 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 breech block into position with the extractor pin in place.

162. Sighting and Fire–Control Equipment

Refer to paragraphs 37 and 42.

163. Ammunition

Refer to paragraph 176.

164. Special Organizational Tools and Equipment

a. Repair Parts. Repair parts are supplied to the using organization for replacement of those parts most likely to become worn, broken, or otherwise unserviceable, providing the replacement of these parts is within the scope of organizational maintenance functions. Repair parts supplied for the 37–mm subcaliber gun, recoil mechanism M1916, and 37–mm subcaliber mount M13A1 are listed in appendix II, which is the authority for requisitioning replacements. Repair parts supplied to organizational maintenance are listed in TM 9–1025–200–20P.

b. Common Tools and Equipment. Standard or commonly used tools and equipment, having general application to this materiel, are authorized for issue by tables of allowances and tables of organization and equipment.

c. Special Tools and Equipment. Special tools and equipment designed for operation and organizational maintenance, repair, and general use with the materiel are listed in appendix II and TM 9–1025–200–20P, which is the authority for requisitioning replacements.

d. Description of Special Tools and Equipment. Recoil filling adapter 4933–966–4271 is used when filling the recoil mechanism. The adapter is screwed into the recoil mechanism filling hole. The oil gun muzzle is screwed into the open end of the adapter to fill the mechanism with fluid.

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CHAPTER 5

AMMUNITION

This AMMUNITION chapter consists of eleven sections. Section I is general information applying to 155-mm howitzer. Sections II, III, IV, V, and VI apply only to the M114 and M114A1 howitzer with the M1 and M1A1 cannon tubes. Sections VII, VIII, IX, X, and XI apply only to the M114A2 howitzer with the M1A2 cannon tube. The reason for the division is that certain new ammunition cannot be fired in the old M114A1 howitzer.

Section I. GENERAL

165. General

Ammunition for your 155-mm howitzer cannon is the separate loading type. The loading of each complete round into the howitzer cannon requires three separate operations; loading the fuzed projectile, the propelling charge, and the primer. The components are shipped separately.

166. Identification

Projectile colors and markings (new and old) are listed in table 11. Additionally, important information is stenciled on each projectile (fig. 196). Knowledge of the color coding and the meaning of the markings will aid in the rapid selection of the required projectile when firing. KNOW YOUR AMMUNITION.

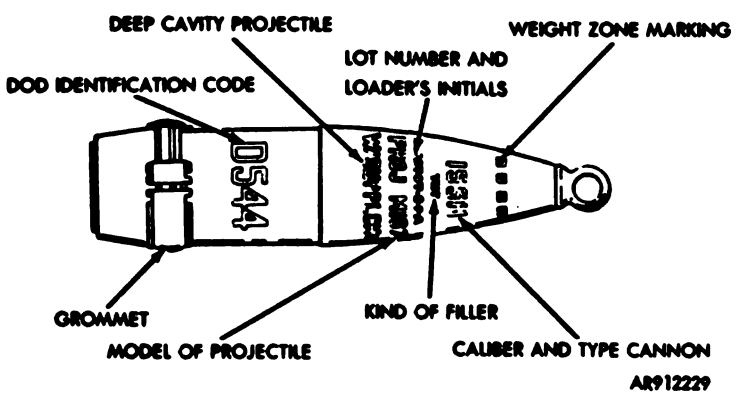


Figure 196. Marking of 155-mm HE projectile.

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Section II. AMMUNITION M114 and M114A1 HOWITZER

This section applies to ammunition used with the M114 and M114A1 howitzer with the M1 and M1A1 cannon tube.

Table 11. Model Numbers and Color Coding of Projectiles for Howitzer Cannon M1A1

Type and model number of projectile	New Manufacture			Old Manufacture		
	Color of projectile	Number/ Color of bands	Marking	Color of projectile	Number/ Color of bands	Color of marking
Agent (H, HD) w/burster, M110	Gray	2/Green 1/Yellow	Green	Gray	2/Green	Green
Agent GB or VX w/buster, M121, M121A1	Gray	3/Green 1/Yellow	Green	Gray	1/Green	Green
Agent GB or VX w/o burster, M121A1	Gray	3/Green	Green	Gray	2/Green	Green
HE ICM, M449 series	Olive drab	Dia-monds*	Yellow	Olive drab	None	Yellow
HE, M107, Comp B and TNT filler w/and w/o supl charge	Olive drab	None	Yellow	Olive drab	None	Yellow
M485A1 (M485E1), M485A2 (M485E2) illuminating	Olive drab	1/White	White	Not applicable		
Smoke, base ejection (HC and colored), M116	Light green	None	Black	Gray	1/Yellow	Yellow
Smoke (WP), M110E1, M110 M110E2	Light green	1/Yellow	Red	Gray	1/Yellow	Yellow
M804 practice	Blue	1/ brown	White	Not Applicable.		

*Row of yellow diamonds between nose and bourrelet of projectiles.

167. Authorized Round

WARNING

Unauthorized assembly and use of projectiles, fuzes, and propelling charges is extremely dangerous. Make sure projectiles are marked 155H (not G).

a. Projectile-fuze combinations for authorized rounds are given in table 13.

b. Projectiles of current manufacture which contain deep fuze cavities and supplementary charges of TNT, are suitable for use with M728 proximity fuzes. Deep cavity projectiles are identified by the words W/SUPPL CHG marked on the projectile. Weight zones are indicated on projectiles by means of one or more squares of the same color as the marking. Four squares indicate standard or normal weight for which no weight corrections are necessary when computing firing data.

c. Authorized projectiles and their characteristics are listed below:

(1) *Projectile, 155-mm, HE, M107.* Used primarily for blast, fragmentation, and mining. This deep or shallow cavity projectile consists of a steel case loaded with either TNT or Comp B. PD, time, or proximity fuzes may be used. The M107 projectile weighs approximately 97 pounds (44 Kg).

(2) *Projectile, 155-mm, gas, persistent, H or HD, M110.*

WARNING

Burster in the WP M110 ammunition is loaded with tetrytol and should not be stored or fired at temperatures exceeding +125° F. (52° C.). Temperatures above 125° F. will cause the tetrytol to melt and/or exude causing premature functioning.

This projectile produces a toxic effect on personnel, and is also used to contaminate habitable areas. This 98-pound (44 Kg) projectile is filled with H or HD gas, with a built-in burster charge.

NOTE

When required for contingency plan purposes, VX or GB filled projectiles M121A1 may be transported fully assem-

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bled with explosive components, otherwise assembly is prohibited except for storage and use.

(3) *Projectile, 155-mm, gas, persistent, VX, M121A1.* VX gas projectiles produce a toxic effect on personnel. A burster charge breaks the projectile apart. This projectile weighs approximately 100 pounds (45 Kg).

(4) *Projectile, 155-mm, gas, Non-persistent, GB, M121A1.* This projectile is similar to the VX projectile M121A1 described above.

(5) *Projectile, 155-mm, smoke, WP, M110E1, and M110.*

WARNING

Burster in the WP M110E1, M110 ammunition is loaded with tetrytol and should not be stored or fired at temperatures exceeding +125° F. (52° C.) Temperatures above 125° F. will cause the tetrytol to melt and/or exude, cuasing premature functioning. Prior to firing, inspect fuze well cup for dents in bottom surface. If dents are found and/or fuse is hard to seat, do not use round.

Smoke projectiles M110 and M110E1 have a burning effect, but are used primarily to produce screening smoke. These projectiles are similar to the M110 gas projectiles and have the same characteristics as the M107 HE. It weighs approximately 98 pounds (44 Kg).

(6) *Projectile, 155-mm, smoke, WP, M110A1 (M110E2), M110A2 (M110E3).* These projectiles are simililar to WP projectiles M110 and M110E1 except that there is no tetrytol in the burster. This projectile may be stored and transported at temperatures up to +145° F. (63° C.).

(7) *Projectile, 155-mm, smoke, BE, M116, M116B1 (M116E1).* The BE smoke projectile M116 is used for screening, and signaling purposes. It is issued with a filler of HC(white) chemical smoke mixture. This is a base ejection type round and contains four smoke canisters. It weighs approximately 86 pounds (39 Kg). M116 Model uses M501 fuze. The M116A1 projectile is a base ejection type similar to the M116 and M116B1 with the exception that it uses the M565 MT and M577 MTSQ Fuzes, and that it has improved M1 and M2 HC(white) smoke canisters.

WARNING

The M485 cannot be fired above zone 6. The M485A1 and M485A2 projectiles can be fired with zones 1 through 7 inclusive. Projectiles M485A1 and M485A2 are not reliable when fired at zones 6 and 7 with fuze settings of 10 seconds or less.

(8) *Projectile, 155-mm, illuminating, M485, M485A1 and M485A2.* This projectile is used for battlefield illumination. The projectile has a hollow steel body containing a primary expelling charge, a canister assembly and a drogue parachute. The canister assembly contains a secondary expelling charge, a delay holder, a light producing chemical, and the main parachute.

(9) *Projectile, 155mm improved conventional munitions (ICM) M449 series.* These projectiles are improved Conventional Munitions used primarily against personnel. They are base ejecting projectiles and contain sixty M43 grenades. The fuze, having been set to function at a pre-determined time in flight, initiates the expulsion charge ejecting the entire grenade load from the rear of the projectile. Centrifugal force disperses the grenades radially from the projectiles line-of-flight. The M43 grenade contains an air-burst submunition which is expelled from its housing on impact with the target. It is projected upward to burst 4 to 6 feet above the ground. The projectile weighs approximately 95 pounds and uses the M565 MT or M577 MTSQ time fuzes.

(10) *Projectile, 155mm, practice, M804* (fig. 196.1).

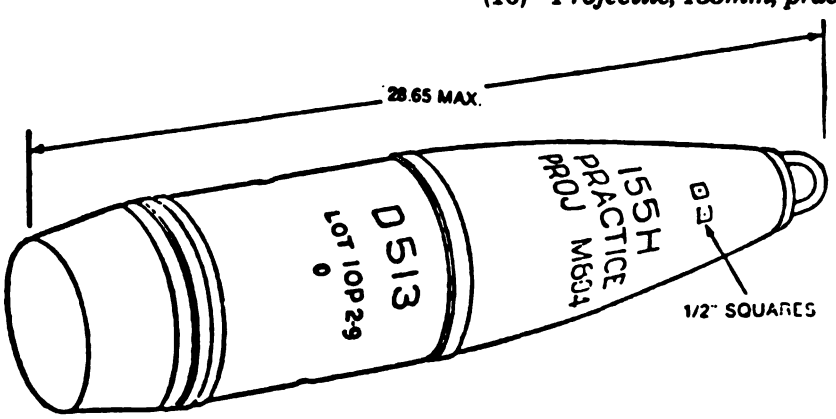


Figure 196.1. Projectile, 155mm, practice, M804.

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The M804 projectile is used in place of the M107 HE projectile in service practice exercises. The M804 contains a small smoke canister in the fuze well which provides flash and smoke for visual determination of functioning. The M804 is similar in weight and external configuration to the M107 HE projectile, and can be used in service practice without the blast and fragmentation which accompany functioning an M107 HE projectile. The body of the M804 projectile contains four holes, 90 degrees apart, which serve to disperse smoke on functioning.

(11) Deleted.

168. Authorized Fuzes

WARNING

The firing of a field artillery round without fuze or with an unauthorized fuze is strictly prohibited. Only authorized fuzes will be used with the authorized projectiles and propelling charges.

The following describes some of the fuzes to be used with this weapon. For additional information and more detailed descriptions and functioning of the authorized fuzes, see TM 43-0001-28. Authorized projectile-fuze combinations are contained in table 12.

Table 12. Authorized Projectile-Fuze Combinations for M114 and M114A1 Howitzer (M1A1 Cannon Tube)

Type and model number of projectiles	Impact PD		MT	MTSQ				Prox	VT
	M78A1	M739 or M557	M565	M501	M564	M577	M582	M732	*** M728
HE, M107	(CP) X	X			X		X	X	P
Smoke, WP, M110 series		X			X		X		
Smoke, HC and colored, BE, M116, M116B1, M116A1			X*	X**		X*			
Agent, GB or VX, M121A1		X							
HE, ICM, M449 Series			X			X			
Illumination, M485			X			X			
Agent, H or HD persistent, M110		X			X				
Practice, M804		X****							

X—Authorized fuze.

P—Supplementary charge must be removed.

* M116A1 uses M565 and M577 fuzes only.

** M116 and M116B1 use M501 fuze only.

*** WARNING: Overhead fire with the M728 fuze is restricted due to possible downrange prematures.

**** M739 Fuze not authorized for M804 projectile.

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Table 13. Authorized Projectile/Propelling Charge Combinations For The M114 (M1A1 Cannon Tube), M114A1 (M1A1 Cannon Tube) Howitzer

CAUTION
ONLY MK2A4 PRIMER MAY BE USED WITH M1A1 CANNON.

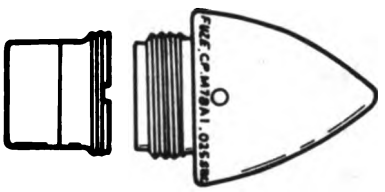
PROJECTILES	PROPELLING CHARGE										FIRING WARNINGS
	(GB) M3 & M3A1 ZONES					(WB) M4A1 & M4A2 ZONES					
	1	2	3	4	5	3	4	5	6	7	
HE, M107	X	X	X	X	X	X	X	X	X	X	
AGENT, H OR HD, M110	X	X	X	X	X	X	X	X	X	X	M110 agent loaded w/tetrytol burster cannot be stored or fired at temperature exceeding +125°F (+52°C).
AGENT, GB OR VX M121A1	X	X	X	X	X	X	X	X	X	X	
SMOKE, WP, M110, M110E1	X	X	X	X	X	X	X	X	X	X	M110 smk loaded w/tetrytol burster cannot be stored or fired at temperature exceeding +125°F (+52°C).
SMOKE, WP, M110A1, M1102A2	X	X	X	X	X	X	X	X	X	X	
SMOKE, BE, HC, M116, M116B1	X	X	X	X	X	X	X	X	X	NO	
SMOKE, BE, HC, M116E2	X	X	X	X	X	X	X	X	X	X	
ILLU, M485A1, M485A2	X	X	X	X	X	X	X	X	*	*	*See note below.
HE, M449 (ICM)	X	X	X	X	X	X	X	X	X	X	
Practice, M804	X	X	X	X	X	X	X	X	X	X	

X-Authorized propelling charge.
*Note: M485A1/A2 projectiles not reliable when fired at zones 6 and 7 with fuze settings of 10 seconds or less. Also, when firing at zone 1 from M114A1 howitzer, effective illumination times less than 90 seconds should be expected.

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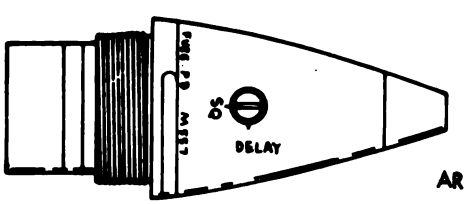
a. Fuze, Point Detonating, Concrete Piercing, M78, M78A1, and Booster M25 (fig. 197). M78 series fuzes are constructed especially for use against concrete targets. M78A1 fuzes are of two types; a nondelay type used primarily for spotting purposes, and a delay type used against concrete targets. The nondelay type has its nose painted white about 1-inch wide from the tip. Booster M25 is a separate assembly, but is packed and shipped with the fuze for assembly to the projectile at the time the projectile is to be fired. This booster is designed especially for use with M78 series and cannot be used with any other fuze. If used with a deep cavity shell, the supplementary charge must remain in the fuze well cavity.



AR912231

Figure 197. Point detonating concrete piercing fuze M78A1 and booster M25.

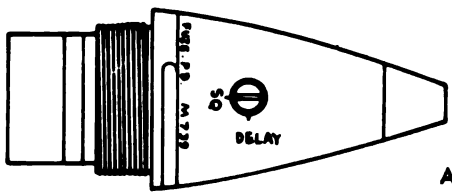
b. Fuze, Point Detonating, M557 (fig. 198). The M557 fuze has a selective superquick setscrew. It is packed set for superquick and has a booster attached. Duds may occur when set for delay functioning and fired with M3A1 Green Bag charge zones 1 and 2. Premature functioning can occur when fuzes are fired in heavy rain fall.



AR912232

Figure 198. Point detonating fuze M557.

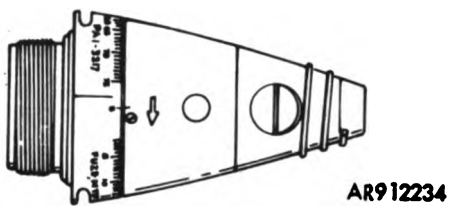
c. Fuze, Point Detonating, M739 (fig. 199). Fuze M739 is the latest improved version of the selective impact fuze. This fuze has an aluminum-filled body, and a rain insensitive head so that it can be fired through a heavy rainstorm without premature functioning of the round of ammunition. The fuze comes shipped set for superquick action, and can be set for delay action by turning the setscrew.



AR912233

Figure 199. Point detonating fuze M739.

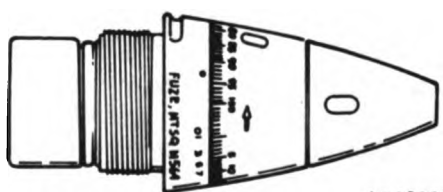
d. Fuze, Mechanical Time and Superquick, M501A1 or M501 (fig. 200). Fuze, M501A1 or M501 is a combination mechanical time and superquick fuze with settings for time action (2 to 75 seconds) and an impact element for superquick action but has no booster for detonation action. Do not use this fuze in any HE, WP, or gas projectile. When set for airburst, 20 percent fail to function with charge 1 and 10 percent with charge 2. Fuze will function on impact.



AR912234

Figure 200. Mechanical time and superquick fuze M501A1.

e. Fuze, Mechanical Time and Superquick, M564 (fig. 201). The M564 fuze is designed to function at time settings from 2.0 seconds up to 100 seconds or upon impact, depending upon which occurs first after arming. Fuzes manufactured through 1969 must be set on 90 seconds if superquick (impact) action is desired. Settings of these fuzes between S and 2 seconds may result in functioning after approximately 2 seconds. The date of manufacture is stamped on the fuze body before the lot number. Fuzes manufactured from 1970 on may be set as shipped on S for superquick (impact) functioning. Premature functioning of this fuze may occur downrange when the fuze is fired in rainfall.



AR912235

Figure 201. Mechanical time and superquick Fuze M564.

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f. Fuze, Mechanical Time, M565 (fig. 202). MT fuze M565 is similar to MTSQ fuze M564 except that the fuze contains neither the point detonating assembly nor the booster cup. Fuze M565 can be set from 2 to 100 seconds. Like the M564, fuze M565 employs a vernier scale to ensure a setting accuracy of 0.1 second. This fuze is used with base ejection projectiles only.

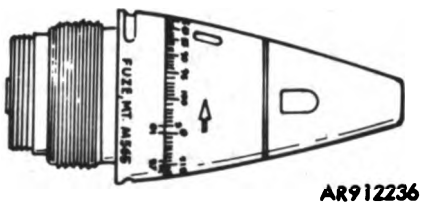


Figure 202. Mechanical time fuze M565.

g. Fuze, Proximity (VT), M728. (fig. 203). The M728 fuze is used with the deep cavity projectiles and is essentially a self-powered radio and transmitting unit. The fuze can be set from 5 to 100 seconds. The setting on the time ring determines at what time along the trajectory the fuze will become activated. It also has an impact element that is armed three seconds after firing and will function either on proximity action or impact action, whichever occurs first. The nose of this fuze has been painted (black) to reduce static electricity.

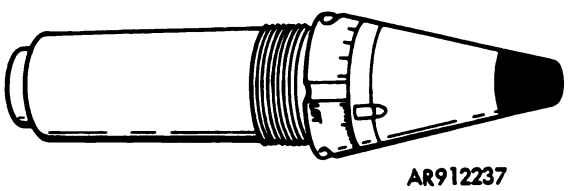


Figure 203. Proximity VT fuze, M728.

h. Fuze, Mechanical Time and Superquick, M577 and M582 (fig. 204). This fuze is used with ICM Projectile and other base ejection projectiles.

(1) This fuze has a 200 second mechanical time mechanism with three movable digital dials similar to a speedometer. The time setting key is located on the end of the fuze nose, and enables the fuze to be set to the nearest 0.1 second. Each fuze has a window through which the dials are viewed. The dial closest to the fuze nose indicates the time in hundreds of seconds (the triangle position is a non-time setting).

The second dial indicates time in tens of seconds and the third dial indicates the nearest second and 0.1 second by using the scale on the right edge of the dial. The time desired is set under the hairline.

(2) The M582 is identical to the M577 with the exception of the standard booster pellet and booster cup which has been installed on the M582.

i. Fuze, Proximity, Variable Time, M732 (fig. 205). This proximity variable time (VT) fuze is a short-intrusion fuze of the same overall length as the standard impact or mechanical time fuze. The supplementary charge must be left in the fuze well for proper functioning of this fuze. This fuze has a time ring that can be set from 0 to 150 seconds.

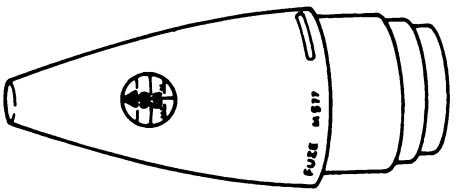


Figure 204. Mechanical time and superquick fuze, M577.

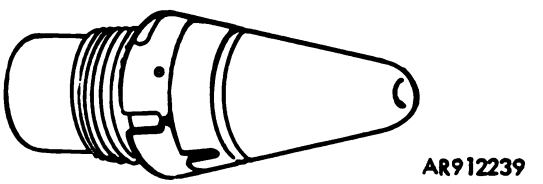


Figure 205. M732 fuze.

169. Authorized Propelling Charges

The following are authorized propelling charges for the M114 and M114A1 howitzers:

a. Propelling Charge M3A1.(fig. 206) This is a green bag charge divided into a base and four increments for firing in zones 1 through 5. It has a flash reducer pad assembled forward of the base charge with similar one-ounce pads assembled forward of increments 4 and 5. The increment bags are tied together by cloth typing straps. A CBI igniter charge in a red cloth bag is sewed to the rear of the base section.

b. Propelling Charge M3 (fig. 206). This is a green bag charge similar to the propelling charge M3A1 except that it is not assembled with a flash reducer and black powder is used in the igniter pad.



Figure 206. 155-mm propelling charges for howitzer.

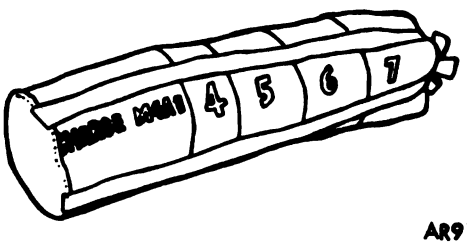
c. Propelling Charge M42A2 (fig. 207). This is a white bag charge consisting of a base charge and four increments for firing zones 3 through 7. The increments are tied together by cloth typing straps. An igniter charge in a red cloth bag is sewed to the rear of the base section. It has a flash reducer pad assembled forward of the base charge.

d. Propelling Charge M4A1 (fig. 207). Propelling charge M4A1 is identical to the M4A2 except that the charge is assembled without a flash reducer, and

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the igniter contains black powder instead of CBI. The M2 flash reducer may be used with this charge and is a separate item of issue.

e. Propelling Charge M4 (fig. 207). This is a white-bag charge identical to the M4A1 except that it is designed for firing in zones 5 through 7 only, and consists of a base charge and two increments. Flash reducer M2 is also used with this charge.

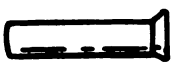


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Figure 207. White-bag charge.

170. Primer MK2A4

Percussion primer MK2A4 (fig. 208) is the only authorized primer to be used in the M1, M1A1, or M1A2 tube. Primers are ready for firing when unpackaged.



AR912242

Figure 208. MK2A4 Primer.

171. Flash Reducer M2 (T2)

M2 flash reducer consists of a red cotton cloth bag, 4 inches square, containing black powder and potassium sulfate or potassium nitrate. It is a separate item of issue and may be used with charges M4 and M4A1 if additional flash reduction is desired. In preparing a white-bag charge M4 or M4A1 for firing, one flash reducer is added at the forward end of each increment used. No flash reducers are required when using green-bag charge M3. Use of M2 flash reducer to reduce muzzle flash when firing propelling charge M4 or M4A1 series is optional, except when TB 9-1300-385-1 or -2 restricts a specific propelling charge lot to use with flash reducer only. The flash reducer pads serve to limit breech flareback as well as muzzle flash and blast overpressure.

Section III. PREPARATION FOR FIRING

172. General

NOTE

Ammunition components are handled by cannoneers No. 2, 3, 4, 5, 6, and 7.

a. Temperature Limits. Unless otherwise specified, observe the following temperature limits when firing:

(1) Lower limit is −40°F (−40°C).

(2) Upper limit is +125°F (+52°C).

b. Packing and Unpacking Ammunition Components. Retain packing materials for repackaging, as required.

(1) Propelling charges M3 series are packed two per metal container, with or without primer MK2A4. Propelling charges M4 series, are packed one per metal container.

CAUTION

Percussion primer MK2A4 is the only authorized primer to be used in the M1, M1A1, and M1A2 tubes. Do not use M82 in these tubes.

(2) Primers MK2A4 are packed one per waterproof bag.

(3) M2 flash reducers (T2) are packed 200 per metal container (four containers, 800 flash reducers per wooden box).

(4) Fuzes are generally packed in metal boxes. The metal boxes are then packed in wooden boxes.

c. Procedures. Inspect ammunition components and verify item identification.

CAUTION

Do not use axes, crowbars, etc., which may damage ammunition or packaging.

(1) Unpack ammunition and perform inspections indicated in paragraphs 174.14 through 174.17 of this chapter.

WARNING

Inspect your ammunition. Failure to accomplish required inspections can result in unnecessary malfunctions.

(2) Return all defective ammunition to Ammunition Supply Point.

173. Preparation For Firing

Preparation for firing the four components of a complete round of 155-mm ammunition requires efficient teamwork among the cannoneers. They must quickly and accurately select, unpack, inspect, and prepare the correct primer, propellant, projectile, and fuze from the fire commands received by the howitzer section. Certain numbered cannoneers prepare the fuze and projectile; other cannoneers prepare the propellant, and still another cannoneer may insert the primer in the firing lock after the fuzed projectile and propellant have been loaded, and the breechblock has been closed. The chief-of-section

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must thoroughly crosstrain the entire crew so that any crewmember can perform any or all of the duties required for any other crewman.

a. Primer MK2A4. Do not open moisture protective bag until ready to use the primer. Cannoneer No. 1 is the crewman that normally loads the primer.

b. Propellant. Cannoneer No. 4 will unpack, inspect, and prepare the designated propelling charge and pass it to cannoneer No. 1 after the fuzed projectile has been loaded.

c. Projectile. Projectiles for this howitzer normally come packed eight to the pallet, with top and bottom of the wood pallets banded together. Each projectile has an eyebolt lifting plug and a grommet attached for protection during shipping and handling activities. Cannoneer No. 7 will select the right projectile, announce in the fire commands, and prepare it for firing as follows:

(1) Inspects and cleans projectile.

(a) Verifies that the projectile is the type designated by the fire commands.

(b) Removes grommet and examines rotating band to insure that it is free from all dirt and burrs.

NOTE

A projectile with a burred rotating band will be put aside until the burrs can be removed with a file.

(c) Cannoneer No. 2 removes eyebolt lifting plug and gasket and examines the fuze well for leaks or damage to the filler. If any high explosive filler residue clings to the threads of the fuze well, reject the round and get another one to complete the fire mission.

(d) Cannoneers No. 2 and 7 examine entire projectile for defects and check to see that the projectile is not damaged or corroded and is free of dirt, grease, sand, oil, and so forth. Slight rust on the projectile is acceptable.

NOTE

Any sand, dirt, oil, or grease left on the projectile will cause wear, scratches, or gouge in the bore.

(2) Cannoneer No. 7 holds projectile upright for fuzing and fuze setting.

(a) If required, holds projectile firmly while cannoneer No. 2 fuzes the projectile and sets the fuze.

(b) Reads and announces the time set on the fuze by cannoneer No. 2 when directed.

(3) Cannoneers No. 2 and 7 carry fuzed projectile to the weapon.

174. Fuzing

a. General (fig. 209). There are three basic types: impact, mechanical time, and proximity VT fuzes. Cannoneer No. 2 must select the right fuze on command FUZE, unpack, inspect, install it in the projectile and set it as commanded (TIME, SUPER-QUICK, DELAY).

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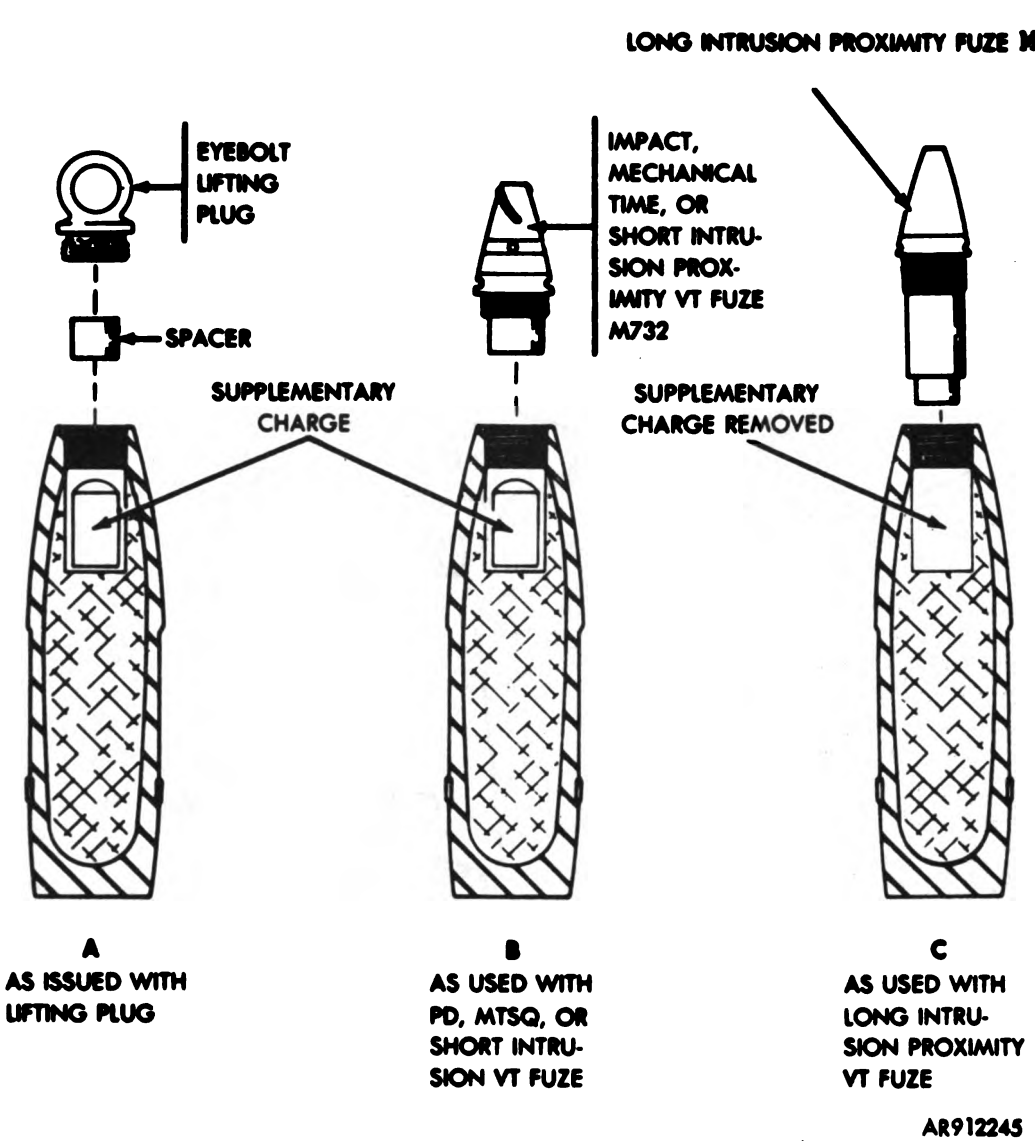


Figure 209. Typical deep-cavity projectiles.

b. Lifting Plug Removal.

WARNING

Do not use projectiles with explosive on the threads or evidence of explosive powder or exudation.

(1) Remove plug and inspect the filler beneath the plug.

(2) Inspect cavity and projectile threads for damage. Remove loose material from cavity. If any high explosive is found stuck to the threaded portion of the projectile throat, do not fire.

c. Supplementary Charge.

WARNING

Do not fire CP, PD, MTSQ, or the new short intrusion VT fuzes in a deep cavity projectile without the supplementary charge.

WARNING

Do not attempt to remove supplementary charge by any means other than the lifting loop. Use of screwdrivers or other tools to remove the charge by force is dangerous.

For the long, intrusion proximity fuze firings, remove supplementary charge by means of its lifting loop. Ifthe charge cannot be removed by its lifting loop, either fire with a short intrustion VT, PD, or MTSQ or dispose of the round.

d. Fuze Assembly.

(1) The following procedures apply to all fuzes. See (2) and (3) below for special instructions for M78 and M577 fuzes.

(a) Screw fuze in by hand. If binding occurs, inspect fuze cavity and threads of both fuze and projectile. Reject whichever is at fault.

WARNING

When tightening fuze to projectile, do not hammer on fuze wrench or use extension

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handle on fuze wrench. Do not stake fuze to projectile under any circumstances. Shocks transmitted to fuzes during assembly may cause a malfunction.

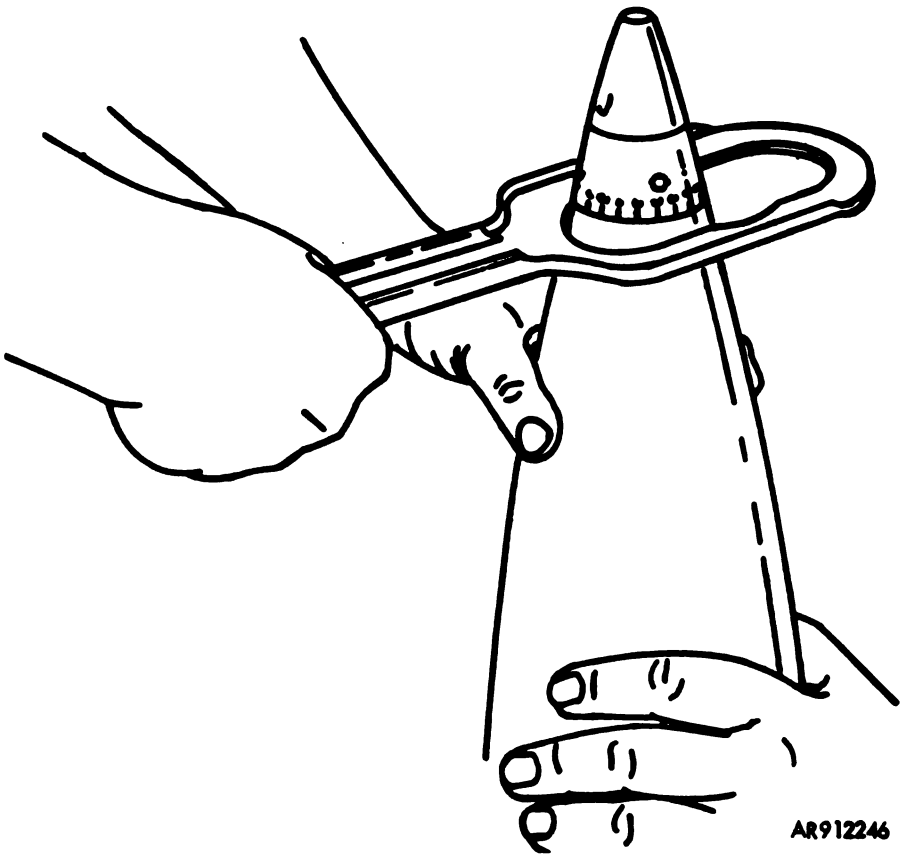


Figure 210. M18 Fuze wrench on M557/M739 fuze.

(b) After assembling fuze by hand, back fuze off ¼-turn. Using fuze wrench M18, tighten fuze to projectile with a sharp snap of the wrench so that the fuze shoulder is seated firmly against the projectile nose (fig. 210).

WARNING

Rounds fired without a fuze or with improperly seated fuzes may result in premature functioning.

NOTE

For proximity fuzes with a gap between the fuze shoulder and projectile, either replace the supplementary charge and fire with impact PD or MTSQ fuze or dispose of round.

(c) If projectile setscrew is present, tighten to below level of contour of projectile.

(2) Special preparation for M78 (CP) fuze.

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Figure 211. M16 Fuze wrench on M78 fuze.

(a) 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 (fig. 211). Boosters that are issued without safety pins should not be used.

NOTE

The booster must always be assembled to the projectile first. It cannot be assembled to the fuze, but it is shipped in the same fuze container.

CAUTION

Always be sure that the supplementary charge is in the deep cavity projectile before adding fuze-booster combination.

(b) Screw fuze M78A1 (or M78) into the fuze cavity and tighten it securely with the fuze end of fuze wrench M16. Make sure that 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.

(3) Special preparation for M577 fuze.-Inspect the fuze setting. If the setting is not between 93.5 and 95.5, or the fuze shows signs of damage, or the window is blackened or sooty inside, the fuze will be considered unserviceable.

WARNING

When screwing the projectile spotting charge onto rear of M577 fuze, assure that the shoulder of projectile spotting charge is seated squarely against the shoulder of the fuze. An improperly seated charge could cause a malfunction.

CAUTION

When assembling the projectile spotting charge to a fuze, exercise care to avoid damaging threads. If binding occurs, consider charge unserviceable and report it for disposition. If binding has occurred, reinspect fuze to assure it is still serviceable.

174.1. Fuze Setting

The following procedures apply to all authorized fuzes. Fuze setting tools and procedures are listed in table 14.

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Table 14. Fuze, Fuze Setting Tools, and Procedures

Fuze									
PD			MT	M501	MTSQ		PROX		
M577	M739	M78 CP series	M565		M564	M577/ M582	M732/ M728	Setter	Procedure number
		X						Fuze setter wrench M16	174.d (2)
X	X							Fuze setter wrench M18	174.1a
							X	M27	174.1b
			X		X			M34	174.1c
						X		M35	174.1d
				X				M27	174.1e

a. Procedures No. 1, M557 and M739 (fig. 211.1).

NOTE

PD fuzes with SQ or delay functioning are shipped set for SQ action.

(1) If superquick action is desired, check the setting to make sure it is set at SQ.

(2) To set fuzes for delay action, use screw driver end of fuze wrench M18 or similar tool and turn slot 90 degrees to align with index mark indicating DELAY.

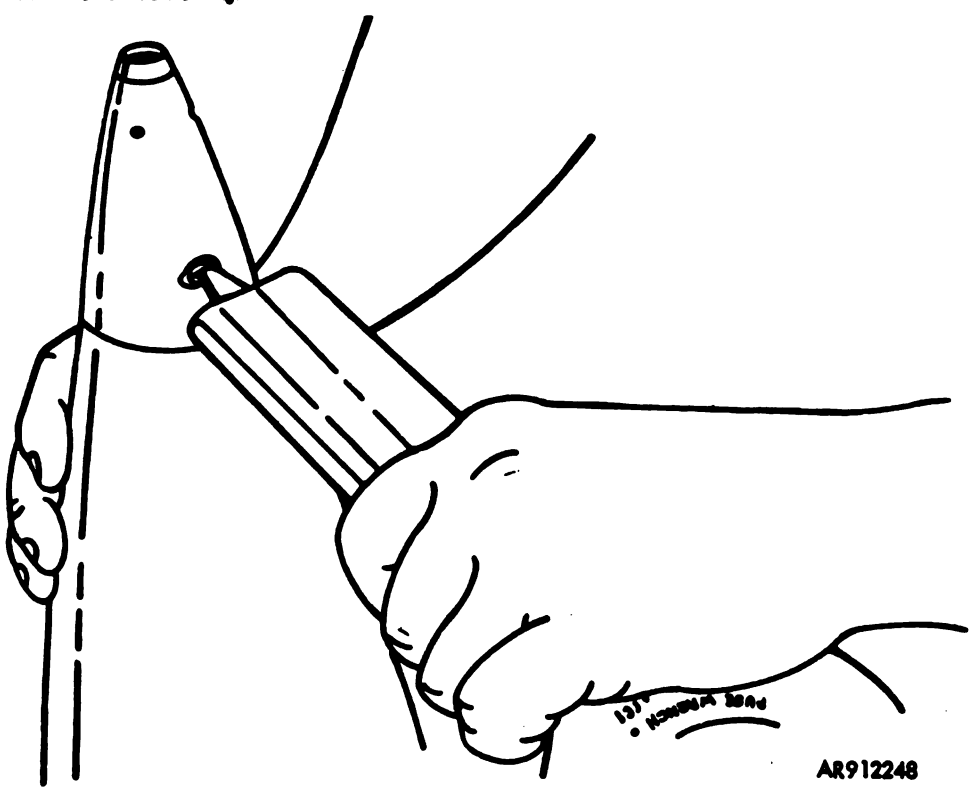


Figure 211.1. M18 Fuze wrench on M557 and M739 fuzes.

b. Procedures No. 2 M728/M732 (fig. 211.2).

CAUTION

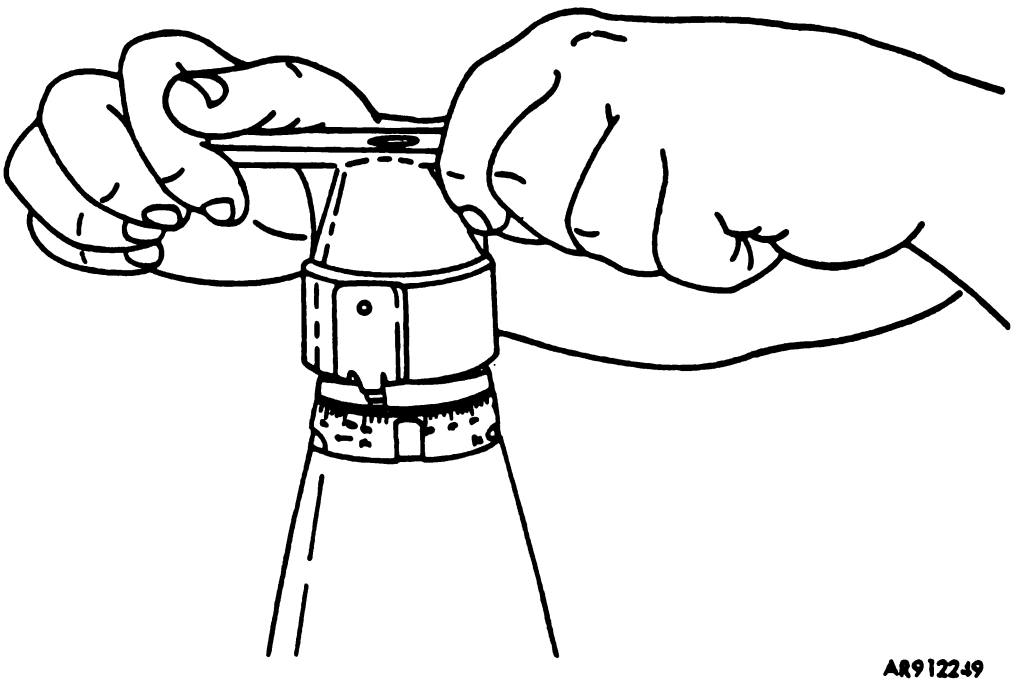
Plastic nose cone rotates with index mark. Damage to plastic will produce duds. However, since there is no backlash, fuze setting can be accomplished or changed one or more turns with no harmful effect. If counter-

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clockwise rotation is used, be sure that fuze has not become loosened from projectile.

NOTE

M728 fuzes are shipped with the index mark on the nose cone set at 10 seconds.



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Figure 211.2. M27 Fuze setter on M728 and M732 fuzes.

(1) To set fuze for proximity action, rotate nose cone with M27 fuze setter (normally in clockwise direction while looking down on nose of fuze) until the index mark coincides with the announced time. Fuze setting can be changed one or more times with no harmful effects.

(2) For impact functioning of M728/M732 fuzes, set fuzes to 90 seconds using the M27 fuze setter.

Note. The PD setting of the M732 VT fuze when fired into soft impact areas will be less deadly than the superquick (SQ) setting of the M739 PD fuze.

(3) Fuze is set when index line at base of nose cone is aligned with time, in seconds, engraved on base of fuze.

(4) Firing temperature limits for proximity fuze M728/M732 are −40° F. to + 140° F.

WARNING

Do not fire projectile unless fuze is fully seated. Avoid firing within 750 meters of friendly elements with this fuze.

c. Procedures No. 3, M565 and M564 (fig. 211.3).

WARNING

TO AVOID ACCIDENTAL FUNCTIONING OF PD ELEMENT IN FUZE M564, DO NOT DROP, ROLL OR STRIKE FUZES UNDER ANY CIRCUMSTANCES (PACKAGED, UNPACKAGED, OR ASSEMBLED TO THE PROJECTILE).

NOTE

Do not attempt to set fuzes until just before firing.

If the M546 fuze is to be fired for superquick action (impact) only, first check the year of manufacture stamped on the fuze body, and follow the instructions below as appropriate.

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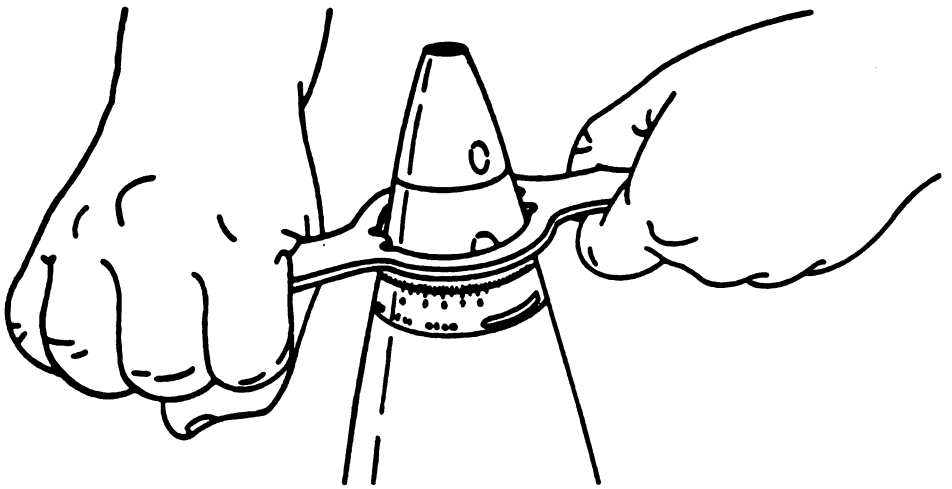


Figure 211.3. M34 Fuze setter on M564 fuze.

(1) *Setting M564 Fuze for superquick (impact) action.*

NOTE

M564 Fuzes manufactured before January 1970 must be set on 90 seconds if superquick action (impact) is desired. M564 Fuzes manufactured from January 1970 on, should be set on "S" for superquick action. The year of manufacture is stamped on the M564 Fuze Body. These fuzes are shipped with the "S" on the lower cap scale aligned with the "0" on the vernier scale (fig. 211.3.1).

(a) M564 fuzes manufactured prior to January 1970. Use fuze setter M34 to rotate the lower cap in the direction of the arrow (clockwise) from shipping "S" position until the 90 second position on the lower cap scale is aligned with the "0" on the vernier scale (fig. 211.3.2).

(b) M564 fuzes manufactured in January 1970 and later. Set the fuze on "S" as shipped for superquick action. Always be sure the "S" on the lower cap scale is aligned with the "0" on the vernier scale (fig. 211.3.3).

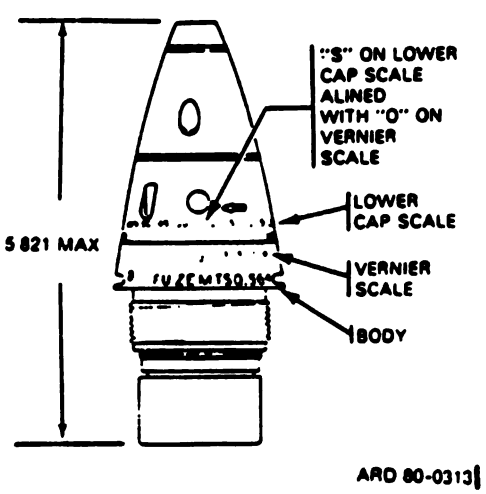


Figure 211.3.1. M564 fuze in "S" shipping position.

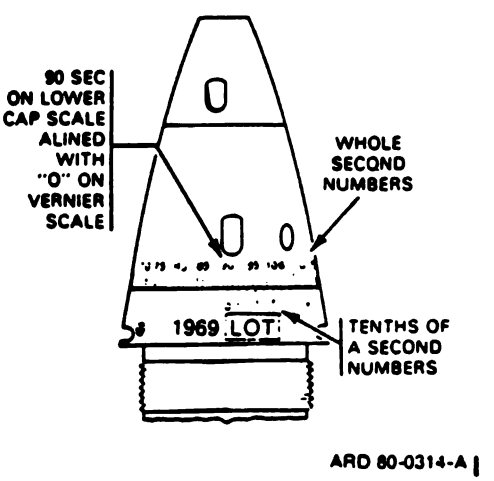


Figure 211.3.2. Correct setting for M564 fuze manufactured prior to January 1970 for superquick action (impact).

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(2) *Setting M564 and M565 fuzes for airburst (time).*

WARNING

INCORRECT SETTINGS OF MT AND MTSQ FUZES CAN AND HAVE RESULTED IN DOWNRANGE PREMATURE MALFUNCTIONS.

(a) To set the M564 or M565 fuze for a whole second time setting, use the fuze setter M34 or M63 to rotate the lower cap IN THE DIRECTION OF THE ARROW (CLOCKWISE), until the desired whole number of seconds (e.g., 20.0 seconds) on the lower cap scale is aligned with the "0"-mark engraved on the vernier scale (fig. 211.4).

(b) To set the M564 or M565 fuze for a tenth of a whole second (i.e., 20.5 seconds), use the fuze setter M34 to set the fuze for the whole seconds on the lower cap scale (in this case the whole is 20 seconds). Next find the desired tenth of a second mark on the vernier scale (the 0.5-second mark is between 29 and 30 whole second marks in figure 211.4). Continue to rotate the lower cap IN THE DIRECTION OF THE ARROW until the adjacent upper right graduation on the lower cap scale is aligned with the desired tenth of a second mark on the vernier scale (the 0.5-second mark is now aligned with the 30-second mark on the lower cap scale (fig. 211.4.1.).

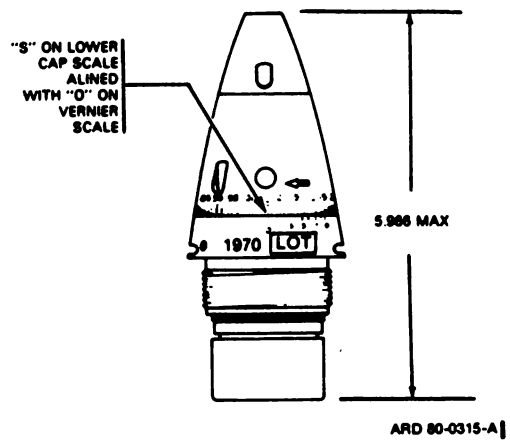


Figure 211.3.3. Correct setting for M564 fuze manufactured from January 1970 on for superquick action (impact).

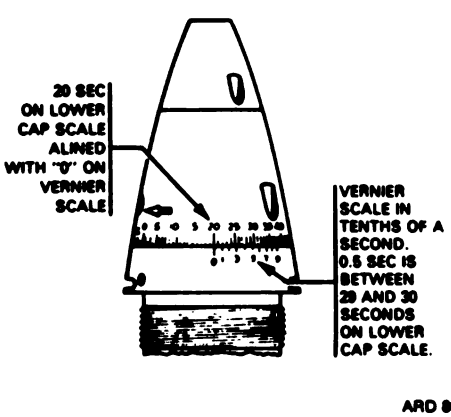


Figure 211.4 Fuze set for 20 seconds.

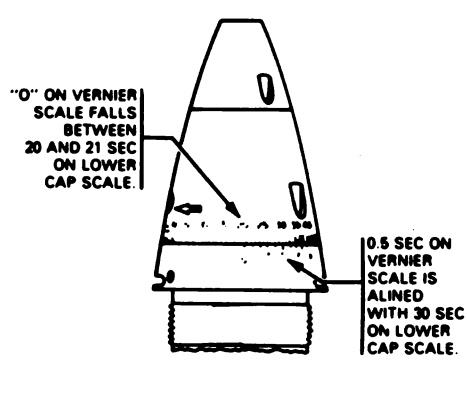


Figure 211.4.1. Correct setting for 20.5 seconds.

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NOTES

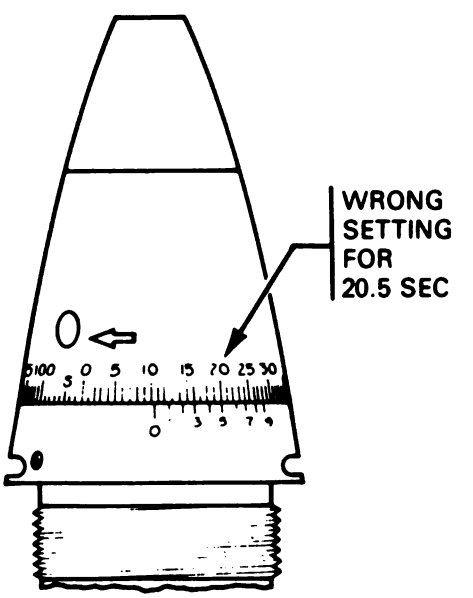
The fuze setting is always indicated by the position of the "0" on the vernier scale. Each vertical mark on the lower cap scale (moveable portion of fuze) represents one whole second of time. For other than whole seconds settings, the "0" on the vernier scale (non-moveable portion of the fuze) must always be to the right of the whole second portion of the desired fuze setting and between the whole second portion of the desired fuze setting and the next one whole second vertical mark. For example, for a setting of 20.5 seconds, the "0" on the vernier scale is to the right of the 20-second mark and midway between the 20 and 21-second marks on the lower cap scale.

An incorrect fuze setting for 20.5 seconds is shown below. If a fuze is set in this way for 20.5 seconds firing, the fuze is actually set on and will function at 10.5 seconds. This would cause the fuze to function earlier than desired (fig. 211.5).

(3) *Resetting fuze.* If you miss the setting, use the M34 fuze setter and turn the lower cap in the opposite direction (counterclockwise) 2 or 3 seconds below the desired setting. Then rotate the lower cap in the direction of the arrow (clockwise) and set the fuze on the correct time. This can also be done by turning the lower cap in the direction of the arrow (clockwise) all the way around (additional turn) to obtain the desired setting.

(4) *Fuzes not fired.* If prepared for firing but not fired, reset the fuze, using fuze setter M34 or M63, by turning the lower cap in the direction of the arrow (clockwise) until the "S" mark on the fuze lower cap scale is in line with the "0" mark on the vernier scale.

(5) *Fuzes fired in heavy rainfall.* If the M564 fuzes are fired in heavy rainfall, occasional downrange premature functioning may occur. The rainfall necessary to cause malfunctioning is comparable to a heavy downpour which occurs during a summer thundershower. The premature rate will vary with the charge fired and the density of the rainfall.



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Figure 211.5. Fuze incorrectly set by placing the 0.5 second on the vernier scale under the 20-second setting.

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(c) Deleted.

d. Procedures No. 4, M577 and M582. (fig. 211.6). The slotted setting key on the nose of the fuze is used for setting the fuze in the following steps:

(1) Press the open end of M35 fuze setter against the setting key.

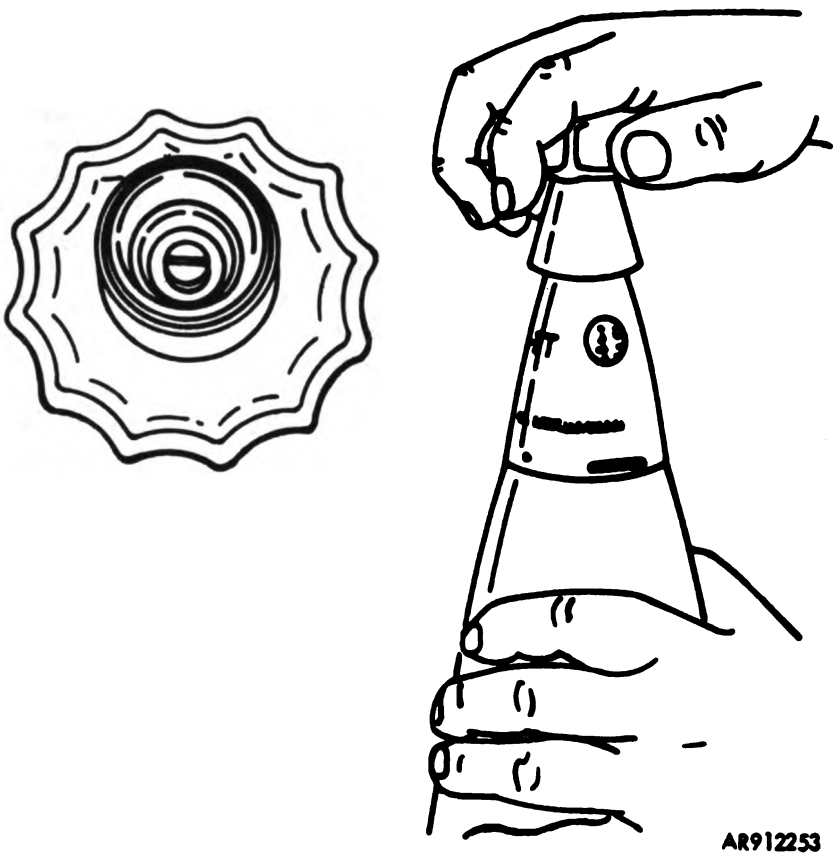


Figure 211.6. M35 Fuze setter on M577 and M582 fuzes.

(2) Turn the knob handle of the fuze setter counterclockwise as viewed from the nose end until setter blade engages fuze setting key slot. The hairline in the window is used for all settings.

NOTE

The fuze M577 or M582 is set to the desired time by rotation of the fuze setter in a counterclockwise direction. To return to shipping and storage setting, the fuze setter must be rotated in a clockwise direction.

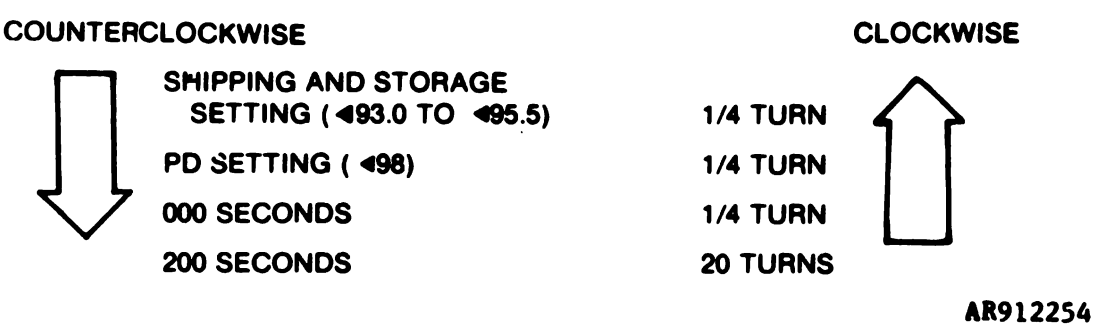


Figure 211.6.1. Fuze setting chart for M577 and M582 fuzes.

CAUTION

Do not attempt to set these fuzes below ◄93.5 when setting them in the clockwise direction or above 200 seconds when setting them in the counterclockwise direction. The settings of 000 to 200 are not authorized service settings.

(3) When setting fuze for PD action

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(superquick), start with shipping and storage position (safe) (◄93.5 to ◄95.5), and then turn counterclockwise to ◄98.0 under the hairline window (fig.211.6.1) for PD action.

(4) To set fuze for mechanical time action, turn the fuze setter counterclockwise from SAFE position (◄93.5 to ◄95.5) past PD (◄98.0) until the triangle (◄) disappears). This action occurs near a 000 setting. Continue to turn fuze setter counterclockwise until desired time appears under the hairline. Maintain a very light turning force against the fuze setter while reading the setting. The sequence is illustrated below for a setting of 25.5. (fig. 211.7).

(5) To set lower time on a fuze already set, reseat fuze setter and turn clockwise (numbers get smaller) to a setting at least 1 second lower than the required setting (for example, at least 24.5 to 25.5).
Reverse direction to counterclockwise (numbers get larger) and set required time under the hairline.

(6) To return fuze to shipping and storage (safe) position, turn fuze setter clockwise (numbers get smaller) until 000 is passed, and continue to turn until setter stops turning freely. This point should be past the PD setting (◄98.0) and between ◄95.5 and ◄93.5. Notice that the triangle has reappeared in the window. Do not apply excessive force on the fuze setter after it has stopped turning and the setting is between ◄95.5 and ◄93.0. Return fuze to reusable fuze container. Fuze is considered unserviceable after being out of container for more than 30 days.

e. Procedure No. 5, M501 Series.

WARNING

Dropping or rough handling of a projectile assembled with Fuze MTSQ M501/M501A1 may result in fuze functioning and expulsion of projectile base plate and contents. When handling projectiles assembled with this fuze, exercise extreme care to protect the fuze from impact. Keep pull wire on fuze in place until immediately prior to firing.

CAUTION

Do not fire fuzes with cocked or loose lower caps. Mark such fuzes "defective" and return them to the ammunition supply point.

NOTE

The M501 series fuzes are shipped with the index mark on the lower cap aligned with the S engraved on the base.

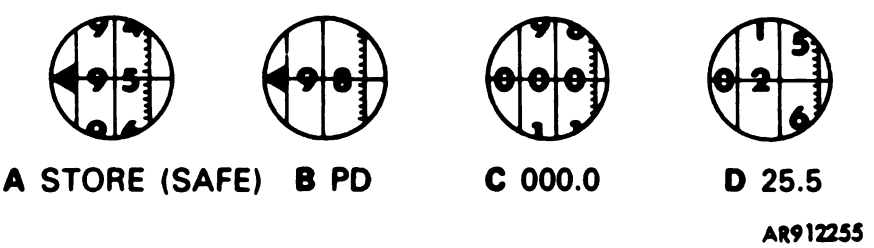


Figure 211.7. Fuze setting sequence.

(1) *Time setting.*

(a) Check fuzes for cocked or loose lower caps.

(b) To remove safety wire before setting, pull end of wire from hole in lower cap, sliding wire off end of fuze.

(c) With fuze setter M27, set fuze by rotating lower cap to desired time—in counterclockwise direction or in direction of arrow marked on lower cap. The fuze is properly set when the index mark on the lower cap is aligned with desired time, in seconds, engraved on the base.

(d) If, after the fuze is set, the round is not fired, reset the fuze to safe (S) and place the safety wire in its proper position.

(2) *Impact setting.* Impact functioning of the MTSQ fuze M501 series may be obtained by either leaving the S (shipping mark) aligned with the index mark on the base or by setting the graduated time ring so that the time setting is greater than the time of flight. Remember, you must remove the safety wire (pull free end of wire off and out of hole) before firing or setting the fuze.

174.2. Propelling Charge Preparation for M3 Series and M4 Series.

WARNING

Under no circumstances will green bag and white bag charges be assembled together for firing. Critical malfunction could occur.

WARNING

White bag charges M4A2 and M4A1 can be expected to perform within design limits at Zones 5 through 7. However, large dispersions may result when these charges are fired at zones 3 and 4. It is recommended that green bag charges M3A1 and M3 be used in lieu of white bag charges at Zones 3 and 4. If green bag charges are not available, white bag charges may be used with the knowledge that range dispersions may result.

(a) If required, untie tie straps and remove unrequired increments from charge.

(b) Retie tie strap tightly over top of charge wit two interlapping square knots.

(c) In preparing white bag charge M4 and M4A1 one M2 flash reducer should be added to the forward

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end of each increment used. The charge must be untied and the proper number of M2 flash reducers inserted (i.e., one flash reducer is added at the forward end of the base charge and each increment used). The charge is then retied with two interlapping square knots.

NOTE

Use of M2 flash reducer, to reduce muzzle flash, is optional except when TB 9-1300-385-1 or -2 restricts a specific propelling charge lot to use with flash reducer only. Propelling charge M4A2 has a flash reducer assembled forward of the base charge (increment No. 3) at the time of manufacture, and does not require use of the M2 flash reducer.

174.3. Loading

WARNING

Do not load or fire artillery ammunition without authorized fuze. Firing of such rounds without fuzes or with unauthorized fuzes could result in in-bore prematures and other hazardous conditions.

Do not load or fire round if fuze is not fully seated.

Firing of fuzes M557 and M564 during heavy rainfall may result in occasional downrange prematures. The amount of rainfall necessary to cause functioning is comparable to the heavy downpour which occurs during a summer thundershower.

Do not fire proximity fuzed ammunition at targets closer than 732 meters (800 yards) to friendly positions.

a. Make sure round is clean and fuze is present and fully seated.

WARNING

Firing a round with an obstruction in the cannon tube can cause an in-bore premature.

b. Make sure there are no obstructions in the cannon tube.

c. Check cannon firing lock to see that primer expended in previous firing has been removed.

d. Remove grommet from projectile.

e. Load fuzed projectile into cannon and ram it solidly into the firing chamber.

WARNING

Never load a propelling charge into the chamber by increments. Only fully assembled charges will be used.

f. Remove the igniter protective cap from propelling charge and load propelling charge into cannon chamber, with igniter end (red bag) toward breech.

WARNING

Never close the breechblock unless you can see the red igniter bag on the base of the propelling charge.

g. Close and lock breechblock.

WARNING

Never insert primer in primer seat unless breechblock is closed and locked.

h. Insert primer in firing mechanism.

i. Insert firing mechanism in firing mechanism housing.

174.4. After Firing

a. Open breechblock and secure in the open position.

b. Wipe face of obturator spindle after each round. Swab powder chamber with sponge and water making sure that all burning fragments of powder charge are removed from firing chamber.

c. All ammunition fired must be recorded by charge number, type, and total number of each fired, and entered on DA Form 2408-4 by the chief-of-section.

174.5. Ammunition Prepared For Firing But Not Fired

a. Using applicable setter and procedure (table 14), reset the fuzes of projectiles prepared for firing but not fired (time fuzes reset to safe, VT fuzes reset to initial setting at which they were shipped, superquick and delay reset to SQ). Replace safety wires in those fuzes so furnished.

b. Disassemble fuze from projectile and repack in original packing. When proximity fuze is removed from projectile, replace supplementary charge in projectile before assembling spacer and lifting plug.

c. Replace grommet over rotating band.

d. Restore propelling charges to original condition. Make sure all zones (increments) are present, tied, in proper order, in good condition, and of the proper lot number.

e. Replace fuzes, primers, and flash reducers in original packing.

f. Make sure the lot number of the ammunition corresponds with the lot number on the container.

WARNING

Use no other lifting plug except the fusible plug removed from the M449 projectile, because it is designed for safety release of pressure inside the projectile in case of a malfunction during storage or shipping actions.

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Section IV. MISFIRE/CHECKFIRE PROCEDURES

174.6. General

a. Conditions described in this section are rarely encountered when authorized and properly maintained ammunition is fired in a properly maintained and operated weapon. However, to avoid injury to personnel and damage to equipment, it is important that all concerned understand the following:

(1) What is involved when this weapon fails to fire.

(2) What should be done when a failure to fire occurs.

b. The authorized rates of fire are:

WARNING

When the authorized rates of fire for the M114 or M114A1, are exceeded, propelling charge cook-off's may occur within 5 minutes after chambering.

(1) Maximum rate: 4 rds/min for 3 minutes.

(2) Sustained rate: 1 rd per minute.

174.7. Definitions

a. Misfire. When the weapon does not fire after an attempt to fire has been made. This failure may be due to tha failure of the primer, the igniter, the propelling charge, or firing mechanism to function wholly or in part. A misfire in itself is not dangerous; however, it cannot be immediately distinguished from a hangfire. Misfires must be treated as hangfires until determined otherwise.

b. Checkfire. A command normally given by the executive officer. But, in an emergency, may be given by anyone present. On this command, regardless of its source, firing will cease immediately and the unloading operation will be initiated.

c. Hangfire. A delay in functioning of the primer, igniter, or propelling charge. This delay is unpredictable and may range from a fraction of a second to 10 minutes.

d. Cook-off. The functioning of the propelling charge or projectile when initiated by the heat of the weapon.

e. Hot Tube. Any tube that causes water from a wet swab to boil, fry, or steam off when placed just forward of the gas check seat.

f. Cold Tube. Any tube that does not cause water from a wet swab to boil, fry, or steam off when placed just forward of the gas check seat.

174.8. Failure To Fire With a Cold Tube

WARNING

Early primer removal (prior to two minutes) can expose the cannoneer to the danger of recoiling weapon in case a hangfire condition exists. Stand clear of recoiling parts, exposing only the hand and the arm when removing the primer at the end of the safe wait period (10 minutes).

a. Follow misfire procedures of figure 211.8.

b. There is no danger of a cook-off in a cold tube.

174.9. Failure To Fire Or Interrupted Fire With a Hot Tube

a. Follow misfire procedures of figure 211.9.

b. Observe the following warnings.

WARNING

Primer removal may expose cannoneer to the danger of a recoiling weapon in case a hangfire condition exists. Stand clear of recoiling parts, exposing only the hand and arm when removing the primer before the end of the safe wait period. If a commander, in order to avoid prolonged loss of weapon, determines to fire projectile, it must be fired within 5 minutes following projectiles chambering to prevent any chance of cook-off.

Do not attempt to remove projectile.

c. Wait two hours, then proceed as follows:

(1) Remove firing mechanism and propelling charge.

(2) Place waste in chamber.

(3) Close breech.

(4) Lock in traveling position.

(5) Carefully move weapon to a remote location.

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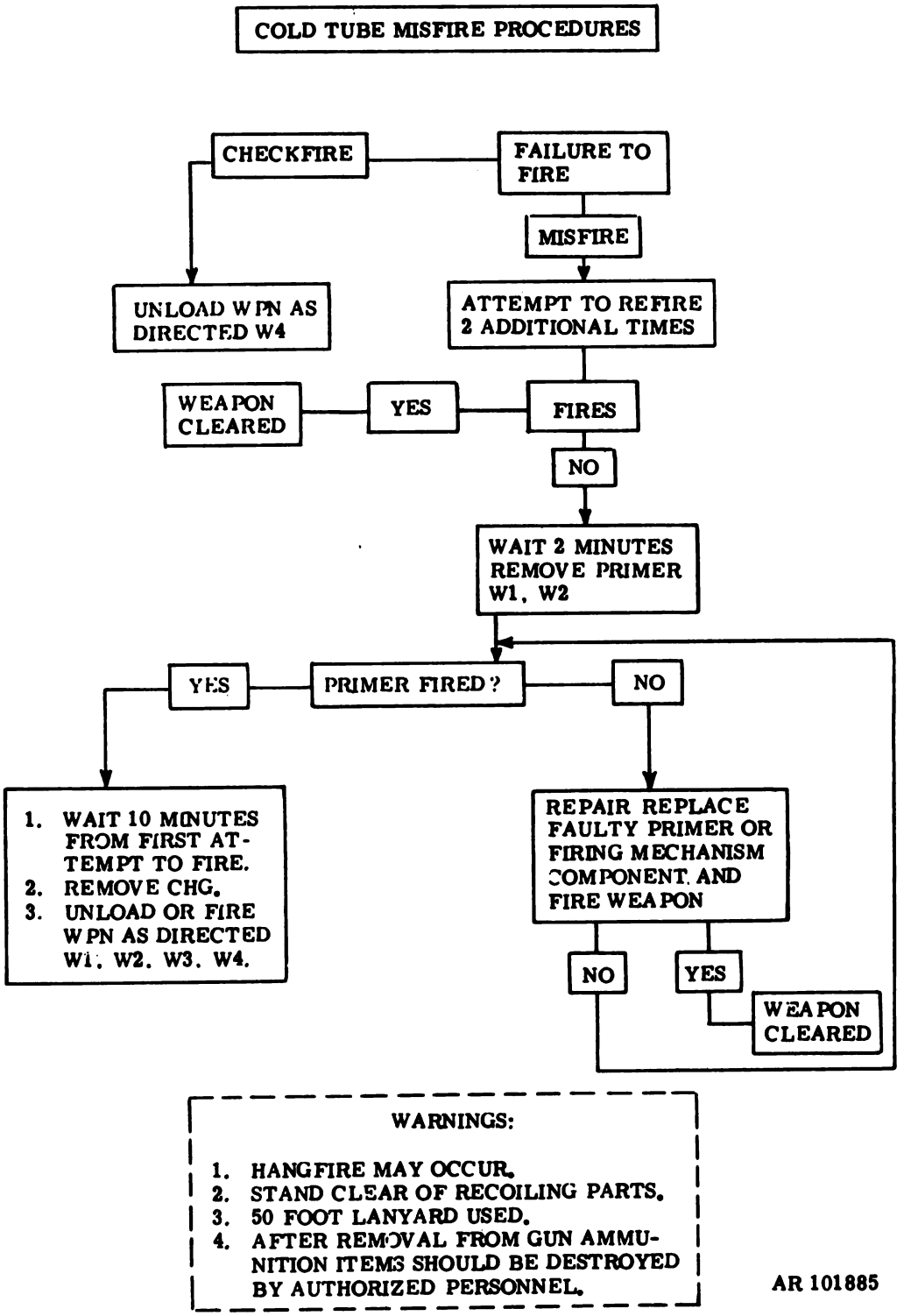


Figure 211.8. Cold tube misfire procedures.

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CAUTION

ONLY 5 MINUTES AVAILABLE FOR CORRECTIVE ACTION AFTER CHAMBERING.

If you get a failure-to-fire, follow the YES/NO procedure below to clear weapon.

HOT TUBE MISFIRE PROCEDURES

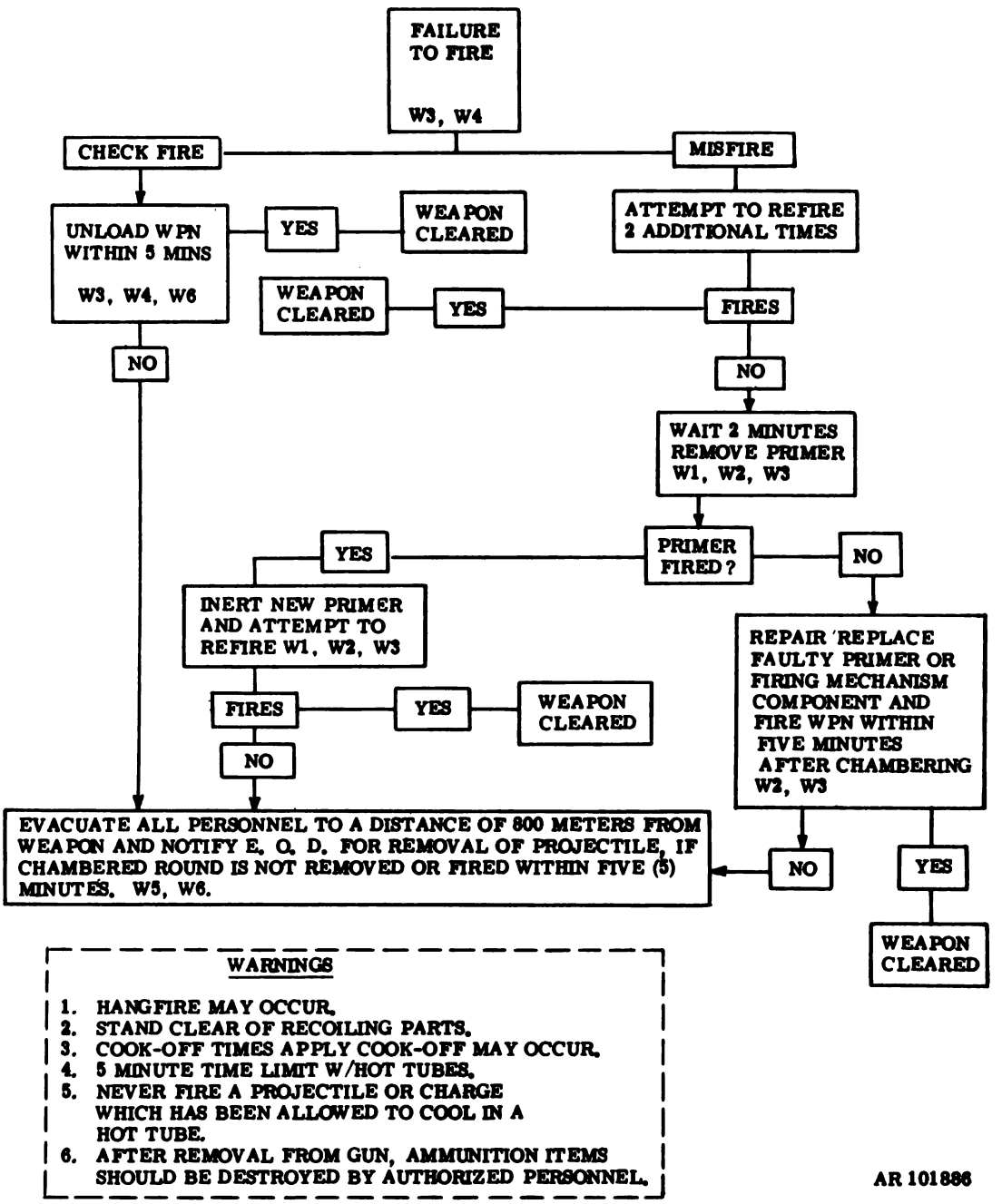


Figure 211.9. Hot tube misfire procedures.

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Section V. MAINTENANCE OF AMMUNITION

174.10. Handling Explosives

WARNING

Handle explosive ammunition and components containing explosives, with utmost care. Do not drop, throw, tumble, or strike packaged or unpackaged ammunition or related components. Explosive elements in primers and fuzes are sensitive to shock.

Do not expose ammunition and components containing explosives to extreme temperatures.

Do not expose to direct sunlight, flame, or other sources of heat.

Do not expose ammunition or components containing explosives to rain, excessive humidity, or ground moisture; otherwise, short ranges may result.

A drop of four feet may cause the electrolyte vial in a VT fuze battery to break, thus creating a dud.

174.11. Care

a. Ammunition is packed to withstand conditions ordinarily encountered in the field. Protect packing boxes from becoming broken or damaged.

b. Since ammunition is impaired by moisture, frost, extreme temperatures, and foreign matter (mud, oil, etc.), observe the following:

(1) Do not break the moisture-resistant seal on container until ammunition is to be used.

(2) Shield ammunition, particularly fuzes and propelling charges, from source of high temperatures (e.g., the direct rays of the sun).

174.12. Handling

a. Protect propelling charges from moisture and foreign matter during handling.

b. Protect fuzes, primers, and flash reducers from foreign matter and impact at all times.

174.13. Maintenance

WARNING

Alteration of loaded ammunition or components is prohibited.

a. Inspect ammunition packaging daily. Open boxes or containers which show deterioration, and inspect ammunition. Do not open sealed boxes or container unless defective ammunition is to be inspected.

b. Inspect unpackaged ammunition and explosive components daily.

Section VI. MAINTENANCE

174.14. Handling

WARNING

Keep fire and flammable materials out of the ammunition area. There will he no smoking in the vicinity of ammunition.

a. Do not expose ammunition and components containing explosives to extreme temperatures. Do not expose to direct sunlight, flame, or other sources of heat.

b. Do not expose unpacked propelling charges and fuzes to rain, excessive humidity, or ground moisture.

c. Prevent rough handling of projectiles and fuzes. Do not strike projectiles together, and do not off-load ammunition by dropping projectile on top of projectile.

d. Protect fuzes, primers, and flash reducers at all times from foreign matter and impact. A drop of 4 feet may cause the electrolyte vial in a VT fuze battery to break, thus causing a dud.

e. Do not disassemble fuses.

174.15. Care

a. Ammunition is packed to withstand conditions ordinarily encountered in the field. Keep packing boxes from becoming broken or damaged.

b. Since ammunition is impaired by moisture, frost, extreme temperatures, and foreign matter (mud, oil, etc.) observe the following:

(1) Do not break the moisture-resistant seal on container until ammunition is to be used.

(2) Shield all ammunition from high temperature sources (e.g., the direct rays of the sun).

174.16. Maintenance

WARNING

Alteration of loaded ammunition or components is prohibited.

a. General.

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(1) Inspect ammunition packaging daily. Open boxes or containers which show evidence of contamination or deterioration, and inspect ammunition. Do not open sealed boxes or containers unless defective ammunition is suspected.

(2) Inspect unpackaged ammunition and explosive components daily.

(3) Wipe off wet or dirty ammunition at once. Remove light corrosion. Do not polish ammunition to make it look better.

(4) Consider ammunition which exhibits severe rust or propellant contamination, particularly moisture, unserviceable. Do not use except in emergency.

(5) When repacking ammunition, put it back into original containers. If other packing material must be used, the old markings should be transferred to the new containers.

NOTE

Proper performance of ammunition maintenance procedure when ammunition is received by using units assures that ammunition on hand is kept ready for use.

b. Projectiles.

(1) Visually inspect projectile for the following defects:

(a) Distorted, out of round or damaged body.

(b) Dirt or other foreign material.

(c) Exudation of explosive filler.

(d) Rust through projectile base plate.

(2) Clean dirt or foreign material from projectile by wiping with a damp rag.

(3) Return defective projectiles to ammunition supply point.

c. Propelling Charges M3 and M4 Series.

(1) Visually inspect propelling charges for defects as follows:

(a) Loose tie straps allowing separation of the charge into increments.

(b) Missing increment, extra increment or incorrect sequencing (order) of increments.

(c) Increment bags torn or damaged to extent black powder or propellant spills out.

(d) Propelling charge wet.

(e) Red igniter pad on base of charge, missing or damaged.

(2) Charges requiring retying may be retied as follows:

(a) Assemble increments in correct order.

(b) Tie the four tie straps over top of charge using two interlapping square knots.

(3) Return all defective charges to the ammunition supply point.

d. Fuzes.

(1) Inspect fuzes for following defects:

(a) Damage to body or threads.

(b) Loose components.

(2) Return defective fuzes to ammunition supply point.

e. Ammunition or Components of Ammunition Prepared for Firing, but not Fired.

(1) Return such ammunition to the original condition and packing. Mark appropriately and use first in subsequent firings in order to keep stocks of open packings to a minimum.

(2) Reassemble ths supplementary charge and lifting plug (with gasket and spacer) to the projectile to restore to its original condition. Return fuzes to original condition. Return fuzes to original packing. In reasembling the components, make certain the supplementary charge is properly inserted (felt-pad end innermost).

(3) Reassemble propelling charges prepared for firing, and not used, and replace in original containers as follows:

(a) If increment was removed, reinstall and retie as indicated above.

(b) Replace igniter protective cap.

(c) Repack charge in container (igniter end first) and close and secure container.

(d) Mark container appropriately and use charge first in subsequent firings.

f. Unserviceable Ammunition.

(1) Conspicuously mark unserviceable ammunition or explosive components UNSERVICEABLE, and return to ammunition supply personnel for disposition.

(2) Repackage ammunition in original containers. If original container is unsuitable, use available package material and transfer all markings. All layers of packing must be conspicuously marked UNSERVICEABLE.

g. Excess Explosive Components.

(1) Park supplementary charges removed from projectiles prior to assembling proximity fuzes in containers from which proximity fuzes were removed.

(2) Properly mark container and return to ammunition supply personnel for dispostion.

(3) Destroy any unused powder increments left over after round has been fired by burning them in a safe place.

174.17. Storage

WARNING

Ammunition exposed directly to sunlight, or in unventilated containers, inclosures, shelters, freight cars, closed vehicles, and similar structures exposed to direct sunlight, may reach temperatures exceeding upper storage limits.

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Avoid exposure of ammunition components to direct sunlight. Do not store ammunition assembled with tetrytol loaded bursters (i.e., projectiles, 155-mm: smoke, WP, M110; gas, H, and HD, persistent, M110) at temperatures exceeding +125°F (+52°C).

a. Temperature Limits.

(1) Except as otherwise specified, observe the following limits:

(a) Lower limit is −80°F (−63°C), for periods of not more than 3 days.

(b) Upper limit is +160°F (+71°C), for periods of not more than 4 hours per day.

(2) Store or transport projectiles containing WP at a temperature below the melting point of the WP filler (+111.4°F(+44°C)). If this is not practicable, store or transport such projectiles on their bases so that, should the WP filler melt, it will resolidify with the void in the nose of the projectile.

(3) Protect proximity fuzes and proximity rounds from long exposure to high humidity. Store M728/M732 fuzes in temperatures between −65°F (−53°C) to +145°F (+63°C).

WARNING

Do not store ammunition under trees or near tall buildings that attract lightning. When ammunition must be stored in the open, select a storage site free of power lines, electrical cables, and flammable materials. Site should not be adjacent to reservoirs, water mains, etc. Do not store ammunition near large concentration of personnel.

b. Sites. Store ammunition in the firing area so that it is protected against accidental explosions. Sites should be level and well drained.

c. Provisions.

(1) Use heavy, well-supported dunnage to keep bottom tier of stack off the ground and to prevent it from sinking into the ground.

NOTE

A hardstand of blacktop or gravel and sand is preferable to excessive use of dunnage.

(2) Allow at least 6 inches (15 cm) of space beneath the pile for air circulation. Dig trenches to prevent water from flowing under pile.

(3) Provide nonflammable covers (e.g., tarpaulin) for all ammunition. Maintain air space of approximately 18 inches (46 cm) between cover and ammunition. Keep cover at least 6 inches (15 cm) from pile on ends and sides to permit circulation of air.

Section VII. AMMUNITION M114A2 HOWITZER (M1A2 CANNON TUBE)

Table 15. Model Numbers and Color Coding of Projectiles for Howitzer Cannon Tube M1A2

Type and model number of projectile	New Manufacture			Old Manufacture		
	Color of projectile	Number/ Color of bands	Marking	Color of projectile	Number/ Color of bands	Color of marking
Agent (H, HD) w/buster, M110	Gray	2/Green 1/Yellow	Green	Gray	2/Green	Green
Agent GB or VX w/buster, M121, M121A1	Gray	3/Green 1/Yellow	Green	Gray	1/Green (GB) 2/Green (VX)	Green
Agent GB or VX w/o burster, M121A1	Gray	3/Green	Green	Gray	2/Green	Green
HE, ICM, M449 series	Olive drab	Diamonds*	Yellow	Olive drab	None	Yellow
HE, M107, Comp B and TNT filler w/and w/o suppl charge	Olive drab	None	Yellow	Olive drab	None	Yellow
M485A1 or M485E1, M485A2 or M485E2 illuminating	Olive drab	1/White	White	Not applicable		
Smoke, base ejection (HC and colored) M116, M116B1, M116A1	Light green	None	Black	Gray	1/Yellow	Yellow
HE, ICM, M483A1	Olive drab	Diamonds*	Yellow	Not applicable		

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Table 15. Model Numbers and Color Coding of Projectiles for Howitzer Cannon Tube M1A2-Continued

Type and model number of projectile	New Manufacture			Old Manufacture		
	Color of projectile	Number/ Color of bands	Marking	Color of projectile	Number/ Color of bands	Color of marking
Smoke (WP), M110, (M110W1), M110A1, (M110E2), M110A1, (M110E3)	Light green	1/Yellow	Red	Gray	1/Yellow	Yellow
Smoke (WP), M825	Light Green	1/Yellow	Red	Not applicable		
HE, RAP, M549, M549A1	Olive drab	None	Yellow	Not applicable		
HE,ICM M692 (ADAM)	Olive drab	**Triangles	Yellow L	Not applicable		
HE, ICM M731 (ADAM)	Olive drab	**Triangles	Yellow S	Not applicable		
AT, M718, (RAAMS***)	Olive drab	**Triangles	Yellow L	Not applicable		
AT, M741 (RAAMS***)	Olive drab	**Triangles	Yellow S	Not applicable		
Practice, M804	Blue	1/Brown	White	Not applicable		
HEAT, M712	Black (except window area of cone)	None	Yellow	Not applicable		
Training, M823	Bronze	None	Black	Not applicable		

*Row of yellow diamonds between nose and bourrelet of projectiles.
**Row of yellow triangles between nose and bourrelet of projectiles with letter S or L painted inside triangles.
***RAAMS-Remote anti-armor mine system.

174.18. Authorized Rounds

WARNING

Unauthorized assembly and use of projectiles and propelling charges is extremely dangerous. Make sure projectiles are marked 155H (not G).

a. Projectile/fuze combinations for authorized rounds are given in table 17.

b. Projectiles of current manufacture which contain deep fuze cavities and supplementary charges of TNT, are suitable for use with M728 proximity fuzes. Deep cavity projectiles are identified by the words W/SUPPL CHG marked on the projectile. Weight zones are indicated on projectiles by means of one or more squares of the same color as the marking. Four squares indicate standard or normal weight for which no weight corrections are necessary when computing firing data.

c. Authorized projectiles and their characteristics are listed below:

(1) *Projectile, 155-mm, HE, M107.* Used primarily for blast, fragmentation, and mining. This deep or shallow cavity projectile consists of a steel case loaded with either TNT or composition B, PD, time, or proximity fuzes may be used. The M107 projectile weighs approximately 95 pounds (43.1 kg).

(2) *Projectile, 155-mm, gas, persistent, H or HD, M110.*

WARNING

Burster in the M110 ammunition is loaded with tetrytol, and should not be stored or fired at temperatures exceeding +125°F (+52°C). Temperatures above +125°F will cause the tetrytol to melt and/or exude, causing premature functioning.

This projectile produces a toxic effect on personnel and is also used to contaminate habitable areas. This 93-pound (42.2-kg) projectile is filled with H or HD gas, with a built-in burster charge.

NOTE

When required for contingency plan purposes, VX or GB filled projectiles M121A1 may be transported fully assembled with explosive components, otherwise assembly is prohibited except for storage and use.

(3) *Projectile, 155-mm, gas, persisent, VX, M121A1.* VX gas projectiles produce a toxic effect on personnel. A burster charge breaks the projectile apart. This projectile weighs approximately 100 pounds (45 kg).

(4) *Projectile, 155-mm, gas, nonpersisent, GB, M121A1.* This projectile is similar to the VX projectile M121A1 described above.

(5) *Projectile, 155-mm, smoke, WP, M110E1, and M110.*

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WARNING

Burster in the WP M110E1, M110 ammunition is loaded with tetrytol, and should not be stored or fired at temperatures exceeding +125°F (+52°C). Temperature above +125°F will cause the tetrytol to melt and/or exude, causing premature functioning. Prior to firing, inspect fuze well cup for dents in bottom surface. If dents are found and/or fuze is hard to seat, do not use round.

Smoke projectiles M110 and M110E1 have a burning effect, but are used primarily to produce screening smoke. These projectiles are similar to the M110 gas projectile and have the same characteristics as the M107 HE. It weighs approximately 98 pounds (44 kg).

(6) *Projectile, 155-mm, smoke, WP M110A1 (M110E2), M110A2 (M110E3).* These projectiles are similar to WP projectiles M110 and M110E1 except that there is no tetrytol in the burster. The burster contains composition B. This projectile may be stored and transported at temperatures up to +145°F (+63°C).

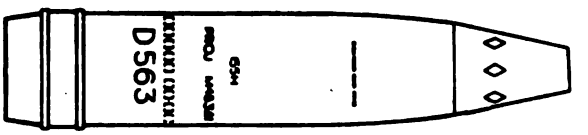
WARNING

White phosphorous (WP) impregnated felt wedges from the M825 are not totally consumed when the WP burns. When the unburned felt wedges are crushed or moved, residual WP will re-ignite, posing a burn-hazard. Personnel should not contact or move the unburned felt wedges.

(7) *Projectile, 155-mm, smoke, WP, M825.* The M825 projectile consists of a modified M483A1 projectile carrier with a payload of white phosphorus impregnated felt wedges. Inflight fuze functioning ejects the smoke payload. The burning wedges fall to the target area producing obscuring smoke.

(8) *Projectile, 155-mm, smoke, BE, M116, M116B1 (M116E1).* The BE smoke projectile M116 is used for screening, spotting, and signaling purposes. It is issued with a filler of HC (white) chemical smoke mixture. This is a base-ejection type round and contains four smoke canisters. It weighs approximately 86 pounds (39 kg). M116 model uses M501 fuze; M116A1 uses M565 and M577 fuzes. The M116A1 projectile is a base-ejection type similar to the M116 and M116B1 with the exception that it uses the M565 MT and M577 MTSQ fuzes, and that it has improved M1 and M2 HC (white) smoke canisters.

(9) *Projectile, 155-mm improved conventional munitions (ICM) M483A1 (fig. 211.10).*



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Figure 211.10. M483A1 projectile.

WARNING

ICM projectiles except for M449, use minimum zone 3 propelling charge and above. Firing below these zones may result in stickers.

This projectile is one of the latest improved conventional munitions of the dual purpose variety-antipersonnel and antimateriel. This high explosive, base-ejection type projectile consists of a steel body containing an expelling charge and 88 shaped charge grenade submissiles. In the *fire-for-effect mode*, the expelling charge ejects the 88 submissiles from the projectile during flight. The grenades orient themselves in the air stream and function upon ground or target impact. A shaped charge jet is expelled downward while the body bursts into a large number of high velocity fragments. The jet is capable of penetrating homogeneous armor plate. Antipersonnel effects are obtained by fragmentation of the body. In the *registration mode*, the expelling charge is removed, a projectile spotting charge is attached to the time fuze and installed into the projectile, which will cause the M483A1 projectile to detonate all of the 88 grenades inside the projectile causing high fragmentation in the same manner as a standard high-explosive projectile. This projectile weighs approximately 103 pounds (47 kg) and uses the M577 fuze only.

(10) *Projectile, 155-mm improved conventional munitions (ICM) M449 series (fig. 211.11).* These projectiles are improved conventional munitions used primarily against personnel. They are base-ejected projectiles and contain 60 M43 grenade submissiles. The grenades are dispersed in the air when the time fuze functions. When the grenades impact in the target area, submunitions are ejected and explode 4 to 6 feet (1.2 to 1.8 m) above the surface, producing fragmentation in a circular pattern. The projectile weighs approximately 95 pounds (43 kg) and uses the M565 or M577 fuzes.

(11) *Projectile, 155-mm: high explosive rocket assisted M549/M549A1 (fig. 211.12).*

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WARNING

A 6,000 meter (19,685 ft) safety zone is required short of the target because of the possibility of rocket motor nonignition.

The M549/M549A1 cannot be fired if the obturating band is missing or broken.

The M549/M549A1 use zone 7 (WB) propelling charges only. There are no firing tables for rocket-off firing the M549/M549A1 projectile. The M549/M549A1 will be fired rocket-on only (protective cap must be removed).

This is a high-fragmentation projectile containing a rocket motor. The protective rocket motor cap is removed from the projectile before firing to increase the range over that attainable ballistically. The M549 differs from the M549A1 only in the type of explosive filler. The M549 is loaded with composition B and M549A1 is loaded with TNT.

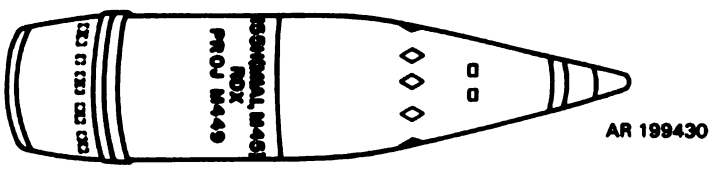


Figure 211.11. M449 series.

The M549/M549A1 projectiles have the energy-absorbing lifting plug designed to protect the projectile fuze area against accidental damage. The new plug has an oversized (3-3/4-in. (9.5-cm)) flange. If this lifting plug is broken at the neck area, the threaded portion of the plug will remain in the projectile and the projectile cannot be fuzed. No attempt should be made to extract any portion of a broken plug from a projectile: the projectile is not to be used and returned to Supply Point.

(12) *Projectile, 155-mm, high explosive M692 (fig. 211.13).* This projectile is known as the Area Denial Artillery Munition. It is painted olive drab with yellow markings. The most significant marking is the row of yellow triangles between the nose and the bourrelet and contains the letter "L" that indicates a long self-destruct time for submunitions. These submunitions are antipersonnel mines to deny the enemy free use of certain areas for a period of time. This is a base-ejection type projectile, and uses the M577 time fuze.

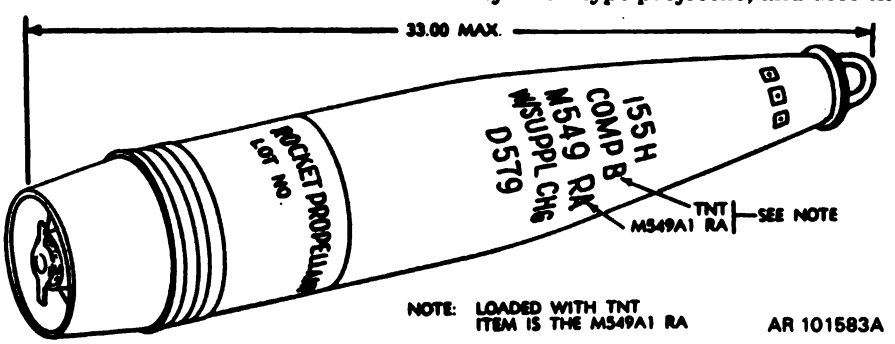


Figure 211.12. M549A1 projectile.

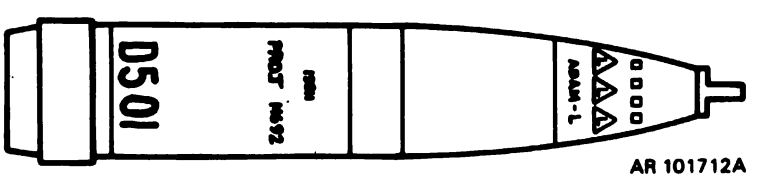


Figure 211.13. M692 projectile.

WARNING

The M731 projectile cannot be fired below zone 3.

(13) *Projectile, 155-mm high explosive, M731 (fig. 211.14).* This projectile is exactly like the M692 above *except* the letter "S" painted in the yellow triangles is different indicating a short self-destruct time of the AP mine submunitions. This is a base-ejection type projectile and uses the M577 fuze.

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WARNING

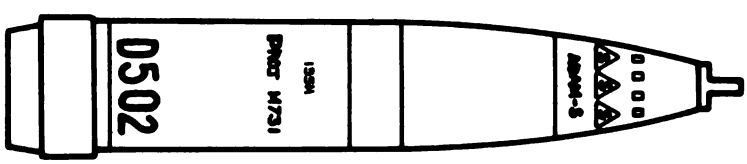
The M485 cannot be fired above zone 6. The M485A1 and M485A2 projectiles can be fired with zones 1 through 7 inclusive. Projectiles M485A1 and M485A2 are not reliable when fired at zones 6 and 7 with fuze settings of 10 seconds or less.

(14) *Projectile, 155-mm: illuminating, M485, M485A1, and M485A2.* This projectile is used for battlefield illumination. The projectile has a hollow steel body containing a primary expelling charge, a canister assembly, and a drogue parachute. The canister assembly contains a secondary expelling charge, a delay holder, a light producing chemical, and the main parachute.

(15) *Projectile, 155-mm, HE, remote, anti-armor mine system, M718 (fig. 211.14.1).* This projectile is used to deliver high-explosive antitank mines in front of enemy forces to deny/delay access to a particular area for a specific time period. This projectile is from the family of scatterable mines (FASCAM) and is the ammunition for the remote anti-armor mine system (RAAMS). It is painted olive drab with yellow markings. The most significant markings are the row of yellow triangles between the nose and bourrelet which contain the letter "L" and "RAMM-L" on the ogive indicating the LONG self-destruct time for submunition. This is a base-ejection type projectile and uses the M577 series MTSQ fuze. DODAC "D503" is lettered on the projectile body.

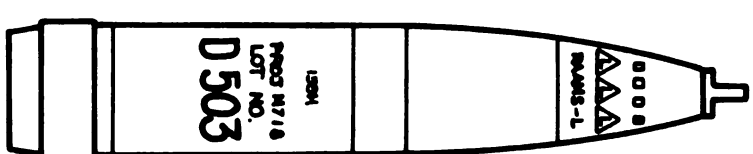
(16) *Projectile, 155-mm, HE, remote anti-armor mine system, M741 (fig. 211.14.2).* This projectile is also the ammunition for the RAAMS system, and it is exactly like the M718 above, except the letter "S" painted in the yellow triangles and "RAAM-S" on the ogive are different to indicate a SHORT self- destruct time. This is a base-ejection type projectile and uses the M577 series MTSQ fuze. DODAC "D509" is lettered on the projectile body.

(17) *Projectile, 155-mm, practice, M804 (fig. 211.14.3).* The M804 projectile is used in place of the M107 HE projectile in service practice exercises. The M804 contains a small smoke canister in the fuze well which provides flash and smoke for visual determination of functioning. The M804 is similar in weight and external configuration to the M107 HE projectile, and can be used in service practice without the blast and fragmentation which accompanies the functioning of an M107 HE projectile. The body of the M804 contains four holes, 90 degrees apart, which serve to disperse smoke on functioning.



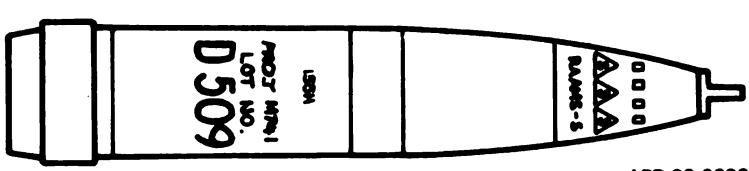
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Figure 211.14. M731 projectile.



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Figure 211.14.1. M718 projectile.



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Figure 211.14.2. M741 projectile.

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(18) *Projectile, 155-mm, HEAT, M712 (fig. 211.14.4).* This projectile is a cannon-launched guided projectile. It is a high-explosive antitank (HEAT) projectile loaded with 14.75 pounds (6.69 kg) of composition B. It is guided to its target by a laser beam directed on the target from a laser designator. The projectile has five, time and code switches, set by the crew prior to firing. The warhead section of the projectile contains its own base-detonating fuze (M740). The projectile is 54 inches (137.16 cm) long, and weighs 138 pounds (62.60 kg). Details on use of M712 projectile begin on page 212.23.

WARNING

The M823 projectile must not be fired. Such firing could be a hazard to personnel forward of the weapon.

(19) *Projectile, 155-mm, training, M823 (fig. 211.14.5).* This projectile is designed to train 155-mm howitzer weapon crews in the handling and setting of the M712 projectile. It simulates the M712 in weight, center of gravity, and external appearance. It contains code and time switches which are set to simulate prefiring activity by the crew. It is shipped and stored in the same container as the M712, color coded bronze for easy identification. Details on use of M823 projectile begin on page 212.23.

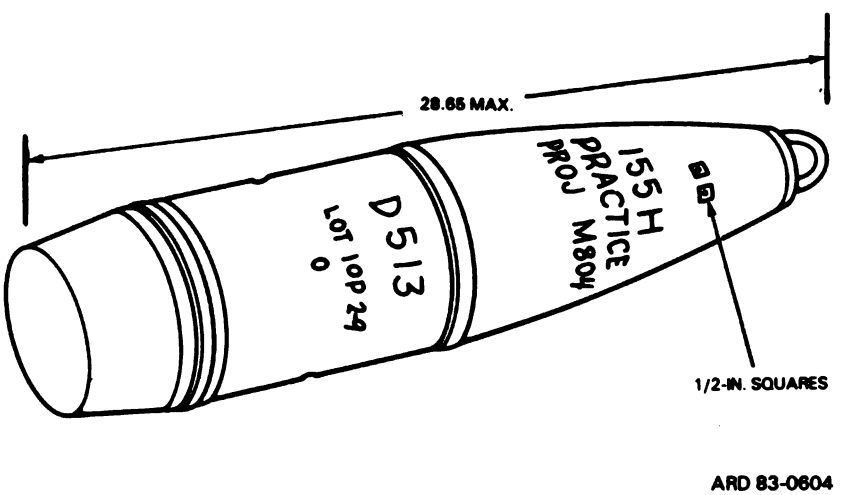


Figure 211.14.3. Projectile, 155-mm practice, M804.

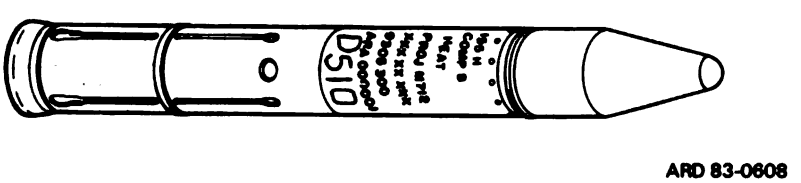


Figure 211.14.4. Projectile, 155-mm, HEAT, M712.

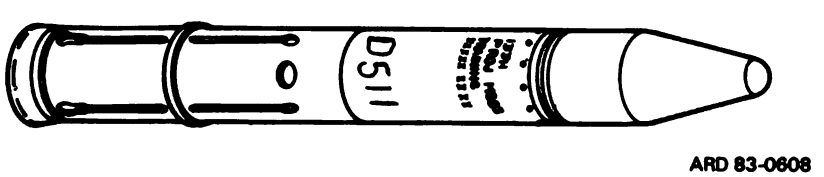


Figure 211.14.5. Projectile, 155-mm, training, M823.

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174.19. Authorized Fuzes

WARNING

The firing of a field artillery round without fuze or with an unauthorized fuze is strictly prohibited. Only authorized fuzes will be used with the authorized projectiles and propelling charges.

The following describes some of the fuzes to be used with this weapon. For additional information and more detailed descriptions and functions of the authorized fuzes, see TM 43-0001-28. Authorized projectile/fuze combinations are contained in table 16.

a. Deleted.

Figure 211.15 Deleted.

b. Fuze, Point Detonating, M557 (fig. 211.16). The M557 fuze has a selective superquick setscrew. It is packed set for superquick and has a booster attached. Duds may occur when set for delay functioning and fired with M3A1 green-bag charge.

Table 16. Authorized Projectile/Fuze Combinations for M1A2 Cannon Tube (M114A2 Howitzer)

Type and model number of projectiles	Impact PD		MT	MTSQ				Prox	VT
	M78A1	M739 series or M557	M565	M501	M564	M577 series	M582 series	M732	* M728
HE, M107	(CP) X	X			X		X	X	P
Smoke, WP, M110 series		X			X		X		
Smoke, WP, M825						X			
Smoke, HC and colored, BE, M116 series			** X	*** X		** X			
Agent, GB or VX, M121A1		X						**** X	**** X
HE, ICM, M449 series			X			X			
HE, ICM, M483A1						X			
Illumination, 485 series			X			X			
Agent, H or HD persistent, M110 series		X			X		X		
*HE, RAP, M549, M549A1		X					X		
*HE, ICM M692/M731 (ADAM)						X			
Practice, M804		X			X		X	X	
AT, M718/M741 (RAMMS)						X			

X-Authorized fuze.
P-Supplementary charge must be removed.
*M728 fuze is restricted from overhead fire due to possible downrange prematures.
**M116A1 uses M565 and M577 fuzes only.
***M116 uses M501 fuze only.
****M728 and M732 proximity fuses are to be fired with the M121A1 VX projectile in combat emergency only.

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Table 17. Authorized Projectile/Propelling Charge Combinations for the M114A2 (M1A2 Cannon Tube)

CAUTION
ONLY MK2A4 PRIMER MAY BE USED WITH M1A2 CANNON

PROJECTILES	PROPELLING CHARGE (GB) M3 & M3A1 ZONES 1	2	3	4	5	(WB) M4A1 & M4A2 ZONES 3	4	5	6	7	FIRING WARNINGS
HE, M107	X	X	X	X	X	X	X	X	X	X	
AGENT, H OR HD, M110	X	X	X	X	X	X	X	X	X	X	M110 agent loaded w/tetrytol burster cannot be stored or fired at temperature exceeding +125°F (+52°C)
AGENT, GB or VX M121	X	X	X	X	X	X	X	X	X	X	
SMOKE, WP, M110, M110E1	X	X	X	X	X	X	X	X	X	X	M110 smk loaded w/tetrytol burster cannot be stored or fired at temperature exceeding +125°F (+52°C)
SMOKE, WP, M110A1, M110A2	X	X	X	X	X	X	X	X	X	X	
SMOKE, WP, M825	X	X	X	X	X	X	X	X	X	X	
SMOKE, BE, HC, M116, M116B1	X	X	X	X	X	X	X	X	X	NO	
SMOKE, BE, HC, M116A2	X	X	X	X	X	X	X	X	X	X	
ILLUM, M118A2, M118A1B1	X	X	X	X	X	X	X	X	X	X	
ILLUM, M485A1, M485A2	X	X	X	X	X	X	X	X	*	*	*See note below
HERA, M549, M549A1	No	No	No	No	No	No	No	No	No	X	M549/M549A1 should not be fired in the rocket off mode, the rocket motor-off cap must be removed prior to firing
HE, M483A1 (ICM)	No	No	X	X	X	X	X	X	X	X	
HE, M449, M449A1, (ICM)	X	X	X	X	X	X	X	X	X	X	
HE, M692/M731 (ADAM)	No	No	X	X	X	X	X	X	X	X	
AT, M718, M741 (RAAMS)	No	No	X	X	X	X	X	X	X	X	
Practice, M804	X	X	X	X	X	X	X	X	X	X	
HEAT, M712 (Copperhead)	No	No	No	X	X	No	X	X	X	X	

X-Authorized propelling charge.

Note: *M485A1/A2 projectiles not reliable when fired at zones 6 and 7 with fuze settings of 10 seconds or less.

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zones 1 and 2. Premature functioning can occur when fuzes are fired in heavy rainfall.

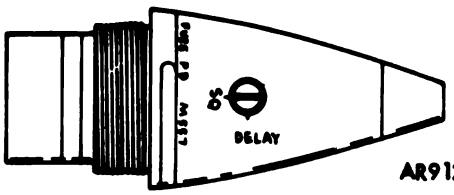


Figure 211.16. Point detonating fuze M557.

c. Fuze, Point Detonating, M739 and M739A1 (fig. 211.17). These fuzes are the latest improved version of the selective impact fuze. Each has an aluminum body, and a rain insensitive head so that it can be fired through a heavy rainstorm without premature functioning of the round of ammunition. These fuzes come shipped set for superquick action, and can be set for delay action by turning the setscrew.The M739A1 fuze contains a new impact delay module which provides more effective functioning in the delay mode. In addition to the stamped markings, the M739A1 fuze is anodized green for positive identification of fuze model.

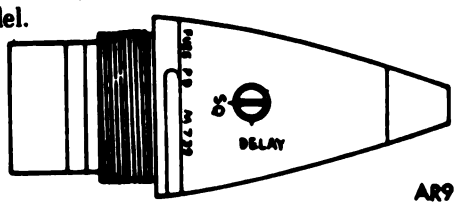


Figure 211.17.Point detonating fuze M739 series.

d. Fuze, Mechanical Time and Superquick, M501A1 or M501 **(fig. 211.18). Fuze, M501A1 or M501 is a combination mechanical time and superquick fuze with settings for time action (2 to 75 seconds), and an impact element for superquick action but has no booster for detonation action. Do not use this fuze in any HE, WP, or gas projectile. When set for airburst, 20 percent fail to function with charge 1 and 10 percent with charge 2. Fuze will function on impact.**

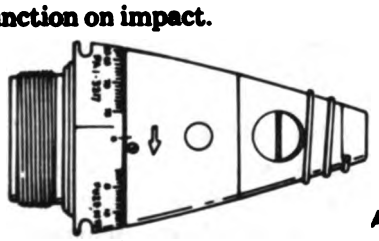


Figure 211.18. Mechanical time and superquick fuze M501A1.

e. Fuze, Mechanical Time and Superquick, M564 **(fig. 211.19). The M564 fuze is designed to function at time settings from 2.0 seconds up to 100 seconds or upon impact, depending upon which occurs first after arming. Fuzes manufactured through 1969 must be set on 90 seconds if superquick (impact) action is desired. Setting of these fuzes between S and 2 seconds may result in functioning after approximately 2 seconds. The date of manufacture is stamped on the fuze body before the lot number. Fuzes manufactured from 1970 on may be set as shipped on S for superquick (impact) functioning. Premature functioning of this fuze may occur downrange when the fuze is fired in rainfall.**

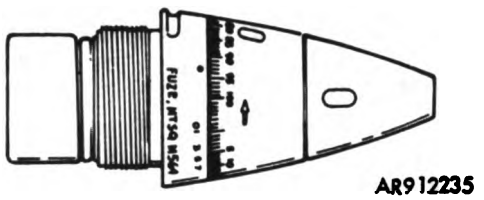


Figure 211.19. Mechanical time and superquick fuze M564.

f. Fuze, Mechanical Time, M565. (fig. 211.20). MT fuze M565 is similar to MTSQ fuze M564 except that the fuze contains neither the point detonating assembly nor the booster assembly. Fuze M565 can be set from 2 to 100 seconds. Like the M564, fuze M565 employs a vernier scale to ensure a setting accuracy of 0.1 second. This fuze is used with base-ejection projectiles only.

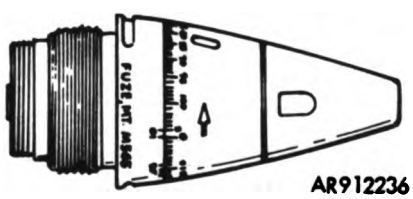


Figure 211.20. Mechanical time fuze M565.

g. Fuze, Proximity (VT), M728 **(fig. 211.21). The M728 fuze is used with the deep cavity projectiles and is essentially a self-powered radio and transmitting unit. The fuze can be set from 5 to 100 seconds. The setting on the time ring determines at what time along the trajectory the fuze will become activated. It also has an impact element that is armed three seconds after firing and will function either on proximity action or impact action, whichever occurs first. The nose of this fuze has been painted (black) to reduce static electricity.**

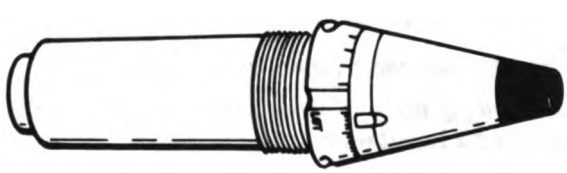


Figure 211.21. Proximity (VT) fuze, M728.

h. Fuze, Mechanical Time and Superquick, M577 Series and M582 series (fig. 211.22). Fuze 577 series is used with ICM and other base ejection projectiles.

(1) This fuze has a 200-second mechanical time mechanism with three movable digital dials similar

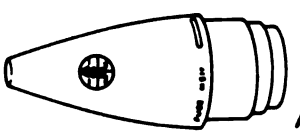
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to a speedometer. The time setting key is located on the end of the fuze nose, and enables the fuze to be set to the nearest 0.1 second. Each fuze has a window through which the dials are viewed. The dial closest to the fuze nose indicates the time in hundreds of seconds (the triangle ◄ position is a non-time setting). The second dial indicates time in tens of seconds and the third dial indicates the nearest second and 0.1 second by using the scale on the right edge of the dial. The time desired is set under the hairline, using the M35 fuze setter or a flat tipped screwdriver.

(2) The M582 series is identical to the M577 series with the exception of the standard booster pellet and booster cup which has been installed on the M582 series.

(2.1) The M577A1 and M582A1 MTSQ fuzes contain a different mechanism for point detonating action. Externally, the major difference is in the configuration of the wrench slots. The M557A1 and M582A1 fuzes are handled, set, and fired the same as the basic models.

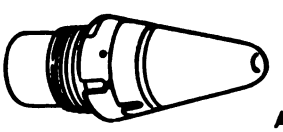
(3) These fuzes are not sensitive to rain. Detailed setting instructions are outlined in paragraph 174.26.



AR912238

Figure 211.22. Mechanical time and superquick fuze, M577 series.

i. Fuze, Proximity, Variable Time, M732 (fig. 211.23). This proximity variable time (VT) fuze is a short-intrusion fuze of the same overall length as the standard impact or mechanical time fuze. The supplementary charge must be left in the fuze well for proper functioning of this fuze. This fuze has a time ring that can be set from 0 to 150 seconds.



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Figure 211.23. M732 fuze.

174.20. Authorized Propelling Charges

The following are authorized propelling charges for the M114A2 howitzers:

a. Propelling Charge M3A1 (fig. 211.24). This is a green-bag charge divided into a base and four increments for firing in zones 1 through 5. It has a flash reducer pad assembled forward of the base charge with similar one-ounce pads assembled forward of increments 4 and 5. The increment bags are tied together by cloth tying straps. *A CBI* igniter charge in a red cloth bag is sewed to the rear of the base section.

b. Propelling Charge M3 (fig. 211.24). This is a green-bag charge similar to the propelling charge M3A1 except that it is not assembled with a flash reducer and black powder is used in the igniter pad.



GREEN-BAG CHARGE

AR912240

Figure 211.24. 155-mm propelling charges for howitzer.

c. Propelling Charge M4A1 (fig. 211.25). This is a white-bag charge consisting of a base charge and four increments for firing in zones 3 through 7. The increments are tied together by cloth tying straps. An igniter charge in a red cloth bag is sewed to the rear of the base section. It has a flash reducer pad assembled forward of the base charge.

d. Propelling Charge M4A1 (fig. 211.25). Propelling charge M4A1 is identical to the M4A2 except that the charge is assembled without a flash reducer, and the igniter contains black powder instead of CBI. The M2 flash reducer may be used with this charge and is a separate item of issue.



WHITE-BAG CHARGE

AR912241

Figure 211.25. White-bag charge.

174.21. Primer MK2A4

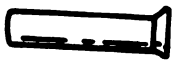
Percussion primer MK2A4 (fig. 211.26) is the only authorized primer to be used in the M1, M1A1, or M1A2 tube. Primers are ready for firing when unpackaged.

174.22. Flash Reducer M2 (T2)

M2 flash reducer consists of a red cotton cloth bag, 4 inches square, containing black powder and potassium sulfate or potassium nitrate. It is a separate item of issue and may be used with charges M4 and M4A1 if additional flash reduction is desired. In preparing a white bag charge M4 or M4A1 for firing, one flash reducer is added at the forward end of each increment used. No flash reducers are required when using green-bag charge M3. Use of M2 flash reducer to reduce muzzle flash when firing propelling charge M4 or M4A1 is optional, except when TB 9-1300-385-1 or -2

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restricts a specific propelling charge lot to use with flash reducer only. The flash reducer pads serve to limit breech flareback as well as muzzle flash and blast overpressure.



AR912242

Figure 211.36. MK2A4 primer.

Section VIII. PREPARATION FOR FIRING

174.23. General

NOTE

Ammunition components are handled by cannoneers no. 2, 3, 4, 5, 6, and 7.

a. Temperature Limits. Unless otherwise specified, observe the following temperature limits when firing:

(1) Lower limit is −40°F (−40°C).

(2) Upper limit is +125°F (+52°C).

b. Packing and Unpacking Ammunition Components. Retain packing materials for repackaging, as required.

(1) Propelling charges M3 series are packed two per metal container, with or without primer MK2A4. Propelling charges M4 series, are packed one per container.

CAUTION

Percussion primer MK2A4 is the only authorized primer to be used in the M1, M1A1, and M1A2 tubes. Do not use M82 in these tubes.

(2) Primers MK2A4 are packed one per waterproof bag.

(3) M2 flash reducers (T2) are packed 200 per metal container (four containers, 800 flash reducers per wooden box).

(4) Fuzes are generally packed in metal boxes. The metal boxes are then packed in wooden boxes.

c. Procedures. Inspect ammunition components and verify item identification.

CAUTION

Do not use axes, crowbars, etc., which may damage ammunition or packaging.

(1) Unpack ammunition and perform inspections indicated in section VI (maintenance) of this chapter.

WARNING

Inspect your ammunition. Failure to accomplish required inspections can result in unnecessary malfunctions.

(2) Return all defective ammunition to Ammunition Supply Point.

174.24. Preparation For Firing

Preparation for firing the four components of a complete round of 155-mm ammunition requires efficient teamwork among the cannoneers. They must quickly and accurately select, unpack, inspect, and prepare the correct primer, propellant, projectile, and fuze from the fire commands received by the howitzer section. Certain numbered cannoneers prepare the fuze and projectile; other cannoneers prepare the propellant, and still another cannoneer may insert the primer in the firing lock after the fuzed projectile and propellant have been loaded, and the breechblock has been closed. The chief-of-section must thoroughly crosstrain the entire crew so that any crewmember can perform any or all of the duties required for any other crewman.

a. Primer MK2A4. Do not open moisture protective bag until ready to use the primer. Cannoneer No. 1 is the crewman that normally loads the primer.

b. Propellant. Cannoneer No. 4 will unpack, inspect and prepare the designated propelling charge and pass it to cannoneer No. 1 after the fuzed projectile has been loaded.

c. Projectile. Projectiles for this howitzer normally come packed eight to the pallet, with top and bottom of the wood pallets banded together. Each projectile has an eyebolt lifting plug and a grommet attached for protection during shipping and handling activities. Cannoneer No. 7 will select the right projectile, announce in the fire commands, and prepare it for firing as follows:

NOTE

Special instruction for M483A1 projectile in following paragraph *d*.

(1) Inspects and cleans projectile.

***(a)* Verifies that the projectile is the type designated by the fire commands.**

(b) Removes grommet and examines rotating band to ensure that it is free from all dirt and burrs.

NOTE

A projectile with a burred rotating band will be put aside until the burrs can be removed with a file.

(c) Cannoneer No. 2 removes eyebolt lifting plug and gasket and examines the fuze well for leaks or damage to the filler. If any high explosive filler residue clings to the threads of the fuze well, reject the round and get another one to complete the fire mission.

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(d) Cannoneers No. 2 and 7 examine entire projectile for defects and check to see that the projectile is not damaged or corroded and is free of dirt, grease, sand, oil, and so forth. Slight rust on the projectile is acceptable.

NOTE

Any sand, dirt, oil, or grease left on the projectile will cause wear, scratches, or gouge in the bore.

(2) Cannoneer No. 7 holds projectile upright for fuzing and fuze setting.

(a) If required, holds projectile firmly while cannoneer No. 2 fuzes the projectile and sets the fuze.

(b) Reads and announces the time set on the fuze by cannoneer No. 2 when directed.

(3) Cannoneers No. 2 and 7 carry fuzed projectile to the weapon.

d. Special Preparation of the M483A1 Projectile for Use in the Registration Mode **(fig. 211.27 and 211.28). When the command for use of the M483A1 ICM projectile includes "registration mode", the expulsion charge inside the nose of the projectile must be removed and a projectile spotting charge threaded onto the fuze. The M483A1 projectile has a pull-wire spring holding the expulsion charge in the fuze well. First, remove the fusible lifting plug and gasket, inspect the fuze well, and complete the following steps.**

(1) Remove the expulsion charge assembly by grasping and firmly pulling the pull-wire. When the lifing plug is removed, the compressed coiled pull-wire will expand and protrude beyond the fuze well of the projectile ogive. Set charge aside for disposition. Visually inspect the fuze well for loose grains of propellant or other foreign material. Remove any loose material. Obtain an M577 series fuze and a spotting charge.

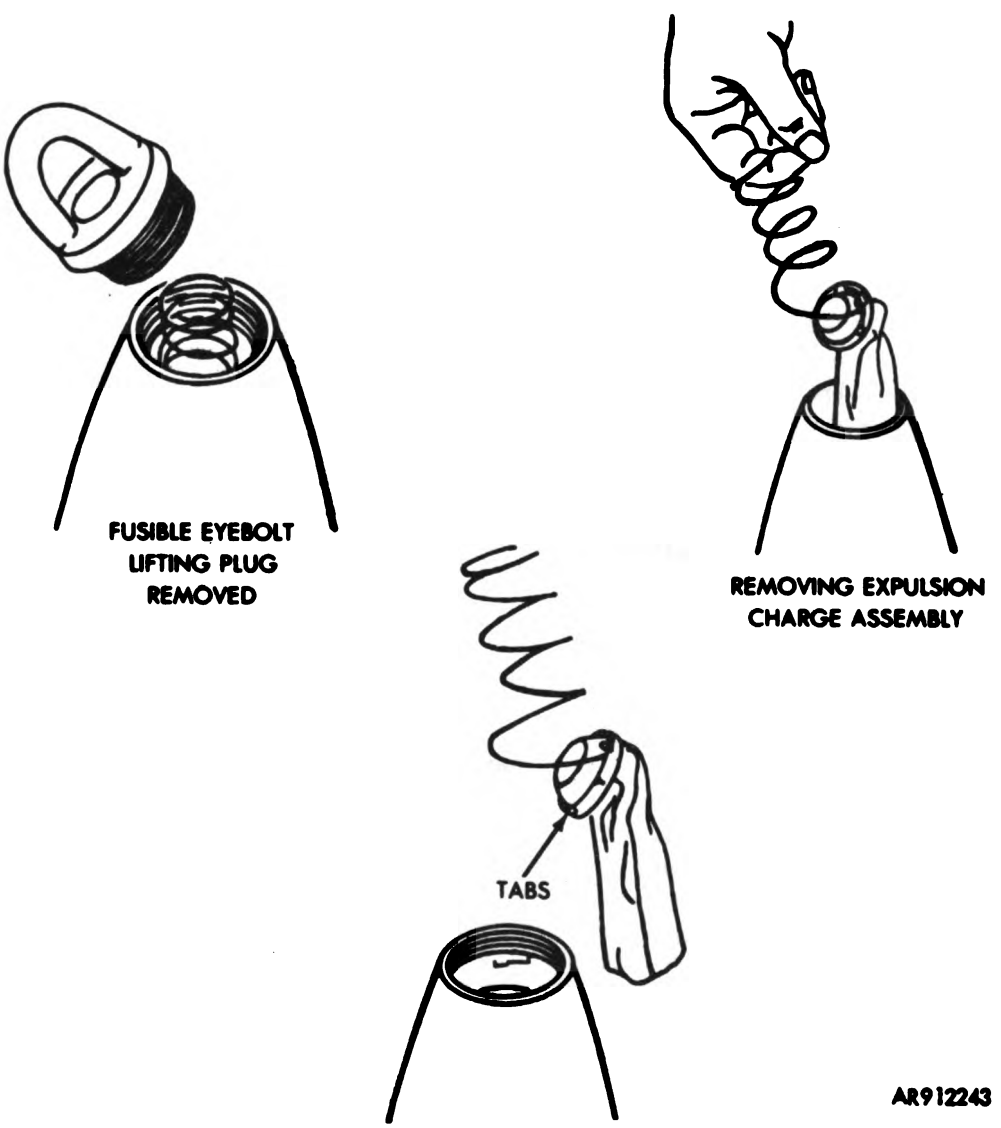


Figure 211.27. Removal of expulsion charge assembly—pull-wire design.

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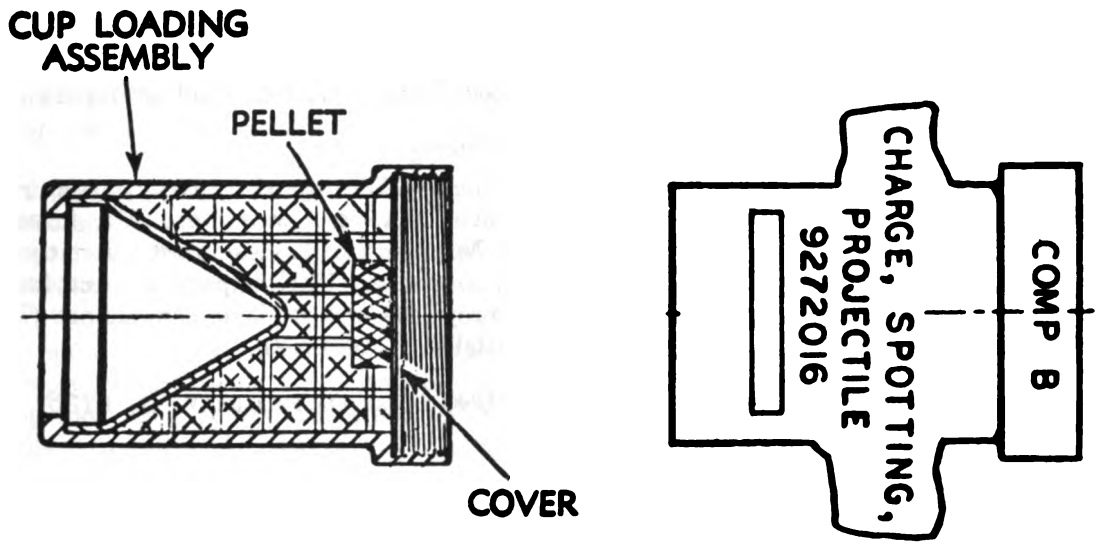


Figure 211.28. Projectile spotting charge for self-registration of M483A1 ICM projectiles.

WARNING

When screwing the projectile spotting charge onto rear of M577 series fuze, assure that the shoulder of projectile spotting charge is seated squarely against the shoulder of the fuze. An improperly seated charge could cause a malfunction.

CAUTION

When assembling the projectile spotting charge to a fuze, exercise care to avoid damaging threads. If binding occurs, consider charge unserviceable and report it for disposition. If binding has occurred, reinspect fuze to assure it is still serviceable.

(2) Special assembly of projectile spotting charge to M577 series fuze (fig. 211.29). Screw the projectile spotting charge handtight onto the rear of the M577 series fuze (left-handed thread) before installing the fuze into the M483A1 ICM projectile prepared for the self-registration mode. See (1) above for removal of the expulsion charge from the fuze well in order to make room for the projectile spotting charge with M577 series fuze. Set fuze as instructed in paragraph 174.26d.



Figure 211.29. Special Assembly of projectile spotting charge to M577 series fuze.

(3) Special assembly of projectile spotting charge (NSN 1320-00-171-0760 D003) to M577 series fuze. Screw the projectile spotting charge handtight onto the M577 series fuze (left-hand thread) when firing the M483A1 projectile in the self-registration mode. Remove expulsion charge first.

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WARNING

When screwing the projectile spotting charge onto rear of fuze, assure that shoulder of projectile spotting charge is seated squarely against shoulder of fuze. An improperly seated charge could cause a malfunction.

CAUTION

When assembling projectile spotting charge to fuze, exercise care to avoid damaging threads. If binding occurs, consider charge unserviceable and report for disposition. If binding has occurred, reinspect fuze to assure it is still serviceable.

174.25 Fuzing

a. General. There are three basic types: impact, mechanical time and proximity VT fuzes (fig. 211.30) Number 2 cannoneer must select the right fuze on command FUZE, unpack, inspect, install it in the projectile and set it as commanded (TIME, SUPERQUICK, DELAY).

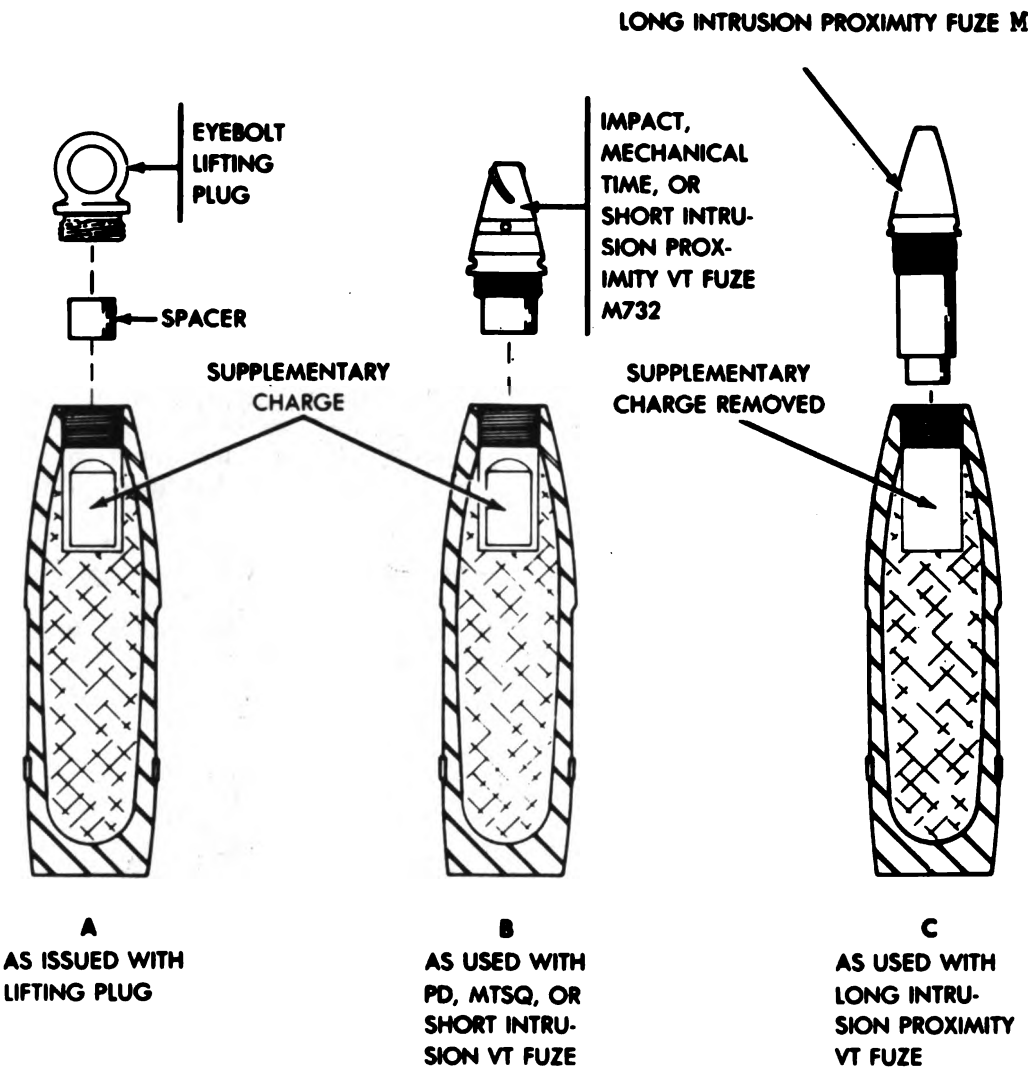


Figure 211.30. Typical deep-cavity projectiles.

b. Lifting Plug Removal.

WARNING

Do not use projectiles with explosive on the threads or evidence of explosive powder or exudation.

(1) Remove plug and inspect the filler beneath the plug.

(2) Inspect cavity and projectile threads for damage. Remove loose material from cavity. If any high explosive is found stuck to the threaded portion of the projectile throat, do not fire.

WARNING

Do not use the M549/M549A1 projectile if the lifting plug has been broken. Do not

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attempt to extract any portion of the plug from the fuze well of the projectile. Return projectile to the supply point.

c. Supplementary Charge.

WARNING

Do not fire PD, MTSQ, or the new short intrusion VT fuzes in a deep cavity projectile without the supplementary charge.

WARNING

Do not attempt to remove supplementary charge by any means other than the lifting loop. Use of screwdrivers or other tools to remove the charge by force is dangerous.

For the long, instruction proximity fuze firings, remove supplementary charge by means of its lifting loop. If the charge cannot be removed by its lifting loop, either fire with a short intrusion VT, PD, or MTSQ or dispose of the round.

d. Fuze Assembly.

(1) *Procedures.* The following procedures apply to all fuzes. See (3) below for special instructions for M577 series fuzes.

(a) Screw fuze in by hand. If binding occurs, inspect fuze cavity and threads of both fuze and projectile. Reject whichever is at fault.

WARNING

When tightening fuze to projectile, do not hammer on fuze wrench or use extension handle on fuze wrench. Do not stake fuze to projectile under any circumstances. Shocks transmitted to fuzes during assembly may cause a malfunction.

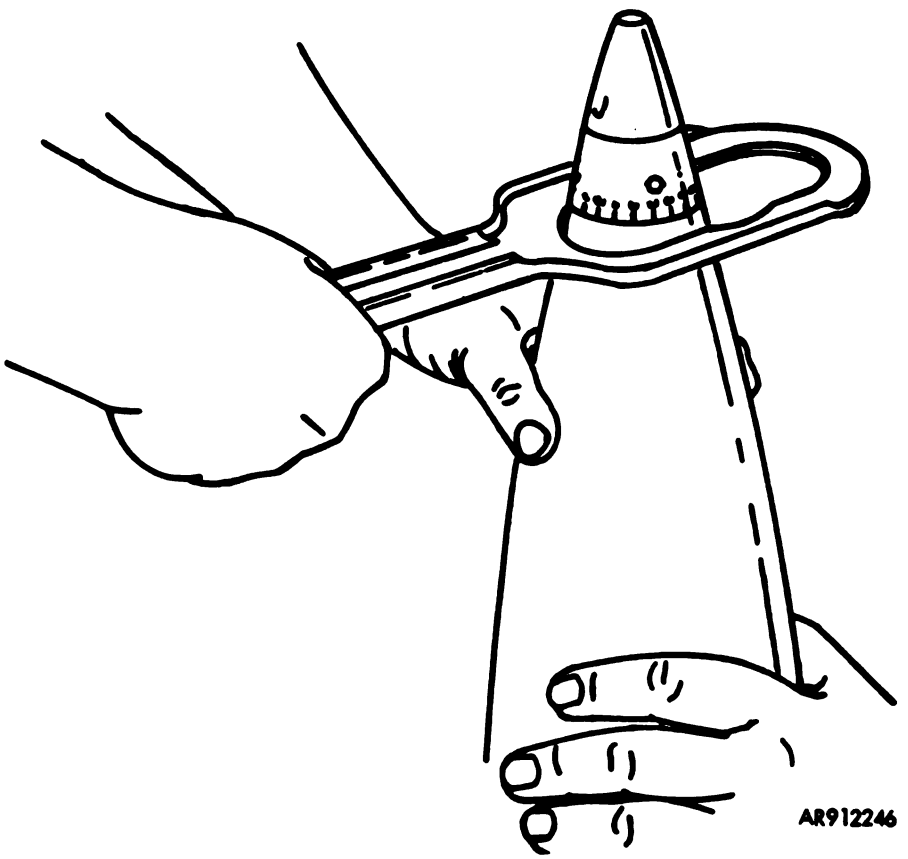


Figure 211.31. M18 Fuze Wrench on M577/M739 fuze.

(b) After assembling fuze by hand, back fuze off 1/4 turn. Using specified fuze wrench (table 18) tighten fuze to projectile with a sharp snap of the wrench so that the fuze shoulder is seated firmly against the projectile nose (fig. 211.31).

WARNING

Rounds fired without a fuze or with improperly seated fuzes may result in premature functioning.

NOTE

For proximity fuzes with a gap between the fuze shoulder and projectile, either replace the supplementary charge and fire with impact PD or MTSQ fuze or dispose of round.

(c) If projectile setscrew is present, tighten to below level of contour of projectile.

(2) Deleted.

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Figure 211.32. Deleted.

(3) Special preparation for M577 series fuze.

(a) Inspect the fuze setting. If the setting is not between ◄93.0 and ◄95.5, or the fuze shows signs of damage, or the window is blackened or sooty inside, the fuze will be considered unserviceable.

WARNING

When screwing the projectile spotting charge onto rear of M577 series fuze, assure that the shoulder of projectile spotting charge is seated squarely against the shoulder of the fuze. An improperly seated charge could cause a malfunction.

CAUTION

When assembling the projectile spotting charge to a fuze, exercise care to avoid damaging threads. If binding occurs, consider charge unserviceable and report it for disposition. If binding has occureed, reinspect fuze to assure it is still serviceable.

174.26. Fuze Setting

The following procedures apply to all authorized fuzes. Fuze setting tools and procedures are listed in table 18.

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Table 18. Fuze, Fuze Setting Tools, and Procedures

Fuze									
PD			MT		MTSQ		PROX		
M557	M739 series	M78 CP series	M565	M501	M564	M577/ M582 series	M732/ M728	Setter	Procedure number
		X						Fuze setter wrench M16	174.25
X	X							Fuze setter wrench M18	174.26a
							X	M27	174.26b
			X		X			M34	174.26c
						X		M35	174.26d
				X				M27	174.26e

a. Procedure No. 1, M557 and M739 Series.

NOTE

PD fuzes with SQ or delay functioning are shipped set for SQ action.

(1) If superquick action is desired, check the setting to make sure it is set at SQ.

(2) To set fuzes for delay action, use screwdriver end of fuze wrench M18 or similar tool and turn slot 90° to align with index mark indicating DELAY.

b. Procedure No. 2 M728/M732 (fig. 211.34).

NOTE

M728 fuzes are shipped with the index mark on the nose cone set at 10 seconds.

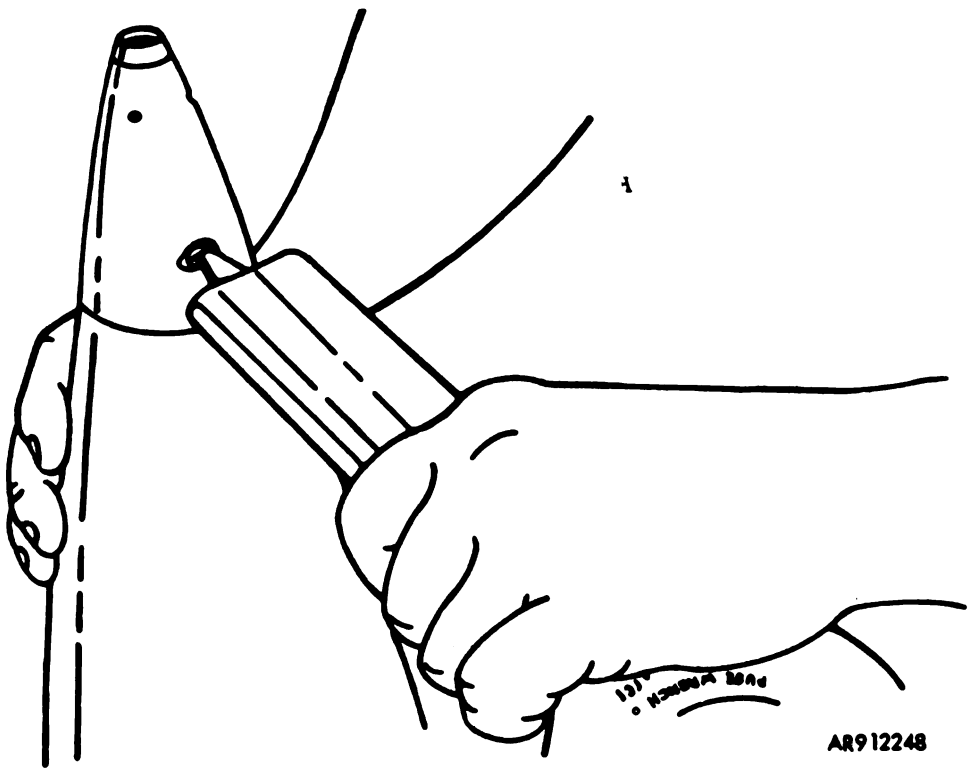


Figure 211.33. M18 fuze wrench on M557 and M739 fuzes.

CAUTION

Plastic nose cone rotates with index mark. Damage to plastic will produce duds. However, since there is no backlash, fuze setting can be accomplished or changed one or more turns with no harmful effect. If counterclockwise rotation is used, be sure that fuze has not become loosened from projectile.

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(1) To set fuze for proximity action, rotate nose cone with M27 fuze setter (normally in clockwise direction while locking down on nose of fuze) until the index mark coincides with the announced time (fig. 211.34). Fuze setting can be changed one or more times with no harmful effects.

(2) For impact functioning of M728/M732 fuzes, set fuzes to 90 seconds using the M27 fuze setter.

(3) Fuze is set when index line at base of nose cone is aligned with time, in seconds, engraved on base of fuze.

(4) Deleted.

(5) Deleted.

(6) Firing temperature limits for proximity fuze M728/M732 are -40°F to +140°F.

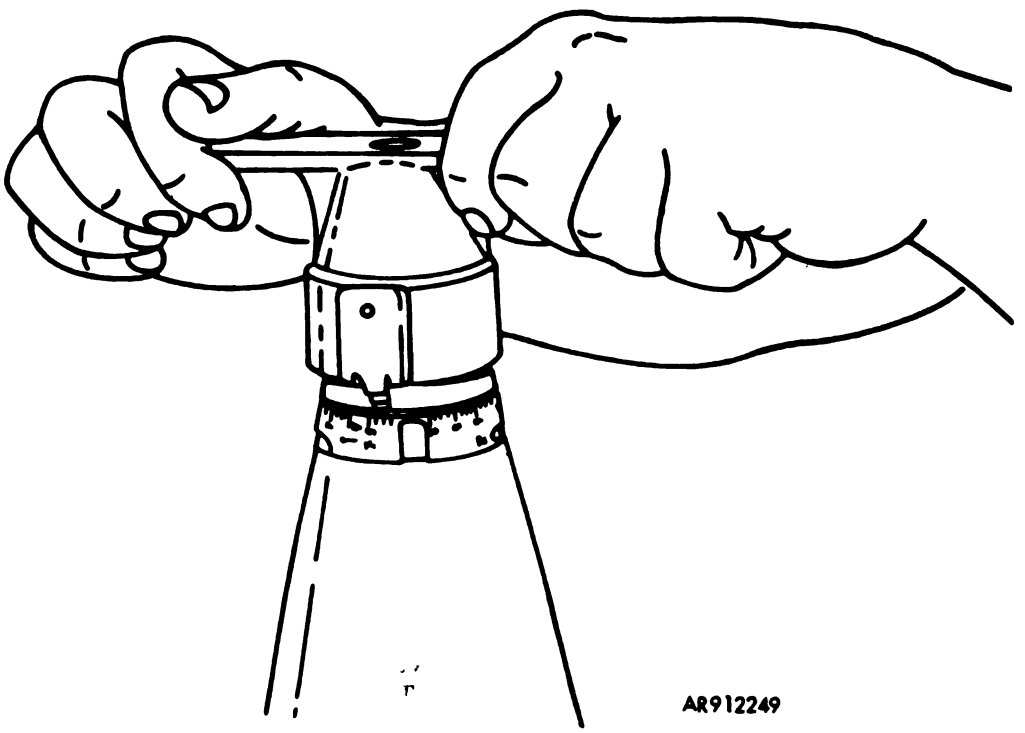


Figure 211.34. M27 fuze setter on M728 and M732 fuzes.

WARNING

Do not fire projectile unless fuze is fully seated. Avoid firing within 750 meters of friendly elements with this fuze. Do not fire these fuzes with the M549 series projectiles over the heads of friendly troops due to the possibility of downrange prematures.

c. Procedure No.3, M565 and M564 (fig. 211.35).

WARNING

TO AVOID ACCIDENTAL FUNCTIONING OF PD ELEMENT IN FUZE M564, DO NOT DROP, ROLL OR STRIKE FUZES UNDER ANY CIRCUMSTANCES (PACKAGED, UNPACKAGED, OR ASSEMBLED TO THE PROJECTILE).

NOTES

Do not attempt to set fuzes until just before firing.

If the M564 fuze is to be fired for super quick action (impact) only, first check the year of manufacture stamped on the fuze body, and follow the instructions below as appropriate.

(1) *Setting M564 fuze for superquick (impact action).*

NOTE

M564 fuzes manufactured before January 1970 must be set on 90 seconds if superquick action (impact) is desired. M564 fuzes manufactured from January 1970 on, should be set on "S" for superquick action. The year of manufacture is stamped on the M564 fuze body. These fuzes are shipped with the "S" on the lower cap scale aligned with the "0' on the vernier scale (fig. 211.35.1).

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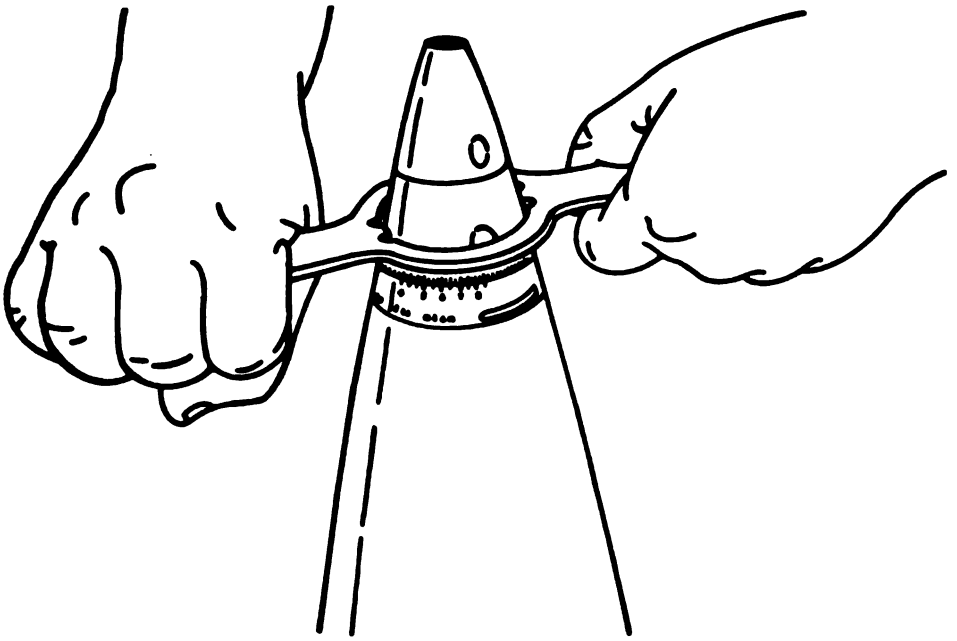


Figure 211.35. M34 fuze setter on M564 fuze.

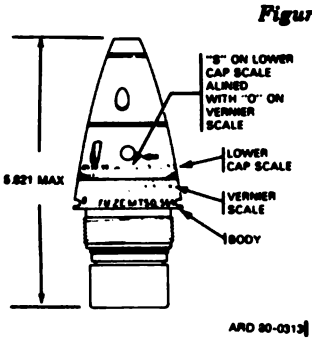


Figure 211.35.1. M564 in "S" shipping position.

(a) M564 fuzes manufactured prior to January 1970. **Use fuze setter M34 to rotate the lower cap in the direction of the arrow (clockwise) from shipping "S" position until the 90 second position on the lower cap scale is aligned with the "0" on the vernier scale (fig. 211.35.2).**

(b) M564 fuzes manufactured in January 1970 and later. **Set the fuze on "S" as shipped for superquick action. Always be sure the "S" on the lower cap scale is aligned with the "0" on the vernier scale (fig. 211.35.3).**

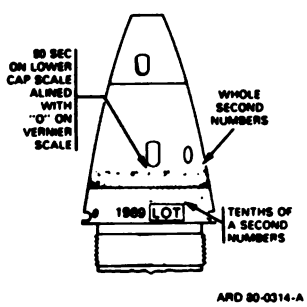


Figure 211.35.2. Correct setting for M564 fuze manufactured prior to January 1970 for superquick action (impact).

(2) Setting M564 and M565 fuzes for airburst (time).

WARNING

INCORRECT SETTINGS OF MT AND MTSQ FUZES CAN AND HAVE RESULTED IN DOWNRANGE PREMATURE MALFUNCTIONS.

(a) **To set the M564 or M565 fuze for a whole second time setting, use the fuze setter M34 or M63 to rotate the lower cap IN THE DIRECTION OF THE ARROW (CLOCKWISE), until the desired whole number of seconds (e.g., 20.0 seconds) on the lower cap scale is aligned with the "0"-mark engraved on the vernier scale (fig. 211.36).**

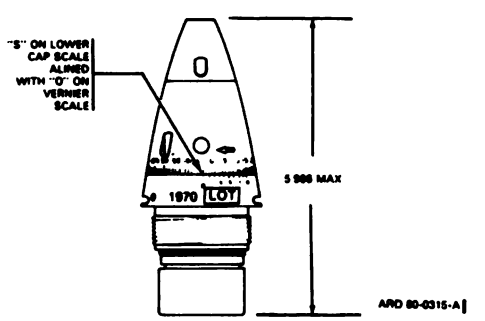


Figure 211.35.3. Correct setting for M564 fuze manufactured from January 1970 on for superquick action (impact).

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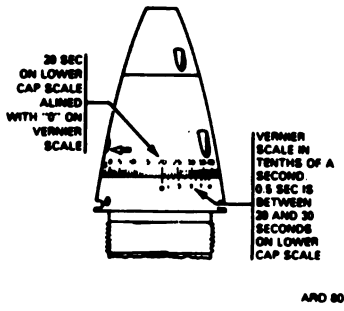


Figure 211.36. Fuze set for 20 seconds.

(b) To set the M564 or M565 fuze for a tenth of a whole second (i.e., 20.5 seconds), use the fuze setter M34 to set the fuze for the whole seconds on the lower cap scale (in this case the whole is 20 seconds). Next find the desired tenth of a second mark on the vernier scale (the 0.5-second mark is between 29 and 30 whole second marks in figure 211.36. Continue to rotate the lower cap IN THE DIRECTION OF THE ARROW until the adjacent upper right graduation on the lower cap scale is aligned with the desired tenth of a second mark on the vernier scale (the 0.5-second mark is now aligned with the 30-second mark on the lower cap scale (fig. 211.36.1).

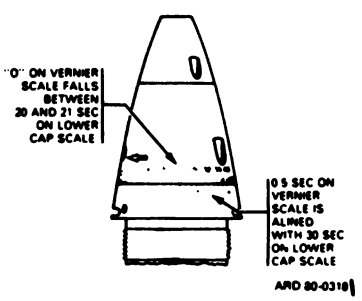


Figure 211.36.1. Correct setting for 20.5 seconds.

NOTE

The fuze setting is always indicated by the position of the "0" on the vernier scale. Each vertical mark on the lower cap scale (moveable portion of fuze) represents one whole second of time. For other than whole seconds settings, the "0" on the vernier scale (non-moveable portion of the fuze) must always be to the right of the whole second portion of the desired fuze setting and between the whole second portion of the desired fuze setting and the next one whole second vertical mark. For example, for a setting of 20.5 seconds, the "0" on the vernier scale is to the right of the 20-second mark and midway between the 20 and 21-second marks on the lower cap scale.

NOTE

An incorrect fuze setting for 20.5 seconds is shown below. If a fuze is set in this way for 20.5 seconds firing, the fuze is actually set on and will function at 10.5 seconds. This would cause the fuze to function earlier than desired (fig. 211.37).

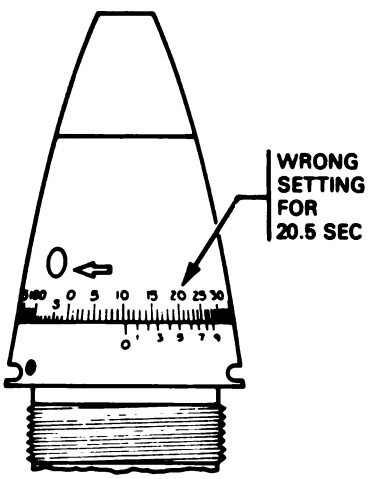


Figure 211.37. Fuze incorrectly set by placing the 0.5 on the vernier scale under the 20-second setting.

(3) *Resetting fuze.* If you miss the setting, use the M34 fuze setter and turn the lower cap in the opposite direction (counterclockwise) 2 or 3 seconds below the desired setting. Then rotate the lower cap in the direction of the arrow (clockwise) and set the fuze on the correct time. This can also be done by turning the lower cap in the direction of the arrow (clockwise) all the way around (additional turn) to obtain the desired setting.

(4) *Fuzes not fired.* If prepared for firing but not fired, reset the fuze, using fuze setter M34 or M63, by turning the lower cap in the direction of the arrow (clockwise) until the "S" mark on the fuze lower cap scale is in line with the "0" mark on the vernier scale.

(5) *Fuzes fired in heavy rainfall.* If the M564 fuze is fired in heavy rainfall, occasional downrange premature functioning may occur. The rainfall necessary to cause malfunctioning is comparable to a heavy downpour which occurs during a summer thundershower. The premature rate will very with the charge fired and the density of the rainfall.

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d. Procedures No. 4, M577 Series and M582 Series (fig. 211.38). The slotted setting key on the nose of the fuze is used for setting the fuze as follows:

(1) Press the open end of M35 fuze setter against the setting key.

(2) Turn the knob handle of the fuze setter counterclockwise as viewed from the nose end until setter blade engages fuze setting key slot. The hairline in the window is used for all settings.

NOTE

The fuze M577 series or M582 series is set to the desired time by rotation of the fuze setter in a counterclockwise direction. To return to shipping and storage setting, the fuze setter must be rotated in a clockwise direction.

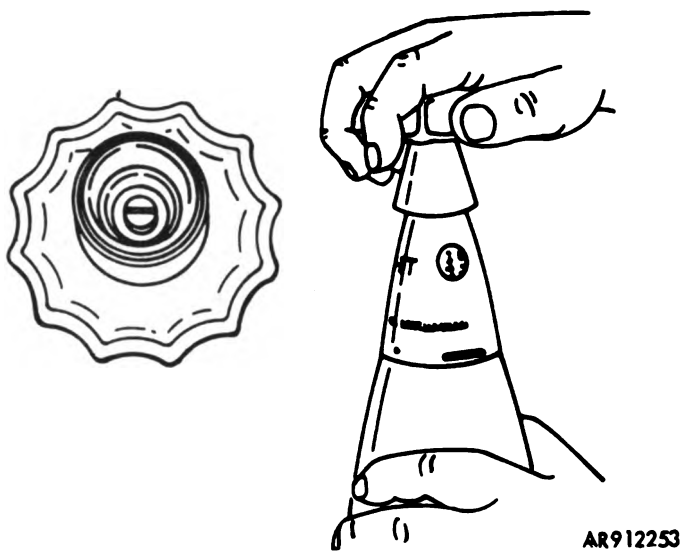


Figure 211.38. M35 fuze setter on M577 series and M582 series fuzes.

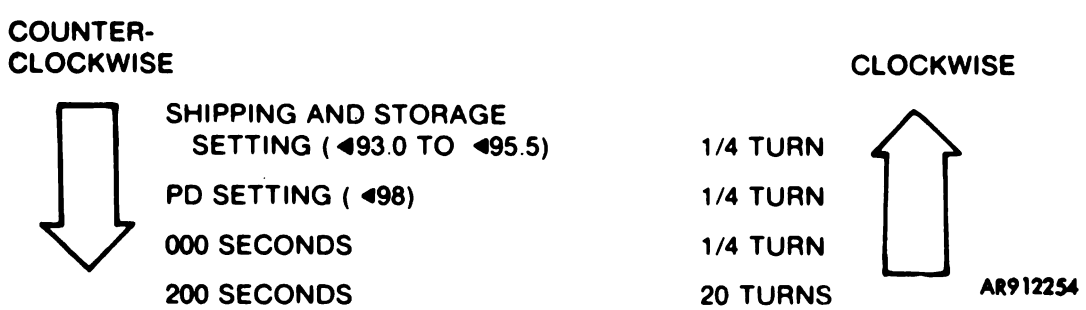


Figure 211.38.1. Fuze setting chart for M577 series and M582 series fuzes.

CAUTION

Do not attempt to set these fuzes below ◄93.5 when setting them in the clockwise direction or above 200 seconds when setting them in the counterclockwise direction. The setting of 000 to 200 are not authorized service settings.

(3) When setting fuze for PD action superquick), start with shipping and storage position (safe) (◄93.5 to ◄95.5), and then turn counterclockwise to ◄98.0 under the hairline window fig. (211.38.1) for PD action.

(4) To set fuze for mechanical time action, turn the fuze setter counterclockwise from safe position (◄93.5 to ◄95.5) past PD (◄98.0) until the triangle (◄) disappears). This action occurs near a 000 setting. Continue to turn fuze setter counterclockwise until desired time appears under

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the hairline. Maintain a very light turning force against the fuze setter while reading the setting. The sequence is illustrated below for a setting of 25.5 (fig. 211.39).

(5) To set a lower time on a fuze already set, reseat fuze setter and turn clockwise (numbers get smaller) to a setting at least 1 second lower than the required setting (for example, at least 24.5 to 25.5) Reverse direction to counterclockwise (numbers get larger) and set required time under the hairline.

(6) To return fuze to shipping and storage (safe) position, turn fuze setter clockwise (numbers get smaller) until 000 is passed, and continue to turn until setter stops turning freely. This point should be past the PD setting (◄98.0) and between ◄95.5 and ◄93.5. Notice that the triangle has reappeared in the window. Do not apply excessive force on the fuze setter after it has stopped turning and the setting is between ◄95.5 and ◄93.6. Return fuze to reusable fuze container. Fuze is considered unserviceable after being out of container for more than 30 days.

e. Procedure No. 5, M501 Series.

WARNING

Dropping or rough handling of a projectile assembled with Fuze MTSQ M501/M501A1 may result in fuze functioning and expulsion of projectile base plate and contents. When handling projectiles assembled with this fuze, exercise extreme care to protect the fuze from impact. Keep pull wire on fuze in place until immediately prior to firing.

CAUTION

Do not fire fuzes with cocked or loose lower caps. Mark such fuzes "defective" and return them to the ammunition supply point.

NOTE

The M501 series fuzes are shipped with the index mark on the lower cap aligned with the S engraved on the base.

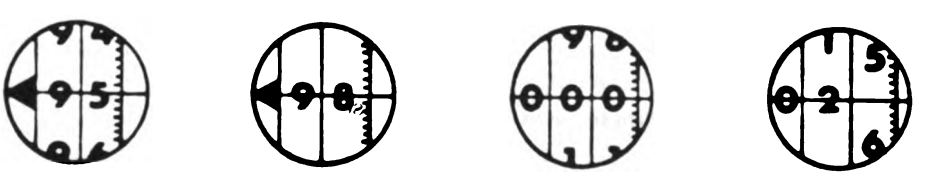


Figure 211.39. Fuze setting sequence.

(1) *Time setting.*

(a) Check fuzes for cocked or loose lower caps.

(b) To remove safety wire before setting, pull end of wire from hole in lower cap, sliding wire off end of fuze.

(c) With fuze setter M27, set fuze by rotating lower cap to desired time—in counterclockwise direction or in direction of arrow marked on lower cap. The fuze is properly set when the index mark on the lower cap is aligned with desired time, in seconds, engraved on the base.

(d) If, after the fuze is set, the round is not fired, reset the fuze to the safe (S) and place the safety wire in its proper position.

(2) *Impact setting.* Impact functioning of the MTSQ fuze M501 series may be obtained by either leaving the S (shipping mark) aligned with the index mark on the base or by setting the graduated time ring so that the time setting is greater than the time of flight. Remember, you must remove the safety wire (pull free end of wire off and out of hole) before firing or setting the fuze.

174.27. Propelling Charge Preparation for M3 Series and M4 Series

WARNING

Under no circumstances will green bag and white bag charges be assembled together for firing. Critical malfunction could result.

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WARNING

White-bag charges M4A2 and M4A1 can be expected to perform within design limits at zones 5 through 7. However, large dispersions may result when these charges are fired at zones 3 and 4. It is recommended that green-bag charges M3A1 and M3 be used in lieu of white-bag charges at zones 3 and 4. If green-bag charges are not available, white-bag charges may be used with the knowledge that range dispersions may result.

a. If required, untie straps and remove unrequired increments from charge.

b. Retie straps tightly over top of charge with two interlapping square knots.

c. In preparing white-bag charge M4 or M4A1, one M2 flash reducer should be added to the forward end of each increment used. The charge must be untied and the proper number of M2 flash reducers inserted (i.e., one flash reducer is added at the forward end of the base charge and each increment used). The charge is then retied with two interlapping square knots.

NOTE

Use of M2 flash reducer, to reduce muzzle flash, is optional except when TB 9-1300-385-1 or -2 restricts a specific propelling charge lot to use with flash reducer only. Propelling charge M4A2 has a flash reducer assembled forward of the base charge (increment No. 3) at the time of manufacture, and does not require use of the M2 flash reducer.

174.28 Loading

WARNING

Do not load or fire artillery ammunition without authorized fuze. Firing of such rounds without fuzes could result in in-bore prematures and other hazardous conditions. Look through cannon tube. If tube is clear, announce bore clear.

Do not load or fire round if fuze is not fully seated.

Firing of fuzes M557 and M564 during heavy rainfall may result in occasional downrange prematures. The amount of rainfall necessary to cause functioning is comparable to the heavy downpour which occurs during a summer thundershower.

Do not fire proximity fuzed ammunition at targets closer than 732 meters (800 yd) to friendly positions.

Do not fire the M483A1, M692/M731 projectiles below zone 3 (GB) and zone 4 (WB). Firing below these zones results in stickers.

a. Make sure round is clean and fuze is present and fully seated.

WARNING

Firing a round with an obstruction in the cannon tube can cause an in-bore premature.

b. Make sure there are no obstructions in the cannon tube.

c. Check cannon firing lock to see that primer expended in previous firing has been removed.

d. Remove grommet from projectile.

e. Load fuzed projectile into cannon and ram it solidly into the firing chamber.

WARNING

Never load a propelling charge into the firing chamber by increments. Only fully assembled charges will be used.

f. Remove the igniter protective cap from propelling charge and load propelling charge into cannon chamber, with igniter end (red bag) toward breech.

WARNING

Never close the breechblock unless you can see the red igniter bag on the base of the propelling charge.

g. Close and lock breechblock.

WARNING

Never insert primer in primer seat unless breechblock is closed and locked.

h. Insert primer in firing mechanism.

i. Insert firing mechanism in firing mechanism housing.

174.29. After Firing

a. Open breechblock and secure in the open position.

b. Wipe face of obturator spindle after each round. Swab powder chamber with sponge and water making sure that all burning fragments of powder charge are removed from firing chamber.

c. All ammunition fired must be recorded by charge number, type, and total number of each fired, and entered on DA Form 2408-4 by the chief-of-section.

174.30. Ammunition Prepared For Firing But Not Fired

a. Using applicable setter and procedure (table 18), reset the fuzes of projectiles prepared for firing but not fired (time fuzes reset to safe, VT fuzes reset to intial setting at which they were shipped, superquick and delay reset to SQ). Replace safety wires in those fuzes so furnished.

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b. Disassemble fuze from projectile and repack in original packing. When proximity fuze is removed from projectile, replace supplementary charge in projectile before assembling spacer and lifting plug.

c. Replace grommet over rotating band.

d. Restore propelling charges to original condition. Make sure all zones (increments) are present, tied, in proper order, in good condition, and of the proper lot number.

e. Replace fuzes, primers, and flash reducers in original packing.

f. Make sure the lot number of the ammunition corresponds with the lot number on the container.

g. Special instruction for the M483 series ICM projectile.

WARNING

Use no other lifting plug except the fusible plug removed from this projectile, because it is designed for safety release of pressure inside the projectile in case of a malfunction during storage or shipping actions.

h. Reinstall expulsion charge assembly to the M483A1 projectile as follows:

(1) Wind the pull-wire under four tabs on the cover of the expulsion charge assembly (1-1/2 turns for proper engagement).

(2) Place expulsion charge assembly into projectile fuze well.

(3) Reinstall fusible lifting plug (with gasket).

i. If rocket-off cap was removed from the M549/M549A1 HERA projectile, replace cap and tighten handtight.

b

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Section IX. MISFIRE/CHECKFIRE PROCEDURES

174.31. General

a. Conditions described in this section are rarely encountered when authorized and properly maintained ammunition is fired in a properly maintained and operated weapon. However, to avoid injury to personnel and damage to equipment, it is important that all concerned understand the following:

(1) What is involved when this weapon fails to fire.

(2) What should be done when a failure to fire occurs.

b. The authorized rates of fire are:

WARNING

When the authorized rates of fire for the M114, M114A1, or M114A2 are exceeded, propelling charge cook-off's may occur within five minutes after chambering.

(1) Maximum rate: 4 rds/min for 3 minutes.

(2) Sustained rate: 1 rd per minute.

174.32. Definitions

a. Misfire. When the weapon does not fire after an attempt to fire has been made. This failure may be due to the failure of the primer, the igniter, the propelling charge, or firing mechanism to function wholly or in part. A misfire in itself is not dangerous: however, it cannot be immediately distinguished from a hangfire. Misfires must be treated as hangfires until determined otherwise.

b. Checkfire. A command normally given by the executive officer. But, in an emergency, may be given by anyone present. On this command, regardless of its source, firing will cease immediately and the unloading operation will be initiated.

c. Hangfire. A delay in functioning of the primer, igniter, or propelling charge. This delay is unpredicable and may range from a fraction of a second to ten minutes.

d. Cook-off. The functioning of the propelling charge or projectile when initiated by the heat of the weapon.

e. Hot Tube. Any tube that causes water from a wet swab to boil, fry, or steam off when placed just forward of the gas check seat.

f. Cold Tube. Any tube that does not cause water from a wet swab to boil, fry, or steam off when placed just forward of the gas check seat.

174.33. Failure to Fire With a Cold Tube

WARNING

Early primer removal (prior or two minutes) can expose the cannoneer to the danger of recoiling weapon in case a hangfire condition exists. Stand clear of recoiling parts, exposing only the hand and the arm when removing the primer at the end of the safe wait period (ten minutes).

a. Follow misfire procedures of figure 211.40.

b. There is no danger of a cook-off in a cold tube.

174.34. Failure to Fire or Interrupted Fire With a Hot Tube

a. Follow misfire procedures of figure 211.41.

b. Observe the following warnings.

WARNING

Primer removal may expose cannoneer to the danger of a recoiling weapon in case a hangfire condition exists. Stand clear of recoiling parts, exposing only the hand and arm when removing the primer before the end of the safe wait period. If a commander, in order to avoid prolonged loss of weapon, determines to fire projectile, it must be fired within five minutes following projectiled chambering to prevent any change of cook-off.

Do not attempt to remove projectile.

c. Wait two hours, then proceed as follows:

(1) Remove firing mechanism and propelling charge.

(2) Place waste in chamber.

(3) Close breech.

(4) Lock in traveling position.

(5) Carefully move weapon to a remote location.

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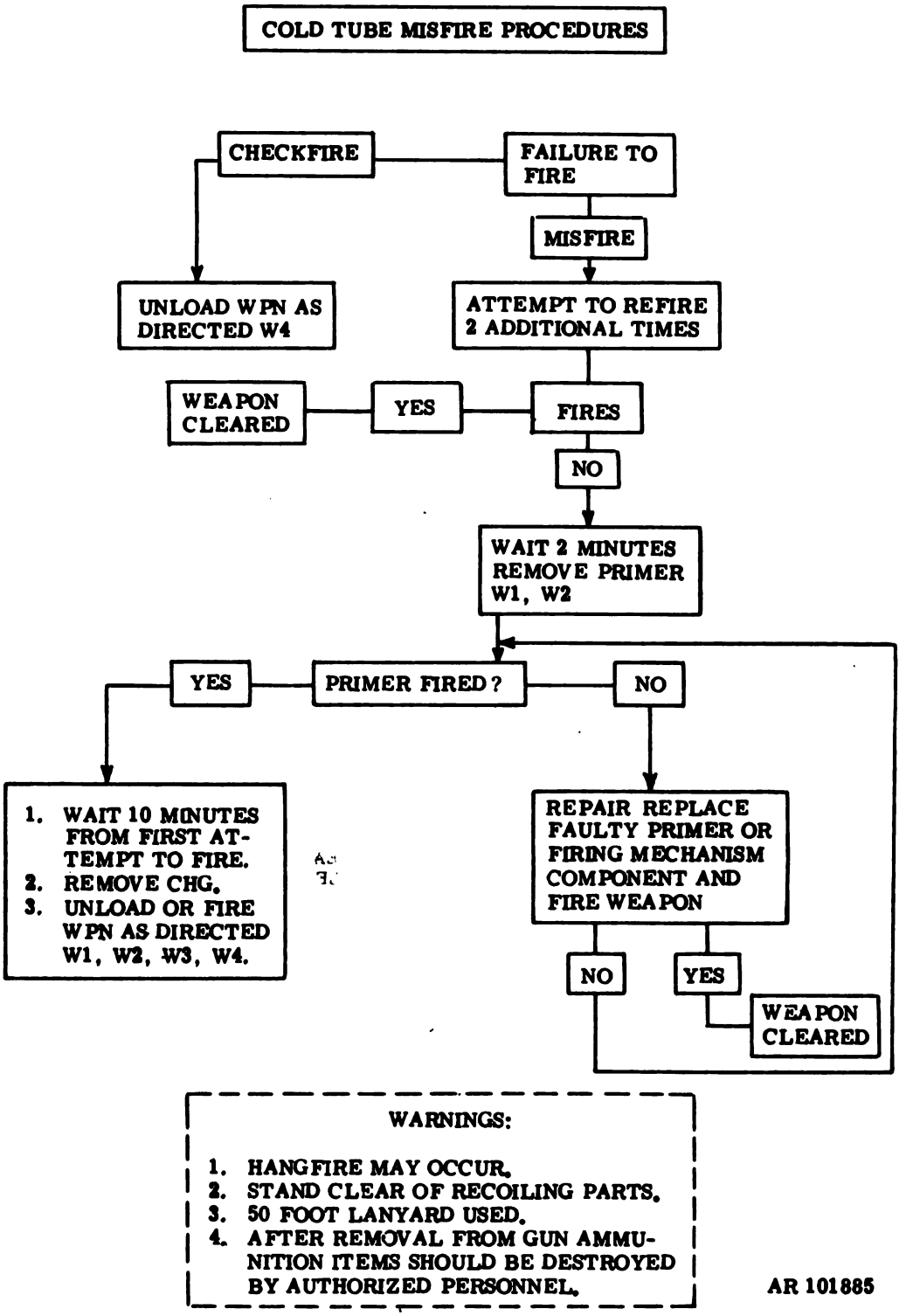


Figure 211.40. Cold tube misfire procedures.

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CAUTION

ONLY 5 MINUTES AVAILABLE FOR CORRECTIVE ACTION AFTER CHAMBERING.

If you get a failure-to-fire, follow the YES/NO procedure below to clear weapon.

HOT TUBE MISFIRE PROCEDURES

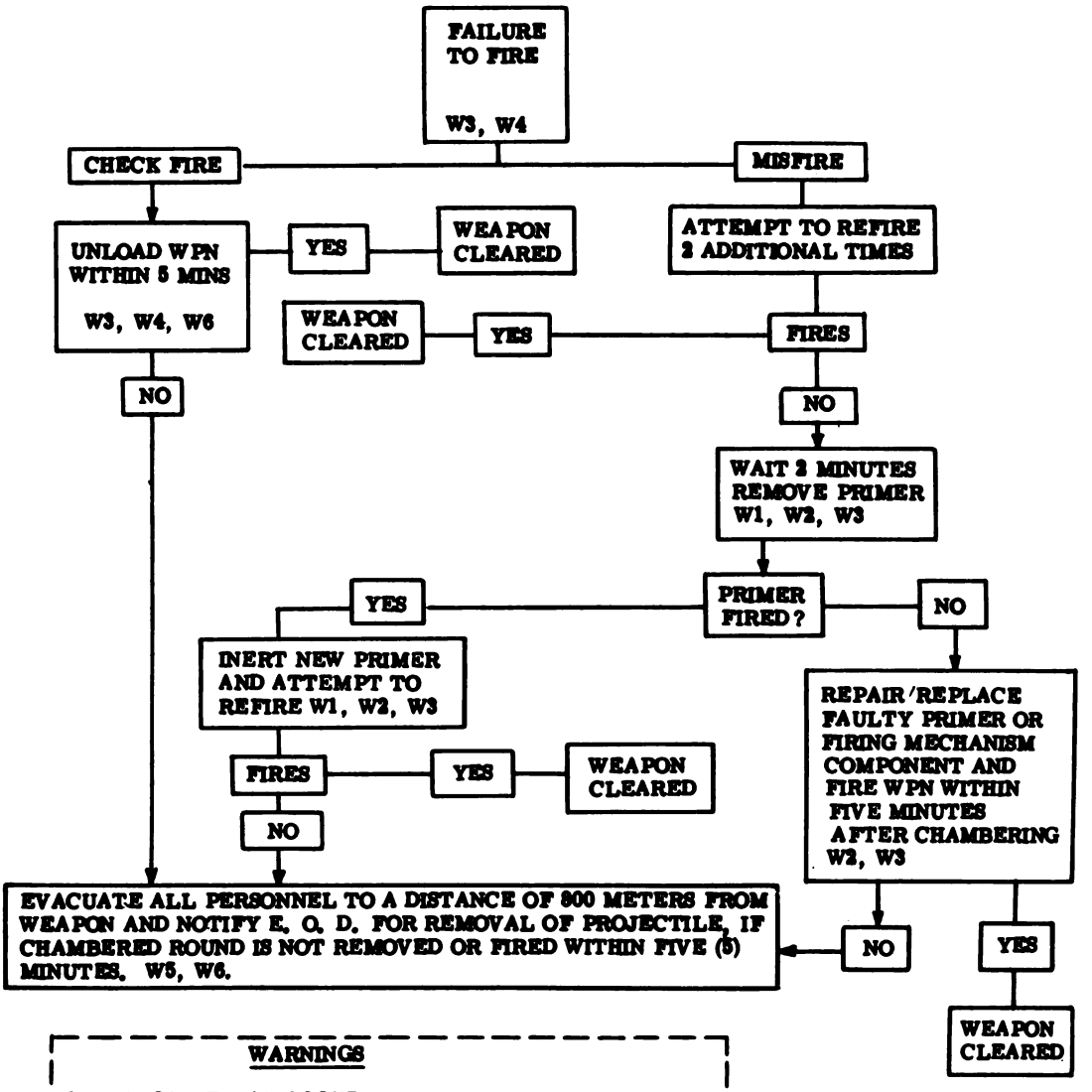


Figure 211.41. Hot tube misfire procedures.

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Section X. MAINTENANCE OF AMMUNITION

174.35. Handling Explosives

WARNING

Handle explosive ammunition and components containing explosives, with utmost care. Do not drop, throw, tumble, or strike packaged or unpackaged ammunition or related components. Explosive elements in primers and fuzes are sensitive to shock.

Do not expose ammunition and components containing explosives to extreme temperatures.

Do not expose to direct sunlight, flame, or other sources of heat.

Do not expose ammunition or components containing explosives to rain, excessive humidity, or ground moisture; otherwise, short ranges may result.

A drop of four feet may cause the electrolyte vial in a VT fuze battery to break, thus creating a dud.

174.36. Care

a. Ammunition is packed to withstand conditions ordinarily encountered in the field. Protect packing boxes from becoming broken or damaged.

b. Since ammunition is impaired by moisture, frost, extreme temperatures, and foreign matter (mud, oil, etc.) observe the following:

(1) Do not break the moisture-resistant seal on container until ammunition is to be used.

(2) Shield ammunition, particularly fuzes and propelling charges, from sources of high temperatures (e.g., the direct rays of the sun).

174.37. Handling

a. Protect propelling charges from moisture and foreign matter during handling.

b. Protect fuzes, primers, and flash reducers from foreign matter and impact at all times.

174.38. Maintenance

WARNING

Alteration of loaded ammunition or components is prohibited.

a. Procedures.

(1) Inspect ammunition packaging daily. Open boxes or containers which show evidence of contaimination or deterioration, and inspect ammunition. Do not open sealed boxes or container unless defective ammunition is to be inspected.

(2) Inspect unpackaged ammunition and explosive components daily.

Section XI. MAINTENANCE

174.39. Handling

WARNING

Keep fire and flammable materials out of the ammunition area. There will no smoking in the viciniy of ammunition.

a. Do not expose ammunition and components containing explosives to extreme temperatures. Do not expose to direct sunlight, flame or other sources of heat.

b. Do not expose unpacked propelling charges and fuzes to rain, excessive humidity, or ground moisture.

c. Prevent rough handling or projectiles and fuzes. Do not strike projectiles together, and do not offload ammunition by dropping projectile on top of projectile.

d. Protect fuzes, primers, and flash reducers at all times from foreign matter and impact. A drop of 4 feet may cause the electrolyte vial in a VT fuze battery to break, thus causing a dud.

e. Do not disassemble fuses.

174.40. Care

a. Ammunition is packed to withstand conditions ordinarily encounted in the field. Keep packing boxes from becoming broken or damaged.

b. Since ammunition is impaired by moisture, frost, extreme temperatures, and foreign matter (mud, oil, etc.) observe the following:

(1) Do not break the moisture-resistant seal on container until ammunition is to be used.

(2) Shield all ammunition from high temperature sources (e.g., the direct rays of the sun).

174.41. Maintenance

WARNING

Alteration of loaded ammunition or components is prohibited.

a. General.

(1) Inspect ammunition packaging daily. Open boxes or containers which show evidence of contamination or deterioration, and inspect am-

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munition. Do not open sealed boxes or containers unless defective ammunition is suspected.

(2) Inspect unpackaged ammunition and explosive components daily.

(3) Wipe off wet or dirty ammunition at once. Remove light corrosion. Do not polish ammunition to make it look better.

(4) Consider ammunition which exhibits severe rust or propellant contamination, particularly moisture, unserviceable. Do not use except in emergency.

(5) When repackaging ammunition, put it back into original containers. If other packing material must be used, the old markings should be transferred o the new containers.

NOTE

Proper performance of ammunition maintenance procedure when ammunition is recieved by using units assures that ammunition on hand is kept ready for use.

b. Projectiles.

(1) Visually inspect projectiles for the following defects:

(a) Distorted, out of round or damaged body.

(b) Dirt or other foreign material.

(c) Exudation of explosive filler.

(d) Rust through projectile base plate.

(2) Clean dirt of foreign material from projectile by wiping with a damp rag.

(3) Return defective projectiles to ammunition supply point.

(4) Inspect the M549/M549A1 Projectile for the following:

(a) Missing or broken obturating band. The projectile cannot be used if the obturating band is broken or missing. Return projectile to the supply point.

(b) Broken lifting plugs. When the lifting plug is broken, the threaded area will ramin in the projectile. Do not attempt to extract any portion of the broken plug. Return the projectile to the supply point.

(5) The M483/M483A1 Projectile can be used if the obturator is missing or broken. Remove and discard broken obturating bands.

c. Propelling Charges M3 and M4 Series.

(1) Visually inspect propelling charges for defects as follows:

(a) Loose tie straps allowing separation of the charge into increments.

(b) Missing increment, extra increment or in correct sequencing (order) of increments.

(c) Increment bags torn or damaged to extent black powder or propellant spills out.

(d) Propelling charge wet.

(e) Red igniter pad on base of charge, missing or damaged.

(2) Charges requiring retying may be retied as follows:

(a) Assemble increments in correct order.

(b) Tie the four tie straps over top of charge using two interlapping square knots.

(3) Return all defective charges to the ammunition supply point.

d. Fuzes.

(1) Inspect fuzes for following defects:

(a) Damage to body or threads.

(b) Loose components.

(2) Return defective fuzes to ammunition supply point.

e. Ammunition or Components of Ammunition Prepared for Firing, but not Fired.

(1) Return such ammunition to the original condition and packing. Mark appropriately and use first in subsequent firings in order to keep stocks of open packings to a minimum.

(2) Reassemble the supplementary charge and lifting plug (with gasket and spacer) to the projectile to restore to its original condition. Return fuzes to original packing. In reassembling the components, make certain the supplementary charge is properly inserted (felt-pad end innermost).

(3) Remove the projectile spotting charge from the M577 fuze (para 174.24) and replace the expulsion charge assembly and fusible lifting plug with gasket to the M583A1 projectiles.

(4) Reassemble propelling charges prepared for firing, and not used, and replace in original containers as follows:

(a) If increment was removed, reinstall and retie as indicated above.

(b) Replace igniter protective cap.

(c) Repack charge in container (igniter end first) and close and secure container.

(d) Mark container appropriately and use charge first in subsequent firings.

f. Unserviceable Ammunition.

(1) Conspicuously mark unserviceable ammunition or explosive components UNSERVICEABLE, and return to ammunition supply personnel for disposition.

(2) Repackage ammunition in original containers. If original container is unsuitable, use available package material and transfer all markings. All layers of packing must be conspicuously marked UNSERVICEABLE.

g. Excess Explosive Components.

(1) Pack supplementary charges removed from projectiles prior to assembling proximity fuzes in

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containers from which proximity fuzes were removed.

(2) Properly mark container and return to ammunition supply personnel for disposition.

(3) Destroy any unused powder increments left over after round has been fired by burning them in a safe place.

174.42. Storage

WARNING

Ammunition exposed directly to sunlight, or in unventilated containers, inclosures, shelters, freight cars, closed vehicles, and similar structures exposed to direct sunlight, may reach temperatures exceeding upper storage limits. Avoid exposure of ammunition components to direct sunlight. Do not store ammunition assembled with tetrytol loaded bursters (i.e., projectiles, 155-mm: Smoke, WP, M110; Gas, H. and HD, Persistent, M110) at temperatures exceeding +125° F.

a. Temperature Limits.

(1) Except as otherwise specified, observe the following limits:

(a) Lower limit is −80° F. for periods of not more than 3 days.

(b) Upper limit is +160° F., for periods of not more than 4 hours per day.

(2) Store or transport projectiles containing WP at temperature below the melting point of the WP filler (+111.4° F.). If this is not practicable, store or transport such projectiles on their bases so that, should the WP filler melt, it will resolidify with the void in the nose of the projectile.

(3) Protect proximity fuzes and proximity rounds from long exposure to high humidity. Store M728/M732 fuzes in temperatures between −65° F. to +145° F.

WARNING

Do not store ammunition under trees or near tall buildings that attract lightning. When ammunition must be stored in the open, select a storage site free of power lines, electric cables, and flammable materials. Sites should not be adjacent to reservoirs water mains, etc. Do not store ammunition near large concentration of personnel.

b. Sites. Store ammunition in the firing area so that it is protected against accidental explosions. Sites should be level and well-drained.

d. Provisions.

(1) Use heavy, well-supported dunnage to keep bottom tier of stack off the ground and to prevent it from sinking into the ground.

NOTE

A hardstand of blacktop or gravel and sand is preferable to excessive use of dunnage.

(2) Allow at least 6 inches of space beneath the pile for air circulation. Dig trenches to prevent water from flowing under pile.

(3) Provide nonflammable covers (e.g., tarpaulin) for all ammunition. Maintain air space of approximately 18 inches between cover and ammunition. Keep cover at least 6 inches from pile on ends and sides to permit circulation of air.

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Section XII. M712 HEAT, CANNON LAUNCHED, GUIDED PROJECTILE AND M823 TRAINING PROJECTILE (COPPERHEAD)

174.43. Description

a. M712 cannon-launched, guided projectile (fig. 211.42) is a terminally guided system launched from the M114A2 howitzer into a ballistic trajectory. During flight, the target is illuminated by a laser beam from a laser designator. An onboard computer continuously refines the terminal trajectory and provides guidance to the control surfaces, causing the round to home in on stationary or moving hardpoint targets. The M712 projectile is fired in the same manner as conventional projectiles.

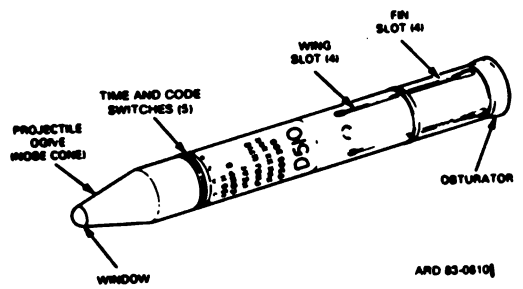


Figure 211.42. Projectile, 155mm, HEAT, M712.

WARNING

The M823 training projectile must not be fired. Such firing could be a hazard to personnel forward of the weapon.

b. The training round for M712 projectile is M823 projectile. The M823 projectile is designed to train 155mm howitzer weapon crews in the handling and setting of the M712 projectile. It simulates the M712 in weight, center of gravity, and external appearance. It contains time and code switches which are set to simulate prefiring activity by the crew; however, it does not have the wings or fins. It is shipped and stored in the same container as the M712 projectile and color coded bronze for easy identification. The containers for both the M712 and M823 projectiles are forest green. Marking for the M712 is yellow; for the M823, it is white. Bronze patches at container ends also identify the M823 inside.

174.44. Unpackaging and Inspection

WARNING

If exuded composition B is observed on the projectile or in the container during the unpackaging and inspection operations, move the projectile to a safe area and notify EOD for disposal.

NOTE

Container with repackaged rounds should be tagged to indicate time of exposure.

a. Unpackaging.

(1) A humidity indicator is located in the aft end of the container. This indicator card (fig. 211.43) is the pie-sector type. The M823 training round has a card that resembles the card for the M712 projectile, but says "DUMMY CARD" on its face. The procedures given below for humidity indicator check, protective bag, and 72 hour repackaging apply only to the M712 projectile; the unpackaging procedures starting with "Cannoneers No. 2 and 7 —" apply to both the M712 and M823.



Figure 211.43. Humidity indicator card.

(2) Open only those containers whose humidity indicator card shows under 40 percent relative humidity (40 percent sector must be colored blue, 30 percent sector may be blue or pink), and only when a fire mission is planned or anticipated. If the 40 percent humidity sector is pink, turn complete item in to battalion ammunition section. Keep all packaging materials in the container. A protective bag is provided inside each container. When mission requirements dictate a need, the M712 projectile may be removed from the shipping and storage container and placed in the protective bag. The protective bag will protect the round against direct effects of water, sunlight, dirt, and debris. However, it will not protect the round from the elements for more than 72 hours at a time. Repackage unfired projectiles within 72 hours and turn in to battalion ammunition section. Projectiles must be repackaged for vehicular transportation. Cannoneers No. 2 and 7 will unpackage the M712 projectile (fig. 211.44) from its container as follows:

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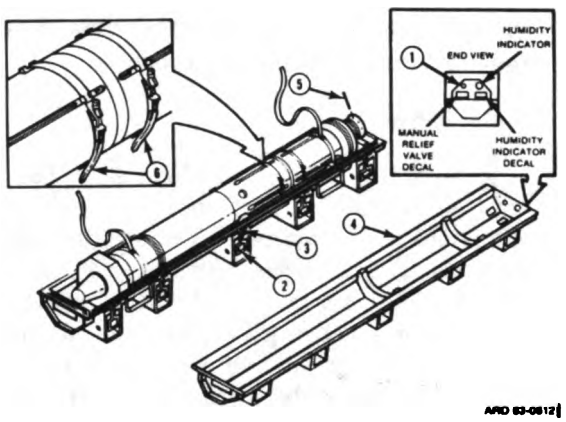


Figure 211.44. Unpackaging round from container.

CAUTION

Before unpackaging round from container, make a quick visual inspection of the projectile for obvious damage or other condition that would prevent use. If projectile appears not useable, replace cover and return to battalion maintenance.

(a) **Break and remove metallic seal wires (if present) located on center latch assembly on both sides of container, using a screwdriver or equivalent tool.**

(b) **Depress manual relief valve (1).**

(c) **Release container latches (2), starting at the manual relief valve end, in pairs. Pull latch handle all the way up, remove barrel nut (T-bolt) (3) from recess in cover, and then pull all the way down.**

(d) **Separate cover (4) from container body and place upside down on ground alongside the body.**

(e) **Partially pull torquing rod (5) from rear end of tension mechanism.**

(f) **Turn torquing rod counterclockwise to release tension, then spin tension mechanism by band until it stops.**

(g) **Open stainless steel fin and wing preload bands (6). Remove and place in the container cover (fig. 211.45).**

CAUTION

Do not let the projectile touch the ground or lay in water. Projectile may be placed on a tarpaulin or may be put down across the top of the open container. Water, dirt, or other materials entering projectile through wing/fin slots may cause projectile to fail during flight. Do not touch or grasp ogive when handling and loading projectile.

(h) **Cannoneers No. 2 and 7 should carefully remove projectile (7) from container by lifting it up and to the rear, using lifting straps (8) provided on the projectile (fig. 211.45).**

(i) **Place the projectile on a clean, dry surface. The projectile should be shielded from direct sunlight, rain, dirt, and other debris.**

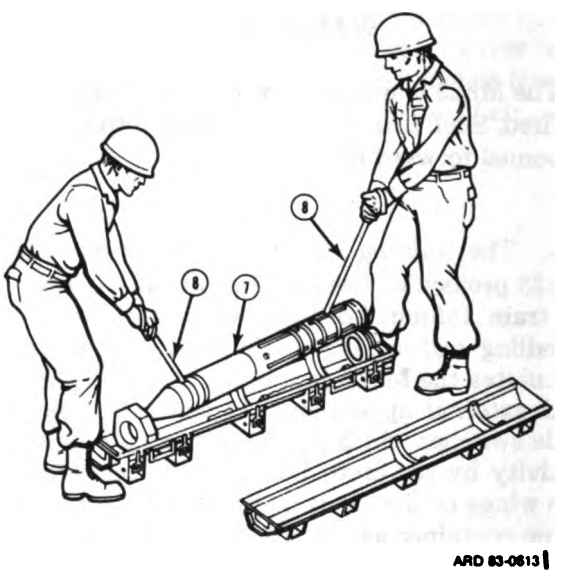


Figure 211.45. Removing projectile from container.

(j) **Remove lifting straps (8), and place them in the container.**

(k) **Keep the container and all packing materials for reuse or return complete container to battalion ammunition section.**

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b. Inspection of M712 Projectile. Cannoneers No. 2 and 7 perform the following inspections immediately after the projectile is unpackaged from its container. If a projectile is found to be unserviceable as a result of damage or other defects as described below, repackage the projectile in its original container; and return to battalion ammunition section. Attach a tag describing the defects.

(1) Inspect the window area of the nose cone to make sure that it is clean and that there are no cracks, fogging, indications of moisture on the inside of the window, or other damage. Clean a dirty window, using a clean wiping rag. Reject a projectile as unserviceable for any of the following reasons:

(a) Window cannot be properly cleaned.

(b) Window shows signs of fogging or has moisture on the inside.

(c) Window is cracked, broken, or badly gouged.

(2) Inspect time and code switches to make sure that they are free of dirt and that all numbers and index marks are legible. Remove dirt, using a clean wiping rag. Reject a projectile as unserviceable for any of the following reasons:

(a) Missing or broken switch dials.

(b) Switch dials cannot be properly cleaned to make numbers and index marks legible.

(c) Switches cannot be rotated freely when the firing codes are being set into the projectile.

(3) Reject a projectile as unserviceable if the obturator has a crack or large gouge.

(4) Inspect wing and fin slots to make sure that there is no dirt, debris, or other foreign matter in them. If slots are blocked, clean out with a small screwdriver, knife blade, or similar tool.

(5) Inspect fins (fig. 211.46) to make sure that they are not in extended position. If they are, perform either *(a)* or *(b)* below to relatch fins. Reject projectile as unserviceable if fins cannot be relatched.

(a) If fin is only part way out, gently push fin back into its slot until it locks in place.

(b) If fin is locked in extended position, insert a small screwdriver, knife blade, or similar tool into fin slot as shown. Depress locking pin with tool, and push fin forward at the same time to lock fin in retracted position.

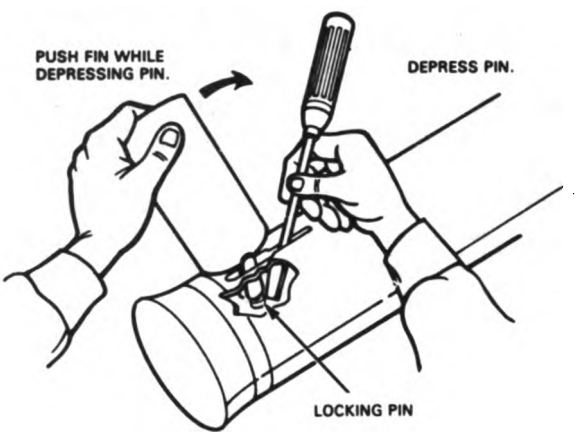


Figure 211.46. Inspecting fins.

(6) Inspect the overall projectile to make sure that there is no caked-on dirt, excessive corrosion, loose items such as screws or access covers (Screws are loose if the head of the screw is higher than the surface around it.), or other damage. Remove dirt and foreign matter, using a clean wiping rag. Reject a projectile as unserviceable if there is excessive corrosion, loose items, or other damage. Minor rust, corrosion, gouges, or burrs on metal projectile body are acceptable.

(c) Inspection of M823 Projectile. Since the M823 projectile will be reused many times, it will be rejected only for the following reasons:

(1) Nose cone is cracked or broken.

(2) One or more switches cannot be rotated or will not stay set to a number.

(3) Severe damage to projectile body which could prevent it from being rammed or extracted and cause damage to the interior of the gun tube.

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(4) Badly damaged or worn obturator which results in fallback.

(5) Damaged base which prevents proper extraction.

174.45. Preparation for Firing.

WARNING

- Forcing cone in the gun tube must be free of oil and grease before ramming. Oil or grease may permit projectile fallback.
- After extracting an M712 projectile from a hot gun tube, forcing cone must be cleaned of melted plastic. Failure to do so may result in projectile fallback. Cleaning may be accomplished by firing another 155mm round if mission requirements permit or firing a propelling charge alone.

NOTE

For training purposes, the M823 training projectile will be used instead of the M712 projectile. All operational procedures which apply to the M712 also apply to the M823 projectile. However, no live propelling charges are used with the M823 training round.

a. Unpackage and inspect M712 or M823 projectile (par. 174.44).

b. The chief of section makes sure that the extractor assembly is set up and ready for use as described in paragraph 174.47.

c. After unpackaging the round, cannoneer No. 7 sets the time and code switches (fig. 211.47) using a screwdriver or the tang end of the M18

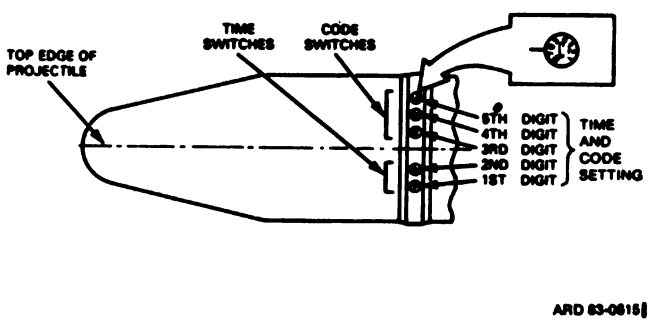


Figure 211.47. Setting time and code switches.

fuze-setter wrench. The fire direction center announces this setting in the fire command in the same place as they usually send "time" for time or VT fuzes. This switch setting will always have five numbers. Switches will be set from left to right as seen when facing the nose of the projectile from the base of the round. The switches are circular dials that can be rotated clockwise or counterclockwise as many times as required without damaging the switches. The appropriate number on the switch must be aligned with the scribe line.

d. The gunner sets the elevation of the gun tube between 250-500 mils for loading the projectile.

WARNING

The M712 projectile is not adaptable for use with the current loading tray. Damage to projectile or injury to personnel could occur.

e. Cannoneers No. 3 and 4 carry the prepared projectile to the howitzer. The chief of section rechecks the nose cone window and obturator cleanness. If necessary, they are wiped clean, using a clean wiping rag.

f. Chief of section rechecks code and time switches. If switches have not been set, or have been set incorrectly, he sets or corrects them at this time. The chief of section also verifies that the steel fin and wing retainer bands have been removed. If the clamps have not been removed, he will have them removed.

g. Cannoneers No. 3 and 4 insert the M712 projectile into the powder chamber. Ramming and firing of M712 projectile is the same as for all other ammunition in this manual.

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174.46. Misfire and Checkfire Procedures

The precautions and actions associated with misfires and checkfires are the same for the M712 projectile as for other projectiles in this manual. See pages 212.17 through 212.19.

174.47. Operation of Extractor Tool Assembly for Projectile, 155mm, M712 and M823 (figs. 211.48 through 211.52)

a. General. The extractor assembly is used to remove the M712 or M823 projectile from the weapon. The following procedures include setting up the extractor assembly in preparation for use and breakdown procedures for stowage by cannoneer No. 1.

b. Setup for Use.

(1) Get wooden packing box containing extractor from ammunition truck, open box and remove extractor.

(2) Inspect to make sure that the five insert sleeves (1) on the extractor assembly are retracted for use with an M114A2 howitzer as shown.

(3) While standing at the rear, loosen drive nut (2) clockwise to middle white mark (of three).

(4) Move brace (3) back.

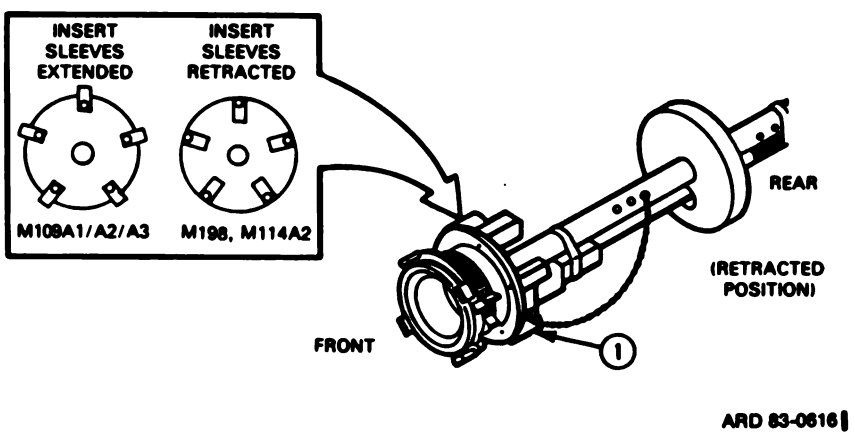


Figure 211.48. Operation of extractor tool assembly for projectile, 155mm, M712 and M823 (view 1 of 5).

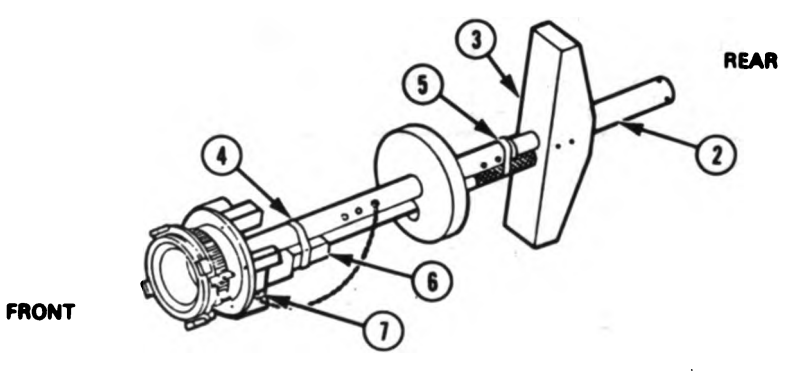


Figure 211.49. Operation of extractor tool assembly for projectile, 155mm, M712 and M823 (view 2 of 5).

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(5) Loosen two strap assemblies (4 and 5).

(6) Remove ratchet (6).

(7) Disengage locking pin (7).

(8) Extend telescoping solid and hollow shafts (8 and 9) until hole in solid shaft (8) aligns with hole (17) in hollow shaft (9).

(9) Move alignment support (10) forward, midway between locking pin chain screw (11) and the two holes (12 and 13) at end of the hollow shaft (9).

(10) Wrap chain holding locking pin (7) around hollow shaft (9) once.

(11) Insert locking pin (7) completely through both shafts (8 and 9) as shown, into hole (17).

(12) Turn drive nut (2) counterclockwise until forward edge aligns with guide mark (white) on solid shaft (8). Use middle mark for M114A2 howitzer.

(13) Cock extractor assembly as follows:

(a) Compress expansion ring (14) by squeezing tabs (15) together.

(b) Align cutout in retaining ring (16) with tabs (15) on expansion ring (14), and slide retaining ring forward over expansion ring.

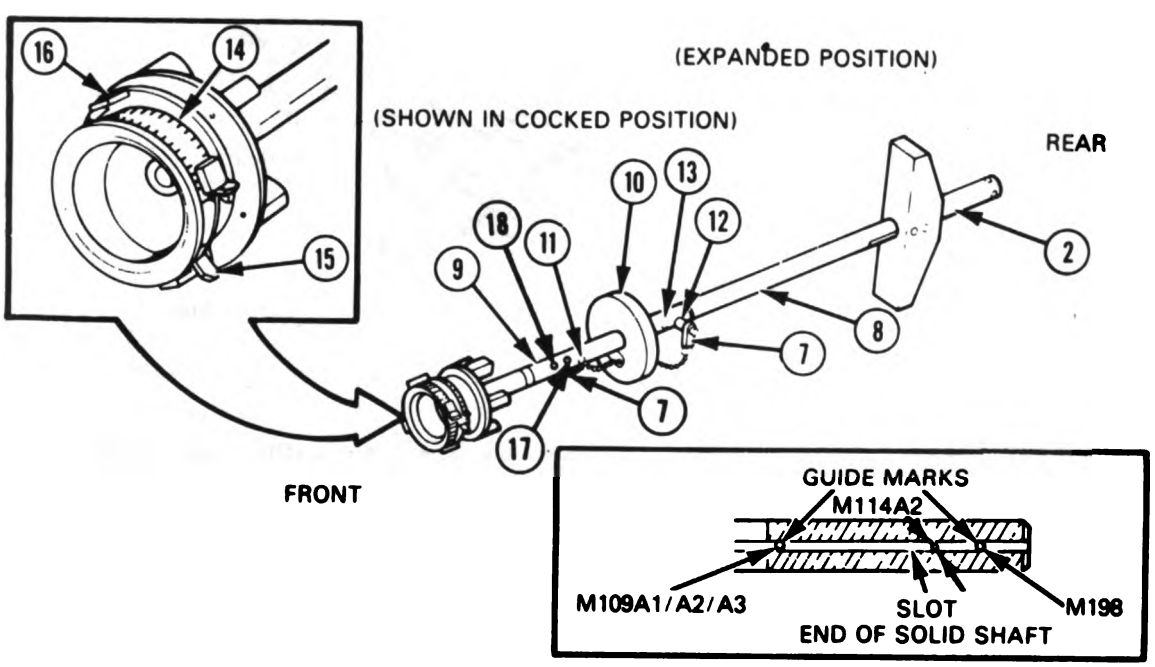


Figure 211.50. Operation of extractor tool assembly for projectile, 155mm, M712 and M823 (view 3 of 5).

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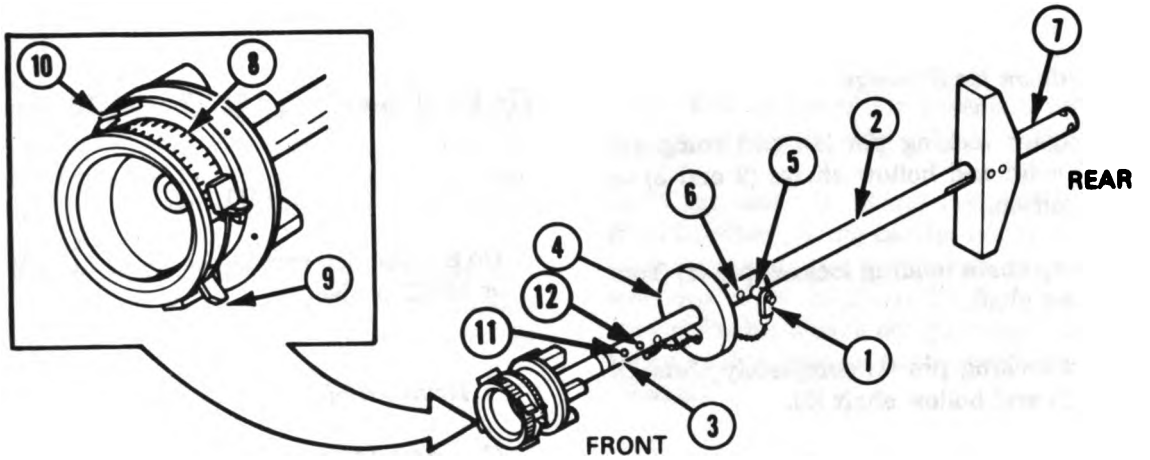


Figure 211.51. Operation of extractor tool assembly for projectile, 155mm, M712 and M823 (view 4 of 5).

c. Setup for Use Under Conditions of Poor Visibility. If the extractor assembly is being expanded under conditions of poor visibility, the alignment hole and shaft detent may be used as described below.

(1) Disengage locking pin (1), and pull solid shaft (2) from hollow shaft (3).

(2) Move alignment support (4) forward of the two holes (5 and 6) in hollow shaft (3).

(3) Wrap chain holding locking pin (1) around hollow shaft (3) once.

(4) Insert locking pin (1) in the alignment hole (11) (third hole from expansion ring (8)).

(5) Insert solid shaft (2) in hollow shaft (3), and rotate until alignment detent in end of solid shaft rests against locking pin (1).

(6) While holding both shafts to prevent them from turning or sliding, remove locking pin (1) from alignment hole (11) and insert locking pin completely through next hole (12) to lock both shafts in extended position.

(7) Turn drive nut (7) counterclockwise until forward edge aligns with guide mark (white) on solid shaft (2). Use middle mark for M114A2 howitzer.

(8) Cock extractor assembly as follows:

(a) Compress expansion ring (8) by squeezing tabs (9) together.

(b) Align cutout in retaining ring (10) with tabs (9) on expansion ring (8), and slide retaining ring forward over expansion ring.

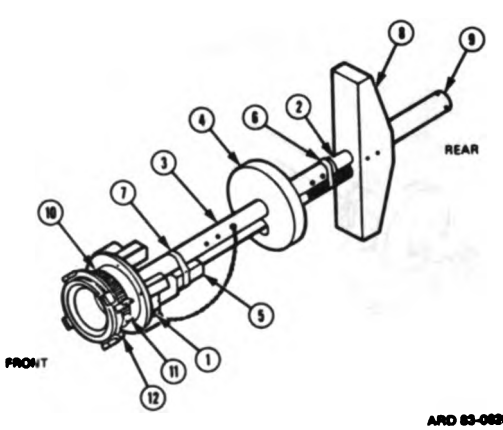


Figure 211.52. Operation of extractor tool assembly for projectile, 155mm, M712 and M823 (view 5 of 5).

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d. Breakdown for Stowage.

(1) Disengage locking pin (1), and compress telescoping solid and hollow shafts (2 and 3) to retracted position.

(2) Unwrap chain holding locking pin (1) from around hollow shaft.

(3) Insert locking pin (1) completely through solid shaft (2) and hollow shaft (3).

(4) Remove ratchet (5), and guide ratchet handle through the slot in alignment support (4).

(5) Strap ratchet (5) to hollow shaft (3), using the strap assemblies (6 and 7) provided.

(6) Slide brace (8) forward until it touches end of ratchet handle. Turn drive nut (9) counterclockwise until brace (8) is held firmly against ratchet handle.

(7) Check to see if extractor assembly is cocked. If it is not cocked, perform the following:

(a) Compress expansion ring (10) by squeezing tabs (11) together.

(b) Align cutout in retaining ring (12) with tabs (11) on expansion ring (10), and slide retaining ring forward over expansion ring.

(8) Stow extractor assembly in wooden packing box.

174.48. Unloading an M712 or M823 Projectile

CAUTION

Do not use bell rammer to unload the M712 or M823 projectile.

a. Removal of Primer and Propelling Charge.

(1) Assistant gunner removes primer and cannoneer No. 3 removes propelling charge as prescribed in this manual.

(2) Gunner elevates/depresses gun tube to approximately 300 mils.

b. Unloading M712 or M823 Projectile (fig. 211.53.) Cannoneer No. 1 unloads M712 or M823 projectile following the steps listed below.

(1) Obtain extractor assembly.

(2) Check to see if extractor assembly is cocked. If expansion ring is cocked, proceed to (3) below; otherwise, cock extractor assembly as follows:

(a) Compress expansion ring by squeezing tabs together.

(b) Align cutout in retaining ring with tabs on expansion ring, and slide retaining ring forward over expansion ring.

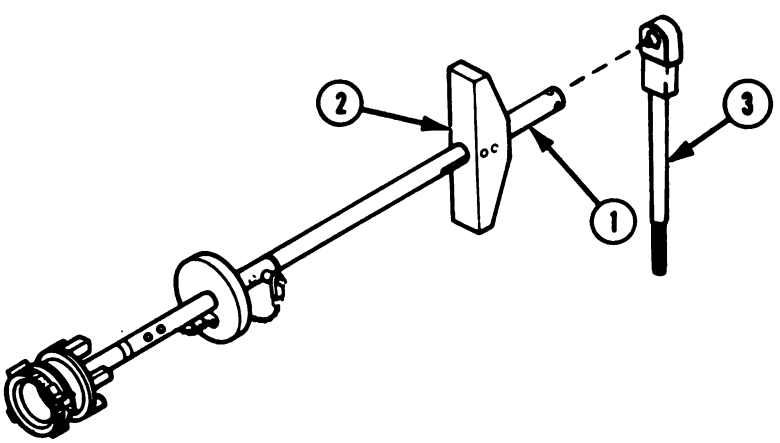


Figure 211.53. Unloading M712 or M823 projectile.

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(3) Insert extractor assembly through breech ring assembly until forward end makes contact with base of projectile. Push extractor assembly firmly against projectile until expansion ring is seated in the base of the projectile. Pull on extractor assembly to make sure that it is engaged with projectile. If extractor assembly did not engage, remove it from gun tube and repeat procedures in steps (2) *(a)* and *(b)* and this step.

(4) Turn extractor drive nut (1) counterclockwise by hand until brace (2) touches and is centered across face of breech ring assembly.

(5) Connect ratchet (3) to end of drive nut. Set ratchet to OFF, and turn ratchet counterclockwise until projectile is pulled free of forcing cone. Remove ratcher from drive nut.

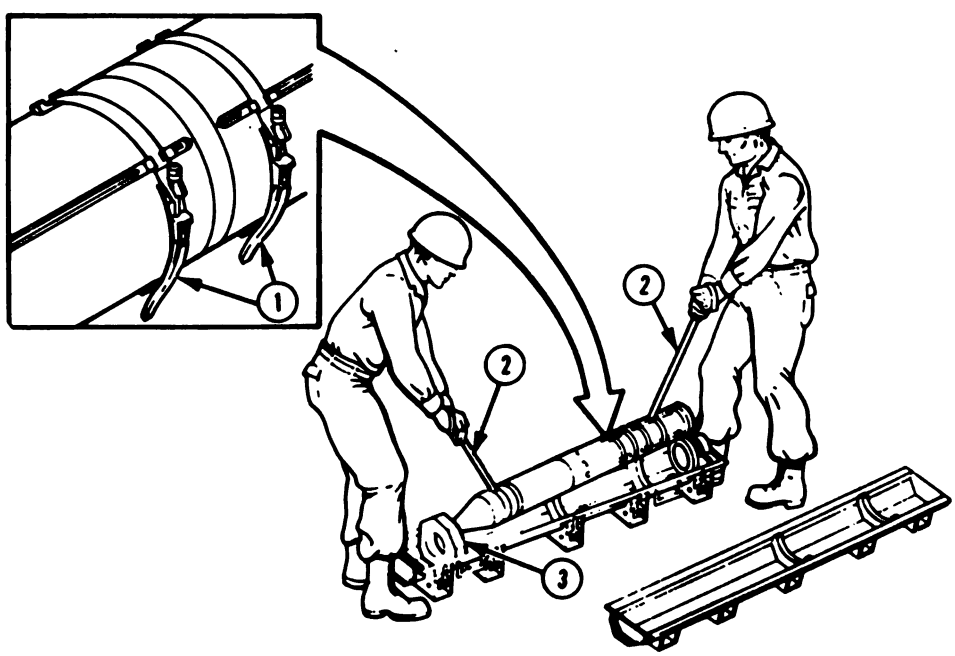
(6) Let projectile and extractor assembly slide slowly out of gun tube until base of projectile has passed through breech ring assembly. Projectile will have to be raised slightly to pass obturator over Swiss groove.

(7) Release extractor assembly by squeezing tabs on expansion ring.

(8) Cannoneers No. 3 and 4 remove the projectile from howitzer, being careful not to strike plastic nose cone, and pass it to cannoneers No. 2 and 7 who repackage the projectile. If the projectile has been unloaded from a hot gun tube, remove it to a safe distance from personnel; and notify EOD for disposal.

174.49. M712 Ammunition Prepared for Firing, but Not Fired, and M823 Repackaging

a. General. M712 projectiles that have been unpackaged, but not fired, will be repackaged within 72 hours and returned to battalion ammunition section for further disposition. Long exposure of the projectile to sunlight and other elements may cause it to fail. Code and time switch settings made during preparation need not be reset. A projectile that has been unloaded from a weapon as a result of a misfire or checkfire will be repackaged as described below, as will an M823 trainer after use.



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Figure 211.54 Repackaging of the M712 or M823 projectile (view 1 of 2).

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b. Repackaging Projectile (figs. 211.54 and 211.55). Cannoneers No. 2 and 7 repackage the M712 or M823 projectile as follows:

(1) Using wiping rag, wipe all loose dirt and moisture from projectile.

(2) Locate original container. If container has become unserviceable, replace it. If original container cannot be found or has been replaced for unserviceability, make sure that markings on replacement container match markings on projectile. If not, return to battalion ammunition section for remarking.

(3) Install projectile into container as follows:

(a) Check red decals at nose end of container halves for matching numbers to assure match of halves. Remove lifting straps. Also remove fin and wing preload bands from container.

CAUTION

Make sure that all four fin and wing preload bands securely engage fins and wings.

(b) Install fin and wing preload bands (1) on projectile.

(c) Install lifting straps (2) on projectile.

(d) Lift projectile, and position over opened container.

(e) Carefully lower projectile, guiding nose cone into retainer ring (3) in the container.

(f) Using torquing rod (4), turn tension mechanism clockwise as far as possible to snug projectile into the retainer ring. Put rod in holes in mechanism as close to horizontal as possible to avoid interference with stops inside cover.

(g) Be sure that desiccant and protective bag are placed inside container.

(h) Place container cover on container body in such a manner that the inside cradles are aligned and the manual relief valve (5) and the humidity indicator card are at the rear end of the container.

(i) Starting on the end opposite the humidity indicator card, straddle container, place T-bolts in cover recesses, and close corresponding left and right side latches (6) at the same time in pairs.

174.50. M712 Projectile Maintenance

Humidity indicators on packaged M712 projectiles must be monitored for humidity every 90 days, as a minimum. If relative humidity in the container is 40 percent or greater (40 percent sector of humidity indicator card is not blue), follow instructions in paragraph 174.44*a*.

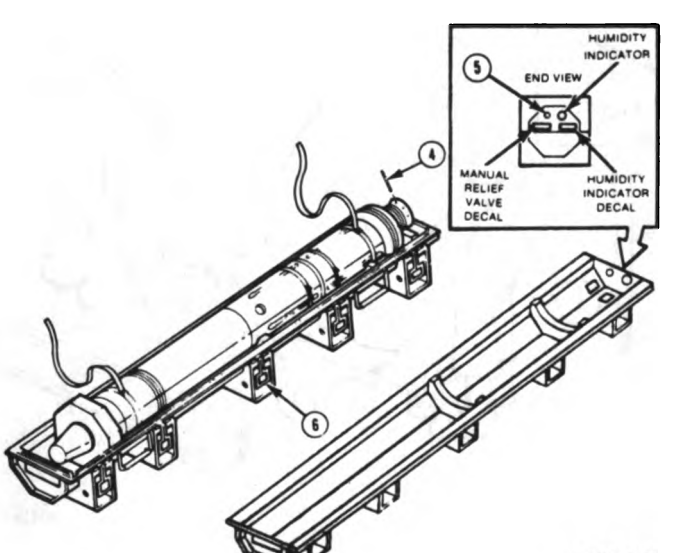


Figure 211.55. Repackaging of the M712 or M823 projectile (view 2 of 2).

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CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

175. Domestic Shipping Instructions

a. Preparation for Shipment in Zone of Interior. When shipping the 155-mm howitzer M114, M114A1, or M123A1 interstate or within the zone of interior, the officer in charge of preparing the shipment *will be responsible* for furnishing the weapons to the carriers for transport in a serviceable condition, properly cleaned, preserved, painted, and lubricated as prescribed in TB 9-299/1.

b. Responsibility for Removal of Preservatives Before 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, and field installations receiving the shipments.

c. Preparation for Shipments to Ports.

(1) *Inspection.* All 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 bs further processed in accordance with TB 9-299/1.

(3) *Marking of arctic-lubricated materiel.* It will be the responsibility of the office in charge of the organization performing arctic lubrication to insure that the equipment is marked as prescribed in SR 746-80-10. It will be the responsibility of the office in charge of the organization shipping arctic-lubricated equipment to insure that each item is so marked. Unit commanders of using organizations will insure that such markings are not obliterated while the equipment is arctic lubricated. When the equipment is deprocessed of this special lubrication, such marking will be immediately and thoroughly obliterated.

d. Army Shipping Documents. Prepare all Army shipping documents accompanying freight in accordance with AR 725-50.

e. Equipment Log Book. During transfer or shipment, place the equipment log book in the weapons records and publications cover and store in the tool chest.

176. 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 indicates that weapons have 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

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technical inspection and processed as prescribed in TB 9-299/1.

b. Receiving Inspections.

(1) Report of weapons received for storage in a damaged condition or improperly prepared for shipment will be made on DD Form 6, in accordance with AR 700-58.

(2) When weapons are inactivated, they will be processed in accordance with type I as prescribed in TB 9-299/1. Standby storage will normally be handled by ordnance maintenance personnel only.

(3) Upon receipt of weapons, they must be inspected and serviced as prescribed in paragraphs 8 through 10. Perform a systematic inspection and replace or repair all missing or broken parts. If repairs are beyond the scope of the unit, and the weapons will be out of service for an appreciable length of time, store weapons 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 an ordnance maintenance unit.

c. Inspections During Storage. Perform a visual inspection periodically to determine general condition. If corrosion is found on any part, remove the rust spots, clean, paint, and treat with the prescribed preservatives.

Note. Touchup painting will be in accordance with TM 9-213.

d. Removal From Limited Storage.

(1) If the weapons are not shipped or issued upon expiration of the limited-storage period, they may either be processed for another limited storage period or be further treated for stand-by storage (weapons inactivated for periods in excess of 90 days up to 3 years) by ordnance maintenance personnel.

(2) If weapons to be shipped will reach their destination within 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 in accordance with TB 9-299/1 when it has been ascertained that they are to be placed into immediate service. Remove all corrosion-preventive compounds and thoroughly lubricate as prescribed in paragraphs 64 through 66. Inspect and service weapons as prescribed in paragraphs 8 through 10.

(4) Repair and/or replace alll items tagged in accordance with *b*(3) above.

e. Storage Site. The preferred type of storage for the weapon is under cover in open sheds or warehouses whenever possible. When it is necessary to store weapons outdoors, protect against the elements as prescribed in TB ORD 379.

177. Loading the 155-mm Towed Medium Howitzer M114 and M114A1, or the 155-mm Auxiliary Propelled Towed Medium Howitzer M123A1 on Railroad Cars

a. Preparation.

(1) When weapons are shipped by rail, every precaution must be taken to see that they are properly loaded and securely fastened and blocked to the floor of car. All materiel normally carried on the carriage will be thoroughly cleaned, preserved, packed (boxed or crated), labeled, and securely blocked and strapped during transit.

(2) Prepare weapons for rail shipment in accordance with paragraph 175. In addition, take the following precautions.

(*a*) Apply the handbrakes after the weapon has been finally spotted

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on the freight car. The weapons must be loaded on the car in such a manner as to prevent the car from carrying an unbalanced load.

(*b*) Increase tire pressure slightly higher than normal for rail shipment, except in cases where shipment is to be exposed to extreme hot-weather conditions.

(*c*) For rail shipment, the howitzer must be placed in normal traveling position by connecting the apex of the traveling lock to the bottom of the cylinder yoke and securing by the traveling lock pin. Close and lock the trails by means of the trail lock.

(3) When shipping the M123A1 auxiliary propelled howitzer, the following procedure must also be used:

(*a*) Disconnect the hydraulic motors from the wheel drive units (paragraph 106) and coat the unpainted surfaces with automotive grease. Cover the coated surfaces with two pieces of 6 x 6 inch barrier material and secure with two pieces of 1 x 12 inch pressure sensitive tape. Prepare two wood blocks 3/4 x 6 x 12 inches and drill a 3-3/8 inch hole in the center. Drill four 5/16-inch diameter holes equally spaced to match the holes in the hydraulic motor in each block. Secure the blocks to the motors with eight 5/16 x 2 carriage bolts and eight 5/16-inch nuts. Strap the hydraulic motors to the trails in back of the recoil mechanism with four pieces of 0.200 x 3/8 x 75 inches steel strapping.

(*b*) Remove the wheel drive units (par. 106) and install the axle hub cover assembly (fig. 88) on the pilot ring. Coat the unpainted surfaces with automotive grease and wrap coated surfaces with three square feet of barrier material secured in place with 1 x 72 inch pressure-sensitive tape. Secure the locks on the wheel drive unit with 1 x 18 inch pressure sensitive tape. Fabricate a wooden container as shown in figure 212, place drive unit in container, and close and strap in accordance with style two box in TM 9-200.

(*c*) Remove the caster assembly (par. 39*d*(3)). Preserve the caster assembly as indicated in TB 9-299/1. Fabricate a style 2 wooden container 29-1/8 x 21-1/2 x 14 inches inside dimensions as shown in TM 9-200. Place caster assembly in container, block to prevent movement, close and strap in accordance with style two box in TM 9-200.

(*d*) Secure the control stick assembly tightly with a 1 x 60 inch piece of filament tape.

(*e*) Immobilize the trail jack assembly by placing a 1 x 50 inch piece of filament tape over the base assembly of the jack.

(*f*) Process the gasoline engine in accordance with TB 9-299/1. Secure the engine cover in place with a 1 x 36 inch piece of filament tape. Protect the instruments on the instrument panel with a 4 x 12 x 1/4 inch plywood board secured with a 1 x 30 inch piece of filament tape.

(*g*) Immobolize all loose hoses with one-inch filament tape.

(*h*) Place the packing box containing basic issue items on the trails direcently behind the breechblock. Place the two packed wheel drive unit boxes side by side on the above box and the caster assembly box on top of the wheel drive unit boxes. Securely strap the boxes to the trails with three pieces of 0.015 x 1 x 190 inches of steel strapping.

b. Types of Cars. Ins ructions contained herein pertain to the loading of weapons in boxcars (cars equipped with side or side and end doors); gondola (an open top car hav-

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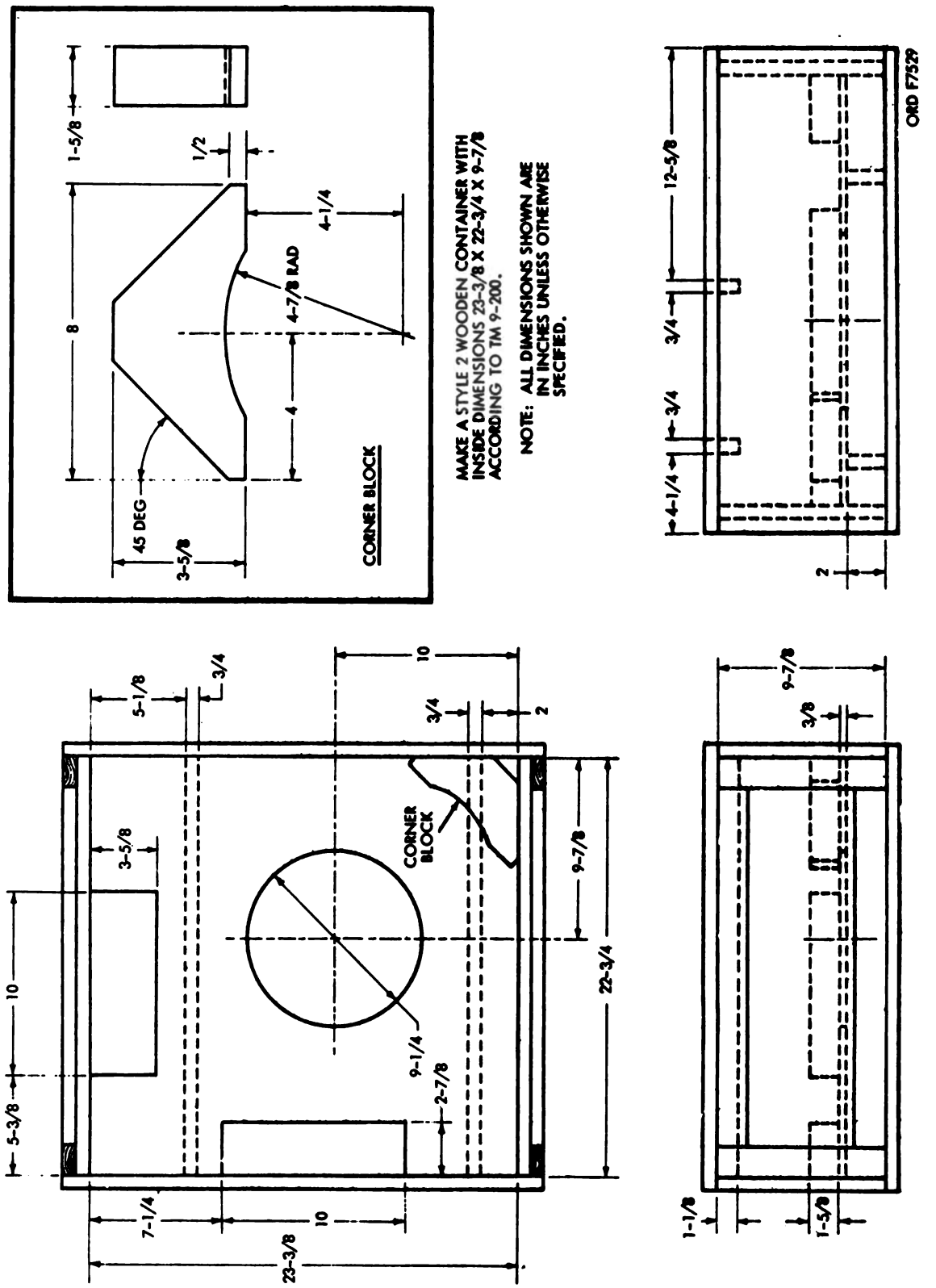


Figure 212. Dimensional drawing for wheel drive unit container.

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ing fixed sides, fixed or drop ends and solid bottom); and flatcars (cars with wooden floors laid over sills and without sides or ends but equipped with stake pockets).

c. Method of Loading Weapons on Freight Cars. When suitable hoisting equipment is not available for loading weapons on or subsequent unloading from a flatcar, gondola, or boxcar, an end ramp must be used. Construction of an improvised end ramp and methods of loading weapons are described in TM 9–200.

d. Loading Rules. For general loading rules pertaining to rail shipment of ordnance weapons, refer to TM 9–200.

Warning: **The height and width of vehicle when prepared for rail transportation must not exceed the limitations indicated by the loading table as prescribed in TM 9–200. Whenever possible, local transportation officers must be consulted about limitations of particular railroad lines to be used for the movement to avoid delays, danger, or damage to equipment.**

178. Blocking the 155–mm Towed Medium Howitzer M114 and M114A1, or the 155–mm Auxiliary Propelled Towed Medium Howitzer M123A1 for Rail Shipment

a. General. All blocking instructions specified herein are minimum and are in accordance with Association of American Railroads "Rules Governing the Loading of Commodities on Open Top Cars." Additional blocking may be added as required at the discretion of the officer in charge. Double–headed nails may be used if available, except in the lower piece of twopiece cleats. All item reference letters given below refer to the details and locations as shown in figures 213 and 214.

b. Brake Wheel Clearance. Load weapons on cars with a minimum clearance of at least 4 inches below and 6 inches above, behind,

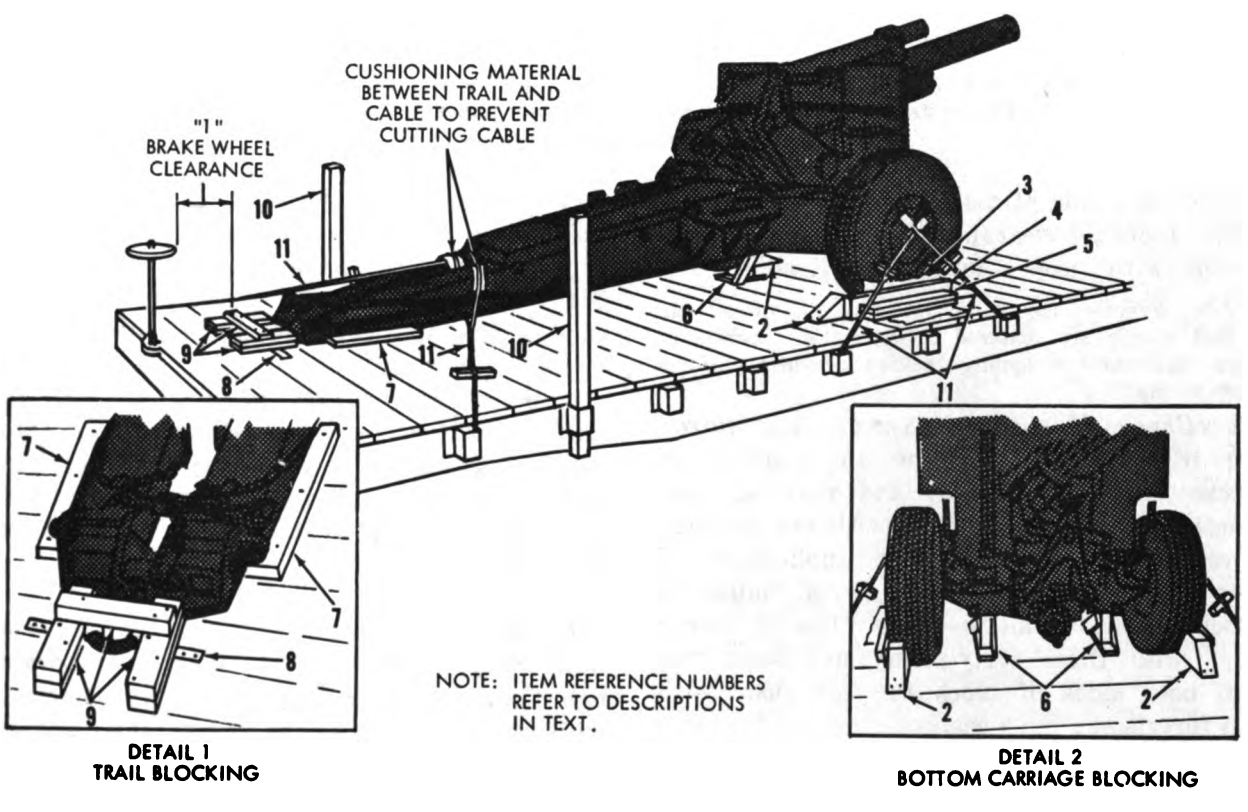


Figure 213. Method of blocking 155–mm cannon on carriage M1A1 for rail shipment.

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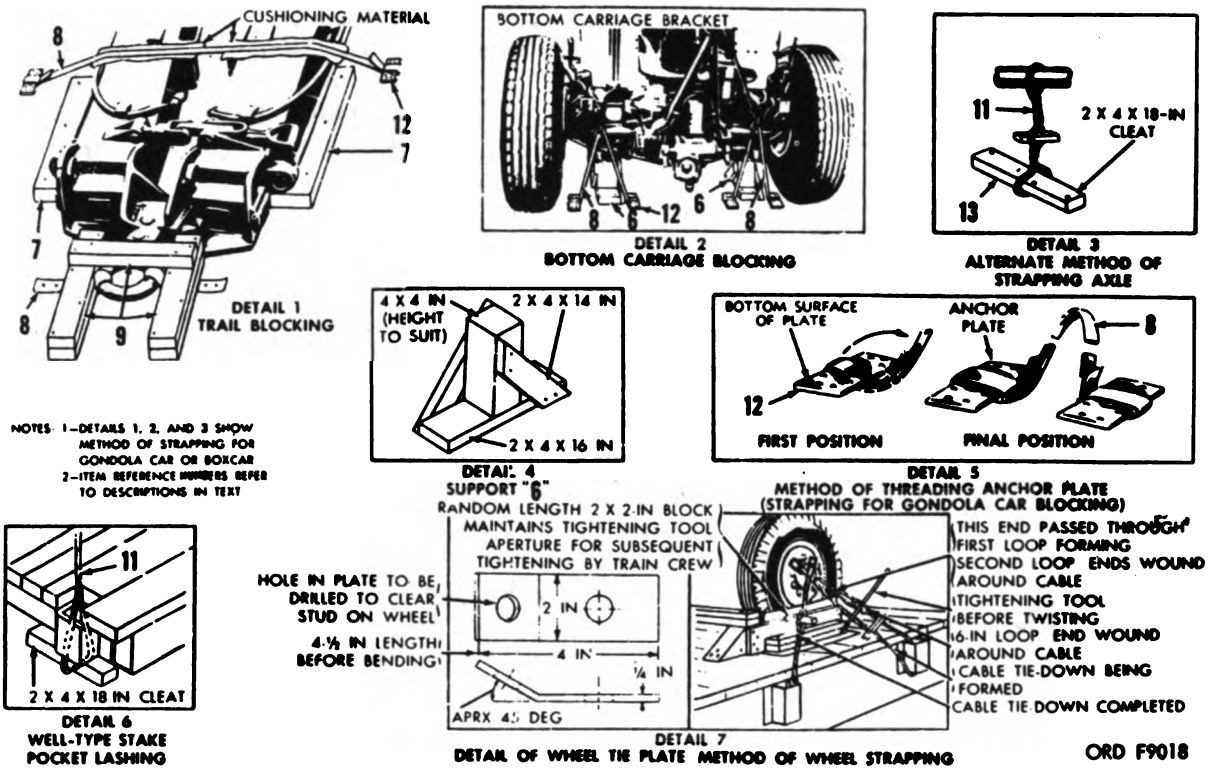


Figure 214. Method of blocking 155-mm cannon on carriage M1A1 for rail shipment—blocking details.

and to each side of the car brake wheel (fig. 213). Increase clearance as much as is consistent with proper location of load.

Note. Weapons should be laterally spotted on car so that wheels are centered between stake pockets in order that wheel strapping (below) provides uniform cross-wiring.

c. Chock Blocks (6 x 8 x 24, 4 Required per Weapon). Locate the 45° surface of blocks against the front and rear of each wheel. Blocks are to be positioned in such a manner as to allow flush application of wheel side cleats (*e* below) when nailed to chock blocks. Nail heel of blocks to car floor with three forty-penny nail sand toe-nail both sides of block to car floor with two fortypenny nails each.

Note. Filler cleats may be used between chock blocks and side cleats to centrally locate the chock block against tires. These cleats are not shown in figure 213. Chock blocks may be cut from timbers (or railroad ties when available) as shown in figure 215.

d. Cushioning Material. Locate suitable cushioning material such as waterproof paper, burlap, etc., between tires and cleats. The cushioning material must protrude beyond cleats at floor and above cleats.

e. Wheel Side Cleats (2 x 8 Lengths to Suit, Two Required per Weapon). Locate cushioning material (*d* above) against tires and locate and nail cleats to chock blocks with tenpenny nails at each end (See *Note* in *c* above).

f. Floor Side Cleats (2 x 4 Lengths to Suit, Four Required per Weapon). Locate two floor side cleats against each side cleat with cushioning material protruding underneath cleat. Nail lower cleats to car floor with thirtypenny nails, staggered and upper cleats to lower cleats and car floor with fortypenny nails, staggered.

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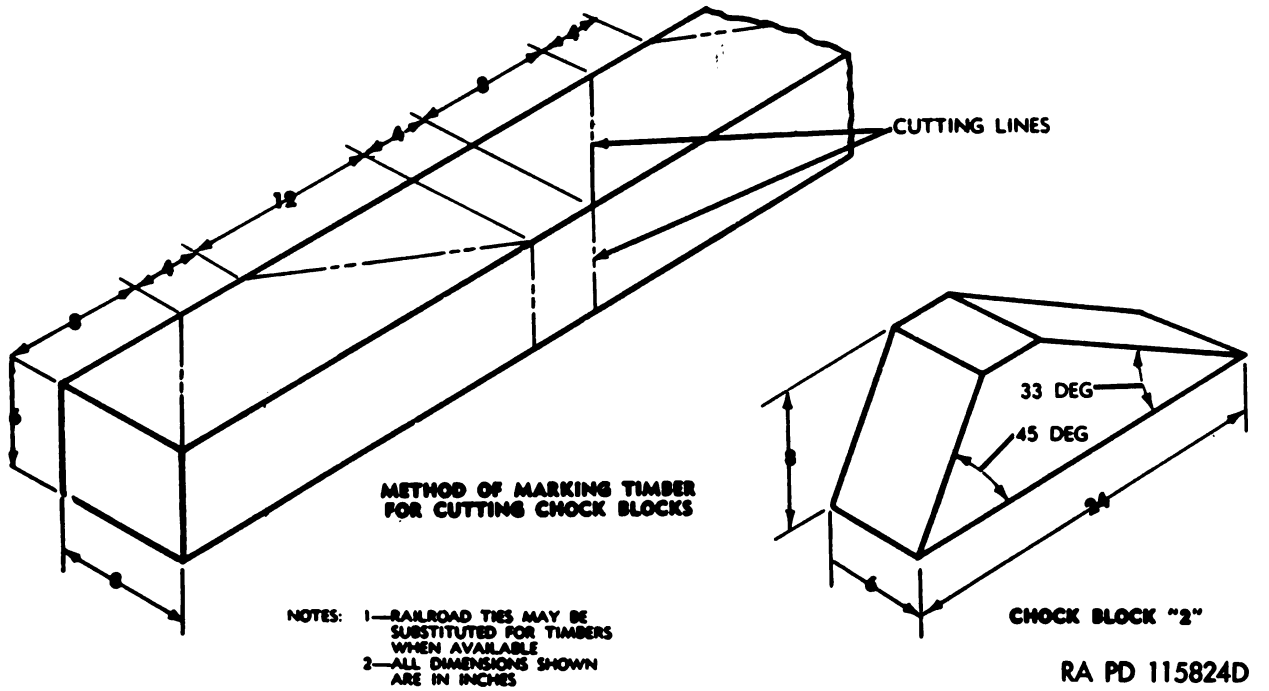


Figure 215. Cutting chock blocks from timbers.

g. Supports (Two Required per Weapon). Construct supports as shown in detail 4, figure 214. Height of supports must be 1 inch higher than the distance between car floor and under front trail of bottom carriage to partially relieve weight from the tires. Jack up the weapon and locate one support under each trail of bottom carriage (detail 2, fig. 213). Lower weapon onto supports and nail each base of support to car floor with fortypenny nails.

Note. If floor of car is not in excellent condition at point of support contact, sufficient planking must first be laid laterally on car floor. Height of supports will then be measured to suit added planking.

h. Trail Blocking.

(1) *Trail cleats (2 x 4 x 18, two required per weapon).* Locate one cleat lengthwise of car against each side of trail under lifting handles. Nail cleats to car floor with thirty penny nails through each cleat staggered.

(2) *Lunette strapping.* Locate a 1-1/4 x 0.85 hot-rolled steel strap through lunette eye and secure to car floor with large headed nails.

(3) *Lunette cleats (2 x 4 x 16, five required per weapon).* Locate two cleats on each side of lunette lengthwise of car on top of strapping. Nail lower cleats to car floor with thirtypenny nails, staggered and upper cleats to the lower cleats and car floor with fortypenny nails staggered. Locate one cleat across the top of lunette and nail each end to upper cleats with thirtypenny nails in each end.

i. Stakes (4 x 5 x 48, Two Required per Weapon For Flatcar Blocking). Cut one end of stake so as to wedge into stake pockets. Locate wedged end of stakes in stake pockets on each side of flatcar, one-third the distance from end of trail to center of wheels. Drive one fortypenny nail into each stake directly below, with head clinched over outside of stake pocket.

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j. Flatcar Strapping (No. 8 Gage Black Annealed Wire or Wires of Equivalent Strength).

Note. For gondola or boxcar blocking, strapping will not be required; see k below.

(1) *Wheel strapping.*

(*a*) Remove two upper stud nuts from each wheel. Screw the wheel tie plate into correct position for tie cables (detail 7, fig. 214). Install stud nuts and tighten securely.

(*b*) Cut four strands of wire to length required according to the location of stake pockets. Twist-tie these wires together to form a single cable. Pass the cable through the wheel tie plate for a length beyond half the distance to stake pocket. Pass the other end of cable through a stake pocket *rearward* of wheel and form a 6-inch loop in end, winding *each* of the four wires *tightly* around the cable a few turns (detail 7, fig. 214). Make certain the loop is positioned well above the free end of cable. Pass the free end of cable through this loop, hand tight, and again wind end of each wire around cable tightly. Insert end of a tightening tool and random length 2 x 2 cleat at approximate center of cable and twist-tie just taut enough to remove all slack. Withdraw tightening tool, leaving cleat in cable for tightening cable during transit.

(*c*) Form another cable and pass end through the other front wheel tie plate, crossing initial cable. Pass other end of cable through a stake pocket *forward* of wheel. Complete and twist-tie as described above.

(*d*) Repeat above operations for the other wheel.

Note. During transit, cables will be checked for looseness and retightened, if necessary, by train personnel.

(*e*) Cables are passed through stake pockets so that the cable loop lies against the car frame. A short stake driven into each stake pocket will protect the cable loop from chafing and loosening. (These stakes are omitted in fig. 213.) If flatcars are received where flooring is flush against the top of the well-type stake pockets, a loop of cable is passed through the stake pocket, and a short cleat about 2 x 4 x 18 is inserted in the loop below the stake pocket. Subsequent tightening of the cable will cause it to draw the wooden cleat securely against the bottom of stake pocket (detail 6, fig. 214).

(2) *Trail strapping.*

(*a*) Wrap some form of cushioning material around trail where contact is to be made with cable (fig. 213).

(*b*) Cut four strands of wire to length required according to the location of stake pocket. Twist-tie these wires together to form a single cable. Pass one end of cable around left trail and down beyond half the distance to stake pocket. Pass the other end of cable through stake pocket and up to meet the other end of the cable. Complete and twist-tie as described in (1) (*b*) above (fig. 213).

(*c*) Repeat above operation for the right trail, attaching cable to opposite side of car stake pocket.

k. Gondola or Boxcar Strapping.

(1) *Trail strapping.*

(*a*) Locate one piece of 1-1/4 x 0.035 hot-rolled steel strap on top of cushioning material across the top of trails and coil around steel anchor plates as shown in detail 1, figure 214. Secure by nailing anchor plates to car floor with not less than 6 twentypenny nails, (double-headed nails preferred).

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(*b*) As an alternate method of securing trails, substitute a cable (consisting of four strands of No. 8 gage block annealed wire or wires of equivalent strength) for steel strapping. Pass cables around trails (detail 3, fig. 214) and around cleat (2 x 4 x 18). Locate cleats lengthwise of car and nail to car floor with four thirtypenny nails in each cleat. Bring both ends of cable together as prescribed in *j*(1)(*b*) above (detail 7, fig. 214).

(2) *Bottom carriage strapping.* Locate one piece of 1-1/4 x 0.035 hot-rolled steel strapping through each hole in brackets on the front of the bottom carriage. Strapping is to be secured to car floor as prescribed for trail strapping ((1) above).

Note. Insert some form of cushioning material between edges of holes and strapping to prevent strapping from being cut by the sharp edge of brackets.

179. Marking

a. Identification marking will be stamped on metal tags after which tags will be dipped in ordnance yellow paint, and securely attached with soft wire to the mount and gun trail of each weapon. Marking will consist of nomenclature, stock number, gross weight, cubage, shipping dimensions, name of contractor, and contract number.

b. Processing directive (identifying number), symbol of installation performing processing, and date processed, will be stenciled with gasoline-soluble white or yellow paint on the gun shield and trail.

c. The complete coded oversea address will be stenciled on the front of gun shield and on one side of gun carriage with gasoline-soluble paint (white or yellow on olive drab surfaces). The stenciling will be in letters not more than 1-1 inches or less than 3/4-inch high. An equilateral triangle (ordnance yellow) not more than 3 inches or less than 1-1/2-inches high will be stenciled on each vehicle adjacent to the oversea address.

d. Boxed items will be marked for identification in accordance with TM 9-200.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

180. General

a. Destruction of the 155-mm howitzer M1 and related materiel 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.

b. The information which follows is for guidance only. Some of the procedures outlined required the use of explosives and incendiary grenades which normally may not be authorized items for the howitzer and carriage. The issue of these and related materials, and the conditions under which destruction will be effected, are command decisions in each case, according to the tactical situation. Of the several means of destruction, those most generally applicable are:

Mechanical	Requires axe, pick mattock, sledge, crowbar, or similar implement
Burning	Requires gasoline, oil, incendiary grenades, or other inflammables.
Demolition	Requires suitable explosives or ammunition.
Gunfire	Includes artillery, machine guns, rifles using rifle grenades, and launchers using antitank rockets. Under some circumstances, hand grenades may be used.

In general, destruction of essential parts, followed by demolition, will render the howitzer and related materiel and equipment useless. However, selection of the particular method of destruction requires imagination and resourcefulness in the utilization of the

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facilities at hand under the existing conditions. Time is usually critical.

c. If destruction to prevent enemy use is resorted to, the materiel must be so badly damaged that it cannot be restored to a usable condition in the combat zone either by repair or cannibalization. Adequate destruction requires that all parts essential to the operation of the materiel, including essential spare parts, be destroyed or damaged beyond repair. However, when lack of time and personnel prevents destruction of all parts, priority is given to the destruction of those parts most difficult to replace. Equally important, the same essential parts must be destroyed on all like materiel so that the enemy cannot construct one complete unit from several damaged ones.

d. If destruction is directed due consideration should be given to:

(1) Selection of a point of destruction that will cause greatest obstruction to enemy movement and also prevent hazard to friendly troops from fragments or ricocheting projectiles which may occur incidental to the destruction.

(2) Observance of appropriate safety precautions.

181. Destruction of Sighting and Fire-Control Instruments and Equipment

All items of sighting and fire-control instruments and equipment, especially such items as telescopes, fire control quadrants, binoculars, and similar items are costly, difficult to replace, yet relatively light, hence, they should be conserved and evacuated whenever practicable. In the event evacuation is impracticable, the equipment will be destroyed completely; all optical elements and mountings will be smashed, and firing tables, trajectory charts, and inflammable items will be burned.

182. Destruction of Howitzer and Carriage

a. General. If time, personnel, and materials are available, the destruction of the carriages should be accomplished in conjunction with the destruction of the howitzer by means of demolition materiels or gunfire (*b* and *c* below). If time, personnel, or materials are limited, priority should be given to the destruction of the barrel, breech, and recoil mechanism by means described in *d* below. Pneumatic tires should be destroyed in conjunction with the howitzer and carriage as described in paragraph 184.

Warning: **The cylinders of the recoil mechanism are charged with nitrogen at a pressure of 1,500 psi; hence, no attempt should be made to smash them with a sledge or similar implement. If smashed, the high pressure gas may escape with explosive force and cause injury to personnel in the immediate vicinity.**

b. Method No. 1—by Demolition. Planning for simultaneous detonation, prepare and place the charges of EXPLOSIVE, TNT using 1-lb blocks or equivalent together with the necessary detonating cord to make up each charge) as indicated below:

15-lb ---------Insert the charge into the chamber.
1-lb ---------Place the charge between the recuperator and counterrecoil cylinders.
1-lb ---------Place the charge on top of the elevating worn wheel housing.
1-lb ---------Place the charge on top of the traversing worn wheel housing.
5-lb ---------Place the charge on the axle adjacent to the *left* wheel.
5-lb ---------Place the charge on the axle adjacent to the *right* wheel.

Connect these charges for simultaneous detonation with detonating cord. Before closing the breechblock, insert an object such as a hammer handle in the breech opening to prevent damage to the detonating cord due to full closing of the breechblock. Plug the muzzle tightly with any available material, such as rags or mud, to a distance of about one foot. For methods of detonating these charges, see paragraph 183. The danger zone is approximately 250 yards. Elapsed time: about 10 minutes.

c. Method No. 2 — by Gunfire. This method cannot be relied upon to destroy the same parts of all weapons and carriages or to produce the same degree of destruction.

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From an adjacent weapon, fire on the howitzers to be destroyed. Several direct hits will be necessary. Unless evacuated, destroy the last howitzer and carriage by the best means available. Elapsed time: about 8 minutes.

Caution: **Firing at ranges of 500 yards or less should be from cover.**

d. Howitzer (Breech, Barrel, and Recoil Mechanism Only).

(1) *Method no. 1 — with demolition charges.* Perform the operations as indicated in *b* above but exclude the charges placed on top of the elevating worm wheel housing, on top of the traversing worm wheel housing, and on the axles. Elapsed time: about 5 minutes.

(2) *Method no. 2—by gun fire with HE ammunition.* With the howitzer at 0° elevation, open drain plugs on the recoil mechanism and allow recoil fluid to drain. It is not necessary to wait for the recoil fluid to drain completely before processing as follows:

(*a*) Jam a fuzed HE shell into the muzzle end of the howitzer and load the howitzer with a fuzed HE shell (fuze set "SQ"), propelling charge, and primer.

(*b*) As an alternative to (*a*) above, remove the safety pin from an HE antitank rifle grenade or an HE antitank rocket. Then insert the grenade or rocket into the bore through the breech end of the weapon with the nose pointing toward the breech. The grenade or rocket must be centered in the tube using rags, earth, or any similar material. The nose of the grenade or rocket should be about 30 inches forward of the origin of rifling. Next, load the howitzer with an unfuzed HE shell, propelling charge, and primer.

Caution: **Exercise extreme caution in handling the armed grenade or rocket.**

(*c*) Fire the weapon from cover using a lanyard about 100 feet long. The danger zone is approximately 300 yards. Elapsed time: about 3 minutes.

(3) *Method no. 3—with incendiary grenades.*

(*a*) With the breech closed and the howitzer at approximately 5° elevation, insert 10 unfuzed incendiary grenades end to end, midway in the tube. Ignite the 10 grenades by means of an eleventh one fitted with a length of safety fuze to give a 15-second delay. The metal from the grenades will fuze with the tube and fill the grooves and also fuze the breechblock to the tube.

(*b*) Place an incendiary grenade between the recuperator and counterrecoil cylinders. This grenade should be fitted with at least five feet of safety fuze. Ignite and take cover; gas at a pressure of 1,500 psi will be released when the cylinder is burned through (See Caution in par. 183). Safety fuze burns at the rate of one foot in 30 to 45 seconds; *test before using.* Elapsed time: about 4 minutes.

183. Priming and Detonation Demolition Charges

Charges should be connected for simultaneous detonation with detonating cord, Provide for dual priming to minimize the possibility of a misfire. For priming, either a nonelectric blasting cap crimped to at least five feet of safety fuze (safety fuze burns at the rate of one foot in 30 to 45 seconds; test before using)), or an electric blasting cap and firing wire may be used. Safety fuze, which contains black powder, and blasting caps must be protected from moisture at all times. The safety fuze may be ignited by a fuze lighter or match before taking cover; the electric blasting cap requires a blasting machine or requivalent source of electricity and is fired after taking cover.

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Caution: **Keep the blasting caps, detonating cord, and safety fuze separated from the charges until required for use.**

Note. **For the successful execution of methods of destruction involving the use of demolition materials, all personnel concerned will be thoroughly familiar with the provisions of FM 5-25. Training and careful planning are essential.**

184. Destruction of Pneumatic Tires

a. General. An attempt must always be made to destroy pneumatic tires even if time will not permit destruction of the remainder of the carriage. The destruction of tires by means of incendiary grenades should be accomplished in conjunction with the destruction of the weapon (par. 182).

b. Method No. 1—With Incendiary Grenades.

(1) Ignite an incendiary grenade under each tire.

(2) When this method is combined with the destruction of materiel by means of demolition materials, the detonation of explosive charges should be delayed until the incendiary fires are well started to offset the possibility of the flames being extinguished by the blast of the explosion. Elapsed time: about 2 minutes.

c. Method No. 2—by Slashing. Slash tires. If tires are inflated, exercise care to prevent injury should the tire blow out while being slashed. Whenever practicable, it is usually preferable to deflate tires before slashing. Elapsed time: about 3 minutes.

185. Destruction of Gasoline Engine Assembly

a. Destruction by Mechanical Means. Use sledge hammers, crowbars, picks, axes, or any other heavy tools which may be available to destroy the following:

(1) The engine crankcase and cylinders.

(2) Carburetor, magneto, and governor.

(3) Intake and exhaust manifold.

Note. **The above steps are minimum requirements for this method.**

(4) Flywheel housing and flywheel.

(5) Shrouds and cylinder air baffles.

b. Destruction by Misuse. Perform the following steps to render the engine inoperative:

(1) Cover the air inlet openings and the air inlet housing and drain the engine oil pan. Put sand, gravel, nuts, bolts, screws, or broken glass in the oil filler tube.

(2) Run the engine at full throttle.

Note. **The above steps are minimum requirements for this method.**

c. Other Destruction Methods.

(1) *Scattering and concealment.* Remove all easily accessible parts such as carburetor, fuel pump, magneto, and governor. Scatter them through dense foliage, bury them in dirt or sand, or throw them in a lake, stream, or other body of water.

(2) *Burning.* Pack rags, clothing, or canvas under, around, and inside the engine shrouds. Saturate this packing with gasoline, oil, or diesel fuel and ignite.

(3) *Submersion.* Totally submerge the engine with the hydraulic power unit in a body of water to provide water damage and concealment. Salt water will damage metal parts more than fresh water.

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APPENDIX I

REFERENCES

1. Publication Indexes

The following indexes should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to materiel covered in this manual.

Index of Army Motion Pictures, Filmstrips, Slides, Tapes, and Phono-Recordings.	DA Pam 108-1
Military Publications:	
Index of Administrative Publications	DA Pam 310-1
Index of Blank Forms	DA Pam 310-2
Index of Doctrinal, Training, and Organizational Publications.	DA Pam 310-3
Index of Graphic Training Aids and Devices.	DA Pam 310-5
Index of Supply Manuals; Ordnance Corps	DA Pam 310-29
Index of Technical Manuals, Technical Bulletins, Supply Manuals (type 4, 6, 7, 8, and 9), Supply Bulletins, Lubrication Orders, and Modification Work Orders.	DA Pam 310-4

2. Supply Manuals

The following Department of the Army Manuals pertain to this materiel:

a. Ammunition.	
Ammunition and Explosives (Class 1305 Ammunition, through 30-mm).	SM 9-5-1305
Ammunition and Explosives (Class 1310 Ammunition, over 30-mm up to 75-mm).	SM 9-5-1310
Ammunition and Explosives (Class 1320 Ammunition, over 125-mm).	SM 9-5-1320
Ammunition and Explosives (Class 1370 Military Pyrotechnics, All Types).	SM 9-5-1370
Ammunition and Explosives (Class 1390 Fuzes and Primers).	SM 9-5-1390
b. Destruction to Prevent Enemy Use.	
Ammunition and Explosives (Class 1375 Explosives, Solid Propellants, and Explosive Devices).	SM 9-5-1375
c. Maintenance and Repair.	
Field Artillery and Combat Vehicle Weapons (SNL Groups C and D).	ORD 6 SNL J-13
Industrial Supplies — FSC Group 53, Class 5350: Abrasive Materials — Stock List, Vol 1 — List of Items.	SM 9-1-C5350-SL-1
Industrial Supplies — FSC Group 53, Class 5350: Abrasive Materials — Stock List, Vol 2 — Army Service Supplementary Data List.	SM 9-1-C5350-SL-2

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3. Forms

The following forms pertain to this materiel:

DA Form 2028, Recommended Changes to DA Technical Manual Parts Lists or Supply Manual 7, 8, or 9 (cut sheet).
DA Form 2404, Equipment Inspection and Maintenance Worksheet.
DA Form 2408, Equipment Log Assembly (Records).
DA Form 2408–1, Equipment Daily or Monthly Log.
DA Form 2408–2, Equipment Lubrication Record.
DA Form 2408–3, Equipment Maintenance Record (Organizational).
DA Form 2408–4, Weapon Record Data.
DA Form 2408–5, Equipment Modification Record.
DA Form 2408–6, Equipment Maintenance Record (Support Echelons).
DA Form 2408–7, Equipment Transfer Report.
DA Form 2408–8, Equipment Acceptance and Registration Record.
DA Form 2408–9, Proof Acceptance Record.
DA Form 2408–10, Equipment Component Register.
DA Form 2409, Equipment Maintenance Log (Consolidated).
DD Form 6, Report of Damaged or Improper Shipment.
Refer to TM 38–750 for additional DA Forms.

4. Other Publications

The following explanatory publications contain information pertinent to this materiel and associated equipment.

a. Ammunition.

Ammunition: Federal Stock Numbers and Department of Defense Codes.	TB 9–AMM5
Ammunition for Antiaircraft, Tank, Antitank, and Field Artillery Weapons.	TM 9–1300–203
Ammunition, General	TM 9–1900
Ballistic Data, Performance of Ammunition	TM 9–1907
Care, Handling, Preservation, and Destruction of Ammunition.	TM 9–1903
Distribution of Ammunition for Training	AR 710–1300–1
Malfunctions Involving Ammunition and Explosives.	AR 700–1300–8
Regulations for Firing Ammunition for Training, Target Practice, and Combat.	AR 385–63

b. Camouflage.

Camouflage, Basic Principles and Field Camouflage.	FM 5–20
Camouflage Materials	FM 5–22

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c. Decontamination.

Chemical, Biological, and Radiological (CBR) Decontamination.	TM 3-220
Small Unit Procedures in Chemical, Biological, and Radiological (CBR) Operations.	FM 21-40

d. Destruction to Prevent Enemy Use.

Demolition Materials	TM 9-1946
Explosives and Demolitions	FM 5-25
Ordnance Ammunition Service	FM 9-5

e. General.

155-mm Howitzer, M1 Towed	FM 6-81
Accident Reporting and Records	AR 385-40
Army Equipment Record Procedures	TM 38-750
Basic Cold Weather Manual	FM 31-70
Care and Maintenance of Pneumatic Tires	TM 9-1870-1
Cleaning, Drying, and Abrading Equipment for Cleaning Ordnance Materiel.	TM 9-208-2
Cleaning of Ordnance Materiel	TM 9-208-1
Command Maintenance Management Inspections	AR 750-8
Data Sheets for Ordnance Type Materiel	TM 9-500
Deepwater Fording of Ordnance Materiel	TM 9-238
Dictionary of United States Army Terms	AR 320-5
Mountain Operations	FM 31-72
Northern Operations	FM 31-71
Operation and Maintenance of Army Materiel in Extreme Cold Weather, 0° to -65°.	TM 9-207
Operator and Organizational Maintenance Manual for M90 Radar Chronograph	TM 9-1290-359-12&P
Operator, Organizational and Field Maintenance Manual: Targets, Target Material, and Training Course Layouts.	TM 9-6920-210-14
Operator's and Organizational Maintenance Manual for Computer Group, Gun Direction	TM 11-7440-283-12-1
Operator's and Organizational Maintenance Manual for Data Display Group	TM 11-7440-283-12-2
Operator's Manual: Radio Set	TM 11-5820-882-10
Principles of Artillery: Weapons	TM 9-3305-1
Requisitioning, Receipt, and Issue System	AR 725-50
The Field Artillery Battery	FM 6-140

f. Maintenance and Repair.

Howitzer, Medium, Towed; 155-mm, M114 and M114A1; and Howitzer, Medium Towed: Auxiliary Propelled, 155-mm, M123A1.	LO 9-1025-200-10
Inspection, Care, and Maintenance of Antifriction Bearings.	TM 9-214
Lubrication of Ordnance Materiel	TM 9-273
Operator, Organizational, and Field Maintenance Manual: Engine Gasoline: Military Standard Models (Model 24042-1) 10 HP FSN 2805-776-0484, (Model 4A084-1) 20 HP FSN 2805-776-0485, (Model 2A042-11), 10 HP FSN 2805-952-3927 (Model 4A084-11) 20 HP FSN 2805-952-3926.	TM 5-2805-204-14

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Organizational and Field Maintenance Repair Parts and Special Tool Lists: Engine Gasoline, Military Standard Models: (Model 2A042-1) 10 HP, FSN 2805-776-0484; (Model 4A084-1) 20 HP, FSN 2805-776-0485.	TM 5-2805-204-24P
Organizational Maintenance Repair Parts and Special Tool Lists for Howitzer, Medium, Towed, 155-mm, M114 and M114A1; and Howitzer, Medium, Towed, Auxiliary Propelled, 155-mm, M123A1.	TM 9-1025-200-20P
Organization, Policies, and Responsibilities for Maintenance Operation.	AR 750-5
Painting Instructions for Field Use	TM 9-213
Use and Care of Handtools and Measuring Tools.	TM 9-243
g. Sighting and Fire-Control Equipment.	
12-inch Graphical Firing Tables	TM 9-524
Auxiliary Sighting and Fire Control Equipment.	TM 9-575
Cannon, 155-mm, Howitzer, M1, M1A1, and M45; Firing Projectile, HE, M107; Projectile, HE, M107B2; Projectile, Smoke, WP, M105; Projectile, Smoke, WP, M110; Projectile, Smoke, BE, M116 and M116B1 (HC and Colored); Projectile, Gas, Persistent, HD, M110; Projectile, Gas, Persistent, H, M110; Projectile, Gas, Nonpersistent, GB, M121A1 and M121; Projectile, Gas, Persistent, VX, M121A1; Projectile, Illuminating, M118 Mods.	FT 155-Q-3
Graphical Firing Tables; M39, M40, M41, M42, M43, M44, M45, M46, M47, M48, M49, M50, and M51.	TM 9-525.
Principles of Fire Control Materiel	TM 9-3305-2
h. Shipment and Storage.	
Color and Marking of Army Materiel	AR 746-5
General Packaging Instructions for Ordnance General Supplies.	TM 9-200
Marking of Arctic Lubricated Materiel and Equipment.	SR 746-30-10
Preparation of Military Materiel for Shipment.	AR 740-20
Preservation, Packaging, and Packing Materials, Supplies, and Equipment Used by the Army.	SB 38-100
Processing of Unboxed Self-Propelled and Towed Class II Ordnance General Supplies and Related Materiel for Shipment and Storage.	TB 9-299/1
Protection of Ordnance General Supplies in Open Storage.	TB ORD 379
Report of Damaged or Improper Shipment	AR 700-58
Standards for Oversea Shipment and Domestic Issue of Ordnance Materiel Other Than Ammunition and Army Aircraft.	TB ORD 385

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APPENDIX II

COMPONENTS OF END ITEM LIST

Section I: INTRODUCTION

1. Scope

This appendix lists integral components of and basic issue items for the howitzer to help you inventory items required for safe and efficient operation.

2. General

This Components of End Item List is divided into the following sections:

a. Section II. Integral Components of the End Item. These items, when assembled, comprise the howitzer and must accompany it whenever it is transferred or turned in. The illustrations will help you to identify these items.

b. Section III. Basic Issue Items. These are the minimum essential items required to place the howitzer in operation, to operate it, and to perform emergency repairs. Although shipped separately packed they must accompany the howitzer during operation and when ever it is transferred between accountable officers. The illustrations will assist you with hard-to-identify items. This manual is your authority to requisition replacement BII, based on TOE/MTOE authorization of the end item.

3. Explanation of Columns

a. Illustration. This column is divided as follows:

(1) *Figure Number.* Indicates the figure number of the illustration on which the item is shown.

(2) *Item Number.* The number used to identify item called out in the illustration.

b. National Stock Number. Indicates the National stock number assigned to the item and which will be used for requisitioning.

c. Part Number. Indicates the primary number used by the manufacturer, which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items.

d. Description. Indicates the Federal item name and, if required, a minimum description to identify the item.

e. Location. The physical location of each item listed is given in this column. The lists are designed to inventory all items in one area of the major item before moving on to an adjacent area.

f. Usable on Code. "USABLE ON" codes are included to help you identify which component items are used on the different models. Identification of the codes used in these lists are:

Code	Used On
021	M114
022	M114A1
G72	M114A2

g. Quantity Required (Qty Reqd). This column lists the quantity of each item required for a complete major item.

h. Quantity. This column is left blank for use during an inventory. Under the Rcv'd column, list the quantity you actually receive on your major item. The Date columns are for your use when you inventory the major item at a later date; such as for shipment to another site.

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Section II.
INTEGRAL COMPONENTS OF END ITEM

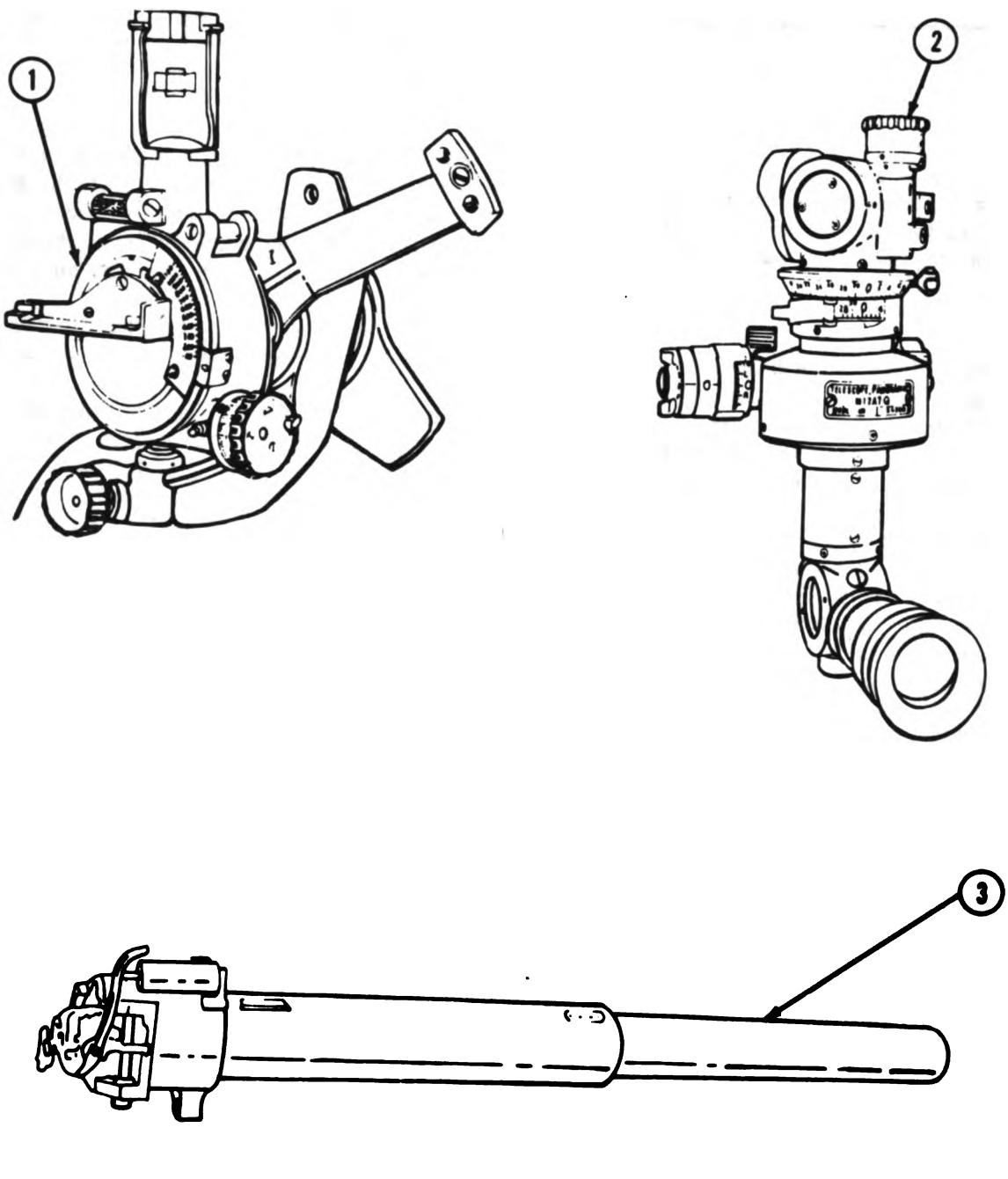


Figure 216. Integral components of end item (1 of 2)

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(1) ILLUS (a) FIG NO.	(1) ILLUS (b) ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) PART NO.	(4) DESCRIPTION	(5) LOCATION	(6) USABLE ON CODE	(7) QTY REQD	(8) QUANTITY RCV'D	DATE	DATE	DATE
216	1	1240-00-757-8429	7578429	MOUNT TELESCOPE, M25		021 022	1				
216	2	1240-00-917-6428	8213035	TELESCOPE PANORAMIC, M12A7Q		022 G72	1				
216	3	1025-00-508-0785	7309248	CANNON 155MM, M1A1		021 022	1				
216	3	1025-01-080-7369	11579272	Cannon 155-mm, M1A2		G72	1				

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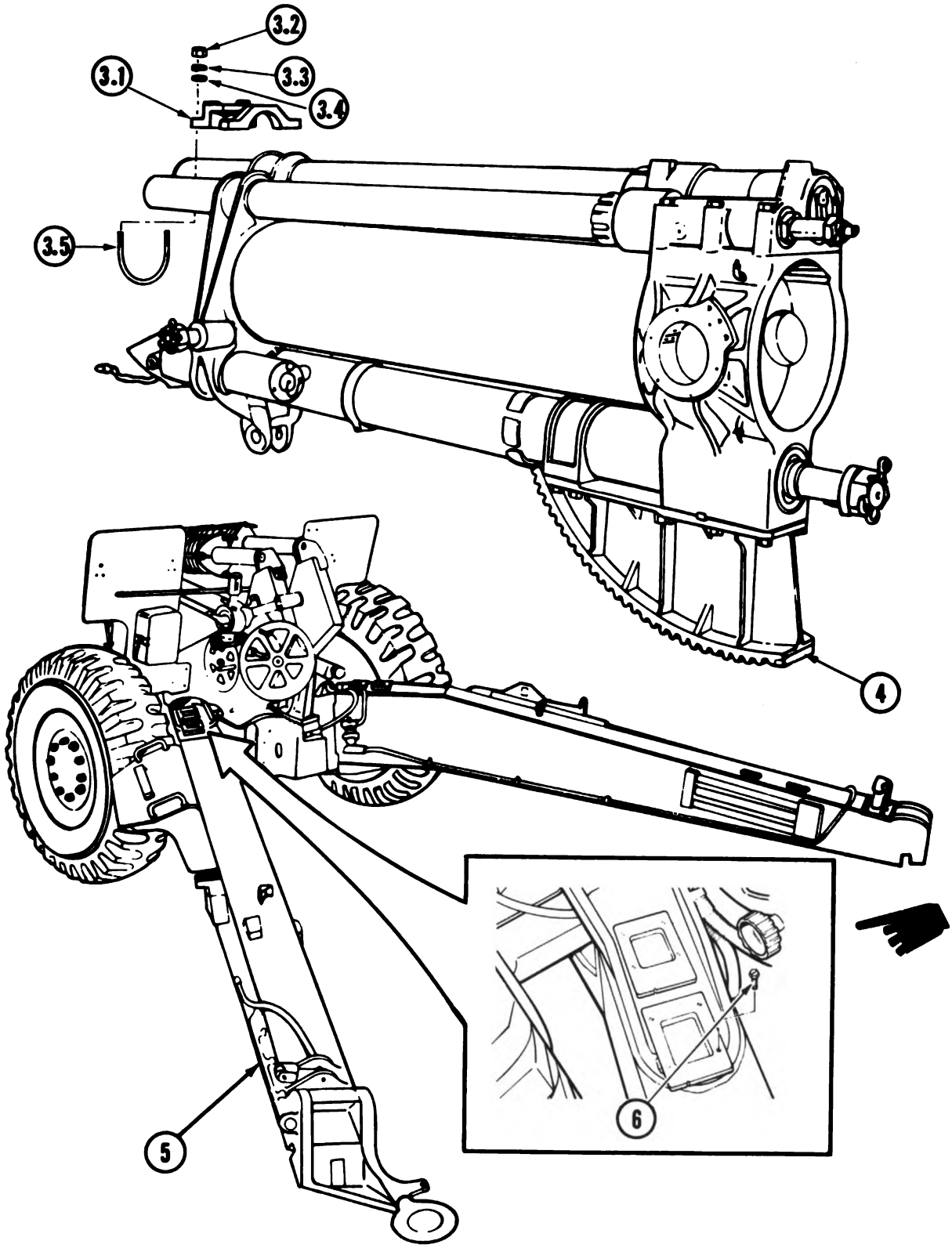


Figure 216. Integral components of end item (2 of 2)

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(1) ILLUS (a) FIG NO.	(1) ILLUS (b) ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) PART NO.	(4) DESCRIPTION	(5) LOCATION	(6) USABLE ON CODE	(7) QTY REQD	(8) QUANTITY RCV'D	(8) QUANTITY DATE	(8) QUANTITY DATE	(8) QUANTITY DATE
216	3.1	1220-01-142-9445	11785073	BRACKET, ANTENNA MOUNTING		021 022 G72	1				
216	3.2	5310-00-985-1800	MS51971-4	NUT, HEXAGON		021 022 G72	4				
216	3.3	5310-00-926-5979	MS35338-161	WASHER, LOCK		021 022 G72	4				
216	3.4	5310-00-985-0057	MS15795-815	WASHER, FLAT		021 022 G72	4				
216	3.5	5306-01-128-4099	11785074	BOLT, U		021 022 G72	2				
216	4	1025-00-714-8074	7148074	RECOIL MECHANISM M6A2		021 022 G72	1				
216	5		7142384	CARRIAGE 155 MM, M1A1		021 G72	1				
216	5		7141821	CARRIAGE 155 MM, M1A2		022 023 G72	1				
216	6	5305-01-016-4344	MS51849-86	SCREW, MACHINE		021 022 G72	8				

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Section III. BASIC ISSUE ITEMS

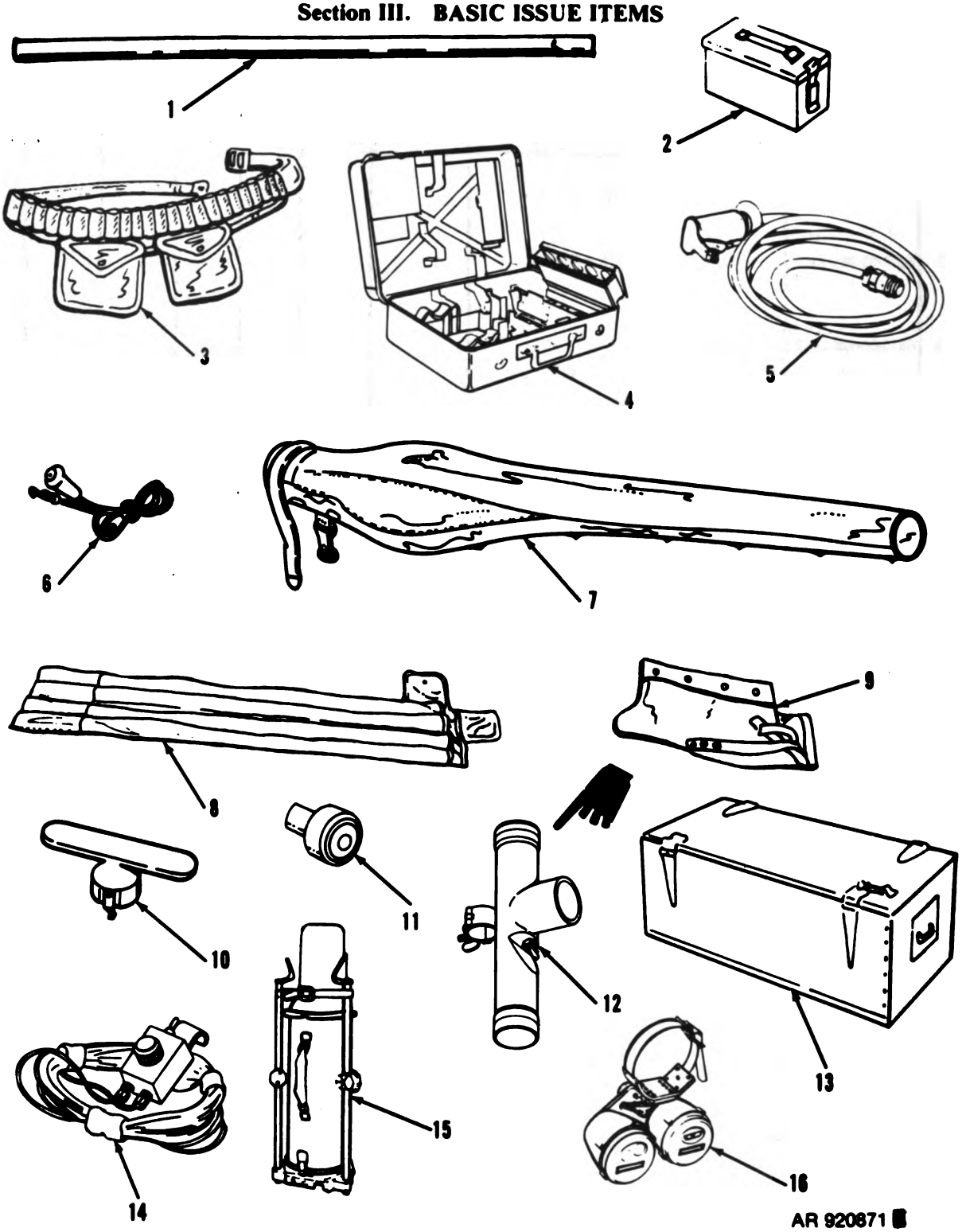


Figure 217. Basic issue items (1 of 3)

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(1) ILLUS (a) FIG NO.	(1) ILLUS (b) ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) PART NO	(4) DESCRIPTION	(5) LOCATION	(6) USABLE ON CODE	(7) QTY REQD	(8) QUANTITY RCVD	(8) QUANTITY DATE	(8) QUANTITY DATE	(8) QUANTITY DATE
217	1	5120-00-617-0995	6170995	BAR, WEAPONS HANDLING			2				
217	2	6110-00-076-0065	8644375	BATTERY, POWER SUPPLY			1*				
217	3	1025-00-860-5446	8767215	BELT, PRIMER			1				
217	4	1290-00-654-5472	6545472	CHEST, LIGHT			1				
217	5	1025-00-072-4944	8426960	CABLE ASSEMBLY, SPECIAL PURPOSE ELECTRICAL			1				
217	6	1025-00-600-6700	6006700	LANYARD, FIRING (6 FT)			1				
217	7	1025-00-409-8372	8445000	COVER ASSEMBLY, OVERALL			1				
217	8	1290-00-653-7993	6537993	COVER, AIMING POST			1				
217	9	1025-00-713-8607	7138607	COVER			1				
217	10	1290-00-764-7761	7647761	FUZE SETTER, M29			1				
217	11	1030-00-859-4511	8765688	HOLDER, CHAMBER SWABBING SPONGE			1				
217	12	1290-01-148-4821	11786401	LT, AIMING POST : M14			2				
217	13	5140-00-653-4198	6534198	CHEST, TOOL			1				
217	14	1240-00-878-5566	10553499	CONTROL, LIGHT SOURCE, REMOTE			1*				
217	15	1240-00-000-0000	8644275	COLLIMATOR, INFINITY M1			1				
				or							
217	15	1240-00-222-1780	1055635	COLLIMATOR, INFINITY M1A1							
217	16	1025-00-072-4946	8426965	LIGHT, BLACKOUT			1				

*For use with the M1 Collimator only.

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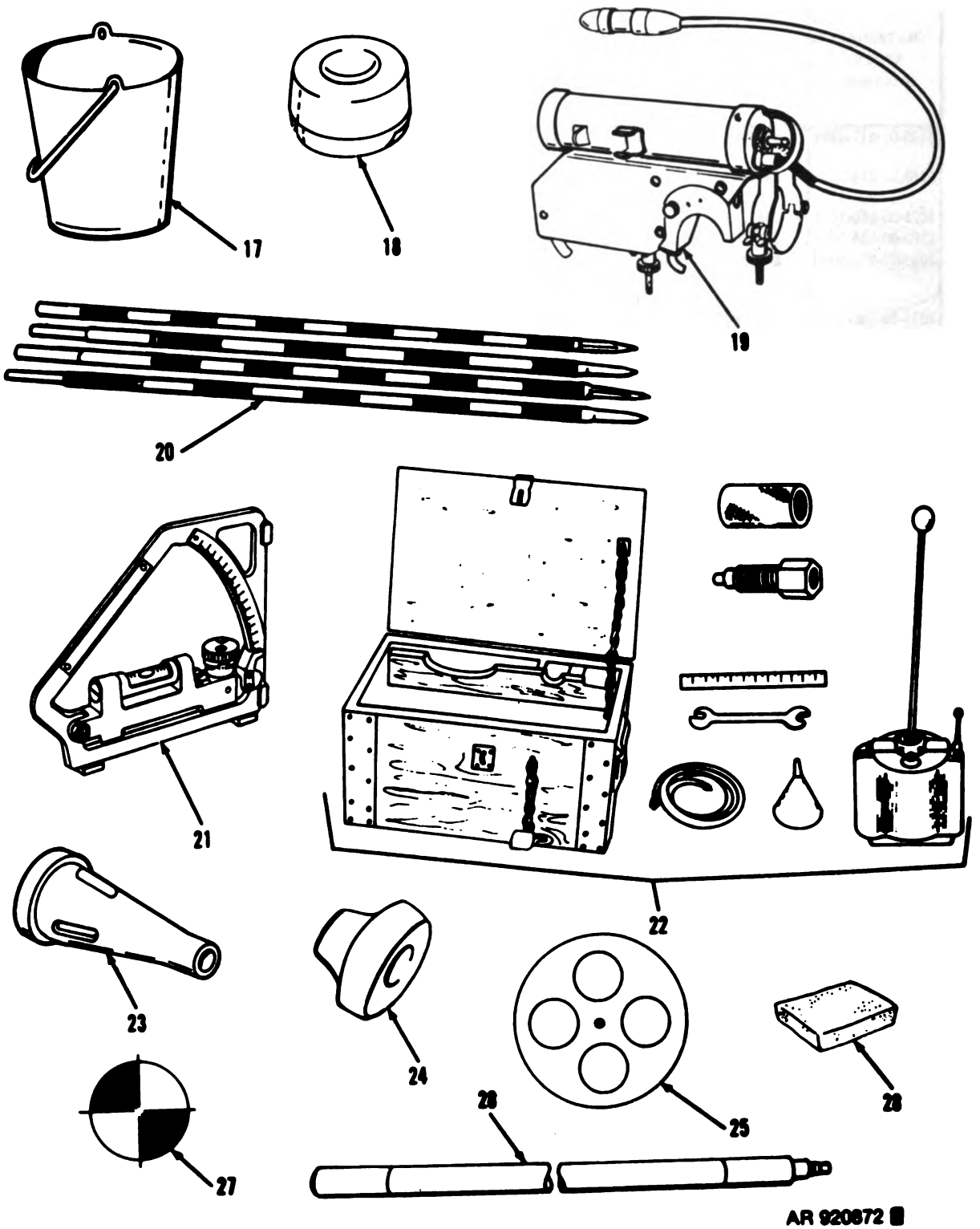


Figure 217. Basic issue items (2 of 3)

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(1) ILLUS (a) FIG NO.	(1) ILLUS (b) ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) PART NO.	(4) DESCRIPTION	(5) LOCATION	(6) USABLE ON CODE	(7) QTY REQD	(8) QUANTITY RCV'D	DATE	DATE	DATE
217	17	7240-00-160-0455	RR-P-35	PAIL, UTILITY			1				
217	18	1025-00-566-3789	7309257	PLUG, MUZZLE			1				
217	19	1290-00-768-9300	7689300	LIGHT, INST, M34			1				
217	20	1290-00-535-7617	7687114	POST, AIMING, M1A2			2				
217	21	1290-00-891-9999	7197156	QUADRANT, FIRE CONTROL, M1A1			1				
217	22	4933-00-712-2378	7122378	PUMP KIT, HYDRAULIC, GUN RECOIL CONSISTING OF:			1				
217	22	4930-00-449-6811	6221723	ADAPTER, PLUG, OIL FILLING, RECOIL MECHANISM			1				
217	22	4930-00-449-6812	6221724	ADAPTER, PLUG, OIL FILLING, RECOIL MECHANISM			1				
217	22	4930-00-449-9642	5154555	CAP, OIL FILLER GUN			1				
217	22	4930-00-449-9644	5169905	CAP, OIL FILLER GUN			1				
217	22	4930-00-449-6900	6539364	CHEST, WOOD			1				
217	22	7240-00-826-4099	L-F-1593	FUNNEL			1				
217	22	4930-00-449-6636	6221731	HOSE, RUBBER			1				
217	22	4933-00-449-7166	7550134	PUMP, HYDRAULIC			1				
217	22	5210-00-600-5757	CME300	RULE, STEEL, MACHINIST'S			1				
217	22	5120-00-187-7129	GOGW536	WRENCH, OPEN END, FIXED			1				
217	23	1025-00-960-5443	8767210	RAMMER, CLEANING AND UNLOADING			1				
217	24	1030-00-730-7416	7307416	RAMMER, LOADING			1				
217	25	4933-00-723-8962	7238962	SIGHT, BORE, BREECH			1				
217	26	7920-00-240-2559	8767156	SPONGE, CELLULOSE			1				
217	27	6920-00-559-0598	5590598	TARGET, BORE-SIGHTING			1				
217	28	1090-00-563-7232	7309228	STAFF SECTION, CLEANING, ARTILLERY			6				

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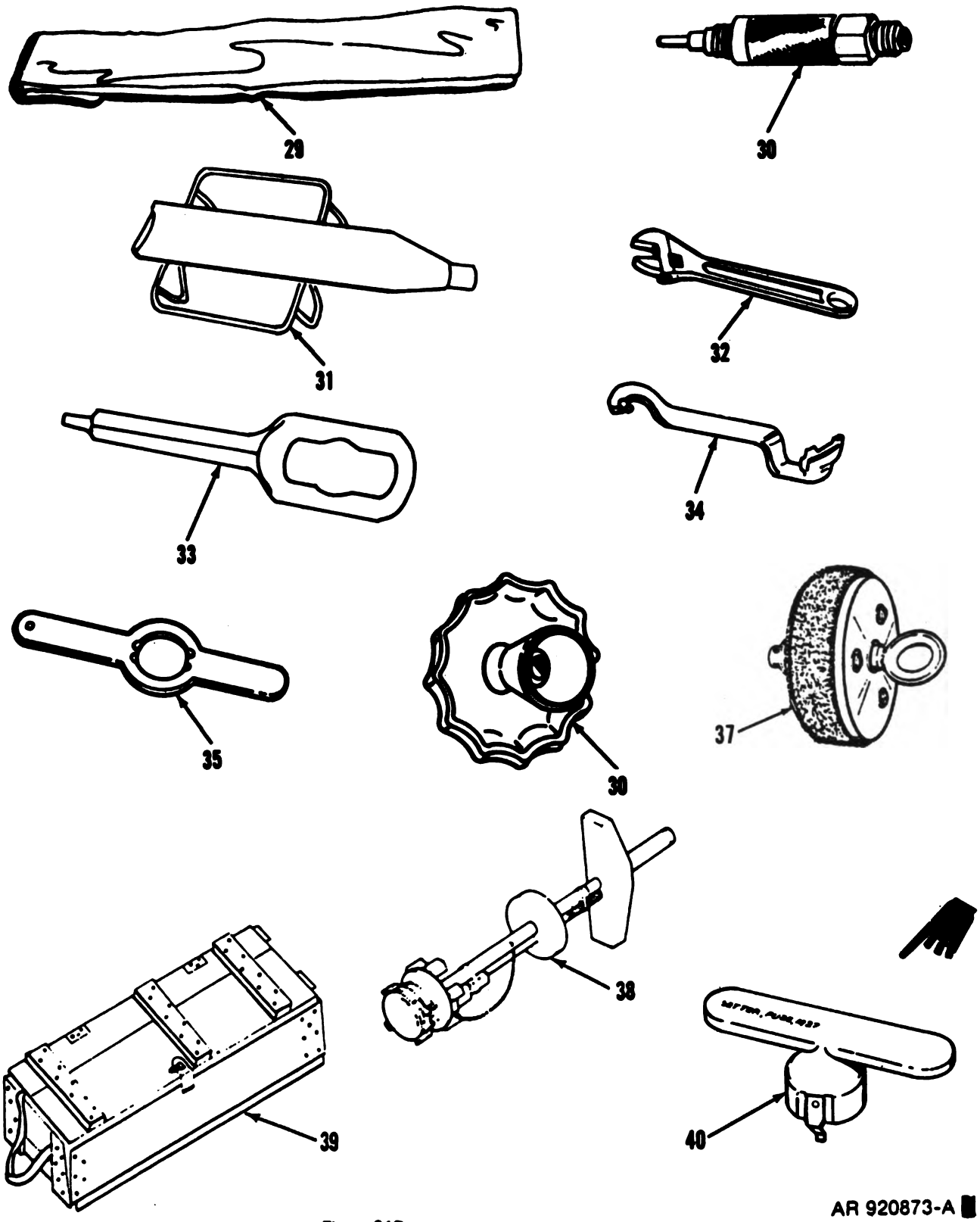


Figure 217. *Basic issue items (3 of 3)*

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(1) ILLUS (a) FIG NO.	(1) ILLUS (b) ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) PART NO.	(4) DESCRIPTION	(5) LOCATION	(6) USABLE ON CODE	(7) QTY REQD	(8) QUANTITY RCV'D	DATE	DATE	DATE
217	29	2540-00-653-7589	6537589	TARPAULIN			1				
217	30	4933-00-626-4157	8410594	TOOL ASSEMBLY, LIQUID RELEASING AND FILLING			1				
217	31	1025-00-557-3641	5573641	TRAY ASSEMBLY			1				
217	32	5120-00-240-5328	GGG-W-631	WRENCH, ADJUSTABLE			1				
217	33	4933-00-723-1161	7231161	WRENCH, FUZE, M18			1				
217	34	4933-00-723-0851	7230851	WRENCH, SPANNER			1				
217	35	1290-00-078-4367	0784367	FUZE SETTER, M34			1				
217	36	1290-00-201-3507	2013507	FUZE SETTER, M35			1				
217	37	1025-00-730-7400	8765094	BRUSH, ARTILLERY, CLEANING			1				
217	38	1025-01-082-3586	9305465	EXTRACTOR TOOL ASSEMBLY FOR PROJECTILE, 155MM, M712 AND M823.			1				
217	39	.....	9331729	BOX, PACKING, FOR EXTRACTOR TOOL ASSEMBLY FOR PROJECTILE, 155MM, M712 AND M823.			1				
217	40	1290-00-764-7761	7647761	FUZE SETTER, M27			1				

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APPENDIX II.1

ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

1. Scope

This appendix lists additional items you are authorized for the support of the howitzer.

2. General

This list identifies items that do not have to accompany the howitzer and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE. TDA. or JTA.

3. Explanation of Listing

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment.

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Section II. ADDITIONAL AUTHORIZATION LIST

(1) NATIONAL STOCK NUMBER	(2) DESCRIPTION PART NUMBER & FSCM USABLE ON CODE	(3) U/M	(4) QTY AUTH
5120-00-224-1372	BAR, PINCH GGG-B-101 (81348)	EA	1
4933-00-730-7183	BRUSH, CLEANING, PRIMER SEAT 7307183 (19206)	EA	1
7920-00-291-5815	BRUSH, WIRE SCRATCH HB-178 (81348)	EA	2
4933-00-601-9667	CLEANING TOOL, VENT 6019667 (19206)	EA	1
1025-00-557-6513	COVER ASSEMBLY 5576513 (19206)	EA	1
1025-00-557-0485	FIRING MECHANISM 5570485 (19206)	EA	1
4933-00-722-5952	GAGE, HEADSPACE 7225952 (19206)	EA	1
5120-00-900-6095	HAMMER, HAND GGG-H-86 (81348)	EA	1
5120-00-240-5292	KEY, SOCKET HEAD SCREW GGG-K-00275 (81348)	EA	1
5120-00-240-5300	KEY, SOCKET HEAD SCREW GGG-K-00275 (81348)	EA	1
4930-00-274-5711	LUBRICATING GUN, HAND 63394 (65282)	EA	1
4930-00-287-8474	OILER, HAND MS15765-1 (96906)	EA	1
5120-00-239-8251	PLIERS FFF-P-471, TYPE 9, CLASS 1, STYLE A (81348)	EA	1
4933-00-501-2216	REAMER, HAND, PRIMER 5012216 (19206)	EA	1
1005-00-650-7349	ROLL, ORDNANCE WEAPONS SPARE PARTS 6507349 (19204)	EA	1
5120-00-236-2140	SCREWDRIVER, FLAT TIP GGG-S-1210, TYPE 1, CLASS 8, STYLE 2 (81348)	EA	1
5120-00-278-1282	SCREWDRIVER, FLAT TIP MS15433-1 (96906)	EA	1
5120-00-278-1283	SCREWDRIVER, FLAT TIP GGG-S-121 (81348)	EA	1
4933-00-520-7129	SPACER, COUNTER BALANCE CYLINDER 5207129 (19207)	EA	1
4933-00-520-7076	TOOL, FIRING MECHANISM HOUSING 5207076 (19206)	EA	1
6675-00-240-1881	TRIPOD, SURVEYING MIL-T-11674 (81349)	EA	1
5120-00-423-6728	WRENCH, ADJUSTABLE 6187328 (19207)	EA	1
5120-00-264-3777	WRENCH, SPANNER GGG-W-665 (81348)	EA	1
5120-00-616-7037	WRENCH, SPANNER 6167037 (19206)	EA	1
5120-00-723-0275	WRENCH, SPANNER 7230275 (19206)	EA	1

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APPENDIX III

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

1. General

This appendix contains the maintenance allocation chart (MAC) which describes, for all levels of maintenance, the lowest available maintenance category authorized to perform each operation (column 3). The basic entries on the chart are a list of functional groups applicable to the end items which may require maintenance parts. The term functional group applies to assemblies and subassemblies, but not to piece parts.

2. Explanation of Maintenance Allocation Chart

a. Column (1), Functional Group. Column (1) lists the noun names of components, assemblies, and subassemblies on which maintenance is authorized.

b. Column (2), Maintenance Function. Column (2) designates the category of maintenance to be performed and is limited to and defined as follows:

(1) *Inspect.* To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

(2) *Test.* To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

(3) *Service.* To clean, preserve, and to add fuel, lubricants, and air.

(4) *Adjust.* To rectify to the extent necessary to bring into proper operating range.

(5) *Install.* To set up for use in an operational environment such as an emplacement, site, or vehicle.

(6) *Replace.* To replace unserviceable items with serviceable assemblies, subassemblies, or parts.

(7) *Repair.* To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

(8) *Overhaul.* To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards using the Inspect and Repair Only as Necessary (IROAN) technique.

(9) *Rebuild.* To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item.

(10) *Function level.* The arabic numeral placed in the appropriate column indicates the level responsible for performing that particular maintenance function.

c. Column (3), Remarks. (Self-explanatory.)

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Section II.

MAINTENANCE ALLOCATION CHART

(1) Functional group	(2) Maintenance function									(3) Remarks
	Inspect	Test	Service	Adjust	Install	Replace	Repair	Overhaul	Rebuild	
155-MM HOWITZER M114, and M123A1										
CANNON, 155-MM HOWITZER: M1 and M1A1	3	3	1			3	3	5		
Barrel assembly			1				3	5		
Breech mechanism			1				3			
Adapter group, firing mechanism housing assembly			1	2		2	3			
Counterbalance assembly			2			3	3			
Crankshaft assembly			1			3	3			
Firing mechanism, M1			1			1	3			
Obturator spindle group			1			2	3			
Ring group, breech			1				2			
CARRIAGE, 155-MM HOWITZER: M1A1, M1A2, and M32			1				3	5		
Adjuster, slack assembly			1	1		3	3			
Brakes, air			1	2		3	3			
Carriage, bottom			1			5	3	5		
Carriage, top			1			5	3	5		
Case, panoramic			1			3	3			
Coupling, hose, air brake			1			3	3			
Elevating, mechanism			1				3			
Equilibrator assembly			1	1		3	3			
Filter, air			1				3			
Hose, air brake, assembly						3	3			
Jack assembly, firing			1			3	3			
Lever, handbrake assembly			1			3				
Trail assemblies			1			5	3	5		
Traveling lock group			1			3	3			
Traversing mechanism			1				3			
Valve assembly, relay						3	3			
Wheel and hub assembly			1	2		2	3			
CASTER ASSEMBLY (For M123A1 only)			1			3	2			
DRIVE UNIT, WHEEL (For M123A1 only)			1		1	3	2			
ENGINE, GASOLINE: 4 cyl, 20 hp, air-cooled (Model 4A084-1, Modified) (For M123A1 only)	1	2	1							
Note. The maintenance allocation below includes only the operational and organizational portion of the gasoline engine covered in this manual. For further maintenance allocation, see TM 5-2805-204-14.										
Cleaner, air	1	2	1							
Filter assembly, fuel	1		1			2				
Filter, oil	1		1							
JACK ASSEMBLY, TRAIL (For M123A1 only)			1			3	3			
POWER UNIT, HYDRAULIC (For M123A1 only)			1	2		3	3			
RECOIL MECHANISM, 155-MM HOWITZER, M6, M6A1, M6A2, M6B1, and M6B2			1			3	3		*5	
*Accomplished only by recoil mechanism depot maintenance shops.										
BRUSH, CLEANING, ARTILLERY	1		1			2	3			
FUZE SETTER: M26	1	3	1	3		2	3	5		
FUZE SETTER: M28	1	3	1	3		2	3	5		
LIGHT, AIMING POST: M14, w/filters	1		1			2		5		

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MAINTENANCE ALLOCATION CHART—Continued

(1) Functional group	(2) Maintenance function									(3) Remarks
	Inspect	Test	Service	Adjust	Install	Replace	Repair	Overhaul	Rebuild	
LIGHT, BLACKOUT	1		1			2	3			
LIGHT, INSTRUMENT	1		1			3		3		
TELECOPE, PANORAMIC, M12A7C	1	3	1	1		2	3	5		
37-MM SUBCALIBER GUN										
CANNON, 37-MM GUN, M1916	3	3	1			3	3			
Barrel			1			3				
Breech mechanism			1				3			
Key, piston crosshead, assembly							3			
MOUNT, GUN, SUBCALIBER, 37MM, M12A1			1			3	3	4		
RECOIL MECHANISM, 37MM, M1916			1			3	3	4		
Striker assembly			1			3	3	4		
Trigger mechanism group			1				3	4		
COLLIMATOR, INFINITY AIMING										
AIMING REFERENCE	1		2	4		3	3	5		
Collimator (scope)						4	4			
Lamp housing (M1)						3	3			
Collar assembly (M1A1)						3	3			
Objective cell assembly						4	4			
Reticle cell assembly (M1)	4		4			4	4			
Optical cell assembly (M1A1)	4		4			4				
Tripod mount						3	3			
Collar assembly (M1A1)						3	3			
Housing assembly (M1)						3	3			
Yoke (M1)						3	3			
Leg assembly						3	3			
Tube assembly						3	3			
Leg						3	3			
Collimator case						3	3			

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APPENDIX IV
EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

1. Scope

This appendix lists expendable supplies and materials you will need to operate and maintain the M114 series howitzer. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

2. Explanation of Columns

a. Column (1) - Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 3 App. IV").

b. Column (2) - Level. This column identifies the lowest level of maintenance that requires the listed itom.

O - Organizational Maintenance

c. Column (3) - National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column (4) - Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the part number.

e. Column (5) - Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
Note. The following items are applicable to the infinity aiming reference collimator only.				
1	O	8105-00-269-4662	BAG, PLASTIC: (81349) MIL-B-117	EA
2	O	7920-00-205-0565	BRUSH, LENS, DUSTING: (81348) H-B-1654	EA
3	O		CLEANING COMPOUND, OPTICAL LENS (81349) MIL-C-43454	
		6850-00-227-1887	qt can	CN
4	O	6240-00-539-9659	LAMP, INCANDESCENT, 12V: (96906) MS-35480-1	EA
5	O	6640-00-436-5000	PAPER, LENS: 7 1/2 x 11 in. (81348) NNN-P-40	
			500 sheets per package	PG
6	O		SEALING COMPOUND: (81349) MIL-S-11031	
		8030-00-275-8110	1 qt container	KT

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Operator and Organizational Maintenance Manual
HOWITZER, MEDIUM, TOWED: 155-MM, M114 (NSN 1025-00-322-9755), M114A1 (NSN 1025-00-322-9768), AND M114A2 (NSN 1025-01-025-9857)

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Operator and Organizational Maintenance Manual

HOWITZER, MEDIUM, TOWED: 155-MM, M114 (NSN 1025-00-322-9755), M114A1 (NSN 1025-00-322-9755), AND M114A2 (NSN 1025-01-025-9857)

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Two items on the change sheet for Change 17 were printed incorrectly. The print date of 31 May 83 should read, "13 Sep 83" and the signature block of E.C. Meyer should read, "John A. Wickham, Jr."

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4. This change incorporates the addition of the BCS mounting plates and screws to the M114/M114A1/M114A2 howitzer. Every illustration in which the BCS mounting plates and screws would appear has not been changed, only those illustrations pertinent to the BCS mounting plates and screws.
5. This change deletes reference to the M12A7C panoramic telescope when referring to the M114A1/M114A2 howitzer. The M12A7C panoramic telescope is used with the M114 howitzer only. The M12A7Q panoramic telescope is used with the M114A1/M114A2 howitzer. This applies to the basic TM 9-1025-200-12 and all previous changes.

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212.1 and 212.2	212.1 and 212.2
212.11 thru 212.16	212.11 thru 212.16
None	212.16.1 and 212.16.2
None	212.23 thru 212.32
237 thru 240	237 thru 239/240 blank
271 and 272	271 and 272

2. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-40, Operator maintenance requirements for Howitzer, 155mm, Towed, M114A1.

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CHANGE
NO. 16

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *8 September 1983*

Operator and Organizational Maintenance Manual

HOWITZER, MEDIUM, TOWED:
155-MM, M114 (NSN 1025-00-322-9755),
M114A1 (NSN 1025-00-322-9768),
AND
M114A2 (NSN 1025-01-025-9857)

TM 9-1025-200-12, 25 March 1965, is changed as follows:

This change incorporates the addition of the M90 chronograph antenna mounting bracket to the M114/M114A1/M114A2 howitzer. Every illustration in which the antenna mounting bracket would appear has not been changed, only those illustrations pertinent to the antenna mounting bracket.

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the outer margin of the page. Added or revised illustrations are indicated by a miniature hand adjacent to the illustration change and a vertical bar adjacent to the illustration identification number.

Remove Pages	*Insert Pages*
1 and 2	1 and 2
5 and 6	5 and 6
9 and 10	9 and 10
31 and 32	31 and 32
55 and 56	55 and 56
125 and 126	125 and 126
None	170.5/(170.6 blank)
227 and 228	227 and 228
231 through 234	231 through 234
269 and 270	269 and 270
273 and 274	273 and 274

2. File this change sheet in front of the publication for reference purposes.

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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *27 January 1983*

OPERATOR AND ORGANIZATIONAL MAINTENANCE MANUAL
HOWITZER, MEDIUM, TOWED: 155-MM, M114 (NSN 1025-00-322-9755) M114A1 (NSN 1025-00-322-9768) AND M114A2 (NSN 1025-01-025-9857)

TM 9-1025-200-12, 25 March 1965, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page. When an entire paragraph or section is added or revised, the vertical bar will be adjacent to the title only. Added or revised illustrations are indicated by a vertical bar adjacent to the identification number.

Remove pages	*Insert Pages*
i (Warning)	a/b (blank)
1 and 2	1 and 2
21 and 22	21 and 22
57 and 58	57 and 58
58.1 and 58.2	58.1 and 58.2
169 and 170	169 and 170
170.1 and 170.2	170.1 and 170.2
None	170.3 and 170.4
235 and 236	235 and 236
267/268 (blank)	267/268 (blank)
None	268.1/268.2 (blank)

2. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

Distribution:

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No. 14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *15 January 1982*

OPERATOR AND ORGANIZATIONAL MAINTENANCE MANUAL HOWITZER, MEDIUM, TOWED: 155-MM, M114 (NSN 1025-00-322-9755) M114A1 (NSN 1025-00-322-9768) AND M114A2 (NSN 1025-01-025-9857)

TM 9-1025-200-12, 25 March 1965, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated below. New or changed material is indicated by a vertical bar in the margin of the page.

Remove pages	Insert pages
187 through 190	187 through 190
None	190.1 and 190.2

2. File this change sheet in front of the publication for reference purposes.

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By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

Distribution:

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CHANGE
No. 13

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *27 September 1979*

Operator's And Organizational Maintenance Manual

HOWITZER, MEDIUM, TOWED: 155-MM, M114 (NSN 1025-00-322-9755) M114A1 (NSN 1025-00-322-9768) and M114A2 (NSN 1025-01-025-9857)

TM 9-1025-200-12, 25 March 1965, is changed as follows:

1. The title is changed to read as shown above. Add M114A2, when reference is made to M114 and M114A1 throughout manual.
2. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page. Added or revised illustrations are indicated by a vertical bar adjacent to the identification number. When a complete chapter or appendix is revised or added, the vertical bar is placed opposite the title only.

Remove pages	*Insert pages*
1 and 2	1 and 2
7/8 (blank)	7/8 (blank)
103 and 104	103 and 104
187 through 211	187 through 212
None	212.1 through 212.22
229 through 236	229 through 236
None	237 through 242/264

3. File this change sheet in front of the publication for reference purposes.

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Distribution:

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TM 9-1025-200-12
C 12

CHANGE
No. 12

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *18 April 1979*

Operator's and Organizational Maintenance Manual
HOWITZER, MEDIUM, TOWED: 155MM, M114 and M114A1

TM 9-1025-200-12, March 1965, is changed as follows:

1. Using pen and ink, delete the procedures contained in paragraph 49 (Misfire, Handfire, and Cook-off) on pages 68 and 68.1, and add the following notation: "for Misfire/Hangfire procedures, refer to paragraphs 174.6 through 174.8."
2. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin. Revised or added chapters are indicated by a vertical bar adjacent to the chapter title. Added or revised illustrations are indicated by a vertical bar adjacent to the identification number.

Remove pages	*Insert pages*
1 and 2	1 and 2
187 through 212	187 through 211
None	

3. File this change sheet in front of the publications for reference purposes.

By Order of the Secretary of the Army:

BERNARD W. ROGERS
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

Distribution:
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