TM 9-1015-211-34

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

FIELD MAINTENANCE MANUAL

105-MM HOWITZER M49
AND
105-MM HOWITZER MOUNT M85

HEADQUARTERS, DEPARTMENT OF THE ARMY
JUNE 1960

TECHNICAL MANUAL
No. 9-1015-211-34

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *14 June 1960*

105-MM HOWITZER M49 AND 105-MM HOWITZER MOUNT M85

***This manual supersedes those portions of TM 9-1324AA, 26 February 1953, that pertain to field maintenance.**

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual contains instructions for the information and guidance of Ordnance maintenance personnel responsible for field maintenance of the 105-mm howitzer M49 and 105-mm howitzer mount M85. They contain information on maintenance that is beyond the scope of the tools, equipment, or supplies normally available to using organizations.

b. This manual contains a description of and procedures for removal, disassembly, inspection, repair, assembly, and installation of the materiel. The appendix contains a list of current references, including supply and technical manuals and other publications applicable to the materiel. TM 9–7204 contains the maintenance allocation chart. Department of the Army Supply Manual ORD 8 SNL C–86 contains a list of repair parts and special tools.

c. TM 9–7204 contains operating and lubricating instructions for the materiel and contains all maintenance operations allocated to using organizations in performing maintenance work within their scope. ORD 7 SNL G–258 contains a list of first and second echelon maintenance parts and equipment.

d. Any errors or omissions will be forwarded on DA Form 2028 direct to the Commanding Officer, Raritan Arsenal, Metuchen, N. J., ATTN: ORDJR-OPRA.

e. This manual differs from TM 9–1324AA/TO 39A–5E–2, dated February 1953, as follows:

(1) Adds information on elevating mechanism

(2) Revises information on both howitzer and mount

(3) Deletes reference to electrical firing mechanism

(4) Deletes reference to former "T" model designations and adds standardized "M" model designations as follows:

Former "T" model designation	Item	Standardized "M" model designation
T98E1	105-mm full-tracked self - propelled howitzer	M52
T96E1	105-mm howitzer	M49
T67E1	105-mm howitzer mount	M85
T77E1	105-mm howitzer concentric - type recoil mechanism	

(No standardized "M" model designation assigned to concentric-type recoil mechanism, as this type recoil mechanism is considered to be part of the 105-mm howitzer mount M85.)

2. Field Maintenance Allocation

In general, the prescribed maintenance responsibilities will be as reflected in the maintenance allocation chart of TM 9–7204.

3. Forms, Records, and Reports

a. General. Responsibility for the proper execution of forms, records, and reports rests upon the officers of all units maintaining this equipment. However, the value of accurate records must be fully appreciated by all persons responsible for compilation, maintenance, and use. Records, reports, and authorized forms are normally utilized to indicate the type, quantity, and condition of materiel to be inspected, repaired, or 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 materiel requiring further repair to Ordnance shops in arsenals, depots, etc. The forms, records, and reports establish the work required, the progress of the work within the shops, and the status of the materiel upon completion of its repair.

b. Authorized Forms. The forms generally applicable to units maintaining this materiel are listed in the appendix. For instructions on

the use of these forms, refer to FM 9–3 and FM 9–4. For a listing of all forms, refer to DA Pam 310–2.

c. Field Report of Accidents.

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

(2) *Ammunition.* Whenever an accident or malfunction involving the use of ammunition occurs, firing of the lot which malfunctions will be immediately discontinued. In addition to any applicable reports required in (1) above, details of the accident or malfunction will be reported as prescribed in AR 700–1300–8.

d. Report of Unsatisfactory Equipment or Materials. Any deficiencies detected in the equipment covered herein, which occur under the circumstances indicated in AR 700–38, should be immediately reported in accordance with the applicable instructions in cited regulations.

Section II. DESCRIPTION AND DATA

4. Description

a. 105-mm Howitzer M49 (fig. 1).

(1) The howitzer M49 is designed primarily for use in the mount M85 (figs. 3 and 4). The howitzer cannon (fig. 2) consists of a tube screwed into a breech ring at the breech end, with an evacuator chamber and locknut mounted on the muzzle end. These components are locked in place by a lock and key.

Note. The term cannon as applied by the Federal item identification guide for supply cataloging and approved by the Armed Forces Supply Support Center is defined as follows: "A complete assembly consisting of a tube and a breech mechanism, a firing mechanism, or a base cap, which is a component of a gun, howitzer, or mortar, and may also include muzzle appendages."

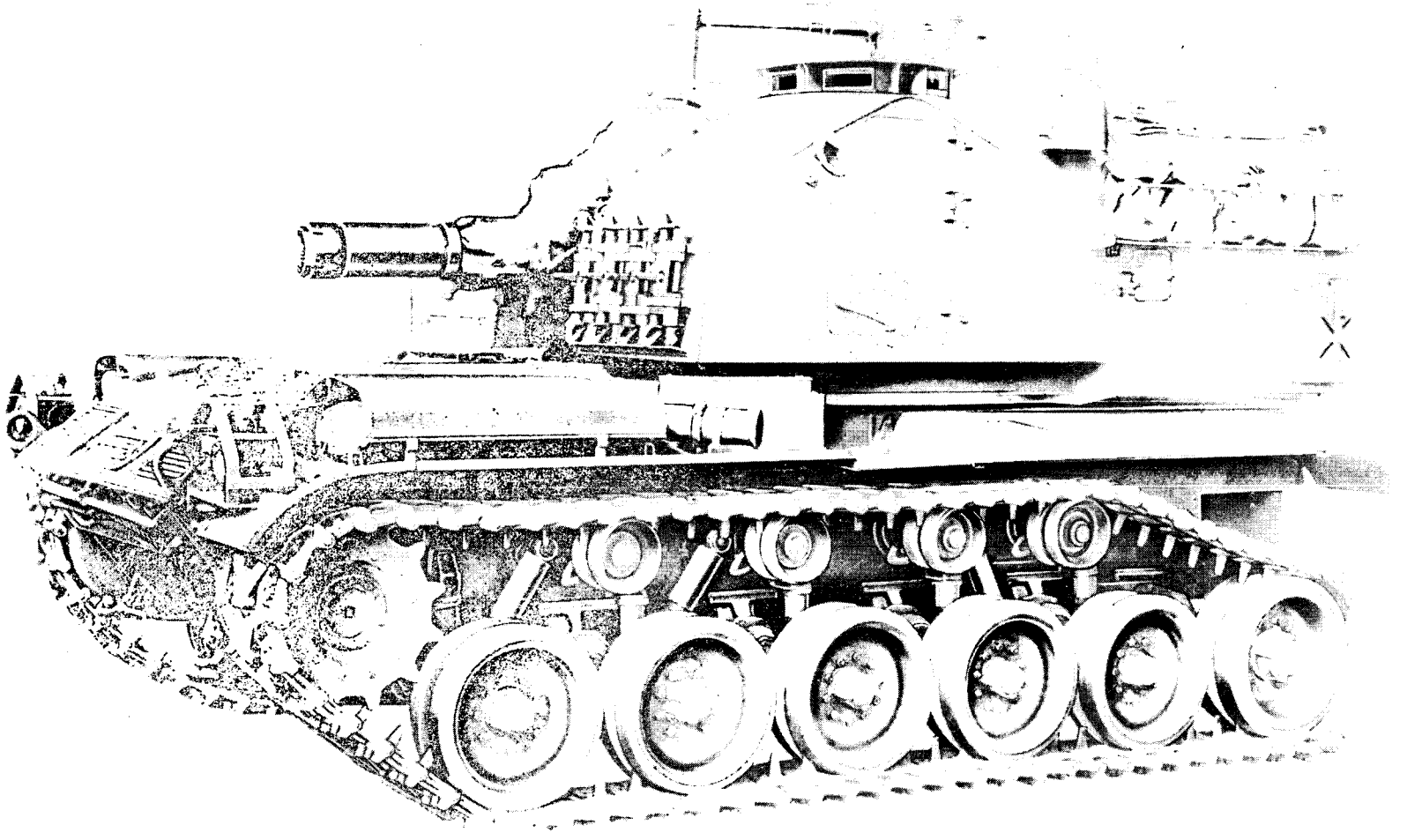

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Figure 1. 105-mm howitzer M49 and 105-howitzer mount M85 mounted in full-tracked self-propelled 105-mm howitzer M52.

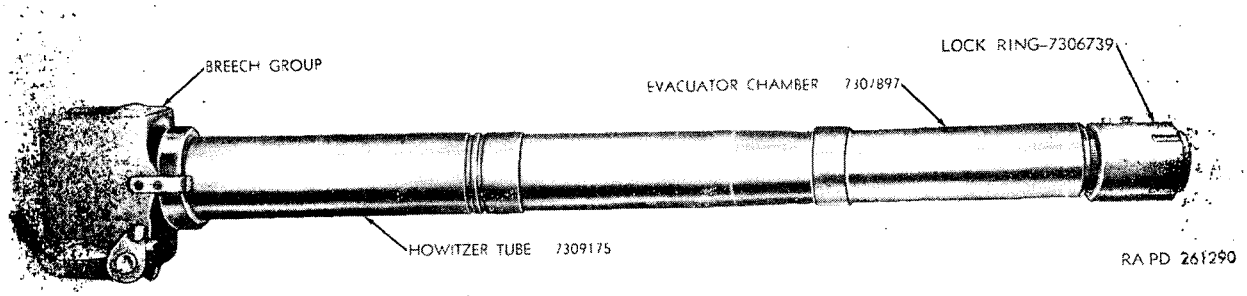


Figure 2. 105-mm howitzer cannon M49.

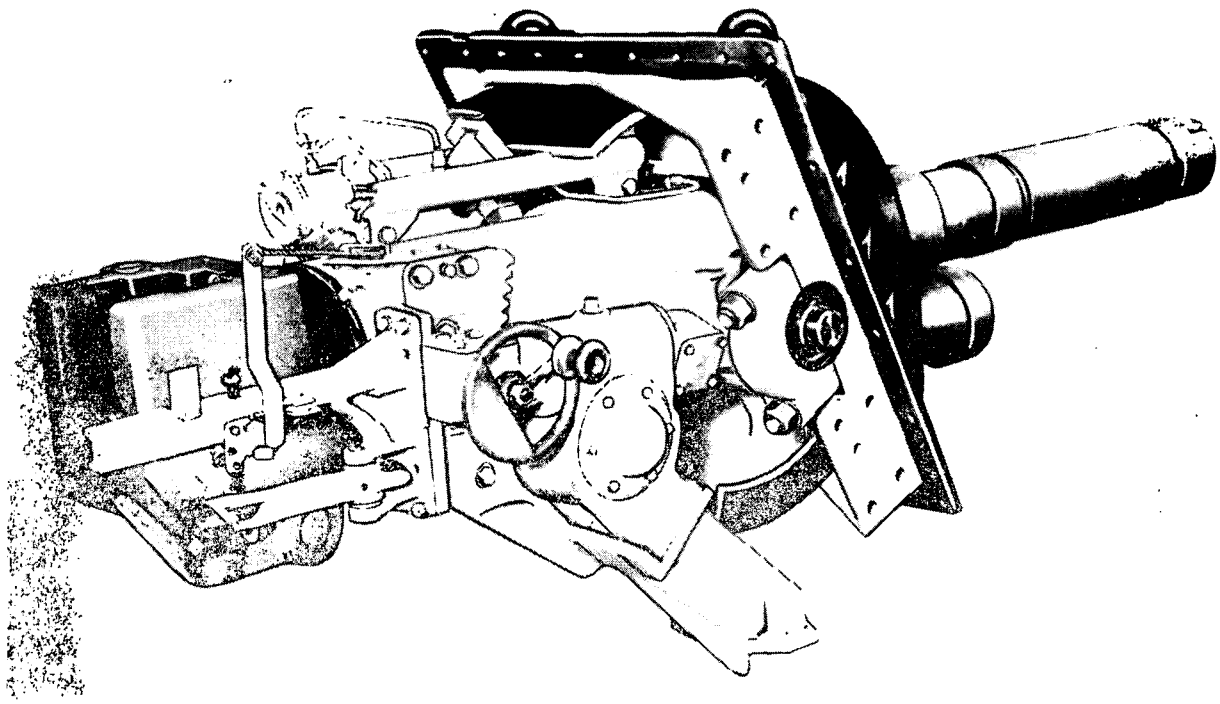


Figure 3. 105-mm howitzer M49 and 105-mm howitzer mount M85—right rear.

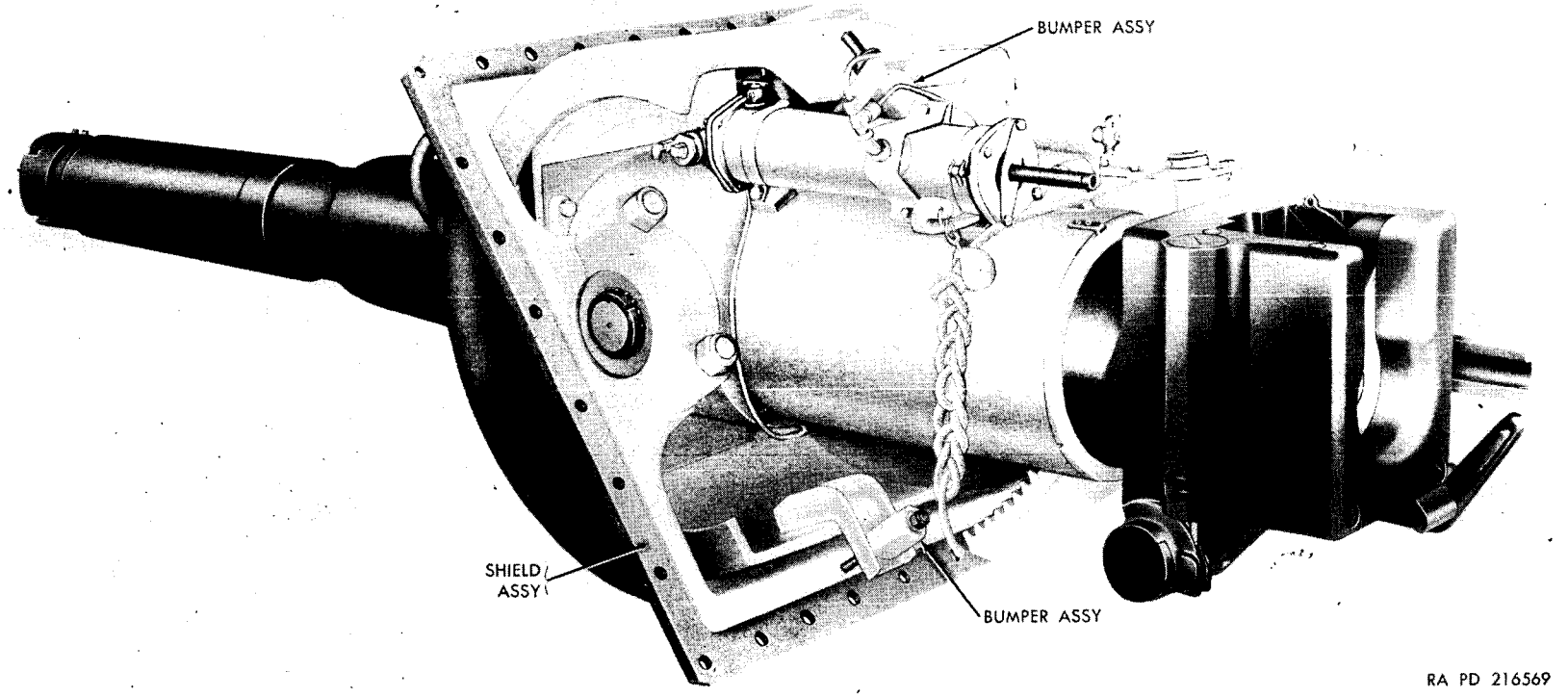


Figure 4. 105-mm howitzer M49 and 105-mm howitzer mount M85—left rear.

(2) Lugs are provided on the bottom of the breech ring to support the breechblock operating shaft assembly and breechblock cranks. A vertical cylinder, an integral part of the left side of breech ring, houses the breechblock closing spring mechanism (fig. 5). The breechblock, which is of the vertical sliding type, rides in the machined interior of the breech ring.

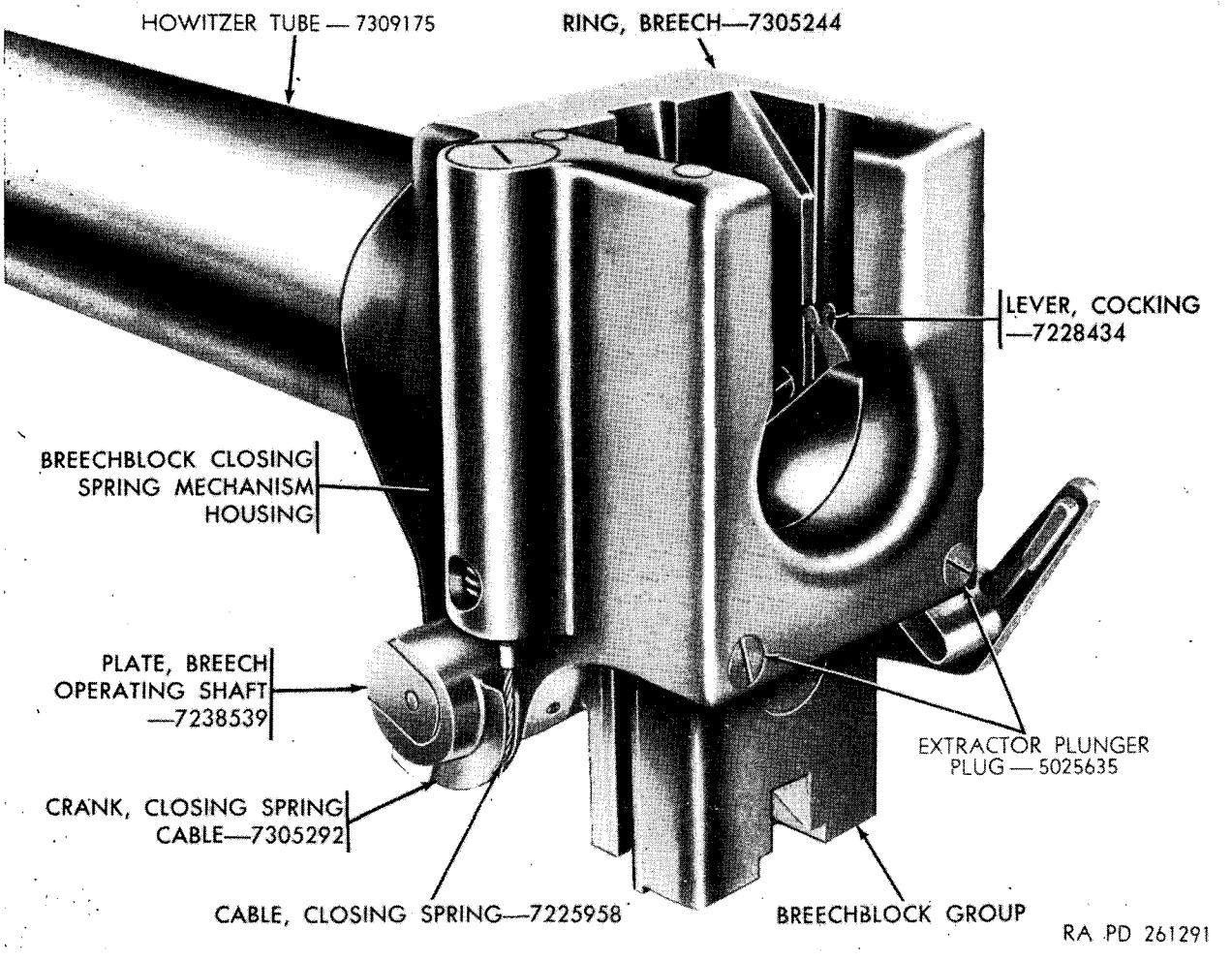


Figure 5. 105-mm howitzer cannon M49—left rear—breech open.

(3) The howitzer is fired by depressing the firing plunger (fig. 6) in the breech ring, which moves the sear to release the percussion mechanism. The firing spring then forces the firing pin to strike the cartridge primer, firing the round. After firing, the howitzer recoils and then counterrecoils into battery. During counterrecoil, the breech is opened automatically by the breech operating cam in the breech operating mechanism, the extractors in the breech ring extract the fired cartridge case, the percussion mechanism is cocked, and the breechblock is locked in the open position by the extractor.

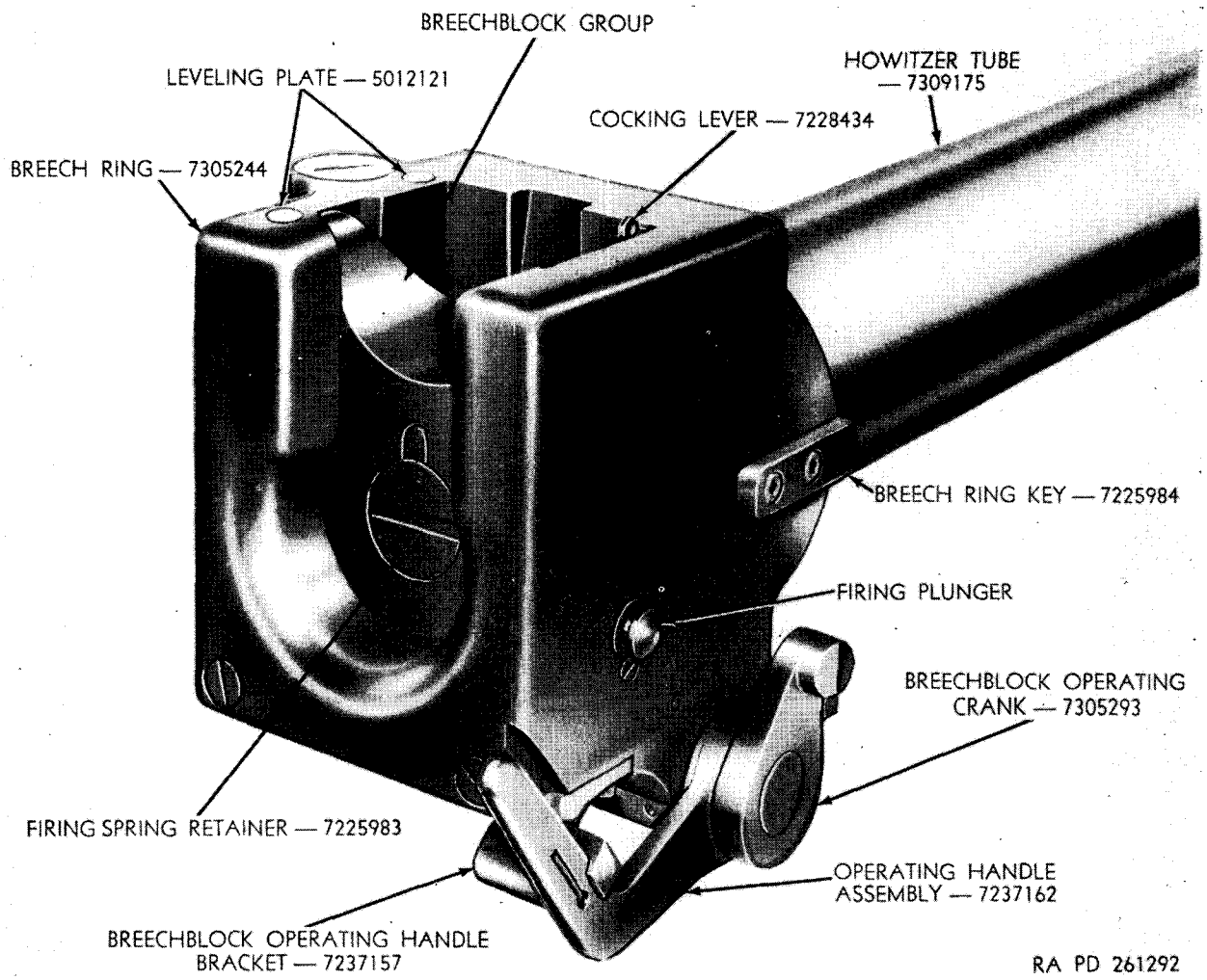


Figure 6. 105-mm howitzer M49—right rear—breech closed.

(4) The howitzer is supported and alined in the mount M85 by means of machined cylindrical bearing surfaces on the rear half of the tube. Annular grooves between these bearing surfaces serve for attachment of the howitzer to the recoil mechanism.

b. Howitzer Mount M85 with Concentric Recoil Mechanism.

(1) *Howitzer mount M85* (figs. 3 and 4). The howitzer mount consists primarily of a cradle, a shield, and a rotor. The shield is an armor steel casting that supports the elevation trunnions of the cradle in self-alining bearings. The cradle is a large cylindrical cast-

ing with a hollow bore. The bore provides the bearing support surfaces in which the howitzer tube slides during recoil and counterrecoil. The cradle also forms the outer cylinder of the recoil mechanism and mounts all the tipping parts, including the replenisher and overflow assembly, breech operating and firing mechanism assembly, rotor, and elevating rack. The elevating rack is actuated by a hand-operated elevating mechanism that is mounted on the floor of the turret.

(2) *Concentric recoil mechanism.* The concentric recoil mechanism differs from the conventional multiple-cylinder recoil mechanism in that the cradle forms the outer cylinder and is concentric with and completely envelops the recoil surface of the howitzer. The recoil mechanism serves to absorb the shock of the howitzer during recoil and counterrecoil and controls the return of the howitzer to battery after recoil. For details concerning the principal parts and functioning of the recoil mechanism, see paragraphs 83 through 87. Additional information may be found in TM 9–7204.

5. Tabulated Data

a. Data Pertaining to 105-mm Howitzer M49.

(1) *General.*

Caliber	(4.134 in.) 105 mm
Length of bore	22.5 cal.
Length (to rear face of breech ring)	99.8 in.
Length of tube to breech face of tube)	93.05 in.
Center of gravity of tube from breech end	37–1/2 in.
Center of gravity of howitzer (from rear face of breech ring)	35–3/8 in.
Type of breechblock	vertical sliding
Type of howitzer support	integral cylindrical bearing on tube
Type of firing mechanism	spring - actuated inertia percussion
Travel of projectile in tube	81.67 in.
Rifling:	
Length	76.85 in.
Twist	uniform right-hand, 1 turn in 20 cal.
Number of grooves	36
Depth of grooves	0.039 in.
Width of grooves	0.21076 in.
Width of lands	0.15 in.
Weight of howitzer tube	595 lb
Weight of howitzer complete	930 lb
Weight of evacuator chamber (est)	19 lb
Ammunition	for complete ammunition data see TM 9–7204

(2) *Performance (average for a new tube).*

Muzzle velocity:	
Shell, HE, AT (charge not adjustable)	1,250 fps
Shell, HE (maximum zone charge)	1,550 fps
Muzzle energy	549.6 ft tons
Maximum powder pressure rated	32,000 psi
Range:	
Shell, HE, AT (625 mils elevation)	6,700 yd
Shell, HE (778.6 mils elevation)	12,205 yd

b. Data Pertaining to Howitzer Mount M85.

Armor thickness, howitzer mount shield (approx)	1/2 in.
Recoil mechanism:	
Type	concentric, hydrospring constant recoil distance
Capacity	4 gal
Length of recoil (maximum)	13–1/4 in.
Length of recoil (normal)	12 in.

CHAPTER 2

PARTS, SPECIAL TOOLS AND EQUIPMENT FOR FIELD MAINTENANCE

6. General

Tools, equipment, and maintenance parts over and above those available to the using organization are supplied to Ordnance field maintenance units for repairing the materiel.

7. Maintenance Parts

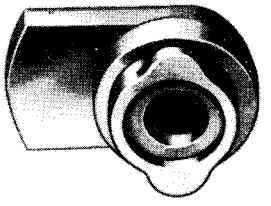
Maintenance parts are listed in ORD 8 SNL C–86, which is the authority for requisitioning replacements.

8. Common Tools and Equipment

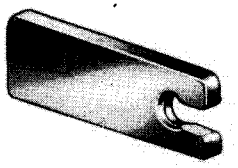
Standard and commonly used tools and equipment having general application to this materiel are listed in SM 9–4–5180–J8–9 and ORD 6 SNL J–8, Section 10, and are authorized for issue by tables of allowances and tables of organization and equipment.

9. Special Tools and Equipment

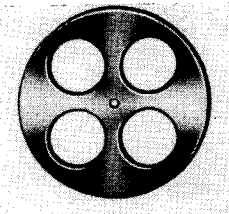
The special tools and equipment tabulated in table I are listed in and authorized for issue by ORD 6 SNL J–13. This tabulation contains only those special tools and equipment necessary to perform the operations described in this manual, is included for information only, and is not to be used as a basis for requisitions.



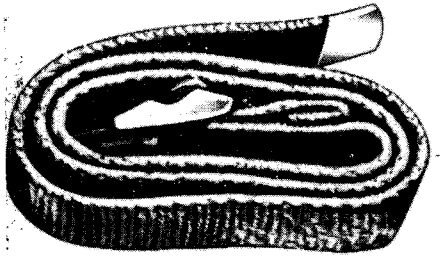
TOOL, BREECHBLOCK
REMOVING—7228897

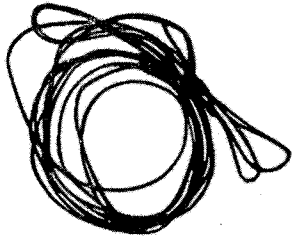


CLOSING SPRING LOCKING TOOL — 7307053

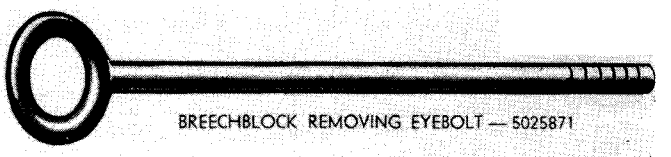


SIGHT, BREECH
BORE—7238954

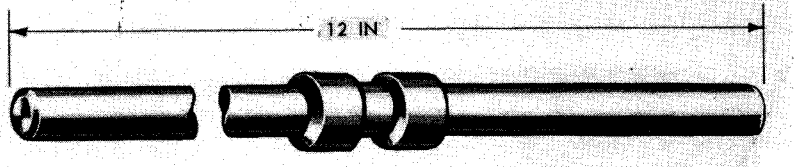




MUZZLE BORE SIGHT — 7238951



BREECHBLOCK REMOVING EYEBOLT — 5025871



ROD, SPLINE SHAFT REMOVING—7238921

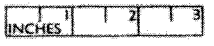


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Figure 7. Special tools.

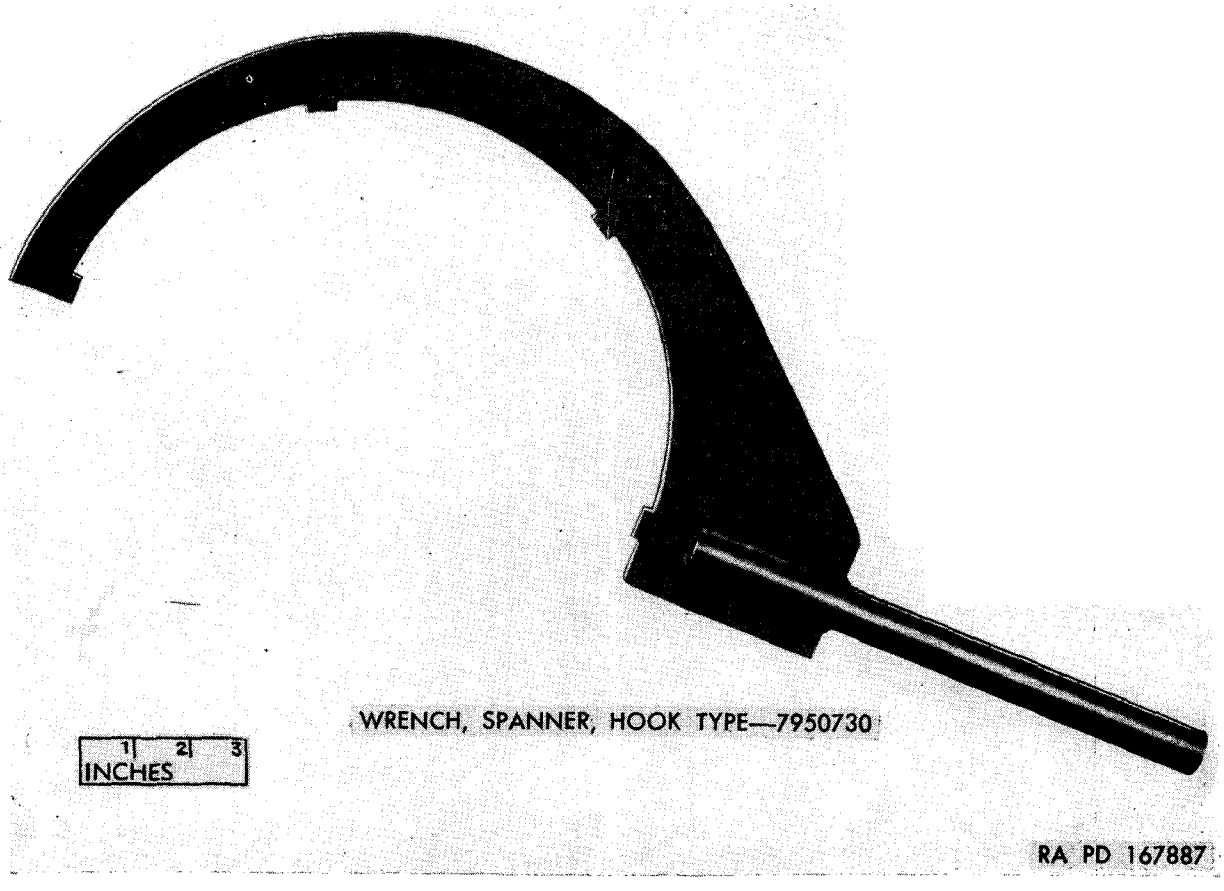


Figure 8. Special tools.

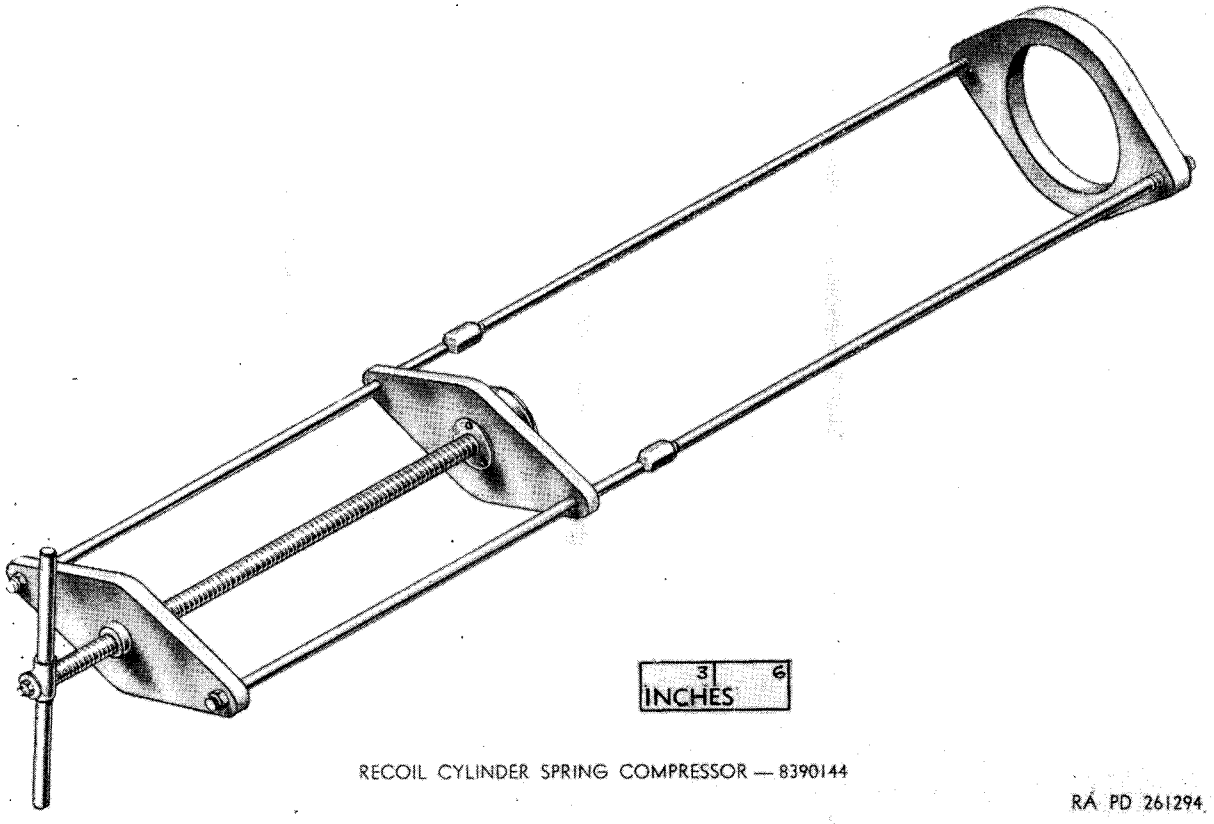


Figure 9. Special tools.

Table I. Special Tools and Equipment for Field Maintenance

Item	Identifying No.	Reference		Use
		Fig.	Par.	
COMPRESSOR, recoil piston spring.	8390144	9,29,30	84,86	To remove or install recoil piston spring.
EYEBOLT, breechblock removing.	5025871	7	.....	To remove and install breechblock.
ROD, spline shaft removing, thd one end, 9/16 dia of bolt, 16 overall lg, 5/8–11NC–2 thd.	7238921	7	.....	To use as handle inserted through breechblock and removing eyebolt in assembly and disassambly operation. To use as buffer or bump bar in disassembly operations of the breech operating shaft.
SEGMENT, split ring	8390011	.....	84,86	To prevent damage to rear follower seals when removing rear follower assembly.
SIGHT, breech bore	7238954	7	.....	To bore sight howitzer.
SIGHT, muzzle bore	7238951	7	.....	To bore sight howitzer.
TOOL, breechblock	7228897	7	.....	To support breechblock during disassembly and assembly of breech mechanism.
TOOL, closing spring locking.	7307053	7	.....	To lock the closing spring mechanism with spring compressed in disassembly and assembly operations.
WRENCH, hook-type spanner. ..	7083666	.....	84,86	To remove retainer ring.
WRENCH, spanner	7950730	8,27	84,86	To remove and install recoil mechanism follower nuts.
WRENCH, spanner	8389991	.....	64,68	To remove and install trunnion bearing locknut.

CHAPTER 3

INSPECTION

Section I. General

10. Scope

This chapter provides specific instructions for the inspection by Ordnance maintenance personnel of materiel in the hands of the troops, in Ordnance shops, and in units scheduled for oversea duty. Troubleshooting information is incorporated wherever applicable as a normal phase of inspection.

11. Purpose of Inspection

Inspections are made for the purpose of (1) determining the condition of an item as to serviceability, (2) recognizing conditions that would cause failure, (3) assuring proper application of maintenance policies at prescribed levels, and (4) determining the ability of a unit to accomplish it maintenance and supply missions.

12. Categories of Inspection

In general, three categories of inspection are performed by Ordnance field maintenance personnel.

a. Inspection of Materiel in the Hands of Troops.

(1) *Spot-check inspection.* A spot-check inspection (AR 750–925) is an inspection performed on a percentage of materiel in order to ascertain the adequacy and effectiveness of organizational maintenance and supply. Included within the scope of spot-check inspection are inspection of equipment to detect incipient failures before unserviceability occurs; inspection to ascertain the availability and use of technical and supply manuals and lubrication orders; and inspection to determine the accuracy of records, authorized levels of equipment and supplies, practice of supply economy, preservation and safekeeping of tools, availability of repair parts and supplies, and knowledge of the proper procedures for requisitioning supplies and equipment and followup thereon.

(2) *Command maintenance inspection.* Command maintenance inspection is performed annually on at least 50 percent of materiel within a unit or organization. The purpose of the inspection is to insure adequacy and effectiveness of organization and supply procedures; determine the condition of materiel; ascertain availability and use of technical and supply manuals and lubrication orders; determine the accuracy of records, authorized level of equipment and supplies, practice of supply economy, preservation, and safekeeping of tools.

b. Preembarkation Inspection. This inspection is conducted on materiel in alerted units scheduled for oversea duty to insure that such materiel will not become unserviceable or worn out in a relatively short time. It prescribes a higher percentage of remaining usable life in serviceable materiel to meet a specific need beyond minimum serviceability.

c. Ordnance Shop Inspection.

(1) *Initial inspection.* This is an inspection of materiel received in Ordnance shops for the purpose of determining the degree of repair and parts requirement. This includes determination of modification work orders to be applied.

(2) *In-process inspections.* These are inspections performed in the process of repairing the materiel as prescribed in paragraphs 36 through 92. This is to insure that all parts conform to the prescribed standards, that the workmanship is in accordance with approved methods and procedures, and that deficiencies not disclosed by the preliminary inspection are found and corrected.

(3) *Final inspection.* This is an acceptance inspection performed by a final inspector after repair has been completed, to insure that the materiel is acceptable for return to user according to the standards established.

Section II. INSPECTION OF MATERIEL IN HANDS OF TROOPS

13. General

***Warning*: Befoe starting an inspection, be sure to clear the weapon. Do not actuate the trigger or firing mechanism until the weapon has been cleared. Inspect the chamber to insure that it is empty and check to see that no ammunition is in position to be introduced. Avoid having live ammunition in the vicinity of the work.**

Check to see that the weapon has been cleaned of all corrosion-preventive compound, grease, excessive oil, dirt, or foreign matter that might interfere with proper functioning. Use dummy or drill cartridges.

14. Command Inspection

a. Refer to TM 9–1100 and AR 750–8 for responsibilities and fundamental duties of inspecting personnel, the necessary notice and preparations to be made, forms to be used, and general procedures and methods to be followed by inspectors. Materiel to be inspected includes organizational spare parts and equipment and the stocks of cleaning and preserving materials.

b. In the course of this inspection, the inspector will accomplish the following:

(1) Determine serviceability, i.e., the degree of serviceability, completeness, and readiness for immediate use, with specific reference to safe and proper functioning of the materiel. If the materiel is found unserviceable or incipient failures are disclosed, the deficiencies will be corrected on the spot or advice given as to corrective measures when applicable. If necessary, the materiel will be tagged for delivery to and repair by Ordnance maintenance personnel.

(2) Determine causes of mechanical and functional difficulties that troops may be experiencing and check for apparent results of lack of knowledge, misinformation, neglect, improper handling and storage, security, and preservation.

(3) Instruct the using personnel in proper preventative-maintenance procedures if existing procedures are found inadequate.

(4) Check on completeness of the organizational maintenance allowances and procedures for obtaining replenishments.

(5) Inspect lettering on nameplates and direction plates for legibility.

(6) Inspect the materiel for paint that has deteriorated or chipped off, exposing the bare metal.

(7) Ascertain when the materiel was last exercised if it has not been fired recently.

(8) Note general appearance. Check exterior of materiel for missing or broken parts.

(9) Check storage conditions of general supplies and ammunition.

(10) Initiate a thorough report on materiel on "deadline," with reasons therefore, for further appropriate action.

(11) Report to the responsible officer any carelessness, negligence, unauthorized modifications, or tampering. This report should be accompanied by recommendations for correcting the unsatisfactory condition.

15. Howitzer Cannon M49

a. Howitzer Tube (H, fig. 13).

(1) Inspect the exterior of the howitzer tube for nicks, cracks scoring, or other damage.

(2) Exterior gouges deeper than one-quarter of the wall thickness or one-tenth of the wall thickness and over ½ caliber in length will require replacement of the howitzer tube.

(3) Verify that the howitzer tube identification markings on the breech of the howitzer tube correspond to those given in the gun book.

(4) Examine the bore for dirt, rust, powder fouling, and copper deposits on the lands and in the grooves.
(5) Inspect for erosion, pitting, and wear of lands and grooves within the bore at origin of rifling that will result in decreased pressure and velocity.
(6) Examine the breech ring key (fig. 6) to make sure it is in place and secure.

b. Evacuator Chamber (F, fig. 13).
(1) Inspect the exterior of the evacuator chamber, including welds, for gas-tightness.
(2) Examine the serrated surface for wear.

c. Lockring (A, fig. 13).
(1) Inspect the lockring for corrosion and cracks.
(2) Examine the central hole (for projectile passage) for evidence of scoring.
(3) Make sure that the central hole is properly alined with the howitzer tube bore.
(4) Inspect the lockring locking key and the evacuator chamber lock to make sure they are in place and secure.

d. Breech Group and Related Parts.
(1) Inspect the leveling plates (fig. 6) for roughness, burs, or scratches.
(2) Examine the exterior and interior of the breech ring for damage.
(3) Inspect the breechblock operating handle assembly (fig. 6) for tightness and make sure it latches securely when in the closed position.

e. Breechblock and Related Parts.
(1) Open and close the breech several times and note if the action is smooth.
(2) If action seems rough, inspect bearing surfaces of breechblock and breech ring for scoring or burs.
(3) Inspect the cocking lever (fig. 6) and the firing plunger (fig. 6) operation and note if there is excessive play.
(4) Remove the firing spring retainer, firing spring, and the percussion mechanism assembly (TM 9–7024).
(5) Check the firing spring (C, fig. 14) for breakage or weakness.
(6) Manually operate the firing pin (D–1, fig. 14) to make sure it moves smoothly.

16. Mount M85

a. Recoil Mechanism Assembly (figs. 25, 32, and 33).
(1) Examine the recoil mechanism for hydraulic oil leaks at front and rear followers and at drain and fill plugs.
(2) Inspect the cradle for cracks or other damage.
(3) If front or rear follower is removed for any reason, inspect the threads inside the cradle and on the follower nuts for damage.

b. Replenisher Group (fig. 23).
(1) Inspect the replenisher assembly, the replenisher-to-cylinder tube, the replenisher-to-tank tubes, and the fittings at both ends of each tube for oil leaks.
(2) Examine overflow storage tank (fig. 20) and saddle assembly (F, fig. 22) for leaks.
(3) Make sure that the replenisher rod indicator marks are legible and indicate the correct amount of oil.

c. Breech Operating and Firing Mechanism Assembly (fig. 24).
(1) Make a viual inspection of the breech operating and firing mechanism assembly parts to make sure they are all present and in good condition.
(2) Inspect the breech operating cam (P, fig. 24) for cracks.

d. Mount Shield Assembly (G, fig. 19) *and Rotor* (G, fig. 20).
(1) Inspect the mount shield and rotor for cracks and damage.
(2) Make sure bolts and safety nuts securing the rotor to the cradle are tight.
(3) Make sure that the shield is securely fastened to the turret and the trunnion.

e. Hand Elevating Mechanism Handwheel Assembly (fig. 35).
(1) Inspect the elevating mechanism handwheel and related parts for indications of malfunctioning. The elevating mechanism must operate smoothly and without binding.
(2) Functionally check the elevating assembly for conditions of effort unbalance throughout the entire range

in either elevation or depression.

f. Elevating Rack (W, fig. 22).

(1) Inspect the elevating rack for cracks, scores, or burs.

(2) Make sure the rack is securely fastened to the cradle and meshes properly with the elevating handwheel assembly.

Section III. ORDNANCE SHOP INSPECTION

17. General

a. The standards set forth herein limit maintenance and repair activities under normal conditions to the inspection, adjustment, and repair or replacement of assemblies, subassemblies, and parts where a complete rebuild of the howitzer M49 and mount M85 is not required. If complete rebuild of major component is indicated, it will be evacuated to a higher echelon of maintenance. Evacuation must not be effected without a thorough inspection to determine the specific damage and repair requiring higher echelon attention.

b. Prior to acceptance of howitzer or mount for repair, inspect the materiel for evidence that proper preventive maintenance and other responsibilities affecting serviceability of the materiel have been performed in accordance with TM 9–7204. All inspections must be performed with regard for the safety of the operating personnel.

c. Inspect the weapon record book as prescribed in TM 9–7204.

d. Examine all bolts, screws, pins, nuts, and locking devices for secure installation and ability to serve the purpose for which they were designed. Inspect all springs for breaks, distortions, cracks, or failure to function properly. Examine all damaged threads to determine practicability of repairs.

e. Inspect painting for conformity with TM 9–2851.

f. Check lubrication for conformity with LO 9–7204. All unpainted metal surfaces of howitzer and mount will be lightly coated with preservative lubricating oil (med) upon completion of inspection.

18. Howitzer M49

a. Howitzer Tube (H, fig. 13).

(1) Perform all inspections on the howitzer tube as prescribed in paragraph 15*a*.

(2) Inspect tube markings for conformity with entries in the weapon record book.

(3) If the tube is to be stored for an indefinite period, inspect it for processing in accordance with TB ORD 408.

(4) If materiel is to be sent overseas, inspect it for processing in accordance with SB 9–4.

b. Evacuator Chamber (F, fig. 13).

(1) Perform all inspections on the evacuator chamber group prescribed in paragraph 15*b*.

(2) Inspect chamber for cracks at welded areas, deformation of sealing lips, and wear on threaded portions.

c. Lockring (A, fig. 13). Perform all inspections on the lockring prescribed in paragraph 15*c*.

d. Breech Group and Related Parts.

(1) Perform all inspections on the breech group and related parts prescribed in paragraph 15*d*.

(2) Examine the breechblock crank assembly (F, fig. 16), breechblock operating crank (fig. 6), and the closing spring cable crank (fig. 5) for scores, ridges, or evidence of rust.

(3) Make sure the cranks are tight on the breech operating shaft assembly (B, fig. 16).

(4) Inspect the breechblock crossheads (E, fig. 16) for scoring or breakage.

(5) Examine all springs for breakage or weakness.

e. Breechblock and Related Parts. Perform all inspections on the breechblock and related parts prescribed in paragraph 15*e*.

19. Mount M85

a. Recoil Mechanism Assembly.

(1) Perform all inspections on the recoil mechanism assembly prescribed in paragraph 16*a*.

(2) Pressure-test the recoil mechanism (par. 87) and examine for oil leakage.

b. Replenisher Group (fig. 23).

(1) Perform all inspections on the replenisher assembly prescribed in paragraph 16*b*.

(2) Examine the replenisher cylinder and overflow tank for cracks and defects.

c. Breech Operating and Firing Mechanism Assembly (fig. 24).

(1) Perform all inspections on the breech operating and firing mechanism assembly prescribed in paragraph 16*c*.

(2) Inspect the breech operating and firing mechanism assembly for smooth operation (TM 9–7204).

d. Mount Shield Assembly (G, fig. 19) *and Rotor* (G, fig. 20). Perform all inspections on the mount shield assembly and rotor prescribed in paragraph 16*d*.

e. Hand Elevating Mechanism Handwheel Assembly (fig. 35).

(1) Perform all inspections on the elevating handwheel assembly prescribed in paragraph 16*e*.

(2) Check that the mounting bracket (J, fig. 35) is securely fastened to the turret floor and the elevating assembly.

f. Elevating Rack (W, fig. 22). Perform all inspections on the elevating rack prescribed in paragraph 16f.

20. Troubleshooting

Table II is intended as a guide to determine probable causes of malfunctions and to prescribe corrective action. For troubleshooting within the scope of organizational maintenance, see TM 9–7204.

Table II. Troubleshooting

Malfunction	Probable cause	Corrective action
Breechblock fails to close.	Breechblock binds	Remove breechblock (par. 47), clean and remove burs from sliding surfaces on breechblock and in breech (par. 49), and lubricate (TM 9–7204).
	Defective closing spring mechanism.	Remove and disassemble closing spring mechanism (par. 53); replace weak closing spring (par. 55), or defective parts.
	Defective extractors	Disassemble breech group (par. 54) and replace or repair defective parts (par. 55).
	Defective ejection assembly	Disassemble breech operating and firing mechanism assembly.
Breechblock fails to open automatically.	Defective breech operating and firing mechanism.	Remove breech operating cam pin and breech operating cam springs (par. 76), clean and lubricate (TM 9–7204), and replace or repair defective parts (par. 77).
	Defective recoil action	See below and TM 9–7204.
Breechblock fails to open manually.	Breechblock is seized	***Warning*: If there is an unfired round in the chamber, place the firing safety rod in safe position immediately.** Remove percussion mechanism assembly (par. 41), remove closing spring mechanism (par. 53), remove breechblock (par. 47), remove live round, clean chamber (TM 9–7204), and replace or repair defective parts.

Table II. Troubleshooting (Cont.)

Malfunction	Probable cause	Corrective action
Howitzer overrecoil	Defective recoil spring	Remove howitzer from mount (par. 32) and replace recoil spring (par. 85).
	Lack of hydraulic oil in recoil system.	Check replenisher indicator rod (TM 9–7204); fill replenisher as directed.
Howitzer does not return to battery.	Dirty or contaminated recoil oil	Drain recoil oil (TM 9–7204), check for contamination of oil, and fill with clean oil (TM 9–7204).
	Weak recoil spring	Remove howitzer from mount (par. 32) and replace recoil spring (par. 85).
Erratic recoil action	Dirty or contaminated recoil oil	Drain recoil oil (TM 9–7204), check for contamination of oil, and fill with clean oil (TM 9–7204).
	Buffer not correctly adjusted	Adjust buffer

Section IV. PREEMBARKATION INSPECTION OF MATERIEL IN UNITS ALERTED FOR OVERSEA MOVEMENT

21. General

Prior to an inspection of materiel in hands of troops preparatory to oversea movement, make a general inspection to determine whether preventive maintenance has been performed in accordance with TM 9–7204. Report neglect of organizational maintenance to higher authority.

22. Inspection

Check whether the materiel meets the standards prescribed in TB ORD 385.

CHAPTER 4

GENERAL MAINTENANCE

23. General

a. This chapter contains important general maintenance information. The procedures described herein must be carefully observed during repair operations.

b. In paragraphs 30 through 92, major units are removed, disassembled, cleaned, inspected, repaired, assembled, and installed.

c. Repair standards for each major unit are listed in paragraphs 98 through 101.

d. Finished howitzer and mount must approximate that of new materiel both in function and appearance.

24. Disassembly and Assembly Procedures

a. In disassembling a unit, remove the major subassemblies and assemblies whenever possible. Subassemblies may then be disassembled as necessary into individual parts.

b. As assemblies are removed and disassembled, the parts should be thoroughly cleaned of all grease, oil, water, and dirt. They should be dried with wiping cloths and then coated with the lubricant prescribed in the lubrication order to prevent rusting while disassembled.

c. During assembly, subassemblies should be assembled first and then installed to form a complete unit. Lubricate bearings and sliding surfaces before assembling. Apply rust-preventive compounds to unpainted parts that will be assembled together permanently.

d. Complete disassembly of a unit is not always necessary in order to make a required repair or replacement. Good judgment should be exercised to keep disassembly and assembly operations to a minimum.

25. Replacement of Parts

a. When assembling a unit, replace taper pins and cotter pins with new ones if possible. If screws, bolts, washers, or nuts are damaged, they should be replaced.

b. All springs should be replaced if they are broken, kinked, bent or cracked of if they fail to function properly or meet specific requirements (par. 101).

c. If a required new part is not available, a reconditioned used part may be substituted. Such reconditioned used parts should be examined carefully to determine their suitability.

d. If a bushing is drilled or has a groove to provide lubrication, be sure that these openings are clean before assembling the parts.

e. Damaged threads should be repaired by use of a thread restorer or by chasing on a lathe.

26. Proper Use of Tools

a. Carefully select tools that fit properly and are suited for the task to be performed; this is necessary to avoid needless mutilation of parts and/or damage to tools.

b. A number of special tools (par. 9 and table I) are provided for the maintenance of the materiel. These tools should be used only for their intended purpose.

c. Keep tools clean and work with clean parts.

27. Painting

a. Paint all surfaces on which paint has deteriorated or become damaged.

b. Do not paint working parts inside groups or mechanisms. Lightly lubricate such components in accordance with the lubrication order.

c. Do not paint highly polished machine-finished surfaces.

d. Do not paint rubber surfaces or electrical parts.

e. Paint filler plugs for recoil and hydraulic mechanism with orange enamel when using petroleum base hydraulic fluid (OHA).

f. For detailed information on finished surfaces and painting, see TM 9–2851.

28. Lubrication and Preservation

a. Lubrication. Refer to LO 9–7204 and TM 9–7204, which cover lubrication by the using arms and Ordnance maintenance personnel, as required.

b. Application of Preservatives.

(1) Apply automotive and artillery grease (GAA) to working parts of breech ring and elevating and traversing mechanism.
(2) Apply heated rust-preventive compound (heavy) to interior of tube, to all exterior finished surfaces, and to all exposed nuts, bolts, screws, etc., not already preserved.

29. Exercising the Recoil Mechanism

a. General. This recoil mechanism contains relatively large, highly finished interior surfaces that are subject to deterioration when the mechanism is not in use. The most critical factor that causes slow deterioration is the corrosive effect of dry, unlubricated seals, wiper, and packing on the inside of the cradle and outside of the howitzer tube. The moving of the howitzer tube practically eliminates this corrosion by reestablishing an oil film between the seals, wiper, packing, and sliding surfaces. This movement is what is termed "exercising" the mechanism. To maintain the long life for which the recoil mechanism was designed, it is necessary to exercise the mechanism a minimum of twice annually.

b. Frequency of Exercising.

(1) *Usual conditions.* Under usual conditions of climate (temperate), the mechanism is to be exercised at intervals not to exceed 6 months. The exercising should consist of three extrusions of the howitzer tube, with extensions to 8 inches considered sufficient. The replenisher assembly is also to be exercised every 6 months.
(2) *Unusual conditions.* Under extreme conditions of climate (arctic and tropic), the frequency of exercising should be increased. The rate of increase should be governed by the condition of the lubricant during exercising. Refer to TB ORD 303 for information concerning inspection necessary to establish frequency of exercising the recoil mechanism in various climates.

c. Methods of Exercising. Two methods of exercising the recoil mechanism are outlined below. The choice of the method depends upon the echelon of maintenance, availability of materials and equipment, and practicability of the method under existing conditions.

(1) *Firing.* Fire the weapon. This is the usual method of exercising the recoil mechanism employed by the using organization and may be employed providing firing range, ammunition, and facilities are available. Refer to TM 9–7204 for firing instructions.
(2) *Screw or hydraulic jack.* Drive the vehicle close to a solid perpendicular object, place a screw or hydraulic jack between the object and the protected muzzle of the weapon, and operate the screw or jack to force the howitzer out of the cradle 6 to 8 inches. Three extensions are sufficient. For an estimate of forces required to exercise recoil mechanism and for further information concerning this method, refer to TB ORD 303.
(3) *Replenisher.* The replenisher assembly is exercised by withdrawing as much oil as possible and then re-filling (TM 9–7204).

CHAPTER 5

REMOVAL AND INSTALLATION

Section I. REMOVAL

30. General

a. The howitzer M49 and mount M85 must be removed from the turret of the 105-mm full-tracked self-propelled howitzer M52 as a unit.

b. The removal of the howitzer and howitzer mount from the vehicle requires partial disassembly of the mount.

c. Before disassembling or removing any components of the howitzer or howitzer mount, install a suitable lifting chain or sling to the lifting hooks on the howitzer mount shield assembly. A sling secured to the howitzer tube just ahead of the rotor will assist in balancing the howitzer and howitzer mount as they are removed from the turret.

d. A hoist capable of lifting the entire weight of the howitzer and mount is required to remove this unit from the turret.

Note. **Hoist capacity should be stenciled on hoist.**

***Warning*: Before starting to disassemble the howitzer mount for removal, make certain that the chamber of the howitzer has been cleared.**

Note. Before disconnecting the howitzer and mount for removal from the vehicle, the telescope mount for the panoramic telescope must be removed. TB 9–1200–203–30 contains procedures for Ordnance maintenance personnel to remove, install, synchronize, and adjust the fire-control system for the howitzer M52.

31. Removal of Howitzer and Mount

***Warning*: When the elevating mechanism is removed, the howitzer is free to swing. Exercise caution to prevent injury to personnel.**

a. Disconnect points are as follows:

(1) Unscrew and remove five safety nuts, two cap screws, and two lockwashers securing the elevating gear mechanism (A, fig. 10) to its mounting. Lift elevating gear mechanism free of the elevation rack.

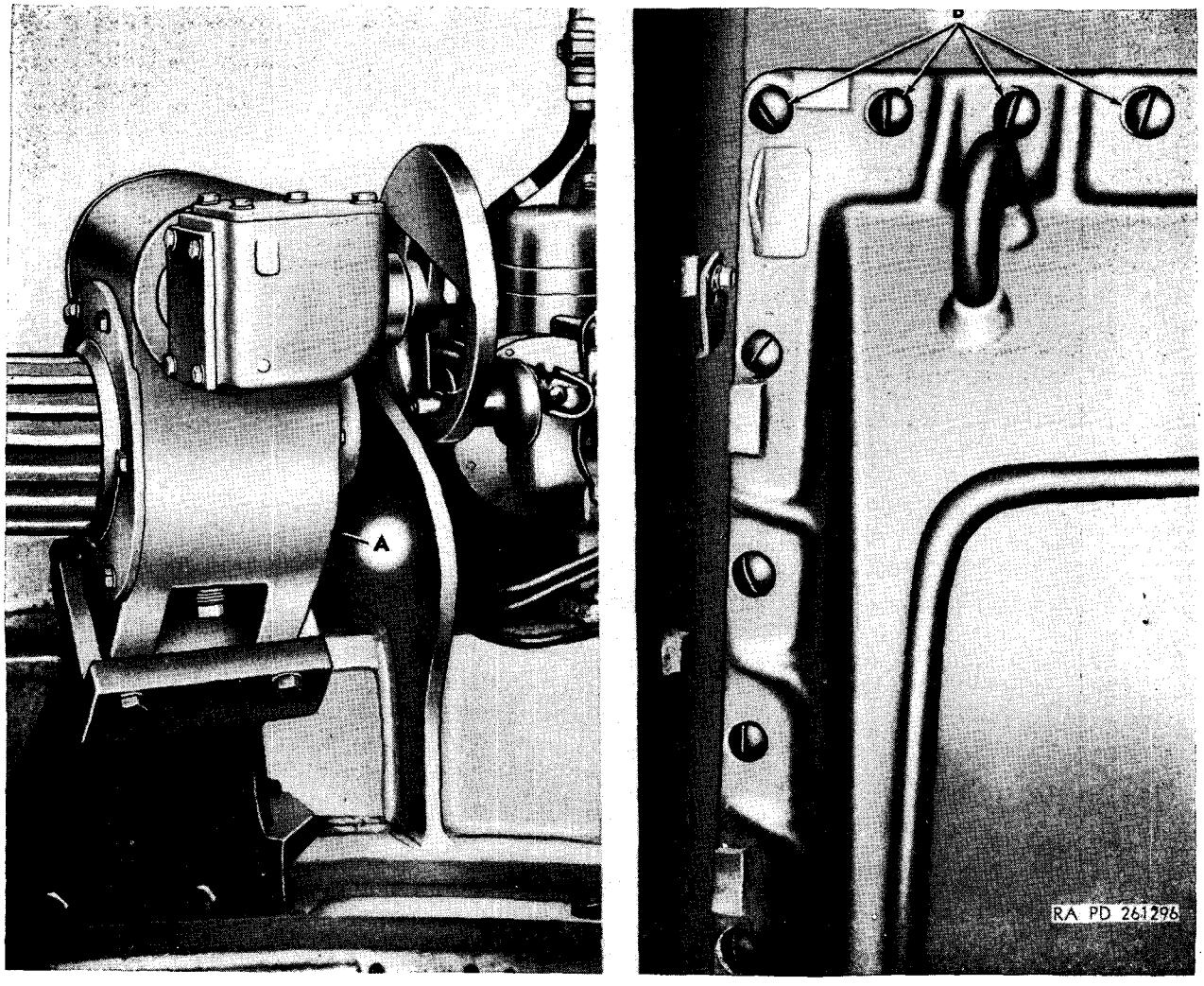


Figure 10. Howitzer mount disconnect points.

(2) Unscrew and remove screws (B, fig. 10) securing howitzer mount shield to face plate of motor carriage.

(3) Make sure all cables, tools, components, etc., are out of the way of the howitzer and mount. Using a lifting sling, carefully pull the howitzer and mount from the vehicle (fig. 11) in easy stages, checking frequently to make sure there is clearance on all sides.

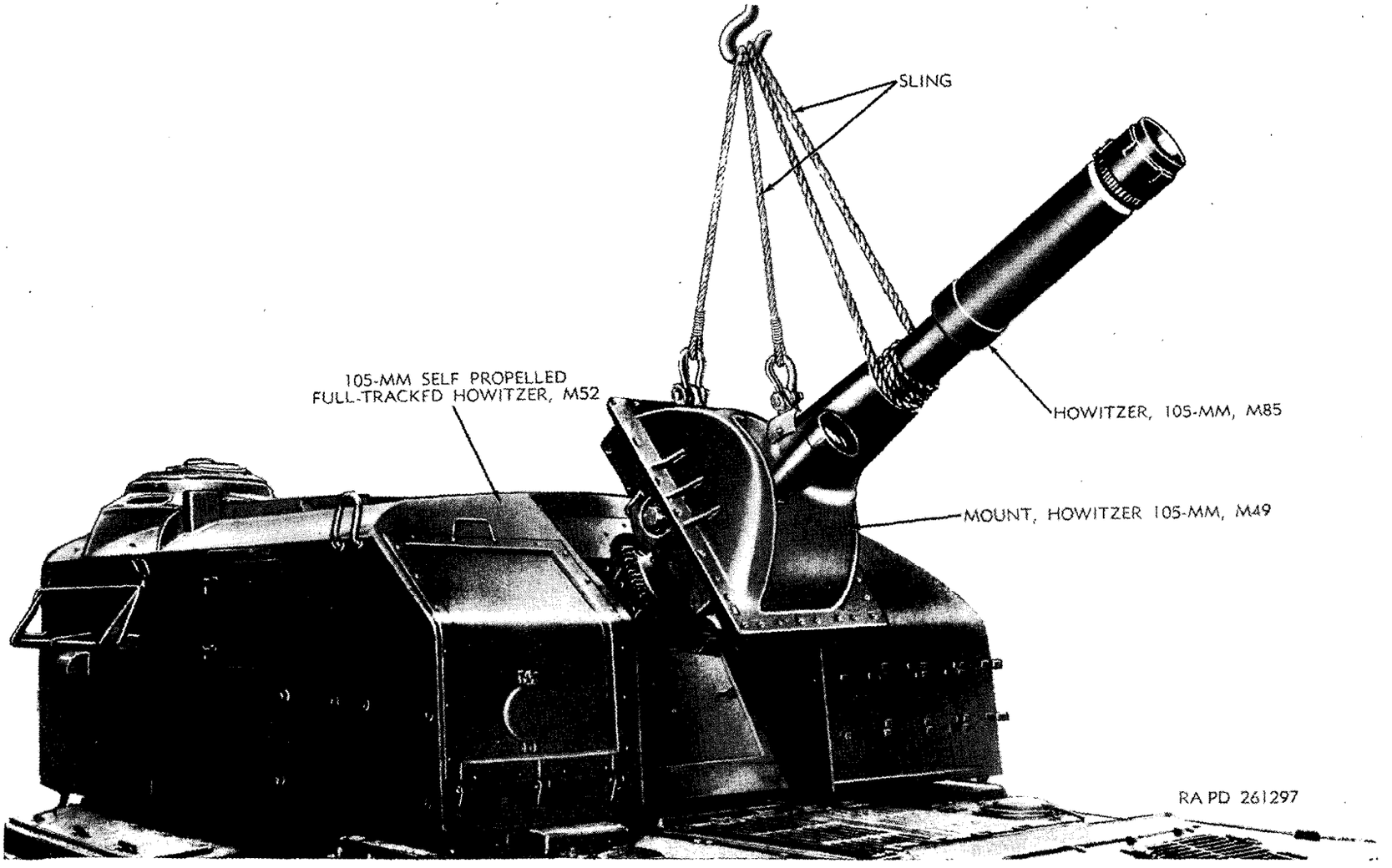


Figure 11. Removing or installing howitzer and mount.

b. After howitzer and mount have been removed from the vehicle, place them on a suitable support and proceed as directed in paragraph 32.

32. Removal of Howitzer from Mount

a. Removal of the howitzer M49 from mount M85 requires partial disassembly of the mount and howitzer.

b. Remove lockring and evacuator chamber (par. 37) from the tube.

c. Remove the howitzer mount shield assembly and rotor (par. 64*a* and *c*).

d. Remove the replenisher assembly (par. 70*a*) and breech operating and firing mechanism assembly (par. 75).

e. Disassemble the recoil mechanism (par. 84).

f. The howitzer barrel assembly and breech group are now removed from the mount (fig. 13).

Section II. INSTALLATION

33. General

a. Before installing the howitzer in the mount, examine all machined surfaces for dirt or rust. Clean all dirt from the surfaces and remove any rust from crocus cloth dipped in oil. Remove rust-preventive compound if any has been used. Apply oil to unpainted portions of howitzer tube to ease assembly of front and rear followers.

b. Before installing the howitzer and mount in the vehicle, remove any obstructions. When installation is complete (par. 34), perform final inspection (pars. 93 — 97).

34. Installation of Howitzer in Mount

a. Perform preliminary operations as directed in paragraph 33*a*. Remove lockring and evacuator chamber.

b. Assemble recoil mechanism on howitzer (par. 86).

c. Install replenisher assembly (par. 73*b*) and breech operating and firing mechanism assembly (par. 79).

d. Install rotor (par. 68*b*) and mount shield assembly (par. 68*d*).

e. Install lockring and evacuator chamber (par. 39).

35. Installation of Howitzer and Mount in Vehicle

a. Perform preliminary operations as directed in paragraph 26*b*.

b. Install suitable lifting sling through lifting hooks on howitzer mount shield and carefully install howitzer and mount in vehicle.

Note. A hoist capable of lifting the entire weight of the howitzer and mount is required to install this unit in the turret. Hoist capacity should be stenciled on hoist.

c. Install elevating gear mechanism (A, fig. 10) on its mount so that it meshes with elevation rack. Secure elevating gear mechanism in place with two capscrews, two lockwashers, and five safety nuts.

d. Secure howitzer mount shield to face plate of vehicle with $\frac{5}{8}$ x 2-$\frac{1}{8}$ oval-head screws and $\frac{5}{8}$ x $\frac{3}{4}$ thick safety nuts.

e. Remove lifting sling from howitzer mount shield (fig. 11).

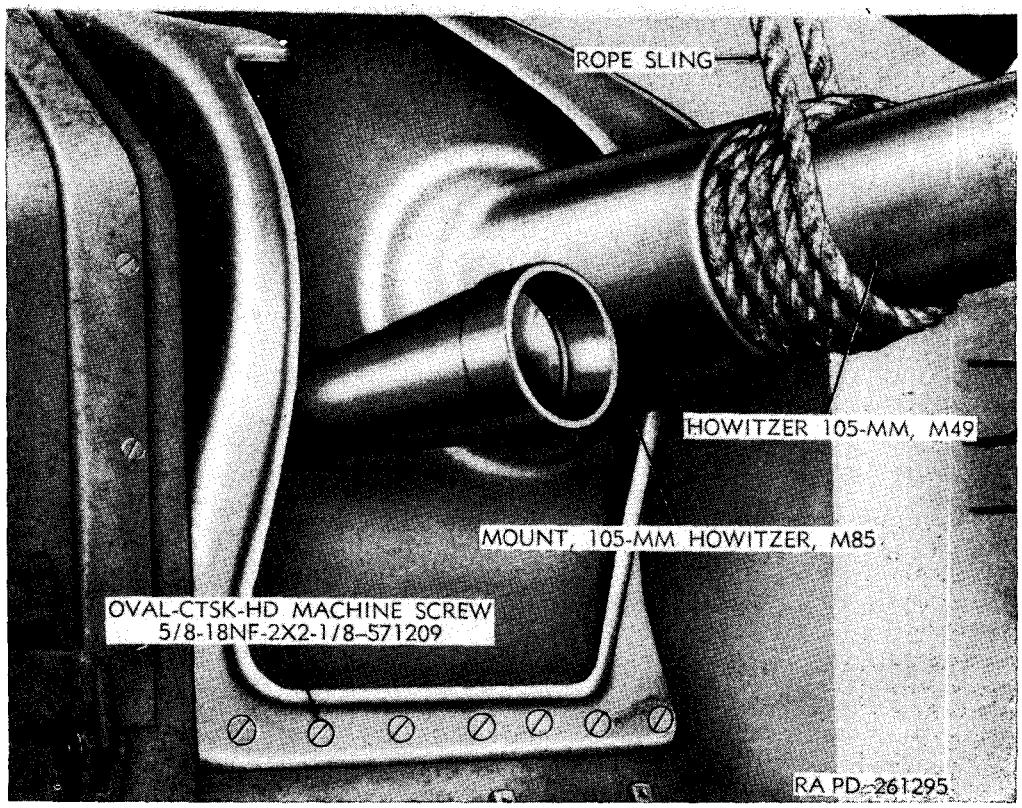


Figure 12. Howitzer M49 and mount M85 installed with attaching screws secured.

CHAPTER 6

REPAIR OF HOWITZER

Section I. EVACUATOR CHAMBER GROUP

Note. The key letters shown below in parentheses in this section refer to figure 13.

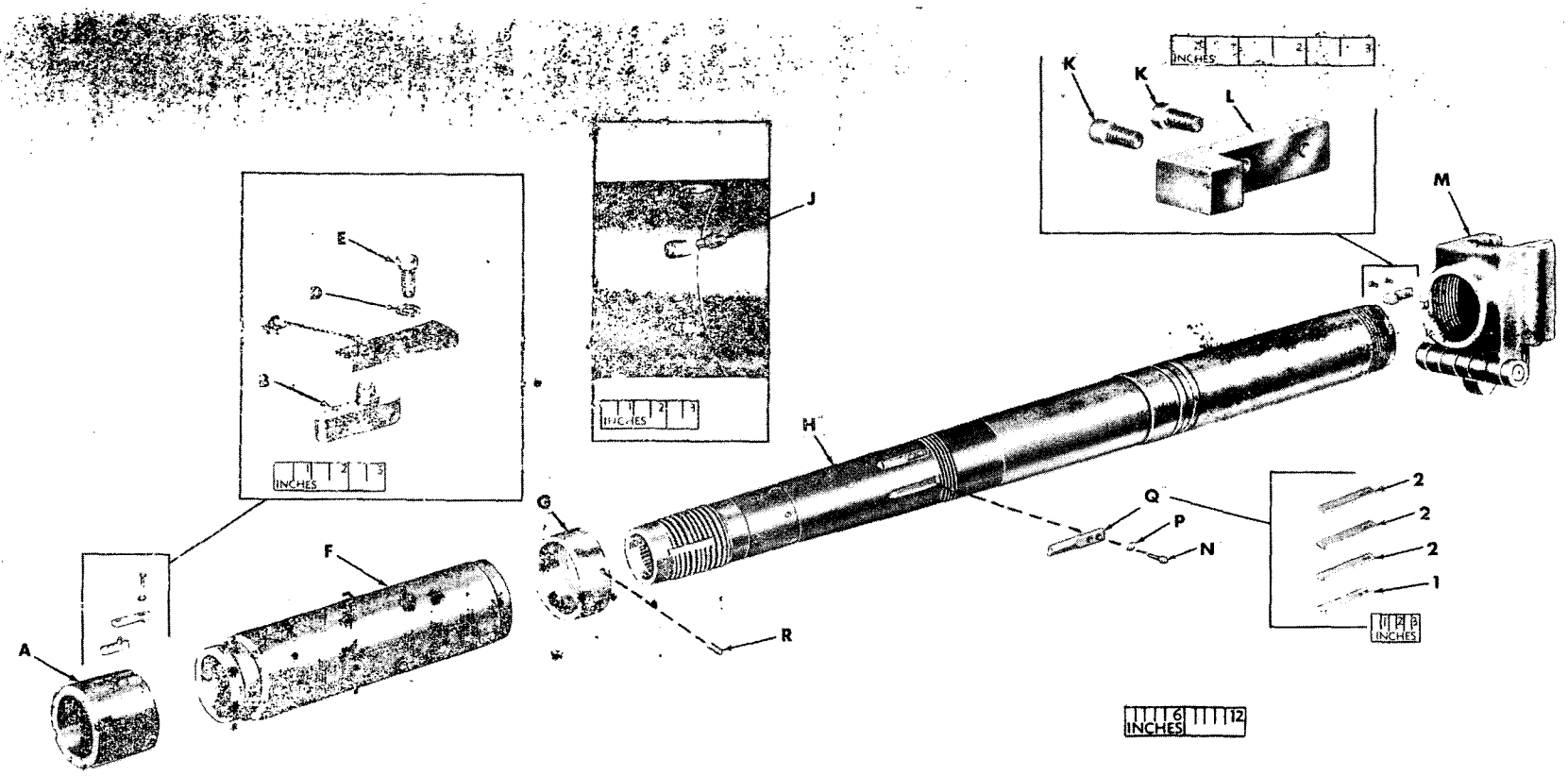
36. General

The evacuator chamber group consists of the evacuator chamber lock and locking key, lockring, evacuator chamber, gate assemblies, evacuator chamber head, evacuator chamber inserts, and related parts.

Note. The lockring, the evacuator chamber, and evacuator chamber head are removed from the howitzer tube while the tube is in the howitzer mount.

37. Removal

a. Preliminary. For removal of evacuator chamber lock (C), locking key (B), lockring (A), evacuator chamber (F), gate assemblies (Q), and evacuator chamber inserts (J), see TM 9–7204.



COMPONENTS OF BARREL ASSY — 7309251

RA PD 261246

A—Lockring 7306739
B—Locking key 7237152
C—Evacuator chamber lock 7308225
D—⅜ in. int-teeth lockwasher 138544
E—⅜-16UNC-2 x ⅝ hexagon-hd cap screw 181106
F—Evacuator chamber 7307897
G—Evacuator chamber head 7308260
H—Howitzer tube 7309175
J—Evacuator chamber insert 7307891
K—½ x ¾ socket-head cap screw 138306
L—Breech ring key 7225984
M—Breech group
N—No. 8 x ⅜ socket-hd cap screw 583885
P—No. 8 int-teeth lockwasher 138166
Q—Gate assy 7308249
1—Leaf (top) 7308248
2—Leaf 7308247
R—5/16 x 7/16 cup-pt hdls setscrew 9400883

Figure 13. Howitzer M49—barrel group.

b. Remove Evacuator Chamber Head. Loosen the headless setscrews (R) and carefully unscrew chamber head (G) from the howitzer tube (H).

38. Cleaning, Inspection, and Repair

a. Evacuator Chamber Lock, Locking Key, and Lockring.

(1) Examine evacuator chamber lock (C) for evidence of damage or wear. Remove all burs or nicks from the lock with a fine stone. Replace lock if serrated surface is worn smooth.

(2) Inspect the hexagon-head capscrew (E) for damaged threads. If repair is not practical, replace the screw. Also examine the internal-teeth lockwasher (D) for evidence of damage. Replace the lockwasher if necessary.

(3) Examine the locking key (B) for evidence of wear or damage. Remove all burs and nicks from the key with a fine stone. If excessively worn or damaged, replace the locking key.

(4) Clean the lockring (A) thoroughly with rifle-bore cleaner solvent cleaning compound. Inspect the ring for cracks and corrosion. Replace ring if damaged.

(5) Check the central hole of the lockring (A) for scoring and alinement. Smooth out scores in the central hole with a file, stone, or abrasive cloth.

(6) Remove all burs and nicks from the internal threads in the rear of the lockring (A) with a fine stone. Remove any burs or foreign matter from the slot for the locking key, using a fine stone.

(7) Remove loose or chipped paint from lockring (A) and paint nonbearing surfaces with one primer and one finish coat. Use rustinhibiting olive-drab enamel as prescribed in TM 9–2851.

b. Evacuator Chamber.

***Caution:* Extreme care must be taken in handling the evacuator chamber to avoid damage to the bore and inner lips of the front and rear end of the evacuator chamber. These lips are formed to a thin edge to provide a seal against the tube. Any deformation of these lips will destroy the sealing action and prevent proper functioning of the evacuator chamber. When removing or installing the evacuator chamber, keep it in line with the axis of the howitzer and use the minimum force necessary to slide the evacuator chamber on or off the howitzer tube.**

(1) Clean the evacuator chamber (F) thoroughly with rifle-bore cleaner solvent cleaning compound and remove all carbon deposits.

(2) Inspect the welds and cylinder surface of the evacuator chamber for cracks and gas-tightness.

(3) Repair by welding if damaged.

(4) Check the inner sealing lips of the evacuator chamber for deformation.

(5) Replace the evacuator chamber if gas-tightness cannot be established by welding or if the inner sealing lips are deformed.

(6) Examine the serrated ring of the evacuator chamber and replace the evacuator chamber if the serrated surface is worn smooth.

(7) Remove all burs and nicks from the internal threads in the front end of the evacuator chamber, using a fine stone.

(8) Remove loose or chipped paint and paint nonbearing exterior surfaces with one primer and one finish coat. Use rust-inhibiting olive drab enamel for both coats (TM 9–2851).

(9) Coat unpainted surfaces with medium lubricating oil preservative.

c. Gate Assemblies.

(1) Clean the gate assemblies (Q) thoroughly in a bath of rifle-bore cleaner solvent cleaning compound and remove all carbon deposits and corrosion.

(2) Inspect for bent or damaged leaves (Q–1 and Q–2). If creases or bends cannot be removed, replace the defective leaves.

(3) Replace the socket-head capscrews (N) that fasten the gate assemblies if threads are worn or damaged. Also replace damaged internal-teeth lockwashers (P) as required.

d. Evacuator Chamber Head.

(1) Inspect evacuator chamber head (G) for evidence of wear or damage. Replace the head if found defective.

(2) Remove all burs, nicks, and foreign material from the internal threads in the rear of the chamber head with a fine stone. Also, remove any burs or foreign matter that may be in the receiving holes for the setscrews with a fine stone.

(3) Replace the headless setscrews (R) if the threads are worn or damaged.

(4) Remove loose or chipped paint from the chamber head and paint non-bearing surfaces with one primer coat and one finish coat. Use rust inhibiting olive-drab enamel as prescribed in TM 9–2581.

e. Evacuator Chamber Plugs.

(1) Clean the evacuator chamber inserts thoroughly with rifle-bore cleaner solvent cleaning compound and remove all carbon deposits and corrosion.

(2) Run a 1/16-inch hand reamer through the gas hole in the evacuator inserts.

(3) Scrape all deposits off the 30-degree cone portion of the inserts.

(4) Remove all burs, nicks, and sharp edges from the threads on the inserts.

(5) Replace the evacuator chamber inserts if the threads are worn excessively or if the slot is damaged.

39. Installation

Note. All threaded portions of evacuator chamber group will have graphite grease applied to threads prior to assembly.

a. Evacuator Chamber Head. Carefully screw evacuator chamber head (G) onto howitzer tube (H) and secure with 5/16 x 7/16 headless setscrews (R).

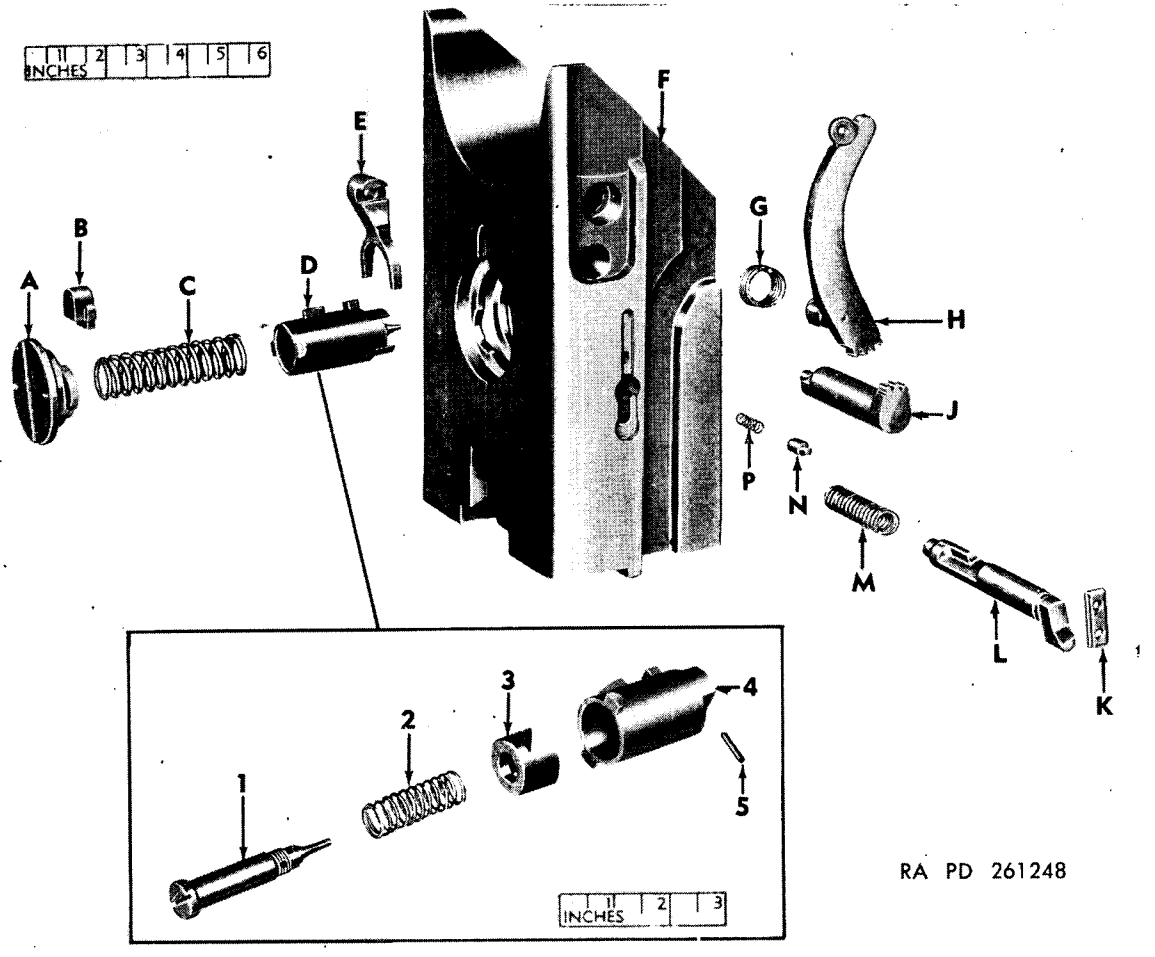
b. Remainder of Evacuator Chamber Group. Install the remaining parts of the evacuator chamber group in accordance with TM 9–7204.

Section II. PERCUSSION MECHANISM

Note. The key letters shown below in parentheses in this section refer to figure 14.

40. General

The percussion mechanism assembly (D) should be removed from the breechblock (F) before the breechblock is removed from the breech ring and installed after the breechblock is installed in the breech ring.



A—Firing spring retainer 7725983
B—Firing spring retainer plate 7225982
C—Firing spring 7225971
D—Percussion mechanism assy 7167897
1—Firing pin 5025829
2—Firing pin retracting spring 5025835
3—Firing spring stop 7225972
4—Firing pin guide 7225978
5—3/32 x 5/8 dl-rd pin 505476
E—Cocking fork 7225977
F—Breechblock 7308242
G—Cocking lever spring 7225973
H—Cocking lever 7228434
J—Cocking shaft 7225980
K—Sear retainer 7225452
L—Sear 7225981
M—Sear spring 5025836
N—Sear retainer plunger 7225451
P—Sear retainer plunger spring 7225450

Figure 14. Howitzer M49—breechblock group.

41. Removal

To remove percussion mechanism assembly (D) from the breechblock (F), refer to TM 9–7204.

42. Disassembly

a. Press the firing spring step (D–3) to the rear and into the firing pin guide (D–4).

b. Drive out the straight pin (D–5) that locks the firing pin (D–1) in the firing pin guide (D–4).

c. Return the firing spring stop to its normal position and unscrew the firing pin from the firing pin guide.

d. Separate the firing pin (D–1), retracting spring (D–2), firing spring stop (D–3), and firing pin guide (D–4).

43. Cleaning, Inspection, and Repair

a. Cleaning. Clean all parts of the percussion mechanism assembly with rifle-bore cleaner solvent cleaning compound.

b. Firing Pin (D–1).

(1) Inspect the firing pin for corrosion, deformation, pitted surfaces, and wear.

(2) Replace the firing pin if it is broken, distorted, or if the point is damaged.

(3) Replace the firing pin if it does not protrude 0.185 inch from the face of the breechblock when pushed forward.

(4) Smooth the shoulder of the firing pin so that it will slide smoothly.

(5) Coat the threads of the firing pin with graphite grease.

c. Firing Pin Retracting Spring (D–2).

(1) Replace the firing pin retracting spring if it is corroded, set, cracked, distorted, or reported inoperative.

(2) Replace the firing pin retracting spring if it does not cause the firing pin to recede approximately 0.045 inch from the face of the breechblock.

d. Firing Pin Guide (D–4), Firing Spring Stop (D–3), and Straight Pin (D–5).

(1) Inspect the firing pin guide, firing spring stop, and the 3/32 x 5/8 straight pin for scores, cracks, breakage, deformation, or other damage.

(2) Repair if possible; replace unserviceable parts.

44. Assembly

a. Insert the firing spring stop (D–3) into the firing pin guide (D–4) pronged end first, so that the prongs project through the openings in the forward end of the guide.

b. Place the firing pin retracting spring (D–2) over the body of the firing pin (D–1).

c. Insert and screw the firing pin into the firing pin guide until the point projects from the end of the guide and the shoulder of the pin seats against the inside of the guide.

d. Press the firing spring stop inward against the firing pin retracting spring until the transverse pinhole in the firing pin guide is exposed. If the pinholes in the firing pin guide and the firing pin are not alined, unscrew the firing pin not more than one-half turn to aline the holes.

e. Insert the 3/32 x 5/8 straight pin (D–5) through the firing pin guide and into the firing pin.

f. Release the firing spring stop to permit the prongs of the firing spring stop to cover the firing pin.

45. Installation

To install the percussion mechanism assembly (D) in the breechblock (F), refer to TM 9–7204.

Section III. BREECHBLOCK GROUP

Note. The key letters shown below in parentheses in this section refer to figure 14, except where otherwise indicated.

46. General

The breechblock group is composed of the breechblock, firing spring retainer, cocking lever, sear, and related parts (A, fig. 16).

47. Removal

To remove the breechblock group (A, fig. 16) from the breech ring, refer to TM 9–7204.

48. Disassembly

To disassemble breechblock group, refer to TM 9–7204.

49. Cleaning, Inspection, and Repair

a. Cleaning. Clean all parts of the breechblock group with rifle-bore cleaner solvent cleaning compound to remove all deposits and corrosion.

b. Breechblock (F).

(1) Inspect the breechblock for cracks. Replace the breechblock if cracks are detected.

(2) Remove all burs and scratches from the sliding surfaces of the breechblock, using a fine stone.

(3) Remove all burs and scratches from openings in the breechblock that house operating parts, using a fine stone.

(4) Polish the breechblock with crocus cloth dipped in dry-cleaning solvent or mineral spirits paint thinner.

c. Firing Spring Retainer (A), Cocking Lever (H), Sear (L), and Related Parts.

(1) Inspect the cocking fork (E), cock-

ing shaft (J), cocking lever (H), sear retainer plunger (N), sear retainer (K), sear (L), firing spring retainer (A), and the firing spring retainer plate (B) for scores, cracks, breakage, deformation, and other damage. Repair if possible or replace unserviceable parts.

(2) Replace the firing spring (C), the cocking lever spring (G), sear spring (M), and the sear retaining plunger spring (P) if corroded, set, cracked, distorted, or reported inoperative.

50. Assembly

Note. Coat all threaded portions of the breechblock group with graphite grease prior to assembly.

To assemble the breechblock group, refer to TM 9–7204.

51. Installation

To install the breechblock group, refer to TM 9–7204.

Section IV. BREECH OPERATING GROUP

52. General

The breech operating group is composed of the breech ring (A, fig. 17) and related parts, excluding the percussion mechanism assembly (par. 40) and the breechblock group (par. 46).

53. Removal

Note. Key letters shown below in parentheses refer to figure 15, except where otherwise indicated.

a. Percussion Mechanism. See paragraph 41.

b. Breechblock Group. See paragraph 47.

c. Remove Breechblock Operating Handle Bracket. Unscrew and remove the two socket-head capscrews (P) and two lockwashers (N) that fasten the breechblock operating handle bracket (R) to the breech ring.

d. Remove Breechblock Closing Spring Mechanism.

Note. The breechblock closing spring mechanism should not be removed except to replace parts that are unserviceable, to correct improper functioning, or to remove the howitzer tube from the breech ring.

(1) Insert the breech operating shaft assembly (B, fig. 16) and slide it to the left through the hub of the breechblock operating crank (K) and into the hub of the closing spring cable crank (B).

(2) Unscrew and remove the breech ring cap (F, fig. 17) from the breechblock closing spring mechanism housing.

(3) Take up all of the slack in the breechblock closing spring mechanism by pushing down firmly on the breechblock operating handle assembly (L).

(4) Remove the cotter pin (A) from its receiving hole in the closing spring cable crank (B).

(5) Push down heavily on the breechblock operating handle assembly while removing the breechblock closing spring locking tool 7307053 (fig. 7) from between the central ball of the closing spring cable (E, fig. 17) and the bottom of the breechblock closing spring mechanism housing.

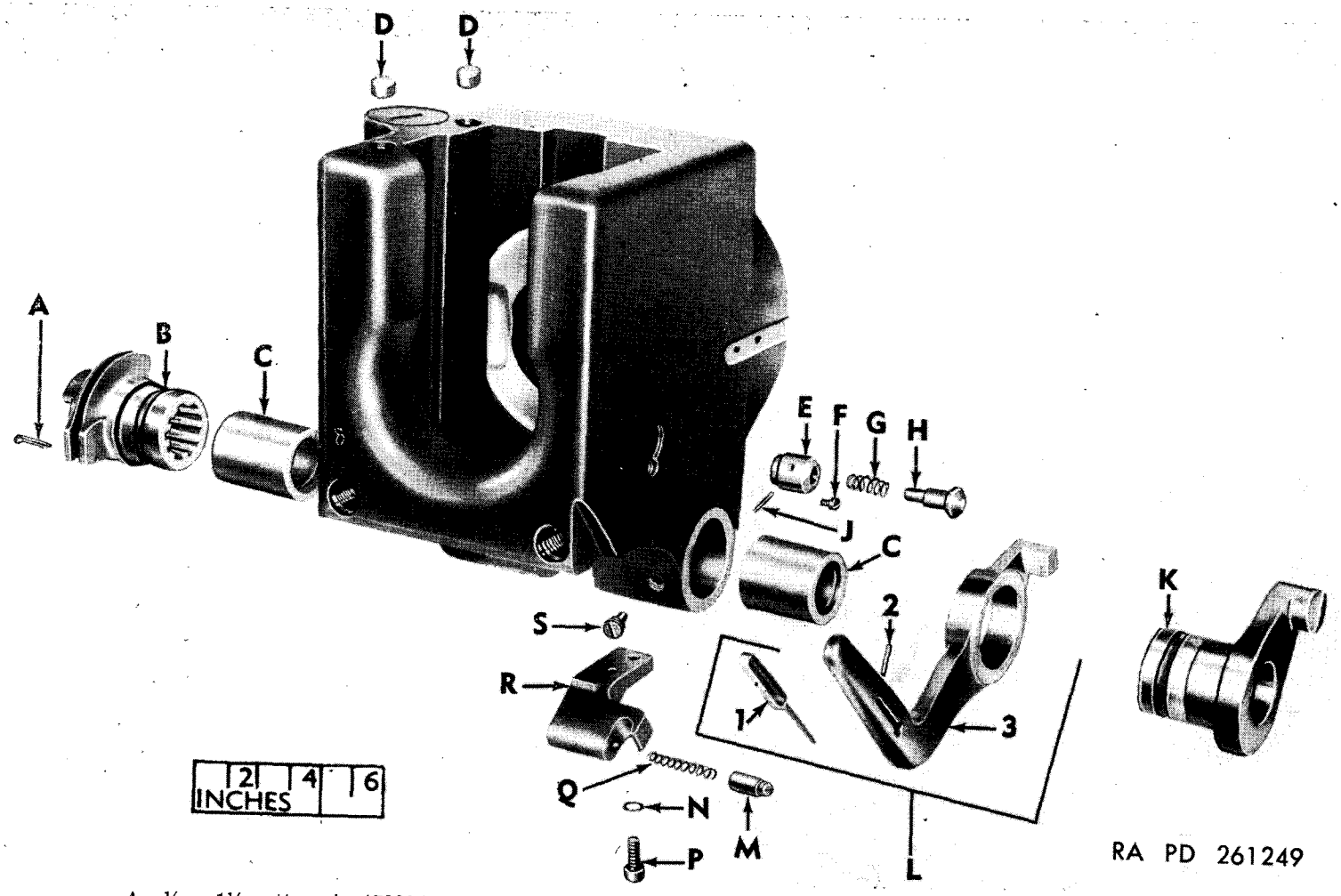
(6) Release the pressure on the breechblock operating handle assembly slowly, allowing the breechblock closing spring to expand until the top of the closing spring piston (C, fig. 17) reaches the top of the breechblock closing spring mechanism housing.

(7) Apply a pressure of about 100 pounds on the closing spring piston from the top of the breech ring, using a wooden block as a buffer.

Warning: **Maintain the pressure (about 100 pounds) on the closing spring piston to prevent the breechblock closing spring from expanding rapidly and throwing the closing spring piston, closing spring cable, and the closing spring cable adapter.**

(8) Remove the ball terminal of the closing spring cable from its socket in the closing spring cable crank.

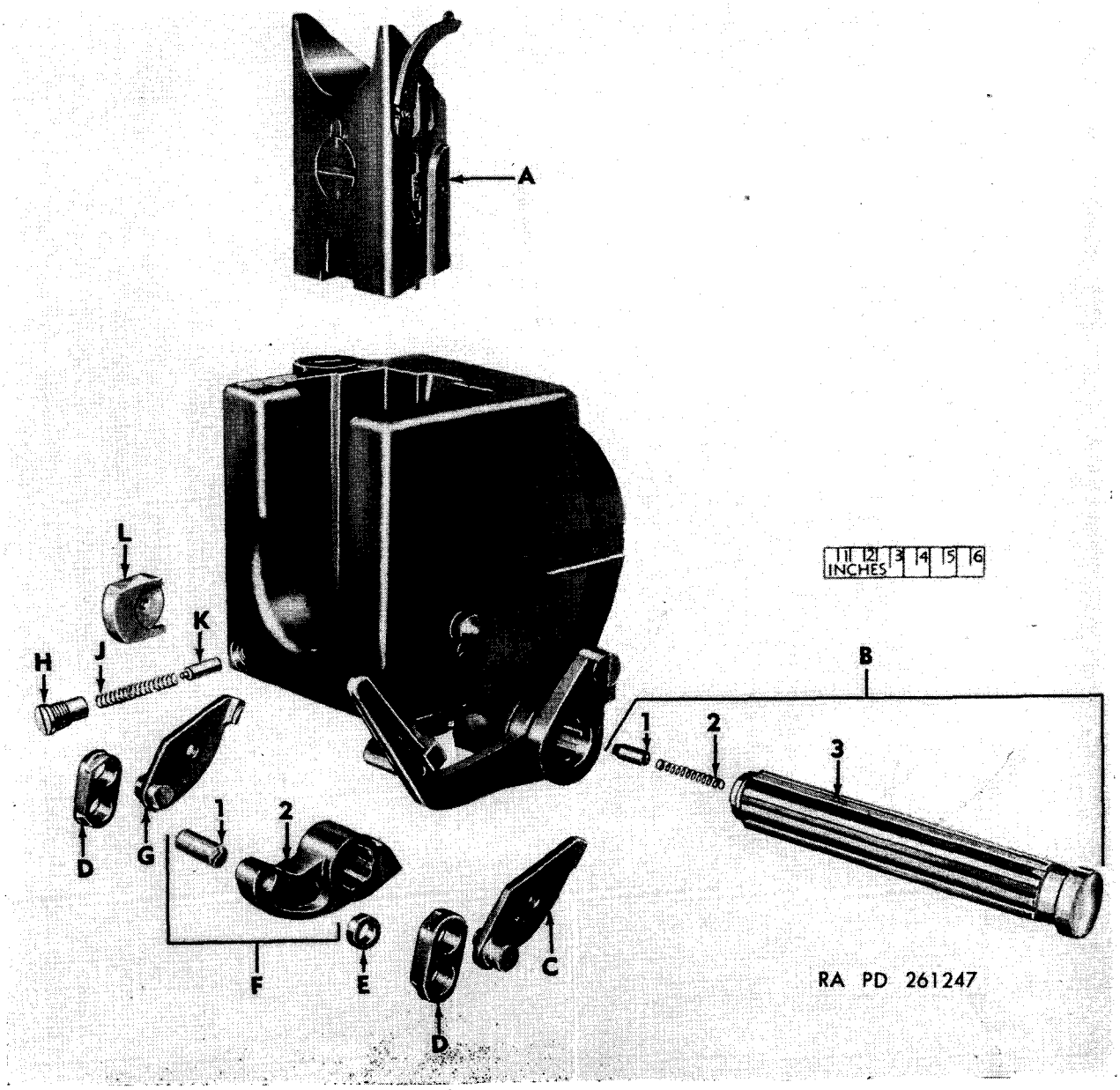
(9) Release the pressure on the closing



A—⅛ x 1½ cotter pin 173205
B—Closing spring cable crank 7305292
C—Operating crank spacer 7305179
D—Leveling plate 5012121
E—Firing plunger bushing 7226322
F—Firing plunger bushing screw 7226321
G—Firing plunger spring 7225970
H—Firing plunger 7226320
J—0.125 x 1 spring pin 586087
K—Breechblock operating crank 7305293

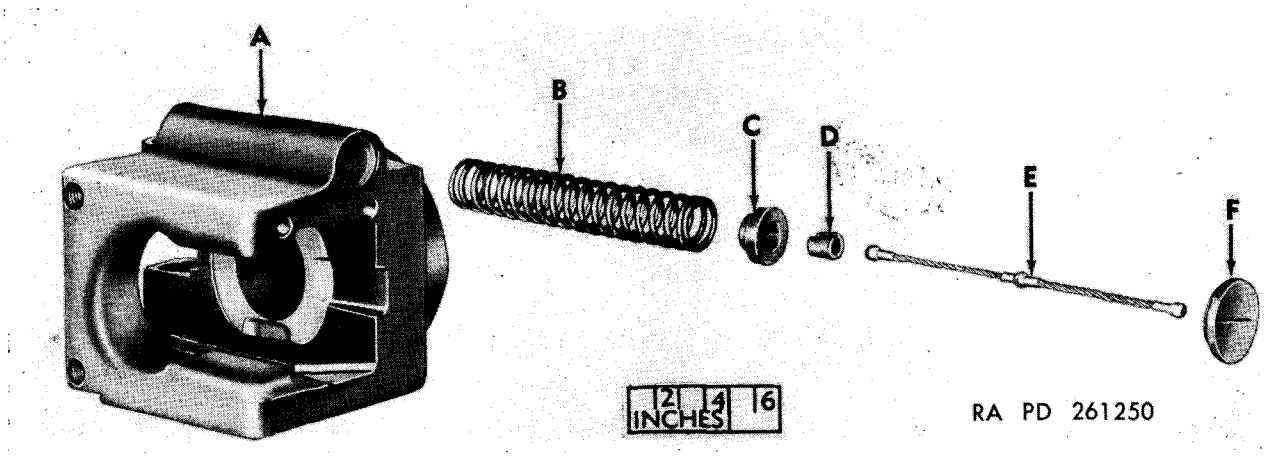
L—Breechblock operating handle assy 7237162
1—Breechblock operating handle latch 7236721
2—5/32 x 1⅜ drill rod pin 505505
3—Breechblock operating handle body 7237161
M—Breechblock operating handle plunger 7236690
N—⅜-in. int-teeth lockwasher 115549
P—⅜ x 1 socket-hd capscrew 571294
Q—Breechblock operating handle spring 7236695
R—Breechblock operating handle bracket 7237157
S—Crank detent 7305174

Figure 15. Howitzer M49—breechblock operating group.



A—Breechblock group
B—Breech operating shaft assy 7305238
  1—Operating shaft plunger 7305518
  2—Operating shaft plunger spring 7305517
  3—Breech operating shaft body 7305239
C—RH extractor 7235605
D—Extractor link 7305235
E—Breechblock crosshead 7225964
F—Breechblock crank assy 7237177
  1—Breechblock crosshead pivot 7225965
  2—Breechblock crank body 7237159
G—LH extractor 7235604
H—Extractor plunger plug 5025635
J—Extractor plunger spring 7229627
K—Extractor plunger 7225966
L—Breech operating shaft plate 7238539

Figure 16. Howitzer M49—breechblock operating group.



A—Breech ring 7305244
B—Breechblock closing spring 7225961
C—Closing spring piston 7225957
D—Closing spring cable adapter 7225956
E—Closing spring cable 7225958
F—Breech ring cap 7225959

Figure 17. Howitzer H49—breechblock operating group.

spring piston slowly, permitting the breechblock closing spring to expand to its free height.

(10) Remove the closing spring piston, closing spring cable adapter (D, fig. 17), closing spring cable, and the breechblock closing spring (B, fig. 17) from the breechblock closing spring mechanism housing in the breech ring (A, fig. 17).

e. Firing Plunger Group. Unscrew and remove the firing plunger bushing screw (F) that locks the firing plunger group in place on the right side of the breech ring. Remove the group from its receiving hole in the breech ring and lift out the firing plunger spring (G).

f. Breech Ring. For removal of breech ring, see paragraph 60*f*.

54. Disassembly

a. Preliminary. For preliminary disassembly of the breech operating group, see TM 9–7204.

b. Breechblock Operating Handle Bracket (R, fig. 15).

Note. The breechblock operating handle bracket, breechblock operating handle plunger, and the breechblock operating handle spring should not be disassembled except to replace parts that are unserviceable or to correct improper functioning.

To disassemble the breechblock operating handle bracket, break the stakes retaining the breechblock operating handle plunger (M) and remove the plunger and the breechblock operating handle spring (Q) from their receiving hole in the breechblock operating handle bracket.

c. Breechblock Closing Spring Mechanism (fig. 17).

(1) Separate the closing spring cable adapter and the closing spring cable from the closing spring piston.

(2) Slide the closing spring cable adapter along the closing spring cable away from the ball of the cable, and pass the cable through the slot in the adapter.

d. Breechblock Crank, Breechblock Handle, and Breech Operating Shaft Assemblies.

(1) To disassemble the breechblock crank assembly (F, fig. 16), remove the crank pivot (F–1, fig. 16) from the breechblock crank body (F–2, fig. 16).

Note. The breechblock crank assembly should not be disassembled except to replace parts that are unserviceable or to correct improper functioning.

(2) To disassemble the breechblock operating handle assembly (L, fig. 15), drive out the drill rod pin (L–2, fig. 15) on which the breechblock operating handle latch (L–1, fig. 15) pivots. Separate the latch from the breechblock operating handle body (L–3, fig. 15).

Note. The breechblock operating

handle assembly should not be disassembled except to replace parts that are unserviceable or to correct improper functioning.

(3) To disassemble the breach operating shaft assembly (B, fig. 16), break the stake retaining the operating shaft plunger (B–1, fig. 16) and remove the plunger and the operating shaft punger spring (B–2, fig. 16) from their receiving hole in the breech operating shaft body (B–3, fig. 16).

Note. The breech operating shaft assembly should not be disassembled except to replace parts that are unserviceable or to correct improper functioning.

e. Disassemble Firing Plunger Group (fig. 15).

(1) Drive out the spring pin (J) that holds the firing plunger (H) in the firing plunger bushing (E).

(2) Separate the firing plunger from the firing plunger bushing.

55. Cleaning, Inspection and Repair

a. Breech Ring (A, fig. 17).

(1) Clean thoroughly with rifle-bore cleaner solvent cleaning compound and remove all corrosion, deposits, and foreign matter from all recesses that house operating parts.

(2) Breech rings that have cracks or damage resulting from high pressure are unserviceable and will be replaced.

(3) Remove all burs and scratches from interior surfaces of the breech ring with a fine stone.

(4) Polish all slide areas of the breech ring with a crocus cloth dipped in dry-cleaning solvent or mineral spirits paint thinner.

(5) Remove all burs, nicks, and sharp edges from the internal threads of the breech ring, using a fine stone.

(6) Check for damaged threads in receiving holes for operating parts, particularly the closing spring mechanism housing, and repair if necessary.

(7) Coat all threads with soft graphite grease.

b. Leveling Plates (D, fig. 15).

(1) *Repair.* If the howitzer tube has not been replaced and if the leveling plates are not damaged beyond repair, proceed as follows:

(*a*) Remove burs and rough areas with a fine stone.

(*b*) Polish with crocus cloth dipped in dry-cleaning solvent or mineral spirits paint thinner.

(*c*) Check surfaces with an accurate face plate coated with Prussian blue or white lead. Surfaces must be flat, smooth, and level with each other. Check with a level.

(2) *Replacement.* Replacement of leveling plates is not authorized at this echelon of maintenance.

c. Extractors, Extractor Plungers, Extractor Plunger Springs, Extractor Plunger Plugs, and Extractor Links (fig. 16).

(1) Clean and inspect all parts. Replace parts if broken, cracked, distorted, or damaged beyond repair.

(2) Remove all burs and scratches from sliding and operating surfaces of the extractors (C and G), extractor plungers (K), and the extractor links (D).

(3) Check the threads of the extractor plunger plugs (H) for damage. Repair if possible; otherwise replace the plugs.

(4) Replace the extractor plunger springs (J) if corroded, cracked, distorted, set, or reported inoperative.

d. Breechblock Operating Handle Bracket (R, fig. 15).

(1) Clean and inspect all parts, and replace parts if broken, cracked, distorted, or damaged beyond repair.

(2) Remove all burs and nicks from operating surfaces of the breechblock operating handle plunger (M) and the receiving hole of the breechblock operating handle bracket (R).

(3) Replace the breechblock operating handle spring (Q) if corroded, cracked, distorted, set, or reported inoperative.

(4) Inspect the $\frac{3}{8}$ x 1 socket-head capscrews (P) that fasten the breechblock operating handle bracket. Replace the screws if damaged beyond

repair.

(5) Replace the 3/8-inch internal-teeth lockwashers (N) if necessary.

e. Breechblock Closing Spring Mechanism (B, fig. 17).

(1) Clean and inspect all parts and replace parts if broken, cracked, distorted, or damaged beyond repair.

(2) Replace the closing spring cable (E) if the ball terminals or the cable show signs of wear.

(3) Remove all burs and scratches from the mating surfaces of the closing spring piston (C) and the closing spring cable adapter (D), using a fine stone.

(4) Inspect the breech ring cap (F). Repair if possible or replace defective cap.

(5) Replace the breechblock closing spring (B) if corroded, cracked, distorted, set, or reported inoperative.

f. Closing Spring Cable Crank and Breechblock Operating Crank (B and K, fig. 15).

(1) Clean and inspect all parts, and replace parts if broken, cracked, distorted, or damaged beyond repair.

(2) Remove all burs and scratches from operating and sliding surfaces of the closing spring cable crank, the breechblock operating crank, and the annular groove for the detent of the breechblock operating crank, using a fine stone.

(3) Remove minor abrasions from the splines of the closing spring cable crank, using a fine stone; replace the crank if the splines are chipped, cracked, or excessively worn.

(4) Replace the 1/8 x 1-1/2 cotter pin (A).

(5) Replace the breechblock operating crank detent and the closing spring cable crank detent (S) if the threads are damaged or if the detent is distorted.

g. Breechblock Crank Assembly (F, fig. 16).

(1) Clean and inspect all parts and replace parts if broken, cracked, distorted, or damaged beyond repair.

(2) Inspect the breechblock crossheads (E) and the breechblock crank pivot (F–1) for gall marks.

(3) Dress the galled surfaces smooth with a fine oil stone.

(4) Remove all burs and scratches from operating and sliding surfaces and the splines of the breechblock crank body (F–2), using a fine stone.

(5) Replace the breechblock crank body if the splines are chipped, cracked, or excessively worn.

h. Breechblock Operating Handle Assembly (L, fig. 15).

(1) Clean and inspect all parts and replace parts if broken, cracked, distorted, or damaged beyond repair.

(2) Remove all burs and scratches from sliding and operating surfaces of the breechblock operating handle body (L–3).

(3) Replace the breechblock operating handle latch (L–1) if damaged.

(4) Replace the 5/32 x 1-3/8 drill rod pin (L–2).

i. Breech Operating Shaft Assembly, Spacers, and Plate (fig. 16).

(1) Clean and inspect all parts and replace parts if broken, cracked, distorted, or damaged beyond repair.

(2) Remove all burs and scratches from operating surfaces of the operating shaft plunger (B–1).

(3) Remove all burs, scratches, and minor abrasions from operating and sliding surfaces and splines of the breech operating shaft body (B–3), using a fine stone.

(4) Replace the breech operating shaft body if the splines are chipped, cracked, or excessively worn.

(5) Replace the operating shaft plunger spring (B–2) if corroded, cracked, distorted, set, or reported inoperative.

(6) Remove all burs and scratches from breech operating shaft plate (L), using a fine stone; replace if cracked.

(7) Remove all burs and scratches from operating surfaces of the operating crank spacers (C, fig. 15), using a fine stone; replace if excessively worn.

j. Firing Plunger Group (fig. 15).

(1) Clean and inspect all parts and replace parts if broken, cracked, distorted, or damaged beyond repair.

(2) Remove all burs and scratches from operating and sliding surfaces, using a fine stone.
(3) Replace the firing plunger (H) if broken, worn, or distorted.
(4) Replace the firing plunger bushing (E) if worn, out-of-round, or scored.
(5) Replace the 1/8 x 1 spring pin.
(6) Replace the firing plunger spring (G) if corroded, cracked, distorted, set, or reported inoperative.
(7) Inspect the firing plunger bushing screw (F) for damage; repair if possible; otherwise, replace the screw.

56. Assembly

Note. Coat all threaded portions of the breech operating group with graphite grease prior to assembly.

a. Firing Plunger Group (fig. 15).
(1) Insert the firing plunger (H) into the firing plunger bushing (E).
(2) Aline the notch on the shank of the firing plunger with the small transverse hole through the firing plunger bushing.
(3) Insert and drive in the 0.25 x 1 spring pin (J) to hold the firing plunger in the firing plunger bushing.

b. Breech Operating Shaft Assembly, Breechblock Operating Handle Assembly, and Breechblock Crank Assembly.
(1) *Assemble breech operating shaft assembly* (B, fig. 16). If the breech operating shaft assembly has been disassembled, proceed as follows:
(*a*) Insert the operating shaft plunger spring (B–2) and the operating shaft plunger (B–1) into their receiving hole in the breech operating shaft body (B–3).
(*b*) Stake the edges of the hole to retain the parts in place.
(2) *Assemble breechblock operating handle assembly* (L, fig. 15). If the breechblock operating handle assembly has been disassembled, proceed as follows:
(*a*) Place the breechblock operating handle latch (L–1) into the latch recess of the breechblock operating handle body (L–3).
(*b*) Aline the small transverse hole in the latch with the hole in the handle body.
(*c*) Insert the 5/32 x 1-3/8 drill rod pin (L–2) about which the latch pivots and stake both ends to secure the assembly.
(3) *Assemble breechblock crank assembly* (F, fig. 16). If the breechblock crank assembly has been disassembled, proceed as follows:
(*a*) Press the breechblock crosshead pivot (F–1) into its receiving hole in the breechblock crank body (F–2).
(*b*) Install the two breechblock crossheads (E) on the ends of the pivot of the breechblock crank assembly.

c. Breechblock Closing Spring Mechanism (fig. 17). If the breechblock closing spring mechanism has been removed and disassembled, proceed as follows:
(1) Seat one ball terminal of the closing spring cable (E) in the closing spring cable adapter (D).
(2) Seat the adapter in the tapered hole of the closing spring piston (C).
(3) Insert the closing spring cable through the breechblock closing spring (B) and shoulder the closing spring piston against the end of the spring.

d. Assemble Breechblock Operating Handle Bracket (R, fig. 15). If the breechblock operating handle bracket has been disassembled, proceed as follows:
(1) Insert the breechblock operating handle spring (Q) and the breechblock operating handle plunger (M) into their receiving hole in the breechblock operating handle bracket (R).
(2) Stake the edges of the receiving hole to retain the plunger and spring.

57. Installation

Note. The key letters shown below in parentheses refer to figure 15, except where otherwise indicated.

a. Breech Group. For installation of breech group, refer to paragraph 62.

b. Firing Plunger Group.
(1) Slide the firing plunger spring (G) into the space between the pilot shaft of the firing plunger (H) and the

firing plunger bushing (E).

(2) Insert the firing plunger group, pin head outward, in the firing plunger group housing hole on the right side of the breech ring.

(3) Aline the locking screw recess on the firing plunger bushing with the counterbore of the tapped hole beneath the firing plunger group housing hole.

(4) Insert and screw in the firing plunger bushing screw (F) to lock the firing plunger group in place.

c. Closing Spring Cable Crank, Breechblock Operating Handle Assembly, Breechblock Operating Crank, Breech Operating Shaft Assembly, and Breechblock Crank Assembly.

(1) Install the closing spring cable crank (B) in the breech ring (A, fig. 17) by sliding the hub of the crank into the left transversely bored lug of the breech ring, with the pulley groove of the crank to the left.

(2) Insert and screw the crank detent (S) into its receiving hole in the left lug of the breech ring so that it engages the annular groove in the hub of the closing spring cable crank and retains the crank.

(3) Slide the hub of the breechblock operating handle assembly (L) over the hub of the breechblock operating crank (K), with the lug on the handle on the side toward the arm of the crank.

(4) Install the breechblock operating crank in the breech ring by sliding the hub of the crank into the right transversely bored lug of the breech ring, with the arm of the crank and the breechblock operating handle assembly to the right.

(5) Insert and screw the crank detent (S) into its receiving hole in the right lug of the breech ring so that it engages the annular groove in the hub of the operating crank and retains the crank.

(6) Insert the breech operating shaft assembly (B, fig. 16) through the hub of the breechblock operating crank and install spacer, breechblock crank, and spacer on operating shaft. Continue to push operating shaft into the hub of the closing spring cable crank and install operating shaft plate into the hub of the closing spring cable crank.

(7) The breechblock crank assembly is installed when the breechblock group is installed (par. 51).

d. Breechblock Closing Spring Mechanism. If the breechblock closing spring mechanism has been removed and disassembled, proceed as follows:

(1) Insert the breechblock closing spring mechanism, piston end up, into the breechblock closing spring mechanism housing on the left side of the breech ring (A, fig. 17).

Note. If the breech operating and firing mechanism has been removed, the following method can be used to install the breech closing spring assembly. Rotate the breechblock operating handle up and as far forward as possible. Connect the end ball of the closing spring cable to the closing spring crank socket and install the cotter pin. Pull the breechblock operating handle down until the center ball of the cable is exposed below the closing spring housing. Install the closing spring cable locking tool 7307053. Allow the breechblock operating handle to move up slowly until the locking tool locks the cable and disconnect the cable.

(2) Apply a pressure of about 100 pounds on the closing spring piston from the top of the breech ring, using a wooden block as a buffer, and allow the closing spring cable (E, fig. 17) to extend downward below the breechblock closing spring mechanism housing.

***Warning*: Maintain the pressure (about 100 pounds) on the closing spring piston (C, fig. 17) to prevent the spring from expanding rapidly and throwing the closing spring mechanism.**

(3) Push down heavily on the breechblock operating handle assembly (L) while inserting the breechblock closing spring locking tool 7307053 (fig. 7)

between the central ball of the closing spring cable and the bottom of the breechblock closing spring mechanism housing.

(4) Rotate the closing spring cable crank (B) until the free ball terminal can be inserted into its socket in the crank.

(5) Replace the ⅛ x 1-½ cotter pin (A) in the small hole in the bottom of the closing spring cable crank and spread the prongs.

(6) Release the pressure on the piston slowly, making certain that the closing spring cable is properly secured to the closing spring cable crank.

(7) Release the pressure on the breechblock operating handle.

(8) Insert and screw the breech ring cap (F, fig. 17) into the breechblock closing spring mechanism housing in the breech ring.

(9) Return the breechblock operating handle to its latched position after the breechblock operating handle bracket is assembled and installed.

e. Breechblock Operating Handle Bracket. Insert and screw in the two ⅜ x 1 socket-head capscrews (P) and two ⅜-inch internal-teeth lockwashers (N) to fasten the breechblock operating handle bracket (R) to the breech ring.

f. Breechblock Group. See paragraph 51.

g. Percussion Mechanism. See paragraph 45.

58. Operational Check

a. Open the breech manually (TM 9–7204) and note that the movement of the breech mechanism is smooth.

b. Depress the extractors, using the ramming or extracting tool or a block of wood to close the breech.

***Warning*: Never nsert the hands or fingers into the brech recess to release the extractors when closing the breech.**

c. The breechblock should move to its fully closed position quickly, but without shock.

d. Cock the percussion mechanism manually (TM 9–7204).

e. Fire the percussion mechanism by operating the firing pin manually.

f. A "click" will indicate that the sear has released the percussion mechanism.

g. Check the operation of the firing safety rod when the howitzer is installed in the mount (TM 9–7204).

Section V. TUBE GROUP

59. General

The tube group consists of the howitzer tube and breech ring key, which secures the tube to the breech ring.

60. Removal

a. Evacuator Chamber Group. Proceed as directed in paragraph 37.

b. Secure Howitzer. Secure the howitzer on a suitable support, such as two sawhorses (fig. 18) approximately 24 inches high, with the breech ring extending over the support. If sawhorses are used, nail wooden cleats on the transverse members of the support on either side of the tube, to prevent the tube from slipping.

c. Breechblock Group. Proceed as directed in paragraph 47.

d. Breech Operating Group. Proceed as directed in paragraph 52.

e. Remove Breech Ring Key (L, fig. 13).

(1) Unscrew and remove the two socket-head capscrews (K) that fasten the breech ring key to the breech group (M).

(2) Remove the breech ring key from its keyway on the right side of the breech ring.

f. Remove Breech Group (fig. 13).

(1) Hold the howitzer tube with a girth pipe wrench (fig. 18).

(2) Place a wooden bar through the breech ring.

(3) Start to unscrew the breech ring from the howitzer tube with a sharp blow on the wooden bar.

(4) Attach a rope sling about the breech ring to support the weight of the ring.

(5) Unscrew the howitzer tube from the breech ring, using a girth pipe wrench to turn the tube (fig. 18).

(6) Lift the breech ring from the howitzer tube.

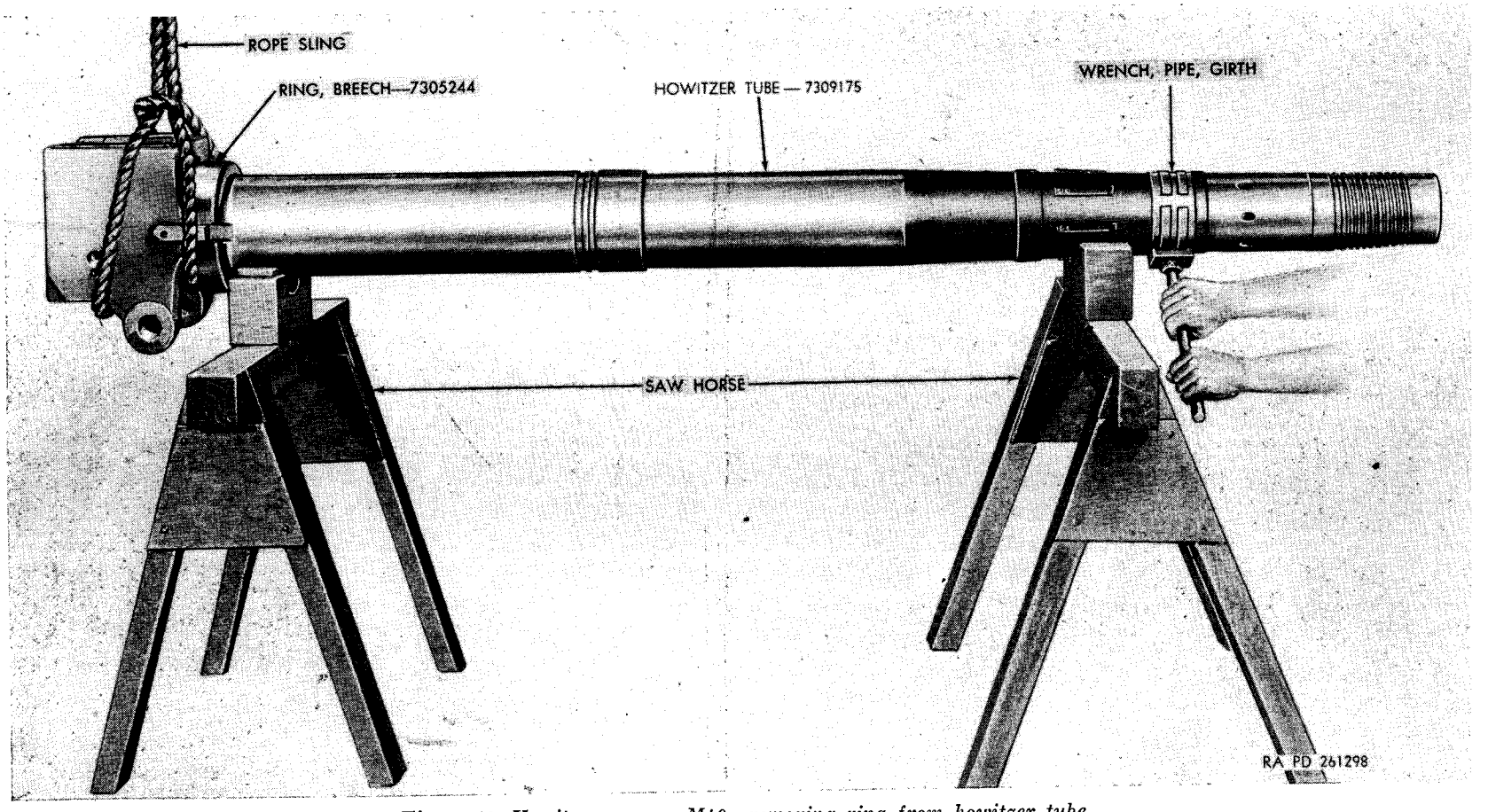


Figure 18. Howitzer cannon M49—removing ring from howitzer tube.

61. Cleaning, Inspection, and Repair

a. Cleaning. Clean the howitzer bore in accordance with TM 9–1000–202–35.

b. Inspection. Inspect the howitzer tube as instructed in paragraph 15.

c. Serviceability. Examine the tube for serviceability in accordance with TM 9–1000–202–35 and TM 9–4933–200–35.

d. Raised Portion of Lands. Reduce the raised portion of lands where possible with a fine file or scraper to the normal height and polish with aluminum oxide abrasive cloth or by stoning.

e. Gouges and Rough Areas on Lands and Grooves.

(1) Remove sharp edges along gouges and damaged portions of lands to blend with undamaged sections.

(2) Smooth out grooves with file, stone, scraper, or abrasive cloth.

f. Flattened Lands. File or scrape the sides of the wider portions of flattened lands where possible until they conform in width to the undamaged portions.

g. Coppered Bore. No attempt will be made to remove coppering of the tube bore.

h. Machined and Polished Portion of the Howitzer Tube. Lap or polish the machined portion of the howitzer tube longitudinally to remove annular grooves or scratches and to provide a proper slide surface.

i. Threads

(1) Remove all burs, nicks, and sharp edges from the threads on both ends of the howitzer tube with a finishing file.

(2) Coat all threads with soft graphite grease.

j. Key slots, Evacuator Chamber Insert Receiving Holes, and Gate Slots.

(1) Remove all foreign matter from the key slots.

(2) Remove all burs and nicks from the slots for the lockring locking key and the breech ring key, using a fine stone.

(3) Remove all carbon deposits from the evacuator chamber insert receiving holes, using rifle-bore cleaner solvent cleaning compound.

(4) Clean the threads of the evacuator chamber insert receiving holes with a thread chaser.

(5) Remove all carbon deposits and foreign matter from valve gate slots, using rifle-bore cleaner solvent cleaning compound.

(6) Remove all burs and nicks from the slots for the valve gates.

(7) Clean the threads for the pan-head screws that attach the gates, using a thread chaser.

k. Breech Ring Key.

(1) Remove all burs, nicks, and sharp edges from the breach ring key (L, fig. 13), using a fine stone.

(2) Check the ½ x ¾ socket-head capscrews (K, fig. 13) that fasten the breech ring key and repair if possible or replace.

62. Installation

a. Breech Group.

(1) Secure the howitzer tube (H, fig. 13) on a suitable support.

(2) Coat the threads of the breech end of the howitzer tube and the inside of the breech ring with soft graphite grease.

(3) Lift the breech ring, using a rope sling, and aline it with the howitzer tube.

(4) Engage the threads and, using a girth pipe wrench, screw the howitzer tube into the breech ring with a clockwise motion.

(5) Remove the rope sling and tighten the breech ring on the tube, using a wooden bar through the breech ring and a girth pipe wrench on the howitzer tube.

b. Breech Ring Key (L, fig. 13).

(1) Aline the keyway on the tube (H) with the keyway of the breech group (M).

(2) Insert the breech ring key (L) in its keyway.
(3) Insert the two ½ x ¾ socket-head capscrews (K) into their holes in the breech ring key and screw them into their receiving holes in the breech ring.

c. Breech Operating Group. Install breech operating group as directed in paragraph 57.

d. Breechblock Group. Install breechblock group as directed in paragraph 51.

e. Evacuator Chamber Group. Install evacuator chamber group as directed in paragraph 39.

CHAPTER 7
REPAIR OF MOUNT

Section I. MOUNT SHIELD ASSEMBLY, TRUNNION BEARINGS, ROTOR, AND ELEVATING RACK

63. General

a. Removal of component assemblies from the mount requires partial disassembly of the howitzer.

b. Place the howitzer and mount on a suitable support. Remove lockring and evacuator chamber (par. 37) and proceed as directed in paragraph 64.

64. Removal

Note. The key letters shown in parentheses in *a* and *b* below refer to figure 19.

a. Mount Shield Assembly.

(1) Since the trunnion bearing caps are machined with mount shield, mark both caps and shield so that they will be kept together during cleaning, inspection, and repair operations.

(2) Place heavy rope sling through lifting eyes on mount shield, and with suitable hoist, support weight of shield.

(3) Remove two self-locking nuts (G–1) from each trunnion bearing cap (G–2) and remove caps.

(4) Remove mount shield by sliding it over the muzzle end of the howitzer.

b. Trunnion Bearings and Related Parts.

(1) Remove trunnion bearing locknut (A), using spanner wrench 8389991 (table I), and key washer (B) from each trunnion.

(2) Remove two ring retainers (F), two dust washers (C), and trunnion roller bearing (E) from right trunnion.

(3) Remove two dust washers (D) and trunnion roller bearing (E) from left trunnion.

c. Rotor and Related Parts.

(1) Place heavy rope sling through rotor, and with suitable hoist, support the rotor so that it will not hang loosely when detached from the cradle.

(2) Unscrew and remove four capscrews (N, fig. 20) and four hexagon nuts (M, fig. 20) securing rotor to cradle.

(3) Remove rotor from mount by sliding it over muzzle end of howitzer.

d. Elevating Rack and Related Parts.

Note. The key letters shown below in parentheses refer to figure 22.

(1) Remove carbon steel wire (T) from capscrews that secure elevating rack to cradle. Unscrew and remove the screws (U), and internal-teeth lockwashers (V).

(2) Remove elevating rack by sliding it off the straight pins (Z) in the cradle.

(3) Remove howitzer mount nameplate (Y) (only if necessary to remove upper straight pin (BB)) by removing drive screws (X).

65. Disassembly

Note. The key letters shown below in parentheses refer to figure 20, except where otherwise indicated.

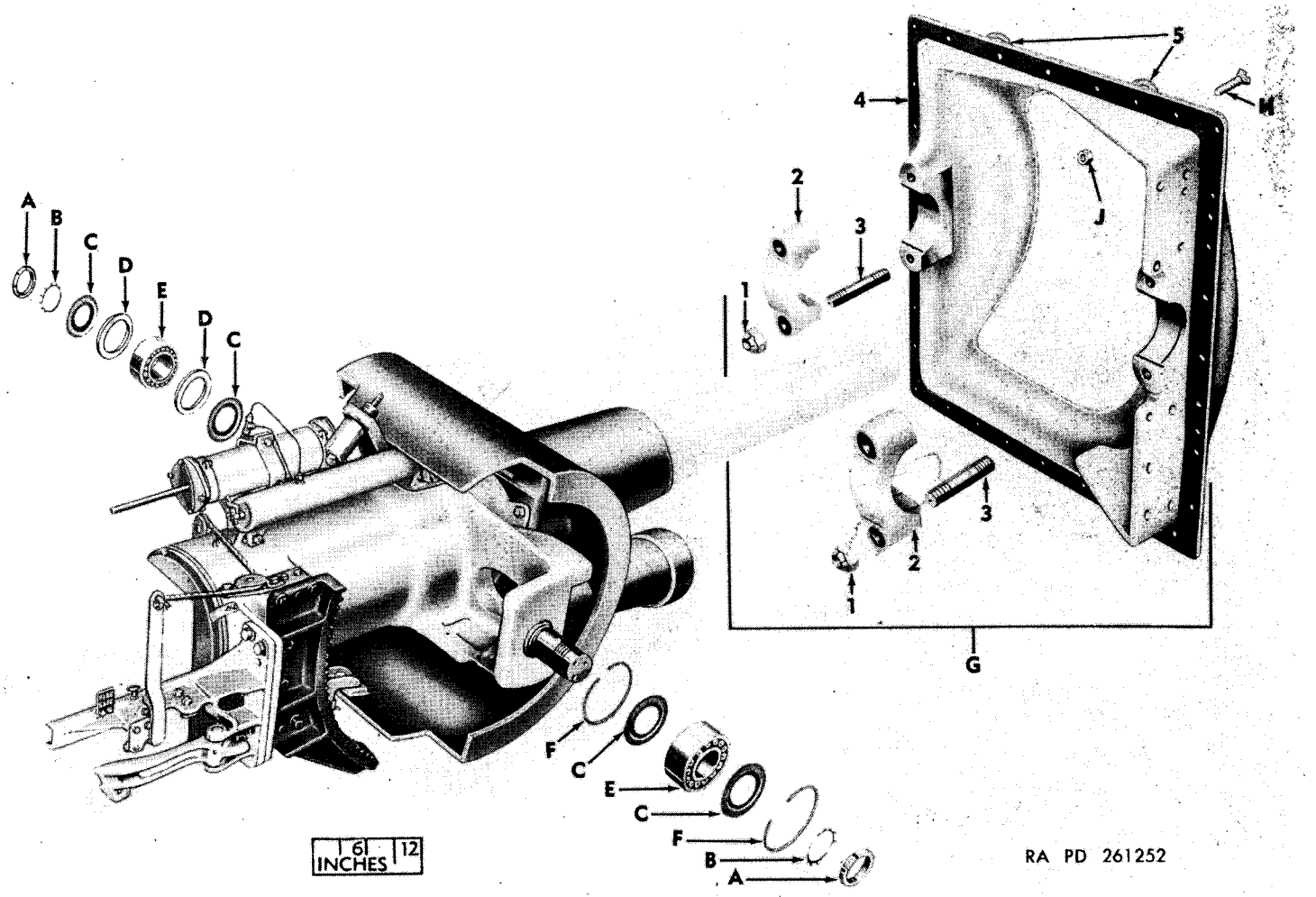
a. Mount Shield Assembly. If necessary, remove two trunnion bearing cap shield studs (G–3, fig. 19) from each side of the mount shield.

b. Rotor and Related Parts.

(1) *Rotor sleeve armor and gasket.* Unscrew and remove capscrews (G–4) and lockwashers (G–3) securing the rotor sleeve armor cover (G–2) and rubber gasket (G–1) to the rotor. Remove the cover and gasket.

(2) *Telescope protecting tube.* Unscrew and remove hexagon-head capscrews (J), flat washers (K), and hexagon nuts (L) securing telescope protecting tube (H) to the rotor. Remove the tube.

(3) *Elevation and depression bumper assemblies.* Unscrew and remove hexagon-head capscrews (F) and lockwashers (E) securing elevation stop assemblies (D) and bumper assem-



A—Trunnion bearing locknut 711019
B—Trunnion bearing key washer 711213
C—Trunnion bearing tension spring dust washer 7333933
D—5.118 od x 4.500 id x 0.125 thk washer 7333934
E—Right and left trunnion roller bearing 7333774
F—Right trunnion bearing ring retainer 7333935
G—Shield assy 7995522

1—1-1/8-in. self-locking nut 503371
2—Trunnion bearing cap 7725423
3—1-1/8 x 6-1/2 plain stud 7725937
4—Mount shield 7995521
5—Mount shield lifting hook 5227648
H—5/8 x 2-1/8 oval-head screw 571029
J—5/8 x 15/16 wd x 3/4 thk self-locking hexagon nut 503331

Figure 19. Mount M85—trunnion group.

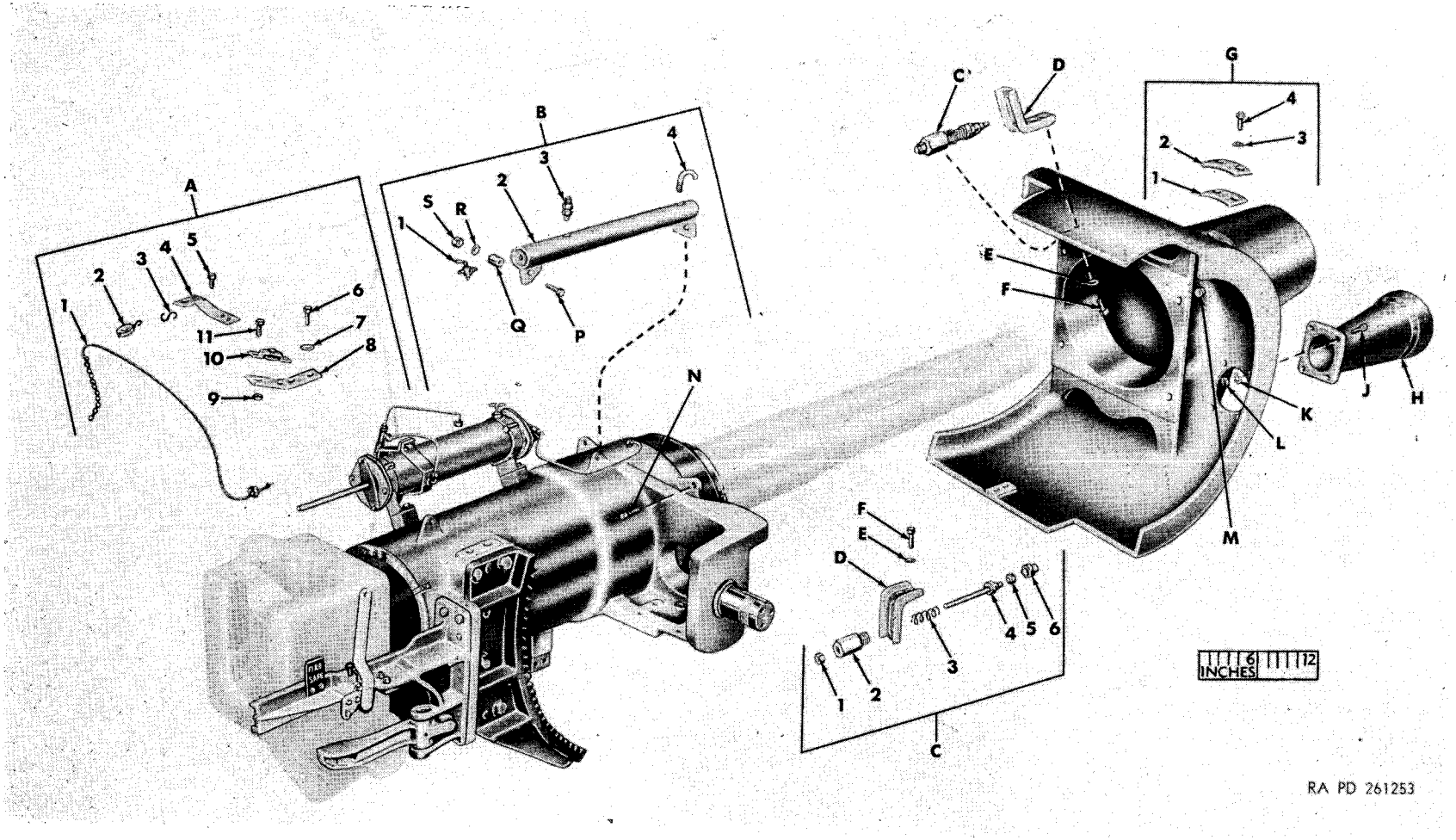


Figure 20. Mount M85—cradle and rotor group.

A—Pulley and lanyard assy 8368423
1—Firing lanyard 8388429
2—Firing lanyard left pulley 8368420
3—"S" chain hook 5068885
4—Lanyard left pulley attaching plate 8368431
5—1/4 x 7/8 hexagon-hd capscrew 106275
6—5/16 x 5/8 machine bolt 123473
7—5/16-in. int-teeth lockwasher 138538
8—Lanyard right pulley attaching plate 8368430
9—No. 10 (0.190) self-locking hexagon nut 503262
10—Firing lanyard right pulley 8368432
11—No. 10 (0.190) x 3/4 flathead screw 120620
B—Storage tank assy 7995889
1—1/4-in. level hdl drain cock 106796
2—Storage tank 7995888
3—3/4 female pipe end x 3/4 od tu adapter 423067
4—13/32 od x 0.065 wall thk, S, storage tank vent 7995887
C—Bumper assy 8688019
1—1/2 x 3/4 wd x 19/32 thk self-locking hexagon nut 503325
2—1-5/8 x 3-1/4 lg spring housing 7981762
3—1-in. od, 11 coil, compression spring 7981763
4—Shank assy 8688020
a—1-3/8 x 3/8 depression bumper head 7981765
b—Shank 8688018
5—1/2 x 3/4 wd x 5/16 thk hexagon nut 596583
6—Bumper extension 8688010
D—Stop assy 7995507
E—3/8-in. lockwasher 131099
F—3/8 x 1-1/2 hexagon-hd capscrew 186687
G—Rotor assy 7995505
1—3-1/2 x 5 x 3/32 rubber gasket 7332798
2—5-in. inside lg armor cover 7332794
3—7/16-in. lockwasher 120383
4—3/8 x 1-1/4 hexagon-hd capscrew 122145
H—Telescope protecting tube 7386095
J—1/4 x 1-1/8 hexagon-hd capscrew 123467
K—9/32 id x 5/8 od x 0.065 thk flat washer 120392
L—1/4-in. self-locking hexagon nut 503339
M—1/2-in. self-locking hexagon nut 503323
N—1/2 x 1-7/8 hexagon-hd capscrew 123899
P—1/2 x 2-1/2 hexagon-hd capscrew 122472
Q—Sleeve spacer 8368193
R—1/2-in. lockwasher 106500
S—1/2 x 3/4 x 7/16 plain hexagon nut 120378

Figure 20—Continued.

blies (C) to the bottom of the rotor. Remove the bumper assemblies.

(4) *Disassembly of elevation and depression bumper assemblies.* Unscrew and remove hexagon nut (C–1) securing bumper assembly (C) to the stop assembly (D). Unscrew and remove spring housing (C–2) from stop (D). Remove compression spring (C–3) from bumper shank (C–4). Remove bumper shank with nut (C–5) and extension (C–6) attached. Unscrew and remove extension (C–6) and nut (C–5) from shank (C–4).

66. Cleaning, Inspection, and Repair

a. Mount Shield Assembly.

Note. The key letters shown below in parentheses refer to figure 19, except where otherwise indicated.

(1) Inspect mount shield (G–4) for weld cracks, scratches, and other signs of damage. Examine mount shield lifting hooks (G–5) to make certain that they are not bent, cracked, or distorted. Inspect threads in all tapped holes and repair if damaged.

(2) Replace trunnion bearing cap shield studs (G–3) if bent distorted, or if threads are damaged beyond repair.

(3) Inspect trunnion bearing caps (G–2) for cracks and deformations. Remove burs, scores, and scratches from bearing retainer grooves and bearing seats in trunnion caps and mount shield with a fine stone or crocus cloth.

(4) If replacement of the mount shield or one of the trunnion bearing caps is necessary because of damage, replace mount shield and both bearing caps, since these parts are machined together. In any event, keep the parts identified so they will be assembled together correctly (par. 67).

b. Trunnion Bearings and Related Parts.

(1) Remove all burs from right trunnion bearing ring retainer (F) with a fine stone. Replace retainer if distorted.

(2) Replace trunnion bearing key washers (B) if they are distorted.

(3) Replace trunnion bearing dust washers (C) if distorted.

(4) Replace washer (D) if damaged.

(5) Inspect threads in trunnion bearing locknuts (A) and repair if necessary. Replace locknuts if damaged beyond repair.

(6) Inspect trunnion roller bearing in accordance with procedures outlined in TM 37–265.

c. Rotor and Related Parts and Assemblies (G, fig. 20).

(1) *Rotor sleeve armor cover and gasket.* Replace sleeve inspection cover gasket (G–1) if necessary. Replace the rotor sleeve armor cover (G–2) if it is damaged beyond repair.

(2) *Telescope protecting tube.* The telescope protecting tube (H) must be free of all dents. Inspect threaded holes and repair threads if necessary.

(3) *Elevation and depession bumper assemblies.*

(*a*) Inspect the stop assemblies (D) and bumper spring housing (C–2);

replace all broken or distorted items.

(*b*) Inspect and repair threads on bumper shanks (C–4) if necessary. Replace the shanks if they are worn, broken, or distorted. Polish unthreaded portions of shanks with crocus cloth dipped in dry-cleaning solvent or mineral spirits paint thinner.

(*c*) Replace the compression springs (C–3) if they are set, corroded, cracked, distorted, or reported inoperative.

(*d*) Replace hexagon nut (C–1 and C–5) and bumper extension (C–6) if they are damaged beyond repair.

d. Elevating Rack and Related Parts (fig. 22).

(1) Remove all burs from the elevating rack teeth with a fine stone or crocus cloth. Replace the rack (W) if excessively worn.

(2) Check the nameplate (Y) for legibility. Replace drivescrews (X) if damaged beyond repair.

67. Assembly

Note. The key letters shown below in parentheses refer to figure 20, except where otherwise indicated.

a. Mount Shield Assembly. Install two trunnion bearing cap shield studs (G–3, fig. 9) in each side of the mount shield.

b. Rotor and Related Parts.

(1) *Elevation and depression bumper assemblies.*

(*a*) Insert bumper shank assembly (C–4), with the hexagon nut (C–5) and extension (C–6) attached, into stop assembly (D). Install bumper compression spring (C–3) over bumper shank (C–4). Install bumper spring housing (C–2) over bumper spring and screw the housing into the stop (D) until tight. Secure the bumper assembly (C) to the stop with the self-locking hexagon nut (C–1).

(*b*) Position the stop assembly (D), with bumper assembly (C) attached, on the rotor; secure in place with two hexagon-head capscrews (F) and two lockwashers (E).

(2) *Telescope protecting tube.* Position the telescope protecting tube (H) to the right shield of the rotor. Secure the tube in place with four hexagon-head capscrews (J), four flat washers (K), and four hexagon nuts (L).

(3) *Rotor sleeve armor cover and gasket.* Position rubber gasket (G–1) on the rotor. Place the rotor sleeve armor cover (G–2) over the gasket. Secure gasket and cover to rotor sleeve with two hexagon-head capscrews (G–4) and two lockwashers (G–3).

68. Installation

a. Elevating Rack and Related Parts.

Note. The key letters shown below in parentheses refer to figure 22.

(1) Position elevating rack (W) on cradle over straight pin the cradle.

(2) Secure the elevating rack to cradle with six hexagon-head capscrews (U) and six lockwashers (V); install carbon steel wire (T) as needed.

(3) Place howitzer mount nameplate (Y) on cradle and secure with drive nuts (X).

b. Rotor.

Note. The key letters shown below in parentheses refer to figure 20

(1) Install heavy rope sling through rotor (G) and, with a suitable hoist, slide rotor over howitzer until it is in position on cradle.

(2) Secure rotor to cradle with four hexagon-head capscrews (N) and four hexagon nuts (M).

(3) Remove rope sling from rotor.

Note. The key letters shown below in parentheses refer to figure 19.

c. Trunnion Bearings and Related Parts.

(1) Install right trunnion bearing ring retainer (F), trunnion bearing dust washer (C), trunnion roller bearing (E), trunnion bearing dust washer (C), trunnion bearing ring retainer (F), and trunnion bearing key washer (B) in the order named. Secure these parts in place on the right trunnion with trunnion bearing locknut (A).

(2) Install left trunnion bearing dust washer (C), trunnion bearing washer (D), trunnion roller bearing (E), trunnion bearing washer (D), trunnion bearing dust washer (C), and trunnion bearing key washer (B) on left trunnion in the order named. Secure these parts with trunnion bearing locknut (A), using spanner wrench 8389991 (table I).

d. Mount Shield Assembly.

(1) Place a rope sling through the lifting eyes on shields and, with a suitable hoist, position the shield on cradle by sliding it over the howitzer.

(2) Position right and left trunnion bearing caps (G–2) on the trunnions and

secure each in place with two self-locking nuts (G–1).

Note. Be certain that right trunnion bearing retainers are seated in their grooves in the cap and shield before securing right trunnion cap.

(3) Install lockring and evacuator chamber (par. 39).

Section II. REPLENISHER ASSEMBLY AND OVERFLOW STORAGE TANK

69. General

The recoil oil must be drained from the replenisher assembly and the overflow storage tank before either component is removed from the mount. The replenisher and the overflow storage tank are both provided with a drain cock to facilitate bleeding and draining operations.

70. Removal

a. Replenisher Assembly.

Note. The key letters shown below in parentheses refer to figure 22, except where otherwise indicated.

(1) Drain recoil oil from the replenisher by opening the drain cock (B, fig. 23) located at the front of the replenisher. Use a recoil oil (filler) gun to remove the recoil oil.

(2) Disconnect the replenisher-to-cradle tube (R) at elbow (Q) in front of replenisher (fig. 21).

(3) Disconnect replenisher oil tube (M–5) at front of replenisher assembly.

(4) Disconnect replenisher oil overflow tube (L) at tee (K).

(5) Remove the two capscrews (A–1) and hexagon nuts (A–5) securing replenisher assembly in clamp assemblies (A) on cradle; remove the replenisher assembly from the clamps.

b. Overflow Storage Tank.

Note. The key letters shown below in parentheses refer to figure 20.

(1) Drain recoil oil from the overflow storage tank by opening the drain cock (B–1) at the rear of the tank. Use a clean, dry container to catch the recoil oil.

(2) Remove two capscrews (P), two sleeve spacers (Q), two lockwashers (R), and two hexagon nuts (S) securing the overflow storage tank to the cradle. Remove the tank from the cradle.

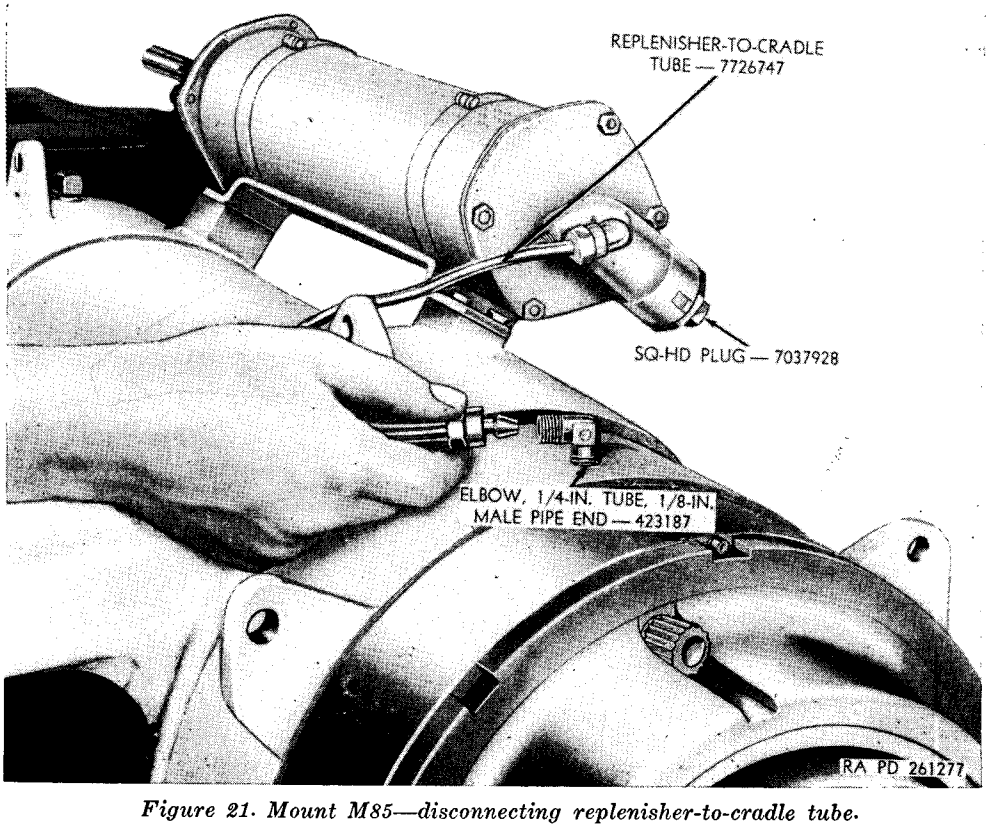


Figure 21. Mount M85—disconnecting replenisher-to-cradle tube.

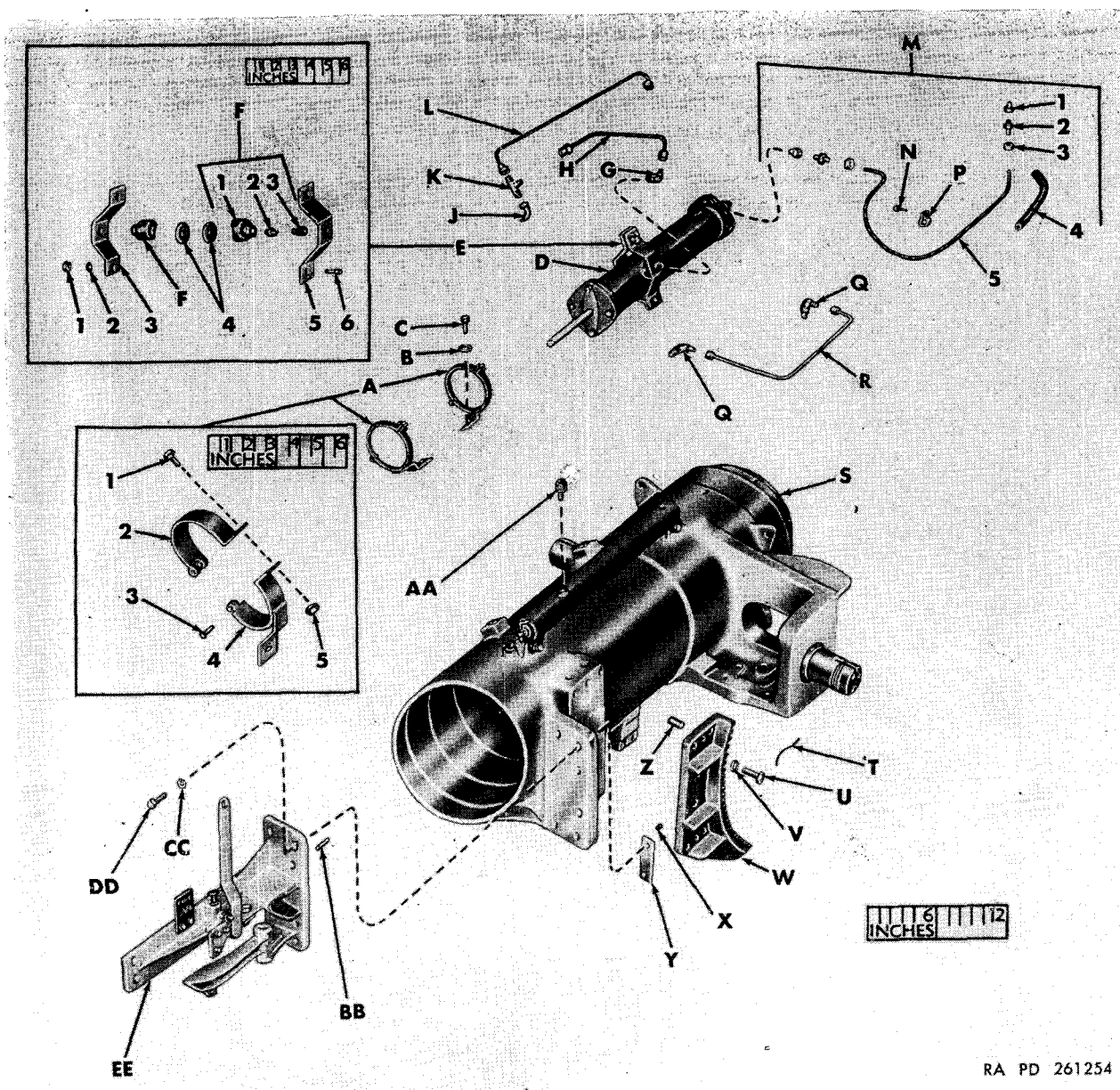


Figure 22. Mount M85—cradle group.

A—Replenisher clamp assy 8367521
1—3/8 x 7/8 hexagon-hd capscrew 120758
2—4-3/4 lg x 3/4 wd steel trap 7107088
3—3/16 x 1 straight pin 103724
4—Replenisher bracket assy 8367518
5—3/8 x 9/16 x 29/64 self-locking hexagon nut 503350
B—1/4-in. int-teeth lockwasher 120423
C—1/4 x 5/8 hexagon-hd capscrew 123436
D—Replenisher assy 7726745
E—Cylinder assy 7993890
1—1/4 x 7/26 x 5/32 plain hexagon nut 124818
2—1/3-in. int-teeth lockwasher 120423
3—Replenisher retaining strap 7995881
4—1 id x 1-3/4 od x 1/8 thk syn-ru replenisher gasket 7995883
5—Replenisher retaining strap 7995897
6—1/4 x 1 hexagon-hd capscrew 121900
F—Saddle assy 8687993
1—Replenisher saddle 8687992
2—1/8-in. pressure relief lubrication fitting 178779
3—1/2 x 1/8 pipe bushing 218943
G—1/4 tube x 1/8 male pipe end pipe-to-tube elbow 423187
H—Replenisher oil overflow steel tube 7995879
J—1/8-in., 45-degree pipe elbow 144117
K—1/4 tube x 1/8 male pipe end pipe-to-tube tee 423723
L—Replenisher oil overflow steel tube 7995880
M—Replenisher and front follower tube assy 8367965
1—1/4 tube x 1/8 male pipe end straight pipe-to-tube adapter 189920
2—1/4-in. tube fitting clinch sleeve 189911
3—1/4 od tu x 9/16 lg coupling tube nut 189894
4—Replenisher tube cover 8367967
5—Replenisher oil tube 8367964
N—No. 10 x 3/8 ext-teeth lockwasher bolt 423544
P—1/4-in. od tube retaining strap 191754
Q—Male thd pipe-to-tube elbow 423187
R—1/4 od x 0.28 wall steel tube 7726747
S—Recoil concentric mechanism assy 7332640
T—Carbon steel wire 22-W-1631-110
U—5/8 x 1-1/4 dld hexagon-hd capscrew 571166
V—5/8-in. int-teeth lockwasher 138557
W—Elevating rack 7725948
X—No. 10 x 3/8 roundhead drivescrew 142281
Y—105-mm howitzer mount nameplate 7981160
Z—0.746 od x 1-3/8 lg straight pin 7726029
AA—3/4 tube x 3/4 female pipe end pipe-to-tube adapter 423067
BB—1/2 x 1-1/4 straight pin 141285
CC—1/2-in. int-teeth lockwasher 138549
DD—1/2 x 1-1/4 dld hexagon-hd capscrew 571157
EE—Breech operating and firing mechanism assy 8368424

Figure 22—Continued.

71. Disassembly

a. Replenisher Assembly—Related Parts.

Note. The key letters shown below in parentheses refer to figure 22.

(1) Disconnect steel tube (H) at tee (K) and elbow (G). Remove tee (K), elbow (G), and elbow (J) from cylinder assembly (E).

(2) Disassemble cylinder assembly (E) by unscrewing two hexagon nuts (E–1) and lockwashers (E–2) from capscrews (E–6). Remove retaining straps (E–3 and E–5), saddle assemblies (F), and replenisher gasket (E–4) from replenisher cylinder.

(3) Disassemble saddle assembly (F) by unscrewing bushing (F–3) and lubrication fitting (F–2) from replenisher saddle (F–1).

(4) Unscrew and remove capscrews (C) and lockwashers (B) that secure replenisher clamp assemblies (A) to cradle; remove assemblies.

(5) Unscrew bolt (N) and remove strap (P) from replenisher oil tube (M–5). Disconnect oil tube by unscrewing adapter (M–1) from its tapped hole in the cradle; plug hole in cradle.

(6) Disconnect replenisher-to-cradle tube (R) at elbow (Q) in front top of cradle. Remove elbow and install pipe plug in hole in cradle.

b. Replenisher Assembly.

Note. The key letters shown below in parentheses refer to figure 23.

(1) Unscrew and remove replenisher plug (R) and plug gasket (Q). Straighten locking prongs on replenisher valve key washer (N). Unscrew replenisher valve assembly (P) and remove valve assembly valve washer (M), and key washer (N).

(2) Unscrew and remove capscrews (G) and lockwashers (F) securing replenisher cylinder filling head (L).

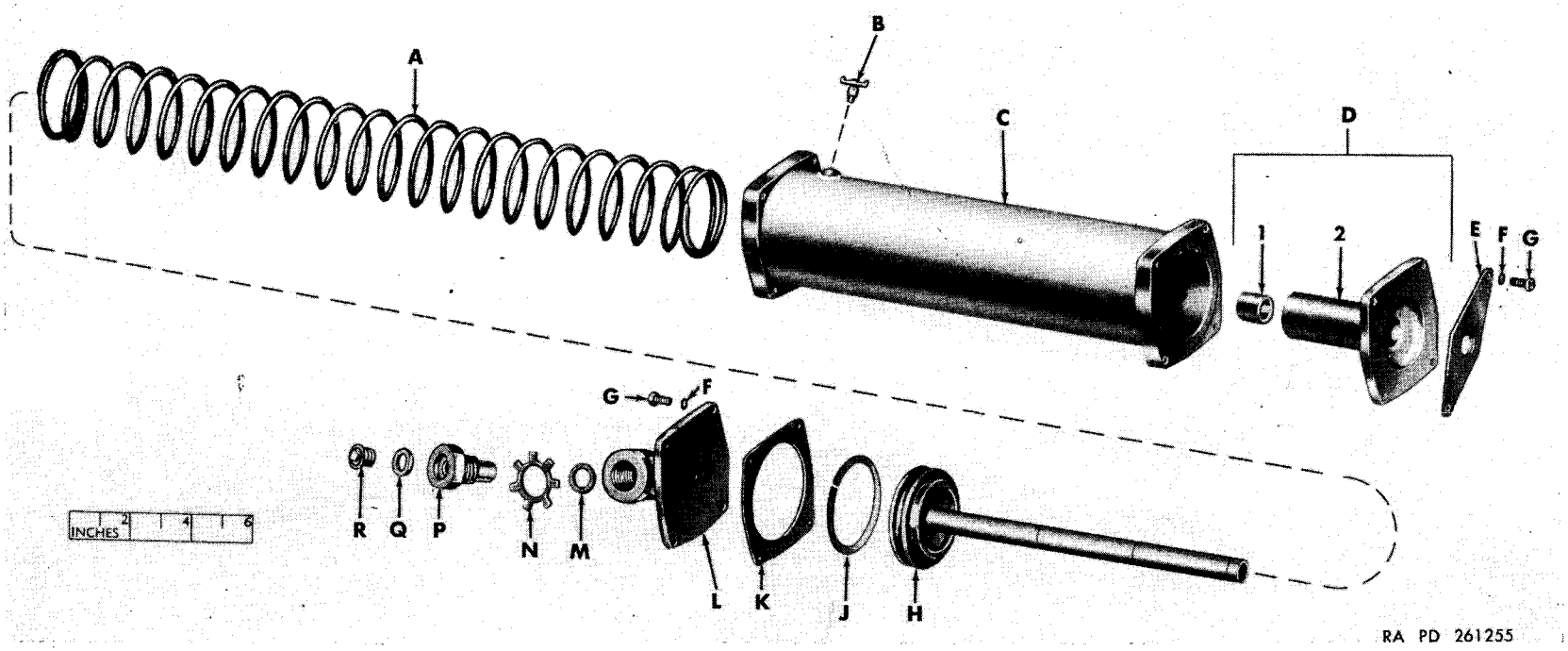
***Warning*: Be careful when removing replenisher cylinder filler head screws to prevent the replenisher spring from throwing the head and flying out of the cylinder.**

Carefully pull filler head (L) away from the replenisher cylinder (C) and remove head (L), replenisher piston (H), replenisher spring (A), gasket (K), and preformed packing (J).

(3) Unscrew and remove four capscrews (G) and four lockwashers (F) securing replenisher cap assembly (D) and indicator (E) to replenisher cylinder. Remove the cap assembly and indicator. Drive out the bushing (D–1) from the retainer cap (D–2).

(4) Remove drain cock (B) from replenisher cylinder (C).

c. Overflow Storage Tank. Remove overflow tube (L, fig. 22) and tube adapter (B–3, fig.



A—2.900-in od, 19 coil, compression spring 8687950
B—1/8-in. male pipe end drain cock 191104
C—Replenisher cylinder 8367957
D—Replenisher cylinder cap assy 8367988
1—0.629 id x 0.754 od x 0.75 lg piston bushing 7107077
2—Retainer cap 8367987
E—Replenisher cylinder indicator 7107080
F—2/4-in. int-teeth lockwasher 115547
G—1/4 x 3/4 hexagon-hd capscrew 123450
H—Replenisher piston 7107087
J—3/16 thk x 2-5/8 id preformed packing 546807
K—1/16-in. thk fbr gasket 7107078
L—Replenisher cylinder filler head 7726742
M—0.750 id x 0900 od x 0.99 thk flat washer 5238398
N—1-1/32 id x 1-3/4 od x 0.059 thk ext-teeth key washer 5238403
P—Replenisher filling valve assy 6224806
Q—0.56 id x 0.75 od x 0.125 thk gasket 5168098
R—1/2 x 3 plug 7037928

Figure 23. Mount M85—replenisher group.

20) from overflow storage tank, along with tank vent (B–4, fig. 20) and drain cock (B–1, fig. 20).

72. Cleaning, Inspection, and Repair

a. Replenisher Assembly — Related Parts.

Note. The key letters shown below in parentheses refer to figure 22.

(1) Inspect all tubes (H, M–5, and R) for dents, cracks, distortions, or other signs of wear that would impair proper functioning of replenisher cylinder. Replace defective tubes.

(2) Inspect threads and seats on elbows (G, J, and Q), tee (K), and adapter (M–1) for signs of wear. Remove burs or scratches from threads with a proper size tap. Replace defective parts if repair is impossible.

(3) Inspect all screws, nuts, and lockwashers for unserviceability. Replace parts that cannot be repaired.

(4) Inspect retaining straps (E–3 and E–5) for cracks or distortions; repair or replace as necessay. Replenisher gaskets (E–4) should be replaced if there is evidence of leaks, scuffing, flat spots, cracks, or other damage.

(5) Inspect replenisher saddles (F–1). Remove burs and scratches from curved faces and threaded holes with a fine stone or tap. Inspect pipe bushings (F–2) for damaged threads. Check that relief fittings function properly and that the spring seats the cap quickly and completely. Replace any part of the saddle assembly damaged beyond repair.

(6) Inspect replenisher clamp assembly (A) for damaged bracket or straps; replace defective parts. Straight pin (A–3) should be driven out and replaced if rusted or bent.

(7) Retaining strap (P) should be replaced if defective.

b. Replenisher Assembly.

Note. The key letters shown below in parentheses refer to figure 23.

(1) Inspect the replenisher valve plug (R) for burred and damaged threads. Replace plug if repair is impossible. Replace the replenisher valve gasket (Q) and the replenisher valve washer (M). Examine the replenisher valve lockwasher (N) for cracks or distortion; replace washer if damaged.

(2) Check operation of replenisher valve assembly spring by pushing ball from its seat with a small piece of wood inserted through the threaded end of replenisher valve assembly (P). Make certain the spring returns ball to its seat. If spring is broken or set, replace replenisher valve assembly. If necessary, repair internal and external threads that are burred or scratched.

(3) Reduce appreciable scores from bore of replenisher cylinder (C) with crocus cloth, using longitudinal strokes. The replenisher cylinder-head gasket (K) and the preformed packing (J) should be replaced if inspection reveals any scuffing, flat spots, cracks, or other damage.

(4) Remove burs, scratches, and blemishes from the machined surfaces of the replenisher cylinder filler head (L) with a fine stone or crocus cloth. Examine threads in all tapped holes and repair if necessary.

(5) Remove burs, scratches, and deformations from the machined surfaces of the cylinder cap (D) with a fine stone or crocus cloth. Examine threads in tapped holes and repair if necessary. Remove minor scratches on the bushing (D–1) by polishing or scraping. Do not alter the internal dimension of the bushing.

(6) Reduce appreciable scores and scratches on all finished surfaces of replenisher piston (H) with a fine stone or crocus cloth. Examine piston rod markings to be certain they are legible.

(7) Replace the replenisher compression spring (A) if set, cracked, distorted, or reported unserviceable.

(8) Inspect replenisher drain cock (B) for evidence of excessive wear, broken or cracked parts, or damaged threads.

Replace cock if damaged beyond repair.

(9) Examine replenisher cylinder indicator (E) for cracks or excessive wear; replace if repair is impossible.

(10) Inspect all screws, nuts, and washers for unserviceability. Replace defective parts.

c. Overflow Storage Tank.

Note. The key letters shown below in parentheses refer to figure 20, except where otherwise indicated.

(1) Inpsect overflow tube (L, fig. 22) for dents, cracks, or distortion. Replace defective tube.

(2) Inspect threads and seat on tube adapter (B–3) for signs of wear. Remove burs or scratches from threads with a fine stone. Replace adapter if damaged beyond repair.

(3) Check that tank vent (B–4) is not clogged and that threads are free from burs or scratches. Replace vent if defective.

(4) Inspect drain cock (B–1) for evidence of excessive wear, broken or cracked parts, or damaged threads. Replace cock if repair is impractical.

(5) Replace hexagon nuts (S), spacers, lockwashers (R), and capscrews (P) if found defective.

(6) Examine storage tank (B) for evidence of leakage, cracks, or fractures. Replace tank if damaged beyond repair. Inspect and repair if necessary tappings in end and top of tank.

73. Assembly

a. Overflow Storage Tank.

Note. The key letters shown below in parentheses refer to figure 20, except where otherwise indicated.

(1) Install overflow tube (L, fig. 22) and tube adapter (B–3) in the tapped hole in the top of the storage tank (B–2).

(2) Install tank vent (B–4) and drain cock (B–1) in their tapped holes in the overflow tank.

b. Replenisher Assembly.

Note. The key letters shown below in parentheses refer to figure 23.

(1) Position replenisher cylinder gasket (K) on filler head (L), and secure filler head to the replenisher cylinder (C) with four capscrews (G) and lockwashers (F).

(2) Position preformed packing (J) on replenisher piston (H). Insert replenisher compression spring (A) over stem of piston. Carefully slide piston and spring into replenisher cylinder (C).

(3) Insert piston bushing (D–1) into replenisher retainer cap (D–2).

(4) Using the replenisher cap assembly (D), compress the replenisher spring (a force of 36 pounds is required). Be certain to guide the replenisher piston rod into the retainer cap assembly. Secure the replenisher cap assembly to the replenisher cylinder with two capscrews (G) and lockwashers (F).

Warning: **Be careful when removing replenisher cylinder filler head screws to prevent the replenisher spring from throwing the head and flying out of the cylinder.**

(5) Position indicator (E) on replenisher cap assembly and secure with two capscrews (G) and two lockwashers (F).

(6) Position replenisher valve washer (M) and replenisher valve key washer (N) over hole in replenisher filler assembly (P) into filler head (L). Bend up two tangs of the key washer (N) to lock the valve assembly in place. Position the plug gasket (Q) over the plug (R) and screw the plug into the replenisher valve.

(7) Install the replenisher drain cock (B) in the top of the replenisher cylinder.

c. Replenisher Assembly — Related Parts.

Note. The key letters shown below in parentheses refer to figure 22.

(1) Remove pipe plug from tapping in front top of cradle and install two elbows (Q) and replenisher-to-cradle tube (R).

(2) Remove pipe plug from tapping in front bottom of cradle and install adapter (M–1), replenisher oil tube (M–5), and related parts. Secure oil tube to cradle with tube strap (P) and bolt (N).

(3) Secure replenisher clamp assemblies (A) to cradle with capscrews (C) and lockwashers (B).

(4) Assemble saddle assemblies (F) by screwing pipe bushing (F–3) and lubrication fitting (F–2) into replenisher saddle (F–1).

(5) Assemble cylinder assembly (E) by positioning replenisher gaskets (E–4) and saddle assemblies (F) over the openings on the sides of the replenisher cylinder assembly (D). Position retaining straps (E–3 and E–5) over saddle assemblies and secure with capscrews (E–6), lockwashers (E–2), and hexagon nuts (E–1).

(6) Install elbow (G) and steel tube (H) in right side of cylinder assembly (E). Install elbow (J) and tube tee (K) in left side of cylinder assembly and connect steel tube (H) to tee.

74. Installation

a. Overflow Storage Tank.

Note. The key letters shown below in parentheses refer to figure 20.

(1) Secure the overflow storage tank (B–2) to the cradle lugs by inserting capscrews (P) through the holes in each tank lug. Place a sleeve spacer (Q) on each screw between the tank lugs and cradle lugs, and tighten a lockwasher (R) and hexagon nut (S) on each screw.

(2) Check that all connections to the storage tank are secure and that drain cock (B–1) is in a closed position.

b. Replenisher Assembly.

Note. The key letters shown below in parentheses refer to figure 22.

(1) Position replenisher assembly in clamp assemblies (A) and secure with capscrews (A–1) and hexagon nuts (A–5).

(2) Attach replenisher oil overflow tube (L) to tee (K).

(3) Connect replenisher oil tube (M–5) at front of replenisher assembly.

(4) Attach replenisher-to-cradle tube (R) to elbow (Q) at front of replenisher (fig. 21).

(5) Check that all connections to the replenisher assembly and the cradle are secure and that the drain cock located at the top of replenisher assembly is closed.

Section III. BREECH OPERATING AND FIRING MECHANISM ASSEMBLY

75. Removal

Note. The key letters shown below in parentheses refer to figure 22, except where otherwise indicated.

a. Untie knot in end of firing lanyard (A–1, fig. 20) and remove lanyard from the handle of the breech operating and firing mechanism.

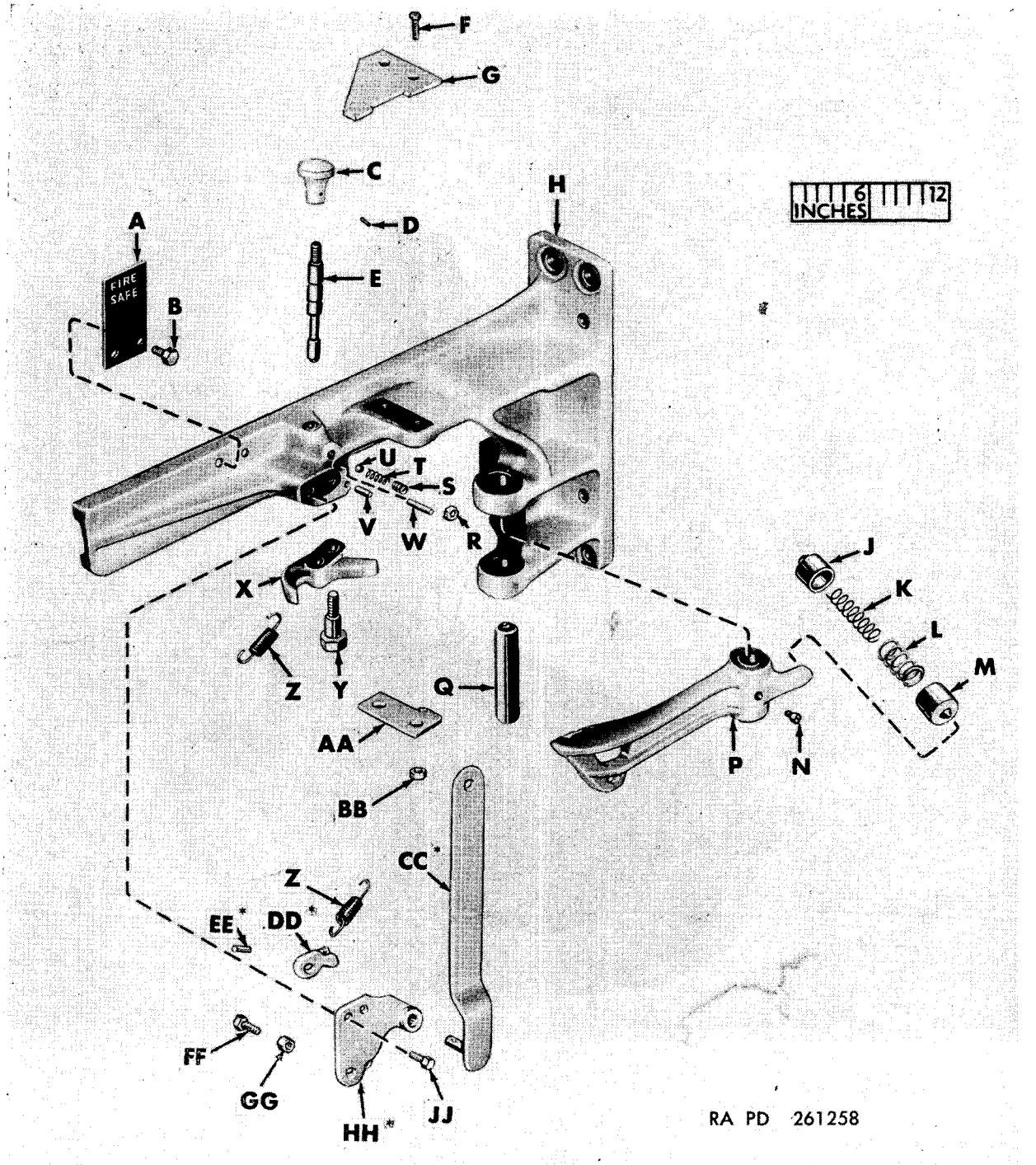
b. Unscrew and remove hexagon-head capscrews (DD) and lockwashers (CC) securing breech operating and firing mechanism (EE) to cradle.

c. Slide breech operating and firing mechanism (EE) off straight pins (BB), and remove the pins from the cradle.

76. Disassembly

Note. The key letters shown below in parentheses refer to figure 24.

a. Remove two springs (Z), one between firing handle fulcrum (DD) and plate (AA), the other between firing arm fulcrum (HH) and firing lever (X).



* COMPONENTS OF HANDLE, ASSY—8368427

A—Safety control position indicator plate 7384029
B—1/4 x 5/8 ext-teeth lockwasher hexagon-hd bolt 425580
C—Safety rod knob 7120255
D—1/8 x 1/2 straight pin 14110
E—Safety rod 7723157
F—1/4 x 1-1/4 hexagon-hd cap screw 123737
G—Firing handle stop plate 8368422
H—Breech operating and firing mechanism bracket 7723165
J—1-1/8-in. od operating cam spring inner retainer 5187498
K—Breech operating cam inner spring 7111325
L—Breech operating cam outer spring 7111324
M—1-1/4-in. od operating cam spring outer retainer 5187497

Figure 24. Mount M85—breech operating and firing mechanism.

N—3/8 x 5/8 setscrew 5188000
P—Breech operating cam 7995819
Q—3-7/8 lg x 0.749 dia. straight pin 7725425
R—3/8 x 9/16 x 7/32 plain hexagon nut 124925
S—3/8 x 7/8 oval-pt hexagon-socket setscrew 138737
T—0.25 od, 9 coil, compression spring 506554
U—1/4-in. ball bearing 104918
V—1/16 x 5/8 dl-rd straight pin 505469
W—3/16 x 1 straight pin 141350
X—Firing lever 7723164
Y—3/8-in. hexagon-hd bolts 7120253
Z—Firing lever spring 5167466
AA—Firing lever spring plate 8368421
BB—1/4 x 7/16 x 5/16 self-locking hexagon nut 503339
CC—Firing handle 8368416
DD—Firing handle fulcrum 8368425
EE—1/16 x 1 straight pin 141159
FF—1/4 x 1-1/2 hexagon-hd capscrew 100112
GG—1/4 x 7/16 x 5/32 plain hexagon nut 124818
HH—Firing arm fulcrum 8368426
JJ—1/4 x 3/4 hexagon-hd assembled washer bolt 425581

(Fig. 24 Cont.)

b. Unscrew and remove washer bolts (JJ) that secure firing arm fulcrum (HH) and other components of the handle assembly to the breech operating and firing mechanism bracket (H). Remove capscrew (FF) and hexagon nut (GG) from firing arm fulcrum (HH).

c. If necessary, disassemble handle assembly by driving out straight pin (EE) that secures firing handle fulcrum (DD) and firing arm fulcrum (HH) on firing handle (CC). Slide both fulcrums off the handle.

d. Unscrew and remove setscrew (N) that locks straight pin (Q) in the breech operating and firing mechanism bracket (H). Drive out pin and remove breech operating and firing mechanism cam (P), outer retainer (M), two compression springs (K and L), and inner retainer (J).

e. Remove stop plate (G) and plate (AA) by unscrewing capscrew (F) and self-locking hexagon nut (BB).

f. Remove hexagon-head bolt (Y) that secures firing lever (X) to breech operating and firing mechanism bracket.

g. Remove safety control position indicator plate (A) by unscrewing hexagon-head bolts (B) that secure plate to breech operating and firing mechanism bracket.

h. Unscrew and remove hexagon nut (R), setscrew (S), compression spring (T), and ball (U) that secure safety rod (E). Remove safety rod by pulling it out of the breech operating bracket (H). If necessary, remove safety rod knob (C) by driving out straight pin (D) and unscrewing knob from the safety rod (E).

77. Cleaning, Inspection, and Repair

Note. The key letters shown below in parentheses refer to figure 24.

a. Examine the springs (Z) for unserviceability; replace if set, broken, distorted, or reported unserviceable.

b. Examine firing handle (CC), firing arm fulcrum (HH), and firing handle fulcrum (EE) for cracks, distortion, or other evidence of damage. Remove burs and scratches on machined surfaces with a fine stone. Replace damaged parts if repair is impractical. Inspect washer bolt (JJ) for damaged threads; repair if possible.

c. Inspect capscrew (FF) and hexagon nut (GG) for damage to threads. Replace screw or nut if defective.

d. Inspect stop plate (G) and plate (AA) for cracks, distortion, or other signs of wear. Replace any plate damaged beyond repair. Check the threads on both capscrews (F) and self-locking hexagon nuts (BB) for wear; replace if necessary.

e. Examine firing lever (X) and hexagon-head bolt (Y) for cracks, distortion, damaged threads, or other conditions of unserviceability. Replace either part if extensively damaged.

f. Inspect safety rod (E) for scoring, burs, scratches, or nicks. Remove all blemishes with a fine stone or crocus cloth. Pay particular attention to the shoulders of the rod. Examine threads on rod and internal threads of rod knob (C). Repair threads if necessary. Replace knob or rod if worn or damaged beyond repair.

g. Examine safety control position indicator plate (A) for scratches or scoring or other damage. Be certain that the words "FIRE" and "SAFE" are legible. Check that threads of hexagon-head bolt (B) are not damaged or stripped. Replace any defective part.

h. Inspect ball bearing (U) for signs of wear or pitting. Replace ball at the slightest indication of wear.

j. Examine compression spring (T), setscrew (S), and hexagon-nut (R) for unserviceability. Spring should be replaced if damaged, set, or

reported unserviceable. Replace nut or screw if damaged threads cannot be repaired.

k. Inspect straight pin (Q) for scoring or wear. Replace pin if damaged.

l. Examine spring retainers (J and M) and cam inner and outer springs (K and L) for evidence of wear or distortion. Replace any defective part.

m. Remove all burs, scratches, and deformation from sliding surfaces of breech operating cam (P) with a fine stone or crocus cloth. Pay particular attention to that end of the cam where contact is made with the outer retainer (M) and be certain that it is free from burs and scratches. Inspect the threaded hole and straight pin hole in the cam; repair threads and remove nicks or burs from interior and shoulders of straight pin hole. Replace setscrew (N) if threads are damaged beyond repair.

n. Examine breech operating and firing mechanism bracket (H) for scores, cracks, or other damage. Machined surfaces must be free of scores, burs, and scratches. Inspect all threaded holes, and repair damaged threads where possible. If bracket cannot be repaired, replace it.

78. Assembly

Note. The key letters shown below in parentheses refer to figure 24.

a. If safety rod knob (C) was removed, screw it on the end of safety rod (E) and secure with straight pin (D).

b. Insert safety rod (E) in its receiving hole in the top of the breech operating and firing mechanism bracket (H). Insert ball bearing (U), compression spring (T), setscrew (S), and hexagon nut (R) in their receiving hole on the side of the bracket and secure safety rod (E).

c. Secure safety control position indicator plate (A) to breech operating and firing mechanism bracket (H) with two hexagon-head bolts (B).

d. Install firing lever (X) on bracket (H) with hexagon-head bolt (Y).

e. Position stop plate (G) on top and spring plate (AA) on bottom of bracket (H). Secure both to bracket with capscrews (F), inserted from top, and self-locking hexagon nuts (BB).

f. Insert the inner retainer (J) into its bore in the breech operating and firing mechanism bracket (H). Place the small inner spring (K) in the inner retainer. Place the large outer spring (L) over the inner spring, then position the outer retainer (M) over both springs and the inner retainer. Hold these in position by placing breech operating cam (P) on the breech operating and firing mechanism bracket (H).

g. Insert the straight pin (Q) through the bottom pinhole on the bracket (H). Push the pin up through the breech operating cam (P) as far as it will go, and rotate the pin until its small hole is alined with the hole in the breech operating cam. Insert setscrew (N) and screw in until tight.

h. If handle assembly was disassembled, first slide firing arm fulcrum (HH), then firing handle fulcrum (DD) on the shaft of firing handle (CC). Aline hole in fulcrum (DD) with the hole in shaft of handle (CC) and insert straight pin (EE).

j. Insert hexagon nut (GG) and capscrew (FF) into their receiving hole in the firing arm fulcrum (HH).

k. Secure the handle assembly to the breech operating and firing mechanism bracket (H) by fastening the assembly with washer bolts (JJ) inserted in their holes in the firing arm fulcrum (HH).

l. Replace springs (Z), one between firing handle fulcrum (DD) and spring plate (AA), the other between firing arm fulcrum (HH) and firing lever (X).

79. Installation

a. Position straight pins (BB, fig. 22) in their receiving holes in the back of the cradle.

b. Place breech operating and firing mechanism assembly (EE, fig. 22) on straight pins, and secure assembly to cradle with capscrews (DD, fig. 22) and lockwashers (CC, fig. 22).

c. Insert end of firing lanyard (A–1, fig. 20) through hole in top of firing handle (CC, fig. 24) and secure by tying knot in end of lanyard.

d. Functionally check operation of breech operating and firing mechanism assembly (TM 9–7204).

Section IV. PULLEY AND LANYARD ASSEMBLY

Note. The key letters shown below in parentheses in this section refer to figure 20.

80. Disassembly

a. Untie firing lanyard (A–1) from breech operating and firing mechanism assembly (par. 64*a*).

b. Slide lanyard through right pulley (A–10) and left pulley (A–2), and remove.

c. Unscrew hexagon nuts (A–9) and screws (A–11) from right attaching plate (A–8) and remove right pulley (A–10).

d. Remove right attaching plate (A–8) by unscrewing and removing machine bolts (A–6) and lockwashers (A–7).

e. Spread "S" chain hook (Z–3), and remove left pulley (A–2) and hook from left attaching plate (A–4).

81. Cleaning, Inspection, and Repair

a. Examine firing lanyard (A–1) for signs of wear or deterioration. If necessary, large knot at left end of lanyard may be untied to give slack if other end is frayed or worn and must be cut. Replace lanyard if necessary.

b. Inspect both pulleys (A–2 and A–10) for indications of wear or excessive damage. Use a fine stone or file to remove any burs or scratches on the face of the pulley that would tend to cut the firing lanyard.

c. Check the attaching plates (A–4 and A–8) for cracks, distortions, or signs of excessive wear. Replace either plate if damaged beyond repair.

d. Inspect "S" chain hook (A–3) for signs of failure due to repeated bending; replace if damaged.

e. Inspect all bolts, nuts, and screws for indications of damage to threaded portions. Repair threads with a tap, fine stone, or file. If repair is impossible, replace defective parts.

82. Assembly

a. Attach left pulley (A–2) to left attaching plate (A–4) with "S" chain hook (A–3). Pinch hook with pliers to assure a secure connection.

b. Position right attaching plate (A–8) over its receiving holes on the cradle and secure with machine bolts (A–6) and lockwashers (A–7).

c. Attach right pulley (A–10) to right attaching plate with hexagon nuts (A–9) and screws (A–11).

d. Slide unknotted end of firing lanyard (A–1) through left pulley (A–2) and right pulley (A–10) and secure to breech operating and firing mechanism assembly (par. 79*c*).

Section V. RECOIL MECHANISM

83. General

a. Disassembly of the concentric recoil mechanism (fig. 25) requires partial disassembly of the howitzer M49 and disassembly of mount M85 into component assemblies.

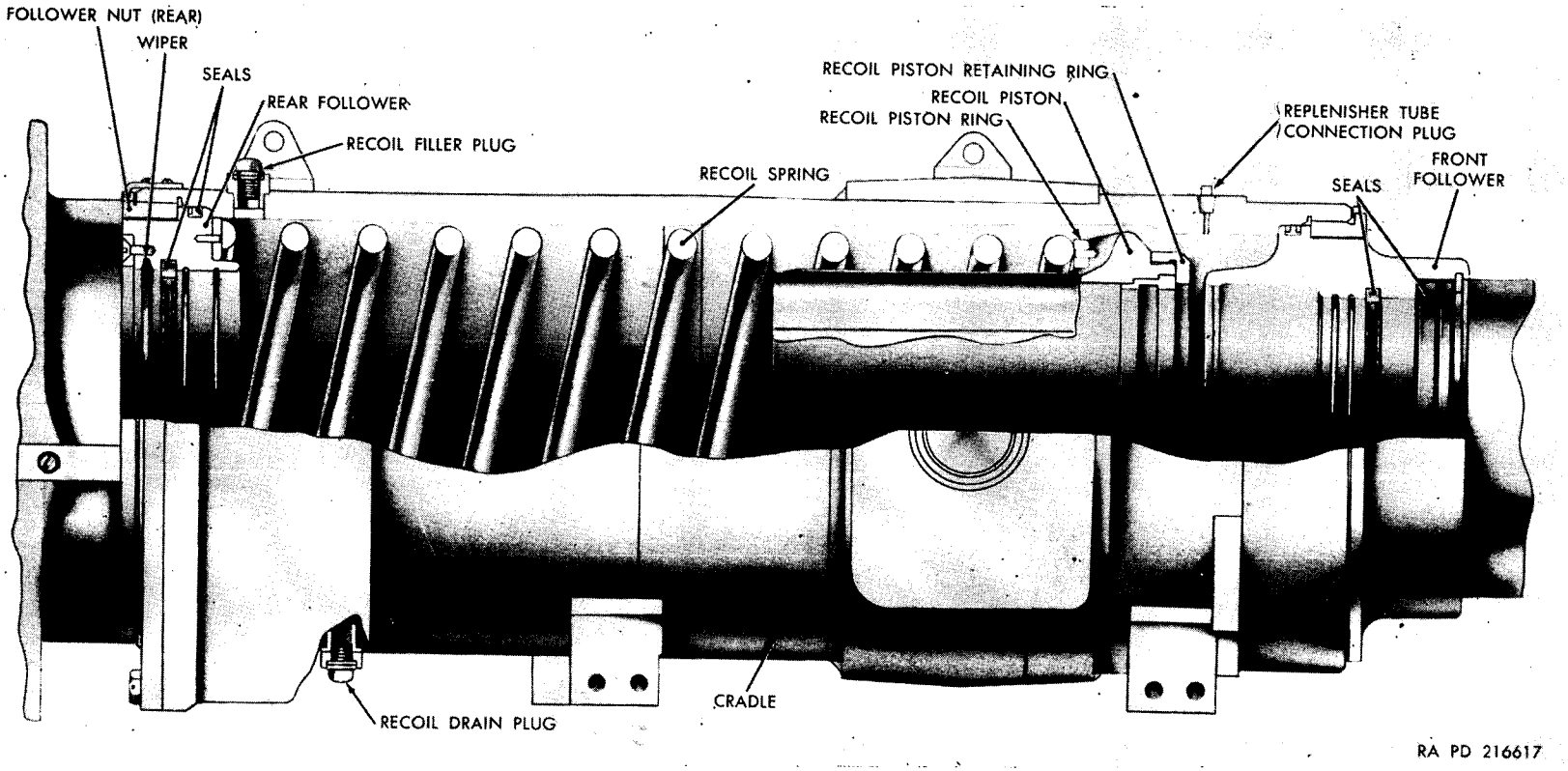


Figure 25. 105-mm howitzer mount M85—concentric-type recoil mechanism—cutaway view.

b. Perform the following removal operations before proceeding with disassembly of recoil mechanism (par. 84):

(1) Evacuator chamber group (par. 37).
(2) Mount shield assembly, trunnion bearings, rotor, and elevation rack (par. 64).
(3) Replenisher assembly and overflow storage tank (par. 70).
(4) Breech operating and firing mechanism assembly (par. 75) and pulley and lanyard assembly (par. 80).

84. Disassembly

a. Care of Recoil Oil.

(1) Care must be exercised not to permit moisture to get into recoil mechanism through open plug holes. Exposure of hydraulic oil to atmosphere in an open can is to be avoided in order to keep out moisture and dirt. The use of cans without covers or of cans with condensed water on inner walls is prohibited. Condensation in a container partly filled with oil or pouring from one container into another with moisture on its inner walls results in moisture being carried along with the oil into the recoil mechanism.

(2) Hydraulic oil should be tested for presence of water. Fill a clean glass bottle with hydraulic oil and allow oil to settle in a warm place. If water is present, it will settle on the bottom of the glass bottle. Also, if bottle is tipped slightly, drops or bubbles will form in lower portion. Invert bottle and hold it to the light. If water is present, drops or bubbles of water may be seen slowly settling in the oil. A cloudy appearance may be due to particles of water.

(3) If this test shows that water is present, the oil on hand should not be used.

(4) The transfer of hydraulic oil to a container not marked with the name of the oil may result in the wrong oil being placed in the recoil mechanism or in the use of hydraulic oil for lubricating purposes. Hydraulic oil must not be put into an unmarked container. Dirty hydraulic oil should be replaced with new oil, except in an emergency when it may be strained through clean cloth before reuse. Do not mix hydraulic oil with any other type oil. If it becomes necessary to mix hydraulic oils, consult TB ORD 586.

b. Unscrew Rear Follower Nut.

Note. The breech ring key can be removed to reduce the effort required to unscrew the rear follower nut.

Using hook spanner wrench 7950730 (fig. 8), unscrew rear follower nut (A, fig. 33) from cradle.

c. Free Cradle from Recoil Spring. Insert compressed air hose into recoil mechanism fill hole (fig. 26). Tie a heavy rope around the howitzer tube, 12 to 18 inches ahead of the front follower. Apply compressed air until cradle is started in motion off the recoil spring.

***Caution:* A pressure of 40 to 60 psi should be sufficient to free the cradle. Pressure in excess of 75 psi will cause damage to the oil seals. If the cradle does not move with the 75 psi, release pressure. Unscrew and remove capscrew (L, fig. 32) and lockwasher (M, fig. 32) that prevent rotation of front follower nut. Unscrew the front follower nut (fig. 27), using hook spanner wrench 7950730. Remove the front follower nut. Blow out the front follower with compressed air (fig. 26).**

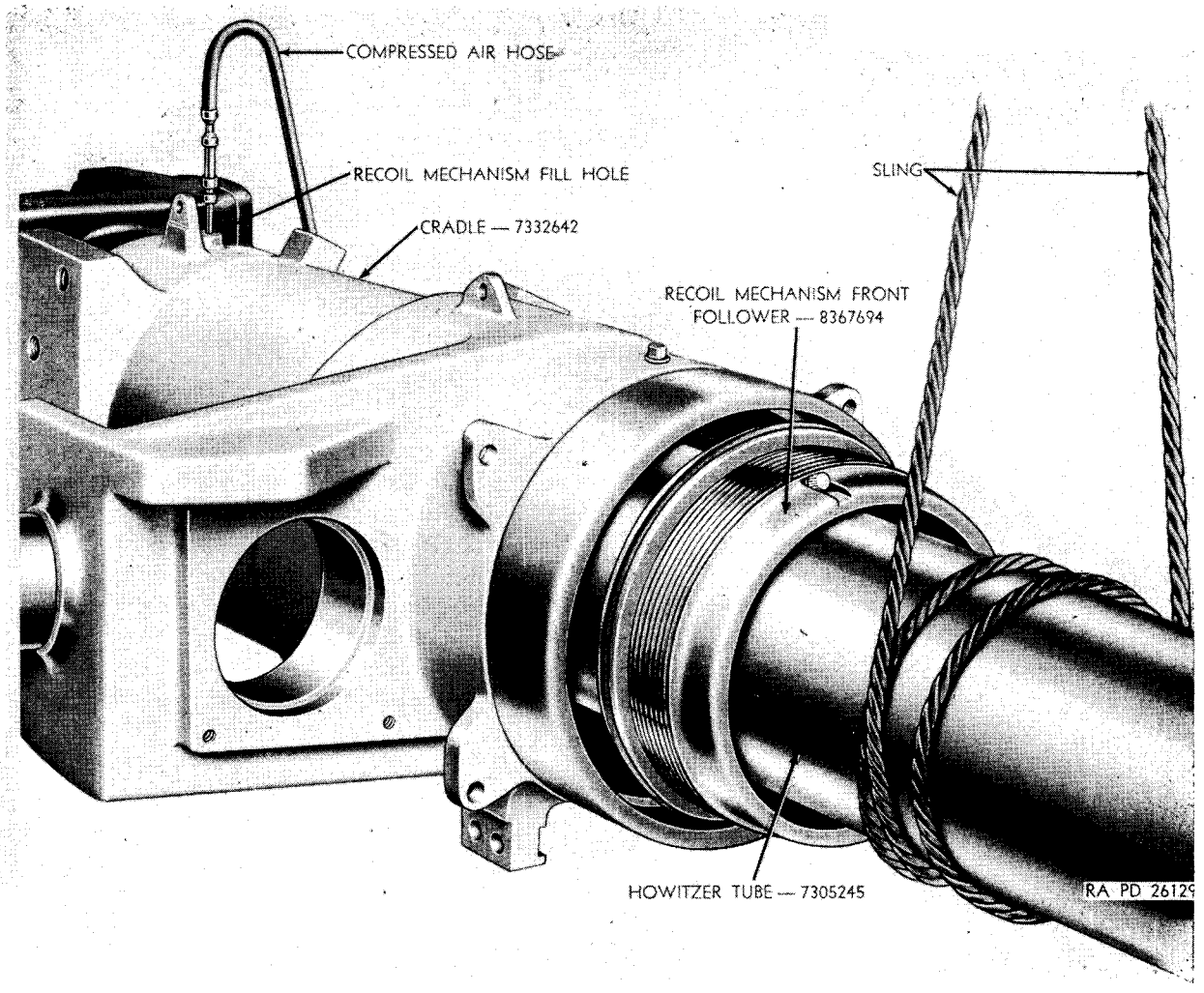


Figure 26. Mount M85—blowing out recoil mechanism front follower, using compressed air.

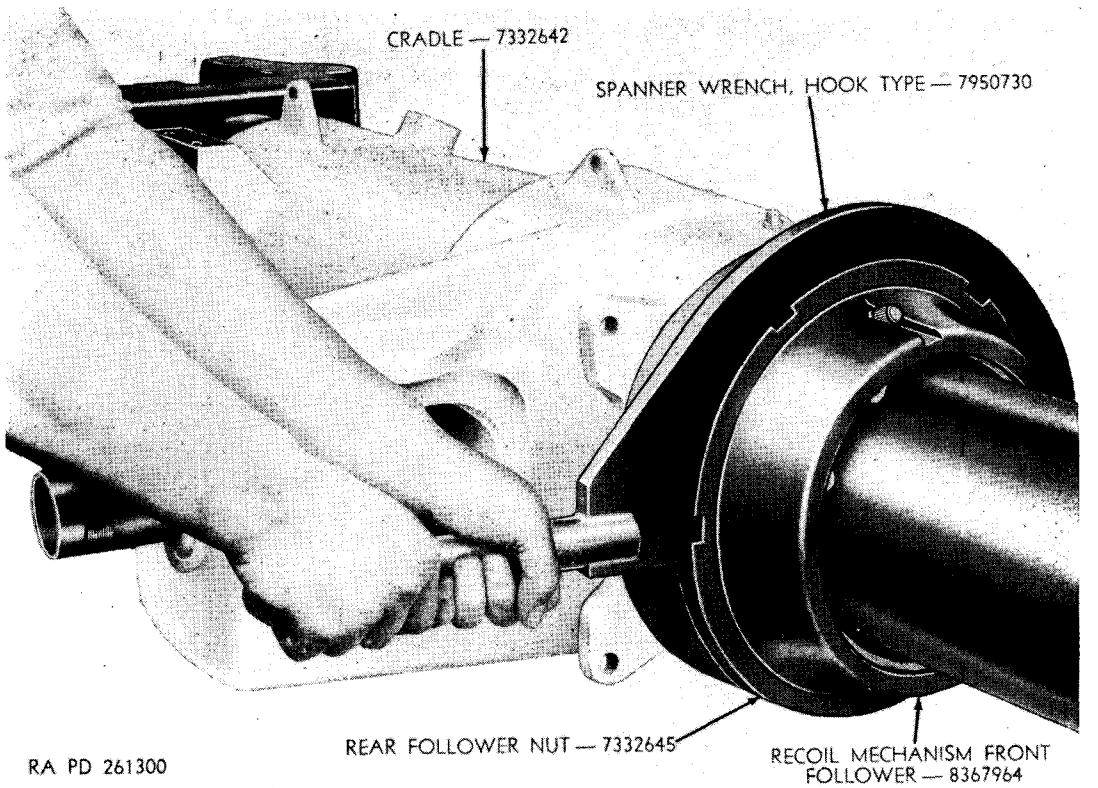


Figure 27. Mount M85—removing recoil mechanism front follower nut.

d. Remove Cradle. Remove rope tied around howitzer tube. Supporting the cradle in a suitable sling (fig. 28), pull the cradle and front follower off the recoil spring and remove them from the howitzer.

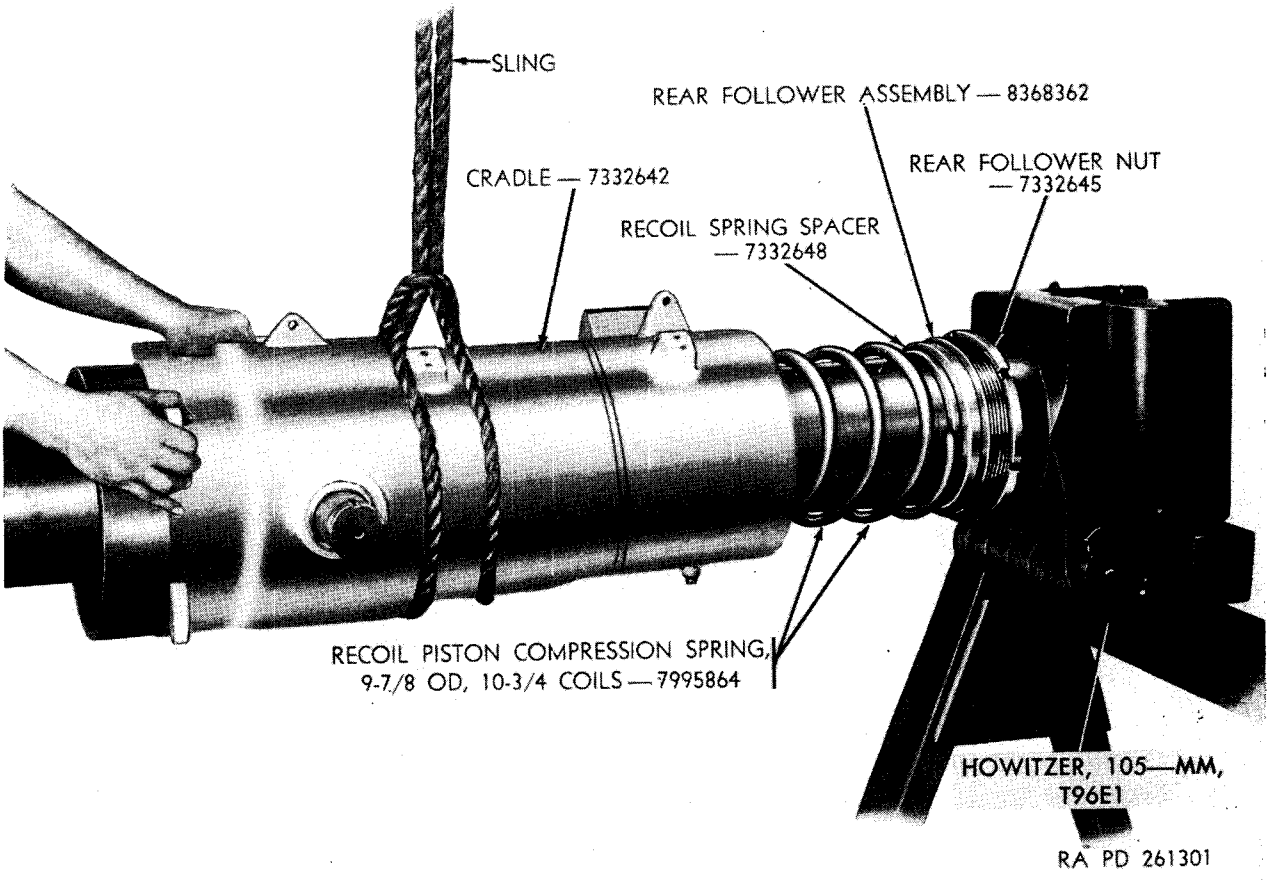


Figure 28. Mount M85—removing cradle.

e. Remove Recoil Piston Retaining Ring.

(1) Install recoil piston spring compressor 8390144 (fig. 29) on the howitzer and recoil piston spring. Be certain that the spring compressor fits tightly against the breech ring and recoil mechanism piston.

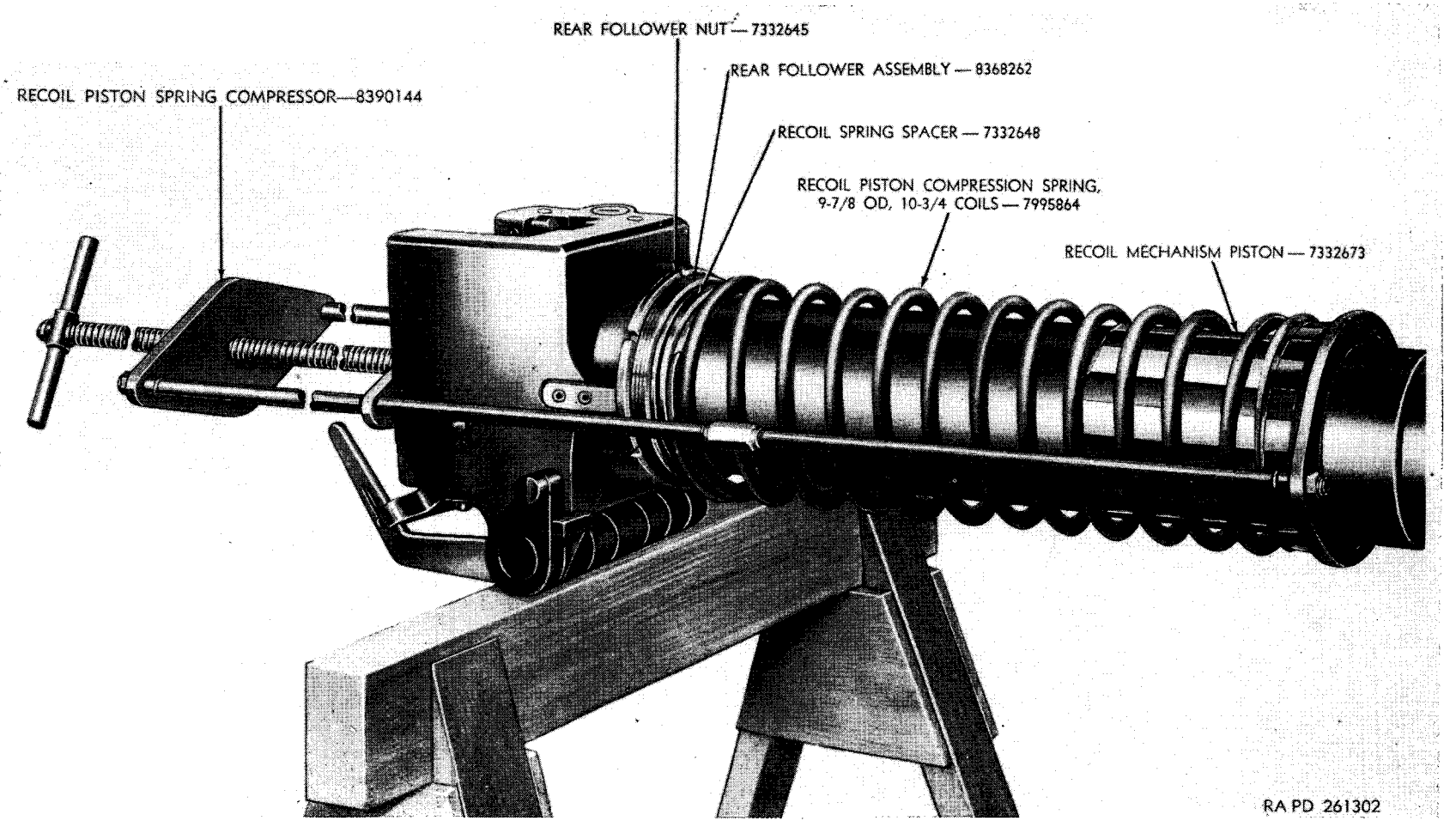


Figure 29. Mount M85—recoil mechanism piston spring.

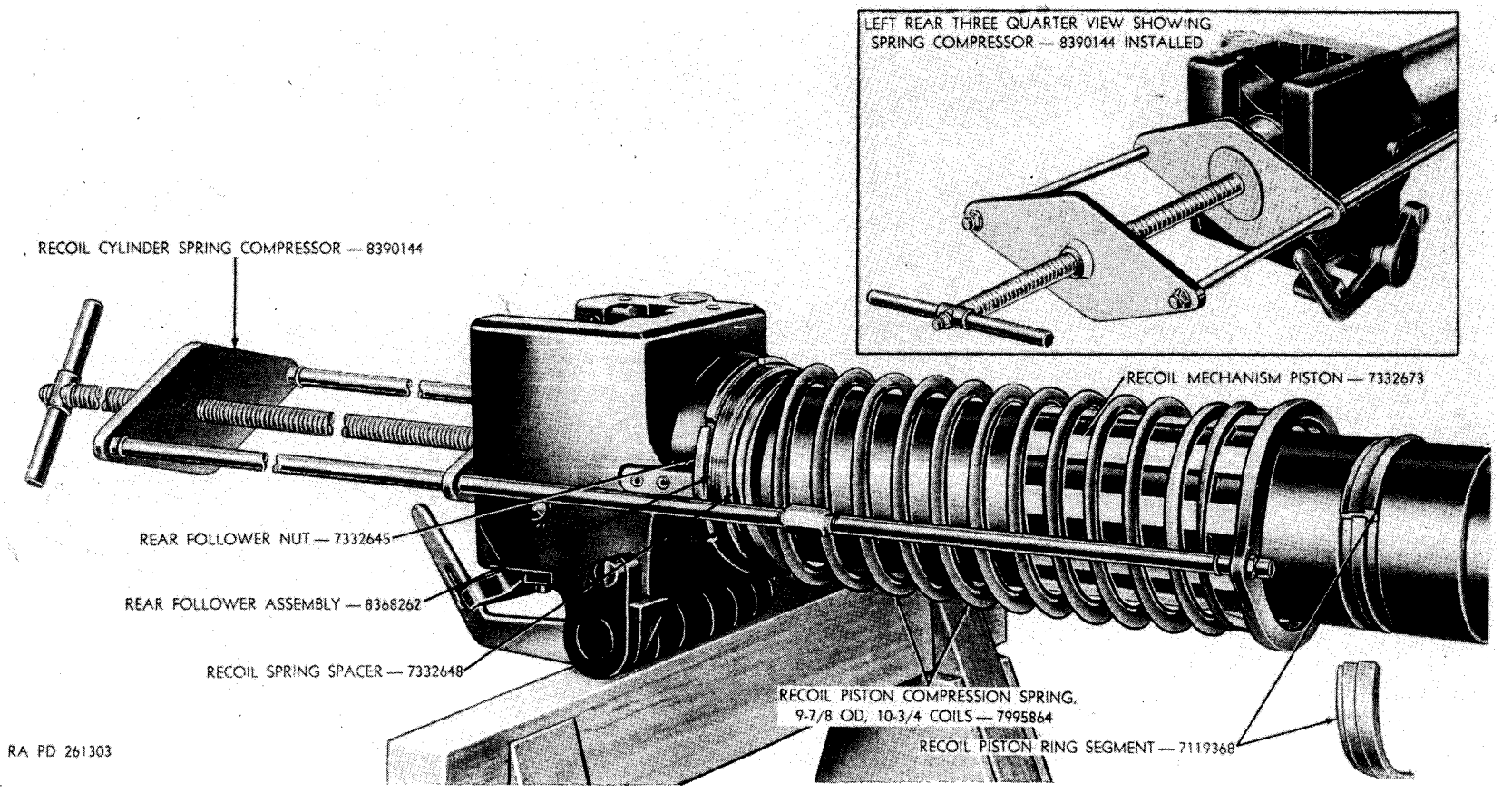


Figure 30. Mount M85—recoil mechanism piston spring compressed to remove recoil piston ring segment.

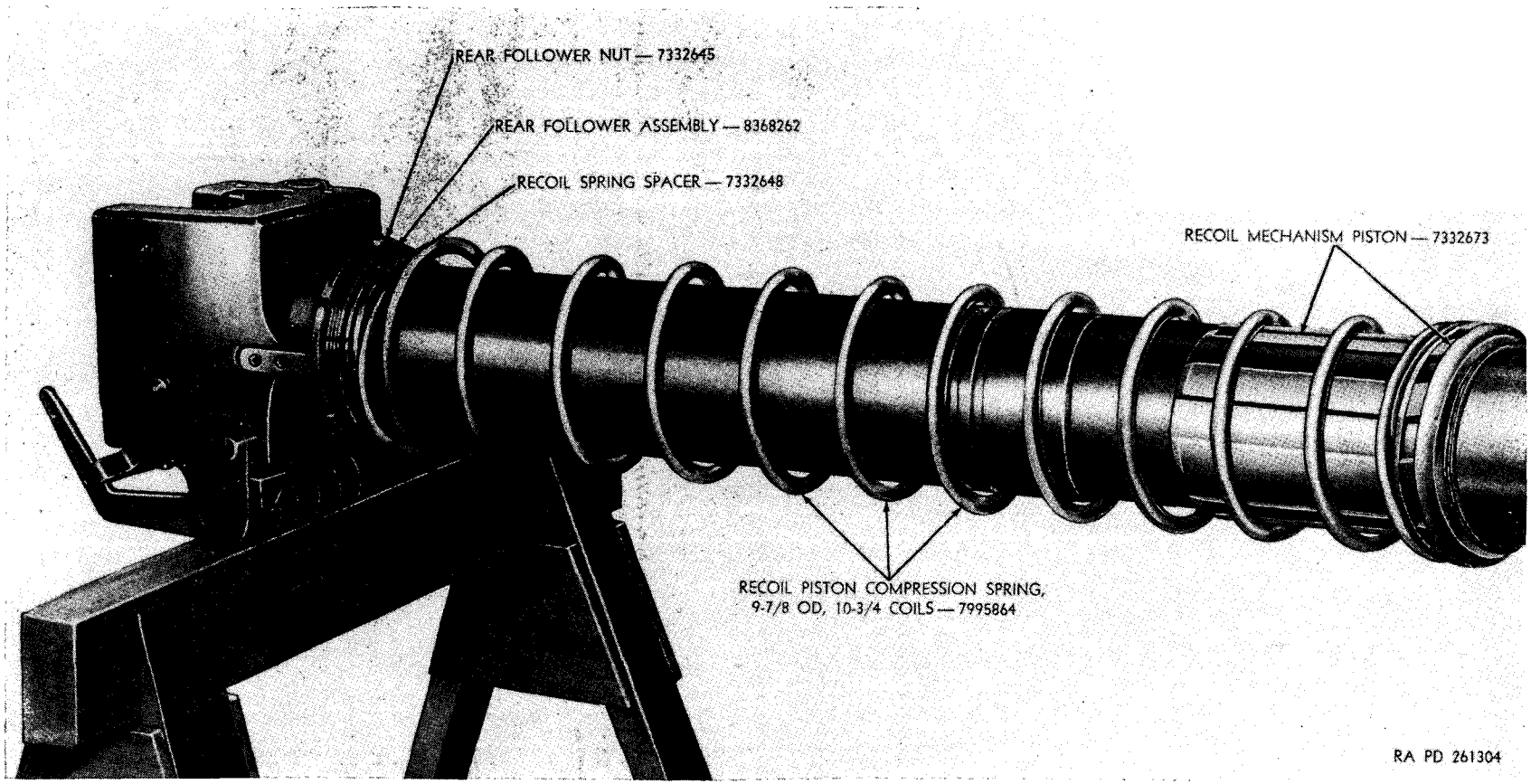
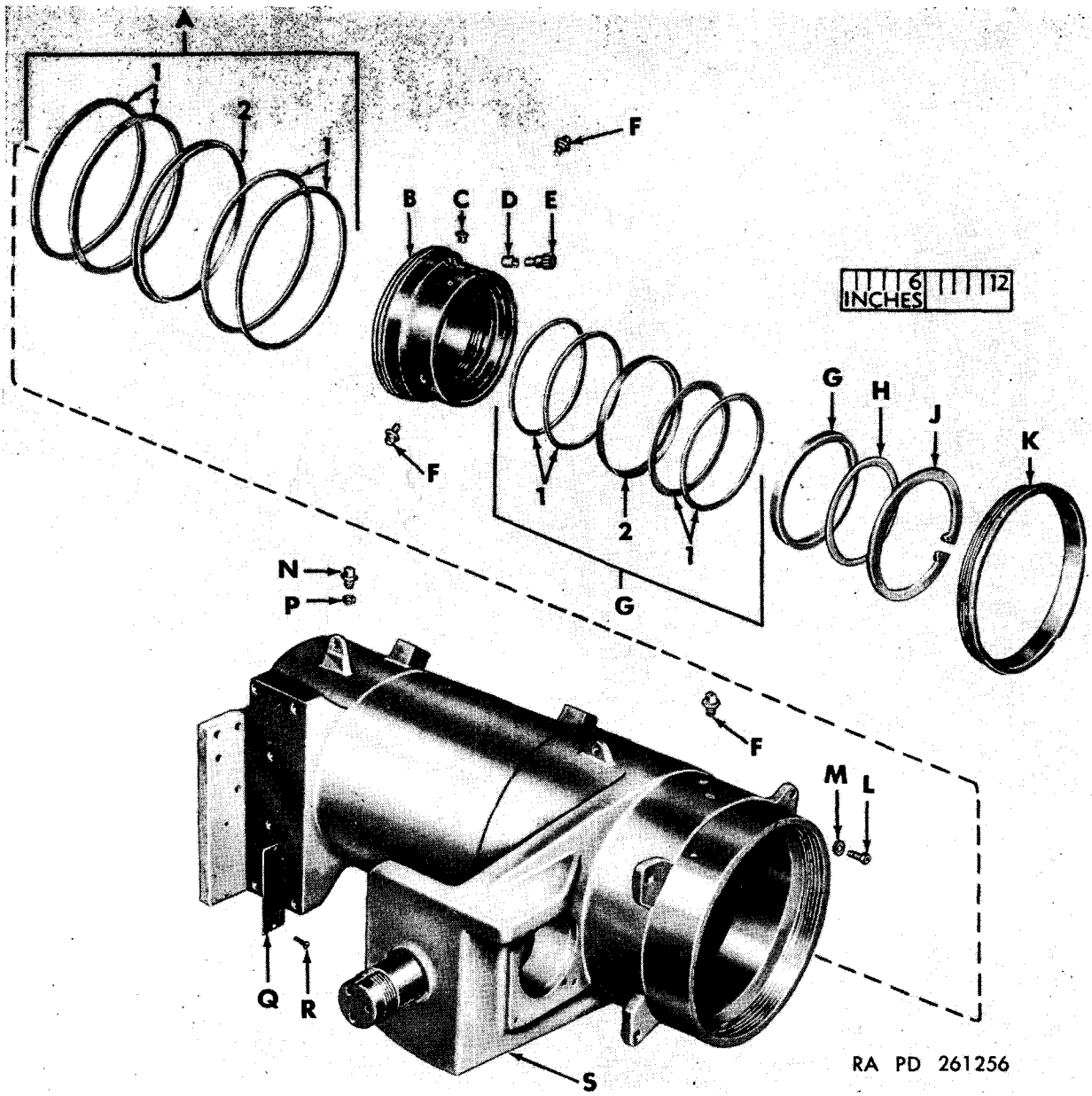


Figure 31. Mount M85—recoil mechanism piston spring released for removal.



A—Front follower inner seal assy 7758906
1—Front follower inner ring 7758908
2—Front follower inner seal packing 7758907
B—Front follower 8367694
C—Buffer locking spring 7732799
D—Buffer regulator oil seal 7537168
E—Recoil cylinder regulator buffer 8668616
F—1/8-in. solid-hd pipe plug 117243
G—Front follower inner seal assy 7120229
1—7.000 id x 7.3750 od ring seal 7120227
2—7.362 id x 7.517 od x 0.366 thk packing 7120228
H—7 id x 8.009 od oil seal 7724995
J—8.527-in. od retaining ring 7724069
K—Follower nut 7332645
L—No. 8 x 3/8 socket-hd capscrew 442034
M—No 8 int-teeth lockwasher 138530
N—1/2-in. squarehead drain and fill plug 7037928
P—0.56 id x 0.75 od x 0.125 thk gasket 5160098
Q—Recoil mechanism nameplate 7981159
R—No. 10 x 3/8 roundhead drive screw 142281
S—Outer cylinder cradle 7332642

Figure 32. Mount M85—concentric-type recoil mechanism.

(2) Unscrew and remove setscrew (N, fig. 33) from recoil piston retaining ring. Using spanner wrench 7083666 (table I), unscrew and remove recoil piston retaining ring (P, fig. 33).

f. Remove Recoil Piston Ring Segment. Rotate handle of spring compressor 8390144 clockwise, compressing recoil spring until the recoil piston uncovers the recoil piston ring segment (fig. 30). Remove the ring segment from its annnular groove in the howitzer tube.

g. Remove Recoil Piston and Recoil Spring.

(1) Rotate handle of spring compressor 8390144 counterclockwise, releasing tension in the recoil spring, and allow the spring to expand until it is fully extended (fig. 30). Remove spring compressor.

(2) Carefully pull recoil piston spring and recoil piston from muzzle end of howitzer tube, removing them from the tube.

h. Remove Rear Follower Assembly.

(1) Place split ring segments 8390011 in annular grooves on howitzer tube to prevent damage to rear follower seals.

(2) Carefully remove recoil piston spring spacer, rear follower assembly, and rear follower nut (fig. 30) from the howitzer tube by sliding them off the muzzle end.

(3) Remove split ring segments from annular grooves.

Note. If recoil mechanism is being disassembled just to remove howitzer tube, only operations *a* through *h* above need to be performed. If further disassembly of recoil mechanism is required, proceed as follows:

i. Front Follower and Related Parts.

Note. The key letters shown below in parentheses refer to figure 32, except where otherwise indicated.

(1) Unscrew and remove regulator buffer (E) and buffer regulator oil seal (D) from front follower.

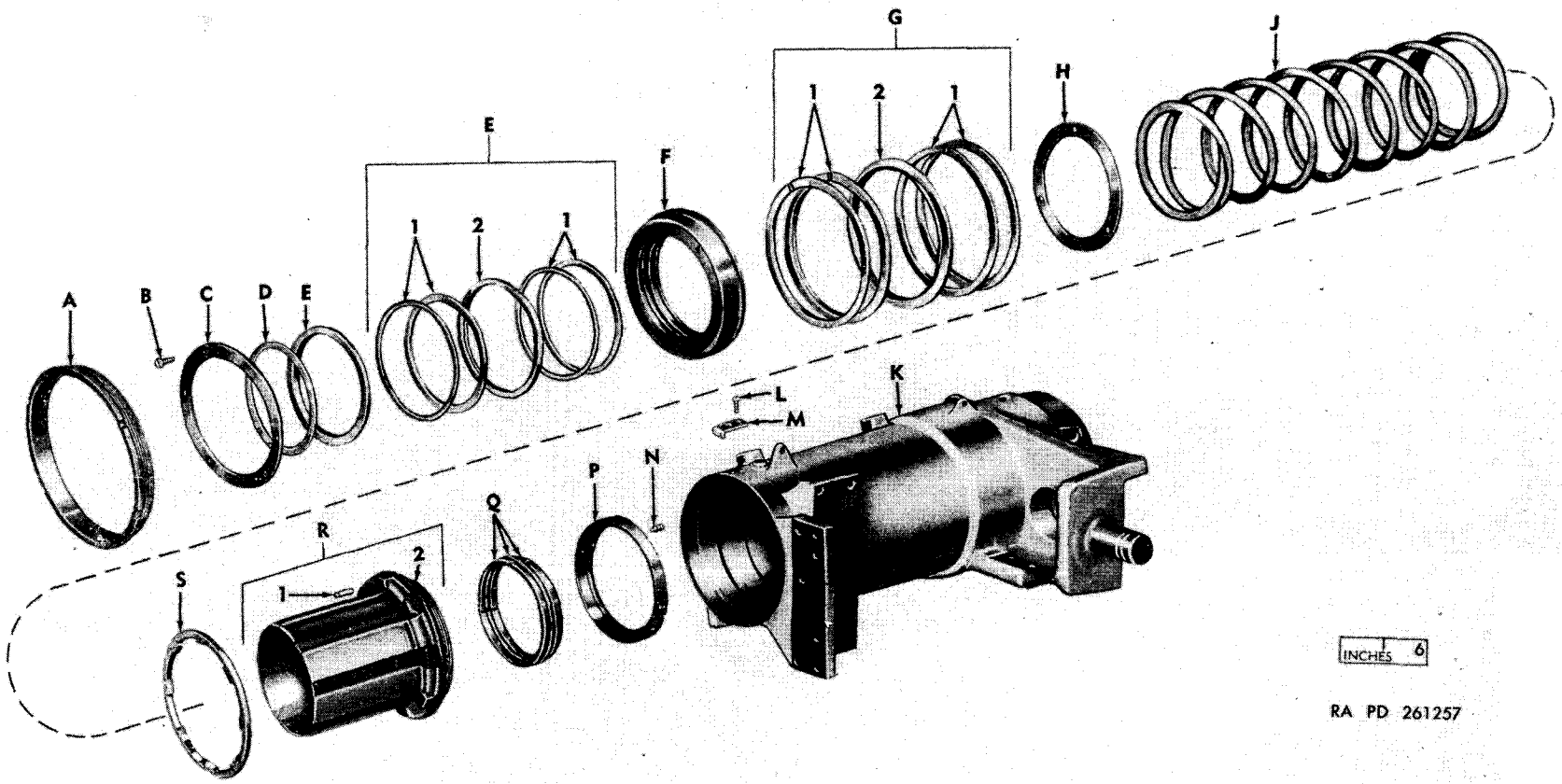
(2) If necessary, remove oil seals (par. 73), retaining ring (J), and oil seal (H) to permit removal of outer and inner end seals (A and G) from inside front follower.

(3) Do not remove the buffer locking spring (C) from the front follower unless there is evidence that it has not been performing its holding function properly. If necessary, pry it from the follower and replace with a new unit.

j. Rear Follower and Related Parts.

Note. The key letters shown below in parentheses refer to figure 33.

(1) Unscrew and remove machine screws (B) securing rear follower fiber washer (C) and shock washer (D) to rear follower. Remove the washers.



A—Rear follower nut 7332645
B—No. 10 x 5/8 flathead machine screw 133569
C—Rear follower hard fiber washer 7119369
D—Rear follower wiper 7720332
E—Rear follower inner seal assy 7720333
1—7.506 id x 7.586 od x 0.042 thk plastic ring 7720335
2—7.735 id x 8.000 od x 0.366 thk syn-ru packing 7720334
F—Rear follower 7995957
G—Rear follower outer seal assy 7758906
1—10.260 id x 10.610 od lam plastic ring seal 7758908
2—10.115 id x 10.481 od x 0.366 thk syn-ru packing 7758907
H—Spacer 7332648
J—Recoil piston spring 7995864
K—Outer cylinder cradle 7332642
L—No. 8 x 1/4 roundhead tapping screw 171350
M—1-1/2-in. locking key 7332756
N—1/4 x 3/8 cup-pt hexagon-socket setscrew 221182
P—9.125 od x 1 w retaining ring 7720342
Q—Key ring segment 7119368
R—Recoil mechanism piston assy 7332673
1—3/16 x 1/2 straight pin 141151
2—Recoil piston 7332646
S—9.750 od x 8.125 id ring 7332647

Figure 33. Mount M85—concentric-type recoil mechanism.

(2) Remove recoil piston spring spacer (H) from front face of rear follower.
(3) If necessary, remove outer and inner oil seals (G and E) and shock washer (D) from follower (par. 73).

k. Recoil Piston. Remove recoil piston ring (S, fig. 33) from recoil piston (R, fig. 33).

85. Cleaning, Inspection, and Repair

a. Cradle. Examine the bore of the cradle (K, fig. 33). The surface must be smooth and free from appreciable scores and scratches. Reduce scores or scratches to a minimum with crocus cloth, using longitudinal strokes. Remove all burs, nicks, and sharp edges from shoulders inside of bore with a fine stone. Inspect threads in both ends of bore and clean with a wire brush. Examine threads in all tapped holes and repair if damaged. Replace the ½-inch squarehead drain and fill plugs (N, fig. 32) if threads are damaged. Replace all gaskets. Remove all metal particles and foreign matter from inside of bore, paying particular attention to recesses and grooves.

b. Recoil Piston and Rings.

Note. The key letters shown below in parentheses refer to figure 33.

(1) *Recoil piston.* The bore of the recoil piston (R–2) must be smooth and free from scores or scratches. Reduce scores or scratches to a minimum with crocus cloth, using longitudinal strokes. Remove all nicks and burs from shoulders inside of bore with a fine stone. Examine the external threads and repair if damaged. Examine straight pins (R–1) that hold recoil piston ring. Remove nicks and burs with a fine stone. Replace pin if excessively worn or bent.
(2) *Recoil piston retaining ring.* Inspect the internal threads on the recoil cylinder piston retaining ring (P) and repair if necessary. Examine threads in hole for setscrew (N) and repair threads if damaged. Remove burs, nicks, and scratches from the retaining ring with a fine stone. Replace ring or setscrew if damaged beyond repair.
(3) *Recoil piston ring.* Examine the surfaces of the recoil piston ring (S) for scores or scratches. Reduce these to a minimum with crocus cloth. Remove all burs, nicks, and sharp edges from the shoulders on the inside of the ring with a fine stone. Examine attaching holes for enlargement. Replace piston ring if necessary.
(4) *Recoil piston ring segment.* Remove burs, nicks, and scratches from inside and outside surfaces of all three sections of the recoil piston ring segment (Q) with a fine stone. Replace segment if excessively damaged.

c. Recoil Piston Spring (j, fig. 33). Replace spring if it is cracked or if it fails to meet the requirement of a height of 22-3/16 inches under a minimum load of 1,200 pounds. Normal howitzer recoil is 12 inches, maximum 14 inches.

d. Seals, Gaskets, Packings, etc. All seals, seal assemblies, gaskets, packings, etc., used on concentric recoil mechanism shall be replaced during repair.

e. Front Follower.

(1) Remove burs and scratches from oil seal groove edges of front follower (B, fig. 32) with a fine stone. Exercise care in reconditioning the follower so that internal measurements are not altered; polish with crocus cloth or fine stone. Examine threads in regulator buffer hole and repair if necessary. Remove all metal particles and foreign matter from the follower, paying particular attention to grooves and oil passages.
(2) Examine external threads on regulator buffer (E, fig. 32) and repair the threads if burred or scratched. Replace buffer if excessively damaged.

f. Follower Nuts. The front follower nut (K, fig. 32) and rear follower nut (A, fig. 33) are identical. Remove burs and scratches from exterior surface with a fine stone. Examine and repair if necessary the external threads of the nut. Reduce scores or scratches on interior surface with crocus cloth. If nut is damaged, repair or replace it.

g. Rear Follower Assembly and Related Parts.

Note. The key letters shown below in parentheses refer to figure 33.

(1) Replace rear follower shock washer

(D) if warped, cracked, or otherwise damaged.

(2) Examine threads in tapped holes in rear follower (F) and repair if necessary.

(3) Remove burs and scratches from oil seal groove edges with a fine stone. Exercise care in reconditioning follower so that internal measurements are not altered. Polish followers with crocus cloth. Remove all metal particles and foreign matter, paying particular attention to the grooves. Replace follower if excessively damaged.

(4) Examine recoil spring thrust washer (H). Remove burs and scratches with a fine stone. Replace washer if damaged beyond repair.

56. Assembly

Note. Refer to figure 25 for cutaway view of recoil mechanism. Careful study of this view will aid in the assembly process described in *a* through *l* below.

Note. The key letters shown in parentheses in *a* through g below refer to figure 33, except where otherwise indicated.

a. General. The recoil mechanism is only partially assembled before being installed on the howitzer. Proceed as follows:

(1) *Front follower and related parts.* Install new buffer locking spring (C, fig. 32) in its hole in the front follower if it has been removed (par. 72*j*). Install buffer regulator oil seal (D, fig. 32), and screw regulator buffer (E, fig. 32) into front follower in that order. Install outer and inner oil seals, oil seal, and packing. Install retaining ring (J, fig. 32).

(2) *Rear follower assembly and related parts.* Install new oil seals if removed (par. 85). Install rear follower wiper (D) and new rear follower fiber washer (C) on rear follower inner seal assembly (E) and secure with flathead machine screws (B). Install recoil spring spacer (H) on pins on front face of rear follower.

(3) *Recoil piston.* Install recoil piston ring (S) on recoil mechanism piston assembly (R).

b. Rear Follower Nut. Slide rear follower nut (A), threaded end towards the muzzle, over howitzer tube and rest it against breech ring.

c. Rear Follower Assembly.

(1) Install split ring segments 8390011 (table I) in annular grooves on howitzer tube to prevent damage to rear follower seals.

(2) Examine rear follower to be certain that the follower oil seals and washers are in good condition. Slide rear follower assembly with fiber wiper and recoil spring spacer installed (*a*(2) above), small diameter first, over howitzer tube until it rests against breech ring.

(3) Remove split ring segments 8390011 from annular grooves.

d. Recoil Spring and Piston. Slide recoil piston spring (J) and recoil piston with piston rings attached (small end first) over howitzer tube.

e. Recoil Piston Ring Segment.

(1) Install recoil piston spring compressor as directed in paragraph 84*f*.

(2) Rotate handle of spring compressor 8390144 (fig. 10) clockwise, compressing recoil piston spring enough to install recoil piston ring segments (Q).

(3) Install recoil piston ring segments in annular groove on howitzer tube.

(4) Rotate handle of spring compressor 8390144 counterclockwise to permit recoil piston spring to expand until recoil piston locks into position on piston ring segments.

(5) Install breech ring key if it has been removed (par. 84*b*).

f. Recoil Piston Retaining Ring.

(1) Slide recoil piston retaining ring (P) over howitzer tube, threaded end first. Screw ring onto recoil piston until tight, using spanner wrench 7083666 (table I).

(2) Aline hole in recoil piston retaining ring with hole in recoil piston. Install setscrew (N) to secure ring to piston.

g. Cradle.

(1) Using a suitable hoist, slide cradle (K) over recoil spring and rear follower.

cradle until tight, using hook spanner wrench 7950730 (fig. 8).

(3) Install recoil mechanism rear locking key (M) and secure with tapping screw (L).

h. Front Follower and Front Follower Nut.

Note. The key letters shown below in parentheses refer to figure 32, except where otherwise indicated.

(1) Examine front follower (B) to be certain oil seals are installed and in good condition. Slide front follower over howitzer tube, buffer regulator end towards the muzzle, until tight against cradle.

(2) Slide front follower nut (K) over howitzer tube, threaded end first, and screw into cradle until tight, using hook spanner wrench 7950730 (fig. 8).

(3) Install hexagon-head capscrew (L) and lockwasher (M) to prevent follower nut from rotating.

i. Fill Recoil Mechanism.

(1) Check that all nuts, screws, and plugs have been properly tightened on recoil mechanism.

(2) Fill recoil mechanism in accordance with procedure outlined in TB ORD 586. For specific instructions, see TM 9–7204.

j. Pressure Test. Perform pressure test as directed in paragraph 87.

k. Install and Paint Plugs. Install ½-inch squarehead fill plug in cradle and paint the plug with synthetic orange enamel.

l. Install breech operating and firing mechanism assembly (par. 79), pulley and lanyard assembly (par. 82), replenisher assembly and overflow storage tank (par. 74), mount shield assembly and related parts (par. 68), and evacuator chamber group (par. 39).

87. Pressure Test

a. Install ¼-inch tube and ⅛-inch male pipe end tube elbow (figs. 21 and 34) in replenisher connection hole in front top of cradle. Connect bleeding tube and open bleeding tube petcock.

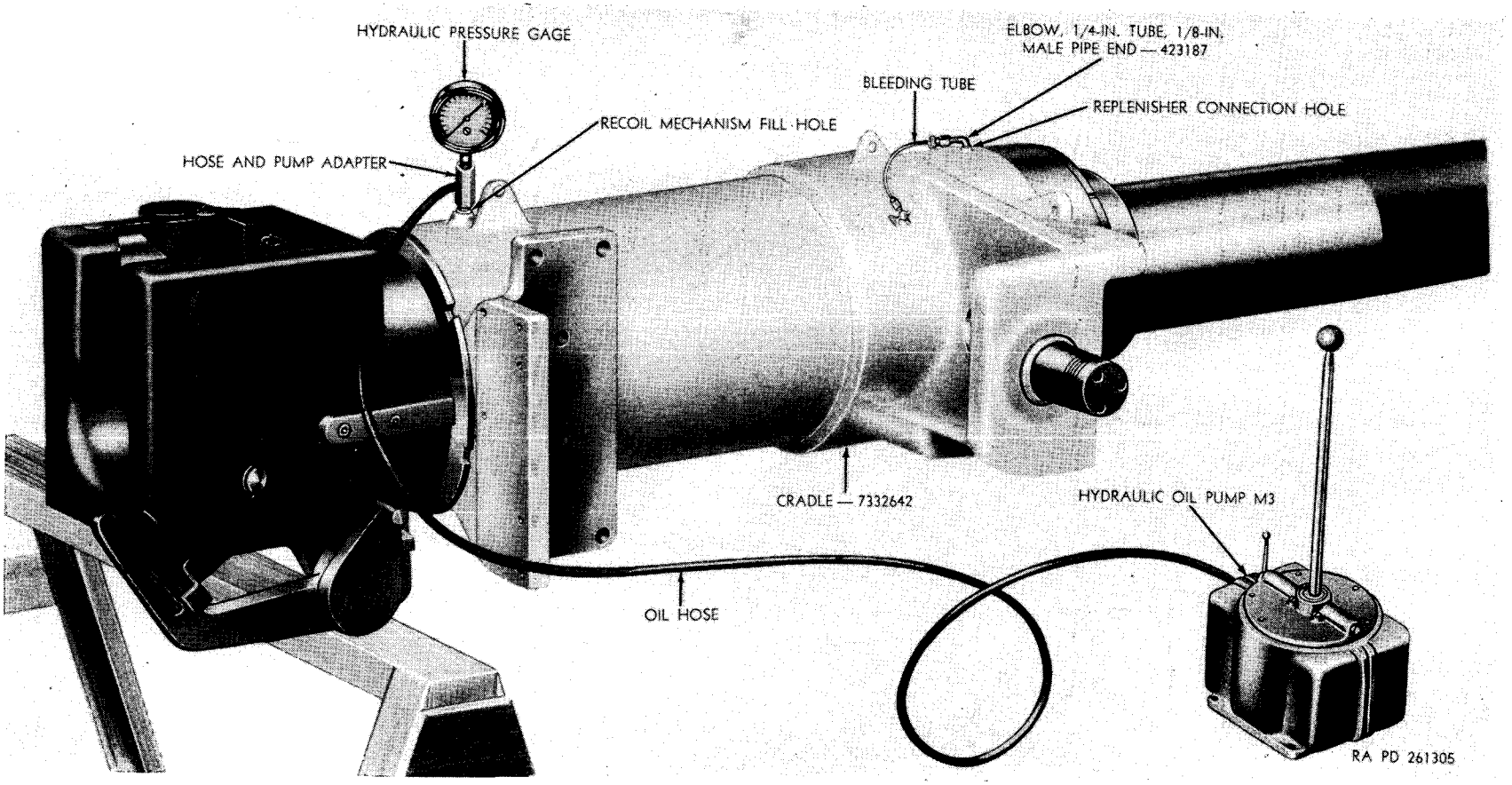


Figure 34. Pressure test.

b. Insert hose and pump adapter in recoil mechanism fill hole at top rear of cradle.

c. Screw hydraulic pressure gage into adapter and connect one end of oil hose to adapter.

d. Connect other end of oil hose to hydraulic oil pump M3.

e. Close petcock in bleeding tube. Apply pressure of 3,000 psi and hold for 5 minutes.

f. Examine front and rear followers for oil leaks. If oil leaks are present, release pressure and remove front and rear followers (par. 84). Replace oil seals, washers, and/or packing as necessary and install howitzer in mount (par. 34).

g. If oil leaks do not occur, release pressure. Remove hydraulic oil pump M3, oil hose, pressure gage, hose and pump adapter, and bleeding tube. Install ½-inch squarehead fill plug.

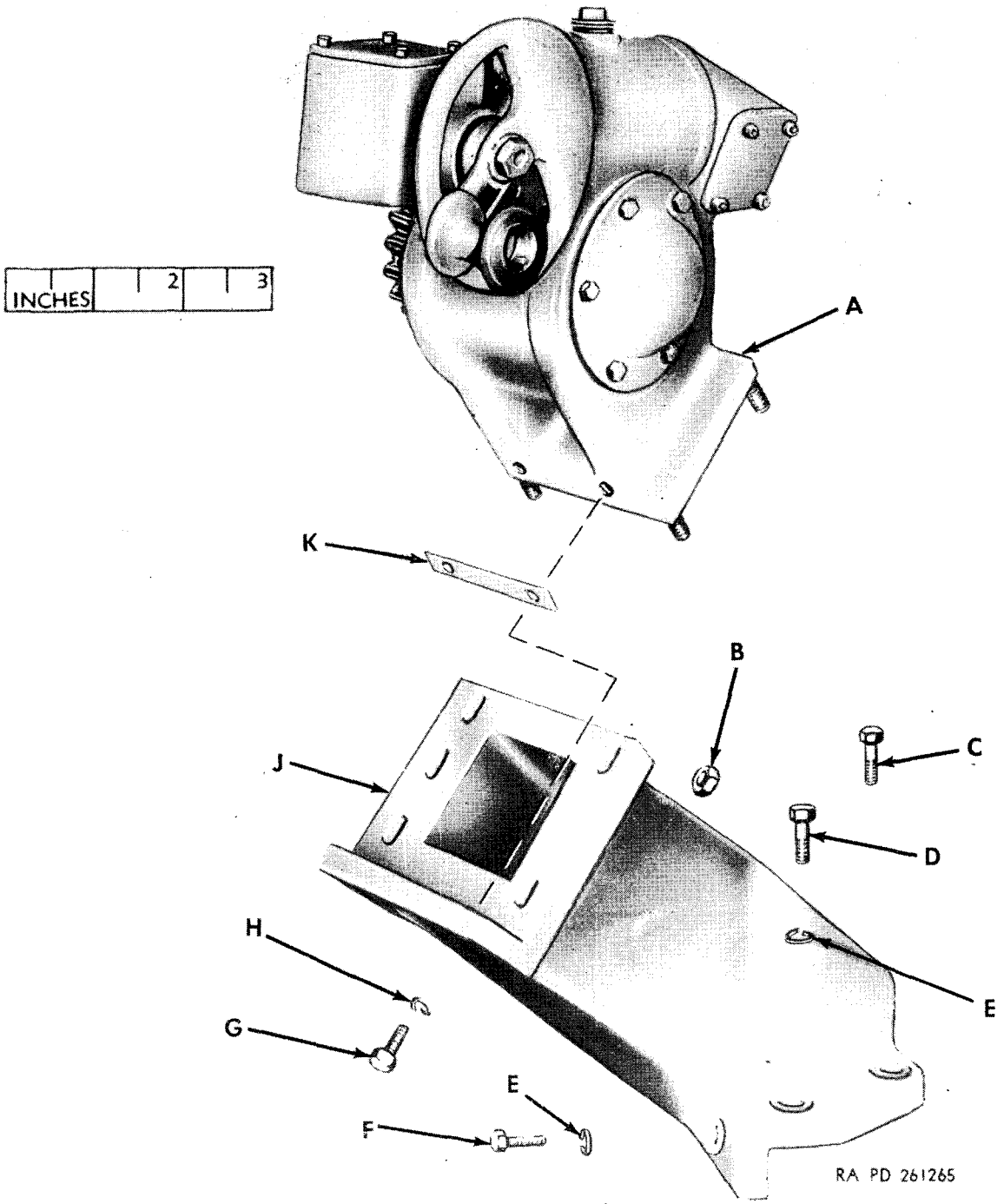
h. Remove elbow from replenisher connection hole in front top of cradle, and install pipe plug to prevent dirt from entering until the replenisher assembly is installed (par. 74).

Section VI. HAND ELEVATING MECHANISM

88. Removal

Note. Key letters shown below in parentheses refer to figure 35, except where otherwise indicated.

a. Unscrew and remove capscrews (F) and lockwashers (E), capscrews (D) and lockwasher (E), and capscrews (C) that secure mounting bracket (J) to turret floor. Remove elevating mechanism from vehicle.



A—Hand elevating mechanism assy 8368359
B—1/2 x 3/4 w x 19/32 thk hexagon-hd self-locking nut 503323
C—5/8 x 1-3/4 hexagon-hd capscrew 223810
D—3/4 x 4-1/4 hexagon-hd capscrew 223834
E—5/8-in. lockwasher 138502
F—⅝ x 1½ hexagon-hd capscrew 223834
G—Hexagon-hd screw 2141192
H—1/2-in. lockwasher 135629
J—Mounting bracket 7333104
K—6-1/4 lg x 1-5/8 overall w x 0.0200 thk shim 7724178
6-1/4 lg x 1-5/8 overall w x 0.0500 thk shim 7724179
6-1/4 lg x 5/8 overall w x 0.0100 thk shim 7724180
Shim 8367709
Shim 8367710
Shim 8367711

Figure 35. Mount M85—hand elevating mechanism assembly with attaching bracket parts.

b. Unscrew self-locking nuts (B) from studs on hand elevating mechanism assembly (A), and remove hexagon-head screws (G) and lockwashers (H).

c. Separate hand elevating mechanism assembly (A) from mounting bracket (J) and remove shims (K).

d. Figure 36 shows the schematic view of the hand elevating mechanism.

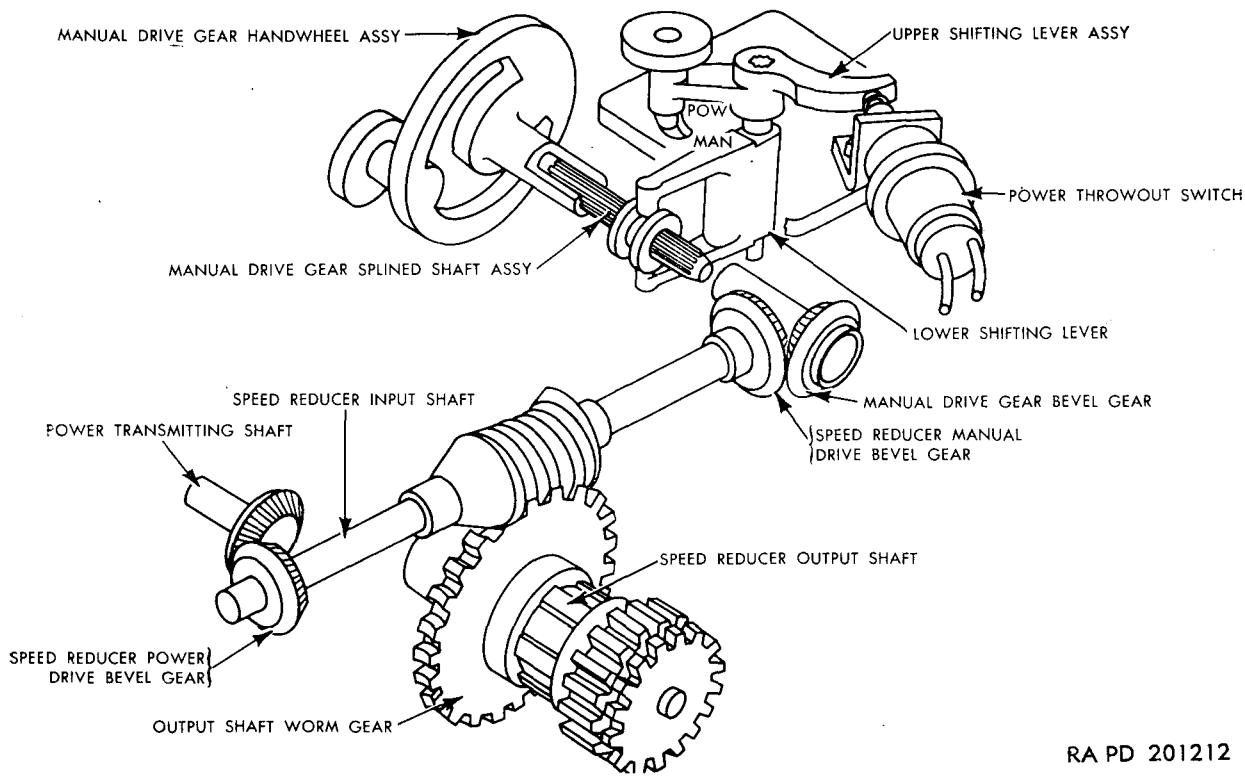


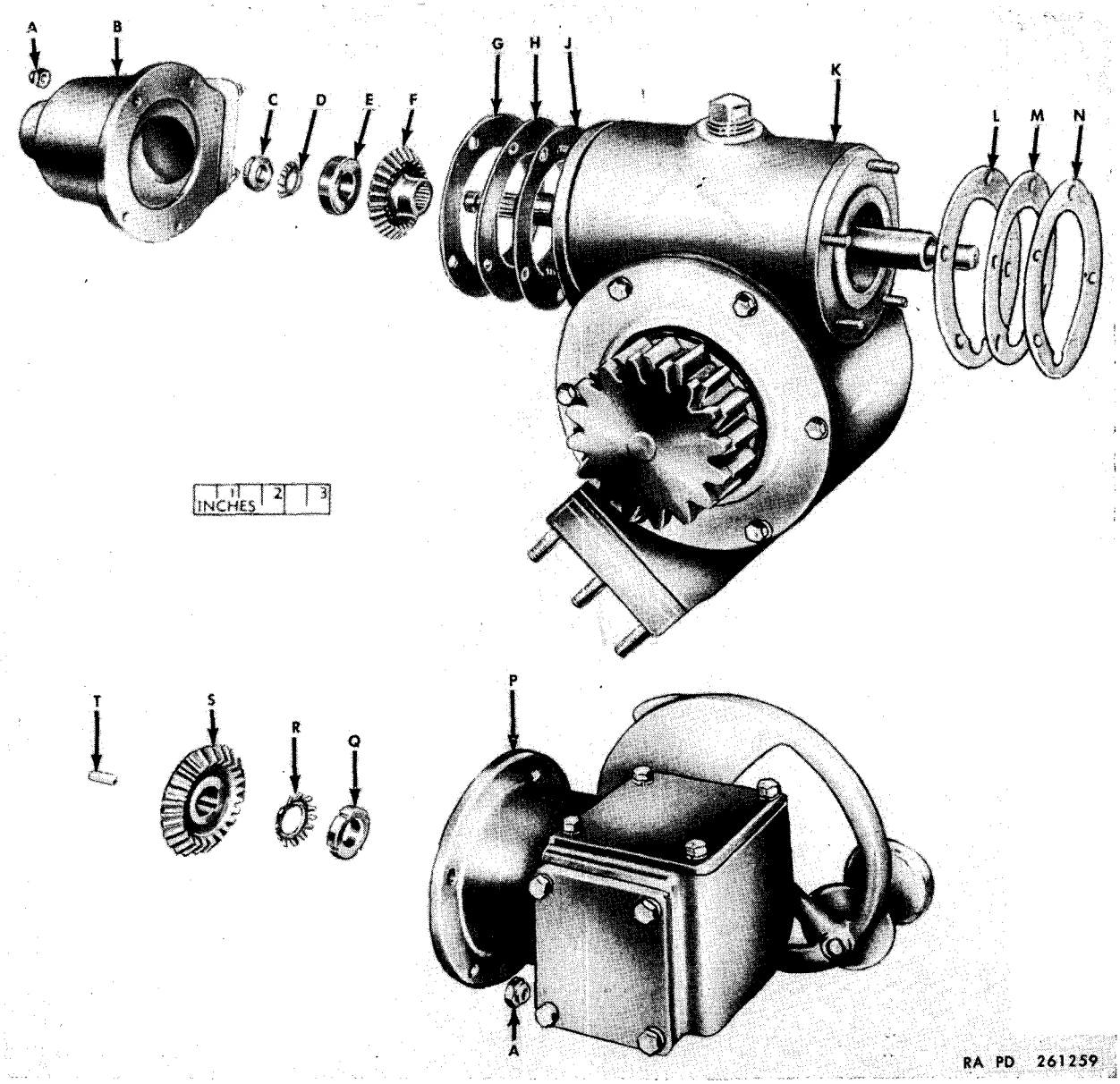
Figure 36. Hand elevating mechanism—schematic view.

89. Disassembly

a. Power Transmitting Case Assembly.

Note. The key letters shown below in parentheses refer to figure 37, except where otherwise indicated.

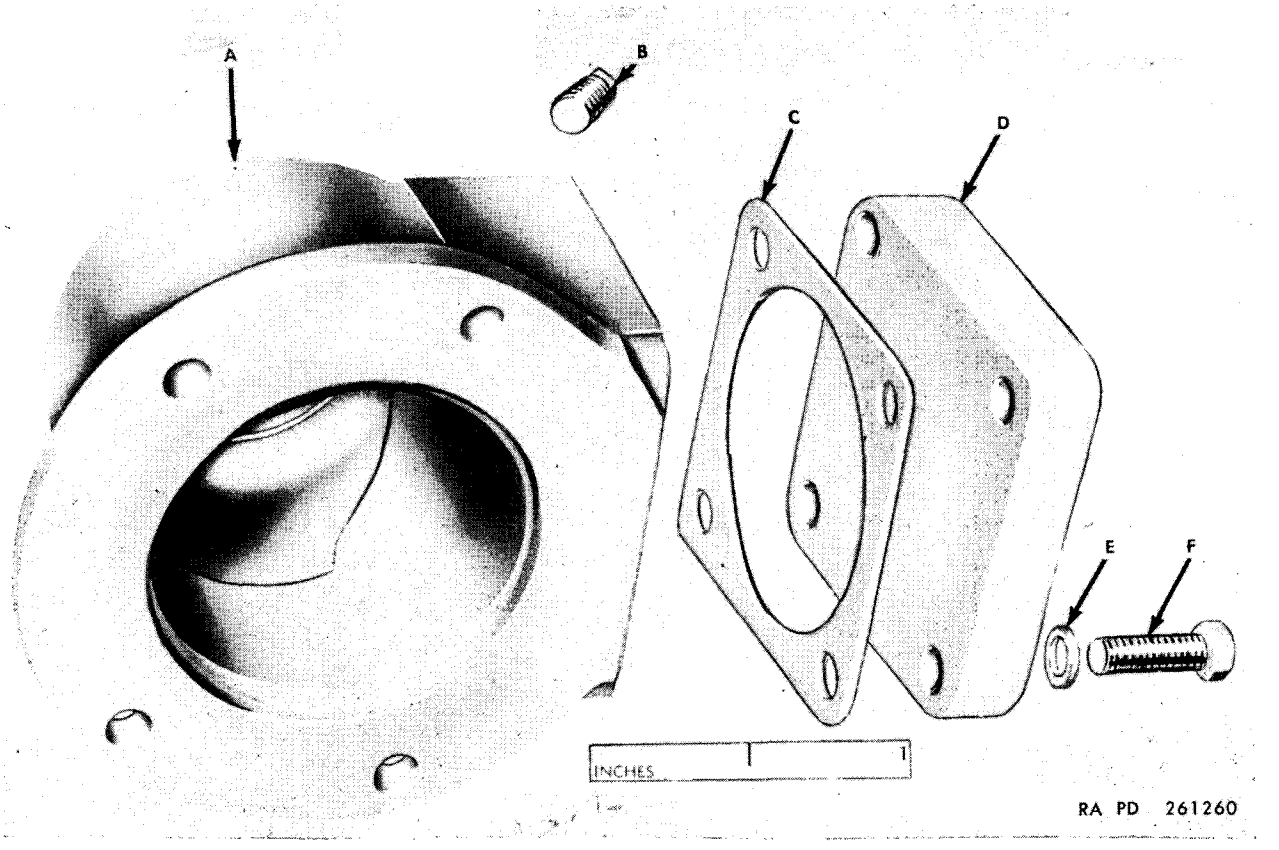
(1) Remove self-locking hexagon nuts (A) that secure case housing (B) to speed reducer assembly (K). Slide the case assembly off the studs and remove shims (G, H, and J).



A—5/16 x 1/2 w x 11/32 thk self-locking hexagon nut 503345
B—Power transmitting case housing 8368356
C—1.000 od w 0.3125 thk special thread locknut 711067
D—1-2/64-in. overall dia key washer 711204
E—0.5906 bore x 1.3780 od x 0.433 w ball bearing 700038
F—Speed reducer power drive bevel gear 7333299
G—0.0020-in. thk shim 7725040
H—0.0050-in. thk shim 7725041
J—0.0100-in. thk shim 7725042
K—Speed reducer assy 7333350
L—0.0020-in. thk shim 7725037
M—0.0050-in. thk shim 7725038
N—0.100-in. thk shim 7725039
P—Manual drive gear assy 8368358
Q—1.1250 od x 0.3438 thk plain round nut 711010
R—0.6060-in. bore key washer 712021
S—Bevel gear 7724176
T—1/8 x 5/8 (No. 405 or 5) Woodruff key 103905

Figure 37. Mount M85—hand elevating mechanism manual drive gear—speed reducer and power transmitting case.

(2) Remove cover plate (D, fig. 36) and fiber gasket (C, fig. 36) from the case housing (A, fig. 36) by unscrewing and removing four hexagon-head bolts (F, fig. 36) and lockwashers (E, fig. 36). Unscrew and remove pipe plug (B, fig. 36) from side of case housing.



A—Case housing 7333297
B—1/8-in. rh squarehead pipe plug 143932
C—3-3/8 w x 3-3/8 lg fiber gasket 8368360
D—3-3/8 x 3-3/8 x 3/16 cover plate 8368355
E—5/16-in. int-teeth lockwasher 138538
F—5/16 x 3/4 ext-teeth header-pt hexagon-hd bolt 191677

Figure 38. Mount M85—hand elevating mechanism power transmitting case.

(3) Unscrew and remove special thread locknut (C) and key washer (D) from shaft of speed reducer assembly (K). Remove ball bearing (E) and slide bevel gear (F) off the splined shaft.

b. Manual Drive Gear Assembly.

(1) Remove self-locking hexagon nuts (A, fig. 37) that secure gear assembly (P, fig. 37) to speed reducer assembly (K, fig. 37). Slide gear assembly off the studs and remove shims (L, M, and N, fig. 37).

Note. Key letters shown below in parentheses refer to figure 39.

(2) Remove control cover (E) and fiber gasket (D) from housing by unscrewing capscrews (F) and lockwashers (G).

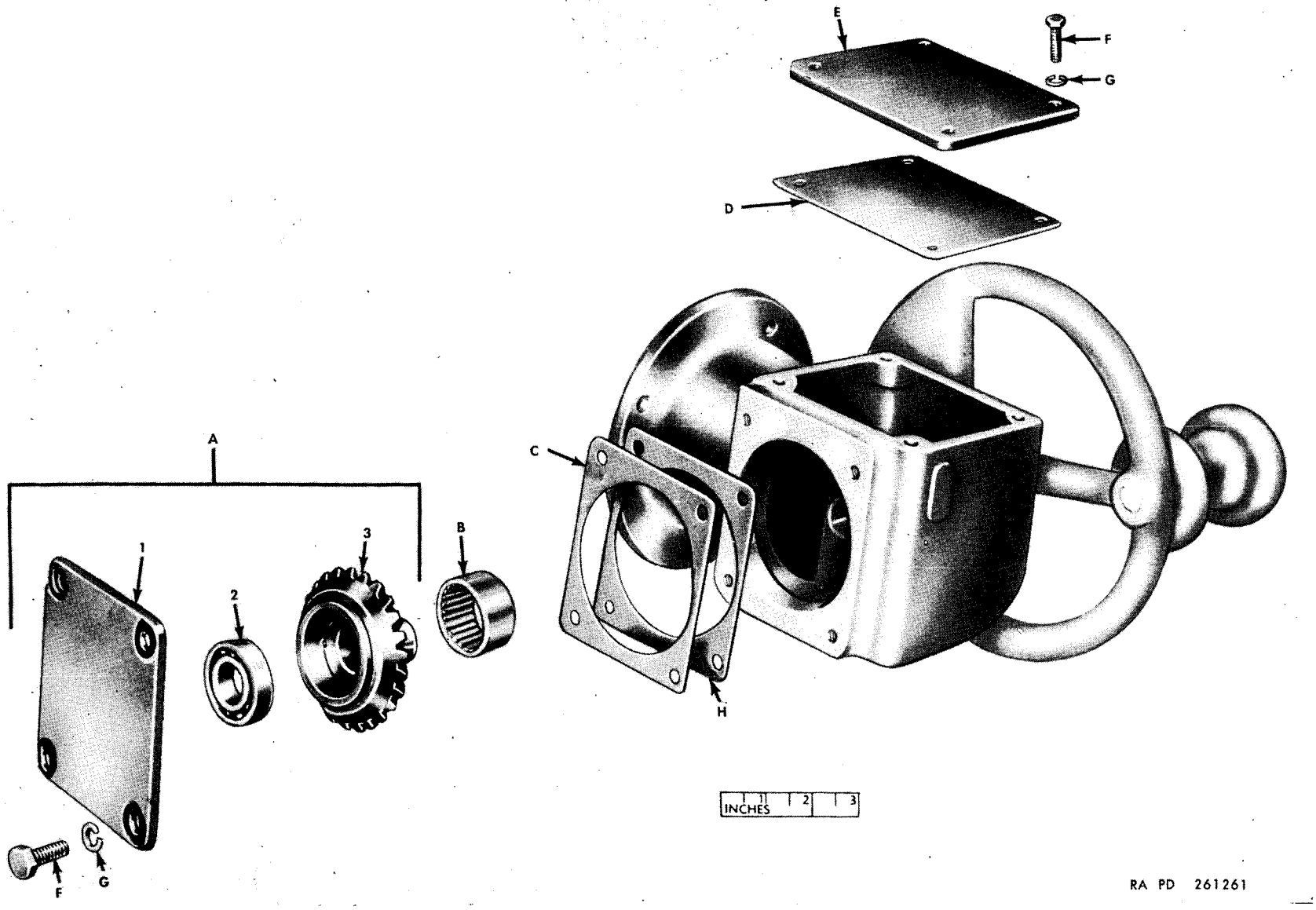
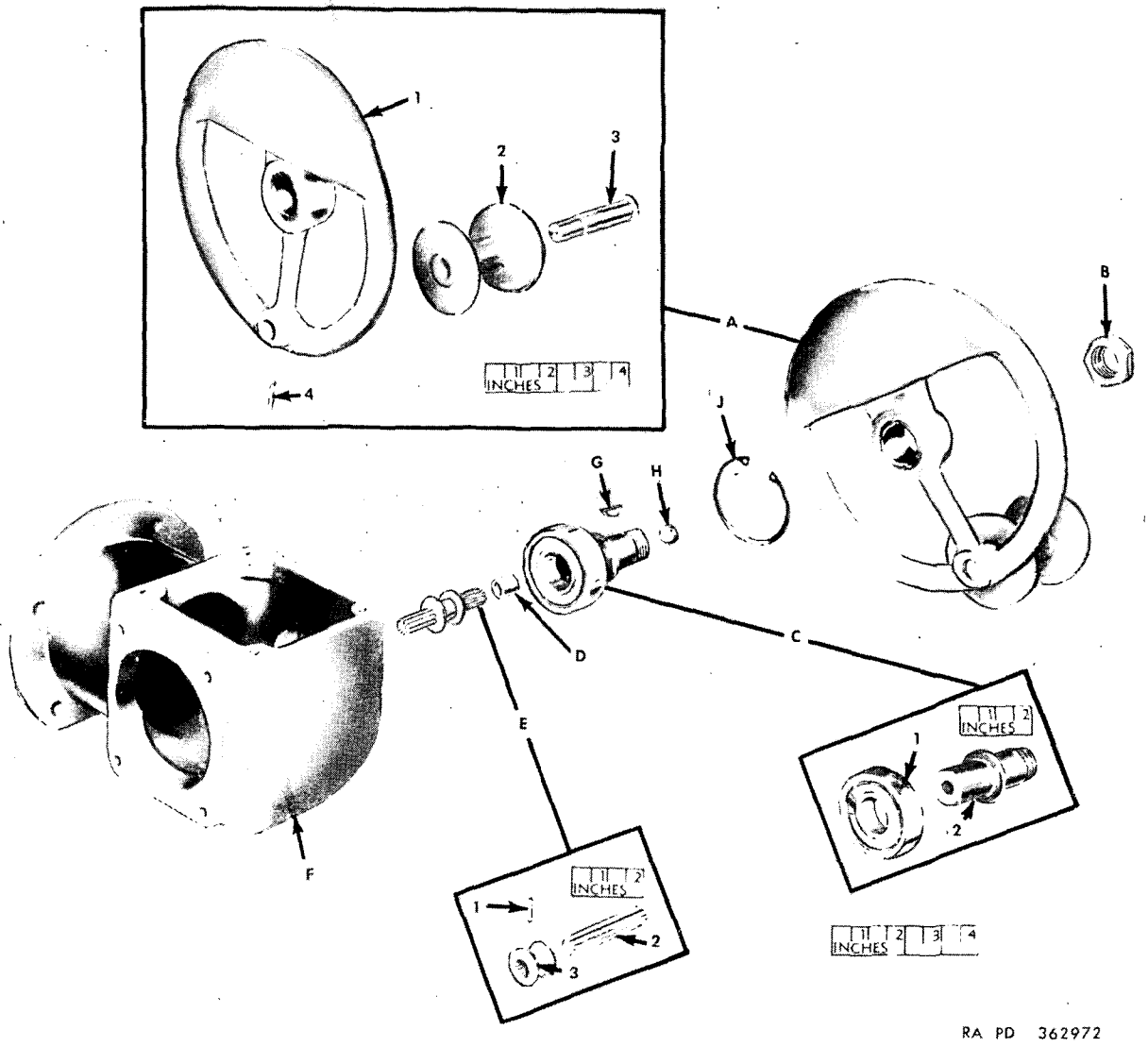


Figure 39. Mount M85—hand elevating mechanism manual drive gear.

Figure 39—Continued

A—Manual drive gear assy 7526225
1—Hand elevating mechanism cover 7526227
2—Annular ball bearing 701179
3—Bevel gear 7526226
B—Needle Roller bearing 710222
C—2-27/32 id x 3-1/8 overall w x 0.0050 thk shim 7526748
D—3-13/16 w x 3-1/2 lg fiber gasket 8687935
E—Control cover 8687933
F—1/4 x 3/4 hexagon-hd capscrew 180020
G—1/4-in. ext-teeth lockwasher 121753
H—2-27/32 id x 3-1/8 overall w x 0.0020 thk shim 7526747



A—Wheel assy 7524455
1—Handwheel 7725429
2—Handwheel knob 7725428
3—Shaft knob headed pin 7725426
4—1/8 x 7/8 headless grooved pin 142487
B—3/4 x 1-1/16 x 3/8 thk self-locking hexagon nut 451038
C—Manual drive handwheel shaft assy 7526222
1—Annular ball bearing 701102
2—Handwheel elevating mechanism shaft 7526223
D—3/8 od x 0.750 lg x 0.1205 thk spacer 836366
E—Manual drive gear wheel shaft assy 7526228
1—3/32 x 1/2 tapered grooved headless pin 142952
2—Splined shaft 7526230
3—Sleeve bearing 7526229
F—Case 7333303
G—1/8 x 5/8 Woodruff key 103905
H—1/4-in. lg overall straight pin 7526224
J—Retaining ring 586211

Figure 40. Mount M85—hand elevating mechanism—manual drive gear—handwheel group.

(3) Remove cover (A–1) and shims (C and H) from housing by unscrewing capscrews (F) and lockwashers (G).

(4) Remove ball bearing (A–2), bevel gear (A–3), and roller bearing (B) from splined shaft in the housing.

Note. Key letters shown below in parentheses refer to figure 40, except where otherwise indicated.

(5) Unscrew and remove hexagon nut (B) and pull wheel assembly (A) from handwheel shaft assembly (C). Remove shaft assembly (E) from splined interior bore of handwheel shaft assembly (C) and remove spacer (D) from shaft assembly (E). Remove retaining ring (J) and push handwheel shaft assembly (C) from its recess in side of case (F). Remove ball bearing (C–1) from elevating mechanism shaft (C–2).

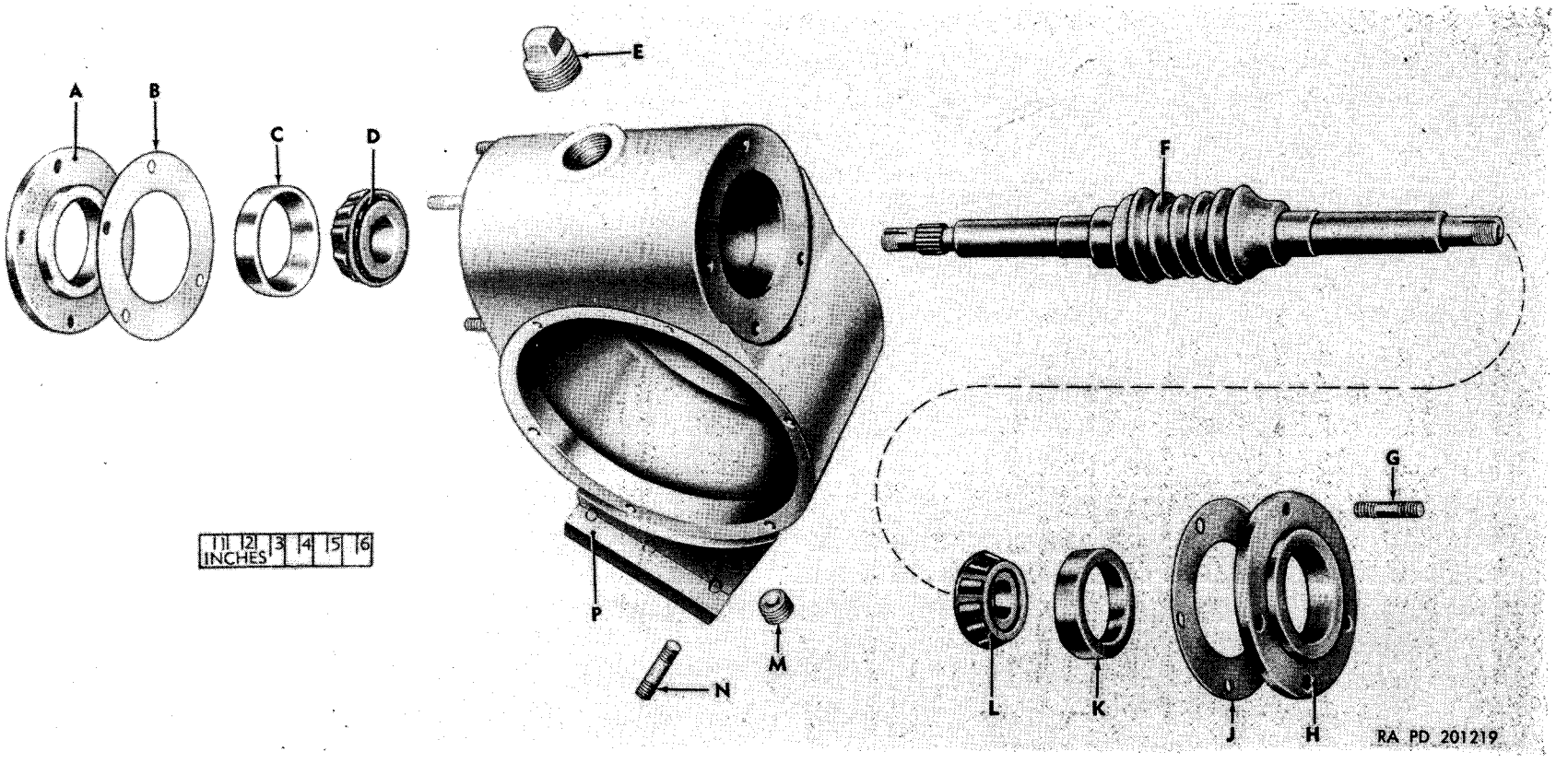
(6) If necessary for repair purposes, drive out headless pin (E–1) and remove sleeve bearing (E–3) from splined shaft (E–2). Drive out headless grooved pin (A–4), and remove shaft knob headed pin (A–3) and handwheel knob (A–2) from handwheel (A–1).

(7) Unscrew and remove plain round nut (Q, fig. 37) and key washer (R, fig. 37) from shaft of speed reducer housing (P, fig. 41). Remove Woodruff key (T, fig. 37) and bevel gear (S, fig. 37) from shaft.

c. Disassembly of Speed Reducer Assembly.

Note. The key letters shown in parentheses in (1) and (2) below refer to figure 42, except where otherwise indicated.

(1) Remove the six 5/16 x ¾ screws (L) and lockwashers (K) securing the output shaft inner bearing carrier cover (J) to the speed reducer housing (P, fig. 41). Remove the cones and gasket (H).



A—Power end bearing cap 7728735
B—Power end bearing cap shim 7728746
C—Power end bearing cup 706888
D—Power end bearing cone 705490
E—1-in. squarehead pipe plug 219304
F—Input shaft 7333300
G—5/16 x 1-5/8 stud 191991
H—Manual end bearing cap 7728734
J—Manual end bearing cap shim 7728747
K—Manual end bearing cup 706888
L—Manual end bearing cone 705490
M—1/2-in. squarehead pipe plug 219200
N—1/2 x 2-1/4 stud 103240
P—Speed reducer housing 7728733

Figure 41. Mount M85—hand elevating mechanism—speed reducer—input shaft—power end.

A–SPACER, OUTPUT SHAFT INNER BEARING–7728743
B–SHIM SET, OUTPUT SHAFT INNER BEARING CARRIER–7728745
C–CARRIER, OUTPUT SHAFT INNER BEARING–7728737
D–CUP, OUTPUT SHAFT INNER BEARING–706875
E–CONE, OUTPUT SHAFT INNER BEARING–705475
F–WASHER, LOCK, BEARING, 2.406 BORE–711213
G–NUT, LOCK, 2.360-18NS-3–711019
H–GASKET, OUTPUT SHAFT INNER BEARING CARRIER COVER–7732766
J–COVER, OUTPUT SHAFT INNER BEARING CARRIER–7728738
K–WASHER, LOCK, 5/16 IN.–138538
L–SCREW, 5/16-18NC-2 X 3/4–216921

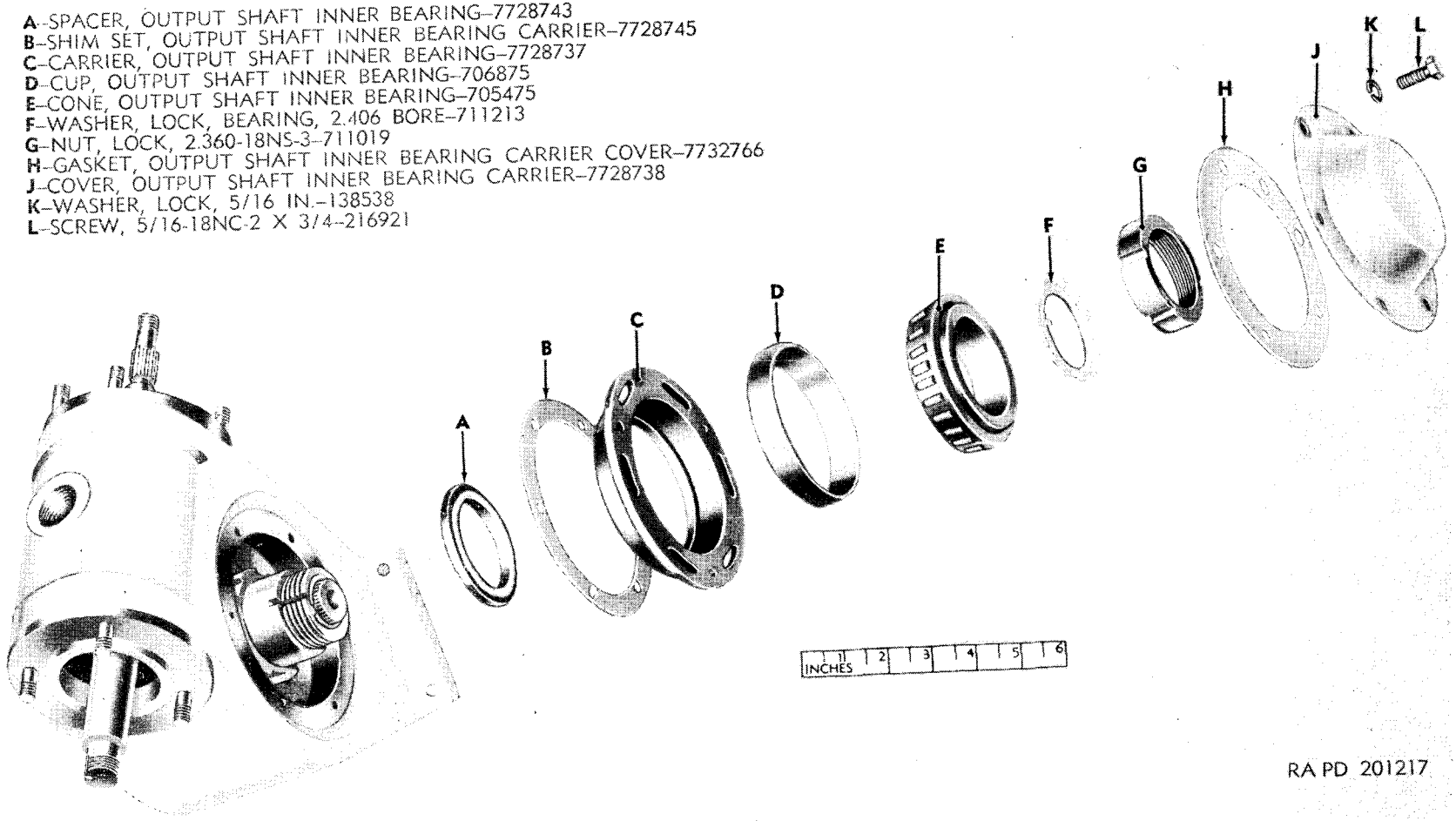
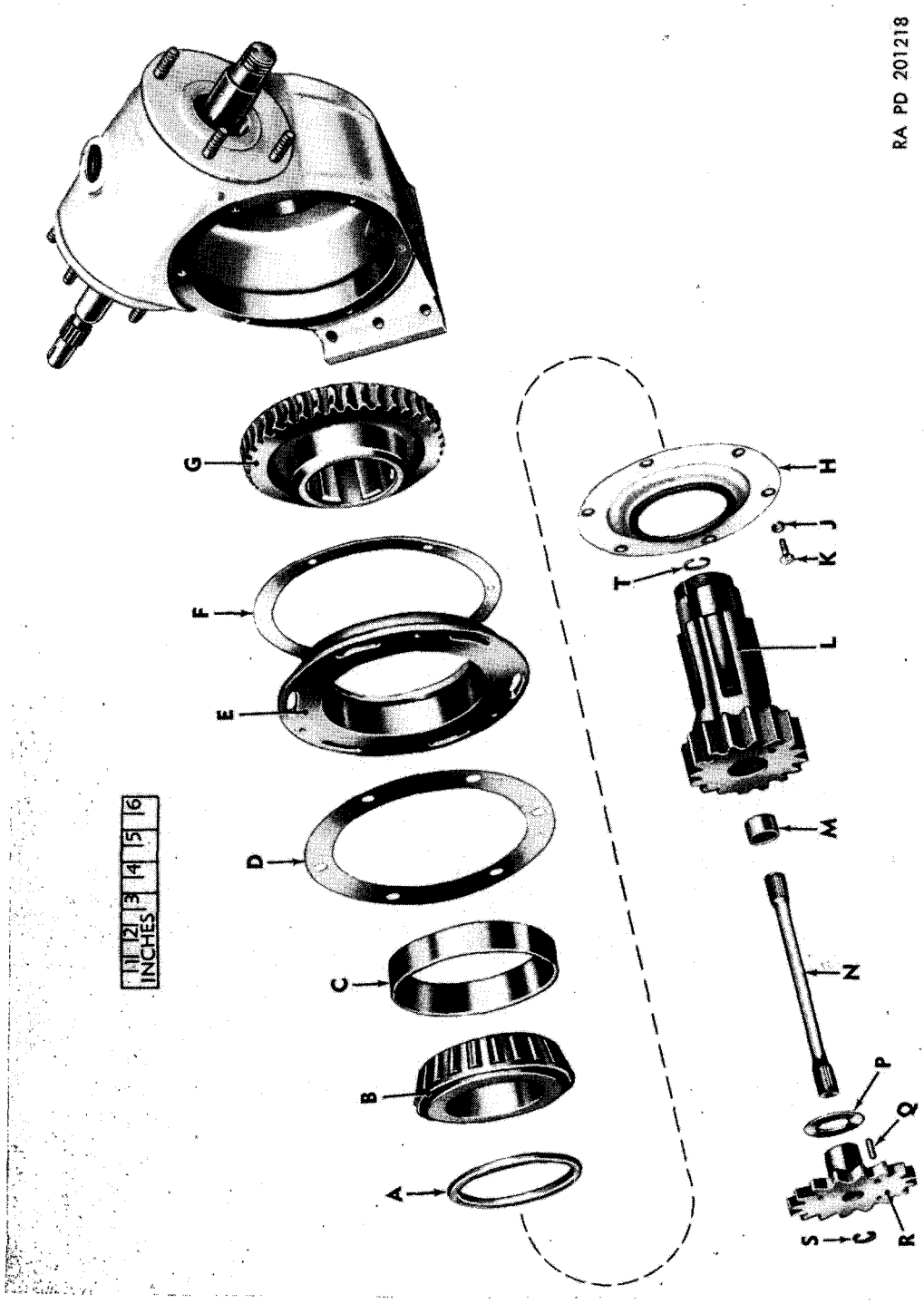


Figure 42. Mount M85—hand elevating mechanism—speed reducer—inner bearing.

(2) Bend the ear of the bearing lockwasher (F) out of the slot in the locknut (G). Remove nut and washer from the speed reducer output shaft (L, fig. 43) and discard the washer. Remove the output shaft inner bearing cone (E), bearing cup (D), output shaft inner bearing carrier (C), carrier shim set (B), and inner bearing spacer (A) from the speed reducer housing (P, fig. 41).



A—Oil seal 7524323
B—Outer bearing cone 705509
C—Outer bearing cup 706898
D—Outer bearing carrier cover gasket 7728732
E—Outer bearing carrier 7728736
F—Outer bearing carrier shim set 7728744
G—Worm gear 7728750
H—Outer bearing carrier cover 7728739
J—5/16-in. int-teeth lockwasher 138538
K—5/16–18NC–2 x 3/4 hexagon-hd machine screw 216921
L—Speed reducer output shaft 7728741
M—Backlash compensating pinion bearing 7524321
N—Backlash compensating pinion torsion bar 7728742
P—Backlash compensating pinion spacer 7728748
Q—5/16 x 3/4 dowel pin 443770
R—Backlash compensating pinion 7728740
S—Torsion bar outer external retaining ring 7524322
T—Torsion bar inner external retaining ring 7524322

Figure 43. Mount M85—hand elevating mechanism—speed reducer—output shaft.

Note. The key letters shown in parentheses in (3) through (10) below refer to figure 43, except where otherwise indicated.

(3) Push the speed reducer output shaft (L) out of the housing (P, fig. 41). Follow the shaft with the hand to catch the output shaft worm gear (G) and to prevent it from falling to the bottom of the housing when the shaft is removed.

Caution: **Lower the gear in the housing carefully to prevent damage to the gear teeth.**

(4) Remove the six 5/16 x ¾ screws (K) and lockwashers (J) securing the outer bearing carrier cover (H) to the speed reducer housing (P, fig. 41). Remove the cover, the carrier cover gasket (D), the outer bearing cone (B), bearing cup (C), outer bearing carrier (E), and the carrier shim set (F) from the speed reducer housing.

(5) Remove the output shaft oil seal (A) from the outer bearing carrier cover (H) and discard the seal.

(6) Remove the worm gear (G) from the speed reducer housing (P, fig. 41).

(7) Clamp the speed reducer output shaft (L) in a soft-jawed vise. Remove the 0.700-inch torsion bar outer external retaining ring (S) from the backlash compensating pinion torsion bar (N). Using a bearing puller or brass wedge, pry and tap the compensating pinion (R) off the torsion bar. Remove the backlash compensating pinion spacer (P) from the pinion.

(8) Drive the 5/16 x ¾ dowel pin (Q) out of the pinion (R).

(9) Remove the 0.700-inch torsion bar inner external retaining ring (T) from the backlash compensating pinion torsion bar (N) and remove the torsion bar from the speed reducer output shaft (L).

(10) Drive the backlash compensating pinion bearing (J) from the speed reducer output shaft (L).

Note. The key letters shown in parentheses in (11) through (14) below refer to figure 41.

(11) Slide the power end bearing cap (A), power end bearing cap shim (B), manual end bearing cap (H), and the manual end bearing cap shim (J) off the studs (G) and the input shaft (F).

Note. The bearing cup (C) is the same as the manual end bearing cup (K) and the power end bearing cone (D) is the same as the manual end bearing cone (L), so that similar disassembly procedures can be followed in removing the input shaft (F) from either end of the speed reducer housing (P).

(12) Push the input shaft (F) out of the power end of the speed reducer housing (P) and remove the power end bearing cup (C) from the shaft. Remove the manual end bearing cup (K) from the speed reducer housing and slide the power end bearing cone (D) and the manual end bearing cone (L) off the shaft.

(13) Remove the 1-inch pipe plug (E) and the ½-inch pipe plug (M) from the speed reducer housing (P).

Note. Remove the following studs only if inspection shows replacement to be necessary.

(14) Remove the eight 5/16 x 1-5/8 studs (G) and the five ½ x 2-¼ studs (N) from the speed reducer housing (P).

90. Cleaning, Inspection, and Repair

Note. Clean all finished machine parts in dry-cleaning solvent or mineral spirits paint thinner and blow dry.

a. Mounting Bracket and Related Parts.

(1) Inspect mounting bracket (J, fig. 35) for breaks, cracks, or other conditions of unserviceability. Remove all burs and scratches from mating surfaces of bracket with a file or abrasive cloth. If necessary, repair cracks or damage by welding.

(2) Check that the threads on all nuts and screws (fig. 35) are not stripped or crossed. Remove burs and scratches from threaded portions with a fine stone, tap, or abrasive cloth. Replace any item damaged beyond repair.

b. Power Transmitting Case Assembly.

(1) Examine the threads on self-locking hexagon nuts (A, fig. 37), special thread locknuts (C, fig. 37), hexagon-

head bolts (F, fig. 38), and pipe plug (B, fig. 38) for damage. Repair damaged threads. Any item excessively damaged should be replaced.

(2) Inspect ball bearing (E, fig. 37) for roughness or wear by spinning and testing for endplay. Replace the bearing if excessively galled, pitted, brinnelled, or worn beyond acceptable limit.

(2) Examine speed reducer power drive bevel gear (F, fig. 37) for cracked or chipped teeth. Contact surfaces of teeth should present a well polished but unworn surface and should be free from galling and fitting. Replace gear if excessively damaged or worn.

(4) Inspect power transmitting case housing (A, fig. 38) and cover plate (D, fig. 38) for indications of cracks, distortions, or wear. If possible, repair cracks by welding. Mating surfaces should be true and free from nicks or gouges. Replace housing or plate if damaged beyond repair.

Caution: **The use of steam, air, and water under pressure is not recommended.**

c. Manual Drive Gear Assembly.

(1) Inspect the threads on self-locking hexagon nuts (A, fig. 37), special thread locknut (C, fig. 37), capscrews (F, fig. 39), and hexagon nut (B, fig. 40) for evidence of damage. If possible, repair damaged threads. Any item excessively damaged should be replaced.

(2) Examine bevel gears (S, fig. 37, and A–3, fig. 39) for cracked or missing teeth. Contact surfaces of teeth must be free from pitting or galling and should present a well polished but unworn surface. Replace gears if damaged or worn belond repair.

(3) Inspect needle bearing (A–2, fig. 39), needle bearing (B, fig. 39), and needle bearing (C–1, fig. 40) for roughness, galling, pitting or flat spots by holding inner race with axis horizontal, pressing down firmly on outer race, and partially rotating outer race in both directions. Inspect bearings for wear by holding inner race and checking outer race for radial and endplay. Replace any bearing if defective or damaged beyond acceptable limits.

(4) Check mechanism cover (A–1, fig. 39) and control cover (E, fig. 39) for evidence of cracks or gouges. Repair by welding if necessary. Mating surfaces must be free from scratches or burs and should be polished with a fine stone or abrasive cloth. Replace either plate if warped or damaged beyond repair.

Note. Key letters shown below in parentheses refer to figure 40.

(5) Examine handwheel (A–1) for damage that would affect proper functioning of the elevating mechanism. Inspect central hole and hole in rim of handwheel for evidence of burs or scratches. Remove any imperfections with a file or abrasive cloth. Cracks or breaks in handwheel may be repaired by welding.

(6) The handwheel knob (A–2) and shaft knob headed pin (A–3) must fit properly and operate satisfactorily when attached to handwheel (A–1). Polish headed pin with an abrasive cloth or a fine stone if burs or scratches are found on its surface. Use a file or abrasive cloth to remove any gouges or raised portions in the central bore of the handwheel knob. Replace either pin or knob if damaged beyond repair. Grooved pin (A–4) should be replaced if sheared or bent beyond repair.

(7) Examine retaining ring (J) for evidence of damage. Replace ring if excessively worn or bent beyond repair.

(8) Inspect handwheel elevating mechanism shaft (C–2) for evidence of wear or damage. Threaded end should be repaired with a fine stone or abrasive cloth if burs or scratches are detected. Pitted or scratched surfaces of shaft should also be repaired with a fine stone or abrasive cloth. Interior splines must be free from burs and gouges and must mate with shaft assembly properly. Discard and re-

place shaft if damaged beyond repair.

(9) Check that splined shaft (E–2) is not excessively damaged or worn. Splines may be repaired with a fine stone or abrasive cloth to remove burs or scratches. Inspect sleeve bearing (E–3) for excessive wear to contact surface and splined interior bore. Replace any component of shaft assembly (E) if repair is impractical.

(10) Inspect case (F) for cracks, paying particular attention to areas adjacent to threaded screw holes. Inspect tapped holes for damaged threads and repair. Examine mating surfaces and bearing bores on the castings for nicks and scratches. Check machined mating surfaces with a straightedge or surface plate. Replace case if extensively damaged.

Caution: **The use of steam, air, and water under pressure is not recommended.**

d. Speed Reducer Assembly.

(1) Examine hexagon-head bolts (L, fig. 42, and J, fig. 43) for damaged threads; replace if repair is impractical.

(2) Inspect power end bearing cap (A, fig 41), manual end bearing cap (H, fig. 41), inner bearing carrier (C, fig. 42), and outer bearing carrier (E, fig. 43) for cracks or burs and rough spots on mating surfaces. Use a fine stone or abrasive cloth to repair scratches or gouges to finished surfaces. Replace each item worn or damaged beyond repair.

(3) Check that carrier covers (J, fig. 42, and H, fig. 43) are not worn or damaged beyond repair; replace if necessary.

(4) Inspect roller bearings for roughness, galling, pitting, or flat spots by holding inner race with axis horizontal, pressing down firmly on outer race, and partially rotating outer race in both directions. Inspect bearings for wear by holding inner race and checking outer race for radial and endplay. Replace any bearing defective or damaged beyond acceptable limits.

41) and plain studs (G and N, fig. 41) for damage to threaded areas. Repair threads with a die, fine stone, or abrasive cloth. Replace items damaged beyond repair.

(6) Inspect speed reducer input shaft (F, fig. 41) worm teeth. Contact surfaces of teeth shall be free from galling or pitting and should represent a well polished but unworn surface. Splined and threaded portions of shaft should be free from burs or scratches. Check that seats for bearings are not worn, repair if possible with a die, fine stone, or abrasive cloth. Input shaft should be replaced if excessively worn or damaged.

(7) Examine locknut (G, fig. 42) for damaged threads. If possible, repair with a tap, fine stone, or abrasive cloth. Replace nut if excessively damaged.

(8) Inspect speed reducer housing (P, fig. 41) for cracks, paying particular attention to areas adjacent to threaded screw holes. Inspect tapped holes for damaged thread and repair with a die or fine stone. Check machined mating surfaces with a straightedge surface plate. Check studs for straightness and battered or stripped threads. Replace housing if damaged beyond repair.

Note. The key letters shown below in parentheses refer to figure 43.

(9) Examine internal splines of speed reducer output shaft worm gear (G) and speed reducer backlash compensating pinion (R) for galling, chipping, or wear. Remove burs or scores with a fine stone or abrasive cloth. Carefully examine all gear teeth surfaces and machined surfaces of the gears for cracks or chips. Discard and replace either gear if damaged or worn beyond repair.

(10) Inspect backlash compensating pinion torsion bar (N) for unserviceability. Splines at both ends of torsion bar should be free from chips, burs, and scratches. Receiving slot for retaining ring (S) should be free from burs

and obstructions. Remove blemishes with a fine stone or abrasive cloth. Torsion bar should be replaced if repair is impossible.

(11) Examine needle roller bearing (M) for roughness, galling, pitting, flat spots, or other conditions of unserviceability. Replace bearing if defective or damaged beyond acceptable limits (pars. 98—101).

(12) Inspect speed reducer output shaft and gear teeth (L) for evidence of wear or damage. Threaded and splined portions of shaft should be repaired with a fine stone or abrasive cloth if burs or scratches are detected. Observe condition of seats for bearings. Check slotted hole in gear for evidence of wear. Contact surfaces of teeth should be free from galling or pitting and should present a well polished but unworn surface. If output shaft is worn or damaged beyond repair, discard and replace with new shaft.

(13) All washers, pins, lockwashers, and other miscellaneous hardware shall be inspected for wear or damage and replaced if defective.

Caution: **The use of steam, air, and water under pressure is not recommended.**

91. Assembly

a. General.

(1) New fiber washers, gaskets, and seals shall be installed during assembly to insure an oil-tight mechanism.

(2) Shims and spacers shall be installed in the proper quantity and combination necessary for smooth functioning of the hand elevating assembly.

(3) Before assembly, coat all gears and pack all bearings with grease MIL–G–10924A.

b. Speed Reducer Assembly.

Note. The key letters shown in parentheses in (1) through (6) below refer to figure 41, except where otherwise indicated.

(1) If removed during disassembly, install the eight 5/16 x 1⅝ studs (G) and the five ½ x 2¼ studs (N) in the speed reducer housing (P).

(2) Install the 1-inch pipe plug (E) and the ½-inch pipe plug (M) in the speed reducer housing (P).

Note. The power end bearing cup (C) is the same as the manual end bearing cup (K) and the power end bearing cone (D) is the same as the manual end bearing cone (L), so that similar assembly procedures can be followed in installing the input shaft (F) into either end of the speed reducer housing (P).

(3) Slide the power end bearing cone (D) and the manual end bearing cone (L) into position against each end of the worm on the input shaft (F), making certain that their larger outside diameters face the worm.

(4) Place the shaft with the bearing cones into the speed reducer housing (P) so that the splined end of the shaft faces to the left when viewed from the side of the housing with the larger output shaft hole. Hold the input shaft in position and slide the power end bearing cup (C) and the manual end bearing cup (K) into place in the housing, making certain that their larger inside diameters face one another.

(5) Slide the power end bearing cap (A), power end bearing cap shim (B), manual end bearing cap (H), and the manual end bearing cap shim (J) into place on the input shaft (F) and the 5/16 x 1⅝ studs (G).

(6) Place the output shaft worm gear (G, fig. 43) into the speed reducer housing (P).

Note. The key letters shown in parentheses in (7) through (17) below refer to figure 43, except where otherwise indicated.

(7) Install a new output shaft oil seal (A) into the output shaft outer bearing carrier cover (H).

(8) Place the outer bearing carrier shim set (F) on the outer bearing carrier (E) and place the bearing carrier in the speed reducer housing (P, fig. 41). Press the outer bearing cup (C) into the bearing carrier, larger inside diameter facing outward. Place the outer bearing cone (B) in the cup.

(9) Press the backlash compensating pinion bearing (M) into the output shaft (L). Place the outer bearing carrier cover (H) on the shaft.

(10) Reach into the speed reducer housing (P, fig. 41), through the hole for the inner bearing, and hold the worm gear (G) in position. Insert the (L) through the outer bearing and into the housing, engaging the splines on the shaft with the splines in the hub of the worm gear.

(11) Place the inner bearing spacer (A, fig. 41), inner bearing carrier shim set (B, fig. 42), inner bearing carrier (C, fig. 42), inner bearing cup (D, fig. 42), and the inner bearing cone (E, fig. 42) over the inner end of the output shaft (L) and into place in the speed reducer housing (P, fig. 41). Slide a new bearing lockwasher (F, fig. 42) on the inner end of the shaft. Screw the bearing locknut (G, fig. 42) up tight, then back it off until one of the ears of the lockwasher alines with one of the notches in the locknut and bend the ear down into the notch to lock the nut in place.

(12) Insert the backlash compensating pinion torsion bar (N) into the output shaft (L) and place the 0.700-inch torsion bar inner external retaining ring (T) into the groove in the inner end of the bar.

(13) Rotate the outer bearing carrier (E) and the inner bearing carrier (C, fig. 42) as required to give 0.001- to 0.002-inch backlash between the worm on the input shaft and the output shaft worm gear (G), noting by the graduations on the carriers that the two are in the same position.

Note. The output shaft outer bearing carrier can be moved by means of a punch inserted through a screw hole in the cover.

(14) Place the inner bearing carrier cover (J, fig. 42) and the inner bearing carrier cover gasket (H, fig. 42) in position against the speed reducer housing (P, fig. 41) and secure with six 5/16-inch screws and lockwashers (K and L, fig. 42).

(15) Press or drive the 5/16 x ¾ dowel pin (Q) into the hole in the backlash compensating pinion (R) until it is flush with the shaft side of the pinion.

(16) Place the backlash compensating pinion spacer (P) on the hub of the backlash compensating pinion (R). Place the pinion over the end of the backlash compensating pinion torsion bar (N), locating it on the splines so that the hole for the 5/16 x ¾ dowel pin (Q) in the pinion is alined with one end of the elongated hole in the gear on the output shaft (L).

Note. Select the end of the elongated hole that will cause the teeth of the pinion to be out of line with the teeth of the gear.

(17) Secure the pinion by installing the 0.700-inch torsion bar outer external expanding ring (S) in the outer groove of the torsion bar.

Note. To test assembly of the speed reducer, hold the input shaft (F, fig. 41) by either end and attempt to move it in the direction of its length. Possible movement should be negligible. Rotate the shaft to ascertain its freedom of movement. Check the plugs and studs for tightness. Check backlash of the output shaft worm gear (G, fig. 43) and the worm on the speed reducer input shaft (F, fig. 41) by attempting to move the output shaft while the speed reducer input shaft is held stationary.

(18) Pack all bearings, prior to assembly with artillery and automotive grease. Coat all gears, shafts, and machined surfaces with artillery and automotive grease.

c. Manual Drive Gear Assembly.

Note. Key letters shown below in parentheses refer to figure 40, except where otherwise indicated.

(1) If wheel assembly has been disassembled (par. 89), insert headed pin (A–3) through handwheel knob (A–2) and secure to handwheel (A–1) with grooved pin (A–4).

(2) Position needle bearing (C–1) on shaft (C–2). Slide spacer (D) over end of wheel shaft assembly (E) and insert wheel shaft assembly into its

receiving hole in the shaft assembly (C).

(3) Place shaft assembly (C) in its receiving hole in the case (F) and secure with retaining ring (J).

(3) Position roller bearing (B, fig. 39) over shaft end of bevel gear (A–3, fig. 39). Slide bevel gear onto the splined end of wheel shaft assembly (E).

Note. Key letters shown below in parentheses refer to figure 39, except where otherwise indicated.

(5) Place ball bearing (A–2) on its shoulder on the hand elevating mechanism cover (A–1). Position shims (C and H) on case (F, fig. 40), and place cover against case so that bearing (A–2) fits properly into its recess in the bevel gear (A–3). Secure cover (A–1) to case with capscrews (F) and lockwashers (G).

(6) Secure control cover (E) to top of case (F, fig. 40), along with new fiber gasket (D), with capscrews (F) and lockwashers (G).

(7) Insert Woodruff key (G, fig. 39) in slot on handwheel shaft assembly (C, fig. 39). Aline slot in wheel assembly with key and secure to shaft assembly with locking hexagon nut (B, fig. 39).

Note. Key letters shown below in parentheses refer to figure 37, except where otherwise indicated.

(8) Place Woodruff key (T) in slot at right end of speed reducer input shaft (F, fig. 41). Aline bevel gear (S) with key and position on pinion. Secure gear to pinion with key washer (R) and plain round nut (Q).

(9) Place required shims (L, M, and N) on studs at right side of speed reducer assembly (K). Place gear assembly (P) on studs and secure to speed reducer assembly with self-locking hexagon nuts (A).

(10) Pack all bearings prior to assembly with artillery and automotive grease. Coat all gears, shafts, and machined surfaces with artillery and automotive grease.

d. Power Transmitting Case Assembly (fig. 38).

(1) Position new fiber gasket (C) and cover plate (D) on case housing (A). Secure plate to housing with hexagon-head bolts (F) and lockwashers (E).

(2) Insert and tighten pipe plug (B) in its receiving hole in the case housing (A).

Note. Key letters shown in parentheses in (3) and (4) below refer to figure 37, except where otherwise indicated.

(3) Slide bevel gear (F) on speed reducer input shaft (F, fig. 41) and position gear on the splined shaft. Place ball bearing (E) on shaft in its recess in bevel gear and secure with key washer (D) and special thread locknut (C).

(4) Position required shims (G, H, and J) on studs of speed reducer assembly (K). Secure case housing (B) to speed reducer assembly with self-locking hexagon nuts (A).

(5) Pack all bearings, prior to assembly with artillery and automotive grease. Coat all gears, shafts, and machined surfaces with artillery and automotive grease.

92. Installation

Note. Key letters shown below in parentheses refer to figure 35, except where otherwise indicated.

a. Wipe lubricant from all parts. Use self-emulsifying degreasing solvent compound (MIL–S–11090), mineral spirits paint thinner, or dry-cleaning solvent (P–S–661) to entirely clean or wash grease and oil from all metal parts.

b. Place mounting bracket (J) on turret floor and secure with capscrews (C, D, and F) and lockwashers (E).

c. Position elevating mechanism assembly (A) on mounting bracket (J). Install proper combination of shims (K) to assure smooth meshing of elevating mechanism assembly with the elevating rack.

d. With mount completely assembled, operate elevating mechanism throughout entire range to assure proper functioning. Check that free movement of elevating handwheel does not exceed 20 degrees. See TB 9–7205–2–1.

CHAPTER 8

FINAL INSPECTION

93. General

This is an acceptance inspection performed after repair has been completed, to insure that the materiel is acceptable for return to user according to standards established.

94. Return to User

All material inspected for return to user should perform satisfactorily according to general standards set up for their expected use: combat, overseas, and zone of interior.

95. Howitzer M49 Checklist

a. Evacuator Chamber Locknut.
- (1) Check for cracks.
- (2) Inspect lock and key for serrations and tightness.

b. Evacuator Chamber.
- (1) Examine welded areas for cracks.
- (2) Examine sealing lips for deformation.
- (3) Examine threads and serrations for burs and wear.

c. Howitzer Tube.
- (1) Inspect in accordance with TM 9–1000–202–35 and TM 9–4933–200–35 to determine serviceability and aid in estimating remaining accuracy life.
- (2) Check identification markings on breech face of tube to correspond with those listed in weapons record book.
- (3) Examine valve gate assemblies and inserts for pitting and correct assembly.

d. Breech Group.
- (1) Check identification markings on rear face of breech ring to correspond with those listed in weapons record book.
- (2) Check breech ring key for proper fit and tightness.
- (3) Check action on breechblock closing spring.
- (4) Check operation of breech group parts, using dummy round, empty shell case, wooden block, or a ramming and extracting tool to trip extractors.

e. Breechblock Group.
- (1) Check for smoothness of operation by opening and closing several times.
- (2) Check condition of firing mechanism.
- (3) Remove percussion mechanism and inspect firing pin and spring for proper function.

96. Mount M85 Checklist

a. Mount Shield Assembly.
- (1) Examine for cracks.
- (2) Make sure trunnion bearing cap shield studs and safety nuts are tight.

b. Rotor Group.
- (1) Examine for cracks and deformations.
- (2) Check to see that rotor sleeve inspection cover is secured in place.
- (3) Check to see that telescope protecting tube is securely fastened to rotor.
- (4) Examine bumper assemblies for proper operation.
- (5) Make sure rotor is securely fastened to cradle.

c. Breech Operating and Firing Mechanism Assembly.
- (1) Inspect safety rod holding in both firing and safe positions.
- (2) Inspect for completeness of parts and proper function.

d. Recoil Mechanism and Replenisher Assembly.
- (1) Check for oil leaks around filler and drain plugs and at tube connections.
- (2) Check type and amount of oil in recoil system (LO 9–7204).
- (3) Check buffer regulator for being operative and correct setting (2 clicks open for proper operating mechanism).
- (4) Check replenisher indicator rod, should read "Full."

e. Hand Elevating Mechanism.

Check free movement of elevating handwheel. Free movement should not exceed 20 degrees.

97. General Checklist

a. All nameplates and instruction plates should be legible and properly secured.

b. Check that all spare parts and equipment are complete and serviceable.

c. Check condition of painted items. Paint must give a protective finish to exposed metal parts.

d. Lubrication must be complete and in accordance with LO 9–7204.

e. Weapon record book, part I and part II, shall be complete and with weapon.

CHAPTER 9
REPAIR STANDARDS

98. General

The standards included herein give the minimum and maximum measurements of required parts. Normally, all parts that have not been worn beyond the dimensions or limits indicated or damaged from corrosion will be approved for service, those beyond the dimensions or limits will be repaired.

99. Breech Operating Group

Fig. No.	Ref. letter	Permissible min or max.
14	D–1	Dia at pin end — min 0.130 in.
14	E	ID of hole — max. 0.317 in., width of slot — max. 0.322 in.
14	F	Firing pin hole, face of breechblock — max. 0.164 in.
14	L	Spring end — min 0.435 in.
15	C	ID — max. 2.015 in., od — min 2.490 in.
15	E	ID — max. 0.695 in., od — min 1.308 in.
15	H	Bearing dia — min 0.677 in. plunger dia — min 0.490 in.
16	C, G	Min dia — 0.985 in.
16	D	ID of holes — max. 1.005 in.
16	E	ID — max. 0.754 in., od — min 1.243 in.
17	E	Proof load — 3,6000 lb.

100. Mount M85

a. Trunnion Bearings and Related Parts (par. 66).

Fig. No.	Ref. letter	Permissible max. or min
19	D	Min — 0.122 in. thk.

b. Replenisher Assembly (par. 72).

Fig. No.	Ref. letter	Permissible max. or min
23	C	ID, piston end — max. 3.005 in.
23	D–1	ID — max. 0.625 in.

c. Breech Operating and Firing Mechanism Assembly (par. 77).

Fig. No.	Ref. letter	Permissible max. or min
24	DD	ID — max. 0.504 in.

d. Hand Elevating Mechanism (par. 90).

Fig. No.	Ref. letter	Permissible max. or min
38	E	ID — 0.378 in.
40	B	Min 0.335 in. thk.
41	L	ID — max. 1.253 in.

101. Coil Spring Standards

Fig. No.	Ref. letter	Permissible min (lb)	At height of (in.)
14	C	42,	2.0,
		22	2.625
17	B	137,	9.25,
		328	5.07
20	C–3	252	2.875
23	A	48	14.312
24	K	26.72	1.312
24	L	28.8	1.312
32	J	1,200	22.187

Note. Springs need not be tested by field maintenance units but will be replaced when authorized if they fail to operate efficiently, are badly damaged, or unfit for further use.

CHAPTER 10
SHIPMENT AND STORAGE SPACE

102. Shipping Instructions

a. Responsibility. When shipping howitzer M49 and mount M85, the unit commander will be responsible for shipping this materiel adequately processed, packaged, and packed to reach the using echelon in a serviceable condition and/or maintenance float stocks (SB 9-140).

b. Army Shipping Documents. Prepare all Army shipping documents accompanying freight in accordance with AR 725–5.

c. Preparation for Shipment.

(1) Materiel removed from storage for shipment must not be reprocessed unless inspection reveals it to be inadequately processed, packaged, and packed for shipment.

(2) Preservation, packaging, and packing must be sufficient to protect the materiel against deterioration and damage during shipment (SB 9–4 and TM 9–1005). Under no condition will the materiel with critical surfaces be packaged without benefit of sufficient preservatives to insure adequate protection of materiel. Materiel will be marked in accordance with TM 9–1005.

d. Loading and Blocking Instructions.

(1) Loading and blocking instructions for the howitzer M49 are contained in TM 9–7204.

(2) For general loading rules and methods and procedures for loading and blocking boxed items for rail shipment, refer to TM 9–1005.

103. Limited Storage Instructions

a. Materiel will be processed, packaged, and packed for limited storage as prescribed in paragraph 102*c*(2).

b. Storage of materiel will be in accordance with TM 743-200–1 and SB 38–8–1.

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, Film Strips, Slides 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 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 Bulletins, Lubrication Orders, and Modification Work Orders .	DA Pam 310-4
Index of Training Publications	DA Pam 310-3

2. Supply Manuals

The following supply manuals of the Department of the Army supply manual pertain to this materiel:

a. Destruction to Prevent Enemy Use.

Ammunition (Class 1375 Explosive, Bulk Propellant and Explosive Devices).	SM 9-5-1375

b. General.

Introduction	ORD 1

c. Repair and Rebuild.

Bearings	SM 9-1-3110
Shop Set, Artillery, Field Maintenance, No. 1 Supplemental (41-S-2990-110)	ORD 6 SNL J-8, Sec. 10
Shop Set, Field Maintenance, Artillery	SM 9-4-5180-J8-9
Shop Sets, Armament and Fire Control Rebuild Company, Depot Maintenance	Ord 6 SNL J-9, Sec. 7
Special Tool Sets for Field Artillery and Combat Vehicle Weapons (SNL Groups C and D).	ORD 6 SNL J-13
Tool Kit, Artillery Repairman	SM 9-4-5180-A59
Tool Kit, General Mechanic's	SM 9-4-5180-A58

d. Weapons.

Cannon, Howitzer, 105-mm, M49 (T96E1); Mount, Howitzer, 105-mm, M85 (T68E1).	ORD (*) SNL C-86
Howitzer, Self-Propelled, Full Tracked: 105-mm, M52 (T98E1).	ORD (*) SNL G-258
Weapons (Class 1015 Guns, 75-mm through 125-mm)	SM 9-5-1015

3. Forms

The following forms pertain to this materiel:

DA Form 5-31, Shop Job Order Register.
DA Form 9-1, Materiel Inspection Tag.
DA Form 9-3, Processing Record for Shipment and Storage of Vehicle and Boxed Engines.
DA Form 9-4, Vehicle Storage and Service Record.
DA Form 9-13, Weapon Record Book (Part I).
DA Form 9-13-1, Weapon Record Book—Part II—Cannon Data.
DA Form 9-79, Parts Requisition (cut sheet).
DA Form 9-80, Job Order File (envelope).
DA Form 9-81, Exchange Part or Unit Identification Tag (tag).
DA Form 421, Stock Record Card.
DA Form 460, Preventive Maintenance Roster.
DA Form 461-5, Vehicle Classification Inspection.

**See DA Pam 310-29, Index of Supply Manuals; Ordnance Corps, for published types of manuals of the Ordnance section of the Department of the Army supply manual.*

DA Form 462, Quarterly Maintenance or Spot Check Tracked Vehicles—Tracked Trailers.
DA Form 468, Unsatisfactory Equipment Report.
DA Form 478, Organizational Equipment File.
DA Form 1546, Request for Issue or Turn-In.
DA Form 2028, Recommended Changes to DA Technical Manuals Parts Lists or Supply Manual 7, 8, or 9 (cut sheet).
DD Form 6, Report of Damaged or Improper Shipment.
Standard Form 94, Statement of Witness.

4. Other Publications

The following explanatory publications contain information pertinent to this materiel and associated equipment:

a. Camouflage.

Camouflage, Basic Principles and Field Camouflage ..... FM 5-20

b. Decontamination.

Decontamination ..... TM 3-220
Small Unit Procedures in Atomic, Biological, and Chemical Warfare ..... FM 21-40

c. Destruction to Prevent Enemy Use.

Explosives and Demolitions ..... FM 5-25

d. General.

Artillery Materiel and Associated Equipment ..... TM 9-2300
Field Inspection and Serviceability Standards for Small Arms Materiel ..... TM ORD 587
Inspection of Ordnance Materiel in the Hands of Troops. ..... TM 9-1100
Logistics (General): Malfunctions Involving Ammunition and Explosive ..... AR 700-1300-8
Lubrication ..... TM 9-2835
Military Symbols ..... FM 21-30/AFM 55-3
Military Terms, Abbreviations, and Symbols:
  Authorized Abbreviations and Brevity Codes ..... AR 320-50
  Dictionary of United States Army Terms ..... AR 320-5
Military Training ..... FM 21-5
Operation and Field and Depot Maintenance: Pullover Gages, Borescopes M1 and M2 and Pressure Gage M3.
Ordnance Direct Support Service ..... FM 9-3
Ordnance General and Depot Support Service ..... TM 9-4933-200-35
Petroleum Base Hydraulic Fluid: Characteristic and Use in Armament and Fire Control Mechanism. ..... FM 9-4, TB ORD 586
Principles of Artillery: Weapons ..... TM 9-3305-1
Safety:
  Accident Reporting and Records ..... AR 385-40
  Regulations for Firing Ammunition for Training, Target Practice, and Combat. ..... AR 385-63/AFR50-13
Techniques of Military Instruction FM21-6

e. Repair and Rebuild.

105-mm Full Tracked Self-Propelled Howitzer M52 (T98E1): Removal, Installation, Synchronization, and Adjustment of the Fire Control System. ..... TB 9-1200-203-30
Cleaning and Black Finishing of Ferrous Metals ..... TM 9-1861
Instruction Guide: Care and Maintenance of Ball and Roller Bearings ..... TM 37-265
Instructions for Exercising all Types of Recoil Mechanisms, Replenishers, and Equilibrators. ..... TB ORD 303
Logistics (General): Unsatisfactory Equipment Report ..... AR 700-38
Lubrication Order ..... LO 9-7204
Maintenance and Care of Hand Tools ..... TM 9-867
Maintenance of Supplies and Equipment:
  Command Maintenance Inspections ..... AR 750-8
  Maintenance Responsibilities and Shop Operations ..... AR 750-5
Spot Check Inspection and Report, Ordnance Corps Materiel ..... AR 750-925
Operating Procedures: Evaluation of Cannon Tubes ..... TM 9-1000-202-35
Operation and Maintenance of Floats: Major Items of Equipment Authorized for Stockage. ..... SB 9-140

Operation and Organizational Maintenance: 105-mm Full-Tracked Self-Propelled Howitzer M52 (T98E1). TM 9-7204

Ordnance Maintenance:

Elevating and Traversing Systems for Self-Propelled 105-mm Howitzer M44 (T194), 155-mm Gun M53 (T97), 105-mm Howitzer T98E1, and 8-Inch Howitzer T108. TM 9-7205-2

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