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TM 9-1326

WAR DEPARTMENT TECHNICAL MANUAL

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BY Rakess ON 022805

ORDNANCE MAINTENANCE

105-mm Howitzer M3 and Howitzer Carriages M3 and M3A1 DESIGN SECTION

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The information contained in restricted documents and the essential characteristics of restricted materiel may be given to any person known to be in the service of the United States and to persons of undoubted loyalty and discretion who are cooperating in Government work, but will not be communicated to the public or to the press except by authorized military public relations agencies. (See also paragraph 18 b, AR 380-5, 28 September 1942.)

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WAR DEPARTMENT • 20 JANUARY 1944

FOR ORDNANCE PERSONNEL ONLY

WAR DEPARTMENT TECHNICAL MANUAL
TM 9-1326

ORDNANCE MAINTENANCE

105-mm Howitzer M3 and
Howitzer Carriages
M3 and M3A1



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WAR DEPARTMENT
Washington 25, D. C., 20 January 1944

TM 9-1326, Ordnance Maintenance: 105-mm Howitzer M3 and Howitzer Carriages M3 and M3A1, is published for the information and guidance of all concerned.

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(For explanation of symbols, see FM 21-6.)

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**ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1**

Section I

INTRODUCTION

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1. SCOPE.

a. This Technical Manual is published for the information and guidance of ordnance personnel. It contains detailed instructions for the inspection, maintenance, and repair of the 105-mm Howitzer M3 and 105-mm Howitzer Carriages M3 and M3A1. These instructions are supplementary to those prepared for the using arms. Additional descriptive matter and illustrations are included to aid in providing a complete working knowledge of the materiel.

2. CHARACTERISTICS.

a. This weapon is designed to provide for direct or indirect fire (figs. 1, 2, 3, 4, 5, and 6). The howitzer fires three types of projectiles: SHELL, H.E.A.T., M67; SHELL, H.E., M1; and SHELL, smoke, H.C., B.E., M84. Ammunition for this weapon is loaded with "quick" powder, which burns more rapidly than that used with the 105-mm Howitzers M2 and M2A1. The maximum range is 8,300 yards. For short bursts, the rate of fire may be four rounds per minute. For prolonged periods, the rate may be two rounds per minute.

b. Two recoil mechanisms, the M13 and M14, are used with this materiel. Both are the hydropneumatic, constant recoil type.

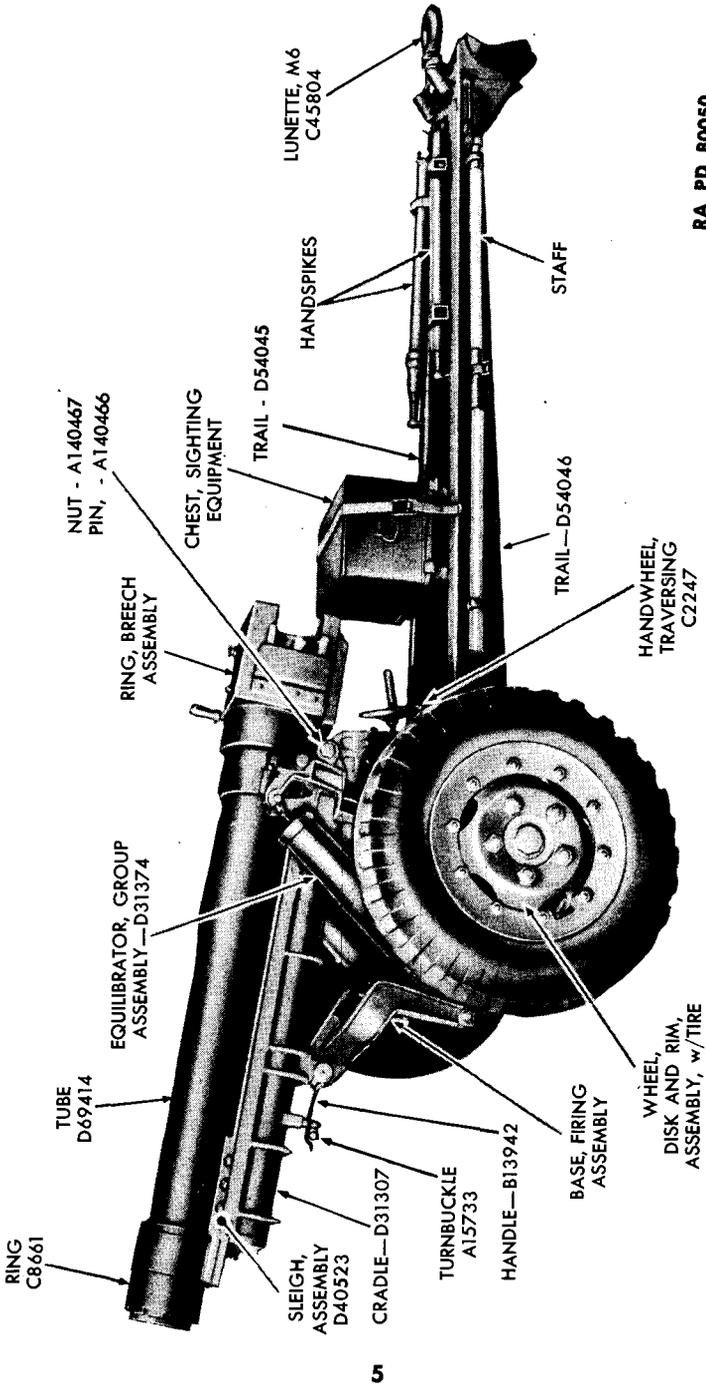
c. Both the Carriages M3 and M3A1 are the split-trail, high-speed type fitted with automobile disk and rim wheels mounted on wheel carriers. Hand brakes are provided for use when parking. The spades at the ends of the trails and the firing base at the front of the carriage allow a 3-point ground contact in firing position.

3. DIFFERENCES AMONG MODELS.

a. The tube of the 105-mm Howitzer M3 is the tube of the 105-mm Howitzer M2 or M2A1 shortened by 27 inches.

b. The 105-mm Howitzer Carriages M3 are substantially similar to the 75-mm Howitzer Carriages M3A1. The new features of the 105-mm Howitzer Carriage 3 are:

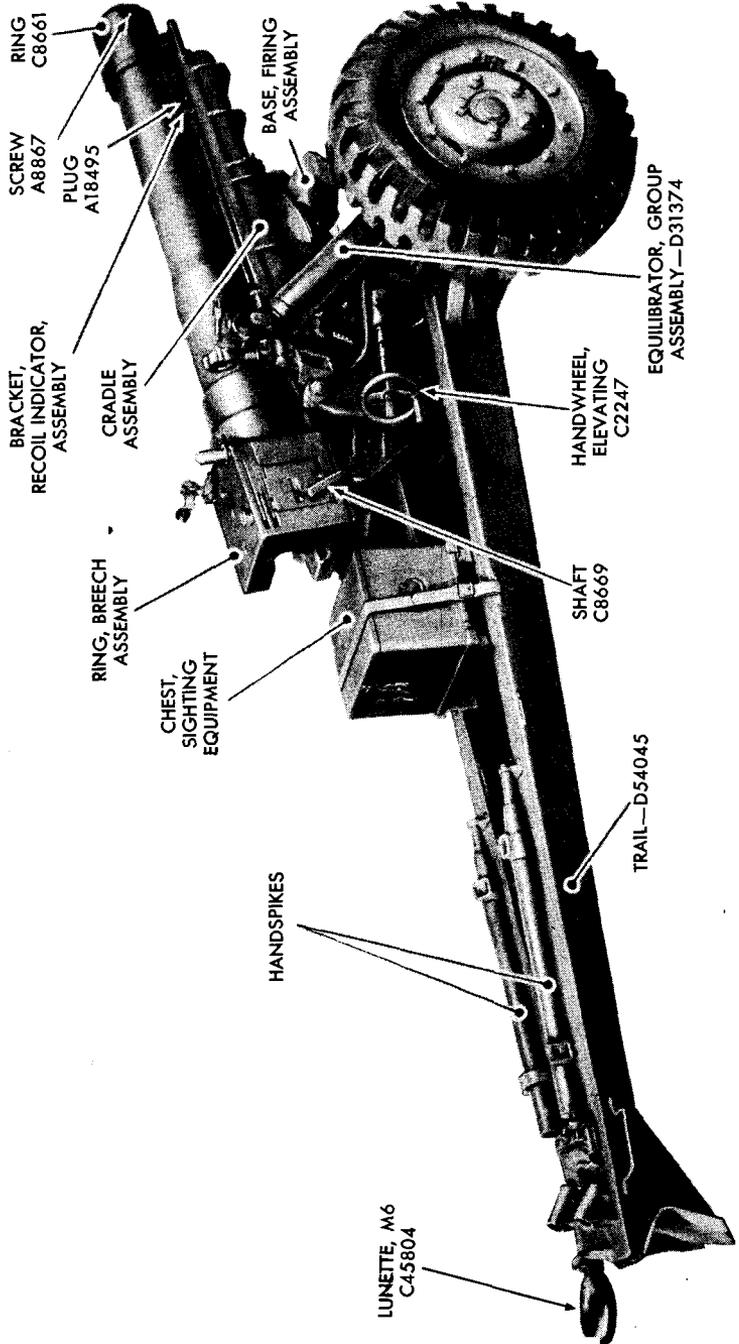
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RA PD 80050

Figure 1 — 105-mm Howitzer M3 and 105-mm Howitzer Carriage M3A1 — Left Side — Traveling Position

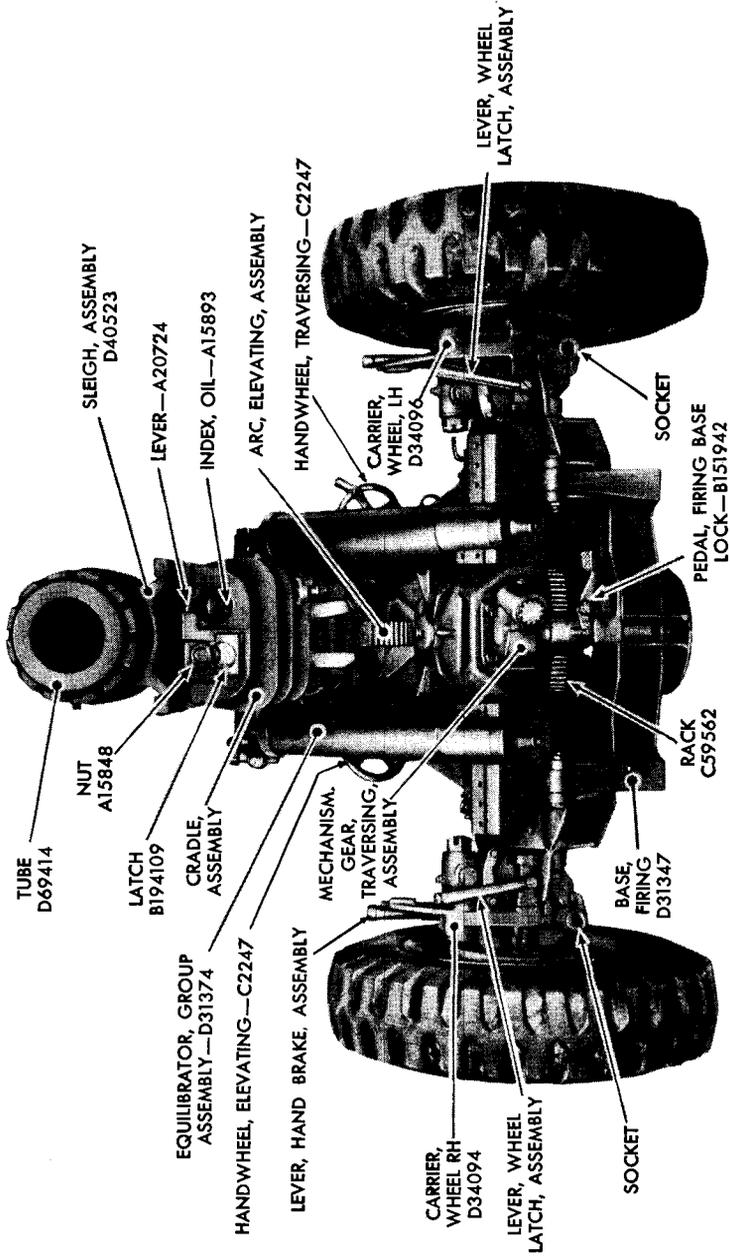
ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3A1



RA PD 69512

Figure 2 — 105-mm Howitzer M3 and 105-mm Howitzer Carriage M3A1 — Right Side — Traveling Position

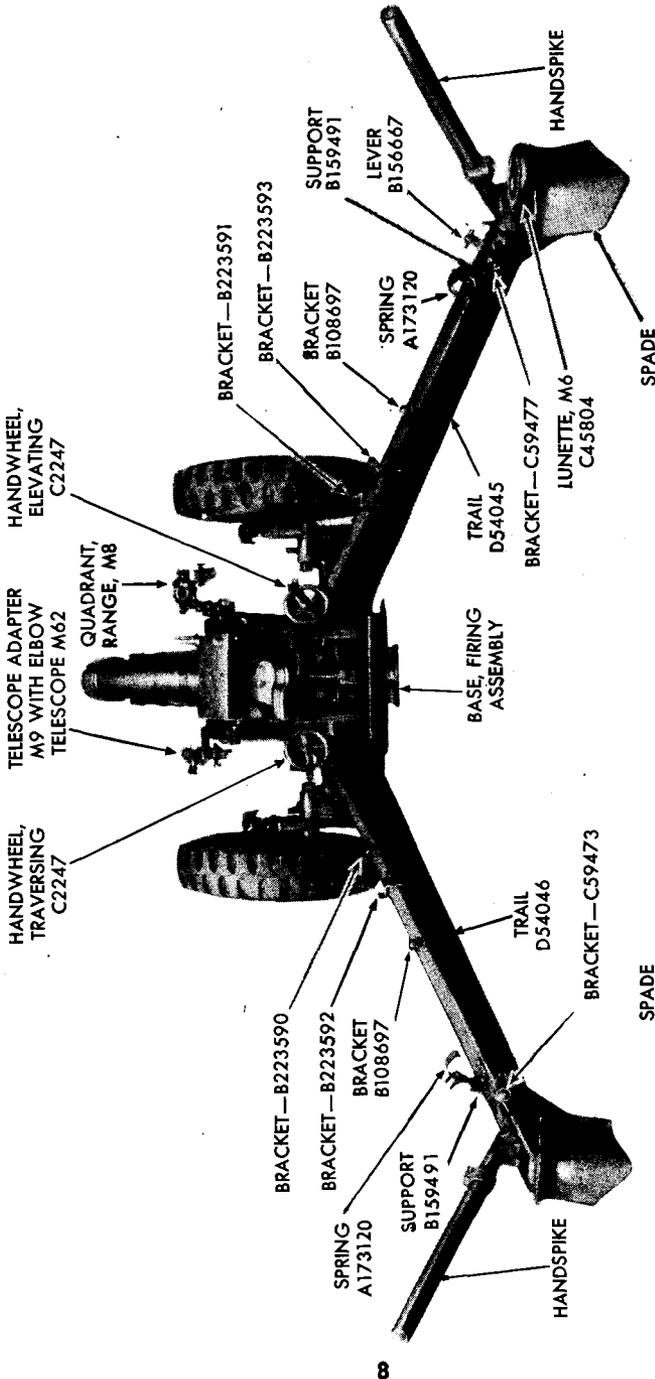
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RA PD 69371

Figure 3 — 105-mm Howitzer M3 and 105-mm Howitzer Carriage M3A1 — Front View

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HOWITZER CARRIAGES M3 AND M3A1



RA PD 80051

Figure 4 — 105-mm Howitzer M3 and 105-mm Howitzer Carriage M3A1 — Rear View — Firing Position

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(1) An automatic piston rod latch stem holds the piston rod latch at the front end of the cradle in either open or closed position. The piston rod latch may be disengaged even when the tube and sleigh are in position, because the tube does not prevent the latch from rising.

(2) A caution plate on the use of the SHELL, H.E., M1, has been installed on most of the top carriages.

(3) Dust guards have been placed at the front ends of the cradle to protect the front ends of the sleigh slides.

(4) Shield supporting brackets have been welded to the top carriage. However, no shield is provided for the 105-mm Howitzer Carriage M3 or M3A1.

(5) Sight chest brackets have been welded to the trails.

c. The 105-mm Howitzer Carriages M3 and M3A1 are entirely similar, except for the trails. The flasks of the Carriages M3A1 are constructed of heavier steel. A spring-type trail lock latch is provided on all of the Carriages M3A1 and on some of the Carriages M3; in the balance of the Carriages M3, the trail lock is secured by a cotter pin. All of the Carriages M3A1 and some of the Carriages M3 are equipped with clasp-type supports for securing the two handspikes when the howitzer is in the traveling position.

d. The Recoil Mechanisms M13 and M14 of the 105-mm howitzer materiel are modifications of the 75mm Howitzer Recoil Mechanism M1A4. The Recoil Mechanisms M13 and M14 do not have a top sleigh; nor do they have a recoil cylinder respirator; however, the action of the recoil mechanisms is similar. The howitzer, recoil and recuperator cylinders, and sleigh are fastened together and recoil as a unit; the recoil piston rod is stationary.

e. The two Recoil Mechanisms M13 and M14 have different regulator group assemblies, different recuperator cylinders, and different cylinder yokes; however, the two recoil mechanisms may be considered as entirely similar for all purposes in connection with maintenance and repair.

4. DATA.

a. 105-mm Howitzer M3.

Caliber	105 mm
Weight of barrel and breech mechanism	995 lb
Muzzle velocity	1,020 ft per sec.
Length of bore (approx.)	16 cal.

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HOWITZER CARRIAGES M3 AND M3A1

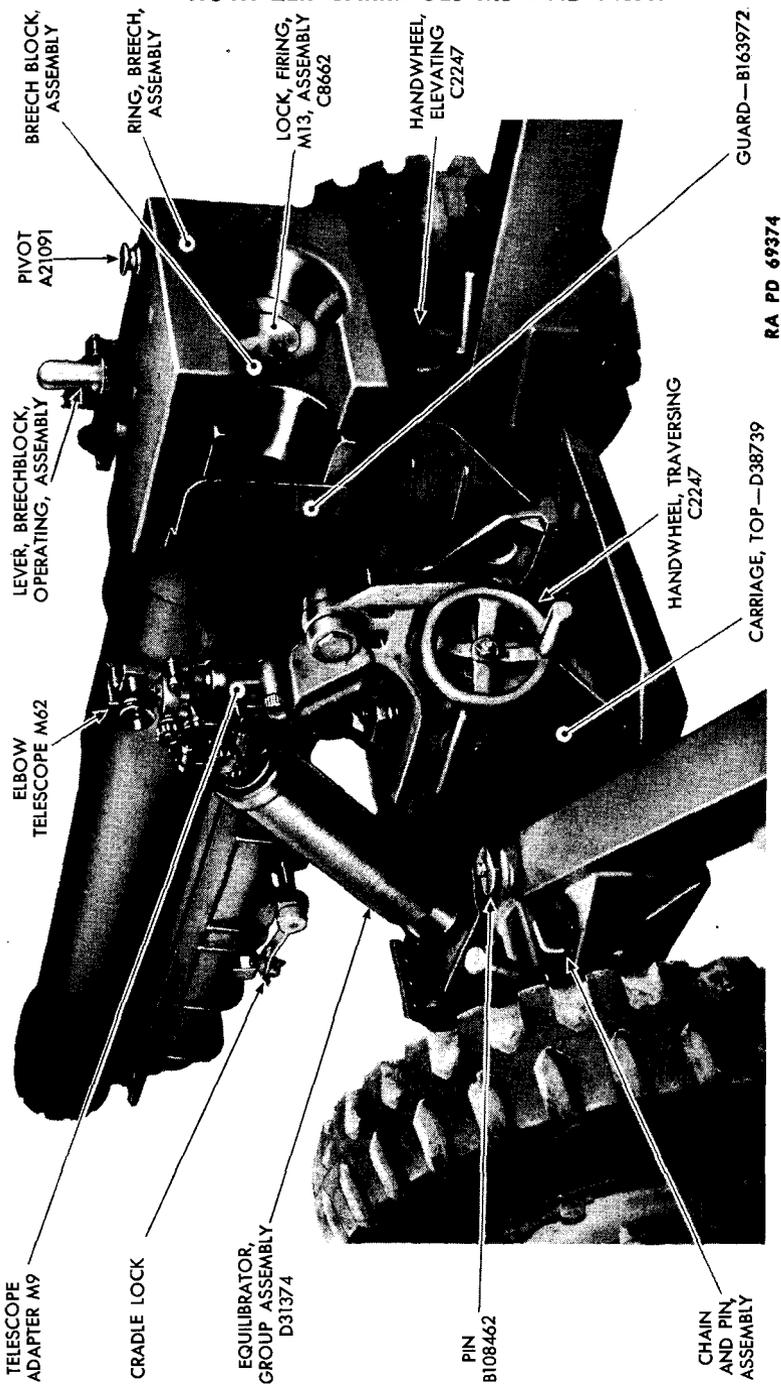


Figure 5 — Close-up of Howitzer M3 and 105-mm Howitzer Carriage M3A1 — Left Side

INTRODUCTION

Maximum range:

H.E., M1 (at 544.4 mils (30.6 deg) elevation).....	7,600 yd
H.E., M1 (at 762.5 mils (42.7 deg) elevation).....	8,300 yd
H.E.A.T., M67 (at 161.6 mils (9 deg) elevation).....	3,000 yd
Twist of rifling, uniform, right-hand.....	1 turn in 20 calibers

b. Ammunition.

Type	Semifixed
Weight of complete round	4,206 lb
Weight of projectile, H.E., M1	33 lb
Weight of projectile, H.E.A.T., M67	29.22 lb
Weight of propelling charge	3 lb

c. Recoil Mechanism.

Type of recoil mechanism	Hydropneumatic
Initial nitrogen pressure at 70 F.....	1,520 lb per sq in.
Normal length of recoil at a 0-degree elevation.....	28¾ in.
Normal length of recoil at a 30-degree elevation.....	29¾ in.
Length of recoil at maximum elevation	32 in.
Weight of recoil mechanism and cradle	379 lb

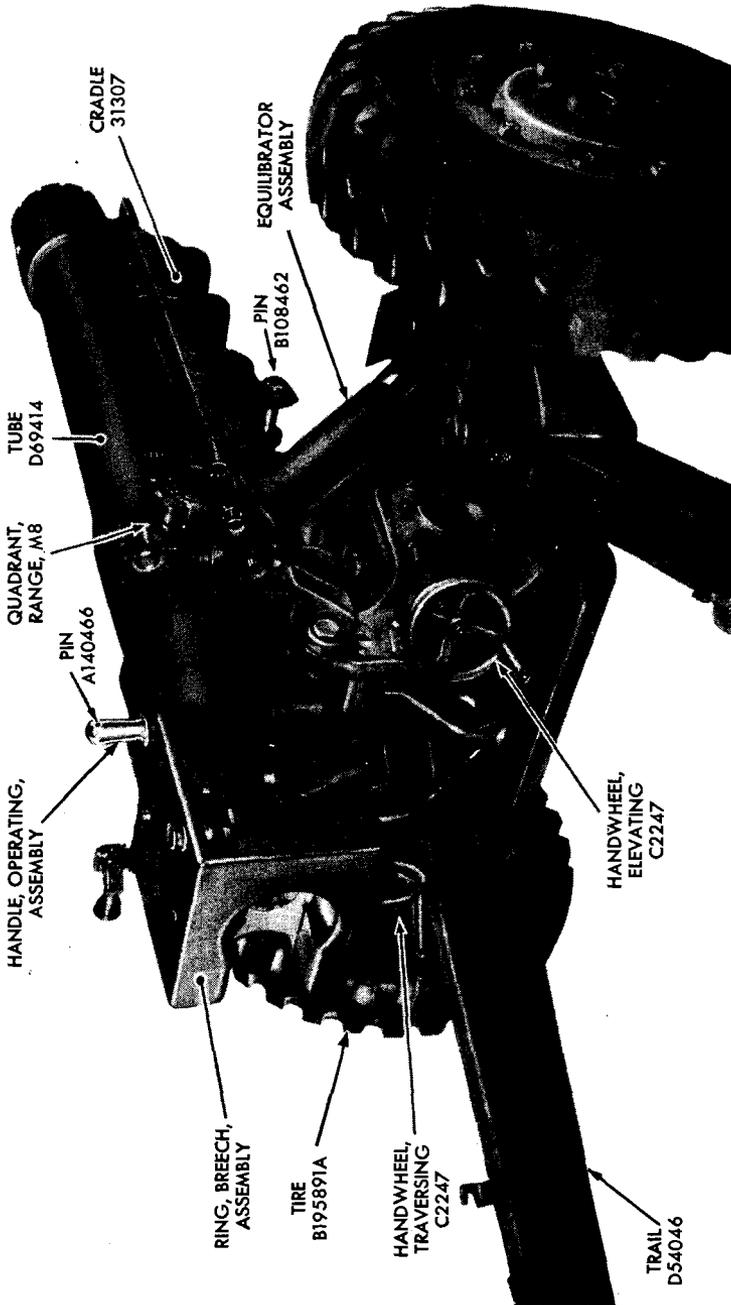
d. Carriages M3 and M3A1.

Weight of howitzer and carriage, in firing position, without accessories	2,495 lb
Length, over-all, traveling position	155 in.
Width over hub caps	68 in.
Width of tread, c to c	56 ¹ / ₁₆ in.
Height, over-all	44 in.
Height of lunette, limbered position	29 in.
Height to center of bore, on wheels	34 ¹ / ₈ in.
Trail spread	46 deg
Maximum trail spread, each way	23 deg
Maximum elevation	30 deg

NOTE: The stops have been relocated on some carriages to a permit a maximum elevation of approximately 45 degrees.

Maximum depression	Minus 9 deg
Turns of elevating handwheel to elevate 30 degrees.....	18½
Turns of elevating handwheel to depress 9 degrees	5½
Maximum traverse right or left	22 deg 30 min
Turns of traversing handwheel to traverse 22 degrees 30 minutes	14½

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RA PD 69421

Figure 6 — Close-up of Howitzer M3 and 105-mm Howitzer Carriage M3A1 — Right Side

INSPECTION

Weight at end of right trail, firing position	148 lb
Weight at end of left trail, firing position	153 lb
Weight at end of trails, closed	345 lb
Weight at end of trails, limbered.....	93 lb
Weight at right wheel, trails closed	1,193 lb
Weight at left wheel, trails closed	1,198 lb
Weight of sleigh	120 lb
Weight at end of lunette, 29 inches above ground	72 lb
Weight at end of lunette, 54½ inches above ground, traveling position	0
Weight at lunette, 58 inches above ground, 9-degree depression	0
Size of tires (combat)	8.00 x 16
Tire pressure	30 lb

e. Sighting Equipment.

Telescope mount	M16
Telescope adapter	M9
Elbow telescope (used with telescope adapter on telescope mount)	M62
Range quadrant	M8
Elbow telescope (for range quadrant)	M61

Section II

INSPECTION

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Carriage	10

5. PURPOSE.

a. Inspection of a weapon is vital. Thorough, systematic inspection at regular intervals is the best insurance against an unexpected gun breakdown at the critical moment when maximum performance is absolutely necessary. Never let materiel run down. Keep it in first class fighting condition by vigilant inspection and prompt maintenance.

b. Inspection is for the purpose of determining by critical examination the condition of the materiel, whether repairs or adjustments

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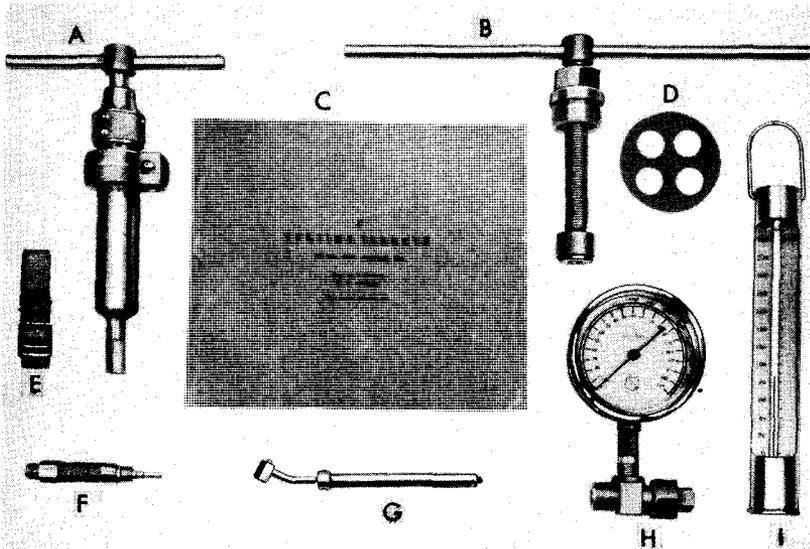


Figure 7 — Tools for Inspection RA PD 69491

are required, that all modifications authorized by Field Service Modification Work Orders have been made, and of insuring serviceability and proper functioning of the materiel. Its immediate aim is trouble prevention, which includes the following:

- (1) Detecting faulty or careless preventive maintenance.
- (2) Determining when repair or replacement of parts is required because of ordinary wear or breakage.
- (3) Determining that all modifications authorized by Field Service Modification Work Orders have been completed.

c. The results of inspection should be noted in the Artillery Gun Book (O.O. Form 5825) by the inspector. Any unusual condition which might result in improper operation, damage to materiel, or injury to personnel, will be remedied immediately.

d. Suggested improvements in design, maintenance, safety, and efficiency of operation prompted by chronic failure or malfunction of the weapon, spare parts, or equipment should be forwarded to the Office, Chief of Ordnance, Field Service Division, Maintenance Branch, with all pertinent information necessary to initiate corrective action. Such suggestions are encouraged in order that other organizations may benefit.

e. The instructions in paragraphs 7 through 10 with reference to inspection are additional to those enumerated in TM 9-326.

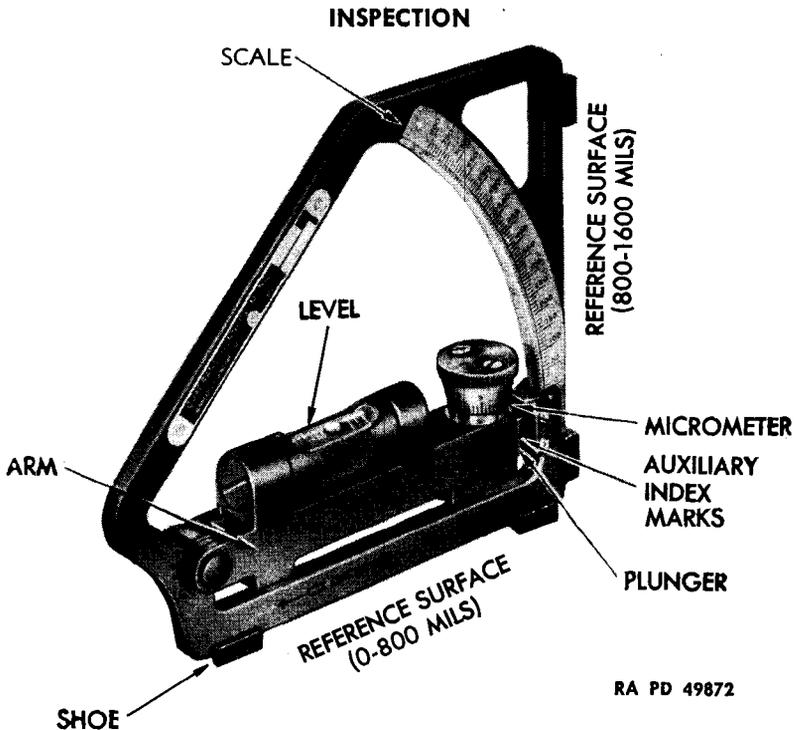


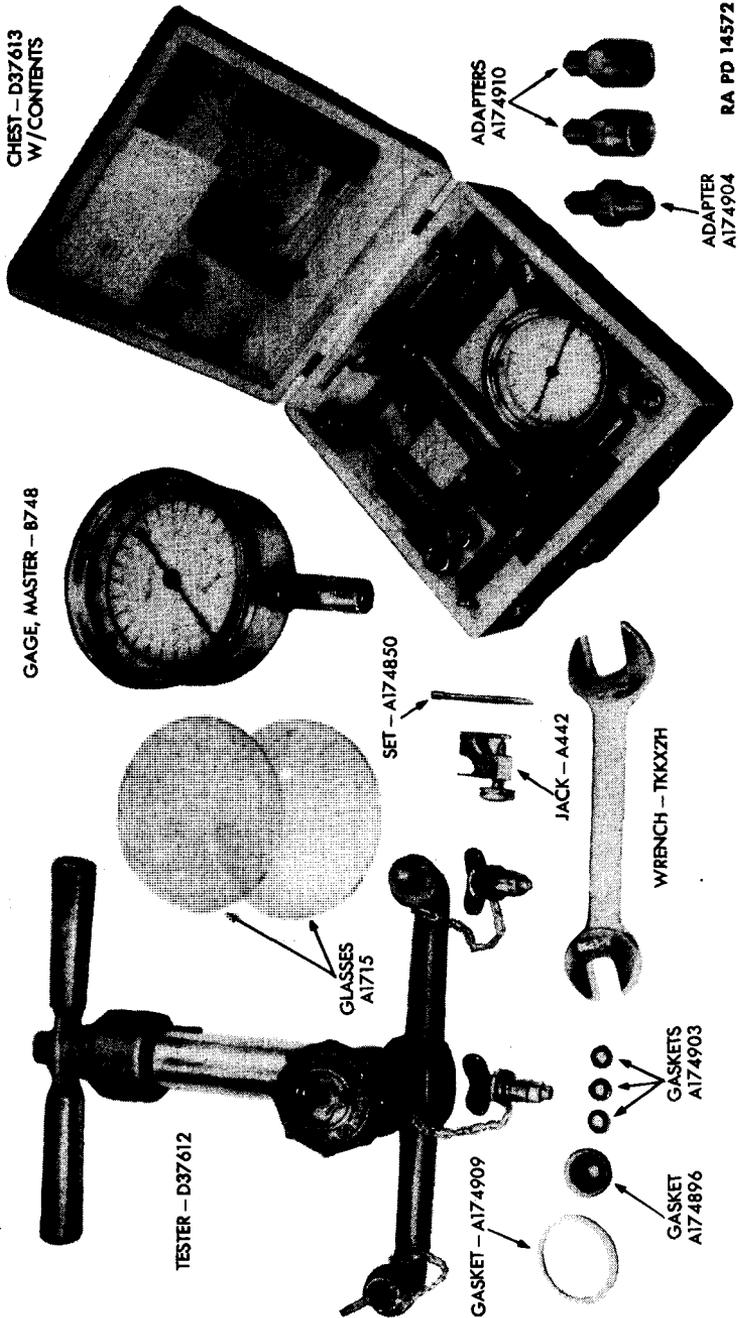
Figure 8 — Gunner's Quadrant M1

6. TOOLS.

a. Tools for Inspection of Recoil Mechanism.

Tools	Use
FILLER , oil screw, M3, with adapter, C6731 (fig. 7)	A high-pressure hand pump used to replenish the recoil mechanism with oil.
GAGE , pressure, with connection, C6385 (fig. 7)	Used for testing gas pressure in recuperator cylinder. The gage is calibrated from zero to 2,844 pounds per square inch and from zero to 200 kilograms per square centimeter.
JACK , screw, recoil piston, B102874 (fig. 7)	Used to force recoil piston and piston rod forward when checking gas pressure in recuperator cylinder, floating piston friction, and combined friction of recoil piston and piston rod stuffing box.

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RA PD 14572

Figure 9 — Pressure Gage Tester, Spare Parts, and Accessories

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Tools	Use
THERMOMETER , Fahrenheit, B243 (fig. 7)	This thermometer is graduated from minus 10 F to plus 220 F. Used for determining temperature of oil in recoil mechanism when checking gas pressure.

b. Miscellaneous Tools.

SIGHT , bore (fig. 7)	Used to check that the line of sight is parallel with the axis (center line) of the howitzer bore. The complete bore sight consists of a breech bore sight RF11TB which is a metal disk that fits accurately in the breech chamber of the howitzer and a muzzle bore sight RF11BD which is a quantity of black linen cord and a web belt. The black linen cord is stretched tightly across the muzzle vertically and horizontally in the score marks of the muzzle. The web belt is put around the cord and muzzle to hold the cord in place.
TARGET , testing paper (fig. 7)	Used during bore sighting to aline line of sight with the axis of the bore. The target should normally be located about 50 yards from the muzzle.

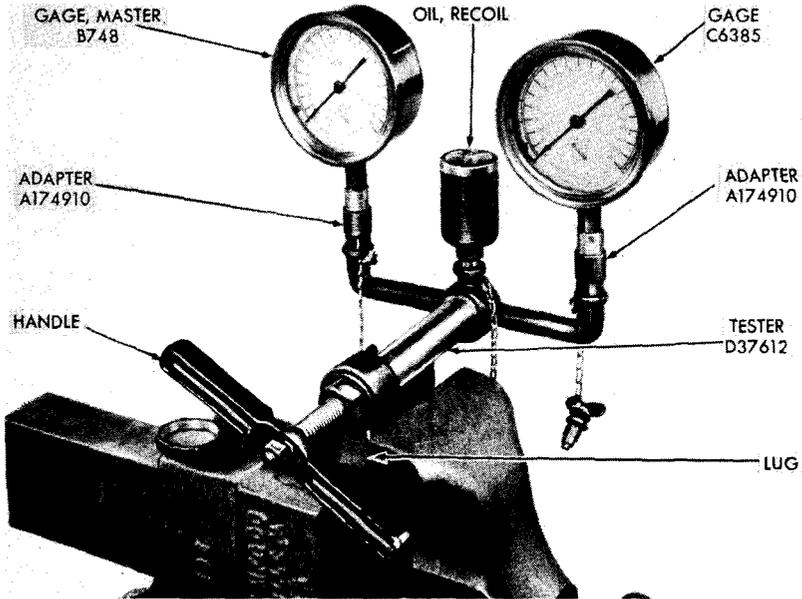
c. Tools for Checking Pressure Gage Used in Inspection of Recoil Mechanism.

(1) The CHEST, pressure gage tester, with contents, complete (fig. 9), is used when checking the service pressure gage against a master gage. The pressure gage tester is filled with recoil oil which is subjected to pressure by a screw. The pressure is transmitted equally to both pressure gages, thereby showing whether the service pressure gage is reading properly.

(2) The following equipment is provided:

Tools	Use
ADAPTER , pressure gage tester, A174910 (fig. 9)	Used to connect pressure gages to tester.
ADAPTER , pressure gage tester, A174904 (fig. 9)	Issued with all outfits but not used with master gage B748.

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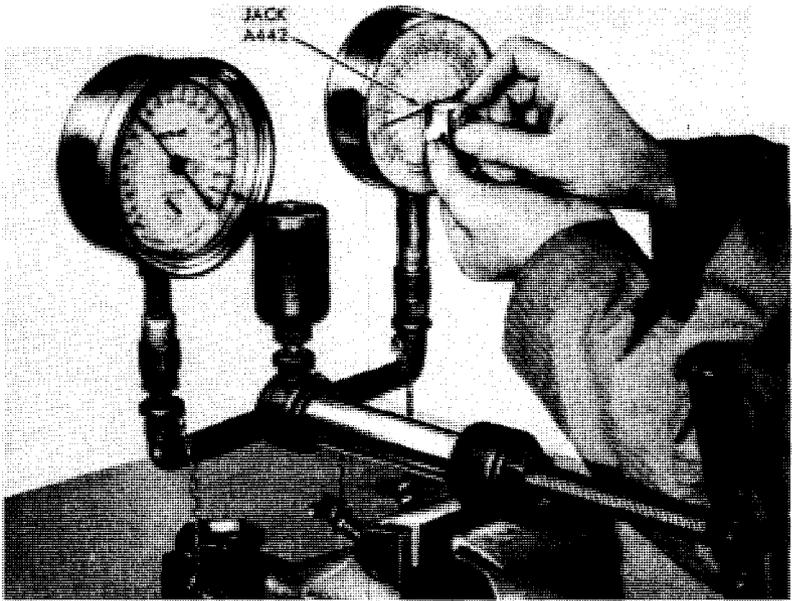


RA PD 69388

Figure 10 — Testing Pressure Gage

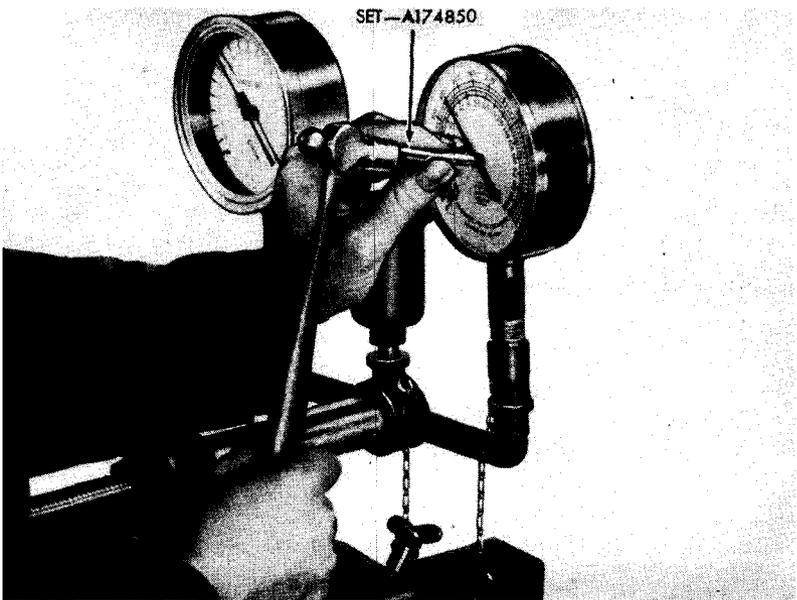
Tools	Use
GAGE, pressure, hydraulic, 0 Kg.—200 Kg., master, B748 (fig. 9)	Used to check accuracy of service pressure gage. It is graduated in pounds per square inch as well as kilograms per centimeter. The gage should be returned to an arsenal once a year for verification of its accuracy. Care must be exercised not to jar instrument at any time. This gage is never used to perform a manometer test.
GASKETS and GLASSES (fig. 9)	GASKET, oil reservoir, A174909; GASKET, suction piston, A174896; GASKET, adapter, A174903; and GLASSES, gage, A1715 are spare parts.
JACK, gage hand, A442 (fig. 9)	Used to remove service pressure gage indicator hand when service gage is not in agreement with master gage.

INSPECTION



RA PD 69489

Figure 11 — Removing Pressure Gage Hand



RA PD 69382

Figure 12 — Resetting Pressure Gage Hand

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Tools	Use
SET, gage hand, A174850 (fig. 9)	Used to place service gage indicator hand in agreement with master gage.

(3) **UES OF PRESSURE GAGE TESTER.** Clamp tester securely in the vise by means of the lug on the under side (fig. 10). Withdraw the screw and fill the apparatus with recoil oil before assembling the pressure gage in order to eliminate possible air bubbles in the connections. Screw the master gage B748 into one arm of the tester and the gage to be tested into the other arm, using the adapters A174910. Apply pressure by means of the operating screw and handle, and compare readings over the entire range of the gages. If the gages are not in agreement, pull the hand off the service pressure gage spindle, using the gage hand jack (fig. 11), and reset the hand in agreement with the master gage. Use a small hammer and the gage hand set when resetting the hand (fig. 12). Tap very lightly. The most effective readings are between 30 and 160 kilograms per square centimeter (430 to 2,300 pounds per square inch).

7. **HOWITZER.**

a. The following points should be scrupulously observed:

Parts to be Inspected	Points to be Observed
Tube (par. 14).	Condition of the recoil mechanism bracket locking ring threads on tube and in ring. Condition and tightness of the recoil mechanism bracket seat ring. Erosion of tube. Wear of lands and grooves.
Breech mechanism (par. 15).	Breech recess for burs, scoring, or other damage. Leveling plates for burs or roughness. Tightness of breech ring on tube. Breechblock for burs, roughness, or scoring. Breechblock bushing for worm firing pin hole and tightness in breechblock. Check that the surface of the breechblock bushing is flush with the surface of the breechblock.

INSPECTION

b. Star-gaging.

(1) The average life of the tube is approximately 7,500 rounds. The howitzers in service should be star-gaged after approximately 90 percent of their estimated accuracy life and thereafter at each 10 percent during the remainder of their service. Tubes are star-gaged any time an inspector finds it advisable. Decoppering of bores of tubes is prohibited at any time.

(2) If a star-gage reading of 4.144 inches is obtained at a point 50.5 inches from the muzzle (an increase of 0.010 inch over the maximum size of 4.134 inches for a new howitzer), the remaining life of the howitzer may be appraised at between 3,500 to 4,500 rounds.

(3) Star-gaging equipment is not issued to all ordnance maintenance companies but may be obtained from a heavy ordnance company or the inspector of the artillery. Instructions for star-gaging are given in TM 9-1860.

(4) When star-gaging equipment is not available, the "diameter of the bore at a point 50.5 inches from the muzzle" must be recorded as "not taken." Tubes must not be reissued on which the wear at any point is appreciably in excess of 0.025-inch increase in diameter.

c. Damage to Forcing Cone.

(1) Scratches and scoring. Scratches, nicks, pitting, and scoring of the bore may permit leakage of gas past the rotating band of the projectile which will cause erosion of the bore, loss of rotational velocity, and consequently loss of range. Such defects must be smoothed and rounded and, depending on their location, character, and extent, decision must be made as to whether the weapon is serviceable from the standpoint of gas leakage or wear on rotating bands. Tubes scored beyond the forcing cone must be reported to the Chief of Ordnance.

(2) PASTILLES. The effect of pastilles, which are small depressions found in some tubes, upon the safety and accuracy of the gun is thought to be negligible; however, as a precautionary measure, tubes having more than three pastilles the size of a 5-cent piece will be reported to the Chief of Ordnance.

8. RECOIL MECHANISM.

a. A detailed description of the construction and operation of the recoil mechanism is given in TM 9-326.

b. The recoil mechanism (figs. 13 and 14) is inspected for the following:

- (1) Oil leakage.
- (2) Oil reserve.
- (3) Proper functioning of oil index.
- (4) Leakage of nitrogen.

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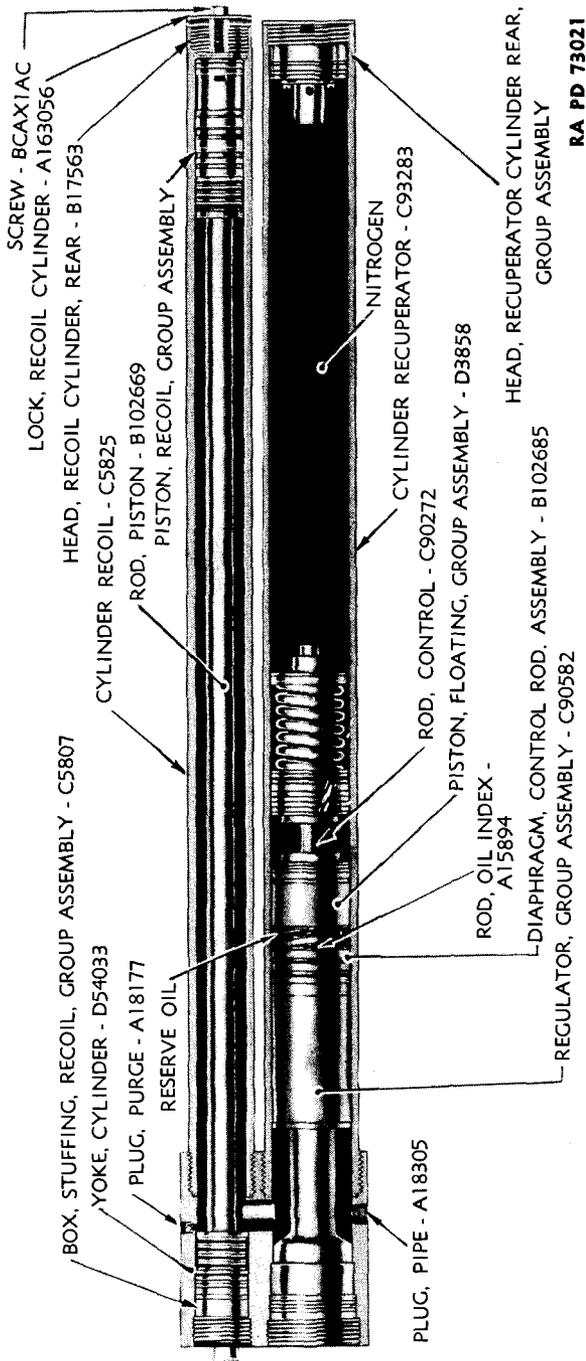
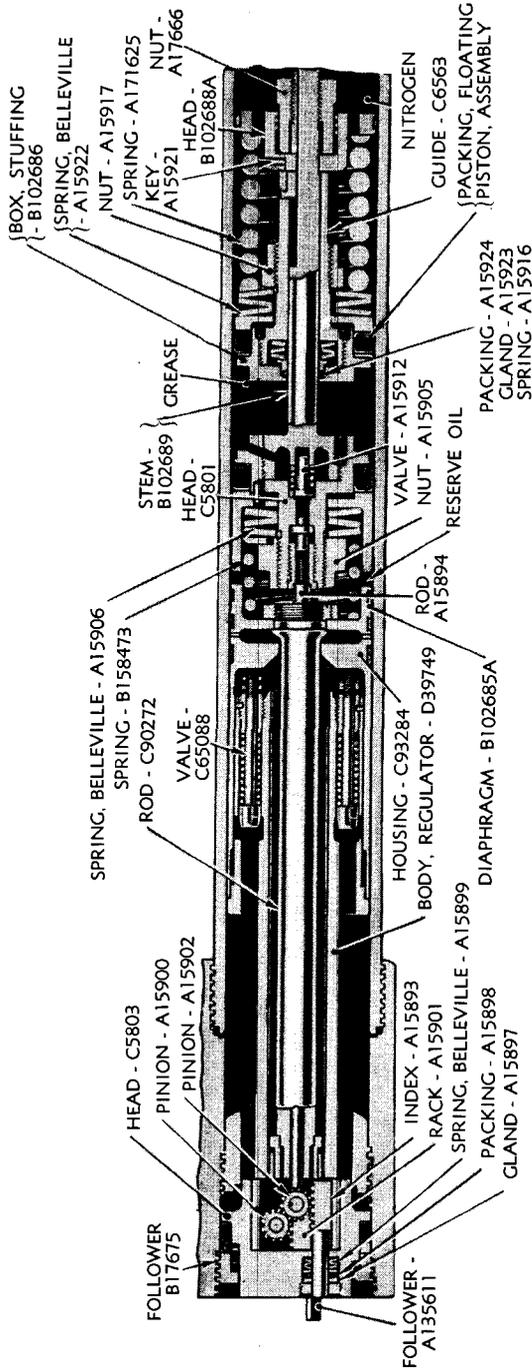


Figure 13 — Recoil and Recuperator Cylinders — Longitudinal Section (Recoil Mechanism M14)

INSPECTION



RA PD 73022

Figure 14 — Regulator and Floating Piston — Sectional View (Recoil Mechanism M14)

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- (5) Pressure of compressed nitrogen.
- (6) Friction of various packings.
- (7) Condition of cradle slides.
- (8) Length of recoil.

9. MANOMETER TEST.

a. General.

(1) In cold weather, the mechanism should be stored for at least 24 hours in a room warmed to at least 50 F.

(2) The recoil piston screw jack and manometer testing tools furnished with the 75-mm field howitzer may be used in making this test, which is an improvisation pending design of the special tool.

(3) The manometer test determines the following characteristics:

- (a) Gas pressure in the recuperator cylinder (AP).
- (b) Floating piston friction (F).
- (c) Combined friction of the recoil piston and the stuffing box (CF).

(4) The recoil mechanism must be level and the tube must be removed.

b. Serviceability of the Oil Index.

(1) Remove the filling and drain valve plug, and note the position of the oil index.

(2) Insert the oil release slowly and drain the reserve oil into the thermometer cup (fig. 15). Note the condition of the oil. (Foamy appearance of the oil indicates that nitrogen is leaking past the floating piston, and the mechanism should be reported to the Chief of Ordnance.) Note whether the oil index has receded. If not, it can usually be dislodged by tapping lightly with a block of wood. Record the oil temperature for use under subparagraph d (2), below.

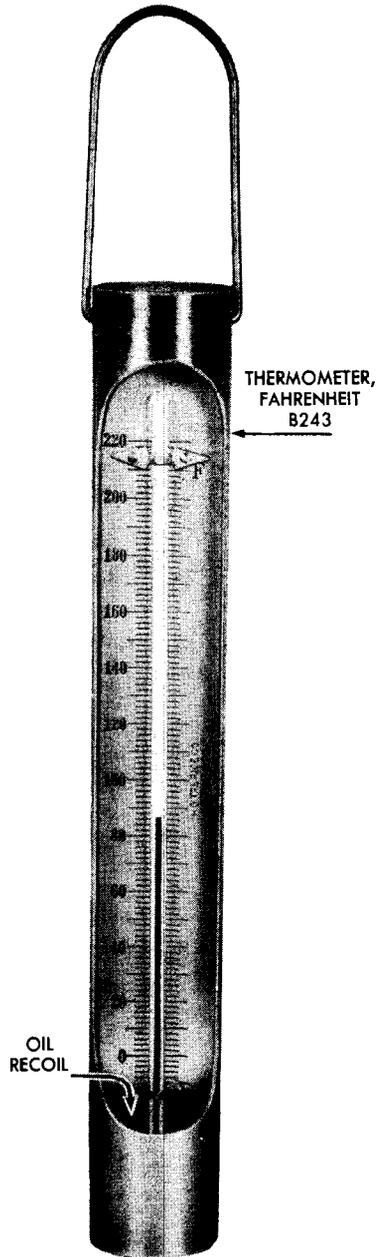
(3) Remove the oil release and attach the oil screw filler. Re-establish the reserve oil, noting the action of the oil index. The pressure of sufficient oil reserve is indicated by the oil index being flush with the extension of the oil index follower.

(4) Repeat steps in subparagraph b (2) and (3), above, if necessary, to insure that the oil index is functioning properly. Finally, redrain the reserve oil, leaving the oil release assembled to the filling and drain valve.

c. Measuring Gas Pressure.

(1) Attach the pressure gage to the oil release, using two wrenches (fig. 16). Close the unused end of the gage T-connection with the filling plug A18495, leaving the plug loose.

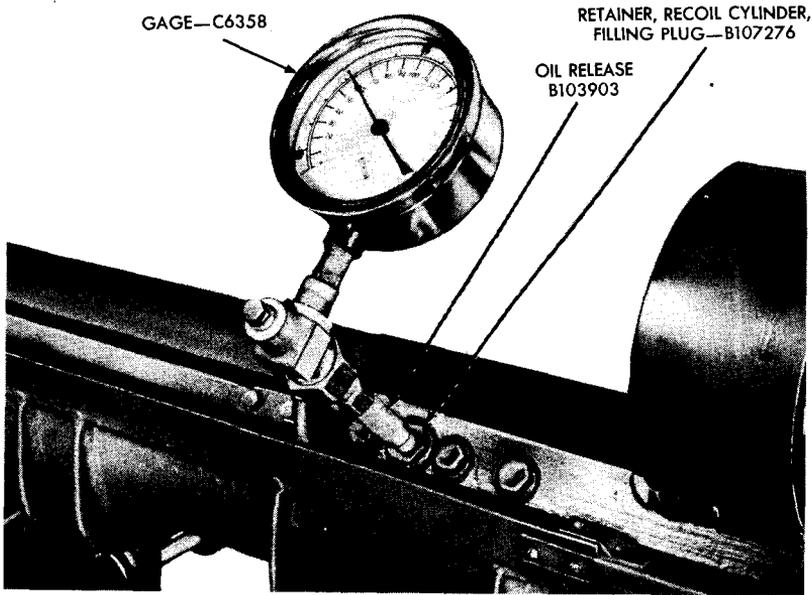
INSPECTION



RA PD 69343

Figure 15 — Thermometer for Oil Temperature

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RA PD 19185

Figure 16 — Checking Gas Pressure.

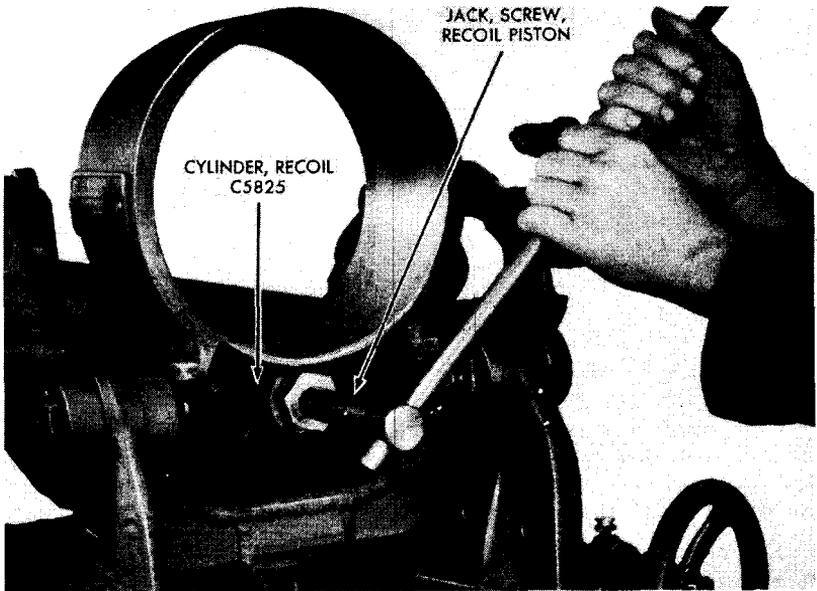
(2) Remove the recoil cylinder rear head. Note that there is no excess leakage of oil past the recoil piston. A small amount of dirty oil is normal and insures lubrication.

(3) Insert the recoil piston screw jack in rear of recoil cylinder and slowly rotate clockwise for a few turns, displacing oil around the loose plug in the T-connection (fig. 17). Tighten the plug when the gage connection is free from air.

(4) Move the recoil mechanism to the rear by means of the recoil piston screw jack until a pressure of 1,520 pounds per square inch is registered on the gage. Turn the jack an additional 10 revolutions and while slowly making the tenth revolution read the pressure gage. Tap the gage lightly to overcome the effect of friction in the gage itself. Record the reading at this point as $AP + F$ (gas pressure plus floating piston friction).

(5) Continue turning the jack five more revolutions; then reverse the direction of motion of the jack. Unscrew for five revolutions, moving slowly on the fifth revolution, and read the gage the second time. Record this reading as $AP - F$ (gas pressure minus floating piston friction).

INSPECTION



RA PD 69319

Figure 17 — Using Screw Jack in Manometer Test

(6) Repeat steps in subparagraph c (4) and (5), above, until three sets of readings which agree closely have been obtained. Average the reading for $AP + F$ and $AP - F$, and use the average figures for calculations.

d. Calculating AP and F .

(1) Substitute the average values obtained for $AP + F$ and $AP - F$ in the following formulas:

$$AP = \frac{(AP+F) + (AP-F)}{2}$$

$$F = \frac{(AP+F) - (AP-F)}{2}$$

(2) Normal AP at 70 degrees is 1,520 pounds per square inch for Recoil Mechanisms M13 and M14. Normal gas pressure (AP) as a function of temperature is given in Table I. A tolerance of plus or minus 50 pounds per square inch on the pressure at any temperature is allowed, within which limits the mechanism is considered serviceable. If repeated tests give a value of gas pressure (AP) which is low (more than 50 pounds per square inch lower than the normal pressure for the temperature at which the tests are conducted), the mechanism should be reported to the Chief of Ordnance.

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TABLE I

Temperature (Degrees F)	Gas Pressure (Lb per Sq In.)	Temperature (Degrees F)	Gas Pressure (Lb per Sq In.)
0	1,319	70	1,520
5	1,334	75	1,535
10	1,348	80	1,549
15	1,363	85	1,563
20	1,376	90	1,577
25	1,391	95	1,592
30	1,405	100	1,606
35	1,420	105	1,621
40	1,434	110	1,635
45	1,448	115	1,649
50	1,463	120	1,664
55	1,477	125	1,678
60	1,492	130	1,693
65	1,506	135	1,706
		140	1,721

NOTE: The variation in pressure per 5 F is 14.4 pounds per square inch.

(3) The allowable limits of floating piston friction (F) as calculated in subparagraph d (1) above are 140-430 pounds per square inch. If repeated tests give a value of F which is less than 140 pounds per square inch or more than 430 pounds per square inch at any temperature, the recoil mechanism should be reported to the Chief of Ordnance.

EXAMPLE:

Average gage reading as found in subparagraph c (4) at 60 deg is.

$$AP + F = 1682 \text{ psi.}$$

Average gage reading as found in subparagraph c (5) at 60 deg is

$$AP - F = 1277 \text{ psi.}$$

Hence,

$$AP = \frac{1682 + 1277}{2} = 1480 \text{ psi at 60 deg F}$$

$$F = \frac{1682 - 1277}{2} = 203 \text{ psi at 60 deg F}$$

(4) From table I the normal gas pressure at 60 F is 1,492 pounds per square inch. Allowable limits within which the mechanism is

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serviceable are from 1,442 pounds per square inch to 1,542 pounds per square inch. The value 1,480 pounds per square inch falls within this range; hence, the gas pressure is satisfactory. Also the value of the floating piston friction (203 psi) falls within the range 140-430 pounds per square inch, hence, the floating piston friction is satisfactory.

e. Measuring Combined Friction.

(1) Rotate the recoil piston screw jack slowly in the clockwise direction until a pressure of about 1,200 pounds per square inch is obtained; then reverse, and back off the jack until the piston head no longer follows the jack screw. Record the gage reading at this point.

(2) Repeat operations described in step (1), above, until three readings which agree within 10 pounds per square inch are obtained. Average the three readings and record the average value as combined friction of recoil piston and stuffing box (CF). The allowable limits are 365-800 pounds per square inch at any temperature, normal being 465 pounds per square inch.

(3) If the reading of combined friction is *low* (less than 365 psi), report the mechanism to the Chief of Ordnance. If reading of friction is *high* (more than 800 psi), loosen up *slightly* (not more than one-tenth of a turn) on recoil cylinder head follower A15852 and piston head A15872.

CAUTION: Mark the original positions of the follower and piston head with a prick punch before loosening these parts.

10. CARRIAGE.

a. The following points should be scrupulously observed:

Parts to be Inspected	Points to be Observed
Cradle (sec. VI).	General condition. Guides for scores or rough spots. Trunnion pins for wear, scores, and tightness. Elevating arc for worn or damaged teeth and stops.
Top carriage and pintle pin (sec. VII).	Condition of all welds on top carriage. No cracks or other damage. Pintle pin bushings for wear or scores. Pintle pin for wear or damage.

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Parts to be Inspected	Points to be Observed
Bottom carriage (sec. VIII).	Condition of all welds on bottom carriage. Wheel carrier bushings for wear or scores. Firing base boss in good condition. Trail hinge pin brackets for damage. No broken teeth on traversing rack.
Firing base.	Condition of all welds. Hinge pins for scores or other defects. Latch for locking firing base in traveling position for scores.
Equilibrators.	Proper seating in cup-shaped bearings. Condition of equilibrator trunnion pins.
Elevating mechanism (sec. X).	Elevating worm, elevating worm wheel, and elevating pinion for wear or damage. Disassemble defective mechanism and repair.
Traversing mechanism (sec. XI).	Traversing worm, traversing worm wheel, and traversing pinion for wear or damage. Disassemble defective mechanism and repair.
Trails (sec. XV).	All welds for cracks or breaks. All brackets and fastenings welded to trails for broken or cracked welds. Lunette for condition and tightness. Handspike sockets for condition. Spades for condition. Handspike supports for operation and condition.
Wheel carriers and wheel latches (sec. XII).	Mounting pin in good condition. Wheel latch bolt not damaged or burred and seats firmly. No broken teeth on wheel latch rack.
Wheels and tires (sec. XIII).	Disk and rim not bent or damaged. Studs and nuts in good condition. Wheels properly alined. No play in wheel bearings.

MAINTENANCE AND REPAIR INSTRUCTIONS

Parts to be Inspected	Points to be Observed
Brakes (sec. XIV).	Functioning of hand brake lever. Brake cam for wear or damage. Brake drums for scored condition. No broken teeth on brake ratchet racks. Proper adjustment without "grabbing." Brake shoe retracting springs in good condition.

Section III

MAINTENANCE AND REPAIR INSTRUCTIONS

	Paragraph
General	11
Tools	12
General recommendations	13

11. GENERAL.

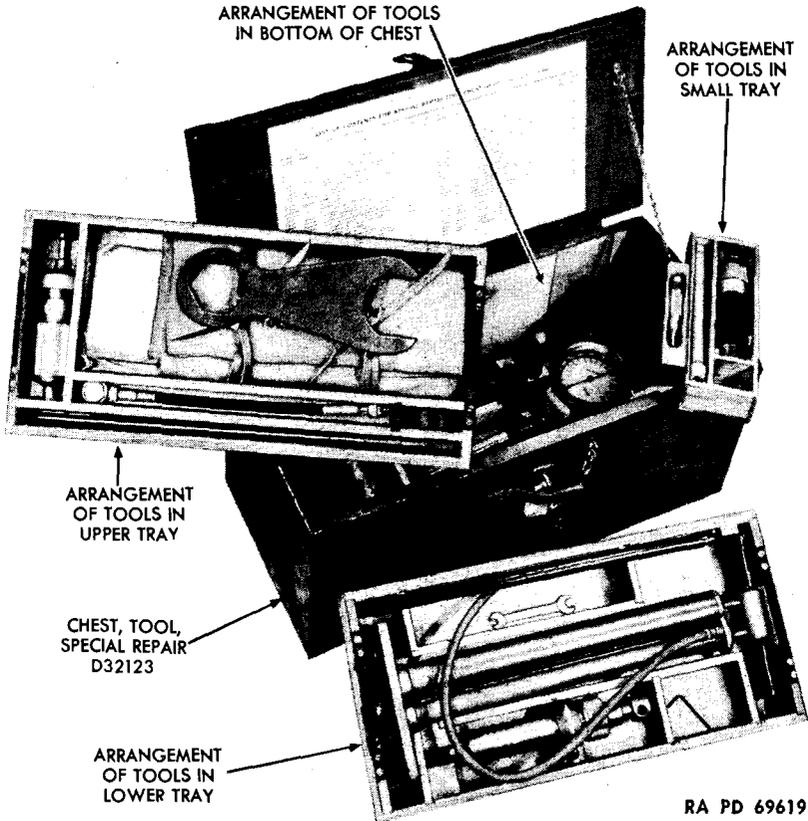
a. Information and instructions contained herein are supplementary to instructions for the using arms contained in TM 9-326; however, operations covered in TM 9-326 are sometimes performed by ordnance maintenance personnel who should refer to TM 9-326 for proper instructions.

b. In this manual, the howitzer, recoil mechanism, and carriage are each covered as major units. Each major unit is further broken down into its main subassemblies. Each subassembly is completely disassembled and corrective steps are outlined for maintenance and repair. Types of maintenance and repair are outlined for each main subassembly. The subassemblies are then reassembled and replaced in their proper position on the major unit; however, many repairs may be made to the subassemblies without complete disassembly of the howitzer and carriage.

12. TOOLS.

a. Special repair tools for maintenance of the 105-mm Howitzer Materiel M3 and M3A1 are listed in SNL C-18. They are carried in chest D32123 (fig. 18). The chest occupies a space of approximately 5.2 cubic feet. Dimensions are 29 inches long, 17 inches wide, and 18 inches deep.

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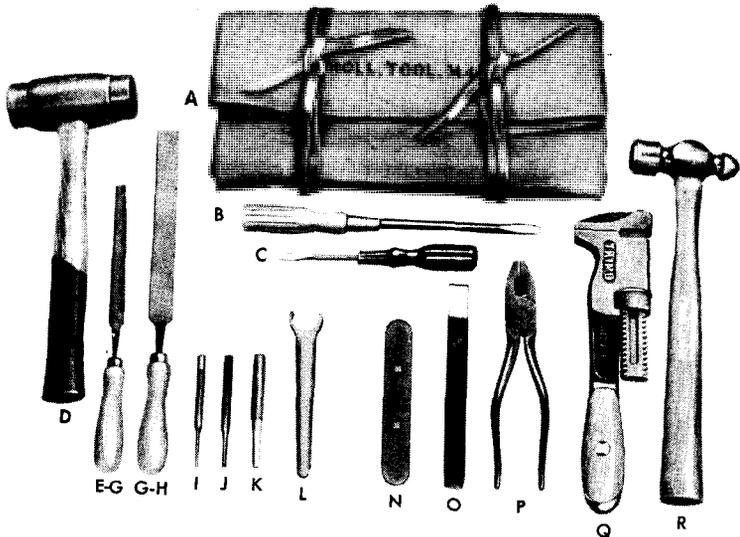
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Figure 18 – Special Repair Tool Chest

b. The names or general characteristics of many of the tools, such as chisels, drifts, files, hammers, pliers, screwdrivers, wrenches, and punches, indicate their uses and application (fig. 19). Tools which are not described in other publications on this weapon are described below.

Tools	Use
BOLT, assembling, equilibrator, A140673 (fig. 20)	Used for removal, installation, and adjustment of equilibrators.
ROLL, tool, M4, with contents, complete (fig. 19)	The tool roll contains common tools, such as files, punches, wrenches, screwdrivers, etc., for general use in work on the materiel.

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- A — D5103 - 1 ROLL, TOOL, M4
- B — TGAX1B - 1 SCREWDRIVER, COMM., NORMAL DUTY, 6-IN. BLADE
- C — TGAX1A - 1 SCREWDRIVER, COMM., NORMAL DUTY, 3-IN. BLADE
- D — TAGX2A - 1 HAMMER, HIDE-FACED, 2-LB
- E — TEAX2CC - 1 FILE, A.S., HALF-RD., SM., 6-IN.
- G — TEHX1C - 1 HANDLE, FILE, 1 1/4 X 4 1/4-IN.
- H — TEAX1DE - 1 FILE, A.S., HAND, SEC-CUT, 8-IN.
- I — TCFX1B - 1 PUNCH, DRIVE PIN, STD., 1/8-IN. PT.
- J — TCFX1D - 1 PUNCH, DRIVE PIN, STD., 3/16-IN. PT.
- K — TCGX2B - 1 DRIFT, BRASS, TAPER, 5/16-IN. PT.
- L — B104033 - 1 WRENCH, RECOIL CYLINDER HEAD FOLLOWER
- N — B104035 - 1 WRENCH, RECOIL CYLINDER HEAD
- O — TBAX1C - 1 CHISEL, MACHS., HAND, COLD, 3/4-IN.
- P — THAX1A - 1 PLIERS, SIDE-CUTT., FL-NOSE, 8-IN.
- Q — TKAX1C - 1 WRENCH, SCREW, ADJ., KNF-HDL., 12-IN.
- R — TAAX1C - 1 HAMMER, MACHS., BALL-PEEN, 20-OZ

Figure 19 — Tool Roll M4 and Contents

Tools	Use
WRENCH, howitzer, locking ring, C7928 (fig. 20)	Face spanner type wrench used on recoil mechanism bracket locking ring when mounting or dismounting tube.
WRENCH, pintle and trail, B108514	Used to remove pintle nut and trail hinge pin nut.
WRENCH, socket, 2 lug, 3 1/16 O.D., B141575	Used with handle B108566 to remove and install roller bearing retainer on elevating pinion.
WRENCH, recoil cylinder head follower, B104033 (fig. 193)	Used to loosen recoil cylinder head follower.
WRENCH, recoil cylinder head, B104035 (fig. 19)	Required for removal and installation of recoil cylinder rear head.

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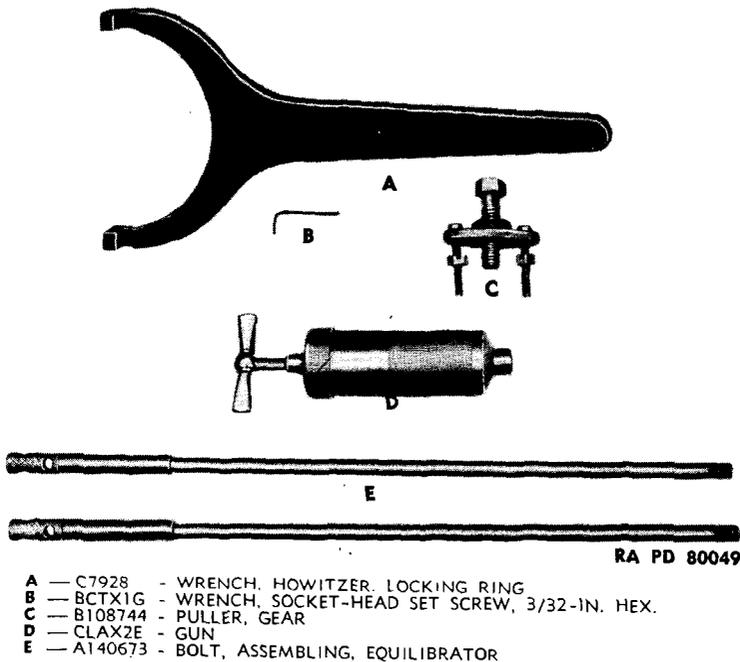


Figure 20 — Tools for Maintenance and Repair

Tools	Use
WRENCH-SET, socket, 1/2-in. sq. drive	Consists of an extension, joint, ratchet, and various size sockets.

13. GENERAL RECOMMENDATIONS.

a. Cautions.

- (1) Do not use gasoline or kerosene for general cleaning purposes. Use only SOLVENT, dry-cleaning.
- (2) Do not use high-pressure air or water hose for cleaning purposes.

b. Antifriction Bearings. Clean antifriction (ball and roller) bearings by flushing with SOLVENT, dry-cleaning, only. When clean, lubricate and wrap in clean paper until used. Do not lay bearings down on a dirty bench or floor; place them on a clean paper. If an antifriction bearing is to be forced over a long shaft or a tight fitting seat in order to reach its location, it may be desirable to expand the bearing slightly by heating it in oil. Bearings should never be forced on a shaft by driving against the outer race. Neither should they be driven into a housing by driving against the inner race. Wherever possible, antifriction bearings should be forced

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into position in an arbor press. In any event, care should be taken to start the bearing straight so as not to damage the shaft or housing. A light film of oil on the shaft or in the housing bore will make the mounting of the bearing easier.

c. **Bushings.** Bushings should not be forced into position by blows applied directly. Whenever possible, they should be forced into position with an arbor press or an improvised tool consisting of a bolt of appropriate diameter, two washers, and a bolt nut. If a suitable press or improvised tool is not available, use a wood block and copper hammer.

d. **Cotter Pins.** Always use new cotter pins when assembling the various subassemblies of the howitzer and carriage.

e. **Used Parts.** In the absence of detailed specifications, used parts may be checked to determine whether they are fit for further use by comparing them with new parts of the same design.

f. **Use of Wrenches.** Use only wrenches that fit snugly on parts. Tools that do not fit will fail or cause damage to the corners of nuts, boltheads, etc. There is also the possibility of spreading the wrenches and rendering them useless.

g. **Assembly of Subassemblies.** When performing complete carriage and howitzer assemblies, assemble all subassemblies before attempting to mount them. As a part of all assembly and mounting operations, clean and lubricate the bearings, slide surfaces, threads, etc.

Section IV

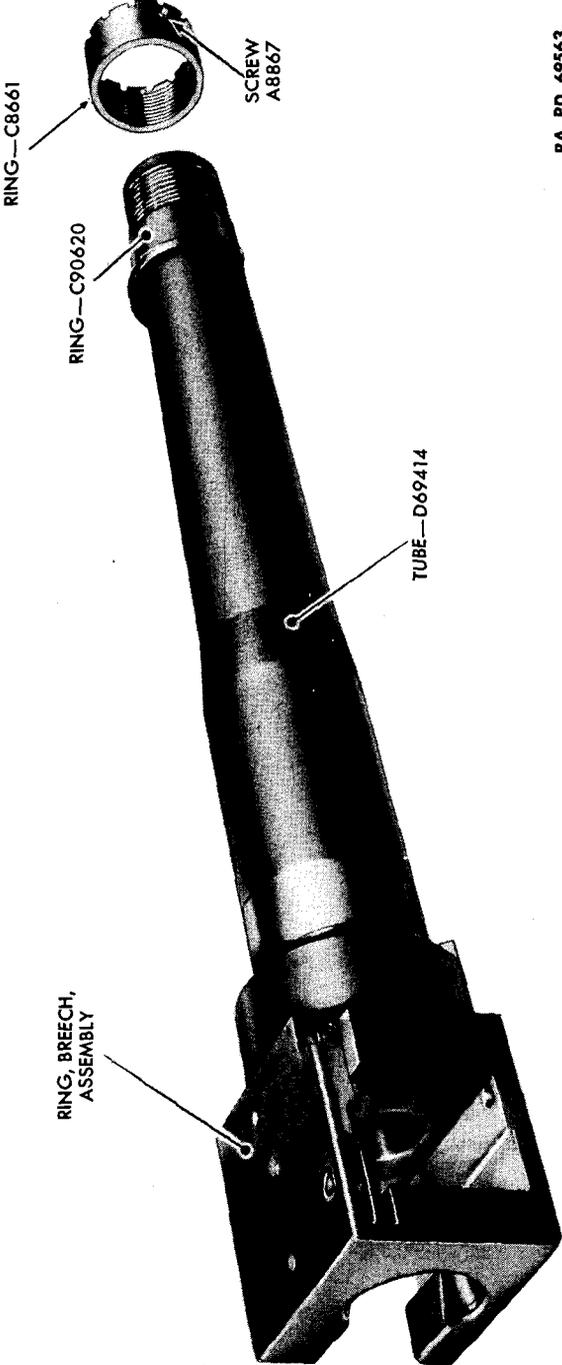
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	Paragraph
Tube	14
Breech mechanism	15
Firing lock	16

14. TUBE.

a. **General.** Two tubes are used with this weapon. The tube and breech ring assembly illustrated in this manual has a recoil mechanism bracket seat ring C90620; the alternate tube and breech ring assembly does not have this ring on the tube. Both tubes are of 1-piece construction and rifled uniformly one turn in 20 calibers. Threads are cut on the breech end of the tube to mate with the breech ring. The breech ring is machined to receive the breech mechanism and has two

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Figure 21 — Tube with Recoil Mechanism Bracket Locking Ring Removed

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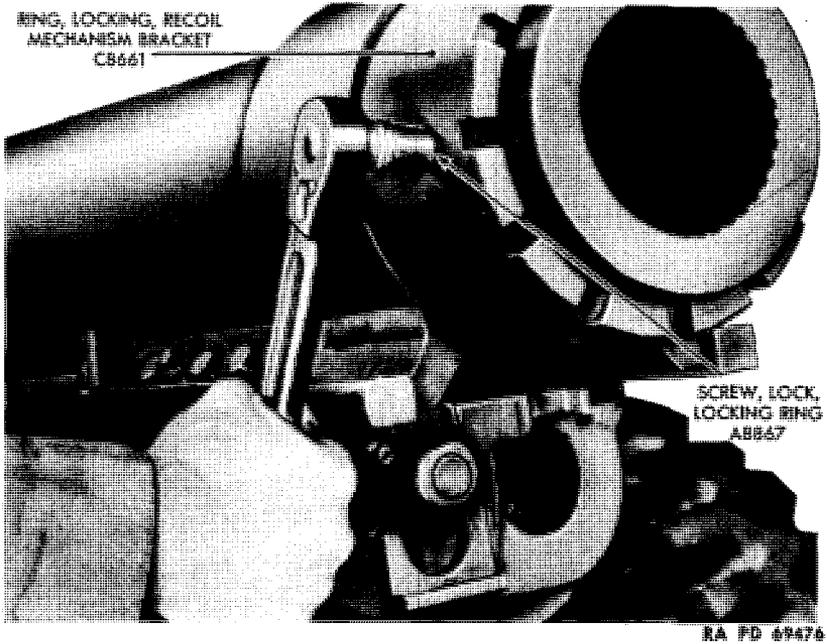


Figure 22 — Removing Lock Screw from Recoil Mechanism Bracket Locking Ring

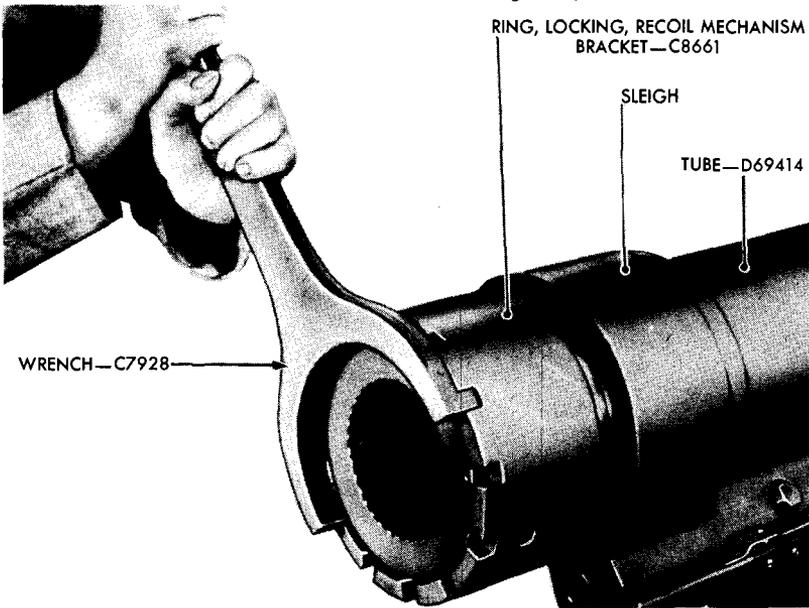
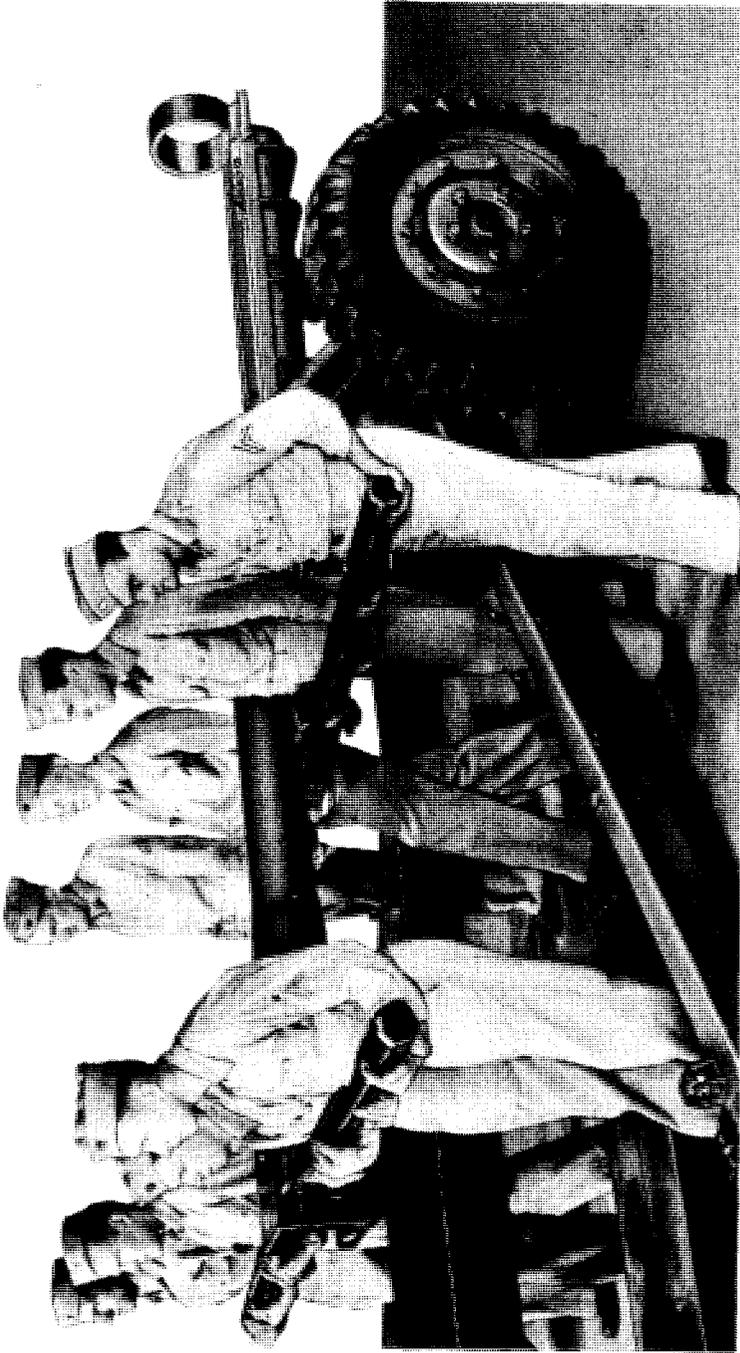


Figure 23 — Removing Recoil Mechanism Bracket Locking Ring

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Figure 24 — Removing Tube

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projecting keys which fit into companion openings in the sleigh. A flash guard is mounted on the breech ring. A recoil mechanism bracket locking ring is located near the front of the tube at a point just forward of where it protrudes from the sleigh (fig. 21).

b. Interchangeability of Tubes. Tubes of the 105-mm Howitzers M3 are interchangeable; however, the tubes may be interchanged only if facilities are available for drilling the seat for the breech ring lock screw.

c. Removal and Disassembly.

- (1) Set the brakes and level the tube.
- (2) Remove the breechblock (TM 9-326).
- (3) Loosen the screw A8867 which holds the recoil mechanism bracket locking ring in position at the muzzle of the tube (fig. 22).
- (4) Remove the recoil mechanism bracket locking ring (fig. 23).
- (5) Bunt the muzzle of the howitzer with a heavy timber to start it moving towards the rear.
- (6) Remove the tube and breech ring. This can be done either by attaching a rope sling and chain hoist at the breech end or by placing four men with suitable wooden lifting bars on each side of the howitzer (fig. 24). The weight to be lifted is 995 pounds.

d. Repairs.

- (1) **LOCKING RING THREADS.** If locking ring threads are bruised or scored, use a double-handled draw scraper and a smooth file to

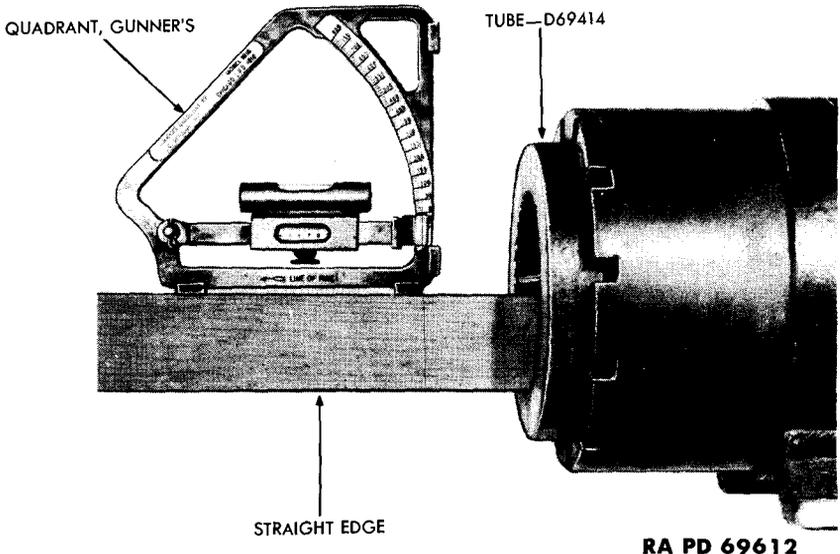


Figure 25 — Checking Bore Alinement with Gunner's Quadrant

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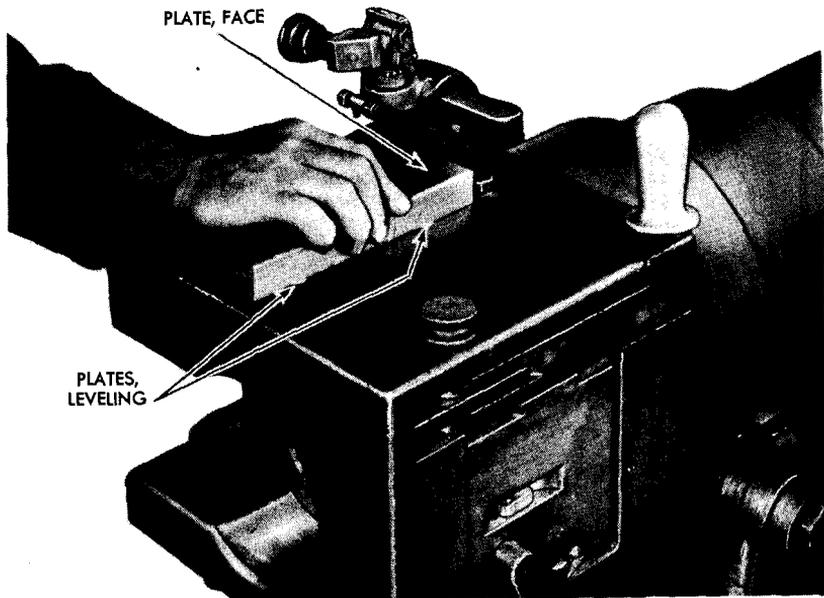


Figure 26 — Checking Surface of Leveling Plates for High Spots

restore contour of threads. Polish with **CLOTH**, crocus, and clean with **SOLVENT**, dry-cleaning. If damage is too great, replace with new ring.

(2) **BREECH RECESS.** A scored or bruised breech recess is usually caused by leakage of gas. Remove bruise or scoring and clean with **SOLVENT**, dry-cleaning.

CAUTION: Burs and high spots should be removed with a scraper or oilstone. **CLOTH**, crocus, should be used to polish.

(3) **LEVELING PLATES.** Leveling plates inset in the top surface of the breech ring are sometimes damaged by accident. Correct as follows:

(a) Place parallel straightedge in muzzle end of the tube on lower side of bore.

(b) Place gunner's quadrant on the protruding end of the parallel straightedge (fig. 25).

(c) Bring the tube exactly level.

(d) Transfer gunner's quadrant to the leveling plates. Remove metal by scraping from the leveling plate toward which the bubble moves until bubble is exactly centered. A flat, true surface or face plate large enough to cover both leveling plates (fig. 26) and coated with blue marking paint (**PRUSSIAN BLUE**) or red lead should be

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used to detect high spots and to insure that entire surface of each leveling plate is true, and that the leveling plates are true, one with the other.

(4) **OPERATING HANDLE CATCH.**

(a) Remove screw from catch.

(b) Pry catch out of dovetailed slot in side of breech ring.

(c) Put a thin film of **COMPOUND**, light, rust-preventive, on rear surface of new catch and on screw threads.

(d) Slide new catch in position and secure with screw. Stake the screw in place.

(5) **FLASH GUARD B163972** (fig. 5). If this becomes bent or damaged, remove and straighten or replace.

e. **Assembly and Installation.**

(1) Level the cradle and sleigh.

(2) Clean the rings of the sleigh with **SOLVENT**, dry-cleaning.

(3) If a rope sling and chain hoist are not available, place four men on each side of the howitzer with suitable lifting bars (fig. 24). While the chain hoist or the eight men support the weight, the muzzle end should be carefully guided through the rear ring of the sleigh and carried forward until the recoil mechanism bracket seat ring of the tube enters the front ring of the sleigh.

(4) Depress the weapon sufficiently to allow the tube to slide forward into position. **NOTE:** To avoid damage to locking ring threads, support the weight of the muzzle end as the tube slides forward into position.

(5) Be sure that the threads of the recoil mechanism bracket locking ring and the recoil mechanism bracket seat ring are free from dirt. Then assemble the locking ring (fig. 23). Care must be taken to avoid damaging the threads since they are close fitting. Apply a light coat of grease or graphite to the threads to make the operation easier and prevent seizing.

(6) Install the locking ring lock screw (fig. 22).

(7) Replace the breechblock (TM 9-326).

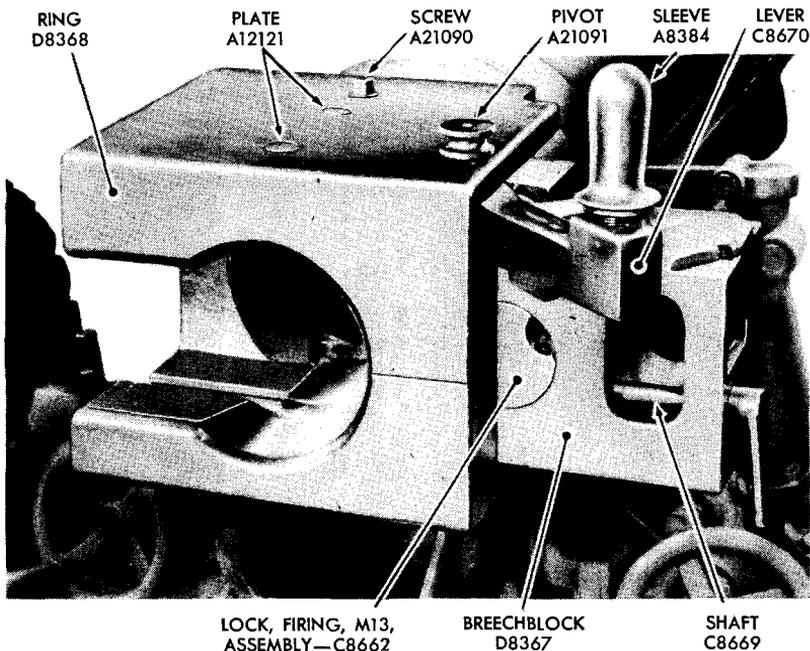
15. BREECH MECHANISM.

a. **General.** The breech mechanism includes the breechblock assembly, breechblock operating lever assembly, detent handle, detent spring, detent spring retaining screw, and extractor (figs. 27 and 28). Description and functioning of these parts are given in TM 9-326.

b. **Removal and Disassembly** (fig. 28).

(1) Remove breechblock (TM 9-326).

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Figure 27 — Breech Mechanism

(2) Disassemble breechblock operating lever (fig. 29).

(a) Place operating lever assembly in a vise equipped with copper jaws. Drive pin BFDX6EU from operating handle sleeve and lift the sleeve from the handle.

(b) Turn lever in vise and push operating handle pivot key from handle and pivot. Slide handle off pivot and out of groove in lever. Spring will come away when handle is removed from pivot.

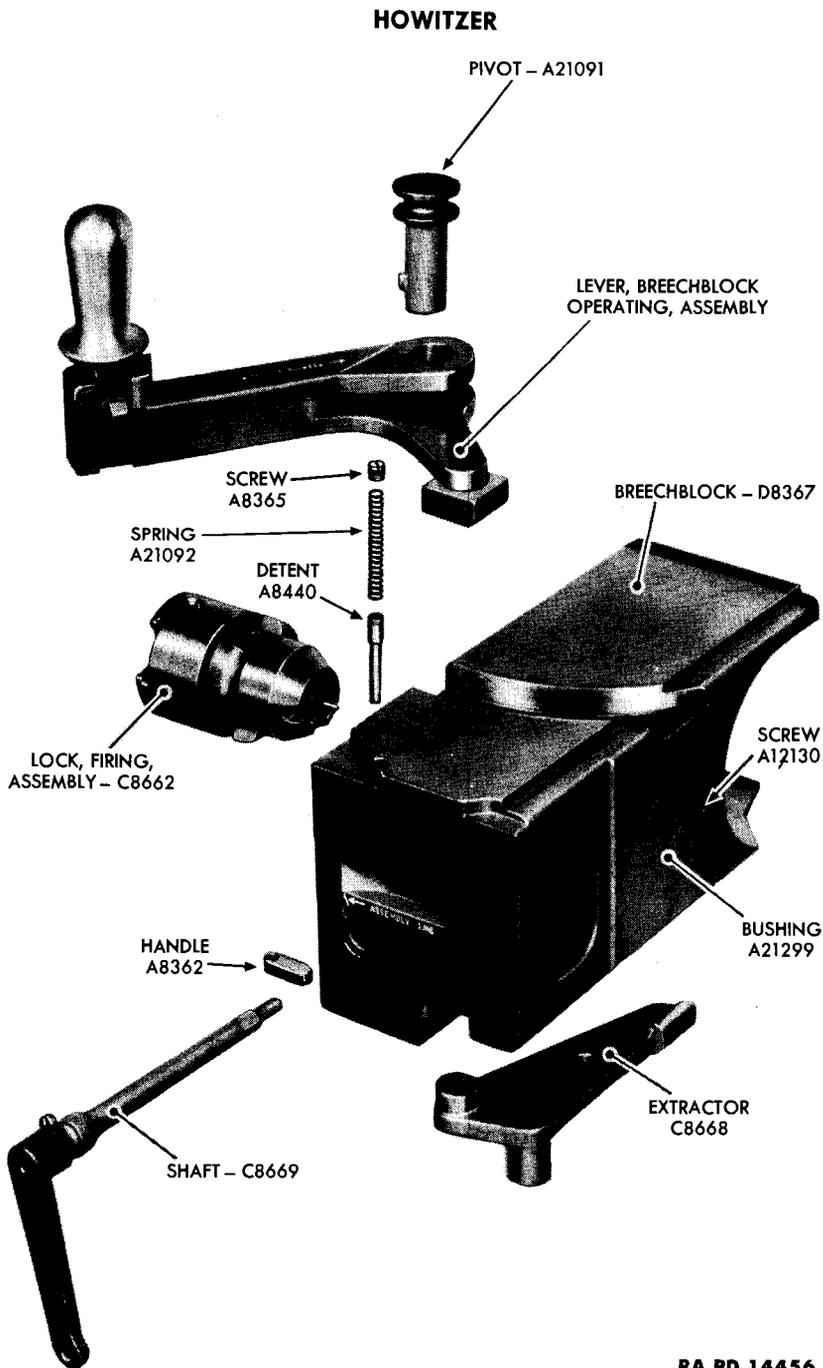
(c) With lever still in the vise, drive operating handle pivot pin A8389 from pivot and lever (fig. 30). Drive the pivot from the lever by inserting punch in drilled hole back of lever.

(d) Remove the crosshead by unscrewing crosshead screw A8391 holding it (fig. 31). The operating lever is now completely disassembled.

c. Repairs.

(1) Clean all parts of the breech mechanism thoroughly with SOLVENT, dry-cleaning. Dry all parts thoroughly, and then coat with OIL, engine, seasonal grade.

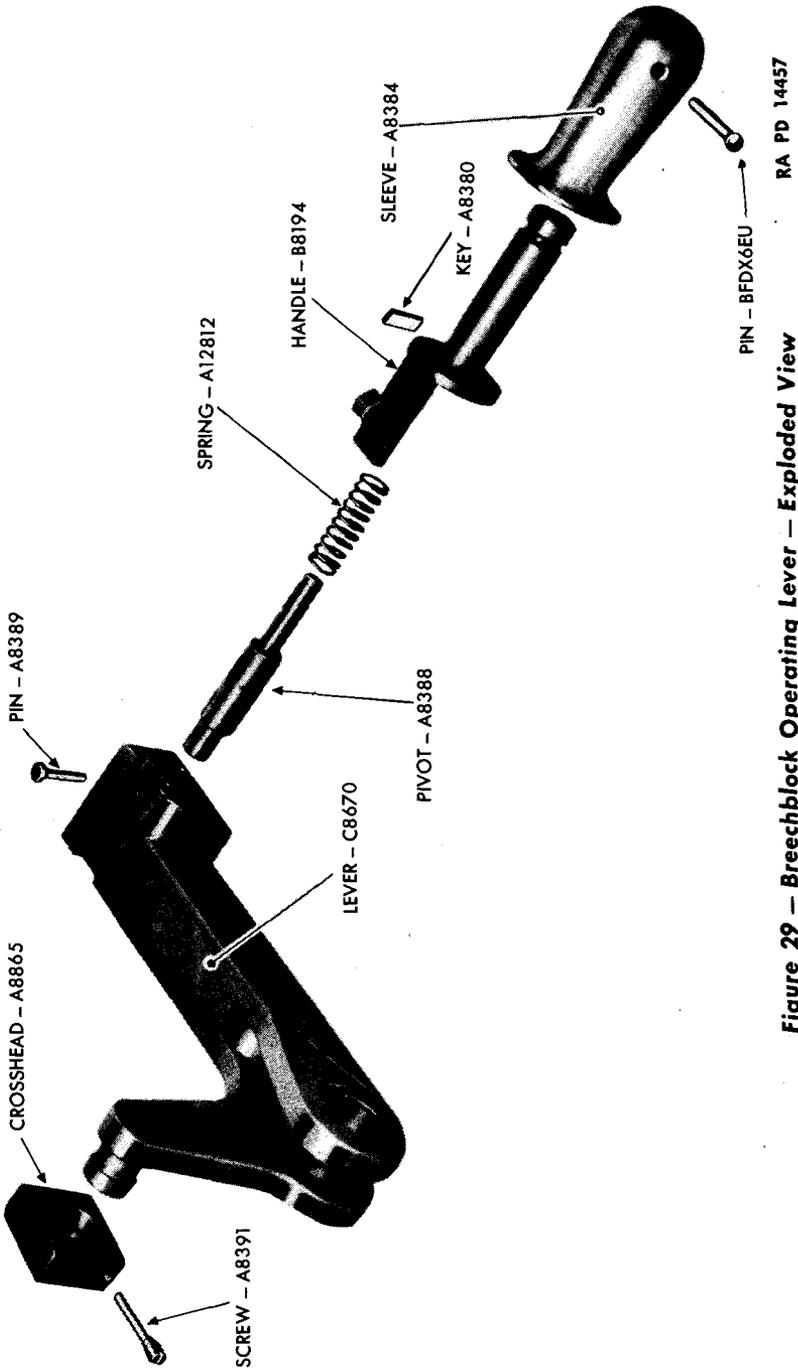
(2) Examine all parts carefully for cracks, burs, wear, or breakage. Remove burs with a scraper or oilstone and polish with CLOTH, crocus. Replace damaged parts.



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Figure 28 - Breech Mechanism - Exploded View

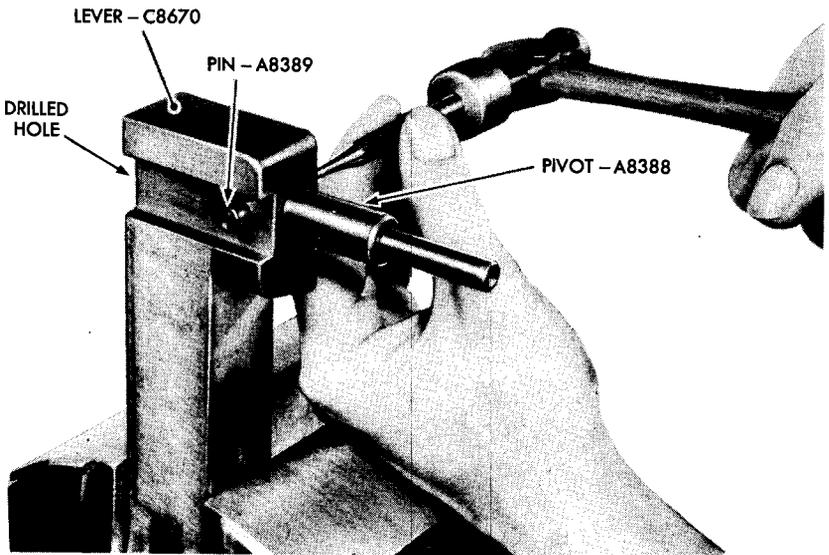
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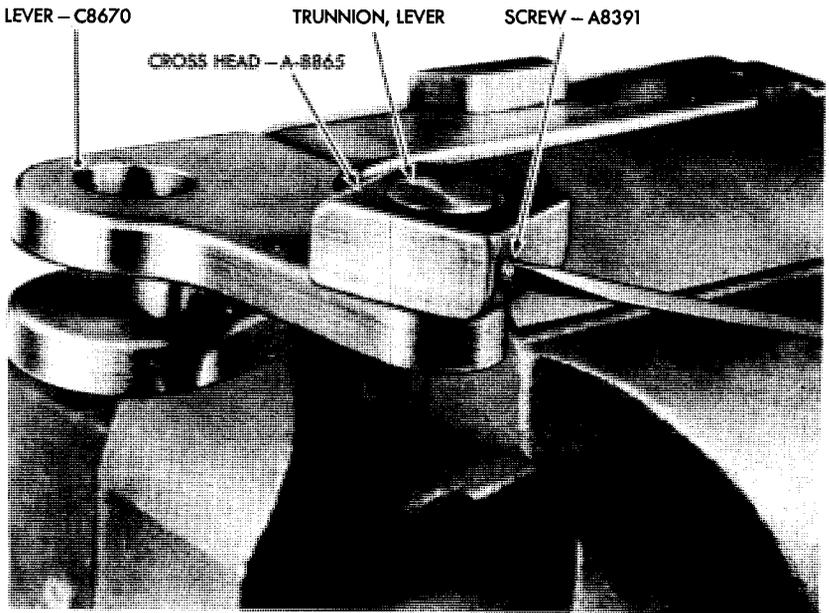
Figure 29 — Breechblock Operating Lever — Exploded View

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Figure 30 - Removing Operating Lever Handle Pivot



RA PD 45011

Figure 31 - Removing Breechblock Operating Lever Crosshead

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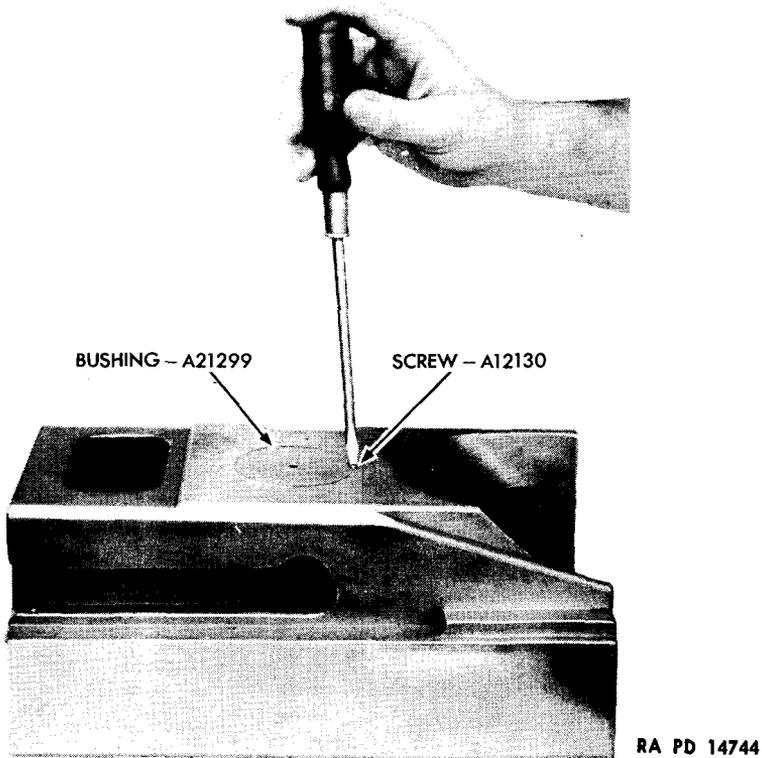


Figure 32 — Removing Bushing Screw from Breechblock

(3) Examine closely for cutting or abrasions on the breechblock and breech recess in breech ring. Remove all scores and bruises on breechblock and in breech recess. Remove burrs on the operating lever.

CAUTION: Remove only enough metal to eliminate the score or bruise.

(4) Replace worn or damaged parts.

(5) **BREECHBLOCK BUSHING.**

(a) A worn firing pin hole in the breechblock may cause fouling of the firing pin. Replace bushing if firing pin hole is worn. Remove screw A12130 from breechblock bushing (fig. 32) and remove bushing.

NOTE: If bushing is too tight to unscrew from breechblock, drill two holes to receive a face spanner wrench; then remove bushing with wrench.

(b) Install new bushing and saw or mill bushing flush with breechblock. Drill and tap a hole (half in bushing and half in breechblock)

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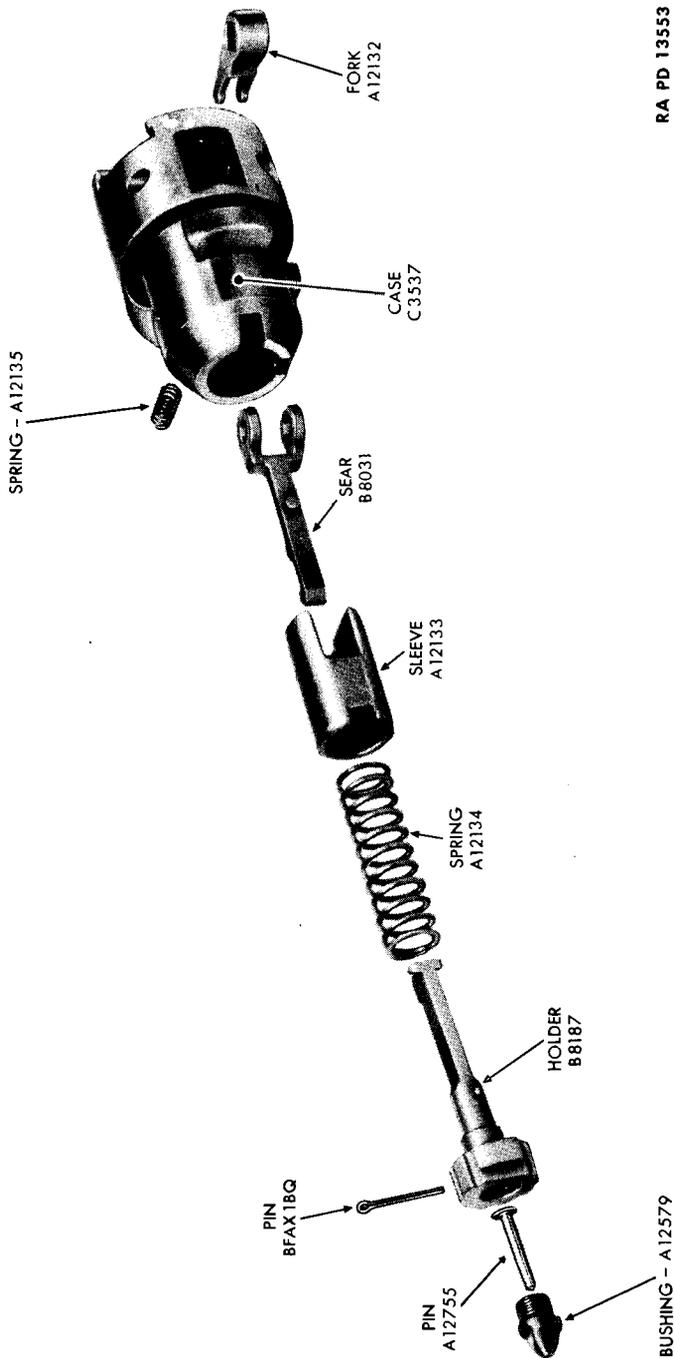


Figure 33 — Firing Lock M13 — Exploded View

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for a 0.190-32NF-3 x 0.40 screw. File and polish the bushing face flush with the breechblock face. Install new screw. File the screw head until it is flush with breechblock face.

d. Assembly and Installation.

(1) BREECHBLOCK OPERATING LEVER.

(a) Place lever in a vise equipped with copper jaws. Place cross-head in position on lever trunnion and secure with crosshead screw A8391 (fig. 31).

(b) Turn lever around in vise so that the end with the handle slot is upright. Tap pivot into position in lever and tap retaining pin A8389 in through lever and pivot (fig. 30). Be sure head of pin fits down into counterbore in slotted side of lever.

(c) Slide pivot spring on pivot; then slide handle on pivot over the spring and into handle slot in lever. Install key in handle and pivot.

(d) Place handle sleeve in position on handle and secure by inserting brass pin BFDX6EU through sleeve. Peen both sides of pin. File ends of pin even with sides of sleeve and polish with CLOTH, crocus.

(2) BREECHBLOCK. See TM 9-326.

16. FIRING LOCK.

a. **General.** The firing pin is designed to deliver a quick blow of sufficient force to fire the primer. Anything which interferes with this quick movement is cause for malfunction, and maintenance and repair are required.

b. **Removal and Disassembly.** See TM 9-326.

c. **Repairs.** Wear in this mechanism (fig. 33) is negligible, except for the firing pin. Although frequent disassembly for the purpose of cleaning, inspection, and replacing worn or damaged parts is required of the using arms, the firing lock is also disassembled, cleaned, inspected, repaired, and assembled by ordnance maintenance personnel. At such time, all burs should be removed, taking care that a minimum of metal is removed.

d. **Assembly and Installation.** See TM 9-326.

Section V

RECOIL MECHANISM

	Paragraph
General	17
Removal and disassembly	18
Repairs	19
Assembly and installation	20

17. GENERAL.

a. Complete disassembly of a recoil mechanism of this type can be undertaken only at a repair shop especially equipped for this purpose. High pressures present in the system at all times make it extremely dangerous to attempt unauthorized disassembly. *It is forbidden to perform disassembly of the recoil mechanism beyond that outlined in this manual. Under no circumstances may an attempt be made to take this mechanism apart.* All work on the recoil mechanism must be performed under the direction of an officer especially designated for this purpose.

b. The sleigh (fig. 34) forms a support for the recoil and recuperator cylinders (fig. 35). The recoil indicator is assembled to the right side of the sleigh and is used to check the length of recoil during firing. The recoil cylinder cushions the shock of recoil after firing, and the recuperator cylinder returns the howitzer to battery. A complete description of the recoil mechanism is contained in TM 9-326.

18. REMOVAL AND DISASSEMBLY.

- a. Level the howitzer and cradle.
- b. Remove the tube (par. 14).
- c. **Remove the Recoil Mechanism from the Cradle.**

(1) Move the piston rod latch up to open position and lock it in that position with the piston rod latch stem (fig. 36).

CAUTION: Never elevate the howitzer when the piston rod latch is in open position because the tube and sleigh will then slide backwards off the cradle.

(2) Move the recoil mechanism back and lift it off the cradle. The weight to be lifted is 221 pounds. Use a rope sling and chain hoist (fig. 37), or station two men at the front ring and two men at the rear ring to lift the recoil mechanism by hand.

- d. **Remove the Recoil Indicator Bracket Assembly.**

(1) Remove the two screws BCBX1AA and the two washers which hold the recoil indicator bracket in position on the side of the sleigh (fig. 34).

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1

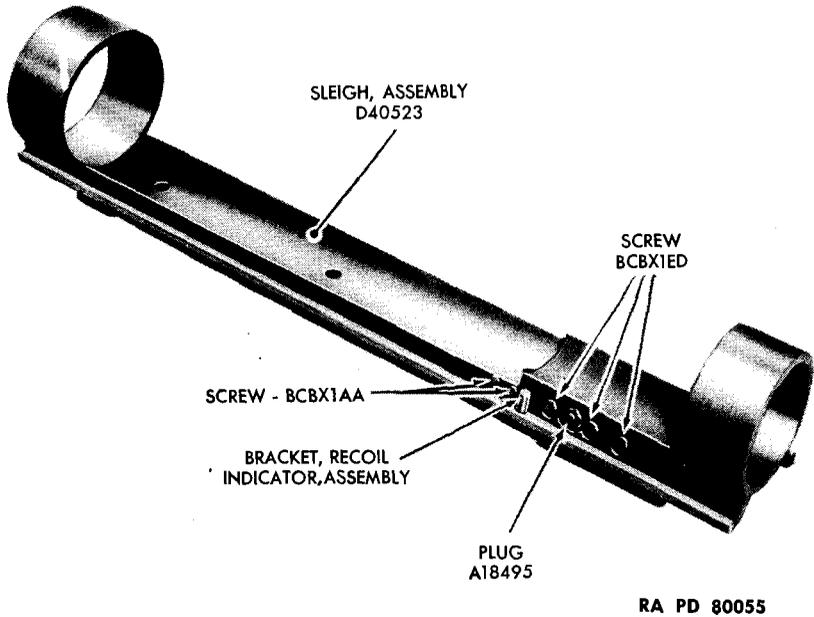


Figure 34 — Sleigh

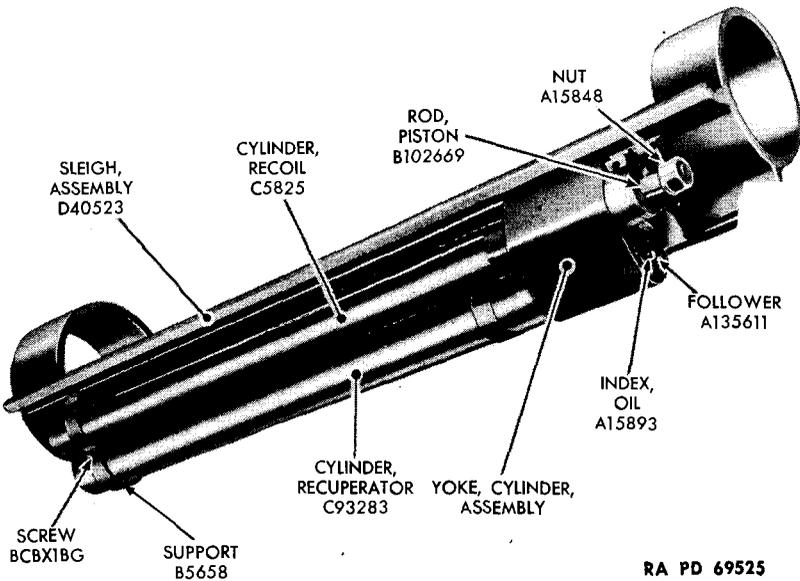
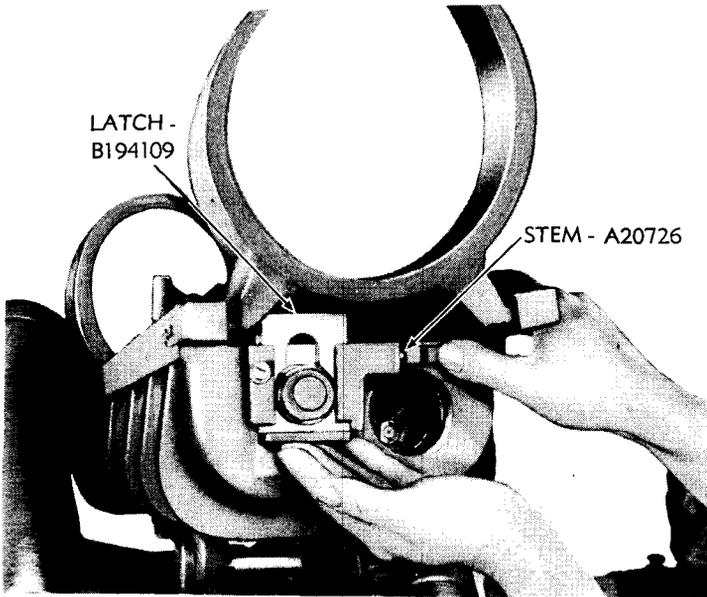


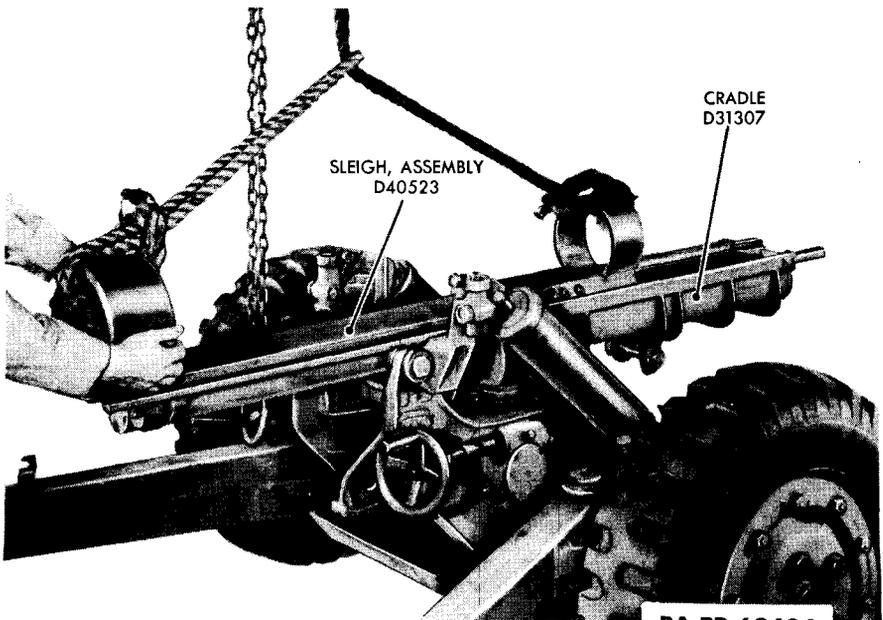
Figure 35 — Recoil Mechanism M14

RECOIL MECHANISM



RA PD 19194

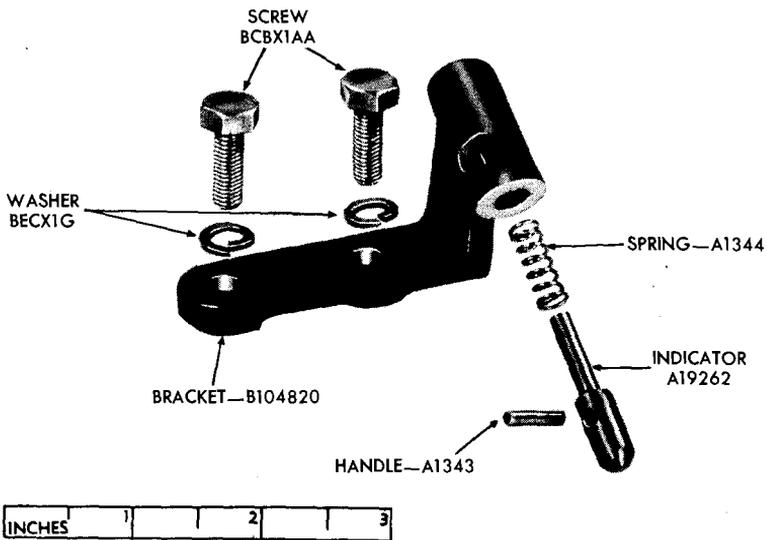
Figure 36 — Unlocking Piston Rod Latch



RA PD 69494

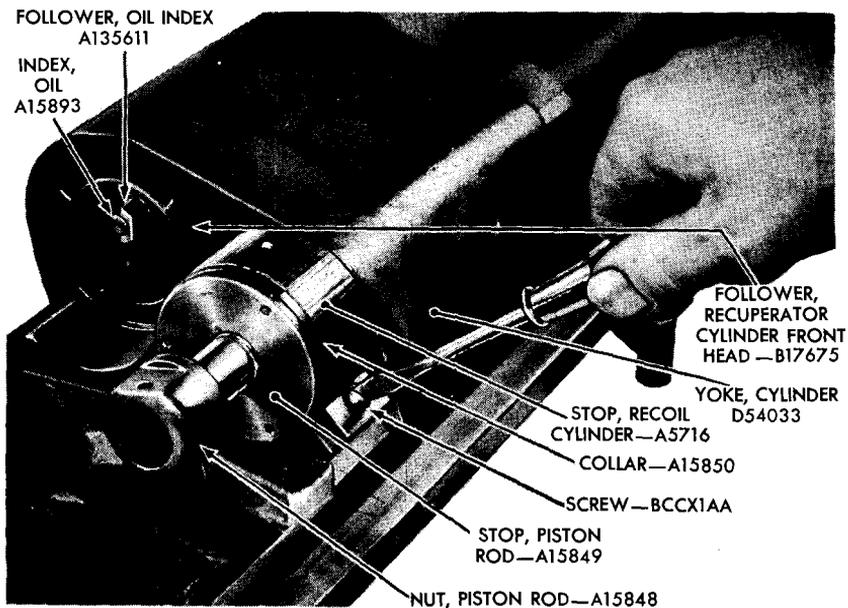
Figure 37 — Removing Sleigh

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 69336

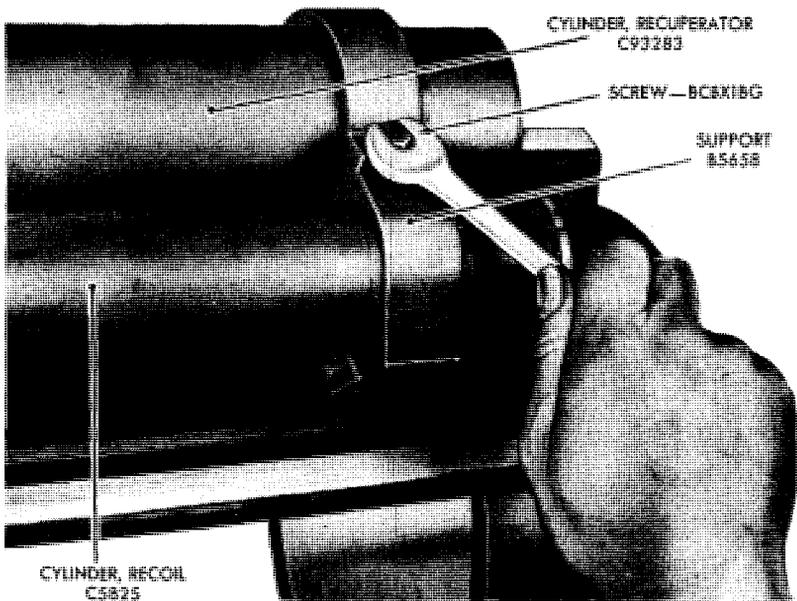
Figure 38 — Recoil Indicator Bracket Parts and Attaching Screws



RA PD 69351

Figure 39 — Removing Recoil Cylinder Stop

RECOIL MECHANISM



RA PD 69415

Figure 40 — Removing Screw from Cylinder Support

(2) Disassemble the recoil indicator bracket by pulling out the handle. The spring and indicator will then come away (fig. 38).

e. Remove the Cylinders and Yoke Assembly from the Sleigh.

(1) Remove the three cap screws BXBX1ED from each side of the sleigh. These cap screws hold the cylinders and yoke assembly to the front end of the sleigh (fig. 34).

(2) Remove the two screws BCCX1AA which hold the recoil cylinder stop A5716 in position at the front end (fig. 39).

(3) Remove the screw BCBX1BG which holds the support B5658 in position at the rear end (fig. 40). Carefully tap off the support with a brass drift and hammer.

(4) Lift off the cylinders and yoke assembly (fig. 41).

CAUTION: Handle the recoil and recuperator cylinders with care because the gas pressure in the recuperator cylinder is approximately 1,500 pounds per square inch, or more. Disassembly of the interior parts of the recoil or recuperator cylinders will be undertaken only at an arsenal or base repair shop especially equipped for this purpose.

f. Disassemble the Recoil Cylinder Filling Plug and Retainer.

(1) Drain the reserve oil (TM 9-326).

(2) Remove the set screw from the filling plug retainer (fig. 42).

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1

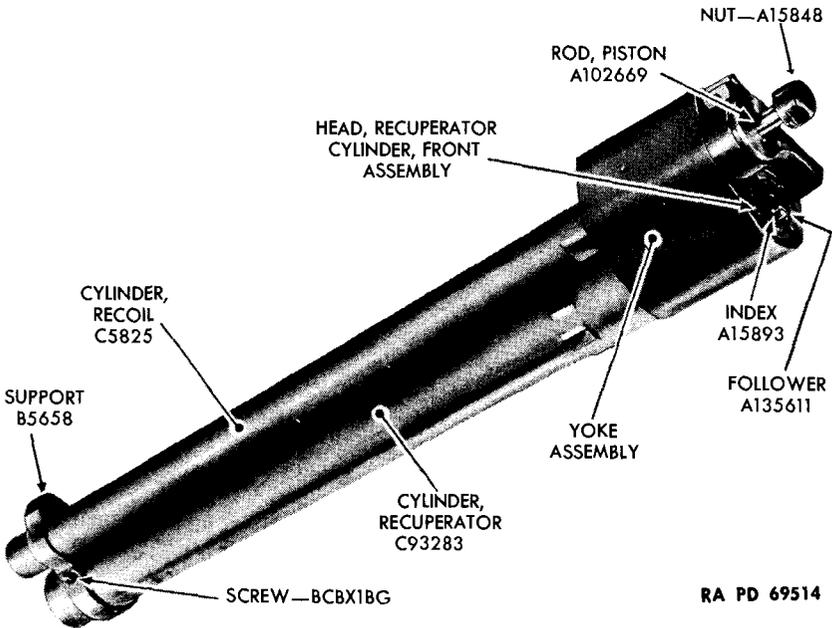


Figure 41 — Cylinders and Yoke Assembly

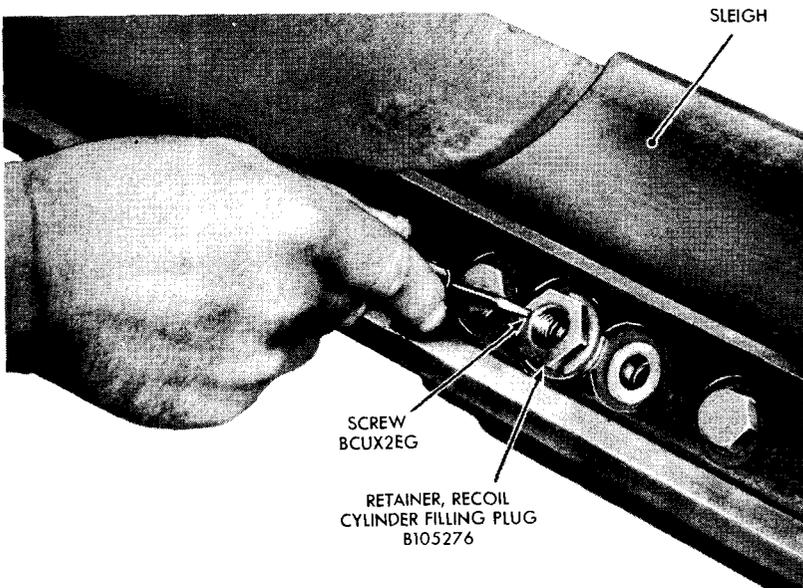


Figure 42 — Removing Filling Plug Retainer Set Screw

RECOIL MECHANISM

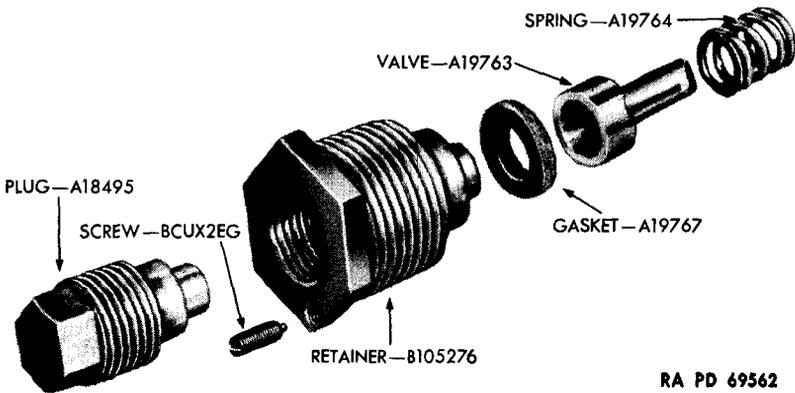


Figure 43 — Filling Plug Retainer and Parts

- (3) Remove the retainer with a 12-inch adjustable wrench.
- (4) Remove the gasket A19767, valve A19763, and spring A19764 (fig. 43).

19. REPAIRS.

NOTE: The repairs described below (with the exception of repair of damaged slides) may be performed without removing the recoil mechanism from the cradle.

a. **Damaged Recoil Sleigh Slides.** Clean the slides thoroughly with SOLVENT, dry-cleaning. Remove scores, or bruises from the slides with a flat scraper. After scraping, again clean the slides thoroughly with SOLVENT, dry-cleaning.

b. Check operation of lubrication fittings on recoil sleigh slides to see that they are clean and open.

c. Check operation and condition of recoil indicator and replace the handle, spring, or indicator if damaged (fig. 38).

d. Excessive oil leakage into the filling plug retainer is an indication that the retainer gasket or filling valve is worn and should be replaced.

e. Oil Index Sticking.

- (1) Drain off all reserve oil.
- (2) Insert approximately $\frac{1}{2}$ fill of the oil screw filler. Tap oil index lightly as the oil is being added.
- (3) If oil index fails to function, remove the oil index follower A135611 using a suitable improvised wrench (fig. 44).
- (4) Insert the oil screw filler and force the glands, packing, and three Bellville springs from the oil index recess.

**ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
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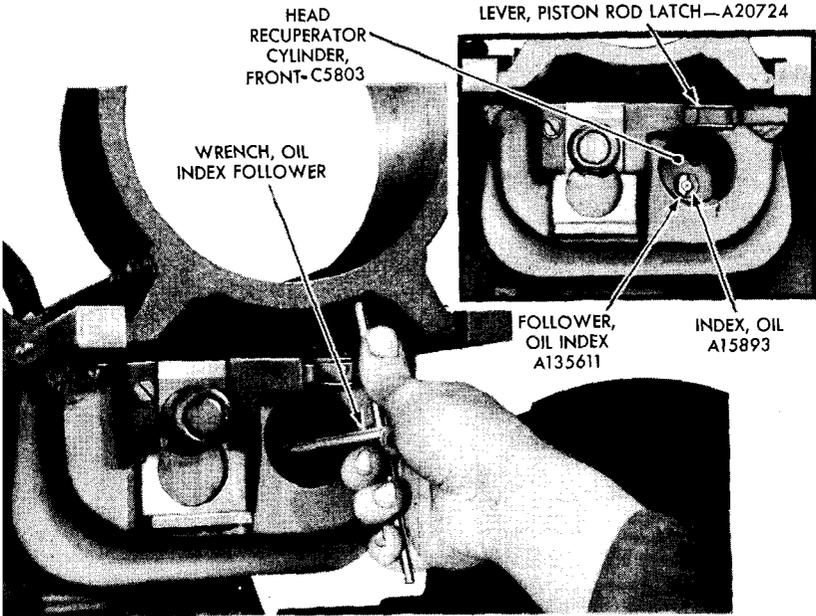


Figure 44 — Removing Oil Index Follower RA PD 80236

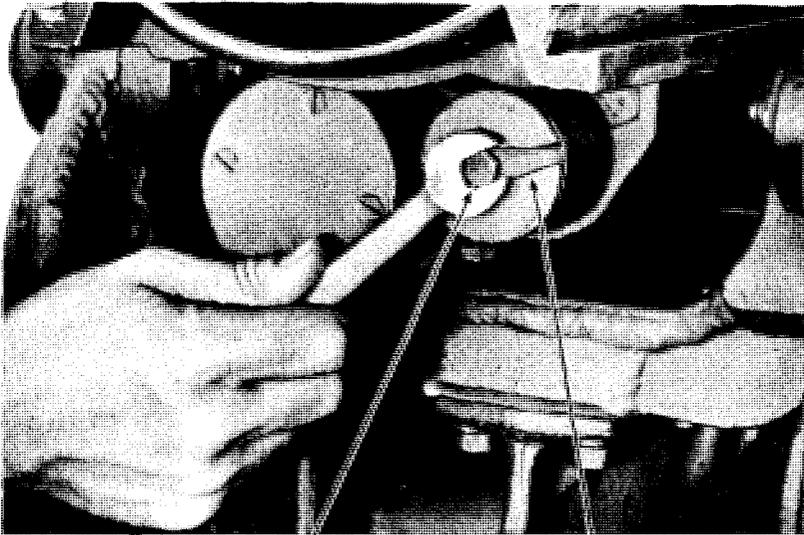
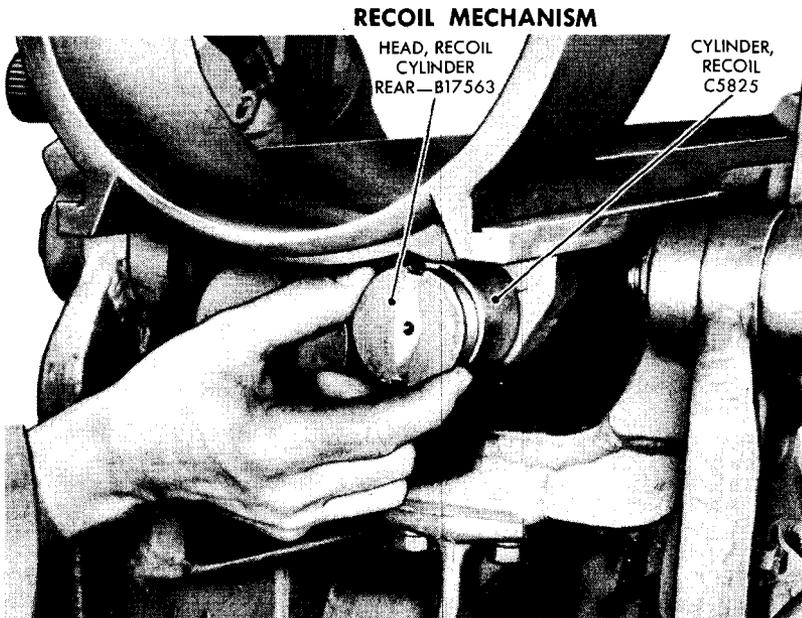


Figure 45 — Removing Recoil Cylinder Lock RA PD 69455



RA PD 69389

Figure 46 — Removing Recoil Cylinder Rear Head

(5) Install new packing and reassemble, making certain that the convex surface of the last spring removed (just to be replaced) faces outward and that the convex surface of the middle spring is toward the convex surface of the spring just inserted; and that the convex surface of the third spring is toward the outside and next to the flat surface of the gland which follows. The concave surfaces of the glands face the packing.

(6) If the oil index still sticks, replace the recoil mechanism with a new one and report the failure to the Chief of Ordnance.

f. Examine the face of the oil index follower for an indication of oil leakage. If a leak exists, tighten the oil index follower slightly, being careful not to bind the oil index. If this does not stop the oil leakage, proceed as follows:

- (1) Remove the oil index follower (fig. 44).
- (2) Remove the two glands, packing, and three Bellville springs.
- (3) Check the packing and replace if necessary.
- (4) If this does not stop the oil leakage, report recoil mechanism to Chief of Ordnance.

g. **Adjust the Recoil Piston Packing** (figs. 45 and 46).

(1) Remove the screw which holds the recoil cylinder lock A163056 in position on the recoil cylinder rear head.

**ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1**

(2) Remove the lock and unscrew the rear head with recoil cylinder head wrench B104035. If an excessive amount of oil has leaked past the piston packings, perform steps (3), (4), and (5), below.

(3) Remove the recoil piston disk assembly and wiper as a unit.

(4) Compress the packing by tightening the piston head slightly.

CAUTION: Tighten up on the recoil piston head carefully. Mark the original and new positions of the piston head with a prick punch.

(5) Replace wiper and disk assembly, recoil cylinder rear head, and lock.

(6) If the oil leakage continues, report the recoil mechanism to the Chief of Ordnance.

h. Loose recoil and recuperator cylinders will be detected by oil leakage at the union with the cylinder yoke. Correct leakage by screwing in cylinders tighter, using suitable wrenches. Do not attempt to remove the cylinders from the cylinder yoke.

i. Damaged Piston Rod. Report to Chief of Ordnance.

20. ASSEMBLY AND INSTALLATION.

a. Assemble the Recoil Cylinder Filling Plug and Retainer.

(1) Install the spring, valve, gasket, and retainer (fig. 43). Make certain that the valve is properly seated and not cocked in housing.

(2) Insert the set screw in the retainer (fig. 42).

(3) Re-establish the oil reserve (TM 9-326).

(4) Replace filling plug.

b. Install Cylinders and Yoke Assembly on Sleigh.

(1) Place the sleigh upside down on two wood horses or blocks. Place the cylinders and yoke assembly in position on the bottom of the sleigh.

(2) Using a brass drift and hammer, carefully tap on the support which holds the cylinders and yoke assembly to the sleigh at the rear end. Insert the screw which holds the support in position (fig. 40).

(3) Insert the two screws which hold the recoil cylinder stop in position at the front end (fig. 39).

(4) Turn the recoil mechanism right side up and insert the three screws on each side which hold the cylinders and yoke assembly to the sleigh.

c. Recoil Indicator Bracket Assembly. Assemble the spring on the indicator and insert the handle (fig. 38). Place the bracket assembly in position on the sleigh and install the washers and screws holding it to the sleigh.

CRADLE

d. Install Recoil Mechanism on Cradle.

- (1) Place the piston rod latch in open position (fig. 36).
- (2) Clean and lubricate the guides of the cradle and slides of the sleigh with SOLVENT, dry-cleaning.
- (3) With the howitzer level, carefully place the slides of the sleigh into the guides at the rear end of the cradle and move the sleigh forward until it is in position.
- (4) Lower the piston rod latch to the closed position and see that it is locked by the piston rod latch stem.

Section VI

CRADLE

	Paragraph
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21. GENERAL.

a. The cradle is the trough-shaped part of the carriage supporting the sleigh and the recoil and recuperator cylinders (figs. 47 and 48). The slides of the sleigh ride on the guides of the cradle. The piston rod latch locks the recoil piston rod to the cradle.

22. REMOVAL AND DISASSEMBLY.

- a. Remove the tube (par. 14) and recoil mechanism (par. 18).
- b. Remove the equilibrators (par. 33).
- c. **Remove the Cradle.**

- (1) Support the weight of the cradle at the front end.
- (2) Remove the cotter pins on the trunnion pin nuts and remove the trunnion pin nuts A140467 (fig. 47).
- (3) Withdraw the cradle trunnion pins from the cradle trunnion pin bushings.
- (4) Lift the cradle from the carriage with a rope sling and chain hoist (fig. 49) or use three men.

NOTE: The elevating pinion should immediately be covered with paper or cloth to keep out dirt and grit.

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1

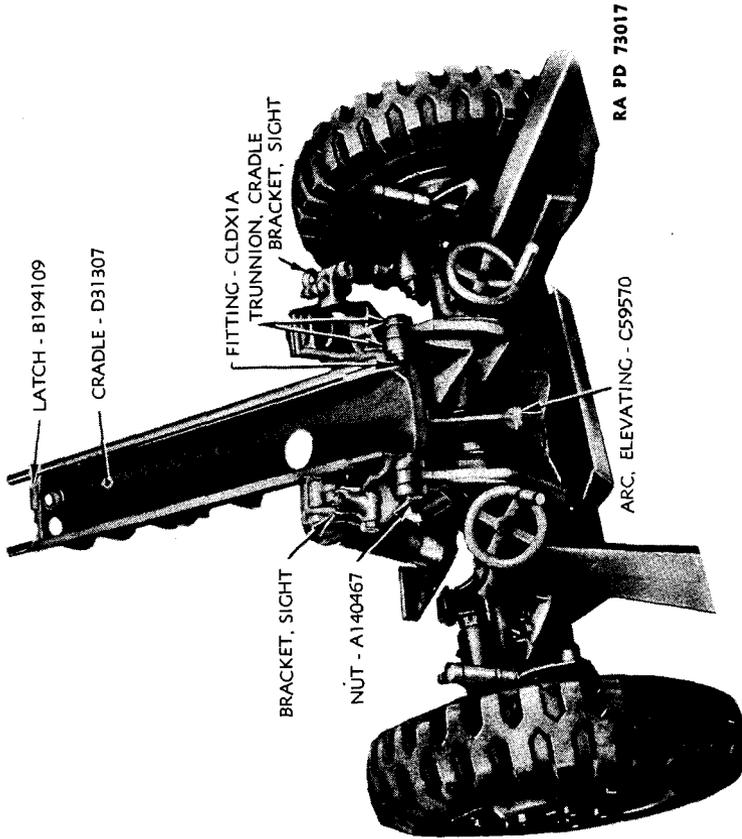
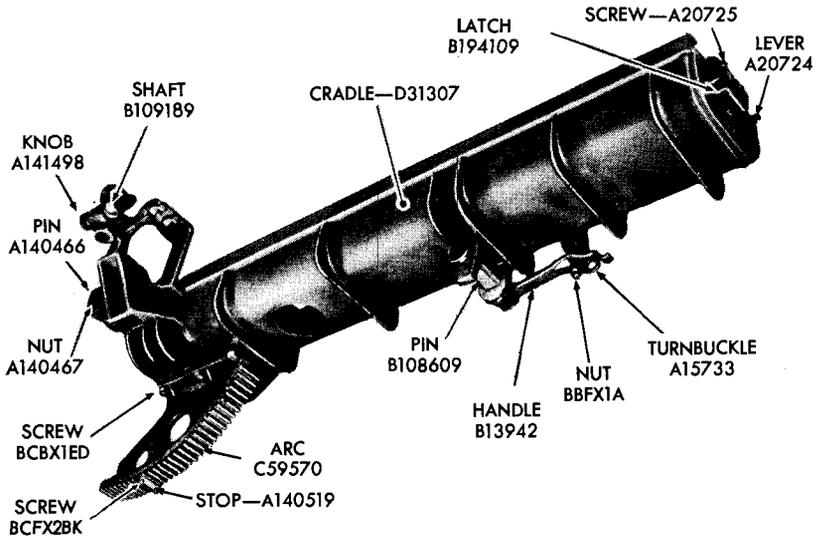


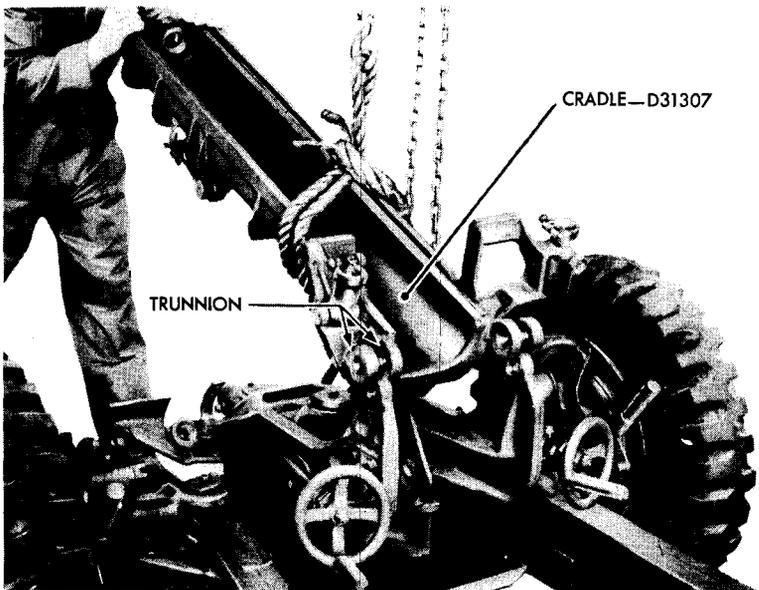
Figure 47 — Cradle Installed on Carriage — Rear View

CRADLE



RA PD 69537

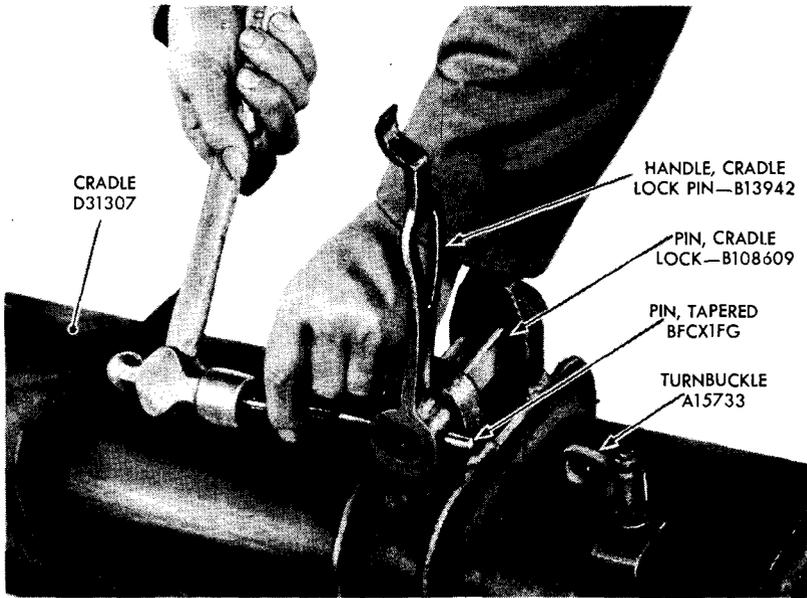
Figure 48 — Cradle



RA PD 69401

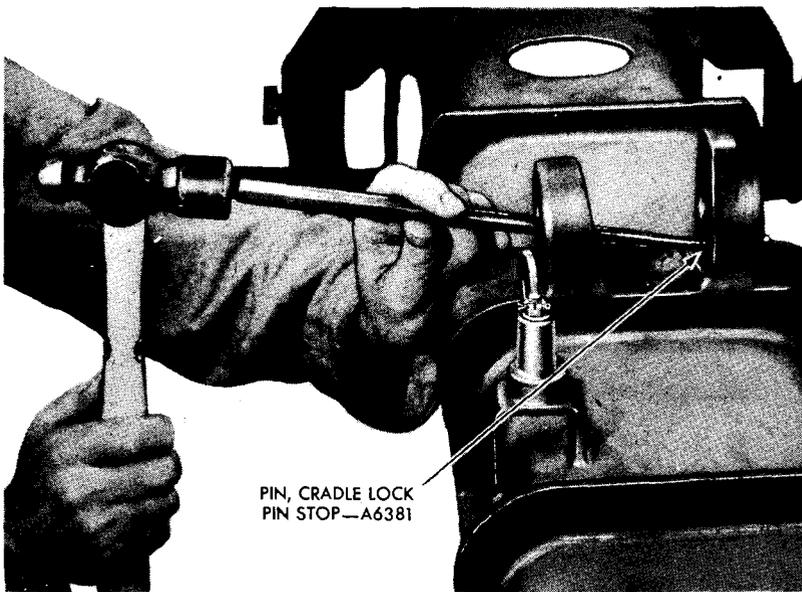
Figure 49 — Removing Cradle

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 69621

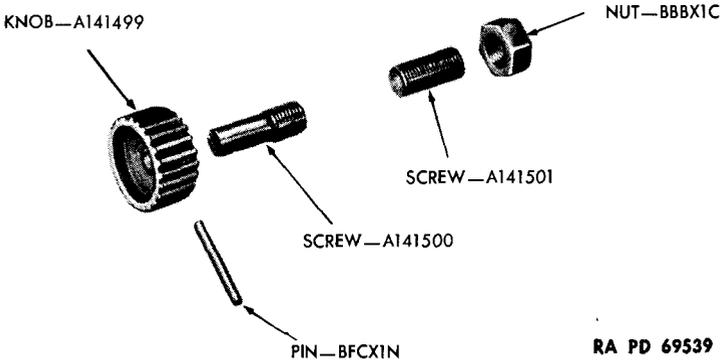
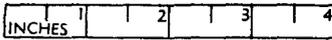
Figure 50 — Driving Pin from Cradle Lock Pin Handle



RA PD 69605

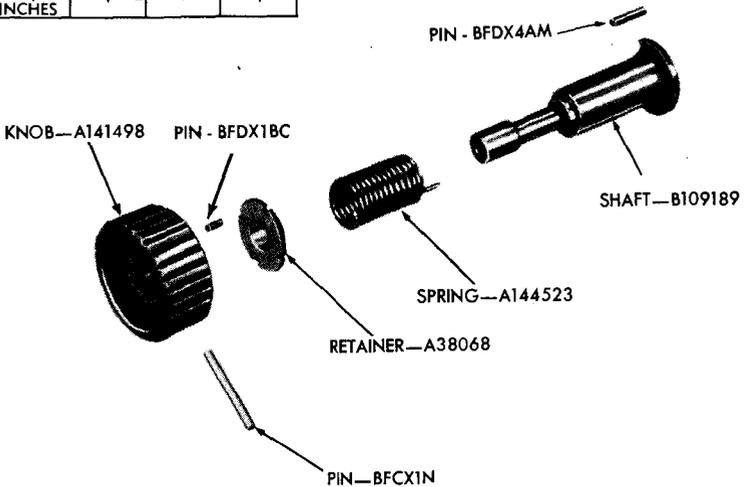
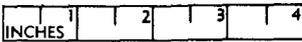
Figure 51 — Driving Out Stop Pin from Cradle Lock

CRADLE



RA PD 69539

Figure 52 — Sight Adjusting Parts



RA PD 80056

Figure 53 — Sight Retaining Parts

d. Disassemble the Cradle Lock.

- (1) Drive out the taper pin BFCX1FG which secures the cradle lock handle to the cradle lock pin B108609 (fig. 50). Lift off the handle.
- (2) Drive out the cradle lock pin with a brass drift and hammer.

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1

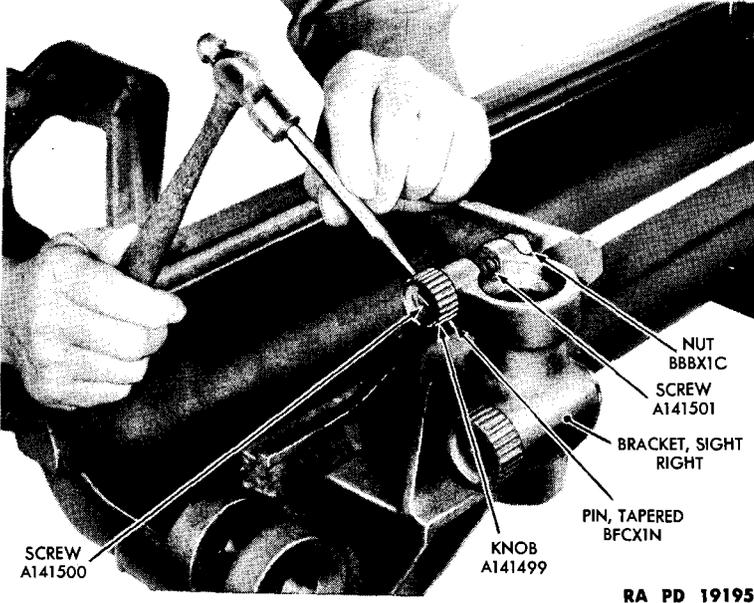


Figure 54 — Driving Out Pin from Sight Adjusting Knob

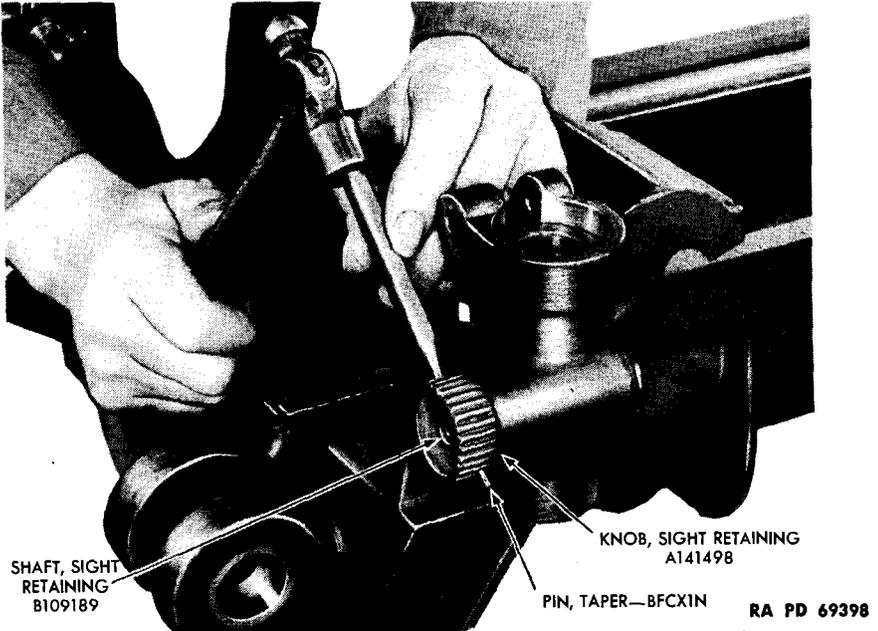


Figure 55 — Removing Pin from Sight Retaining Shaft Knob

CRADLE

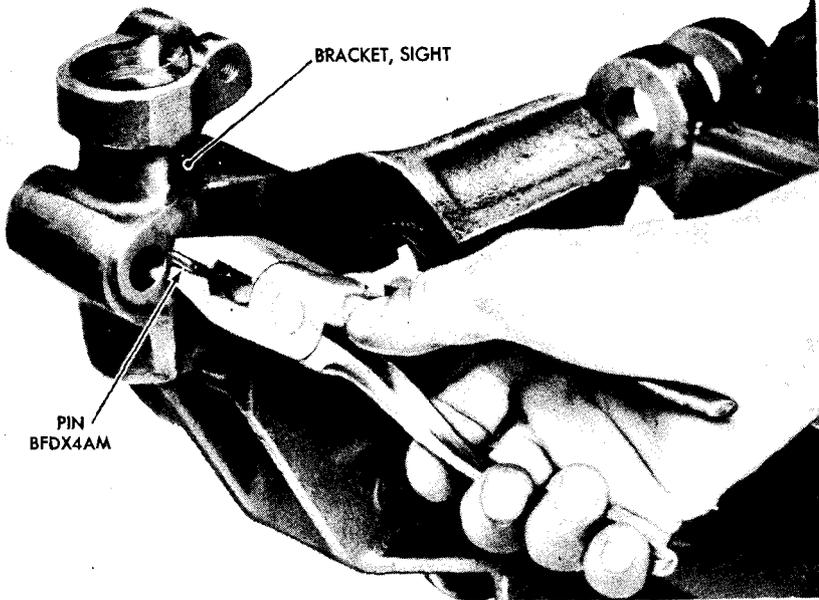


RA PD 69396

Figure 56 — Removing Sight Retaining Shaft and Spring

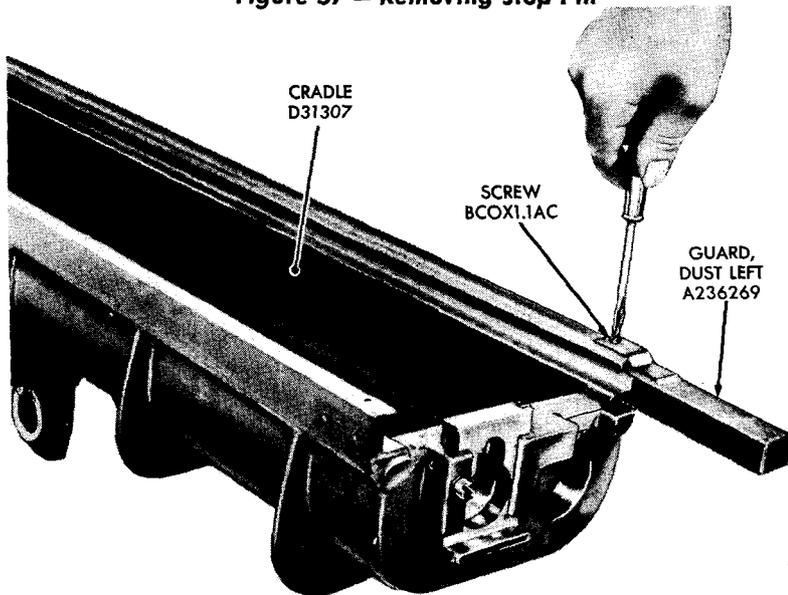
- (3) Drive out the cradle lock pin stop pin A6381 (fig. 51).
 - (4) Remove the turnbuckle and its compression spring by removing the cotter pin, hexagonal nut, and the washer on the turnbuckle (fig. 50).
- e. Disassemble the Sight Bracket Parts** (figs. 52 and 53).
- (1) Tap out the taper pin BFCX1N from the sight adjusting knob and remove the knob (fig. 54).
 - (2) Remove the headless steel screw A141501 and nut BBBX1C.
 - (3) Remove the sight clamping screw A141500 by screwing it through both holes and out. The sight adjusting parts are now completely disassembled.
 - (4) Drive out the taper pin BFCX1N from the sight retaining shaft knob and remove the knob (fig. 55).
 - (5) Remove pin BGDY1BC, retainer A38068, torsion spring A144523 and shaft B109189 (figs. 53 and 56). It may be necessary to loosen the shaft with a punch and hammer.
 - (6) Remove the sight retaining shaft stop pin BFDX4AM from the front of the sight bracket (fig. 57). The sight retaining parts are now entirely disassembled.

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 69579

Figure 57 — Removing Stop Pin



RA PD 69316

Figure 58 — Removing Dust Guards from Cradle

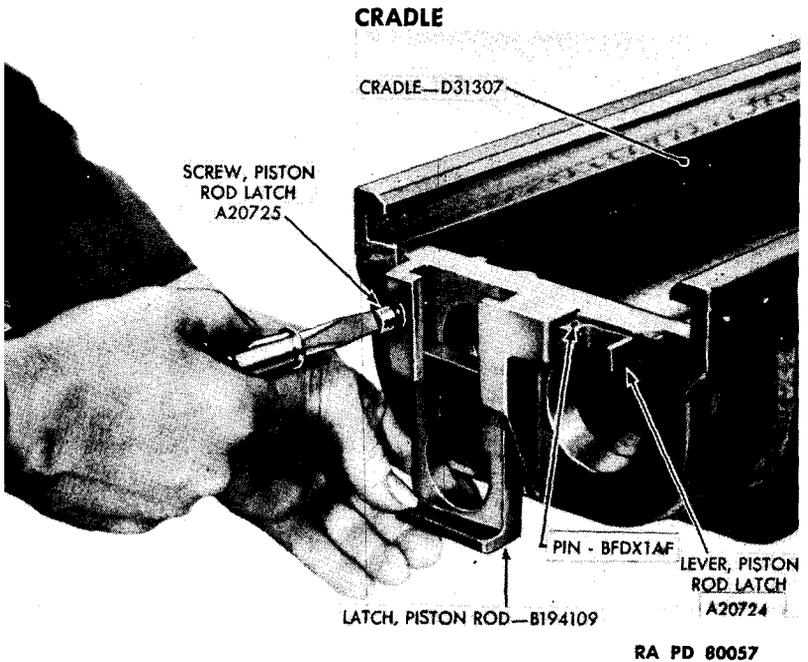


Figure 59 — Removing Screw from Piston Rod Latch

f. Repeat the above operations for disassembly of the left sight bracket parts

g. Remove both dust guards from the front of the cradle by removing the two screws and washers on the side and the one screw and washer on the top of each guard (fig. 58).

h. Disassemble the Piston Rod Latch and Latch Stem.

(1) Remove the piston rod latch screw A20725 which holds the piston rod latch in position (fig. 59). The latch can then be dropped down and out of the cradle.

(2) Drive out the straight pin BFDX1AF which connects the piston rod latch lever to the piston rod latch stem (fig. 59). The lever can then be removed and the stem and its compression spring taken out (fig. 60).

i. Disassemble the Elevating Arc.

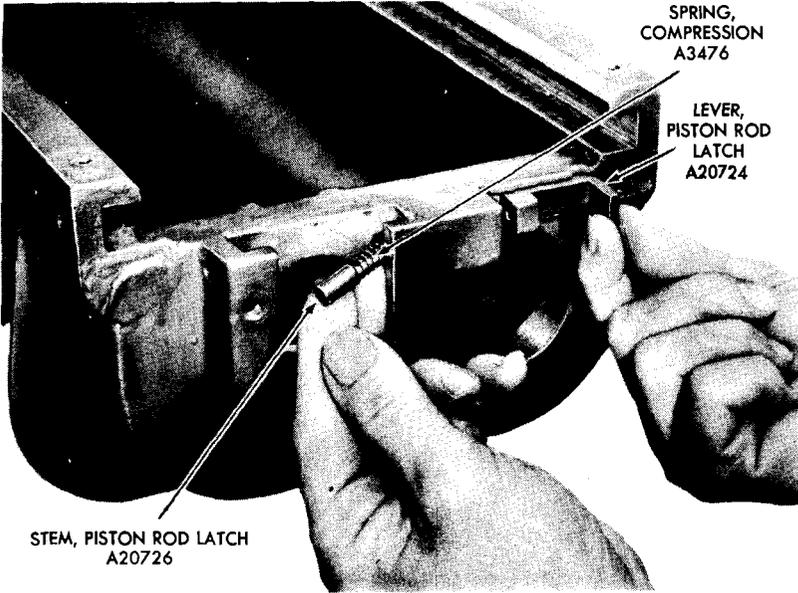
(1) Place the cradle upside down on blocks or two wood horses.

(2) Remove the six screws and washers which hold the elevating arc to the pad on the bottom of the cradle and remove the arc (fig. 61).

(3) Remove the elevating arc stop.

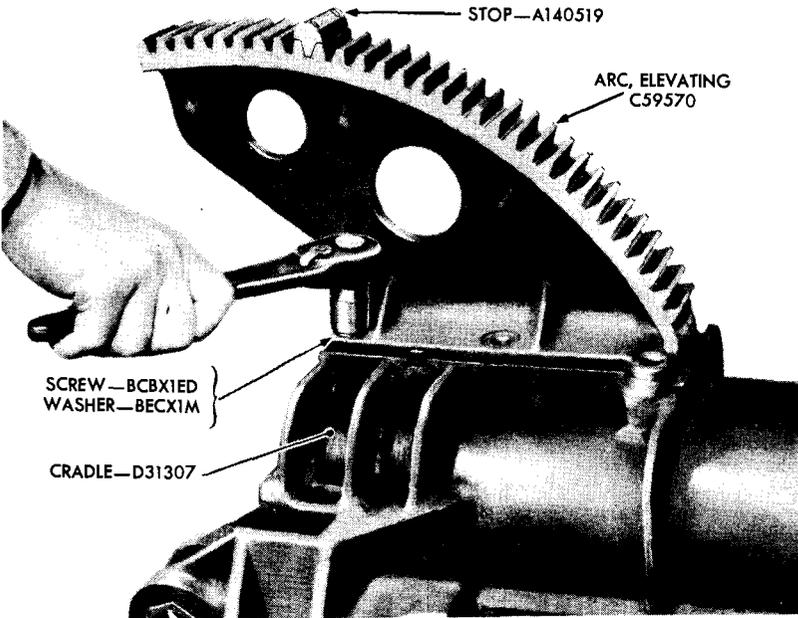
(4) The key A140465 will remain in the keyway in the pad and can be tapped out with a drift and hammer.

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 80058

Figure 60 — Removing Piston Rod Latch Stem



RA PD 69397

Figure 61 — Removing Elevating Arc from Cradle

CRADLE

23. REPAIRS.

a. Cradle.

(1) Clean all parts thoroughly with SOLVENT, dry-cleaning. Dry, and then coat with a film of OIL, engine (seasonal grade).

(2) Check steel cradle guides for scores, bruises, and burs. If not scored, bruised, or damaged beyond repair, remove scores and burs with a flat scraper. Remove only enough metal to overcome the score or bruise. Polish with CLOTH, crocus. Always clean guides with SOLVENT, dry-cleaning, after scraping and polishing; otherwise, small particles of metal will act as an abrasive when the gun and sleigh are in operation.

(3) Replace any cradle having deeply scored guides. Replace a cradle which is sprung.

(4) Replace cradle trunnion pins if damaged or worn.

b. Cradle Lock.

(1) Clean all parts thoroughly with SOLVENT, dry-cleaning.

(2) Check the turnbuckle, cradle lock pin, and cradle lock pin handle for wear or damage. Replace worn or damaged parts.

(3) Examine the threads on the turnbuckle nut for stripping. Replace a stripped nut.

(4) Replace a weak or distorted turnbuckle spring.

c. Piston Rod Latch and Piston Rod Latch Stem.

(1) Clean all parts thoroughly with SOLVENT, dry-cleaning.

(2) Replace all worn or damaged parts.

(3) Check the latch, stem, and lever. If roughened or burred, smooth with a file and polish with CLOTH, crocus.

(4) Replace the stem spring if bent, broken, or weak.

d. Replace dust guards if bent or damaged.

e. Elevating Arc.

(1) Clean thoroughly with SOLVENT, dry-cleaning.

(2) Check face for burs or damage and remove by filing with a smooth file and polishing with CLOTH, crocus.

(3) Remove burs from key with CLOTH, crocus. If key is distorted, it should be replaced.

(4) Place elevating arc in a vise equipped with copper jaws. File burs from arc teeth and polish with CLOTH, crocus. Remove all filings and abrasive material with SOLVENT, dry-cleaning. If any teeth are damaged beyond repair, replace elevating arc.

(5) Check elevating arc stop for distortion or other damage and replace if necessary.

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1

24. ASSEMBLY AND INSTALLATION.

a. Right Sight Bracket Parts.

(1) Clean all parts thoroughly with SOLVENT, dry-cleaning, dry, and then lubricate with engine oil.

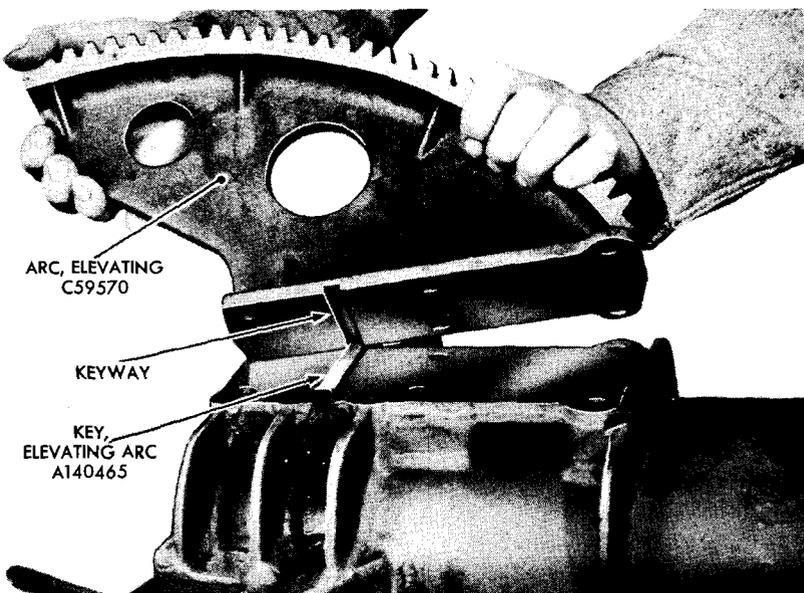
(2) Install sight retaining shaft, torsion spring, retainer, and spring retainer pin BFDX1BC in the sight bracket (fig. 56).

(3) Install the sight retaining shaft knob on the end of the sight retaining shaft. Hold the knob in position with a C-clamp and tap in the taper pin. Remove the C-clamp.

(4) Turn the knob to create the proper tension on the torsion spring and lock in position by inserting the stop pin BFDX4AM in the hole in the front of the sight bracket.

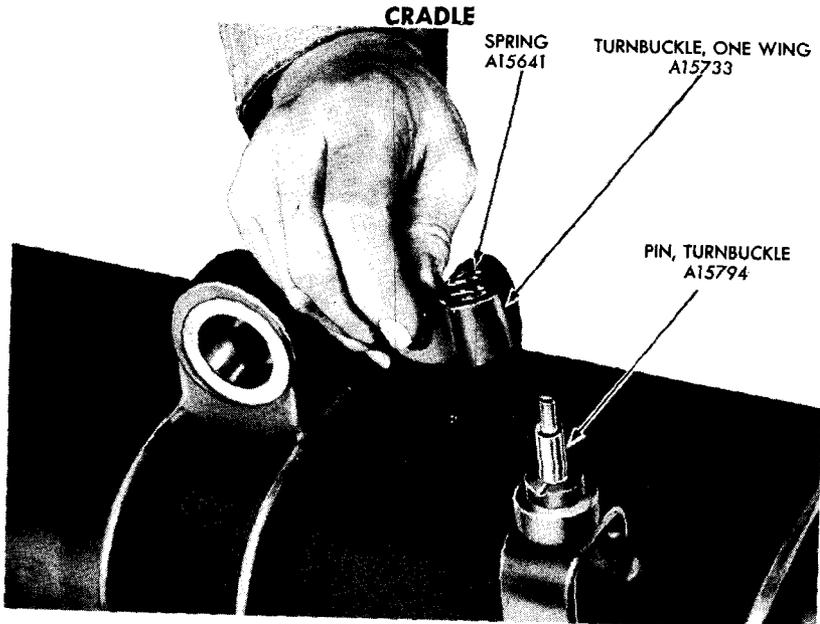
(5) Install the sight clamping screw A141500 by inserting it head first into the hole in the front of the bracket (figs. 52 and 54). Insert screwdriver through the rear hole in the bracket and, by turning the screwdriver counterclockwise, draw the sight clamping screw into position.

(6) Install the headless steel screw A141501 and nut BBBX1C in the front of the bracket.



RA PD 69353

Figure 62 — Replacing Elevating Arc on Cradle



RA PD 69315

Figure 63 – Installing Cradle Lock Turnbuckle

(7) Install the sight adjusting knob on the clamping screw and tap in the taper pin which secures the knob to screw A141500.

b. Assemble the left sight bracket parts in the same manner as described above.

c. Elevating Arc.

(1) Clean all parts thoroughly with SOLVENT, dry-cleaning.

(2) Install the elevating arc stop by inserting the two screws (fig. 61). Stake the screws.

(3) Coat the two contacting surfaces on the cradle and the arc with LEAD, white.

(4) Install the key in the keyway in the pad on the cradle.

(5) Place the elevating arc in position on the pad (fig. 62) on the bottom of the cradle and install the six screws and washers.

d. Cradle Lock.

(1) Clean all parts thoroughly with SOLVENT, dry-cleaning.

(2) Insert the spring in the cradle lock turnbuckle and assemble the spring and turnbuckle on the pin, A15794 on the bottom of the cradle (fig. 63). Install the washer, hexagonal nut, and cotter pin (fig. 48).

(3) Tap the stop pin into position in its hole in the traveling lock bracket (fig. 51).

**ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1**

(4) Lubricate the cradle lock pin and install in the bracket on the bottom of the cradle. Attach the cradle lock handle and secure it in position with taper pin BFCX1FG (fig. 50).

e. Piston Rod Latch and Piston Rod Latch Stem.

(1) Install the latch stem and its spring in the lever (fig. 60). Secure in place with straight pin BFDX1AF.

(2) Put the piston rod latch in place on the cradle and insert the piston rod latch screw (fig. 59).

f. Dust Guards. Mount the dust guards in place on the front end of the cradle by inserting the two screws and lock washers on the side and one screw and lock washer on the top of each guard (fig. 58).

g. Install the Cradle on the Top Carriage.

(1) Use a rope sling and chain hoist or three men to support the weight of the cradle. Guide the trunnion brackets on the rear of the cradle so they will meet their companion parts on the top carriage, being careful to mesh the elevating pinion in the top carriage with the teeth in the elevating arc.

(2) Lubricate and insert the trunnion pins in the cradle trunnion pin bushings. Screw on the nuts and insert the cotter pins.

Section VII

TOP CARRIAGE AND PINTLE PIN

	Paragraph
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Assembly and installation.....	28

25. GENERAL.

a. The top carriage forms the connection between the bottom carriage and the cradle. It provides the ultimate means of traversing the gun. It supports the traversing mechanism and elevating mechanism. A large steel pin, the pintle pin, passes vertically through the top carriage and bottom carriage. When the traversing mechanism is operated, the top carriage rotates around this pintle pin. Two large bronze bushings placed in the top and bottom of the top carriage serve as radial and thrust bearings for the pin.

TOP CARRIAGE AND PINTLE PIN

26. REMOVAL AND DISASSEMBLY.

a. Remove the tube, recoil mechanism, equilibrators, and cradle (pars. 22 and 33).

b. Remove the traversing mechanism (par. 39).

c. **Remove the Top Carriage.**

(1) Remove the cotter pin from the pintle pin nut on the lower side of the bottom carriage. Remove the nut with pintle and trail wrench B108514. Lift off the washer (fig. 64).

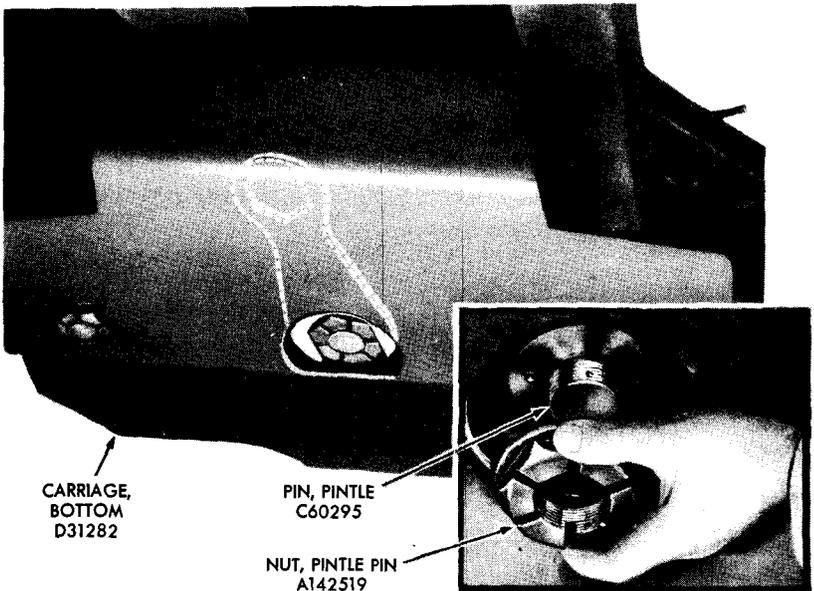
(2) Remove the pintle pin by lifting it up (fig. 65), and remove the upper washer. If necessary, loosen the pintle pin by tapping it lightly with a brass drift and hammer. Do not attempt to rotate the pintle pin for it is keyed to the bottom carriage.

(3) Remove top carriage. Use a rope sling and chain hoist (fig. 67) or three men.

d. **Disassemble the Top Carriage and Pintle Pin.**

(1) Remove the elevating mechanism and elevating handwheel shaft bracket (par. 35).

(2) Drive the top pintle pin bushing B109876 (fig. 68) out of the top part of the top carriage with a wood block and hammer. **NOTE:** Pintle pin bushings are to be removed only when replacement is necessary.



RA PD 69500

Figure 64 — Removing Pintle Pin Nut

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1

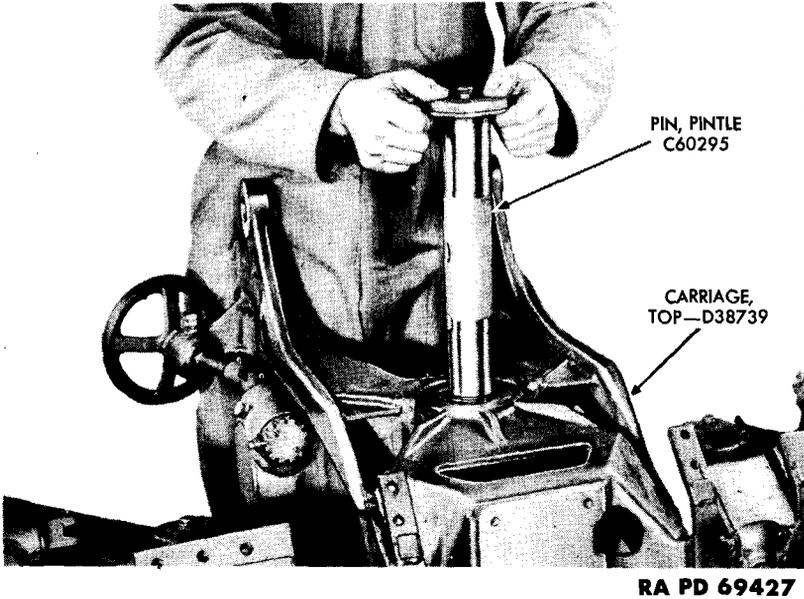


Figure 65 — Removing Pintle Pin

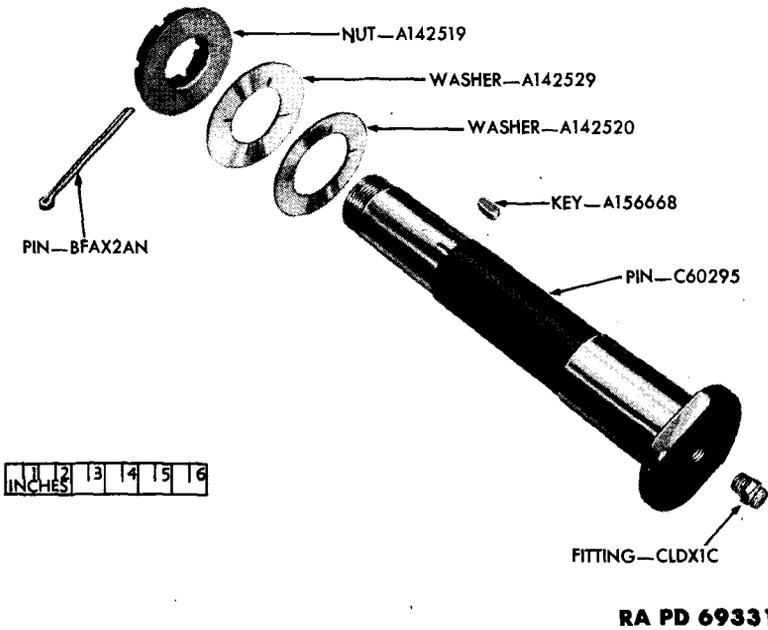
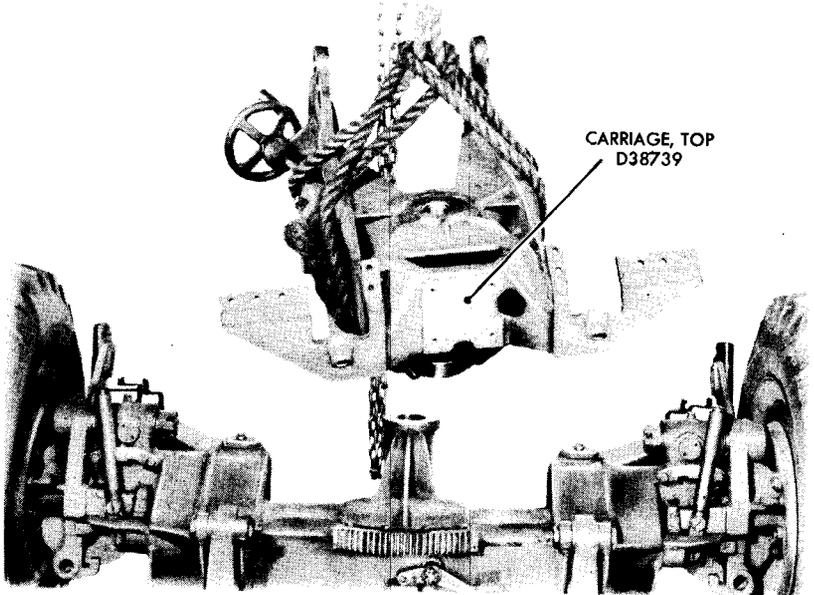


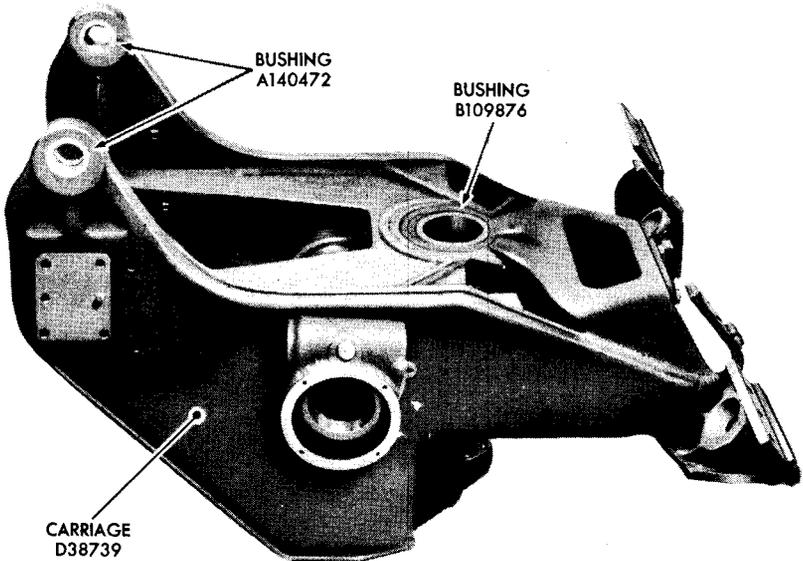
Figure 66 — Pintle Pin — Exploded View

TOP CARRIAGE AND PINTLE PIN



RA PD 69338

Figure 67 — Removing Top Carriage



RA PD 69369

Figure 68 — Top Carriage — Right Side

**ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1**

(3) Turn the top carriage over and remove the lower pintle pin bushing B109866 in the same manner.

(4) Drive out the cradle trunnion bushings A140472 (fig. 68) with a wood block and hammer. **NOTE:** Cradle trunnion bushings are to be removed only when replacement is necessary.

(5) Place the pintle pin in a copper-jawed vise and drive out the key from its keyway.

27. REPAIRS.

a. Clean all parts thoroughly with **SOLVENT**, dry-cleaning.

b. Examine top carriage for cracks or other damage. Slight damage, insufficient to cause more serious damage to the howitzer and carriage in future service, may be repaired by welding. If damage is serious, replace the top carriage with a new one.

c. Check the Cradle Trunnion Bushings.

(1) Carefully check the trunnion bushings for scoring, wear, or other deformation. Scored bushings can be repaired by careful scraping, filing, and polishing with **CLOTH**, crocus. Whenever **CLOTH**, crocus, is used, the bushing must be washed clean in **SOLVENT**, dry-

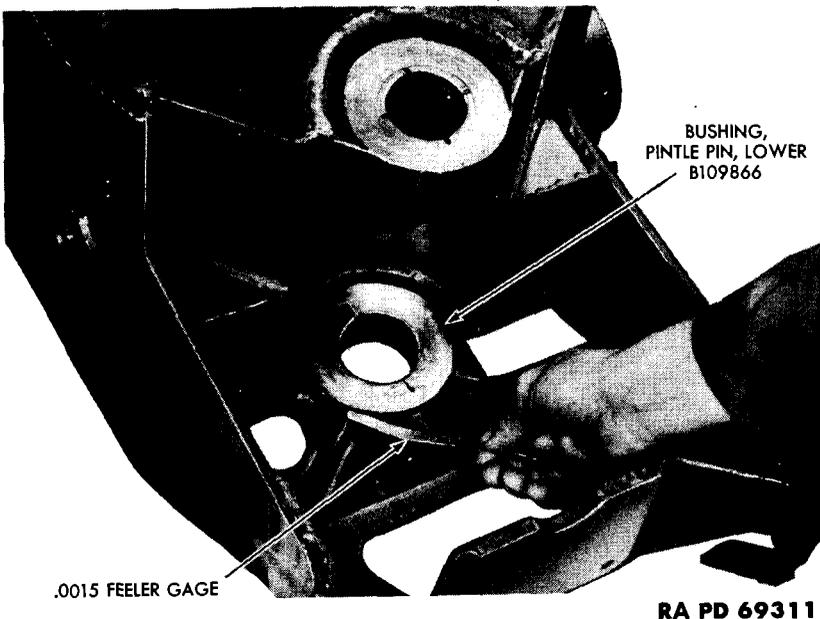
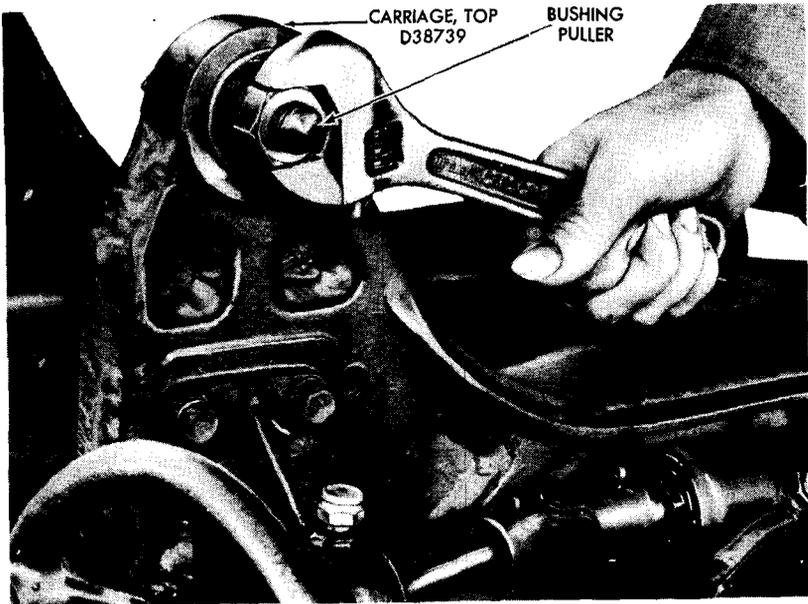


Figure 69 — Gaging Pintle Pin Bushing Fit

TOP CARRIAGE AND PINTLE PIN



RA PD 69416

Figure 70 – Installing Cradle Trunnion Pin Bushing

cleaning, to remove all small filings which might act as abrasive when the cradle trunnion pins are assembled in the top carriage.

(2) Replace worn bushings.

d. **Check the Pintle Pin.** Clean all parts of the pintle pin group (fig. 66) thoroughly in SOLVENT, dry-cleaning. Examine parts carefully for wear or damage. Check bearing surfaces of pintle pin for scores, bruises, or wear. Remove scores or bruises with a file and CLOTH, crocus. Do not file away any more metal than is necessary to restore original contour of pin. Replace a badly worn pintle pin.

28. ASSEMBLY AND INSTALLATION.

a. **Assemble Top Carriage.**

(1) Place the top carriage in an arbor press and insert the top pintle pin bushing A109876.

(2) Press the lower pintle pin bushing B109866 into place in the same manner.

(3) Use feeler gage (0.0015) to be sure that bushings are properly seated (fig. 69).

(4) Install the cradle trunnion bushing using a suitable improvised tool (fig. 70).

(5) Install the elevating mechanism (par. 37).

**ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1**

b. Assemble Pintle Pin.

(1) With the pintle pin held in a vise with copper jaws, tap the pintle pin key A156668 into the keyway in the side of the pintle pin (fig. 66).

(2) Clean the pintle pin with SOLVENT, dry-cleaning, dry, and then lubricate with GREASE, O. D. (seasonal grade).

c. Install the Top Carriage and Pintle Pin.

(1) Aline the pintle pin holes in the top and bottom carriages and install the top carriage on the bottom carriage.

(2) Place the upper washer on the pintle pin with the grease grooves facing up, and insert the pintle pin and washer through the top and bottom carriages (fig. 65).

(3) Install the lower washer and screw on the pintle pin nut (fig. 64). Insert the cotter pin.

Section VIII

BOTTOM CARRIAGE

	Paragraph
General	29
Removal and disassembly	30
Repairs	31
Assembly and installation	32

29. GENERAL.

a. The bottom carriage (fig. 71) is a welded and machined unit which forms the connection between the top carriage and trails. The firing base and the wheel carriers are mounted on it. When the weapon is fired, the firing stresses are transmitted through the bottom carriage to the firing base and trails and thence to the ground.

30. REMOVAL AND DISASSEMBLY.

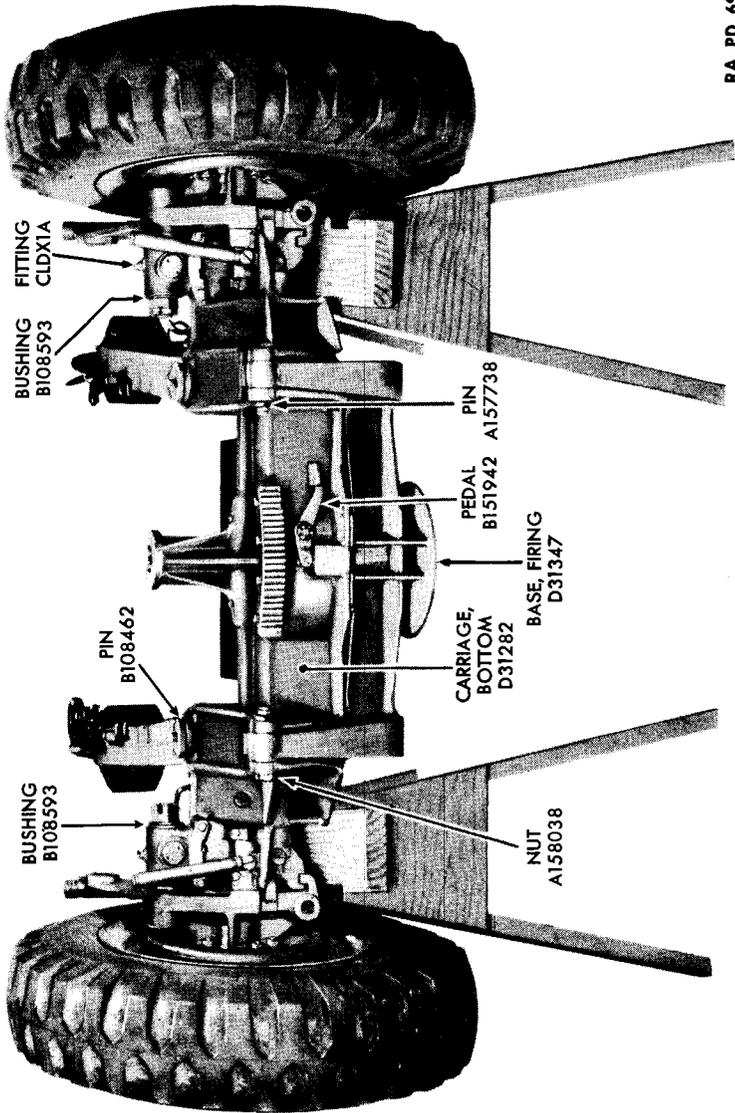
a. Remove the tube, recoil mechanism, equilibrators, cradle, traversing mechanism, and top carriage.

b. Place two wood horses under the bottom carriage as shown in figure 71.

c. Remove the wheels (TM 9-326).

d. Remove the wheel carriers and wheel carrier latches (par. 43).

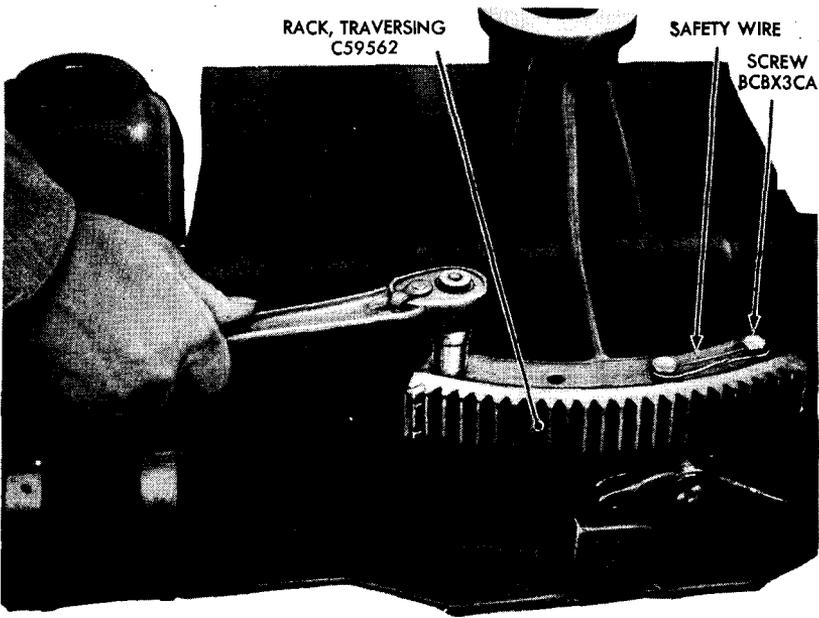
BOTTOM CARRIAGE



RA PD 69368

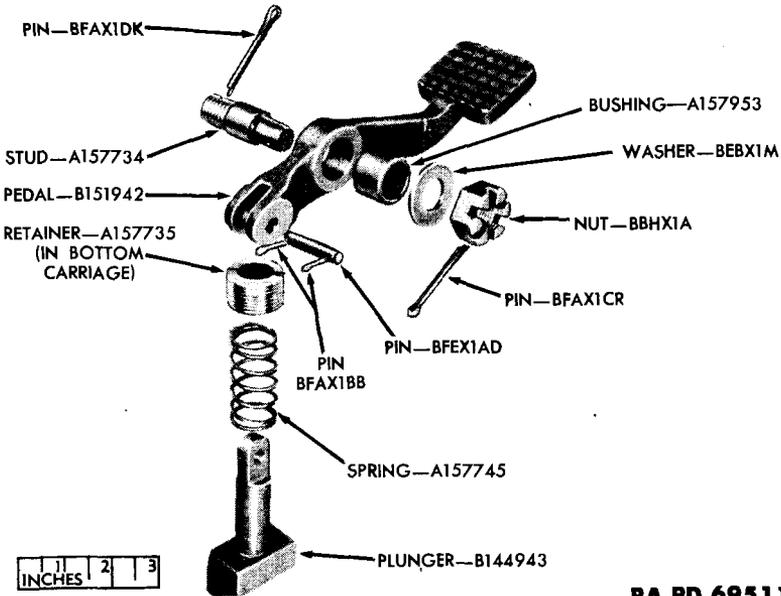
Figure 71 — Bottom Carriage and Trails

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 69381

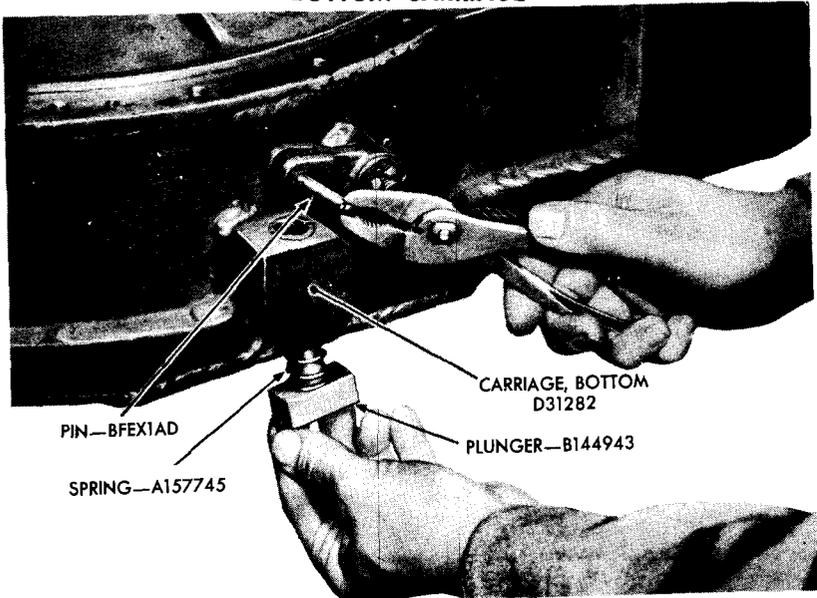
Figure 72 — Removing Traversing Rack



RA PD 69511

Figure 73 — Firing Base Lock — Exploded View

BOTTOM CARRIAGE



RA PD 69439

Figure 74 — Removing Firing Base Lock Plunger

e. Drive out the wheel carrier bushings B108593 (fig. 71) from the bottom carriage with a wood block and hammer. **NOTE:** Removal of bushings is not required except when replacement is necessary.

f. Remove the firing base (TM 9-326).

NOTE: The firing base may be removed without removing the bottom carriage by blocking up or rigging the bottom carriage so that the firing base clears the ground. If the tube is not removed, be sure the piston rod latch is locked in the closed position *before* blocking or rigging the bottom carriage.

g. Remove the Traversing Rack.

NOTE: The traversing rack cannot be removed until the traversing gear mechanism is removed (par. 39).

(1) Remove the safety wires and four screws which hold the rack to the bottom carriage (fig. 72).

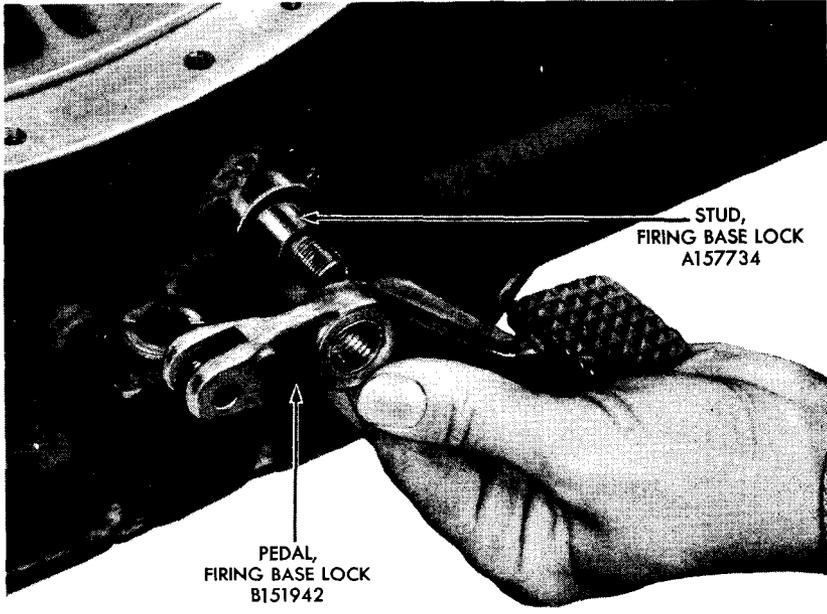
(2) Remove the two dowel pins with a punch and hammer. Lift off the rack.

(3) Place the traversing rack in a vise equipped with copper jaws and remove the traversing stops.

h. Remove the Firing Base Lock (fig. 73).

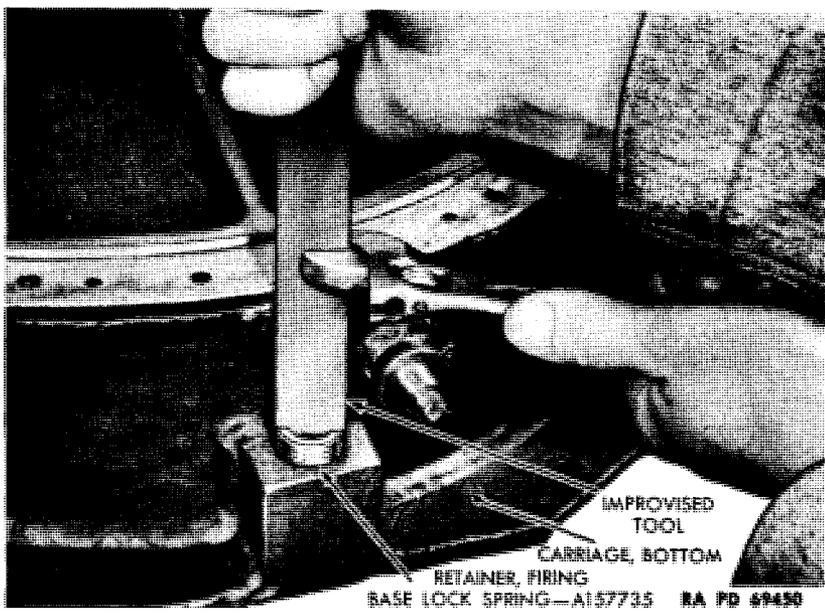
(1) Remove the cotter pins from the firing base lock pedal pin BFEX1AD.

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 69349

Figure 75 — Removing Firing Base Lock Pedal



RA PD 69450

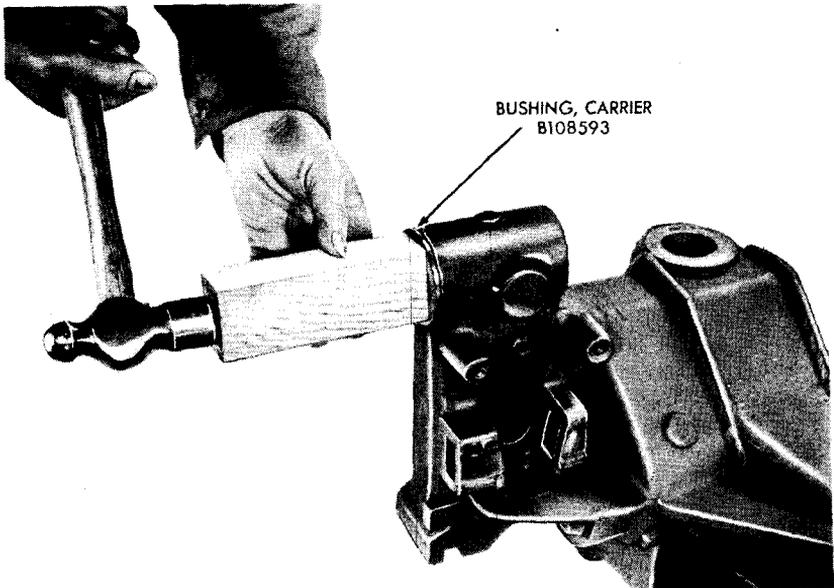
Figure 76 — Removing Retainer from Firing Base Lock Housing

BOTTOM CARRIAGE

- (2) Remove pin BFEX1AD and pull out the firing base lock plunger and spring (fig. 74).
- (3) Remove the cotter pin, nut and washer from the firing base lock pedal stud (fig. 73).
- (4) Slide off the firing base lock pedal (fig. 75).
- (5) Unscrew the firing base lock spring retainer A157735 from the bottom carriage with an improvised open-end wrench and an adjustable wrench (fig. 76).
- (6) Remove the cotter pin BFA1DK from firing base lock pedal stud (fig. 73) and unscrew stud from bottom carriage. **NOTE:** Stud should be removed only when replacement is necessary.
 - i. Remove the trails (par. 55).

31. REPAIRS.

- a. Clean all parts thoroughly with SOLVENT, dry-cleaning.
- b. Examine the bottom carriage for cracks or other damage. Slight damage may be repaired by welding. If the damage is serious, replace the bottom carriage with a new one.
- c. **Wheel Carrier Bushings.**
 - (1) Scored bushings may be repaired by careful scraping, filing, and polishing with CLOTH, crocus. Whenever CLOTH, crocus, is



RA PD 69478

Figure 77 — Installing New Wheel Carrier Bushing in Bottom Carriage

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 69321

**Figure 78 — Drilling Hole for Lubrication Fitting in New
Wheel Carrier Bushing**

used, the bushings must be washed clean in SOLVENT, dry-cleaning, to remove all small particles which might act as an abrasive. Bushings which are seriously worn should be replaced.

(2) Remove the lubrication fittings from the top of the wheel carrier bushings. Clean out oil passages with a fine wire and cloth saturated with SOLVENT, dry-cleaning. Damaged fittings should be replaced with new ones.

d. Replace the firing base hinge pins and hinge pin bushings if worn or damaged.

e. Check the teeth of the traversing rack for burs or breaks. Burs may be removed by filing. Broken or seriously damaged teeth will necessitate replacing the rack. Damaged stops should also be replaced with new ones.

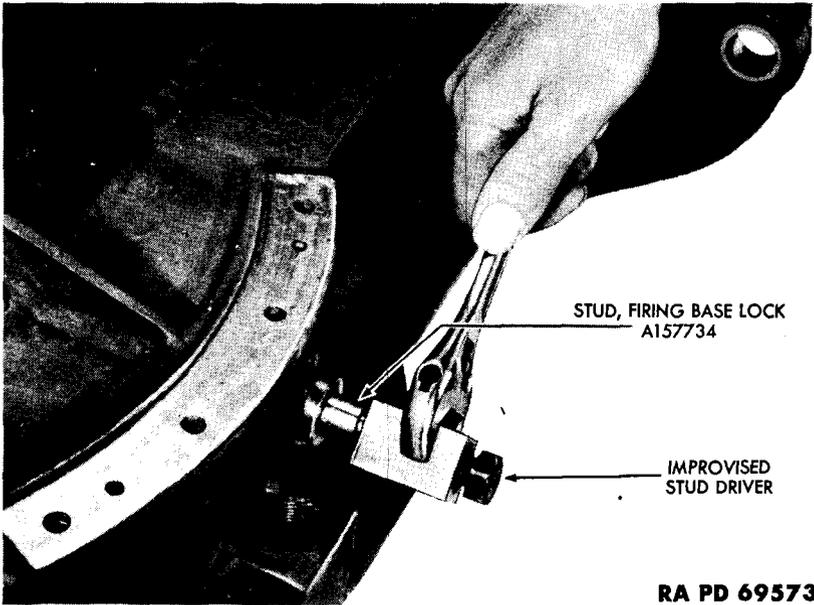
f. Replace broken or worn firing base lock parts.

32. ASSEMBLY AND INSTALLATION.

a. Replace the trails (par. 57).

b. Install new wheel carrier bushings, if the old ones were removed.

BOTTOM CARRIAGE



RA PD 69573

Figure 79 – Installing New Firing Base Lock Stud

(1) Wheel carrier bushings B108593 may be installed by driving them into position with a wood block and hammer (fig. 77).

(2) Drill a hole in the bushing for the lubrication fitting (fig. 78).

(3) Install the lubrication fitting.

c. Assemble and Install the Firing Base Lock.

(1) Install a new firing base lock stud by screwing it into position with a suitable improvised tool (fig. 79). Drill the new stud for cotter pin BFAX1CR (fig. 80).

(2) Install the firing base lock spring retainer by screwing it into position with an improvised tool which fits into the slot in the retainer (fig. 76).

(3) Place the firing base lock pedal in position on the stud on the bottom carriage (fig. 75).

(4) Install the washer, hexagonal nut, and cotter pin on the pedal stud.

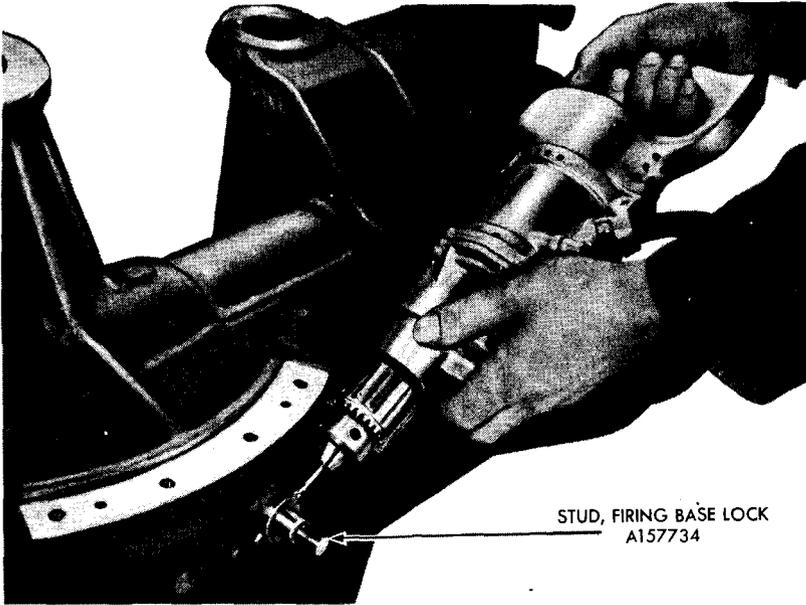
(5) Assemble the spring and plunger and insert them into their housing in the bottom carriage (fig. 74).

(6) Insert the firing base lock pedal pin BFEX1AD through the pedal and firing base lock plunger. Install the two cotter pins.

d. Install the Traversing Rack.

(1) Clean all parts thoroughly.

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 69576

Figure 80 — Drilling Hole for Cotter Pin in New Firing Base Lock Stud

- (2) Replace the two traversing stops, if they were removed. Stake the traversing stop screws.
- (3) Coat the rack and its mating surface on the carriage with LEAD, white.
- (4) Install the traversing rack and screw in the four screws which hold it to the front of the bottom carriage (fig. 72). Secure the screws with safety wire.
- (5) Insert the two dowel pins in the rack.
 - e. Install the firing base (TM 9-326).
 - f. Install the wheel carriers and wheel carrier latches (par. 45).

Section IX

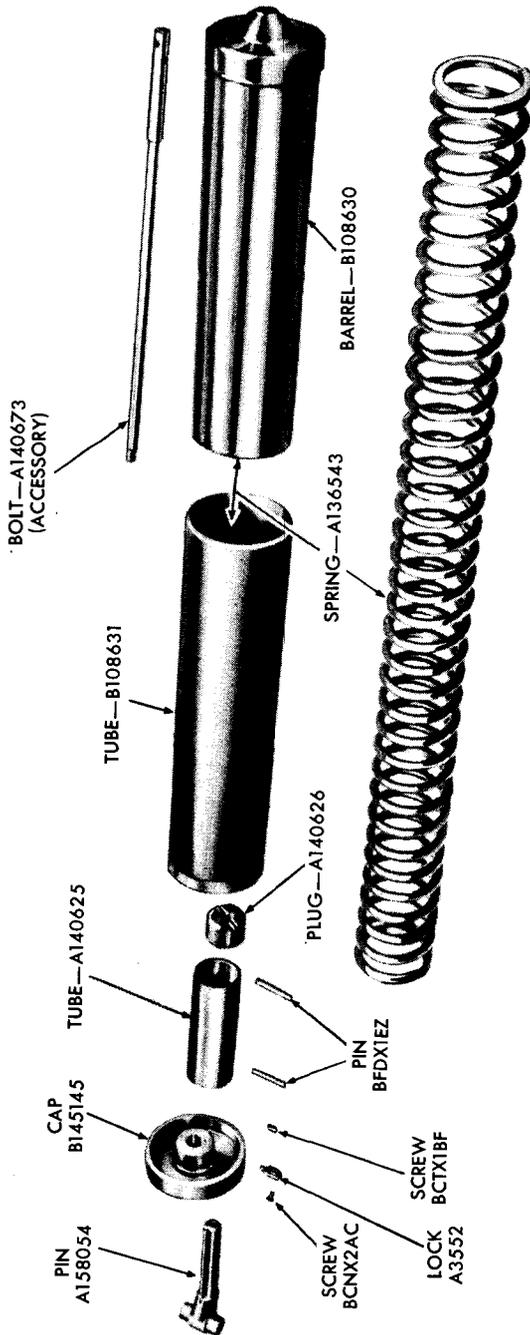
EQUILIBRATORS

General	Paragraph 33
---------------	-----------------

33. GENERAL.

- a. Functioning, removal and installation, and adjustment of equilibrators is described in TM 9-326.

EQUILIBRATORS



RA PD 69513

Figure 81 — Equilibrator — Exploded View



**ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1**

b. Because of the high tension of the equilibrator spring (fig. 81) disassembly of the equilibrators will be undertaken only at an arsenal or specially equipped base repair shop.

c. Equilibrators that do not function properly should be removed and sent to an arsenal or base shop for repairs.

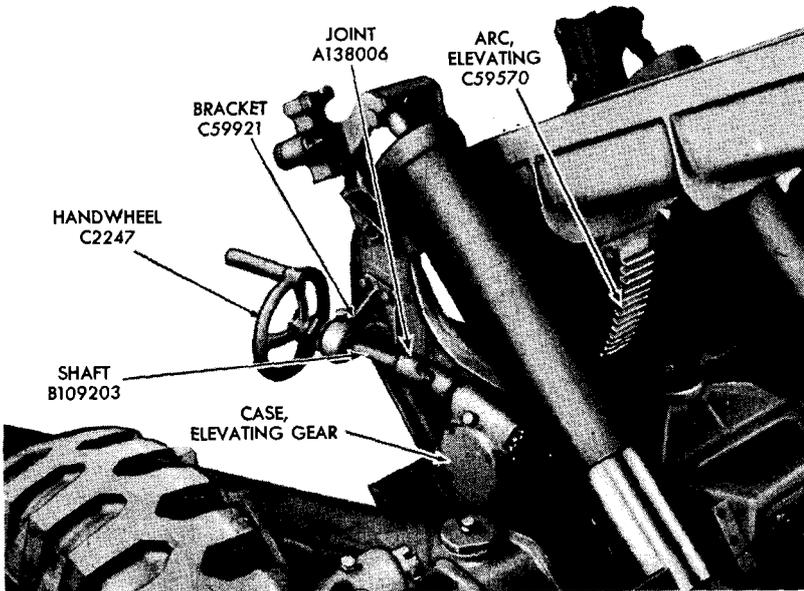
Section X

ELEVATING MECHANISM

	Paragraph
General	34
Removal and disassembly	35
Repairs	36
Assembly and installation	37

34. GENERAL.

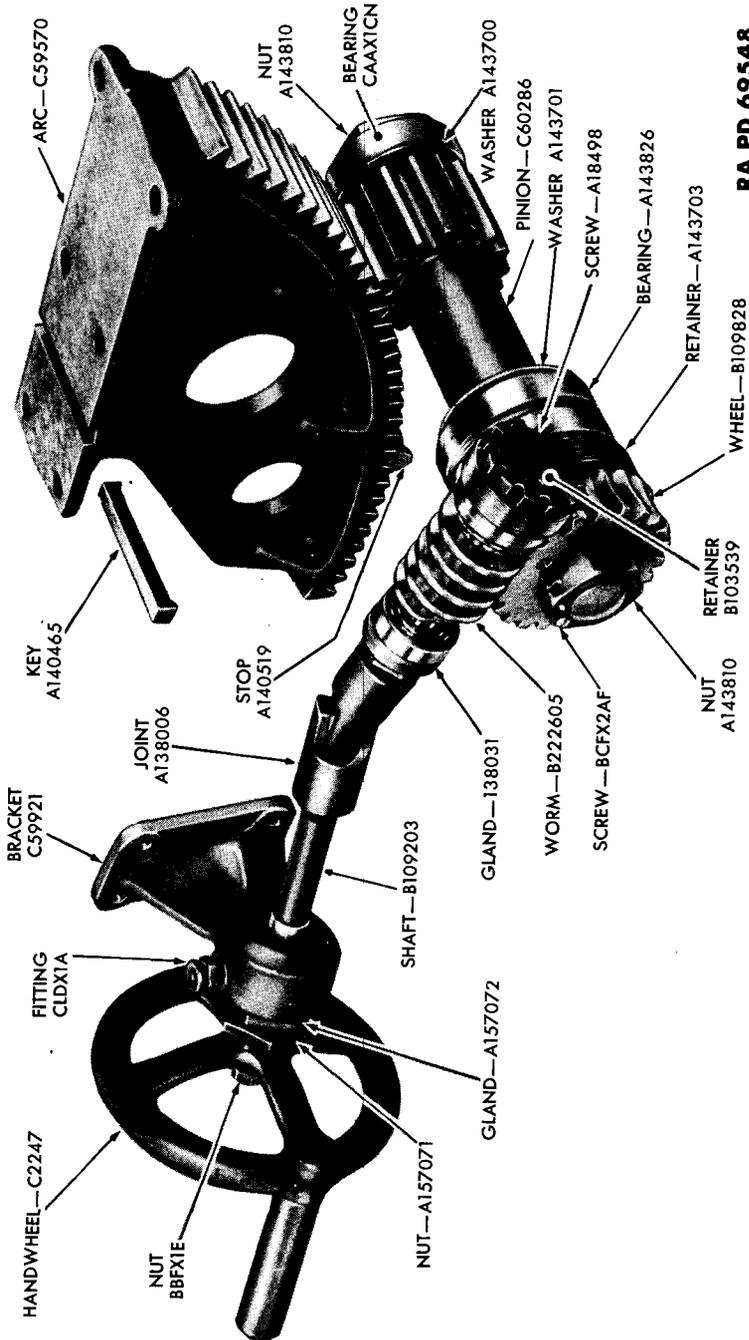
a. The elevating mechanism is located on the right side of the carriage (fig. 82). Motion of the elevating handwheel is transmitted through the elevating handwheel shaft, elevating worm, and worm



RA PD 69467

Figure 82 — Elevating Mechanism

ELEVATING MECHANISM

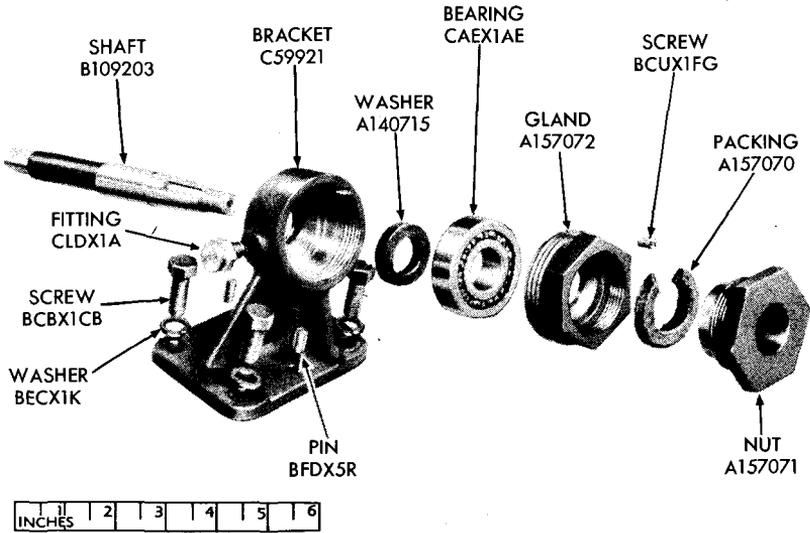


RA PD 69548

WHEEL—B109828

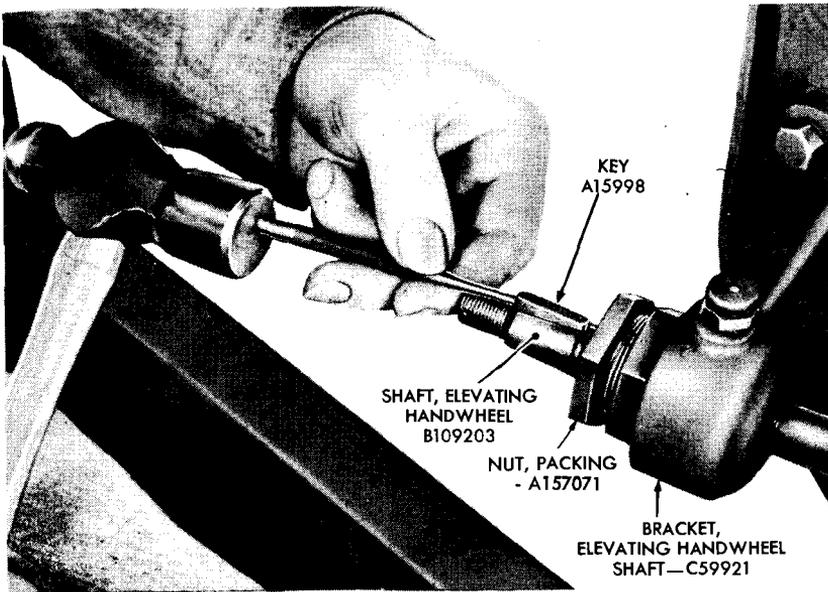
Figure 83 — Elevating Mechanism (Carriages M3 and Early M3A1)

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 69341

Figure 84 — Elevating Handwheel Bracket — Exploded View



RA PD 80059

Figure 85 — Removing Key from Elevating Handwheel Shaft

ELEVATING MECHANISM

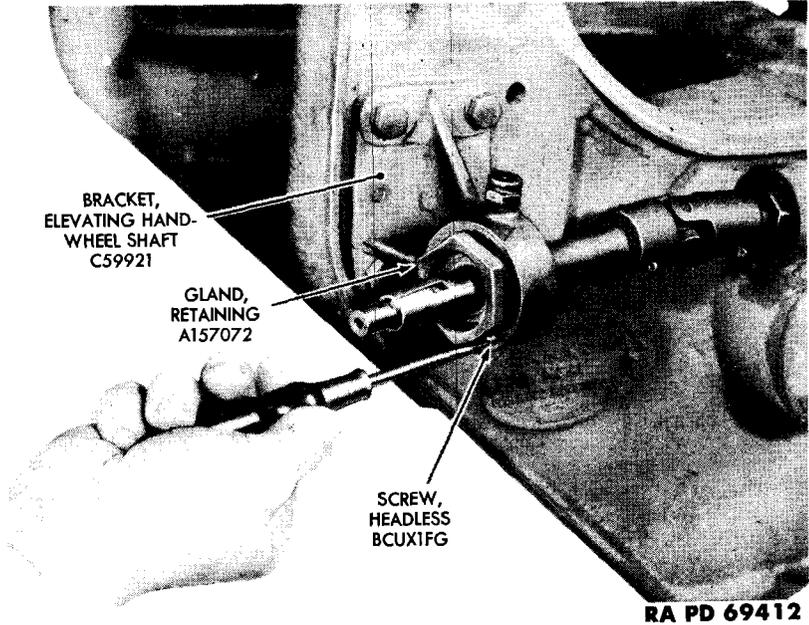


Figure 86 – Removing Set Screw from Gland on Elevating Handwheel Shaft Bracket

wheel to the elevating pinion (fig. 83). The elevating pinion engages the elevating arc mounted on the cradle.

NOTE: The elevating mechanism shown in figure 83 applies only to the Carriages M3 and early M3A1. Late Carriages M3A1 have the elevating mechanism shown on drawing D54325.

b. Failure of the elevating mechanism to function properly will generally be due to one or more of the following causes:

- (1) Defective elevating handwheel shaft.
- (2) Damaged flexible joint.
- (3) Chipped or broken teeth in the elevating worm, worm wheel, or pinion.
- (4) Defective or improperly adjusted equilibrators.
- (5) Improper adjustment of the retainer B103539 which will permit too much play in worm and worm wheel.

35. REMOVAL AND DISASSEMBLY.

a. Remove the tube, recoil mechanism, equilibrators, and cradle.

NOTE: The parts must be removed or else suitably blocked; otherwise, the cradle, sleigh, and tube will drop when the elevating shaft and pinion are removed. The equilibrator must be locked.

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1

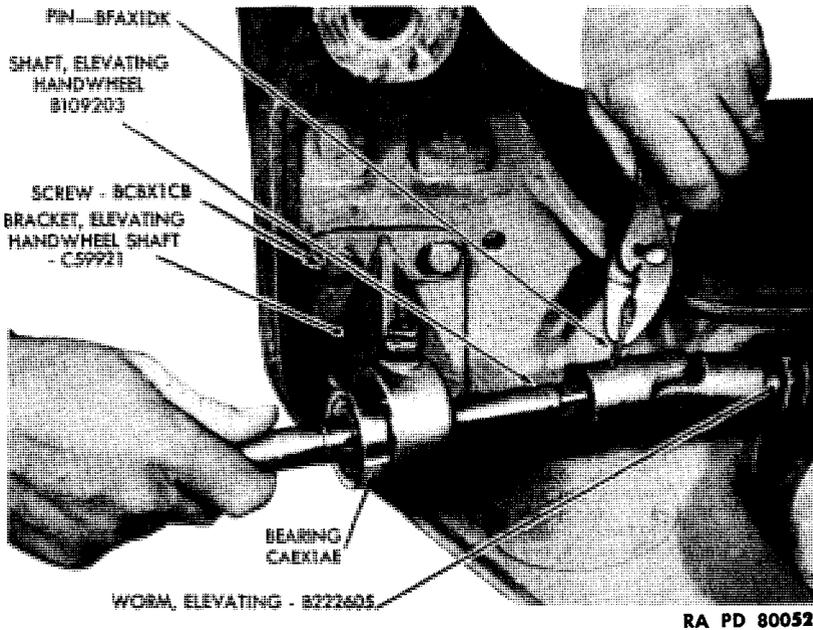


Figure 87 — Removing Elevating Handwheel Shaft

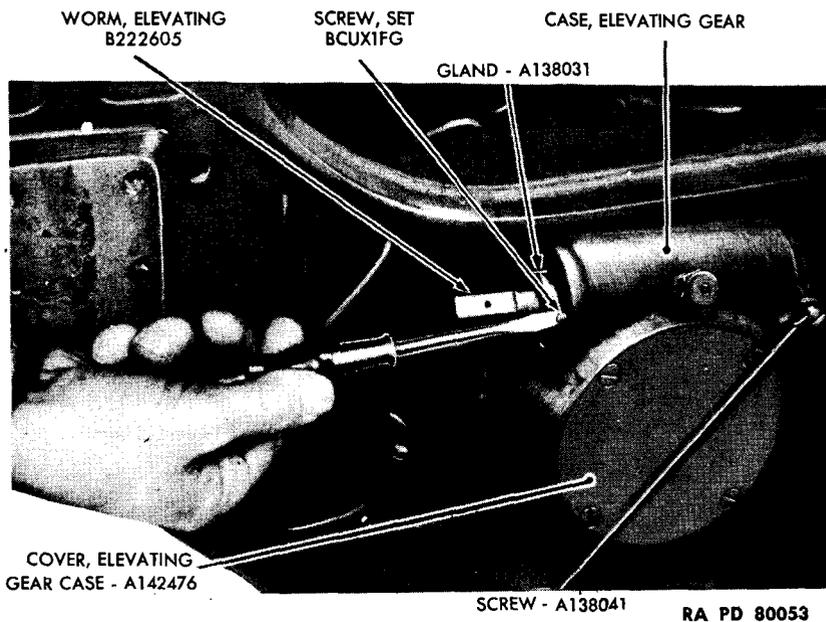
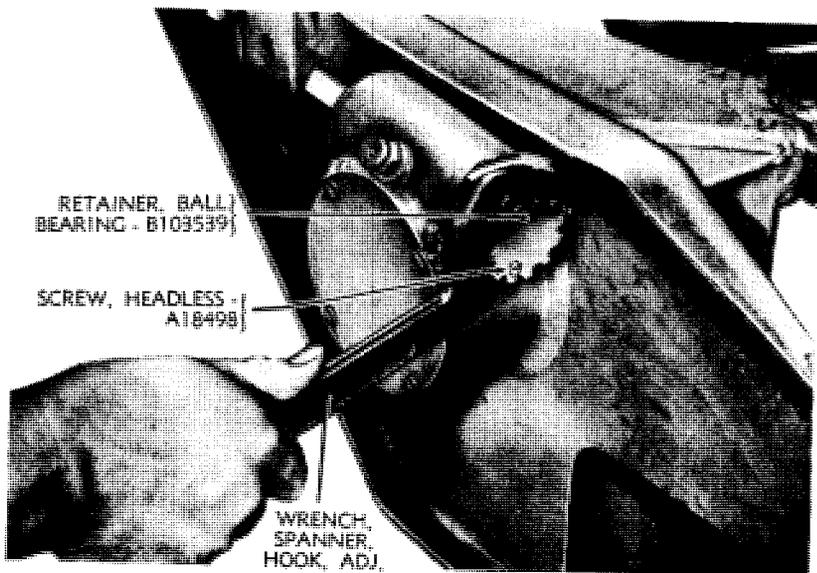


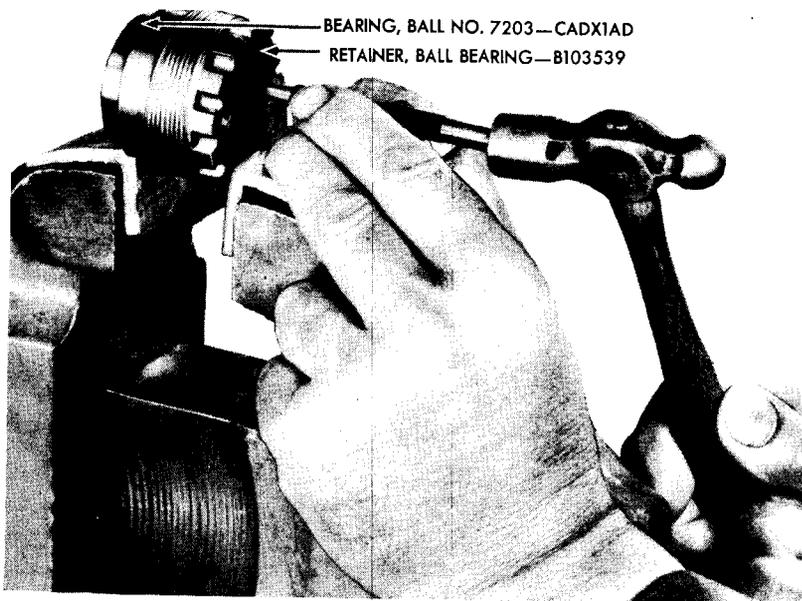
Figure 88 — Removing Set Screw from Elevating Worm Gland

ELEVATING MECHANISM



RA PD 19188

Figure 89 — Loosening Ball Bearing Retainer



RA PD 69550

Figure 90 — Removing Front Ball Bearing from Ball Bearing Retainer

**ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1**

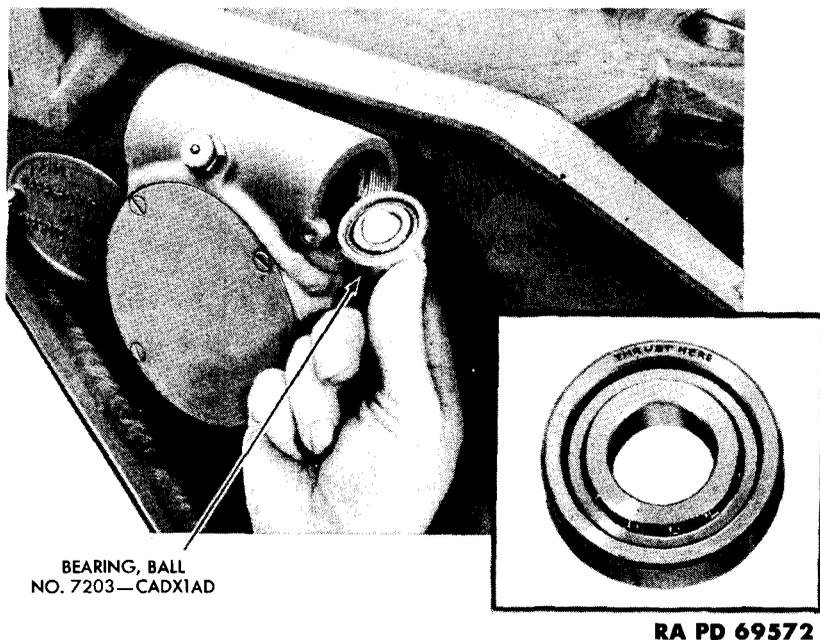


Figure 91 — Removing Rear Ball Bearing

b. Remove and Disassemble Elevating Handwheel, Elevating Handwheel Shaft, and Elevating Handwheel Shaft Bracket.

(1) Remove cotter pin and nut from elevating handwheel shaft. Pull elevating handwheel off shaft.

(2) Remove key A15998 from slot in elevating handwheel shaft (fig. 85).

(3) Remove packing nut A157071 from elevating handwheel shaft bracket. Remove packing A157070 (fig. 84).

(4) Remove set screw BCUX1FG which holds retaining gland in position on elevating handwheel shaft bracket (fig. 86). Unscrew gland with a 12-inch adjustable wrench.

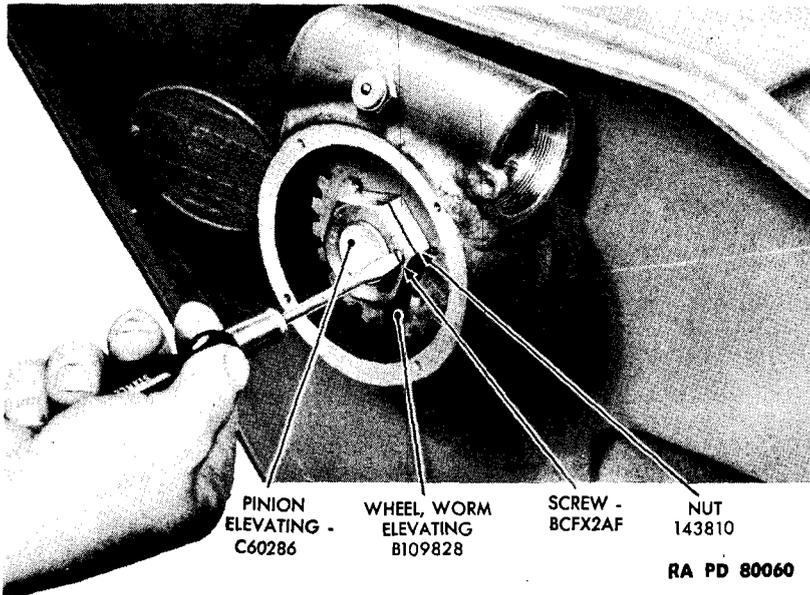
(5) Remove cotter pin from flexible joint and elevating handwheel shaft and remove shaft by drawing it through the elevating handwheel shaft bracket (fig. 87).

(6) Remove elevating handwheel shaft ball bearing CAEX1AE and felt washer A140715 from the shaft (fig. 84).

(7) Take out lubrication fitting from elevating handwheel shaft bracket.

(8) Remove elevating handwheel shaft bracket by taking out the four cap screws and washers which secure it to the top carriage. Two dowel pins will come away in bracket.

ELEVATING MECHANISM



RA PD 80060

Figure 92 — Removing Machine Screw from Elevating Pinion Nut

(9) Remove cotter pin from flexible joint and elevating worm and remove the flexible joint.

c. Remove Elevating Worm.

(1) Remove set screw BCUX1FG (fig. 88).

(2) Using an open-end wrench, unscrew and remove gland A138031.

(3) Take out the lock screw A138041 which secures the ball bearing retainer B103539 against rotation in the elevating gear case (fig. 88).

(4) Remove the ball bearing retainer and (front) ball bearing as a unit with an adjustable spanner wrench (fig. 89).

(5) Put the ball bearing retainer and ball bearing in a vise fitted with copper jaws. Remove screws A18498 and remove bearing CADX1AD from retainer B103539 (fig. 90). NOTE: Drive the bearing from the retainer by pushing against the outer race.

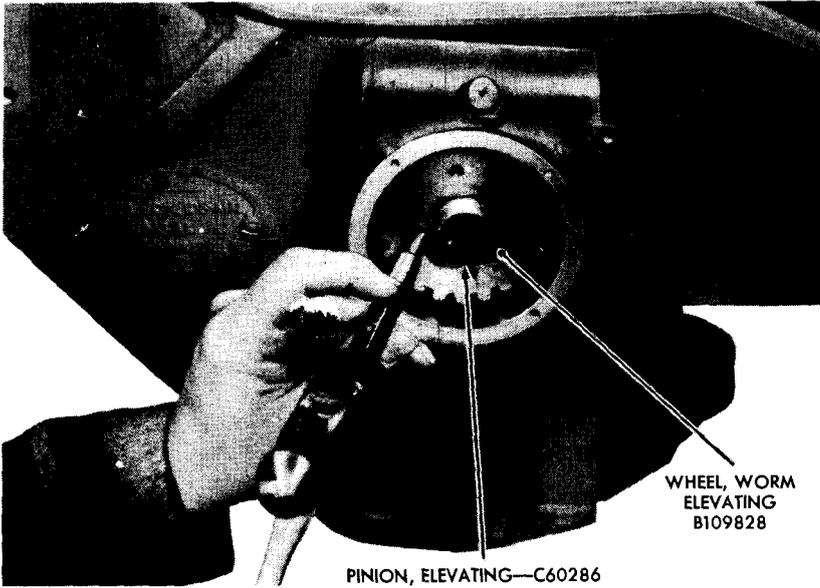
(6) Lift out the elevating worm from the elevating gear case.

(7) Loosen the rear ball bearing CADX1AD with a punch and wood block and lift out the bearing through the front end of the elevating gear case (fig. 91).

d. Remove Elevating Worm Wheel and Elevating Pinion.

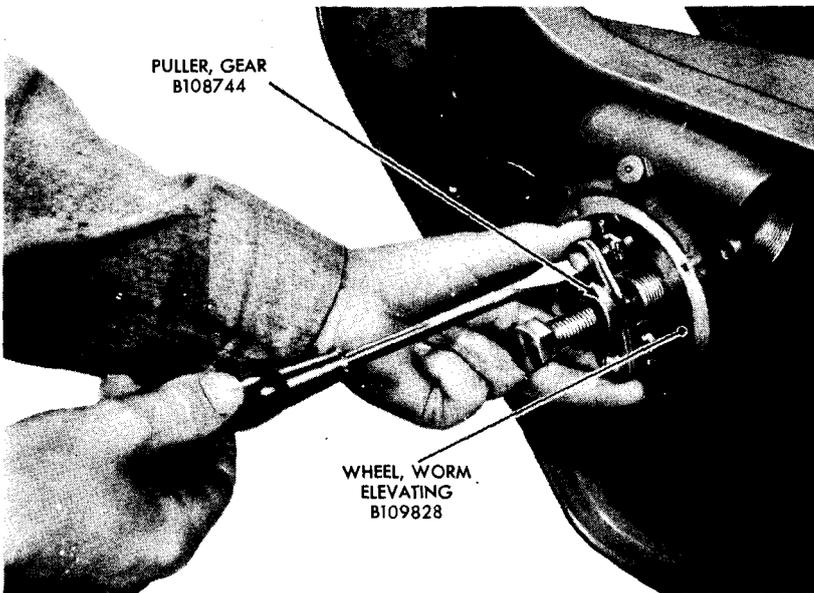
(1) Remove the elevating gear case cover by taking out the four

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 69418

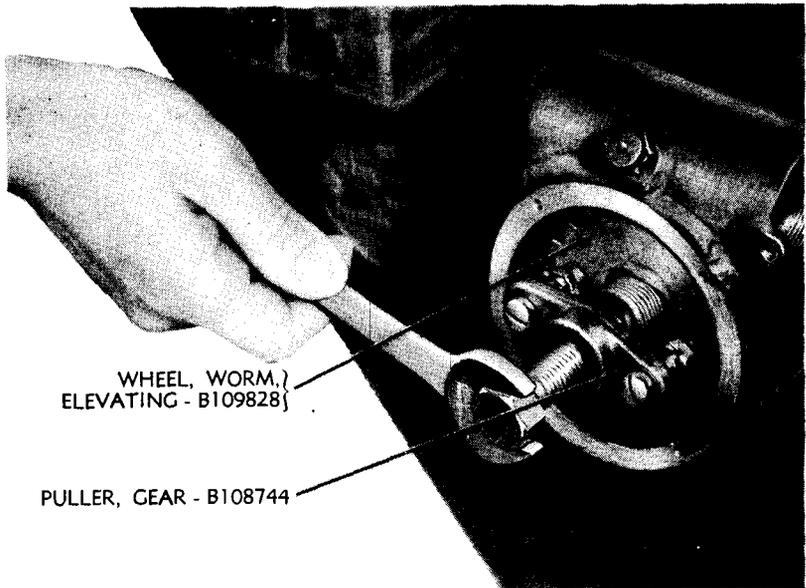
Figure 93 — Putting Assembly Marks on Worm Wheel and Pinion



RA PD 69470

Figure 94 — Installing Gear Puller on Elevating Worm Wheel

ELEVATING MECHANISM



WHEEL, WORM, }
ELEVATING - B109828 }

PULLER, GEAR - B108744

RA PD 19193

Figure 95 – Removing Elevating Worm Wheel

screws holding it (fig. 88). Remove elevating gear case cover gasket.

(2) Loosen the machine screw BCFX2AF in elevating pinion nut A143810 (fig. 92).

(3) Remove the nut with a 12-inch adjustable wrench. (Insert wood bar in the teeth of the elevating pinion to hold it while removing the nut.)

(4) Place assembly marks on worm wheel and pinion (fig. 93).

(5) Install gear puller and remove elevating worm wheel from elevating pinion (figs. 94 and 95).

(6) Take out the headless set screw BCUX1FG which holds the roller bearing retainer A143703 in place (fig. 96).

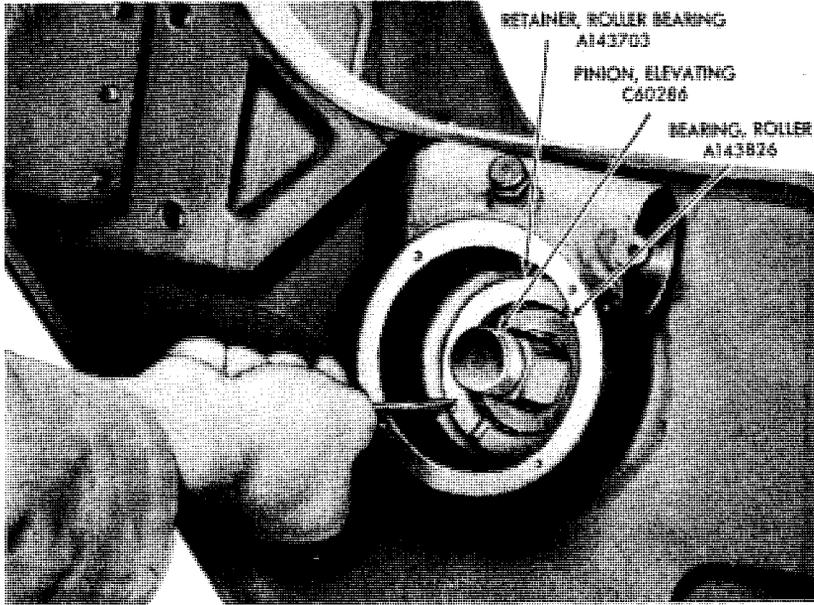
(7) Remove the roller bearing retainer with socket wrench B141575 and handle B108566 (fig. 97).

(8) Remove the lubrication fitting on the elevating pinion gland A143812 on the left side of the carriage (fig. 98).

(9) Loosen the set screw BCUX1FG on the elevating pinion gland and remove the gland with a 12-inch adjustable wrench.

(10) Tap out the elevating pinion from the left side of the carriage and pull the pinion out from the right side (fig. 99).

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 69419

Figure 96 — Removing Set Screw BCUX1FG from Roller Bearing Retainer

(11) Place the elevating pinion in a vise fitted with copper jaws and loosen but do not remove the machine screw which secures the nut on the pinion (fig. 100). Remove the nut with a 12-inch adjustable wrench.

(12) Place the elevating pinion in an arbor press and press out the pinion from taper roller bearing A143826 and washer A143701 (fig. 101).

(13) Remove the single roller bearing CAAX1CN and washer A143700. Use two pieces of $\frac{3}{16}$ - x 4-inch key stock between washer and elevating pinion (figs. 102 and 83).

36. REPAIRS.

a. Thoroughly clean all parts with SOLVENT, dry-cleaning. Dry, and then coat with a film of OIL, engine (seasonal grade).

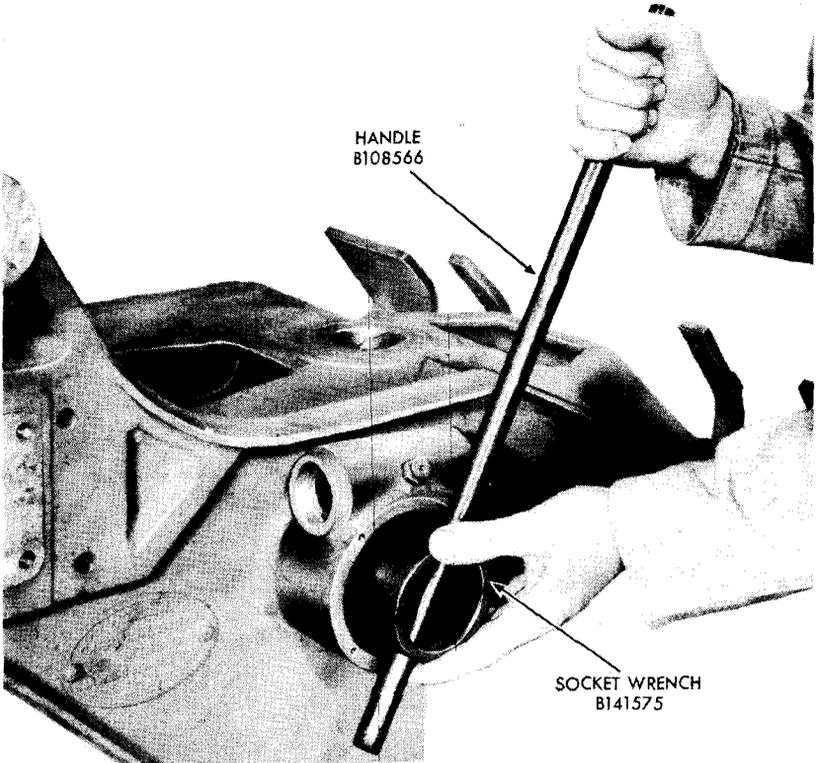
b. Remove all burrs with a smooth file and CLOTH, crocus.

c. Inspect all glands, shafts, bushings, pinion, worm, worm wheel, and bearings for wear or damage.

Replace worn or damaged parts.

NOTE: Elevating arc is checked when repairing cradle (par. 23).

ELEVATING MECHANISM



RA PD 69422

Figure 97 — Removing Roller Bearing Retainer from Elevating Pinion

37. ASSEMBLY AND INSTALLATION.

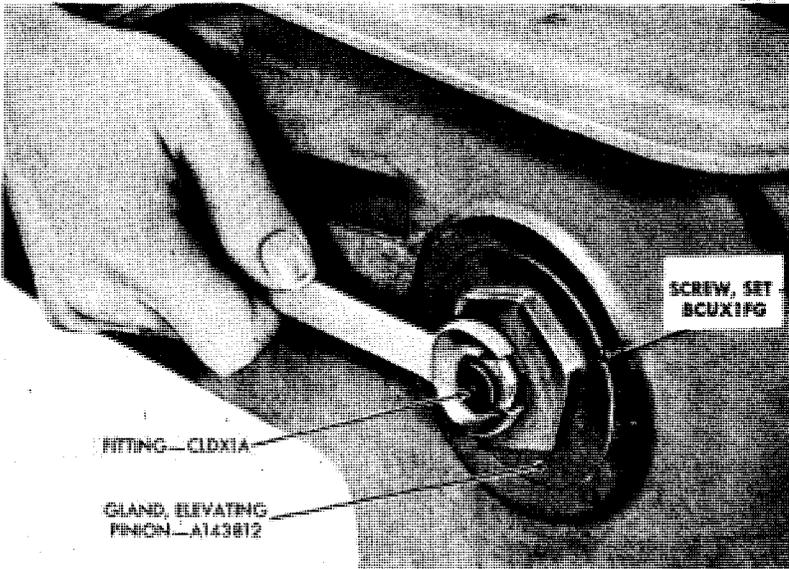
a. Install Elevating Pinion and Elevating Worm Wheel.

(1) All parts including elevating gear case must be thoroughly clean.

(2) Pack single bearing with GREASE, O. D., No. 0, for temperatures above plus 32 F or GREASE, O. D., No. 00, for temperatures below plus 32 F. Coat washer with a thin film of OIL, engine, SAE 30, for temperatures above 32 F or SAE 10, for temperatures below plus 32 F. Coat surface of elevating pinion that mates with bearing with a thin film of engine oil. Press washer and single roller bearing into place on elevating pinion.

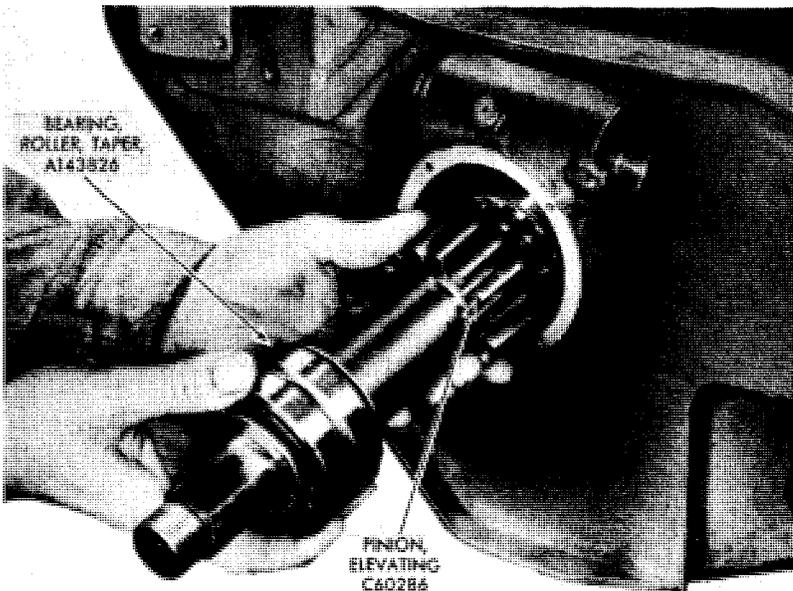
(3) Pack (double) taper roller bearing with O.D. grease. Coat washer with a thin film of engine oil. Coat surface of elevating pinion that mates with bearing with a thin film of engine oil. Press washer and (double) taper roller bearing into place on elevating pinion (fig. 103).

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



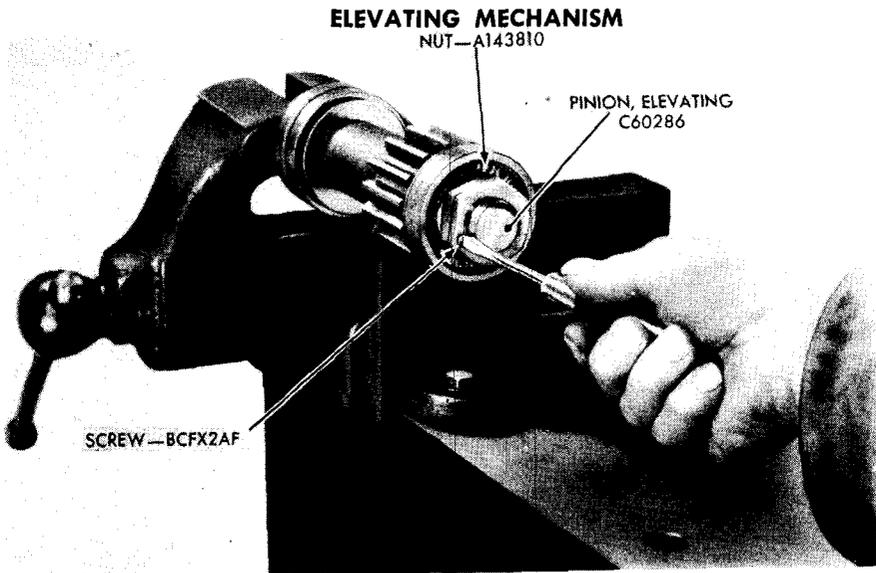
RA PD 80062

Figure 98 — Removing Lubrication Fitting from Elevating Pinion Gland



RA PD 80136

Figure 99 — Removing Elevating Pinion



RA PD 69391

Figure 100 — Loosening Machine Screw on Nut on Elevating Pinion

(4) Put elevating pinion in vise. Install the nut with a 12-inch adjustable wrench. Tighten the machine screw (fig. 100). Stake the screw.

(5) Coat the elevating pinion all over with a thin film of engine oil and install in elevating gear case. Tap into position with a bronze hammer.

(6) Lubricate and install the roller bearing retainer, being sure that it is tight enough to prevent any end play in the elevating pinion (fig. 97).

(7) Drill and tap the retainer for a No. 10-32NF screw (fig. 104). (Make sure that no chips fall into the bearings.) Install the headless set screw which holds the retainer in position (fig. 96).

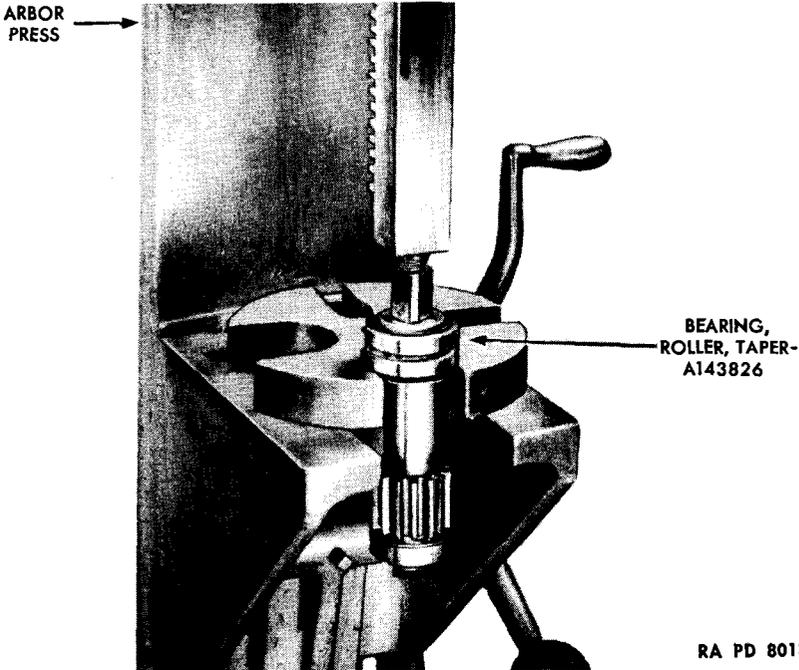
(8) Coat the elevating worm wheel all over with a thin film of engine oil. Install the worm wheel being sure to line up the assembly marks.

(9) Lubricate elevating pinion nut and screw it securely on the elevating pinion with a 12-inch adjustable wrench. (Insert a wood bar in the elevating pinion while tightening the nut.)

(10) Insert the machine screw BCFX2AF in the nut (fig. 92). Stake the screw in place.

(11) Install gasket and cover on elevating gear case and secure with four screws (fig. 88). Coat the threads of the screws with COM-POUND, rust-preventive, light.

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 80137

Figure 101 — Removing Taper Roller Bearing from Elevating Pinion

(12) Pack the gear case opening on the left side of the carriage with GREASE, O. D., No. 0, above plus 32 F or GREASE, O. D., No. 00, below plus 32 F.

(13) Install elevating pinion gland in the gear case opening on the left side of the carriage. Secure with set screw. Rust-proof threads of set screw. Install lubrication fitting in gland (fig. 98).

b. Install Elevating Worm.

(1) Pack the rear ball bearing with GREASE, O. D., No. 0, above plus 32 F and GREASE, O. D., No. 00, below plus 32 F. Install bearing in elevating gear case with the side stamped "THRUST HERE" toward the worm teeth (fig. 91).

(2) Lubricate the elevating worm and install in elevating gear case.

(3) Pack the front ball bearing with grease and assemble on the end of the elevating worm.

(4) Lubricate threads of ball bearing retainer. Screw retainer into elevating gear case. Install two screws A18498 (fig. 89).

(5) Secure ball bearing retainer with lock screw A138041 (fig. 88).

(6) Lubricate threads of packing gland and install gland in ele-

ELEVATING MECHANISM

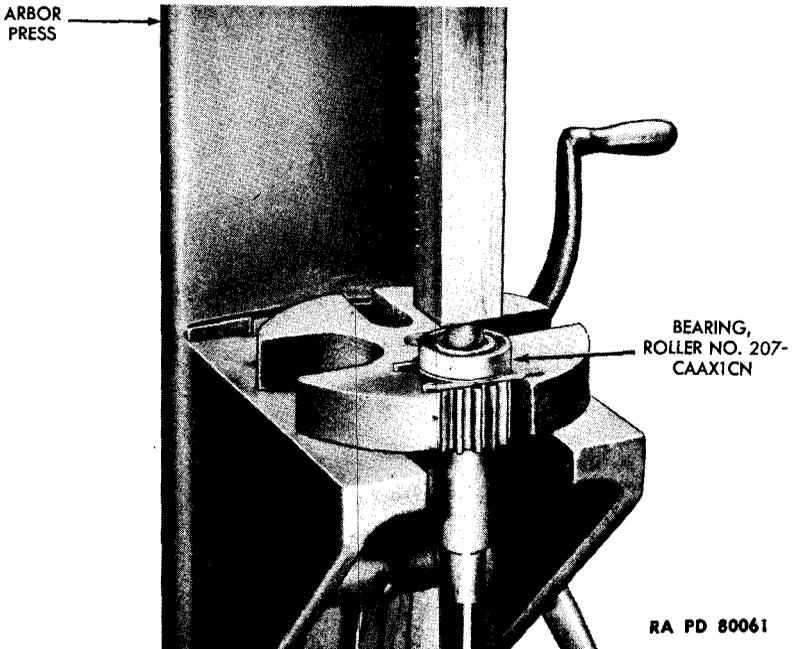


Figure 102 — Removing Single Roller Bearing from Elevating Pinion

vating gear case. Be sure felt washer is in gland. Secure gland with set screw (fig. 88).

c. Assemble Elevating Handwheel, Elevating Handwheel Shaft, and Elevating Handwheel Shaft Bracket.

(1) Place the forward end of the flexible joint on the elevating worm and insert the cotter pin.

(2) Clean the elevating handwheel shaft bracket with SOLVENT, dry-cleaning, and dry thoroughly. Coat the mating surfaces of the handwheel shaft bracket and top carriage with LEAD, white. Coat the threads of the four bracket retaining screws with COMPOUND, rust-preventive, light. Mount the bracket on the top carriage, taking care to line up the dowel pins with their holes in the top carriage. Install the four retaining screws and washers.

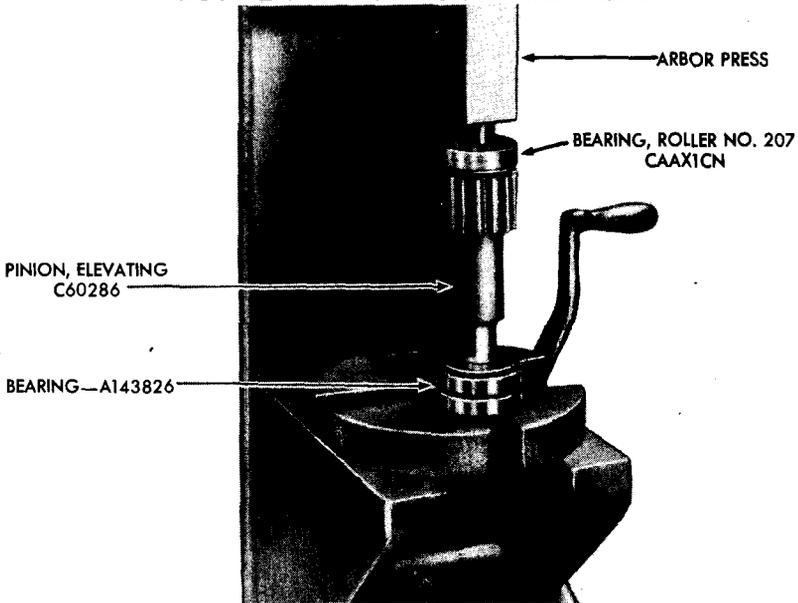
(3) Install the lubrication fitting on the bracket.

(4) Pack the elevating handwheel shaft ball bearing with GREASE, O. D., No. 0, above plus 32 F or GREASE, O. D., No. 00, below plus 32 F, and install bearing in the bracket (fig. 84).

(5) Lubricate the elevating handwheel shaft with OIL, engine, SAE 30, above plus 32 F and SAE 10, below plus 32 F and insert the shaft in the elevating handwheel shaft bracket.

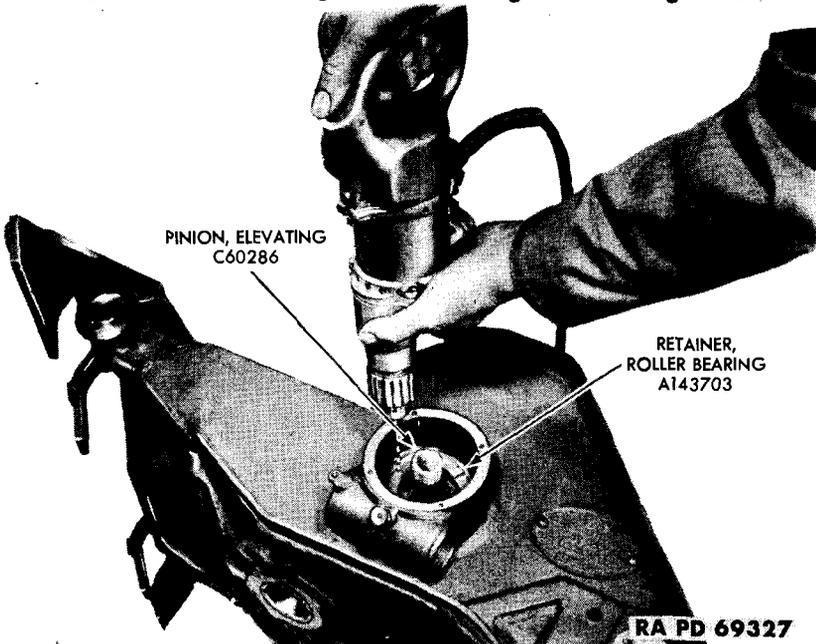
(6) Assemble the rear end of the flexible joint on the elevating handwheel shaft and insert the cotter pin.

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 69574

Figure 103 — Installing Double Bearing on Elevating Pinion



RA PD 69327

Figure 104 — Drilling Hole in Roller Bearing Retainer

TRAVERSING MECHANISM

- (7) Place the felt washer on the elevating handwheel shaft (fig. 84).
- (8) Lubricate the threads of the retaining gland and install the gland in the elevating handwheel shaft bracket. Secure the gland in place with the set screw (fig. 86).
- (9) Install packing A157070.
- (10) Coat the threads of the packing nut with COMPOUND, rust-preventive, light, and screw it in place.
- (11) Coat the elevating handwheel shaft key with a light film of engine oil, and insert the key in the shaft (fig. 85).
- (12) Attach the handwheel and secure with nut and cotter pin.

Section XI

TRAVERSING MECHANISM

	Paragraph
General	38
Removal and disassembly	39
Repairs	40
Assembly and installation.....	41

38. GENERAL.

a. The traversing mechanism is mounted on the left side of the top carriage (fig. 5). The traversing handwheel shaft is connected through a flexible joint to the traversing worm. The worm drives the traversing worm wheel and traversing pinion. The pinion meshes with the traversing rack mounted on the front of the bottom carriage. The worm and worm wheel operate on roller bearings in the traversing gear case mounted on the front of the top carriage.

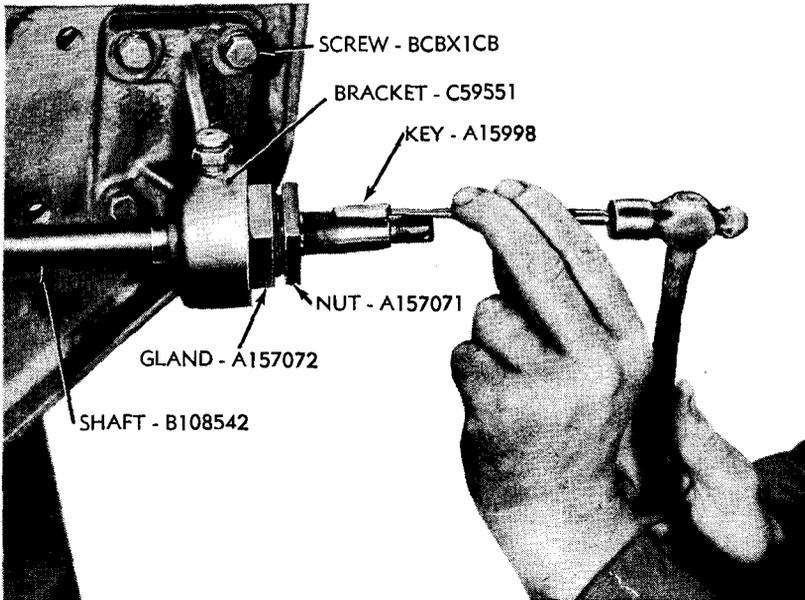
b. The traversing mechanism was designed for easy operation. Binding, "hard spots," or backlash in excess of one-sixth turn of the handwheel demand inspection to locate the source of trouble.

c. Failure to traverse properly may be due to the following:

- (1) Binding of the traversing worm or worm wheel.
- (2) Worn worm or worm wheel or both. Worn pinion or traversing rack, or both.
- (3) Worn or damaged pintle pin bushings in the top carriage.
- (4) Damaged bearing in the traversing handwheel shaft bracket.

d. The traversing mechanism can be removed from the carriage for repairs without removing any other part of the carriage.

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 80138

Figure 105 — Removing Key from Traversing Handwheel Shaft

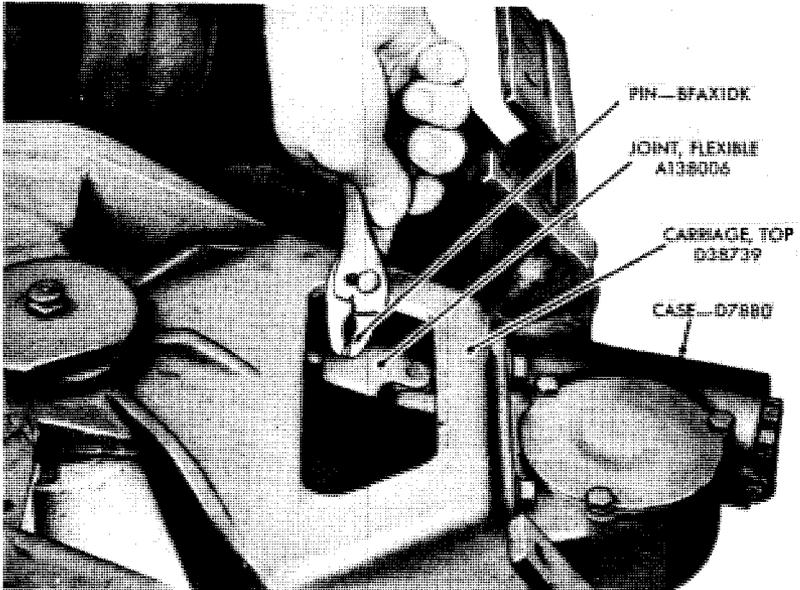
39. REMOVAL AND DISASSEMBLY.

a. Remove and Disassemble Traversing Handwheel, Traversing Handwheel Shaft, and Traversing Handwheel Shaft Bracket.

NOTE: Disassembly and removal of the traversing handwheel, shaft, and bracket are similar to the disassembly and removal of the elevating handwheel, shaft, and bracket (par. 35).

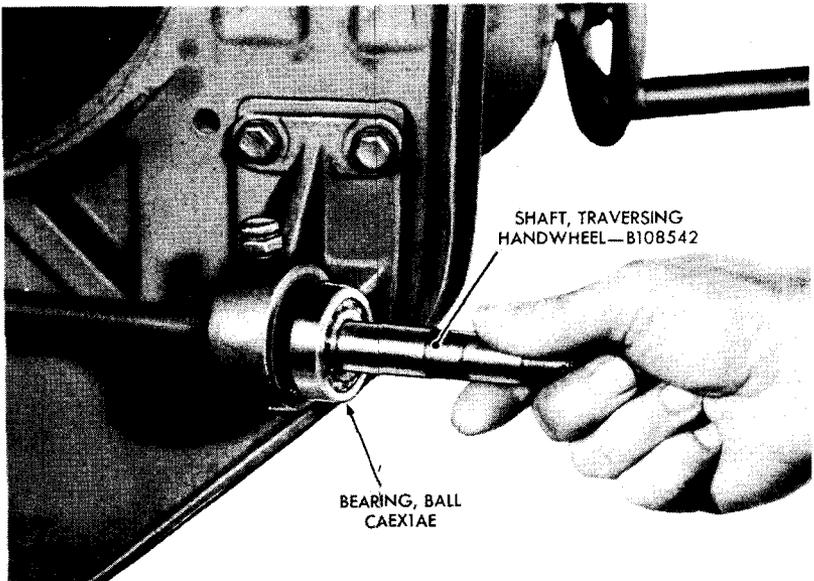
- (1) Remove the cotter pin and nut holding the traversing handwheel to the handwheel shaft and pull off the handwheel.
- (2) Tap out the key A15998 from the keyway in the traversing handwheel shaft (fig. 105).
- (3) Remove the packing nut A157071 on the traversing handwheel shaft with a 12-inch adjustable wrench. Remove the packing.
- (4) Remove the set screw BCUX1FG from the retaining gland A157072 and unscrew the gland.
- (5) Remove the cotter pin from the flexible joint and traversing handwheel shaft (fig. 106).
- (6) Pull out the traversing handwheel shaft and ball bearing CAEX1AE from the traversing handwheel shaft bracket (fig. 107).
- (7) Pull the ball bearing from the shaft.
- (8) Remove felt washer A140715 from traversing handwheel shaft bracket.

TRAVERSING MECHANISM



RA PD 69447

Figure 106 — Removing Cotter Pin from Flexible Joint and Traversing Handwheel Shaft



RA PD 69492

Figure 107 — Removing Traversing Handwheel Shaft and Bearing

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1

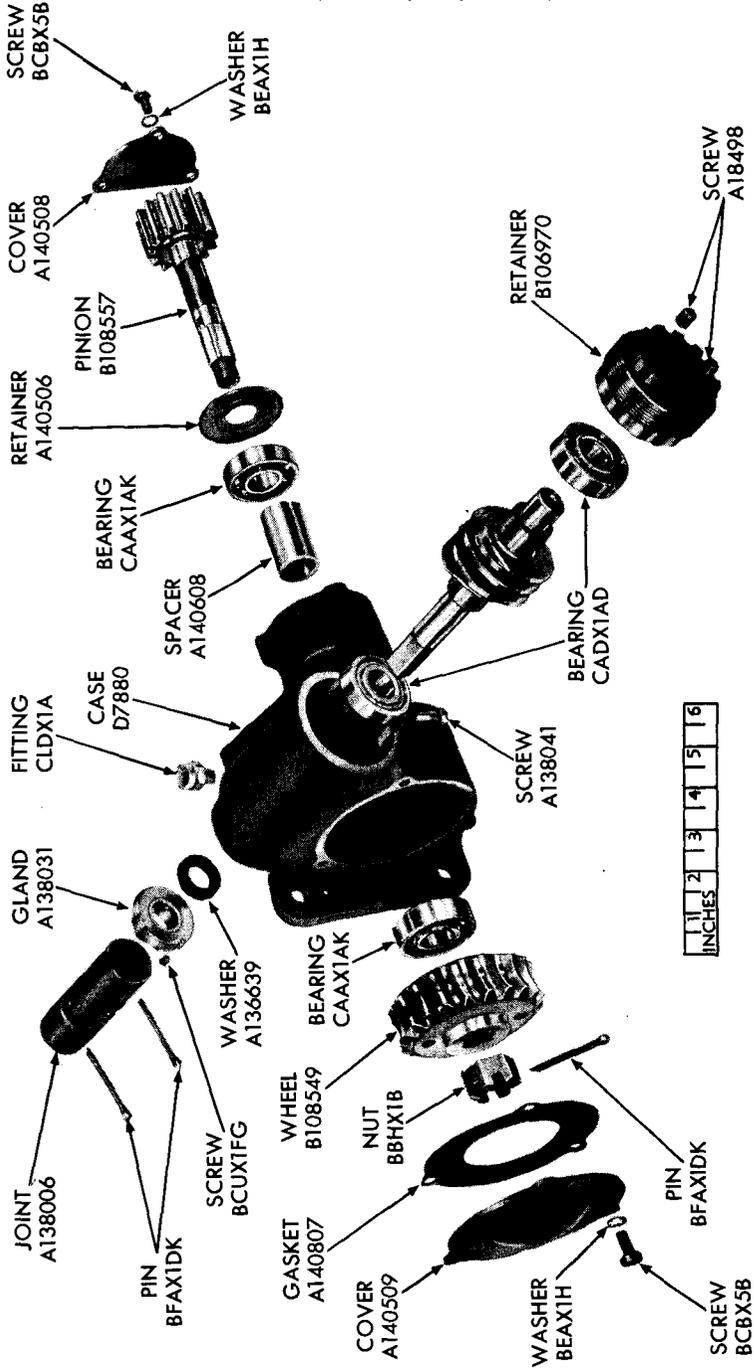


Figure 108 — Traversing Mechanism — Exploded View

TRAVERSING MECHANISM

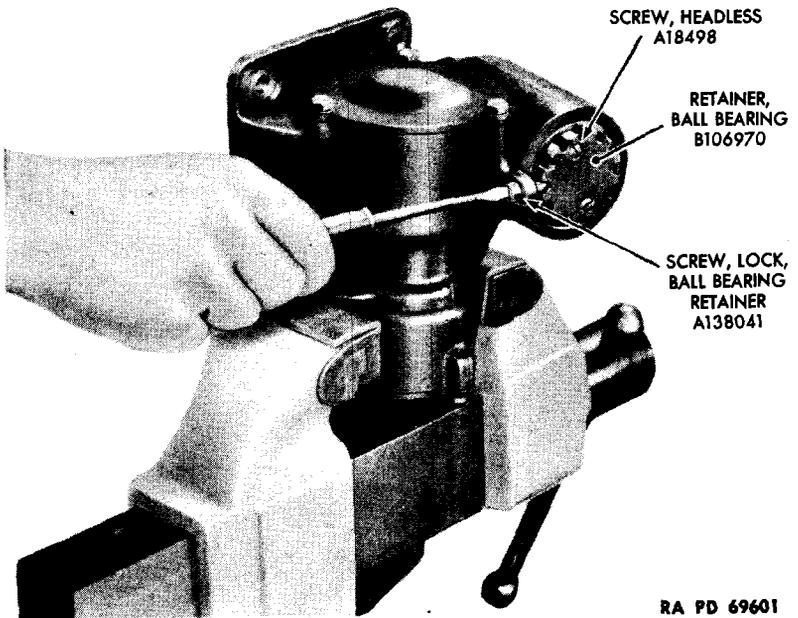


Figure 109 — Removing Lock Screw from Ball Bearing Retainer

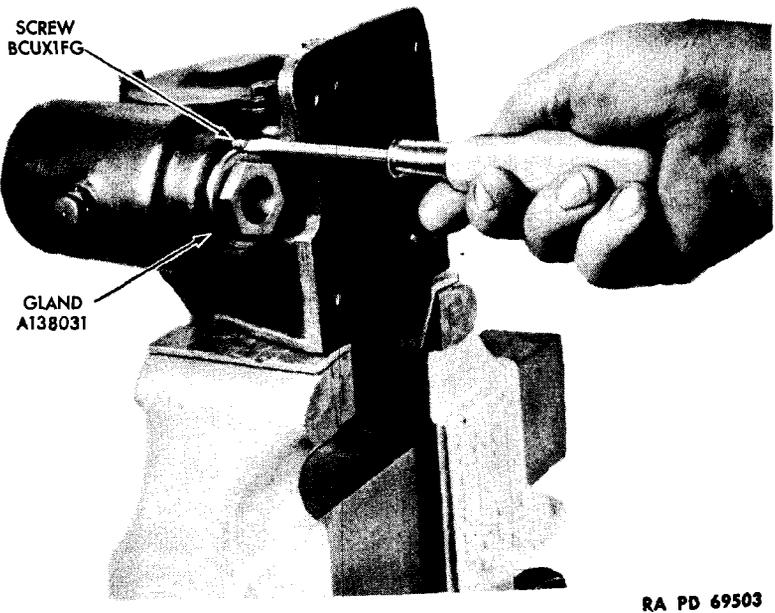
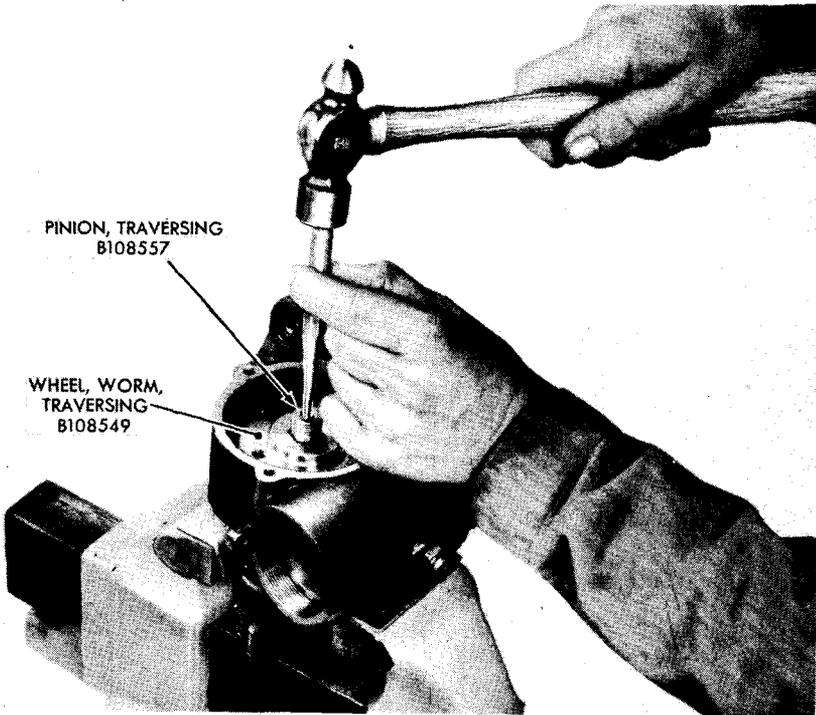


Figure 110 — Removing Set Screw from Packing Gland

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HOWITZER CARRIAGES M3 AND M3A1



RA PD 69600

Figure 111 — Putting Assembly Marks on Traversing Worm Wheel and Pinion

(9) Remove the lubrication fitting from the bracket.

(10) Remove the traversing handwheel shaft bracket by taking out the four screws and washers holding it to the top carriage (fig. 105). Two dowel pins will come away with the bracket.

b. Remove Traversing Gear Case.

(1) Remove the four screws and washers which hold the traversing gear case D7880 to the top carriage (fig. 106). The right top screw must be removed last and the case pulled away at the same time because it hits the nut on the cover. Two dowel pins will come away with the case.

(2) Remove the traversing gear case and flexible joint as a unit.

c. Remove Traversing Worm (fig. 108).

(1) Place traversing gear case in a vise fitted with copper jaws being careful that the exposed teeth of the pinion are not clamped in the vise.

TRAVERSING MECHANISM

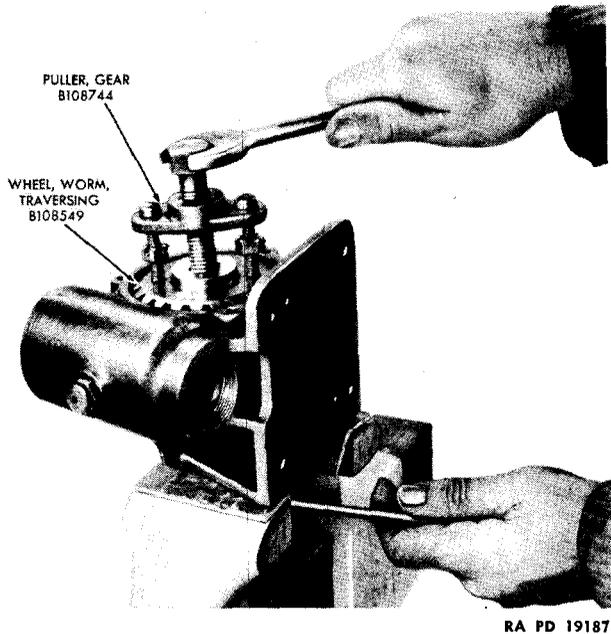


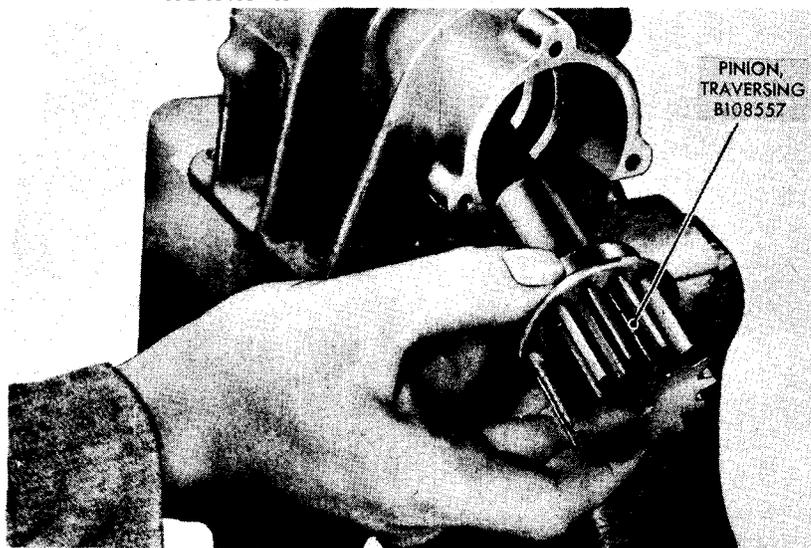
Figure 112 – Removing Traversing Worm Wheel

- (2) Remove the cotter pin from the flexible joint and tap the joint off the worm.
- (3) Remove the lock screw from the ball bearing retainer (fig. 109).
- (4) Using an adjustable spanner wrench, remove retainer B106970 and front ball bearing CADX1AD as a unit.
- (5) Remove retainer screws A18498 and remove bearing from retainer.
- (6) Remove the traversing worm.
- (7) Remove set screw BCUX1FG from gland A138031 (fig. 110).
- (8) Remove gland with felt washer A136639 (fig. 108).
- (9) Remove rear ball bearing CADX1AD. (It may be necessary to tap the bearing *lightly* with a brass drift and hammer to loosen it.)

d. Disassemble Traversing Pinion (fig. 108).

- (1) With the gear case still in the vise, remove the three screws and three washers from the traversing gear case large cover A140509 and remove cover and gasket A140807.
- (2) Remove cotter pin BFA1DK and nut BBHX1B from the traversing pinion. Prevent the pinion from turning by locking it with a piece of wood.

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HOWITZER CARRIAGES M3 AND M3A1**



RA PD 69428

Figure 113 — Removing Traversing Pinion

(3) Place assembly marks on the traversing pinion and worm wheel (fig. 111).

(4) Use gear puller to remove the worm wheel, holding the pinion from turning by locking it with a piece of wood (fig. 112).

(5) Turn the case in the vise and remove the traversing gear case small cover A140508 by removing the three screws and washers.

(6) Remove the pinion from the traversing gear case. Spacer A140608, lower bearing CAAX1K, and retainer A140506 will come off on the pinion (fig. 113). Remove spacer, bearing, and retainer from the shaft.

(7) Remove the top ball bearing CAAX1AK from the gear case.

40. REPAIRS.

a. Clean all parts thoroughly with SOLVENT, dry-cleaning. Dry, and then coat with a film of OIL, engine (seasonal grade).

b. Replace worn or damaged bearings.

c. Remove all burrs or scratches from parts.

d. Replace all damaged or worn parts with new ones.

41. ASSEMBLY AND INSTALLATION.

a. Assemble Traversing Pinion (fig. 108).

(1) Wash all parts with SOLVENT, dry-cleaning, and dry thoroughly. Apply a thin film of OIL, engine (seasonal grade).

TRAVERSING MECHANISM

(2) Pack ball bearings CAAX1AK with GREASE, O. D., No. 0, above plus 32 F or GREASE, O. D., No. 00, below plus 32 F. Coat the pinion, ball bearing retainer, and ball bearing spacer with a thin film of OIL, engine, SAE 30, above plus 32 F or OIL, engine, SAE 10, below plus 32 F. Install retainer and one ball bearing on the pinion.

(3) Place the traversing gear case in a vise fitted with copper jaws. Insert the pinion, retainer, and ball bearing in the case.

(4) Put the traversing gear case small cover in position on the gear case and insert three screws and washers.

(5) Turn the case in the vise and install the ball bearing spacer on the pinion.

(6) Install the top ball bearing on the pinion. (Both ball bearings were packed with grease in step (2), above.)

(7) Lubricate the traversing worm wheel with a thin film of oil. Install the worm wheel, being careful to align the assembly marks on the wheel and pinion.

(8) Screw on the nut holding the worm wheel. Lock the pinion with a piece of wood while doing so.

(9) Insert the cotter pin in the nut.

NOTE: Do not install the traversing gear case large cover and gasket until the traversing gear case is mounted on the carriage. It is not possible to install the right top traversing gear case screw with the large cover in place.

b. Assemble Traversing Worm (fig. 108).

(1) Wash all parts with SOLVENT, dry-cleaning, and dry thoroughly.

(2) Lubricate the rear (shaft) portion of the traversing worm with a thin film of OIL, engine, SAE 30, above plus 32 F or OIL, engine, SAE 10, below plus 32 F. Pack the rear ball bearing with GREASE, O. D., No. 0, above plus 32 F or GREASE, O. D., No. 00, below plus 32 F. Install the bearing on the worm with the side stamped "THRUST HERE" toward the worm teeth.

(3) Lubricate the worm all over and install worm and bearing in the traversing gear case.

(4) Pack the front ball bearing and place the bearing on the front end of the worm.

(5) Lubricate the ball bearing retainer and install in the traversing gear case. Replace retainer screws A18498.

(6) Insert and tighten the lock screw in bearing retainer (fig. 109).

(7) Coat the threads of the packing gland with COMPOUND, rust-preventive, light, and install the gland in the traversing gear case. Be sure felt washer A136639 is in the gland.

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(8) Drill and tap the gland for the No. 10-32NF headless set screw BCUX1FG. Insert the screw and stake it in place (fig. 110).

(9) Install the flexible joint on the worm and insert the cotter pin through the flexible joint and worm.

c. Install Traversing Gear Case.

(1) Coat the mating surfaces of the traversing gear case and top carriage with LEAD, white. Line up the dowel pins in the case with the holes in the top carriage and mount the case on the carriage. Be sure the pinion and traversing rack are properly meshed.

(2) Insert the four screws and washers which secure the traversing gear case to the top carriage. Coat the threads of the screws with COMPOUND, rust-preventive, light.

(3) Place the large cover and gasket of the traversing gear case in position on the case and install the three retaining screws and washers.

d. Install Traversing Handwheel Shaft Bracket, Handwheel Shaft, and Handwheel.

(1) Wash all parts with SOLVENT, dry-cleaning, and dry thoroughly. Coat with a thin film of OIL, engine (seasonal grade).

(2) Coat the mating surfaces of the traversing handwheel shaft bracket and top carriage with LEAD, white. Coat the threads of the four bracket retaining screws with COMPOUND, rust-preventive, light. Line up the dowel pins in the bracket with the holes in the top carriage and mount the bracket on the top carriage with four screws and washers.

(3) Put on the lubrication fitting.

(4) Lubricate the traversing handwheel shaft with a thin film of OIL, engine, SAE 30, above plus 32 F or OIL, engine, SAE 10, below plus 32 F. Insert the shaft through the bracket and bring it into alinement with the flexible joint on the end of the worm. Install the cotter pin in the joint and shaft.

(5) Install the felt washer in the traversing handwheel shaft bracket.

(6) Pack the traversing handwheel shaft bracket ball bearing with GREASE, O. D., No. 0, above plus 32 F or GREASE, O. D., No. 00, below plus 32 F and install the bearing in the bracket.

(7) Lubricate the threads of the retaining gland. Screw the gland in the bracket and secure with set screw.

(8) Insert packing in the gland and replace the packing nut. Coat the threads of the packing nut with COMPOUND, rust-preventive, light.

(9) Tap key into its slot in the handwheel shaft (fig. 105).

(10) Place the handwheel in position on the shaft and secure with nut and cotter pin.

Section XII

WHEEL CARRIERS AND WHEEL LATCHES

	Paragraph
General	42
Removal and disassembly	43
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Assembly and installation	45

42. GENERAL.

a. The wheel carriers are assembled to the bottom carriage by mounting pins (fig. 114). Bronze washers, lock washers, and slotted nuts retain the mounting pins with just enough tension to allow a revolving movement of the wheels without end play. The wheel spindles are assembled rigidly to the wheel carriers.

b. The wheel latch mechanism consists of a wheel latch bolt and a wheel latch lever assembly. When the wheel latch lever is in position close to the wheel, the wheel carrier is locked in firing position. When the wheel latch lever is in position close to the trail, the wheel carrier is locked in traveling position.

c. Wheel carriers are designed for easy changing of the carriage from traveling to firing position or from firing to traveling position. Failure of the wheel carrier to swing freely from firing to traveling position or vice versa may be due to a worn carrier bushing in the bottom carriage or a worn or burred mounting pin. Failure of the wheel latch to function properly may be due to a weak or broken wheel latch spring, worn or burred wheel latch bolt, worn or damaged wheel latch rack.

d. Wheel carriers and wheel latches may be removed without disassembly of other parts of the howitzer or carriage.

43. REMOVAL AND DISASSEMBLY.

- a. Remove wheel and hub (par. 47).
- b. Remove the brake lever and housing plate (par. 51).
- c. **Remove the Wheel Carrier.**

(1) Remove the cotter pin and nut from the end of the mounting pin.

(2) Remove the bronze washer and lock washer from the mounting pin.

(3) Pull the wheel carrier off. Take care not to damage the carrier bushing in the bottom carriage when the mounting pin is being drawn through it.

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HOWITZER CARRIAGES M3 AND M3A1

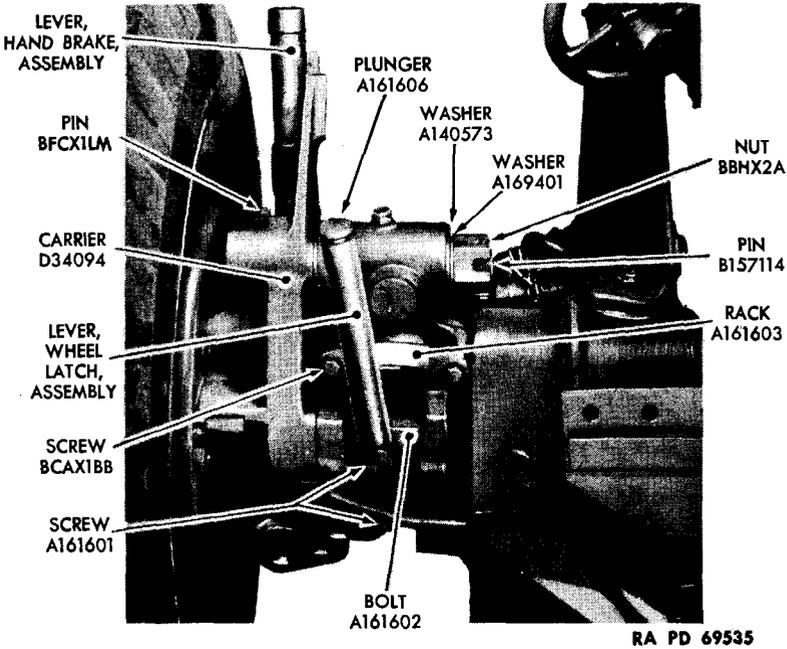


Figure 114 – Wheel Carrier and Wheel Latch

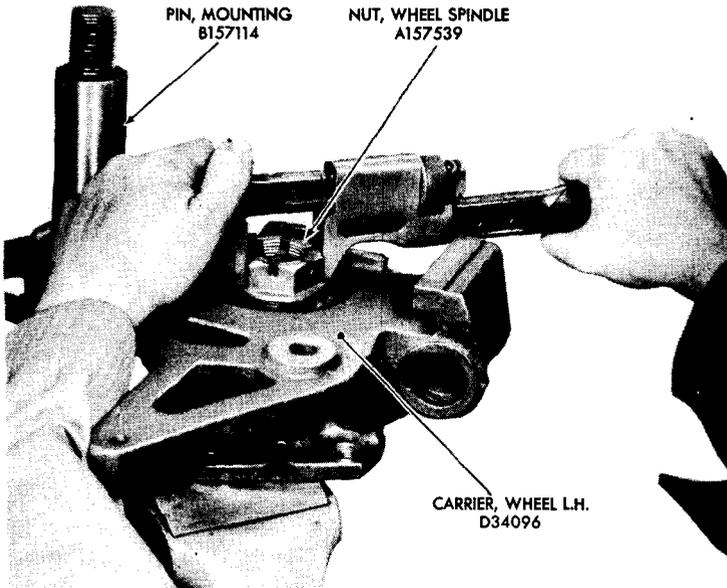
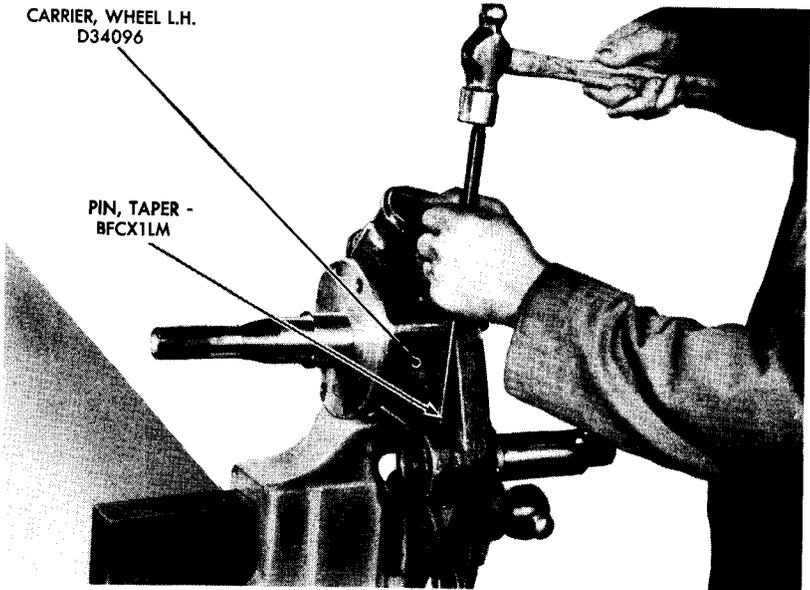


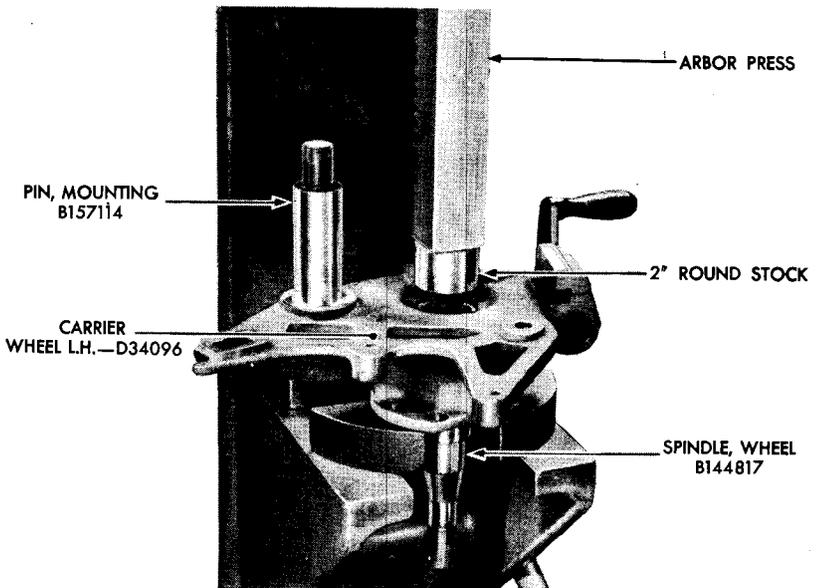
Figure 115 – Removing Inner Wheel Spindle Nut

WHEEL CARRIERS AND WHEEL LATCHES



RA PD 80063

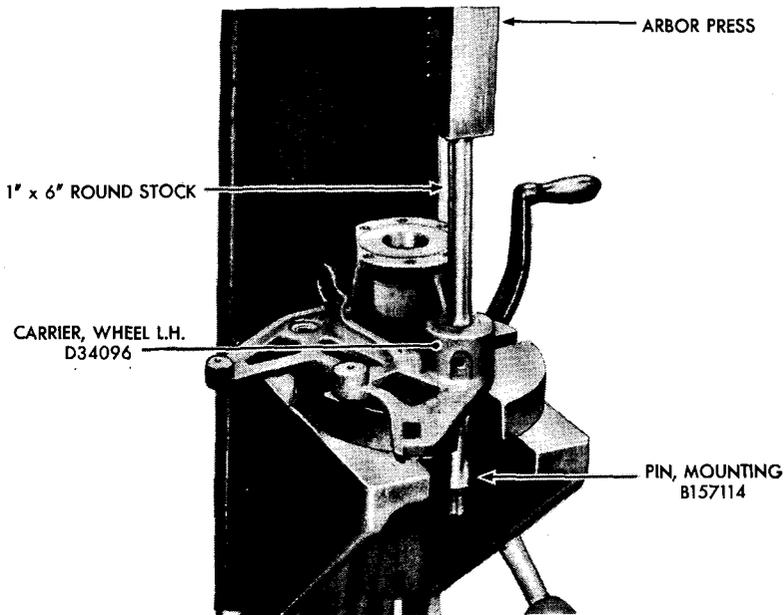
Figure 116 — Driving Out Taper Pin from Wheel Carrier Mounting Pin



RA PD 69434

Figure 117 — Removing Wheel Spindle

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HOWITZER CARRIAGES M3 AND M3A1**



RA PD 69435

Figure 118 — Removing Wheel Carrier Mounting Pin

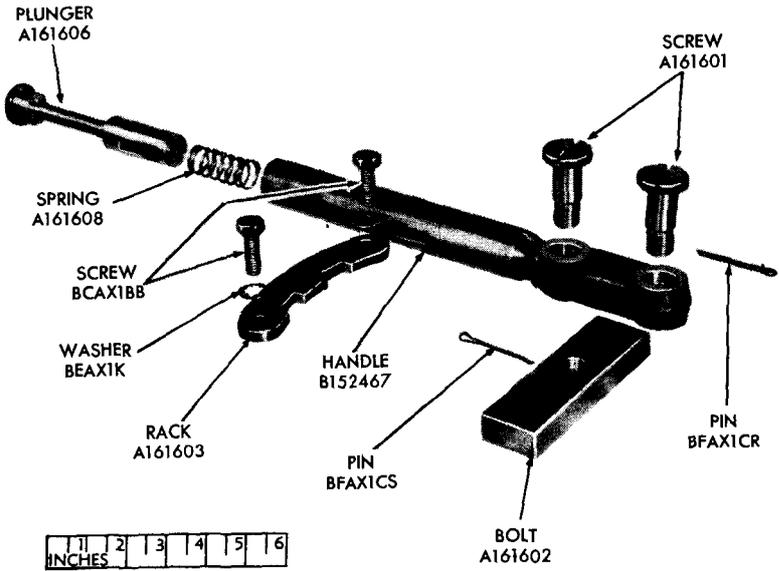
d. Disassemble the Wheel Carrier.

- (1) Place the wheel carrier in a vise fitted with copper jaws.
- (2) Remove the cotter pin from the wheel spindle nut on the inside of the wheel spindle and remove the nut (fig. 115).
- (3) Turn the carrier in the vise and drive out the taper pin BFCX1LM which holds the wheel carrier mounting pin in position (fig. 116).
- (4) Place the carrier in an arbor press and press out the wheel spindle (fig. 117).
- (5) Turn the carrier in the arbor press and with a 1- x 6-inch steel bar, press out wheel carrier mounting pin (fig. 118).

e. Remove and Disassemble the Wheel Latch (fig. 119).

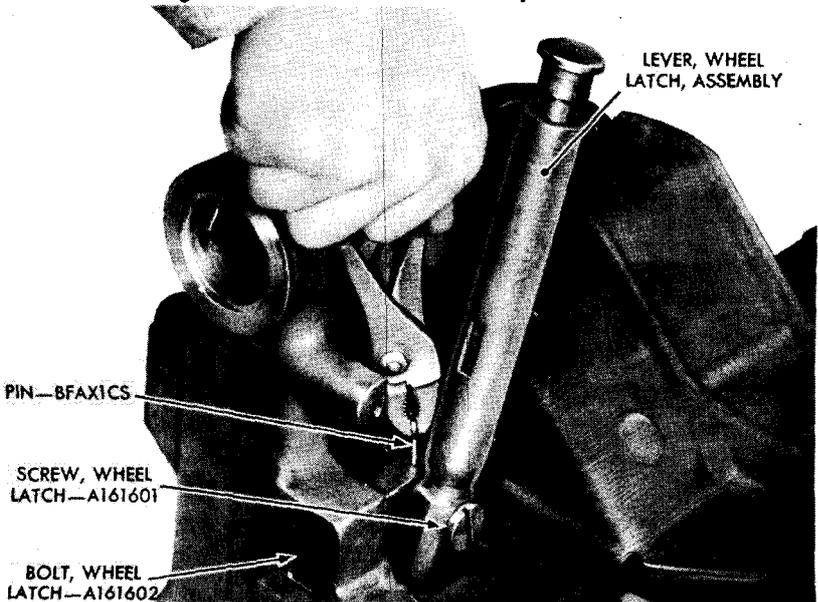
- (1) Remove the two screws and washers holding the wheel latch rack in place and remove the rack.
- (2) Take out the cotter pin from the wheel latch screw which holds the wheel latch bolt in place (fig. 120).
- (3) Remove the wheel latch screw from the wheel latch bolt (fig. 121).
- (4) Pull out the wheel latch bolt.

WHEEL CARRIERS AND WHEEL LATCHES



RA PD 69334

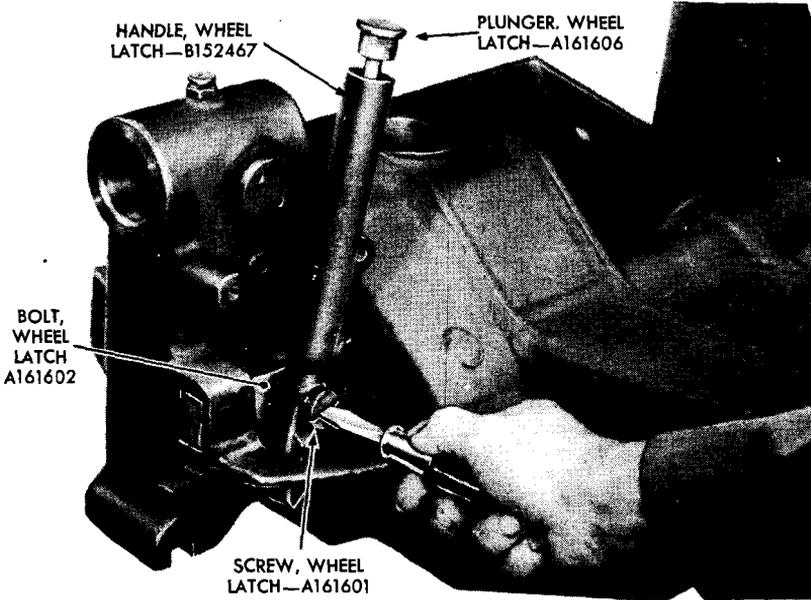
Figure 119 — Wheel Latch — Exploded View



RA PD 69378

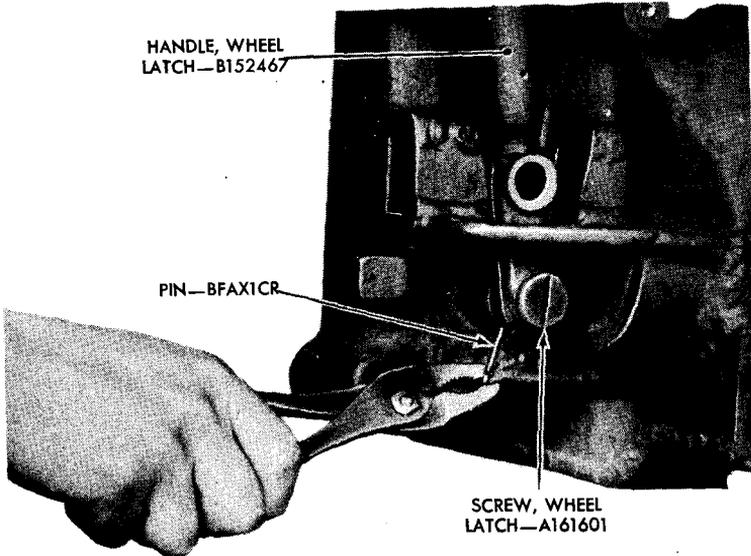
Figure 120 — Removing Cotter Pin from Wheel Latch Bolt and Screw

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HOWITZER CARRIAGES M3 AND M3A1



RA PD 69510

Figure 121 — Removing Upper Wheel Latch Screw



RA PD 69451

Figure 122 — Removing Cotter Pin from Lower Wheel Latch Screw

WHEEL CARRIERS AND WHEEL LATCHES

(5) Take out the cotter pin in the screw at the bottom of the wheel latch lever which holds the wheel latch lever in position (fig. 122). Remove the screw.

(6) Pull out the plunger and spring from the top of the lever.

44. REPAIRS.

a. Inspect the mounting pin bushing. Replace if damaged or worn.

b. Remove burrs or scratches on the mounting pin.

c. Replace the spring in the wheel latch handle if weak or broken.

d. Replace the wheel latch rack if worn or damaged.

e. Replace worn or damaged wheel latch screws or bolts.

45. ASSEMBLY AND INSTALLATION.

a. Assemble and Install Wheel Latch.

(1) Clean all parts with SOLVENT, dry-cleaning. Dry, and then coat with a film of OIL, engine (seasonal grade). Lubricate the wheel latch plunger and spring lightly and insert the plunger and spring in the wheel latch lever.

(2) Coat the wheel latch screws with COMPOUND, rust-preventive, light. Place the wheel latch lever in position on the bottom carriage and install one screw in the bottom of the wheel latch lever.

(3) Insert the cotter pin in the screw at the bottom of the wheel latch lever (fig. 122).

NOTE: If a new screw has been installed, it will be necessary to drill a $\frac{3}{32}$ -inch hole for the cotter pin (fig. 123).

(4) Install the wheel latch bolt.

(5) Insert the upper wheel latch screw which holds the wheel latch bolt in place (fig. 121).

(6) Insert the cotter pin in the wheel latch screw and wheel latch bolt.

NOTE: If a new wheel latch screw has been installed, it will be necessary to drill a hole through the wheel latch bolt and screw for the cotter pin.

(7) Place the wheel latch rack in position on the bottom carriage and install the two washers and screws.

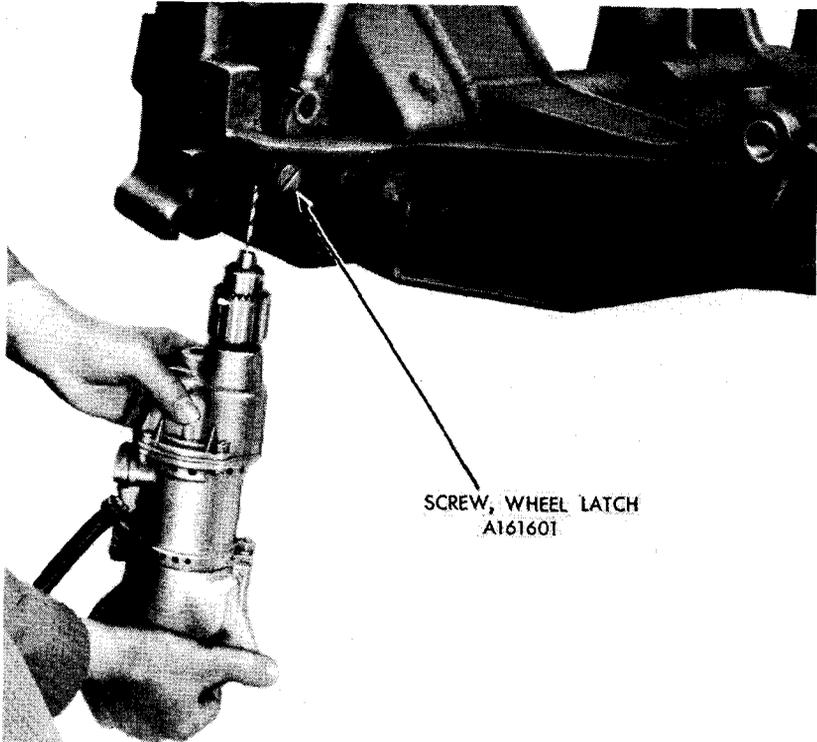
b. Assemble Wheel Carrier.

(1) Clean the carrier, mounting pin, and wheel spindle with SOLVENT, dry-cleaning.

(2) Place the carrier in an arbor press and press in the spindle.

(3) Turn the carrier in the arbor press and press in the mounting pin.

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Figure 123 — Drilling Hole for Cotter Pin for Lower Wheel Latch Screw

(4) Place the carrier in a vise with copper jaws and drill a hole for the taper pin holding the mounting pin in position. Ream the hole (No. 8 reamer). Drive in the taper pin.

(5) Install the wheel spindle inner nut and cotter pin (fig. 115).

c. Install the Wheel Carrier.

(1) Clean the bronze wheel carrier bushing with SOLVENT, dry-cleaning. Dry, and then coat with a thin film of OIL, engine (seasonal grade). Be sure the bushing and pin are free from dirt and grit.

(2) Coat the exposed surface of the mounting pin and the bore of the carrier bushing in the bottom carriage with a thin film of OIL, engine, SAE 30, above plus 32 F or OIL, engine SAE 10, below plus 32 F. Guide the mounting pin carefully into the bushing and push the carrier forward until the mounting pin is firmly seated.

WHEELS, HUBS, AND TIRES

- (3) Install the washer, lock washer, and slotted nut on the mounting pin.
- (4) Tighten the nut, then back it off one-sixteenth to one-quarter turn and rotate the carrier to be sure that it moves freely but without undue end play.
- (5) Insert the cotter pin through the mounting pin and nut.

Section XIII

WHEELS, HUBS, AND TIRES

	Paragraph
General	46
Removal and disassembly	47
Repairs	48
Assembly and installation	49

46. GENERAL.

a. The wheels are disk and rim assemblies with tire locking rings (fig. 124). They are designed for high-speed traveling. The tires are 8.00 x 16 combat type designed for use with a beadlock on 6.50 C.S. rims. A beadlock permits safe traveling for a considerable distance on a deflated tire.

NOTE: The tire size has not been changed but the former 7.50 x 16 tires have been redesignated 8.00 x 16 to avoid confusion with the standard 7.50 x 16 truck tire.

b. Wobbly wheels will generally require complete disassembly in order to replace scored or worn wheel bearings.

c. Wheels, hubs, and tires can be removed without disassembly of any other parts of the carriage.

47. REMOVAL AND DISASSEMBLY.

a. Remove the wheels (TM 9-326).

b. Remove the tires, beadlocks, and tubes (TM 9-326).

c. Remove and Disassemble Drum, Hub, and Wheel Bearings (fig. 125).

(1) Remove cotter pin BFAX2AC, nut BBHX2A, and disk and rim wheel spindle washer A139604 from the wheel spindle.

(2) Remove outer cone and roller A157218.

(3) Pull the drum and hub from the spindle. Usually oil retainer A157237, inner cone and roller A157221, and cup A157222 will come away in the hub.

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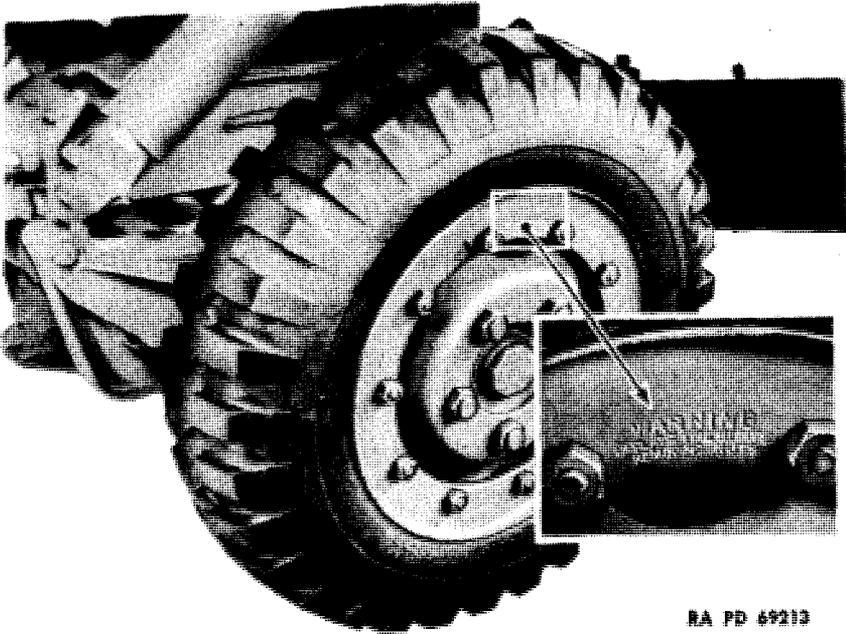


Figure 124 — Wheel and Tire

(4) With drum side of assembly down, remove inner cup A157222. Use an arbor press if this is available. A second satisfactory method is to use a block of wood or a piece of pipe of a size that will contact the whole circumference of the cup. A third method is to use a brass drift and hammer as illustrated in figure 126. If this method is used, take care to drive against the cup uniformly at several points around the cup. As the cup is forced out of the hub, retainer A157237 and cone and roller A157221 will also come away.

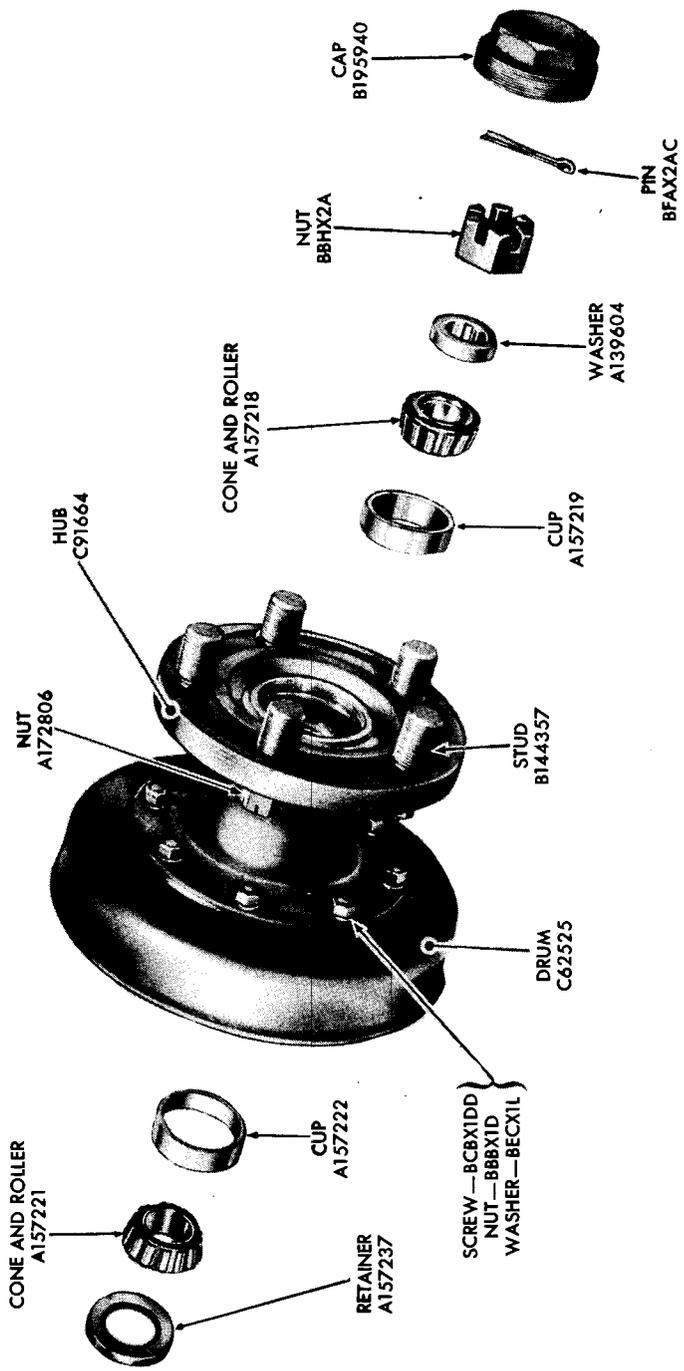
(5) Turn drum and hub over so that drum is up and remove cup A157219.

(6) Disassemble the hub from the brake drum by removing eight nuts BBBX1B, washers BECX1L, and screws BCBX1DD (figs. 125 and 127).

48. REPAIRS.

- a. Replace worn or damaged disk.
- b. Replace worn or damaged tires or tubes.
- c. Replace beadlock if damaged or out of alignment.
- d. Replace studs which are broken or have damaged threads. Remove nut A172806 and drive out damaged stud with a hide-faced hammer. The end of the stud marked with an "R" should be on the outside, away from the drum.

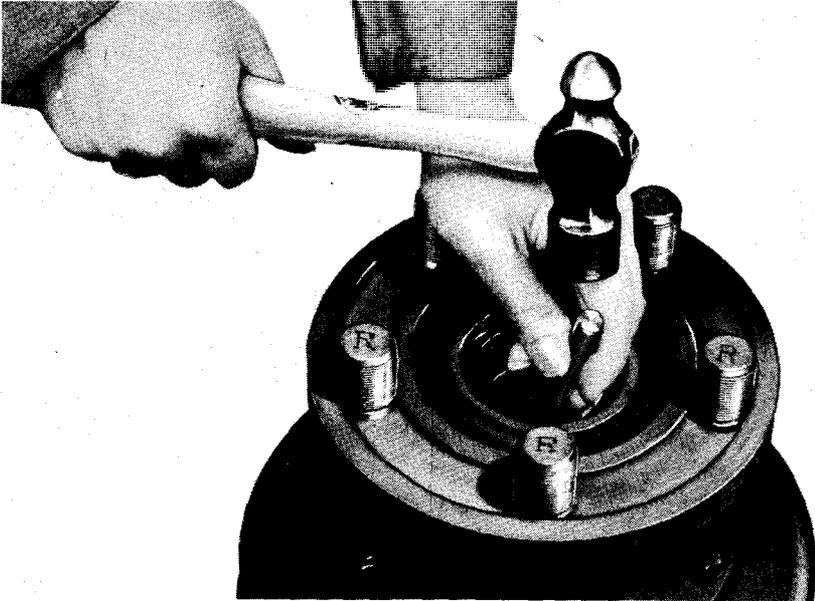
WHEELS, HUBS, AND TIRES



RA PD 69519

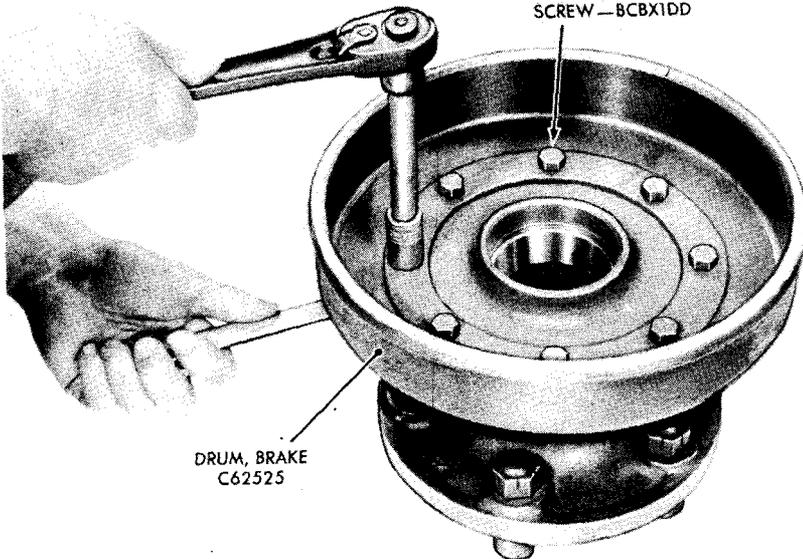
Figure 125 — Wheel Bearings — Exploded View

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RA PD 69509

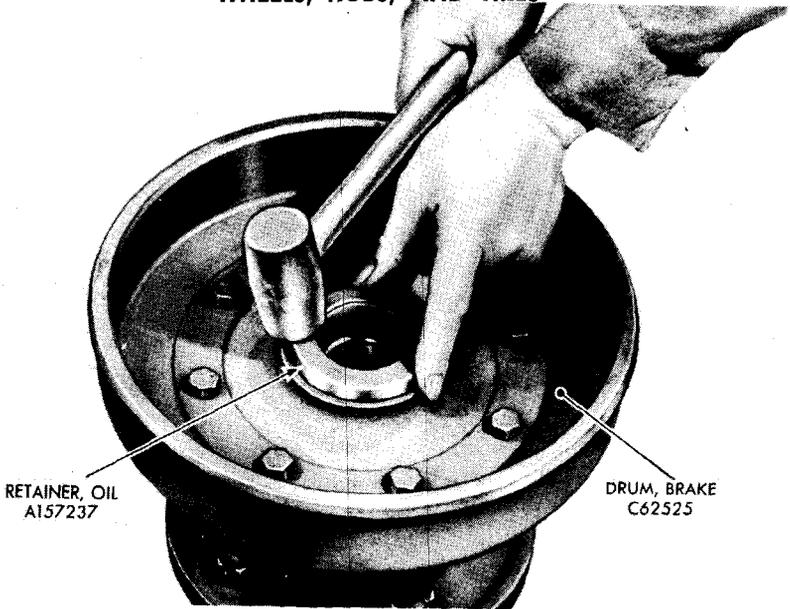
Figure 126 — Driving Inner Roller Bearing Cup from Hub



RA PD 69551

Figure 127 — Removing Hub from Brake Drum

WHEELS, HUBS, AND TIRES



RA PD 69469

Figure 128 – Replacing Oil Retainer in Hub

e. Replace damaged tire locking ring.

f. The drum surface against which the brake shoe linings operate should be checked for scoring and out-of-round condition. Badly scored and out-of-round drums should be resurfaced in a drum turning lathe or replaced.

49. ASSEMBLY AND INSTALLATION.

a. Install tires, tubes, and beadlocks (TM 9-326).

b. Assemble and Install Drum, Hub, and Wheel Bearings (fig. 125).

(1) Clean the drum, hub, taper roller bearing cone and rollers and cups with SOLVENT, dry-cleaning, and dry thoroughly. Coat wheel spindle and inside of hub with a thin film of GREASE, general purpose, No. 2.

(2) Place the inner and outer taper roller bearing cups in the hub and drive them into position. Use an arbor press, a block of wood, or piece of pipe of the same outside diameter as that of the cup which is being replaced, or a brass drift and hammer.

CAUTION: Be sure the cups are installed with the thick edge toward the center of the hub. Also, drive the cups in evenly so as not to cause binding and possible scoring of the hub surface.

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(3) Coat mating surfaces of hub and drum with **PRIMER**, synthetic, rust-inhibiting. Coat threads of screws with a thin film of **COMPOUND**, rust-preventive, light. Assemble the drum and hub and install the eight screws, washers, and nuts.

(4) Pack the inner cone and roller with **GREASE**, general purpose, No. 2, as described in paragraph 59 b (5). Install cone and roller in inner cup. Install oil retainer (fig. 128). Tap the retainer at several places and make sure it is completely seated in the hub.

(5) Install drum and hub assembly on the wheel spindle.

(6) Pack the outer cone and roller with grease. Slide the cone and roller on the wheel spindle and press it firmly into its seat in the hub.

(7) Install the disk and rim wheel spindle washer and nut on the spindle. To seat the bearings in place, tighten the nut and, at the same time, rotate the wheel in both directions. When the bearings are firmly seated, a resistance to the rotation of the wheel will be noted. Back off the nut approximately one-sixth turn to permit the wheel to rotate freely, but without any noticeable shake. Insert the cotter pin in the nut and spindle.

c. Mount the wheels. (TM 9-326.)

Section XIV

BRAKE MECHANISM

	Paragraph
General	50
Removal and disassembly	51
Repairs	52
Assembly and installation	53

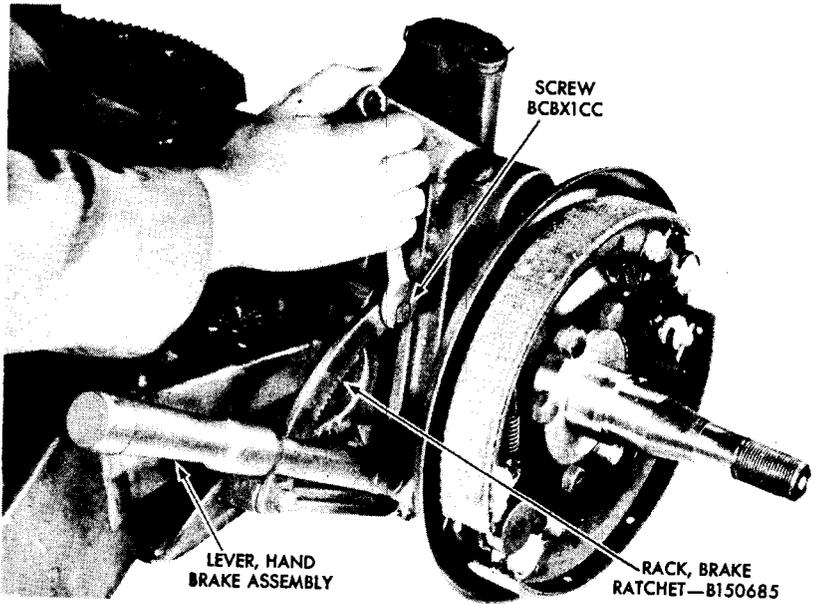
50. GENERAL.

a. The brakes are the hand-operated, mechanical type with internal, expanding brake shoes. If the brakes are in good condition and properly adjusted, they should take hold when the hand brake lever is retracted one-third of the way, or less, along the brake ratchet rack. Also, when the hand brake lever is in the "OFF" position, the wheel should revolve freely and without drag.

b. If the brakes do not function properly, they should be disassembled for replacement or repair of worn parts. Malfunctioning of the brakes may be due to one or more of the following causes:

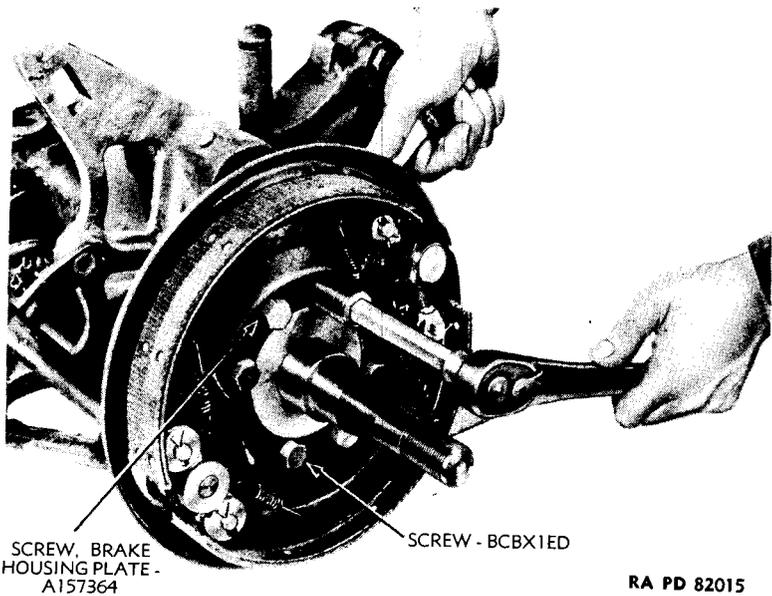
- (1) Mashed or broken teeth on the brake ratchet rack.
- (2) Weak or broken hand brake lever spring.

BRAKE MECHANISM



RA PD 69359

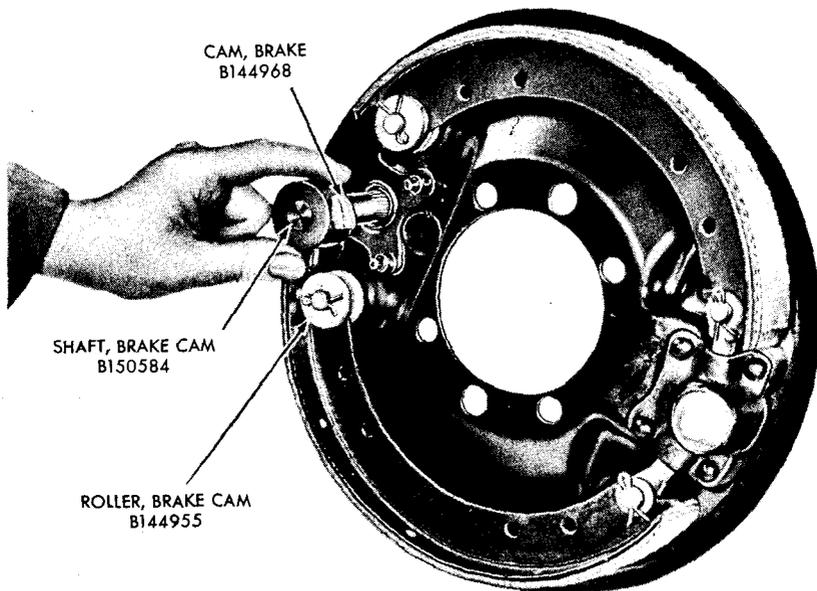
Figure 129 — Removing Brake Ratchet Rack



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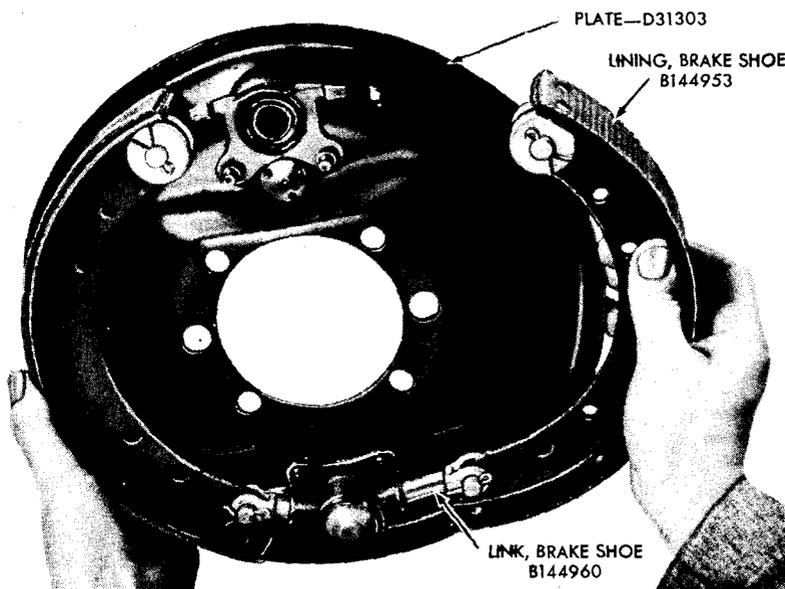
Figure 130 — Removing Screws Holding Brake Housing Plate to Wheel Carrier

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
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RA PD 69314

Figure 131 — Removing Brake Camshaft and Cam



RA PD 69361

Figure 132 — Removing Brake Shoe from Brake Housing Plate

BRAKE MECHANISM

- (3) Glazed or greasy brake shoe linings.
- (4) Weak or broken brake shoe retracting springs.
- (5) Worn brake cam or brake camshaft.

c. Brakes may be disassembled without disassembly of other parts of the howitzer or carriage.

51. REMOVAL AND DISASSEMBLY.

a. Remove the Wheel and Drum and Hub Assembly (fig. 47).

b. Remove and disassemble brake mechanism.

(1) Remove the two screws and washers which hold the brake ratchet rack to the wheel carrier (fig. 129).

(2) Remove the cotter pin in the screw at the lower end of the hand brake lever.

(3) Loosen the nut at the bottom of the lever. This is done to permit removal of the brake camshaft.

(4) Remove the six brake housing plate screws and washers which hold the plate to the wheel carrier. Note that there are four screws BCBX1ED and two screws A157364 (fig. 130).

(5) Steady the hand brake lever and brake ratchet rack with one hand and lift off the brake housing plate assembly and the hand brake lever and rack as a unit.

(6) Press the plunger down and carefully withdraw the brake ratchet rack from the hand brake lever body.

(7) Remove the nut (previously loosened) and screw which secure the hand brake lever to the brake camshaft and remove the hand brake lever.

(8) Remove the three brake shoe retracting springs.

(9) Spread the brake shoes apart slightly and remove the brake camshaft and the brake cam (fig. 131).

(10) Withdraw the brake shoes with rollers and links attached (fig. 132).

(11) Remove the cotter pins and brake cam roller pins and remove the rollers.

(12) Remove the cotter pins and brake shoe link pins and remove the links.

(13) Drive out the brake cam hub bushing from the brake housing plate.

(14) Remove the brake adjusting wedge by turning it clockwise until the expansion cap on the inside of the brake backing plate is forced off. The wedge can then be screwed out.

(15) Disassemble the hand brake lever (fig. 133).

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND HOWITZER CARRIAGES M3 AND M3A1

RA PD 69526

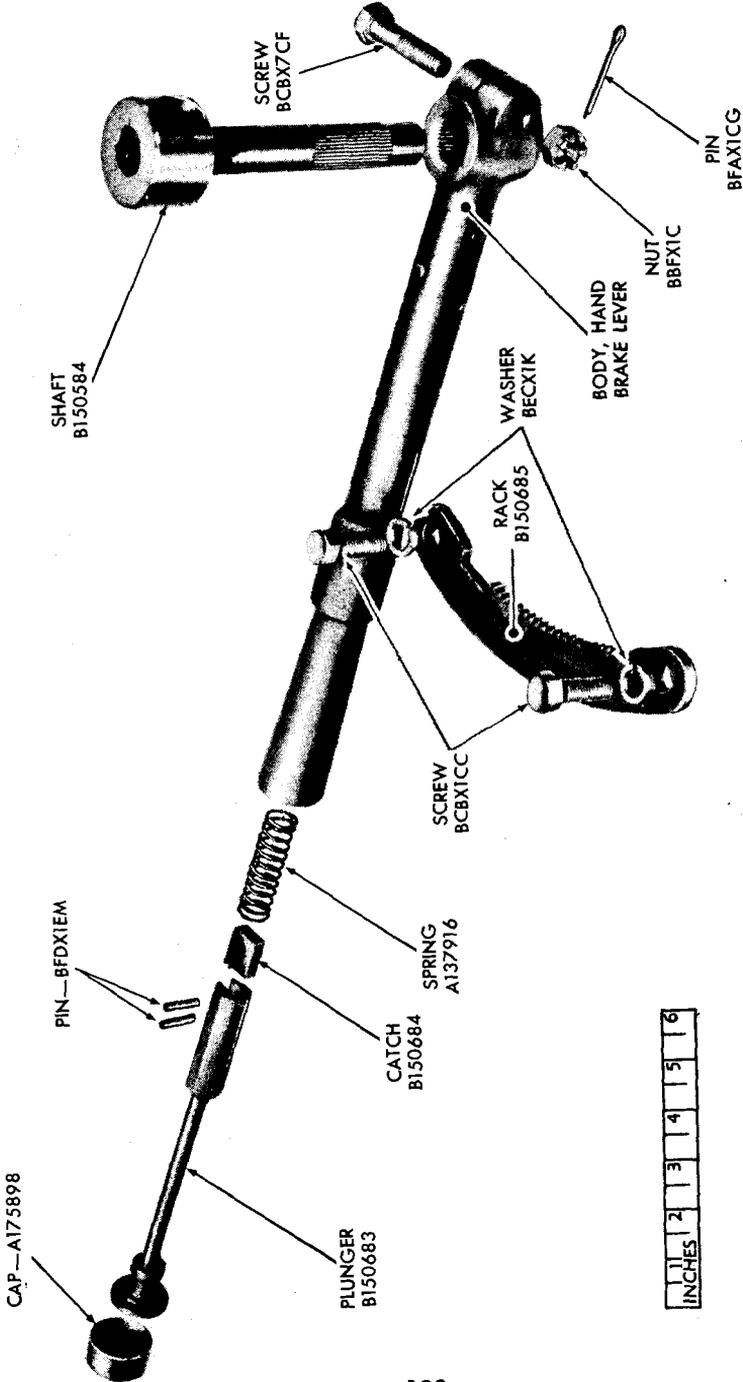
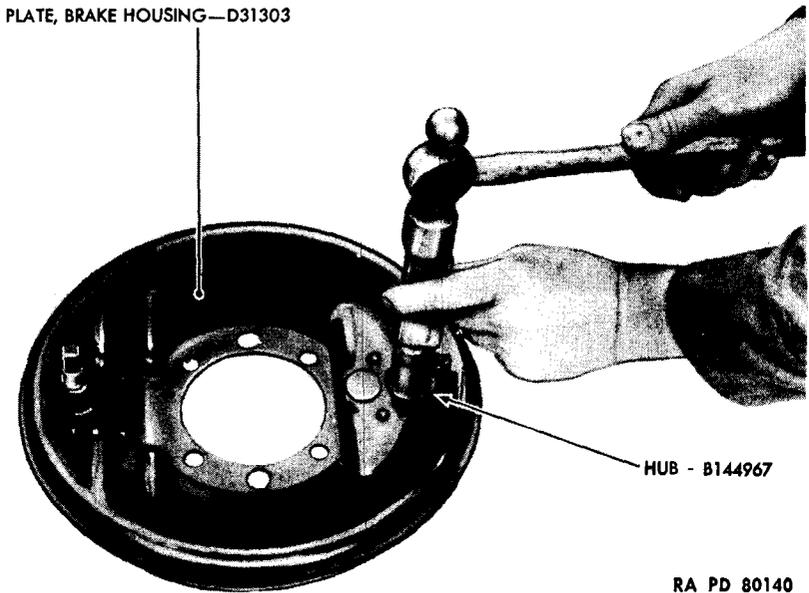


Figure 133 — Hand Brake Lever and Related Parts

BRAKE MECHANISM



RA PD 80140

Figure 134 — *Installing Brake Cam Hub Bushing in Brake Housing Plate*

- (a) Pull the plunger up and out of the lever and remove the spring from the hand brake lever body.
- (b) Place the plunger in a vise fitted with copper jaws and drive out the two pins which secure brake rack catch B150684 in the plunger.
- (c) Pull brake handle plunger cap A175898 from the plunger.

52. REPAIRS.

a. Brakes.

- (1) Examine the brake linings and replace if worn or badly glazed. If moderately glazed, roughen the braking surface.
- (2) Examine the brake cam hub bushing and replace if worn.
- (3) Check each brake cam for condition, and replace if worn or damaged.
- (4) Examine all springs and check for tension. Replace weak or broken springs.
- (5) Examine the threads of all bolts and screws. Replace any that show signs of damage or wear.
- (6) Examine the brake housing plate and replace if cracked or damaged.

NOTE: All brake parts must be thoroughly clean and dry and must not be lubricated. Extreme care must be taken to avoid getting any lubrication on the brake linings.

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1

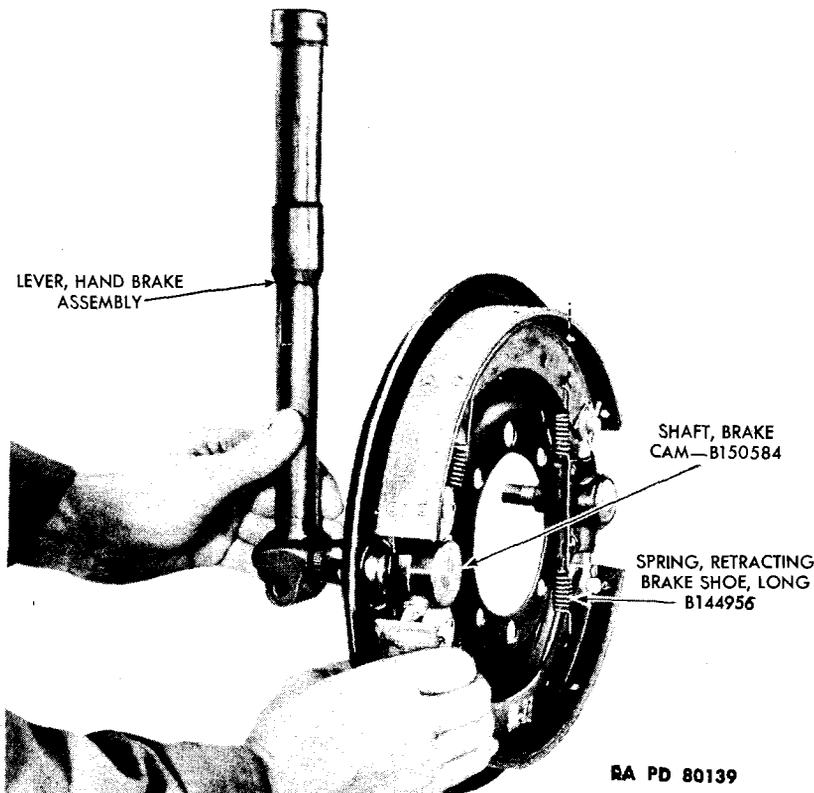


Figure 135 — Replacing Hand Brake Lever on Camshaft

b. Hand Brake Lever.

- (1) Clean all parts thoroughly with SOLVENT, dry-cleaning. Dry and then coat with a film of OIL, engine (seasonal grade).
- (2) Replace a worn or damaged catch in the plunger with a new one. If the point is too blunt to seat properly in the rack, file as necessary, and polish with CLOTH, crocus.
- (3) Remove burs from brake ratchet rack teeth. Replace rack if teeth are chipped or broken.

53. ASSEMBLY AND INSTALLATION.

a. Hand Brake Lever (fig. 133).

- (1) Install brake handle plunger cap on the end of the plunger.
- (2) Lubricate the catch and plunger with a thin film of OIL, engine, SAE 30, above plus 32 F or OIL, engine, SAE 10, below plus

BRAKE MECHANISM

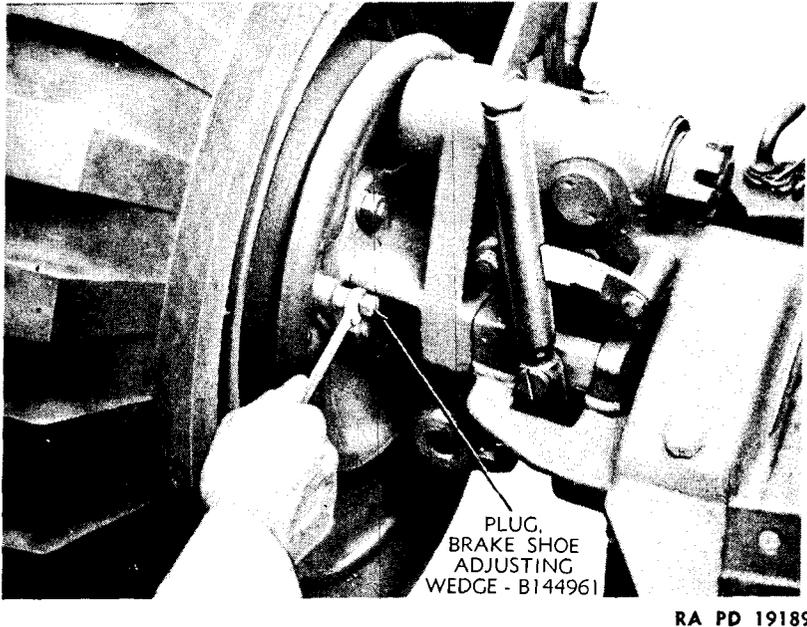


Figure 136 — Adjusting Brakes

32 F, and install the catch in the plunger by inserting the two small pins which hold it.

(3) Lubricate the spring lightly and place the spring in the hand brake lever body. Install the plunger.

b. Brake Housing Plate.

(1) Press the brake cam hub bushing into the brake housing plate (fig. 134).

(2) Install the brake adjusting wedge by screwing it into its recess in the brake backing plate. Replace the expanding cap on the inside of the brake backing plate by tapping it into place. Peen the edges.

(3) Install the brake links on the brake shoes and insert the brake shoe pins and cotter pins.

(4) Place the brake cam rollers in position on the brake shoes and insert the brake cam roller pins and cotter pins.

(5) Install the brake shoe assemblies in the brake housing plate (fig. 132).

(6) Install the brake camshaft and the brake cam (fig. 131).

(7) Install the three brake shoe retracting springs.

(8) Install the hand brake lever on the end of the camshaft which protrudes from the rear of the brake housing plate. Be sure that the hand brake lever is in a position which is parallel to the long brake shoe retracting spring B144956 (fig. 135).

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NOTE: This is done to avoid necessity of adjusting hand brake lever.

(9) Insert screw BCBX7CF and install castle nut BBFX1C at the bottom of the lever. Do not tighten the nut at this time.

(10) Mount the assembled brake housing plate and hand brake lever by guiding the protruding end of the camshaft into its opening in the wheel carrier.

(11) Insert the six screws and washers which hold the backing plate to the wheel carrier, being sure to install the two screws having shoulders in the larger holes first. Tighten all screws firmly (fig. 130).

(12) Insert the rack in the slot in the hand brake lever with the release slot at the front. Install the two screws and washers which hold the rack in position (fig. 129).

NOTE: The brake lever is now in correct position and requires no further adjustment.

(13) Tighten the castle nut at the bottom of the brake lever and insert the cotter pin.

(14) Install drum and hub assembly and wheel (sec. XIII).

c. Adjust Brakes. Adjustment of the brakes may be accomplished by rotating the brake shoe adjusting wedge which extends to the outside of the brake housing plate (fig. 136). The outside end of the adjusting wedge is machined square so that an open-end wrench may be used. Set the brake lever in full "OFF" position. Place the carriage in firing position. Turn the brake adjusting wedge until a drag is felt on the wheel; then back off just enough so that the brake does not drag.

CAUTION: Brakes must be cold when making adjustment.

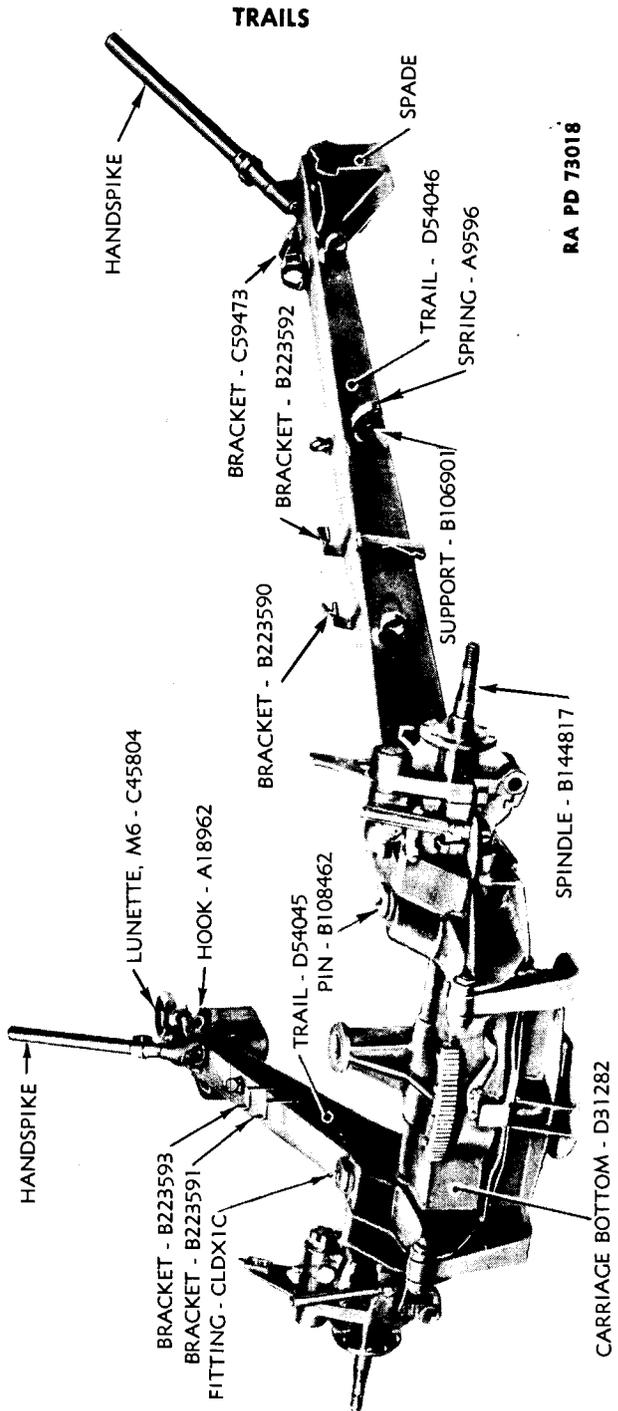
Section XV

TRAILS

	Paragraph
General	54
Removal and disassembly	55
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54. GENERAL.

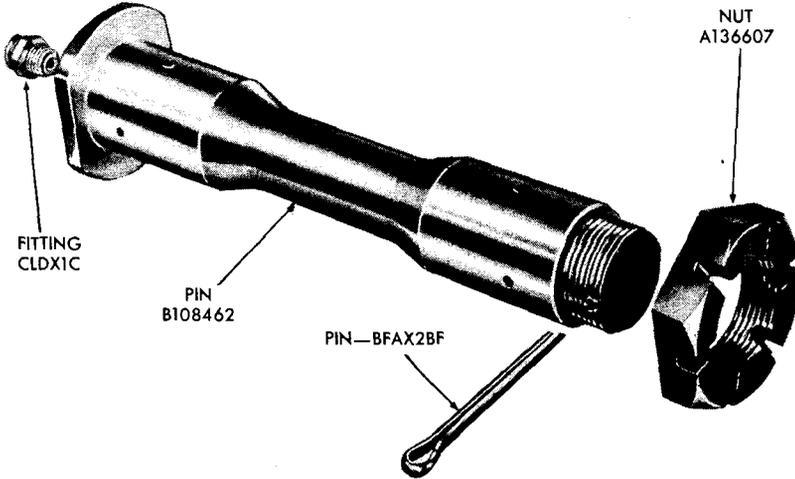
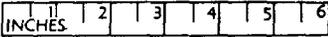
a. The trails function as a support for the howitzer and carriage when in firing position, and are a means of towing when the carriage is attached to a prime mover (fig. 137). They are welded and machined units to which are welded brackets and supports for carrying accessories.



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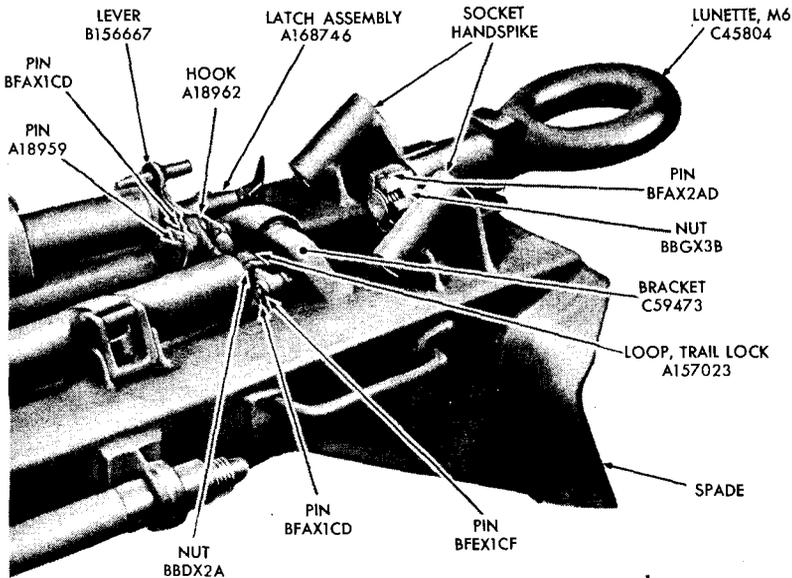
Figure 137 — Bottom Carriage and Trails

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 69560

Figure 138 — Trail Hinge Pin — Exploded View



RA PD 69520

Figure 139 — Trail Rear End Group

TRAILS

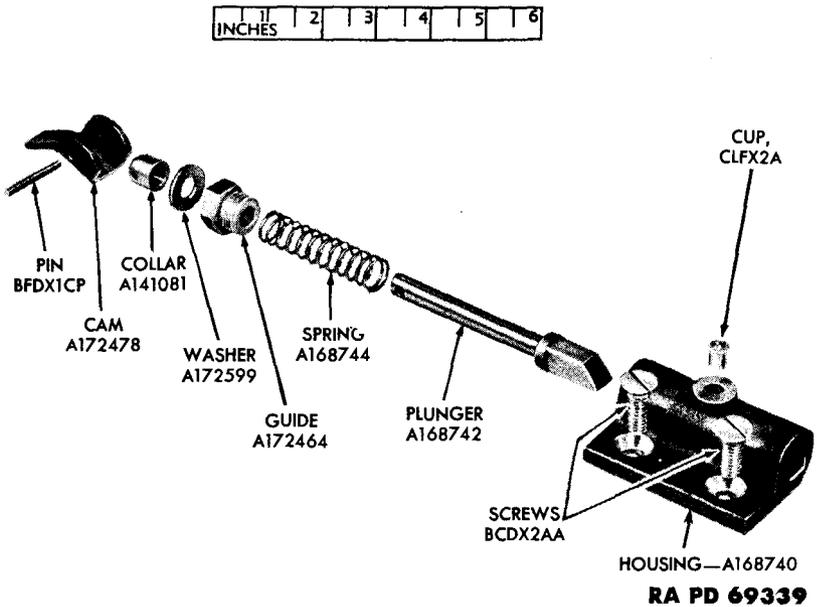


Figure 140 — Trail Lock Latch — Exploded View

b. The carriage illustrated in this manual has no drawbar; instead, the lunette is installed in a bracket on the right trail. Later carriages will be provided with a “gooseneck” drawbar to improve cross-country travel characteristics, to improve turning radius, and to increase the distance between the spade tips and ground in traveling position.

c. When the trails are opened or closed, they pivot about the trail hinge pins. Failure of the trails to open or close readily is generally due to dirt, sand, or grit in the trail hinge pin recesses in the trails.

d. Maintenance consists of cleaning, lubrication, replacement of worn or broken parts, and adjustment of the trail lock.

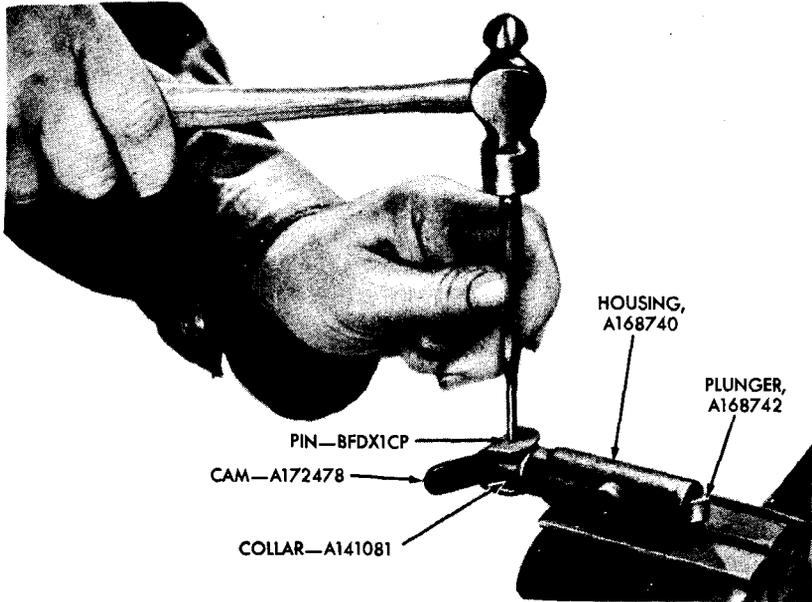
55. REMOVAL AND DISASSEMBLY.

NOTE: The trails may be removed or installed with the howitzer and carriage completely assembled and in firing position or at any stage of disassembly, provided the carriage is suitably blocked.

a. Remove Trail Hinge Pin (fig. 138).

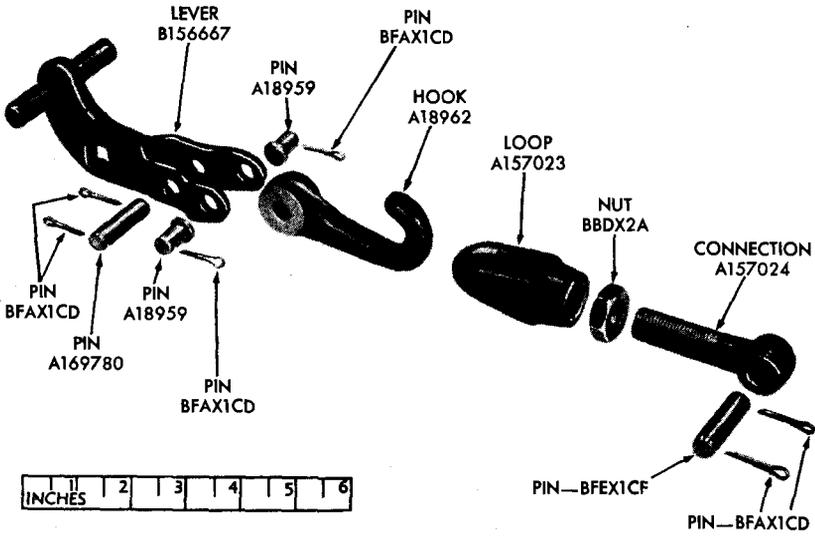
(1) Remove the cotter pin and remove the trail hinge pin nut with pintle and trail wrench B108514.

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RA PD 69502

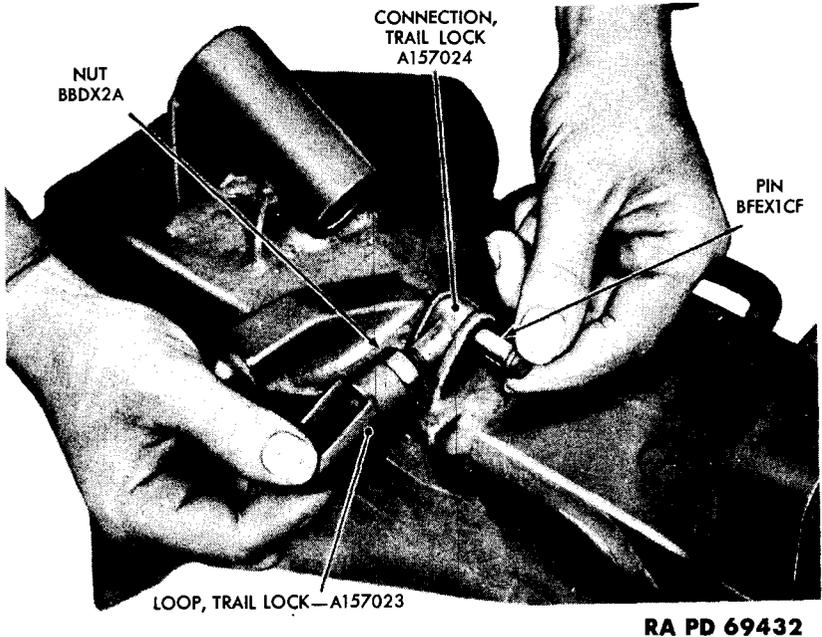
Figure 141 — Driving Out Pin from Trail Latch Housing



RA PD 69335

Figure 142 — Trail Lock — Exploded View

TRAILS



RA PD 69432

Figure 143 — Removing Headless Pin from Trail Lock Connection

(2) Drive the trail hinge pin upward with a bronze or hide-faced hammer.

(3) Pull the hinge pin up and out of the trail. During the operation, the trail must be moved about to prevent binding of the hinge pin.

(4) Place trail on wood horses.

b. Remove Lunette (fig. 139).

(1) Remove the cotter pin and nut from the end of the lunette.

(2) Drive lunette off its bracket on right trail with a hide-faced hammer.

c. Remove and Disassemble Trail Lock Latch (figs. 139 and 140).

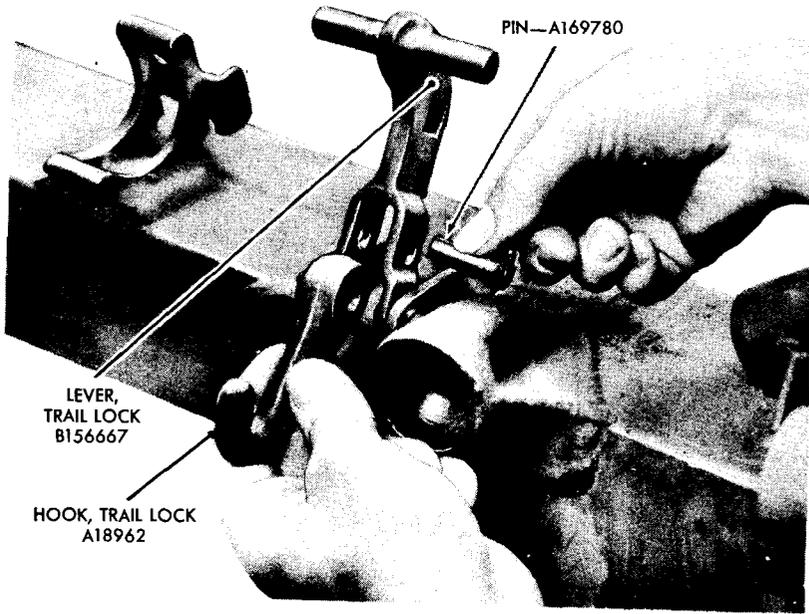
(1) Open the trail lock and remove the two screws which secure the trail latch housing A168740 to the trail. The latch assembly will then come away.

(2) Put the trail latch housing in a vise fitted with copper jaws and drive out the pin which secures cam A172478 to the collar A141081 and plunger A168742 (fig. 141). Lift off the cam, collar, and washer.

(3) Unscrew the latch plunger guide from the housing.

(4) Draw out the latch spring and plunger.

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



RA PD 69357

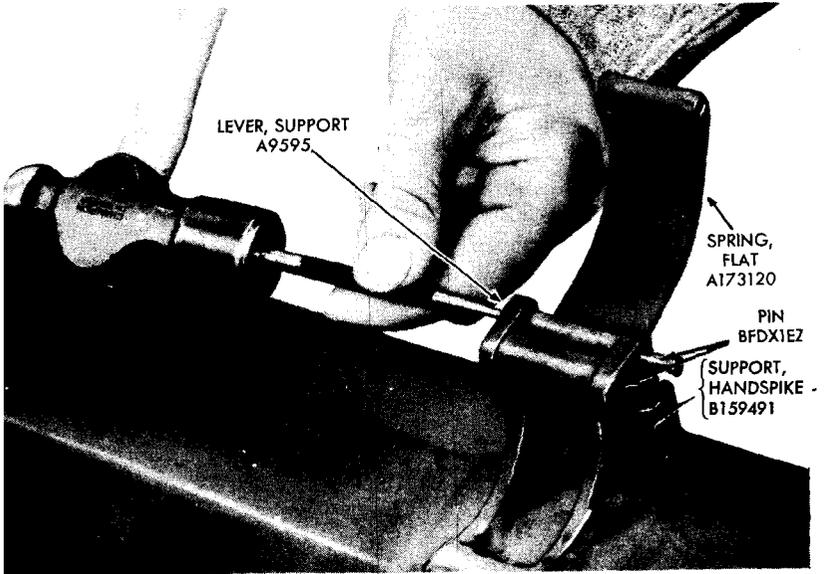
Figure 144 — Removing Pin from Trail Lock Hook



RA PD 69400

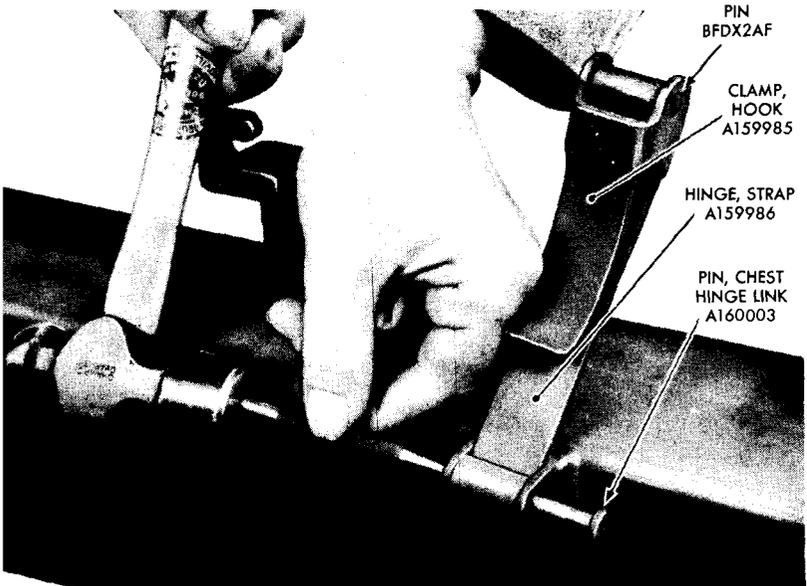
Figure 145 — Removing Trail Lock Lever Pin

TRAILS



RA PD 80141

Figure 146 — Driving Pin from Handspike Support



RA PD 69408

Figure 147 — Removing Sighting Equipment Chest Strap Hinge

**ORDNANCE MAINTENANCE - 105-MM HOWITZER M3 AND
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d. Remove Trail Lock (fig. 142).

(1) Remove one of the cotter pins from the pin BFEX1CF which holds the trail lock connection to the bracket on the trail and remove the pin BFEX1CF (fig. 143).

(2) Lift out the trail lock connection and loop.

(3) Loosen jam nut BBDX2A which secures the trail lock loop to the trail lock connection. Unscrew the loop from the connection. Remove the jam nut.

(4) Remove the cotter pins from the pin A169780 which holds the trail lock hook in the lever. Remove pin A169780 and lift the trail lock hook from the trail lock lever (fig. 144).

(5) Remove the two cotter pins from the two rod end pins A18959 which secure the lever to the bracket welded to the trail. Remove the pins A18959 and lift the trail lock lever from the bracket (fig. 145).

e. Disassemble Handspike Support Group (fig. 146).

NOTE: There is one handspike support on each trail.

(1) Drive out pin BFDX1EZ which holds the flat spring and the support lever together. Drive out pin BFDX1EZ which secures the lever to the handspike support welded to the trail.

f. Remove Staff Support Group. Follow procedure outlined in subparagraph e, above.

g. Remove Sighting Equipment Chest Hinge and Clamp (fig. 147).

(1) Remove the cotter pin from the chest hinge link pin A160003 which secures the strap hinge to the bracket welded on the trail. Drive out pin A160003 and remove hinge and clamp.

(2) Place the hook clamp in a vise and drive out pin BFDX2AF which secures the hook clamp to the strap hinge.

h. Remove Trail Lock Pin (fig. 148).

(1) Disconnect the chain assembly from the bumper on the trail.

(2) Remove the trail lock pin and chain assembly.

56. REPAIRS.

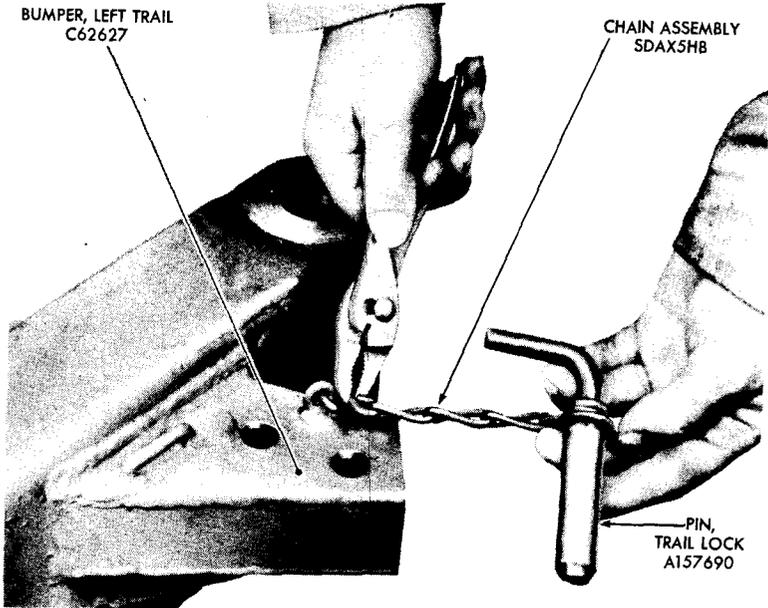
a. Trails.

(1) Tighten all loose fittings.

(2) Clean and check all lubrication fittings including trail hinge pin fittings.

(3) Remove scores or burs from the trail hinge pins. Replace a worn trail hinge pin.

TRAILS



RA PD 69558

Figure 148 — Replacing Trail Lock Pin

b. Lunette.

- (1) Remove burrs from lunette.
- (2) If lunette heel is worn to a loose fit, weld bead across it and file down to close fit.

c. Trail Lock. Replace worn or damaged pins or other parts.

d. Trail Lock Latch.

- (1) Replace worn parts including broken or bent spring.
- (2) Remove all burrs from the latch plunger.

e. Handspike Support Groups.

- (1) Replace worn pins.
- (2) Replace the flat spring if it is bent or damaged.

f. Staff Support Group.

- (1) Replace worn pins.
- (2) Replace spring if it is bent or otherwise damaged.

g. Sighting Equipment Chest Hinge and Clamp. Replace worn or damaged pins, hinge, or clamp.

**ORDNANCE MAINTENANCE – 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1****57. ASSEMBLY AND INSTALLATION.**

a. **Lunette.** Drive Lunette into position on right trail with hide-faced hammer. Install hexagonal nut and insert cotter pin.

b. **Trail Lock** (fig. 142).

(1) Clean all parts with SOLVENT, dry-cleaning, and dry thoroughly. Coat the threads of the connection jam nut and loop with COMPOUND, rust-preventive, light.

(2) Install the lever in the trail lock bracket which is welded to the right trail.

(3) Insert the two small pins holding the lever to the bracket and insert the cotter pins (the heads of the two small pins should be on the inside) (fig. 145).

(4) Insert the hook in the trail lock lever and install the pin A169780 through the lever and hook (fig. 144). Insert the cotter pins and wrap them around the pin A169780.

(5) Screw jam nut on connection. Screw trail lock loop on to the connection and tighten the jam nut.

(6) Install the connection in its bracket on the left trail and insert the pin BFEX1CF which secures it in position (fig. 143). Insert the cotter pin and wrap it around pin BFEX1CF.

(7) Adjust the trail lock by closing the trails and adjusting the loop and jam nut until trails are locked securely.

c. **Trail Lock Latch** (fig. 140).

(1) Clean all parts with SOLVENT, dry-cleaning, and dry thoroughly. Coat the threads of the trail latch housing and latch plunger guide with COMPOUND, rust-preventive, light.

(2) Put the trail lock latch housing in a vise fitted with copper jaws.

(3) Lubricate latch plunger and spring lightly and insert plunger and spring into housing.

(4) Screw the guide into position in the housing.

(5) Lubricate the washer, collar, and cam lightly and install in the housing.

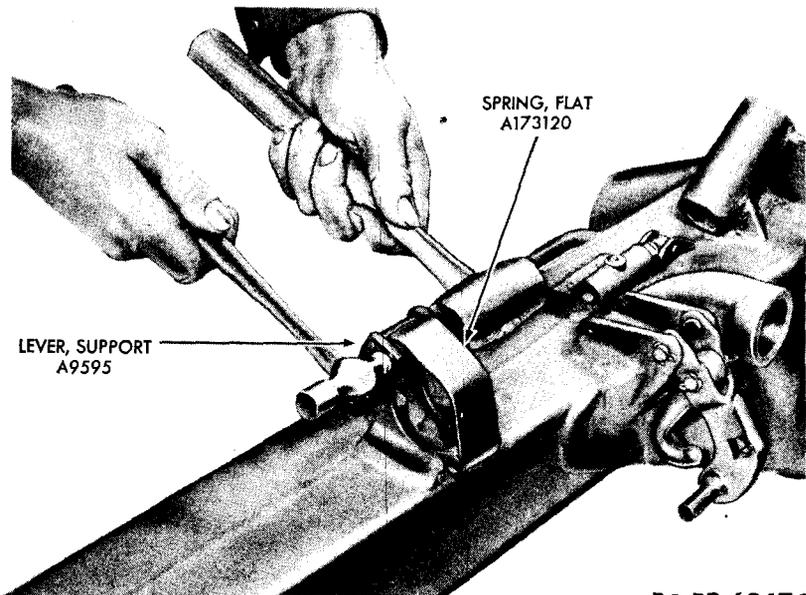
(6) Insert the straight pin through the cam, collar and plunger. Peen both ends of the pin.

(7) Attach the trail lock latch housing to the trail by means of the two screws.

d. **Handspike Support Group** (fig. 146).

(1) Clean parts with SOLVENT, dry-cleaning, and dry thoroughly.

TRAILS



RA PD 69474

Figure 149 – Peening Pin in Handspike Support

(2) Mount the support lever in the handspike support welded to the trail. Insert the straight pin through the support lever and support. Peen the end of the pin.

(3) Assemble the flat spring to the support lever. Insert the pin through the spring and lever. Close the lever and peen the end of the pin (fig. 149).

e. Assemble Trail Lock Pin (fig. 148). Attach link of chain to rivet welded on the trail and weld securely.

f. Staff Support Group. Follow procedure outlined in subparagraph e, above.

g. Sighting Equipment Chest Hinge and Clamp.

(1) Clean parts with SOLVENT, dry-cleaning, and dry thoroughly.

(2) With the hook clamp in a vise, assemble the strap hinge by inserting the pin. Peen the end of the pin.

(3) Assemble the hook clamp and hinge to the bracket welded to the trail by inserting the chest hinge link pin (fig. 147).

(4) Insert the cotter pin through the end of the chest hinge link pin.

ORDNANCE MAINTENANCE - 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1

h. Install Trails.

- (1) Clean parts with SOLVENT, dry-cleaning, and dry thoroughly.
- (2) Place the trail in position. Line up the holes in the trail and in the bottom carriage.
- (3) Install the trail hinge pin and drive it downward with a bronze or hide-faced hammer, taking care not to damage the lubrication fitting.
- (4) Coat the threads of the trail hinge pin and nut with COMPOUND, rust-preventive, light. Install the nut with pintle and trail wrench B108514 and insert the cotter pin.

Section XVI

LUBRICATION

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Introduction	58
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Reports and records	60

58. INTRODUCTION.

a. Lubrication is an essential part of preventive maintenance, determining to a great extent the serviceability of parts and assemblies.

59. LUBRICATION GUIDE.

a. **General.** Lubrication instructions for this materiel are consolidated in a lubrication guide (figs. 150 and 151). These specify the points to be lubricated, the periods of lubrication, and the lubricant to be used. In addition to the items on the guide, other small moving parts, such as hinges and latches, must be lubricated at frequent intervals.

b. **Lubrication Notes.** The following notes apply to the lubrication guide (figs. 150 and 151). All note references in the guide itself are to the subparagraph below having the corresponding number:

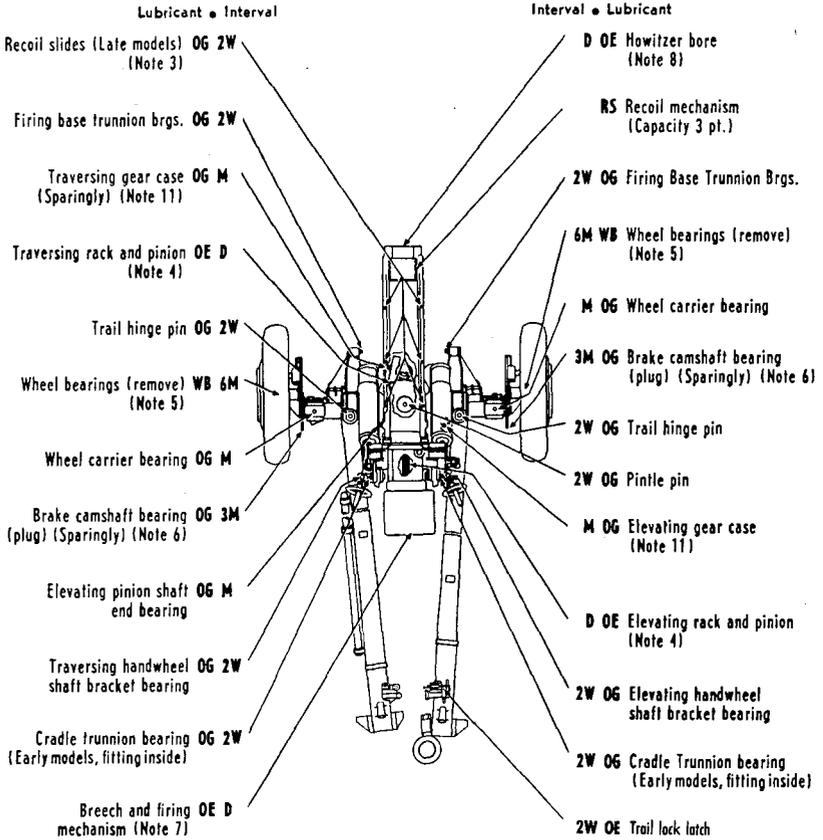
(1) **FITTINGS.** Clean before applying lubricant. Where bearings can be seen, lubricate until new lubricant is forced from the bearing.

CAUTION: Lubricate after washing howitzer and carriage.

(a) Do not use high-pressure washing system for cleaning artillery materiel.

(2) **INTERVALS.** Intervals indicated are for normal service. For extreme conditions of speed, heat, water, sand, mud, snow, rough roads, dust, etc., lubricate more frequently.

LUBRICATION



— KEY —

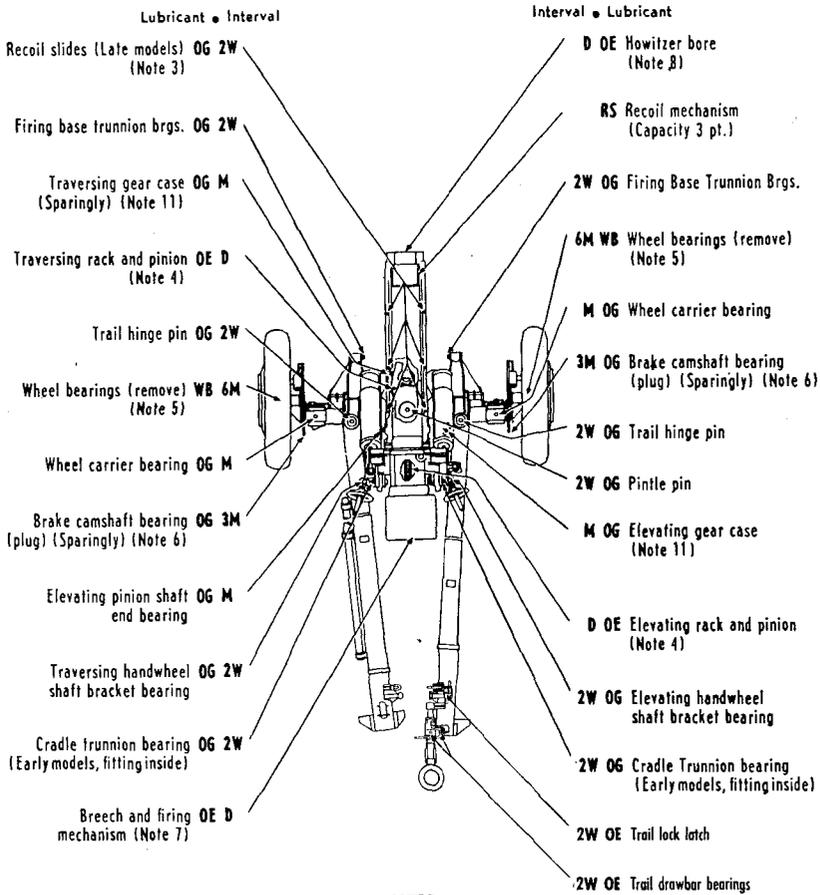
LUBRICANTS	
OE—OIL, engine SAE30 (above +32° F.) SAE10 (+32° F. to 0° F.)	WB—GREASE, general purpose No. 2
OG—GREASE, O.D. No. 0 (above +32° F.) No. 00 (below +32° F.)	RS—OIL, recoil, special

INTERVALS
D—DAILY
2W—2 WEEKS
M—MONTHLY
3M—3 MONTHS
6M—6 MONTHS

RA PD 19184

Figure 150 — Lubrication Guide

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1



KEY

LUBRICANTS	
OE—OIL, engine SAE 30 (above +32° F.) SAE 10 (+32° F. to 0° F.)	WB—GREASE, general purpose No. 2
OG—GREASE, O.D. No. 0 (above +32° F.) No. 00 (below +32° F.)	RS—OIL, recoil, special

INTERVALS
D—DAILY
2W—2 WEEKS
M—MONTHLY
3M—3 MONTHS
6M—6 MONTHS

RA PD 19183

Figure 151 — Lubrication Guide (Late Models)

LUBRICATION

(3) **RECOIL SLIDES (EARLY MODELS).** Daily, and before firing, retract sleigh, clean, and apply engine oil (See Key).

(4) **TRAVERSING AND ELEVATING RACKS AND PINIONS.** Daily, clean and apply OIL, engine (See Key).

(a) The teeth of the elevating and traversing racks require little lubrication, but, as a protection against rust, they must be covered with a thin coat of oil. Dust and grit will adhere to this oily film. Consequently the teeth must be thoroughly cleaned and fresh oil applied before elevating or traversing the gun; otherwise, the grit will cause rapid wear of racks and pinions.

(b) If considerable dust is present when gun is operated, the oil should be removed from the teeth and they should remain dry until action is over. If the surfaces are dry, there is less wear than when coated with a lubricant contaminated with grit.

(5) **WHEEL BEARINGS.** To clean and pack wheel bearings properly, they must be removed from the hub. Follow the procedure below:

(a) Remove bearings from hub and wash in SOLVENT, dry-cleaning, until all the old lubricant is removed from both inside and outside of cage.

(b) Lay bearings aside to dry and wash inside of hub and spindle with SOLVENT, dry-cleaning.

(c) When bearings are thoroughly dry, pack races with GREASE, general purpose, No. 2, and reassemble in hub. To pack a bearing satisfactorily, it is necessary to knead lubricant by hand into space between the cage and inner race. Coat inside of hub and spindle with a thin film of lubricant to prevent rusting. The lubricant packed in bearing races is sufficient to provide lubrication until the next service period. An excess may result in leakage of lubricant into the brake drum.

(d) Replace wheel and adjust bearings (par. 49 b (7)).

(6) **BRAKE CAMSHAFT BEARINGS.**

CAUTION: Remove plug from brake camshaft housing, insert fitting, and apply GREASE, O. D. (See Key), sparingly. Excess lubricant will damage brake linings.

(7) **BREECH AND FIRING MECHANISM.** Daily, and before and after firing, clean and oil all moving parts and exposed metal surfaces with OIL, engine (See Key).

CAUTION: To insure easy breech operation and to avoid misfiring in cold weather, clean with SOLVENT, dry-cleaning; dry, and then lubricate with OIL, lubricating, preservative, special. To clean firing mechanism, remove and operate pin in SOLVENT, dry-cleaning.

(8) **HOWITZER BORE.** Daily, and after firing, clean and coat with OIL, engine (See Key).

**ORDNANCE MAINTENANCE - 105-MM HOWITZER M3 AND
HOWITZER CARRIAGES M3 AND M3A1**

(9) **ELEVATING GEAR CASE (Late Models).** This case is equipped with plugs and requires LUBRICANT, gear, universal. Every 6 months, drain, clean, and refill to plug level.

(10) **OIL CAN POINTS.** Daily, lubricate flexible joints, handwheel handles, brake linkage, locks, latches, turnbuckles, equilibrators trunnions, recoil indicator, etc., with OIL, engine (See Key).

(11) **POINTS TO BE SERVICED AND/OR LUBRICATED BY ORDNANCE MAINTENANCE PERSONNEL AT THE TIME OF ORDNANCE INSPECTION.**

(a) *Traversing Gear Case and Elevating Gear Case (Early Models).* Lubricate these units with GREASE, O. D., No. 0, where temperatures above plus 32 F. prevail, and GREASE, O. D., No. 00, where continued temperatures below plus 32 F. are expected. When changing from one grade to another, it is essential that the old lubricant be completely removed from the housing and enclosed parts. This will necessitate total disassembly and cleaning with SOLVENT, dry-cleaning. When replacing the bearings, repack each separately with GREASE, O. D. Fill the gear case half full and cover gears with lubricant.

60. REPORTS AND RECORDS.

a. **Reports.** If lubrication instructions are closely followed, proper lubricants used, and satisfactory results are not obtained, a report will be made to the ordnance officer responsible for the maintenance of the materiel.

b. **Records.** Record of seasonal changes of lubricants and recoil oil will be kept in the Artillery Gun Book.

Section XVII
REFERENCES

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61. PUBLICATIONS INDEXES.

The following publications indexes should be consulted frequently for latest changes or revisions of references given in this section and for new publications relating to materiel covered in this manual:

- a. Ordnance Publications for Supply Index (index to SNL's) ASF Cat.
ORD-2 OPSI
- b. Index to Ordnance Publications (listing FM's, TM's, TC's, and TB's of interest to ordnance personnel, FSMWO'S, BSD, S of SR's, OSSC's, and OFSB's, and includes Alphabetical List of Major Items with Publications Pertaining Thereto)..... OFSB 1-1
- c. List of Publications for Training (listing MR's, MTP's, T/BA's, T/A's, FM's, TM's, and TR's concerning training) FM 21-6
- d. List of Training Films, Film Strips, and Film Bulletins (listing TF's and FS's, and FB's, by serial number and subject)..... FM 21-7
- e. Military Training Aids (listing Graphic Training Aids, Models, Devices, and Displays)..... FM 21-8

62. STANDARD NOMENCLATURE LISTS.

a. Ammunition.

- Ammunition, fixed and semifixed, all types, including subcaliber for pack, light and medium field artillery, including complete round data . SNL R-1
- Ammunition instruction material for pack, light and medium field artillery..... SNL R-6

- b. Cleaning, preserving and lubricating materials; recoil fluids, special oils, and miscellaneous related items SNL K-1
- Soldering, brazing and welding material, gases and related items..... SNL K-2

ORDNANCE MAINTENANCE — 105-MM HOWITZER M3 AND
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c. Howitzer Materiel.

Howitzer, 105-mm, M3; Carriage, howitzer, 105-mm, M3 and M3A1.....	SNL C-50
Major items of pack, light and medium field artillery; and armament of these calibers for airplane and combat vehicles	SNL C-1
Tools, maintenance, for repair of pack, light and medium field artillery; and armament of these calibers for airplane and combat vehicles.....	SNL C-18

d. Sighting Equipment.

Adapter, telescope, M9 (for elbow telescope M62)	SNL F-262
Mount, telescope, M16 (for 75-mm howitzer carriages M2A1, M3, M3A1, and M3A2 and 105-mm howitzer carriages M3 and M3A1)....	SNL F-169
Quadrant, range M8 (for 105-mm howitzer car- riages M3 and M3A1).....	SNL F-169
Telescope, elbow, M61 (for 105-mm howitzer carriages M3 and M3A1).....	SNL F-169
Telescope, elbow, M62 (for 105-mm howitzer carriages M3 and M3A1, and 75-mm pack howitzer carriages M1 and M8).....	SNL F-262

63. EXPLANATORY PUBLICATIONS.

a. 105-mm howitzer M3 and 105-mm howitzer car- riage M3 and M3A1.....	TM 9-326
b. Chemical decontamination materials and equip- ment	TM 3-220
c. Cleaning, preserving, lubricating, and welding materials and similar items issued by the Ord- nance Department.	TM 9-850
d. Defense against chemical attack.....	FM 21-40
e. Maintenance and Repair.	
Maintenance; general	OFSB 4-1
Maintenance and care of pneumatic tires and rubber treads	TM 31-200
Lubrication	War Dept. Lubrication guide No. 129
f. Ordnance maintenance: Star-gaging equipment, impression outfits and pressure gages.....	TM 9-1860

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