DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR AND ORGANIZATIONAL MAINTENANCE MANUAL

CRANE-SHOVEL, CRAWLER MOUNTED 121/2-TON, 3/4-CU YD; DIESEL ENGINE DRIVEN (BUCYRUS-ERIE MODEL 22BM) FSN 3810-869492

This copy is a reprint which includes current pages from Changes 1 and 2.

HEADQUARTERS, DEPARTMENT OF THE ARMY
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CHANGE

NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY.
Washington D. C., 5 July 1991

Operator and Organizational Maintenance Manual

CRANE-SHOVEL, CRAWLER MOUNTED, 12 1/2-TON, 3/4 CU YD;
DIESEL ENGINE DRIVEN (BUCYRUS-ERIE MODEL 22BM)
NSN 3810-00-869-3092

TM 5-3810-289-12, 13 March 1970, is changed as follows:

Cover: The manual title is changed to read as shown above.

Inside front cover: The following WARNING should be added:

WARNING:

If NBC exposure is suspected, all air filter media should be handled by personnel wearing protective equipment. Consult you unit NBC Officer or NBC NCO for appropriate handling or disposal instructions.

Page i.
The manual title is changed to read as shown above. Table of Contents, Chapter 3. Delete the entry for "Section VIII, Maintenance of electrical system components".

Page ii, Table of Contents. The title of Section XVI is changed to "Maintenance of chain case assembly and gear case covers".

Page iv, List of Illustrations.
Delete the following entries:
Figure No. 3-1.
Figure No. 3-4.
Figure No. 3-5.
Figure No. 3-8.
Figure No. 3-9.
Figure Nos. 3-15 through 3-18.
Figure No. 4-15.
Figure No. 4-16.

Add the following entries:
Figure No. 4-5.1, Oil filter service, page 4-7.
Figure No. 4-5.2, Control levers, page 4-10.
Figure No. 4-6.1, Swing lock adjustment, page 4-12.
Figure No. 4-19.1, Belt adjustment, page 4-27.
Figure No. 4-23.1, Water pump removal, page 4-26.
Figure No. 4-23.2, Water pump being secured to block, page 4-26.
Figure No. 4-25.1, Alternator belt, page 4-35.

Page v, List of Illustrations.
Add the following entries:
Figure No. 4-51.1, Operating clutch inspection, page 4-68.
Figure No. 4-51.2., Operating clutch adjustment, page 4-68.
Figure No. 4-51.3, Boom hoist brakeband adjustment, page 4-68.
Figure No. 4-51.4, Steering clutches adjustment, page 4-53.
Delete Figure No. 4-53.

Page 1-1.
Paragraph 1-1*b*, Change "TM 750-244-3, Destruction Of Materiel to Prevent Enemy Use" to read "TM 750-244-6, procedures for the Destruction of Tank-Automotive Equipment to Prevent Enemy Use."

Paragraph 1-2, Change "TM 38-750" to read "DA Pam 738-750".

Paragraph 1-3 is superseded as follows:

1-3. Reporting Errors and Recommending Improvements

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Forms) direct to: Commander, U.S. Army Tank Automotive Command, ATTN: AMSTA-MB, Warren, MI 48397-5000. A reply will be furnished to you.

Paragraph 1-3.1 is added after paragraph 1-3.

1-3.1 Reporting Equipment Improvement Recommendations (EIRs)

If your crane-shovel needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Quality Deficiency Report). Mail it to us at: Commander, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MB, Warren, MI 48397-5000. We'll send you a reply.

Page 1-8. Figure 1-4 (sheet I of 2) is superseded as follows:

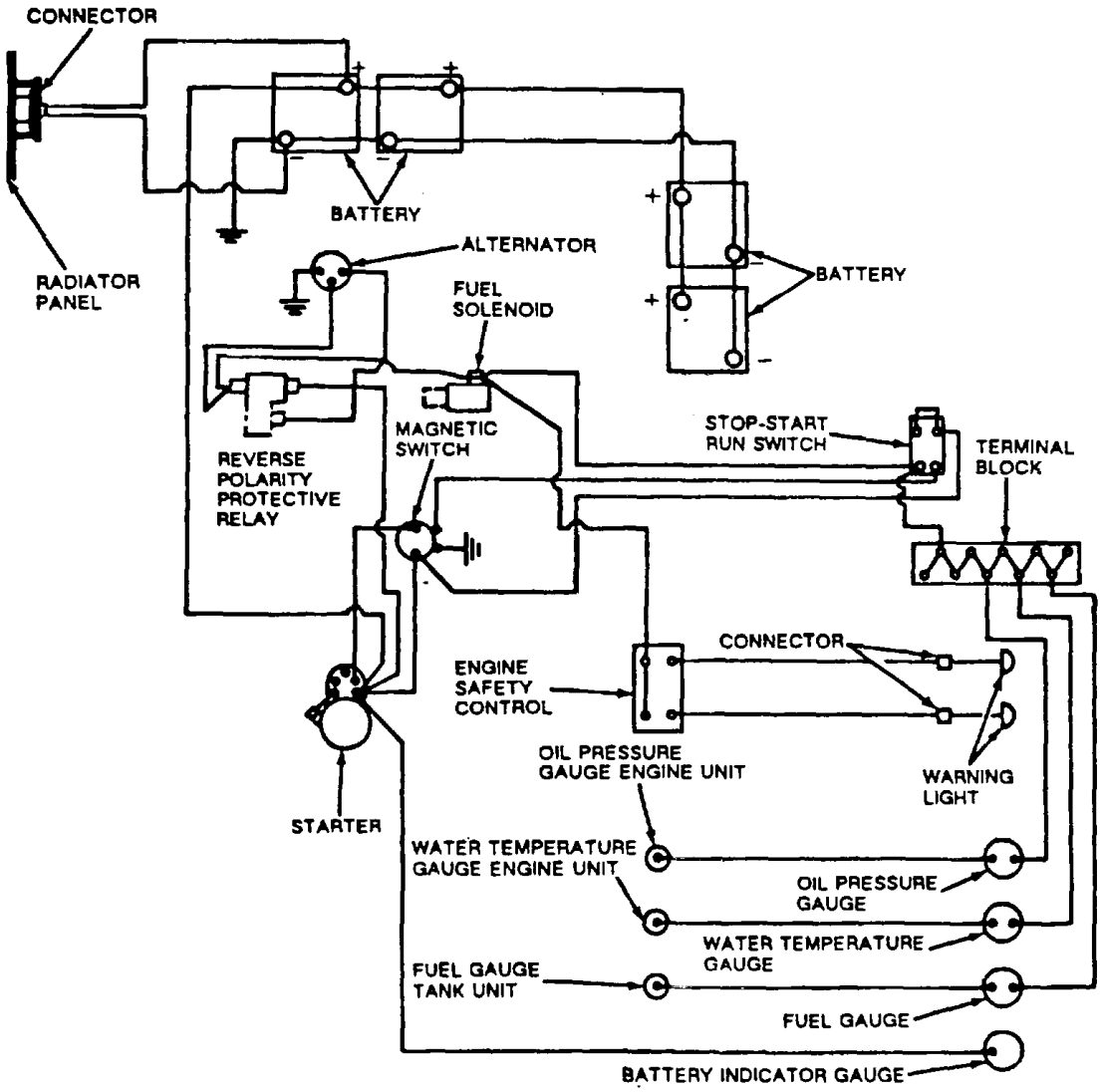


Figure 1-4. Electrical system, schematic diagram (sheet I of 2).

Page 2-39. Paragraph 2-14.1 is added after paragraph 2-14.

2-14.1. Air Cleaner/Air Filter NBC Warning Decal

A decal has been developed that warns of NBC exposure. It is to be positioned in a noticeable place on or near the air cleaner or air filter housing. You may order the decal using part number 12296626, CAGEC 19207. Refer to TB 43-0219 for further information. (See Figure : page 3-13 and Figure 4-12, page 4-18).

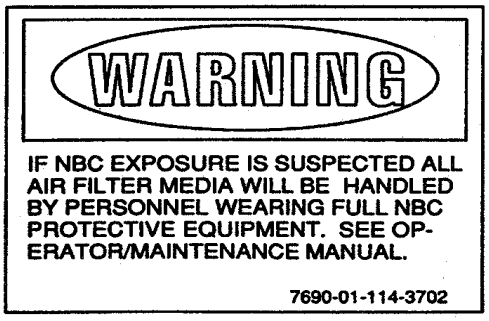


Figure 2-37a. NBC Warning Decal

Page 3-1.

Paragraph 3-2 is superseded as follows:

3-2. Maintenance and Operating Supplies

Maintenance and operating supplies required for initial operation are listed in table 2-1.

Paragraph 3-3. Change "DA PAM 310-4 (Military Publications)" to "DA PAM 25-30 (Consolidated Index of Army Publications and Blank Forms)".

Paragraph 3-4*e* is rescinded.

Page 3-2. Figure 3-1 is rescinded.

Page 3-3.

The title for Section III is changed to read as follow

Section III. Operator/Crew Preventive Maintenance Checks and Services.

Section III is superseded as follows:

3-5. General

Your Preventive Maintenance Checks and Service table (Table 3-1) lists the inspection and care of your equipment required to keep it in good operating condition.

3-6. Operator/Crew Preventive Maintenance Checks and Services

1. The number column of your PMCS is the source for the number used on the TM number column on DA Form 2404.
2. The interval column of your PMCS table tells you when to do a certain check or service.

a. Do your *Before* (B) PMCS before you operate. Always keep in mind the WARNINGS and CAUTIONS.
b. Do your *During* (D) PMCS while you operate. Always keep in mind the WARNINGS and CAUTIONS.
c. Do your *After* (A) PMCS after you operate.
d. Do your *Weekly* (W) PMCS once a week.
e. Do your *Monthly* (M) PMCS once a month.

3. The procedure column of your PMCS table tells you how to do the required checks and services. Carefully follow these instructions. If you do not have the tools, or if the procedure tells you to, contact unit maintenance.
4. If your equipment does not perform as required, refer to the manual troubleshooting section for possible problems. Report any malfunctions or failures on DA Form 2404 or report the problem to your first line supervisor and unit maintenance.

NOTE

The terms ready/available and mission capable refer to the same status: Equipment is on hand and is able to perform all its combat missions without further endangering the lives of crew or operators in a combat environment (see DA Pam 738-750).

5. The "Equipment is not ready/available if:" column. This column tells you when and why your equipment cannot be used.

6. Always do your PMCS in the same order so it gets to be a habit. Once you've had some practice, you'll spot anything wrong in a hurry.
7. When you do your PMCS, take along a rag or two.
8. While performing PMCS, observe WARNINGS and CAUTIONS preceding those operations which could endanger your safety or result in damage to the equipment.

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves an use only In well ventilated area. Avoid contact with skin, eyes, and clothes and don't breath vapors. Do not use near open flame or excessive heat. The flash point Is 100 0 F-1380 F(38C - 59° C). If you become dizzy while using cleaning solvent, get fresh air immediately and get medical aid. If contact with eyes is made wash your eyes with water and get medical aid immediately.

a. Keep it clean; dirt, grease, oil and debris only get in the way and may cover up a serious problem. Clean as you work and as needed. Use dry cleaning solvent (P-D-68C to clean metal surfaces. Use soap and water when you clean rubber or plastic material.

b. Bolts, nuts, and screws: Check that they are not loose, missing, bent or broken. You can't try them all with a tool, of course, but look for chipped paint, bare metal or rust around bolt heads. Tighten any bolt, nut, or screw that you find loose.

c. Welds: Look for loose or chipped paint, rust or gap where parts are welded together. If you find a broken/ cracked weld, report it to unit maintenance.

d. Electric wires and connectors: Look for cracked or broken insulation, bare wires and loose or broken connectors. Report damaged or loose wiring to unit maintenance.

e. Hoses and fluid lines: Look for wear, damage and, leaks. Make sure clamps and fittings are tight. Wet spots show leaks, but a stain around a fitting or connector can also mean a leak. If leakage comes from a loose fitting or connector, tighten the fitting or connector. If something is broken or worn out, report it to unit maintenance.

f. Vehicle must be on level ground in order to get correct fluid level measurement.

9. It is necessary for you to know how leaks affect the status of your equipment. The following are definitions of the types/classes of leakage you need to know to be able to determine the status of your equipment. Learn and be familiar with them and REMEMBER - when in doubt, notify your supervisor.

Leakage Definitions for Operator/Crew PMCS

CLASS I

See page of fluid (as indicated by wetness or discoloration) not great enough to form drops.

CLASS II

Leakage of fluid great enough to form drops but not great enough to cause drops to drop from item being checked/ inspected.

CLASS III

Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

Equipment operation is allowable with minor leakage (Class I or II). Of course, consideration must be given to the fluid capacity in the item/system being checked/inspected. When operating with Class I or II leaks, continue to check fluid levels as required in your PMCS. Class II leaks should be reported to your supervisor or unit maintenance. Any class of brake fluid/gasoline leakage, or class II/III diesel fuel leakage will render the equipment not ready/available.

WARNING

If NBC exposure is suspected, all air filter media should be handled by personnel wearing protective equipment. Consult your unit NBC Officer or NBC NCO for appropriate handling or disposal Instructions.

Table 3-1. Operator/Crew Preventive Maintenance Checks and Services

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - BEFORE D - DURING A - AFTER W - WEEKLY M - MONTHLY

ITEM NO	INTERVAL					ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED, OR ADJUSTED AS NEEDED	EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A	W	M		
						NOTES Perform weekly as well as before PMCS if: a. You are the assigned operator, but have not operated the equipment in the last week. b. You are operating the equipment for the first time. **WARNING** To avoid injury/death to personnel, or damage to equipment, do not run the equipment engine when performing before operations PMCS. **WARNING** Your safety, and the safety of those around you, depends upon YOU using care and good judgment in operation of equipment. Know the positions and functions of ALL CONTROLS before operating this equipment. Do not operate the equipment in an enclosed area unless exhaust gases are piped outside. Exhaust fumes can cause serious illness or death. Read and observe all warnings and cautions in the front of the operators manual before performing your PMCS. **GENERAL** Perform all daily and/or weekly lubrication of the equipment prior to operation. Check for loose/missing nuts, bolts/pins and cotter keys. Walk around the equipment. Check for obvious damage and rust.	

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - BEFORE D - DURING A - AFTER W - WEEKLY M - MONTHLY

ITEM NO	INTERVAL B	D	A	W	M	ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED, OR ADJUSTED AS NEEDED	EQUIPMENT IS NOT READY/AVAILABLE IF:
						-- WARNING -- PRESSURIZED COOLING SYSTEM. Remove cap slowly and only when the engine Is cool, or painful burns could result.	
1.	X					**ENGINE ASSEMBLY**: Check engine oil level. The level must be between "Add and Full." Check to Insure the coolant level Is 2 Inches below the filler neck. Check the chain case and transmission oil levels.	Class III oil leak.
2.	X					**HOSES AND PIPES**: Check for bulging or collapsed rubber hose. hose.	Bulging/collapsed
3.	X					**BELTS**: Check for frayed, cut, obviously loose or missing belts. or broken.	2 Fan belts missing
						WARNING **If NBC exposure Is suspected, all air filter media should be handled by personnel wearing protective equipment Consult your unit NBC Officer or NBC NCO for appropriate handling or disposal Instruction &**	1 Alternator or 1 Water Pump belt missing/ broken.
4.	X					AIR CLEANER: Check for missing air cleaner element and dirt/dust Inside the air cleaner assembly.	Filter element missing.
						-- WARNING-- Do not smoke or allow a flame or spark in the vicinity while checking or filling the batteries. The batteries generate hydrogen - a highly explosive gas. Wear safety goggles when adding liquid (distilled water) to the batteries. DO NOT ADD ELECTROLYTE	

OPERATOR/CREW PREVENTATIVE MAINTENANCE CHECKS AND SERVICES

B - BEFORE D - DURING A - AFTER W - WEEKLY M - MONTHLY

ITEM NO	INTERVAL					ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED, OR ADJUSTED AS NEEDED	EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A	W	M		
						--CAUTION-- In cold weather operation, charge the batteries by running the engine Immediately after adding liquid (distilled water) to prevent freezing and damage to the batteries. Run the crane engine 1 hour e 1500 RPM.	
5.	X					BATTERIES: Check the liquid level. The level should be above the plates and below the bottom of the fill hole. corrosion, loose clamps, and damaged cables. Crank (start) the engine.	Batteries will not Check forcrank (start) engine.
6.	X	X				MUFFLER AND PIPES: Check for holes In the exhaust system. Check for exhaust fume leaks. Black carbon at the exhaust pipe system connections Indicate a leak.	Any exhaust leak.
7.	X	X				GAUGES: Check for proper operation. tachometer inoperable.	Oil, water gauge or
						--NOTE-- Low oil pressure light goes on when the ignition Is turned on. When operating pressure is reached, the light goes off. If the light goes on during normal operation, Immediately shut down the engine and Inform organizational maintenance. Oil Gauge - Normal running pressure, 40 PSI. Low oil pressure light comes on at 10 PSI. Water Temperature Gauge - 185 to 195 degrees (F). Tachometer - Idle speed should be 625 RPM.	

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - BEFORE D - DURING A - AFTER W - WEEKLY M - MONTHLY

ITEM NO	INTERVAL					ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED, OR ADJUSTED AS NEEDED	EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A	W	M		
8.	X					HORN/SIREN: Check for proper operation.	Horn/siren Inoperable.
9.	X					LIGHTS: Check for proper operation.	
10.				X		CAB: Check the cab, doors, windshield and operator seat for obvious damage. Check for missing data plates or load chart.	Load Chart missing Or unreadable.
11.	X					TRACK SUPPORT ROLLERS, IDLERS, AND BRACKETS: Check for secure mounting and evidence of wear. Check for missing sprocket teeth and rollers.	2 or more idler or sprocket teeth are Is missing.
12.	X					TRACK ASSEMBLY: Check for loose/sagging track. Check for loose keeper pins and excessively worn track pads. Adjust the track if slack on the upper track exceeds 5 inches. Adjust between 4-5 inches. **--WARNING--** Wear leather/work gloves when handling wire rope (cable).	Track won't adjust
13.	X					SHOVE FRONT: Check the boom, saddleblock, dipperstick and sheaves for wear, cracks, and broken hardware. Check wire rope for broken strands, crushed or bridcaging. Check for proper operation of the shovel front assembly.	Any weld broken through the metal. See "Wire Rope Service-Ability Criteria" at the end of this PMCS for non-mission capable criteria.
14.	X					DIPPER (BUCKET) ASSEMBLY: Check for missing, broken, or excessively worn teeth.	2 or more teeth missing
		X				Check for proper operation of the dipper trip assembly.	Trip assembly Inoperative.

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - BEFORE D - DURING A - AFTER W - WEEKLYM - MONTHLY

ITEM NO	INTERVAL B	D	A	W	M	ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED, OR ADJUSTED AS NEEDED	EQUIPMENT IS NOT READY/AVAILABLE IF:
						--NOTE-- Absolutely no repairs to the lattice/chord angles are authorized at organizational (Unit) level. Organizational repair to the boom is limited to replacing the sheaves and common hardware such as cotter pins, nuts and bolts, etc:	
15.	X	X				**CRANE BOOM/JIB ASSEMBLY**: Visually check for obviously bent lattice/chord angles. Check hook block/boom sheaves for rough or chipped/sharp edges. Check for serviceability of the hook block safety latch.	3 or more lattice on one side bent. Any bend In the chords.
						--WARNING-- Wear leather/work gloves when handling wire rope (cable).	
16.	X	X				**WIRE ROPE**: Check for frayed, split, crushed, broken, or birdcaged wire rope. Monthly, unwind the cable from the drums (except one (1) wrap) and Inspect the entire length of the main and auxiliary cable. mission capable criteria.	See "Wire Rope Service-ability Criteria" at the end of this PMCS for non-
17.	X					**CLAMSHELL/DRAGLINE/CONCRETE BUCKETS**: Check for missing, broken or excessively worn teeth (if applicable).	2 or more missing teeth. See "Wire Rope Service-ability Criteria" at the end of this PMCS for non-mission capable criteria. Bucket won't hold the material.
	X					Check sheaves for wear and sharp edges.	
	X				X	Check wire rope for damage.	
		X			X	Check for proper operation of the bucket.	

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - BEFORE D - DURING A - AFTER W - WEEKLY M - MONTHLY

ITEM NO	INTERVAL B	D	A	W	M	ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED, OR ADJUSTED AS NEEDED	EQUIPMENT IS NOT READY/AVAILABLE IF:
18.	X					**BACKHOE ATTACHMENT**: Check for worn teeth or sidecutters.	2 or more missing teeth.
	X					Check the padlock sheave assembly for wear and damage.	Boom Inoperative.
	X	X				Check the backhoe boom for damage and proper operation.	
19.	X					**PILE DRIVING ATTACHMENT (LEADS)**: Check for broken lattice and damage to the catwalk.	2 or more broken lattice in any one lead section.
20.	X					**CLUTCHES**: Check for obvious damage or leaks.	Clutch will not raise a load, or engage properly to propel (move) the equipment.
		X				Check for proper operation.	

NOTE
Wire Rope Serviceability Criteria

Any of the following conditions will render the wire rope unserviceable. Replace the wire rope if these conditions exist

a. Crushing - Because of loose windings on a drum, rope was pulled between laying wraps of wire rope and crushed when the loose wraps were tightened.
b. Birdcaging - Sudden release of a load causing birdcaging. Birdcaging is strands open/pulled away from each other displaying the core.
c. Locking. Corrosion. Pitting and Abrasion - Lack of lubrication, premature breaking of wires, excessive dirt, sand or gravel embedded in the strands of the wire rope.
d. Reverse Bending - Caused by running the rope over one sheave and under another sheave.
e. Pinch - Caused by undersized sheave grooves; breaking wire strands.
f. Wear of one-third (1/3) of the original diameter of the outside individual wires.
g. Reduction from nominal diameter of more than one-thirty-second (1/32) inch for one-half (112) inch wire.
h. Consult the manufacturer's lube chart for lubrication instructions. When local climatic conditions dictate, U.S. Army and local commanders may prescribe lubrication policies for wire rope.

Page 3.6. Add the following WARNING preceding Chart 3-1:

WARNING

If NBC exposure is suspected, all air filter media should be handled by personnel wearing protective equipment. Consult your unit NBC Officer or NBC NCO for appropriate handling or disposal Instructions.

Page 3-6, Chart 3-1.

Malfunction 4. Change Corrective action *b* to read "Notify unit maintenance to adjust the fan belt."

Malfunction 6.

Change Corrective action *b* to read "Notify unit maintenance to service the oil filter."

Change Corrective action to read "Notify unit maintenance to drain crankcase and refill with proper oil (refer to LO)."

Malfunction 8. Change Corrective action to read “Notify unit maintenance to adjust loose belt."

Malfunction 9. Change Corrective action to read “Notify unit maintenance to adjust belt."

Malfunction 16. Change Corrective action *a* to read "Notify unit maintenance to adjust clutch brakebands

Page 3-7, Chart 3-1.

Malfunction 17.

Change Corrective action a to read "Notify unit maintenance to adjust brakebands."

Change Corrective action *b* to read "Notify unit maintenance to adjust clutch.

Malfunction 24. Change Corrective action *b* to read "Notify unit maintenance to adjust brakes."

Paragraphs 3-11 and 3-12 are rescinded.

Page 3-10. Figure 3-4 is rescinded.

Page 3-11. Figure 3-5 is rescinded.

Page 3-12. Add the following WARNING preceding paragraph 3-13*a*:

WARNING

If NBC exposure is suspected, all air filter media should be handled by personnel wearing protective equipment. Consult your unit NBC Officer or NBC NCO for appropriate handling or disposal Instructions.

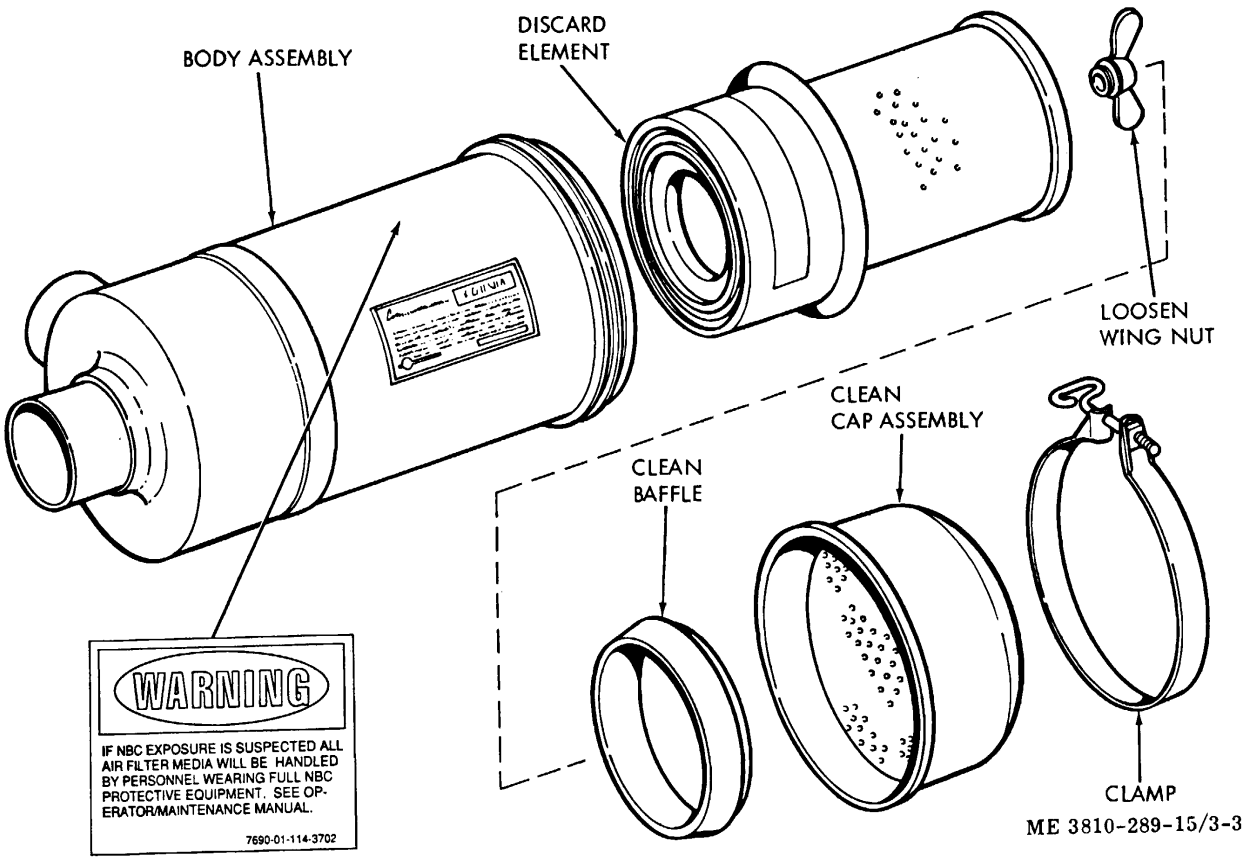


Figure 3-6. Air cleaner service.

Page 3-13. Figure 3-6 is superseded

Page 3-15. Paragraph 3-16*b* and Figure 3-8 are rescinded.
Page 3-16. Section VII (paragraphs 3-17 and 3-18 figure 3-9) is rescinded in its entirety.

Page 3-24. Paragraphs 3-27 through 3-30 are rescinded

Page 3-26. Figure 3-15 is rescinded.

Page 3-27. Figure 3-16 is rescinded.

Page 3-28. Figure 3-17 is rescinded.

Page 3-28. Figure 3-18 is rescinded.

Page 3-29. Paragraph 3-36. Delete all references paragraphs 3-29 and 3-30.

Page 4-1. Section II is superseded as follows:

Section II. Unit Preventive Maintenance Check and Services (PMCS)

4-4. General

a. To make sure that your vehicle is ready for operation at all times, inspect it systematically so you can discover any defects and have them corrected before they result in serious damage or failure. Table 4-2 contains your unit PMCS. The item numbers indicate the sequence of minimum inspection requirements. If you're operating the vehicle and notice something wrong which could damage the equipment if you continue operation, stop operation immediately.

b. Record all deficiencies and shortcomings, along with the corrective action taken on DA Form 2404. The Item Number column is the source for the number used in the TM Number column on DA Form 2404.

4-5. Unit Preventive Maintenance Checks Services

a. The item numbers of Table 4-2 indicate the sequence of the PMCS. Perform at the intervals shown below:

(1) Do your *Semiannually* (S) PREVENTIVE MAINTENANCE every six months.

(2) Do your *Annually* (A) PREVENTIVE MAINTENANCE once every year.

(3) Do your *Biennially* (B) PREVENTIVE MAINTENANCE once every two years.

(4) Do your *Hours* (H) PREVENTIVE MAINTENANCE at the hour interval listed.

(5) Do your *Miles* (M) PREVENTIVE MAINTENANCE at the mile interval listed.

b. If something doesn't work, troubleshoot it according to the instructions in this manual or the commercial manual or notify your supervisor.

c. Always do your preventive maintenance in the same order so it gets to be a habit. Once you've had some practice, you'll spot anything wrong in a hurry.

d. If anything looks wrong and you can't fix it, write it down on your DA Form 2404. If you find something seriously wrong, report it to direct support as soon as possible,

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves and use only in well ventilated area. Avoid contact with skin, eyes, and clothes and don't breathe vapors. Do not use near open flame or excessive heat. The flash point Is 10$^{0^{\circ}}$ F - 1380 F (380C - 590 C). If you become dizzy while using cleaning solvent, get fresh air immediately and get medical aid. If contact with eyes Is made, wash your eyes with water and get medical aid immediately.

WARNING

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid Injury to personnel.

(I) Keep it clean: Dirt, grease, oil, and debris only get in the way and may cover up a serious problem. Clean as you work and as needed. Use dry cleaning solvent (P-D-680) to clean metal surfaces. Use soap and water when you clean rubber or plastic material.

(2) Bolts, nuts, and screws: Check that they are not loose, missing, bent or broken. You can't try them all with a tool, of course, but look for chipped paint, bare metal or rust around bolt heads. Tighten any bolt, nut, or screw that you find loose.

(3) Welds: Look for loose or chipped paint, rust or gaps where parts are welded together. If you find a bad weld, report it to direct support.

(4) Electric wire and connectors: Look for cracked or broken insulation, bare wires and loose or broken connectors. Tighten loose connections and make sure the wires are in good condition.

(5) Hoses and fluid lines: Look for wear, damage and leaks. Make sure clamps and fittings are tight. Wet spots show leaks, but a stain around a fitting or connector can also mean a leak. If leakage comes from a loose fitting or connector, tighten the fitting or connector. If something is broken or worn out, either correct it or report it to direct support (refer to the Maintenance Allocation Chart).

e. Refer to paragraph 3-6 for leakage definitions.

UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES

M - MONTHLY Q - QUARTERLY S - SEMIANNUALLY A - ANNUALLY B - BIENNIALLY H - HOURS MI - MILES

ITEM NO.	INTERVAL							ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED, OR ADJUSTED AS NEEDED **PERFORM ALL OPERATOR'S PMCS FIRST**
	M	**Q**	**S**	**A**	**B**	**H**	**MI**	
								--WARNING-- Compressed air, used for cleaning purposes will not exceed 30 PSI. Use only with effective chip guarding and personal protective equipment (goggles/shield/gloves, etc.) Never aim compressed air gun/hose at other personnel or yourself.
1.			X					**BELTS**: Check for correct adjustment. See Paragraph 3-16 and 3-17.
								--WARNING-- Do not smoke or allow an open flame or spark In the vicinity while checking or filing the batteries. The batteries generate HYDROGEN - a highly explosive gas. Wear safety goggles when adding liquid (distilled water) to the batteries. **DO NOT ADD ELECTROLYTE.** **--CAUTION--** In cold weather operation, charge the batteries by running the engine immediately after adding liquid (distilled water) to prevent freezing and damage to the batteries. Run the crane engine 1 hour e 1500 RPM.
2.			X					**BATTERIES**: Remove, clean, and service the batteries. Clean and paint the battery box with corrosive resistant battery box paint.
3.			X					**WATER PUMP**: Check for unusual noise or vibration.
4.			X					**FAN BLADE AND GUARD**: Check for loose/missing hardware or broken guard.
5.			X					**FUEL FILTERS**: Replace filter cartridge, clean metal filter screen. Remove/clean and replace fuel pump filter screen as required. Clean fuel tank strainer.

UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES

M - MONTHLY Q - QUARTERLY S - SEMIANNUALLY A - ANNUALLY B - BIENNIALLY H - HOURS MI - MILES

ITEM NO.	INTERVAL							ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED, OR ADJUSTED AS NEEDED **PERFORM ALL OPERATOR'S PMCS FIRST**
	M	Q	S	A	B	H	MI	
6.	X							**OPERATING CLUTCHES AND BRAKES**: Check for wear and correct adjustment, see Paragraph 3-27. Lift the maximum load one foot above ground, hold the load one minute, then lower the load to the ground. Adjust the clutches/brakes as required.
7.	X							**ENGINE CLUTCH**: Check adjustment, adjust as required, see Paragraph 4-16.
								--WARNING-- Pressurized cooling system. Remove cap slowly and only when engine Is cool, or painful burns could result.
8.	X							**RADIATOR**: Check anti-freeze protection. Protect to -20° F. Perform alkalinity test.
9.	X							**STARTING MOTOR**: Every 200 hours, add 3 to 5 drops of OE30 oil to each reservoir.
10.	X							**STEERING CLUTCHES**: Check adjustment, adjust as required, see Paragraph 3-28.
11.	X							**TRANSMISSION ASSEMBLY**: Check gears and shafts for signs of damage/wear.
12.	X							**HOIST**: Check for proper operation, see Paragraph 3-36.
13.	X							**CONTROL LEVERS**: Check adjustment, adjust as required, see Paragraph 3-11.
14.	X							**TRACK ASSEMBLY**: Check adjustment, adjust as required, see Paragraph 3-22.
15.	X							**SWING LOCK**: Check adjustment, adjust as required, see Paragraph 4-72.

UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES

M - MONTHLY Q - QUARTERLY S - SEMIANNUALLY A - ANNUALLY B - BIENNIALLY H - HOURS MI - MILES

ITEM NO.	INTERVAL							ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED, OR ADJUSTED AS NEEDED **PERFORM ALL OPERATOR'S PMCS FIRST**
	M	**Q**	**S**	**A**	**B**	**H**	**MI**	
								--WARNING-- **Use leather work gloves when working with wire rope.**
16.	X							**WIRE ROPE**: Unreel the main and auxiliary hoist drum except for 1 full wrap. Check the wire rope for damage, cuts, frayed, or birdcaging. See "Wire Rope Serviceability Criteria" for wire rope NMC standards, at the end of this PMCS. Check clamps/wedges for tightness. Tighten securely. Replace damaged clamps and wedges. Lubricate the wire rope IAW the current Lubrication Order.
17.	X							**CRANE BOOM/INSERT**: Check sheaves, rollers, and guides for signs of wear. Check for damaged, bent, or broken lattice/chords. Check the hook block and sheaves for damage/wear. **NOTE** **Wire Rope Serviceability Criteria** Any of the following conditions will render the wire rope unserviceable. Replace the wire rope if these conditions exist. a. Crushing - Because of loose windings on a drum, rope was pulled between laying wraps of wire rope and crushed when the loose wraps were tightened. b. Birdcaging - Sudden release of a load causing birdcaging. Birdcaging is strands open/pulled away from each other displaying the core. c. Locking. Corrosion. Pitting and Abrasion - Lack of lubrication, premature breaking of wires, excessive dirt, sand or gravel embedded in the strands of the wire rope. d. Reverse Bending - Caused by running the rope over one sheave and under another sheave. e. Pinch - Caused by undersized sheave grooves; breaking wire strands. f. Wear of one-third (1/3) of the original diameter of the outside individual wires. g. Reduction from nominal diameter of more than one-thirty-second (1/32) inch for one-half (1/2) inch wire. h. Consult the manufacturer's lube chart for lubrication instructions. When local climatic conditions dictate, U.S Army and local commanders may prescribe lubrication policies for wire rope.

Page 4-2, Chart 4-1. Malfunction 7. Change Correction action e to read "Notify direct support maintenance to replace brushes."

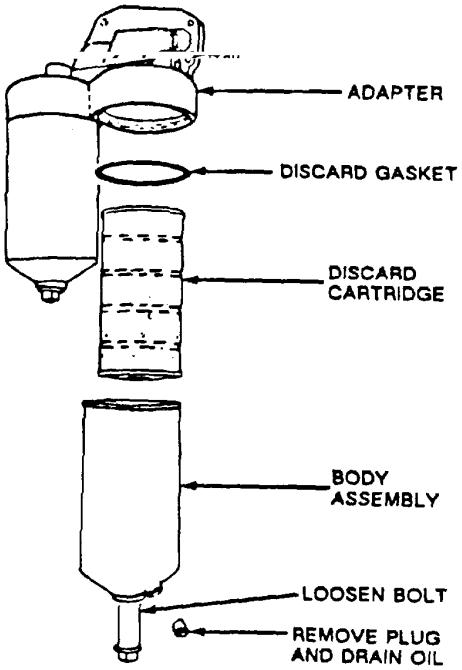
Page 4-7.

Paragraph 4-15a. Change "(fig. 3- 1)" to "(fig. 4-5.1)".

Paragraph 4-15c. Change "(fig. 3-1)" to "(fig. 4-5.1)".

Paragraph 4-15*d* is added after paragraph 4-15*c*.

d. Service. Refer to figure 4-5.1 and service the oil filter.



NOTE: THE OIL FILTER SHOULD BE CHANGED AFTER 800 GALLONS OF FUEL HAVE BEEN USED OR AFTER 250 HOURS. WHICH EVER COMES FIRST.

Figure 4-5.1. Oil filter service.

Page 4-10.

Paragraph 4-17. Change "Refer to figure 3-4." to "Refer to figure 4-5.2.".

Figure 4-5.2 is added as shown on the following page.

Page 4-12.

Paragraph 4-18*c* is superseded as follows:

c. Swing Lock Adjustment (fig. 4-6. i).

(1) Pull the swing lock lever back and check the engagement of the lock between the teeth of the fixed gearing. The lock should extend at least halfway along the teeth profile; if it does not, put the control lever in the forward position, remove pins "A" and "B", and unscrew the adjusting screw one or two turns.

(2) Reassemble the pins in the toggle links and check that the lock does not foul the top of the teeth.

(3) Swing the revolving frame and ensure that there is clearance between the lock and the gear ring all around.

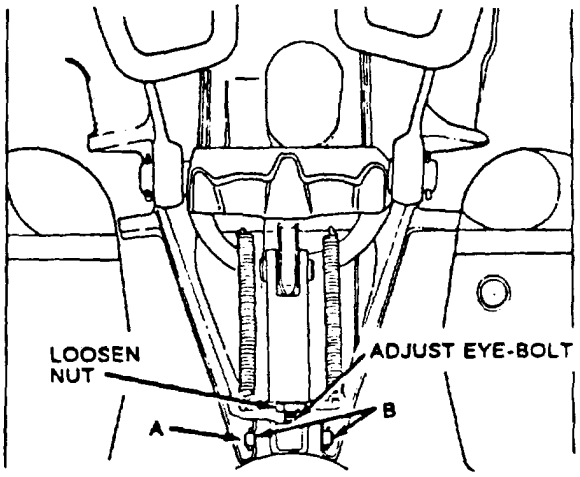


Figure 4-6.1. Swing lock adjustments.

Page 4-12. Add the following WARNING preceding paragraph 4-22:

WARNING

If NBC exposure is suspected, all air filter media should be handled by personnel wearing protective equipment. Consult your unit NBC Officer or NBC NCO for appropriate handling or disposal Instructions.

Page 4-18. Add the NBC warning decal (Figure 2-37a) above the specification plate. (See Figure 3-6, page 3-13).

Paragraph 4-25 is rescinded.

Page 4-21. Figure 4-15 is rescinded.

Page 4-22. Paragraph 4-28 is rescinded.

Page 4-23. Figure 4-16 is rescinded.

Page 4-26.

Paragraph 4-31 is superseded as follows:

4-31. Radiator

a. Service. Maintain coolant level 2 inches below filler neck.

b. Test. Refer to TB 750-651 and test radiator.

c. Replacement.

(1) Refer to figure 4-19 and replace the radiator.

(2) Replace a cracked or frayed hose and defective clamps.

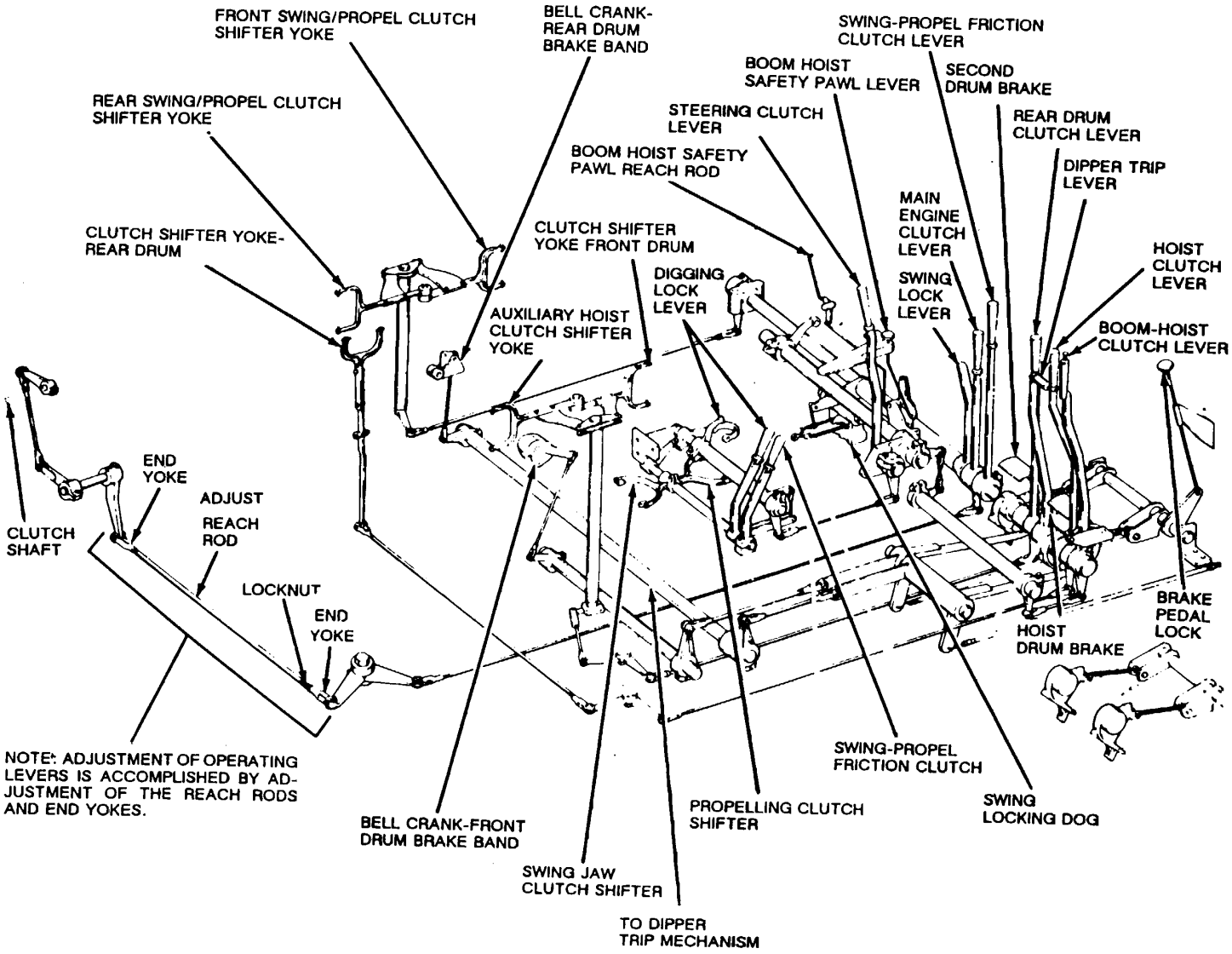


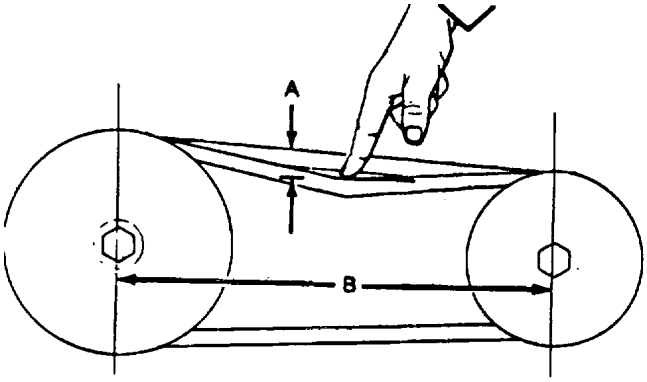
Figure 4-5.2. Control levers.

Paragraph 4-32. Change the title of paragraph 4-32 to read "Fan Belt Inspection, Adjustment, and Replacement".

Paragraphs 4-32a. 1 and *4-32a.2* are added after paragraph 4-32a.

4-32a.1. Inspection. Inspect the belt frequently for proper tension, cracks, and wear.

4-32a.2. Adjustment. Tighten belt so pressure of index finger extended straight down will depress belt (A, fig. 4-19.1) to value shown. Force applied will be approximately 13 lbs. for each foot of belt free span (B, fig 4-19.1). The fan belt is 11/16 inches wide.



BELT WIDTH IN.	DEFLECTION PER FT. OF SPAN IN.
1/2	13/32
11/16	13/32
3/4	7/16
7/8	1/2
1	9/16

Figure 4-19.1. Belt adjustment.

After paragraph 4-34, paragraph 4-34.1 is added as follows:

4-34.1. Water Pump Replacement

a. General. The water pump assembly is mounted on the right front of the engine. It is belt driven and circulates the coolant through the engine block, cylinder head, and radiator.

b. Removal.

(1) Disconnect the water inlet and outlet hose and couplings from the water pump.

(2) Remove mounting capscrews and lockwashers securing water pump to block.

(3) Lift water pump from engine (fig. 4-23.1).

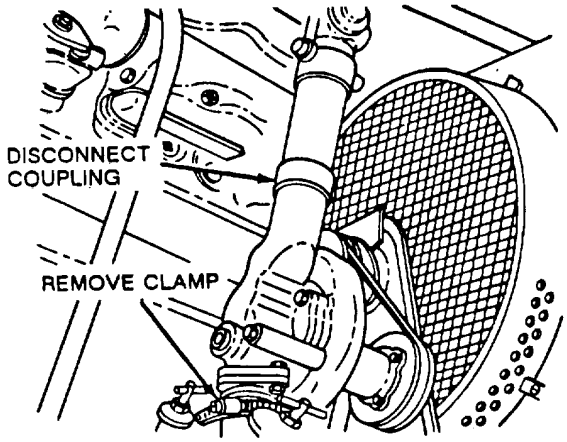


Figure 4-23. Water pump removal.

c. Installation.

(1) Lift water pump into position against side of block.

(2) Install lockwashers and capscrews and tighten securely (fig. 4-23.2).

(3) Connect water inlet and outlet hose and couplings to water pump.

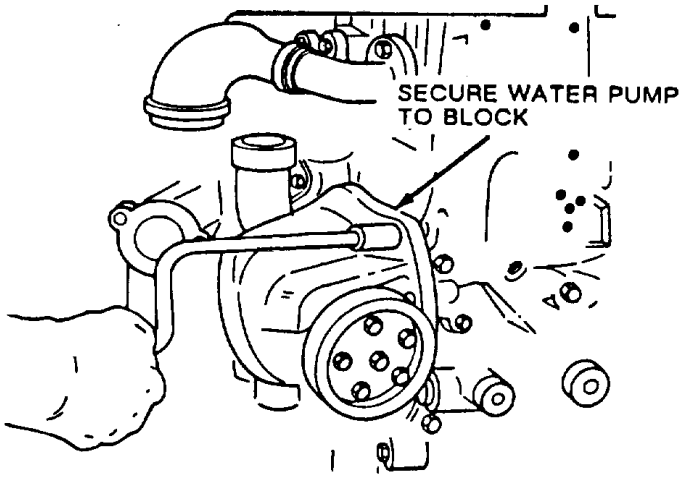


Figure 4-23.2. Water pump being secured to block.

Page 4-32.

Paragraph *4-35d* (1). Change "figure 3-9" to "figure 4-25.1".

Figure *4-25.1* is added as shown on the following page.

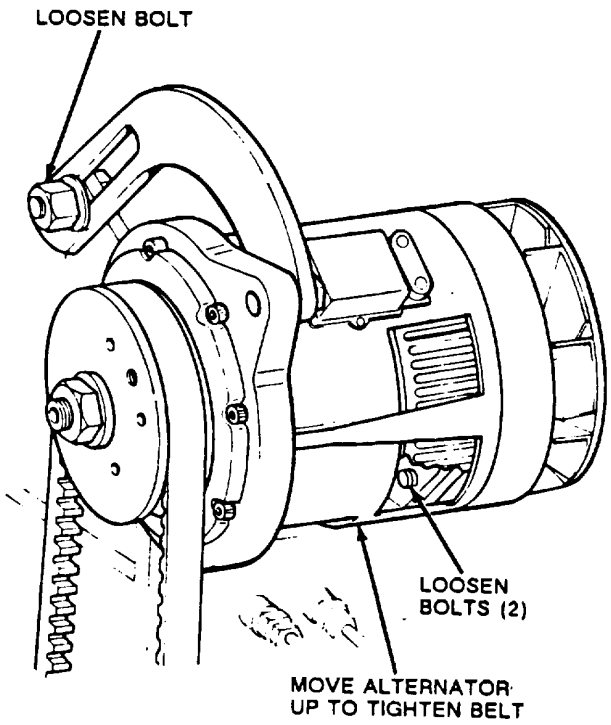


Figure 4-25.1. Alternator belt.

Page 4-39. Paragraph 4-42 is rescinded,

Page 4-44.

Paragraph 4-49. Delete "and Repair" from the paragraph title.

Paragraph 4-*49c* is rescinded.

Paragraph 4-50 is rescinded.

Page 4-49. Paragraph 4-52.1 is added after paragraph 4-52.

4-52.1. Data Plates

a. General. Refer to paragraph 1-5 for data plate information. Replace data plates when damaged or illegible.

b. Replacement. Remove mounting hardware and plate. Install new plate with mounting hardware.

Page 4-54, Figure 4-39. Change callout number "4" to "5" and change "5" to "4".

Page 4-69.

Paragraph *4-62b.* Change "paragraph 3-27" to "paragraph 4-62.1"

4-62.1. Operating Clutches Inspection, Service, and Adjustment

a. General. Operating clutches (fig. 4-51.1 and 4-51.2) should hold securely when engaged and be completely free when levers are in neutral position.

b. Inspection.

(1) Check liners and shifter yokes for wear and damage. See if all connecting pins and bolts are secure.

(2) See if shifter yoke reach arms are adjusted so that clutches fully engage and release. Shifter yokes do not necessarily have to be parallel; however, they must engage and disengage clutch completely. Ensure that control levers are a lined in accordance with paragraph 4- 1*7c.*

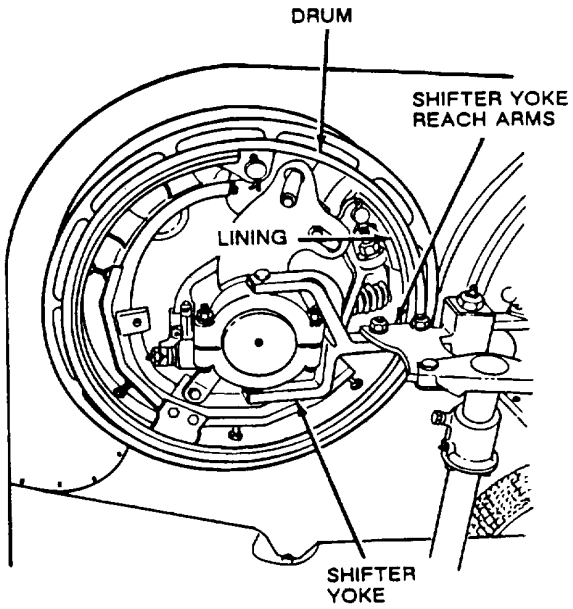


Figure 4-51.1. Operating clutch inspection.

c. Service.

(1) remove oil and grease from lining and drums with approved solvent.

NOTE

Linings should be replaced before they are worn flush with rivets.

(2) Replace worn or defective linings.

(3) Lubricate clutches in accordance with the lubrication order.

d. Adjustment (fig. 4-51.2).

(1) Set clutch in engaged position.

Paragraph 4-62.1 is added after paragraph 4-62

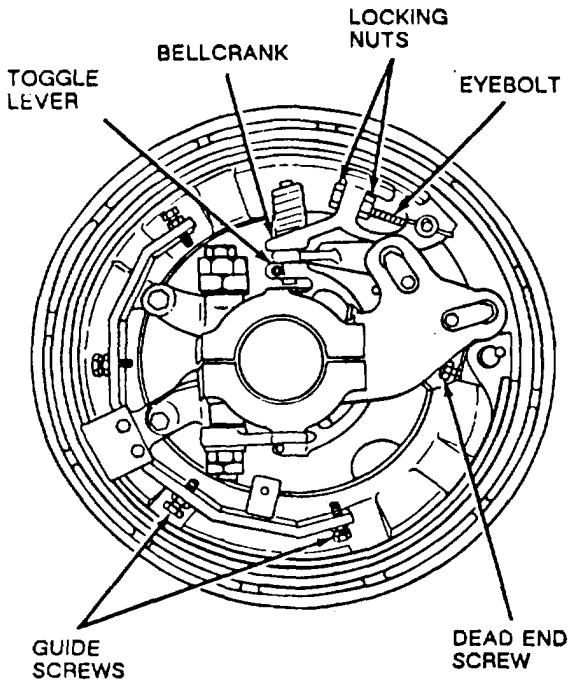


Figure 4-51.2. Operating clutch adjustment.

(2) Adjust eyebolt until the gap between the lugs (of toggle-link and bellcrank) at the spring bolt is no more than 1/8 inch with the clutch cold. If clutch is adjusted while hot, the gap should be smaller than 1/8 inch.

(3) Adjust guide screws so band clears housing. The guide screws enable the clutch band to be moved slightly in and out or up and down to even out the clearance between the band and the clutch housing. If the band clearance is less than 1/32 inch all around, loosen all guide screws, and then make the adjustment.

(4) Adjust the dead end screw to provide about 1/32 inch clearance between the lining and the housing when clutch is disengaged.

Paragraph 4-63d. Change "paragraph 3-29" to "paragraph 4-63.1 ".

Paragraph 4-63.1 is added after paragraph 4-63.

4-63.1. Boom Hoist Clutch Band Inspection and Adjustment

a. Inspection. Inspect boom hoist clutch and booster bands for wear or damage. If satisfactory operation cannot be obtained by adjustment, worn band should be replaced.

b. Adjustment.

(*I) Booster band.* With control lever in neutral position, adjust booster clutch band wear adjustment nuts until booster band will have minimum clearance all around its housing and engage the main clutch on pulling hand lever. A good way to determine sufficient clearance is to handgrasp the booster band at joint. If it can be moved sideways freely, clearance should be satisfactory.

(2) Main Clutch. Adjust the main clutch release spring just enough to allow main clutch to disengage when the lever is placed in neutral position and the booster clutch is disengaged.

Paragraph 4-64c. Change "paragraph 3-30" to "paragraph 4-64.1".

Paragraphs 4-64.1 through 4-64.3 are added after paragraph 4-64.

464.1. Boom Hoist Brakeband Inspection and Adjustment

a. Inspection. Inspect boom hoist brakeband for wear. If satisfactory operation can no longer be obtained, the band should be replaced.

b. Adjustment (fig. 4-51.3). Adjustments must be made in sequence as follows:

(1) With control lever in neutral position, adjust length of control reach rod until rear detent in cam is centered by brake cam roller.

(2) With control lever in neutral position, adjust brakeband wear adjustment nuts until gap is 1/8 to 3/16 inch (between cam rear detent faces and brake cam roller).

(3) The above adjustment must be made periodically, as brake linings wear, to secure proper timing between clutch set and brake release during boom raising.

(4) The brake set spring, which supplies the brakeband setting force, is adjusted at the factory and should not require any further adjustment for loads within the rated capacity of the machine.

464.2. Vertical and Horizontal Swing and Propel Shafts Inspection and Service.

a. Inspection. Inspect shaft couplings and assemblies for wear or damage.

b. Service. Check for proper lubrication and lubricate if necessary. Refer to lubrication order.

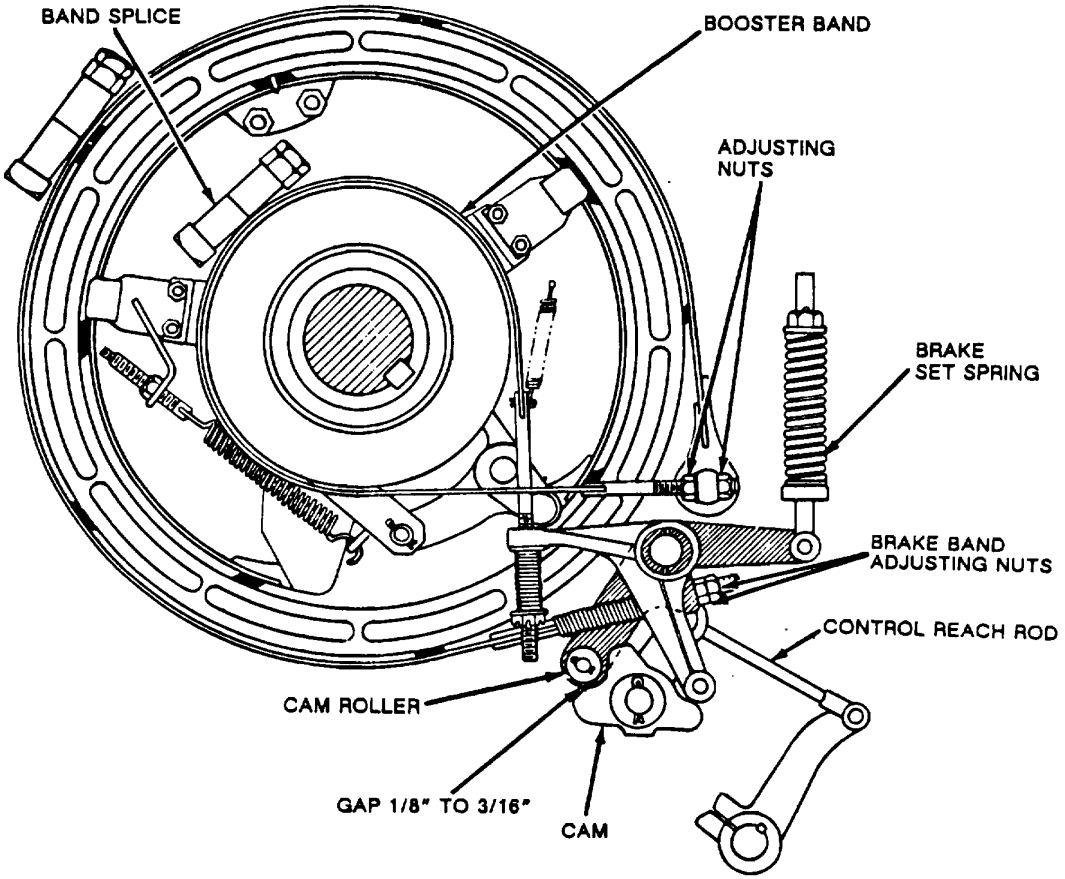


Figure 4-51.3. Boom hoist brakeband adjustment.

464.3. Steering Spline Clutch Adjustment

Adjustment should seldom be required, but if needed, adjust the reach rods in the bevel gear case (fig. 4-51.4) With the steering spline clutch lever in neutral, the reach rod lengths should be adjusted so that both clutches are in full engagement.

Page 4-71.

The title of Section XVI is changed to read "Maintenance of chain case assembly and gear case cover".

Paragraph 4-66 is rescinded.

Page 4-73. Figure 4-53 is rescinded.

Page A-1.

Paragraph A-1.

Change "TB 54200-200-10" and its title to read "TB5-4200-200-100, Hand Portable Fire Extinguishers Approved for Army Users".

Add "DA Pam 24-30, Consolidated Index of Army Publications and Blank Forms".

Paragraph A-3.

Change "TM 38-750" and its title to read "DA Pam 738-750, The Army Maintenance Management System (TAMMS)".

Change "TM 9-6140-200-15" and its title to read "TM 9-6140-200- 14, Operator's, Organizational, Direct Support and General Support Maintenance Manual for Lead-Acid Storage Batteries".

Paragraph A-4. Change "TM 9-213" to "TM 43-0139".

Paragraph A-5. Change "TM 11-483" and its title to read "FM 11-65, High Frequency Radio Communications".

Paragraph A-7. Change "TM 750-244-3" and its title to read "TM 750-244-6, Procedures for the Destruction of Tank-Automotive Equipment to Prevent Enemy Use".

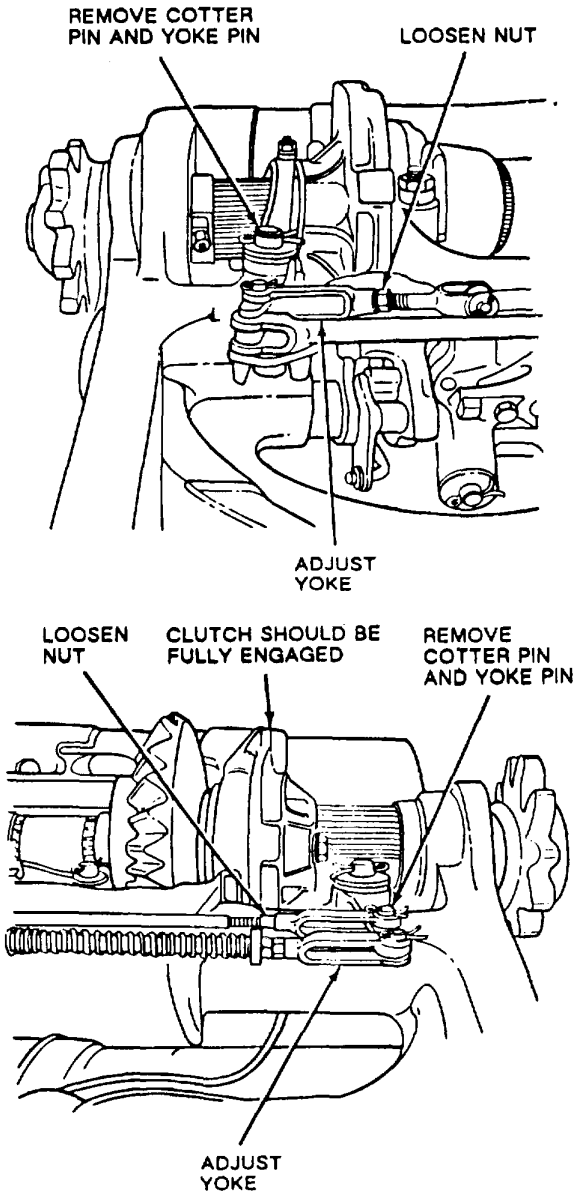


Figure 4-51.4. Steering clutches adjustment.

Page B-I. Appendix B is superseded as follows:

APPENDIX B
MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. GENERAL

a. This section provides a general explanation of all maintenance and repair functions authorized at the various maintenance levels.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels.

c. Section I lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. Maintenance Functions

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

b. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. Aline. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/Install. To remove and install the same

item when required to perform service or other maintenance functions. Install may be the act of emplacing seating, or fixing into position a spare, repair part or module (component or assembly) in a manner to allow the proper functioning of equipment or a system.

h. Replace. To remove an unserviceable item install a serviceable counterpart in its place. "Replace", is authorized by the MAC and is shown as the third position of the SMR code.

i. Repair. The application of maintenance service including fault location/installation, and disassembly/assembly procedures, and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable operational condition as required by maintenance standards in appropriate technical publications i.e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

B-3. Explanation of Columns In the MAC, Section II

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next 1 assembly. End item group number shall be "00".

b. Column 2, Component/Assembly. Column 2 contains the names of components, assemblies, assemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in column 2. (For a detailed explanation of these function paragraph B-2).

d. Column 4. Maintenance Level. Column 4 specifies by the listing of a *work time* figure in the appropriate column(s), the level of maintenance authorized to perform the function listed in Column 3. This figure 1 sends the active time required to perform that maintenance function at the indicated level of maintenance the number or complexity of the tasks within the maintenance function vary at different maintenance levels, appropriate work time figures will be shown for Each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the Maintenance Allocation Chart. The symbol designations for the various maintenance levels are as follows:

C .....Operator or Crew
O .....Unit (Organizational) Maintenance
F .....Direct Support Maintenance
H .....General Support Maintenance
D .....Depot Maintenance

e. Column 5, Tools and Equipment. Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

f Column 6, Remarks. This column shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks contained in Section IV.

B-4. Explanation of Columns In Tool and Test Equipment Requirements, Section III

a. Column I, Tool or Test Equipment Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

b. Column 2, Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National/NATO Stock Number. The National/NATO Stock Number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number.

B-5. Explanation of Columns In Remarks, Section IV

a. Column 1, Reference Code. The code recorded in Column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

Section II. MAINTENANCE ALLOCATION CHART

SECTION II.
MAINTENANCE ALLOCATION CHART
CRANE-SHOVEL, CRAWLER MOUNTED 12 ½ TON, ¾ CU. YD., MODEL 22BM

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
			C	Unit O	DS F	GS H	Depot D		
01	Engine							3, 4, 5, 6, 7, 9, 10	
0100	Engine Assembly	Inspect	0.1						
		Test		2.0					
		Service	1.0	1.0					
		Replace			16.0				
		Repair				24.0			
		Overhaul					60.0		
0101	Crankcase, Block and Cylinder Head								
	Block Assembly	Replace				12.0			
		Repair				16.0			
		Overhaul					16.0		
	Cylinder Head	Replace			16.0				
		Repair				12.0			
		Overhaul					16.0		
0102	Crankshaft	Inspect				2.0			
		Replace				6.0			
		Repair				8.0			
		Overhaul					16.0		
0103	Flywheel Assembly	Inspect			0.2				
		Replace			0.3				
		Repair			2.0				
0104	Pistons, Connecting	Inspect				0.5			
		Replace				0.8			
		Repair				1.0			
0105	Valves, Camshafts and Timing System								
	Rocker Arm Assembly	Adust		2.0				2	
		Replace			6.0				
		Repair			4.0				
	Camshaft Assy	Replace				8.0			
		Repair				6.0			

MAINTENANCE ALLOCATION CHART (Continued)

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	Unit O	DS F	GS H	Depot D	(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
0105 Cont'd	Valve Assembly, Push Rods, Guides and Seats	Replace			5.0				
		Repair				8.0			
0106	Engine Lubrication System							4, 12	
	0il Cooler	Replace		1.0					
		Repair		2.0					
	0il Filter Assembly	Replace		1.0					
		Repair		1.0					
	Oil Pan	Replace			6.0				
		Repair			2.0				
	Oil Pump	Replace			4.0				
		Repair			2.0				
0108		Manifolds						12	
	Intake	Inspect			0.5				
		Replace			3.0				
	Exhaust	Inspect		0.3					
		Replace		2.0					
0109	Accessory Driving Mechanism	Replace			4.0			7	
		Repair			3.0				
02	CLUTCH							4,12	
0200	Clutch Assembly (Engine)	Adjust		1.0					
		Replace			8.0				
		Repair			2.0				
0202	Clutch Release Mechanism								
	Rods, Levers	Adjust		0.5					
		Replace		1.5					
		Repair		0.5					
				26					

MAINTENANCE ALLOCATION CHART (Continued)

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	Unit O	DS F	GS H	Depot D	(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
03	FUEL SYSTEM							4, 13	
0301	Fuel Injector	Test			0.5				
		Replace			0.5				
		Repair			1.0				
0302	Fuel Pump	Service		1.0					
		Test			1.0		1.0		
		Adjust			1.0				
		Replace			2.0				
		Repair			2.0		8.0		
	Fuel Shut-Off Valve	Replace		1.0					
		Repair			2.0				
	Throttle Assembly	Inspect			0.5				
		Replace			2.0				
0304	Air Cleaner Assembly	Inspect	0.5					12	
		Service	0.5						
		Replace		1.0					
		Repair		0.5					
	Element	Inspect	0.5						
		Service		0.5					
		Replace		0.2					
0306	Tanks, Lines, Fittings and Headers							12, 14	
	Fuel Tank	Replace		2.0					
		Repair			3.0				
	Cap and Strainer	Service	0.2						
		Replace		0.1					
0308	Engine Speed Governor and Controls	Adjust			1.0			4, 7, 12	
		Replace			3.0				
		Repair			4.0				
0309	Fuel Filters	Service		1.0				12	
		Replace		0.8					

MAINTENANCE ALLOCATION CHART (Continued)

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
			C	Unit O	DS F	GS H	Depot D		
04	EXHAUST SYSTEM							12	
0401	Muffler and Pipes	Inspect	0.2						
		Replace		2.0				5, 6, 12, 14, 15	
05	COOLING SYSTEM								
0501	Radiator, Evaporator Cooler, or Heat Exchanger								
	Radiator	Inspect		0.2					
		Service		0.5					
		Test		1.0	2.0				
		Replace		2.0					
		Repair			3.0				
0503	Water Manifold Headers, Thermostats, and Housing Gasket							5, 6, 12	
	Thermostat	Test		0.1					
		Replace		1.0					
	Hoses/Pipes	Inspect	0.1						
		Replace		0.5					
0504		Water Pump	Inspect			0.2			
		Replace		2.0					
	Belts	Inspect	0.1						
		Adjust		0.5					
		Replace		1.0					
0505		Fan Assembly							
	Blade and Guard	Inspect		0.1					
		Replace		0.5					
	Belts	Inspect	0.1						
		Adjust		0.5				1	
		Replace		1.0					

MAINTENANCE ALLOCATION CHART (Continued)

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	Unit O	DS F	GS H	Depot D	(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
06	ELECTRICAL SYSTEM						3, 5, 12	13	
0601	Generator, Alternator								
	Alternator Assembly	Test		0.5	1.0				
		Replace		1.0					
		Repair			2.0				
	Belts	Inspect	0.1						
		Adjust		0.5					
		Replace		1.0					
0603	Starting Motor	Test		1.0					
		Replace		1.0					
		Repair			4.0				
0606	Engine Safety Control	Adjust		0.1					
		Replace		0.8					
0607	Instrument or Engine Control Panel								
	Wiring Harness	Inspect		0.2					
		Replace			6.0				
		Repair			4.0				
	Switches/Gauges (Electrical)	Inspect	0.1						
		Test		0.5					
		Replace		1.0					
	Lamps/Switches	Inspect	0.1						
		Test		0.2					
		Replace		0.5					
0609		Lights	Inspect		0.1				
		Replace		0.3					
		Repair		0.2					
0610	Sending Units and Warning Switches	Inspect		0.1					
		Replace		0.3					
0611	Horn, Siren	Inspect	0.1						
		Replace		0.5					

MAINTENANCE ALLOCATION CHART (Continued)

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	Unit O	DS F	GS H	Depot D	(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
0612	Batteries	Inspect	0.1						
		Test		0.2				3	
		Service	0.1	0.2					
		Replace		0.5					
		Repair		0.1	1.5				
	Cables	Inspect		0.1					
		Replace		0.8					
		Repair		0.2					
13	WHEELS AND TRACKS						5, 6, 7, 8, 9		
1302	Track Support Rollers and Brackets	Inspect	0.1						
		Service	0.4						
		Replace		2.0					
1303	Track Idlers and Brackets	Inspect	0.1						
		Service	0.2						
		Replace			6.0				
		Repair			4.0				
1304	Track Drive Sprockets	Inspect			1.0				
		Replace			6.0				
		Repair			4.0				
1305	Track Assembly	Inspect	0.3		1.0				
		Adjust	0.8						
		Replace			6.0				
		Repair			4.0				
	Track Pad	Inspect	0.1						
		Replace		2.0					
15	FRAME, TOWING ATTACHMENTS AND DRAWBARS							12, 14	
1502	Counterweights	Replace		1.0					
		Repair			2.0				

MAINTENANCE ALLOCATION CHART (Continued)

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	Unit O	DS F	GS H	Depot D	(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
18	BODY, CAB, HOOD AND HULL							4, 5, 6, 7, 16	
1801	Body, Cab, Hood and Hull								
	Cab	Inspect	0.2						
		Replace			6.0				
		Repair			4.0				
	Doors	Inspect	0.1						
		Replace		0.5					
		Repair			4.0				
1802	Fenders, Running Boards w/Mounting And Attaching Parts, Windshield, Outriggers, Glass, etc.								
	Windshield and Glass	Inspect	0.1						
		Replace			2.0				
1806	Upholstery, Seats and Carpets								
	Seat Assembly	Inspect	0.1						
		Adjust	0.1						
		Replace		1.0					
22	BODY, CHASIS, OR HULL ACCESSORY ITEMS							5, 6, 12	
2210	Data Plates and Instructional Holders	Inspect	0.1						
		Replace		0.2					
47	Gauges, (Non-Electrical) Weighing and Measuring Devices							5, 6, 12	
4701	Instruments								

MAINTENANCE ALLOCATION CHART (Continued)

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	Unit O	DS F	GS H	Depot D	(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
4701 Cont'd	Tachometer	Inspect	0.1						
		Replace		0.5					
4702	Gauges, Lines, Mountings and Fittings								
	Boom Angle Indicator	Inspect	0.1						
		Replace		0.5					
74	CRANES, SHOVELS, AND EARTHMOVING EQUIPMENT COMPONENTS							5, 6, 7, 8, 9, 12, 14	
7410	Shovel Front Attachment	Inspect	0.2						
		Service	0.5						
		Replace		2.0					
		Repair		2.0	6.0				
	Boom Assembly	Inspect	0.1						
		Replace		2.0					
		Repair		2.0	4.0		24.0		
	Saddle Block/Shipper Shaft	Adjust	0.8						
		Replace	2.0						
		Repair	1.0	6.0					
	Crowd/Dump Chain And Latch Bar	Adjust		0.3					
		Replace		1.0					
		Repair		0.5					
	Dipper Assembly	Inspect	0.2						
		Service	0.5						
		Replace		2.0					
		Repair		2.0					
	Dipper Trip	Adjust		0.3					
		Replace		1.0					
7411	Crane, Dragline or Clamshell Attachment								
				32					

MAINTENANCE ALLOCATION CHART (Continued)

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	Unit O	DS F	GS H	Depot D	(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
7411 Cont'd	Boom, Jib and insert	Inspect	0.3	0.8					Weld at Depot only. Cold Repair At DS.
		Test		2.0		2.0			
		Replace	2.0						
		Repair	2.0	6.0		24.0			
	Clamshell Bucket	Inspect	0.2						
		Service	0.2						
		Replace		2.0					
		Repair		2.0	6.0				
	Tagline	Replace		1.5					
		Repair		1.0					
	Dragline Bucket	Inspect	0.2						
		Service	0.2						
		Replace		1.0					
		Repair		2.0	6.0				
	Fairlead	Replace		2.0					
		Repair		1.0					
	Sheaves	Inspect	0.1						
		Service	0.1						
		Replace		0.5					
		Repair		2.0					
	Boom Stop	Replace		0.8					
		Repair		1.0					
	Wire Rope	Inspect	0.2						
		Replace		2.0					
7412	Backhoe Attachment	Inspect	0.2						
		Service	0.5						
		Replace		2.0					
		Repair		2.0	6.0				
				33					

MAINTENANCE ALLOCATION CHART (Continued)

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	Unit O	DS F	GS H	Depot D	(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
7412 Cont'd	Boom	Replace		2.0					
		Repair		2.0	6.0		24.0		
	Bucket/Teeth	Inspect	0.1						
		Replace		2.0					
	"A" Frame	Replace		2.0					
		Repair		2.0					
7413	Pile Drive Attachment								
	Pile Driver Leads	Inspect	0.2						
		Replace		2.0					
		Repair		0.8	4.0				
	Catwalk	Replace	0.5						
		Repair		0.5					
7414	Base Deck								
	Frame Covers	Inspect		0.1					
		Replace		2.0					
	Gear Covers	Inspect		0.1					
		Replace		2.0					
7415	Clutch								
	Steering Spline Clutch	Inspect		0.2					
		Adjust		0.5					
		Replace		2.0					
		Repair		2.0					
	Boom Hoist Clutch/ Brake	Inspect		0.2					
		Adjust		0.5					
		Replace		2.0					
		Repair		2.0					
	Operating Clutches	Inspect		0.2					
		Adjust		0.5					
		Replace		2.0					
		Repair		2.0					

MAINTENANCE ALLOCATION CHART (Continued)

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
				Unit	DS	GS	Depot		
			C	O	F	H	D		
7416	Shafts								
	Front/Rear Drum Shafts	Replace			6.0				
		Repair			4.0				
	Swing Shaft	Replace			6.0				
		Repair			4.0				
7417	Hoists	Inspect		1.0					
		Replace			6.0				
		Repair			4.0				
7418	Transmission Assembly	Inspect		0.5					
		Service		0.8					
		Replace			6.0				
		Repair			4.0				
7419	Turntable								
	Cone Rollers	Inspect		0.2					
		Service	0.8						
		Replace			6.0				
	Anti-Rotation Lock	Replace		1.0					
		Repair		0.5					
7422	Machinery Mechanism Controls	Adjust		0.5					
		Replace		2.0					
7423	Gantry	Replace		2.0					
		Repair		1.0					
7424	Crawler Bed, Frame and Ring Gear								
	Frame	Inspect			1.0				
		Replace				32.0			
		Repair				16.0			
	Ring Gear	Inspect			0.5				
		Replace				24.0			

MAINTENANCE ALLOCATION CHART (Continued)

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	Unit O	DS F	GS H	Depot D	(5) TOOLS AND TEST EQUIPMENT	(6) REMARKS
7425	Propel and Steering Mechanism								
	Vertical/Horizontal Shaft	Inspect			1.0				
		Replace			6.0				
		Repair			4.0				
	Lines and Fittings	Inspect		0.2					
		Replace		1.0					
				36					

MAINTENANCE ALLOCATION CHART (Continued)

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/ NATO STOCK NUMBER	TOOL NUMBER	FSCM
1.	O	Gage, Belt Tension	5220-01-021-9379	ST-968	15434
2.	O	Wrench Adapter	5120-00-103-4687	ST-669	55719
3.	O,F,H	Analyzer Set, STE-ICE	4910-11-124-2554	2389409	49671 LIN's
4.	F,H	Shop Equip, Auto Maint & Repair	4910-00-348-7626	SC4910-95-CL-A02	T09905
5.	O	Shop Equip, Auto Org, Common No.1	4910-00-754-0654	SC4910-95-CL-A74	W32593
6.	O	Shop, Auto Org, Common No. 1 Supplemental, Less Power	4910-00-754-0653	SC4910-95-CL-A73	W32867
7.	F,H	Shop Equip, Auto Org Common No. 2	4910-00-754-0650	SC4910-95-CL-A72	W32730
8.	F,H	Tool Set, Full Track, Org Suppl No. 2 Less Power	4910-00-754-0743	SC4910-95-CL-A08	W65747
9.	H	Field Maint, Post Camp, Station Set Less Power	3470-00-348-7390	SC3470-95-CL-A03	T15645
10.	D	Shop Set, Engine Rebuild, Set 7	4910-00-754-0673	SC4910-95-CL-A39	T29044
11.	D	Shop Set, Power Train Rebuild, Depot Set 1	3470-00-348-7390	SC3470-95-CL-A03	T33428
12.	O	Tool Kit, General Mechanics	5180-00-177-7033	SC5180-90-N26	W33004
13.	F,H	Shop Set, Fuel & Elec. Field Maint.	4910-00-754-0714	SC4910-95-CL-A01	T30414
14.	F,H,D	Shop Equip, Cutting & Welding Set 3	3470-00-764-6205	SC3470-95-CL-A06	W67980
15.	F	Shop Equip, Radiator Test, Shop B	4910-00-071-0747	SC4910-95-CL-A76	T35483
16.	F	Tool Kit, Glass Cutting, Auto	4940-00-357-7737	SC4940-95-CL-A18	W39169

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

PATRICIA P. HICKERSON
Brigadier General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-25-E (Block 0526) Unit maintenance requirements for TM 5-3810-289-12.

CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *17 May 1973*

Operator and Organizational Maintenance Manual
for
CRANE-SHOVEL, CRAWLER MOUNTED, 12 .-TON, ¾-CU YD; DIESEL ENGINE DRIVEN (BUCYRUS-ERIE MODEL 22 BM) FSN 3810-869-3092

TM 3810-289-12, 13 March 1970, is changed as follows:

Page 1-1. Paragraph 13 is superseded as follows:

1-3. Reporting of Equipment Publication Improvements
The reporting of errors omissions and recommendations for improving this bulletin by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forward direct to Commander, US Army Troop Support Command, AITTN: AMSTS-MPP, 4300 Goodfellow Boulevard, St. Louis, Missouri 63120. A reply will be furnished directly to you.

Page 2-7. Paragraph 2*3d* is added as follows:

d. Maintenance and Operating Supplies. Refer to table 21 for a list of maintenance and operating supplies necessary for initial operation of this equipment.

Table 2-1. Maintenance and Operating Supplies

(1) Component application	(2) Federal stock number	(3) Description	(4) Quality required F/initial operation	(5) Quality required F/8 hrs operation	(6) Notes
CHAIN CASE		OIL, LUBRICATING: 5-gal drum as follows:			(1) Includes quantity of oil to fill engine oil system as follows: 20 qt - crankcase w/filters
	9150-265-9435 (2)	OE 30	3 qt	(3)	
	9150-265-9428 (2)	OE 10	3 qt	(3)	
	9150-242-7603 (2)	OES	3 qt	(3)	
CRANKCASE		OIL. LUBRICATING: 5-gal drum as follows:			(2) See C9100-IL for additional data and requisitioning procedures.
	9150-265-9435 (2)	OE 30	20 qt	(3)	(3) See current LO for grade application and replenishment intervals.
	9150-265-9428 (2)	OE 10	20 qt	(3)	
	9150-242-7603 (2)	OES	20 qt	(3)	
GEARCASE, MAIN		OIL, LUBRICATING, GEAR 5-gal drum as follows:			(4) Average fuel consumption is 2.3 gal per hour of continuous eration.
	9150-577-5844 (2)	GO 90	32 qt	(3)	
	9150-259-5440 (2)	GOS	32 qt	(3)	
GEARCASE, CRAWLER		OIL, LUBRICATING, GEAR gal drum as follows:			(5) Maximum protection is obtained at 60 percent by volume (4.8 pt per gal of solution).
	9150-577-5844 (2)	GO 90	2 qt	(3)	
	9150-254-5440 (2)	GOS	2 qt	(3)	

Table 2-1. Maintenance and Operating Supplies - continued

Table 2-1. Maintenance and Operating Supplies

(1) Component application	(2) Federal stock number	(3) Description	(4) Quality required F/initial operation	(5) Quality required F/8 hrs operation	(6) Notes
GEARS, EXPOSED		OIL, LUBRICATING, EXPOSED GEAR: 5-ga can as follows:			
	9150-234-5199 (2)	CW-11-B	5 lb	(3)	
GREASE POINTS		GREASE, AUTOMOTIVE AND ARTILLERY: 5-lb can as follows:			
	9150-190-0905	GAA	5 lb	(3)	
OIL CAN POINTS		OIL, LUBRICATING: 5-gal drum as follows:			
	9150-265-9435 (2)	OE 30	1 qt	(3)	
	9150-265-9428 (2)	OE 10	I qt	(3)	
	9150-242-7603 (2)	OES	1 qt	(3)	
RADIATOR		WATER	28 qt		
		ANTIFREEZE: 1-gal can as follows:			
	6850-664-1403	Ethylene-glycol	18 qt	(5)	
		ANTIFREEZE: 55-gal drum as follows:			
	6850-174-1806	Antifreeze, arctic	28 qt		
TAG LINE		OIL, LUBRICATING, GEAR: 5-gal drum as follows:			
	9150-577-5844 (2)	GO-90	4 qt	(3)	
TANK, FUEL		FUEL, DIESEL: Bulk as follows:			
	9140-286-5294 (2)	DF-2 Regular	50 gal	(4)	
	9140-286-5286 (2)	DF-1 Winter	50 gal	(4)	
	9150-286-5283 (2)	DF-A Arctic	50 gal	(4)	

Page 4-7, paragraph 4-13b. In line 1, change "60/70 to "25/30".

Page 4-2. Paragraph 435b. 1 is added as follows:

b. 1. On-*Equipment Troubleshooting.*

(1) Remove the alternator terminal cover to expose the positive output terminal, and using a volt meter, check the voltage between this terminal an ground. The ignition switch should be on when this check is made. Full battery voltage should be indicated. If no voltage is indicated between the positive alternator terminal and ground, an open circuit between the positive alternator and battery is indicated. This may be due to loose or broken wiring, or possibly a defective ignition switch, circuit breaker or ammeter.

(2) Full battery voltage must be present at both alternator terminals in order for the vehicle to function properly.

(3) Do not, under any circumstances, attempt to run the alternator with its output circuit open and its ignition lead energized. This will create extremely high voltages which will seriously damage the alternator.

(4) The high-low top is not adjustable and should not be changed. If batteries show indication

of over or under charging, adjustment should be made in the following manner.

(a) Connect voltmeter across positive and negative terminals of the battery.

(b) Start engine and run at 1000-1500 RPM Do not turn on external loads such as lights, healers, etc.

(c) Voltmeter should read 28.0 volts. If the reading is above or below this figure, voltage should be adjusted.

(d) Remove socket head pipe plug from drive end housing to gain access to voltage adjustment screw.

(e) Using a small screwdriver, turn the adjusting screw until 28.0 volts is indicated on the voltmeter. Turn screw counterclockwise to increase voltage and clockwise to decrease.

(f) After adjustment, replace plug.

Page C-1 Appendix C is superseded as follows:

APPENDIX C

BASIC ISSUE ITEM LIST AND ITEMS TROOP INSTALL OR AUTHORIZED

Section I. INTRODUCTION

C-1. Scope

This appendix lists basic issue items, items troop installed or authorized which accompany the crane shovel, and are required by the crew/operator for operation, installation, or operator's maintenance.

C-2. General

This basic issue items, items troop installed or authorized list is divided into the following sections

a. Basic Issue Items List-Section II. No applicable.

b. Items Troop Installed. or Authorized List – Section III. A list in alphabetical sequence of item which at the discretion of the unit commander may accompany the end item, but are NOT subject to be turned in with the end item.

C-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items List, Section II, and Items Troop Installed or Authorized, Section III.

a. Source, Maintenance, and Recoverability Code(s) (SMR): Not applicable.

b. Federal Stock Number. This column indicates the Federal stork number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required.

d. Unit of Measure (U/M). A 2-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. Quantity Authorized (Items Troop Installed or Authorized Only). This column indicates the quantity of the item authorized to be used with the equipment.

Section III. ITEMS TROOP INSTALLED OR AUTHORIZED LIST

(1) SMR Code	(2) Federal stock number	(3) Description Ref No. & Code / Usable on Code	(4) Unit of Meas	(5) Qty Auth
	7520-599-9618	CASE, Maintenance and Operating Manual	EA	1
	2590-045-9611	CASE, Rifle	EA	1
	4210-889-2221	EXTINGUISHER, Fire	EA	1

By 0rder of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25B (qty rqr block No. 921) operator maintenance requirements for Crane Shovel, Crawler, 10-20 Ton.

TECHNICAL MANUAL
No. 5-3810-289-12

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 13 *March 1970*

OPERATOR AND ORGANIZATIONAL MAINTENANCE MANUAL
CRANE-SHOVEL, CRAWLER MOUNTED; 12½-TON, 3/4CU YD; DIESEL ENGINE DRIVEN (BUCYRUS-ERIE MODEL 22BM)
FSN 3810-869-3092

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List of Illustrations

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* This manual supersedes Operator and Organizational maintenance portion of TM 5-3810-289-15, 3 July 1968.

LIST OF ILLUSTRATIONS

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual contains instructions for us by personnel to whom model 22BM crane-shove is issued. It provides information on operation preventive maintenance checks and services, an, maintenance and repair of equipment, accessories components, and attachments. Also included are descriptions of main units and their functions ii relationship to other components. Numbers ii parentheses following nomenclature callouts or illustrations indicate quantity; numbers preceding nomenclature callouts indicate preferred sequence.

b. Instructions for Administrative Storage an Destruction of Materiel to Prevent Enemy Us are contained in the following technical manuals

TM 740-90-1 Administrative Storage of equipment
TM 750-244-3 Destruction of Materiel to Prevent Enemy Use

1-2. Maintenance Forms and Records

Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

1-3. Reporting of Errors

Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commanding General, U. S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Boulevard, St. Louis, Mo. 63120.

Section II. DESCRIPTION AND DATA

1-4. Description

a. General. The model 22BM crane-shovel (fig.1-1 and 1-2) is a crawler-mounted lifting crane which can be converted to a dragline, clamshell backhoe, shovel, or pile driver. The lifting crane consists of a 30-ft, two-section boom, a 121/2-ton capacity hook block, and associated cables. The boom can be lengthened by the addition of sections between the upper and lower boom section In addition, a jib can be added to the end of the upper boom assembly. The lifting crane can be used for unloading heavy cargo, placing steel beams in construction work, and other heavy lifting jobs. Load control afforded by the regular hoist line is supplemented by an independent boom hoist. Full power control of both raising and lowering the boom permits accurate spotting of the load in the horizontal as well as the vertical plane

b. Basic Crane-Shovel. The basic crane-shovel is divided into three sections: the front end equipment, the upper works, and the lower works.

(1) The front end equipment consists of the crane, dragline, clamshell, backhoe, pile driver, and shovel components.

(2) The upper works consist of the revolving frame, main machinery, engine, operating controls, and the operator's cab. The necessary controls and instruments provided for operating the crane-shovel are located in the operator's compartment, in front of and to the left of the operator's seat.

(3) The lower works consist of the steering and propelling machinery, truck frame, crawler frames, track rollers and idlers, and the track belts.

c. Dragline. The dragline consists of the crane boom, fairlead, dragline bucket, and the hoist and drag cables. The fairlead assembly is mounted inside the lower section of the boom feet to guide the bucket drag cable. The dragline is used for excavating materials below machine level.

d. Clamshell. The clamshell consists of the crane boom, clamshell bucket, and tagline. The

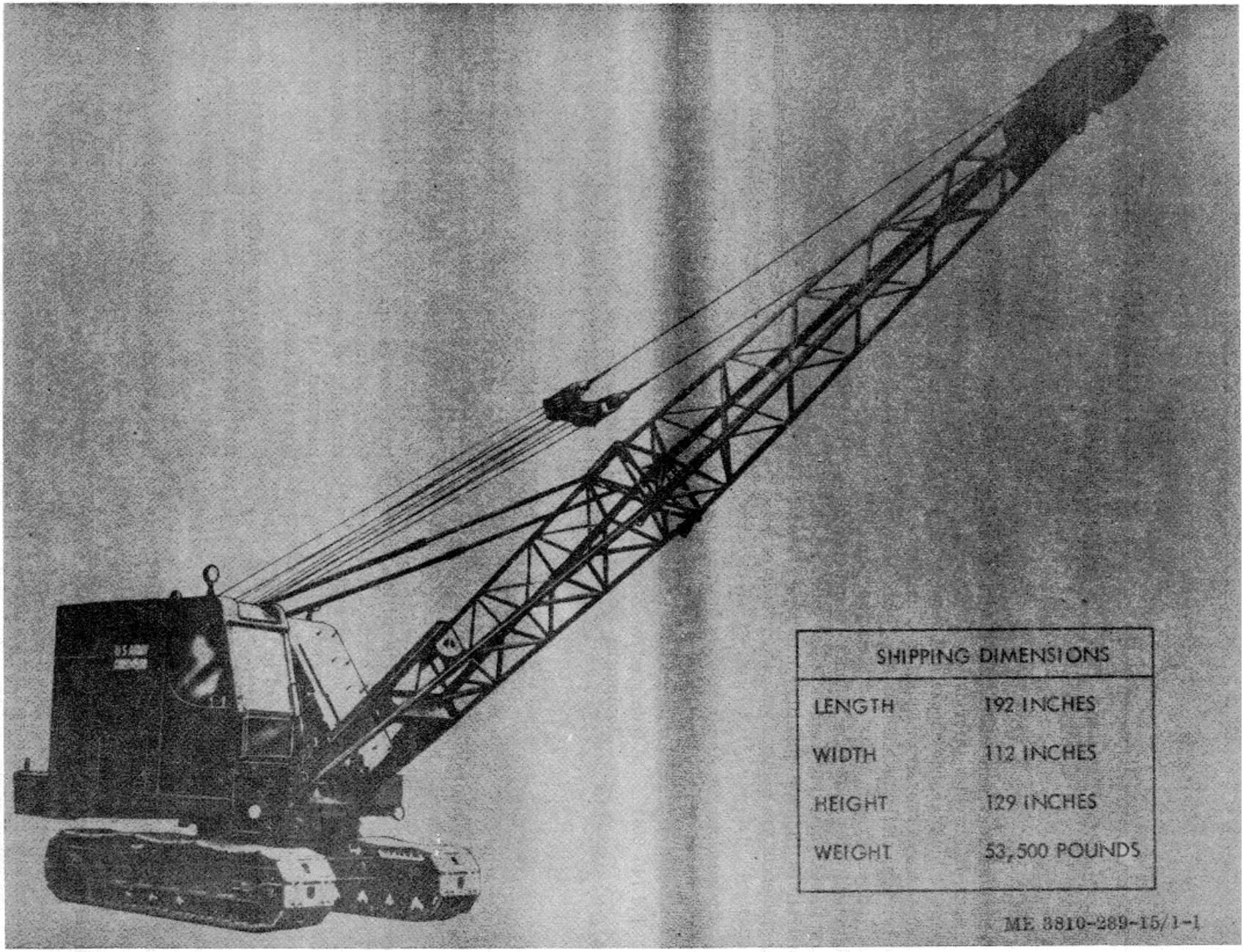


Figure 1-1. Right front view of model 22BM crane-shovel.

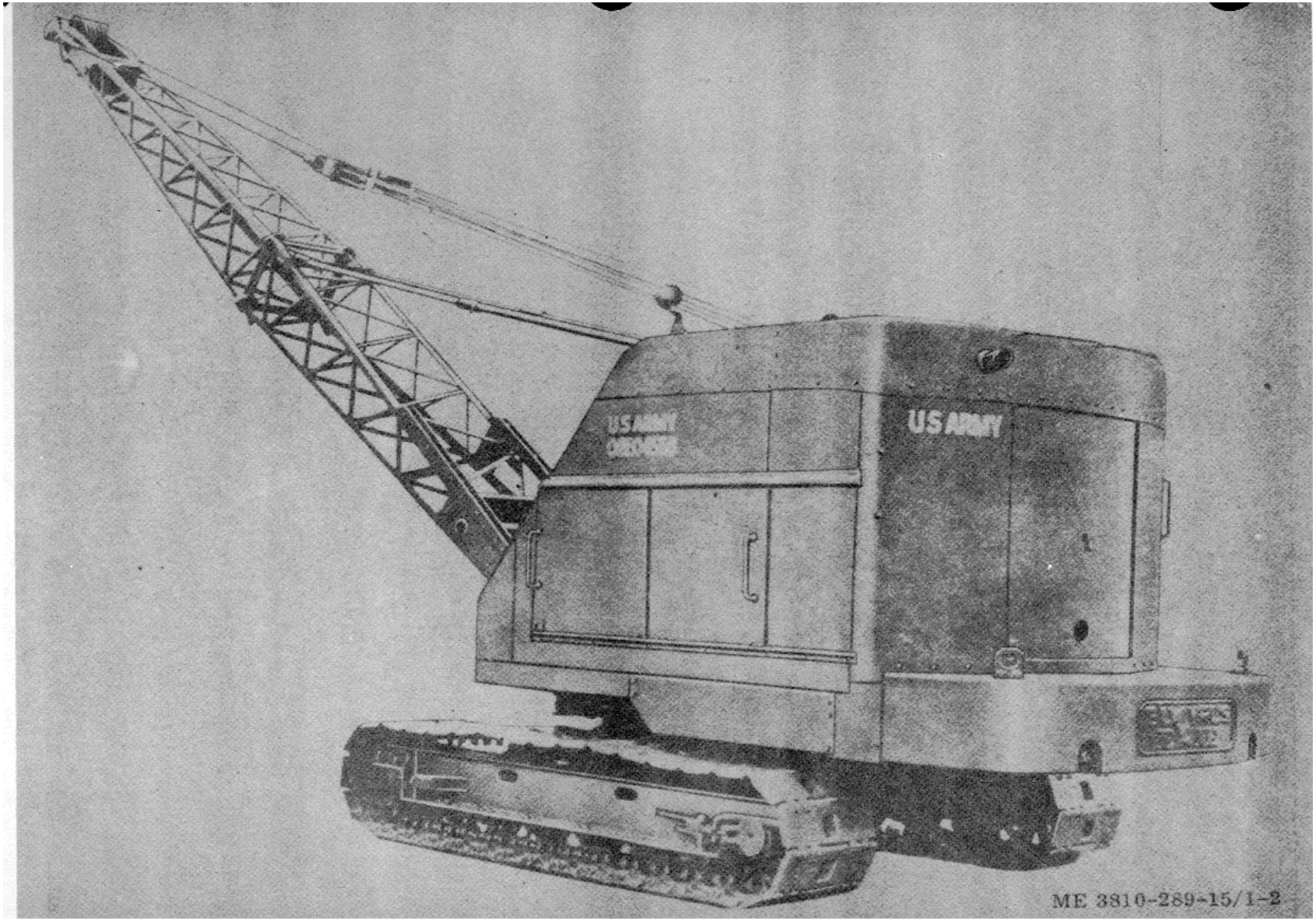


Figure 1-2. Left rear view of model 22BM crane-shovel.

clamshell may be equipped with teeth for excavating, or without teeth for rehandling material in a stock pile. The tagline prevents bucket oscillation during operation.

e. Backhoe. The backhoe consists of the 'backhoe boom, dipper, dipper handle, and an auxiliary A-frame. The dipper handle is hinged at the point to allow scoop action by the dipper as pulled in toward the boom. The digging a of the backhoe is opposite that of the shovel.

f. Shovel. The shovel consists of a shovel boom dipper, dipper handle, and a dipper trip mechanism. A shipper shaft and saddle block mounted midway in the boom, holds and guides the dipper handle. The shovel is used for scooping away from the machine.

g. Piledriver. The piledriver uses the boom. Hammer leads are attached to the point to hold the pile in driving position and the hammer. The hammer leads consist of or section and four lower sections, comprising foot pile-driving lead assembly. The top section is fifteen feet long. Each of the four lower sections is ten feet long. The lead assembly can be used all drop hammers weighing up to 3,000 pounds and with all air, steam, or diesel hammers weighing up to 12,000 pounds. It is adaptable power-excavator-crane-shovels listed in STD-179-8, tables I, II, and III**.** At the end of the lead assembly, a catwalk attached between brackets on the boom foot and lower section holds the lead assembly in driving position. The catwalk assembly consists of two changeable outer sections, each 7 feet, 8 inches long, and one telescoping inner section, 8 feet long.

h. Power. Power to operate the crane-shovel is supplied by a 6-cylinder, 4 cycle, naturally-aspirated diesel engine. The power is transmitted from the engine, through the power takeoff unit, the chain drive transmission, to the main machinery controlling the crane-shovel operations.

1-5. Identification and Tabulated Data

a. Identification.

(*1) Crane-shovel.* The plate indicate make, model, serial number and other basic information about the crane-shovel.

(*2) Transportation data plate.* The contains transportation information regarding shipment of the crane-shovel.

(3) tipper section plate. The plate identifies the proper upper boom section to be used with a particular unit, as called out by a serial number on the plate.

(4) Lower section plate. The plate identifies the proper lower boom section to be used with a particular unit, as called out by a serial number on the plate.

(5) Cold starting plate. The plate gives instructions on starting in cold weather.

b. Tabulated Data.

(*1) Crane-shovel.*

Manufacturer	Bucyrus-Erie Co.
Model	22BM
Type	Crawler mounted
Serial numbers	129566-129742 129905-130081 131944-131963 132052-132151

(*2) Engine.*

Manufacturer	Cummins
Model	JN-6-1
Number of cylinders	6
Type of engine	Diesel
Cycle	4
Unit	Fan to flywheel
Bore (in.)	4% in.
Stroke (in.)	5 in.
Displacement (cu. in.)	401
Compression ratio	16.3 : 1
Type drive	Mechanical
Type air intake	Naturally aspirated
Altitude-range (ft.)	0-5000+107'F
Rotation	Counterclockwise
Cooling	Liquid
Fuel	Diesel fuel oil
Exhaust valve opens	62° BBC
Exhaust valve closes	44° ATC
Intake valve opens	44° BTC
Intake valve closes	40° ABC
Gross 3 HP	101
Lubrication	Pressure
Firing order	1-5-3-6-2-4

(3) Starting motor.

Manufacturer	Leece-Neville
Model	M001093018
Volts	24
Mfg. No.	186763

(*4) Accessories.*

(a) Alternator.

Make	Leece-Neville
Model	A001300ZAC
Amps	60
Mfg. No.	183380

(b) Air cleaner element.

Make	Donaldson
Model	FWA08-0022
Type	Dry

(c) Governor.

Make ---------- Cummins
Type ---------- Mechanical variable speed

(d) Fuel injector.

Make ---------- Cummins
Model ---------- PT

(e) Fuel pump.

Make ---------- Cummins
Model ---------- G

(f) Fuel filter.

Make ---------- Fram
Model ---------- FRM-1826

(g) Batteries.

Make ---------- MIL-STD-MS 35000-3
Type ---------- 6 TH (dry charge)
Volts ---------- 12
Qty ---------- 4 ea

(5) Capacities.

(a) Engine.

Crankcase ---------- 16 quarts
Oil filter ---------- 4 quarts
Fuel tank ---------- 50 gallons
Fuel filter ---------- 3 quarts
Coolant system ---------- 7 gallons

(b) Crane-shovel.

Transmission gear case ---------- 3 quarts
Machinery gear case ---------- 8 gallons
Propel gear case ---------- 2 quarts

(6) Adjustment data. Refer to the appropriate chapter and paragraph for the adjustment of specific components.

(7) Settings.

Thermostat full open ---------- 195’

(*8) Nut and bolt torque data.* Refer to appropriate paragraph for nut and bolt torque data.

(9) Maximum allowable lifting loads. Refer to figure 1-3 for crane boom angles.

Table 1-1. *Operating Ranges*

Boom length In feet	Radius in feet	Boom angle in degrees	Boom point pin height	Crane service
30	12	73	33’ 6"	25,000
	15	67	32’ 6"	19,000
	20	57	29’ 9"	12,9000
	25	44	25’ 6"	9,600
	30	28	18’ 6"	7,600
40	12	78	43’ 9"	24,800
	15	73	42’ 9"	18,800
	20	66	41’ 0"	12,700
	25	57	38’ 3"	9,400
	30	48	34’ 6"	7,350
	35	38	29’ 3"	6,000
	40	24	21’ 0"	5,000
50	15	77	53’ 3"	18,600
	20	71	51’ 9"	12,400
	25	65	49’ 9"	9,200
	30	58	47’ 0"	7,150
	35	51	43’ 6"	5,750
	40	43	38’ 9"	4,750
	50	21	23’ 0"	3,400
60	20	74	62’ 3"	12,200
	25	69	60’ 6"	8,950
	30	64	58’ 6"	6,900
	35	58	5 5’ 9"	5,550
	40	53	52’ 3"	4,500
	50	39	42’ 6"	3,150
	60	20	24’ 9"	2,300

Note. The preceding ratings apply only to machines that are level and standing on hard level uniform supporting surfaces. Loads must be freely suspended. The radii specified are loaded radii. Ratings include blocks, hooks, slings, or other equipment used in handling loads. Proper care must be exercised by the operator at all times to avoid shock or side loadings on the boom. Loads do not exceed 75% of tipping loads with the machine in the least stable position. Loads shown in table 1-1 are for general crane service with the machine on firm, level ground. Maximum boom angle is 78%.

(10) *Recommended hoist tackle.*

Loads over	7,000	13,500	19,000
Parts of line	2	3	4

Deduct weight of hook blocks, hooks and from listed loads:

12%-ton double sheave swivel hook block

---- weighs---------- 195 lbs

(11) *Jibs.* Use jibs for lifting crane service only. Allowable loads on main boom sheave, jib is attached, must be reduced as follows

15 ft jib ---------- 800 lbs.

The allowable load over the jib sheave, at any radius from centerline of rotation of the machine, is the same load that may be lifted over the boom sheave (without jib) with boom lowered to that radius, but not to exceed 7,500 lbs. Maximum length of boom to which a jib may attached is 60 ft.

(12) *Machine equipment.* Structural steel angle boom: 7,000 lbs. of outside counterweight.

(a) Hook block.

Capacity ---------- 12.5 tons
Weight ---------- 195 lbs

(b) Wire rope specification.

Pendant (2) ---------- 1 in. dia. x 15 ft
Tackle rope ---------- 1/2 in. dia. x 211 ft
Hoist rope ---------- See table 4-2

(c) Wiring diagram. Refer to figure 1-4.

(d) Shipping dimension and weights. Refer to figure 1-1. Bridge weight classification is 27.

1-6. Difference in Models

This manual covers only the model 22BM crane-shovel. No known unit differences exist for the model covered by this manual.

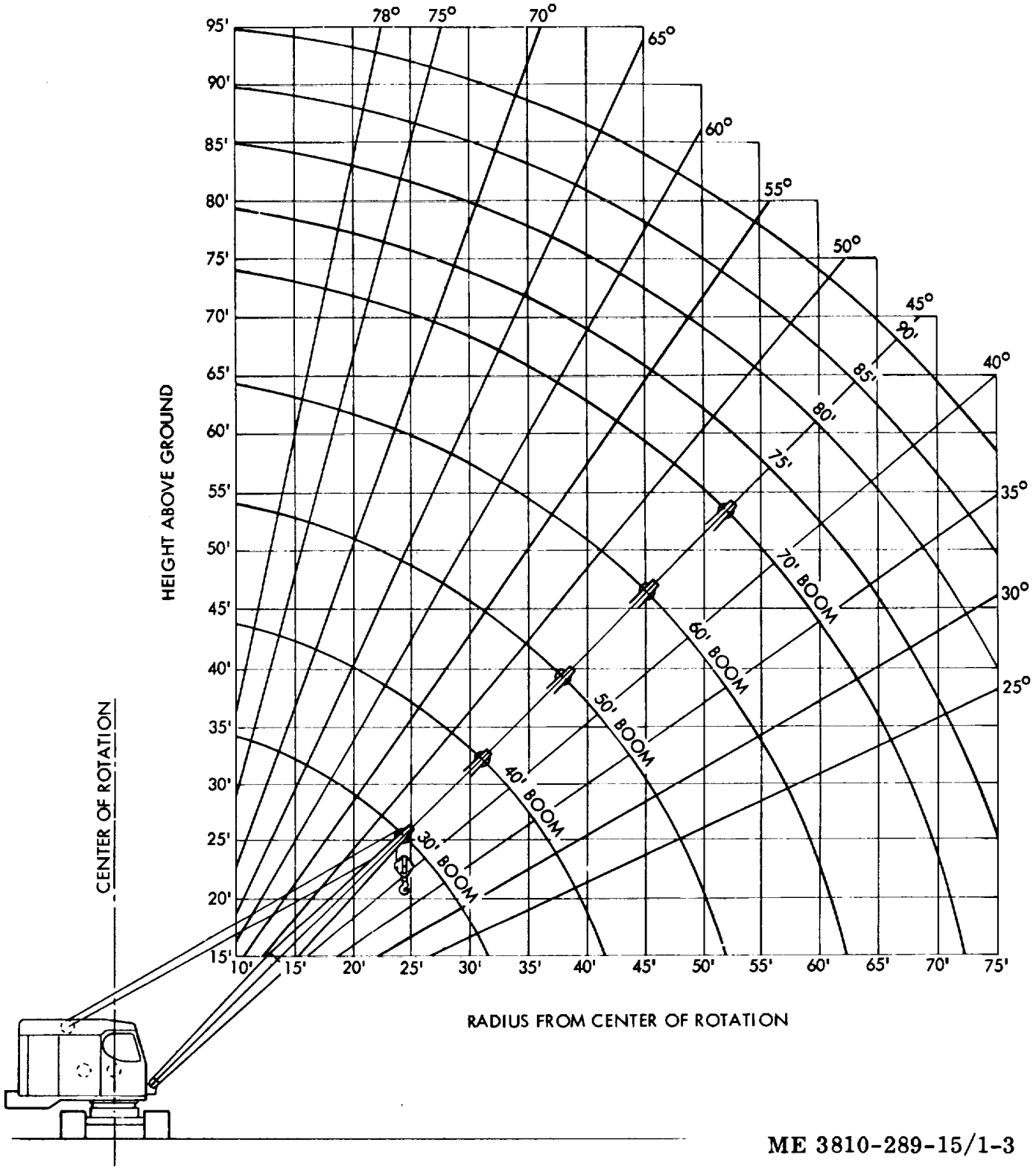


Figure 1-3. Crane boom angle chart.

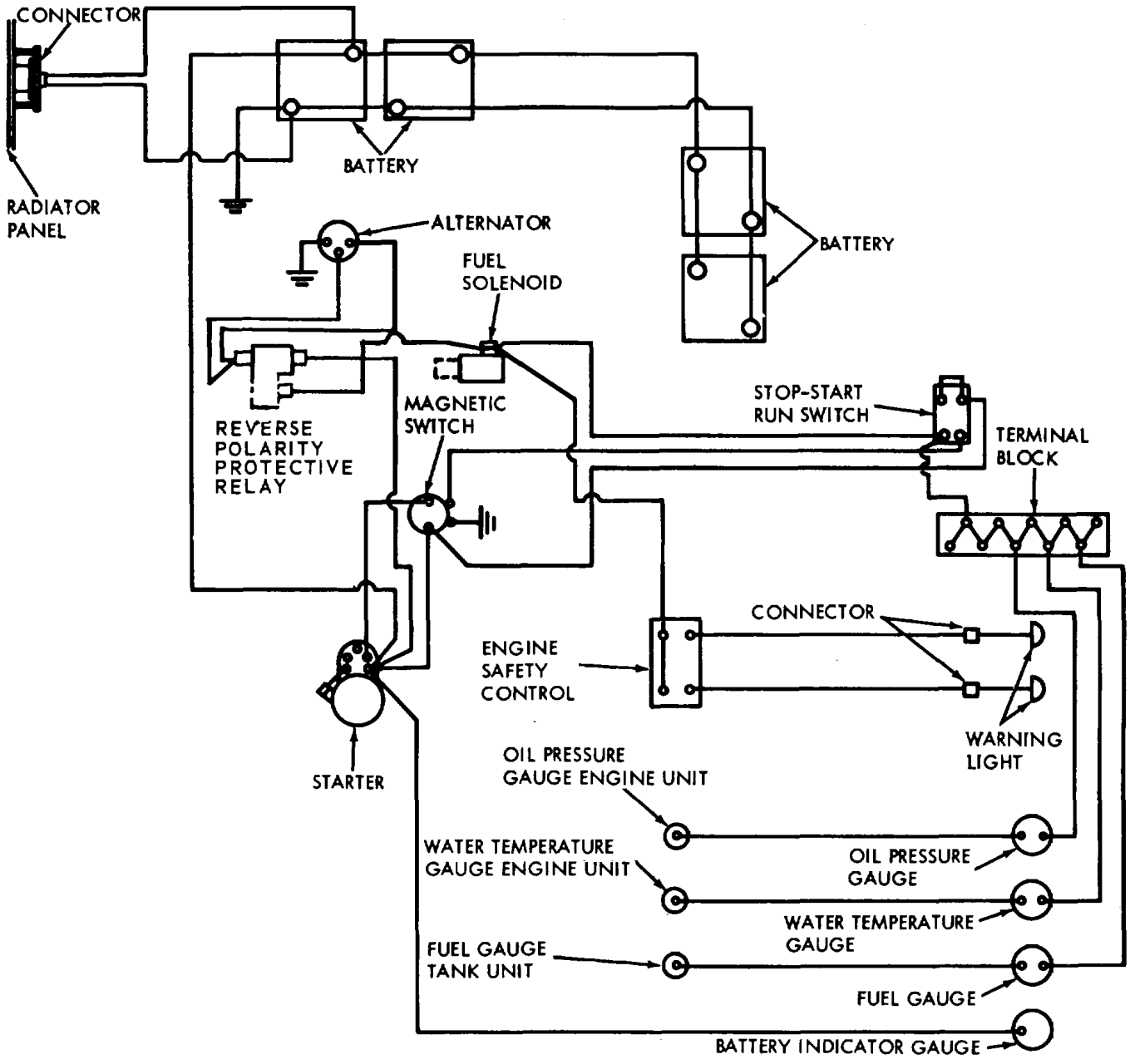


Figure 1-4. Electrical system, schematic diagram (sheet 1 of 2).

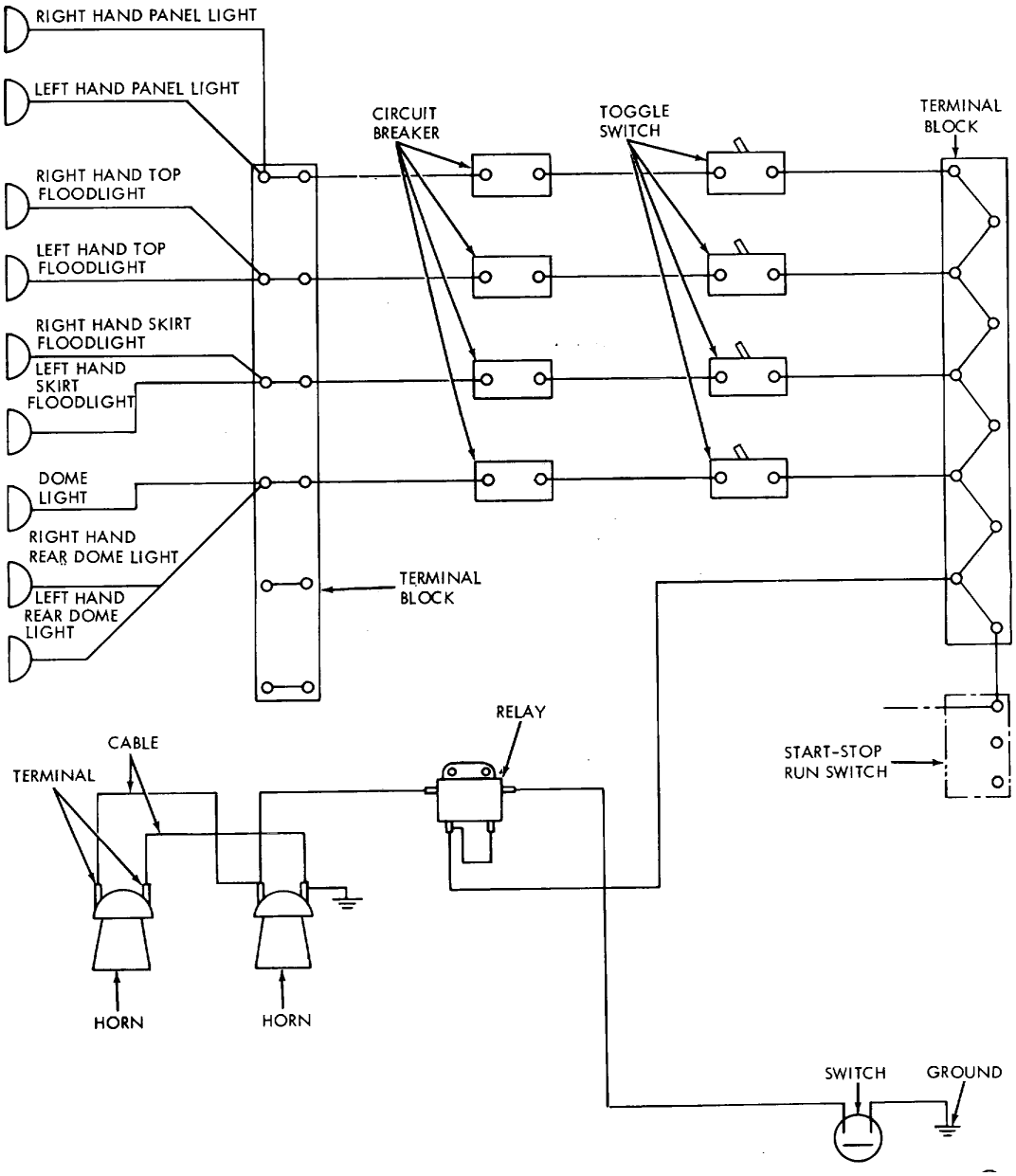


Figure 1-4. Electrical system, schematic diagram,. (Sheet 2 of 2).

CHAPTER 2
OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIEL

2-1. Inspecting and Servicing the Equipment

a. General. When a crane-shovel unit is received by the organization, it must be thoroughly inspected and serviced to insure that it is in good operating condition.

b. Inspecting the Equipment.

(1) Make a complete visual inspection to make sure the required tools, repair parts, and publications are with the equipment.

(2) Inspect the unit for missing items or damage that may have occurred during shipment.

(3) Inspect all components for loose mounting hardware or connections.

(4) Inspect wiring, fuel and oil lines, radiator and hoses, gages and instruments and lights, for missing items, and broken, loose, or damaged parts.

(5) Inspect engine compartment for loose missing parts, or damage to air cleaner, manifold, muffler, fuel pump, or fuel lines.

(6) Inspect fuel tank filler pipe for de cracks, or other damage. Insure removal of preservative or barrier material.

(7) Inspect battery installation for tightness of cables, level of electrolyte, and for pro connection.

Note. The crane is wired with a negative ground.

(8) Inspect drain plubs, filler caps, and drain cocks, to be sure they are secured and not leak or damaged.

(9) Inspect cab for broken windows or d glass.

(10) Inspect floodlights for serviceability, and test operation of switches on control pan

(11) Inspect all controls for freedom movement through operating range, and m sure all handles or knobs are in place.

(12) Report all discrepancies to pro authority.

c. Servicing the Equipment. After the equipment has been unpacked and separately packed components have been installed (para 2-2), equipment must be serviced as follows:

(1) Perform the necessary preventive maintenance checks and services (para 3-6).

(2) Lubricate the crane-shovel in accordance with current lubrication order and paragraph 3-4.

(3) Fill engine crankcase with oil as specified in lubrication order.

Caution: **Connect negative connection last when installing batteries.**

(4) Connect the battery cables (fig. 2-1).

(5) Remove filler caps and check electrolyte level. It should be approximately 3/8 inch above the cell plates. Add distilled water if necessary.

Note. **Batteries may be shipped separately or installed dry charged, with electrolyte shipped separately.**

(6) If the unit is received with dry-charge batteries, service as follows:

Warning: **Exercise care when filling batteries with electrolyte to prevent splashing or spilling the acid on clothing and body. Do not smoke or use open flame in the vicinity. Batteries generate explosive gas during charging.**

(a) Remove box cover and filler caps.

(b) Pour electrolyte into each battery cell to a depth of 3/8 inch above the separators.

(c) Install the filler caps and battery box cover.

(7) Service cooling system (TB 750-651) with water or proper mixture of antifreeze solution. For cold weather operation requirements, refer to paragraph 2-23.

(8) Fill the fuel tank.

2-2. Unpacking Separately Packed Components

a. The following items are packed in watertight boxes. Use care in removing covers from boxes so that damage is not incurred in unpacking.

(1) Hook block.

(2) Pendant bridle.

(3) Boom angle indicator.

(4) In addition, the counterweight will be shipped disassembled from the crane-shovel.

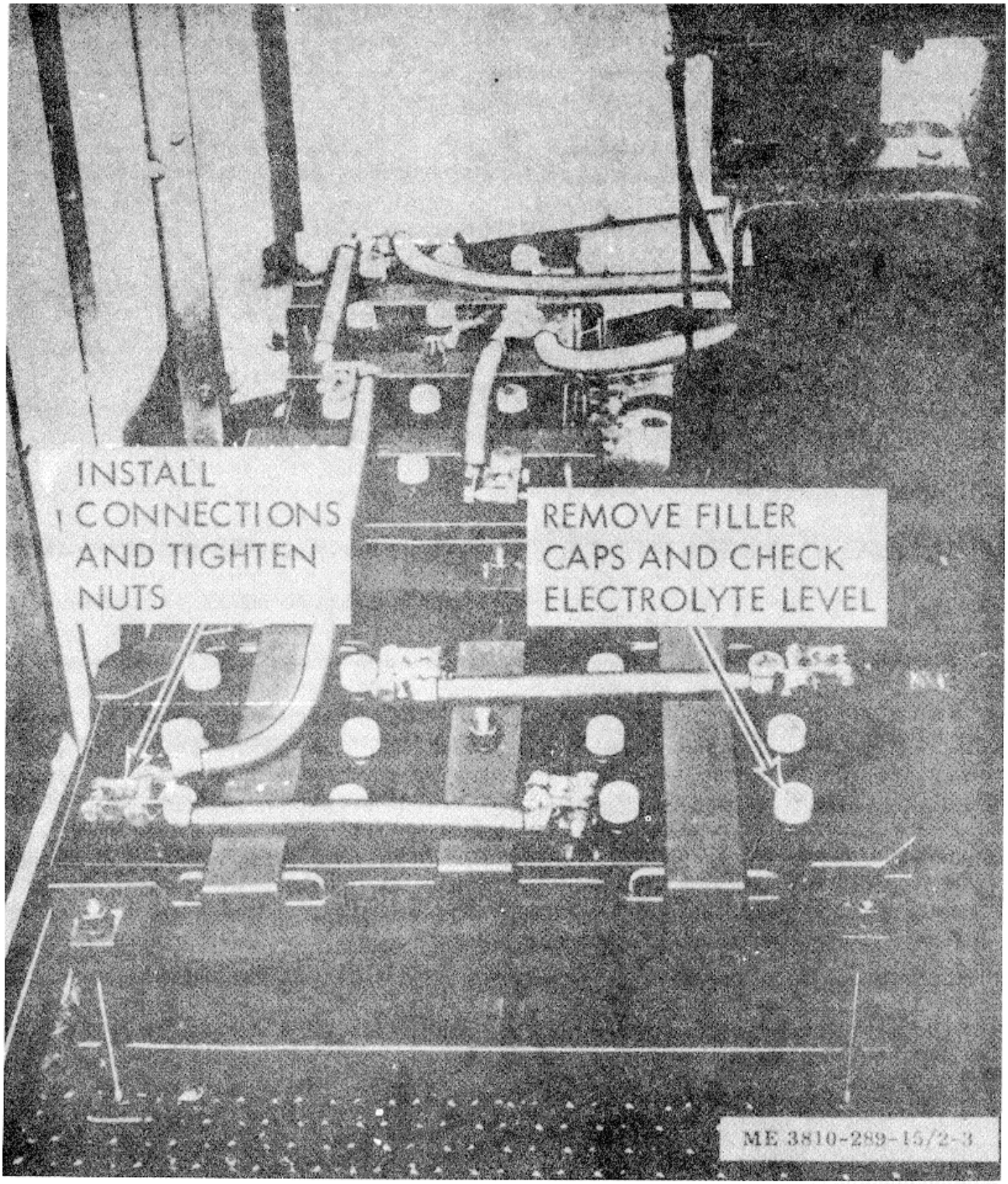
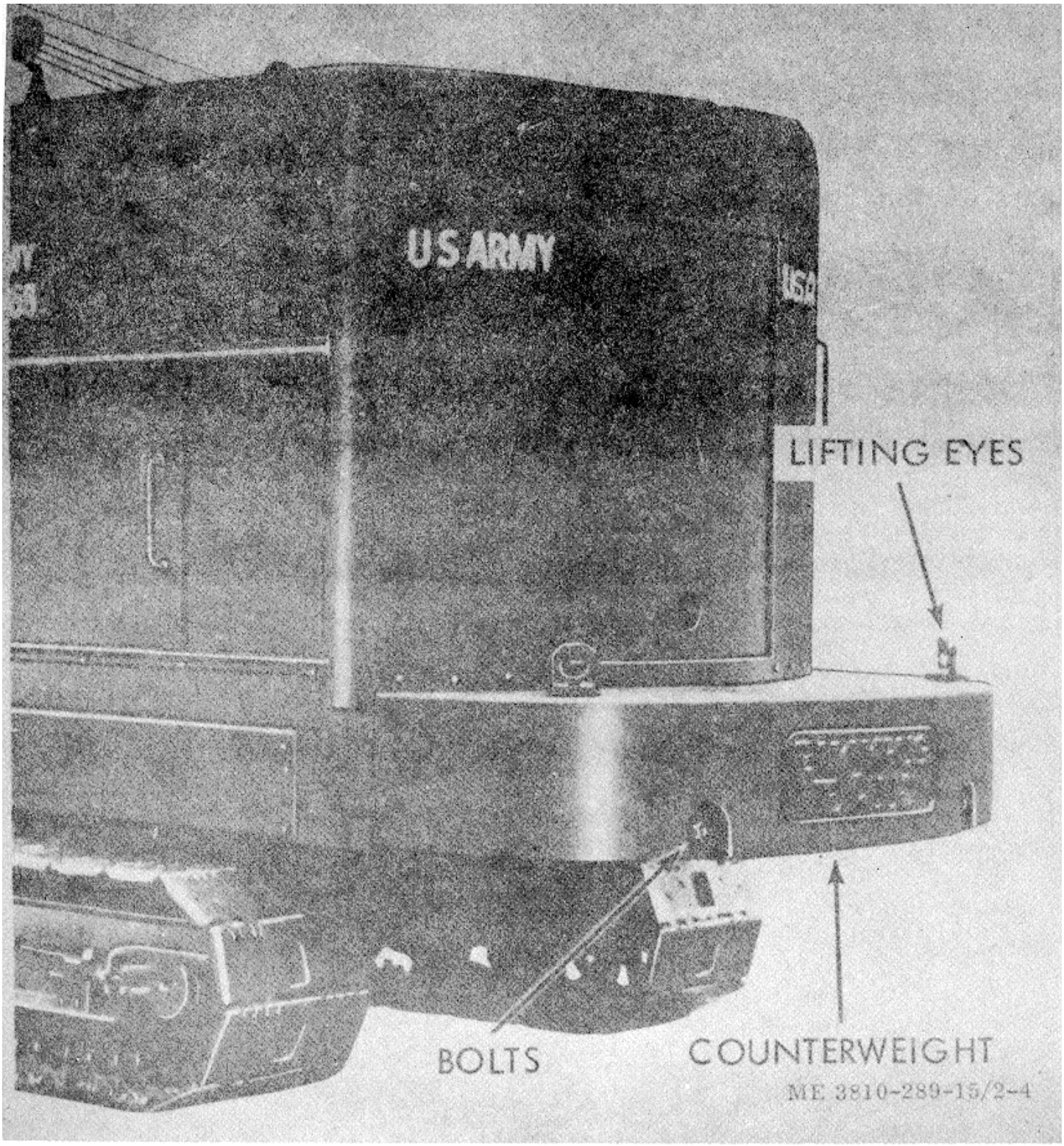
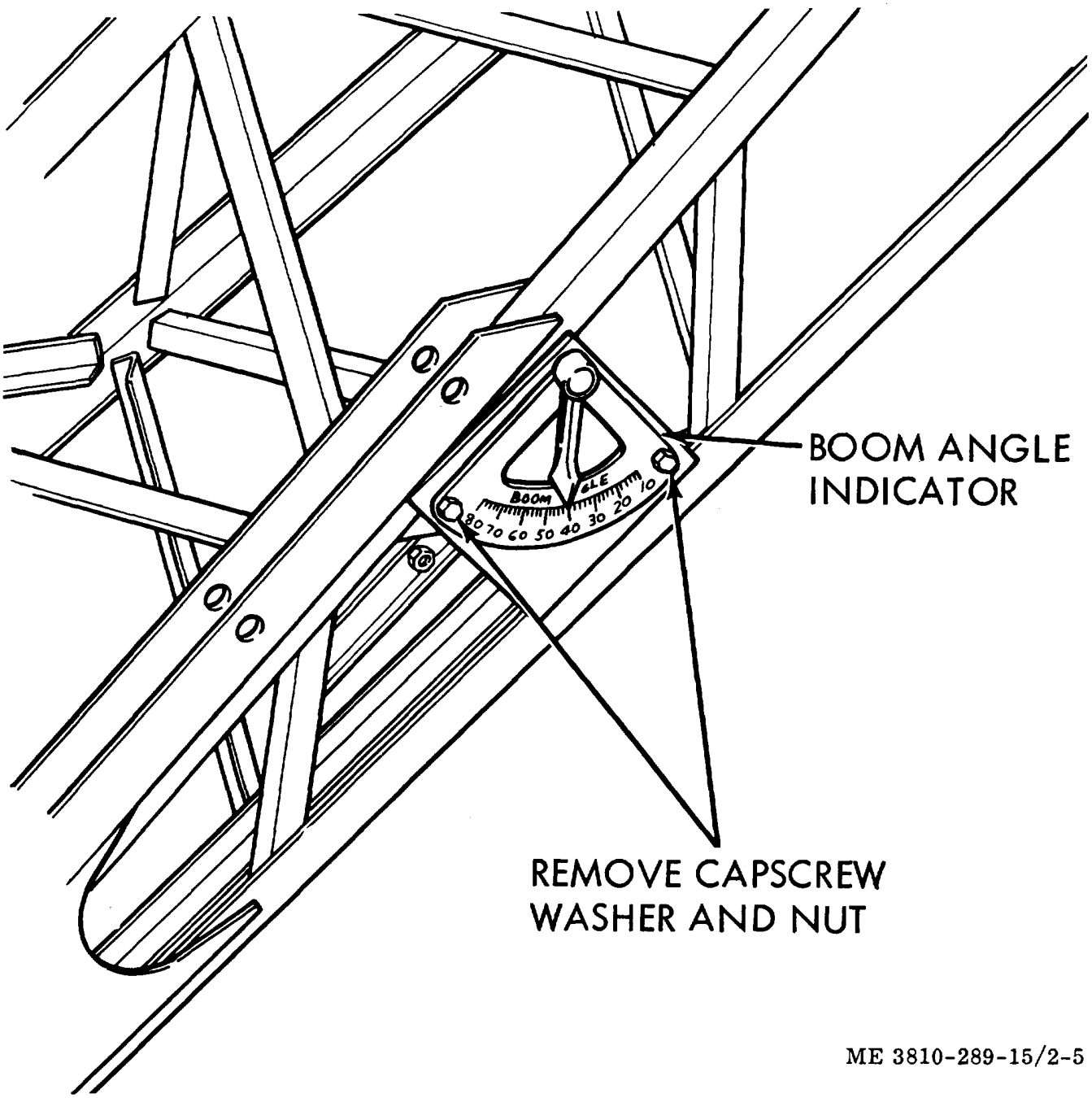


Figure 2-1. Battery cable connection



Counterweight.

Figure 2-2. Installation of counterweight and boom angle indicator (sheet 1 of 2).



Boom angle indicator.

Figure 2-2. Installation of counterweight and boom angle indicator (sheet 2 of 2).

b. Inspect the equipment against the packing list. Report discrepancies to proper authority.

2-3. Installation or Setting Up Instructions

a. Installation of Separately Packed Components.

(*1) Counterweight.* Install the counterweight into position at the rear of the cab as shown in figure 2-2.

Caution: **The counterweight weighs 700 pounds. Use suitable hoisting equipment and caution when installing.**

(*2) Boom.* Refer to paragraph 4-56 for boom installation.

(*3) Boom angle indicator.* Refer to figure 2-2 and assemble the boom angle indicator to the lower boom section.

(*4) Hook block.* Refer to paragraph 4-55 for hook block installation.

b. Setting Up Instructions for Crane Operation

(*1) Description of equipment required.* Refer to paragraph 1-4.

(*2) Installation of separately packed components.* Refer to paragraph *a.,* above.

(*3) Operating levers.* Refer to figure 2-3 (A) and change operating lever linkage, if not in correct configuration, as follows:

*(*a) Set levers to neutral.

(b) Remove pin securing reach rod (5) to lever (3); remove reach rod (5), place or lever (4) and install pin.

(c) Remove capscrews (10) securing lever extension (8) to short lever extension (6) Insert capscrew (10) through short lever (9) and secure lever extension (8) to short lever (9)

(d) Middle lever (1) now controls real drum reach rod (5) and hoist lever (2) controls front drum reach rod (7).

(*4) Operating pedals.* Refer to figure 2-4 (B) and change operating pedal linkage, if not in correct configuration, as follows:

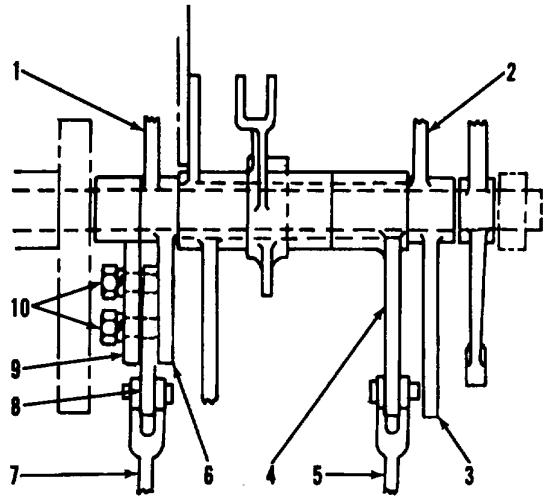
*(*a) Disconnect long reach rod (2) and short reach rod (1) at brake pedals. Remove levers (6) and (7) from shafts (3) and (4) by loosening clamping bolts. (8).

*(*b) Remove spacer from shaft (3) and install on shaft (4).

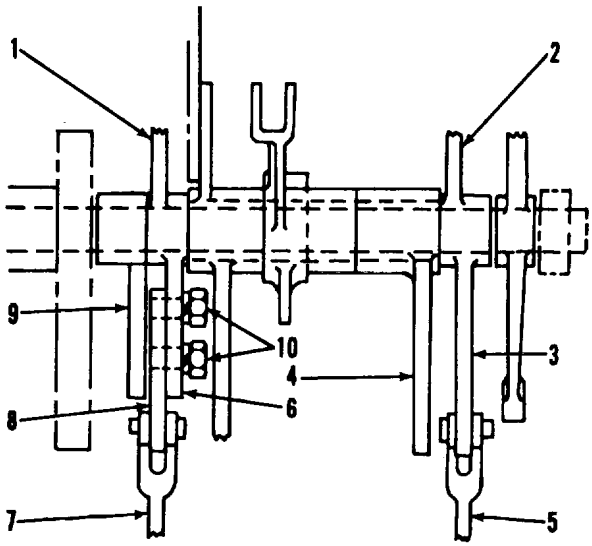
(c) Install lever (6) on shaft (3) and lever (7) on shaft (4). Tighten clamping bolts (8).

*(*d) Connect long reach rod (2) and short reach rod (1) to brake pedals.

(e) Right pedal controls front drum brake and left pedal controls rear drum brake.



A. CRANE, DRAGLINE, CLAMSHELL AND BACKHOE OPERATING LEVER CONFIGURATION.



B. SHOVEL OPERATING LEVER CONFIGURATION.

ME 381028912/23

1 Middle lever
2 Hoist lever
3 Short lever
4 Lever
5 Rear drum reach rod
6 Short lever extension
7 Front drum reach rod
8 Lever extension
9 Short lever
10 Capscrews

Figure 2-3. Operating levers.

(5) Crowd clutch linkage. Refer to figure 2-5 (B) and change crowd clutch linkage, if not in correct configuration, as follows:

*(*a) Disconnect reach rods (2) and (3) by removing cotter pins (7) and pins (6).

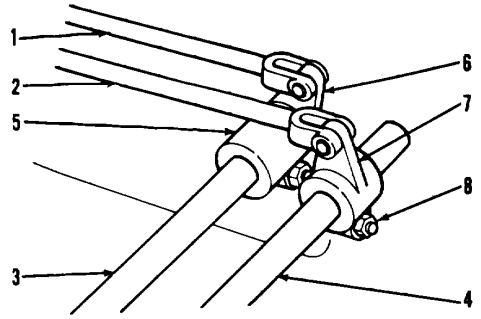
(b) Turn bellcrank (1) to correct position.

(c) Connect reach rod (3) by installing pin (6) and cotter pin (7).

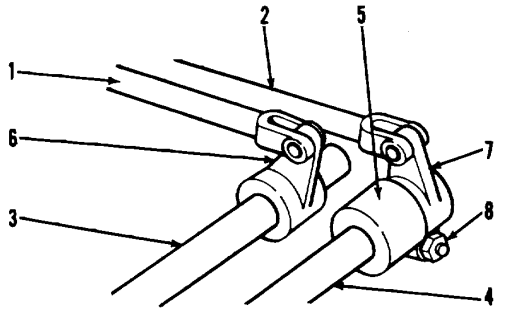
*(*d) Loosen locknut (5) 1/turn and remove reach rod (2).

(e) Swing clevis (4) to correct position.

*(*f) Install reach rod (2) and connect by installing pin (6) and cotter pin (7).



A. SHOVEL, BACKHOE, CLAMSHELL AND DRAGLINE OPERATING PEDAL CONFIGURATION

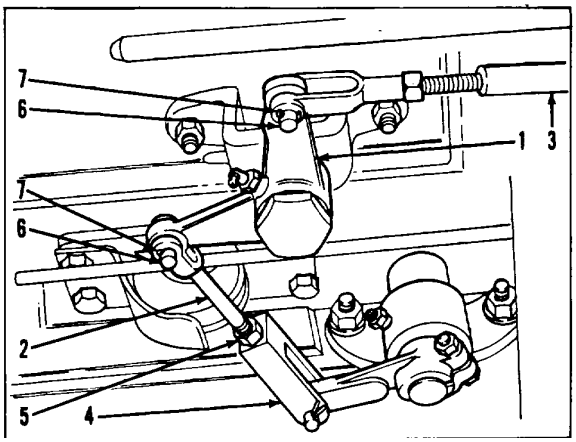


B. CRANE OPERATING PEDAL CONFIGURATION

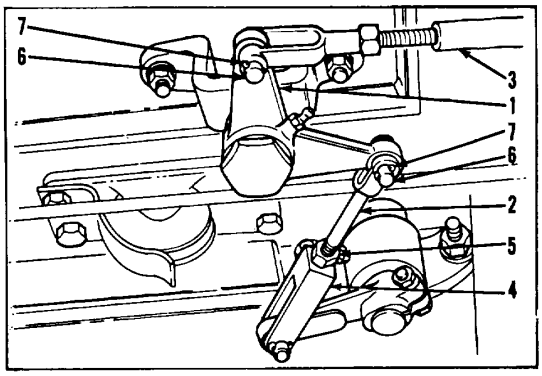
ME 381028912/2-4

1 Short reach rod
2 Long reach rod
3 Rear drum brake shaft
4 Front drum brake shaft
5 Spacer
6 Brake shaft lever
7 Brake shaft lever
8 Clamping bolts

Figure 2-4. Operating pedals.



A. SHOVEL CROWD CLUTCH LINKAGE CONFIGURATION.



B. CRANE, DRAGLINE, CLAMSHELL AND BACKHOE CROWD CLUTCH LINKAGE CONFIGURATION.

ME 381028912/2-5

1 Bell crank
2 Reach rod
3 Reach rod
4 Clevis
5 Locknut
6 Pin
7 Cotter pin

Figure 2-5. Crowd clutch linkage.

*(*g) Tighten locknut (5).

(6) Forward drum brakeband. Refer to figure 2-6 (A) and change band linkage, if not in correct configuration, as follows:

*(*a) Remove pins and adjusting bolt.

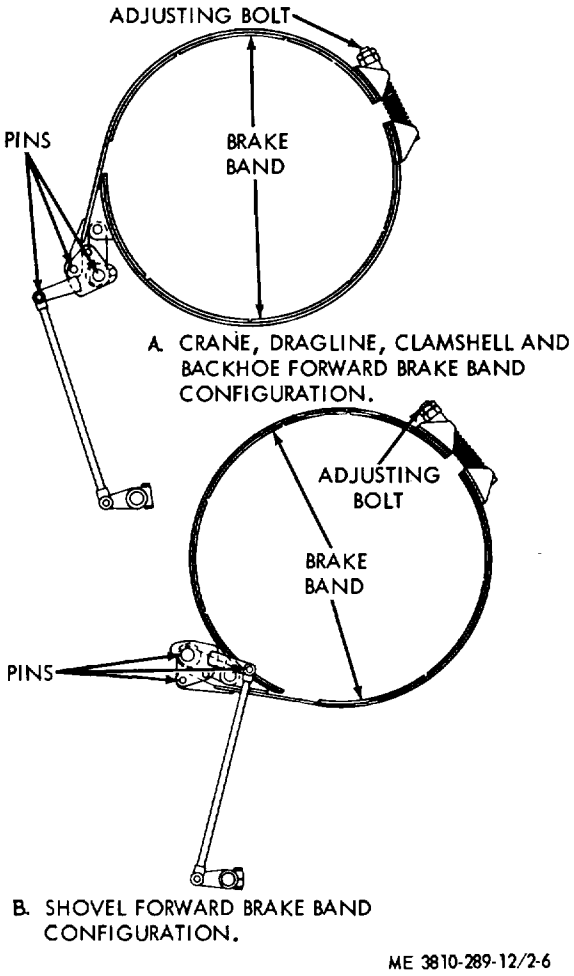
*(*b) Turn bellcrank over and interchange live and dead end halves of the band.

(c) Install pins and adjusting bolt.

(*7) Cable reeving.* Refer to paragraphs 4-54 and 4-55.

c. Jib Boom Installation.

(*1) General.* The basic components for jib boom installation are a 30foot boom, boom ex



ME 3810-289-12/2-6

Figure 2-6. Forward brakeband.

tension, jib strut, jib boom, and jib boom suspension cables. Maximum length of boom to which a jib may be attached is 60 feet.

(2) *Installation.*

(a) Install crane boom (para 4-56) and hook block (para 4-55).

(b) Secure jib strut to jib boom with pin and cotter pin as shown in figure 2-7.

(c) Position jib boom in the boom point supports and secure with the two pins, cotter pins, rod ends, lockwashers, and capscrews.

(3) *Cable reeving.*

(a) Secure lower jib support in the dead end socket in boom cable support; reeve it through the jib strut pulley and secure to deadend socket on other boom cable support. Position it in the proper hole to give desired jib boom angle.

(b) Reeve upper jib boom point support cable through the strut pulley. Secure the two ends of the cable to the two deadend sockets on jib boom point.

(c) Using proper length and size cable, reeve the jib boom cable by securing one end of righthand drum with the wedge. Reeve the cable between the boom pendant cables and the lower jib support cables, over the jib strut sheave, between the upper jib support cables and then over the jib boom point sheave.

(d) Secure weight hook to cable with cable clamps.

2-4. Equipment Conversions

The craneshovel is normally equipped as a lifting crane, but front end attachments are available for conversion to dragline, clamshell, backhoe and shovel (figs. 2-8 and 2-9), and piledriver front end operating units. Refer to paragraph 1-4 for description of front end equipment. The following paragraphs provide detailed instructions for converting the machine from a crane to any of the attachments available for use. If the machine is already equipped with other than a crane boom, refer to the applicable paragraph for removal instructions, and the applicable paragraph of the attachment being installed for the installation instructions.

2-5. Dragline Front End Conversion

a. *Installation.*

(1) *Operating levers.* Refer to paragraph 2-3b (3) for correct operating lever linkage configuration.

(2) *Operating pedals.* Refer to figure 2-4A and change operating pedal linkage, if not in correct configuration, as follows:

(a) Disconnect long reach rod (2) and short reach rod (1) at brake pedal levers.

(b) Remove levers (6) and (7) from brake shafts (3) and (4) by loosening clamping bolts (8).

(c) Remove spacer (5) from front drum brake shaft (4) and install on rear drum brake shaft (3).

(d) Install lever (6) on rear drum brake shaft (3). Install lever (7) on front drum brake shaft (4).

(e) Tighten bolts (10).

(f) Left pedal controls front drum brake and right pedal controls rear drum brake.

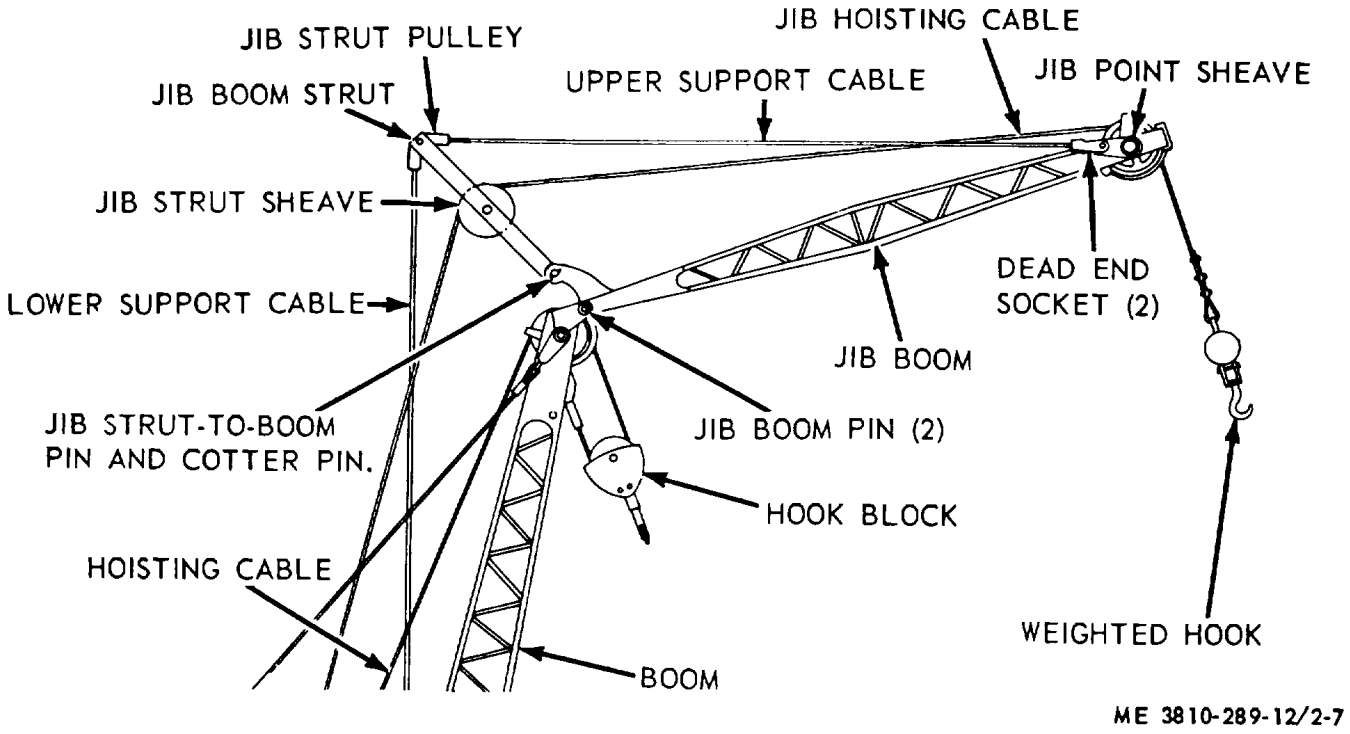


Figure 2-7. Jib boom cable reeving diagram.

(3) Crowd clutch linkage. Refer to paragraph 2-3b (5) for correct crowd clutch linkage configuration.

(*4) Forward drum brakeband.* Refer to paragraph 2-3b (6) for correct brakeband linkage configuration.

(*5) Boom installation.* Refer to paragraph 4-56 and install boom.

(*6) Dragline fairlead installation.* Refer to figure 2-10.

(*7) Dragline bucket installation.* Refer to figure 2-11.

(*8) Drag cable reeving.* Refer to figure 2-11.

*(*a) Refer to table 4-3 for correct cable length.

*(*b) Lead cable between fairlead sheaves.

(c) Attach end to right side of front drum.

*(*d) Attach other end to drag chain socket.

(9) Hoist cable reeving (fig. 2-11).

*(*a) Refer to table 4-3 for cable length.

*(*b) Lead cable over left boom point sheave.

(c) Attach end to right side of rear drum.

*(*d) Attach other end to dump sheave frame.

(10) *Suspension cable reeving.* Refer to paragraph 4-55.

(11) *Drag bucket.adjustment.*

Note. Drag chains are carried in low position for regular digging and in high position for deeper digging. Install drag chain clevis as required (fig. 2-12).

*(*a) Remove clevis pin locking pin.

*(*b) Remove clevis pin.

(c) Separate clevis from wearing ring.

(d) Turn clevis over and replace in wearing ring.

Note. Clevis must be reversed to prevent twisting in wearing ring.

(e) Attach clevis to drag bucket.

b. Removal. Removal procedure is reverse of installation, a above.

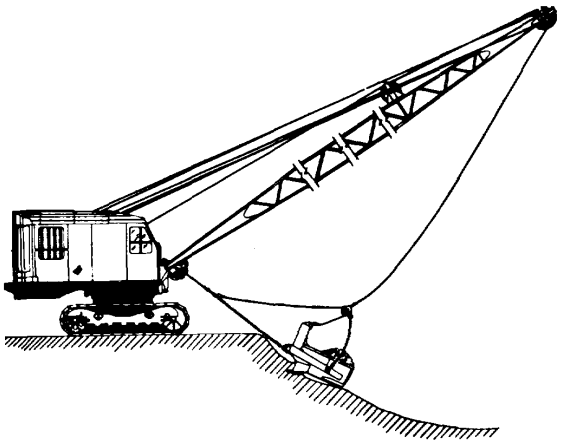
2-6. Clamshell Front End Conversion

a. Installation.

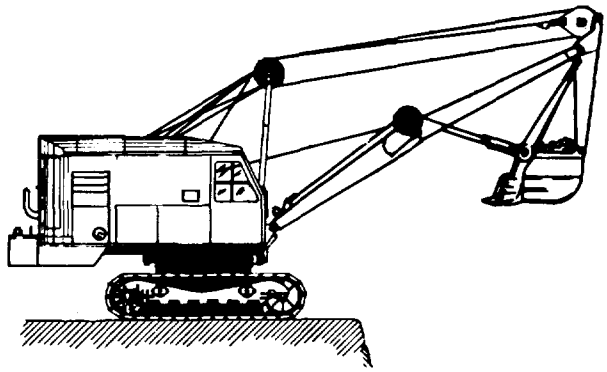
(*1) Operating levers.* Refer to paragraph 2-3b (3).

(*2) Operating pedals.* Refer to paragraph *2-5a* (2)

(*3) Crowd clutch linkage.* Refer to paragraph 2-3b (5).



A. DRAGLINE



A. BACKHOE

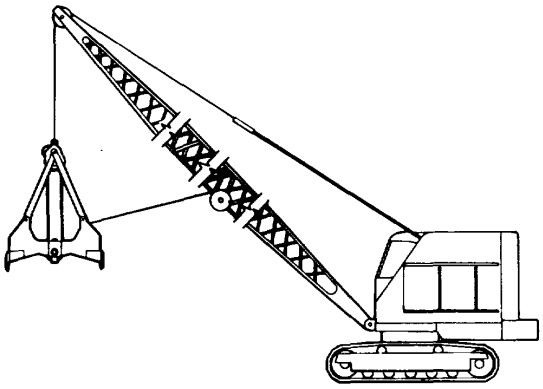


Figure 2-8. Dragline and clamshell front end attachment.

(4) Forward drum brakeband. Refer to paragraph 2-3b (6)

(5) Boom installation. Refer to paragraph 4-56.

(6) Boom extension. Refer to paragraph 4-56.

(7) Tagline unit installation. Refer to figure 2-13.

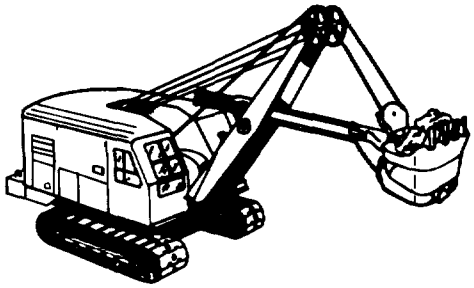


Figure 2-9. Backhoe and shovel end attachment.

(8) Clamshell bucket installation. Refer to figure 2-13.

(9) Cable reeving (fig. 2-14).

(a) Suspension cable. Refer to paragraph 4-54.

(b) Holding cable.

1. Refer to table 4-3 for correct cable length.

2. Lead cable over left boom point sheave.

3. Attach end to rear drum.

4. Attach other end to socket on bucket.

(c) Closing cable.

1. Refer to tables 4-2 and 4-3 for correct cable length.

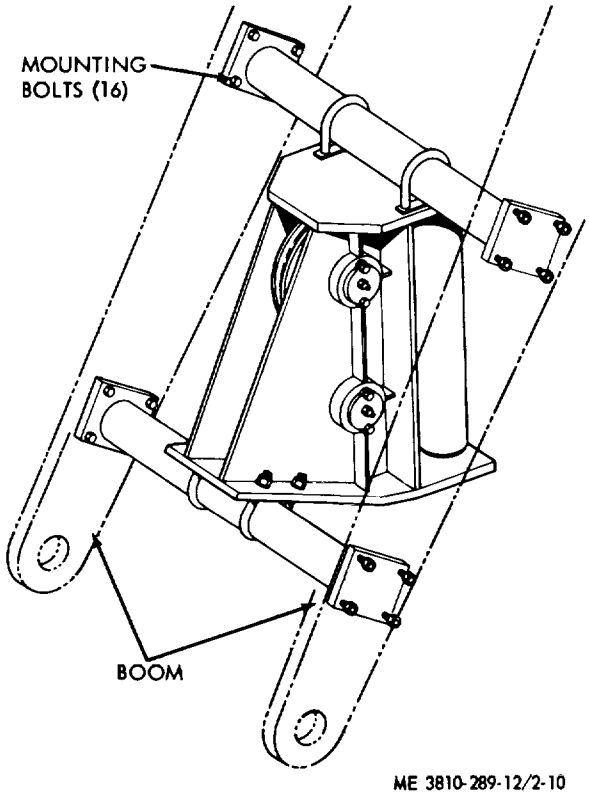


Figure 2-10. Dragline fairlead, removal and installation.

2. Lead cable over right boom point sheave.

3. Reeve cable through clamshell sheave and anchor.

4. Attach other end to front drum.

(d) Tagline cable.

1. Lead cable from tagline unit over sheave to bucket.

2. Anchor end to clamshell bucket,

(10) *Tagline unit adjustment (fig. 2-13)* Turn cable wheel counterclockwise to wind tag line spring.

b. Removal. Removal procedure is reverse of installation.

2-7. Backhoe Front End Conversion

a. Installation.

(*1) Operating levers.* Refer to paragraph 2-3b (3).

(*2) Operating pedals.* Refer to paragraph 2-5a (2).

(*3) Crowd clutch linkage.* Refer to paragraph 2-3b (5).

(*4) Forward drum brakeband.* Refer to paragraph 2-3b (6).

(5) Backhoe boom installation.

(a) Build cribbing to support backhoe boom at correct height (fig. 2-15).

*(*b) Propel machine forward until boom feet enter lugs on revolving frame. Use jack to raise or lower boom until aligned.

(c) Install boom foot pins and locking bolts.

(*6) Auxiliary A-frame installation (fig 2-16).*

*(*a) Place auxiliary A-frame in lugs on revolving frame.

*(*b) Install pins and locking bolts.

(*7) Auxiliary A-frame suspension cable reeving (fig. 2-16).*

*(*a) Refer to table 4-1 for correct cable length.

*(*b) Lead cable over right auxiliary A frame sheave.

*(*c) Lead cable around A-frame yoke sheave and under left auxiliary A-frame sheave.

*(*d) Lead cable over left A-frame sheave and attach to boom hoist drum.

(e) Attach other end to anchor on A-frame.

(*8) Roller and spacer assembly arrange mert.*

*(*a) Model 22BM craneshovel roller and spacer assembly is shown in figure 2-17.

*(*b) Spacers and shaft dimensions are shown in figure 2-18.

(9) Backhoe cable reeving (fig. 2-16).

(a) Hoist cable.

1. Refer to table 4-3 for correct cable length.

2. Lead cable over right center A-frame sheave.

3. Lead cable under and around dipper handle sheave over the left center A-frame sheave and attach to hoist drum.

4. Attach other end to anchor on dipper handle.

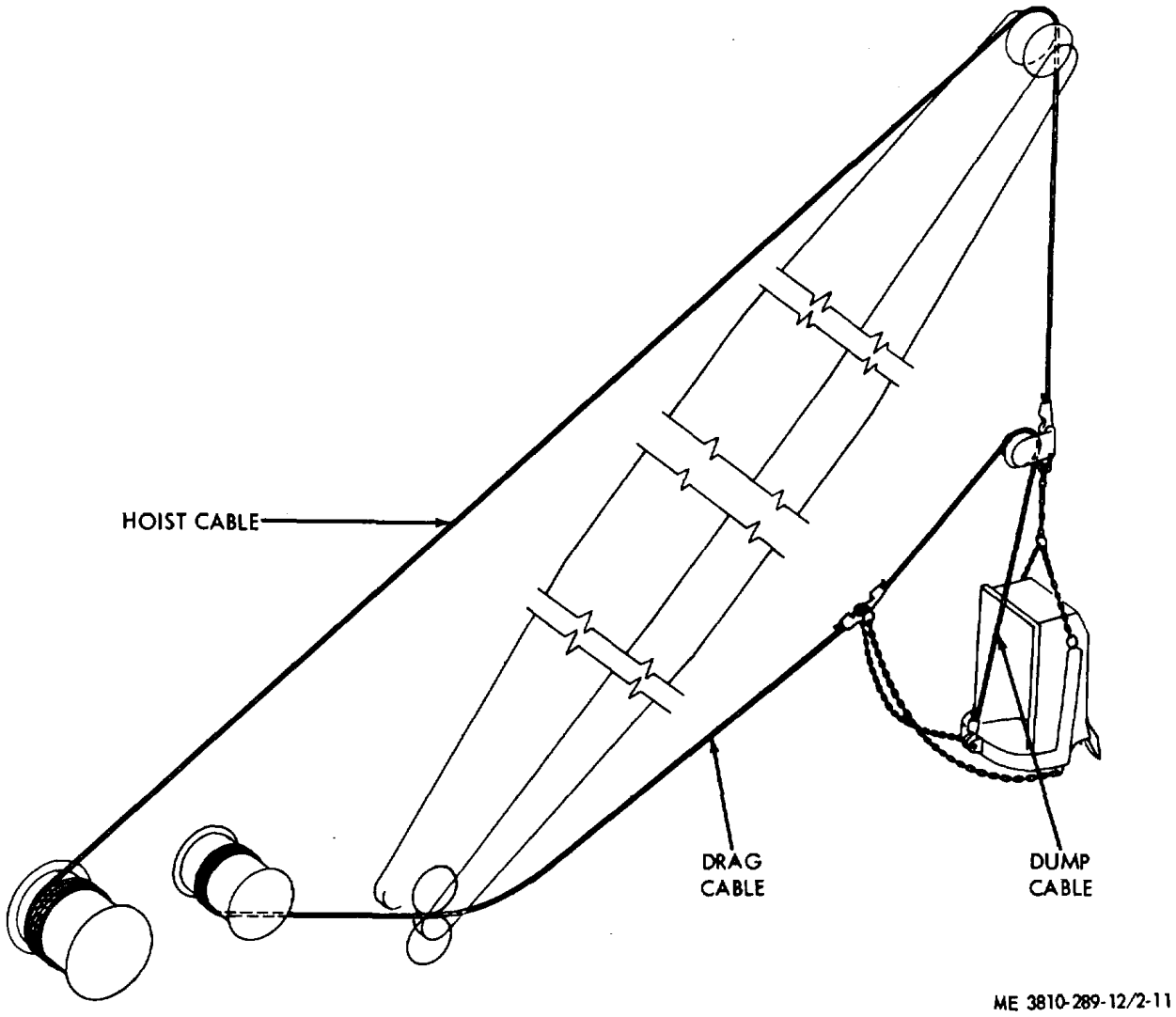


Figure 2-11. Dragline cable reeving.

(b) Drag cable.

1. Refer to table 4-3 for correct cable length.

2. Lead cable over left guide sheave, around padlock sheave, and over right guide sheave.

3. Attach end to drag drum.

4. Attach other end to anchor on left side of boom.

b. Removal. Removal procedure is reverse of installation.

2-8. Shovel Front End Conversion

a. Installation.

(1) Operating levers. Refer to figure 2-3 (B) and change operating levers linkage, if not in correct configuration, as follows:

(a) Set levers to neutral.

(b) Remove pin securing reach rod (5) to lever (4); remove reach rod (5), place on lever (3) and install pin.

(c) Remove capscrews (10) securing lever extension (8) to short lever (9). Insert cap screws (10) through short lever extension (6) and secure short lever extension (6) to lever extension (8).

(d) Middle lever (1) now controls front drum reach rod (7) and hoist lever (2) controls rear drum reach rod (5).

(2) Operating pedals. Refer to figure 2-4b.

(3) Installation of crowd chain sprocket on front drum. Refer to figure 2-19.

(4) Rear crowd chain installation (fig. 2-20).

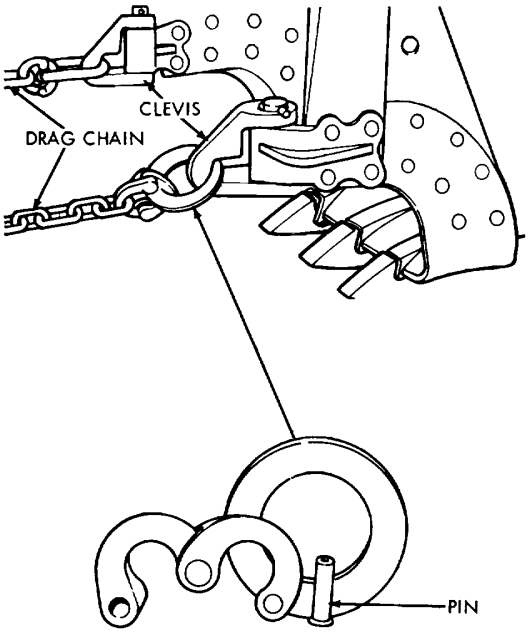


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Figure 2-12. Drag chain clevis, removal and installation.

(a) Install connecting link.

(b) Install connecting link pin.

(5) Crowd chain adjusting bracket installation. Refer to figure 2-21.

(6) Crowd clutch linkage. Refer to figure 2-5(A) and change crowd clutch linkage, if not in correct configuration, as follows:

(a) Disconnect reach rods (2 and 3) by removing pins (6) and cotter pins (7).

(b) Turn bellcrank (1) to correct position.

(c) Connect reach rod (3) by installing pin (6) and cotter pin (7).

(d) Loosen locknut (5) 1/4 turn and remove reach rod (2).

(e) Swing clevis (4) to correct position.

(f) Install reach rod (2).

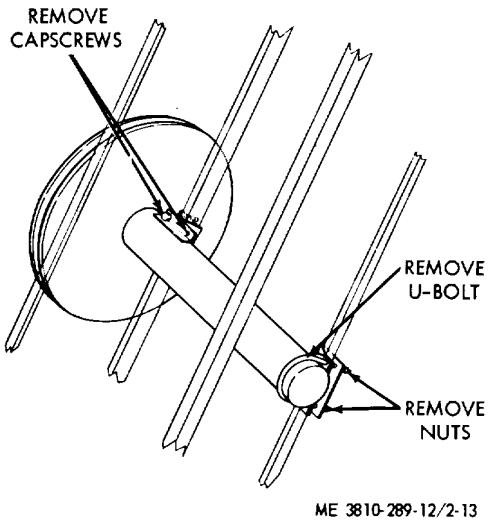

Figure 2-13. Tagline unit, removal and installation.

(g) Connect reach rod (2) by installing pin (6) and cotter pin (7).

(h) Tighten locknut (5).

(7) Forward drum brakeband. Refer to figure 2-6(B) and change band linkage, if not in correct configuration, as follows:

(a) Remove pins and adjusting bolt.

(b) Turn bellcrank over and interchange live and deadend halves of the band.

(c) Install pins and adjusting bolt.

(8) Shovel boom, dipper, and handle installation.

(a) Build cribbing to support shovel boom (fig. 2-22).

(b) Using a crane or suitable lifting device, place the shovel boom and dipper handle on the cribbing.

(c) Propel machine forward until boom foot enters lugs on revolving frame.

1. Raise or lower boom foot until it is aligned with boom foot lugs.

2. Install boom foot pins and locking bolts.

(9) Front crowd chain installation (fig.2-20).

(a) Install connecting link.

(b) Install connecting link pin.

(10) *Shovel boom suspension cable reeving (fig. 2-23).*

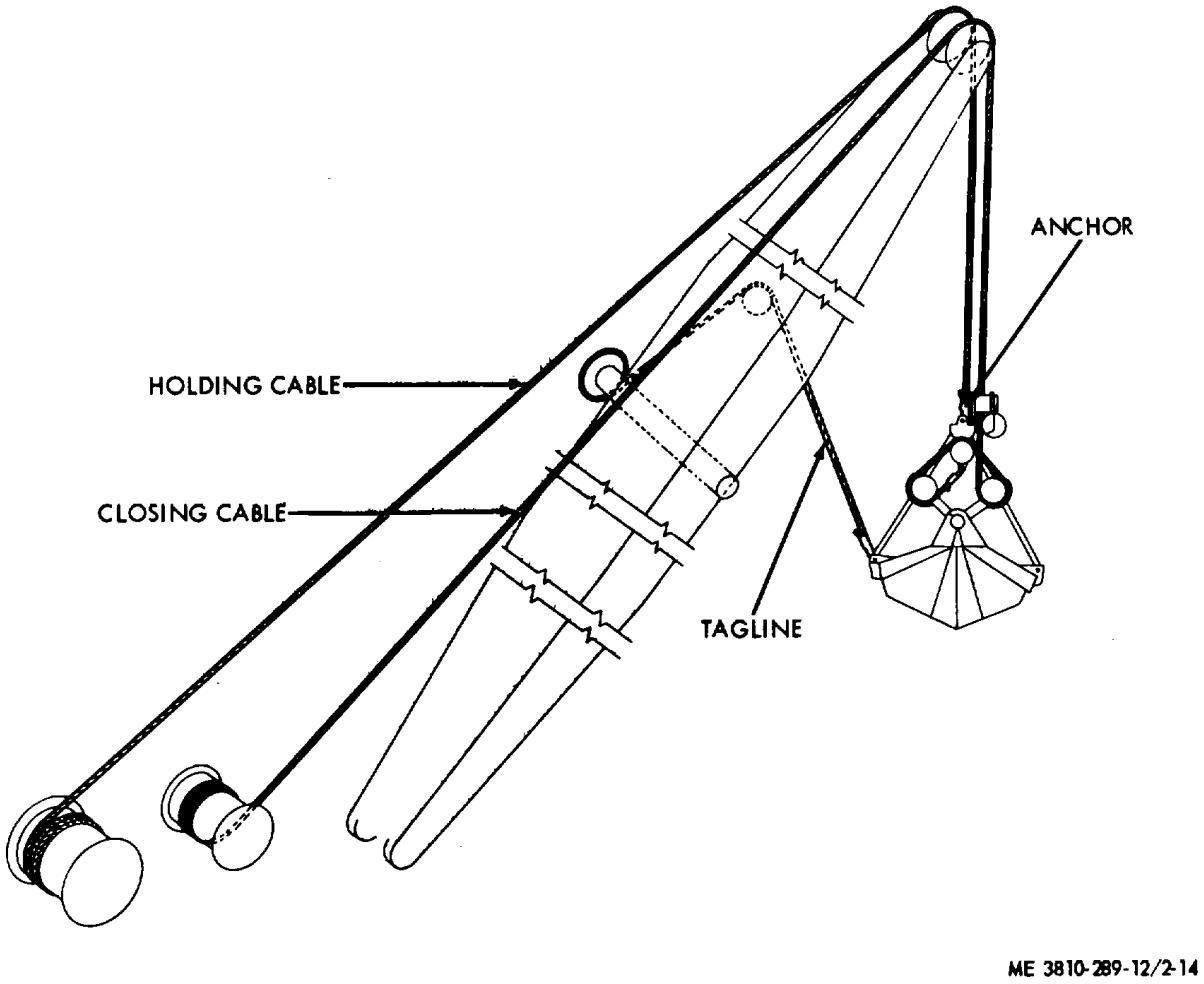

Figure 2-14. Clamshell cable reeving.

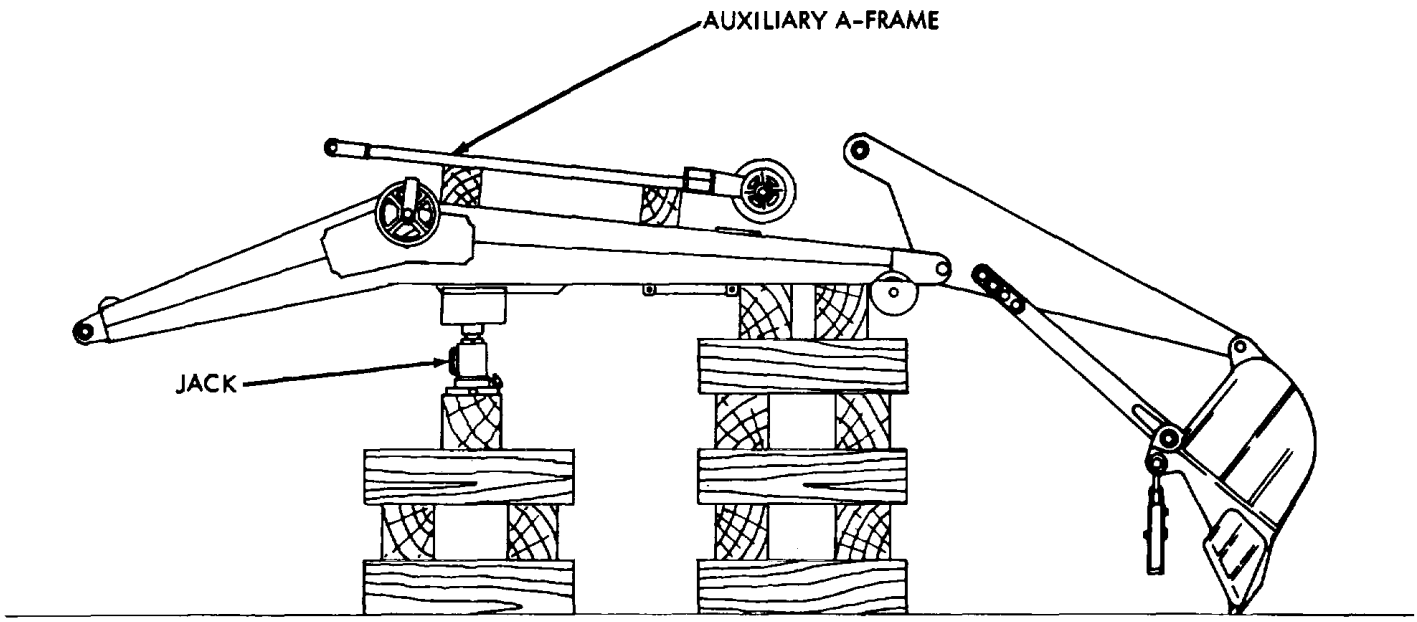

Figure 2-15. Backhoe boom support cribbing.

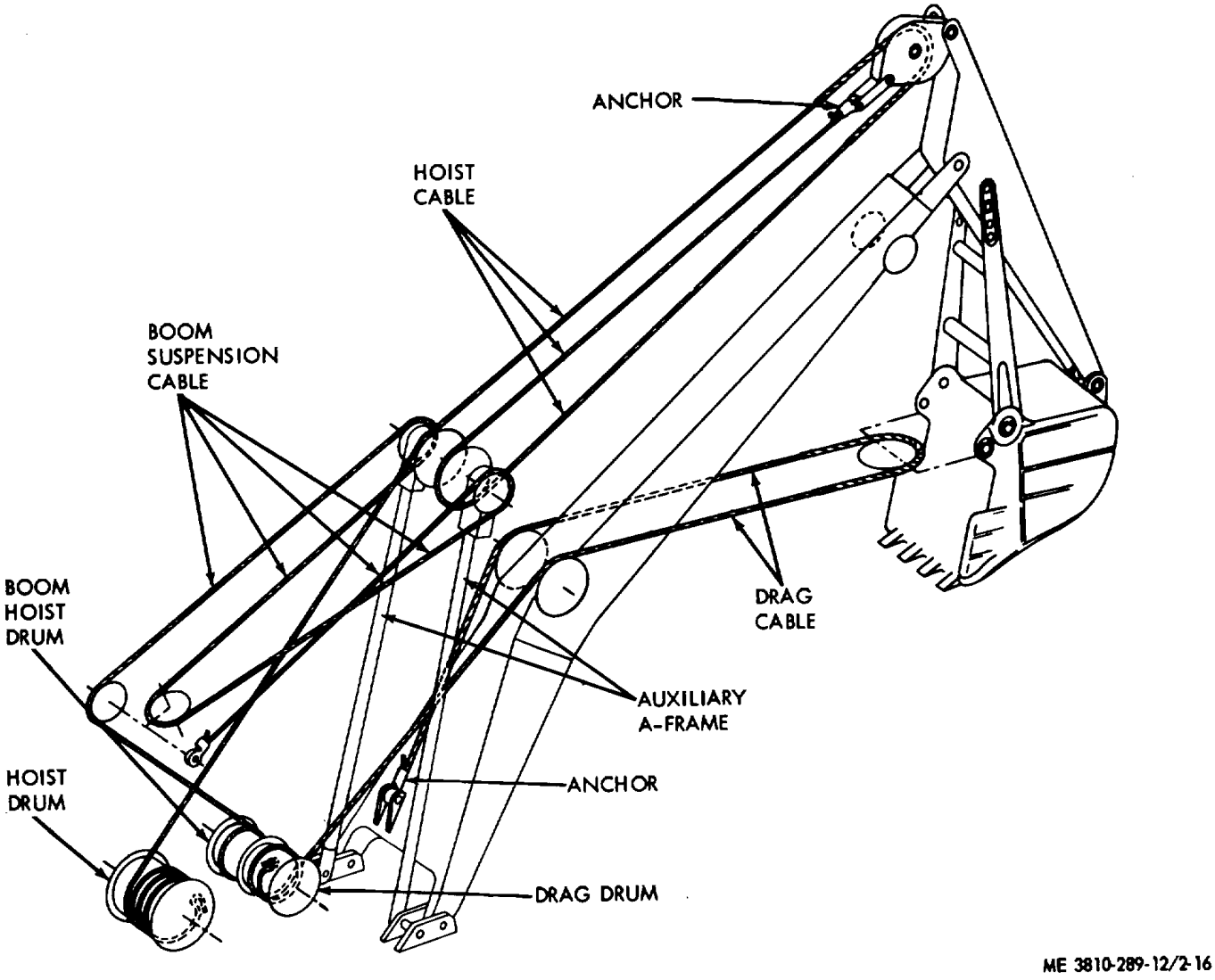

Figure 2-16. Backhoe cable reeving.

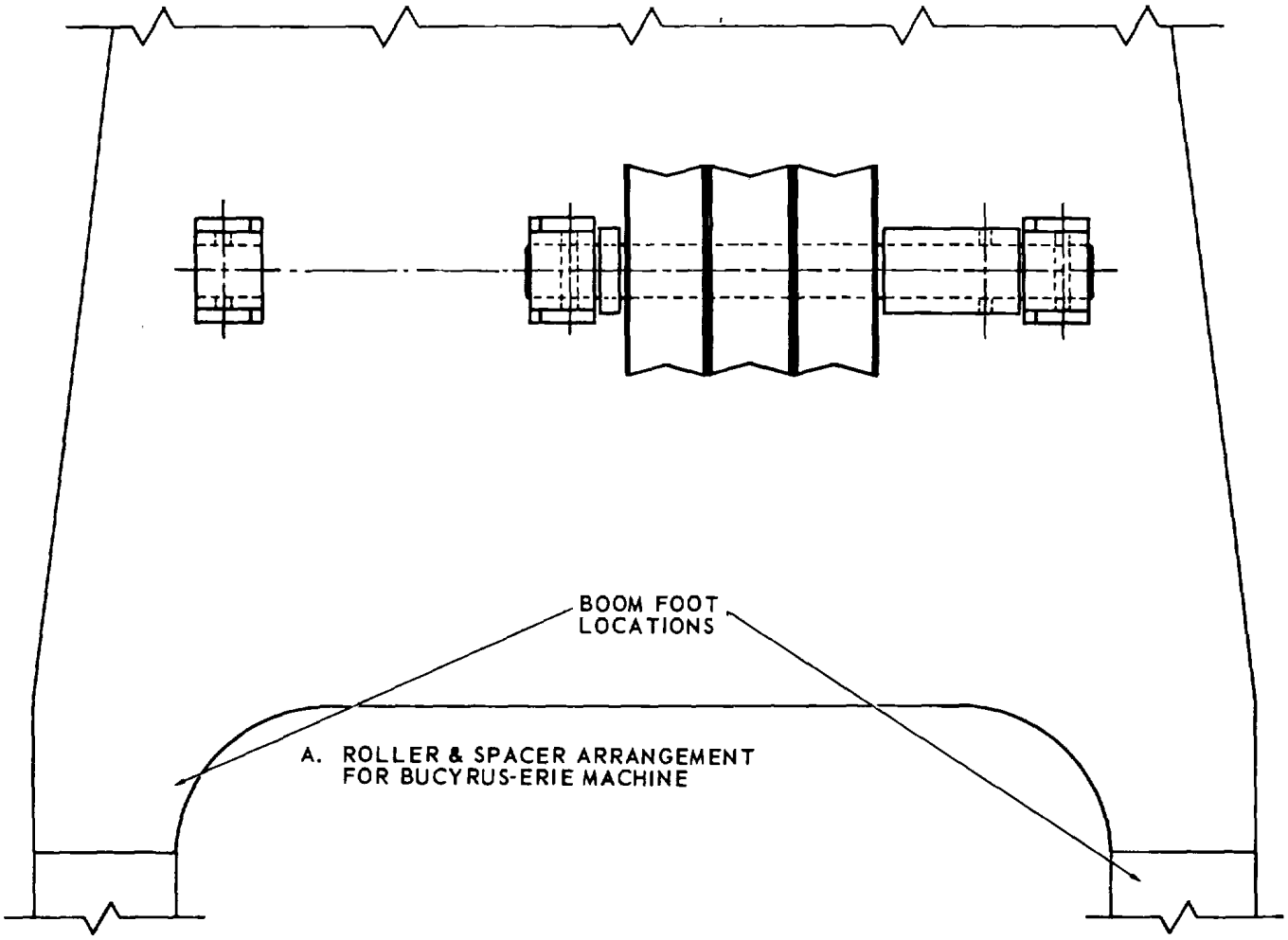

Figure 2-17. Roller and spacer arrangement.

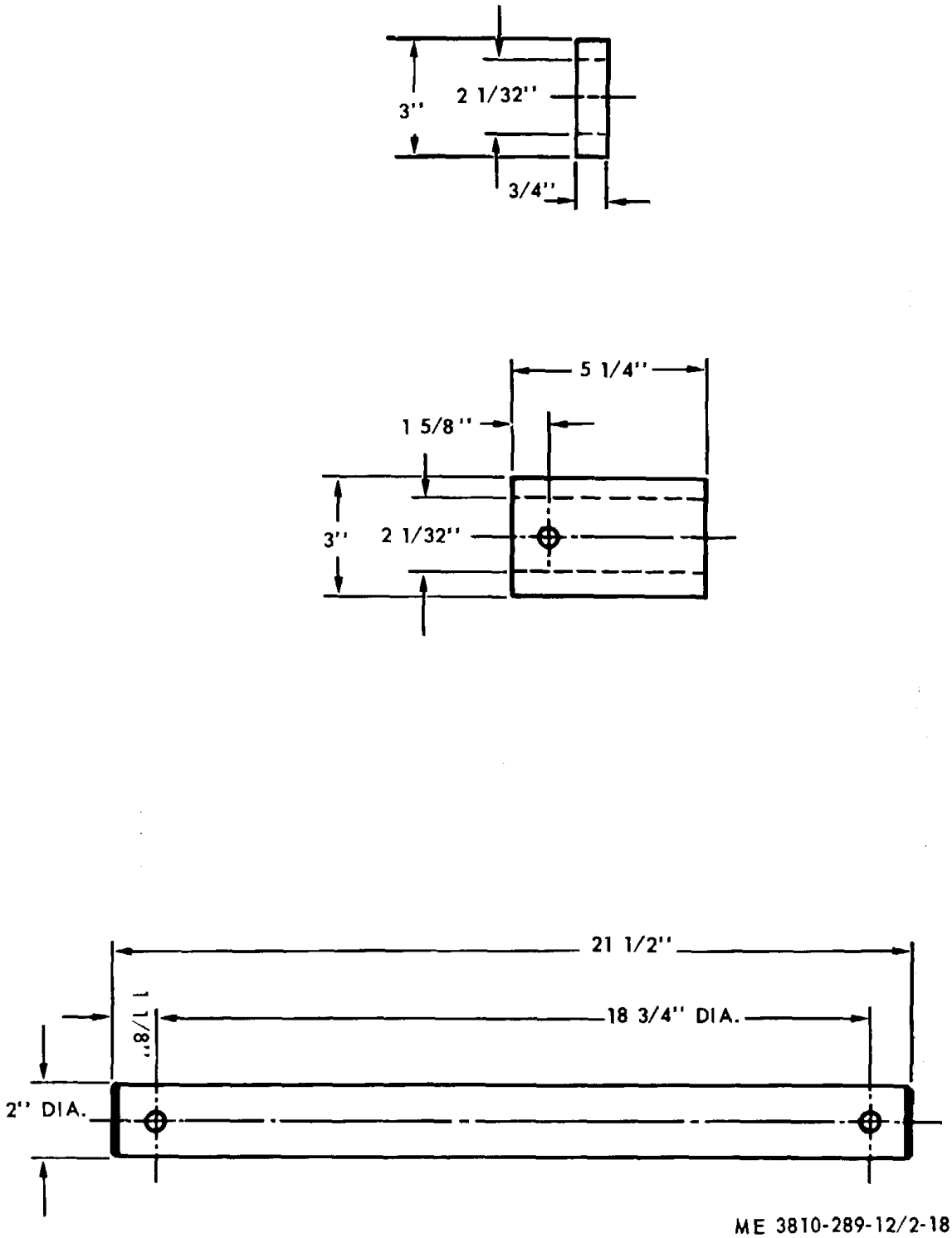

Figure 2-18. Roller Assembly, shaft and spacers.

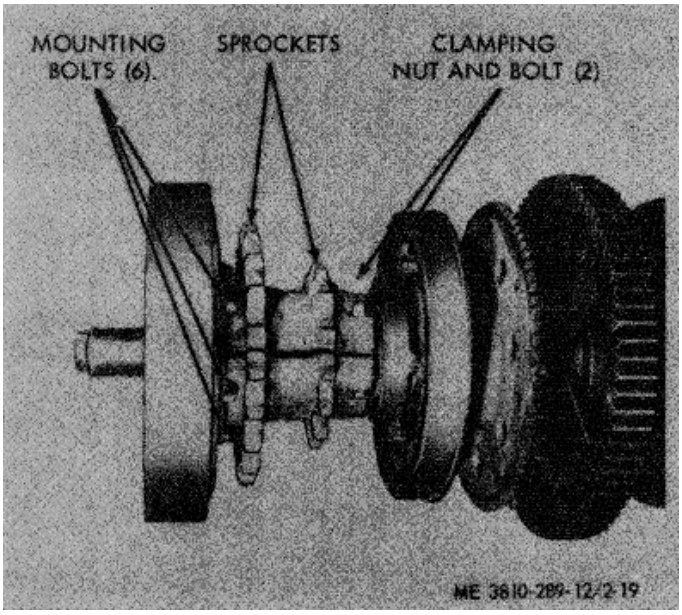

Figure 2-19. Crowd cha*in sprocket, removal and installation*

(a) Refer to table 4-43 for correct cable length.

*(*b) Lead cable (1) over left A-frame sheave and attach to boom hoist drum.

(c) Lead cable under left boom point sheave.

*(*d) Lead cable (2) around upper A-frame yoke sheave and over right boom point sheave

(e) Lead cable (4) over right A-frame sheave and under right boom point sheave.

(f) Lead cable (6) around lower A-frame yoke sheave and over left boom point sheave.

(g) Attach cable (8) to anchor on A-frame.

(11) *Boom raised to 45° angle.* Refer to figure 2-23.

(12) *Shovel cable reeving.*

(a) Hoist (fig. 2-23).

1. Refer to table 4-3 for correct cab length.

2. Lead cable over right boom point sheave through padlock sheave and over left boom point sheave.

3. Attach end to hoist drum end.

4. Attach end to anchor on boom.

(b) Crowd (fig. 2-23).

1. Refer to table 4-3 for correct cable length.

2. Remove cable guard on end of dipper handle.

3. Loop middle of cable over anchor casting.

4. Lead right end of cable down and around shipper shaft drum, through lower section of boom to the right groove, and anchor in socket at right side of crowd drum.

5. Lead left end of cable down and around shipper shaft drum, through lower section of boom to the left groove, and anchor in socket at left side of crowd drum.

6. Install cable guard and run handle all the way out until stops rest against saddle block.

(c) Backhaul (fig. 2-23)

1. Refer to table 4-3 for correct cable length.

2. Insert cable in drum socket.

3. Wind one wrap on center section of drum and attach.

4. Lead other end over top of center groove on shipper shaft drum and attach to adjusting bolt on dipper handle.

5. Turn nuts on adjustment bolt as far down as possible.

(d) Dipper trip (fig. 2-24).

1. Lead end over sheave on right side of boom and through guide sheave located at boom foot on right side.

2. Lead cable under deck, around guide sheave, and attach to dipper trip drum.

3. Attach other end to drum lever on top of dipper.

(13) *Adjustments.*

(a) Dipper trip clutch (fig. 2-25).

1. Dipper trip cable should follow dipper in all movements.

2. Clutch wear is compensated for by loosening locknut (1) and adjusting screw (2)

3. When full thread travel has been used on adjusting screw (2), it is necessary to increase tension on spring (3).

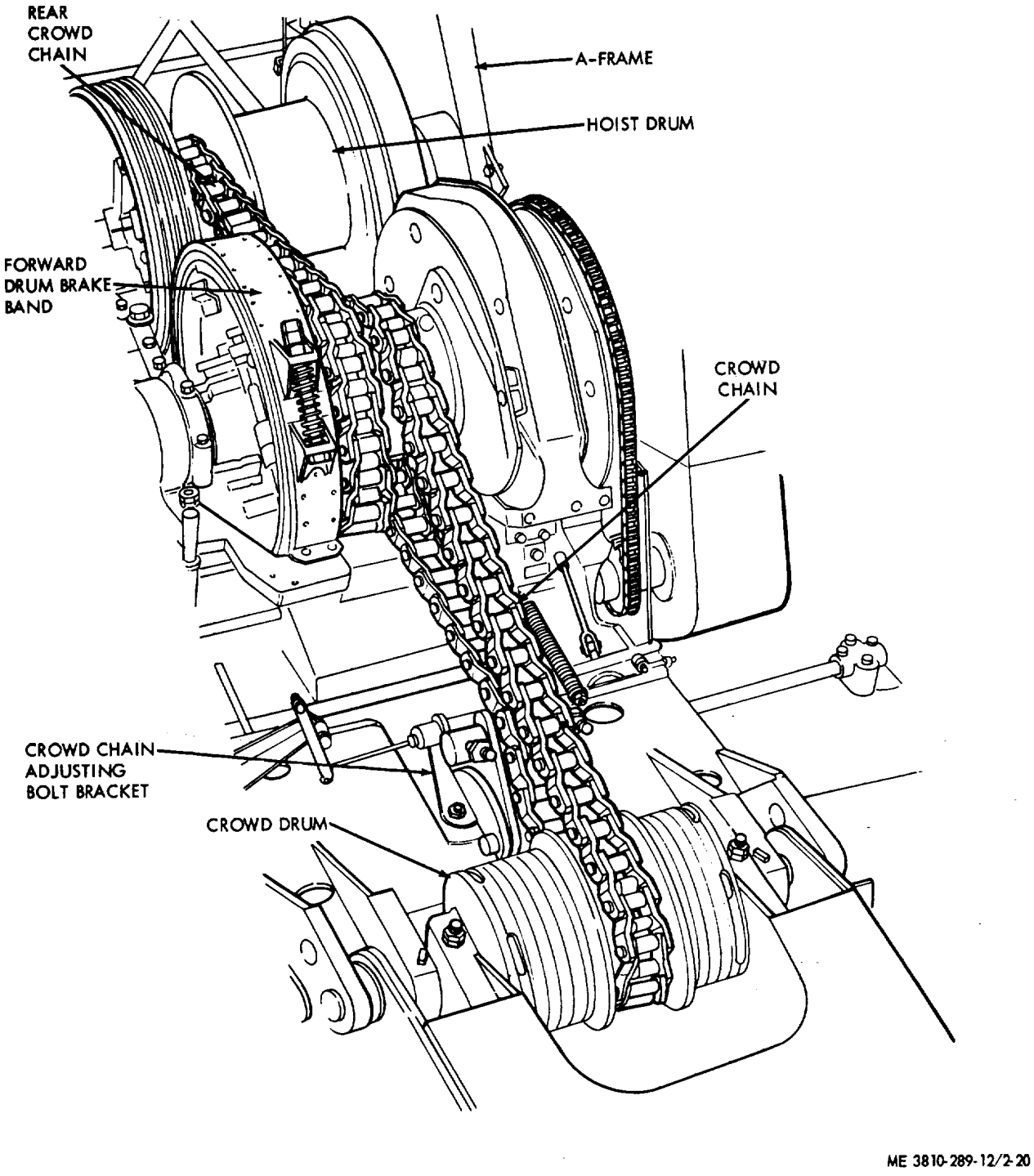

Figure 2-20. Shovel components.

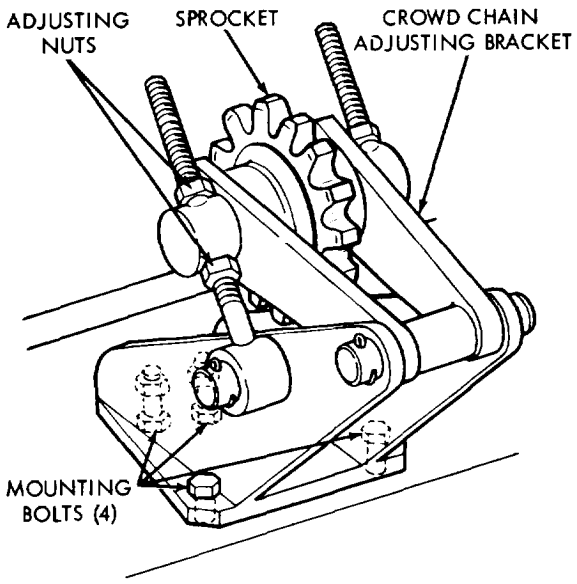

Figure 2-21. Crowd chain adjusting bracket.

(a) Back out nut.

(b) Install washer(s) (6) behind spring (3).

4. Adjustment is correct if cable follows dipper handle without tripping dipper latch and toggle lever is free.

(b) Dipper.

1. Dump chain (fig. 2-26).

(a) Composed of two chains.

(b) Length can be adjusted by changing position of pinch link.

2. Latch bar (fig. 2-26).

(a) Make rough adjustment by changing dump chain length.

(b) Make fine adjustments by increasing or decreasing number of washers on fulcrum pin.

(c) Latch bar should enter latch keeper 1½/ inch.

3. Digging angle (fig. 2-26).

(a) Increase angle by installing pitch braces on higher holes.

(b) Decrease angle by installing pitch braces on lower holes.

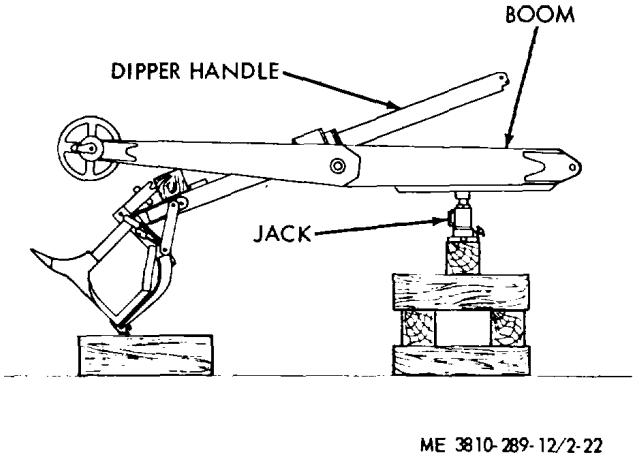

Figure 2-22. Shovel boom support cribbing.

(c) Backhaul cable (fig. 2-27).

1. Two inches is maximum allowable sag with dipper handle horizontal and fully extended with end of handle crowded against the saddle block.

2. Tighten the adjusting bolt until cable sag is within limits.

(d) Crowd chain (fig. 2-21).

1. Loosen locknuts.

2. Turn adjusting nuts until lower chain has approximately 2inch sag when upper chain is tight.

3. Tighten locknuts.

(e) Saddle block weailing plates (fig. 2-28).

1. Maximum allowable clearance between handle and wearing plates is 1/8 inch.

2. Insert shims to adjust clearance. (a) Raise dipper until handle is horizontal.

(b) Loosen capscrew, holding wearing plate, insert shims, and tighten capscrews.

(c) Clearance between wearing plates and handle on same side of saddle block must be equal so handle is not forced out of line.

b. Removal. Removal procedure is reverse of installation.

2-9. Piledriver Front End Conversion

a. Hammer Lead Assembly. Refer to figure 2-29.

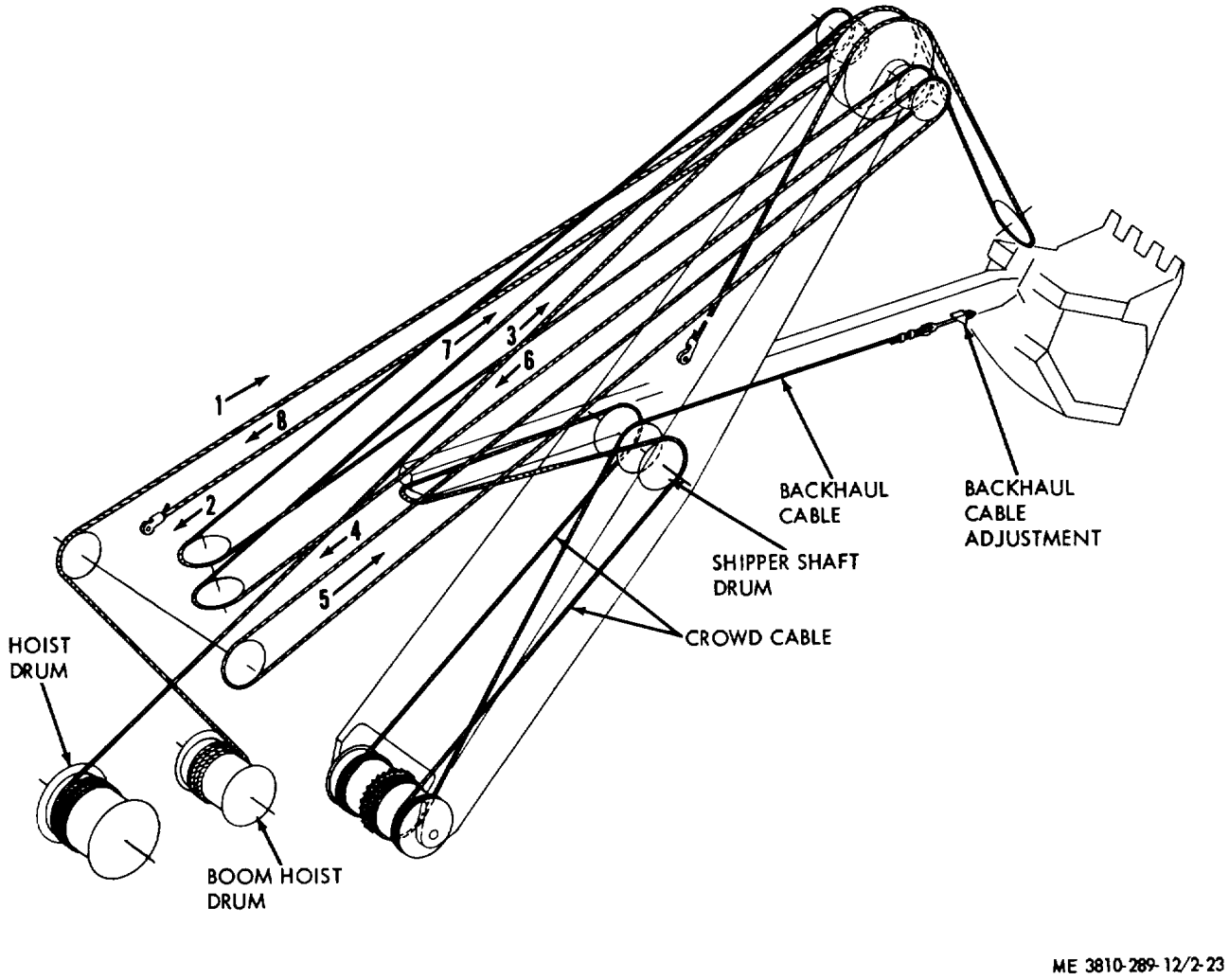

Figure 2-23. Shovel cable reeving.

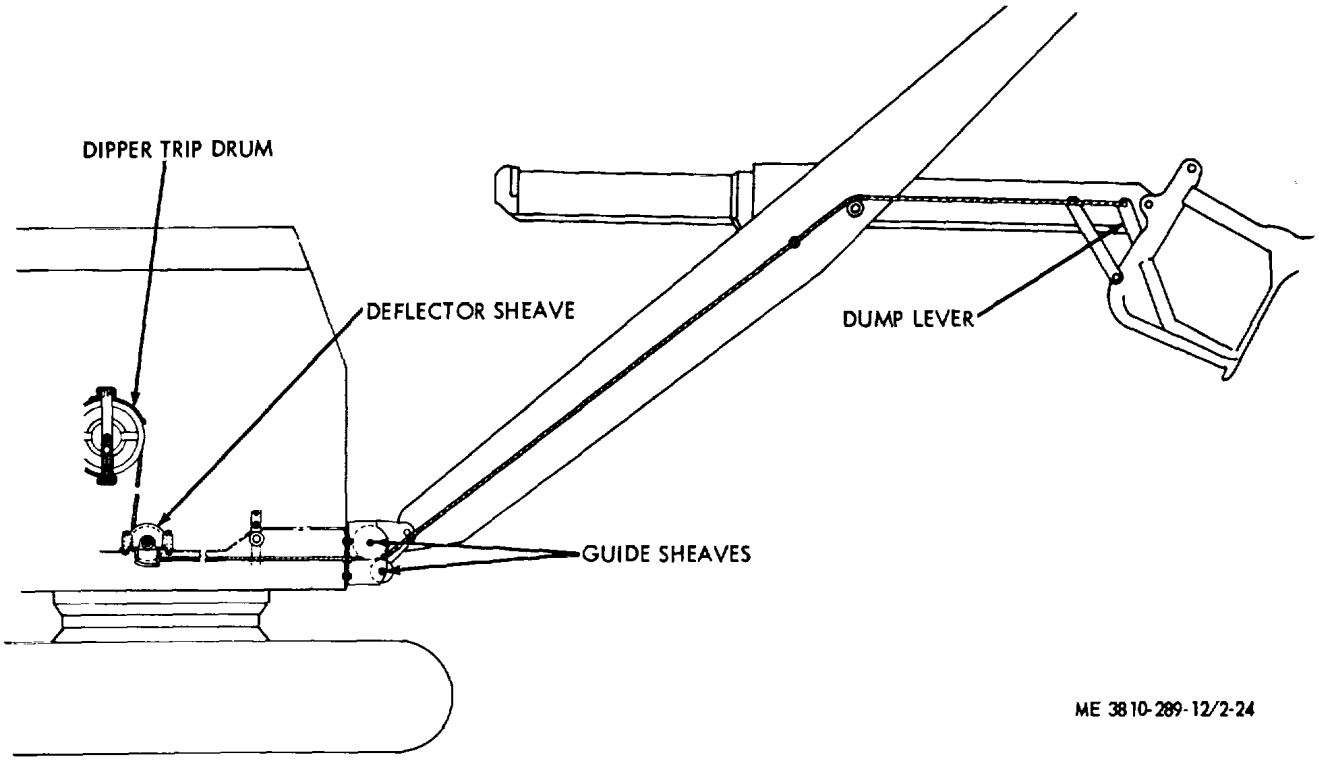

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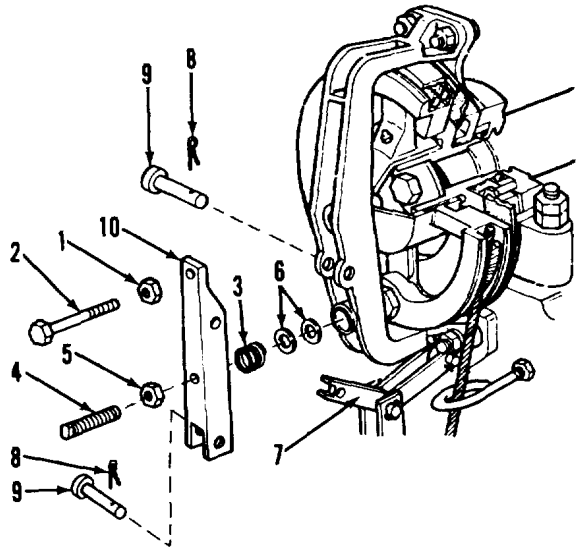
Figure 2-24. Dipper trip cable reeving.



1 Locknut
2 Adjusting screw
3 Spring
4 Slotted screw
5 Locknut
6 Washer(s)
7 Toggle link
8 Cotter pin
9 Pin
10 Toggle link

Figure 2-25. Dipper trip clutch adjustment.

(1) Place lead sections on a flat surface in horizontal position resting on blocks or cribbing. Bolt corresponding (one top and four lower) sections together, using hardware listed in *d,* below.

(2) Lower boom to horizontal position in line with upper end of lead assembly and bolt securely to outside of adapter plates on boom point.

(3) Using boom hoist, raise boom and lead assembly to working position (fig. 2-29).

(4) Using hoist line, place hammer below leads and lower boom to enter hammer leads into hammer guides.

b. Catwalk Assembly.

(1) Assemble two outer sections in horizontal position with inner or telescoping member between (fig. 2-29) and bolt loosely, using hardware listed in *d,* below.

(2) Hoist as a unit; bolt one end to boom foot bracket and other end to lead assembly bracket.

(3) Adjust so lead assembly hangs vertical as shown on figure 2-29; bolt securely.

Note. Lead assembly length can be adjusted by changing boom angle and adding or deleting **lower lead** sections.

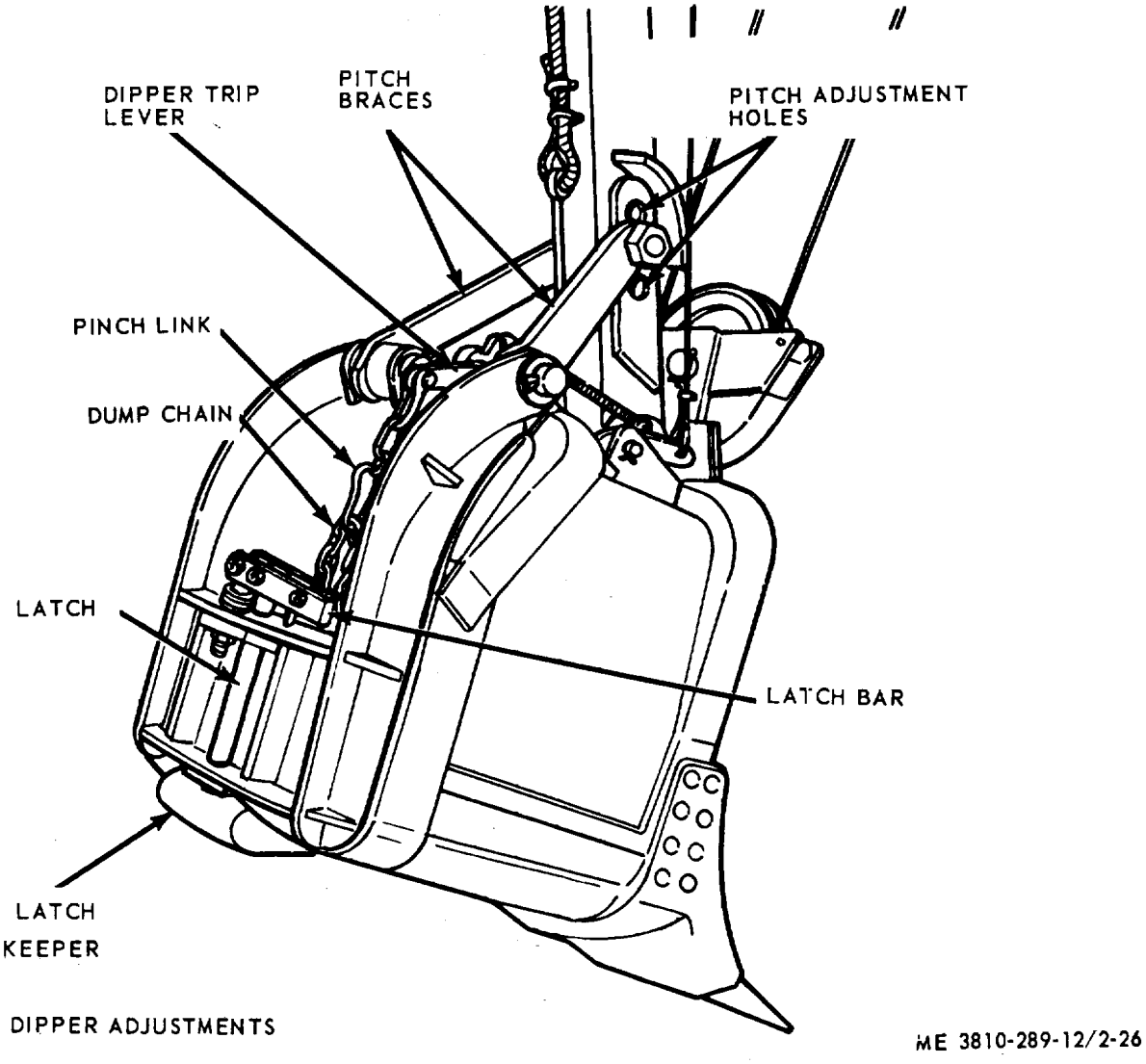


Figure 2-26. Dipper adjustment.

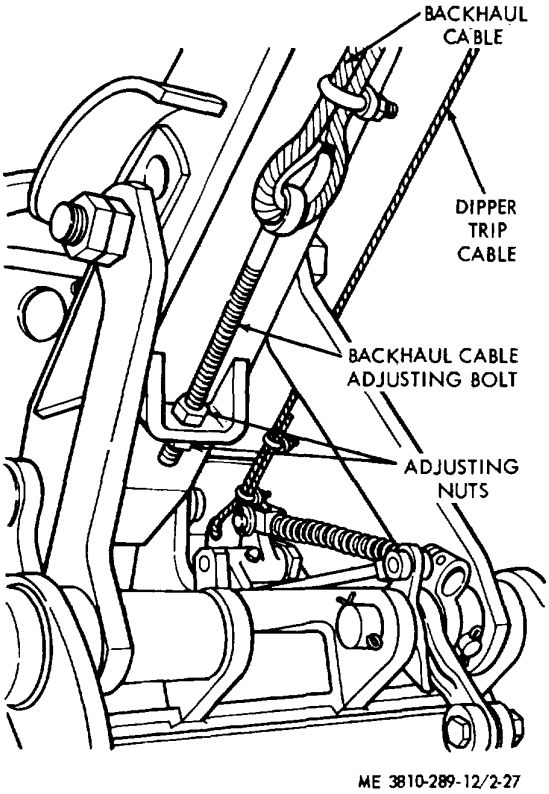


Figure 2-27. Backhaul cable adjustment.

c. Disassembly.

(1) To disassemble catwalk, reverse procedure in b, above.

(2) To disassemble lead sections, lower boom so lead assembly rests on ground. Back up machine and lower boom simultaneously, coordinating the two movements until lead assembly rests on blocks or ground.

d. List of Common Hardware (fig. 2-29).

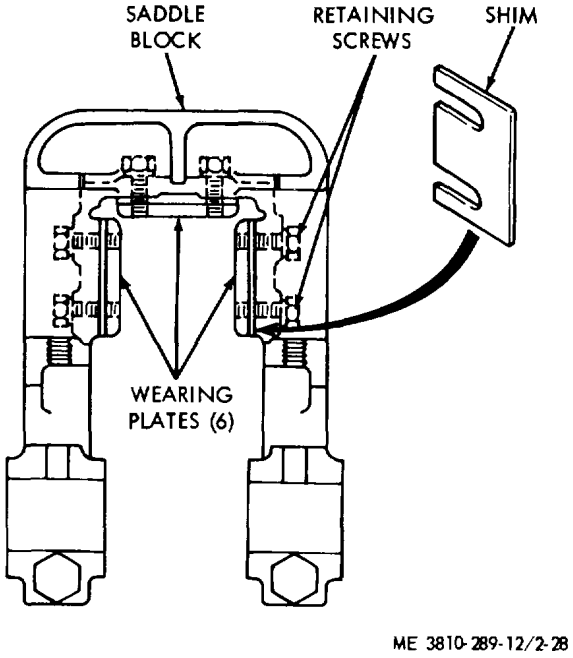


Figure 2-28. Saddle block wearing plate adjustment.

(1) Lead assembly top section (each).
Twelve hexagon bolts, % in. x 2 in. long
Twelve lockwashers
Twelve hexagon nuts, % in.
Four hexagon bolts, 7% in. x 3 in. long
Four lockwashers
Four hexagon nuts, %A in.

(2) Lead assembly lower section (each).
Sixteen hexagon bolts, % in. x 2 in. long
Sixteen lockwashers
Sixteen hexagon nuts, h in.
Four hexagon bolts, 7% in. x 3 in. long
Four lockwashers
Four hexagon nuts, % in.

(3) Catwalk assembly.
Two square bolts, % in. x 26% in. long
Eight hexagon bolts, 12 in. x 2 in. long
Ten lockwashers
Ten hexagon nuts, % in.

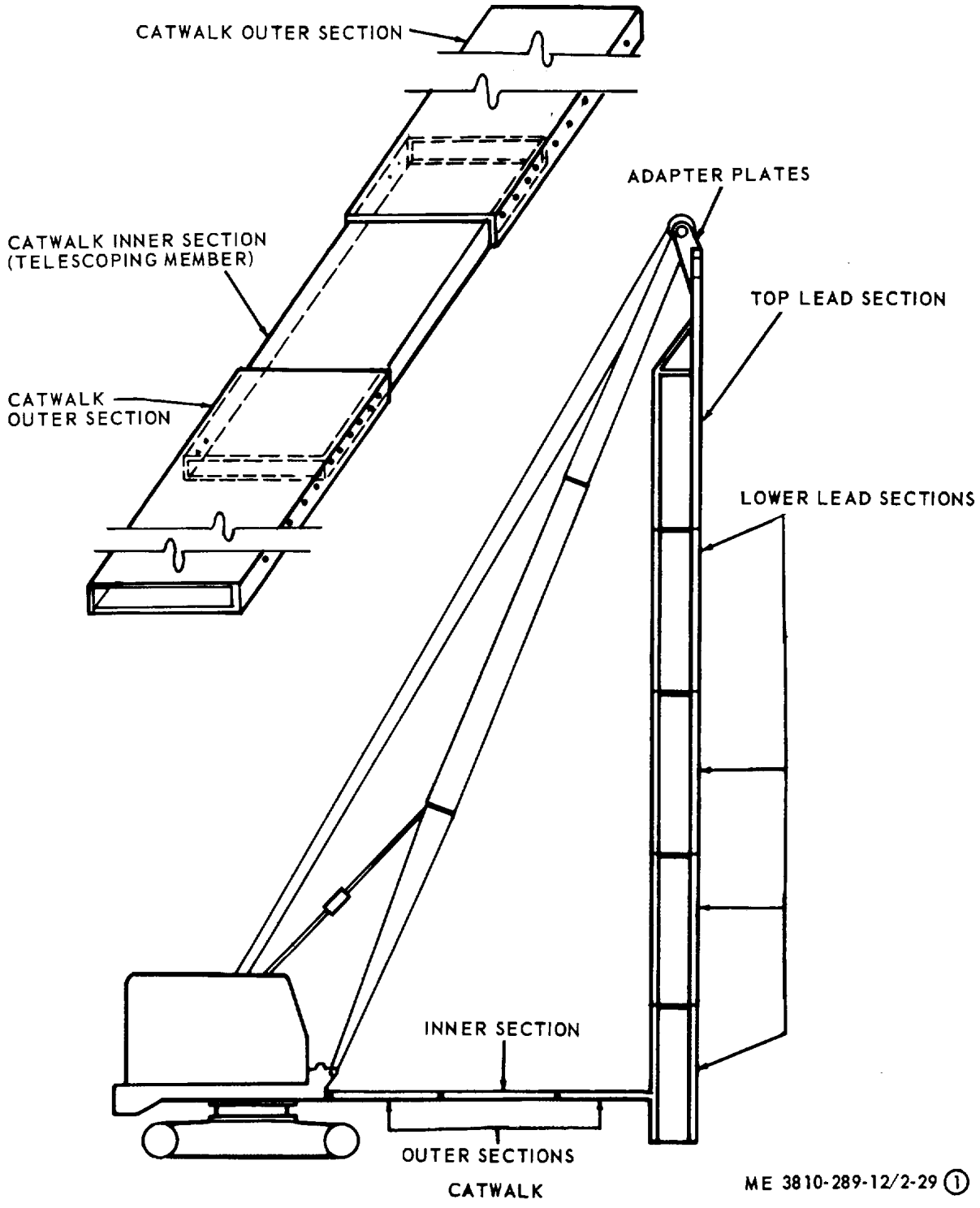


Figure 2-29. Piledriver, assembly and disassembly (sheet 1 of 3).

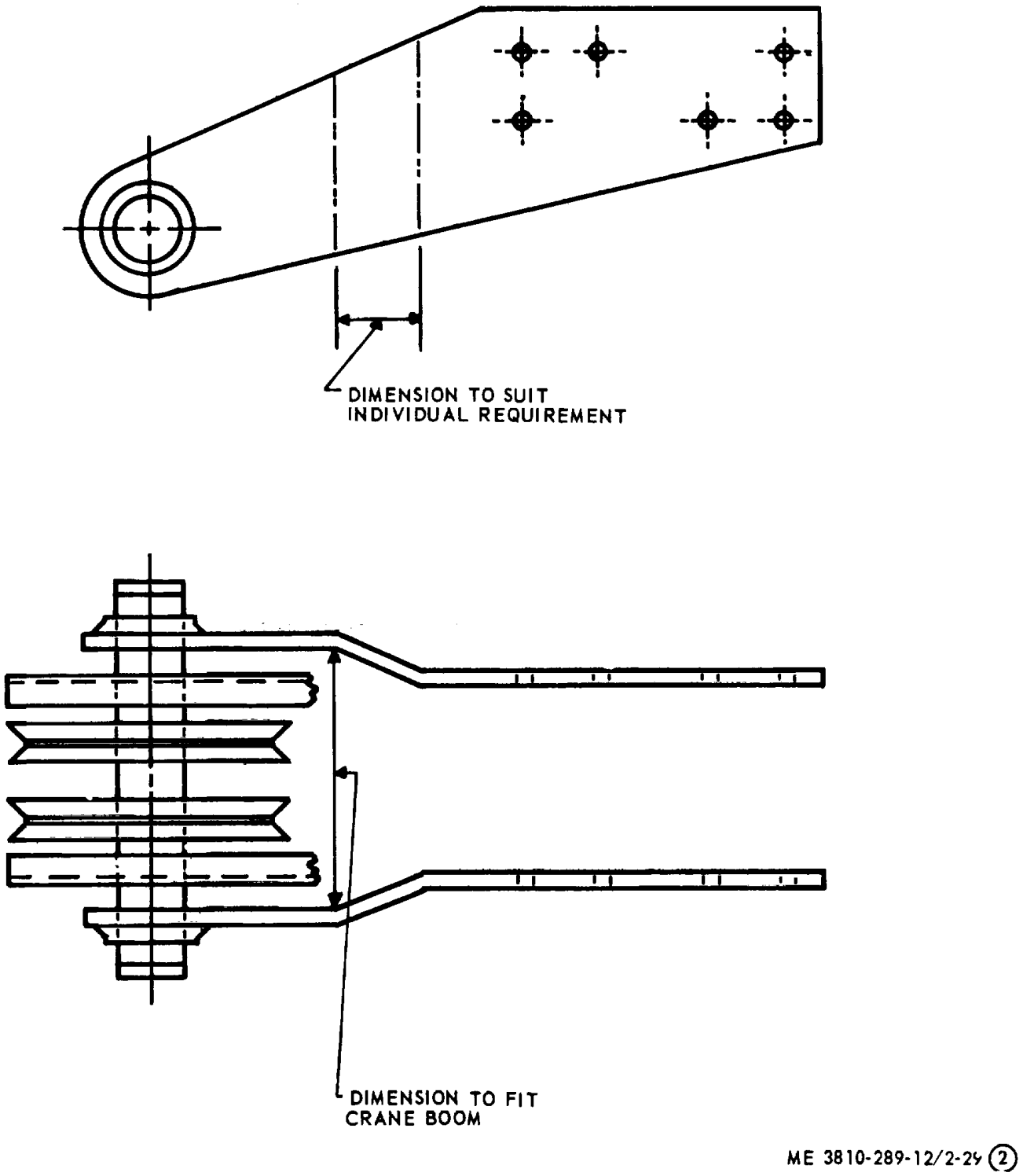


Figure 2-29. Piledriver, assembly and disassembly (sheet 2 of 3).

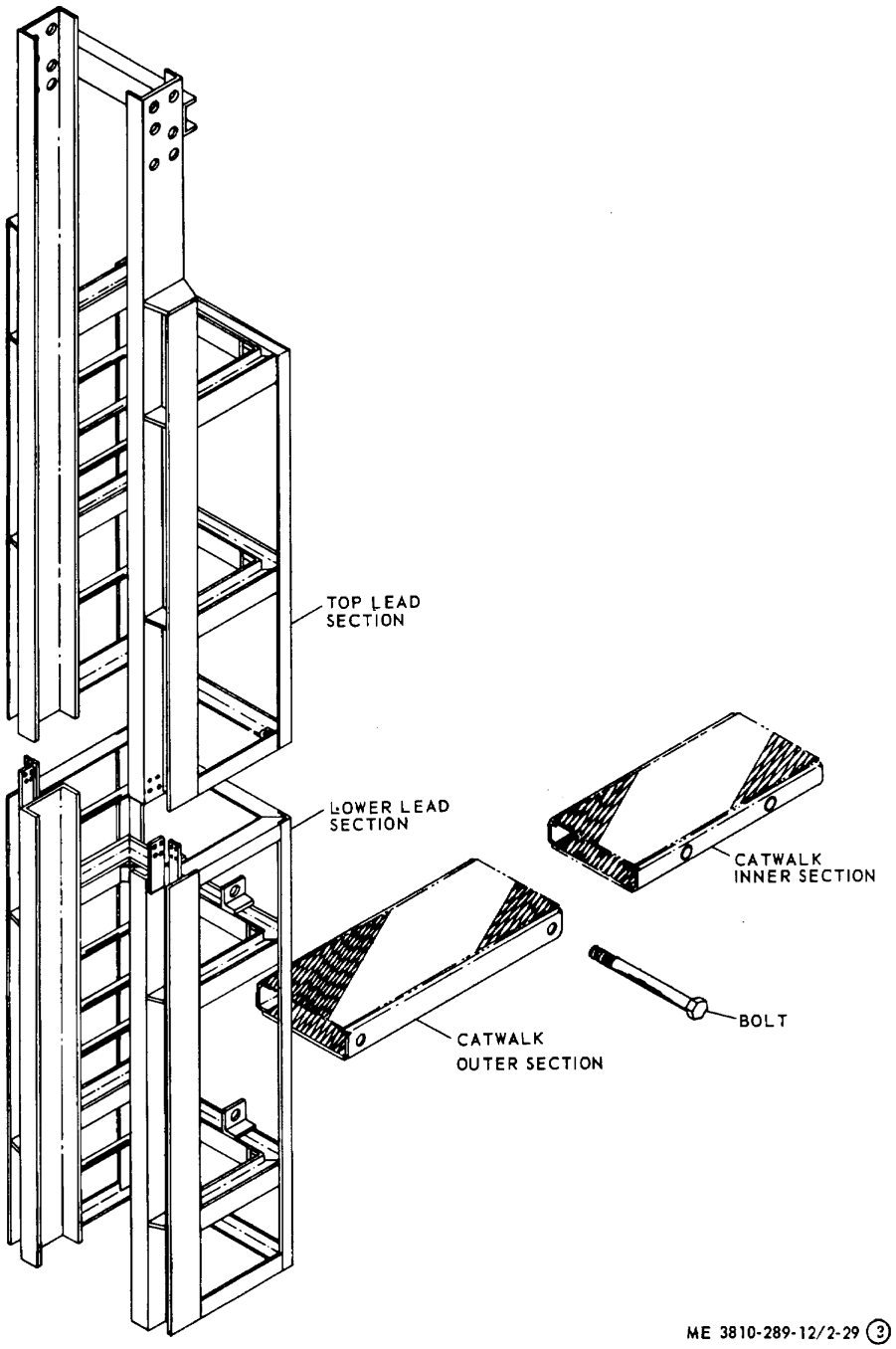


Figure 2-29. Piledriver, assembly and disassembly (sheet 3 of 3)

Section II. MOVEMENT TO NEW WORKSITE

2-10. Dismantling and Movement

a. General. When it is necessary to move crane-shovel to another worksite, it may be driven under its own power, or it may be transported truck, rail, or air. Method of movement will pend on destination and distance involved.

b. Movement Short Distance. The crane-shovel is not dismantled when moved a short distance under its own power. Proceed as follows:

(1) Perform preventive maintenance checks and services (para 3-6).

(2) Make sure all tools and equipment to move with the crane-shovel are clean, serviceable, and properly stowed.

(3) Start engine (para 2-15) and drive crane-shovel to new worksite.

c. Short Distance Movement by Carrier. For short distance moves by trailer or railroad car, the upper boom section can be removed stacked on top of the lower section (fig. 2-30). The counterweight should be supported by an A-frame of wood timber (fig. 2-31).

d. Dismantling for Long Distance Movements. Refer to the appropriate paragraphs in chapter 4 and remove the front end attachment.

e. Loading by Drive-On.

(1) Refer to paragraph 2-15 and start engine.

(2) Drive crane-shovel slowly and carefully up ramp onto carrier.

f. Loading by Lifting.

(1) Position adequate lifting device at carrier.

(2) Place lifting slings over lifting device hook and attach to crane-shovel lifting eyes (fig. 2-2).

(3) Attach a tagline to keep crane-shovel from twisting or turning during lifting process.

***Warning:* Keep all personnel not engaged in loading procedure back and away from working area to avoid injury, should slings break during lift.**

***Caution:* Do not allow crane-shovel to turn or twist during lift. The added stress on lift slings might cause them to break and drop crane-shovel, causing extensive damage to the equipment.**

(4) Lift crane-shovel (on signal) and swing it over carrier and lower to position for tiedown.

2-11. Reinstallation After Movement

For installation after movement to a new worksite, refer to paragraphs 2-2 and 2-3.

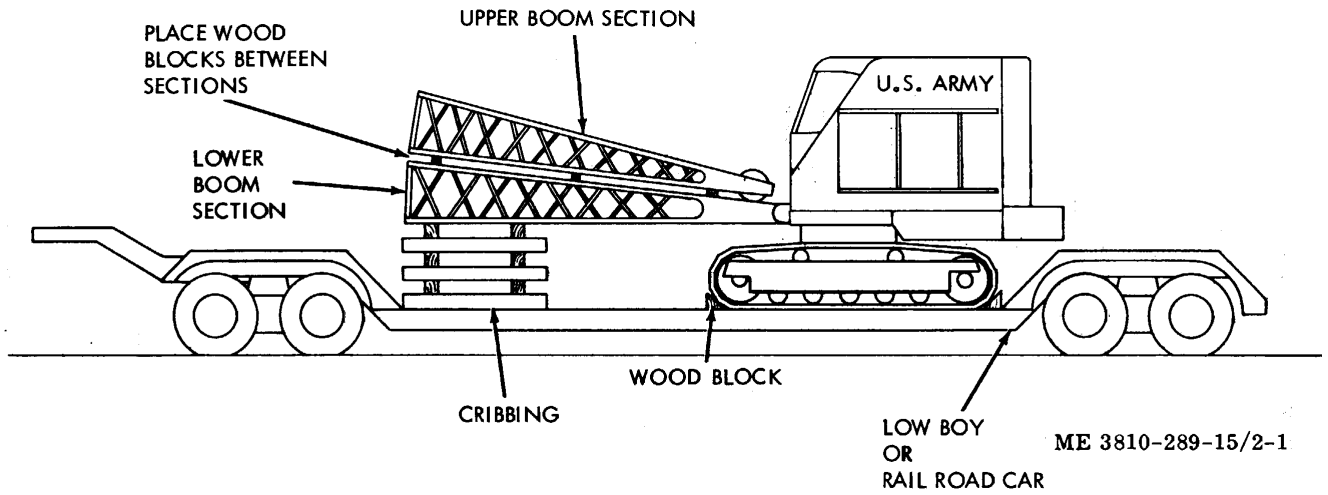


Figure 2-30. Crane-shovel mounted on trailer.

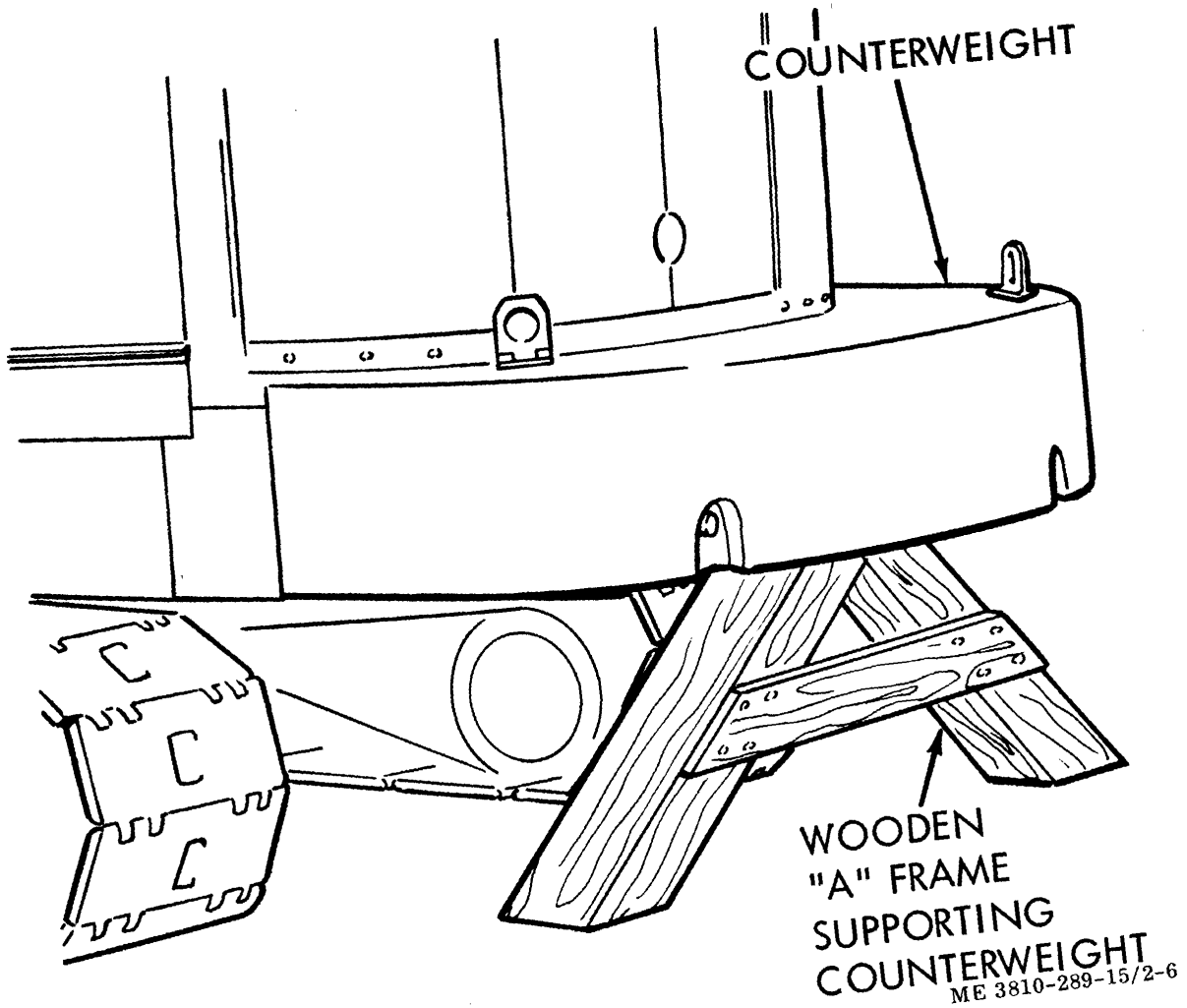


Figure 2-31. Counterweight blocking.

Section III. CONTROLS AND INSTRUMENTS

2-12. General

This section describes, locates, illustrates, and furnishes operator, crew, or organizational maintenance personnel sufficient information about various controls and instruments for proper operation of the model 22BM crane-shovel,

2-13. Controls and Instruments

The purpose of controls and instruments and their normal and maximum reading are illustrated in figures 2-32 through 2-37.

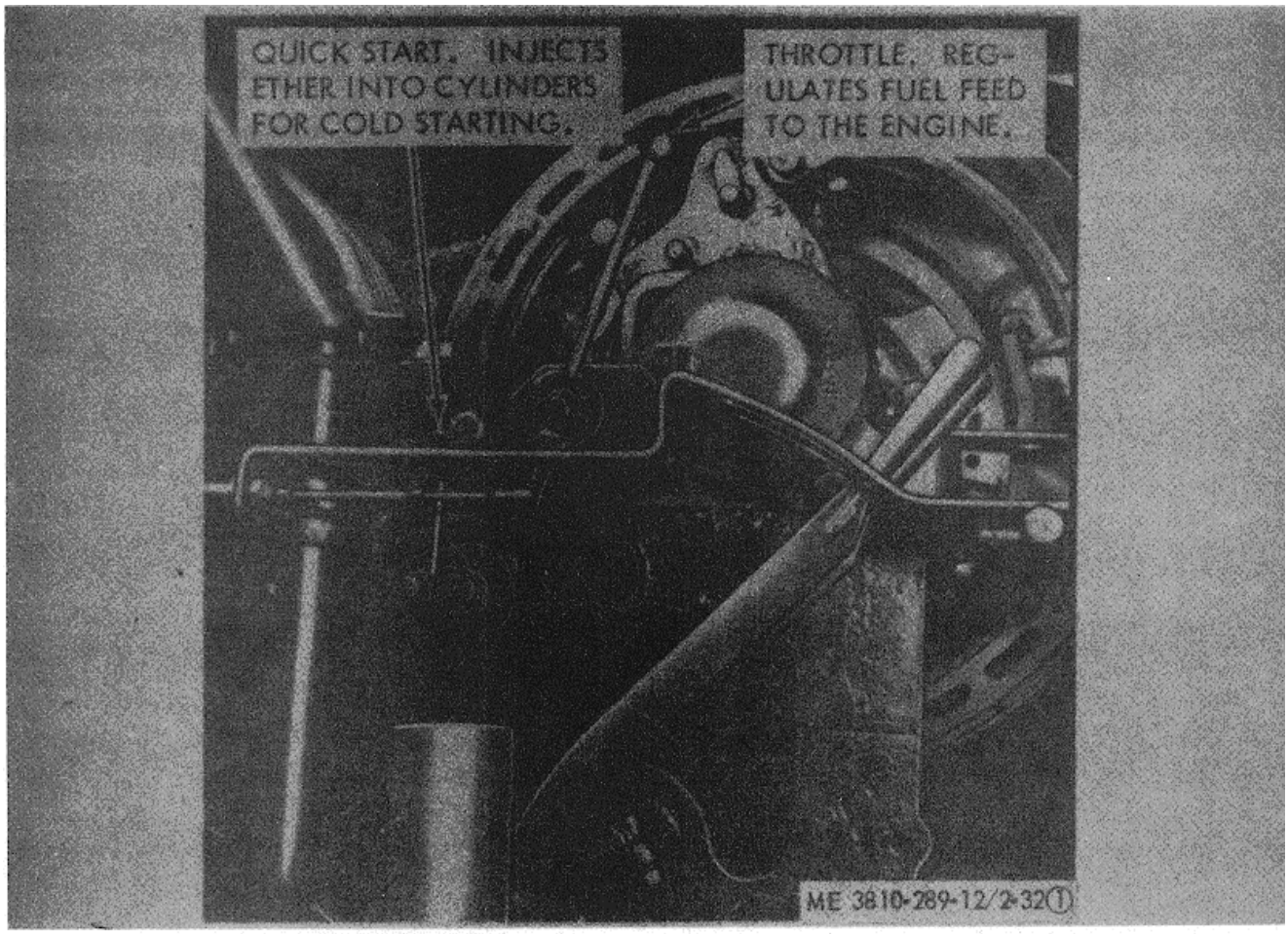


Figure 2-32. Engine controls and instruments (sheet 1 of 2).

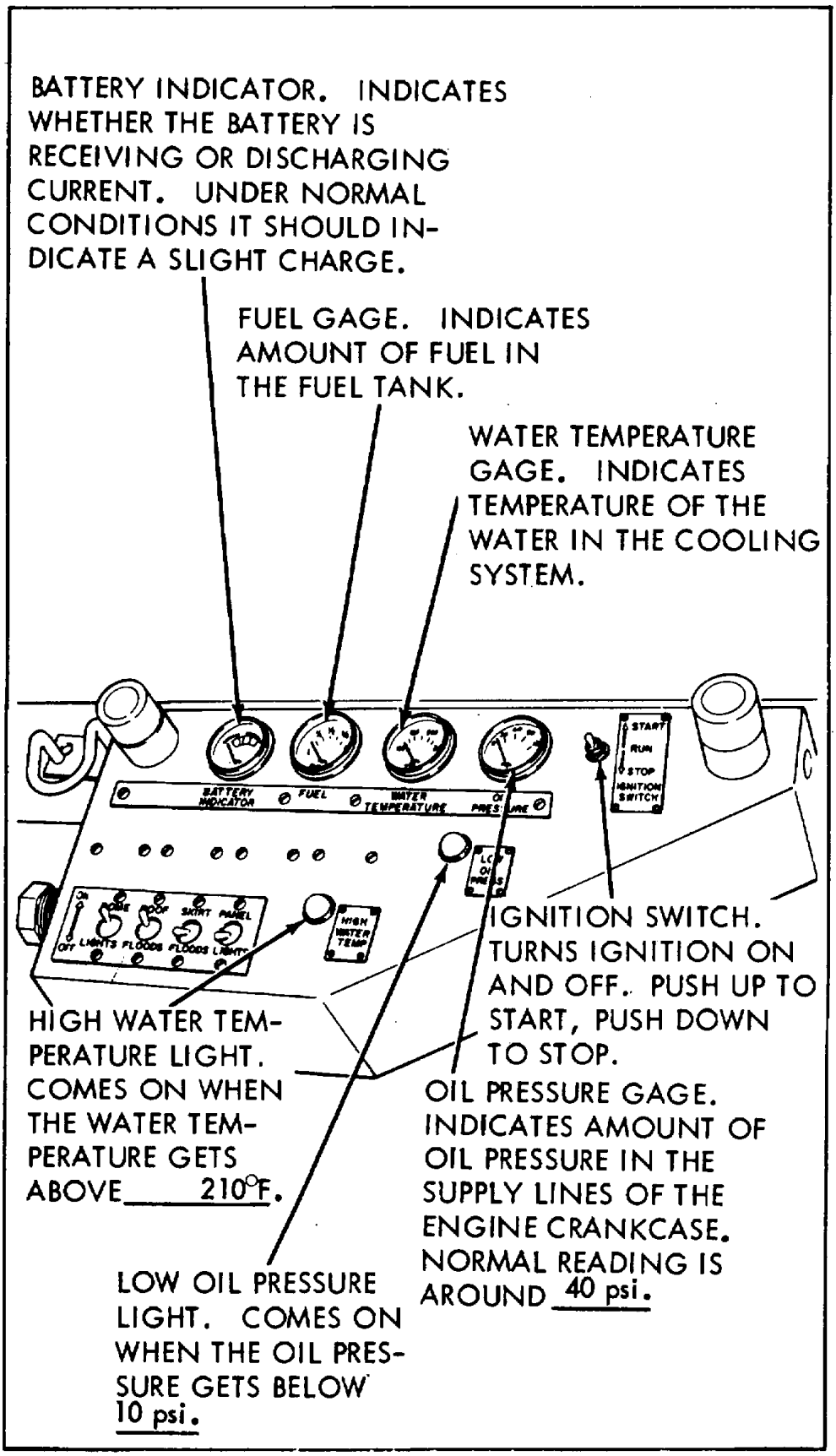


Figure 2-32. Engine controls and instruments (sheet 2 of 2).

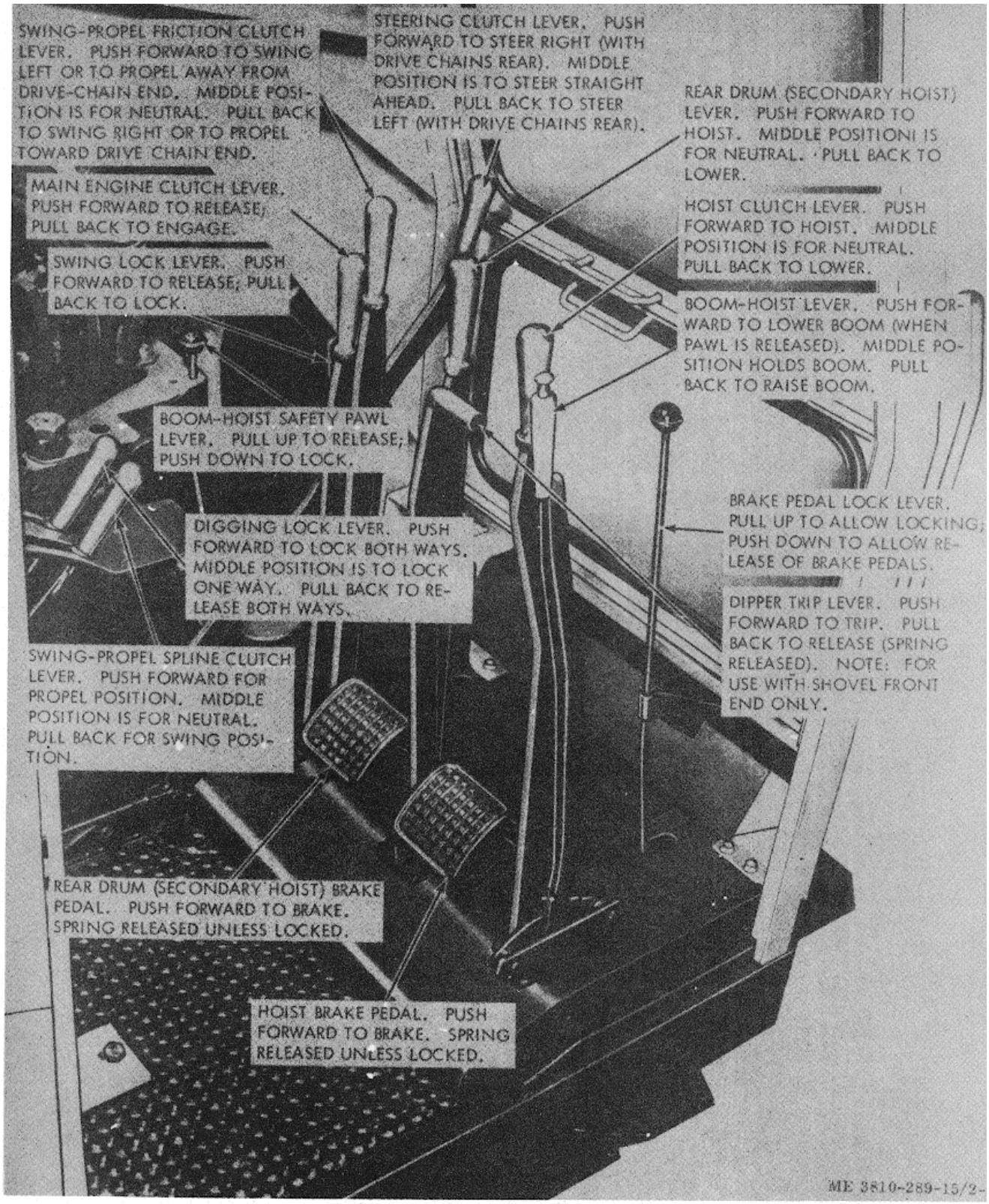


Figure 2-33. Operating controls.

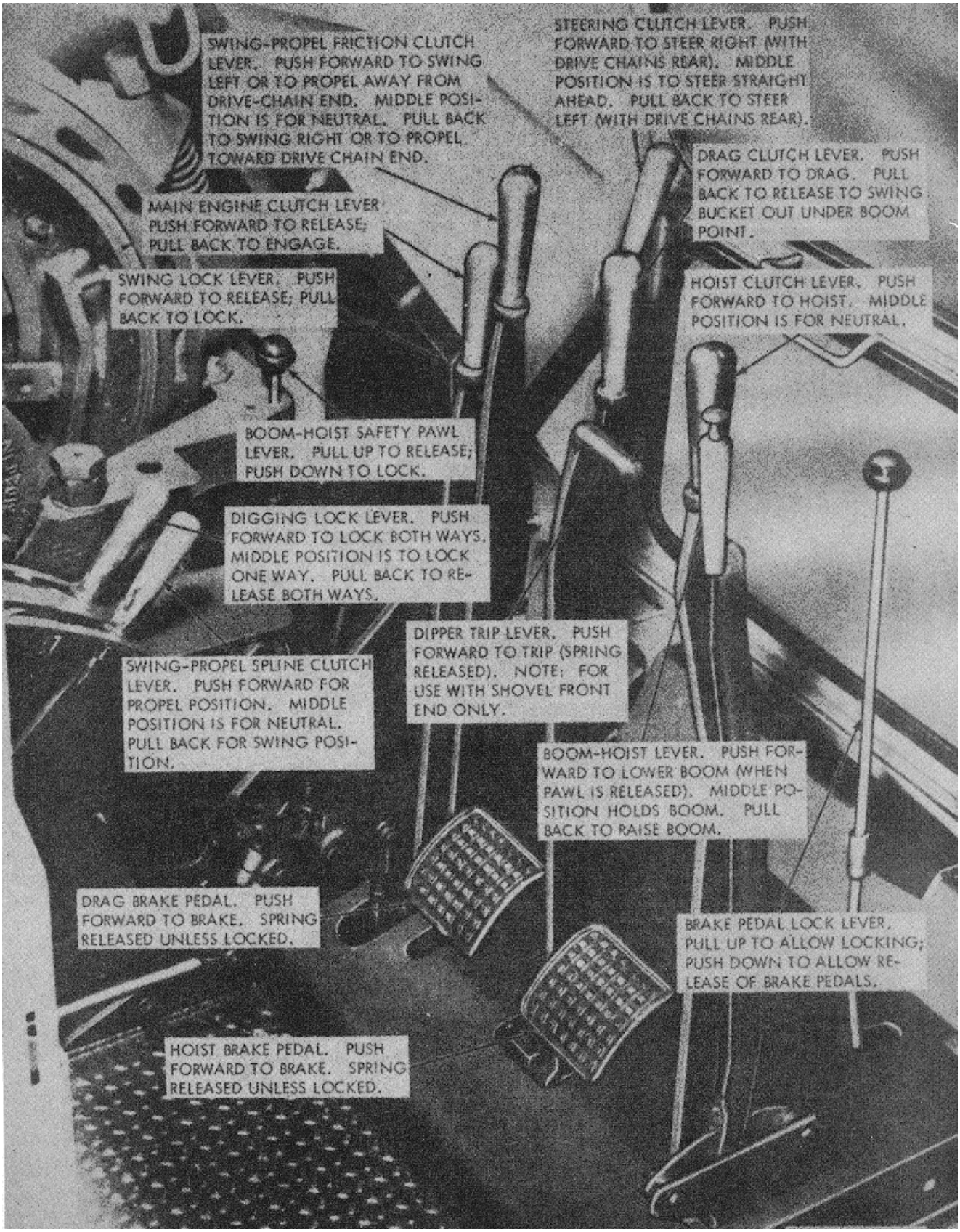


Figure 2-34. Dragline operating controls.

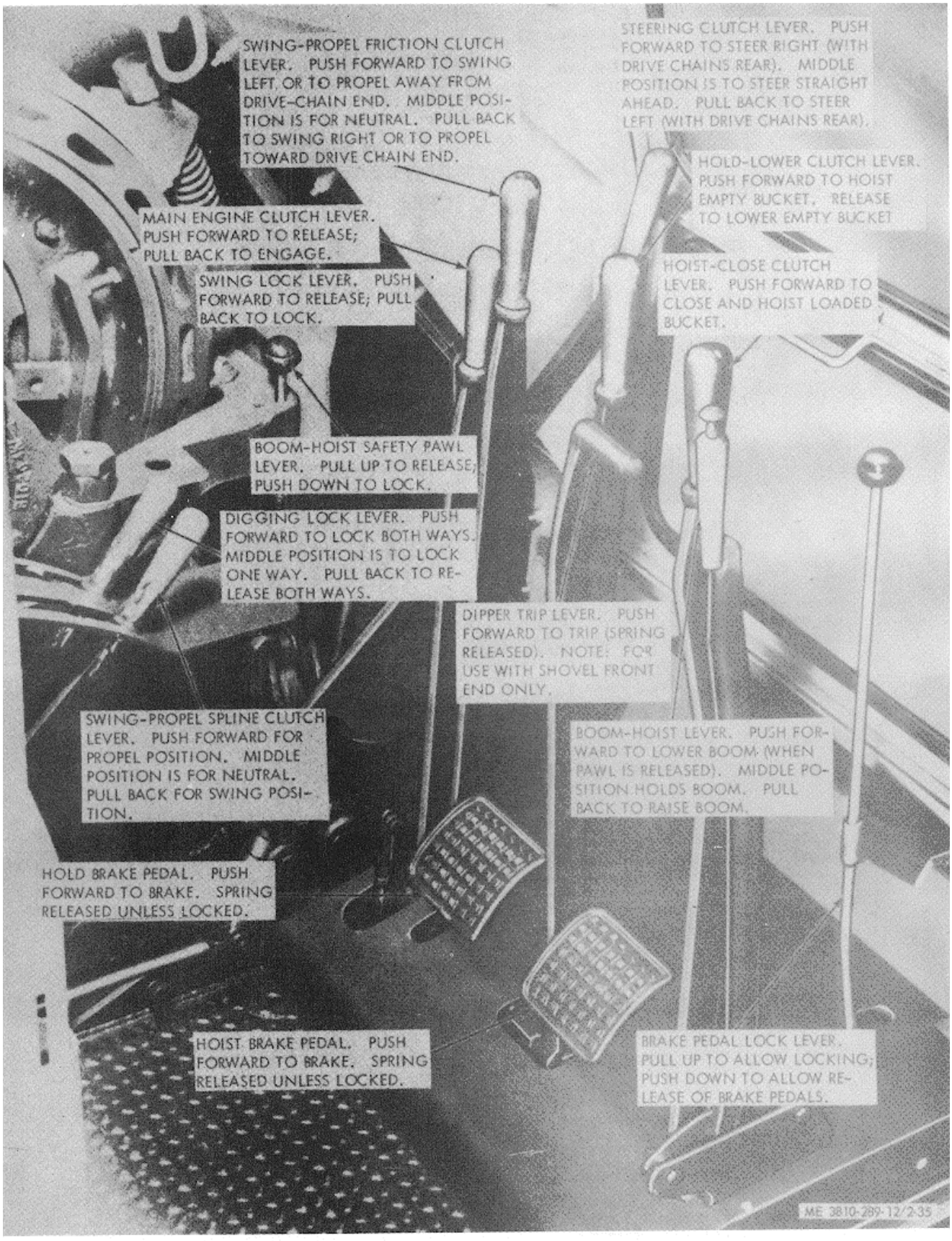


Figure 2-35. Clamshell operating controls.

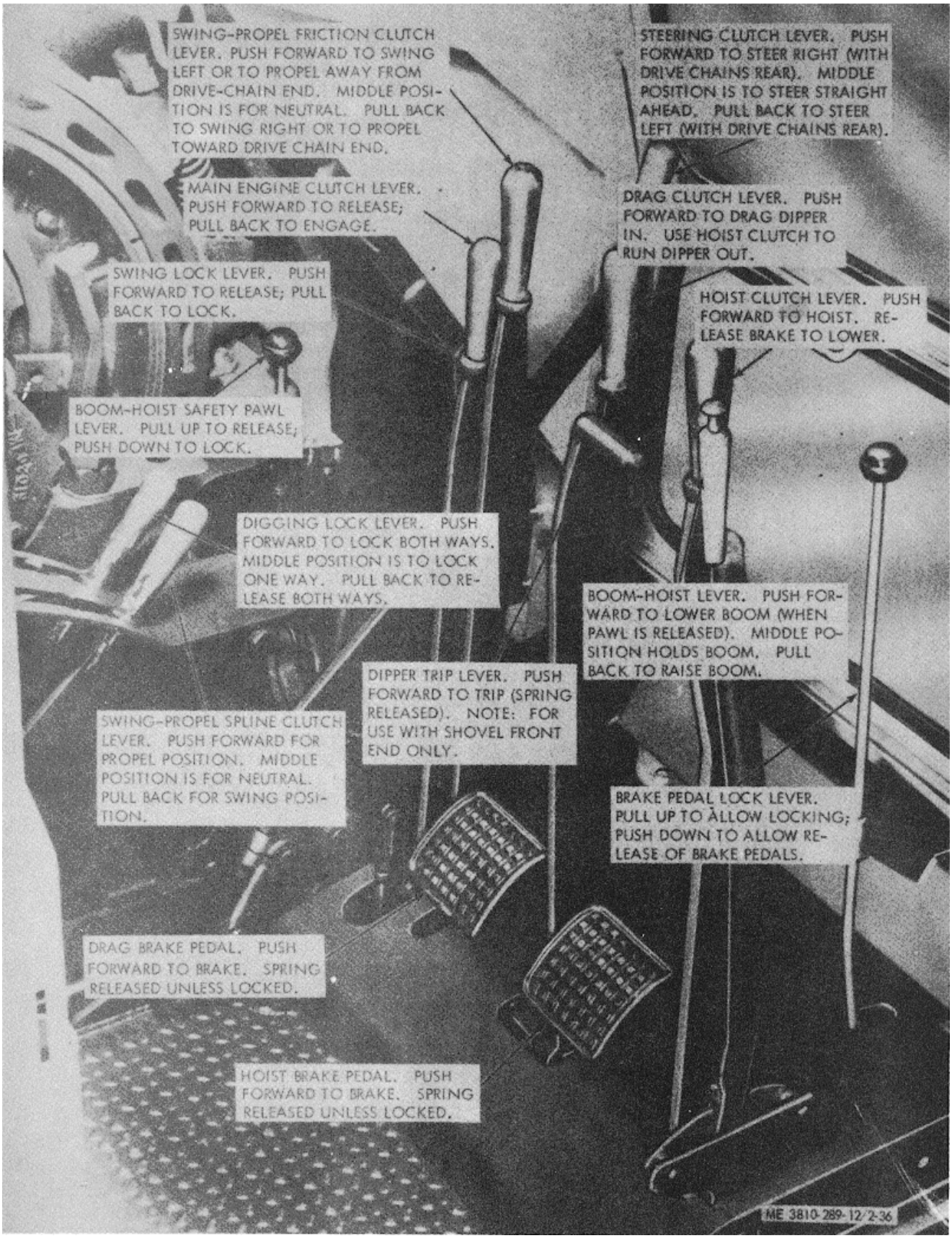


Figure 2-36. Backhoe operating controls.

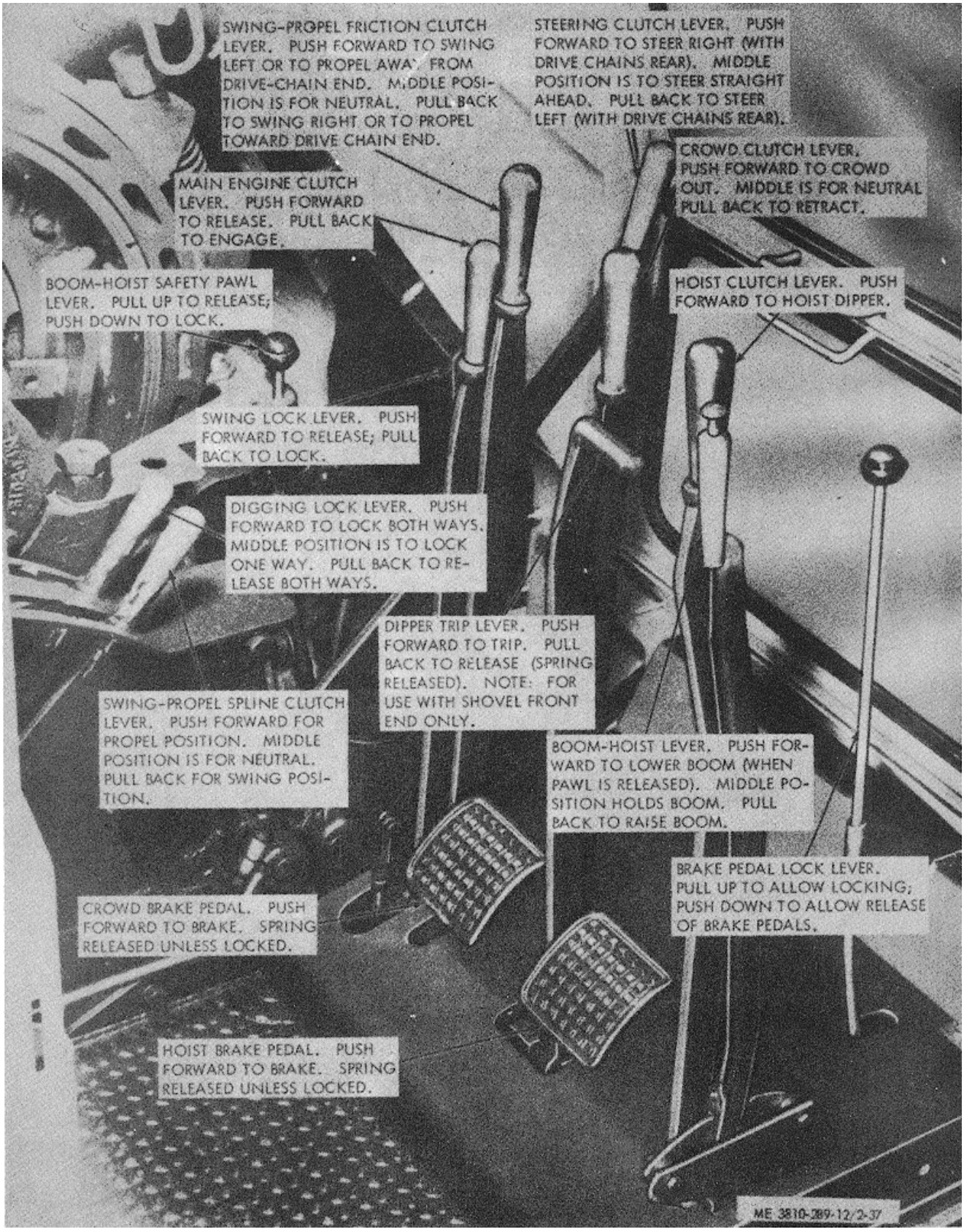


Figure 2-37. Shovel operating controls.

Section IV. OPERATION UNDER USUAL CONDITIONS

2-14. General

a. Instructions in this section are published for information and guidance of personnel responsible for operation of the crane-shovel.

b. The operator must know how to perform every operation of which the crane-shove is capable. This section gives instructions on starting and stopping the crane-shovel, basic motions of the crane-shovel, and on coordinating basic motions to perform specific tasks for with the equipment is designed. Since nearly every presents a different problem, the operator have to vary given procedures to fit the individual job.

2-15. Starting

a. Preparation for Starting.

(1) Perform necessary daily prevent maintenance services (para 3-6).

(2) Check load requirements.

b. Starting. Refer to figure 2-38 and start the crane-shovel.

2-16. Stopping

a. Refer to figure 2-39 and stop the crane shovel.

b. Perform the necessary daily preventive maintenance operations (para 3-6).

2-17. Operation of Crane

a. General.

(1) Be sure the boom length and boom al are such that the load to be lifted comes with the limit given in the table of maximum allowable lifting loads (para 1-5b, (9)).

(2) Crane ratings are based on a firm level foundation for the crane and if the footing is soft enough so that the crane will sink in to extent, due allowance must be made.

(3) Swing the boom directly in line with load before picking up the load.

(4) Pick up the load gradually and do catch it suddenly on the brake when lowering such practice places unnecessary strain on boom.

(5) If necessary to propel with the load suspended, snub it to the foot of the boom to prevent it swinging out beyond the boom point.

(6) Keep the load as low as possible and use extreme care when traveling with a high boom.

(7) Use the auxiliary hoist line for light loads only.

(8) Be sure hoist and boom suspension cables are in good condition before making any heavy lifts.

(9) Use the boom hoist to change the boom angle for accurately spotting the load, but avoid using the boom hoist with heavy loads suspended.

b. Operation.

(1) Start the crane-shovel (para 2-15).

(2) Refer to figures 2-40 through 2-44 to operate the crane.

2-18. Operation of Dragline

a. General.

(1) Work with boom at highest angle that will allow the reach and accuracy needed for the particular job.

(2) Avoid pulling the drag cable socket into the fairlead.

(3) Be sure that the bucket teeth are kept sharp.

(4) Do not use bucket of larger capacity than recommended for normal rapid operation. Overloading results in extra maintenance and delay.

(5) Take an even cut and fill the bucket, being sure to fill the back corners. Keep the drag hitch adjusted for the best penetration of materials.

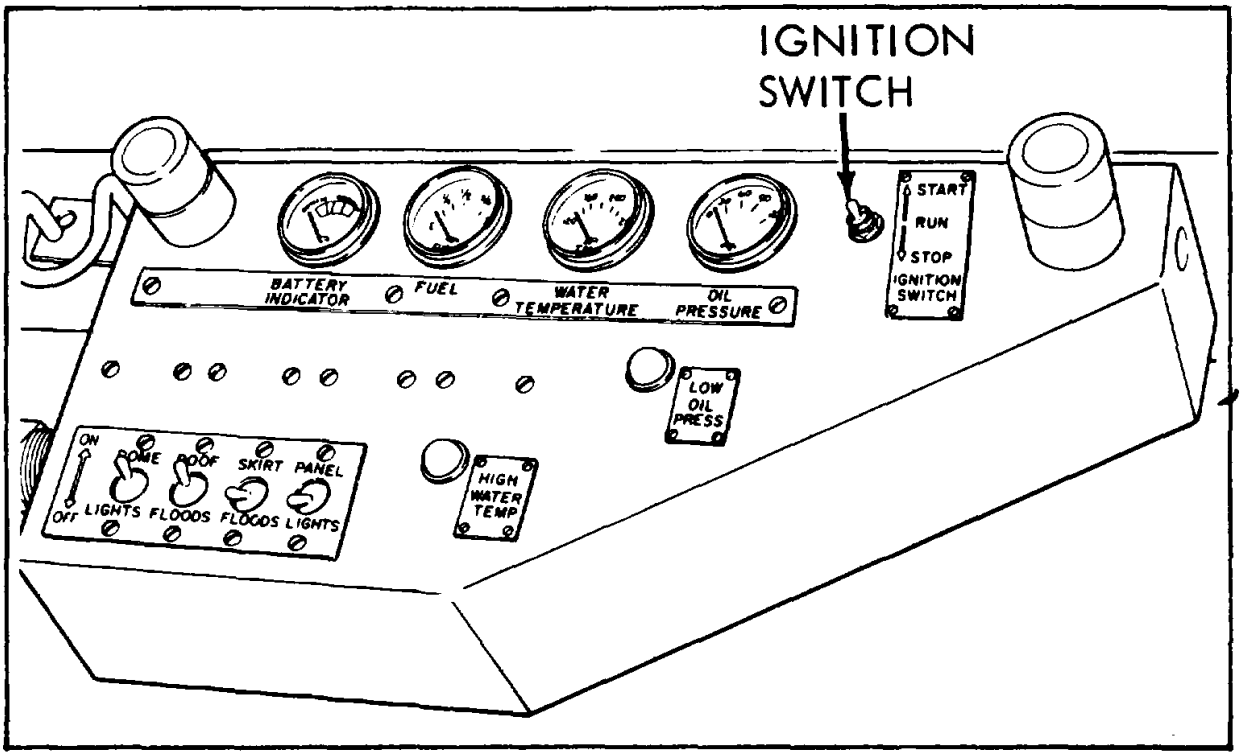
(6) Piling dirt under the boom foot wastes time and power and makes a wearing trap for the drag cable.

(7) It is important to use the proper length of dump-cable so that the bucket can be picked up at a considerable distance ahead of the machine without spilling the dirt.

b. Operation.

(1) Start the crane-shovel (para 2-15).

(2) Refer to figure 2-45 to operate the drag-line.



STEP 1. SET THROTTLE FOR IDLE SPEED.

STEP 2. DISENGAGE THE MAIN ENGINE CLUTCH (PUSH FORWARD).

STEP 3. PUSH THE IGNITION SWITCH UP TO START THE ENGINE.

CAUTION. TO PREVENT PERMANENT CRANKING MOTOR DAMAGE, DO NOT CRANK ENGINE FOR MORE THAN 30 SECONDS CONTINUOUSLY. IF ENGINE DOES NOT FIRE WITHIN FIRST 30 SECONDS, WAIT ONE TO TWO MINUTES BEFORE RECRANKING.

STEP 4. CONTINUE TO CRANK UNTIL THE ENGINE **FIRES.**

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Figure 2-38. Starting the engine (sheet 1 of 2).

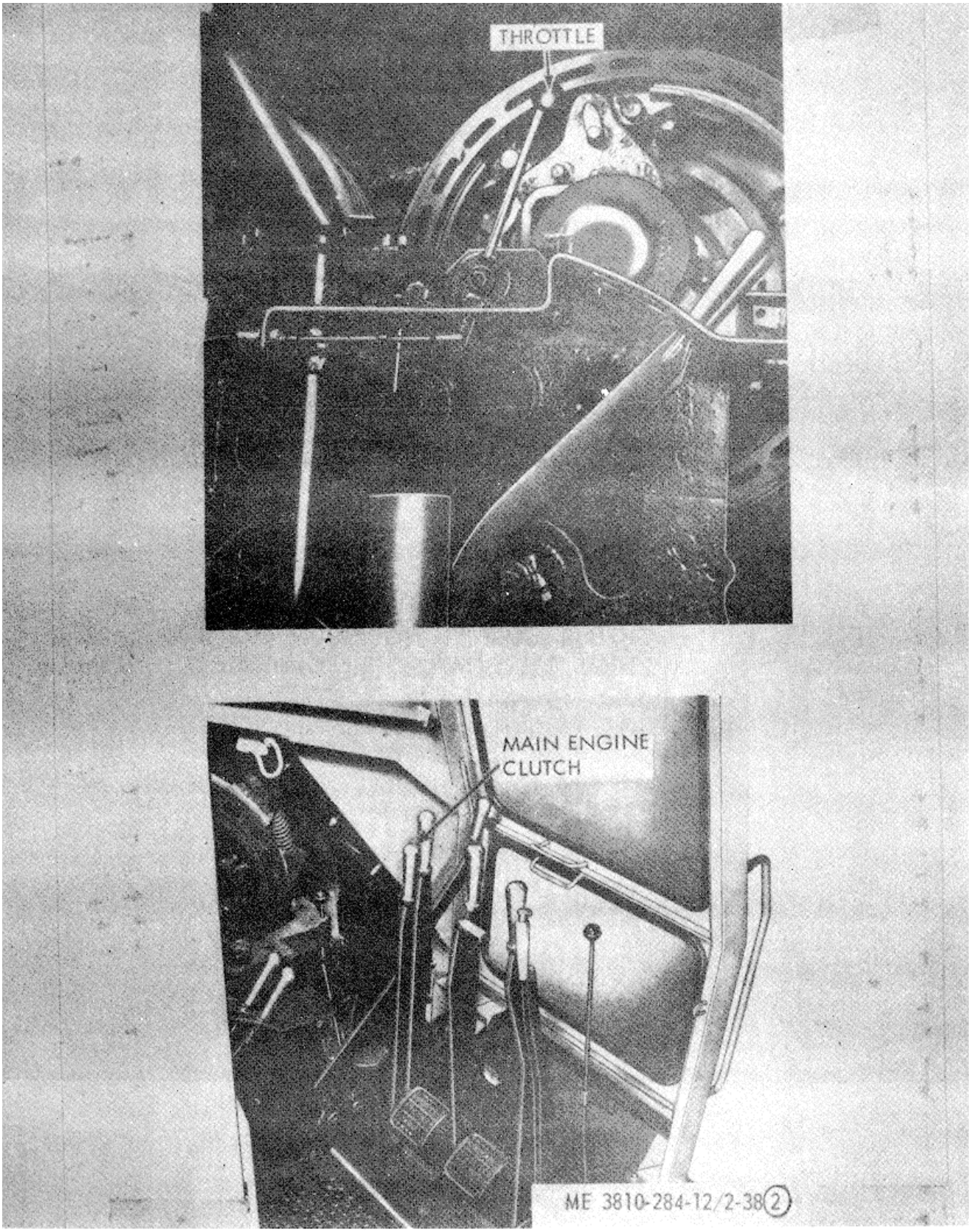
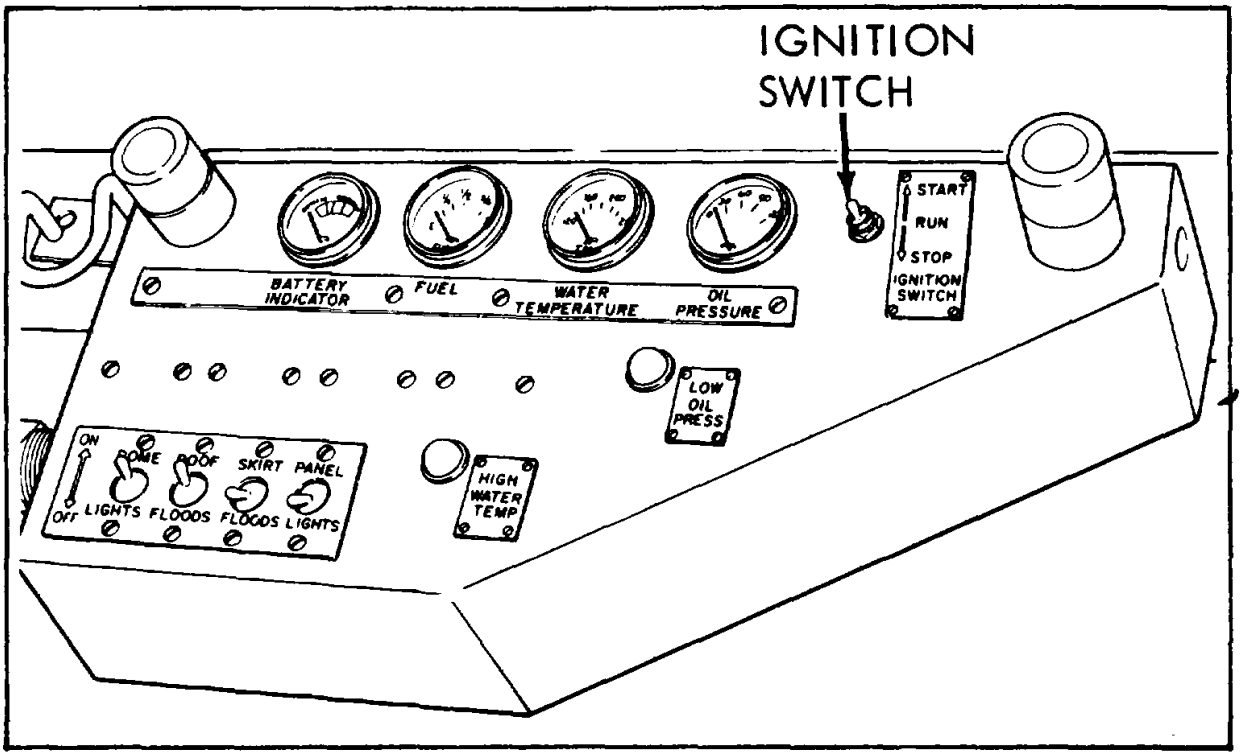


Figure 2-38. Starting the engine (sheet 2 of 2).



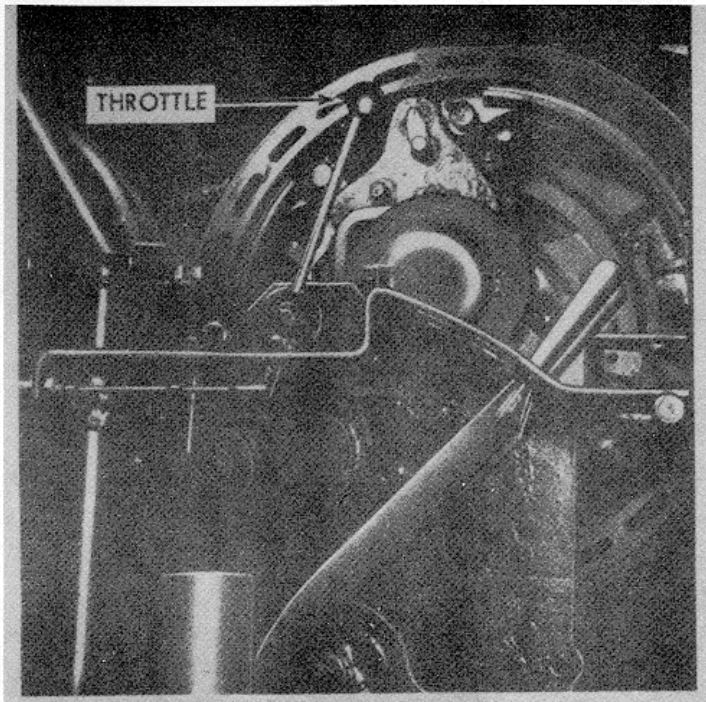
NOTE. IT IS IMPORTANT TO IDLE AN ENGINE 3 TO 5 MINUTES BEFORE SHUTTING IT DOWN TO ALLOW LUBRICATING OIL AND WATER TO CARRY HEAT AWAY FROM THE COMBUSTION CHAMBER, BEARINGS, SHAFTS, ETC.

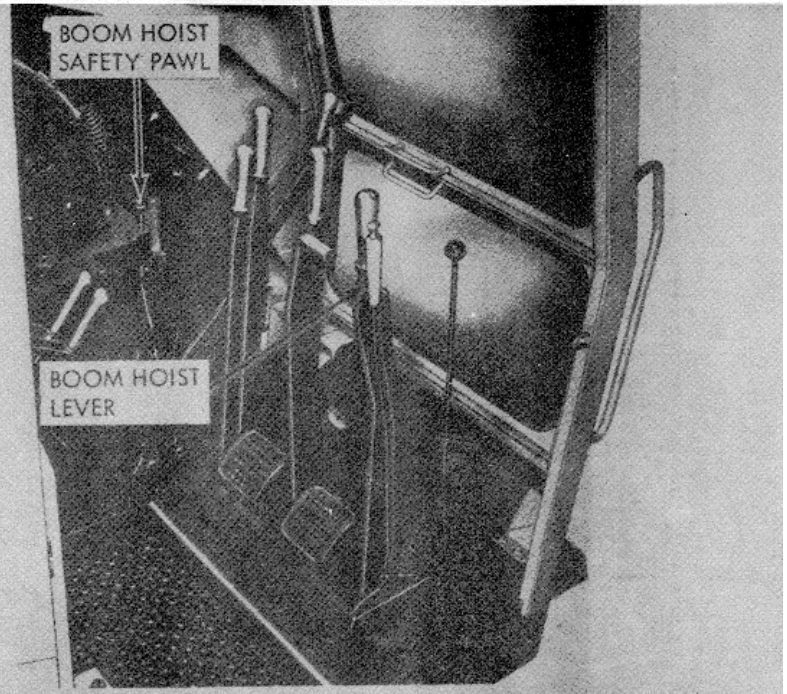
CAUTION. LONG PERIODS OF IDLING ARE NOT GOOD FOR AN ENGINE BECAUSE OPERATING TEMPERATURES DROP SO LOW THE FUEL MAY NOT BURN COMPLETELY. THIS WILL CAUSE CARBON TO CLOG THE INJECTOR SPRAY HOLES AND PISTON RINGS.
IF ENGINE COOLANT TEMPERATURE BECOMES TOO LOW, RAW FUEL WILL WASH LUBRICATING OIL OFF CYLINDER WALLS AND DILUTE CRANKCASE OIL SO ALL MOVING PARTS OF THE ENGINE WILL SUFFER FROM POOR LUBRICATION.

STEP 1. THE ENGINE CAN BE SHUT DOWN COMPLETELY BY PUSHING DOWN THE IGNITION SWITCH.

ME 3810-289-15/2-10

Figure 2-39. Stopping the engine.





STEP 1. SPOTTING THE LOAD REQUIRES ACCURATE CONTROL OF THE BOOM AND SWING MOVEMENTS, TO LOCATE THE LOAD AT THE EXACT SPOT WITHOUT HUNTING OR OVERSHOOTING.

STEP 2. TO LOWER THE BOOM, RAISE THE BOOM SLIGHTLY, BY PULLING BACK ON THE BOOM HOIST LEVER, TO RELIEVE THE LOAD ON THE SAFETY PAWL. RELEASE PAWL BY PULLING UP ON THE BOOM-HOIST SAFETY PAWL LEVER. PUSH THE BOOM-HOIST LEVER FORWARD. THIS RELEASES THE SPRING-SET BRAKE AND PERMITS THE BOOM TO LOWER, AT A RATE DEPENDENT UPON THE SPEED OF THE ENGINE.

STEP 3. STOP THE BOOM LOWERING BY RETURNING THE BOOM HOIST LEVER TO NEUTRAL. IF THE BOOM HAS A TENDENCY TO CONTINUE LOWERING AFTER THE BOOM HOIST LEVER HAS BEEN PLACED IN NEUTRAL, PULL THE BOOM HOIST LEVER BACK PAST NEUTRAL. THIS SETS THE CLUTCH FOR RAISING THE BOOM AND QUICKLY STOPS THE BOOM. AS SOON AS THE BOOM HAS STOPPED LOWERING, ENGAGE THE BOOM-HOIST SAFETY PAWL BY PUSHING DOWN ON THE BOOM-HOIST SAFETY PAWL LEVER.

STEP 4. TO RAISE THE BOOM, PULL BACK ON THE BOOM-HOIST LEVER (IT IS NOT NECESSARY TO RELEASE THE BOOM-HOIST SAFETY PAWL). WHEN THE BOOM HAS REACHED THE DESIRED POSITION, RETURN THE BOOM-HOIST LEVER TO NEUTRAL.

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Figure 2-40. Operating the crane-shovel, spotting operation (sheet 1 of 2)

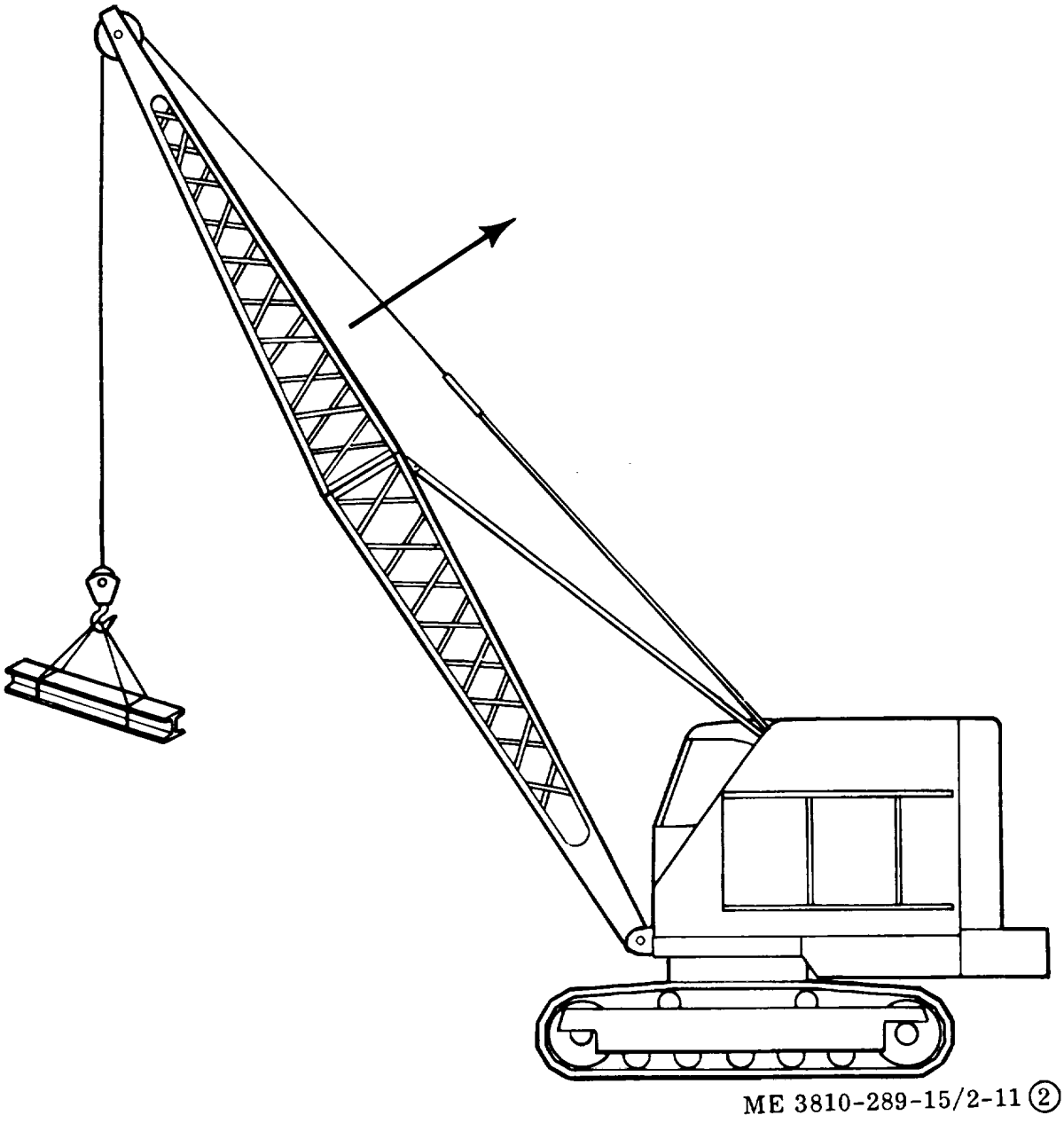


Figure 2-40. Operating the crane-shovel, spotting operation (sheet 2 of 2)

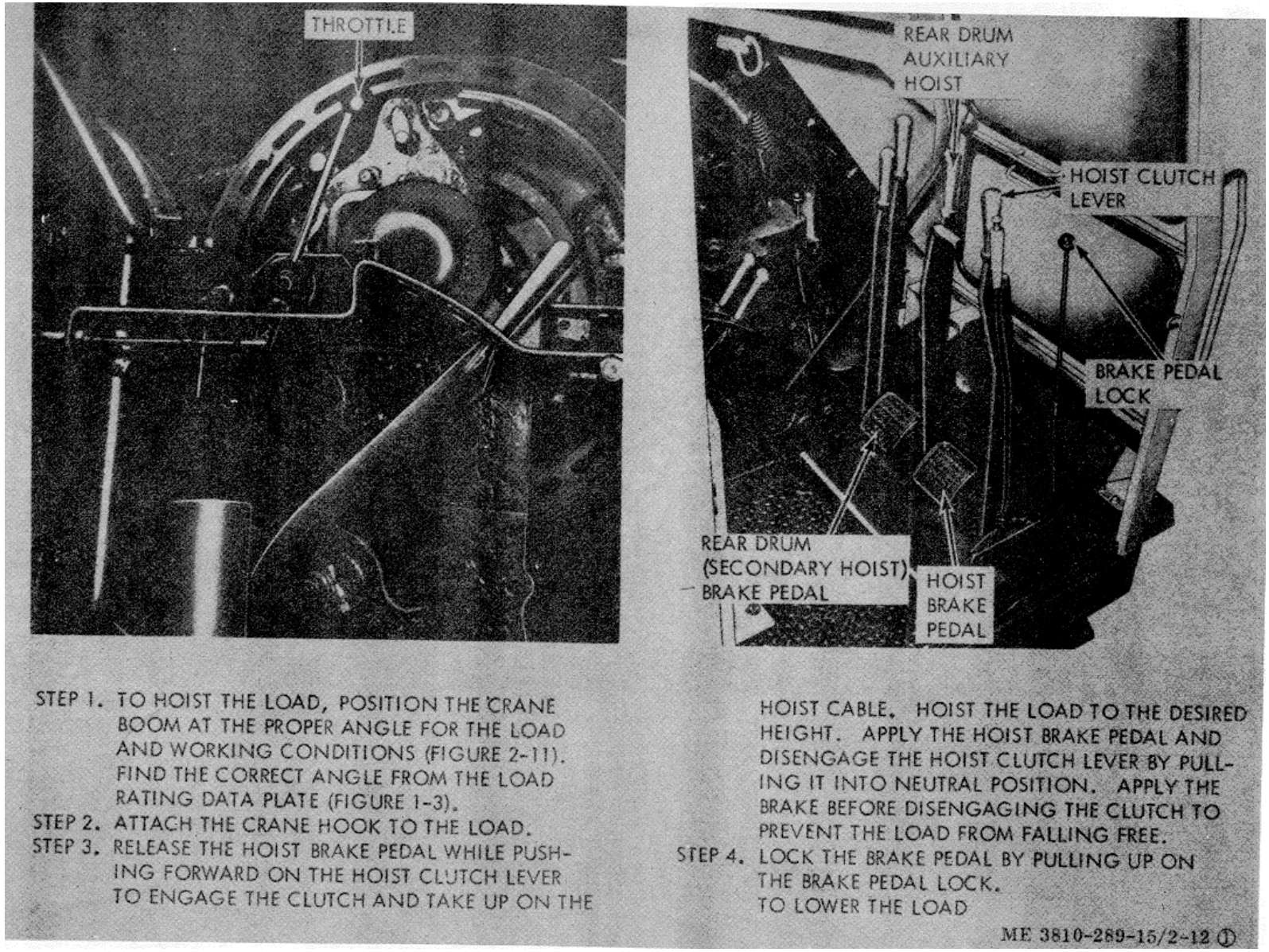
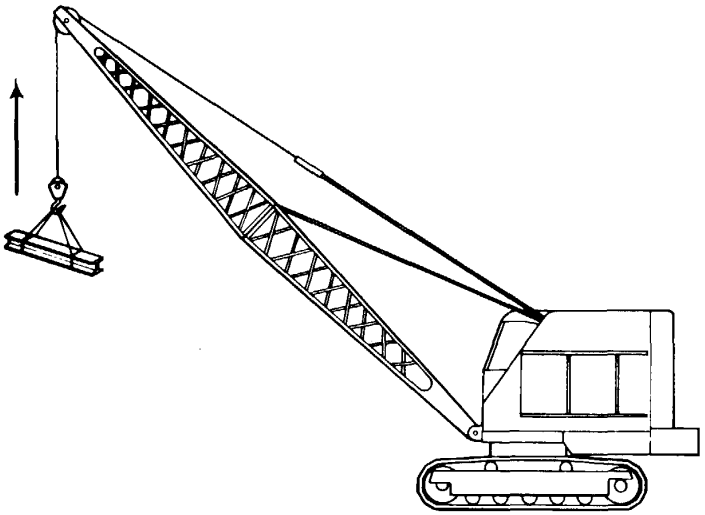


Figure 2-41. Operating the crane-shovel, hoisting and lowering operation (sheet 1 of 2).

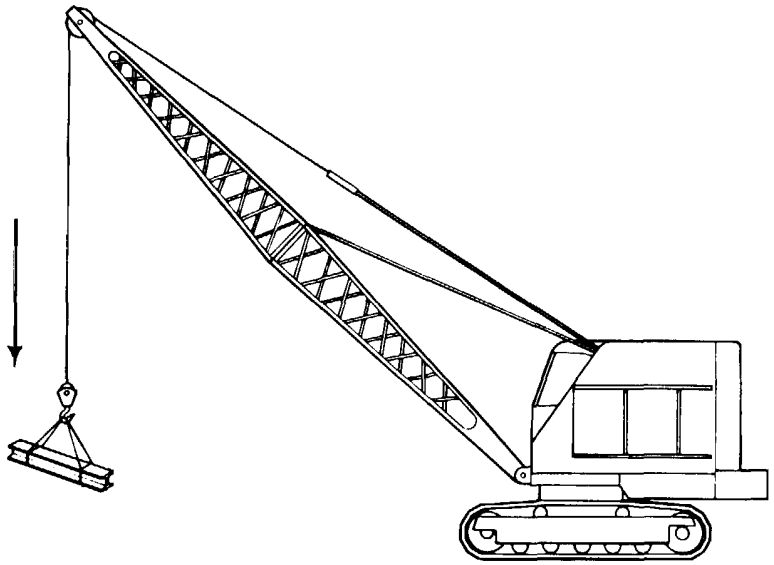


A. RAISING THE LOAD

STEP 1. TO LOWER THE LOAD UNDER CONTROL OF THE ENGINE, PULL THE HOIST CLUTCH LEVER BACKWARD WHILE RELEASING THE HOIST BRAKE PEDAL. THE SPEED AT WHICH THE LOAD DESCENDS CAN BE CONTROLLED BY THE ENGINE THROTTLE CONTROL.

STEP 2. TO LOWER THE LOAD BY GRAVITY, LEAVE THE HOIST CLUTCH LEVER IN NEUTRAL AND CONTROL THE RATE OF DESCENT WITH THE HOIST BRAKE PEDAL ONLY.

STEP 3. TO LOCK THE BRAKE IN POSITION, PULL UP ON THE BRAKE PEDAL LOCK LEVER, THEN DEPRESS THE PEDAL UNTIL THE LATCH ENGAGES. TO



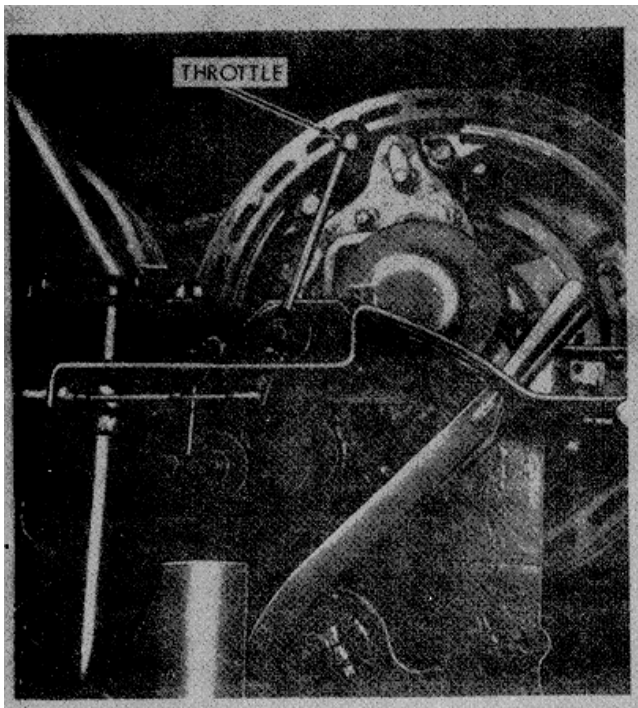
B. LOWERING THE LOAD

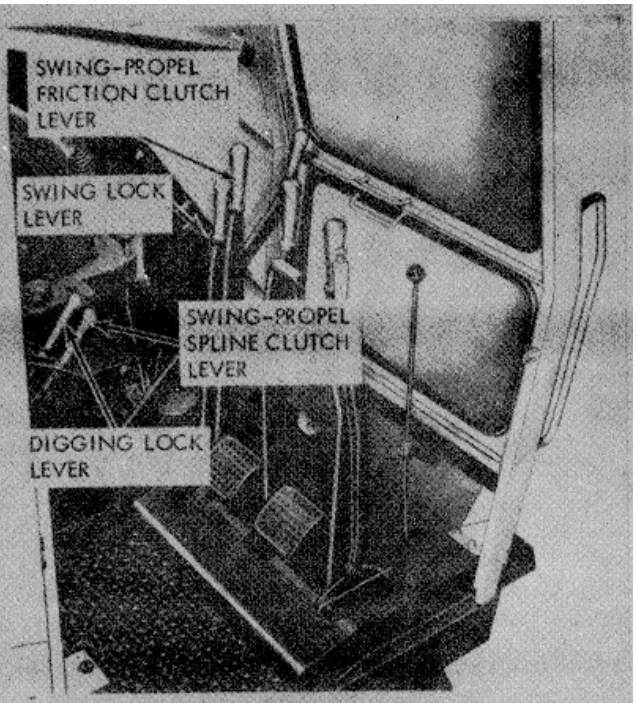
RELEASE THE BRAKE, PUSH DOWN THE BRAKE PEDAL LOCK LEVER THEN DEPRESS THE PEDAL. ONLY THE PEDAL PUSHED DOWN WILL DISENGAGE THE LOCK.

STEP 4. THE AUXILIARY HOIST LINE REEVED TO THE REAR DRUM IS CONTROLLED BY THE REAR DRUM BRAKE PEDAL AND THE REAR DRUM AUXILIARY HOIST.

WARNING. NEVER LEAVE THE MACHINE WITH A LOAD SUSPENDED ON THE LOCKED FOOT BRAKE. THE COOLING OF THE BRAKE HOUSING TENDS TO RELEASE THE BRAKE AND MAY DROP THE LOAD. ME 3810-289-15/2-12

*Figure 2-*41. *Operating the crane-hovel, hoisting and lowering operation (sheet 2 of 2).*





STEP 1. SWING AND PROPEL MOTIONS ARE POWERED FROM THE TWO MAIN FRICTION CLUTCHES AT THE LEFT SIDE OF THE MACHINE. THE SWING PROPEL SPLINE CLUTCH LEVER IS USED TO SELECT WHICH MOTION (SWING OR PROPEL) THE FRICTION CLUTCHES ARE TO PERFORM.

CAUTION. DO NOT ATTEMPT TO ENGAGE THE SWING OR PROPEL SPLINE CLUTCHES, WITHOUT DISENGAGING THE SWING PROPEL FRICTION CLUTCH LEVER BY PLACING IN THE NEUTRAL (MIDDLE) POSITION. IF THE SPLINES DO NOT ENGAGE READILY, ROTATE THEM SLIGHTLY BY USING THE FRICTION CLUTCH. IT WILL BE EASIER IF THE ENGINE IS SLOWED DOWN BY MEANS OF THE THROTTLE CONTROL LEVER.

STEP 2. PLACE THE DIGGING LOCK LEVER IN THE FORWARD NOTCH. THIS LOCKS THE TRACKS AGAINST MOVEMENT IN EITHER DIRECTION.

CAUTION. DO NOT TRY TO SWING THE MACHINE WHEN THE SWING LOCK LEVER IS ENGAGED.

STEP 3. PLACE THE SWING-LOCK LEVER IN THE FORWARD POSITION.

STEP 4. PLACE THE SWING-PROPEL FRICTION CLUTCH LEVER IN THE NEUTRAL (MIDDLE) POSITION.

STEP 5. PULL THE SWING-PROPEL SPLINE CLUTCH LEVER TO THE REAR POSITION. THIS RELEASES THE PROPEL SPLINE CLUTCH AND ENGAGES THE SWING SPLINE CLUTCH.

STEP 6. TO SWING LEFT, PUSH THE SWING PROPEL FRICTION CLUTCH LEVER FORWARD; TO SWING RIGHT, PULL THE SWING PROPEL FRICTION CLUTCH LEVER BACKWARD. THE MIDDLE POSITION IS NEUTRAL, IN WHICH THE MACHINE WILL "COAST" AS FAR AS SWING IS CONCERNED.

STEP 7. TO STOP SWING MOTION, REVERSE SWING-PROPEL FRICTION CLUTCH LEVER, WHICH APPLIES OPPOSITE DRIVE SWING AS A BRAKE.

CAUTION. DO NOT ATTEMPT TO USE THE SWING-LOCK LEVER WHEN REVOLVING FRAME IS IN MOTION. IT IS MERELY A HOLDING CONTROL, AND USING IT AS A BRAKE MAY CAUSE DAMAGE TO THE GEAR TEETH.

STEP 8. PLACE THE SWING-LOCK LEVER IN THE REAR (ENGAGED) POSITION.

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Figure 2-42. Operating the crane-shovel, swinging operation (sheet 1 of 2).

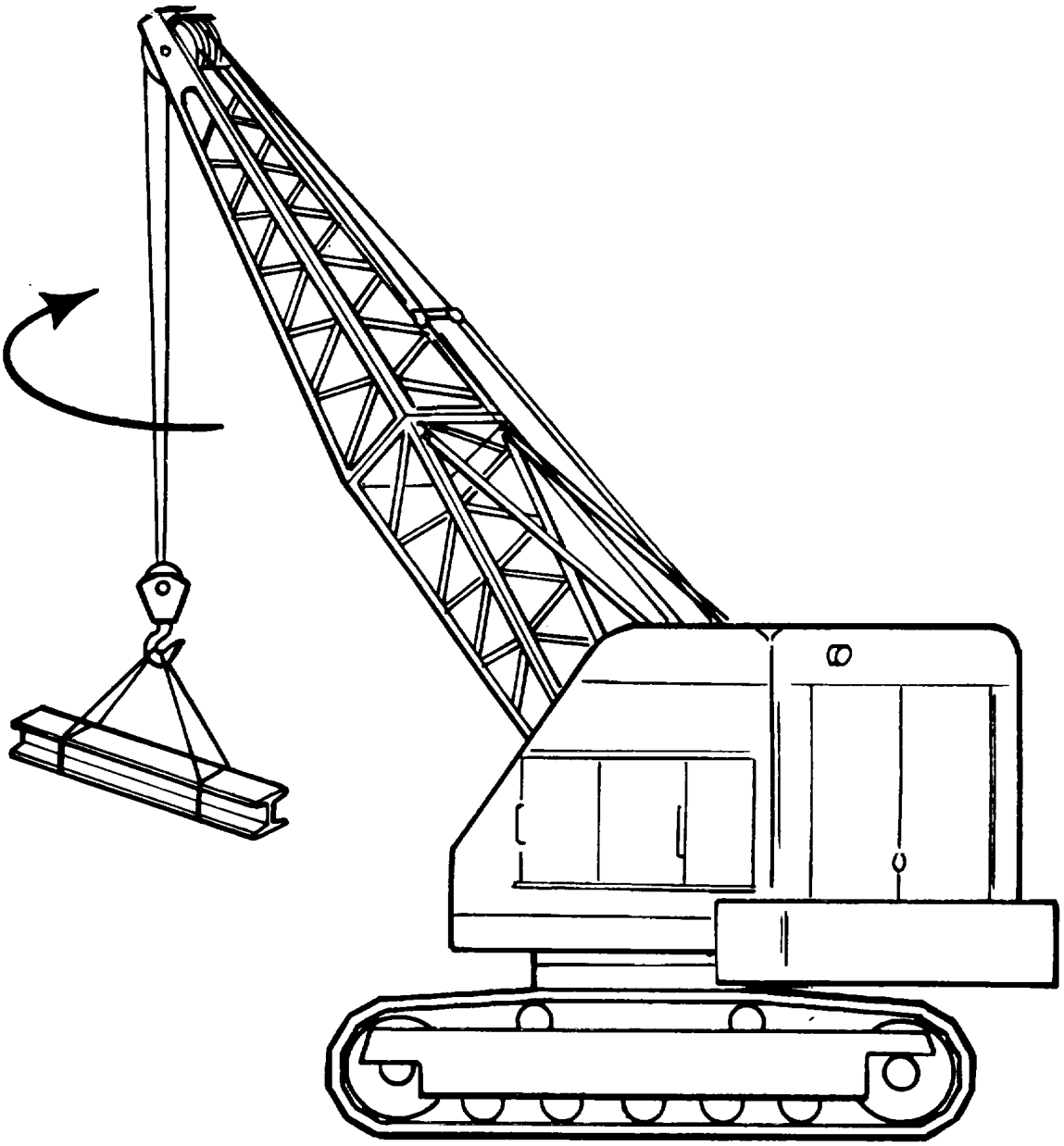
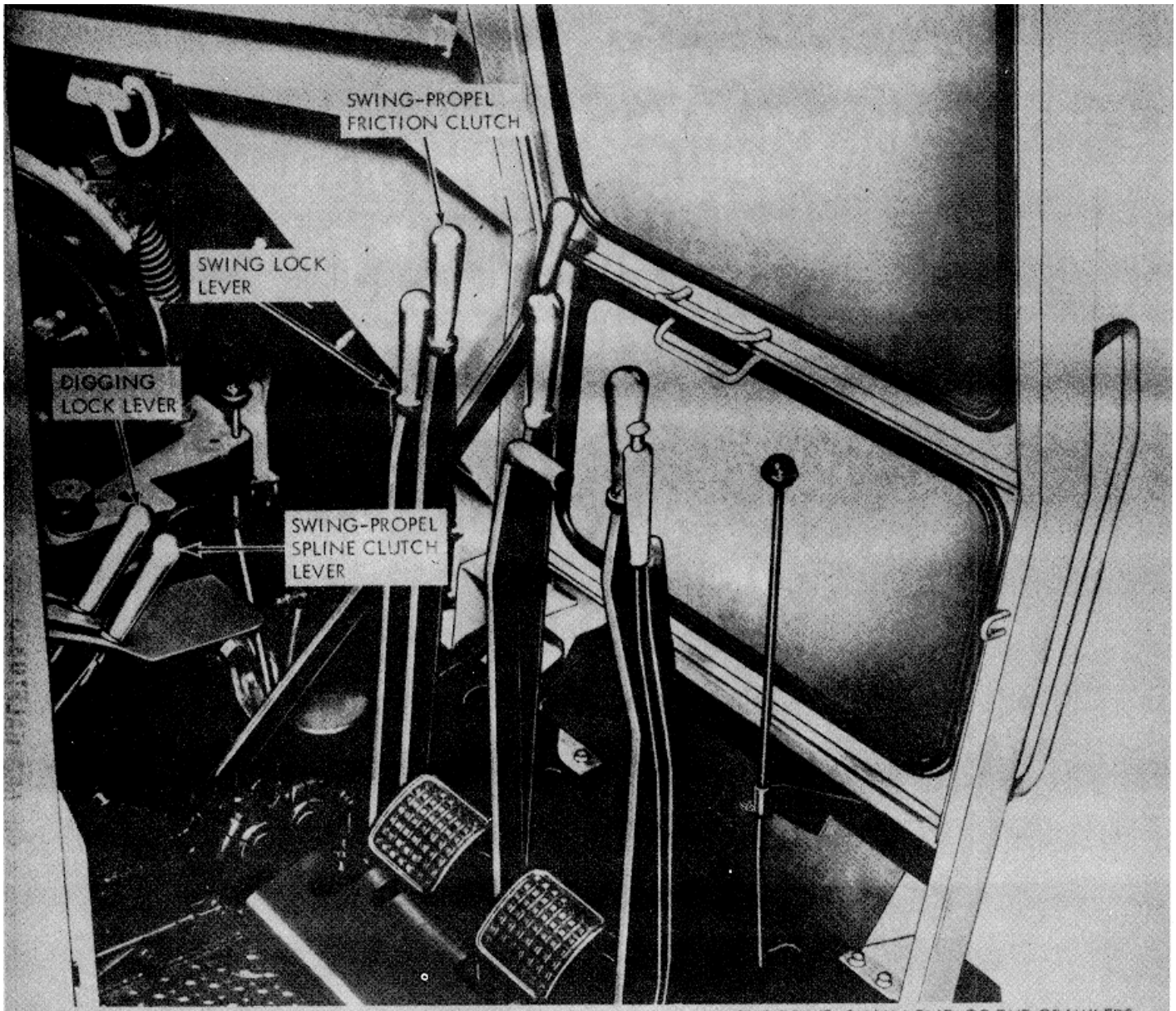


Figure 2-42. Operating the crane-shovel, swinging operation (sheet 2 of 2).



STEP 1. PLACE THE SWING LOCK LEVER TO THE REAR POSITION. THIS PREVENTS THE CAB FROM SWINGING IN EITHER DIRECTION. THE SWING-LOCK LEVER SHOULD BE RELEASED ONLY AFTER THE SWING PROPEL SPLINE CLUTCH LEVER HAS BEEN PLACED IN THE SWING (REAR) POSITION.

STEP 2. SINCE THE REVOLVING FRAME SWINGS SO THAT THE OPERATOR MAY BE FACING EITHER END OF THE CRAWLERS, DIRECTION OF TRAVEL MUST BE BASED ON THE DRIVE-CHAIN END OF THE CRAWLERS.

STEP 3. PUSH THE SWING-PROPEL SPLINE CLUTCH LEVER FORWARD.

STEP 4. PUSH THE SWING-PROPEL FRICTION CLUTCH LEVER FORWARD TO TRAVEL FORWARD WITH THE DRIVE-CHAIN END OF THE CRAWLERS TRAILING.

STEP 5. PULL THE SWING-PROPEL FRICTION CLUTCH LEVER BACKWARD TO TRAVEL FORWARD WITH THE DRIVE-CHAIN END OF THE CRAWLERS LEADING.

STEP 6. TO STOP THE MACHINE QUICKLY, REVERSE POSITION OF THE SWING PROPEL FRICTION CLUTCH LEVER.

CAUTION. DON'T ENGAGE THE DIGGING LOCK LEVER WHEN MACHINE IS IN MOTION. DON'T PARK MACHINE ON A GRADE WITHOUT ENGAGING THE DIGGING LOCK LEVER.

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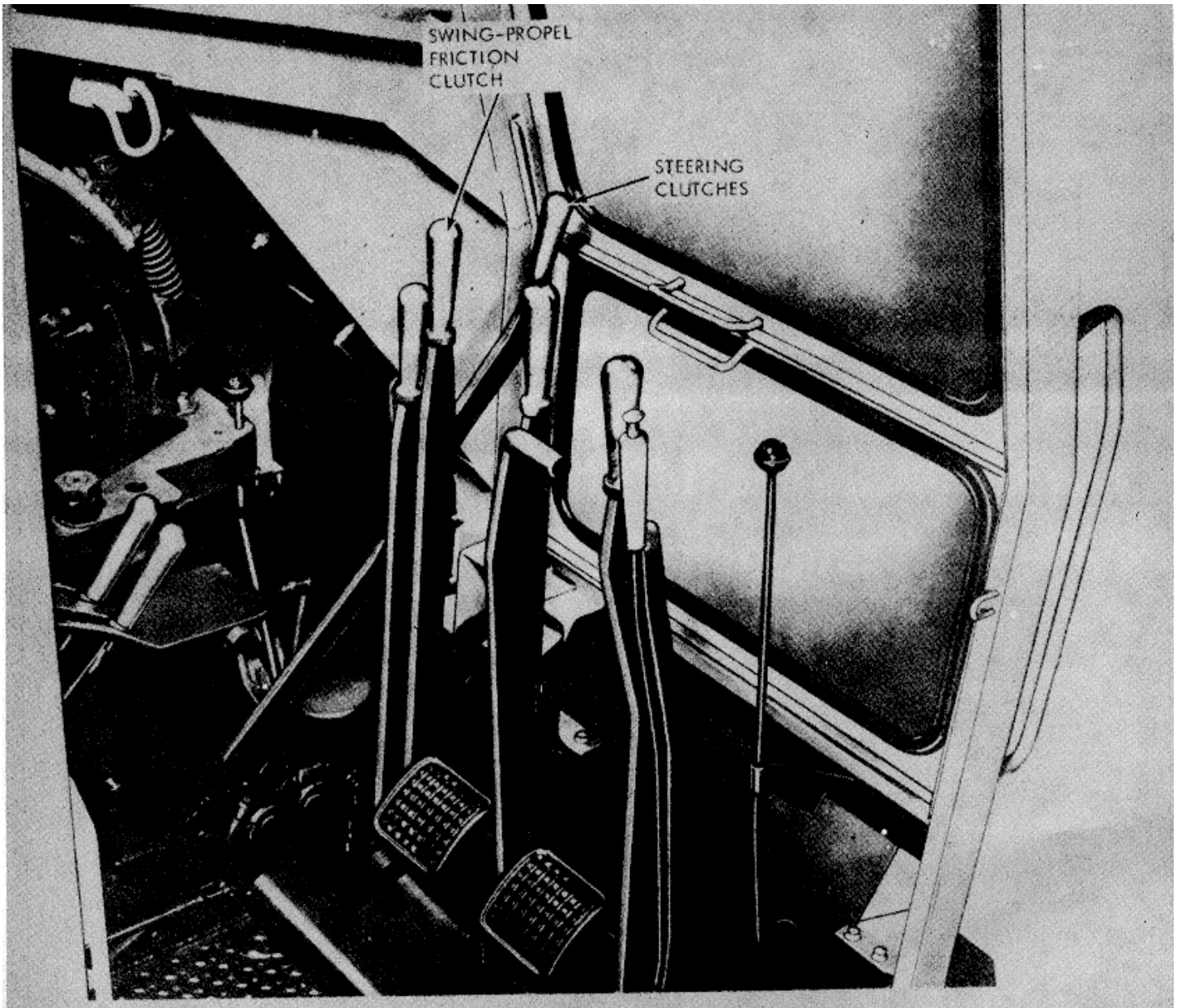
Figure 2-43. Operating the crane-shovel, propelling



STEP 1. IT IS NECESSARY TO STOP PROPELLING TO RELEASE OR ENGAGE STEERING CLUTCHES FOR CHANGING DIRECTION. IF STEERING CONTROL LEVER DOES NOT RELEASE EASILY, ENGAGE SWING-PROPEL FRICTION CLUTCH LEVER LIGHTLY FOR REVERSE DIRECTION TO RELIEVE PRESSURE ON SPLINE ENGAGEMENT.

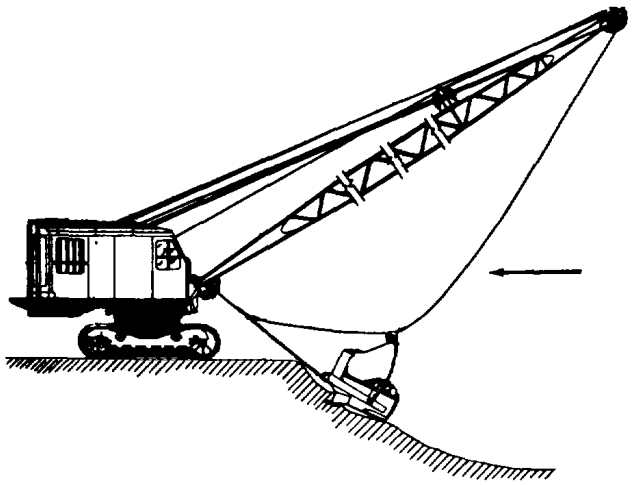
STEP 2. PLACING THE STEERING CLUTCH LEVER IN THE MIDDLE POSITION ALLOWS THE CRANE-SHOVEL TO TRAVEL IN A STRAIGHT PATH.

STEP 3. TO TURN TO THE RIGHT (CRAWLER DRIVING CHAINS TO THE REAR) PUSH THE STEERING CLUTCH LEVER PART WAY FORWARD (FROM NEUTRAL) FOR A GRADUAL TURN, AND ALL THE WAY FORWARD FOR A SHARP TURN.

STEP 4. TO TURN TO THE LEFT (CRAWLER DRIVING CHAINS TO THE REAR) PULL THE STEERING CLUTCH LEVER PART WAY BACK (FROM NEUTRAL) FOR A GRADUAL TURN AND ALL THE WAY BACK FOR A SHARP TURN. THE CLUTCHES ARE SPRING SET, SO DON'T SEE-SAW.

ME 3810-289-15/2-15

Figure 2-44. Operating the crane-shovel, steering.

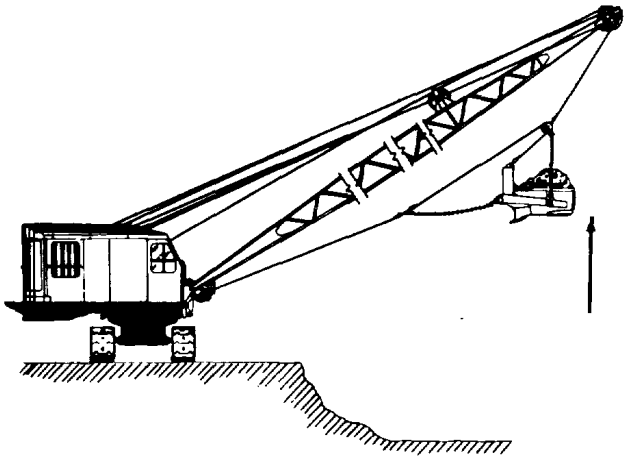


A. DRAGING THE BUCKET

STEP 1. LOWER BUCKET TO DIGGING AREA. IF CUT IS BELOW MACHINE LEVEL, IT WILL BE NECESSARY TO PAY OUT DRAG CABLE TO OBTAIN MAXIMUM BOOM REACH.

STEP 2. RELEASE THE DRAG BRAKE, ENGAGE DRAG CLUTCH, AND EASE OFF THE HOIST BRAKE TO ALLOW HOIST CABLE TO FOLLOW BUCKET.

NOTE: DO NOT PULL THE DRAG CABLE ANCHOR INTO THE FAIRLEAD.



B. HOISTING THE BUCKET

STEP 3. AS SOON AS THE BUCKET IS FILLED, DISENGAGE DRAG CLUTCH, RELEASE HOIST BRAKE, AND ENGAGE HOIST CLUTCH. AS THE BUCKET RISES, EASE OFF THE DRAG BRAKE SO THAT THE DRAG CABLE WILL FOLLOW THE BUCKET.

STEP 4. HOIST BUCKET UNTIL IT IS CLEAR OF OBSTRUCTIONS. DISENGAGE HOIST CLUTCH AND ENGAGE HOIST AND DRAG BRAKES.

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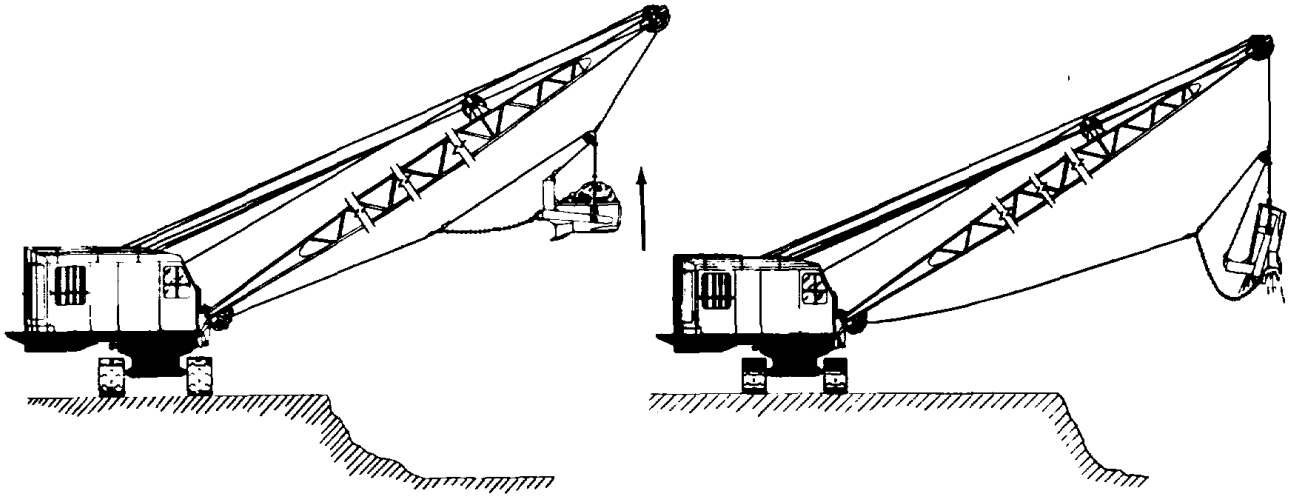
Figure 2-45. Operating the dragline (sheet 1 of 2).



C. SWINGING THE MACHINE

STEP 5. SWING THE MACHINE (FIGURE 2-42) TO THE DUMPING AREA.

D. DUMPING THE BUCKET

STEP 6. DUMP THE BUCKET BY RELEASING THE DRAG BRAKE. WHEN THE LOAD IS DUMPED RETURN TO DIGGING AREA.

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Figure 2-45. Operating the dragline (sheet 2 of 2).

2-19. Operation of Clamshell

a. General.

(1) Keep the boom as high as conditions permit, but be careful not to let the bucket swing against the underside of the boom.

(2) Keep sufficient tension on the bucket tagline so that the bucket will not spin and the cables.

(3) When transferring material from stockpile, always excavate the center of it so that the material falls inwards, and helps to insure a full bucket every time.

(4) Start and stop the swing motion slowly so that the loaded bucket will not swing excessively.

(5) Do not disengage the main clutch leave the cab when the bucket is off the ground.

b. Operation.

(1) Start the crane-shovel (para 2-15).

(2) Refer to figure 2-46 to operate the clam shell.

2-20. Operation of Backhoe

a General.

(1) Be sure that the dipper teeth are kept sharp and built up to proper size.

(2) When dragging in the dipper, keep a slight pressure on the hoist brake; this will insure that the weight of the boom is not transferred to the dipper.

(3) Don't swing into trench walls. Be sure to clear bank or trench wall when hoisting out of the cut before attempting to swing.

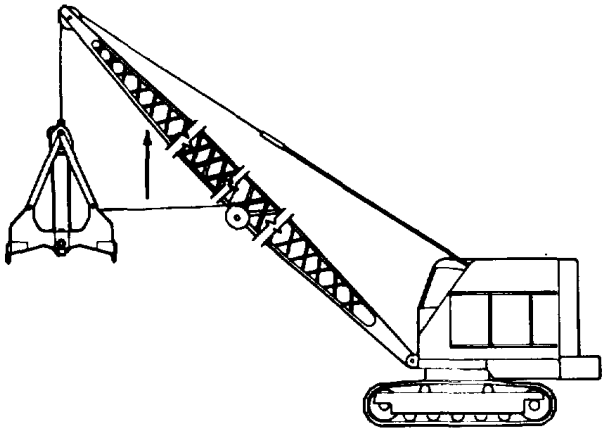
(4) Do not allow the machine to stand at the end of the trench or near the edge of other excavation during the shutdown hours.

(5) Do not propel the machine back over a partly excavated trench.

b. Operation.

(1) Start the crane-shovel (para 2-15).

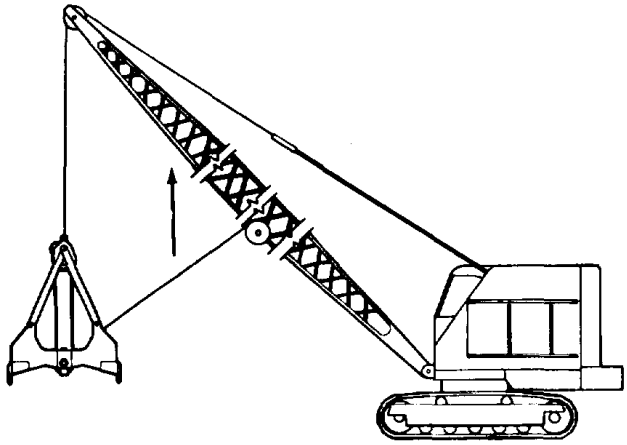
(2) Refer to figure 2-47 to operate the backhoe,



A. RAISING OPEN BUCKET

STEP 1. HOIST OPEN BUCKET BY RELEASING HOLD AND HOIST BRAKES AND PUSHING HOLD-LOWER CLUTCH LEVER FORWARD, HOIST UNTIL BUCKET IS CLEAR OF OBSTRUCTIONS.

STEP 2. DISENGAGE HOLD-LOWER CLUTCH AND ENGAGE HOIST AND HOLD BRAKES.



B. LOWERING OPEN BUCKET

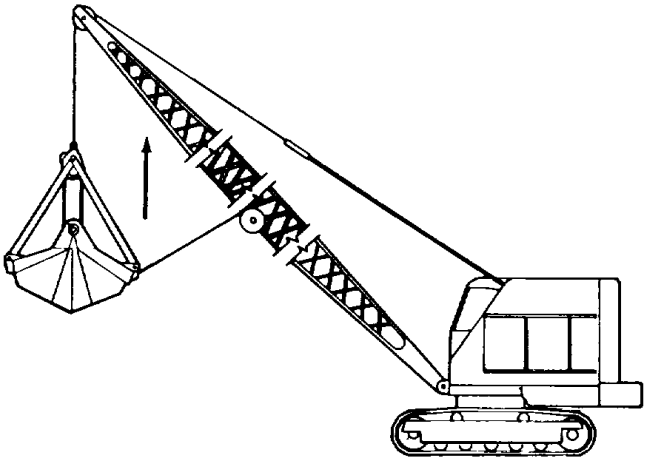
STEP 3. SWING MACHINE (FIGURE 2-42) TO DIGGING AREA.

STEP 4. LOWER OPEN BUCKET BY RELEASING HOLD AND HOIST BRAKES.

NOTE: DO NOT ALLOW BUCKET TO BOUNCE ON GROUND. THIS MAY CAUSE THE CABLES TO FOUL.

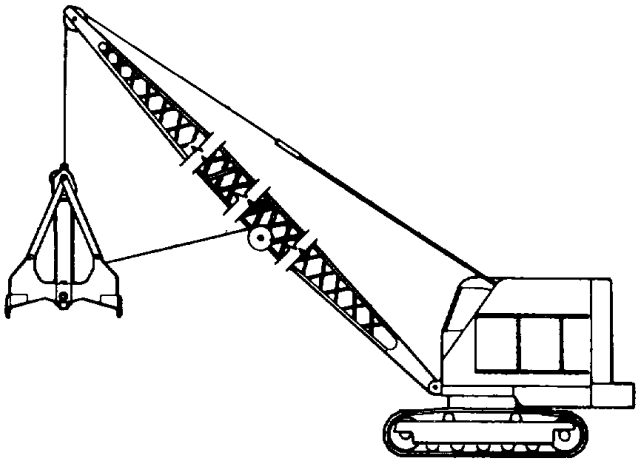
ME 3810-289-12/2-46 (1)

Figure 2-46. Operating the clamshell (sheet 1 of 2).



C. RAISING CLOSED BUCKET

STEP 5. FILL, CLOSE, AND HOIST BUCKET BY PUSHING HOIST-CLOSE CLUTCH LEVER FORWARD AND PUSHING HOLD-LOWER CLUTCH LEVER FORWARD JUST ENOUGH TO PLACE SLIGHT DRAG **ON** REAR DRUM CLUTCH DRAG WILL CAUSE REAR DRUM TO WIND HOLDING CABLE WHILE BUCKET IS BEING CLOSED AND HOISTED BY THE CLOSING CABLE.



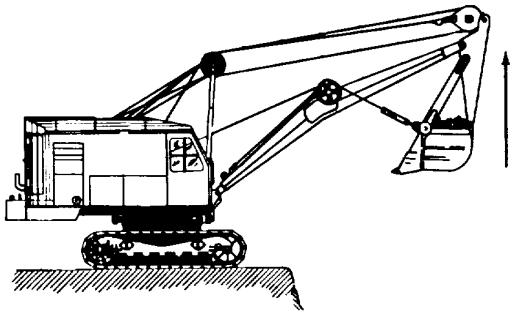
D. DUMPING BUCKET

STEP 6. SWING MACHINE (FIGURE 2-42) TO DUMP AREA.

STEP 7. DUMP BY RELEASING HOIST BRAKE.

ME 3810-29-12/2-46 (2)

Figure 2-46. Operating the clamshell (sheet 2 of 2).

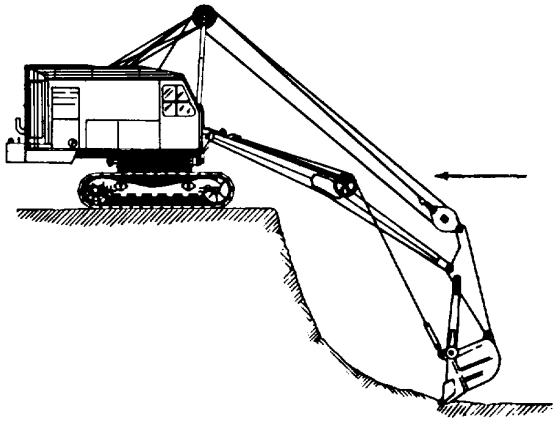


A. HOISTING THE DIPPER

STEP 1. HOIST AND EXTEND DIPPER BY PUSHING HOIST CLUTCH LEVER FORWARD AND RIDING DRAG BRAKE SO THAT DRAG CABLE FOLLOWS DIPPER.

STEP 2. WHEN DIPPER IS FULLY EXTENDED DISENGAGE HOIST CLUTCH AND ENGAGE HOIST BRAKE.

STEP 3. LOWER DIPPER BY RELEASING HOIST BRAKE.



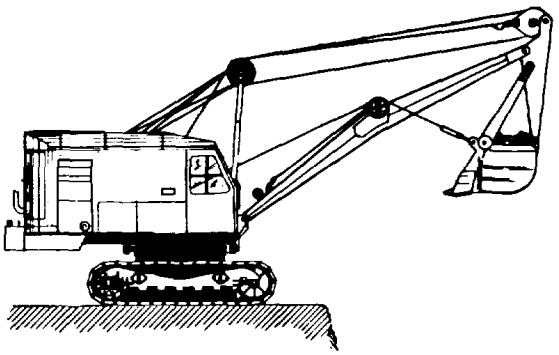
B. DRAGING THE DIPPER

STEP 4. DRAG DIPPER BY PUSHING DRAG CLUTCH LEVER FORWARD AND EASING OFF THE HOIST BRAKE.

STEP 5. WHEN DIPPER IS FULL, DISENGAGE DRAG CLUTCH AND ENGAGE DRAG BRAKE. HOIST DIPPER BY PUSHING HOIST CLUTCH LEVER FORWARD AND RELEASING HOIST BRAKE.

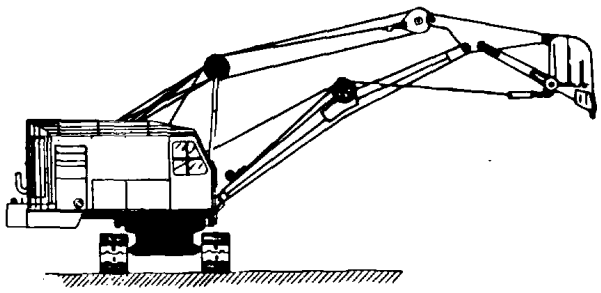
ME 381**0-**28*9-12*/2-47 (1)

Figure 2-47. Operating the backhoe (sheet 1 of 2).



C. SWINGING THE MACHINE

STEP 6. SWING MACHINE (FIGURE 2-42) TO DUMP AREA.



D. DUMPING THE DIPPER

STEP 7. DUMP BY RELEASING DRAG BRAKE, PUSHING THE HOIST CLUTCH LEVER FORWARD, AND RELEASING THE HOIST BRAKE.

ME 3810-289-12/2-47 (2)

Figure 2-47. Operating the backhoe (sheet 2 of 2).

2-21. Operation of Shovel

a. General.

(1) Keep dipper teeth sharp.

(2) Overcrowding slows down the hoist and does not increase speed of filling.

(3) Spot trucks so that they can be loaded from the rear.

Warning: **Never swing over cab of truck.**

(4) Keep the machine working with the full length of both tracks on a solid footing.

(5) Be careful not to ride the crowd brake when crowd clutch is engaged. Stop movement of the dipper handle by engaging the opposing clutch and use the crowd brake only when it is necessary to hold the handle in position with the crowd lever in neutral.

(6) When lowering back into the pit, allow the dipper handle to run in by gravity while the handle is above the horizontal and run out when the handle is below horizontal.

(7 Avoid excessive crowding and hoisting.

(8) Do not pull the dipper through full depth of the bank to fill. Take just enough out to fill your dipper and pull out. For high banks, take top passes first.

(9) See that the dipper pitch braces are adjusted to give dipper the most efficient digging angle.

b. Operation.

(1) Start the crane-shovel (para 2-15).

(2) Refer to figure 2-48 to operate the shovel.

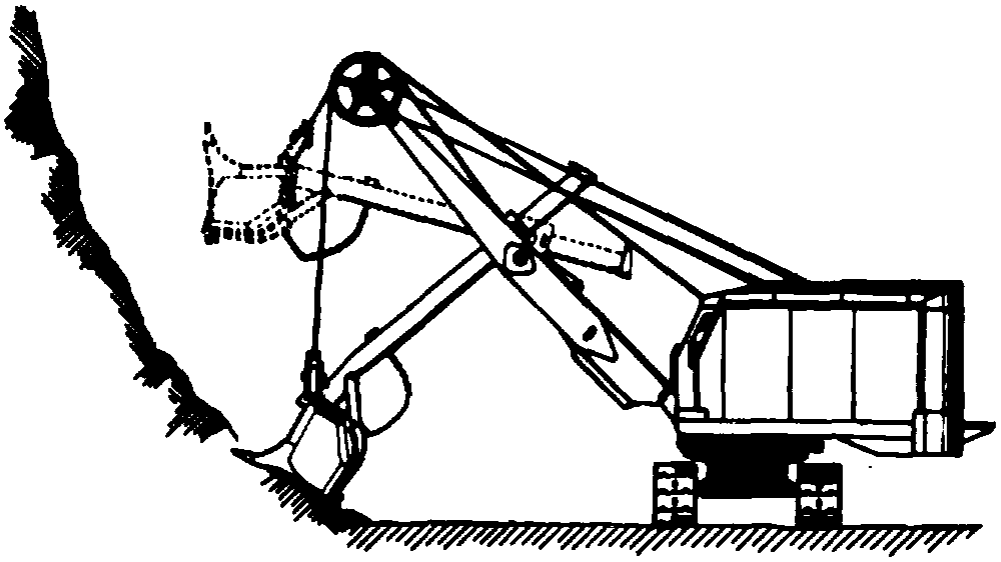
2-22. Operation of Piledriver

a. Start engine (para 2-15) and engage clutch.

b. Attach piledriver front-end equipment (para 2-9).

c. Attach pile follower cable to hooks on hammer, then lift hammer and pile follower by moving hoist clutch lever toward operator (fig. 2-31). When hammer reaches top of hammer guides, return hoist clutch lever to neutral, apply hoist brake pedal, and set hoist brake lock to hold hammer in raised position.

d. Run pile handling cable off drum by moving crowd and retract clutch lever away from operator; at same time, apply pressure to digging brake pedal to prevent cable from overrunning. Attach pile handling cable to upper end of a pile and raise it into position within pile leads by moving crowd and retract clutch lever toward operator;



A. HOISTING AND CROWDING

STEP 1. RAISE DIPPER BY PUSHING HOIST CLUTCH LEVER FORWARD. HOLD CROWD BRAKE. CROWD AS NECESSARY.

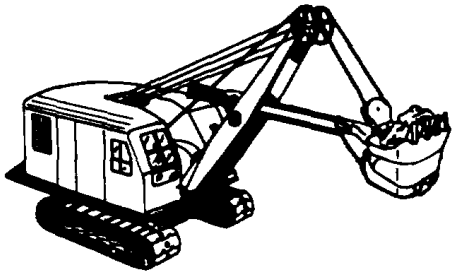
STEP 2. HOIST DIPPER UNTIL CLEAR OF OBSTRUCTIONS. DISENGAGE HOIST AND CLUTCH AND ENGAGE HOIST AND CROWD BRAKES.

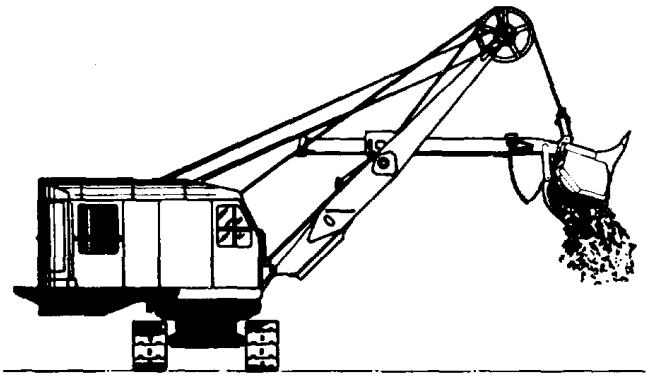
STEP 3. SWING MACHINE (FIGURE 2-42) TO DIGGING AREA.

STEP4. DIG BY RELEASING HOIST BRAKEAND PUSHING HOIST CLUTCH LEVER FORWARD. AT THE SAME TIME RELEASE THE CROWD BRAKE AND LET DIPPER RUN OUT. USE CROWD CLUTCH TO REGULATE DEPTH OF CUT.

ME 381**0**-289-12/2-48(1)

Figure 2-48. Operating the shovel (sheet 1 of 2).





B. SWINGING THE MACHINE

STEP 5. WHEN DIPPER IS FULL, RELEASE HOIST AND CROWD CLUTCHES AND RETRACT DIPPER TO CLEAR BANK RELEASING CROWD BRAKE CAREFULLY.

STEP 6. AS SOON AS DIPPER IS CLEAR APPLY BRAKE FULLY.

STEP 7. SWING MACHINE (FIGURE 2-42) TO DUMP AREA.

C. DUMPING THE BUCKET

WARNING: NEVER SWING LOADED BUCKET OVER THE CAB OF THE TRUCK.

STEP 8. DUMP LOAD BY PUSHING DIPPER TRIP LEVER FORWARD.

ME 381-289-12/2-48(2)

Figure 2-48. Operating the shovel (sheet 2 of 2).

return clutch to neutral and apply digging brake when pile is within pile leads.

e. Position pile in desired location by moving crane as required (para 2-12); then, lower point of pile to ground by slowly moving crowd and retract lever away from operator, at same time applying digging brake pedal to prevent cable overrunning drum.

f. Wrap a heavy chain around pile and leads to hold pile within leads; then, remove pile handling cable from pile.

Note. The chain should be sufficiently loose not to bind pile when driving begins.

g. Lower hammer and pile follower by releasing hoist brake lock and pressure on hoist brake pedal allowing hammer and pile follower to drop slowly to top of pile. Position pile in follower, then remove pile follower cables from hooks on hammer.

h. To drive the pile, raise hammer by pulling hoist clutch lever toward operator. As hammer reaches top of pile leads, return hoist clutch to neutral and apply hoist brake pedal immediately after hammer hits pile follower, to prevent hammer cable overrunning the drum. Repeat this step until pile is driven.

i. Position another pile and repeat the above operating cycle as often as necessary.

j. When work is through for the day, lower hammer to rest on pile follower, and disengage engine clutch.

k. Stop engine (para 2-16).

Section V. OPERATION UNDER UNUSUAL CONDITIONS

2-23. Operation in Extreme Cold

a. The use of an antifreeze is necessary when the temperature of the outside air is apt to below 32° F. Protect the cooling system against freezing early enough so that there will be no danger of a sudden cold spell causing a freeze-up and possible damage to the engine head, block or radiator. Refer to paragraph 2-1.

b. Clean out excessive mud or dirt in the track belts. This is particularly important in freezing weather. Put planks, brush or dry material under crawlers before shutting down machine if it likely to freeze.

2-24. Operation in Extreme Heat

The most important precaution in operating extreme heat is to watch engine operating temperature and keep radiator well filled. Use correct lubricants for operating temperatures. Consult engine section.

2-25. Operation in Mud or Soft Terrain

a. It is generally advisable to avoid a bad spot by detouring, if possible, even if it means an extra mile or two of traveling. If this is not possible, send a man on foot ahead of the machine to probe the firmness of the ground. A long rod can be pushed down in soft spots to test for firmness under the mud. When the track sinks in the mud below 6 inches, planks or logs laid crossways under caterpillars, or the use of mats are necessary. When approaching a point of being bogged down, back up about 20 feet immediately. By reversing the tracks, the mud will work out and clean itself so that full propelling power can again be utilized. Do not try steering when bogged down. When working in mud, it is common practice to operate with looser track belts than on dry ground.

b. When bogged down in a mud hole, machine can often be cleared by anchoring the hoist rope to a dead man, pulling the boom down to lift rear of tracks up and placing timber or planking under them. Swing machine 180 degrees and repeat above steps to free opposite track belt. If track belts are caked with mud, it may be necessary to back off front tumbler takeoff screws to relieve tension in track belts. If a tree or heavy equipment is not available to serve as an anchor, a dead man can be made by digging a 2-foot trench, inserting a log therein, and driving stakes to hold log down.

c. Help in propelling, across soft ground, and when track belts slip, thus not making full use of power, can be obtained by attaching hook to a stationary object and pulling on the hoist cable by slipping clutch while propelling for a short period of time. It is far better to put a longer cable on drum and use a block on an anchor to make a two-part hitch. Thus the two-part rope speed nearly equals the traveling speed and drag clutch can be fully engaged.

d. The crane-shovel has sufficient bearing area for propelling over average soft ground. Where ground is too soft to support the machine, timber mats should be used. These can be made by drilling holes through logs or timber and inserting rod bolts or wire rope to hold them together. Use of rope gives completed mat more flexibility follow uneven ground conditions than use of rod bolts. Addition of timbers or planks along side of mat will help prevent machine slipping side ways off mat. Mats can be made in sections about 4 feet wide by 12 feet long with rope slings ends. Sections can be hoisted with a separate rope or chain sling and swung from rear to front machine progresses.

e. If material or time for mat construction not available, logs or branches can be laid crossways of tracks to form corduroy road for propelling over soft ground.

f. Extra traction for unusually soft or loose footing can be improvised by drilling four holes in every fourth tread and bolting on bars

short lengths of chain. The use of bolts only in the drilled holes will in some cases provide the extra traction required.

2-26. Operation in Salt-Water Areas

If machine is operated within a few miles of sea coast, paint exposed painted surfaces (outside of cab, boom, etc.) carefully with suitable paint and take care in repainting wherever and whenever paint becomes scratched or worn away. Exposed metal parts that cannot be painted should be kept well coated with oil or grease. If machine operates with lower works immersed in salt water, all parts that are in contact with water should be kept well coated with asphaltum.

2-27. Operation in High Altitudes

The crane-shovel is designed to operate at altitudes up to 5,000 feet above sea level. Higher altitudes will require readjustment of the fuel pump and fuel injectors to maintain the proper air and fuel mixture.

CHAPTER 3

OPERATOR'S MAINTENANCE INSTRUCTIONS

Section I. BASIC ISSUE ITEMS

3-1. Tools and Equipment

Tools, equipment, and repair parts issued with or authorized for the model 22BM crane-shove are listed in the basic issue items list, appendix C.

3-2. Maintenance and Operating Supplies

Maintenance and operating supplies required for initial operation are listed in section III of appendix C.

Section II. LUBRICATION INSTRUCTIONS

3-3. General

This section contains lubrication instructions which are supplemental to, and not specifically covered, in the lubrication order. For the current lubrication order, -refer to DA PAM 310-4 (Military Publications).

3-4. Detailed Lubrication Information

a. General. Keep all lubricants in closed containers and store in a clean, dry place, away from external heat. Allow no dust, dirt, or other foreign material to mix with the lubricants. Keep all lubrication equipment clean and ready for use.

b. Cleaning. Keep all external parts not requiring lubrication clean of lubricants. Before lubricating the equipment, wipe all lubrication points free of dirt and grease. Clean all lubrication points after lubricating to prevent accumulation of foreign matter.

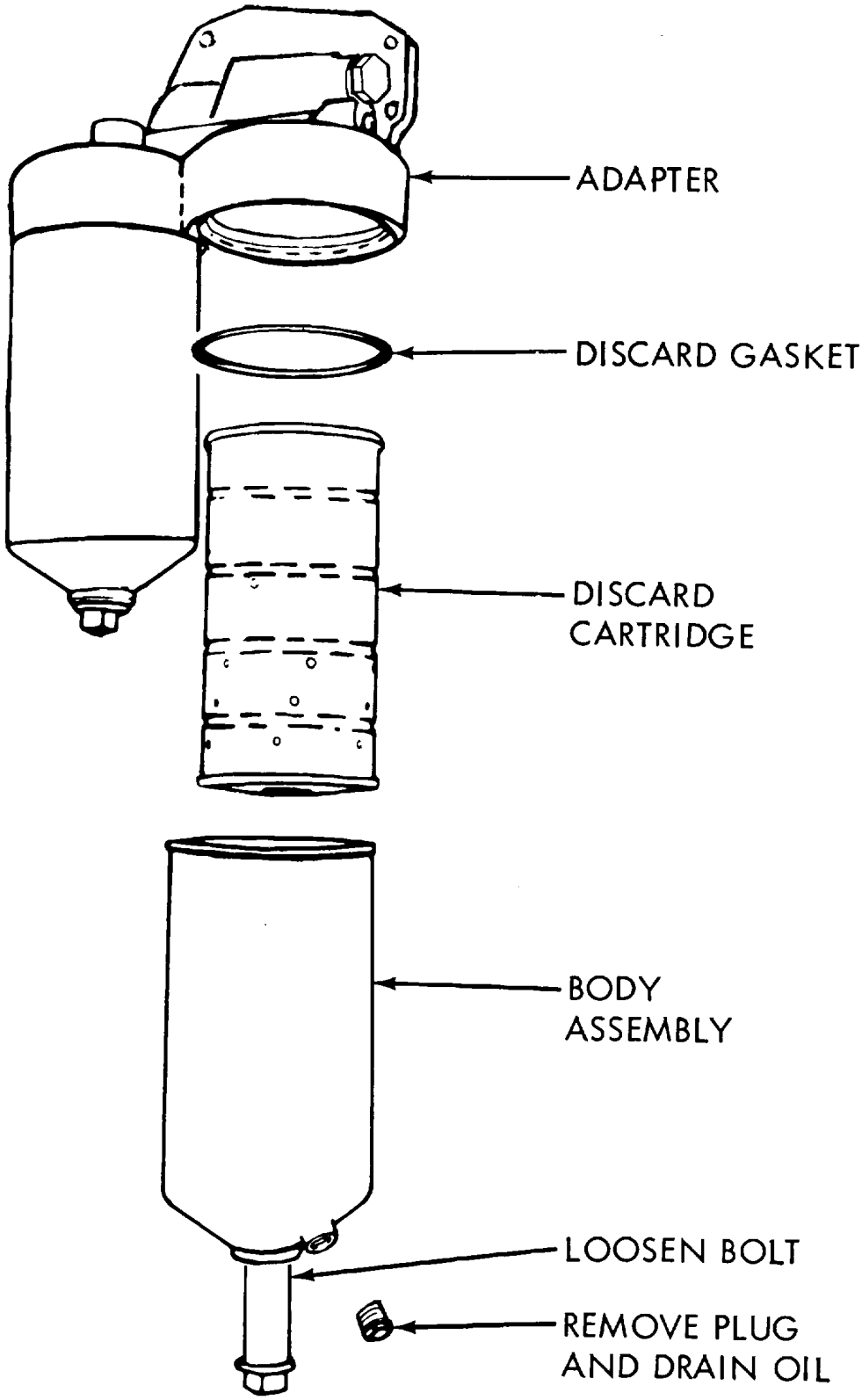
c. Points of Lubrication. Service the lubrication points at proper intervals as illustrated on the lubrication order.

d. OES Oil.

(1) Crankcase oil level must be checked frequently, as oil consumption may increase.

(2) Oil may require changing more frequently than usual because contamination by dilution and sludge formation will increase under cold weather operation conditions.

e. Oil Filter Service. Refer to figure 3-1 and service the oil filter.



NOTE: THE OIL FILTER SHOULD BE CHANGED AFTER 800 GALLONS OF FUEL HAVE BEEN USED, OR AFTER 250 HOURS, WHICHEVER COMES FIRST.

ME 3810-289-15/3-2

Figure 3-1. Oil filter service.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-5. General

To insure that the crane-shovel is ready operation at all times, it must be inspected systematically so that defects may be discovered corrected before they result in serious damage failure. Defects discovered during operation the unit shall be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is not which would damage the equipment if operation were continued. All deficiencies and shortcoming will be recorded, together with the corrective action taken, on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

3-6. Preventive Maintenance Checks and Services

This paragraph contains a tabulated listing of preventive maintenance services which must be performed by the operator. The item numbers are listed consecutively and indicate the sequence of minimum requirements. Refer to table 3-1 for the preventive maintenance checks and services.

Table 8-1. Preventive Maintenance Checks and Services

Item Number	Interval: Operator Daily B	Operator Daily D	Operator Daily A	Operator Daily W	M	Org Q	Item to be inspected	Procedure	Reference
							B-Before operation D-During operation A-After operation W-Weekly M-Monthly Quarterly		
1				X			FUEL FILTERS	Check for loose mounting and leaks.	
						1		Inspect and service.Para 4-23	
2				X			FUEL PUMP	Check for loose mounting and leaks.	
						2		Inspect and service.	Para 4-19
3	X		X				FUEL TANK	Inspect tank and cap strainer. Add fuel as required.	Para 3-14
						3		Tighten loose mounting. Clean cap vent. Replace defective cap gasket. Replace leaking tank.	Para 4-26 and 4-27
4	X		X			4	CRANKCASE OIL LEVEL GAGE	Add oil as required.	Lubrication order
5	X		X				RADIATOR	Proper coolant level is 2 inches below filler neck.	
						5		Replace cracked or frayed hose. Remove obstructions in air passages. Replace defective radiator. Tighten all mountings and leaking connections. Correct pressure for cap is 7 pounds.	Para 4-31
6				X			ALTERNATOR BELT	Inspect and adjust.	Para 3-17
7				X			FAN BELT	Inspect and service.	Para 3-16
						6		Replace a worn, frayed, or cracked belt.	Para 4-32
8				X			BATTERIES	Tighten loose cables and mounting. Remove corrosion. Fill to 3/8 inch above plates. In freezing weather run engine a minimum of one hour after adding water. Clean vent hole in filler cap.	Para 2-3
						7		Replace a cracked or leaking battery.	Para 4-46
9	X	X	X			8	CONTROLS AND INSTRUMENTS	Inspect for damage and insecure mounting. With unit operating, inspect for improper operation. Normal operating readings for instruments are as follows: Battery indicator-Slightly to right of center. Oil pressure-40 psi. Water temp-185° F.	
10	X		X				ENGINE	Check for fuel, water or oil leaks.	
11	X		X				ENGINE ACCESSORIES	Check for secure mounting of engine accessories.	
12		X					CLUTCH ASSEMBLY	Check operation of clutch for binds.	Para 3-10
13	X		X				FIRE EXTINGUISHER	Check for broken seal and inspection date.	
14	X		X				AIR CLEANER	Check for loose connections. In dusty areas check for excessive collections of dust.	Para 3-13

15		X					CRANE-SHOVEL	If the crane operates unusually or develops an unusual noise, stop the machine and check it.	Para 2-13
16	X						CONTROL LEVERS AND CLUTCH LEVER	When starting the crane-shovel, see that all control levers are in neutral position and the engine clutch lever is in neutral position.	Para 2-11
17	X						TOOLS AND EQUIPMENT	Make sure all tools and equipment assigned to the unit are in serviceable condition, clean, and properly stowed or mounted.	
18	X						LIGHTS	Clean and check all lights for proper operation if the equipment is to be used at night.	
19	X						TRACK ASSEMBLY	Check the train tension.	Para 3-22
						9	CRANE-SHOVEL	OPERATIONAL TEST: During operational test observe for any unusual noises or vibrations. Note. Make all adjustments during operational test.	Para 2-13
						10	GEARS	Check all gears carefully for wear or damage.	
						11	CHAIN DRIVES AND SPROCKETS	Check for wear.	
						12	ENGINE CLUTCH	Check adjustments.	Para 4-16
						13	SHEAVES AND PULLEYS	Check for wear or damage.	Para 4-56
						14	WIRE ROPES	Check for wear or damage.	Para 4-54
						15	VALVES	Check valve adjustments.	Para 4-13

Section IV. TROUBLESHOOTING

3-7. General

This section provides information for diagnosing and correction unsatisfactory operation or failure of the crane-shovel and its components. Any trouble beyond the scope of operator's maintenance shall be reported to organizational maintenance.

3-8. Troubleshooting Chart

In chart 3-1, each malfunction listed is followed by parable causes of the trouble. The corrective action required is described opposite the probable cause.

Chart 3-1. Troubleshooting

Malfunction	Probable cause	Corrective action
1. Engine fails to start.	a. Engine too cold.	a. Use starting aid.
	b. Lack of fuel.	*b.* Check fuel tank.
	c. Air cleaner clogged.	c. Service air cleaner (fig. 3-6).
2. Irregular firing of engine.	Air cleaner clogged.	Service air cleaner (fig. 3-6).
3. Engine smokes.	a. Crankcase oil level too high.	a. Check and drain any excess oil. Refer to current LO.
	b. Air cleaner clogged.	*b.* Service air cleaner (fig. 3-6).
4. Engine overheating indicated.	a. Low coolant level.	a. Add coolant.
	b. Loose fan belt.	*b.* Adjust fan belt (para 3-16).
	c. Continuous overload.	c. Reduce load.
	d. Oil level low.	*d.* Add oil (para 3-4).
5. Engine knocks excessively.	Lack of lubricating oil.	Check and fill crankcase to proper oil level (refer to current LO).
6. Low or no lubricating oil pressure indication.	*a.* Crankcase oil level low.	*a.* Check and refill crankcase (refer to LO).
	b. Oil filter clogged.	*b.* Service oil filter (fig. 3-1).
	c. Leaking connections.	*c.* Tighten connections.
	d. Oil too light or diluted.	*d.* Drain crankcase and refill with proper oil (refer to LO).
7. Starter will not crank engine.	Loose connection or defective wiring.	Inspect battery cables and wiring for loose connections or defective wiring. Tighten connections. Report defective wiring to organizational maintenance.
8. Alternator not charging.	Alternator drive belt loose or broken.	Adjust loose belt (para 3-17).
9. Alternator output low or unsteady.	Alternator belt not properly adjusted.	Adjust belt (para 3-17).
10. Fully charged battery and high charging rate.	Poor ground connection at Regulator.	Check ground connection.
11. Batteries will not hold charge.	*a.* Loose terminals or connections.	a. Check and tighten.
	b. Short in electrical system.	*b.* Check cables and wiring.
12. Floodlights and/or dash light	*a.* Electrical system disconnect Switch is in OFF position.	*a.* Turn switch to ON position.
	b. Loose connection.	*b.* Tighten connections.
13. Cables wear excessively.	*a.* Cable sheaves stuck to shaft.	*a.* Free sheaves and lubricate.
	b. Cables lack lubrication.	*b.* Lubricate cables.
14. Cables flatten out.	*a.* Cable crossed on drum.	*a.* Wind cables evenly and correctly on drums.
	b. Cable too long, allowing cable to Pile up on drum.	*b.* shorten cable to proper length.
15. Crane tilts under load.	*a.* Crawler not positioned properly.	*a.* Level position of crawler.
	b. Overload.	*b.* Check for overloading.
16. Boom will not raise.	*a.* Boom hoist clutch slips	*a.* Adjust clutch brakebands (para 3-29).
	b. Cable frayed or off sheave.	*b.* Replace cable in sheave and inspect.

Chart 3-1. Troubleshooting-Continued

Malfunction	Probable cause	Corrective action
17. Clamshell operates erratically.	*a.* Hoist brake grabbing.	*a.* Adjust brakeband (para 3-30).
	b. Clutches grabbing.	*b.* Adjust clutch (para 3-29).
	c. Lack of lubrication.	*c.* Lubricate (see LO).
18. Clamshell bucket fails to close.	Closing line jammed in sheavens.	Lower bucket and free line.
19. Clamshell bucket fails to open.	Holding line jammed in sheavens.	Lower bucket and free line.
20. Dragline not operating properly.	*a.* Dump cable not adjusted properly.	*a.* Shorten or lengthen dump cable until proper operation is obtained.
	b. Fairlead rollers and sheaves.	*b.* Lubricate (refer to LO).
21. Shovel bucket fails to open.	*a.* Dipper trip cable jammed.	*a.* Check dipper trip cable reeving (fig. 2-24).
	b. Dipper latch bar bent.	*b.* Check bar (fig. 2-26).
22. Shovel bucket fails to close.	*a.* Door or latch jammed.	*a.* Remove foreign material.
	b. Dipper trip handle stuck.	*b.* Operate handle.
23. Shovel not operating properly.	*a.* Dipper pitch not correct.	*a.* Correct the dipper pitch (fig. 2.26).
	b. Crowd brake not adjusted.	*b.* Adjust crowd brake (fig. 2-21).
24. Backhoe not operating properly.	*a.* Cable out of sheave groove.	*a.* Replace cable in sheave groove.
	b. Brakeband dragging.	*b.* Adjust brake (para 3-30).

Section V. MAINTENANCE OF ENGINE CLUTCH ASSEMBLY, RELEASE MECHANISM CONTROL LEVERS, AND TURNTABLE SWINGLOCK

3-9. General

Instructions in this section are publishes the information and guidance of the operator to maintain the crane-shovel.

3-10. Clutch Assembly

a. General. The main engine clutch (fig. 3-2) should engage smoothly with a distinct snap and reasonably hard lever action. It should be adjusted at the first sign of slippage.

*b. Inspection (fig. 3-*3*).* Check to see if operating clutches hold securely when engaged and are completely free when operating levers are in neutral position. Check operating linkage for wear and proper operation, and see that connecting pins and bolts are secure.

c. Service. The engine clutch pilot bearing be sealed-type or may be greased sparingly 50 hours of operation. Remove chain case to determine if shaft has a pipe plug or lubrication fitting. (Sealed bearings will be replace every time clutch is disassembled.)

3-11. Control Levers Adjustment

Adjust linkage by tightening or loosening adjusting nuts on rod ends or adjustable devices; adjust until control levers are in a vertical position when in neutral and alined with each other in the main lever bank (fig. 3-4).

3-12. Swing Lock Adjustment (fig. 3-5)

a. Pull the swing lock lever back and check the engagement of the lock between the teeth of the fixed gear ring. The lock should extend at least half way along the teeth profile; if it does not, put the control lever in the forward position, remove pins "A" and "B" and unscrew the adjusting screw one or two turns.

b. Reassemble the pins in the toggle links and check that the lock does not foul the top of the teeth.

c. Swing the revolving frame and ensure that there is clearance between the lock and the gear ring all around.

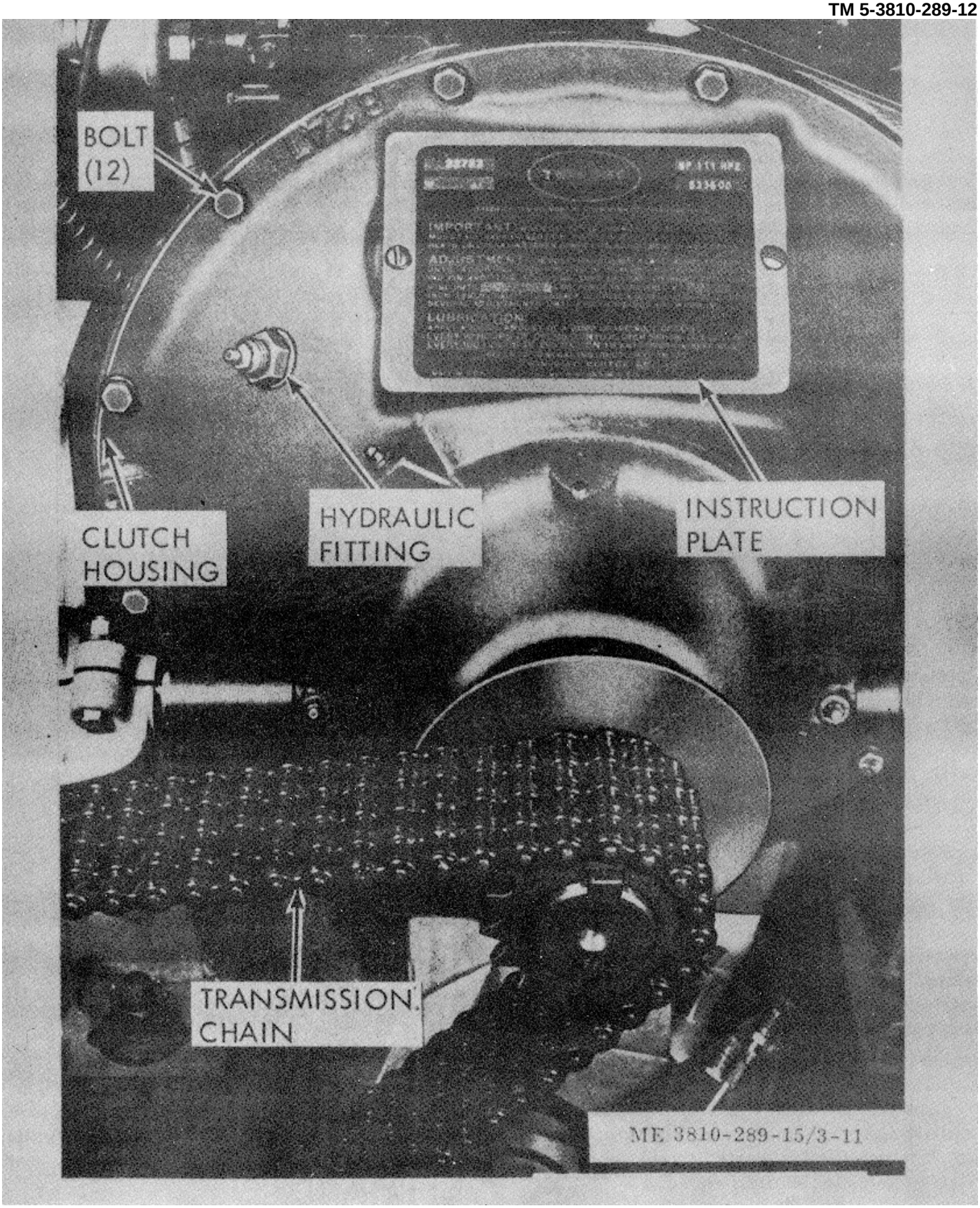


Figure 3-2. Engine clutch assembly.

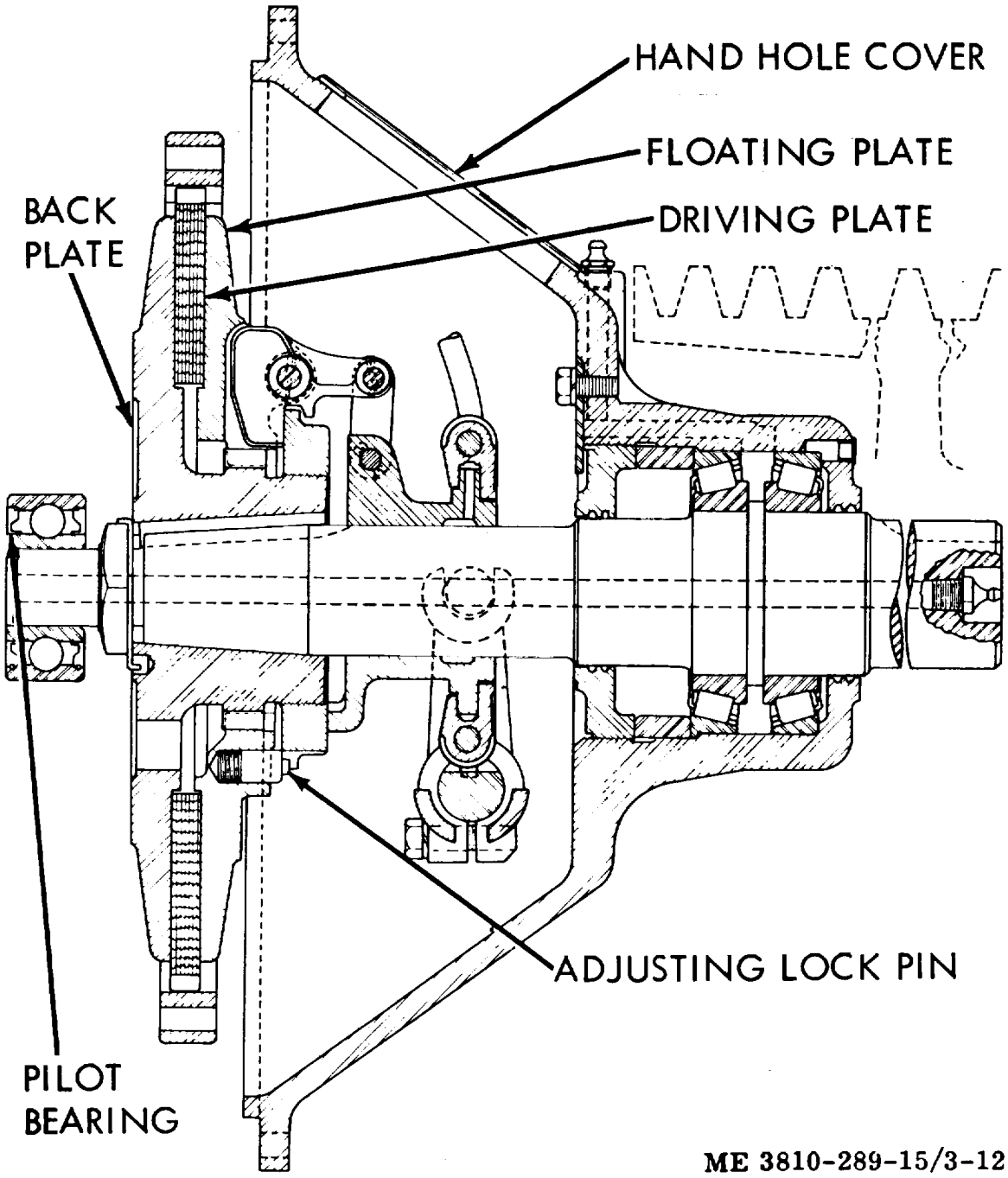


Figure 3-3. Engine clutch assembly inspection.

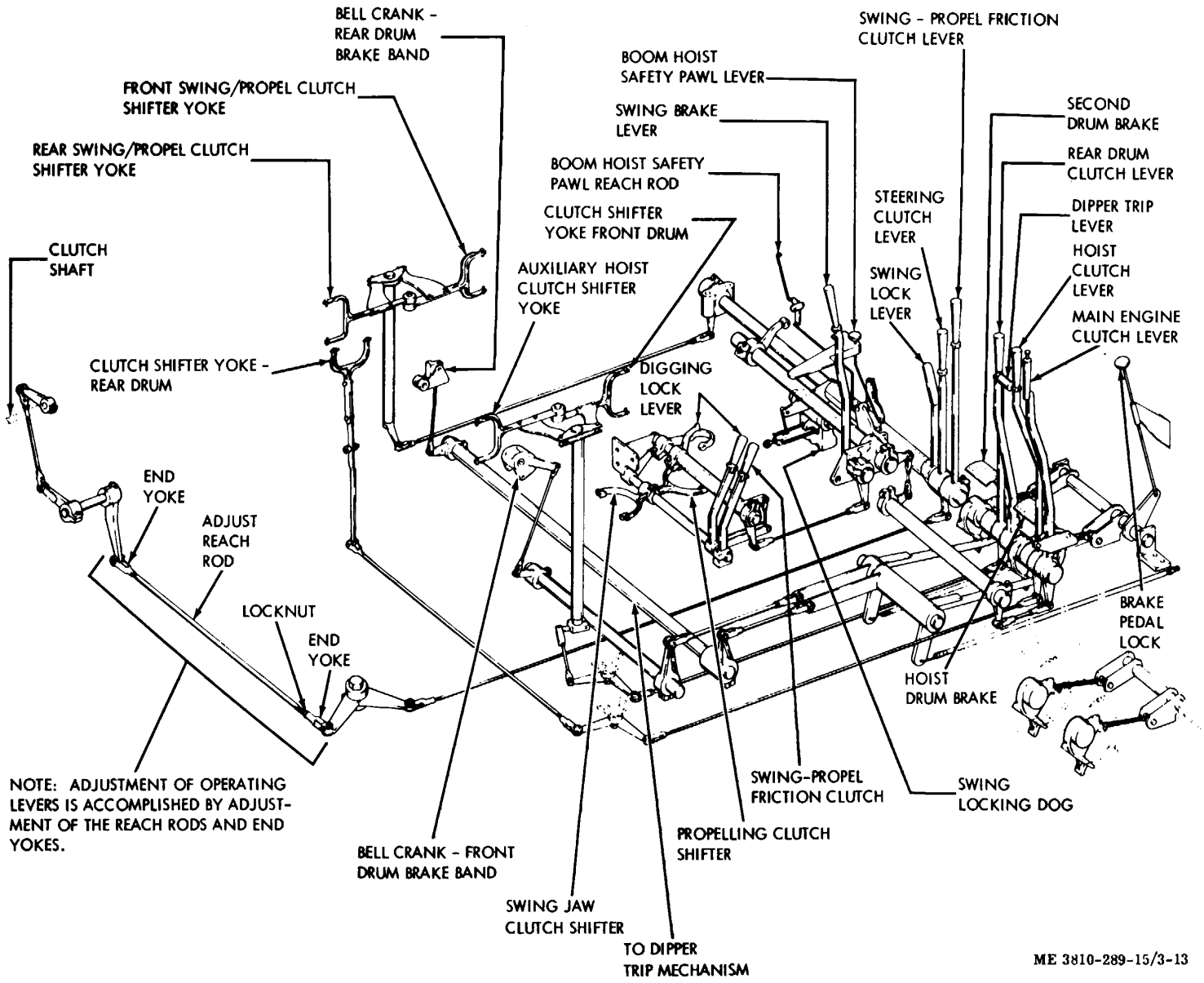


Figure 3-4. Control levers.

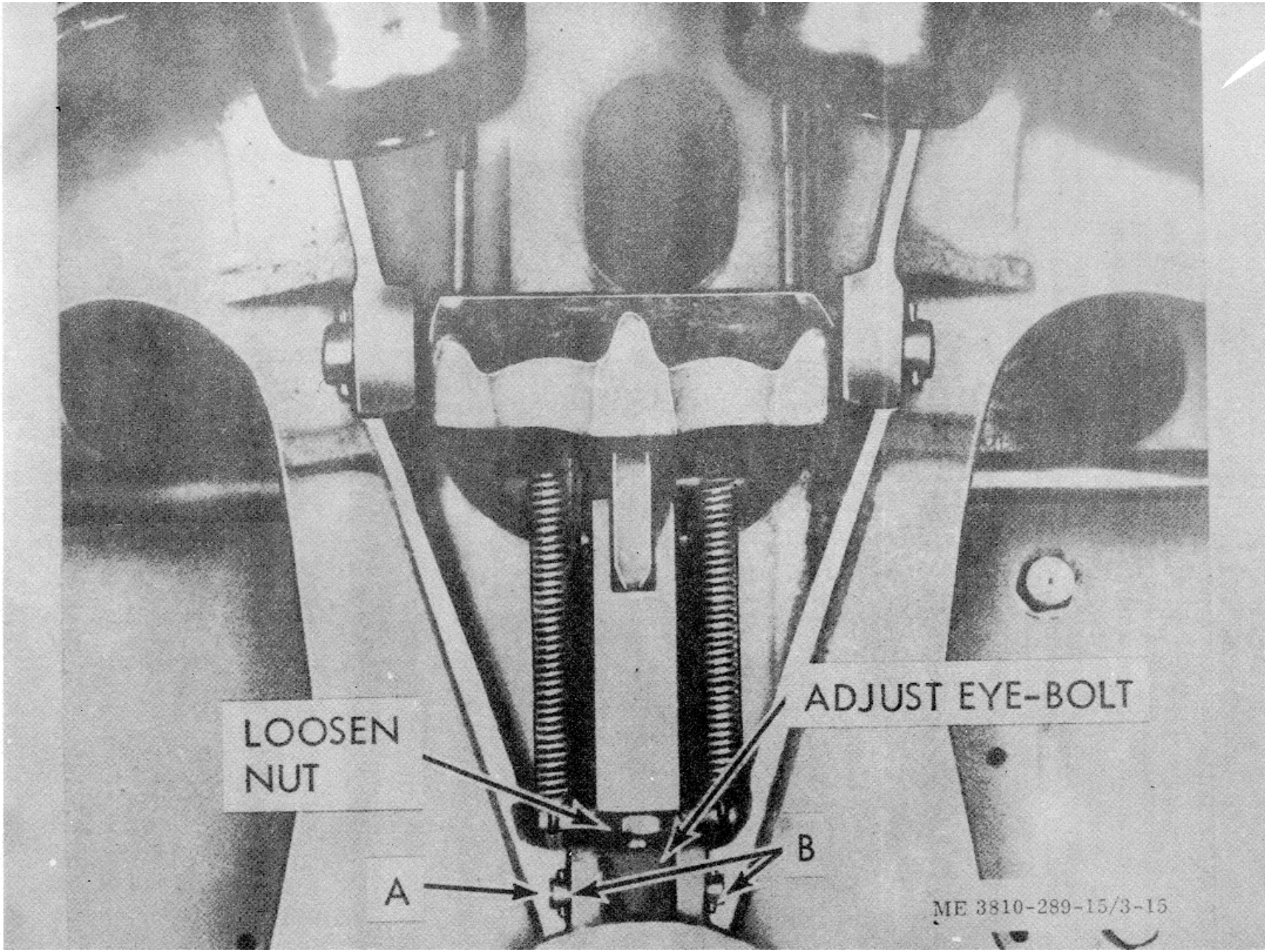


Figure 3-5. Swing lock adjustment.

Section VI. MAINTENANCE OF FUEL SYSTEM COMPONENTS

3-13. Air Cleaner Service

a. General. Regular service intervals, a with close visual inspection of the dry-type cleaner, are necessary for proper cleaning of the engine inlet air. The service interval will with the weather and working conditions. Where dust conditions are severe, it will be necessary service the air cleaner frequently.

b. Service. Refer to figure 3-6 and service air cleaner.

3-14. Fuel Tank and Cap Strainer

a. Fuel Tank Inspection.

(1) Inspect for leaks and loose mounting bolts or fuel line connections.

(2) Tighten mounting bolts and fuel line connections if necessary. See that cap vent is
open.

b. Tank Cap Strainer Service. Refer to figure 3-7 and service the fuel tank cap strainer.

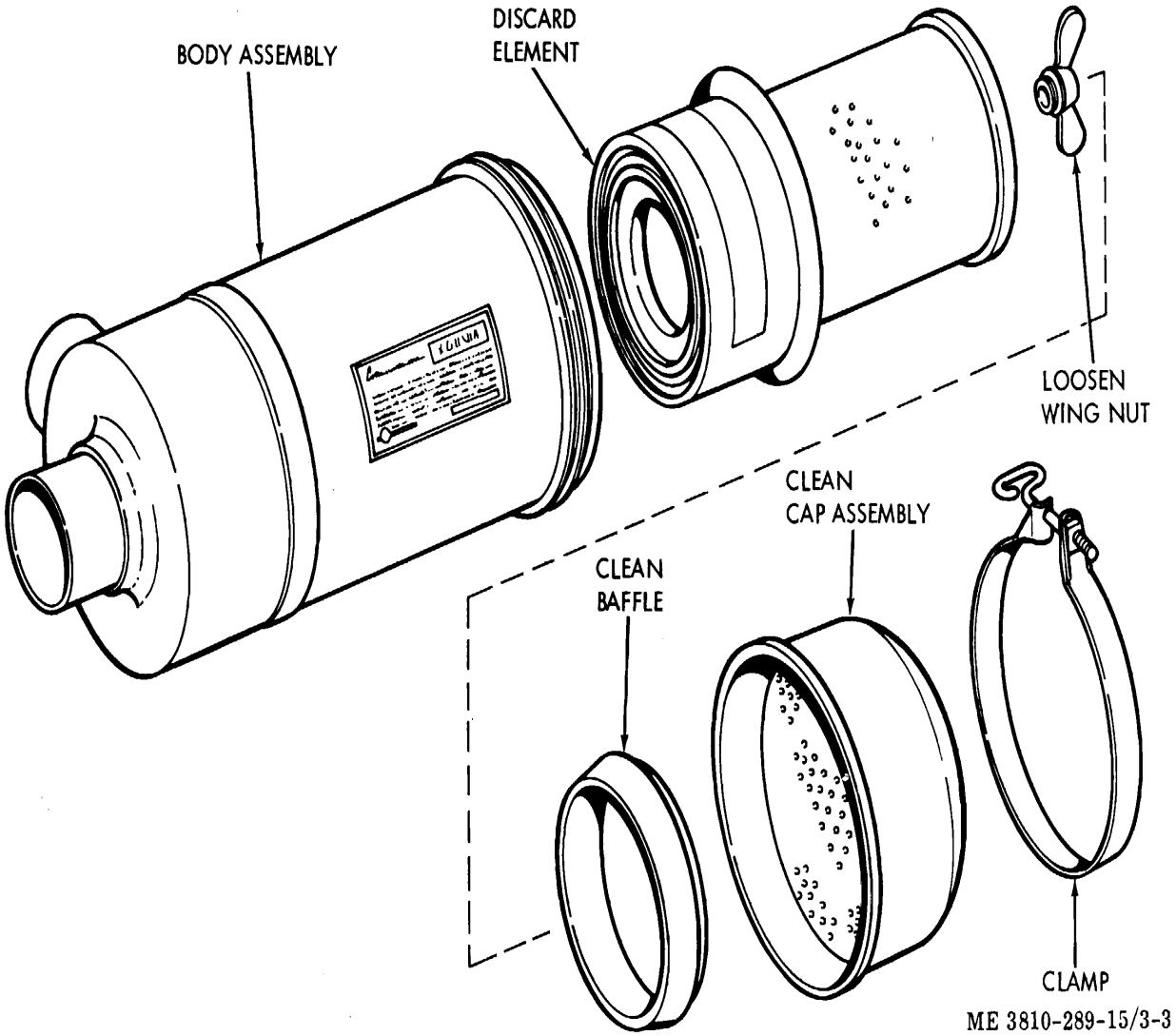
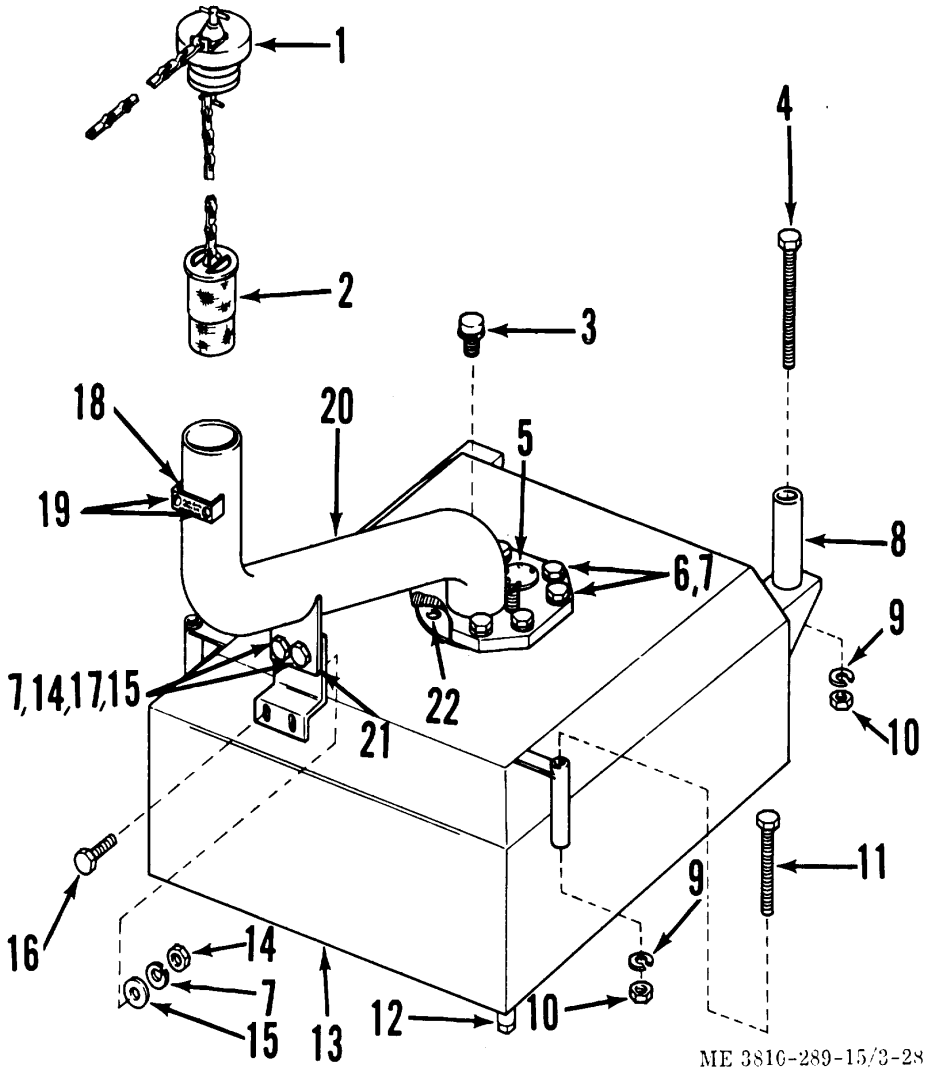


Figure 3-6. Air cleaner service.



1	Cap, Filler pipe	9	Washer, lock –5/8”	17	Screw, cap-3/8” x 1”
2	Strainer assembly	10	Nut, full-5/8”	18	Plate, instruction
3	Breather	11	Bolt, hex-5/8” x 7’	19	Screw, drive
4	Bolt, hex-5/8” x 81/2”	12	Plug, pipe	20	Pipe, filler
5	Tube, suction	13	Tank, fuel	21	Brace
6	Screw, cap-3/8” x 1 ¾”	14	Nut, full-3/8”	22	Gasket
7	Washer, lock-3/8”	15	Washer, plain-3/8”		
8	Spacer	16	Screw, cap-3/8” x 1 ½”		

Figure 3-7. Fuel tank and cap, service and replacement.

Section VII. MAINTENANCE OF ENGINE COOLING SYSTEM COMPONENTS

3-15. Radiator Inspection and Service

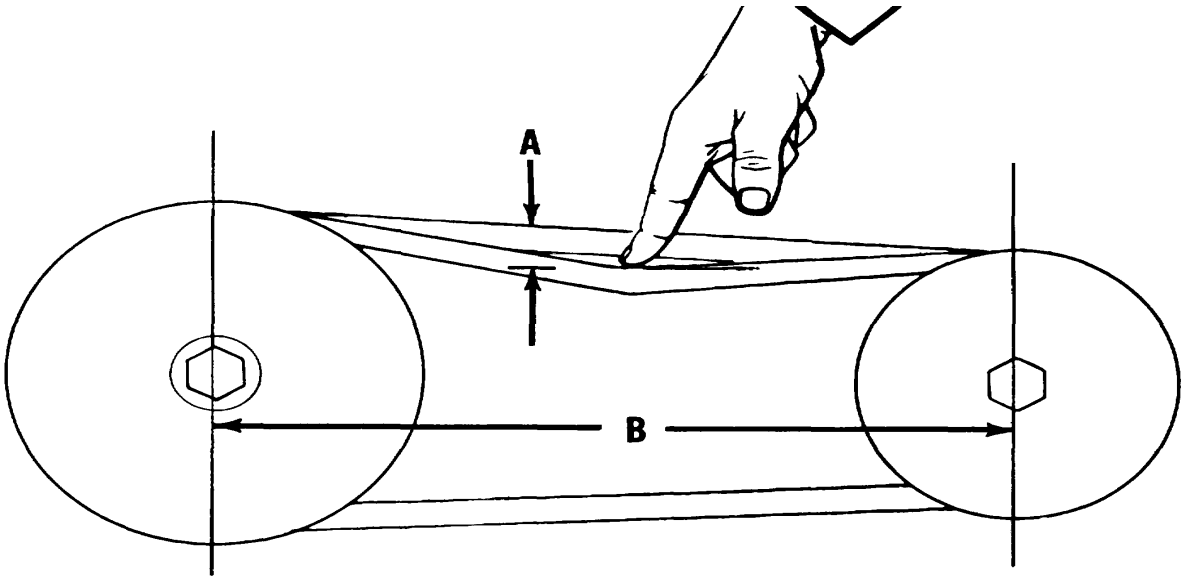
a. Check coolant level in radiator. Proper level is 2 inches below filler neck.

b. Check radiator for leaks, dents, and other damage.

3-16. Fan Belt Inspection and Service

a. Inspect the belt frequently for proper tension, cracks, and wear.

b. Tighten belt so pressure of index finger extended straight down will depress belt (A, fig. 3-8) to value shown. Force applied will be approximately 13 lbs for each foot of belt free span (B, fig. 3-8). The fan belt is 11/16 inches wide.



BELT WIDTH IN.	DEFLECTION PER FT. OF SPAN IN.
1/2	13/32
11/16	13/32
3/4	7/16
7/8	1/2
1	9/16

ME 3810-289-15/3-31

Figure 3-8. Belt adjustment.

Section VIII. MAINTENANCE OF ELECTRICAL SYSTEM COMPONENTS

3-17. Alternator Belt Inspection and Adjustment

a. Inspect alternator belt frequently for proper tension, cracks and wear.

b. Refer to figures 3-8 and 3-9 and adjust alternator belt.

3-18. Starting Motor Service

Every 200 hours, add at least 3 to 5 drops of OE-30 lubrication oil in each oil reservoir.

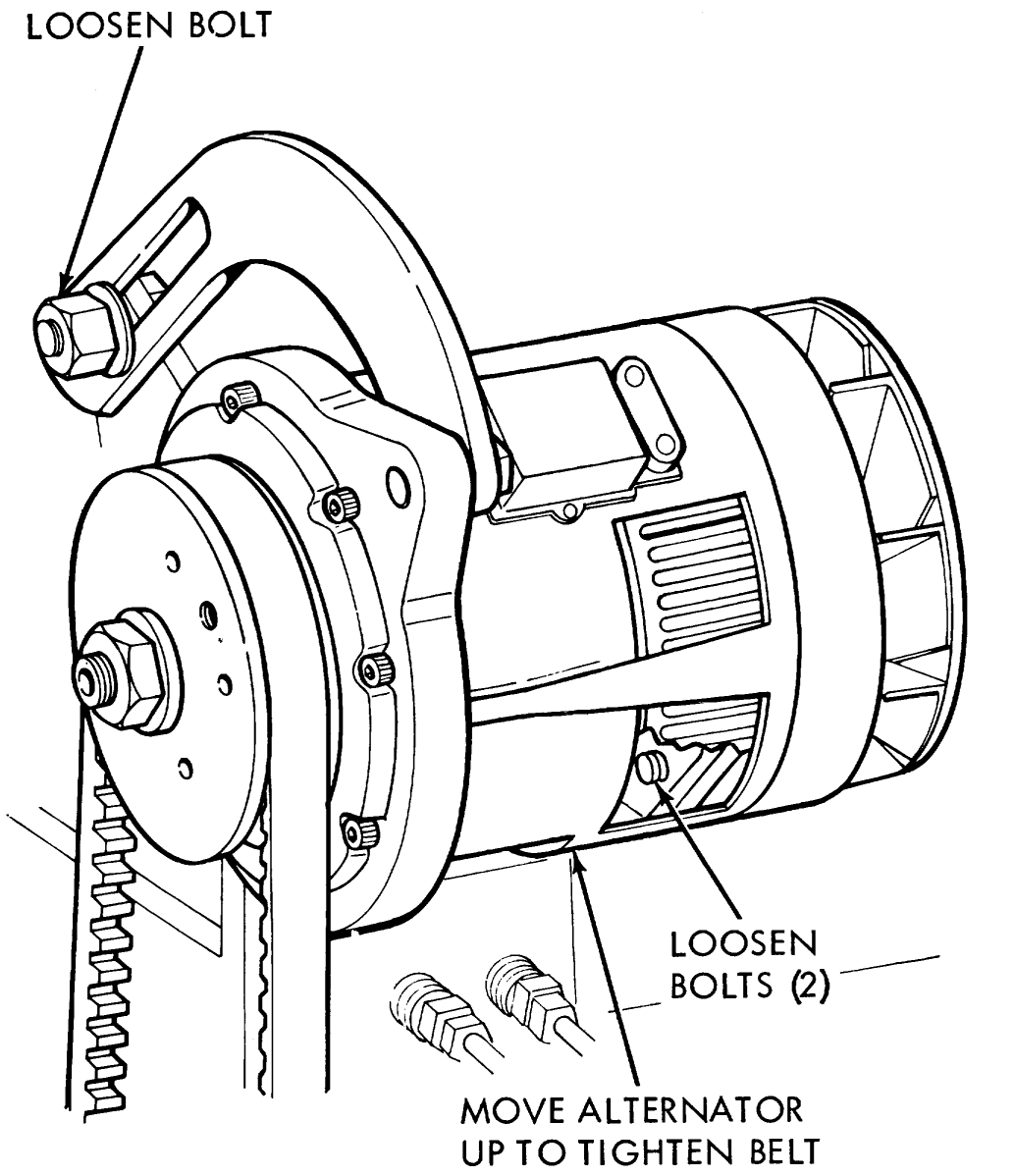


Figure 3-9. Alternator belt.

Section IX. MAINTENANCE OF TRANSMISSION ASSEMBLY

3-19. Inspection

Inspect transmission assembly for evidence of leakage. Report leaky transmission to organization maintenance.

Section X. MAINTENANCE OF WHEELS AND TRACKS

3-20. Track Support Rollers and Brackets

a. Inspection.

(1) Make sure rollers and brackets are securely mounted.

(2) Check for proper lubrication of rollers and evidence of wear.

b. Service. Lubricate rollers in accordance lubrication order.

3-21. Track Idlers and Brackets (fig. 3-10 and 3-11)

a. Inspection.

(1) Make sure idlers and brackets are securely mounted.

(2) Check for proper lubrication and evidence of wear.

b. Service. Lubricate track idlers in accordance with lubrication order.

3-22. Track Assembly

a. Inspection.

(1) Watch the belts closely when the machine is working in loose dirt, sand, or mud, and loosen the adjustments of the belt if the dirt takes up all the slack. Propelling with tight belts is extremely hard on the propelling machinery.

(2) See that tracks are free before moving machine. Check closely in freezing weather.

(3) Check condition of track, links, and pins. Check pins and keeper pins to see that they are secure.

b. Adjustment (fig. 3-12).

(1) Loosen the takeup tumbler shaft clamping bolts (opposite chain drive end). Remove the adjusting screw nut locks and turn the adjusting nuts until the correct adjustment is obtained (4-5 inch slack of upper belt section).

(2) Turn the adjusting nuts on both sides of the track frame the same amount, to keep the takeup tumbler shaft parallel to the front of the track frame.

(3) After adjustment, replace the adjusting nut locks and retighten the clamping bolts.

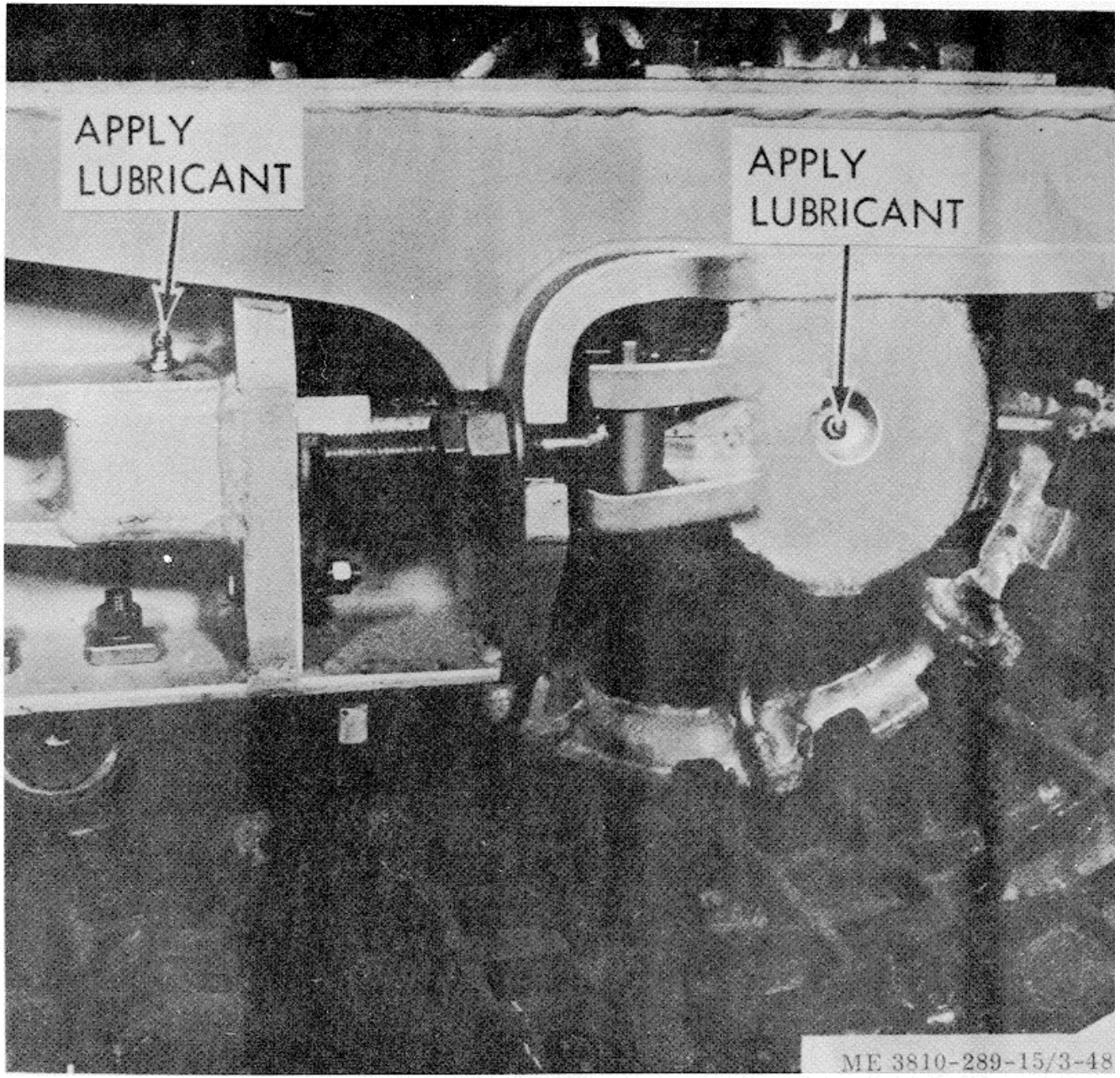


Figure 3-10. Track idler service (inner side view).

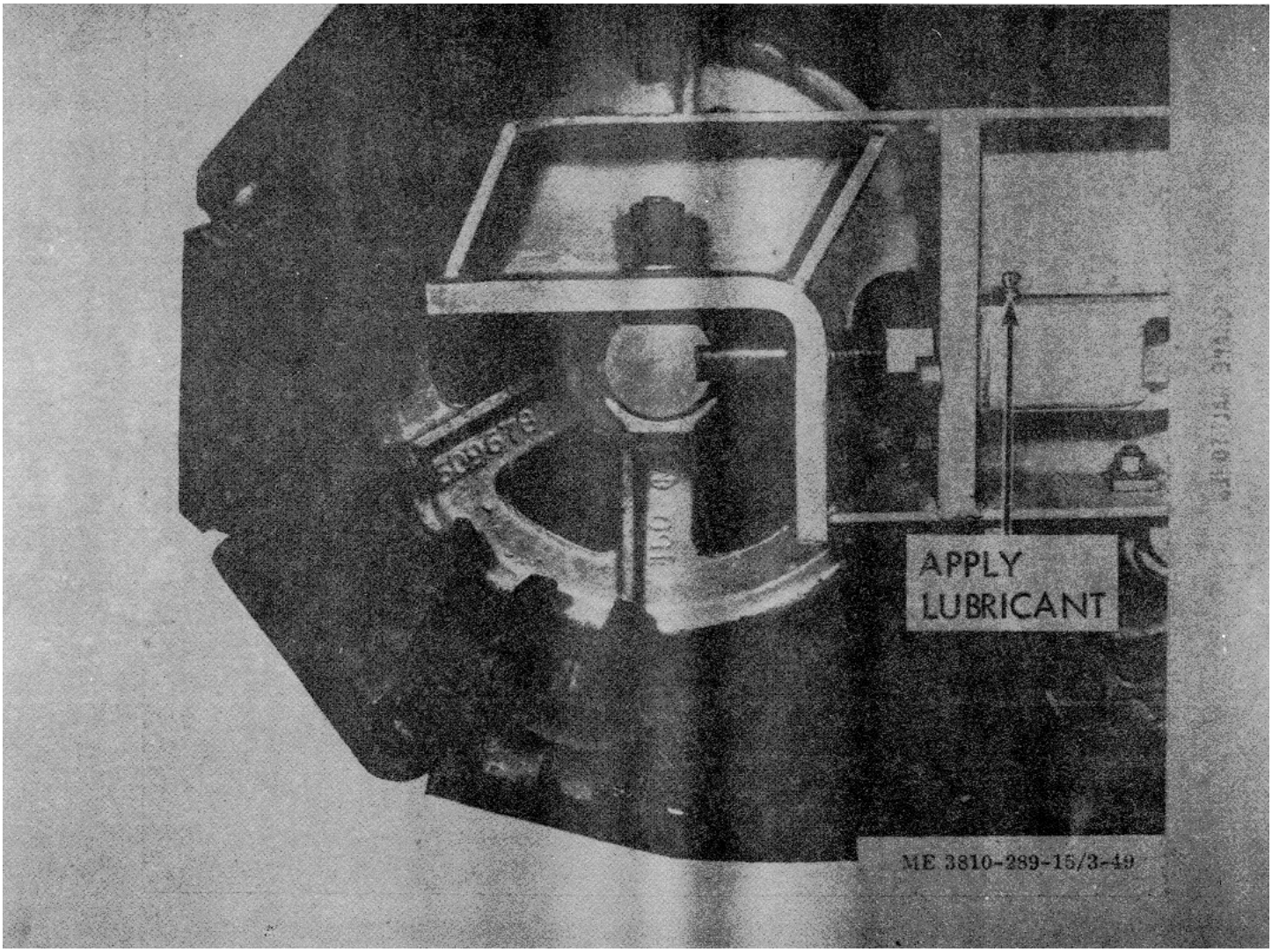


Figure 3-11. Track idler service (outer side view).

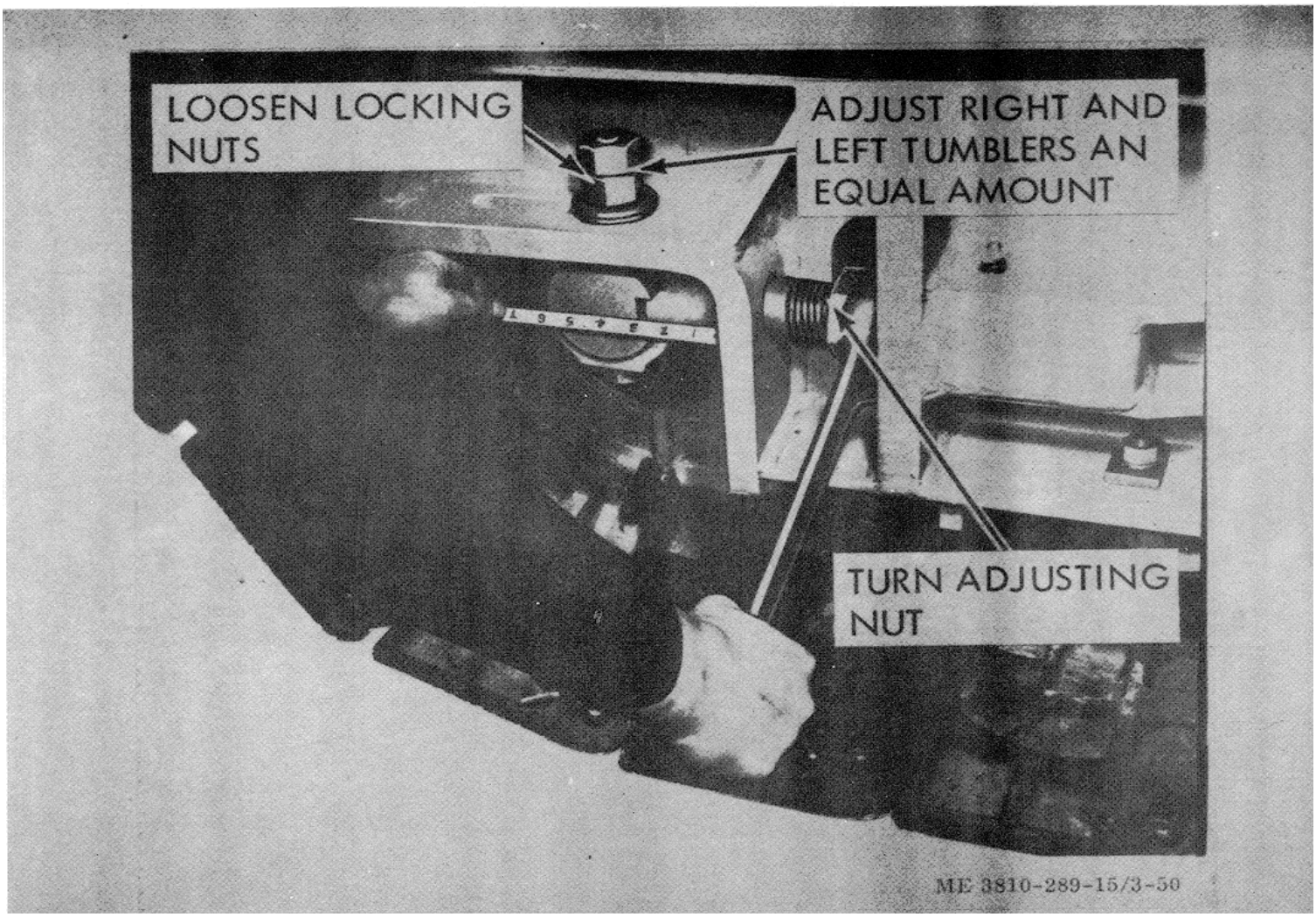


Figure 3-12. Track belt and roller chain adjustment.

Section XI. MAINTENANCE OF CAB COMPONENTS

3-23. Cab Assembly Inspection

a. Check for cracks and loose bolts.

b. Check for proper operation of doors ; hinged panels.

3-24. Seat Assembly Adjustment

Refer to figure 3-13 to adjust the seat assembly.

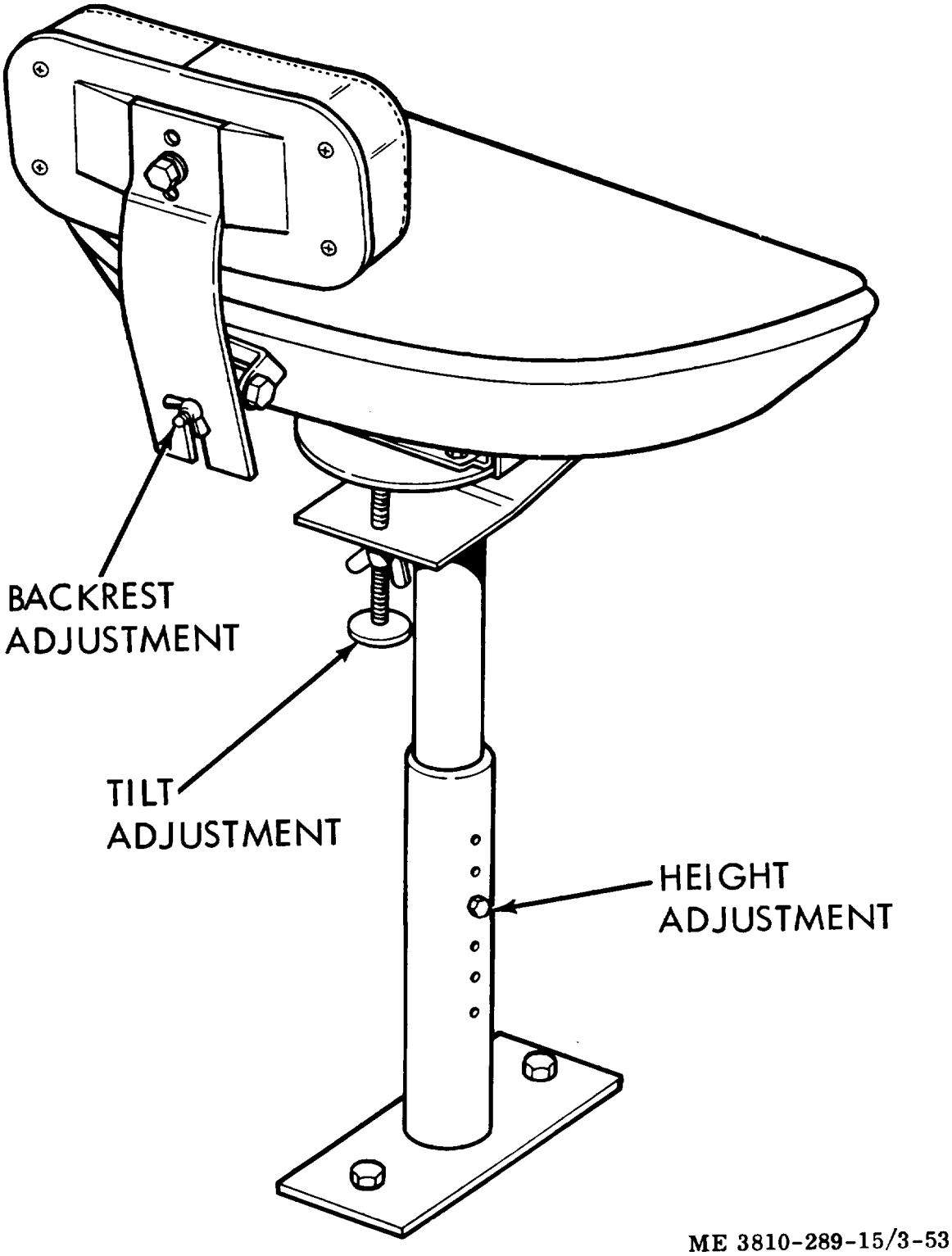


Figure 3-13. Seat assembly adjustment.

Section XII. MAINTENANCE OF CRANE, SHOVEL, AND EARTHMOVING EQUIPMENT COMPONENTS

3-25. Cable Harness and Cable Inspection

Examine cables frequently for flats or broken wires.

3-26. Crane Boom Assembly Inspection and Service

a Inspection.

(1) Lower the boom and support on cribbing (fig. 3-14).

(2) Spool off a few turns of the suspension and hoist ropes so boom point sheaves can be rotated by hand.

(3) Examine all sheaves for side wear of rope grooves.

(4) Inspect block and hook for secure mountings and proper lubrication.

(5) Inspect crane boom for bent or damaged cords and lacings and for loose bolt mountings butt joints. Tighten loose bolts; replace missing bolts.

(6) Inspect the boom foot pins; make sure they are secure.

b. Service. Lubricate all points on boom and hook block in accordance with lubrication order.

3-27. Operating Clutches Inspection, Service, Adjustment

a. General. Operating clutches (fig. 3-15 and 3-16) should hold securely when engaged and be completely free when levers are in neutral positive.

b. Inspection.

(1) Check linkage and shifter yokes for wear and damage. See if all connecting pins and bolts are secure.

(2) See if shifter yoke reach arms are adjusted so that clutches fully engage and release. Adjust if necessary (para 3-11).

c. Service.

(1) Remove oil and grease from lining and drums with approved solvent.

Note. Linings should be replaced before they are Worn flush with rivets.

(2) Report worn or defective linings to organizational maintenance.

(3) Lubricate clutches in accordance with the lubrication order.

d. Adjustment (fig. 3-16).

(1) Set clutch in engaged position.

(2) Adjust eyebolt until the gap between the lugs (of toggle-link and bellcrank) at the spring bolt is no more than 1/8 inch with the clutch cold. If clutch is adjusted while hot, the gap should be smaller than 1/8 inch.

(3) Adjust guide screws so band clears housing by about 1/32 inch all the way around when clutch is released.

(4) djust the dead end screw to provide about 1/32 inch clearance between the lining and housing when clutch is disengaged.

3-28. Steering Spline Clutch Adjustment

Adjustment should seldom be required, but if needed, adjust the reach rods I the bevel gear case (fig. 3-17). With the steering spline clutch lever in neutral, the reach rod lengths should be adjusted so that both clutches are in full engagement.

3-29. Boom Hoist Clutch Band Inspection and Adjustment

a. Inspection.

(1) Inspect boom hoist clutch and booster bands for wear or damage. If satisfactory operation cannot be obtained by adjustment, worn band should be replaced.

(2) Report defective or worn band to organizational maintenance.

b. Adjustment.

(1) *Booster band.* With control lever in neutral position, adjust booster clutch band wear adjustments nuts until booster band will have minimum clearance all around its housing and engage the main clutch on pulling hand lever. A good way to determine sufficient clearance is to hand grasp the booster band at joint. If it can be moved sideways freely, clearance should be satisfactory.

(2) *Main clutch.* Adjust the main clutch release spring just enough to allow main clutch to disengage when the lever is placed in neutral position and the booster clutch is disengaged.

3-30. Boom Hoist Brakeband Inspection and Adjustment

a. Inspection. Inspect boom hoist brakeband for wear. If satisfactory operation can no longer

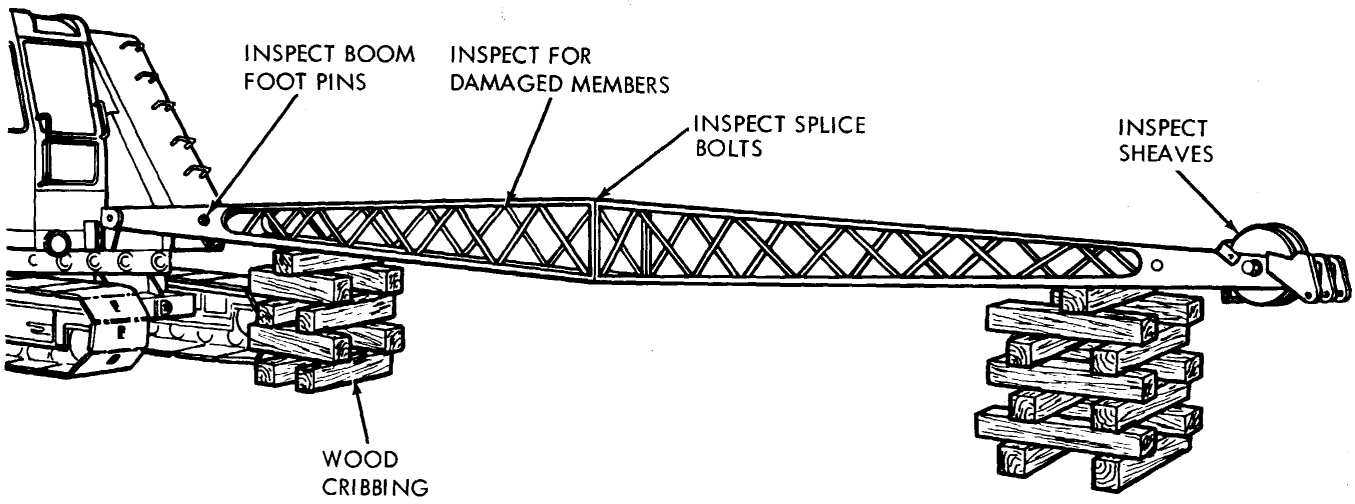


Figure 3-14. Boom assembly inspection.

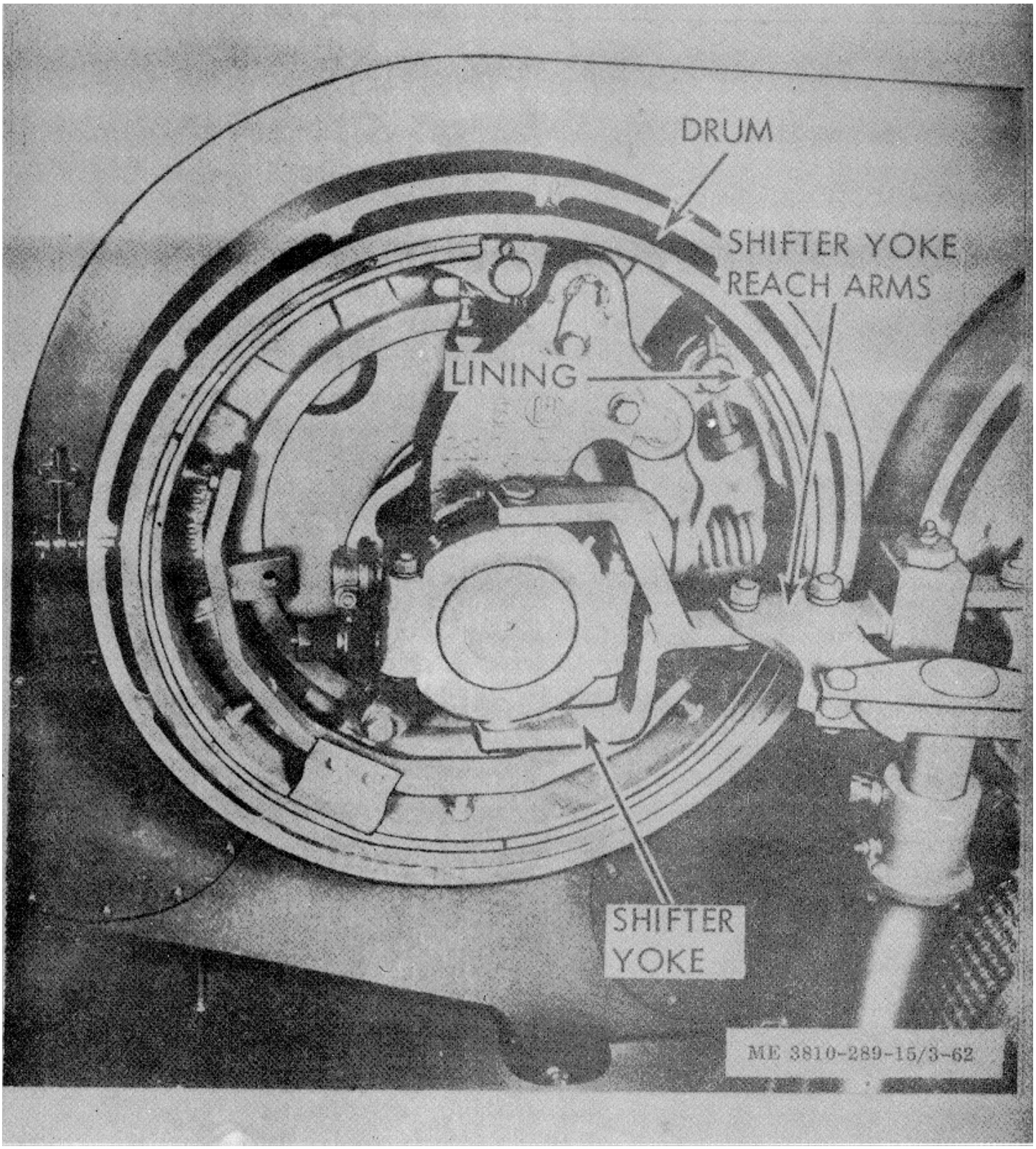


Figure 3-15. Operating clutch inspection.

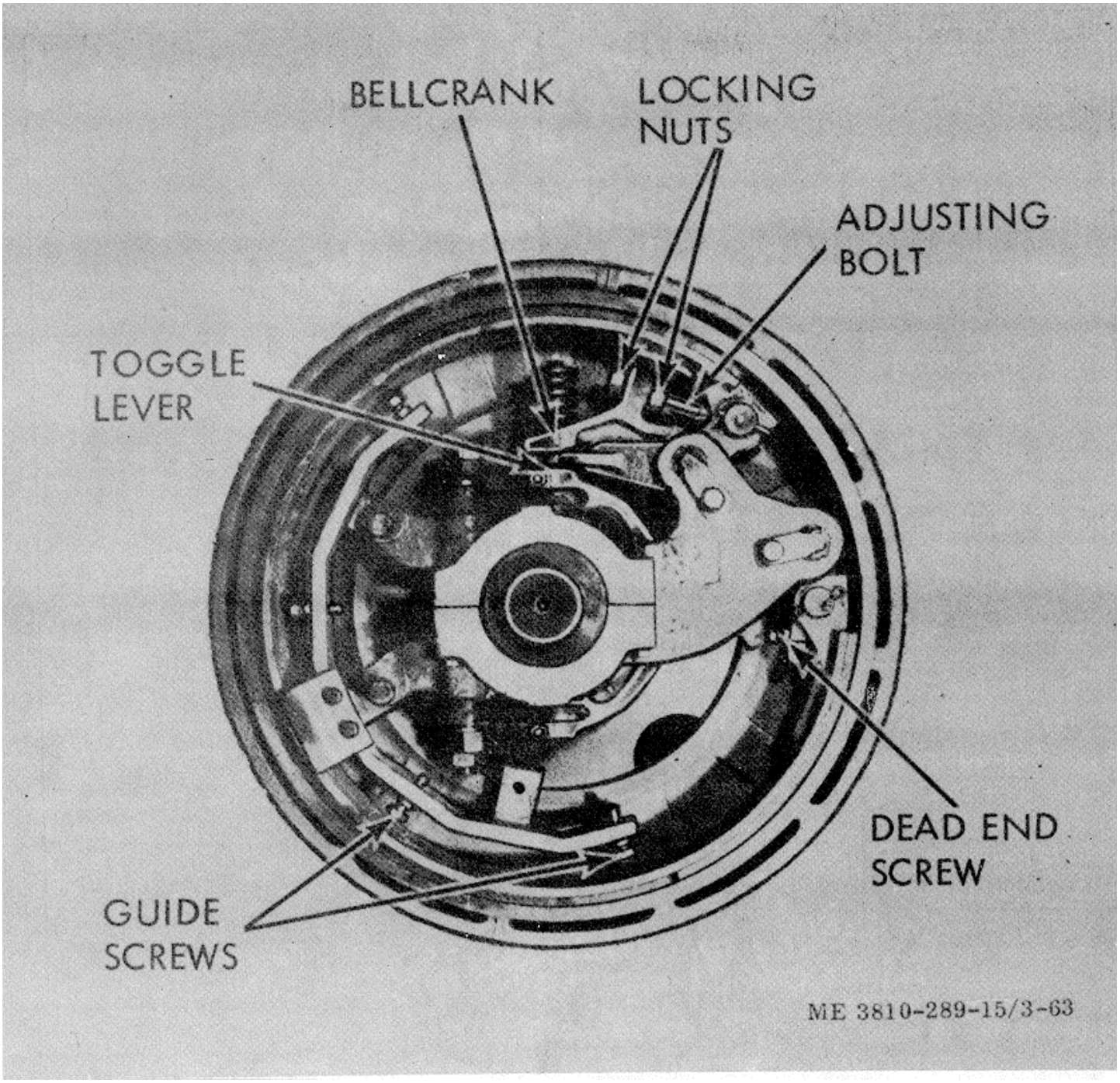


Figure 3-16. Operating clutch adjustment.

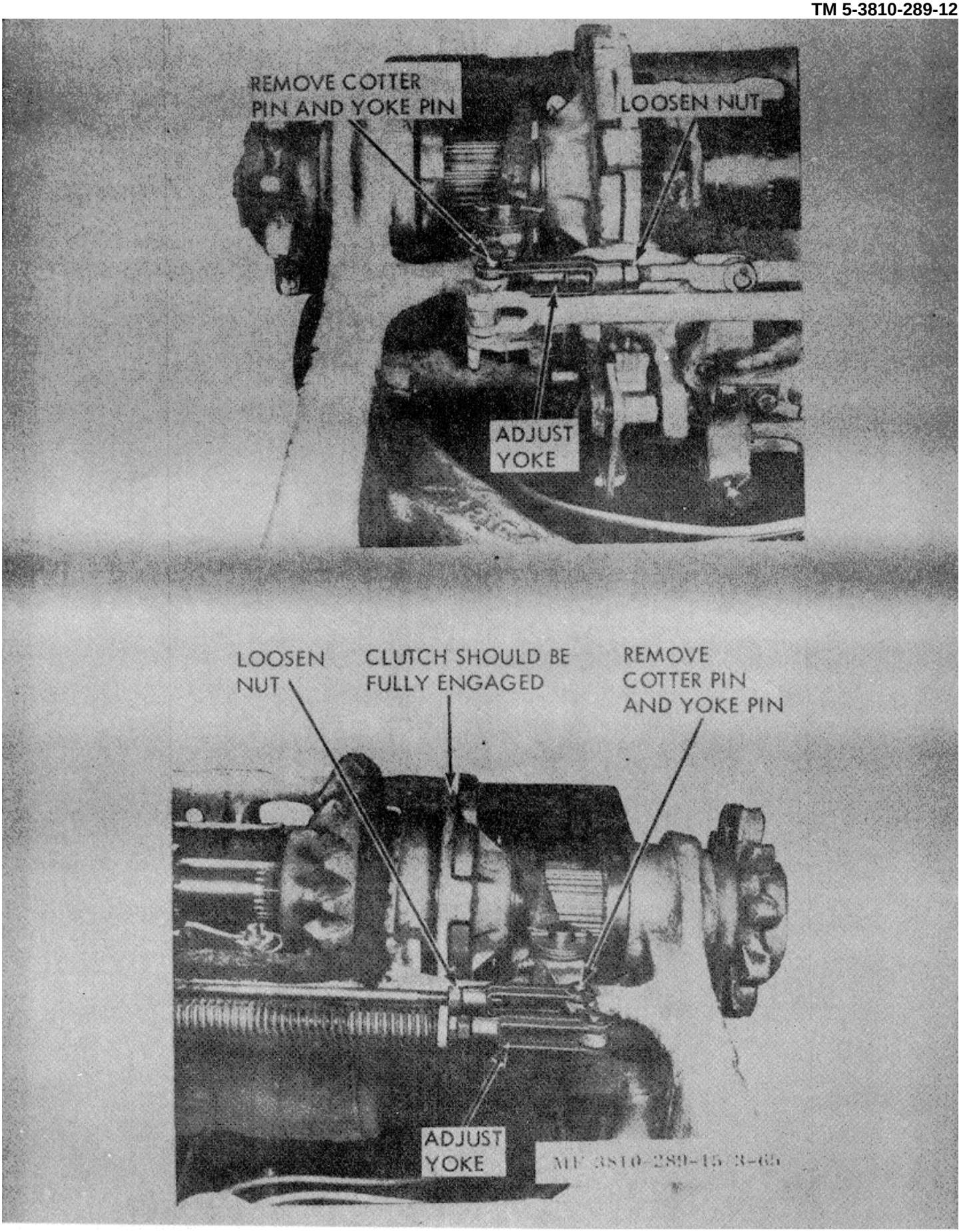


Figure 3-17. Steering clutches adjustment.

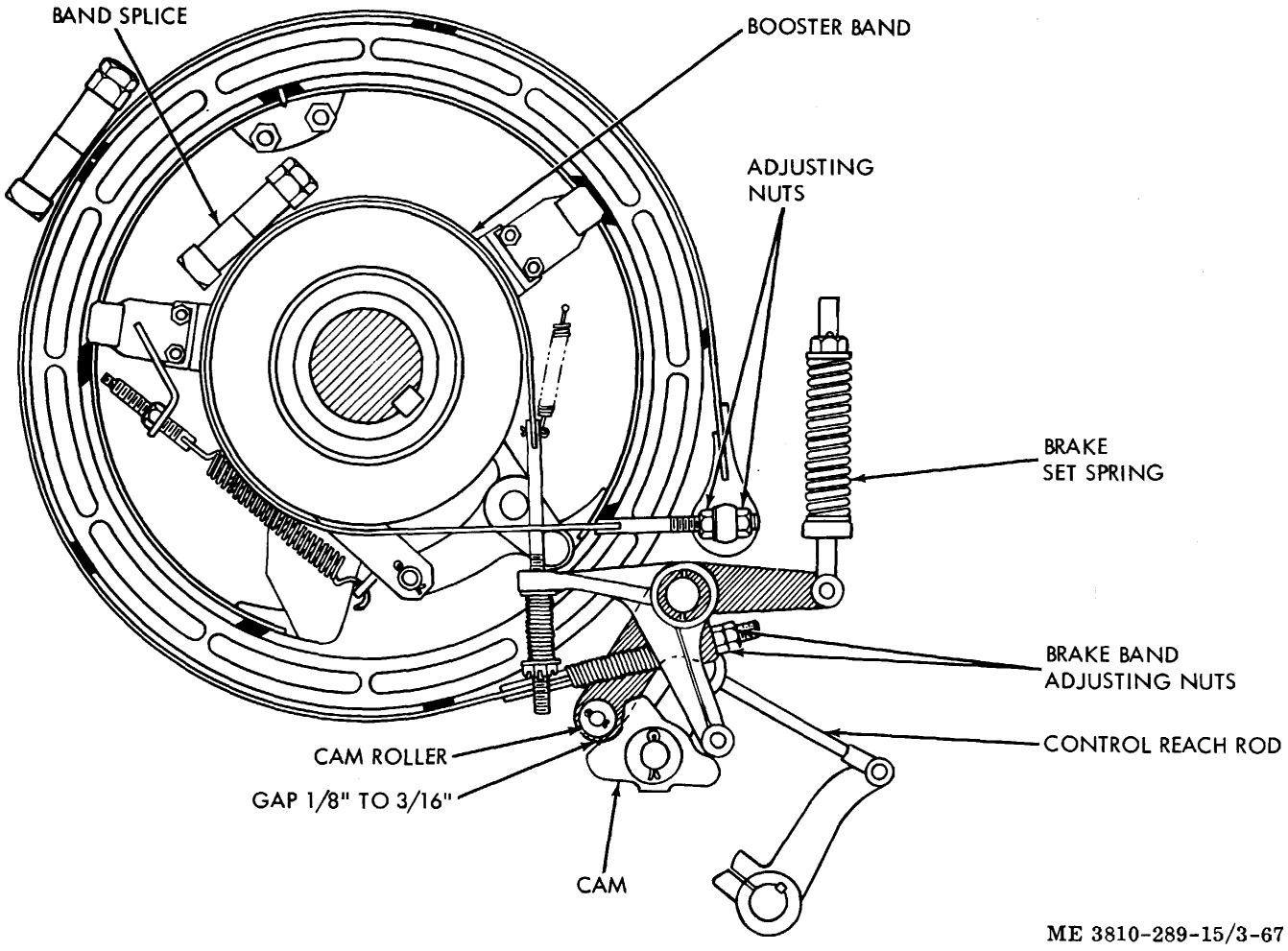


Figure 3-18. Boom hoist brakeband adjustment.

be obtained by adjustment, the band should be replaced.

b. Adjustment (fig. 3-18). Adjustment must be made in sequence as follows:

(1) With control lever in neutral position adjust length of control reach rod until rear detent in cam is centered by brake cam roller.

(2) With control lever in neutral position, adjust brakeband wear adjustment nuts until gap is 1/8 to 3/16 inch (between cam rear detent faces and brake cam roller).

(3) The above adjustment must be made periodically as brake lining wears, to secure proper timing between clutch set and brake release during boom raising.

(4) The brake set spring, which supplies the brakeband setting force, is adjusted at the factory and should not require any further adjustment for loads within the rated capacity of the machine.

3-31. Digging Lock Inspection and Service

a. Inspection. The digging lock has no fraction linings or springs to get out of adjustment. It will seldom require attention, but if it is not operating properly, place the digging lock lever in the forward notch of its quadrant and check to see that the two pawls (fig. 3-19) drop into full engagement with the ratchet teeth.

b. Service.

(1) Grind or file ends of pawls if a bur prevents full engagement.

(2) Clean and oil pawl pins so that the pawls move freely.

3-32. Chain Case Assembly Inspection and Service

a. Inspection. Inspect chain case for secure mounting and proper oil level.

b. Service.

(1) Tighten loose mounting.

(2) Fill chain case to proper oil level. Refer to lubrication order.

3-33. Center Gudgeon Bushing Service

a. Lubricate center gudgeon bushing as required. Refer to lubrication order.

b. Refer to lubrication order and service the pivot bushing.

3-34. Cone Roller Service

Refer to current lubrication order and lubricate the cone rollers as required.

3-35. Vertical and Horizontal Swing and Propel Shafts Inspection and Service

a. Inspection. Inspect shaft couplings and assemblies for wear or damage.

b. Service. Check for proper lubrication and lubricate if necessary. Refer to lubrication order.

3-36. Hoist Assemblies Inspection and Service

a. Inspection.

(*1) Boom hoist.* Check for proper operation and secure mounting. Proper operation, in this case, means the boom responds correctly to being raised or lowered according to the position of the boom hoist lever, and that, when the lever is placed in the neutral position, the boom hoist brake effectively holds the boom in position. If the boom continues to creep lower after putting the boom hoist lever in neutral, the boom hoist brake must be adjusted (para 3-30) or replaced. If the boom hoist clutch slips, it should be adjusted (para 3-29) or replaced.

(*2) Hoist.* The hoist should respond properly while raising or lowering a load. If the hoist clutch slips, it should be adjusted (para 3-29) or replaced.

(*3) Lowering chain.* Check condition and tension of power load lowering chain and shorten if necessary. To shorten chain, remove connecting link by taking out cotter pins. Take off desired number of links and reconnect again with connecting link.

b. Service. Lubricate as required. Refer to lubrication order.

3-37. Piledriver Service

In normal operation with drop hammers, leads should be lubricated once per shift with open gear lubricant. After applying lubricant, run hammer up and down; apply lubricant until hammer leads and guides are well lubricated.

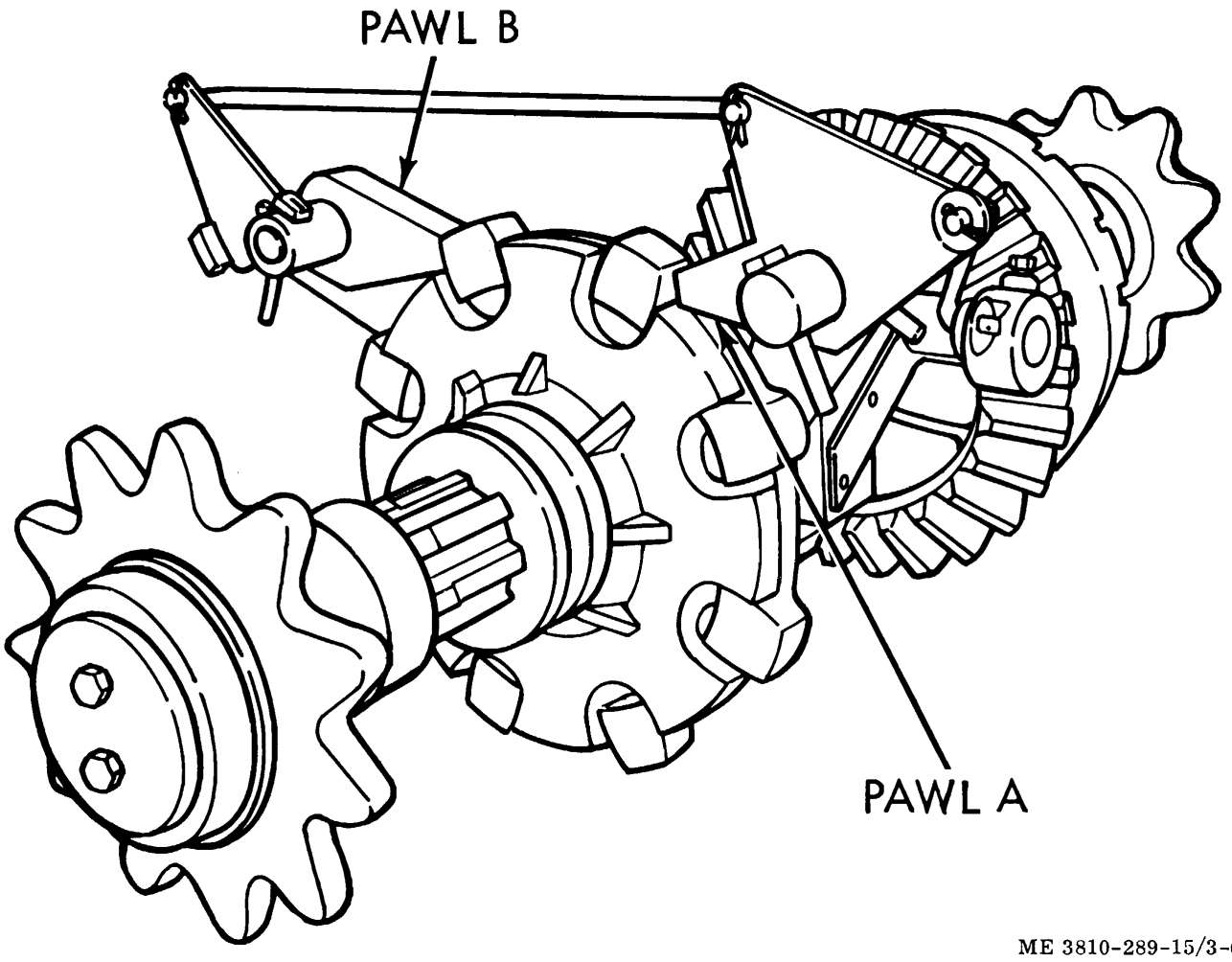


Figure 3-19. Digging lock.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

4-1. Tools and Equipment

Tools and equipment issued with or authorized For the crane-shovel are listed in the basic issue Items list, appendix C.

4-2. Special Tools and Equipment

Special tools and equipment required for organizational maintenance are listed in table 4-1.

Table 4-1. Special Tools and Equipment

Item	FSN or part no.	Reference		Use
		Fig.	Para	
Belt tension gage	ST-968	4-20	4-32	Check belt tension.
Wrench adapter	ST-669	4-3	4-13	Adapts torque wrench to locknuts of valve crossheads.

4-3. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated In TM 5-3810-289-20P.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-4. General

This section contains instructions for preventive maintenance checks and services which must be performed by organizational maintenance personnel at quarterly intervals. A quarterly interval is equal to three calendar months, or 250 hours operation, whichever occurs first.

4-5. Preventive Maintenance Checks and Services

Refer to table 3-1 for the quarterly preventive maintenance checks and services. The item numbers in the tabular list indicate the sequence of minimum requirements.

Section III. TROUBLESHOOTING

4-6. General

This section provides information useful diagnosing and correcting unsatisfactory operation or failure of the crane-shovel and its components.

4-7. Troubleshooting Chart

In chart 4-1, each malfunction listed is followed by a list of probable causes. The corrective action required is described opposite the probable cause. Any trouble beyond the scope of organizational maintenance shall be reported to direct support maintenance.

Chart 4-1. Troubleshooting

Malfunction	Probable cause	Corrective action
1. Engine fails to start.	*a.* Engine too cold.	*a.* Use starting aid.
	b. Lack of fuel.	*b.* Check fuel tank.
	c. Clogged fuel filters.	*c.* Clean element in primary filter. Replace elements in final filter (para 4-23).
2. Irregular firing of engine.	*a.* Clogged fuel filter elements.	*a.* Clean element in primary filter. Replace elements in final filter (para 4-23).
	b. Inlet or exhaust valves, improper	*b.* Adjust valves (para 4-12). adjustment.
3. Engine overheating indicated.	*a.* Loose fan belts.	*a.* Adjust fan belt (para 4-32).
	B Radiator clogging.	*b.* Clean radiator (para 4-31).
	c. Water temperature gage defective.	*c.* Replace gage (57, fig. 4-31).
	d. Thermostats defective.	*d.* Test thermostats (para 4-33).
	e. Radiator sealed pressure overflow	*e.* Clean or replace (para 4-31).defective.
4. Engine knocks excessively.	*a.* Main bearings worn or burned out.	*a.* Replace main bearings (report to direct support maintenance).
	b. Connecting rod bearings worn or burned out.	*b* Replace connecting rods (report to direct support maintenance).
5. Low or no lubricating oil pres-	Defective gage.	Replace gage (56, fig. 4-31). sure indication.
6. Low or no fuel pressure indica- tion.	*a.* Clogged fuel filters.	*a.* Clean element in primary filter. Replace elements in final filter (para 4-23).
	b. Defective gage.	Replace gage (56, fig. 4-31).'
7. Starter will not crank engine.	*a.* Batteries weak.	*a.* Test batteries and charge if necessary (para 4-46).
	b. Loose connection or defective wiring.	*b.* Inspect and replace damaged wiring. Inspect all connections to starter, magnetic switch, ignition switch, and batteries.
	c. Defective switch.	*c.* Inspect all switches to determine their condition. Connect jumper lead around any switch suspected of being defective; if system functions, replace the bypass switch.
	d. Commutator dirty or worn.	*d.* Inspect commutator by removing inspection plugs. If commutator is dirty or slightly grooved, polish by placing a strip of fine sandpaper around commutator and under brushes (rough side toward commutator) and rotate armature. Blow dust from commutator after polishing.
	e. Starter brushes worn.	*e.* Replace brushes.
8. Alternator not charging.	*a.* Alternator drive belt loose or broken.	*a.* Adjust or replace drive belt (para 4-36).
	b. Alternator inoperative.	*b.* Refer to paragraph 4-35.
9. Alternator output low or unsteady.	*a.* Alternator belt not properly adjusted.	a. Adjust belt (para 4-36).
	b. Brushes sticking in brush holder.	*b.* Free brushes in holder.

Chart 4-1. Troubleshooting

Malfunction	Probable cause	Corrective action
10. Batteries will not hold charge.	*a.* Short in electrical system.	a. Check cables and wiring.
	b. Defective battery.	*b.* Replace defective battery (para 4-46).
	c. Alternator regulator not operating properly.	*c.* Refer to paragraph 4-35.
11. Floodlights and/or dash light will not light.	*a.* Bulb burned out.	*a.* Replace bulb (para 4-43).
	b. Defective circuit breaker.	*b.* Replace circuit breaker.
	c. Loose connection.	c. Tighten connections.
	d. Electrical system disconnect switch is in OFF position.	*d.* Turn switch to ON position.
12. Cables wear excessively.	Cables of wrong specification.	Check for correct specifications.
13. Clamshell bucket fails to close.	Tooth in bucket twisted.	Replace tooth (para *4-60d).*

Section IV. RADIO INTERFERENCE SUPPRESSION

4-8. General Methods Used to Attain Proper Suppression

Essentially, suppression is attained by providing a low resistance path to ground for the stray currents. The methods used include shielding the ignition and high-frequency wires, grounding the frame with bonding straps, and using capacitors and resistors.

4-9. Interference Suppression Components

a. Primary Suppression Components. The primary suppression components are those whose primary function is to suppress radio interference.

b. Secondary Suppression Components. The secondary suppression components have radio interference suppression functions which are incidental or secondary to their primary function.

4-10. Replacement of Suppression Components

a. General. Replacement of suppression components requires positive metal-to-metal contact with washers and ground straps.

b. Replacement. Replace defective suppression components.

4-11. Testing of Radio Interference Suppression Components

Test capacitors for leaks and shorts on a capacitor tester; replace defective capacitors. If test equipment is not available and interference is indicated, isolate the cause of interference by trial and error method of replacing each capacitor in turn until the cause of interference is located and
eliminated.

Section V. MAINTENANCE OF ENGINE CYLINDER HEAD AND VALUE MECHANISM

4-12. Valve Cover and Gasket

a. Removal.

(1) Remove capscrews, washers and preformed packing securing cover to cylinder her (fig. 4-1).

(2) Lift cover and gasket from head; discard gasket.

b. Cleaning and Inspection.

(1) Remove all gasket material from sealing edge of cover.

(2) Inspect cover for cracks, dents, distorted sealing area, and other damage.

c. Installation.

(1) Assemble gasket, preformed packing, washers and capscrews, to valve cover.

(2) Mount cover on engine cylinder head. Tighten holddown capscrews

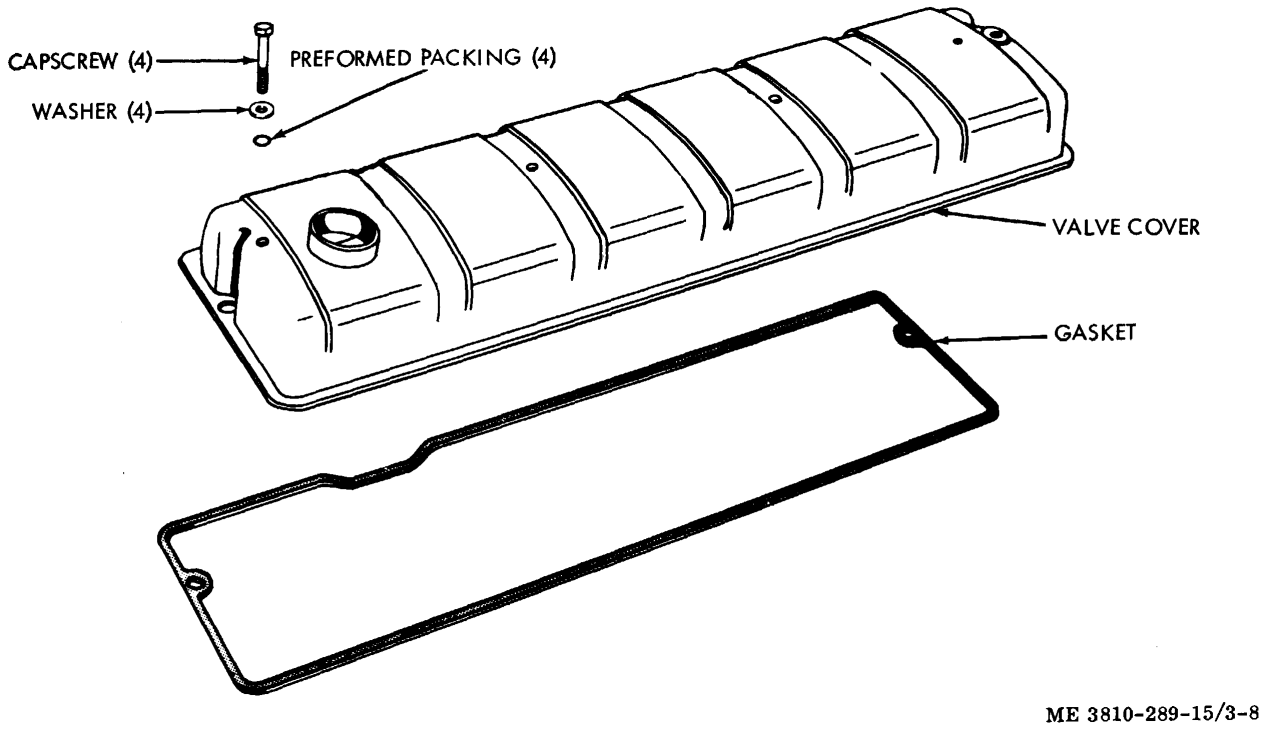


Figure 4-1. Value cover replacement.

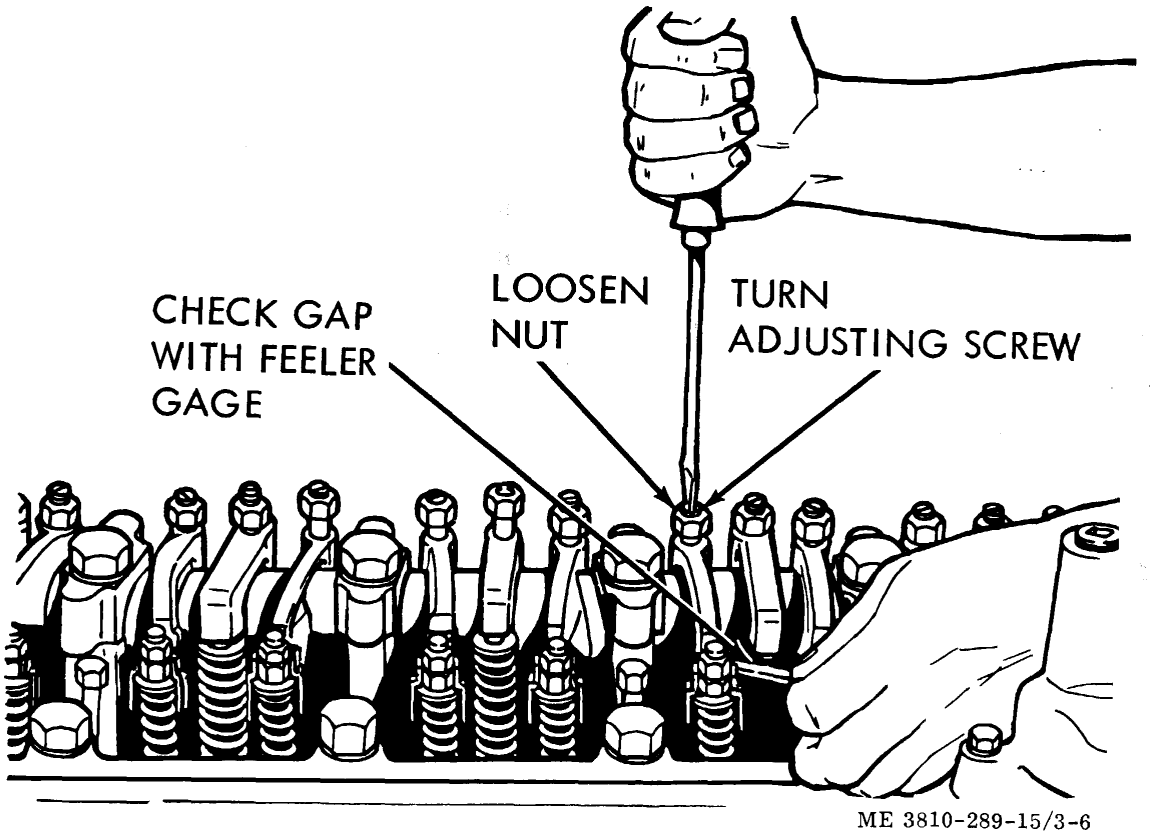


Figure 4-2. Rocker arm adjustment (locknut torque)

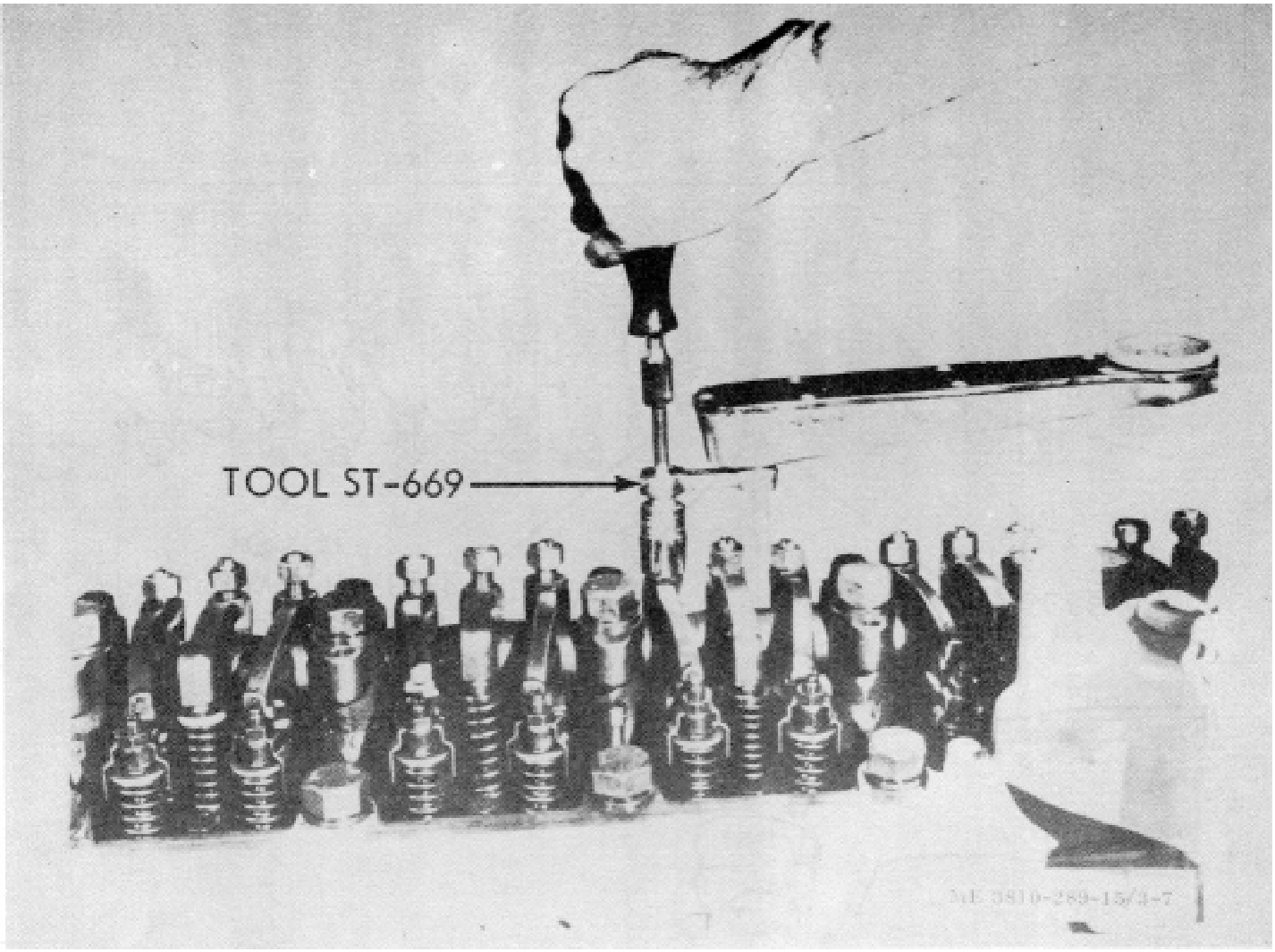


Figure 4-3. Rocker Arm Assembly Adjustment

4-13. Rocker Arm Assembly Adjustment

a. Loosen locknut and back off adjustment screw (fig. P2). Insert feeler gage between rocker lever and top of valve stem or crosshead. Turn screw down until lever just touches feeler gage; lock adjusting screw in this position with locknut.

b. Torque locknut to 60/70 foot-pounds (fig. 4-3).

c. Always make final valve adjustment with the engine at operating temperature (para 1-5b (7)). Valve tappet clearances are 0.015 inch (intake) and 0.025 inch (exhaust).

Section VI. MAINTENANCE OF ENGINE OIL COOLER AND OIL FILTER ASSEMBLY, AND MAIN CLUTCH ADJUSTMENT

4-14. Oil Cooler

a. Removal and Disassembly.

(1) Refer to figure 4-4 and remove oil cooler.

(2) Refer to figure 4-5 and disassemble oil cooler.

b. Repair.

(1) Repair damaged tubes by inserting a smaller o.d. (outside diameter) tube inside damaged tube. Do not restrict more than 5 percent of total number of tubes in this manner.

(2) If more than 5 percent of tubes are defective, discard element.

Caution: **Do not damage adjacent with heat while soldering.**

c. Reassembly and Installation.

(1) Refer to figure 4-5 and reassemble cooler.

(2) Refer to figure 4-4 and install oil cooler.

4-15. Oil Filter Assembly

a. Removal and Disassembly. Remove and disassemble oil filter (fig. 3-1).

b. Cleaning, Inspection and Repair.

(1) Clean parts with an approved cleaning solvent.

(2) Inspect for cracks, breaks, and other damage.

(3) Replace defective parts.

c. Reassembly and Installation. Reassemble and install oil filter assembly (fig. 3-1).

4-16. Clutch Adjustment

a. Remove handhole cover (fig. 3-3).

b. Turn clutch until adjusting lockpin can be reached.

c. Disengage the pin and turn adjusting yoke clockwise until pin will seat in a new hole.

d. Turn adjusting yoke one hole at a time until any tendency of the clutch to slip under normal load conditions is overcome.

e. Install handhole cover.

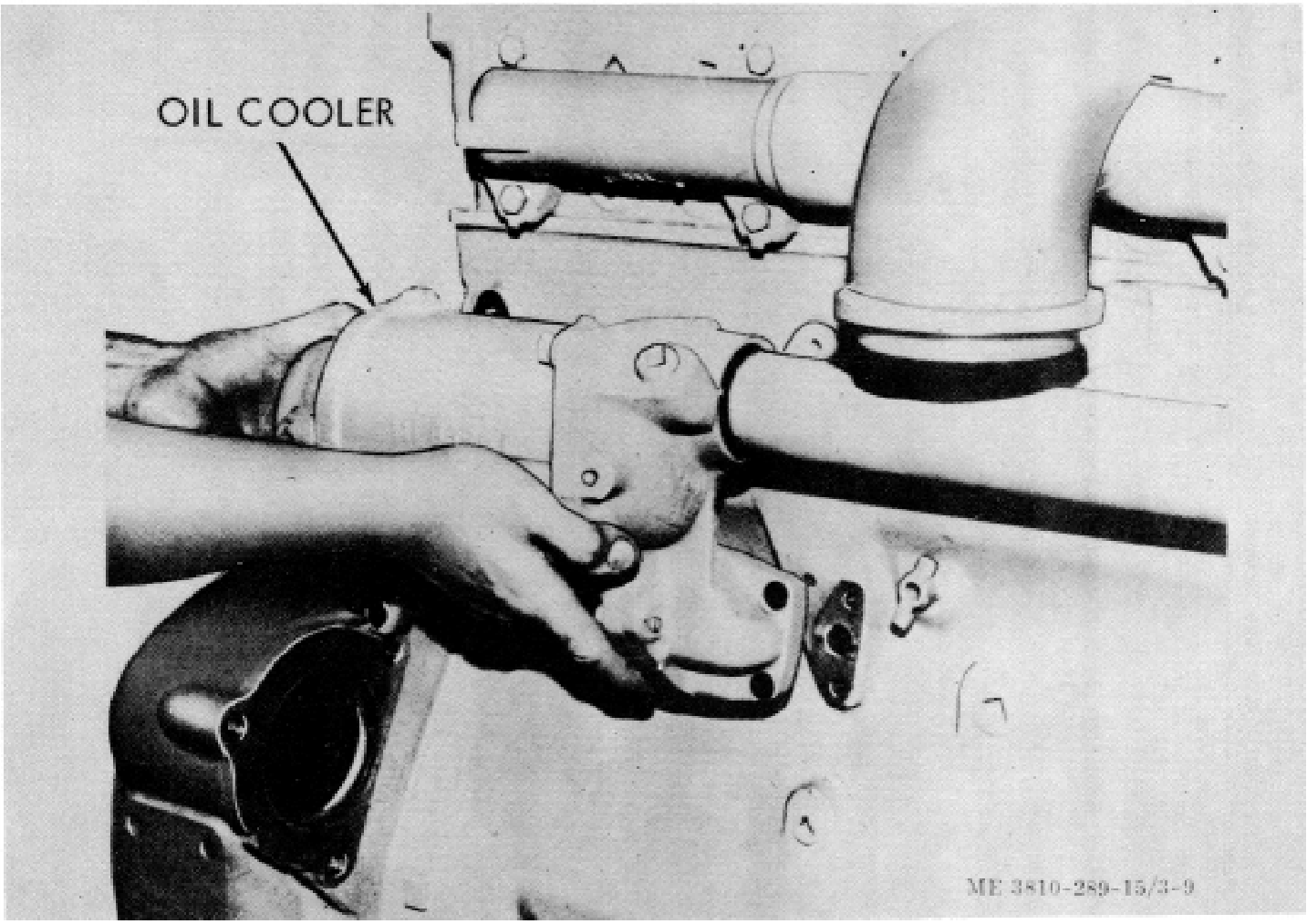
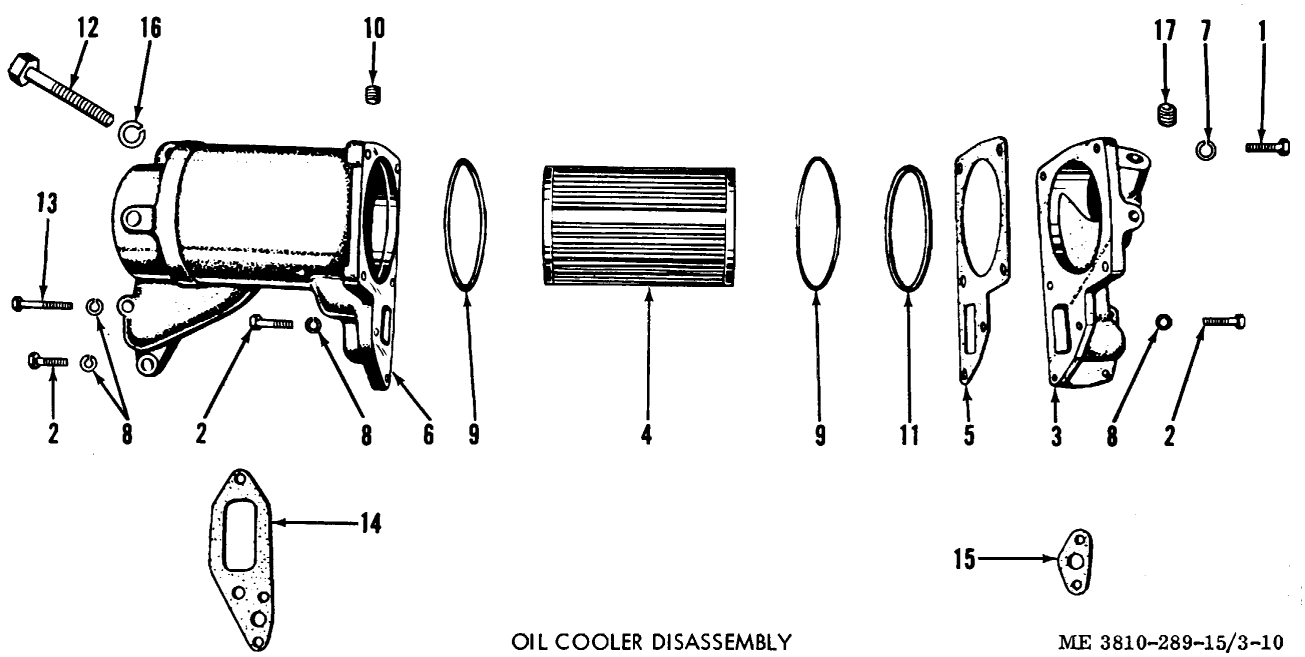


Figure 4-4. Oil cooler, removal and installation.



1 Capscrew, cover to housing (4)
2 Capscrew (5)
3 Lubricating oil cooler cover
4 Element
5 Gasket, front cover to housing
6 Housing
7 Lockwasher, cover to housing (4)
8 Lockwasher (6)
9 O-ring (2)
10 Pipe plug
11 Cooler and O-ring retainer
12 Capscrew, cooler to block
13 Capscrew, cooler to block
14 Gasket, cooler to block (rear)
15 Gasket, cooler to block (front)
16 Lockwasher, housing to block
17 Pipe plug

Figure 4-5. Oil cooler disassembly.

Section VII. MAINTENANCE OF CLUTCH RELEASE MECHANISM CONTROL LEVERS, AND TURNTABLE SWING LOCK

4-17. Control Levers

Refer to figure 3-4.

a. Removal.

(1) Remove any grease fittings likely be damaged in disassembly.

(2) Remove any springs in the assembly.

(3) Remove reach rods. Most reach rods have an adjusting arrangement at one end. Do not disassemble this adjusting arrangement unless necessary and then retain setting if possible. If parts are not to be replaced immediately, mark adjustment setting so it can be made if accidentally disturbed. If a number controls are disassembled at the same time, number the reach rods from left to right machine (taking left as operator's left as sits in his seat facing controls), to save time on reassembly. While off from machine, be sure reach rods are placed in a safe place where they are not likely to be bent. Replace pins and cotter pins in rods for convenience in reassembly.

(4) To remove bellcranks, remove their fulcrum pins. If fulcrum pin is headed with nut behind bellcrank brackets, it is sometimes more convenient to remove the bracket bolts and then disassemble the crank from bracket by removing fulcrum pin.

(5) Control shafts (these are fulcrums for grouped levers) slide out after members lock to shaft have been freed by loosening clamp bolts and opened by inserting a small wedge in slot Before removing, number the units on the shaft (front left to right) for convenience in reassembly.

b. Installation.

(1) Insert control shafts (fulcrums for grouped levers), through holes in operating levers and bearings in revolving frame. Remove wedges from slots in levers and tighten lever clamp bolts just enough to support levers. Tighten bolts when final adjustment is made.

(2) Bolt on bellcranks, being sure to place them in correct position.

(3) Attach reach rods, checking to be sure original adjustment is retained. If reach rod is to be replaced and original length is still apparent, adjust new rod to match old before inserting. If original rod is badly bent or destroyed set and fasten both control and operating lever in neutral position and adjust reach rod to make proper connection. Call change to attention of operator who will have to make final adjustment after experimenting with operating performance.

(4) Attach springs.

(5) Check to be sure all clamp connections are securely tightened, and that cotter pins are safely spread. Safe operation of the machine depends on a reliable control system.

c. Adjustment. Adjust linkage by tightening or loosening adjusting nuts on rod ends or adjustable devices until levers are in a vertical position when in neutral and aligned with each other in the main lever bank.

4-18. Swing Lock

Refer to figure 4-6.

a. Removal.

(1) Remove toggle springs and detach control reach rod which is attached with two cotter pins and washers.

(2) Remove pin connecting short toggle link to eyebolt in locking-dog.

(3) Remove pin from one end of locking-dog shaft and slide out shaft.

(4) Remove pin connecting long toggle link to center casting.

(5) Remove center pin from toggle linkage.

(6) Remove eyebolt from locking-dog, but note original position so same adjustment can be secured when locking-dog is reassembled.

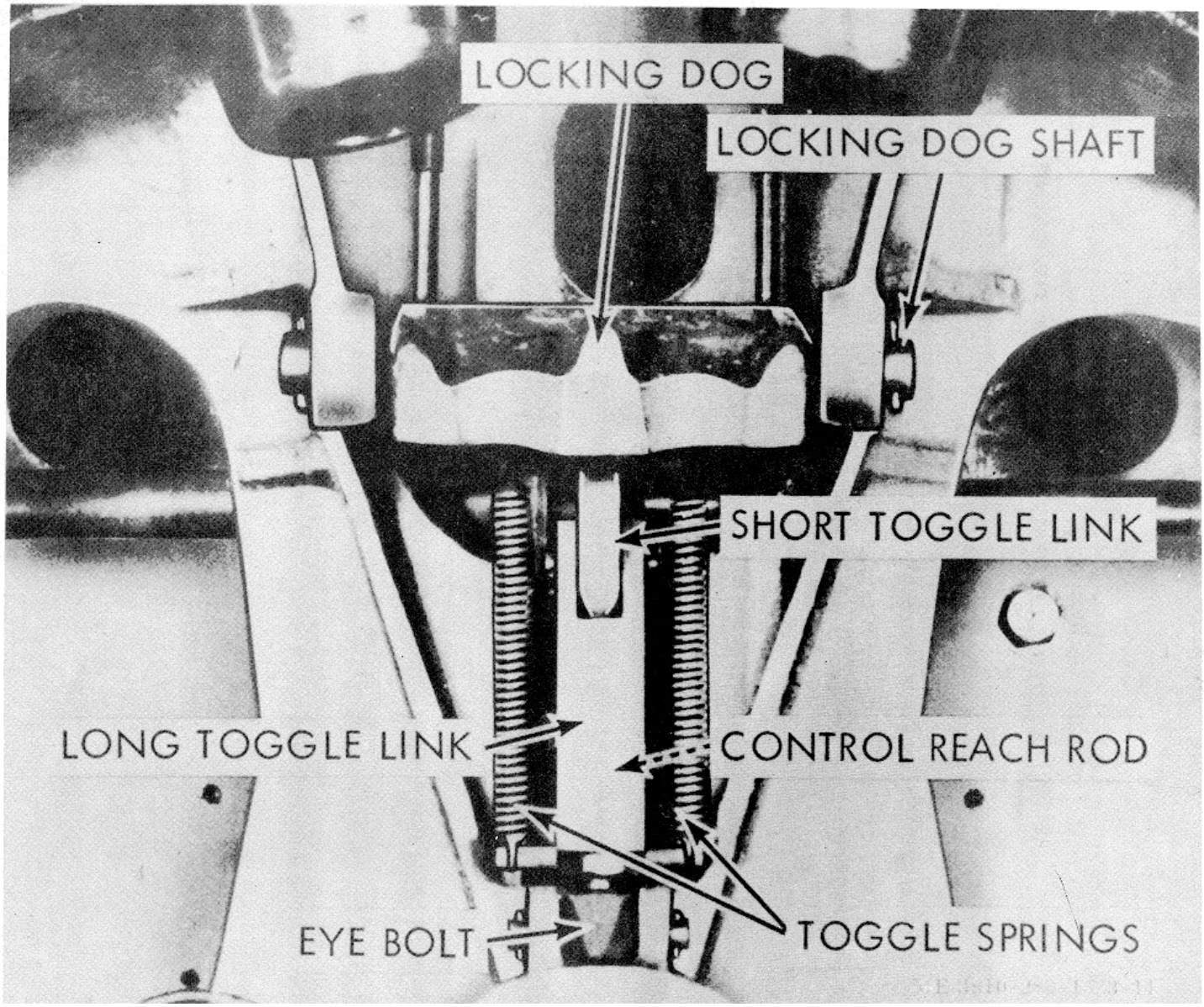


Figure 4-6. Swing lock replacement.

b. Installation.

(1) Insert eyebolt in locking-dog in original position if engagement has been satisfactory.

(2) Place locking-dog in frame, insert shaft and lock with two cotter pins.

(3) Assemble two toggle links with toggle link pin (14) and cotter pin.

(4) Place split end of short toggle link over eyebolt. (18), insert pin and lock with cotter pin.

(5) Insert end of long link in recess in center casting, insert pin and lock with cotter pin.

c. Adjustment of Swing Lock Levers. Refer to paragraph 3-12.

Section VIII. MAINTENANCE OF ENGINE FUEL SYSTEM COMPONENTS

4-19. Fuel Pump Service

Refer to figure 4-7 and service the fuel pump filter screen.

4-20. Fuel Lines, Fittings, Shutoff Valve Replacement

Refer to figures 4-8, 4-9 and 4-10 to replace the fuel lines and fittings.

4-21. Shutdown Valve Replacement

a. Removal.

(1) Refer to figure 4-11 and remove shutdown valve.

(2) Discard preformed packing.

b. Installation. Refer to figure 4-11 and install the shutdown valve, using new preformed packing.

4-22. Air Cleaner Service and Replacement

a. Regular service intervals, along with close visual inspection of the dry-type air cleaner, are necessary for proper cleaning of the engine inlet air. The service interval will vary with weather and working conditions. Where dust conditions are severe, it will be necessary to service the air cleaner frequently. Refer to paragraph 3-13 and service the air cleaner.

b. Refer to figure 4-12 and replace the cleaner.

4-23. Fuel Filters, Service and Replacement

a. Refer to figure 4-13, disassemble, as necessary, to replace or clean the fuel filters.

b. Discard filter cartridge assemblies.

c. Wash strainer element (7) and filter bodies in an approved cleaning solvent; blow dry with compressed air.

4-24. Primer Assembly Replacement

Refer to figure 4-14 and replace the primer unit, lines and fittings.

4-25. Throttle Control Replacement

Refer to figure 4-15 to replace the throttle control.

4-26. Tank Cap Strainer Service and Replacement

Refer to figure 3-7 and service and replace the fuel tank cap strainer.

4-27. Fuel Tank Inspection and Replacement

a. Inspect fuel tank for leaks and loose mounting bolts or fuel line connections.

b. Tighten loose mounting bolts or fuel line connections if necessary. See that cap vent is open.

c. Refer to figure 3-7 and replace the fuel tank.

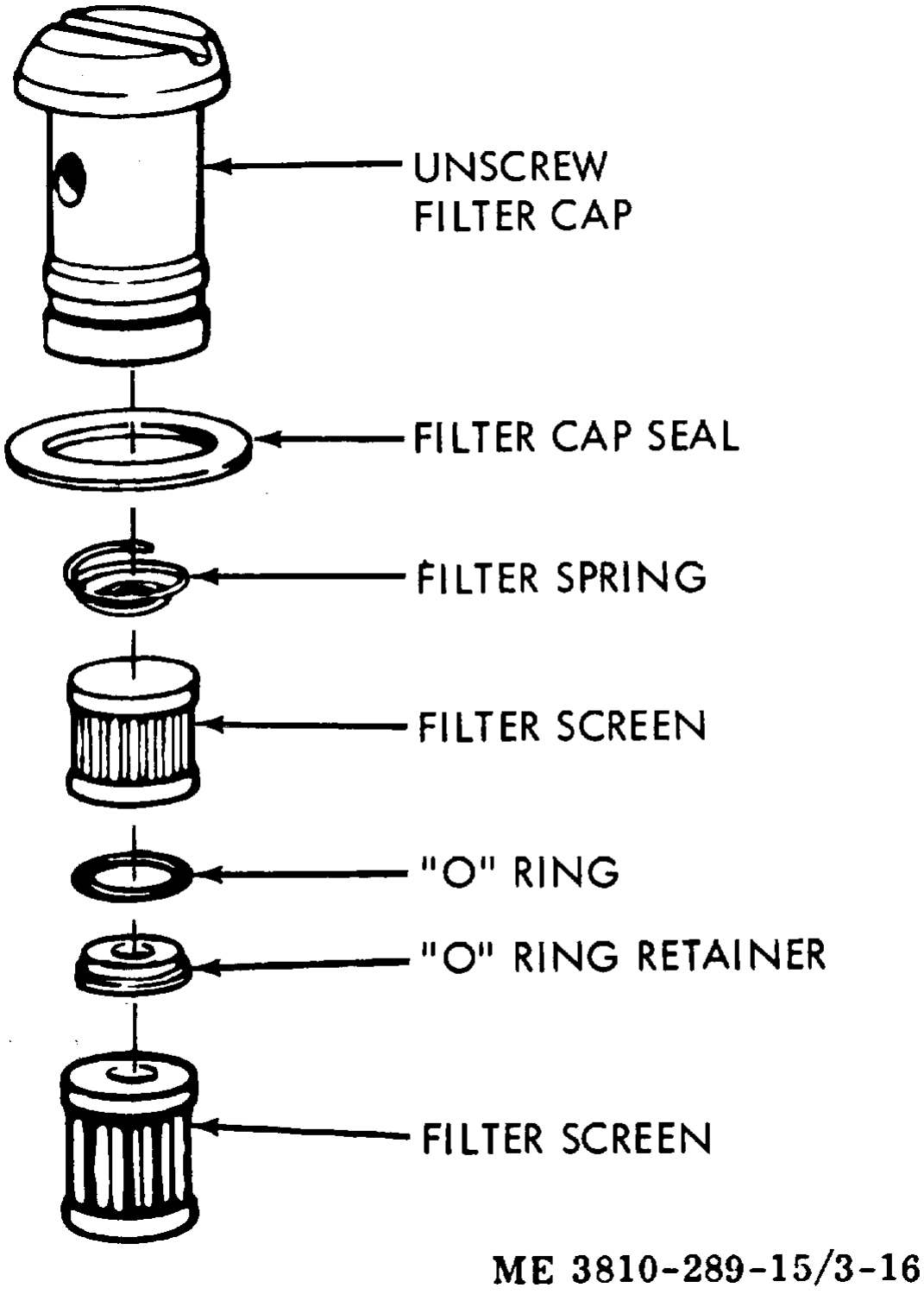


Figure 4-7. Fuel pump filter screen service.

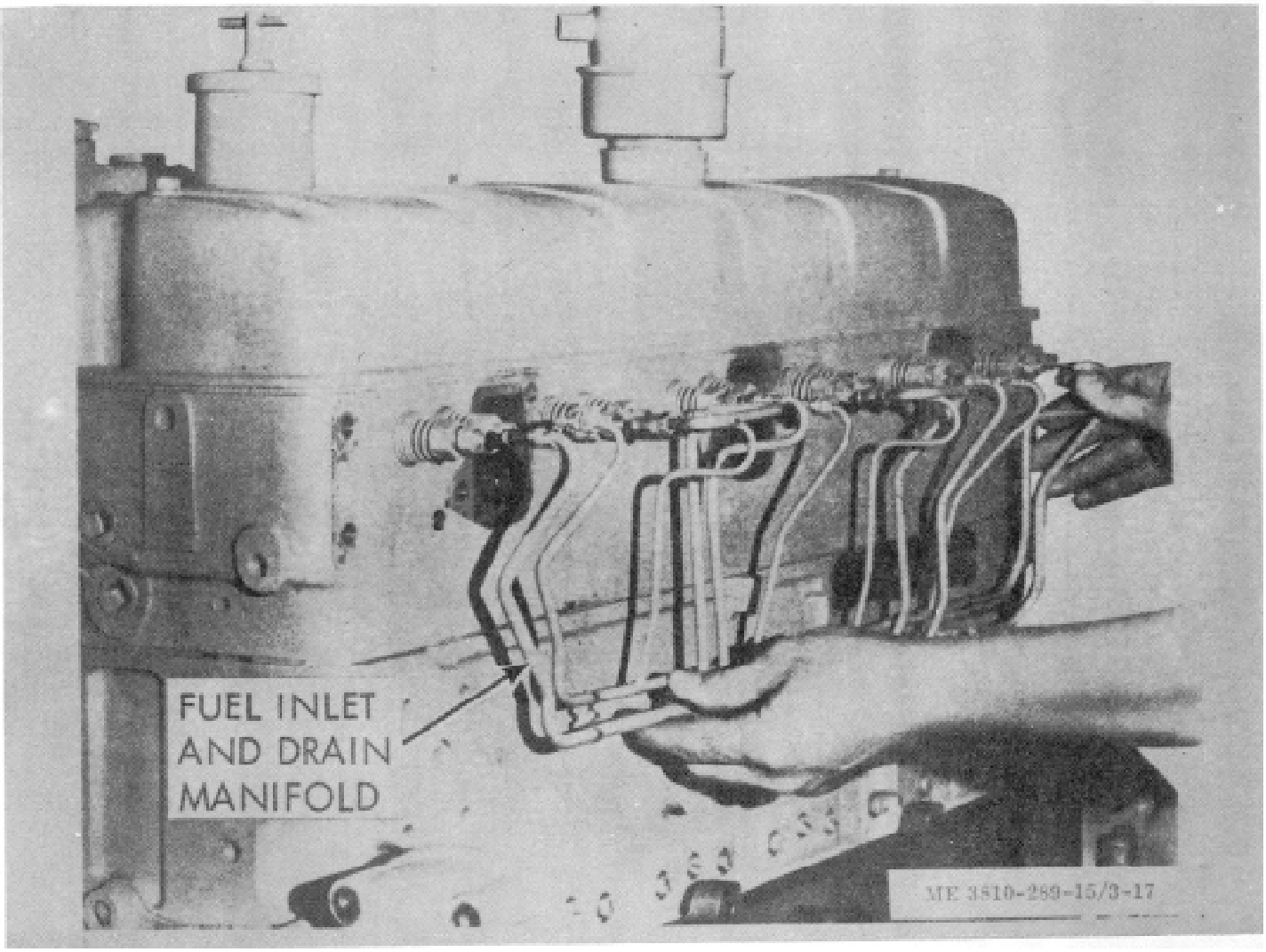


Figure 4-8. Fuel lines and fittings replacement.

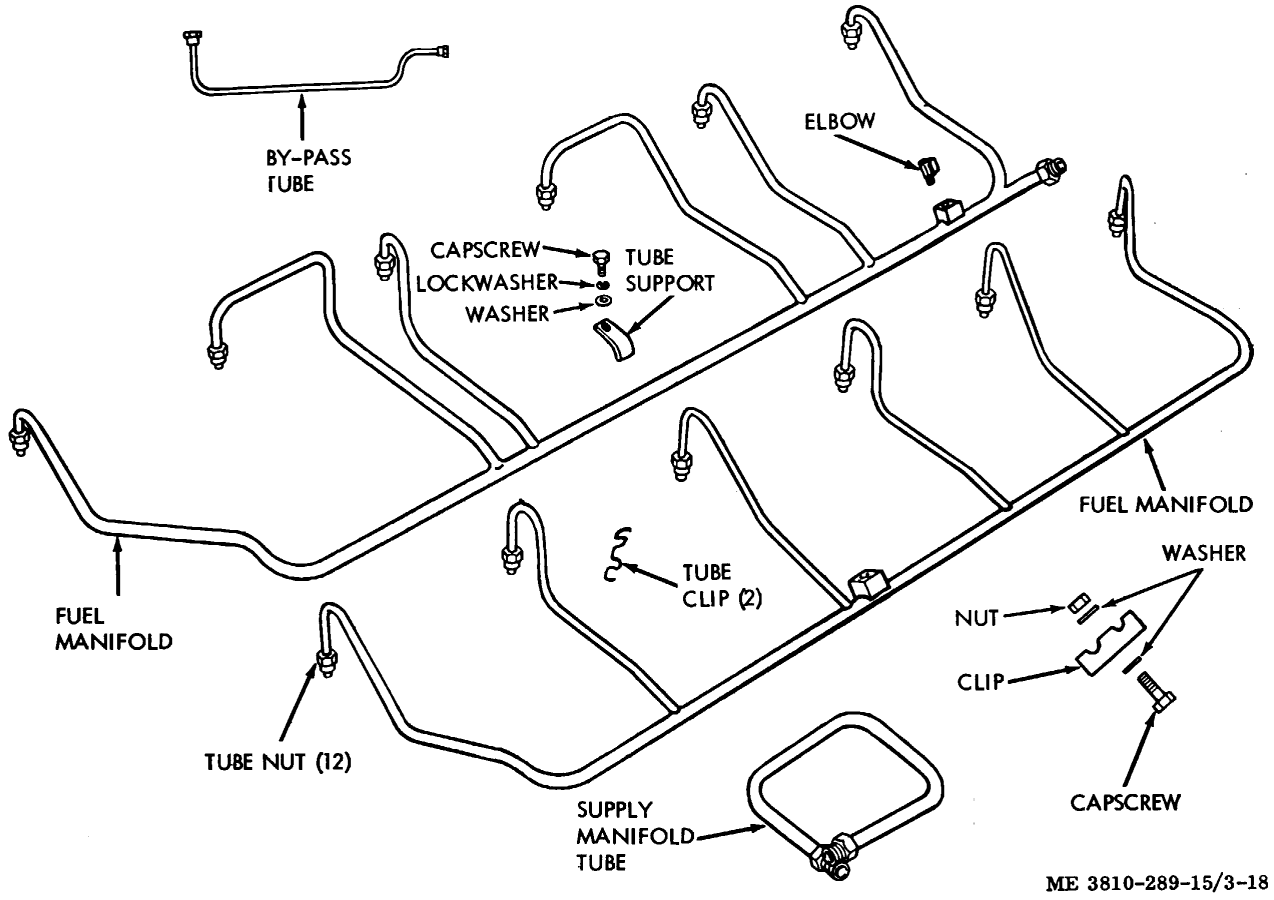


Figure 4-9. Fuel lines and fittings.

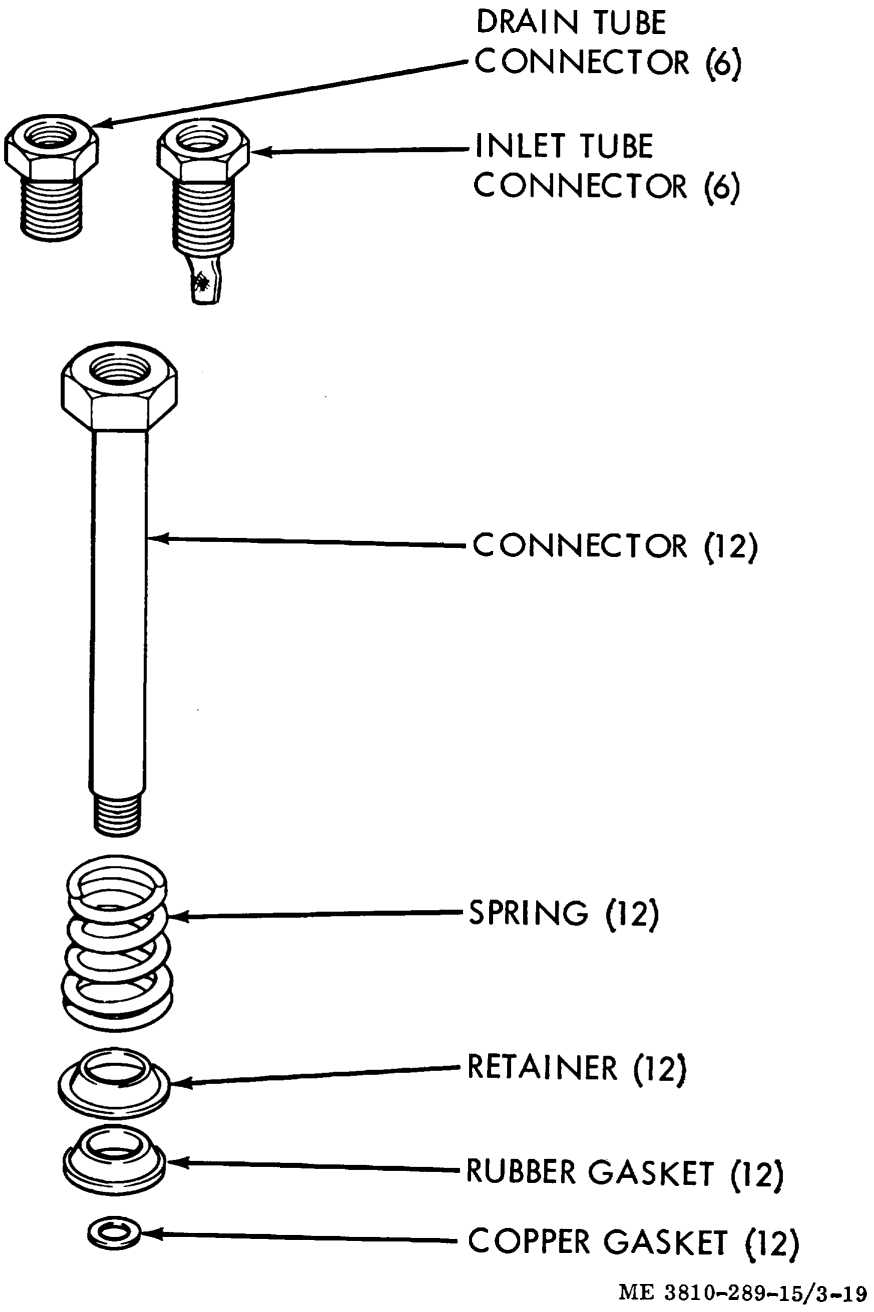


Figure 4-10. Fuel inlet and drain connection.

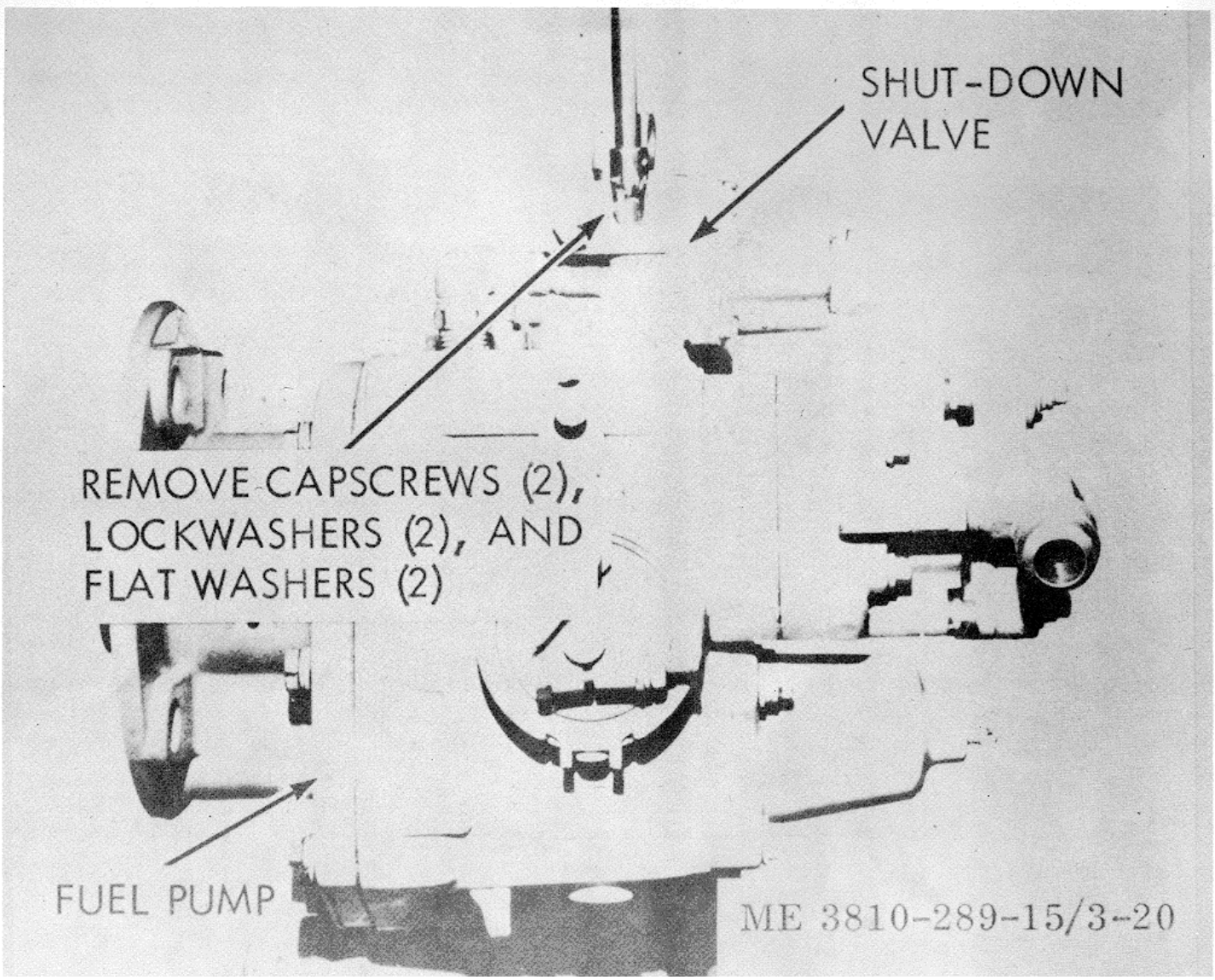


Figure 4-11. Shutdown valve replacement.

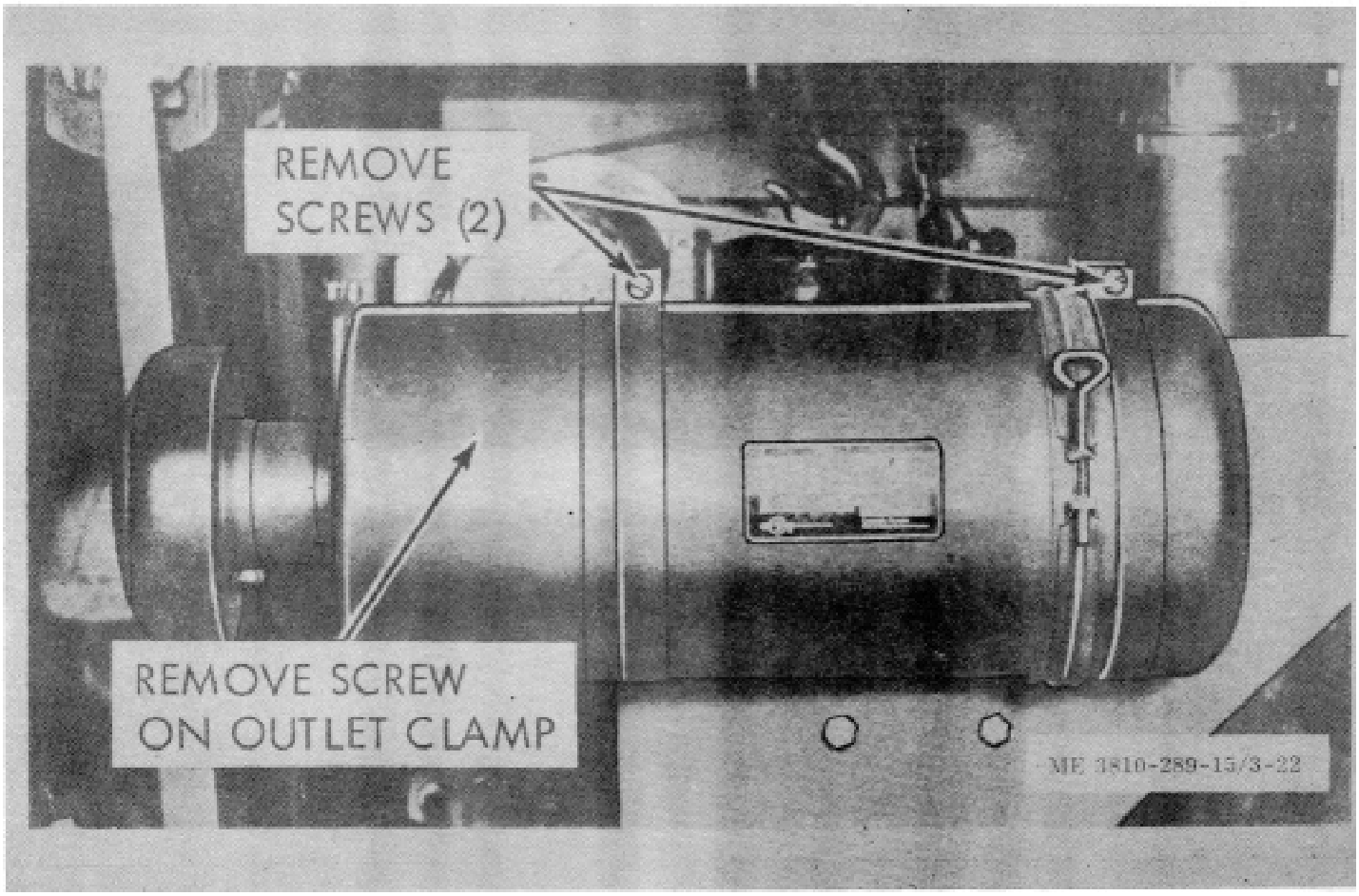
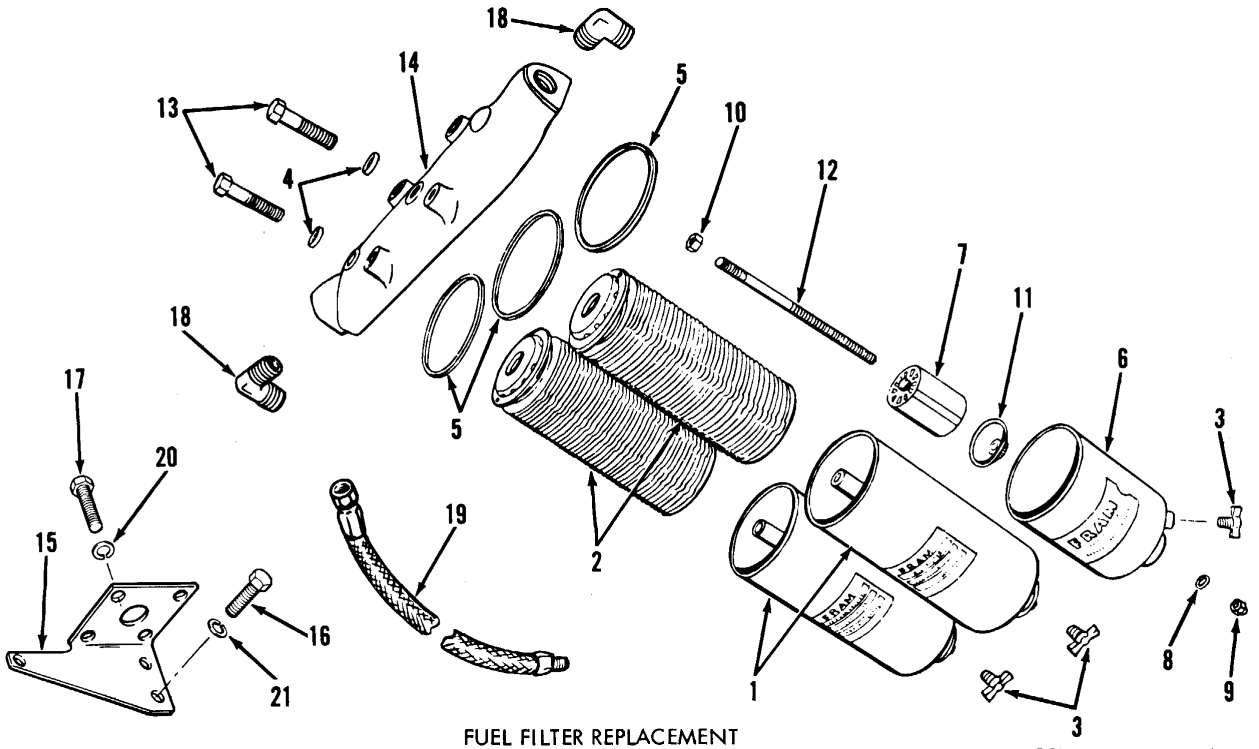


Figure 4-12. Air cleaner replacement.



1 Filter body assembly (2)
2 Filter cartridge assembly (2)
3 Drain cock (2)
4 Gasket, capscrew (2)
5 Head gasket (2)
6 Strainer body assembly cartridge
7 Strainer element
8 Washer
9 Nut, crown
10 Nut, hex
11 Retainer assembly
12 Stud
13 Capscrew, head (2)
14 Filter head
15 Filter mounting bracket
16 Capscrew, bracket to block (3)
17 CaDscrew, filter to bracket (4)
18 Filter inlet and outlet elbow
19 Filter to pump hose
20 Lockwasher, bracket to block (3
21 Lockwasher, filter to bracket (4)

Figure 4-13. Fuel filter replacement.

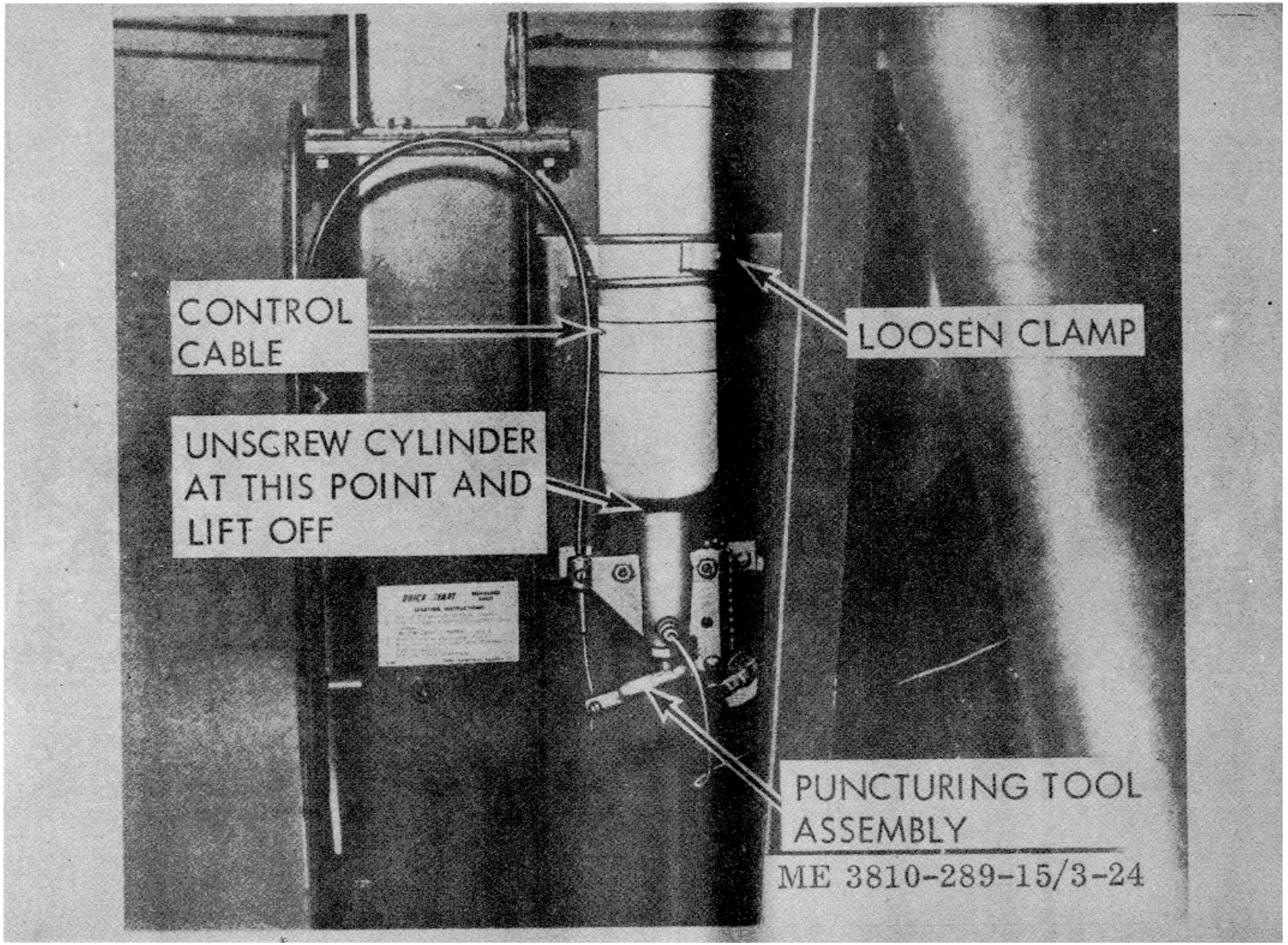
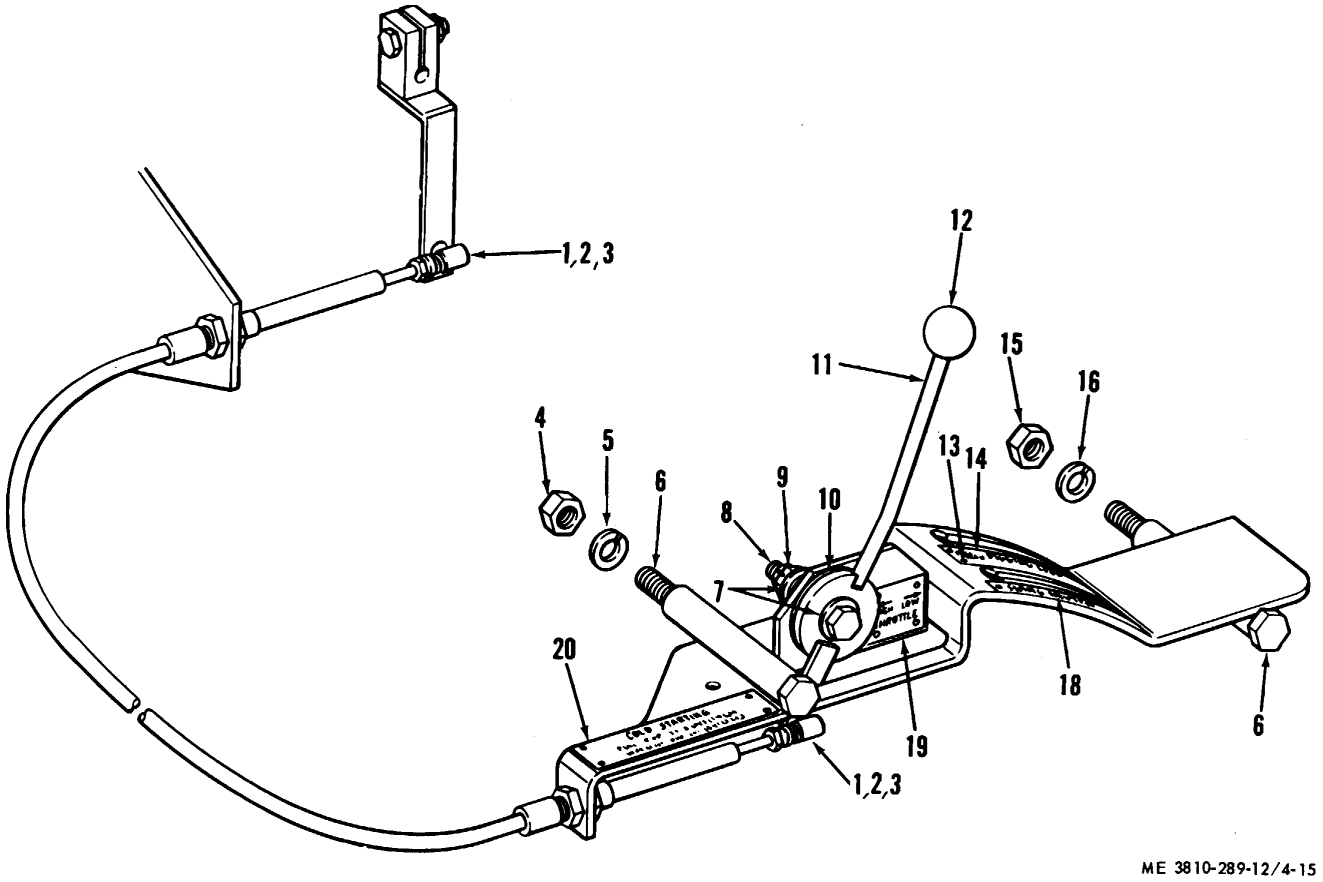


Figure 4-14. Primer assembly service and replacement.



1 Ball joint
2 Nut. hexagon
3 Lockwasher
4 Nut, hexagon
5 Lockwasher
6 Bolt, hexagon
7 Washer, plain
8 Locknut
9 Spring
10 Disk
11 Arm
12 Knob
13 Screw, drive
14 Instruction plate
15. Nut, hexagonl
16 Lockwasher
17 NOT USED
18 Instruction plate
19 Instruction plate
20 Instruction plate

Figure 4-15. Throttle control assembly.

Section IX. MAINTENANCE OF ENGINE EXHAUST SYSTEM COMPONENTS

4-28. Air Intake Manifold Replacement

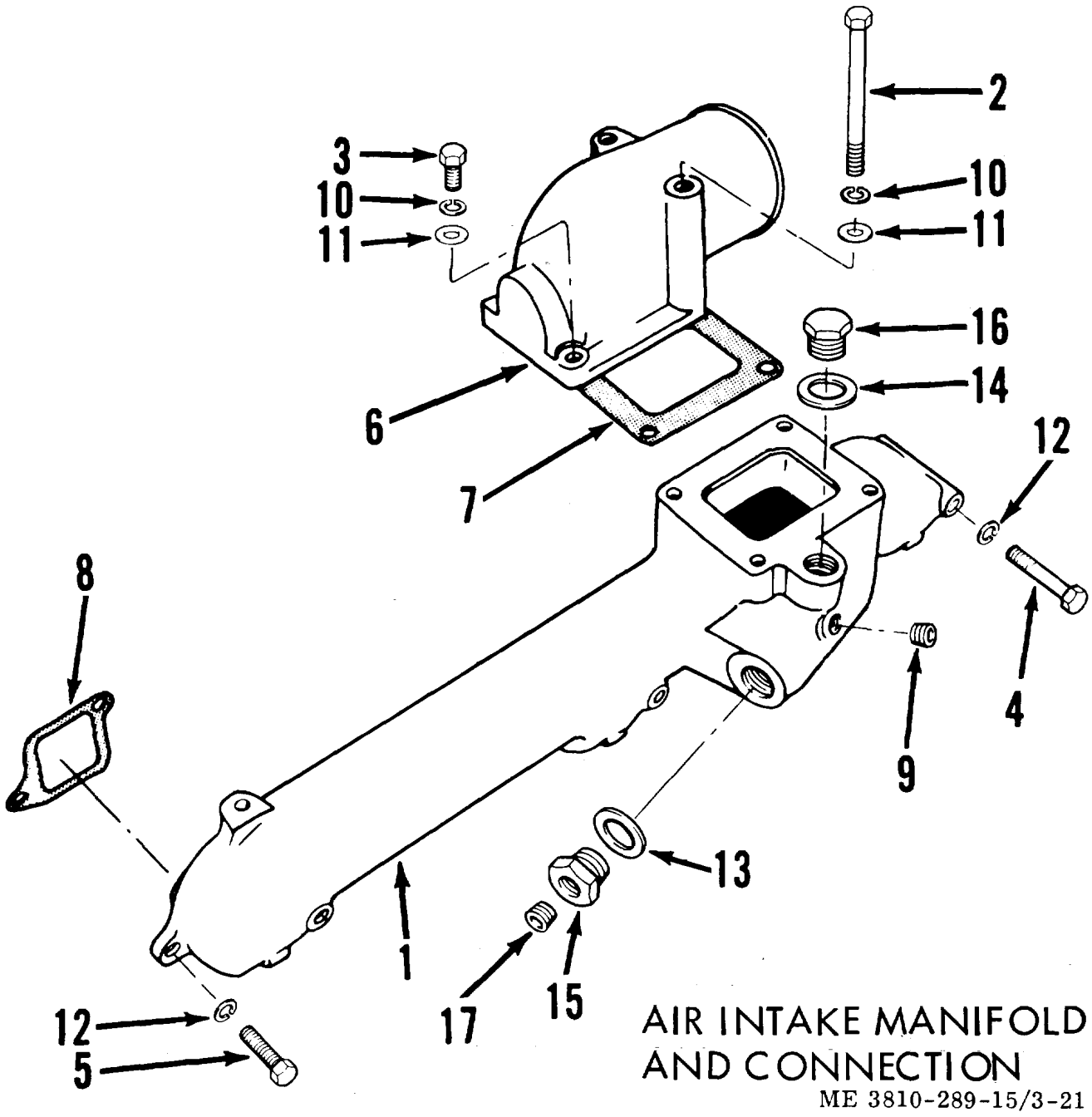
Refer to figure 4-16 and replace the air intake manifold.

4-29. Muffler and Pipes Replacement

Refer to figure 4-17 to replace the muffler and Pipes.

4-30. Exhaust Manifold Replacement

Refer to figure 4-18 to replace the exhaust manifold.



1 Manifold, air intake
2 Capscrew (long) (2)
3 Capscrew (short) (2)
4 Capscrew, manifold (3)
5 Capscrew, manifold (2)
6 Connection, air intake
7 Gasket, connection
8 Gasket, manifold (3)
9 Plug, pipe (%" hex-head) (2)
10 Lockwasher (7)
11 Washer, plain (6)
12 Washer, copper (6)
13 Gasket
14 Gasket
15 Plug
16 Plug
17 Pipe plug

Figure 4-16. Air intake manifold replacement.

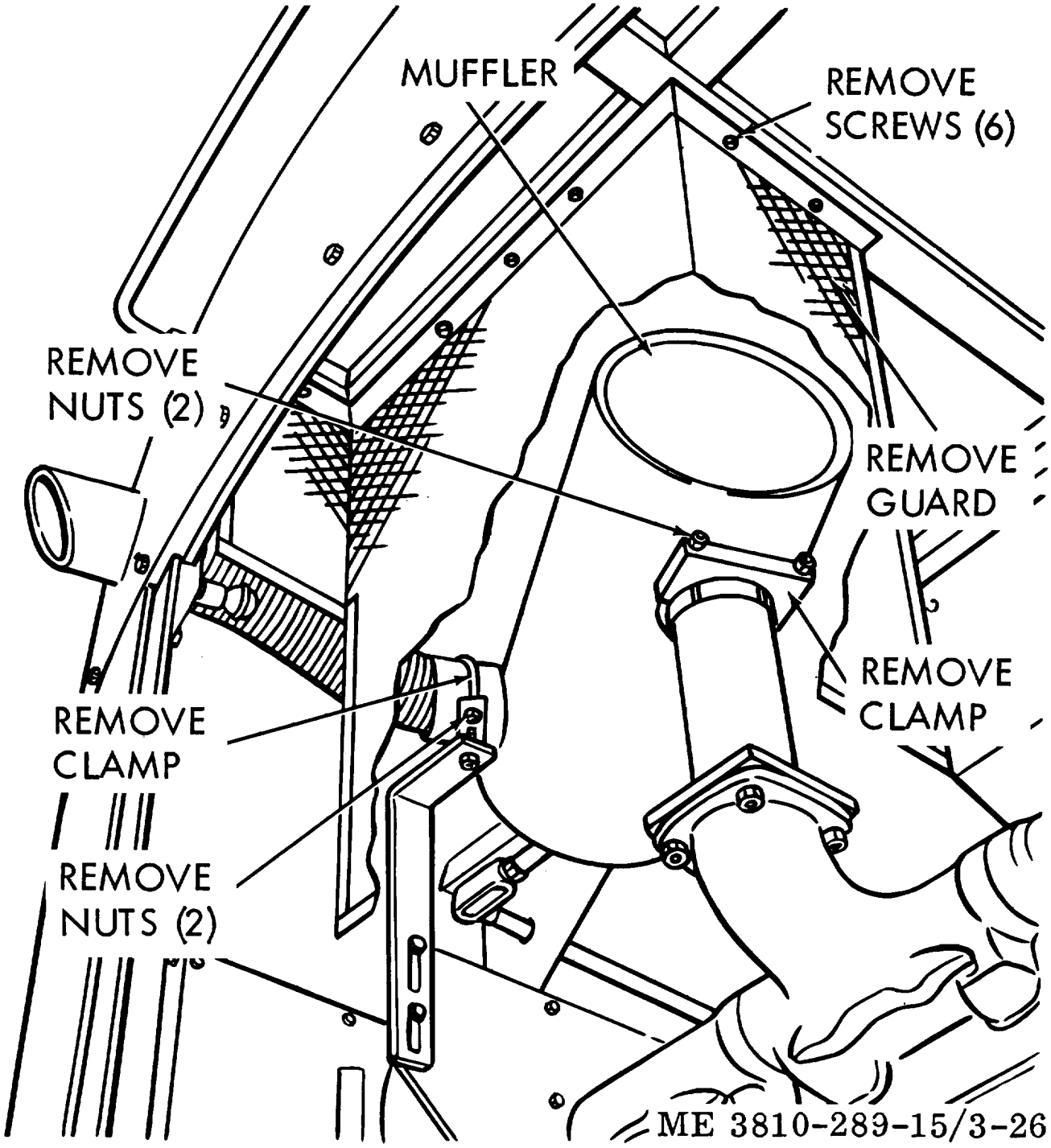


Figure 4-17. Muffler and exhaust pipe replacement.

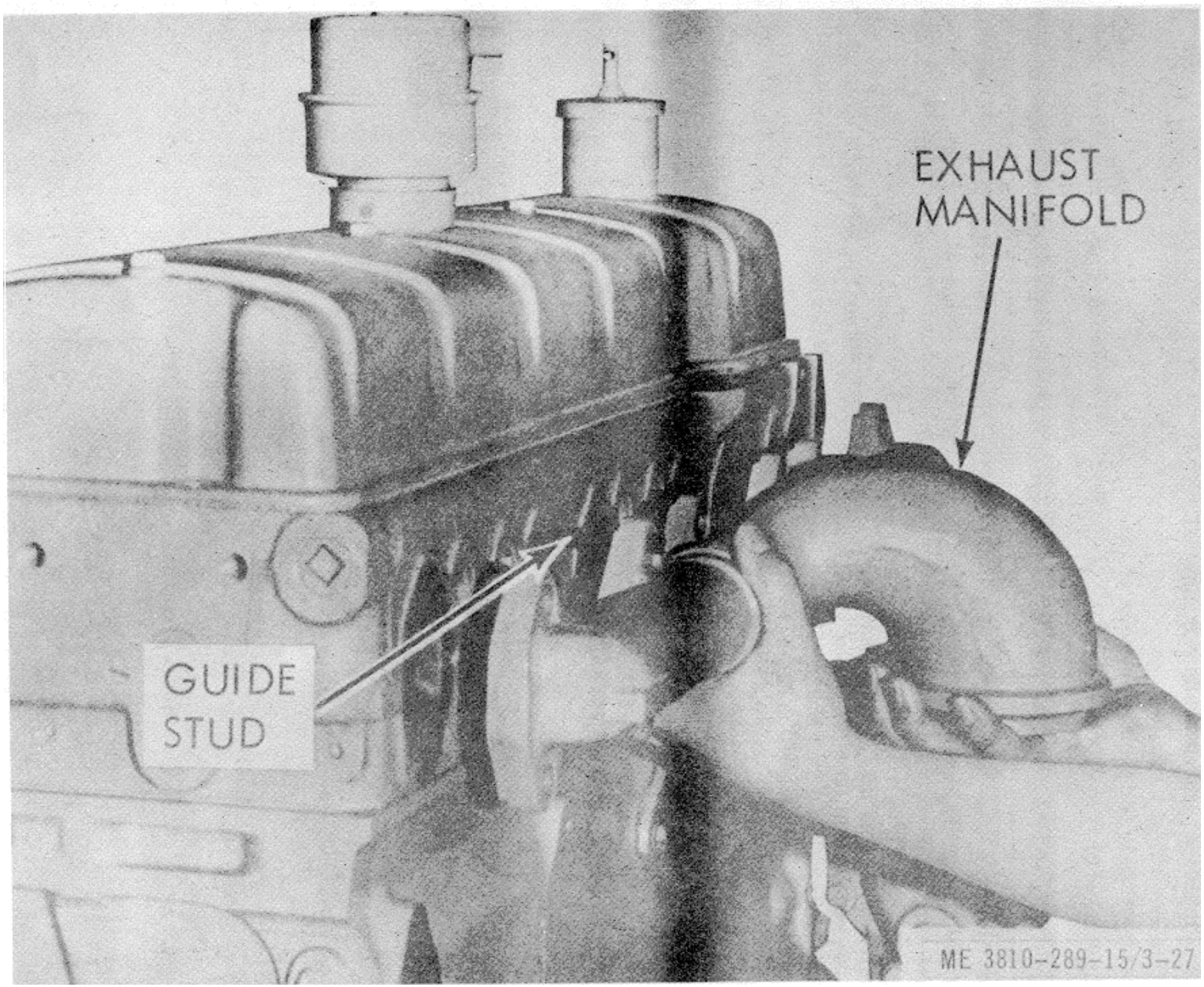


Figure 4-18. Exhaust manifold replacement.

Section X. MAINTENANCE OF ENGINE COOLING SYSTEM COMPONENTS

4-31. Radiator Test and Replacement

a. Refer to TB 750-651 and clean and test radiator.

b. Refer to figure 4-19 and replace the radiator.

c. Replace cracked or frayed hose and defective clamps.

4-32. Fan Belt Replacement

a. General. When a new belt is installed, it should be tightened until a reading of 90-to 110-lbs (pounds) force is obtained as registered on ST-968 gage. All new belts will loosen after running an hour or more and may require readjustment. Recheck belt tension with ST-968 gage; if reading is less than 80 lbs, loosen the fan bracket mounting screws. Turn the adjusting screw, as required, to obtain a reading of 90 to 110 lbs. Retighten the fan bracket mounting screws. Belt tension should be checked every 400 to 500 hours operation.

b. Replacement. Refer to figure 420 and replace the fan belt.

4-33. Thermostat and Thermostatic Housing

a. Testing. The opening and closing of the high range (180/1950 F) thermostat can be checked against a thermometer while immersed in water, as the water is brought up to temperature by heating. See figure 4-21.

b. Replacement. Refer to figure 4-22 and replace the thermostat and thermostat housing.

4-34. Fan Blade Replacement

a. Refer to figure 4-19 and remove the fan blade guard.

b. Refer to figure 4-23 and replace the fanblade.

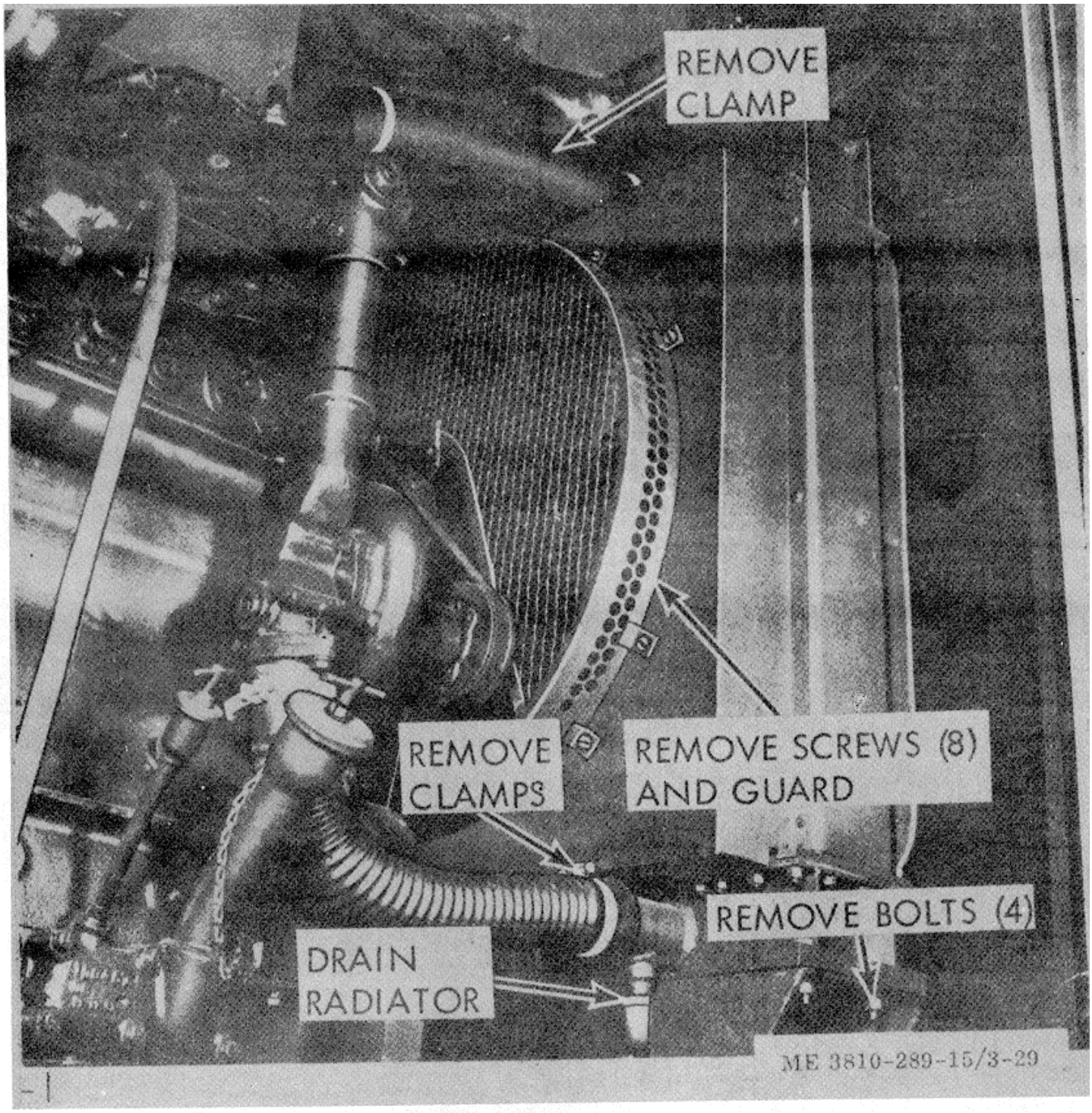


Figure 4-19. Radiator service and replacement.

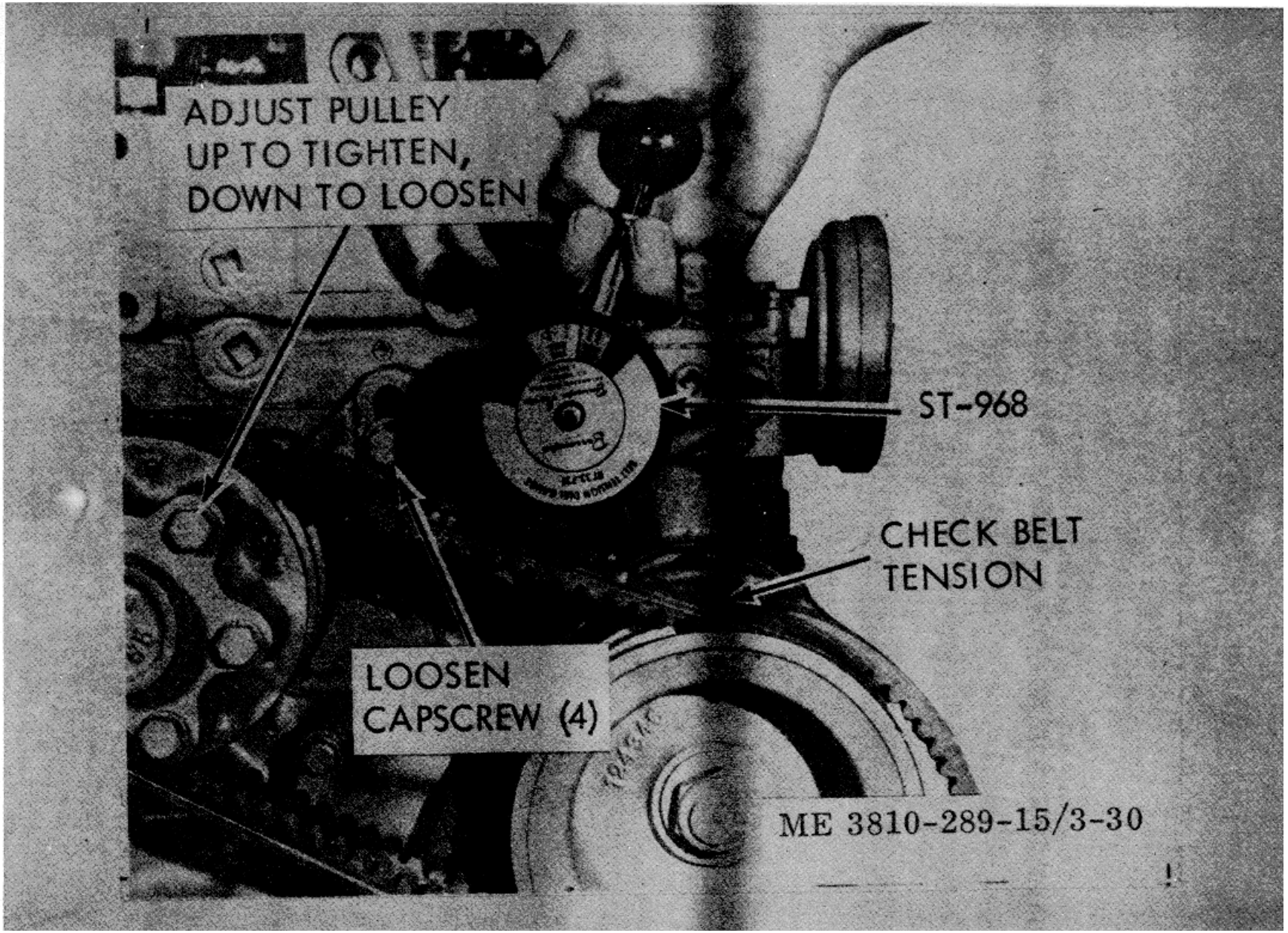


Figure 4-20. Belt adjustment.

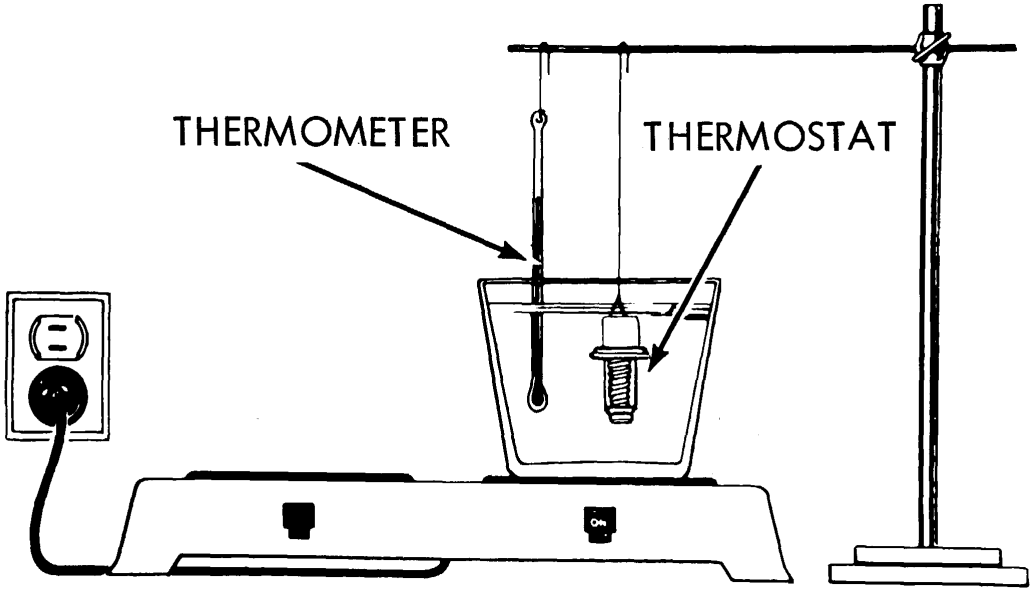
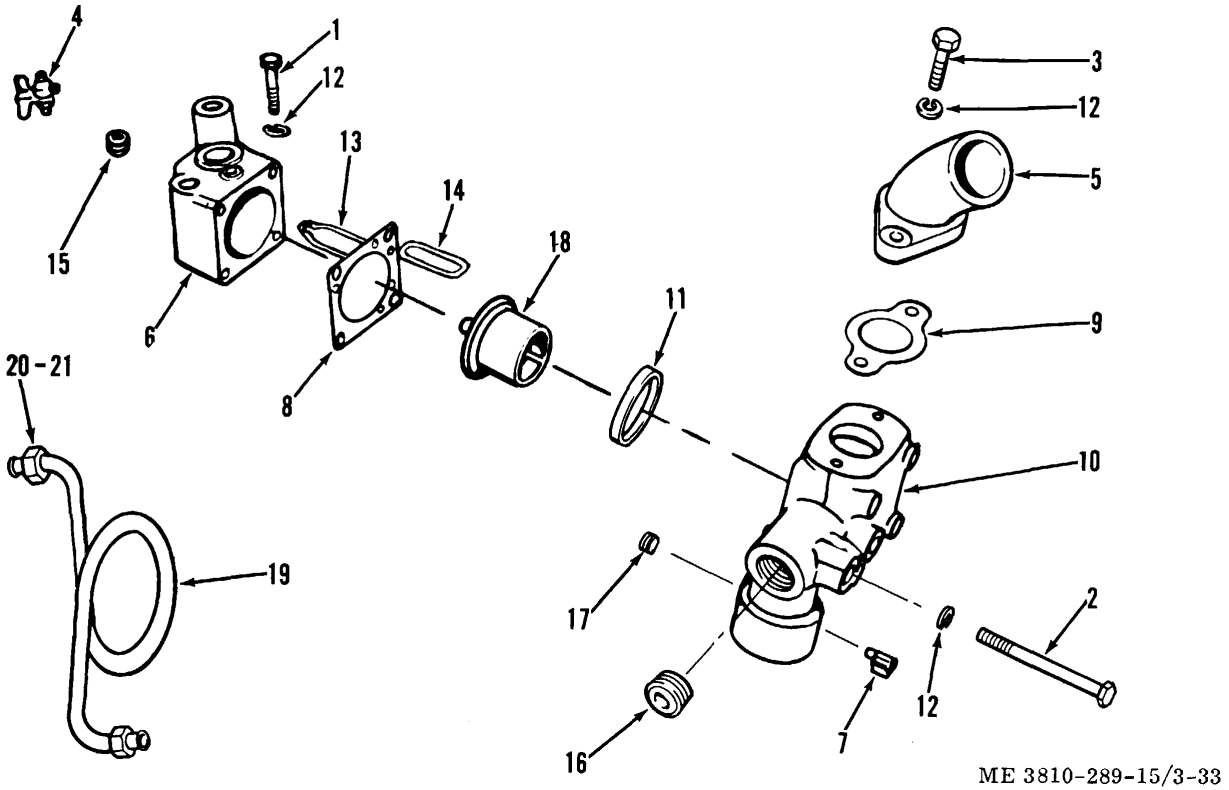


Figure 4-21. Thermostat testing.



1 Capscrew (%"-16 x 1%") (2)
2 Capscrew (-%"-16 x 3%") (4)
3 Capscrew (%"-16 x 1") (2)
4 Drain cock
5 Water outlet connection
6 Cylinder head water outlet connection
7 Flexible elbow restrictive elbow
8 Gasket, thermostat housing
9 Connection gasket
10 Thermostat housing
11 Seal
12 Lockwasher (%") (8) Plate and insert
13 Connection to head plate &
14 Connection to head insert
15 Pipe (1/2") plug
16 Pipe (1") plug
17 Pipe (1/4") plug
18 Thermostat (180' to 195°)
19 Tube assembly
20 Nut, tube (2)
21 Tube nut (rubber) sleeve (2)

Figure 4-22. Thermostat and thermostat housing replacement.

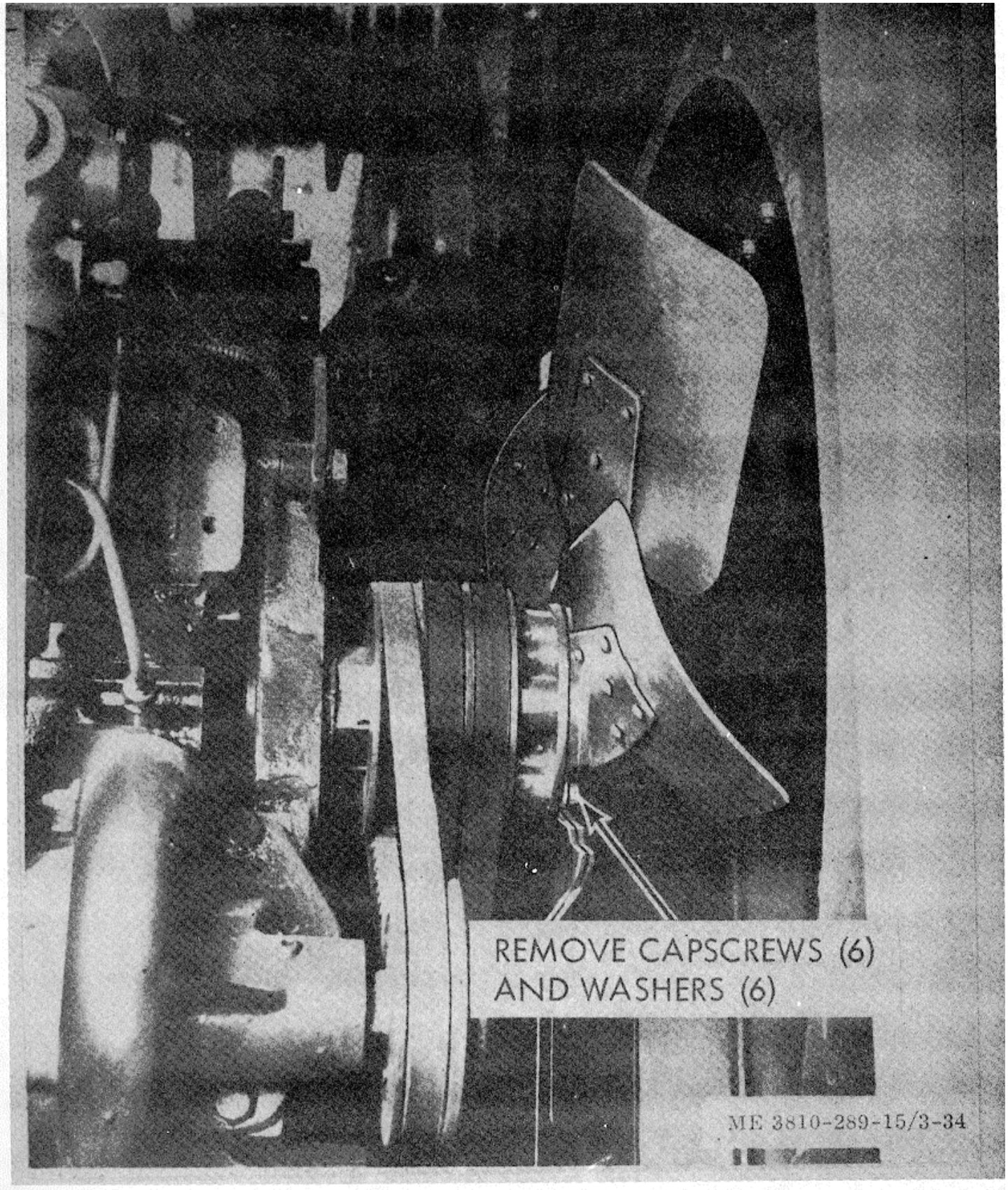


Figure 4-23. Fan blade replacement.

Section XI. MAINTENANCE OF ELECTRICAL SYSTEM COMPONENTS

4-35. Alternator Assembly Service, Test, and Replacement

a General.

(1) The self-rectifying charging alternator is designed to give long life and satisfactory service with a minimum amount of maintenance, but the following precautions must be observed.

Caution: **Do not make, or break, any alternator connections while alternator is operation This would damage the voltage regulator.**

Caution: **Never operate alternator without battery being connected in circuit.**

Caution: **When charging batteries from an external source of power, be sure battery is connected from circuit before beginning charging operation, to prevent damage to alternator rectifying diodes.**

(2) Before removing alternator for repair replacement, inspect the drive belt, mounting brackets, and wiring harness, in the following manner:

(a) Check belts for proper tension, excess wear, or the presence of oil or grease which could cause them to slip.

(b) Check pulleys for discoloration which could indicate overheating due to belt slippage. Inspect pulleys for wear which could allow belts to bottom in the pulley grooves. Replace worn or defective parts.

(c) Check mounting brackets and tension adjusting arm. Wear or looseness of these parts will prevent proper belt adjustment and may result in misalignment which will cause premature wear on belts, pulleys, and bearings. Tighten replace parts as necessary.

(d) Inspect all wiring and terminals for signs of wear, looseness, or corrosion. Check for worn or frayed insulation which could result in shorts or grounds. Clean and tighten all terminal connections.

(e) Check batteries. Take a specific gravity reading on each cell. Replace batteries which indicate one or more defective cells.

b. On-Equipment Test.

(*1) Continuity.* Refer to figure 1-4 a make continuity check of electrical circuit. Repair or replace defective wiring or terminals.

(*2) Negative heat sink-rectifier test (fig. 4-24).*

(a) The negative heat sink is grounded to the housing by means of its mounting screws and stud. Be sure that these screws are clean and tight so that the negative heat sink makes good contact with the housing.

(b) Correct the negative lead of an ohmmeter to check point one and touch the positive lead to terminals 4, 5, and 6. A high resistance reading should be obtained. If a low resistance reading is obtained the diode is shorted. Replace the alternator.

c. Alternator Replacement. Refer to figure 4-25 and replace the alternator.

d. Alternator Belt Replacement.

(1) Refer to figure 3-9 and replace the alternator belt.

(2) Refer to figure 4-20 and adjust alternator belt.

4-36. Reverse Current Polarity Protective Relay

a. General. Since alternators are sensitive to electric current polarity, incorrect wiring will cause the diodes in the alternator to short out. To protect against this, a reverse current polarity protective relay is installed in the engine electrical system (fig. 1-4).

b. Removal.

(1) Disconnect the three cannon-plug-type electrical connections to the reverse polarity relay.

(2) Remove the two mounting capscrews and lockwashers and remove the protective relay.

c. Installation. Installation is reversed of removal procedures.

4-37. Starting Motor Service, Test and Replacement

a. Removal and Installation. Refer to figure 4-27 to remove or install the starting motor.

b. Service.

(1) At installation, add two or three drops of OE-30 lubricating oil in each oil reservoir.

(2) Every 200 hours add at least 3 to 5 drops of OE-30 lubrication oil in each oil reservoir.

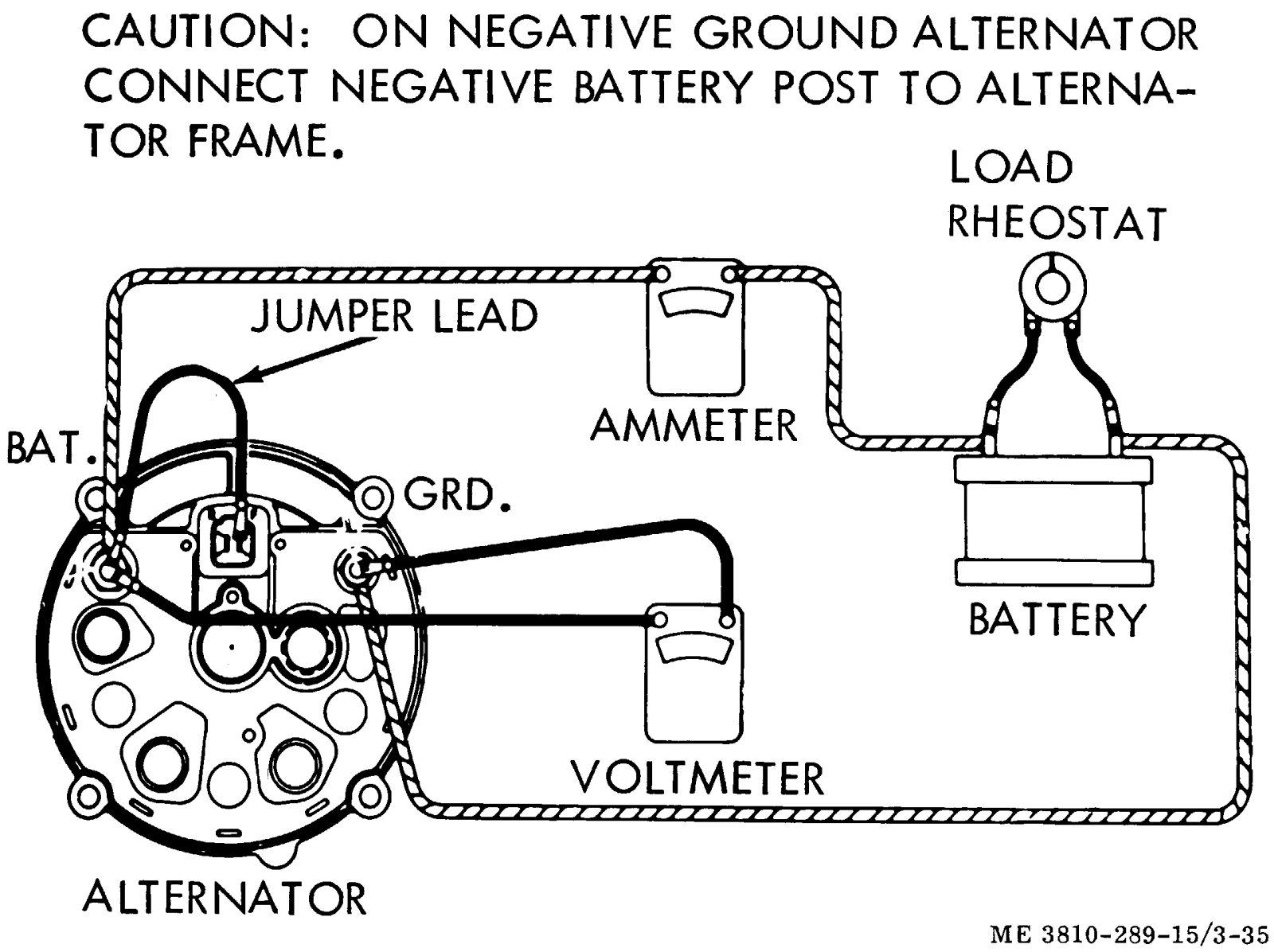


Figure 4-24. Alternator test connection (sheet 1 of 2).

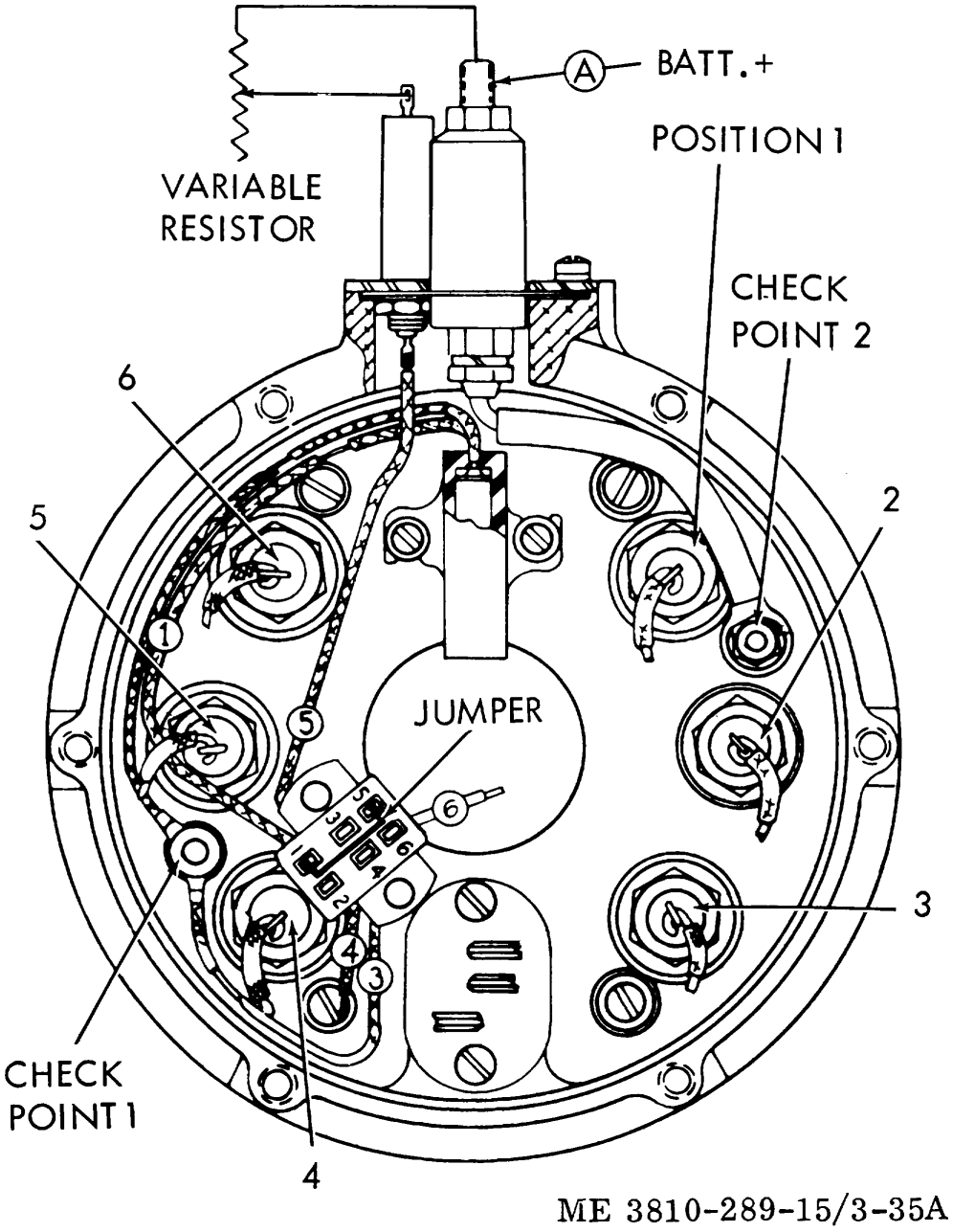


Figure 4-24. Alternator test connection (sheet 2 of 2).

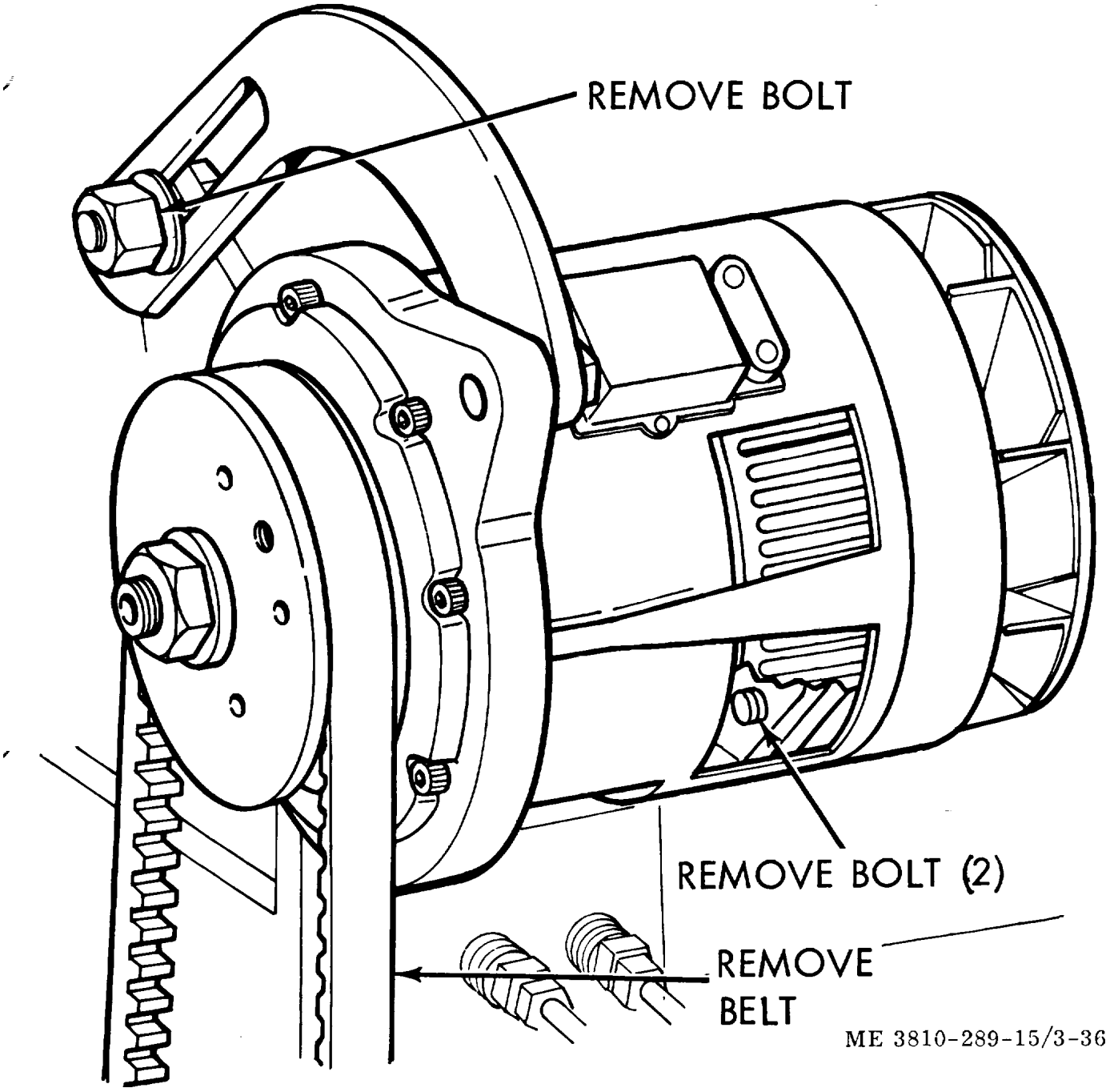


Figure 4-25. Alternator replacement.

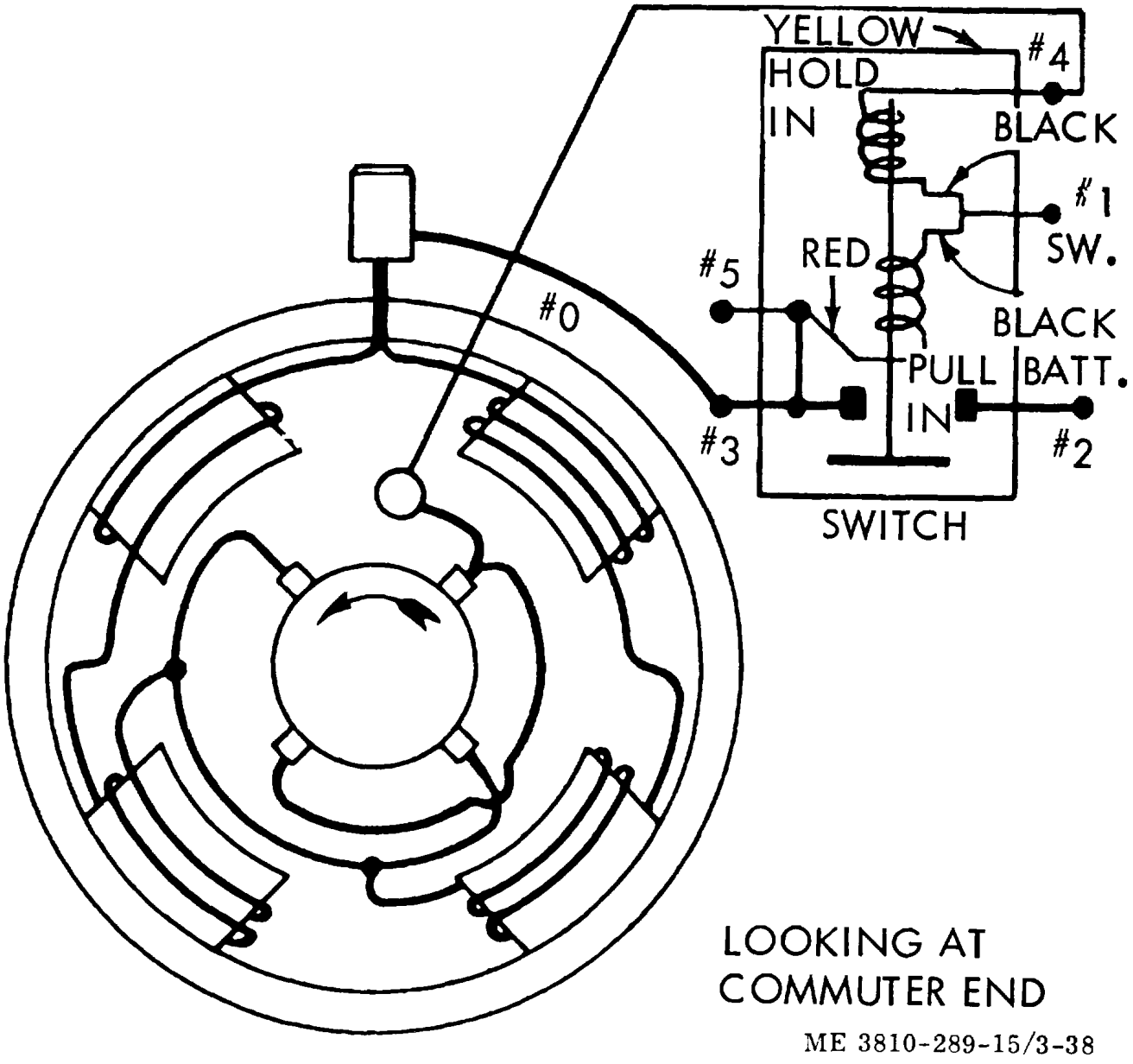


Figure 4-26. Starting motor, internal wiring diagram.

(3) Annually remove cranking motor from engine and lubricate bushing of the drive and drive spline. This bushing is in the nose housing and cannot be reached without removing the cranking motor. Clean the splines of the drive with gasoline or kerosene to remove any gummy deposit; then, apply a thin film of light graph grease so the pinion will move freely.

Note. Do not use excessive oil or heavy oil grease.

c. Test.

(1) Field coil. Make test only after coils have been dried if they have been cleaned. With test lamp prods, one held on the field ring and the other on the field terminal, determine that the windings are not grounded to field ring or pole pieces. If coils are shorted or grounded, remove and inspect if they can be reinsulated to eliminate the trouble. Replace coils if short or ground cannot be eliminated. Refer to internal wiring diagram (fig. 4-26).

(*2) Armature.*

*(*a) Check the armature for grounds with a 110-volt test light by touching one probe to a commutator bar riser and the other to the armature core. Test all commutator bars in this manner. If test light glows, the armature is ground and must be replaced.

*(*b) Check armature for short circuit with a growler. Place the armature in the growler, and hold a thin strip of steel such as a hacksaw blade about 1/32 to 1/16 inch away from the armature core. While holding the steel strip in position, rotate the armature slowly in the growler. A short circuit will pull the steel strip tightly against the armature core, and cause the strip to vibrate. If a short circuit is found, the armature must be replaced.

(*3) Load test.*

(a) Connect the starting motor in series with a 12-volt, fully charged battery (a minimum specific gravity of 1.250) and an ammeter.

(b) The starting motor, turning clockwise from the drive end, should draw between 85-90 amps at 3800 rpm.

4-38. Solenoid Test and Replacement

a. Removal and Installation. Refer to figure 429 to remove or install the solenoid.

b. Test.

(1) After reassembly of the motor, the switch solenoid is installed on the field ring and the timing checked for proper travel of the drive pinion on the armature shaft.

(2) The shaft lever is inserted through the switch cover seal. Make certain the nylock insert is in position in the threaded shaft, and that the shaft is aligned with the threaded hole in the plunger.

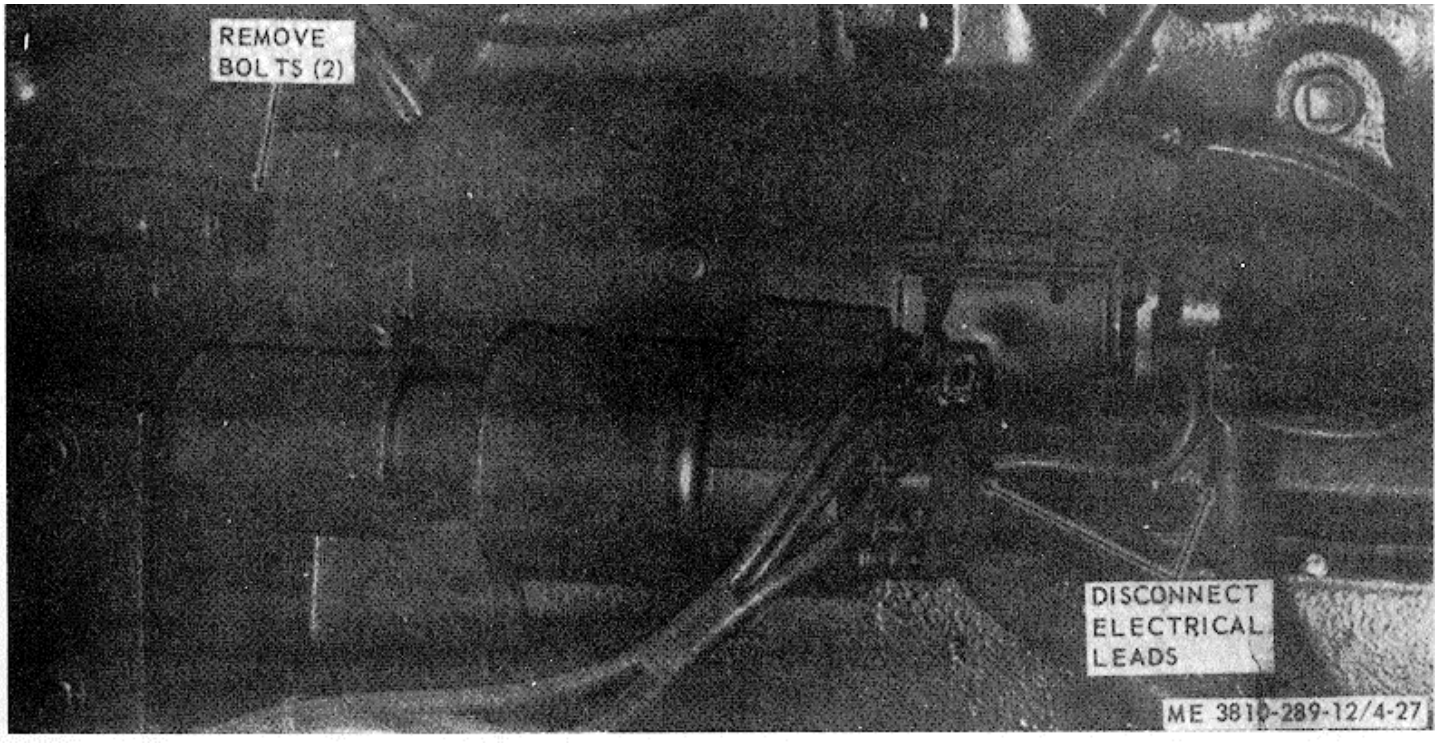


Figure 4-27. Starting motor, removal and installation.

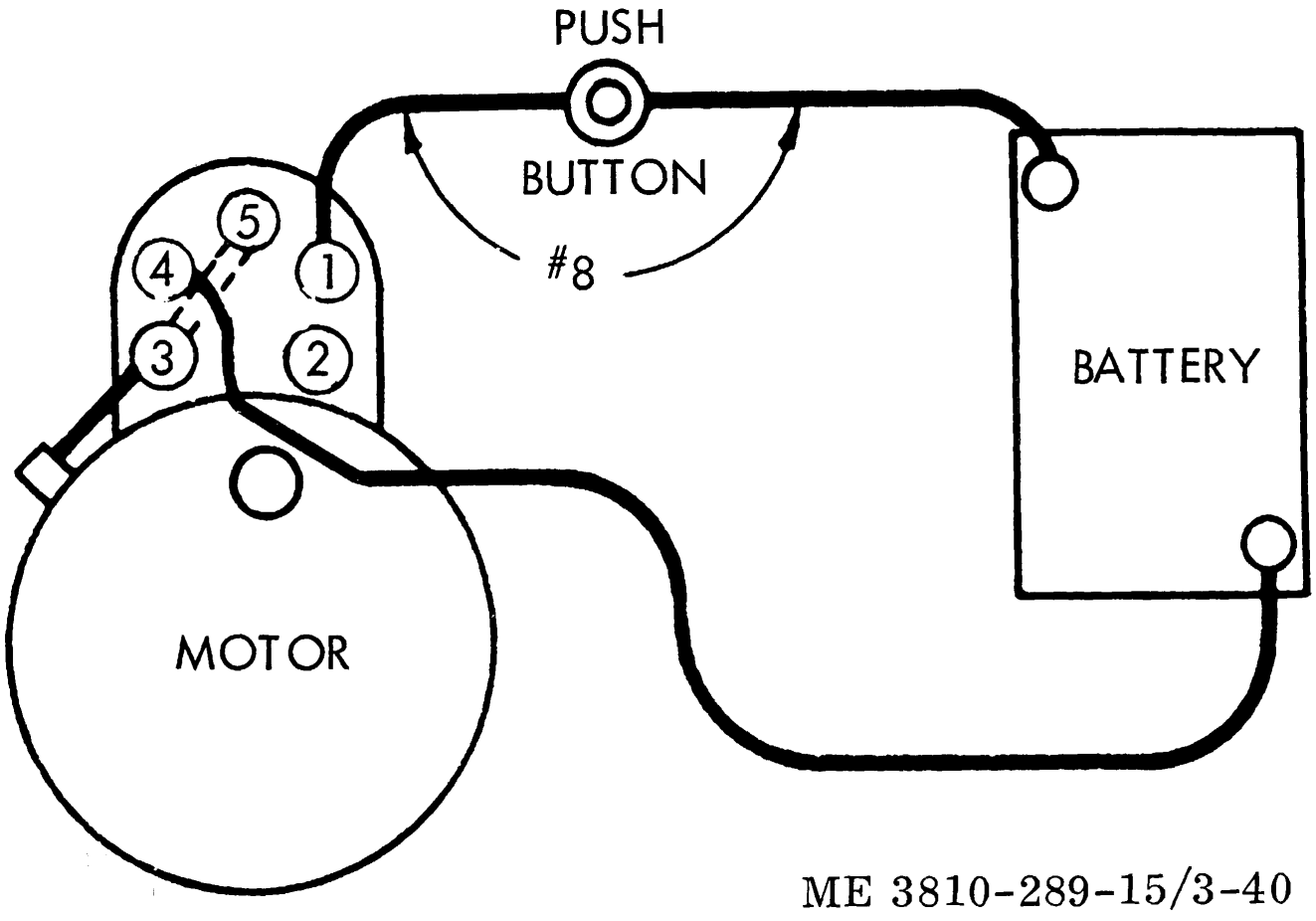


Figure 4-28. Solenoid testing.

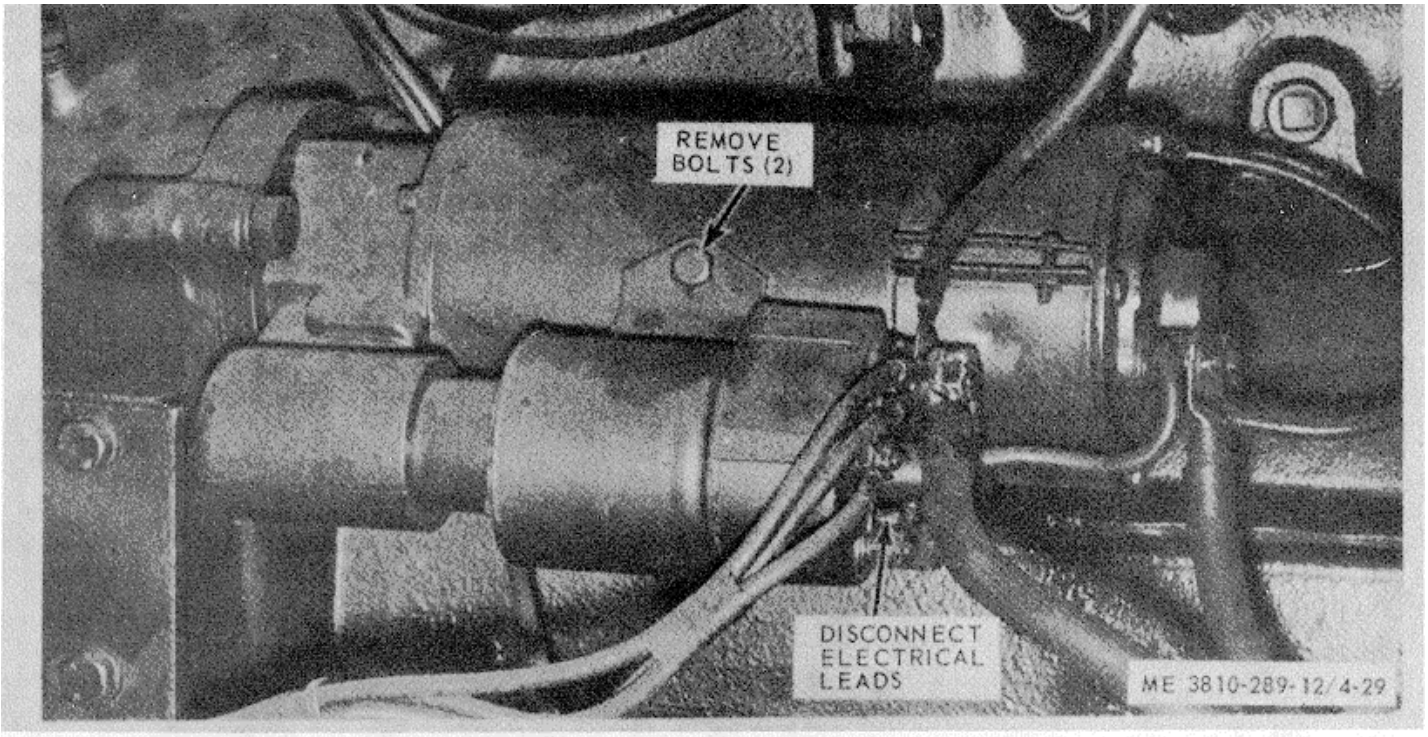


Figure 4-29. Solenoid replacement.

(3) Insert the switch shaft adjusting tool through the access hole in the switch terminal housing, and turn the shaft clockwise until it bottoms. Back off counterclockwise approximately five turns and push the switch forward into the shaft housing. Aline the mounting holes in switch with the ones in the field ring and install two mounting screws.

(4) Connect a 12-volt battery to the switch terminals, numbers 1 and 4 (fig. 4-28). With the solenoid switch energized, gently push the drive assembly back against the shift arm cams and check the spacing between the face of the pinion and thrust washer, using a 0.187 inch thick gage. The final-adjustment is accomplished by turning the adjusting tool clockwise or counter clockwise until the 0.187-inch gage just fits between pinion and thrust washer.

Note. This adjustment must be made with the solenoid switch deenergized.

(5) Replace the pipe plug in the switch terminal housing and seal with gasket sealer.

4-39. Engine Safety Control Replacement

a. General. The safety switch responds to normal temperature or pressure. If the water temperature goes above 210 degrees or the pressure goes below 10 psi (pounds per square inch) the safety switch activates a warning lie on the control panel. The safety switch can be adjusted to react within a pressure range of 10 to 70 psi, in increments of ten, and a temperature range of 170-210 degrees, in increments of twenty. The engine safety control is not serviceable. Failure to operate properly requires replacement of the entire unit.

b. Removal. Refer to figure 4-30 and remove the engine safety control.

c. Installation. Follow the reverse procedure of removal.

4-40. Switches, Gages, Meters Replacement

Refer to figure 4-31 and replace the switches, gages and meters on the engine control panel.

4-41. Lamp Replacement

Refer to figure 4-31 and replace the lamps and fuses.

4-42. Wiring Harness Repair

Refer to figure 4-31 and repair wiring harness.

4-43. Floodlight and Lamp Replacement

Refer to figure 4-31 and replace the floodlights.

4-44. Horn Replacement

Refer to figure 4-31 and replace the horn.

4-45. Panel Lights

Refer to figure 4-30 to replace panel lights.

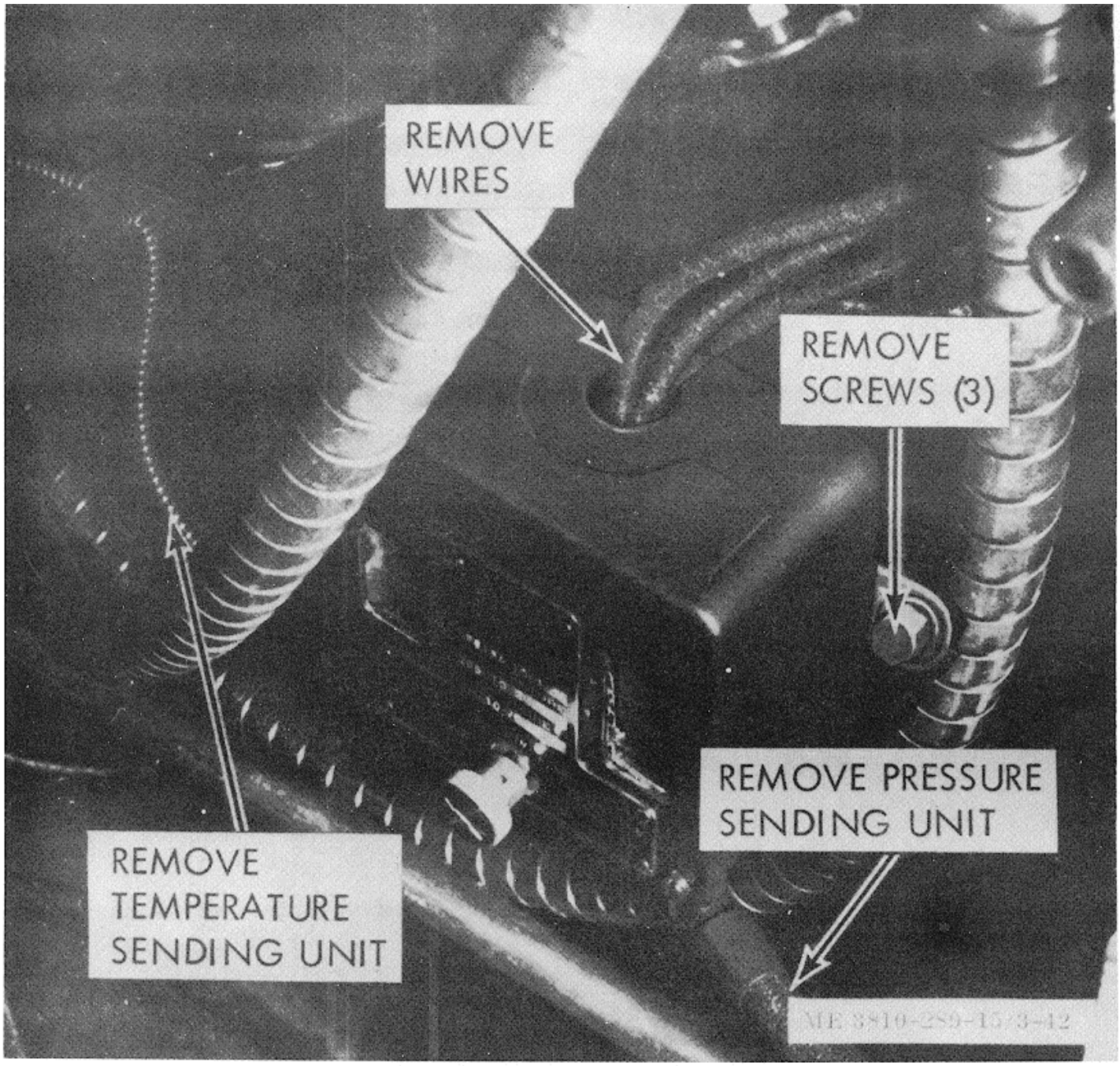


Figure 4-30. Engine safety control replacement.

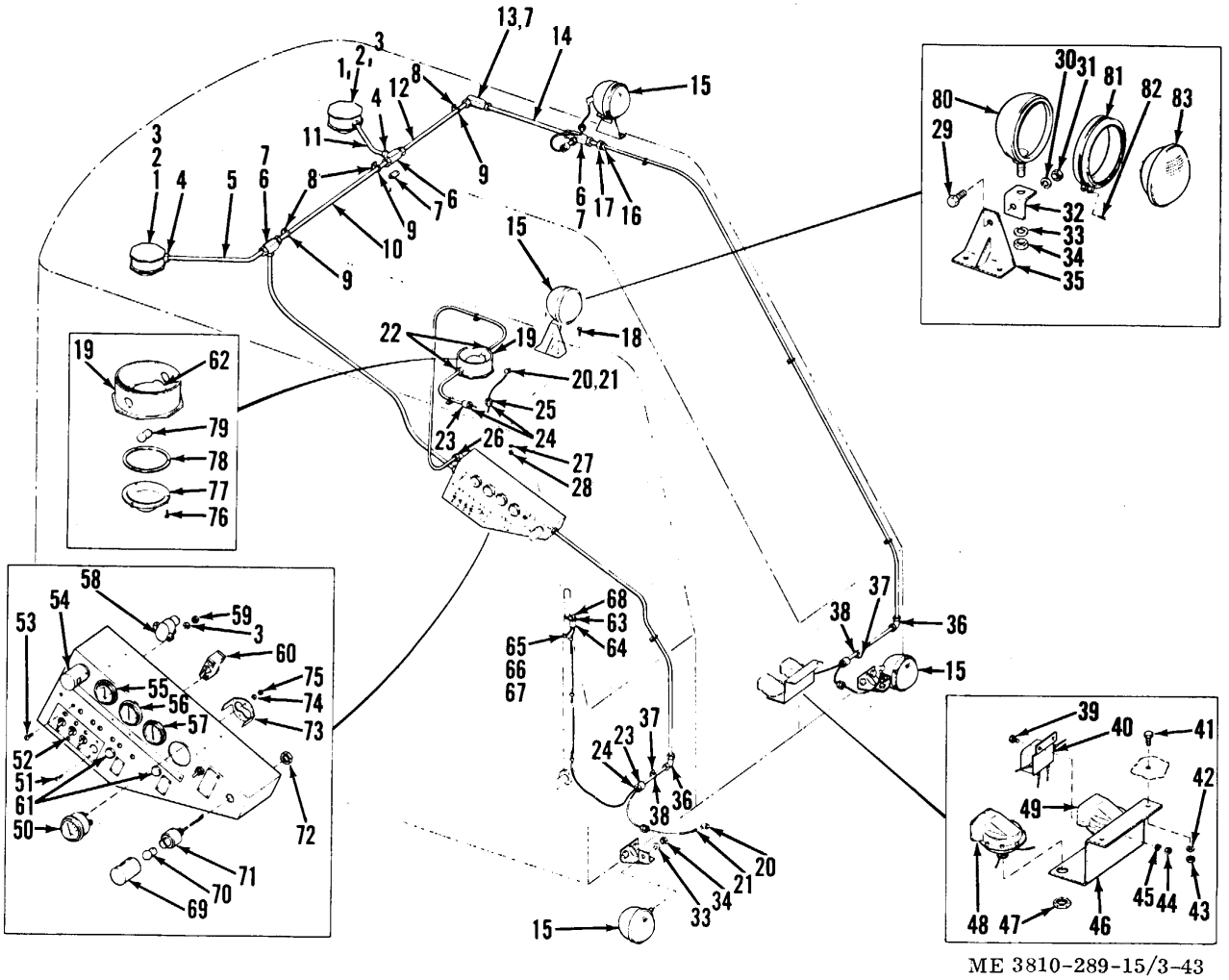


Figure 4-31. Horns, lights an control panel.

1 Dome light box
2 Washer 10# x ½"
3 Washer, spring lock 10#
4 Connector %"
5 Conduit 3/4"
6 Box %"
7 Cover
8 Bracket
9 V-bolt
10 Conduit X"
11 Conduit %"
#10
12 Conduit "%"
13 Box 4"
14 Conduit **/4"**
15 Floodlamp
16 Reducer **3/4**"-**%"**
17 Conduit **3/4"**
18 Screw, cap 3i" x 1**14"**
19 Dome light box
20 Nipple, terminal
21 Tongue, terminal ring
22 Connector %"
23 Coupling, pipe *%"*
24 Nipple, chase 5"
25 Locknut, conduit 5"
26 Elbow %"
27 Washer, spring lock ¾"
28 Nut, full %"
29 Screw, cap %" x 1%"
30 Washer, spring lock ½"
31 Nut, full ½"
32 Bracket
33 Washer, spring lock %"
34 Nut, full %"
35 Support
36 Elbow %"
37 Bracket
38 V-bolt
39 Screw, cap 1/4" x 3/4"
40 Relay
41 Screw, cap %" x 1"
42 Washer, spring lock %"
43 Nut, full 3%"
44 Nut, full 1"
45 Washer, spring lock 1"
46 Bracket
47 Nut
48 Horn
49 Horn
50 Gauge, oil pressure
51 Screw #8-32 x %"
52 Panel, instrument
53 Screw #10-24 x ¾A"
54 Lamp, panel
55 Gauge, battery indicator
56 Gauge, fuel
57 Gauge, water temperature
58 Breaker, circuit
59 Nut #10-24
60 Switch, toggle
61 Light, warning
62 Socket, lamp
63 Bracket
64 Switch
65 Terminal
66 Screw #10 x ½"
67 Washer, spring lock
68 Button, horn
69 Shield
70 Lamp
71 Socket, lamp
72 Nut
73 Clamp
74 Washer, spring lock
75 Nut
76 Screw, cap
77 Lens
78 Gasket
79 Lamp
80 Body assembly
81 Ring
82 Screw, cap
83 Sealed beam unit

Figure 4-31. Horns, lights and control panel.

4-46. Battery and Battery Cables

a. Inspection. If the battery requires frequent addition of water and is gassing excessively, it. If in good condition, it is undoubtably due to overcharging. If one or more cells continually require more water than others, it is an indication of a damaged cell which should be checked by the maintenance repair.

b. Service.

(1) Do not allow the surface of the electrolyte to get below the top of the separators. Use only clean, distilled water to keep the battery filled. Do not fill higher than just below the bottom of the filling tube, for "gassing" will cause the electrolyte to spill over. Never add acid to the battery, as this will give a false reading as to the condition of the battery.

(2) Keep the terminals tight and clean. If they show a tendency to corrode, clean and apply a thin coat of vaseline to protect them from the acid. Keep the outside of the battery clean. Neutralize any electrolyte that may be on the metal surfaces with a cloth saturated with ammonia or bicarbonate of soda solution (one pound of baking soda to one gallon of water), then wash off with water and dry.

(3) Clean vent hole in filler caps before installing.

(4) Replace a cracked or leaking battery.

c. Test. Test the specific gravity of each cell with a hydrometer. A reading of 1.270 to 1.285 indicates fully charged; 1.230, half charged; and 1.150, dead. Never take a reading just after adding water for the reading will not be true.

Caution: **Do not allow battery to stand in the discharged state. It will become ruined by sulphation.**

Note. It is especially important in cold weather to test the specific gravity. A battery freezes between the temperatures 20 degrees above zero and 50 degrees below zero depending on the state of its charge. Do not add water after shutting down for the night, or it will freeze quickly; see that it gets a charge after adding water.

d. Replace. Refer to figure 4-32 to replace the batteries or battery cables.

Caution: **Always disconnect the negative cable first when removing batteries and connect the negative cable last when installing batteries.**

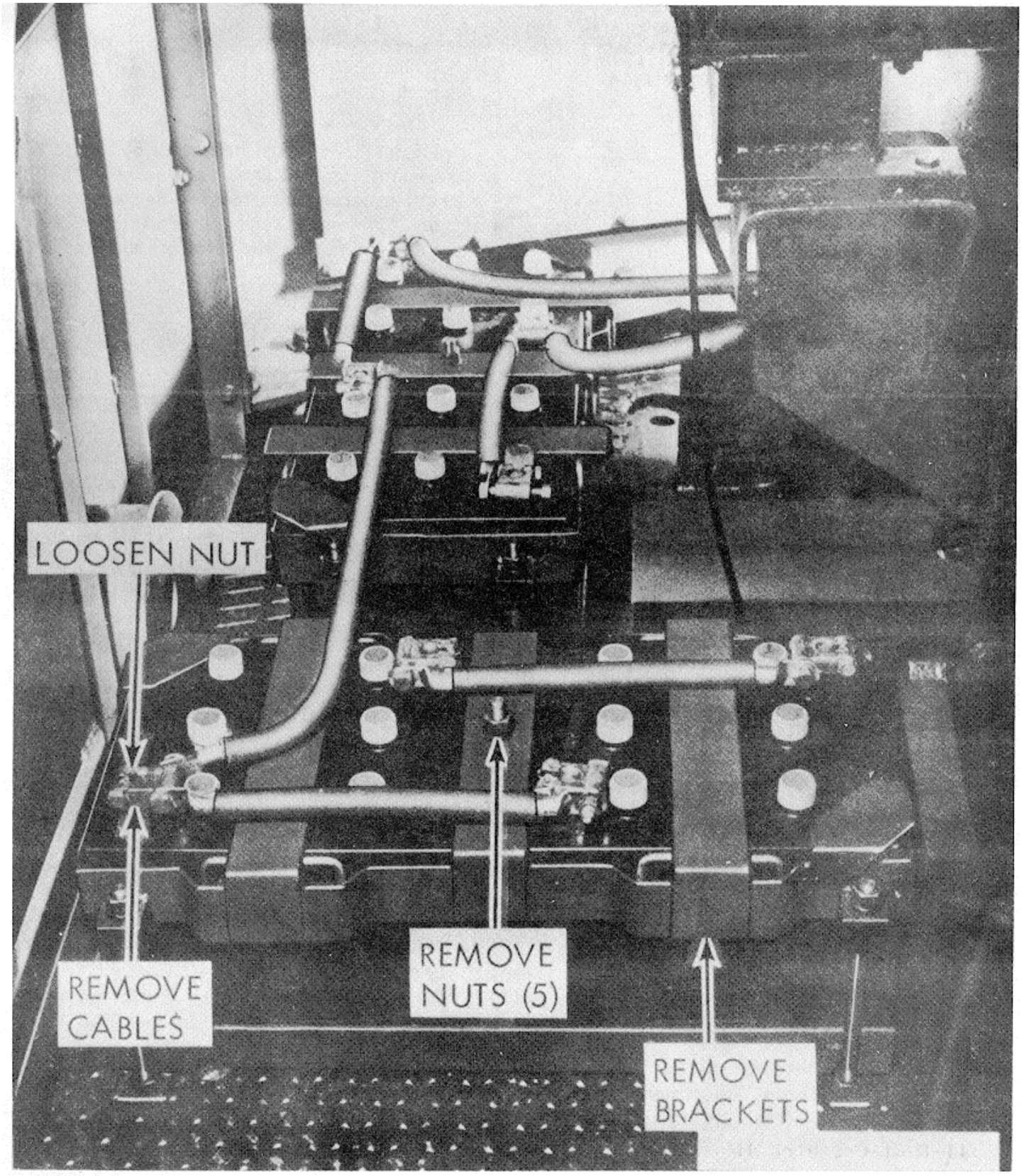


Figure 4-32. Battery and battery cable replacement.

Section XII. MAINTENANCE OF TRANSMISSION ASSEMBLY WHEELS AND TRACK COMPONENTS

4-47. Transmission Assembly Inspection and Service

Inspect the gears for damage and wear. Lubricate the shaft in accordance with the current lubrication order. See figure 4-33.

4-48. Track Support Rollers and Bracket Replacement and Repair

a. General. Check rollers for flat spots, cracks or other damage. Flat spots or cracks in rollers can be built up by welding. Repair dust shield welding.

b. Replacement of Upper Support Rollers. The upper idler rollers (fig. 4-34) which support the top of the tread belt can be removed without connecting the belt, as follows:

(1) With machine on firm level ground, travel it forward for a distance equal to length of machine so that all slack in belt is at the top.

(2) Pry up track near roller for clearance and insert blocking to hold tread belt clearance roller.

(3) Remove blank bolt. Withdraw roller shaft and remove roller.

(4) Installation is the reverse process of the removal steps.

c. Replacement of Lower Support Rollers. Anyone or all of the lower idler rollers (fig. 4-35 the side frame may be removed without taking the tread belt apart by proceeding as follows:

(1) Propel onto a block of wood so block is under tumbler nearest roller to be removed. This should allow enough sag of treads to clear roller. If not, release takeup tumbler adjustment.

(2) Remove the two lower U-bolts which allow roller shaft assembly to drop down.

(3) Installation is the reverse process of removal steps.

4-49. Track Roller Chain Adjustment, Replacement and Repair

a. Adjustment.

(1) Before attempting to adjust the drive chains, loosen the track belts by means of adjusting nuts at the take-up tumbler end (para 3-22).

(2) Take off the locknuts and loosen bearing bolts on drive sprocket end (fig. 3-12).

(3) Turn the adjusting nuts until there is 3- or 4-inches slack on the lower side of the chain, with the top being tight.

(4) Be sure to turn both nuts of a pair the same amount (fig. 3-12) so as to keep the chain sprockets in correct alinement. When correct adjustment is obtained, replace the adjusting nuts, tighten the bearing bolts, and tighten the lock-nuts.

(5) Readjust the crawler track belts for correct tension as described in paragraph 3-22.

b. Replace.

(1) Remove propelling chain adjusting lock-nuts and turn adjusting nuts as far as possible to slack off roller chain adjustment.

(2) Select a pin link in mesh with one of the sprockets and remove cotter pin from that link and drive out.

(3) Slide pin fully out to separate chain and remove chain from sprockets. Insert cotter pin in chain pin to prevent loss.

(4) To install roller chain, follow the removal steps in reverse order.

c. Repair. To repair a defective link, follow the instructions for removing the propelling chain and remove the defective link only.

4-50. Track Assembly Repair

a. Loosen clamping bolts on tumbler shaft.

b. Loosen the nuts on the track adjusting screws at the takeup tumbler end by equal amounts.

c. Propel machine so that the damaged link is in a position corresponding to ten o'clock on the driving tumbler.

d. Secure the link below the faulty one to the driving tumbler by means of a rope and put a chock under the belt.

e. Remove the keeper pins securing the track link pins. If necessary, get a purchase on the upper run of the track belt with a pinch bar and remove the four link pins (fig. 4-36).

f. Fit the new link to the upper run first, and using the pinch bar if necessary for alignment, install the link pins.

g. Fit the four keeper pins, remove rope and packing, and readjust the tension of the track belt.

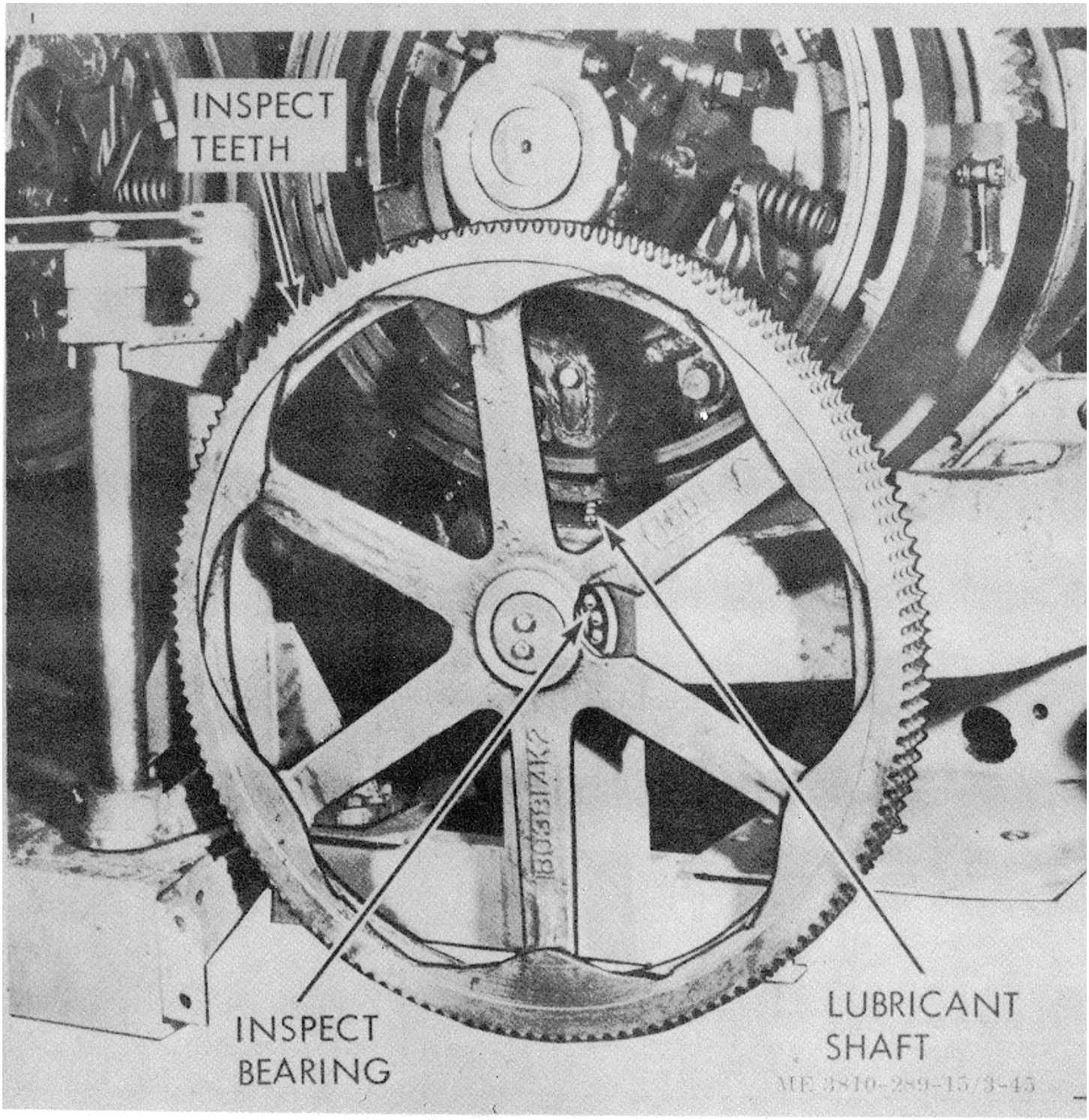


Figure 4-33. Transmission shaft.

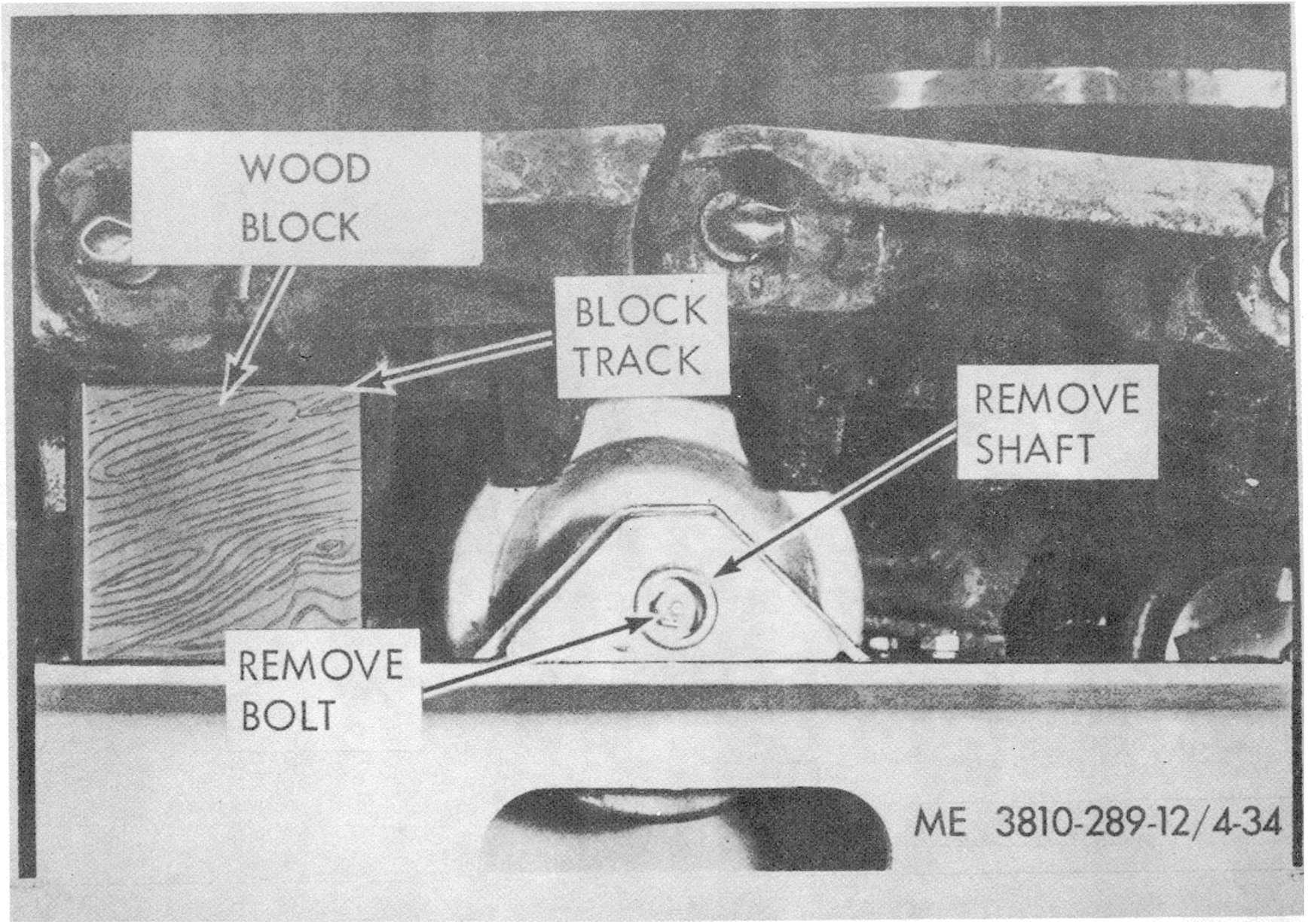


Figure 4-34. Upper track support rollers.

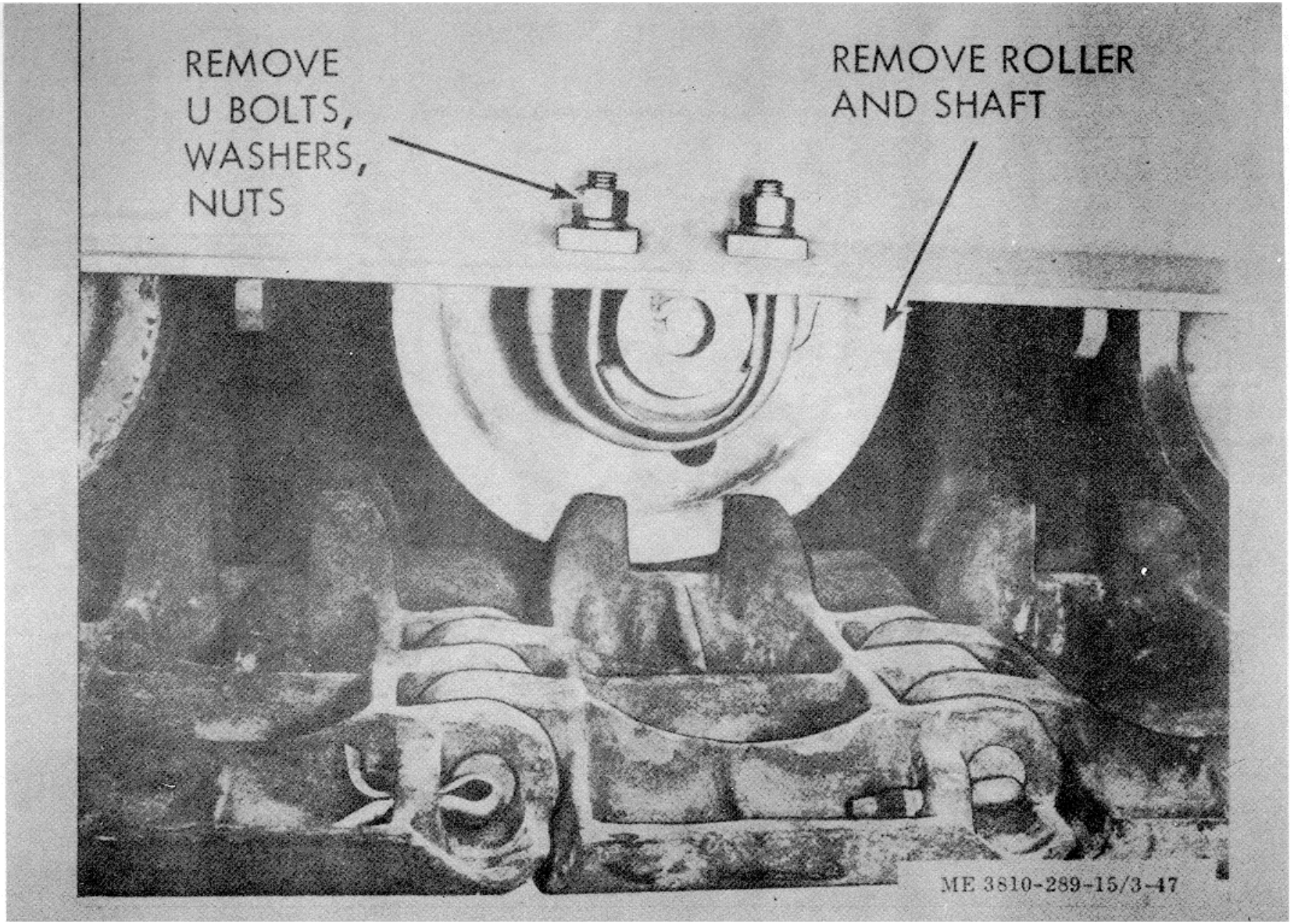


Figure 4-35. Lower track support rollers.

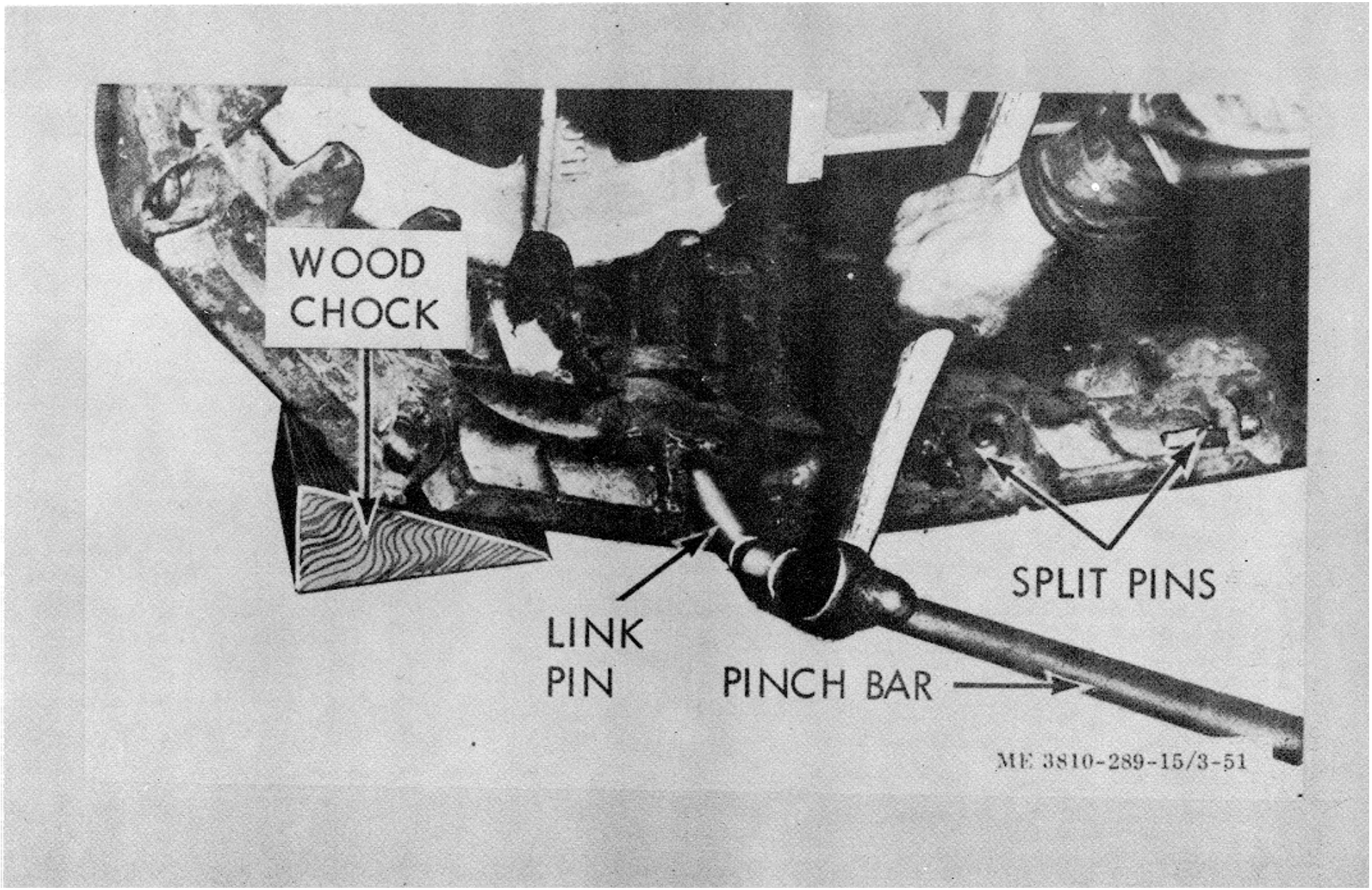


Figure 4-36. Track belt, removal and installation.

Section XIII. MAINTENANCE OF CAB COMPONENTS

4-51. Cab Assembly Replacement

Inspect for cracks and loose bolts, and check for proper operation of doors and hinged panels. Refer to figure 4-37 to replace parts of the cab assembly.

4-52. Seat Assembly Replacement and Repair

Refer to figure 4-38 to replace or repair the seat assembly.

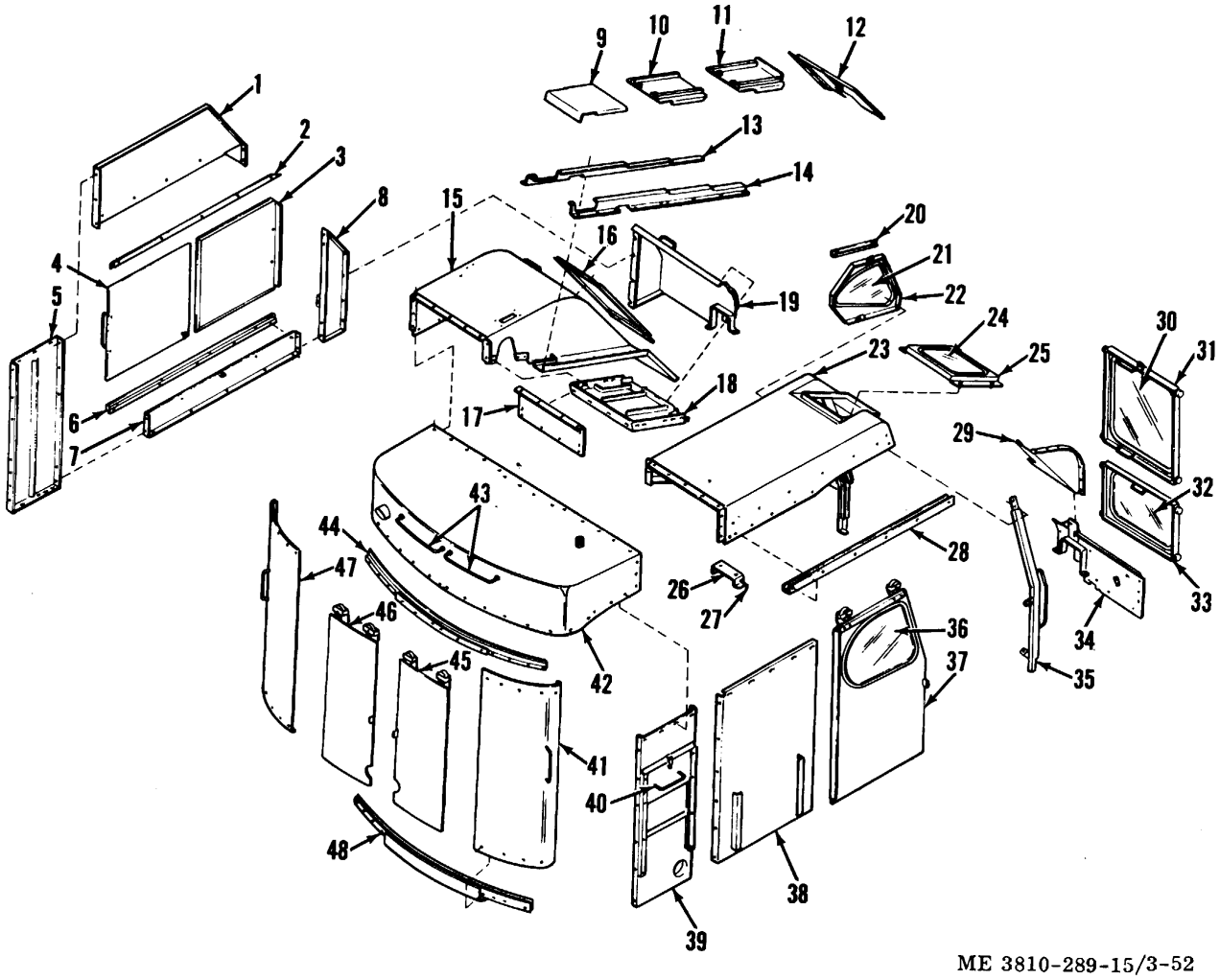


Figure 4-37. Cab assembly.

1 L.H. front panel
2 Rail, upper door
3 Sliding door
4 Sliding door
5 L.H. side panel
6 Rail, lower door
7 L.H. lower side panel
8 L.H. front panel
9 Center panel cover
10 Center panel cover
11 Center panel cover
12 Lower center panel cover
13 L.H. guide rail
14 R.H. guide rail
15 L.H. front roof
16 L.H. front roof cover
17 Strip
18. A-frame cover
19. L.H. front panel
20. Strip
21. Glass
22. Sash
23. R. H. front roof
24. Glass
25. Sash
26. Spring bracket
27. Spring bar
28. Strip
29. Lower R.H. center panel
30. Glass
31. Sash
32. Glass
33. Sash
34. R.H. front panel
35. Corner post
36. Glass
37. R.H. door
38. R.H. side panel
39. Radiator panel
40. Grab iron
41. Corner post
42. Rear roof
43. Grab irons
44. Strip
45. R.H. rear door
46. L.H. rear door
47. Corner post
48. Rear lower rail

Figure 4-37. Cab assembly.

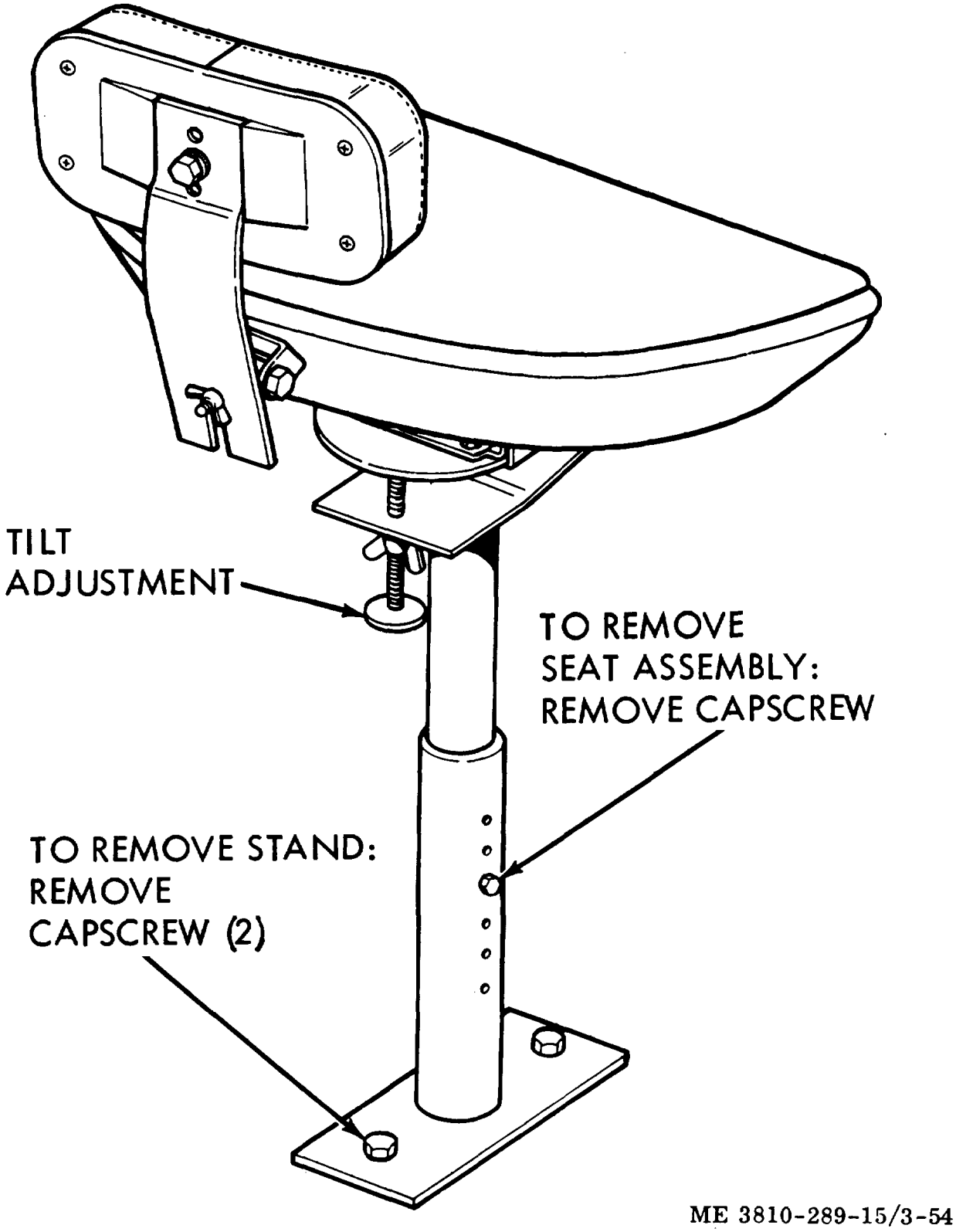


Figure 4-38. Seat assembly, removal and installation.

Section XIV. MAINTENANCE OF CRANE BOOM ASSEMBLY, DRAGLINE, AND CLAMSHELL FRONT END EQUIPMENT

4-53. General.

The crane, clamshell, and dragline front end attachments use a similar boom arrangement which consists of the base section and an up) section which may be lengthened by insertion boom sections (para 4-56e). For dragline operation (para 2-18), a fairlead is installed. For clamshell operation (para 2-19), a tagline unit is used to stabilize the bucket. All of these attachment use the boom backstop, boom angle indicator, a boom harness spreader. All use drum cable lagging and cables, although size and lengths differ according to operation being performed or lens of boom in use (tables 4-2 and 4-3).

4-54. Crane Boom Suspension Cable

a. Removal.

(1) Engage engine clutch and throttle engine to slowest speed.

(2) Release locking pawl and brake by powering boom hoist drum down.

(3) Place boom at rest on ground or blocking.

(4) Unspool, remaining cable from drum by hand.

(5) Drive wedge out of drum and remove cable.

(6) Remove cable from A-frame, pendant bridle, and yoke sheaves.

(7) Remove cable socket from anchor on yoke on the A-frame.

(8) Inspect, lubricate, and coil the cable.

b. Reeving (boom in horizontal position fig. 4-89)

(1) Install one end of cable in socket which is attached to the A-frame sheave yoke.

(2) Reeve the cable from the anchor around the lower left pendant bridle sheave from left to right, then around the lower yoke sheave from left to right, then around the lower right pendant bridle sheave from left to right, around the right hand A-frame sheave from bottom to top, around the upper right hand pendant bridle sheave from right to left, through the upper yoke sheave from right to left, around the upper left hand pendant bridle from right to left, over the left hand A-frame sheave from top to bottom and then to the boom hoist drum.

(3) Anchor the cable in the boom hoist drum socket and install wedge to take up the slack in the cable.

4-55. Crane Hoist Cable

a. Removal.

(1) Unspool cable from the hoist drum, drive out wedge, and remove the cable from drum.

(2) Remove cable from the boom point and hook block sheave.

(3) Inspect, lubricate, and coil the cable.

b. Reeving (Boom in Horizontal Position). Refer to figure 4-40 and reeve the hoist cable.

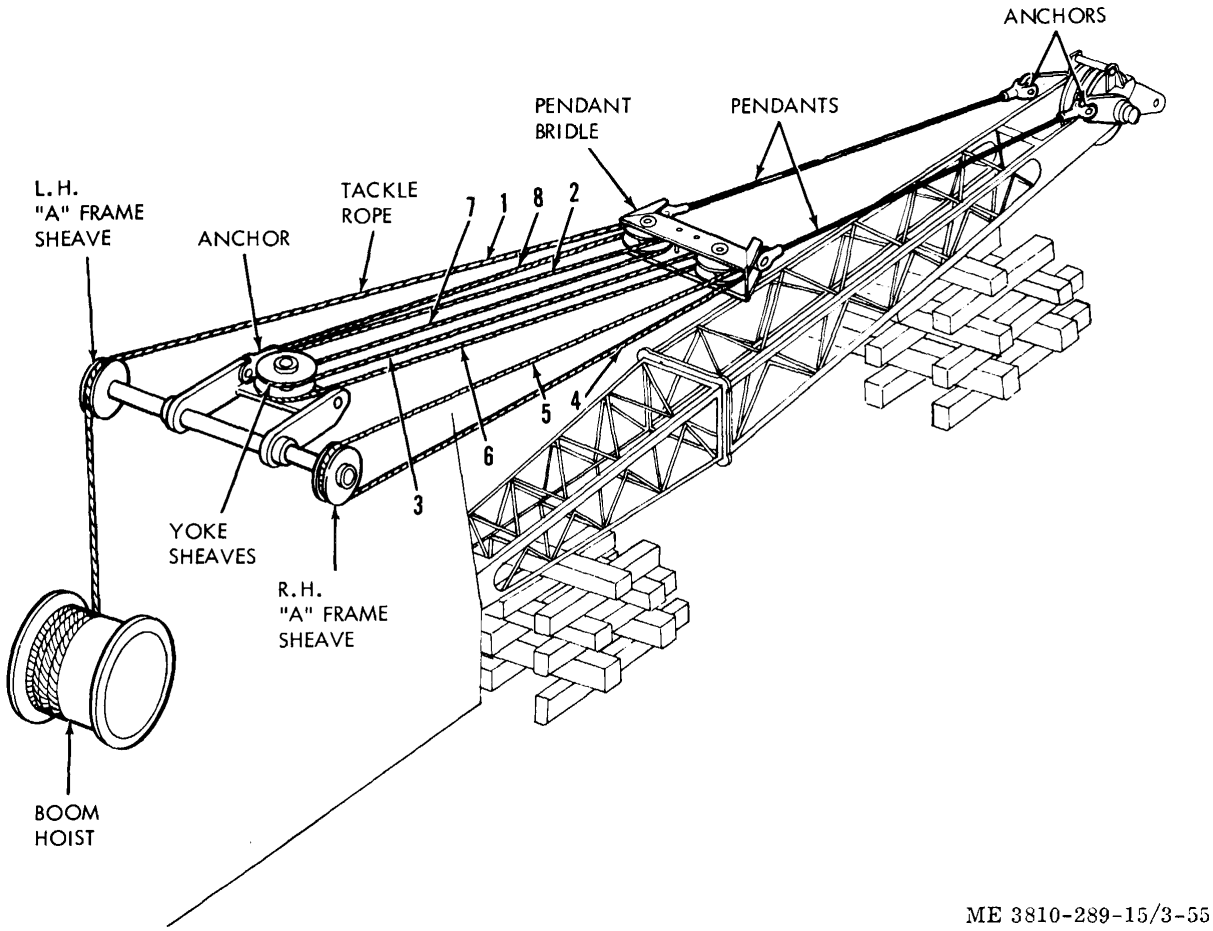


Figure 4-39. Reeving boom suspension cable.

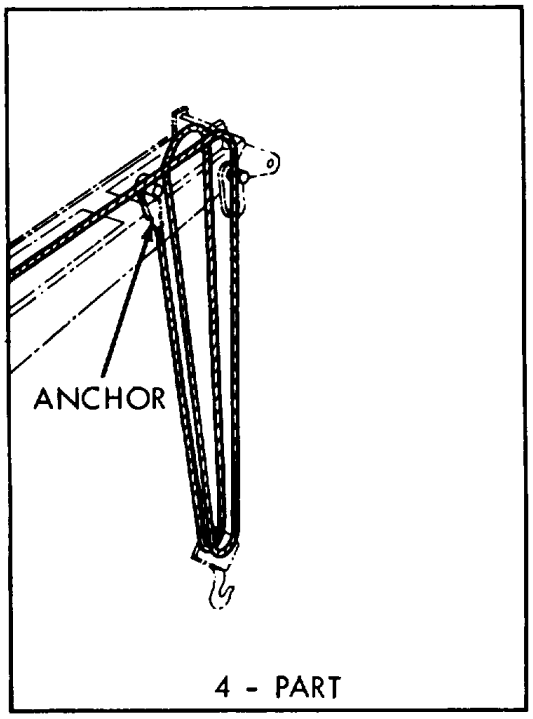


Figure 4-40. Reeving crane hoist cable.

Table 4-2. Primary Hoist Cable Lengths

Boom length	Cable lengths (4-part)
80	250
40	300
50	350
60	400

Note. Add a 10' pendant for each additional section.

Table 4-.3 Cable Specifications and Lengths

Crane (30 ft).	*Cable Dia. Length*
Boom suspension	½" x 241''
Primary and secondary hoist	5/8" x 250'
Dragline.	
Boom suspension	Same as crane
Hoist	5/8" x 130'
Drag	3/4" x 170'
Clamshell.	
Boom suspension	Same as crane
Holding	5/8" x 140'
Closing	5/8" x 170'
Backhoe.	
Boom suspension	5/8" x 75'
Hoist	5/8" x 100'
Drag	3/4" x 65'
Shovel.	
Boom suspension	1/2" x 241''
Hoist	5/8" x 100'
Backhaul	3/4" x 26' 6"
Crowd	3/4" x 51' 6"
Dipper trip	5/16" x 35'

Note. When adding boom sections, add cable accordingly.

4-56. Boom Assembly

a. Inspection.

(1) Lower the boom and support on cribbing (fig. 3-14). Spool off a few turns of the suspension and hoist ropes so that the boom point sheaves can be rotated by hand.

(2) Examine all the sheaves for side wear of the rope grooves.

(3) Inspect block and hook for secure mountings and proper lubrication.

(4) Inspect crane boom for bent or damaged cords and lacings and for secure bolt mountings of butt joints. Tighten all attaching bolts and replace any that may be missing. Inspect the boom foot pins to see that they are secure.

b. Service. Lubricate all points on the boom (fig. 4-41) and the hook block, as instructed on the lubrication order.

c. Removal.

(1) Remove crane hook by removing the hoist rope (para 4-55).

(2) Build up cribbing about four feet high, which will support the boom foot and boom point at approximately the height at which it is attached to the revolving frame (fig. 4-32). Propel machine up to the cribbing and lower boom on cribbing. Remove boom suspension rope (para 4-54).

(3) Remove lagging from front drum by taking out the six attaching bolts, nuts and lock-washers.

(4) Drive wedges under boom foot as may be necessary to relieve boom foot pins of boom weight. Remove boom foot pin locking screws and take out the pins. Back machine away from boom and put pins back into revolving frame for use on front end which is to be installed.

d. Installation. To install, follow the removal procedure in reverse.

e. Extra Ten-Foot Sections.

(1) Build up cribbing to support crane boom upper section. Lower boom until it rests on the cribbing.

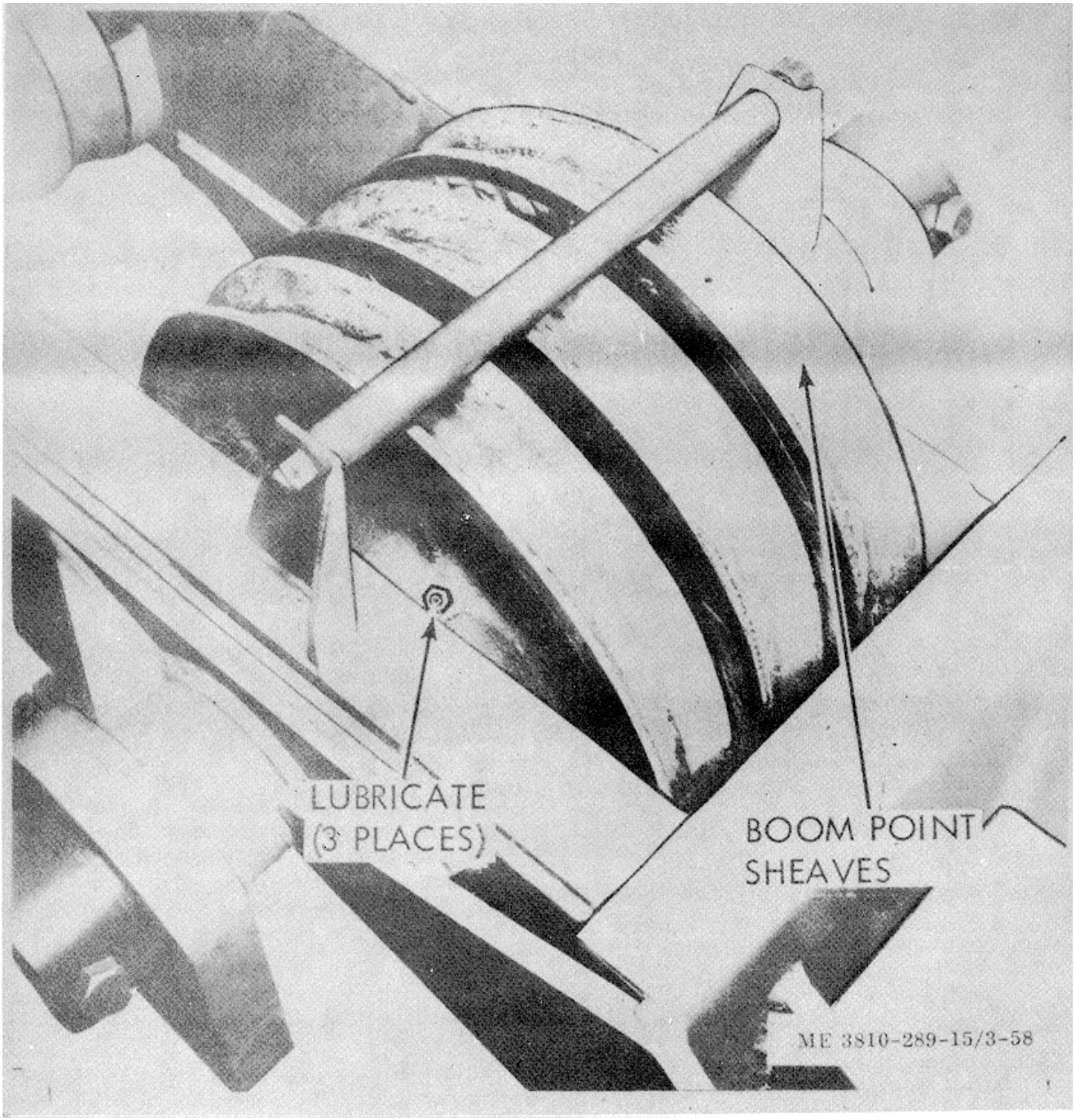


Figure 4-41. Boom point sheaves.

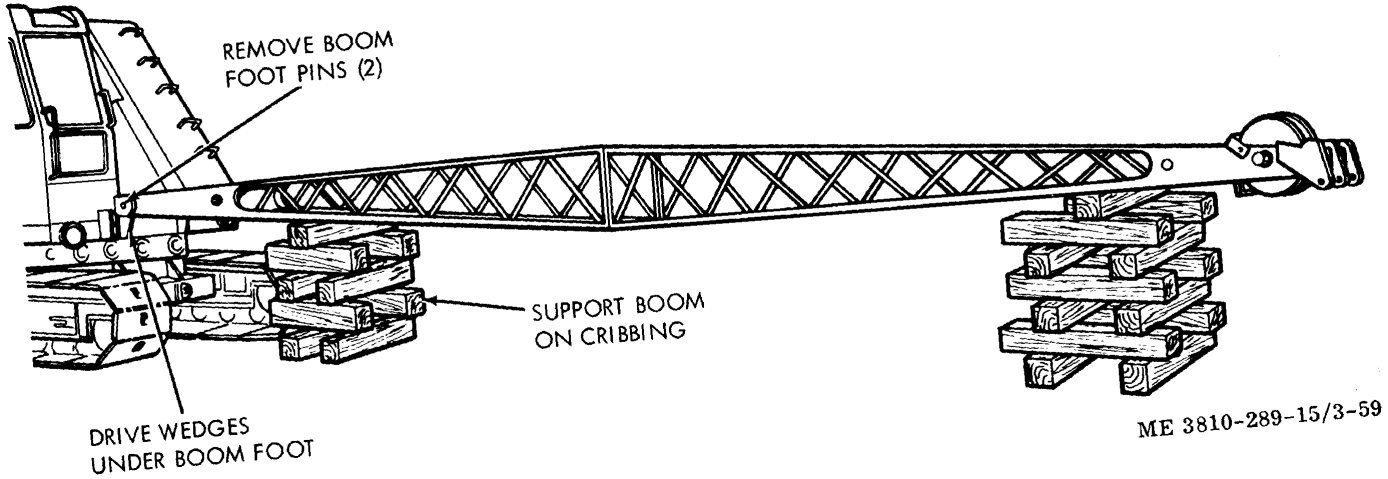


Figure 4-42. Boom, removal.

(2) Pay off boom suspension and hoist ropes until there is sufficient slack to permit insertion of the extra sections. Remove splice bolts attaching upper and lower section of boom (fig. 4-43).

(3) By slowly propelling machine backwards, separate boom halves to permit addition of extra boom sections; put each section in place. (Brace cribbing against drag of boom before propelling.) Be sure cross bracing at the ends of the section do not interfere with the track if they are installed in the boom. Bolt new sections to the upper and lower sections of the boom.

(4) Bolt pendents to boom.

(5) Raise boom to position with boom hoist.

(6) Install hoist rope in reverse order of disassembly procedure.

f. Repair. Repair of crane boom is limited to wear-out type items of the point section and minor repair or replacement of lattice members.

Note. Bent, broken or kinked booms are restricted to repair by replacement.

g. Replace. Refer to figure 4-44 to replace parts of the boom assembly.

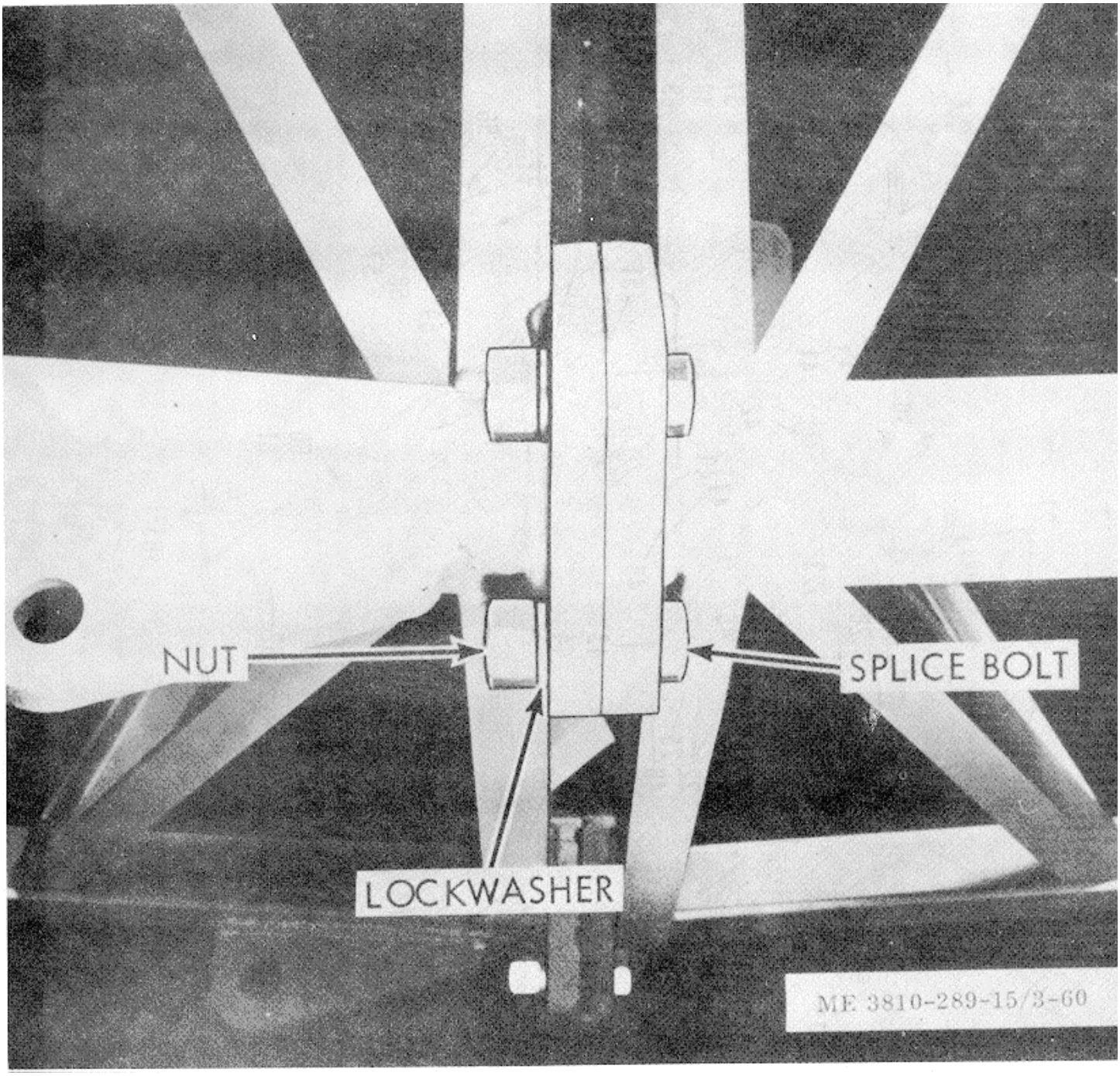


Figure 4-43. Splice bolts.

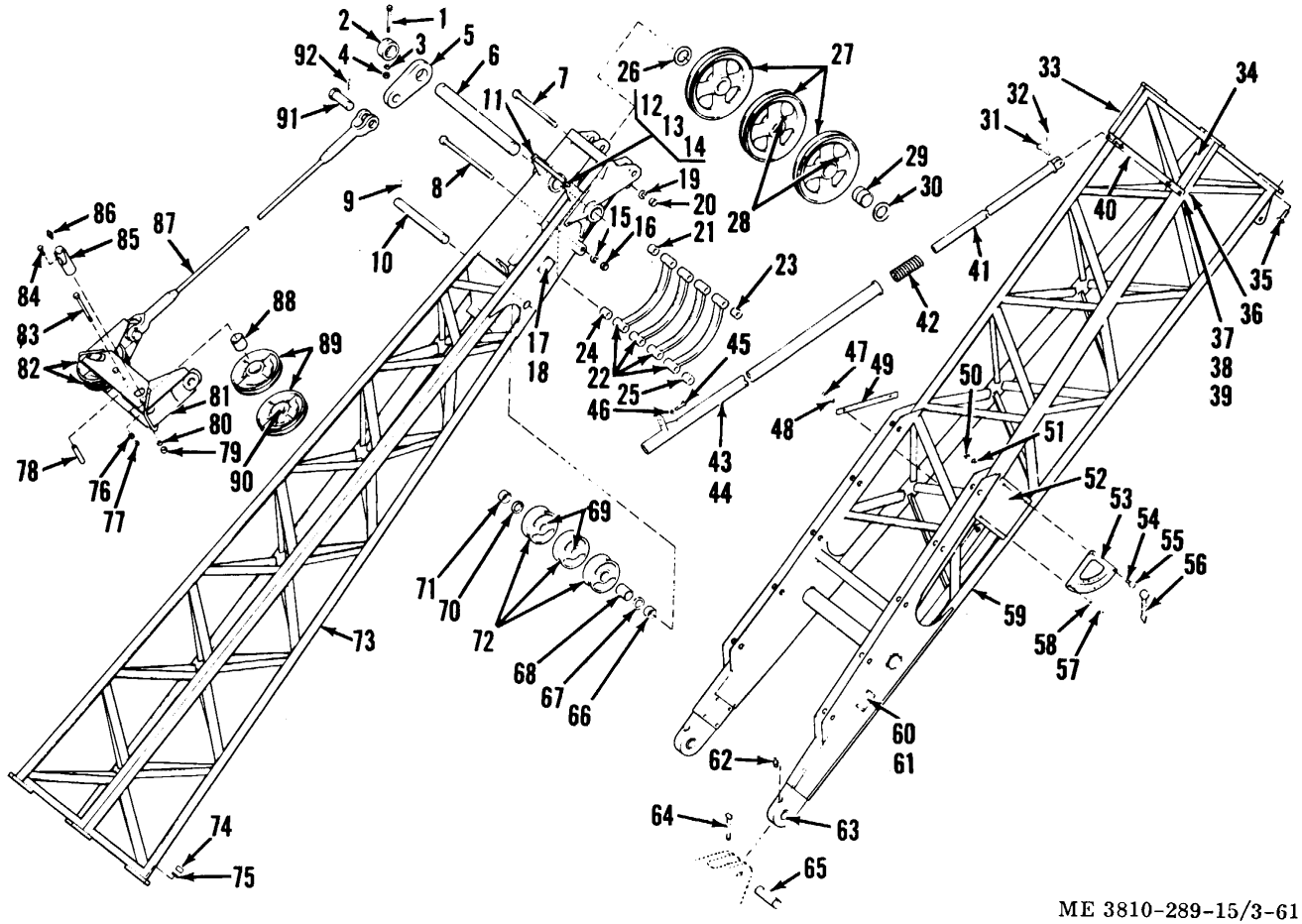


Figure 4-44. Boom assembly, exploded view.

1 Screw, cap 4" x 5%" UNC C.P.
2 Set collar
3 Washer, lock 3/4" C.P.
4 Nut, full 3/4" UNC C.P.
5 Pendant link
6 Boom paint pin
7 Bolt. hexagon hd. 1" x 17" UNC C.P.
8 Bolt, hexagon hd. 1" x 19" UNC C.P.
9 Pin, cotter E" x 3 C.P.
10 Pin
11 Spacer
12 Screw, cap %" x 14%" UNC C.P.
13 Washer, lock %" C.P.
14 Nut, full %" UNC C.P.
15 Washer, lock 1" C.P.
16 Nut, full 1" UNC C.P.
17 Identification plate
18 Screw, PK drive #4 x %"
19 Washer, lock *1"* C.P.
20 Nut, full 1" UNC C.P.
21 Spacer
22 Cable guard
23 Spacer
24 Spacer
25 Spacer
26 Washer, thrust
27 Sheave
28 Fitting, lubrication %"-45'
29 Bushing
30 Washer, thrust
31 Pin
32 Pin, cotter 3/16" x 1%4" UNC C.P.
33 Angle
34 Angle
35 Screw, cap 3/4" x 2%" UNC C.P.
36 Angle
37 Screw, cap ½" x 4
38 Washer, lock %" C.P.
39 Nut, full %" UNC C.P.
40 Boom stop bracket
41 Upper boom stop
42 Spring
43 R.H. boom stop anchor
44 L.H. boom stop anchor
45 Screw, cap ½" x 1**/4"** UNC C.P.
46 Washer, lock %" C.P.
47 Nut, full %" UNC
48 Washer, lock %"
49 Brace
50 Nut, full %" UNC
51 Washer, lock %"
52 Boom angle indicator bracket
53 Indicator
54 Pivot
55 Bearing
56 Pointer
57 Screw, cap %" x 1 3/4UNC
58 Washer, lead %"
59 Lower boom section (15'0")
60 Identification plate
61 Screw, cap /4" x *8"* UNC
62 Fitting, lubrication
63 Bushing
64 Bolt, T-head
65 Boom foot pin
66 Spacer
67 Washer, plain 2" C.P.
68 Bushing
69 Bushing
70 Washer, plain 2" C.P.
71 Spacer
72 Guide roller
73 Upper boom section (15'0")
74 Nut, full /4" UNC C.P.
75 Washer, lock 3/4" C.P.
76 Nut, full ½"
77 Nut, jam ½" UNC
78 Spacer
79 Nut, full 3/4"
80 Washer, lock 3/4"
81 Pendant bridal
82 Sheave
83 Screw, cap *3*/4" x 9 UNC
84 Screw, cap ½" x 2 UNC
85 Sheave pin
86 Fitting & lubrication
87 Pendant
88 Bushing
89 Sheave
90 Bushing
91 Pin
92 Pin, cotter

4-57. Safety Boom Stop, Replacement and Repair

Refer to figure 4-44 to replace or repair safety boom stop.

4-58. Dragline Bucket

a. Removal.

(1) Lower dragline bucket to ground, then slacken hoist and drag cables.

(2) Remove drag, hoist, and dump cables from dead ends (fig. 2-11).

(3) Wind cables on drum, slowly, as cable ends are guided through sheaves.

b. Disassembly. Refer to figure 4-45 and disassemble bucket.

c. Cleaning, Inspect, and Repair.

(1) Clean parts with an approved cleaning solvent and dry thoroughly.

(2) Replace defective parts.

d. Bucket Teeth Replacement.

(1) Position bucket on its side and remove keeper lock and keeper.

(2) Remove tooth point from shank (fig. 4-45).

(3) Remove cotter pin and remove shank from bucket.

e. Reassembly. Refer to figure 4-45 and assemble dragline bucket.

f. Installation.

(1) Reeve drag, hoist, and dump cables (fig. 2-11).

(2) Connect cables to dead ends.

4-59. Dragline Fairlead

a. Removal. Refer to figure 2-10 and remove fairlead.

b. Disassembly. Refer to figure 4-46 and disassemble fairlead.

c. Cleaning, Inspection and Repair.

(1) Clean parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect bushings and bearings for wear and scoring.

(3) Inspect sheave shafts and sheaves for wear, cracks, or bends.

(4) Inspect mounting base and frame for bends, cracks, or breaks, and mounting hardware for stripped threads, elongated hole, or other defects.

(5) Repair by welding cracks or breaks, straightening bends, or replacing defective parts.

d. Reassembly. Refer to figure 4-46 and reassemble fairlead.

e. Installation. Refer to figure 2-10 and install fairlead.

4-60. Clamshell Bucket

a. General. The clamshell bucket consists of

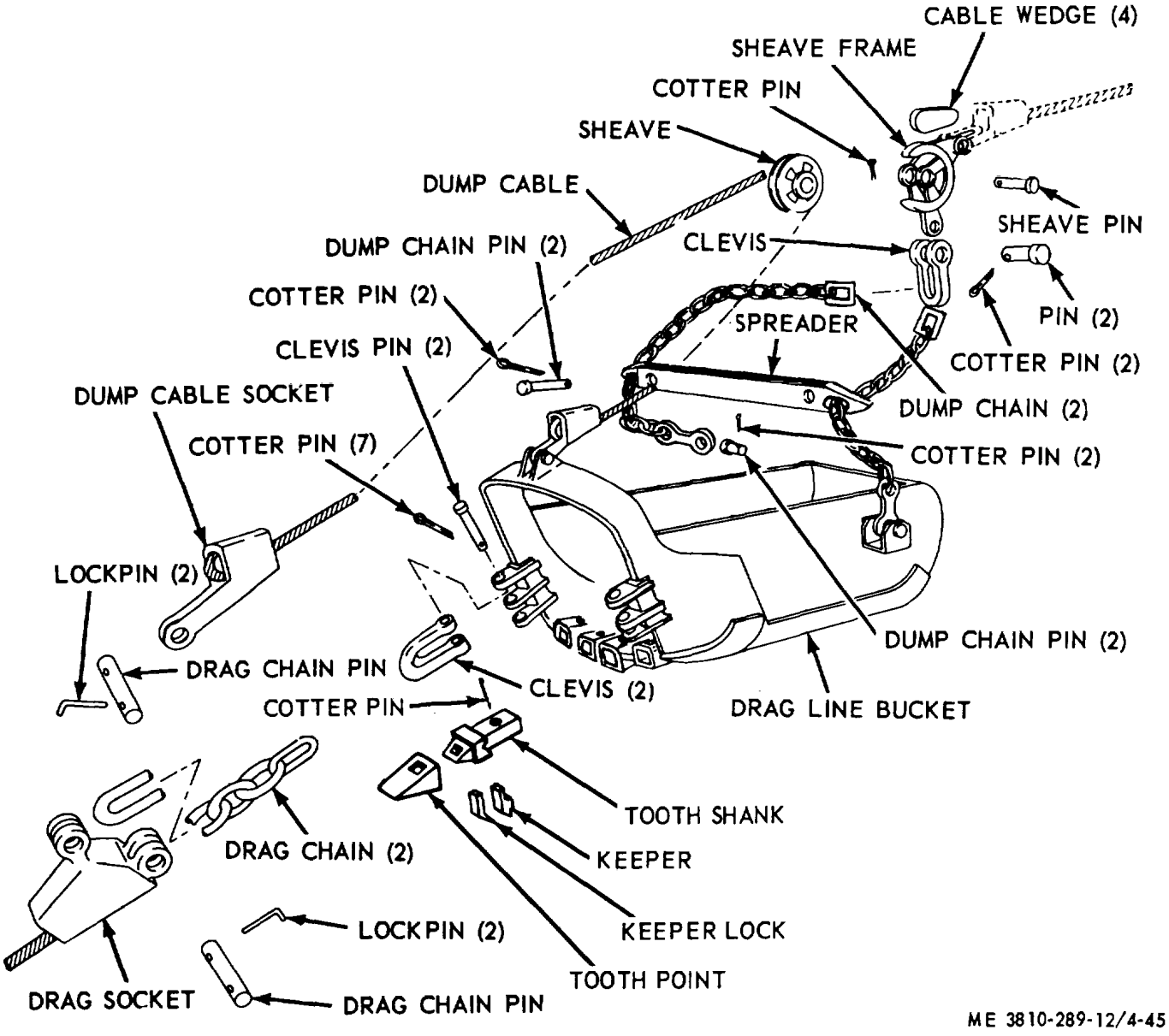


Figure 4-45. Dragline bucket, disassembly and reassembly.

two half-scoops, hinged together at top so that they will close over material to be picked up. Bucket opens when closing line is allowed to run free, and closes when pressure on hoist brake is slackened and crowd and retract clutch is engaged.

b. Removal.

(1) Lower open bucket to ground until there is slack in the holding and closing cables.

(2) Disconnect tagline from bucket.

(3) Disconnect holding and closing cables at dead end sockets on bucket (fig. 2-14).

c. Disassembly. Refer to figure 4-47 and disassemble clamshell bucket.

d. Bucket Teeth Replacement.

(*1) Removal.* Position bucket on its side. Remove nuts, lockwashers and bolts, and remove teeth from clam jaws.

(*2) Cleaning, inspection and repair.*

(a) Clean parts with an approved cleaning solvent and dry thoroughly.

(b) Inspect mounting hardware for stripped threads or other defects.

(c) Inspect teeth for bent, cracked, or worn condition.

(d) Replace defective parts.

(*3) Installation.* Install teeth on jaws. Secure with bolts, lockwashers and nuts.

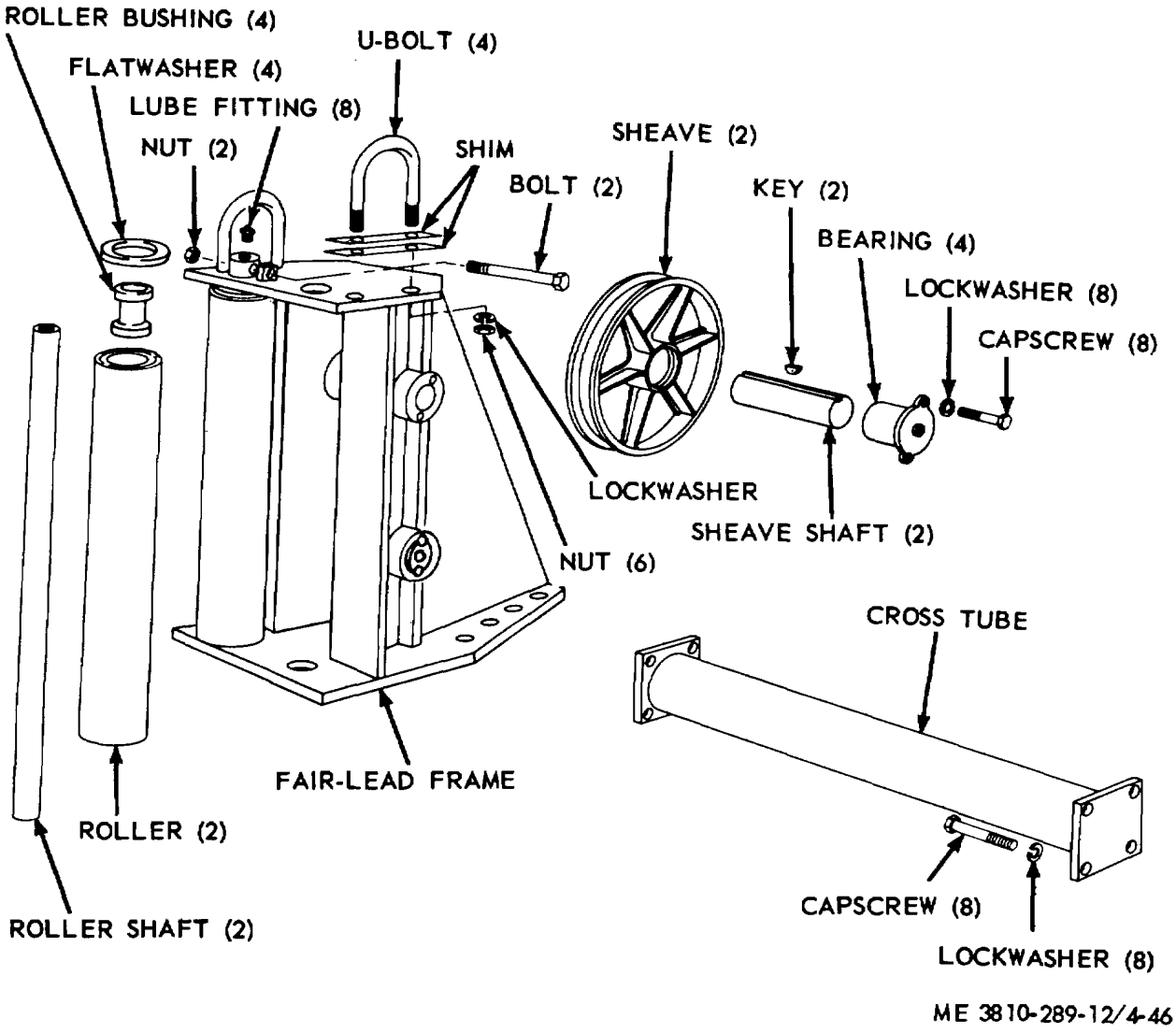


Figure 4-46. Dragline fairlead, disassembly and reassembly.

e. assembly. Refer to figure 4-17 and reassemble clamshell bucket.

f Installation.

(1) Position boom over bucket. Reeve the holding and closing cables (fig. 2-14), and secure to dead end sockets on bucket.

(2) Attach tagline to bucket.

4-61. Jib Boom and Most

a. Removal.

(1) Lower the boom and build up cribbing beneath the jib boom (fig. 4-48).

(2) Remove the jib lower support cables (fig. 2-7) from cable supports. Allow jib boom strut to fall back on the jib boom.

(3) Remove weighted hook from cable.

(4) Remove jib cable from jib boom and right-hand drum.

(5) Remove two cotter pins, capscrews, lockwashers, jib boom pins, and jib boom, from the crane boom. Remove the two rod ends from jib boom pins.

b. Disassembly. Refer to figures 4-49 and 4-50 and disassemble jib boom and mast.

c. *Cleaning, Inspection and Repair.*

(1) Clean parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect parts for defective condition.

(3) Repair or replace defective parts.

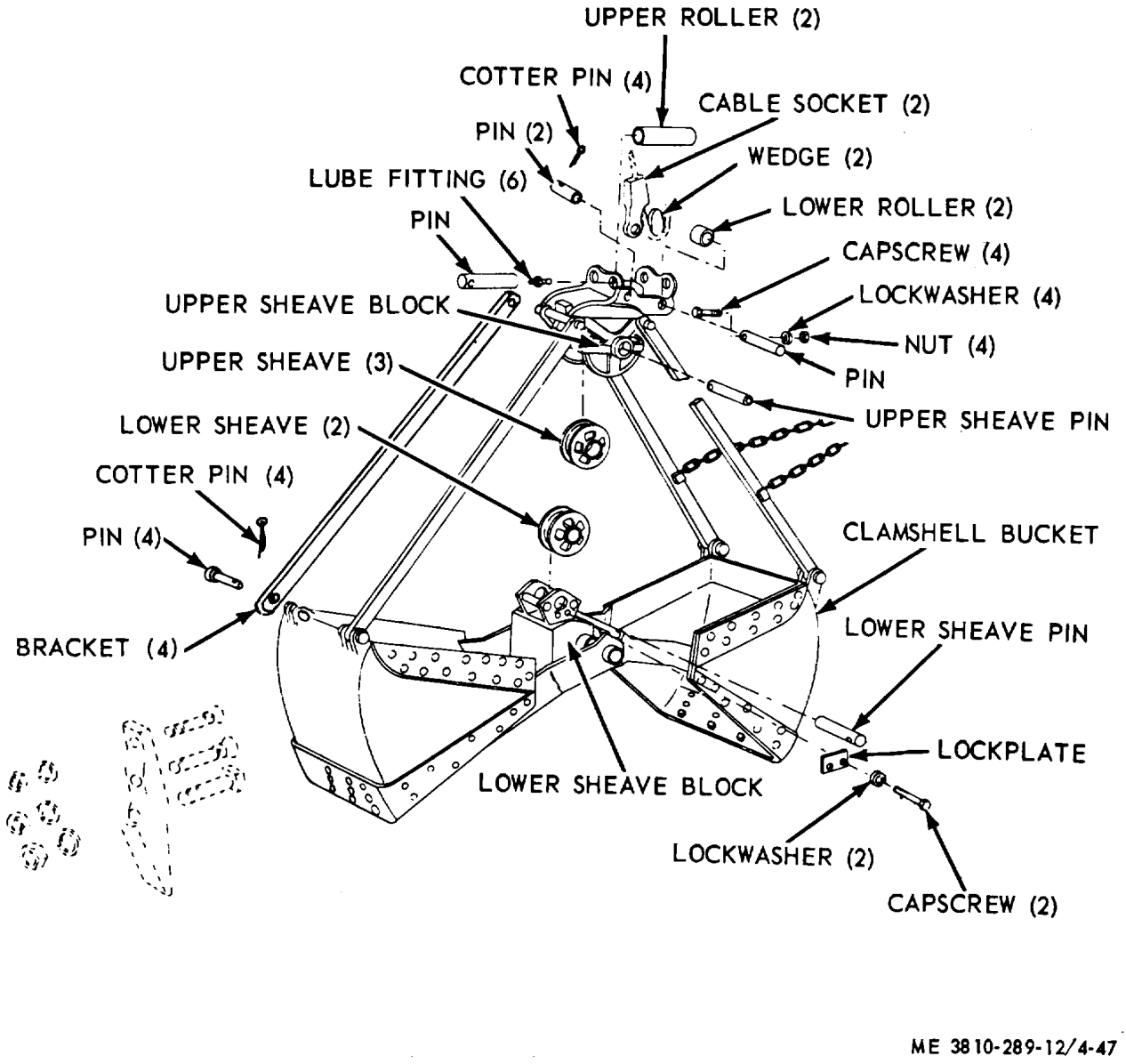


Figure 4-47. Clamshell bucket, disassembly and reassembly.

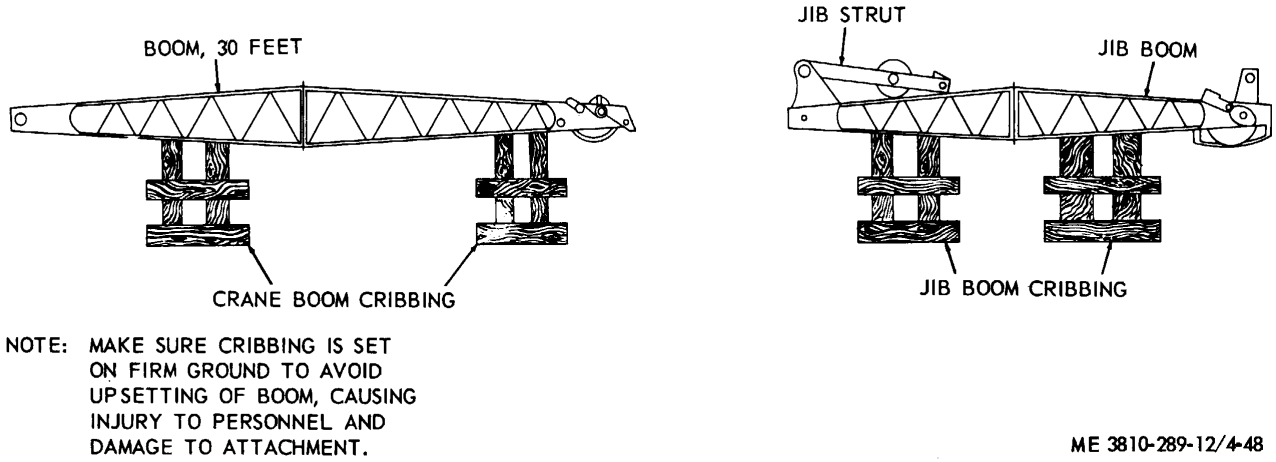


Figure 4-48. Boom cribbing method.

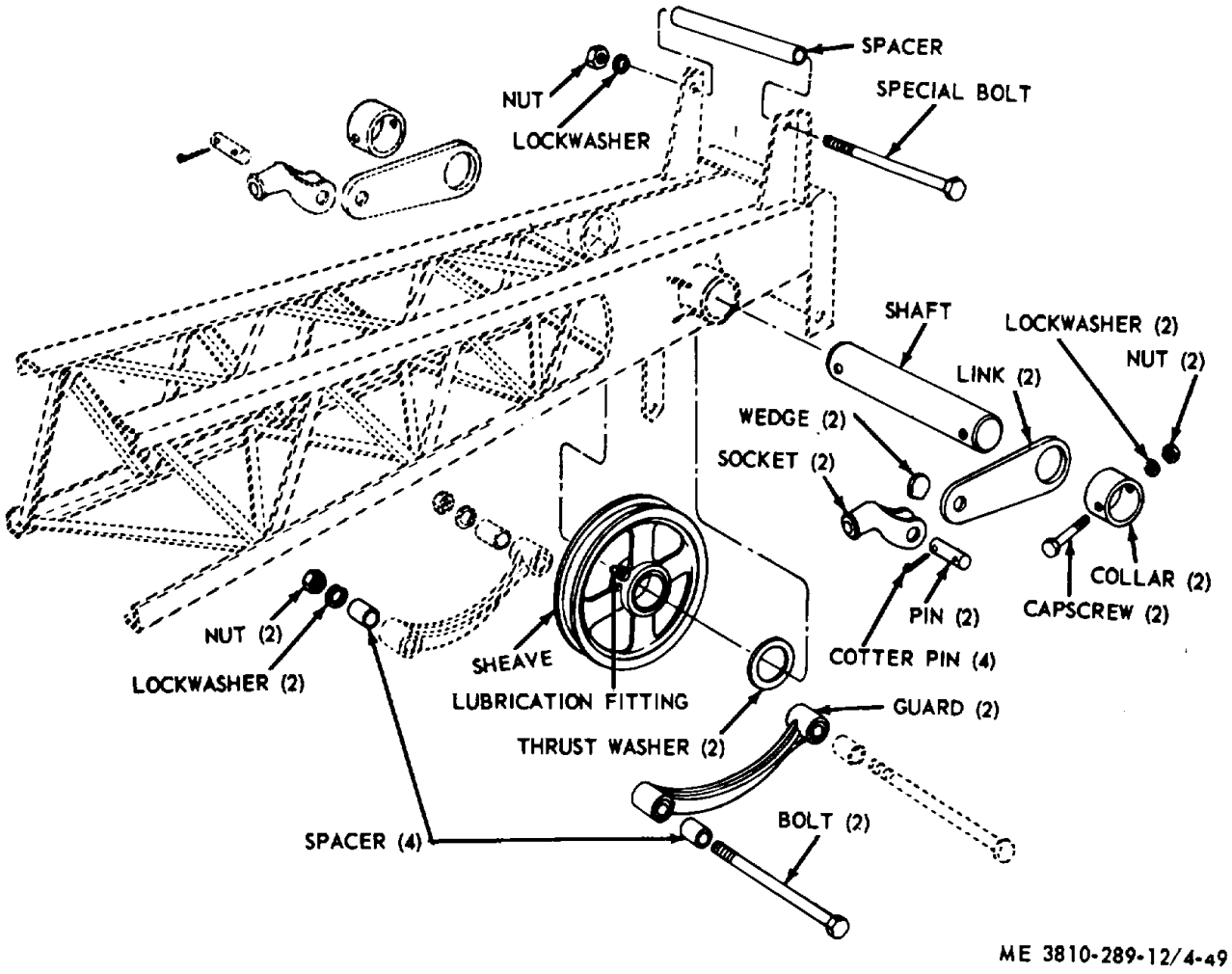


Figure 4-49. Jib boom assembly, exploded view.

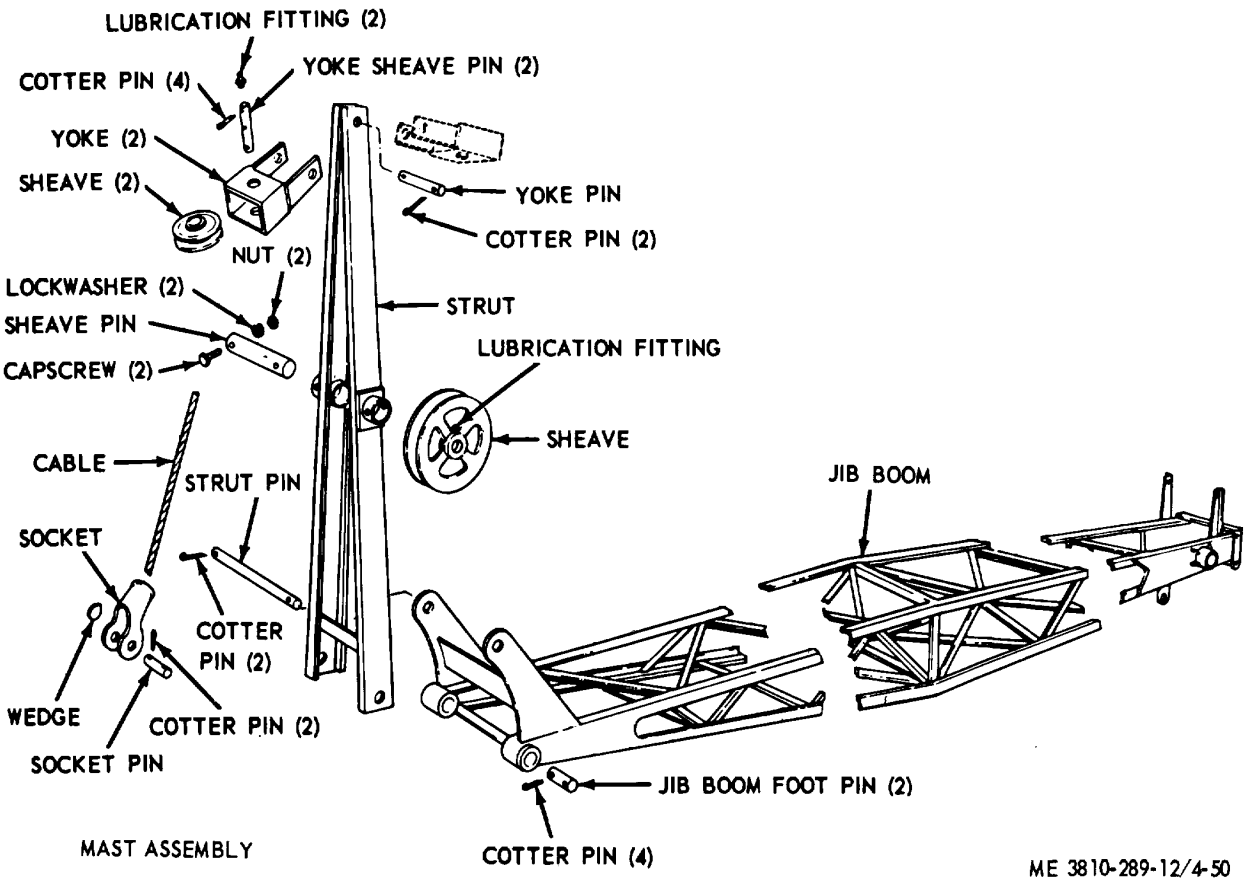


Figure 4-50. Jib boom mast assembly, exploded view.

d Reassembly. Refer to figures 4-49 and 4-50 and reassemble jib boom and mast.

e. Installation. Install jib boom (para 2-3*c*).

Section XV. MAINTENANCE OF CLUTCH AND BRAKE ASSEMBLIES

4-62. Operating Clutch Band, Removal and Installation

a. Refer to figure 4-51 to remove and install the clutch band.

b. Refer to paragraph 3-27 for clutch adjustment.

4-63. Boom Hoist Clutch Band, Removal and Installation

a. Booster Band Removal.

(1) Remove booster band joint bolt (10, 4-51).

(2) Remove booster band clutch adjusting nuts (4).

(3) Remove cushion spring nut (11), cushion spring (6).

(4) Remove both sections of the booster band (1).

b. Clutch Band Removal.

(1) Remove booster band *(a,* above).

(2) Remove clutch release spring (13, 4-51) and take off band guides (8).

(3) Take out the four cotter pins (14) holding the main clutch bellcrank (9) in place.

(4) Slide main clutch band (12) out of housing and separate at splice, if necessary.

c. Installation.

(1) The main clutch band and booster band are installed in reverse of the removal procedure.

(2) When installing a replacement booster band, place band halves in place and connect band splice at joint, leaving bolt (10, fig. 4-51) one-half thread loose. Lock adjusting nuts (4) at location where circumference of band matches circumference of booster drum. Then, with the cushion spring (6) and booster band release spring in place, tighten the cushion spring nut (11) for 0.010-inch gap between the cam and booster band cam roller (3).

d. Adjustment. Refer to paragraph 3-29.

4-64. Boom Hoist Brakeband, Removal and Installation

a. Removal.

(1) Remove guard.

(2) Remove brakeband joint bolt (10, fig. 4-51).

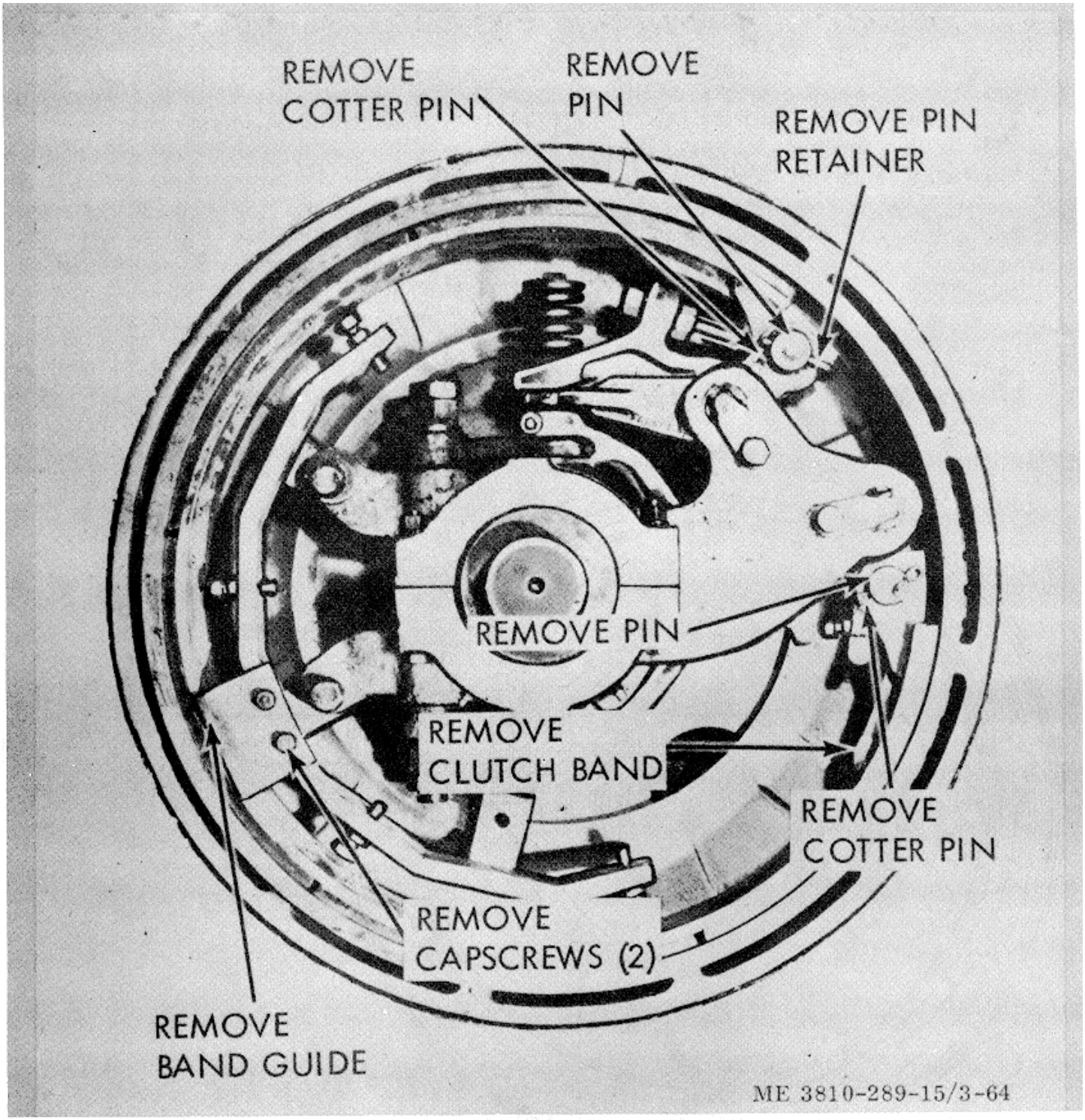
(3) Remove dead-end pin (7).

(4) Remove brakeband adjusting nuts (5).

(5) Remove both sections of the brakeband (2).

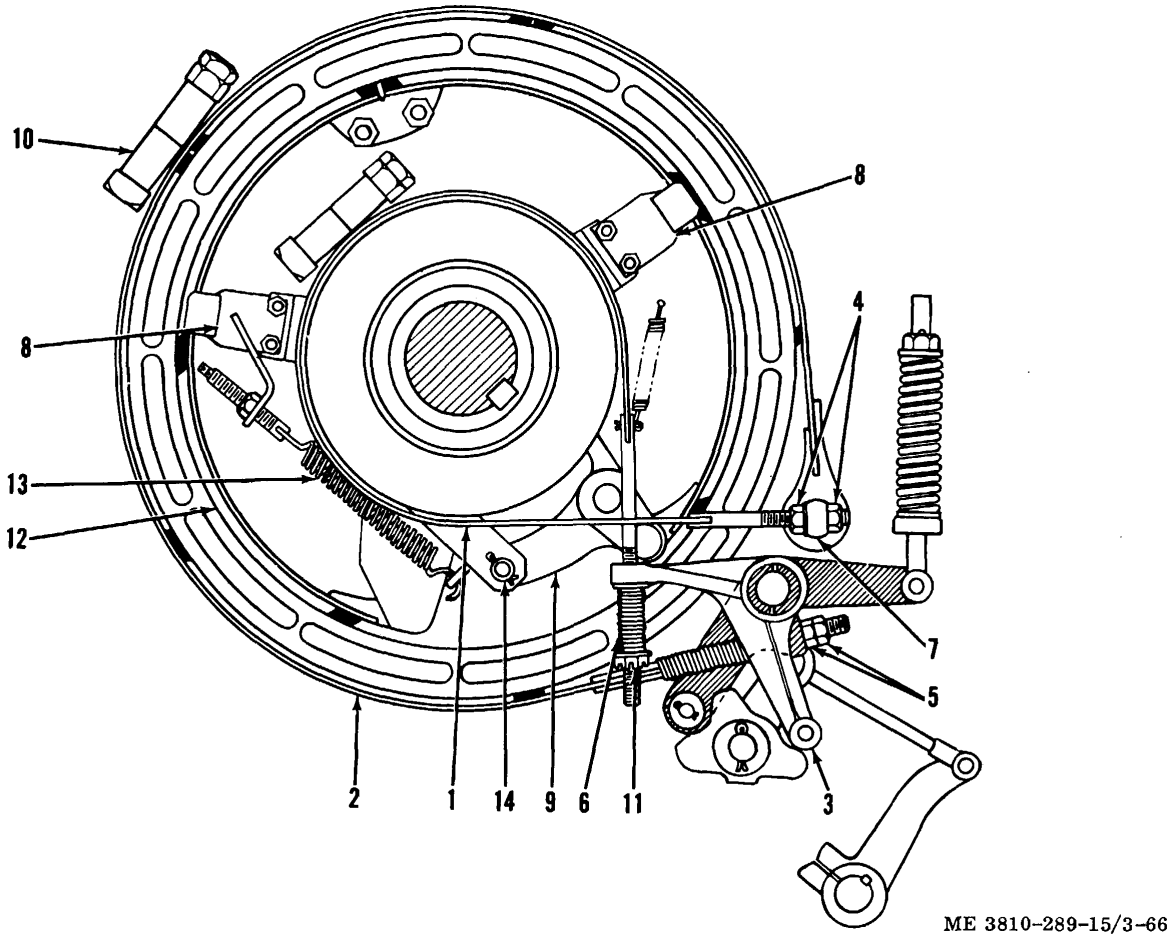
b. Installation. The brakeband is installed in reverse of the removal procedure.

c. Adjustment. Refer to paragraph 3-30.



Operating clutch band.

Figure 4-51. Clutch and brakebands, removal and installation (sheet 1 of 2).



Boom hoist clutch and brakebands.

Figure 4-51. Clutch and brakebands, removal and installation (sheet 2 of 2).

1 Booster band
2 Brakeband
3 Booster band cam roller
4 Booster band clutch adjusting nuts
5 Brakeband adjusting nuts
6 Cushion spring
7 Dead end pin
8 Band guides
9 Main clutch bellcrank
10 Booster band joint bolt
11 Cushion spring nut
12 Main clutch band
13 Clutch release spring
14 Cotter pins

Boom hoist clutch and brakebands.

Figure 4-51. Clutch and brakebands, removal and installation (sheet 2 of 2).

Section XVI. MAINTENANCE OF CHAIN CASE ASSEMBLY, CONE ROLLERS, AND GEAR CASE COVERS

4-65. Chain Case Assembly

a. Check chain case for cracks, breaks,and defective plugs, or hardware.

b. Replace defective drain or oil level plugs or hardware (fig. 4-52).

c. Lubricate in accordance with current lubrication order.

4-66. Cone Roller Replacement

a. Removal (fig. 4-53).

(1) Lift upper works just enough so cone rollers are free in their path. Lift can be made by:

(a) Crane with sling fastened to lifting eyes provided on A-frame yoke and lugs boom foot pins.

(b) Jacking up revolving frame and building cribbing to support it. Four jacks should be used, one under each corner of revolving frame (do not jack against light constructed decks)

(2) Remove lockwire, nut, and washer.

(3) Remove cone roller, bushing, O-ring, retainer.

b. Installation.

(1) Refer to figure 4-53 and reassemble in numerical order.

(2) Check to be sure that rollers turn freely.

(3) Install washer, nut, and lockwire.

4-67. Frame and Bevel Gear Case Covers Replacement

a. Frame Covers. Refer to figure 4-54 and 4-55 to replace the frame covers.

b. Bevel Gear Case Cover (fig. 4-56).

(1) Remove drain plug in bottom of bevel gear case and drain lubricant into clean container for replacement. Cover container with lubricant in it for protection against dust and other foreign matter.

(2) Remove four bolts attaching gear case truck frame and lower the case with steering clutch guards attacked. Clean the gasket off from truck frame and gear case.

(3) Installation is the reverse of the removal instructions.

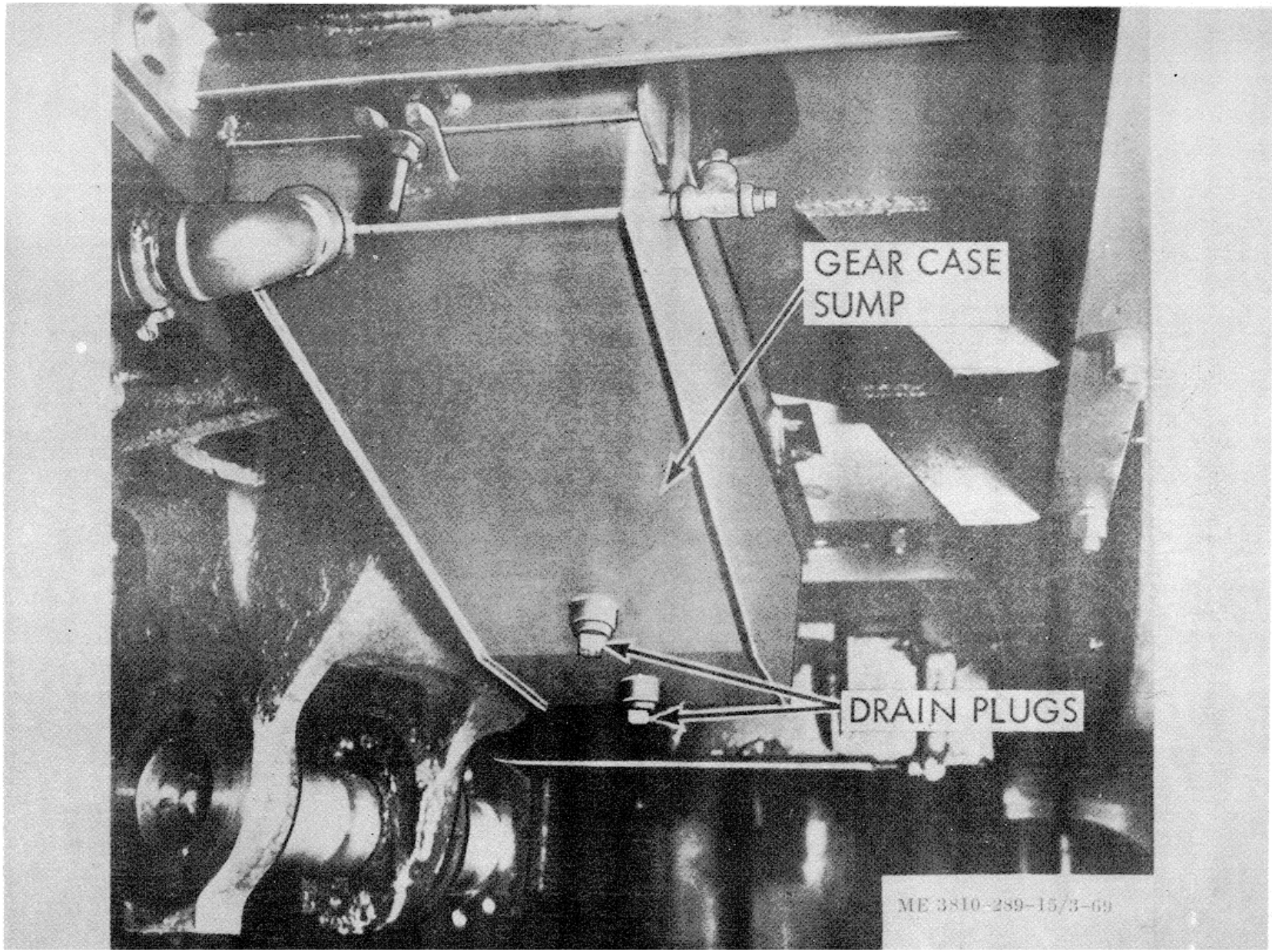
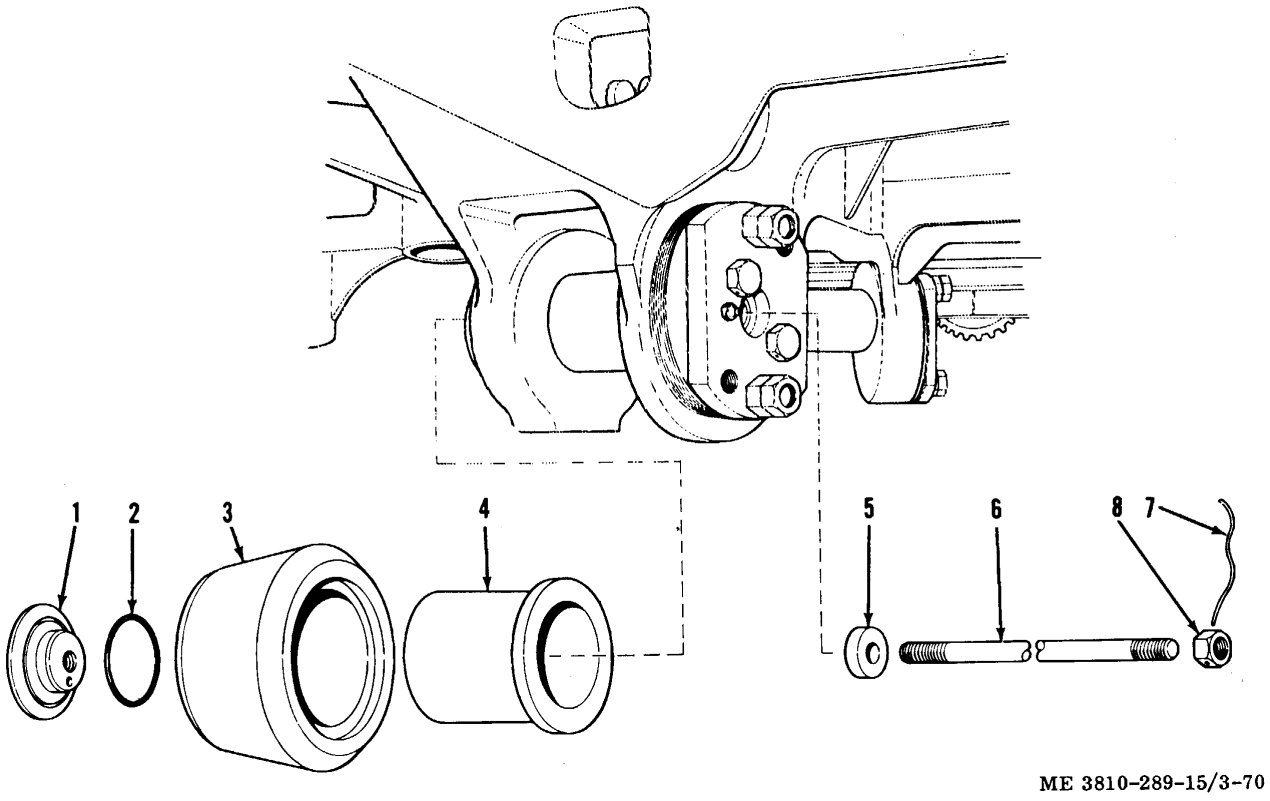


Figure 4-52. Gear case sump.



1 Nut
2 O-ring
3 Cone roller
4 Bushing
5 Washer
6 Bolt
7 Lock wire
8 Nut

Figure 4-53. Cone roller replacement.

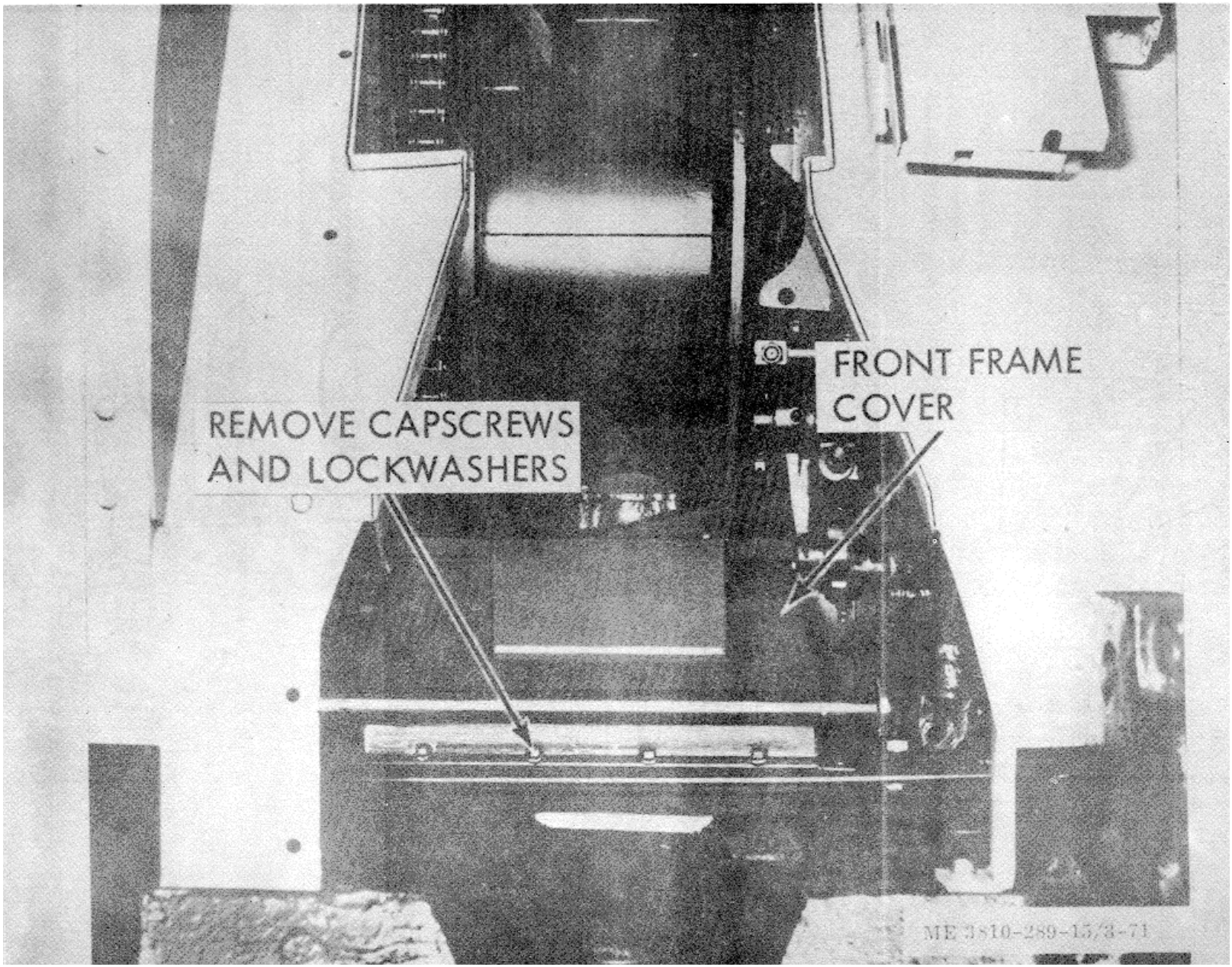


Figure 4-54. Front frame cover.

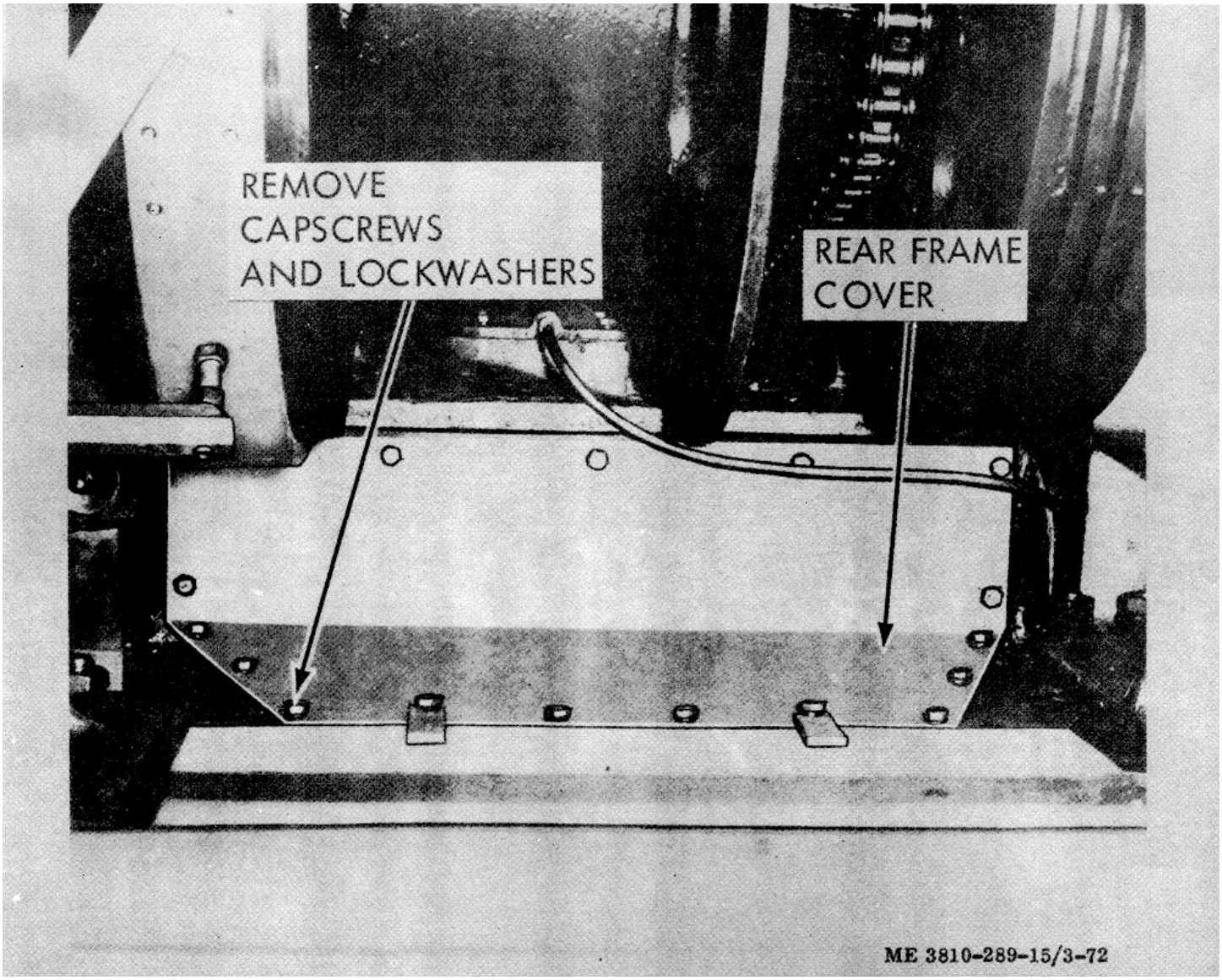


Figure 4-55. Rear frame cover.

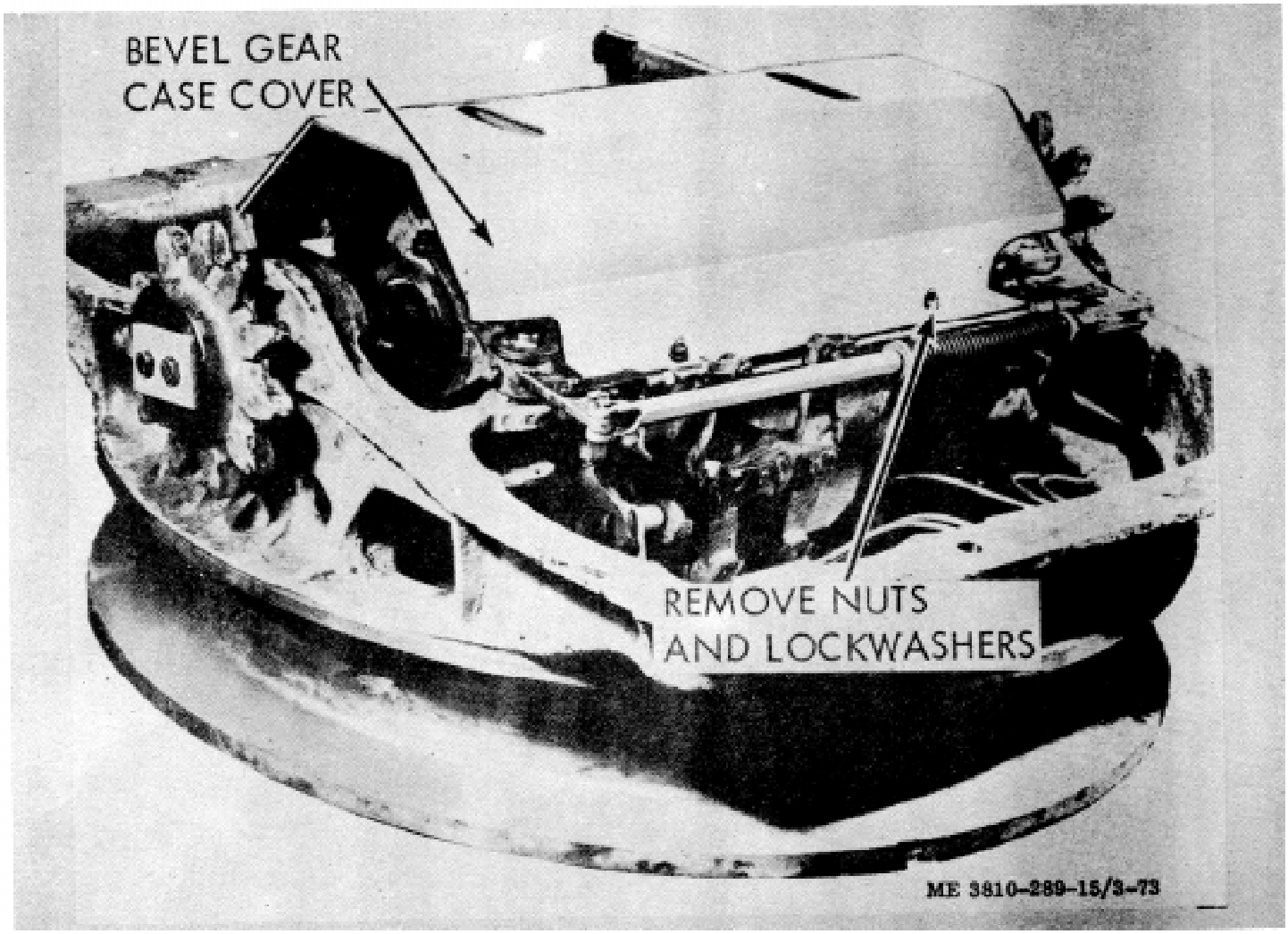


Figure 4-56. Bevel gear case cover.

Section XVII. MAINTENANCE SHOVEL FRONT END EQUIPMENT

4-68. General

a. This section contains instructions for replacing the shovel front end equipment and for maintenance of components. For front end conversion to a shovel, refer to paragraph 2-8.

b. Refer to paragraph 1-4f for description of the shovel front end equipment.

c. Use a crane or other adequate lifting device for removing and installing components of the shovel front end attachment.

4-69. Replacement of Shovel Front End Equipment

a. Removal.

(1) Lower boom on support cribbing (fig 2-22).

(2) Remove shovel dipper and boom suspension cables (fig. 2-23).

(3) Remove front crowd chain (fig. 2-20).

(4) Remove boom foot locking bolts and pins.

(5) Propel machine slowly backward until boom foot is separated from lugs on revolving frame.

b. Cleaning, Inspection and Repair.

(1) Clean and inspect boom assembly, dipper, and handle, for damaged or missing parts. Lubricate in accordance with current lubrication order.

(2) Repair or replace damaged or defective components.

c. Installation. Installation procedure is reverse of removal, a, above.

4-70. Shovel Dipper and Padlock

*a. Remova*l.

(1) Lower dipper to rest on blocks, then remove hoist cable from bail sheave (fig. 4-57).

(2) Disconnect trip cable from trip lever. Remove nuts from pins securing braces to dipper handle, and remove pins.

(3) Remove nuts and washers from pin securing dipper to handle. Remove handle pin and remove dipper and padlock from handle.

b. Installation. Installation procedure is reverse of removal, a, above. Refer to paragraph 2-8 for adjustments.

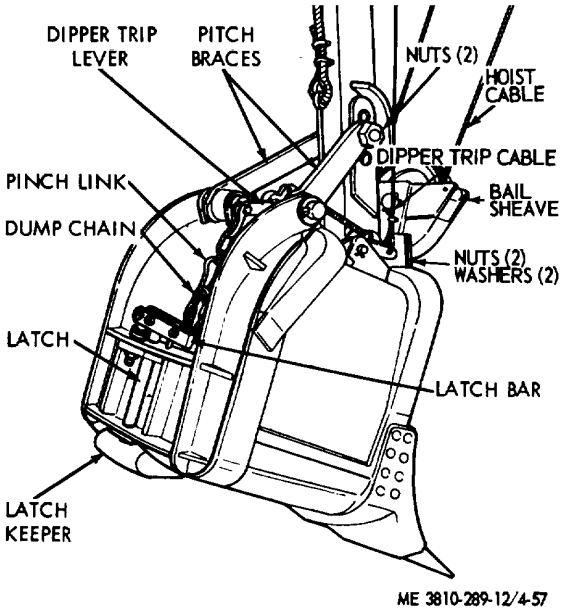


Figure 4-57. Shovel dipper assembly, removal and installation.

4-71. Shovel Dipper Handle

a. General. The dipper handle, with the saddle lock, is attached to the shipper shaft at the center of the boom and provides crowd action and support for the dipper.

b. Removal.

(1) Lower dipper to rest on blocks and remove hoist cable from bail sheave (fig. 4-57).

(2) Disconnect trip cable from trip lever. Remove nuts from pins securing braces to dipper handle and remove pins.

(3) Remove front crowd chain (fig. 2-20).

(4) Lash saddle block to boom to prevent it from changing angles when dipper handle is removed from shipper shaft.

(5) Attach lifting sling to handle with ends of sling attached three feet from each end of handle. Attach sling to lifting device.

(6) Remove cable guard from end of handle.

(7) Back machine, slowly, until the handle is pulled from the saddle block.

(8) Remove cotter pins and washers from handle pins. Remove handle pins and handle from dipper.

c. *Installation.* Installation procedure is reverse of removal, b, above.

4-72. Saddle Block and Shipper Shaft

a. General. The saddle block and shipper shaft consist primarily of a shaft, bushings, saddle block, and wear bars.

b. Removal.

(1) Remove dipper and handle (para 4-71).

(2) Attach lifting sling to saddle block and sheave. Attach sling to lifting device.

(3) Remove shipper shaft bushing and lift saddle block and sheave from shovel boom.

c. Disassembly. Refer to figure 4-58 and disassemble saddle block.

d. Cleaning, Inspection and Repair.

(1) Clean and inspect parts for wear and damage. Replace worn or damaged parts.

(2) Check wearing plates for proper clearance. Adjust if necessary.

e. Reassembly. Refer to figure 4-58 and reassemble saddle block.

f. Adjustment of Saddle Block Wearing Plates. Refer to paragraph 2-8a(13).

g. Installation. Installation procedure is reverse of removal, *b,* above.

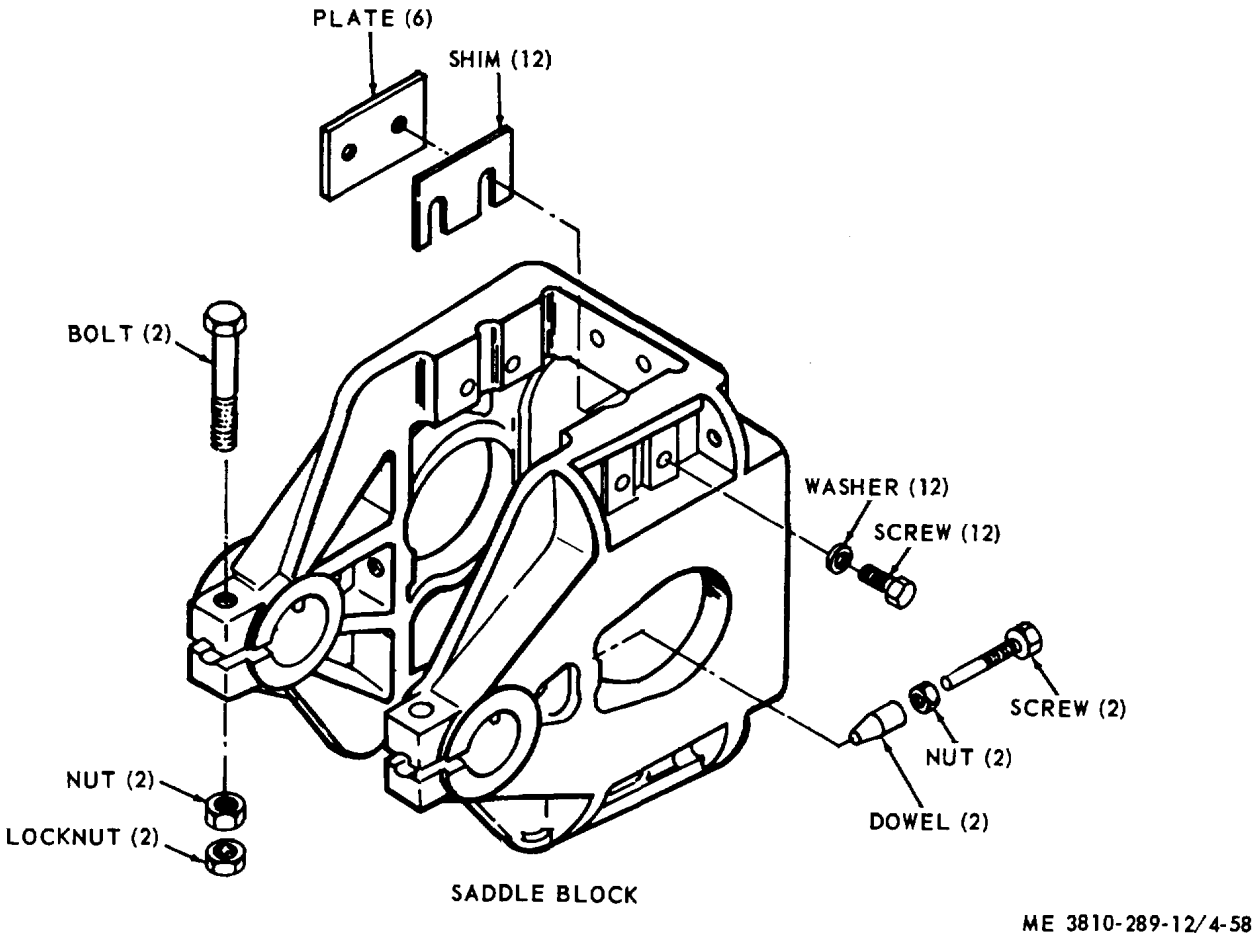


Figure 4-58. Saddle block, disassembly and reassembly.

4-73. Shovel Boom

a. General. The shovel boom is attached at the base to the superstructure turntable. It supports the dipper and handle assemblies. The outer end of the boom is supported by the boom hoist cables. The shovel boom consists of the boom weldment, cable sheaves, guards, bushings, and shafts.

b. Removal.

(1) Remove boom assembly, dipper, and handle (para 4-69a).

(2) Remove dipper handle and dipper assembly (para 4-71).

(3) Remove saddle block and shipper shaft (para 4-72).

c. *Cleaning, Inspection and Repair.* Clean and inspect parts for wear and damage. Replace worn or damaged parts.

d. Installation. Installation procedure is reverse of removal, b, above. Refer to paragraph 2-8 for adjustments.

Section XVIII. MAINTENANCE OF BACKHOE FRONT END EQUIPMENT

4-74. General

a. This section contains instructions for replacing the backhoe front end equipment and for maintenance of components. For front end conversion to a backhoe, refer to paragraph 2-7.

b. Refer to paragraph 1-4e for description the backhoe front end equipment.

c. Use a crane or other adequate lifting device for removing and installing components.

4-75. Replacement of Backhoe Front End Equipment

a. Removal.

(1) Lower boom on support cribbing (fig 2-15).

(2) Remove backhoe dipper and boom suspension cables (fig. 2-16).

(3) Remove boom foot locking bolts and pins.

(4) Propel machine slowly backward until boom foot is separated from lugs on revolving frame.

b. Cleaning, Inspection and Repair.

(1) Clean and inspect boom assembly, dipper, and handle, for damaged or missing parts. Lubricate in accordance with current lubrication order.

(2) Repair or replace damaged or defective components.

c. Installation. Installation procedure is reverse of removal, *a,* above.

4-76. Backhoe Dipper and Padlock

a. General. The dipper assembly consists of the dipper, dipper teeth, side cutters, attaching pins and bushings, and the padlock sheave assembly. The dipper is attached to the handle and pitch brace assembly. It is actuated by the pull cables through the padlock sheave assembly.

b. Removal.

(1) Lower dipper to rest on blocks, then remove drag cable from padlock sheave.

(2) Remove cotter pins and washers from handle and pitch brace pins. Remove handle and pitch brace pins, and remove dipper and padlock from handle.

c. Disassembly. Refer to figure 4-59 and disassemble dipper.

d. Cleaning, Inspection and Repair.

(1) Clean and inspect parts and attaching hardware for damage and wear.

(2) Inspect teeth and side cutters for wear and damage.

(3) Inspect padlock assembly for worn or damaged links, broken pins, and missing parts. Inspect sheave and bushing for wear and damage.

(4) Repair or replace damaged, worn, or missing parts.

e. Reassembly. Refer to figure 4-59 and reassemble dipper.

f. Installation. Installation procedure is reverse of removal, b, above.

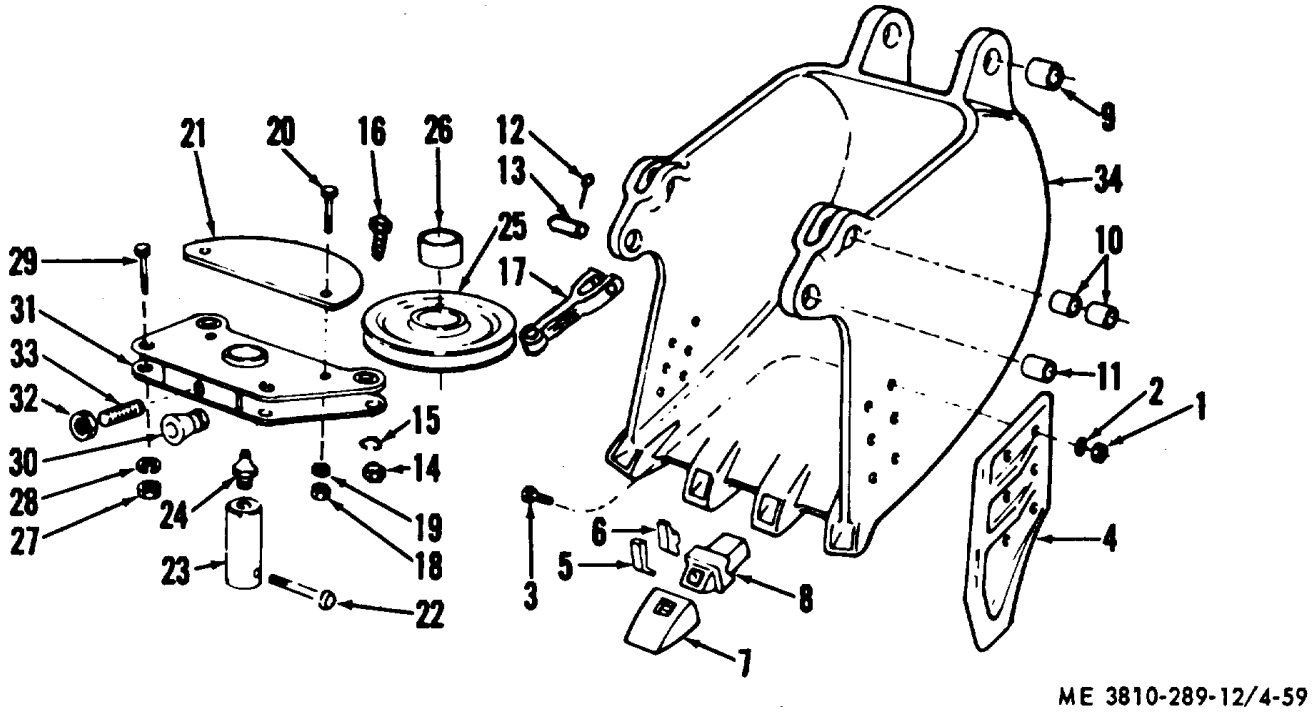
4-77. Backhoe Handle and Back Brace

a. Removal.

(1) Lower dipper to rest on blocks. Build cribbing under boom (fig. 2-15).

(2) Remove deflector and hoist cables (fig. 2-16).

(3) Attach lifting sling to handle with ends of sling attached near each end of handle. Attach sling to lifting device.



2 Washer, lock (12)
3 Bolt, special (12)
4 Side cutter (2)
5 Keeper, lock
6 Keeper
7 Tooth (4)
8 Shank (4)
9 Bushing (2)
10 Bushing 4)
11 Bushing (2)
12 Pin, cotter (2)
14 Nut (2)
15 Washer, lock (2)
16 Screw, cap (2)
17 Link (2)
18 Nut (2)
19 Washer, lock (2)
20 Screw, cap (2)
21 Cover plate
22 Bolt
23 Pin
24 Fitting, lubrication
26 Bushing
27 Nut (2)
28 Washer, lock (2)
29 Bolt (2)
30 Guide, cable (2)
31 Frame
32 Nut, lock
33 Screw, set
34 Scoop

Figure 4-59. Backhoe dipper assembly, exploded view.

(4) Remove cotter pin from dipper back brace pin and remove pin.

(5) Remove handle end pin from end bolt and remove bolt securing handle to dipper.

(6) Remove boom hoist hinge pin and remove handle and back brace.

b. Disassembly. Refer to figure 4-60 and disassemble handle and back brace.

c. Cleaning, Inspection and Repair.

(1) Clean and inspect parts for damage and wear.

(2) Repair or replace worn or damaged parts.

d. Reassembly. Refer to figure 460 and reassemble handle and back brace.

e. Installation. Installation procedure is reverse of removal, *a,* above.

4-78. Backhoe Auxiliary A-Frame

a. Removal.

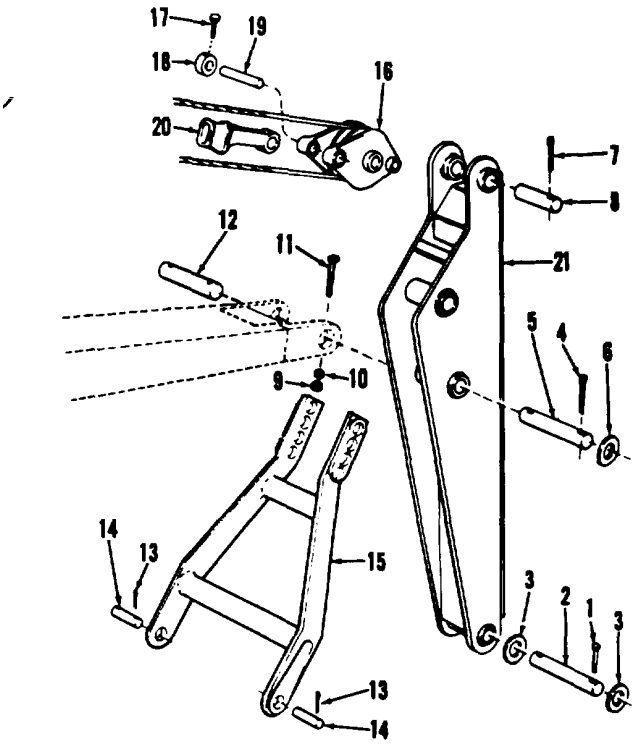
(1) Lower boom to rest on cribbing (fig.2-15).

(2) Remove hoist and suspension cables (fig. 2-16). Disconnect cables at dead-end sockets and wind on drums.

(3) Remove locking bolts and pins securing A-frame to lugs on revolving frame and remove auxiliary A-frame.

b. Disassembly and Reassemble. Refer to figure 4-61 for disassembly and reassembly of auxiliary A-frame.

c. Installation. Installation procedure is reverse of removal, *a,* above.



1 Pin, cotter	11 Bolt (2)
2 Pin	12 Pin
3 Washer, flat (2)	13 Pin, cotter
4 Pin, cotter	14 Pin
5 Pin	15 Pitch brace
6 Washer, fiat	16 Pulley and block assembly
7 Pin, cotter	17 Bolt
8 Pin	18 Collar
9 Nut (2)	19 Pin
10 Washer, lock (2)	20 Socket, cable

Figure 4-60. Backhoe handle and pitch brace assembly, exploded view

4-79. Backhoe Boom

a. Removal.

(1) Remove backhoe front end equipment (para 4-7***Sa***).

(2) Remove dipper (para 4-76), handle (para 4-77), and auxiliary A-frame (para 478).

b. Disassembly and Reassembly. Refer to figure 4-62 for disassembly and reassembly of backhoe boom assembly.

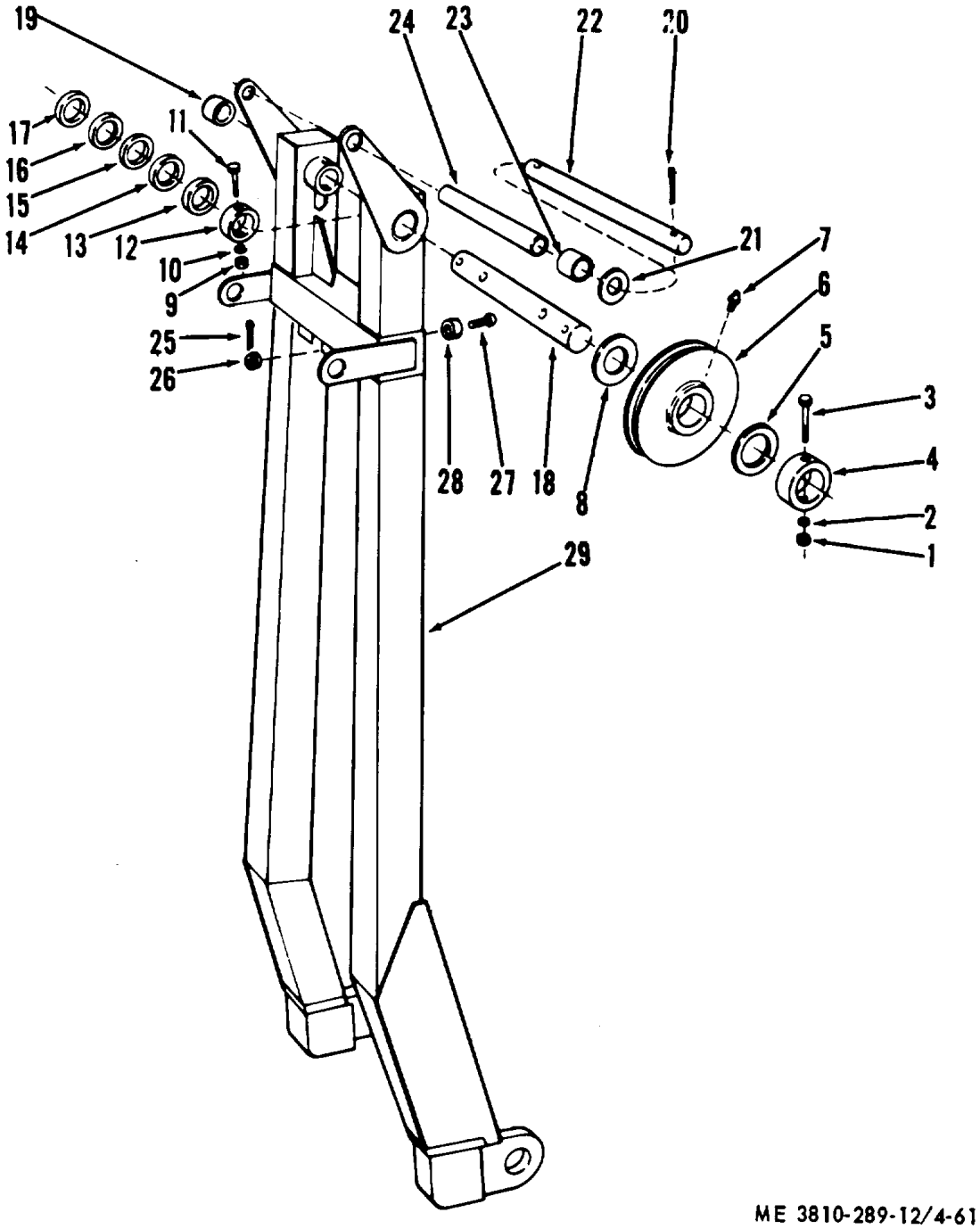
c. Cleaning, Inspection and Repair.

(1) Clean parts with an approved cleaning solvent.

(2) Inspect boom, sheaves, and bushings for wear and damage. Replace worn or damaged parts.

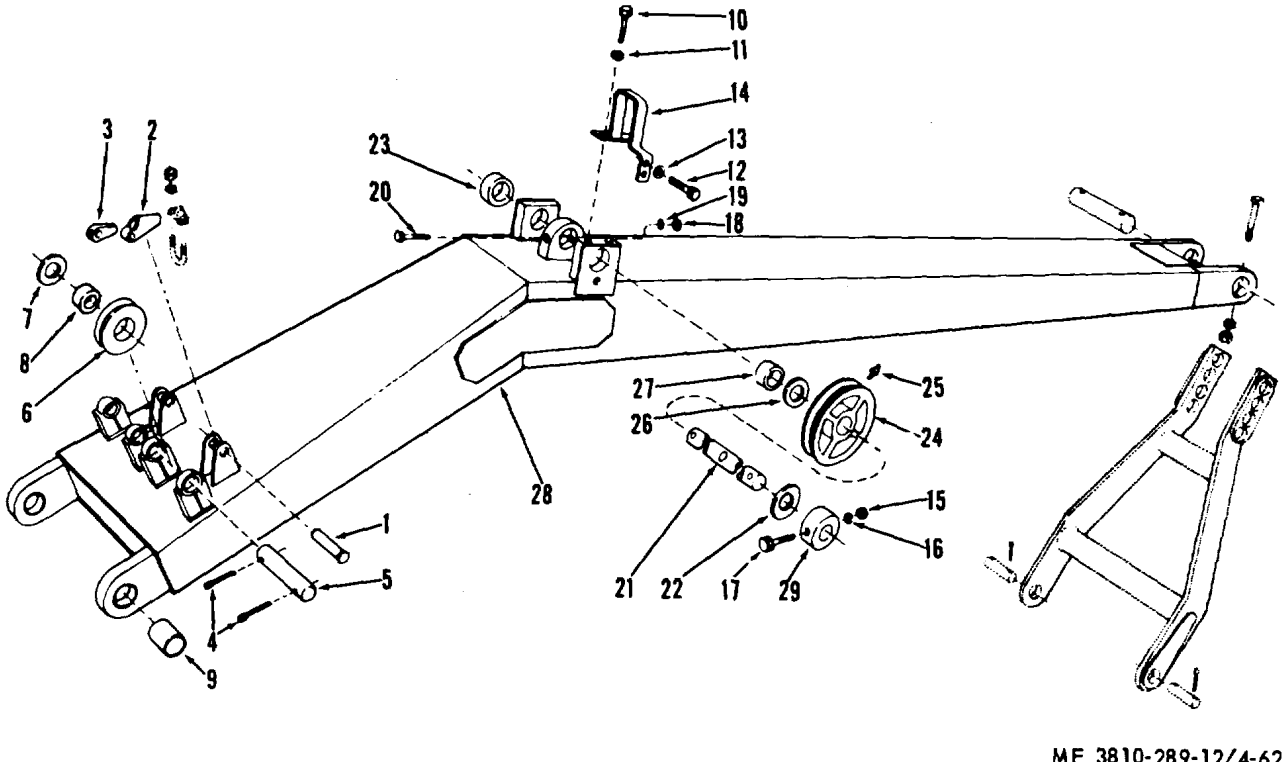
(3) Lubricate boom assembly in accordance with current lubrication chart.

d. Installation. Installation procedure is reverse of removal, a, above.



1 Nut
2 Washer, lock
3 Bolt
4 Collar
5 Washer, flat
6 Sheave (4)
7 Fitting, lubrication
8 Washer, flat
9 Nut
10 Washer, lock
11 Bolt
12 Collar
13 Spacer
14 Spacer
15 Spacer
16 Spacer
17 Spacer
18 Shaft
19 Bushing
20 Pin, cotter
21 Washer, flat
22 Shaft
23 Spacer, pipe
24 Spacer, pipe
25 Pin, cotter (2)
26 Nut (2)
27 Bolt (2)
28 Bumper (2)

Figure 4-61. Backhoe A-frame assembly, exploded view.



1 Pin
2 Socket, cable
3 Wedge, cable
4 Pin (2)
5 Pin
6 Sheave roller
7 Washer, flat
8 Bushing
9 Bushing
10 Screw, cap
11 Washer, lock
12 Screw, cap
13 Washer, lock
14 Guard, cable
15 Nut
16 Washer, lock
17 Bolt
18 Nut
19 Washer, lock
20 Bolt
21 Shaft
22 Washer, flat
23 Collar
24 Sheave
25 Fitting, lubrication
26 Washer, flat
27 Bushing
28 Boom
29 Collar

Figure 4-62. Backhoe boom assembly, exploded view.

APPENDIX A

REFERENCES

A-1. Fire Protection

TB 5-4200-200-10	Hand Portable Fire Extinguishers for Army Users

A-2. Lubrication

C9100-1L	Fuels, Lubricants, Oils and Waxes
LO 5-3810-289-12	Lubrication Order for Crane-Shovel, Crawler Mtd, 121/2-Ton Capacity, ¾-Cu Yd, Bucyrus Erie Model 22BM.

A-3. Maintenance

TB 750-651	Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems
	Army Equipment Record Procedures00052
TM 38-750	Organizational Maintenance, Repair Parts and Special Tool List for Crane-Shovel, Crawler Mounted, 121/2-Ton Capacity, ¾-Cu Yd, Bucy Rus-Erie Model 22BM
TM 5-3810-289-20P	Lifting, Loading and Hauling Equipment
TM 5-331B	Operator and Organizational, Field and Depot Maintenance Storage Batteries, Lead-Acid Type
TM 9-6140-200-15	
TM 5-764	Electric Motor and Generator Repair
TB 385-101	Safety Use of Cranes, Crane-Shovel, Draglines And Similar Equipment Near Electric Power Lines

A-4. Painting

TM 9-213	Painting Instructions for Field Use

A-5. Radio Suppression

TM 11-483	Radio Interference Suppression

A-6. Shipment and Storage

TM 740-90-1	Administrative Storage of Equipment

A-7. Destruction of Materiel

TM 750-244-3	Destruction of Material to Prevent Enemy Use

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or components will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from section II.

d. Section IV contains supplemental instructions, explanatory notes and/or illustrations required for a particular maintenance function.

B-2. Explanation of Columns in Section II

a. Group Number, Column (1). The functional group is a numerical group set up on a functional basis. The applicable functional grouping indexes are listed on the MAC (Maintenance Allocation Chart) in the appropriate numerical sequence. These indexes are normally set up in accordance with their function and proximity to each other.

b. Functional Group, Column (2). This column contains a brief description of the components of each functional group.

c. Maintenance Functions, Column (3). This column lists the various maintenance functions (A through K) and indicates the lowest maintenance level authorized to perform these functions. The symbol designations for the various maintenance levels are as follows:

C-Operator or crew
O-Organizational maintenance
F-Direct support maintenance
H-General support maintenance
D-Depot maintenance

The maintenance functions are defined as follows:

A- Inspect. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

B- Test. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

C- Service. To clean, to preserve, to charge, to paint, and to add fuel, lubricants, cooling agents, and air.

D- Adjust. To rectify to the extent necessary to bring into proper operating range.

E- Aline. To adjust specified variable elements of an item to bring to optimum performance.

F- Calibrate. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

G- Install. To set up for use in an operational environment such as an emplacement, site, or vehicle.

H- Replace. To replace unserviceable items with serviceable assemblies, subassemblies, or parts.

I- Repair. To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

J- Overhaul. To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards, using the Inspect and Repair Only as Necessary (IROAN) technique.

K- Rebuild. To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, Inspection of all parts or components,

repair or replacement of worn or unservice able elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item.

d. Tools and Equipment, Column (4). This column is provided for referencing by code the special tools and test equipment (sec III) required to perform the maintenance functions (sec II).

e. Remarks, Column (5). This column is provided for referencing by code the remarks (sec IV) pertinent to the maintenance functions

B-3. Explanation of Columns in Section

a. Reference Code. This column consists of a number and a letter separated by a dash. The number references the T&TE requirements column on the MAC. The letter represents the specific maintenance function the item is to be used with. The letter is representative of columns A through K on the MAC.

b. Maintenance Level. This column shows the lowest level of maintenance authorized to use the special tool or test equipment.

c. Nomenclature. This column lists the name or identification of the tool or test equipment.

d. Tool Number. This column lists the manufacturer's code and part number, or Federal stock number of tools and test equipment.

B-4. Explanation of Columns in Section IV

a. Reference Code. This column consists of two letters separated by a dash, both of which are references to section II. The first letter references column (5) and the second letter references a maintenance function, column (3), A through K.

b. Remarks. This column lists information pertinent to the maintenance function being performed, as indicated on the MAC, section II.

Section II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
01	ENGINE													
0100	Engine Assembly	C	F	C	--	--	F	--	F	F	H	D	--	A
0101	Crankcase, Blk, Cyl Head; Block, cylinders,													
	Crankcase	--	--	--	--	--	--	--	F	F				
	Head, cylinder	--	--	--	--	--	--	--	F	F				
0102	Crankshaft:													
	Crankshaft Assembly;													
	Bearings	--	--	--	--	--	--	--	H	--	H	D		B
	Seals													
	Damper and pulley	F	--	--	--	--	--	--	F					
0103	Flywheel Assembly:	--	--	--	--	--	--	--	F	F				
0104	Pistons; Connecting Rods:	--	--	--	--	--	--	--	H	H				
0105	Valves, Camshafts and Timing Systems:													
	Arm assembly rocker	--	--	--	O	--	--	--	H	H	--	--	1	
	Bushings, camshaft, gears	H	--	--	--	--	--	--	H					
	Cover, valve	O	--	--	--	--	--	--	O					
	Push rods, springs, guides, locks, valves and seats	--	--	--	--	--	--	--	H	H				
0106	Engine Lubrication System:													
	Cooler, oil	O	--	--	--	--	--	--	O					
	Filter assembly, oil	--	--	C	--	--	--	--	O	O				
	Lines; pan, oil	F	--	--	--	--	--	--	F					
	Pump, oil	--	--	--	--	--	--	--	H	D				
	Valve, bypass	O	--	--	--	--	--	--	O					
0108	Manifolds	O	--	--		--	--	--	O					
0109	Accessory Driving Mechanism	F	--	--	--	--	--	--	F					
02	CLUTCH													
0200	Clutch Assembly	C	--	C	C	--	--	--	F	F	F			
0202	Clutch Release Mechanism:													
	Bearings	F	--	--	--	--	--	--	F					
	Rods, levers	--	--	--	C	--	--	--	O					

Section II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) FUNCTIONAL GROUP	(3) (4) (5) MAINTENANCE FUNCTIONS EQUIPMENT											TOOLS and equipment	Remarks
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
03	FUEL SYSTEM													
0301	Fuel Injector	--	F	--	F	--	--	--	F	F				
0302	Fuel Pump	--	H	O	F	--	--	--	F	F	H	D		C
0304	Air Cleaner	--	--	C	--	--	--	--	O					
0306	Tank, Lines, Fittings:													
	Lines, fittings, valve, shutoff	O	--	--	--	--	--	--	O					
	Strainer, cap, tank	--	--	C	--	--	--	--	O					
	Tank, fuel	C	--	--	--	--	--	--	O	F				
0308	Engine Speed Governor	--	O	--	O	--	--	--	O	F	H			
0309	Fuel Filters	--	--	O	--	--	--	--	O	--	--	--		
0311	Engine Starting Aids:													
	Primer unit, lines, fittings	--	--	--	--	--	--	--	O	F				
0312	Throttle Control	--	O	--	--	--	--	--	O					
04	EXHAUST SYSTEM													
0401	Muffler and Pipes	O	--	--	--	--	--	--	O					
05	COOLING SYSTEM													
0501	Radiator	C	O	C	--	--	--	--	O	F				
	Cap	O	--	--	--	--	--	--	O					
0502	Shroud	--	--	--	--	--	--	--	O	O				
0503	Water Manifold, Thermo-stats and Housing Gasket	O	--	--	--	--	--	--	O					
0504	Water Pump	--	--	--	--	--	--	--	F	F	H			
0505	Fan Assembly:													
	Blade and guard	O	--	--	--	--	--	--	O					
	Bearings	--	--	C	--	--	--	--	F					
	Shaft and pulley	F	--	--	--	--	--	--	F					
	Belt, fan	C	--	C	--	--	--	--	O	--	--	--	2	
06	ELECTRICAL SYSTEM:													
0601	Alternator													
	Alternator assembly	--	O	C	--	--	--	--	O	F				
	Pulley	O	--	--	--	--	--	--	O					
	Belts	C	--	--	C	--	--	--	O	--	--	--	2	
0603	Starting Motor:													
	Motor, starting	--	O	C	--	--	--	--	O	F	--	--		E
	Solenoid	--	O	--	--	--	--	--	O					
0606	Engine Safety Controls													
	Governor, over speed	--	--	--	O	--	--	--	O	O				
	Switch	O	--	--	--	--	--	--	O					

0607	Instrument or Engine Control Panel: Switches; gages; Meters	O	--	--	--	--	--	--	O			
	Lights, panel Lamps; fuses	O	--	--	--	--	--	--	O			
	Wiring harness	--	--	--	--	--	--	--	F	O		
0609	Lights: Floodlights	O	--	--	--	--	--	--	O			
	Lamps, floodlight	O	--	--	--	--	--	--	O			
0610	Sending Units and Warning Switches	O	--	--	--	--	--	--	O			
0611	Horn	O	--	--	--	--	--	--	O			
0612	Batteries, Storage: Batteries	C	O	C	--	--	--	--	O			
	Box, battery, cables, Battery	C	--	C	--	--	--	--	O	O		
0613	Chassis Wiring Harness	--	--	--	--	--	--	--	F	O		
0615	Radio Interfer Supp	--	O	--	--	--	--	--	O			
07	TRANSMISSION											
0700	Transmission Assembly, Shaft	C	--	O	--	--	--	--	F	F	H	
13	WHEELS, AND TRACKS											
1301	Suspension Assembly	O	--	--	--	--	--	--	H	F		
1302	Track Support Rollers & Brackets	C	--	C	--	--	--	--	0	0		
1303	Track Idlers & Brackets	C	--	C	--	--	--	--	F	F		
1304	Track Drive Sprockets: Sprockets	F	--	--	--	--	--	--	F			
	Chain, roller	--	--	--	O	--	--	--	O	O		
1305	Track Assembly	C	--	--	C	--	--	--	F	O		
15	FRAME											
1502	Counterweights	O	--	--	--	--	--	--	O			
18	CAB											
1801	Cab assembly: Doors, guides, glass, panels, platforms	C	--	--	--	--	--	--	O			
1806	Upholstery Seats & Carpets: Seat assembly	--	--	--	C	--	--	--	O	O		
74	CRANES, SHOVELS & EARTH-MOVING EQ COMPONENTS											
7410	Shovel Front Attachment: Boom assembly	--	--	--	--	--	--	--	O	O		
	Saddle block assembly	--	--	--	--	--	--	--	O	O		
	Dipper assembly	--	--	--	--	--	--	--	O	O		
	Padlock assembly	--	--	--	--	--	--	--	O	O		

Section II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
7411	Crane Attachments:													
	Boom assembly; sheaves; hook block; bridle assembly	C	--	C	--	--	--	--	O	O				
	Cables	C	--	--	--	--	--	--	O					
	Safety boom stop	--	--	--	--	--	--	--	O	O				
	Pulleys, pins and Bushings	O	--	--	--	--	--	--	O					
7412	Backhoe Attachments:													
	Boom assembly	--	--	--	--	--	--	--	O	O				
	Dipper	--	--	--	--	--	--	--	O	O				
	Auxiliary A-frame													
7413	Piledriver Attachment	--	--	--	--	--	--	--	O	O				
7414	Base Deck:													
	Upper structure assembly	C	--	C	--	--	--	--	H	F	D			
	Revolving base	C	--	C	C	--	--	--	D	F				
7415	Clutches	C	--	C	C	--	--	--	O	F				
7416	Shafts:													
	Chain, drive	--	--	--	O	--	--	--	O	O				
	Sprockets, gears, bearings	F	--	--	--	--	--	--	F					
	Case assembly, chain	C	--	C	--	--	--	--	O	F				
	Coupling, shaft; shaft ay	C	--	C	--	--	--	--	H	H				
7417	Hoists:													
	Hoist assemblies	C	--	C	--	--	--	--	F	H				
	Guards, shields, lagging and drums	O	--	--	--	--	--	--	O					
7419	Turntable:													
	Bushing, pivot	--	--	C	--	--	--	--	H					
	Rollers	--	--	C	--	--	--	--	O	F				
	Swinglock	--	--	C	--	--	--	--	O	O				
7420	Machinery Gear Case or Frame:													
	Breathers	--	--	C	--	--	--	--	O					
	Covers; guads; pan ay, oil	--	--	--	--	--	--	--	O	O				
7421	Independent or Precision Boom Hoist	C	--	C	C	--	--	--	O					
7422	Machinery Mechanism Controls	C	--	C	C	--	--	--	O					

7423	Gantry:										
	Frame, gantry	--	--	C	--	--	--	--	O	O	
	Bushing, roller, shaft	--	--	C	--	--	--	--	O		
	Sheave assembly	--	--	C	--	--	--	--	O		
7424	Crawler Bed, Frame & Ring Gear:										
	Rack and track	C	--	--	--	--	--	--	H	D	
	Gear, ring, bearings	H	--	--	--	--	--	--	H		
7425	Propel and Steering Mechanism Bearings, Gears, Seals	F	--	--	--	--	--	--	F		
7603	FIREFIGHTING EQUIP-MENT										
7603	Fire Extinguishers	C	--	--	--	--	--	--	C		

SECTION III. SPECIAL TOOL AND SPECIAL TEST EQUIPMENT REQUIREMENTS

REFERENCE CODE	MAINTENANCE LEVEL	NOMENCLATURE	TOOL NUMBER
1-D	0	Wrench adapter	ST-669
2-D	0	Belt tension gage	ST-968

Section IV. REMARKS

Reference Code	Remarks
A-F	Test includes engine operation and compression.
B-J	Metalize, grind and resize.
C-B	Test includes bench test.
D-H	Replace filter element.
E-I	Install repair kit.

APPENDIX C

BASIC ISSUE ITEMS LIST

C-1. Scope

This appendix lists items which accompany the crane-shovel or are required for installation, operation, or operator's maintenance.

C-2. General

This basic issue items list is divided into the following sections:

a. Basic Issue Items-Section If. A list of items which accompany the crane-shovel and are required by the operator/crew for installation, operation, or maintenance.

b. Maintenance and Operating Supplies-Section III. A listing of maintenance and operating supplies required for initial operation.

C-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of basic issue items, section II.

a. Source, Maintenance, and Recoverability Codes (SMR).

(1) Source code indicates the source for the listed item. Source code is:

Code	Explanation
P	Repair parts which are stocked in or supplied from the GSA/DSA or Army supply system, and authorized for use at indicated maintenance levels.

(2) Maintenance code indicates the lowest level of maintenance authorized to install the listed item. The maintenance level code is:

Code	*Explanation*
C	Operator/crew

(3) Recoverability code indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes are:

Code	Explanation
R	Repair parts (assemblies and components) which are considered economically reparable at direct and general support maintenance levels. When the maintenance capability to repair these items does not exist, they are normally disposed of at the GS level. When supply considerations dictate, some of these repair parts may be listed for automatic return to supply for depot level repair as set forth in AR 710-50. When so listed, they will be replaced by supply on an exchange basis.
S	Repair parts and assemblies which are economically reparable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by a GSU to be uneconomically reparable, they will be evacuated to a depot for evaluation and analysis before final disposition.
T	High dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts normally are repaired or overhauled at depot maintenance activities.
U	Repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, or high dollar value reusable casings or castings.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required. The abbreviation "w/e", when used as a part of the nomenclature, indicates the Federal stock number includes all armament, equipment, accessories, and repair parts issued with the item. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers in parentheses. Repair parts quantities included in kits, sets, and assemblies, are shown in front of the repair part name.

d. Unit of Measure (U/M). A two-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based; e.g., ft, ea, pr, etc.

e. Quantity Incorporated in Unit. This column indicates the quantity of the item used in the assembly group. A "V" appearing in this column in lieu of a quantity indicates that a definite quantity cannot be indicated (e.g., shims, spacers, etc.)

f. Quantity Furnished With Equipment. This column indicates the quantity of an item furnished with the equipment.

g. Illustration. This column is divided as follows:

(*1) Figure number.* Indicates the figure number of the illustration in which the item shown.

(*2) Item number.* Indicates the callout number used to reference the item in the illustration.

C-4. Explanation of Columns in the Tabular List of Maintenance and Operating Supplies-Section III

a. Component Application. This column identifies the component application of each maintenance or operating supply item.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the item name and brief description.

d. Quantity Required for Initial Operation. This column indicates the quantity of each maintenance or operating supply item required for initial operation of the equipment.

e. Quantity Required for 8 Hours' Operation. This column indicates the estimated quantities required for an average 8 hours of operation.

f. Notes. This column indicates informative notes keyed to data appearing in a preceding column.

Section II. BASIC ISSUE ITEMS

Template missing

Section III. MAINTENANCE AND OPERATING SUPPLY

(1) COMPONENT APPLICATION	(2) Federal STOCK NO.	(3) F/INITIAL DESCRIPTION	(4) QTY REQ F/8 HRS OPN	(5) QTY REQ OPN	(6) NOTES
CHAIN CASE		OIL, LUBRICATING; 5-gal drum As follows:			(1) Includes quantity of oil to engine oil system as follows:
	9150-265-9435 (2)	OE 30	3 qt	(3)	20-qt crankcase w/filters
	9150-265-9428 (2)	OE 10	3 qt	(3)	
	9150-242-7603 (2)	OES	3 qt	(3)	(2) See C9100-IL for additional data and requisitioning procedures.
CRANKCASE		OIL, LUBRICATING: 5-gal drum As follows:			
	9150-265-9435 (2)	OE 30	20 qt	(3)	(3) See current LO for grade ap-
	9150-265-9428 (2)	OE 10	20 qt	(3)	application and replenishment I
	9150-242-7603 (2)	OES	20 qt	(3)	tervals.
GEARCASE, MAIN		OIL, LUBRICATING, GEAR: 5-gal drum as follows:			(4) Average fuel consumption is 2.3 gal per hour of continuous operation.
	9150-577-5844 (2)	GO 90	32 qt	(3)	(5) Maximum protection is obtained
	9150-259-5440 (2)	GOS	32 qt	(3)	at 60 percent by volume (4.8 pt per gal of solution).
GEARCASE CRAWLER		OIL, LUBRICATING, GEAR: 5-gal drum as follows:			
	9150-577-5844 (2)	GO 90	2 qt	(3)	
	9150-254-5440 (2)	GOS	2 qt	(3)	
GEARS, EXPOSED		OIL, LUBRICATING, EXPOSED GEAR: 5-gal can as follows:			
	9150-234-5199 (2)	CW-11-B	5 lb	(3)	
GREASE POINTS		GREASE, AUTOMOTIVE AND ARTILLERY: 5-lb can as follows:			
	9150-190-0905	GAA	5 lb	(3)	
OIL CAN POINTS		OIL, LUBRICATING: 5-gal drum As follows:			
	9150-265-9435 (2)	OE 30	1 qt	(3)	
	9150-265-9428 (2)	OE 10	1 qt	(3)	
	9150-242-7602 (2)	OES	1 qt	(3)	
RADIATOR		WATER ANTIFREEZE: 1-gal can as Follows:	28 qt		
	6850-664-1403	Ethylene-glycol ANTIFREEZE: 55-gal drum as Follows:	18 qt	(5)	

6850-174-1806		Antifreeze, arctic	28 qt		
TAG LINE		OIL, LUBRICATING, GEAR: 5-gal drum as follows:			
	9150-577-5844 (2)	GO 90	4 qt	(3)	
TANK, FUEL		FUEL, DIESEL: Bulk as Follows:			
	9140-286-5294 (2)	DF-2 Regular	50 gal	(4)	
	9140-286-5286 (2)	DF-1 Winter	50 gal	(4)	
	9140-286-5283 (2)	DF-A Arctic	50 gal	(4)	

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff

Official:

KENNETH G. **WICKHAM,**
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form **12-25, Section** II (qty rqr block No. 341) operator maintenance requirements for Crane-Shovels, Crawlers, 121/2 Ton.

U.S. GOVERNMENT **PRINTING OFFICE** : 1992 0 - 311831 (60099)

WARNING

EXPLOSION AND FIRE HAZARD

Is present when servicing batteries and filling fuel tank.

DEATH

Or severe injury may result if personnel fail to observe safety precautions. Do not smoke or use open flame around flammable material or when servicing the batteries. Do not fill the fuel tank while the engine is running. Be sure there are no open flames or exposed heated parts that can ignite fuel vapors while tank is being filled. Keep fuel container and funnel in contact while tank is being filled, or provide a ground to prevent static sparks from igniting the fuel. Do not attempt to weld a fuel tank unless the tank has been filled with the water and thoroughly flushed to eliminate combustible fuel vapors.

HIGH VOLTAGE HAZARD

Is present if the boom accidentally contacts a power line.

DEATH

Or severe injury may result if personnel fail to observe safety precautions. Keep the boom away from power lines. If the boom accidentally contacts a power line, jump from the machine; do not step off.

TEAR ALONG PERFORATED LINE

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