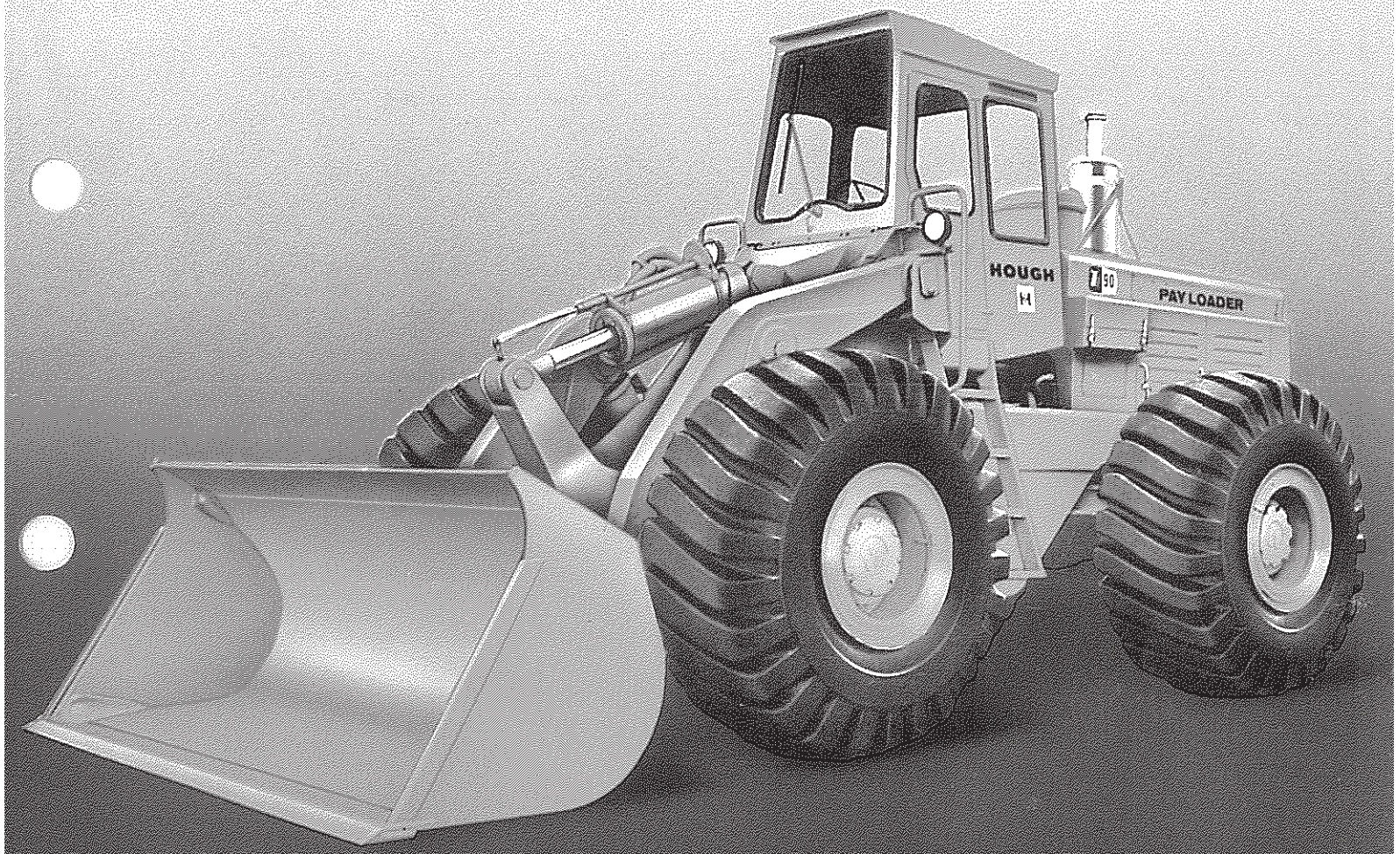
H-90E

PAY® loader Specifications



PAY LINE DIVISION

International®

H-90E
PAY.loader®

ENGINE:

Make and model ..... International—DVT-573B
Type ..... 4 cycle diesel, turbocharged, direct start, direct injection.
*Rated horsepower (kW) 260 (196)
**Flywheel horsepower (kW) 239 (180)
governed rpm 2500
Max. torque
(lb.-ft.) 655
(N·m) ..... (888)
rpm 1700
Bore and stroke, in. ..... 4.5 x 4.5 (114 x 114 mm)
No. of cylinders 8
Displacement, cu. in. (litre) 573 (9.39)
Electrical system ..... 24 Volt
AMA HP U.S. tax purposes 64.8

*Rated horsepower output of standard engine complete with water pump, lubricating oil pump and fuel pump under SAE standard ambient temperature and barometric conditions of 29.38" Hg. (99.2 kPa) and 85°F (29.4°C).

**Flywheel horsepower output of standard engine as installed in this vehicle with addition of fan, air cleaner, alternator and air compressor. No deration required up to 10,000 ft. (3048 m) altitude.

TORQUE CONVERTER:

Single stage, single phase type, 2.6 to 1 stall ratio.

TRANSMISSION:

Full power shift, countershaft type, constant mesh.

Speeds	1st	2nd	3rd	4th
Fwd. & Rev. mph	0—4.6	0—8.3	0—17.3	0—31.7
(km/h)	(7.40)	(13.35)	(27.83)	(51.00)

DIFFERENTIALS:

Power transfer.

AXLES:

Heavy-duty type with full-floating axle shafts and planetary final drive. Four wheel drive.
Front axle fixed, rear axle oscillates a total of 30°. Vertical wheel travel of 23" (584 mm).

STEERING:

Articulated frame. Full hydraulic power with mechanical follow-up.

BRAKES:

Service—Four wheel, air-over-hydraulic, wedge-actuated shoe brakes with separate axle-by-axle operation. Operator's choice braking: left pedal neutralizes transmission and applies brakes, right pedal applies brakes only. Automatic, low-pressure-apply brake system with low-pressure warning buzzer. Parking-mechanical type intermediate drive shaft.

HYDRAULIC SYSTEM:

Type: Closed with pressure control (30 lb. per sq. in.) (0.21 MPa) and vacuum relief.
Raise boom in 7.9 sec. Lower boom in 5.6 sec.
Roll back bucket in 2.5 sec. Dump bucket in 3.8 sec.
Reservoir: Cylindrical type with (4) 6" x 18" (152 x 457 mm) five-micron filters for full flow filtering, suction screen, removable full diameter cover for quick servicing.
Pumps: 3 Vane type, driven from accessory drive.
Main Hyd: Output at 2500 rpm and 1000 psi (6.89 MPa) 98 gpm (371 l/min).
Steering Hyd: Output at 2500 rpm and 1000 psi (6.89 MPa) 41.5 gpm (157 l/min).
Valve: Two-spool with relief valve.
Valve remote mounted.
Relief valve pressure 2500 psi (17.24 MPa).
Cylinders (double acting)—hardened chrome plated piston rods.
Boom-Bore and Stroke (2) ..... 7" x 39" (178 x 991 mm)
Bucket-Bore and Stroke (2) ..... 8" x 20.5" (203 x 521 mm)
Steering-Bore and Stroke (2) ..... 4" x 17" (102 x 432 mm)

HYDRAULIC CONTROLS:

Boom circuit: Automatic kickout adjustable from operator's deck from ground level to full lift height.
Positions: Raise, hold, down pressure and float.
Bucket circuit: Bucket indicator provides visual indication of bucket position.
Positions: Roll back, hold and dump.

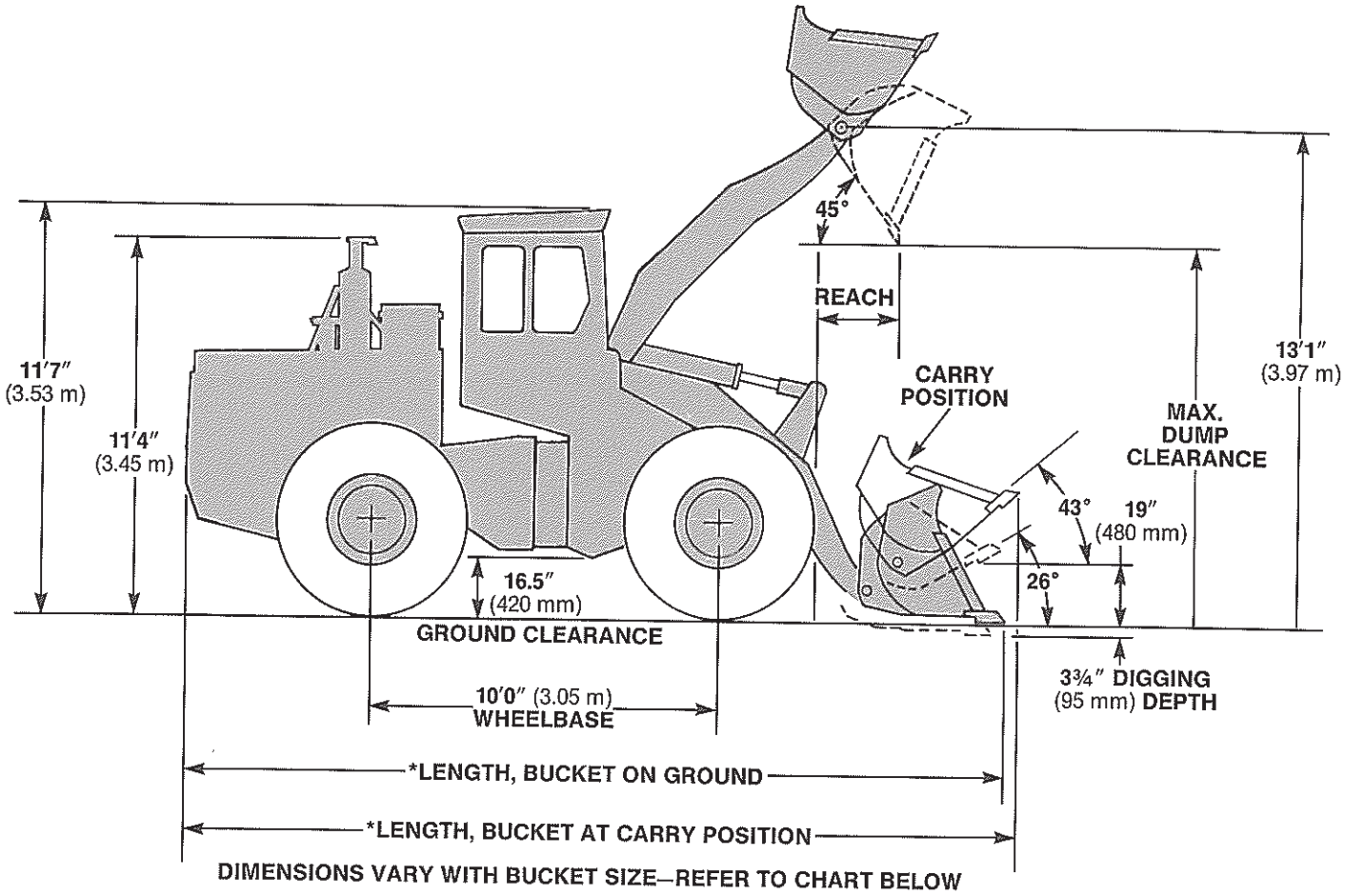
SERVICE CAPACITIES: (Approx.)

	U.S. Gal.	(litre)
Cooling system	18	(68.13)
Lube systems:		
Crankcase	8	(30.28)
Transmission	7½	(28.38)
Differential & final drive, front	8	(30.28)
Differential & final drive, rear	8	(30.28)
Hydraulic system	45	(170.33)
Fuel Tank	97	(367.17)

STANDARD EQUIPMENT:

Air cleaner, dry type dual stage with safety element
Adjustable bucket seat
Air horn
Cab, ROPS (SAE J394) with seat belt (SAE J386) tinted glass, front windshield wipers.
Cartridge type filters for engine oil
Drawbar, recessed
Engine compartment side panels
Engine coolant temperature
Hand throttle
Hydraulic system cooler
Ladders, dual access
Lights, working and traveling, 2 front, 2 rear, 2 stop and tail
Muffler
Neutral safety start
Parking brake with indicator light
Quick access service panels

GAUGES: Color-coded.
Air pressure
Air cleaner service indicator
Engine oil pressure
Fuel
Service meter
Torque converter oil temperature
Voltmeter
Water Temp



DIMENSIONS VARY WITH BUCKET SIZE—REFER TO CHART BELOW

BUCKET TYPE		General Purpose	General Purpose	General Purpose	Spade Nose Rock	Coal & Light Material
SAE Bucket Capacity	Rated-cu. yds. (m^3)	4.0 (3.1)	4.5 (3.44)	5.0 (3.82)	4.0 (3.1)	7.0 (5.35)
	Struck-cu. yds. (m^3)	3.2 (2.44)	3.8 (2.90)	4.25 (3.25)	3.4 (2.60)	6.25 (4.78)
Width—(mm)		120" (3048)	120" (3048)	120" (3048)	120" (3048)	136" (3454)
Max. Mat'l. Weight Per Cu. Yd./Lb. (kg/m^3)	Excavating	3000 (1780)	2666 (1582)	2400 (1424)	3000 (1780)	—
**Static Tipping Load with ROPS, lb. (kg)	Straight	29,924 (13573)	29,637 (13443)	29,269 (13276)	29,437 (13352)	28,694 (13015)
	Full Turn	26,932 (12216)	26,673 (12098)	26,342 (11953)	26,493 (12017)	25,825 (11714)
**Basic Operating Weight w/ROPS, lb. (kg). No Attachments Included		40,260 (18261)	40,480 (18361)	40,740 (18479)	40,480 (18362)	40,480 (18361)
*Dump Clearance, Max. Height and 45° Dump Angle—(m)		9'10" (3.00)	9'7" (2.92)	9'4" (2.84)	9'6" (2.90)	9'3" (2.82)
*Reach @ 7' Cut Edge Clearance and 45° Dump Angle—(m)		5'4" (1.63)	5'7" (1.70)	6'0" (1.84)	5'8" (1.74)	5'11" (1.82)
*Reach at Max. Height and 45° Dump Angle—(m)		3'9" (1.15)	4'0" (1.22)	4'2" (1.29)	4'1" (1.26)	4'4" (1.33)
Overall Length, Bucket on Ground—(m)		23'3.75" (7.10)	23'7.75" (7.21)	23'11.25" (7.30)	23'9.75" (7.26)	24'2" (7.37)
Overall Length, Bucket @ 19" Carry—(m)		23'11" (7.29)	24'1.6" (7.36)	24'3.9" (7.41)	24'2.9" (7.39)	24'5.7" (7.46)
Turning Radius, Outside Corner of Bucket—(m)		22'4.5" (6.82)	22'5.5" (6.85)	22'6.4" (6.87)	22'6" (6.86)	23'2.4" (7.07)
Lifting Capacity @ SAE Carry, lb. (kg)		49,278 (22352)	47,985 (21766)	44,957 (20392)	47,519 (21554)	45,282 (20539)
Breakout Force, lb. (kg)		37,478 (17122)	34,366 (15588)	32,029 (14528)	32,979 (14959)	25,672 (11645)

*Increases or Decreases according to tire size—Refer to Machine Dimensions—All dimensions and weights per SAE J-732C.

**Machine stability and weight can be increased for stockpile loading by adding larger tires, ballast or counterweights, proper selection of optional equipment for optimum machine performance is dependent upon material weight and operating conditions.

H-90E PAY loader

OPTIONAL ATTACHMENTS:

- Bucket, positioner (automatic)
- Bucket teeth
- Cab Non-ROPS w/doors, front & rear windshield wipers, floor mat
- Cab, ROPS, heater with front and rear defrosters
- Cab, Non-ROPS, tinted windshield
- Cold weather starting aid
- Counterweights
- Fenders
- Hydraulic 3-spool valve
- Lighting system, low level
- Optional buckets
- Optional gauges
- Seat suspension, "airride"
- Seat belt
- Tire inflation kit
- Rear Wipers
- Tachometer

TIRES, Ballast and Counterweights—lb. (kg)	Change in Operating Weight		Change in Full Turn, Tipping Load	
	Tires Only	4 Tires w/75% Ca Cl_2 in Rear Only	Tires Only	4 Tires w/75% Ca Cl_2 in Rear Only
23.5 x 25—12 PR (L-3)	0	+2396 (1087)	0	+3235 (1467)
23.5 x25—12 PR (L-4)	+1116 (506)	+3512 (1593)	+753 (341)	+3987 (1808)
23.5 x 25—16 PR (L-3)	+120 (54)	+2516 (1141)	+81 (37)	+3316 (1504)
23.5 x 25—20 PR (L-3)	+252 (114)	+2648 (1201)	+170 (77)	+3405 (1544)
26.5 x 25—14 PR (L-3)	+1036 (469)	+4264 (1934)	+699 (317)	+5057 (2293)
26.5 x 25—20 PR (L-3)	+1260 (571)	+4488 (2035)	+850 (385)	+5208 (2362)
26.5 x 25—20 PR (L-4)	+2428 (1101)	+5656 (2565)	+1639 (809)	+5697 (2584)
26.5 x 25—20 PR (L-5)	+3420 (1551)	+6648 (3015)	+2309 (1047)	+6666 (3023)
Side Counterweights	+1400 (635)		+2520 (1143)	
ROPS CAB not furnished	—1200 (544)		—920 (417)	

*Weights reflect an average of all tire brands. Ballast indicated for rear tires only.

MACHINE DIMENSIONS, Approx.

Tire Size	12 PR		14 PR	16 PR	20 PR		
	23.5 x 25 (L-3)	23.5 x 25 (L-4)	26.5 x 25 (L-3)	23.5 x 25 (L-3)	23.5 x 25 (L-3)	26.5 x 25 (L-3)	26.5 x 25 (L-4 & L-5)
Tread—(m)	7′5″ (2.26)	7′5″ (2.26)	7′7″ (2.31)	7′5″ (2.26)	7′5″ (2.26)	7′7″ (2.31)	7′7″ (2.31)
Width over Tires—(m)	9′5.5″ (2.88)	9′6″ (2.90)	10′10.5″ (3.31)	9′5.5″ (2.88)	9′5.5″ (2.88)	10′10.5″ (3.31)	10′10.5″ (3.31)
Change in Vert. Dimen. (mm)	0	+1.25″ (31.7)	+2.25″ (57)	0	0	+2.25″ (57)	+3.5″ (89)
Change in Reach—(mm)	0	—1.25″ (31.7)	—2.25″ (57)	0	0	—2.25″ (57)	—3.5″ (89)

Specifications subject to change without notice. Illustrations may include optional equipment and accessories and may not include all standard equipment. PAY is a registered trademark of International Harvester Company designating a family of IH products.

INTERNATIONAL HARVESTER

PAY LINE DIVISION

AD-5641-D6 7/75 LITHOGRAPHED IN UNITED STATES OF AMERICA

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INTRODUCTION

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INTRODUCTION

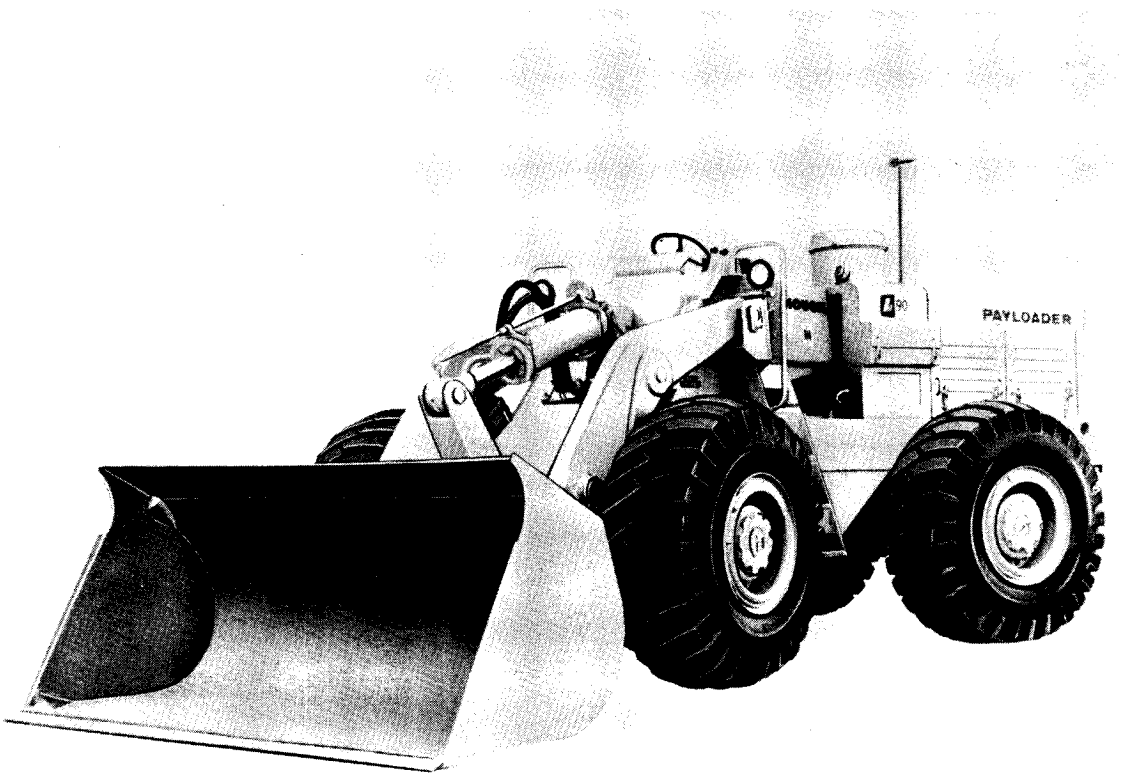
INTRODUCTION

GENERAL

The instructions contained in this service manual are for the information and guidance of servicemen responsible for the overhaul and repair of the Model H-90E PAY loader.

This manual provides the serviceman with fast, convenient reference to information on maintenance and repairs, as well as descriptions of the major units and their functions in relation to other components of the PAY loader.

Each section of the manual is provided with a contents page, and where applicable, a paragraph showing special torques and specifications necessary for inspection and/or assembly. A general specification table and a standard torque chart are provided in this section.



CE-95120

Model H-90E PAY loader - Left Front View.

LUBRICATION

Instruction on the lubrication of each assembly are given in the Lubrication Chart in the Operator's Manual. During the assembly of any parts, always coat all wearing surfaces with the lubricant specified in the chart. Except for such installations as taper pins, etc. whose surfaces should be clean and dry, use sufficient quantities of lubricant to prevent any danger of seizing, scoring or excessive wear when the assembly is first operated. Failure to provide "starting lubrication" may result in serious damage.

INTRODUCTION

SERVICE PARTS

IH and Hough Construction Equipment deserve genuine service parts. The best material obtainable and experience gathered through many years of manufacturing power equipment, enable International and Hough to produce quality that will not be found in imitation or "just as good" repair parts. No serviceman can afford to guarantee a repair job that is not serviced with genuine IH and Hough parts. No owner should be satisfied with other than genuine parts.

For the correct service parts to be used on a machine, always refer to the Parts Catalog for that particular machine. The loose leaf parts catalogs are accurate and are continually being brought up-to-date by the issuance of new pages covering any changes in part numbers.

SERIAL NUMBERS

The tractor serial number plate is located on the front left side of the operators compartment.

The IH Diesel Engine serial number is stamped on the right rear surface of the crankcase below the cylinder head.

ENGINE

The Model H-90E PAY R loader is equipped with the IH DVT-573 Diesel Engine. Instructions for removal and installation of the engine are covered in this manual. For detailed information on overhauling and adjusting the engine refer to IH Service Manual ISS-1504.

DIESEL FUEL SYSTEM

If detailed information on the fuel system of the DVT-573 Diesel Engine is desired, refer to the Injection Pump Manual, ISS-1042.

SERVICE TOOLS

The design of IH and Hough Construction Equipment machines requires a minimum of service tools other than those in the mechanic's tool kit. Whenever the application of inexpensive special service equipment will facilitate work, it is shown. Other, it is assumed that the servicemen will select from their tool kits as required. Information regarding special tool equipment is given in the "Service Tool Manual" ISS-1002. The IH and Hough Construction Equipment distributors have most of this equipment and are in an excellent position to service these PAY loaders.

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GASKETS AND SEALS

Always use new gaskets and seals. When installing a leather seal, be careful to install it as specified in the instructions. Be extremely careful not to damage the seal in any way during installation.

Do not "roll an "O"-ring during installation. To correctly install the "O"-ring, position the ring at one point and using a blunt, narrow tool, stretch the "O"-ring into position (refer to Fig. I-1). Do not stretch the "O"-ring any more than is required for proper installation.

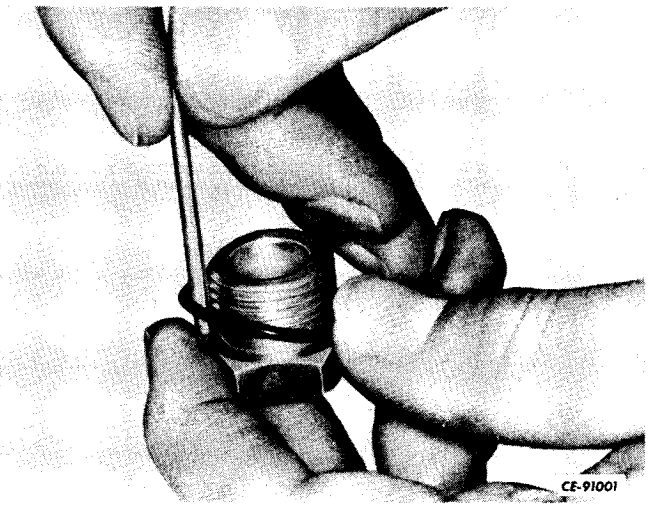

Figure I-1
Correct "O"-Ring Installation.

RECOMMENDED BEARING PROCEDURES

NEW BEARINGS

Keep bearings in original cartons or wrappings until ready for use. If package is opened and bearing is not used immediately, protect it by re-wrapping.

Before wrapping and packing, bearings are carefully cleaned by the manufacturer and are thoroughly coated with a protective lubricant.

Keep bearings clean and away from moisture.

Handle bearings with clean hands and use clean tools. Handle bearings as little as possible. Finger marks are hard to wash off and perspiration starts corrosion.

Don't wash the oil or grease out of a new bearing.

Don't take new bearings apart. They were assembled correctly in the first place.

BEARING REMOVAL

Wash off bearing housing; take care to prevent loose dirt from entering the housing.

Take a few moments to study the assembly. Determine the best way to undertake bearing removal.

Be careful and avoid damage. The bearings may be good enough to use again.

The best tool for removing a bearing is usually an arbor press. Most field work however, is done with some type of bearing puller. Where required, this manual will refer to the correct tool to employ. Use it for speed and safety.

To remove a bearing, press or pull only on the race that is tight.

Press or pull straight and square to keep the race from cocking and scoring the shaft or damaging the bearing.

Never press or pull against bearing shields or separators.

Keep the press table and support blocks clean and square. Provide some means to keep the shaft from falling on the floor. Protect the end of the shaft with a pad of lead, copper or other soft metal or a hardwood block.

(Continued on next page)

INTRODUCTION

RECOMMENDED BEARING PROCEDURES

BEARING REMOVAL - Continued

Use pullers properly. Set them up so that they will push or pull straight and square. Take care not to damage shaft threads, keyways or shoulders in the process.

With proper care, bearings may be removed quite safely with improvised methods when the right tools are not available.

A vise may do in place of an arbor press and a drift can take the place of the press ram. If the shaft is held in a vise, protect its surface with copper sheet or hardwood blocks.

A suitable block, placed over the end of a tube type driver, will allow the hammer blows to be struck in dead center. This will prevent the bearing from cocking.

If bearing fit does not permit the use of a bearing puller or arbor press the bearing will have to be cut off. Cut the outer race and ball retainer with an acetylene torch. Burn the inner race only part way through. This will protect the shaft. Crack the race the rest of the way with a hammer and chisel, using care to prevent personal injury from flying parts.

CLEANING

Don't judge the condition of a bearing until after it has been cleaned.

Don't spin dirty bearings. Rotate them slowly while washing.

Don't spin any bearings with an air hose. Rotate one race by hand, when using air, to expose all parts of the bearing.

Bearings with a shield or seal on one side only should be washed, inspected and handled in the same manner as bearings without shields or seals.

Bearings with shields or seals on both sides should not be washed. Wipe them off to keep dirt from working inside. Smooth turning bearings may be coated with protective lubricant and then wrapped and stored or used in their original application.

If a small tank and wire baskets to soak and wash bearings are not available, a clean grease can or bucket filled with solvent may be used. Let the bearings soak long enough to loosen the grease and dirt. This may require several hours or longer. Then slosh the bearing around near the top of the container, giving it a turn now and then until it is clean. Rinse in a clean container of clean solvent.

A short, clean bristle brush from which the bristles will not come out or break off is a help in removing dirt, scale or chips.

After bearings have been thoroughly cleaned, inspect them immediately.

INSPECTION

A little tarnish, stain or corrosion on the outside surfaces of the races is not detrimental to the operation of the bearing and need not be removed.

Bearings are inspected by holding the inner race so that its axis is vertical (bearing is then horizontal), and turning the outer race slowly.

Bearings should not be rejected because they feel slightly rough or have a tendency to stick at certain points when rotated by hand until the bearings have been re-cleaned. If bearings still feel rough and/or have a catch, inspect them closely to determine the cause.

The following defects are common causes of bearing rejection:

Broken or cracked races.

Dented seals or shields.

Cracked or broken separators.

Broken or cracked balls or rollers.

Flaked areas on balls, rollers or raceways.

Bearings that have been overheated. These bearings are generally darkened to brownish blue or blue-black color.

Bearings whose raceways are indented or "brinelled" by ball or roller impressions in the races.

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RECOMMENDED BEARING PROCEDURES

An anti-friction bearing, properly lubricated, should not wear unless dirt or abrasive foreign matter gets into it. If dirt is allowed to enter a bearing it mixes with the grease or oil and forms a lapping compound that will quickly lap down the balls or rollers.

The load carrying surfaces of anti-friction bearings are finished with extreme care and will sustain very heavy loads unless the surfaces are damaged by abuse in handling or by foreign matter which may be abrasive or corrosive.

BEARING INSTALLATION

Clean shafts and bearing housings thoroughly. Remove all dirt from keyways, splines and grooves. Remove burrs and slivers.

Clean and oil bearing seats.

Press bearings in straight and square.

Press only on the tight fitting race.

Press bearings until they are seated against the shaft or housing shoulder.

Bearing installation is just the reverse of bearing removal. Use an arbor press if available. Press the shaft into the bearing, supporting the inner race on blocks or a suitable press adapter to prevent bearing damage. Be sure the blocks or adapter does not scrape the shaft or threads.

If the distance between the end of the shaft and the bearing seat is fairly short, hold the shaft in a vise or suitable support and press the bearing onto the shaft with a clean tube. This may be done either in an arbor press or by tapping with a hammer. Cover the end of the tube with a suitable soft metal or hardwood block. This will allow the hammer blows to strike the tube dead-center and avoid cocking the bearing.

Do not leave bearings exposed in partial assemblies. Cover the bearings until ready to complete the assembly, to prevent damage by moisture, dirt or other foreign matter. Any clean cloth or paper will do as long as the bearings are well covered.

HEATING BEARINGS FOR INSTALLATION

The inner bearing race, in some applications, may be shrunk on the shaft. This is a very simple operation consisting of heating the bearing in clean oil (Fig. I-2) or temperature controlled oven to a temperature of between 200° and 250°F. This expands the inner race sufficiently to allow it to slip over the shaft to the bearing seat. DO NOT OVERHEAT THE BEARING OR IT WILL LOSE ITS HARDNESS. Do not keep the bearing in the oil or oven after the correct temperature has been reached.

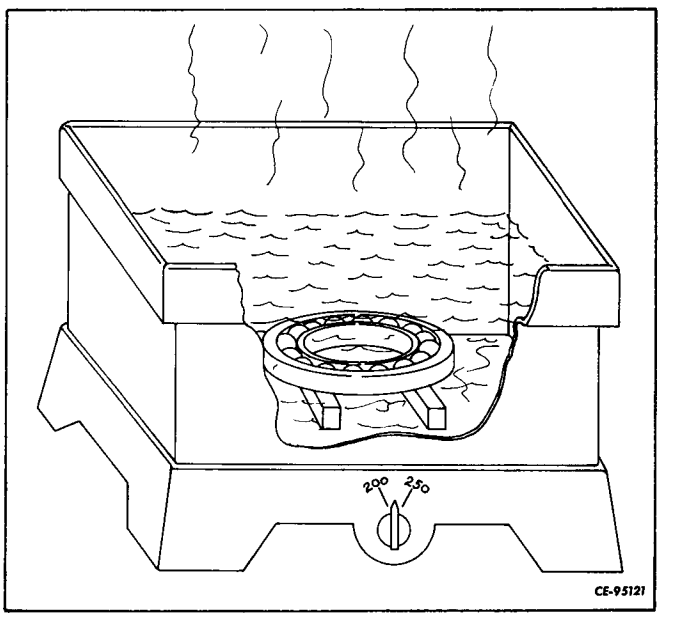

Figure I-2
Expanding Bearing in Heated Oil.

If expanding the race is not enough to get it on the shaft, freeze the shaft in dry ice for approximately 30 minutes. This will shrink the shaft and allow bearing installation.

ADJUSTMENT

Certain types of ball bearings and most dual-purpose bearings with tapered or barrel shaped rollers require adjustment in assembly. Specific instructions covering bearing adjustment are contained in this manual where required.

If a bearing is set up too tight it will heat up and fail. Loose bearings will pound and fail or cause component parts to fail. Be sure to follow the bearing adjustment procedures carefully.

RECOMMENDED BEARING PROCEDURES

LUBRICATION

Each assembly in this manual is supplied with a lubrication chart that specifies the kind of grease or oil to be used and how much. Operators Manuals specify the lubrication interval.

Follow instructions. Use only grease where grease is specified and oil where oil is specified. Be sure to use exactly the kind of lubricant the instructions call for.

Store grease in clean containers. Handle grease with clean paddles or grease guns. Keep grease containers covered.

Don't overfill. Grease or oil will ooze from overfilled housings past seals and closures, collect dirt and thereby lay the groundwork for bearing failure. Too much lubricant will also cause overheating. This is particularly true of bearings running at high speeds where the churning of the lubricant will cause the bearings to run excessively hot.

Don't let any machines stand idle for months without turning it over once in a while so that bearing surfaces will be covered with lubricant. Oil tends to drain down off a standing bearing. Moisture condensing in the housing is then free to corrode the un-coated bearing.

Be sure to inspect seals and vents regularly.

LOCTITE AND LOCQUIC DATA

LOCTITE

Loctite is a lock or seal for metal parts. It is furnished as a liquid plastic. Contact with air keeps it liquid. When confined between mating parts, the exclusion of air causes the liquid Loctite to set by chemical action.

LOCQUIC

Locquic is a priming rinse used to speed the setting of the Loctite sealant and also must be used on zinc or cadmium plated parts for surface preparation to enable the Loctite sealant to completely set. Locquic Grade "Q" is available in six ounce pressure spray cans.

LOCTITE RECOMMENDATION

Use Loctite Grade "B" (yellow color) on all threaded connections with the exception of the following:

1. Exhaust pipe mounting hardware.

2. Elastic stop nuts.

3. When lock washers are used.

4. When bolt or nut retaining lock plates are used.

5. On items requiring frequent service (500 hours or less), such as filler caps, adjusting screws, wheel stud clamp retaining nuts, etc.

6. On brass pipe plugs and fittings in air systems and all other pipe fittings.

7. All stud applications.

PART PREPARATION FOR LOCTITE

PLAIN, PHOSPHATE COATED, OR PLATING OTHER THAN ZINC OR CADMIUM: Clean the surfaces where Loctite is to be applied to remove heavy coating of oil, grease and dirt (rust or light oil film are not detrimental). Normal shop practice of cleaning or degreasing is adequate. Allow surface to dry before applying Loctite. Care must be used on blind tapped holes to remove chips and oil.

ZINC OR CADMIUM PLATED PARTS OR FOR QUICK SETTING: To assure setting of Loctite on zinc or cadmium surfaces and quick setting on other surfaces at least one of the mating surfaces should be sprayed with Locquic Grade "Q." Locquic Grade "Q" is an effective rinse for oily parts. Allow surfaces to dry before applying Loctite Grade "B" sealant.

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LOCTITE AND LOCQUIC DATA

LOCTITE APPLICATION

BOLT THREADS: Fill the first two or three leading threads in area of engagement with Loctite Grade "B."

PIPE THREADS: Use Loctite pipe sealant.

ALL STUD APPLICATIONS: Use Loctite plastic gasket.

SETTING

NORMAL TIME: Three to four hours.

WITH LOCQUIC GRADE "Q": Fifteen minutes.

REMOVAL

With the exception of soft metal parts and bearings, parts difficult to remove can be pre-heated to approximately 450° F. prior to removal.

GENERAL SAFETY PRECAUTIONS

A great deal of material contained in this service manual concerns itself with the removal and installation of exceptionally heavy items. During the time these operations are being carried out, safe working conditions and procedures are mandatory, to not only insure personal safety but the safety of others in the area. The following items are listed as a reminder of basic shop safety practices, too often neglected in day-to-day operation.

During service operation be sure safety bar is properly installed on tractor frame.

Hoists must be of sufficient capacity to lift the heavier units (i.e. engine, grille, fuel tank) and have an ample safety margin.

Floors must be clean and dry. After draining operations be sure all spillage is cleaned up. Electrical cords and wet floors make a dangerous combination.

Provide sturdy step ladders to mount and dismount from the engine compartment; do not climb on tires.

Be sure heavy items are properly supported from hoist or floor jack before removing supporting members from tractor.

Have sufficient service personnel available when removing or installing large heavy items in order to maintain control at all times.

If a heavy item begins to fall, let it fall; don't try to catch it.

Bucket and/or boom must be resting on ground at all times during machine servicing and periods of idleness.

Do not start an engine indoors unless adaquate exhaust ventilators are provided. Once an engine is running, move the machine outdoors as soon as possible. Be sure air pressure is sufficient to provide positive brake application.

Keep hands, feet, clothing away from rotating engine parts.

As a machine is being moved, the operator must face the direction of travel.

Think before you act. Carelessness is one luxury the serviceman cannot afford.

SPECIFICATIONS

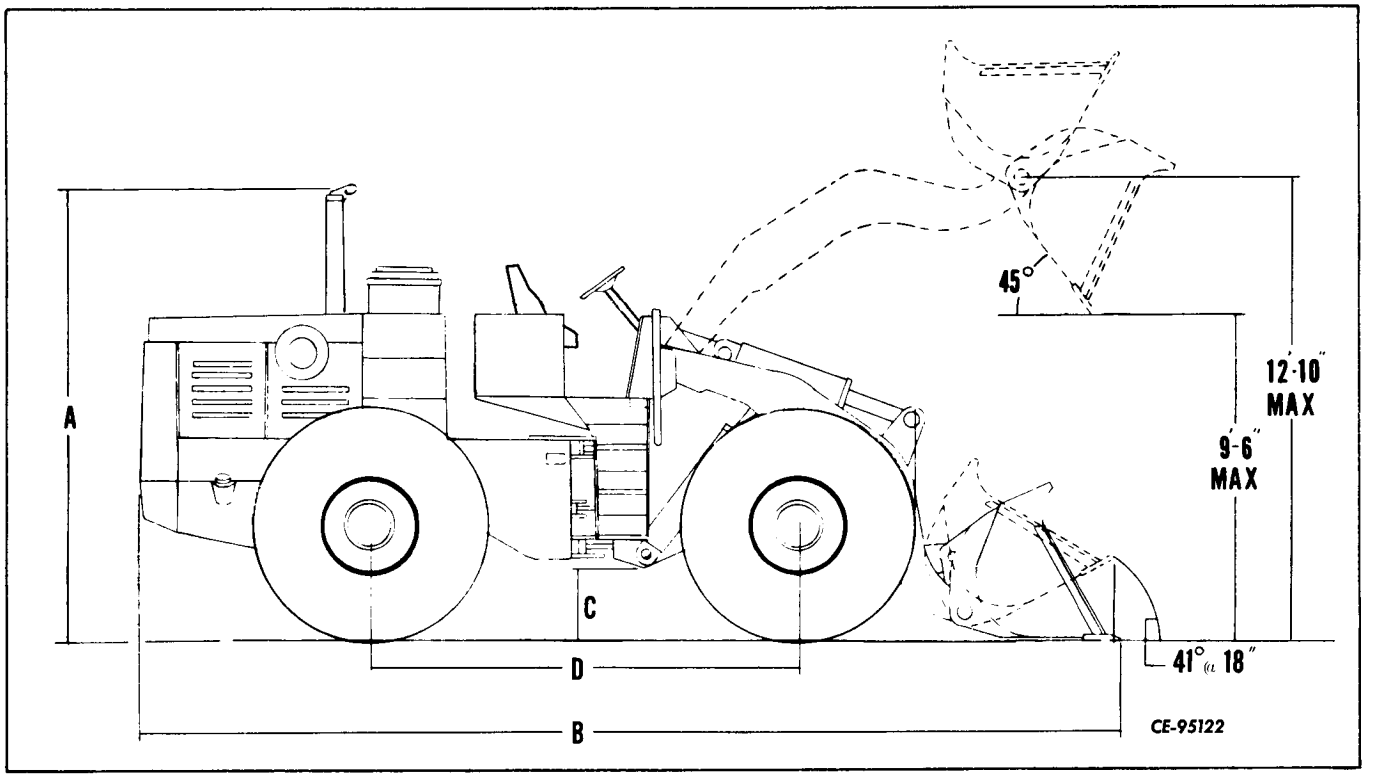

Figure I-3
Dimension Diagram.

GENERAL

A. Height to top of exhaust stack . . . . 10' 8"
B. Length with bucket on ground . . . . 23' 8"
C. Ground clearance (minimum) . . . . . 1' 3"
D. Wheel base . . . . . 10'
E. Width at front and rear tires . . . 9' 5-1/2"

Total rear axle oscillation (included angle) . . . . . 30°

Maximum articulated steering angle . . . . 70°

Turning radius at 32° articulation
To outside of rear wheel . . . . . 20' 5"
To outside bucket corner at carry . . . . . 22' 3"

Tread, front . . . . . 7' 5"
Tread, rear . . . . . 7' 5"

Max. dump angle at Max. Dump Height . . . . . 45°

Max. dump angle at 7' 0" Dump Height . . . . . 58°

WEIGHT

Approximate weight over front axle . . . . . 18,000 LBS.

Approximate weight over rear axle . . . . . 19,000 LBS.

Approximate total weight . . . . . 37,000 LBS.

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STANDARD TORQUE DATA

Recommended torques, in foot pounds, for standard application nuts bolts shown below are applicable, provided:

A. All threads are lubricated with engine oil or chassis grease (refer to NOTE).

B. Joints are rigid; for example, no gaskets or compressible materials are used.

NOTE: Multiply standard assembly torques by the following factors:

1. .85 when metallic plated bolts or nuts are used.
2. .75 when parkerized bolts or nuts are used.
3. .70 when Molykote, white lead or similar mixtures are used as lubricants.
4. .90 when hardened surfaces are used under the nut or bolt head.
5. 1.20 when Loctite is used for plain bolts and nuts on the threads.
6. 1.25 when taper head bolts are used with bolt heads torqued.
7. 1.40 when Loctite is used for taper head bolts on the threads with bolt heads torqued.

When re-using bolts and nuts in service, use minimum torque values.

BOLT SIZE	TYPE 5		TYPE 8	
	MIN.	MAX.	MIN.	MAX.
1/4	9	10	12	14
5/16	18	20	25	29
3/8	32	37	45	50
7/16	52	58	70	80
1/2	80	90	110	125
9/16	115	125	160	180
5/8	160	165	225	230
3/4	280	315	400	440
7/8	420	460	650	700
1	625	700	950	1050
1-1/8	840	950	1350	1500
1-1/4	1150	1300	1900	2100
1-3/8	1500	1700	2500	2800
1-1/2	2000	2300	3350	3500
1-3/4	3300	3700	5300	6000
2	5000	5500	8000	9000

BOLT TYPE IDENTIFICATION CHART

IH Type	Obsolete IH Type	SAE Grade	DESCRIPTION	BOLT HEAD MARKING
5	2	5	WILL HAVE 3 EQUALLY SPACED RADIAL LINES Quenched and tempered medium carbon steel	
8	4	8	WILL HAVE 6 EQUALLY SPACED RADIAL LINES Quenched and tempered medium carbon alloy or medium carbon boron steel	

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SECTION I

CHASSIS

Page

SECTION I CHASSIS

GENERAL INFORMATION

DESCRIPTION

The chassis components are divided into four groups to simplify maintenance and to provide a better understanding of each group. The groups are as follows: Main Frame, Sheet Cowling, Operator's Compartment, Boom and Bucket.

The forward portion of the articulated frame provides a mount for the operator's compartment. Seated on the forward portion, the operator is always in line with the bucket allowing a greater degree of control and operating accuracy. The rear section of the main frame provides a platform to mount the engine, converter, transmission, grille and bulkhead.

In addition to their center hinge pins the frame sections are linked together by a pair of steering cylinders. The bases of the cylinders are anchored in the forward frame section with the rod ends pinned to the rear section. As one cylinder extends, the opposite contracts, pivoting the frame sections on the hinge pins and steering the tractor. This type of articulated steering has definite advantages; it eliminates the need of a steering axle with its additional parts, eliminates the drag link and tie rod and it allows the rear wheels to track in the path of the front wheels. This latter item insures a much shorter turning radius than that afforded by the more conventional rigid frame and steering axle type.

The front axle is fastened directly to the forward frame section. The rear axle is connected to a bolster which in turn is fastened by two pins to the rear frame section. This allows the rear axle to oscillate on uneven terrain.

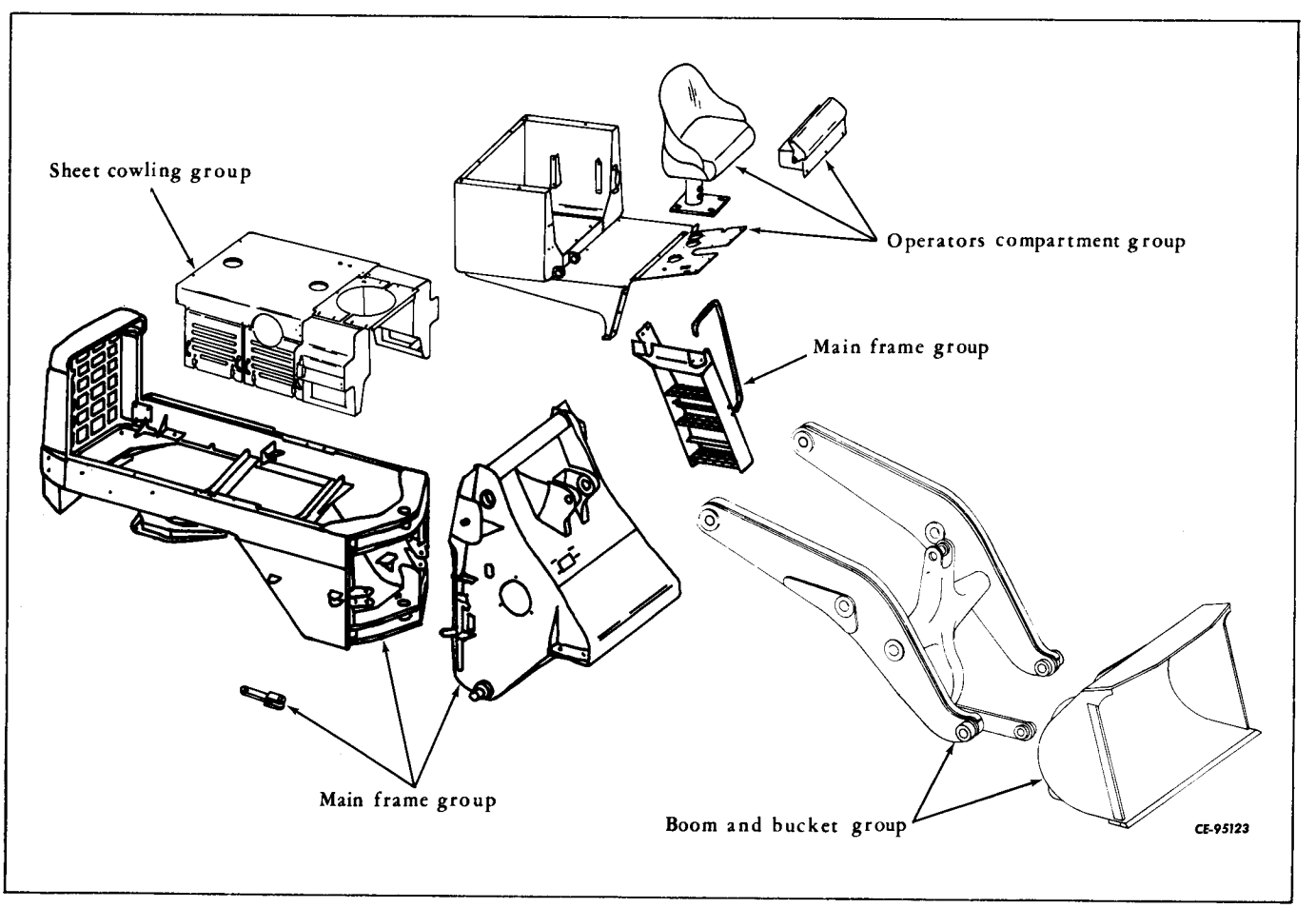

Figure 1-1
Chassis Components.

CHASSIS

MAIN FRAME

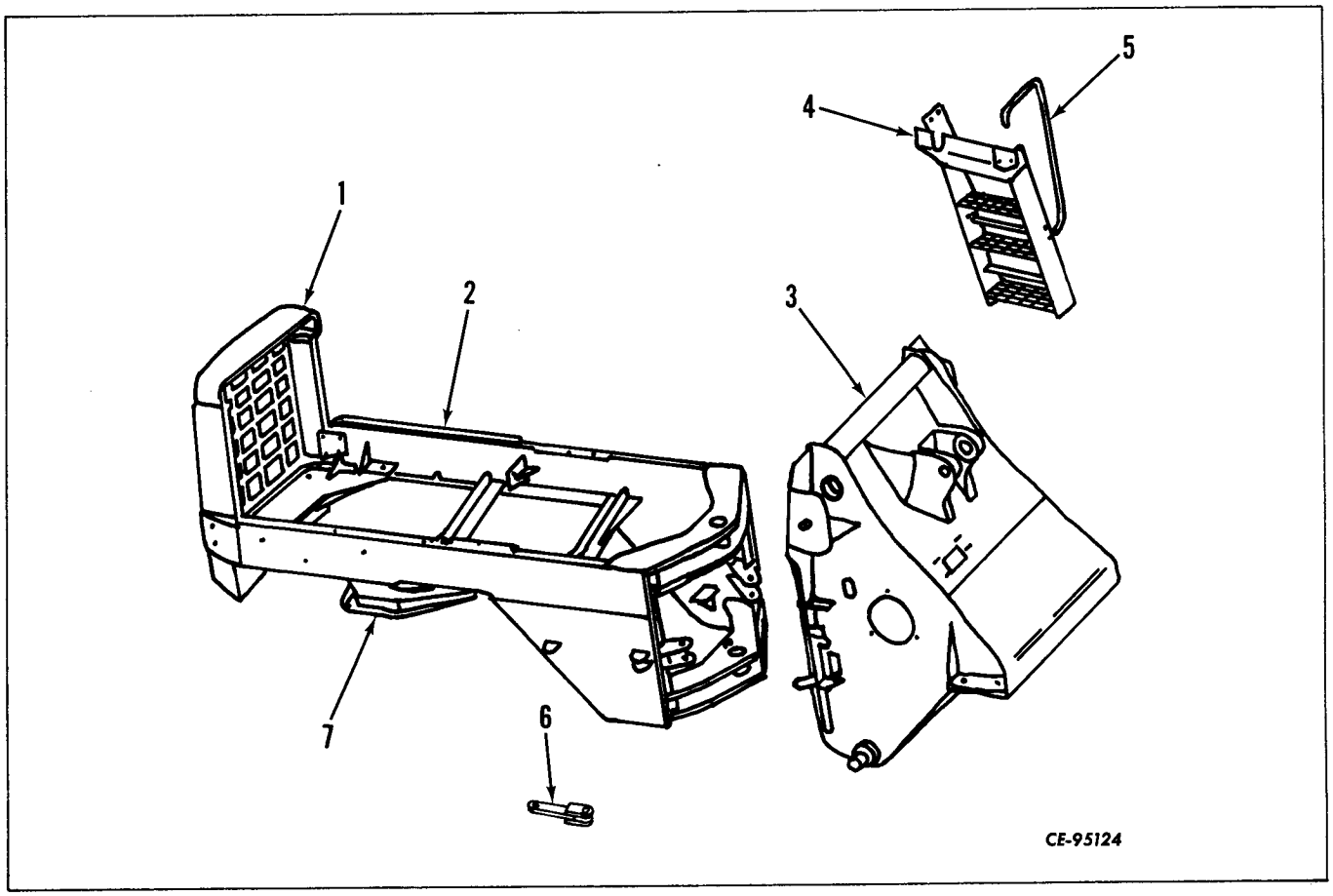

Figure 1-2
Main Frame Assembly.

1. Grille.
2. Main frame - rear section.
3. Main frame - front section.
4. Ladder.
5. Handrail.
6. Frame locking bar.
7. Bolster.

DESCRIPTION

Each main frame component is composed of many smaller items welded together to form a single rigid assembly. Bushings are pressed into bores at pivot points and the grille is bolted to the rear of the rear frame section. The two frame sections are connected at their hinge points by a pin and bearing assembly. The rear axle bolster is connected to the rear main frame by pin and bushing arrangement.

The frame locking bar is pinned and locked to the right hand side of the rear frame section in its rest position. The bar and pins are used to lock the two tractor halves when the tractor is serviced or transported.

To lock the tractor halves in the straight position, the rear pin and cotter pin are removed, the bar swung forward and aligned with hole in forward section and pins replaced. (Fig. 1-3.)

MAIN FRAME

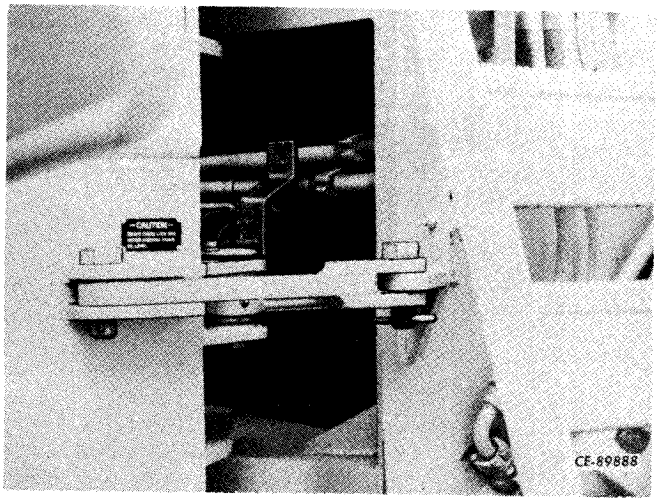

Figure 1-3
Safety Bar and Pin in Straight Lock Position.

To lock the tractor in either a full left or full right turn, only one pin is used. Position the tractor in its full turn position and insert pin in holes on closed side of tractor. Lock with cotter pin. (Fig. 1-4.)

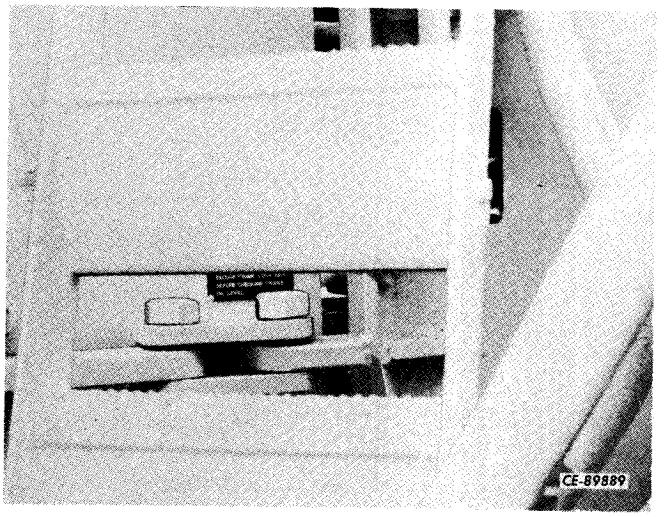

Figure 1-4
Pin only in Full Turn Lock Position.

Be sure to install bar, pins and cotter pins in storage position when tractor operation is resumed. (Fig. 1-5.)

Replace any missing parts immediately to be sure the safety device is available for immediate use. Do not attempt to service or transport the tractor if the safety bar or pins are broken or missing.

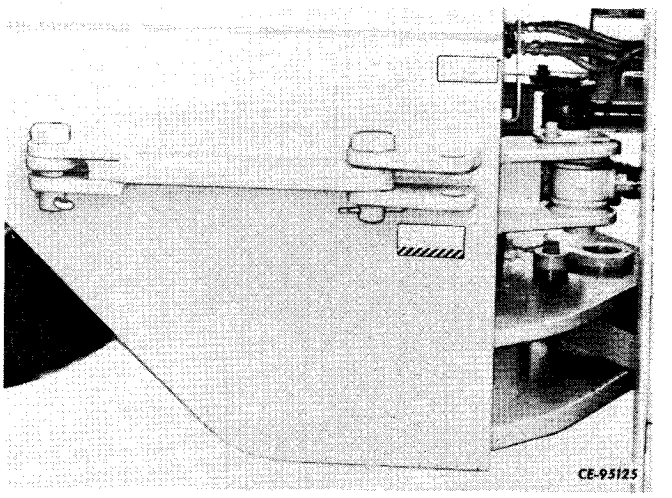

Figure 1-5
Safety Bar and Pins (Stowed Position).

SERVICE

INSPECTION

A periodic inspection of the chassis should be made to detect weld cracks, broken welds, or damaged brackets. Check bolster bushings and pins for wear or damage. Special attention should be given to the hinge pin assemblies being sure they are properly centered and seals and bushings are in good condition.

To keep rust and corrosion to a minimum, periodic painting of abrasions and bare metal is recommended.

WELDING

Successful welding repairs require some knowledge of the materials being worked, use of the correct type and size of welding rod and preparation of material to be welded. The alloy steels used in the construction of this tractor have a low carbon content but have been heat treated to obtain maximum strength, hardness, and wear resistance. To retain their strength, the steel members must not be subjected to high residual temperatures.

(Continued on next page)

SERVICE - Continued

WELDING - Continued

To acquaint the serviceman with the technique required to produce successful repairs it is recommended that the manual entitled "WELDING MAINTENANCE," form SM-WELD-1 and the Construction Equipment Technical Service Tips Bulletin "WELDING TECHNIQUES," Form AD-5573-S be obtained through your local INTERNATIONAL and HOUGH CONSTRUCTION EQUIPMENT dealer.

ADJUSTMENT

CENTER HINGE BUSHING

Place linkage in "FLOAT" position so that weight of bucket is on ground. If machine is without bucket, rest boom ends on blocks.

Adjust hinge spacing using top nut (3, Fig. 1-6) so that frame tongues (7, 18) are centered between rear frame ears (5, 16). Bottom nut (20) must be loose during spacing adjustment.

If front frame tongues are too high, loosen top nut (3) until they are centered.

If front frame tongues are too low, tighten top nut (3) until they are centered.

Install retainer plate (4). Note that two retainer plate positions are available by turning the plate over.

Tighten bottom nut (20) with a one inch air impact wrench (300 to 400 ft. lbs.) to seat mating parts in hinge assembly.

Loosen bottom nut (20).

Tighten bottom nut (20) using retainer plate (19) as a wrench. Hinge should be just snug at this point - DO NOT OVER TIGHTEN.

If holes in retainer plate (19) line up with tapped holes in frame, install plate. Note that two positions are available by turning retainer plate over.

If holes in retainer plate (19) do not line up with tapped holes in frame (in either retainer plate position), loosen nut (20) until plate holes line up with frame holes. Because two retainer plate positions are available, the amount of nut loosening required will always be less than 30°.

NOTE: Never loosen nut (20) more than 30°.

Install retainer plate (19).

Lubricate upper and lower hinge.

(Continued on page 6)

Legend for Figure 1-6

Upper Hinge Pin

1. Cap screw and lock washer.
2. Flatwasher.
3. Hex nut.
4. Retainer plate.
5. Rear main frame ear.
6. Cord ring.
7. Front main frame tongue.
8. Cam.
9. Cap screw and lock washer.
10. Ball bushing.
11. Bushing.
12. Hinge pin.
13. Pin lock plate.

Lower Hinge Pin

14. Cap screw and lock washer.
15. Cam.
16. Rear main frame ear.
17. Cord ring.
18. Front main frame tongue.
19. Retainer plate.
20. Hex nut.
21. Flatwasher.
22. Cap screw and lock washer.
23. Pin lock plate.
24. Hinge pin.
25. Bushing.
26. Ball bushing.

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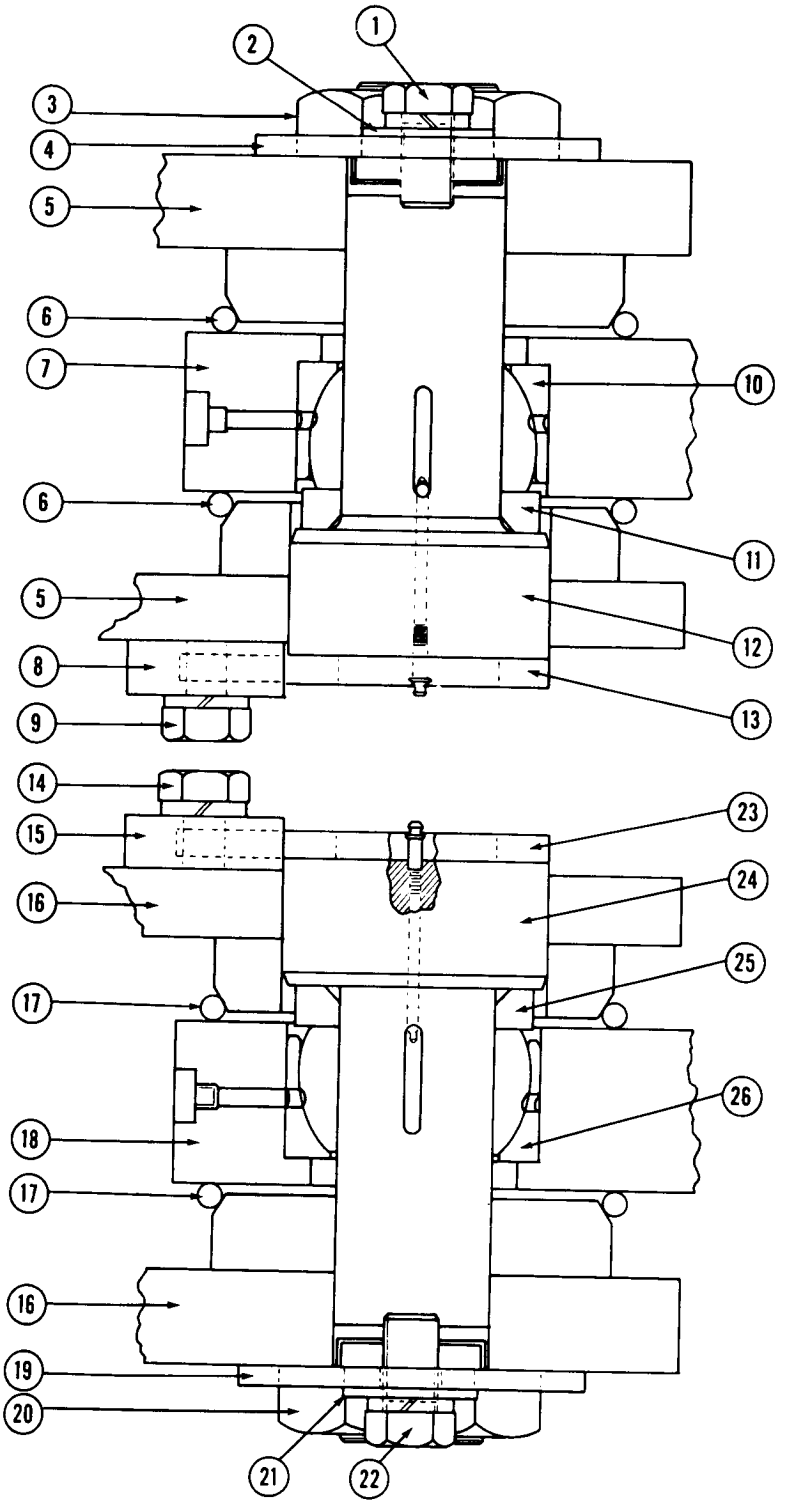

Figure 1-6
Center Hinge Bushing.

ADJUSTMENT - Continued

CENTER HINGE BUSHING - Continued

To adjust pin lock:

Bring pin lock plate (13, 23) into contact with block (6, Fig. 1-7).

Rotate cam (8, 15, Fig. 1-6) clockwise to contact pin lock plate (13, 23).

Tighten cam cap screw (9, 14).

As a final inspection:

Operate machine through several forward/reverse cycles to be sure all mating parts in hinge assembly are seated. This should be performed using first gear, engine speed approximately 1500 rpm and changing direction at approximately 2 mph.

Stop machine. Place linkage in "FLOAT" position so that the weight of the bucket is on the ground. If machine is without bucket rest boom ends on blocks.

Remove lower retainer plate (19).

Loosen bottom nut (20).

Tighten bottom nut (20) using retainer plate (19) as a wrench. Hinge should be just snug at this point - DO NOT OVER TIGHTEN.

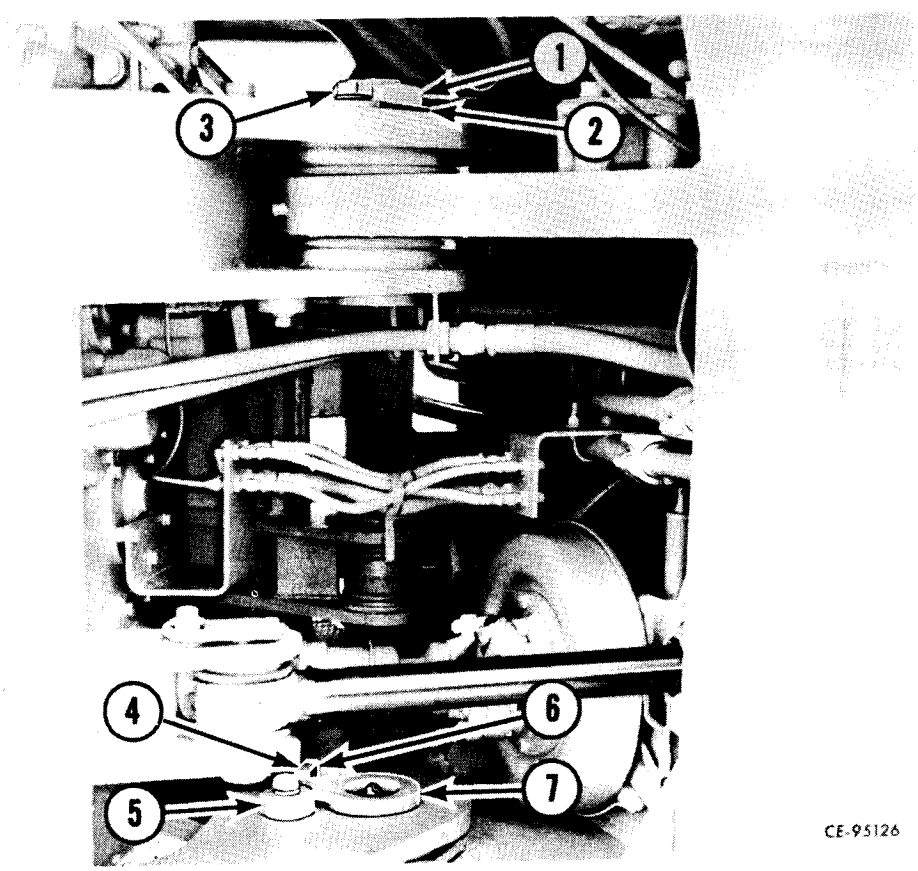

Figure 1-7
Pin Retaining Details.

1. Pin locknut.
2. Retainer plate.
3. Cap screw and lock washer.
4. Cap screw and lock washer.
5. Cam.
6. Block.
7. Pin lock plate (part of hinge pin weld assembly).

MAIN FRAME

If holes in retainer plate (19) line up with tapped holes in frame, install retainer plate. Note that two positions are available by turning retainer plate over.

If holes in retainer plate (19) do not line up with tapped holes in frame (in either plate position), loosen nut (20) until plate holes line up with tapped holes. Because two plate positions are available, the amount of nut loosening required will always be less than 30°.

NOTE: Never loosen nut (20) more than 30°.

Install retainer plate (19). Lubricate if necessary.

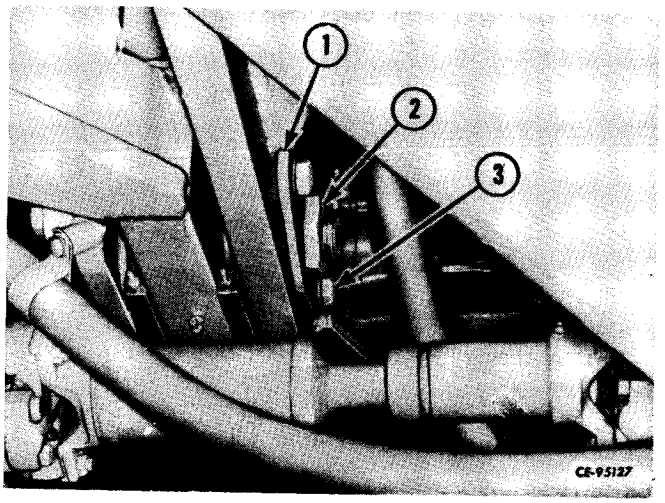

Figure 1-8

BOLSTER PIVOT

Tighten nut (2, Fig. 1-8) with a one inch air impact wrench (300 to 400 ft. lbs.) to seat mating parts in hinge assembly.

Loosen nut (2).

Tighten bottom nut (2) using retainer plate (1) as a wrench. Pivot should be just snug at this point - DO NOT OVER TIGHTEN.

If holes in retainer plate (1) line up with tapped holes in frame, install plate. Note that two positions are available by turning retainer plate over.

If holes in retainer plate (1) do not line up with tapped holes in frame (in either retainer plate position), loosen nut (2) until plate holes line up with frame holes. Because two retainer plate positions are available, the amount of nut loosening required will always be less than 30°.

NOTE: Never loosen nut (2) more than 30°.

Secure retainer plate (1) with cap screws (3).

Lubricate the pivots.

SHEET COWLING

DESCRIPTION

The sheet cowling, as in the case of the main frame, is made primarily by joining various weldments. The frames (3, Fig. 1-9), assisted by the grille (1, Fig. 1-2) of the main frame group, forms a backbone for the sheet cowling. The hood (1, Fig. 1-9) supported by the frames and grille provides the suspension member for the hood side panels (5). The battery boxes, both left and right, are constructed as part of the left and right frame weldments (3, Fig. 1-2). To these boxes the cover assemblies (4) are added.

SERVICE

Service of sheet cowling is limited. Bent components should be straightened and painted to prevent rust and corrosion.

Oil battery box cover hinges occasionally to prevent rusting.

Be sure engine side panel latches are lubricated occasionally with a few drops of oil. Latches must be kept in good working order. Replace damaged latches.

SHEET COWLING

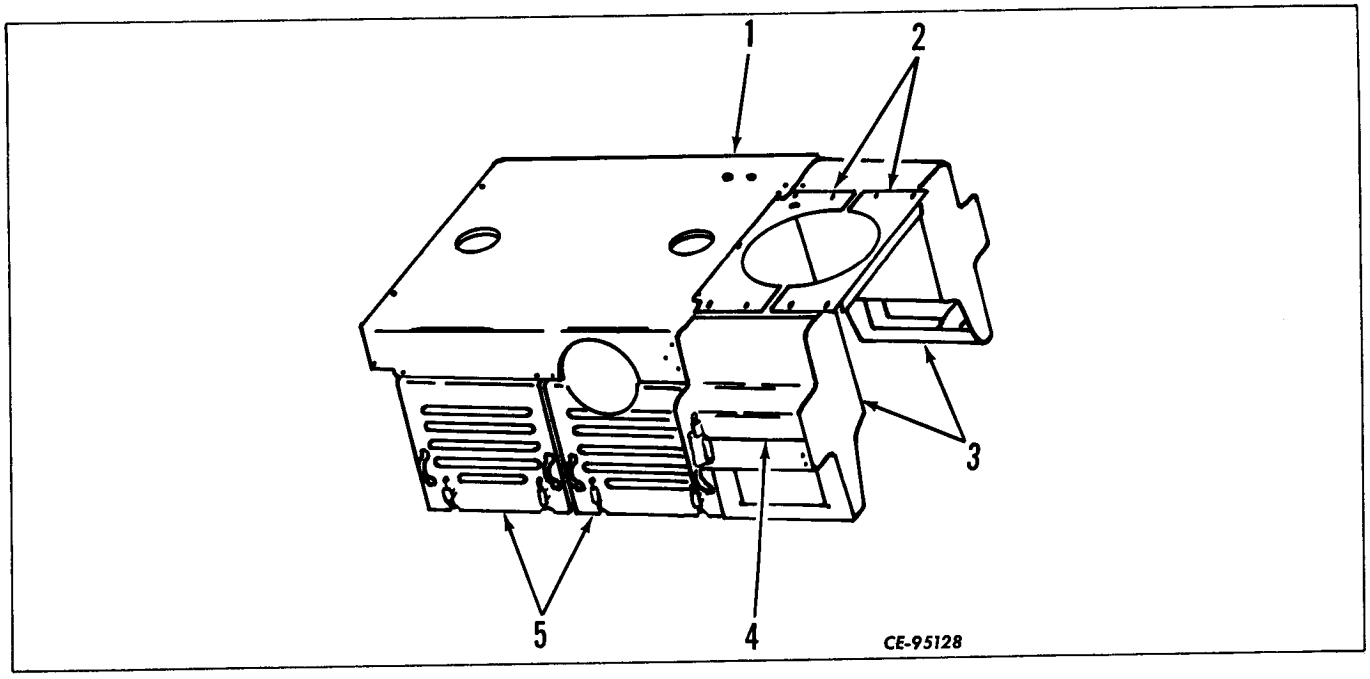

Figure 1-9
Sheet Cowling.

1. Hood.
2. Supports.
3. Frames.
4. Battery box covers.
5. Side panels.

OPERATOR'S COMPARTMENT

DESCRIPTION

The operator's compartment is composed of the compartment enclosure (5, Fig. 1-10), the instrument panel and box assembly (2), the operator's seat assembly (1, 3) and the compartment floorboards (4). The operator's cab is an optional accessory. Cab side enclosures are also available.

The compartment enclosure (5) is bolted to the front main frame (3, Fig. 1-2) with the operator's seat assembly mounted on a raised platform at the rear of the enclosure. The seat height is controlled by the adjustable mounting bracket (3, Fig. 1-11).

Directional movement of the seat is controlled by a spring loaded ratchet device. A handle (1) to operate the locking mechanism is provided. A second locking device (2), allows the seat to be tipped forward during periods of inactivity. This protects the cushions from the heat of the sun and inclement weather.

The loader control levers are mounted to the upright portion of the elevated platform and to the right of the operator. Where included, the heater is mounted to the upright portion of the elevated platform and to the left of the operator.

The two brake pedals and accelerator pedal are mounted on the front floorboard and the transmission control cables, hand throttle linkage and steering gearshaft, pass through it.

The instrument panel and box are mounted on the front main frame, to the front of the operator's seat. All wires leading to the instrument panel pass through a common connector at the base of the instrument box. The cold weather starting aid is located on a bracket attached to the right hand side of the instrument panel.

The hydraulic control valve is fastened beneath the platform floor in the right rear corner of the enclosure.

SERVICE

Service on metal parts is limited to straightening dented or damaged sheet metal parts and where necessary, repairing cab components.

OPERATOR'S COMPARTMENT

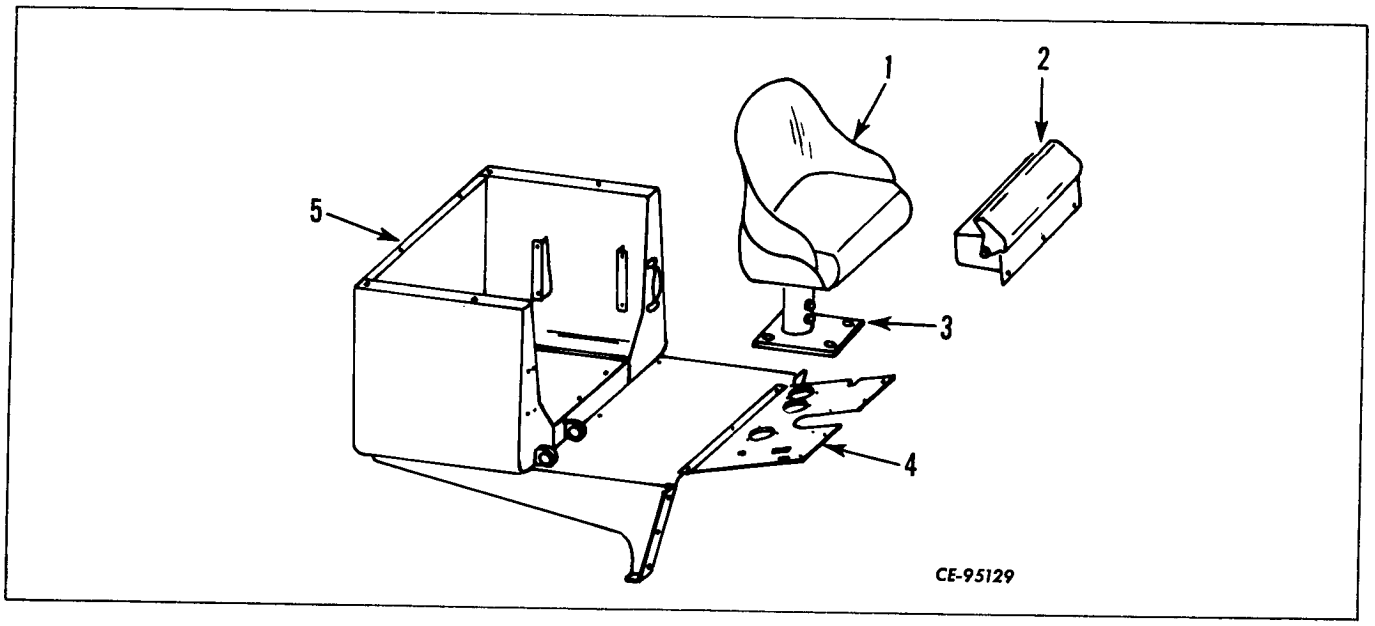

Figure 1-10
Operator's Compartment.

1. Operator's seat.
2. Instrument panel box assembly.
3. Seat mounting bracket.
4. Floor boards.
5. Compartment enclosure.

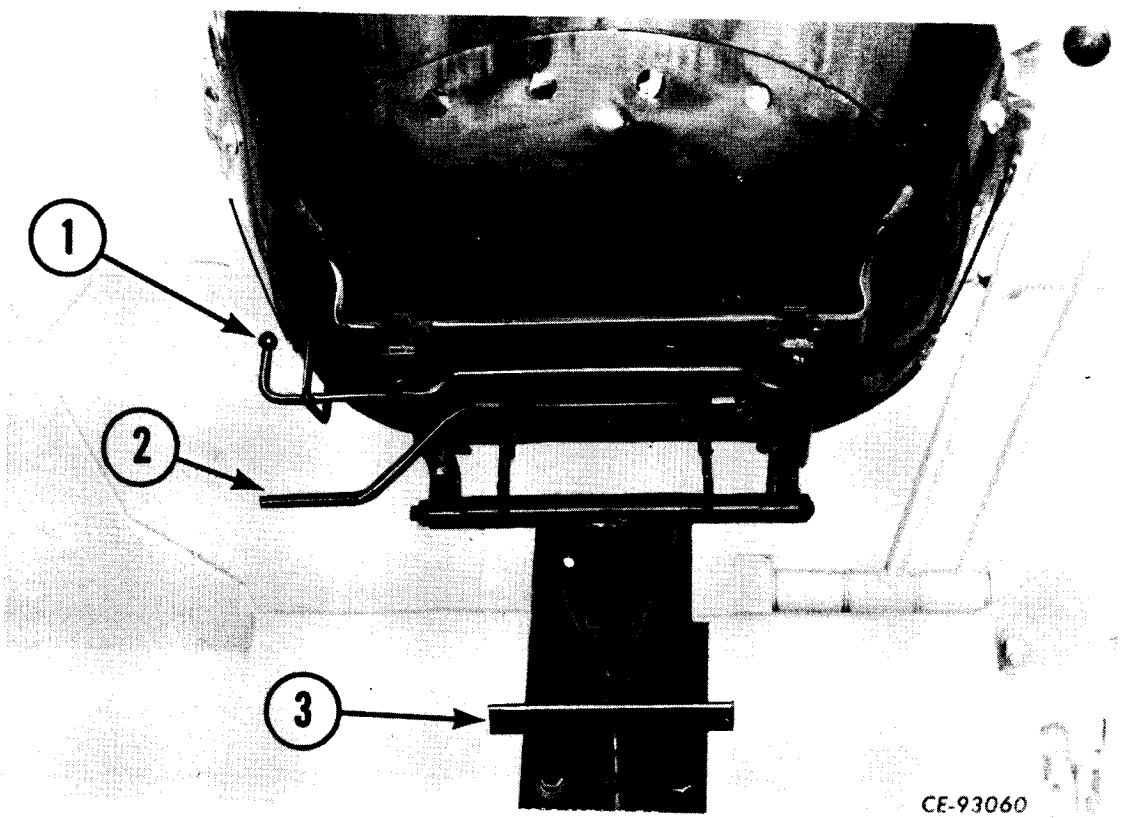

Figure 1-11
Seat Adjustment Mechanism.

1. Directional control release handle.
2. Tip-up latch.
3. Adjustable mounting brackets.

BOOM AND BUCKET

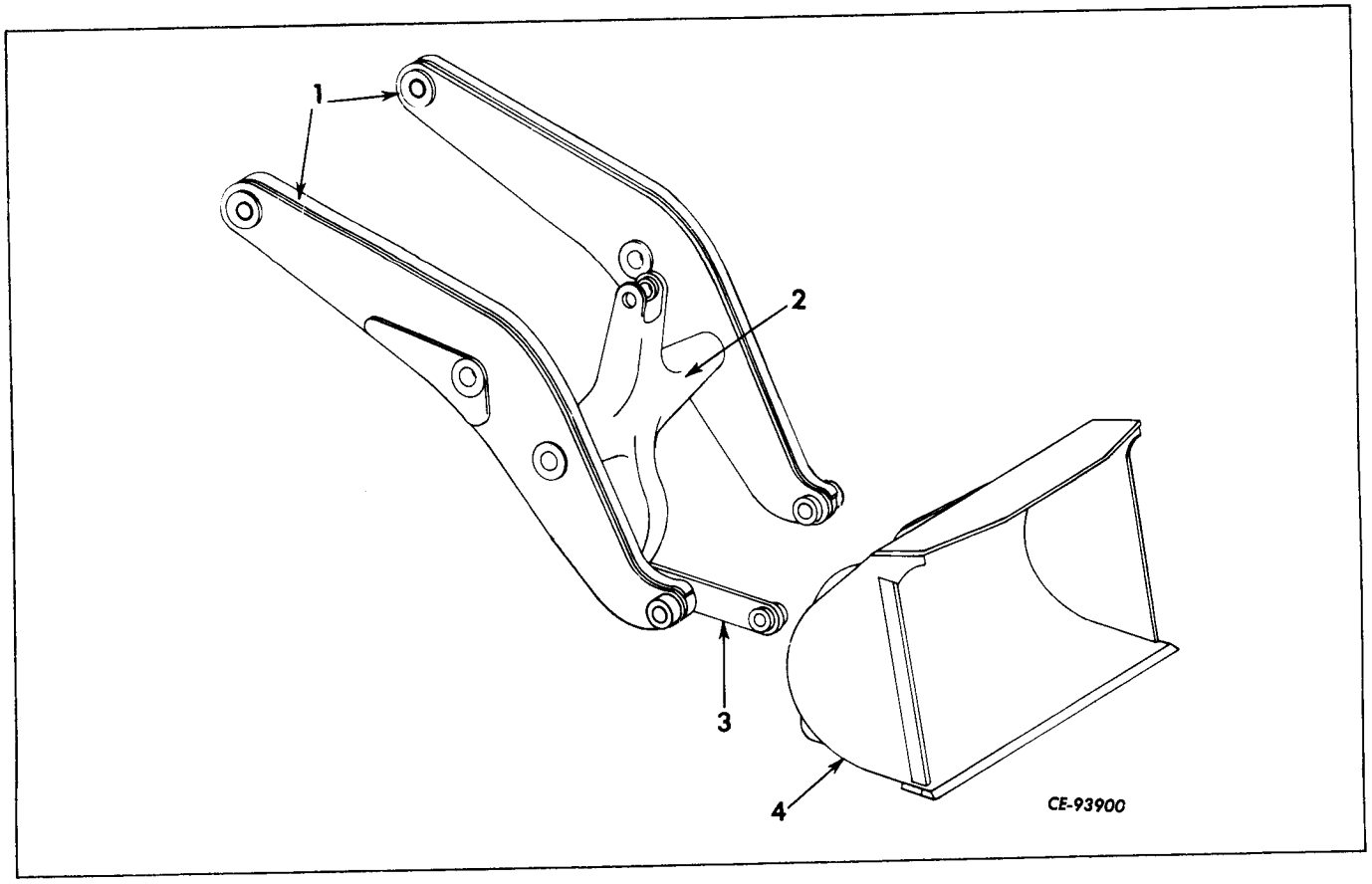

Figure 1-12
Boom and Bucket.

1. Boom arms.
2. Bellcrank.
3. Bucket link.
4. Bucket.

DESCRIPTION

The loader linkage and bucket transform the energy produced by the tractor hydraulics into a visible working force. The hydraulic lift cylinders raise and lower the boom and the bucket cylinder actuates the bucket through the bellcrank and bucket link. The bucket may be moved from the fully retracted to the fully dumped position in a few seconds.

The boom arms (1, Fig. 1-12) are of welded box section construction. The bellcrank (2), joining the boom arms at its pivot point, is a one piece casting. The heavy bucket link transfers the stroke of the bucket cylinder rod, multiplied by the bellcrank, to the bucket. The bucket is heavily ribbed for added strength. Locking pins retain the bucket to the boom arms and dump link. The bucket is equipped with a replaceable, weld on, cutting edge.

The automatic boom kick-out control is located on the inside of the left-hand boom arm, near the upper boom pivot. The boom kick-out automatically stops the boom at any preselected height. The automatic kick-out is operated by air pressure supplied from the right brake treadle to the air control valve mounted on the inside of the operator's compartment, to the left of and below the transmission control

levers. A cam roller (1, Fig. 1-13) is mounted on the valve lever, and rides on the cam segment (4) which is permanently mounted on the boom arm.

A movable cam (3), which is adjustable on the cam segment, determines the height to which the boom will raise before activating the air valve (2). When the cam hits the air control valve lever, it opens the air valve. Air from the valve actuates a piston on the main hydraulic control valve, which unlocks the balls from the detent boom raise position. The spring in the hydraulic control valve forces the spool into neutral position and halts the raising of the boom.

SERVICE

BUCKET REMOVAL

Place bucket on ground, bottom sheet parallel to ground. Place loader controls in neutral ("HOLD") position. Securely block rear of bucket to prevent it from rolling back when bucket is separated from linkage assembly.

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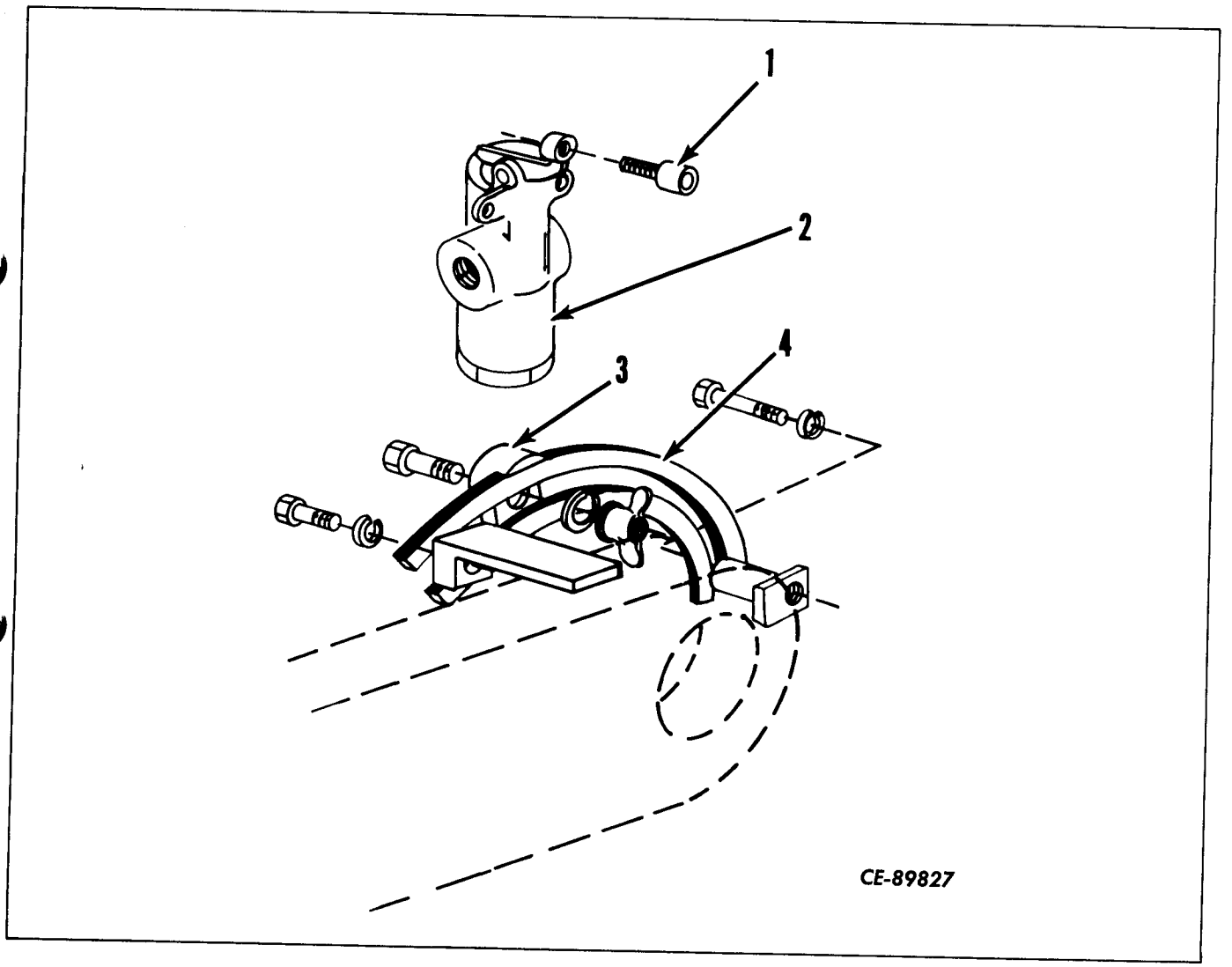

Figure 1-13
Boom Kickout Control.

1. Cam roller.
2. Air valve.
3. Movable cam.
4. Cam segment.

BOOM AND BUCKET

SERVICE - Continued

BUCKET REMOVAL - Continued

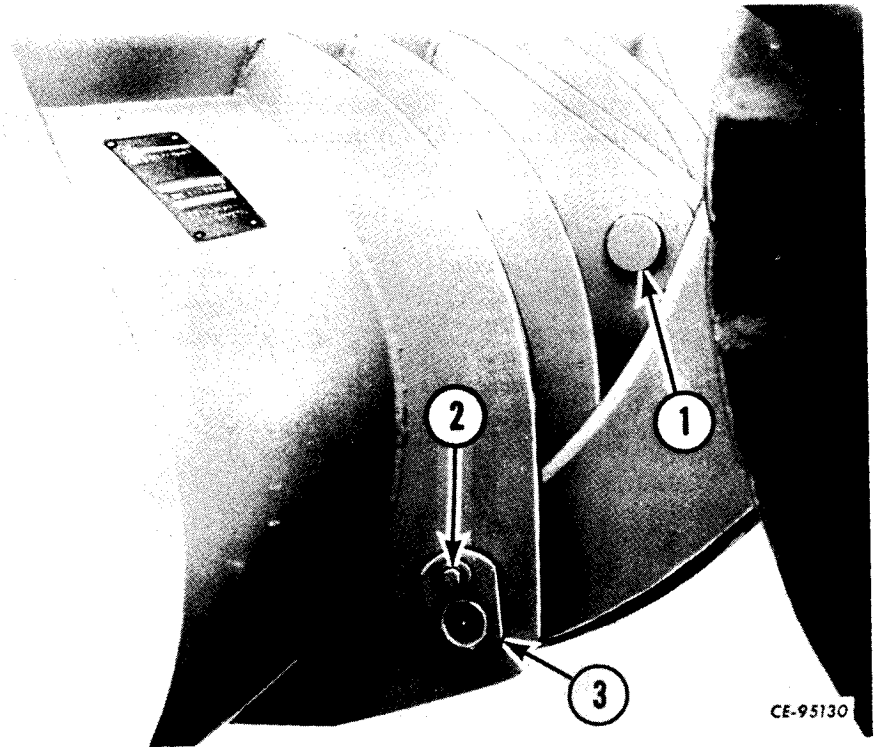

Figure 1-14
Bucket Removal.

1. Pin assembly.
2. Cap screw.
3. Pin assembly.

Remove the pin locking cap screws with lock washers and flat washers. Remove the pin (1, Fig. 1-14) that attaches the bucket link to the bucket.

◆ CAUTION: SUPPORT BUCKET LINK DURING PIN REMOVAL. AFTER REMOVING PIN, CAREFULLY LOWER LINK TO GROUND.

Retain cord rings.

Using a heavy gauge wire, wire the bucket link to the top of the bellcrank as shown in Fig. 1-15.

Remove cap screws (2, Fig. 1-14) with lock washers and flat washers. Remove pins (3) that secure the boom arms to the bucket. Place the boom control lever in "FLOAT" position allowing the boom arms to drop away from the bucket. Retain cord rings. Back tractor away from bucket.

NOTE: If available, support bucket with suitable chain hoist during removal operation.

As an alternate method, remove bucket link pin (1) as described above.

NOTE: If bucket is being removed to provide access to the tractor for servicing, the bucket link may be disconnected at the bellcrank.

BOOM AND BUCKET

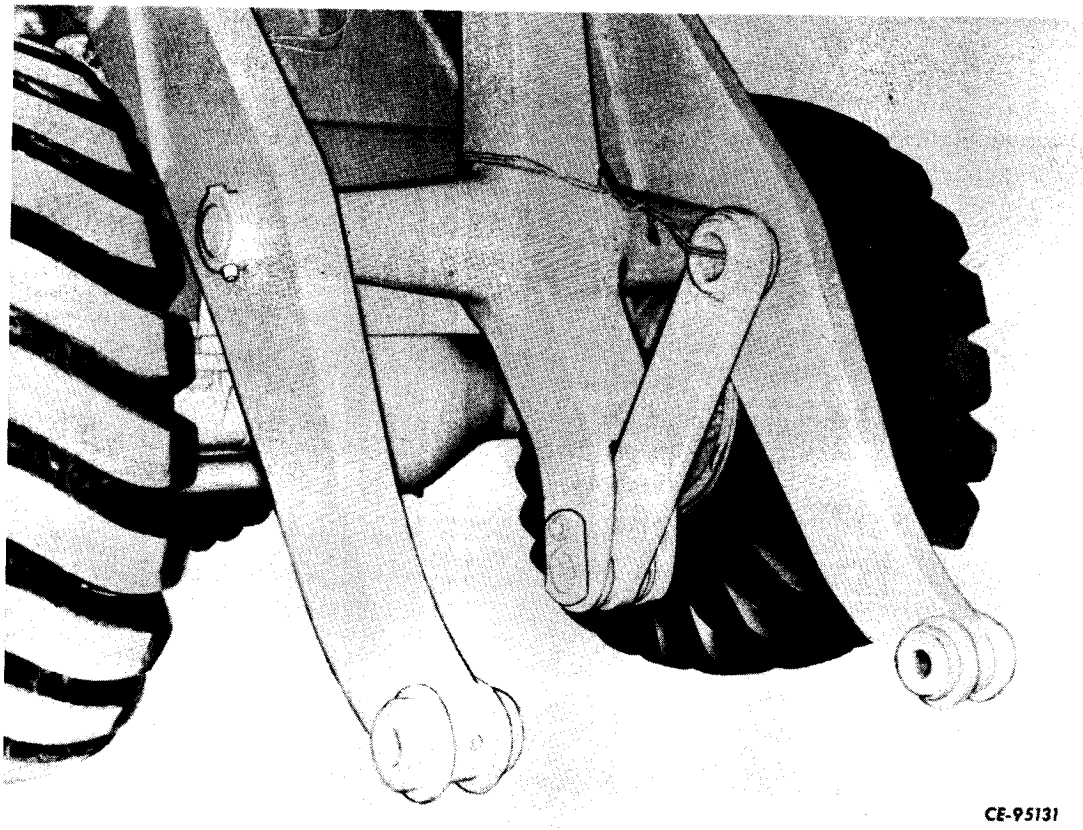

Figure 1-15
Bucket Link Wired Up.

Using a heavy gauge wire, wire the bucket link to the top of the bellcrank as shown in Fig. 1-15.

Start the engine. With the engine running slowly, raise the boom arms as the tractor is allowed to creep forward (Fig. 1-16). This will roll the bucket over allowing it to rest on the cutting edge and spillguard.

Place boom control lever in "HOLD" position. Remove boom pins (3, Fig. 1-14) and back tractor away from bucket.

Retain all cord rings.

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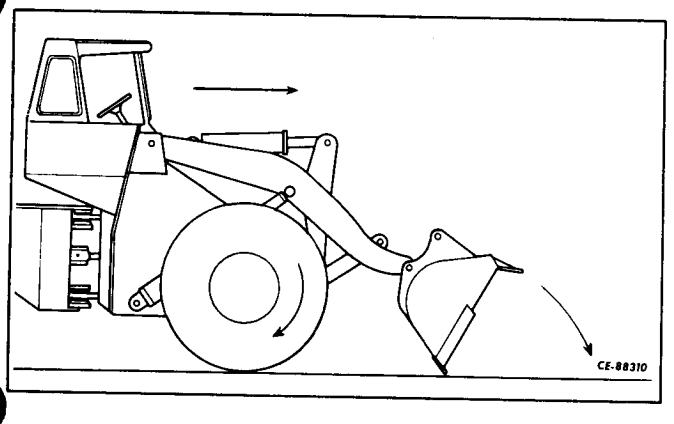

Figure 1-16
Rolling Bucket with Bucket Link Disconnected.

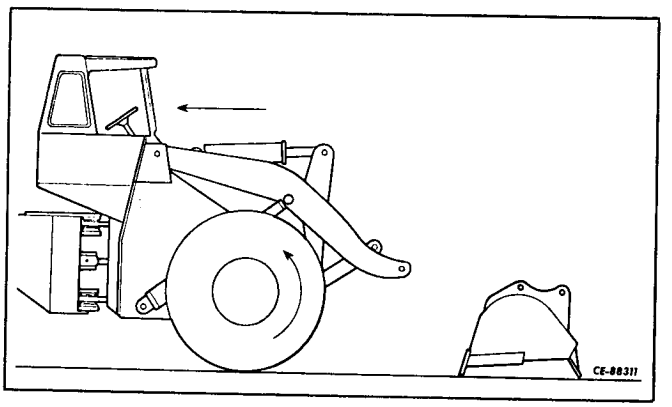

Figure 1-17
Backing Away from Bucket.

SERVICE - Continued

BUCKET REMOVAL - Continued

To prevent loss of parts, install pins (1, 3, Fig. 1-14) in their respective bucket bores, looping cord rings over pins as they are installed. Thread locking cap screws (2, Fig. 1-14) with lock washer and flat washers through pinlock and into respective bores. Coat all pin shanks with a heavy, waterproof grease to prevent rusting.

To install bucket, reverse procedures described previously, being sure to install cord rings.

CUTTING EDGE TIP REPLACEMENT

Replace the cutting edge tip before it wears back to the weld joining the tip and its backing plate. Use a carbon-graphite electrode to remove weld at rear of tip. Attach replacement tip to backing plate using a dry, low hydrogen E-7018 (AWS) electrode.

Replace tip as follows:

Prior to removing worn tip, straighten any bow that may be in cutting edge.

Tack weld a brace in the center of the bucket to hold straightened cutting edge (Fig. 1-18).

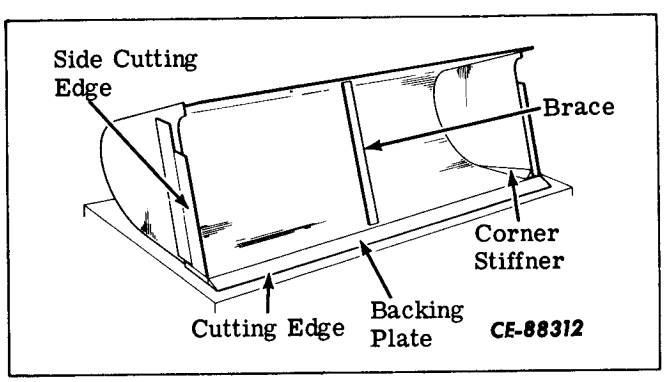

Figure 1-18

Clamp a stout piece of stock, having a straight edge, along the weld, joining the tip and backing plate. Cut off front of tip at upper weld with cutting torch. Use clamped straight edge as guide for torch (Fig. 1-19).

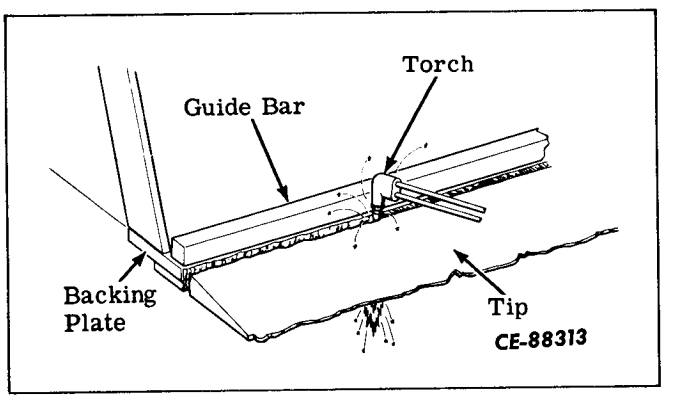

Figure 1-19

Remove weld at rear of cutting edge tip and on bottom of backing plate (Fig. 1-20). Use air carbon arc process. Keep heat penetration (heat build-up) in backing plate to a minimum to control plate warpage.

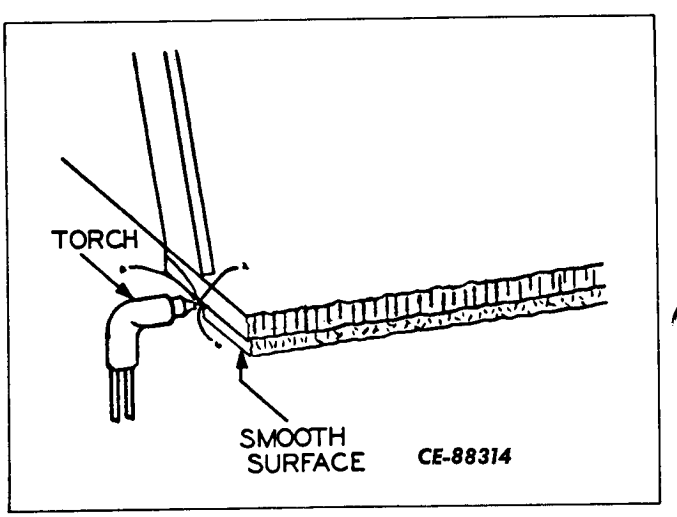

Figure 1-20

Dress backing plate along forward face and lower surface to receive replacement tip (Fig. 1-21).

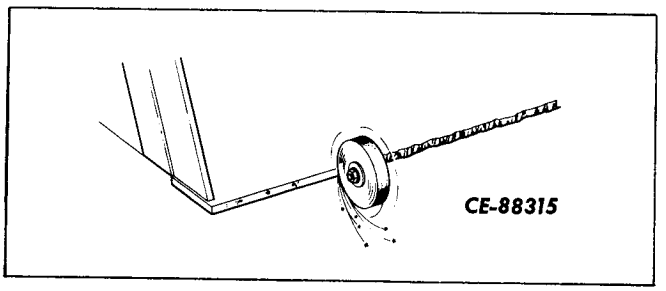

Figure 1-21

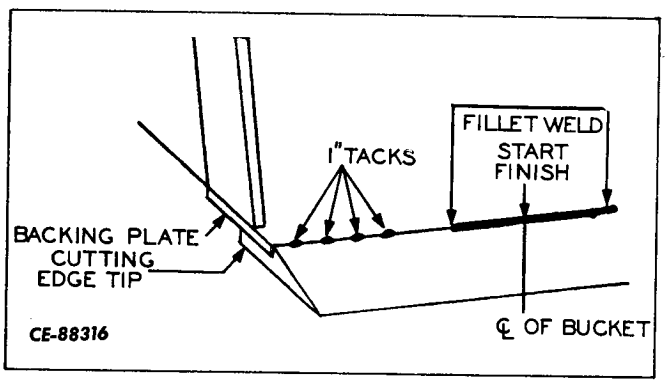

Figure 1-22

Position new cutting edge tip on backing plate. Tack weld tip to backing plate at front of plate and along back of tip (Fig. 1-22). Start tacks at center of tip and work alternately between front edge of plate and rear of tip toward both ends. Fix tip ends with firm welds.

Best results will be obtained by preheating the tip and backing plate to 200°F. to 300°F. Use a 5/16" fillet weld to join the rear of tip to bottom of backing plate. Start a weld six inches on either side of tip center and work alternately toward the center. Skip six inches from previous welds and work back. Continue to back-step welds alternately on either side of tip center until weld is completed at bucket side plates. Join front tip to front of backing plate in same manner. Remove tack welded brace.

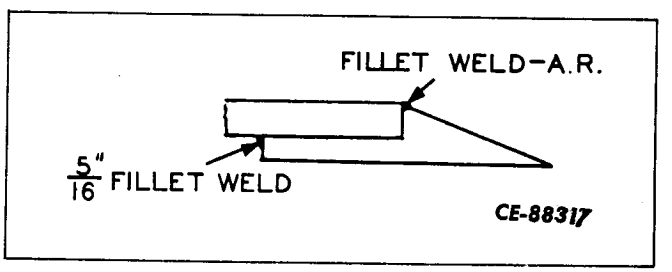

Figure 1-23

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SECTION 11

ENGINE

Page

SECTION II ENGINE

TRACTOR POWER UNIT

REMOVAL

Position unit under an overhead hoist and apply the parking brake. Position safety bar (1, Fig. 2-1) and pins (2) in the straight lock position. It is recommended to steam clean the engine compartment and torque converter area before engine removal.

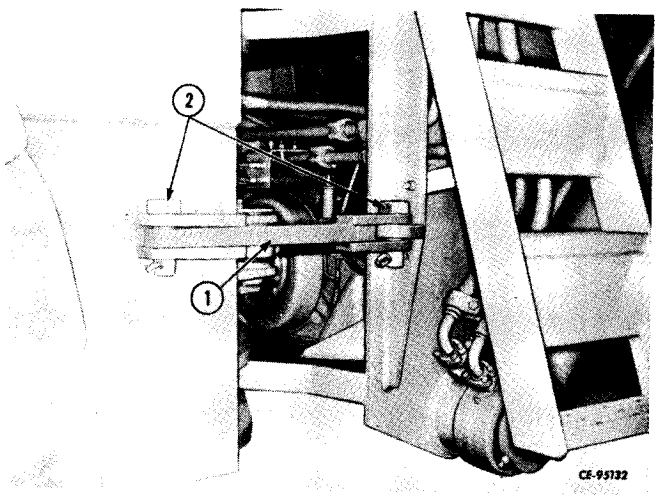

Figure 2-1

Remove battery cables (1, Fig. 2-2) from batteries (2) on each side of the unit. Remove ground cable first.

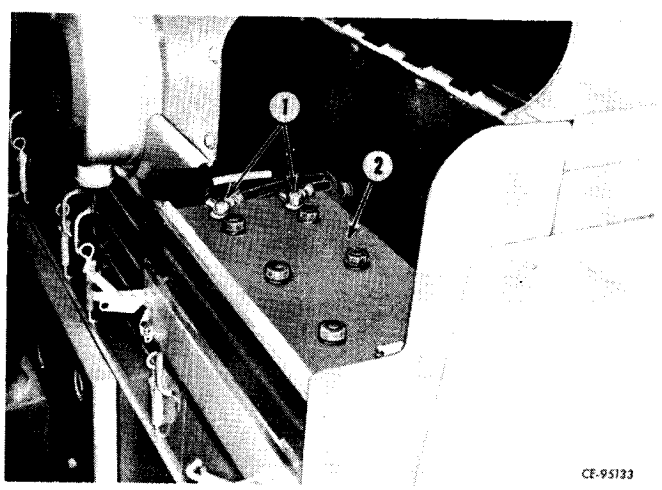

Figure 2-2

From inside the engine compartment, loosen bolt and nut (1, Fig. 2-3) from muffler clamp and nuts (2) from "U" clamp. Remove exhaust stack (3) from exhaust manifold (4) and up through "U" clamp.

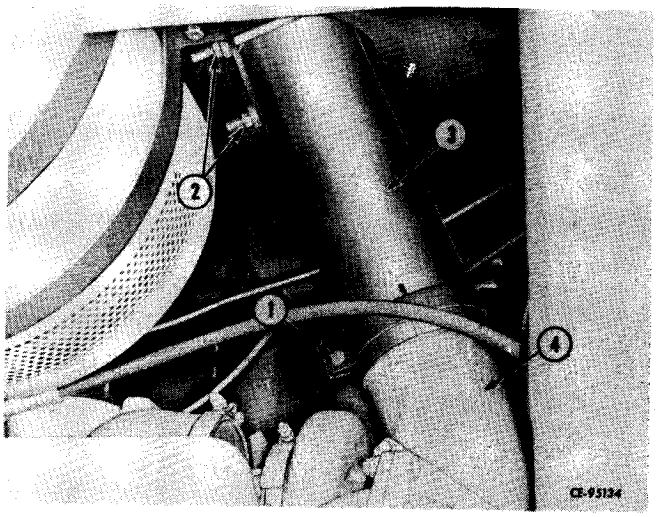

Figure 2-3

Remove oil filters (2, Fig. 2-4) from side of hood (3) by removing bolts and nuts (1). Secure oil filters to top of engine. The filters are removed with the engine.

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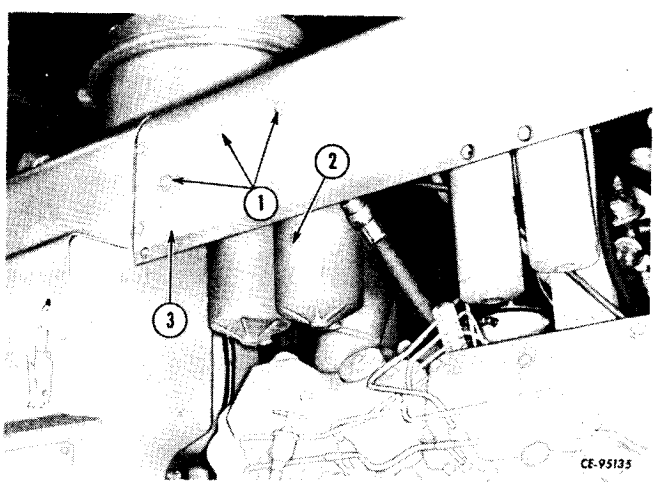

Figure 2-4

REMOVAL - Continued

Remove air compressor line (2, Fig. 2-5) from end of air cleaner (5) by loosening hose clamp (1). Loosen hose clamp (3) from air intake tube (4). Air intake tube (4) will disconnect from intake manifold during hood removal.

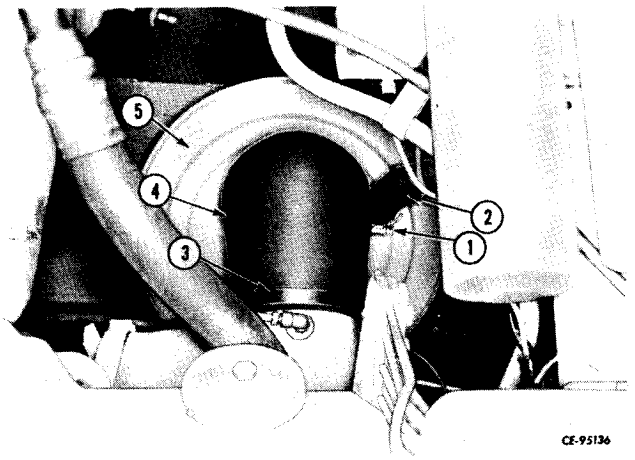

Figure 2-5

Remove cap screws and nuts (1, Fig. 2-6) disconnecting hood (2) from grille and bulkhead. Using a suitable hoist, remove hood. Engine air cleaner (3) will also be removed with the hood.

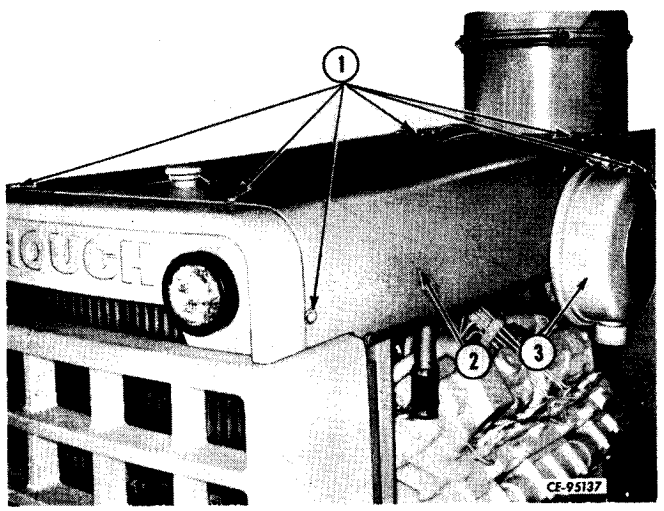

Figure 2-6

Disconnect and tag electrical wires from the upper rear driving lights.

Remove tail light brackets (2) by removing nuts and bolts (1).

Disconnect and tag tail light electrical wires.

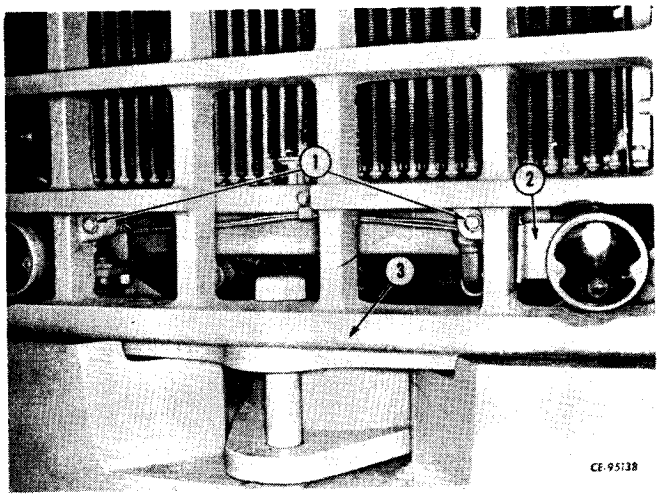

Figure 2-7

With a suitable hoist attached, remove cap screws (1, Fig. 2-8) on each side of the grille and lower grille (2) to floor.

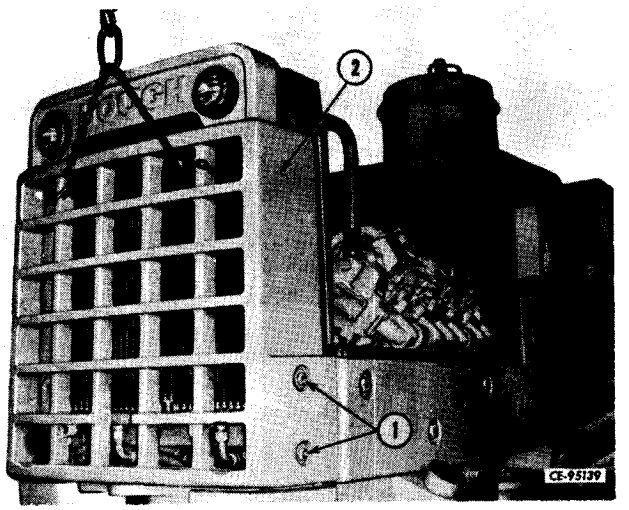

Figure 2-8

Disconnect transmission oil cooler lines (1, 2, Fig. 2-9) from the bottom of oil cooler (4). Insert plastic plugs into both the oil cooler and disconnected lines (1, 2), to keep fluid from dripping. Remove cap screws and nuts securing the top of the oil cooler to the radiator. Install an overhead hoist and remove cap screws and nuts (3). Lower oil cooler to floor.

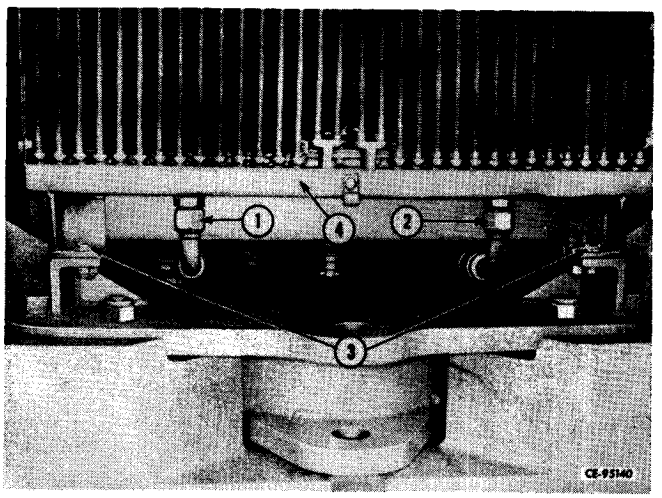

Figure 2-9

Position suitable drain drum close to rear of the machine. Using a flexible drain hose, disconnect hydraulic lines (1, 2, Fig. 2-10) from the bottom of the radiator (3) and drain.

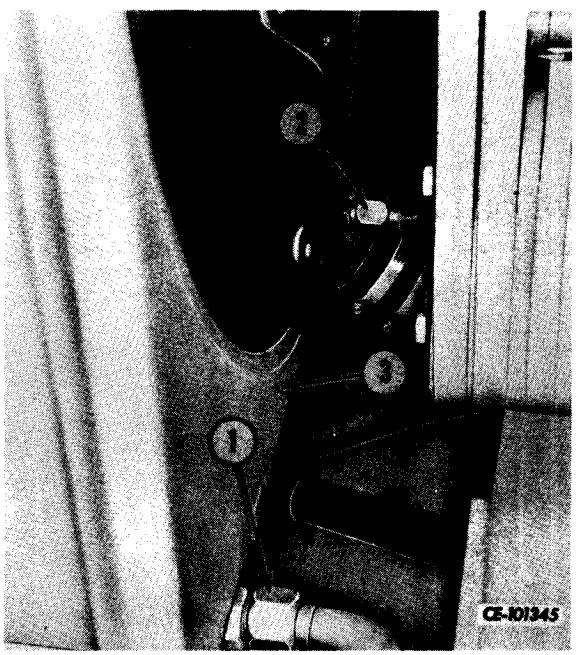

Figure 2-10

The hydraulic lines are connected to the hydraulic reservoir and will drain the hydraulic reservoir. Disconnect one line at a time and drain.

Drain radiator (2, Fig. 2-11) into a clean resealable container by opening petcock located under the radiator. Loosen hose clamps (1) on each side of radiator and disconnect hoses from radiator.

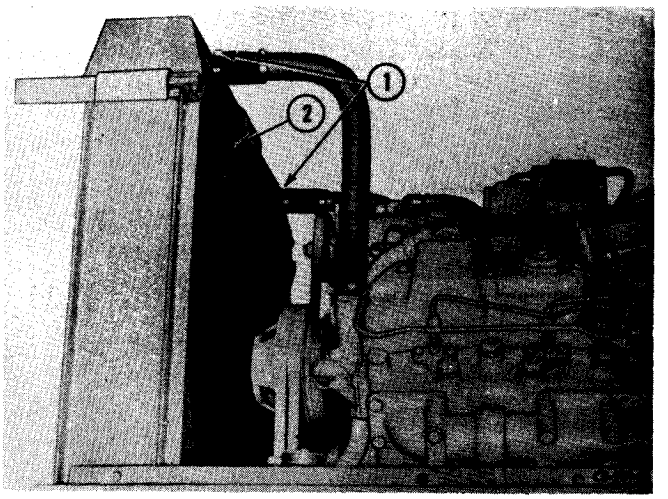

Figure 2-11

Close radiator petcock (4, Fig. 2-12). Loosen hose clamps (2) from bottom of radiator hose. Hose will disconnect when radiator is removed. With an overhead hoist attached, remove cap screws and nuts (1) and lower radiator to floor.

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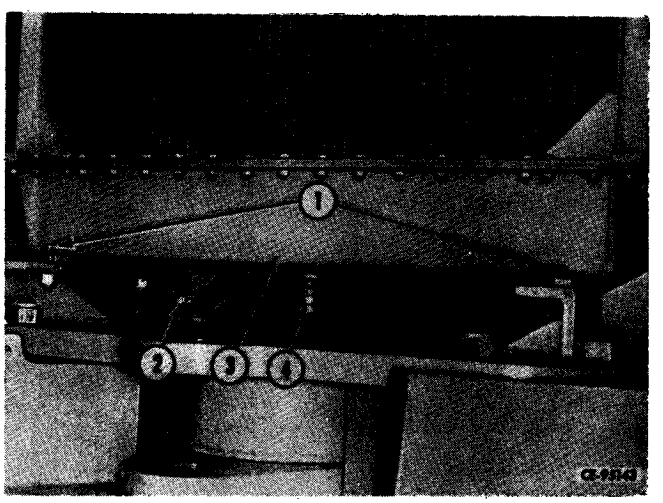

Figure 2-12

REMOVAL - Continued

From the top of the engine, disconnect accelerator linkage by removing spring (1, Fig. 2-13), ball joint and nut (2), spring return bracket (3) and jam nut (4) from end of control cable (8). Remove cable boots (5), cable nut and washer (6) and pull control cable out through support bracket.

Disconnect cold weather lines (9, 10) from intake manifold. Disconnect tachometer cable (11) from end of tachometer and secure to engine. Remove air line (12) from air regulator valve. Disconnect and tag electrical wires (13, 14, 15 and 16).

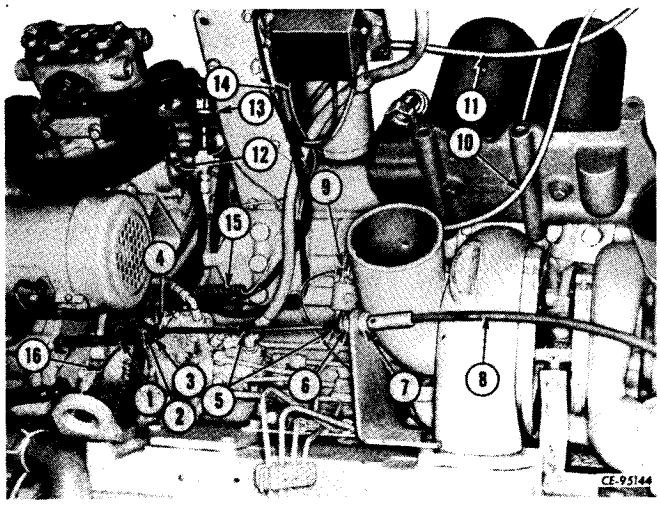

Figure 2-13

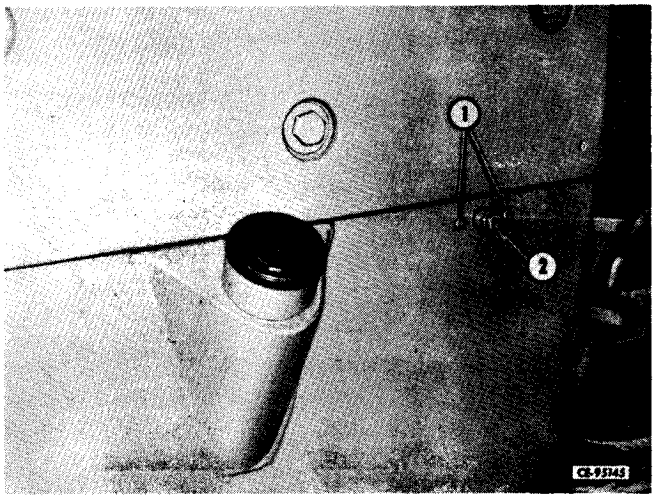

Figure 2-14

Remove cap screws (1, Fig. 2-14) disconnecting engine crankcase drain line (2) from side of fuel tank. Wire drain line to side of engine.

Position a suitable drip pan under the torque converter area. Remove hydraulic reservoir drain plug (1, Fig. 2-15) and using a flexible hose drain the reservoir through drain valve.

Remove pump intake lines by removing split flanges (2, 3, 4, 5 and 6) from the hydraulic pumps. Discard all "O"-rings from the ends of the hydraulic hoses.

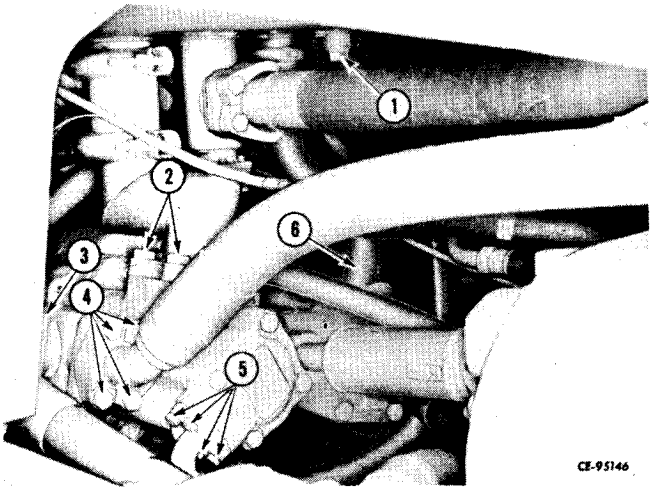

Figure 2-15

Disconnect lines (4, 5, Fig. 2-16) from transmission charging pump (6). Remove drive shaft

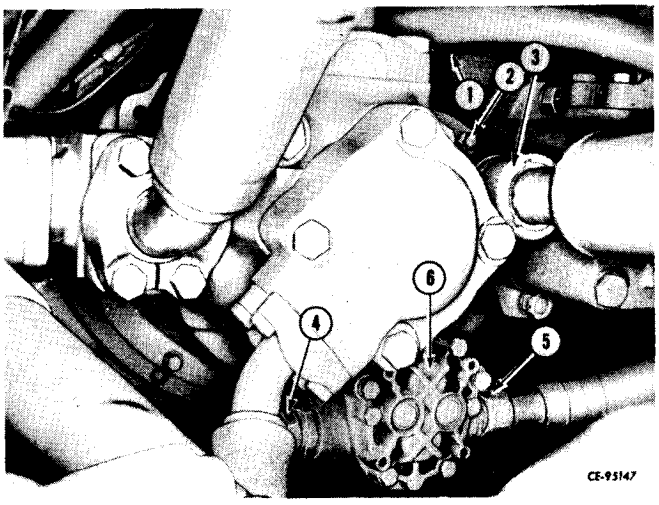

Figure 2-16

(3) from torque converter by removing cap screws and nuts (2). Disconnect and tag converter temperature sender wire (1).

From under the engine and torque converter disconnect drain line (1, Fig. 2-17) from flywheel housing.

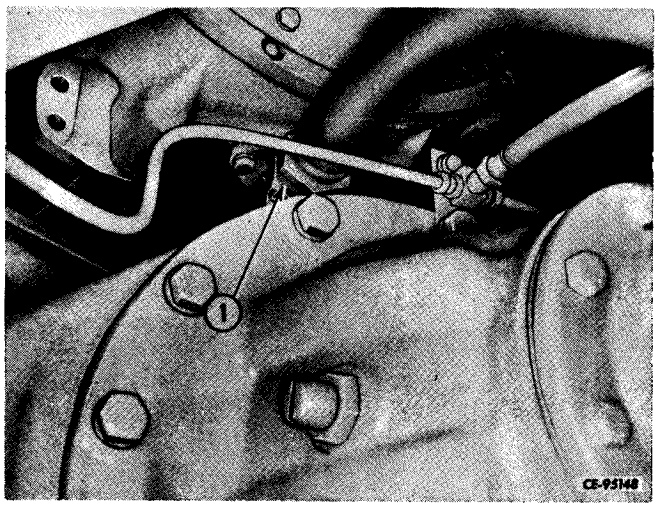

Figure 2-17

Disconnect fuel line (1, Fig's. 2-18, 2-19) from fuel pump. Disconnect fuel return line from top of fuel tank. Disconnect and tag electrical leads from starter (2), solenoid (3) and fuel pump. Disconnect air compressor output line.

Position a suitable hoist to the engine lifting brackets and remove cap screws and nuts (4) securing engine to tractor frame. Remove front cap screws and nuts separating engine mounting bracket (5) from tractor frame and using overhead hoist slowly lift engine from engine compartment to suitable engine stand. During engine removal check for any electrical leads or hoses still connected.

INSTALLATION

Secure engine oil filters and crankcase line to the engine and gently position engine in engine compartment with hoist.

With engine properly positioned, install cap screws and nuts (4, Fig. 2-18) that secure both front (5, Fig's. 2-18, 2-19) and rear engine mounts to tractor frame. Tighten hex nuts to recommended torque (refer to "SPECIAL TORQUES").

Torque:
Front mounting brackets-to-flywheel housing: _____

Front mounting bracket-to-frame: _____

Engine-to-rear mounting bracket: _____

Rear mounting bracket-to-frame: _____

Connect fuel line (1, Fig's. 2-18, 2-19) to the fuel pump. Connect return line to top of fuel tank.

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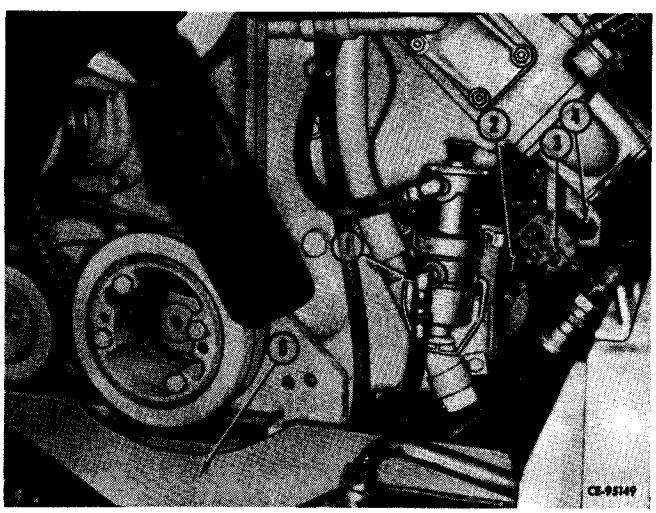

Figure 2-18
Early Fuel Pump Mounting.

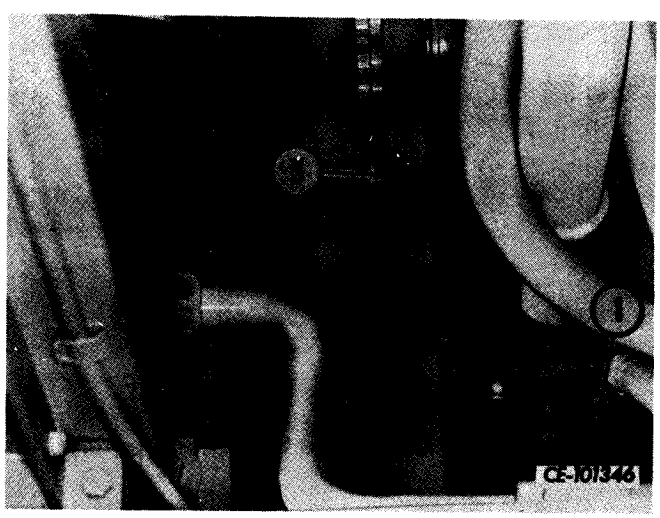

Figure 2-19
Late Fuel Pump Mounting.

INSTALLATION - Continued

Secure electrical wires to starter (2), starter solenoid (3) and fuel pump.

Connect drain line (1, Fig. 2-20) to bottom of torque converter.

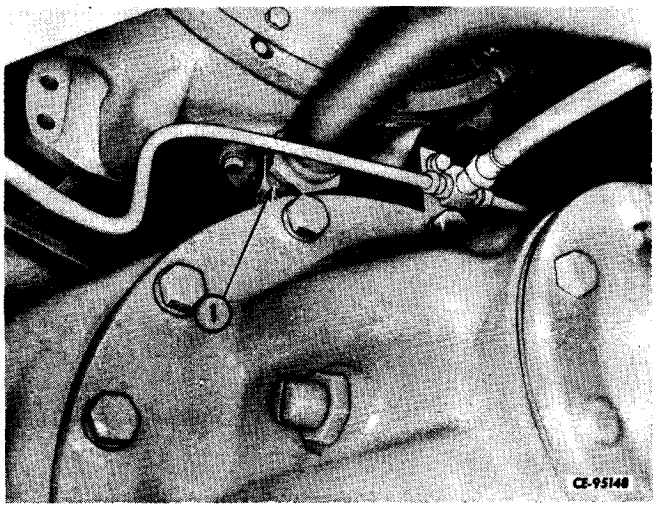

Figure 2-20

Connect electrical lead (1, Fig. 2-21) to converter temperature sender. Install and tighten cap screws and nuts (2) that secure drive shaft (3) to torque converter. Install and tighten hydraulic lines (4, 5) to transmission charging pump (6).

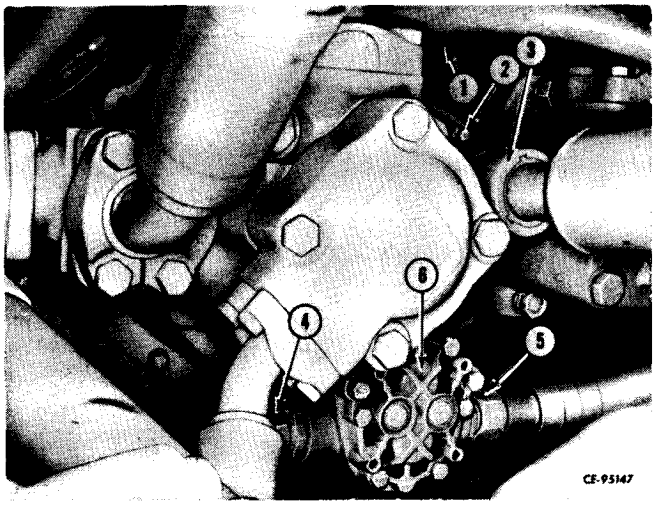

Figure 2-21

Close reservoir drain valve. Install and tighten the drain plug (1, Fig. 2-22).

Install new "O" rings in stem grooves on ends of all hydraulic lines and connect hydraulic lines to the pumps. Install and tighten cap screws (2, 3, 4, 5 and 6) securing split flanges to hydraulic pumps.

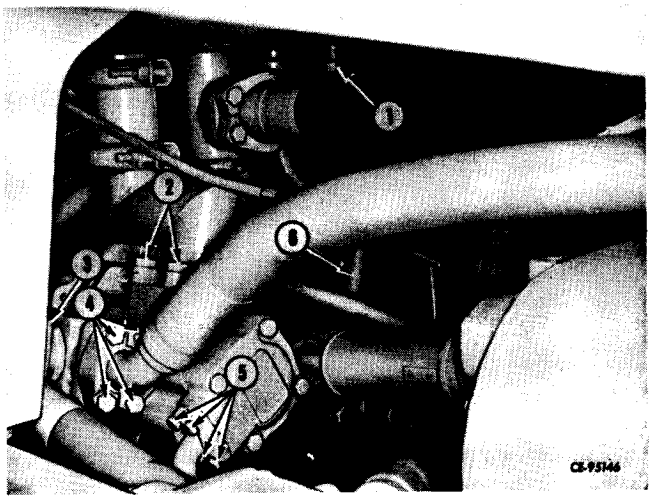

Figure 2-22

Position crankcase drain line (2, Fig. 2-23) into side of fuel tank. Install and tighten cap screws and nuts (1).

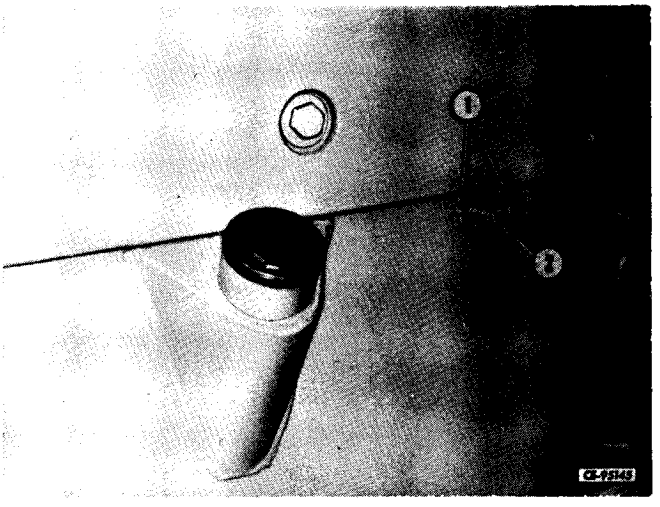

Figure 2-23

TRACTOR POWER UNIT

From the top of the engine connect accelerator control to fuel injection pump lever by installing control cable through support bracket. Install and tighten cable nut and washer (6, Fig. 2-24). Install cable boots (5), jam nut (4), spring bracket (3) and ball joint (2). Install and tighten nut and lock washer securing ball joint (2) to fuel injection pump lever. Install cable return spring (1). For accelerator linkage adjustment, refer to Section 9, "ACCELERATOR LINKAGE."

Connect cold weather starting lines (10, 9) to intake manifold. Connect tachometer cable (11) to end of tachometer. Connect air line (12) to air regulator valve. Connect all electrical wires (13, 14, 15 and 16).

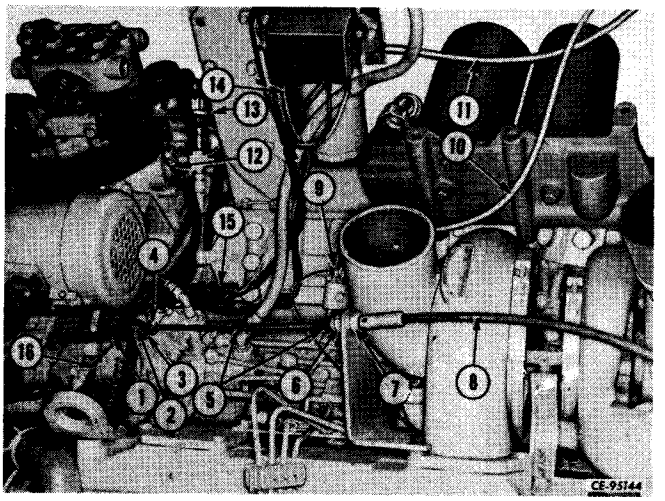

Figure 2-24

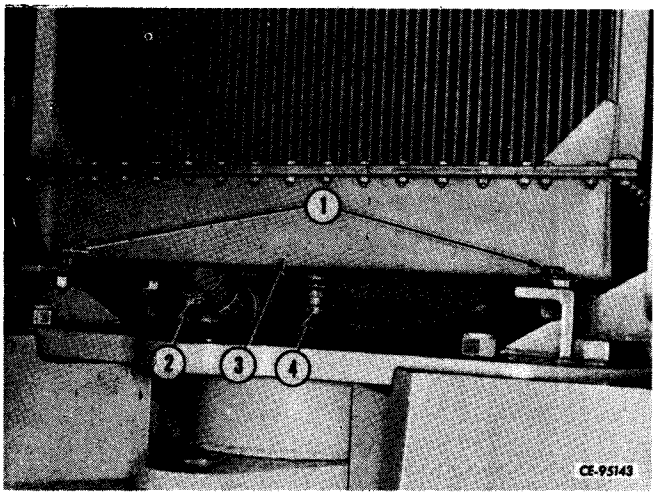

Figure 2-25

Using a suitable hoist, lift radiator (3, Fig. 2-25) into position, inserting lower radiator outlet into hose (2). Install and tighten cap screws and nuts (1). Position and tighten hose clamp (2). Be sure petcock (4) is closed.

Position upper radiator hoses on radiator (2, Fig. 2-26). Install and tighten hose clamps (1).

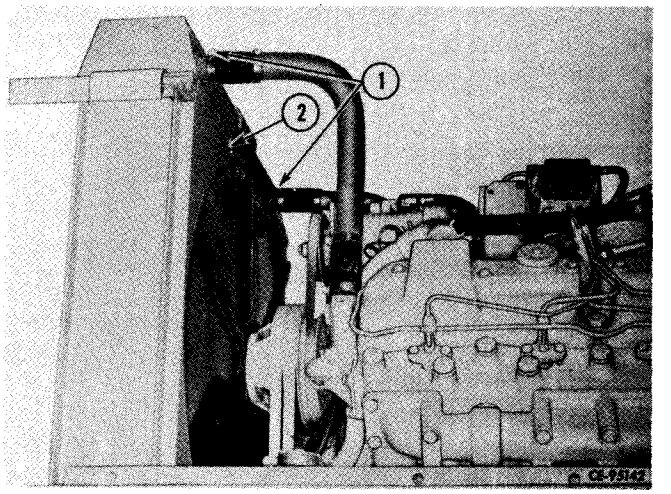

Figure 2-26

Install and tighten both hydraulic lines (1, 2, Fig. 2-27) to bottom of radiator (3). Connect fuel line to fuel tank.

(Continued on next page)

Figure 2-27

INSTALLATION - Continued

Using a suitable hoist, lift and position oil cooler (4, Fig. 2-28) onto frame. Install and tighten cap screws and nuts (3). Install and tighten the cap screws and nuts that secure the top of the oil cooler to the radiator. Install and tighten cooler lines (1, 2) to oil cooler (4).

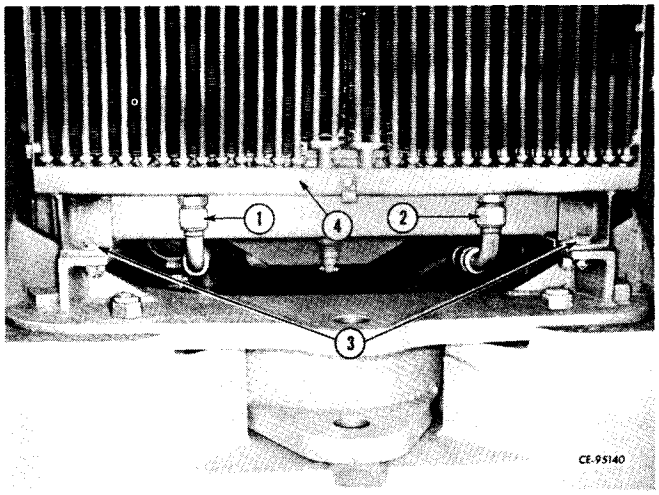

Figure 2-28

Using a suitable hoist, position grille (2, Fig. 2-29) on tractor frame. Install and tighten cap screws and nuts (1) on each side of grille.

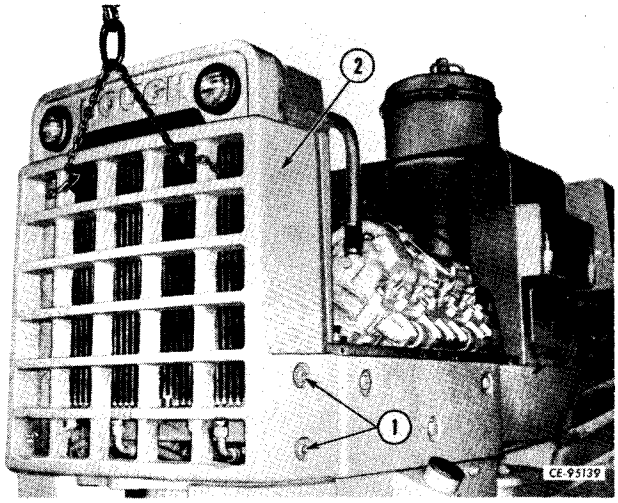

Figure 2-29

Connect tagged electrical wires to top rear driving lights. Connect lower electrical wires to stop lights before installing tail light brackets to grille (3, Fig. 2-30). Insert tail light brackets inside grille. Install and tighten cap screws and nuts (1).

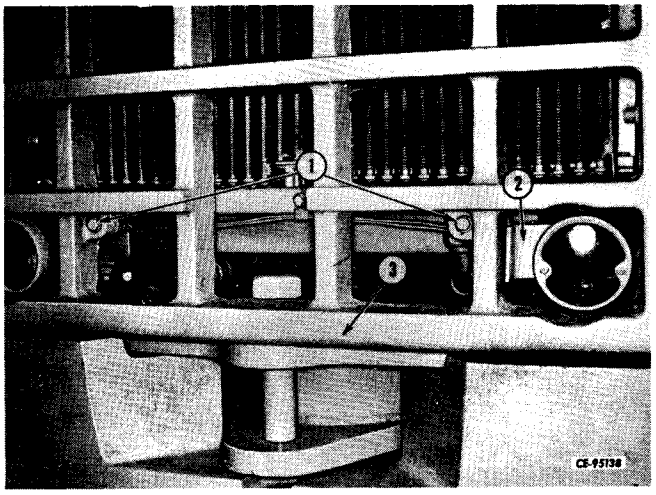

Figure 2-30

Using a suitable hoist, position hood (2, Fig. 2-31) on the grille and bulkhead. During hood installation, insert air cleaner (3) outlet tube on intake manifold. Install and tighten cap screws and nuts (1).

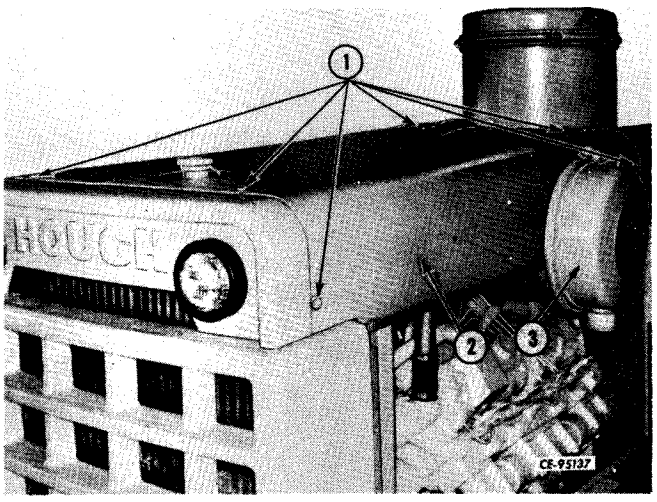

Figure 2-31

Install air compressor hose (2, Fig. 2-32) in end of air cleaner (5). Position and tighten hose clamp (1). Position and tighten hose clamp (3) securing tube (4) to intake manifold.

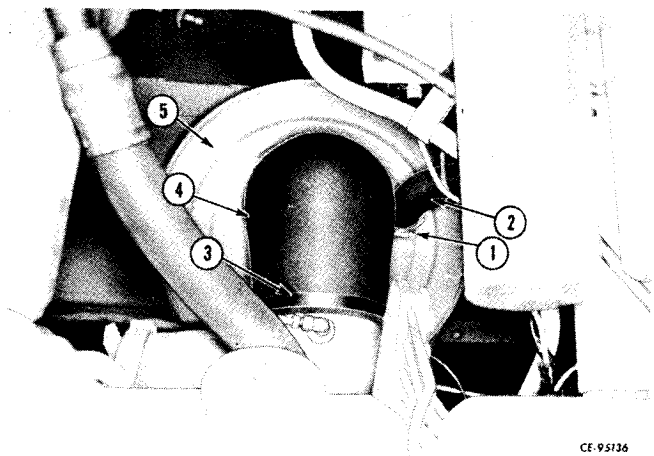

Figure 2-32

Position engine oil filters (2, Fig. 2-33). Install and tighten cap screws and nuts (1) securing oil filters to hood (3).

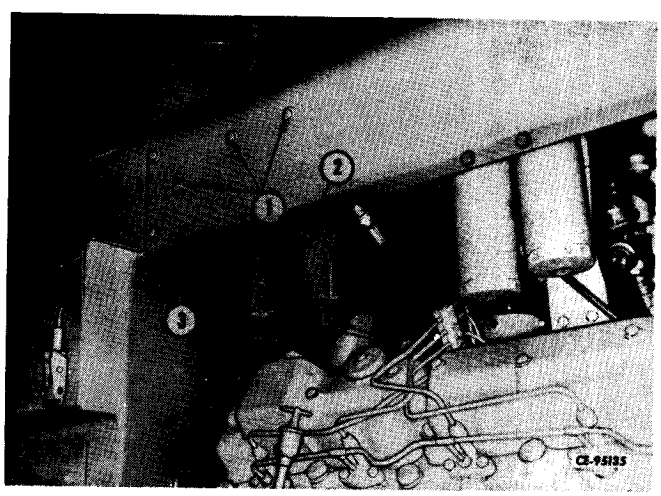

Figure 2-33

Insert exhaust stack (3, Fig. 2-34) through hood and "U" clamp. With lower clamp in position, install end of exhaust stack onto exhaust manifold (4). With clamp in position tighten cap screw and nut (1). Tighten nuts (2).

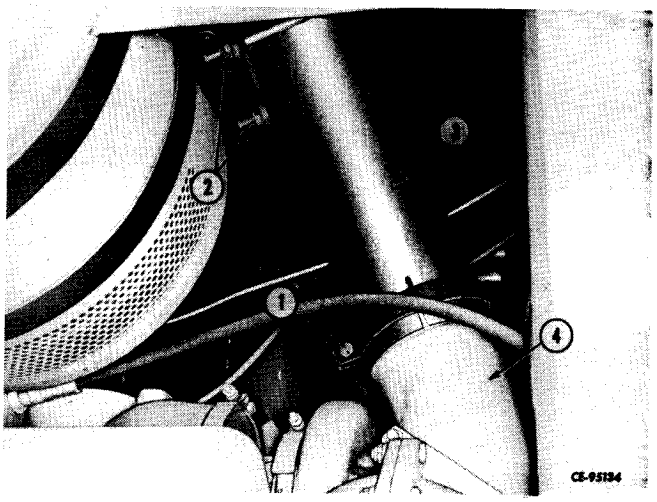

Figure 2-34

With batteries (2, Fig. 2-35) cleaned and installed on each side of unit, install and tighten battery cables to the correct battery posts (1). Install ground cable last. Refer to Section 12, "ELECTRICAL SYSTEM" for additional information.

(Continued on next page)

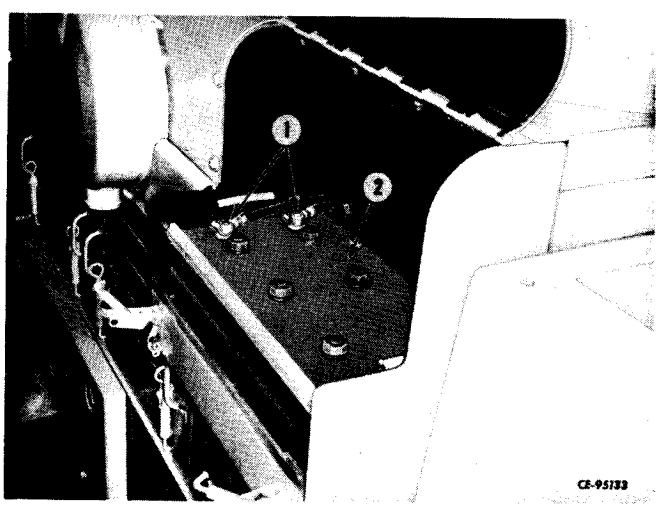

Figure 2-35

ENGINE

TRACTOR POWER UNIT

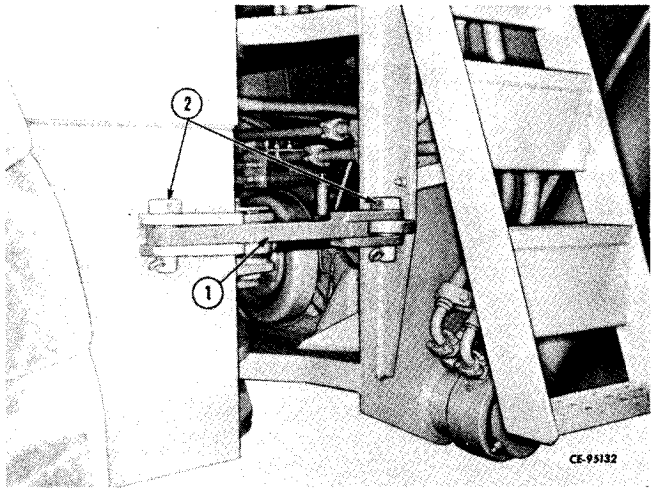

Figure 2-36

INSTALLATION - Continued

Fill radiator with clean, fresh coolant (refer to "SERVICE INFORMATION" for type and capacity). Fill the hydraulic reservoir with clean, new fluid (refer to Section 11, "HYDRAULIC SYSTEM" for type, capacity and level check procedure). Check for leaks during refill operations. Check the engine oil level before starting engine. Start engine. With engine at low idle, check transmission fluid level. Add fluid as required (refer to Section 4, "TRANSMISSION" for type of lubricant and level check procedure). Check gauge readings on instrument panel.

Remove safety bar (1, Fig. 2-36) and pins (2). Install safety bar in storage position.

RADIATOR AND OIL COOLER

REMOVAL

The radiator and oil cooler may be removed from the engine compartment by removing the grille and properly supporting the hood.

Position unit under an overhead hoist and apply the parking brake. Position safety bar (1, Fig. 2-37) and pins (2) in the straight lock position.

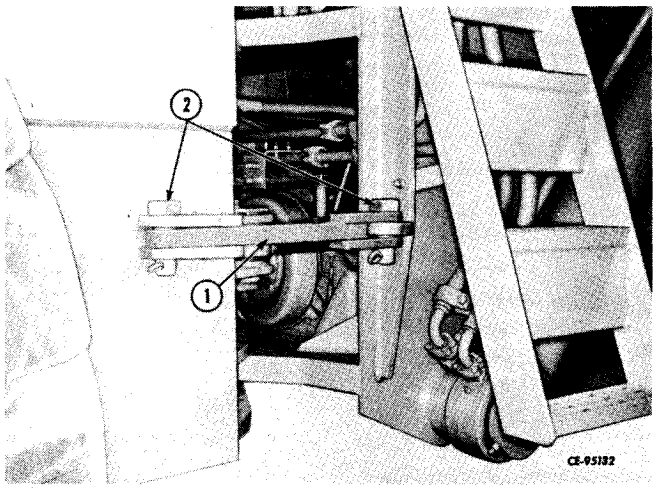

Figure 2-37

Remove battery cables (1, Fig. 2-38) from batteries (2) on each side of the unit. Remove ground cable first.

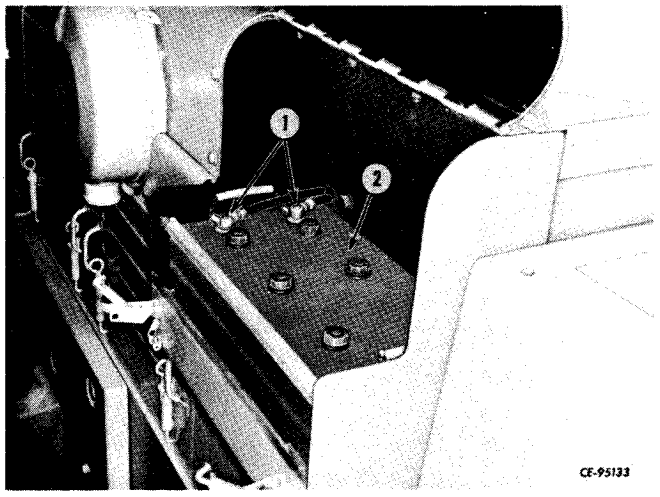

Figure 2-38

In order to remove the grille, cap screws (1, Fig. 2-39) are removed connecting the hood to the grille and cap screws (2) are loosened connecting hood to bulkhead.

RADIATOR AND OIL COOLER

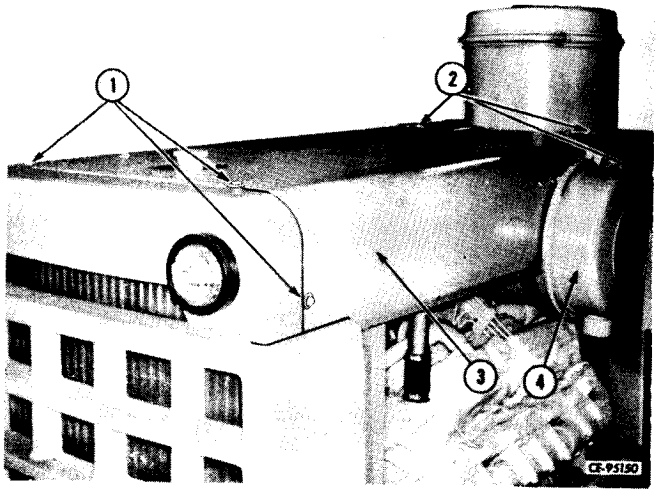

Figure 2-39

Using a block of wood prop the rear of the hood high enough to eliminate interference with grille.

Disconnect and tag electrical wires from the rear driving lights.

Remove tail light brackets (2, Fig. 2-40) by removing cap screws and nuts (1). With tail lights removed, disconnect electrical wires and tag.

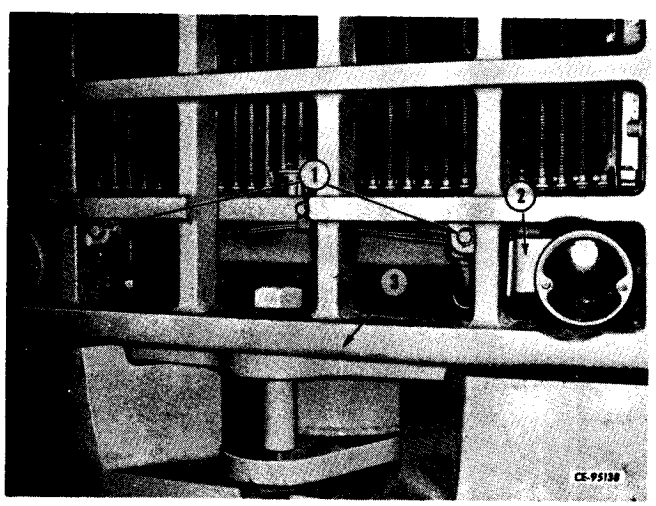

Figure 2-40

With a suitable hoist attached, remove cap screws (1, Fig. 2-41) on each side of the grille and lower grille (2) to floor.

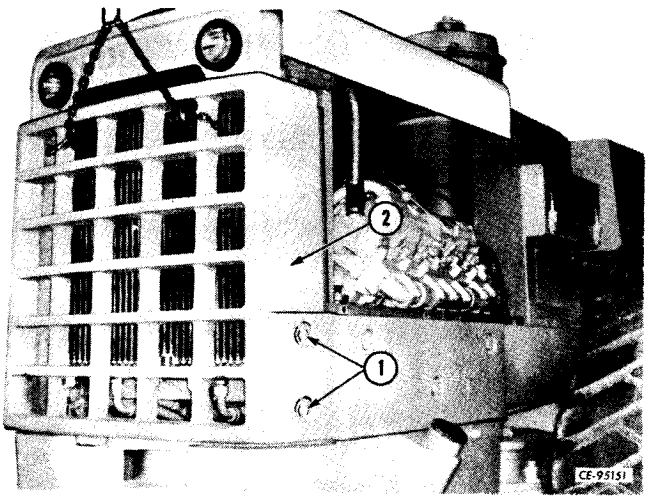

Figure 2-41

Disconnect transmission oil cooler lines (1, 2, Fig. 2-42) from the bottom of the oil cooler (4). Insert plastic plugs into both the oil cooler and disconnected lines (1, 2) to keep fluid from dripping.

Remove cap screws and nuts securing the top of the oil cooler to the radiator. Secure cooler to overhead hoist and remove cap screws and nuts (3). Lower oil cooler to floor.

(Continued on next page)

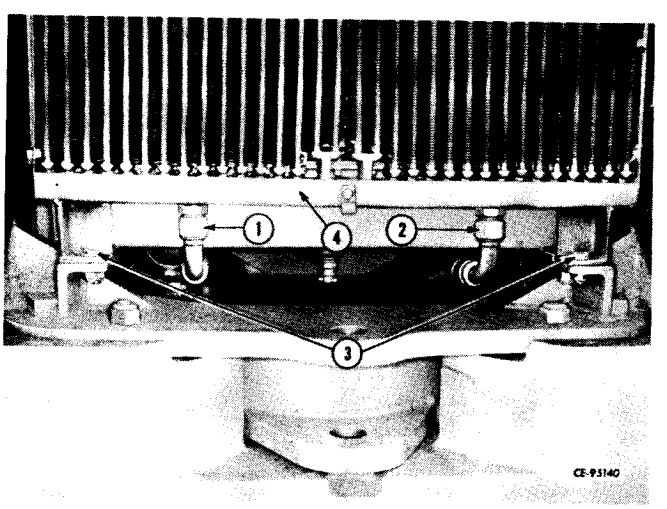

Figure 2-42

RADIATOR AND OIL COOLER

REMOVAL - Continued

Disconnect hydraulic lines (1, 2, Fig. 2-43) from the bottom of the engine radiator (3).

NOTE: Disconnect one hydraulic line at a time. These lines are hooked indirectly to the hydraulic reservoir and must be plugged immediately to avoid hydraulic oil being drained from the reservoir. Plug the radiator end also.

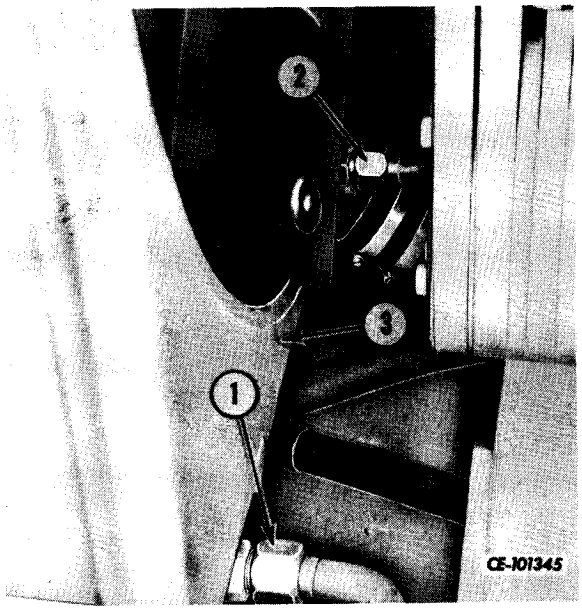

Figure 2-43

Drain radiator (3, Fig. 2-44) into a clean resealable container by opening petcock (4). Loosen upper hose clamps (not shown) and remove hoses from top of radiator.

Loosen hose clamp (2) from bottom of radiator hose. Hose will disconnect when radiator is removed. With an overhead hoist attached, remove cap screws and nuts (1) and lower radiator to floor.

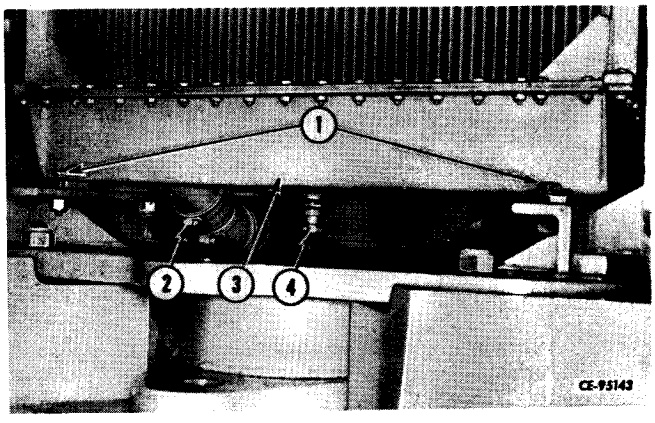

Figure 2-44

INSTALLATION

Using a suitable hoist, lift radiator (3, Fig. 2-45) into position, inserting lower radiator outlet into hose (2). Install and tighten mounting cap screws and nuts (1). Position and tighten hose clamp (2). Install upper radiator hoses (not shown) to radiator and position and tighten hose clamps. Close petcock (4).

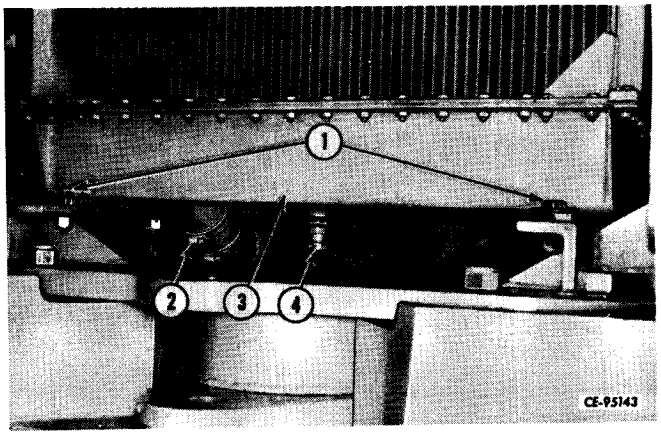

Figure 2-45

Remove plugs and quickly connect and tighten hydraulic lines (1, 2, Fig. 2-46) to bottom of radiator (3).

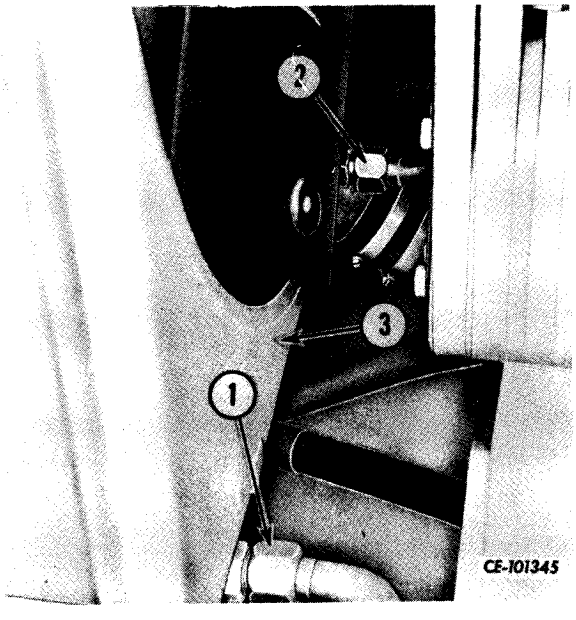

Figure 2-46

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RADIATOR AND OIL COOLER

Using a suitable hoist, lift and position oil cooler (4, Fig. 2-28) on frame. Install and tighten cap screws and nuts (3). Install and tighten cap screws and nuts securing the top of the oil cooler to the radiator (not shown). Install and tighten cooler lines (1, 2) to oil cooler (4).

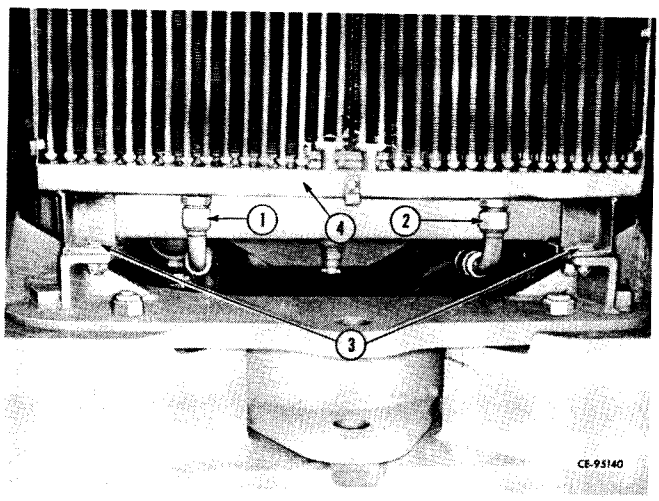

Figure 2-47

Using a suitable hoist, lift and position grille (2, Fig. 2-48) on tractor frame. Install and tighten cap screws and nuts (1) on each side of grille.

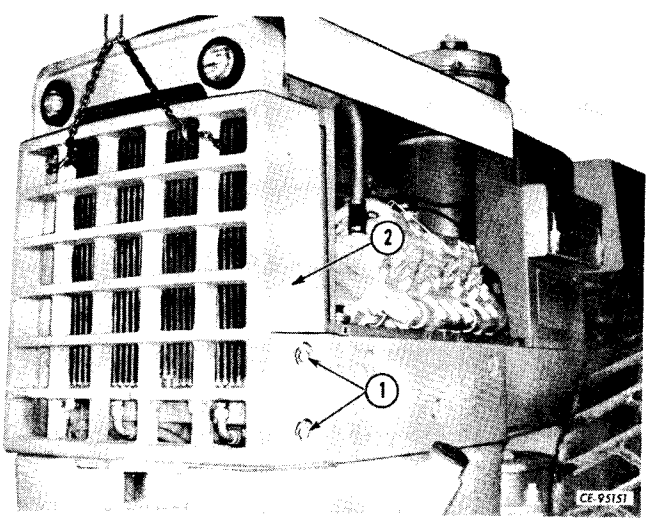

Figure 2-48

Connect tagged electrical wires to top rear driving lights (not shown). Connect electrical wires to stop lights before installing tail light brackets on grille (3, Fig. 2-49). Insert tail light brackets inside grille and secure with cap screws and nuts (1).

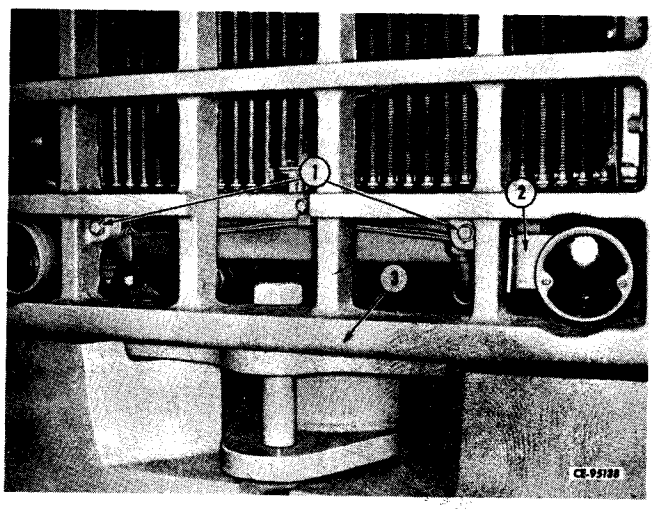

Figure 2-49

Remove wood block used to support hood during grille removal. Install and tighten cap screws and nuts (1, Fig. 2-39). Tighten cap screws and nuts (2).

(Continued on next page)

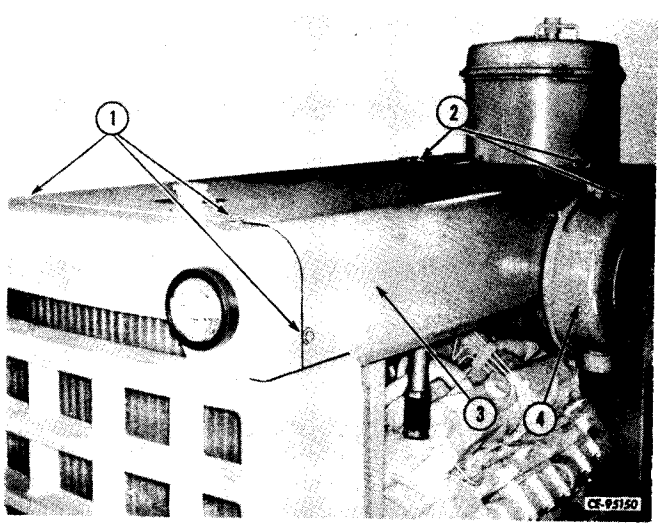

Figure 2-50

RADIATOR AND OIL COOLER

INSTALLATION - Continued

With batteries (2, Fig. 2-51) cleaned and installed on each side of unit, install and tighten battery cables to the correct battery posts (1). Install ground cable last. Refer to Section 12, "ELECTRICAL SYSTEM" for additional information.

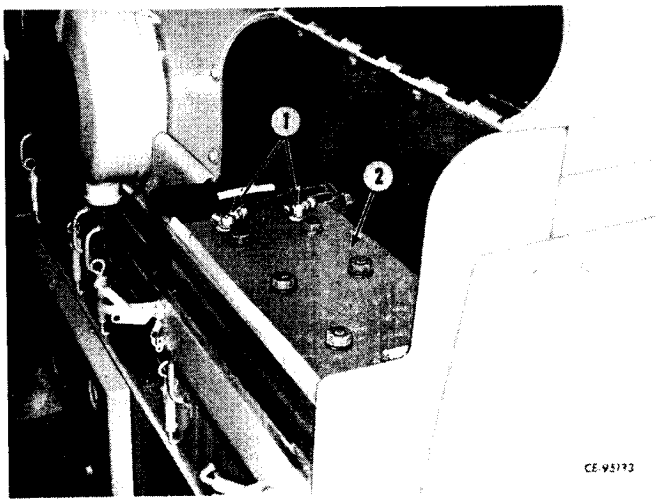

Figure 2-51

Fill radiator with clean, fresh coolant. Check the fluid level in the hydraulic reservoir (refer to Section 11, "HYDRAULIC SYSTEM" for type of liquid and fill and check procedure). Check for leaks during refilling operation. Check the engine oil level before starting the engine. Start the engine. With the engine at idle, check the transmission fluid level (refer to Section 4, "TRANSMISSION" for type, capacity and fill and check procedures). Check all gauge readings on the instrument panel.

Remove safety bar (1, Fig. 2-52) and pins (2) and install bar in the storage position.

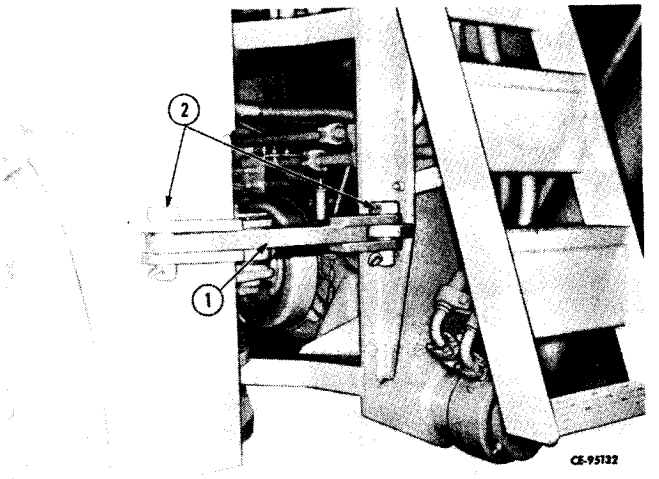

Figure 2-52

COLD WEATHER STARTING AIDS

GENERAL

To aid in cold weather starting, the IH diesel engine is equipped with an ether injection system. The system consists of an actuator button (1, Fig. 2-53), a mounting bracket (2), housing the ether container (3), an injection line to the intake manifold (5) and a temperature control line (4) from the engine block.

When the actuator button (1) is depressed, ether is routed to the intake manifold to aid combustion in a cold engine. A safety feature is built into the injection system which prevents ether injection into a warm engine. A temperature control line (4) stops any injection attempt over engine temperatures above 85°F.

OPERATION

Turn main electrical switch ON.

Set hand throttle above idle position.

Push the engine starter button and as the engine starts to turn over, inject starting fluid (ether) by depressing the actuator button (1), located on a bracket to the right of the instrument panel.

If the engine does not start within 20 seconds of continual cranking, stop and wait 30 seconds before repeating cranking and injection procedures.

COLD WEATHER STARTING AIDS

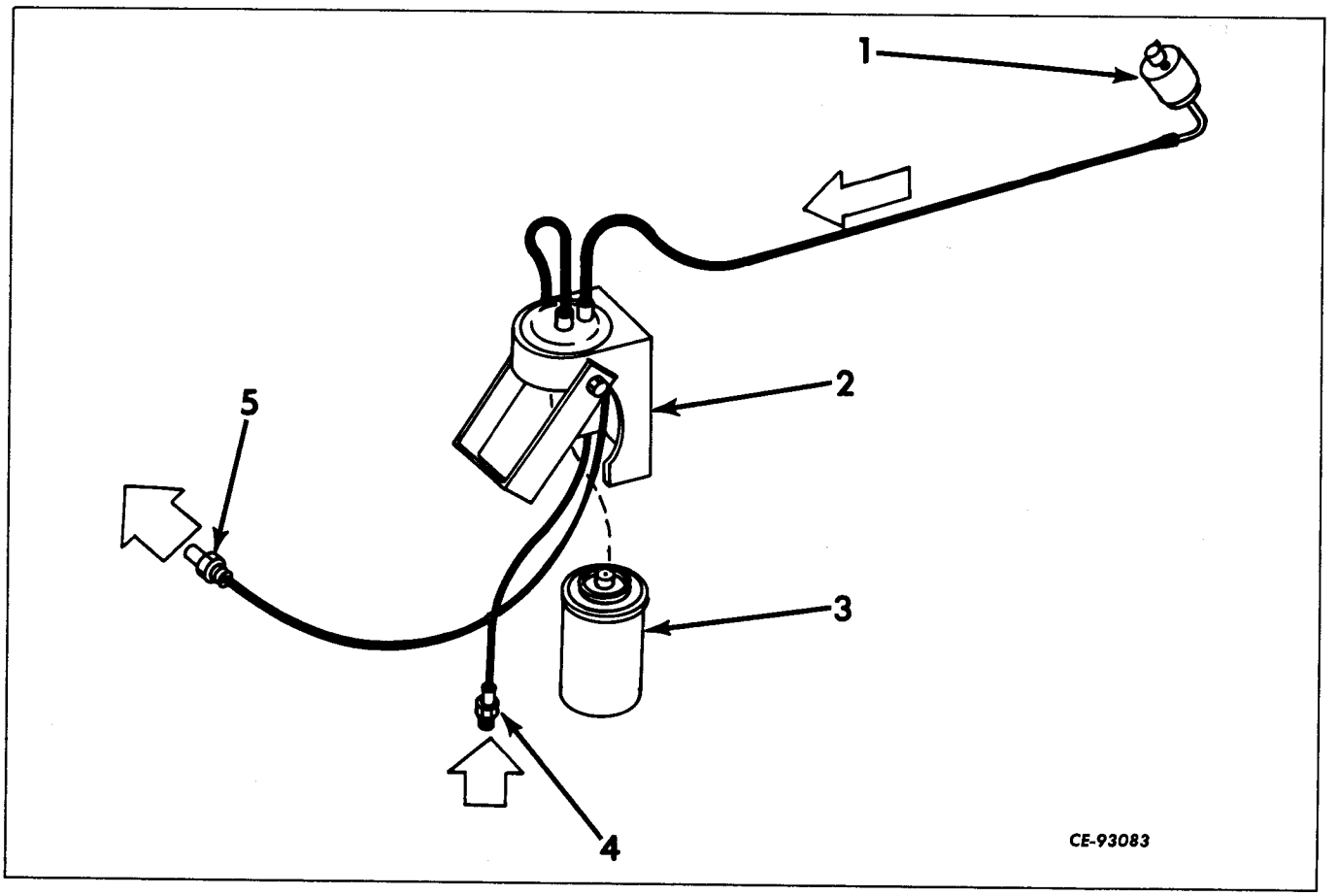

Figure 2-53
Cold Weather Starting Aid (IH Diesel).

1. Actuator button.
2. Ether container mounting bracket.
3. Ether container.
4. Temperature control line.
5. Intake manifold nozzle.

After the engine starts, release starter button but inject enough ether until the engine is running smoothly. Allow engine to warm up to normal operating temperatures before putting tractor to work.

SERVICE

If the engine gives no indication of starting, remove ether container (3, Fig. 2-53) and check to see if container is empty. Check supply by pointing container nozzle away from any possible body contact, and press down on nozzle. If container is not empty, check condition of lines from the operator's compartment to mounting bracket and between mounting bracket and injection nozzle. Remove line at intake manifold and while a helper operates the actuator button (1), check by smell to determine if the injection system is operating. If ether is not getting to the injection nozzle, the lines are not crimped or broken and the engine is not warmer than 85°F. the temperature control unit may be causing the block, stopping the ether from entering the engine. Disconnect all lines from the mounting bracket and remove and install serviced mounting bracket.

◆ CAUTION: WHEN REMOVING LINE FOR INSPECTION, HOLD LOOSE END AT ARMS LENGTH TO PREVENT POSSIBLE BODY CONTACT OR INHALING OF ETHER FUMES.

AIR CLEANER SYSTEM

GENERAL

Air is drawn into the air cleaner by the engine. From the cleaner, air is routed directly to the engine intake manifold or carburetor.

Dirty air is drawn through the screened portion of the air cleaner intake. As this dirty air enters the tank it is swirled around separating the heavier particles which drop into the removable cup assembly.

The partially cleaned air is then directed through a paper filter element, eliminating fine particles of dirt from the air. From the filter the cleaned air is routed to the engine and air compressor.

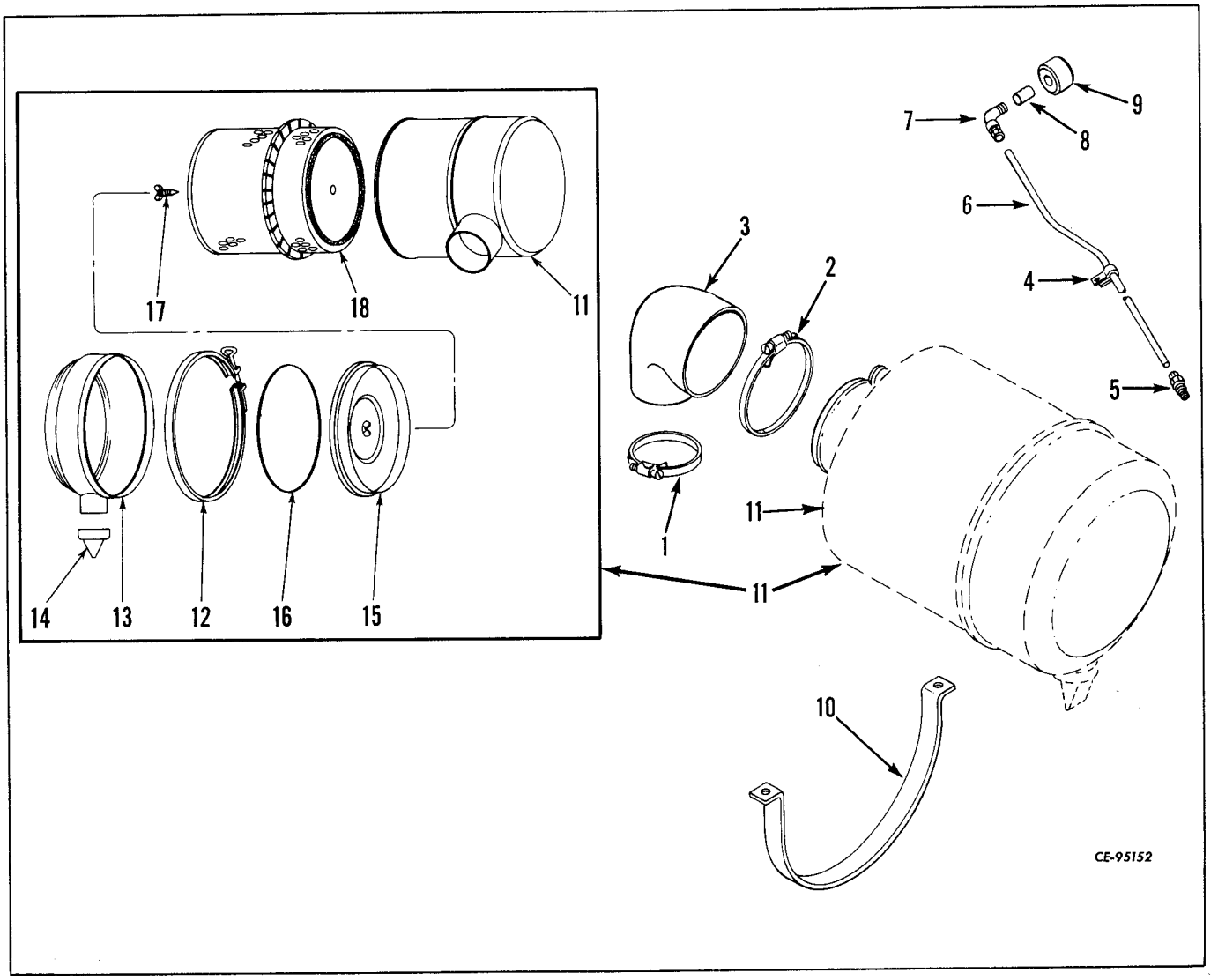

Figure 2-54
Engine Air Cleaner - Exploded View.

1. Hose clamp.
2. Hose clamp.
3. Hose.
4. Clamp.
5. Connector.
6. Tube.
7. Elbow.
8. Nipple.
9. Service indicator.
10. Mounting clamp.
11. Air cleaner.
12. Clamp.
13. Cup.
14. Vacuator valve.
15. Baffle.
16. "O"-ring.
17. Bolt.
18. Element.

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AIR CLEANER SYSTEM

The filter element and cup assembly should be serviced frequently. A vacuum indicator is mounted on the bulkhead next to the tachometer and indicates when the filter element should be serviced. When the filter is dirty and incoming air is restricted, the indicator will show red. After servicing the element, press down on the top of the vacuum indicator to restore it to its service position. A clear window indicates that the air cleaner is unrestricted.

The hoses and connections should be checked for leakage and wear. Dirty air entering the system without going through the air cleaner can cause serious damage to the engine.

For maintenance instructions on the air cleaner system, refer to the Operator's Manual, OM-H-90-E.

DISASSEMBLY

Disassemble in numerical order (Fig. 2-54).

SERVICE

Remove the filter element from the air cleaner assembly by removing the cap screw from the cup clamp. Remove cup assembly and mounting bolt and remove filter element from air cleaner body.

Inspect the filter element for leaks or damage by placing a bright light inside the element. Inspection of the element on the outside will disclose any holes where concentrated light shines through. The slightest rupture requires replacement of the filter element.

The element can be cleaned by either of two methods; washing or compressed air.

Washing is the preferred method as it removes more dust and soot than cleaning with compressed air. Washing results in better performance and longer intervals between required element service. It is suggested that spare elements be available for use while the serviced element is drying. This will reduce unit downtime to only a few minutes and will allow sufficient time to properly service the restricted element.

NOTE: A filter element must be replaced after six washings.

Cleaning the element with compressed air is not considered an entirely satisfactory method. Some dust will remain in the element causing more frequent servicing of the element. This method is to be used only as a temporary measure until sufficient time is available to clean the element by washing.

NOTE: After cleaning, if an element is to be stored for later use, place it in a plastic bag and store in an element shipping container to protect against dirt and damage.

WASHING

NOTE: Never wash elements in fuel oil, gas or solvent. DO NOT OIL ELEMENTS. Do not attempt to take elements apart. Do not tap the element against a hard surface; this will damage the element.

1. Tap the side or end of the element against the palm of your hand to remove loose dust.

2. Wash the element in clean, warm water (+70°F to +100°F). A small amount of non-sudsing detergent added to the water will facilitate the removal of soot.

3. Rinse the element in clear water (if a hose is used, do not exceed 40 psi). Shake the element carefully to remove excess water.

NOTE: Do not use compressed air to speed the drying of the element; the air pressure will rupture the wet element.

4. Lay the element on its side and allow it to air dry before re-installing. Overnight drying is usually sufficient. When drying the element protect it from dirt and/or freezing.

NOTE: If no spare element is available, the wet element, after excess water has been shaken out, may be installed in the air cleaner and the engine operated at low idle for 10 minutes before operating.

(Continued on next page)

AIR CLEANER SYSTEM

SERVICE - Continued

COMPRESSED AIR

NOTE: Do not tap the element against a hard surface; this will damage the element.

1. Carefully tap the side or the end of the element against the palm of your hand to remove loose dust.

2. Direct clean, dry compressed air up and down the pleats on the "clean side" (inside) of the element. Always direct the compressed air opposite the normal operating air flow through the element.

NOTE: Air pressure at the nozzle must not exceed 100 psi. Keep a reasonable distance between the air nozzle and the element.

ASSEMBLY

Assemble in reverse numerical order (Fig. 2-54).

FUEL SYSTEM

GENERAL

The fuel used in your diesel powered engine should have the proper combustion characteristics to secure the highest measure of performance and economy. CLEANLINESS of the fuel system is most important because of the harmful effect the impurities, particularly those of an abrasive nature, may have on the fuel system.

The fuel system should be serviced regularly. Refer to Operator's Manual, OM-H-90-E for periodic maintenance instructions and interval.

FUEL TANK

REMOVAL

Drain the fuel tank before removal. Remove the drain plugs (9, Fig. 2-55). Disconnect the fuel supply line and fuel return line from the fuel tank. Disconnect fuel level sender wire (5). Remove cap screws and nuts disconnecting crankcase drain line from mounting bracket on side of fuel tank.

Install hydraulic floor jack in position and properly blocked tight against tank. From inside the engine compartment, remove cap screws and nuts freeing the fuel tank from the tractor frame. Gently lower the tank from the tractor frame.

INSTALLATION

With the aid of a hydraulic jack raise the fuel tank up into the tractor frame. Do not force. Align fuel tank with mounting brackets and tractor frame. Install and tighten cap screws and nuts.

Install fuel supply line and fuel return line to the fuel tank. Install crankcase drain line to side of fuel tank and install and tighten cap screws and nuts. Install and tighten fuel tank drain plugs (9).

Connect electrical wire to fuel level sender (5). Fill tank with fresh, clean fuel and start the engine. Check for leaks.

INTERNATIONAL HARVESTER DIESEL

GENERAL

Fuel from the fuel tank is drawn up through the tube assembly (7, Fig. 2-55) by the fuel transfer pump (1). From the transfer pump, fuel is directed to the primary filter (2), final filter (3) and then enters the fuel injection pump (4). The injection pump (4) pumps fuel to the injection nozzles.

Excess fuel from the fuel injection pump and fuel injection nozzles is combined and returned to the fuel tank.

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FUEL SYSTEM

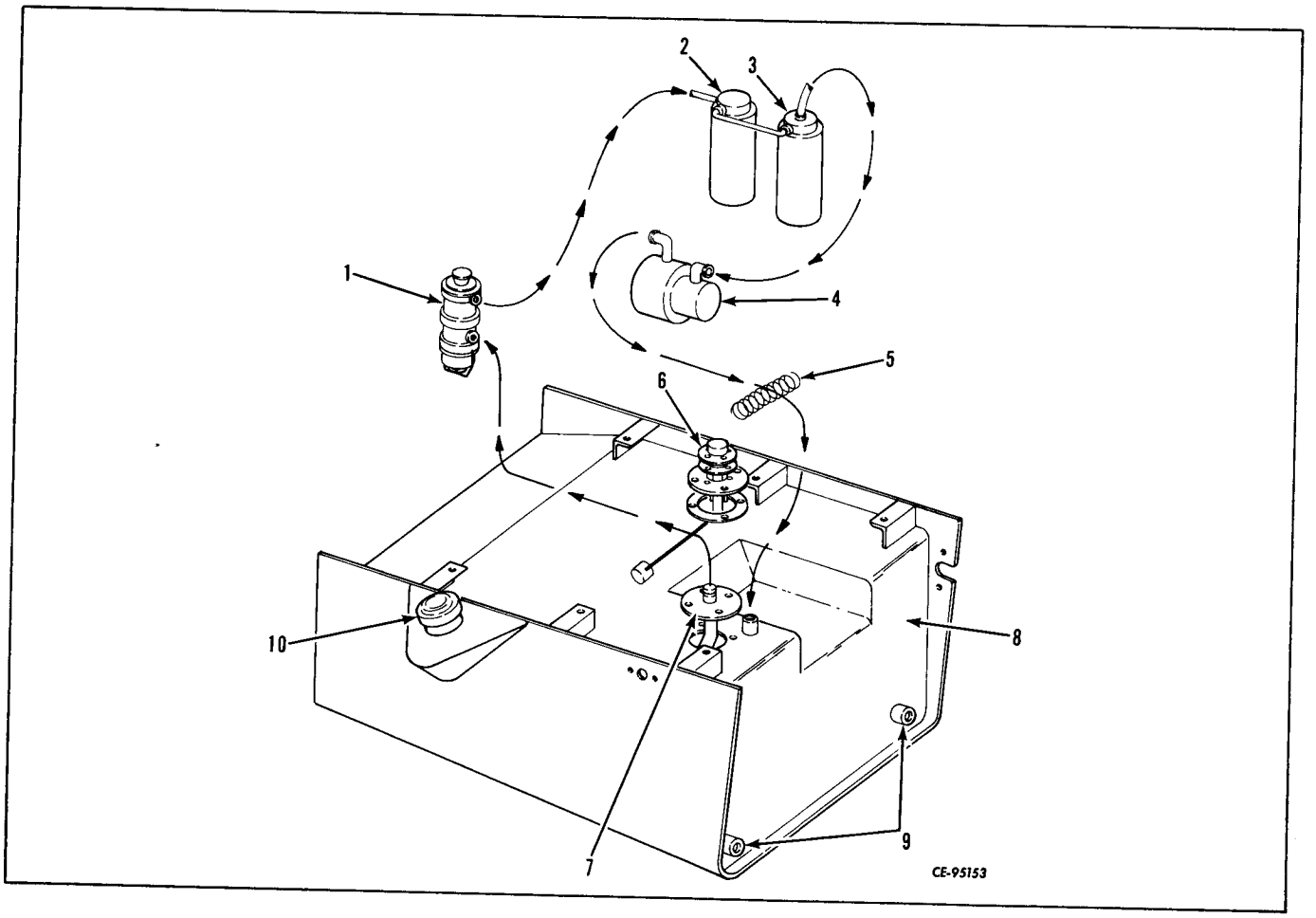

Figure 2-55
Fuel System - IH Diesel.

1. Fuel transfer pump.
2. Primary fuel filter.
3. Final fuel filter.
4. Fuel injection pump.
5. Level sender wire.
6. Fuel level sender.
7. Tube assembly.
8. Fuel tank.
9. Drain plugs.
10. Fill cap.

The fuel level sender indicates the amount of fuel in the fuel tank. A float, mounted on the end of the sender (6), floats on top of the fuel level. Refer to Operator's Manual, OM-H-90-E for periodic maintenance instructions and interval.

VENTING THE SYSTEM

All air must be eliminated from the fuel lines before the engine will operate properly. All fuel line connections must be tight to avoid leakage and to prevent air from entering the system. The system must be vented when:

An engine, in operation, runs out of fuel.

A new engine is being started for the first time.

Fuel filters have been replaced.

Fuel piping has been disconnected or loosened.

Vent the system as follows:

1. Fill the fuel tank. Turn starting key to the "ON" position but do not start engine.

(Continued on next page)

INTERNATIONAL HARVESTER DIESEL - Continued

VENTING THE SYSTEM - Continued

2. Open the valve (A, Fig. 2-56) on the primary fuel filter header. When fuel flows out in a solid stream free of bubbles, close the valve.

3. Open the valve (B) on the final fuel filter header. When fuel flows out in a solid stream free of bubbles, close the valve.

4. Start the engine.

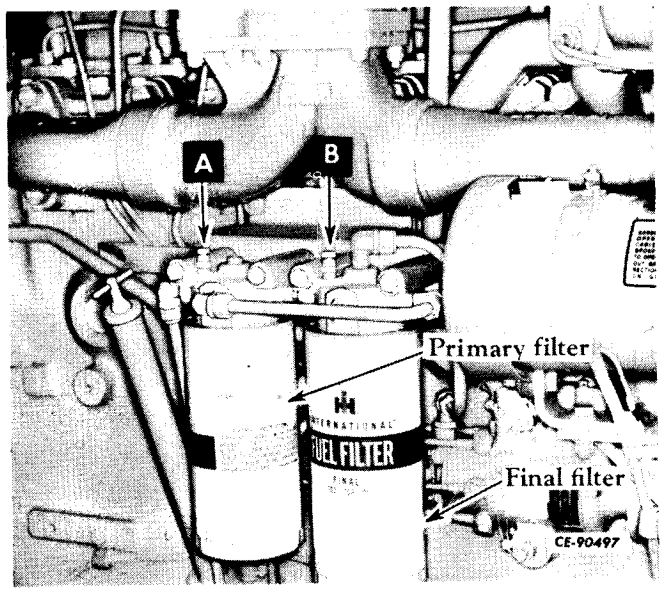

Figure 2-56
Fuel Filters and Vent Valves.

FUEL FILTER ELEMENT SERVICE

These filters cannot be cleaned and must not be disturbed except for replacement.

The standard primary filter is the viscose wound type with a controlled density to avoid premature plugging. This filter is the first in the system to filter the fuel as it comes from the tank.

The final filter is the paper pleated type. This filter will need replacement less often than the primary filter if proper primary filter service and water draining procedures are followed.

NOTE: NEVER USE THE VISCOSE WOUND TYPE FILTER AS THE FINAL FILTER.

When to Replace Filters

Loss of engine power or misfiring of the engine may indicate fuel filter restriction.

1. Before replacing filter(s), drain the water from the diesel fuel tank.

2. If the engine still shows loss of power proceed as follows:

Replace the primary fuel filter. Vent the fuel system. Start the engine. If the engine has not regained full power or continues to misfire; stop the engine; replace the final fuel filter, then vent the fuel system.

Replacing the Filter

Be careful not to allow dirt, water and other foreign material to get on the filter. Keep the new filter in the package until ready for installation.

1. Unscrew the filter from the header; discard the filter. A filter wrench can be used for this purpose if unable to turn by hand. This tool provides leverage to break the bond between the filter header and the filter seal.

NOTE: Do not use any tool for installation.

2. Thoroughly clean the filter header with kerosene or diesel fuel to prevent dirt or foreign material from falling into the new filter.

3. Apply a light coating of clean engine oil or chassis grease to the seal surface on the new filter.

4. Install, but do not "spin," the new filter, turning it until the seal just contacts the filter header.

5. Make aligning marks on the filter and the filter header; give the filter an additional 1/4 to 1/2 turn.

NOTE: Do not over-tighten the filter.

6. Vent the system as outlined in this section.

TRANSFER PUMP ELEMENT SERVICE

Loosen thumb nut mounted on the pump bail (7, Fig. 2-57) and remove the bowl (6), spring (5), base (4) and element (3) all at the same time. Discard the element (3).

Clean the bowl (6), spring (5) and base (4) thoroughly in solvent and allow to dry. Inspect the fuel pump gasket (2) and replace with a new gasket if necessary. It is recommended to replace the gasket.

Re-install spring (5), base (4) and new element (3) in the bowl (6). Re-install the bowl (6) to the body (1) and tighten the thumb nut mounted on the pump bail (7). Vent the fuel system as described under "Priming and Venting the Fuel System."

NOTE: DO NOT remove the switch assembly from the pump under any circumstances.

Legend for Figure 2-57

1. Fuel transfer pump.
2. Fuel pump gasket.
3. Fuel bowl filter.
4. Fuel filter base.
5. Spring.
6. Bowl.
7. Pump bail.

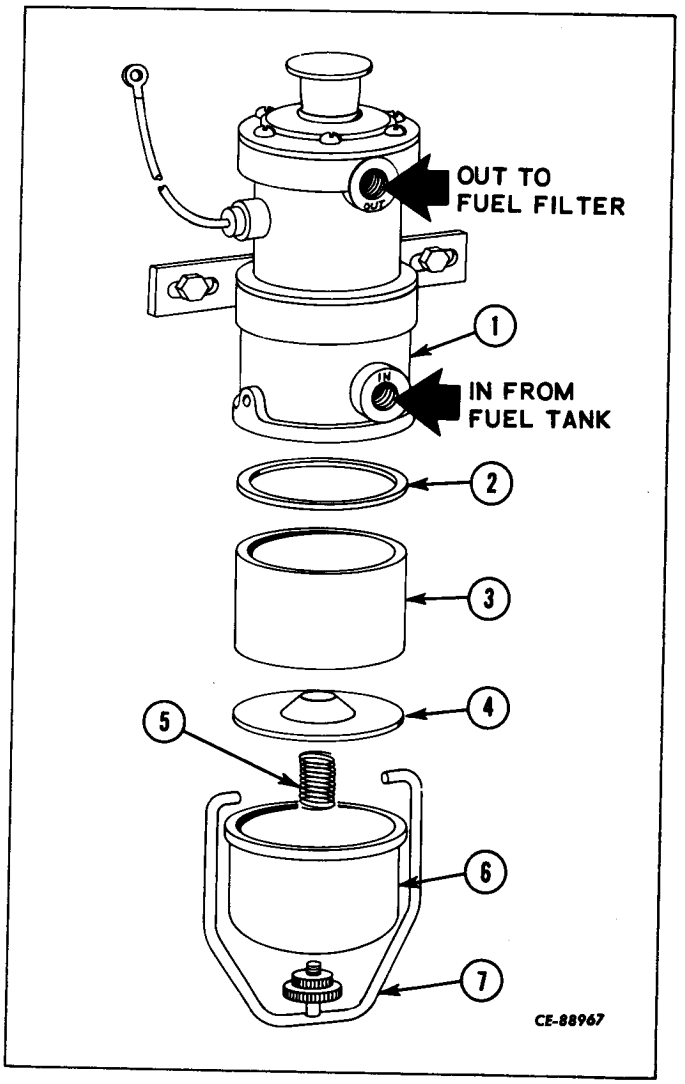

Figure 2-57
Fuel Transfer Pump.

ENGINE

DRIVE BELTS

GENERAL

Power transmission through V-belts requires proper belt installation, tensioning, pulley alignment and maintenance. Neglect or improper tensioning procedures leads to short belt and pulley life, engine cooling problems, and early component bearing failures.

Belts on new machines and replacement belts lose their tension as they seat into the pulley grooves. Check the tension of these belts at one, ten and fifty hour intervals to stabilize the belt tension. If tension falls below the required minimum the belts slip, damaging the belts and pulley grooves. Belt tensions must be watched during the break-in period.

TENSION REQUIREMENTS FOR GATES 7/16" POLYFLEX BELTS ONLY

The tension applied to a new belt (initial installation only) is higher than the retention applied to a used belt. A used belt is one that has been run five minutes or longer.

Belt tensions are to be measured by means of "Gates 150 Tensiometer" or by Borrough's Gauge No. BT-56851 to insure correct belt tensions. The gauges may be obtained from:

BORROUGH'S TOOL & EQUIPMENT CO.
2429 NORTH BURDICK STREET
KALAMAZOO, MICHIGAN 49007

GATES RUBBER COMPANY
999 SOUTH BROADWAY
DENVER, COLORADO 80217

The required belt tensions are shown in the following chart.

BELT TENSION CHART

CONDITION		FAN AND WATER PUMP BELTS	GENERATOR BELT
NEW BELT INSTALLATION		130 - 135	70 - 75
RETENSION	New machine upon delivery. 1 hour after belt replacement. After 10 hours of operation. After 50 hours of operation. *At intervals of 200 hours.	105 - 110	60 - 65
MINIMUM PERMISSIBLE TENSION		80	40

* WHEN OPERATING IN ABRASIVE TYPE ENVIRONMENTAL CONDITIONS, BELT TENSION SHOULD BE CHECKED BEFORE REACHING 200 HOURS, PREFERABLY AT 100 HOURS DURING ENGINE OIL CHANGE PERIOD.

NOTE: DO NOT ALLOW BELT TENSIONS TO FALL BELOW THE SPECIFIED "MINIMUM PERMISSIBLE TENSION" VALUES. CHECK BELT TENSION MORE OFTEN IF NECESSARY. DO NOT RETENSION BELTS TO VALUES HIGHER THAN THOSE INDICATED ON CHART.

In emergency cases only, when a belt tension gauge is not available and the machine must be operated, belt tension may be checked by deflecting the belt with your thumb (approx. 25 lb. load) as shown in the following chart.

If belts can be pushed down 1/8 inch more than the "Retension Deflection Values", retension the belts.

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DRIVE BELTS

BELT DEFLECTION CHART				
CONDITIONS		FAN AND WATER PUMP		GENERATOR BELT ONLY
		POINTS		
		A	B	POINT C
NEW BELT INSTALLATION		1/2"	5/16"	1/2"
RETENSION	New machine upon delivery. 1 hour after belt replacement. After 10 hours of operation. After 50 hours of operation. At intervals of 200 hours.	9/16"	3/8"	9/16"

CHECK POINTS

MAIN DRIVE

Whenever possible, fan and water pump belts tensions should be checked at a point (A, Fig. 2-58) midway between the vibration damper (5) and fan pulley (2).

In case this point cannot be utilized, it is permissible to use alternate point (B, Fig. 2-58) midway between the fan pulley (2) and idler pulley (3). It is permissible to check tension of a single belt only.

AUXILIARY DRIVE

The generator belt tension should be checked at a point (C, Fig. 2-58) midway between generator pulley (1) and fan pulley (2).

TEST WITH "GATES" METER

Lift tab (A, Fig. 2-59) and place meter on belt. Belt must be held securely between tabs (A, B).

Move indicator hand (D, Fig. 2-59) to its starting position, the plus (+) sign.

(Continued on next page)

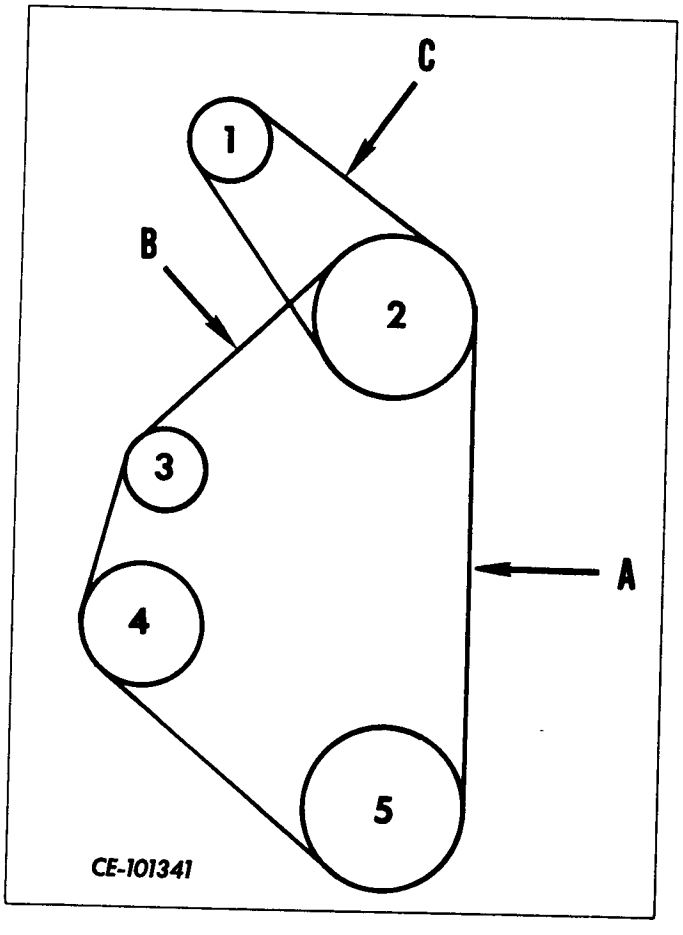

Figure 2-58
Engine Belt Drives.

1. Generator.
2. Fan.
3. Idler.
4. Water pump.
5. Damper.

CHECK POINTS - Continued

TEST WITH "GATES" METER - Continued

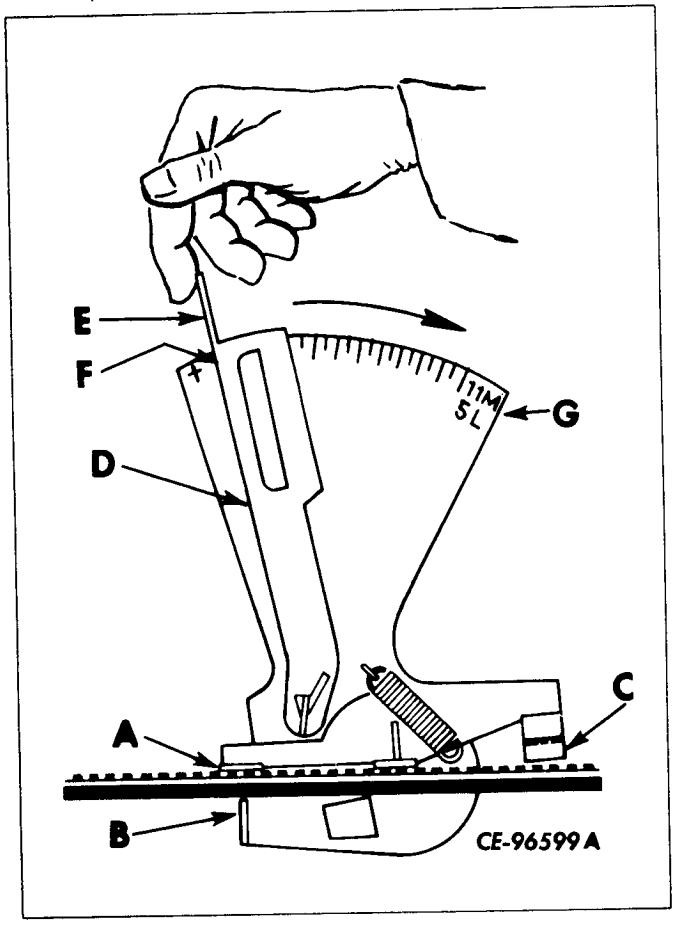

Figure 2-59
Using "Gates" 150 Tensiometer.

With end of forefinger on button at top of leaf spring (E, Fig. 2-59), pull button around top circumference of meter. Indicator hand (D) will move with leaf spring (E) as tab (C) approaches top of belt. For increased accuracy, apply a steady gradual pull.

Place a thin piece of paper between tab (C, Fig. 2-59) and belt to establish contact by drag felt when paper is moved between tab (C) and belt.

When tab (C, Fig. 2-59) just touches top of belt and a slight drag is felt on paper, release pressure on button of leaf spring (E). Indicator hand (D) will stay in place so that belt tension can be read.

Read belt tension in pounds at left side (F, Fig. 2-59) of indicator hand (D) on top scale (G) (corresponding to 11M and 5L section belts) and adjust belt if necessary.

NOTE: If leaf spring (E, Fig. 2-59) is subjected to a jerky motion, erroneous reading may result. Return the gauge to its starting point and recheck using a steady gradual pull.

To assure accuracy of readings, it is recommended that a minimum of three readings be taken and averaged.

NOTE: Accuracy of "Gates 150 Tensiometer" is dependant on leaf spring (E, Fig. 2-59) only. Abuse of this spring must be avoided.

TEST WITH BORROUGHS GAUGE

Grasp tension gauge by "T" handle and completely depress ball handle. Be certain hook (A, Fig. 2-60) extends beyond the two legs (B) to pick up belt.

Apply gauge to belt, being sure belt is positioned between nose piece (C, Fig. 2-60) and hook and that nose piece is centered on belt.

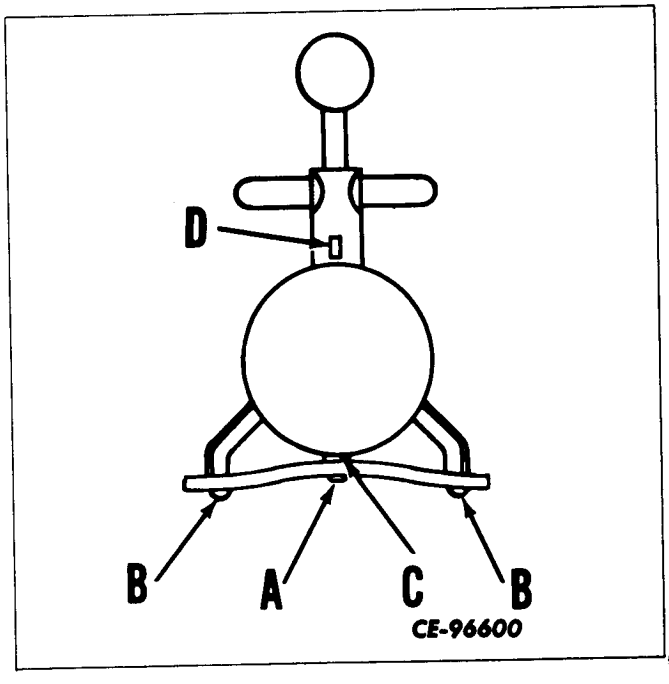

Figure 2-60
Borroughs Belt Tension Gauge.

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DRIVE BELTS

Release the ball handle quickly. A slow release may prevent a full return of the hook, thus giving a false reading.

Read belt tension in pounds at index mark (D, Fig. 2-60) on gauge face. Adjust belt if necessary.

NOTE: Before adjustinb belt, check tension several times to observe gauge readings.

ADJUSTMENT

GENERATOR BELT

Loosen the two generator adjusting brace screws and the two mounting screws.

Move generator out to tighten belt or in to loosen until correct tension is obtained.

Retighten adjusting brace and mounting cap screws.

FAN AND WATER PUMP BELTS

Loosen adjusting turnbuckle jam nut and two cap screws securing fan idler pulley bracket to crankcase front cover.

NOTE: No attempt should be made to rotate turnbuckle without first loosening the two fan idler bracket cap screws.

Rotate turnbuckle to move idler out to tighten belts or in to loosen them, until correct tension is obtained.

Retighten two cap screws securing fan idler pulley bracket to crankcase front cover. Tighten adjusting turnbuckle jam nut.

BELT AND PULLEY REPLACEMENT

Replace badly worn or severely cracked belts immediately.

When replacing a belt(s), always check the condition of the remaining belt(s) and if necessary, replace at the same time. When replacing fan and water pump belts, always replace belts as a matched set.

Prior to installing new belt(s), inspect all pulley grooves for wear and the presence of grease, oil, dirt, etc. If foreign material is present, it must be removed. If a pulley is damaged or grooves worn, it should be replaced. A slight grooving along belt tension cord line, approximately .005" deep and .040" wide may be tolerated. If groove side faces are worn and have stages of grooving toward root of groove, pulley must be replaced.

When replacing belts and pulleys, pulley alignment must be checked. A misalignment that can be detected by the naked eye is detrimental.

During assembly, do not force the belt(s) into the pulley grooves by prying with a screw driver, pry bar, etc. The resulting damage to belt side cords will cause belt(s) to turn over in pulley grooves and end in complete destruction of belt in operation.

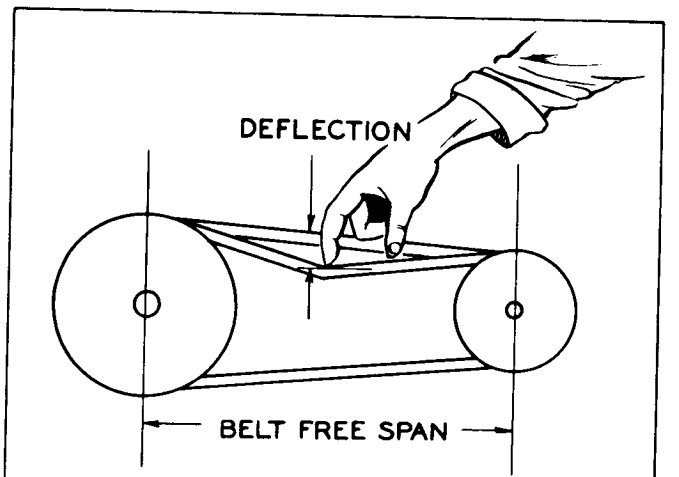
If fan and water pump belts are disturbed for any reason, belts must be adjusted to correct belt tension.

TENSION REQUIREMENTS FOR CONVENTIONAL BELTS

Check belt tension by depressing belt midway between drive and driven pulleys (Fig. 2-61). Extend the index finger straight down against the belt.

Replace frayed belts. Do not pry or roll belts onto pulleys. Use the adjusting mechanism provided. Relieve belt tension if the machine will be idle for a period in excess of one month.

Clean belts by wiping them off with hydraulic brake fluid. This will eliminate belt squeak.



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

CE-88602

Figure 2-61

ITEM	TEMP RANGE °F	TYPE REFILL & DESIGNATION				APPROX. REFILL CAPACITY	OPERATION PERIOD (Hrs. Oper.)		
		IH	MIL. SPEC.	SAE	API		CHECK	CLEAN	ADD OR CHANGE
Engine Crankcase	120 to 20 70 to -10 10 to -30		Series 3 or MIL-L-45199B	30 10W *	DS	25 qts. w/ Filters	D		100
Diesel Fuel System Normal Service Extended Idling or →	 to 10 Below 10		ASTM D-975		Grade 2-D Grade 1-D	100 gals.	D	AO	AR
Cooling System	Above 32	Water and 5% Corrosion Inhibitor Solution				72 qts.	D	1000	Seasonal
	Below 32		O-A-548a	Ethylene Glycol					
Batteries		Distilled Water				AR	100	Terminals 100	AR
Chassis Lubrication	All	IH 25IH EP	MIL-L-10924	Multi-Purpose Lithium Base	NLG1 Grade 2		See Machine Lube Plate		

* 10W diluted with 10% kerosene.

AR - As Required
AO - At Overhaul
D - Daily

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SERVICE INFORMATION

SPECIFICATIONS

ENGINE

Make . . . . . International Harvester
Model - DT-573
Type . . . . . Turbocharger, four stroke cycle, diesel
Maximum horsepower (2500 RPM) 260
Maximum torque (2000 RPM) 575
Number of cylinders 8
Bore . . . . . 4-1/2 in.
Stroke . . . . . 4-1/2 in.
Piston displacement . . . . . 573 cu. in.
Compression ratio . . . . . 16 to 1
Air flow . . . . . 617 cfm
Injector type . . . . . Radial distributor
Net weight with standard accessories . . . . . 2300 lb.
Model compressor . . . . . Tu-flo 400

NORMAL GAUGE READINGS

SYSTEM	GAUGE	INTERNATIONAL HARVESTER DT-573	
		Min	Max
ENGINE	Water Temperature (degree Fahrenheit)	180°	195°
	Oil Pressure (psi)	40*	60*
TACHOMETER	Low Idle (RPM)	600	775
	High Idle (RPM)	2550 - 2700	
	Governed Speed (RPM)	2500	
	Converter Stall (RPM)	2560 - 2700	
	Hydraulic Stall (RPM)	2500 - 2700	
	Full Stall (RPM)	1900 - 2300	

* HIGH IDLE

SPECIAL TORQUES

Front mounting brackets-to-flywheel housing, cap screws . . . . . 80-90 lbs. ft.
Front mounting brackets-to-tractor frame, cap screws . . . . . 700 lbs. ft.
Engine-to-rear mounting bracket, cap screws . . . . . 160 lbs. ft.
Rear mounting bracket-to-tractor frame, cap screws . . . . . 315 lbs. ft.

SERVICE INFORMATION

NUMBER	DATE	SUBJECT	CHANGES

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SECTION III

TORQUE CONVERTER

Page

SECTION III TORQUE CONVERTER

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GENERAL INFORMATION

DESCRIPTION

The torque converter housing contains a single stage, single phase, three element torque converter and a power take-off to drive the charging, hydraulic, and steering systems pumps. The torque converter performs two functions: it couples the engine to the transmission and multiplies engine torque. The three major components of the converter are the impeller, turbine, and stator (or guide wheel).

OPERATION

TORQUE CONVERTER

During operation the converter is filled, or charged, with oil. Oil is a fluid that has weight, mass, and is virtually incompressible. When this fluid is put in motion (given velocity) it produces a force that can be directed to do work. The element of the torque converter which gives motion to the oil is the impeller. The impeller is indirectly connected to the engine flywheel, and therefore, always rotates at engine speed. The force of the oil is directed against the turbine causing it to rotate in the same direction as the impeller. The turbine is connected to the converter output shaft. It is important to remember that the turbine is not connected to the impeller, but is driven by the force, or kenetic energy, of the oil put in motion by the impeller. The third element of the converter is the stator or guide wheel. It is a stationary ring of blades that is connected to the converter housing and is separate from the turbine or impeller. The purpose of the stator is to redirect the oil from the turbine to the impeller in the direction of engine rotation. This action provides a fluid coupling between the engine and transmission.

To multiply torque, oil from the charging pump leaves the housing and is directed through the guide carrier into the inside circle portion of the impeller. The motion of the impeller forces the oil outward toward the turbine. The oil strikes the blades of the turbine, causing it to rotate. Because the turbine blades are curved, not all of the force of the oil is absorbed by the turbine. For example, suppose the oil leaving the impeller carries a force of 100 lbs. Assume, in this instance, that the turbine absorbs only 80 lbs. of this force. Oil leaving the turbine carrying a force of 20 lbs, is directed to the stator. The curved stator blades will absorb only 10 lbs. of this 20 lbs. of force. The oil from the stator that is redirected to impeller carries a force of 10 lbs. This 10 lbs. force is added to the original 100 lbs. The converter will therefore continue to increase (multiply) the input torque up to the limits of the converter design ratio as stated in "SPECIFICATIONS."

As stated previously the torque converter is a three element, single stage, single phase type. The three elements are the stator, the impeller, and the turbine. Stage refers to the number of turbines used or the number of times the oil passes through the turbine before it returns to the impeller. This torque converter has one turbine and the oil passes through it just once before returning to the impeller. The phase of the torque converter is the number of separate functions accomplished by the stator. The stator in this converter is "locked" or fixed and performs one function; helps to multiply torque.

POWER TAKE-OFF

The torque converter housing also contains a power take-off to drive the charging, hydraulic, and steering pumps. A power take-off gear attached to the impeller drives three idler gears attached to the converter housing. The inside of the center hub of each idler gear is splined to receive the pumps drive shafts.

TORQUE CONVERTER

GENERAL INFORMATION

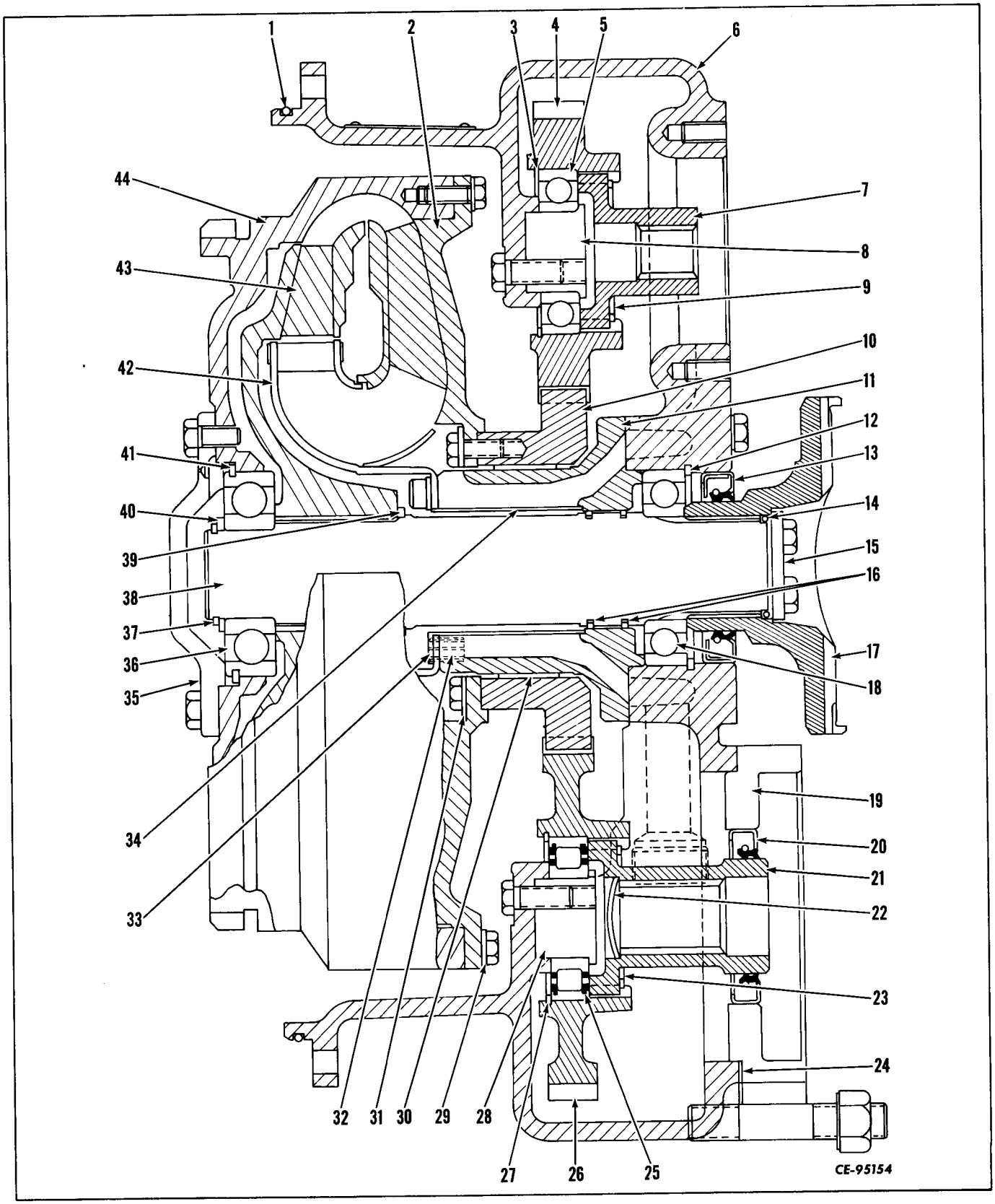

Figure 3-1
Torque Converter - Cross Section.

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GENERAL INFORMATION

Legend for Figure 3-1

1. Seal ring.
2. Impeller wheel.
3. Retaining ring.
4. Charging pump driven gear.
5. Idler gear bearing.
6. Converter housing.
7. Splined hub.
8. Bearing retainer.
9. Retaining ring.
10. Pump drive gear.
11. Guide wheel carrier.
12. Retaining ring.
13. Output yoke oil seal.
14. "O"-ring.
15. Output yoke clamp plate.
16. Hook-type seal rings.
17. Output yoke.
18. Output shaft bearing.
19. Hydraulic pump adapter plate.
20. Adapter plate seal.
21. Splined hub.
22. Expansion plug.
23. Retaining ring.
24. Adapter plate gasket.
25. Hydraulic pump idler gear bearing.
26. Hydraulic pump driven gear.
27. Retaining ring.
28. Bearing retainer.
29. Flat washer.
30. Pump drive gear bushing.
31. Clamp plate.
32. Roll pins.
33. Clamp plate.
34. Split sleeve.
35. Bearing retainer.
36. Output shaft bearing.
37. Snap ring.
38. Output shaft.
39. Snap ring.
40. Spacer.
41. Snap ring.
42. Guide wheel.
43. Turbine wheel.
44. Rotating housing.

PREVENTIVE MAINTENANCE

OIL LEVEL CHECK AND CHANGE PERIODS

The torque converter shares a common pump with the transmission. The torque converter fluid is, therefore, serviced along with the transmission. See Section 4, "TRANSMISSION."

CONVERTER STALL CHECK

A full power stall check is made to determine whether or not the engine has rated power and if converter and transmission are operating correctly.

NOTE: Before making a stall check, accelerate the engine to 1000 rpm with transmission in neutral. At 1000 rpm, clutch pressure should equal recommended minimum (refer to "SPECIFICATIONS"). If this minimum pressure is not obtained DO NOT MAKE THE STALL CHECK. If clutch pressure is below minimum clutches will slip and burn at full stall.

A stall check is accomplished by:

1. Engine, converter and transmission operating at proper temperature.

2. Apply parking brake.

3. Run the engine to be sure it will operate at high idle (refer to "SPECIFICATIONS").

4. Shift transmission to either forward or reverse direction and fourth range.

5. Depress the accelerator to its maximum position and record the engine RPM. Refer to "SPECIFICATIONS" for stall speed limitations.

TORQUE CONVERTER

DISASSEMBLY, INSPECTION AND ASSEMBLY

REMOVAL

Drain the hydraulic reservoir.

Disconnect the battery cables, ground cable first. Disconnect positive (hot) cable at starter. Remove cable clamps.

Remove the inlet lines to the hydraulic pumps.

NOTE: Whenever lines are disconnected both open line ends should be capped immediately to prevent the entrance of dirt. Open valve and pump ports should be plugged. Serious damage to system components may result due to the entrance of tiny particles of foreign material in the fluid.

Discard "O"-rings at split flange connections.

Remove the valve-to-reservoir return line. Discard "O"-ring.

Disconnect transmission filter lines at the filter. Tag lines for proper identification during assembly.

Disconnect the cold weather starting aid lines from the bracket. Tag the lines.

Remove all hood sides.

Disconnect the tachometer drive from the tachometer.

Disconnect the line from the air cleaner restriction indicator.

Remove hood retaining cap screws from forward end of hood. Loosen rear cap screws. Securely block forward end of hood. Blocking should be high enough to allow a slight gap between hood and bulkhead.

Secure the bulkhead assembly to a hoist of sufficient capacity using a suitable sling. Remove the cap screws, nuts and lock washers that secure the bulkhead assembly to the rear main frame. Move the bulkhead slightly forward to clear the hood and then raise the entire assembly from the tractor.

NOTE: While raising the bulkhead slowly from the tractor be sure all wires, hoses and tubes have been disconnected.

Disconnect all lines to the hydraulic pumps. Cap and tag lines. Plug open ports. Discard all "O"-rings removed from split flange connections. Disconnect, cap and tag converter lines.

Remove drive shaft between converter and transmission. Wire up bearing caps to avoid loss.

Disconnect electrical leads.

Disconnect breather line from elbow on top of converter housing.

Secure converter in a suitable sling attached to hoist. Remove slack from hoist.

Remove cap screws and lock washers that secure converter to engine flywheel housing. Carefully remove the converter.

DISASSEMBLY

Place the converter on a clean work bench or table with the output yoke up.

Mark the location of the hydraulic pumps with punch or chisel. Remove the pumps, adaptor plates (1, Fig. 3-3) and gaskets (3). Discard gaskets. Remove and discard seals (2) from adaptor plates.

NOTE: Refer to "CHARGING PUMP" in this section for overhaul procedures.

Refer to Section 11, "HYDRAULIC SYSTEM" for detailed instructions on overhauling the longer loader and steering pumps.

Remove the cap screws that secure the clamp plate (1, Fig. 3-4) to the output shaft. Remove the "O"-ring (2) from the yoke bore. Remove the yoke (3). Discard the "O"-ring.

(Continued on page 6)

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DISASSEMBLY, INSPECTION AND ASSEMBLY

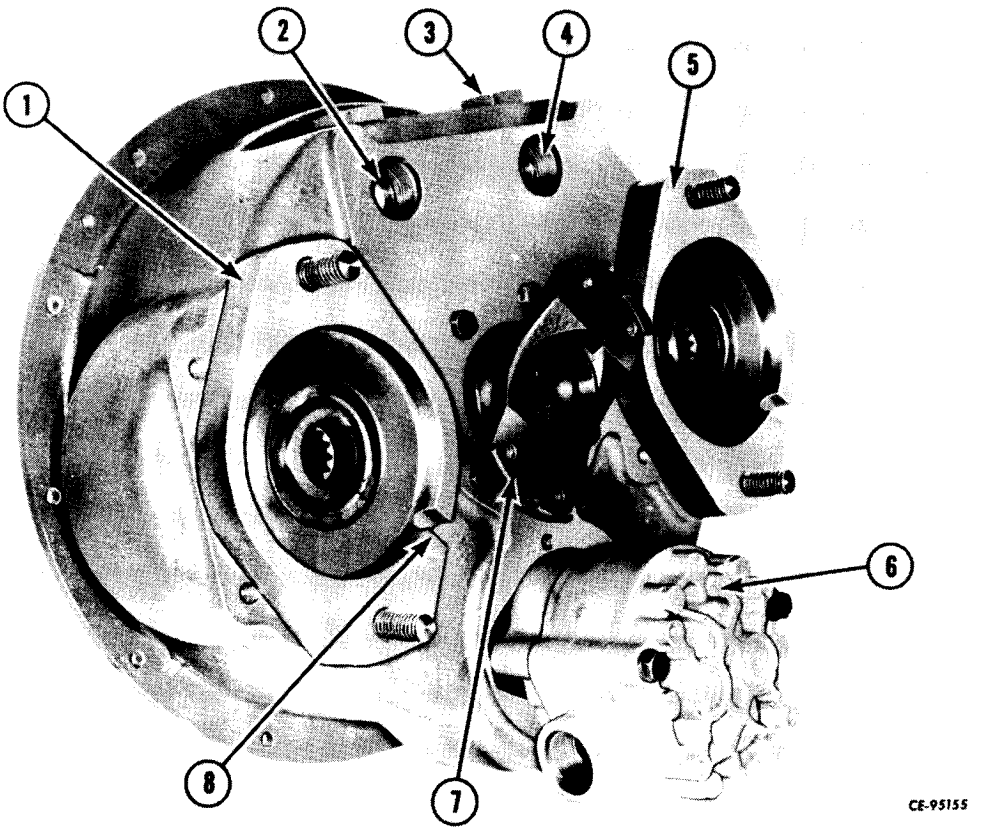

Figure 3-2
Torque Converter Assembly.

1. Adaptor, main hydraulic pump.
2. Converter-in port.
3. Converter-out port.
4. Temperature sender port.
5. Adaptor, switch pump.
6. Converter charging pump.
7. Output yoke.
8. Adaptor plate drain slots.

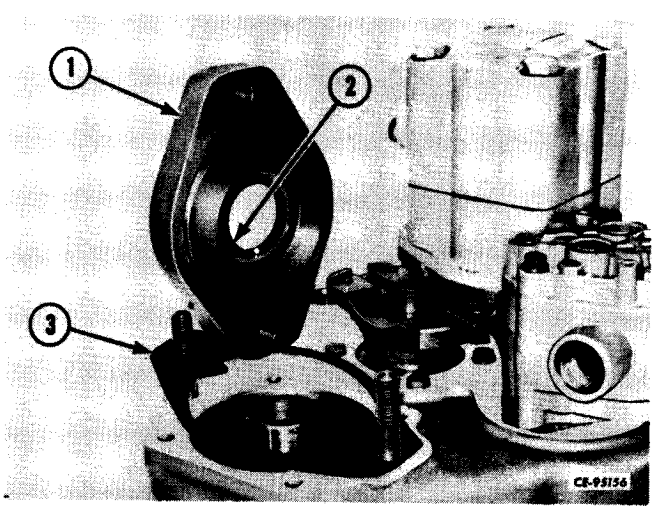

Figure 3-3

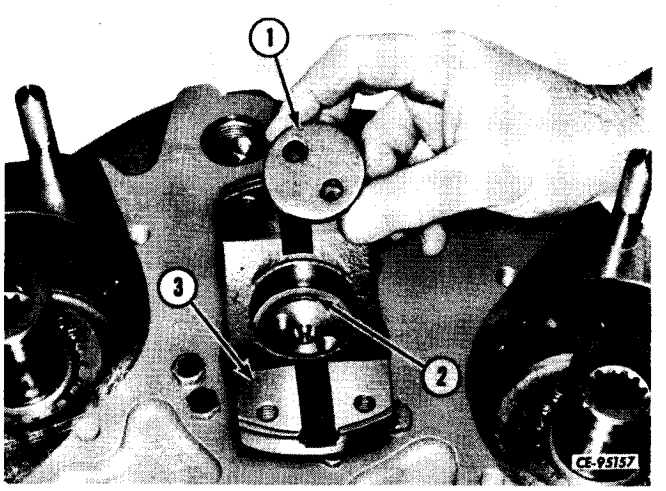

Figure 3-4

TORQUE CONVERTER

DISASSEMBLY, INSPECTION AND ASSEMBLY

DISASSEMBLY - Continued

Invert the converter assembly. Remove the cap screws that secure the bearing retainer (1, Fig. 3-5) to the rotating housing (2). Remove the retainer.

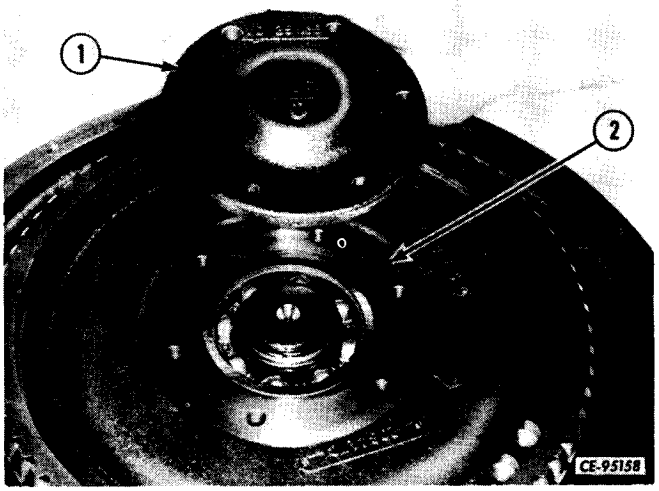

Figure 3-5

Remove the snap ring (1, Fig. 3-6) and bearing spacer (2) that retain the output shaft bearing (3) on the output shaft (4).

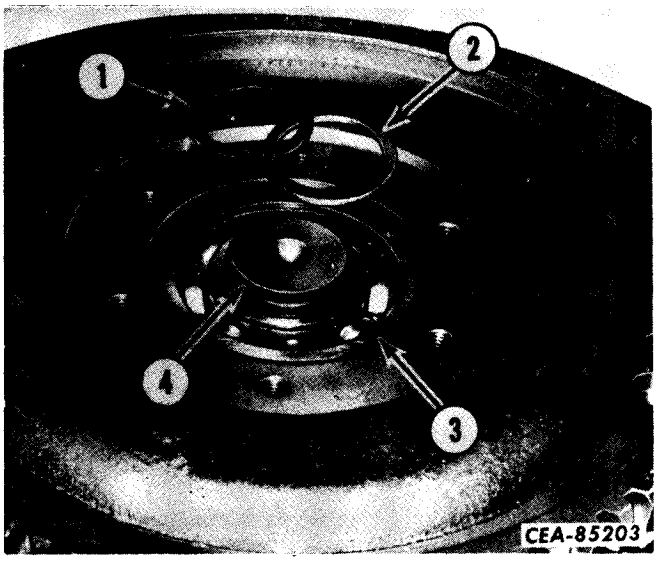

Figure 3-6

Carefully invert the converter assembly. Remove the cap screws (1, Fig. 3-7) and copper washers (2) that hold the guide wheel carrier to the converter housing. Discard the copper washers.

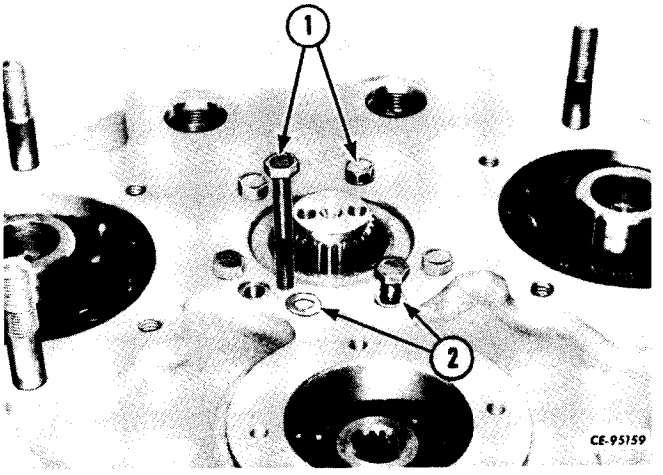

Figure 3-7

Lift the converter housing (1, Fig. 3-8) off of the converter (2).

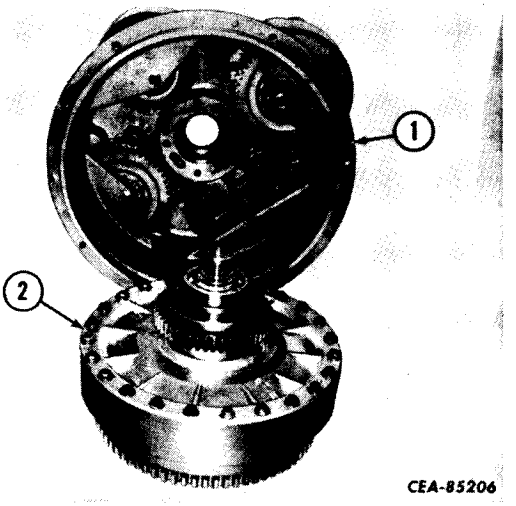

Figure 3-8

DISASSEMBLY, INSPECTION AND ASSEMBLY

Remove the cap screws (1, Fig. 3-9) and special flat washers (2) that hold the impeller wheel to the rotating housing.

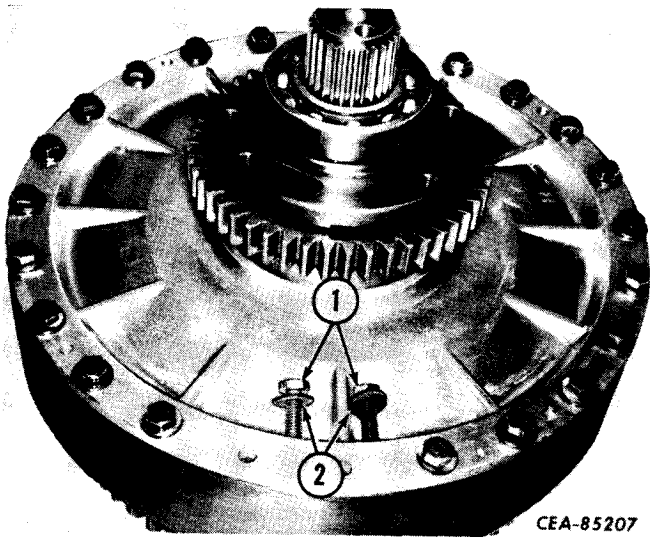

Figure 3-9

Use four of the cap screws as jackscrews (1, Fig. 3-10) in the threaded holes provided in the impeller wheel (3). By rotating the jackscrews evenly the impeller wheel and rotating housing (2) will be separated.

NOTE: Jackscrews must be turned down evenly to avoid distortion or fracture of impeller wheel.

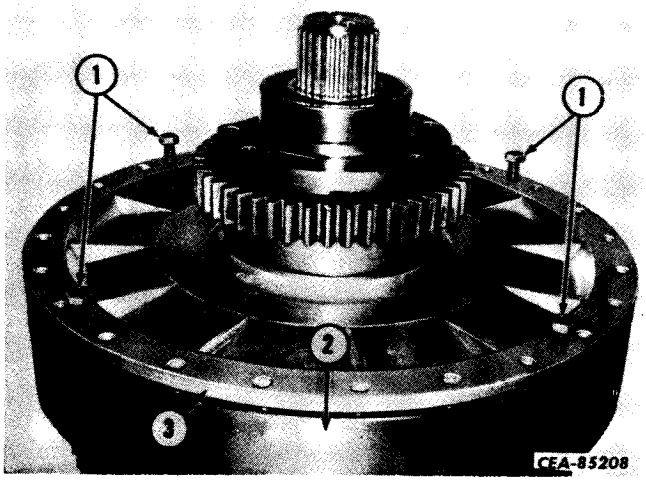

Figure 3-10

Lift the impeller wheel assembly (2, Fig. 3-11) off of the rotating housing (3). The output shaft ball bearing (1) will also be removed by this operation.

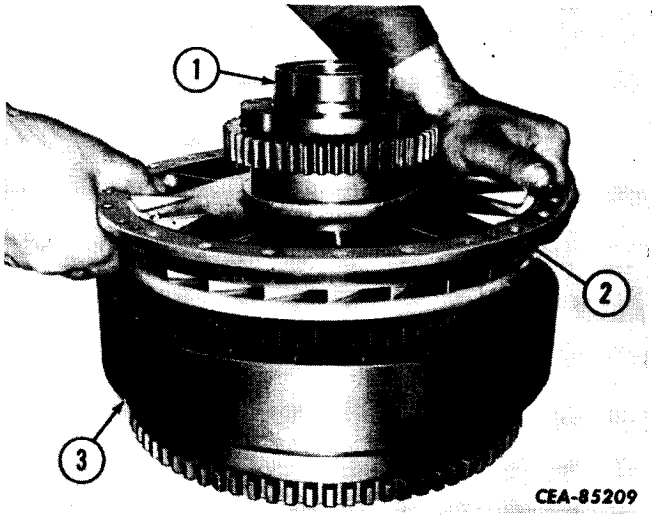

Figure 3-11

Remove the 12 point cap screws (1, Fig. 3-12) and clamp plates (2) that secure the guide wheel (3) to the guide wheel carrier.

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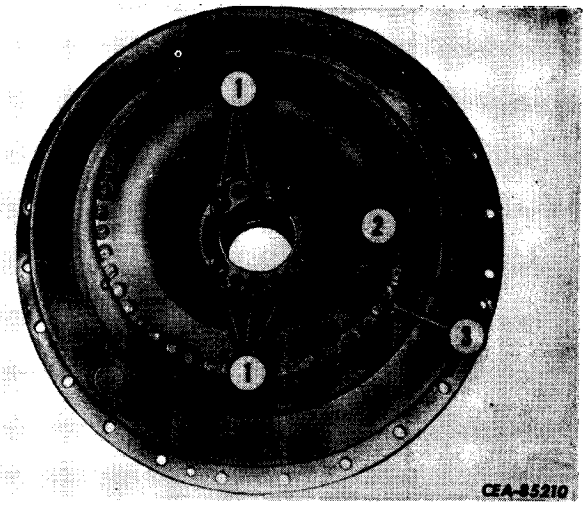

Figure 3-12

DISASSEMBLY - Continued

Taper the ends of two wooden boards (Fig. 3-13) and carefully and evenly pry the guide wheel (1) from the guide carrier. Remove the impeller wheel (2) from the guide carrier.

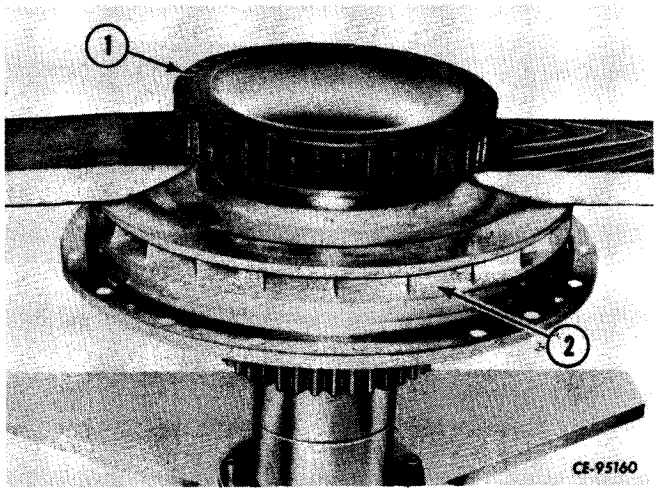

Figure 3-13

Remove the guide wheel carrier (1, Fig. 3-14) from the impeller wheel (2).

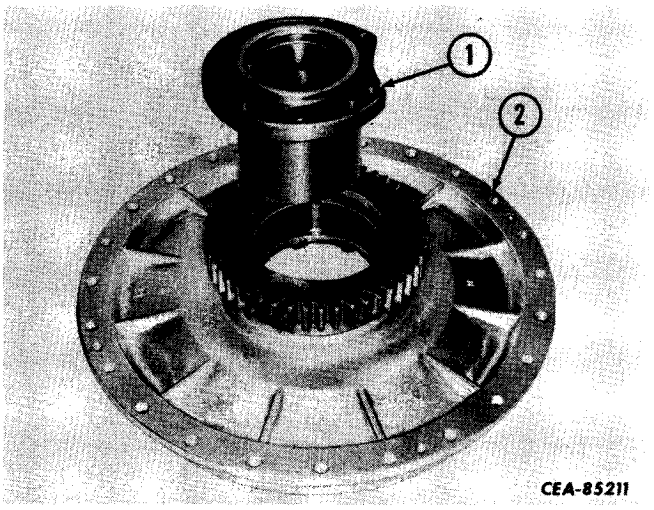

Figure 3-14

Remove the roll pins (1, Fig. 3-15) from the guide wheel carrier (3) only if replacement is necessary. Remove the split sleeve (2) from the carrier.

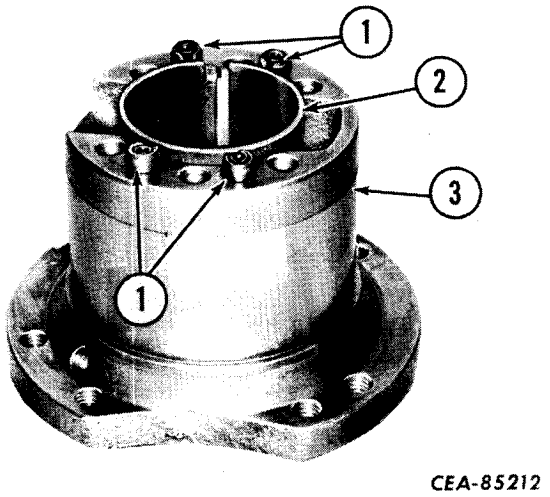

Figure 3-15

Remove the cap screws (3, Fig. 3-22) and clamp plates (1, 5) that fasten the pump drive gear (4) to the impeller wheel (2). Remove the pump drive gear.

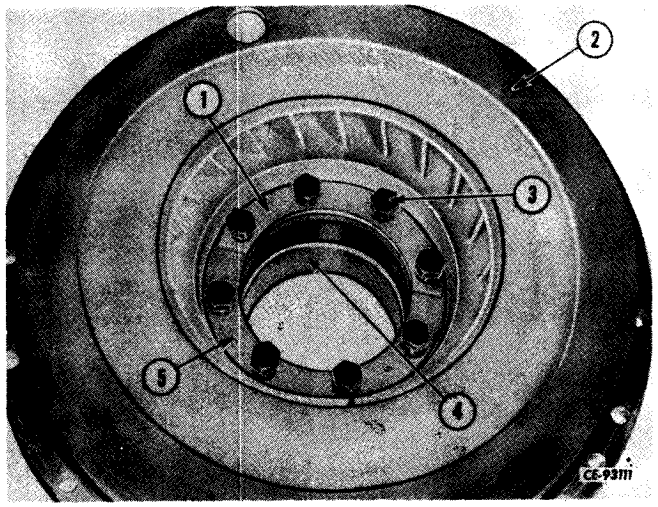

Figure 3-16

If the bushing (2, Fig. 3-17) in the pump drive gear (1) is unsuitable for further use the gear and bushing must be replaced as an assembly.

DISASSEMBLY, INSPECTION AND ASSEMBLY

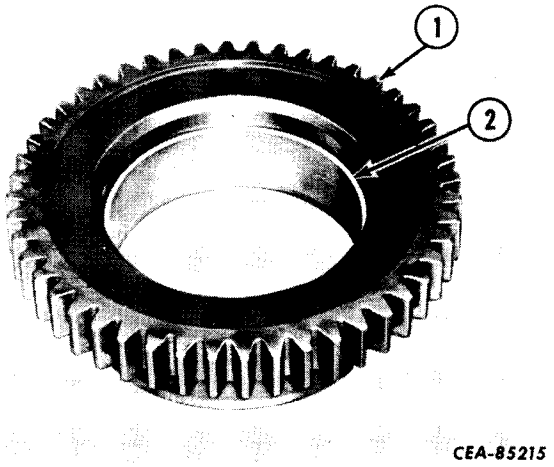

Figure 3-17

Using wooden or brass drift, drive the output shaft (3, Fig. 3-18) and turbine wheel (2) from the bearing (4) in the hub of the rotating housing (1).

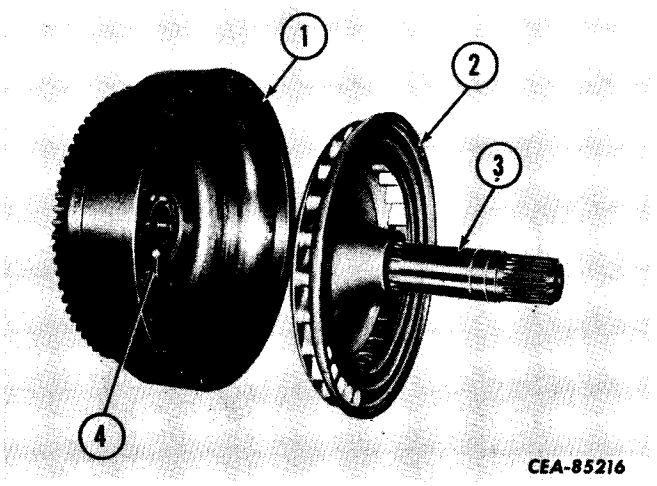

Figure 3-18

Press the output shaft ball bearing (1, Fig. 3-19) from the rotating housing. Due to bearing retaining snap ring, bearing may be pressed in one direction only.

NOTE: During pressing operation pressure must be applied to the outer bearing race only.

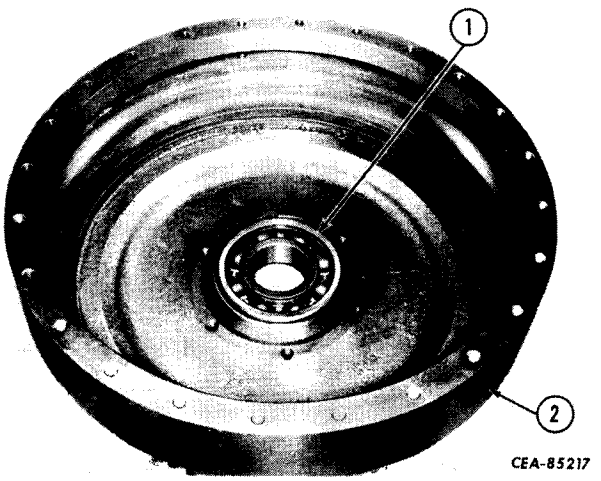

Figure 3-19

Remove the snap ring (2, Fig. 3-20) and hook type seal rings (1) from the output shaft (3).

(Continued on next page)

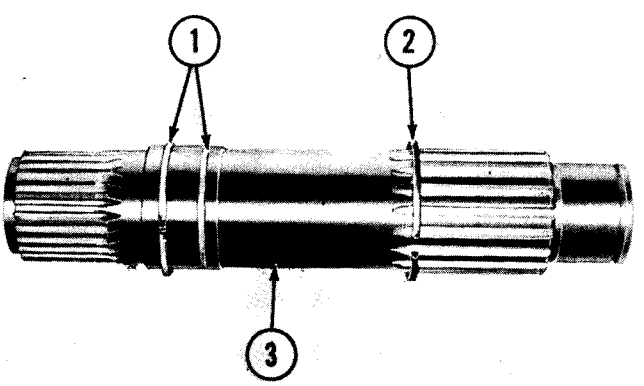

Figure 3-20

DISASSEMBLY, INSPECTION AND ASSEMBLY

DISASSEMBLY - Continued

Remove the snap rings (2, Fig. 3-21) that hold the splined hubs (1) to the driven gears. Remove the splined hubs.

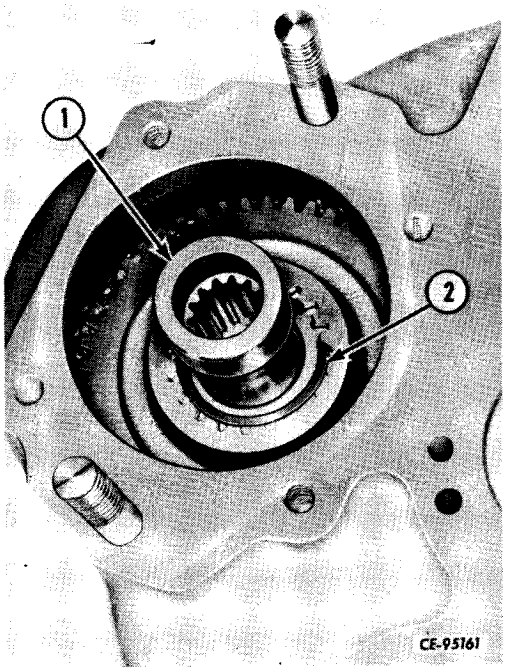

Figure 3-21

Remove the bearing retainer cap screws (1, Fig. 3-22) from the housing webs. Slide out the driven gear assemblies.

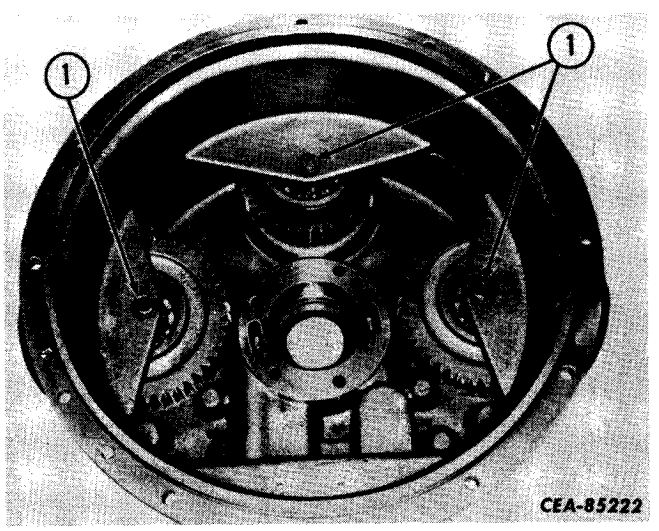

Figure 3-22

Remove the snap ring (2, Fig. 3-23) that holds the bearing assembly (1) in the driven gear (3).

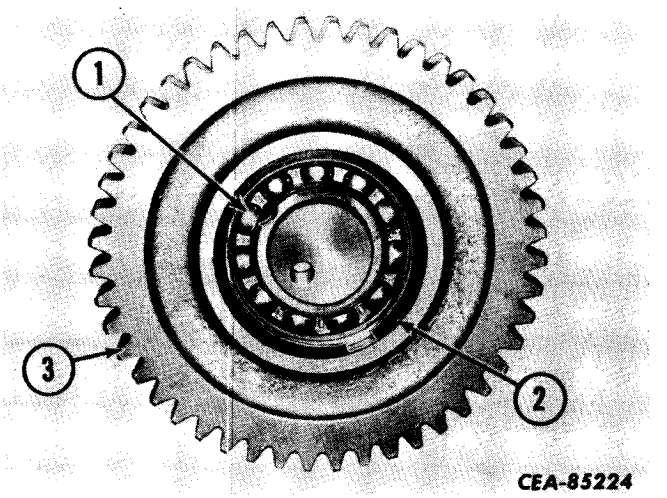

Figure 3-23

Insert the splined hub (1, Fig. 3-24) into the driven gear (2) as shown. Place the gear and hub in an arbor press and press the bearing assembly out of the driven gear.

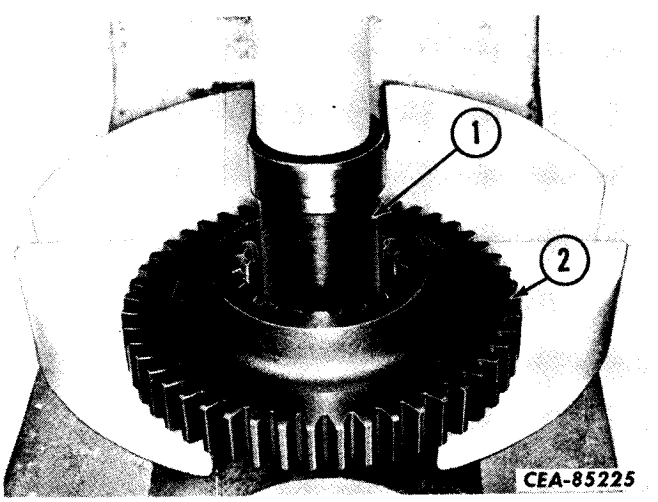

Figure 3-24

Place the driven gear bearing in the arbor press. Press the bearing retainer (1, Fig. 3-25) out of the bearing (2). Be sure the bearing inner race is supported during the pressing operation to prevent bearing failure.

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DISASSEMBLY, INSPECTION AND ASSEMBLY

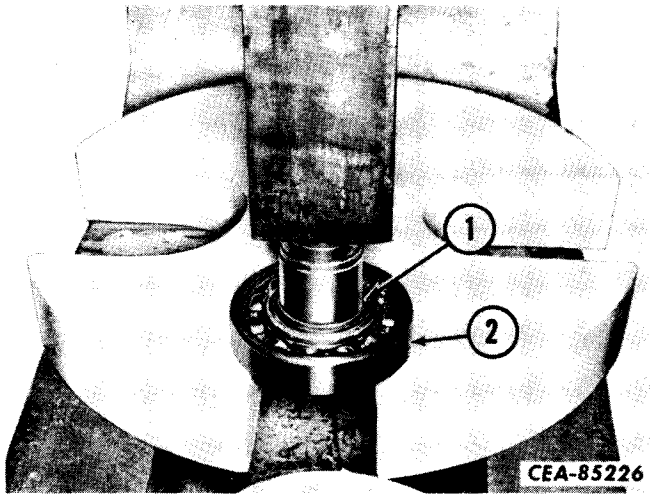


Figure 3-25

Remove the snap ring (2, Fig. 3-26) from the groove in the housing. Press the output yoke oil seal (1) from the housing.

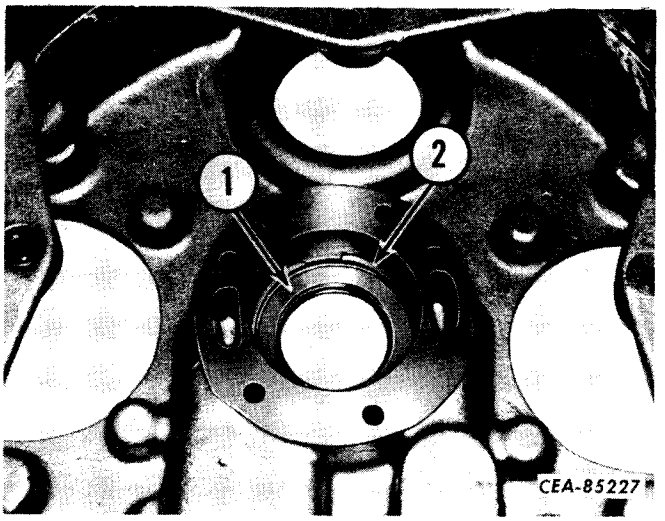


Figure 3-26

CLEANING AND INSPECTION

CLEANING

Clean all metal parts in cleaning solvent and dry with compressed air. Lubricate all machined surfaces with clean oil. During the cleaning operation, give particular attention to oil passages, bearing assemblies, bearing bores, snap and seal ring grooves and screw threads.

INSPECTION

Inspect all parts for wear or damage. Check the converter and rotating housings for cracks. Inspect the bearing bores and mounting faces for wear, grooves or scratches. Remove burrs and scratches with a crocus cloth. Inspect all splined parts for worn, twisted, chipped or burred splines. Remove burrs with a soft stone. Check the turbine, impeller and guide wheel for cracks or other damage. Replace any parts that are in doubt or cannot be repaired.

Discard all old oil seals, "O"-rings and gaskets. Reusing old gaskets and seals is false economy.

NOTE: Special Torque, Pressure, etc. recommendations are listed under "SERVICE INFORMATION." This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil and revised when necessary.

ASSEMBLY

Coat the OD of a new output yoke oil seal with "Mar-Seal" or equivalent sealant. Press the seal (1, Fig. 3-26) into the converter housing bore. This is a double lip seal. The large lip with spring tensioner must face converter housing interior (refer to "SEAL INSTALLATION DETAILS"). Use output shaft oil seal tool shown in "SPECIAL TOOLS" to install seal. Lubricate seal lips with clean grease.

Install the snap ring (2) in the housing groove.

(Continued on next page)

ASSEMBLY - Continued

Press the bearing retainer (1, Fig. 3-27) into the driven gear bearing (2). Be sure to support bearing inner race during pressing operation.

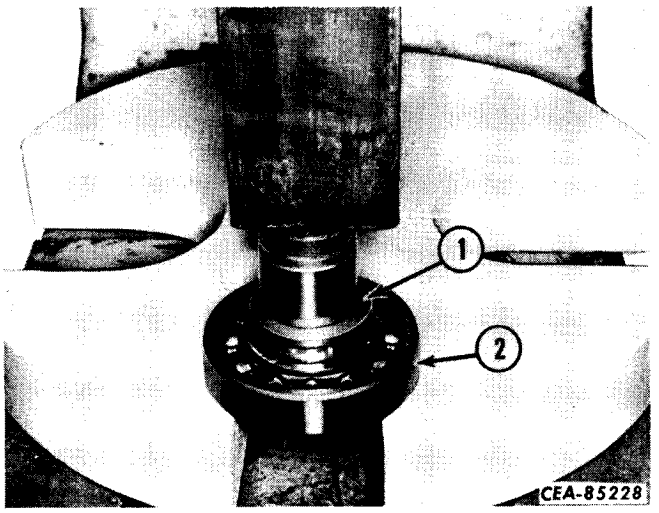


Figure 3-27

Press the driven gear bearing assembly (1, Fig. 3-28) into the driven gear (2). Be sure press pressure is exerted on bearing outer race.

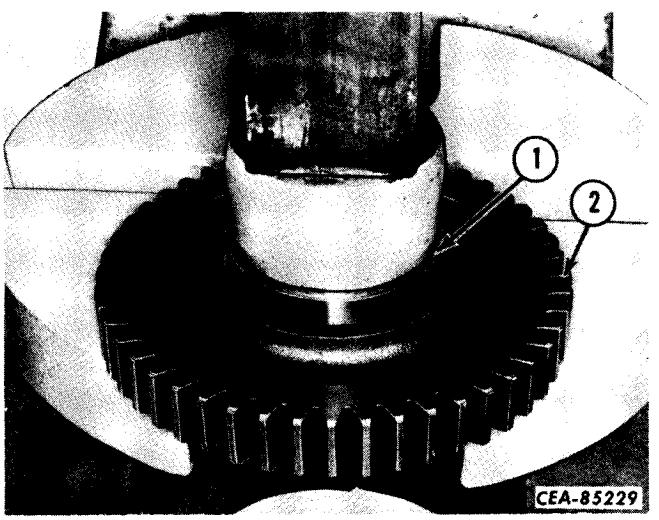


Figure 3-28

Install the snap ring (2, Fig. 3-29) in the groove in the driven gear (3). Bearing assembly (1) must be bottomed on gear shoulder to allow proper snap ring installation.

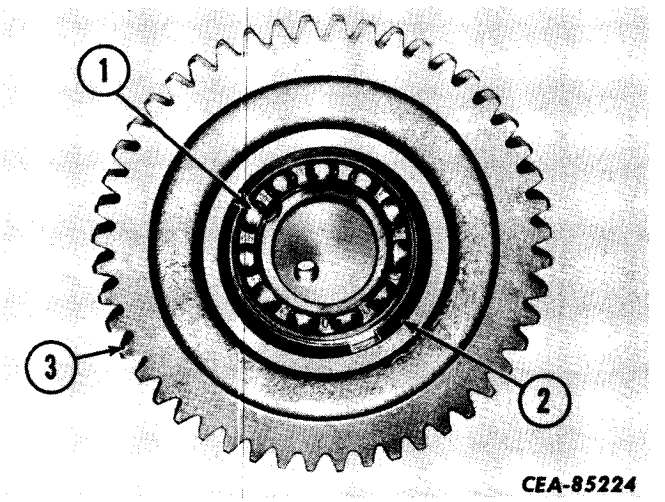


Figure 3-29

Install the driven gear assemblies (1, Fig. 3-30) in the converter housing. Align the cap screw holes in the bearing retainers with the holes in the housing webs.

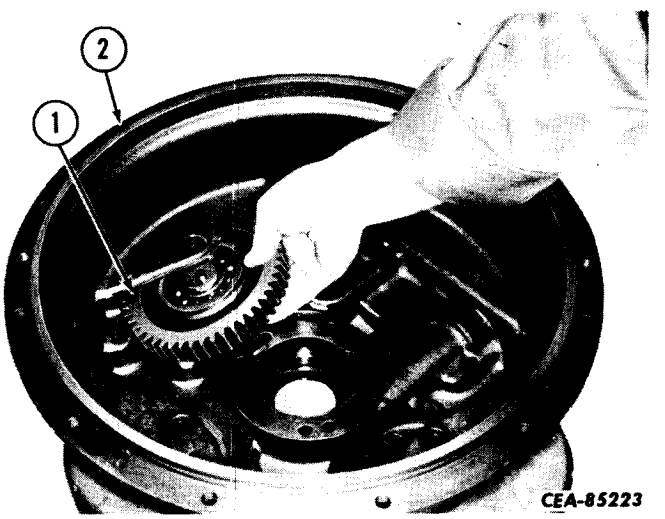


Figure 3-30

DISASSEMBLY, INSPECTION AND ASSEMBLY

Install the bearing retainer cap screws (1, Fig. 3-31). Tighten the cap screws to the recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

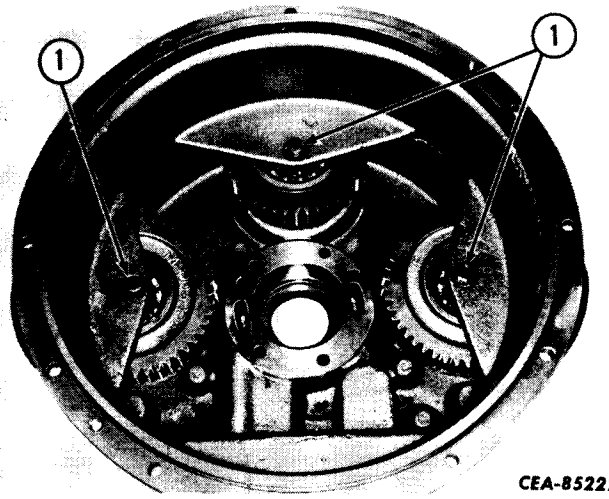


Figure 3-31

Insert the splined hubs (1, Fig. 3-32) into the driven gears and secure with snap rings (2). Be sure snap rings bottom in their grooves.

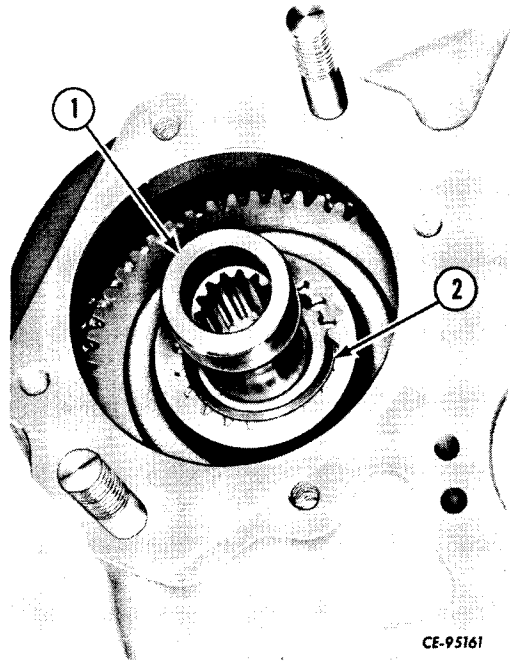


Figure 3-32

Install new seal rings (1, Fig. 3-33) on the output shaft (3). Install the snap ring (2) in its groove on the shaft. Be sure snap ring bottoms about its entire circumference in the groove.

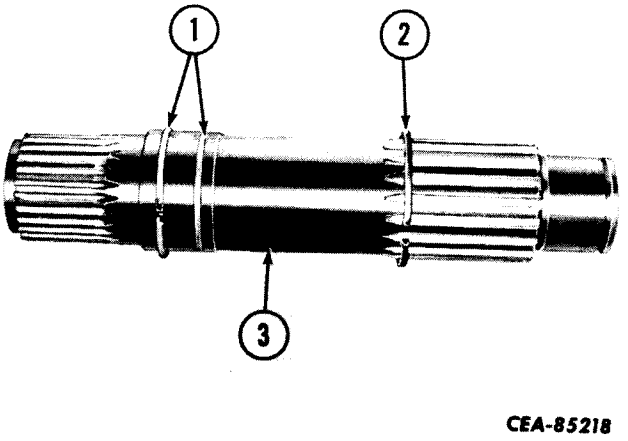


Figure 3-33

Insert the output shaft (2, Fig. 3-34) into the splined bore of the turbine wheel. Turbine wheel must bottom on snap ring.

(Continued on next page)

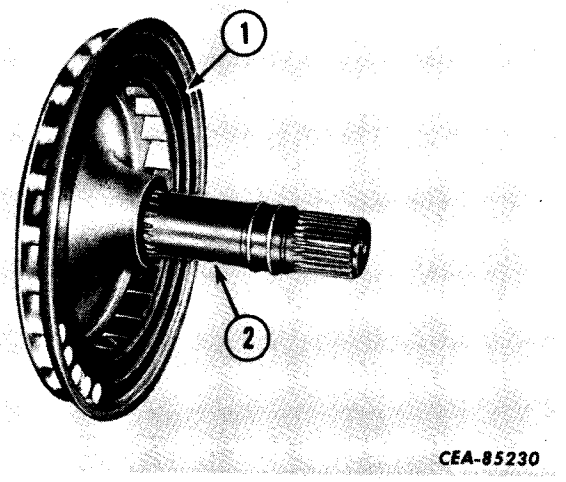


Figure 3-34

DISASSEMBLY, INSPECTION AND ASSEMBLY

ASSEMBLY - Continued

Press bearing and snap ring assembly (1, Fig. 3-35) into center bore of rotating housing (2). Be sure snap ring bottoms on housing shoulder about its entire circumference. During pressing operation, pressure must be applied to outer bearing race only.

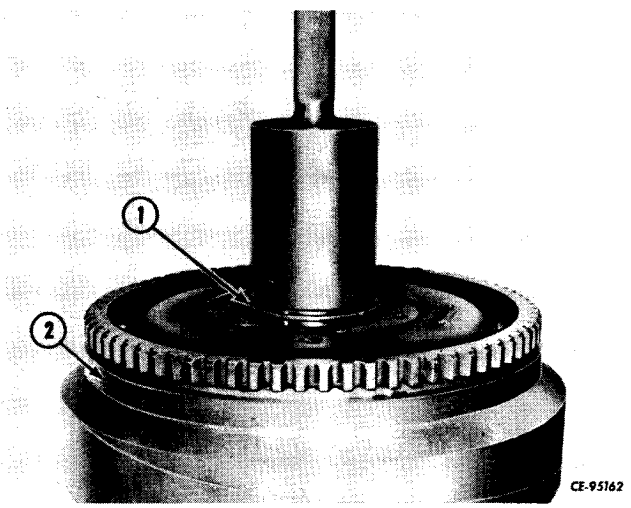


Figure 3-35

Using the output shaft bearing installation tool (3, Fig. 3-36) (refer to "SPECIAL TOOLS"), drive the housing (1) and bearing (4) assembly down on the output shaft (6) and turbine wheel (5) assembly. Bearing must bottom on shaft shoulder and turbine wheel hub (5).

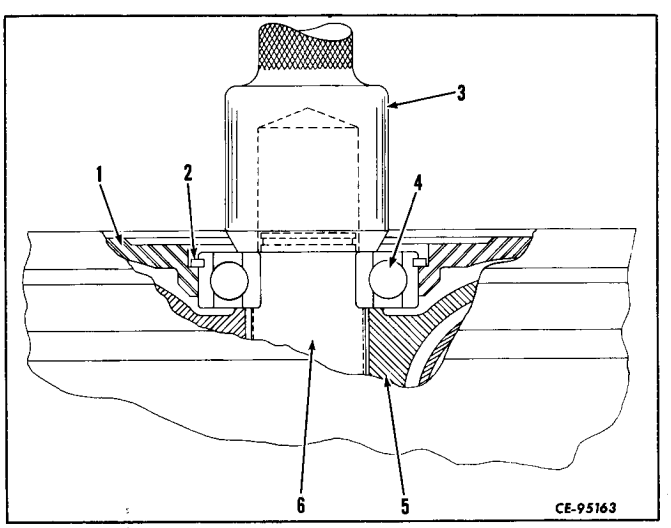


Figure 3-36

Place the bearing spacer (2, Fig. 3-37) on the output shaft (3) and secure with snap ring (1). Be sure snap ring bottoms around its entire circumference in shaft groove.

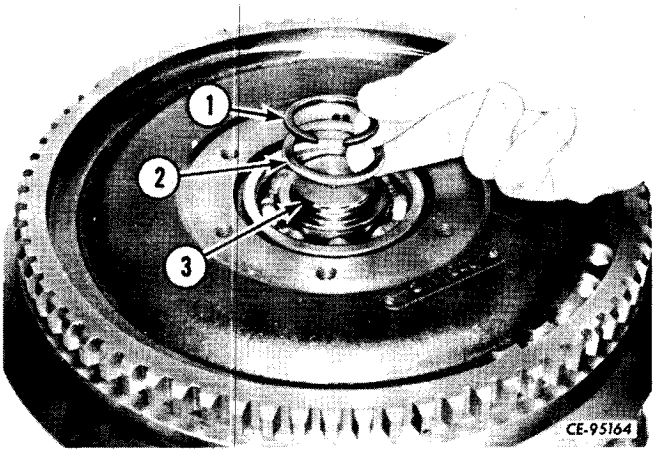


Figure 3-37

Place the pump drive gear (4, Fig. 3-38) in position on the impeller wheel (2) and secure with the clamp plates (1, 5) and cap screws (3). Tighten the cap screws to the recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

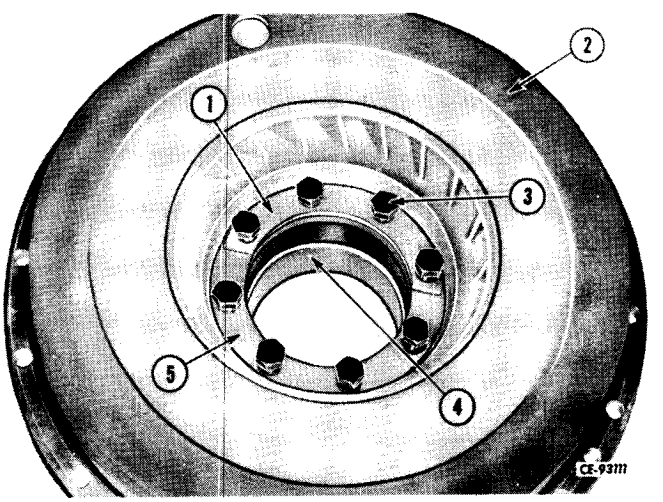
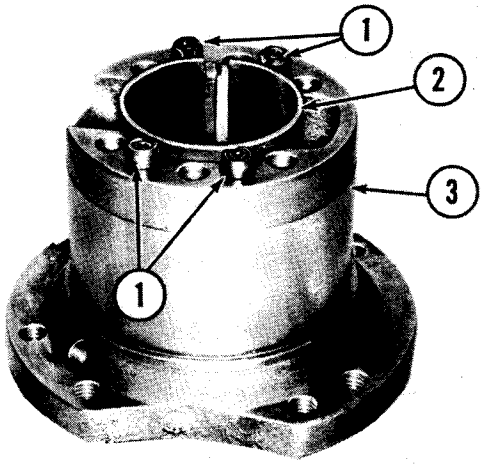


Figure 3-38

DISASSEMBLY, INSPECTION AND ASSEMBLY

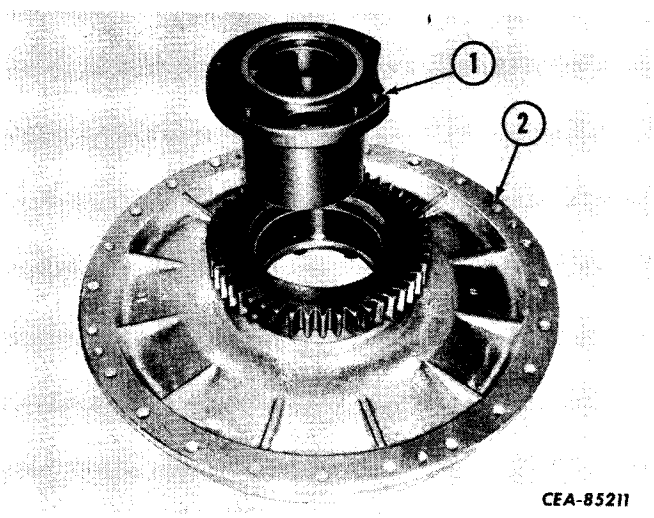
Install split sleeve (2, Fig. 3-39) in the guide wheel carrier (3). If roll pins (1) were removed, install new pins.



CEA-85212

Figure 3-39

Lubricate the guide wheel carrier (1, Fig. 3-40) bearing surface and pump drive gear bearing with clean new transmission fluid. Install the guide wheel carrier in the impeller assembly (2).

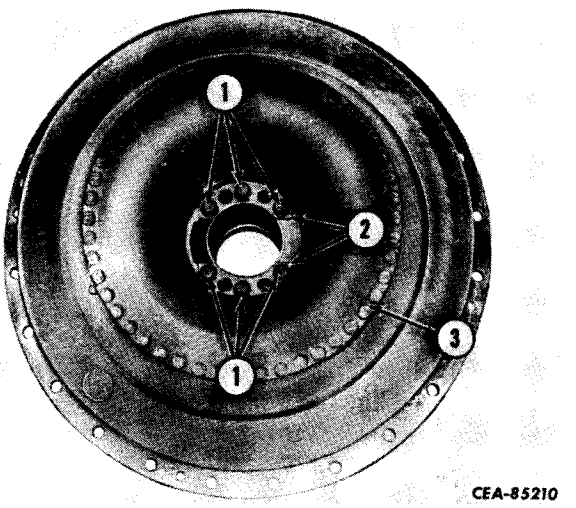


CEA-85211

Figure 3-40

Position the guide wheel (3, Fig. 3-41) on the guide wheel carrier. Install the clamp plates (2) and 12 point cap screws (1). Tighten the cap screws to the recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

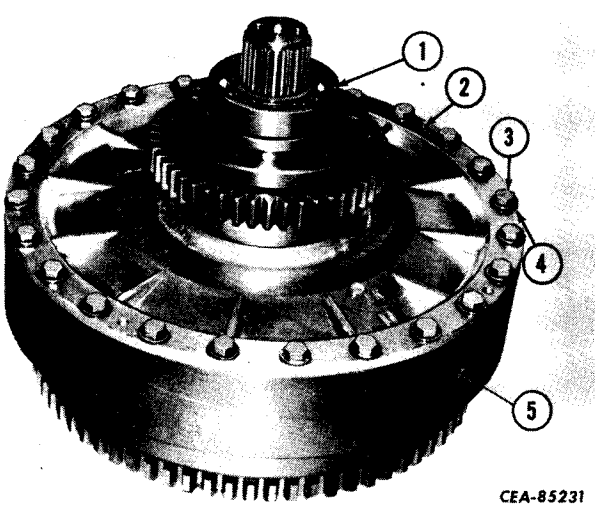


CEA-85210

Figure 3-41

Install the impeller wheel assembly (2, Fig. 3-42) on the rotating housing (5) and secure with cap screws (3) and special flat washers (4).

(Continued on next page)



CEA-85231

Figure 3-42

DISASSEMBLY, INSPECTION AND ASSEMBLY

ASSEMBLY - Continued

NOTE: Both the inner bore of the guide wheel carrier and the output shaft in the area of the hook-type seal rings must be well lubricated with clean, new transmission fluid. Great care must be used during the installation of the guide wheel carrier on the output shaft to avoid breaking the hook-type seal rings.

Tighten the cap screws (3) to the recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Install the bearing (1) using the output shaft bearing installation tool (refer to "SPECIAL TOOLS"). Bearing must bottom about its entire circumference on the guide wheel carrier.

Carefully lower the converter housing assembly (1, Fig. 3-43) over the converter assembly (2). Be careful not to damage the output yoke oil seal in the housing. Align the cap screw holes in the guide wheel carrier with the holes in the converter housing.

NOTE: Two or three headless bolts may be used as guide pins to position housing on guide wheel carrier.

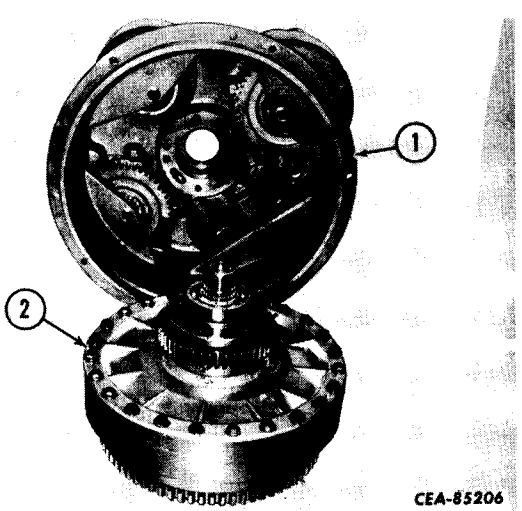


Figure 3-43

Install new copper washers (2, Fig. 3-44) on cap screws (1). Install cap screws through converter housing and into guide wheel carrier. Tighten cap screws to the recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

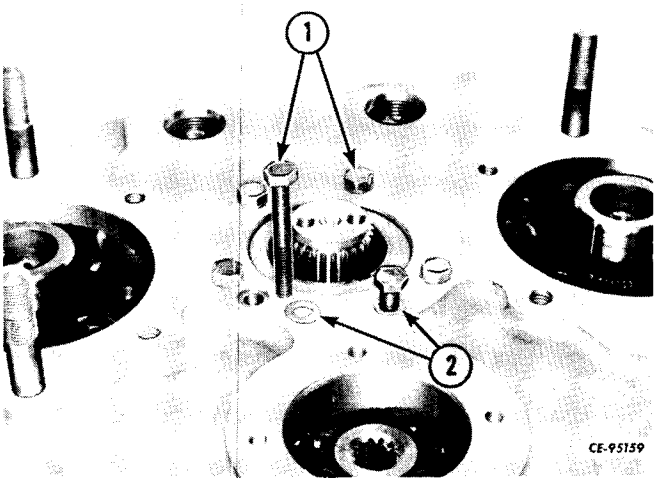


Figure 3-44

Invert the converter assembly. Position the bearing retainer (1, Fig. 3-45) on the rotating housing (2) and secure with cap screws. Tighten cap screws to the recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

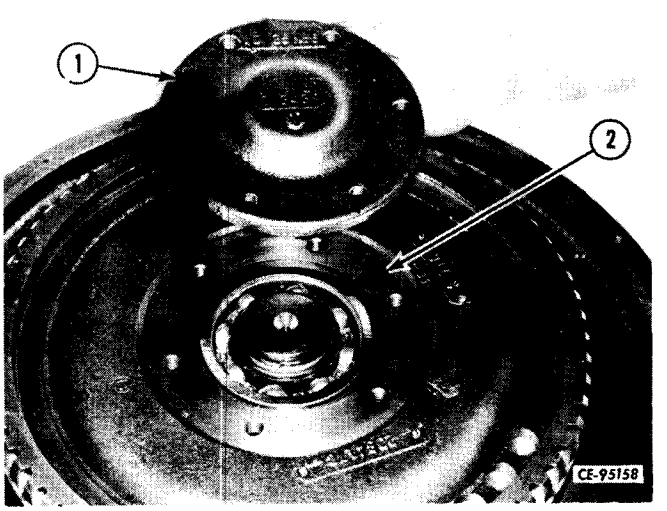


Figure 3-45

DISASSEMBLY, INSPECTION AND ASSEMBLY

Apply clean grease to the output yoke (3, Fig. 3-46) sealing surface. Install yoke on the splined shaft. Position a new "O"-ring (2) and clamp plate (1) in the yoke bore. Install clamp plate retaining cap screws and tighten to the recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

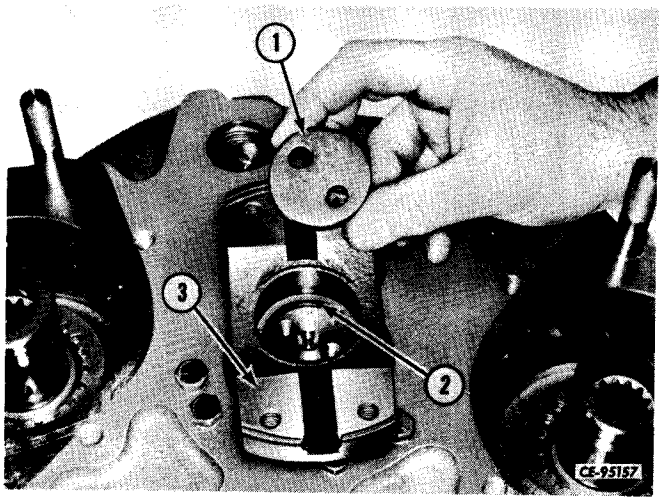


Figure 3-46

Apply plastic gasket to mounting flange of charging pump. Coat mounting capscrews lightly with oil to prevent any plastic gasket which might run into tapped holes from seizing the capscrews. Install the charging pump (6, Fig. 3-2) and secure with capscrews. Tighten the capscrews to the recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Coat the OD of the new pump adaptor plate seals with "Mar-Seal" or equivalent sealant and press seals into adaptor plate bores. These are double lip seals. The large lip with the spring tensioner must face the interior of the converter housing. Seal should be positioned just slightly below inner face of pump adaptor plate (refer to "SEAL INSTALLATION DETAILS").

Position new gaskets on the converter housing and install pump adaptor plates.

NOTE: Be sure adaptor plate drain slots (8, Fig. 3-2) are positioned towards bottom of converter housing.

Position the two large hydraulic pumps on their respective mounting plates. Install retaining hex nuts and lock washers and tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

INSTALLATION

Support the converter assembly with suitable sling and hoist and position it on the engine flywheel housing. Install the retaining cap screws and lock washers. Tighten the cap screws to the recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Connect the breather line to the elbow at the top of the converter housing.

Connect electrical leads.

Install drive shaft between converter and transmission. Tighten retaining cap screws to recommended torque (refer to Section 5, under "SPECIAL TORQUES").

Torque: _____

Connect all lines to the hydraulic pumps and converter housing. The identification tags, attached to the lines during removal, will aid in this operation. Be sure to use new "O"-rings at all split-flange type connections.

Position the bulkhead assembly on the tractor and secure with cap screws, lock washers and hex nuts. Tighten nuts securely.

Fasten front end of hood to bulkhead and tighten all hood fasteners, front and rear.

Connect the tachometer drive.

Connect the following lines:

Air cleaner restriction indicator.
Cold weather starting aid.
Transmission filter lines.
Control valve to reservoir return line.
Inlet lines to hydraulic pumps.

(Continued on next page)

INSTALLATION - Continued

Install battery cable clamps. Connect the battery cables, ground cable last.

Fill the hydraulic reservoir (refer to Section 11, "HYDRAULIC SYSTEM").

Add required fluid to transmission-converter system (refer to Section 4, "TRANSMISSION" for fill and check procedure).

TORQUE CONVERTER AND TRANSMISSION CHARGING PUMP - EARLY TYPE

GENERAL

Do not remove or disassemble the pump unless it is known to be in need of repairs. First eliminate all other possibilities of transmission system malfunction as outlined in the "TROUBLE SHOOTING" section.

Before disassembly, have the correct pump gasket set on hand. Pump disassembly will probably damage "O"-rings, back-up rings and seals. Pump assembly without replacing these parts is not practical.

NOTE: For correct repair parts, refer to current "PARTS MANUAL."

DISASSEMBLY

Scribe reference marks (1, Fig. 3-47) on pump housing to aid in positioning parts during assembly. Remove plugs (3) and "O"-rings (4) (where used). Remove cap screws (2) that secure cover (5) to gear plate.

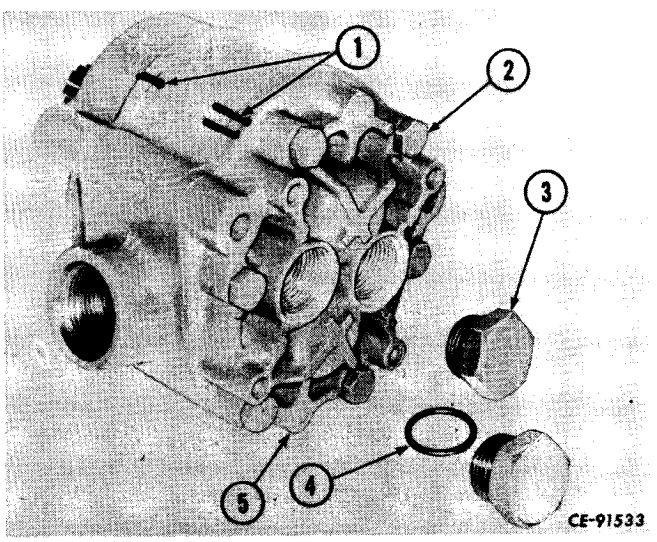


Figure 3-47

Remove the wear plate (1, Fig. 3-48) from the cover (2).

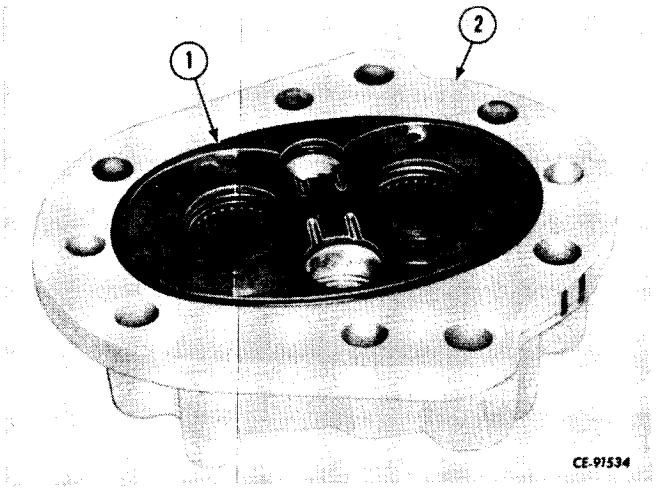


Figure 3-48

Remove the back-up ring (2, Fig. 3-49), "O"-ring (5) and seal rings (1 and 4) from the cover (3).

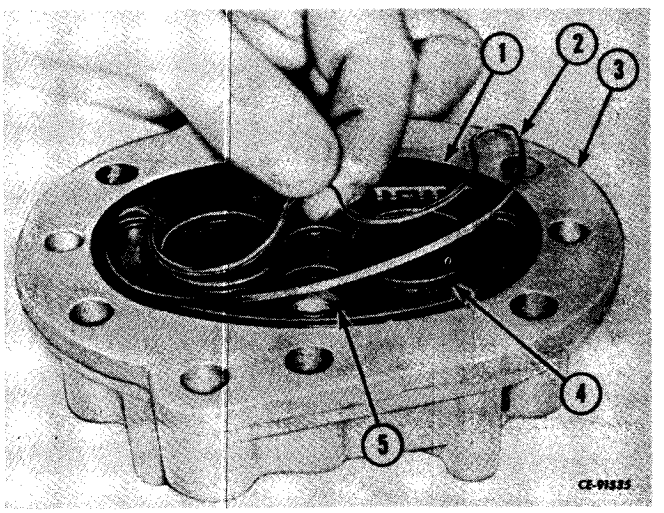


Figure 3-49

Place mating marks (2, Fig. 3-50) on the gear assemblies (1 and 3) so they can be reinstalled

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in the same way to maintain existing wear patterns, if they are usable. Remove the gear assemblies.

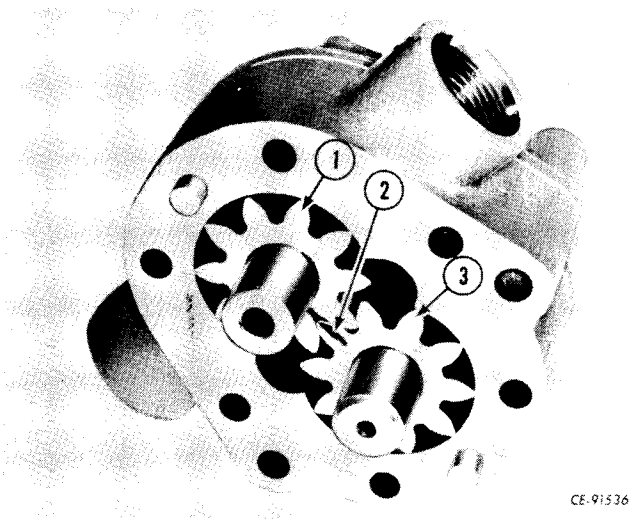

Figure 3-50

Remove the dowel pins (1, Fig. 3-51) and gear plate (2) from the body assembly (3).

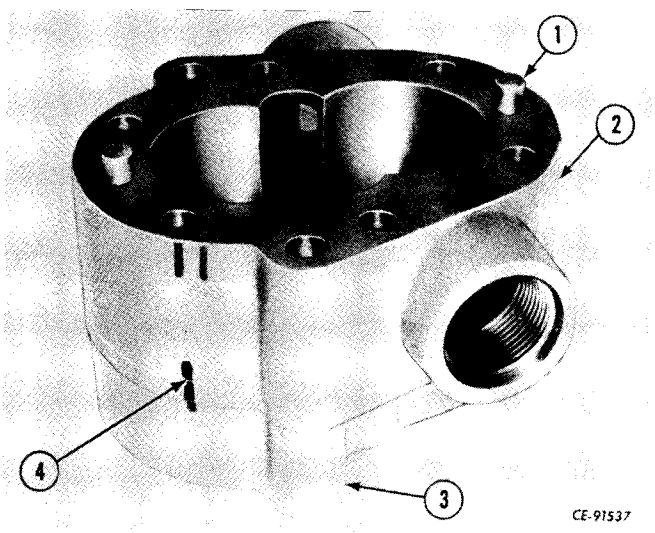

Figure 3-51

Remove the wear plate (1, Fig. 3-52) from the body (2).

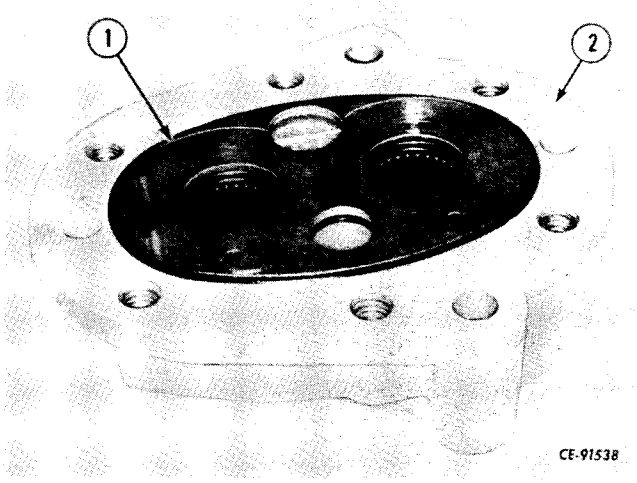

Figure 3-52

Remove the back-up ring (2, Fig. 3-53) "O"-ring (5) and seal rings (1 and 4) from the body (3).

(Continued on next page)

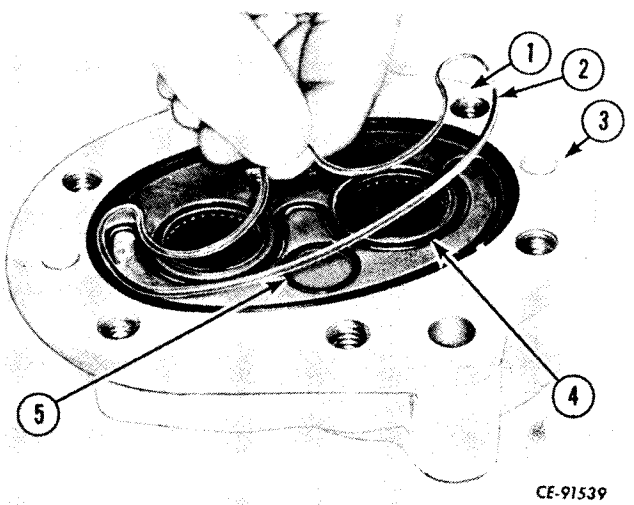

Figure 3-53

DISASSEMBLY, INSPECTION AND ASSEMBLY

TORQUE CONVERTER AND TRANSMISSION CHARGING PUMP - EARLY TYPE - Continued

DISASSEMBLY - Continued

Remove the cap screws that secure the seal retainer (1, Fig. 3-54) to the body (3). Press the old seal (2) from the retainer (1). Using the proper seal installation tool (Fig. 3-62), press a new seal in the retainer being careful not to damage the seal.

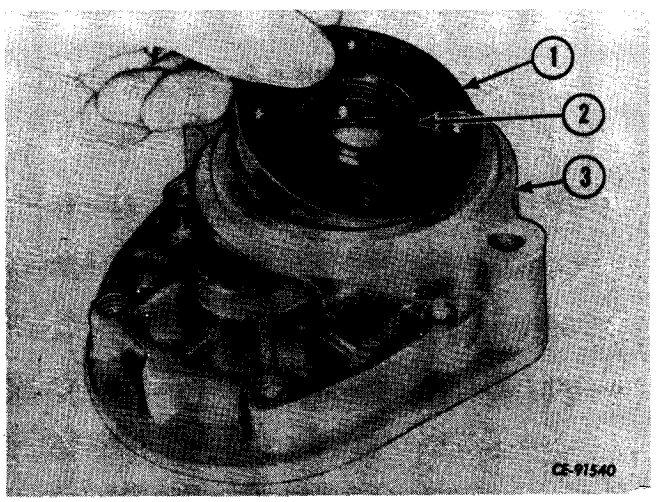

Figure 3-54

Remove and discard the "O"-ring (1, Fig. 3-55) from the body (2).

Using a suitable puller, pull the old needle bearings from the body and cover.

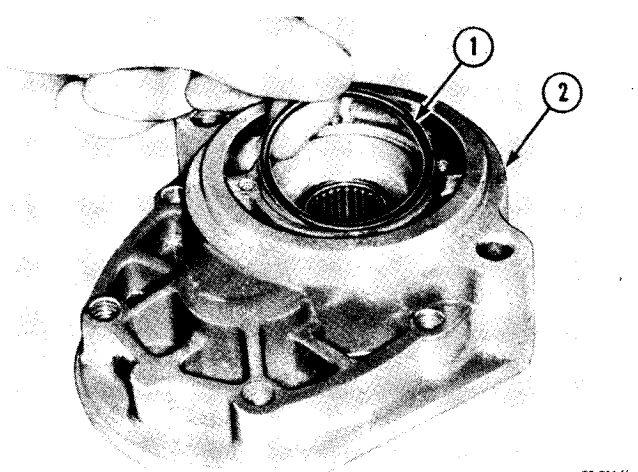

Figure 3-55

Press new bearings (1, Fig. 3-56, 3-57) in the body (2, Fig. 3-56) and cover (2, Fig. 3-57).

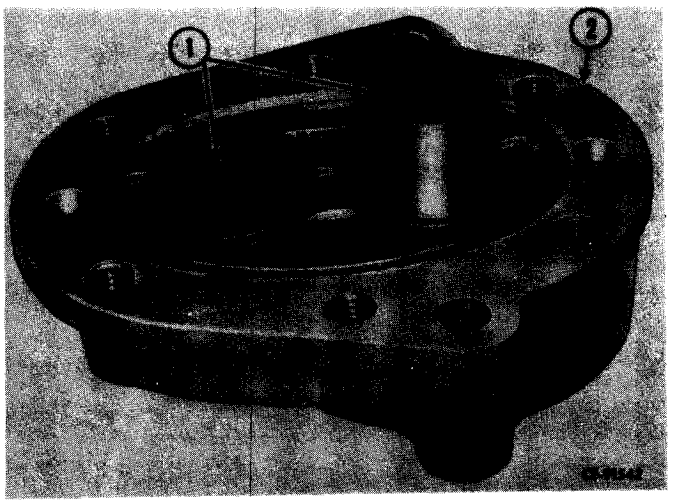

Figure 3-56

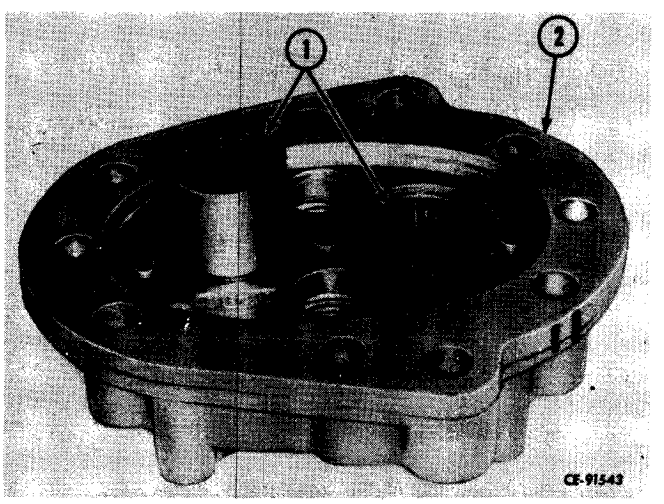

Figure 3-57

CLEANING AND INSPECTION

Clean and dry all parts.

Remove nicks and burrs from all parts with emery cloth.

Inspect drive gear shaft for damaged splines.

Inspect both the drive gear and idler gear shafts at bearing points and seal areas for rough surfaces and excessive wear. Inspect the gear faces for scoring and excessive wear.

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DISASSEMBLY, INSPECTION AND ASSEMBLY

Each gear/shaft assembly may be replaced separately, but neither the shafts or the gears are furnished separately and are available as assemblies only.

If edges of gear teeth are sharp, break edge with emery cloth.

ASSEMBLY

Install new "O" ring (1, Fig. 3-55) in the body (2).

Install the retainer assembly (1, Fig. 3-54) in the body (3) and secure with the cap screws.

Install the new seal rings (1 and 4, Fig. 3-53), "O" ring (5) and back-up ring (2) in the body (3).

Install the wear plate (1, Fig. 3-52) in the body (2).

NOTE: The bronze face of the wear plate is the gear side and the small hole covers the small "O" ring.

Install the dowel pins (1, Fig. 3-51) in the gear plate (2) with the pins extending equal distance from each face of the plate. Install the plate on the body (3) being sure the reference marks (4) are aligned.

Wrap the splines of the drive gear (1, Fig. 3-50) with masking tape. Lubricate the oil seal with multi-purpose grease. Slide the gear into the body. Install the driven gear (3) making sure the reference marks (2) are aligned. Remove the tape.

Install the new seal rings (1 and 4, Fig. 3-49), "O" ring (5) and back-up ring (2) in the body (3).

Install the wear plate (1, Fig. 3-48) in the cover (2).

NOTE: The bronze face of the wear plate is the gear side and the small hole covers the small "O" ring.

Install the cover (5, Fig. 3-47) making sure the reference marks (1) are aligned. Install the cap screws (2) and tighten to the recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Where used, install new "O" rings (4) on the plugs (3) being careful not to damage "O" ring on plug threads. Install plugs.

TORQUE CONVERTER AND TRANSMISSION CHARGING PUMP - LATE TYPE

DISASSEMBLY

Remove cap screws (2, Fig. 3-58) that secure mounting flange (3) to drive plate (8). Remove drive plate and flange gasket (4). Remove locating ring (5) and oil seal (1) from mounting flange. Remove cap screws (6, 7) that hold pump assembly together. Remove drive plate from case (11). Remove drive shaft (13) and idler shaft (15) with gears (17) attached. Remove retaining rings (12) from drive and idler shafts. Slide gears from shafts. Remove dowel keys (14, 16) from shafts.

CLEANING AND INSPECTION

Clean all metal parts in a good cleaning solvent.

Inspect parts for signs of wear or damage. Check bushings in drive plate and end plate. Replace any worn or damaged parts.

Discard old "O" rings and oil seal.

Lubricate all parts with light oil before assembly.

ASSEMBLY

Position new "O" ring (10) in groove in case (11) towards end plate (18). Place case in position on end plate.

Place dowel keys (14 and 16) in grooves in drive (13) and idler (15) shafts. Slide gears (17) on shafts and secure with retaining rings (12). Install gear and shaft assemblies into end plate.

Place a new "O" ring (10) in groove of case (11). Position drive plate on case and install cap screws. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

(Continued on next page)

TORQUE CONVERTER

DISASSEMBLY, INSPECTION AND ASSEMBLY

TORQUE CONVERTER AND TRANSMISSION CHARGING PUMP - LATE TYPE - Continued

Install new oil seal (1) and locating ring (5) in adapter flange (3). Position a new gasket (4) and flange on drive plate (8) and secure with cap screws (2). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

ASSEMBLY - Continued

Torque: _____

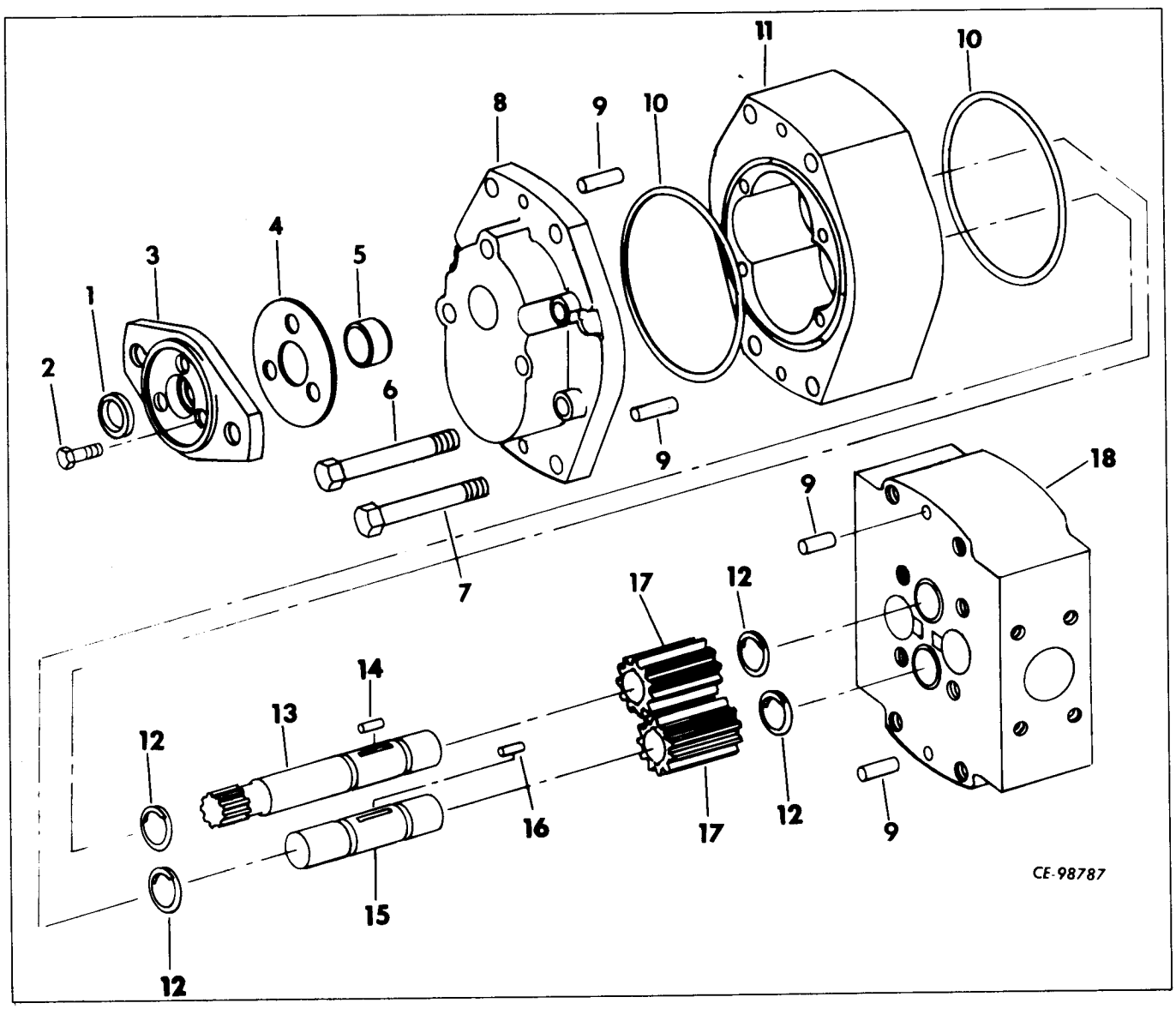

Figure 3-58
Torque Converter and Transmission Charging Pump – Late Type.

1. Oil seal.
2. Cap screw.
3. Mounting flange.
4. Gasket.
5. Locating ring.
6. Cap screw.
7. Cap screw.
8. Drive plate.
9. Dowel pin.
10. "O" ring.
11. Case.
12. Retaining ring.
13. Drive shaft.
14. Dowel key.
15. Idler shaft.
16. Dowel key.
17. Gear.
18. End plate.

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TROUBLE SHOOTING

TROUBLE SHOOTING CHART

COMPLAINT	POSSIBLE CAUSE	REMEDY
High converter oil temperature.	1. Transmission sump oil level too high or too low.	1. Add or drain oil to proper level.
	2. Foamed oil.	2. (a) Check oil level. (b) Air leaks in suction line.
	3. Clogged oil cooler.	3. Clean oil cooler.
	4. Low converter "IN" pressure.	4. See low converter "IN" pressure.
	5. Faulty converter.	5. Repair or replace.
	6. Low oil flow thru converter.	6. Check charging pump for excessive wear.
High converter "IN" pressure.	1. Clogged oil cooler.	1. Remove and clean oil cooler.
	2. Stuck converter pressure regulator valve.	2. (a) Clean and inspect valve body and bore. (b) Inspect valve spring.
	3. Stuck lube pressure regulator valve.	3. (a) Clean and inspect valve body and bore. (b) Inspect valve spring.
Low converter "IN" pressure.	1. Low transmission sump oil level.	1. Add oil to proper level.
	2. Low clutch pressure.	2. See SECTION IV, TRANSMISSION.
	3. External oil leak.	3. Check external oil lines.
	4. Converter regulator valve sticking.	4. (a) Clean and inspect valve body and bore. (b) Inspect valve spring.
	5. Internal oil leaks.	5. Overhaul converter.
Loss of power.	1. Low engine output.	1. See low engine speed at converter stall.

(Continued on next page)

TROUBLE SHOOTING

TROUBLE SHOOTING CHART - Continued

COMPLAINT	POSSIBLE CAUSE	REMEDY
Loss of power (Cont).	2. Low converter "IN" pressure. 3. Foamed oil.	2. See low converter in pressure. 3. (a) Correct oil level. (b) Check for air leak in suction line. (c) Use proper type oil.
High engine speed at converter stall.	1. Low transmission sump oil level. 2. Low converter "IN" pressure. 3. Foamed oil.	1. Add oil to proper level. 2. See low converter "IN" pressure. 3. (a) Correct oil level. (b) Check for air leak in suction line. (c) Use proper type oil.
Low engine speed at converter stall.	1. Low engine output. 2. Excessive oil in converter housing. (a) Charging pump seal worn. (b) Excessive charging pump wear. 3. Plugged drain line.	1. Tune engine and check output. 2. (a) Replace seal. (b) Repair or replace pump. 3. Clean line.

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SERVICE INFORMATION

SPECIFICATIONS

Converter type	Single stage, single phase, three element
Torque multiplication at stall	2.75:1
Oil system	
Type	Integral with transmission
Charging pump:	
Type	Positive displacement, gear type
Capacity:	
Early Type	33.5 GPM at 2100 RPM and 500 PSI
Late Type	35.49 GPM at 2100 RPM and 500 PSI
Oil pressure	50-80 PSI at high idle
Oil temperature	250°F. maximum
Oil filter	Full flow - remote mounted
Oil cooler	Remote mounted
Converter stall speed	2560 RPM

LUBRICANTS AND CAPACITIES

Refer to Section 4, "TRANSMISSION."

SPECIAL TORQUES

(Threads lubricated with oil or grease)

Idler gear bearing retainer cap screws	37 lbs. ft.
Pump drive gear-to-impeller cap screws	21 lbs. ft.
Guide wheel-to-carrier cap screws	26 lbs. ft.
Impeller wheel-to-rotating housing cap screws	21 lbs. ft.
Guide wheel carrier-to-converter housing cap screws	38 lbs. ft.
Output shaft bearing retainer cap screws	37 lbs. ft.
Output yoke retaining cap screws	38 lbs. ft.
Charging pump mounting cap screws	38 lbs. ft.
Hydraulic system pumps mounting hex nuts	160-180 lbs. ft.
Converter housing-to-flywheel housing cap screws	33-37 lbs. ft.
Charging pump assembly cap screws	32-37 lbs. ft.
Charging pump mounting flange-to-drive plate cap screws (Late Type Pump)	19-21 lbs. ft.

SEAL INSTALLATION DETAILS

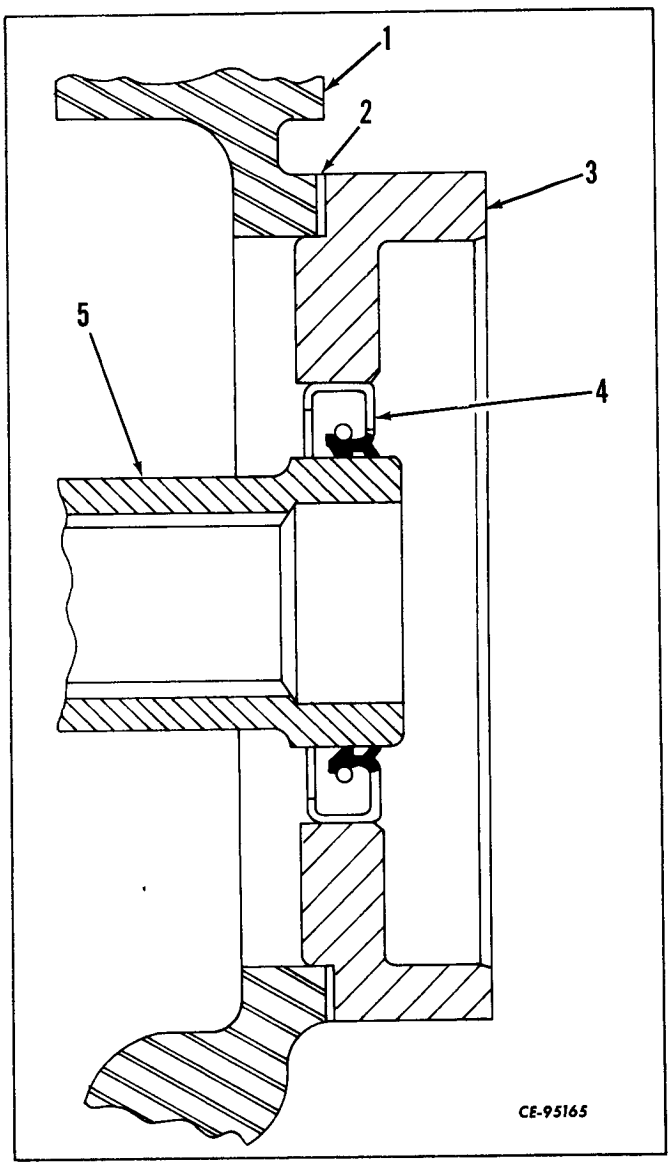


Figure 3-59
Hydraulic Pump Adapter Plate Seal.

1. Converter housing.
2. Mounting plate gasket.
3. Pump mounting plate.
4. Double lip seal.
5. Splined hub.

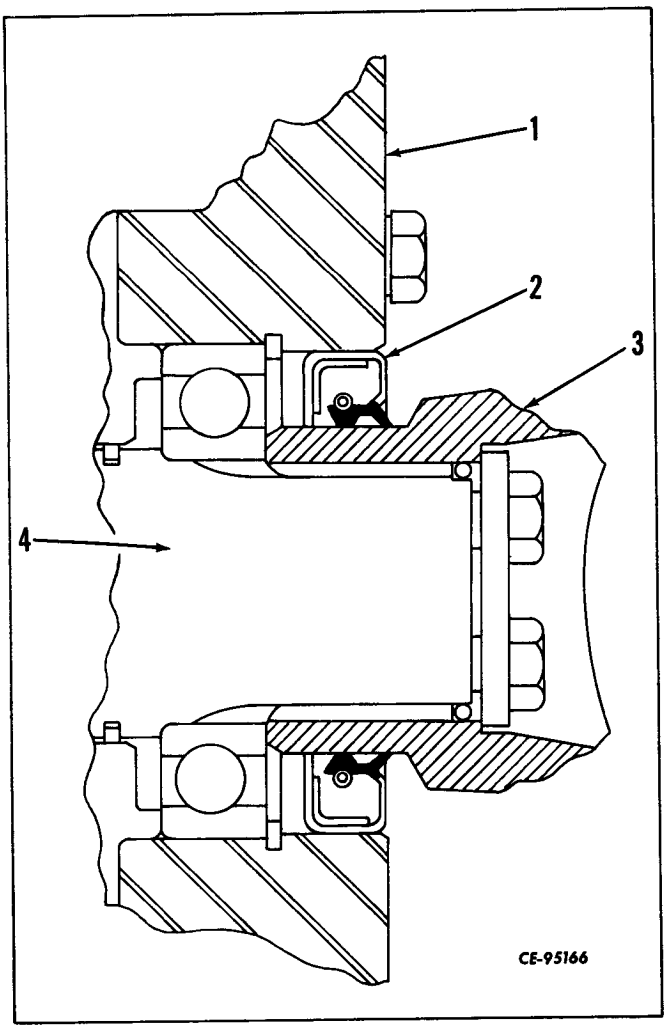


Figure 3-60
Converter Output Yoke Seal.

1. Converter housing.
2. Double lip seal.
3. Output yoke.
4. Output shaft.

SPECIAL TOOLS

OUTPUT SHAFT OIL SEAL INSTALLATION TOOL

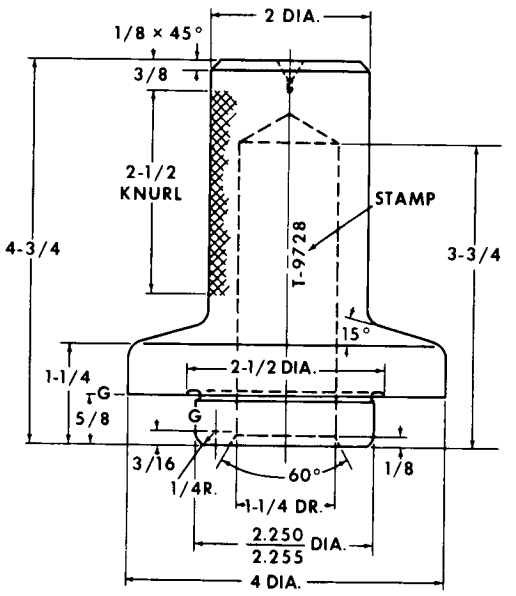


Figure 3-61

OUTPUT SHAFT BEARING INSTALLATION TOOL

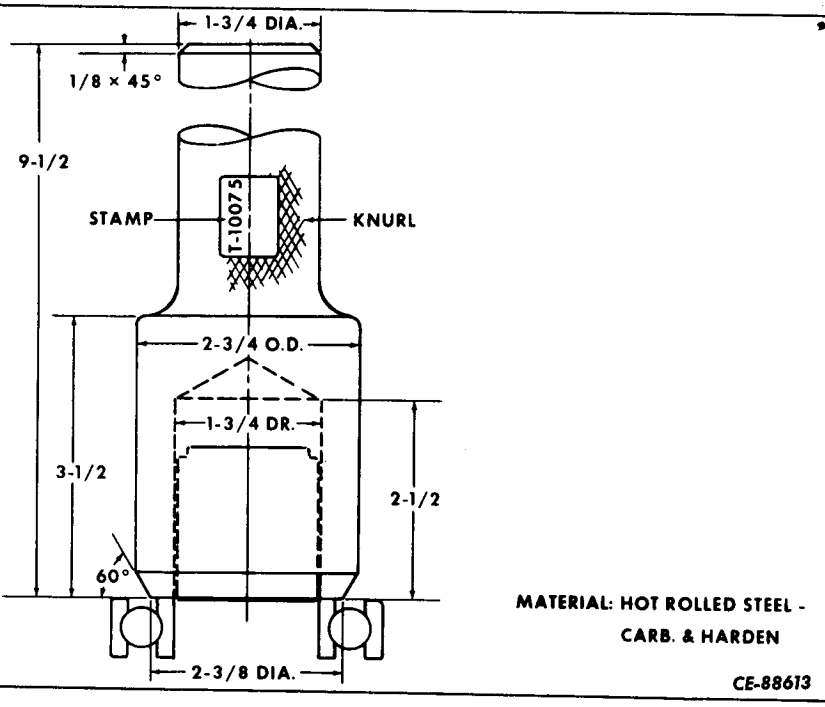
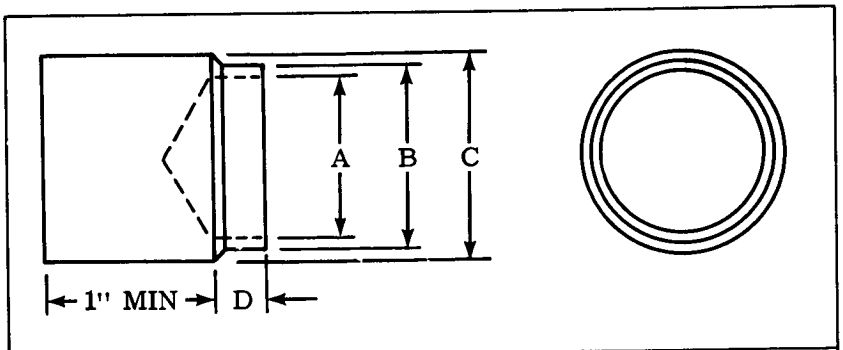


Figure 3-62

SPECIAL TOOLS - Continued

CHARGING PUMP SEAL INSTALLATION TOOL



SEAL INSTALLATION TOOL

Seal O.D. of Shaft	I.D. A (inches)	O.D. B (inches)	O.D. C (inches)	Length D (inches)
3/4"	1.016	1.078	1.240	5/16
7/8"	1.032	1.125	1.240	5/16

CE-91544

Figure 3-63

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SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SECTION IV

TRANSMISSION

SECTION IV TRANSMISSION

GENERAL INFORMATION

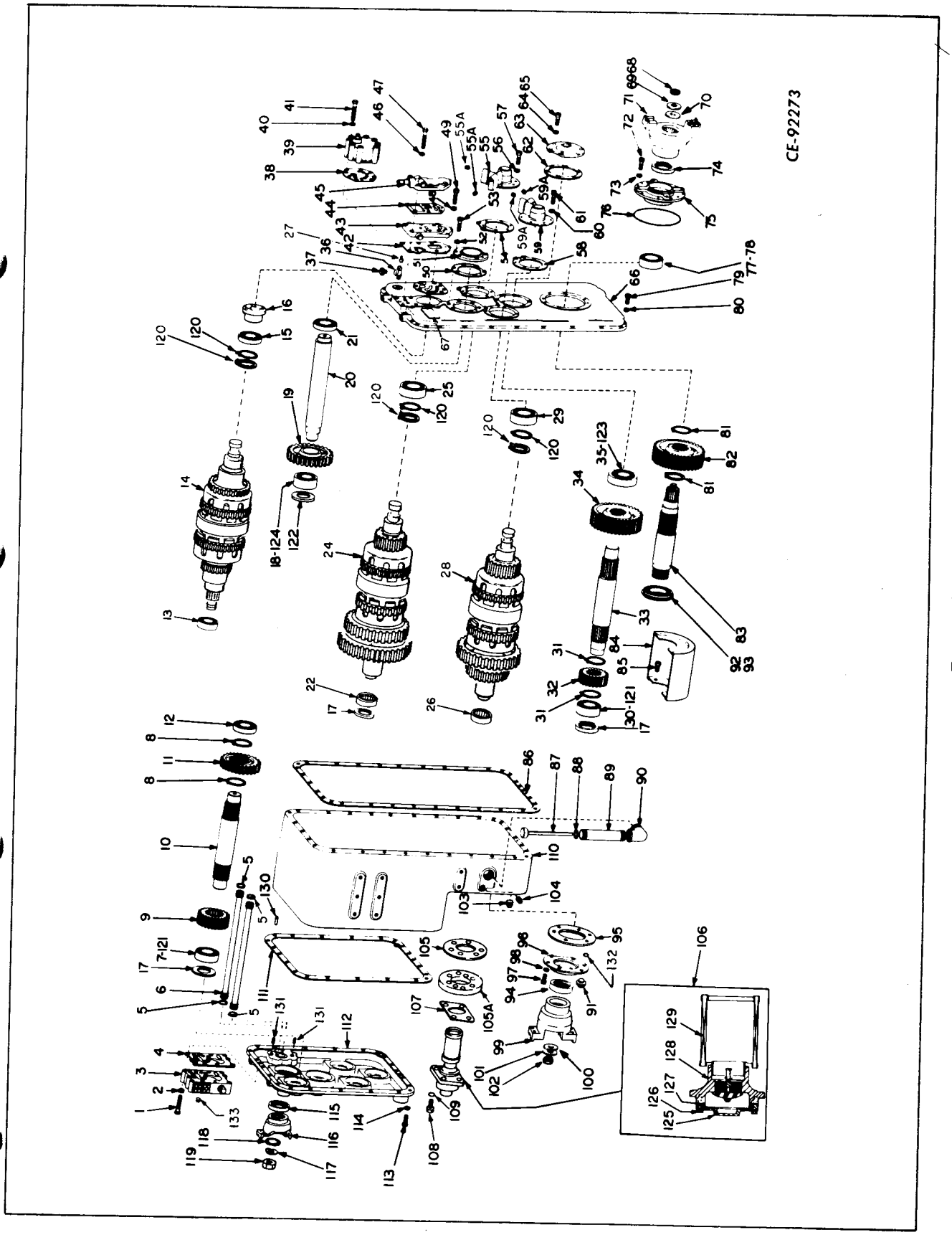

Figure 4-1
Exploded View of Transmission.

TRANSMISSION

GENERAL INFORMATION

Legend for Fig. 4-1

1. Cap screw.
2. Lock washer.
3. Main regulator valve.
4. Gasket.
5. "O"-ring.
6. Lube.
7. Roller bearing.
8. Retaining ring.
9. Gear, 29 teeth.
10. Reverse idler shaft.
11. Gear, 39 teeth.
12. Ball bearing.
13. Roller bearing.
14. Forward and reverse clutch assembly.
15. Roller bearing.
16. Bearing retainer.
17. Spacer.
18. Bearing assembly.
19. Gear, 46 teeth.
20. Main idler shaft.
21. Ball bearing.
22. Roller bearing.
24. First and third clutch assembly.
25. Bearing assembly.
26. Bearing assembly.
27. Pipe plug.
28. Second and fourth clutch assembly.
29. Roller bearing.
30. Bearing.
31. Snap ring.
32. Gear, 26 teeth.
33. Lower counter shaft.
34. Gear, 52 teeth.
35. Bearing assembly.
36. Tee.
37. Breather.
38. Gasket.
39. Range Valve.
40. Lock washer.
41. Bolt.
42. Gasket.
43. Neutral knockdown valve.
44. Gasket.
45. Directional control valve.
46. Lock, washer.
47. Bolt.
48. Lock washer.
49. Bolt.
50. Gasket.
51. Main idler cap.
52. Lock washer.
53. Bolt.
54. Gasket.
55. Oil supply cap.
55A. Pipe Plug.
56. Lock washer.
57. Bolt.
58. Gasket.
59. Oil supply cap.
60. Lock washer.
61. Bolt.
62. Gasket.
63. Lower counter shaft cap.
64. Washer.
65. Bolt.
66. Large cover.
67. Name plate.
68. Nut.
69. Yoke retainer.
70. Gasket.
71. Rear output yoke.
72. Bolt.
73. Lock washer.
74. Seal.
75. Output shaft retainer.
76. "O"-ring.
77. Bearing cup.
78. Bearing cone.
79. Bolt.
80. Lock washer.
81. Snap ring.
82. Gear, 52 teeth.
83. Output shaft.
84. Oil baffle.
85. Bolt.
86. Gasket.
87. Dipstick.
88. Seal.
89. Pipe.
90. Elbow.
91. Seal.
92. Bearing cup.
93. Bearing cone.
94. Seal.
95. Shim.
96. Output shaft retainer.
97. Bolt.
98. Lock washer.
99. Front output yoke.
100. Gasket.
101. Yoke retainer.
102. Nut.
103. Pipe plug.
104. Pipe plug.
105. Gasket.
105A. Filter retainer.
106. Oil filter.
107. Gasket.
108. Bolt.
109. Lock washer.
110. Main housing.
111. Gasket.
112. Small cover.
113. Bolt.
114. Lock washer.
115. Seal.
116. Input yoke.
117. Washer.
118. Rubber washer.
119. Nut.
120. Snap ring.
121. Inner bearing race.
122. Spacer.
123. Inner bearing race.
124. Inner bearing race.
125. Flange.
126. Screw.
127. "O"-ring.
128. Valve assembly.
129. Filter element.
130. Dowel.
131. Pipe plug.
132. "O"-ring.
133. Pipe plug.

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DESCRIPTION

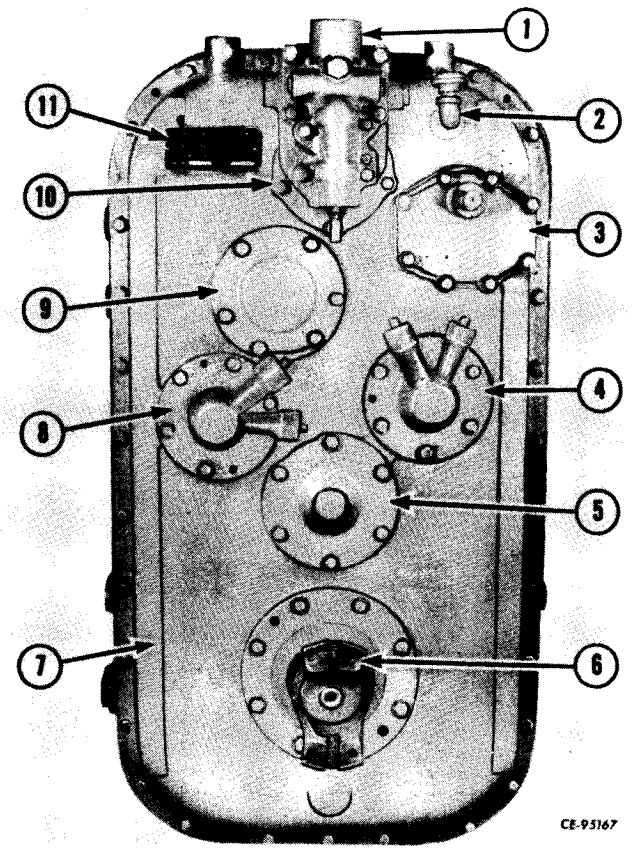

Figure 4-2
Front of Transmission.

1. Forward and reverse control valve.
2. Breather.
3. Range selector valve.
4. 1st and 3rd oil supply cover.
5. Gather shaft bearing cover.
6. Front output yoke.
7. Front housing cover.
8. 2nd and 4th oil supply cover.
9. Idler shaft bearing cover.
10. Neutral knockdown valve.
11. Name plate.

The full power shift transmission is designed to increase the useful range of the torque converter by using the countershaft method of gearing with hydraulic actuated clutches. The transmission can be shifted into first range to increase the engine force for starting and, as the power demands, grow less on the converter, the transmission can be progressively shifted into higher ranges.

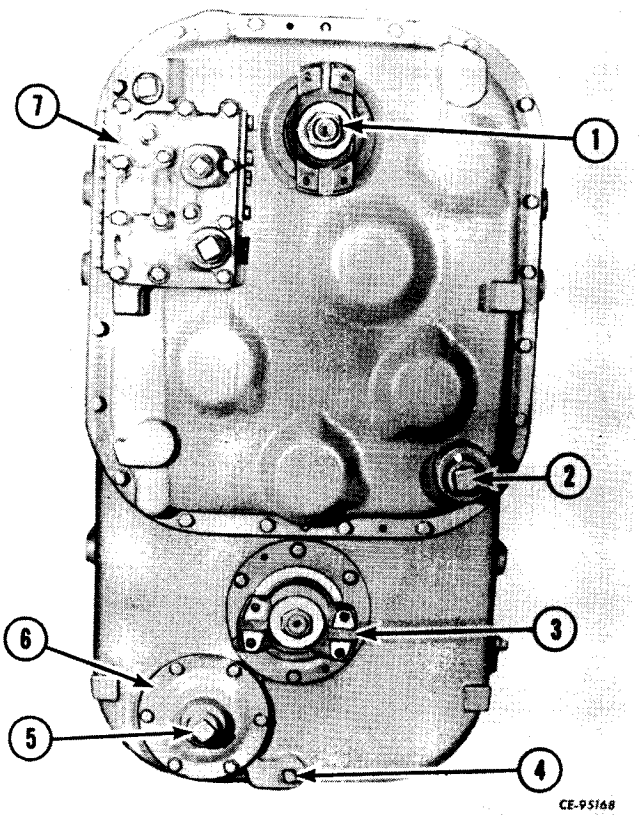

Figure 4-3
Rear of Transmission.

1. Input yoke.
2. Converter housing drain.
3. Output yoke.
4. Transmission drain.
5. Pump suction.
6. Sump oil screen.
7. Main regulator valve.

The transmission has four speeds forward and four speeds reverse and full power shift in all ranges.

The transmission employs the countershaft type of design. This means that shafts are positioned parallel to, and driven by, the input shaft for transfer of power to the output shaft. Gears mounted on the parallel shafts run free unless "clutched" to the shaft and thereby transmitting power in the power train.

(Continued on next page)

DESCRIPTION

To assure smooth, high speed shifts, all clutches are mounted in pairs. Pairing the clutches affords compactness in design and hydraulic balance. The clutches are designed with simplicity, allowing the transfer of oil from the disengaged clutch into the cavity created by the engaging clutch. Thus, a low volume of high pressure oil actuates the clutch for high speed shifting.

PREVENTIVE MAINTENANCE

OIL

Description: "Dexron®"

Quantity for original fill: Refer to "SPECIFICATIONS."

CHANGE PERIODS

1. Oil change - 1000 hours of operation.

2. Clean transmission sump screen - 1000 hours of operation.

3. Change transmission filter - 500 hours of operation.

4. Change the oil and filter and clean the filter screen whenever traces of dirt or the effects of high operating temperatures are present as evidenced by discoloration or strong odors.

5. After any internal failure, change oil and completely flush and clean the converter and transmission including filter, lines, oil cooler and valve bodies. Failure to perform this service will result in additional failures through contamination.

6. Metal particles in the oil indicate a failed or wearing part and the entire system and units should be drained, flushed and thoroughly cleaned.

7. To drain the system, remove the drain plug in the bottom of the transmission housing.

LEVEL CHECK

Oil level should be checked daily or at the beginning of each shift.

NOTE: Tractor must be on level ground when checking oil level.

PRE-START CHECK

Be sure there is sufficient oil in the system before starting the engine. Remove dipstick from oil filler tube located on right side of transmission sump. Oil in transmission sump should be near the "FULL" mark (top mark) on the dipstick. If not, add oil to level of top mark.

HOT OIL CHECK

With engine and transmission at normal operating temperature, transmission in neutral, and engine idling, oil in the transmission sump should be near the "FULL" mark. For greatest accuracy, oil level check should be made with engine idling at 1000 rpm. If the oil is not near the "FULL" mark, add oil to bring it to this level.

OPERATING TEMPERATURE

Normal operating temperature - Refer to "SPECIFICATIONS."

Maximum operating temperature - Refer to "SPECIFICATIONS."

The operating temperature of the oil is registered as oil leaves the converter and is read on the temperature gauge on the vehicle dash. Converter "OUT" temperature check point is located on the converter housing (see Fig. 4-4).

To cool the oil, shift transmission into neutral, apply parking brake and accelerate engine to 1000 to 1500 rpm. The temperature of the oil should drop to a safe operating range.

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PREVENTIVE MAINTENANCE

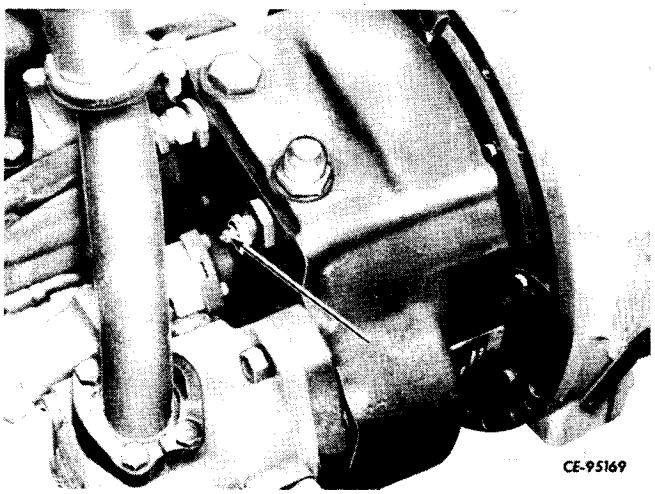

Figure 4-4

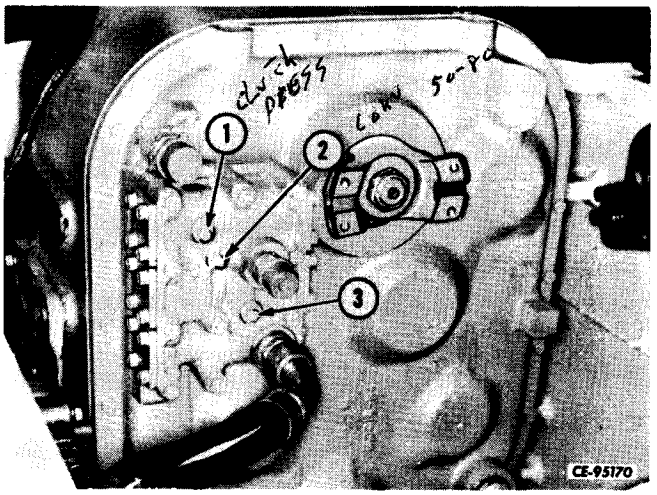

Figure 4-5

OPERATING PRESSURES

Pressure checks should be made with engine and transmission at normal operating temperature. Transmission oil temperature should approximate minimum engine water temperature (refer to "SPECIFICATIONS").

Pressure checks should be made at full power stall.

CLUTCH PRESSURE AT STALL

a. Refer to "SPECIFICATIONS" for clutch pressure limitations.

b. Pressure may be read on dash gauge.

c. Service gauge may be attached to clutch pressure tap in pressure valve body (1, Fig. 4-5) on transmission.

CONVERTER CHARGING PRESSURE (HIGH IDLE)

a. Refer to "SPECIFICATIONS" for converter charging pressure limitations.

b. Service gauge may be attached to converter tap (2, Fig. 4-5) on pressure regulator valve on the transmission.

LUBE PRESSURE (HIGH IDLE)

a. Refer to "SPECIFICATIONS" for lube pressure limitations.

b. Service gauge may be attached to lube pressure tap (3, Fig. 4-5) on pressure regulator valve.

CONVERTER STALL CHECK

Refer to Section 3, "TORQUE CONVERTER" for stall check procedure.

LINKAGE ADJUSTMENT

Both range and directional linkage must be adjusted to allow free movement and a definite "Detent" feel as the lever is moved from one position to another. Linkage should not bind or hold valves or levers between "Detent" position.

NOTE: Never position between detents.

EXTERNAL LINES

All external lines should be inspected periodically for:

1. Loose fittings that allow oil or air leaks.

2. Damaged, collapsed or worn hose.

WIRING

All wiring should be inspected periodically for loose connections and broken or damaged wires. Tape all frayed insulation.

DISASSEMBLY, INSPECTION AND ASSEMBLY

DISASSEMBLY PREPARATION

The following should be made available for removal and disassembly of the transmission:

Provisions for steam cleaning the transmission. Do not use caustic soda.

Prepare a dirt-free work area at least 12 ft. square.

A suitable hoist.

The following tools:

a. Low bench for disassembly.
b. Mechanical gear and bearing puller set.
c. Standard set of mechanics tools.
d. Special tools (see "SPECIAL TOOLS").
e. Shop press.

REMOVAL

Drain transmission fluid.

NOTE: The transmission may be removed without removing the operator's compartment by positioning a hoist on the two supports (2, Fig. 4-6) provided under the operator's compartment (1). This hoist can be used to lower the transmission from the tractor.

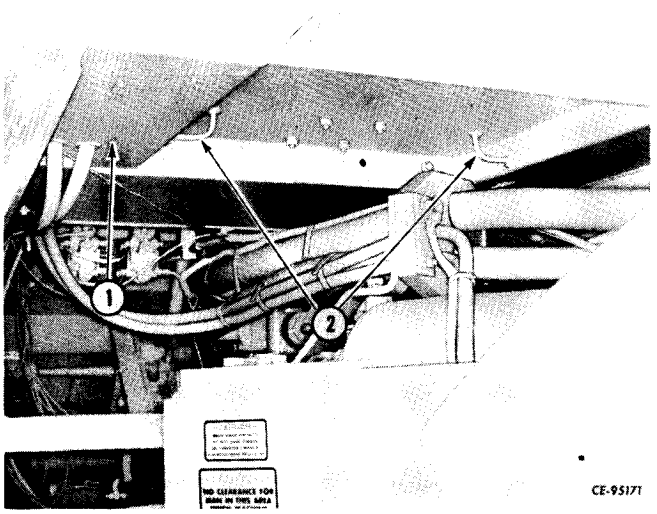

Figure 4-6

Remove the cap screws that secure the ladders (3, Fig. 4-7) and hand rail (4) to the front frame (1) and the operator's compartment (2). Remove ladders.

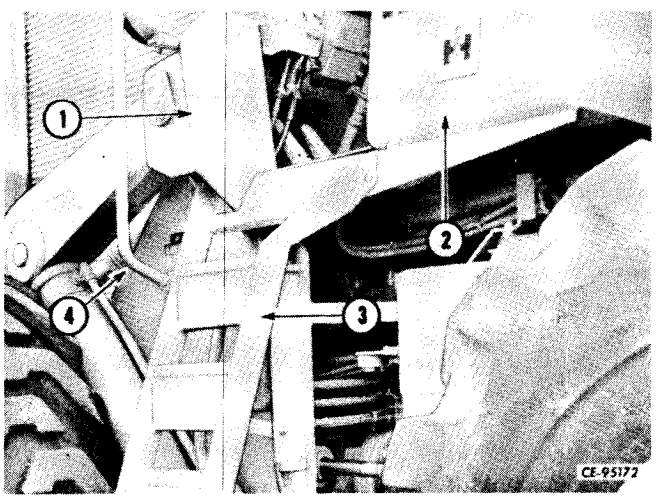

Figure 4-7

Remove cap screws (3, Fig. 4-8) that secure rear floorboard (1) to operator's compartment (2) and front floorboard (4). Remove floorboard.

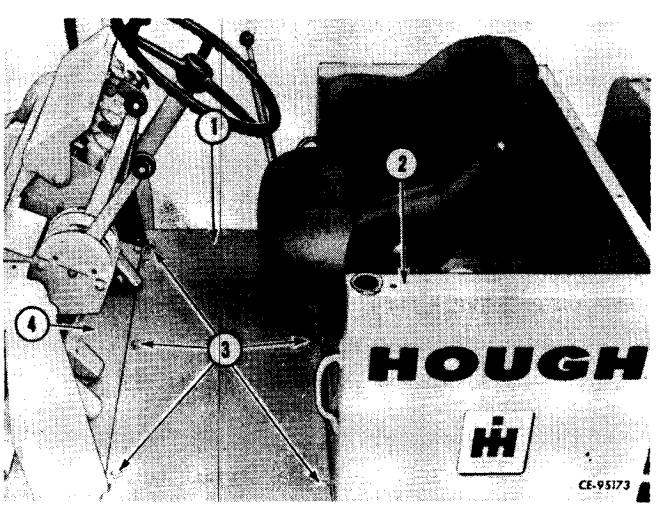

Figure 4-8

Remove the cotter pins and pins (4, Fig. 4-9) that connect the hydraulic control valve levers (1) to the control rods (2).

Disconnect parking brake cable (3) from bracket (5).

DISASSEMBLY, INSPECTION AND ASSEMBLY

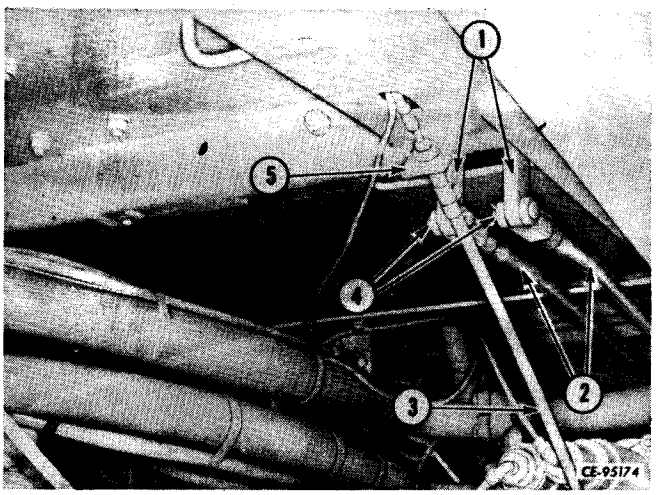

Figure 4-9

Support the operator's compartment (2, Fig. 4-10) with a sling and hoist. Remove the cap screws and nuts (3) that mount the operator's compartment to the front frame (1). Remove operator's compartment.

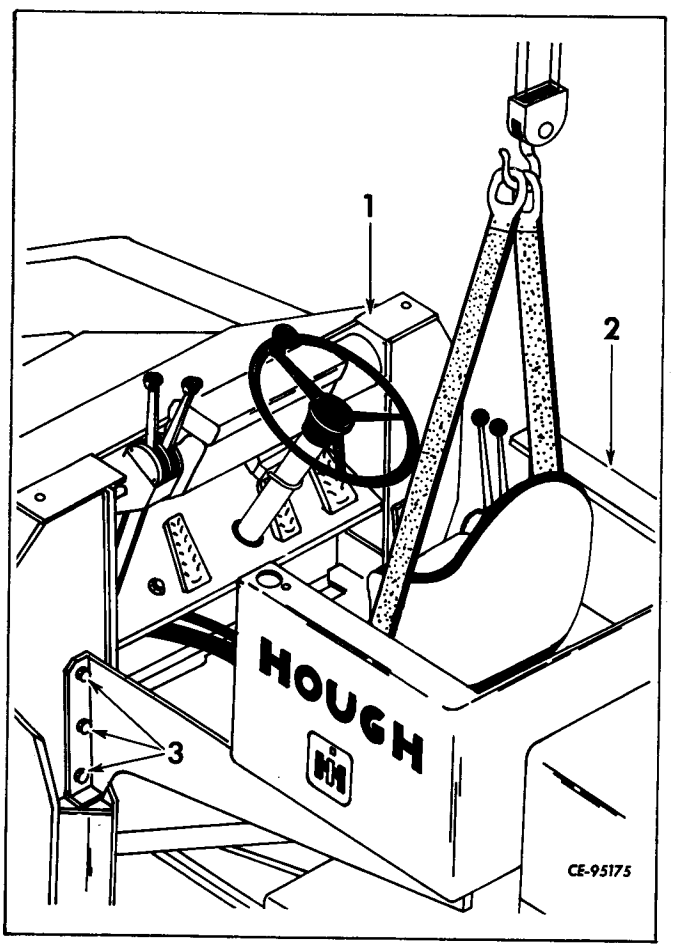

Figure 4-10

Disconnect the transmission to parking brake driveshaft (3, Fig. 4-11) from the transmission (5). Remove the cap screws (4) that attach the hose support (2) to the transmission. Disconnect line (1) from transmission.

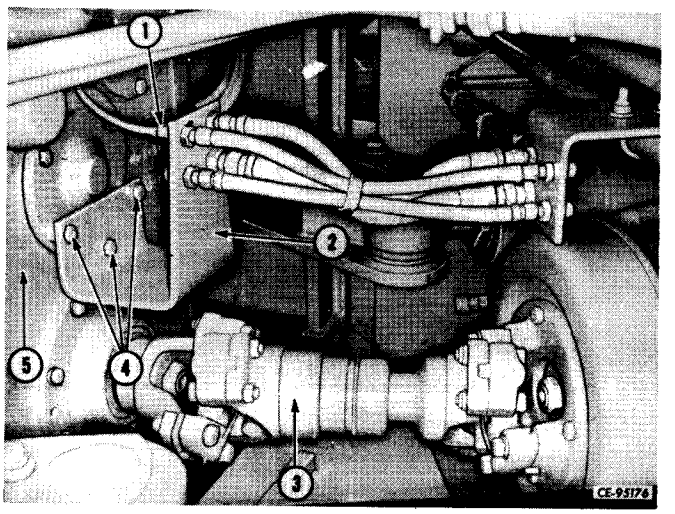

Figure 4-11

Disconnect shift linkage by removing rod (1, Fig. 4-12) from range valve and bars (2) from directional valve.

(Continued on next page)

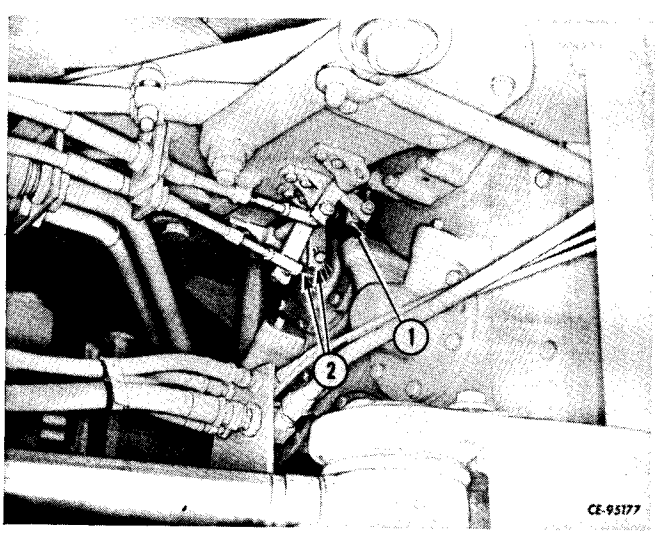

Figure 4-12

REMOVAL - Continued

Disconnect transmission to rear axle driveshaft (1, Fig. 4-13) from transmission. Disconnect sump hose (3) and strainer hose (2).

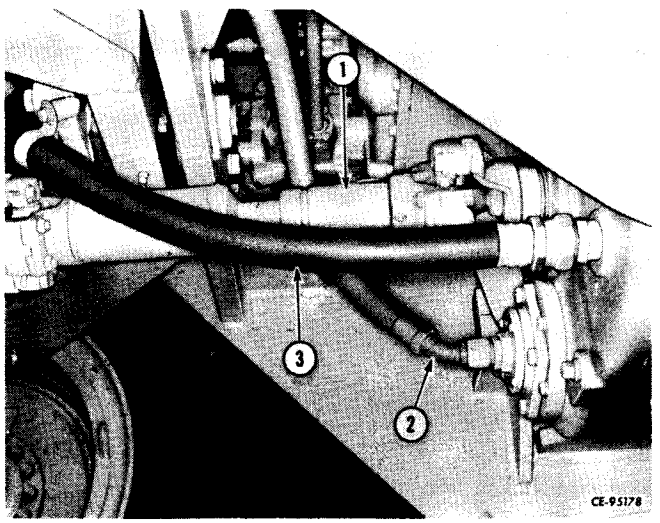

Figure 4-13

Remove the cap screws (1, Fig. 4-14) that secure the pin support caps (2) to the pin supports (3). Remove the caps.

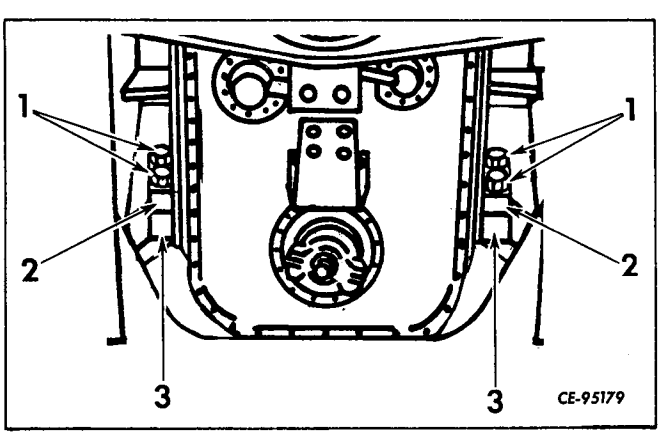

Figure 4-14

Disconnect the transmission to torque converter driveshaft (2, Fig. 4-15) from the transmission (1). Disconnect filter to transmission line (6) from transmission. Disconnect valve to torque converter line (3) and valve to cooler line (4) from transmission. Remove air line clamp (5) from transmission. Remove right hand hydraulic steering tube if necessary.

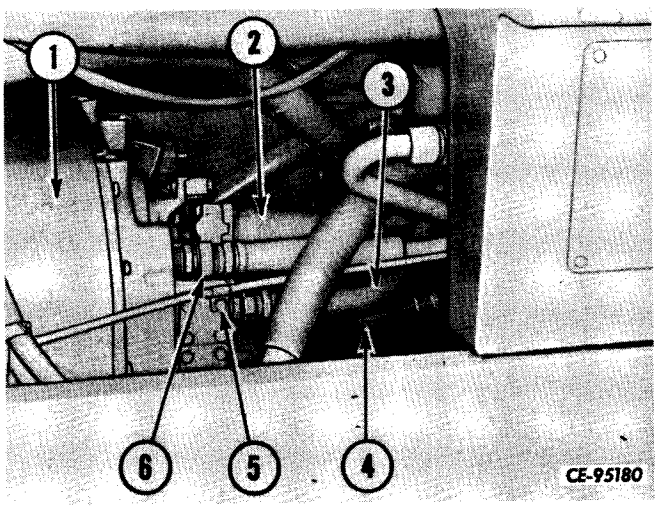

Figure 4-15

Remove cap screws and nuts (3, Fig. 4-16) that secure hose pad (2) to transmission supports (1). Disconnect line (6) from breather (5). Block transmission from underneath to prevent tipping. Remove cap screws (4) that secure supports to frame and transmission. Remove supports and install special lifting eyes (refer to "SPECIAL TOOLS") in holes on top of transmission.

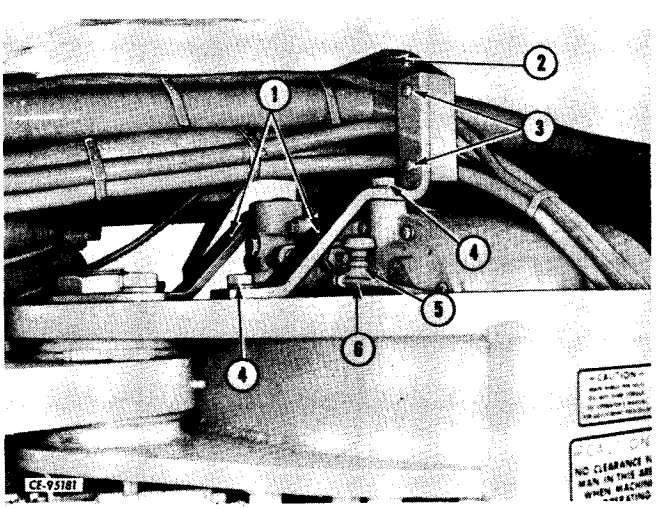

Figure 4-16

DISASSEMBLY, INSPECTION AND ASSEMBLY

Attach a long chain (1, Fig. 4-17) to the lifting eyes (2) and lower the transmission out of the tractor. It will be necessary to raise the transmission high enough to clear the pin supports (3, Fig. 4-14).

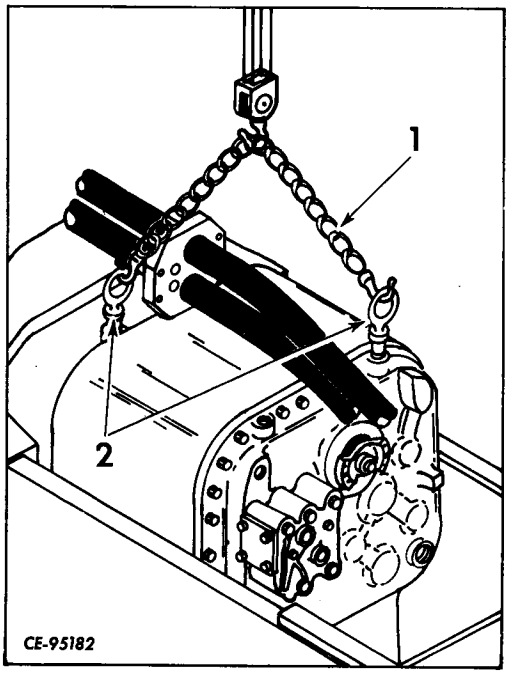

Figure 4-17

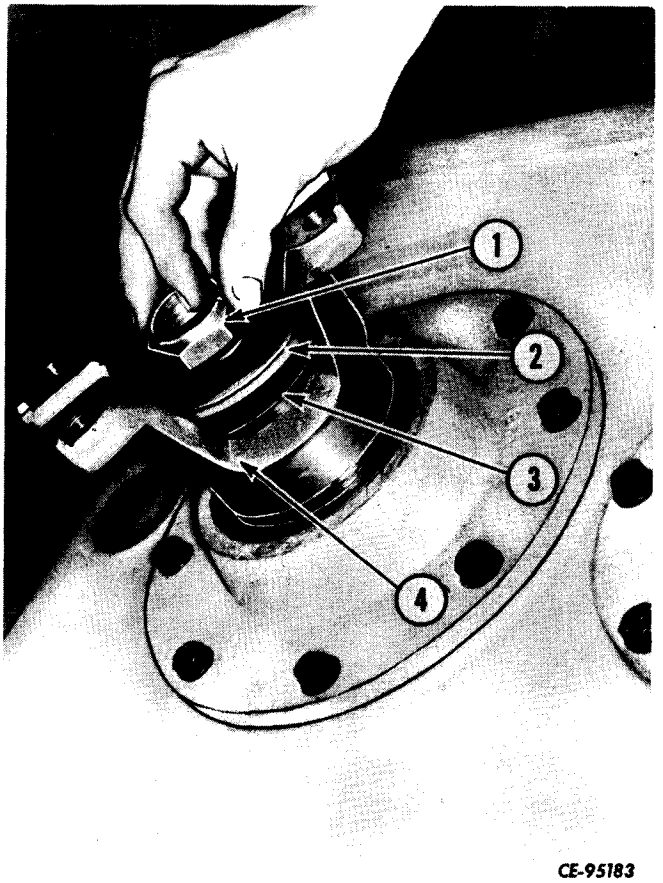

Figure 4-18

DISASSEMBLY

Clean the exterior of the transmission with steam. DO NOT USE CAUSTIC SODA.

Place transmission in stand, front cover up. Remove front output yoke retainer nut (1, Fig. 4-18), washer (2), gasket (3) and output yoke (4).

Remove output shaft retainer cap screws. Use two of the cap screws (2, Fig. 4-19) in the jack screw holes to remove retainer (1) with "O"-ring.

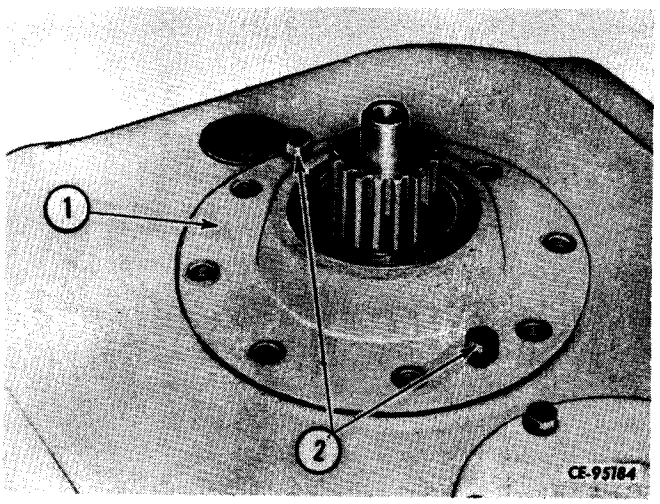

Figure 4-19

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

DISASSEMBLY - Continued

Remove oil supply covers (2, Fig. 4-20) by removing cap screws (4), washers (5) and threading two of the cap screws in jack screw holes provided (6) to force covers from housing. Discard gaskets (3) and "O"-rings (1).

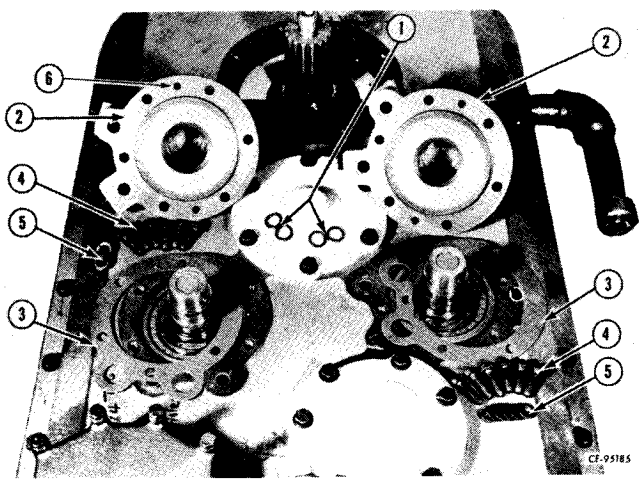

Figure 4-20

Remove lower counter shaft cover cap screws (3, Fig. 4-21), washers (4), cover (1) and gasket (2).

Remove main idler shaft cover cap screws (7), washers (8), cover (5) and gasket (6). Discard gaskets (2, 6).

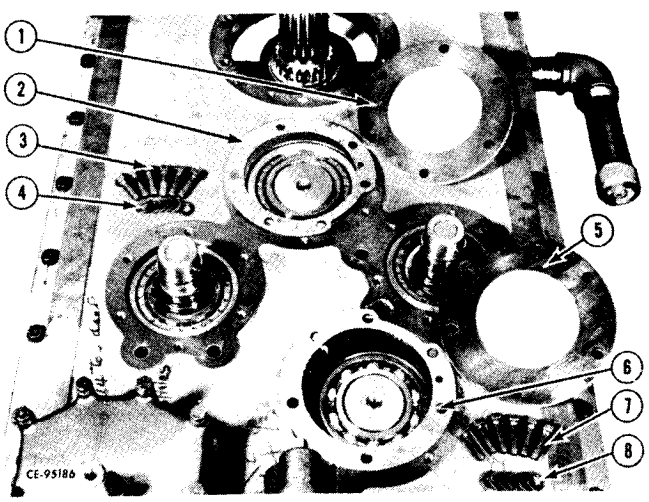

Figure 4-21

Remove directional selector valve cap screws (2, Fig. 4-22), washers (3), control valve (1) and gasket (4). For further disassembly of valve, see "DIRECTIONAL VALVE." Discard gasket.

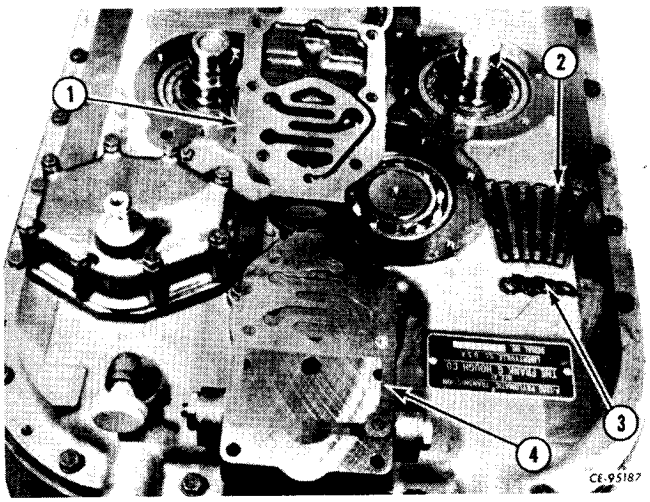

Figure 4-22

Remove neutral knockdown valve (1, Fig. 4-23) by removing remaining cap screws (3), washer (4) and gasket (2). For further disassembly of valve, see "NEUTRAL KNOCKDOWN VALVE." Discard gasket.

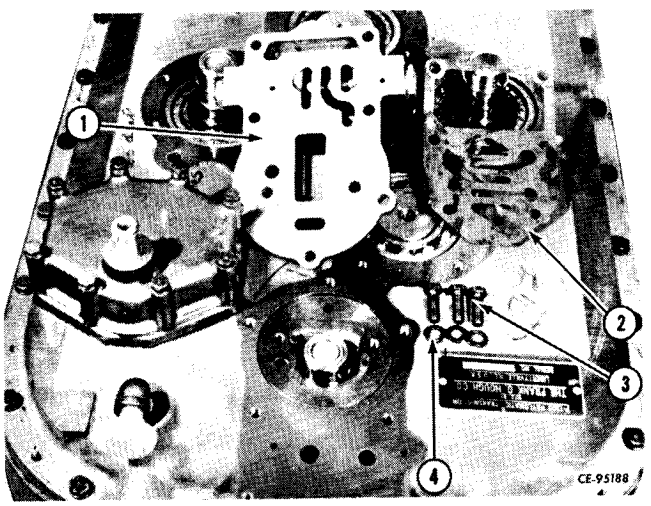

Figure 4-23

DISASSEMBLY, INSPECTION AND ASSEMBLY

Remove range selector valve cap screws (3, Fig. 4-24), washers (4), range selector valve (1) and gasket (2). Remove breather (5). For further disassembly, see "RANGE VALVE." Discard gasket.

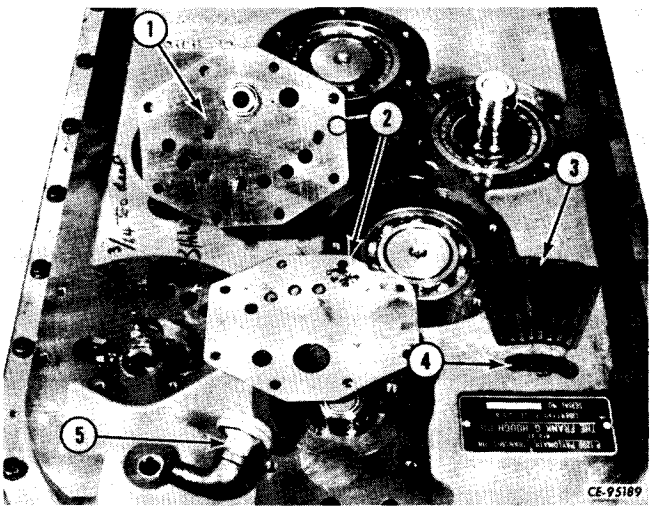

Figure 4-24

Remove cover attaching bolts and insert three of the bolts in jack screw holes provided to raise cover (1, Fig. 4-25) off dowels. Attach a chain to cover and remove cover and gasket (2). Discard gasket.

NOTE: Lift cover uniformly to avoid binding.

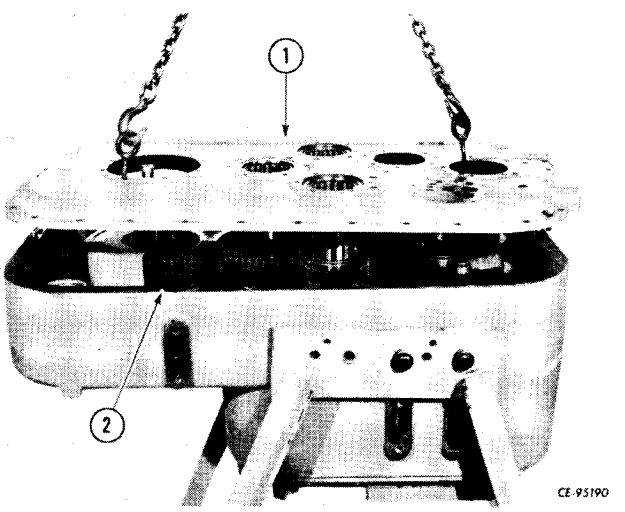

Figure 4-25

Remove oil transfer tubes (1, Fig. 4-26) by pulling straight up.

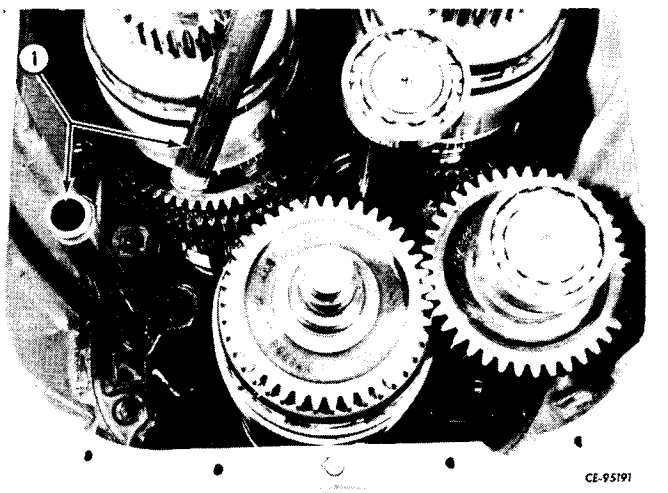

Figure 4-26

Attach lifting tool (1, Fig. 4-27) (refer to "SPECIAL TOOLS") to the forward and reverse clutch pack. Remove clutch pack while simultaneously lifting the reverse idler pack (2). For overhaul procedure refer to "CLUTCH PACKS."

CAUTION: Do not attempt to lift clutch packs by the oil supply ports as serious damage may result.

(Continued on next page)

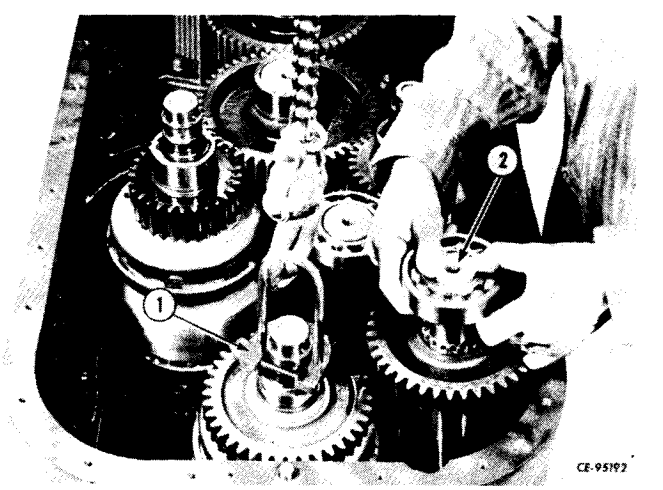

Figure 4-27

DISASSEMBLY - Continued

Remove lower counter shaft (1, Fig. 4-28) by grasping low speed transfer gear (2), lifting and cocking it slightly toward the bottom of the transmission.

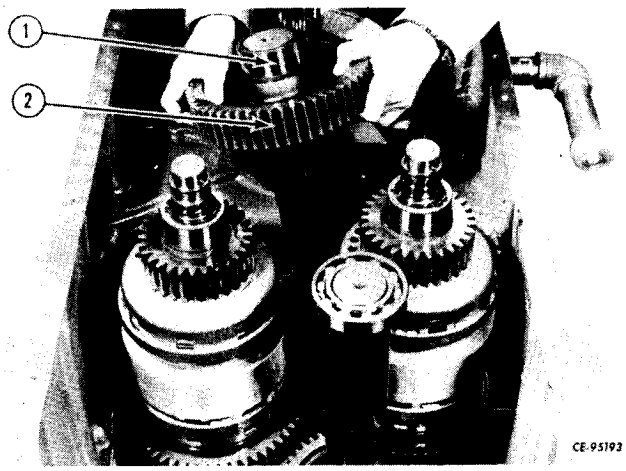

Figure 4-28

Attach special lifting tool (refer to "SPECIAL TOOLS") to the second and fourth clutch pack (1, Fig. 4-29) and remove pack from transmission (2). For overhaul procedure refer to "CLUTCH PACKS."

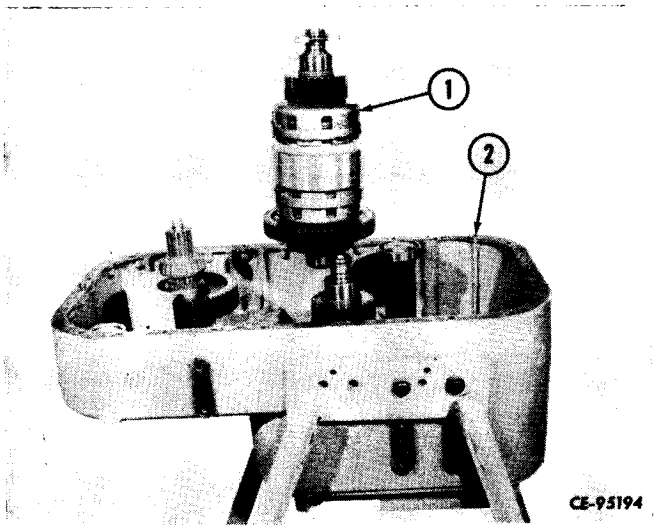

Figure 4-29

Attach special lifting tool (refer to "SPECIAL TOOLS") to first and third clutch pack (1, Fig. 4-30) and remove from transmission (2). For overhaul procedure refer to "CLUTCH PACKS."

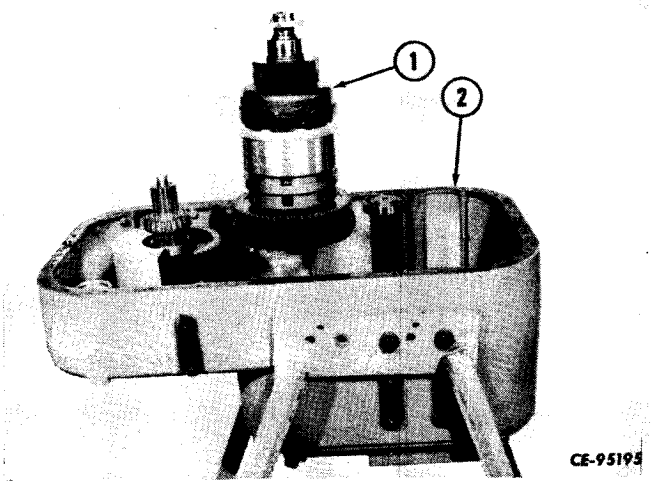

Figure 4-30

Remove main idler shaft (1, Fig. 4-31).

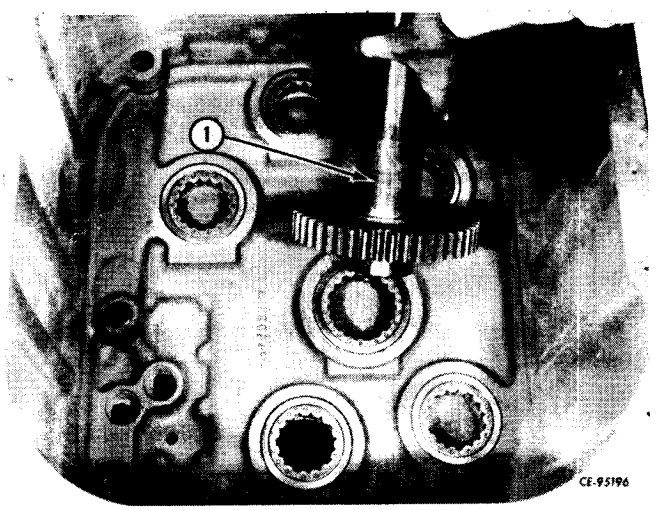

Figure 4-31

Position transmission vertically, output shaft end down. Remove the output shaft retainer nut (4, Fig. 4-32), washer (3), gasket (2) and yoke (5). Remove the shaft bearing retainer cap screws (1).

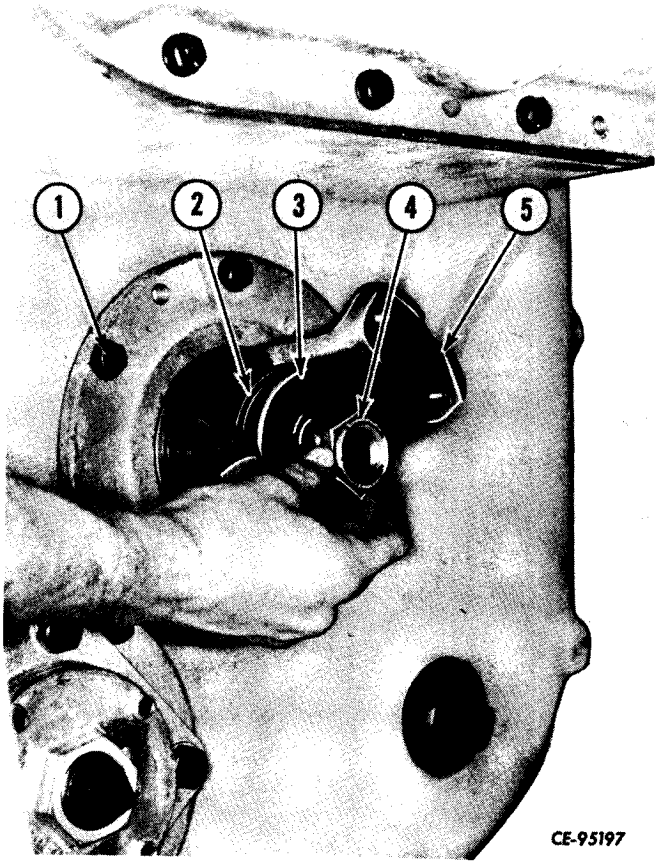

Figure 4-32

Install jack screws (2, Fig. 4-33) in the tapped holes provided in the bearing retainer (3). Tighten jack screws evenly until retainer is free. Tie the shim pack (1) to the retainer for use during assembly. Remove the output shaft (4).

Remove the cap screw (2, Fig. 4-34) that secure the baffle (1) to the transmission housing and remove the baffle.

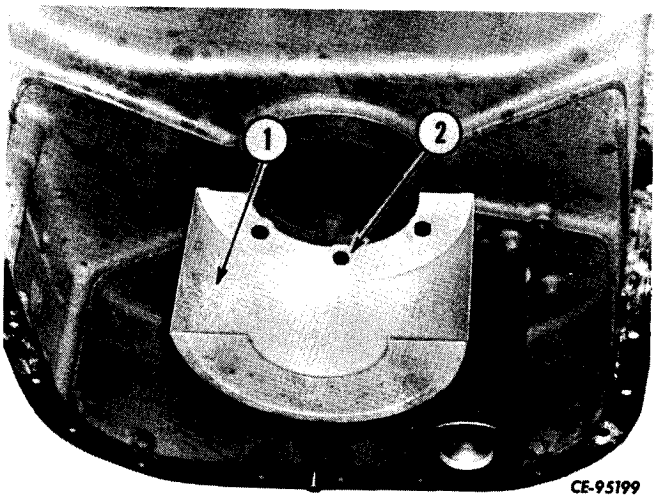

Figure 4-34

Remove the cap screws (1, Fig. 4-35) and washers that secure the strainer assembly (2) to the transmission housing. Remove the strainer and discard the gasket.

(Continued on next page)

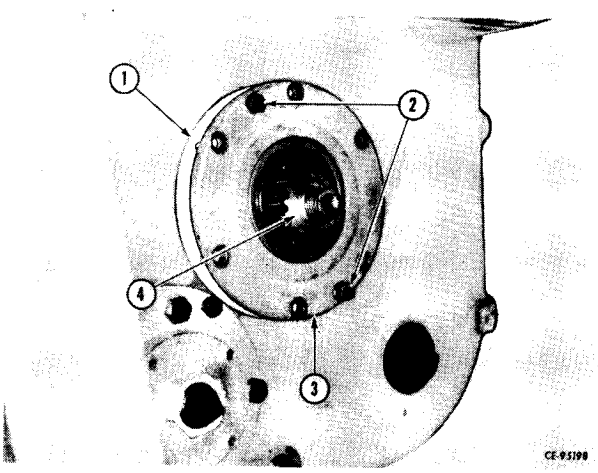

Figure 4-33

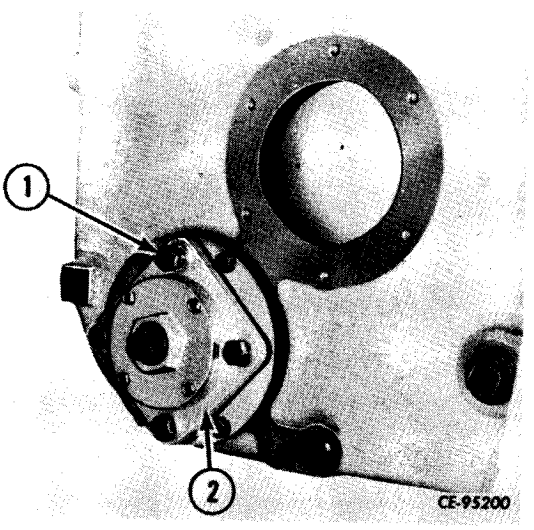

Figure 4-35

DISASSEMBLY - Continued

Remove cap screws (1, Fig. 4-36) and flange (3) from valve housing (4). Unscrew filter element (5) from valve housing. Check operation of valve. Discard "O"-ring (2).

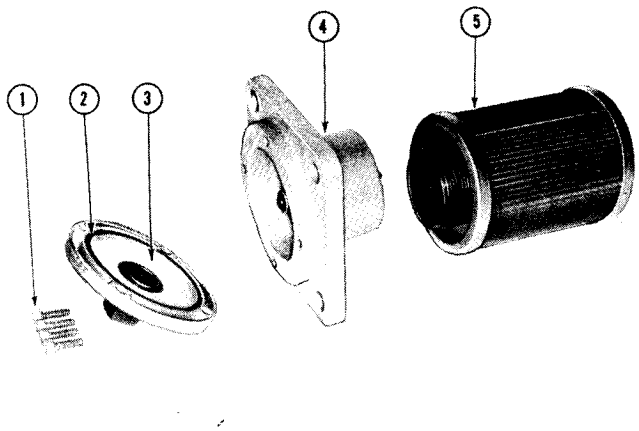

Figure 4-36

Remove and discard output shaft front seal (2, Fig. 4-37) from bearing retainer (3). After inspection, bearing cup (1) may be removed if replacement is required.

NOTE: If replacement is required, bearing cup and cone must be replaced as a set.

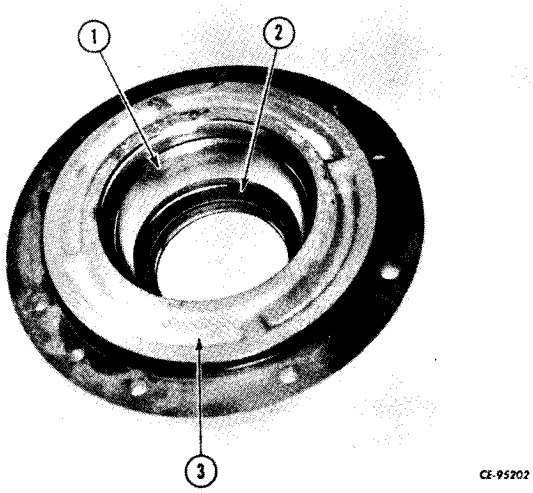

Figure 4-37

Remove and discard output shaft rear seal (2, Fig. 4-38) from bearing retainer (3). After inspection, bearing cup may be removed if replacement is required.

NOTE: If replacement is required, bearing cup and cone must be replaced as a set.

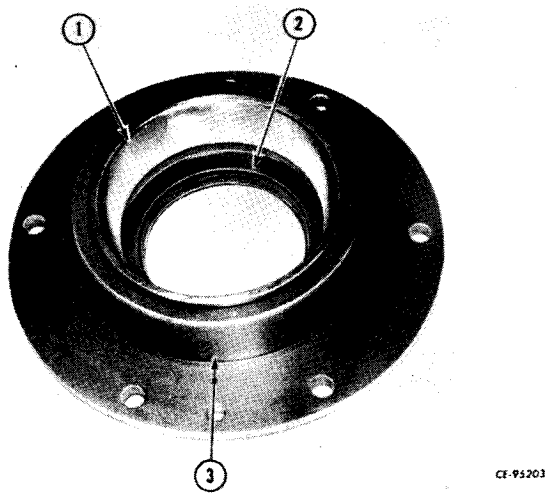

Figure 4-38

Rotate transmission until input yoke (1, Fig. 4-39) is on top. Remove the input yoke retaining nut (6), washer (7), gasket (8) and yoke (1). Remove the main regulator valve (2) and discard gasket (3). Remove rear cover retaining cap screws (4). Using jack screws in tapped holes (9) provided, remove the rear cover (5).

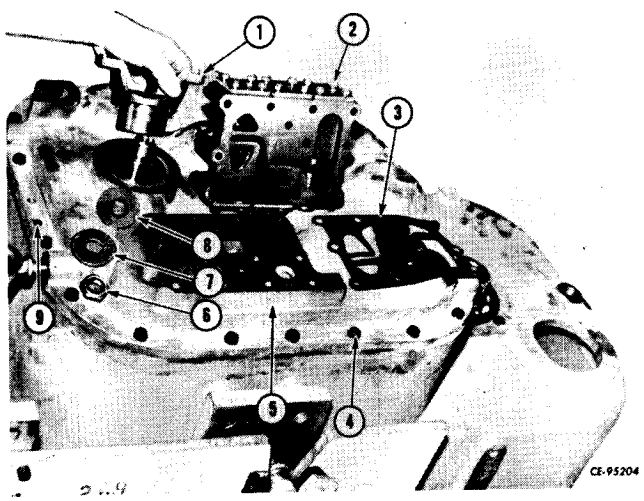

Figure 4-39

NOTE: Jack screws must be turned in evenly to avoid damaging cover.

Discard cover gasket.

If bearing (1, Fig. 4-40) on reverse idler shaft (5) is damaged or worn, remove it with a suitable puller. Remove snap ring (2) and reverse transfer driven gear (3). The inner snap ring (4) may be removed if replacement is required. With a suitable puller, remove the reverse transfer drive gear (6) and bearing inner race (7) together.

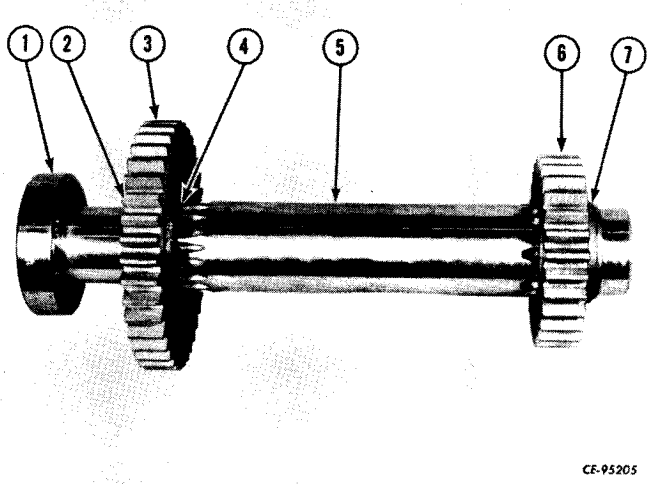

Figure 4-40

Using a suitable puller, remove the bearing inner race (1, Fig. 4-41) from the lower counter shaft (5). Remove snap ring (2) and high speed transfer gear (3). Remove the snap ring (4) if replacement is required. Use a suitable puller to remove the low speed transfer gear (6) and bearing inner race (7) together.

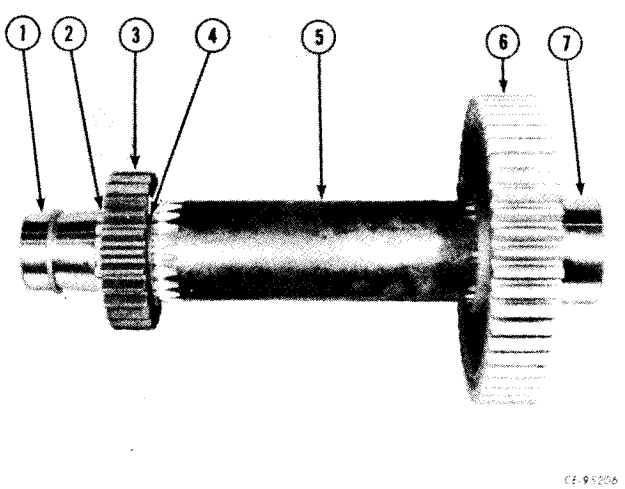

Figure 4-41

With a suitable puller, remove the main idler gear (2, Fig. 4-42) and bearing inner race (1) from the main idler shaft (3). Remove bearing (4) if replacement is required.

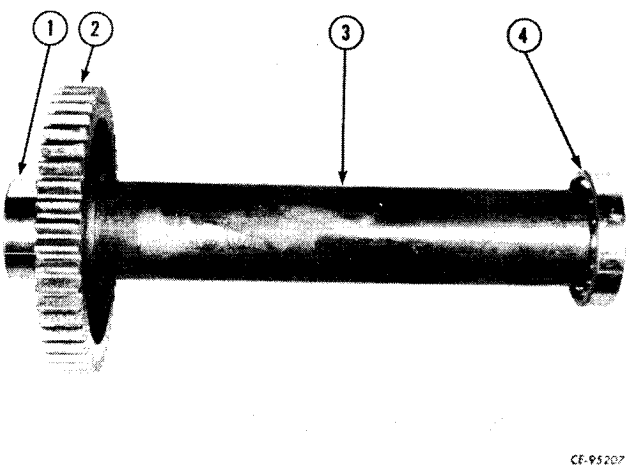

Figure 4-42

Using a puller, remove bearings (1, 3, Fig. 4-43) from output shaft (2). Remove snap ring (5) and gear (4).

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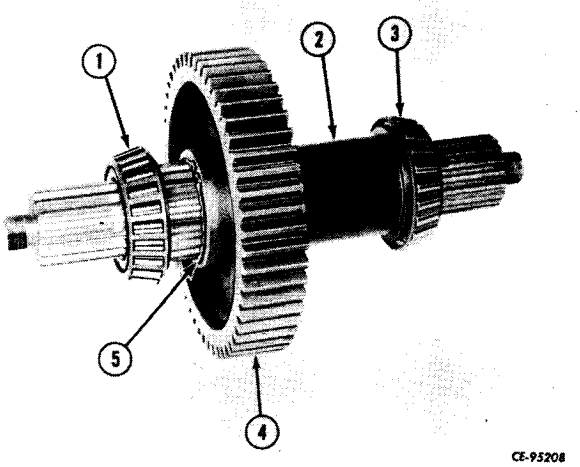


Figure 4-43

DISASSEMBLY - Continued

Remove bearings (1, Fig. 4-44) and spacers (4) with an acceptable puller that will exert its pressure on the outer bearing race only.

NOTE: These cover bearings and spacers need not be removed unless replacement is deemed necessary.

If cover (2) is to be replaced and bearings reused, tie bearing and spacer sets together and identify them with a tag. Reused bearings must be matched with their original shafts during assembly.

Remove input shaft seal (3) from cover (2) bore. Discard seal.

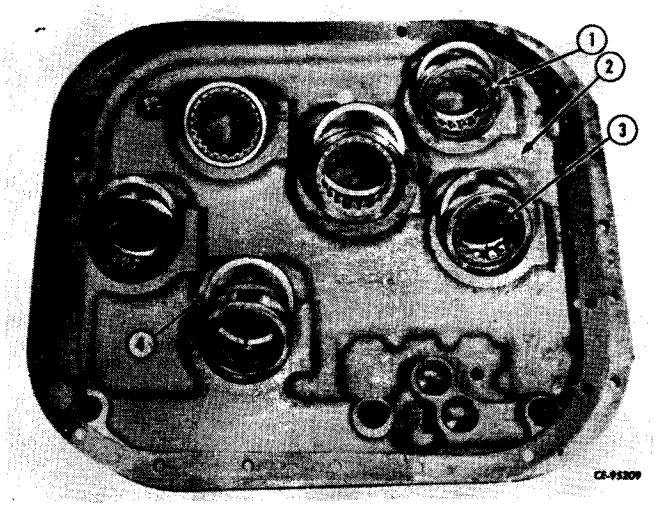


Figure 4-44

Remove bearings (4, Fig. 4-45) from open bearing bores in front cover (3) with a suitable drift or hardwood block if replacement is required.

Before the removal of the bearing (2) and retainer (5) assembly, the position of the retainer in the cover must be indicated with punch or chisel marks. This precaution is to keep the oil passages in the retainer in proper alignment with cover bores. After removing retainer, remove the bearing with a suitable puller. Puller must exert pressure on outer bearing race only.

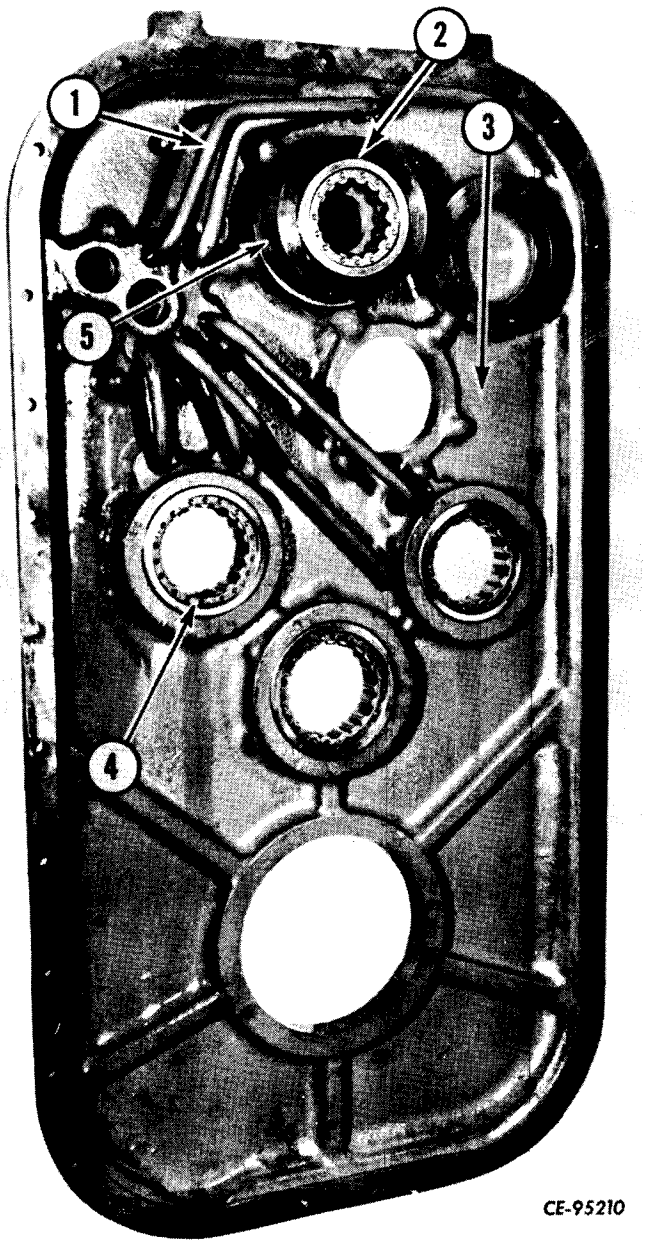


Figure 4-45

Care must be taken not to damage oil supply tubes (1). Tubes are serviced with the cover (3) as an assembly only.

CLEANING AND INSPECTION

Cleaning and inspection of the transmission in preparation for assembly should include the following:

a. Cleaning all parts thoroughly in solvent or plain steam. (Do not use caustic soda.)

DISASSEMBLY, INSPECTION AND ASSEMBLY

Use compressed air to dry parts. If steam is used to clean parts, oil immediately thereafter. Carefully inspect all parts for excessive wear, cracks and for breakage.

b. Inspecting all bearings for pits and spalled areas. Replace all damaged parts.

c. Replacing all seals, hook type seal rings, gaskets, "O"-rings and snap rings.

d. Inspecting all sealing surfaces for wear and for grooving.

e. Inspecting housing for dirt particles, and flushing all passageways thoroughly.

f. Inspecting splines on all shafts and drive gears for wear.

g. Provisions should be made for heating bearing in either oil or on oven.

h. Clean and flush oil supply tubes.

NOTE: Special Torque, Pressure, etc. recommendations are listed under "Service Information." This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil, and revised when necessary.

ASSEMBLY

Coat the OD of a new output shaft seal (2, Fig. 4-46) with "Mar-Seal" or equivalent sealant and press seal into output shaft front bearing retainer (3). Large, spring reinforced lip of seal should face in toward bearing cup (1). Press seal flush with outer edge of retainer.

If bearing cup was removed, press in a new cup. Cup must bottom on shoulder in retainer bore about its entire circumference.

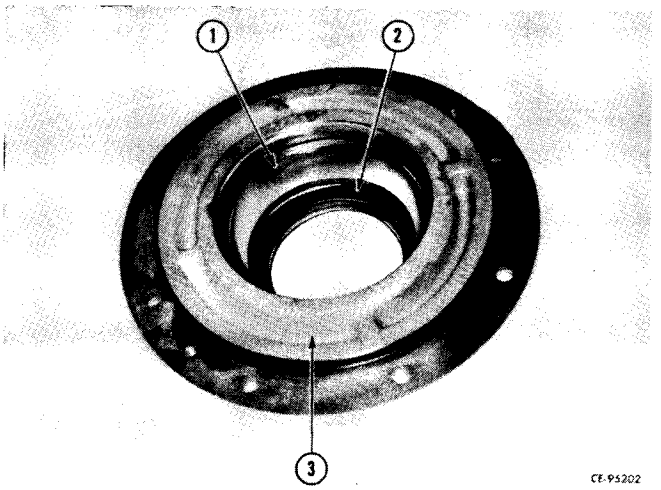


Figure 4-46

Coat the OD of a new output shaft seal (2, Fig. 4-47) with "Mar-Seal" or equivalent sealant and press seal into output shaft rear bearing retainer (3). Large, spring reinforced lip of seal must face in toward bearing cup (1).

If bearing cup was removed, press in a new cup. Cup must bottom on shoulder in retainer bore about its entire circumference.

(Continued on next page)

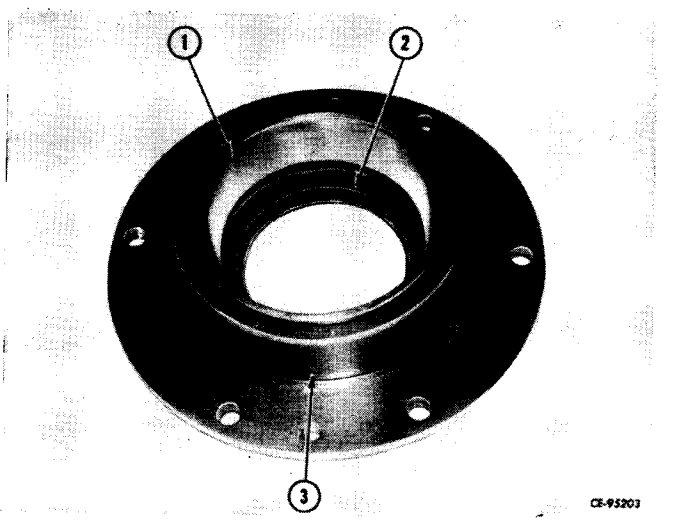


Figure 4-47

DISASSEMBLY, INSPECTION AND ASSEMBLY

ASSEMBLY - Continued

Install bearings (4, Fig. 4-48) in large cover using a proper bearing driver or a hardwood block. Driving pressure must be exerted on outer bearing race only.

Press input shaft bearing (2) into retainer (5) until it bottoms about its entire circumference on shoulder in retainer bore.

Install retainer in cover (3) bore, aligning identification marks made during disassembly.

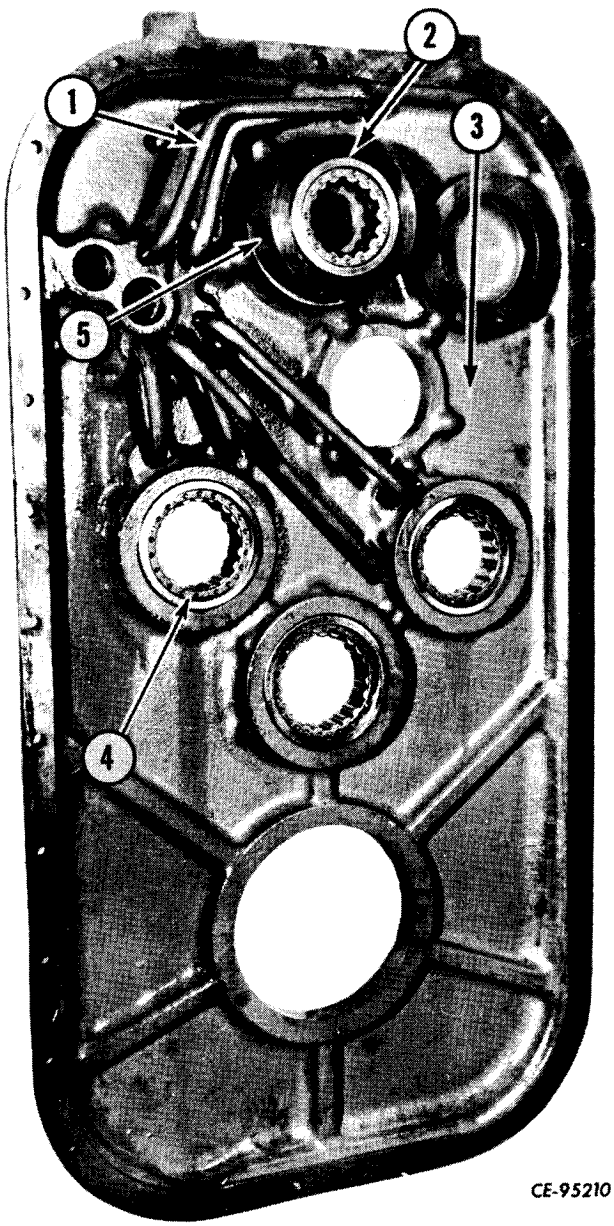


Figure 4-48

Be sure oil supply tubes (1) are not damaged during these operations.

Install spacers (4, Fig. 4-49) in their proper bearing bores in small cover (2). Install bearings (1) using a wooden block or mallet.

NOTE: Drive on bearing outer races only.

Be certain bearings are properly seated at bottom of bores. Coat the OD of a new input shaft seal with "Mar-Seal" or equivalent sealant. Press seal in cover bore with spring reinforced lip of seal facing bearing (3).

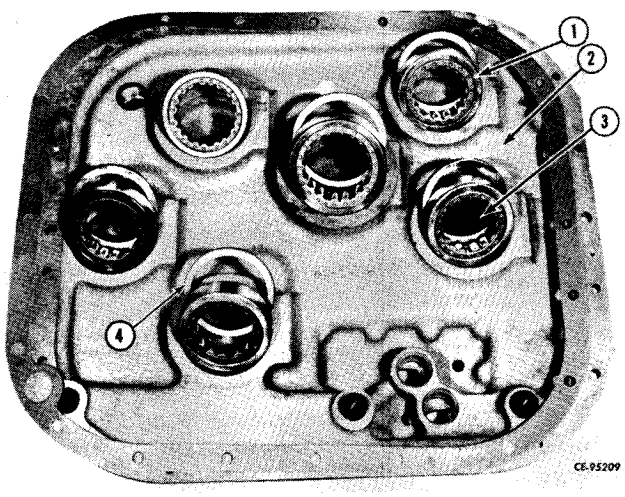


Figure 4-49

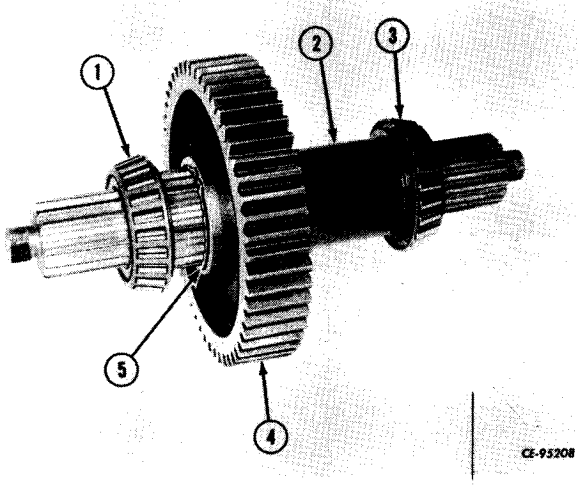


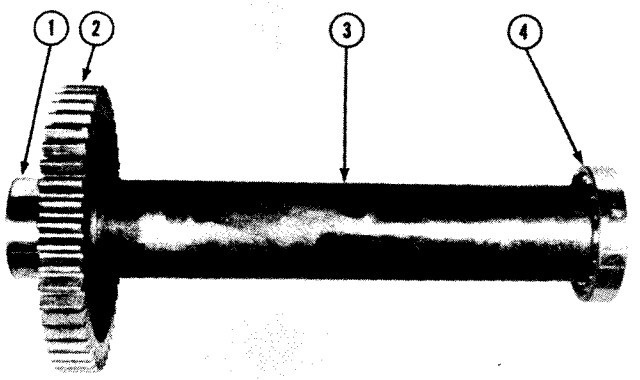
Figure 4-50

DISASSEMBLY, INSPECTION AND ASSEMBLY

Press bearing (3, Fig. 4-50) on output shaft (2). Install gear (4) on shaft and secure with snap ring (5). Press on the remaining bearing.

Place main idler gear (2, Fig. 4-51) in press and press shaft (3) into gear. Turn shaft over and press on bearing (4). Heat bearing inner race (1) in oil or an oven to 250°F. and install, with shoulder toward gear, on main idler shaft. Be sure bearing race bottoms against idler gear.

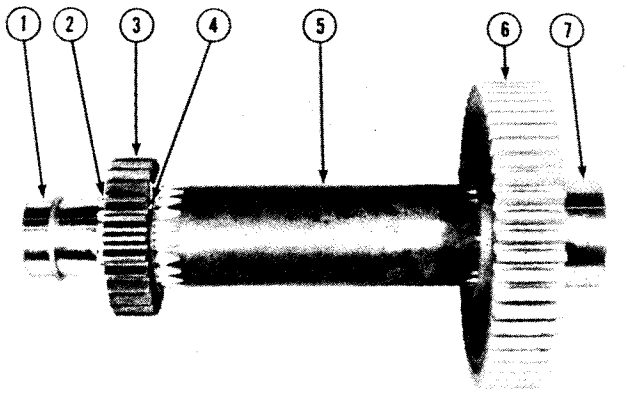
NOTE: Coat shaft with "Molykote" or comparable lubricant prior to pressing on gear.



CE-95207

Figure 4-51

Install snap ring (4, Fig. 4-52), high speed transfer gear (3) and snap ring (2) on lower counter shaft (5). Heat bearing inner race (1) in oil or an oven to 250°F. and install on shaft with shoulder toward gear (3). Install low speed transfer gear (6) on opposite end of shaft. Heat bearing inner race in oil or an oven to 250°F. and install on shaft with shoulder of race toward gear (6). Be sure both races (1, 7) are bottomed on shaft.



CE-95206

Figure 4-52

Install snap ring (4, Fig. 4-53) on reverse idler shaft (5). Install reverse transfer driven gear (3), snap ring (2) and bearing (1). Install reverse transfer drive gear (6) and bearing inner race (7). Heat the bearing in oil or an oven to 250°F. and install on shaft with shoulder toward gear (6). Be certain bearing inner race is bottomed on shaft.

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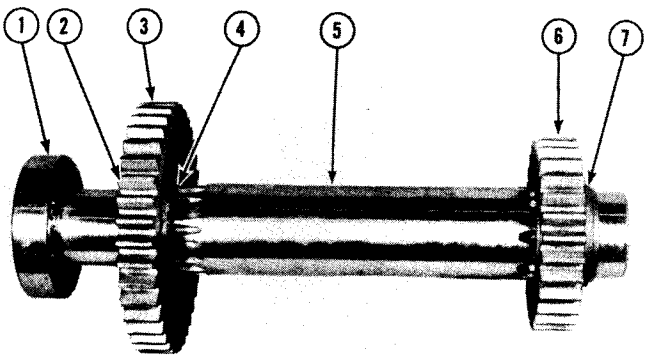

CE-95205

Figure 4-53

DISASSEMBLY, INSPECTION AND ASSEMBLY

ASSEMBLY - Continued

Screw a new strainer element (5, Fig. 4-54) into valve assembly (4). Position a new "O"-ring (2) in flange (3) and attach flange to valve assembly with cap screws (1) and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

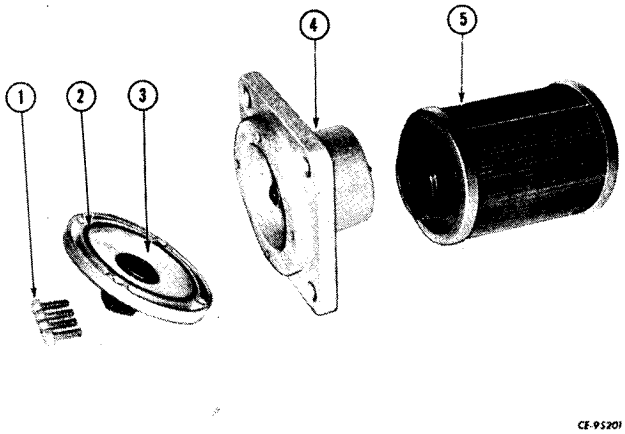

Figure 4-54

Using a new gasket, install the strainer assembly (2, Fig. 4-55) on the transmission housing and secure with cap screws (1) and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

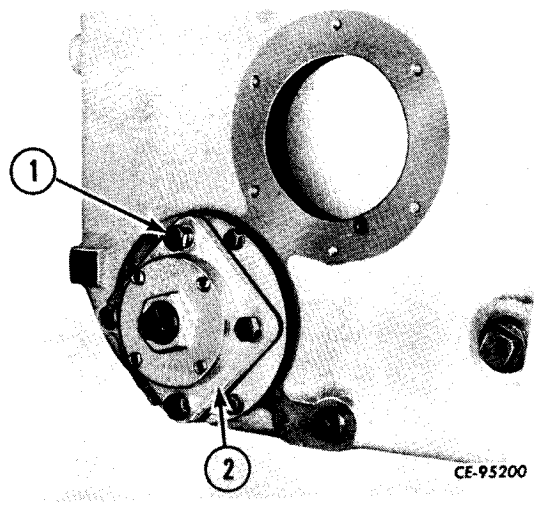

Figure 4-55

Install small cover (1, Fig. 4-56) using new gasket. Secure with cap screws. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

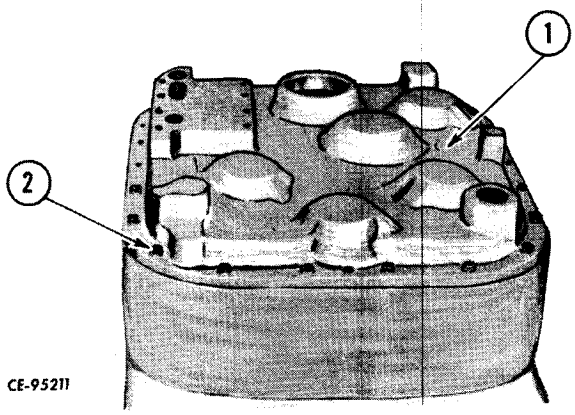

Figure 4-56

Rotate transmission until output shaft bore is at bottom. Install oil baffle (1, Fig. 4-57). Tighten

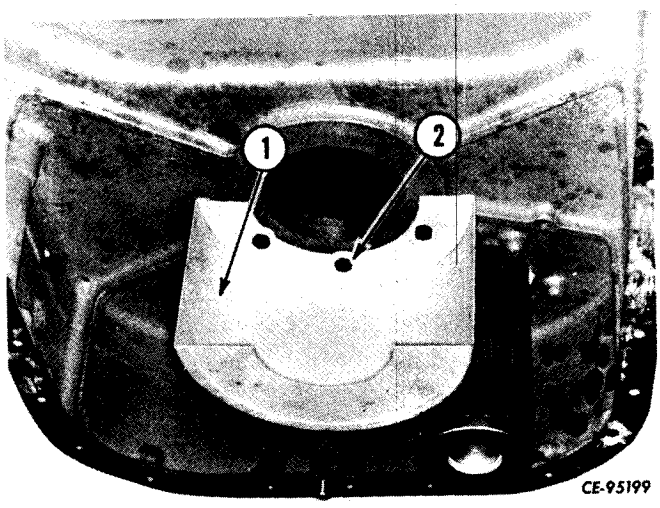

Figure 4-57

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cap screws (2) to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Install assembled output shaft (1, Fig. 4-58) in its bore in housing (2).

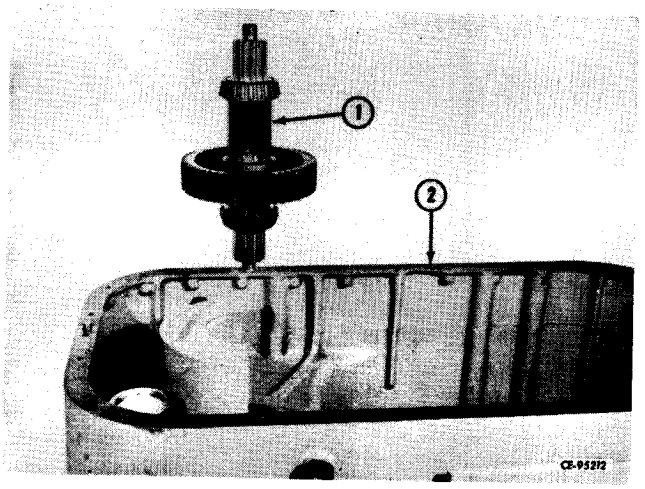

Figure 4-58

Install output shaft retainer (2, Fig. 4-59) and secure with a pair of cap screws, 180° apart. Snug up cap screws just enough to hold retainer in place.

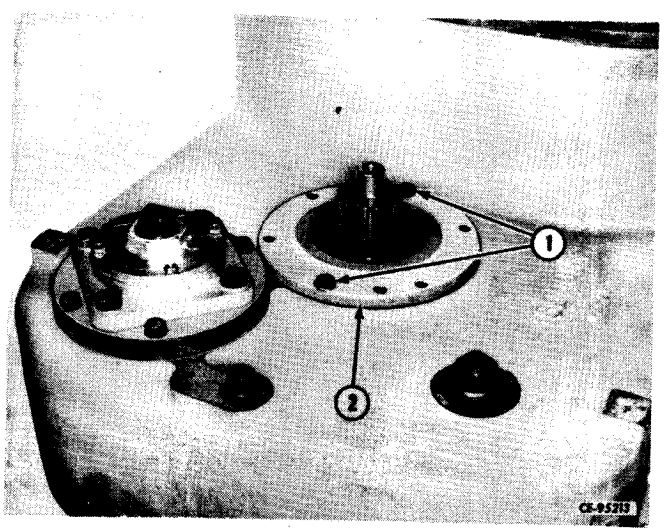

Figure 4-59

Install main idler shaft (1, Fig. 4-60).

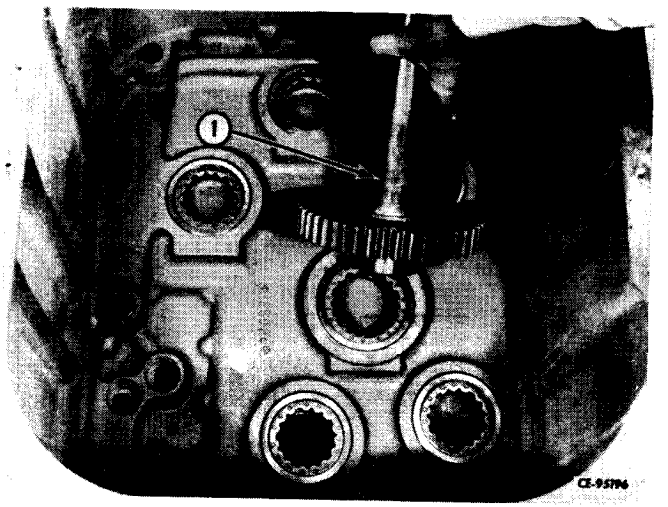

Figure 4-60

Attach lifting tool (refer to "SPECIAL TOOLS") to first and third clutch pack (1, Fig. 4-61) (pack with large double gears on one end) and lower assembly into housing (2).

NOTE: Do not attempt to lift any of the clutch packs by the oil supply ports.

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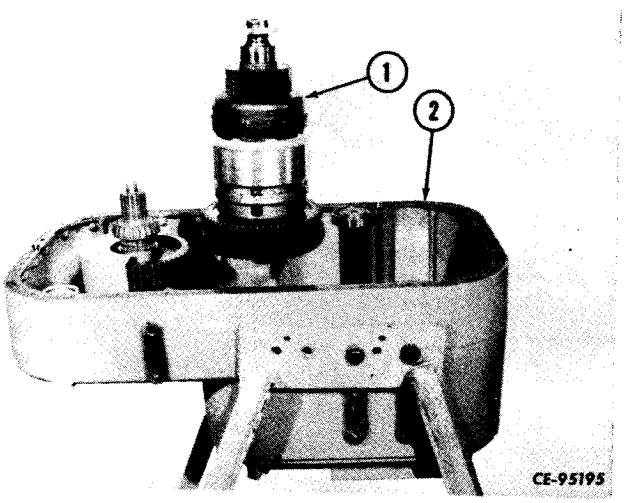

Figure 4-61

TRANSMISSION

DISASSEMBLY, INSPECTION AND ASSEMBLY

ASSEMBLY - Continued

Attach lifting tool to second and fourth range clutch pack (1, Fig. 4-62) (pack with one large and one small gear on input end). Lower clutch pack into transmission housing (2).

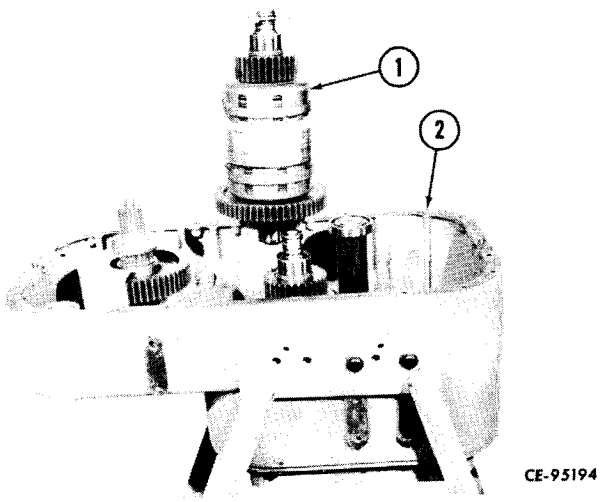

Figure 4-62

Install lower counter shaft (1, Fig. 4-63) by turning the shaft slightly to align teeth on gears and cocking low speed transfer gear (2) toward bottom of housing.

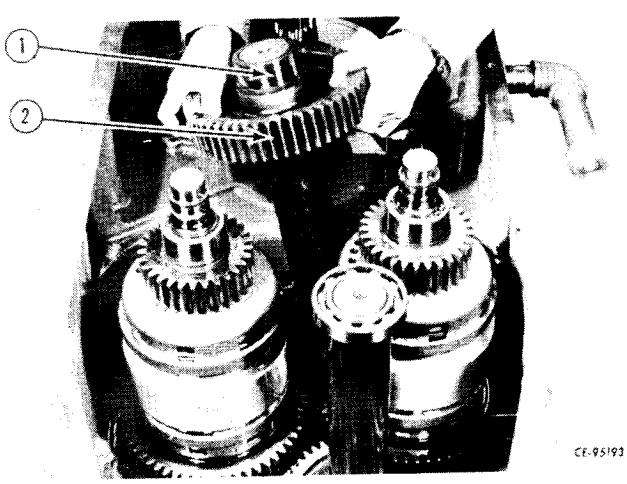

Figure 4-63

Attach lifting tool to forward and reverse clutch pack (1, Fig. 4-64). Lower clutch pack into housing while installing the reverse idler shaft (2) at the same time.

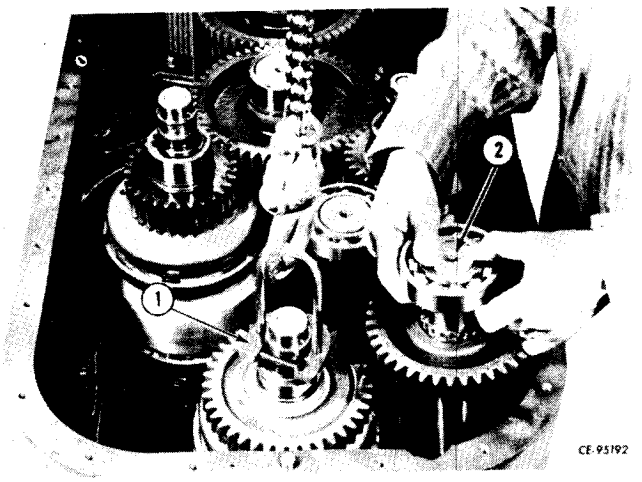

Figure 4-64

Install new "O"-rings (2, Fig. 4-65) on both ends of each oil transfer tube (1). Coat the "O"-rings with grease and install tubes in their housing bores.

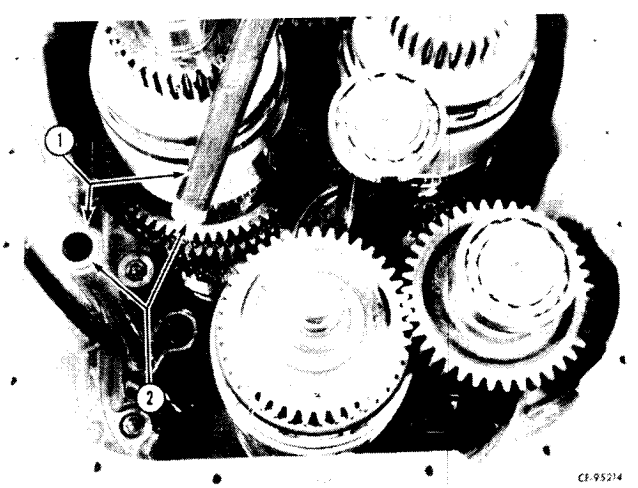

Figure 4-65

Before installing the cover, the following should be checked:

1. Be sure forward and reverse oil supply seal ring has been properly installed and are coated with grease.

2. Be sure all gears are properly in mesh.

3. All bearings are properly seated.

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DISASSEMBLY, INSPECTION AND ASSEMBLY

4. Housing and passage ways have been thoroughly cleaned.

5. Be sure oil transfer tube "O"-rings are well greased.

Place new gasket (2, Fig. 4-66) on transmission housing and use grease to hold in place. Support cover (1) on hoist as level as possible. Gently lower cover, aligning first and third and second and fourth clutch shafts with bearings in cover. Reach through the front side of cover with two screw drivers to align oil transfer tubes. Lower cover and align on dowels. Gently tap cover down, do not force cover by pulling it down with bolts. Install cap screws and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Position a new range selector valve gasket (5, Fig. 4-67) on transmission cover. Install new seal ring (6) on selector valve and coat with grease. Position valve on gasket, being careful not to break seal ring (6) during valve installation. Secure valve with cap screws (2) and lock washers (3). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Install breather (4) in the up position.

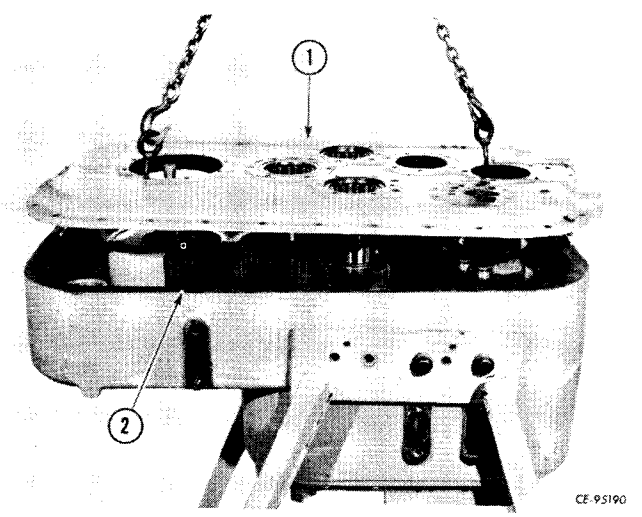

Figure 4-66

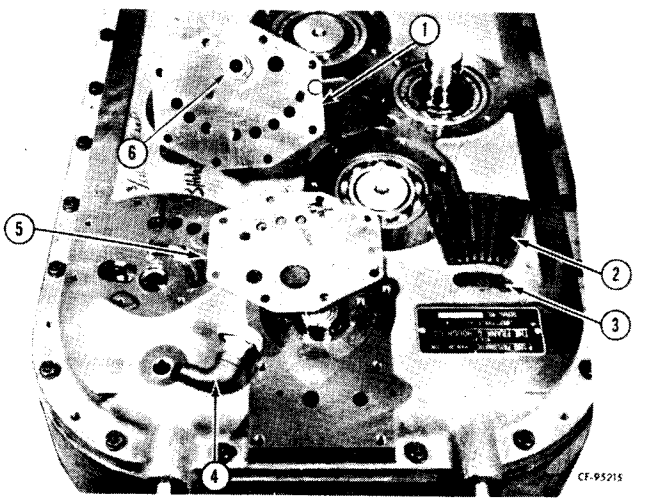

Figure 4-67

Using a new gasket (2, Fig. 4-68), install the neutral knockdown valve (1). Retain valve assembly with cap screws (3) and lock washers (4).

NOTE: Do not tighten cap screws until directional selector valve has been installed.

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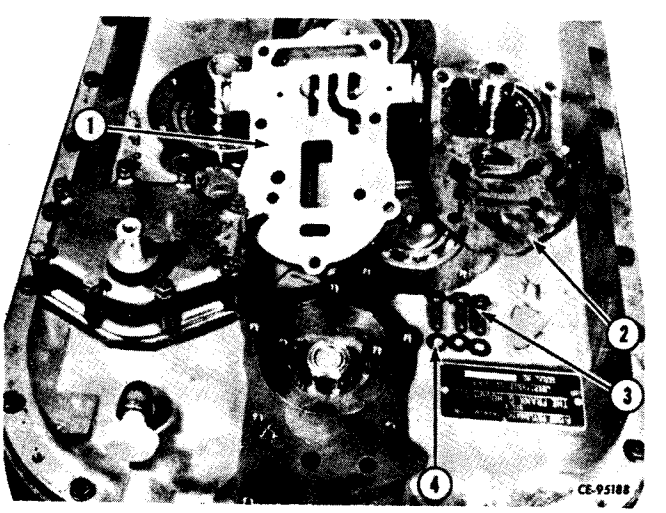


Figure 4-68

DISASSEMBLY, INSPECTION AND ASSEMBLY

ASSEMBLY - Continued

Position new directional selector valve gasket (4, Fig. 4-69) on neutral knockdown valve. Install valve (1) and secure with cap screws (2) and lock washers (3). Tighten all cap screws (neutral knockdown valve included) to the recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

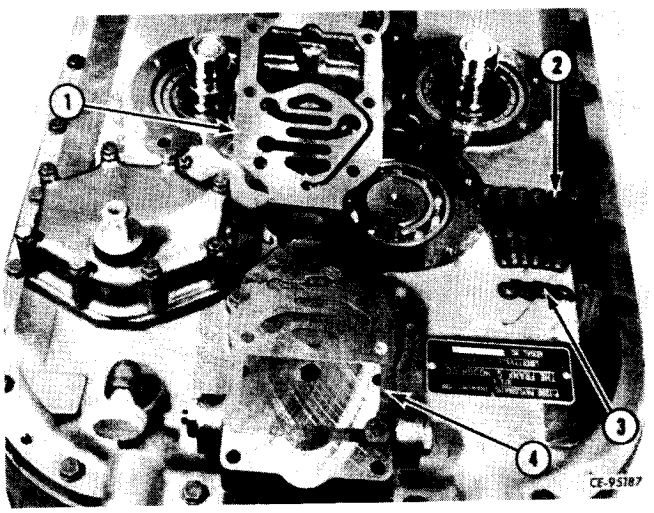


Figure 4-69

Install lower counter shaft cover (1, Fig. 4-70) with new gasket (2). Secure with cap screws (3) and lock washers (4). Install main idler shaft cover (5) with new gasket (6) and secure with cap screws (7) and lock washers (8). Tighten all cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

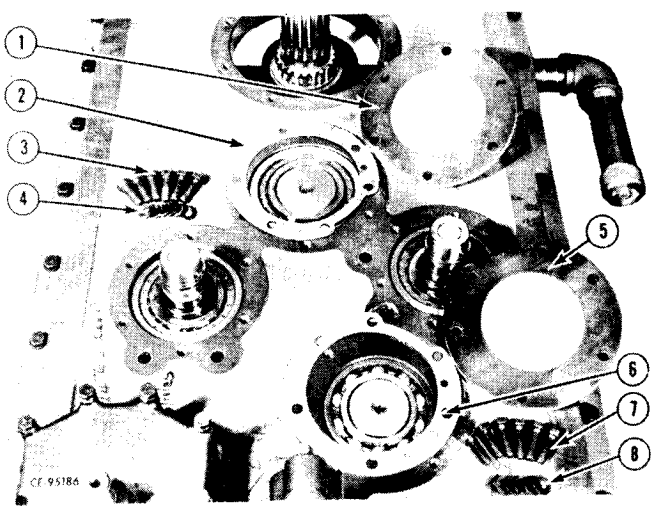


Figure 4-70

Install new gaskets (3, Fig. 4-71) and "O"-rings (1) beneath oil supply covers (2). Secure covers with cap screws (4) and lock washers (5). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

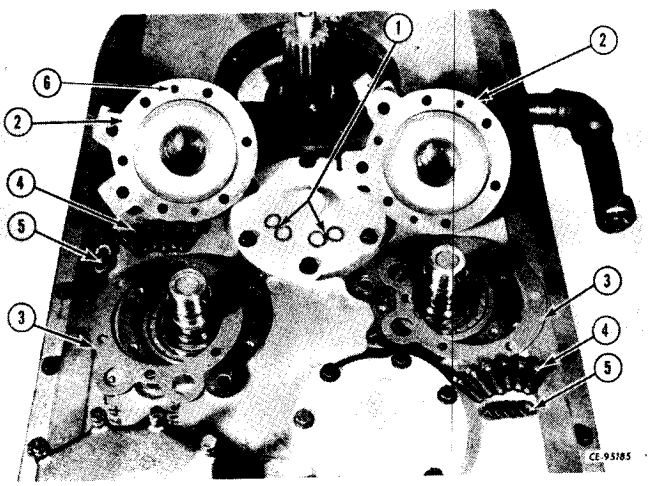


Figure 4-71

Install output shaft front bearing retainer (1, Fig. 4-72) with new "O"-ring on transmission.

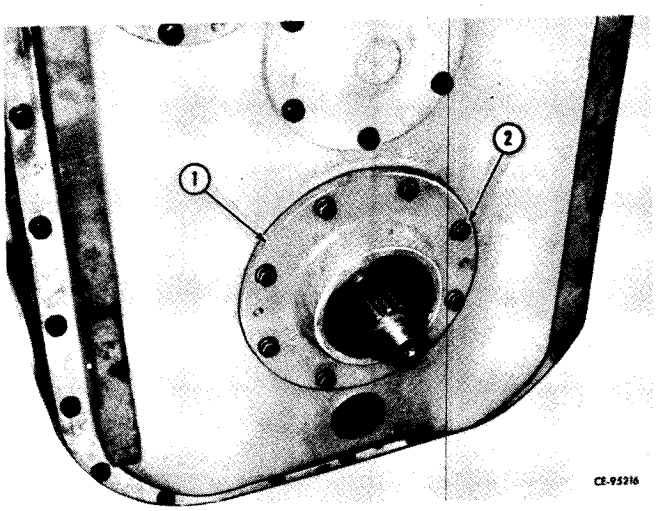


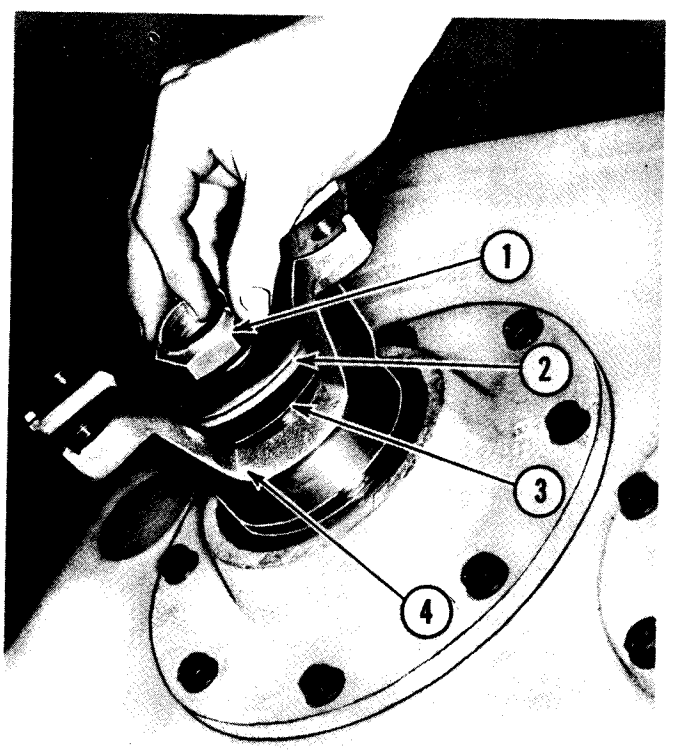
Figure 4-72

Secure with cap screws (2) and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Install front output yoke (4, Fig. 4-73), gasket (3) and washer (2). Secure with nut (1). Tighten nut to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____



CE-95183

Figure 4-73

Turn transmission over. Position a new main regulator valve gasket (3, Fig. 4-74) on mounting pad. Install valve and secure with cap screws. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

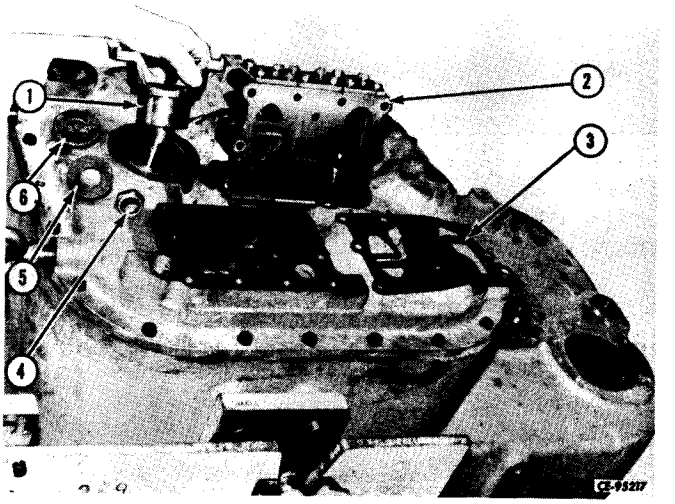


Figure 4-74

Grease machined surface (1) of input yoke and install yoke, rubber washer (5), steel washer (6) and nut (4). Tighten nut to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Loosen the two cap screws installed previously in the rear output shaft end cap. Torque the cap screws (Fig. 4-75) to the recommneded preliminary torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION") (Fig. 4-75).

Torque:_____

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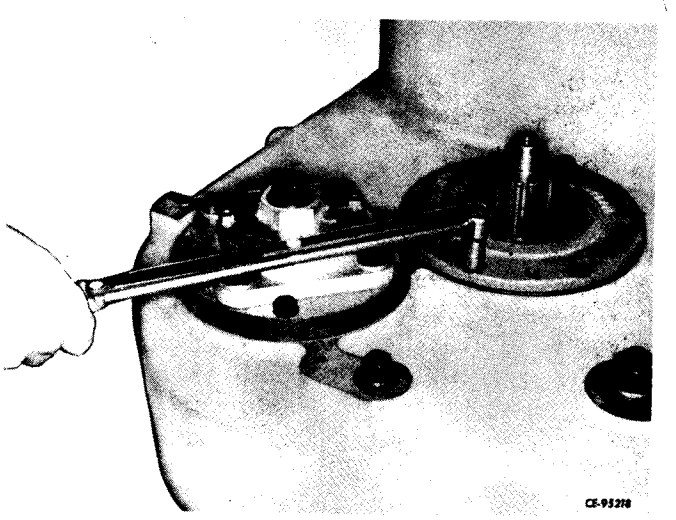

Figure 4-75

ASSEMBLY - Continued

Rotate the output shaft several times. Torque the two cap screws to the secondary torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

Rotate the output shaft several times to seat the bearings. Use a feeler gauge to measure the gap between the housing and the end cap at each cap screw (Fig. 4-76). If the readings are not the same, total the two readings and divide by 2. To this reading add .025". Make up a shim pack equal to this thickness. Install the shim pack between the end cap and the housing. Install the end cap and secure with cap screws and lock washers. Tighten the cap screws to the final torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

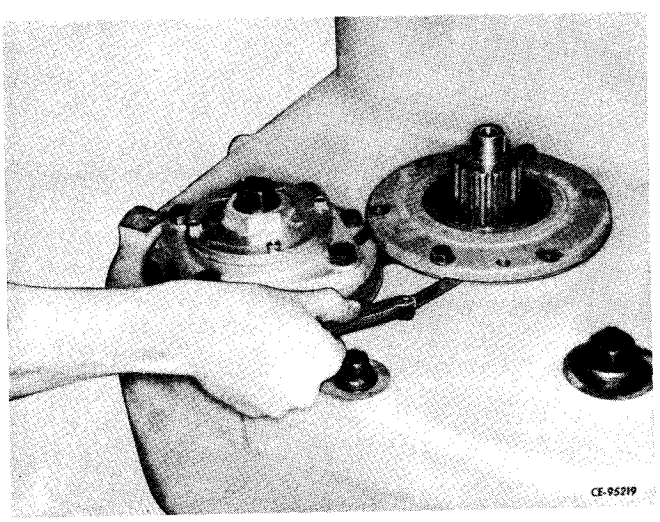

Figure 4-76

Install a dial indicator on the transmission as shown (Fig. 4-77). Place a jack under the opposite end of the output shaft (do not contact the shaft). Using a pry bar to exert pressure on the end of the shaft, note the reading on the dial indicator. This distance should be within that recommended (refer to "TOLERANCES" under "SERVICE INFORMATION").

Output shaft end play: _____

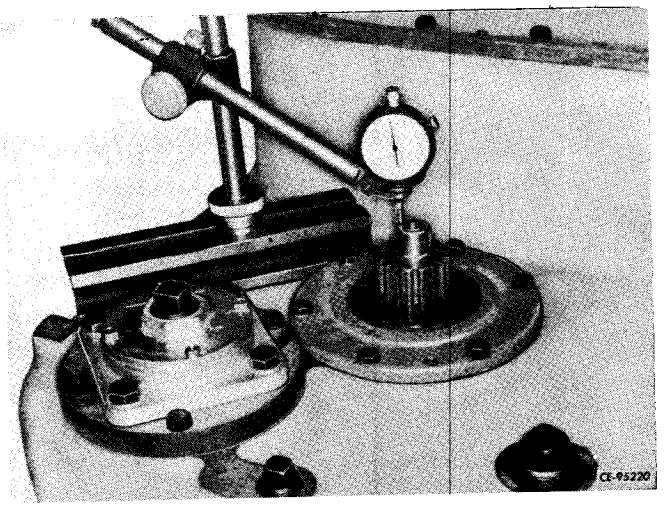

Figure 4-77

If reading is not within recommended limitations, the shim pack should be corrected.

Install rear output yoke (5, Fig. 4-78) gasket (2) and washer (3). Secure with new nut (4). Tighten

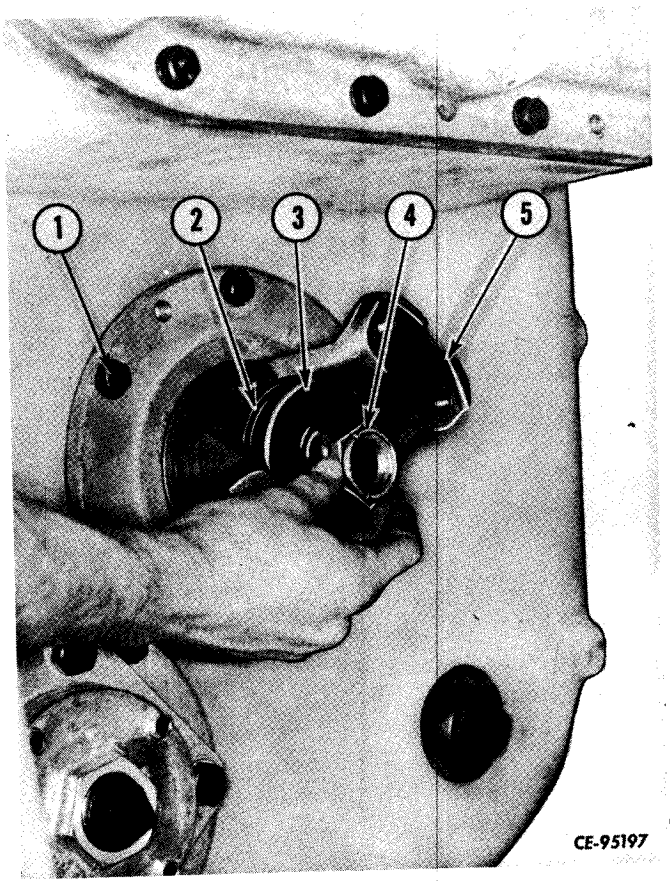

Figure 4-78

nut to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

INSTALLATION

Attach a chain (1, Fig. 4-79) to the lifting eyes (2) lift transmission into tractor and position it on the pin supports (3, Fig. 4-82). Block transmission from underneath and remove chain and lifting eyes.

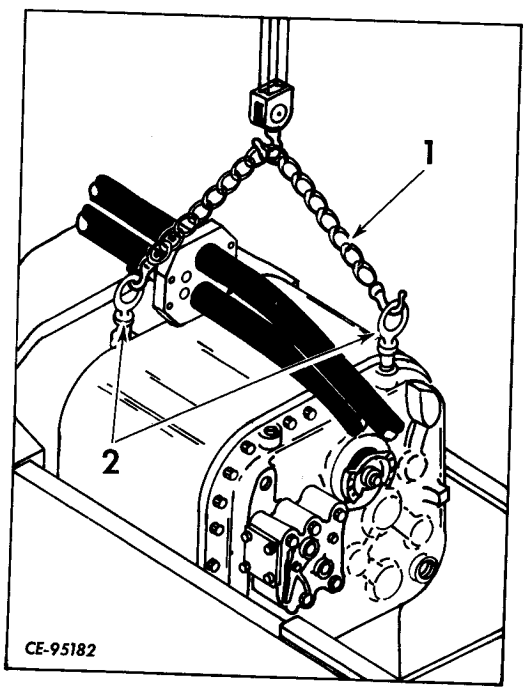

Figure 4-79

Install supports (1, Fig. 4-80) and secure with cap screws (4) and lock washers. Position hose pad (2) and secure with cap screws (3) and nuts. Connect line (6) to breather (5).

Torque: _____

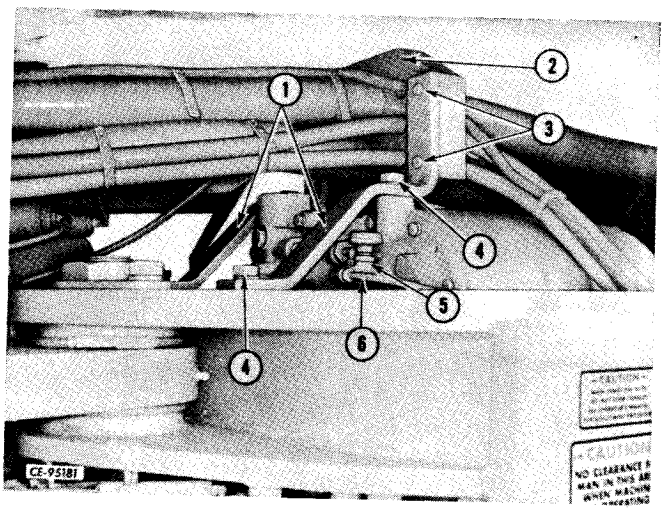

Figure 4-80

Connect the transmission-to-torque converter drive shaft (2, Fig. 4-81) to the transmission (1). Connect valve to torque converter line (3), filter to transmission line (6) and valve-to-cooler line (4) to transmission. Secure air line clamp (5) to transmission.

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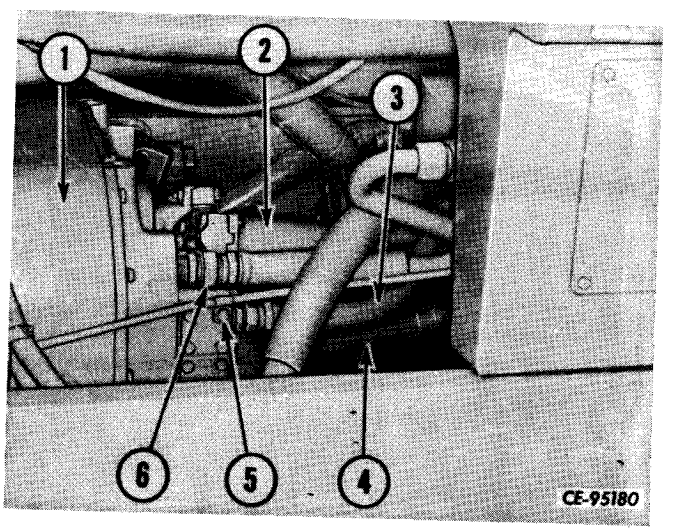

Figure 4-81

INSTALLATION - Continued

Install caps (2, Fig. 4-82) on pin supports (3). Secure with cap screws (1). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

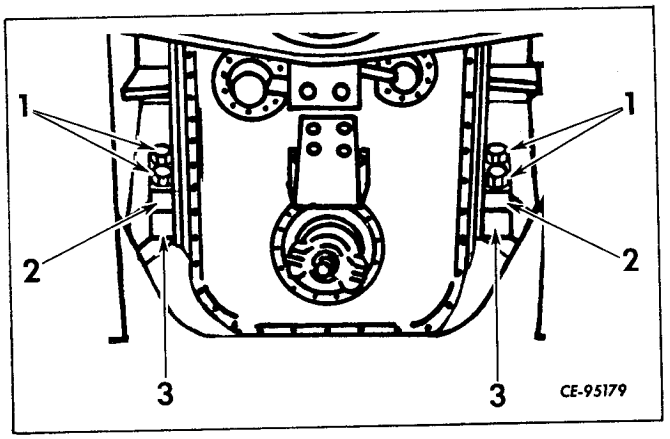

Figure 4-82

Connect transmission to rear axle drive shaft (1, Fig. 4-83) to transmission. Connect sump hose (3) and strainer hose (2).

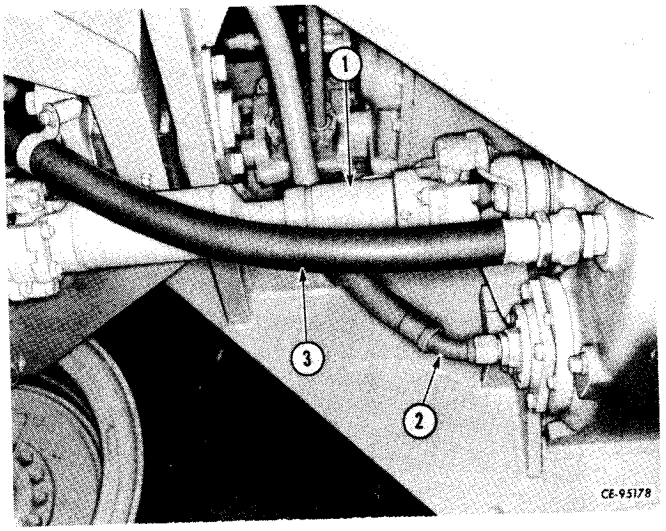

Figure 4-83

Connect rod (1, Fig. 4-84) to range valve and bars (2) to directional valve.

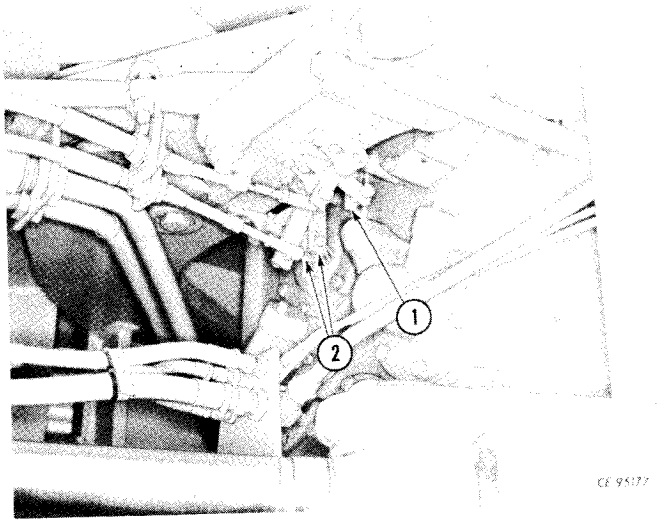

Figure 4-84

Connect transmission-to-parking brake drive shaft (3, Fig. 4-85) to transmission (5). Install hose support (2) and secure with cap screws (4). Connect line (1) to transmission.

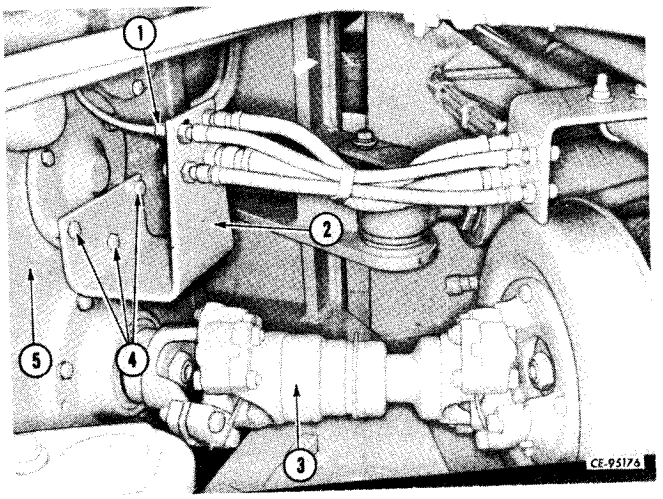

Figure 4-85

Using a sling and hoist, install operator's compartment (2, Fig. 4-86). Secure with cap screws (3) and nuts to front frame (1).

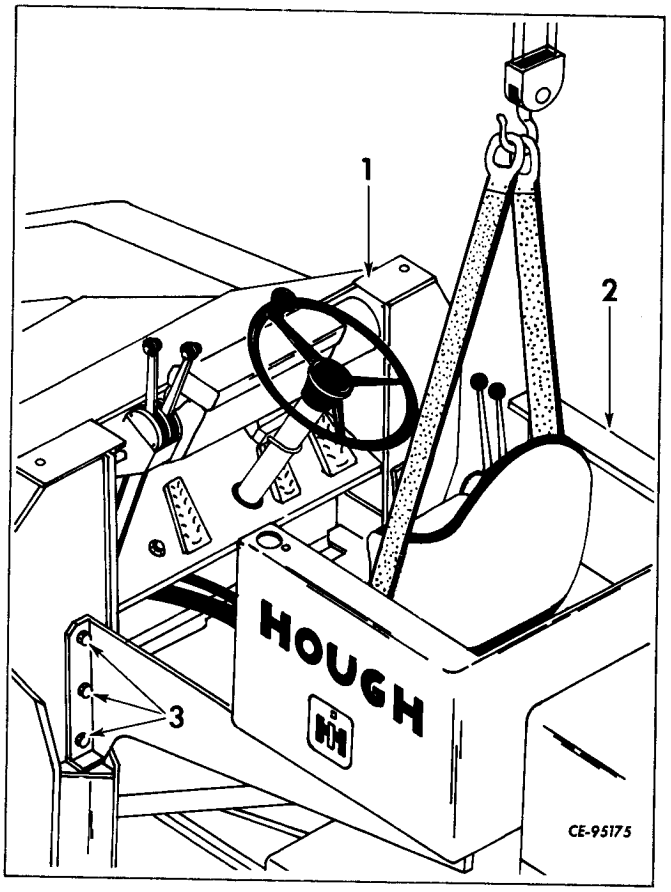

Figure 4-86

Connect control rods (2, Fig. 4-87) to hydraulic control valve levers (1) with pins and cotter pins (4). Connect parking brake cable (3) to bracket (5).

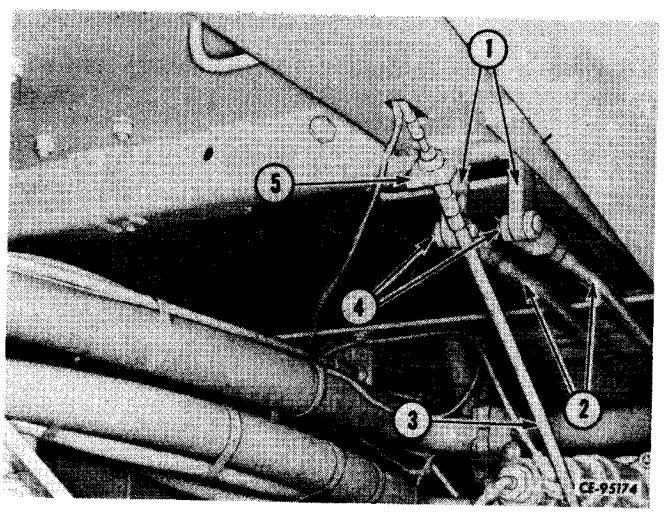

Figure 4-87

Install rear floorboard (1, Fig. 4-88) and secure to operator's compartment (2) and front floorboard (4) with cap screws (3).

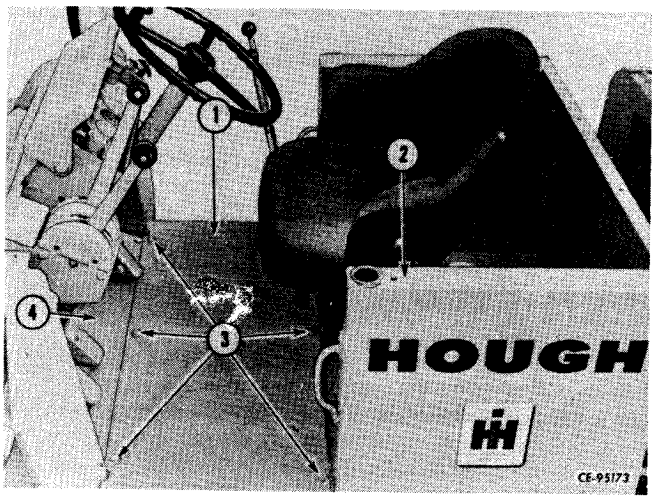

Figure 4-88

Install ladder (3, Fig. 4-89) and hand rail (4) and secure with cap screws to front frame (1) and operator's compartment (2).

Fill transmission with correct fluid (refer to "LUBRICANTS AND CAPACITIES" and "LEVEL CHECK" in this section.

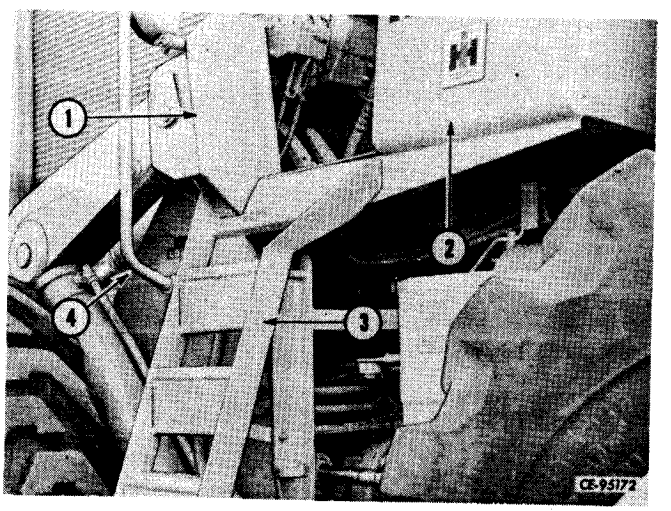

Figure 4-89

DISASSEMBLY, INSPECTION AND ASSEMBLY

CLUTCH PACKS

NOTE: Service instructions are given below for the Directional clutch assembly. The Range clutch assemblies are serviced in an identical manner with the exception of the removal of their drive gear. These differences will be noted later in this section.

REMOVAL

Follow the necessary steps described under "DISASSEMBLY" in this section to remove the clutch pack assembly from the transmission.

Place the clutch pack assembly on a clean work bench. Bench should have a hole in it large enough to receive the clutch pack shaft.

DISASSEMBLY

Remove the hook-type seal rings (1, Fig. 4-90) and snap ring (2) from shaft (3). Discard the seal rings (3).

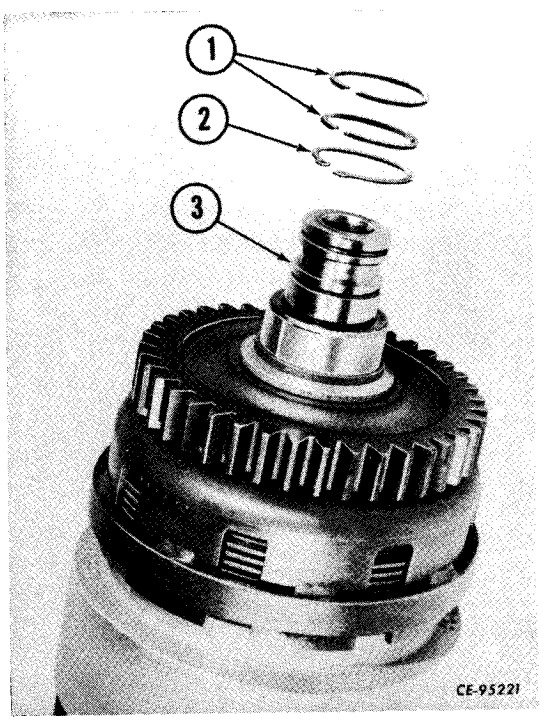

Figure 4-90

Remove the bearing inner race (3, Fig. 4-91), bronze thrust washer (2) and drive gear assembly (1) using a suitable puller. Repeat this operation at the opposite end of clutch pack.

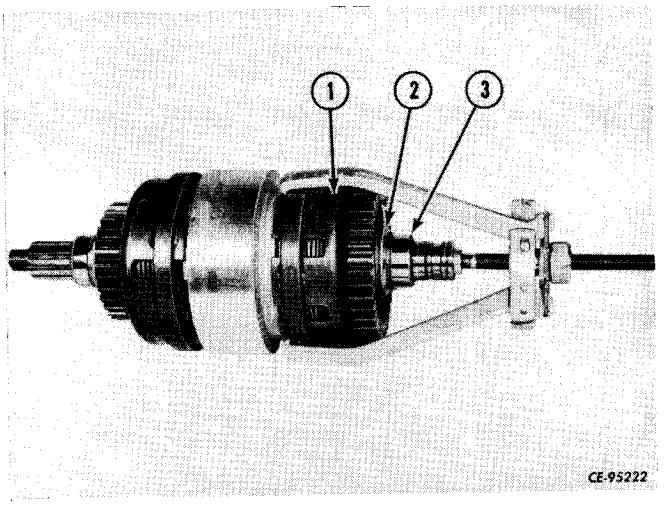

Figure 4-91

Remove the bearings (1, Fig. 4-92), spacer washer (2), bronze thrust washer (3) and spacer (4) from each end of shaft (5).

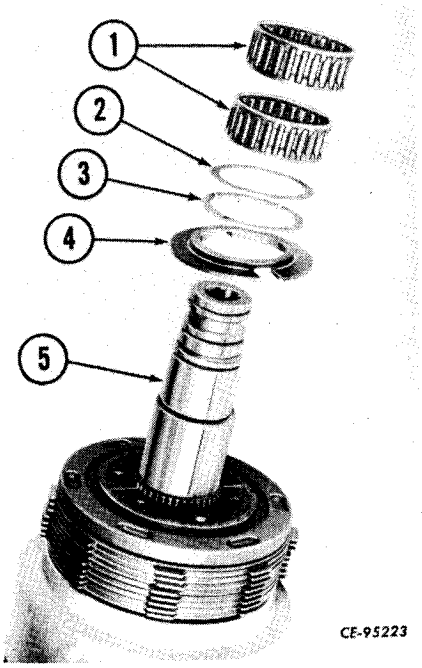

Figure 4-92

Remove the cap screws (2, Fig. 4-93) that secure the clutch hub retainers (3). Remove retainers. Lift the hub and plate assembly (4) from the shaft (1).

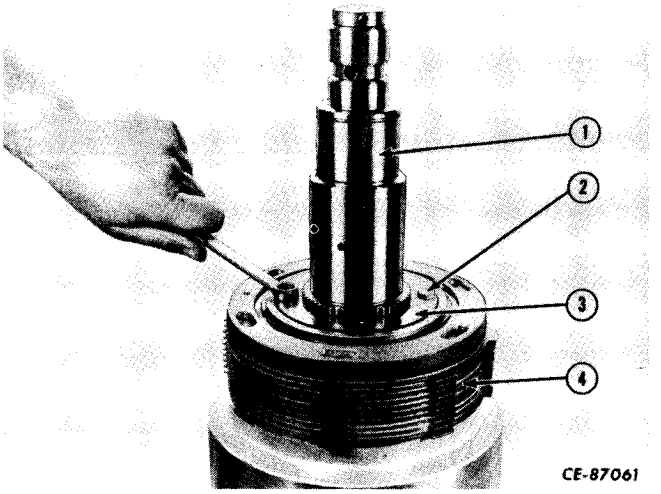

Figure 4-93

Remove the Spir-O-Lox retaining ring (1, Fig. 4-94) from the hub and plate assembly.

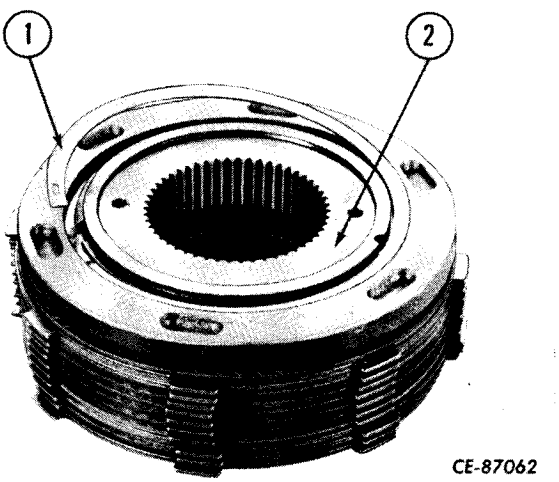

Figure 4-94

Remove the snap ring (1, Fig. 4-95) from the hub and plate assembly.

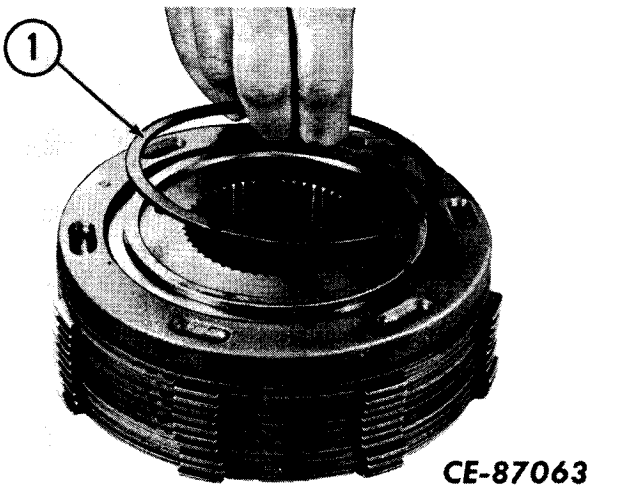

Figure 4-95

Remove the snap ring retainer (1, Fig. 4-96) and clutch backing plate (2) from hub and plate assembly. Remove dowel pin (3) where used.

NOTE: On later model transmissions the dowel pin is no longer used. The backing plate is splined and fits into splines of clutch hub.

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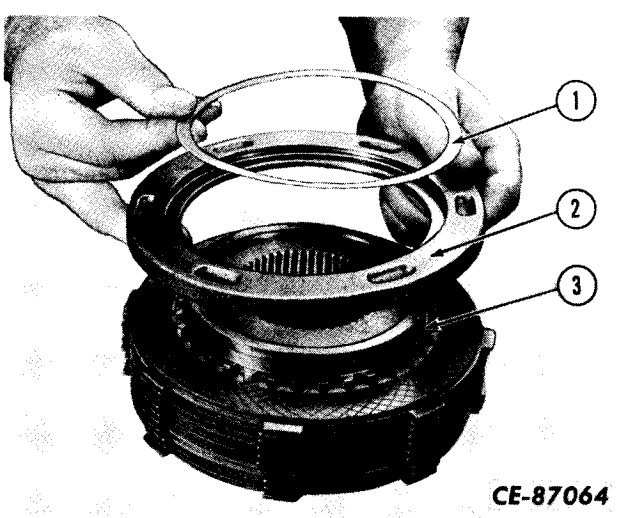

Figure 4-96

DISASSEMBLY, INSPECTION AND ASSEMBLY

CLUTCH PACKS - Continued

DISASSEMBLY - Continued

Clutch plates, both bronze (1, Fig. 4-97) and steel (2) may be removed from the clutch hub assembly (4).

Inspect the rubber plugs (3, Fig. 4-97) on alternate steel plates (directional clutch packs only). If plugs are damaged or worn, plugs and plate must be replaced as an assembly.

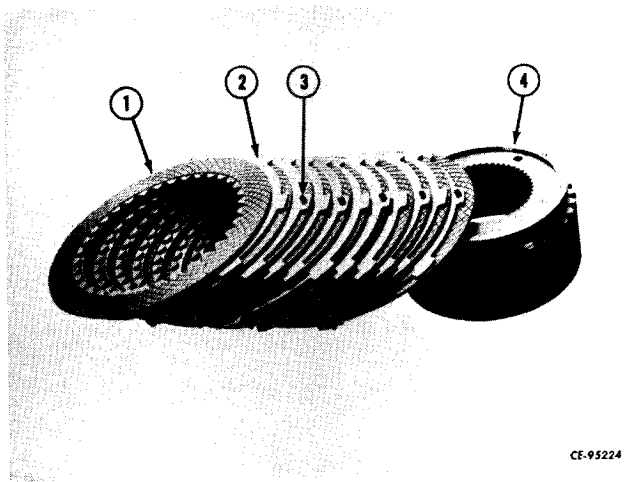

Figure 4-97

Using a plastic mallet, tap clutch piston (1, Fig. 4-98) down making snap ring (2) accessible. Remove snap ring.

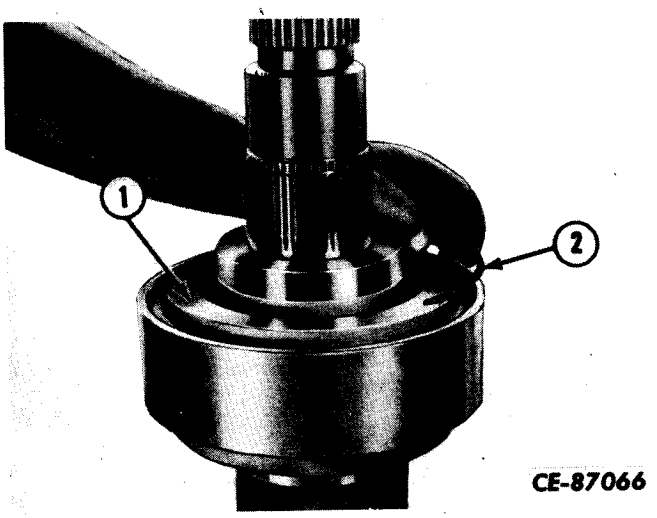

Figure 4-98

Install special snap ring groove filler (2, Fig. 4-99) (refer to "SPECIAL TOOLS") with narrow face down in piston housing (1) snap ring groove.

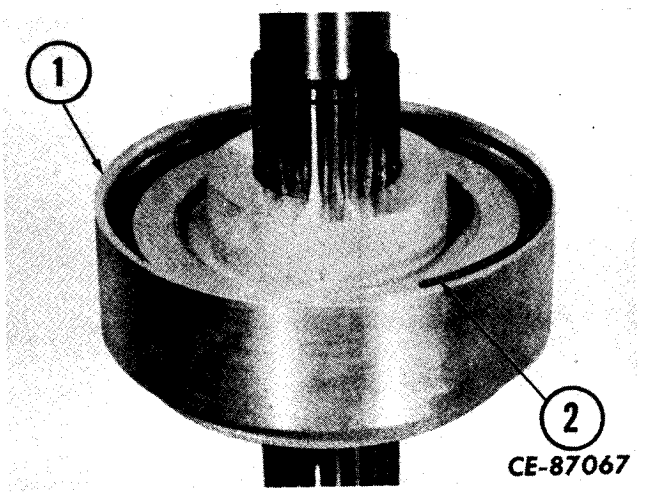

Figure 4-99

Using a plastic mallet, tap around the outer edge of the piston housing (1, Fig. 4-100).

NOTE: Do not allow piston housing to fall on bench.

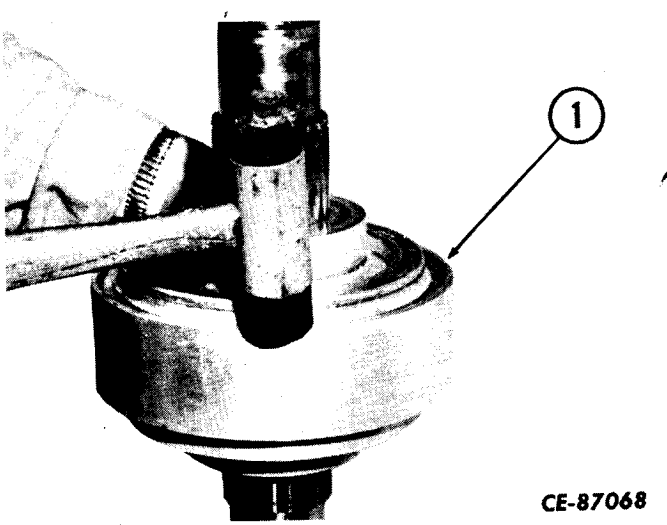

Figure 4-100

Remove clutch piston (1, Fig. 4-101) and seal (2) assembly. Discard rectangular seal (2). Remove special tool.

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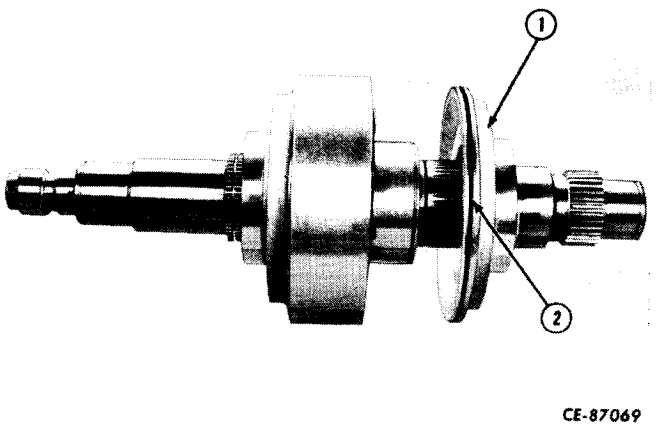


Figure 4-101

Remove piston housing (1, Fig. 4-102). Remove and discard "O"-ring (2).

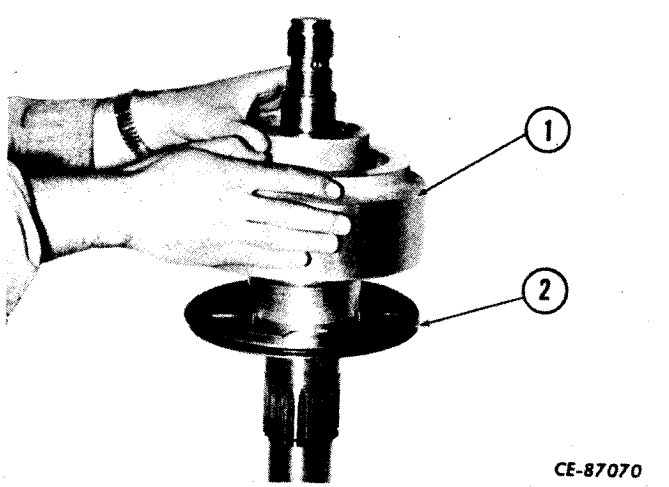


Figure 4-102

Remove and discard the hook-type seal rings (1, Fig. 4-103) from the clutch shaft assembly.

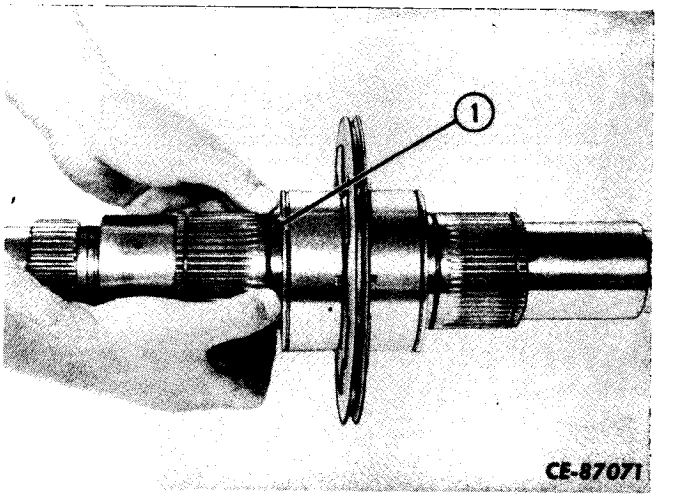


Figure 4-103

Remove the accelerating pistons retaining snap rings (3, Fig. 4-104). Remove the accelerating pistons (1). Remove and discard hook-type seal rings (2) from the pistons.

(Continued on next page)

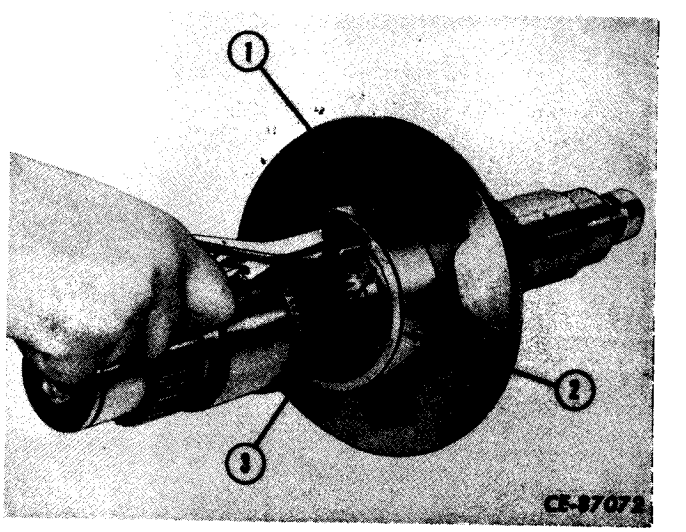


Figure 4-104

CLUTCH PACKS - Continued

DISASSEMBLY - Continued

Remove disc valve (1, Fig. 4-105), reinforcing disc (2), hook-type seal ring (3) and dowel pins (4). Discard hook-type seal ring (3).

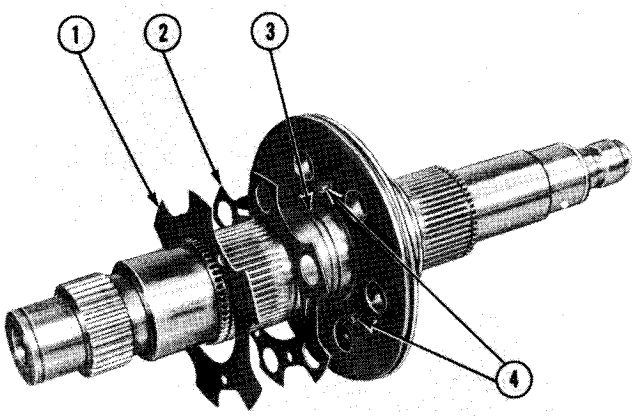


Figure 4-105

The following items are called out for identification:

1. Reverse oil supply plug.

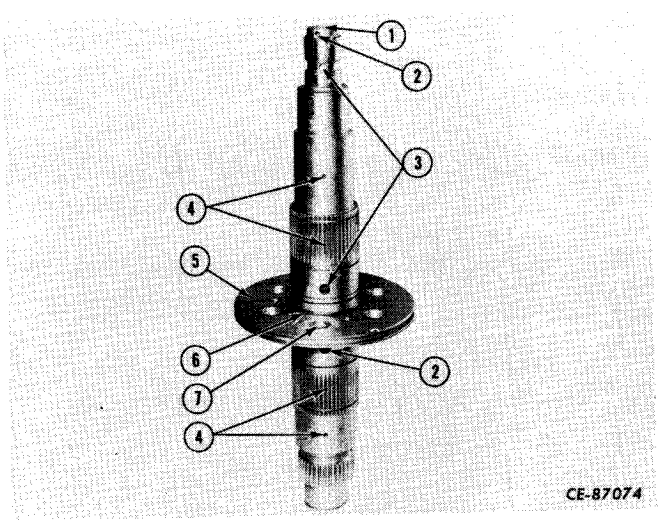


Figure 4-106

2. Reverse oil supply port.

3. Forward oil supply port.

4. Lube oil holes.

5. Separator plate.

6. Separator plate locating snap ring.

7. Oil transfer holes.

NOTE: Shaft is serviced as an assembly only. If locating snap rings, shaft or separator plate are damaged, the entire assembly must be replaced.

CLEAN, INSPECT AND REPAIR

Cleaning and inspection of the clutch assembly in preparation for assembly should include the following:

1. Cleaning all parts thoroughly in solvent. Use compressed air to dry parts. Carefully inspect all parts for excessive wear, cracks and/or breakage. All bores must be perfectly clean. Do not use caustic soda to clean parts.

2. Inspection of splines on all shafts and drive gears for excessive wear.

3. Inspection of all sealing surfaces for wear or grooving.

4. Inspection of bearing inner races and bushings for pits and spalled areas. Replace any bearing or bushings that are pitted or spalled.

5. Inspection of sintered bronze and steel discs for wear, signs of burning and/or warping. Replace discs if these conditions exist.

6. Replacing all seals, hook-type seal rings; "O"-rings and snap rings.

7. The use of a non-fibrous grease with a low melting point during assembly.

NOTE: Drive gear and drive cup assembly bushing wear limits and thrust washer wear limits are located under "TOLERANCES."

DISASSEMBLY, INSPECTION AND ASSEMBLY

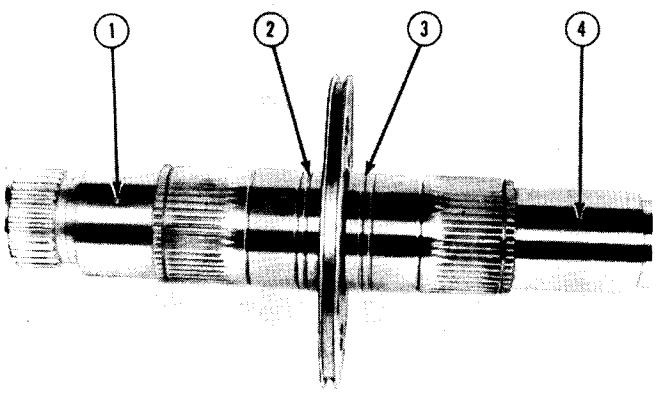
NOTE: Special Torque recommendations are listed under "SERVICE INFORMATION." This simplifies revision, when necessary. To eliminate constant referral, blank spaces are provided at points where special torques are required. These may be filled in by the manual holder, in pencil, and revised when necessary.

ASSEMBLY

Place shaft horizontally on bench. Install new hook-type seal rings (2, 3, Fig. 4-107) on inner shaft grooves.

NOTE: Use caution when installing hook-type seal rings to avoid ring breakage.

Be sure roll pins (1, 4) are in place and bores are clean.

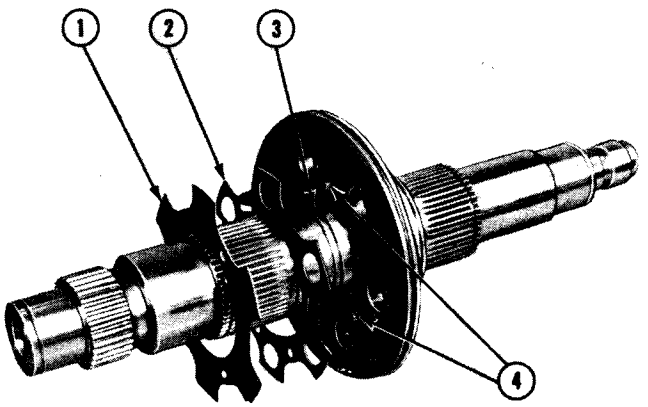


CE-87075

Figure 4-107

Install dowel pins (4, Fig. 4-108) in separator plate. Install a reinforcing disc (2) on each side of separator plate. Install a disc valve (1) on each side of the separator plate. Align reinforcing discs and disc valves on dowel pins.

Install a hook-type seal ring (1, Fig. 4-109) on each accelerating piston.



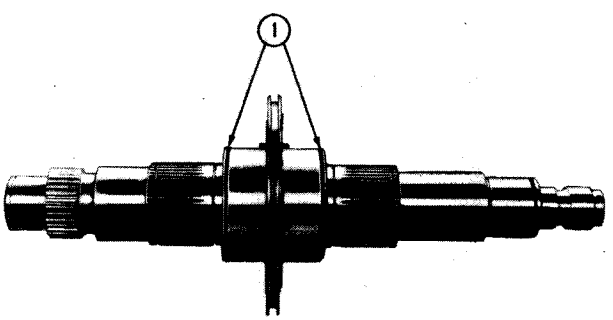
CE-87073

Figure 4-108

Install pistons on shaft.

NOTE: Use caution when installing pistons to prevent breaking the hook-type seal rings on the shaft. Lubricate seal rings and inner bore of accelerating pistons liberally with clean, new transmission fluid or grease before assembling.

(Continued on next page)



CE-87077

Figure 4-109

DISASSEMBLY, INSPECTION AND ASSEMBLY

CLUTCH PACKS - Continued

ASSEMBLY - Continued

Install the snap rings (3, Fig. 4-110) that retain the accelerator pistons (1).

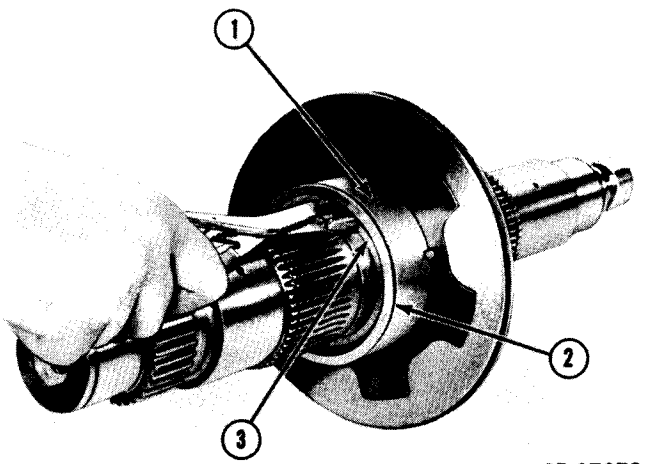


Figure 4-110

Place shaft in vertical position with reverse oil supply plug down. Install new hook-type seal ring (1, Fig. 4-111) in groove on shaft.

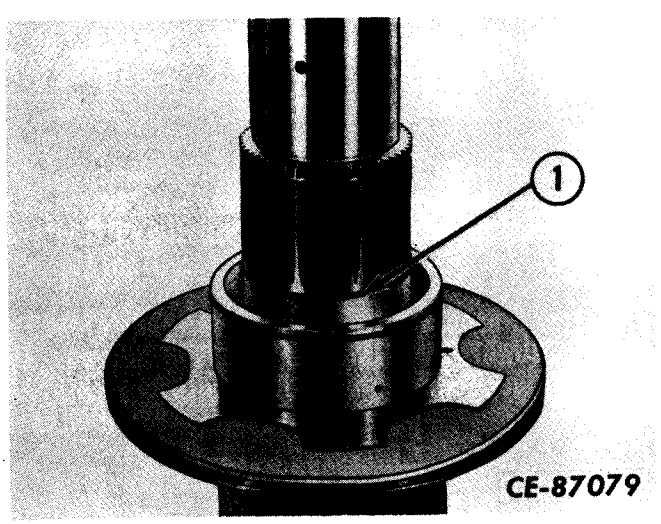


Figure 4-111

Install new rectangular seal ring (1, Fig. 4-112) on the outer diameter of the clutch piston (2). Coat seal ring on shaft, seal ring on accelerating piston and inner bore of clutch piston with grease or clean, new transmission fluid. Install clutch piston on shaft assembly being careful not to damage the hook-type seal rings.

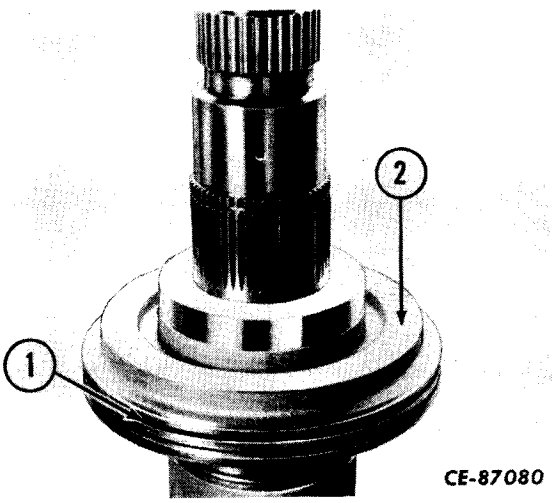


Figure 4-112

Invert shaft. Install new hook-type seal ring (2, Fig. 4-113) in shaft groove.

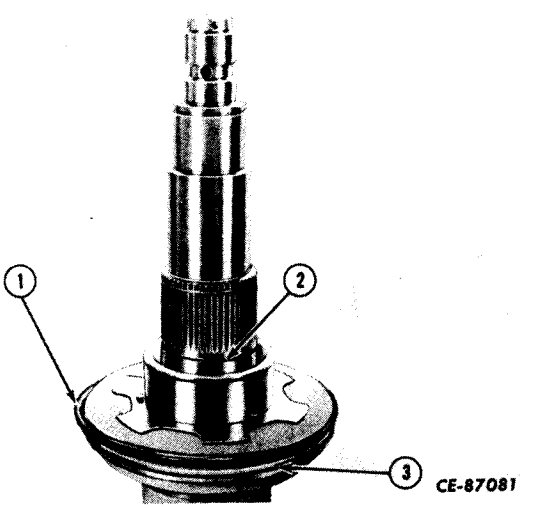


Figure 4-113

DISASSEMBLY, INSPECTION AND ASSEMBLY

Install new "O"-ring (1) on outer diameter of separator plate. Coat both seals with heavy grease. Coat rectangular seal (3) on clutch piston with grease.

NOTE: The "O"-ring seal on the outer diameter of the separator plate is designed with a larger diameter than its groove hose. Once inside the piston housing however, this excess material is compressed into the groove, filling it completely.

Install the special snap ring groove filler, (refer to "SPECIAL TOOLS") in the piston housing, with its beveled edge up. Lubricate groove area and mouth of piston housing with heavy grease.

Install piston housing (1, Fig. 4-114) on shaft assembly.

NOTE: The "O"-ring (3) is larger in diameter than the separator plate groove base. This design allows the inside diameter of the piston housing (1) to compress the seal ring to the proper fit.

Carefully feed in the "O"-ring seal (3) while applying pressure to the piston housing (1). Push piston housing over "O"-ring seal and clutch piston (2).

NOTE: Care must be taken during assembly to prevent cutting or otherwise damaging seal rings.

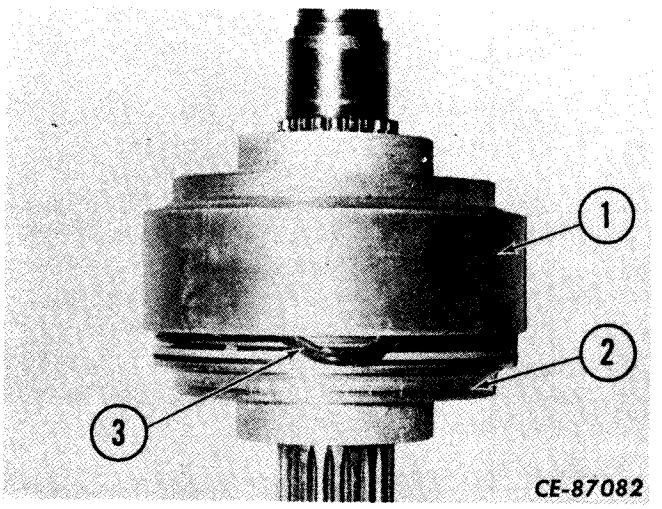


Figure 4-114

Invert the shaft assembly. Depress the clutch piston (1, Fig. 4-115) into the piston housing. Remove the special snap ring groove filler. Install snap ring (2).

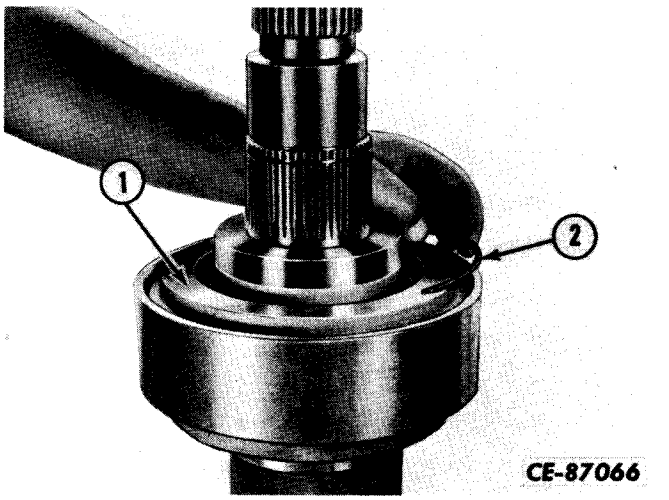


Figure 4-115

Apply air pressure to oil port holes to check operation of the clutch apply mechanism. The clutch piston/piston housing should move freely.

NOTE: DO NOT exceed 100 psi air pressure.

NOTE: The next five steps apply to both sides of the clutch pack.

(Continued on next page)

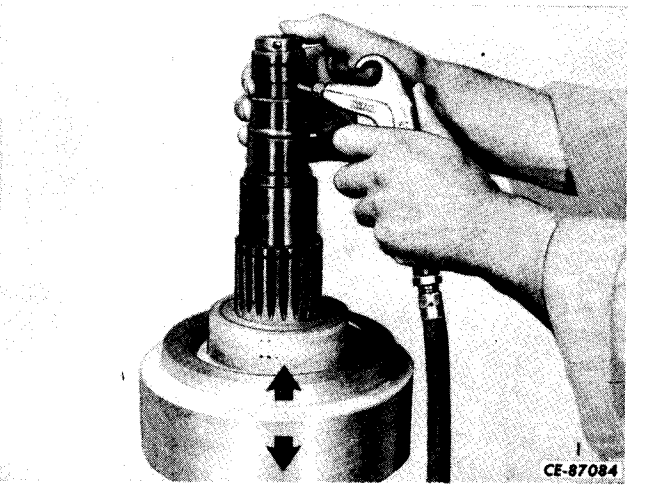


Figure 4-116

DISASSEMBLY, INSPECTION AND ASSEMBLY

CLUTCH PACKS - Continued

ASSEMBLY - Continued

Install the hub assembly (2, Fig. 4-117) and hub retainers (1). Install and tighten the retaining cap screws (3) to the recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

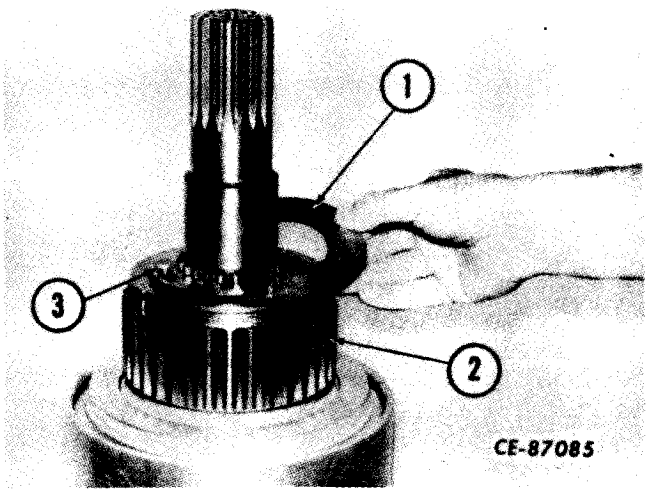


Figure 4-117

Install spacer (3, Fig. 4-118) and locking retainer bolts (4). Coat lightly with heavy grease and install bronze thrust washer (2) and thin spacer washer (1).

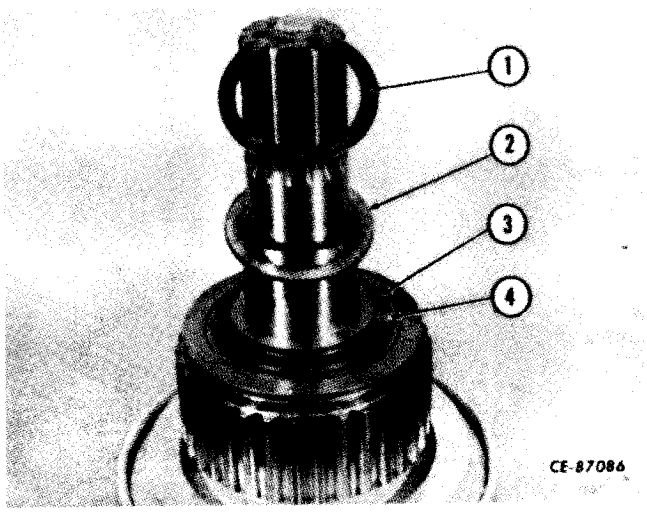


Figure 4-118

Install the correct number of steel and bronze plates (3, Fig. 4-119) in the order prescribed in the step below. Start with a bronze plate. Refer to the current Parts Catalog for the correct amount of plates. Note that alternate steel plates on late model directional clutch packs are equipped with rubber plugs.

With all plates (3) installed, position the backing plate (2) and install dowel pin (1) where used.

NOTE: On later model transmissions the dowel pin is no longer used. The backing plate is splined and fits into splines of clutch hub.

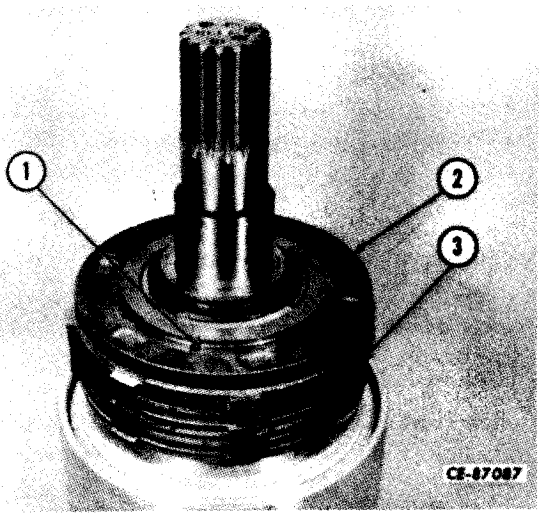


Figure 4-119

Start the stacking procedure with a bronze plate (3, Fig. 4-120). Follow with a steel plate (with rubber plugs where required), another bronze plate (3), a plain steel plate (2), a bronze plate (3), a steel plate (with rubber plugs where required), etc., until the correct amount of plates are installed. (Refer to current Parts Catalog for correct amount of plates.)

NOTE: Rubber plug equipped, steel plates (1) used in late model directional clutches are supplied as an assembly only.

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DISASSEMBLY, INSPECTION AND ASSEMBLY

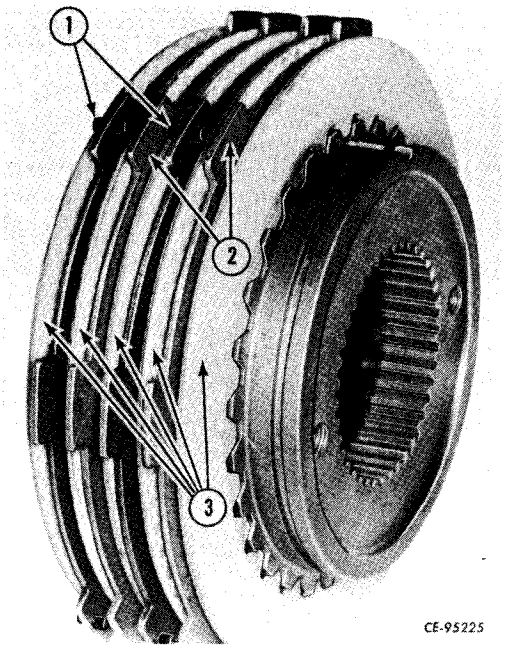

Figure 4-120
Partial Clutch Pack - Late Model Directional.

1. Steel plates with rubber plugs (late model - directional clutches only).
2. Plain steel plates.
3. Bronze plates.

Install snap ring retainer (1, Fig. 4-121) and external snap ring (3) in hub recess (2).

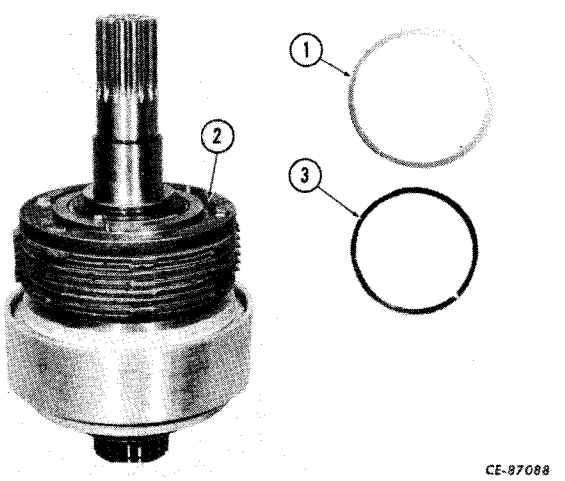

Figure 4-121

Install Spir-O-Lox retaining ring (1) in backing plate (3). This locks in the external snap ring (2).

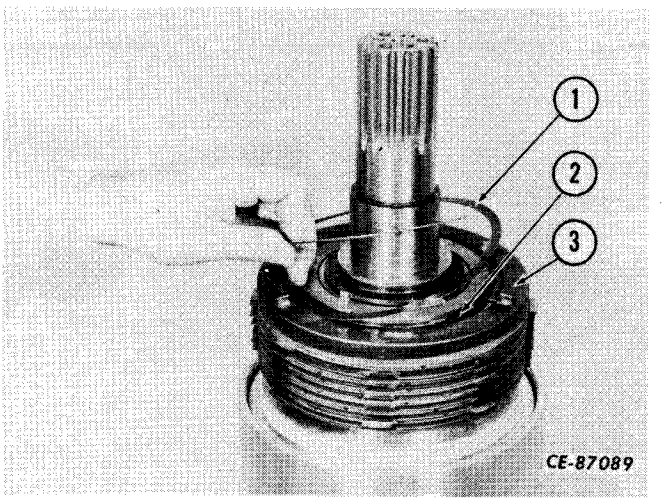

Figure 4-122

Install the spacer (4, Fig. 4-123), thrust washer (3), spacer washer (2) and bearings (1) on shaft assembly (5). Notches on spacer (4) must fit over retaining nuts.

(Continued on next page)

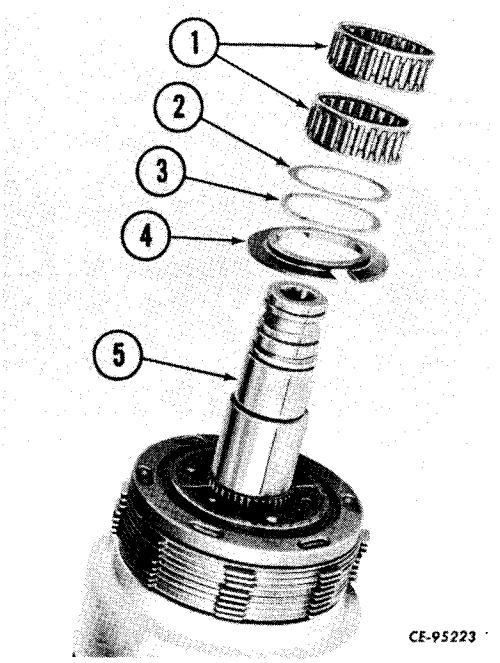

Figure 4-123

DISASSEMBLY, INSPECTION AND ASSEMBLY

CLUTCH PACKS - Continued

ASSEMBLY - Continued

Install gear and cup assembly (3, Fig. 4-124) thrust washer (2) and inner bearing race (1) on shaft.

NOTE: Heat bearing inner race (1) in oil or an oven to 250°F. prior to installation.

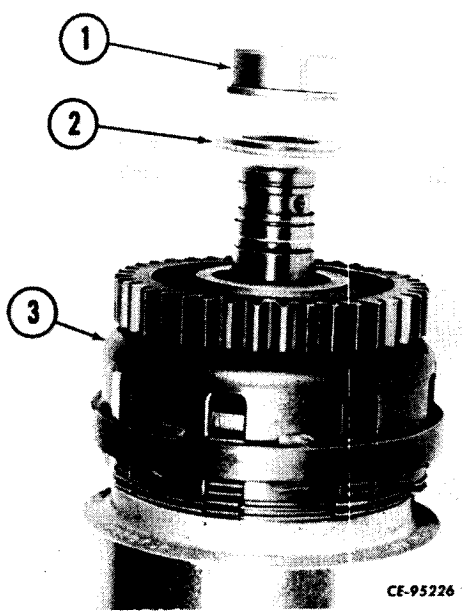

Figure 4-124

Install snap ring (2, Fig. 4-125) and hook-type seal rings (1) on shaft (3). Be sure snap ring bottoms in its groove about its entire circumference. Use caution during installation of seal rings (1) to avoid breaking rings.

Invert the clutch pack assembly and repeat the last nine steps on the splined end of the shaft.

NOTE: Splined end of shaft does not employ the last set of hook-type seal rings (1, Fig. 4-125).

RANGE CLUTCH ASSEMBLY

As previously stated the range and directional clutch packs may be assembled in an identical

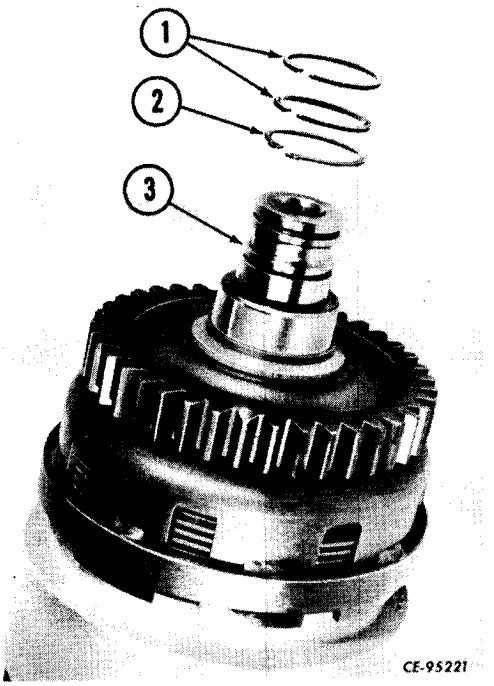

Figure 4-125

manner. Range clutches however, require the installation of a drive gear on their input end.

After gear and cup (5, Fig. 4-126) installation, position a thin bronze thrust washer (4) on splined end of shaft against cup gear (5). Install

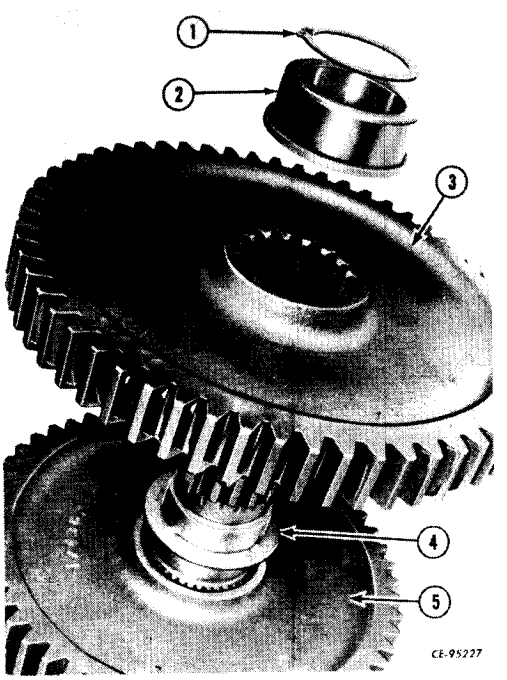

Figure 4-126

DISASSEMBLY, INSPECTION AND ASSEMBLY

drive gear (3) on shaft with the longer of its two hubs facing end of shaft. Install inner bearing race (2) with shoulder towards gear.

NOTE: Heat the bearing inner race to 250°F. in oil or an oven prior to installation.

Be sure bearing race (2) bottoms against drive gear (3). Install snap ring (1) being sure it bottoms in its groove about its entire circumference.

It will be noted (Figs. 4-127, 4-128) that while assembly procedures for both types of clutch

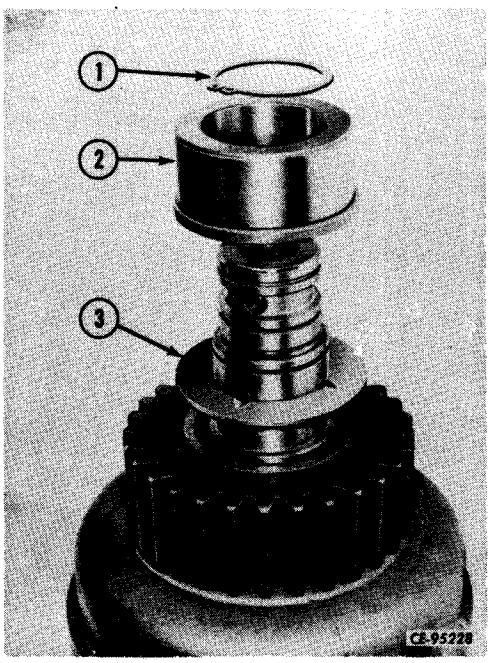

Figure 4-127
Range Clutch Pack.

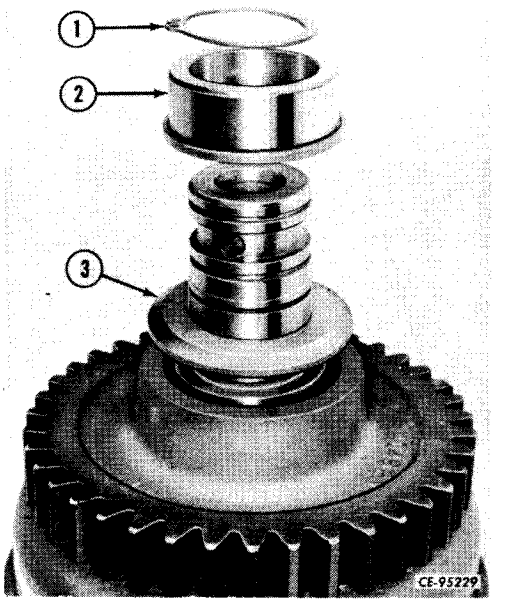

Figure 4-128
Directional Clutch Pack.

packs is identical at the oil inlet end of shaft, the type of thrust washer (3) varies. The range clutch pack (Fig. 4-126) uses a thin bronze washer while the directional pack (Fig. 4-127) uses a thick, beveled washer. This beveled washer is installed with the bevel facing the inner bearing race (2).

NOTE: Heat inner bearing races to 250°F. in oil or an oven prior to installation.

Be sure bearing race (2) bottoms against thrust washer (3). Install snap ring (1) being sure it bottoms in its groove about its entire circumference.

DISASSEMBLY, INSPECTION AND ASSEMBLY

DIRECTIONAL VALVE

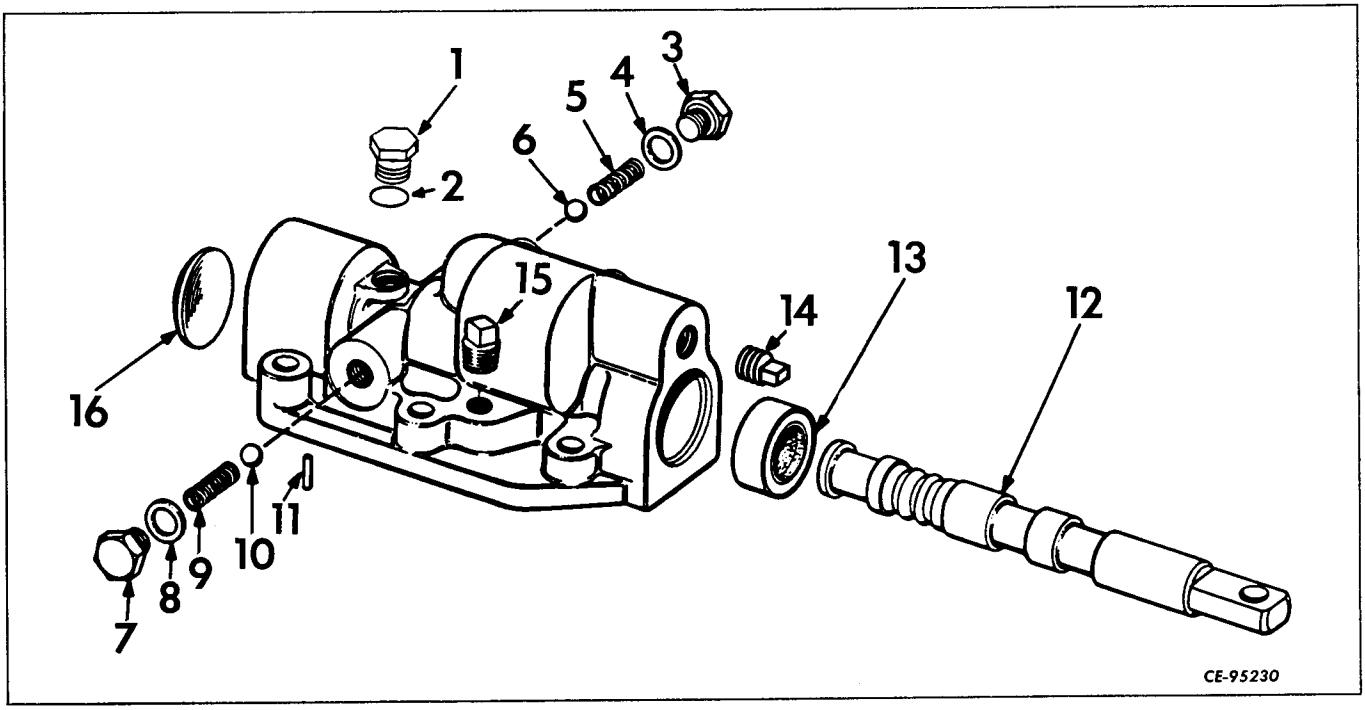

Figure 4-129
Directional Valve.

Disassemble in numerical order.

Remove item 16 only if damaged or leaking.

Clean and inspect parts.

Replace parts: 2, 4, 8, 13.

Assemble in reverse order.

1. Plug.
2. "O"-ring.
3. Plug.
4. Gasket.
5. Spring.
6. Ball.
7. Plug.
8. Gasket.
9. Spring.
10. Ball.
11. Pin.
12. Valve spool.
13. Seal.

DISASSEMBLY, INSPECTION AND ASSEMBLY

RANGE VALVE

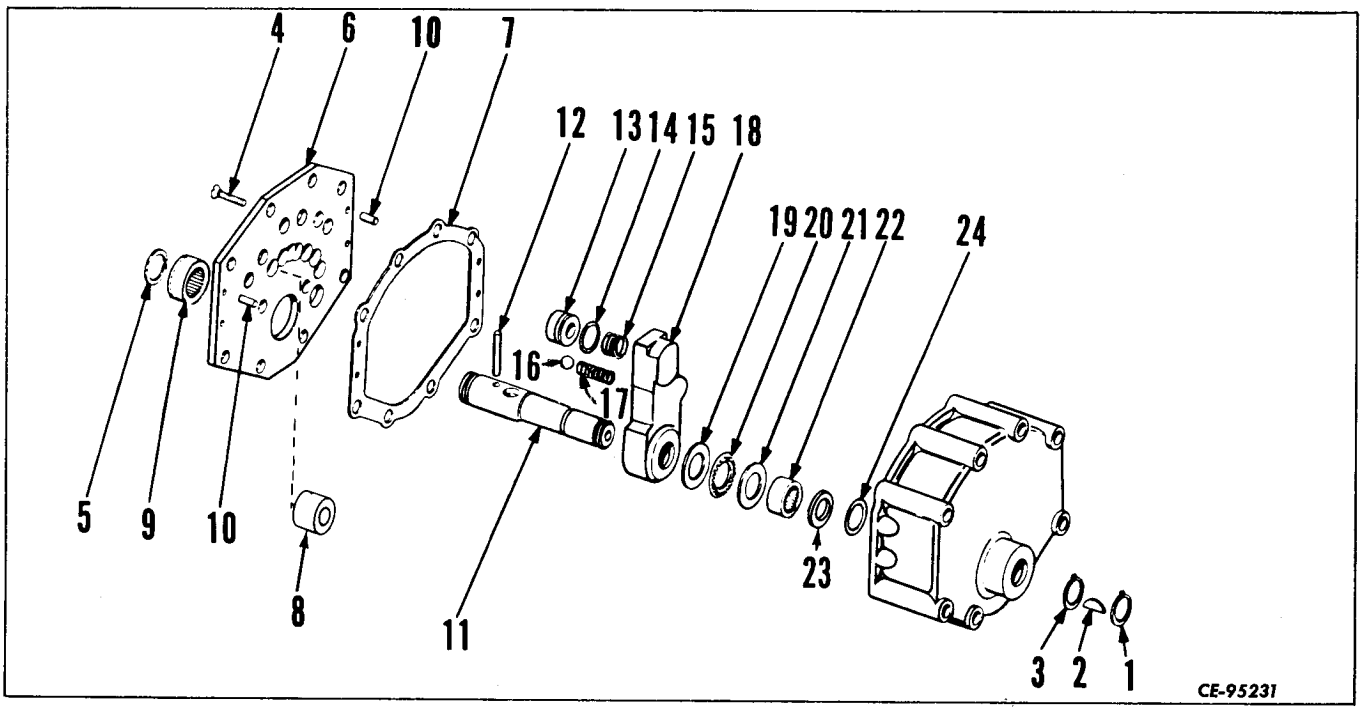

Figure 4-130
Range Valve.

Disassemble in numerical order.

Clean and inspect parts.

Replace parts: 5, 7, 14, 24.

Assemble in reverse order.

1. Snap ring.
2. Key.
3. Snap ring.
4. Screw.
5. Seal ring.
6. Plate.
7. Gasket.
8. Spacer.
9. Needle bearing.
10. Pin.
11. Shaft.
12. Pin.
13. Oil inlet valve.
14. Seal.
15. Spring.
16. Ball.
17. Spring.
18. Valve.
19. Thrust washer.
20. Thrust bearing.
21. Thrust washer.
22. Needle bearing.
23. Washer.
24. Seal.

DISASSEMBLY, INSPECTION AND ASSEMBLY

NEUTRAL KNOCKDOWN VALVE

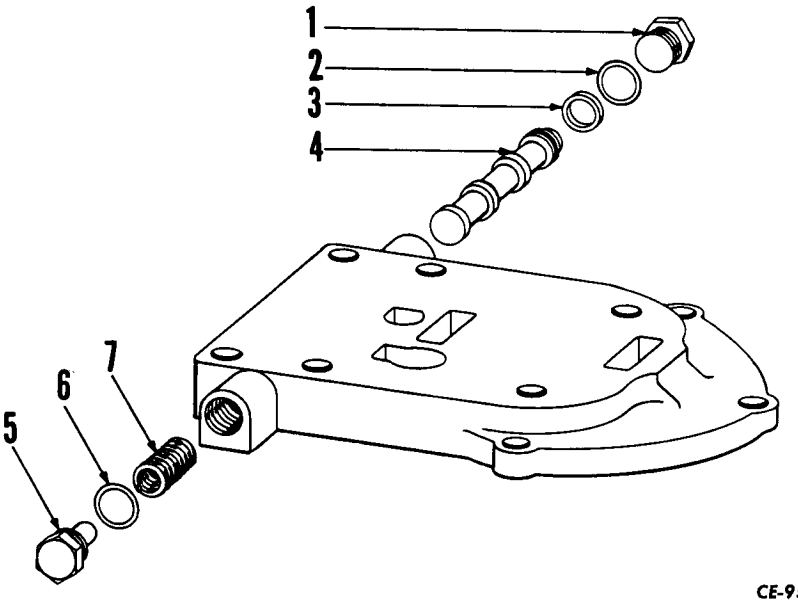

Figure 4-131
Neutral Knockdown Valve.

Disassemble in numerical order.

Clean and inspect parts.

Renew parts: 2, 3, 6.

Assemble in reverse order.

1. Plug.
2. Gasket.
3. Seal ring.
4. Valve spool.
5. Plug assembly.
6. Gasket.
7. Spring.

DISASSEMBLY, INSPECTION AND ASSEMBLY

MAIN REGULATOR VALVE

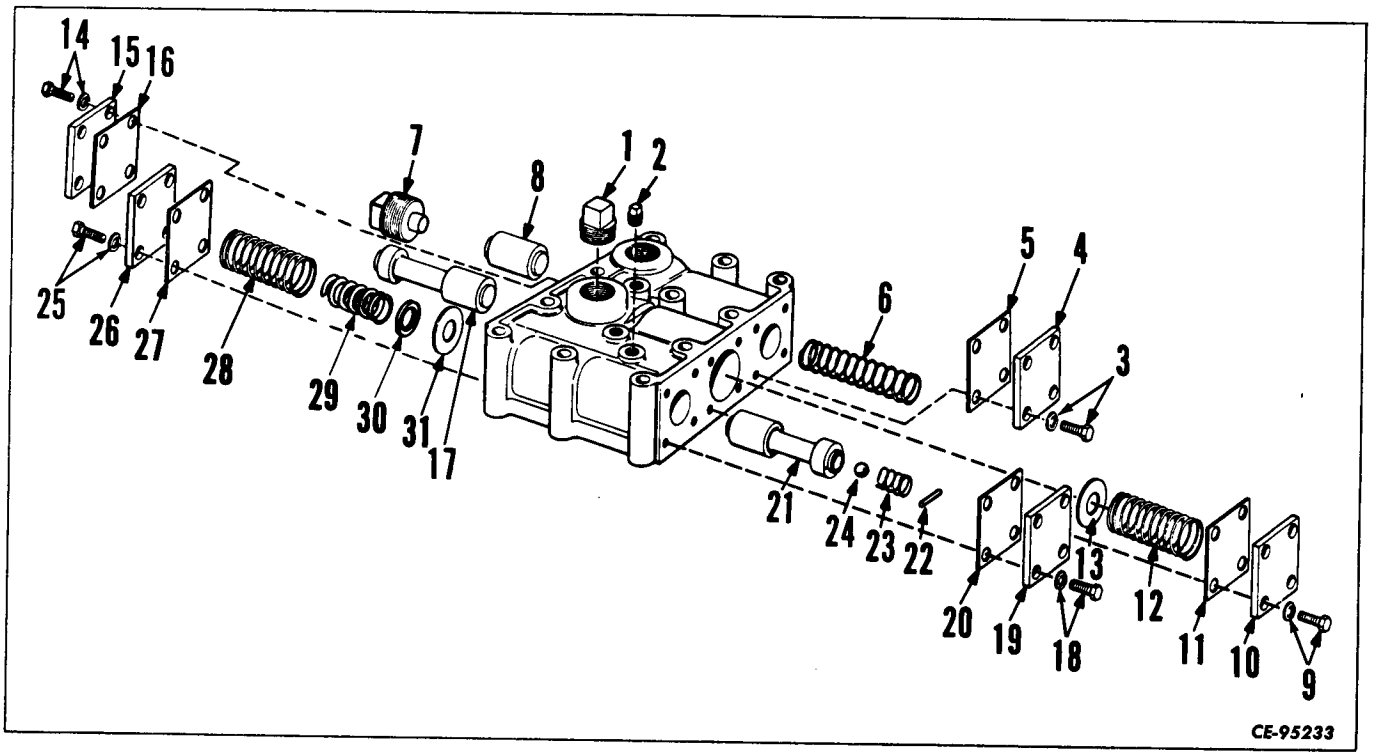

Figure 4-132
Main Regulator Valve.

Disassemble in numerical order.

Clean and inspect parts.

Renew parts: 5, 11, 16, 20, 27.

Assemble in reverse order.

1. Plug.
2. Plug.
3. Screw and washer.
4. Cover.
5. Gasket.
6. Spring.
7. Plug.
8. Lube valve.
9. Screw and washer.
10. Cover.
11. Gasket.
12. Spring.
13. Washer.
14. Screw and washer.
15. Cover.
16. Gasket.
17. Valve spool.
18. Screw and washer.
19. Cover.
20. Gasket.
21. Valve spool.
22. Pin.
23. Spring.
24. Ball.
25. Screw and washer.
26. Cover.
27. Gasket.
28. Spring.
29. Spring.
30. Washer.
31. Washer.

TRANSMISSION

TROUBLE SHOOTING

Diagnostic Checks to be Made When Trouble Occurs:

(1) Transmission sump oil level.
(2) Cleanliness of oil and oil filter.
(3) Air flow through oil cooler.
(4) Condition of all oil lines and fittings.
(5) Condition of all wiring and connections.
(6) Engine-converter stall speed.
(7) Proper linkage positioning of all valves and levers.
(8) Converter and transmission oil pressures.
(9) All drive lines and mounting brackets for tightness.

COMPLAINT	CAUSE	REMEDY
High engine speed at converter stall.	1. Low transmission sump oil level. 2. Low converter "IN" pressure at stall. 3. Slipping direction or range clutch. 4. Foaming oil. 5. Neutral knockdown valve sticking.	1. Add oil to proper level. 2. (a) Check external lines for leaks. (b) See low converter "IN" pressure. 3. (a) Cross check direction and range clutches by applying other clutches to varify slipping. (b) Observe movement in drive line between converter and transmission. 4. (a) Low oil level. (b) Water in oil. (c) Oil line suction leak. (d) Improper oil. 5. (a) Clean and inspect valve body bore. (b) Inspect valve spring.
Low engine speed at converter stall.	1. Low engine output. 2. Stator installed backwards. 3. Excessive oil in converter housing. 4. Plugged or restricted accessory drive and torque converter housing drain line.	1. Tune engine and check output. 2. Disassemble converter and check stator. 3. (a) Converter pump hub seal worn. (b) Input pump seal failure. (c) Excessive input pump wear. 4. Clean or replace drain line.
High oil temperature.	1. Low transmission sump oil level. 2. High transmission sump oil level. 3. Foamed oil. 4. Clogged oil cooler. 5. Low converter "IN" pressure. 6. Improper vehicle operation. 7. Stator assembled in converter backwards. 8. Low oil flow thru converter.	1. Add oil to proper level. 2. Drain oil to proper level. 3. (a) Check oil level. (b) Air leaks in suction lines. 4. Clean oil cooler. 5. See low converter "IN" pressure. 6. (a) Operate in correct range. (b) Downshift into lower range. (c) Remaining in stall too long. 7. (a) Check converter stall. (b) Disassemble converter and check stator. 8. Check input pump for excessive wear.

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TROUBLE SHOOTING

COMPLAINT	CAUSE	REMEDY
Slow or erratic clutch engagement.	1. Low transmission sump oil level. 2. Clogged oil filter screen. 3. Foamed oil. 4. Improper linkage adjustment. 5. Low clutch pressure. 6. Clutch pressure regulator valve stuck. 7. Neutral knockdown valve sticking. 8. Internal oil leaks.	1. Add oil to proper level. 2. Remove and clean. 3. Eliminate air leak into pump suction line. 4. (a) Free linkage and adjust. (b) Check selector valve positioning. 5. See low clutch pressure. 6. (a) Clean and inspect valve body bore. (b) Inspect valve spring. 7. (a) Clean and inspect valve body bore. (b) Inspect valve spring. 8. (a) Cross check clutches by applying other clutches. (b) Damaged or worn seals in clutch pack. (c) Damaged oil transfer tubes. (d) Damaged or worn shaft seals. (e) Overhaul transmission.
High clutch pressure.	1. Improper main pressure regulator valve operation. 2. Stuck converter regulator valve.	1. (a) Clean and inspect. (b) Inspect spring. (c) Inspect valve bore. 2. (a) Clean and inspect. (b) Inspect spring. (c) Inspect valve bore.
Low clutch pressure.	1. Low transmission sump oil level. 2. Clogged oil filter or transmission sump oil screen. 3. Foamed oil. 4. External oil leaks. 5. Improper clutch pressure regulator valve operation. 6. Worn input oil pump. 7. Neutral knockdown valve sticking. 8. Internal oil leaks.	1. Add oil to proper level. 2. Clean and/or replace. 3. (a) Eliminate air leaks in suction line. (b) Tighten fittings. (c) Check oil level. 4. Check external oil lines. 5. (a) Clean and inspect. (b) Inspect spring. (c) Check valve body bore. 6. Overhaul input oil pump. 7. (a) Clean and inspect valve body bore. (b) Inspect valve spring. 8. (a) Watch for excessive pressure drop in a specific direction or range clutch. (b) Overhaul transmission.
High converter "IN" pressure.	1. Clogged oil cooler. 2. Stuck converter regulator valve. 3. Stuck lube pressure regulator valve.	1. Remove and clean. 2. (a) Clean and inspect valve body bore. (b) Inspect valve spring. 3. (a) Clean and inspect valve body bore. (b) Inspect valve spring.

TRANSMISSION

TROUBLE SHOOTING

COMPLAINT	CAUSE	REMEDY
Low converter "IN" pressure.	1. Low transmission sump oil level. 2. Low clutch pressure. 3. External oil leak. 4. Converter regulator valve sticking. 5. Internal oil leak.	1. Add oil to proper level. 2. See low clutch pressure. 3. Check external lines for leaks. 4. (a) Clean and inspect valve body bore. (b) Inspect valve spring. 5. Overhaul converter.
Low lube pressure.	1. Low oil level. 2. Worn input pump. 3. Stuck lube pressure regulator valve. 4. Internal leaks.	1. Correct oil level. 2. Overhaul input pump. 3. (a) Clean and inspect valve body bore. (b) Inspect valve spring. 4. Overhaul transmission.
High lube pressure.	1. Stuck lube pressure regulator valve.	1. (a) Clean and inspect valve body bore. (b) Inspect valve spring.
Loss of Power.	1. Low engine output. 2. Stator assembled backward. 3. Low converter "IN" pressure. 4. Direction or range selector valves inoperative. 5. Improper vehicle operation. 6. Parking brake dragging. 7. Foaming oil. 8. Slipping clutches. 9. Vehicle brakes dragging.	1. See low engine speed at converter stall. 2. Disassemble converter and check stator. 3. See low converter "IN" pressure. 4. (a) Check linkage. (b) Disassemble valve bodies and inspect. 5. Operate in proper range for load and terrain. 6. (a) Adjust linkage to allow full release. (b) Release brake. 7. (a) Correct oil level. (b) Check for air leak in suction line. (c) Oil used not meeting specifications. 8. See low clutch pressure. 9. (a) Adjust brakes. (b) Check brake linkages
Vehicle drives in one direction and creeps in that direction in neutral but stalls when shifted to the opposite direction.	1. Failed directional clutch.	1. Overhaul transmission.
Vehicle drives in one range but stalls when shifted to another range.	1. Failed range clutch.	1. Overhaul transmission.

TROUBLE SHOOTING

COMPLAINT	CAUSE	REMEDY
All range pressures normal in one direction but all low in opposite direction.	1. Directional selector valve linkage out of adjustment. 2. Internal oil leaks in forward or reverse clutch.	1. Adjust linkage. 2. Overhaul transmission.
Low clutch pressure in one range clutch in either direction.	1. Linkage out of adjustment. 2. Internal oil leaks in clutch.	1. Adjust linkage. 2. Overhaul transmission.

SERVICE INFORMATION

SPECIFICATIONS

Transmission model P-1202
Transmission make . . . . . Hough Division of I.H.
Transmission type. . . . . Four speed, constant mesh, full reversing

Road speeds:

RANGE	FORWARD	REVERSE
1	4.6	4.6
2	8.4	8.4
3	17.5	17.5
4	32.0	32.0

Clutch type . . . . . Multiple disc, pressure balanced, oil cooled
Rating . . . . . 2500 RPM, max. governed input speed
Gearing . . . . . Countershaft design, spur type
Charging pump make . . . . . Webster Electric
Oil sump. . . . . Integral
Filtration . . . . . One, replaceable pleated paper, radial fin type element. Filter is remote mounted.
Oil cooler . . . . . Remote mounted, oil-to-air type heat exchanger
Weight . . . . . 1150 lbs. (approx.)

SERVICE INFORMATION

OPERATING RANGES

Torque converter charging pressure	*50-80 PSI
Clutch apply pressure	**170-190 PSI
Lube pressure	*5-15 PSI
Transmission temperature range:	
Desired operating	180°F.
Maximum operating	250°F.

* High idle ** At stall

LUBRICANTS AND CAPACITIES

Type lubricant	"Dexron®"
Initial fill capacity	45 qts.
Refill capacity	30 qts.

TOLERANCES

Output shaft end play	.005"-.009"

DRIVE GEAR AND DRIVE CUP ASSEMBLY BUSHING WEAR LIMITS

When measuring the bushing in a clutch drive gear and drive cup assembly, the bushing should be measured at the outer edge of the inner diameter of the bushing. The following are the maximum wear limits:

A. Forward and Reverse Shaft Assembly

1. Bushing in drive gear and drive cup assembly has a maximum wear limit of 2.252 - 2.254.

2. Bushing in drive gear and drive cup assembly has a maximum wear limit of 2.252 - 2.254.

B. 1-3 Shaft Assembly

1. Bushing in drive gear and drive cup assembly has a maximum wear limit of 2.252 - 2.254.

2. Bushing in drive gear and drive cup assembly has a maximum wear limit of 2.252 - 2.254.

C. 2-4 Clutch Shaft Assembly

1. Bushing in drive gear and drive cup assembly has a maximum wear limit of 2.252 - 2.254.

2. Bushing in drive gear and drive cup assembly has a maximum wear limit of 2.252 - 2.254.

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SERVICE INFORMATION

CLUTCH PACK THRUST WASHER WEAR LIMITS

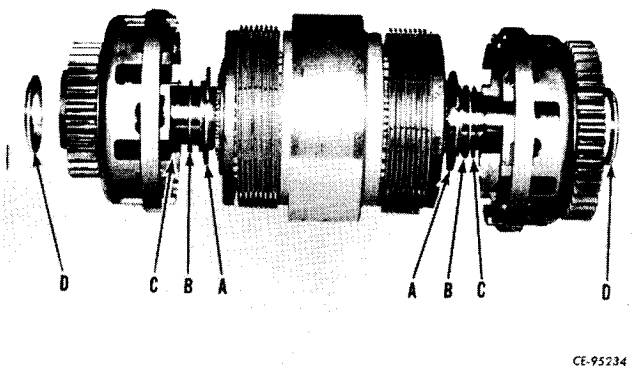

Figure 4-133
Directional Clutch Pack.

A. Steel spacer washer thickness .324" I. D. 2.270"
B. Bronze thrust washer thickness .090" I. D. 2.270"
C. Thin steel spacer washer thickness .030" I. D. 2.270"
D. Bronze thrust washer thickness .246" I. D. 1.781"

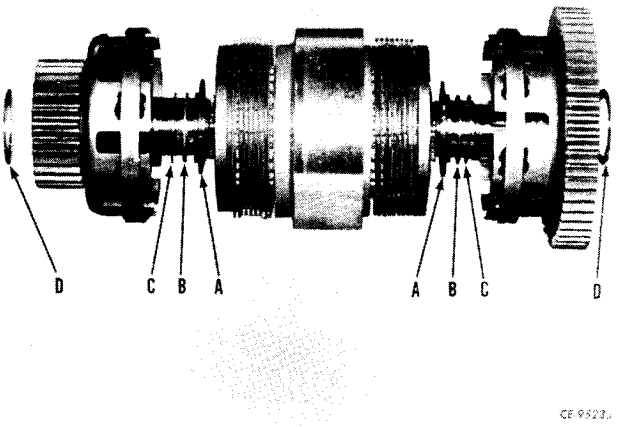

Figure 4-134
Range Clutch Packs.

A. Steel spacer washer thickness .324" I. D. 2.270"
B. Bronze thrust washer thickness .090" I. D. 2.270"
C. Thin steel spacer washer thickness .030" I. D. 2.270"
E. Bronze thrust washer thickness .090" I. D. 2.000"
F. Bronze thrust washer thickness .090" I. D. 2.265"

NOTE: Washers exceeding these limits should be replaced.

SPECIAL TORQUES

Strainer flange-to-valve assembly cap screws	9-10 lbs. ft.
Oil strainer mounting cap screws	33-37 lbs. ft.
Small cover-to-housing cap screws	33-37 lbs. ft.
Output shaft oil baffle mounting cap screws	33-37 lbs. ft.
Large cover-to-housing cap screws	33-37 lbs. ft.
Range selector valve retaining cap screws	19-21 lbs. ft.
Directional selector valve retaining cap screws	33-37 lbs. ft.
Lower counter shaft cover cap screws	33-37 lbs. ft.
Clutch shaft oil supply covers cap screws	33-37 lbs. ft.
Output shaft front bearing retainer cap screws	33-37 lbs. ft.
Front output yoke retaining nut	200 lbs. ft.
Regulator valve retaining cap screws	33-37 lbs. ft.
Input yoke retaining nut	200 lbs. ft.
Output shaft rear bearing retainer:	
Preliminary torque	25-30 lbs. in.
Secondary torque	50 lbs. in.
Final torque	33-37 lbs. ft.
Rear output yoke retaining nut	200 lbs. ft.
Cap-to-pin support cap screws	165 lbs. ft.

SPECIAL TOOLS

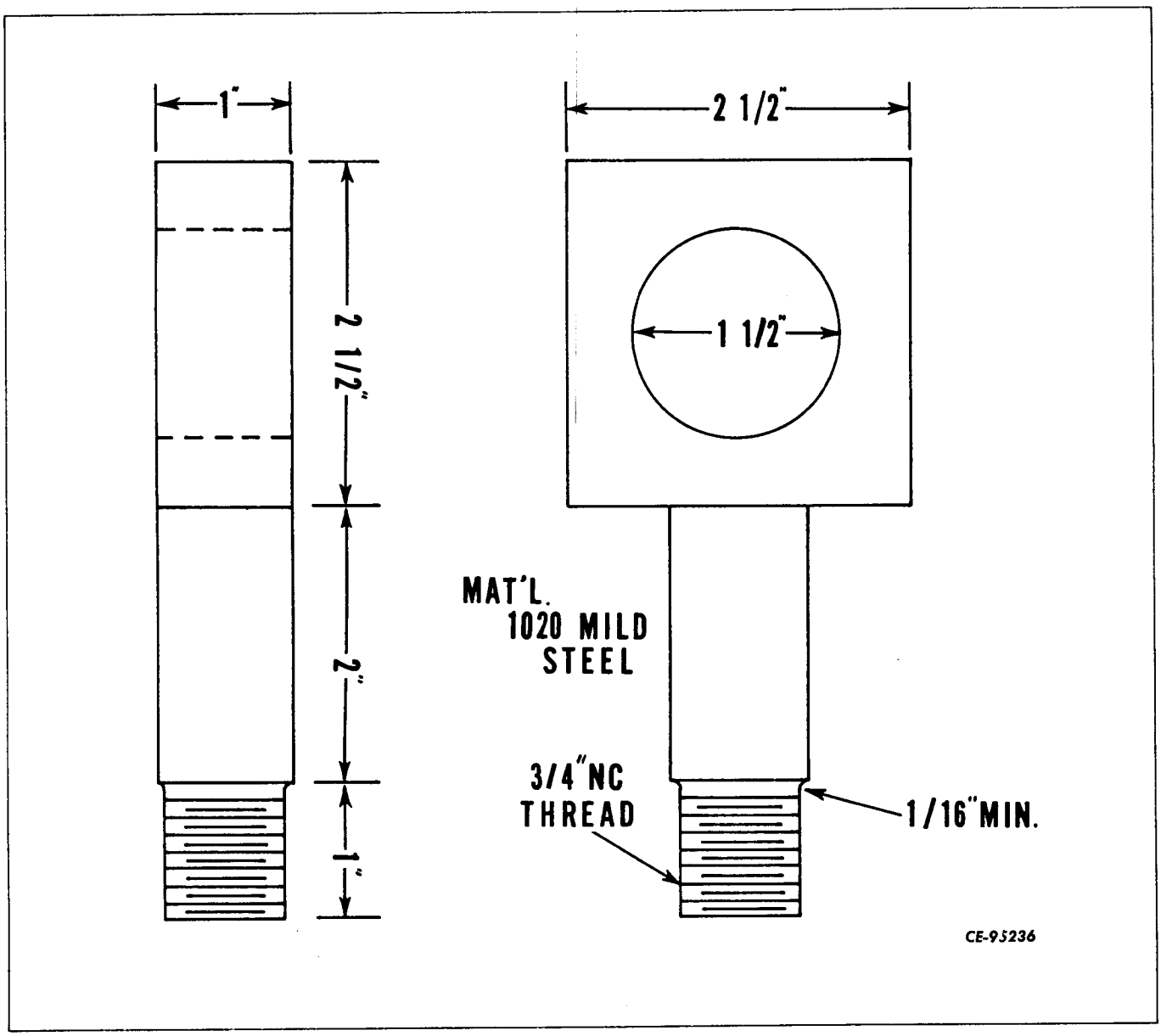

Figure 4-135
Lifting Eye.

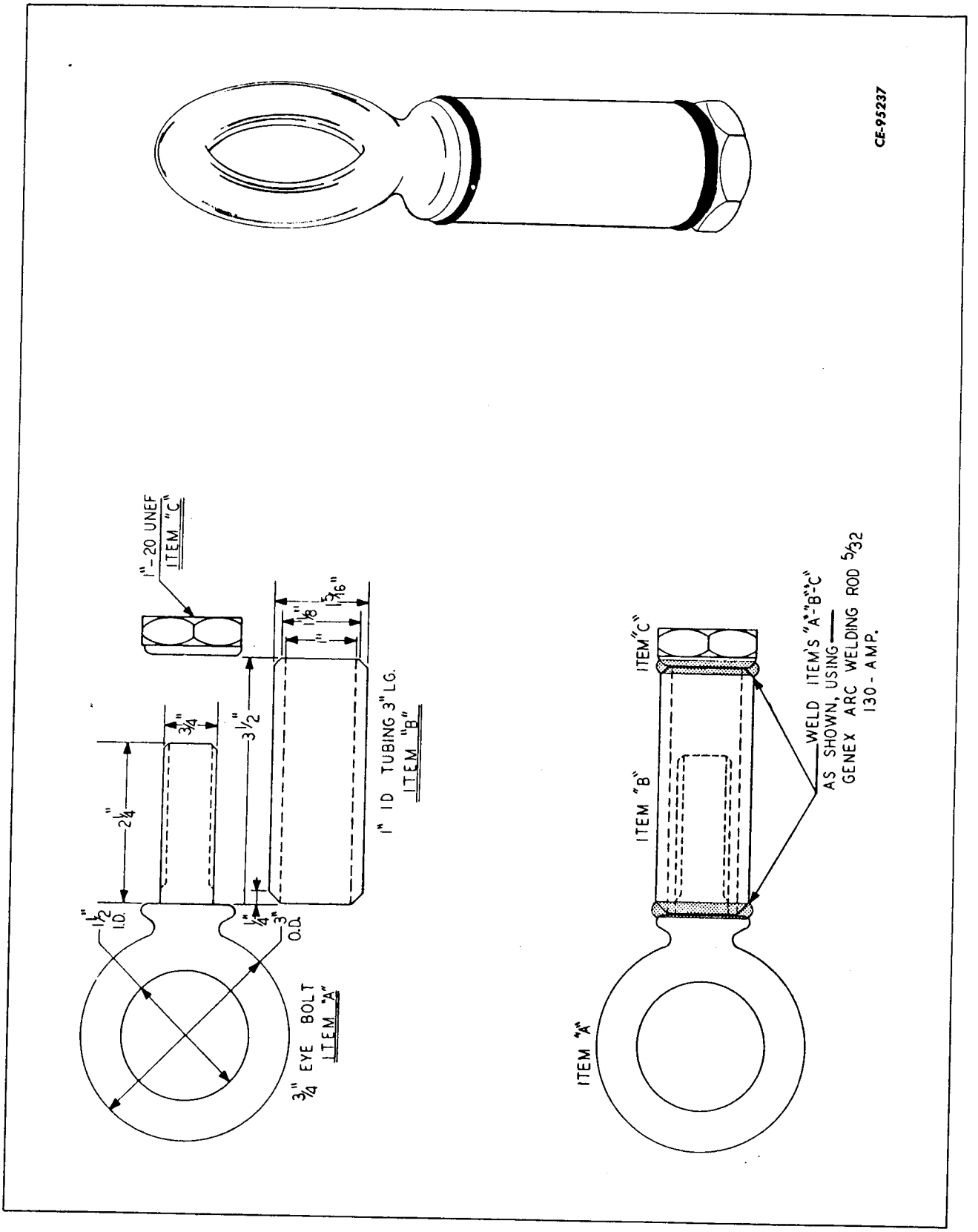

Figure 4-136
Output Shaft Lifting Tool.

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TRANSMISSION

SERVICE INFORMATION

SPECIAL TOOLS - Continued

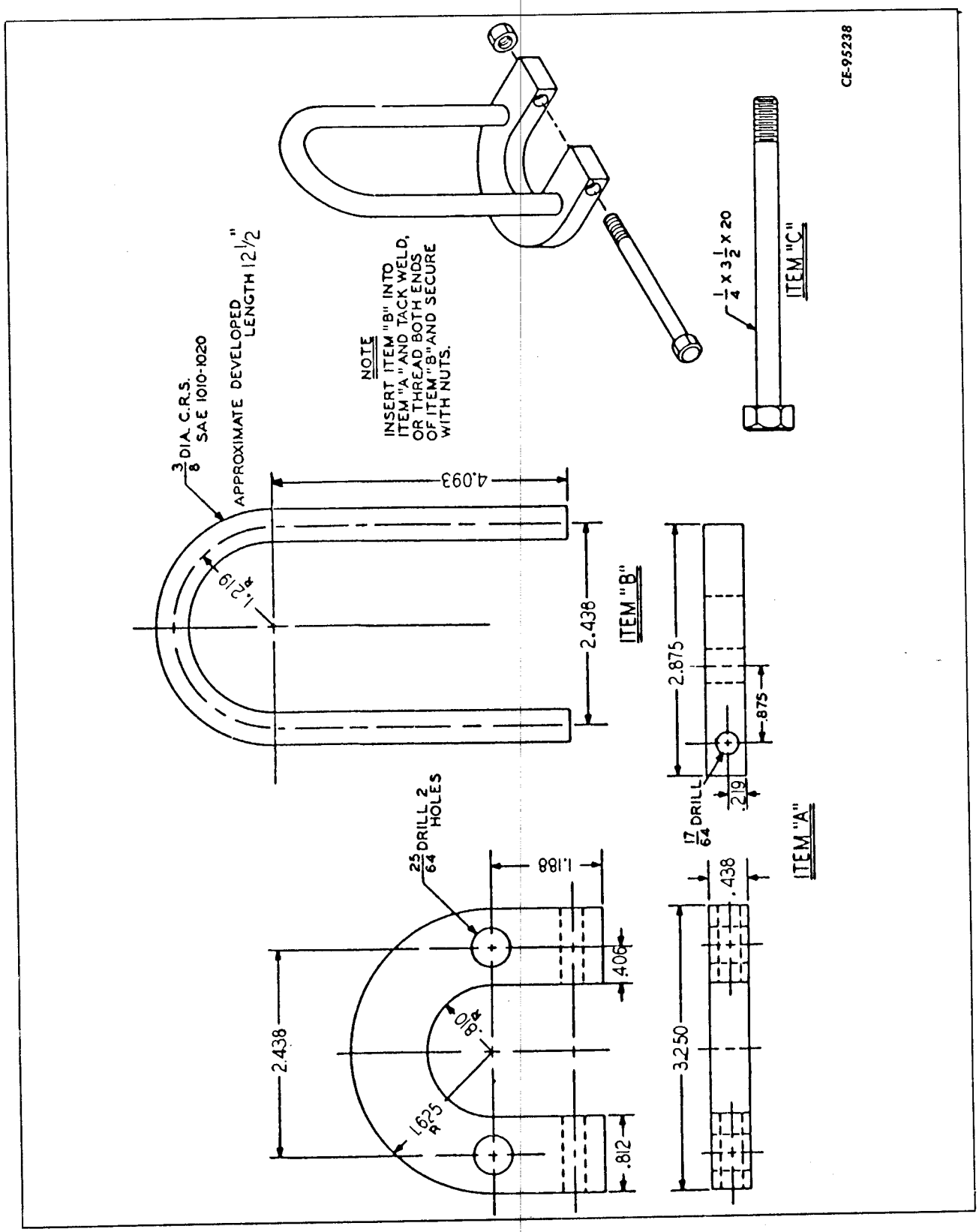

Figure 4-137
Clutch Lifting Tool.

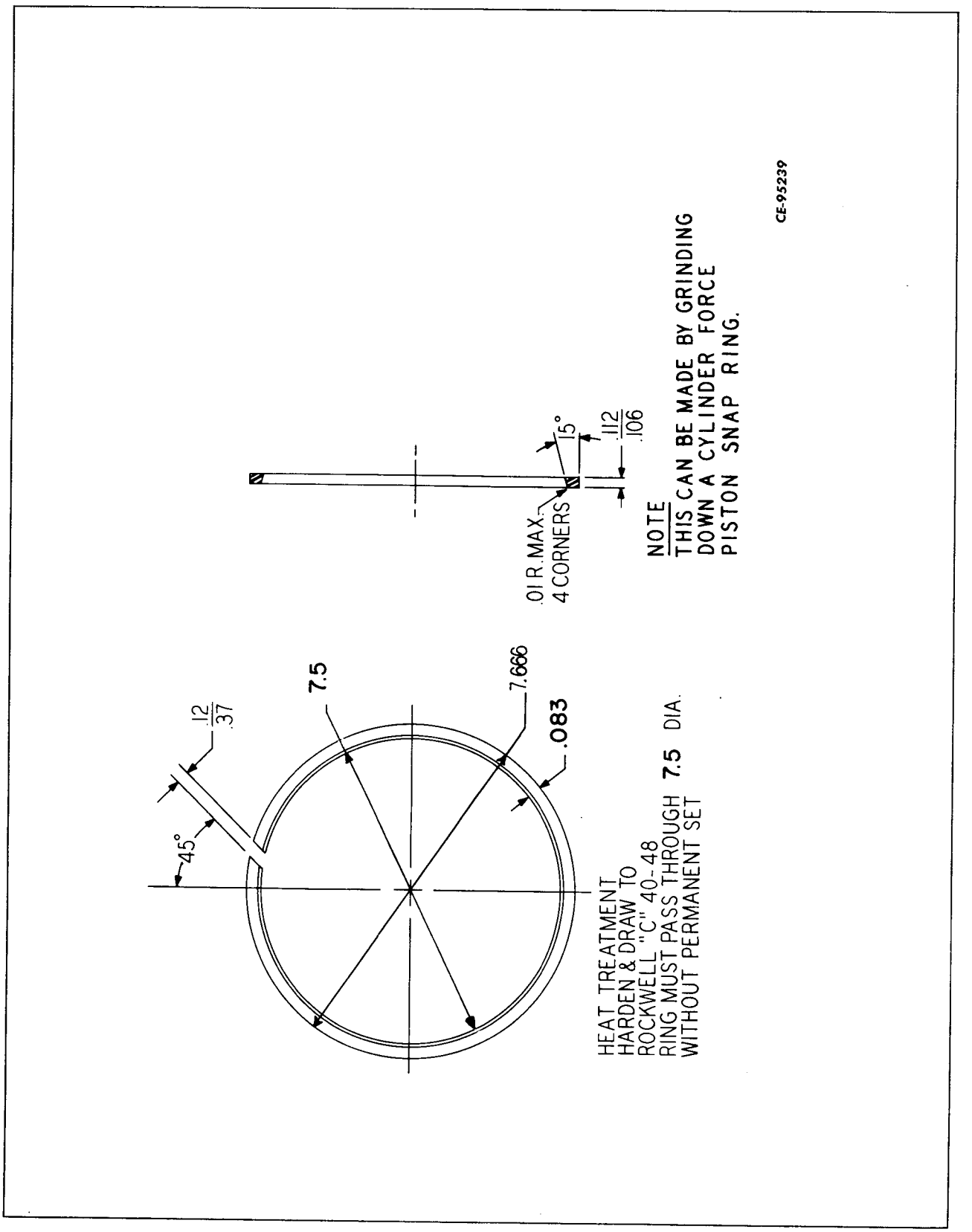

Figure 4-138
Snap Ring Groove Filler.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SECTION V

DRIVE SHAFTS

Page

SECTION V DRIVE SHAFTS

DRIVE SHAFTS

DESCRIPTION

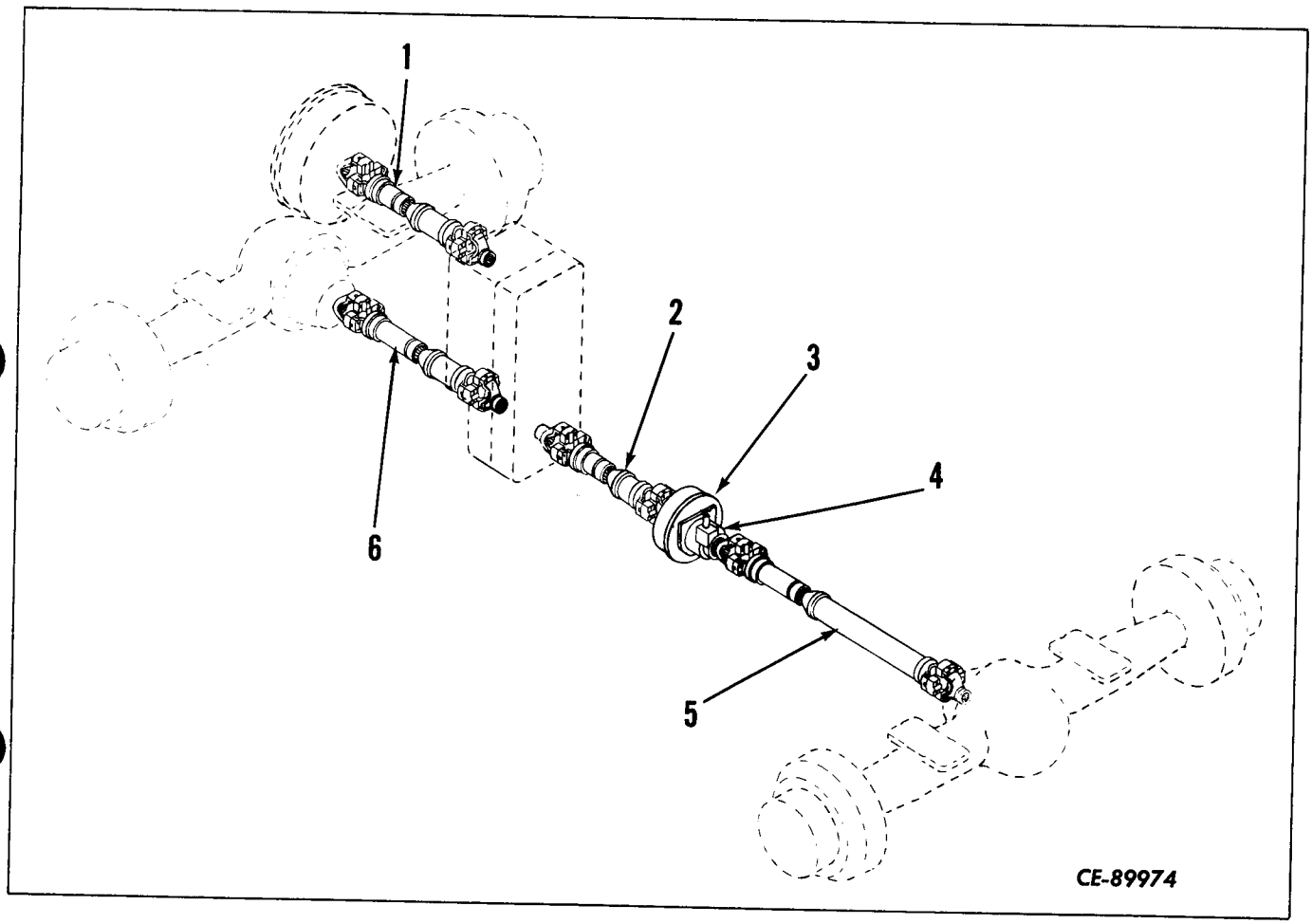

Figure 5-1
Drive Shafts.

1. Drive shaft, torque converter to transmission.
2. Drive shaft, transmission to transfer drive.
3. Parking brake assembly.
4. Transfer drive assembly.
5. Drive shaft, transfer drive to front differential.
6. Drive shaft, transmission to rear differential.

DRIVE SHAFTS

DESCRIPTION

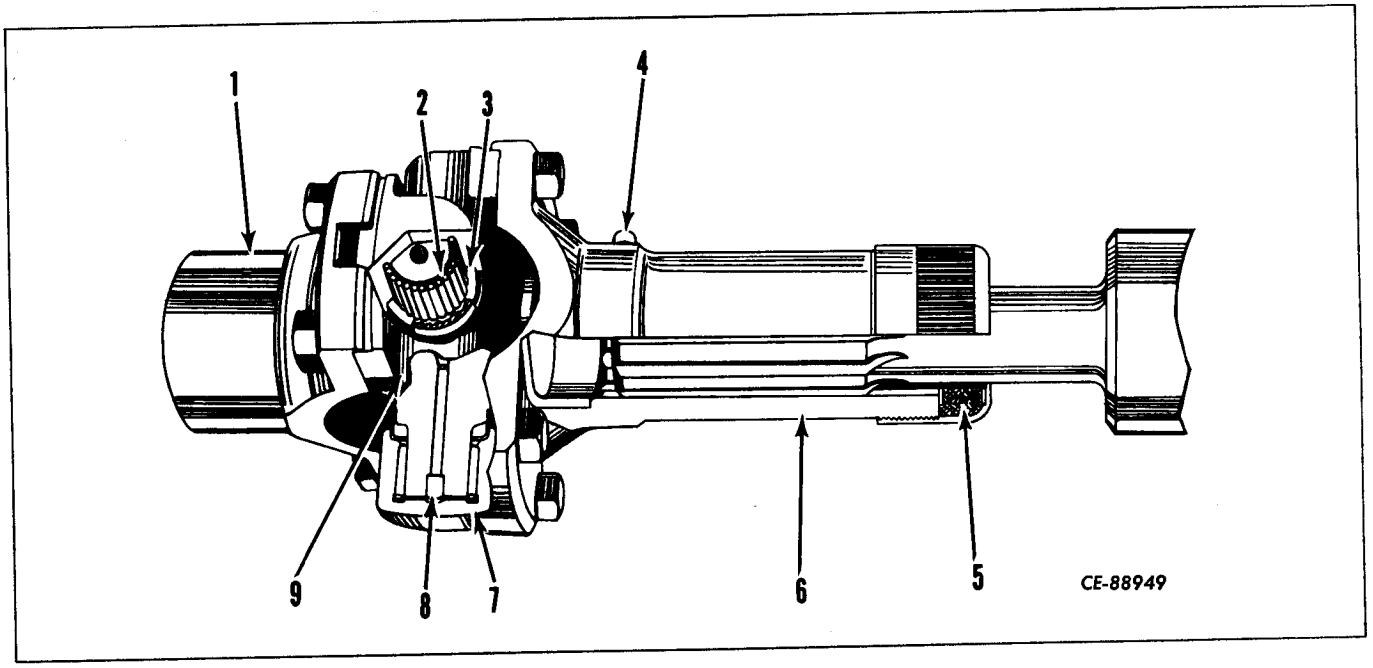

Figure 5-2
Universal Joint.

1. Yoke.
2. Roller bearing.
3. Grease seal.
4. Grease fitting.
5. Grease seal.
6. Slip yoke.
7. Bearing cap.
8. Lube channel.
9. Spider.

DRIVE SHAFTS

The purpose of the drive shafts is to transmit power. All the drive shafts on the tractor are similar in construction. (Fig. 5-2.) There is a universal joint located at each end of the shaft to permit pivoting in all directions and accommodate any misalignment. A slip joint is provided to allow the shaft to telescope, to compensate for changes in the distance between the connected components. During normal operation, the rear axle undergoes considerable axial movement due to surface irregularities and varying axle loads. Each time these conditions are encountered, a proportional change in the overall length of the drive shaft occurs. The slip joint accommodates these variations by telescoping. This eliminates the forces of tension that would be present in a shaft not so equipped.

TRANSFER DRIVE

The transfer drive (Fig. 5-3) transmits power from the transmission to the front differential across the tractor articulation point. The transfer drive consists of a shaft supported by two roller bearing assemblies, held in a lubricant filled housing. A yoke is attached to each end of the shaft. The parking brake assembly is mounted to the rear side of the transfer drive.

DESCRIPTION

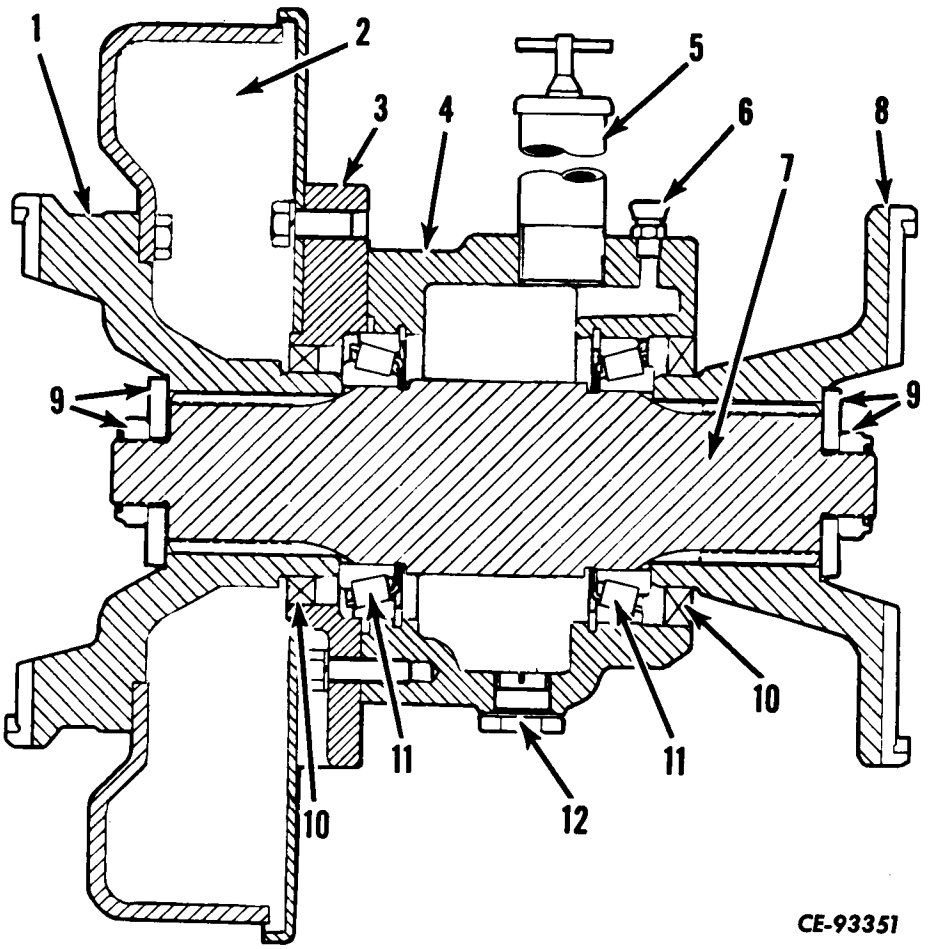

Figure 5-3
Transfer Drive.

1. Rear yoke.
2. Parking brake assembly.
3. Cover.
4. Housing.
5. Dipstick and filler tube.
6. Breather.
7. Shaft.
8. Front yoke.
9. Elastic stop nut and washer.
10. Seal.
11. Bearing.
12. Drain plug.

PREVENTIVE MAINTENANCE

The drive line components on the tractor are subject to constant strain during operation. It is important, therefore, that they be properly maintained. Listed below are recommended maintenance procedures.

DRIVE SHAFTS

After every 100 hours of tractor operation and after overhaul, apply the proper lubricant to all drive shaft universal joints and slip joints (Fig. 5-4). Refer to "SPECIFICATIONS" for type of lubricant.

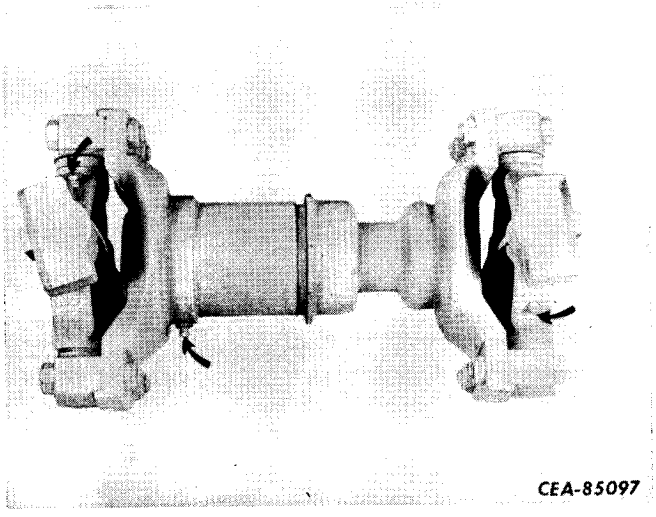

Figure 5-4

TRANSFER DRIVE

LEVEL CHECK - Every 100 hours of tractor operation, check the oil level in the transfer drive housing. Remove the filler tube cap (Fig. 5-5) and check the oil level. The level should be kept at the full mark at all times. Should make-up fluid be needed, add the type oil recommended in "SPECIFICATIONS."

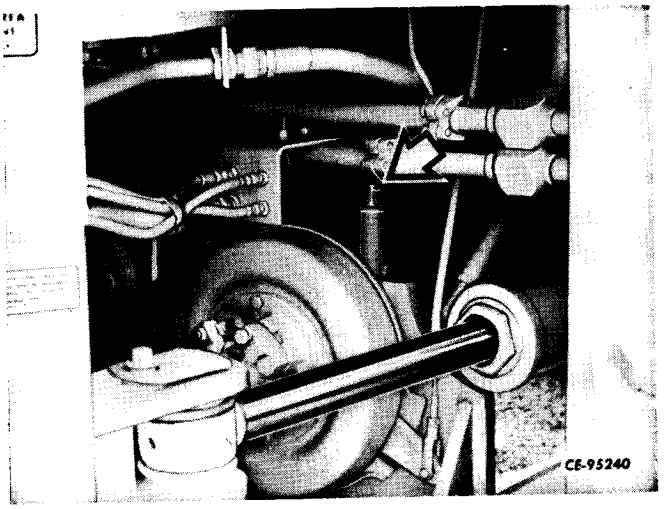

Figure 5-5

OIL CHANGE - Every 1000 hours of tractor operation, the transfer drive should be drained and refilled with fresh oil. Remove the filler tube cap (5, Fig. 5-3) and the drain plug (12). After all the oil has drained, replace the drain plug and fill the housing to the full mark on the dipstick, with the type lubricant recommended in "SPECIFICATIONS."

DISASSEMBLY, INSPECTION AND ASSEMBLY

DRIVE SHAFTS

GENERAL

All drive shafts on the tractor are similar and are serviced in the same manner.

Prepare the tractor for removal of the drive shafts as follows:

a. Park the tractor on a level surface.

b. Lower the bucket to ground level.

c. Securely block the tractor wheels to prevent the tractor from rolling.

REMOVAL

Remove the cap screws (1, Fig. 5-6) and locknuts (2) from each end of the drive shaft. Using a small pry bar, apply leverage to telescope the slip yoke (4) inward. Remove the drive shaft from the tractor.

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DISASSEMBLY, INSPECTION AND ASSEMBLY

NOTE: The bearing caps (3) may stick in the grooves in the yoke. Tap them at an angle with a soft hammer to unseat.

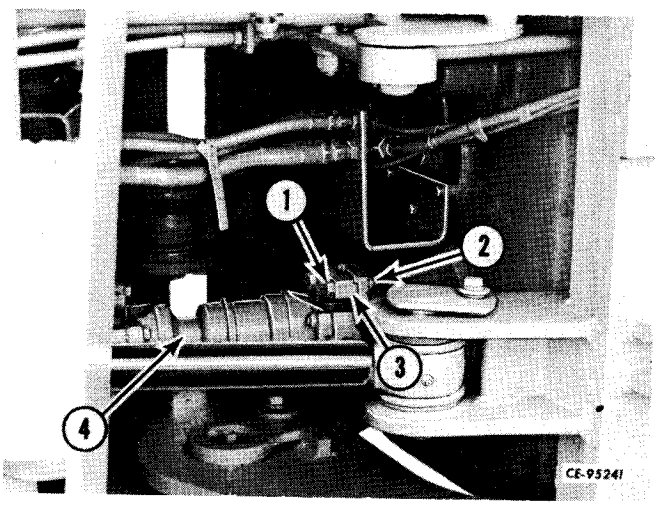

Figure 5-6

DISASSEMBLY

Place the drive shaft on a clean work bench.

Remove the cap screws (1, Fig. 5-7) and locknuts (2) that secure the spider and bearing assembly (3) to the yoke (4).

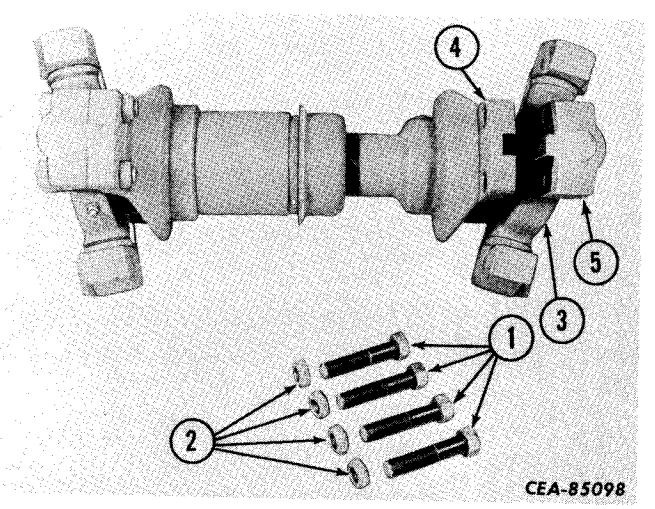

Figure 5-7

NOTE: The bearing caps (5) may stick in the grooves in the yoke. Tap them at an angle with a soft hammer to unseat.

Cut the strap (1, Fig. 5-8) that holds the bearing assemblies (2) on the spider (3). Remove the grease seals (4) and bearing assemblies from the spider.

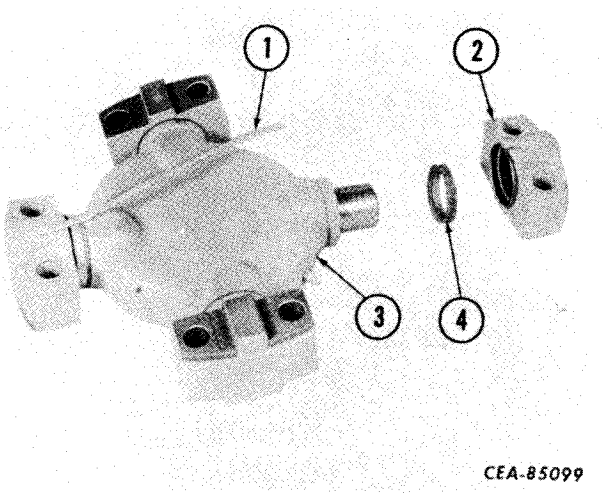

Figure 5-8

Punch mark the slip yoke (1, Fig. 5-9) and splined shaft (2) so they will be reassembled in the same alignment.

(Continued on next page)

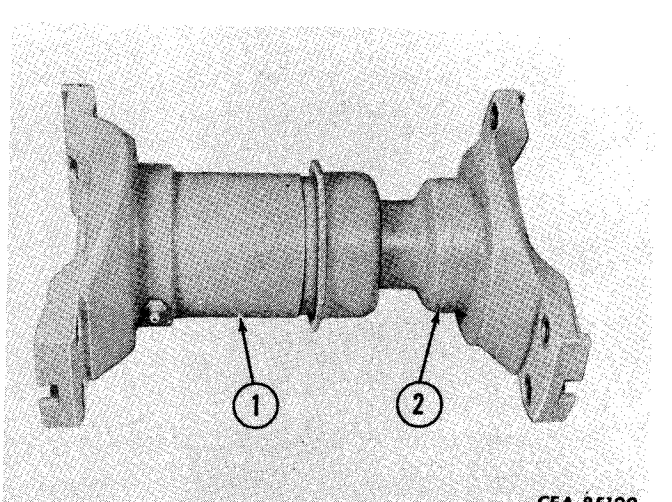

Figure 5-9

DISASSEMBLY, INSPECTION AND ASSEMBLY

DRIVE SHAFTS - Continued

DISASSEMBLY - Continued

Unscrew the packing retainer (1, Fig. 5-10) and slide it back on the splined shaft. Remove the slip yoke (4), packing retainer washers (2) and packing (3).

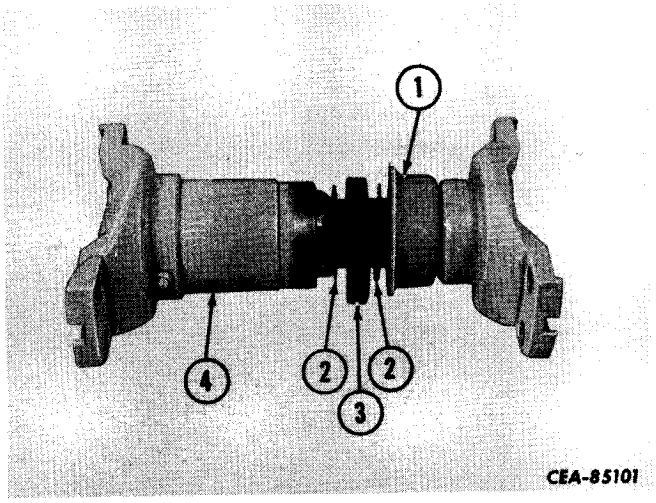

Figure 5-10

INSPECTION

Clean all parts in solvent. Remove all burrs and rough spots from the yoke flanges and from slip joint splines. Use a fine tooth file or an India stone. Do not disassemble the bearing assemblies. Clean them with a brush and dry with compressed air.

Inspect the drive shaft for signs of torsional fractures or other indications of impending failure.

Parts that are to be assembled immediately should be coated with light oil to prevent corrosion. If parts are to be stored, coat them with a good grade rust preventive, and wrap them in paper treated to prevent corrosion.

Replace all seals and packings.

Place the bearing assemblies on the spider and check for wear. If they are worn, replace the complete spider and bearing assembly.

ASSEMBLY

Place the packing retainer (1, Fig. 5-11), packing (3), and packing retainer washers (2) on the splined shaft (4) as shown. Use a new packing. Coat the shaft splines liberally with chassis grease.

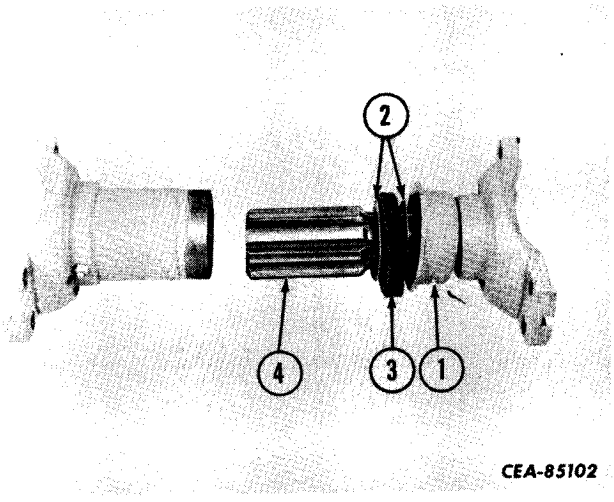

Figure 5-11

Slide the slip yoke (2, Fig. 5-12) onto the splined shaft (1) aligning the punch marks made at disassembly. Screw the packing retainer (3) onto the slip yoke and tighten it enough to avoid leakage when the shaft is greased.

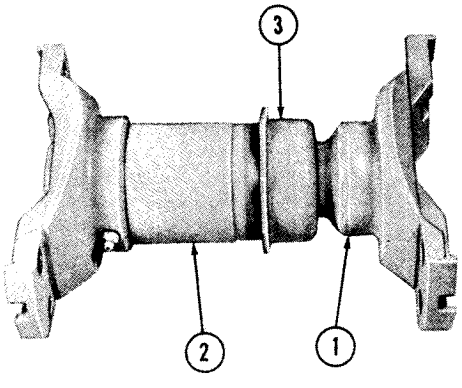

Figure 5-12

DISASSEMBLY, INSPECTION AND ASSEMBLY

Install two opposite bearing assemblies (1, Fig. 5-13) on the spider (2). Install the spider assembly in the yoke by inserting the lug on the bearing cap into the groove in the yoke (3) as shown. Tap the opposite bearing cap at an angle to seat the spider and bearing assembly.

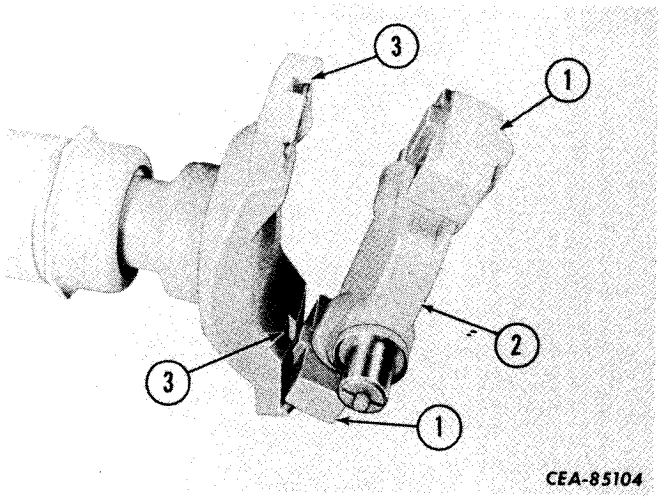

Figure 5-13

Install the cap screws (1, Fig. 5-14) and locknuts (2) in the bearing caps (3). Torque the cap screws and locknuts. Refer to "SPECIAL TORQUES" in this section.

NOTE: Use new locknuts (2) when assembling drive shaft.

Torque: _____

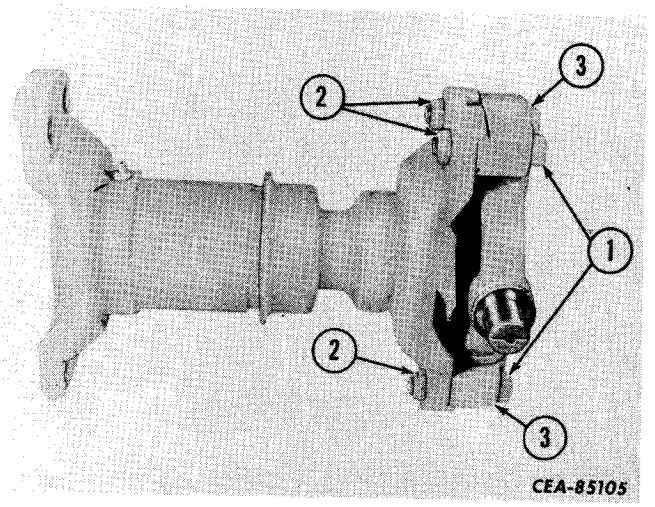

Figure 5-14

Install the other two bearing assemblies on the spider and wire as shown. This will hold the bearing caps on the spider while the drive shaft is being installed on the tractor, and will not interfere with the installation of the shaft (Fig. 5-15).

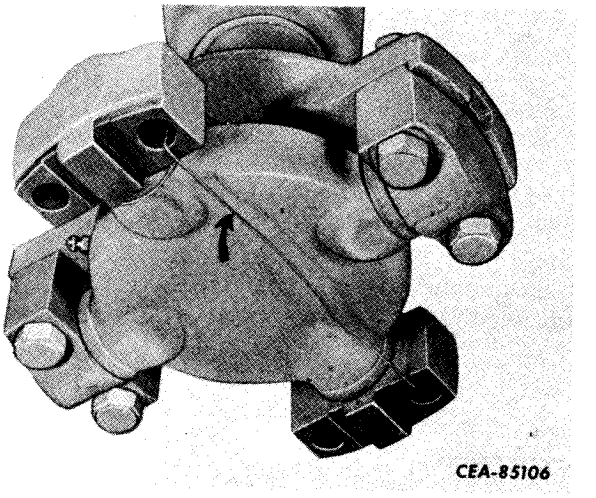

Figure 5-15

INSTALLATION

Install the drive shaft in the tractor. Be certain the slip joint end of the shaft is located as it was at removal. Fit the bearing caps securely in the grooves in the mounting yokes. Install two cap screws (1, Fig. 5-16) and nuts (2) in the bearing

(Continued on next page)

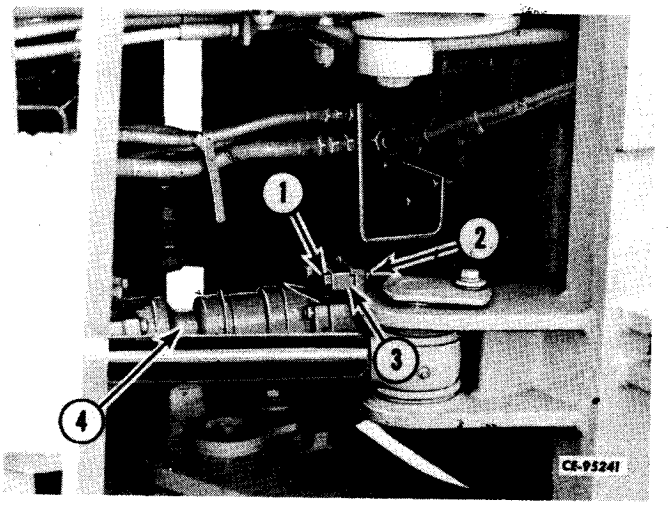

Figure 5-16

DRIVE SHAFTS - Continued

INSTALLATION - Continued

cap holes that are not wired. Tighten them just enough to hold the caps in place. Remove the wire from the other two holes and install the cap screws and locknuts.

NOTE: Use new locknuts (2) when assembling drive shaft.

Torque the cap screws and locknuts. Refer to "SPECIAL TORQUES" in this section. Remove the pipe plug from the slip yoke and apply the type grease specified in "SPECIFICATIONS." Install the pipe plug. Apply grease to the universal joint fittings at each end of the shaft.

Torque: _____

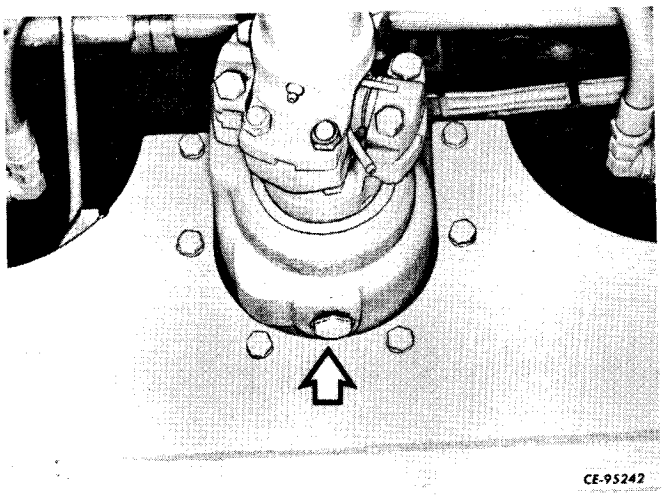

Figure 5-17

TRANSFER DRIVE

GENERAL

Prepare the tractor for removal of the transfer drive as follows:

a. Park the tractor on a level surface.

b. Install the safety pins to lock the tractor halves in a full turn position. Refer to the tractor operator's manual for safety pin installation instructions.

c. Block the tractor wheels to prevent the tractor from rolling.

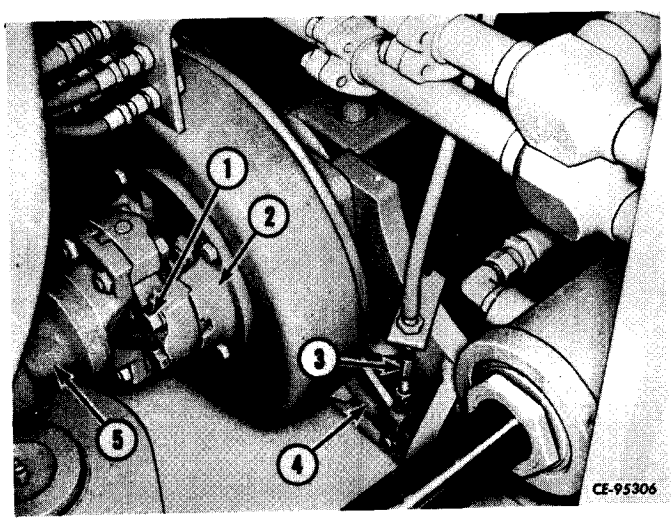

Figure 5-18

REMOVAL

Remove the dipstick (Fig. 5-6) and drain plug (Fig. 5-17) from the transfer drive housing. Allow all the oil to drain from the housing. Replace the dipstick and drain plug.

Remove the cap screws (1, Fig. 5-18) that secure the drive shafts (5) to the transfer drive yokes (2). Remove the drive shafts from the yokes.

Disconnect the parking brake linkage (3) from the operating cam lever (4).

Remove the cap screws (3, Fig. 5-19) and lock washers that secure the transfer drive (1) to the

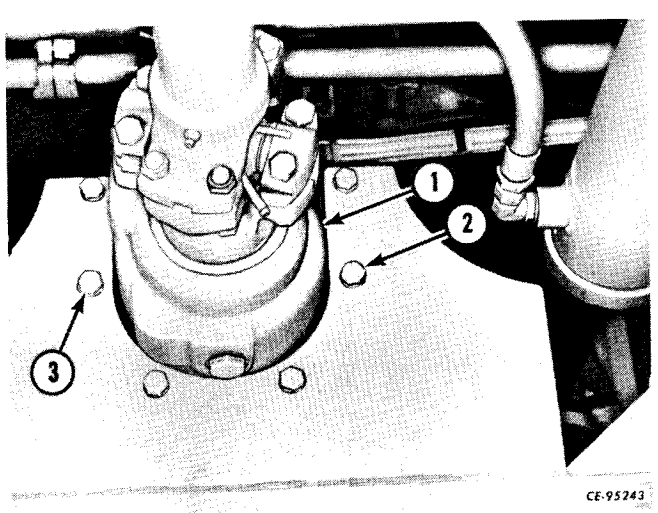

Figure 5-19

front frame. Remove the transfer drive from the rear side of the frame crossmember to which it mounts.

DISASSEMBLY

Place the transfer drive on a clean work bench for disassembly.

Remove the locknut (1, Fig. 5-20), retainer (2), and seal washer (3, where used) that secure the yoke and drum assembly (4) to the shaft (5).

Remove the yoke and drum assembly.

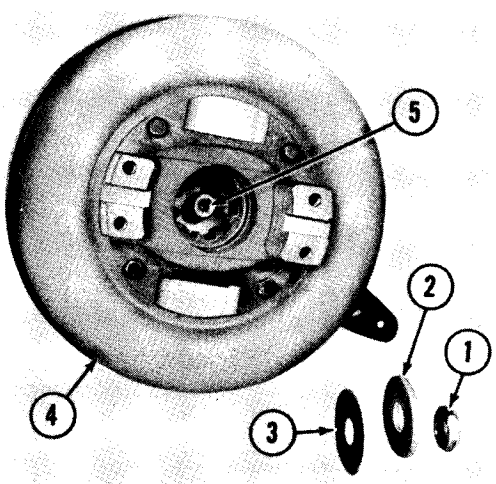

Figure 5-20

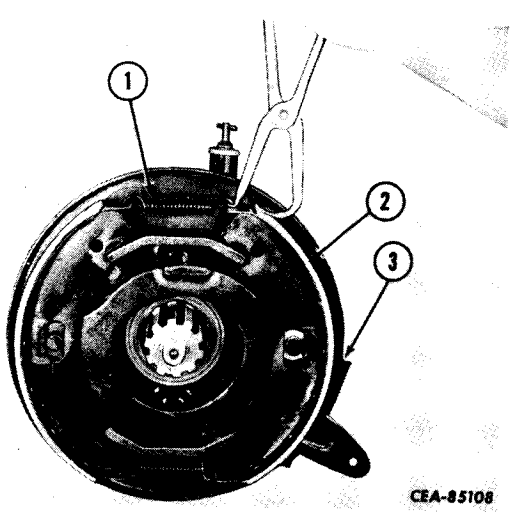

Figure 5-21

Using a brake spring pliers, remove the brake springs (1, Fig. 5-21) from the brake shoes (2) as shown.

Remove the brake shoes from the backing plate (3).

Remove the operating cam lever (2, Fig. 5-22 and the roller (1) from the pawls (3) on the backing plate.

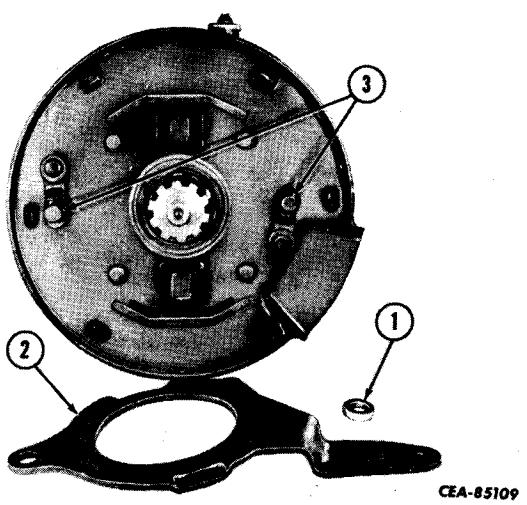

Figure 5-22

Remove the cap screws and lock washers (1, Fig. 5-23) that secure the backing plate (2) to the transfer drive housing.

(Continued on next page)

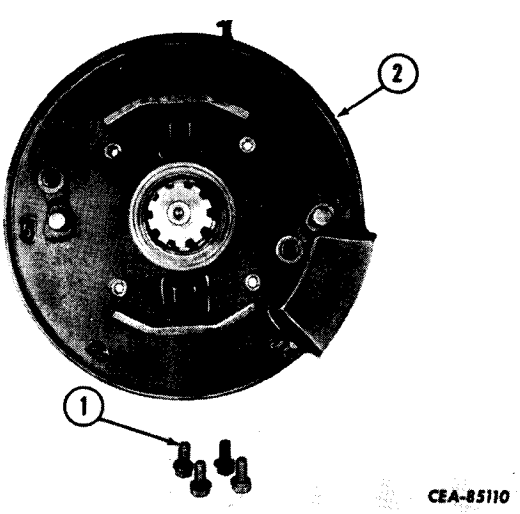

Figure 5-23

DISASSEMBLY, INSPECTION AND ASSEMBLY

TRANSFER DRIVE - Continued

DISASSEMBLY - Continued

Remove the locknut (1, Fig. 5-24), retainer (2), and seal washer (3) that secure the output yoke (4) to the shaft (5). Remove the yoke.

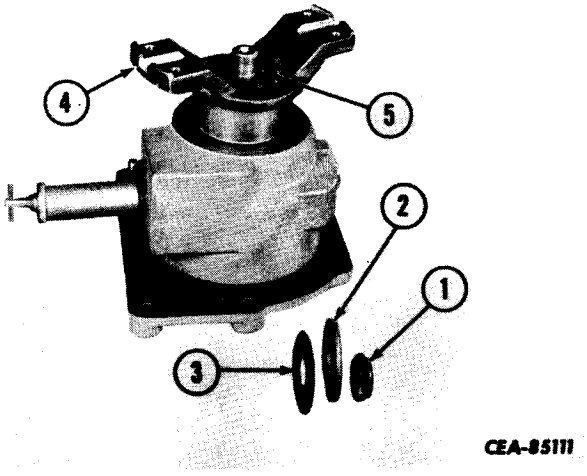

Figure 5-24

Remove the drain plug (1, Fig. 5-25) from the housing.

Remove the cap screws (2) that secure the cover (3) to the housing (4). Remove the cover and the cover "O"-ring.

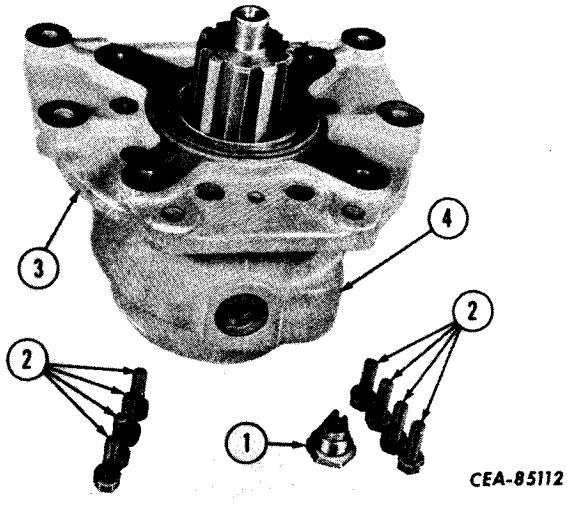

Figure 5-25

Press the oil seal (1, Fig. 5-26) out of the cover (2). Discard the oil seal.

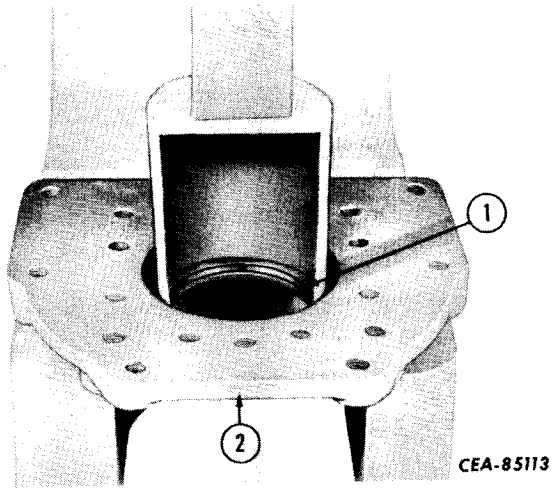

Figure 5-26

Using a suitable tool, press the shaft (1, Fig. 5-27) out of the housing (2). Press on the output end of the shaft.

NOTE: Do not press on threaded end of shaft. Use a suitable sleeve.

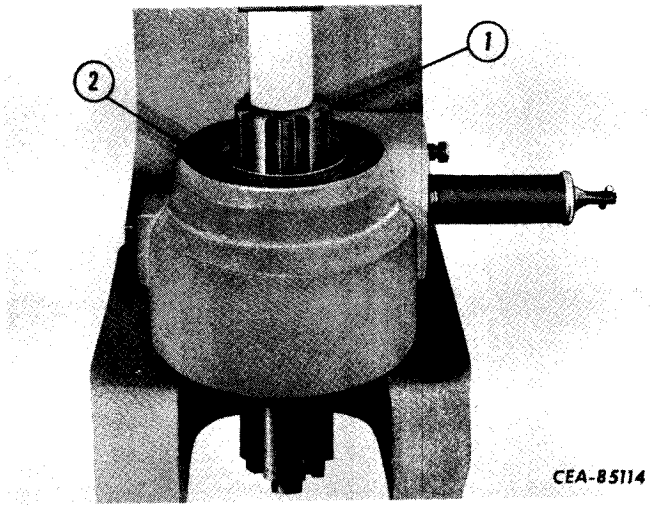

Figure 5-27

DISASSEMBLY, INSPECTION AND ASSEMBLY

The bearing cone (1, Fig. 5-28) will come out with the shaft.

If replacement is required, use a flat head drift to drive bearing cup (2) from housing.

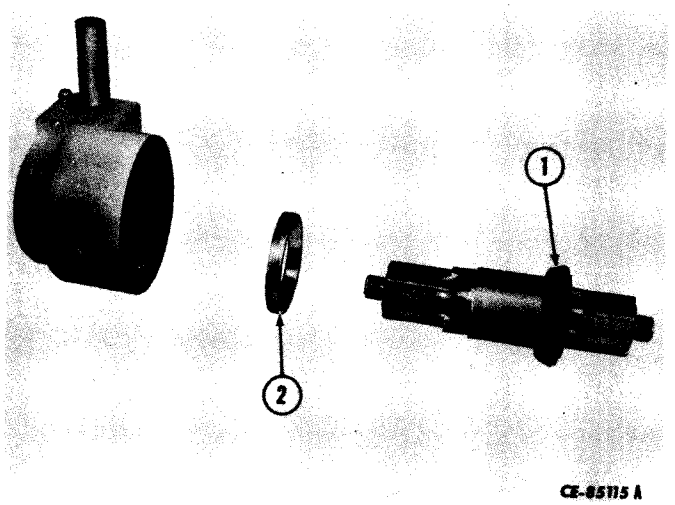

Figure 5-28

Press the shaft (1, Fig. 5-29) out of the bearing cone (2) as shown.

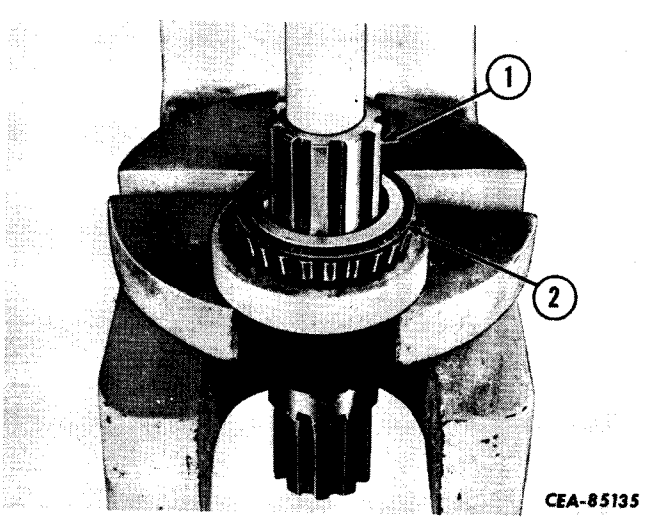

Figure 5-29

Using a flat head drift, drive the oil seal (1, Fig. 5-30), bearing cone (2), and bearing cup (3) out of the housing output end (5). Discard the oil seal.

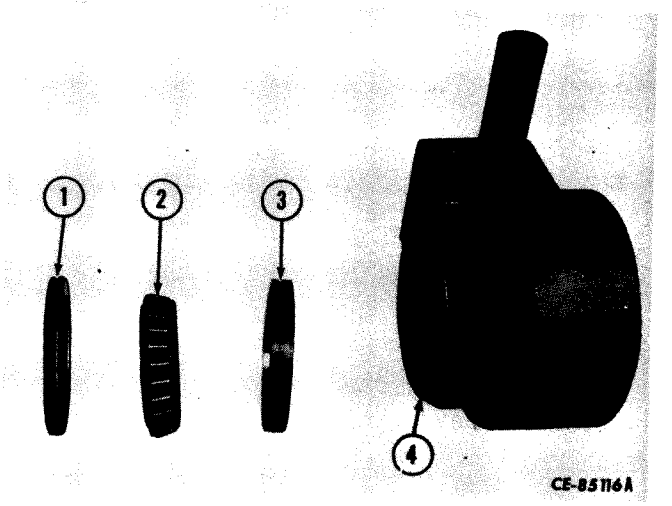

Figure 5-30

Remove the breather (1, Fig. 5-31) and dipstick tube (2) from the housing if they are damaged.

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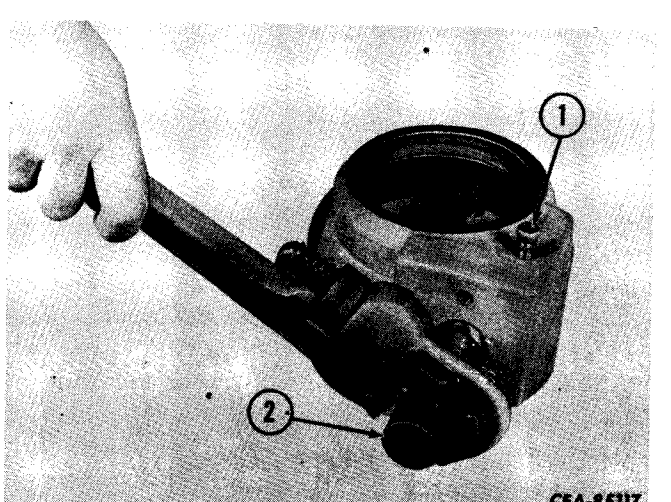

Figure 5-31

DISASSEMBLY, INSPECTION AND ASSEMBLY

TRANSFER DRIVE - Continued

INSPECTION

Clean and inspect all parts as follows:

a. Clean all parts thoroughly in solvent. Use compressed air to dry parts.

CAUTION: NEVER dry bearings by spinning with compressed air.

b. Inspect all bearing cups and cones. Check that the bearings rotate freely and smoothly. Replace any bearings that are worn or damaged in any way.

c. Inspect the transfer drive shaft for signs of wear or ridging. Replace if worn or damaged in any way.

d. Inspect the transfer drive housing for wear or damage. Replace if found defective.

e. Replace all oil seals, seal washers, and "O"-rings.

f. Parts that are to be assembled immediately should be dipped in light oil to prevent corrosion. If any parts are to be stored for any length of time, they should be coated with a good grade rust preventive and wrapped in paper treated to prevent corrosion.

NOTE: Special Torque, Pressure, etc. recommendations are listed under "SERVICE INFORMATION". This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil, and revised when necessary.

ASSEMBLY

Coat the threads on the breather and the dipstick tube with Mar-Seal or a comparable sealant and install them in the housing.

Using a suitable tool, press the output end bearing cup (3, Fig. 5-32) into the housing as shown. Press until the cup bottoms securely against housing shoulders.

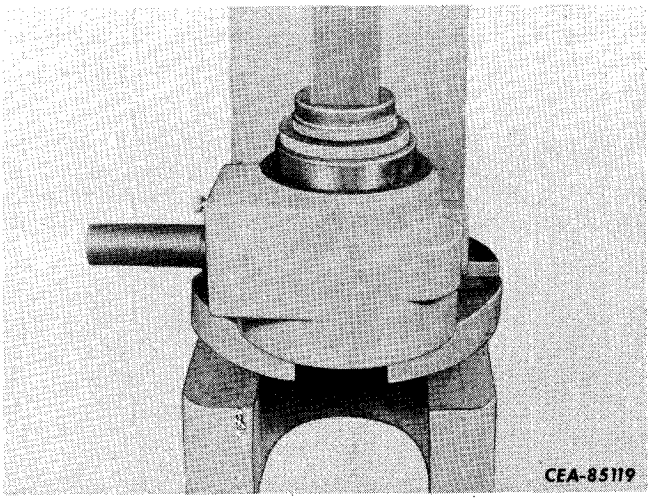

Figure 5-32

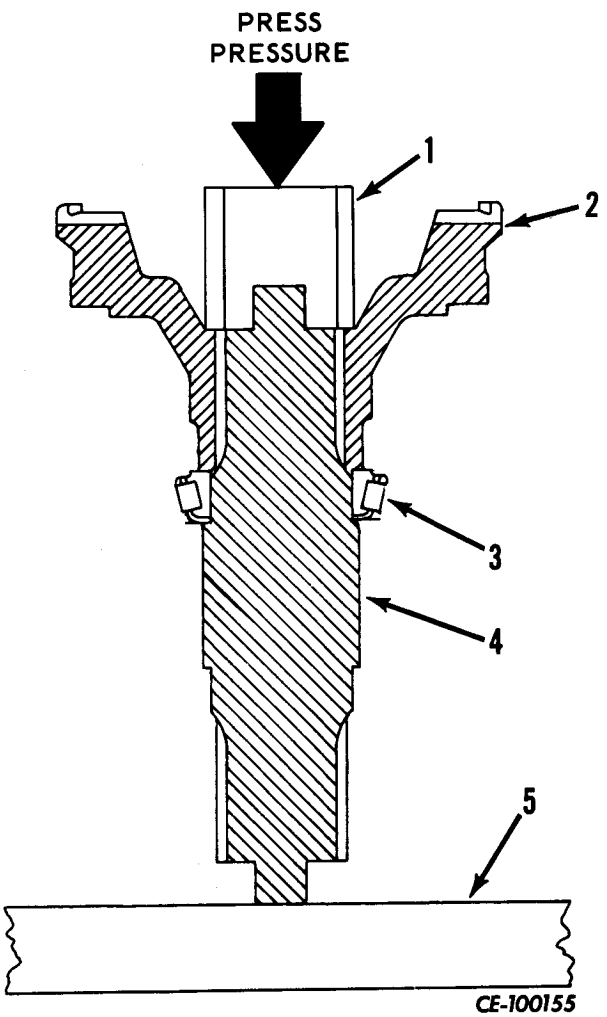

Figure 5-33

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DISASSEMBLY, INSPECTION AND ASSEMBLY

TRANSFER DRIVE - Continued

ASSEMBLY - Continued

Position transfer drive shaft (4, Fig. 5-33) in an arbor press, input side up. Position bearing (3) on shaft. Install output yoke (2).

NOTE: For ease in handling the use of the output yoke is recommended when pressing bearing on shaft.

Using a suitable sleeve (1) press bearing on shaft. Continue press pressure until yokes bottom on end of splines. Bearing (3) is now correctly positioned on shaft. Remove yoke (2) from shaft.

Install shaft and bearing assembly in drive housing.

Coat the O. D. of a new oil seal (1, Fig. 5-34) with Mar-Seal or a comparable sealant and press seal (1) into outside face of cover (2). Spring loaded lip of seal must face in toward center of housing. Press until seal is flush with face of cover.

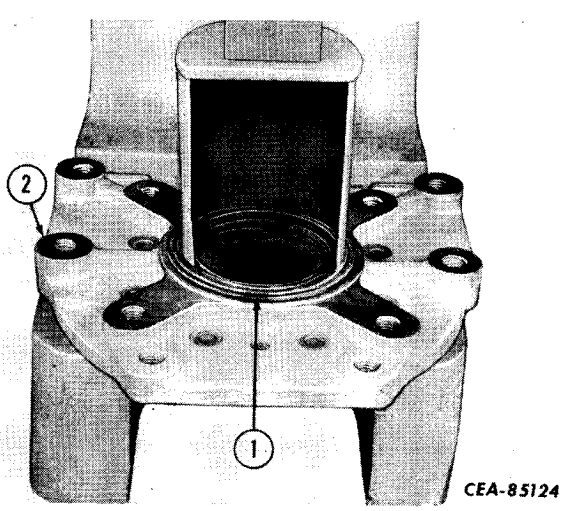

Figure 5-34

Place a new cover "O"-ring in the groove in the housing.

Install the cover (3, Fig. 5-35) on the housing and secure with the cap screws (2). Torque the cap screws. Refer to "SPECIAL TORQUES" in this section.

Torque: _____

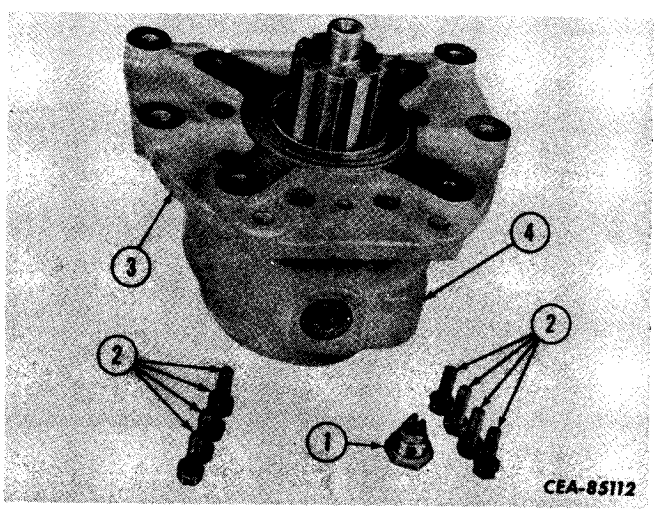

Figure 5-35

Install the parking brake backing plate (2, Fig. 5-36) on the transfer drive and secure with cap screws and lock washers (1). Torque the cap screws. Refer to "SPECIAL TORQUES" in this section.

Torque: _____

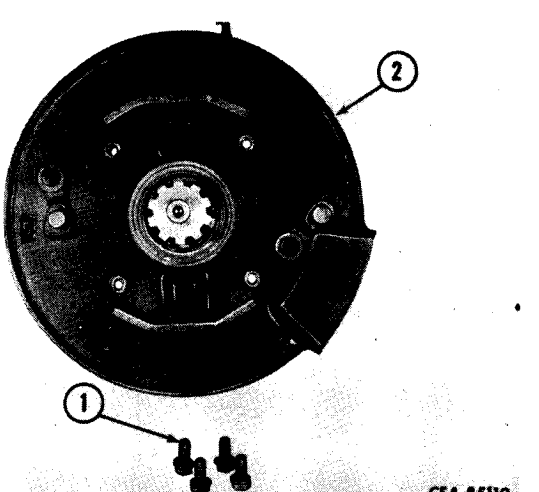

Figure 5-36

DISASSEMBLY, INSPECTION AND ASSEMBLY

TRANSFER DRIVE - Continued

ASSEMBLY - Continued

Place the roller (1, Fig. 5-37) on the pawl (3) on the backing plate. Place the operating cam lever (2) on pawl (4) and under roller (1).

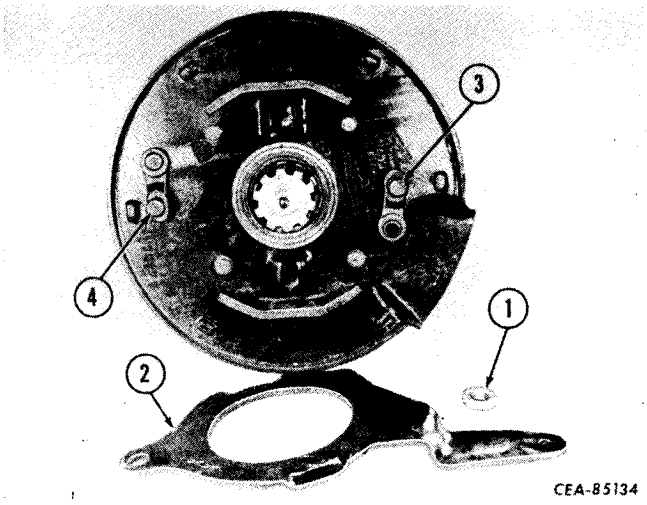

Figure 5-37

Install the brake shoes (2, Fig. 5-38) on the backing plate (3). Install the brake springs (1) with a brake spring pliers as shown. Be sure springs are installed in rear holes.

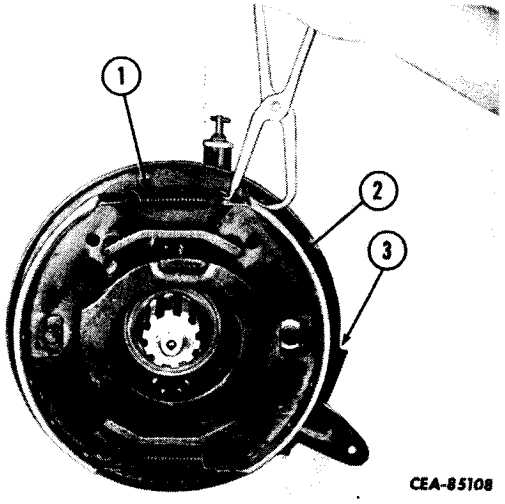

Figure 5-38

Place the yoke and drum assembly (4, Fig. 5-39) on the shaft (5) after lubricating seal lip and seal contact surface of yoke with clean, new transfer drive lubricant. Place a new seal washer (3, where used), on the shaft. Install the retainer (2) and a new locknut (1). Torque the locknut. Refer to "SPECIAL TORQUES" in this section.

Torque: _____

(Continued on next page)

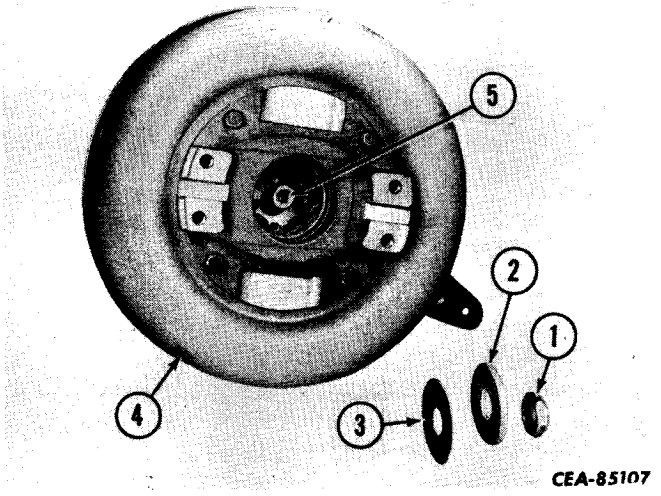

Figure 5-39

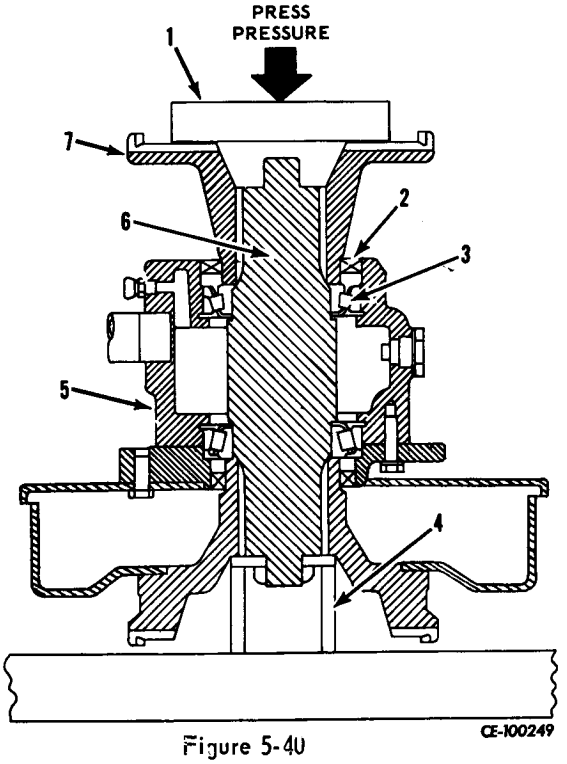

Figure 5-40

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DISASSEMBLY, INSPECTION AND ASSEMBLY

TRANSFER DRIVE - Continued

ASSEMBLY - Continued

Position transfer drive assembly, input yoke down, in arbor press (Fig. 5-40). Use a suitable spacer (4) between yoke retainer and press table. Press pressure should be on spacer, not yoke ends.

Position bearing (3) on shaft (6) and slide output yoke (7) on shaft splines. Position a suitable adapter (1) on yoke and carefully, using yoke as a driver, press bearing cone into cup.

Pressure on yoke (7) must be applied slowly and carefully. Rotate housing (5) while pressing bearing into position. As soon as bearings bind slightly during rotation, stop press pressure.

Measure distance from large diameter face of shaft (1, Fig. 5-41) to retainer contact surface (1) on yoke. This is Dimension "A".

NOTE: This measurement may be made by drilling a hole in the yoke retainer (2, Fig. 5-24) large enough to accept the shaft of a depth micrometer. Position retainer (3, Fig. 5-41) on shaft and measure distance from top of retainer to large diameter face on shaft (Dimension "B"). "Mike" the thickness of the retainer (Dimension "C") and subtract this from Dimension "B". The remainder is Dimension "A".

Dimension "A" is the thickness of the required shim pack. Add to this pack sufficient shims to produce the recommended shaft end play. (Refer to "TOLERANCES".)

End Play: _____

Install shim pack, yoke retainer and new lock nut. Tighten lock nut to recommended torque. (Refer to "SPECIAL TORQUES".)

Torque: _____

Using a new gasket, install the drain plug (1, Fig. 5-25) in the housing and tighten securely.

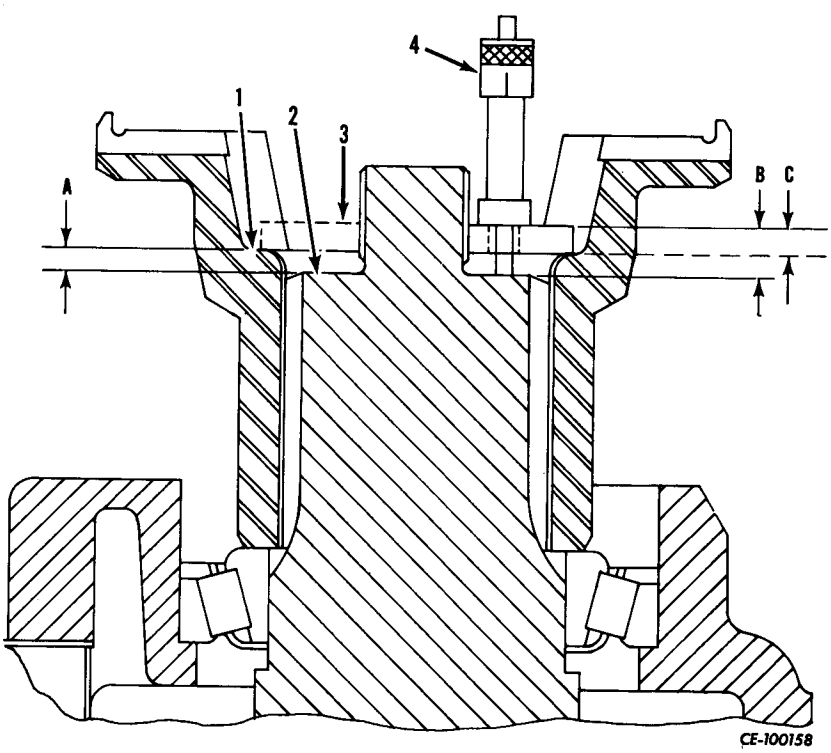

Figure 5-41

DISASSEMBLY, INSPECTION AND ASSEMBLY

TRANSFER DRIVE - Continued

INSTALLATION

Install the transfer drive in the tractor frame crossmember. Install the cap screws (3, Fig. 5-42), hose support (2), and cap screws and lock washers (1). Torque the cap screws. Refer to "SPECIAL TORQUES" in this section.

Torque: _____

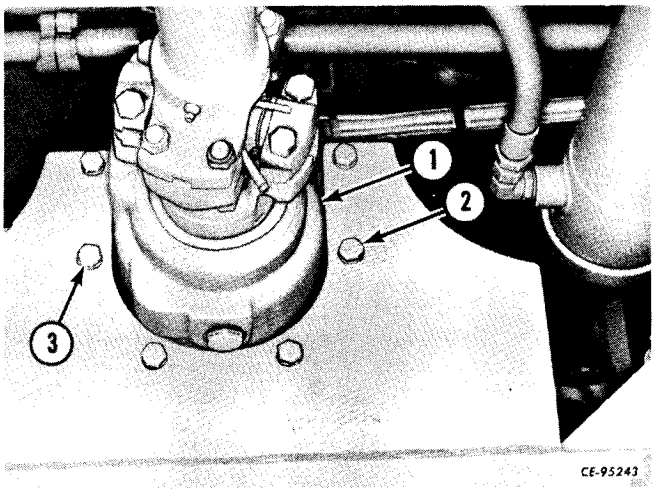

Figure 5-42

Install the drive shafts (5, Fig. 5-43) in the transfer drive yokes (2) and secure with cap screws (1). Torque the cap screws. Refer to "SPECIAL TORQUES" in this section.

Torque: _____

Attach the parking brake linkage (3) to the operating cam lever (4).

Fill the transfer drive housing to the full mark on the dipstick with the type oil recommended in "SPECIFICATIONS."

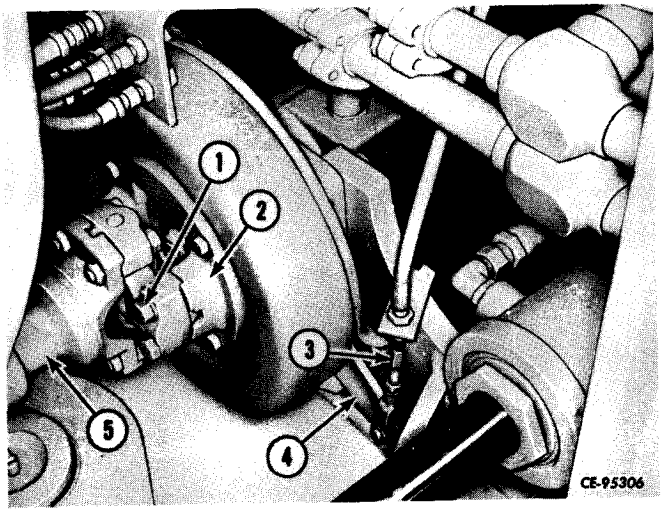

Figure 5-43

TROUBLE SHOOTING

GENERAL

Drive line failures are usually indicated by noise or vibrations. The noise or vibration may come and go as different drives are reached.

The trouble shooting chart below will help to identify and isolate the cause of trouble in the drive line components.

Inspect the areas of the tractor around the drive shafts for signs of grease that may have been thrown out by the universal joint or slip joints. If grease is found in the area of the universal joints, replace the grease seals on the spider and bearing assemblies. If grease is found in the area of the slip joint, tighten the slip joint seal retainer. If the leakage continues, replace the slip joint grease seal. Refer to "DRIVE SHAFTS" for service instructions for the drive shaft assemblies.

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TROUBLE SHOOTING

Check the drive yokes on the torque converter, transmission, transfer drive and differentials for looseness. If the yokes can be moved back and forth any appreciable amount, disconnect the drive shaft at the yoke and tighten the yoke mounting nuts or cap screws. Torque the nuts or cap screws as directed under "SPECIAL TORQUES." Before tightening the yoke, check for backlash. Backlash indicates that the yoke splines are worn and the yoke should be replaced.

Check the universal joint spider and bearing assemblies for excessive play. If excessive play is found the spider and bearing assemblies on the drive shaft should be replaced as described under "DISASSEMBLY, INSPECTION AND ASSEMBLY."

TROUBLE SHOOTING CHART

DRIVE SHAFTS

COMPLAINT	POSSIBLE CAUSE	REMEDY
Noise	1. Lack of lubricant.	1. Check grease seals in slip joints and universals.
	2. Back lash due to worn universal spider or bearings.	2. Replace spider and bearing assembly.
	3. Mounting yokes loose.	3. Tighten yoke mounting nuts or capscrews.
	4. Worn splines in drive shaft slip joints.	4. Replace drive shaft.
Vibration	1. Drive shaft sprung or bent.	1. Replace drive shaft.
	2. Universal joint bearings not seated properly.	2. Correct or replace bearing and spider.
	3. Mounting yokes loose.	3. Tighten mounting nuts or capscrews.

TRANSFER DRIVE

Noise	1. Lubricant level too low or incorrect lubricant.	1. Fill to FULL mark on dipstick with type lubricant recommended in "SPECIFICATIONS."
	2. Bearings scored or damaged.	2. Replace bearings.
Loss of Lubricant	1. Lubricant level too high.	1. Drain to correct level.
	2. Lubricant foams excessively.	2. Drain and fill with correct type lubricant. Refer to "SPECIFICATIONS."
	3. Worn or broken seals.	3. Replace seals.

SERVICE INFORMATION

SPECIFICATIONS

GENERAL

DRIVE SHAFT - TORQUE CONVERTER TO TRANSMISSION

Make	Mechanics Universal Joint Division Borg-Warner Corporation
Model	2A-13376-13
Length compressed (bearing center to bearing center)	17-1/16 in.
Length extended (bearing center to bearing center)	19-5/16 in.

DRIVE SHAFT - TRANSMISSION TO REAR DIFFERENTIAL

Make	Mechanics Universal Joint Division Borg-Warner Corporation
Model	2A-14322-14C
Length compressed (bearing center to bearing center)	19.94 in.
Length extended (bearing center to bearing center)	22.44 in.

DRIVE SHAFT - TRANSMISSION TO TRANSFER DRIVE

Make	Mechanics Universal Joint Division Borg-Warner Corporation
Model	2A-20714-1
Length compressed (bearing center to bearing center)	10-3/4 in.
Length extended (bearing center to bearing center)	12-1/8 in.

DRIVE SHAFT - TRANSFER DRIVE TO FRONT DIFFERENTIAL

Make	Mechanics Universal Joint Division Borg-Warner Corporation
Model	2A-20675-1
Length compressed (bearing center to bearing center)	18-3/4 in.
Length extended (bearing center to bearing center)	21-1/4 in.

TRANSFER DRIVE

Make	Hough Division International Harvester Co.

LUBRICANT AND CAPACITY

ITEM	TYPE LUBRICANT				CAPACITY
	I. H.	API	SAE	MILITARY SPECIFICATION	
Drive Shafts	IH 251H EP	Multi-Purpose NLGI Grade 2 Lithium base		MIL-G-10924B	AR
Transfer Drive	IH 135H EP	GL-5	90	MIL-L-2105B	1 pt.

SERVICE INFORMATION

SPECIAL TORQUES

Drive shaft mounting cap screws	
Torque converter to transmission	45-55 ft-lbs.
All others	70-80 ft-lbs.
Drive shaft mounting locknuts	30 ft-lbs.
Drive shaft spider and bearing mounting cap screws	
Torque converter to transmission	45-55 ft-lbs.
All others	70-80 ft-lbs.
Drive shaft spider and bearing mounting locknuts	30 ft-lbs.
Parking brake backing plate mounting cap screws	36 ft-lbs.
Transfer drive cover cap screws	33-37 ft-lbs.
Transfer drive mounting cap screws	80-90 ft-lbs.
Transfer drive yoke locknuts	200 ft-lbs.

TOLERANCES

Transfer drive shaft end play	.002"-.004"

DRIVE SHAFTS

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SECTION VI

SOLID AXLES

Page

SECTION VI SOLID AXLES

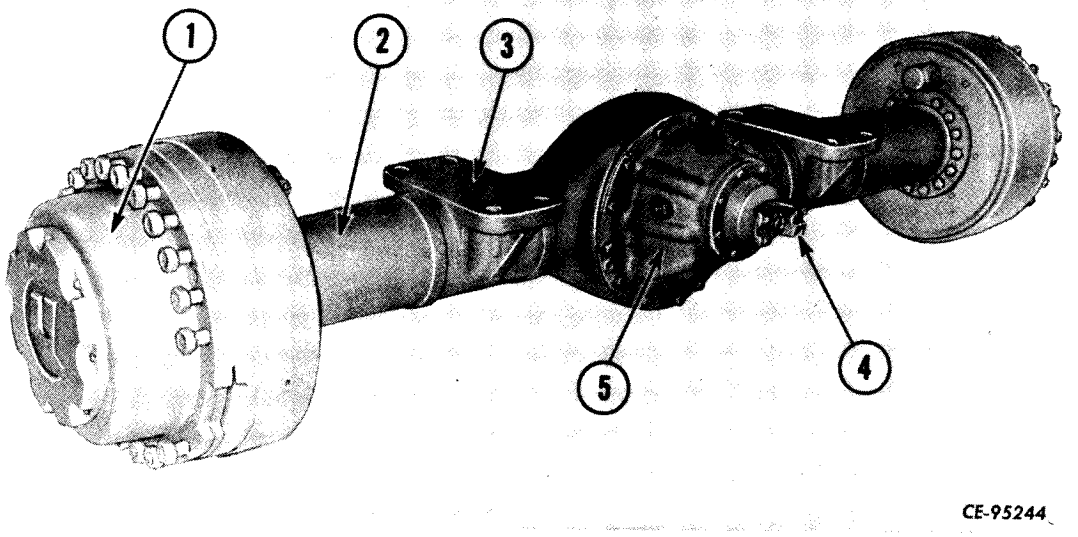

Figure 6-1
Solid Axle - Front.

1. Planetary carrier.
2. Axle housing.
3. Mounting pad.
4. Input yoke.
5. Differential assembly.

DESCRIPTION

The axle assemblies accomplish three main functions; transmit the out-going twisting force (torque) at 90° to the left and right of its input direction, increase the input torque through reduction gearing, and provide a means of securing the wheels and at the same time support the tractor. To each of these main functions several secondary requirements are added suggesting a complex piece of machinery. In reality, each axle uses a minimum of parts to carry out its many functions. Simplicity of design increases reliability and provides easy servicing.

Both axles are full floating, double reduction type. The axles are rigidly attached to their supporting members; the front main frame in the case of the front axle and an oscillating cradle called a bolster for the rear. By allowing the rear axle to oscillate, the tractor is assured great stability in rough terrain.

The first gear reduction takes place in the differential; the second in the planetaries. Each wheel revolves on two tapered roller bearings mounted on the axle spindle. The axles are full floating in that none of the weight is supported by, or transmitted to, the axle shafts. All weight on the axle is supported by the wheels, bearings and axle housing.

All components of the axle assemblies are identical with the exception of the housings. The front axle assembly employs a one piece, welded axle housing. The rear uses a three piece housing; two outer axle housings, flange bolted to a center axle bowl. Should necessity require the removal of both axle assemblies, they must be installed in their original positions; the welded one piece housing in the front and the bolted three piece axle in the rear.

The differential assemblies are rigidly mounted; one on the forward side of the rear axle housing and one on the rear side of the front axle housing. The differentials are connected by splined yokes to the yokes on the propeller shafts from the transmission.

The basic differential consists of a hypoid ring gear, pinion gear and spider gear assembly. The differential and spider gear assembly rotate on tapered roller bearings. The pinion is straddle

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GENERAL INFORMATION

DESCRIPTION - Continued

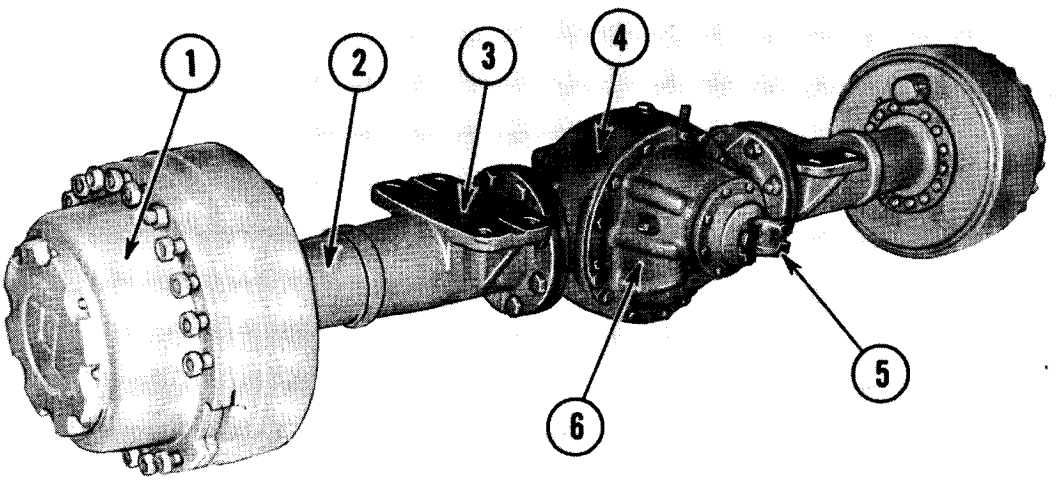

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Figure 6-2
Solid Axle - Rear.

1. Planetary carrier.
2. Axle housing.
3. Mounting pad.
4. Axle bowl.
5. Input yoke.
6. Differential assembly.

mounted, having two tapered roller bearings in front of the pinion teeth to take the forward and reverse thrust and a straight roller bearing behind the pinion teeth to carry the radial load.

Three functions of the differential are: transmitting torque from the propeller shaft to the axle shafts; producing the first torque multiplication in the double reduction axles, and allowing one drive wheel to rotate at a different speed than opposite wheel.

PREVENTIVE MAINTENANCE

LUBRICANT

Quantities and recommended lubricant are listed under "SERVICE INFORMATION" in this section.

OIL CHANGE INTERVALS

Axle lubricant should be changed at regular intervals of 1000 hours. Drain while assembly is warm to allow contaminates to flow out with the draining lubricant. Refill the assembly with the specified lubricant. Check the lubricant level after each 100 hours of operation.

LEVEL CHECK

Check the level of the lubricant in the differentials at the oil level plug (1, Fig. 6-4 and 6-5).

(Continued on page 4)

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GENERAL INFORMATION

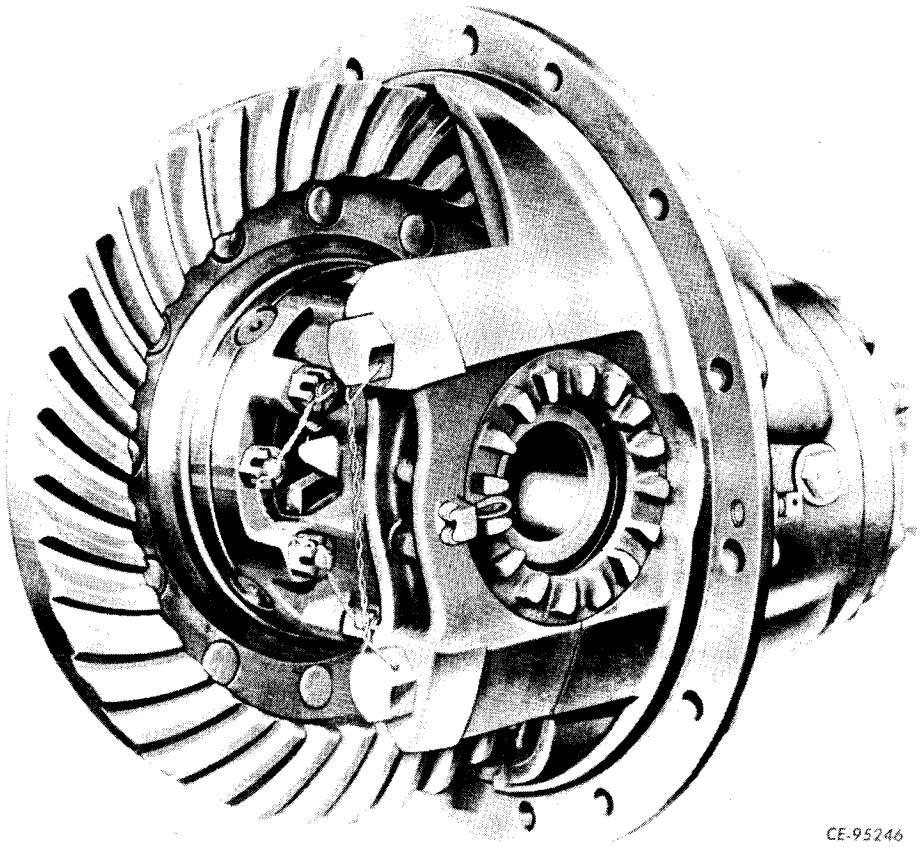

Figure 6-3
Differential Assembly.

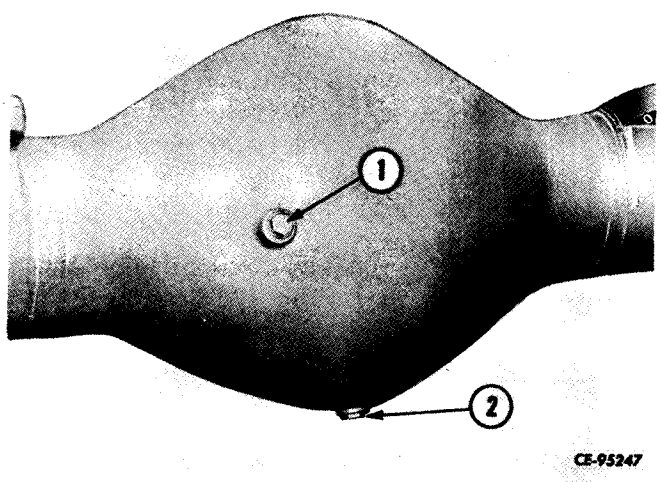

Figure 6-4
Lubricant Plugs - Front Axle.

1. Level plug.
2. Drain plug.

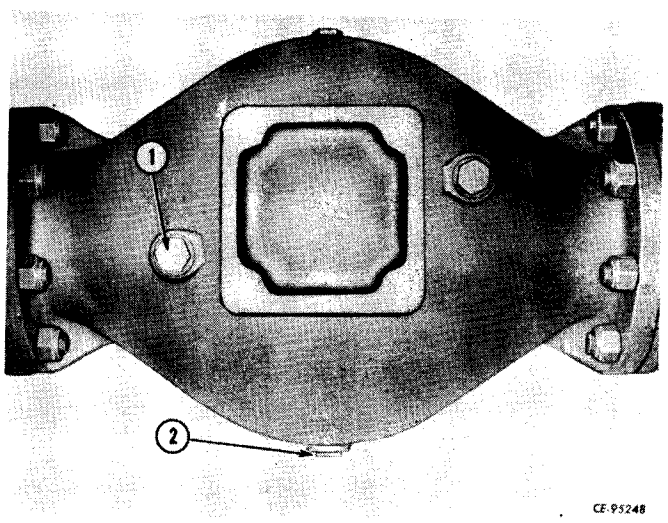

Figure 6-5
Lubricant Plugs - Rear Axle.

1. Level plug.
2. Drain plug.

GENERAL INFORMATION

PREVENTIVE MAINTENANCE - Continued

LEVEL CHECK - Continued

The lubricant should be even with the level of the plug hole.

NOTE: Be sure the machine is on level ground before checking the lubricant level.

Prior to checking the level of the lubricant in each planetary hub, rotate the wheel until the "Oil Level" mark on the planetary cover is horizontal and below the centerline of the wheel and hub assembly. The lubricant should be even with the level of the plug hole (1, Fig. 6-6).

BRAKE ADJUSTMENT

Refer to Section 13, "BRAKE SYSTEM" for correct adjustment procedure.

DIFFERENTIAL ADJUSTMENT

The differential gears should be checked for backlash and correct tooth patterns after overhaul. If differential trouble is suspected, check these adjustments before overhaul to determine whether adjustment will correct the trouble. Refer to "DIFFERENTIAL DISASSEMBLY AND ASSEMBLY" for correct adjustment procedure.

AXLE DISASSEMBLY AND ASSEMBLY

DISASSEMBLY PREPARATION

Axle disassembly preparation should include:

Installing safety bar with tractor in straight ahead position.

Removing wheels and tires.

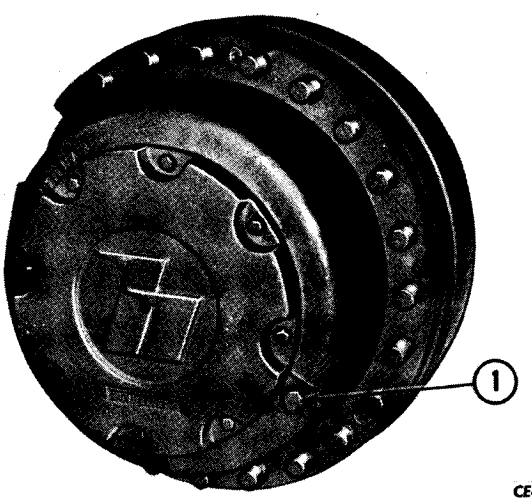

Figure 6-6

Disconnecting drive shaft and brake lines at the axle.

Removing the axle from the tractor.

Using plain steam (no caustic soda) to clean the exterior of the axle.

Preparing a clean work area of sufficient size.

Providing a suitable hoist and sling to lift component parts.

Support the axle assembly with the axle bowl drain plug facing down.

Drain the planetary hubs by rotating them until the drain filler plugs (1, Fig. 6-6) are at the bottom. Remove the plugs and "O"-rings and drain the lubricant.

DISASSEMBLY

Remove the cap screws (1, Fig. 6-7) and sealing washers (2) that secure the planetary cover (4) to the carrier assembly (3). Remove the planetary cover and discard its gasket. Discard sealing washers.

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AXLE DISASSEMBLY AND ASSEMBLY

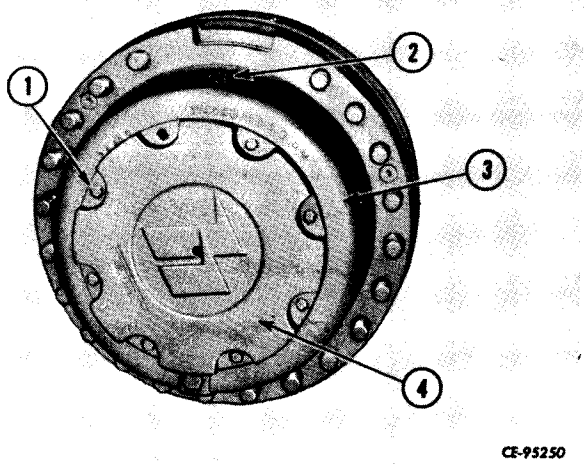

Figure 6-7

Thread the axle removal tool (1, Fig. 6-8) (refer to "SPECIAL TOOLS" under "SERVICE INFORMATION") in the tapped pilot hole in the axle shaft. Remove the shaft from the housing.

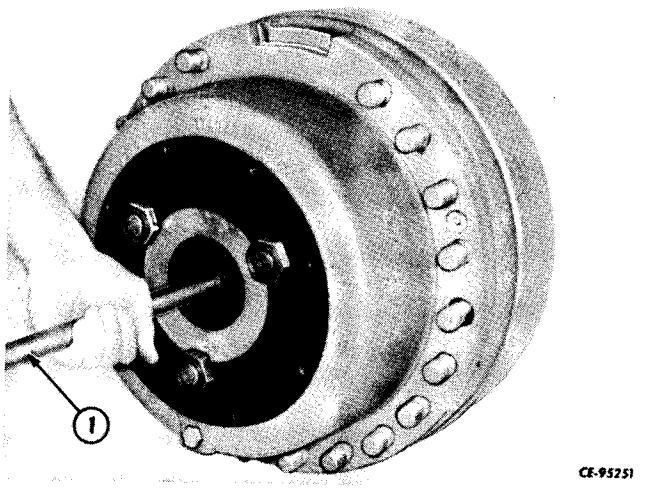

Figure 6-8

Using a socket head screw key remove the flat head cap screws (2, Fig. 6-9) that secure the planetary carrier (3) to the wheel hub (1).

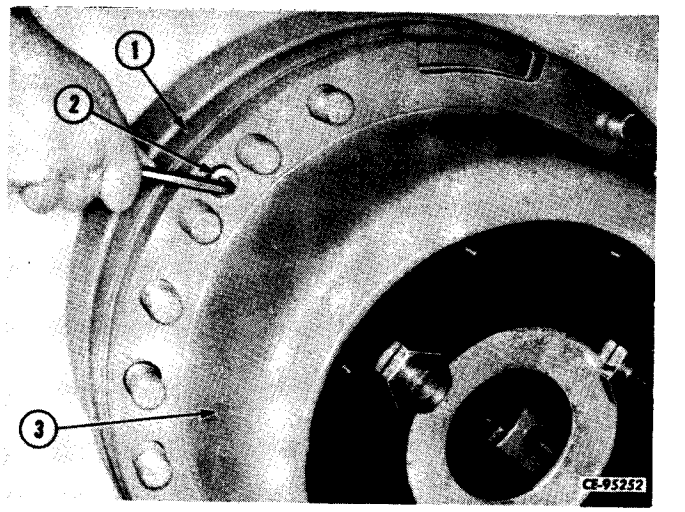

Figure 6-9

Using hoist with a suitable sling, remove the planetary carrier assembly (1, Fig. 6-10).

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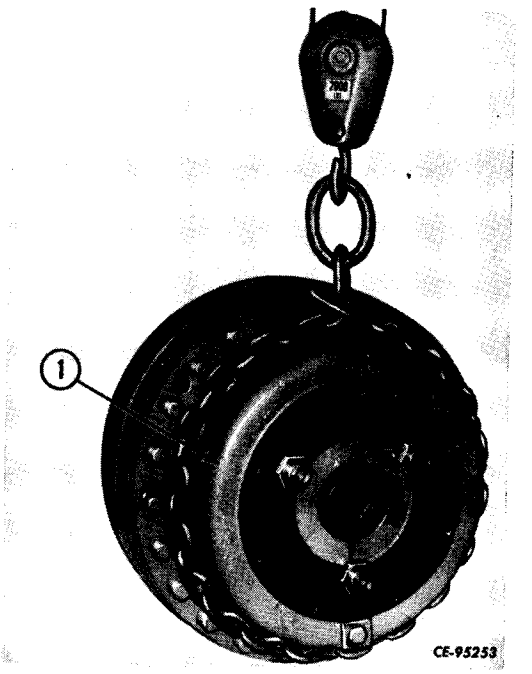

Figure 6-10

AXLE DISASSEMBLY AND ASSEMBLY

DISASSEMBLY - Continued

For carrier assembly overhaul, refer to "PLANETARY DISASSEMBLY AND ASSEMBLY."

Remove the seal ring (1, Fig. 6-11) from the wheel hub shoulder. Remove the retainer cap screws, retainer (2) and shim pack (1). Tie shim pack together and tag to indicate which side of the axle assembly they were removed from. Clean all sealant from retainer cap screws.

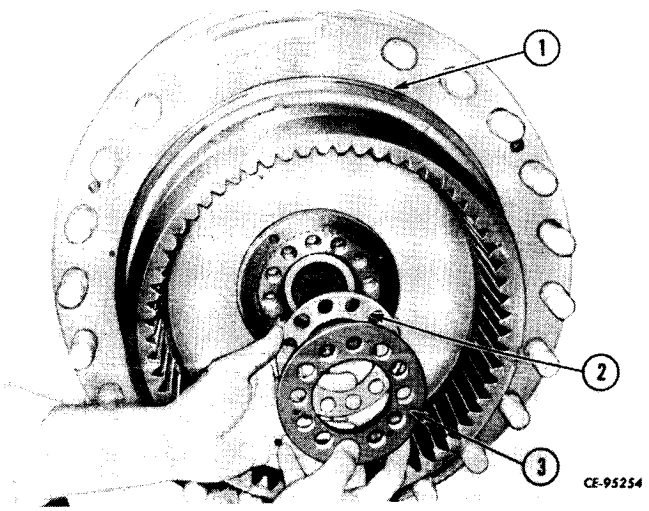

Figure 6-11

Using a hoist and sling remove the ring gear and hub assembly (2, Fig. 6-12) from the axle housing splines.

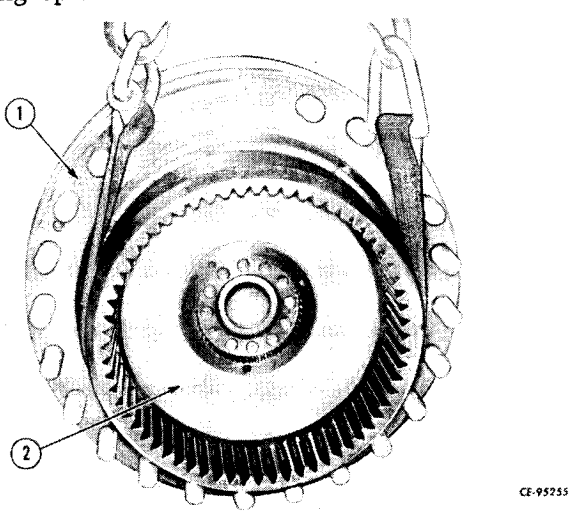

Figure 6-12

In some cases it may be necessary to pry the ring gear and hub assembly from the axle splines. Use a pair of suitable pry bars, placed opposite each other, between wheel hub (1) and ring gear assembly (2).

NOTE: Do not damage bearing cage, bearing race, or seal surfaces with pry bars.

For ring gear and hub overhaul refer to "PLANETARY DISASSEMBLY AND ASSEMBLY."

Attach the hub and drum lifting tool (1, Fig. 6-13) (refer to "SPECIAL TOOLS" under "SERVICE INFORMATION") to one of the wheel studs. Lift off the wheel hub (3) and brake drum (2) as an assembly. Do not allow the brake drum to pull free of the hub and fall. (Under most circumstances these two items will be snug fitting.)

Refer to "WHEEL HUB DISASSEMBLY AND ASSEMBLY" for overhaul procedures.

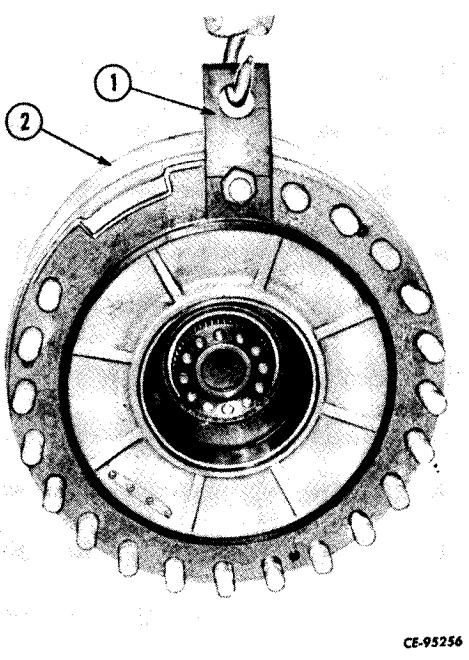

Figure 6-13

AXLE DISASSEMBLY AND ASSEMBLY

Remove the cap screws (1, Fig. 6-14) and hex nuts that secure the brake spider to the axle housing. Remove the brake assembly.

Refer to Section 13, "BRAKE SYSTEM" for brake overhaul procedures.

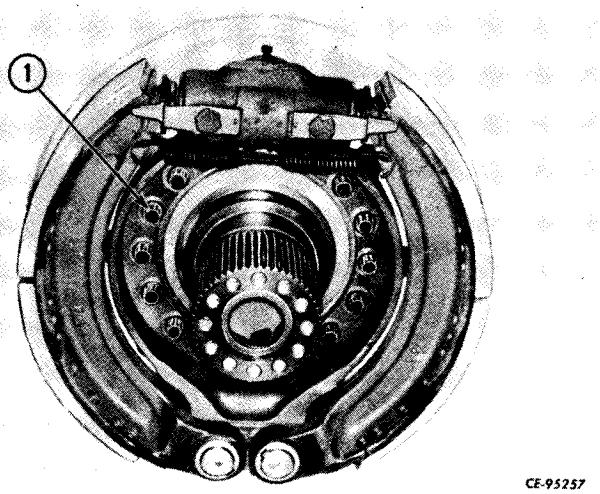

Figure 6-14

Remove and discard the axle seal (2, Fig. 6-15) from the housing bore.

Remove the seal retainer (1) from the housing hub.

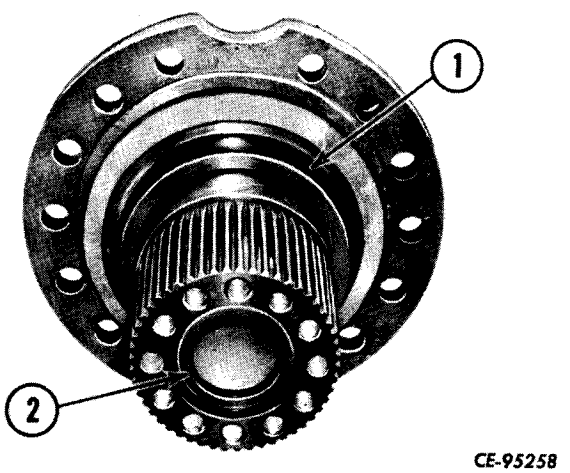

Figure 6-15

Remove and discard the "O"-ring (1, Fig. 6-16) from the seal retainer. Check the polished surfaces and ring groove of the retainer for nicks, dents or burrs. Replace retainer if damage is beyond repair.

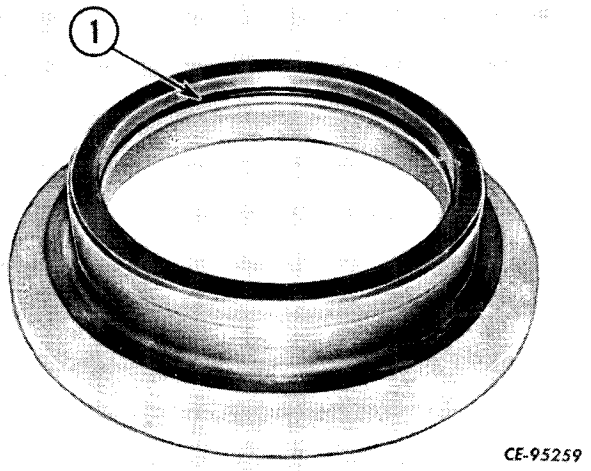

Figure 6-16

Remove the drain plug (2, Fig. 6-4 and 6-5) from the axle bowl and drain the lubricant. When the housing is completely drained rotate the housing until the differential yoke is in a vertical position.

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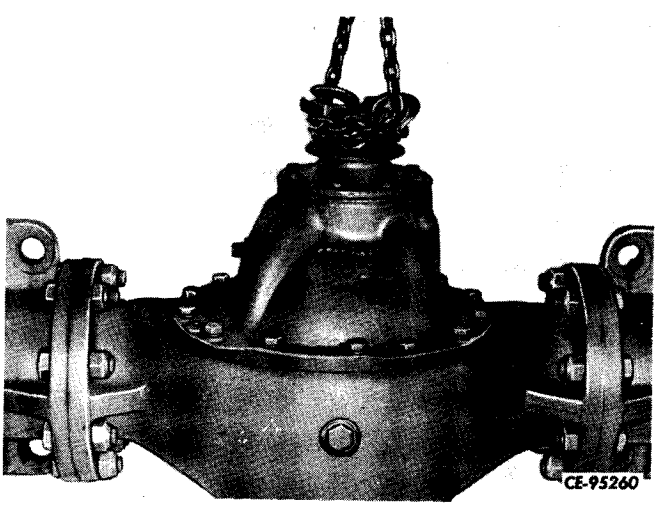

Figure 6-17

AXLE DISASSEMBLY AND ASSEMBLY

DISASSEMBLY - Continued

To remove the differential assembly the following steps must be taken:

a. One at a time, using an acetylene torch, heat the axle housing in the area of each screw bore. Sufficient heat will liquify the plastic gasket material and allow the cap screw to be removed with a reasonable amount of effort.

As each screw bore is heated, apply approximately 200 lbs. of torque in a counterclockwise direction to the cap screw (1, Fig. 6-17). When the bore is heated sufficiently the cap screw will begin to turn out.

b. Place a chain sling about the input yoke and using a suitable hoist, exert an upward pressure on the differential assembly.

Again, using the acetylene torch, heat the entire flange of the differential carrier to liquify the plastic sealant and free the differential assembly.

NOTE: Both axle shafts must be removed before the differential assembly can be pulled from the housing.

In some cases it may be necessary to pry the heated units apart.

Refer to "DIFFERENTIAL DISASSEMBLY AND ASSEMBLY" for procedures.

REAR AXLE

If a section of the axle housing requires removal, index the two pieces to be separated with a felt marker or two punch marks (1, Fig. 6-18) to insure correct assembly.

Remove the cap screws and hex nuts (2) that secure the axle housing to the differential housing. Separate the two housings and discard the "O"-ring seal.

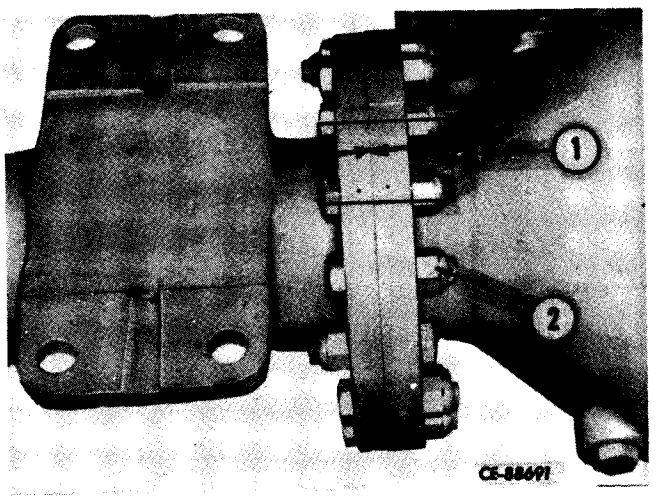

Figure 6-18

CLEANING AND INSPECTION

CLEANING

Clean all parts thoroughly. Rough parts such as casting or all metal parts without finished, ground or polished surfaces may be cleaned in a hot solution of mild alkali. Parts should remain in the tank until thoroughly clean and heated through.

◆ WARNING: EXERCISE CARE TO AVOID SKIN RASHES, FIRE HAZARDS AND INHALATION OF VAPORS WHEN USING SOLVENT TYPE CLEANERS.

Clean other parts with a solvent type cleaner excluding gasoline.

Flush out axle housing being sure it is completely clean. Be sure all flaked metal deposits and dirt are removed from the corners. Cover the differential opening with a plastic cover when housing is clean and dry.

◆ WARNING: EXERCISE CARE TO AVOID SKIN RASHES, FIRE HAZARDS AND INHALATION OF VAPORS WHEN USING SOLVENT TYPE CLEANERS.

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AXLE DISASSEMBLY AND ASSEMBLY

Dry parts thoroughly with soft, clean absorbent paper towel or abrasive free cloth.

CAUTION: NEVER dry bearings by spinning with compressed air.

INSPECTION

Inspect all bearings, cups and cones, including those not removed from the axle. Replace any parts that are worn, pitted or damaged in any way. Remove parts needing replacement with a puller or press, using suitable arbors. Avoid the use of drifts or hammers.

Inspect all gears and splines for wear or damage. Replace all parts that are scored, pitted, ridged or worn.

Inspect axle shafts for signs of torsional fractures or other indication of impending failure.

Coat parts that are to be assembled immediately with light oil to prevent corrosion. If parts are to be stored for any length of time or if they are not to be assembled immediately, coat them with a good grade of rust preventive and wrap in paper, treated to prevent corrosion.

Replace all seals, gaskets, "O"-rings and retaining rings.

Assemble the following tools and supplies.

Torque wrench - 500 ft. lb. capacity.
Torque multiplier - 4-to-1.
Loctite Plastic Gasket, or equivalent.
Axle shaft tool - Refer to Section 6, under "SPECIAL TOOLS."

NOTE: Special Torque, Pressure, etc. recommendations are listed on a single page in Section 6. This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil, and revised when necessary.

ASSEMBLY

REAR AXLE

Install new "O"-ring (2, Fig. 6-19) in position on axle housing (1) boss. Align the identification marks (1, Fig. 6-18) on the two housings (1, 3) and secure with cap screws and hex nuts (nuts face in toward differential). Tighten hex nuts to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

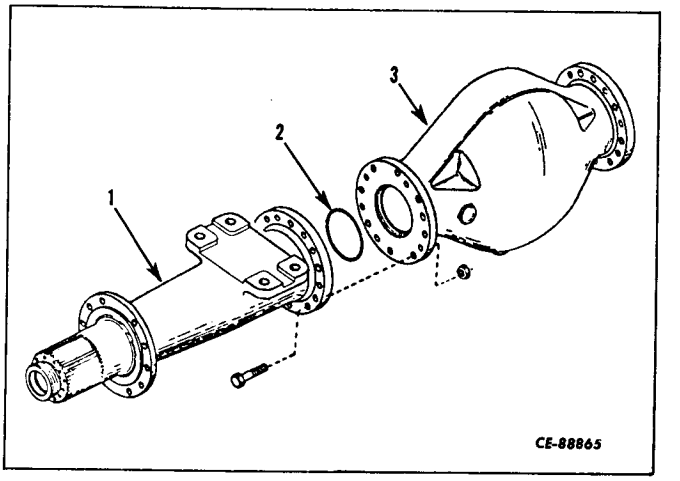

Figure 6-19

ALL UNITS

Be sure the mating surfaces of the differential carrier and axle housing are absolutely clean and free of nicks or burrs.

Coat the differential mounting face of the axle housing with "LOCTITE PLASTIC GASKET." Apply a light coating of plastic gasket to the threads of the retaining cap screws (1, Fig. 6-20). With the axle housing blocked securely

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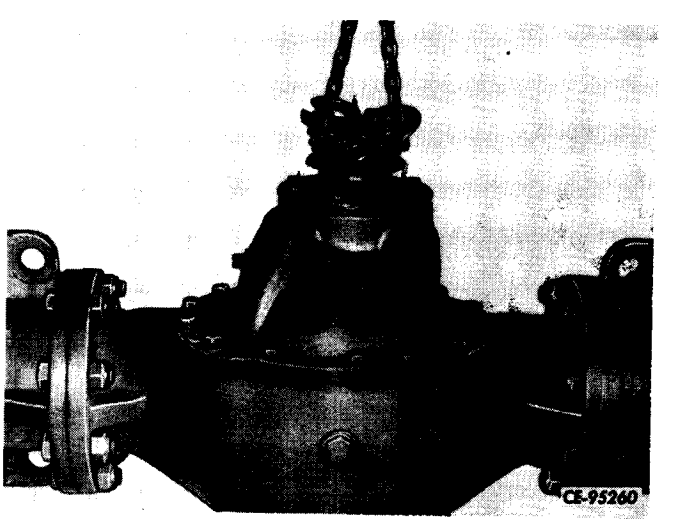

Figure 6-20

AXLE DISASSEMBLY AND ASSEMBLY

ASSEMBLY - Continued

ALL UNITS - Continued

lift the differential into position on the axle housing, being sure the holes are correctly aligned.

NOTE: Follow the manufacturers instructions for application and curing time for "LOCTITE PLASTIC GASKET."

Install cap screws (1) and lock washers, tightening gradually and evenly around the circumference of the carrier flange. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Install a new "O"-ring seal (1, Fig. 6-16) in the groove of the seal retainer (1, Fig. 6-21). Grease the seal surface of the axle hub and the "O"-ring. Push the retainer (1) into position being sure it contacts the axle housing flange about its entire circumference.

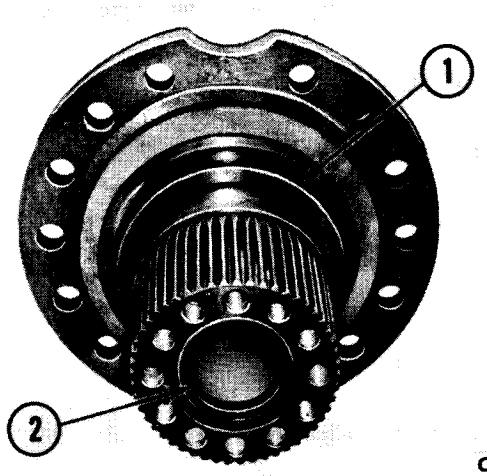

Figure 6-21

Inspect the end surface of the axle spindle for nicks, burrs or other irregularities. If necessary, file surface until it is flat and smooth. File carefully to prevent a wavy surface. Entire surface must be at 90° to centerline of axle bore.

Coat O. D. of a new axle seal (2) with "Mar-Seal" or equivalent sealant and using a suitable driver, install seal in axle bore with lip facing in. This seal must bottom in its bore.

Position the brake assembly on the axle housing and secure the spider, the axle flange with cap screws (1, Fig. 6-22) and nuts. Tighten the nuts to the recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

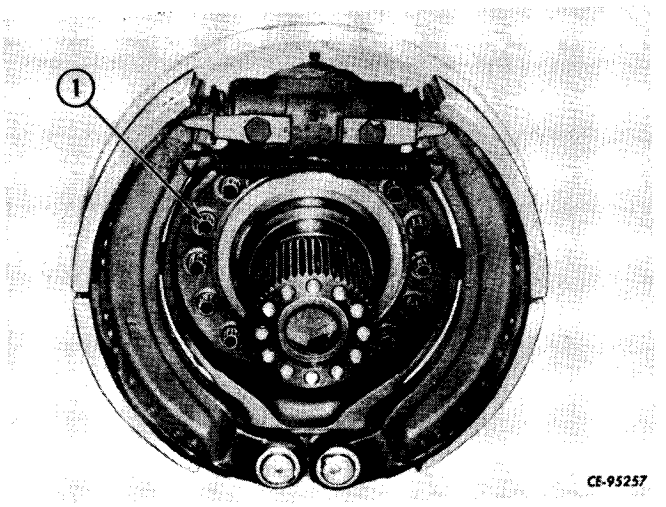

Figure 6-22

Using the special lifting tool (1, Fig. 6-23), position the wheel hub/brake drum assembly on the axle spindle.

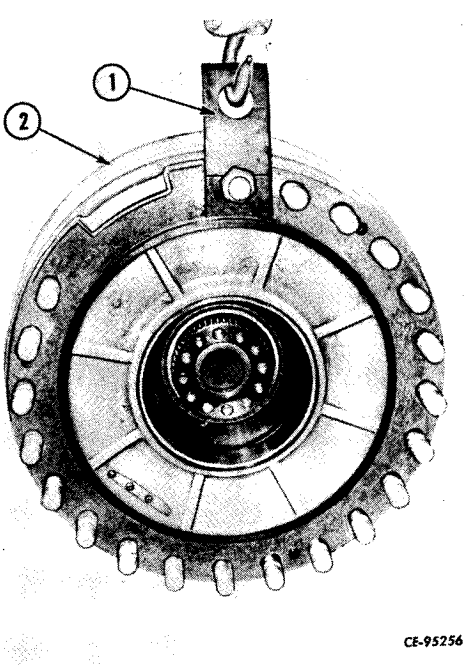

Figure 6-23

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AXLE DISASSEMBLY AND ASSEMBLY

Start the ring gear and hub assembly (2, Fig. 6-24) on the axle spindle splines. Place a 4" x 4" wooden block across the ring gear and using a sledge or heavy mallet, drive the ring gear and hub assembly on the spindle until it bottoms in the wheel hub (1) bearing cup.

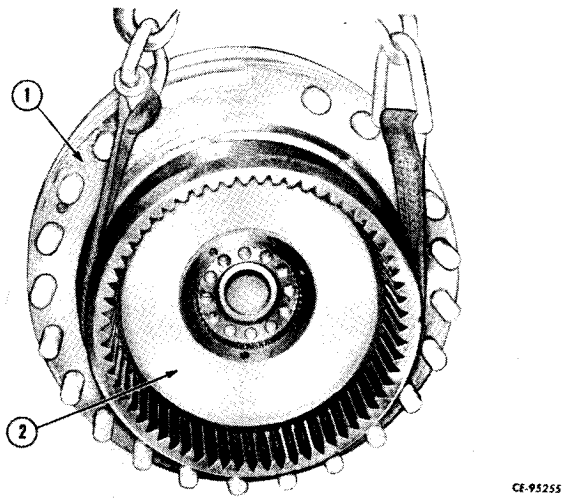

Figure 6-24

Position the retainer (3, Fig. 6-11) against the ring gear hub WITHOUT shims. Secure the retainer with three equally spaced cap screws. Tighten the cap screws evenly to the recommended preliminary torque (refer to "SPECIAL TORQUES") WHILE ROTATING THE WHEEL HUB.

Preliminary Torque:_____

Carefully measure the gap as shown in Fig. 6-25. Measure shims individaully to obtain a shim pack thickness equal to the gap. To this shim pack add the recommended additional shims (refer to "TOLERANCES").

Additional Shim Pack:_____

The total shim pack should equal the measured gap plus the required additional shims or as close as possible to this dimension on the plus side.

Remove the retainer and install the entire shim pack. Install the retainer and secure with all cap screws. Coat the threads of each cap screw with "LOCTITE PLASTIC GASKET" before installation. Tighten the cap screws to the

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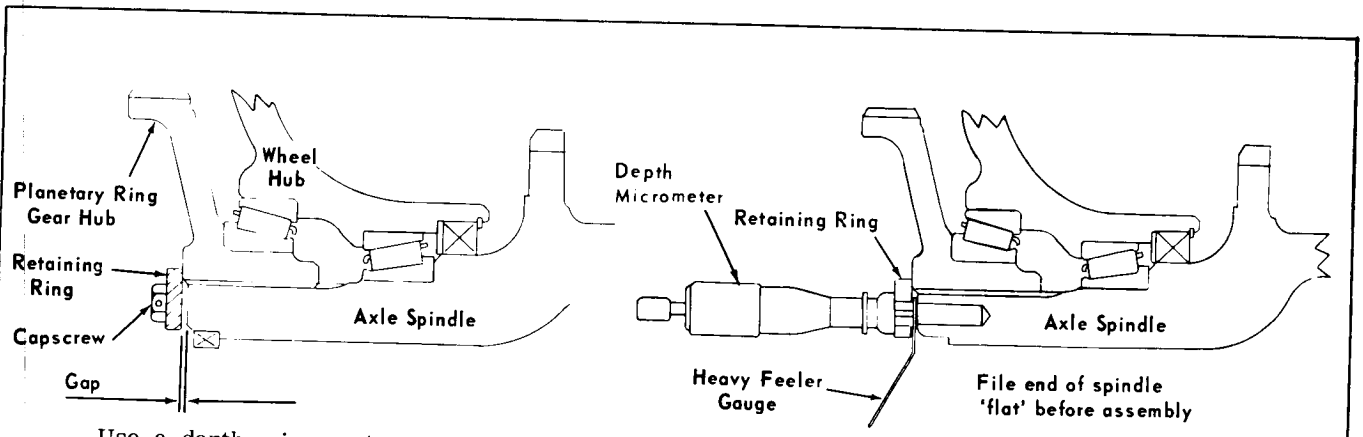

Figure 6-25
Shimming Procedure.

AXLE DISASSEMBLY AND ASSEMBLY

ASSEMBLY - Continued

ALL UNITS - Continued

recommended final torque (refer to "SPECIAL TORQUES") WHILE ROTATING THE WHEEL HUB.

Final Torque:_____

Lubricate a new seal ring (1, Fig. 6-11) with grease and install on wheel hub shoulder. Be sure there are no twists in seal ring.

Using a suitable sling and hoist, position the planetary carrier assembly (1, Fig. 6-26) on the axle. As carrier is installed planet gear teeth must mesh with ring gear teeth; large cut-out in carrier must be in alignment with cut-out in wheel hub.

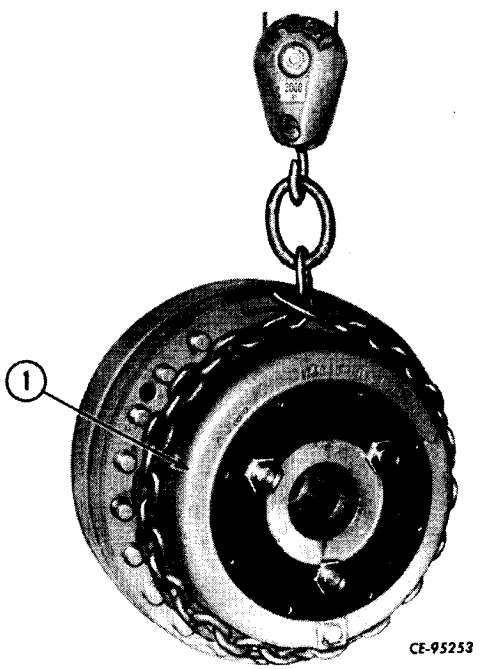

Figure 6-26

Be sure carrier assembly (3, Fig. 6-27) is flush against wheel hub (1). Install the flat head cap screws (2) to secure the two assemblies and tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

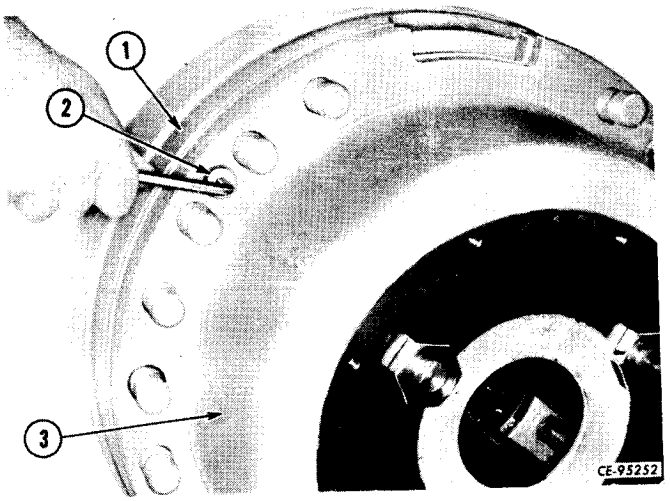

Figure 6-27

Using the axle removal and installation tool (1, Fig. 6-28) (refer to "SPECIAL TOOLS") install the axle in the housing.

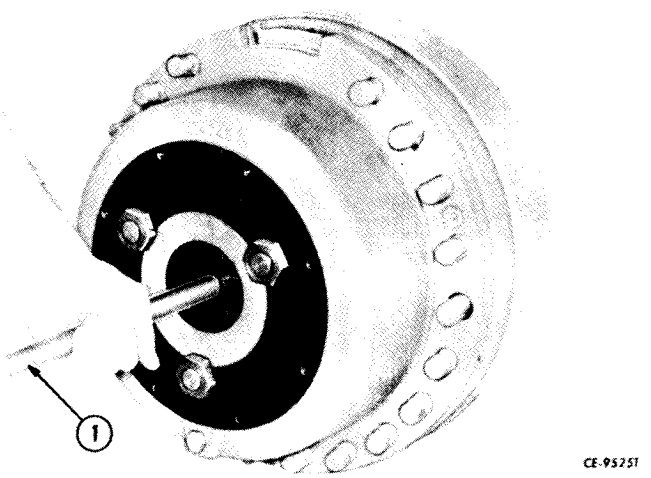

Figure 6-28

Using the tool as a lever, raise the inner end of the axle shaft to engage the differential side gear splines. As the sun gear end of the shaft enters the planetary assembly align the shaft gear teeth with the planet gear teeth.

Carefully inspect the thrust button (1, Fig. 6-29) in the planetary cover for excessive wear. Replace unit if required.

Position a new gasket on the planetary cover being careful to align the cap screw holes. Position cover and gasket assembly on planetary

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AXLE DISASSEMBLY AND ASSEMBLY

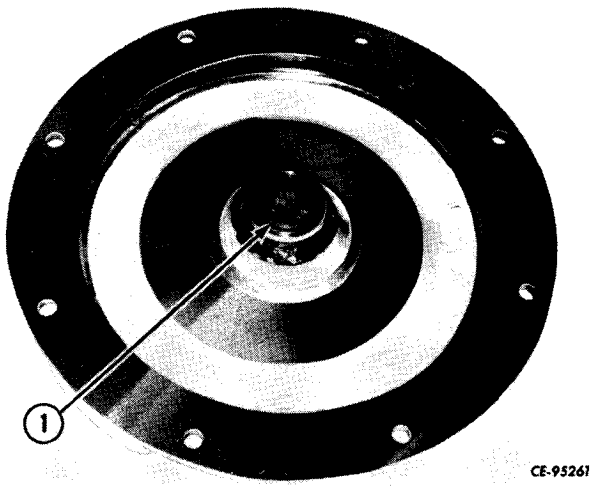

Figure 6-29

carrier; align cap screw holes and secure with cap screws and new sealing washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Rotate planetary hub until "Oil Level" line is horizontal (Fig. 6-30). Remove the drain and fill plug (1) and "O"-ring. Discard "O"-ring. Fill planetary hub to level of plug hole with recommended lubricant (refer to "LUBRICANTS AND CAPACITIES"). Install plug with new "O"-ring. Tighten plug securely.

Rotate the axle until the differential input is horizontal. Install drain plug (2, Fig. 6-31, FRONT AXLE; 2, Fig. 6-32, REAR AXLE) with new "O"-ring in axle bowl and tighten securely. Remove the level/fill plug (1, Fig. 6-31, FRONT AXLE; 1, Fig. 6-32, REAR AXLE) and "O"-ring and discard "O"-ring. Fill axle bowl to the level of the plug hole with recommended lubricant (refer to "LUBRICANTS AND CAPACITIES").

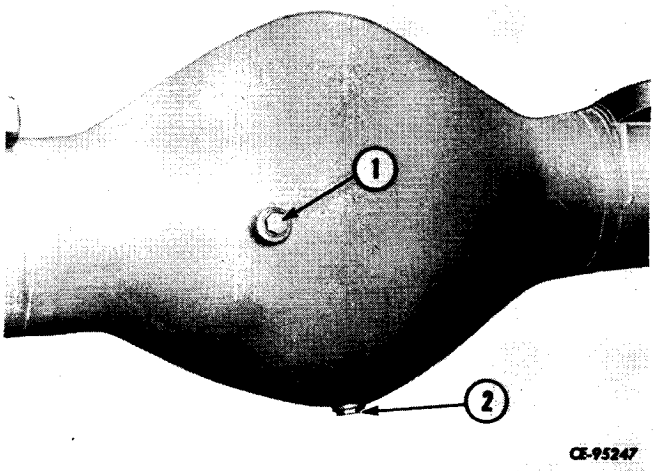

Figure 6-31

Install a new "O"-ring on the level plug and install the plug assembly in housing. Tighten plug securely.

After mounting axle in tractor with wheels and tines installed, adjust each brake assembly (refer to Section 13, "BRAKE SYSTEM").

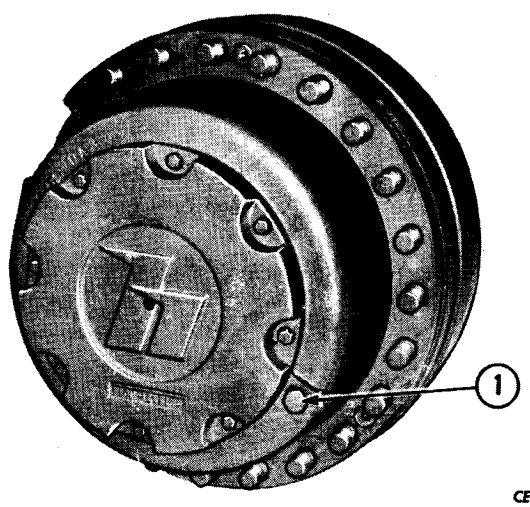

Figure 6-30

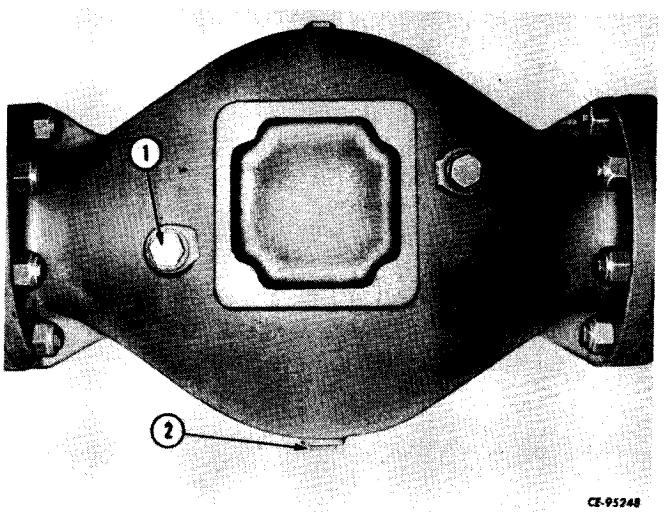

Figure 6-32

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

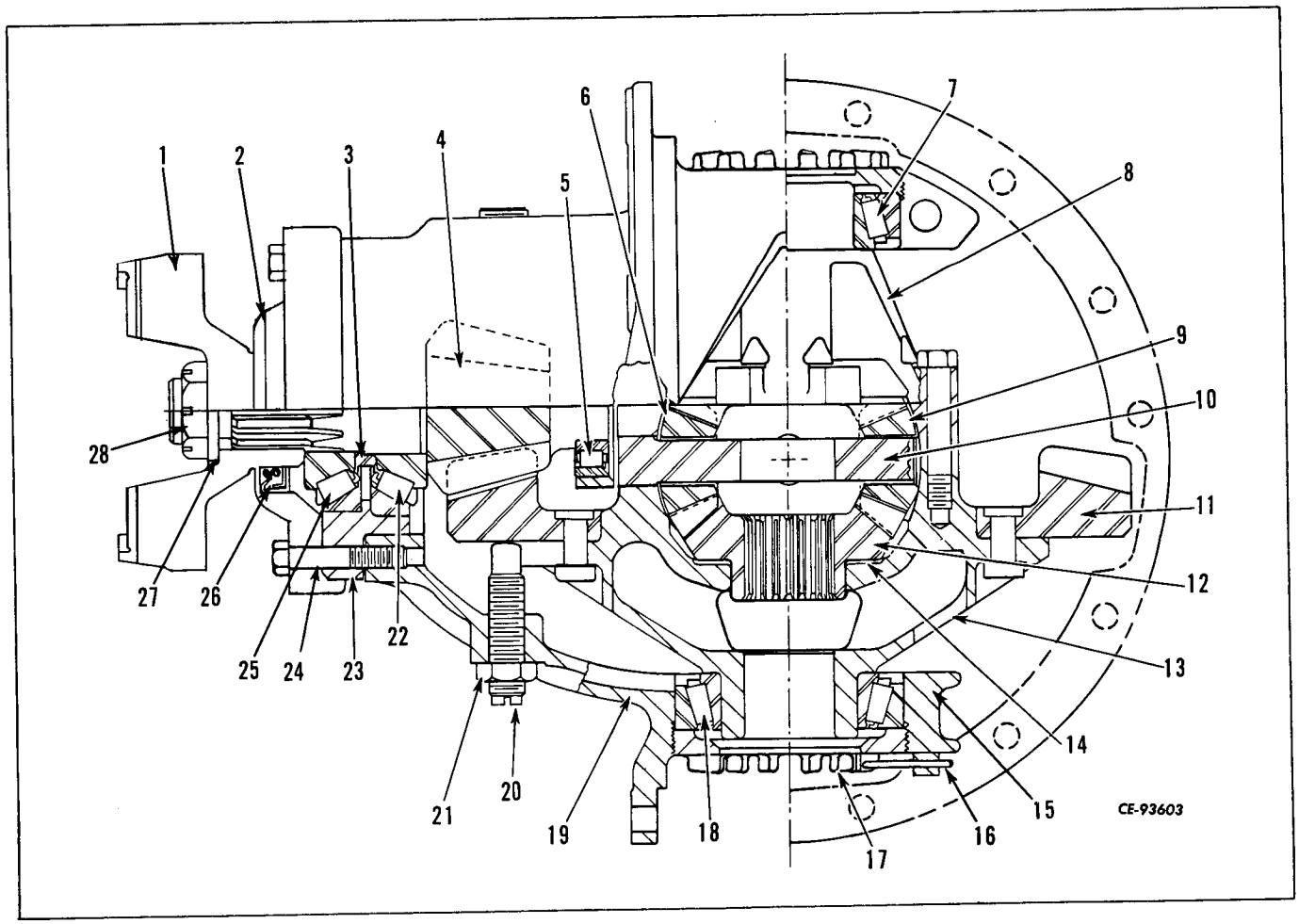

Figure 6-33
Typical Differential - Cross Section.

1. Input yoke.
2. Bearing cover.
3. Spacer.
4. Pinion gear and shaft.
5. Pinion pilot bearing.
6. Differential pinion gear thrust washer.
7. Ring gear thrust bearing.
8. Differential case - plain half.
9. Differential pinion gear.
10. Differential spider.
11. Ring gear.
12. Differential side gear.
13. Differential case - flanged half.
14. Side gear thrust washer.
15. Bearing cap.
16. Cotter pin.
17. Adjusting nut.
18. Ring gear thrust bearing.
19. Differential carrier.
20. Thrust screw.
21. Jam nut.
22. Inner pinion thrust bearing.
23. Pinion bearing cage.
24. Retaining cap screw.
25. Outer pinion thrust bearing.
26. Seal.
27. Flat washer.
28. Pinion nut.

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

DISASSEMBLY PREPARATION

Remove the differential assembly from the axle (refer to "AXLE DISASSEMBLY AND ASSEMBLY"). Differential disassembly preparation should include:

a. Using plain steam (no caustic soda), clean the outside of the differential housing thoroughly.

b. Preparing a clean work area.

c. Gathering the following tools and equipment:

A differential holding fixture (refer to "SERVICE INFORMATION" under "SPECIAL TOOLS").

A shop press.

A hoist of sufficient capacity.

DISASSEMBLY

Place differential assembly in a suitable holding fixture (refer to "SERVICE INFORMATION" under "SPECIAL TOOLS").

If initial inspection indicates that drive gears will not be replaced, record the backlash of the ring gear and pinion before disassembly. This measurement will be used during assembly.

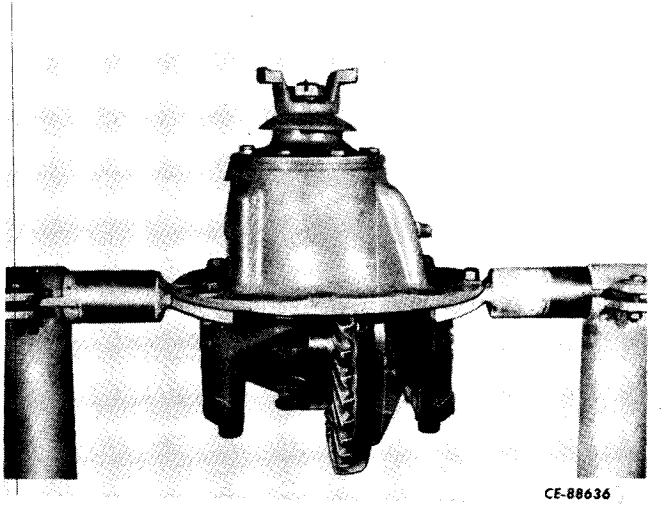

Figure 6-34

To measure backlash, position dial indicator as shown in Fig. 6-35. Secure the yoke and rotate ring gear back and forth. The indicated movement is the backlash (clearance) between the teeth. A predetermined amount of backlash is necessary and should not be altered to any great extent.

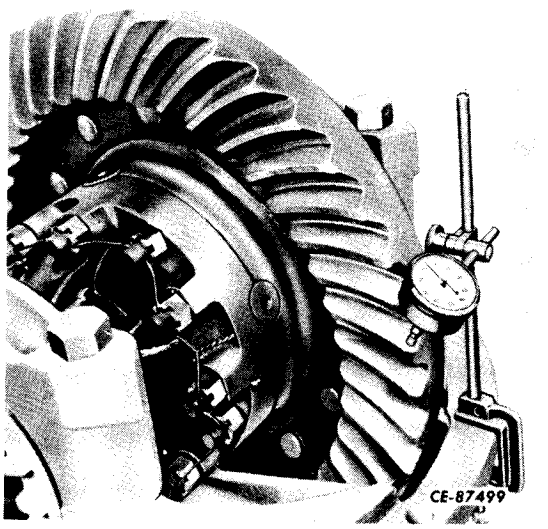

Figure 6-35

The bearing caps (3, Fig. 6-36) and carrier housing legs (4) are marked at the factory to assure correct assembly. If the original identification marks are not clear, mark one bearing

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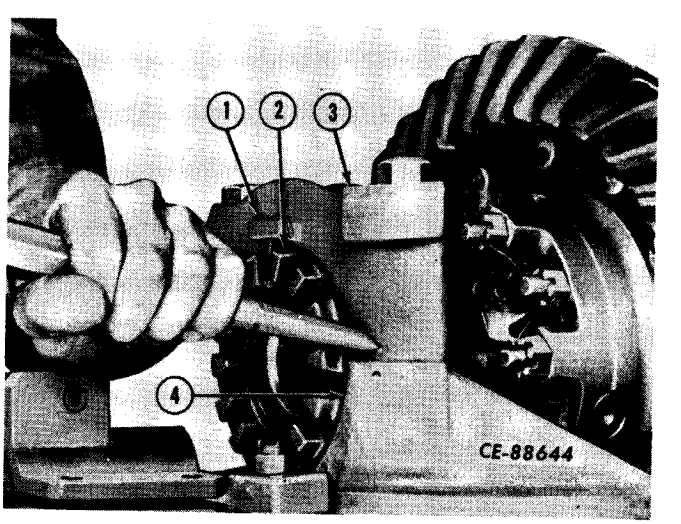

Figure 6-36

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

DISASSEMBLY - Continued

cap and carrier leg with a center punch or chisel to identify for correct assembly. Remove the cotter pins (1) that secure the adjusting nuts (2).

Remove the lock wire and bearing cap bolts that secure the bearing caps (1, Fig. 6-37) to the carrier housing.

Tap the bearing caps with a fiber hammer to loosen and remove them from the carrier bearings. Remove the bearing adjusting nuts (2).

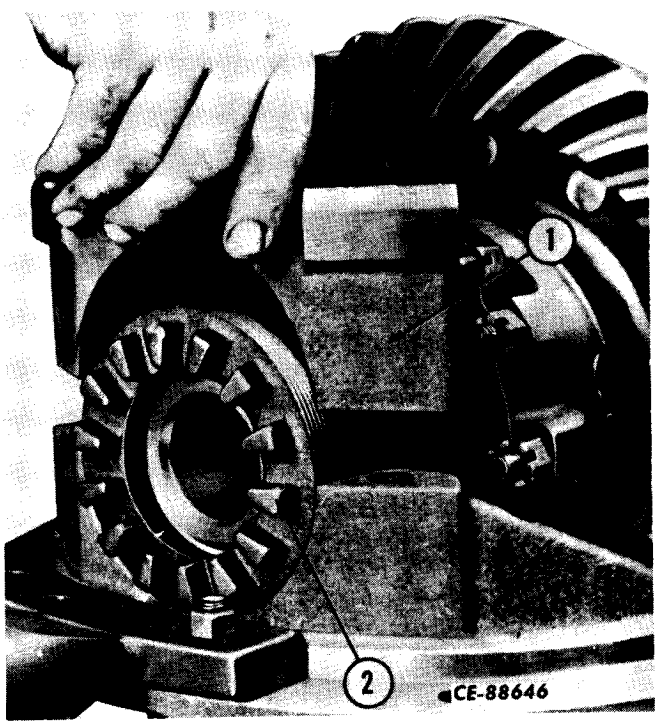

Figure 6-37

Loosen the jam nut (2, Fig. 6-38) and back off the thrust adjusting screw (1).

Lift the differential assembly just high enough to remove the carrier bearing cups. Tag the cups to identify them for correct assembly. As the differential is lifted out of the carrier housing (Fig. 6-39), tip it slightly to allow the ring gear to clear the pinion shaft bearing boss.

Remove the thrust block from the carrier housing.

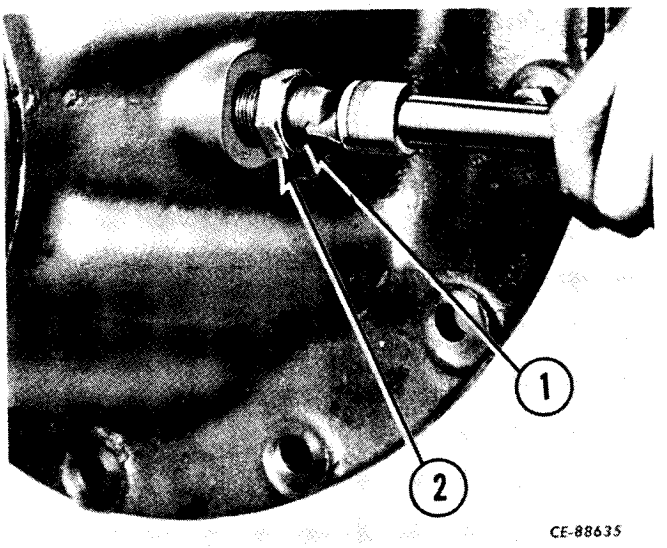

Figure 6-38

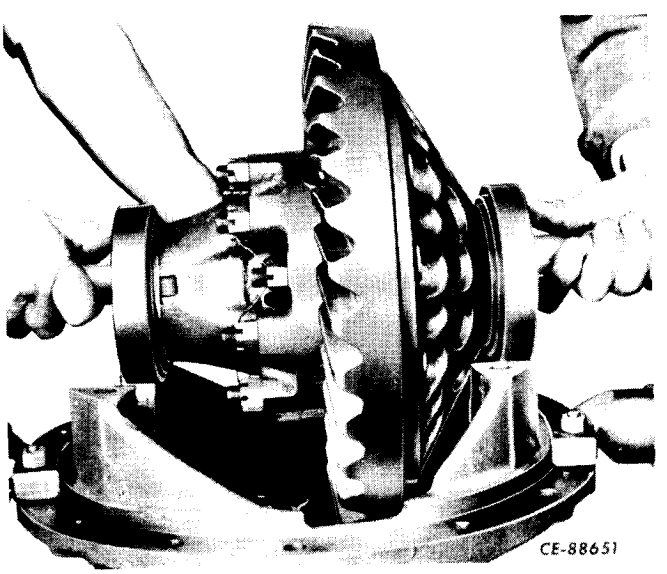

Figure 6-39

If original identification marks are not clear, mark the differential case halves with a punch or chisel to insure correct alignment during assembly (4, Fig. 6-40).

Cut the lock wire; remove hex nuts and cap screws (1) that secure the case halves (2, 3) and lift the plain half (2) from the flanged half (3). If a side gear comes off with the plain case half be sure it does not fall.

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

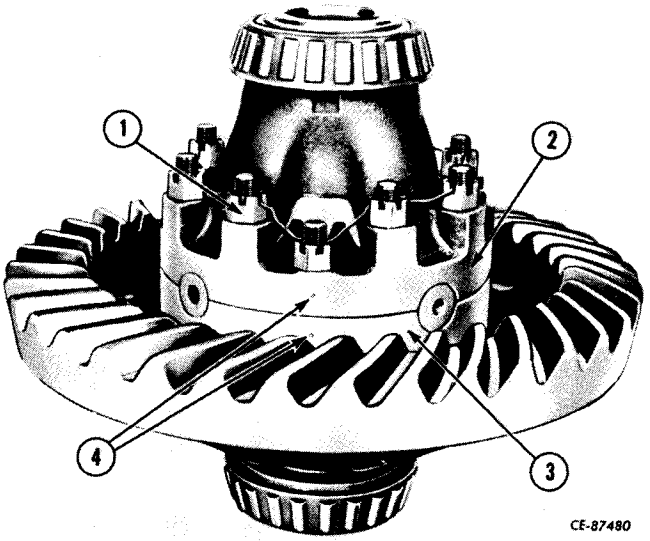

Figure 6-40

Remove the spider (1, Fig. 6-41) with spider gears (2) and thrust washers (3). The spider may be installed four ways and need not be marked before removal. Remove the remaining side gear (4) and thrust washer (5).

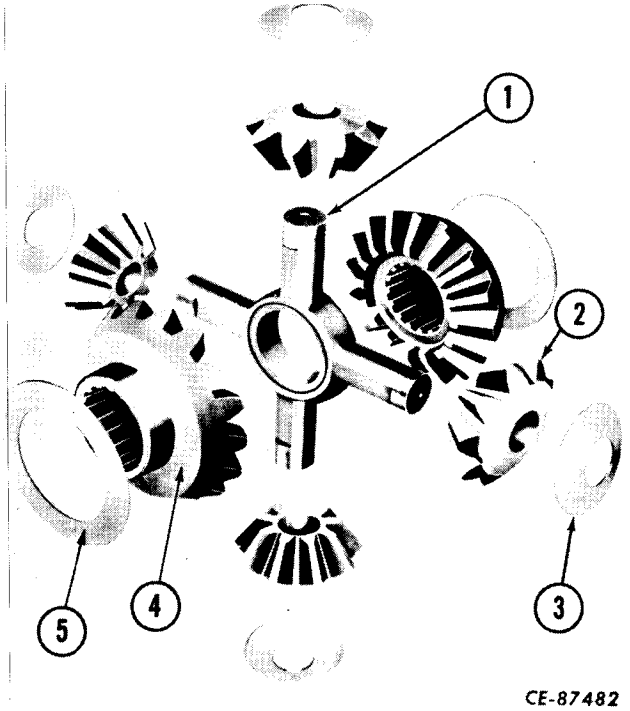

Figure 6-41

If removal of the ring gear is required, carefully center punch the rivets in the center of the head. Use a drill bit 1/32 inch smaller. Than the body of the rivet to drill through the head (Fig. 6-42). Press out the rivets and separate the gear from the case.

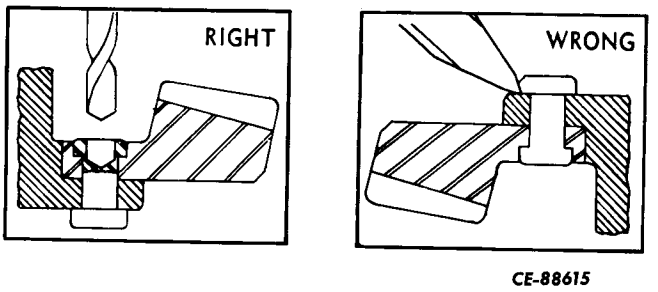

Figure 6-42

If replacement is required remove differential bearings, using a suitable bearing puller or a shop press (Fig. 6-43). Be sure force is exerted on the inner race, not the bearing cage.

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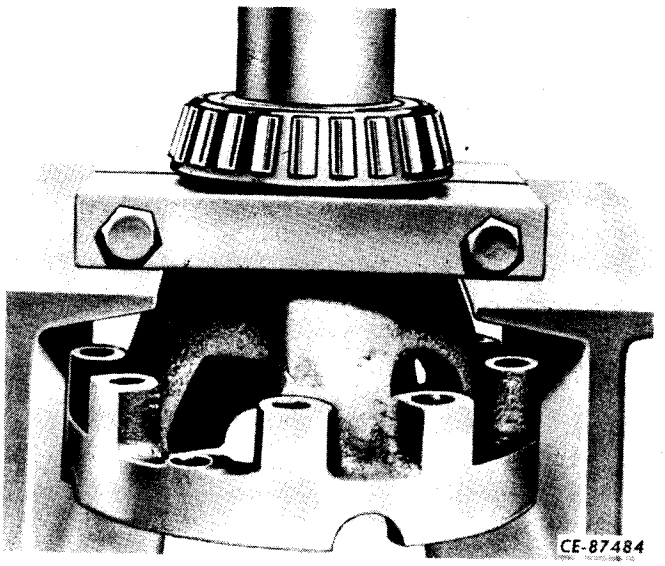

Figure 6-43

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

DISASSEMBLY - Continued

Hold the input yoke (1, Fig. 6-44) and remove the cotter pin (where used) (3) and hex nut (2). With a suitable puller, remove the input yoke (1) and flat washer.

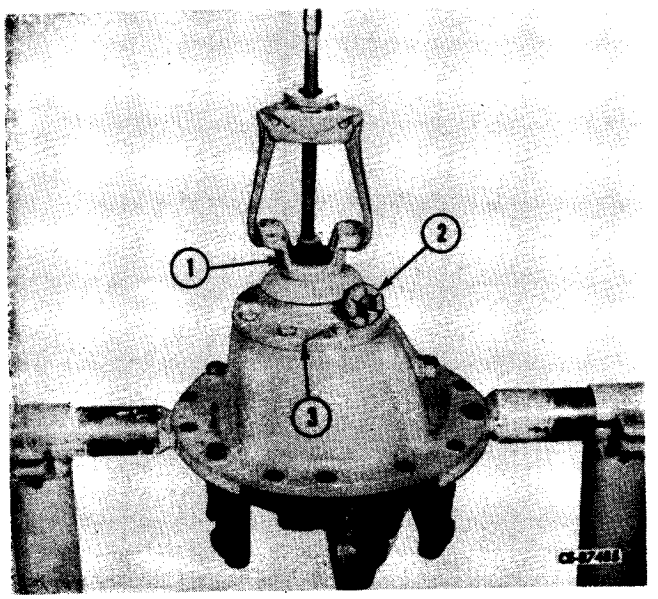

Figure 6-44

Remove the cap screws that secure the bearing cage (23, Fig. 6-33) to the carrier housing. Remove the bearing cover and oil seal assembly (2, 26, Fig. 6-33). Install three jack screws (2, Fig. 6-45) in the tapped holes provided in the bearing cage. Rotating jack screws evenly, remove cage assembly. Wire the shim pack (3) together to prevent loss.

NOTE: If the pinion bearing assembly is to be reused it will be necessary to retain the same relationship between the cups and cones because of the established wear pattern. Proper parts identification should be made during disassembly.

Support the bearing cage (3, Fig. 6-46) and press the pinion shaft (1) from the pinion outer thrust bearing (2). The bearing cups may be pressed out of the bearing cage, if necessary.

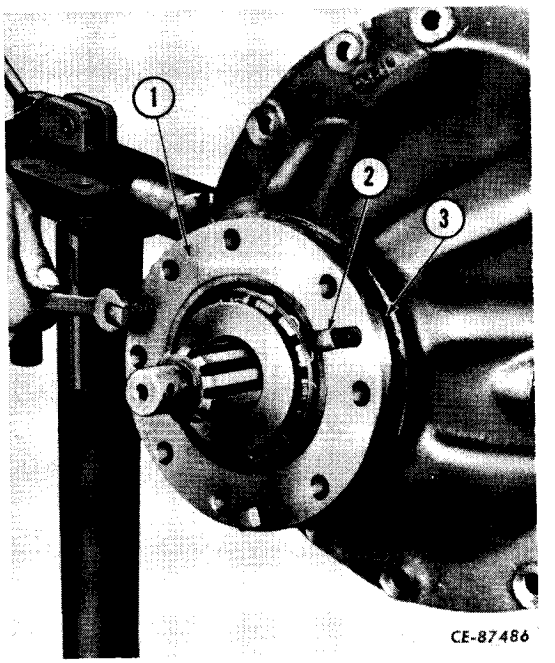

Figure 6-45

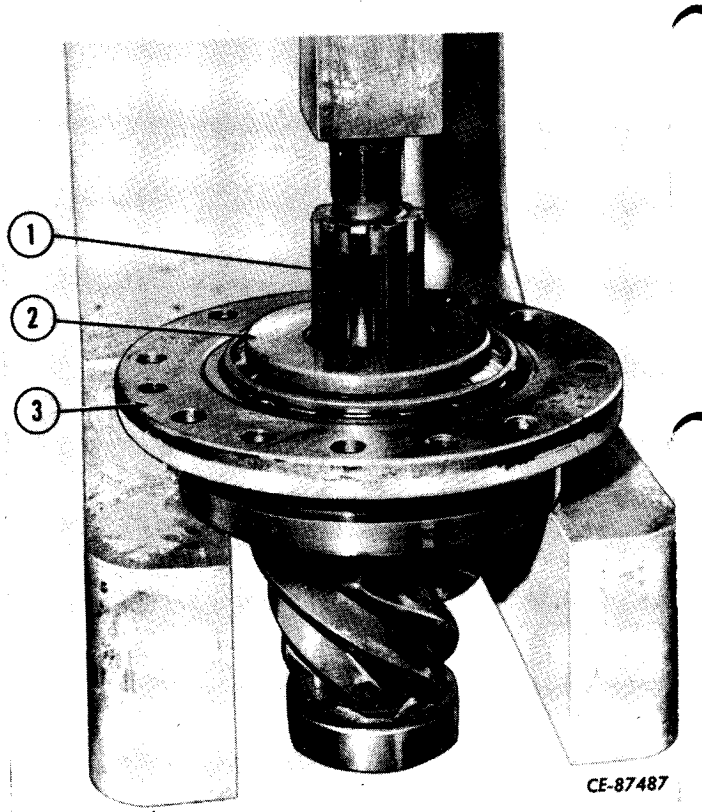

Figure 6-46

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

Using a suitable adapter press the inner thrust bearing (2, Fig. 6-47) from the pinion shaft (1).

Remove the snap ring (4) that retains the pinion shaft pilot bearing (3).

Using a suitable adapter, press the pilot bearing from the shaft.

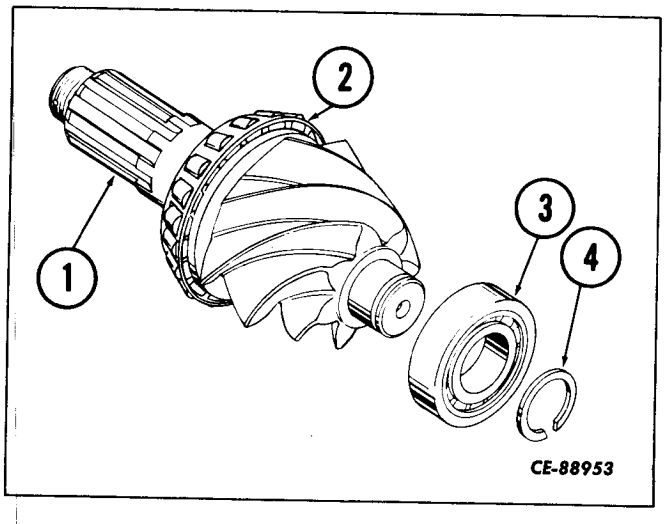

Figure 6-47

CLEAN, INSPECT AND REPAIR

CLEANING

Parts having ground and polished surfaces such as gears, bearings, shafts and collars, should be cleaned in a suitable solvent like kerosene or diesel fuel oil.

NOTE: DO NOT USE GASOLINE
DO NOT USE A HOT SOLUTION TANK
DO NOT USE WATER AND ALKALINE SOLUTIONS
(Sodium hydroxide, orthosilicates or phosphates)

Steam cleaning assembled drive units after their removal from the axle housing is not recommended. Water trapped in these assemblies promotes corrosion of critical parts. This rust can be deposited in the lubricant causing premature failures.

Complete disassembly is necessary for thorough cleaning.

Rough parts such as differential castings may be cleaned in a hot solution of mild alkali providing these parts are not ground and polished. Parts should remain in the tank long enough to be thoroughly cleaned and heated through. This will aid the evaporation of the rinse water. Parts should be thoroughly rinsed to remove all traces of alkali.

◆ WARNING: EXERCISE CARE TO AVOID SKIN RASHES AND INHALATION OF VAPORS WHEN USING ALKALI CLEANERS.

Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless, absorbent paper towels or rags, free of abrasive material. Bearings should never be dried by spinning with compressed air.

Parts that have been cleaned, dried and inspected and are to be assembled immediately should be coated with light oil to prevent corrosion. If parts are to be stored for any length of time, they should be treated with a good rust preventive and wrapped in special paper or other material designed to prevent corrosion.

INSPECTION

Careful inspection procedures will determine the success of the overhaul operation. A careful selection of reusable parts will eliminate the expense of down time in the near future.

Inspect all bearing cups and cones, including those not removed from parts of the drive unit. Replace these items if cups or rollers are worn, pitted or damaged in any way. Remove parts to be replaced with a suitable puller or press. Do not use drifts or hammers. They may easily damage or distort component parts.

Inspect hypoid gears for wear or damage. Worn, ridged, pitted or scored gears should be replaced. When it becomes necessary to replace either the ring or pinion gear, both gears must be replaced with a matched set.

(Continued on next page)

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

CLEAN, INSPECT AND REPAIR - Continued

INSPECTION - Continued

Inspect differential case halves, thrust washers, spider trunnions and differential gears for pitted, scored or worn thrust surfaces. Thrust washers must be replaced in sets.

Inspect differential pinion gears and side gear teeth for wear or damage. Pinion and side gears must be replaced in sets.

REPAIR

Replace all worn parts including hex nuts with rounded corners.

Replace all seals, gaskets and lock washers.

Remove nicks, mars and/or burrs from machined or ground surfaces using a mill file or India stone. All threads must be clean and free to obtain accurate adjustment and correct torque.

Where possible, use a press when assembling component parts.

Tighten all nuts to specified torque. Use a soft iron locking wire to eliminate wire breakage.

The burrs caused by lock washers at the spot surface of stud holes of gages and covers, should be removed to assure easy assembly.

NOTE: Special Torque, Pressure etc. recommendations are listed under "SERVICE INFORMATION." This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil, and revised when necessary.

ASSEMBLY

If new bearing cups (1, Fig. 6-48) are to be installed, press the cups firmly against pinion bearing cage (2) shoulders.

Lubricate bearing cups and cones with light machine oil.

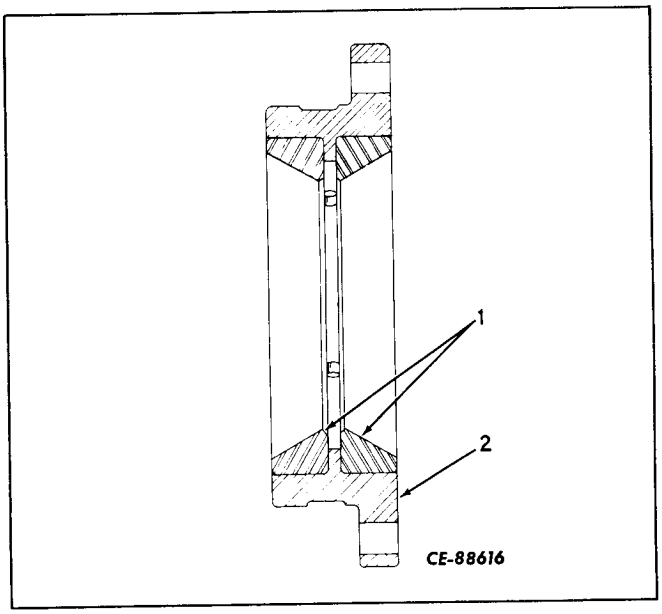

Figure 6-48

Press inner thrust bearing (2, Fig. 6-49) on pinion shaft (3). Be sure bearing cone bottoms on gear shoulder.

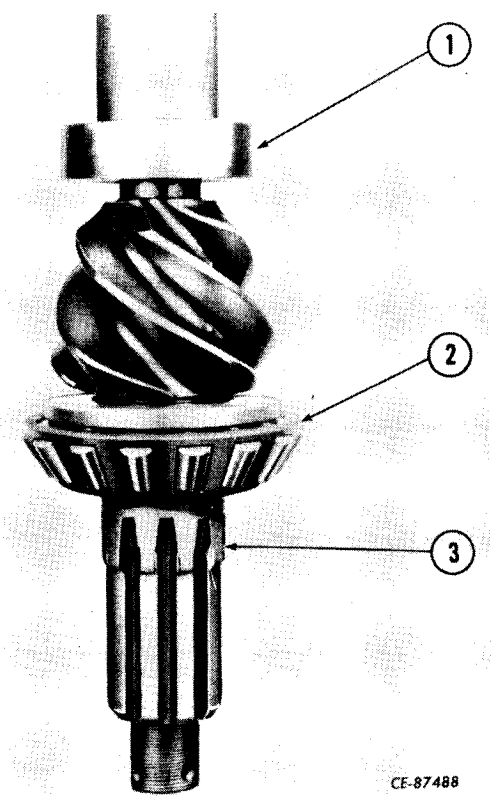

Figure 6-49

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

Press pilot bearing (1) on pinion shaft. Install the retaining snap ring. Be sure snap ring bottoms in groove in pinion shaft.

Install spacer (5, Fig. 6-50) on pinion shaft and place entire assembly in bearing cage (4).

Press outer thrust bearing (3) on the pinion shaft. Be sure the bearing bottoms on the spacer (5) and the spacer is flush against inner thrust bearing race (6).

Rotate cage (4) several revolutions to assure normal bearing contact.

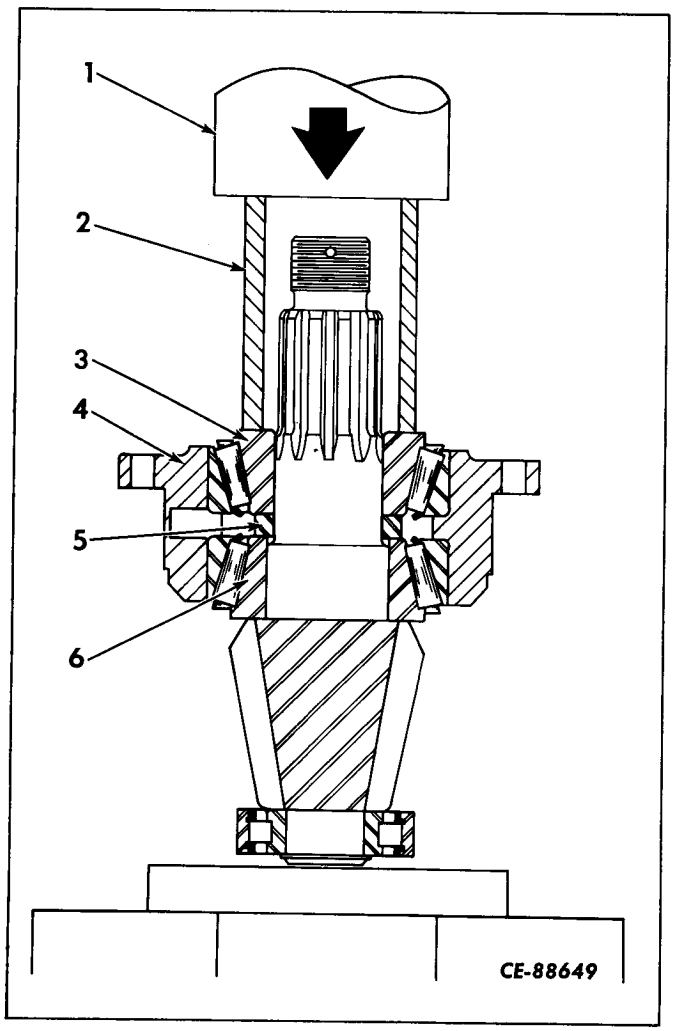

Figure 6-50

1. Press ram.
2. Suitable sleeve.
3. Outer thrust bearing.
4. Bearing cage.
5. Spacer.
6. Inner thrust bearing.

With cage and pinion assembly in press (Fig. 6-50) check bearing preload torque (refer to "SERVICE INFORMATION" under "TOLERANCES" for correct press tonnage). If press is not available, the pinion nut may be tightened to the recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION") and preload checked.

If assembly is checked in press, refer to "TOLERANCES" under "SERVICE INFORMATION" for correct press tonnage.

Press Tonnage: _____

Pinion Nut Torque: _____

Wrap soft iron wire around cage (Fig. 6-51) and pull in a horizontal line using a pound scale. Read the indicated rotating torque.

NOTE: Use rotating torque, not starting torque.

If torque is not within recommended limitations (refer to "TOLERANCES" under "SERVICE INFORMATION"), install a thinner spacer to increase or thicker spacer to decrease preload.

Preload Torque Limits: _____

(Continued on next page)

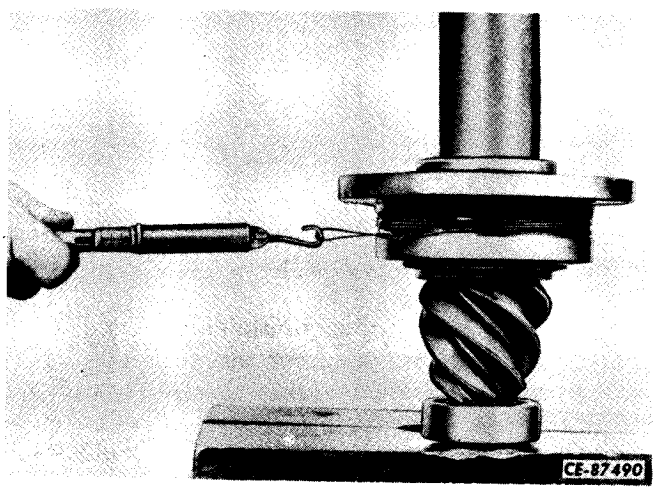

Figure 6-51

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

ASSEMBLY - Continued

As an example, let us assume the pinion cage diameter is 7 inches. The radius would be 3.5 inches and with 4 pounds of pull the preload torque would be 14 pound inches (3.5 x 4 = 14).

Press the yoke (1, Fig. 6-33) against the outer pinion thrust bearing and install flat washer and pinion shaft nut.

Install the pinion and cage assembly on differential carrier and secure with retaining cap screws. Cap screws need only be snugged up.

Holding the yoke with a suitable tool (Fig. 6-52), tighten the shaft nut to the correct torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

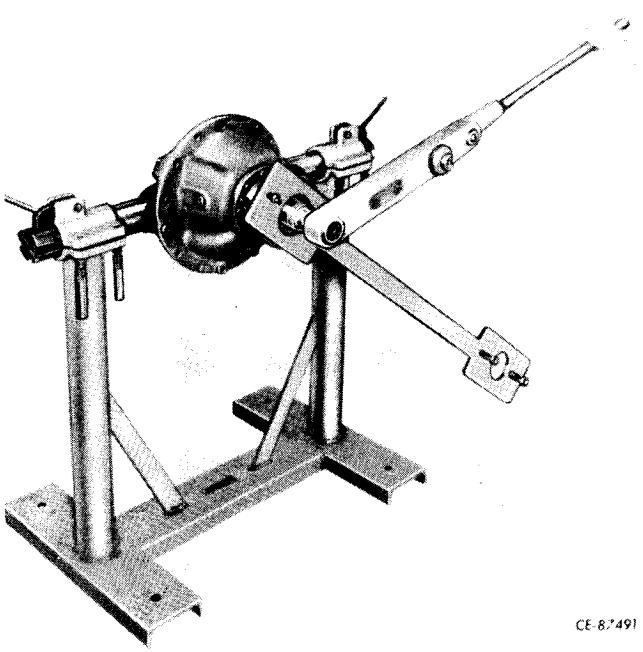

Figure 6-52

Remove the pinion and cage assembly from the differential carrier. Recheck the pinion bearing preload torque. If the rotating torque is not within the recommended limitations (refer to "TOLERANCES" under "SERVICE INFORMATION") repeat the adjusting procedure.

Hold the pinion yoke and remove the shaft nut, washer and yoke.

Lubricate the pinion shaft oil seal (1, Fig. 6-53). Coat the OD of the seal body with a non-hardening sealing compound. Install the seal in the pinion bearing cover (adapter) (2) using a suitable driver. Be sure lip of seal is toward pinion cage. Seal body must bottom on shoulder of bearing cover.

Install a new gasket on bearing cage assembly. Place bearing cover (adapter) (2) on cage.

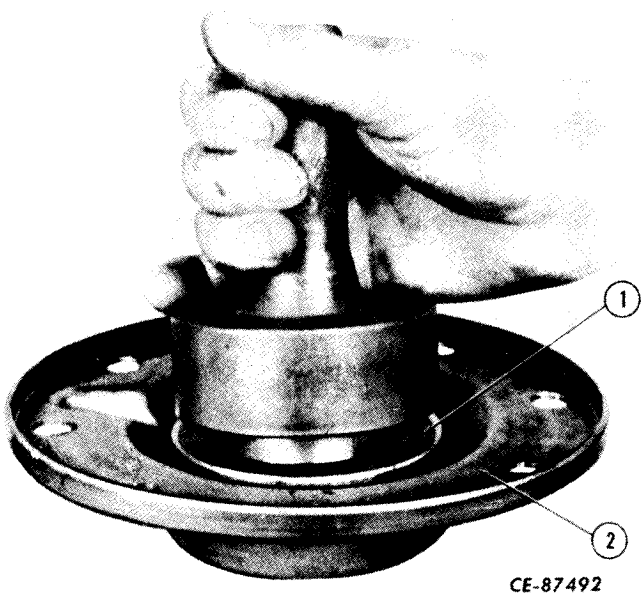

Figure 6-53

Press input yoke on pinion shaft and against outer thrust bearing.

Install the flat washer (27, Fig. 6-33) and pinion nut (28, Fig. 6-33). Tighten nut to recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

Install cotter pin.

NOTE: Do not back off nut to align cotter pin holes.

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

Install shim pack (2, Fig. 6-54), removed during disassembly, between the bearing cage (1) and the carrier (3).

NOTE: Locate thin shims on outside of pack for best sealing ability.

Tap pinion and cage assembly in position with a soft mallet.

Install cage/cover retaining cap screws and tighten to the recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

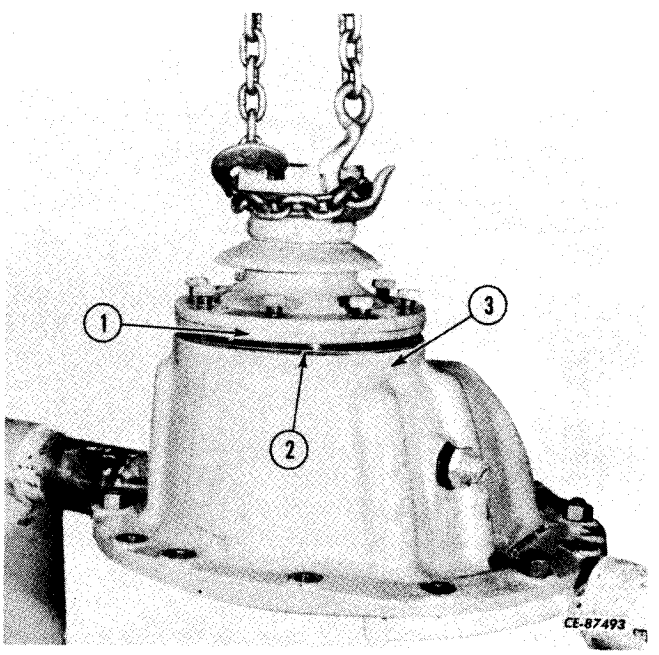

Figure 6-54

Rivet ring gear to case half with new rivets.

If a new gear or case is to be used, the rivet holes in the gear and case should be checked for alignment and line reamed if necessary. The gear must be tight on the case pilot and riveted flush with the differential case flange. Check with a .002" feeler gauge.

Rivets should not be heated, but should be upset cold. When the correct rivet and rivet set is used, the head being formed will be at least 1/8" larger in diameter than the rivet hole.

The head will be approximately the same height as the preformed head. Excessive pressure will cause distortion of the case holes and result in gear eccentricity. Refer to "TOLERANCES" under "SERVICE INFORMATION" for recommended press tonnage.

Press Tonnage: _____

Final pressure should be held for approximately one minute to be sure the rivet has filled the hole.

Position thrust washer (3, Fig. 6-55) and side gear (2) in ring gear and case half assembly (1) after lubricating parts with new axle lubricant (refer to "LUBRICANTS AND CAPACITIES" under "SERVICE INFORMATION").

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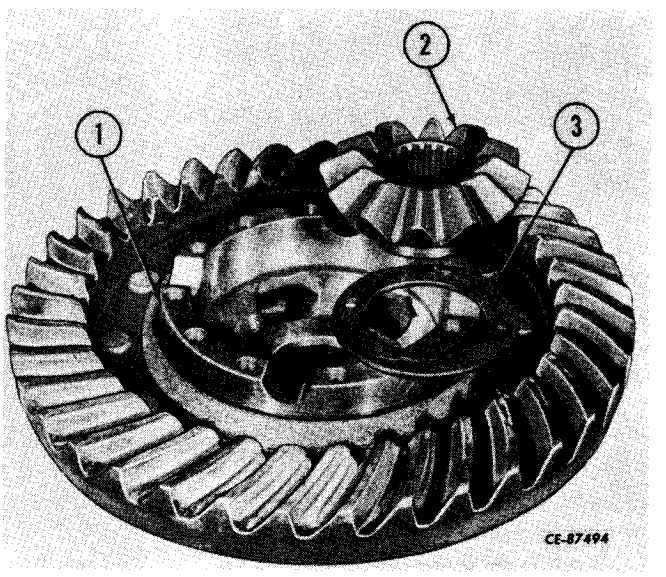

Figure 6-55

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

ASSEMBLY - Continued

Lubricate spider (6, Fig. 6-56), pinion gears (2) and thrust washers (5) with new axle lubricant.

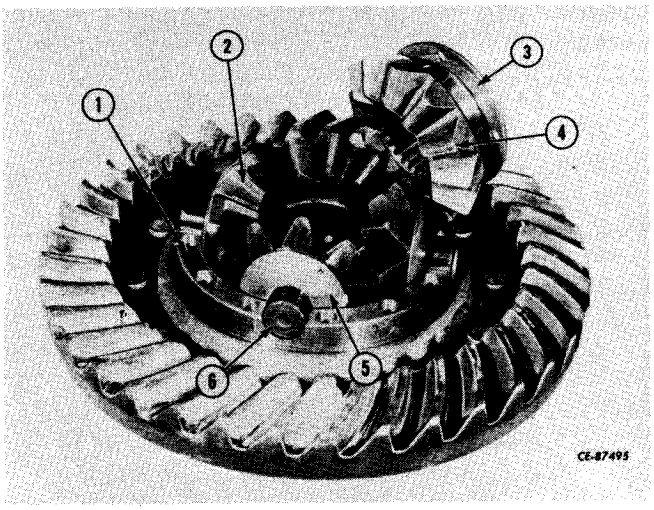

Figure 6-56

Place spider, pinion gears and thrust washers in position in case half (1).

Install remaining side gear (4) and thrust washer (3) after lubricating with new axle lubricant.

Align mating marks (1, Fig. 6-57) on case halves and secure assembly with four equally spaced cap screws and hex nuts.

Check assembly for free rotation of differential gears. Correct if necessary.

Install remaining cap screws and hex nuts. Tighten all differential case cap screws to recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

Lock wire case retaining cap screws.

If ring gear thrust bearings (7, 18, Fig. 6-33) were removed, press new bearings squarely on case halves being sure they bottom on case shoulders. Use a suitable sleeve and press only on bearing inner race.

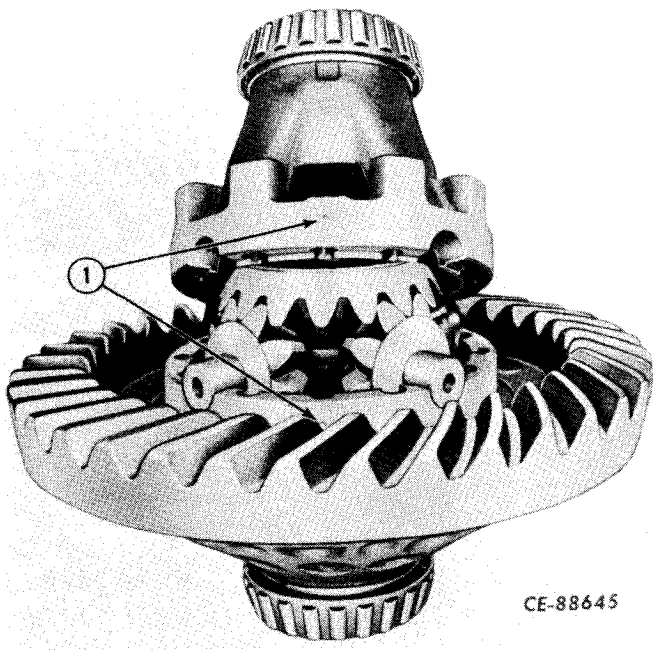

Figure 6-57

Lubricate bearings with new axle lubricant.

If the differential assembly will not be installed in the axle housing immediately, cover the complete assembly with a plastic cover to eliminate the entrance of dirt.

Temporarily install bearing cups (1, Fig. 6-58) and bearing caps (3). Tighten bearing cap

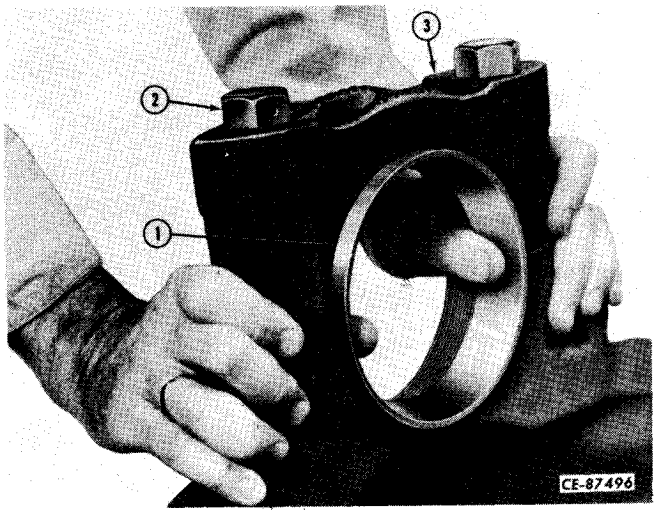

Figure 6-58

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

retaining cap screws (2) to recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque:_____

NOTE: Observe reference punch marks (Fig. 6-36) when installing bearing caps.

The bearing cups (1, Fig. 6-58) must be a hand push fit in their respective bores. If cups are too tight, bores must be reworked with emery cloth until a push fit is obtained. Use a blued bearing cup as a gauge and check the fit often. When cups fit properly, remove the bearing caps.

Coat the differential bearing cones and cups with new axle lubricant.

Place bearing cups over differential bearing cones and position differential assembly in carrier (Fig. 6-59).

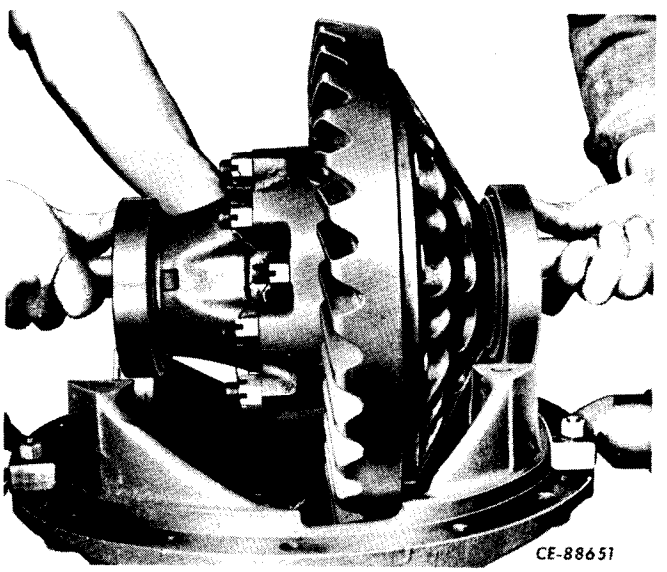

Figure 6-59

Install bearing adjusting nuts (2, Fig. 6-60). Hand turn them against bearing cups.

Install bearing caps (1) on their respective sides (refer to identification marks, Fig. 6-36) and tap lightly into position.

If caps do not position properly, adjusting nuts may be cross threaded. Remove caps and reposition the adjusting nuts.

NOTE: Do not force caps into position.

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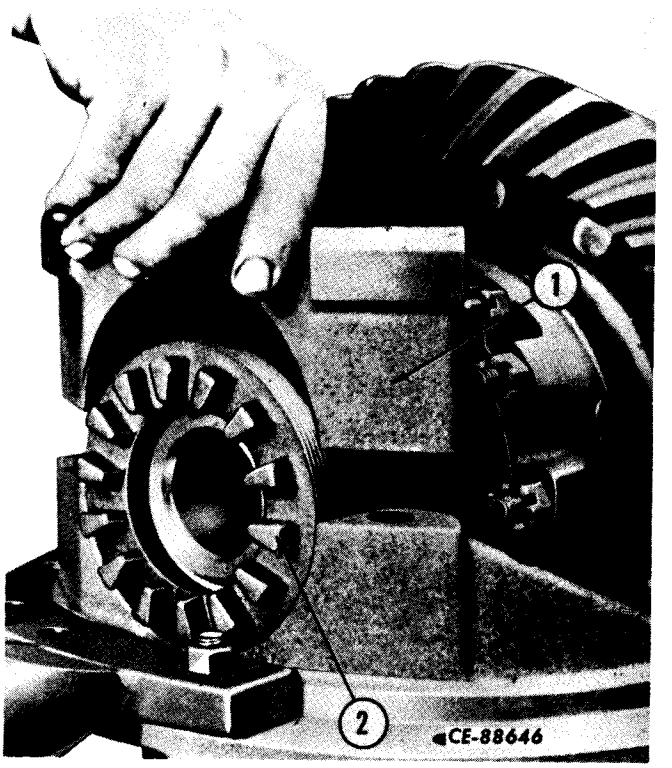

Figure 6-60

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

ASSEMBLY - Continued

Install flat washers (2, Fig. 6-61) and cap screws (1). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

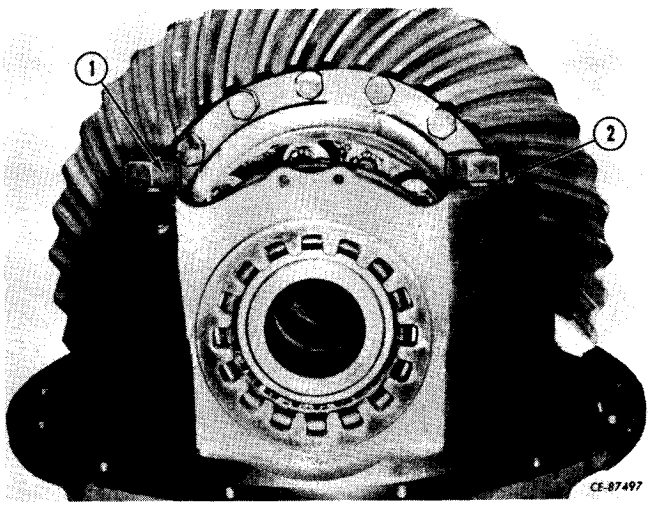

Figure 6-61

Using a dial indicator on the back face of the ring gear (Fig. 6-62) loosen the bearing adjusting nut on the side opposite the gear teeth just enough to notice end play on the indicator.

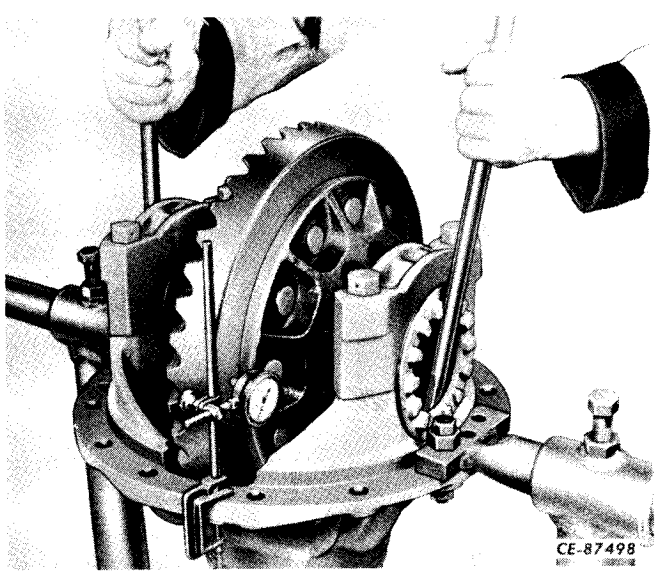

Figure 6-62

Tighten the same adjusting nut just sufficient to obtain .000 end play.

Check ring gear for runout. If runout exceeds recommended maximum (refer to "TOLERANCES" under "SERVICE INFORMATION"), remove differential and determine cause.

Max. Runout: _____

From the .000 end play setting, tighten the adjusting nuts one notch each to preload the differential bearings.

If ring and pinion gears were not replaced, the backlash dimension (Fig. 6-63) recorded before disassembly should be used.

If gear set was replaced the recommended backlash setting for new gears (refer to "TOLERANCES" under "SERVICE INFORMATION") should be adhered to.

Initial Backlash - New Gears: _____

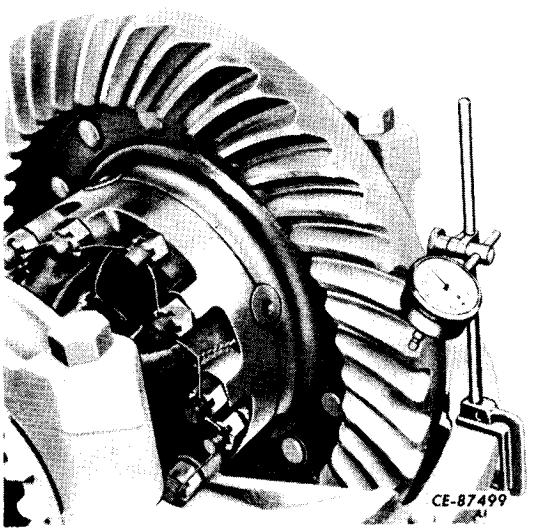

Figure 6-63

Backlash is adjusted by backing off one lock ring and advancing the opposite ring the same amount.

Apply oiled red lead (Fig. 6-64) to the ring gear teeth. When the pinion is rotated the red lead

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

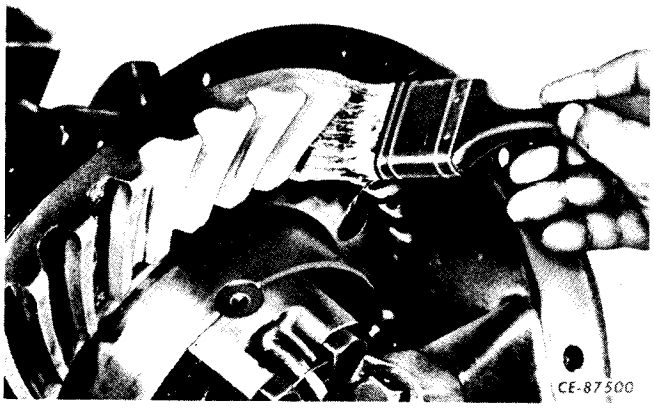

Figure 6-64

is squeezed away by the contact of the teeth leaving an imprint the exact size, shape and location as the contact.

Sharper impressions may be obtained by applying a small amount of resistance to the ring gear with a steel bar and using a wrench to rotate the pinion. When marking adjustments, check the drive side of the ring gear teeth. Coating approximately 12 teeth is sufficient to check tooth contact.

After a satisfactory tooth contact is obtained, especially in relation to the top and bottom of the tooth, the backlash may be altered within recommended limits (refer to "TOLERANCES" under "SERVICE INFORMATION") to obtain a better contact position relative to the length of the tooth.

Backlash Alteration Limits: _____

A high backlash setting can be used to keep the contact from starting too close to the toe. A low backlash setting can be used to keep the contact from starting too far away from the toe.

After establishing correct tooth contact, install adjusting nut locks (2, Fig. 6-65). Lock wire bearing cap retaining cap screw (1).

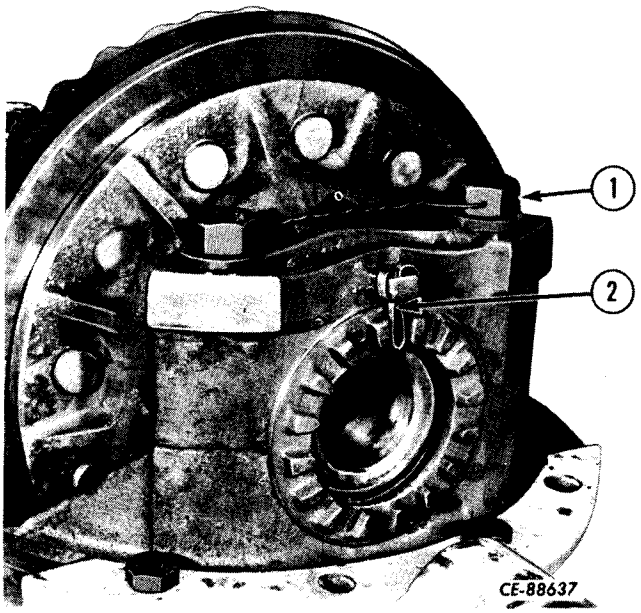

Figure 6-65

With adjustments properly made, the contacts shown in Fig. 6-66 will be obtained. The area of contact favors the toe and is centered between the top and bottom of the tooth.

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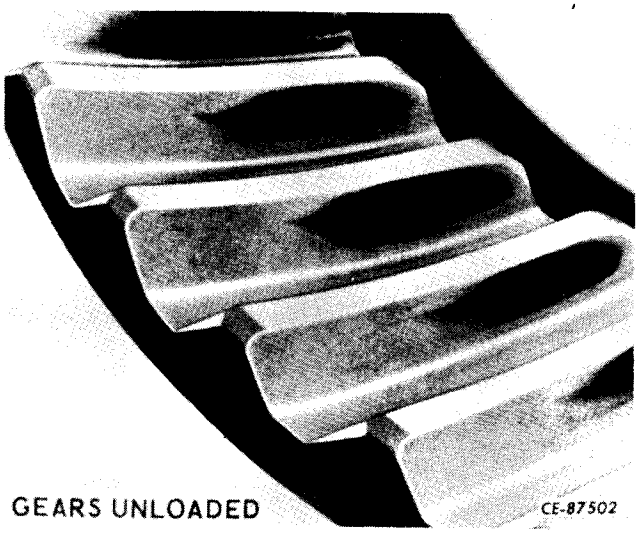

Figure 6-66

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

ASSEMBLY - Continued

The hand rolled pattern shown in Fig. 6-67 will result in a pattern centered in the length of the tooth when the gears are under load. The loaded pattern will be almost full length and the top of the pattern will approach the top of the gear tooth.

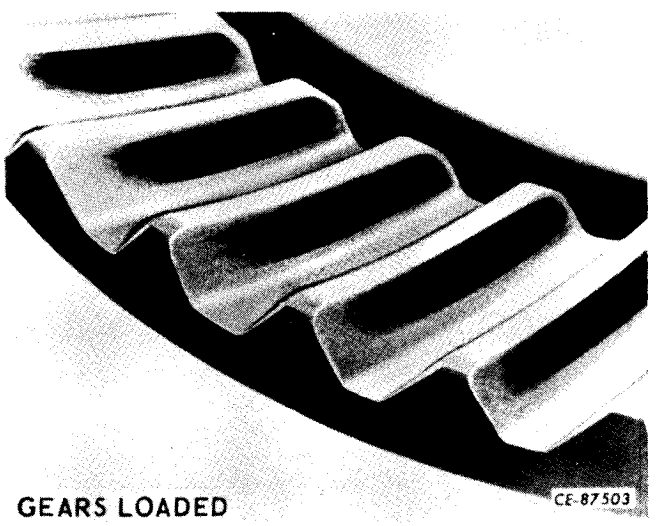

Figure 6-67

The pattern on the coast side of the teeth will appear the same width as the drive side; however the over-all length will be centered between the toe and heel of the gear tooth.

Set used gears to have tooth contacts to match the established wear pattern. Hand rolled patterns of used gears will be smaller in area and should be at the toe end of the wear pattern.

A high contact (Fig. 6-68) indicates the pinion is too far out. Set the pinion to the correct depth by removing shims under the pinion cage. A slight outward movement of the ring gear may be necessary to maintain correct backlash.

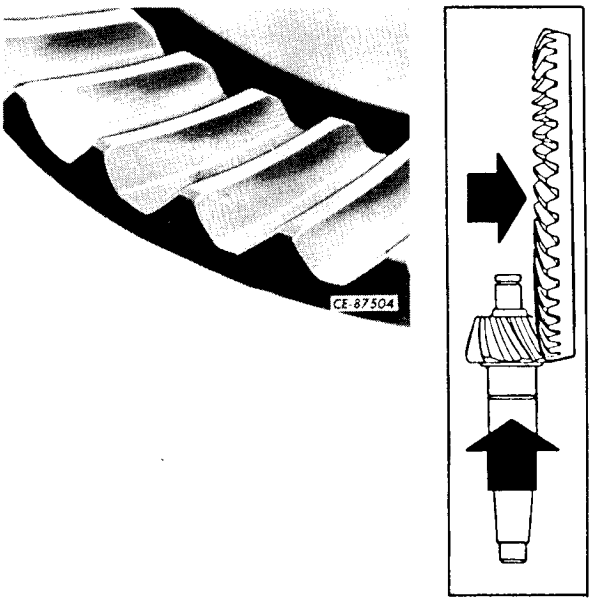

Figure 6-68

A low contact (Fig. 6-69) indicates the pinion is too deep. Set the pinion to the correct depth by adding shims under the pinion cage. Slight inward movement of the ring gear may be necessary to maintain correct backlash.

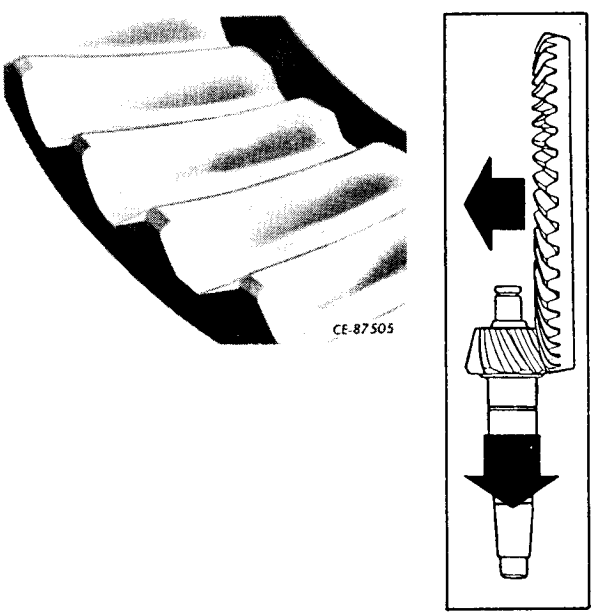

Figure 6-69

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

Remove carrier from the holding fixture. Position the assembly with the back face of the ring gear upward.

Inspect thrust screw (20, Fig. 6-33) for excessive wear and scoring. Replace screw if in doubt.

Install thrust screw (20, Fig. 6-33) and jam nut (21). Tighten adjusting screw sufficiently to locate it firmly against back face of hypoid gear.

Back off the adjusting screw until the recommended clearance (refer to "TOLERANCES" under "SERVICE INFORMATION") is obtained.

Thrust Screw Clearance:_____

Hold adjusting screw and tighten the jam nut securely.

Recheck the thrust screw-to-ring gear clearance for a full rotation of the ring gear.

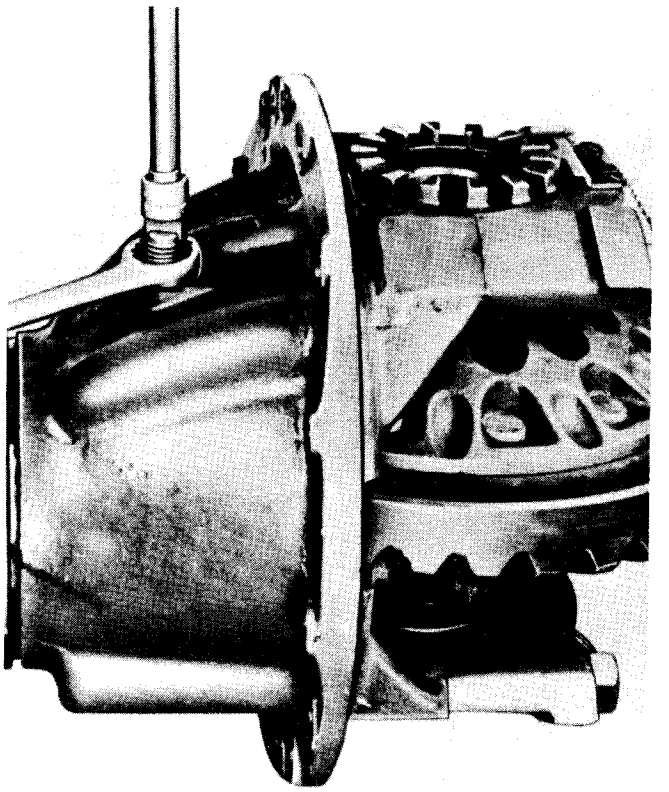

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Figure 6-70

PLANETARY DISASSEMBLY AND ASSEMBLY

DISASSEMBLY PREPARATION

Disassembly preparation should include:

a. Removing planetary assemblies from the axle (refer to "AXLE DISASSEMBLY AND ASSEMBLY").

b. Preparing a clean work area of sufficient size.

c. Cleaning the outside of the planetary carrier assembly with solvent (no caustic soda).

d. Secure the following equipment:

Work bench
Suitable hoist
Hydraulic press

A quantity of dry ice, sufficient to chill the ring gear hubs, will be required if hub bearing cones are removed.

SOLID AXLES

PLANETARY DISASSEMBLY AND ASSEMBLY

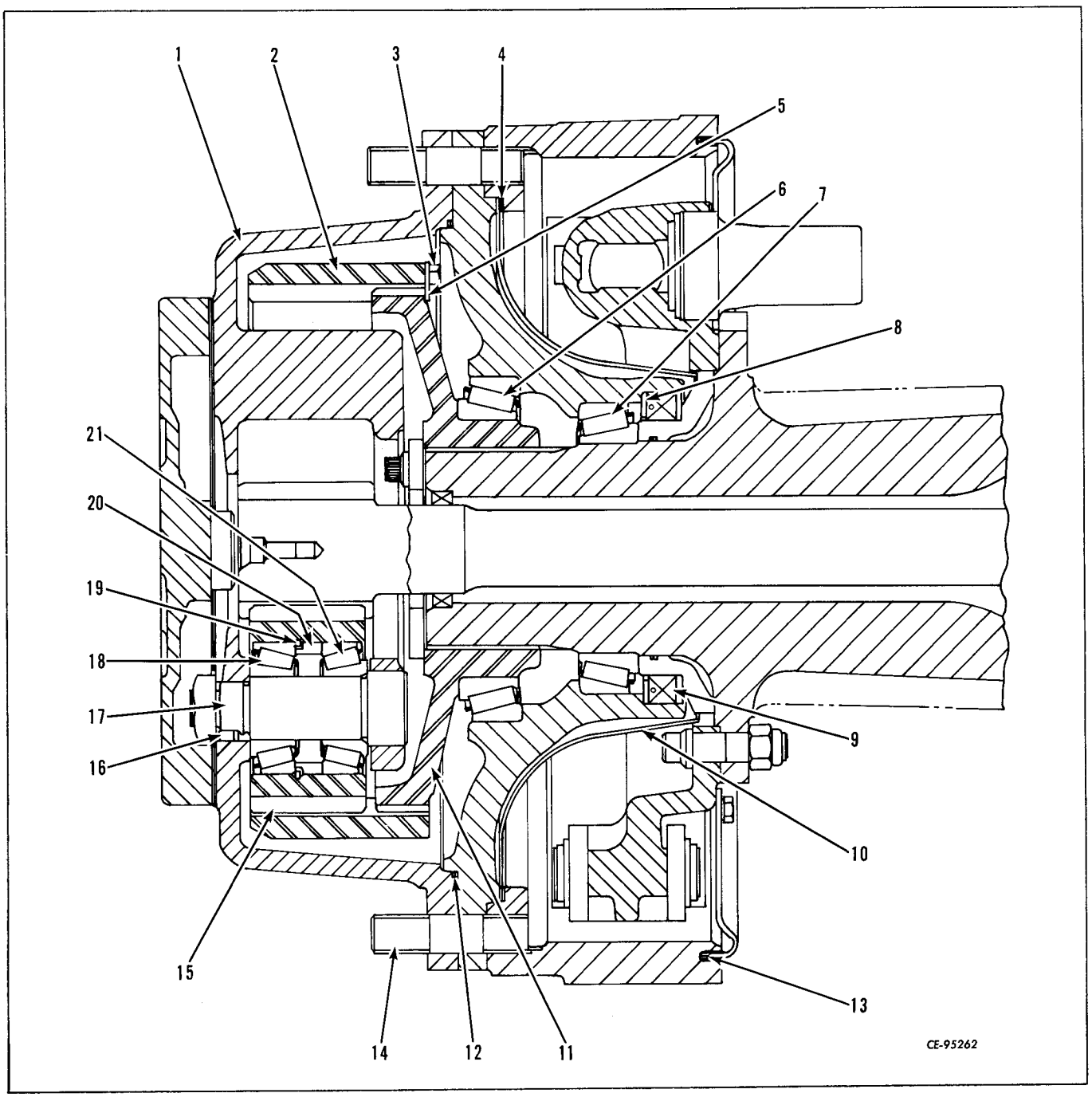

Figure 6-71
Planetary Assembly - Cross Section.

1. Planetary carrier.
2. Ring gear.
3. Cap screw.
4. Seal ring.
5. Lock plate.
6. Outer wheel hub bearing.
7. Inner wheel hub bearing.
8. Spacer.
9. Oil seal (o = seal spring).
10. Scavenger.
11. Ring gear hub.
12. Seal ring.
13. Felt brake drum seal.
14. Wheel stud.
15. Pinion gear.
16. Dowel pin.
17. Planetary pinion shaft.
18. Pinion bearing.
19. Retaining ring.
20. Spacer.
21. Pinion bearing.

PLANETARY DISASSEMBLY AND ASSEMBLY

CARRIER

DISASSEMBLY

Remove the hex nuts (2, Fig. 6-72) from the planetary pinion shafts (1).

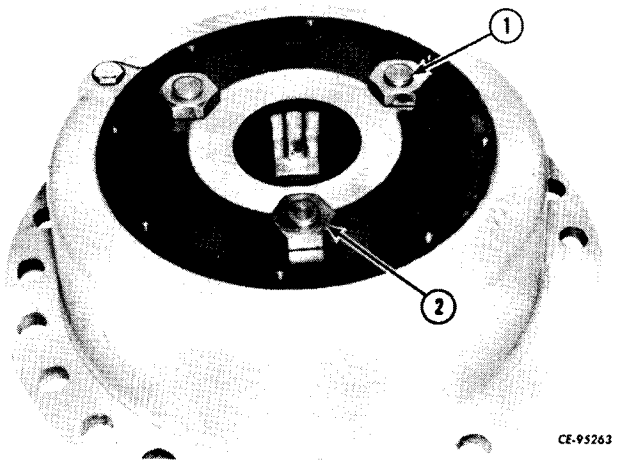

Figure 6-72

Press the planetary pinion shafts (3, Fig. 6-73) from the planetary carrier (1) using a hydraulic press. Exert the pressure on the small end of the pinion shafts.

NOTE: Do not lose dowel pins (4) as pinion shafts are removed.

After pressing all pinion shafts from the carrier the assembled pinion gears and bearings (2) may be removed.

Inspect the pinion bearings (1, 2, 6, 7, Fig. 6-74). Check for smooth, free rotation. If the bearings do not operate properly, remove the bearing cups (2, 7), spacer (5) and snap ring (3) from the pinion gears.

NOTE: Bearing cones and cups must be replaced together.

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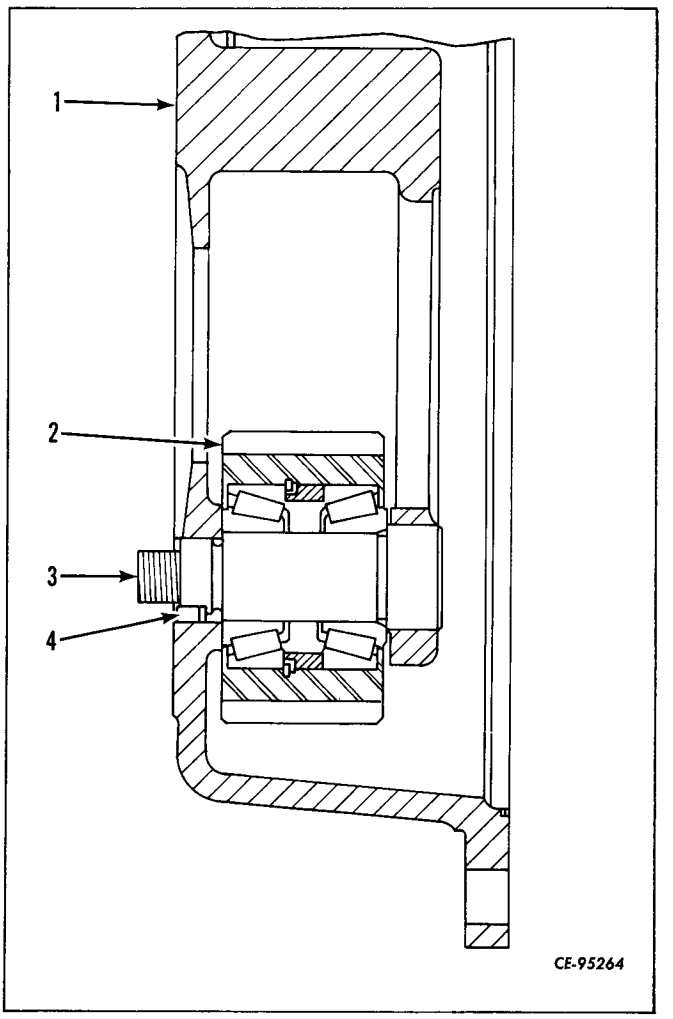

Figure 6-73

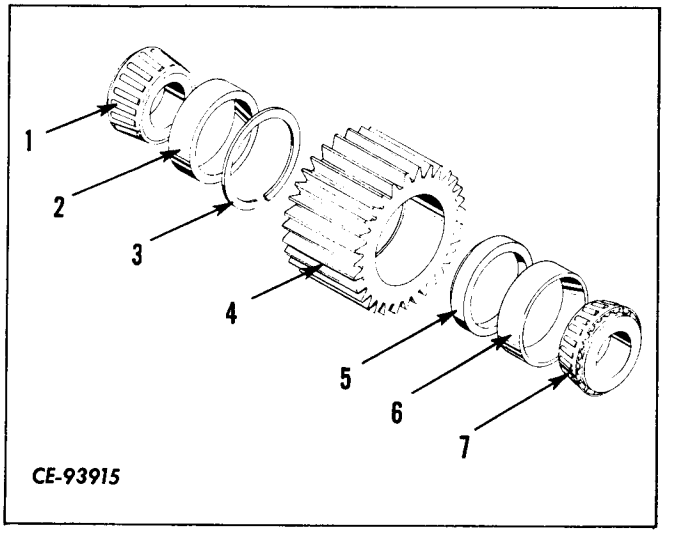

Figure 6-74

PLANETARY DISASSEMBLY AND ASSEMBLY

CARRIER - Continued

CLEANING AND INSPECTION

Clean all parts thoroughly in solvent. Dry parts with compressed air.

CAUTION: NEVER dry bearings by spinning with compressed air.

Inspect all bearings, cups and cones, including those not removed.

Inspection of pinions for wear or damage. Pinions showing wear or damage should be replaced.

Inspection of pinion shafts for wear or ridging.

Replace all snap rings, gaskets, "O"-rings and sealing washers.

Parts to be assembled immediately should be dipped in light oil to prevent corrosion. Parts to be stored should be coated with a good grade of rust preventive and wrapped in treated paper.

NOTE: Special Torque, Pressure etc. recommendations are listed under "SERVICE INFORMATION." This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil, and revised when necessary.

ASSEMBLY

Install a new snap ring (3, Fig. 6-74) in the groove in the pinion bore.

Install spacer (5) against snap ring. Press in bearing cups (2, 6).

Install bearing cones (1, 7) in cups with spacer (5) between cones.

Slide the assembled pinions (Fig. 6-75) into the carrier in their approximate positions. All three must be installed before any shafts are installed. Align the holes of the pinion bearings and planetary carrier.

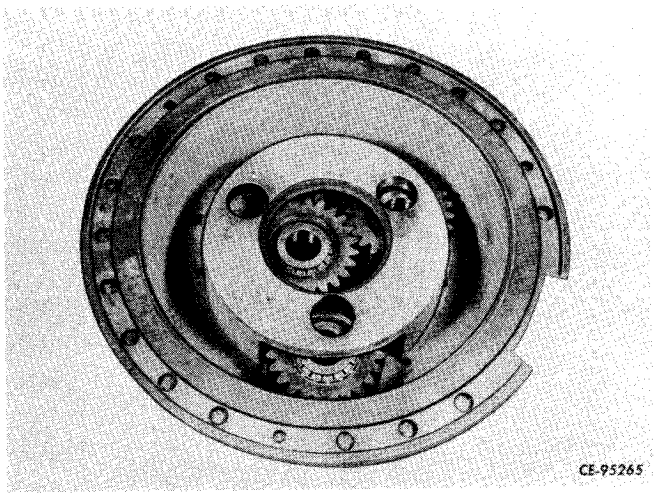

Figure 6-75

Pack the pinion shafts in dry ice to shrink them for easier installation. With the assembled pinions in position, install the pinion shafts (1, Fig. 6-76), aligning the dowel holes, and drive the shafts into position. Install the dowels (2) and drive into position against the shoulder of the shaft.

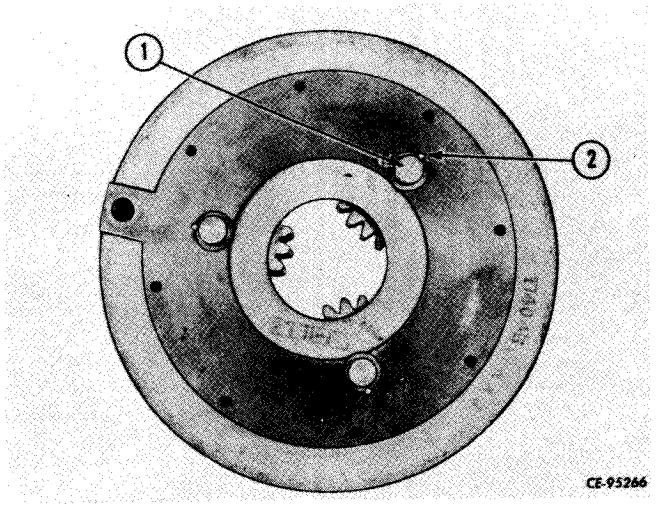

Figure 6-76

Install pinion nuts (1, Fig. 6-77) and tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Position the nut to fit inside the ID of the gasket (2) to provide clearance to install the cover.

PLANETARY DISASSEMBLY AND ASSEMBLY

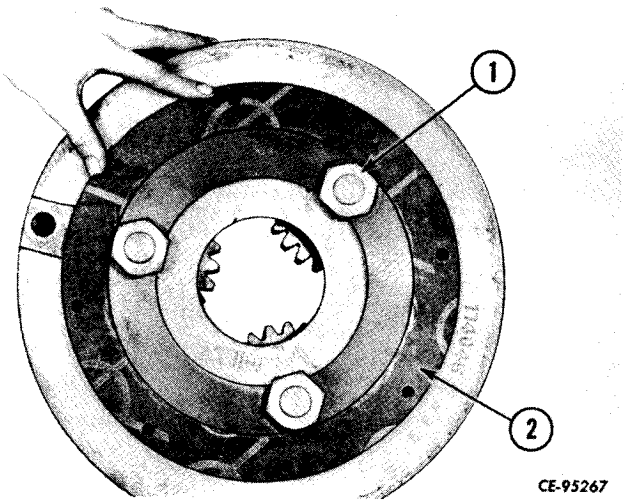

Figure 6-77

NOTE: In order to correctly position the nut, it may be necessary to vary the torque above or below that specified.

RING GEAR AND HUB

DISASSEMBLY

Remove the cap screws (4, Fig. 6-78) and lock plates (3) that secure the ring gear (1) to the ring gear hub (2). Remove the ring gear.

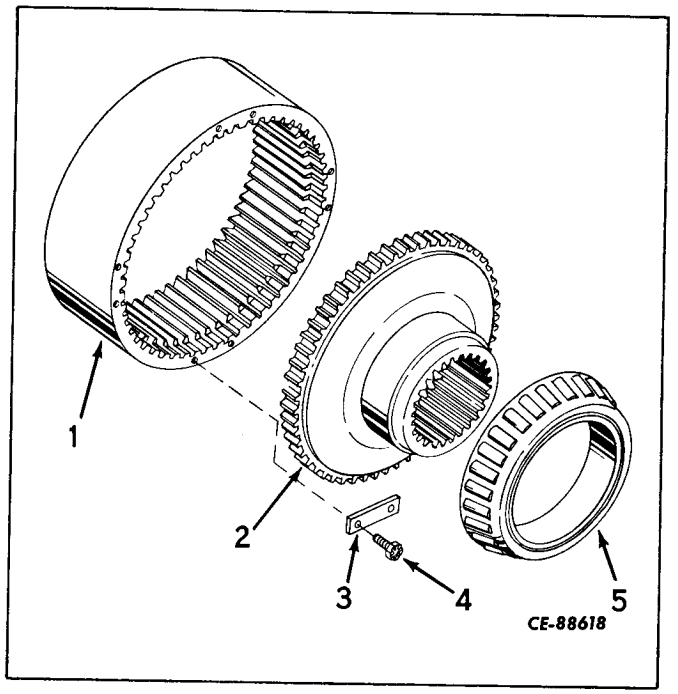

Figure 6-78

Using a suitable puller, remove the bearing cone (5) from the ring gear hub.

Wash all parts in fresh cleaning solvent. Inspect parts and replace if worn or damaged in any way.

ASSEMBLY

Chill ring gear hub (2, Fig. 6-78) in dry ice for 30 minutes. Install bearing cone (5) against shoulder of hub.

Position ring gear (1) on hub. Secure assembly with lock plates (3) and cap screws (4). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

WHEEL HUB AND BEARING

DISASSEMBLY

Remove the seal (6, Fig. 6-79) and spacer (5) from the hub. Discard the oil seal.

Remove the bearing cone (4) from the hub. Mark the bearing cup and cone so the pair can be rematched if they are reused. Examine the bearing cone and cups for wear or damage. Check the rollers for flat or worn spots.

(Continued on next page)

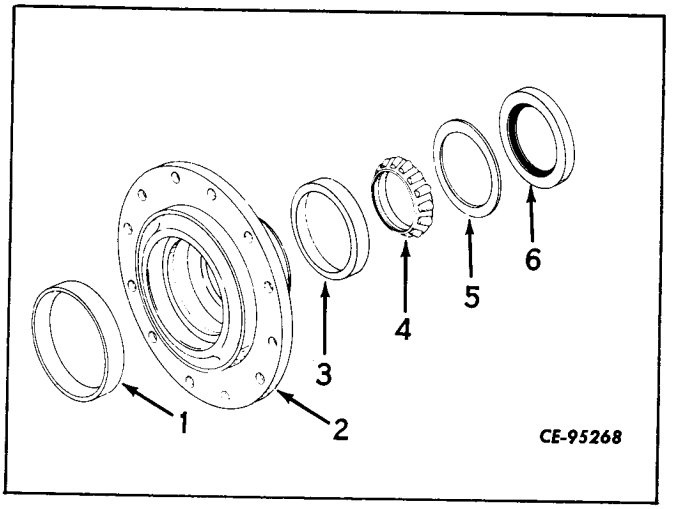

Figure 6-79

PLANETARY DISASSEMBLY AND ASSEMBLY

WHEEL HUB AND BEARING - Continued

DISASSEMBLY - Continued

Wash all parts in fresh cleaning solvent. Dry with compressed air.

CAUTION: NEVER dry bearings by spinning with compressed air.

Dip cones in light oil and check for wear, flat spots or damage. If cups or cones are damaged or worn, replace complete bearing. Remove damaged bearing cup(s) (1 and/or 3) by pressing from hub.

ASSEMBLY

If bearing cups (1, 3, Fig. 6-79) were removed from the hub (2), press new cups in the hub. Lubricate the bearing cone (4) with new axle lubricant (refer to "LUBRICANTS AND CAPACITIES" under "SERVICE INFORMATION") and install it in the bearing cup (3) in the hub.

Install the spacer (5) against the hub shoulder.

Coat the OD of a new seal (6) with mar-seal or equivalent sealant. Press new seal in hub against spacer.

BRAKE DRUM

DISASSEMBLY

If the scavenger (3, Fig. 6-80) is damaged and requires replacement, drive it from the drum assembly with a heavy mallet. Remove the seal ring (4, Fig. 6-71) that lies between the scavenger and the brake drum. Discard seal and scavenger.

Remove the felt seal (1, Fig. 6-80) from its groove in the brake drum (2). Discard the seal.

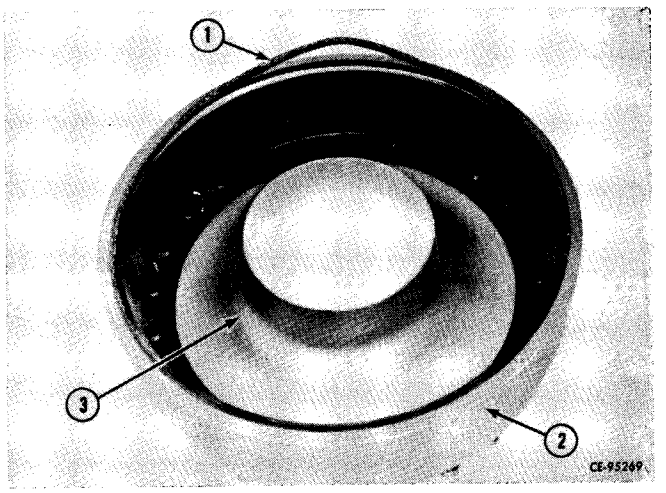

Figure 6-80

If any wheel studs are damaged, replace them. In addition, replace the studs on either side of the damaged stud. If approximately half of the studs are damaged, replace all of the studs on that drum.

ASSEMBLY

Replace the necessary wheel studs as described above.

Install a new seal (4, Fig. 6-71) on the drum shoulder of the drum. Position a new scavenger (3, Fig. 6-80) on the drum and tap edges lightly to start scavenger into bore. Position a hardwood block across the FULL DIAMETER of the scavenger and using a mallet drive the scavenger into position. Rotate the block while striking it with the mallet. Be sure the scavenger is seated around its entire circumference against the drum shoulder.

Install a new drum seal (1, Fig. 6-80) in the drum groove. Do not damage or distort the seal during installation. Seal must not be twisted during installation.

TROUBLE SHOOTING

Noise and vibration, originating in the transmission, drive shafts or tires is often attributed to an axle. The source of noise should be investigated before deciding that the cause is in the axle.

Axle noise may be isolated within the axle by jacking up the tractor so the tires clear the ground. If the noise is in one axle, disconnect the drive shaft of the opposite axle at the transmission. Now the noise may be isolated with only the noisy axle turning. Run the engine at a moderate speed with the transmission in first gear. Both wheels must be off the ground to prevent damage to the differential.

CAUTION: If a failure should occur in the differential, the tractor must not be operated under its own power. If the tractor must be moved, disconnect the drive shaft at the transmission, or remove the drive shaft completely. Drain both planetary hubs of the noisy axle, remove the planetary covers and pull the axle shafts to prevent further damage. When shafts are removed, install planetary covers and fill hubs before moving tractor. The tractor may be driven a short distance with one axle if the drive shaft and axle shafts are removed from the noisy axle or differential.

TROUBLE SHOOTING CHART

COMPLAINT	PROBABLE CAUSE	REMEDY
	AXLE	
Noise.	1. Incorrect lubricant, or level too low.	1. Check level; fill with correct grade and type of lubricant.
	2. Wheel bearings scored or damaged.	2. Replace bearings.
	3. Wheel bearings improperly adjusted.	3. Adjust wheel bearings.
	4. Sun gear teeth excessively worn or damaged.	4. Replace axle shaft.
Loss of lubricant.	1. Lubricant level too high.	1. Drain to correct level.
	2. Lubricant foams excessively.	2. Drain and fill with correct type and viscosity of oil.
	3. Lubricant leaks at planetary cover.	3. Tighten cap screws or replace gasket.
	4. Worn or broken oil seal on axle spindle housing (oil leak from behind wheel into brake compartment).	4. Replace spindle oil seal.
	5. Worn or broken drive axle oil seal (oil level in differential rises).	5. Replace axle shaft oil seal.

(Continued on next page)

TROUBLE SHOOTING

TROUBLE SHOOTING CHART - Continued

COMPLAINT	PROBABLE CAUSE	REMEDY
	DIFFERENTIAL	
Noise when turning.	1. Worn spider gears or side gears.	1. Replace gears.
Loss of lubricant.	1. Worn drive pinion oil seal. 2. Scored or worn differential drive yoke.	1. Replace oil seal. 2. Replace drive yoke and drive pinion oil seal.
Differential overheats.	1. Incorrect lubricant or level too low. 2. Pinion or ring gear bearing worn. 3. Gear teeth excessively worn or damaged. 4. Unmatched pinion and ring gear.	1. Check level; fill with correct grade and type of lubricant. Check differential housing for leaks. 2. Replace worn bearings. 3. Replace gears. 4. Replace with a new matched pinion and ring gear.
Noise when driving.	1. Incorrect lubricant or level too low. 2. Pinion and ring gear adjustment too tight.	1. Check level; fill with correct grade and type of lubricant. Check differential housing for leaks. 2. Readjust pinion and ring gear backlash.
Noise when coasting.	1. Pinion or ring gear bearings damaged. 2. Pinion and ring gear adjustment too loose.	1. Replace bearings. 2. Readjust pinion and ring gear backlash.
NOTE: The following problems can be checked when the differential has been removed and disassembled.		
Side gear broken at hub.	1. Misaligned or bent drive axle.	1. Replace damaged gears. Check drive axle for alignment and examine other gears and bearings for possible damage and replace as needed.

TROUBLE SHOOTING

COMPLAINT	PROBABLE CAUSE	REMEDY
Side gear broken at hub (Con't).	2. Worn thrust washers.	2. Replaced damaged gears. Examine other gears and bearings for possible damage. Replace all thrust washers.
Gears scored.	1. Incorrect lubricant or level too low.	1. Replace scored gears. Inspect all gears and bearing for possible damage. Clean out housing and fill with correct grade and type of lubricant.
	2. Excessive wheel spinning.	2. Replace scored gears. Inspect all gears, pinion bores and shafts for scoring. Inspect bearings for possible damage and replace as needed.
Pinion and/or ring gear tooth breakage.	1. Improper pinion and ring gear adjustment (backlash). 2. Excessive shock loading of gears.	1. Replace gears with new matched set. 2. Inspect remaining parts for possible damage and replace as needed.
	PLANETARY	
Noise.	1. Planetary gears or ring gear teeth worn, chipped or broken. 2. Bearings in planetary gears worn or broken.	1. Replace planetary gears or ring and pinion gears. 2. Replace gear shafts and bearings.
	BRAKES	
Brakes drag.	1. Brakes incorrectly adjusted. 2. Return springs broken. 3. Wedge return spring broken.	1. Adjust brakes. 2. Replace springs. 3. Replace spring.

SOLID AXLES

SERVICE INFORMATION

SPECIFICATIONS

AXLE

Overall Length	109-1/2"
Track - With Standard Wheels	92"
Approximate Weight	Front - 2600 lbs. Rear - 2550 lbs.

RATIOS

Differential	6.167
Planetary	5.2
Total	32.07

BRAKES

Diameter of Brake Drum	20.25"
Width of Brake Shoes	4"
Brake Cylinder Diameter	1.75"

LUBRICANTS AND CAPACITIES

	CAPACITY	LUBRICANT		
Differential (each)	36 pts.	IH-135H EP OR MIL-L-2105B	GL-5	Above 32° --- 140 Below 32° --- 90
Planetaries (each)	6-1/2 pts.			

TOLERANCES

Additional shim pack; planetary ring gear hub retainer-to-axle housing spindle	.005"
Press tonnage - differential pinion cage preload test	11 tons
Preload torque limits - differential pinion cage	5-15 lbs. in.
Press tonnage - rivets; ring gear-to-flanged case	45 ton
Ring gear runout - maximum	.008"
Initial backlash - new ring and pinion gear set	.010"
Backlash alteration limits - permissible during adjustment	.005"-.015"
Thrust screw clearance	.010"-.015" (1/4 turn of adjusting screw)

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SERVICE INFORMATION

SPECIAL TORQUES

(Threads lubricated with oil or grease)

Axle housing-to-axle bowl cap screws	430-450 lbs. ft.
Differential mounting cap screws	160-180 lbs. ft.
Brake spider-to-axle flange nuts	175-180 lbs. ft.
Ring gear hub retainer cap screws:	
Preliminary torque	30 lbs. ft.
Final torque	200 lbs. ft.
Planetary carrier-to-wheel hub, flat head cap screws	80-90 lbs. ft.
Planetary cover-to-carrier cap screws	33-37 lbs. ft.
Axle mounting cap screws	3500 lbs. ft.
Differential:	
Pinion nut torque	700-900 lbs. ft.
Pinion cage/cover retaining cap screws	81-104 lbs. ft.
Case half retaining cap screws	92-118 lbs. ft.
Bearing cap bolts	470-500 lbs. ft.
Planetary pinion shaft retaining nuts	300 lbs. ft.
Planetary ring gear-to-ring gear hub retaining cap screws	33-37 lbs. ft.
Wheel lug nuts	*900 lbs. ft.

*Wheel lug nuts must be torqued dry.

BRAKE ADJUSTMENT

Refer to Section 13, "BRAKE SYSTEM."

SPECIAL TOOLS

AXLE REMOVAL AND INSTALLATION TOOL

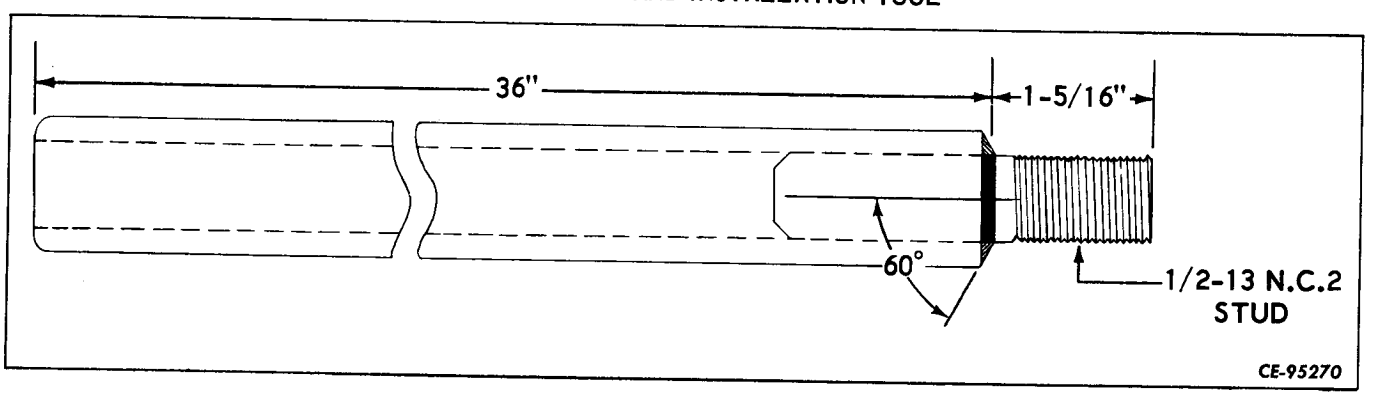

Figure 6-81

(Continued on next page)

SPECIAL TOOLS - Continued

DIFFERENTIAL HOLDING FIXTURE

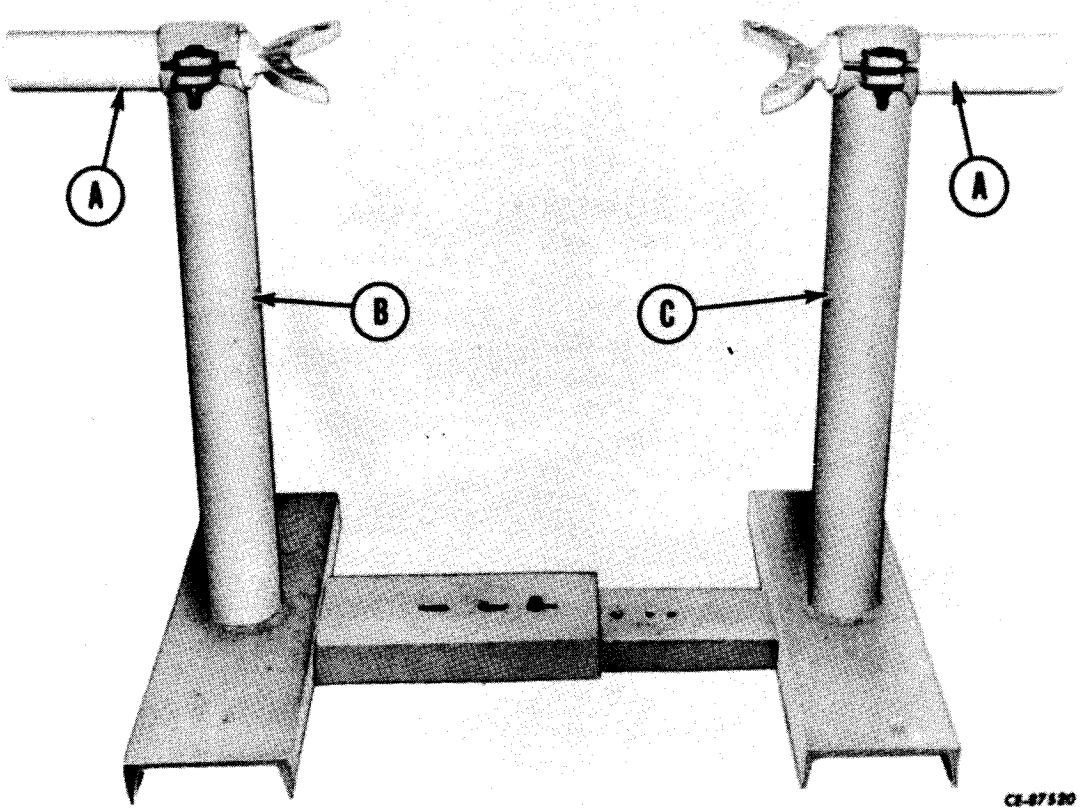

Figure 6-82
Assembled Differential Holding Fixture.

A. Swivel weldment (Fig. 6-83).
B. Stand weldment - left hand (Fig. 6-84).
C. Stand weldment - right hand (Fig. 6-85).

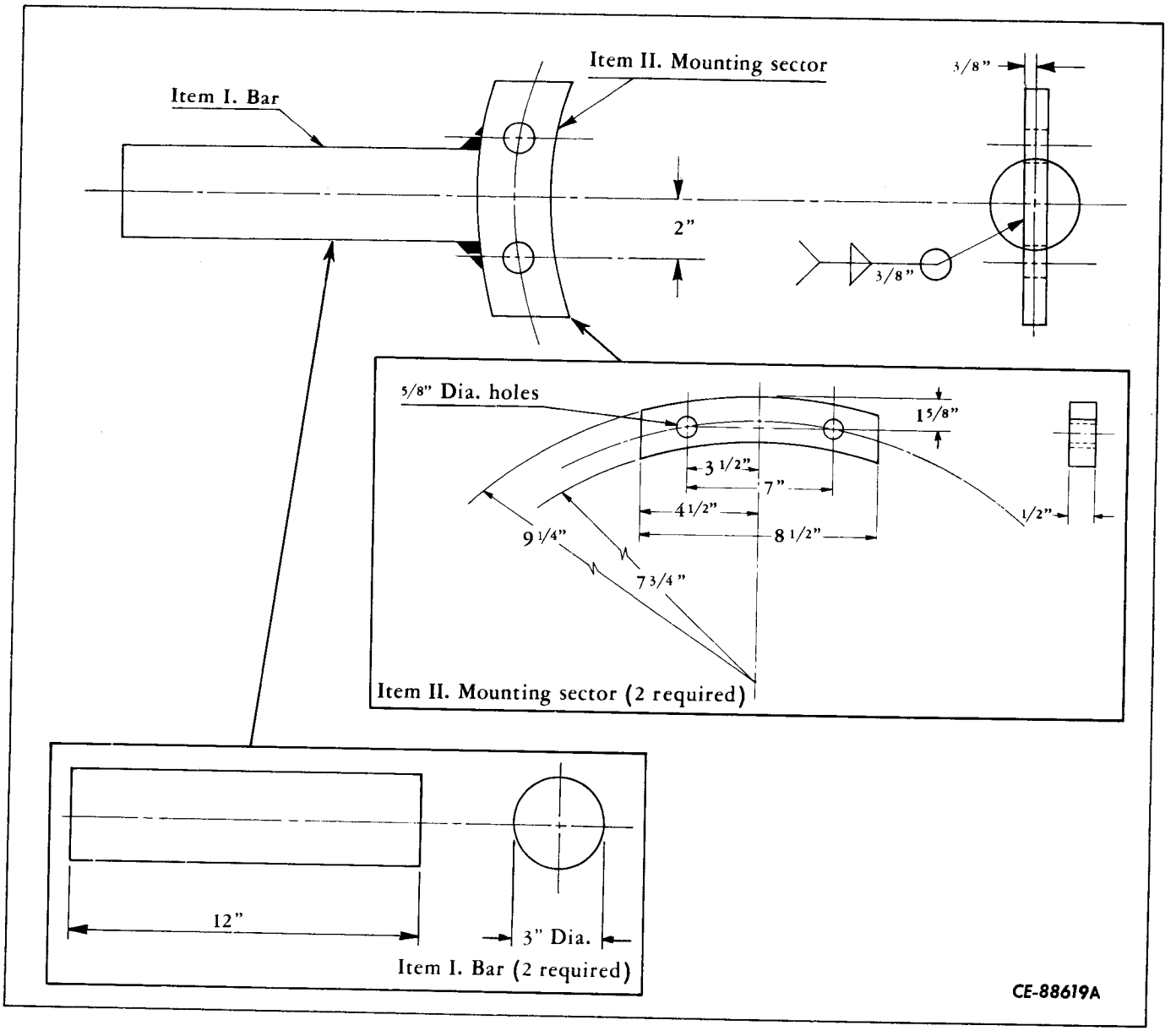

Figure 6-83
A. Swivel Weldment (2 Required).

SERVICE INFORMATION

SPECIAL TOOLS - Continued

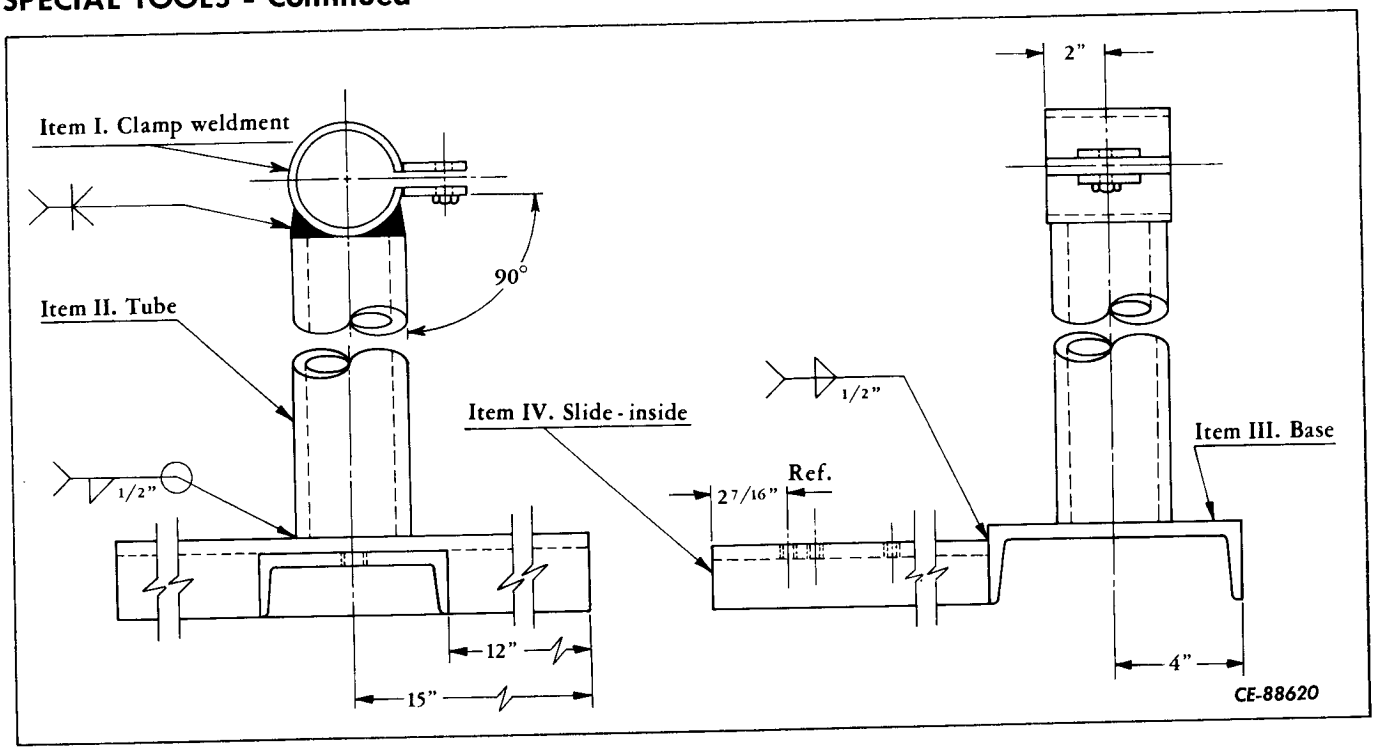

Figure 6-84
B. Stand Weldment Assembly - Left Hand (1 Required).
(Details Shown in Figures 6-86, 6-87, 6-88 and 6-90.)

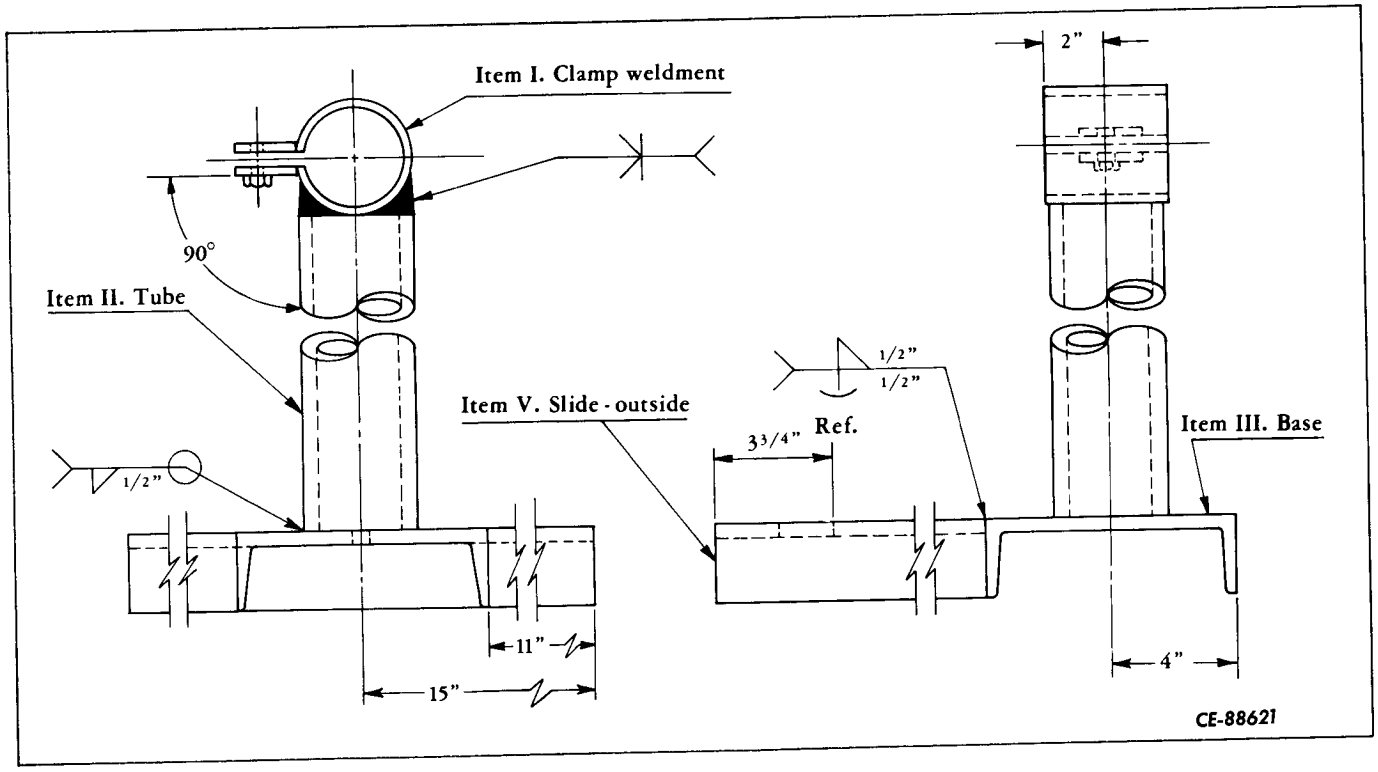

Figure 6-85
C. Stand Weldment Assembly - Right Hand (1 Required).
(Details Shown in Figures 6-86, 6-87, 6-88 and 6-89.)

SERVICE INFORMATION

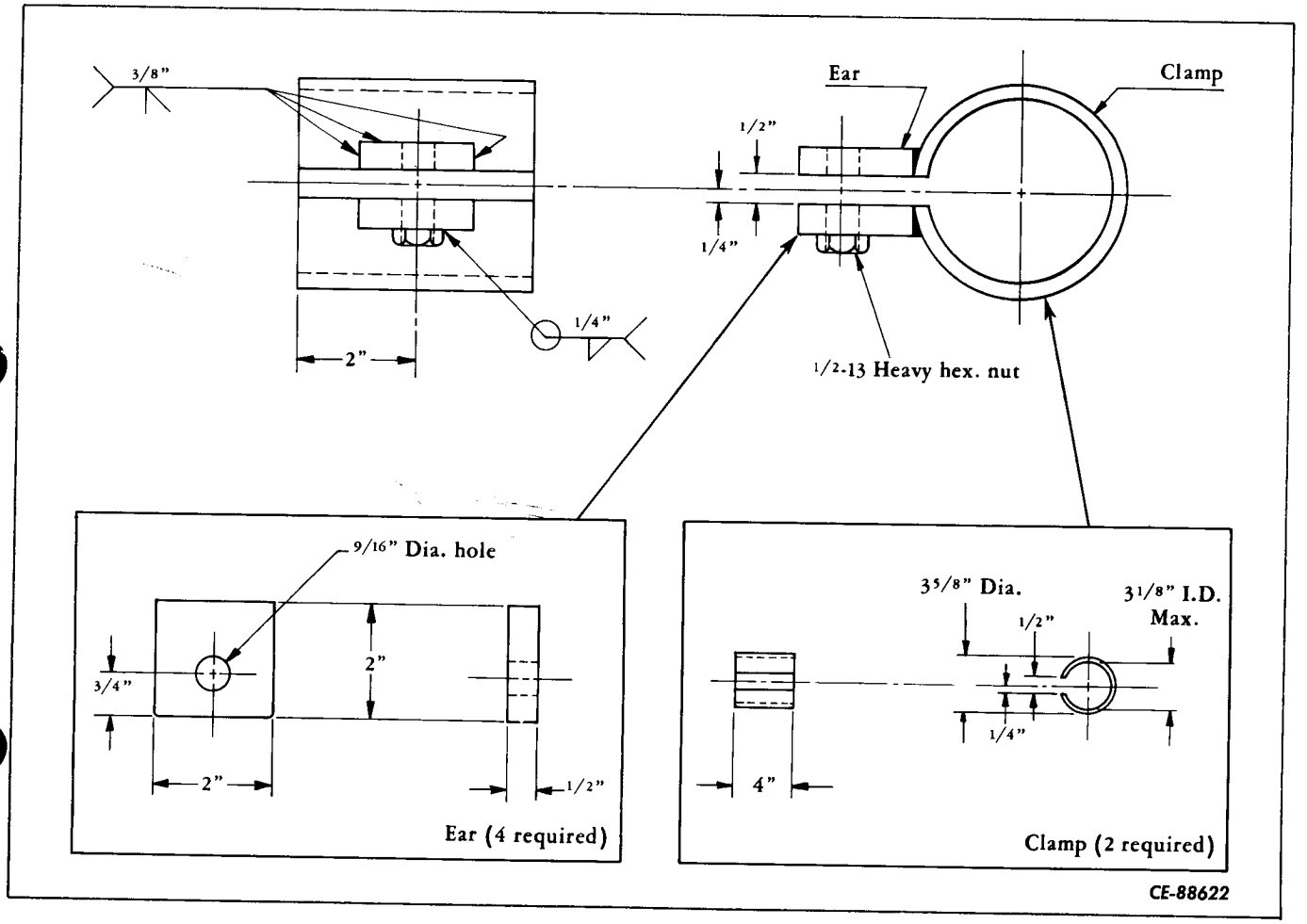

Figure 6-86
Item I. Clamp Assembly (2 Required).

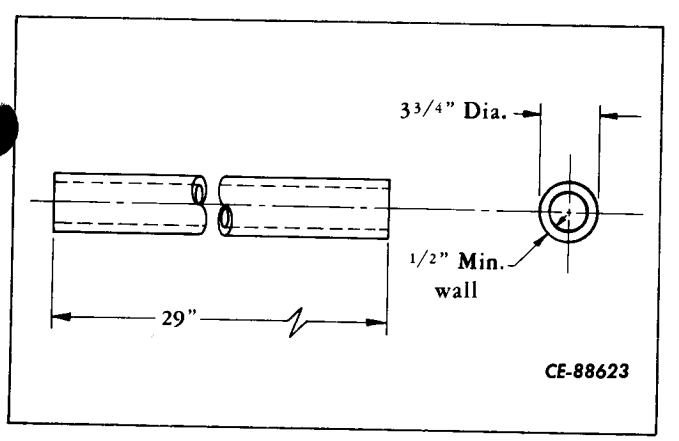

Figure 6-87
Item II. Tube (2 Required).

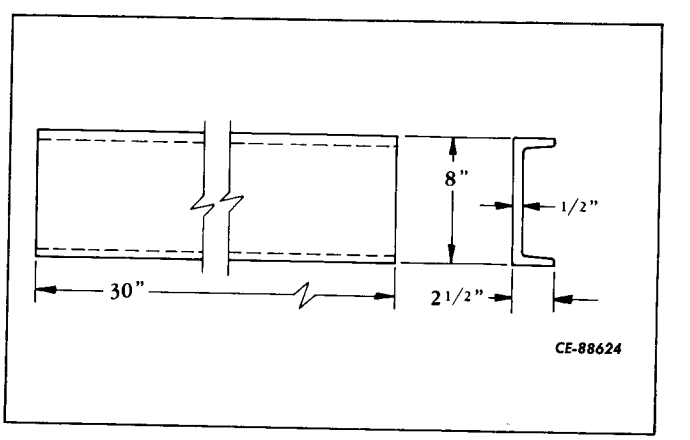

Figure 6-88
Item III. Base (2 Required).

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SPECIAL TOOLS - Continued

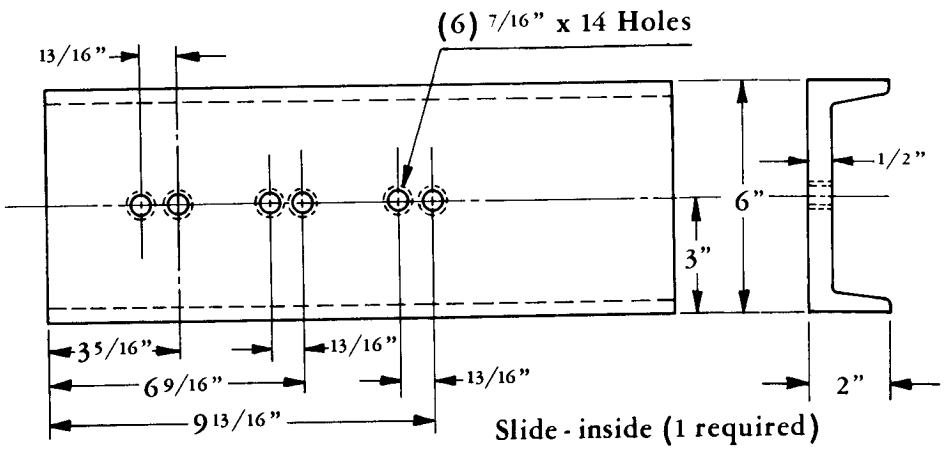

Figure 6-89
Item IV. Slide-Stand Weldment (Right Hand).

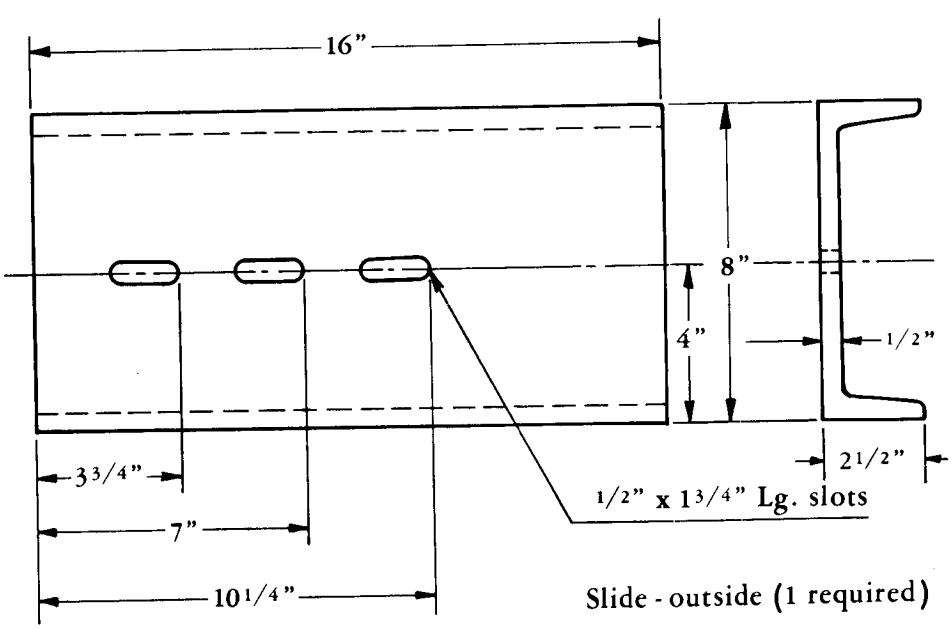

Figure 6-90
Item V. Slide-Stand Weldment (Left Hand).

SERVICE INFORMATION

WHEEL HUB - BRAKE DRUM LIFTING TOOL

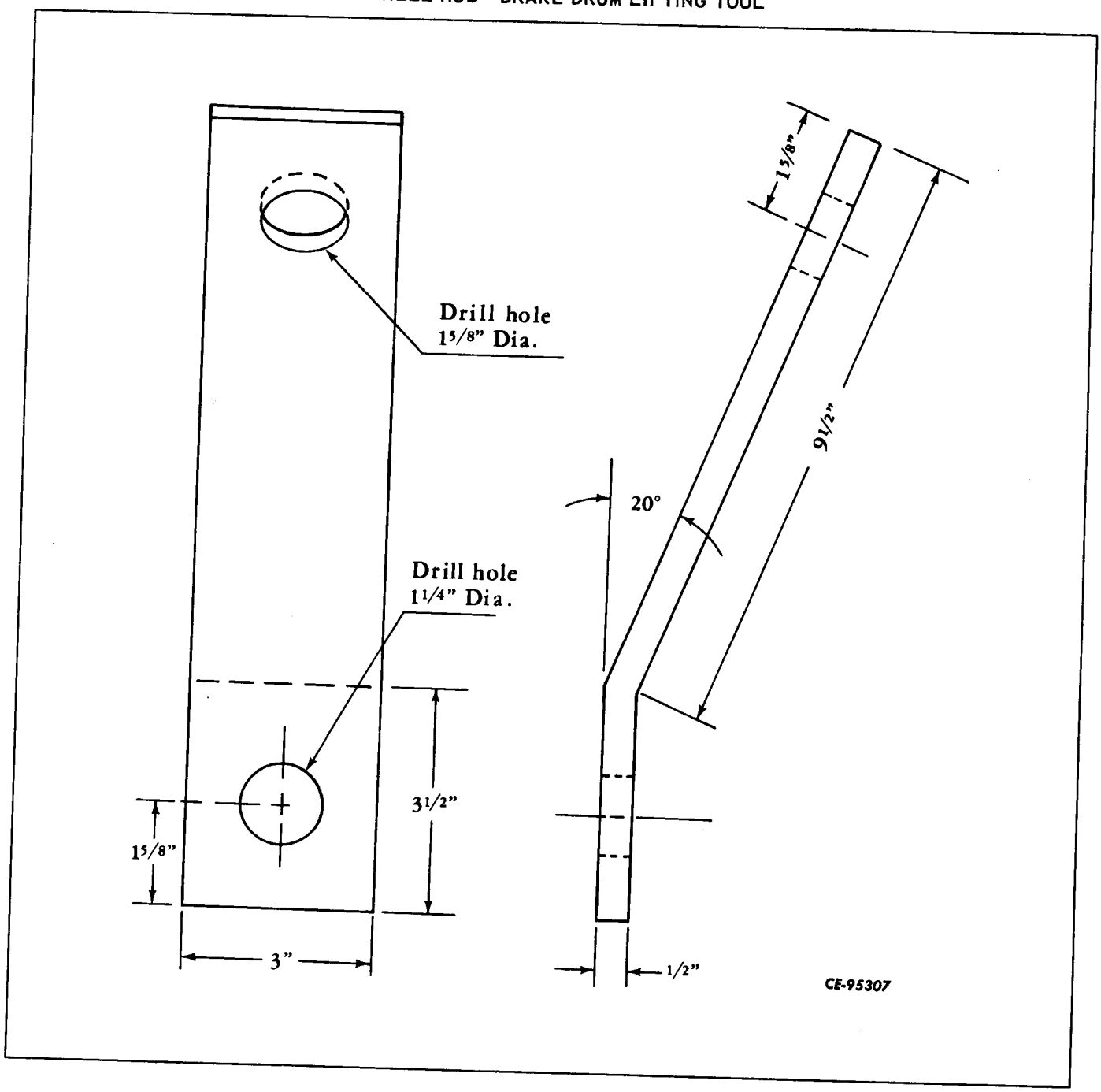

Figure 6-91

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SECTION VII

STEERING AXLE

(Not Applicable)

SECTION VIII

STEERING GEAR

Page

SECTION VIII STEERING GEAR

GENERAL INFORMATION

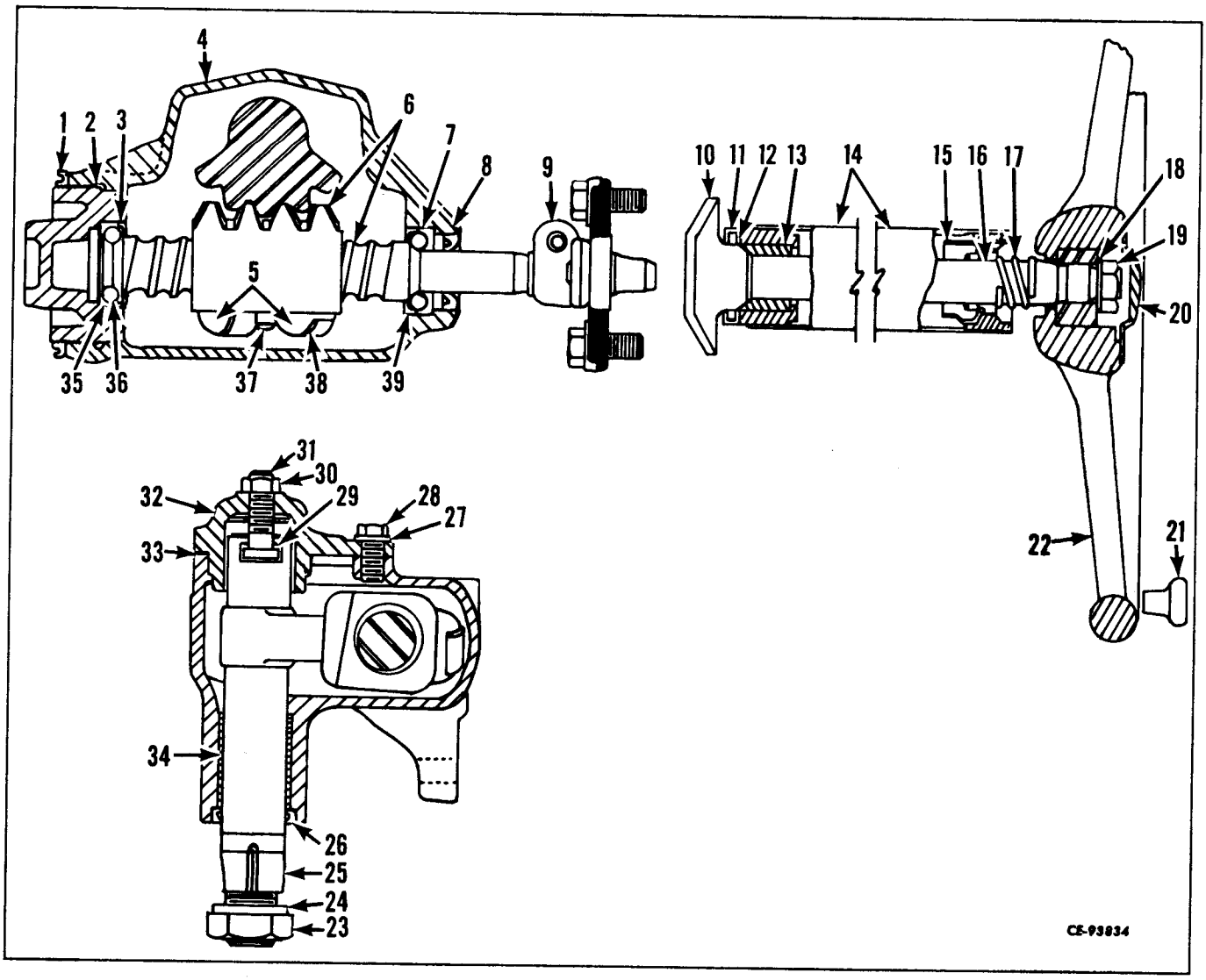

Figure 8-1
Steering Gear - Cross Section.

1. Adjuster lock nut.
2. Bearing adjuster.
3. Bearing retainer.
4. Housing.
5. Ball return guide.
6. Shaft and nut.
7. Bearing cup.
8. Seal.
9. Flange.
10. Steering shaft.
11. Seal retainer.
12. Seal.
13. Bushing.
14. Jacket.
15. Bearing.
16. Spring seat.
17. Spring.
18. Washer.
19. Nut.
20. Cap.
21. Spinner knob.
22. Steering wheel.
23. Pitman arm nut.
24. Washer.
25. Gear and shaft.
26. Seal.
27. Washer.
28. Cap screw.
29. Shim.
30. Nut.
31. Lash adjuster.
32. Side cover.
33. Gasket.
34. Bushing.
35. Bearing cup.
36. Bearing.
37. Screw and washer.
38. Guide clamp.
39. Bearing.

STEERING GEAR

GENERAL INFORMATION

DESCRIPTION

The steering gear is a recirculating ball bearing, worm and nut type.

The recirculating ball type gear consists of a "ball nut" connected to the steering worm and in mesh with the sector gear. Precision finished helical grooves within the ball nut match helical grooves in the worm. The ball bearings roll within these grooves when the steering wheel is turned. There are two complete circuits using tubular ball guides to deflect the balls away from their helical path at one end of the grooves and guide them back to the other end.

PREVENTIVE MAINTENANCE

Cleanliness, the correct type and sufficient lubricant are the most important maintenance requirements.

REQUIRED TOOLS

Standard Mechanics Hand Tool Set

Torque wrench - 0-50 in. lbs. rating
Torque wrench - 0-200 ft. lbs. rating

DISASSEMBLY, INSPECTION AND ASSEMBLY

STEERING GEAR

REMOVAL

Remove the gear as follows:

a. Disconnect the drag link from the Pitman arm. Remove the Pitman arm.

b. Disconnect the flange from the column.

c. Remove the cap screws and lock washers securing the gear to tractor.

d. Remove the steering gear assembly from the tractor.

DISASSEMBLY

Place gear assembly in vise.

NOTE: Do not clamp the housing too tightly in vise as damage may result from excess pressure.

Scribe a mark (2, Fig. 8-2) on the shaft in line with the reference indicator on the flange (1) to insure the proper positioning of parts during assembly.

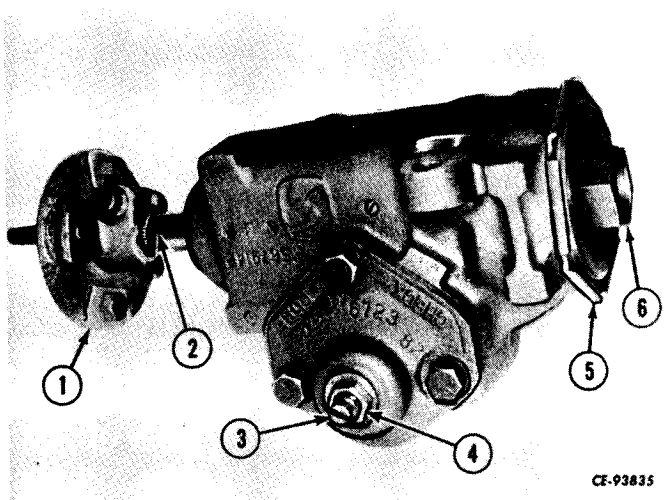

Figure 8-2

Remove the flange.

Remove the locknut (4) from the lash adjuster screw (3).

Turn the lash adjuster screw (3) a few turns counterclockwise. This will remove the load from the worm bearings caused by the close meshing of the rack and sector teeth.

DISASSEMBLY, INSPECTION AND ASSEMBLY

Loosen the bearing adjuster nut (5) and remove the adjuster (6) with ball bearing retainer and nut.

Remove the cap screws and lock washers that secure the side cover (1, Fig. 8-3) to the housing (3).

Pull the side cover with the sector and shaft from the housing.

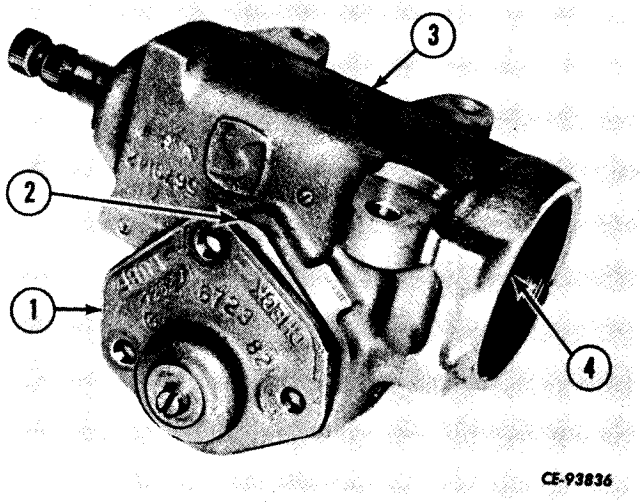

Figure 8-3

NOTE: If sector does not clear the opening in the housing easily, turn the worm shaft by hand until the sector will pass through the opening.

Remove and discard the cover gasket (2).

Carefully withdraw worm shaft (4) and ball nut as an assembly from the housing assembly (3).

NOTE: If shaft with ball nut is held in vertical position, ball nut will travel by its own weight to the end of the shaft. If ball nut strikes either end of worm sharply, ball guides will be damaged. If ball nut does not require disassembly, tape each end of worm to prevent movement of ball nut.

Try action of ball nut on worm. Nut must rotate smoothly with no evidence of binding or roughness. If damage is evident, disassemble as follows (Fig. 8-4):

a. Remove screw (1) attaching ball guide clamp (2) to ball nut (5). Remove clamp. Pull ball guides (4) out of ball nut, one pair at a time. Separate guides and remove balls.

b. Turn ball nut upside down, rotate shaft (3) back and forth until all balls have dropped from ball nut into a clean pan. With balls removed, pull ball nut endwise from shaft worm.

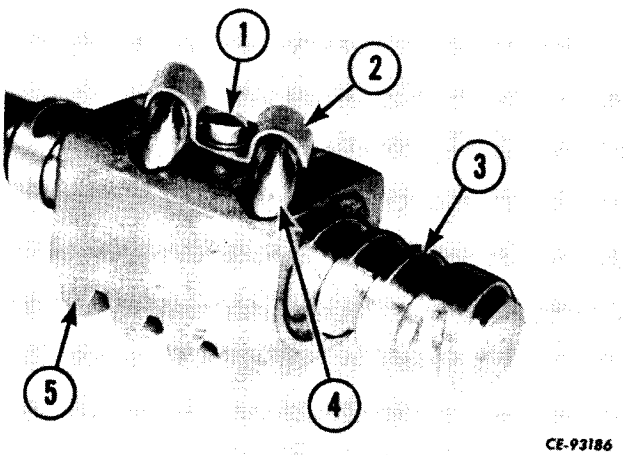

Figure 8-4

Removal and replacement of housing bushing may be deferred until after the inspection of parts.

Remove and discard seals (1 and 3, Fig. 8-6).

CLEAN

Thoroughly clean all parts in clean solvent and dry with compressed air.

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

STEERING GEAR - Continued

INSPECTION

Inspect gear housing for cracks or stripped threads in tapped holes.

Check clearance between Pitman shaft and bushing in housing. If bushing is worn, replace. Refer to "REPAIR."

Inspect upper and lower ball bearing. If balls are damaged or worn replace.

Examine side cover for cracks or damage. Check clearance between Pitman shaft and side cover bushing. If bushing is scored, damaged or excessively worn, replace side cover and bushing assembly.

Inspect Pitman shaft for damaged splines and/or threads. Examine sector gear teeth for scuffing and scoring. Check shaft OD (1.12"). If excessive wear is evident or any of these points, replace shaft.

Inspect bearing areas and thread groove on worm. If worm is galled, replace steering shaft and ball nut assembly completely.

Check worm ball nut teeth for scuffing and scoring. Inspect holes and passages for obstructions. Check all worm balls for flat spots, wear or other damage. Balls must be the same size within 0.0001 inch.

Examine ball guides for distortion and bent pick-up fingers. Place two halves of guide together and try action of balls.

Inspect threads on lower end of worm gear. Threads must be clean and free of nicks and burrs.

REPAIR

To replace Pitman shaft bushing (2, Fig. 8-5) press bushing from housing (1) using improvised tool.

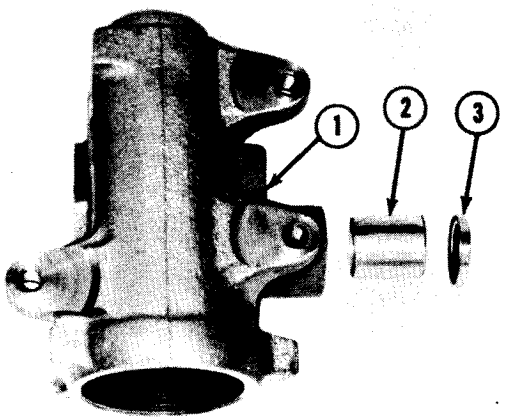

Figure 8-5

Carefully press new shaft bushing into position using a suitable driver. Press bushing flush with edge of housing bore (Fig. 8-6).

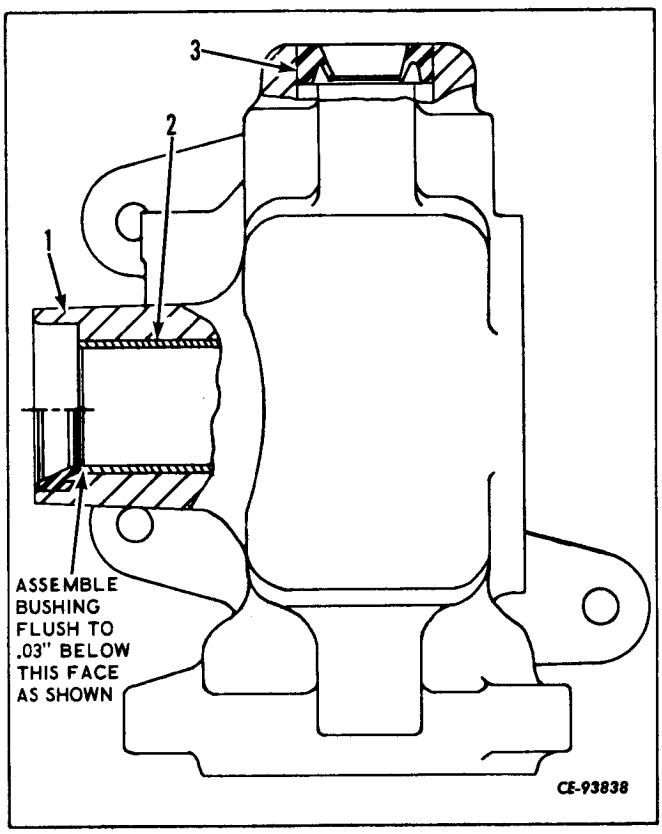

Figure 8-6

A tubular driver may be fabricated to install seals (1 and 3) during the final assembly.

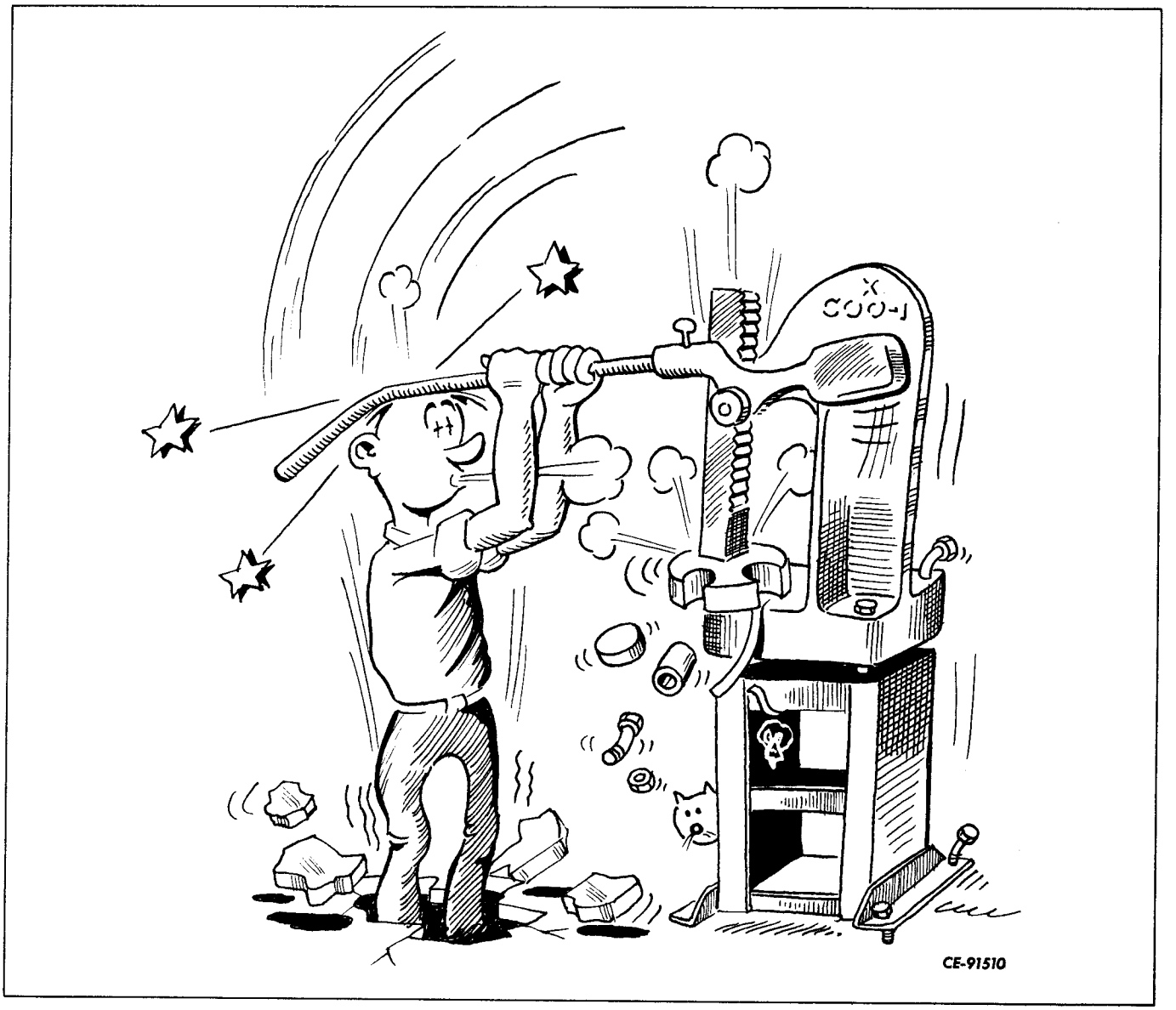

Figure 8-7

Pull old cup (1, Fig. 8-8) from the adjuster (2). Carefully press a new cup into the adjuster using a minimum of 7,000 lbs. force to seat the cup.

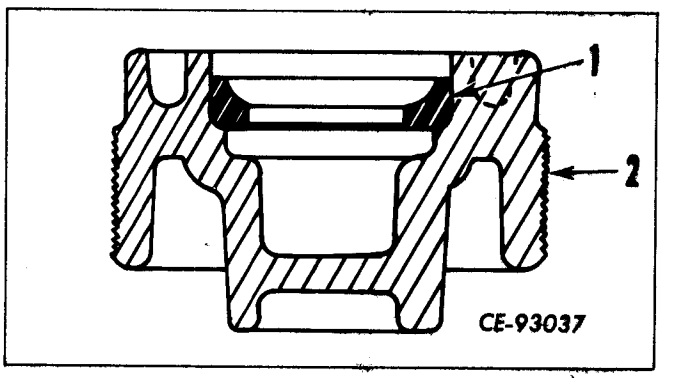

Figure 8-8

ASSEMBLY

One of the most important phases of assembling the steering gear components is cleanliness. All parts must be kept clean. Any abrasive

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

STEERING GEAR - Continued

ASSEMBLY - Continued

material remaining in the housing during assembly will quickly damage the mechanism. Grease and oil used during assembly must be free from dirt or other contaminates. Prelubricate all bearings and moving parts with "Lubriplate" or equivalent.

Place worm shaft assembly horizontal on clean work bench. Place ball nut over worm with return guide holes in nut facing up. Align groove in worm and ball nut by sight. (Fig. 8-9)

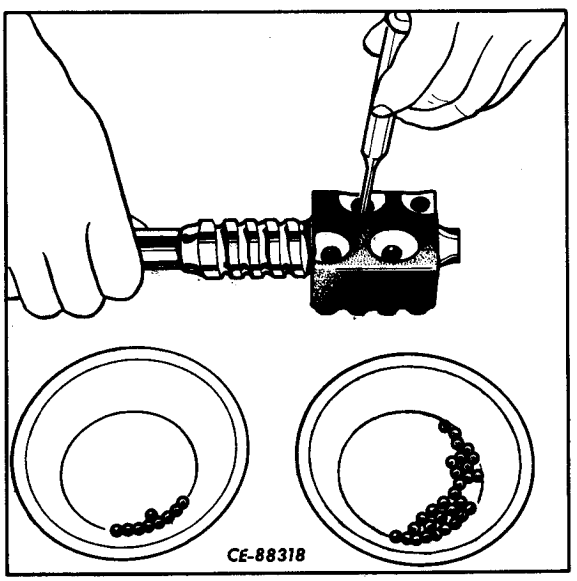

Figure 8-9

Count one-half of the total amount of balls into a clean container.

Drop balls into one of the ball return guide holes. Slowly rotate worm away from that hole while inserting balls. Continue until circuit is filled from the bottom of one hole to the bottom of the other, or until stopped by reaching end of worm.

If balls are stopped by reaching end of worm hold down balls already installed with a rod or punch. Rotate shaft in a reverse direction a few turns. Filling of the circuit may then be continued. It may be necessary to work shaft back and forth holding balls down first in one hole and then in the other. This will close-up spaces between balls filling the circuit completely.

Lay one half of ball guide groove up, on bench. Place the remaining balls into the groove of the guide. Cover assembly with opposite half of guide. Hold the two halves together and plug each end with vaseline to prevent balls from dropping out while installing guide. (Fig. 8-10)

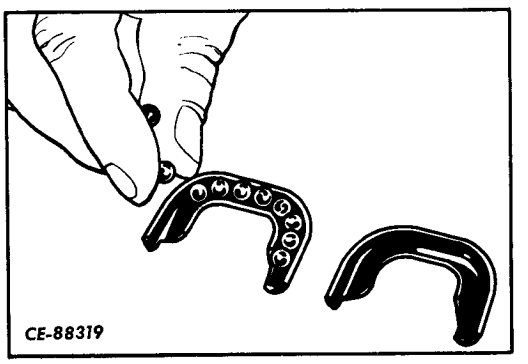

Figure 8-10

Push ball return guide completely into holes in ball nut (Fig. 8-11). If guide does not push down all the way easily, tap it lightly into place with the wooden handle of a screw driver. This completes one circuit of balls.

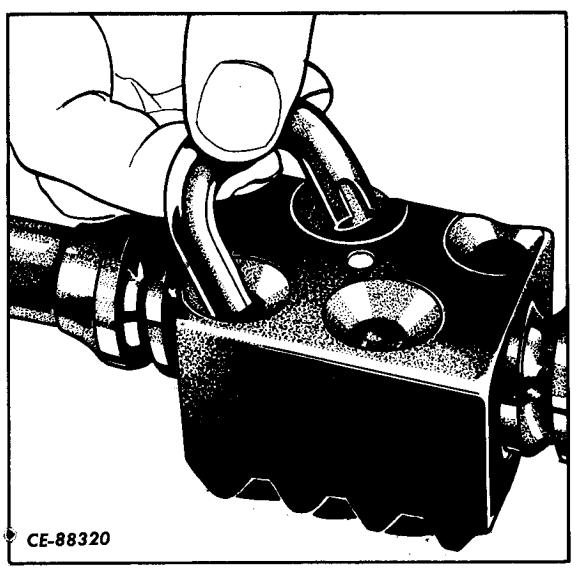

Figure 8-11

DISASSEMBLY, INSPECTION AND ASSEMBLY

Fill remaining circuit with balls in same manner described above.

Install ball return guide clamp (2, Fig. 8-4) on ball nut with screw (1).

Be certain ball nut and balls are thoroughly lubricated. Test assembly by rotating ball nut on worm. Do not rotate ball nut to end of worm threads. Assembly must move freely. Temporarily tape shaft at both ends of ball nut until ready to install assembly in housing.

Remove tape. Grasp worm below and above ball nut to prevent nut from running to extreme ends. Insert worm shaft through lower opening in gear housing and guide shaft carefully through the upper housing bearing.

Place original shim (3, Fig. 8-12) on lash adjuster screw (2). Insert adjuster screw and shim into slotted end of Pitman shaft (1).

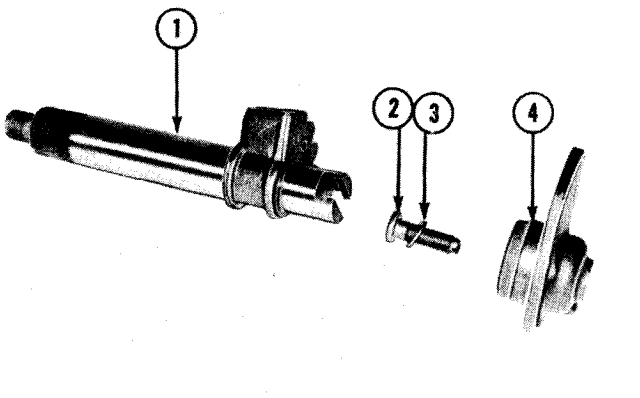

Figure 8-12

Check clearance between screw head and shaft. Clearance must not exceed .002 in. If clearance is greater, select a thicker shim. Four sizes are available. (Fig. 8-13.)

With lash adjuster screw and shim in place in slotted end of Pitman shaft, start side cover (4, Fig. 8-12) over end of shaft. Engage screw slot with screw driver using hole in side cover.

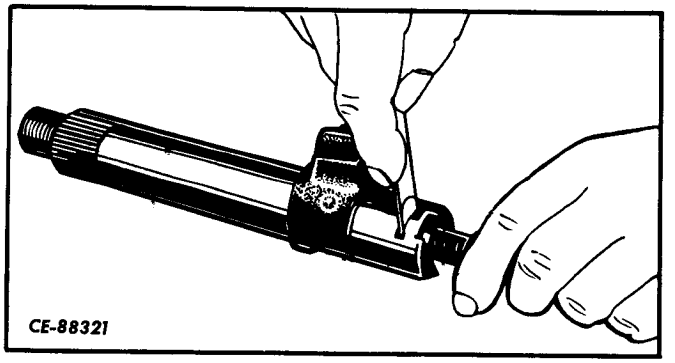

Figure 8-13

Rotate worm shaft until ball nut is in approximate center of worm. Center tooth of sector gear must enter center tooth space of ball nut.

With new gasket (2, Fig. 8-3) in place on side cover (1), insert Pitman shaft into housing (3), meshing teeth as described above. Rotate lash adjuster screw to pull cover over end of shaft. Back off adjuster screw to permit lash (play) between sector gear and ball nut.

Install side cover bolts with lock washers and tighten to recommended torque. Refer to "SPECIAL TORQUES."

Torque: _____

Place the lower ball bearing in the adjuster and secure with the retainer. Thread the adjuster (6, Fig. 8-2) into the housing until snug. Be sure the bearing is seated on the end of the shaft. Install the nut (5) but do not tighten.

Lubricate steering gear assembly. Refer to "COMPONENT SPECIFICATIONS."

Install the steering gear on the tractor. Adjust the gear. Refer to "ADJUSTMENTS."

STEERING COLUMN

REMOVAL

Remove the button plug from the steering wheel.

(Continued on next page)

STEERING GEAR

DISASSEMBLY, INSPECTION AND ASSEMBLY

STEERING COLUMN - Continued

REMOVAL - Continued

Remove the nut, washer, and spring securing the steering wheel. Remove the steering wheel. Reinstall the spring, washer and nut.

Disconnect the column from the flange on the steering gear. Remove the "U" bolt securing the column to the frame. Remove the steering column.

DISASSEMBLY

Remove the nut (1, Fig. 8-14), washer (2), spring (3), seat (4) and bearing (5), from the column jacket (6).

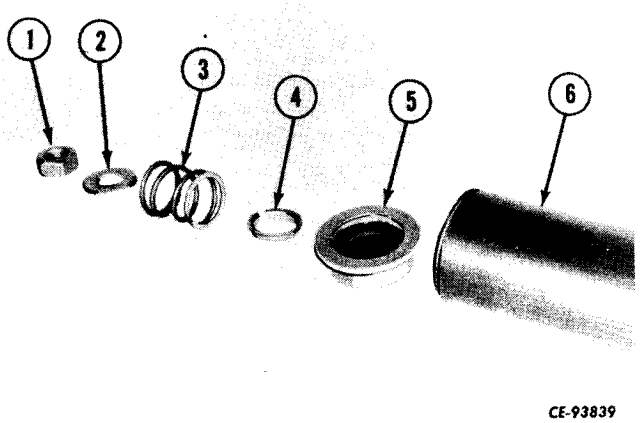

Figure 8-14

Slide the shaft (1, Fig. 8-15) from the column jacket (2).

Remove the retainer (1, Fig. 8-16) and seal (2). Pull the old bushing (3) from the column jacket (4).

INSPECTION

Thoroughly clean all metal parts in clean solvent and dry with compressed air.

Inspect column upper bearing and lower bushing. Replace if necessary.

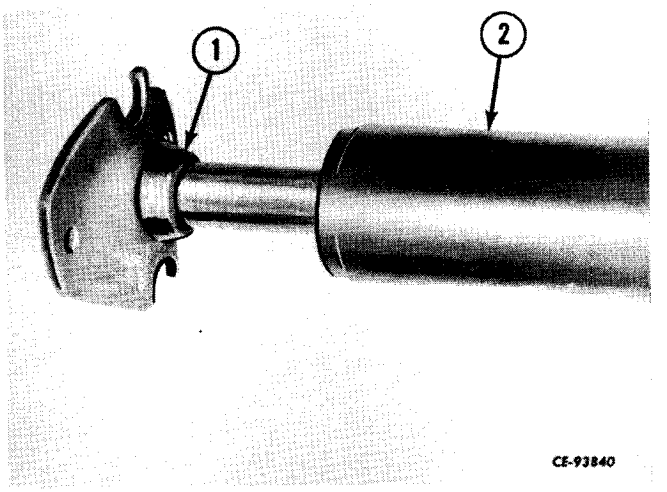

Figure 8-15

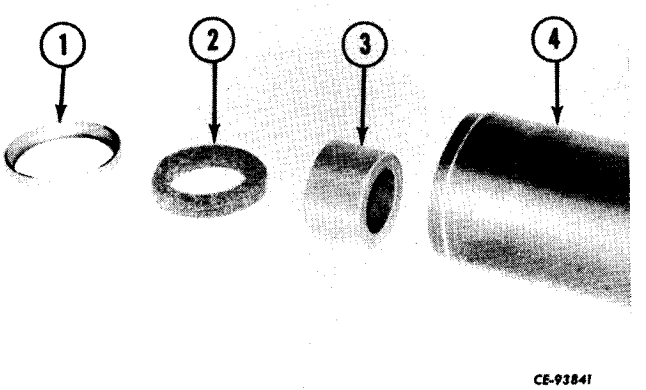

Figure 8-16

ASSEMBLY

Press the bushing (3, Fig. 8-16) into the column jacket (4). Install the seal (2) and retainer (1).

Slide the shaft (1, Fig. 8-15) into the jacket (2) being careful not to damage the bushing.

Install the bearing (5, Fig. 8-14) into the jacket (6). Install the seat (4), spring (3), washer (2) and nut (1) on the shaft.

INSTALLATION

Install the column on the frame and secure with the "U" bolts. Connect the column to the flange. Torque the nuts. Refer to "SPECIAL TORQUES."

Torque: _____

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TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Steering wheel stops turning before tractor halves hit stop blocks.	1. Steering gear not centered.	1. Adjust.
Play in steering gear.	1. Worn gears in steering gear housing. 2. Sector shaft gear lash out of adjustment.	1. Overhaul. 2. Adjust gear lash.
Hard steering while driving.	1. Frozen hinge pin bearings. 2. Steering adjustment tight.	1. Replace bearings. 2. Check adjustment by removing Pitman arm from sector shaft or disconnecting linkage from Pitman arm ball. Adjust if necessary.
Poor steering return.	1. Frozen hinge pin bearings. 2. Tires not inflated properly. 3. Tight steering linkage. 4. Steering adjustment tight.	1. Replace bearings. 2. Inflate to specifications. (Refer to "Operator's Manual.") 3. Lubricate. 4. Check adjustment by removing Pitman arm from sector shaft or disconnecting linkage from Pitman arm ball. Adjust if necessary.
Gear noise (rattle or chuckle).	1. Loose over-center adjustment. NOTE: A slight rattle may occur on turns because of the increased lash on either side of the high point. 2. Gear mounting loose.	1. Adjust. 2. Check mounting bolts and tighten as necessary.
Hard steering when turning slowly.	1. Lack of lubrication in linkage. 2. Tires not properly inflated.	1. Lubricate. 2. Inflate to recommended pressure. (Refer to "Operator's Manual.")
Excessive wheel kick-back or loose steering.	1. Excess lash in steering linkage. 2. Excessive lash between sector shaft and ball nut.	1. Adjust lash. 2. Adjust.

SERVICE INFORMATION

COMPONENT SPECIFICATIONS

STEERING COLUMN

Manufacturer: Saginaw

STEERING GEAR

Manufacturer: Saginaw.

Type:
Recirculating ball bearing, worm and nut.
Ratio, 20 to 1
Pitman arm travel:
Left turn, 45-1/2°
Right turn, 45-1/2°

LUBRICANTS AND CAPACITIES

LUBRICANT

The steering gear housing should be kept full of lubricant. Lubricate through side cover upper bolt hole.

Lubricants falling under one or more of the following specifications are recommended:

IH 135H EP, MIL-L-2105B, A. P. I. Classification: GL-5.

CAPACITIES

Steering gear housing - 1 quart

SPECIAL TORQUES

Column-to-flange nuts	15-20 ft. lbs.
Flange bolt	25-35 ft. lbs.
Lash adjuster locknut	18-27 ft. lbs.
Lash adjuster assembly cover cap screws	25-40 ft. lbs.
Pitman arm nut	100-125 ft. lbs.
Worm bearing adjuster lock nut	70-100 ft. lbs.

ADJUSTMENTS

The following adjustments must be made with the drag link disconnected from the Pitman arm and the flange removed from the worm shaft.

Loosen the locknut (2, Fig. 8-17) and turn the lash adjuster screw (1) all the way in (clockwise), then out (counterclockwise) three turns. This will remove the load imposed on the worm bearings by the close meshing of/rack and sector teeth.

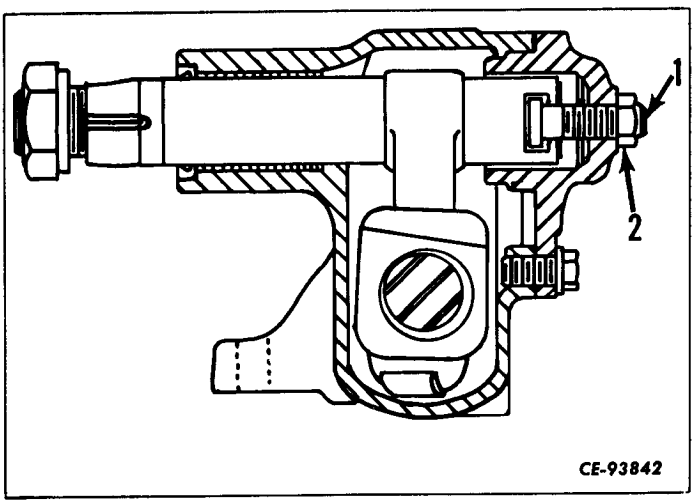

Figure 8-17

Using a socket on the steering gear worm shaft, turn the shaft from one stop all the way to the other, carefully counting the total number of turns.

NOTE: Do not turn hard against stops when drag link is disconnected as damage to ball guides may result.

Turn the shaft back to the center position and using an inch-pound torque wrench, measure the pull required to keep the worm shaft in motion through the center position. This should be 1-1/2 - 5-1/2 inch pounds.

If the indicated pull does not lie between the given limits, make the following adjustments:

a. Loosen the locknut (2, Fig. 8-18).

b. Turn the adjuster (1) until the required resistance to pull is reached.

c. Tighten the locknut and recheck pull. It must lie between limits specified after locknut is tightened.

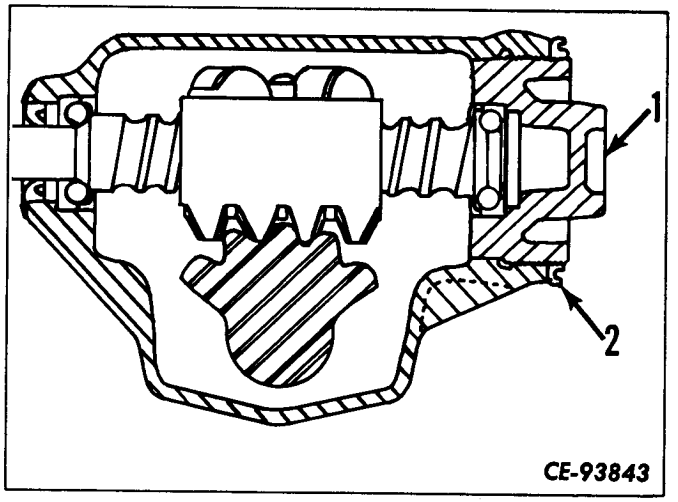

Figure 8-18

d. Turn lash adjuster screw (1, Fig. 8-17) clockwise to remove lash from gear teeth and tighten locknut (2).

e. Check pull with socket and inch-pound torque wrench as before, taking the highest reading of scale as shaft is turned through center position. This should be 3-7 inch-pounds over the bearing adjustment but not to exceed a total of 11 inch-pounds.

f. Readjust the lash adjuster screw if necessary to obtain proper pull.

g. Tighten locknut and recheck pull. It must lie between the specified limits after nut is tightened.

Reconnect the drag link to the Pitman arm.

Install flange on gear and connect column to the flange. Torque the nuts. Refer to "SPECIAL TORQUES."

Torque: _____

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SECTION IX

LINKAGE

Page

SECTION IX LINKAGE

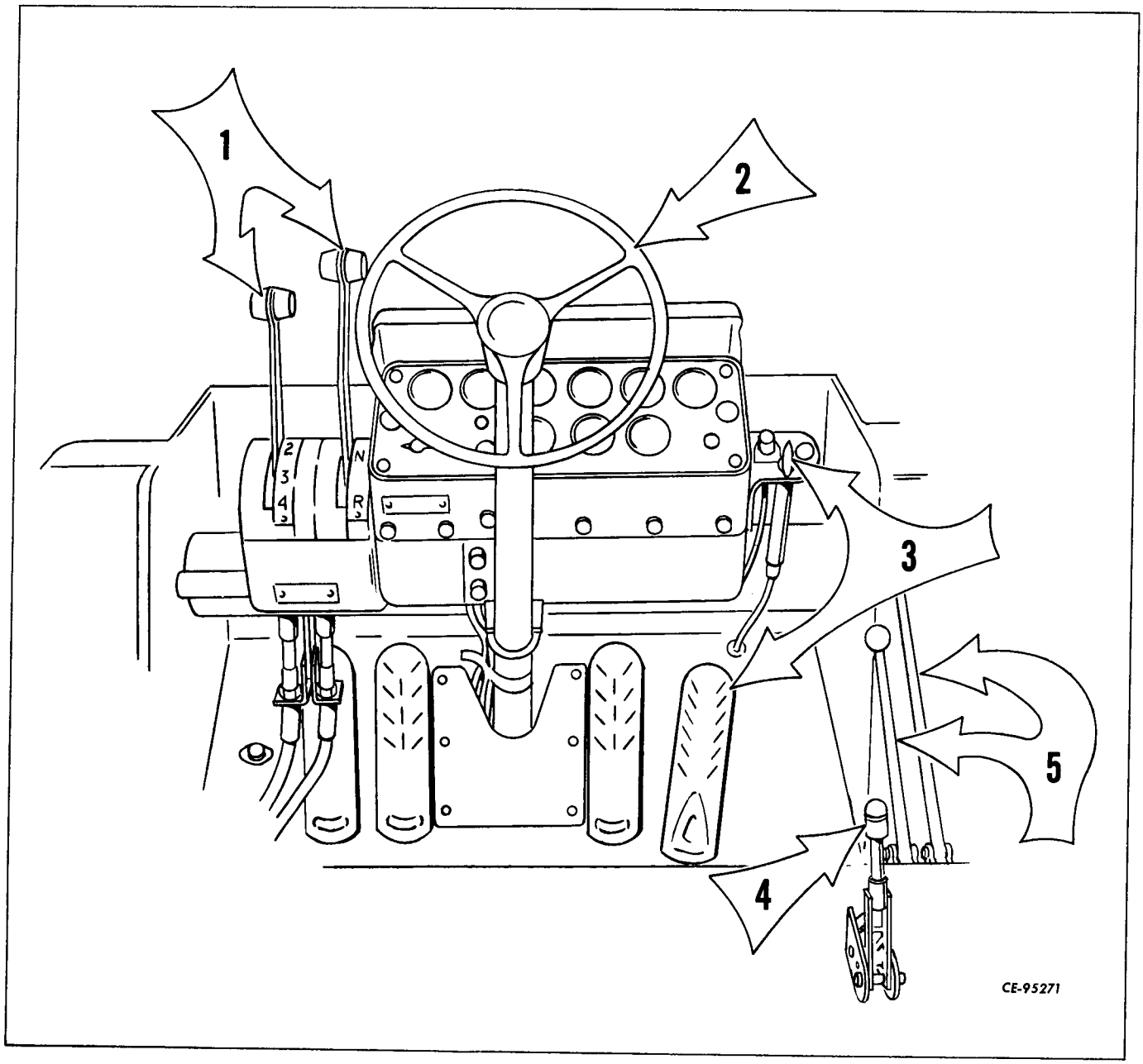

Figure 9-1
Control Linkage.

1. Transmission control linkage.
2. Steering linkage.
3. Accelerator linkage.
4. Parking brake linkage.
5. Hydraulic control linkage.

LINKAGE

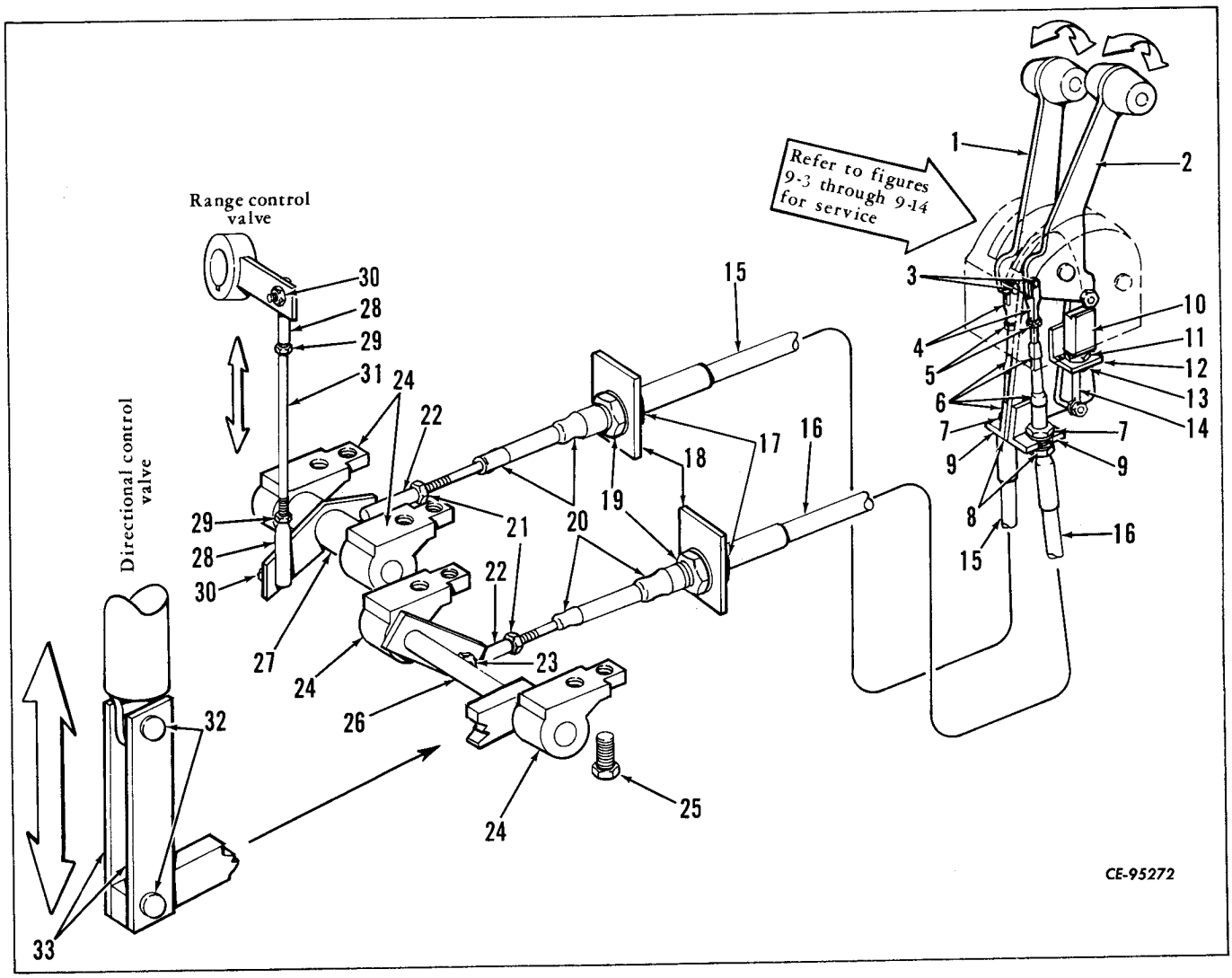

Figure 9-2
Transmission Control Linkage.

1. Range control lever.
2. Directional control lever.
3. Cotter pin and clevis pin.
4. Clevis.
5. Jam nut.
6. Cable boots.
7. Cable nut and washer.
8. Cable nut and washer.
9. Cable mounting bracket.
10. Neutral safety switch.
11. Adjusting nut.
12. Switch mounting bracket.
13. Adjusting nut.
14. Switch spool.
15. Range control cable.
16. Directional control cable.
17. Cable nut and washer.
18. Support bracket.
19. Cable nut and washer.
20. Cable boots.
21. Jam nut.
22. Ball joint.
23. Nut and lock washer.
24. Support bearing.
25. Cap screw and lock washer.
26. Pivot lever.
27. Pivot lever.
28. Ball joint.
29. Jam nut.
30. Nut and lock washer.
31. Rod.
32. Cotter pin and clevis pin.
33. Links.

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TRANSMISSION CONTROL LINKAGE

CABLE REMOVAL

From the operator's compartment, disconnect control cables (15, 16, Fig. 9-2) from control levers (1, 2) by removing cotter pins and clevis pins (3). Remove clevises (4), jam nuts (5), cable boots (6) and cable nuts and washers (7) from ends of control cables.

From the units pivot point, disconnect control cables (15, 16) from pivot levers (26, 27) by removing nuts and lock washers (23). Remove ball joints (22), jam nuts (21), cable boots (20) and cable nuts and washers (19).

Remove cable clamp and bar from inside front frame (where used) and pull cables from unit. Discard clamp and bar.

CABLE INSTALLATION

Remove all hardware from the control cables (15, 16, Fig. 9-2) except the inside cable nuts and washers (8). Insert cable ends through support brackets (9). Install top cable nuts and washers (7), cable boots (6), jam nuts (5) and clevises (4). Install clevis pins and cotter pins (3) securing control levers to ends of control cables. Refer to linkage adjustment for adjustment procedures. Adjust and tighten jam nuts (5), cable nuts and washers (7, 8).

With inside cable nuts and washers (17) installed on control cables, insert ends of control cables through support brackets (18) and install remaining cable nuts and washers (19), cable boots (20), jam nuts (21) and ball joints (22). Insert ball joint stems through pivot levers (26, 27) and install and tighten lock washers and nuts (23). Refer to linkage adjustment for adjustment procedures. Adjust and tighten jam nuts (21), cable nuts and washers (17, 19).

Do not install clamp and bar to inside front frame. Elimination of these items allows freer cable movement.

VALVE LINKAGE REMOVAL

Disconnect control cables (15, 16, Fig. 9-2) from pivot levers (26, 27) by removing lock washers and nuts (23).

Disconnect rod (31) from range control valve and pivot lever (27) by removing lock washers and nuts (30) from both ends of rod (31).

Disconnect links (33) from directional control valve and pivot lever (26) by removing cotter pins and clevis pins (32).

Remove support bearings (24) from frame member by removing cap screws (25).

VALVE LINKAGE INSTALLATION

Install pivot levers (26, 27, Fig. 9-2) by inserting support bearings (24) on each end of pivot lever. Install and tighten cap screws (25) securing support bearings to tractor frame. Connect rod (31) to range control-pivot lever (27) and install and tighten lock washer and nut (30). Position links (33) between valve spool and pivot lever (26) and install clevis pins and cotter pins (32). Refer to "ADJUSTMENT" for proper linkage adjustment.

SERVICING CONTROL LEVER BRACKET LIGHTS

To service the lights in the control lever brackets (2, 3, Fig. 9-3), remove cap screws (1) separating positioning strips (2, 3) from bracket housings.

(Continued on next page)

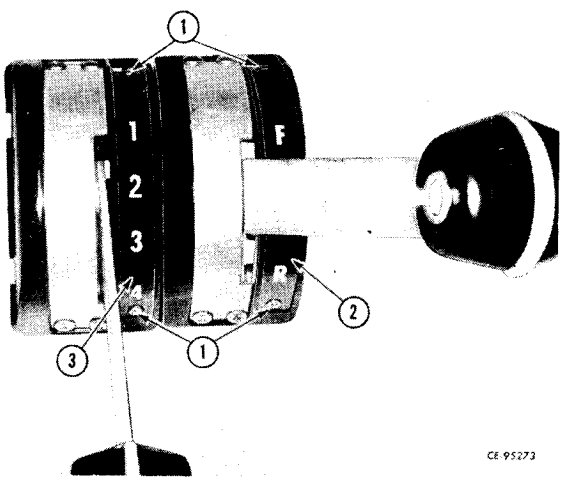

Figure 9-3

TRANSMISSION CONTROL LINKAGE

SERVICING CONTROL LEVER BRACKET LIGHTS - Continued

Replace bulb (1, Fig. 9-4) from lever brackets. Install positioning strips (2, 3, Fig. 9-3) and install and tighten cap screws (1, Fig. 9-3).

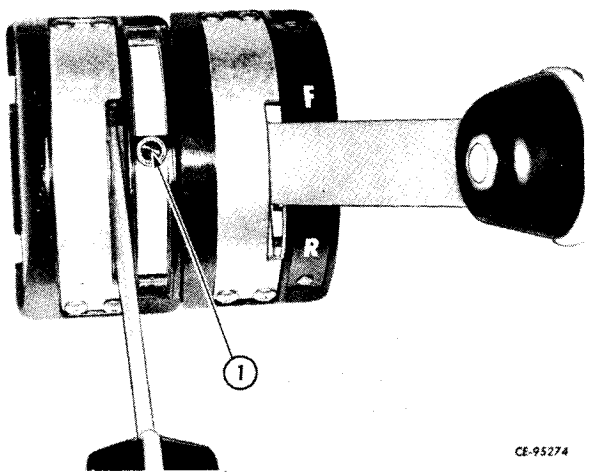

Figure 9-4

CONTROL LEVER

REMOVAL

From under the control lever bracket, disconnect the four electrical connections.

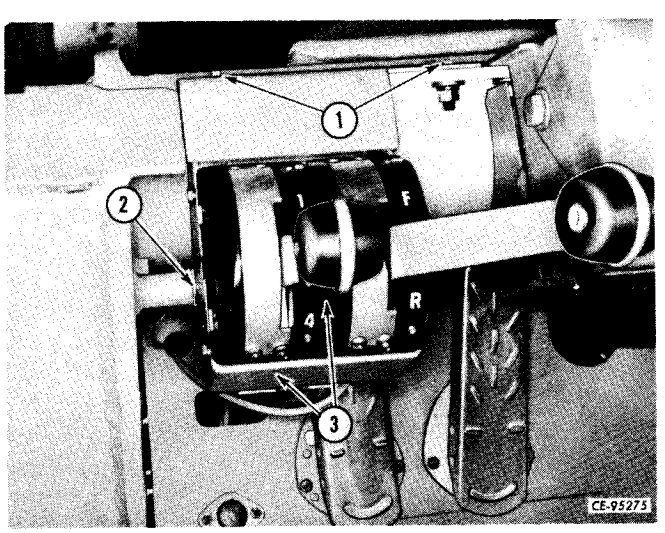

Figure 9-5

Remove cotter pins and clevis pins disconnecting control levers from control cable ends.

Remove control lever bracket (3, Fig. 9-5) by removing cap screws and nuts (1) and cap screw (2). Remove bracket (3) from unit and disassemble on a clean work bench.

DISASSEMBLY

Separate control lever assembly (1, Fig. 9-6) from mounting bracket (2) by removing cap screws and lock washers (2).

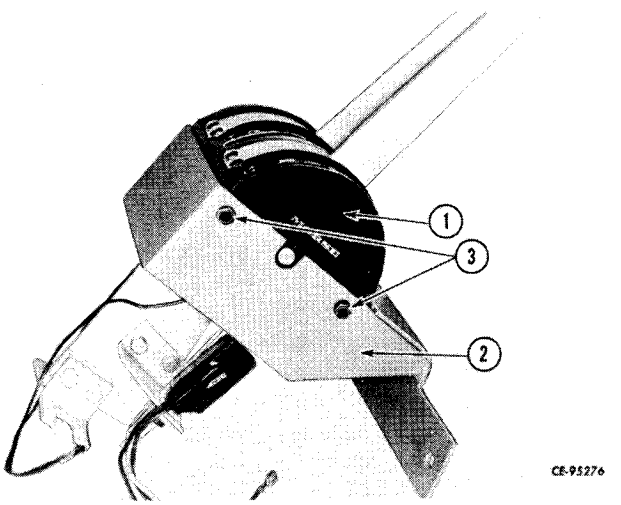

Figure 9-6

Disconnect link (3, Fig. 9-7) from directional control lever (2) and neutral safety switch spool (4) by removing nuts (1) and "O"-rings.

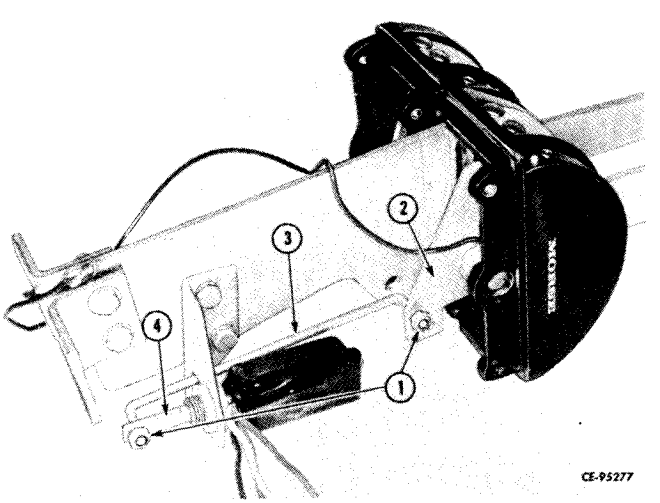

Figure 9-7

TRANSMISSION CONTROL LINKAGE

Remove cap screws and nuts (1, Fig. 9-8) separating handles (2) from control levers (5, 6). Loosen lock screws (3) and with the aid of a suitable punch, drive pivot pin (4) out of lever bracket disconnecting control levers (5, 6) from lever bracket.

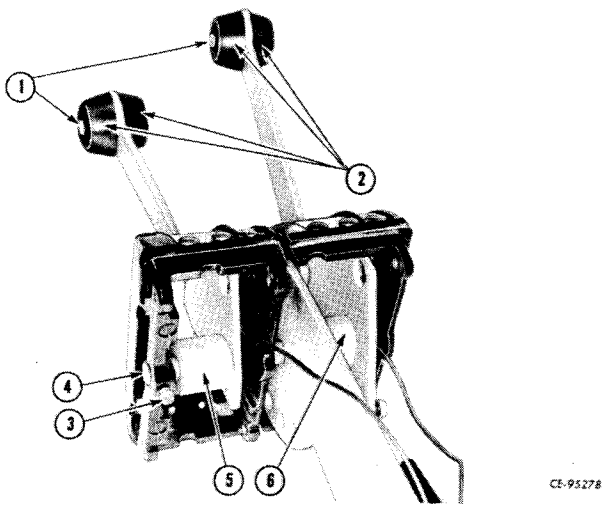

Figure 9-8

Remove cap screws (1, Fig. 9-9) separating lever brackets (2, 3) and adapter plate (4). Remove cap screws and nuts (5, 7) disconnecting cable brackets (6) and switch bracket (8).

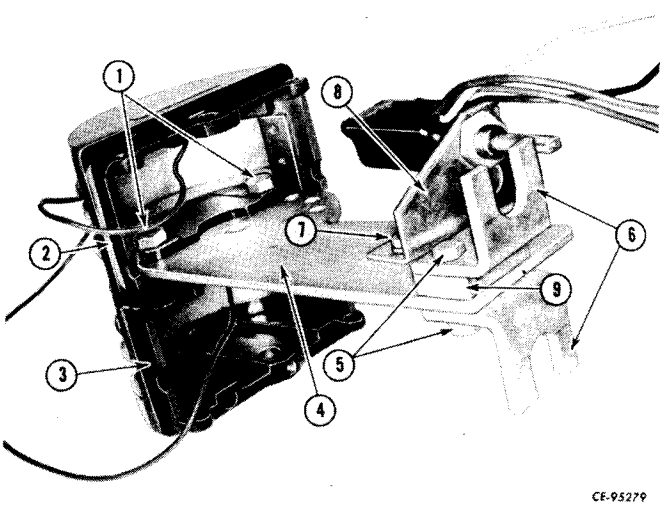

Figure 9-9

ASSEMBLY

Position control lever brackets (2, 3, Fig. 9-10), adapter plate (4) and install and tighten cap screws (1). Position safety switch bracket (8) on adapter plate and install and tighten cap screw and nuts (7). Position cable brackets (6), spacer (9) on adapter plate (4). Install and tighten cap screws and nuts (5).

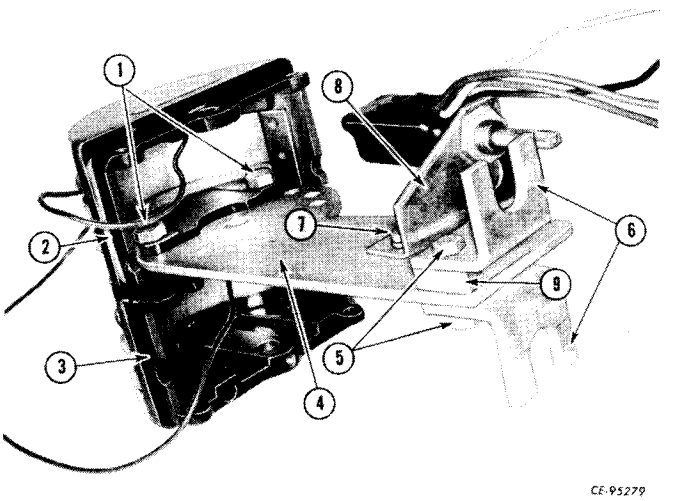

Figure 9-10

Install control levers (5, 6, Fig. 9-11) up through bottom of mounting brackets and drive pivot pin (4) through brackets. Rotate pivot pin

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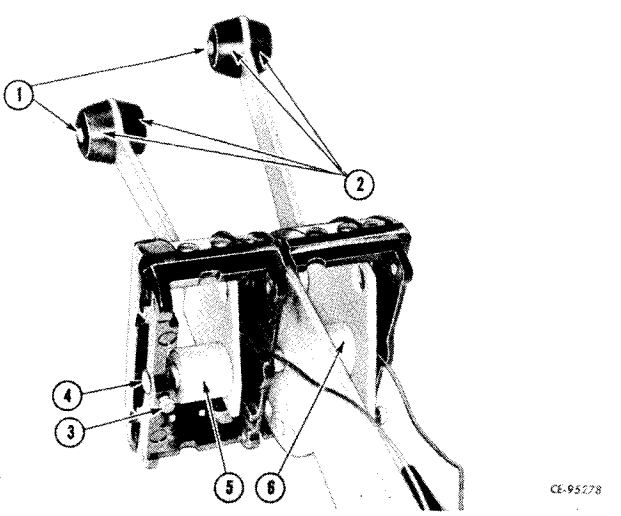

Figure 9-11

TRANSMISSION CONTROL LINKAGE

CONTROL LEVER - Continued

ASSEMBLY - Continued

(4) so the flat side of pin is in position for the locking screw (3). Tighten lock screw (3). Position lever handles (2) on ends of control levers and install and tighten cap screws and nuts (1).

Install actuator lever (3, Fig. 9-12) connecting directional control lever (2) and the switch spool (4). Install and tighten "O"-rings and nuts (1).

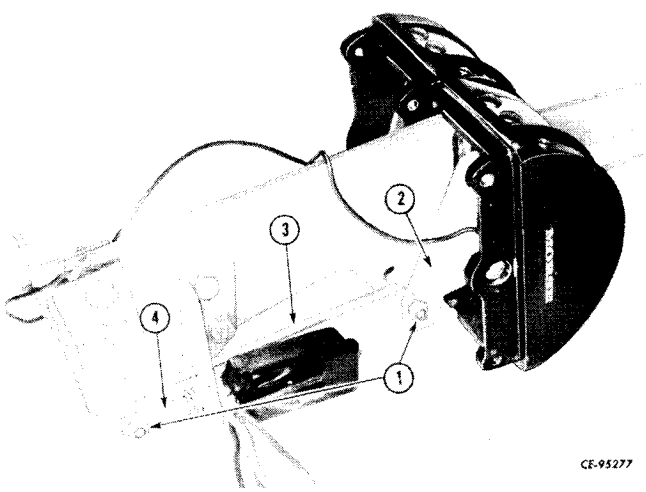

Figure 9-12

Position lever bracket assembly (1, Fig. 9-13) inside mounting bracket (2) and install and tighten lock washers and cap screws (2).

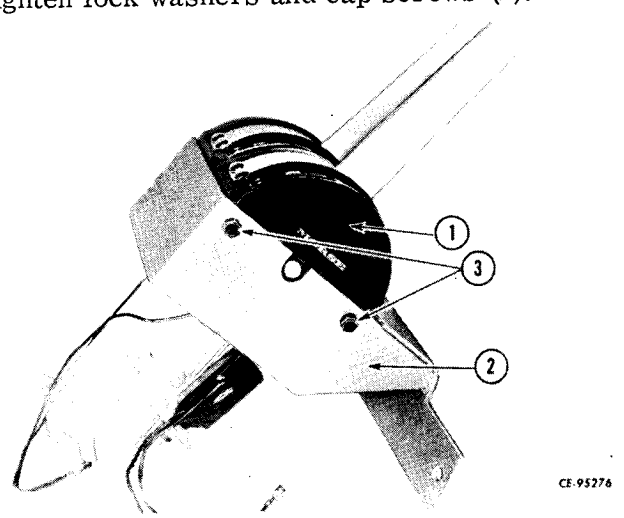

Figure 9-13

INSTALLATION

Position control lever assembly (3, Fig. 9-14) on frame and install and tighten cap screws and nuts (1, 2).

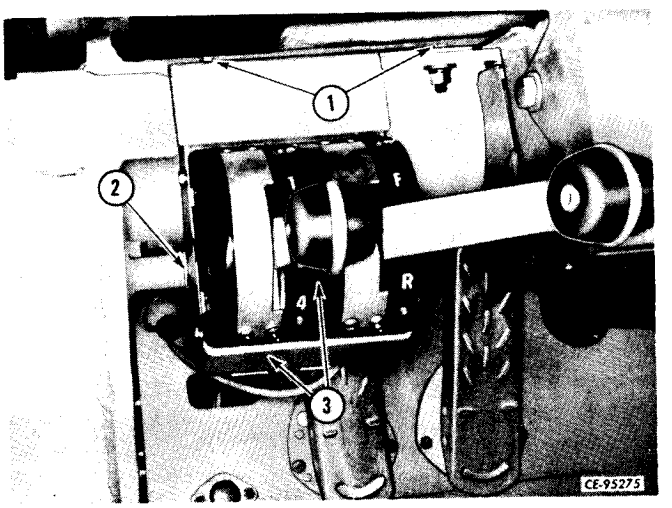

Figure 9-14

Connect electrical wires to the electrical loom. Install clevises to the control levers and install cotter pins. For linkage adjustments refer to "ADJUSTMENTS" in this section.

ADJUSTMENT

A correctly adjusted transmission linkage will allow full engagement of the control plunger detents at each indicated lever position. Correct linkage adjustment prevents clutch slippage.

The nuetral safety switch must be readjusted if the control linkage has been serviced and adjusted.

Start adjustment by positioning control valve spools in NEUTRAL and FIRST.

Adjust control levers (1, 2, Fig. 9-2) in the NEUTRAL and FIRST position. This is accomplished by disconnecting clevises (4) and removing cotter pins and clevis pins (3). Rotate jam nuts (5) away from clevises (4) and rotate clevises in either direction depending on the amount of adjustment needed to fit the lever

TRANSMISSION CONTROL LINKAGE

positions. Once proper adjustment is accomplished, install clevis pins and cotter pins (3) securing clevises (4) to control levers. Tighten jam nuts (5) against clevises (4).

Correct adjustment of the neutral safety switch will permit the engine to be started only when the directional control lever is in the neutral position.

To obtain proper adjustment loosen adjusting nuts (11, 13) on the switch (10). With directional control lever (2) in neutral, move switch (10) up or down until engine starts to turn. While moving switch, turn ignition switch on press starter button. With the switch in the correct position tighten adjusting nuts (11, 13). Recheck adjustment.

STEERING LINKAGE

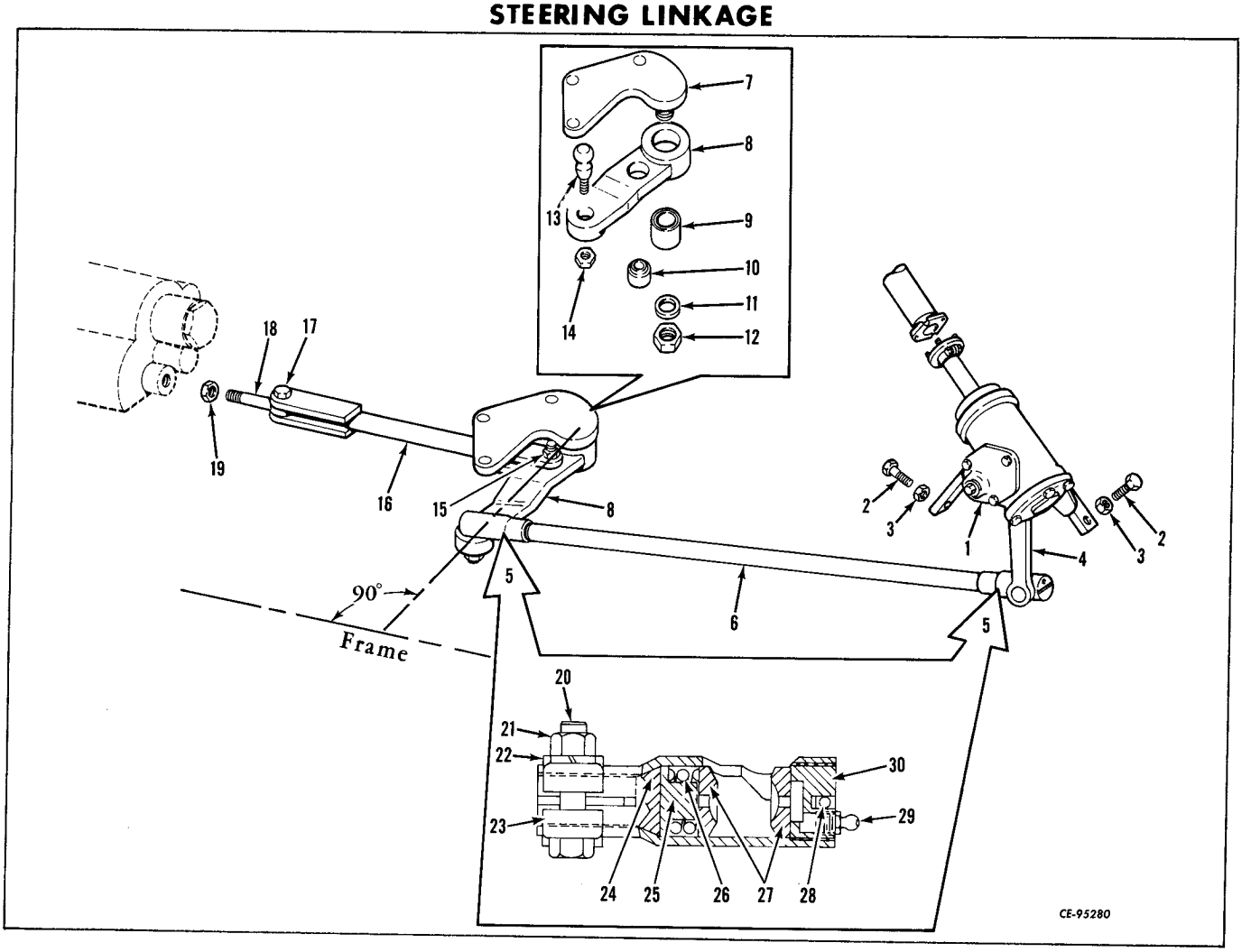

Figure 9-15
Steering Linkage.

1. Steering gear and support bracket.
2. Cap screw.
3. Jam nut.
4. Pitman arm.
5. Rod ends.
6. Drag link.
7. Pivot plate.
8. Lever.
9. Bearing.
10. Bearing.
11. Flat washer.
12. Nut.
13. Ball stud.
14. Nut.
15. Cap screw and nut.
16. Rod and clevis.
17. Cap screw and nut.
18. Rod end.
19. Jam nut.
20. Cap screw.
21. Nut.
22. Lock washer.
23. Clamp.
24. Seat.
25. Safety plug.
26. Spring.
27. Ball seats.
28. Cotter pin.
29. Grease fitting.
30. Adjustment plug.

STEERING LINKAGE

REMOVAL

Remove drag link (6, Fig. 9-15) from the Pitman arm (4) and pivot lever (8) by disassembling rod ends (5).

To disassemble rod ends (5) remove cotter pin (28) and loosen adjusting plug (30) until rod end becomes disconnected from Pitman arm (4) and pivot lever (8).

Remove Pitman arm, if necessary, from steering gear by removing arm nut. Using a suitable puller, remove Pitman arm from steering gear sector shaft. Mark position of arm on shaft with a punch or chisel before removing arm.

Disconnect rod (16) from pivot lever (8) and steering valve eye (18) by removing cap screws and nuts (17, 15).

Disassemble pivot lever (8) by removing nut (12), flat washer (11) and lever (8) from pivot plate (7). Inspect and replace all worn or damaged bearings (9, 10).

INSTALLATION AND ADJUSTMENT

Install ball stud (13, Fig. 9-15) into pivot lever (8) and install and tighten nut (14). If bearings (9 or 10) have been removed, press new bearings into pivot lever (8). Position lever (8) on pivot plate (7) and install flat washer (11), nut (12) and tighten.

If Pitman arm (4), has been removed from sector shaft install arm after centering shaft. If items were marked during disassembly align marks and install arm. If no marks were made or if one or both of the items were replaced, rotate the steering wheel until it stops. Turn the wheel back in the opposite direction counting the number of turns, stop-to-stop. Turn the wheel back one-half the total turns centering the sector shaft. Install Pitman arm (4), positioning the arm in the center of the steering gear support bracket. With Pitman arm correctly centered, install and tighten arm nut and lock washer.

Assemble rod ends (5) by installing seat (24), safety plug (25), spring (26), ball seats (27) and plug (30). Partially thread plug into rod end. Install grease fitting (29) in plug end. Assemble other rod end in the same manner.

Position assembled rod ends, with end clamps (23) installed, on ends of rod (6) and rotate rod ends the same number of turns.

Install drag link end to Pitman arm and tighten plug (30) against ball. Back off just enough to insert cotter pin (28).

With tractor halves in a straight line and pivot lever (8) 90 degrees to the frame, adjust drag link (6) to fit pivot lever. Adjustment can be accomplished by holding rod end and rotating drag link in the direction needed. With drag link properly positioned, tighten plug (30) against ball. Back off just enough to insert cotter pin (28).

Position rod and clevis (16) on pivot lever (8) and install and tighten cap screw and nut (15). Loosen jam nut (19) on rod end (18) and rotate rod end in either direction needed to install cap screw (17) into bore of rod (16) and rod end (18). Tighten jam nut (19) and cap screw and nut (17). Apply grease to rod ends through grease fittings using multipurpose chassis grease (IH 251H EP or NLG1 Grade 2).

Check adjustment by starting engine and turning unit in each direction. If additional adjustment is required, stop engine and refer back to adjustment procedures.

Adjustment of the Pitman arm stops is accomplished by turning unit in a full turn with the front and rear frames one-half inch from hitting. In this position adjust stop bolt (2) against Pitman arm and tighten jam nut (3). Adjust the other stop bolt in the same manner.

CAUTION: While making the final steering linkage adjustment, use a helper and keep him in sight at all times.

ACCELERATOR LINKAGE

CABLE REMOVAL

To remove accelerator cable, disconnect cable (37, Fig. 9-16) on top of the engine at the fuel injection pump lever by removing cable return spring (45). Remove nut and lock washer from

(Continued on next page)

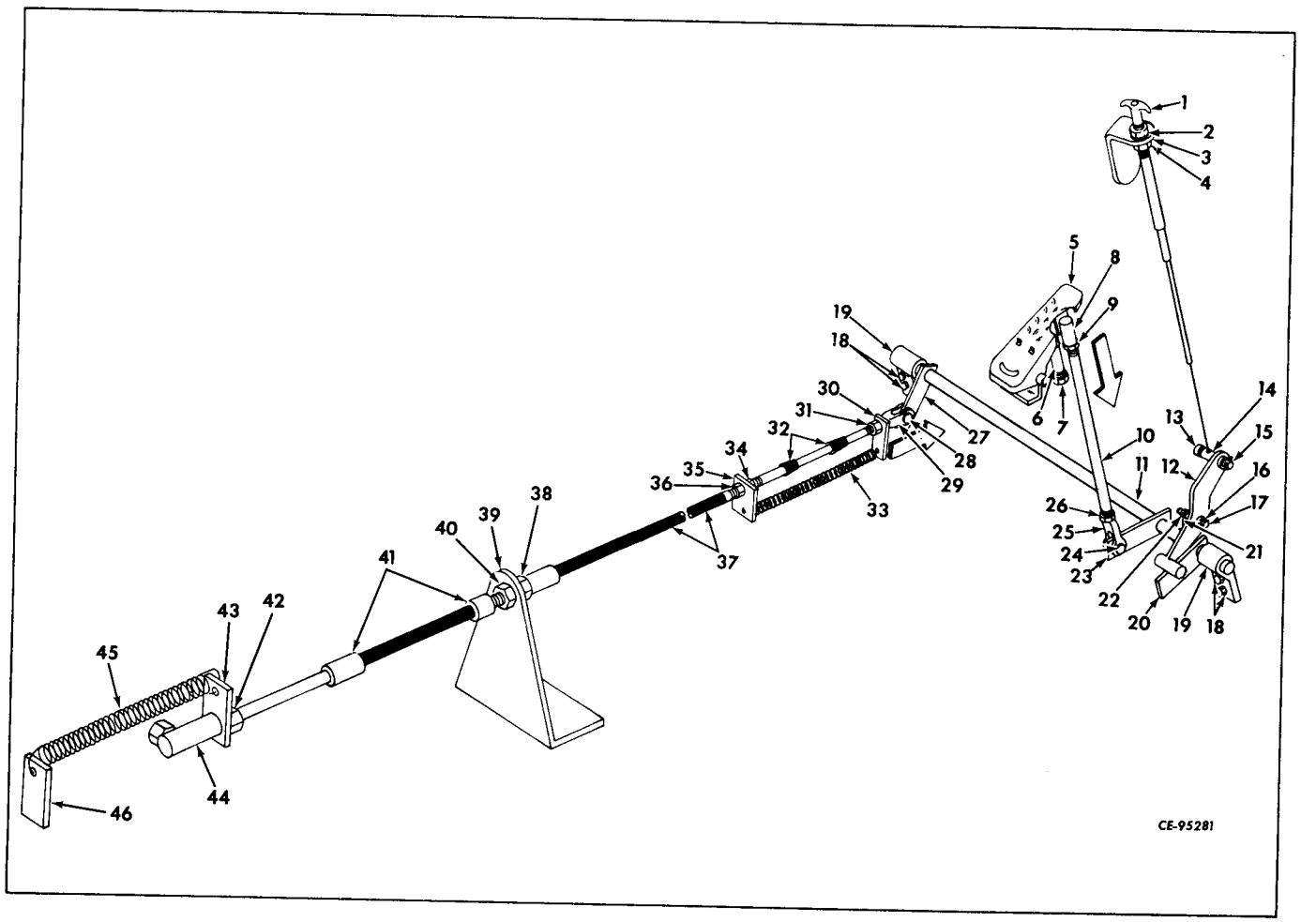

Figure 9-16

1. Hand throttle and cable.
2. Cable nut and washer.
3. Support bracket.
4. Cable nut and washer.
5. Accelerator pedal.
6. Cap screw.
7. Jam nut.
8. Ball joint.
9. Jam nut.
10. Rod.
11. Cross shaft.
12. Hand throttle lever.
13. Set screw.
14. Cable fitting.
15. Cotter pin.
16. Washer.
17. Cap screw.
18. Cap screw, lock washer and nut.
19. Mounting bearing.
20. Cross shaft lever.
21. Mounting bracket.
22. Nut.
23. Cross shaft lever.
24. Clevis pin and cotter pin.
25. Clevis.
26. Jam nut.
27. Cross shaft lever.
28. Clevis pin and cotter pin.
29. Clevis.
30. Spring return bracket.
31. Jam nut.
32. Cable boots.
33. Cable return spring.
34. Cable nut and washer.
35. Support bracket.
36. Cable nut and washer.
37. Accelerator cable.
38. Cable nut and washer.
39. Support bracket.
40. Cable nut and washer.
41. Cable boots.
42. Jam nut.
43. Spring bracket.
44. Ball joint, lock washer and nut.
45. Spring.
46. Spring bracket.

ACCELERATOR LINKAGE

CABLE REMOVAL - Continued

ball joint (44). Remove ball joint (44), spring bracket (43) and jam nut (42) from end of control cable. Remove cable boots (41), cable nut and washer (40) and pull cable out thru support bracket (39).

From under the operator's compartment disconnect cable return spring (33) from support bracket (35) and spring bracket (30). Remove cotter pin and clevis pin (28) disconnecting control cable from cross shaft lever (27). Remove clevis (29), spring bracket (30), jam nut (31), cable boots (32), cable nut and washer (34). Pull cable out through support bracket (35).

CABLE INSTALLATION

Remove all hardware from the control cable except inside cable nuts and washers (38, 36, Fig. 9-16). From under the operator's compartment, install control cable end through support bracket (35). Install cable nut and washer (34). Install cable boots (32), jam nut (31), spring bracket (30) and clevis (29) on end of control cable. Install clevis pin and cotter pin (28) connecting control cable to the cross shaft lever (27). Position and tighten cable nuts and washers (36, 34). Tighten jam nut (31) and install cable return spring (33) to support bracket (35) and spring bracket (30).

Thread remaining control cable end through the frame and insert cable end through support bracket (39), located on top of the engine. Install cable nut and washer (40). Install cable boots (41), jam nut (42), spring bracket (43) and ball joint (44). Refer to "ADJUSTMENT," this section, for proper adjustment procedures. Install and tighten nut and lock washer (44) securing ball joint and fuel injection lever. Tighten jam nut (42), cable nuts and washers (40, 38) and install cable return spring (45).

HAND AND FOOT LINKAGE REMOVAL

Remove the hand accelerator control cable by disconnecting the cable from hand throttle lever (12, Fig. 9-16) by loosening cap screw (13) and removing cable from cable fitting (14). Remove bottom cable nut and washer (4) and pull cable out through support bracket (3).

To remove accelerator throttle lever (12), remove cap screw (17), washer (16) and nut (22) disconnecting lever from mounting bracket (21).

Disconnect control cable (37) from cross shaft lever (27) by removing cable return spring (33) and cotter pin and clevis pin (28). Remove cotter pin and clevis pin (24) disconnecting cross shaft lever (23) from foot pedal rod (10).

For cross shaft removal, remove cap screws, lock washers and nuts (18) disconnecting mounting bearings (19) from the frame. Remove cross shaft (11).

Remove foot pedal rod (10) from foot pedal (5) by removing nut and washer from ball joint (8).

HAND AND FOOT LINKAGE INSTALLATION - Continued

Position one counting bearing (19, Fig. 9-16) to the tractor frame and install and tighten cap screws, lock washer and nut (18). Insert cross shaft with remaining mounting bearing positioned on shaft, into previously installed bearing. Position loose bearing and secure with cap screw, lock washer and nut (18).

Install jam nut (9) and ball joint (8) on one end of foot pedal rod (10) and jam nut (26) and clevis (25) on other end.

Install foot pedal rod (10) to cross shaft lever (23) by installing clevis pin and cotter pin (24). Install other end of rod (10) to foot pedal by inserting ball joint stem through foot pedal bracket and install and tighten nut and washer.

Install hand throttle lever (12) to mounting bracket (21) by installing lever (12), cap screw, spacer, flat washer and nut (22). Tighten cap screw and nut (22). Assemble hand throttle lever (12) so lever arm rides on cross shaft lever (20).

Remove lower cable nut and washer (4) from hand accelerator cable; insert cable through support bracket (3) and install and tighten lower cable nut and washer (4). Insert end of cable through cable fitting (14) and with the cable in the idle position tighten set screw (13).

ACCELERATOR LINKAGE

ADJUSTMENT

Adjust accelerator control cable (37, Fig. 9-16) so center cross shaft lever (23) is parallel with the ground. Adjustment of the control cable can be accomplished by removing cable return spring (33) from support bracket (35) and spring bracket (30). Remove cotter pin and clevis pin (28) disconnecting control cable from cross shaft lever (27). Adjust clevis (29) positioning cross shaft lever (23) parallel with the ground by rotating jam nut (31) and clevis (29) in either direction needed. Additional adjustment can be made by disconnecting control cable from fuel injection pump lever and using the same procedure as used on the front of the control cable. With proper adjustment accomplished, install clevis pin and cotter pin (28) connecting end of control cable with cross shaft lever (27). Tighten all loose jam nuts and install cable return spring (33) to support bracket (35) and spring bracket (30).

Adjust foot pedal (5) to the idle position. The pitch of the foot pedal should be the same as the pitch of the brake treadles. Adjustment of the accelerator pedal can be accomplished by disconnecting ball joint from foot pedal and rotating ball joint (8) and jam nut (9) in either direction required for proper adjustment. Additional adjustment can be accomplished by using the same procedure on the other end of rod (10). Once proper adjustment is accomplished install ball joint stem to accelerator pedal and tighten ball joint nut and jam nut (9).

Adjust foot pedal stop (6) by pressing foot pedal down until maximum travel is reached. Adjust stop (6) to rest against foot pedal in this position by turning stop bolt in either direction. Once proper adjustment is obtained, tighten jam nut (7) against floorboard.

Adjust hand accelerator cable by loosening set screw (13) and permitting hand throttle lever (12) to rest on cross shaft lever (20) in the idle position. Once proper adjustment is made, tighten set screw (13).

With the accelerator linkage correctly adjusted the injection pump lever (44) will be against the low idle stop with the pedal (5) released and against the high idle stop with the pedal fully depressed.

PARKING BRAKE LINKAGE

REMOVAL

From the operator's compartment, remove cotter pin and flat washer (5, Fig. 9-17) and pull clevis pin (5) from parking brake assembly disconnecting control cable (11) from link (3).

Remove clevis (6) and jam nut (7) from end of control cable. Remove cable nut and washer (8) from the top side of cable support bracket (9) and pull control cable from support bracket.

Remove cotter pin and clevis pin (17) from brake actuating lever (18). Remove clevis (16) and jam nut (15) from end of control cable. Remove cable nut and washer (14) from bottom side of support bracket (13) and pull control cable out of bracket.

To remove the lever assembly (2), remove cap screws and lock washers (4) from frame mounting bosses. Do not remove cap screws from lever assembly (2) during removal. This will retain spacers within the assembly until it is removed from the tractor.

LINKAGE

PARKING BRAKE LINKAGE

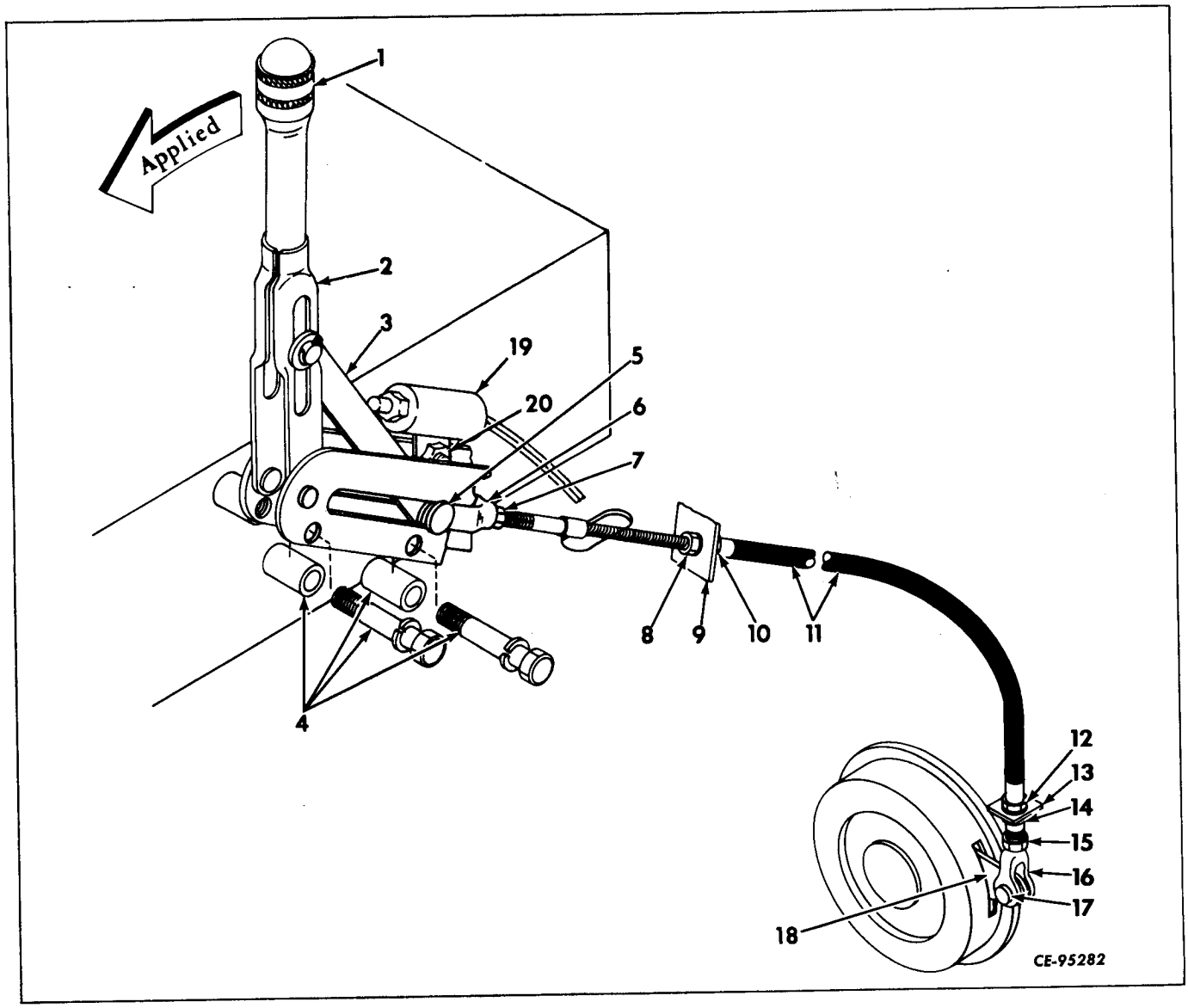

Figure 9-17
Parking Brake Linkage.

1. Adjustment cap.
2. Parking brake assembly.
3. Link.
4. Spacer cap screw and lock washer.
5. Clevis pin, flat washer and cotter pin.
6. Clevis.
7. Jam nut.
8. Cable nut and washer.
9. Support bracket.
10. Cable nut and washer.
11. Control cable.
12. Cable nut and washer.
13. Support bracket.
14. Cable nut and washer.
15. Jam nut.
16. Clevis.
17. Clevis pin and cotter pin.
18. Brake actuating lever.
19. Warning light switch.
20. Cap screw and nut.

PARKING BRAKE LINKAGE

INSTALLATION

Install lever assembly (2, Fig. 9-17) to frame mounting bosses by inserting and tightening cap screws (4) and lock washers. Spacers should be assembled between brake lever assembly.

Install end of control cable up thru cable support bracket (9) with bottom cable nut (10) already installed on cable. Install top cable nut and washer (8). DO NOT TIGHTEN. Install jam nut (7) and clevis (6) to end of control cable. Position parking brake lever in the "OFF" position and install clevis pin through lever assembly (2), link (3) and install flat washer and cotter pin (5). Position and tighten cable nuts and washers (8, 10).

Install remaining end of control cable down through support bracket (13) with top cable nut (12) already installed on cable. Install bottom cable nut (14). DO NOT TIGHTEN. Install jam nut (15) and clevis (16) to end of control cable. Insert clevis pin (17) through clevis (16) and brake lever (18). Insert cotter pin. Position and tighten cable nuts and washers (12, 14).

ADJUSTMENT

A minor parking brake adjustment can be made by rotating the adjusting cap (1, Fig. 9-17) mounted on top of the parking brake lever. To increase tension, turn cap clockwise. If adjustment is at its maximum, major adjustment is necessary.

A major adjustment is made by removing the control cable (11) from the lever assembly. Remove the cotter pin, flat washer and clevis pin (5). Turn adjusting cap (1) counterclockwise until cap adjustment is at a minimum. Back off jam nut (7) and rotate clevis (6) in required direction until clevis pin enters bosses in clevis and link freely. Install clevis pin, flat washer and cotter pin (5). Check adjustment.

If additional adjustment is required, remove control cable from brake actuating lever (18) by removing cotter pin and clevis pin (17). Back off jam nut (15) and rotate clevis (16) in required direction until clevis pin enters clevis and lever bosses freely. Install clevis pin (17) and cotter pin. Check adjustment.

To check parking brake adjustment, start engine and position transmission levers in FORWARD and HIGH range. Apply parking brake and accelerate the engine to maximum engine rpm. If parking brake does not hold, stop engine and repeat linkage adjustment.

If the adjustment within the brake linkage has been taken up several times, it is advisable to check for brake lining wear and roughness of the parking brake drum.

Once linkage has been properly adjusted loosen cap screws and nut (20) and position switch (19) against link (3), with parking brake in the off position. Tighten cap screw and nut (19). Recheck switch position.

LINKAGE

HYDRAULIC CONTROL VALVE LINKAGE

REMOVAL

Remove control rods (12, Fig. 9-18) from control levers (1, 2) and bellcranks (20) by removing cotter pins and clevis pins (9, 15).

Remove links (25) from valve spools and bellcranks (20) by removing cotter pins and clevis pins (24, 26).

Disassemble control levers (1, 2) from mounting brackets (3) by removing cap screws (4) from each bracket and drive hinge pin (5) out through brackets. There are teflon bushings (7, 22) located inside the hub of the control levers and bellcranks. Inspect these bushings for wear and/or damage. If replacement is required, remove cap screw plugs from the bellcranks and press the bushings out.

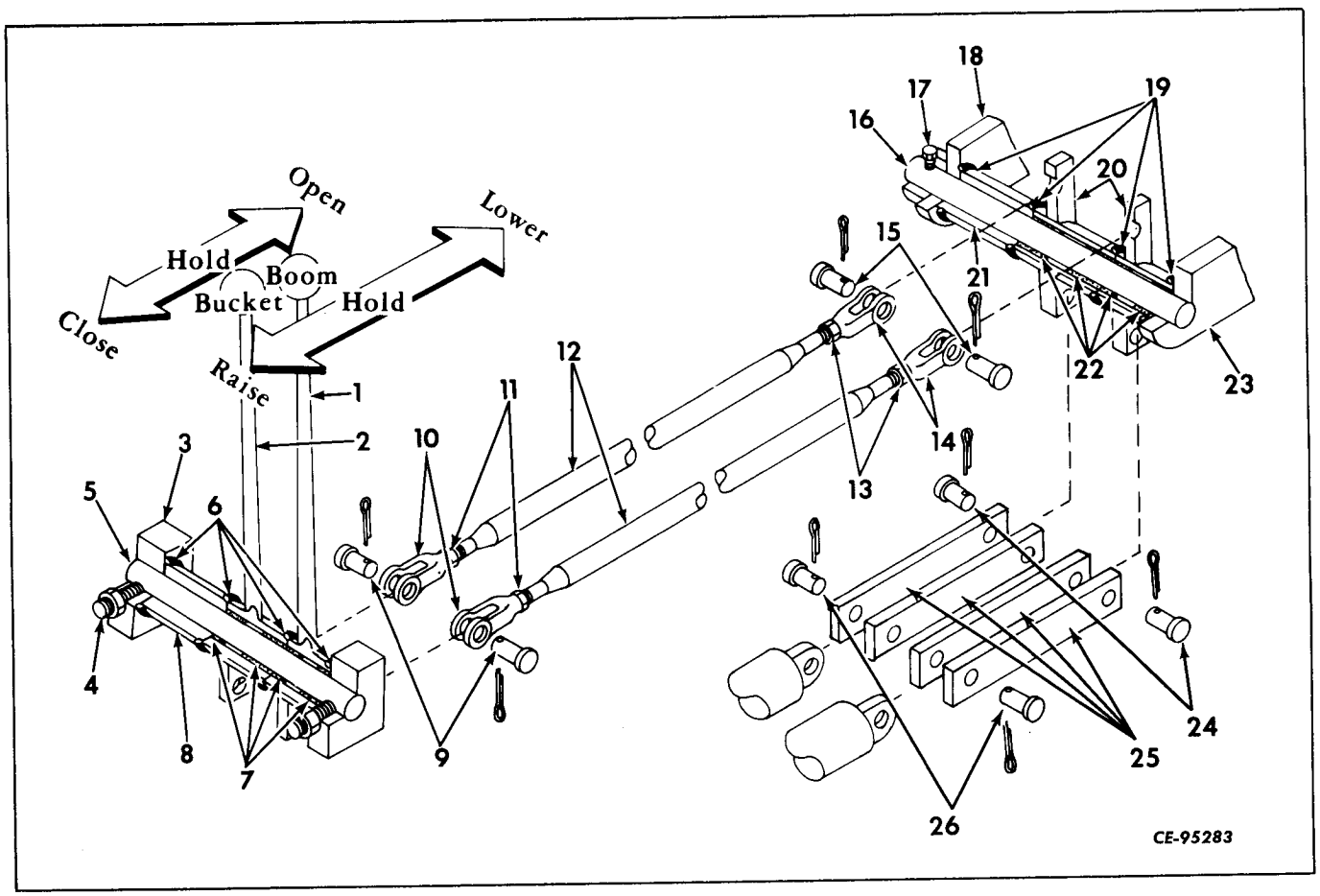

Figure 9-18
Hydraulic Control Linkage.

1. Boom control lever.
2. Bucket control lever.
3. Mounting bracket.
4. Cap screw, lock washer and nut.
5. Hinge pin.
6. "O"-ring.
7. Bushing.
8. Spacer.
9. Clevis pin and cotter pin.
10. Clevis.
11. Jam nut.
12. Rod.
13. Jam nut.
14. Clevis.
15. Clevis pin and cotter pin.
16. Hinge pin.
17. Cap screw, lock washer and nut.
18. Mounting bracket.
19. "O"-ring.
20. Bellcrank.
21. Spacer.
22. Bushing.
23. Mounting bracket.
24. Clevis pin and cotter pin.
25. Links.
26. Clevis pin and cotter pin.

HYDRAULIC CONTROL VALVE LINKAGE

Disassemble the bellcrank assemblies (20) by removing hex nut and cap screw (17) from mounting bracket (18) and drive hinge pin (16) out through brackets (18, 23). Inspect bushings (22) and replace if necessary.

INSTALLATION

If bellcrank bushings (7, 22, Fig. 9-18) have been removed, press in new bushings. Press bushings flush with open ends of bellcrank hubs. Hand pack bellcrank hubs with chassis grease (NLG1-Grade 2). Install and tighten cap screw plugs in each bellcrank.

NOTE: With the use of teflon bushings it is advisable to hand pack control levers and bellcranks with grease. Pressure greasing may cause serious damage to the teflon bushings.

Assemble bellcranks (20) by inserting hinge pin (16) in through mounting bracket (18) with bore in pin entering last. Install pin approximately half way through mounting bracket (18) allowing installation of bellcranks. Position spacer (21), with new "O"-rings on each end, on installed hinge pin. Install bellcrank on hinge pin. Position remaining bellcrank (20) with new "O"-rings on each end and drive hinge pin completely thru both mounting brackets. Align bore in hinge pin with bore in mounting bracket (18) while driving hinge pin through brackets. Bellcranks (20) must be installed with cap screw plugs facing toward the front of the tractor. Install and tighten cap screw and hex nut (17).

Install links (25) connecting bellcranks (20) with valve spools by inserting clevis pins and cotter pins (24, 26). Position valve spools in the "HOLD" or middle position.

Assemble control rods (12) with jam nuts (13, 11) and clevises (10, 14) installed on each end. Install end of assembled control rods (12) to bellcrank arms (20) and install clevis pins and cotter pins (15).

Assemble control levers (1, 2) to mounting brackets (3) by inserting hinge pin (5) half way through mounting bracket allowing installation of control levers. Position spacer (8) with new "O"-rings on each end, on installed hinge pin. Install bucket control lever (2) on hinge pin. The bucket lever is the short lever. Position boom control lever (1) with new "O"-rings on each end and drive hinge pin through mounting brackets. Align bores in hinge pin with bores in mounting brackets while driving hinge pin through bellcranks and brackets. Control lever bellcranks must be installed with cap screw plugs facing toward the front of the tractor. Install and tighten cap screws (4) in each mounting bracket.

Connect control rod (12) to control lever by installing clevis pins and cotter pins (9). For linkage adjustment refer to "ADJUSTMENT."

ADJUSTMENT

The only adjustable components in the control linkage are the threaded clevisis (10, 14, Fig. 9-18) on the ends of control lever-to-bellcrank rods (12).

To adjust control rods (12), remove cotter pins and clevis pins (9) from the clevises (10). The control valve spools must be in the "HOLD" or middle position during linkage adjustment.

Loosen jam nuts (11) and rotate clevises (10) in the required direction until the clevis pins pass freely through the clevis and properly positioned control lever bellcrank. Control lever bellcrank arms must be in a vertical position for proper adjustment. Install clevis pins and cotter pins (9).

Apply parking brake, disengage transmission and start the engine. Run the loader mechanism through several cycles to check the linkage adjustment. If additional adjustment is required, stop the engine, lower the bucket to the ground and repeat the adjustment procedures.

Once proper adjustment is accomplished, tighten all jam nuts and bend over all cotter pins.

NOTE: Hold clevises in horizontal position while tightening jam nuts. This will prevent clevises from turning during tightening of jam nuts and imposing a frictional bind on the pin, clevis and levers.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

PRINTED IN UNITED STATES OF AMERICA

SECTION X

HYDRAULIC LINES AND FITTINGS

(This Material Included in Section XI)

SECTION XI

HYDRAULIC SYSTEM

Page

SECTION XI HYDRAULIC SYSTEM

GENERAL INFORMATION

DESCRIPTION

This section has been prepared for convenient reference to information on the H-90E Hydraulic System. It presents a description of the Hydraulic System, maintenance and repair in addition to repair of hydraulic components.

PREVENTIVE MAINTENANCE

Cleanliness, the correct type of oil and sufficient oil supply for the system are the most important maintenance requirements.

a. The correct viscosity oil should be used according to ambient temperature. Oil added to the system should be of the same type and viscosity.

b. Proper oil storage will eliminate the possibility of contamination. Improper storage and handling of oil will encourage failures. It is easier to keep foreign material out of the oil before it is used than it is to remove it once it is in the hydraulic system.

c. Oil level in the reservoir should be kept to "H" mark on dipstick at all times.

d. Reservoir oil and filter should be changed at regular intervals, to be determined by type of operation, ambient temperature and work conditions.

e. System pressures should be checked at regular intervals - at least once per month and at the first suspicion of a system problem.

Fittings, "O"-rings, hoses and cap screws should be checked often.

a. All connections should be checked for leaks and "O"-rings replaced if damaged. All cap screws kept tightened.

b. Reservoir dipstick should be kept tightened at all times. No other means of covering opening or different type dipstick should be used.

c. Covers on valve adjusting screws should be tightened and "O"-rings checked to prevent dirt from entering.

REQUIRED TOOLS

Standard Mechanics Hand Tool Set

Hose	- 3500 PSI minimum working pressure rating.
Gauge	- 5000 PSI minimum working pressure rating.
Connectors	- Sufficient to attach gauge and hose to following pressure ports:
	1/8" NPT steering pressure port
	1/4" NPT hydraulic pressure port

Torque wrench - 0-500 ft. lbs. rating

DISASSEMBLY, INSPECTION AND ASSEMBLY

HYDRAULIC RESERVOIR

GENERAL

All components of the hydraulic reservoir may be serviced or removed without removing the reservoir from the tractor.

Perform the following operations before disassembling the reservoir for replacement and servicing of internal parts.

a. Start the engine and operate the hydraulic control levers several times until the system oil becomes warm. Stop the engine.

b. Loosen the reservoir filler cap gradually to bleed off reservoir pressure before removing the filler cap.

c. Place a container under the reservoir drain. The container used should be large enough to catch the volume of oil in the reservoir. Remove the drain plug and direct the flow of draining oil through a large funnel and a length of hose fitted over the funnel spout.

REMOVAL

Remove the front and rear supports. Remove the lines from the reservoir. Cap the lines to prevent the entry of dirt. Identify each line to insure proper installation. Remove the cap screws and lock washers that attach the reservoir to the tractor. The reservoir can then be lifted free of the tractor.

DISASSEMBLY

Disassemble the reservoir in numerical order.
* - Refer to "RELIEF VALVE" for disassembly.
** - Refer to "DRAIN VALVE" for disassembly.

Clean and inspect parts. Refer to "INSPECTION" in this section.

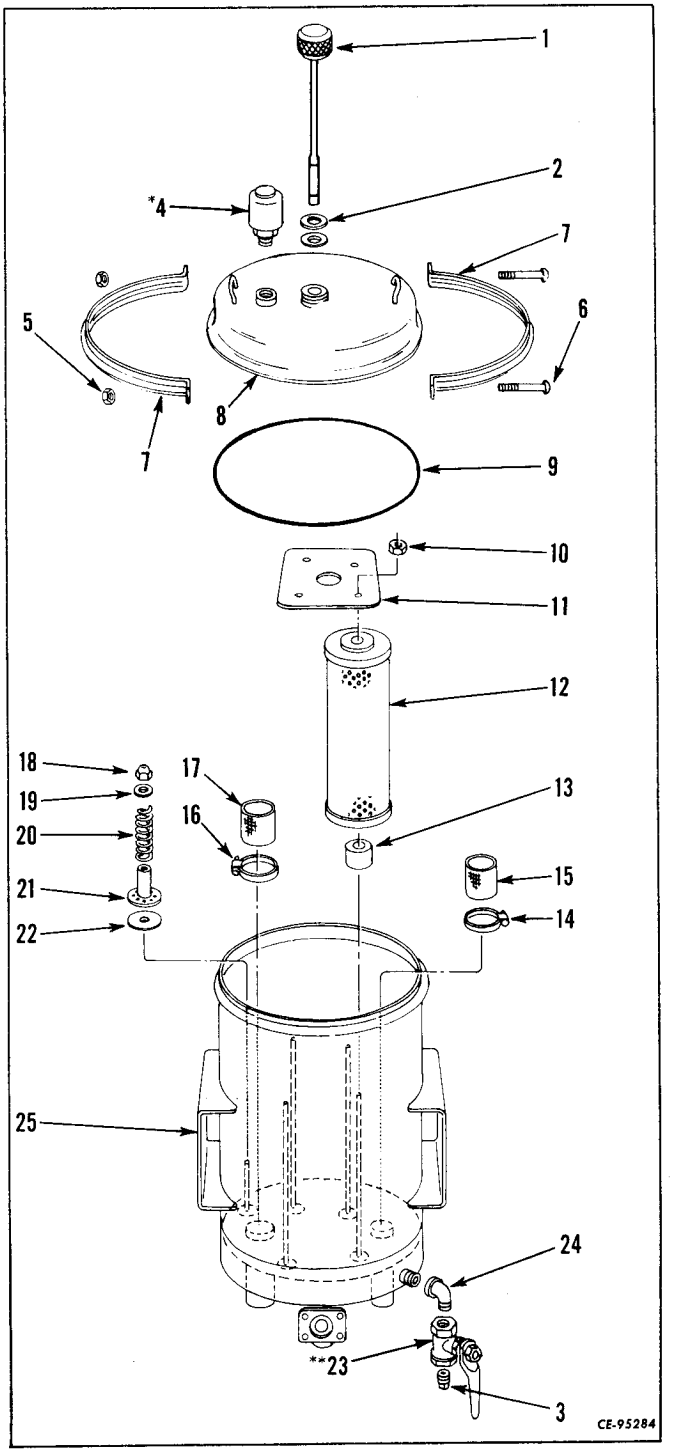

Figure 11-1
Hydraulic Reservoir.

DISASSEMBLY, INSPECTION AND ASSEMBLY

Legend for Figure 11-1

1. Dipstick.
2. Dipstick seal (2).
3. Pipe plug.
4. Relief valve.
5. Nut (2).
6. Bolt (2).
7. Retainer (2).
8. Cover.
9. "O"-ring.
10. Nut (4).
11. Retainer.
12. Filter (4).
13. Spacer (4).
14. Clamp.
15. Screen.
16. Clamp.
17. Screen.
18. Acorn nut.
19. Washer.
20. Spring.
21. Valve.
22. Insulator.
23. Drain valve.
24. Elbow.
25. Reservoir.

Replace parts: 9, 12

Assemble in reverse order.

Special Torque: Item 10 (4) -_____ ft. lbs.

INSPECTION

Check the parts for wear and deterioration. Replace if necessary.

Clean the reservoir as follows:

Clean the reservoir exterior and screens with a spray of clean solvent. Rinse the inside of the reservoir with a warm flushing solution made of four parts clean diesel fuel oil to one part clean lubricating oil. Dry the reservoir interior with compressed air and cover the large opening.

NOTE: Do not use steam or caustic soda when cleaning inside of reservoir or any of the internal parts.

ASSEMBLY

Assemble reservoir in reverse order. Install the reservoir on the tractor and attach with the cap screws and lock washers. Connect the lines to the reservoir. Install the front and rear supports.

Add oil to the reservoir through the dipstick opening in the reservoir. Refer to "SERVICE INFORMATION" for the type oil to use according to expected work and ambient temperature conditions.

Filter the oil, added to the reservoir, through a fine-mesh screen. Continue filling the reservoir until the "H" mark is reached on the dipstick. Start and run the engine at a reduced speed. Operate the hydraulic controls to circulate oil through the circuits. Purge air from the system. Check the reservoir oil level frequently and add fresh oil as needed to keep the level in the reservoir at the "H" mark on the dipstick.

Stop the engine, lower the boom and place the bucket flat on ground. Recheck oil level.

HYDRAULIC SYSTEM

DISASSEMBLY, INSPECTION AND ASSEMBLY

RELIEF VALVE

Disassemble the valve in numerical order.

Clean and inspect parts.

Replace parts: 5, 9, 13, 14.

Assemble in reverse order. Apply Loctite Grade "E" to the threads of Item No. 15.

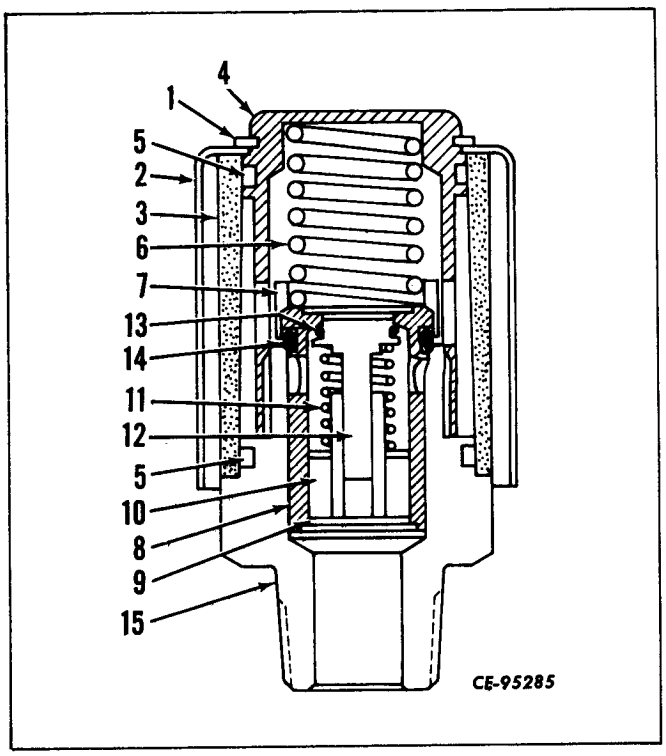

Figure 11-2
Relief Valve.

1. Lock ring.
2. Cover.
3. Filter.
4. Cap.
5. Filter seal (2).
6. Spring.
7. Retainer.
8. Sleeve.
9. Lock ring (2).
10. Guide.
11. Poppet spring.
12. Poppet.
13. Poppet seal.
14. Sleeve seal.
15. Body.

DRAIN VALVE

Disassemble the valve in numerical order.

Clean and inspect parts.

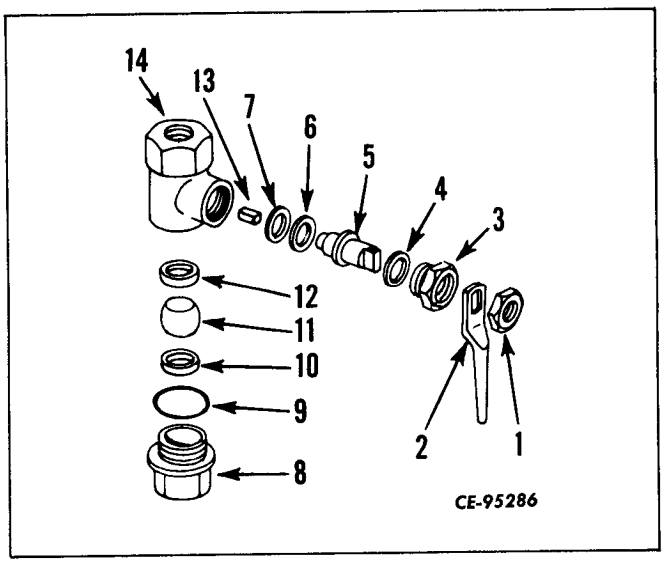

Figure 11-3
Drain Valve.

1. Locknut.
2. Handle.
3. Bushing nut.
4. Thrust washer.
5. Stem.
6. Back-up ring.
7. Stem seal.
8. End cap.
9. Body seal.
10. Seat.
11. Ball.
12. Seat.
13. Stop pin.
14. Body.

Replace parts: 6, 7, 9.

Assemble in reverse order.

MAIN HYDRAULIC PUMP

GENERAL

Do not remove or disassemble the pump unless it is known to be in need of repairs. First, eliminate all other possibilities of hydraulic system malfunction as outlined in the "TROUBLE SHOOTING" section of this manual.

Before disassembly, have the correct pump gasket set on hand. Pump disassembly will probably damage "O"-rings, back-up rings and seals. Pump assembly without replacing these parts is not practical.

NOTE: For correct repair parts, refer to current "PARTS MANUAL."

DISASSEMBLY, INSPECTION AND ASSEMBLY

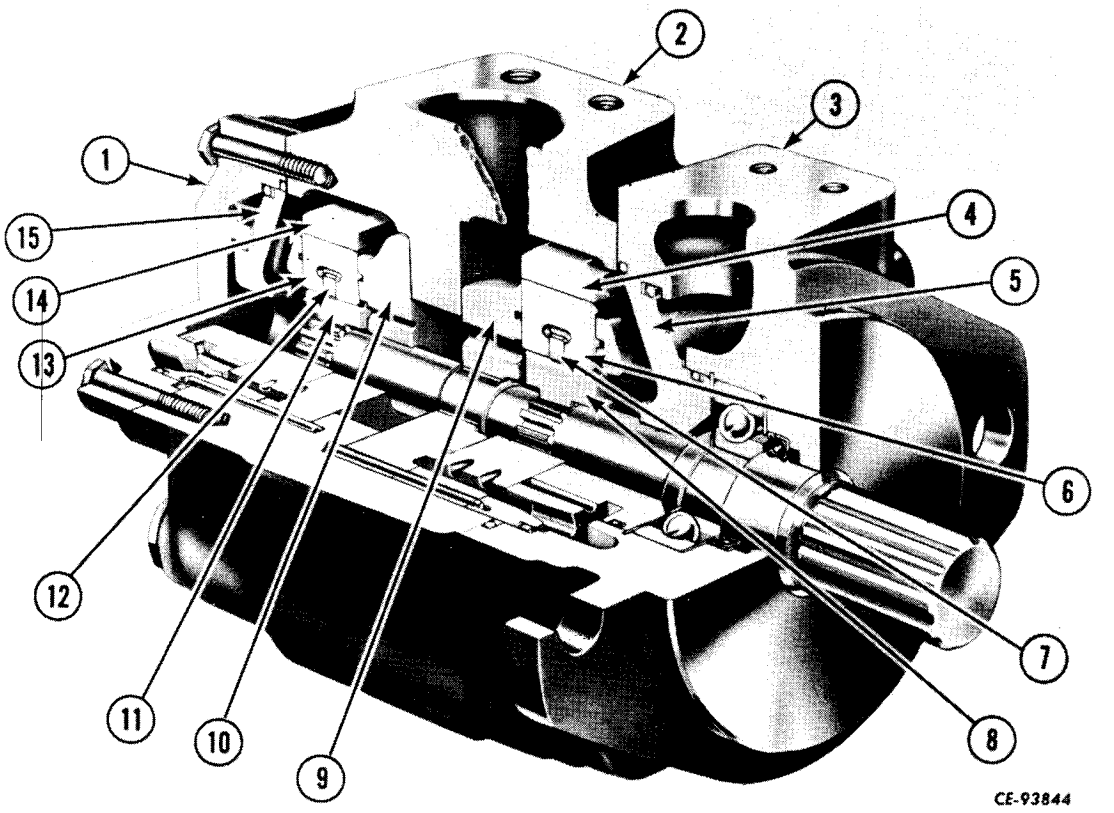

Figure 11-4
Typical Double Vane Pump.

1. Outlet cover.
2. Inlet housing.
3. Outlet body.
4. Ring.
5. Pressure plate.
6. Vane.
7. Intra-vane.
8. Rotor.
9. Wear plate.
10. Wear plate.
11. Rotor.
12. Intra-vane.
13. Vane.
14. Ring.
15. Pressure plate.

When reinstalling the pump, use "Never Seeze" or its equivalent on the splines.

REMOVAL

a. Drain the oil from the reservoir. Remove pump lines and cap to prevent the entry of dirt. Identify each line to insure proper installation when pump is replaced on tractor.

b. Remove cap screws holding pump to converter. Remove pump carefully being sure that splined shaft is not damaged. Cap pump ports and clean exterior of pump before disassembly.

c. Disassemble the pump on a clean work bench to prevent the entry of dirt and/or foreign material.

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

MAIN HYDRAULIC PUMP - Continued

DISASSEMBLY

Remove the cap screws (4, Fig. 11-5). Remove the cover (3) and cartridge (2) from the pump (1).

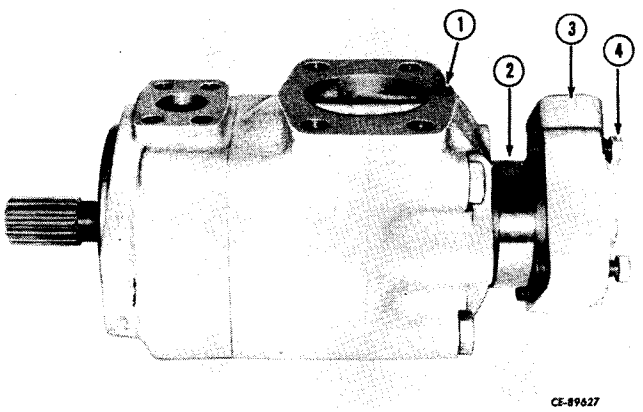

Figure 11-5

Remove the "O"-ring (1, Fig. 11-6) from the cover (2).

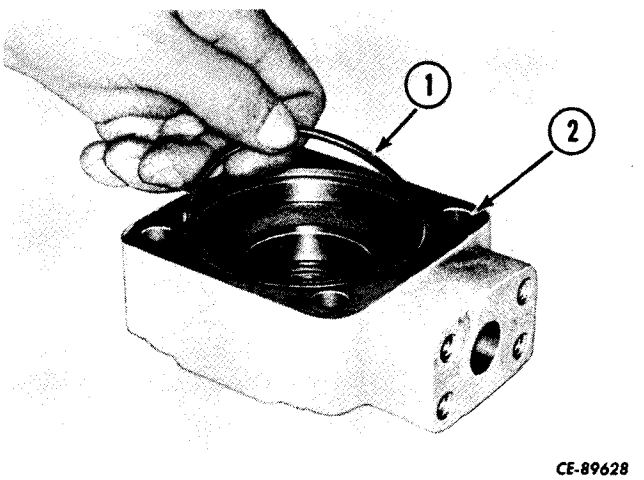

Figure 11-6

Remove the "O"-rings (2 and 3, Fig. 11-7) and back-up rings (1 and 4) from the cartridge.

Remove the screws (9) from the cartridge. Note capacity and direction of rotation (10) stamped on ring (6) of cartridge.

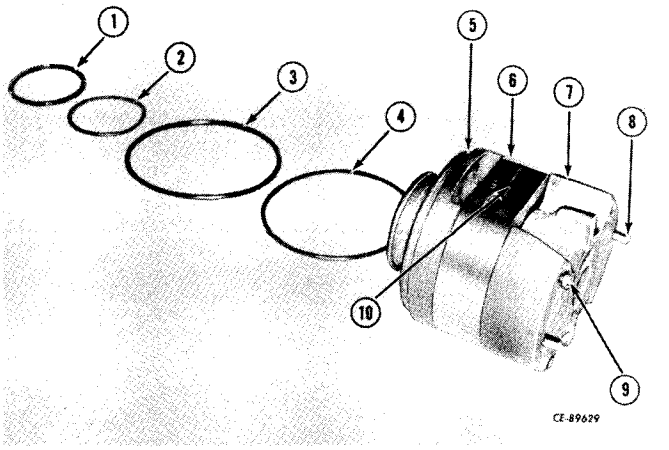

Figure 11-7

Remove wear plate (7). Remove rotor being careful that vanes stay in position. Remove cam ring (6) and locating pins (8).

NOTE: If it is necessary to remove the vanes from the rotor, be sure during assembly that the highest edge of the bevel (1, Fig. 11-8) is in the direction of rotation.

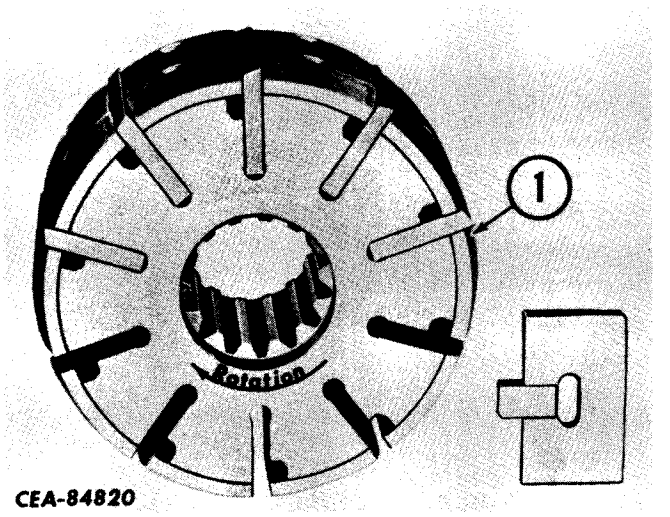

Figure 11-8

Remove the cap screws (5, Fig. 11-9). Remove the housing (4), cartridge (3) and "O"-ring (2) and back-up ring from the body (1).

DISASSEMBLY, INSPECTION AND ASSEMBLY

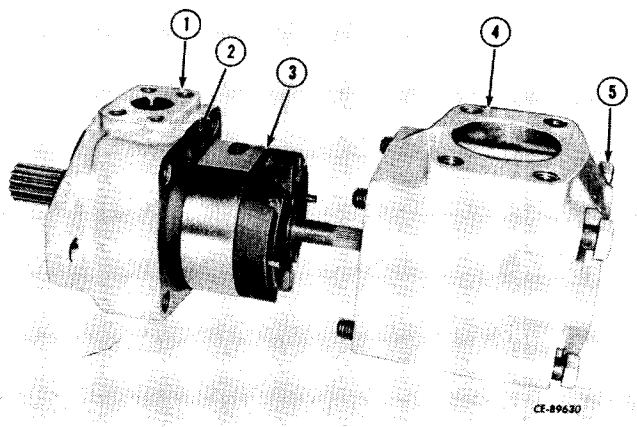

Figure 11-9

Remove the "O"-rings (2 and 3, Fig. 11-10) and back-up rings (1 and 4) from the cartridge.

Remove the screws (8) from the cartridge. Note capacity and direction of rotation (10) stamped on ring (6) of cartridge.

Remove wear plate (7). Remove rotor being careful that vanes stay in position. Remove cam ring (6) and locating pins (9).

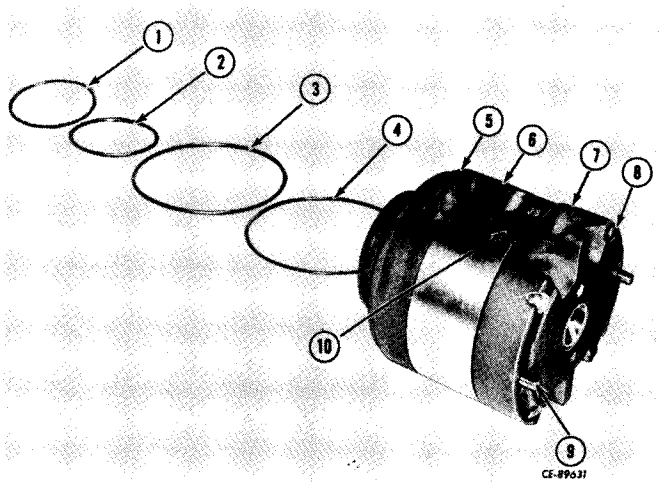

Figure 11-10

NOTE: If it is necessary to remove the vanes from the rotor, be sure during assembly that the highest edge of the bevel (1, Fig. 11-11) is in the direction of rotation.

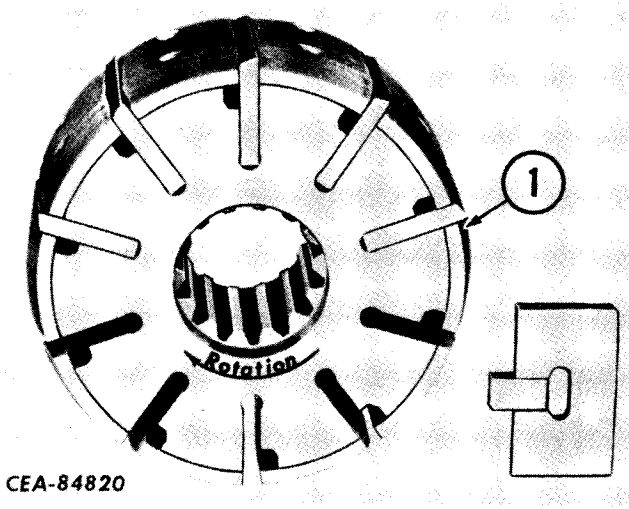

Figure 11-11

Remove the snap ring (3, Fig. 11-12). Remove the shaft with bearing (2) from the body (1).

(Continued on next page)

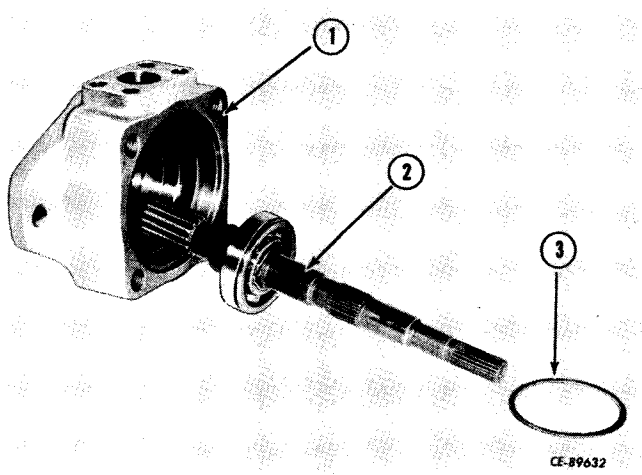

Figure 11-12

DISASSEMBLY, INSPECTION AND ASSEMBLY

MAIN HYDRAULIC PUMP - Continued

DISASSEMBLY - Continued

Remove the washer (4, Fig. 11-13), seal (3) and wiper (2) from the body (1).

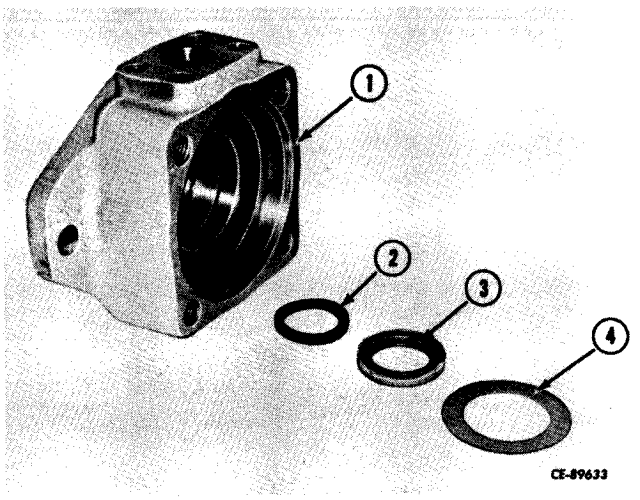

Figure 11-13

Using a snap ring pliers (1, Fig. 11-14) remove the snap ring (2).

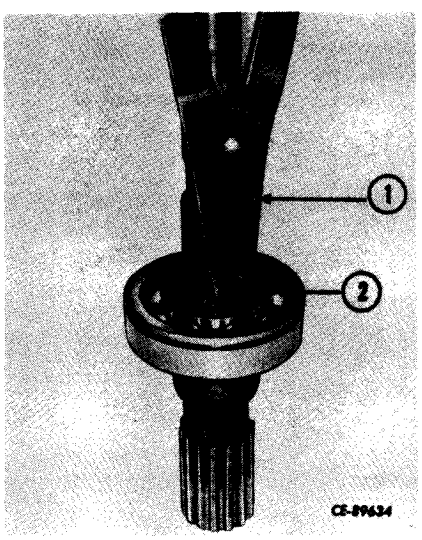

Figure 11-14

Press the bearing (1, Fig. 11-15) from the shaft in an arbor press, supporting the inner race.

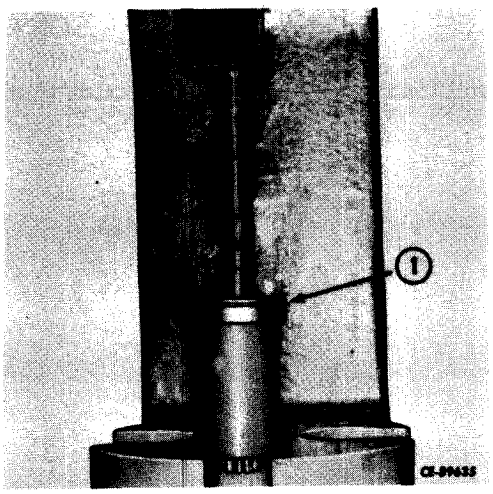

Figure 11-15

INSPECTION

Discard the shaft seal and all "O"-rings and back-up rings. Use a new gasket kit for assembly. Wash the metal parts in clean mineral solvent, dry with filtered compressed air and place them on a clean surface for inspection.

Check the pumping cartridges for signs of wear. Inspect the cam rings for scoring and corresponding marks on vanes. All vanes should slide freely in the rotor slots without sticking or side play. Vanes should drop in the rotor slots by their own weight when both slots and vanes are dry. Check slots and rotor shaft for wear.

Do not repair or "touch-up" any of the parts contained in the pump cartridges. These parts are machined to close tolerances which can easily be destroyed. Replacement of complete cartridge assemblies is recommended if worn rings or vanes are found.

Check the pressure plate faces for scoring marks. Lap out score marks if possible or replace the plates.

DISASSEMBLY, INSPECTION AND ASSEMBLY

ASSEMBLY

NOTE: Coat all parts with clean hydraulic fluid to facilitate assembly and provide initial lubrication. Use small amounts of petroleum jelly to hold the "O"-rings in place during assembly.

Install a new felt wiper and a new oil seal. Using the proper seal installation tool (refer to "SPECIAL TOOLS" under "SERVICE INFORMATION"). Press the seal into position (Fig. 11-16).

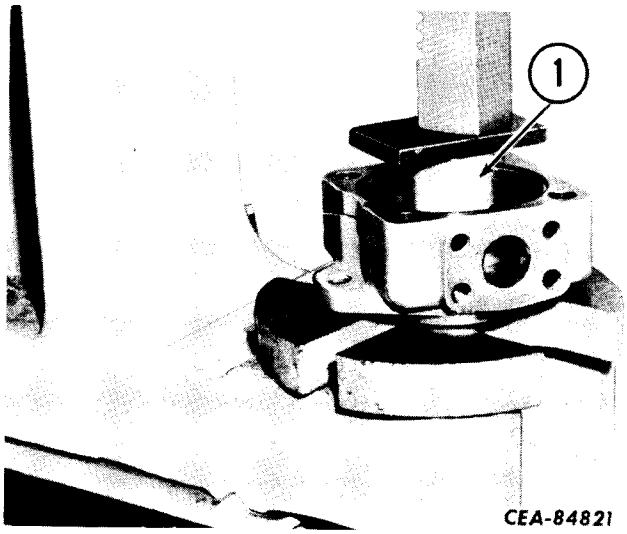

Figure 11-16

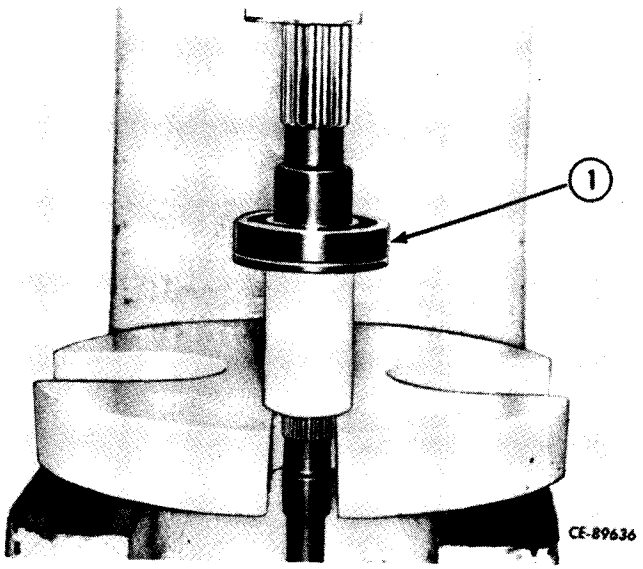

Figure 11-17

Press the shaft into the bearing (1, Fig. 11-17) in an arbor press, supporting the inner race.

Using a snap ring pliers (1, Fig. 11-14), install the snap ring (2) on the shaft.

Install washer in the body (4, Fig. 11-13).

Install the shaft with bearing (2, Fig. 11-18) in the body (1) and secure with the ring (3).

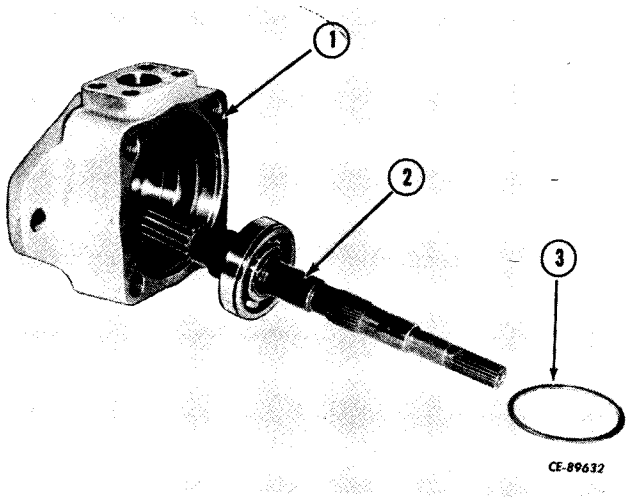

Figure 11-18

NOTE: The direction of rotation is viewed from the shaft end; right hand rotation is clockwise; left hand, counterclockwise.

Place the rotor on the pressure plate (5, Fig. 11-18) with the arrow on the rotor pointed in the correct direction of rotation (10). Place the inserts in the vanes and install the assembly in the rotor slots. Be sure the sharp edges are toward the direction of rotation.

Install the locating pins (9) in the pressure plate and place the ring (6) over them with the ring arrow pointing in the correct direction of rotation. Apply a small amount of grade CV-4-10 "Loctite" to screw threads. Install the wear plate (7) and screws (8). Be certain to tighten the screws securely.

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

MAIN HYDRAULIC PUMP - Continued

ASSEMBLY - Continued

Install new "O"-rings (2 and 3, Fig. 11-19) and back-up rings (1 and 4) after lubricating them with petroleum jelly.

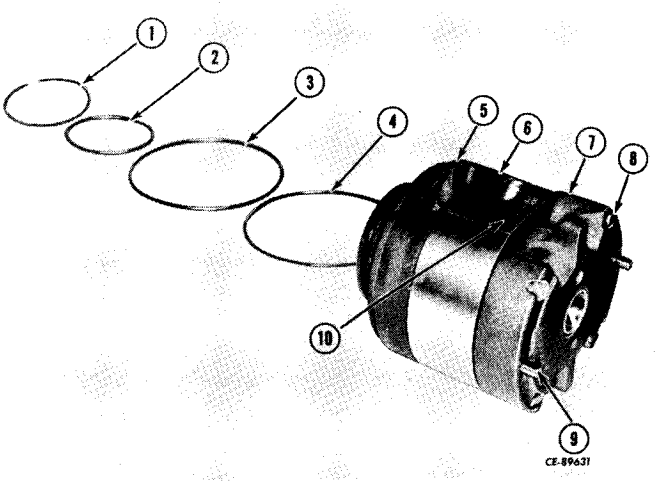

Figure 11-19

Install a new back-up ring and "O"-ring (2, Fig. 11-20) after lubricating them with petroleum jelly. Install the cartridge (3) in the body (1) (using a twisting motion). Be certain the pins engage in the body.

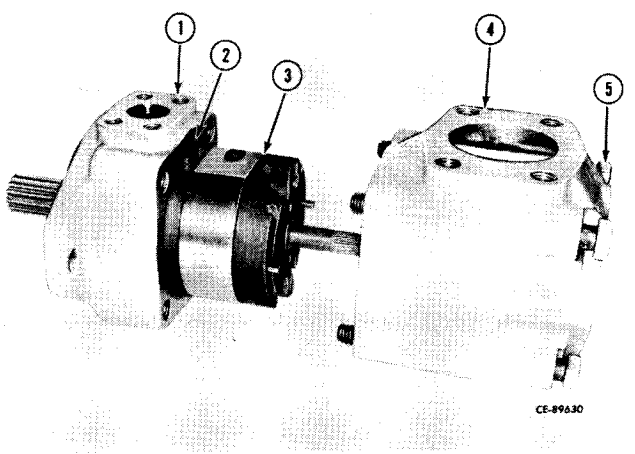

Figure 11-20

Install the housing (4) and secure with the cap screws (5). Torque the cap screws. Refer to "SPECIAL TORQUES."

Torque: _____

Place the rotor on the pressure plate (5, Fig. 11-21) with the arrow on the rotor pointed in the correct direction of rotation (10). Place the inserts in the vanes and install the assembly in the rotor slots. Be sure the sharp edges are toward the direction of rotation.

Install the locating pins (8) in the pressure plate and place the ring (6) over them with the ring arrow pointing in the correct direction of rotation. Apply a small amount of grade CV-4-10 "Loctite" to screw threads. Install the wear plate (7) and screws (9). Be certain to tighten the screws securely.

Install new "O"-rings (2 and 3, Fig. 11-21) and back-up rings (1 and 4) after lubricating them with petroleum jelly.

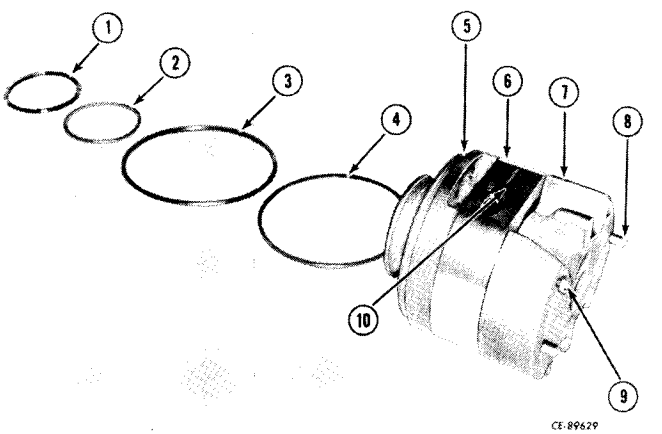

Figure 11-21

Install a new "O"-ring (1, Fig. 11-22) in the cover (2).

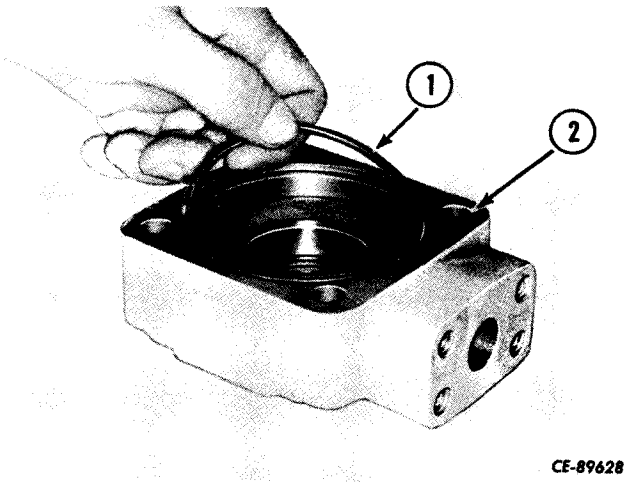

Figure 11-22

Install the cartridge (2, Fig. 11-23) being certain the pins engage in the housing (1). Install the cover (3). Secure with the cap screws (4). Torque the cap screws. Refer to "SPECIAL TORQUES."

Torque:_____

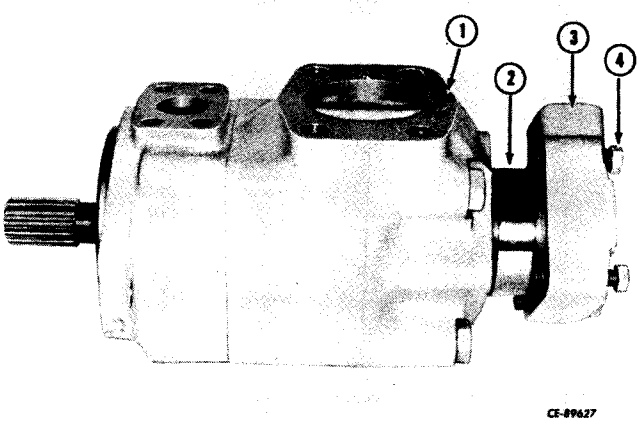

Figure 11-23

SWITCH PUMP

GENERAL

Do not remove or disassemble the pump unless it is known to be in need of repairs. First, eliminate all other possibilities of hydraulic system malfunction as outlined in the "TROUBLE SHOOTING" section of this manual.

Before disassembly, have the correct pump gasket set on hand. Pump disassembly will probably damage "O"-rings, back-up rings and seals. Pump assembly without replacing these parts is not practical.

NOTE: For correct repair parts, refer to current "PARTS MANUAL."

REMOVAL

Drain the oil from the reservoir. Remove pump lines and cap to prevent the entry of dirt. Identify each line to insure proper installation.

Remove cap screws holding pump to converter. Remove pump carefully being sure that splined shaft is not damaged. Cap pump ports and clean exterior of pump before disassembly.

Disassemble the pump on a clean work bench to prevent the entry of dirt and/or foreign material.

DISASSEMBLY

Scribe marks (4, Fig. 11-24) on pump housing to aid in positioning parts during assembly.

(Continued on next page)

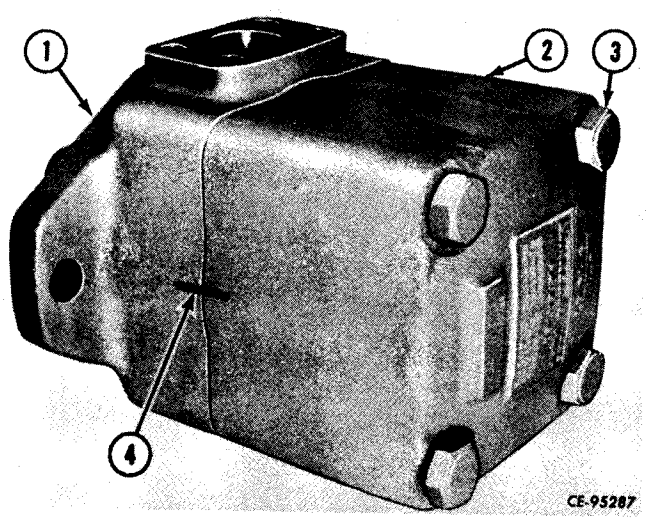

Figure 11-24

DISASSEMBLY, INSPECTION AND ASSEMBLY

SWITCH PUMP - Continued

DISASSEMBLY - Continued

Remove cap screws (3) that secure cover (2) to body (1).

Remove the "O"-ring (2, Fig. 11-25) and cartridge (3) from the body (1).

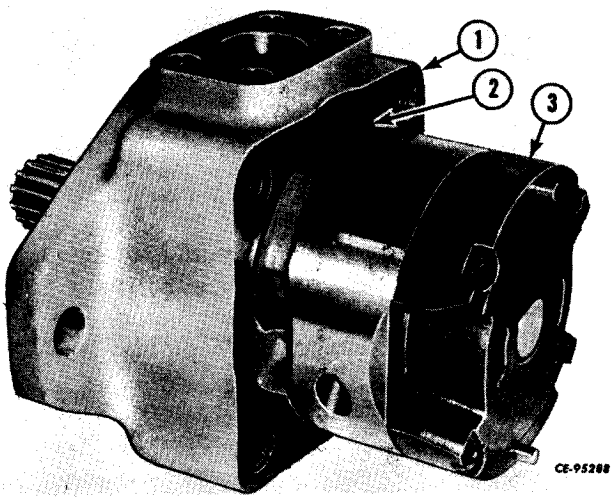

Figure 11-25

Remove the "O"-rings (2 and 3, Fig. 11-26) and back-up rings (1 and 4) from the cartridge.

Remove the screws (9) from the cartridge. Note capacity and direction of rotation (10) stamped on ring (6) of cartridge.

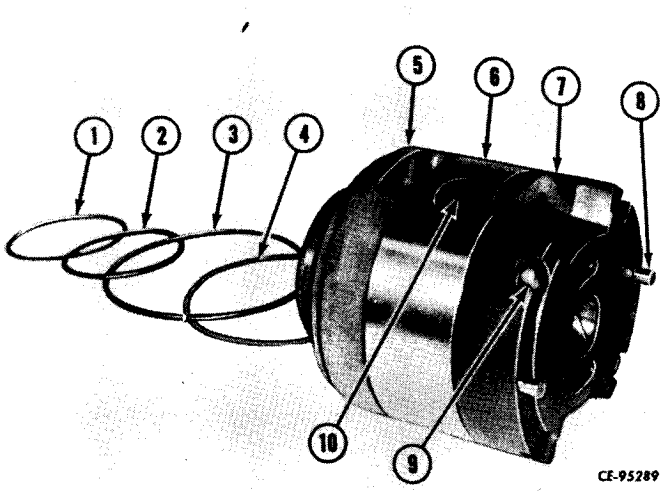

Figure 11-26

Remove wear plate (7). Remove rotor being careful that vanes stay in position. Remove cam ring (6) and locating pins (8).

NOTE: If it is necessary to remove the vanes from the rotor, be sure during assembly that the highest edge of the bevel (1, Fig. 11-27) is in the direction of rotation.

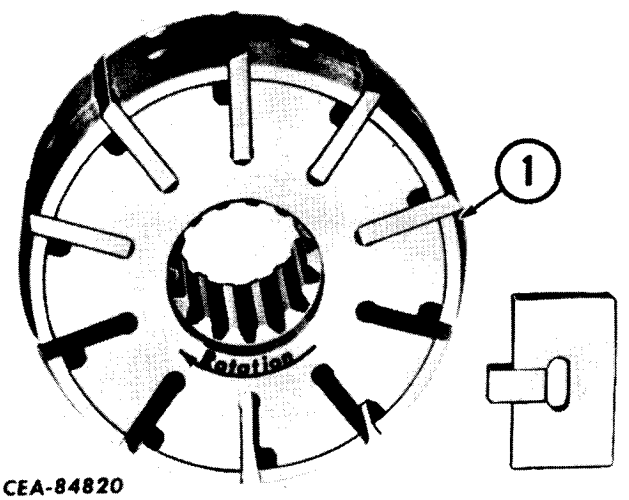

Figure 11-27

Remove the snap ring (3, Fig. 11-28). Remove the shaft with bearing (2) from the body (1).

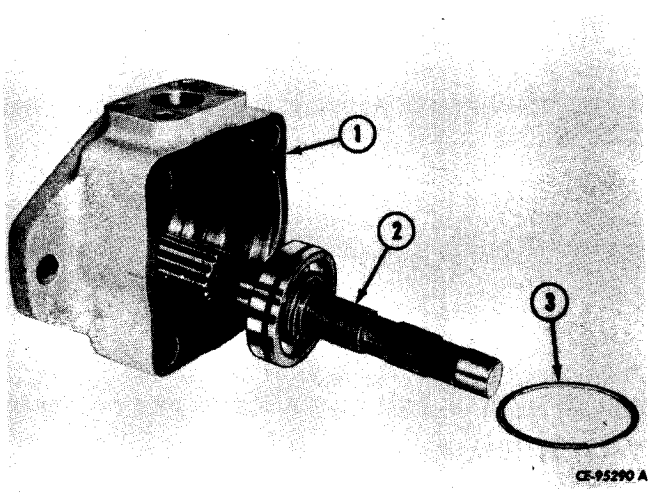

Figure 11-28

Remove the washer (4, Fig. 11-29), seal (3) and wiper (2) from the body (1).

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DISASSEMBLY, INSPECTION AND ASSEMBLY

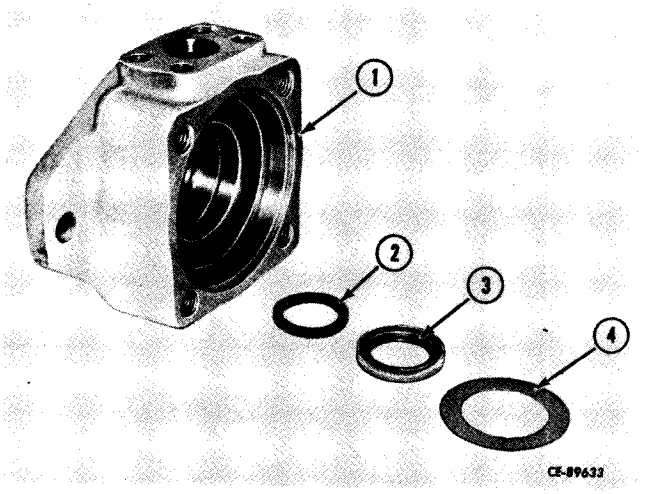

Figure 11-29

Using a snap ring pliers (1, Fig. 11-30) remove the snap ring (2).

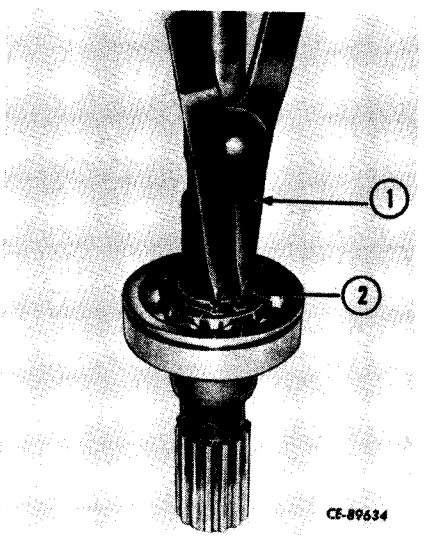

Figure 11-30

Press the bearing (1, Fig. 11-31) from the shaft in an arbor press, supporting the inner race.

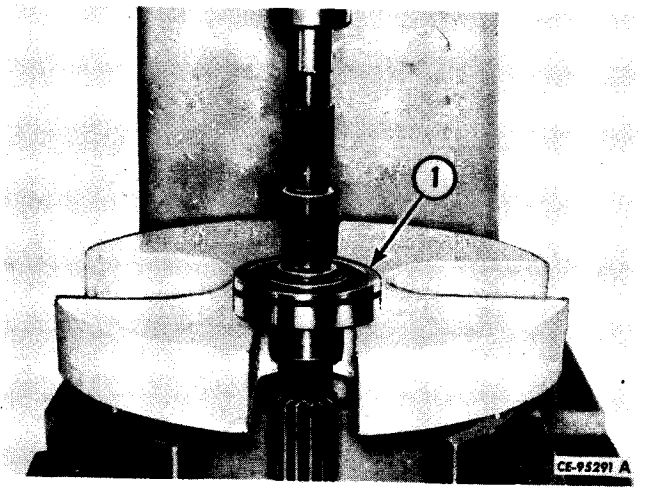

Figure 11-31

INSPECTION

Discard the shaft seal and all "O"-rings and back-up rings. Use a new gasket kit for assembly. Wash the metal parts in clean mineral solvent, dry with filtered compressed air and place them on a clean surface for inspection.

Check the pumping cartridges for signs of wear. Inspect the cam rings for scoring and corresponding marks on vanes. All vanes should slide freely in the rotor slots without sticking or side play. Vanes should drop in the rotor slots by their own weight when both slots and vanes are dry. Check slots and rotor shaft for wear.

Do not repair or "touch-up" any of the parts contained in the pump cartridges. These parts are machined to close tolerances which can easily be destroyed. Replacement of complete cartridge assemblies is recommended if worn rings or vanes are found.

Check the pressure plate faces for scoring marks. Lap out score marks if possible or replace the plates.

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

SWITCH PUMP - Continued

ASSEMBLY

NOTE: Coat all parts with clean hydraulic fluid to facilitate assembly and provide initial lubrication. Use small amounts of petroleum jelly to hold the "O"-rings in place during assembly.

Install a new felt wiper and new oil seal. Using the proper seal installation tool (refer to "SPECIAL TOOLS" under "SERVICE INFORMATION"). Press the seal into position (Fig. 11-32).

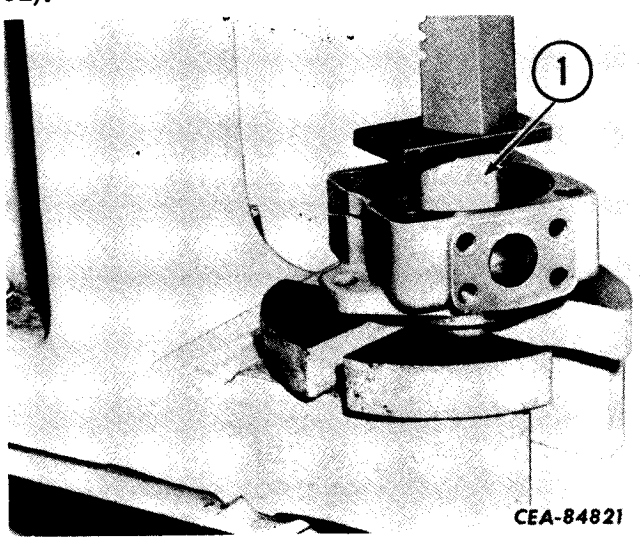

Figure 11-32

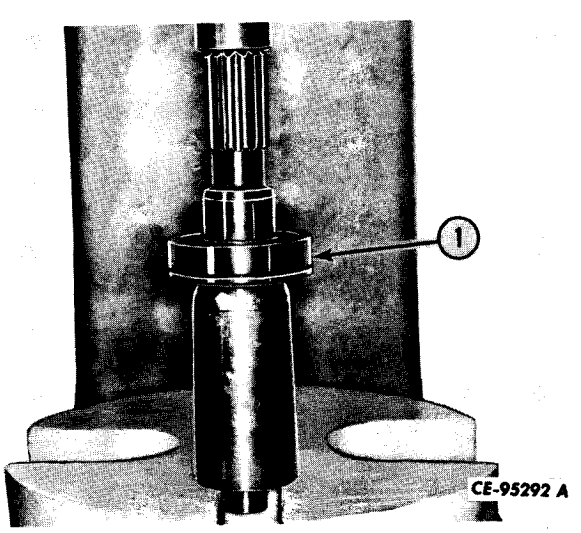

Figure 11-33

Press the shaft into the bearing (1, Fig. 11-33) in an arbor press, supporting the inner race.

Using a snap ring pliers (1, Fig. 11-34), install the snap ring (2) on the shaft.

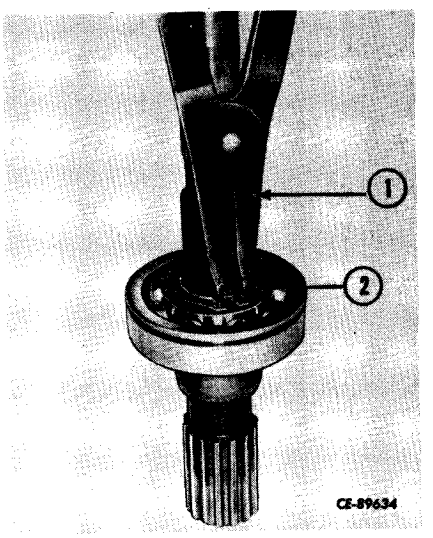

Figure 11-34

Install washer in the body (4, Fig. 11-29).

Install the shaft with bearing (2, Fig. 11-35) in the body (1) and secure with the ring (3).

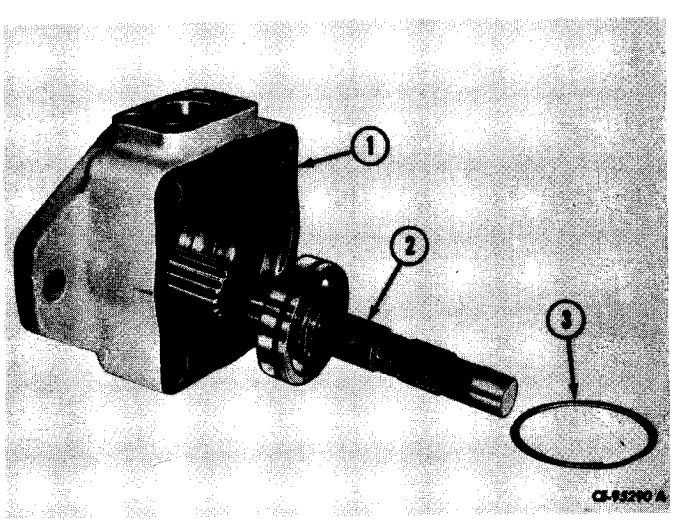

Figure 11-35

NOTE: The direction of rotation is viewed from the shaft end; right hand rotation is clockwise; left hand, counterclockwise.

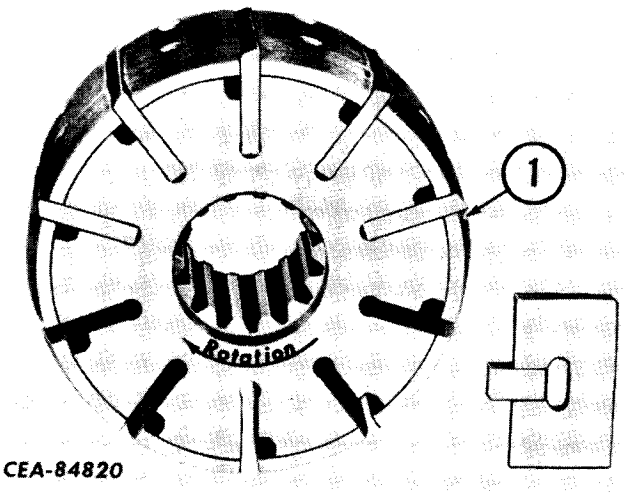

Figure 11-36

Place the rotor on the pressure plate (5, Fig. 11-37) with the arrow on the rotor pointed in the correct direction of rotation (10). Place the inserts in the vanes and install the assembly in the rotor slots. Be sure the sharp edges are toward the direction of rotation.

Install the locating pins (8) in the pressure plate and place the ring (6) over them with the ring arrow pointing in the correct direction of rotation. Apply a small amount of grade CV-4-10 "Loctite" to screw threads. Install the wear plate (7) and screws (9). Be certain to tighten the screws securely.

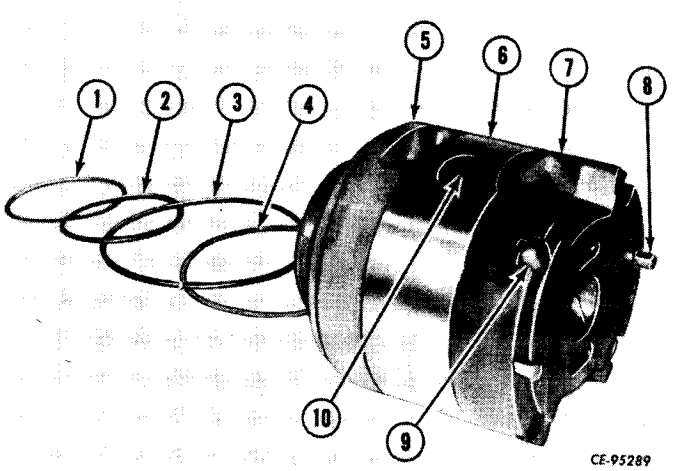

Figure 11-37

Install new "O"-rings (2 and 3, Fig. 11-37) and back-up rings (1 and 4) after lubricating them with petroleum jelly.

Install the cartridge (3, Fig. 11-38) and "O"-ring (2).

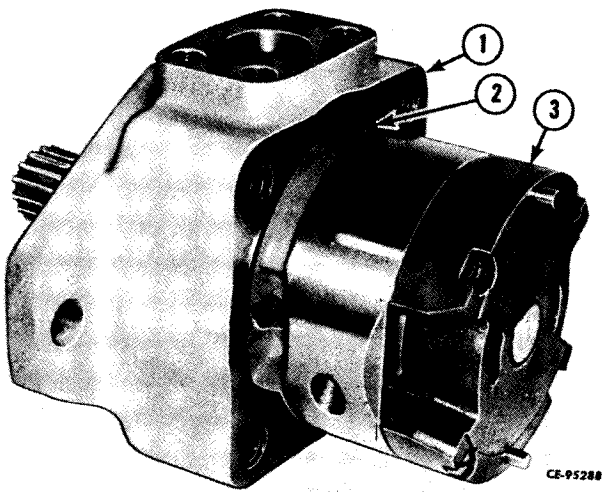

Figure 11-38

Install the cover (2, Fig. 11-39). Be certain the cartridge pins engage in the cover. Align the marks (4) on the body (1) and cover (2). Install the cap screws (3). Torque the cap screws. Refer to "SPECIAL TORQUES."

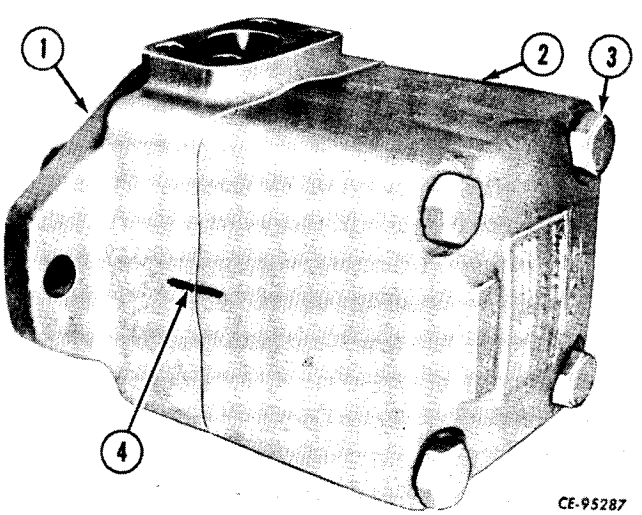

Figure 11-39

DISASSEMBLY, INSPECTION AND ASSEMBLY

MAIN CONTROL VALVE

REMOVAL

Remove the valve as follows:

a. Disconnect the control valve linkage from the valve.

b. Remove, cap and tag the connecting lines.

c. Remove the cap screws, washers and nuts that secure the valve to the frame.

DISASSEMBLY

Remove plug (4, Fig. 11-40) from sleeve (1). Slide piston (2) and spacer (3) from sleeve. Spacer is found only in bucket plunger. (Spacer nut used on machines equipped with bucket leveler); remove "O"-rings (5) from plugs (4) and discard.

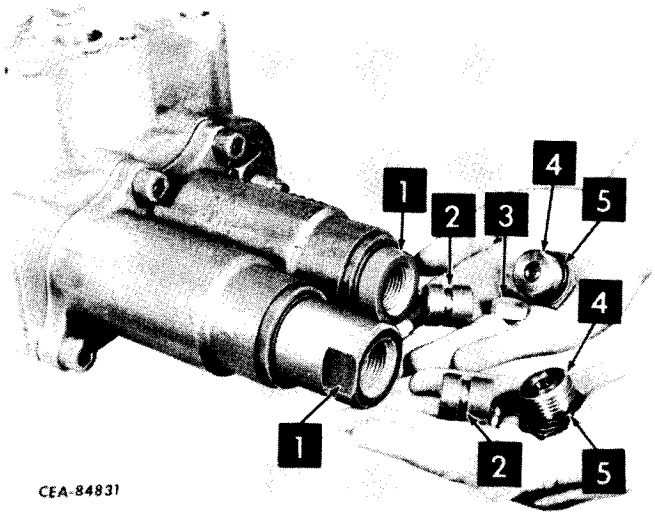

Figure 11-40

Remove Spir-O-Lox (2, Fig. 11-41) and spacer (1) from detent sleeve (3).

Remove recessed head cap screws (3, Fig. 11-42) that secure plunger cap (4), to valve body (1).

Remove scraper ring (3, Fig. 11-43), spacer ring (2) and "O"-ring (1) from eye (4) end of plunger. Discard seal components.

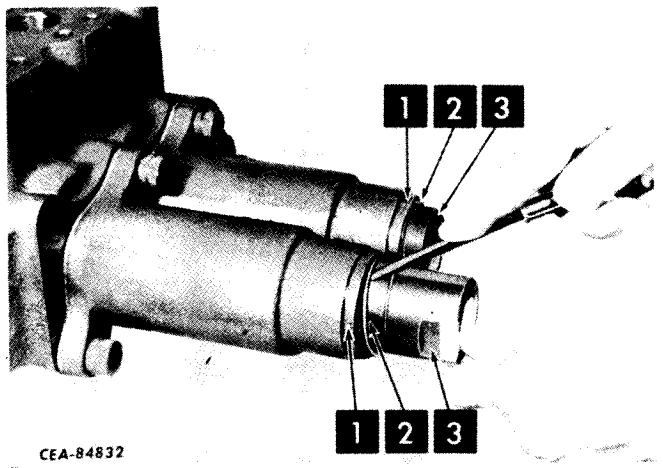

Figure 11-41

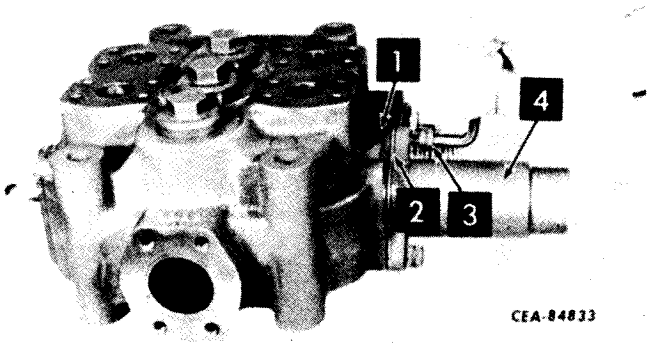

Figure 11-42

Figure 11-43

Pull the boom plunger assembly (2, Fig. 11-44) from the valve body (1).

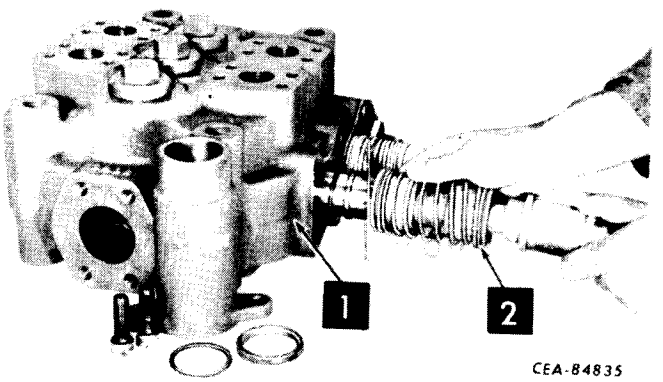

Figure 11-44

Slide the plunger cap (1, Fig. 11-45) from the plunger (3) using a punch to depress the detent cam. Use caution to prevent the loss of the detent balls (2).

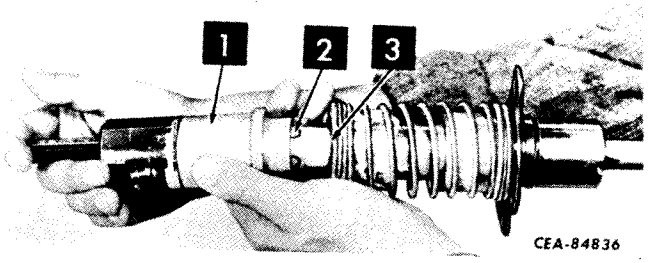

Figure 11-45

After removing plunger cap (1, Fig. 11-46) from the plunger pin (2), slide spring (3), detent cam (5) and detent balls (4) from plunger assembly.

Place eye end of plunger in vise with protective jaws. Remove plunger pin (1, Fig. 11-47) from plunger assembly (2) using a rod of the approximate diameter as the holes in the end of plunger. Use caution to prevent damage to the holes.

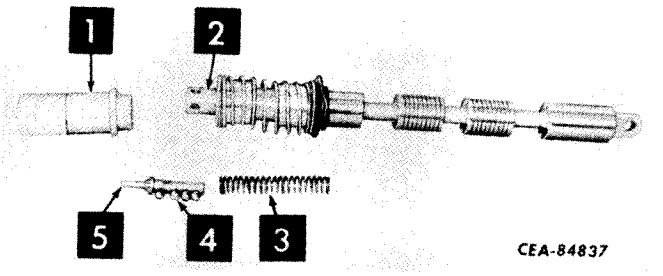

Figure 11-46

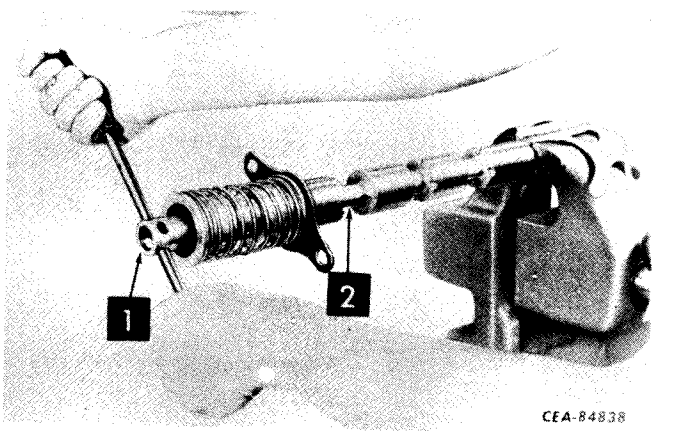

Figure 11-47

Remove plunger pin (1, Fig. 11-48), spring (2), spring seat (5) and seal plate (3) from plunger (4). Exert pressure against the plunger pin as it disengages the plunger and release the spring tension slowly.

(Continued on next page)

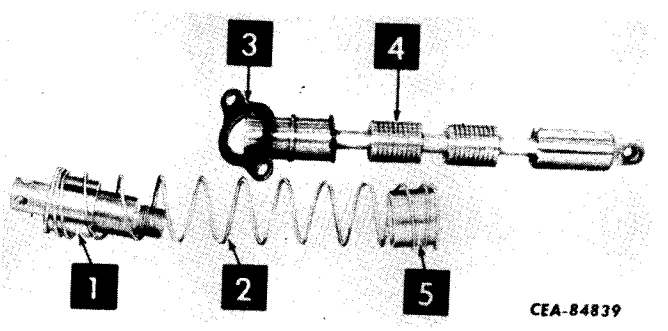

Figure 11-48

DISASSEMBLY, INSPECTION AND ASSEMBLY

MAIN CONTROL VALVE - Continued

DISASSEMBLY - Continued

Remove three check valves (1, Fig. 11-49). Remove check valve plug (4), spring (3) and poppet (2) from valve body. Discard "O"-ring (5).

Remove plug (2, Fig. 11-50) and "O"-ring (1). Discard "O"-ring.

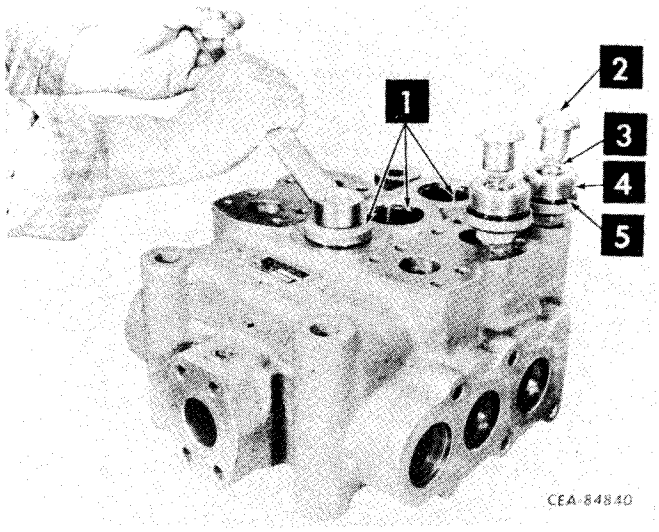

Figure 11-49

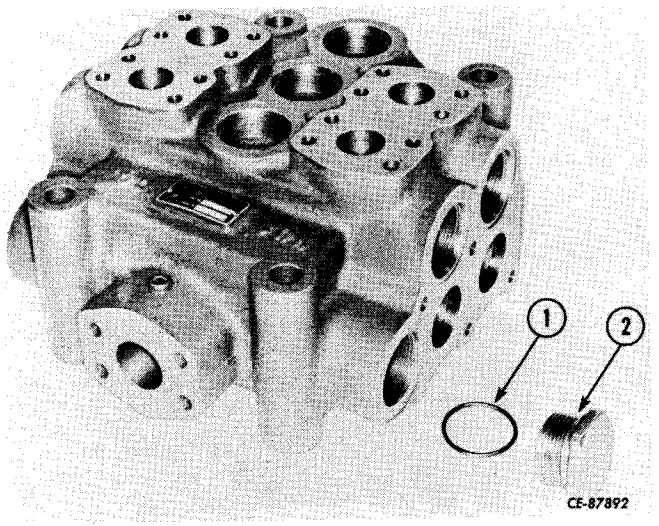

Figure 11-50

Loosen and remove the acorn nut (17, Fig. 11-51) and washer (16). Remove jam nut (15), washer (14) and screw (13). Slide spring (12) and poppet (11) from plug (10). Remove plug (10). Remove and discard "O"-rings (7 and 9) and back-up ring (8) from plug. Slide spring (6), piston (5) and poppet (2) from sleeve (1). Remove and discard "O"-ring (4) and back-up ring (3) from poppet. Tap the sleeve (1) from the valve body.

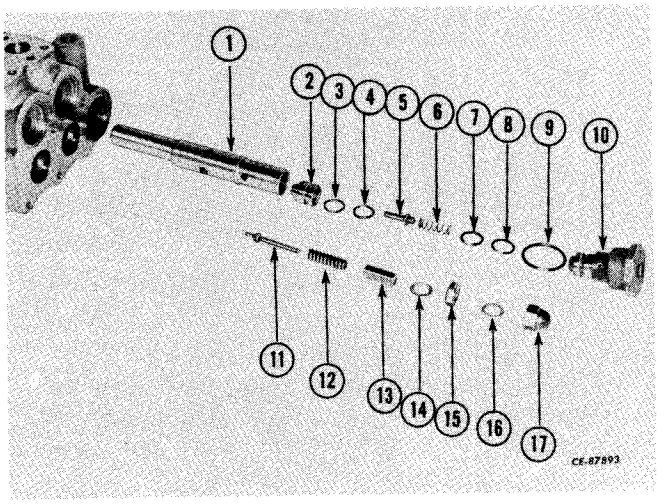

Figure 11-51

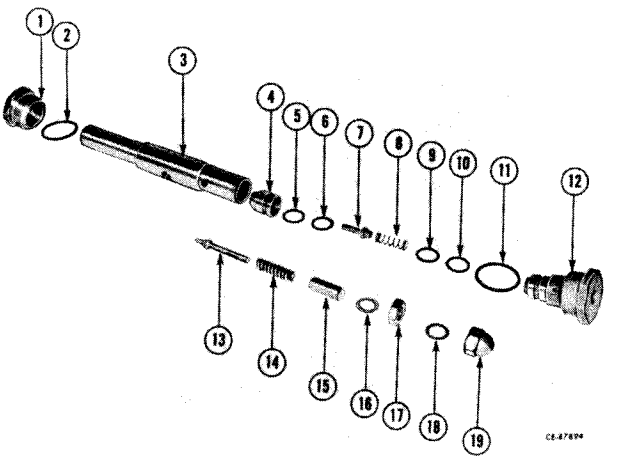

Figure 11-52

1. Plug.
2. "O"-ring.
3. Sleeve.
4. Poppet.
5. Back-up ring.
6. "O"-ring.
7. Piston.
8. Spring.
9. "O"-ring.
10. Back-up ring.
11. "O"-ring.
12. Plug.
13. Poppet.
14. Spring.
15. Adjusting screw.
16. Copper washer.
17. Jam nut.
18. Copper washer.
19. Acorn nut.

DISASSEMBLY, INSPECTION AND ASSEMBLY

Check orifice (1, Fig. 11-53) in boom spool bore to be sure there are no obstructions.

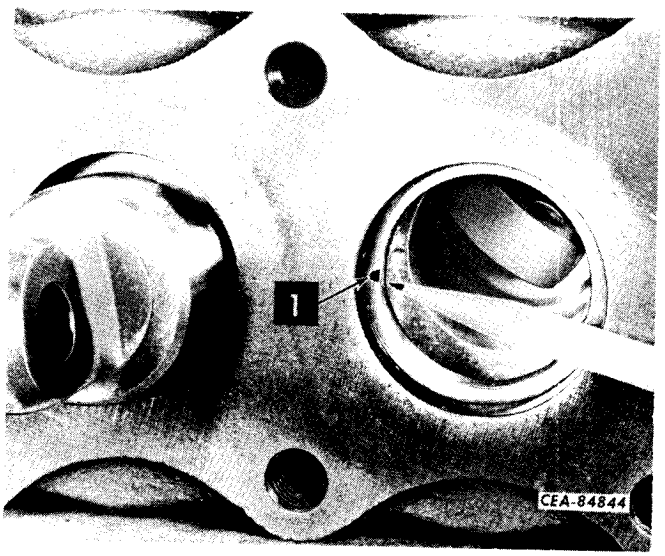

Figure 11-53

INSPECTION

Thoroughly wash all parts in a clean mineral oil solvent. Dry with filtered compressed air and place on clean paper for inspection.

Inspect all surfaces for burrs, scratches, nicks, scores and other abrasions. Stone or lap all burrs. If scoring is deep enough to produce excessive leakage, replace valve assembly. Stone or use crocus cloth on small scores.

All parts with sliding fit must move freely in their bores. All grooves and passages must be free of foreign matter.

Replace springs if they are broken or distorted.

Replace detent balls that are worn or deformed.

Replace all "O"-rings and back-up rings.

Listed below are instructions that must be followed to insure correct installation and effective sealing of "O"-rings.

a. Seal counter bores must be thoroughly cleaned.

b. "O"-rings, plungers, and counter bores must be lubricated on assembly.

c. "O"-rings must be free of molding defects and handling damage.

d. "O"-RINGS MUST NOT BE STRETCHED beyond the yield point. (Wrap a stiff paper around plunger to protect the "O"-ring passing over the sharp machined edges.)

e. EXTREME care must be taken to avoid "ROLLING" the "O"-ring into the counter bore. (A twisted "O"-ring is not likely to straighten itself after installation, and is almost certain to leak.) Refer to "GASKETS AND SEALS" under "INTRODUCTION."

f. Care in handling of parts and hydraulic system cleanliness cannot be over stressed.

g. Use ONLY the oil type and viscosity ranges specified under "SERVICE INFORMATION."

ASSEMBLY

Install sleeve (1, Fig. 11-51) in valve body bore being sure the hollow end of sleeve is toward relief valve end of bore. Install new "O"-ring (1, Fig. 11-50) on plug (2) and install plug in valve body bore opposite relief valve. Seat sleeve against plug. Install new back-up ring (3, Fig. 11-51) and "O"-ring (4) in groove of poppet (2). Install piston (5) in poppet (2). After lubricating with clean hydraulic fluid, install poppet assembly in sleeve (1). Install spring (6) over piston (5) in recess of poppet (2). Install new back-up ring (8) and "O"-ring (7) in groove in small diameter of plug (10). Install new "O"-ring (9) in groove in large diameter of plug (10). Install plug in valve body. After lubricating with clean hydraulic fluid, be sure spring (6) fits in recess of plug. Tighten plug securely. Install pilot poppet (11) in center bore of plug (10). Install spring (12) on pilot poppet stem. Thread adjusting screw (13) into plug bore until it begins to compress spring (12). Place copper washer (14) over adjusting screw (13) and install jam nut (15). Do not tighten jam nut.

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

MAIN CONTROL VALVE - Continued

ASSEMBLY - Continued

Adjust valve pressure setting. Refer to "PRESSURE CHECKS AND ADJUSTMENTS."

Install copper washer (16) and acorn nut (17) after completing adjustment.

Install new "O"-rings (5, Fig. 11-49) on valve plugs (4) being careful not to damage "O"-ring on plug threads. Install poppets (2) in housing bores. Install valve springs (3) in poppet recesses. Lubricate "O"-rings with clean hydraulic fluid and install plugs in housing bores. Be sure valve springs center in plug recesses. Tighten plugs securely.

Lubricate both valve plungers with clean hydraulic fluid and install in their respective bores. Align the "eyes" in the ends of the plungers and install a 1/2" x 4NF cap screw (1, Fig. 11-54) and hex nut (2). Tighten the nut hand tight.

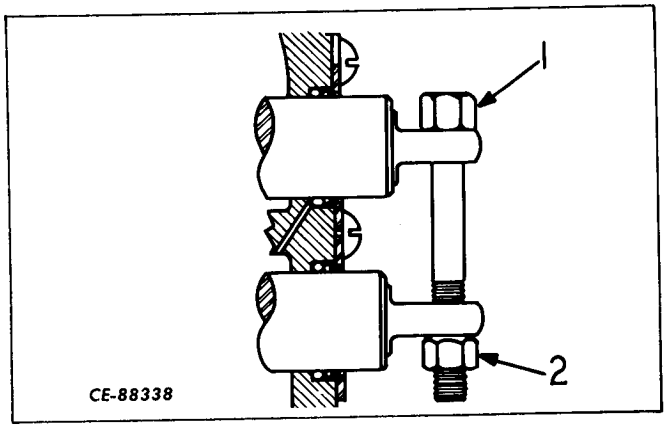

Figure 11-54

Lubricate "O"-ring and "slide" (DO NOT ROLL) on to bucket plunger. Lubricate retaining ring and slide on plunger against "O"-ring. Using seal plate as a tool, push the "O"-ring and the retaining ring into the seal counter bore in the valve housing (Fig. 11-55).

Install spring seat (5, Fig. 11-48) on plunger (4) against seal plate (3), insert plunger pin (1) through remaining spring seat and into plunger

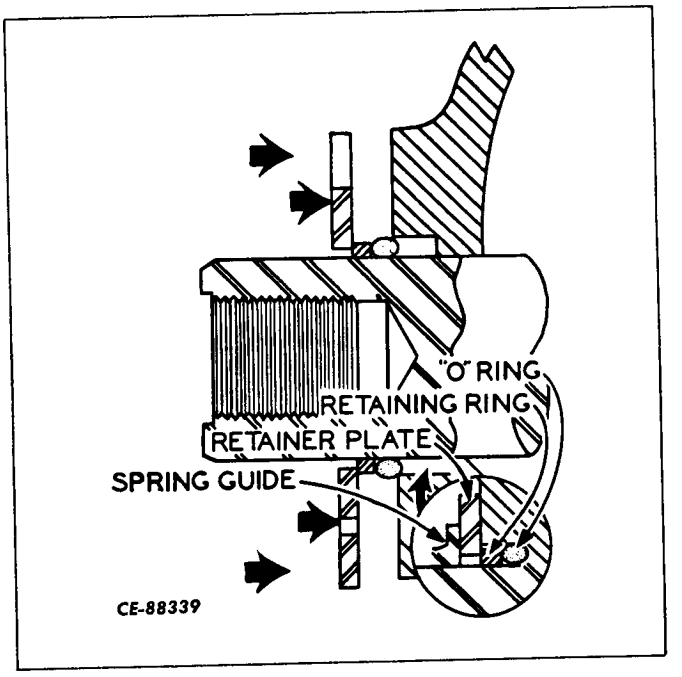

Figure 11-55

spring (2). With the rod used during disassembly, screw plunger pin assembly into plunger and tighten securely. Use caution to prevent damage to detent ball holes in plunger pin.

Install detent cam (5, Fig. 11-46) and spring (3) in bore of plunger pin (2) after lubricating cam assembly liberally with multi-purpose grease. Place a punch within the bore of the detent sleeve; depress the detent cam with the punch, place the detent balls (4) in their respective holes and slide the sleeve over the detent cam assembly. Release the punch.

Place the plunger cap (1, Fig. 11-45) over the detent assembly and firmly against the seal plate with screw holes in cap, plate and valve housing (1, Fig. 11-42) properly aligned. Install retaining screws (3) and tighten securely.

Inspect the spacer (1, Fig. 11-41) and Spir-O-Lox (2) for damage. Install spacer and Spir-O-Lox being sure Spir-O-Lox is properly seated in detent sleeve groove.

Lubricate piston (2, Fig. 11-40). Insert piston and spacer (3) in bore of detent sleeve. Lubricate new "O"-ring (5) and install on plug (4), using caution to avoid cutting ring on plug

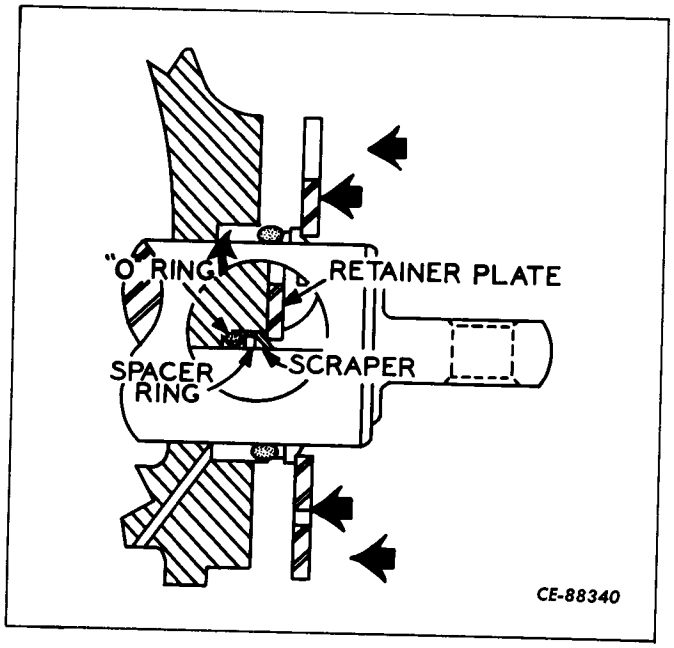

Figure 11-56

threads. Install plug in bore of detent sleeve and tighten securely.

Repeat the above operations for the boom plunger assembly.

NOTE: The spacer (3, Fig. 11-40) is used in the bucket plunger only.

Remove the cap screw and hex nut from the plunger "eyes" (Fig. 11-54). Working one plunger at a time, slide (DO NOT ROLL) a new "O"-ring, spacer and split scraper over the plunger. Lubricate all parts thoroughly before installation. Using the retainer plate, with a slight rocking motion push the assembly into the seal counter bore. Install retainer plate cap screws and tighten securely.

Repeat operation for remaining plunger (Fig. 11-56).

BUCKET CIRCUIT RELIEF VALVES

DISASSEMBLY

These are cartridge type valves and may be removed as a unit.

a. Loosen and remove the valve housing (12, Fig. 11-57) from the control valve body (20).

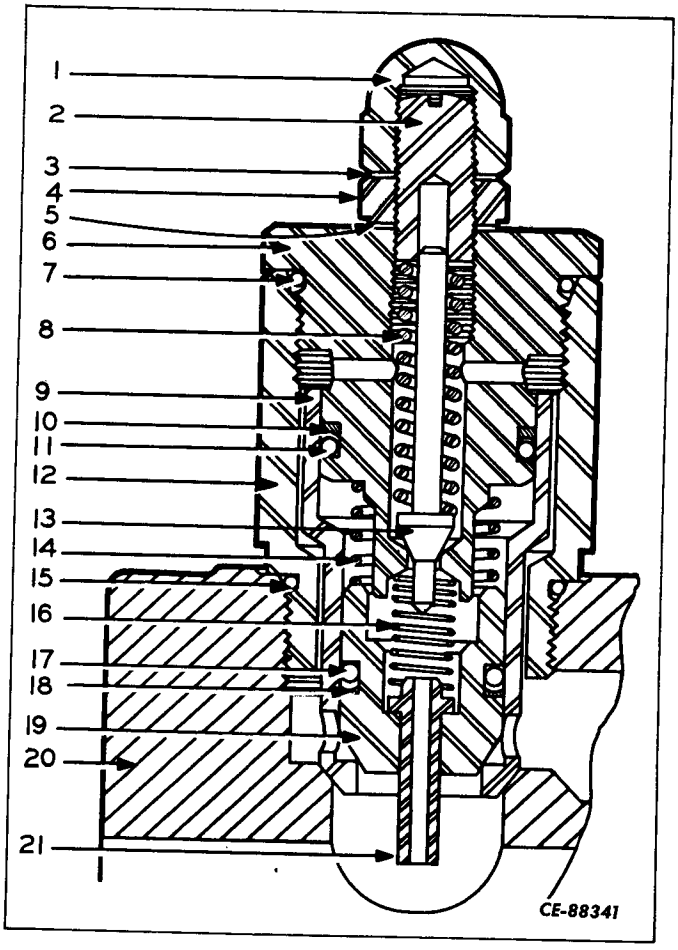

Figure 11-57

1. Acorn nut.
2. Adjusting screw.
3. Copper washer.
4. Jam nut.
5. Copper washer.
6. Plug.
7. "O"-ring.
8. Pilot poppet spring.
9. Check valve poppet.
10. Back-up ring.
11. "O"-ring.
12. Housing.
13. Pilot poppet.
14. Poppet spring.
15. "O"-ring.
16. Piston spring.
17. "O"-ring.
18. Back-up ring.
19. Poppet.
20. Main control valve housing.
21. Piston.

The relief valve may be placed on a bench for further disassembly.

b. Remove the plug (6) from the housing (12). If desirable, the plug assembly may be left intact. In this manner the valve setting will

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

MAIN CONTROL VALVE - Continued

BUCKET CIRCUIT RELIEF VALVES - Continued

remain unchanged. For a thorough inspection however, the valve must be completely disassembled.

c. Remove the "O"-rings (7-11) and back-up ring (10) from the plug (6) and discard the rings.

d. Remove the acorn nut (1), jam nut (4) and copper washers (3-5) from the adjusting screw (2).

e. Remove the adjusting screw (2), spring (8) and pilot poppet (13) from the plug bore.

f. Remove the check valve poppet (9) from the housing (12). Remove and discard the "O"-ring (15) from the housing (12).

g. Remove the springs (14-16) poppet (19) and piston (21) from the check valve poppet (9). Remove and discard the "O"-ring (17) and back-up ring (18) from the poppet (19).

INSPECTION

Refer to "INSPECTION" under "MAIN CONTROL VALVE."

ASSEMBLY

a. Install new "O"-ring (17, Fig. 11-57) and back-up ring (18) on poppet (19).

b. Lubricate the rings with clean hydraulic fluid. Install the large poppet (19) in the check valve poppet (9).

c. Install the piston (21) in the center bore of the poppet (19).

d. Install the small spring (16) over the piston (21) and place the poppet assembly aside.

e. Place the pilot poppet (13) in the center bore of the plug (6). Install the spring (8) in the plug center bore and over the stem of the pilot poppet (13).

f. Thread the adjusting screw (2) into the plug center bore until it begins to compress the spring (8).

g. Install a new back-up ring (10) in the groove in the center of the plug (6). Install a new "O"-ring (11) below the back-up ring. Install a new "O"-ring (7) in the groove below the flange of the plug (6).

h. Lubricate the "O"-ring (11) and back-up ring (10) with clean hydraulic fluid. Place the large spring (14) over the small diameter of the plug (6). Carefully slide the poppet assembly (9-16-19-21) over the plug.

NOTE: Be sure springs (14-16) do not kink or bind and are seated correctly.

i. Place housing (12) over poppet assembly and thread plug (6) into housing. Hold housing and tighten plug securely.

j. Install new "O"-ring (15) in groove above threads on housing (12). Lubricate "O"-ring with clean hydraulic fluid and thread valve into main control valve body (20). Tighten the valve assembly securely.

k. Install a new copper washer (5) on the adjusting screw (2). Thread the jam nut (4) on the adjusting screw. The valve is now ready for adjustment. Refer to "PRESSURE CHECKS AND ADJUSTMENTS." Install copper washer (3) and acorn nut (1) after completing adjustment.

ANTI-VOID CONTROL VALVES

DISASSEMBLY

a. Loosen and remove the plug (1, Fig. 11-58) from the main control valve body (10). Remove the "O"-ring (4) from the plug and discard.

b. Remove the spring (2) and poppet assembly (3-7-9) from the valve bore.

c. Hold the lower portion of the poppet (9) and remove the locknut (3). Remove and discard the "O"-ring (5-8) and back-up ring (6).

DISASSEMBLY, INSPECTION AND ASSEMBLY

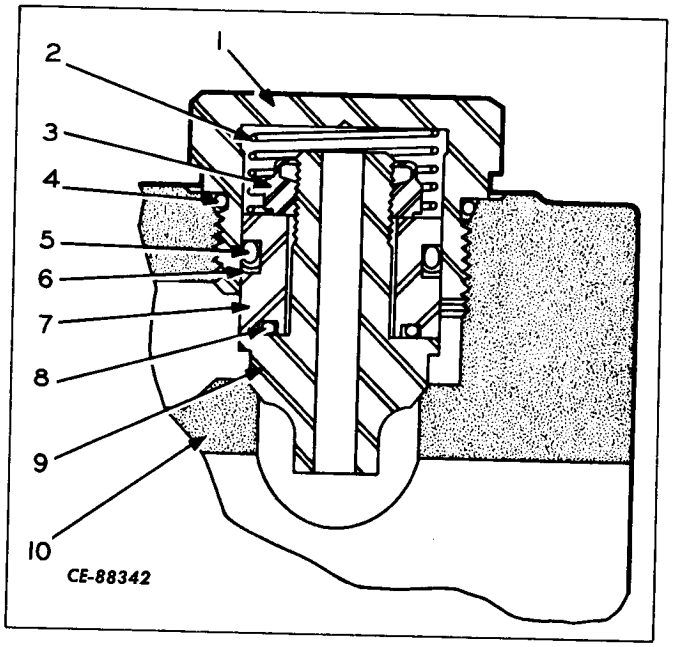

Figure 11-58

1. Plug.
2. Spring.
3. Lock nut.
4. "O"-ring.
5. "O"-ring.
6. Back-up ring.
7. Poppet - upper portion.
8. "O"-ring.
9. Poppet - lower portion.
10. Main control valve body.

INSPECTION

Refer to "INSPECTION" under "MAIN CONTROL VALVE."

ASSEMBLY

a. Lubricate a new "O"-ring (8) with clean hydraulic fluid and install in groove in poppet upper portion (7).

b. Place poppet upper portion (7) over stem of lower portion (9) and fasten with locknut (3). Tighten nut securely.

NOTE: Be sure "O"-ring (8) is correctly seated in poppet groove during assembly.

c. Install new back-up ring (6) and "O"-ring (5) in groove of poppet assembly.

d. Install spring (2) in recess of plug (1). Lubricate "O"-ring (5) and back-up ring (6) with clean hydraulic fluid and install poppet assembly in plug.

e. Install new "O"-ring (4) in groove of plug. Lubricate "O"-ring with clean hydraulic fluid and install complete assembly in bore of main control valve body. Tighten the plug securely.

DEMAND VALVE

REMOVAL

Disconnect, cap and tag all connecting lines. Remove the cap screws, lock washers and nuts that secure the valve to the tractor frame.

DISASSEMBLY

Remove the snap ring (5, Fig. 11-59), orifice (4), sleeve (3) and orifice (2) from the valve (1).

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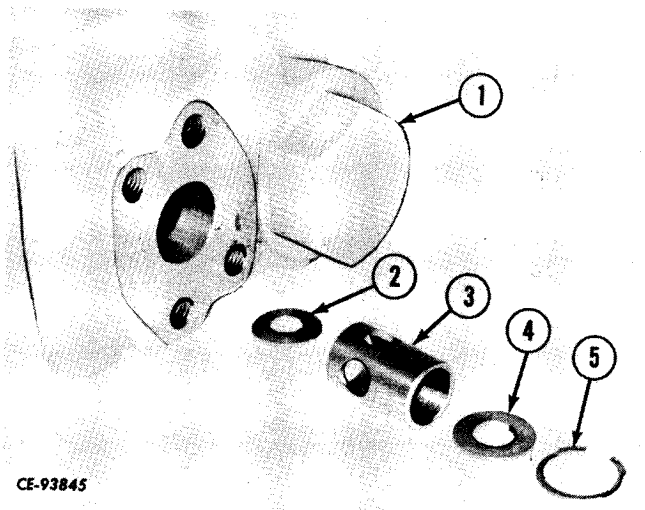

Figure 11-59

DISASSEMBLY, INSPECTION AND ASSEMBLY

DEMAND VALVE - Continued

DISASSEMBLY - Continued

Remove the plug (6, Fig. 11-60) and slide the spring (2) and spacer (3) from the valve (1). Remove the "O"-ring (4) and seal ring (5) from the plug.

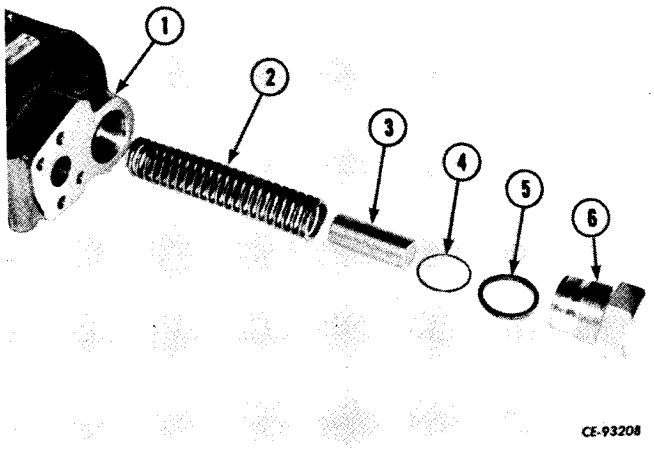

Figure 11-60

Remove the plug (4, Fig. 11-61) and slide the plunger body (2) from the valve (1). Remove the seal ring (3) from the plug.

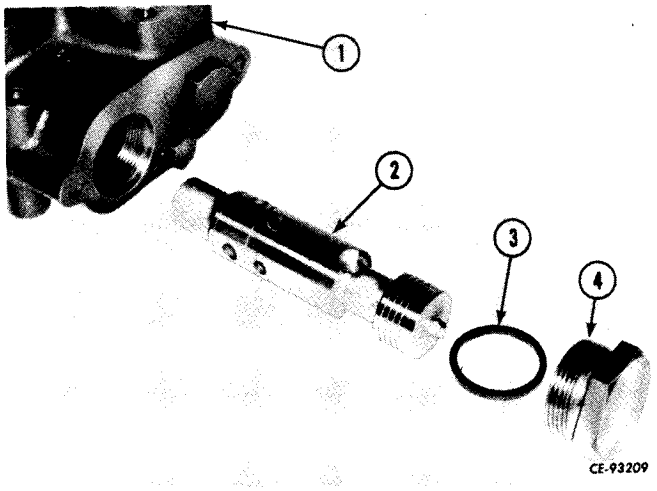

Figure 11-61

Remove the snap ring (7, Fig. 11-62) and slide the plug (5) from the plunger body (1). Remove the snap ring (4) and slide the spring (3) and plunger (2) from the body. Remove the "O"-ring (6) from the plug.

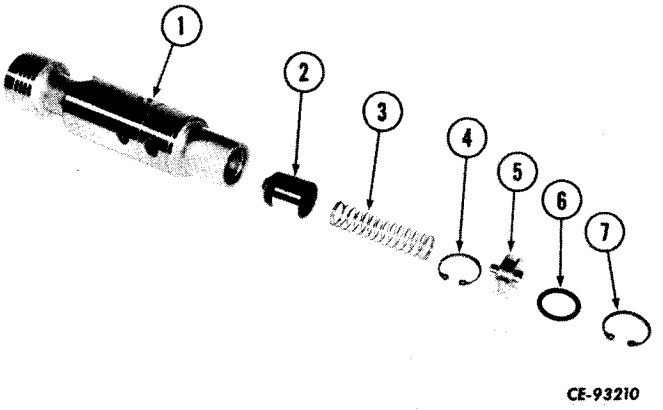

Figure 11-62

Remove the plug (5, Fig. 11-63) and slide the check (2) and spring (3) from the valve (1). Remove the seal ring (4) from the plug.

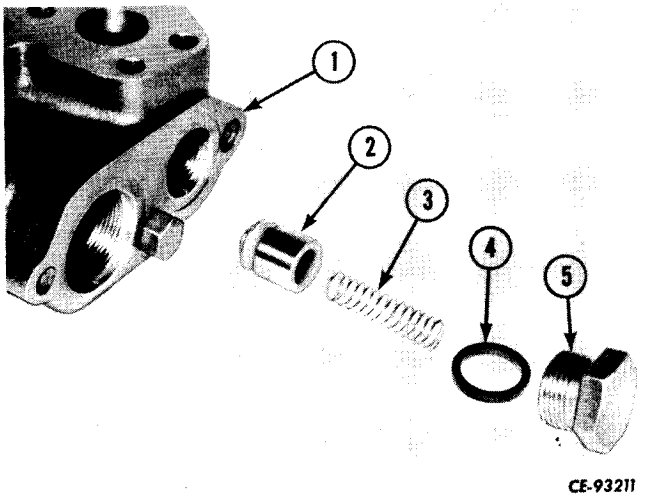

Figure 11-63

Remove the plug (3, Fig. 11-64) from the valve (1). Remove the seal ring (2) from the plug.

DISASSEMBLY, INSPECTION AND ASSEMBLY

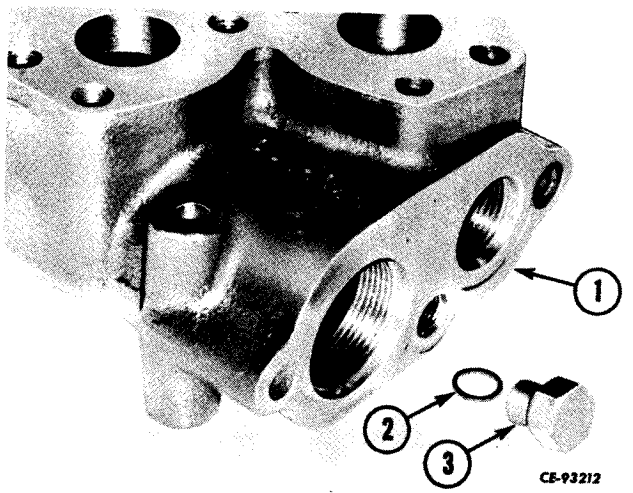

Figure 11-64

INSPECTION

Thoroughly wash all parts in a clean mineral oil solvent. Dry with filtered compressed air and place on clean paper for inspection.

Inspect all surfaces for burrs, scratches, nicks, scores and other abrasions. Stone or lap all burrs. If scoring is deep enough to produce excessive leakage, replace valve assembly. Stone or use crocus cloth on small scores.

All parts with sliding fit must move freely in their bores. All grooves and passages must be free of foreign matter.

Replace springs if they are broken or distorted.

Replace all "O"-rings.

Listed below are instructions that must be followed to insure correct installation and effective sealing of "O"-rings.

a. Seal counter bores must be thoroughly cleaned.

b. "O"-rings, plungers, and counter bores must be lubricated on assembly.

c. "O"-rings must be free of molding defects and handling damage.

d. "O"-RINGS MUST NOT BE STRETCHED beyond the yield point.

e. EXTREME care must be taken to avoid "ROLLING" the "O"-ring into the counter bore. (A twisted "O"-ring is not likely to straighten itself after installation, and is almost certain to leak.) Refer to "GASKETS AND SEALS" under "INTRODUCTION."

f. Care in handling of parts and hydraulic system cleanliness cannot be over stressed.

g. Use ONLY the oil type and viscosity ranges specified under "SERVICE INFORMATION."

ASSEMBLY

Lubricate a new "O"-ring (2, Fig. 11-65) and position on the plug (3). Install the plug in the valve (1).

(Continued on next page)

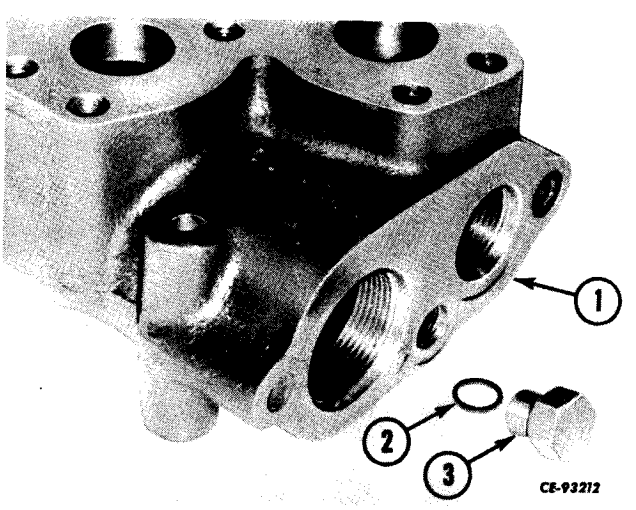

Figure 11-65

HYDRAULIC SYSTEM

DISASSEMBLY, INSPECTION AND ASSEMBLY

DEMAND VALVE - Continued

ASSEMBLY - Continued

Lubricate a new "O"-ring (4, Fig. 11-66) and position on the plug (5). Lubricate the check (2). Install the check, spring (3) and plug (5) in the valve (1).

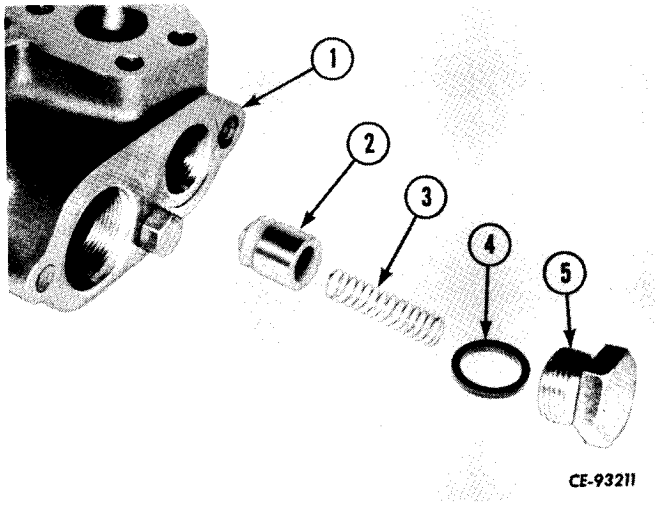

Figure 11-66

Lubricate a new "O"-ring (6, Fig. 11-67) and position on the plug (5). Lubricate the plunger (2). Slide the plunger and spring (3) into the plunger body (1) and secure with the snap ring (4). Install the plug (5) and secure with the snap ring (7).

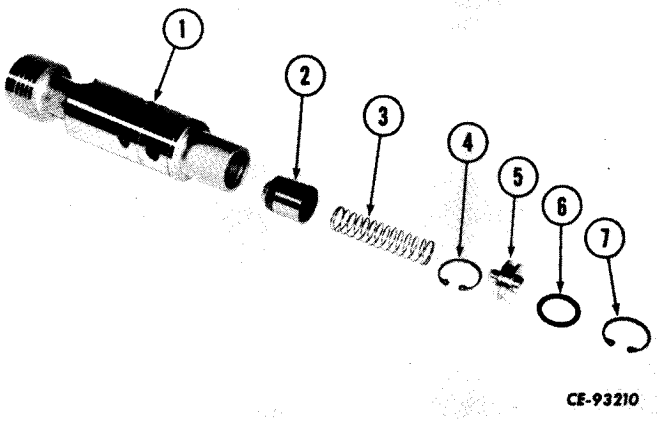

Figure 11-67

Lubricate a new "O"-ring (3, Fig. 11-68) and install on the plug (4). Lubricate the plunger body (2) and slide into the valve (1). Install the plug.

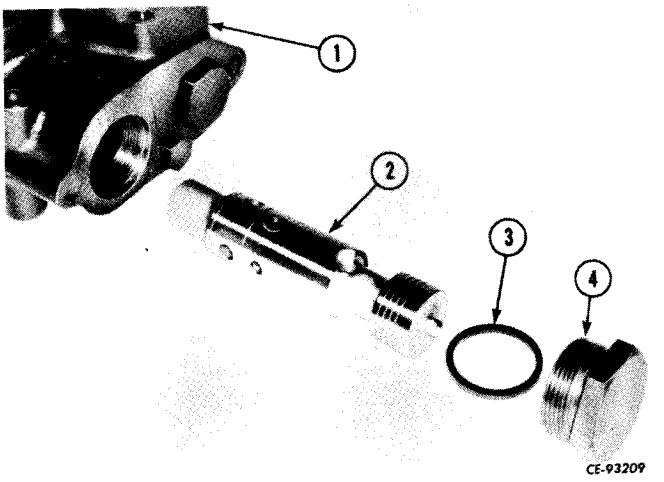

Figure 11-68

Lubricate new "O"-rings (4 and 5, Fig. 11-69) and install on the plug (6). Slide the spring (2) and spacer (3) in the valve (1). Install the plug.

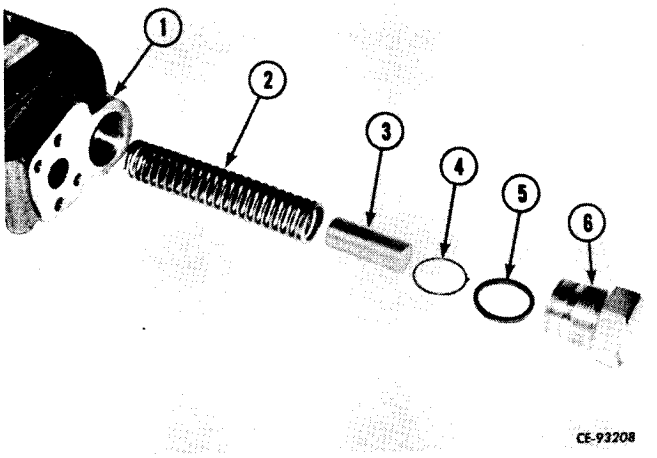

Figure 11-69

Install the orifice (2, Fig. 11-70), sleeve (3) and orifice (4) in the valve (1) and secure with the snap ring (3).

DISASSEMBLY, INSPECTION AND ASSEMBLY

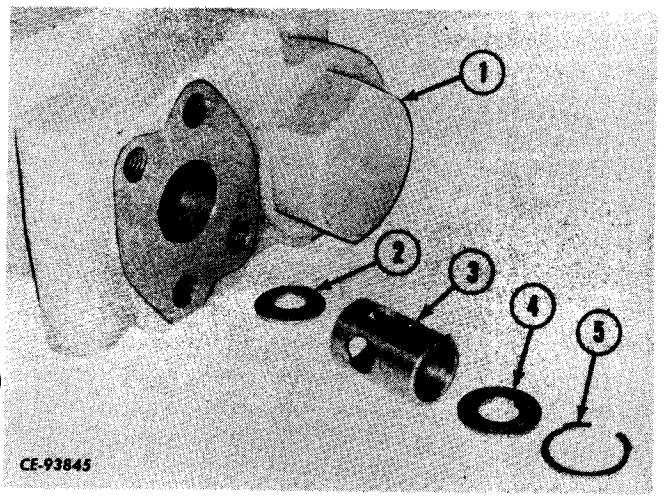

Figure 11-70

STEERING CONTROL VALVE

REMOVAL

Disconnect the control linkage. Disconnect, cap and tag all connecting lines. Remove the cap screws and lock washers that secure the valve to the tractor frame.

DISASSEMBLY

Remove the cap screws (4, Fig. 11-71) that secure the cap (3) to the valve (1). Remove the cap and shim pack (2).

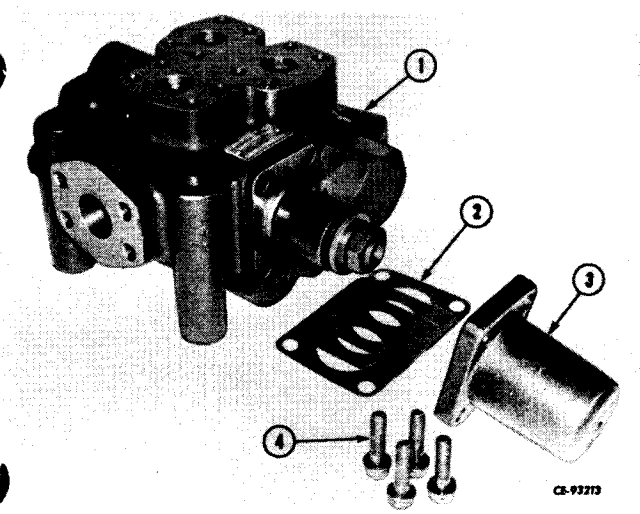

Figure 11-71

NOTE: The control plunger is adjusted at the factory using shims. Measure the thickness of the shim pack (2). The same thickness of shims must be used upon reassembly of the valve.

Remove the screws securing the seal plate (5, Fig. 11-72). Remove the wiper (4). Slide the control plunger (2) into the valve (1). Remove and discard the seal (3).

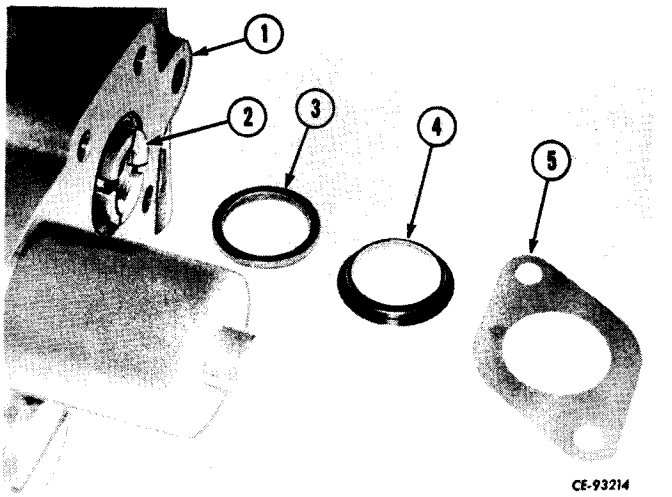

Figure 11-72

Slide the plunger assembly from the valve. Remove the back-up ring (10, Fig. 11-73), shim pack (9) and spacer (8) from the plunger (7).

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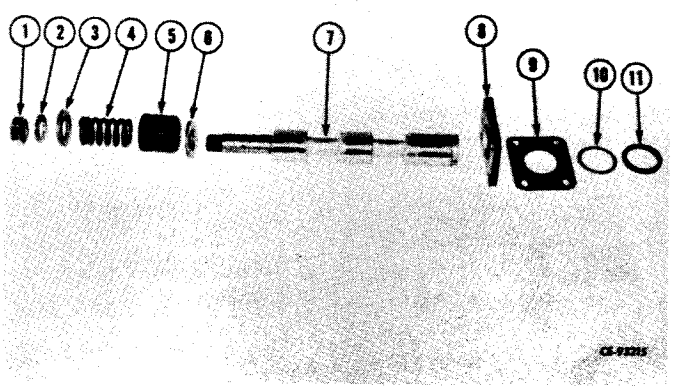

Figure 11-73

STEERING CONTROL VALVE - Continued

DISASSEMBLY - Continued

NOTE: The control plunger is adjusted with shims at the factory. Measure the thickness of the shim pack (9). The same thickness of shims must be used during assembly of the valve. If shims are in good condition tie the pack together and reuse.

Remove the nut (1) and slide the washer (2), spacer (3), spring (4), spacer (5) and spacer (6) from the plunger. Remove the seal (11) from the valve and discard.

Remove the cap (4, Fig. 11-74). Slide the lock plunger (2) out of the valve (1). Remove the seal ring (3) from the cap.

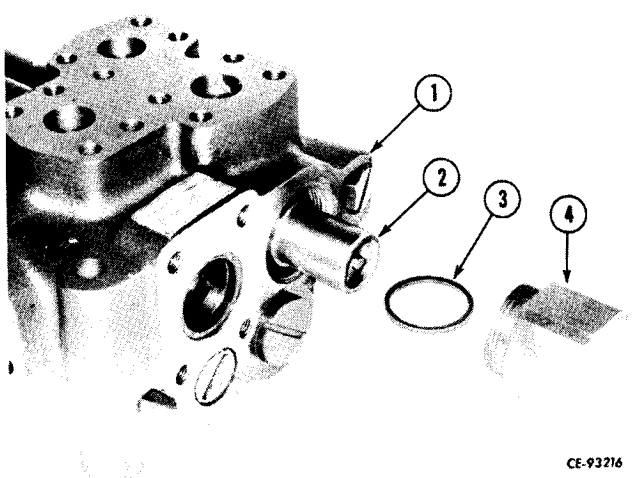

Figure 11-74

Remove the snap ring (6, Fig. 11-75) and slide the plug (5), spring (3) and check (2) from the plunger (1). Remove the "O"-ring (4) from the plug. Repeat the procedure for the opposite end of the plunger.

Remove the cap (4, Fig. 11-76) and slide the spring (2) from the valve (1). Remove the seal ring (3) from the cap.

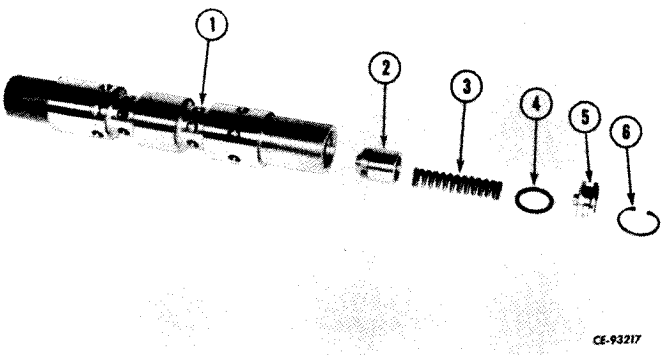

Figure 11-75

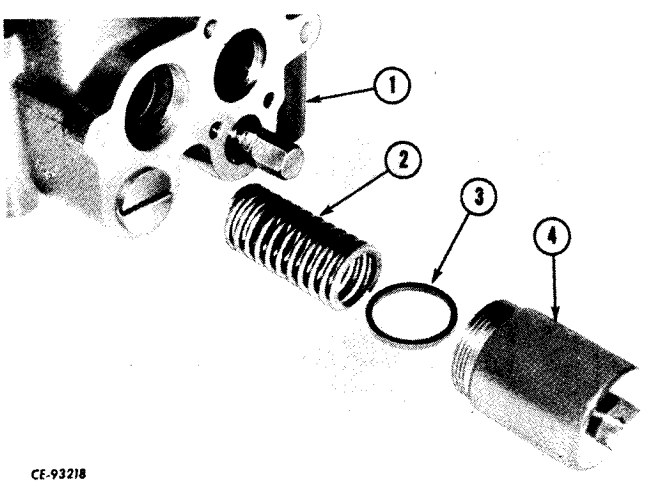

Figure 11-76

Remove the acorn nut (5, Fig. 11-77) and washer (4). Hold the adjusting screw (3) and loosen the jam nut (2). Remove the screw and washer (1).

Remove the cap (9, Fig. 11-78) and slide the spring (7), poppet (6), seat (5), spring (3) and check (2) from the valve (1). Remove the "O"-rings (4 and 8).

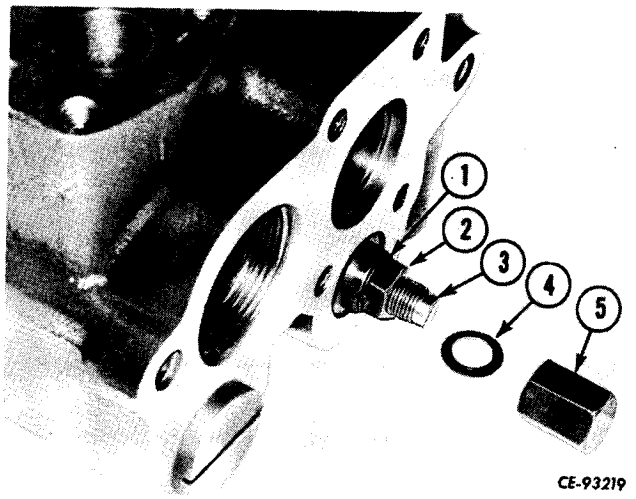

Figure 11-77

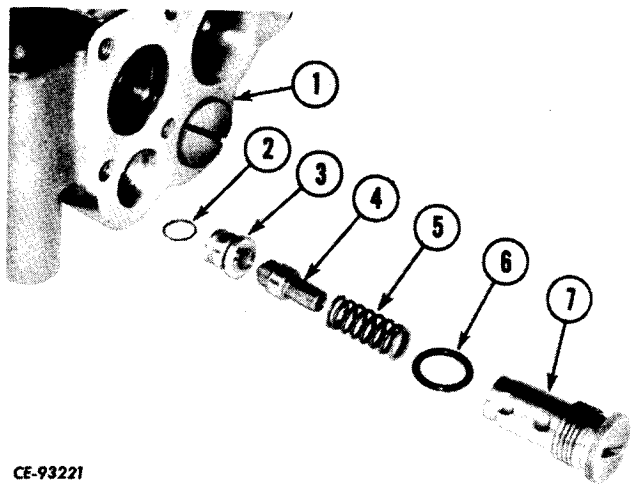

Figure 11-79

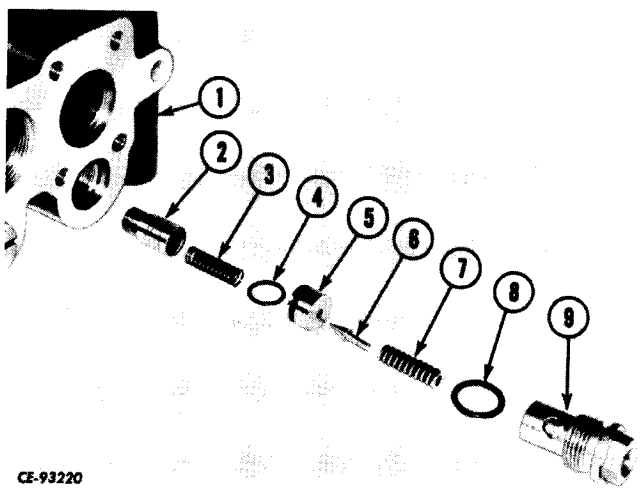

Figure 11-78

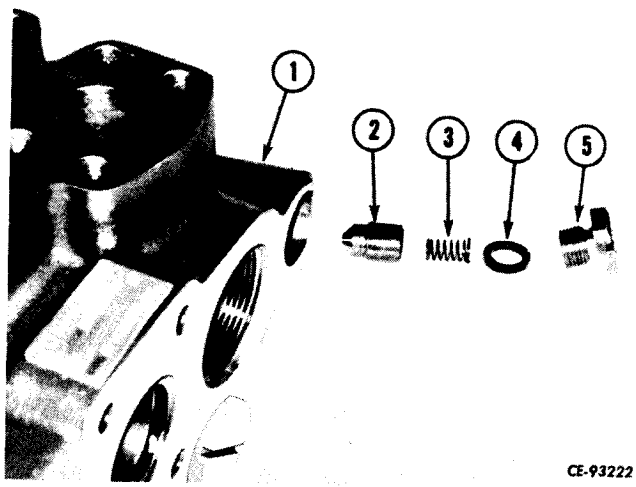

Figure 11-80

Remove the cap (7, Fig. 11-79) and slide the spring (5), check (4) and seat (3) from the valve (1). Remove the "O"-rings (2 and 6).

Remove the cap (5, Fig. 11-80) and slide the spring (3) and check (2) from the valve (1). Remove the seal ring (4).

Remove the seat (6, Fig. 11-81) and slide the valve (3) and spring (2) from the valve (1). Remove the "O"-ring (4) and seal ring (5). Repeat the above procedure for the remaining valve.

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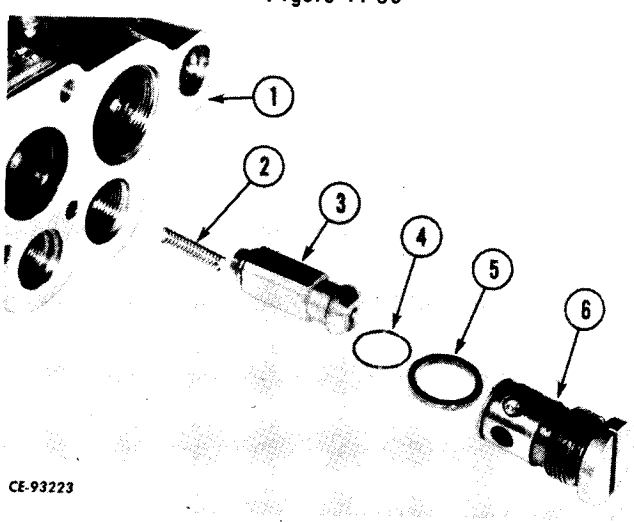

Figure 11-81

STEERING CONTROL VALVE - Continued

INSPECTION

Thoroughly wash all parts in a clean mineral oil solvent. Dry with filtered compressed air and place on clean paper for inspection.

Inspect all surfaces for burrs, scratches, nicks, scores and other abrasions. Stone or lap all burrs. If scoring is deep enough to produce excessive leakage, replace valve assembly. Stone or use crocus cloth on small scores.

All parts with sliding fit must move freely in their bores. All grooves and passages must be free of foreign matter.

Replace springs if they are broken or distorted.

Replace all "O"-rings, seal rings and gaskets.

Listed below are instructions that must be followed to insure correct installation and effective sealing of "O"-rings.

a. Seal counter bores must be thoroughly cleaned.

b. "O"-rings, plungers, and counter bores must be lubricated on assembly.

c. "O"-rings must be free of molding defects and handling damage.

d. "O"-RINGS MUST NOT BE STRETCHED beyond the yield point.

e. EXTREME care must be taken to avoid "ROLLING" the "O"-ring into the counter bore. (A twisted "O"-ring is not likely to straighten itself after installation, and is almost certain to leak.) Refer to "GASKETS AND SEALS" under "INTRODUCTION."

f. Care in handling of parts and hydraulic system cleanliness cannot be over stressed.

g. Use ONLY the oil type and viscosity ranges specified under "SERVICE INFORMATION."

ASSEMBLY

Lubricate the "O"-ring (4, Fig. 11-82) and seal ring with petroleum jelly and install on the seat (6). Slide the spring (2) and valve (3) into the valve (1). Install the seat and tighten securely. Repeat the above procedure for the remaining valve.

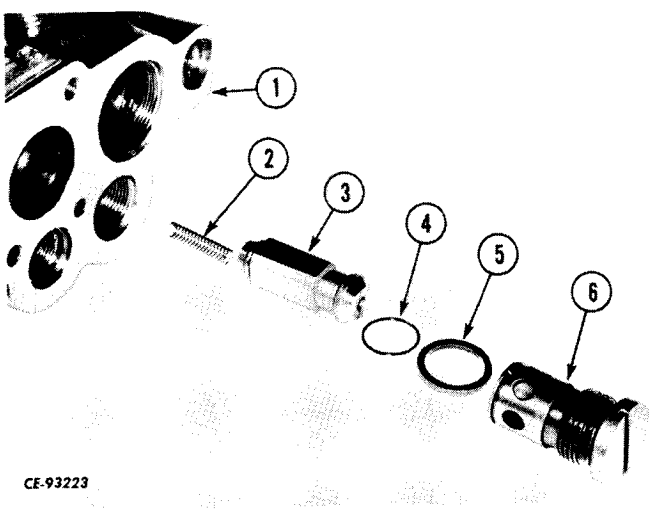

Figure 11-82

Lubricate the seal ring (4, Fig. 11-83) with petroleum jelly and install on the cap (5). Slide the check (2) and spring (3) into the valve (1). Install the cap and tighten securely.

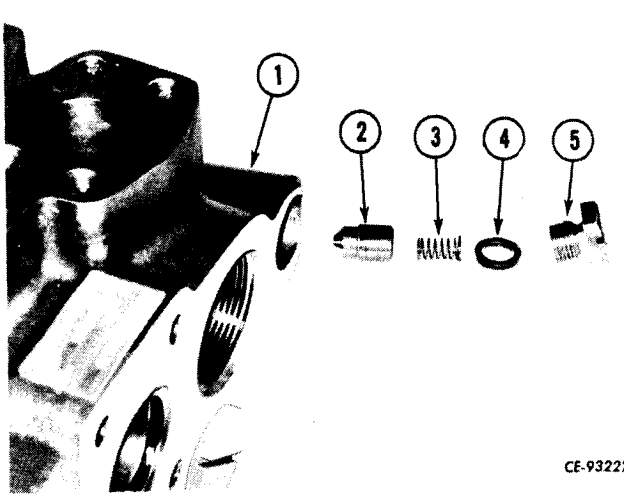

Figure 11-83

DISASSEMBLY, INSPECTION AND ASSEMBLY

Lubricate the "O"-rings (2 and 6, Fig. 11-84) with petroleum jelly and install on the seat (3) and cap (7). Slide the seat, check (4) and spring (5) into the valve (1). Install the cap and tighten securely.

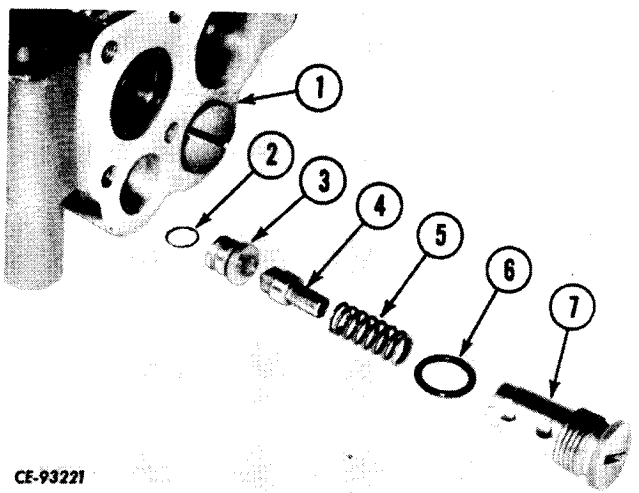

Figure 11-84

Lubricate the "O"-rings (4 and 8, Fig. 11-85) with petroleum jelly and install on the seat (5) and cap (9). Slide the check (2), spring (3), seat, poppet (6) and spring (7) into the valve (1). Install the cap and tighten securely.

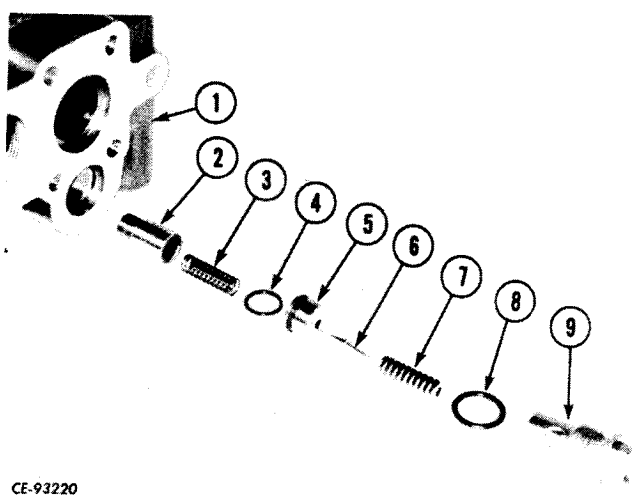

Figure 11-85

Install the adjusting screw (3, Fig. 11-86). Turn the screw into the approximate position at time of removal. Install a new washer (1) with jam nut (2). Install a new washer (4) and acorn nut (5) finger tight. Refer to "STEERING CONTROL RELIEF VALVE" under "PRESSURE CHECKS AND ADJUSTMENTS" for correct adjustment procedure.

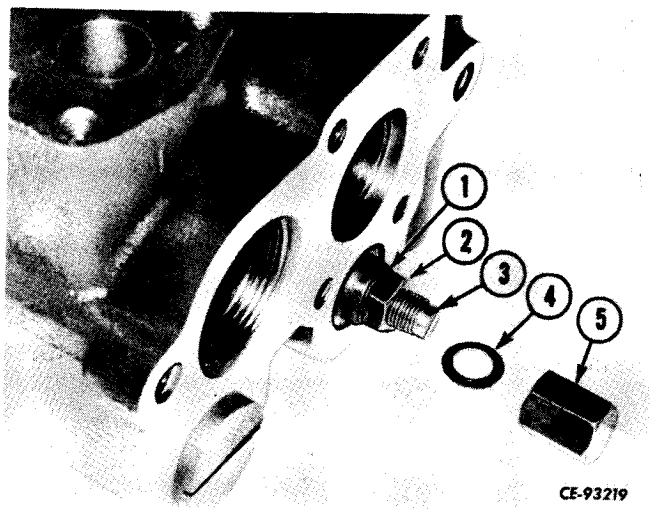

Figure 11-86

Lubricate the seal ring (3, Fig. 11-87) with petroleum jelly and install on the cap (4). Slide the spring (2) into the valve (1) and install the cap.

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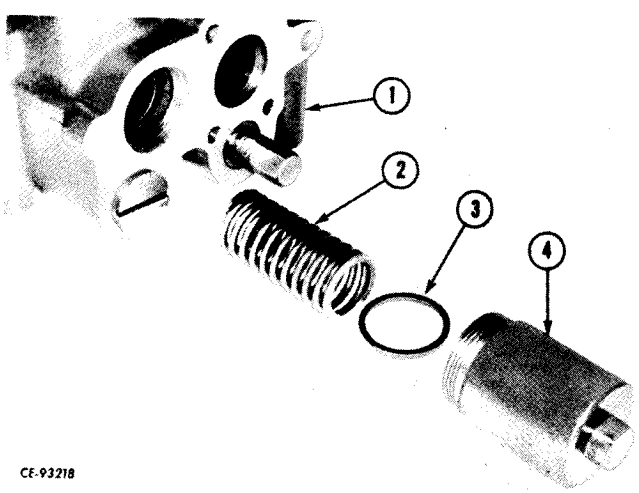

Figure 11-87

STEERING CONTROL VALVE - Continued

ASSEMBLY - Continued

Lubricate the "O"-ring (4, Fig. 11-88) with petroleum jelly and install on the plug (5). Slide the check (2), spring (3) and plug into the plunger (1). Hold the plug down and install the snap ring (6). Repeat the above procedure for the opposite end of the plunger.

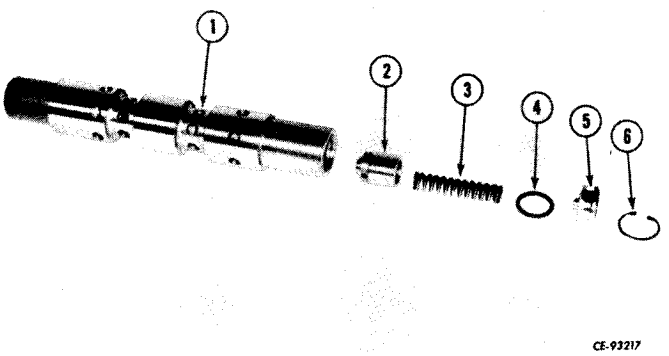

Figure 11-88

Lubricate the seal ring (3, Fig. 11-89) with petroleum jelly and install on the cap (4). Slide the plunger assembly (2) into the valve (1) and install the cap.

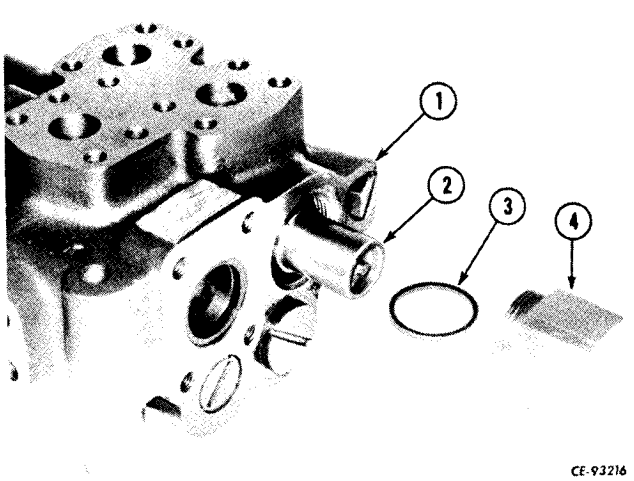

Figure 11-89

Slide the spacer (6, Fig. 11-90), spacer (5), spring (4), spacer (3) and washer (2) on the plunger (7). Secure with the nut (1) after applying "Loctite" type "A" on threads. Refer to "SPECIAL TORQUES" for correct torque.

Torque: _____

Slide the spacer (8), shim pack (9) and back-up ring (10) on the plunger. Lubricate the new oil seal (11) with petroleum jelly and press into the valve.

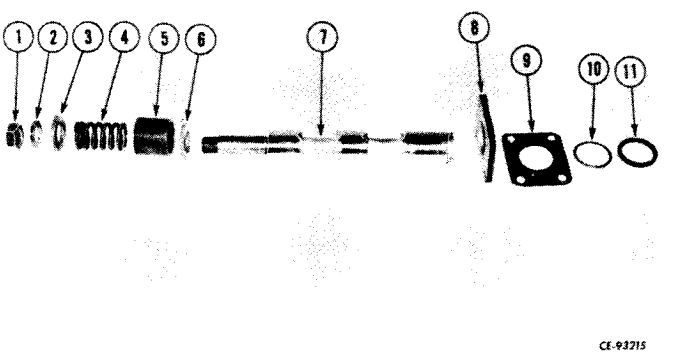

Figure 11-90

Slide the plunger assembly (2, Fig. 11-91) into the valve (1). Lubricate the new oil seal (3) with

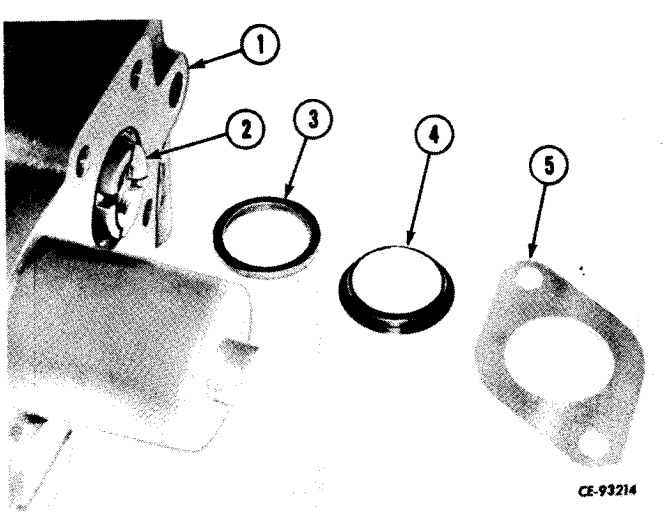

Figure 11-91

DISASSEMBLY, INSPECTION AND ASSEMBLY

petroleum jelly and press into the valve. Install the wiper (4) and seal plate (5). Secure the plate with the screws.

Install the shim pack (2, Fig. 11-92) and cap (3). Secure with the cap screws (4). Refer to "SPECIAL TORQUES" for correct torque.

Torque: _____

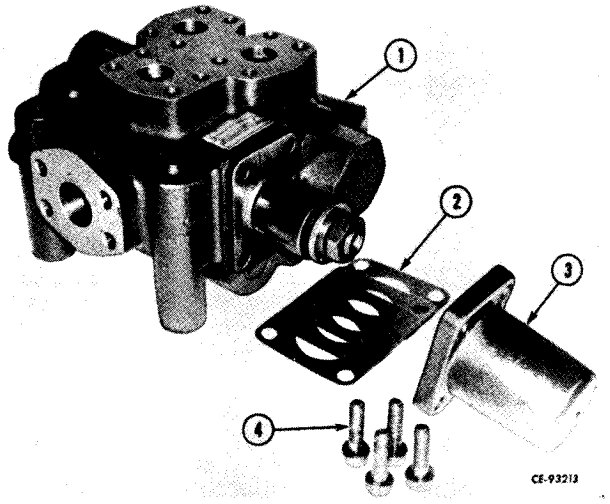

Figure 11-92

HYDRAULIC CYLINDERS - BOOM AND BUCKET

GENERAL

Replace cylinder packing when excessive leakage occurs.

To replace packing, the cylinder must be disassembled. Drain the cylinder to be removed as much as possible. Tape, plug and tag the disconnected lines to protect and identify them for assembly. Do not damage the pivot bushings or port flanges during removal.

NOTE: The following instructions describe the disassembly, inspection and assembly of a typical large hydraulic cylinder. A variation in parts configuration may be found between cylinders of different application on any given machine; however, the basic design remains the same.

DISASSEMBLY

Disassemble the cylinder in a clean area as follows:

Remove the cap screw and lock washers (2, Fig. 11-93) that retain the cylinder end cover (3) to the cylinder (1).

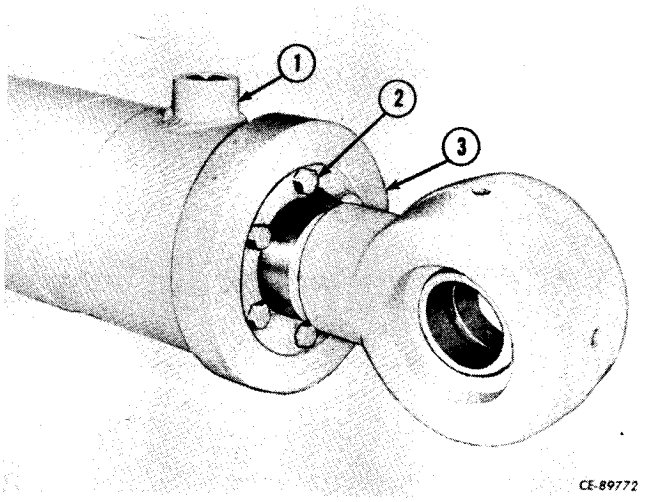

Figure 11-93

Slide the cover (3, Fig. 11-94) down the rod and remove the "O"-ring (2) from the cylinder.

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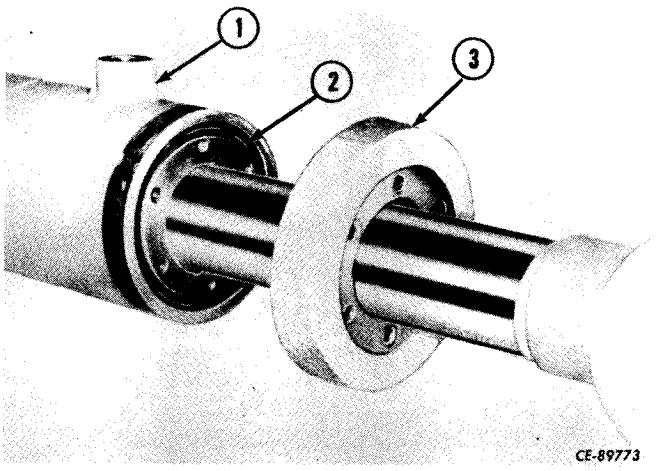

Figure 11-94

HYDRAULIC CYLINDERS - BOOM AND BUCKET - Continued

DISASSEMBLY - Continued

Push the cap assembly (1, Fig. 11-95) in slightly and remove the multi-piece lock ring (2).

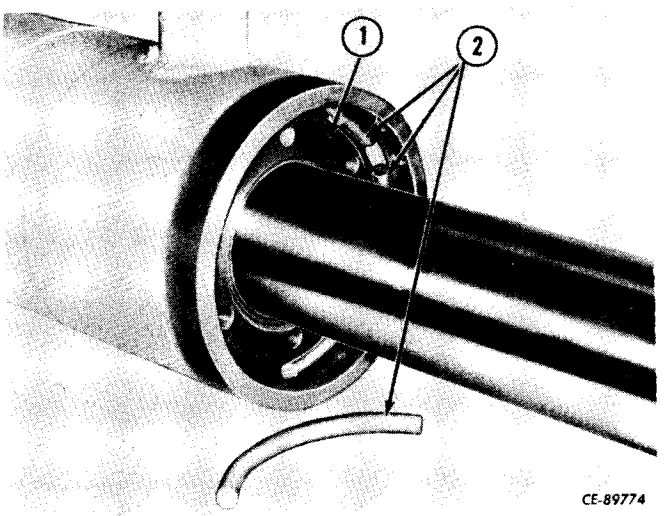

Figure 11-95

Pull the rod free of the cylinder. The cylinder cap and cover assemblies will come out with the rod and piston.

Remove the retaining lock wires (2, Fig. 11-96) from the piston screws (1); remove the screws and disassemble the piston.

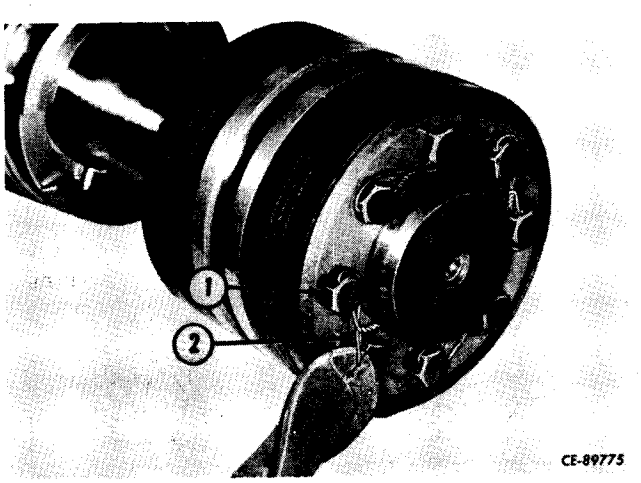

Figure 11-96

Remove and discard the used piston packing (3, Fig. 11-97).

NOTE: Do not discard the piston halves (4), lock ring halves (1) or bushings (2).

Remove the remaining parts from the rod.

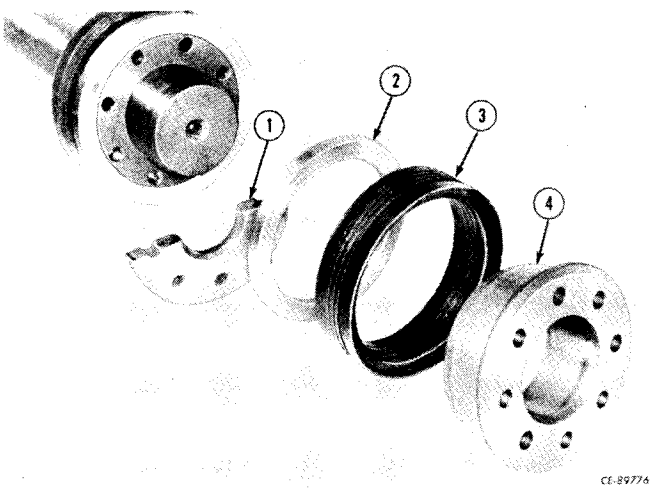

Figure 11-97

Remove and discard the "O"-rings (2, Fig. 11-98) and back-up rings (1) from the piston end of the rod.

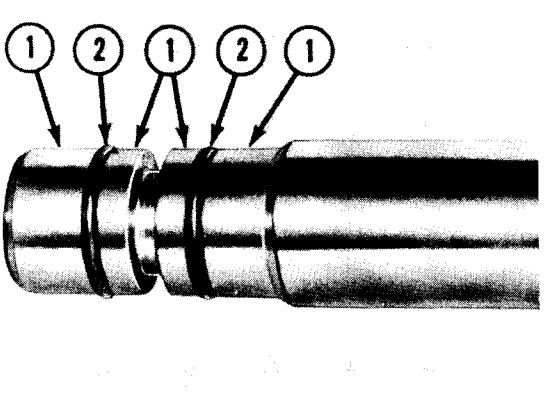

Figure 11-98

Remove the retaining ring (3, Fig. 11-99) from the cap (4). Remove and discard the "O"-ring (2) and back-up ring (1).

DISASSEMBLY, INSPECTION AND ASSEMBLY

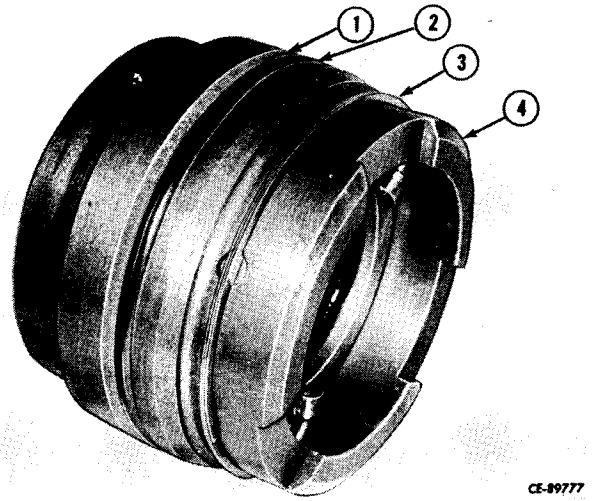

Figure 11-99

Remove the retaining pins (1, Fig. 11-100) and bushing (2). Remove and discard the rod packing (3).

Press out the old oil seal (1, Fig. 11-101) and bushing (2).

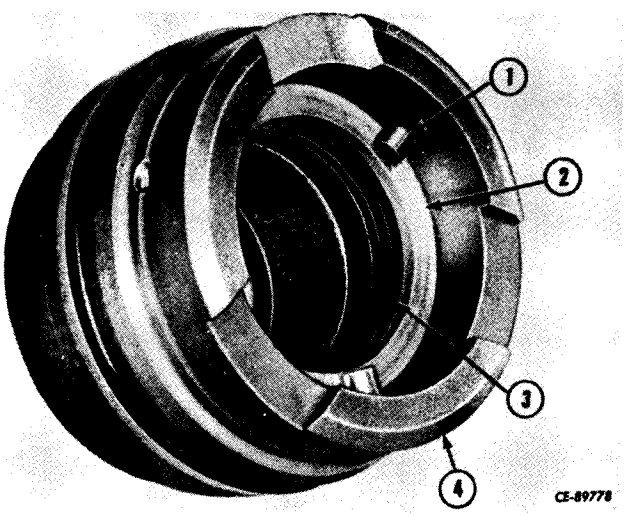

Figure 11-100

INSPECTION

Wash all metal parts including the cylinder in solvent. Dry all parts with filtered compressed air. Protect the components with a light film of oil. Flush the cylinder with oil to remove all traces of solvent and protect the cylinder walls from oxidation.

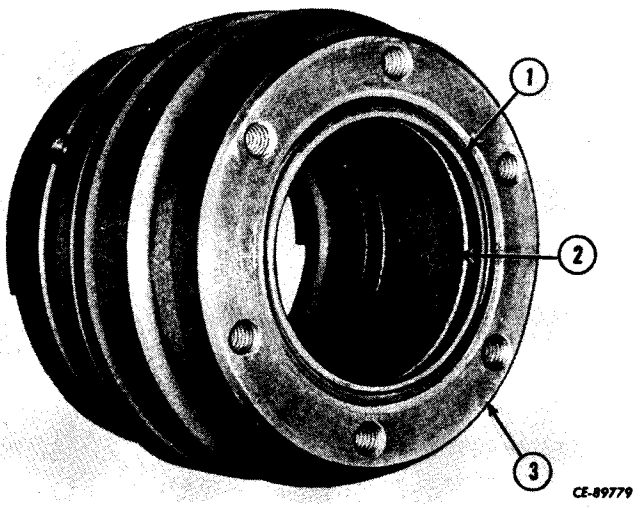

Figure 11-101

Check the cylinder bore and rod surface for scratches and/or abrasions that may have been caused by grit deposits in the cylinder packings. Carefully remove small rough or sharp surfaces with a fine grained stone. The closer these surfaces are to a mirror finish, the more efficiently the new packing will operate.

ASSEMBLY

Assemble the cylinder as follows:

Press a new bushing (2, Fig. 11-101) and oil seal (1) in the cap (3).

Install a new packing (3, Fig. 11-100) in the cap (4). Cross section of packing ring is "V" shaped. Open end of "V" must face piston when cap is installed. Install bushing (2) and retaining pins (1).

Install the retaining ring (3, Fig. 11-99), new "O"-ring (2) and back-up ring (1) on the cap (4). Lubricate assembly with clean hydraulic oil.

Install new "O"-rings (2, Fig. 11-98) and back-up rings (1) on piston rod. Lubricate "O"-rings with clean hydraulic oil.

Install cylinder end cover, new cover "O"-ring and cap assembly on rod.

(Continued on next page)

HYDRAULIC CYLINDERS - BOOM AND BUCKET - Continued

ASSEMBLY - Continued

Carefully install the piston half with threaded holes, on rod. Do not damage "O" rings. Install one half of packing set (3, Fig. 11-97) with open end of "V" facing lip on piston half. Install a bushing (2) on piston against the packing. Install remaining half of packing set on piston with smooth bore holes. Open end of "V" must face lip of piston half. Install a bushing (2) on piston against packing. Start the remaining piston half on the rod. Do not damage the "O" ring. Insert one section of lock ring (1) between piston halves and start one of the piston cap screws. Position remaining half of lock ring and install balance of piston cap screws. Refer to torque specifications for correct torque. Safety wire cap screws in pairs.

Coat the piston with a film of oil and insert the piston and rod assembly into the cylinder. To prevent damage to piston packing rings, wrap the piston with shim stock. Remove shim stock as piston starts into cylinder bore.

Slide the cap assembly, end cover and "O" ring toward the cylinder. Push the cap assembly into the cylinder. Be sure the "O" ring and back-up ring on the outside of cap are correctly positioned. Install the three piece lock ring (2, Fig. 11-95) in the cylinder recess.

NOTE: If required, use a heavy grease that is soluble in hydraulic oil to hold lock ring segments in place.

Install the "O" ring (2, Fig. 11-94) in the cylinder (1).

Secure the end cover (3, Fig. 11-93) to the cylinder (1) with the cap screws and lock washers (2).

Manually extend the rod sharply several times, driving the piston against the cap assembly. The cap should, in turn, seat the three piece lock ring. Tighten the cap screws. Refer to torque specifications for correct torque value.

After installing cylinder on the tractor, start the engine and allow the hydraulic oil to reach operating temperature. Cycle the cylinder several times. Retorque the cap screws with the cylinder under pressure.

HYDRAULIC CYLINDERS - STEERING

GENERAL

Replace cylinder packing when excessive leakage occurs.

To replace packing, cylinder must be disassembled. Drain cylinder to be removed as much as possible. Plug and tag disconnected lines to protect and identify them for assembly. Do not damage pivot bushings or port flanges during removal.

DISASSEMBLY

Disassemble the cylinder in a clean area as follows:

Loosen set screws (5, Fig. 11-101a) and remove rubber plug (2).

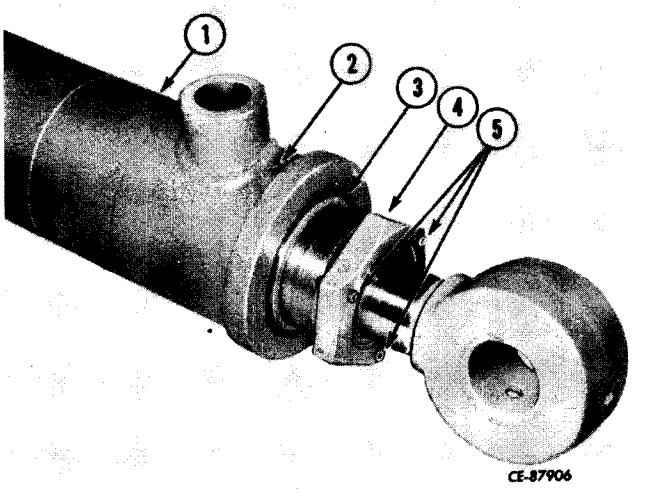

Figure 11-101a

Rotate cylinder cap (10, Fig. 11-101c) until hole in cap is aligned with plug hole (2, Fig. 11-101a) in cylinder. Insert a steel rod or punch in holes to prevent cap from turning and remove packing nut (4). Remove retaining ring (3).

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DISASSEMBLY, INSPECTION AND ASSEMBLY

Extend rod (3, Fig. 11-101b) and slide end cover (2) down rod. Push cap assembly (1) in slightly and remove multi-piece ring (4).

Pull rod free of cylinder. Cylinder cap and cover assemblies will come out with rod and piston.

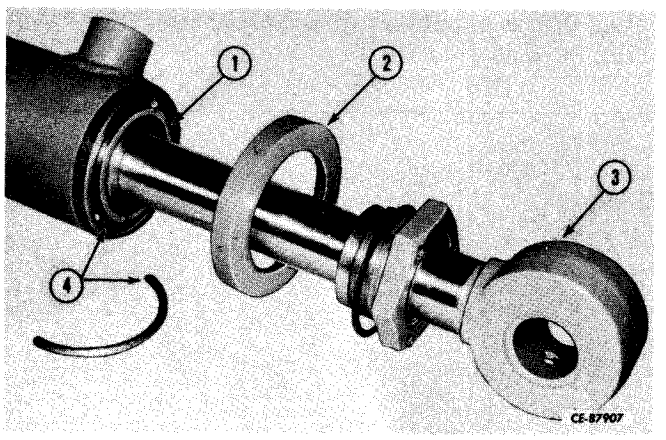

Figure 11-101b

Remove piston half (5, Fig. 11-101c) by unscrewing it from rod. Remove bearing (7). Thread remaining piston half (9) further onto rod until it clears plastic lock ring (8). Remove and discard lock ring.

NOTE: THE USE OF THIS PLASTIC LOCK RING HAS BEEN DISCONTINUED. LOCTITE, GRADE HVV IS NOW USED AS A LOCKING AGENT. REFER TO "ASSEMBLY" FOR CORRECT PROCEDURE.

Remove piston half from rod. Remove cylinder cap (10), end cover (15) and gland nut (17) from rod.

Discard used cylinder cap rod packing (14) and remove cylinder cap "O" ring seal (11) and back-up washer (12). Remove retaining ring (20) and wiper seal (19) from gland nut (17). Remove piston packing (6) from both piston halves (5, 9).

INSPECTION

Wash cylinder parts in solvent and dry with filtered compressed air.

Flush cylinder with oil to remove all traces of solvent and protect cylinder walls from oxidation. Protect all parts with a light oil film. Check inside cylinder surface for scratches and pitted areas. Use a fine grained hand stone to remove surface irregularities. The closer rod and cylinder surfaces are to a mirror-like finish, the more efficiently the new packing can operate.

Check new packing sets for cuts or other possible flaws. Do not use incomplete or defective packing sets. Soak new packing in oil so they will be pliable during installation.

NOTE: Special Torque, Pressure etc. recommendations are listed under "SERVICE INFORMATION." This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil, and revised when necessary.

ASSEMBLY

Insert new rod packing (14, Fig. 11-101c) into cylinder cap (10), one ring at a time. Use a wooden stick with smooth, rounded edges to press new packing into place. The point of the "V" of each ring must point toward threaded opening of cylinder cap.

Install new "O" ring seal (11) and back-up washer (12) in outer groove of cylinder cap (10). Install a new wiper seal (19) and retaining ring (20) in the gland nut (17).

Coat piston rod with thin film of oil and slide gland nut onto rod. Be careful not to damage wiper seal in nut.

(Continued on next page)

HYDRAULIC CYLINDERS - STEERING - Continued

ASSEMBLY - Continued

Slip retaining ring (16), end cap (15) and cylinder cap assembly onto rod. Be careful not to tear or nick rod packing in cylinder cap (10).

Clean threads of piston rod (21) and piston halves (5, 9) thoroughly with Grade "T" Loctite primer and allow to air dry. On threaded portion of rod furthest from end apply enough Loctite, grade "HVV" to cover about five leading threads and wipe it around threads to coat entire diameter. Thread inside piston half (9) onto rod. Install new packing (6) on piston half, being sure point of "V" of each ring points toward bearing (7).

NOTE: Each set of packing rings contain one ring with a shoulder. It is imperative that this ring be installed first.

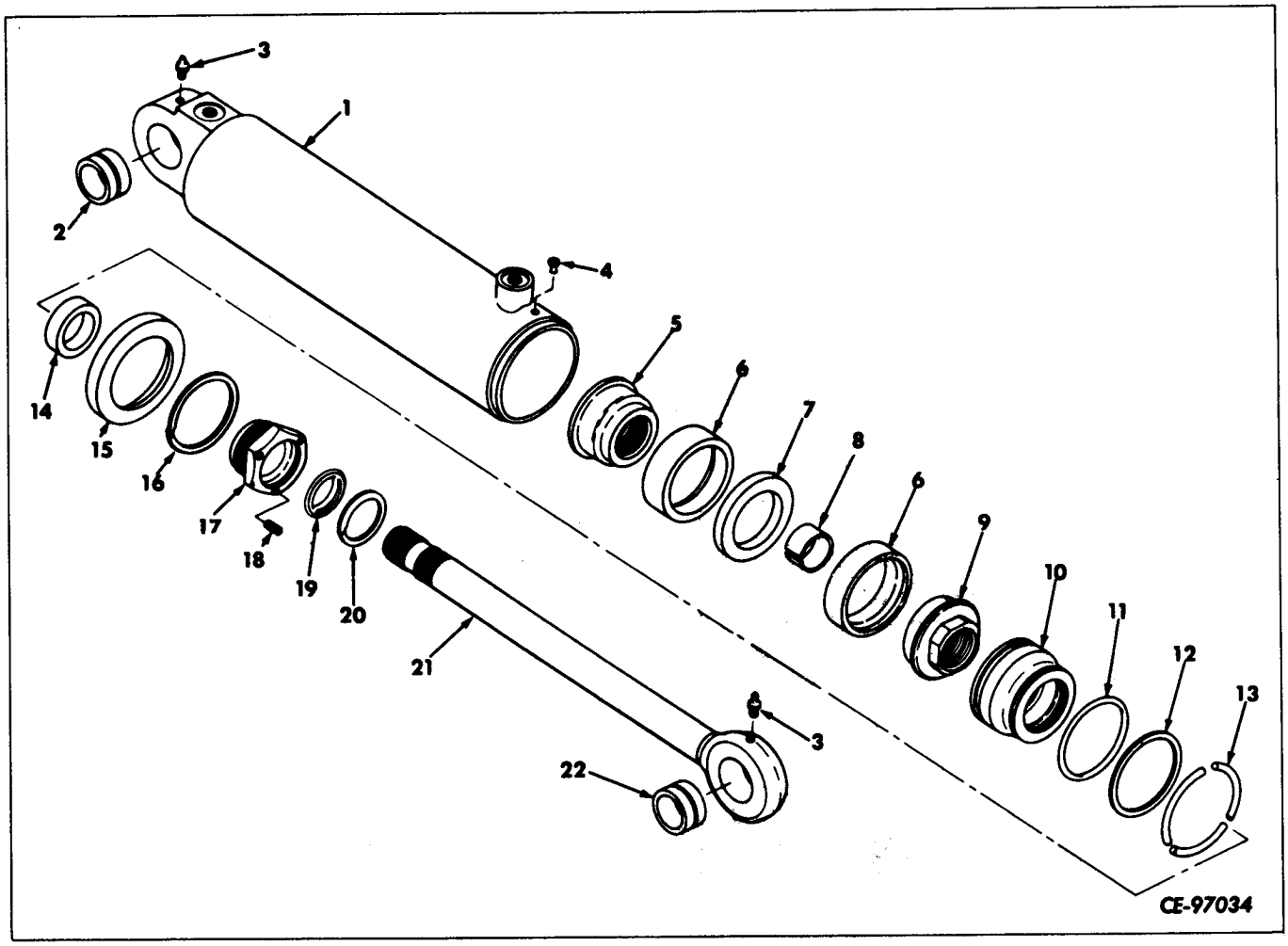

Figure 11-101c
Steering Cylinder.

1. Cylinder.
2. Bushing.
3. Lube fitting.
4. Rubber plug.
5. Rear piston half.
6. Piston packing.
7. Bearing.
8. Thread lock ring (Used on early models. Now discontinued).
9. Front piston half.
10. Cylinder cap.
11. "O" ring.
12. Back-up washer.
13. Lock ring.
14. Rod packing.
15. End cover.
16. Retaining ring.
17. Gland nut.
18. Screw.
19. Seal.
20. Retaining ring.
21. Piston rod.
22. Bushing.

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DISASSEMBLY, INSPECTION AND ASSEMBLY

Slip bearing onto rod, being sure it seats on shoulder of piston half.

Repeat procedure for outside piston half (5), threading second piston half all the way up to first piston half. Tighten piston halves to recommended torque. (Refer to "SPECIAL TOOLS" and "SPECIAL TORQUES.")

Torque:_____

Adjust piston assembly in either direction until the distance between the end of the rod (21) and the forward edge of the inside piston half (9) is equal to the recommended dimension. (Refer to Fig. 11- 102.)

Rod end-to-piston edge dimension:_____

Refer to Fig. 11-102 for points of measurement.

Set piston and rod assembly aside for a minimum of one hour to allow Loctite to cure before proceeding with assembly.

Coat piston assembly with a film of oil and insert piston and rod assembly into cylinder. Wrap shim stock around piston to prevent damage to packing as piston is inserted.

Push head assembly into cylinder far enough to install multi-piece lock ring (13) in groove.

Pull piston rod out until head locks against lock ring. Install cylinder end cover and its retaining ring.

Turn packing gland nut in until it seats on rod packing in head. Turn head assembly by turning nut until a metal keeper can be inserted through hole in rod end of cylinder and head assembly.

With head locked in position, adjust gland nut to obtain proper compression on head packing. Remove steel rod and install rubber plug (4). Lock gland nut in place with set screws (18).

When properly adjusted, a light film of oil will appear on piston rod.

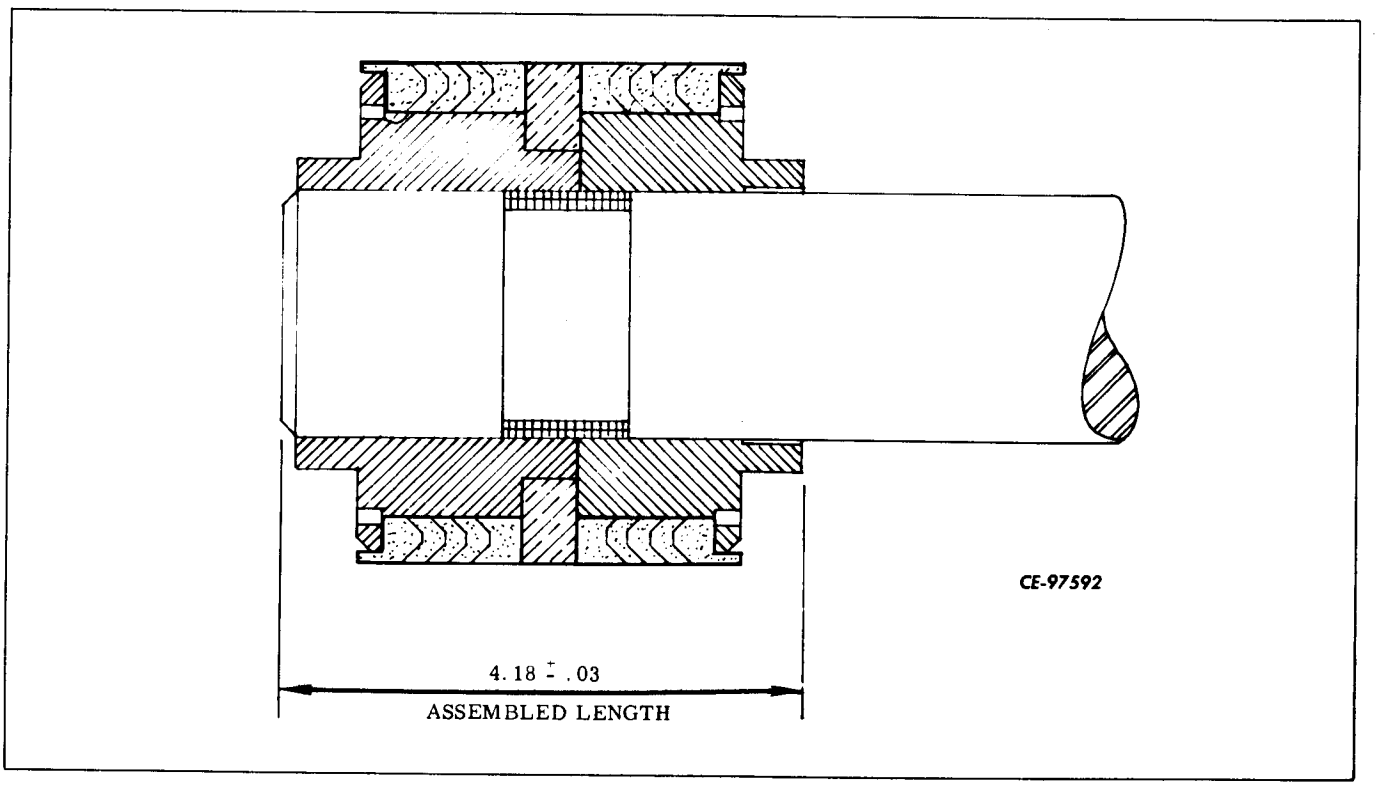


Figure 11-102
Piston Dimension.

TROUBLE SHOOTING

GENERAL

COMPLAINT	POSSIBLE CAUSE	REMEDY
Poor hydraulic system performance or failure.	1. Defective pump.	1. Repair or replace pump.
	2. Dirt in relief valve.	2. Disassemble and clean.
	3. Relief valve defective.	3. Disassemble, repair and adjust.
	4. Worn cylinders.	4. Repair or replace.
	5. Load too heavy.	5. Check line pressure.
	6. Internal crack.	6. Replace valve assembly.
	7. Plunger not in full stroke.	7. Check movement and linkage.
	8. Reservoir low on oil.	8. Add oil. Fill to level indicated on dipstick.
	9. System filters clogged.	9. Replace filter elements and clean reservoir.
	10. Restrictions in lines.	10. Check lines. Remove obstruction or replace line.
Excessive oil foaming.	1. Improper type or viscosity oil.	1. Drain entire hydraulic system and refill with proper oil.
	2. Excessive by-passing of oil over relief valves.	2. Adjust relief valve per recommendation if pressure adjustment is too low. Repair damaged relief valve. Change operating methods to eliminate long periods of maximum pressure operation.
Excessive oil temperature.	1. Sustained maximum pressure operation with by-passing of oil over relief valves.	1. Correct method of operation to eliminate long periods of maximum pressure operation.

TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Excessive oil temperature (Con't).	2. Incorrect viscosity or type of oil.	2. Drain entire hydraulic system and fill with correct oil.
	3. Worn hydraulic pump.	3. Replace or rebuild pump per recommendations in this manual.
Foreign material in reservoir screens.	1. Lint - Worn, frayed or damaged cylinder packing.	1. Replace packing.
	2. Chips - Worn pump or damage in cylinders.	2. Disassemble system components, inspect and repair.
Insufficient pressure build-up.	1. System relief valve set too low.	1. Adjust relief valve according to specifications. Refer to "Main Relief Valve Adjustment."
	2. Worn pump components causing internal leakage.	2. Replace pump cartridge.
Low pressure in boom circuit.	1. Damaged, worn or improperly adjusted hydraulic relief valve.	1. Refer to "Main Control Valve" for disassembly and inspection procedures. Refer to "Bucket Circuit Relief Valves" for adjustment procedures.
	2. By-pass in cylinders.	2. Replace worn packing and repair as necessary. Refer to "Hydraulic Cylinders - Boom and Bucket."
	3. Hydraulic pump worn.	3. Repair or replace hydraulic pump. Refer to "Main Hydraulic Pump."
Low pressure in bucket circuit.	1. Refer to causes 1, 2, and 3 in "Boom Circuit" above.	1. Refer to remedy 1, 2 and 3 in boom circuit above.
Low pressure in steering circuit.	1. Damaged, worn or improperly adjusted steering circuit relief valve.	1. Disassemble, inspect, repair and adjust relief valve.

(Continued on next page)

GENERAL - Continued

COMPLAINT	POSSIBLE CAUSE	REMEDY
Low pressure in steering circuit. (Continued)	2. By-pass in steering cylinders.	2. Inspect cylinders and rebuild if necessary.
	3. Worn steering pump.	3. Repair or replace steering pump.

MAIN CONTROL VALVE

Difficult operation or sticking of control valve plungers.	1. Over-heated hydraulic oil.	1. Refer to "Excessive Oil Temperature."
	2. Dirt in valve bores, plungers and/or oil.	2. Change oil, clean valve and entire system.
	3. Valve warped from incorrect mounting procedure.	3. Loosen mounting cap screws and torque correctly. Refer to "Special Torques."
	4. Fittings too tight.	4. Loosen fittings and retighten.
	5. Excessively high pressure in valve.	5. Check pressures on inlet and outlet lines.
	6. Linkage binding.	6. Free-up linkage.
	7. Plunger bent.	7. Replace valve assembly.
	8. Detent or return spring damaged.	8. Replace necessary parts.
	9. Spring or detent cap binding.	9. Loosen cap, recenter and retighten.
	10. Valve not at thermal equilibrium.	10. Allow system to warm-up.
Unable to move plunger in or out.	1. Dirt in valve.	1. Clean and flush system.
	2. Plunger cap full of oil.	2. Replace seals.
	3. Bind in linkage.	3. Free-up linkage.
Detent control fails to hold.	1. Worn detent cam.	1. Replace worn parts.
	2. Spring or ball broken or deformed.	2. Replace damaged parts.
	3. Excessive vibration.	3. Locate source of vibration and correct.
	4. Plunger stroke restricted.	4. Check linkage.
Load drops when plunger moved from neutral.	1. Dirt in check valve.	1. Disassemble and clean.
	2. Scored check valve poppet or seat.	2. Replace poppet or lap poppet to seat.

TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Load will not hold.	1. Cylinder leaking or worn.	1. Check cylinders.
	2. Oil by-passing valve plunger.	2. Replace valve assembly.
Leaking seals.	1. Paint on or under seal.	1. Remove and clean.
	2. Excessive back pressure.	2. Open line to reservoir.
	3. Dirt under seal.	3. Remove and clean.
	4. Scored plunger.	4. Replace valve.
	5. Loose seal plates.	5. Clean and tighten.
	6. Cut or scored seal.	6. Replace faulty parts.

MAIN CONTROL VALVE - MAIN PRESSURE RELIEF VALVE

No pressure.	1. Large poppet, check valve poppet or pilot poppet stuck open or dirt under valve seat.	1. Check for foreign material between poppets and their mating members. Members must slide freely. Clean all parts thoroughly.
Erratic pressure.	1. Pilot poppet seat damaged. Small poppet sticking in large poppet.	1. Replace damaged parts. Thoroughly clean all parts and remove surface marks.
Pressure setting incorrect.	1. Wear due to dirt. Jam nut and adjusting screw loose.	1. Refer to "Pressure Checks and Adjustments."
Leaks.	1. Damaged seats, worn "O"-rings.	1. Replace worn or damaged parts. Check for free movement of components.
	2. Parts sticking due to dirt.	2. Check seats for scratches, nicks or foreign material.

MAIN CONTROL VALVE - ANTI-VOID VALVE

Valve inoperative.	1. Sensing hole in small poppet plugged.	1. Thoroughly clean all parts; removing all foreign material and check for free movement of parts.
	2. Poppet sticking.	2. Check for foreign material or nicks and scratches on components. Thoroughly clean all parts and check for free movement.

TROUBLE SHOOTING

PUMP

COMPLAINT	POSSIBLE CAUSE	REMEDY
Pump does not deliver fluid.	1. Shaft sheared or disengaged.	1. Disassemble the pump and check the shaft and cartridge for damage. Replace necessary parts.
	2. Reservoir-to-pump intake line restricted.	2. Check all strainers and filters for foreign material. Clean if necessary.
	3. Fluid viscosity too heavy to pick up prime.	3. Completely drain the system. Add new filtered fluid of the proper viscosity.
	4. Relief valve stuck open.	4. Remove relief valve from main hydraulic control valve. Inspect components and repair or replace as necessary.
	5. Vane(s) stuck in the rotor slot(s).	5. Disassemble the pump. Check components for metal chips or dirt. Clean all parts thoroughly and replace damaged parts. Flush the system and refill with new fluid.
Pump making noise.	1. Low oil supply.	1. Fill reservoir to level mark.
	2. Cavitation in hydraulic pump.	2. Clean obstruction to pump oil supply. Clean tank strainers and check pump inlet line.
	3. Air in pump oil supply.	3. Locate air entry hole and repair. Check all hose fittings and connections.
	4. Excessive fluid foaming.	4. Drain hydraulic system and refill with proper type and viscosity fluid. Refer to "LUBRICANT."
	5. Vortex or spiral in oil circulating in reservoir.	5. Check installation and condition of suction screens. Check oil level.

TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Pump making noise. (Continued)	6. Excessive pump speeds.	6. Adjust engine governed speeds.
	7. High engine speeds with cold hydraulic oil.	7. Warm-up engine and hydraulic system prior to high speed or full load operation.
	8. Hydraulic oil viscosity too high.	8. Drain hydraulic system and refill with proper viscosity oil according to operating conditions. Allow sufficient warm-up period prior to full load or high speed operation.
	9. Pump components in mis-alignment.	9. Check shaft seal, bearings, etc., for damage. Replace parts as required. Align pump components correctly.

STEERING CONTROL VALVE

Hard steering when turning slowly.	1. Low fluid level in reservoir.	1. Fill to proper level. If excessively low, check all lines and connections for evidence of external leakage.
	2. Low oil pressure due to kink in hose.	2. Remove kink.
	3. Low oil pressure due to foreign object struck in hose.	3. Remove restriction or replace hose.
	4. Pressure loss in cylinder(s) due to worn piston packing and/or rod packing.	4. Overhaul cylinder(s). Replace worn packing.
	5. Steering control valve leaks.	5. Overhaul or replace valve.
	6. Loose fit of spool in valve body.	6. Replace valve.
No effort required to turn.	1. Loose or worn valve.	1. Replace valve.

(Continued on next page)

TROUBLE SHOOTING

STEERING CONTROL VALVE - Continued

COMPLAINT	POSSIBLE CAUSE	REMEDY
Poor steering return.	1. Sticky valve spool.	1. Remove and clean or replace valve.
Tractor leads to one side or the other.	1. Unbalanced or badly worn valve. NOTE: If this is the cause, steering effort will be very light in direction of lead and heavy in opposite direction.	1. Replace valve.
Momentary increase in effort required when turning wheel fast.	1. Insufficient oil supply to pump. 2. High internal leakage.	1. Check oil level in reservoir. 2. Replace valve. Check cylinder packing.
Excessive wheel kick-back or loose steering.	1. Air in system.	1. Add fluid to reservoir.

SERVICE INFORMATION

COMPONENT SPECIFICATIONS

RESERVOIR

Type:
Closed system with controlled pressure and vacuum relief.

Construction:
Cylindrical shape with 1/8 inch wall thickness, 19-1/2 inch diameter x 40 inches high and removable cover.
Vacuum valve setting, 2.3 psi.
Pressure relief valve setting, 30 psi.
Relief valve spring, correct adjusted length, 3 inches.
Pressure required to deflect relief valve spring 1/10 inch, 6.7 lbs.

Filters:
Three replaceable, pleated paper, radial fin type elements rated at 5 microns each.
Burst pressure, 100 psi minimum.
Flow rate, inside out, 60 GPM at 15 psi with SAE 10 oil at 100°F.
Strainers #6 square mesh wire cloth.
Capacity, "H" mark on dipstick = 37 gals., reservoir only.

PUMP

Manufacturer: Vickers.

Type:
Main pump: vane, double element, positive displacement.
Switch pump: vane, single element, positive displacement.

Rotation:
Counterclockwise as viewed from shaft end.

Pump capacity: (1200 rpm, 100 psi.)
Main pump:
Small element, 21 GPM.
Large element, 25 GPM.
Switch pump: 25 GPM.

SERVICE INFORMATION

MAIN CONTROL VALVE

Manufacturer: Husco.

Type:
Two spool, balanced spool design with integral pilot operated relief valve.

Relief valve setting:
2000 psi at high idle engine speed.

Rating:
102 GPM at velocity of 22 ft/sec.

Plunger movement between detents: 9/16 inch.

Spring forces:
- Anti-void valve spring: 1-5/8 inches free length; 3.47 lbs. force at 21/32 inch length.
- Check valve spring: 2-11/16 inches free length; 6 lbs. force at 1-3/8 inch length.
- Detent spring: 8 lbs. force at 2-1/4 inch length.
- End plate poppet spring: 3-1/4 inches free length; 8.7 lbs. force at 2-7/16 inch length.
- Guide pin spring: 1-13/32 inches free length; 10 lbs. force at 1-1/8 inch length; 29 lbs. force at 9/16 inch length.
- Plunger spring: 13 inches free length; 36.4 lbs. force at 3-29/32 inch length; 41 lbs. force at 2-25/32 inch length.
- Relief valve piston spring: 1-1/4 inches free length.
- Relief valve piston poppet spring: 1-5/16 inches free length; 3 lbs. force at 11/16 inch length.
- Relief valve poppet spring: 1-11/16 inches free length; 196 lbs. force at 1-27/64 inch length.

STEERING VALVE

Manufacturer: Hydreco.

Type:
Plunger operated.

Circuit pressures: Refer to "SYSTEM PRESSURES."

Spring forces:
- Check valve spring: .61 inches free length; 1.1 lbs. force at 3/8 inch length.
- Cylinder relief valve spring: 1.57 inches free length; .30 lbs. force at 1 inch length.
- Lock plunger spring: 3.39 inches free length; 88.8 lbs. force at 2-1/4 inch length.
- Lock check spring: 1.78 inches free length; 60 lbs. force at 1.688 inch length.
- Main relief check spring (primary): 1.392 inches free length; 10 lbs. force at 11/16 inch length.
- Main relief check spring (secondary): 1.325 inches free length; 20 lbs. force at 7/8 inch length.
- Main relief poppet spring: 1.275 inches free length; 68 lbs. force at 1.118 inch length.
- Plunger spring: 2 inches free length; 120 lbs. force at 1-1/2 inch length.

DEMAND VALVE

Manufacturer: Hydreco.

Type:
Pressure operated, non-adjustable.

Spring forces:
- Check spring: 2-1/4 inches free length; .57 lb. force at 9/16 inch length.
- Plunger spring: 6-29/32 inches free length; 64 lbs. force at 3-11/16 inch length.

HYDRAULIC CYLINDERS

BOOM CYLINDERS

Type: Double acting.
- Diameter of bore, 7 inches.
- Stroke (pin C/L to pin C/L), 39 inches.
- Extended length (pin C/L to pin C/L), 99 inches.
- Retracted length (pin C/L to pin C/L), 60 inches.
- Rod (chrome plated) diameter, 3-1/2 inches.
- Rod pin bore, 3-1/2 inches.
- Cylinder pin bore, 4 inches.
- Piston packing: "V" ring design. Combination cotton duck and Buna N compound.
- Rod packing: "V" ring design. Combination cotton duck and Buna N compound.

(Continued on next page)

SERVICE INFORMATION

COMPONENT SPECIFICATIONS - Continued

HYDRAULIC CYLINDERS - Continued

BUCKET CYLINDER

Type: Double acting.
Diameter of bore, 8 inches.
Stroke (pin C/L to pin C/L), 20-1/2 inches.
Extended length (pin C/L to pin C/L), 66-1/2 inches.
Retracted length (pin C/L to pin C/L), 46 inches.
Rod (chrome plated) diameter, 4 inches.
Rod pin bore, 3-1/2 inches.
Cylinder pin bore, 3-1/2 inches.
Piston packing: "V" ring design. Combination cotton duck and Buna N compound.
Rod packing: "V" ring design. Combination cotton duck and Buna N compound.

STEERING CYLINDERS

Type: Double acting.
Diameter of bore, 4 inches.
Stroke (pin C/L to pin C/L), 17 inches.
Extended length (pin C/L to pin C/L), 46-1/2 inches.
Retracted length (pin C/L to pin C/L), 29-1/2 inches.
Rod (chrome plated) diameter, 2 inches.
Rod pin bore, 2 inches.
Cylinder pin bore, 2 inches.
Piston packing: "V" ring design. Combination cotton duck and Buna N compound.
Rod packing: "V" ring design. Combination cotton duck and Buna N compound.

LINKAGE RATE OF TRAVEL

Boom raises, empty, 7.5 sec.
Boom lowers, empty (float position), 4 sec.
Bucket retracts, empty, 2.57 sec.
Bucket dumps, empty, 1.93 sec.

LUBRICANTS AND CAPACITIES

LUBRICANT

TEMPERATURE	TYPE REFILL AND SERVICE		
	SAE	API	MILITARY SPECIFICATIONS
Below 20°F.	10W/30	**MS DM	SUP. 1**, MIL-L-2104B, SERIES 3
Above 20°F.	20-20W	DS	

** MS wear test sequence

CAPACITY

Initial fill (dry system) . . . . . 49 gals.
Refill (approx) . . . . . 45 gals.

SERVICE INFORMATION

SPECIAL TORQUES

HYDRAULIC RESERVOIR

Filter retaining plate nuts . . . 41-49 ft. lbs.

HYDRAULIC PUMP - MAIN

Outlet cover retaining cap screws . . . . . 65-75 ft. lbs.
Inlet housing-to-body cap screws . . . . . 85-95 ft. lbs.

HYDRAULIC PUMP - SWITCH

Cover retaining cap screws. . . . 50-60 ft. lbs.

CYLINDERS

Boom cylinder piston cap screws. . 165 ft. lbs.
Boom cylinder cap screws (under pressure) . . . . . 85 ft. lbs.
Bucket cylinder piston cap screws . 170 ft. lbs.
Bucket cylinder cap screws (under pressure) . . . . . 85 ft. lbs.
Steering cylinder piston halves . . 500 ft. lbs.

STEERING CONTROL VALVE

Plunger cap cap screws . . . . . 30 ft. lbs.
Plunger nut . . . . . 50-60 ft. lbs.

SYSTEM PRESSURES

Main relief valve . . . . . ~~2000~~ 2520 psi
Cylinder relief valve . . . . . 3000 psi
Steering relief valve:
Main pressure . . . . . 2000 psi
Service ports . . . . . 3500 psi
Vacuum: Pressure relief valve
Pressure, crack . . . . . 30 psi
Vacuum, crack . . . . . 0 psi to .3 psi

PRESSURE CHECKS AND ADJUSTMENTS

MAIN RELIEF VALVE

In addition to the regular periodic system pressure checks and checks to detect system problems, the main relief valve must be pressure checked and adjusted if it has been completely disassembled or if repairs have been made to the hydraulic system.

The pilot section of the relief valve may be removed without disturbing the valve setting.

By loosening and removing the plug (6, Fig. 11-103) the pilot section may be lifted from the main control valve body.

◆ CAUTION: BEFORE ATTEMPTING TO ADJUST PRESSURE RELIEF VALVE, ALIGN FRAME HALVES AND INSTALL TRACTOR SAFETY BAR IN STRAIGHT AHEAD POSITION. DO NOT MOVE STEERING WHEEL WHILE ADJUSTING HYDRAULIC SYSTEM MAIN RELIEF VALVE.

(Continued on next page)

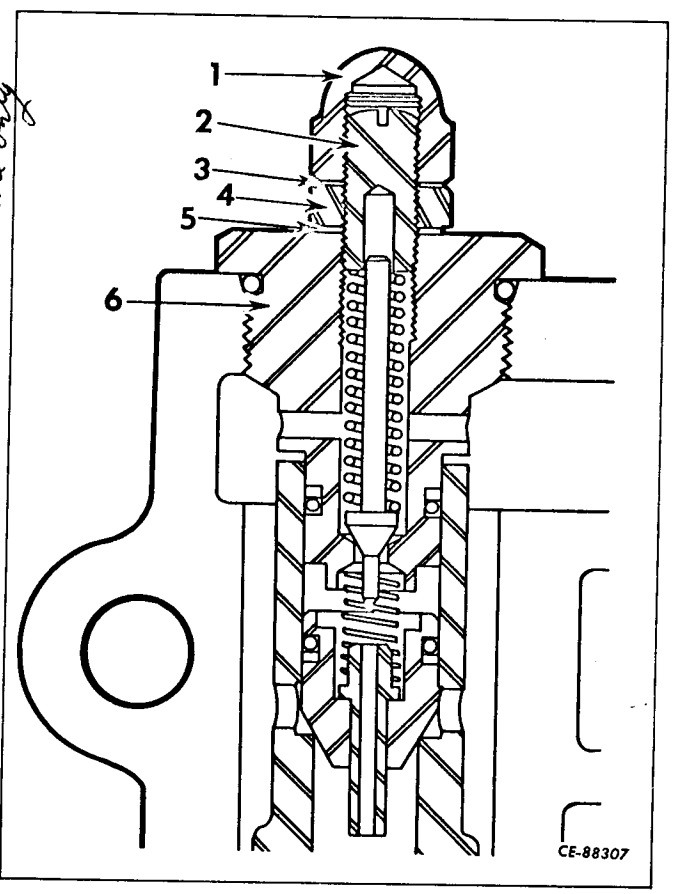


Figure 11-103
Main Relief Valve.

PRESSURE CHECKS AND ADJUSTMENTS - Continued

MAIN RELIEF VALVE - Continued

Adjust the relief valve as follows:

a. Remove the pipe plug from the main control valve and install a test gauge (3000 psi capacity).

b. Start the engine and check for leaks around the relief valve. The plugs at either end of the relief valve bore must be tight.

c. Remove the acorn nut (1) from the adjusting screw (2). It will be necessary to hold the jam nut (4) while removing the acorn nut.

d. Accelerate the engine to "High Idle" and hold the bucket control lever in the "Rolled Back" (retracted) position. Note the indicated pressure on the gauge.

e. Idle the engine. If the indicated pressure was not within the recommended limits, adjustment is necessary. Refer to "SYSTEM PRESSURES" for recommended setting.

f. Hold the adjusting screw (2) and loosen the jam nut (4). To adjust the pressure hold the jam nut and rotate the adjusting screw clockwise to increase and counterclockwise to decrease pressure. Recheck the indicated pressure. When the correct pressure is obtained, hold the adjusting screw and tighten the jam nut.

g. Be sure the copper washer (3) is in good condition and install the acorn nut (1).

h. Stop the engine. Remove the test gauge and replace the pipe plug.

BUCKET CIRCUIT RELIEF VALVES

Bucket circuit relief valves are adjusted at the factory and will seldom require adjustment. These valves are designed to protect the bucket during closed circuit operation, that is during back-dragging or leveling (Fig. 11-104) when the bucket control lever is in the "Hold" position. Resistance developed at the cutting edge is transferred to the loader linkage. Unless protected by the circuit relief valves these pressures, if excessive, could inflict serious damage on the loader linkage.

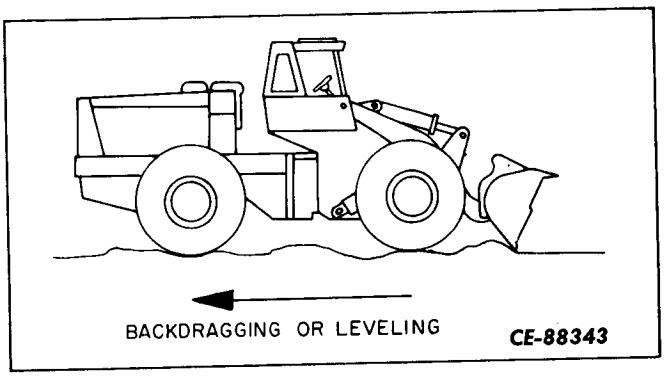


Figure 11-104

To adjust the bucket circuit relief valve:

a. Place bucket on ground and all controls in "Hold" or "Neutral." Apply parking brake.

b. Insert a tee connection in the hydraulic line on the high pressure side of each relief valve.

c. Insert a hose connected to a 5000 psi gauge in the stem of each tee. The gauge hoses must be long enough to reach to the operator's compartment.

d. Check the oil level in the reservoir and add oil if necessary.

e. Start the engine. Raise the boom slightly and retract the bucket 3/4 of its travel. Release the bucket control lever as soon as the bucket reaches the desired position.

f. Release the parking brake and move the tractor forward allowing the underside of the bucket cutting edge to contact an immovable object. Contact must be along full length of edge.

g. By depressing the accelerator increase the pressure on the cutting edge. Note the pressure at which the valve discharges. This pressure should equal the recommended maximum. Refer to "SYSTEM PRESSURES."

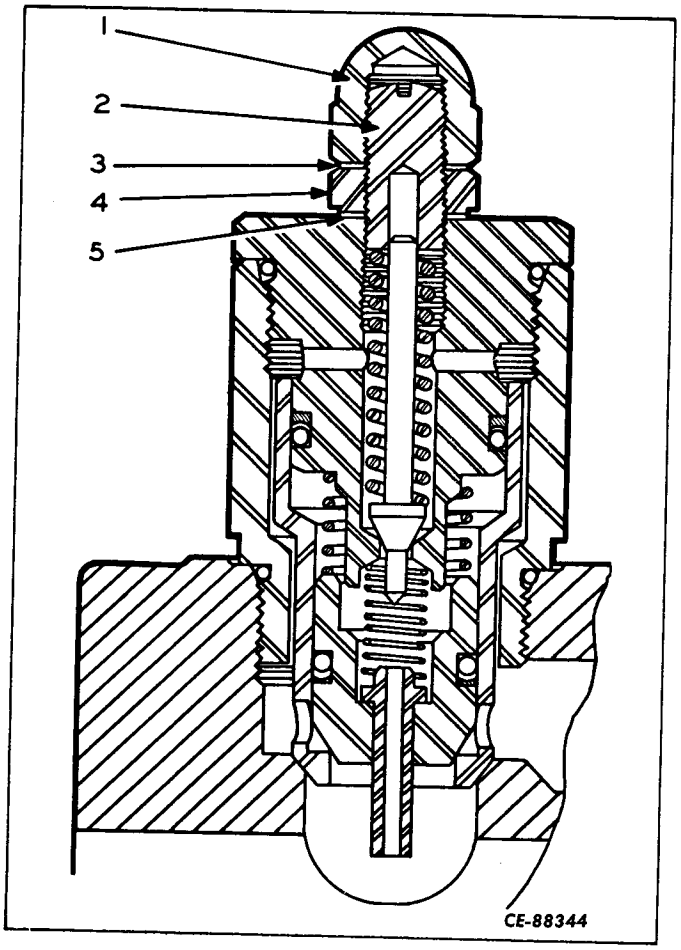


Figure 11-105
Bucket Relief Valve.

1. Acorn nut.
2. Adjusting screw.
3. Copper washer.
4. Jam nut.
5. Copper washer.

h. If an adjustment is required hold the jam nut (4) and remove the acorn nut (1). Hold the adjusting screw (2) and loosen the jam nut. Rotate the adjusting screw in a clockwise direction to increase and counterclockwise direction to decrease pressure. Again check the valve discharge pressure. Continue the test and adjust procedure until the recommended setting is obtained.

i. When the correct adjustment is obtained, hold the adjusting screw (2) and tighten the locknut (4). Be sure the copper washer (3) is in good condition and install the acorn nut (1).

j. To test the opposite valve, place the bucket cutting edge under a very heavy object and slowly "Raise" the boom while the bucket remains in the "Hold" position. Note the pressure at which the valve discharges. This pressure should equal the recommended pressure. Refer to "SYSTEM PRESSURES" for recommended setting.

k. If adjustment is required, follow procedure in step "h." When correct adjustment is obtained, hold the adjusting screw (2) and tighten the locknut (4). Be sure the copper washer (3) is in good condition and install the acorn nut (1).

l. Stop the engine. Relieve the pressure in the system by moving the loader controls through their full travel several times. Relieve the reservoir pressure by slowly removing the filler cap. Remove the 5000 psi gauges and the "tees" and reconnect the loader hydraulic lines. Check the level of the hydraulic system and add fluid as required.

STEERING CONTROL RELIEF VALVE

Adjust the relief valve as follows:

a. Remove the pipe plug from the tee at the rear end of the left hand steering cylinder and install a test gauge (5000 psi capacity).

◆ CAUTION: BEFORE ATTEMPTING TO ADJUST PRESSURE RELIEF VALVE, ALIGN FRAME HALVES AND INSTALL TRACTOR SAFETY BAR IN STRAIGHT AHEAD POSITION.

b. Start engine and allow it to run until the hydraulic fluid reaches operating temperature.

c. Accelerate the engine to high idle, turn steering wheel, and read maximum indicated pressure on the test gauge.

(Continued on next page)

SERVICE INFORMATION

PRESSURE CHECKS AND ADJUSTMENTS - Continued

STEERING CONTROL RELIEF VALVE - Continued

d. Idle the engine. If the indicated pressure was not within the recommended limits, adjustment is necessary. Refer to "SYSTEM PRESSURES" for recommended setting.

e. Remove the acorn nut (1, Fig. 11-106) from the adjusting screw (2). It will be necessary to hold the jam nut (4) while removing the acorn nut.

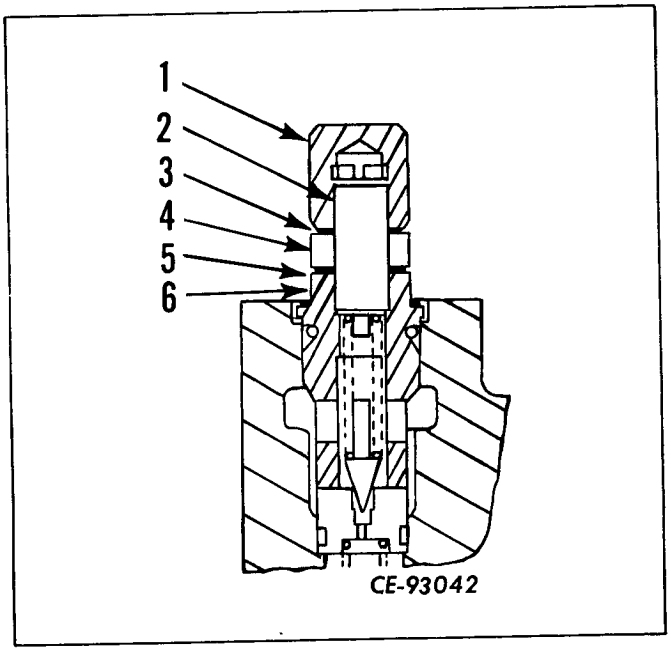


Figure 11-106
Steering Control Relief Valve.

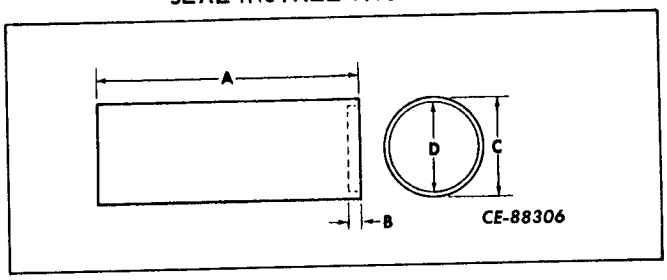
f. Hold the adjusting screw (2) and loosen the jam nut (4). To adjust the pressure, hold the jam nut and rotate the adjusting screw clockwise to increase and counterclockwise to decrease pressure. Recheck the indicated pressure. When the correct pressure is obtained, hold the adjusting screw and tighten the jam nut.

g. Be sure the washer (3) is in good condition and install the acorn nut.

h. Stop the engine. Remove the test gauge and replace the pipe plug. Remove the safety bar.

SPECIAL TOOLS

SEAL INSTALLATION TOOL



SEAL INSTALLATION TOOL

PUMP SERIES	LENGTH A (IN)	UNDERCUT B (IN)	O. D. C (IN)	I. D. D (IN)
35V 3525	3-1/4	1/4	1-25/32	1-11/16

Figure 11-107

SPECIAL TOOLS

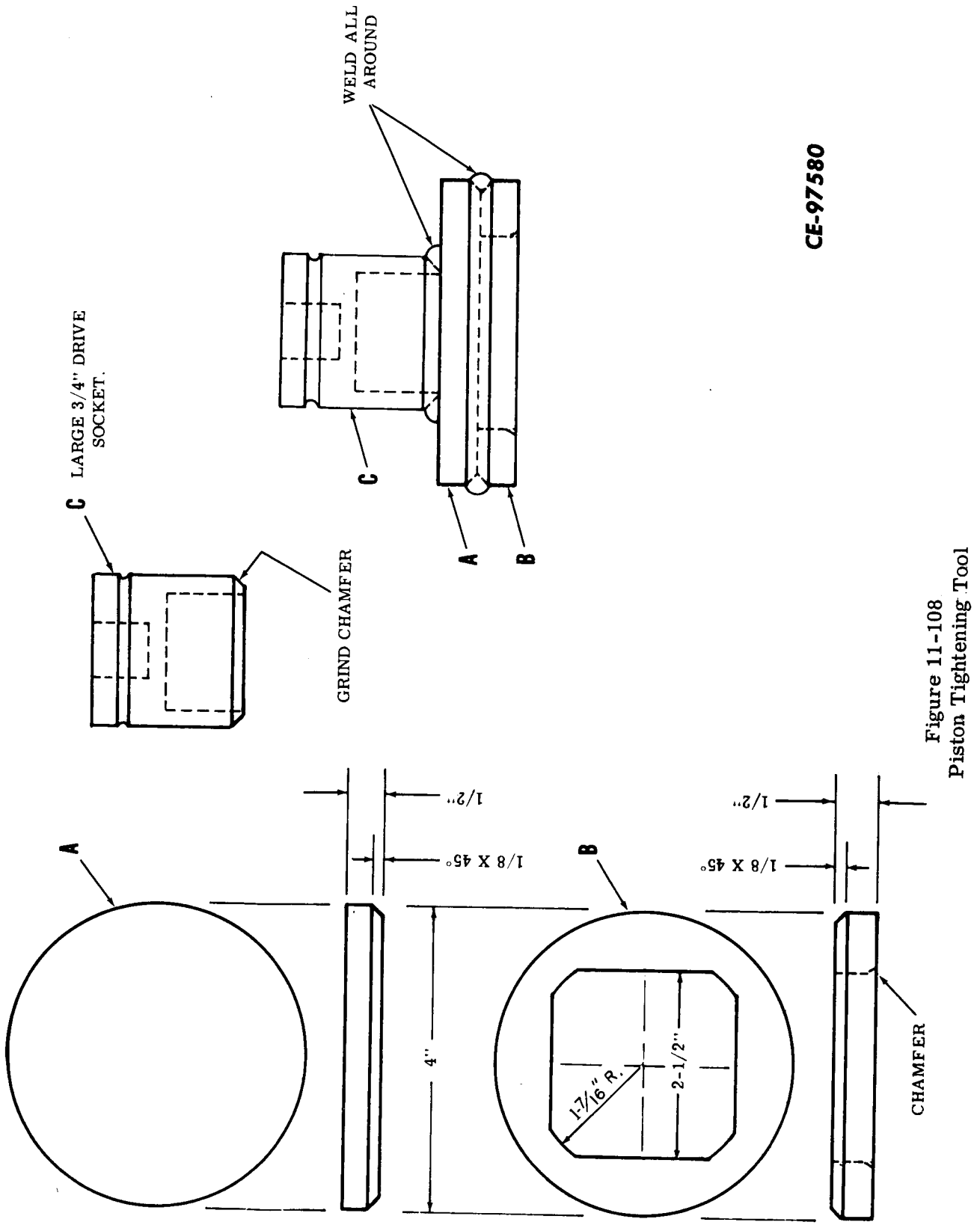


Figure 11-108
Piston Tightening Tool

HYDRAULIC SYSTEM

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SECTION XII

ELECTRICAL SYSTEM

SECTION XII ELECTRICAL SYSTEM

DESCRIPTION OF SYSTEM

The electrical circuit used on the H-90E series tractor is a 24 volt, negative ground system. Electrical energy stored in the batteries, is available upon demand to the system components. These components, which include the instruments, headlights, back-up lights, stop and tail lights and cranking motor, are dependent upon battery energy until the engine drives the generator at a speed sufficient to carry the electrical load. Above this predetermined speed, electrical energy produced by the generator, supplies the normal demands of the system. A portion of this energy is sent to the batteries to keep them in a state of full charge.

A regulator is installed in the system to control the output of the generator. By using a regulated control, electrical energy produced by the generator, is supplied to the system components on demand.

Two heavy duty, 12 volt batteries, wired in series produce a 24 volt system. A battery is housed in each of the battery boxes located on the left and right hand side of the rear main frame. Hinged tops on the battery boxes provide easy access for servicing.

The system may be divided into two circuits; the cranking circuit, in use during engine starting and the charging circuit, supplying current to the remainder of the system when the engine is operating. In addition, the charging circuit replaces electrical energy drained from the batteries.

ELECTRICAL SYSTEM

DESCRIPTION OF SYSTEM

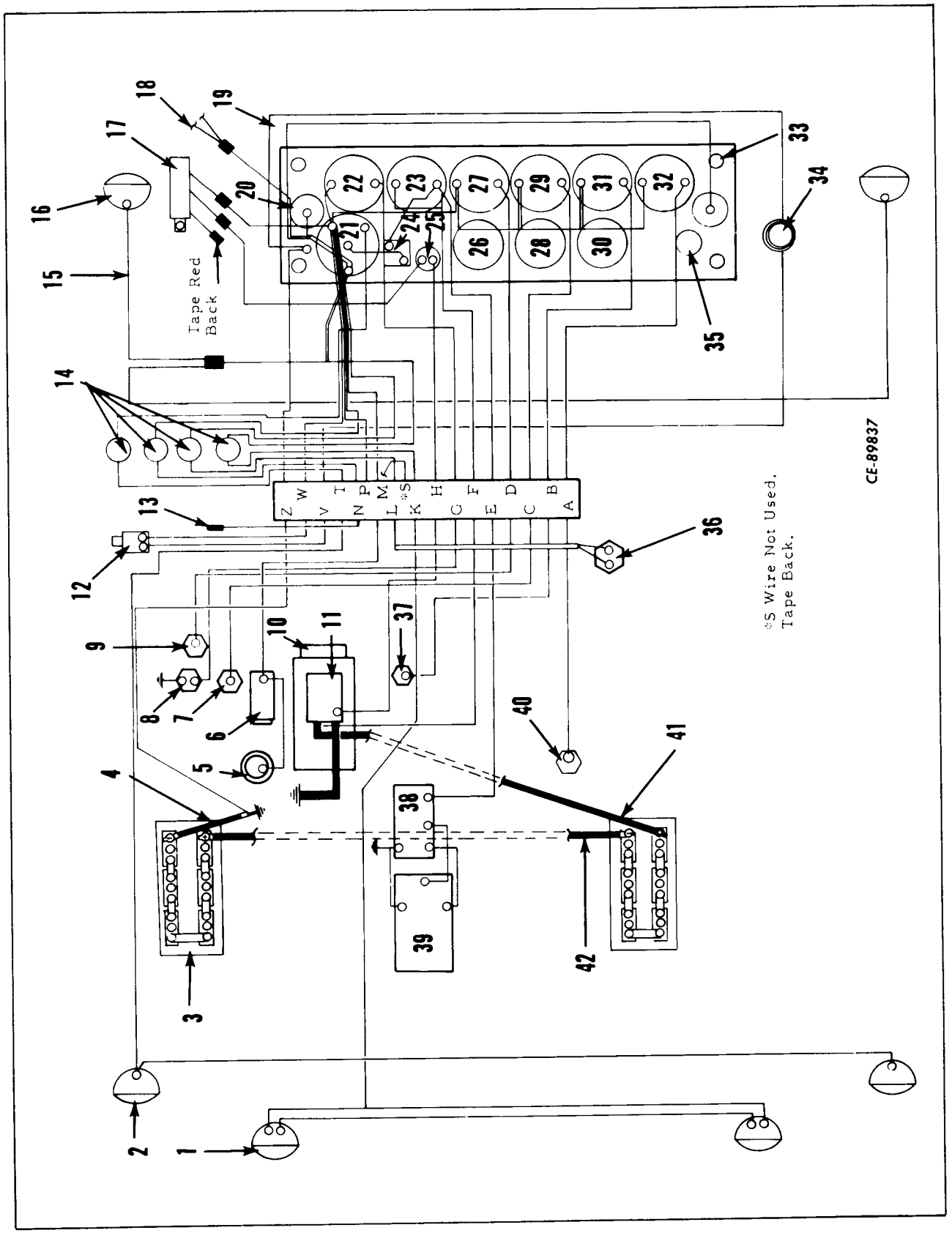


Figure 12-1
Wiring Diagram.

DESCRIPTION OF SYSTEM

Legend for Figure 12-1

1. Lamp assembly - comb. tail and stop.
2. Lamp assembly - rear driving.
3. Battery (negative ground).
4. Cable, battery ground.
5. Auxiliary fuel pump.
6. Fuel solenoid.
7. Water temperature sender.
8. Hourmeter switch.
9. Engine oil pressure sender.
10. Starting motor.
11. Starting motor solenoid.
12. Parking brake switch.
13. Heater lead wire.
14. Fuse assembly.
15. Wire, jumper - front drive lights.
16. Lamp assembly - front driving.
17. Neutral safety switch.
18. Shifter indicator lights.
19. Instrument panel.
20. Lamp assembly - dash.
21. Switch - main (combination).
22. Hourmeter.
23. Ammeter.
24. Main circuit breaker.
25. Push button starting switch.
26. Air pressure gauge.
27. Engine oil pressure gauge.
28. Hydraulic pressure gauge.
29. Engine water temperature gauge.
30. Transmission clutch pressure gauge.
31. Converter temperature.
32. Fuel gauge.
33. Shock mount.
34. Parking brake warning light.
35. Plug button.
36. Stop light switch.
37. Converter temperature sender.
38. Regulator - voltage.
39. Generator.
40. Fuel sender.
41. Cable - to starter solenoid.
42. Cable - battery jumper.

WIRE	COLOR	GAUGE	WIRE	COLOR	GAUGE
A	Tan	18	M	Lt. Blue	12
B	Lt. Green	18	N	Red	14
C	Dk. Green	18	P	Black w/White Tracer	14
D	Black	18			
E	Yellow	10	V	White	10
F	Red	10	W	Black	10
G	White	18	Z	Black w/Yellow Tracer	12
H	Brown	14			
J	Orange	12	T	Violet	14
K	Pink	14	S	Dk. Green w/ White Tracer	14
L	Dk. Blue	14			

ELECTRICAL SYSTEM

BATTERIES

DESCRIPTION

A lead-acid storage battery of the type used in the electrical system of the tractor, contrary to popular belief, does not store electricity. The hard rubber case stores the chemical ingredients necessary to produce electrical energy. This energy is produced only when a circuit to which the battery is connected is completed. During periods of inactivity, when no electrical energy is being supplied, a slow chemical breakdown or discharge is taking place. If the period of idleness is of sufficient length a condition known as a permanent sulfation will develop. Once permanently sulfated, a battery cannot be restored to its normal maximum capacity. Routine battery service greatly extends the useful life of the battery.

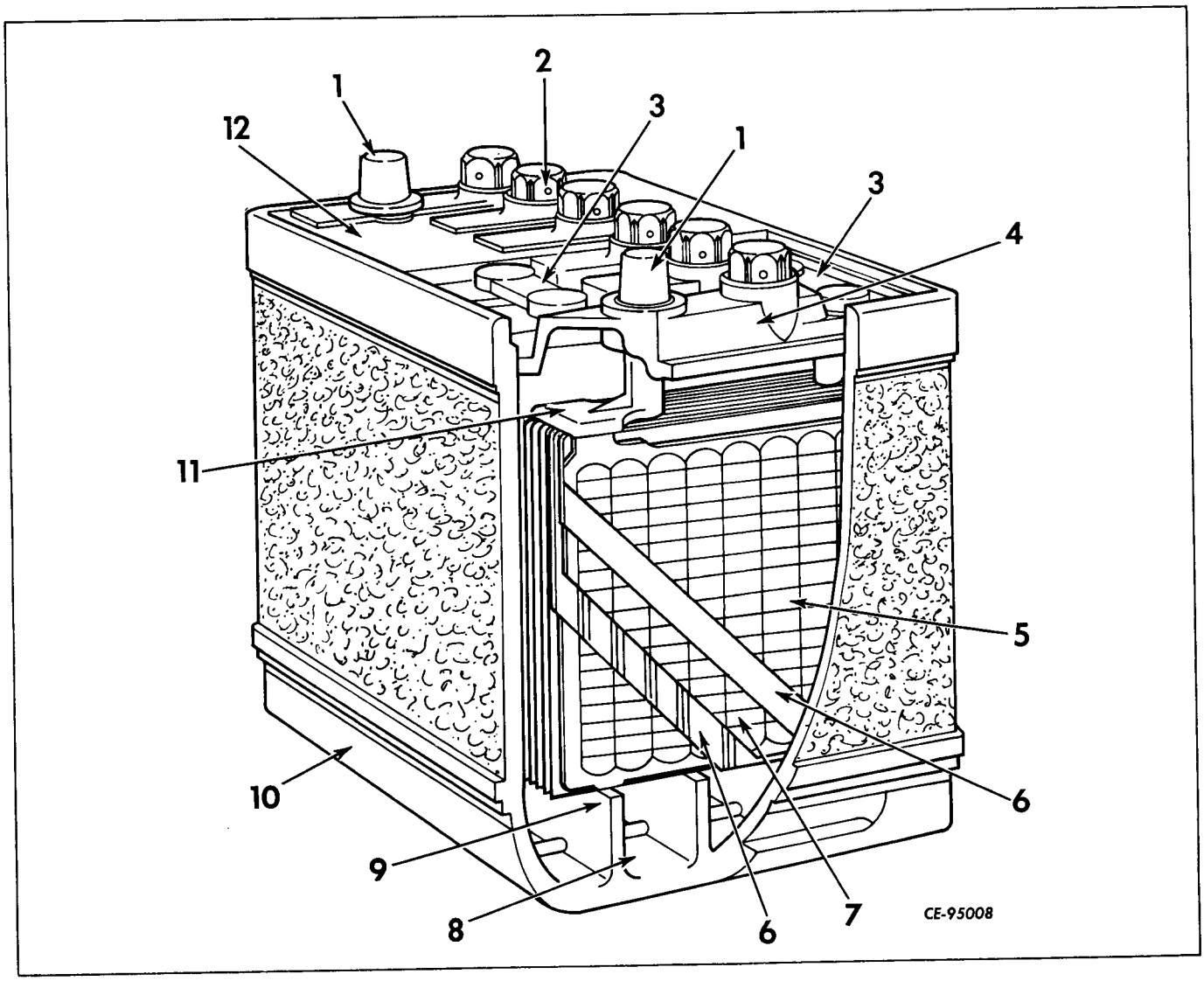


Figure 12-2
Typical 12 Volt Storage Battery.

1. Terminal post.
2. Vent plug.
3. Cell connector.
4. Cell cover.
5. Negative plate.
6. Separator.
7. Positive plate.
8. Sediment space.
9. Element rest.
10. Case.
11. Post strap.
12. Sealing compound.

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BATTERIES

OPERATION

A twelve volt battery is composed of one large case (Fig. 12-3) divided into six equal compartments called cells.

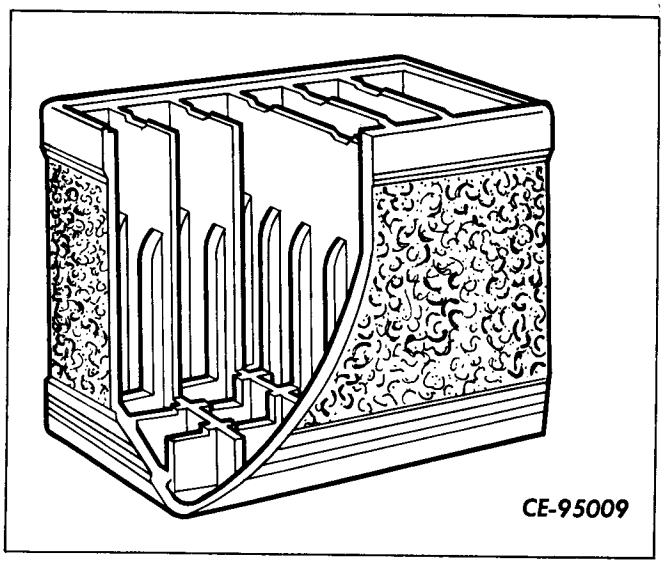

Figure 12-3
Battery Case.

Within each cell are a series of plates (Fig. 12-4) containing the active chemical material used in producing the electrical energy. The plates are immersed in a fluid called electrolyte. The plate frame is a grid design and the active material is attached by a process of pasting and bonding. Depending upon the material attached to the grid, some plates are classed as negative plates while the others are considered positive plates. Within each cell these plates are alternately spaced with each group being connected to its own common post strap (Fig. 12-6); that is one negative and one positive post strap per cell.

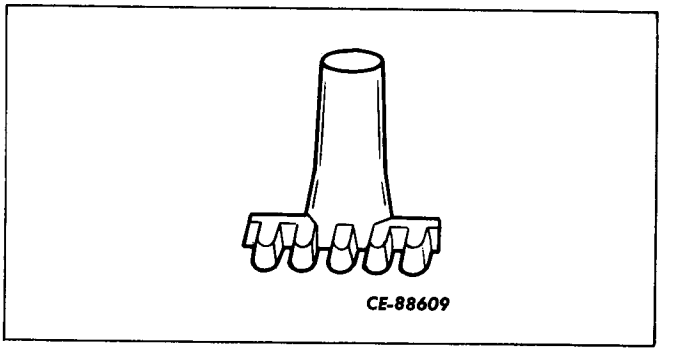

Figure 12-5
Post Strap.

Plates are kept from touching one another by sheets of insulating material called separators. Separator material ranges from cellulose fiber to rubber and plastics with the best materials being used in the top quality batteries. The ribs on the separator plates (Fig. 12-6) always face the positive plates to provide a greater acid volume at this point with resulting improved efficiency.

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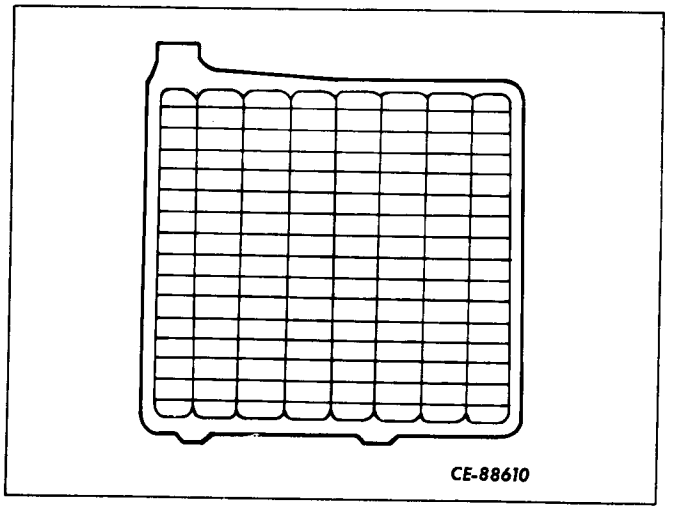

Figure 12-4
Battery Plate.

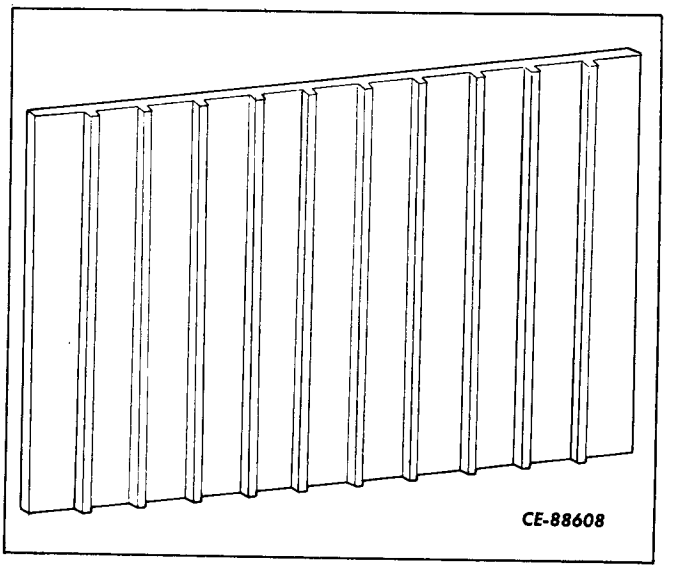

Figure 12-6
Separator Plate.

OPERATION - Continued

In addition to insulating one plate from the other, the separator must be porous enough to permit rapid electrolytic action. This action is the energy producing chemical process that takes place between the negative and positive plates using the electrolyte in which the plates are immersed as a conductor. This electrolyte is basically a sulphuric acid and water solution. Each cell is capable of producing two volts.

Cell cover construction is primarily of moulded hard rubber providing an acid tight seal through the use of moulded bushings for the two terminal posts and intermediate connections that protrude through the cover. The covers (Fig. 12-7) are also provided with vent openings of various construction.

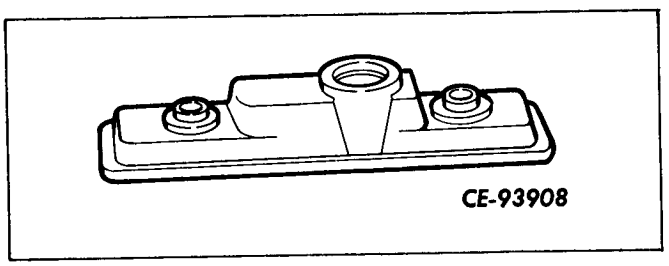

Figure 12-7
Cell Cover.

Battery covers (Fig. 12-8) provide six cell covers in a one piece unit. The covers are sealed on after all intercell connections are made. Vent plugs are an important part of cover construction.

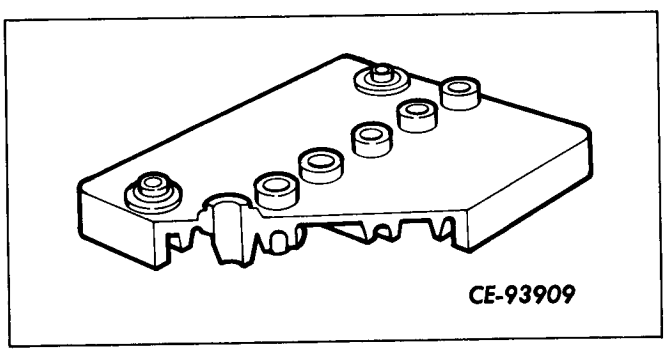

Figure 12-8
Battery Cover.

The cells are joined by heavy metal straps called cell connectors (Fig. 12-9). The positive plates of one cell are connected to the negative plates of the adjoining cell and so on. With six cells connected in series, a battery capable of generating 12 volts is produced. If the battery is connected into a complete electrical circuit a chemical reaction between the active plate material and the electrolyte causes a flow of electrical current.

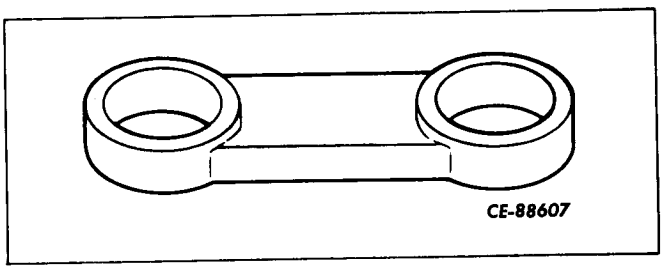

Figure 12-9
Cell Connector.

The products of the positive active material and the electrolyte are lead sulfate and water. While the lead sulfate is being deposited on the positive plate the electrolyte is being transformed into water.

The negative active material and electrolyte produce only lead sulfate which builds up on the negative plate.

As lead sulfate continues to build up on the plates it reaches a point where the chemical reaction stops. At this point the battery is considered discharged.

As the battery is charged a reverse chemical action takes place and the built up lead sulfate is converted back to active material as the water is transformed into its original capacity, electrolyte.

During normal cycling the battery loses vaporized water through the vent caps. This water must be replaced before the electrolyte solution falls below the tops of the plates. If the plates are exposed the active material dries and hardens and becomes permanently sulfated. Once permanently sulfated the area may not be reactivated again.

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BATTERIES

SERVICE

Close adherence to a regular service schedule will greatly extend the useful life of the battery. Battery service should cover the following:

a. Electrolyte Level - Check the level of the solution after battery cap removal. Fill to level indicated on battery cap or until plates are covered. Do not overfill. Overfilling results in loss of electrolyte and excessive corrosion around battery. Use fresh distilled water or water approved by the battery manufacturer.

b. Cables - Check cables for defects and/or corrosion. Replace badly corroded cables. Remove corrosion from terminals, cables, battery top, hold-down and battery box with a diluted ammonia or soda solution. Rinse with clean water. Terminals may be cleaned with a wire terminal cleaning brush. Coat terminals and cable clamps with a light coat of petroleum jell. Tighten cable clamps securely.

c. Visual Inspection - Inspect the battery case exterior for cracks or leaking electrolyte solution. Check top for cracked or missing sealing compound. Be sure battery hold-down is snug. Do not overtighten hold-down as this may result in distorting and cracking the battery case.

In addition to the above service procedures the specific gravity of the electrolyte should be checked to observe the battery state of charge. A battery hydrometer is used to check specific gravity. Use a hydrometer equipped with a thermometer, drawing the electrolyte into the tube and expelling it several times to stabilize the temperature. To obtain an accurate reading the hydrometer must be held so that the eye is on a level with the liquid surface. Draw just enough electrolyte into the hydrometer to allow the glass float to float freely in the tube. The float must not touch the top, bottom or side of the tube.

The temperature of the electrolyte has a definite effect on the specific gravity reading. To compensate for each 10°F. change above 80°F. add four (.004) gravity points. For each 10°F. drop below 80°F. subtract four (.004) gravity points. For example: a specific gravity reading of 1.235 at an indicated electrolyte temperature of 100°F. would have an actual value of 1.243 (1.235 + .008 = 1.243). A specific gravity reading of 1.250 at an indicated electrolyte temperature of 20°F. would have an equal value of 1.226 (1.250 - .024 = 1.226).

1.260 Sp. Gr.	1.280 Sp. Gr.	100% Charged
1.230 Sp. Gr.	1.250 Sp. Gr.	75% Charged
1.200 Sp. Gr.	1.220 Sp. Gr.	50% Charged
1.170 Sp. Gr.	1.190 Sp. Gr.	25% Charged
1.140 Sp. Gr.	1.160 Sp. Gr.	Very little useful capacity
1.110 Sp. Gr.	1.130 Sp. Gr.	Discharged

CE-88606

Figure 12-10
State of Charge Scale.

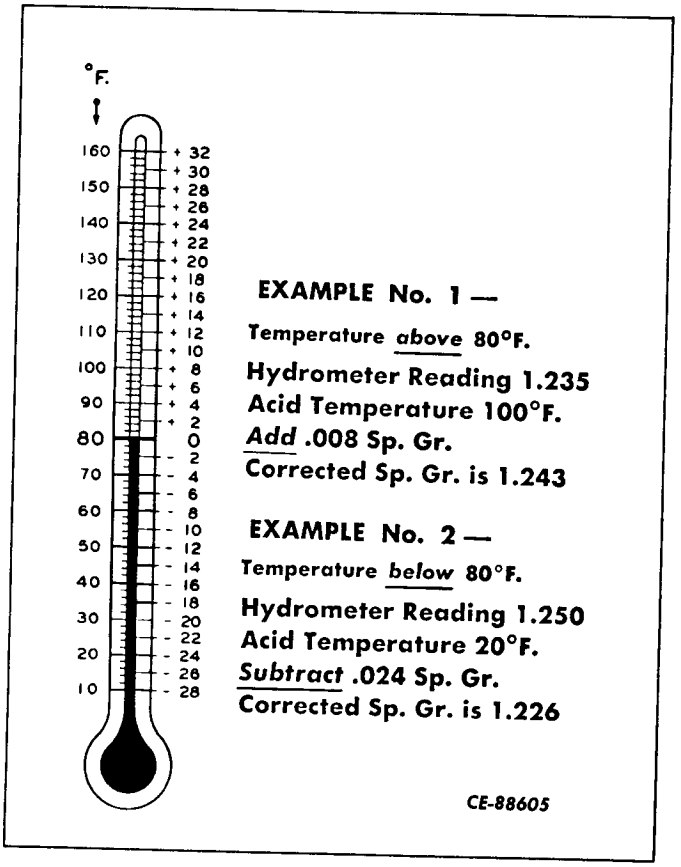

Figure 12-11
Temperature Correction Scale.

BATTERY CHARGING

Fast Charging - In this method current is fed to the battery at a greatly accelerated rate. The charging period is comparatively short in order to bring the battery up to a state of charge before the temperature of the electrolyte becomes excessive. Temperature above 125°F. must be reduced by stopping the charging process or reducing the rate.

This "quick charge" method will not completely charge a battery. An additional slow charge must be used to bring the battery up to maximum capacity.

Slow Charge - This method is a complete reversal of the fast charge. A small amount of current is supplied for periods up to 24 hours.

Charging Safety - A product of the battery charging operation is an explosive gas escaping from the vent hole in each battery cap. A portion of this gas remains in the area beneath each cell cover. Although this condition is normal certain safety precautions must be observed to prevent ignition and resultant explosion.

a. Do not smoke near charging or recently charged batteries.

b. Do not pull the charging leads from the battery terminals while the charger is in operation. Sparks occurring at the terminals can ignite the gas. Turn off the charger before disconnecting the leads.

In addition, never fast charge a frozen battery. Thaw the electrolyte solution at room temperature before attaching the charger. Check the battery case for cracks.

Before recharging a battery, regardless of the method used, the electrolyte must be brought up to the recommended level.

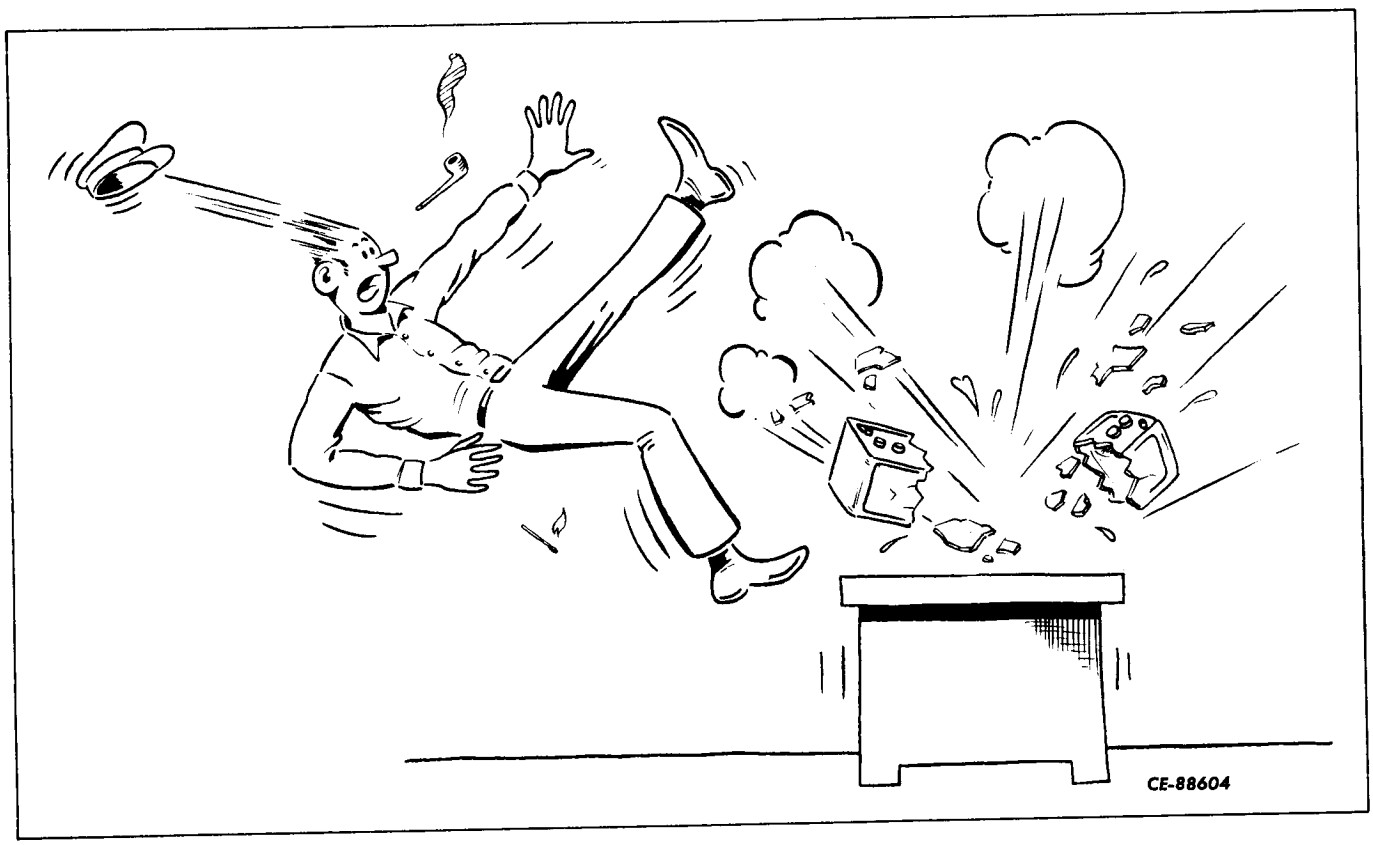

Figure 12-12

GENERATOR

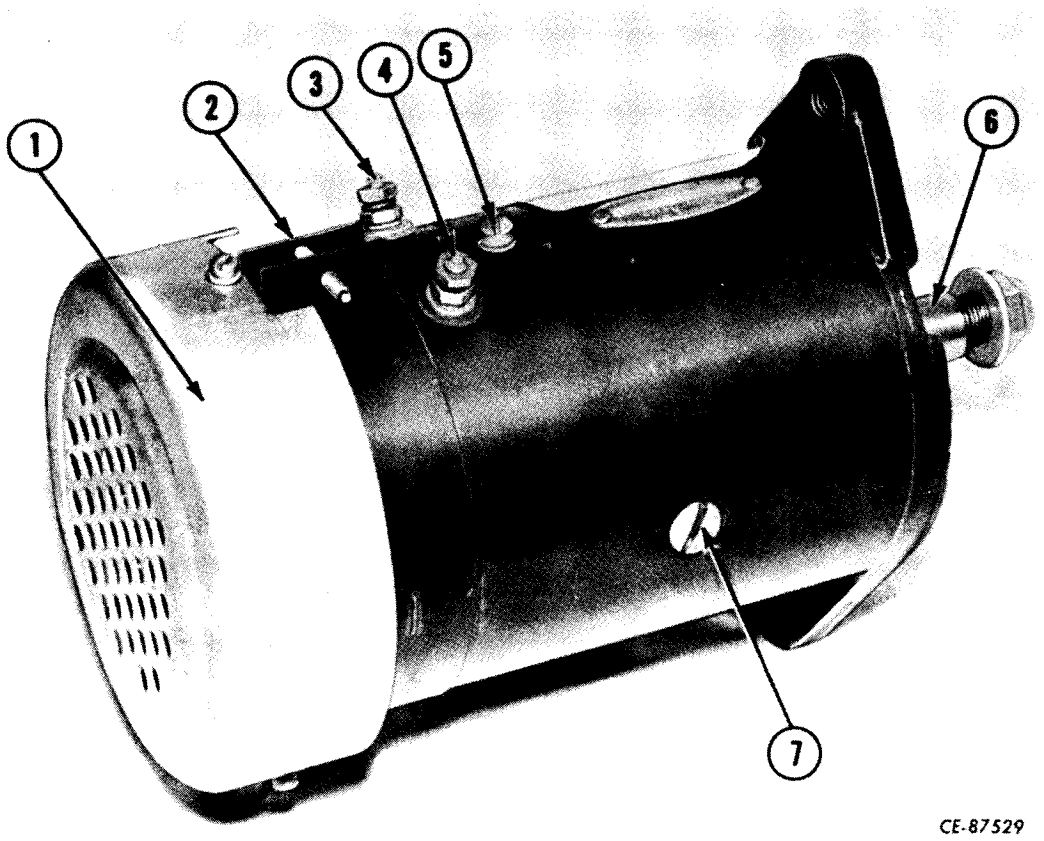

Figure 12-13
Generator.

1. End cover.
2. Cover band.
3. Field terminal.
4. Armature terminal.
5. Ground screw.
6. Armature shaft.
7. Pole shoe retaining screw.

DESCRIPTION

The generator is the second and largest source of electrical energy in electrical system. Unlike the battery however, the generator converts the mechanical energy of the engine into electrical energy. Since it depends upon the engine for its driving force, the generator may produce electrical energy only during the time the engine is running. Due to the nature of its construction, the faster the generator rotates, the more electrical energy is produced. It may be seen then, that without a method of control the generator is capable of destroying itself. The controlling device is called the regulator.

GENERATOR

OPERATION

A piece of copper wire, passed through a magnetic field (lines of force) produces a voltage in the wire (Fig. 12-14); this occurrence is the basic principle of the operation of the generator. By passing the wire through the magnetic field repeatedly at a given rate, a definite voltage is produced. To increase this output three things may be done; increase the amount of copper wires, strengthen the magnetic field and increase the rate at which the wire(s) pass through the magnetic field. All of these methods are employed in the tractor generator.

Instead of one wire, hundreds of copper wires (5, Fig. 12-15) are wound on a laminated iron core (2). A shaft (3), passing through its center, is attached to the core and is supported at each end by a suitable bearing (1, 4). This rotatable iron core or armature as it is called, is placed in the center of a magnetic field.

The magnetic field is created by placing two iron pole pieces, a north and a south (1, 2, Fig. 12-16) in opposing positions within the iron armature housing.

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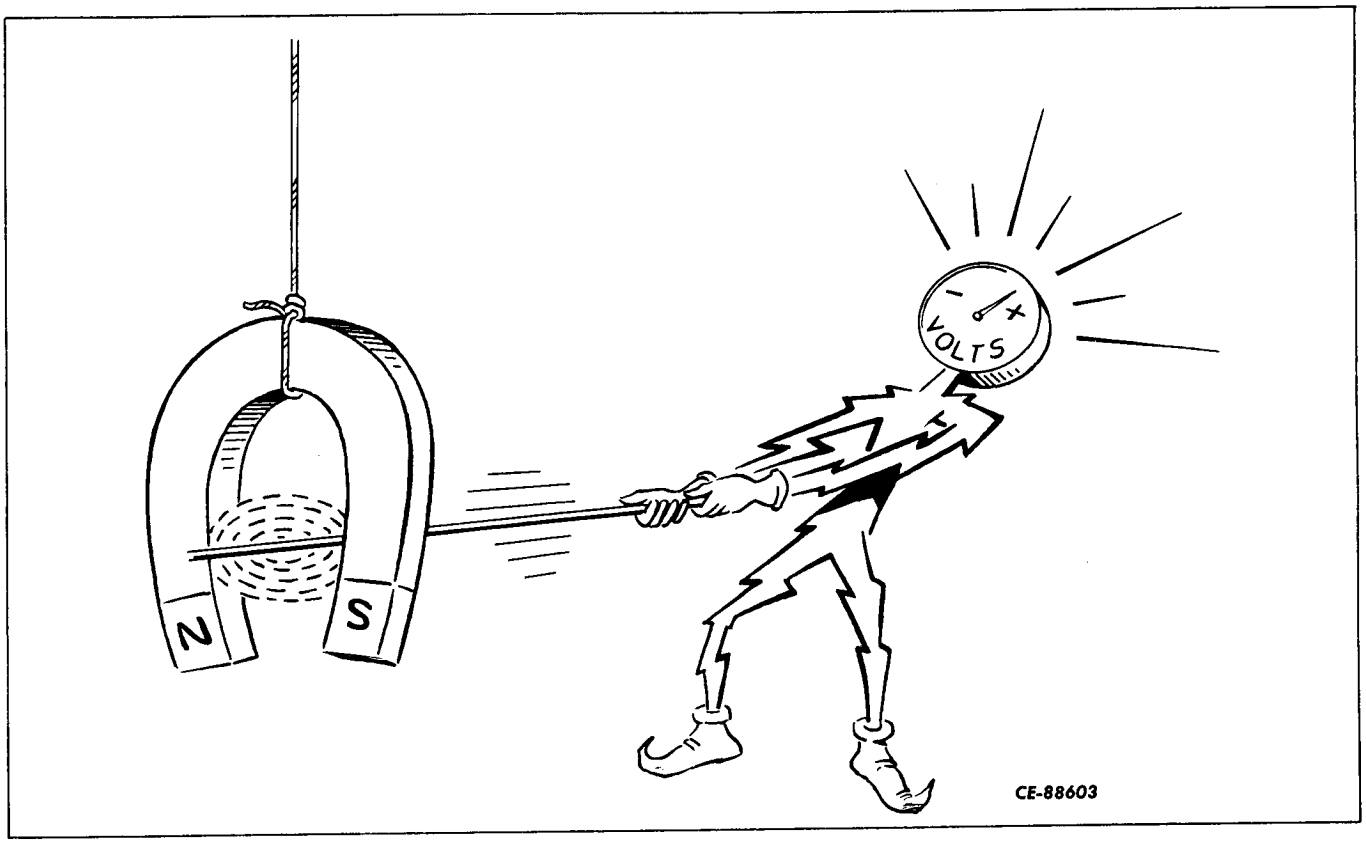

Figure 12-14

GENERATOR

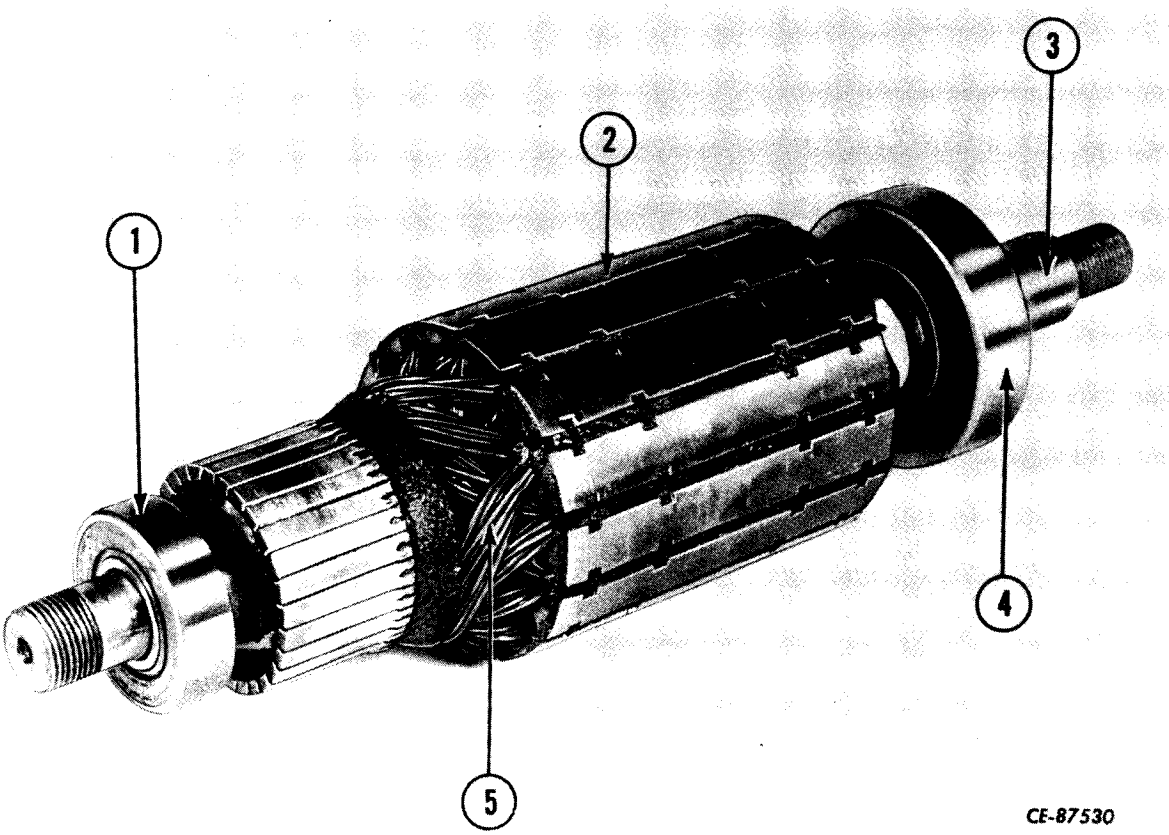

Figure 12-15

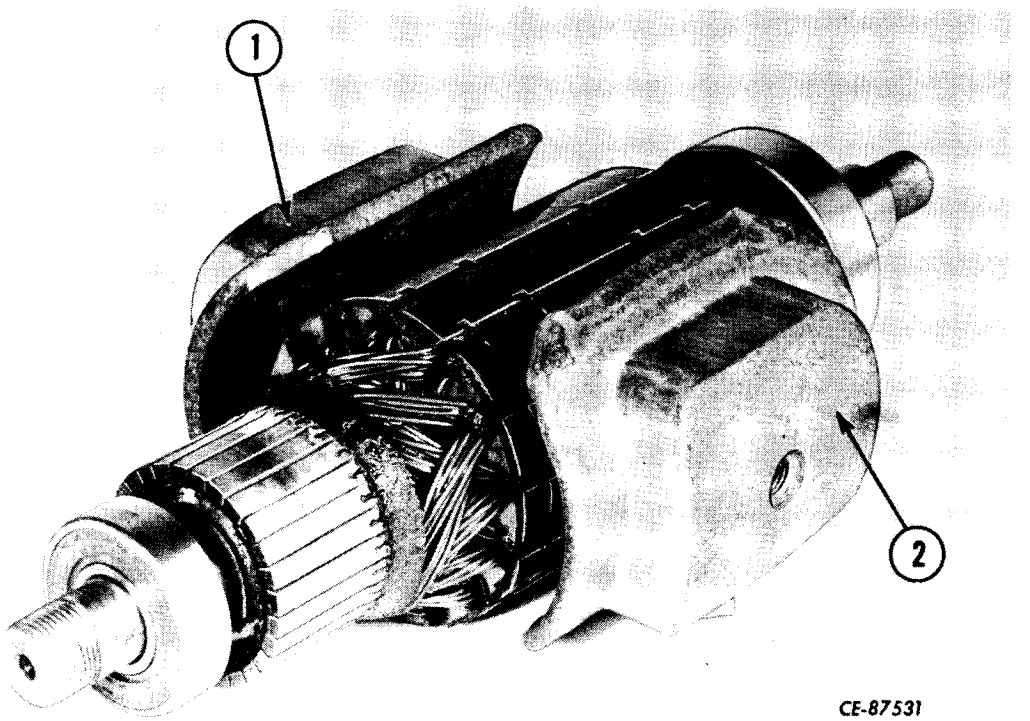

Figure 12-16

OPERATION - Continued

The pole pieces are wrapped about their length with many turns of wire (1, 2, Fig. 12-17). The pole windings are connected in series. Actually the only magnetic field present is a weak field of residual magnetism.

Returning to the armature we will see that the end of each wire is attached to a metal segment (3, Fig. 12-17). These segments, insulated from one another, are arranged in a circle about one end of the armature shaft and are referred to as the commutator. These segments are conductors of the current built up in the rotating copper wires.

In order to conduct the current away from the commutator while the armature is in motion, two carbon brushes (1, 3, Fig. 12-18) are placed opposite one another and in contact with the commutator (2). These brushes may be connected to the windings around the pole pieces (field windings) completing a circuit.

As the armature starts to turn, a small current is directed from the commutator, through the brushes, to the field windings. With current passing through the field windings and around the iron pole pieces, an electromagnet is formed. The electromagnetic field is considerably stronger than the residual field consequently the armature wires will cut a larger number of lines of force and produce a larger current with increased voltage. As the speed of rotation increases more lines of force are cut in a given time and more current flows through the field windings strengthening the magnetic field.

It may be seen then that as the speed of rotation increases the output increases. Left unchecked, the generator would reach a speed at which it would burn itself out. If other system components requiring electrical energy were connected in circuit with the generator they too would be burned out as their ability to absorb electrical energy was exceeded.

The generation of electrical current produces heat. Excessive current flow is capable of producing sufficient heat to damage the generator. Solder will be thrown from the connections; insulation will peel and split and

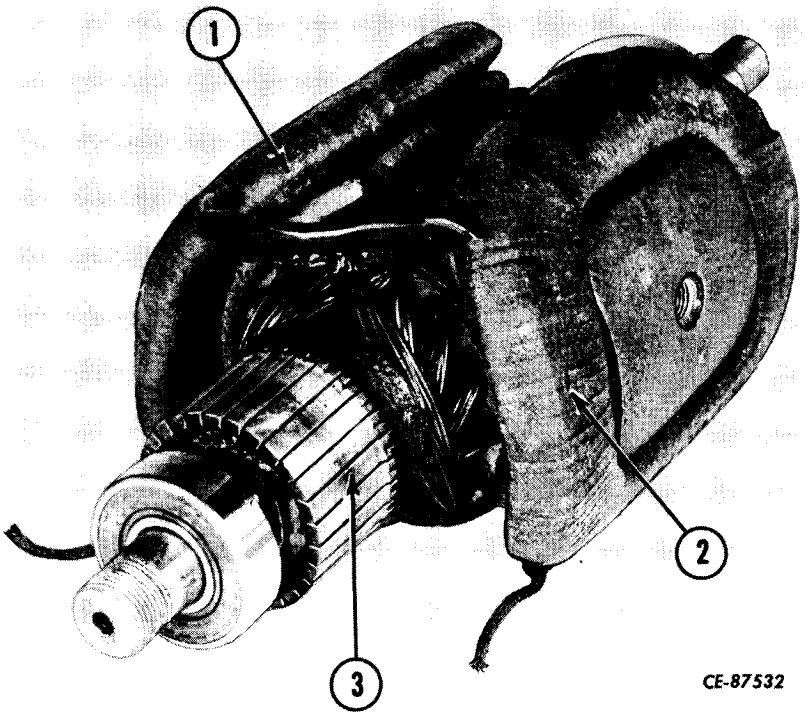

Figure 12-17

GENERATOR

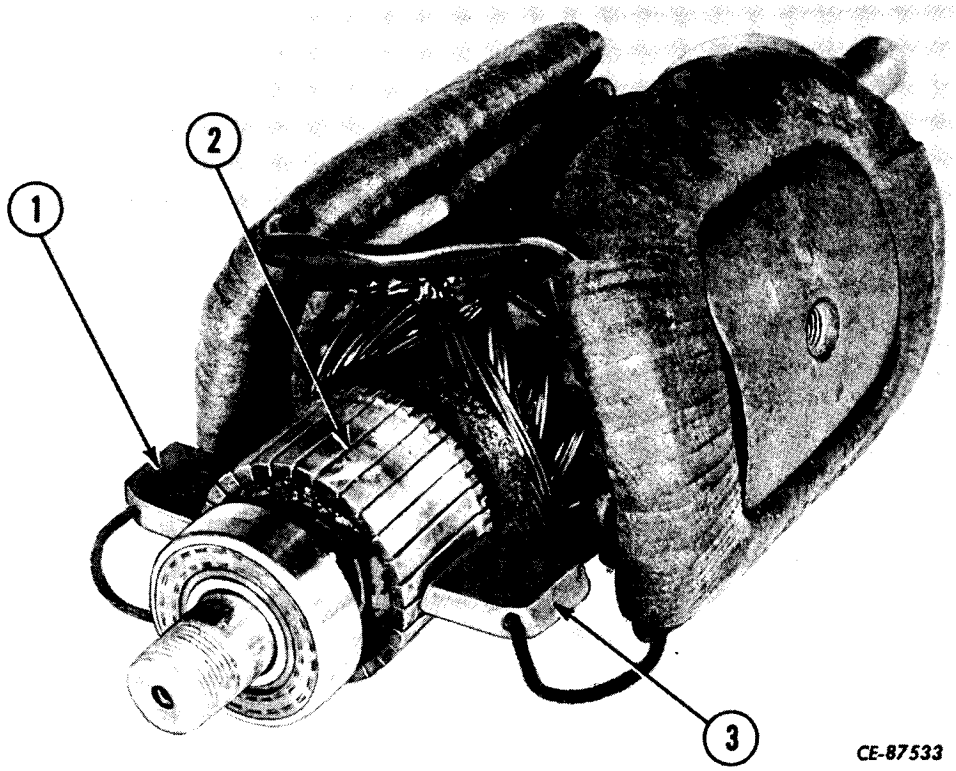

Figure 12-18

varnish will blister and chip. The necessary control and protection is provided by the regulator described elsewhere in this section. In addition, the generator is equipped with any one of a number of air cooling systems.

POLARIZING

If for any reason generator or regulator leads are disconnected, the following polarizing procedure must be performed.

After reconnecting all leads and before starting the engine, momentarily connect a jumper lead between the "BAT" and "GEN" terminal of the regulator (Fig. 12-23). This allows a momentary surge of current to flow through the generator which correctly polarizes it. Reversed polarity may result in vibration, arcing and burning of the relay contact points.

NOTE: NEVER POLARIZE AN ELECTRICAL SYSTEM EQUIPPED WITH AN ALTERNATING CURRENT GENERATOR.

SERVICE

DRIVE BELT TENSION - Neglect or improper care of the generator drive belt may result in undercharged batteries, short belt life and/or worn bearings. Overly tight belts place an additional strain on pulleys, bearings and the belts themselves. Loose belts slip, overheat and wear rapidly.

(Continued on next page)

GENERATOR

SERVICE - Continued

Check belt tension using an approved gauge at recommended check points. Refer to Section II, "ENGINE" under "DRIVE BELTS."

Replace frayed belts. Do not pry or roll belts onto pulleys. Use the adjusting mechanism provided. Relieve belt tension if the machine will be idle for a period in excess of one month.

Clean belts by wiping them off with hydraulic brake fluid. This will eliminate belt squeak.

OVERHAUL - For overhaul information and/or service contact your Delco-Remy distributor.

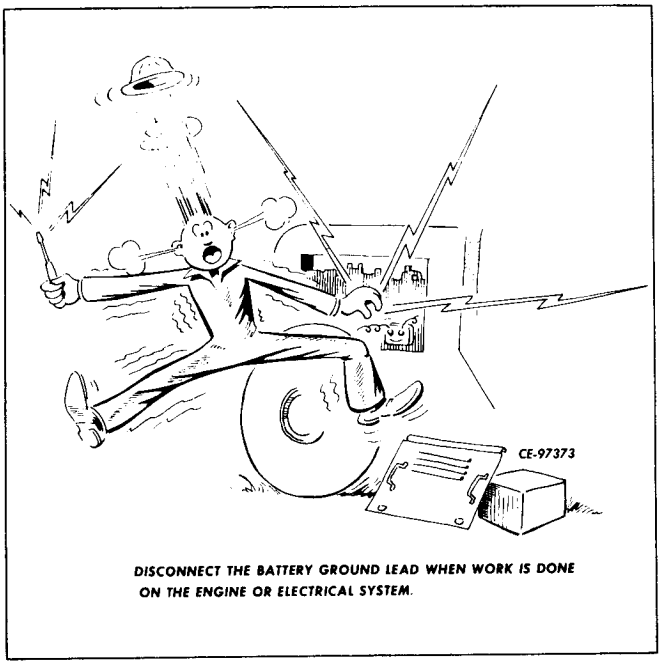

Figure 12-19

REGULATOR

DESCRIPTION

The regulator is in effect a combination relief and control valve for the electrical system. It is composed of three units; a cutout relay, a current regulator and a voltage regulator. All three units are mounted on a single chassis and share a common cover.

The regulator is required to control the generator output, divert electrical energy from the generator to charge the batteries and disconnect the generator from the battery circuit when generator voltage drops below battery voltage. Each of the three regulator units is an electromagnetic switch. The cutout relay switch closes when energized; the current regulator and voltage regulator switches open when energized.

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REGULATOR

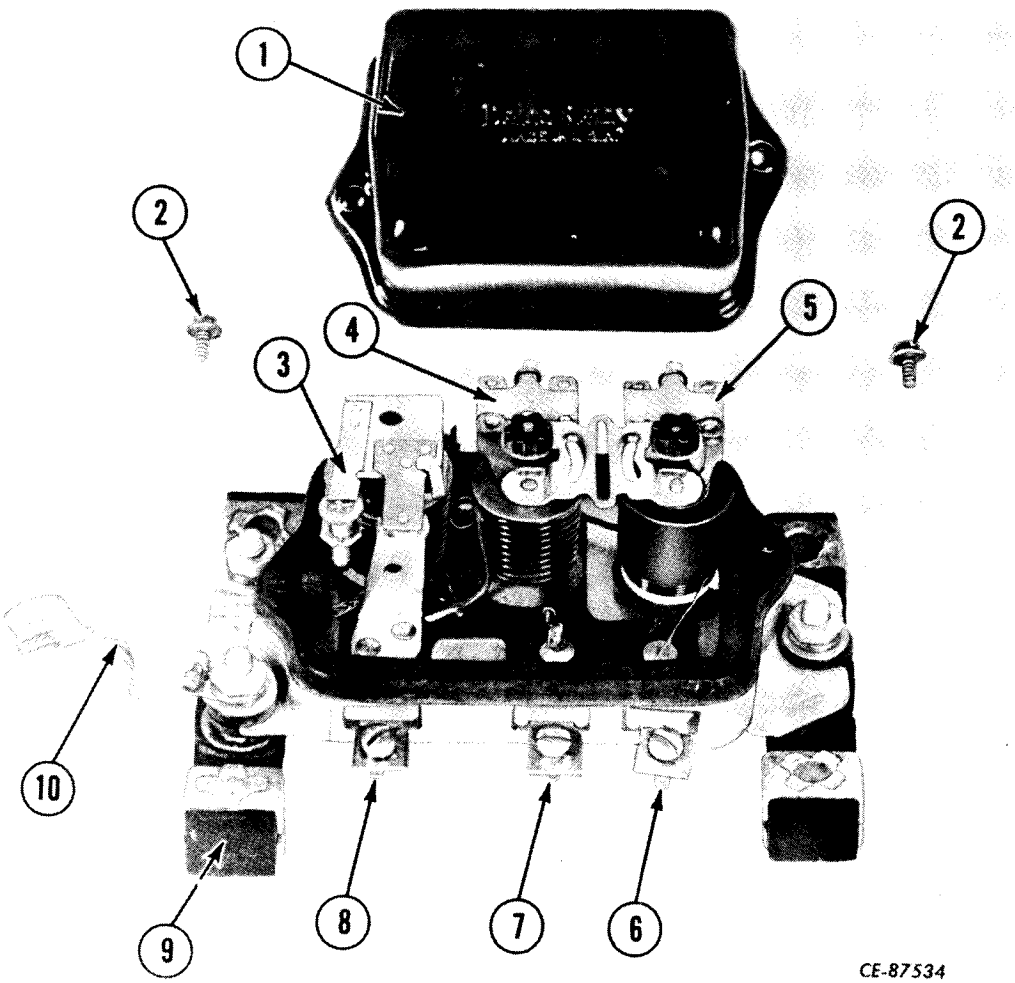

Figure 12-20
Regulator - Cover Removed.

1. Cover.
2. Cover retaining screws.
3. Cutout relay.
4. Current regulator.
5. Voltage regulator.
6. "F" Terminal.
7. "GEN" Terminal.
8. "BAT" Terminal.
9. Shock proof mounting.
10. Ground wire.

REGULATOR

OPERATION

CUTOUT RELAY - During engine starting and operation in low rpm range (below approx. 1000 rpm) the batteries supply current to the electrical system. Throughout this period the cutout points are open and the generator is disconnected from the charging system.

As engine speed increases the generator produces more and more current. A portion of this current is absorbed by the electromagnetic coil of the cutout relay. As the generator reaches a point at which its output is greater than that of the battery, the strength of the coil is great enough to attract the contact point arm and activate the switch, closing the points.

With the points closed the generator is placed in the circuit and, since its output is greater than that of the batteries the generator provides the current necessary to supply the entire system. In addition to supplying the demands of the system the generator supplies current to charge the batteries.

When the load placed upon the system exceeds the maximum output of the generator, there is insufficient current to charge the batteries. At this point the batteries work with the generator,

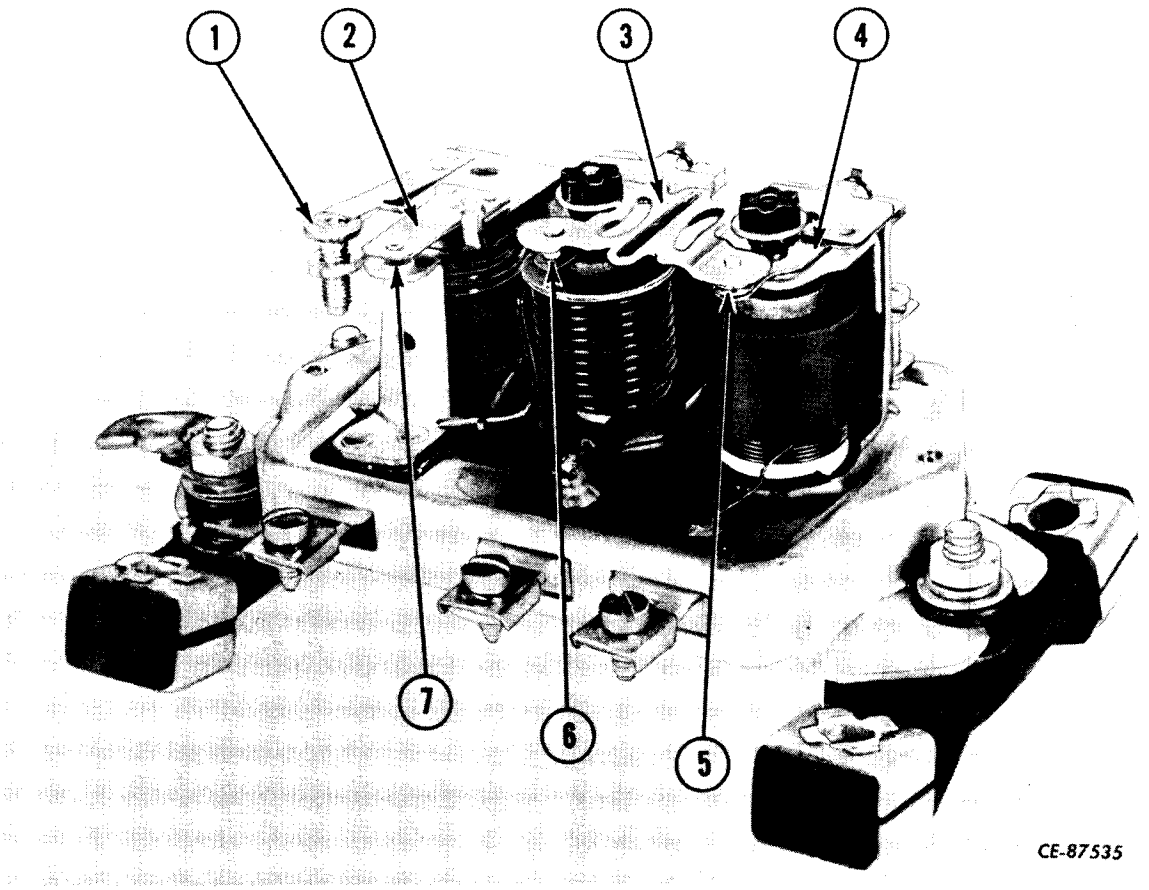

Figure 12-21
View Beneath Control Units.

1. Closing voltage adjustment screw.
2. Cutout relay.
3. Current regulator.
4. Voltage regulator.
5. Contact points.
6. Contact points.
7. Contact points.

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REGULATOR

adding their current to that being produced by the generator.

As the speed of the generator declines its output is reduced. When it decreases to a point where the battery output is stronger than the generator, the coil in the electromagnetic switch has insufficient strength to retain the contact relay arm. As the arm raises the contact points separate and the generator is taken out of the circuit. This prevents the batteries from discharging into the generator.

VOLTAGE REGULATOR - The voltage regulator, equipped with a voltage sensitive electromagnetic coil, controls the generator's field current. The amount of voltage at which the points will open is determined by adjusting the tension on the limit setting spring.

As generator output increases, voltage increases. When the voltage reaches its maximum allowable strength, coil strength is sufficient to attract the movable arm. As the arm moves down the contact points open and the current travels through a resistance unit.

Current formerly going directly to the field windings now must pass through a resistance unit. This resistance reduces field strength, cutting generator output. As output drops, coil strength diminishes releasing the movable contact arm. Once more current by-passes the resistance unit and moves directly to the field windings. This cycle is repeated at a rate of 50 to 200 times per second, holding the voltage to the predetermined maximum.

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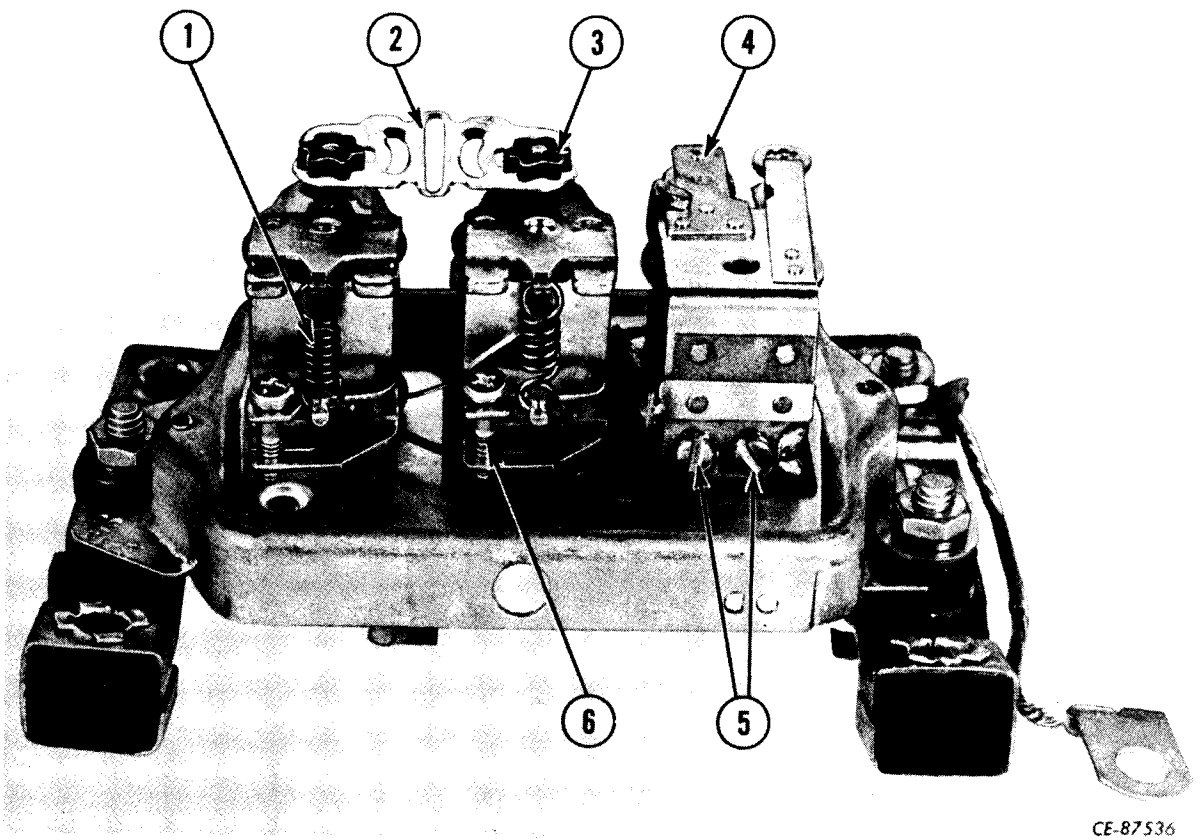

Figure 12-22
View Above Cutout Units.

1. Contact point return spring.
2. Upper contact.
3. Contact support nut.
4. Movable contact arm.
5. Air gap adjustment screws.
6. Contact point adjustment screw.

REGULATOR

OPERATION - Continued

CURRENT REGULATOR - The current regulator portion of the regulator is similar to the voltage regulator except that it contains an electromagnetic coil sensitive to current rather than voltage. The maximum allowable system current is determined, as in the case of the voltage regulator, by adjusting the amount of tension on the limit setting spring.

If the demand on the generator is great, it will by nature of its construction, attempt to supply any amount of current that is demanded of it. As it reaches its maximum allowable limit, the coil has built up sufficient strength to attract the movable arm on the contact points. As the points open, generator current is directed through a resistance unit in the field circuit thereby limiting generator output.

As generator output drops off, the magnetic attraction of the current regulator coil weakens and the tension on the limit spring returns the movable contact arm to the closed position. With the points closed, current may now flow directly to the generator field allowing an increase in generator output. This cycle repeats itself 50 to 200 times a second, restricting current output to the predetermined maximum.

Both voltage regulator and current regulator use the same field resistance. This is possible because due to their electrical characteristics only one may operate at any given time. As a rule, at times of high current draw, voltage is low, and conversely when current draw is low, voltage is high.

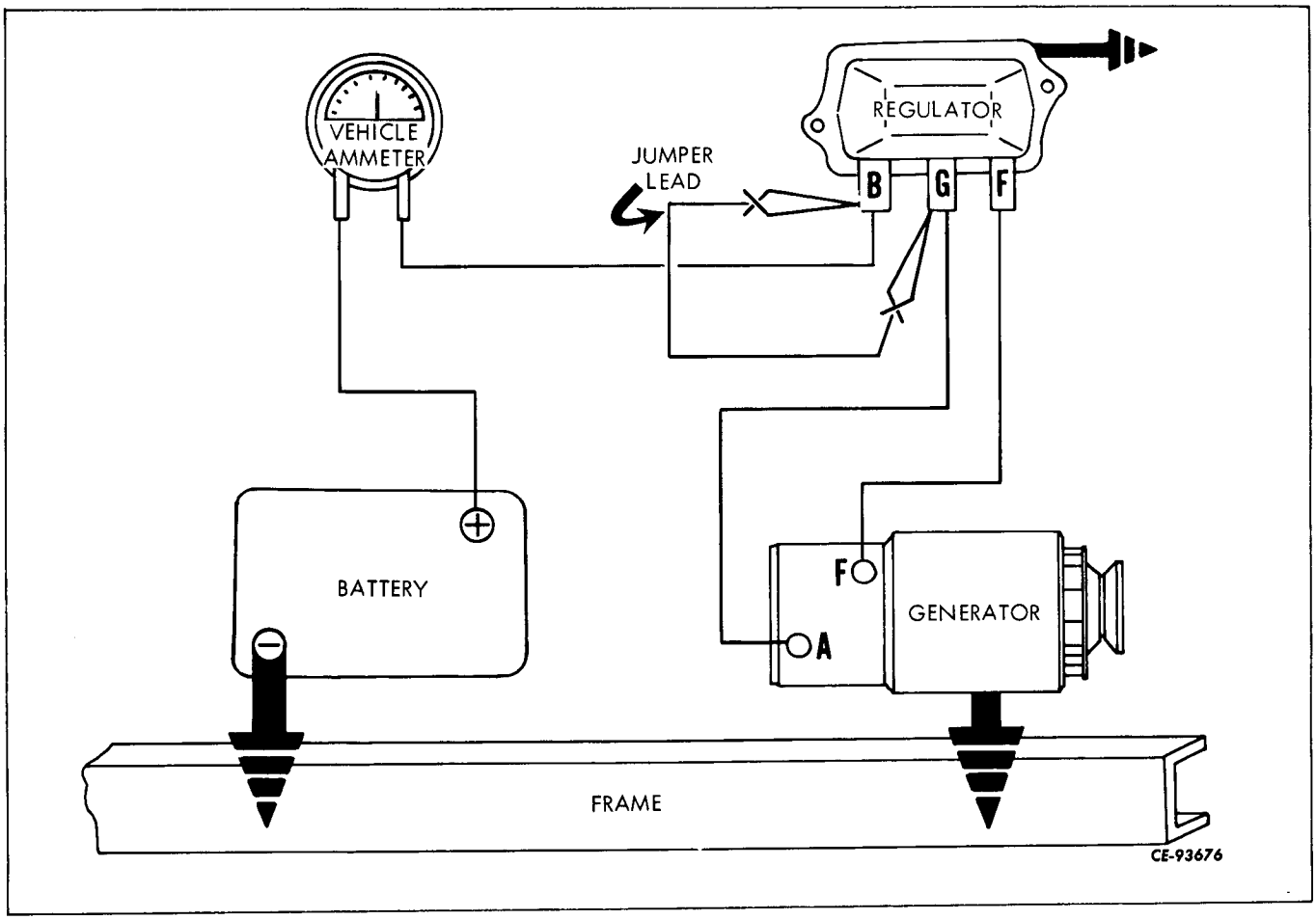

Figure 12-23

REGULATOR

POLARIZING

If for any reason generator or regulator leads are disconnected, the following polarizing procedure must be performed.

After reconnecting all leads and before starting the engine, momentarily connect a jumper lead between the "BAT" and "GEN" terminal of the regulator (Fig. 12-). This allows a momentary surge of current to flow through the generator which correctly polarizes it. Reversed polarity may result in vibration, arcing and burning of the relay contact points.

NOTE: NEVER POLARIZE AN ELECTRICAL SYSTEM EQUIPPED WITH AN ALTERNATING CURRENT GENERATOR.

SERVICE

For service and/or overhaul information contact your local Delco-Remy distributor.

CRANKING MOTOR

DESCRIPTION

A simple description of the cranking motor, commonly referred to as the "STARTER," is an electric motor used to rotate the engine crankshaft during the starting procedure. In reality this is an oversimplified explanation. The cranking motor is an electric motor of a

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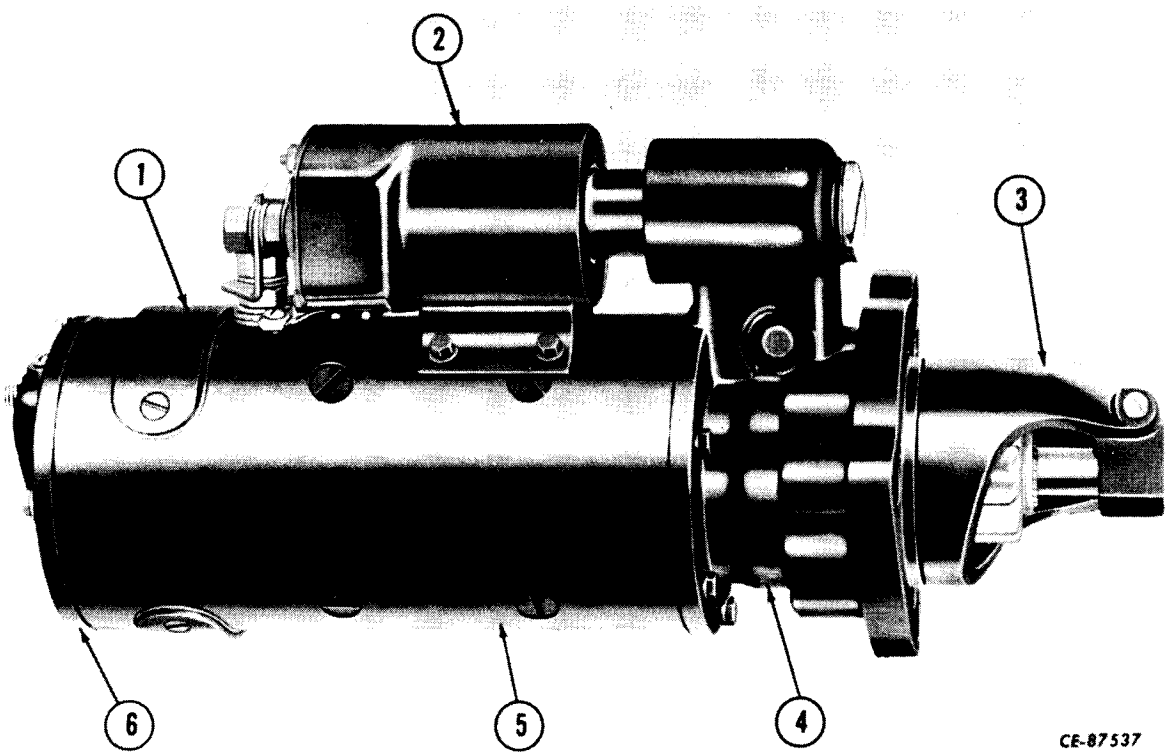

Figure 12-24
Cranking Motor.

1. Cover plate.
2. Solenoid.
3. Nose housing.
4. Lever housing.
5. Field frame.
6. Commutator end frame.

CRANKING MOTOR

DESCRIPTION - Continued

highly specialized design. It is capable of producing high horsepower and tremendous torque despite its small size. This high output is restricted to very short intervals; 30 seconds or less. During its periods of operation the motor is actually overloaded and if subjected to long periods of continuous operation will burn itself out.

One end of the cranking motor is fitted with a pinion gear to engage the engine flywheel and one of several different engagement mechanisms. Mounted on top of the motor housing is a heavy duty solenoid used to actuate the engaging mechanism. The ratio of the drive pinion to the flywheel ring gear is approximately 15 or 20 to 1; that is 20 teeth on the ring gear for each tooth on the pinion. This allows the cranking motor to operate at a high rpm and exert a considerable amount of torque.

OPERATION

Current enters the cranking motor and passes through the field windings developing a magnetic field. The current then passes to the commutator brushes, commutator and then through the armature windings developing a second magnetic field. As the two strong magnetic fields oppose each other it causes the armature to rotate.

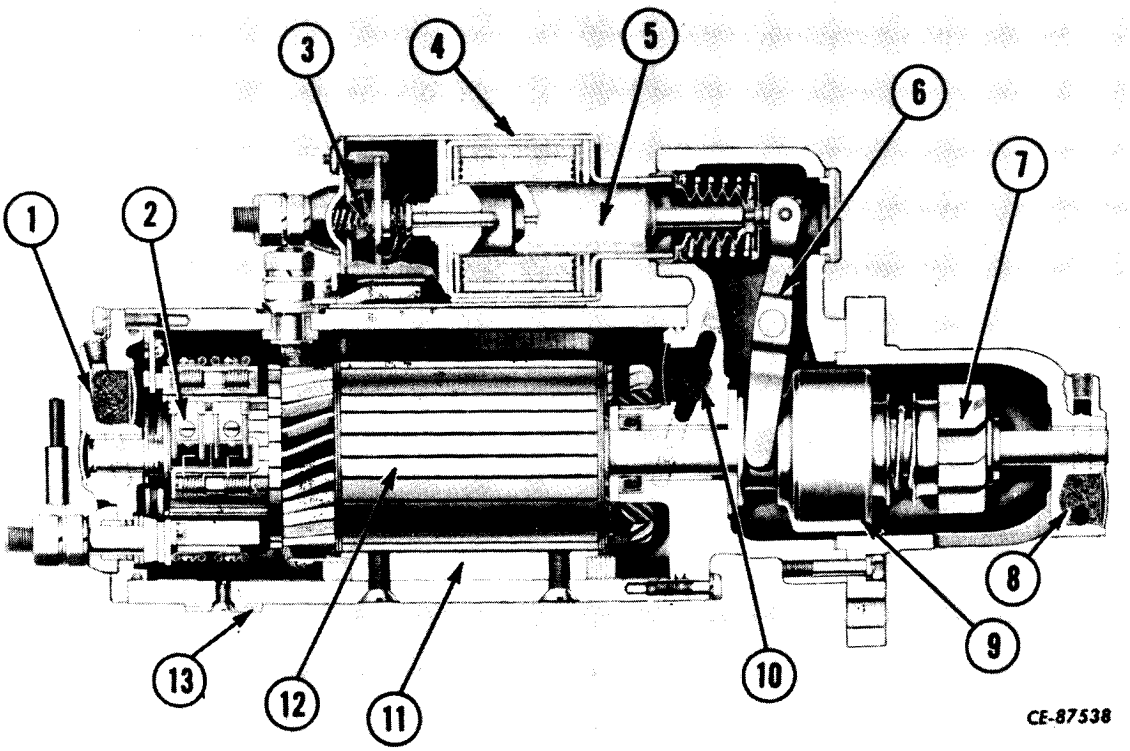

Figure 12-25
Cranking Motor - Cross Section.

1. Oil reservoir.
2. Brushes.
3. High amperage switch.
4. Solenoid housing.
5. Solenoid plunger.
6. Pivoting shift lever.
7. Pinion gear.
8. Oil reservoir.
9. Sprag clutch.
10. Oil reservoir.
11. Field winding.
12. Armature.
13. Brush inspection plate.

CRANKING MOTOR

The cranking motor employed on the H-90E is equipped with an overrunning clutch drive mechanism. A solenoid is mounted on top of the motor housing. The solenoid plunger is connected to one end of a pivoting shift lever, the opposite end of the lever engages the drive pinion mechanism. The pinion mechanism uses a sprag type clutch to drive the pinion gear. A high amperage switch is located in the end of the solenoid opposite that from which the plunger rod projects.

When the solenoid is energized the plunger is drawn to the left (Fig. 12-25) pulling the upper end of the shift lever to the left. This forces the lower end of the lever to the right moving the attached pinion assembly into the engage position. Both the spirally splined sleeve on which the pinion rides and the bevels on the gear teeth allow the pinion to rotate during engagement. Should a butt tooth engagement occur, a pinion block prevents the closing of the contact points and resultant spinning meshes with the ring gear. A second try will engage the pinion.

As the solenoid plunger reaches the end of its stroke it activates the high amperage switch allowing battery current to flow into the cranking motor. As the cranking motor shaft begins to rotate, the sprags, by nature of their design wedge themselves between their housing and the pinions spiral spline causing the pinion, spiral spline, sprag clutch and motor armature to rotate as a unit. The pinion being in mesh with the flywheel ring gear causes the engine crankshaft to rotate.

When the engine starts, it drives the pinion faster than the armature is rotating. This relieves the jamming action of the sprags and the pinion "freewheels" within the starting housing. As the operator releases the starting switch, the solenoid is de-energized allowing the return spring in the solenoid to move the plunger to the right (Fig. 12-25). When the plunger moves to the right the shift lever draws the pinion assembly from the engage position. At the same time the plungers movement to the right breaks the contact at the high amperage switch, stopping armature rotation.

SERVICE

At 200 hour intervals the housing cover plates should be removed and accumulated dust and dirt blown out with a jet of compressed air. At the same time inspect the brushes to be sure they are in good condition and capable of another 200 hours of service.

For further service and overhaul information contact your local Delco-Remy distributor.

INSTRUMENTS

The instruments, housed in the panel and box assembly to the left of the operator's seat are self explanatory. Each indicates the immediate condition of the system to which it is connected. The converter temperature gauge, hourmeter, fuel gauge, engine oil pressure gauge, engine temperature gauge and ammeter are all electrically operated. Due to the complex construction of each gauge and their relative low cost, repair parts for gauges are not offered. If a gauge is proven to be defective it should be replaced.

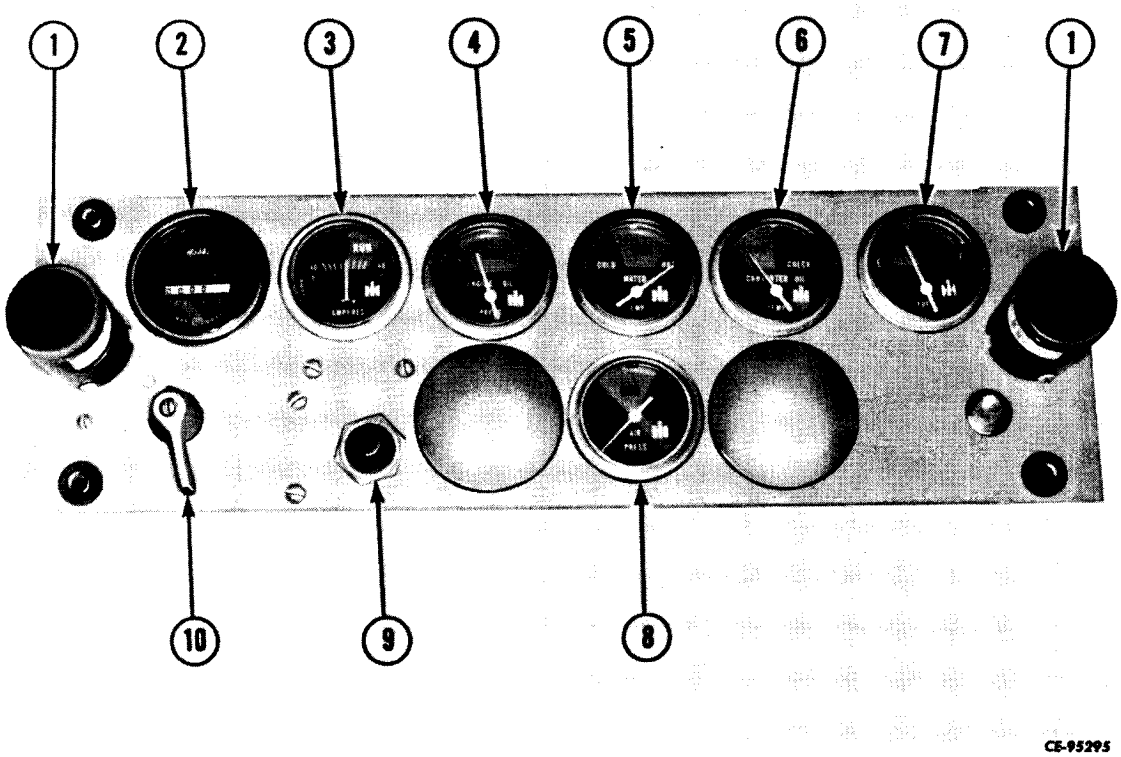

Figure 12-26
Instrument Panel.

1. Panel light.
2. Hourmeter.
3. Ammeter.
4. Engine oil pressure.
5. Engine temperature.
6. Converter temperature.
7. Fuel gauge.
8. Air pressure.
9. Starter button.
10. Combination light and main electrical switch.

TROUBLE SHOOTING

The electrical system, as previously mentioned, may be divided into two circuits, the cranking circuit and the charging circuit. To trouble shoot the system, a primary analysis should be made to determine which circuit is at fault.

COMPLAINT	POSSIBLE CAUSE	REMEDY
Charge too low or no charge at all.	1. Defective battery. 2. Slipping generator drive belt. 3. Defective generator. 4. Malfunctioning regulator.	1. Replace battery. 2. Adjust drive belt. 3. Repair or replace generator. 4. Adjust or replace regulator.
Charge too high; overcharged battery.	1. Malfunctioning regulator. 2. Incorrect pulley used on generator.	1. Adjust or replace regulator. 2. Replace with pulley of correct size.
Battery uses an excessive amount of water.	1. Charging rate too high. 2. Incorrect pulley used on generator.	1. Check and adjust or replace regulator. 2. Check pulley size.
Rapid burn out of light bulbs.	1. Charging rate too high.	1. Check and adjust or replace regulator. Check pulley size.
Cranking motor operates slowly or not at all.	1. Battery discharged. 2. Defective cranking motor. 3. Corroded, loose or defective cables. 4. Defective solenoid.	1. Recharge battery. 2. Repair or replace cranking motor. 3. Clean, tighten or replace cables. 4. Replace solenoid.
Low or intermittent generator output.	1. Dirty or worn generator commutator. 2. Brush(es) sticking. 3. Weak brush springs.	1. Clean or repair commutator or replace armature. 2. Clean brush holders thoroughly. Replace brushes if necessary. 3. Replace springs.

(Continued on next page)

TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Low or intermittent generator output. (Continued)	4. Slipping drive belt.	4. Adjust drive belt.
	5. Malfunctioning regulator.	5. Adjust or replace regulator.
Lights dim.	1. Batteries low.	1. Charge batteries.
	2. Poor ground.	2. Provide a clean, tight ground.
	3. Loose connections.	3. Tighten all connections.
One electrical gauge not operating.	1. Bad connection at gauge, connector plug or sender.	1. Make a positive connection.
	2. Sender defective.	2. Replace.
	3. Gauge defective.	3. Replace.
Ignition "ON"- no gauges or lights working.	1. Dead battery.	1. Recharge or replace.
	2. Loose connection from battery to ammeter.	2. Tighten or correct.
	3. Broken wire between battery and ammeter.	3. Repair or replace.
Ignition "ON" - no electrical gauges working or lights operating.	1. Bad connection between ammeter, circuit breaker or ignition switch to gauges.	1. Make a positive connection.
All electrical gauges working. No lights.	1. Loose connection between ammeter and switch.	1. Tighten.
	2. Bad light switch.	2. Replace.

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DEFINITIONS

AMPERE - The electrical current produced by one volt acting through a resistance of one ohm.

AMPERE HOUR - A unit of measure for battery capacity, obtained by multiplying the current flow in amperes by the time in hours during which the current flows. For example, a battery delivering 3 amperes for 20 hours is rated at 60 ampere hours.

CIRCUIT - The complete path of an electrical current including, usually, the generating device. The complete path is referred to as a closed circuit. If the continuity is broken it becomes an open circuit.

FIELD - The lines of force set up by a permanent or electromagnet.

GROUND - The conducting body used as a common return for an electric circuit.

OHM - The resistance of a circuit in which a potential difference of one volt produces a current of one ampere.

POLARITY - The particular state, either positive or negative with regard to electrification.

RESISTANCE - The opposition offered by a substance or body, to the passage through it of an electric current.

VOLT - The electromotive force which steadily applied to a conductor whose resistance is one ohm, will produce a current of one ampere.

WATT - The work done by one ampere of current under one volt of pressure.

WATT-HOUR - The unit of electrical energy obtained by multiplying the ampere hour output by the average voltage during the discharge. Watt-hours = volts x amperes x hours.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SECTION XIII

BRAKE SYSTEM

Page

SECTION XIII BRAKE SYSTEM

GENERAL INFORMATION

DESCRIPTION

This section has been prepared for convenient reference to information on the H-90E Brake System. It presents a description of the Brake System, its operation, maintenance and repair. Also operation and repair of brake components.

The tractor brake system is a combination air over hydraulic type. An engine driven compressor supplies compressed air for the system. The compressed air is stored in air reservoirs located under the operator's compartment deck. Air compressor output is regulated by a governor. Brake operation is controlled by two brake treadle valves. When a brake treadle is depressed, a flow of compressed air is directed from the dry reservoir to the power clusters. The air cylinders in the power clusters then act upon the hydraulic cylinder portions directing a flow of hydraulic fluid to the wheel cylinders in each brake assembly, applying the wheel brakes.

The late type system (Fig. 13-1) includes valving in the left hand treadle valve to apply the brakes automatically when the pressure drops to 50 psi. A warning buzzer sounds when the pressure drops to 60 psi.

Legend for Figure 13-1

1. Air compressor.
2. Governor.
3. Hydraulic brake line to left rear wheel cylinder.
4. Boom kick-out control valve.
5. Air pressure gauge.
6. Right hand treadle valve.
7. Left hand treadle valve (includes section for automatic brake application).
8. Horn valve.
9. Double check valve.
10. Double check valve.
11. Left hand power cluster.
12. Check valve.
13. Moisture ejector.
14. Wet reservoir.
15. Hydraulic brake line to left front wheel cylinder.
16. Hydraulic brake line to right front wheel cylinder.
17. Safety valve.
18. Drain cocks.
19. Check valve.
20. Dry reservoir.
21. Horns.
22. Right hand power cluster.
23. Loader control valve.
24. Transmission disconnect.
25. Hydraulic brake line to right rear wheel cylinder.

BRAKE SYSTEM

GENERAL INFORMATION

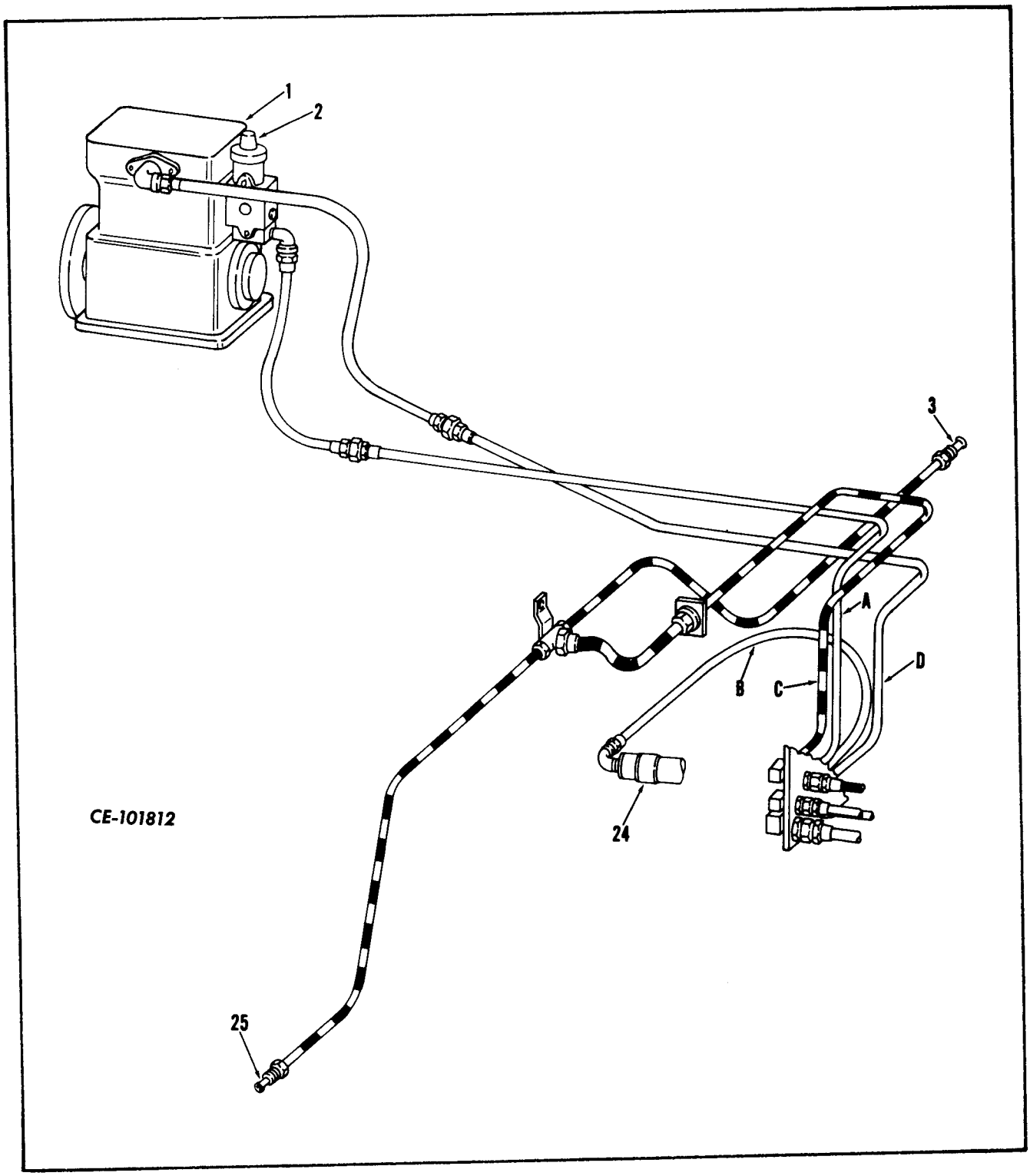

Figure 13-1
Brake System Schematic – Late Type Including
Low Pressure Automatic Brake Application (Sheet 1 of 2).

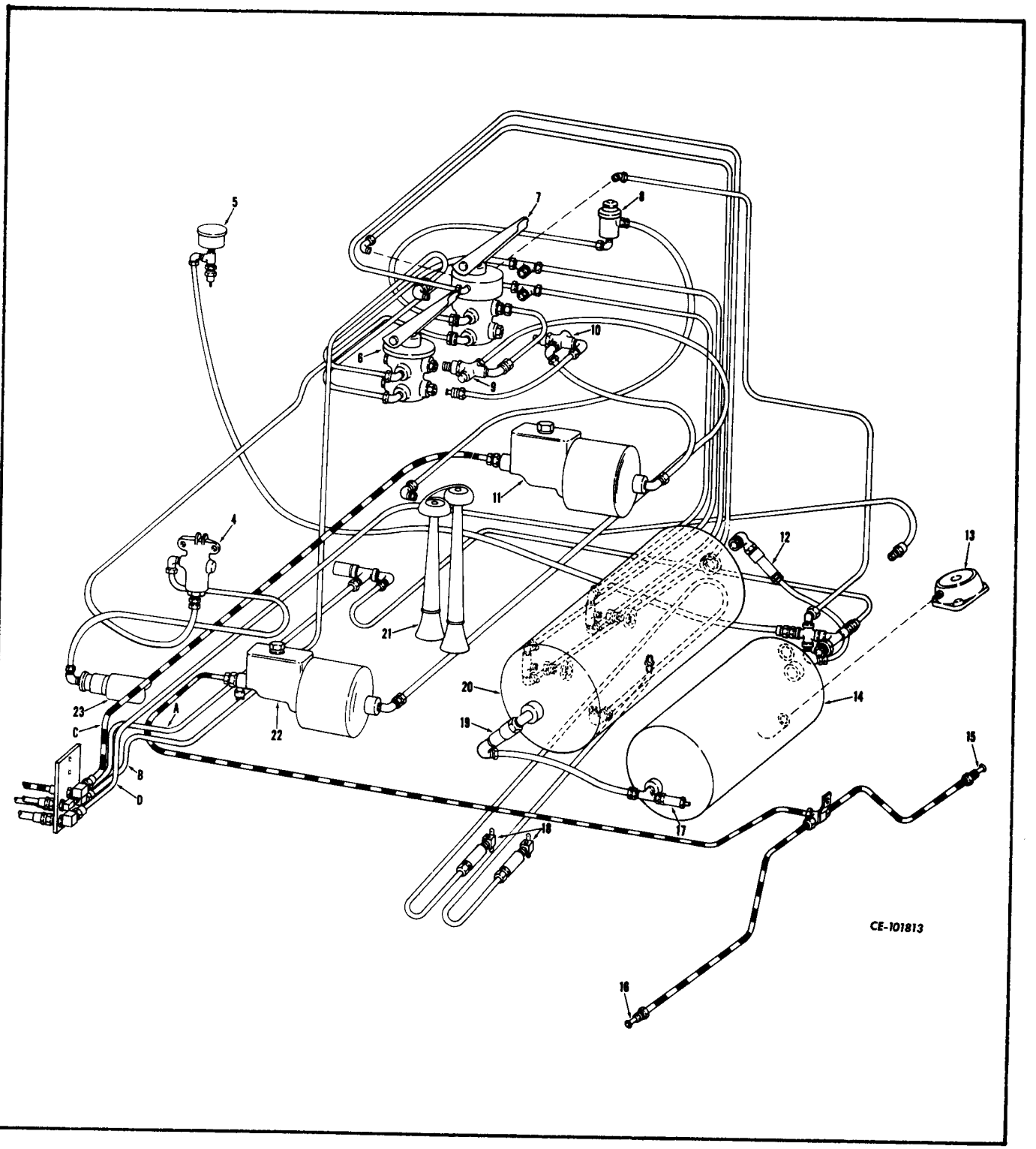

Figure 13-1
Brake System Schematic – Late Type Including
Low Pressure Automatic Brake Application (Sheet 2 of 2).

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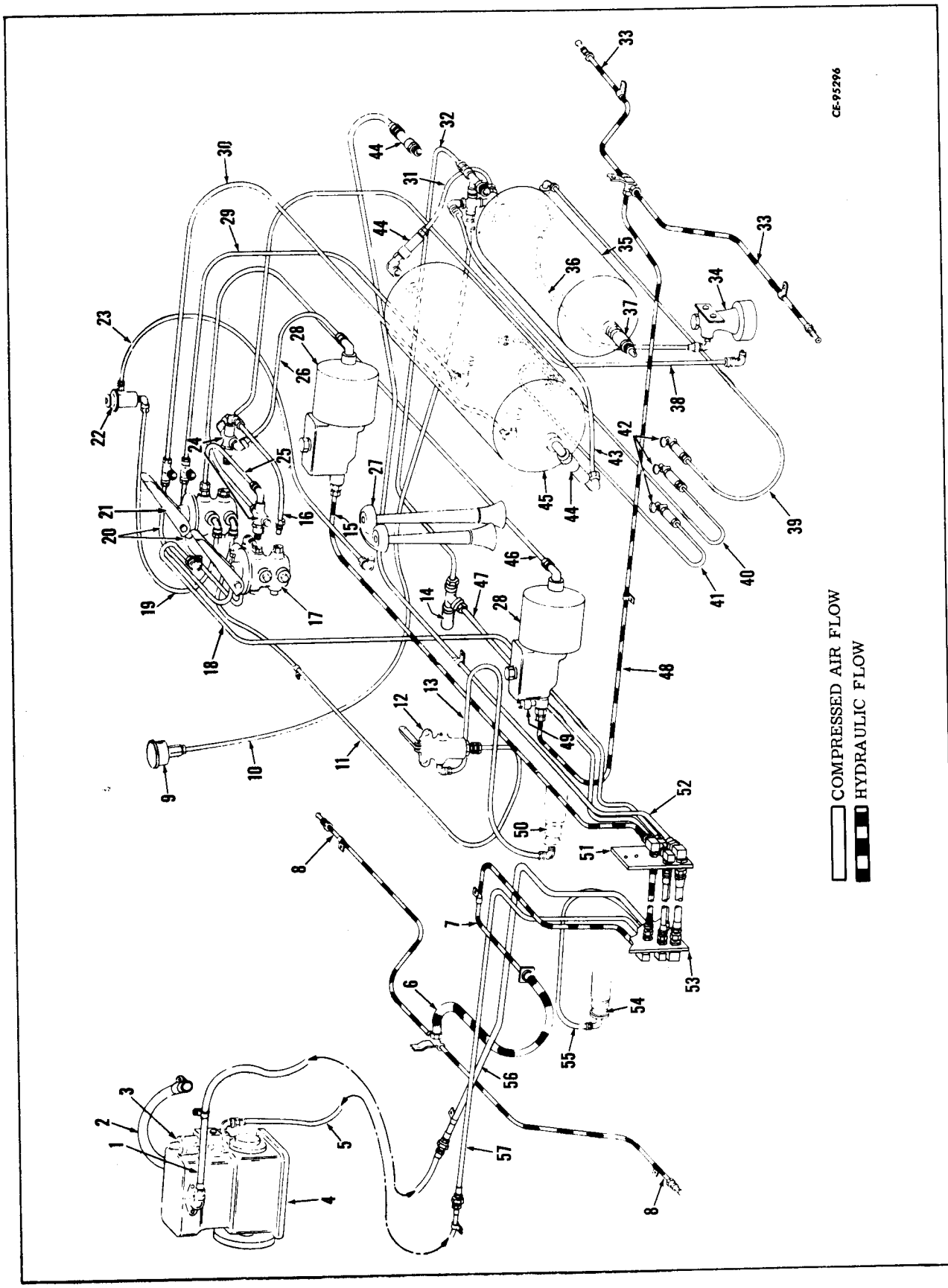

Figure 13-1A
Brake System Schematic – Early Type Without Low Pressure Automatic Brake Application.

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GENERAL INFORMATION

Legend for Figure 13-1A

1. Line, compressor outlet.
2. Line, air cleaner to compressor.
3. Governor.
4. Compressor.
5. Line, governor inlet.
6. Line, tube to tee hydraulic.
7. Line, hose to bulkhead.
8. Line, tee to wheel cylinder.
9. Air pressure gauge.
10. Line, tank to gauge.
11. Line, treadle valve to kickout control.
12. Kickout control valve.
13. Line, kickout to boom spool.
14. Check unit.
15. Line, power cluster outlet.
16. Line, valve to double check valve.
17. RH treadle valve.
18. Line, treadle to transmission.
19. Line, treadle to horn valve.
20. Line, treadle to treadle.
21. LH treadle valve.
22. Horn valve.
23. Line, horn valve to horn.
24. Double check valve.
25. Line, valve to double check valve.
26. Line, valve to power cluster.
27. Horn.
28. Power cluster.
29. Line, reservoir to valve.
30. Line, reservoir to valve.
31. Line, reservoir to check valve.
32. Line, reservoir to check unit.
33. Line, tee to wheel cylinder.
34. Moisture ejector.
35. Wet reservoir.
36. Line, reservoir to ejector.
37. Safety valve.
38. Line, valve to ejector.
39. Line, reservoir to drain.
40. Line, reservoir to drain.
41. Line, reservoir to drain.
42. Drain valves.
43. Line, reservoir to reservoir.
44. Check valve.
45. Dry reservoir.
46. Line, valve to power cluster.
47. Line, tee to bulkhead.
48. Line, cluster to tee.
49. Stop light switch.
50. Main control valve.
51. Front bulkhead support.
52. Line, reservoir to bulkhead.
53. Rear bulkhead support.
54. Transmission disconnect.
55. Line, bulkhead to transmission.
56. Line, compressor line to bulkhead.
57. Line, bulkhead to governor.

PREVENTIVE MAINTENANCE

In order to insure proper operation, the brake system components should be properly maintained.

Periodic maintenance operations are listed in the table on page 4. These operations should be performed at the time intervals listed.

DRAIN MOISTURE FROM RESERVOIRS

The tractor's compressed air system will normally be kept free of accumulations of emulsified oil and moisture by the system's moisture ejector, Fig. 13-2. The ejector removes accumulations automatically when the tractor brakes are applied and air pressure exists in the system.

Each air tank in the air system is provided with a drain valve so condensation that may collect during tractor storage can be removed. Charge the air system and open each drain valve to remove condensation from air tanks.

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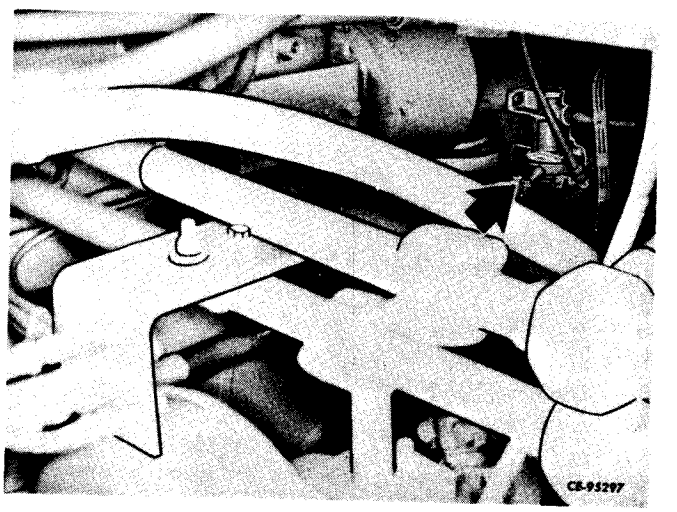


Figure 13-2

PREVENTIVE MAINTENANCE - Continued

MAINTENANCE OPERATIONS	HOUR INTERVAL						
	10	100	200	500	1000	1500	3000
Drain moisture from reservoirs	X						
Check fluid level in power clusters		X					
Check compressed air system			X				
Lubricate brake treadle valves			X				
Check and adjust brake lining to drum clearance			X				
Clean or replace governor filters				X			
Inspect brake treadle valves				X			
Inspect air compressor					X		
Check and adjust compressor unloader valve clearance					X		
Disassemble and clean safety valve						X	
Disassemble and clean double check valve						X	
Disassemble and clean moisture ejector valve						X	
Disassemble and clean air compressor							X
Disassemble and clean governor							X
Disassemble and clean treadle valves							X

CHECK FLUID LEVEL IN POWER CLUSTERS

Hydraulic brake fluid level in the power clusters should be kept within 1/2 inch to 3/8 inch of the filler hole to prevent the possibility of air entering the hydraulic brake system. Clean around the filler hole of the power clusters before removing plug. If fluid must be added, use the type listed in "SPECIFICATIONS."

CHECK COMPRESSED AIR SYSTEM

Both the compression and application parts of the air system should be checked periodically. Exhaust any air that may be present in system by making several brake applications or by opening all air tank drain valves. Close drain valves after exhausting all compressed air from system. Air system gauge on the instrument

panel should indicate that no pressure is present in system. Start engine to build system pressure. With all air system devices in a non-apply condition and engine running at fast idle, the pressurizing part of the system should develop 50 to 90 pounds within 5 minutes. After system governor cuts out at maximum system pressure, stop engine. Leakage rate in pressurizing part of air system should not exceed 2 pounds per minute. With brakes fully applied, leakage rate in application part of air system should not exceed 3 pounds per minute.

If pressure drops are excessive in either part of the air system, check the system for leaks. Cover all tubing connections, valve port openings and gaskets with soap suds. Leaks will be indicated by the formation of bubbles in the soap suds.

BRAKE TREADLE VALVES

Lift the boot under the treadle away from the mounting plate and lubricate the valve plunger with a few drops of SAE 20 MS Oil (MIL-L-2104). Wipe off excess oil and replace the rubber boot on the mounting plate. Avoid using too much oil. It could contact and deteriorate the rubber spring in the top of the valve.

Inspect the inlet and exhaust valve, exhaust diaphragm, "O"-rings, and rubber graduating spring. If any parts show signs of wear or damage, they should be replaced.

Disassemble and clean the tractor brake treadle valves periodically to insure proper operation. Refer to "BRAKE TREADLES" for service procedures.

GOVERNOR

The two small screen filters in the compressor and reservoir ports of the governor should be cleaned or replaced periodically. To clean, disconnect the air lines to the governor and rinse filters with a cleaning solvent which is known to have no detrimental effect on metal or rubber materials. If the filters are removed, they should be replaced.

The governor should be disassembled, cleaned, and reset to assure proper operation. Refer to "GOVERNOR" for service procedures.

AIR COMPRESSOR

Remove the compressor discharge line and check for excessive carbon build-up. If excessive carbon is found, clean or replace the compressor cylinder head. The discharge line should also be inspected and replaced if necessary.

The air compressor should be disassembled, cleaned and assembled at recommended intervals. Refer to "DISASSEMBLY, INSPECTION AND ASSEMBLY."

SAFETY VALVE

The safety valve on the wet reservoir should be disassembled, cleaned, and reset to assure proper operation. Refer to "SAFETY VALVE" for service procedures.

MOISTURE EJECTION VALVE

To insure continuous operation the moisture ejection valve should be disassembled and cleaned periodically. Refer to "MOISTURE EJECTION VALVE" for service procedures.

DOUBLE CHECK VALVE

The double check valve should be disassembled and cleaned periodically to assure proper operation. Refer to "DOUBLE CHECK VALVE" for service procedures.

ADJUST BRAKES

Jack up the wheel to be adjusted. Remove the adjustment covers in the brake backing plate. Using a brake adjusting tool, rotate the star wheels until lining drags on drum. Rotate wheel being adjusted.

Rotate star wheels in opposite direction until drag is relieved.

REQUIRED TOOLS

Standard Mechanics Hand Tool Set.
Torque Wrench - 0-500 ft. lbs. rating.

DISASSEMBLY, INSPECTION AND A...

GENERAL

Disassembly, inspection, and reassembly instructions for the tractor or brake system are given in this section.

Before servicing any portion of the brake system, park the tractor on a level surface, preferably in an enclosure, and set the parking brake, the tractor wheels may also be blocked to prevent the tractor from rolling, lower the bucket to ground level and shut down the engine. Release the air from the system by opening the reservoir drains.

GOVERNOR

REMOVAL

Disconnect the unloader line (2, Fig. 13-3) from the governor (1). Remove the cap screws, lock washers and nuts that secure the governor. Remove the governor.

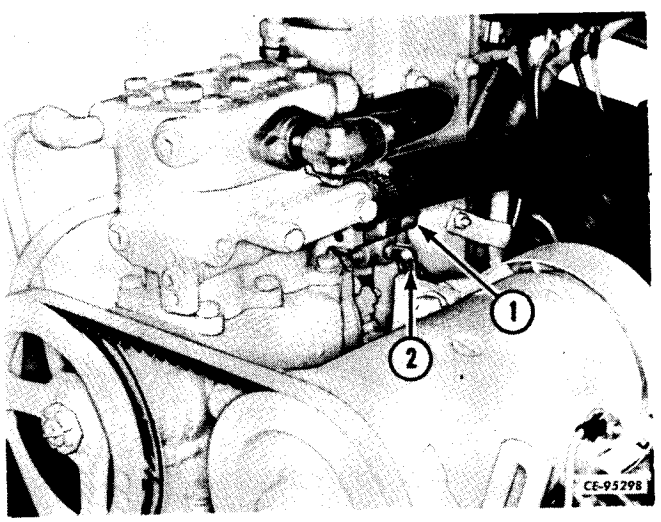


Figure 13-3

DISASSEMBLY

Clean the exterior of the governor with a good cleaning solvent.

Remove the pipe plugs (1, Fig. 13-4) from the governor body (2).

Figure 13-4

Unscrew the cover (3, Fig. 13-5). Using a snap ring pliers, remove the retaining ring (2) from the governor body (4). Slide the adjusting screws and spring assembly (1) from the body.

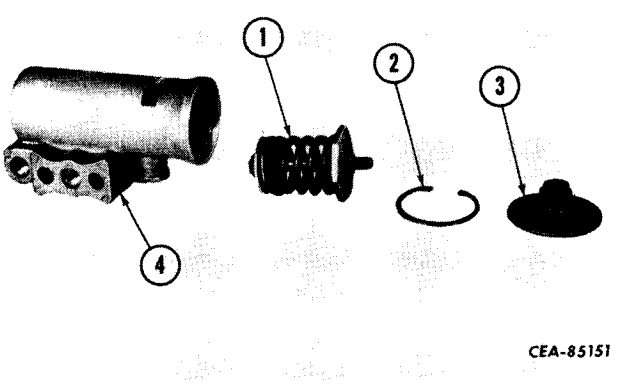
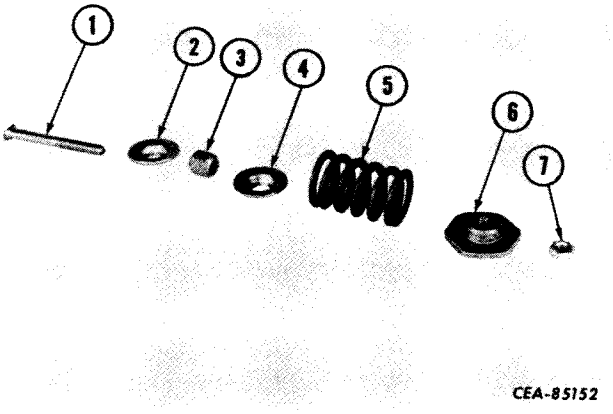


Figure 13-5

Remove the locknut (7, Fig. 13-6) from the adjusting screw (1). Unscrew the adjusting screw (1) from the upper spring seat (6). Remove the spring (5), lower spring seats (2 and 4), and guide (3).

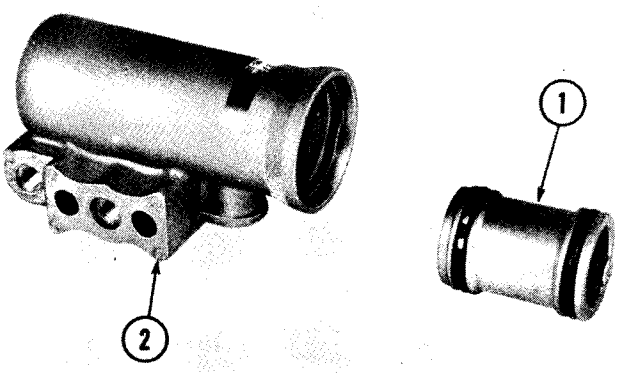
DISASSEMBLY, INSPECTION AND ASSEMBLY



CEA-85152

Figure 13-6

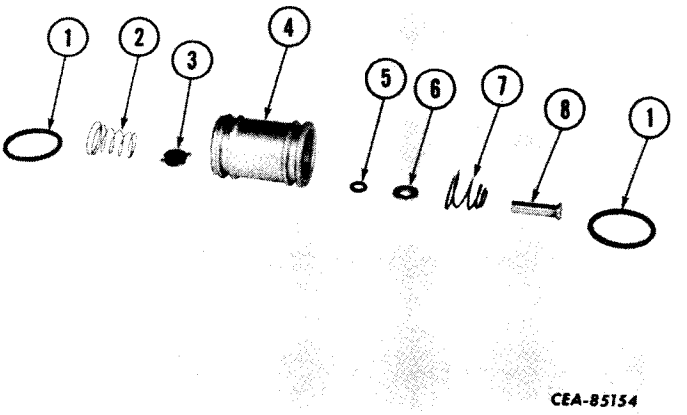
Slide the piston assembly (1, Fig. 13-7) out of the governor body (2).



CEA-85153

Figure 13-7

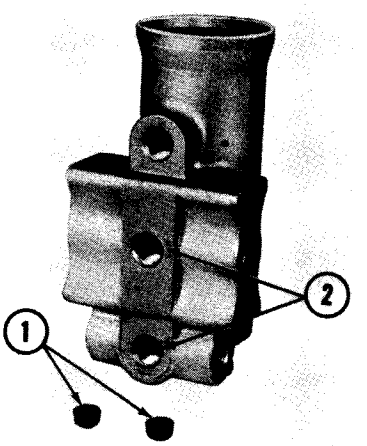
Remove the "O"-rings (1, Fig. 13-8) from the piston (4). Remove the spring (2) and valve (3). Slide the exhaust stem (8), and spring (7) out of the piston. Remove the washer (6) and "O"-ring (5).



CEA-85154

Figure 13-8

Remove the filter screws (1, Fig. 13-9) from the ports (2) in the governor body.



CEA-85155

Figure 13-9

INSPECTION

Clean and inspect all parts as follows:

a. Clean all metal parts in good cleaning solvent. Use compressed air to dry parts.

(Continued on next page)

GOVERNOR - Continued

INSPECTION - Continued

b. Inspect all parts for wear or damage. Check the governor body for cracks or other damage. Be certain that all air passages in the body, piston, and exhaust stem are clean. Check the springs for cracks or distortion. Replace all parts found to be worn or damaged.

c. Replace all "O"-rings in the governor.

ASSEMBLY

Prior to reassembly, lubricate the lower body bore, the top of the piston "O"-rings, spring guide and adjusting screw with a good barium base grease (Bendix-Westinghouse Part No. 240176).

Install the exhaust stem "O"-ring (5, Fig. 13-10) in the piston (4) and cover with washer (6). Drop the valve (3) into the piston and install the spring (2) with its small end towards the valve (3). Press the spring (2) in until its large coiled end snaps into the groove in the piston. Place the exhaust stem spring (7) on the stem (8) and install in piston. Place the "O"-rings (1) on the piston.

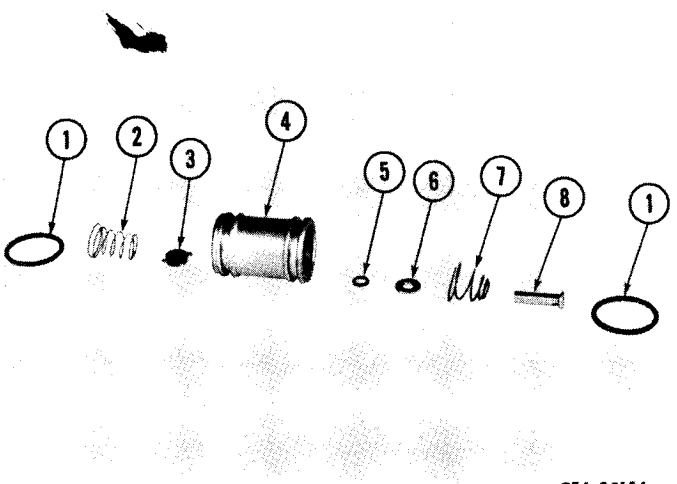


Figure 13-10

Install the piston assembly (1, Fig. 13-11) in the governor body (2).

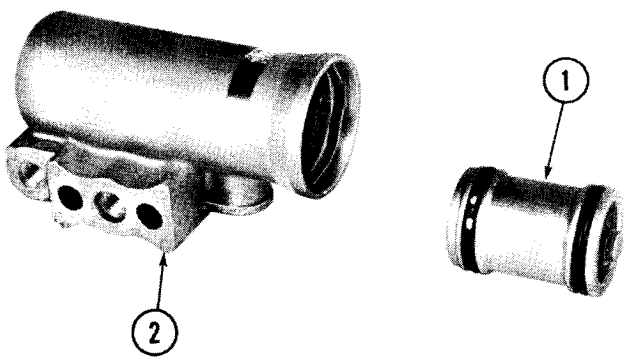


Figure 13-11

Install the lower spring seat (2, Fig. 13-12), guide (3), and spring seat (4) on the adjusting screw (1). Place the spring (5), upper spring seat (6), and locknut (7) on the adjusting screw.

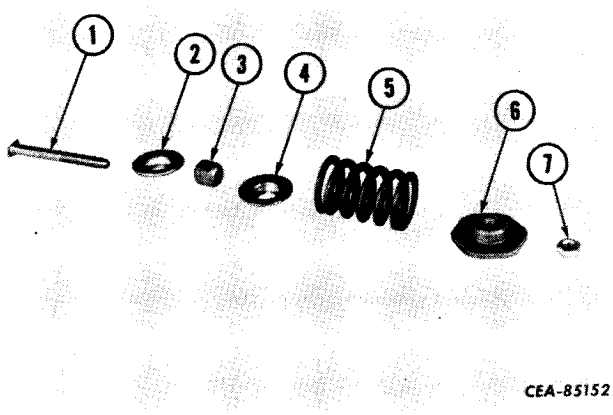


Figure 13-12

Screw the upper spring seat down until the dimension between the adjusting screw head and the upper spring seat is approximately 1-7/8 in. Fig. 13-13.

DISASSEMBLY, INSPECTION AND ASSEMBLY

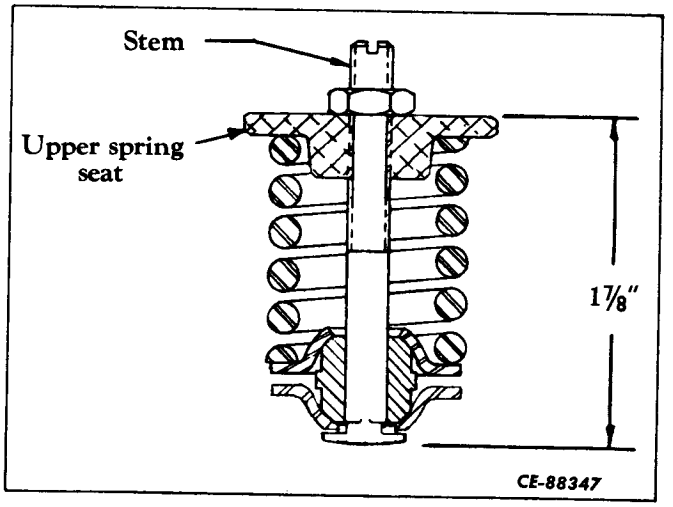


Figure 13-13

Insert the adjusting screw and spring assembly (1, Fig. 13-14) into the governor body (4). Install the retaining ring (2) with a snap ring pliers. Screw the cover (3) in place.

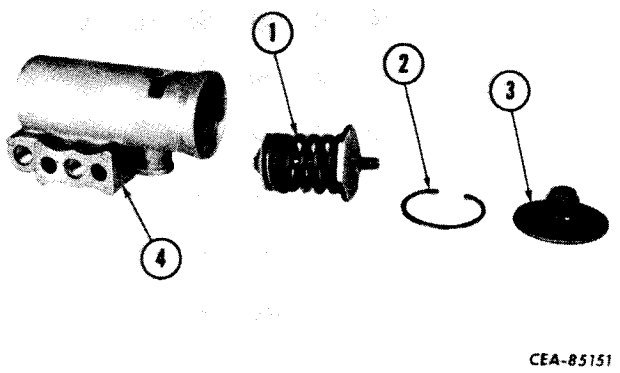


Figure 13-14

Install new filter screens (1, Fig. 13-15) in the unloader and reservoir ports (2) in the governor body. The screens can be inserted with the blunt end of a pencil.

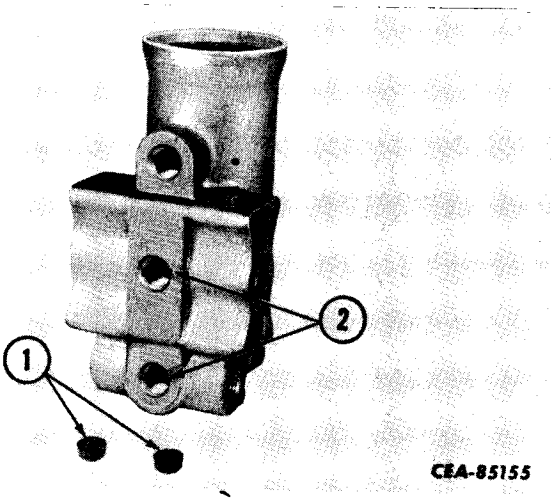


Figure 13-15

Install the pipe plugs (1, Fig. 13-16) in the ports in the governor body. Coat the pipe plugs with a small amount of Mar-Seal or a similar sealant before installing.

(Continued on next page)

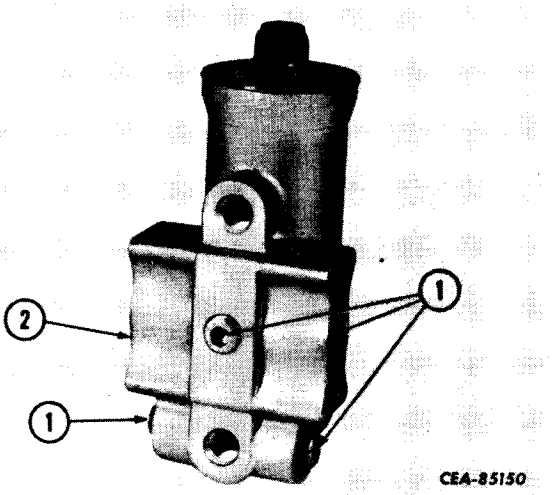


Figure 13-16

GOVERNOR - Continued

INSTALLATION

Install the governor and secure with cap screws, lock washers and nuts. Attach the unloader line (2, Fig. 13-17).

Make final adjustments to governor as described below.

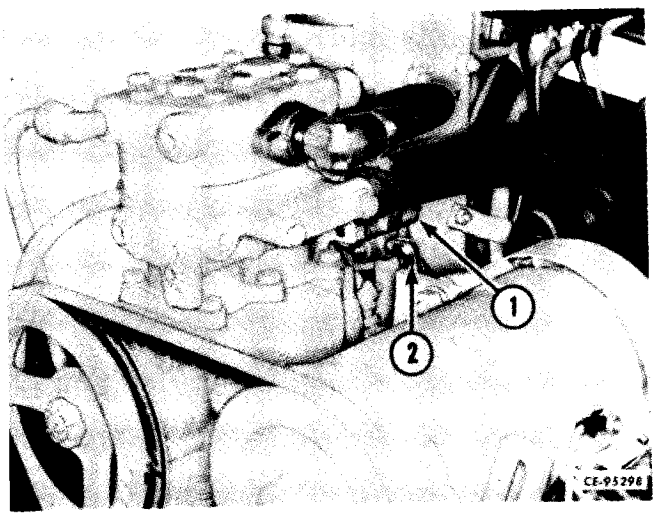


Figure 13-17

ADJUSTMENT

Start the tractor engine and build up air system pressure. Note the pressure at which the governor cuts out. This pressure should be as listed in "SPECIFICATIONS." If the cutout pressure is incorrect remove the governor cover, loosen the coil nut, and use a screwdriver to turn the adjusting screw.

Turn the adjusting screw clockwise to lower the setting, and counterclockwise to raise it. When proper adjustment is obtained, tighten the locknut and reinstall the cover.

RESERVOIRS

REMOVAL

DRY RESERVOIR - Disconnect the lines (3, 5, 6 and 7, Fig. 13-18) and check valves (1) from the reservoir (4). Remove the U-bolts (2) and locknuts that secure the reservoir to the frame.

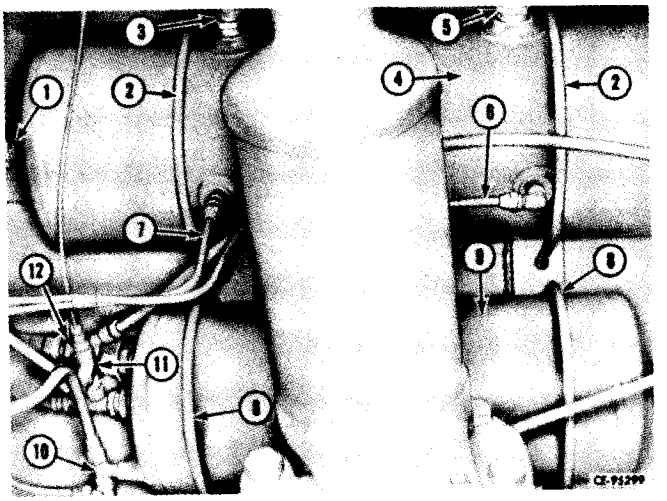


Figure 13-18

WET RESERVOIR - Disconnect the check valve (12, Fig. 13-18), tee (10) and pipe cross (11) from the reservoir (9). Remove the safety valve. Remove the U-bolts (8) and locknuts that secure the reservoir to the frame.

INSPECTION

Clean and inspect the air reservoirs as follows:

a. Clean the exterior and interior of the reservoirs with hot water and steam.

b. Inspect the exterior of the reservoir for damage or corrosion. A badly damaged reservoir should be replaced. Keep the exterior of the reservoir painted to retard corrosion.

c. Use water pressure to test the air reservoirs for leaks, if tests are to be made at pressures higher than normal.

INSTALLATION

WET RESERVOIR - Attach the reservoir (9, Fig. 13-19) to the frame using the U-bolts (8) and locknuts. Connect the check valve (12), tee (10) and pipe cross (11) to the reservoir. Install the safety valve.

DRY RESERVOIR - Attach the reservoir (4, Fig. 13-19) to the frame using the U-bolts (2) and locknuts. Connect the lines (3, 5, 6 and 7) and check valves (1) to the reservoir.

DISASSEMBLY, INSPECTION AND ASSEMBLY

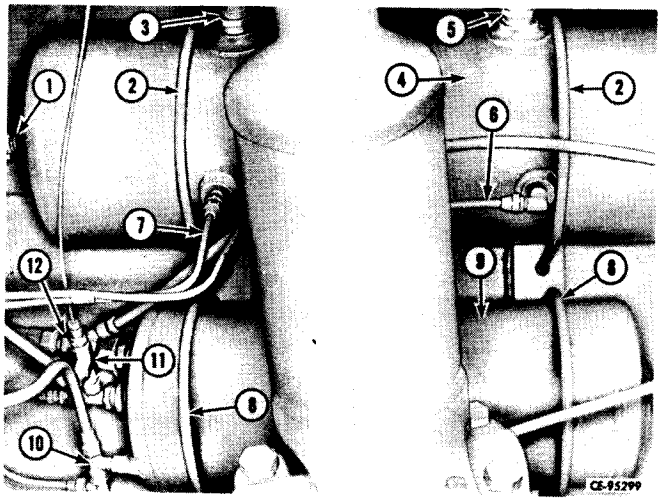


Figure 13-19

SAFETY VALVE

REMOVAL

Unscrew the safety valve (2, Fig. 13-20) from the bushing in the reservoir (1).

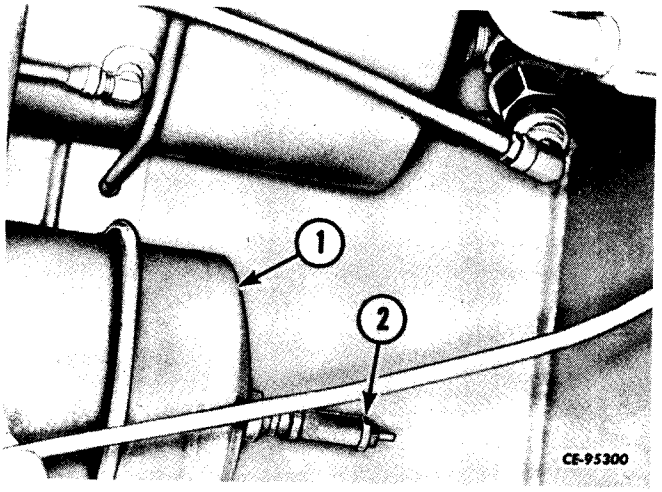


Figure 13-20

DISASSEMBLY

Unscrew the spring cage (5, Fig. 13-21) from the body (1). Lift the ball (2) from the body. Remove the release pin (3) and spring (4) from the spring cage.

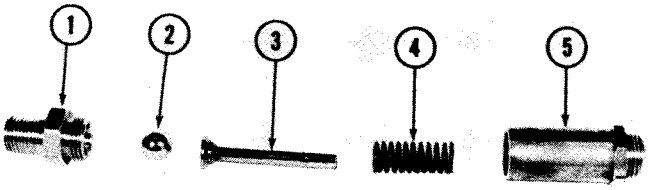


Figure 13-21

INSPECTION

Clean and inspect the safety valve as follows:

a. Clean all parts in a good cleaning solvent. Use compressed air to dry parts.

b. Inspect the ball for signs of pitting or scratches. If the ball is damaged it should be replaced. Clean the ball seat thoroughly.

c. Inspect the body and spring cage for cracks, and replace if any are found.

d. Check that the exhaust port in the spring cage is not plugged.

(Continued on next page)

SAFETY VALVE - Continued

ASSEMBLY

Place the spring (4, Fig. 13-22) on the release pin (3) and insert them into the spring cage (5). Place the ball (2) in the body (1). Position the spring cage, release pin and spring over the ball and screw the cage into the body.

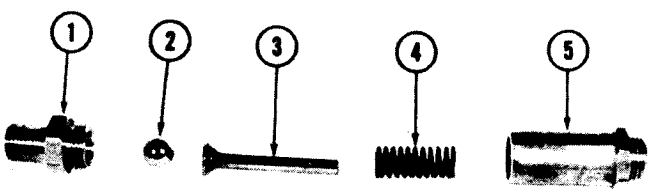


Figure 13-22

INSTALLATION

Screw the safety valve (2, Fig. 13-23) into the bushing in the reservoir.

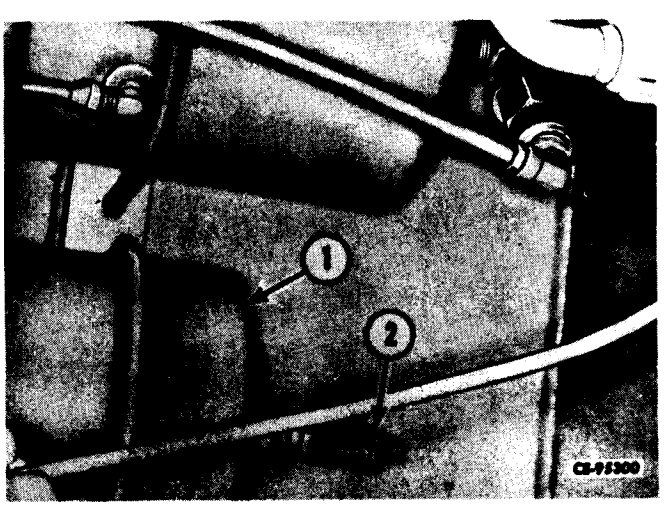


Figure 13-23

ADJUSTMENT

Using the necessary equipment, test and adjust the safety valve as follows:

a. Pull on the exposed end of the safety valve release pin. This removes the spring load from the ball and permits the valve to exhaust.

b. If the valve does not "blow off" when this is done, the ball is stuck on its seat. The valve should be removed and cleaned.

c. Coat the exhaust port in the spring cage with soap suds to test leakage. Leakage should not exceed a three inch soap bubble in three seconds.

d. The safety valve should be set to "blow off" at approximately 150 psi. The setting may be adjusted by loosening the locknut and turning the adjusting screw.

e. Turn the adjusting screw clockwise to raise the pressure setting. Turn the adjusting screw counterclockwise to lower the setting.

f. Tighten the locknut after each adjustment.

TREADLE VALVES

REMOVAL

Completely exhaust all air from reservoirs. Disconnect all air line connections to treadle valve (1, 2, Fig. 13-24). Tag all lines so they will connect properly at installation.

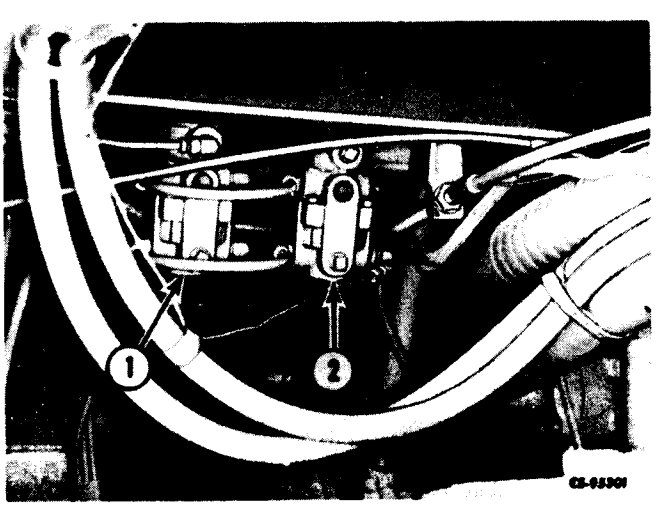


Figure 13-24

DISASSEMBLY, INSPECTION AND ASSEMBLY

Disconnect any treadle fittings that would prevent treadle removal through cut-out in floorboard. Remove hardware securing treadle to floorboard. Remove treadle valve.

NOTE: On the late type brake systems the treadle valve furthest to left of operator has one section more than right hand valve. This extra "Tandemergency" section provides for automatic application of vehicle brakes in case of air failure. The following disassembly instructions up to and including removal of plunger boot (Fig. 13-27) are applicable for both valves.

DISASSEMBLY

Clean outside of treadle valve with a good grade cleaning solvent.

Place treadle valve on a clean work bench.

Remove cotter pin from fulcrum pin (2, Fig. 13-25). Drive out fulcrum pin securing treadle (1) to mounting plate (3). Remove treadle assembly.

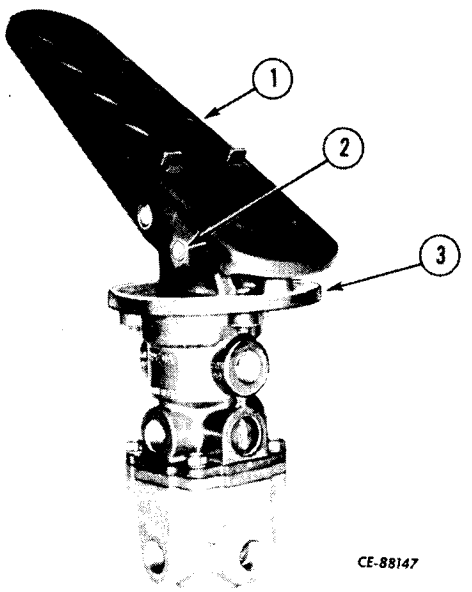


Figure 13-25

Remove cotter pin (2, Fig. 13-26) from roller pin (3). Remove roller pin from treadle (1). Remove roller (3).

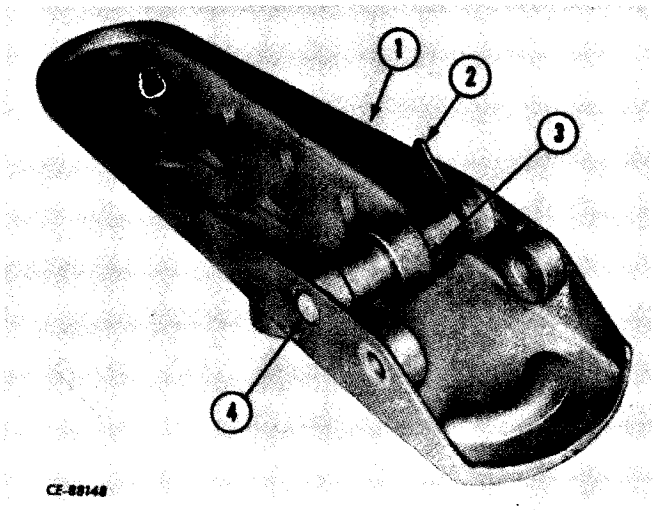


Figure 13-26

Remove rubber boot (1, Fig. 13-27) from plunger (2) and mounting plate (4). Remove treadle stop nut and set screw (3) from mounting plate.

(Continued on next page)

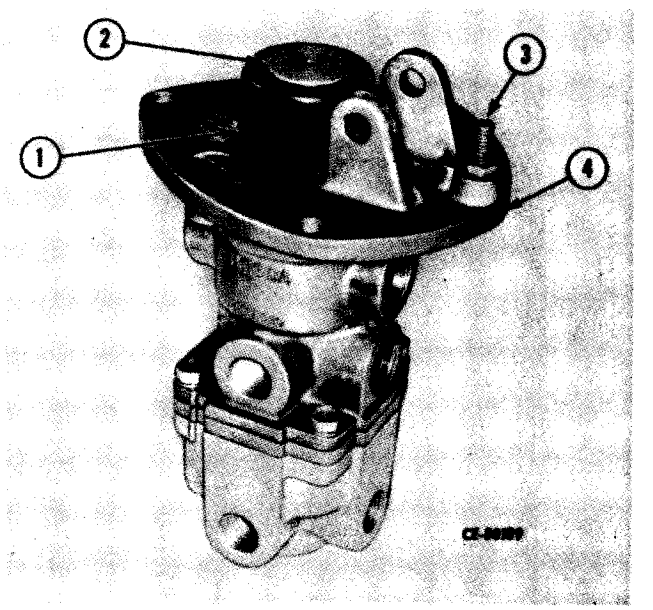


Figure 13-27

DISASSEMBLY, INSPECTION AND ASSEMBLY

TREADLE VALVES - Continued

DISASSEMBLY - Continued

RIGHT TREADLE VALVE - Remove plunger (2, Fig. 13-28) from mounting plate (1).

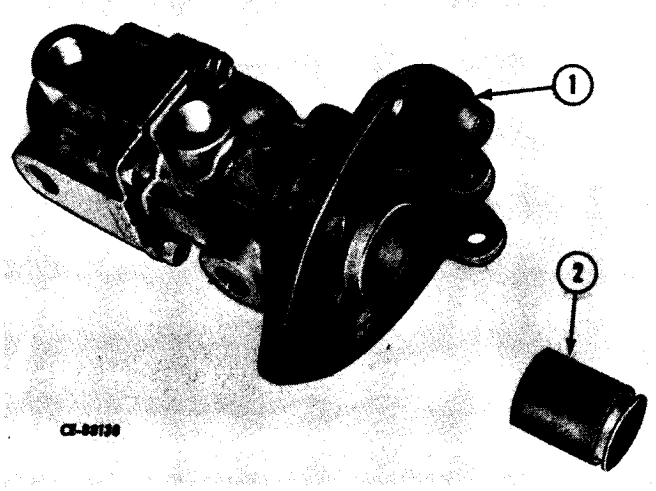


Figure 13-28

BOTH VALVES - Punch mark mounting plate (2, Fig. 13-29) and body (1) for reference at assembly.

Remove screws (3) that secure mounting plate (2) to body (1). Remove mounting plate.

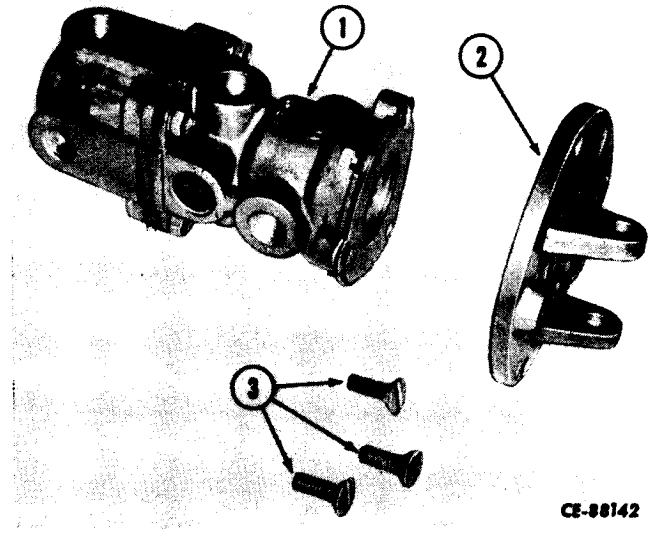


Figure 13-29

LEFT TREADLE VALVE - The following instructions are for the extra "Tandemergency" section only.

Punch mark section and body for assembly reference. Carefully remove hardware (4, Fig. 13-30) securing section (3) to body (1). Remove gasket (2).

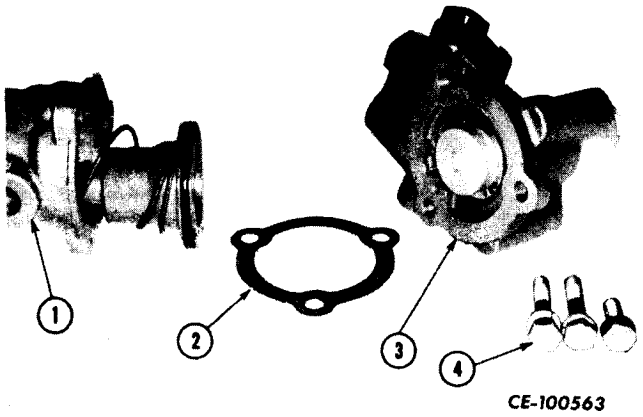


Figure 13-30

Remove plugs (5, Fig. 13-31) from section (1). Do not damage copper washers (3). Remove screens (4) and springs (2) from plugs. Remove snap ring (6) with snap ring pliers. Spring (8) and seat (7) will pop out.

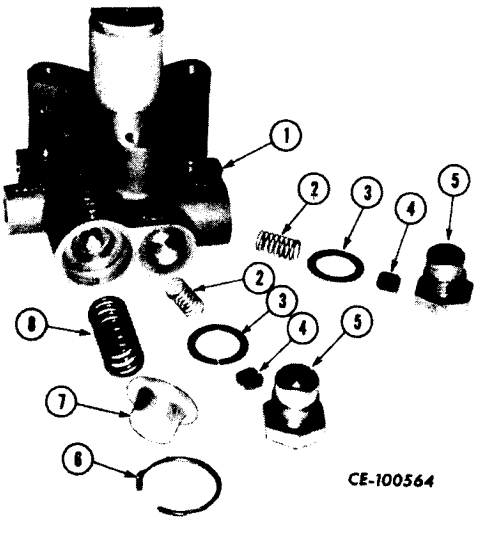


Figure 13-31

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DISASSEMBLY, INSPECTION AND ASSEMBLY

Push plunger (2, Fig. 13-32) down through section (1) to remove. Remove and discard seal ring from plunger. Tap section sharply on wooden block to pop valve (3) out of section. Discard valve "O" rings (4).

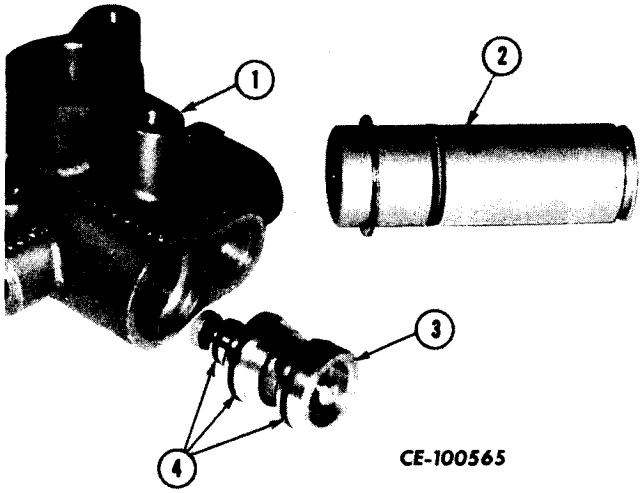

Figure 13-32

BOTH VALVES - Depress primary piston assembly (3, Fig. 13-33) and remove retaining ring (4). Remove piston assembly and spring (2) from upper body (1).

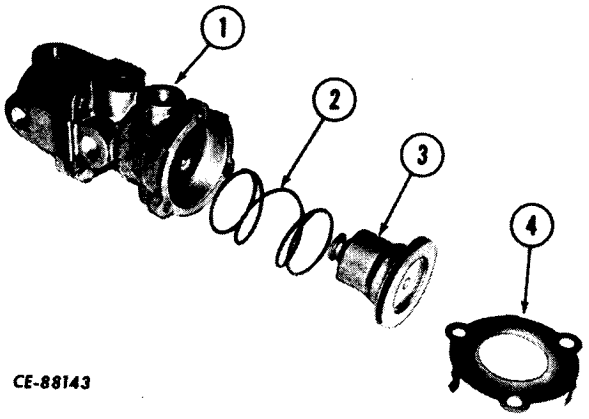

Figure 13-33

NOTE: Retaining ring (4) not used in "Tandemergency" valve.

Using snap ring pliers, remove retaining ring (5, Fig. 13-34). Remove spring retainer (4) and spring (3) from piston (1). Discard "O" ring (2) from groove in piston.

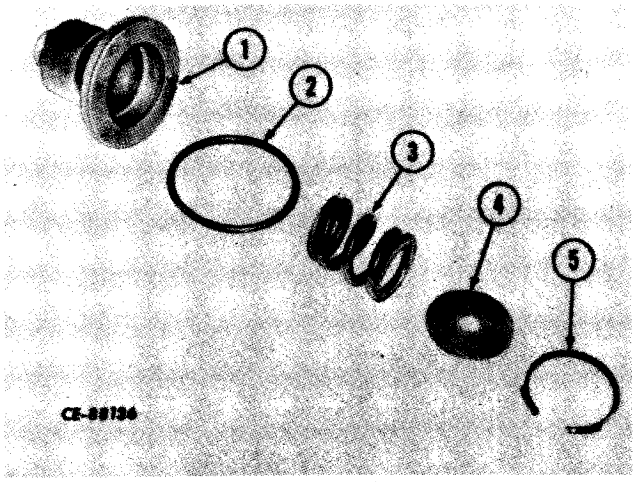

Figure 13-34

Punch mark upper and lower body for assembly reference. After removing cap screws (6, Fig. 13-35) separate upper valve body (5) from cover (2) and lower valve body (1). Remove push rod (3) and push rod guide (4).

(Continued on next page)

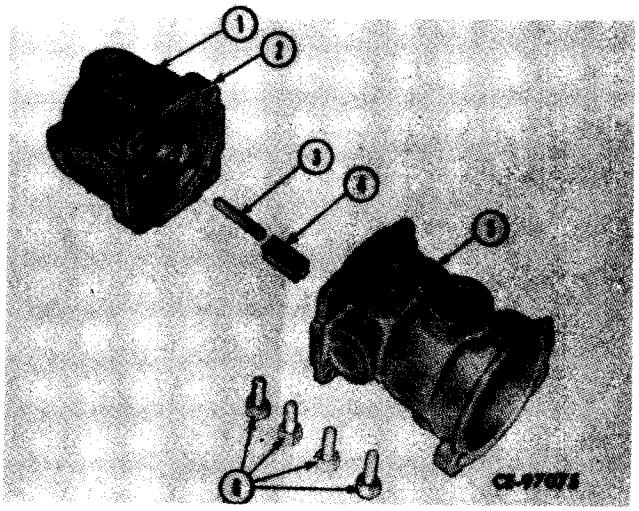

Figure 13-35

TREADLE VALVES - Continued

DISASSEMBLY - Continued

Having removed and separated push rod (7, Fig. 13-36) and push rod guide (6), remove primary inlet valve guide (5) from upper valve body (1). Discard seal (4) from outer groove of valve guide (5) and packing from inner groove. Separate primary inlet spring (3) and valve (2).

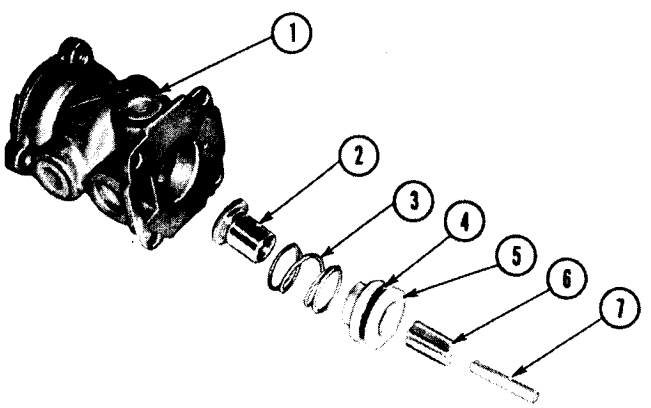

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Figure 13-36

Punch mark valve body (1, Fig. 13-37) and cover (7). Remove cover (7) from lower valve body (1). Discard seal (6) from groove in cover.

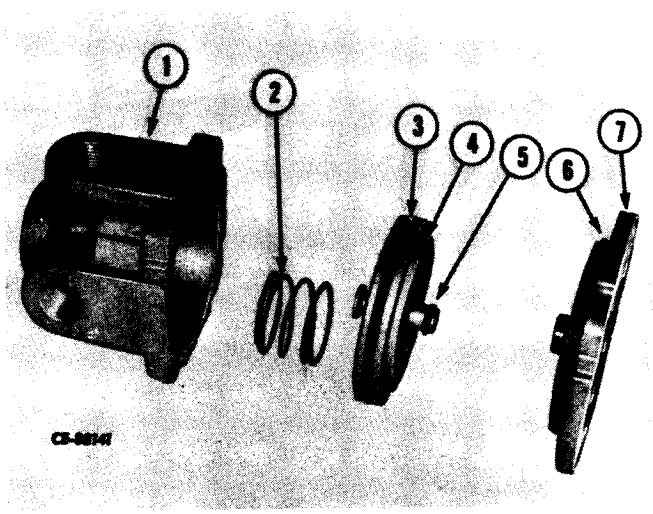

Figure 13-37

Remove secondary piston (4) from body. Discard small "O" ring (5) and large "O" ring (3) from grooves in piston. Remove spring (2) from body.

Using snap ring pliers, remove retaining ring (1, Fig. 13-38). Remove exhaust shield (2) and inlet and exhaust valve assembly (3) from lower body (4).

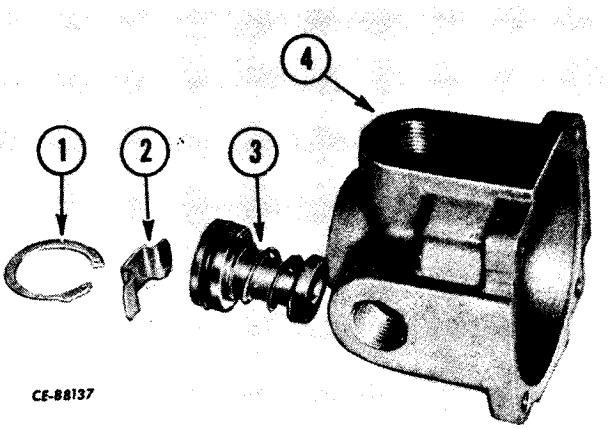

Figure 13-38

Disassemble valve assembly (3, Fig. 13-38) by removing inlet valve (6, Fig. 13-39), spring (5), valve guide (4) and seal (3) from shield retainer (1). Remove vee packing (2) from groove in retainer. Discard seal (3).

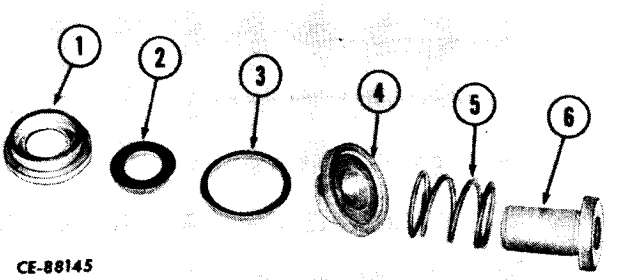

Figure 13-39

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DISASSEMBLY, INSPECTION AND ASSEMBLY

INSPECTION

Clean and inspect the treadle valves as follows:

a. Clean all parts in good cleaning solvent using compressed air to dry parts.

b. Wipe all rubber parts clean.

c. Inspect valve seats for nicks and burrs.

d. Check springs for cracks, distortion or corrosion.

e. Check exhaust valve diaphragm for flexibility, wear, and deterioration.

f. Replace all "O" rings, seals, gaskets and parts found to be worn or damaged.

ASSEMBLY

Lightly lubricate piston, valve bores, and "O" rings prior to assembly.

Install vee packing (2, Fig. 13-40) in groove of shield retainer (1). Install a new seal (3) and guide (4) on retainer. Insert inlet valve (6) into spring (5), guide and retainer.

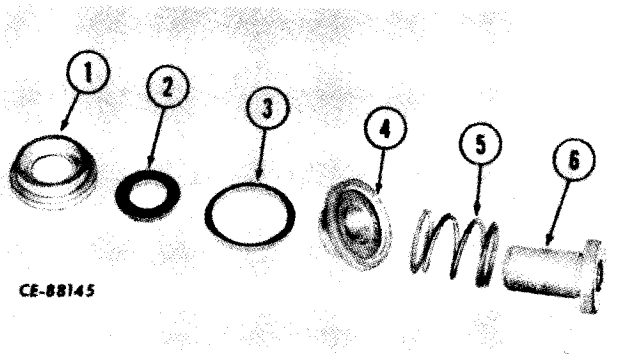

Figure 13-40

Insert inlet and exhaust valve assembly (3, Fig. 13-41) and exhaust shield (2) into lower body (4) and secure with retaining ring (1).

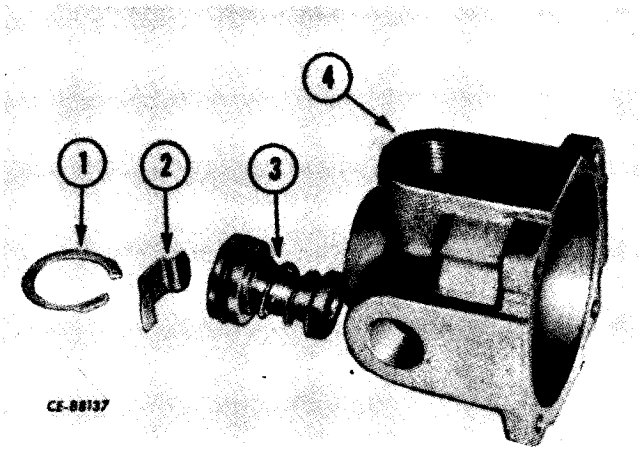

Figure 13-41

Install a new large "O" ring (3, Fig. 13-42) and a new small "O" ring (5) on secondary piston (4). Install new seal (6) on cover (7). Insert spring (2), piston and cover into lower body (1). Match previously made punch marks.

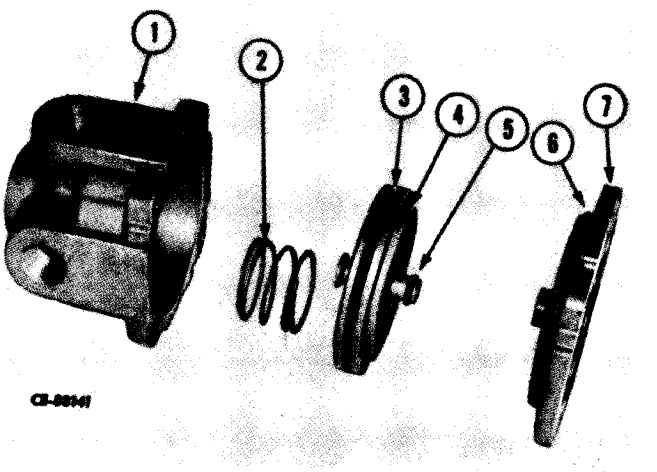

Figure 13-42

Install new seal (4, Fig. 13-43) in outer groove and packing in inner groove of valve guide (5). Insert primary inlet valve (2) into spring (3) and valve guide (5) and insert into upper valve body (1). Slip push rod guide (6) and push rod (7) into valve in upper valve body.

(Continued on next page)

TREADLE VALVES - Continued

ASSEMBLY - Continued

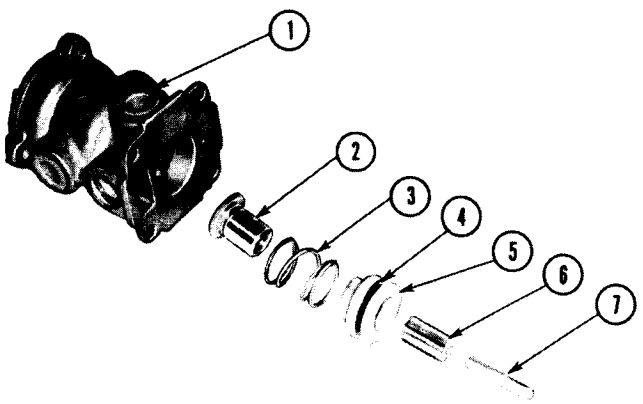

Figure 13-43

Align previously made punch marks and secure lower body (1, Fig. 13-44), cover (2) and upper body (5) with cap screws and lock washers (6).

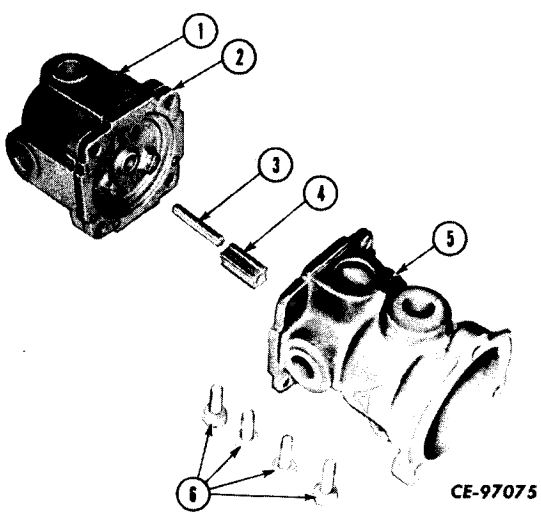

Figure 13-44

Install a new "O" ring (2, Fig. 13-45) in groove on primary piston (1). Insert spring (3) and retainer (4) into piston and secure with retaining ring (5).

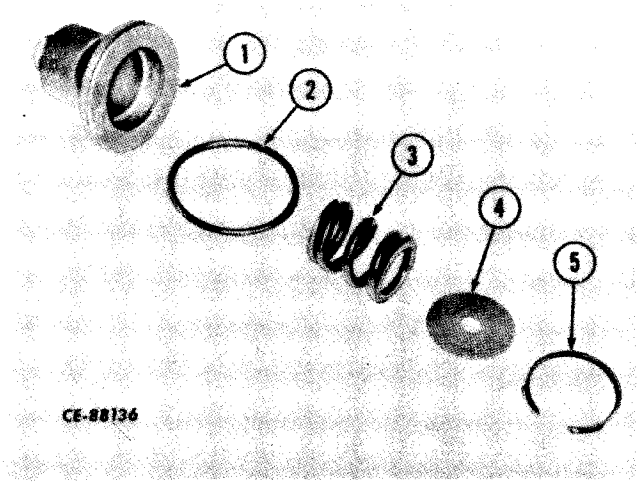

Figure 13-45

RIGHT TREADLE VALVE - Insert spring (2, Fig. 13-46) and primary piston assembly (3) into upper body (1) and secure with retaining ring (4).

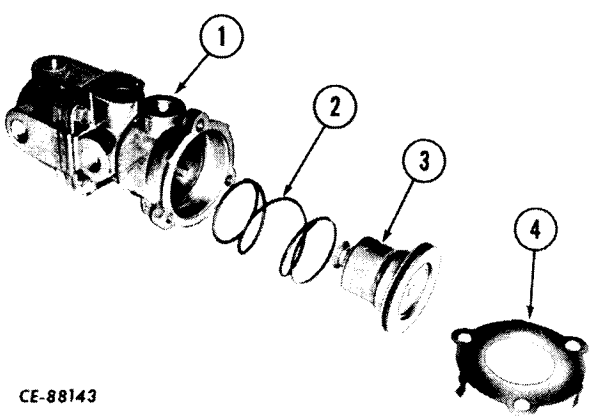

Figure 13-46

LEFT TREADLE VALVE - The following is for the "Tandemergency" section only.

Install new "O" rings (4, Fig. 13-47) on valve (3) and carefully insert into bore of section (1). Install new seal ring on plunger (2) and slide plunger into section, from bottom up. Replace plunger snap ring if required.

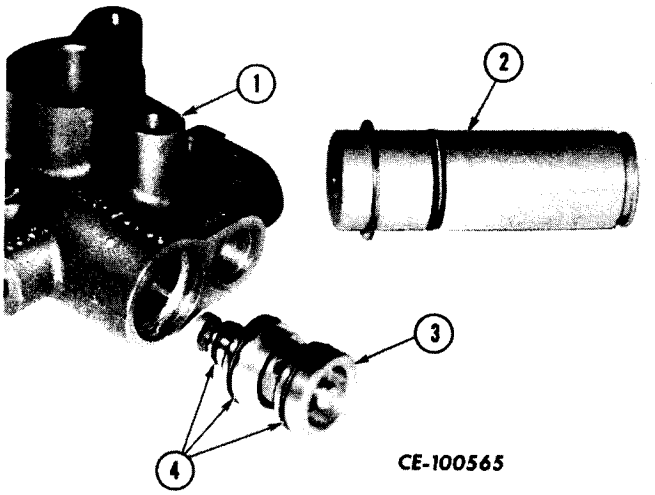

Figure 13-47

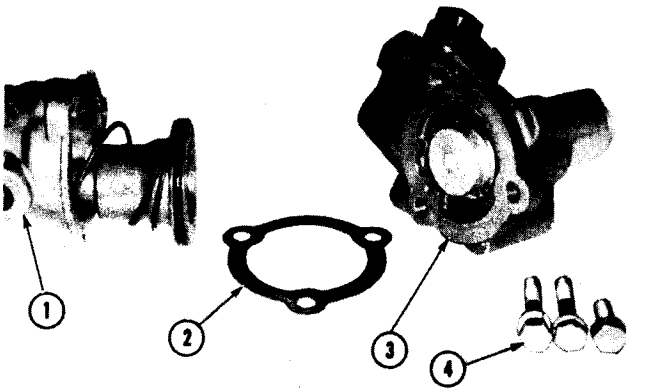

Figure 13-48A

Insert screens (4, Fig. 13-48) into plugs (5). Seat them with a blunt stick or pencil eraser. Slip copper washers (3) over plugs. Seat springs (2) in plugs and install in proper bores in section (1). Tighten plugs securely. Slide spring (8) onto spring seat of valve. Place spring seat (7) over spring and compress spring and seat. Install snap ring (6) while holding compressed spring and seat. Install spring (2, Fig. 13-46) and primary piston assembly (3) into valve body (1, Fig. 13-48A). Position new gasket (2) on body. Align punch marks on body and section (3), compress spring and install hardware (4). Tighten cap screws evenly and securely.

BOTH VALVES - Place mounting plate (2, Fig. 13-29) on valve body (1), aligning punch marks made at disassembly, and secure with screws (3).

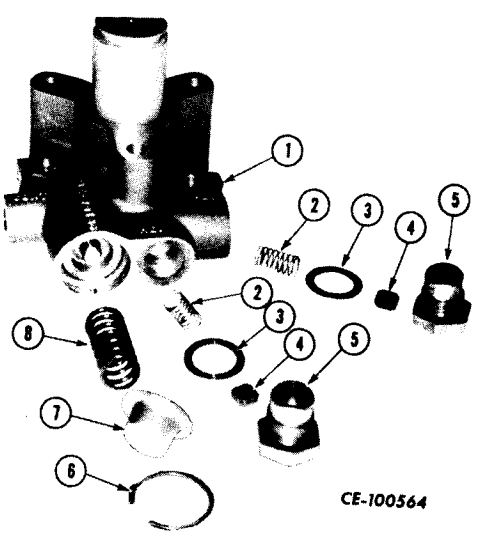

Figure 13-48

Insert plunger (2, Fig. 13-28) into mounting plate (1) of right-hand treadle valve.

Install treadle stop nut and set screw (3, Fig. 13-27) in mounting plate (4). Install rubber boot (1) over plunger (2).

Place roller (3, Fig. 13-26) in treadle (1). Insert roller pin (4) through treadle and roller and secure with cotter pin (2).

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

TREADLE VALVES - Continued

ASSEMBLY - Continued

Place treadle assembly (1, Fig. 13-48B) on mounting plate (3) and insert fulcrum pin (2). Align holes in treadle and fulcrum pin and insert cotter pin.

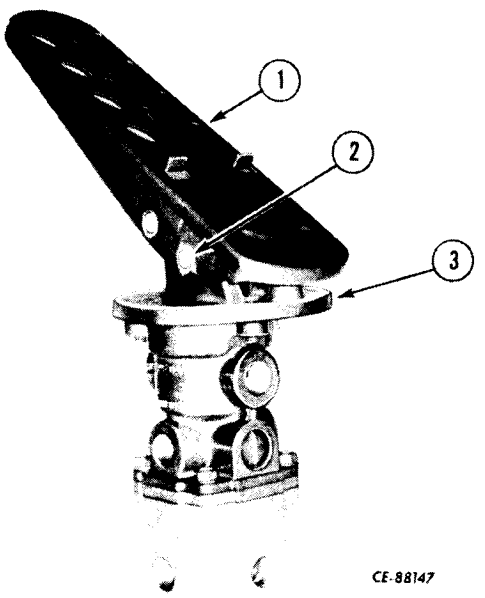

Figure 13-48B

INSTALLATION

Install the treadle through the hole in the floorboard and secure with the cap screws and nuts.

Install the pipe plugs and pipe fittings in the treadle valve ports from which they were removed.

Connect the air lines to the proper ports on the valve.

BOOM KICKOUT CONTROL VALVE

REMOVAL

Drain all air from reservoirs.

Drive lever arm pin (6, Fig. 13-48C) from valve assembly disconnecting lever arm from valve.

Disconnect air lines from valve.

Remove mounting hardware.

DISASSEMBLY

Remove cap nut (12, Fig. 13-48C), valve spring (10) and valve (9) from lower end of valve body (7). Remove "O" ring (11) from cap nut and discard.

Remove retaining ring (1, Fig. 13-48C), plunger seal (2), plunger (3) and plunger return spring (5) from upper end of valve body (7). Remove "O" ring (4) from plunger. Discard "O" ring and plunger seal (2) felt washer.

INSPECTION

Clean all metal parts in a good cleaning solvent.

Inspect plunger and plunger bore in valve body for wear or damage. Replace parts as required. If part is doubtful, replace it.

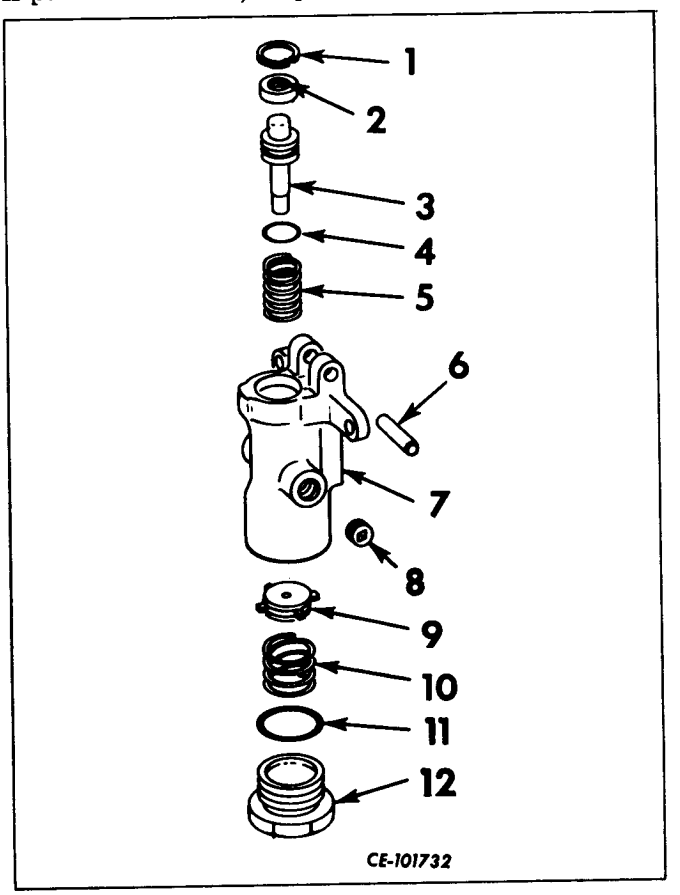

Figure 13-48C
Boom Kickout Control Valve.

1. Retaining ring.
2. Plunger seal.
3. Plunger.
4. "O" ring.
5. Plunger return spring.
6. Pin.
7. Valve body.
8. Pipe plug.
9. Valve.
10. Valve spring.
11. "O" ring.
12. Cap nut.

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DISASSEMBLY, INSPECTION AND ASSEMBLY

Inspect sealing faces of valve and valve seat for wear or damage.

Replace all "O" rings. Install a new felt washer in plunger seal body.

ASSEMBLY

Install new "O" ring (7, Fig. 13-48C) on plunger (3). Lubricate "O" ring, plunger and plunger bore in valve body with a light coat of petroleum jelly. Install spring (5), plunger (3) and plunger seal assembly (2) in plunger bore in valve body (7). Secure with retaining ring (1) being sure ring bottoms in its groove about its entire circumference.

Install valve (9, Fig. 13-48C) and spring in lower bore of valve body (7). Install new "O" ring (11) on cap nut (12). Lubricate "O" ring with a light coat of petroleum jelly and install nut assembly in valve body. Tighten securely.

INSTALLATION

Position valve on front main frame wall and secure with mounting hardware.

Connect air lines.

Position lever arm in valve and secure by installing lever arm pin (6, Fig. 13-48C).

DOUBLE CHECK VALVES

REMOVAL

Disconnect and tag the air lines at the double check valves from the treadle valves and power clusters.

Unscrew the valves from the treadle valves. Remove the reducing nipples from the valves.

DISASSEMBLY

Remove the cap (4, Fig. 13-49) and gasket (3). Slide the seat (2) from the body (1). Remove the plug (5).

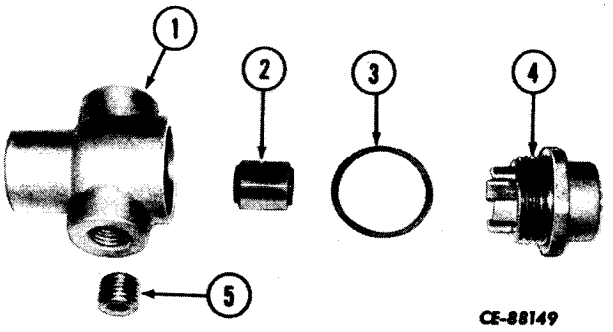

Figure 13-49

INSPECTION

Clean and inspect the double check valve as follows:

a. Clean all metal parts in good cleaning solvent. Use compressed air to dry parts.

b. Inspect the seat for damage.

c. Inspect the body and end cap for signs of wear or damage.

d. Replace the gasket and any parts found to be damaged.

ASSEMBLY

Lightly oil the seat (2, Fig. 13-50) prior to assembly. Insert the seat in the body (1). Place the gasket (3) on the cap (4) and install in the body (1). Install the plug (5) in the body.

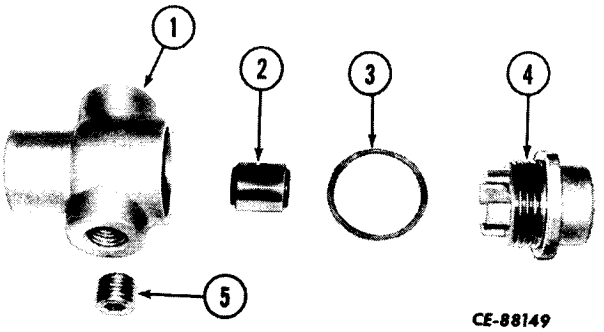

Figure 13-50

DISASSEMBLY, INSPECTION AND ASSEMBLY

MOISTURE EJECTION VALVE

REMOVAL

Disconnect and tag the air lines (1 and 2, Fig. 13-51) at the moisture ejection valve (3) from the treadle valve and wet reservoir.

Remove the cap screws, lock washers and nuts that secure the valve to the bracket. Remove valve.

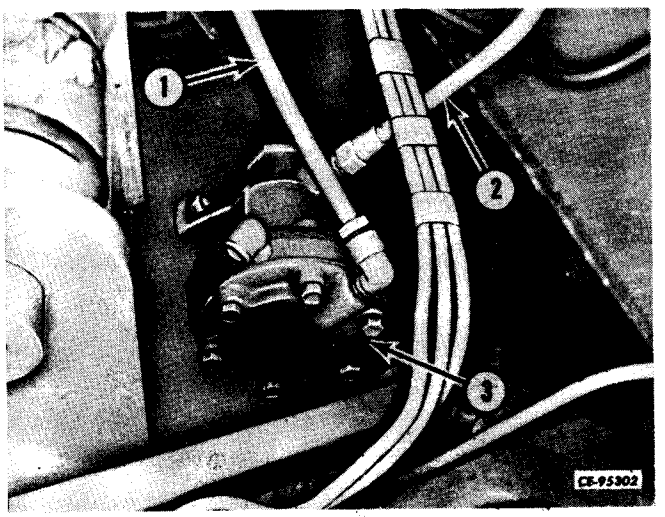

Figure 13-51

DISASSEMBLY

Remove the cap (6, Fig. 13-52), gasket (7), spring (8) and valve (9). Remove the cap screws (3) and lock washers (2). Separate the body (1), diaphragm (4), body (5) and diaphragm (13) from the main body (10). Remove the nut (11), push rod (14) and two washers (12) from the diaphragm.

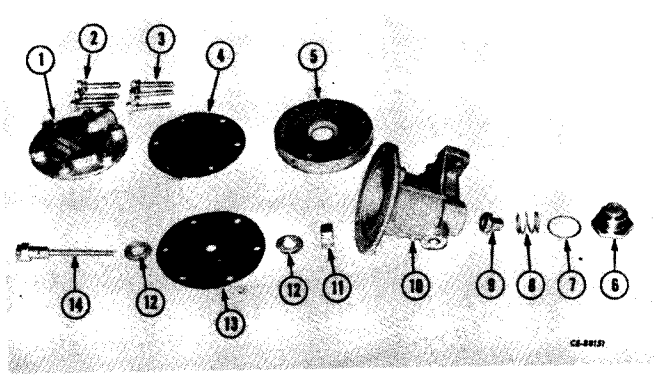

Figure 13-52

INSPECTION

Clean and inspect the valve as follows:

a. Clean all metal parts in a good grade cleaning solvent. Use compressed air to dry parts.

b. Inspect the diaphragms for signs of wear or damage.

c. Check the valve (9) and spring (8) for wear or damage.

d. Replace the gasket and any parts found to be damaged.

ASSEMBLY

Install a washer (12, Fig. 13-53), diaphragm (13), washer (12) and nut (11) on the push rod (14). Place the diaphragm (13), body (5), diaphragm (4) and body (1) on the main body (10). Secure in place with the cap screws (3) and lock washers (2). Install the valve (9), spring (8), gasket (7) and cap (6) in the top of the body (10).

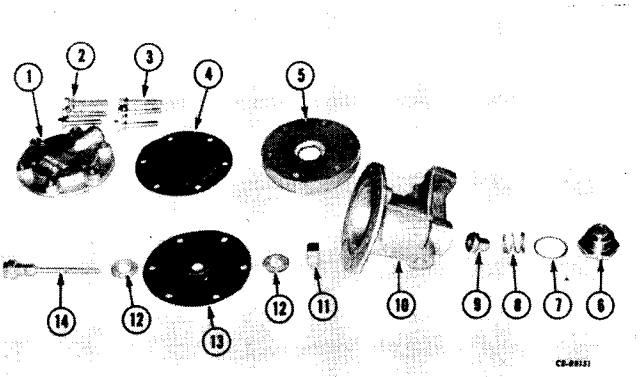

Figure 13-53

INSTALLATION

Install the valve (3, Fig. 13-54) on the bracket and secure with the cap screw, lock washers and nuts.

Connect the air lines (1 and 2) to the valve.

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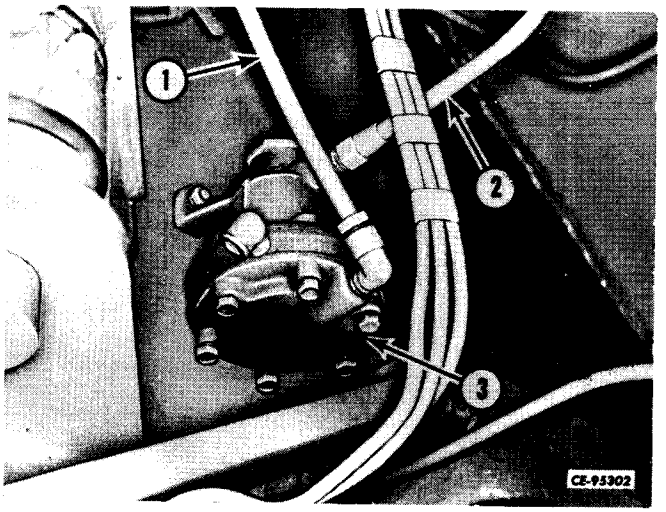

Figure 13-54

POWER CLUSTERS

REMOVAL

Disconnect the air line (1, Fig. 13-55) at the power cluster and the hydraulic line (2). Remove the nuts and lock washers that secure the power cluster to the frame. Remove the power cluster.

If the right cluster is being removed, the stop light switch wires should be removed.

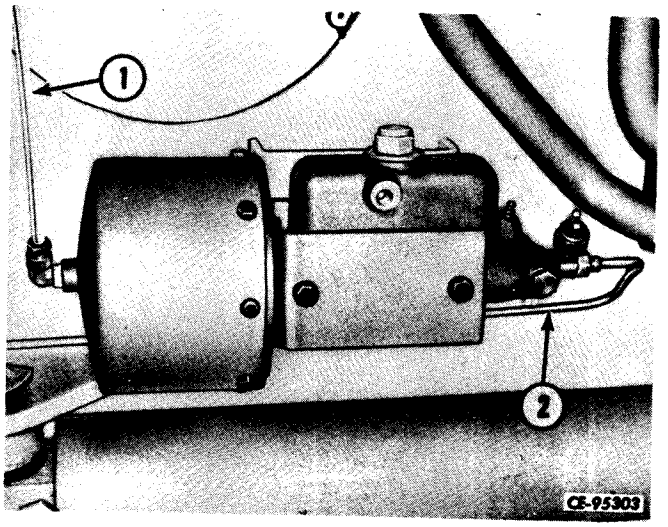

Figure 13-55

DISASSEMBLY

Remove the hydraulic cylinder filler cap and drain the hydraulic fluid.

Wash the exterior of the power cluster with a good grade cleaning solvent.

Remove cap screws and lock washers (2, Fig. 13-56) that attach the hydraulic cylinder (1) to the bracket (3).

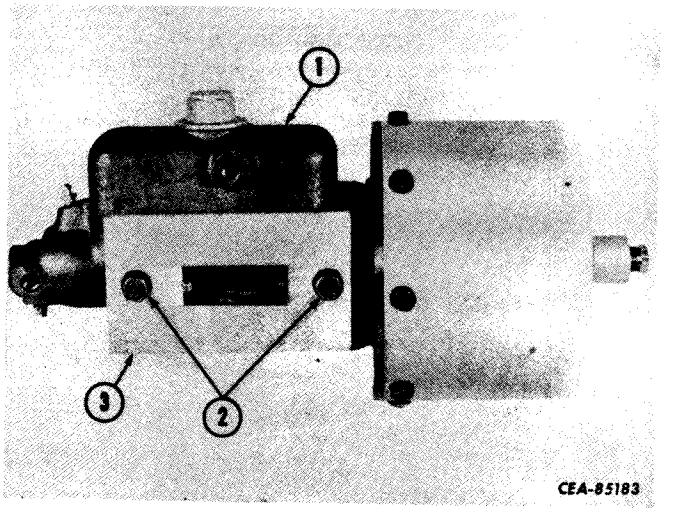

Figure 13-56

NOTE: Certain model power clusters are equipped with a piston stroke indicator, which indicates piston travel required for brake application in order to warn of the need for brake lining clearance adjustment. Remove stroke indicator from air cylinder by unscrewing bolt with lock washer.

Remove the mounting studs (3, Fig. 13-57) that attach the hydraulic cylinder (2) to the bracket (1). Remove the hydraulic cylinder.

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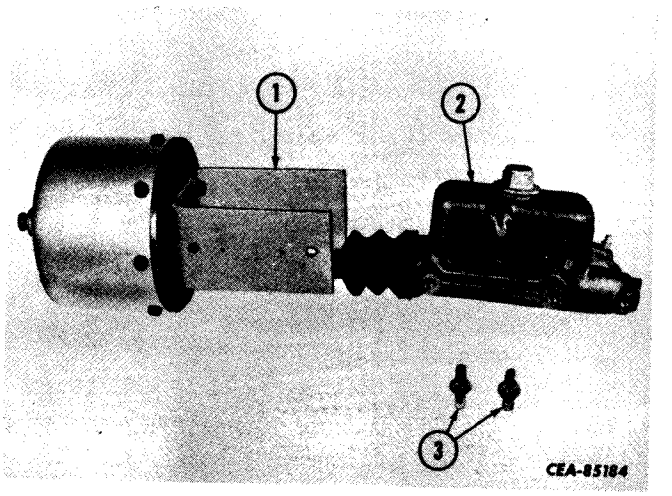

Figure 13-57

POWER CLUSTERS - Continued

DISASSEMBLY - Continued

Remove the cap screws and lock washers (2, Fig. 13-58) that secure the bracket (1) to the air cylinder (3). Remove the bracket.

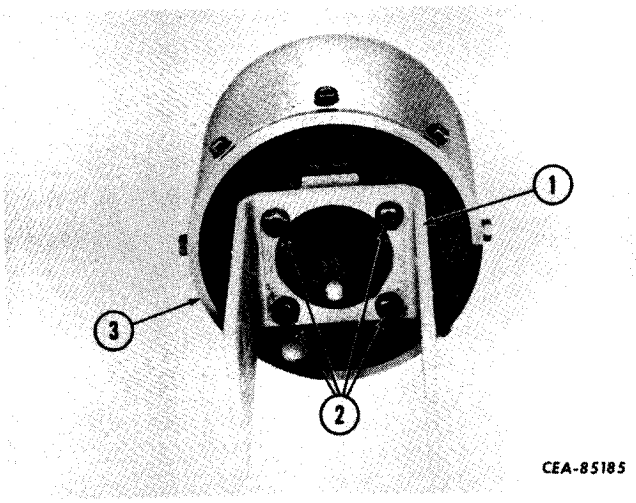

Figure 13-58

Remove the cap screws and lock washers (4, Fig. 13-59) that fasten the shell (1) to the head (3). Remove the head and the piston return spring (2).

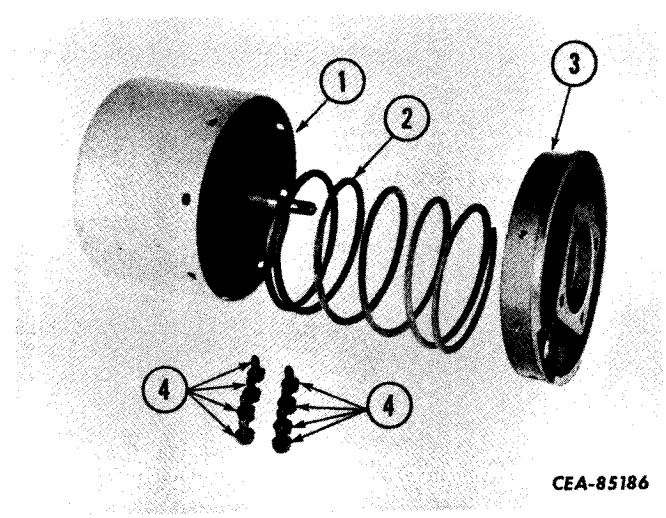

Figure 13-59

Slide the piston and rod assembly (2, Fig. 13-60) out of the shell (1).

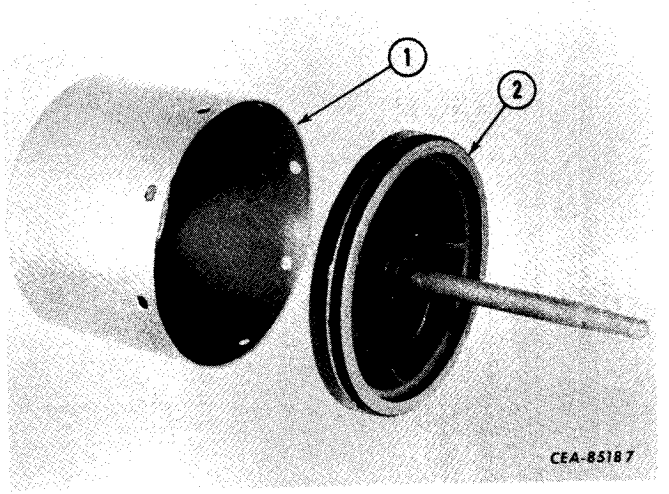

Figure 13-60

Remove the air cylinder piston cup (3, Fig. 13-61) and wiper (2) from the piston (1).

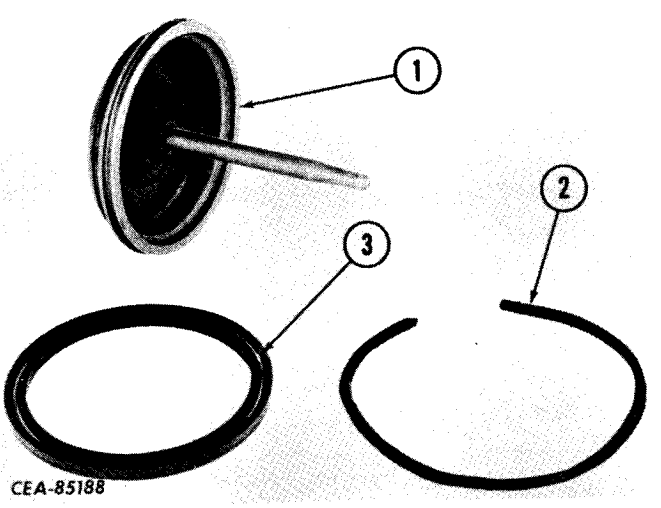

Figure 13-61

DISASSEMBLY, INSPECTION AND ASSEMBLY

Separate the piston rod boot (2, Fig. 13-62) from the hydraulic cylinder (1).

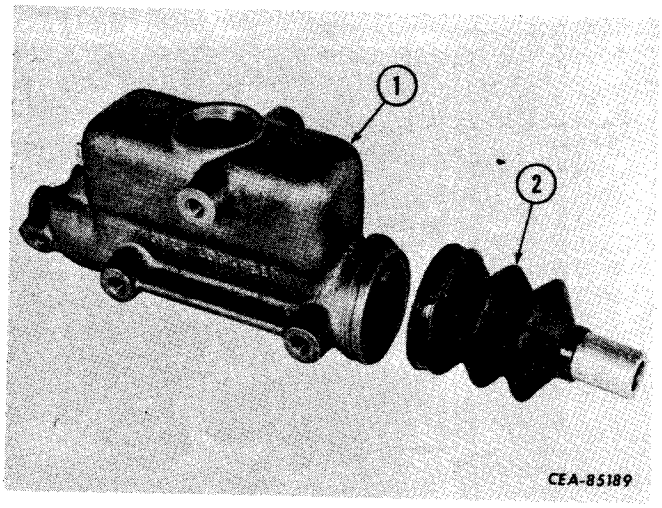

Figure 13-62

Using a snap ring pliers, remove the snap ring (7, Fig. 13-63). Slide piston stop plate (6), piston (5), primary cup (4), and piston return spring (3) out of the body (1). The check valve (2) will come out with the return spring.

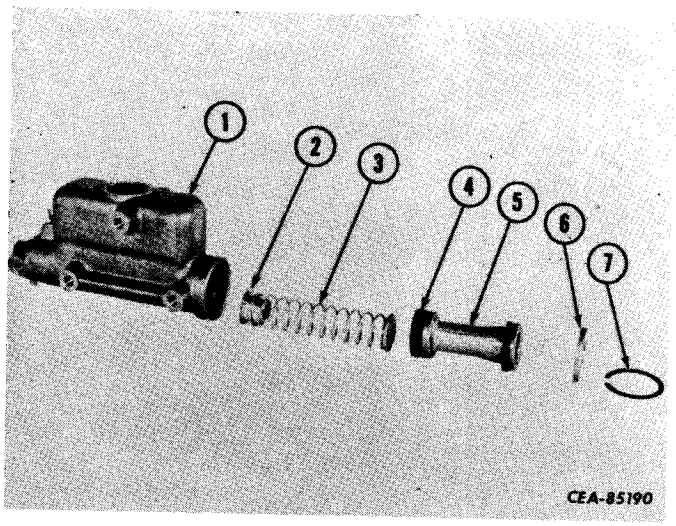

Figure 13-63

Remove the secondary cup (1, Fig. 13-64) from piston (2).

Separate the check valve and seat (1, Fig. 13-65) and the spring (2) from the valve retainer (3).

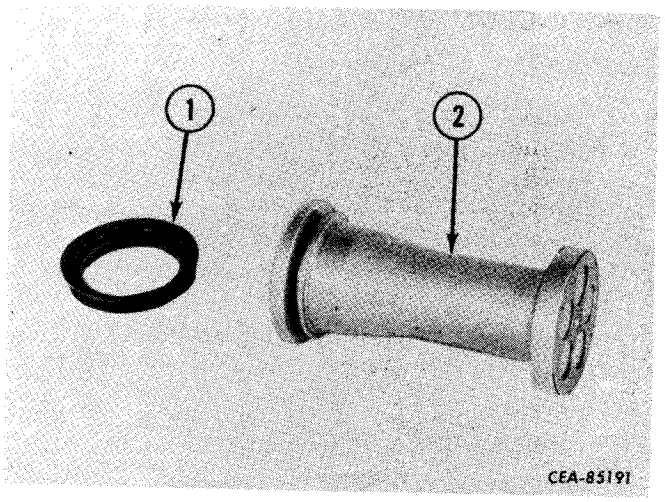

Figure 13-64

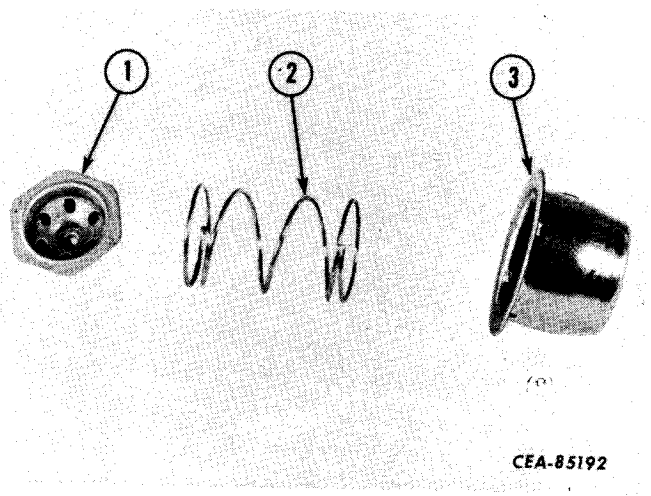

Figure 13-65

INSPECTION

Clean and inspect the power cluster as follows:

a. Determine need for lining clearance adjustment by fully applying brakes and measuring travel of piston stroke indicator located on power cluster. Adjustment is required when indicator travel reaches 2". After adjustment, indicator travel should be at least 3/8"-3/4".

b. Clean all air cylinder metal parts in a good grade cleaning solvent. Use compressed air to dry parts.

(Continued on next page)

POWER CLUSTERS - Continued

INSPECTION - Continued

c. Inspect the air cylinder piston cup and felt for wear or deterioration. Replace as necessary.

d. Clean the hydraulic cylinder parts in alcohol.

e. Inspect the hydraulic cylinder bore to be certain that it is smooth. It may be necessary to hone the cylinder to obtain a smooth finish.

f. After honing the cylinder, wash the cylinder in clean alcohol. Check that the compensating port (the smaller hole in the bottom of the reservoir) is open by inserting a wire through it.

g. Check the filler cap gasket for wear or damage.

h. Replace the screens and filter in the air cylinder head if necessary. Use a drift to drive the old screens and filter out of the head. Insert a new inner screen, filter, and a new outer screen in the head.

ASSEMBLY

Before assembling hydraulic cylinder parts, they should be dipped in hydraulic brake fluid.

Place the spring (2, Fig. 13-66) in the valve retainer (3). Insert the check valve and seat (1) into the retainer.

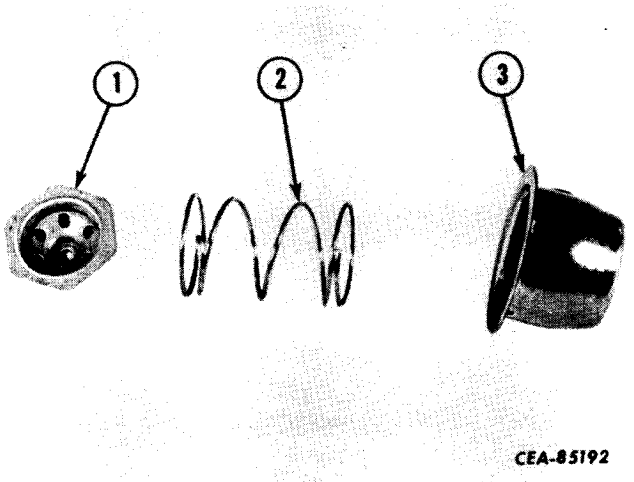

Figure 13-66

Install the secondary cup (1, Fig. 13-67) on the piston (2).

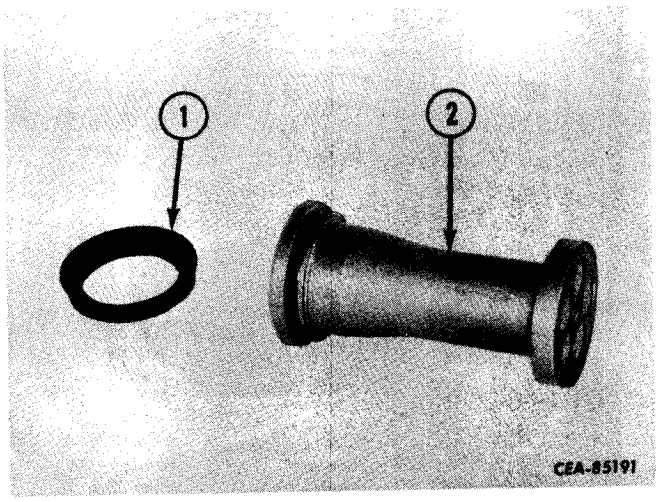

Figure 13-67

Install the check valve assembly (2, Fig. 13-68) in the end of the piston return spring (3). Insert the spring into the body (1). Place the primary cup (4) on the opposite end of the spring. Place the spring check valve, and cup in the body (1). Insert the piston (5), cup end first, into the body. Install the stop plate (6) and snap ring (7).

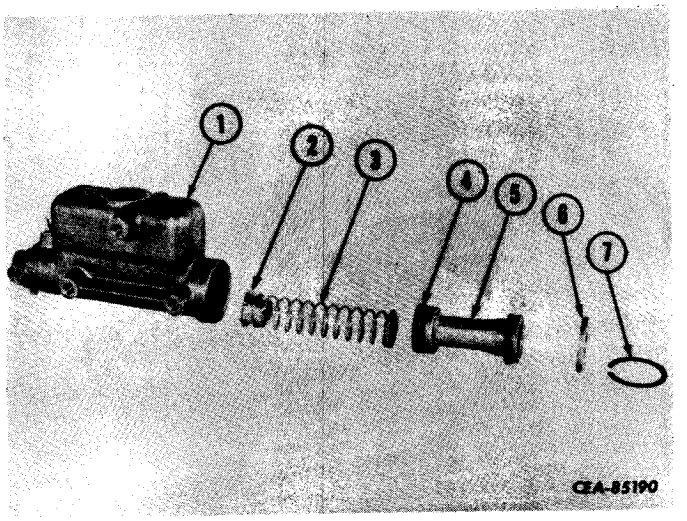

Figure 13-68

Attach the boot (2, Fig. 13-69) to the end of the cylinder body (1).

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DISASSEMBLY, INSPECTION AND ASSEMBLY

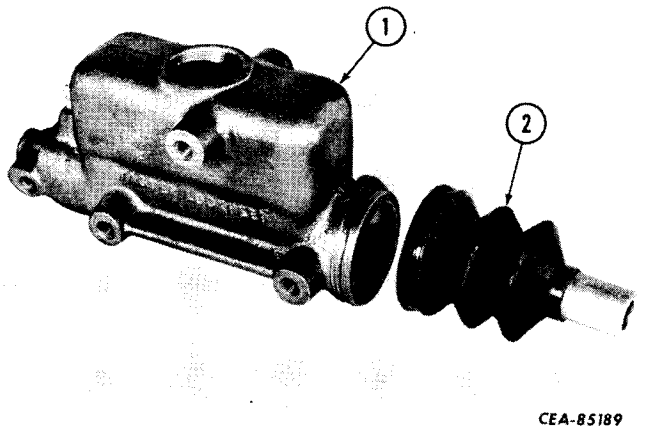

Figure 13-69

Lubricate the air cylinder cup (3, Fig. 13-70) and wiper (2) with light oil and install them on the piston and rod assembly (1).

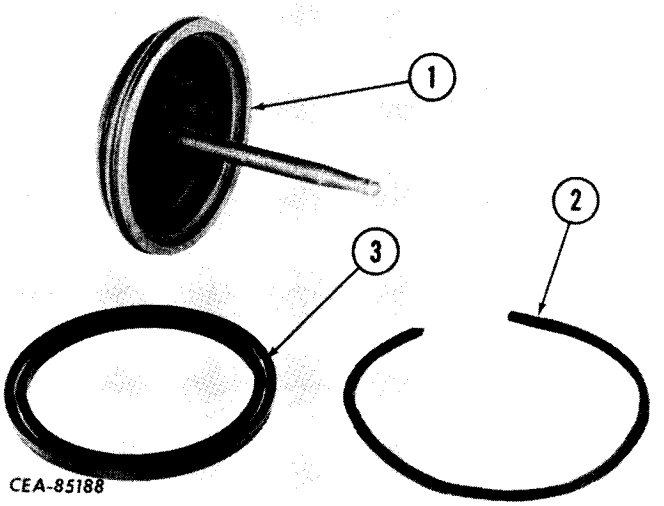

Figure 13-70

Insert the piston and rod assembly (2, Fig. 13-71) into the shell (1).

Place the piston return spring (2, Fig. 13-72) in the shell (1). Insert the head (3) into the shell and secure with the cap screws and lock washers (4).

Place the bracket (2, Fig. 13-73) on the shell (1) and secure with cap screws and lock washers (3).

(Continued on next page)

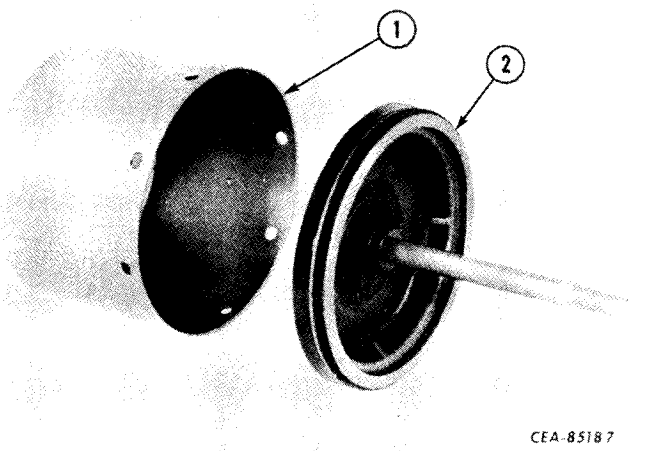

Figure 13-71

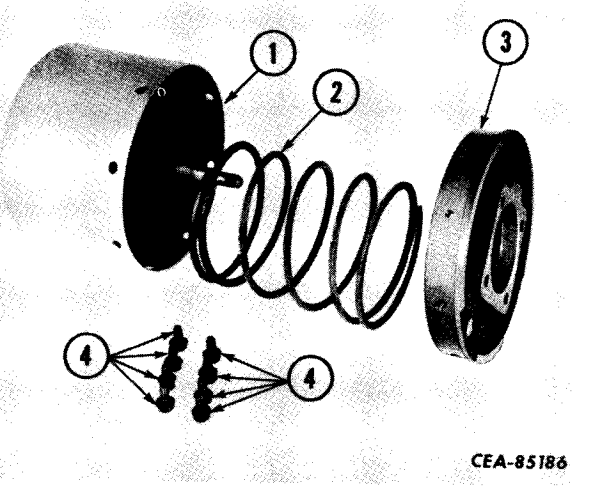

Figure 13-72

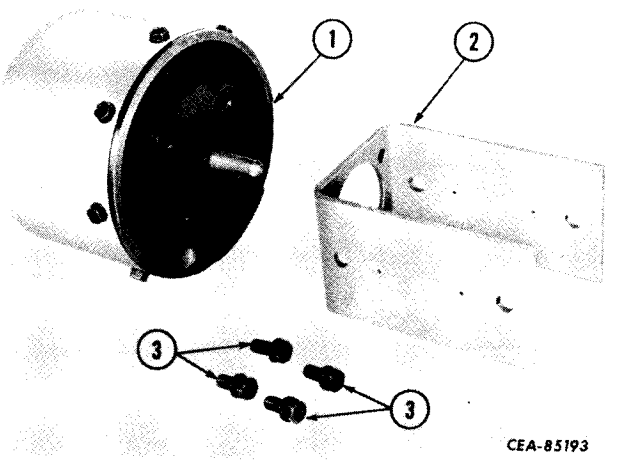

Figure 13-73

DISASSEMBLY, INSPECTION AND ASSEMBLY

POWER CLUSTERS - Continued

ASSEMBLY - Continued

Place the hydraulic cylinder (2, Fig. 13-74) in the bracket (1). Be certain that the plunger on the air cylinder fits in the metal grommet in the boot on the hydraulic cylinder. Install and tighten the mounting studs (3).

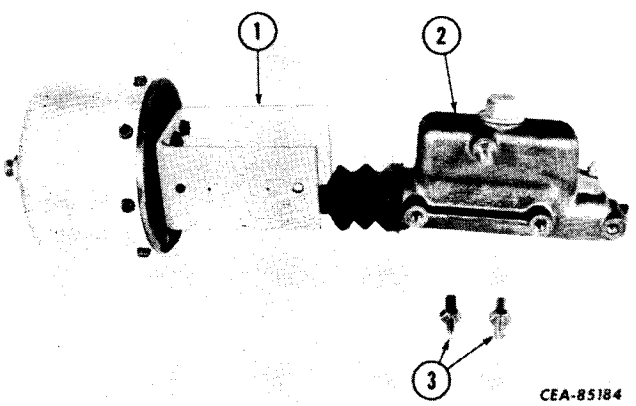

Figure 13-74

Install and tighten the cap screws and lock washers (2, Fig. 13-75) that secure the hydraulic cylinder (1) to the bracket (3).

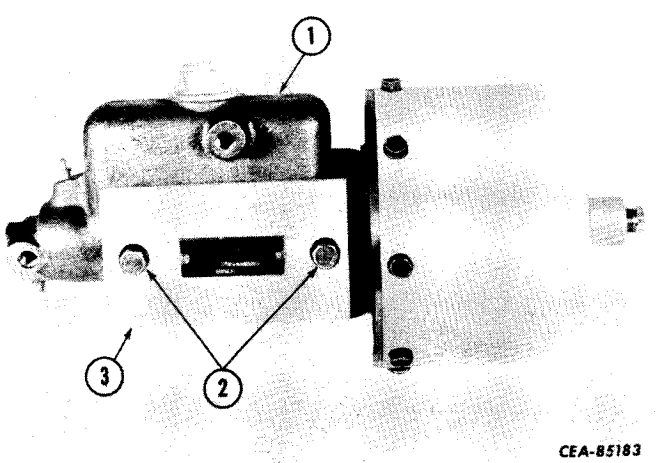

Figure 13-75

INSTALLATION

Place the power cluster on the tractor frame and fasten with the nuts and lock washers. Connect the air line (1, Fig. 13-76) and hydraulic line (2) to the power cluster.

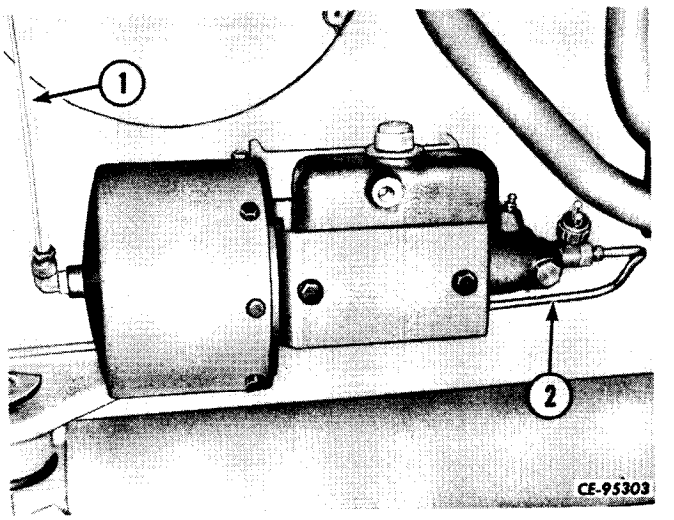

Figure 13-76

If the right power cluster was removed, connect the stop light switch wires.

Fill the power cluster reservoir with hydraulic fluid. Bleed the hydraulic circuit as described in this section under BLEED HYDRAULIC BRAKE CIRCUIT.

AIR COMPRESSOR

REMOVAL

Drain the air system by opening the drain valves on the air reservoirs. Close valves on reservoirs when they are empty.

> ◆ CAUTION: BLOCK OR HOLD THE TRACTOR BY MEANS OTHER THAN THE BRAKES WHENEVER THE AIR SYSTEM IS TO BE DRAINED BELOW 85 PSI.

Drain the water from the cooling system to drain the compressor.

(Continued on page 28)

DISASSEMBLY, INSPECTION AND ASSEMBLY

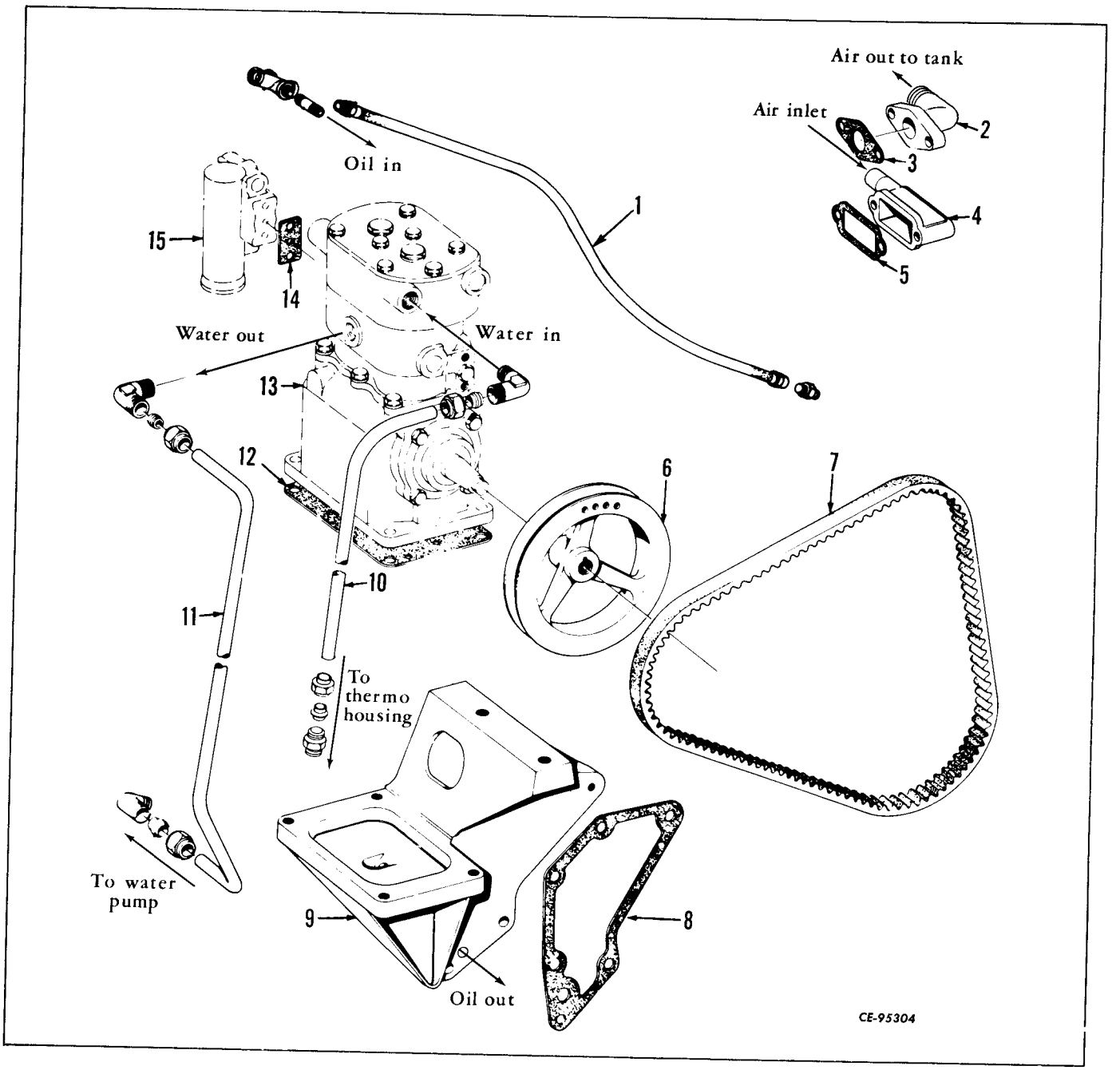

Figure 13-77
Compressor, Mounting Base and Related Parts.

1. Oil inlet tube.
2. Air discharge elbow.
3. Gasket.
4. Air inlet elbow.
5. Gasket.
6. Pulley.
7. Drive belt.
8. Gasket.
9. Compressor base.
10. Water inlet tube.
11. Water outlet tube.
12. Gasket.
13. Compressor.
14. Gasket.
15. Governor.

DISASSEMBLY, INSPECTION AND ASSEMBLY

AIR COMPRESSOR - Continued

REMOVAL - Continued

Loosen the generator support arm and move the generator to relieve the tension on the drive belt. Slip the belt off the compressor pulley.

Disconnect all air, water, oil pressure sending unit electrical lead and oil lines connected to the compressor.

Remove the bolts and lock washers that attach the compressor to the mounting base and lift the compressor off.

DISASSEMBLY

Before starting disassembly, remove all grease and dirt from the exterior of the compressor, using cleaning solvent and a brush.

Mark the following items to show their proper relationships prior to disassembly.

Position of cylinder block in relation to crankcase.

Position of end covers in relation to crankcase.

Position of crankshaft in relation to crankcase.

Remove the cap screws securing the cylinder head to the cylinder block and lift off cylinder head. The cylinder head may have to be tapped with a rawhide hammer to break the gasket joint.

Scrape the cylinder head gasket off the cylinder head and block.

Remove the discharge valve cap nuts (Fig. 13-78) and lift out discharge valve springs and discharge valves. The discharge valve seats can be removed, but it is not necessary unless they are badly worn or nicked.

Remove the inlet valve springs and inlet valves from the cylinder block (Fig. 13-80).

Remove the connecting rod bearing caps and push the pistons with connecting rods attached, out the top of the cylinder block (Fig. 13-80).

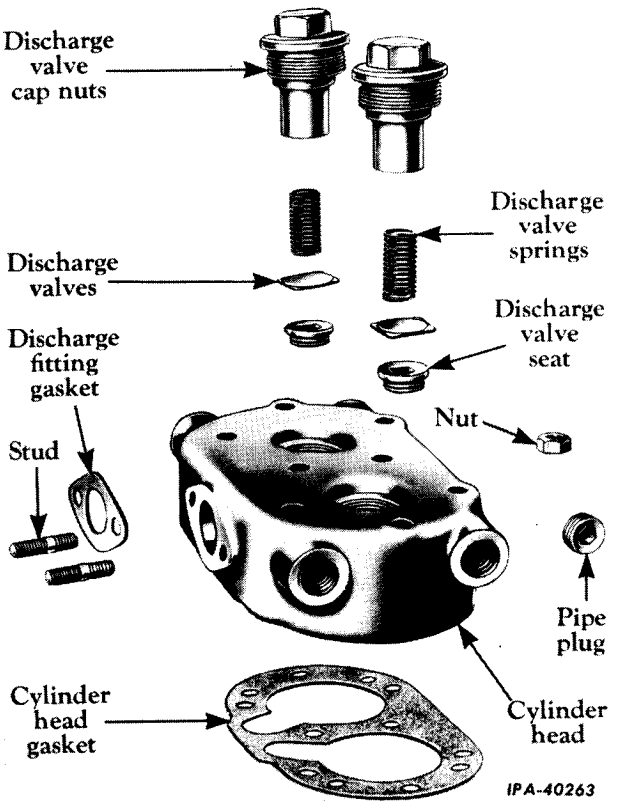

Figure 13-78
Exploded View of Cylinder Head.

Replace the caps on each connecting rod. Note that the caps are punch marked to show the proper position of the caps on the rods.

Remove the piston rings (11, Fig. 13-79) from each piston. If the pistons are to be removed from the connecting rods, remove the wrist pin lock wire (12) and press the wrist pin out of the piston and connecting rod.

Remove the nut securing the drive pulley to the crankshaft and use a gear puller to remove it from the crankshaft (44). Remove the key (5) from the crankshaft.

Remove the cap screws securing the front end cover (2) to the crankcase. Slide the front

(Continued on page 30)

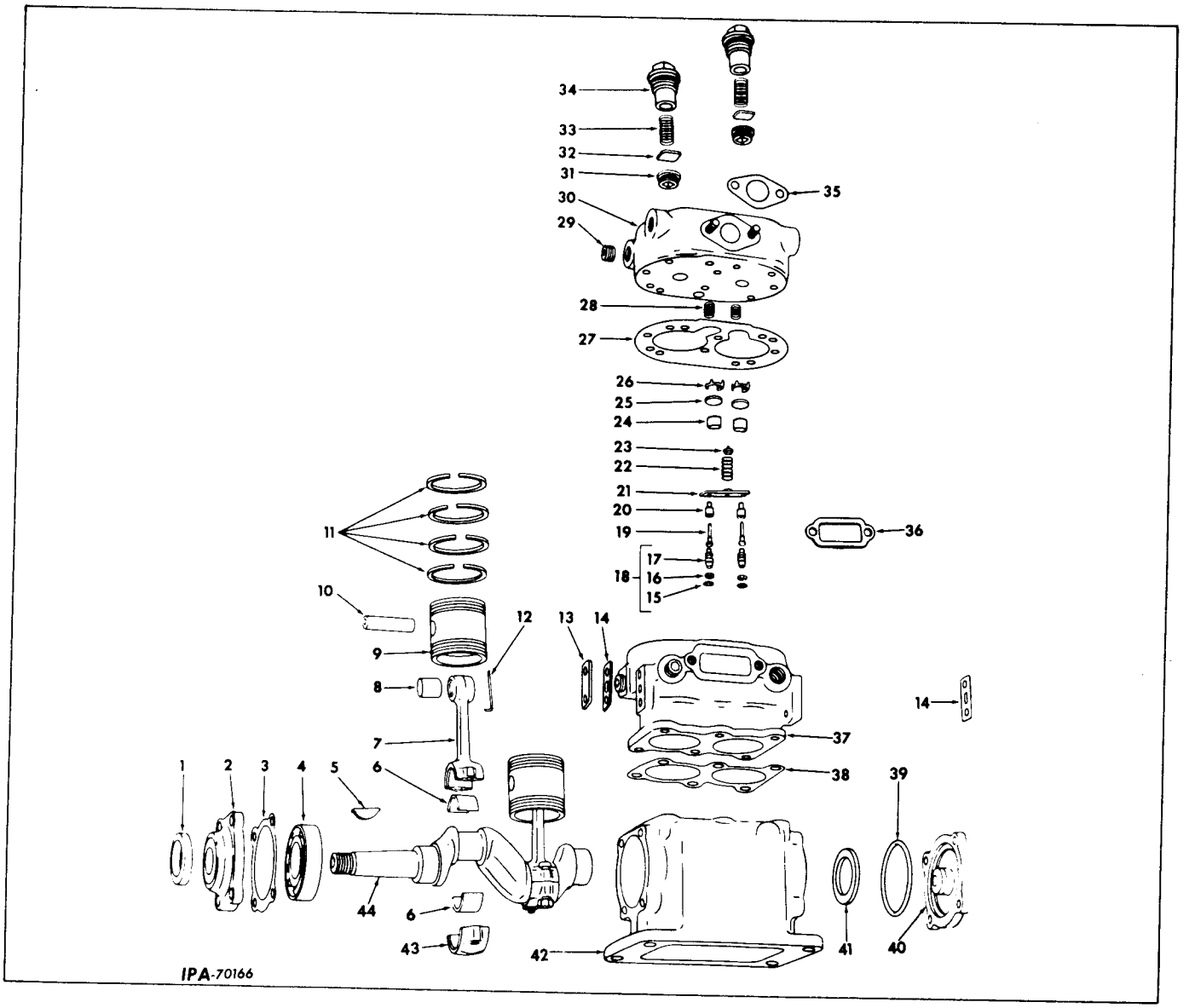

Figure 13-79
Air Compressor (Exploded View).

1. Crankshaft seal.
2. Front end cover.
3. End cover gasket.
4. Crankshaft ball bearing.
5. Key.
6. Connecting rod bearing.
7. Connecting rod.
8. Wrist pin bushing.
9. Piston.
10. Wrist pin.
11. Ring set.
12. Wrist pin lock wire.
13. Cover plate.
14. Gasket.
15. Unloader plunger grommet.
16. Back-up ring.
17. Piston.
18. Piston Assembly.
19. Plunger.
20. Guide.
21. Saddle.
22. Spring.
23. Seat.
24. Seat.
25. Inlet valve.
26. Inlet valve guide.
27. Cylinder gasket.
28. Inlet valve spring.
29. Pipe plug.
30. Cylinder head.
31. Discharge valve seat.
32. Discharge valve.
33. Discharge valve spring.
34. Discharge valve cap.
35. Flange gasket.
36. Gasket.
37. Cylinder block.
38. Cylinder block gasket.
39. Rear cover "O"-ring seal.
40. Cover with bushing.
41. Rear thrust washer.
42. Crankcase.
43. Connecting rod cap.
44. Crankshaft.

DISASSEMBLY, INSPECTION AND ASSEMBLY

AIR COMPRESSOR - Continued

DISASSEMBLY - Continued

cover with oil seal off the crankshaft. Do not remove the oil seal from the cover unless it is to be replaced. Remove the cap screws securing the rear cover (40) to the crankcase.

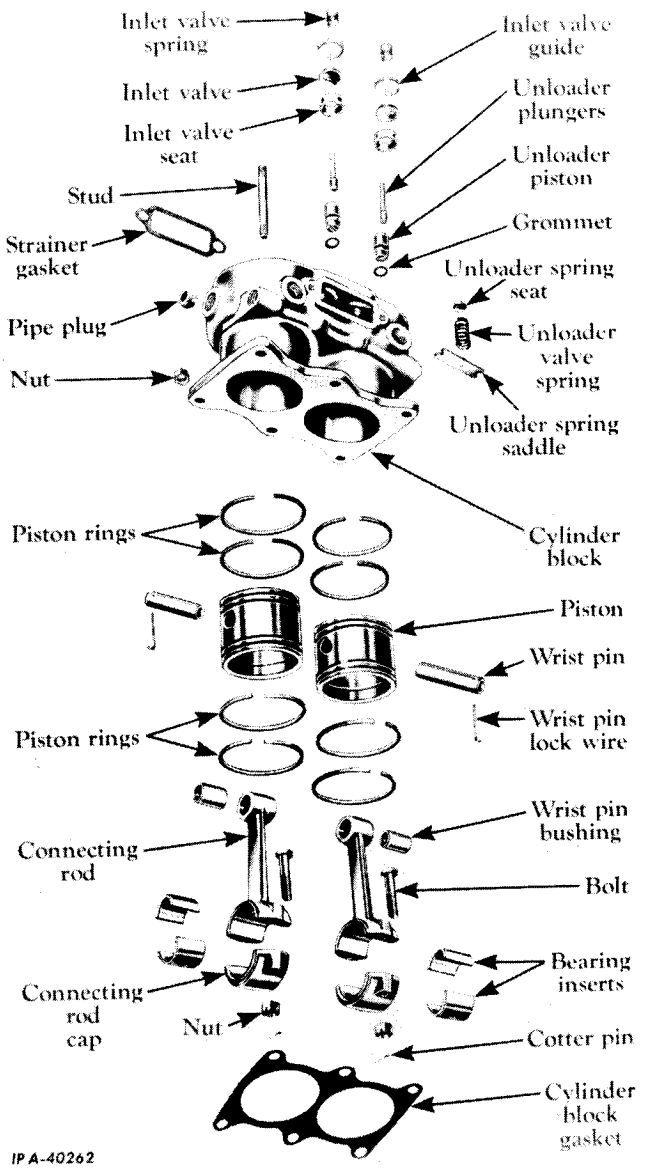

Figure 13-80
Exploded View of Cylinder Block.

Press or drive the crankshaft with the ball bearing out of the crankcase from the drive end of the compressor. The ball bearing can be pressed off the crankshaft if necessary to replace.

Remove the cap screws and lock washers securing the cylinder block to the crankcase and remove the cylinder block and gasket.

Remove the unloader valve spring and spring seat. Remove the unloader spring saddle, unloader plunger, unloader pistons and piston "O"-rings (Fig. 13-80).

NOTE: It may be necessary to apply air pressure, WITH CAUTION, at the governor port of the cylinder block to remove the unloader pistons.

Remove the inlet valve seat bushings only if the seats are worn or damaged.

CLEANING, INSPECTION AND REPAIR

Wash all parts in an oil solvent, and dry thoroughly with compressed air.

Put the cylinder head through a cleaning solution to remove all carbon from the discharge valve cavities and to remove all rust and scale from water cavities. Scrape carbon, dirt and particles of old gaskets from all surfaces.

Clean thoroughly all oil passages through crankshaft, connecting rods, crankcase, base plate and end cover. If necessary, prod oil passages with wire and flush with cleaning solvent.

Put the cylinder block through a cleaning solution to remove all carbon and dirt from the inlet passages and unloader passages and to remove rust and scale from water cavity. Scrape particles of old gaskets from all surfaces.

Inspect the cylinder head for cracks or breaks. Replace if any are found.

Test water jacket of cylinder head and cylinder block for leakage, using air pressure. Replace unit if leakage is found.

DISASSEMBLY, INSPECTION AND ASSEMBLY

Check crankcase, cylinder block and end cover for cracks and broken lugs. Replace if any are found.

Check the fit of bearing in crankcase. Bearings must be a finger press fit. If the crankcase bearing bores are worn or damaged, the crankcase should be replaced. Check the crankshaft bushing in the rear cover.

Check the fit of the unloading pistons and the piston "O"-rings in the cylinder block for excessive wear. New "O"-rings or grommets should be installed after which the unloading pistons should be a neat sliding fit in their bores. The bores must not be scratched or damaged in any way which might accelerate "O"-ring wear.

Check the unloading piston return spring for a permanent set. If the spring does not have sufficient tension to return the unloader pistons to the loaded position, replace the unloader unit.

Inspect the inlet valves and seats. If the valves are grooved deeper than .003 inch where they contact the seat, they should be replaced. Inlet valves not worn excessively or damaged, can be reclaimed by lapping them on a piece of crocus cloth on a flat surface. If the valve seats show signs of slight scratches or wear they can be reclaimed by using a lapping stone, grinding compound, lapping disc and valve grinding tool. If the seats cannot be reclaimed in this manner, they should be replaced. The dimension from the top of the cylinder block to the inlet valve seat should not exceed .145 inch. After installing new seats, the dimension should be .101 to .113 inches.

Discard old discharge valve springs and replace with new springs. Inspect the discharge valves and discharge valve seats. If the discharge valves are not worn excessively, they can be cleaned by lapping them on a piece of crocus cloth on a flat surface. If the seats are worn excessively so there is no longer sufficient metal left to reclaim the seat by using a lapping stone, the seats should be replaced. If new discharge valves, springs and cap nuts are installed, the discharge valve travel should be as indicated under "TOLERANCES."

Test the discharge valves for leakage by applying 100 pounds of air pressure through the discharge port of the cylinder head and apply soap suds to the discharge valve openings (Fig. 13-81). Leakage in the forming of soap bubbles is permissible.

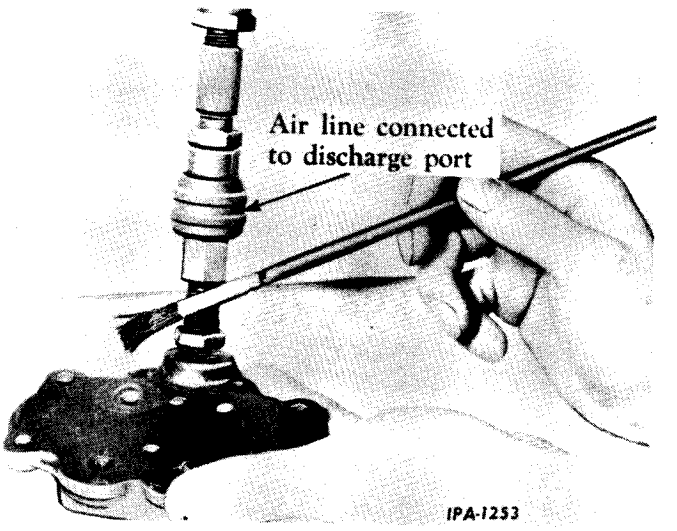

Figure 13-81
Testing Discharge Valve for Leakage.

If excessive leakage is found, leave the air pressure applied and using a fiber or hardwood dowel and light hammer, tap the discharge valves off their seats several times to improve the seal between the valves and their seats. If the valves and seats have been reconditioned properly, this will reduce the leakage (Fig. 13-82).

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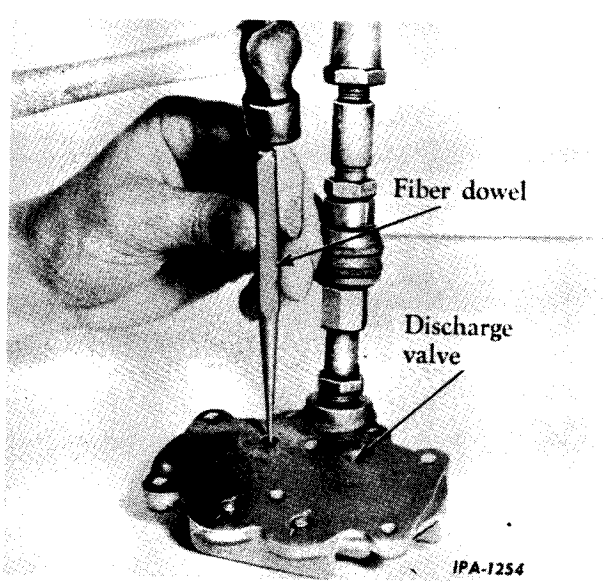

Figure 13-82
Seating Discharge Valve With Dowel.

DISASSEMBLY, INSPECTION AND ASSEMBLY

AIR COMPRESSOR - Continued

CLEANING, INSPECTION AND REPAIR - Continued

Leakage tests must also be made by applying soap suds around the discharge valve cap nuts, with air pressure applied as above. Leakage at cap nuts is not permissible.

Check the cylinder bores for evidence of excessive wear, out-of-round or scoring. Cylinder bores which are scored or out-of-round more than .002 inch or tapered more than .003 inch should be rebored or honed oversize. Cylinder bores should be finished honed while bolted to the compressor crankcase if possible. Oversize pistons (.010, .020 and .030) are available. Cylinder bores must be smooth, straight and round.

Inspect the pistons for scores, cracks or damage of any kind. If scores or cracks are found, replace the piston.

Check the clearance between the pistons and the cylinder bores with feeler gauge stock, (Fig. 13-83). The clearance should be as noted under "TOLERANCES."

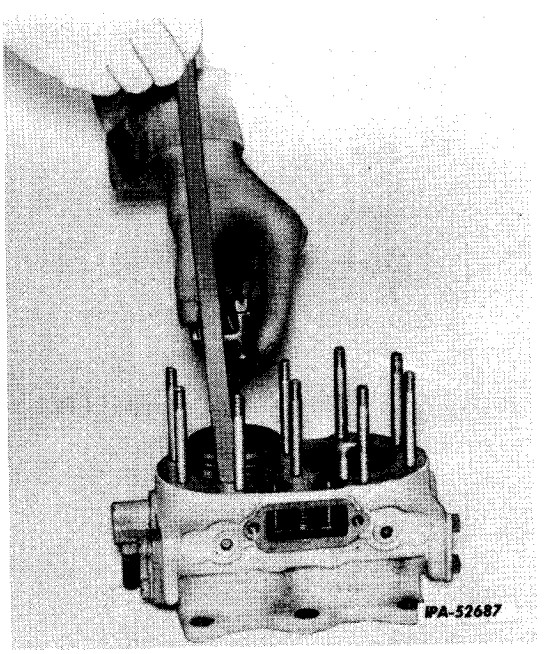

Figure 13-83
Checking Piston and Cylinder Bore Clearance.

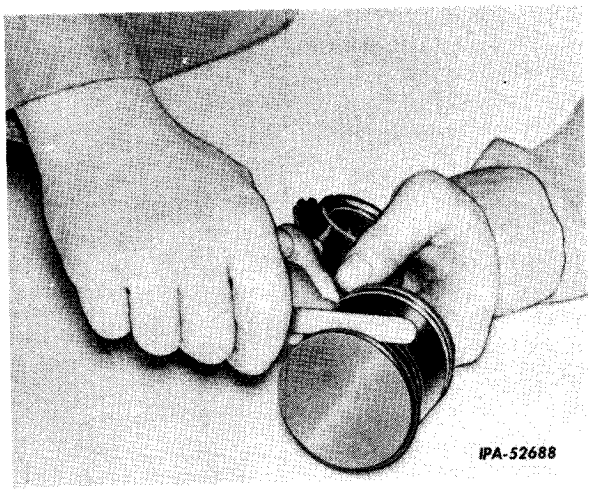

Figure 13-84
Checking Piston Ring Groove Clearance.

Check the pistons for correct clearance between the rings and the ring grooves, (Fig. 13-84). Also check the ring gap with the rings installed in the cylinder bores, (Fig. 13-85). The correct ring gap and groove clearance is listed under "TOLERANCES."

Check fit of wrist pins in the pistons and connecting rods. Wrist pins must be a light press fit in the pistons. If the wrist pin is a loose fit

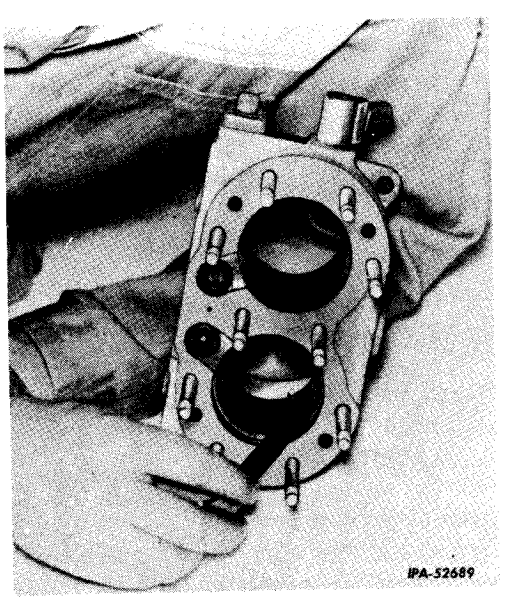

Figure 13-85
Checking Piston Ring Gap.

DISASSEMBLY, INSPECTION AND ASSEMBLY

in the piston, the wrist pin, piston or both must be replaced. Check fit of the wrist pin in the connecting rod bushing by rocking the piston. Clearance of the wrist pin to connecting rod bushing should not exceed recommended limits (refer to "TOLERANCES"). If excessive clearance is apparent, replace the wrist pin bushings in the connecting rods.

When pressing new bushings into place, be sure that the oil hole in the bushing lines up with the oil hole in the connecting rod. Bushings must then be reamed, honed or bored to provide specified clearance between the bushing and wrist pin (refer to "TOLERANCES").

Inspect the connecting rod bearings for proper fit on the crankshaft journals. Also check connecting rod bearings for wear. If worn, cracked or broken, the inserts must be replaced. Connecting rod caps are not interchangeable. Position the caps so that the two insert locking slots are adjacent to the same cap screws.

Crankshaft journals which are out-of-round (refer to "TOLERANCES") must be reground. When regrinding, the fillets at the ends of the journals must be maintained. Undersize connecting rod bearing inserts (.010, .020 and .030) are available. Check to be sure the oil passages are open and clean through the crankshaft.

Main bearing journals must not be worn sufficiently to prevent the ball bearing being a press fit.

The oil seal ring grooves in the crankshaft must not be worn sufficiently to prevent a good fit on the oil seal rings. Walls of the oil seal ring grooves must be square and have a good finish.

Inspect the ball bearings for wear of flat spots, replace bearings if these conditions exist.

ASSEMBLY

Place a new cylinder block gasket (38, Fig. 13-79) in position on the crankcase. Position the cylinder block on the crankcase according to marking made prior to disassembly. Install cap screws and tighten securely.

Press the ball bearing (4) on the crankshaft if it was removed. Install a new "O"-ring (39) in the rear cover (40) groove. Lubricate the "O"-ring and tap the cover with crankshaft bushing installed in place. Fasten with cap screws and washers.

Place the rear thrust washer (41) on the crankshaft with the washer oil grooves toward the crankshaft shoulder. Lubricate the crankshaft with engine oil and carefully insert into the crankcase (42).

Use a new gasket (3) and install the front cover (2) with a new oil seal (1) to the crankcase (4). Rotate the crankshaft to be sure it is not binding.

Position the connecting rod in the piston and press the wrist pin into the piston with the lock wire holes in the pin aligned with the lock wire holes in the piston.

Install new wrist pin lock wire in the wrist pin so that the long end extends through the piston and wrist pin. Snap the short end into the lock wire hole near the bottom of the piston skirt (Fig. 13-86).

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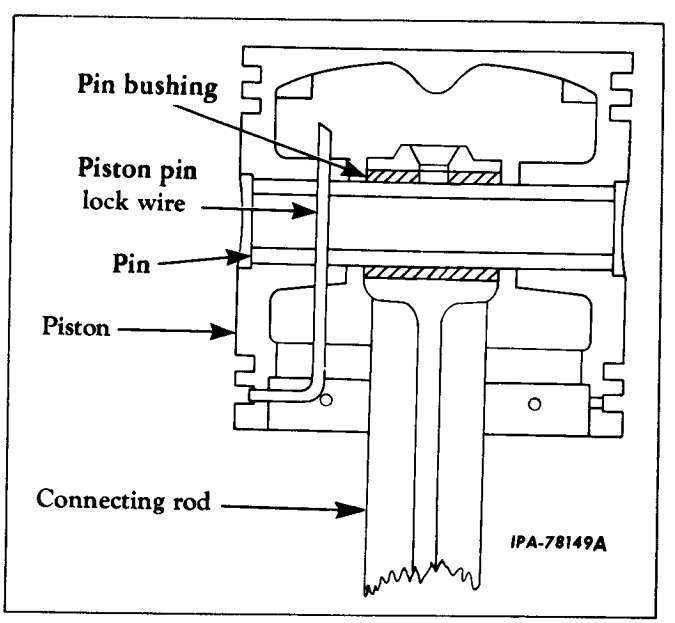

Figure 13-86
Method of Installing Wrist Pin Lock Wire.

AIR COMPRESSOR - Continued

ASSEMBLY - Continued

Install the piston rings in their proper location and with the pip marks or bevel up, stagger the piston ring gaps so that they are not in line.

Before installing pistons and connecting rods, thoroughly lubricate pistons, piston rings, wrist pin bushings and connecting rod bearings with clean engine oil.

Turn the crankshaft so as to position one crankshaft journal downward. Remove the bearing cap from one connecting rod leaving the connecting rod bolts in the rod.

Using a ring compressor, install the connecting rod and piston through the top of the cylinder. Push the piston down until the connecting rod bearing makes contact with the crankshaft journal.

Install the connecting rod bearing cap. Be sure that the aligning marks on the cap and rod coincide. If the cap and rod are not marked, position the cap on the rod so that the two locking slots in the bearing inserts, rod and cap are both located adjacent to the same connecting rod bolt. Secure the cap to the rod with bolts and lock washers. Tighten bolts evenly. Bend the lock washer prongs up against the bolt heads. Install the other connecting rod and piston in the same manner.

Lubricate the unloader piston cavity in the cylinder block, the unloader piston and "O"-ring with clean engine oil.

Place the unloader piston "O"-rings on the unloader pistons. Install the unloader pistons and plungers through the top of the cylinder block, taking care to avoid cutting the "O"-rings on the cylinder block (Fig. 13-80).

Install the unloader spring saddle (21, Fig. 13-79) on the unloader plungers. Install the unloader spring seat (23) in the top of the cylinder block air inlet opening. Place the unloader spring (22) between the spring guide and the spring saddle.

Install the inlet valve guides (26) in the top of the cylinder block if they were removed. Install the inlet valves (25) and inlet valve springs (28) in the cylinder block.

Install the discharge valves, springs and valve cap nuts in the cylinder head (Fig. 13-80).

Place a new cylinder head gasket on the block. Carefully align the inlet valve springs with the inlet valve guides in the cylinder head as it is placed on the cylinder block. Secure the cylinder head to the block with the cylinder head bolts. Tighten these bolts evenly.

Install the key and drive pulley to the crankshaft, add and tighten nut, and lock with cotter pin.

TESTING REBUILT COMPRESSOR

In order to properly test a compressor under operating conditions, a test bench is necessary for properly mounting, cooling, lubricating and driving the compressor. If such facilities are available, the oil supply line must furnish at least 15 psi during all tests and the crankcase kept drained of oil during the tests. Water for cooling must also be provided. Such tests are not compulsory, if the unit has been carefully rebuilt.

Connect the compressor to an oil line of at least 15 psi during the test.

Install an oil drain line to keep the crankcase drained.

Install water lines for cooling to provide a minimum of 2.5 gpm of water.

Connect an air reservoir to the discharge port. The air reservoir volume plus the connecting line volume should be 1300 cubic inches.

Run the compressor at 1700-1750 rpm. The elapsed time for the compressor to build up from 0 psi to 100 psi should be a maximum of 47 seconds.

During the test the compressor should be checked for oil leakage and noisy operation.

DISASSEMBLY, INSPECTION AND ASSEMBLY

INSTALLATION

Using a new gasket, install the compressor to the compressor base. Attach the compressor with the hex-head bolts and lock washers.

Slip the compressor belt onto the pulley and adjust to the proper tension.

Reconnect all of the air, water and oil lines.

Fill the cooling system.

Start the engine and visually check for oil and water leaks.

WHEEL BRAKES

REMOVAL

Disconnect the hydraulic lines from the wheel cylinder. Disassemble the axle as far as necessary to remove the assembled brake and spider. Remove the cap screws and locknuts that secure the brake spider to the axle housing.

DISASSEMBLY

Remove the bleeder screw (3, Fig. 13-87) from the wheel cylinder (4). Drain the hydraulic brake fluid from the cylinder. Loosen the setscrew (2) that holds the wheel cylinder in position. Unscrew the wheel cylinder from the spider (1).

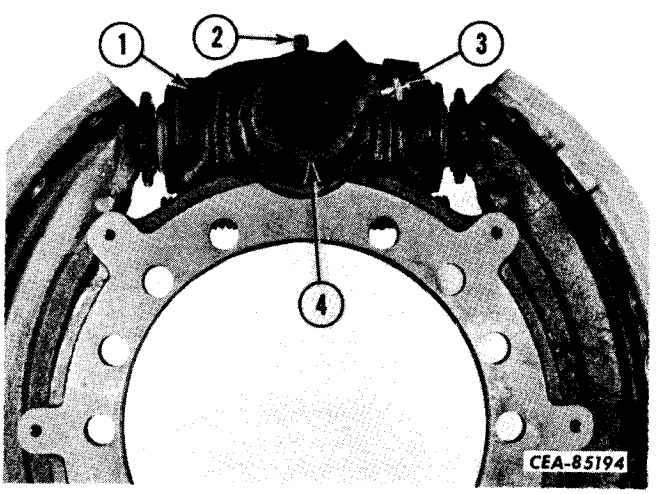

Figure 13-87

Shake or slide the piston (5, Fig. 13-88) out of cylinder (1). Remove the cup (4), plug (3), and spring (2). Remove the "O"-ring (6) from the piston.

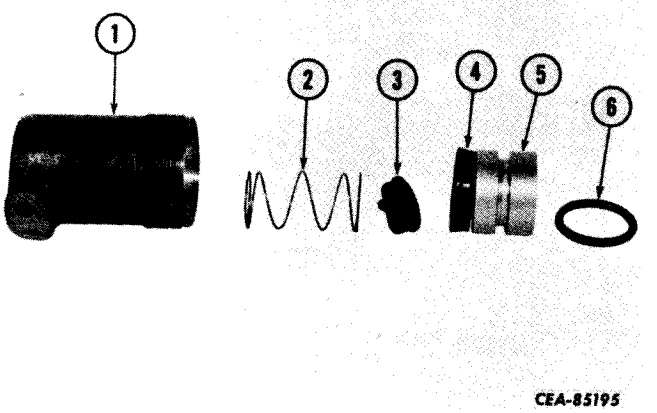

Figure 13-88

Remove the wedge and roller assembly from the brake spider. (Fig. 13-89.)

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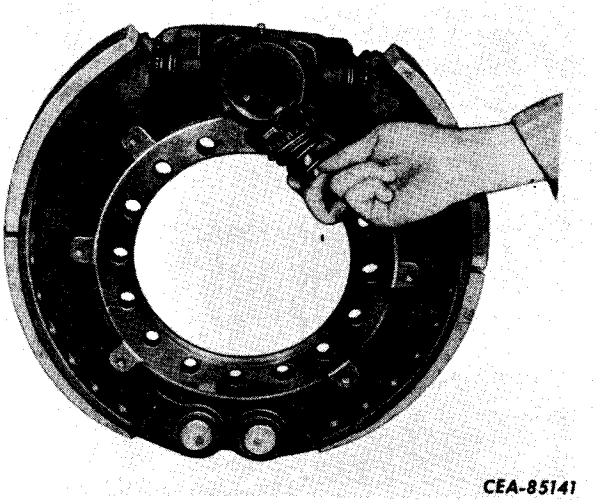

Figure 13-89

DISASSEMBLY, INSPECTION AND ASSEMBLY

WHEEL BRAKES - Continued

DISASSEMBLY - Continued

Compress the spring (4, Fig. 13-90) and remove the E-washer (6) and flat washer (5). Slide the spring (4) and washer (3) off the wedge (1). Remove rollers (7) from cage (2) and slide wedge out of the cage (spread height of cage with screwdriver to remove rollers).

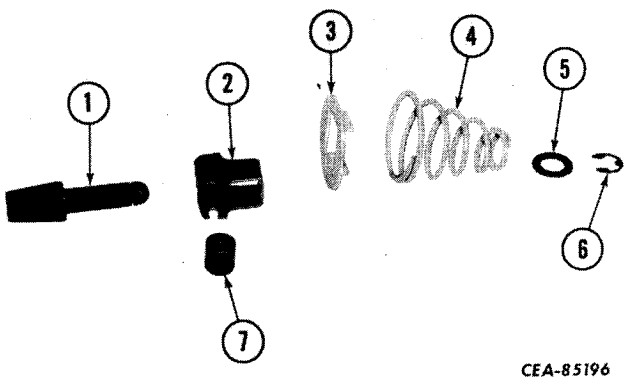

Figure 13-90

Remove the brake shoe return spring (1, Fig. 13-91). Remove the retaining springs (2) from the anchor pins (5). Remove the felt retainer (3) and felt (4). Slide the anchor pins (5) out of the spider and shoes. Remove the shoe and lining assemblies (6).

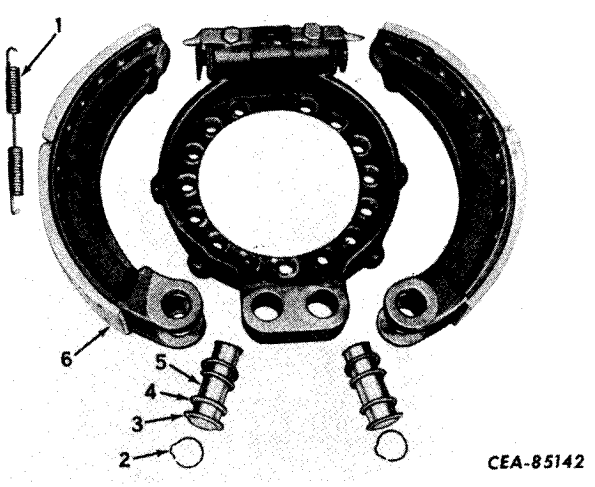

Figure 13-91

Bend back the lock (2, Fig. 13-92) and remove the cap screw (1). Remove the lock and detent (3). Remove the adjustment bolt (7) from the plunger (5). Remove the seal (6) and plunger (5) from the plunger housing.

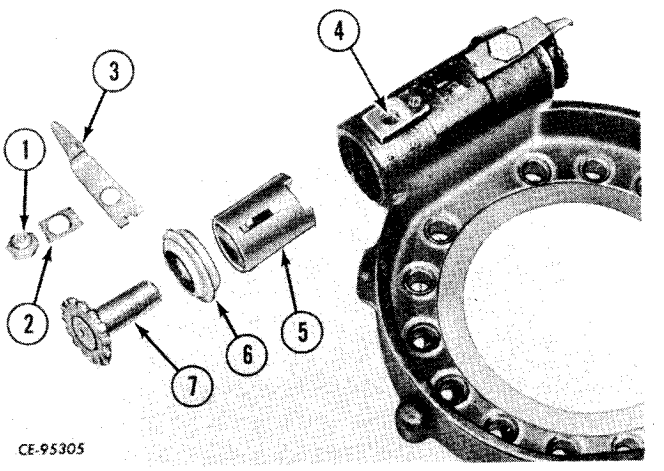

Figure 13-92

INSPECTION

Clean and inspect the brake assembly parts as follows:

a. Clean all metal parts in a good grade cleaning solvent. Use compressed air to dry parts.

b. Inspect the wheel cylinder cup and plug for signs of wear or cracking. Replace any defective parts.

c. Inspect the wheel cylinder for scoring or damage. Hone the cylinder if scored.

d. Inspect the parts of the wedge and roller assembly and the plunger assembly for signs of wear or damage. Replace any defective parts.

e. Inspect the plunger seal. Replace if defective.

f. Inspect the anchor pins for wear or misalignment. Inspect the brake shoes for wear at the anchor pin holes. Replace the anchor pin felts and retaining springs.

DISASSEMBLY, INSPECTION AND ASSEMBLY

Lubricate the internal actuating parts of the brake assembly (wedge assembly, guide screws, plunger, and actuator cavity) with multi-purpose NLGI, Grade 2 lithum base chassis grease (IH 251H EP) before assembly.

Dip the wheel cylinder cup, piston, and piston seal ring in hydraulic brake fluid before assembly.

Reline the brake shoe assemblies as described below.

BRAKE RELINING

Punch out the rivets and remove the old linings from the shoes. Clean the lining and shoe contact faces. Clamp the lining to the shoe with C-clamps so the holes in both pieces are in alignment.

Rivets of the correct body diameter, head size and shape, length, and material should be used.

Using a rivet press, install the rivets following the sequence shown in Fig. 13-93.

Check lining installation with a 0.002-inch feeler gauge to assure proper lining and shoe contact.

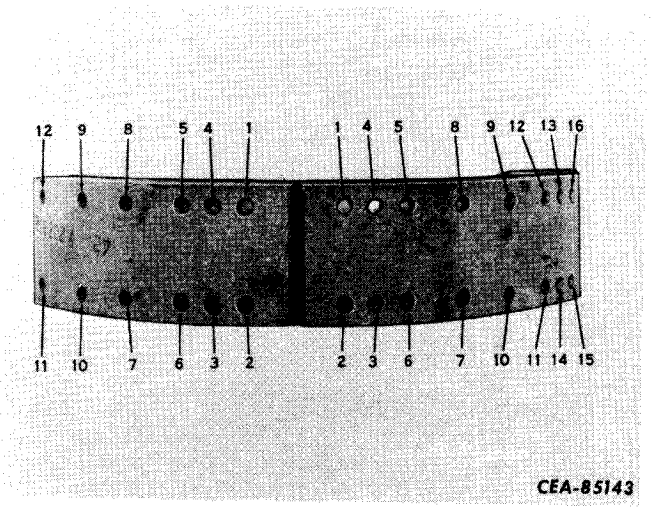

Figure 13-93

ASSEMBLY

Insert the plunger (5, Fig. 13-94) into the seal (6) until the inner lip of the seal enters the groove in the plunger. Slide the plunger into the housing, aligning the groove in the plunger with the guide screw hole (4) in the housing. Seat the seal on the housing. Place the detent (3) and lock (2) on the housing and install and tighten the guide screw (1). Lock in place by bending the lock against the screw. Screw the bolt (7) into the plunger.

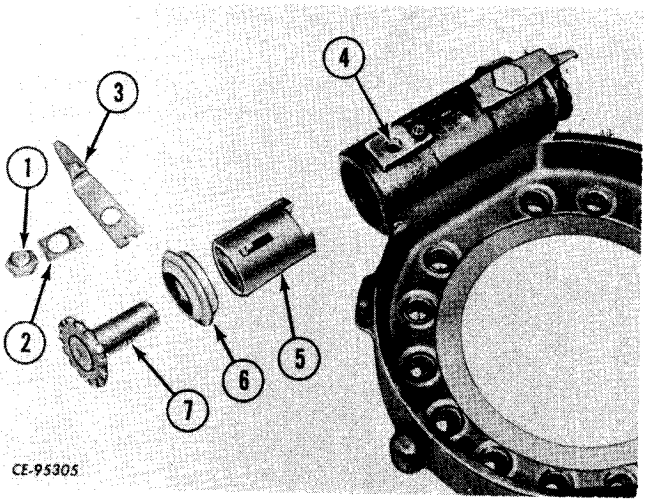

Figure 13-94

Position the brake shoe and lining assemblies (6, Fig. 13-95) on the spider. Position a felt (4) and felt retainer (3) on each anchor pin (5). Insert the anchor pins through the holes in the

(Continued on next page)

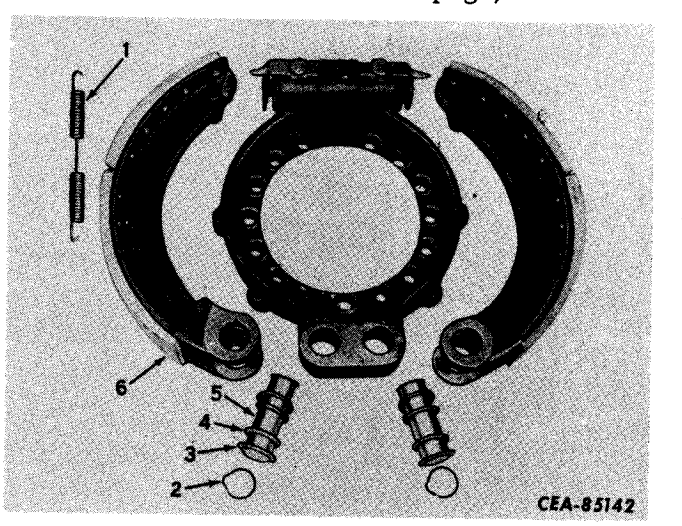

Figure 13-95

DISASSEMBLY, INSPECTION AND ASSEMBLY

WHEEL BRAKES - Continued

ASSEMBLY - Continued

spider and shoes. Place a felt and felt retainer on each pin. Secure the pins with the retaining rings (2). Install a new brake shoe return spring (1).

Insert the wedge (1, Fig. 13-96) into the roller cage (2). Install the rollers (7) in the cage. Place the washer (3), spring (4), and washer (5) on the wedge shaft. Compress the spring and install the E-washer (6) in the groove in the wedge shaft.

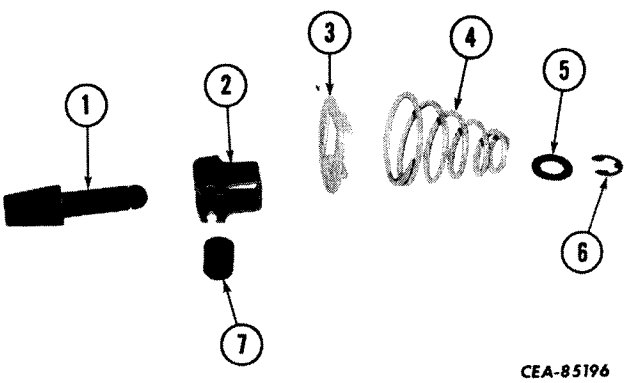

Figure 13-96

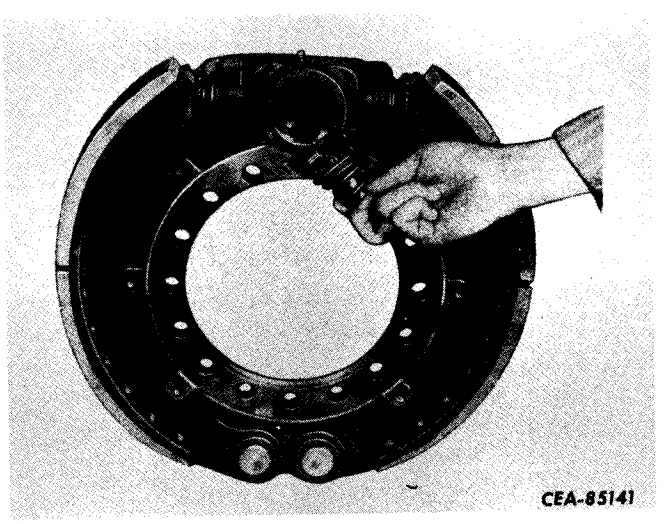

Figure 13-97

Install the assembled wedge and roller assembly in the spider. Be certain that the rollers enter the slots in the plungers. (Fig. 13-97.)

Install the "O"-ring (6, Fig. 13-98) on the piston (5). Slide the spring (2), plug (3), cup (4) and piston into the cylinder (1).

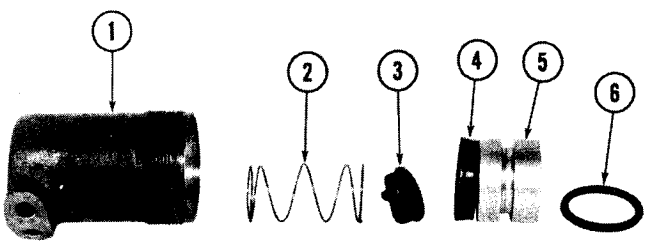

Figure 13-98

Screw the wheel cylinder (4, Fig. 13-99) into the spider (1) until it bottoms. If the bleeder and brake line holes are not in the desired position, unscrew the cylinder to align as desired. This will require less than one full turn. Install and tighten the setscrew (2). Tighten the setscrew just enough to hold the cylinder in place.

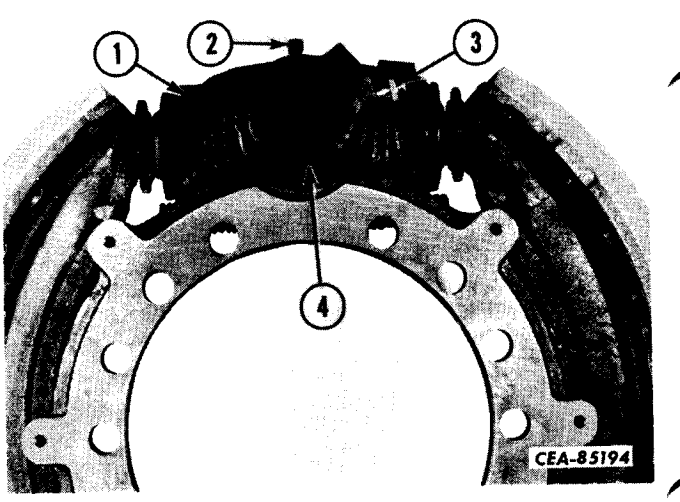

Figure 13-99

NOTE: Over-tightening may distort the cylinder housing.

Install the bleeder screw (3) in the cylinder.

INSTALLATION

Install the brake and spider assembly. Secure with the cap screws and lock washers. Torque the screws. Refer to "SPECIAL TORQUES" in this section.

Torque:_____

Connect the hydraulic lines to the wheel cylinder. Reassemble the axle components. Bleed the hydraulic brake circuit. Adjust the brake lining to drum clearance as described under "ADUST BRAKES."

BLEED HYDRAULIC BRAKE CIRCUIT

The hydraulic portion of each power cluster and wheel brake assembly must be "bled" when it is suspected that air is present in the brake fluid, such as after overhaul.

Manually bleed the hydraulic lines of a power cluster as described below:

a. Start and run the engine to charge the compressed air portion of the brake system. Shut down the engine.

b. Remove the fill cap and fill the power cluster reservoir with the type fluid recommended in "SPECIFICATIONS." Keep the reservoir full during the entire bleeding operation.

c. Attach a bleeder hose, if available, to the bleeder screw at the power cluster. Submerge the opposite end of the hose in a jar partially filled with brake fluid.

d. Open the bleeder screw one turn and slowly apply one of the treadle valves. Make additional treadle applications until no bubbles escape from the bleeder hose. If a bleeder hose is not used, close the bleeder screw each time before releasing the treadle valve.

e. Close the bleeder screw and remove the bleeder hose. Then bleed the hydraulic cylinders on the wheels. Fill the cylinder reservoir to within 1/2" to 3/8" of the fill hole.

BRAKE LINES AND ACCESSORIES

GENERAL

The brake air and hydraulic lines should be inspected periodically for signs of wear or damage. Inspect the tube fittings for leakage. Replace any lines or fittings found to be defective. Care should be taken when installing brake lines that they are not crimped or bent too sharply.

PARKING BRAKE

GENERAL

Prepare the tractor for disassembly of the parking brake as follows:

a. Park the tractor on a level surface.

b. Install the safety pins to lock the tractor halves in a full turn position. Refer to the tractor operator's manual for safety pin installation instructions.

c. Block the tractor wheels to prevent the tractor from rolling.

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

PARKING BRAKE - Continued

DISASSEMBLY

Remove the cap screws (1, Fig. 13-100) that secure the transmission to transfer drive shaft (5) to the transfer drive yoke (2). Remove the drive shaft from the yoke.

Disconnect the parking brake linkage (3) from the operating cam lever (4).

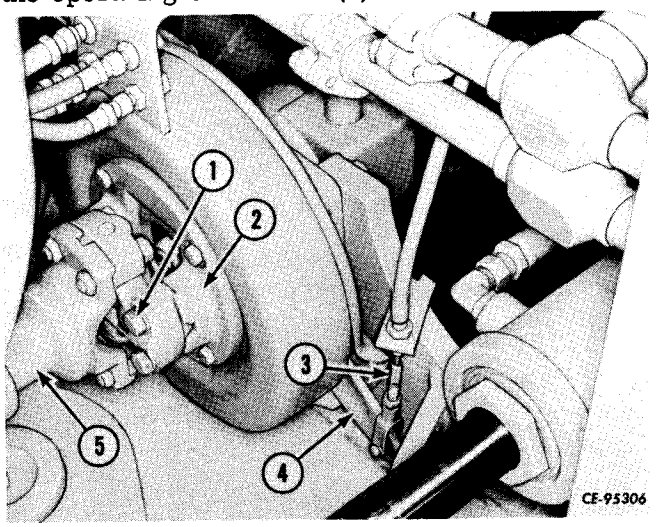

Figure 13-100

Remove the locknut (1, Fig. 13-101), retainer (2), and seal washer (3) that secure the yoke and drum assembly (4) to the transfer drive shaft (5).

Remove the yoke and drum assembly.

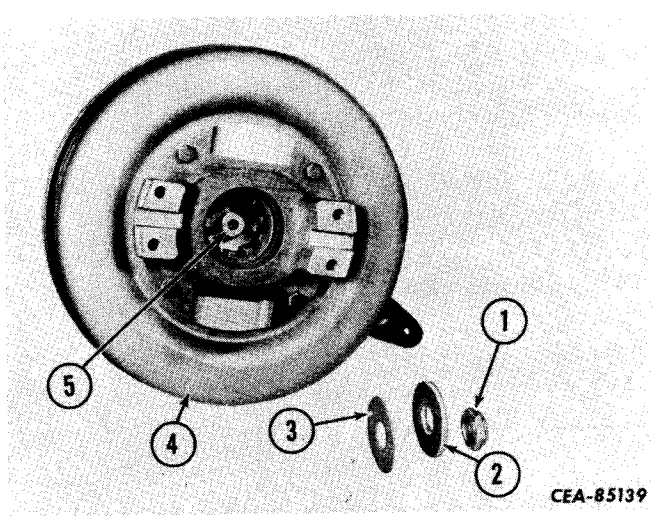

Figure 13-101

Remove the cap screws and locknuts (1, Fig. 13-102) that secure the drum (2) to the yoke (3). Separate the drum and yoke.

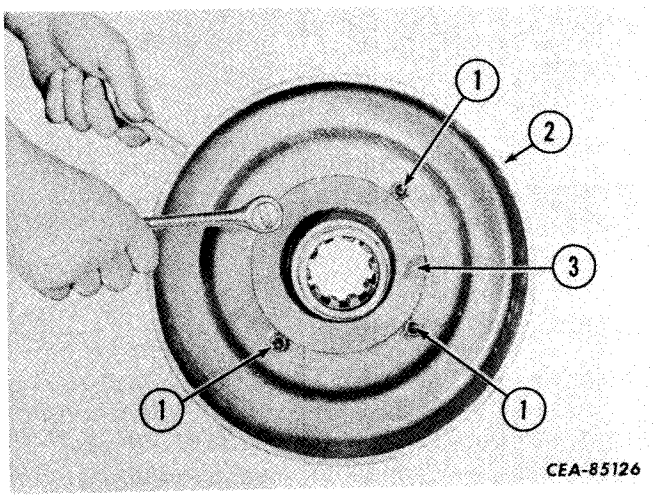

Figure 13-102

Using a brake spring pliers, remove the brake springs (1, Fig. 13-103) from the brake shoes (2) as shown.

Remove the brake shoes from the backing plate.

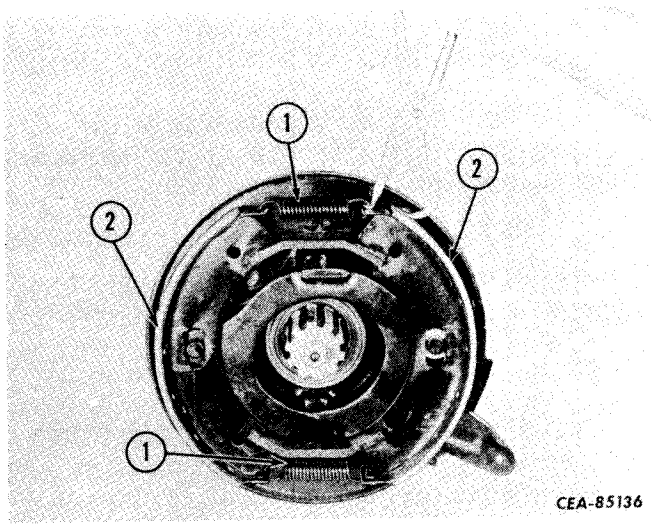

Figure 13-103

Remove the operating cam lever (2, Fig. 13-104) and roller (1) from the pawls (3 and 4) on the backing plate.

DISASSEMBLY, INSPECTION AND ASSEMBLY

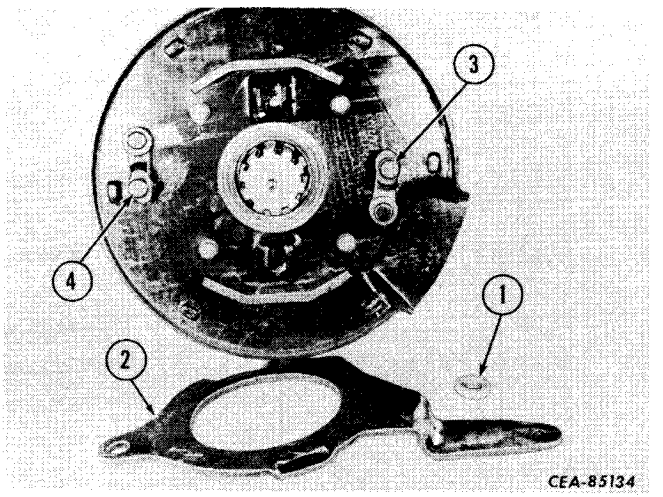

Figure 13-104

Remove the cap screws and lock washers (1, Fig. 13-105) that secure the backing plate (2) to the transfer drive housing.

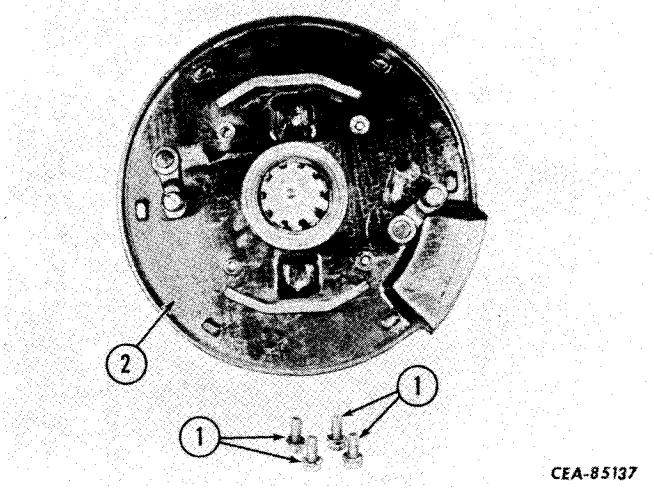

Figure 13-105

INSPECTION

Clean and inspect all parts as follows:

a. Inspect the brake linings and drum for wear. Replace worn linings as described under "BRAKE RELINING."

b. Clean all parts in solvent. Use compressed air to dry parts.

c. Lubricate the actuating parts of the brake (operating cam lever, roller, pawls) with chassis grease.

d. Inspect the parking brake parts for signs of wear or damage. Replace any parts found to be defective.

BRAKE RELINING

Reline the parking brake shoes as follows:

a. Punch out the rivets and remove the old lining from the shoe.

b. Clamp the new lining to the shoe so that the rivet holes in both pieces are in alignment. Use a C-clamp and locate it as near the rivet holes as possible.

NOTE: The lining and shoe contact faces should be clean before assembling. Rivets of the correct size and shape should be used.

c. Using a rivet press, install the rivets following the sequence shown in Fig. 13-106.

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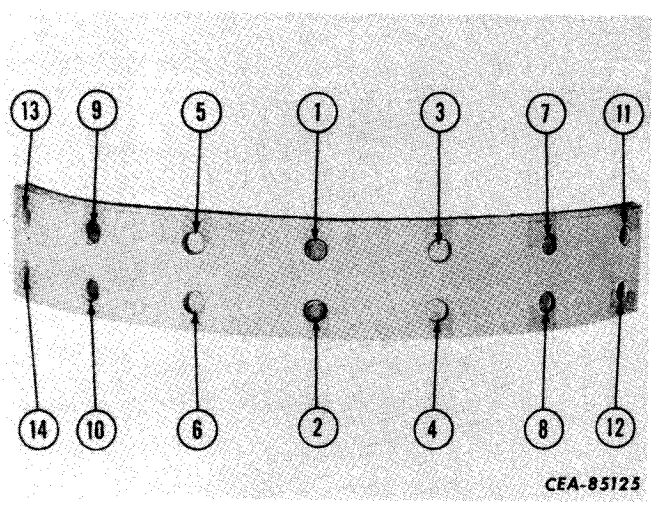

Figure 13-106

DISASSEMBLY, INSPECTION AND ASSEMBLY

PARKING BRAKE - Continued

ASSEMBLY

Install the backing plate (2, Fig. 13-107) on the transfer drive housing and secure with the cap screws and lock washers (1). Torque the cap screws. Refer to "SPECIAL TORQUES" in this section.

Torque:_____

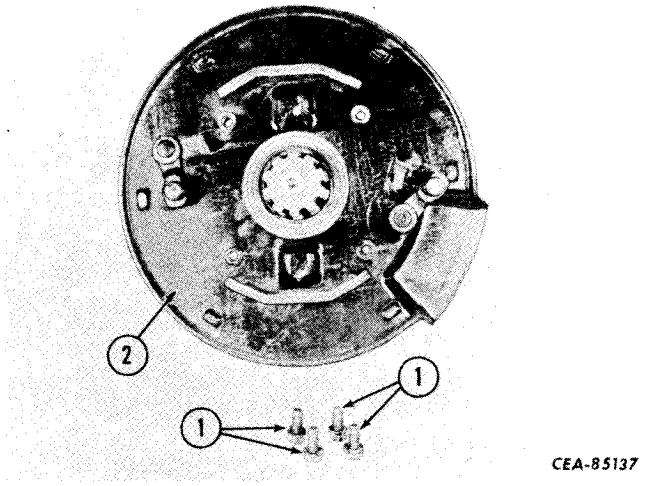

Figure 13-107

Place the roller (1, Fig. 13-108) on the pawl (3) on the backing plate. Install the operating cam lever (2) on the left pawl (3) and under the roller (1).

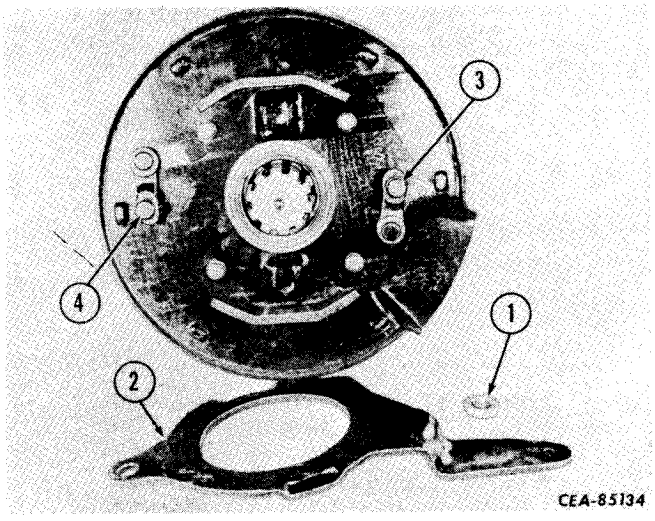

Figure 13-108

Install the brake shoes (2, Fig. 13-109) on the backing plate. Install the brake springs (1) on the shoes using a brake spring pliers. Be sure springs are installed in rear holes.

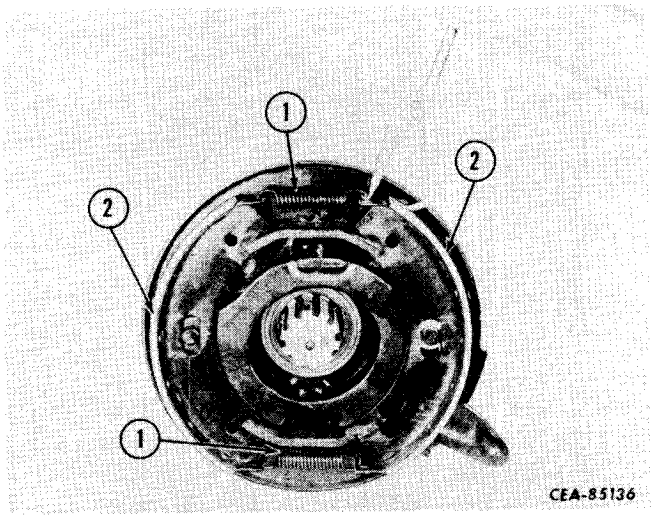

Figure 13-109

Place the yoke (3, Fig. 13-110) in the drum (2) and secure with the cap screws and locknuts (1). Torque the locknuts. Refer to "SPECIAL TORQUES" in this section.

Torque:_____

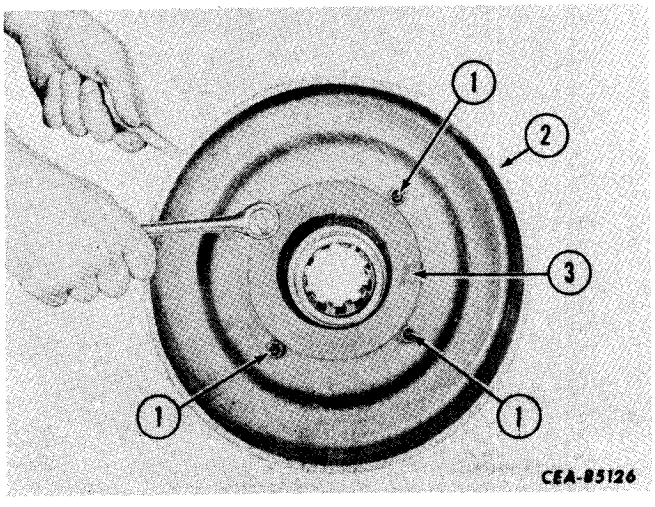

Figure 13-110

DISASSEMBLY, INSPECTION AND ASSEMBLY

Install the yoke and drum assembly (4, Fig. 13-111) on the shaft (5). Place a new seal washer (3) on the shaft. Install the retainer (2) and a new locknut (1). Torque the locknut. Refer to "SPECIAL TORQUES" in this section.

Torque: _____

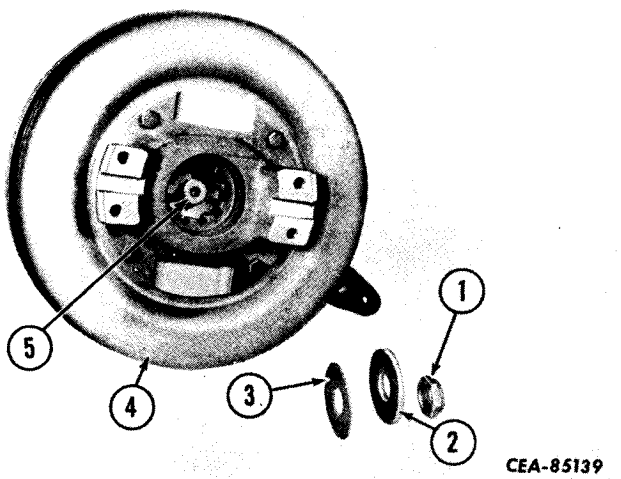

Figure 13-111

Connect the parking brake linkage (3, Fig. 13-112) to the operating cam lever (4).

Install the drive shaft (5) in the yoke (2) and secure with the cap screws (1).

Adjust the parking brake linkage as described under "PARKING BRAKE LINKAGE" in the "LINKAGE" section.

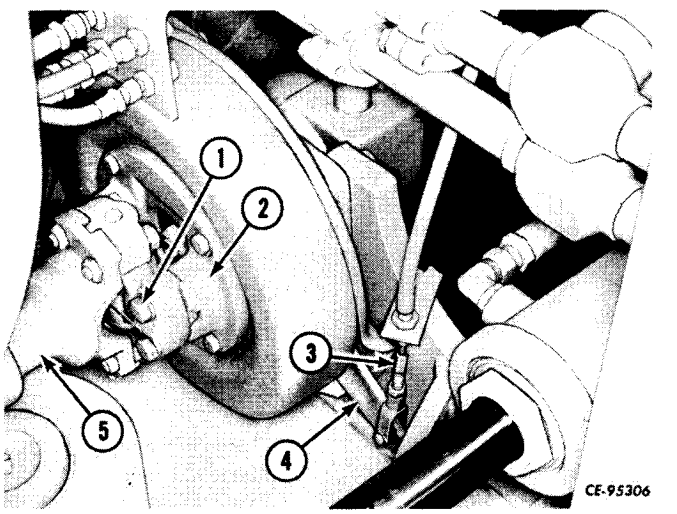

Figure 13-112

TROUBLE SHOOTING

GENERAL

The chart below contains trouble shooting information for the brake system. Each trouble or symptom listed is followed by the possible cause(s) and suggested remedy or remedies. The chart should be used as an aid in the isolation and correction of brake system problems.

COMPLAINT	POSSIBLE CAUSE	REMEDY
Inadequate braking.	1. Brakes need adjusting.	1. Adjust.
	2. Brake linings worn.	2. Reline.
	3. Low fluid level in power clusters.	3. Fill with proper fluid.
	4. Wheel cylinders defective.	4. Repair or replace.
	5. Low air system pressure due to:	5.
	a. Air leaks.	a. Correct.
	b. Faulty governor.	b. Repair or replace.
	c. Faulty compressor.	c. Repair or replace.
	6. Brake treadle valve delivery pressure too low.	6. Clean, repair or replace treadle valve.
	7. Defective power cluster.	7. Repair or replace.
	8. Restricted air or hydraulic lines.	8. Clean or replace lines.
Brakes apply too slowly.	1. Brakes need adjusting.	1. Adjust.
	2. Low air pressure in brake system.	2. Correct.
	3. Brake treadle valve delivery pressure is too low.	3. Clean, repair or replace treadle valve.
	4. Leakage in air system.	4. Correct.
	5. Restricted air or hydraulic lines.	5. Clean or replace lines.
Brakes will not apply.	1. No air pressure in brake system.	1. Correct.
	2. Defective brake treadle valve.	2. Repair or replace.
	3. Defective power cluster.	3. Repair or replace.
	4. Defective wheel cylinders.	4. Repair.
	5. Low fluid level in power cluster.	5. Fill with proper fluid.

TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Brakes release too slowly.	1. Brake shoe return springs broken.	1. Replace.
	2. Defective wheel cylinders.	2. Repair.
	3. Brake treadle valve not returning to fully released position.	3. Clean, lubricate, or repair treadle valves.
	4. Brake treadle valve exhaust port plugged.	4. Clean.
	5. Defective power cluster.	5. Repair or replace.
	6. Restricted air or hydraulic lines.	6. Clean or replace lines.
Brakes do not release.	1. Brake shoe return springs broken.	1. Replace.
	2. Defective wheel cylinders.	2. Repair.
	3. Brake treadle valve not returning to fully released position.	3. Clean, lubricate, or repair treadle valves.
	4. Defective power cluster.	4. Repair or replace.
	5. Restricted air or hydraulic lines.	5. Clean or replace lines.
Brakes grab when applied.	1. Grease on lining.	1. Reline brakes.
	2. Brake drum out of round.	2. Repair or replace.
	3. Defective brake treadle valve.	3. Repair or replace treadle valve.
Brakes pull when applied.	1. Brakes need adjusting.	1. Adjust.
	2. Low fluid level in power clusters.	2. Fill with proper fluid.
	3. Brake linings worn.	3. Reline.
	4. Defective wheel cylinders.	4. Repair.
	5. Grease on brake lining.	5. Reline.
	6. Brake return spring broken.	6. Replace.
	7. Defective power cluster.	7. Repair or replace.
	8. Brake drum out of round.	8. Repair or replace.

(Continued on next page)

GENERAL - Continued

COMPLAINT	POSSIBLE CAUSE	REMEDY
Air pressure will not rise to normal reading.	1. Defective air pressure gauge.	1. Replace gauge.
	2. Excessive leakage in air system.	2. Find and correct leaks.
	3. Air reservoir drain open.	3. Close.
	4. Governor out of adjustment.	4. Adjust.
	5. Defective compressor.	5. Repair or replace.
Air pressure rises to normal reading too slowly.	1. Excessive leakage in air system.	1. Find and correct air leaks.
	2. Engine speed too slow.	2. Increase speed.
	3. Compressor discharge valves leaking.	3. Repair.
	4. Defective compressor.	4. Repair or replace.
	5. Excessive carbon in compressor discharge line or cylinder head.	5. Clean compressor and lines.
Air pressure rises above normal reading.	1. Defective air pressure gauge.	1. Replace gauge.
	2. Governor out of adjustment.	2. Adjust.
	3. Defective governor.	3. Repair or replace.
	4. Restricted line from governor and compressor unloading mechanism.	4. Clean or replace line.
	5. Compressor unloading cavities and passages blocked with carbon.	5. Clean.
Air pressure drops too quickly with engine stopped and brakes released.	1. Leaking brake treadle valve.	1. Repair or replace.
	2. Leaking hoses or lines.	2. Repair or replace.
	3. Compressor discharge valve leaking.	3. Repair or replace.
	4. Governor leaking.	4. Repair or replace.
Air pressure drops too quickly with engine stopped and brakes applied.	1. Leaking power cluster.	1. Repair or replace.
	2. Leaking brake treadle valve.	2. Repair or replace.
	3. Leaking hoses or lines.	3. Repair or replace.

TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Noisy compressor.	1. Worn bearings.	1. Replace.
	2. Excessive carbon deposits in compressor.	2. Clean.
	3. Inadequate lubrication.	3. Check oil supply line.
	4. Compressor worn excessively.	4. Replace.
Safety valve "blows off".	1. Safety valve adjustment.	1. Adjust.
	2. Air pressure in system too high.	2. Check and correct.
Excessive water or oil in system.	1. Defective moisture ejector valve.	1. Repair or replace.
	2. Compressor passing excessive oil.	2. Repair or replace.

PARKING BRAKE

COMPLAINT	POSSIBLE CAUSE	REMEDY
Lever will not operate	1. Incorrect linkage or lever adjustment.	1. Adjust.
	2. Lever joints frozen or binding.	2. Lubricate or free joints.
	3. Brake mechanism frozen or rusted.	3. Clean and lubricate brake mechanism.
Brake will not hold	1. Incorrect linkage or lever adjustment.	1. Adjust.
	2. Broken linkage.	2. Replace.
	3. Broken drum.	3. Replace.
	4. Defective brake mechanism.	4. Repair or replace brake mechanism.

SERVICE INFORMATION

SPECIFICATIONS

GOVERNOR

Make	Bendix-Westinghouse
Model	D-2
Pressure Range	90 psi to 105 psi

SAFETY VALVE

Make	Bendix-Westinghouse
Model	205105
Pressure Setting	150 psi ± 5 psi

TREADLE VALVES

Make	Wagner Electric
Model	AF-48360
Type	Treadle

DOUBLE CHECK VALVE

Make	Wagner Electric
Model	AC-36709

MOISTURE EJECTOR VALVE

Make	Wagner Electric
Model	AE-21857-L

POWER CLUSTERS

Make	Wagner Electric
Model	AF-49810

WHEEL BRAKES

Make	Rockwell-Standard
Type	Two shoe, Internal Expanding
Diameter	20-1/4 in.
Liner Width	4 in.

AIR COMPRESSOR

Make	Bendix-Westinghouse
Model	Tu-Flo 400
Capacity at 1250 rpm	7-1/4 C.F.M
Bore	2-1/16 in.
Stroke	1-1/2 in.

SERVICE INFORMATION

LUBRICANT

Hydraulic Brake Fluid	IH Heavy Duty or J-1703a

TOLERANCES

Discharge valve travel	.036"-.058"
Piston-to-cylinder bore clearance	.002"-.004"
Wrist pin-to-connecting rod bushing clearance	.0001"-.0006"
Max. permissible crankshaft journal out-of-round before reconditioning	.001"
Ring gap in cylinder bore	.007"-.019"
Ring fit in grooves:	
Top	.0015"-.003"
Second	.0015"-.003"
Third	.0015"-.003"
Fourth	.0015"-.003"
Max. permissible clearance in connecting rod bushing before replacing	.0015"
Connecting rod bearing clearance	.0003"-.0021"
Clearance between top of inlet valve seat and cylinder block	.101"-.113"

SPECIAL TORQUES

Brake mounting cap screws	177 ft-lbs.
Parking brake backing plate-to-cover cap screws	53-60 ft-lbs.
Parking brake drum locknuts	36 ft-lbs.
Transfer drive shaft nut	200 ft-lbs.

BRAKE SYSTEM

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

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