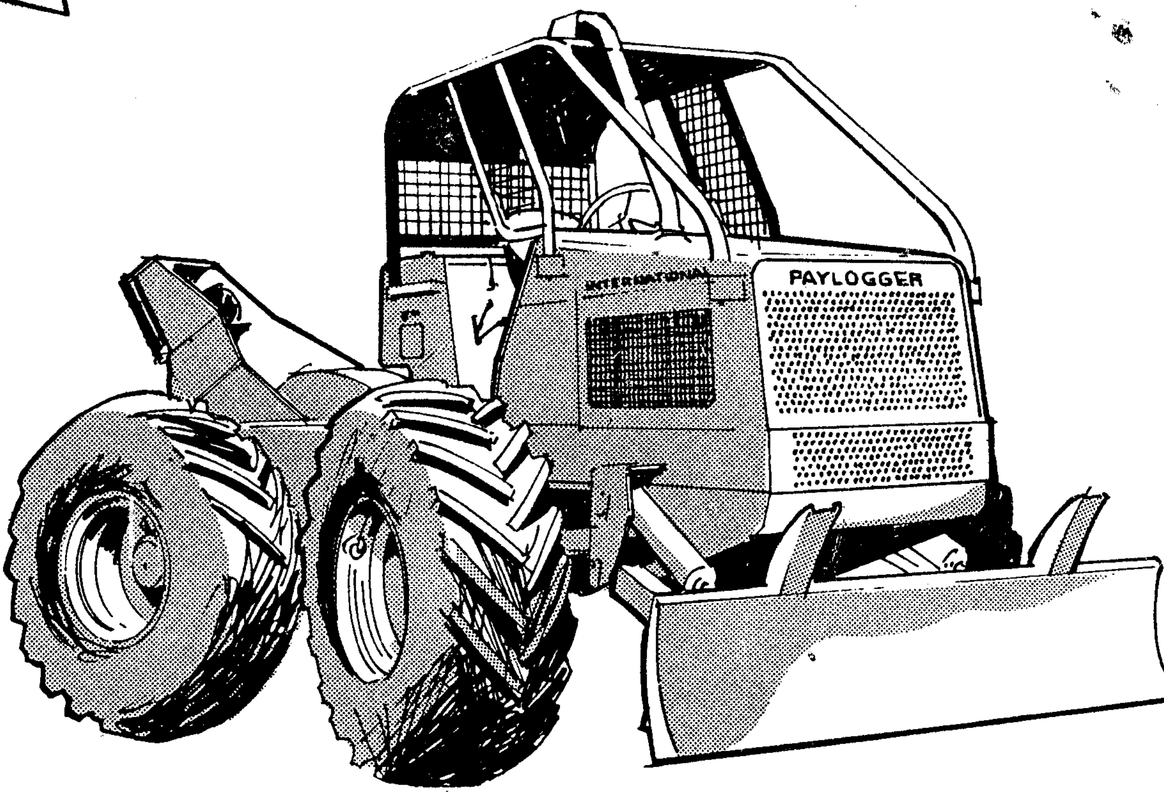
Service Manual

Potter



GSS-1415

PAY® LOGGER
Model S-7C

INTERNATIONAL HARVESTER COMPANY
FARM EQUIPMENT DIVISION
401 NORTH MICHIGAN AVENUE • CHICAGO, ILLINOIS, 60611, U.S.A.

FOREWORD

The instructions and special tools shown in this Blue Ribbon Service Manual are for use by International Harvester factory trained servicemen.

The specifications as listed in this manual are current as of the printing date. Due to changes and improvements in our products, service bulletins are periodically issued to keep this manual up-to-date. We suggest you refer to the most recent information when performing service work on this equipment.

International Harvester Factory Trained servicemen are best qualified to service IH equipment.

LIBRARY FILING INFORMATION

1. File this manual in Book 20 after Divider Tab GSS-1415.
2. Enter the following information in the Service Manual Index.

   In the following Sections, print, or preferably type in, the Manual Description, Form Number, and the Book Filed in.

   Tractor Specifications
   Tractor Engine
   Tractor Fuel System
   Tractor Cooling System
   Tractor Electrical System
   Tractor Transmission
   Tractor Differential and Final Drive
   Tractor Brakes
   Tractor Chassis
   Tractor Hydraulics

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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 S-7C PAY logger.

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

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.

Model S-7C PAY logger.

LUBRICATION

Instructions on the lubrication of each assembly are given in the Lubrication Chart in the operator's manual. When assembling 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 Equipment deserves genuine service parts. The best material obtainable and experience gathered through many years of manufacturing power equipment, enable International Harvester 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 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 is located on a plate on the right side of the operator's compartment on the seat support.

The engine serial number and model number are stamped on the right side of the cylinder block. A plate, attached to the valve rocker cover includes all optional equipment used on the engine together with the engine serial and model number.

ENGINE

The Model S-7C PAY logger is equipped with a Detroit Diesel 3-53. Instructions for removal and installation of the engine plus the air and fuel systems are covered in Section II, ENGINE. For detailed information on overhauling and adjusting the engine, refer to the latest Detroit Diesel manual.

An "Option Plate" is mounted on the rocker cover of the Detroit Diesel engine. The plate contains the engine model, unit and type number. Refer to this plate when ordering parts.

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.

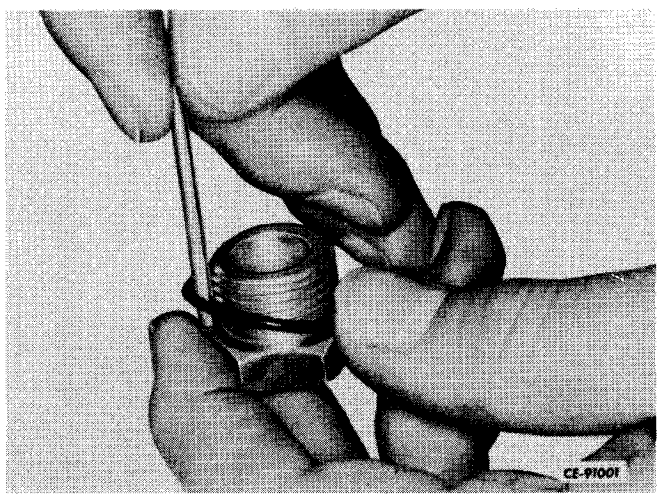

Figure I-1
Correct "O" Ring Installation.

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.

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.

(Continued on next page)

RECOMMENDED BEARING PROCEDURES

CLEANING - Continued

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.

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

RECOMMENDED BEARING PROCEDURES

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.

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.

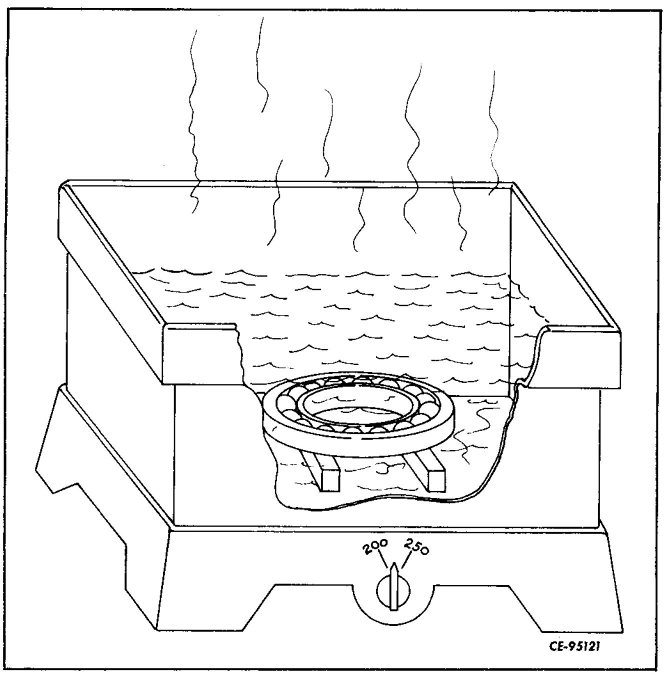

Figure I-2
Expanding Bearing in Heated Oil.

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.

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. Operator's 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.

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

Parts difficult to remove can be pre-heated to approximately 500° F prior to removal.

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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.

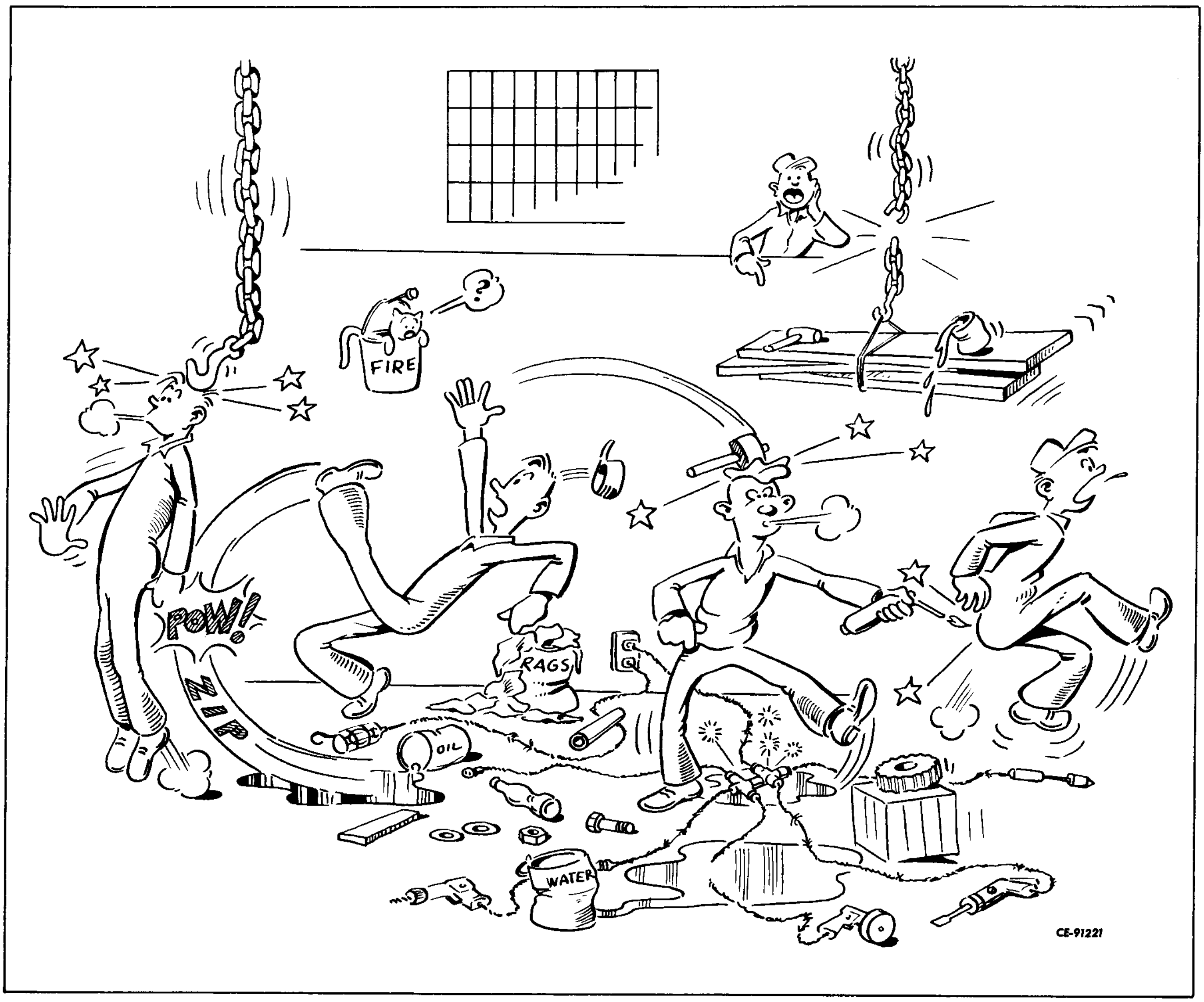
Hoists must be of sufficient capacity to lift the heavier units (i.e. engine, grille, fuel tank) and have an ample safety margin.

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.



"Hey Snarlie - Where Ya Wanna Hang Them Safety First Signs?"

GENERAL SAFETY PRECAUTIONS

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

The blade must be resting on ground at all times during machine servicing and periods of idleness.

Do not start an engine indoors unless adequate exhaust ventilators are provided. Once an engine is running, move the machine outdoors as soon as possible.

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

GENERAL

A	Height (over canopy) (with 16.9 x 30 tires)	104 in.
B	Width (over tires)	89 in.
C	Width (blade)	82 in.
D	Length (overall)	199 in.
E	Ground clearance	24 in.
F	Wheelbase	92 in.
Turning radius (outside corner of blade - raised)		207 in.
Front axle oscillation		20°
Turning radius:		
Inside tires		124 in.
Outside tires		215 in.
Outside corner of blade		207 in.

WEIGHT

Approximate weight over front axle	8,000 lbs.
Approximate weight over rear axle	3,200 lbs.
Total weight	11,200 lbs.

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SPECIFICATIONS

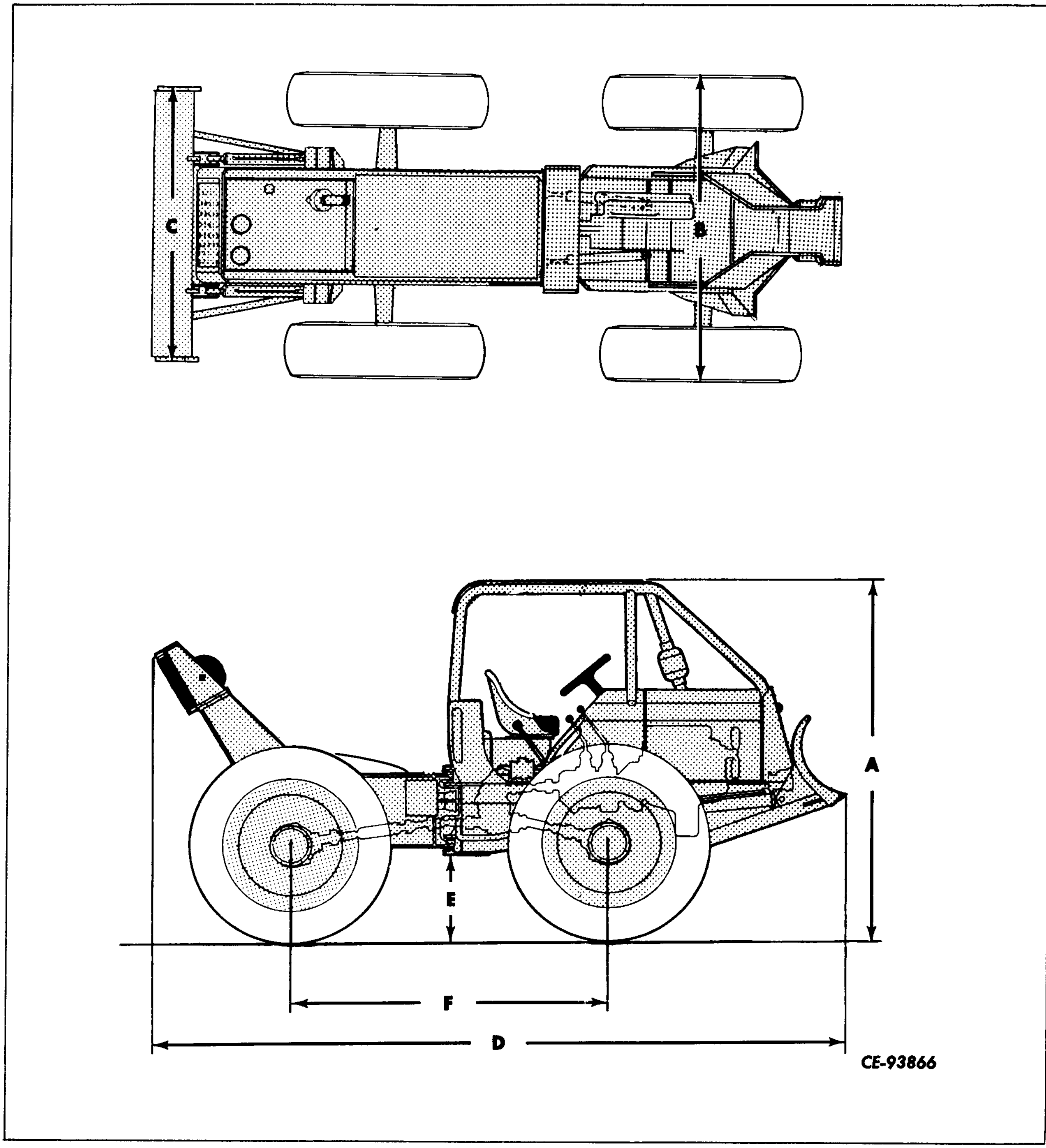

Figure I-3
Dimension Diagram.

STANDARD TORQUE DATA

(For special torque data refer to the pertinent section of this manual.) Recommended torques, in foot-pounds, for standard application nuts and 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 2		TYPE 4	
	MIN.	MAX.	MIN.	MAX.
1/4	9	10	12	14
5/16	19	21	27	30
3/8	33	37	45	50
7/16	53	60	75	85
1/2	80	90	115	130
9/16	115	130	160	180
5/8	160	180	220	250
3/4	290	320	400	450
7/8	420	470	650	730
1	630	710	970	1090
1-1/8	850	950	1380	1550
1-1/4	1200	1350	1940	2180
1-1/2	2000	2300	3300	3700
1-3/4	3300	3700	5300	6000
2	5000	5500	8000	9000

BOLT TYPE IDENTIFICATION CHART

IH Type	SAE Grade	DESCRIPTION	BOLT HEAD* MARKING
2	5	WILL HAVE AN IH AND 3 RADIAL LINES Quenched and tempered medium carbon steel	
4	8	WILL HAVE AN IH AND 6 RADIAL LINES Quenched and tempered special carbon or alloy steel	

* The center marking identifies the bolt manufacturer. The IH monogram is currently used. Some bolts may still have a raised dot which previously identified IH bolts.

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CHASSIS

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SECTION I CHASSIS

GENERAL INFORMATION

DESCRIPTION

The chassis components are divided into four groups to simplify and provide a better understanding of each group. The groups are as follows:

Dozer Blade Group
Sheet Cowling Group
Operator's Compartment Group
Main Frame Group

The front frame contains the operator's and engine compartment and provides a mounting pad for the transmission, transfer drive, fuel tank and hydraulic reservoir. The rear frame provides a platform to mount the winch and winch mast.

In addition to their center hinge pins the frame sections are linked together by a steering cylinder. The base of the cylinder is anchored to the front frame section with the rod end pinned to the rear section. As the cylinder extends the frame sections pivot on their hinge pins resulting in steering the tractor. This type of steering is known as "Articulated Steering" and has definite advantages; it eliminates the need of a steering axle with its additional parts, and provides easier maneuvering. It enables the machine to "wiggle" out of muddy terrain, and provides shorter turning radius through the roughest terrain.

The front axle is mounted to a bolster which in turn is fastened by two pins to the front frame section. This allows the front axle to oscillate over uneven terrain while providing maximum tractor effort. The rear axle is fastened directly to the rear frame section.

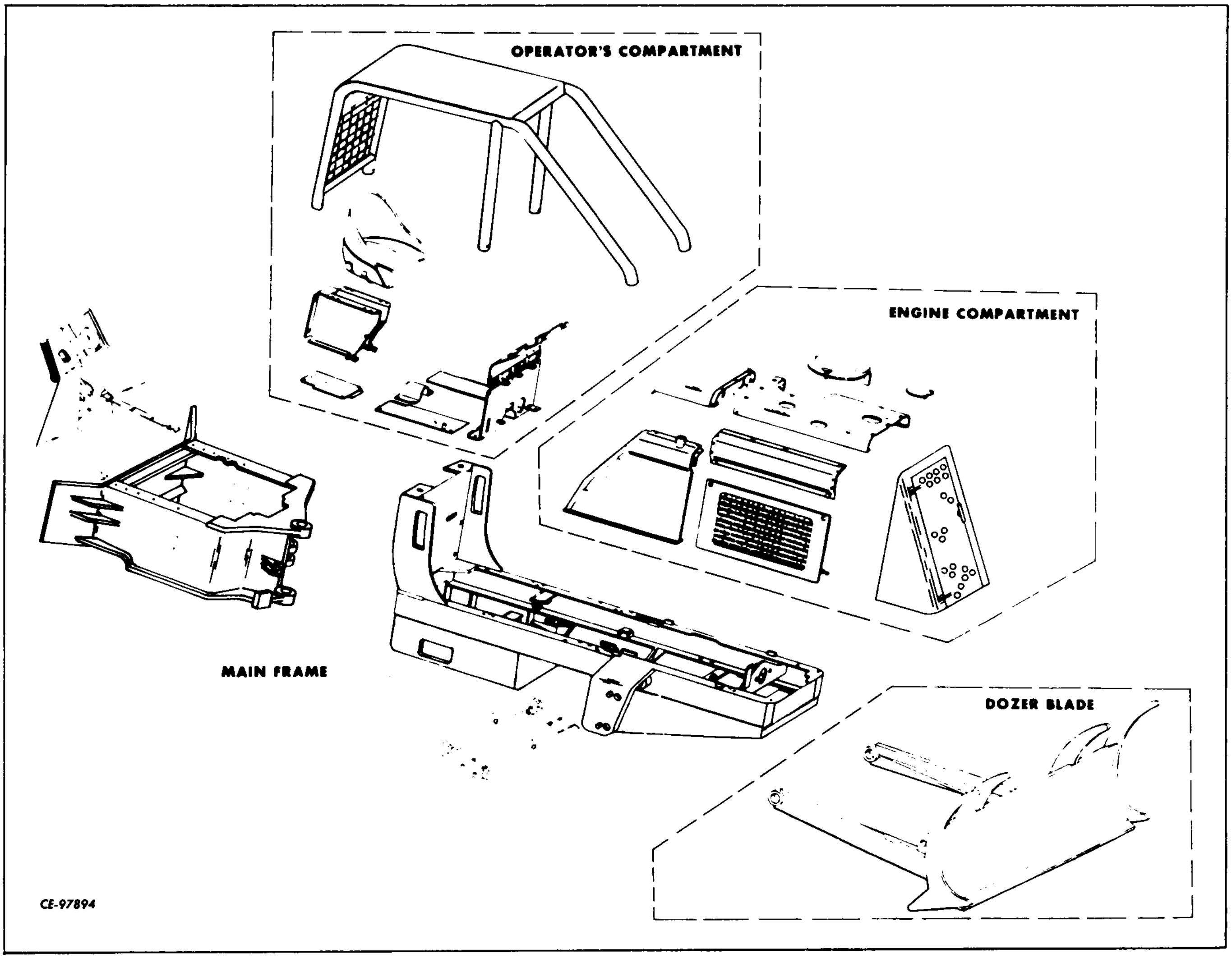

Figure 1-1

MAIN FRAME

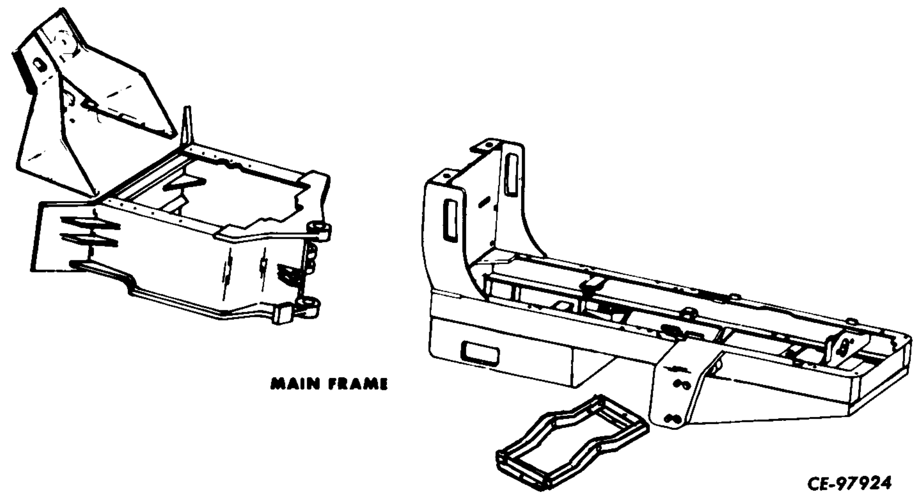

Figure 1-2

DESCRIPTION

Each main frame component is composed of many smaller items welded together to form a single rigid assembly. The two frame sections are connected at their hinge points by a bushing and pin arrangement.

The axle bolster is connected to the front frame by pin and bushing.

The winch mast and winch assembly are mounted on the rear frame.

SERVICE

A periodic inspection of the chassis should be made to detect weld cracks, broken welds, or damaged brackets. Check bolster and hinge bushings and pins for wear or damage.

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

WINCH MAST REMOVAL

Remove rollers (3, Fig. 1-3) by removing cap screws (1), lock washers and flat washers. Re-

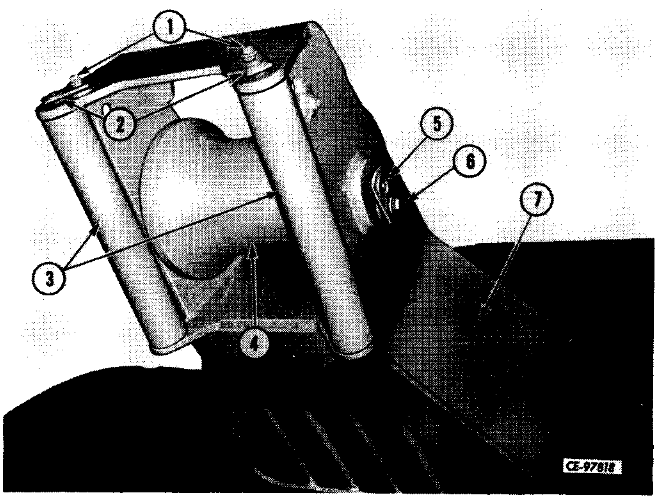

Figure 1-3

MAIN FRAME

move pins (2). Inspect and clean bearings located inside rollers (3). If replacement is required pull bearings out of rollers. Press in new bearings.

Remove roller drum (4) by removing cap screws (6) and pin (5). Inspect and clean bearings located inside of drum. If bearings need replacement, pull bearings out of roller. Press in new bearings.

To install rollers or drum, reverse procedures described above.

To remove winch mast (7) as an assembly, connect to an overhead hoist and remove cap screws, lock washers and nuts, securing winch mast to the rear frame.

For winch mast installation, reverse procedure described above.

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.

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.

ENGINE COMPARTMENT

DESCRIPTION

Information on Engine Compartment Removal or Installation procedures can be obtained by referring to Section II, ENGINE.

The engine compartment consists of the radiator grille (4, Fig. 1-4), side panels (6) and cowl (1) which are bolted to the front frame. The hood (2) and side panels are supported by the grille and cowl.

SERVICE

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

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.

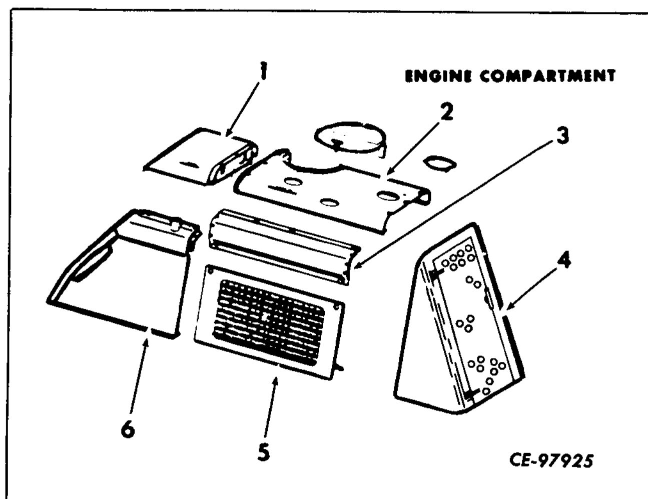

Figure 1-4

1. Cowl.
2. Hood.
3. Brace.
4. Radiator grille.
5. Engine panel.
6. Side panel.

OPERATOR'S COMPARTMENT

DESCRIPTION

The Operator's Compartment group is composed of the canopy (1, Fig. 1-5), instrument panel (5), floorboards (4), seat (2), seat base (3) and firewall panel (6).

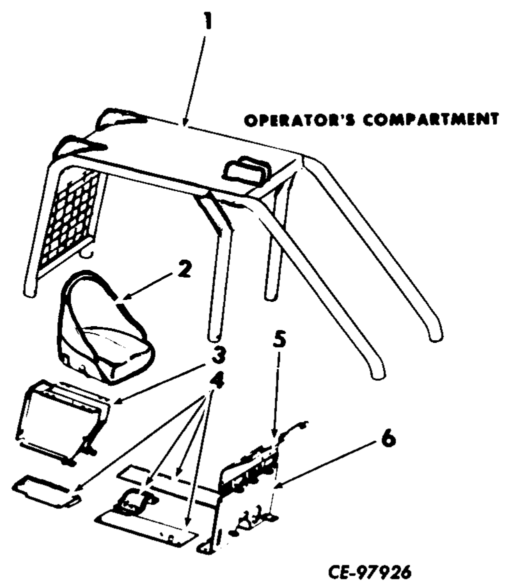

Figure 1-5

1. Canopy.
2. Seat.
3. Seat base.
4. Floorboards.
5. Instrument panel.
6. Firewall panel.

The instrument panel (5) and firewall panel (6) are bolted to the cowling of the engine compartment group.

The floorboards (4) and seat base (3) are bolted to the front frame. The operator's seat (2) is bolted to the seat base (3). Directional movement of the operator's seat (2) is controlled by a spring loaded ratchet device connected to a lever and allows seat to move forward or back.

The winch control lever, transfer case control lever and the brake lock valve are mounted on the seat base (3). The dozer blade control lever and steering valve are located under the instrument panel (5).

The brake pedal and accelerator pedal are mounted to the firewall panel (6). The hand throttle, steering wheel and various gauges are mounted on the instrument panel (5).

The canopy (1) mounts to the rear of this front frame, cowl and grille.

SERVICE

Service on metal parts is limited to straightening dented or damaged sheet metal parts.

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

DOZER BLADE

DESCRIPTION

The dozer blade linkage transforms the energy produced by the tractor hydraulics into a visible working force. The blade hydraulic lift cylinders raise and lower the dozer blade.

The blade arms are of welded box section construction. Locking pins retain the blade and hydraulic cylinders.

SERVICE

Place dozer blade on ground and position dozer control lever in the neutral or hold position. Using chains and an overhead hoist, connect chains to the blade arms (5, Fig. 1-6) and remove the slack.

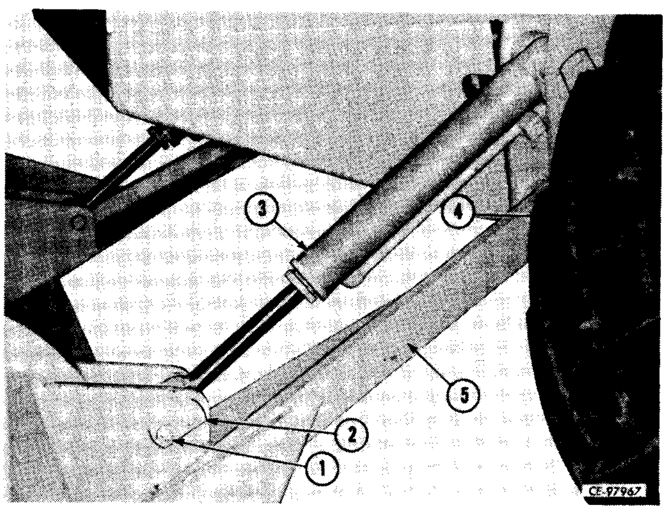

Figure 1-6

Remove the pin locking cap screws (1) with lock washer and flat washer. Remove pin (2) disconnecting hydraulic cylinders (3) from blade arms (5).

Remove locking cap screw, lock washers and flat washers. Remove pin (4) disconnecting dozer arms (5) from front main frame.

> CAUTION: Support dozer blade arms during pin removal. After removing pins, carefully lower dozer blade arms to ground. Retain cord rings.

Using a heavy gauge wire, wire hydraulic cylinders to canopy mounting bracket on front shroud.

To prevent loss of parts, install pins in their respective pin bores, looping cord rings over pins as they are installed. Thread locking cap screws with lock washers and flat washers through pin lock and into respective bores. Coat all pin shanks with a heavy, waterproof grease to prevent rusting.

To install blade, reverse procedures described previously, being sure to install cord rings. Replace any damaged cord rings.

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ENGINE

SECTION II ENGINE

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TRACTOR POWER UNIT

GENERAL

The canopy, exhaust stack, radiator, hood and grille must be removed in order to remove the engine from the tractor frame.

It is recommended that the transmission be removed with the engine to aid in engine removal.

The engine coolant must be drained, for engine removal.

To further aid in engine removal position unit under an overhead hoist or position a portable hoist over the unit. Position dozer blade on the ground, lock tractor halves together using the safety bar and pins, Fig. 2-1. If engine is running, turn ignition switch "OFF" and pull "Engine Shut-down" lever out.

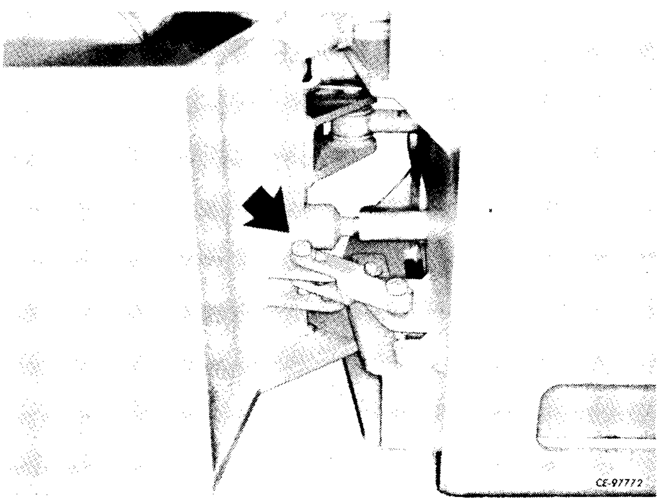

Figure 2-1

ENGINE REMOVAL

Remove cover and piece of wood from the battery box. Disconnect battery ground cable (2, Fig. 2-2) from battery terminals (1, 3).

Remove exhaust stack and muffler from the exhaust manifold and canopy.

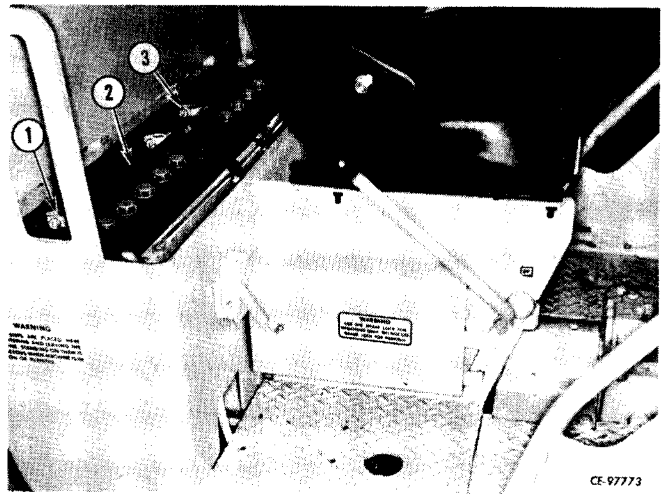

Figure 2-2

Remove cap screws and lock washers from canopy limbs and using an overhead hoist, remove canopy.

NOTE: On units equipped with driving lights, disconnect electrical wiring before canopy is removed.

(Continued on next page)

Figure 2-3

ENGINE REMOVAL - Continued

Open radiator grille (2, Fig. 2-4) and remove cotter and clevis pins (1, 5).

Remove side panels (3), on each side, by removing panel clamps (4).

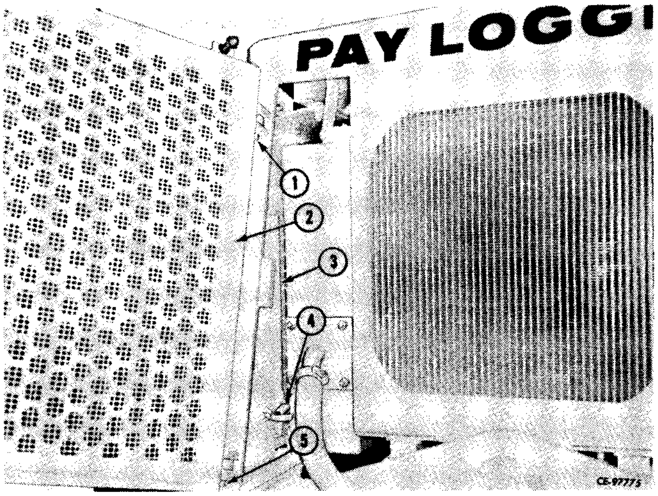

Figure 2-4

Remove exhaust pipe (6, Fig. 2-5) from exhaust manifold by removing cap screws and lock washers. Insert a plug into exhaust port to keep dirt from entering the engine.

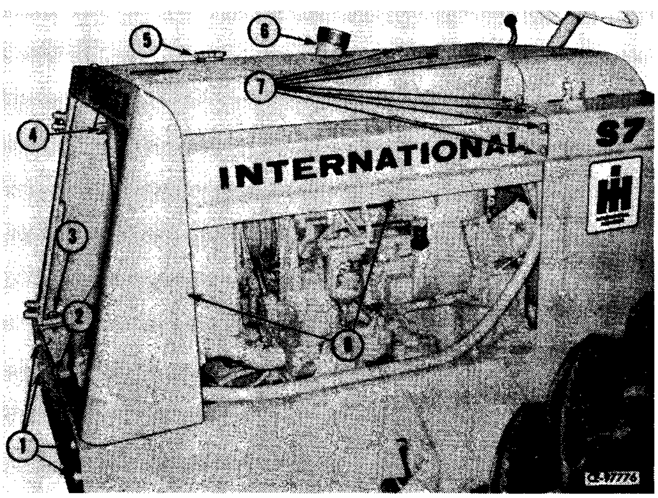

Figure 2-5

Disconnect radiator support bracket (4), on each side, by removing cap screws, lock washers and spacers.

Remove cap screws, lock washers and nuts (3), on each side separating the radiator grille from the frame.

Remove cap screws, flat washers, lock washers and nuts (7) separating hood from cowl.

Using a suitable sling and overhead hoist, remove hood and radiator grille (8) as a unit. Remove reservoir cap and dipstick (5) for hood removal. Replace cap after hood is removed. Remove cap screws, lock washers and nuts (1) and remove plate (2).

Drain engine coolant into a clean, resealable container, by opening petcock on the bottom of radiator and using a clean flexible drain tube.

Loosen hose clamps (2, 6, Fig. 2-6) and remove hoses (1, 5). Remove special nuts (4), on each side, and remove radiator (3).

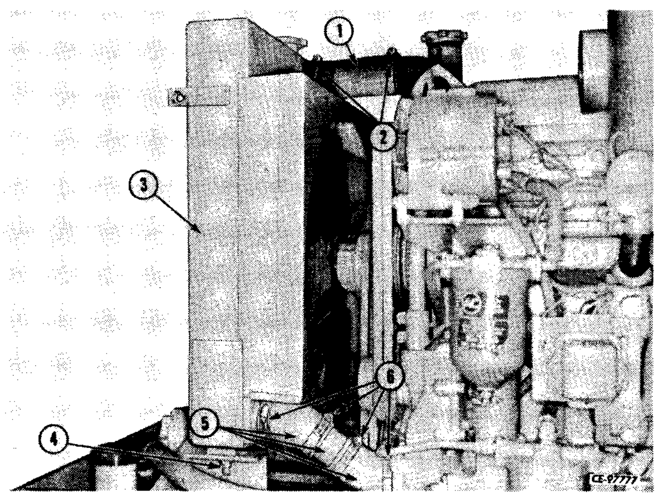

Figure 2-6

Rotate engine fan blades by hand to eliminate contact with radiator during its removal.

Remove cap screw (1, Fig. 2-7) and drive shaft (2) between engine and hydraulic pump.

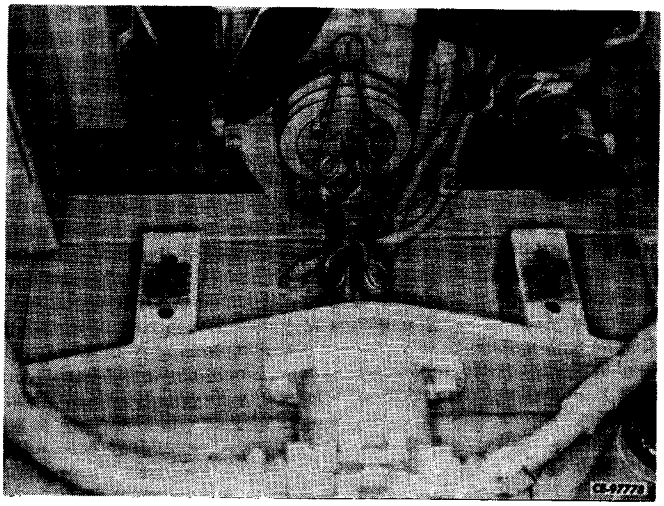

Figure 2-7

Disconnect, plug and tag engine fuel supply line (2, Fig. 2-8) and fuel return line (1). Pull fuel lines free of engine.

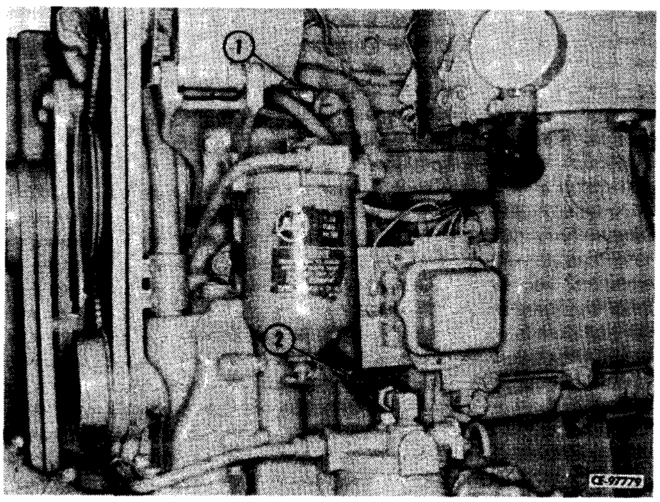

Figure 2-8

Disconnect and tag the following electrical wires: (Fig. 2-9).

Water temperature sender wire (1).

Voltage regulator ground wire (3).

Regulator switch block (4).

Three wires from the generator (2).

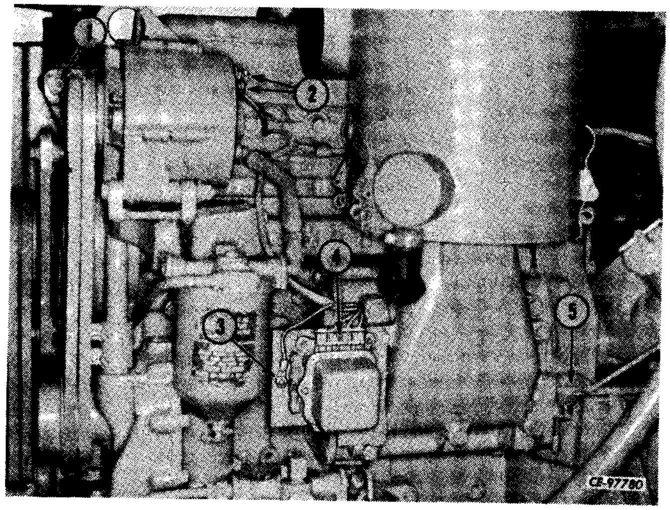

Figure 2-9

Disconnect emergency shut down rod (5) by removing cotter pin and rod from shut down lever.

Disconnect and tag the following electrical wires: (Fig. 2-10).

3 wires from battery solenoid (4).

Oil pressure sender (2, 3).

Loom and engine ground (1).

Starter solenoid ground (4).

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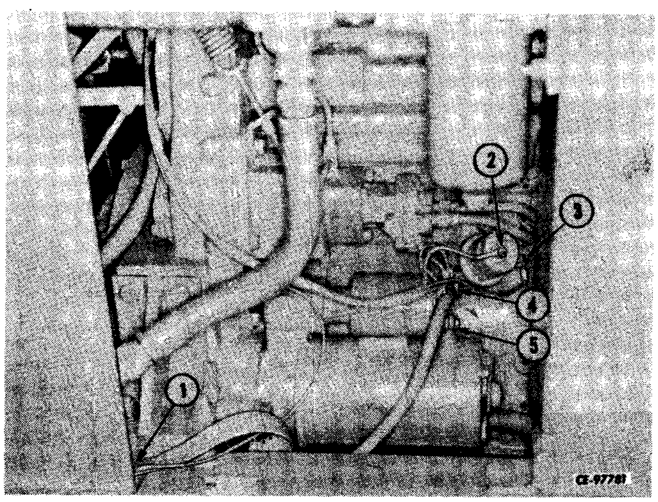

Figure 2-10

TRACTOR POWER UNIT

ENGINE REMOVAL-Continued

Disconnect accelerator linkage by removing cotter pin and clevis pin (1, 2, Fig. 2-11). Disconnect shut down linkage (4) and remove knob from end of shut down rod (3). Pull rod out through dash panel.

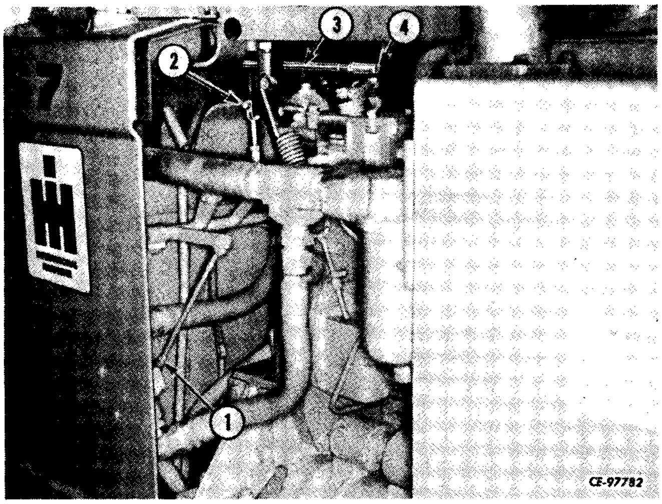

Figure 2-11

From underneath the tractor remove cap screws, lock washers and nuts (1, Fig. 2-12) disconnecting crankcase drain line (2) from frame. Wire line to side of engine.

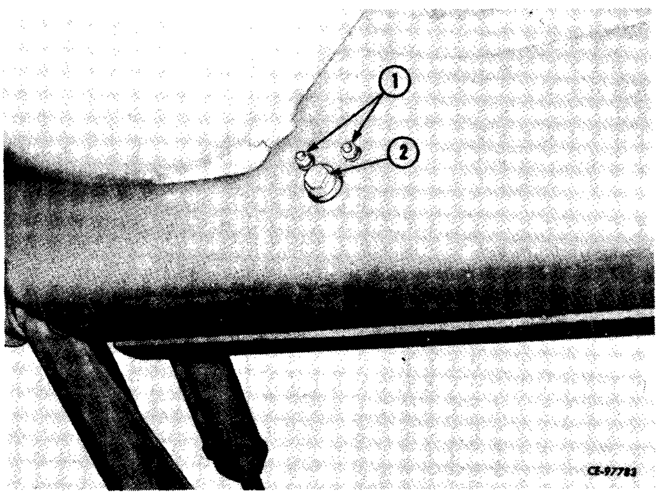

Figure 2-12

From inside the operator's compartment disconnect accelerator pedal (3, Fig. 2-13) by removing cap screws and lock washers (4).

Remove cap screws, flat washers and lock washers and remove floor panels (1, 2).

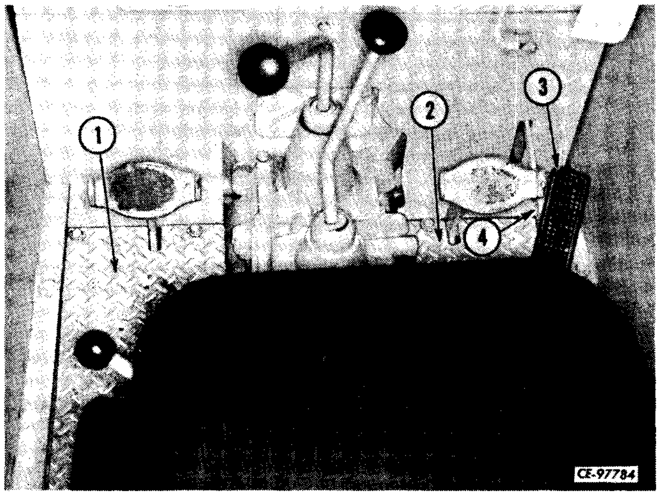

Figure 2-13

Remove cap screws and lock washers (1, 4, Fig. 2-14) and remove gear shift lever housings (3, 5). Disconnect clutch pedal control rod (2) from clutch lever on bellcrank.

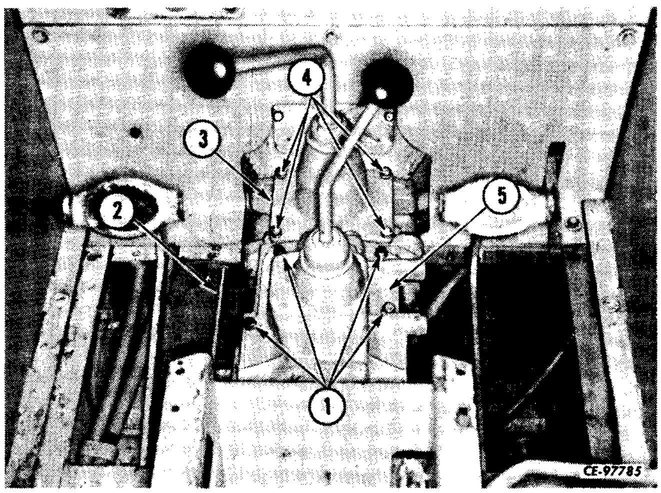

Figure 2-14

TRACTOR POWER UNIT

Remove front firewall panel (4, Fig. 2-15) by removing cap screws, flat washers and lock washers (3). Remove cap screw, lock washer and nut (2) disconnecting hydraulic hose clamp.

Lift loose firewall as far as possible and press down on clutch pedal (1). Angle panel out away from operator's compartment.

Disconnect drive shaft between transmission and transfer case by removing nuts, lock washers and "U" bolts. Tape loose bearing caps on the drive shaft preventing them from becoming separated from trunnion.

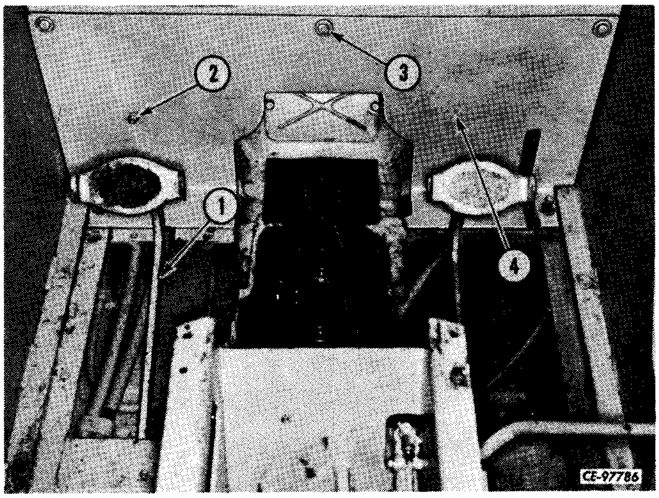

Figure 2-15

To allow engine removal, disconnect hydraulic return line from hydraulic filter housing (2, Fig. 2-16) by removing allen head cap screws (1).

Remove cap screws, lock washers and nuts (not shown) disconnecting hydraulic reservoir from tractor frame.

Position suitable hoist over engine and install sling. Attach sling to engine lifting hook provided. Take out slack.

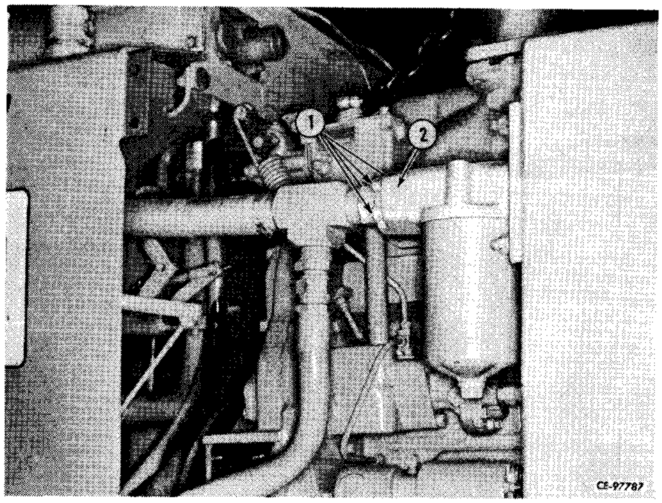

Figure 2-16

Remove cap screws, washers and nuts (1, 2, Fig. 2-17) separating engine from tractor frame.

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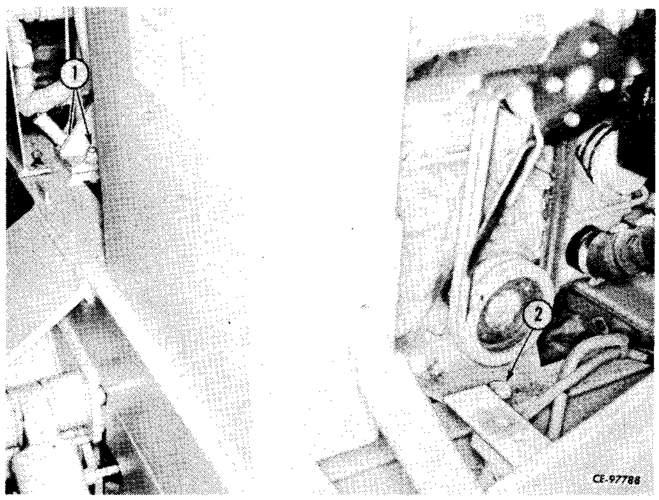

Figure 2-17

ENGINE REMOVAL - Continued

Attach a suitable cable to the top of the hydraulic reservoir and utilizing an overhead support, lift the reservoir (1, Fig. 2-18) out away from engine.

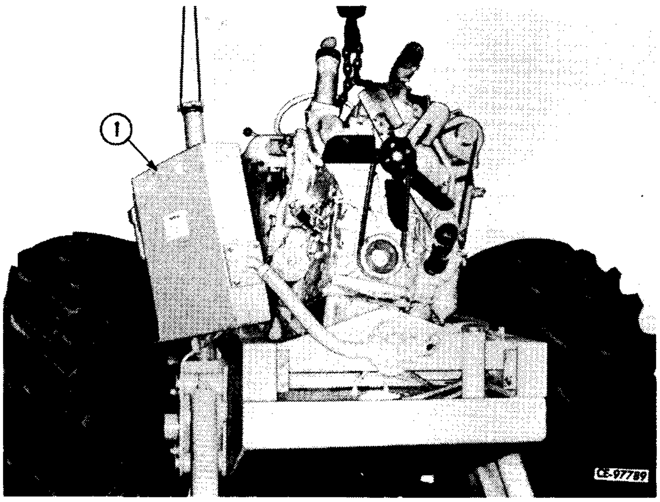

Figure 2-18

Slowly lift engine and transmission up out of engine frame. Check for connected electrical wiring or hydraulic lines during engine removal. Place engine in an engine stand. Refer to manufacturer's engine manual for all service and parts information.

ASSEMBLY

Before installing engine in frame clean engine and engine compartment using a steam cleaner.

Suspend hydraulic reservoir (1, Fig. 2-18) from an overhead support and carefully install engine in engine compartment.

Install and tighten cap screws, lock washers and nuts (1, 2, Fig. 2-17) securing front and rear engine mounts to frame.

Position hydraulic reservoir on its mountings and install and tighten cap screws, lock washers and nuts. Check condition of "O" ring inside groove in hydraulic filter housing (2, Fig. 2-16). Install and tighten allen head cap screws (1).

From underneath tractor position engine crankcase drain line (2, Fig. 2-12) through frame. Install and tighten cap screws, lock washers and nuts (1).

Connect accelerator linkage by installing clevis and cotter pins (1, 2, Fig. 2-11). Install shut down rod (3) through dash panel and tighten nut (4) connecting rod to engine shut down lever.

Connect the following electrical wires to right side of engine as shown in Fig. 2-10:

Three wires to starter solenoid (4).

Oil pressure sender (2, 3).

Electrical loom and engine ground wire (1).

Starter solenoid ground (5).

Connect the following electrical wires to left side of engine as shown in Fig. 2-9:

Water temperature sender wire (1).

Voltage regulator ground wire (3).

Regulator switch block (4).

Three wires to generator (2).

Connect emergency engine shut down lever (5).

Position and connect engine fuel supply and return lines (1, 2, Fig. 2-8).

Install drive shaft (2, Fig. 2-7) between the engine and hydraulic pump and install and tighten cap screws (1). Use "Loctite" sealant on cap screws (1).

Slowly lower radiator (3, Fig. 2-6) into position on its mounting brackets. Move fan blades until cowling of radiator permits installation. Install and tighten nuts and washers (4). Position hoses (1, 5) between radiator and engine and tighten hose clamps (2, 6). Close radiator petcock and fill radiator with fresh or clean engine coolant. Refer to "LUBRICANTS AND CAPACITIES" under "SERVICE INFORMATION" for recommended engine coolant.

Remove reservoir cap and dipstick (5, Fig. 2-5) and using overhead hoist, lower hood and radiator grille (8) on frame. Install reservoir cap (5). Install exhaust pipe (6) to exhaust manifold. Install cap screws, spacers, lock washers and nuts (4), on each side securing radiator to support brackets. Install cap screws, flat washers and special nuts (7) securing hood to engine cowling. Install and tighten cap screws, lock washers and nuts (3) securing grille to frame. Position plate (2) and install and tighten cap screws (1).

From inside operator's compartment press down on clutch pedal (1, Fig. 2-15) and position fire wall (4) in operator's compartment. Install and tighten cap screws and flat washers (3). Install and tighten cap screw, lock washer and nut (2) securing hydraulic hose clamp to firewall (4).

Position transmission control lever housings (3, 5, Fig. 2-14) and gaskets on transmission case and install and tighten cap screws and nuts (1, 4). Connect clutch pedal rod (2) to clutch.

Position floor panels (1, 2, Fig. 2-13) and install and tighten cap screws and lock washer. Connect accelerator pedal (3) to linkage (4).

Position radiator grille (2, Fig. 2-4) and install clevis and cotter pins (1, 5).

Using a suitable overhead hoist, position canopy limbs on mounting brackets and install and tighten cap screws, washers and nuts.

NOTE: If tractor is equipped with lights, connect electrical wire to lights.

Connect battery ground cable (2, Fig. 2-2) to battery posts (1, 3). Install battery box cover and piece of wood.

Before starting engine, check engine oil, engine coolant, hydraulic reservoir fluid levels. If fluid is needed refer to Section 11, "LUBRICANTS AND CAPACITIES" for the recommended type.

Start engine and check for loose connections and disconnected wires. Once tractor is operating satisfactorily, remove safety bar and pin (Fig. 2-1).

COLD WEATHER STARTING AID (OPTIONAL EQUIPMENT)

GENERAL

To aid in cold weather starting, the PAY logger employs, as optional equipment, an ether injection system. The system consists of a primer pump (1, Fig. 2-19); located to the left of the steering wheel on the instrument panel, a mounting bracket (2); located under the instrument panel, 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 primer pump (1) is actuated, ether is routed to the intake manifold to aid combustion of 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) prevents any injection attempt at engine temperatures above 85°F.

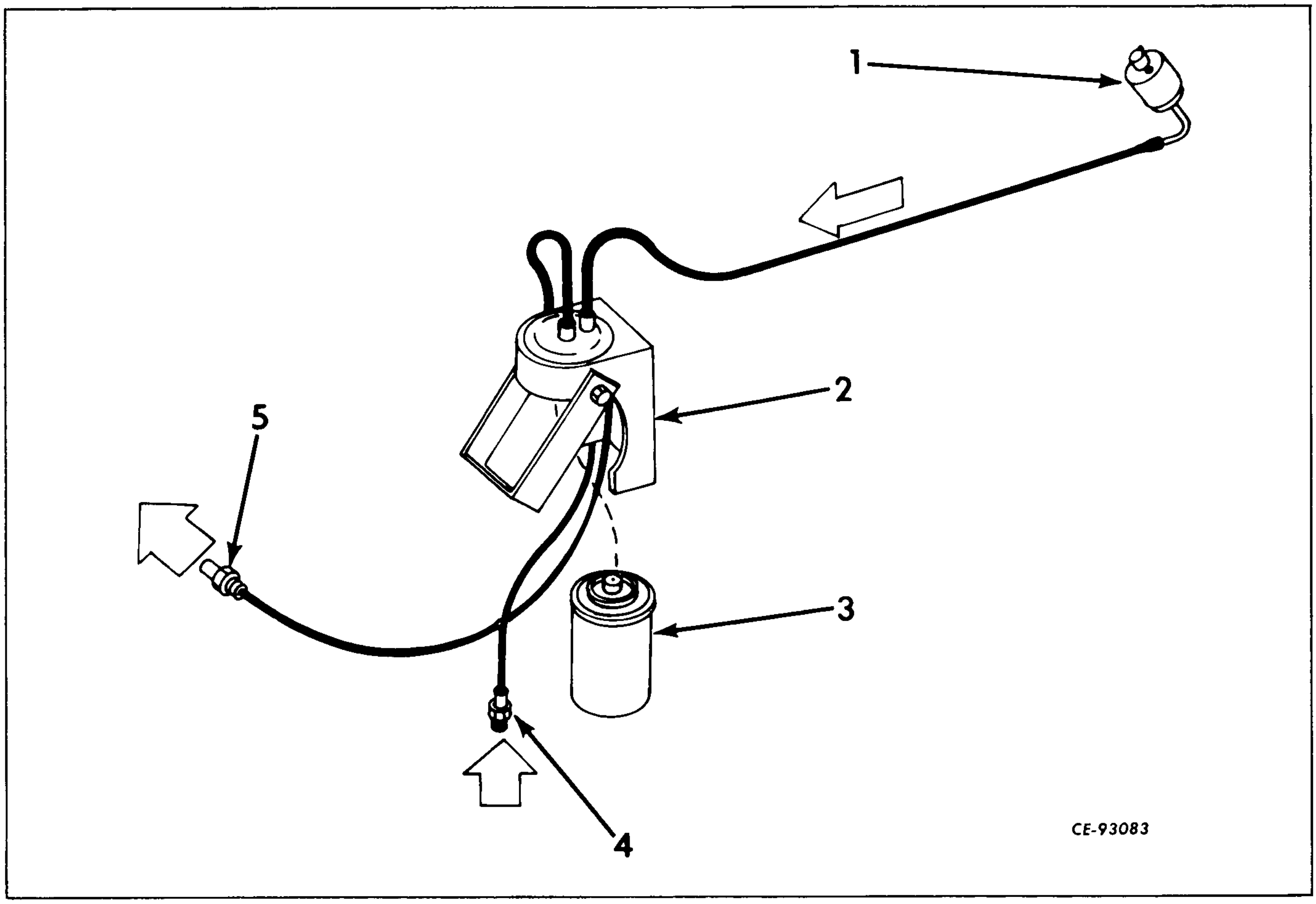

Figure 2-19
Cold Weather Starting Aid.

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

COLD WEATHER STARTING AID
(OPTIONAL EQUIPMENT)

OPERATION

Position transmission directional control lever in NEUTRAL.

Turn main electrical switch ON.

Set hand throttle slightly above idle position.

Push the engine starter button and as the engine starts to turn over, inject starting fluid (ether) by operating the actuator button (1), located on the instrument panel, left of the steering wheel.

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

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 temperature before putting tractor to work.

SERVICE

If the engine gives no indication of starting, remove ether container (3, Fig. 2-19) and check to see if it is empty. Check supply by pointing container nozzle away from any possible body contact, and depress nozzle. If container is not empty, check condition of lines between actuator button and 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 ARMS LENGTH TO PREVENT POSSIBLE BODY CONTACT OR INHALING OF ETHER FUMES.

AIR CLEANER SYSTEM

GENERAL

The air cleaner housing is mounted directly on the intake manifold of the DETROIT DIESEL engine.

Dirty air entering the air cleaner body is directed through the filtering element. The air cleaner body is equipped with an automatic dust unloader. The vacuum created on the dirty air side of the air cleaner is sufficient to keep the lips closed. However, when dust builds up to a certain height, the weight overcomes the vacuum and the lips open discharging the accumulated dust. When the engine is shut down, there is no vacuum and the unloader discharges all the dirt.

For service interval on the Air Cleaner System refer to the Operator's Manual, OM-S-7C.

AIR CLEANER SYSTEM

REMOVAL

Loosen tee bolt (1, Fig. 2-20) and remove air cleaner cover (2).

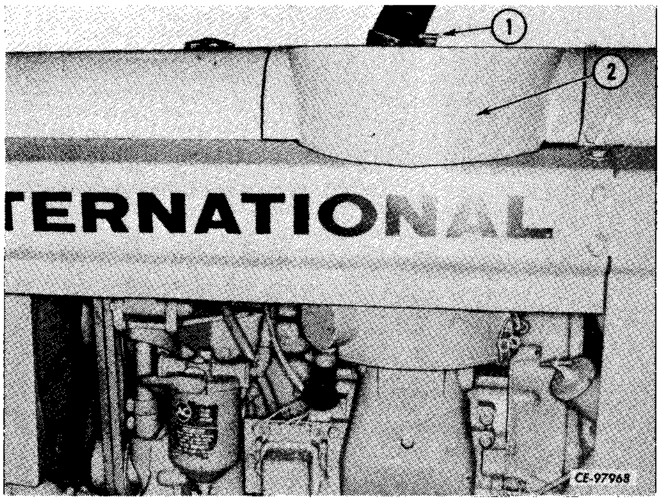

Figure 2-20

Remove side panel. Unfasten body springs (2, Fig. 2-21) and lift body (1) off.

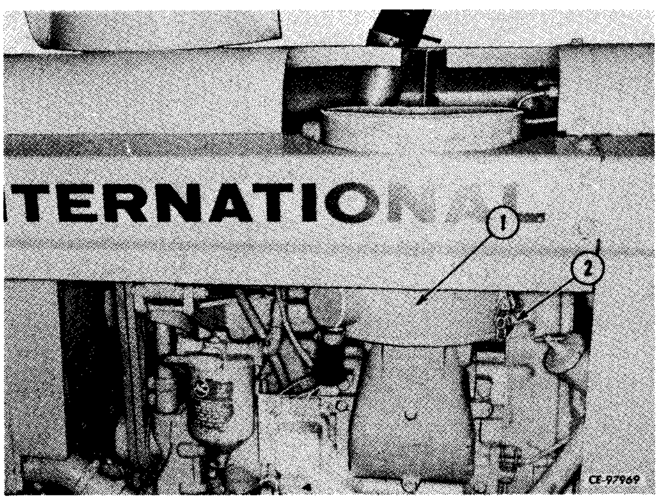

Figure 2-21

Remove and replace or clean filter element (1, Fig. 2-22).

Figure 2-22

INSTALLATION

Position new or clean filter element and install body. Fasten body to air cleaner housing. Check unloading valve.

Install air cleaner cover on hood and tighten tee bolt.

SERVICE

FILTER ELEMENT SERVICE

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.

AIR CLEANER SYSTEM

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.

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.

AIR CLEANER BODY

Clean inside of air cleaner body with a dry cloth or wash it in clean water. Thoroughly dry before installation. A small amount of non-sudsing detergent added to the water will facilitate the removal of soot.

FUEL SYSTEM

GENERAL

The fuel system consists of fuel injectors, fuel manifolds (integral with the cylinder head), fuel pump, fuel strainer, fuel filter, and the necessary connecting fuel lines.

A restricted fitting, installed in the return fuel manifold, assists in maintaining a pressure in that part of the fuel system between the inlet and outlet manifolds.

Fuel is drawn from the supply tank through the strainer and enters the fuel pump at the inlet side. Upon leaving the pump under pressure, the fuel is forced through the filter and into the fuel inlet manifold where it passes through pipes into the inlet side of each fuel injector.

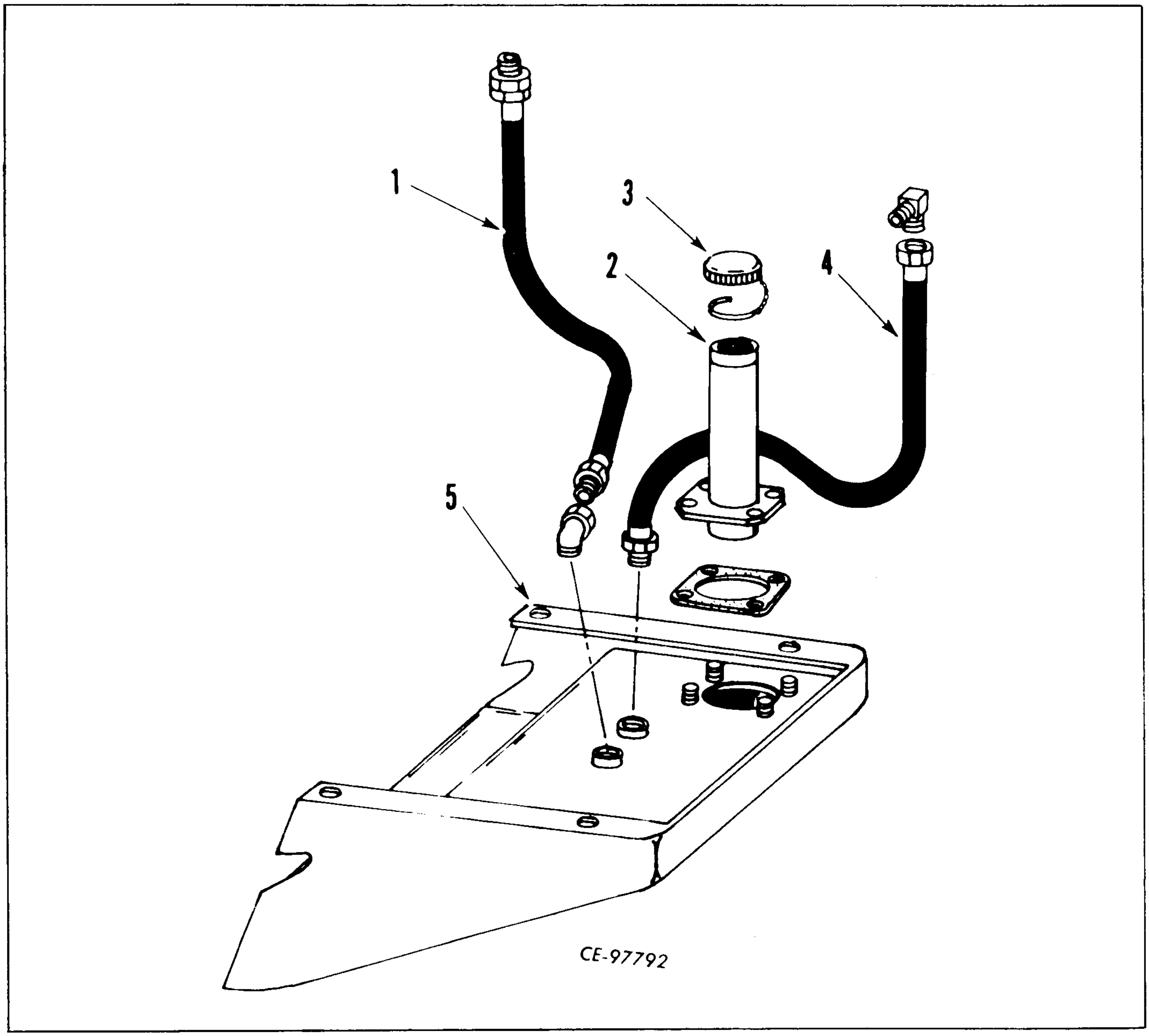

Figure 2-23

1. Fuel return line.
2. Filler tube.
3. Cap.
4. Fuel supply line.
5. Fuel tank.

FUEL SYSTEM

The fuel is filtered through elements in the injectors and atomized through small spray tip orifices into the combustion chamber. Surplus fuel, returning from the injectors, passes through the return manifold and connecting lines back to the tank.

The continuous flow of fuel through the injectors helps to cool the injectors and remove air from the fuel system.

Fuel used in the diesel 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 the Operator's Manual, OM-S-7C for periodic maintenance instructions and interval.

FUEL TANK

REMOVAL

Drain fuel tank before removing tank from tractor frame. Remove drain plug from the bottom of the tank and drain fuel oil into a clean container.

Disconnect and tag fuel supply and return line located beneath the front of the engine.

Position a stand, hydraulic jack, or suitable support blocks under the fuel tank and remove cap screws, flat washers and nuts.

INSTALLATION

Using a suitable lift, position fuel tank under the tractor. Install and tighten cap screws, flat washers and nuts. Connect fuel supply and return line. Install and tighten drain plug.

FUEL STRAINER AND FUEL FILTER

GENERAL

A replaceable element type fuel strainer (7, Fig. 2-24) and fuel filter (3) are used in the fuel system to remove impurities from the fuel. The strainer removes the larger particles and the filter removes the small foreign particles.

The fuel strainer and fuel filter are basically identical in construction, both consisting of a cover, shell and replaceable element. Since the fuel strainer is placed between the fuel tank and fuel pump, it functions under suction; the fuel filter, installed between the fuel pump and fuel inlet manifold in the cylinder head, operates under pressure.

FUEL FILTER ELEMENT SERVICE

1. Turn engine off and place a suitable container under fuel strainer or filter. Open petcocks (4, Fig. 2-24). The fuel will drain more freely if the cover nuts (1, 5) are loosened slightly.

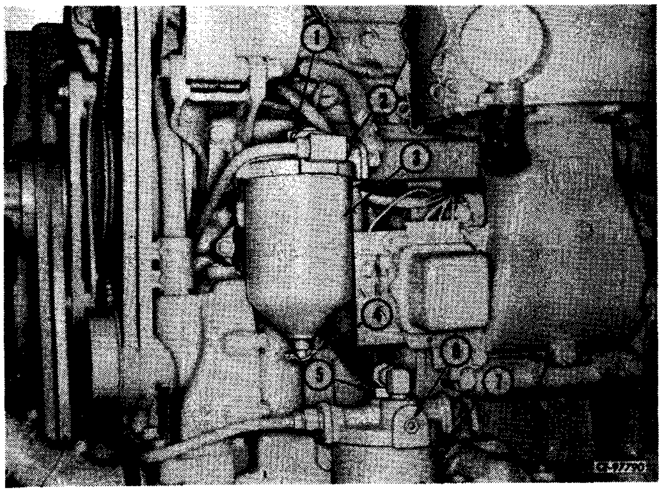

Figure 2-24

2. Support shells (3, 7), unscrew cover nuts (1, 5) and remove shell and elements.

3. Remove and discard elements and gaskets. Clean shells with fuel oil and dry with a cloth or compressed air.

4. Place a new element, which has been thoroughly soaked in clean fuel oil, over stud and push it down on seat. Close drain cock and fill shell approximately two-thirds full with clean fuel oil.

5. Affix a new shell gasket, place shell and element into position under cover and start cover nut on shell stud.

6. Tighten cover nut just enough to prevent fuel leakage.

7. Remove plug (6) in strainer or filter cover (2) and fill shell with fuel.

8. Start and operate engine and check fuel system for leaks.

SERVICE INFORMATION

SPECIFICATIONS

ENGINE

Make	Detroit diesel
Model	3-53
Type	Two stroke cycle diesel
Maximum horsepower (at 2600 RPM)	95
Maximum torque (at 1800 RPM)	195 ft. lbs.
Number of cylinders	3
Bore	3-7/8 in.
Stroke	4-1/2 in.
Piston displacement	159 cu. in.

SERVICE INFORMATION

NORMAL GAUGE READINGS

SYSTEM	GAUGE	DETROIT DIESEL 3-53	
		MIN.	MAX.
COOLING	Water Temperature (Degrees Fahrenheit)	177°	202°
LUBRICATION	Oil Pressure (psi)		40
ENGINE SPEED	Low Idle (rpm)		675
	High Idle (rpm)		2800
	Governed Speed (rpm)	2600	

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

PRINTED IN UNITED STATES OF AMERICA

SECTION III
TORQUE CONVERTER

Not Applicable

SECTION IV
TRANSMISSION

Page

SECTION IV TRANSMISSION

CLUTCH, TRANSMISSION AND TRANSFER CASE

GENERAL

The following text outlines procedures for removal of the clutch, transmission and transfer case from the tractor frame.

The transmission must be removed in order to service the clutch assembly and remove the transfer case.

The following text includes the removal of the transmission, clutch assembly and transfer case.

Installation of the transmission, clutch and transfer case is a reverse of the removal procedure.

REMOVAL

From inside the operator's compartment disconnect accelerator pedal (3, Fig. 4-1) from accelerator linkage by removing nuts and lock washers.

Remove cap screws and washers securing floor panels (1, 2). Remove remaining floor panels by removing cap screws and washers.

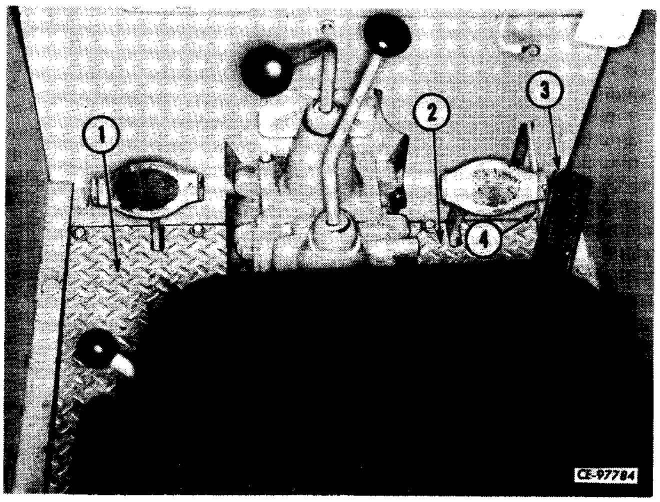

Figure 4-1

Remove cap screws and lock washers (1, 4, Fig. 4-2). Lift off transmission control lever housings (3, 5). Disconnect clutch pedal control rod (2) from clutch lever arm by removing the clevis pin.

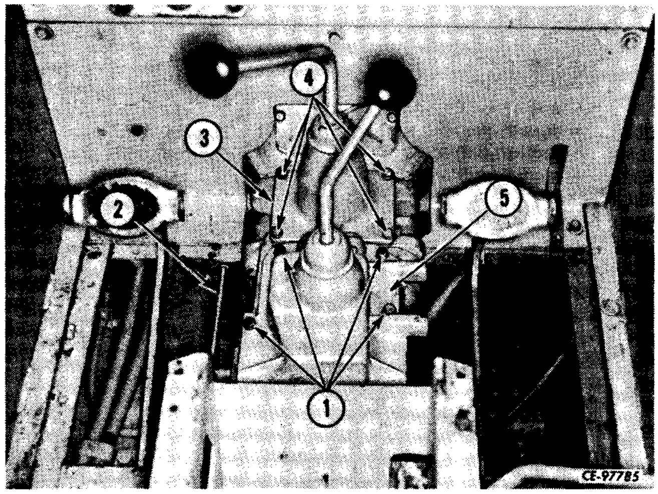

Figure 4-2

Remove cap screws (2, 3, Fig. 4-3), disconnecting hydraulic hose bracket and firewall panel.

Raise loose firewall (4) as far as possible and press down on clutch pedal (1) enabling panel be removed from operator's compartment.

Disconnect drive shaft between transmission and transfer case by removing nuts, lock washers and "U" bolts. Tape loose bearing caps to the trunion to prevent loss of the many bearings housed inside caps.

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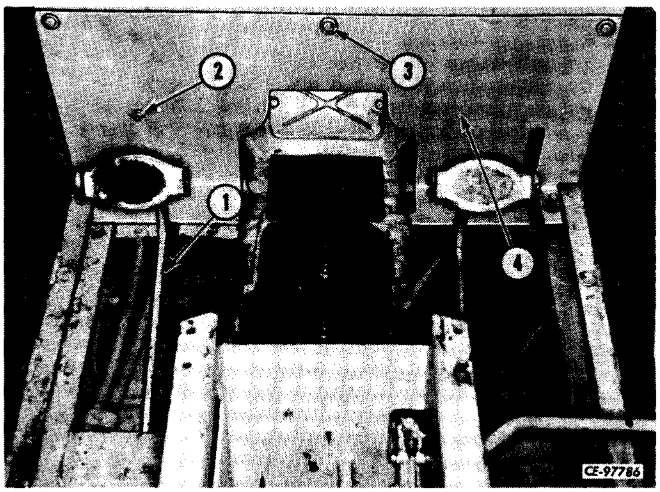

Figure 4-3

CLUTCH, TRANSMISSION AND TRANSFER CASE

REMOVAL - Continued

Remove operator's seat (1, Fig. 4-4) from seat base (3) by removing nuts and lock washers (2), on each side.

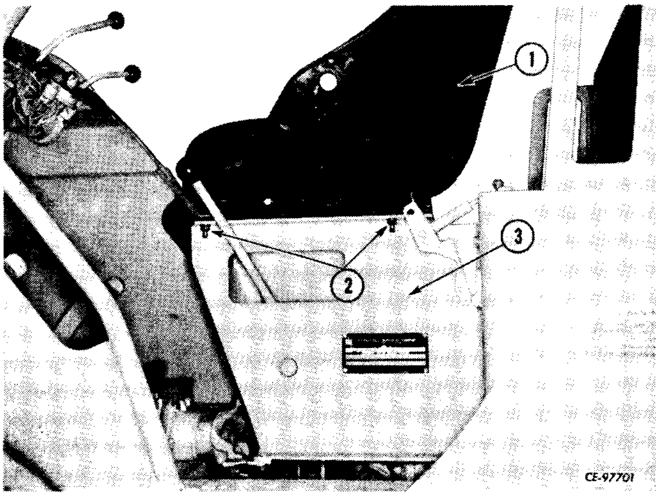

Figure 4-4

Disconnect and tag all hydraulic lines, brake lock lines and brake electrical wires. Plug all hydraulic and brake lines to keep dirt from entering the system and fluid from draining out.

Brake lock lines (1, 2, Fig. 4-5).
Winch hydraulic lines (4, 5, 6).
Brake lock electrical wires (3).

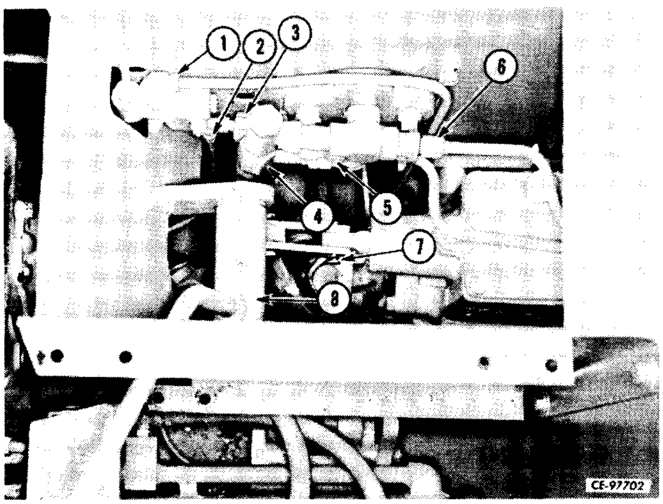

Figure 4-5

Disconnect transfer case control lever (8) by removing cotter and clevis pin (7).

Remove cap screws, flat washers (2, Fig. 4-6) and seat base (1).

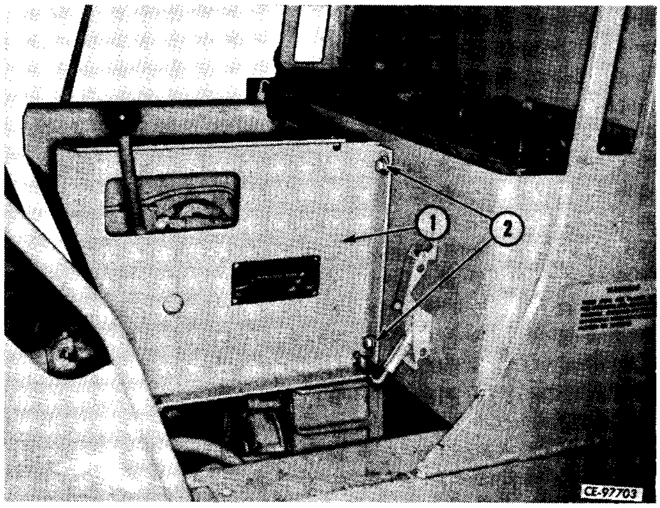

Figure 4-6

Position a suitable sling evenly on transmission (2, Fig. 4-7) and attach sling to hoist. Remove cap screws and lock washers (1).

Slowly pull transmission straight back from engine. Serious damage to transmission and clutch may result if not separated carefully.

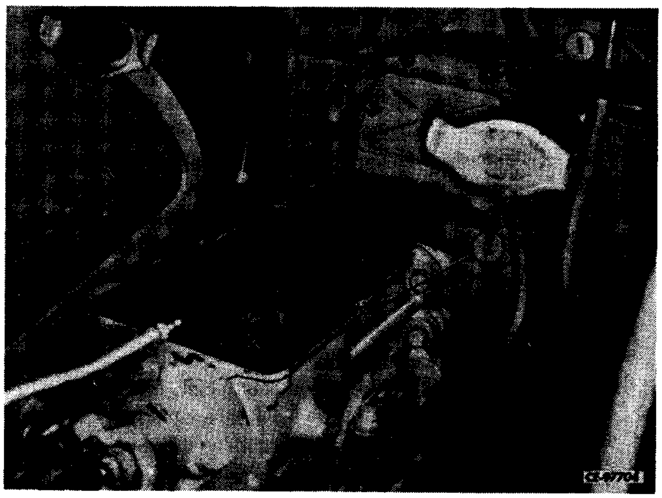

Figure 4-7

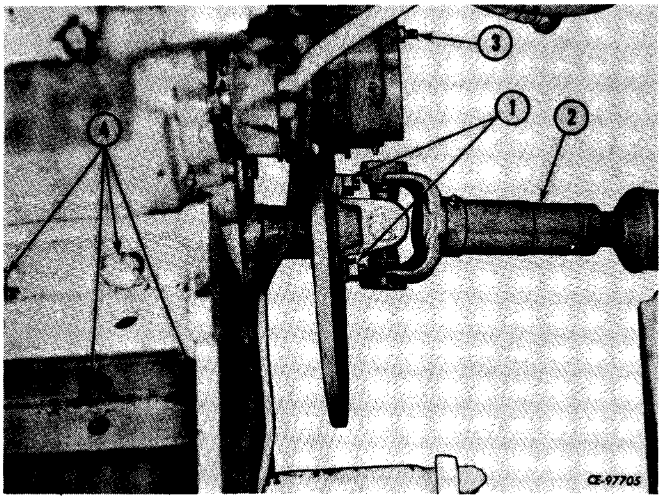

Figure 4-8

Disconnect end of drive shaft (2, Fig. 4-8) from brake disc by removing nuts (1). Disconnect and plug brake hydraulic line from brake caliper (3).

Disconnect upper and lower drive shafts from rear of transfer case by removing nuts, lock washers and "U" bolts. Disconnect ends of the drive shaft from transfer case yokes. Tape bearing caps to trunnion to prevent bearing loss or damage.

Attach a suitable sling to hoist and transfer case. Remove cap screws, lock washers (4) and transfer case.

INSTALLATION

Using a cleaning solvent or steam, clean inside of the front frame.

With the aid of a suitable hoist and sling, position transfer case inside front frame. Install and tighten cap screws and lock washers (4, Fig. 4-8).

Connect ends of drive shafts to the upper and lower rear transfer case yokes. Install "U" bolts, lock washers, and nuts.

Connect end of drive shaft (2, Fig. 4-8) to brake disc. Install and tighten nuts (1). Connect hydraulic brake line to brake caliper (3).

With the aid of a suitable hoist and sling, position transmission (2, Fig. 4-7) in frame. Align transmission evenly and rotate transmission gears until input shaft enters the clutch plate. Extreme caution should be used during installation. Do not pry, force or install at an angle. Install and tighten cap screws and lock washers (1).

Connect drive shaft between transmission and transfer case by installing ends of drive shaft into yoke. Install "U" bolts, lock washers and nuts.

Position seat base (1, Fig. 4-6) against battery box. Install and tighten cap screws and lock washers (2), on each side.

Connect all hydraulic lines, brake lock lines and brake electrical wires.

Brake lock lines (1, 2, Fig. 4-5).
Winch hydraulic lines (4, 5, 6).
Brake lock electrical wires (3).

Connect transfer case control lever with case spool by installing clevis and cotter pins (7).

From inside operator's compartment, press down on clutch pedal (1, Fig. 4-3) and position firewall panel (4). Install and tighten cap screws and washers (3). Position hydraulic hose bracket to rear of firewall and install and tighten cap screw, lock washers and nut (2).

Position new gaskets and transmission control levers (3, 5, Fig. 4-2) on the transmission housing. Install and tighten cap screws and lock washers (1, 4). Connect clutch pedal control rod (2) to clutch lever arm by installing clevis and cotter pins.

Start the engine and warm it up to normal operating temperature. Cycle the winch, transmission and transfer drive in their various ranges. Check for hydraulic leaks or drive train malfunctions. Repair all necessary problems. Stop engine.

Install floor panels (1, 2, Fig. 4-1). Connect accelerator linkage (4) to accelerator pedal (3) and install and tighten nuts and lock washers.

Position operator's seat (1, Fig. 4-4) on seat base (3). Install and tighten nuts and lock washers (2).

CLUTCH

GENERAL

The clutch assembly is located inside the clutch housing which is connected to the transmission housing.

The clutch plate (2, Fig. 4-9) is mounted between the flywheel and the cover assembly (3). When the clutch pedal is depressed the throw-out bearing (4) is forced against three levers in the cover assembly, releasing tension between

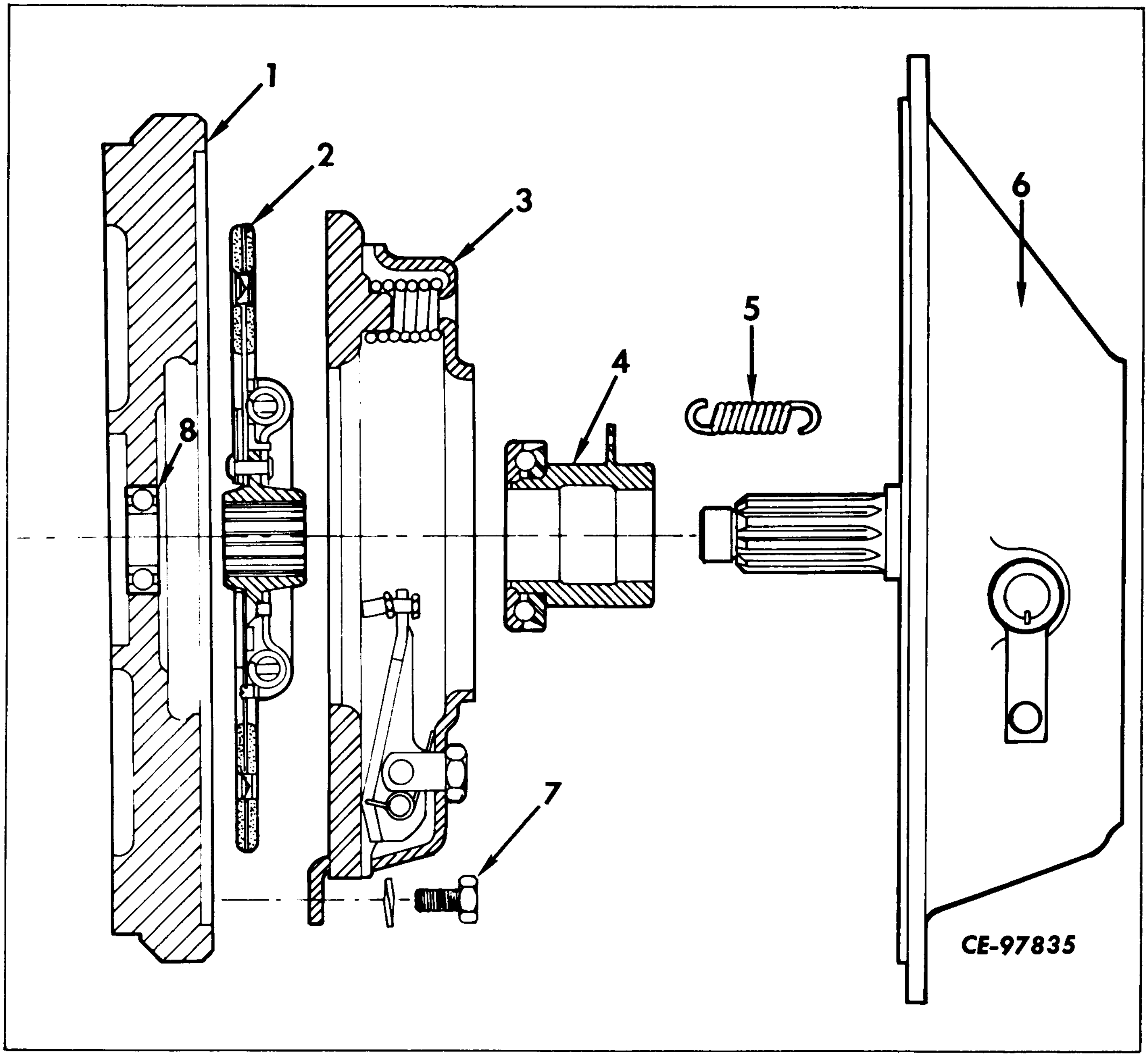

Figure 4-9

1. Flywheel.
2. Clutch plate.
3. Cover assembly.
4. Throw-out bearing assembly.
5. Spring.
6. Clutch housing.
7. Cap screws and lock washers.
8. Pilot bearing.

CLUTCH

the pressure plate and clutch plate. In this condition the power train is motionless, permitting shifting of the transmission or transfer case.

DISASSEMBLY

In order to gain access to the clutch plate or cover assembly, the transmission must be removed from the tractor frame. Refer to "CLUTCH, TRANSMISSION AND TRANSFER CASE," "REMOVAL" and "INSTALLATION" for recommended procedure.

Punch mark the flywheel and cover assembly to aid in assembly. Remove cap screws and lock washers (7) a turn or two at a time in rotation to avoid binding rim to cover.

It is recommended to replace the pilot bearing (8) and throw-out bearing assembly (4) when the clutch plate or cover assembly has been replaced.

ASSEMBLY

Install driver plate (2, Fig. 4-9) and clutch cover assembly (3) to flywheel (1). If only the clutch plate was serviced, install clutch cover assembly matching identification marks made during disassembly.

Line up clutch plate (2) and pilot bearing (8). A used input shaft is an ideal tool to align plate and pilot. Tighten cover cap screws (7) evenly.

To adjust clutch linkage refer to Section 9, "LINKAGE."

Install transmission on engine as outlined in "CLUTCH, TRANSMISSION AND TRANSFER CASE."

TRANSMISSION

GENERAL

The transmission used in the S-7C "PAY logger" consists of two primary units: A reversing unit (Fig. 4-11) to provide direction of travel and a 4-speed gear box (Fig. 4-10) which is synchronized for on-the-go shifting without gear clash.

Little maintenance is required on the transmission. If the correct oil level is maintained, the oil changed regularly and the breather kept free of dirt; the transmission should give satisfactory service for an extended period of time.

Within the reversing unit are several gears and shafts. The input gear is integral with the input shaft and is in constant mesh with the countershaft reverse gear. The countershaft reverse gear is a free gear supported on a roller bearing and is in constant mesh with the smaller gear end of the reverse idler cluster gear. The reverse idler cluster is supported on two roller bearings.

The main shaft reverse gear is splined to the transmission main drive gear shaft and has three positions.

When in its center or NEUTRAL position there is no drive from the reversing unit. In its FORWARD position, this gear is moved to the front and directly engages the input gear to the transmission main drive shaft. In its REVERSE position the gear is moved to the rear and meshes with the large gear of the reverse idler and sends drive into the transmission section in the reverse rotation.

In the transmission section the main drive gear is integral with its shaft and is in mesh with the countershaft 4th speed gear. All four gears on the countershaft are part of a cluster which is supported on roller bearings. 1st and 2nd and 3rd and 4th synchronizers are splined to the main shaft and 2nd and 3rd are free gears on this shaft.

TRANSMISSION

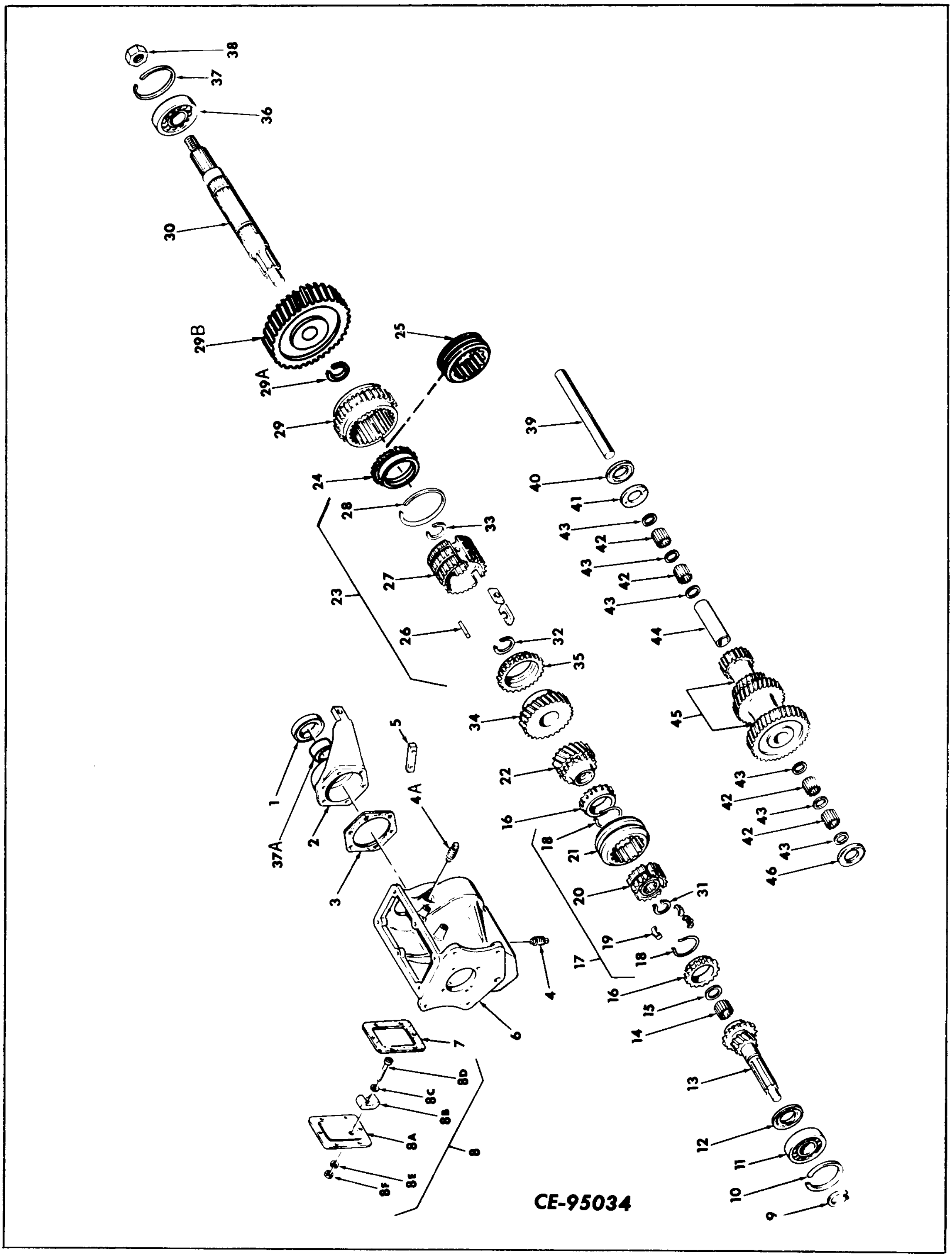

Figure 4-10
Transmission - 4-Speed Gear Box.

TRANSMISSION

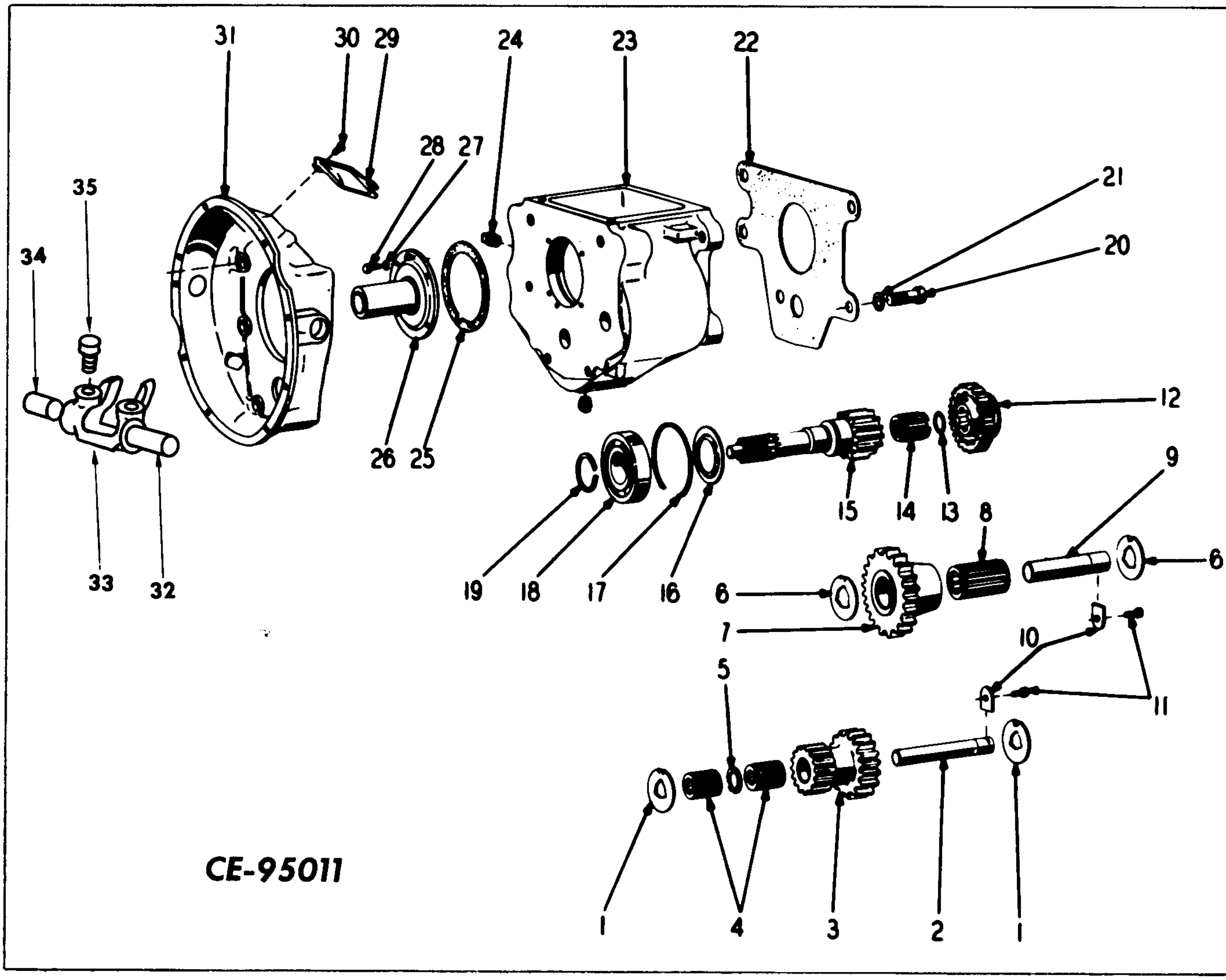

Figure 4-11
Transmission - Reversing Unit.

REMOVAL

To gain access to the transmission and to remove it from the tractor frame, refer to "CLUTCH, TRANSMISSION AND TRANSFER CASE," "REMOVAL."

DISASSEMBLY

Remove the throw-out bearing spring (1, Fig. 4-12) and slide bearing carrier assembly (2) from the retainer (3).

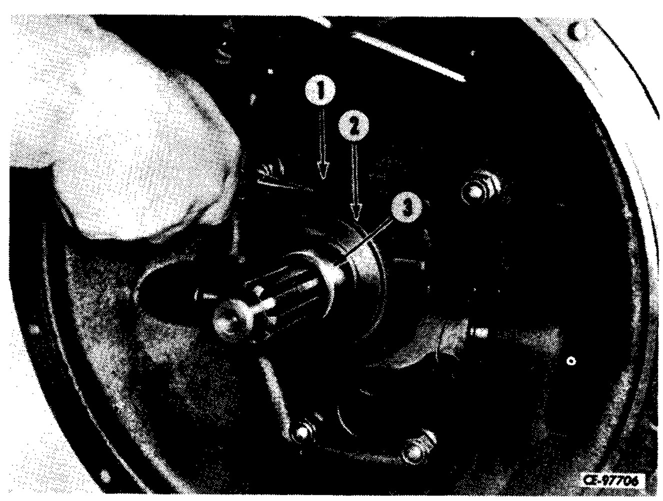

Figure 4-12

(Continued on next page)

TRANSMISSION

DISASSEMBLY - Continued

Remove nuts (1, Fig. 4-13). Tap the clutch housing (2) from the transmission studs. Tap evenly.

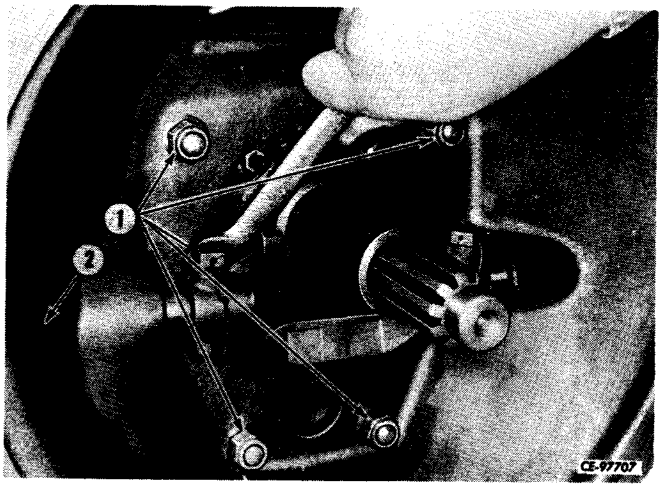

Figure 4-13

Cut lock wires (1, Fig. 4-14) and remove lock screws (2) from yoke (3). Drive shaft (4) into housing and remove yoke (3). Remove shafts (4, 5) from housing.

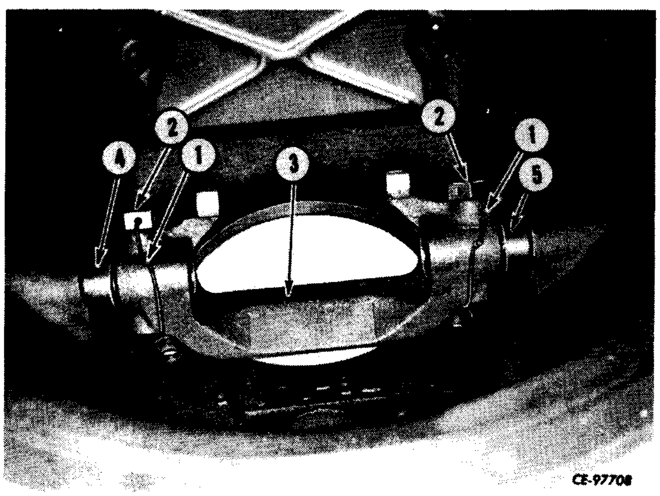

Figure 4-14

Remove cap screws (1, Fig. 4-15) and retainer (2) from reverse housing. Remove and discard gasket.

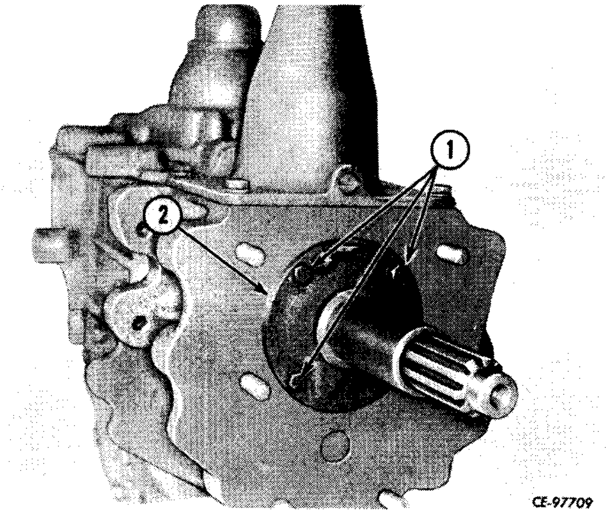

Figure 4-15

Remove oil seal (1, Fig. 4-16) from hub of retainer (2). Press a new seal into hub of retainer with lip of oil seal facing reverse housing.

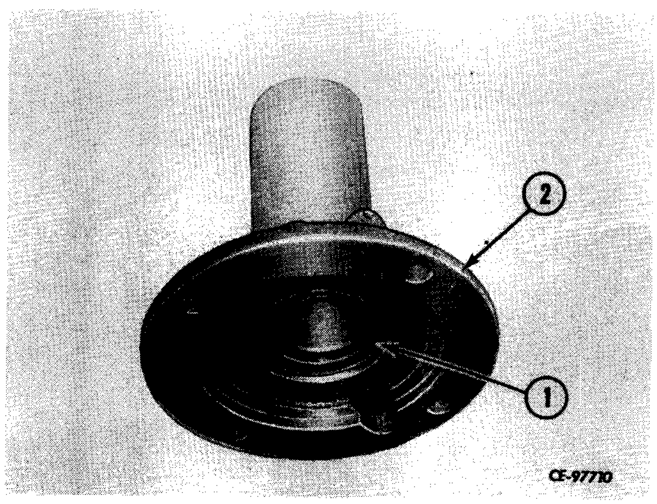

Figure 4-16

TRANSMISSION

Remove cap screws (1, Fig. 4-17) and remove control housing (2) from the reverse housing.

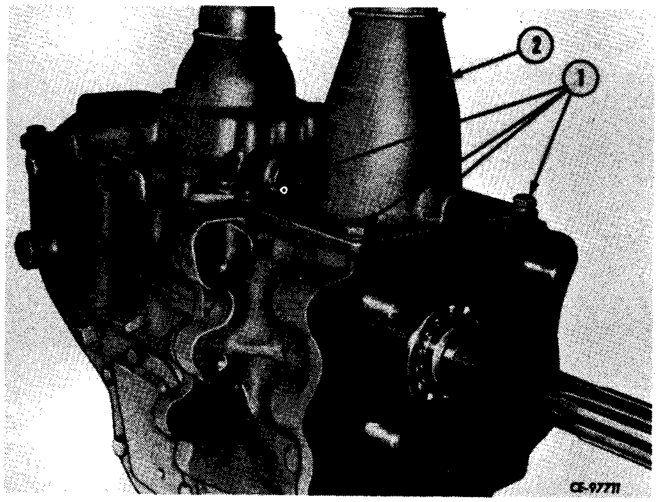

Figure 4-17

Loosen cap housing (1, Fig. 4-18), spring washer (2) and spring (3). Remove control bracket pin (4) and remove control lever from housing (5).

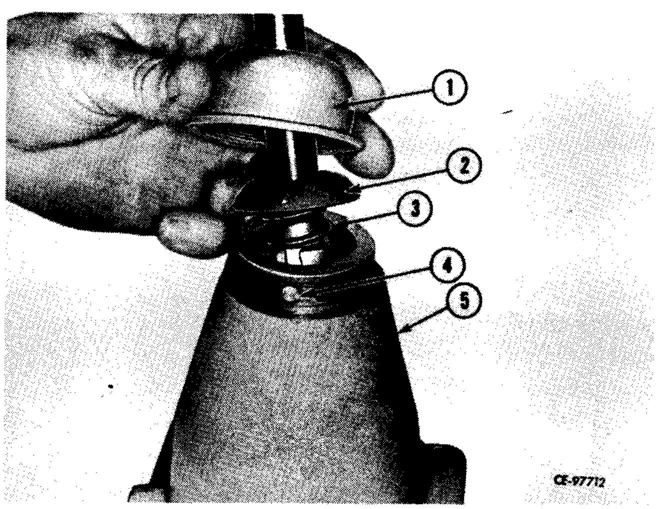

Figure 4-18

NOTE: Shifting fork is made offset. Mark its installed position to insure correct assembly.

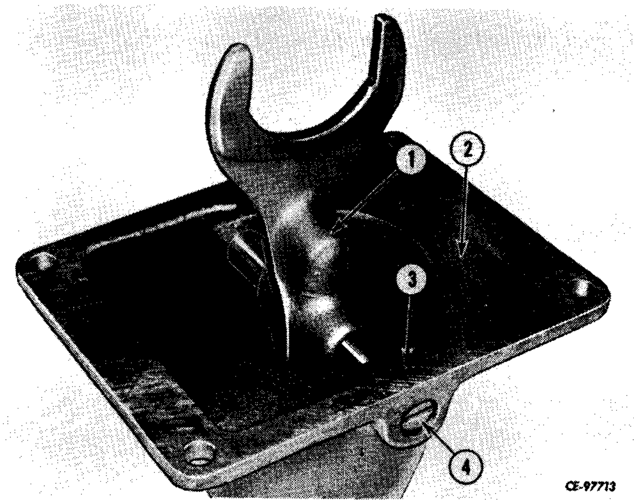

Figure 4-19

Using a suitable punch remove groove pin from bore (3, Fig. 4-19). Drive reverse shift rail (4) out through the housing (2) and shift fork (1).

NOTE: A ball and poppet spring are spring loaded inside of shift fork (1) and will be ejected when shift rail (4) is removed.

Remove cap screws (1, Fig. 4-20) and washers and remove transmission control housing (2).

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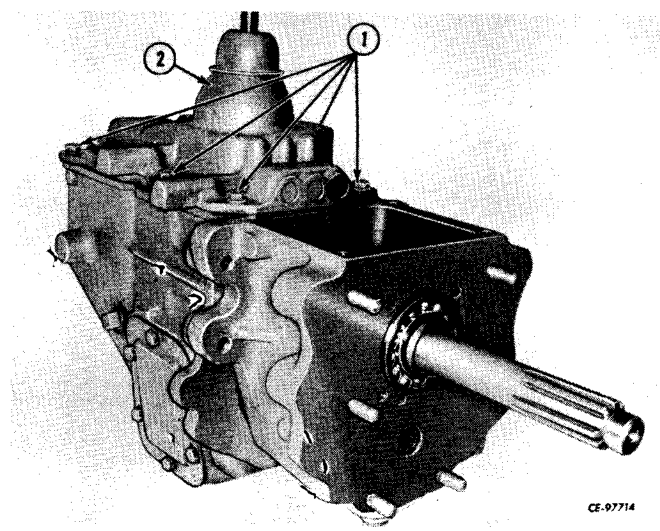

Figure 4-20

TRANSMISSION

DISASSEMBLY - Continued

Loosen cap housing (1, Fig. 4-21), spring washer (2) and spring (3) from housing (5). Remove pin (4) from housing and remove lever assembly from housing.

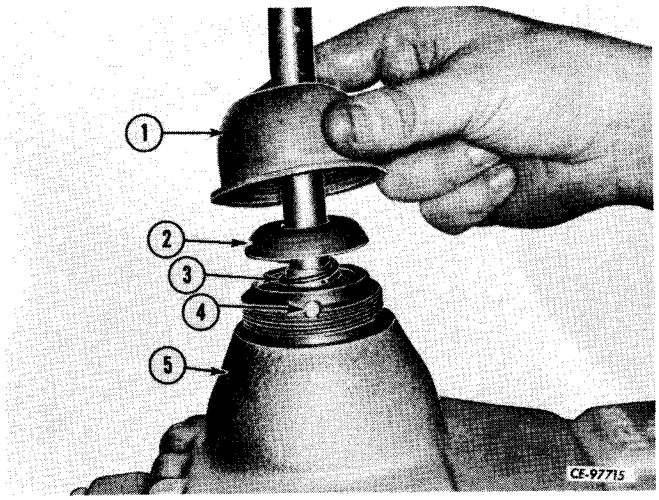

Figure 4-21

NOTE: Shifting forks are made offset. Mark their installed position to insure correct assembly.

Remove roll pins (6, Fig. 4-22) separating shifting forks from shifting rails. Drive shifting rails (3, 5) out through control housing removing expansion plugs (7) on the way out.

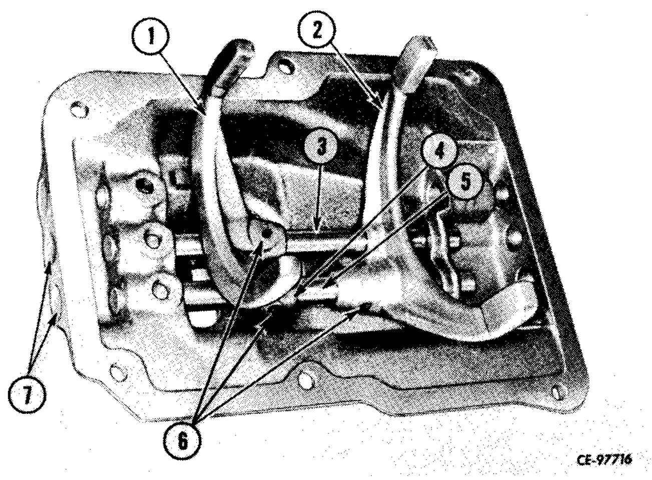

Figure 4-22

NOTE: A ball and poppet spring are spring loaded inside a bore in the housing and will be ejected when the shift rails are removed.

Remove cap screws and washers (1, Fig. 4-23) separating reversing housing (2) from transmission housing (3).

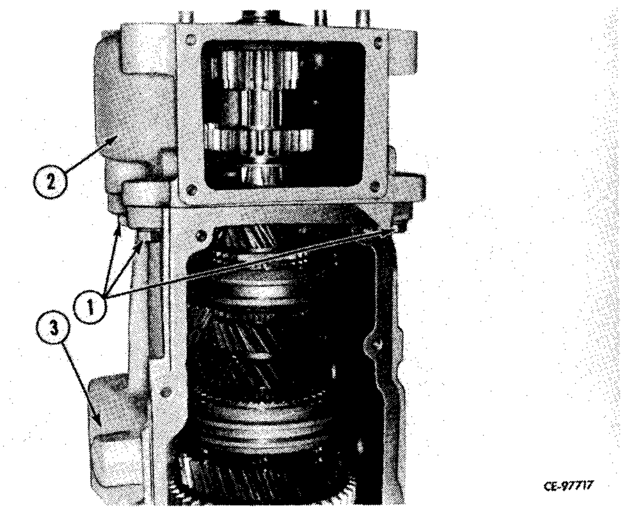

Figure 4-23

Using a suitable puller remove main drive gear and bearing from the reverse housing. Using a suitable press remove bearing (1, Fig. 4-24) and oil fling from main drive gear (2).

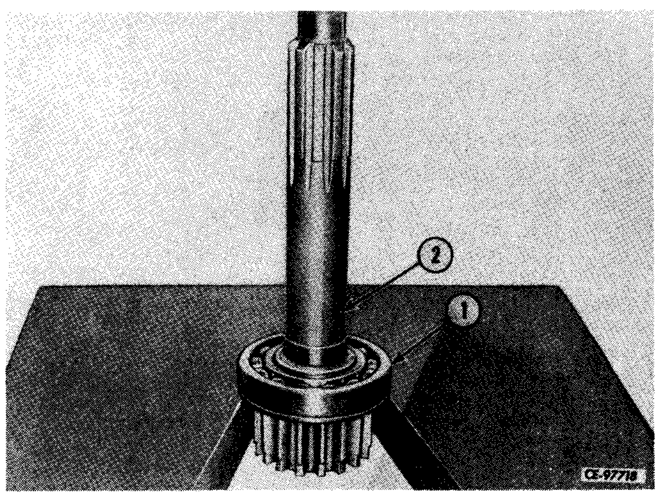

Figure 4-24

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TRANSMISSION

Remove roller bearing (1, Fig. 4-25), ring spacer and main shaft reverse gear (2). Remove snap ring (3) from reverse housing.

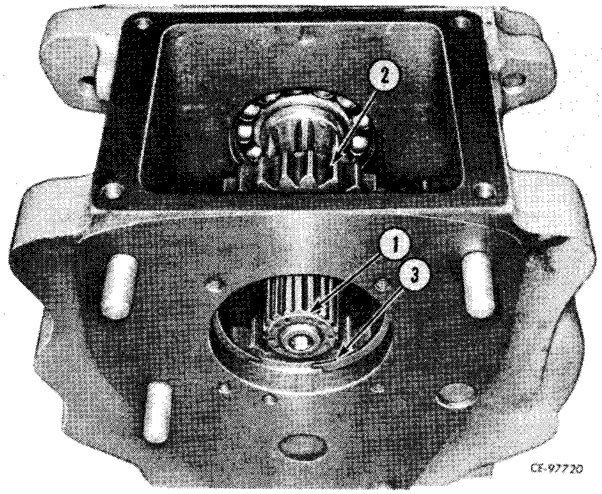

Figure 4-25

Remove cap screws (1, 4, Fig. 4-26) and lock plates (2, 5) from transmission housing.

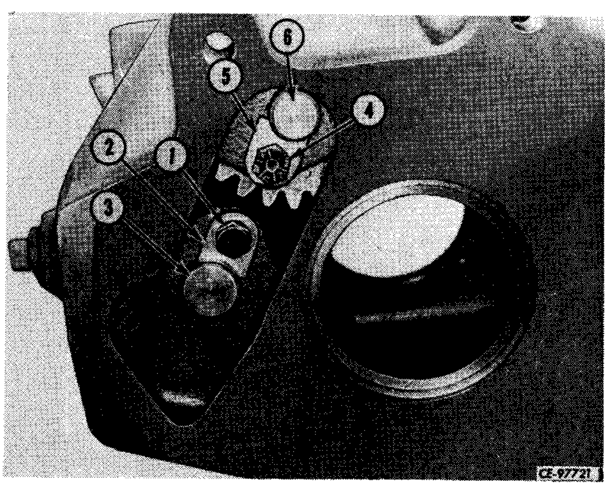

Figure 4-26

Using a suitable punch, drive reverse idler gear shaft (1, Fig. 4-27) and reverse countershaft gear shaft (2) out through transmission housing and gears. Remove both gear assemblies from housing.

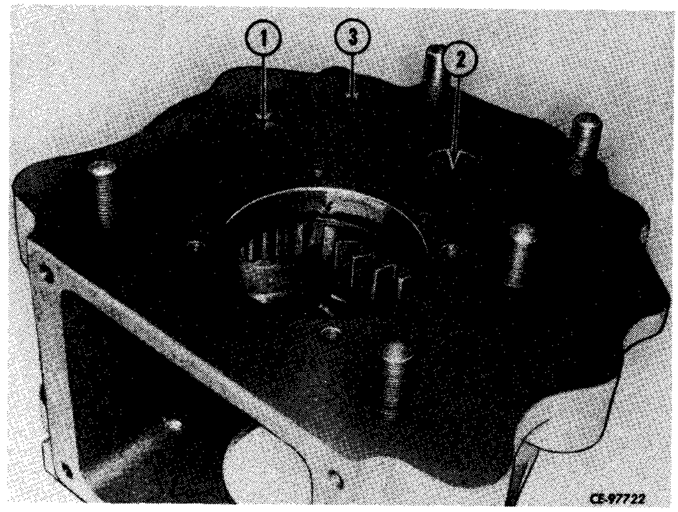

Figure 4-27

Remove main shaft nut (1, Fig. 4-28) and yoke (2) from main shaft (3).

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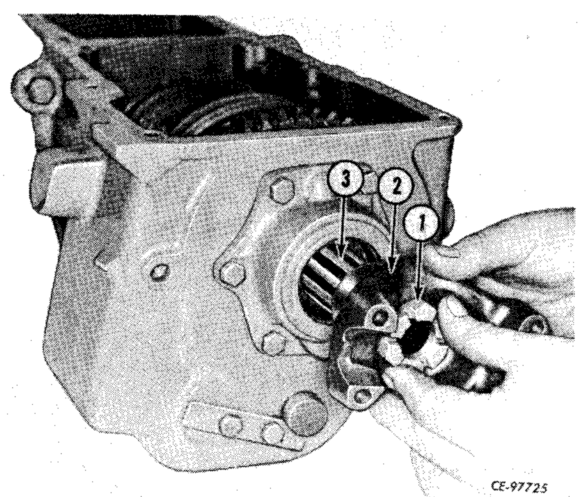

Figure 4-28

TRANSMISSION

DISASSEMBLY - Continued

Remove cap screws and lock washers (1, Fig. 4-29) separating bearing retainer (2) and gasket from transmission housing. Remove spacer (3).

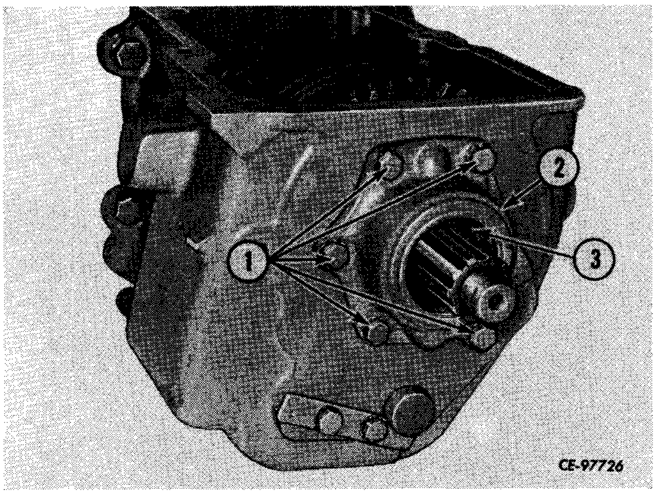

Figure 4-29

Remove and replace oil seal (1, Fig. 4-30) from retainer (2). Press a new oil seal into retainer with lip of seal facing transmission housing.

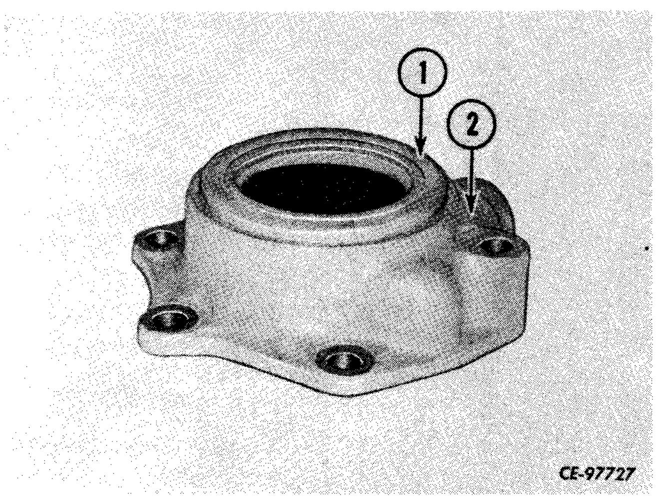

Figure 4-30

Remove cap screws and lock washers (1, Fig. 4-31) and countershaft lock plate (2) from housing (3).

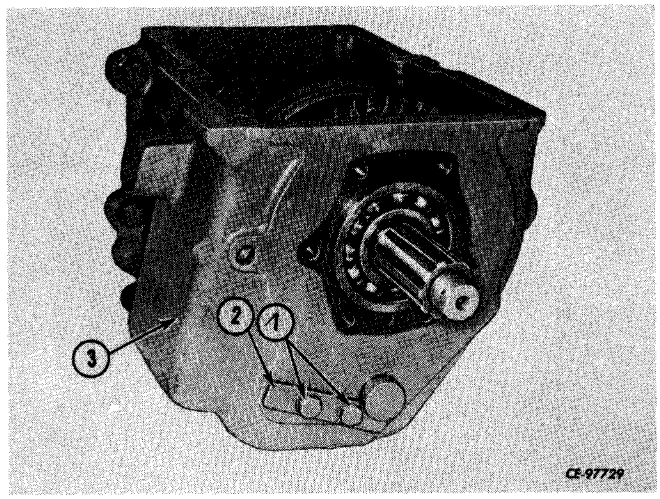

Figure 4-31

Remove snap ring (1, Fig. 4-32) and using a suitable puller remove bearing (2) from housing.

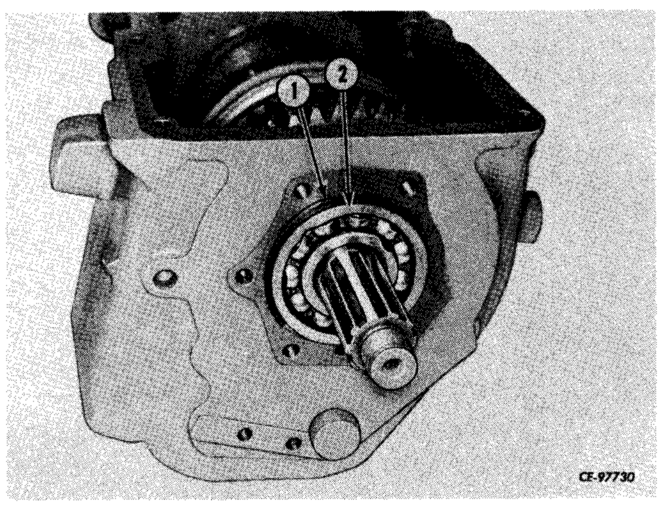

Figure 4-32

TRANSMISSION

Remove snap ring (3, Fig. 4-33) from main drive gear (4) and snap ring (1) from bearing (2). Using a suitable puller remove bearing (2) from housing and gear (4). Remove gear (4).

NOTE: While removing main drive gear be careful not to lose any of the roller bearings inside the gear bore.

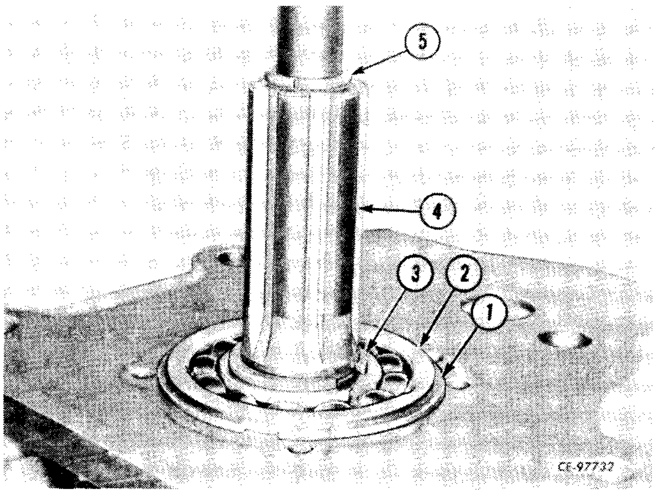

Figure 4-33

Remove bearing spacer (1, Fig. 4-34) and remove transmission gear assembly (2) from transmission housing.

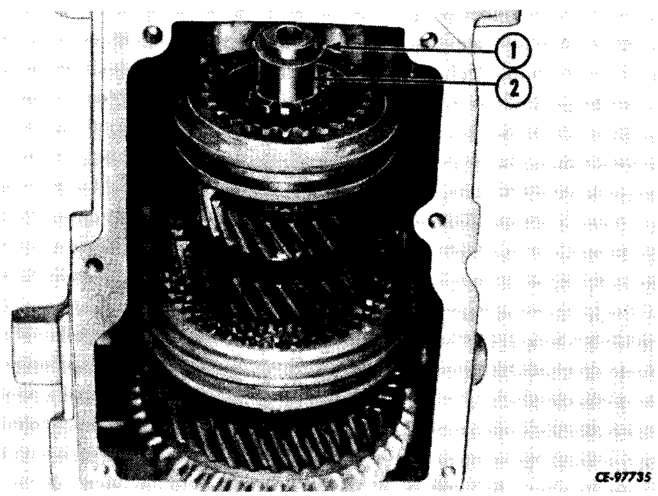

Figure 4-34

Remove snap ring (1, Fig. 4-35) and synchronizer assembly (3) from main shaft (2).

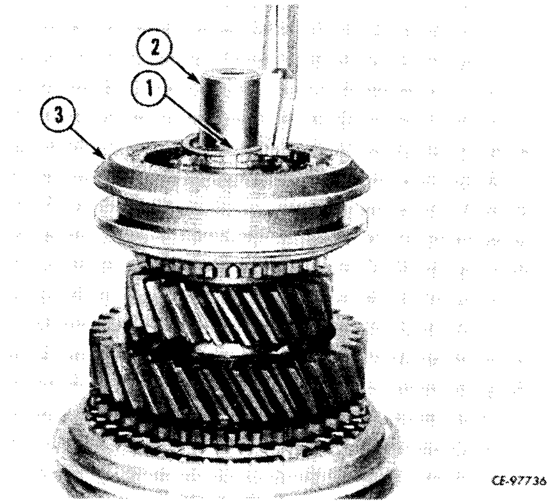

Figure 4-35

Remove spring (1, Fig. 4-36) separating shifting plates (2), 3rd and direct hub (4) and sleeve (3).

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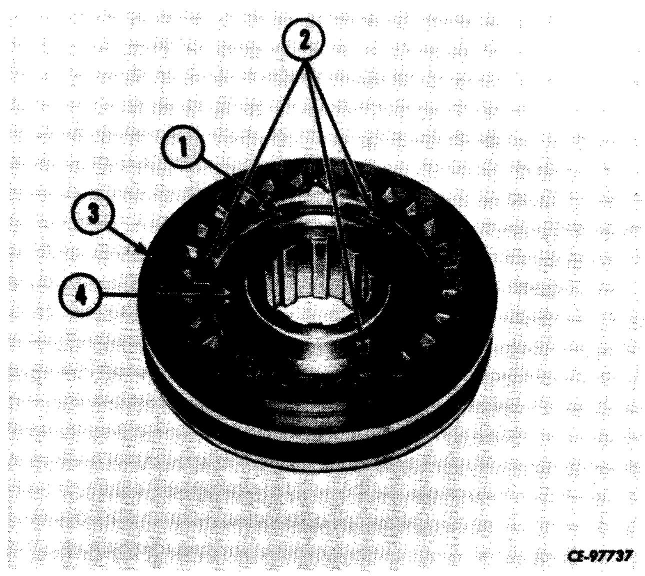

Figure 4-36

TRANSMISSION

DISASSEMBLY - Continued

Remove blocking ring (1, Fig. 4-37) and 3rd gear assembly (2) from main shaft (3).

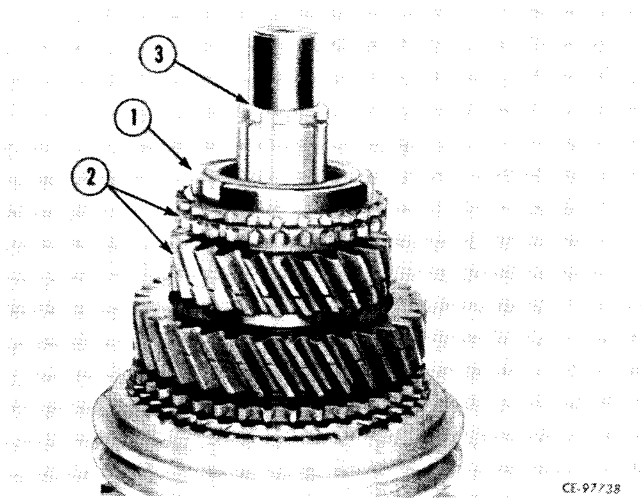

Figure 4-37

Using a suitable puller remove main reverse gear (1, Fig. 4-38) from main shaft.

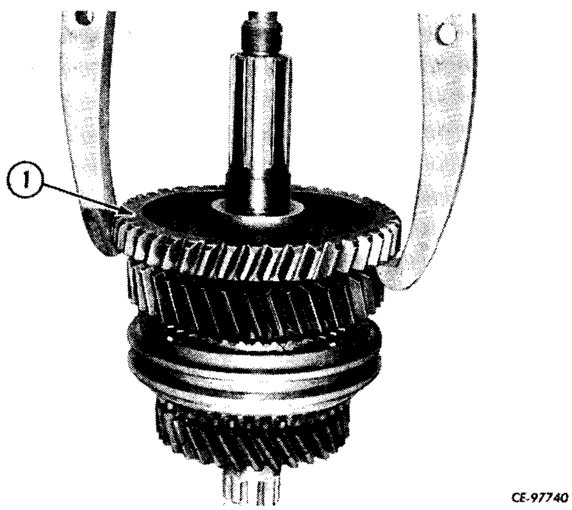

Figure 4-38

Remove snap ring (1, Fig. 4-39) and 1st gear (2) from main shaft.

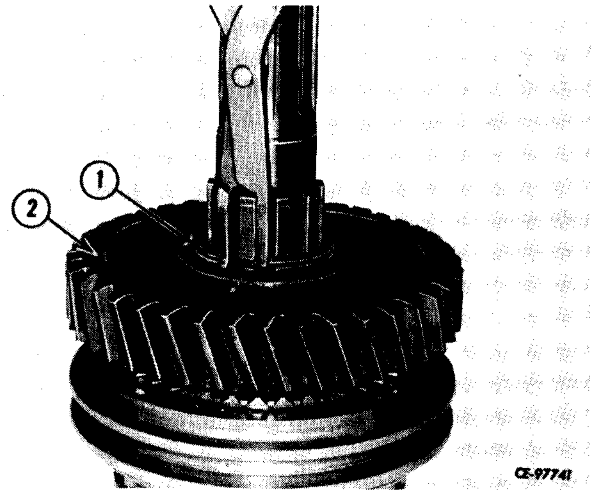

Figure 4-39

Remove snap ring (1, Fig. 4-40) and synchronizer assembly (2) from main shaft (3).

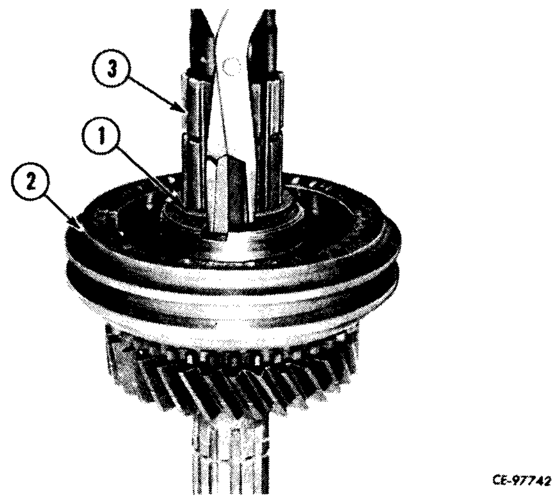

Figure 4-40

TRANSMISSION

Remove snap ring (1, Fig. 4-41) separating shifting plates (2), 1st and 2nd hub (4) and collar (3).

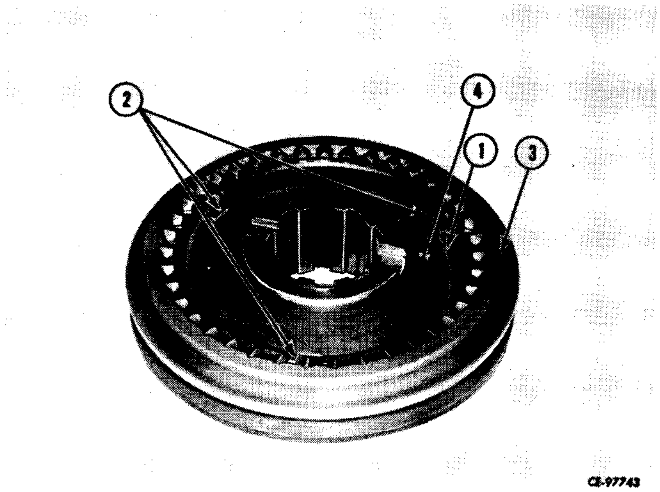

Figure 4-41

Remove snap ring (1, Fig. 4-42), blocking ring (2) and 2nd gear (3) from main shaft (4).

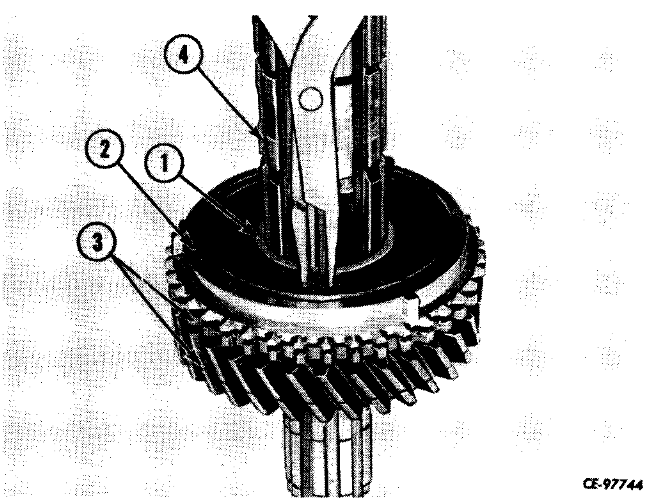

Figure 4-42

Drive countershaft (1, Fig. 4-43) out through housing and countershaft gear (3) using a special pilot shaft (2).

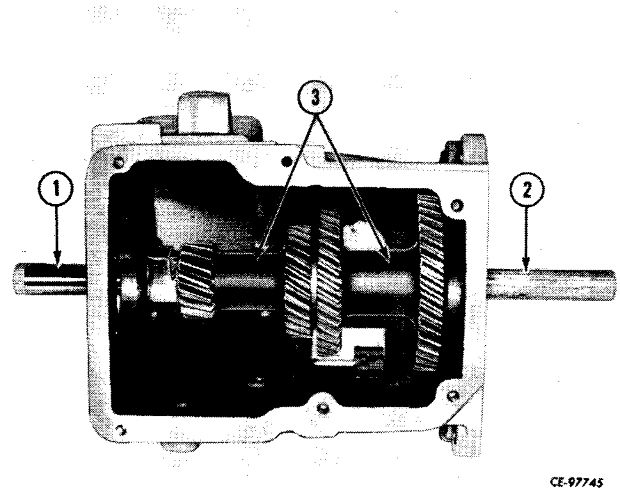

Figure 4-43

NOTE: Drive countershaft (1) from case only enough to install a pilot shaft (2) made of wood dowel rod 1-1/8" x dia x 9-1/2" long. Pilot shaft (2) will hold bearing assemblies in position for removal and installation of countershaft gear assembly (3).

ASSEMBLY

Position pilot shaft (12, Fig. 4-44) partially in countershaft gear bore (13) and install bearing spacer (5), spacer (11), twenty-two roller bearings (6), spacer (11), twenty-two roller bearings (7) and spacer (11).

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TRANSMISSION

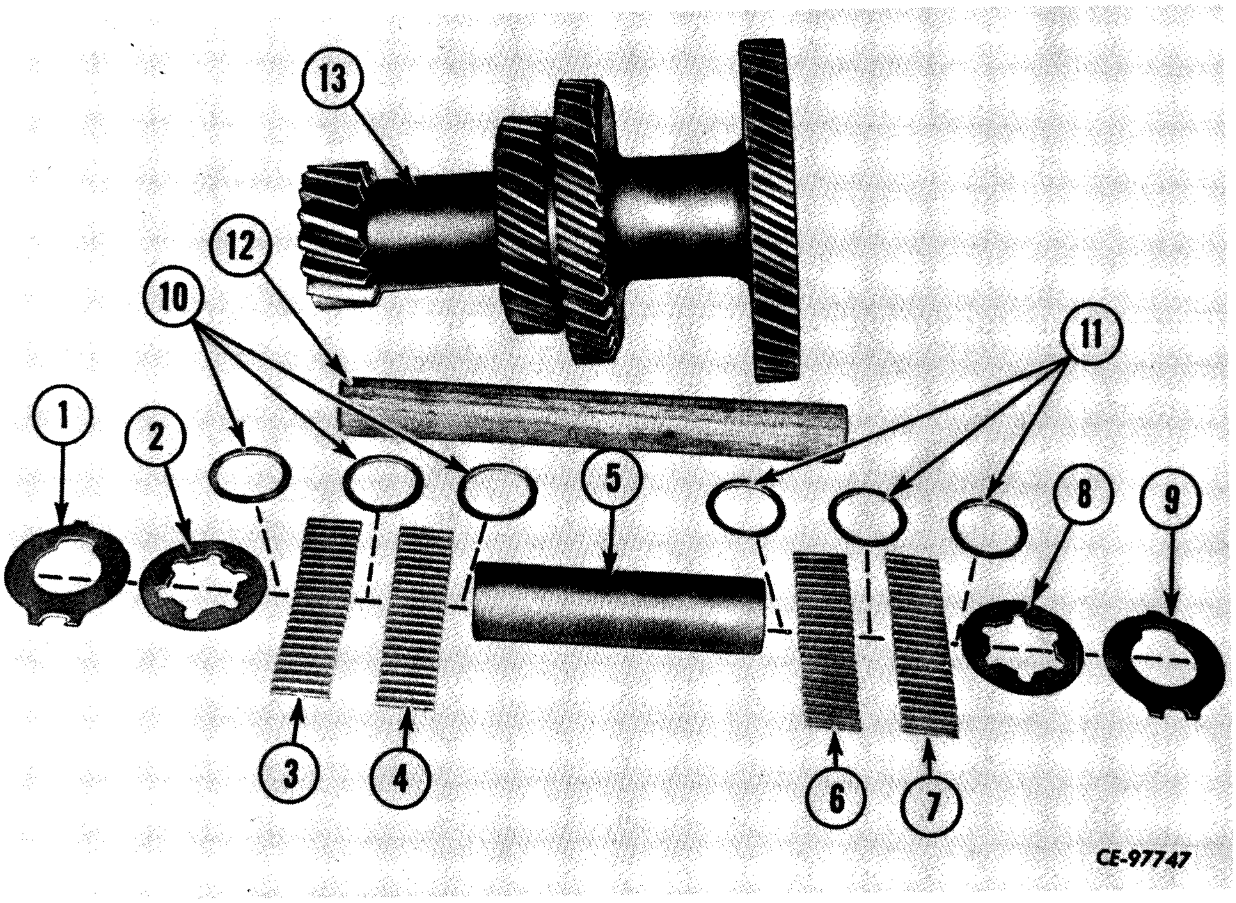

Figure 4-44

1. Washer.
2. Washer.
3. Roller bearing.
4. Roller bearing.
5. Bearing spacer.
6. Roller bearing.
7. Roller bearing.
8. Washer.
9. Washer.
10. Bearing spacers.
11. Bearing spacers.
12. Pilot shaft.
13. Countershaft gear.

ASSEMBLY - Continued

Push pilot shaft partially through bore of countershaft gear and install spacer (10), twenty-two roller bearings (4), spacer (10), twenty-two roller bearings (3) and spacer (10).

Using grease to hold washers (1, 2, Fig. 4-45) in position install assembled countershaft gear into transmission housing. Install remaining washers between housings and countershaft gear.

TRANSMISSION

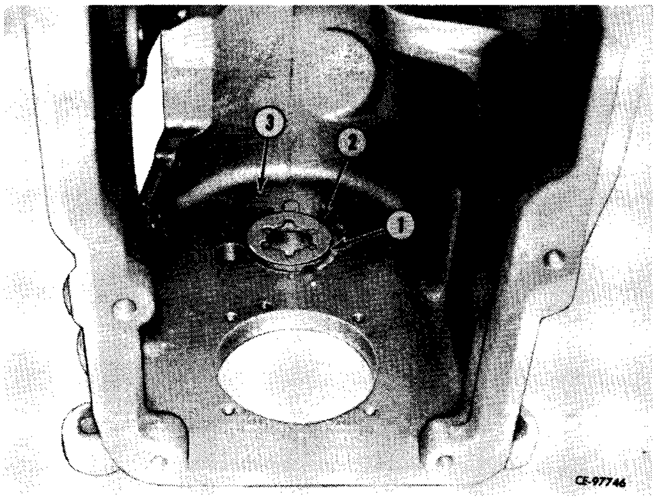

Figure 4-45

Install countershaft (1, Fig. 4-46) with notched end of shaft matching locking end of housings, into housing and countershaft gear.

Gently press countershaft (1) through housing and gear (3) checking position of washers between gear and housing.

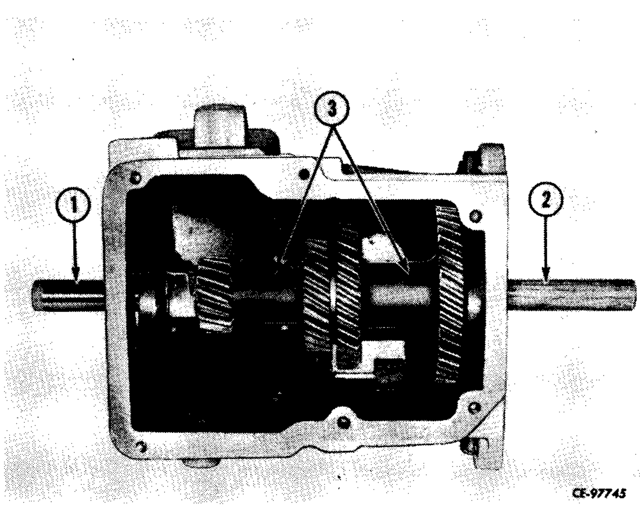

Figure 4-46

Install 2nd gear (3, Fig. 4-47) and blocking ring (2) on main shaft (4) and install snap ring (1).

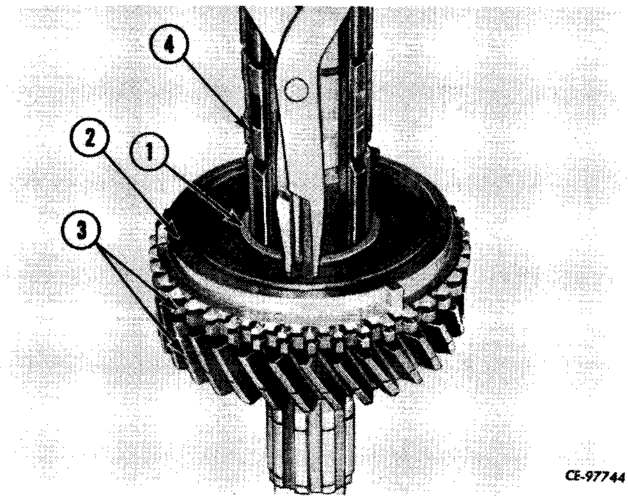

Figure 4-47

Install 1st and 2nd gear hub (4, Fig. 4-48) inside of collar (3) and install shifting plates (2). Install snap ring (1).

(Continued on next page)

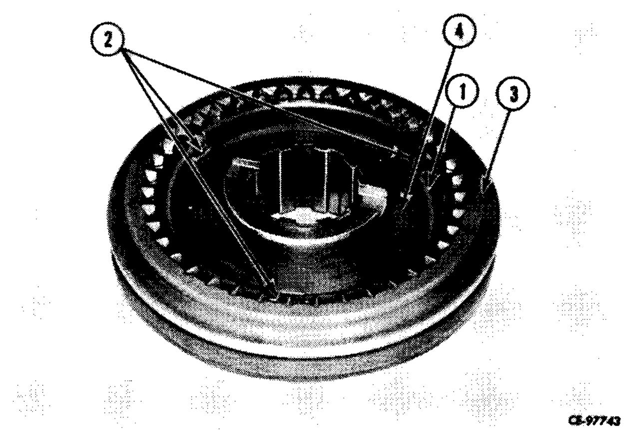

Figure 4-48

TRANSMISSION

ASSEMBLY - Continued

Install assembled 1st and 2nd gear collar (2, Fig. 4-49) on main shaft (3) and install snap ring (1).

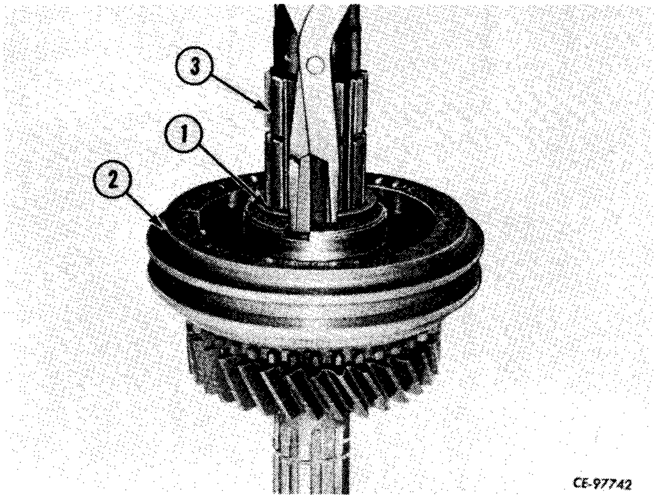

Figure 4-49

Install 1st speed gear (2, Fig. 4-50) on main shaft and install snap ring (1).

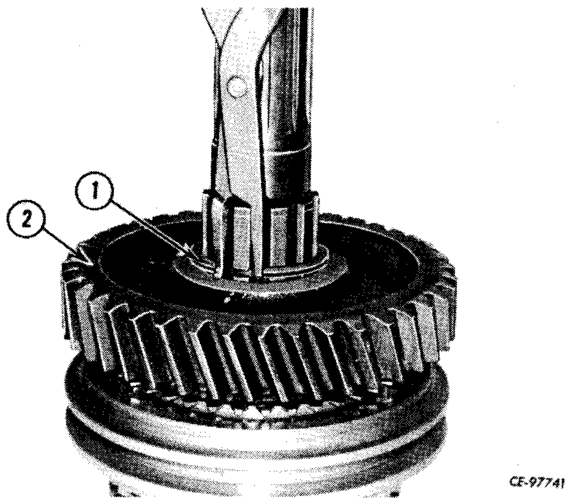

Figure 4-50

Using a suitable press install main reverse gear (1, Fig. 4-51) on main shaft assembly.

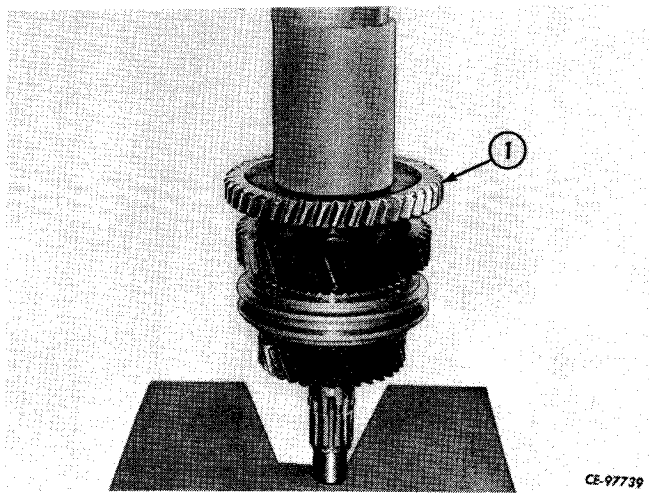

Figure 4-51

Install 3rd speed gear (2, Fig. 4-52), blocking ring (1) on main shaft (3).

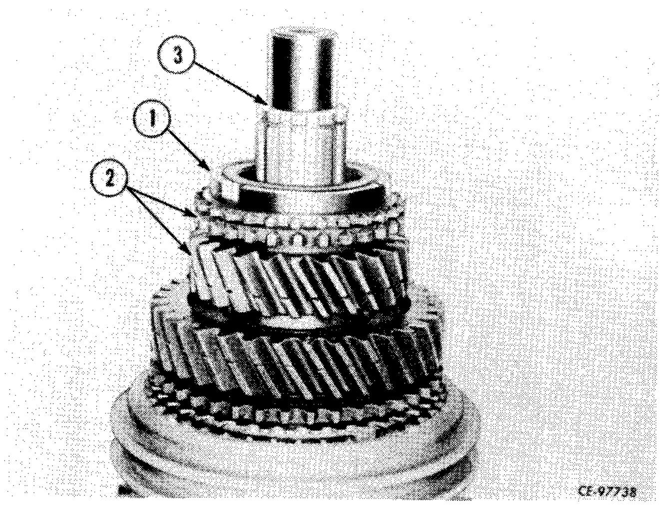

Figure 4-52

TRANSMISSION

Install 3rd and 4th hub (4, Fig. 4-53) into collar (3) and install shifting plates (2). Install snap ring (1).

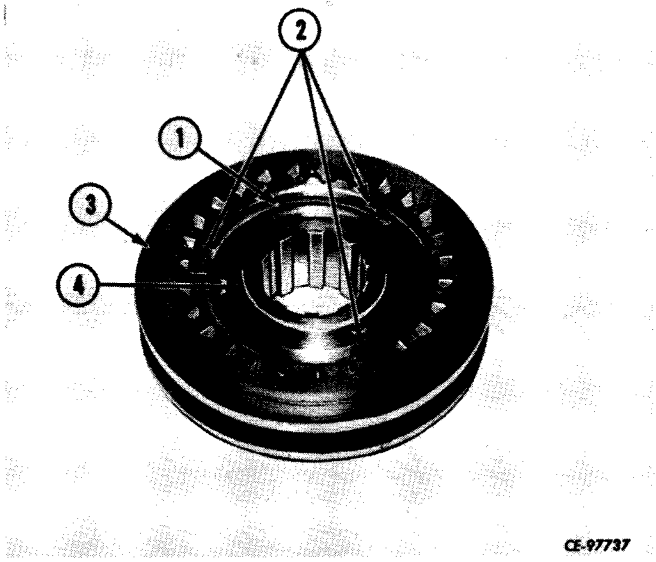

Figure 4-53

Install assembled 3rd and 4th shifting collar (3, Fig. 4-54) on main shaft (2) and install snap ring (1).

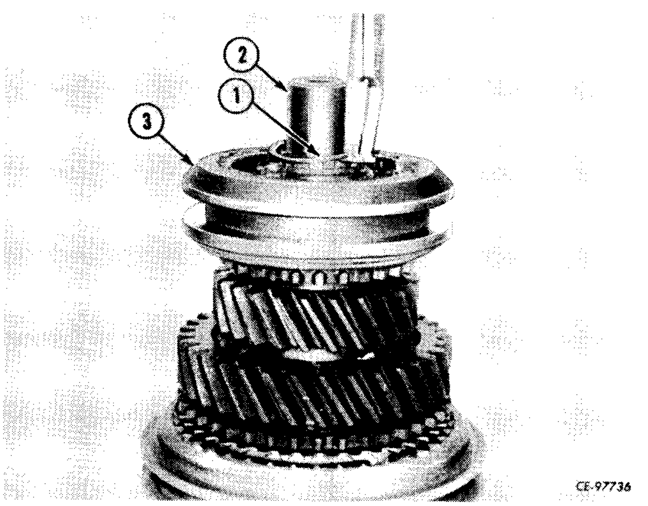

Figure 4-54

Positioned assembled main shaft (2, Fig. 4-55) inside of transmission housing and install washer (1).

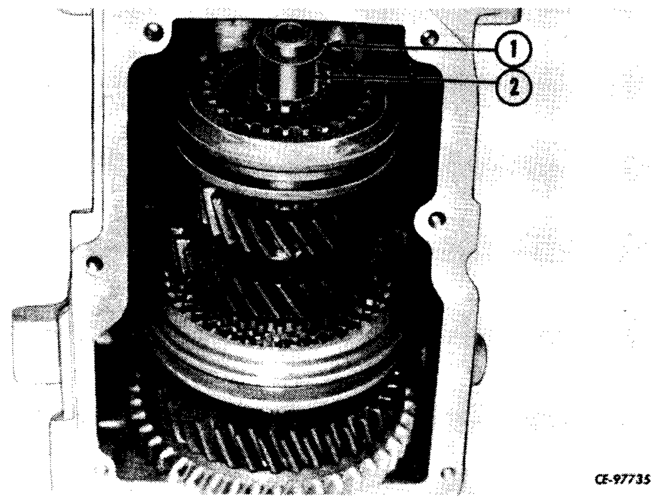

Figure 4-55

Apply grease to bore of main drive gear (1, Fig. 4-56) and position twenty-two loose roller bearings. Install gear (1) over end of main drive shaft.

(Continued on next page)

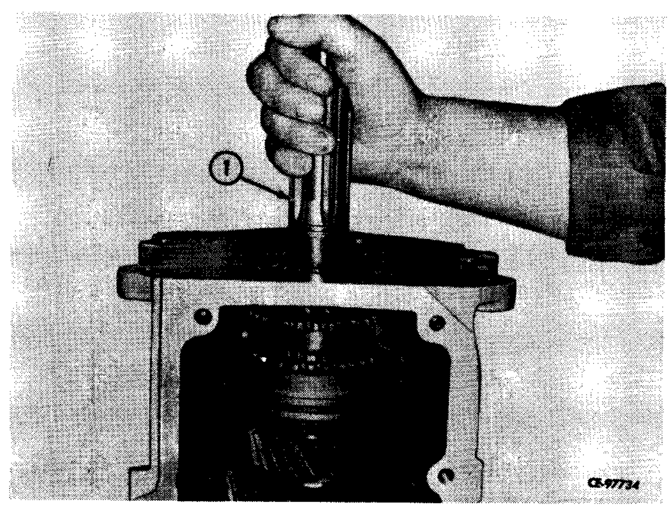

Figure 4-56

TRANSMISSION

ASSEMBLY - Continued

Using a suitable press install bearing (2, Fig. 4-57) in housing (3).

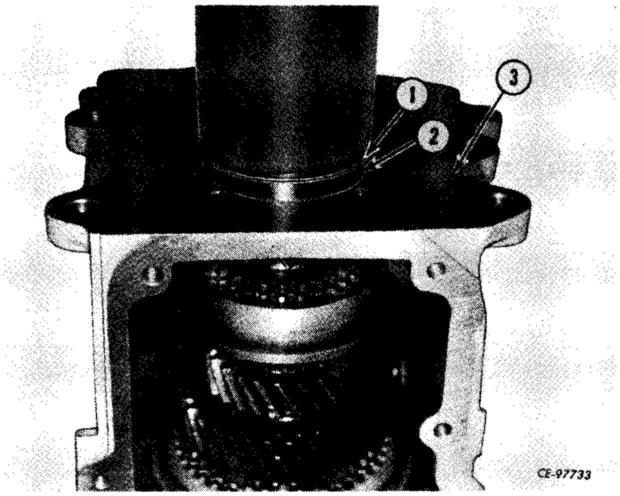

Figure 4-57

Install snap rings (1, 3, Fig. 4-58) into shaft (4) and bearing (2) and press shaft (4) tight into position. Install spacer ring (5) and tape into position on assembly of main drive gear.

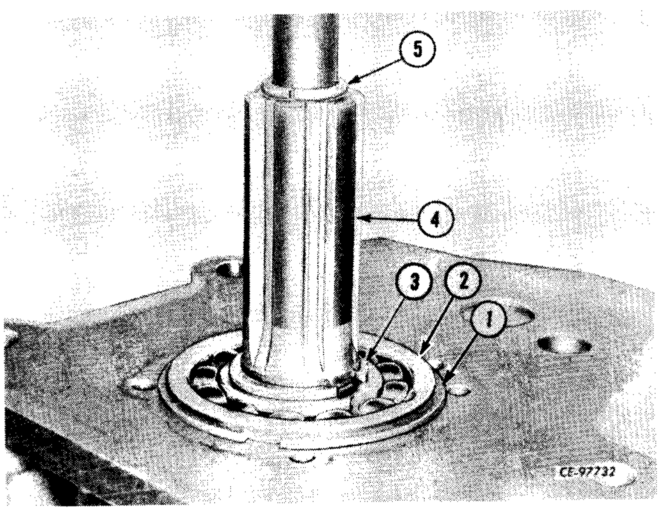

Figure 4-58

Using a suitable press install bearing (2, Fig. 4-59) into end of transmission housing.

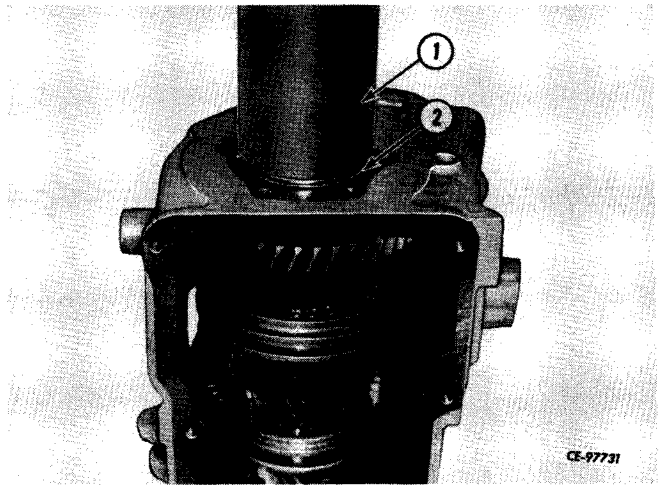

Figure 4-59

Install snap ring (1, Fig. 4-60) in bearing (2) and continue to press bearing tight.

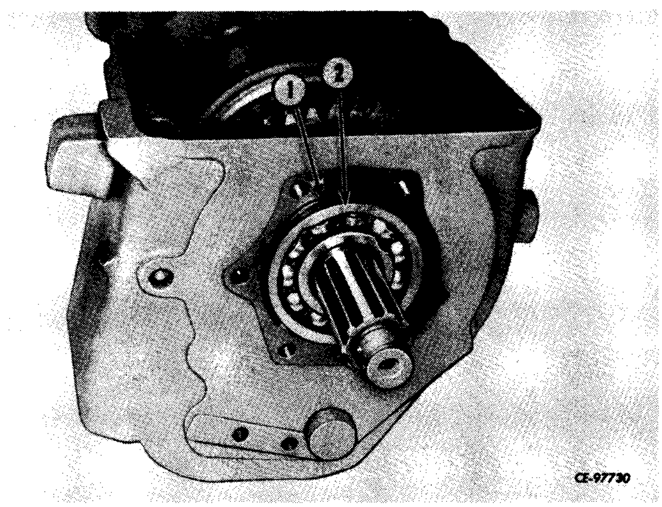

Figure 4-60

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TRANSMISSION

Position countershaft lock plate (2, Fig. 4-61) in shaft groove and install and tighten cap screws and lock washers (1).

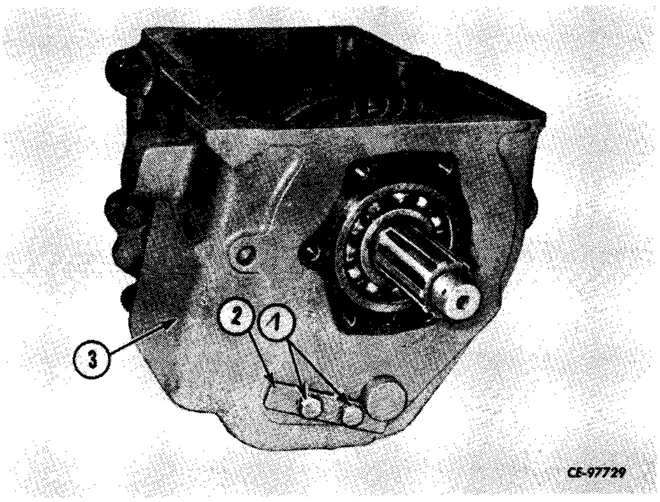

Figure 4-61

Using a suitable press install a new seal in main shaft bearing retainer (1, Fig. 4-62). Lip of seal must face in toward bearing.

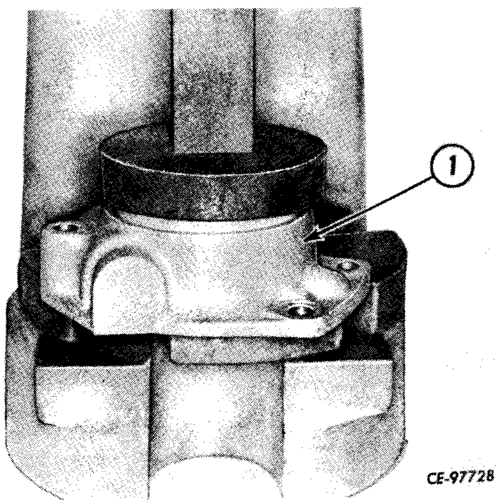

Figure 4-62

Position main shaft bearing retainer (2, Fig. 4-63), gasket and install and tighten cap screws and lock washers (1). Install spacer (3).

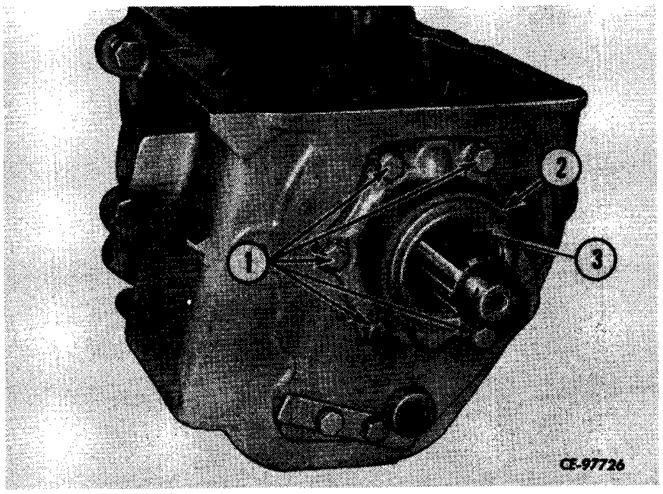

Figure 4-63

Install output yoke (2, Fig. 4-64) on main shaft (3). Install and tighten nut (1) to recommended torque. Refer to "SPECIAL TORQUES" under "SERVICE INFORMATION."

Torque: ___________

Before continuing assembly check the assembled gear train for proper assembly. Using a screw driver check all blocking gears for looseness and that all drive gears rotate.

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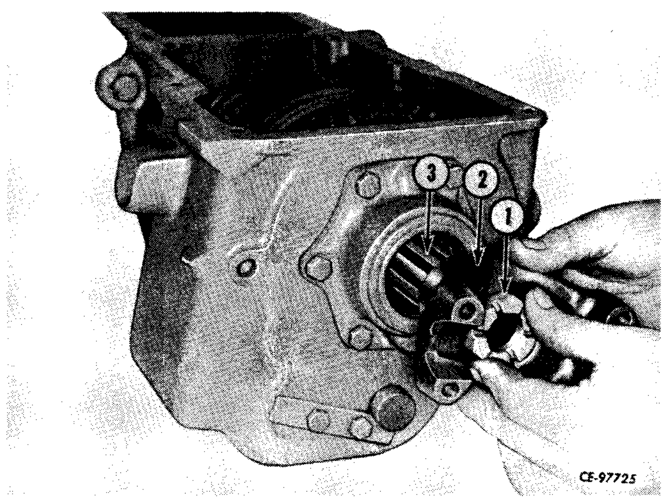

Figure 4-64

TRANSMISSION

ASSEMBLY - Continued

Use shaft (1, Fig. 4-65) to aid assembly of this reverse idler gear (6). Install roller bearings (5), bearing spacer (4), roller bearings (3) and position thrust washers (2, 7) on each end of gear (6).

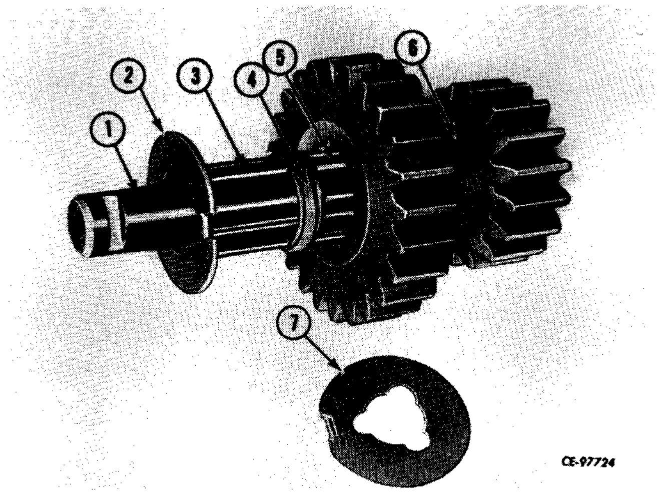

Figure 4-65

Use shaft (5, Fig. 4-66) to aid assembly of reverse countershaft gear (2). Install roller bearing (3) and thrust washers (1, 4) on each end of gear (2).

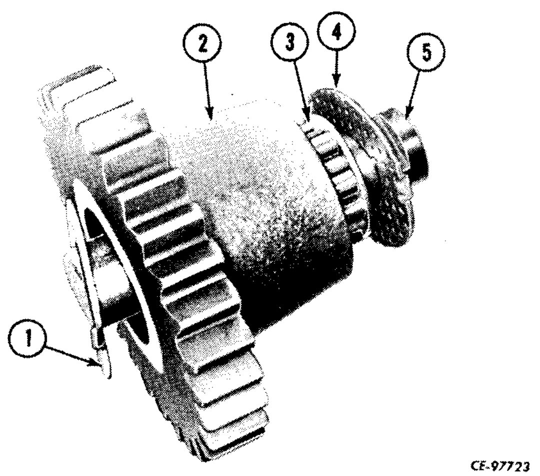

Figure 4-66

Position assembled reverse idler gear and reverse countershaft gear in reverse housing. Check that all thrust washers and properly installed and drive gear shafts (3, 6, Fig. 4-67) through housing and gears. Install shafts so lock grooves in shafts match locking plates. Position locking plates and install and tighten cap screws (1, 4).

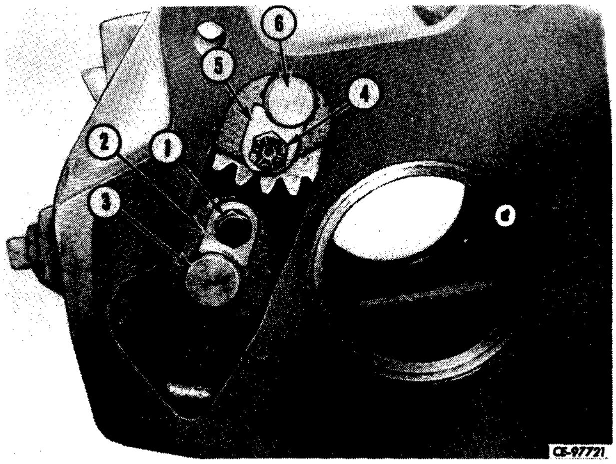

Figure 4-67

Position main transmission housing and reverse housing together using a new gasket between. Install and tighten cap screws and lock washers securing housings. Install main shaft reverse gear (2, Fig. 4-68) and roller bearing (1) on end of main shaft. Install snap ring (3).

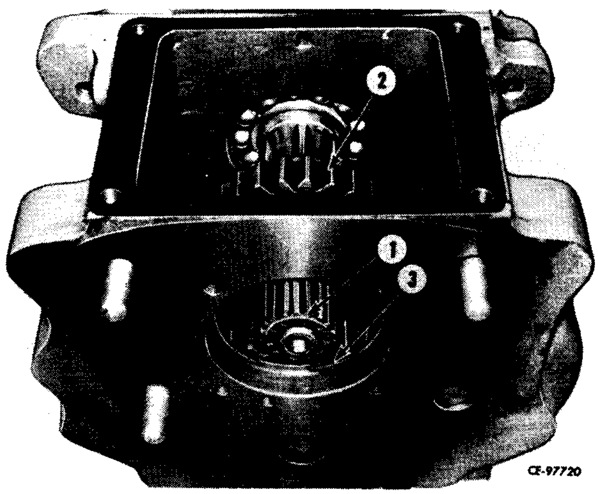

Figure 4-68

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TRANSMISSION

Install oil fling on main drive gear (2, Fig. 4-69) and with a suitable press install bearing (1) in position on drive gear.

Install snap rings on bearing and on shaft. Press shaft and bearing into end of reverse housing.

NOTE: Before pressing main drive gear into housing be sure roller bearing and ring spacer are installed on end of main drive gear.

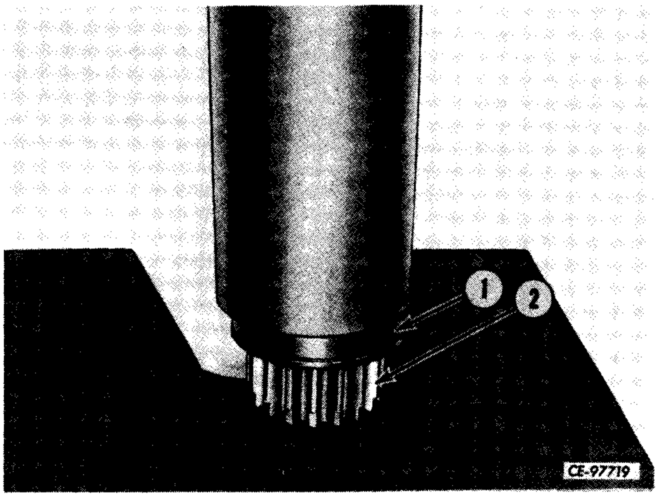

Figure 4-69

Match bores in shifting rails (3, 5, Fig. 4-70) with those in the shifting forks (1, 2, 4) and partially install rails in end of cover housing.

Install poppet springs and detent balls into housing bores and using a piece of 5/8" dia rod, press down on detent ball and drive shifting rails past detent balls and through shifting forks (1, 2, and 4).

NOTE: Fork offsets must be correctly positioned.

With shifting forks in proper position on shifting rails install interlock pins (6) securing shifting

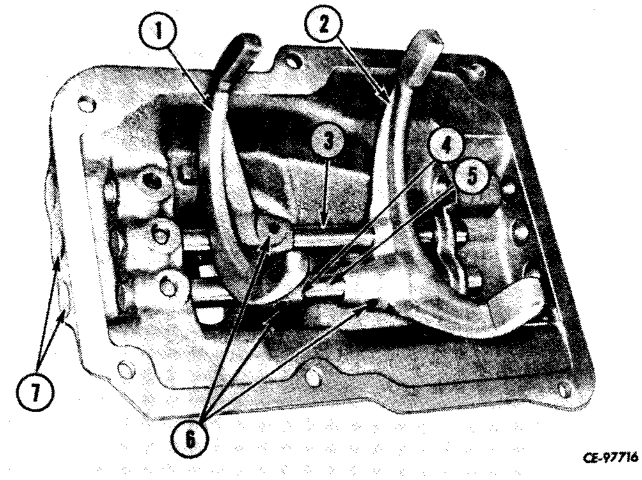

Figure 4-70

forks on shifting rails. Install new expansion plugs (7) into cover housing.

Insert shifting lever into bore of cover housing and install pin (4, Fig. 4-71) in housing and lever. Install spring (3), spring washer (2) and cap (1).

(Continued on next page)

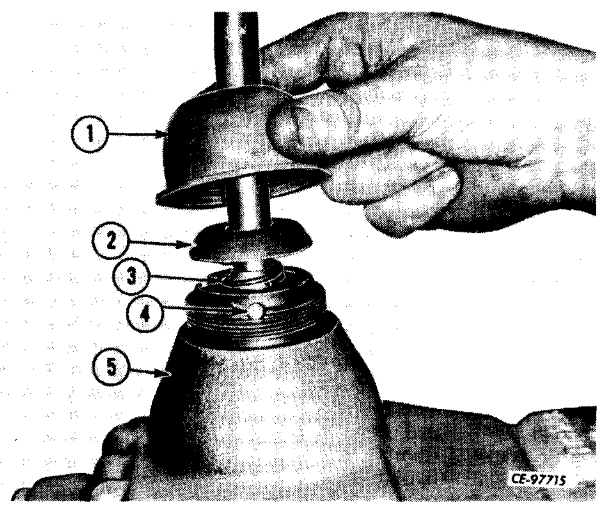

Figure 4-71

TRANSMISSION

ASSEMBLY - Continued

Install a new gasket on transmission housing and slowly position shift control housing (2, Fig. 4-72) on transmission housing. Align shifting forks with proper gears. Install and tighten cap screws and lock washers (1).

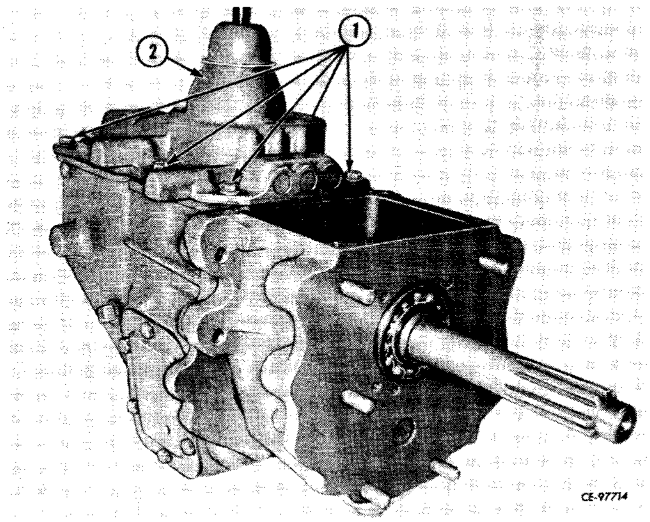

Figure 4-72

Install poppet spring and ball into bore of reverse shifting fork (1, Fig. 4-73). Using a piece of 5/8" dia rod, press down on detent ball and slide shift rail (4) through housing (2) and fork (1). Rotate shifting rail (4) until bore in rail matches bore in housing (2) and install groove pin.

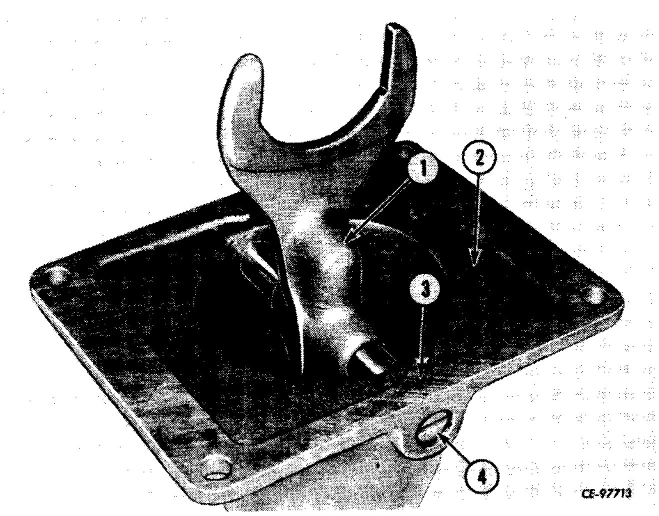

Figure 4-73

Insert shifting lever into bore of reversing housing (5, Fig. 4-74) and install pin (4) into housing and lever.

Install spring (3), spring washer (2) and cap (1).

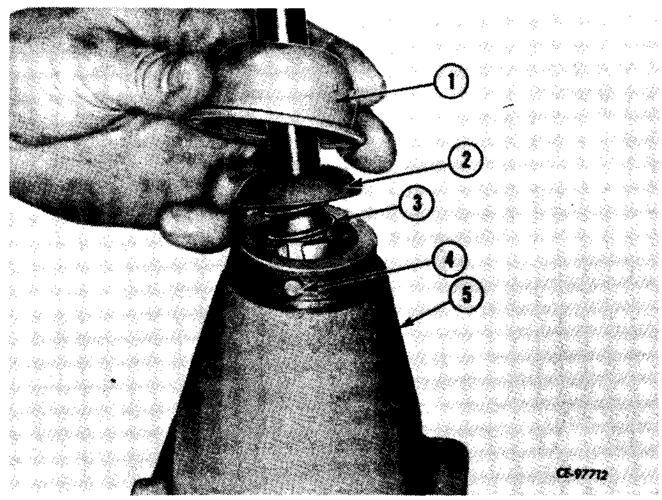

Figure 4-74

Install a new gasket on housing and slowly position shift control housing (2, Fig. 4-75) on reversing housing. Align shifting fork with proper gear.

Install and tighten cap screws and lock washers (1).

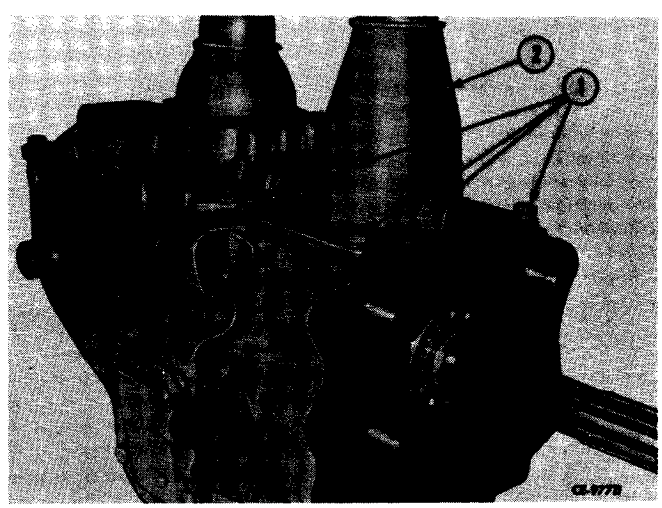

Figure 4-75

TRANSMISSION

Using a new gasket, install retainer (2, Fig. 4-76), with spring bracket on top, on reversing housing. Install and tighten cap screws and lock washers (1).

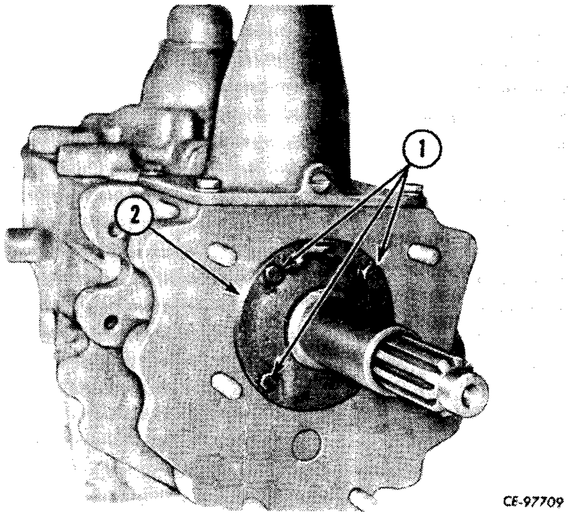

Figure 4-76

Position yoke (3, Fig. 4-77) between shafts (4, 5) and drive shaft (4, 5) into position. Install and tighten lock screws (2). Install lock wires (1).

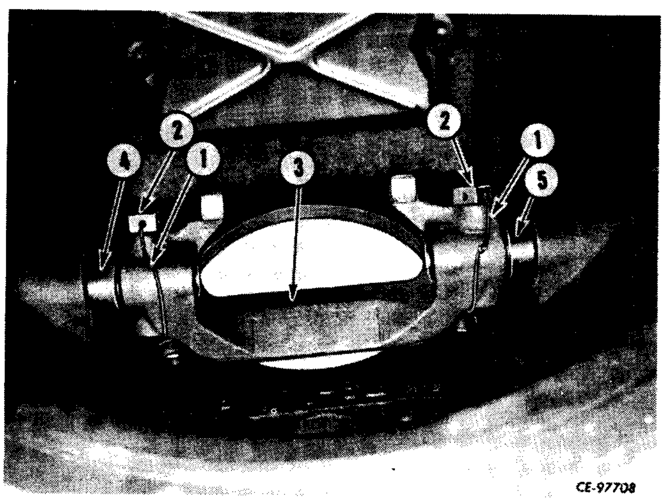

Figure 4-77

Position clutch housing (2, Fig. 4-78) on end of reverse housing and install and tighten nuts (1).

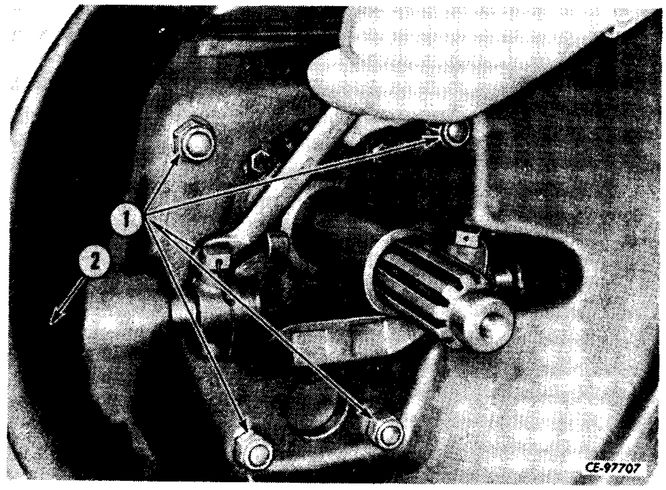

Figure 4-78

Install throw-out bearing (2, Fig. 4-79), retainer (3) and spring (1).

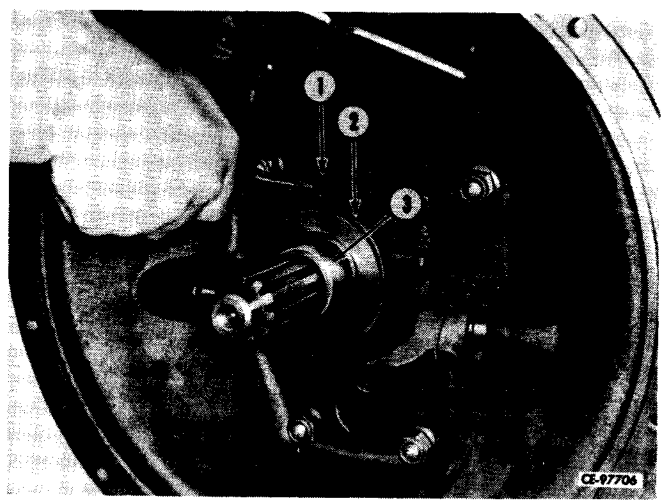

Figure 4-79

INSTALLATION

Refer to "CLUTCH, TRANSMISSION AND TRANSFER DRIVE CASE," "INSTALLATION."

TRANSFER CASE

GENERAL

The transfer case, located behind the transmission provides two speed ranges. There are output yokes for driving both axles.

The two transfer case ranges, couple with the 4-speed ratios available from the transmission provide eight speeds forward or reverse.

The transfer case control has three positions; HIGH, NEUTRAL and LOW. Power comes into the input shaft whenever the transmission and reversing unit are engaged. This power continues on through the input shaft to drive the winch regardless of the position of the transfer case control. The transfer case output shaft is fitted with a caliper type brake at the forward end to provide machine braking. With the sliding gear moved to the rear position, it is in mesh with the drive gear and power will flow through the drive gear to the high speed idler gear on the idler shaft.

The high-speed idler is in mesh with the driven gear on the output shaft and power will be transmitted to both front and rear drive axles. With the sliding gear moved forward, drive will go from the sliding gear to the low-speed idler fixed to the idler shaft; then from the high-speed idler to the driven gear on the output shaft at a lower speed than HIGH. The drive gear is bushed on the input shaft and will now be free to rotate.

Legend for Figure 4-80

1. Case and cover assembly.
2. Breather and tube assembly.
3. Shifter cover.
4. Cover gasket.
5. Gear shift lock spring.
6. Plunger.
7. Ball.
8. Retainer.
9. Packing.
10. Gear shift shaft.
11. Main shaft front cover.
12. Oil seal.
13. Yoke.
14. Shim and gasket.
15. Idler shaft front cap and bushing.
16. Bearing cup.
17. Bearing cone.
18. Idler shaft.
19. Shim and gasket.
20. "O" ring.
21. Sleeve.
22. Companion flange.
23. Brake disc.
24. Brake assembly.
25. Seal.
26. Brake adapter.
27. Plug.
28. Main cover gasket.
29. Shim and gasket.
30. Driven shaft rear cap.
31. Oil seal.
32. Yoke.
33. Nut.
34. Cotter pin.
35. Driven shaft.
36. Bearing cone.
37. Bearing cup.
38. Shim and gasket.
39. Snap ring.
40. Nut.
41. Rear idler shaft cap.
42. Cage assembly.
43. Oil seal.
44. Nut.
45. Cotter pin.
46. Drive shaft.
47. Yoke.
48. Bearing.
49. Rear bearing washer.
50. Driven gear.
51. High speed idler gear.
52. Low speed idler gear.
53. Shift fork.
54. Sliding gear.
55. Front drive gear washer.
56. Bushing.
57. Main drive gear.
58. Rear cage gasket.
59. Pin.
60. Cover.

TRANSFER CASE

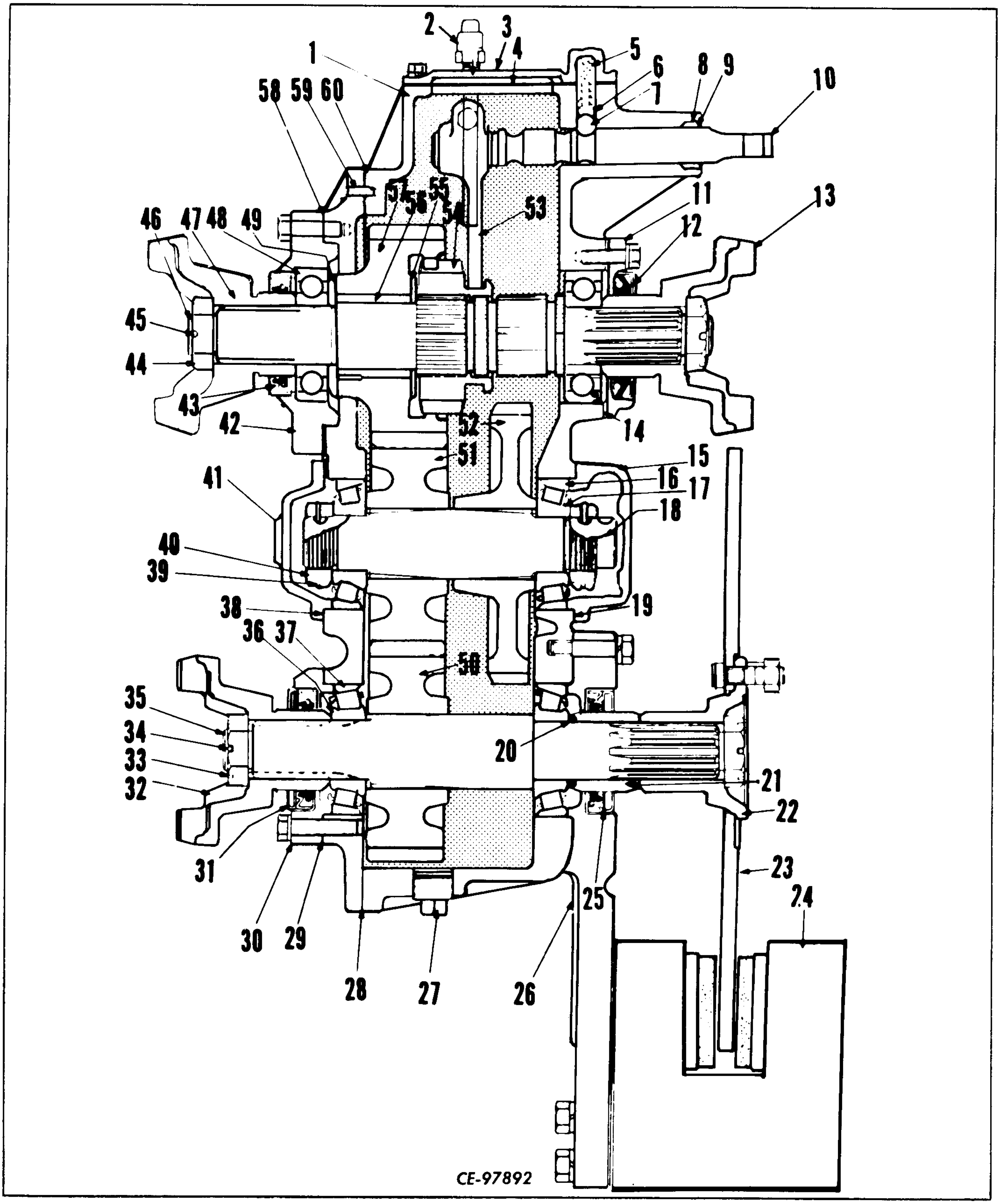

Figure 4-80
Transfer Case.

TRANSFER CASE

REMOVAL

To gain access to the transfer case and remove it from the tractor, refer to "CLUTCH, TRANSMISSION AND TRANSFER CASE," "REMOVAL."

DISASSEMBLY

Drain transfer case housing by removing drain plug (4, Fig. 4-81).

Remove cap screws and lock washers (3) separating brake caliper (1) from mounting bracket (2).

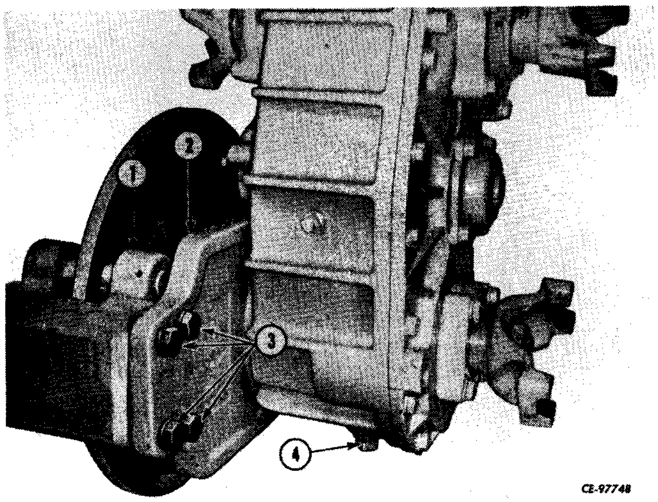

Figure 4-81

Remove cotter pin (1, Fig. 4-82) and lock nut (2).

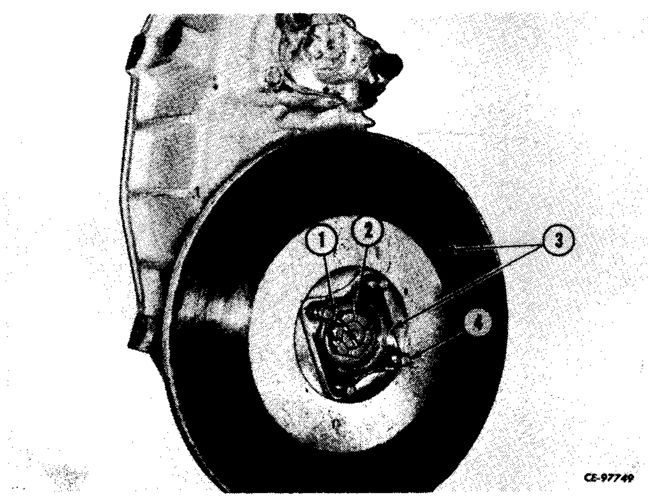

Figure 4-82

Brake disc and companion yoke (3) can be separated by driving special cap screws (4) out through brake disc and yoke (3).

Remove cotter pin (2, Fig. 4-83), lock nut (1) and yoke (3).

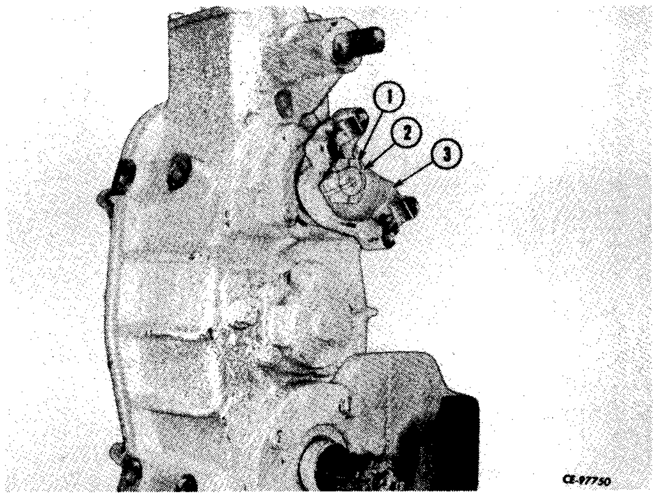

Figure 4-83

Remove cotter pins (1, 4, Fig. 4-84), lock nuts (2, 5) and yokes (3, 6).

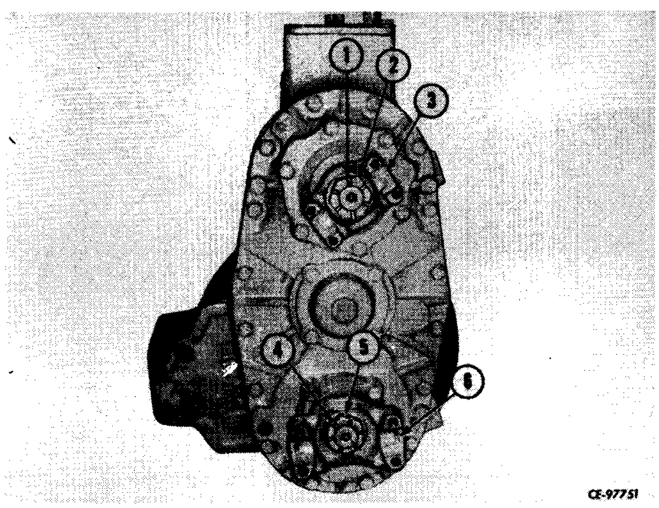

Figure 4-84

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TRANSFER CASE

Remove cap screws and lock washers (3, 4, 6, Fig. 4-85), cage assembly (2), idler cap (5) and rear driven shaft cap (8). Tie a string around all shim packs and tag. This will aid assembly.

Remove oil seals (1, 7) and, with a suitable press, press in new seals.

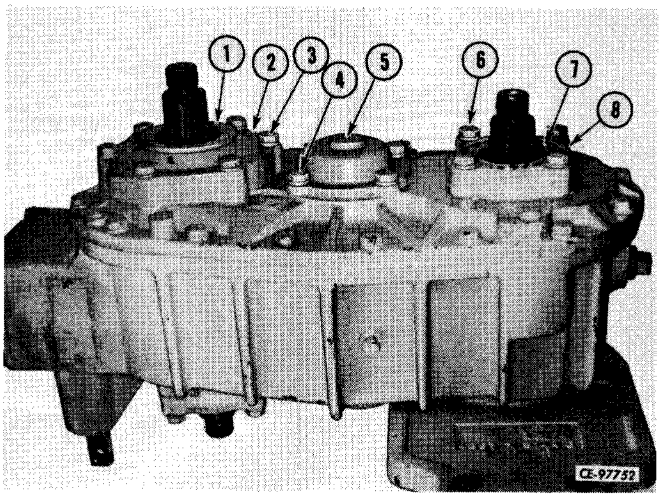

Figure 4-85

Remove cover cap screws and lock washers.

Using a suitable punch, drive up on pins (1, 4, Fig. 4-86). This will separate the cover (6) from case (5).

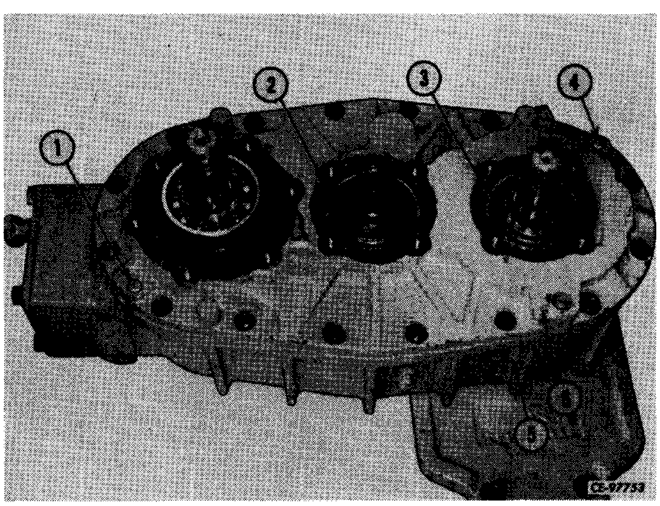

Figure 4-86

If bearings are replaced on the idler shaft or driven shaft the bearing cups (2, 3) in the cover must also be replaced.

Remove idler gear (1, Fig. 4-87) and driven shaft (2) from case.

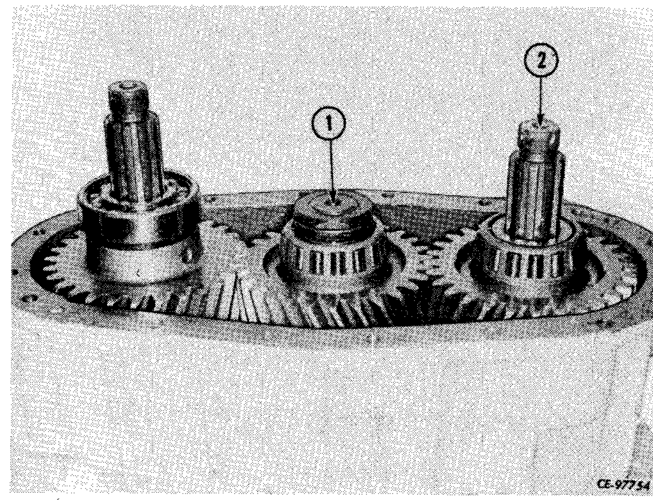

Figure 4-87

Remove snap rings (2, 7, Fig. 4-88) and nuts (1, 8). Using a suitable puller, remove gears (4, 5) and bearings (3, 6).

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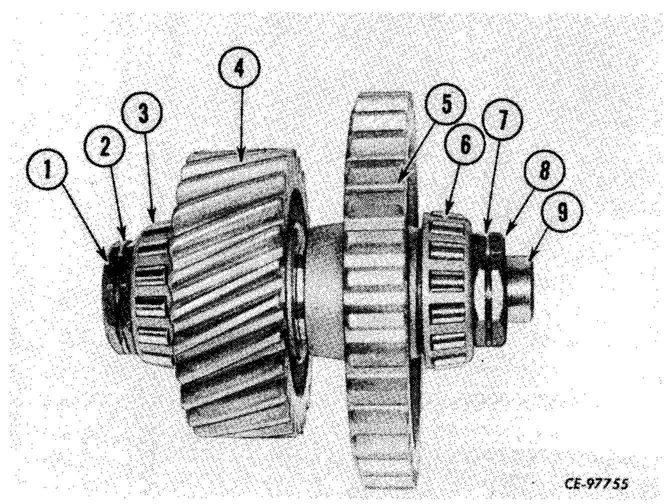

Figure 4-88

DISASSEMBLY - Continued

Remove sleeve (6, Fig. 4-89) and "O" ring (5) from driven shaft (3). Using a suitable puller, remove bearing (4). With a suitable puller, remove gear (2) and bearing (1).

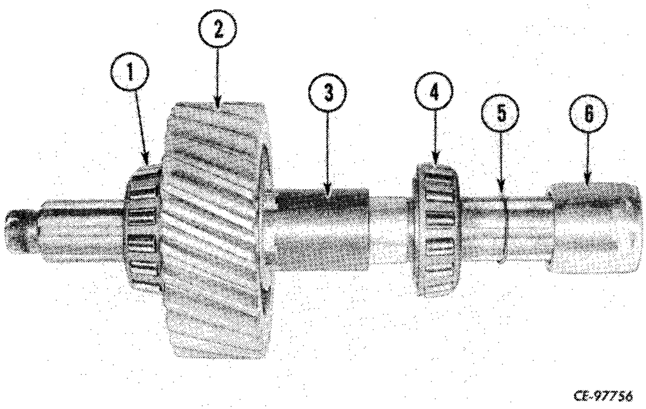

Figure 4-89

Punch mark shifting fork (2, Fig. 4-91) and shaft (4) to identify position for assembly.

Loosen cap screw and special nut (1) on end of shifter fork (2). Insert a pin or bolt in end of shaft (4) and rotate shaft removing it from shifting fork.

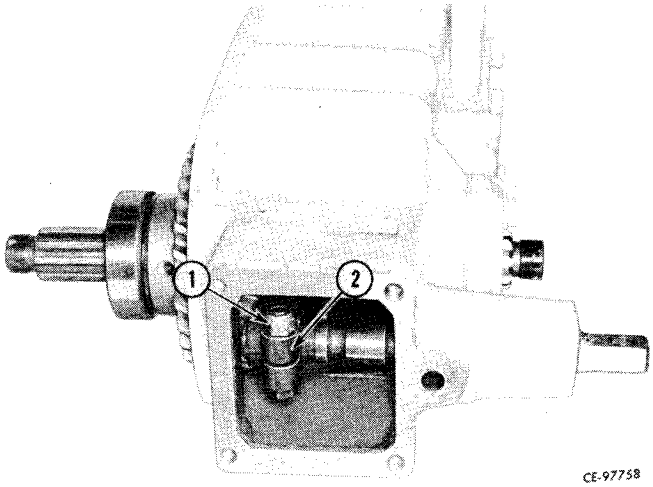

Figure 4-91

Remove cap screws, lock washers (1, Fig. 4-90) and cover (2). Slowly lift cover off and remove shifter lock spring, plunger and detent ball from the case.

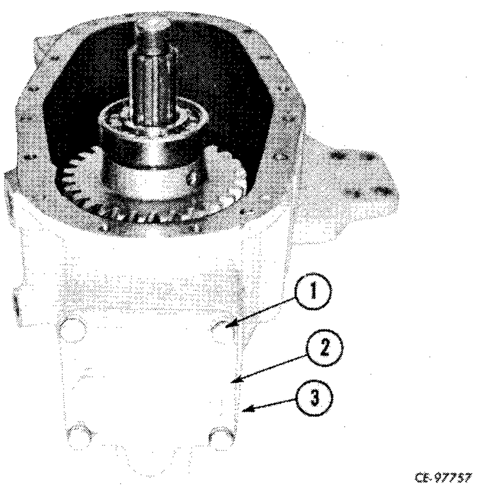

Figure 4-90

Remove main drive gear assembly (1, Fig. 4-92) from case (2).

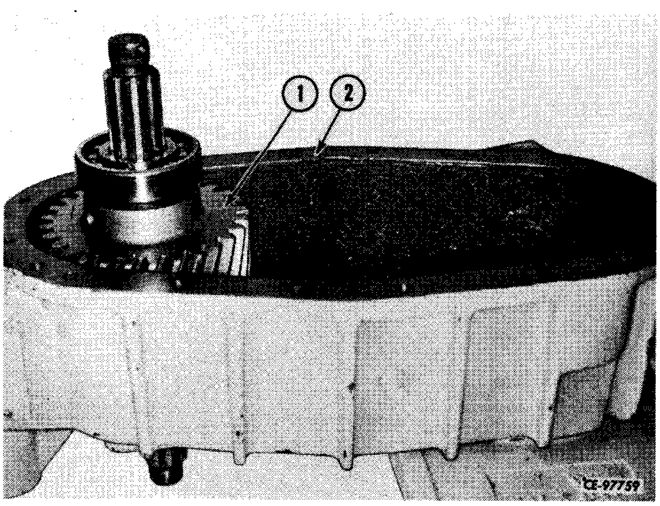

Figure 4-92

Using a suitable puller, remove bearing (1, Fig. 4-93), sliding gear (3) and washer from main drive shaft (2).

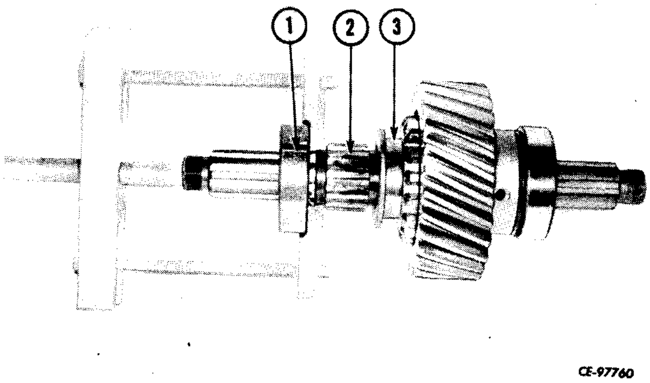

Figure 4-93

Using puller, remove bearing (1, Fig. 4-94), bearing washer (2) and main drive gear (3) from main drive shaft (4).

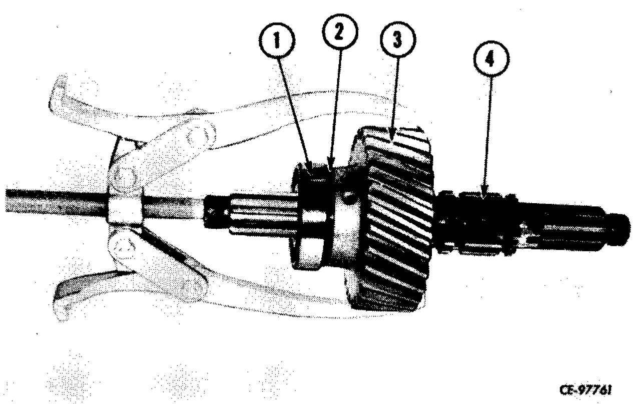

Figure 4-94

Remove cap screws and lock washers (4, 6, 7, Fig. 4-95), main shaft cover (1), idler shaft cap (5) and brake adapter (9) from bottom of case. Tie shim packs individually and tag. This will aid assembly.

Remove oil seals (2, 8), and with a suitable press, press in new seals.

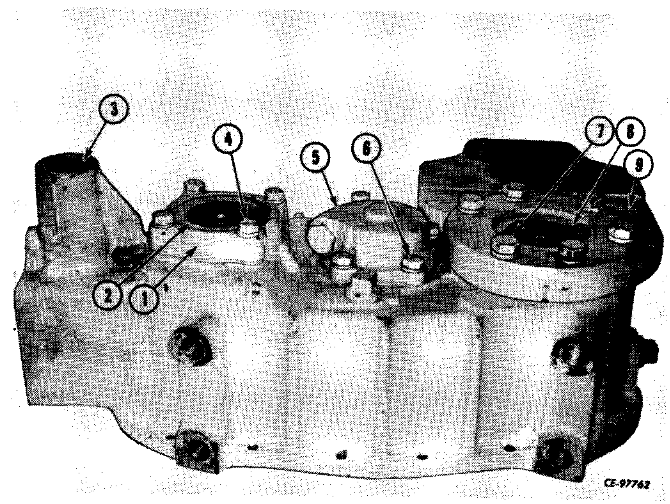

Figure 4-95

If bearings on idler shaft or driven shaft have been replaced, remove and install new cups (1, 2, Fig. 4-96) in case (3).

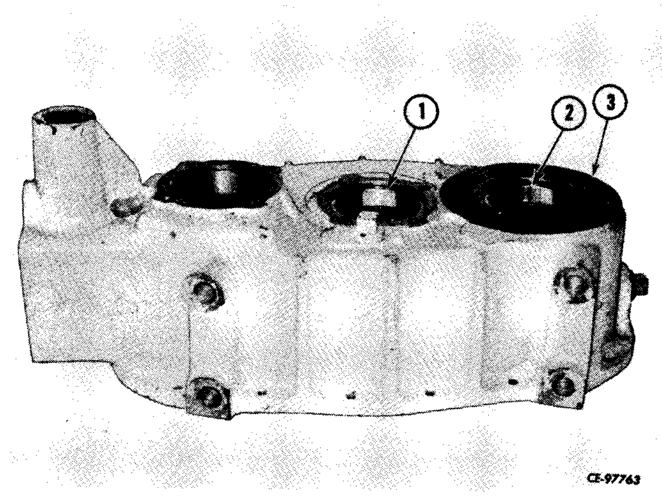

Figure 4-96

ASSEMBLY

If bearings have been replaced on idler shaft or driven shaft, new bearing cups (1, 2, Fig. 4-96) must be pressed into case (3).

Install gaskets, shim packs, and caps (1, 5, 9, Fig. 4-95) on bottom of transfer case. Install and tighten cap screws and lock washers (4, 6, 7). Install new oil seals (2, 8) and packing (3).

Using a suitable press install main drive gear (3, Fig. 4-97), washer (4) and bearing (5) to drive shaft (6).

Install bearing washer (not shown) and sliding gear (2) (collar of gear away from main drive gear). Using a suitable press, install bearing (1).

Install main drive gear assembly (1, Fig. 4-92) in case (2). Using a rawhide hammer, drive gear and bearing into bore of case.

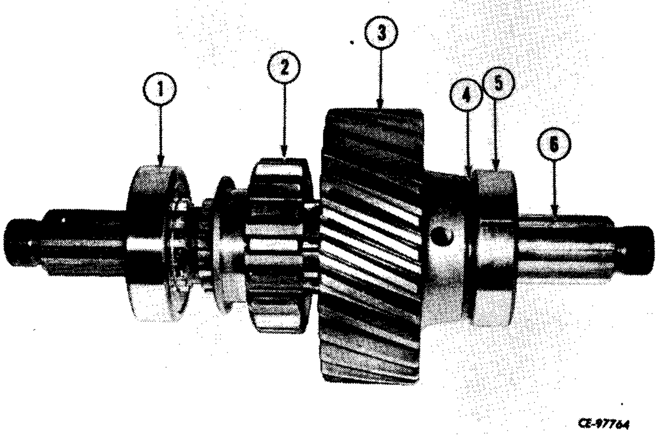

Figure 4-97

Using a suitable press, install driven gear (2, Fig. 4-98) and bearing (1) on driven shaft (3). If bearing (1) has been replaced, replace bearing cup in case cover.

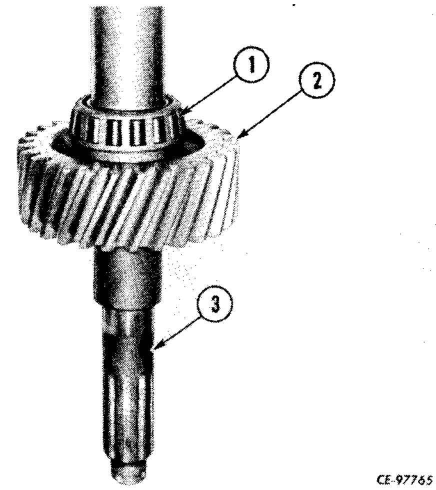

Figure 4-98

With press, install bearing (4, Fig. 4-89) on driven shaft (3). If bearing (4) has been replaced, install new bearing cup in case. Install "O" ring (5) and sleeve (6) on end of driven shaft (3).

Install idler gears (4, 5, Fig. 4-88) and bearings (3, 6) with press. If bearings (3, 6) have been replaced, install new cups in case and cover. Install and tighten nuts (1, 8). Back off enough to install snap rings (2, 7). Refer to "SPECIAL TORQUES," "SERVICE INFORMATION."

Torque: ___________

Install idler gear assembly (1, Fig. 4-87) and driven gear (2), into case.

Install new gasket and cover (6, 7, Fig. 4-86). Drive pins (1, 4) positioning cover on case. Install and tighten cap screws and nuts securing cover to case.

Install gaskets, shim packs and caps (2, 5, 8, Fig. 4-85) on case cover. Install and tighten cap screws and lock washer (3, 4, 6). Install new oil seals (1, 7).

(Continued on next page)

TRANSFER CASE

Position a dial indicator (1, Fig. 4-99) against end of driven gear (2) and measure end play in gear assembly. Refer to "TOLERANCES" under "SERVICE INFORMATION," for recommended end play.

To adjust end play, alter shim pack (4) between cap (3) and case cover.

End Play Adjustment: ________

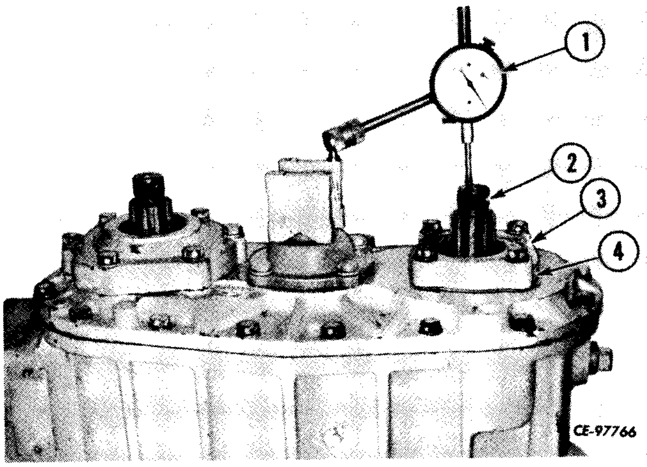

Figure 4-99

Idler shaft end play can be checked by removing fluid check plug (3, Fig. 4-100) and position a dial indicator through hole. Insert a pry bar through shift cover hole at top of case and work idler gear back and forth. No more than a very slight end play should be felt.

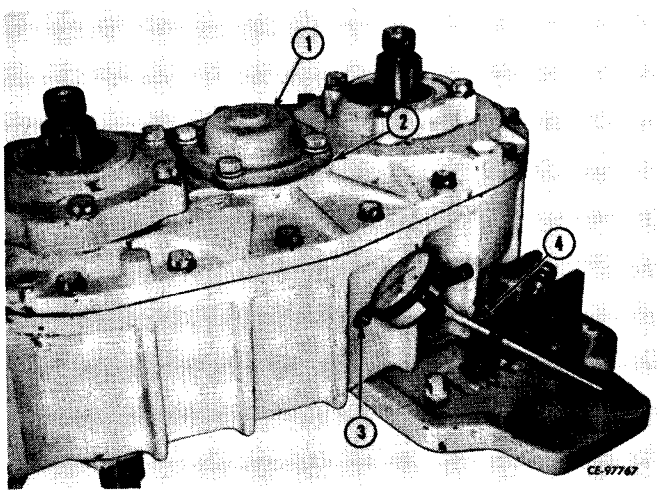

Figure 4-100

To adjust end play, alter shim pack (2) between cap (1) and case cover.

Position a dial indicator (1, Fig. 4-101) against the end of main drive gear (2) and measure end play in gear assembly. Refer to "TOLERANCES" under "SERVICE INFORMATION" for recommended end play.

To adjust end play, alter shim pack (4) between cap (3) and case.

End Play Adjustment: ________

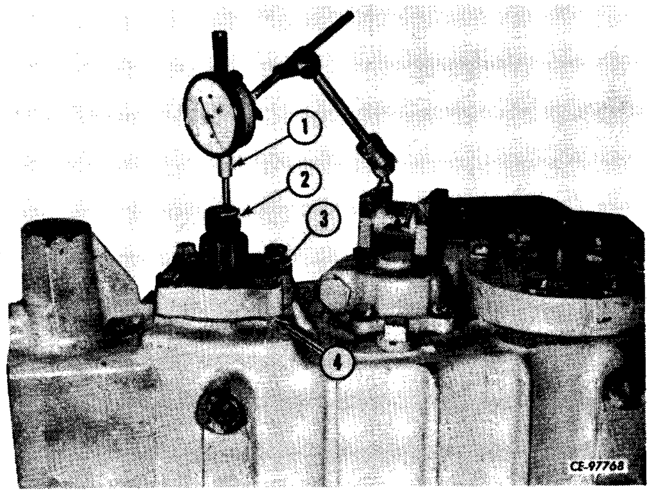

Figure 4-101

Position shifting fork (2, Fig. 4-91) in case (3), with cap screw and special nut installed. Install shaft (4), rotating shaft through shifting fork (2). Match identifying marks made during disassembly. Tighten cap screw and special nut (1).

(Continued on next page)

TRANSFER CASE

ASSEMBLY - Continued

Insert detent ball (3, Fig. 4-102), plunger (4) and gear shift lock spring (5) into bore (2) in case. Position new gasket and shift cover (1) on case. Install and tighten cap screws and lock washers.

Install yokes (3, 6, Fig. 4-84) and lock nuts (2, 5). Tighten lock nuts to recommended torque (refer to "SPECIAL TORQUES").

Back off just enough to install cotter pins (1, 4).

Torque: __________

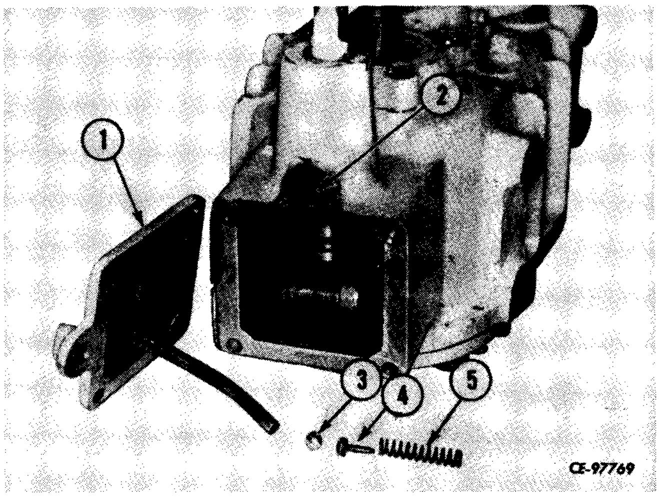

Figure 4-102

Install yoke (3, Fig. 4-83) and lock nut (1). Tighten lock nut to recommended torque (refer to "SPECIAL TORQUES").

Back nut off enough to insert cotter pin (2).

Torque: __________

Install companion yoke and brake disc, (3, Fig. 4-82). Install and tighten lock nut (2). (Refer to "SPECIAL TORQUES.")

Back off nut enough to insert cotter pin (1).

Torque: __________

Install brake caliper (1, Fig. 4-103) on adapter plate. Install and tighten two cap screws (3). Measure the distance between brake disc and inner face of the guide pins on each side. Add enough shims between the adapter plate and brake caliper, to center brake disc between the guide pins. Install and tighten cap screws and lock washers.

Using a suitable sling and hoist, position transfer case in tractor frame. Refer to "CLUTCH, TRANSMISSION AND TRANSFER CASE," "INSTALLATION," for recommended installation procedures.

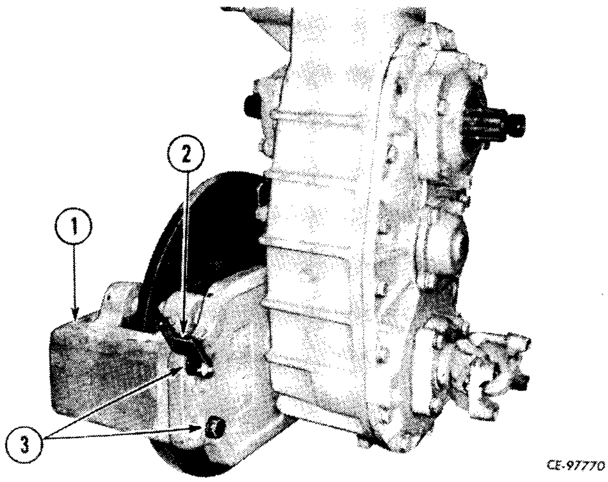

Figure 4-103

SERVICE INFORMATION

TROUBLE SHOOTING CHART

COMPLAINT	POSSIBLE CAUSE	REMEDY
CLUTCH		
Clutch slips.	Clutch out of adjustment.	Adjust clutch pedal (refer to "LINKAGE," Section 9).
Clutch chatters.	Worn clutch plate.	Replace clutch plate.
TRANSMISSION - TRANSFER CASE		
Noisy gear box.	Low on fluid.	Check and repair fluid level.
Will not engage.	Broken gear train.	Remove and disassemble.

SPECIFICATIONS

CLUTCH

Make . . . . Rockford Clutch
Type . . . . Dry disc type
Diameter . . . . 12 in.

TRANSMISSION

Make . . . . Warner Gear
Type . . . . Full reversing four speed synchro-mesh

TRANSFER CASE

Make . . . . Rockwell Std
Type . . . . Sliding gear, two speed

ROAD SPEEDS

	FIRST	SECOND	THIRD	FOURTH
FORWARD:				
High Range (MPH)	0-2.6	0-5.5	0-10.1	0-17.0
Low Range (MPH)	0-1.2	0-2.5	0-4.6	0-7.7
REVERSE:				
High Range (MPH)	0-2.6	0-5.5	0-10.1	0-17.0
Low Range (MPH)	0-1.2	0-2.5	0-4.6	0-7.7

SERVICE INFORMATION

LUBRICANTS AND CAPACITIES

	SAE	API	MILITARY SPECIFICATIONS
TRANSMISSION Above 32°F. Below 32°F.	 140 90	I. H. 135H EP GL-5	MIL-L-2105B
TRANSFER CASE Above 32°F. Below 32°F.	 140 90		

TRANSMISSION . . . . 7 PTS

TRANSFER CASE . . . . 4 PTS

SPECIAL TORQUES

Transmission output yoke . . . . 350-400 ft. lbs.
Idler gear shaft nuts . . . . 300-400 ft. lbs.
Transfer case yokes (all) . . . . 300-400 ft. lbs.

TOLERANCES

Driven gear shaft end play . . . . .003"-.005"
Main drive gear shaft end play . . . . .003"-.005"

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SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SECTION V

DRIVE SHAFTS

SECTION V DRIVE SHAFTS

DESCRIPTION

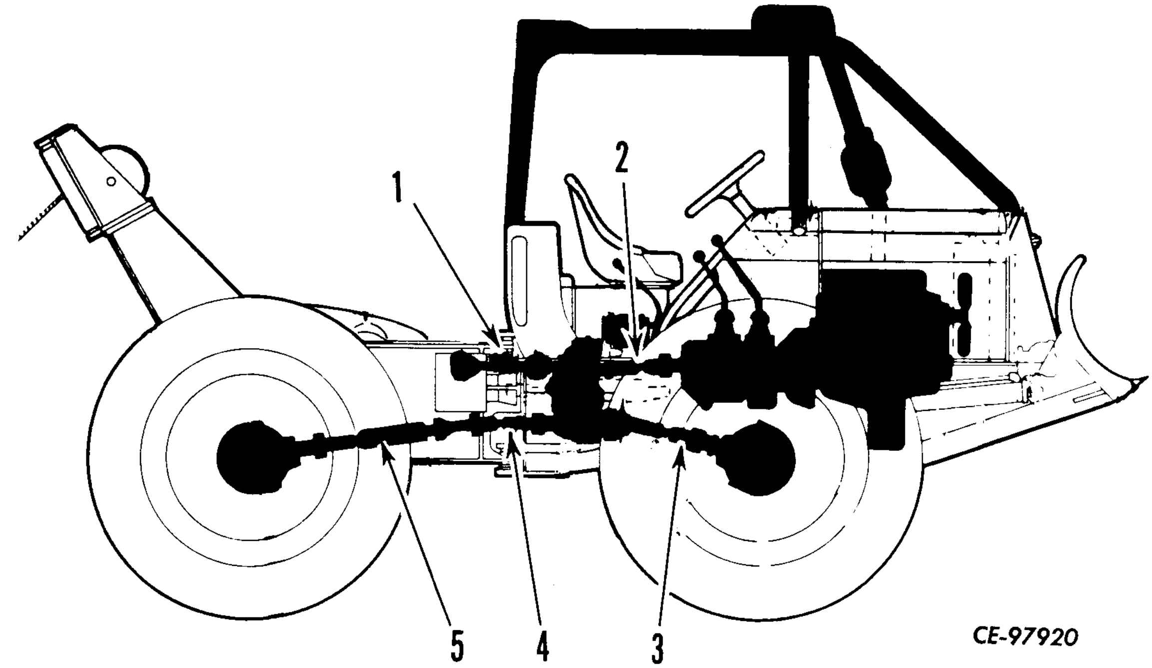

Figure 5-1
Drive Shafts.

1. Transfer case-to-winch drive shaft.
2. Transmission-to-transfer case drive shaft.
3. Transfer case-to-front axle.
4. Transfer case-to-center bearing drive shaft.
5. Center bearing-to-rear axle drive shaft.

GENERAL

The function of the drive shafts is to transmit power within the drive train of the unit. The PAY logger has five drive shafts; each similar in construction. Power from the transmission is transmitted to the transfer case by a drive shaft. From the transfer case, power is transmitted to the winch and axles. Because of the pivoting action of the tractor, the lower drive shaft between the transfer case and rear axle is composed of two shafts, connected through a center bearing.

The drive shafts are attached to yokes by universal joints that permit pivoting in all directions and accommodate any misalignment. The drive shafts contain a slip joint to allow the shafts to telescope. This compensates for changes in the distance between the connected components. During normal operation, the front axle undergoes considerable vertical movement due to oscillation over the irregularities of the terrain. Each change in terrain requires a proportional change in the overall length of the drive shaft. The slip joint accommodates these variations. This eliminates the forces of tension that would be present in solid shaft.

PREVENTIVE MAINTENANCE

After each 100 hours of operation and after completing a drive shaft overhaul, apply the proper type lubricant (refer to "LUBRICANTS AND CAPACITIES") to the center bearing and drive shaft grease fittings.

DISASSEMBLY, INSPECTION AND ASSEMBLY

GENERAL

To remove drive shafts from tractor drive train, disconnect "U" bolts or remove cap screws connecting drive shaft end to yoke.

Access to drive shafts between transfer case and transmission or front axle can be obtained by removing floorboards in operator's compartment. Access to drive shaft between center bearing and rear axle can be obtained by removing a shield and center bearing from tractor frame.

REMOVAL

CENTER BEARING

Remove cap screws and nuts (1, 2, Fig. 5-2) and shield (3) from tractor frame.

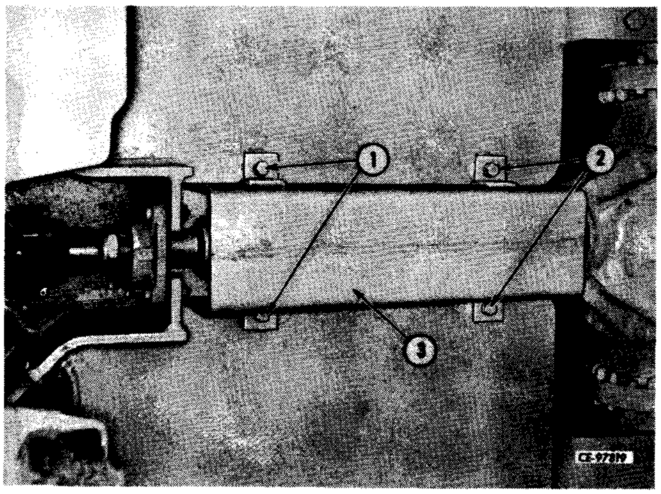

Figure 5-2

Disconnect ends of drive shaft (3, Fig. 5-3) by removing nuts, lock washers and "U" bolts (1, 4). Disconnect center bearing from frame by removing cap screws and nuts (2). Remove drive shaft (3).

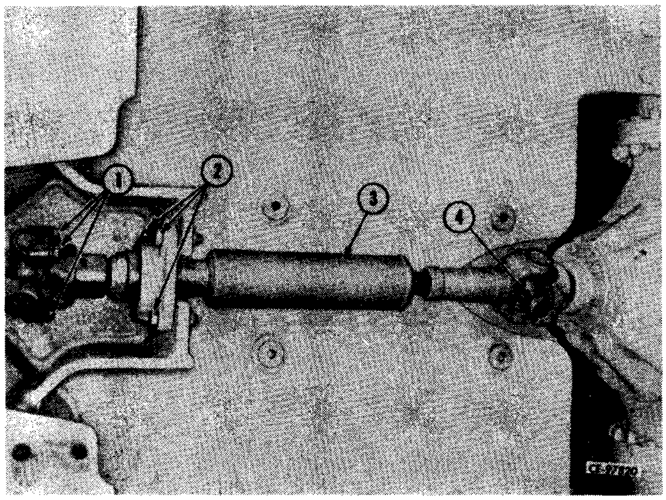

Figure 5-3

DISASSEMBLY

CENTER BEARING

Disassemble center bearing (4, Fig. 5-4) from end of drive shaft by removing cotter pin (1) and nut (2).

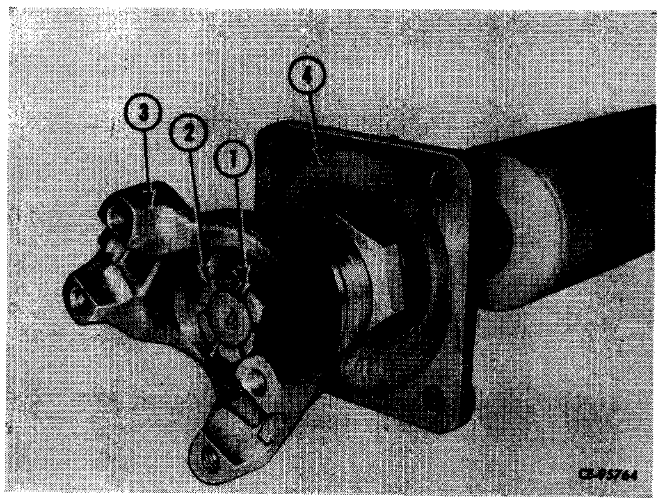

Figure 5-4

DISASSEMBLY, INSPECTION AND ASSEMBLY

Using a suitable puller, remove yoke (1, Fig. 5-5) from end of drive shaft (2).

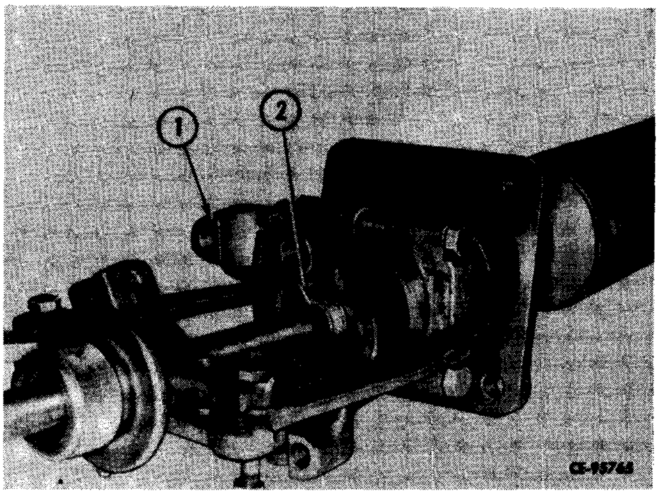

Figure 5-5

Remove key (1, Fig. 5-6) from end of drive shaft (4). Remove lock nut (2) and center bearing (3).

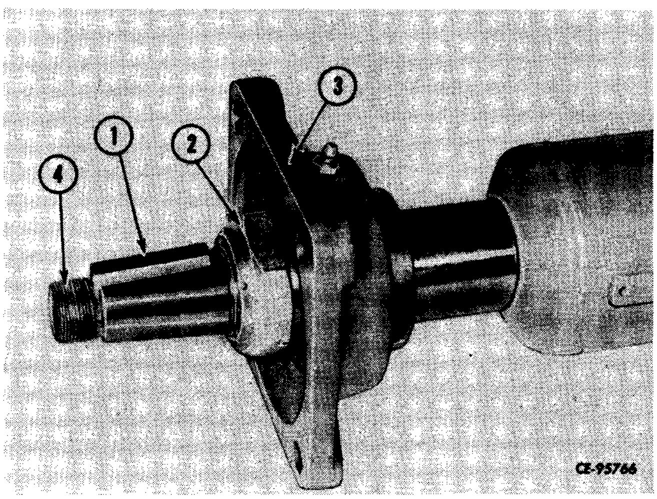

Figure 5-6

DRIVE SHAFTS

Remove bearing caps (3, Fig. 5-7) and grease fittings (2) from spider and drive shaft. Remove snap rings (1) from each end of yoke (4).

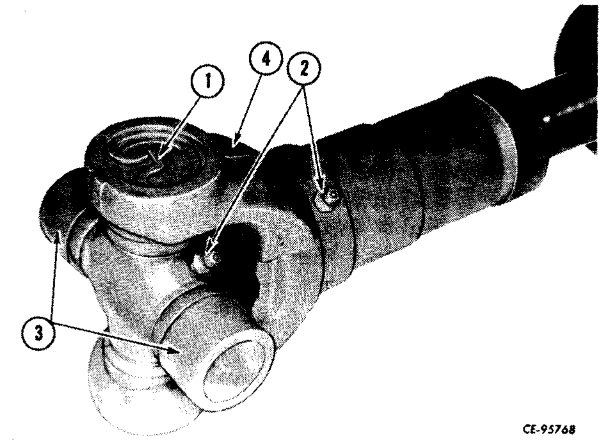

Figure 5-7

Place end of drive shaft on a shop press and press down on bearing. Spider (1, Fig. 5-8) will force lower bearing out of yoke (2).

(Continued on next page)

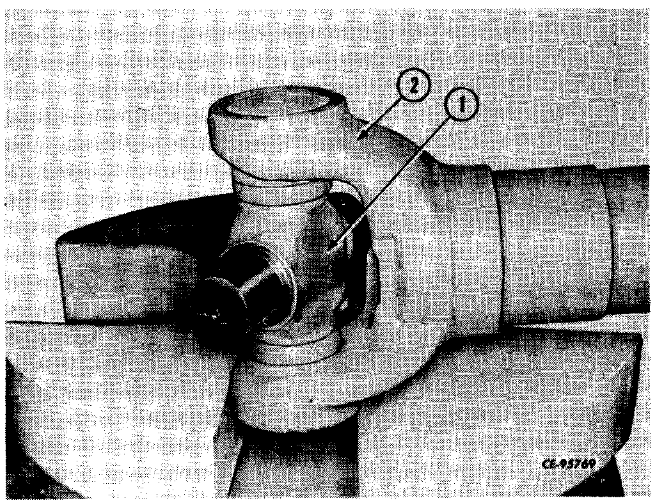

Figure 5-8

DISASSEMBLY, INSPECTION AND ASSEMBLY

DISASSEMBLY - Continued

DRIVE SHAFTS - Continued

Turn drive shaft over and using a suitable driver, press down on spider (1, Fig. 5-9) to remove lower bearing (2).

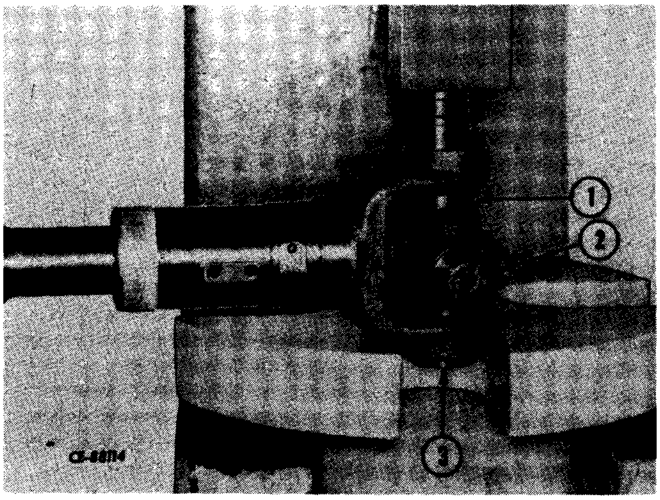

Figure 5-9

Before separating shaft halves, mark both halves with a punch (1, Fig. 5-10) assuring proper alignment at assembly.

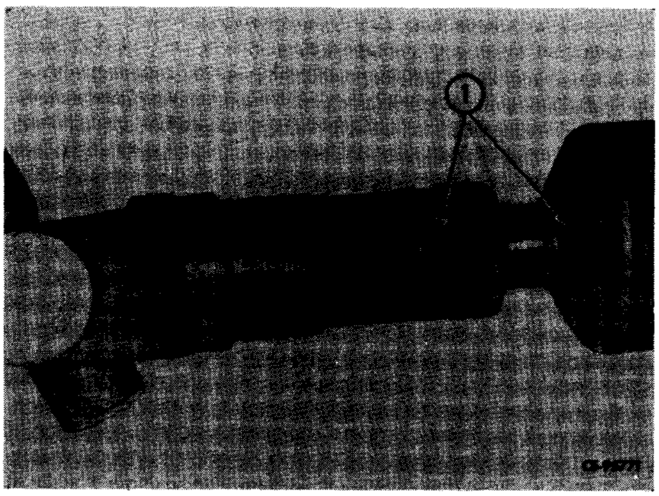

Figure 5-10

Loosen dust cap (4, Fig. 5-11) and separate the shaft halves (1 and 5). Remove steel washer (3) and cork washer (2).

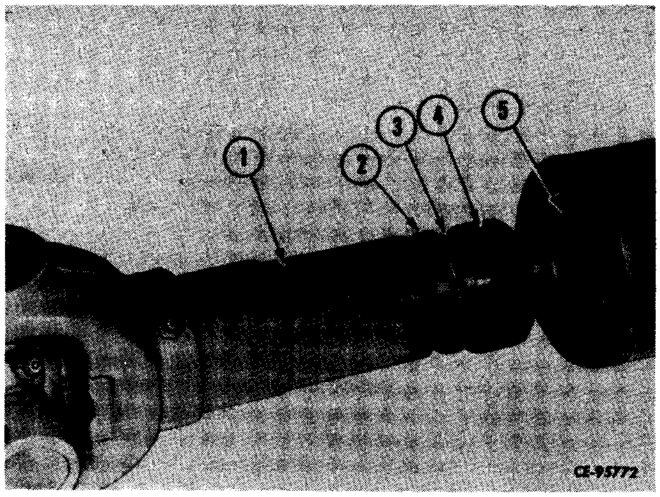

Figure 5-11

CLEANING AND INSPECTION

Clean all parts in solvent. Remove all burrs and rough spots from the yoke ears and from slip joint splines. Use a fine tooth file or an India stone. Do not disassemble the bearing assemblies. Clean them with a soft 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 worn, replace the complete spider and bearing assembly.

DISASSEMBLY, INSPECTION AND ASSEMBLY

ASSEMBLY

DRIVE SHAFTS

Position dust cap (4, Fig. 5-11), steel washer (3) and cork washer (2) on splined shaft half (5), Insert splined shaft into yoke (1) aligning index marks made during disassembly. Tighten dust cap hand tight.

Position spider (3, Fig. 5-12) inside of yoke (2) and using a suitable press, press bearings (1 and 4) into shaft yoke (2) and spider (3).

NOTE: Coat loose needle bearings inside of bearings (1 and 4) with a heavy grease insuring proper position of needles during the press operation. If resistance is encountered, remove bearings and check needles for proper position.

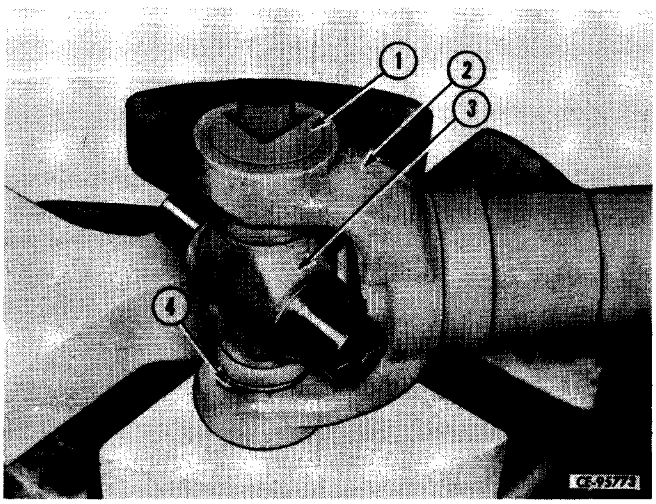

Figure 5-12

Install bearing retaining snap rings (1, Fig. 5-13) on each end, in yoke snap ring grooves. Install grease fittings (2) in slip yoke and spiders.

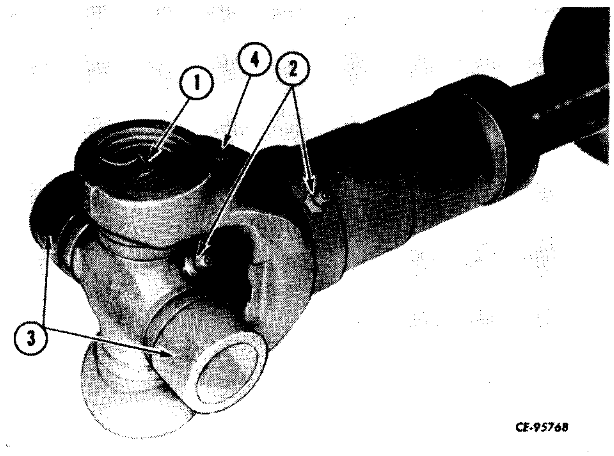

Figure 5-13

CENTER BEARING

Install center bearing (3, Fig. 5-14) on end of drive shaft (4) and install and tighten new lock nut (2). Tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque: ______________

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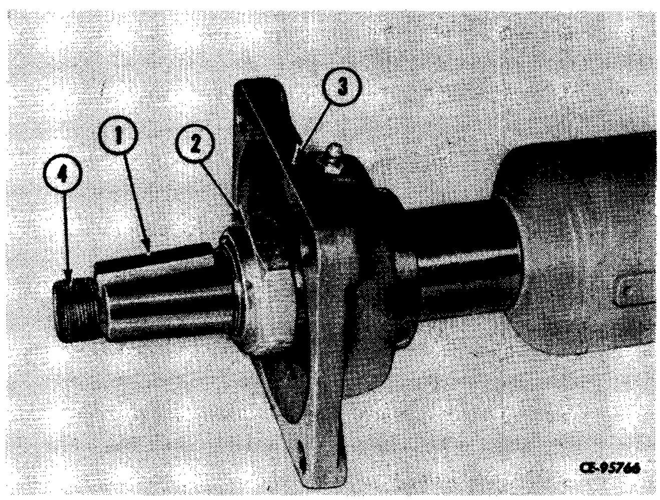

Figure 5-14

DISASSEMBLY, INSPECTION AND ASSEMBLY

ASSEMBLY - Continued

CENTER BEARING - Continued

Install key (1) in groove at end of shaft (4).

Align yoke (3, Fig. 5-15) with key and install on shaft. Tighten nut (2) to recommended torque (refer to "SPECIAL TORQUES").

Torque: __________

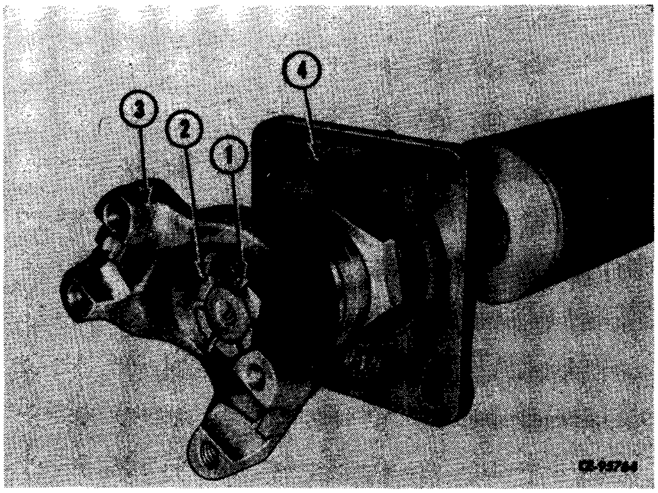

Figure 5-15

Align nut to allow cotter pin (1) installation.

INSTALLATION

DRIVE SHAFTS

Install drive shafts between various drive train components and refer to recommended torques listed under "SERVICE INFORMATION."

CENTER BEARING

Position drive shaft (3, Fig. 5-16) between rear axle and front drive shaft and install and tighten

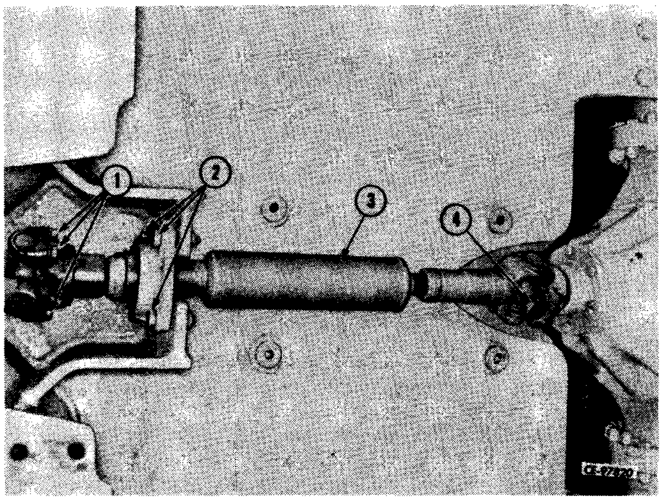

Figure 5-16

cap screws and nuts (2) securing center bearing to frame. Install end of drive shaft to rear axle and drive shaft. Tighten to recommended torque listed under "SERVICE INFORMATION."

Install shield (3, Fig. 5-17) over drive shaft and install and tighten cap screws and lock washers (7, 2).

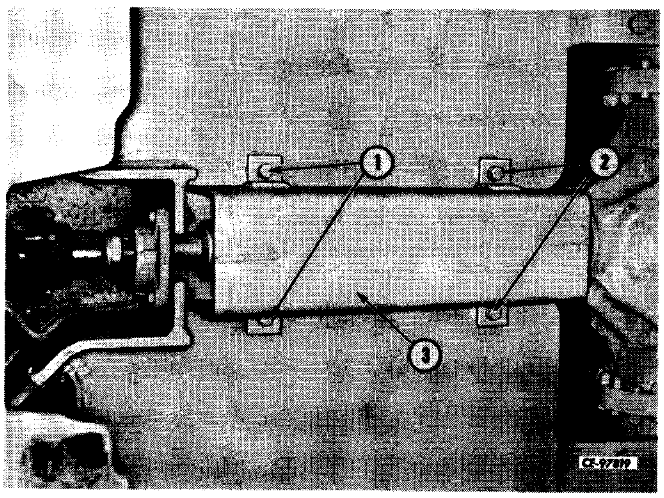

Figure 5-17

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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.

Check the drive yokes on the transmission, transfer case 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.

TROUBLE SHOOTING CHART

COMPLAINT	POSSIBLE CAUSE	REMEDY
Noise	1. Lack of lubricant.	1. Check grease seals in slip joints and universals.
	2. Backlash due to worn universal spider or bearings.	2. Replace spider and bearing assembly.
	3. Mounting yoke loose.	3. Tighten yoke mounting nuts or cap screws.
	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 cap screws.

SERVICE INFORMATION

SPECIFICATIONS

DRIVE SHAFT - TRANSMISSION TO TRANSFER CASE

Make . . . . Dana Corporation
Length compressed (bearing center to bearing center) . . . . 6.531"
Length extended (bearing center to bearing center) . . . . 7.281"

DRIVE SHAFT - TRANSFER CASE TO FRONT AXLE

Make . . . . Dana Corporation
Length compressed (bearing center to flange face) . . . . 14"
Length extended (bearing center to flange face) . . . . 17-15/32"

DRIVE SHAFT - TRANSFER CASE TO WINCH

Make . . . . Dana Corporation
Length compressed (bearing center to flange face) . . . . 10.125"
Length extended (bearing center to flange face) . . . . 12.125"

DRIVE SHAFT - TRANSFER CASE TO CENTER BEARING

Make . . . . Dana Corporation
Length compressed (bearing center to bearing center) . . . . 12.125"
Length extended (bearing center to bearing center) . . . . 13.344"

DRIVE SHAFT - CENTER BEARING TO REAR AXLE

Make . . . . Dana Corporation
Length compressed (bearing center to lip of yoke) . . . . 23-13/16"
Length extended (bearing center to lip of yoke) . . . . 26.156"

LUBRICANTS AND CAPACITIES

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

SPECIAL TORQUES

Center bearing lock nut . . . . 981 (DRY) ft. lbs.
Yoke to center bearing nut . . . . 200 ft. lbs.
Transmission to transfer case drive shaft
Nuts . . . . 37 ft. lbs.
Transfer case to front axle drive shaft
Cap screws . . . . 58 ft. lbs.
Nuts . . . . 37 ft. lbs.
Transfer case to winch drive shaft
Cap screws . . . . 52 ft. lbs.
Nuts . . . . 20 ft. lbs.
Transfer case to center bearing drive shaft
Nuts . . . . 37 ft. lbs.
Center bearing drive shaft to rear axle
Nuts . . . . 37 ft. lbs.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

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SECTION VI
SOLID AXLES

Page

SECTION VI SOLID AXLES

GENERAL INFORMATION

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 rear main frame in the case of the rear axle and an oscillating cradle called a bolster for the front. By allowing the front axle to oscillate the tractor is assured great stability in rough terrain.

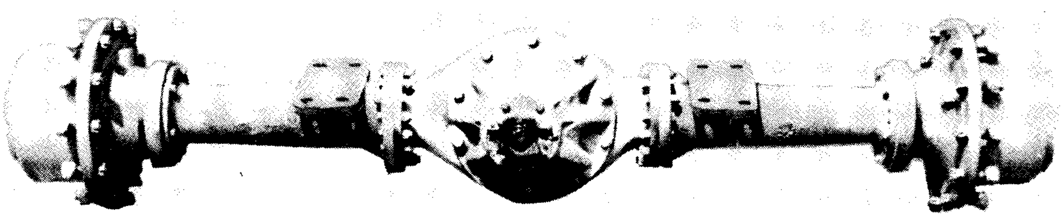
The first gear reduction takes place in the differential; the second in the planetaries. Each wheel revolves on two tapered roller bearings mounted on the axle spindle. The axles are full floating in that none of the weight is supported by, or transmitted to, the axle shafts. All weight on the axle is supported by the wheels, bearings and axle housing.

All components of the axle assemblies are identical with the exception of the yokes. Both axles use a three piece housing; two outer axle housings, and a flange bolted to a center axle bowl.

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 front axle differential is of the conventional spider gear type. The rear axle is equipped with a NoSPIN spider assembly. The pinion is straddle mounted, having two tapered roller bearings in front of the pinion teeth to take the forward and 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.



CE-97971

Figure 6-1
Planetary Drive Axle.

GENERAL INFORMATION

PREVENTIVE MAINTENANCE

LUBRICANT

Quantities and recommended lubricant are listed under "LUBRICANTS AND CAPACITIES" at the end of this section.

OIL CHANGE INTERVALS

Axle lubricant, planetary carrier and differential, should be changed at regular intervals of 1000 hours. Drain while assemblies are warm to allow contaminates to flow out with the draining lubricant. Refill assemblies with specified lubricant. Check lubricant level after each 100 hours of operation.

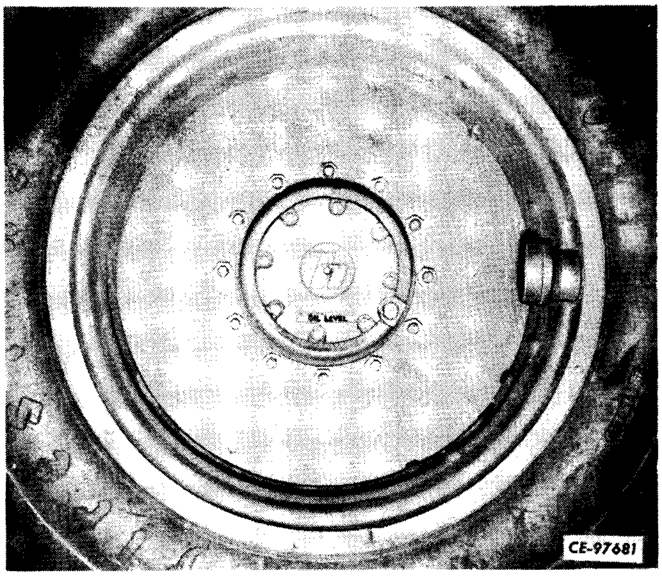


Figure 6-2

LEVEL CHECK

Check level of the lubricant at oil plugs located in the planetary hubs (Fig. 6-2) and differentials (Fig. 6-3).

NOTE: Be sure tractor is on level ground before checking lubricant level.

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.

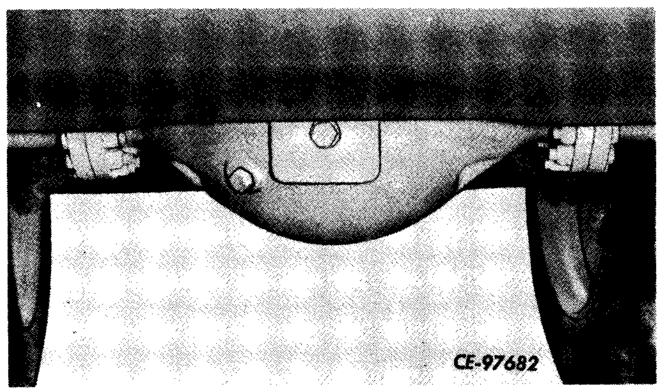


Figure 6-3

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AXLE DISASSEMBLY AND ASSEMBLY

DISASSEMBLY PREPARATION

Axle disassembly preparation should include:

Installing safety bar with tractor in straight position.

Removing wheels and tires.

Disconnecting drive shafts at the axles.

Removing axles from tractor.

Using plain steam (no caustic soda) to clean exterior of axle.

Preparing a clean work area of sufficient size.

Providing a suitable hoist and sling to lift component parts.

Support axle assembly with differential drain plug facing down.

DISASSEMBLY

Rotate planetary hub until drain plug is at bottom. Remove plugs and "O" rings and drain lubricant.

Punch mark planetary carrier (1, Fig. 6-4) and hub bearing unit (2) to aid in assembly.
Support carrier with a suitable sling and hoist.

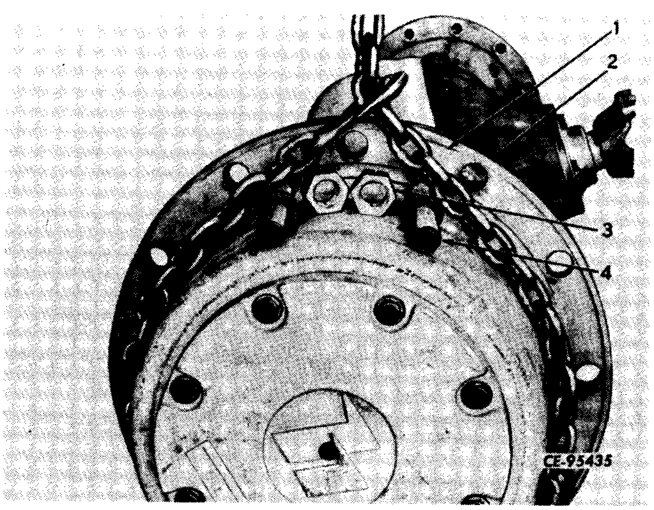

Figure 6-4

Remove nuts (3) and studs (4) that secure planetary components to hub and bearing unit; remove planetary assembly.

Remove seal ring (1, Fig. 6-5) from lip of hub and bearing assembly. Remove axle shaft (2) from axle housing.

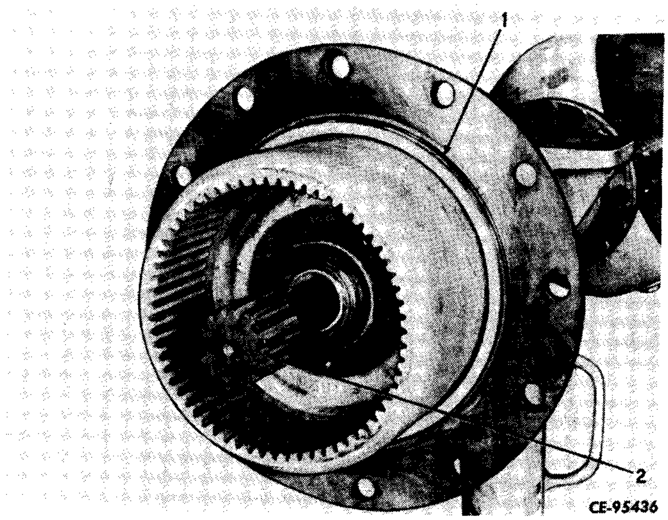

Figure 6-5

Remove cotter pin and cap screw (1, Fig. 6-6) that hold bearing adjusting nut (2) in position.

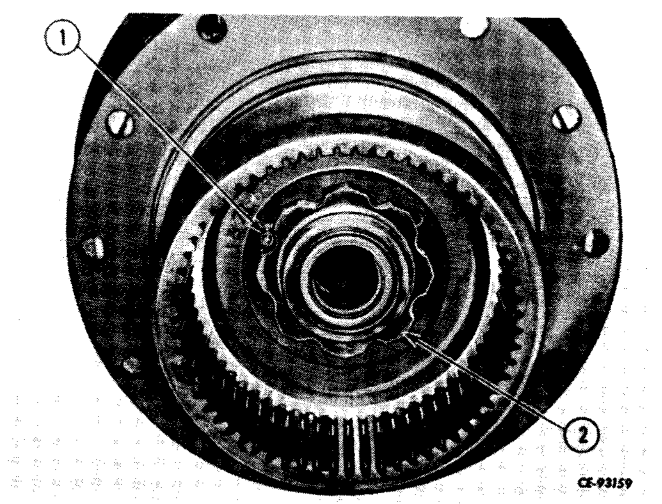

Figure 6-6

AXLE DISASSEMBLY AND ASSEMBLY

DISASSEMBLY - Continued

Remove bearing adjustment nut (1, Fig. 6-7) using a suitable wrench (2).

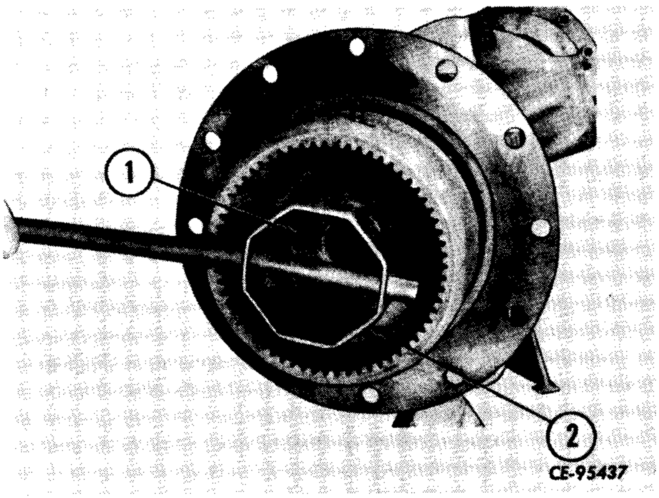

Figure 6-7

Remove ring gear and hub assembly (1, Fig. 6-8) straight out and off of axle housing splines.

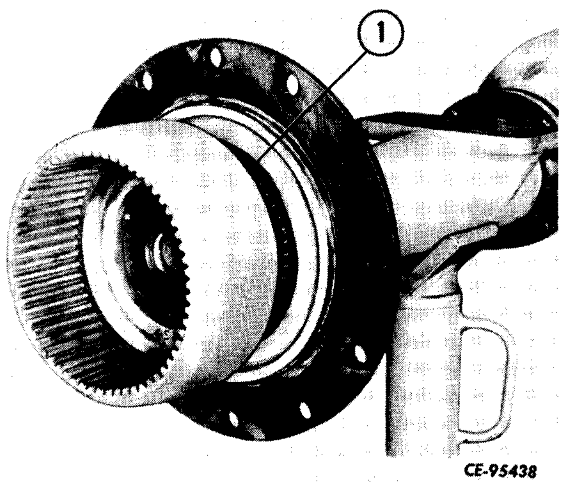

Figure 6-8

Using a hoist, remove wheel hub and bearing assembly (2, Fig. 6-9) from axle housing. Remove and discard "O" ring (3). Remove axle seal (1) from housing.

Refer to "PLANETARY DISASSEMBLY AND ASSEMBLY" for wheel hub overhaul.

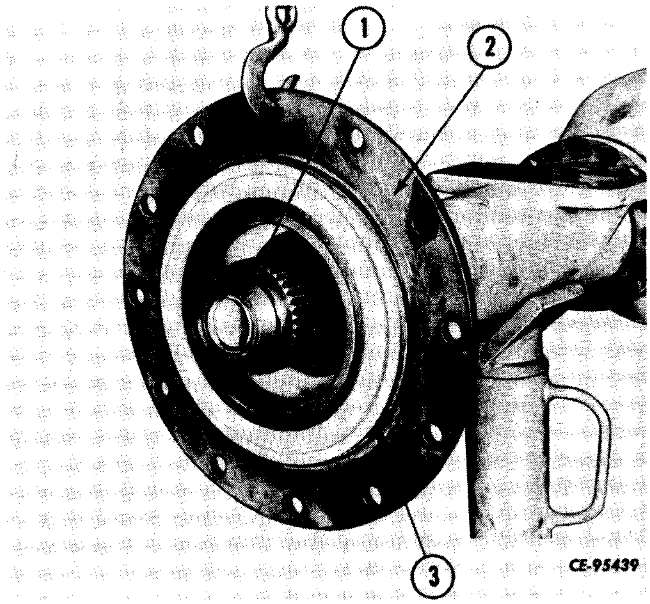

Figure 6-9

Remove cap screws (1, Fig. 6-10) and lock washers (2) that secure guard (3) to flange of axle housing (5). Remove guard (3).

Remove seal retainer (4) from axle housing. Remove "O" ring from groove in I. D. of seal retainer.

Remove drain plug and "O" ring from differential bowl of axle housing and drain lubricant. When completely drained, rotate housing until differential yoke is in a vertical position.

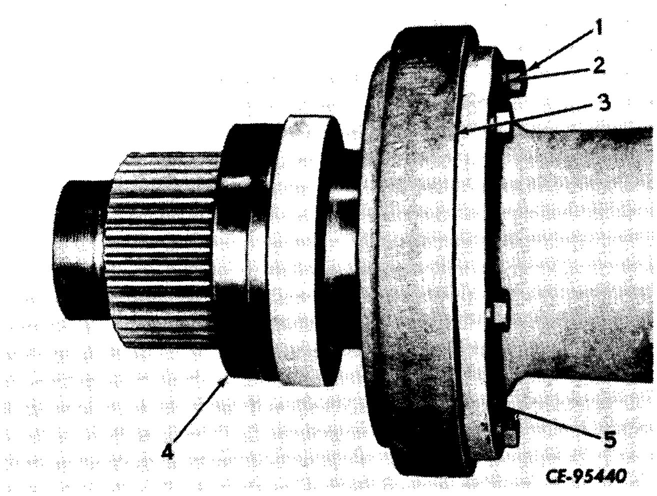

Figure 6-10

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AXLE DISASSEMBLY AND ASSEMBLY

Remove cap screws (2, Fig. 6-11) and lock washers that secure differential assembly (1) to differential housing.

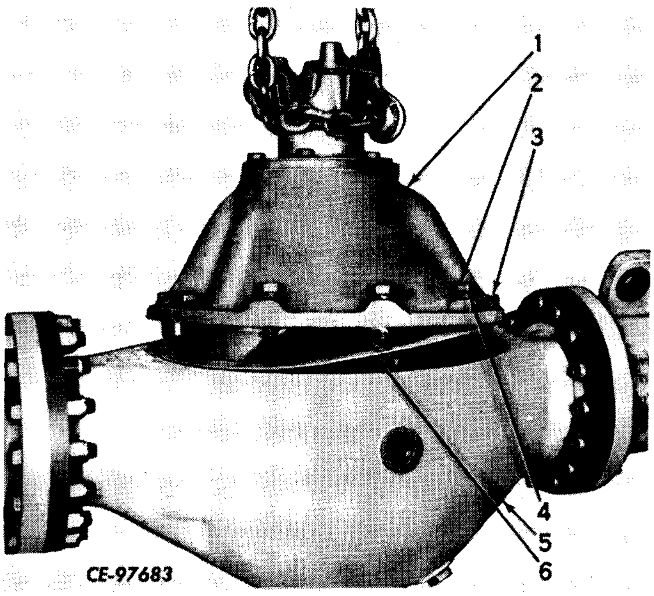

Figure 6-11

Using a suitable hoist, pull differential assembly from housing.

NOTE: Both axle shafts must be removed before differential assembly can be removed from differential housing.

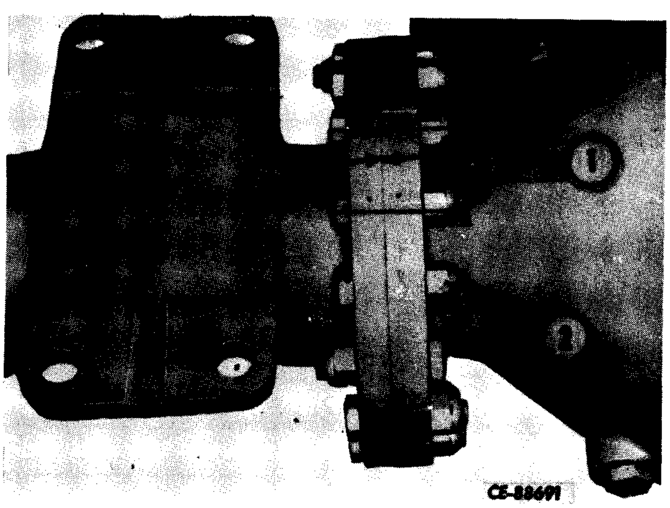

Figure 6-12

If a section of axle housing requires removal, index two pieces to be separated with a felt marker or two punch marks (1, Fig. 6-12) to insure correct assembly.

Remove cap screws and hex nuts (2) that secure axle housing to differential housing. Separate two housings and discard "O" ring seal.

CLEANING AND INSPECTION

Axle assembly preparation should include:

a. Cleaning 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 AND INHALATION OF VAPORS WHEN USING ALKALI CLEANERS.

b. Cleaning other parts with a solvent type cleaner such as petroleum solvents, 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.

c. Drying parts thoroughly with soft, clean absorbent paper towel or abrasive free cloth.

CAUTION: NEVER dry bearings by spinning with compressed air.

(Continued on next page)

AXLE DISASSEMBLY AND ASSEMBLY

CLEANING AND INSPECTION Continued

d. Inspection of 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.

e. Inspection of all gears and splines for wear or damage. Replace all parts that are scored, pitted, ridged or worn.

f. Inspection of axle shafts for signs of torsional fractures or other indication of impending failure.

g. Coating 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.

h. Replacing all seals, gaskets, "O" rings and retaining rings.

i. Assembling the following tools and supplies:

Torque wrench - 500 ft. lb. capacity.
Axle shaft tool - Refer to Section VI under "SPECIAL TOOLS."

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 new "O" ring (2, Fig. 6-13) in position on axle housing (1) boss. Align chisel or punch marks on two housings (1, 3) and secure with cap screws and hex nuts. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: __________

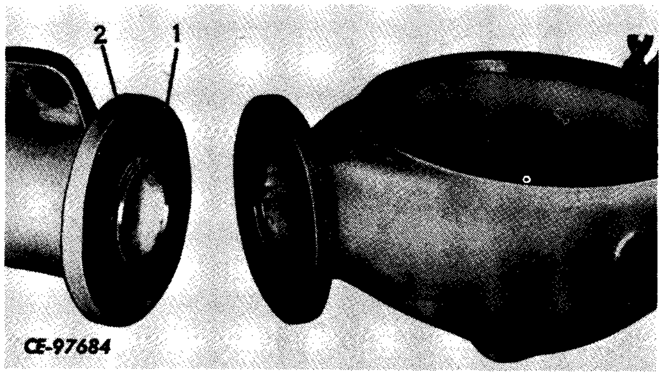

Figure 6-13

Position a new gasket on differential housing and lower differential assembly (1, Fig. 6-14) into housing. Coat retaining cap screws threads (2) with "MAR-SEAL" or equivalent sealant and install with lock washers. Tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque: __________

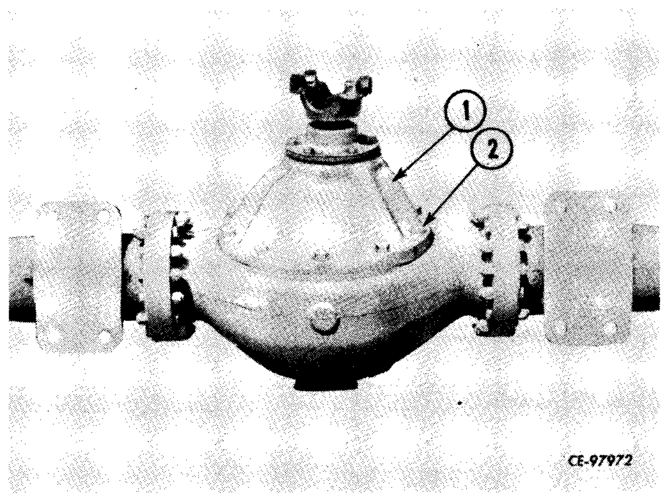

Figure 6-14

AXLE DISASSEMBLY AND ASSEMBLY

Install guard (3, Fig. 6-15) against axle housing flange (5). Install and tighten cap screws (1) and lock washers (2) (refer to "SPECIAL TORQUES").

Torque: ________

Install "O" ring in groove in I. D. of seal retainer (4). Carefully install assembled retainer over axle housing, being careful not to damage "O" ring on housing splines. Seat retainer (4) against axle housing flange.

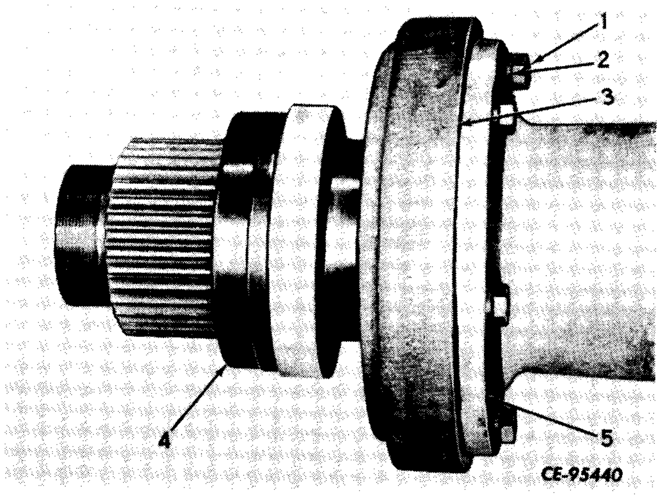

Figure 6-15

Install wheel hub assembly (2, Fig. 6-16) on axle housing, being careful not to damage seal.

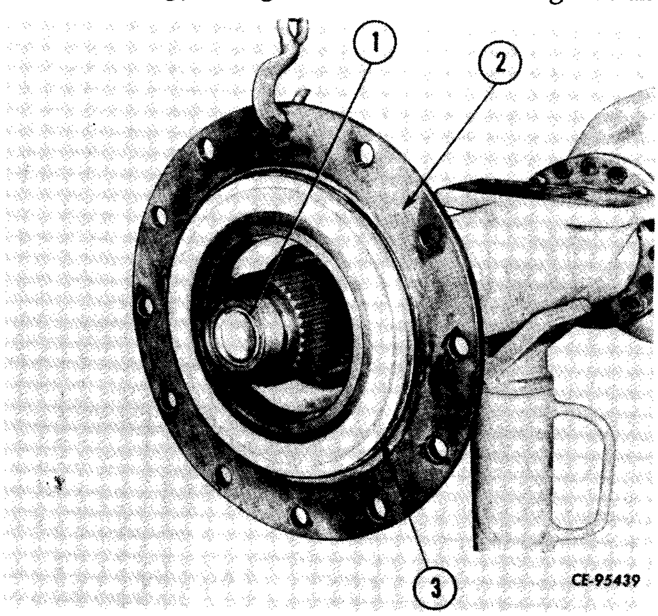

Figure 6-16

Be sure rear of hub fits inside guard. Install a new, lightly greased "O" ring (3) on hub shoulder.

Install oil seal (1) in recess in axle housing.

Slide assembled ring gear and hub (1, Fig. 6-17) on axle housing splines. Seat bearing cone into cup in hub.

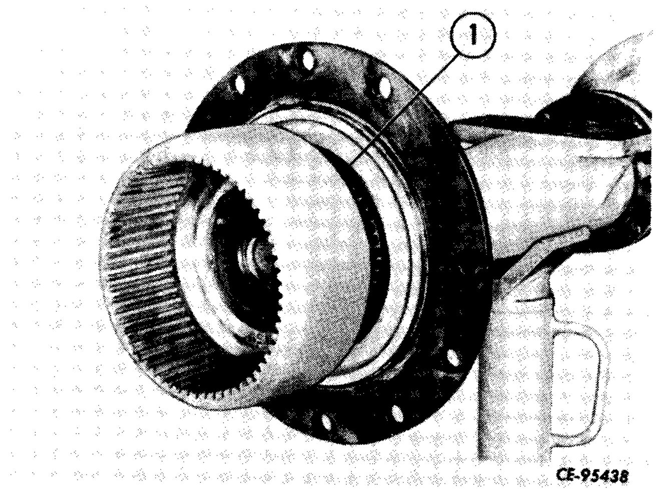

Figure 6-17

Install bearing adjusting nut (1, Fig. 6-18) on axle spindle. Tighten nut to recommended torque (refer to "SPECIAL TORQUES").

Torque: ________

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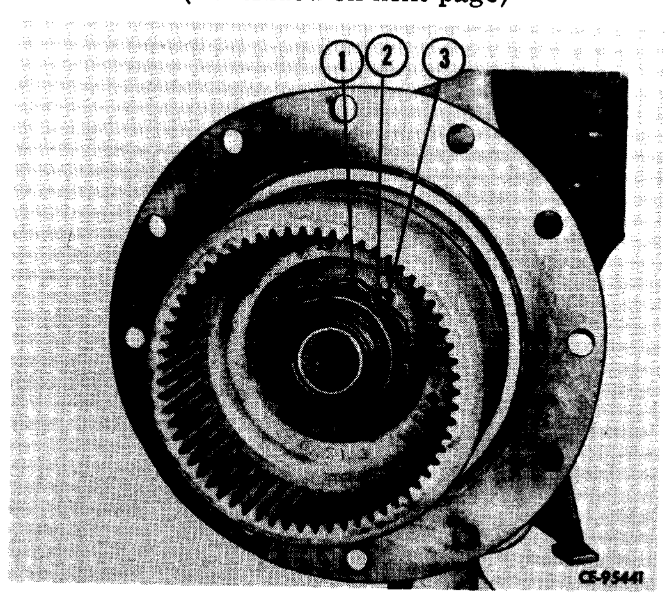

Figure 6-18

AXLE DISASSEMBLY AND ASSEMBLY

ASSEMBLY - Continued

NOTE: Rotate wheel hub while torquing adjusting nut.

Back off adjustment and retighten to recommended torque.

Back off nut (1) to nearest notch and install and tighten cap screw (3) and cotter pin (2).

Using a suitable sling and hoist, position pinion carrier assembly (2, Fig. 6-19) on ring gear. Install wheel studs (3) through carrier and wheel hub and secure with nuts (4) to recommended torque (refer to "SPECIAL TORQUES").

Torque: __________

NOTE: When installing wheel studs (3), short end is toward the differential assembly.

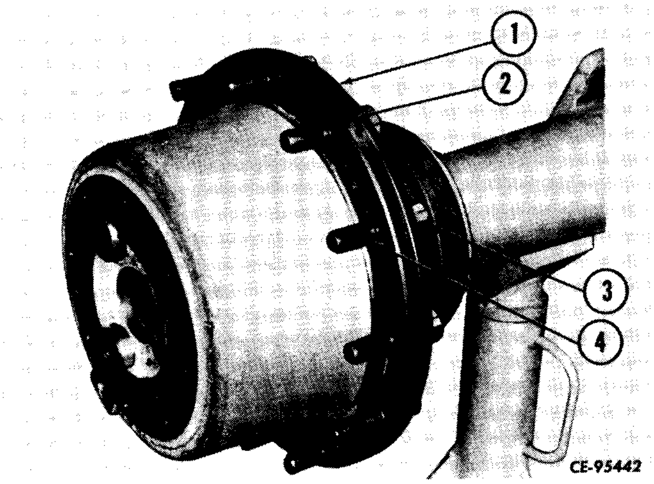

Figure 6-19

Using axle shaft removal and installation tool as a lever (Fig. 6-20), raise inner end of axle shaft to engage differential side gear splines. As sun gear end of shaft enters planetary assembly, align planetary gears with shaft gear.

Position gasket (1, Fig. 6-21) on planetary carrier (2), with holes aligned. Install cover (3) on gasket and carrier. Install cap screws and new seal washers. Tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque: __________

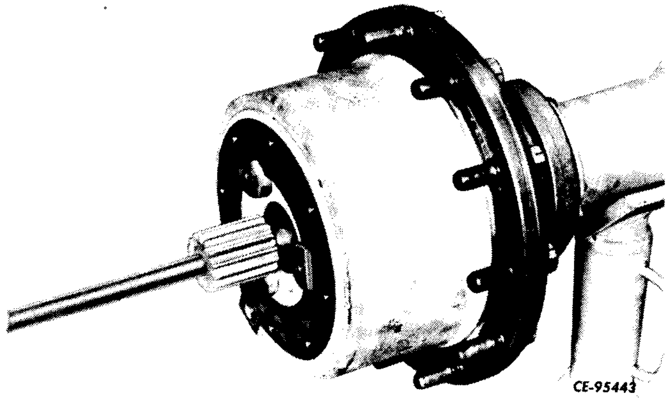

Figure 6-20

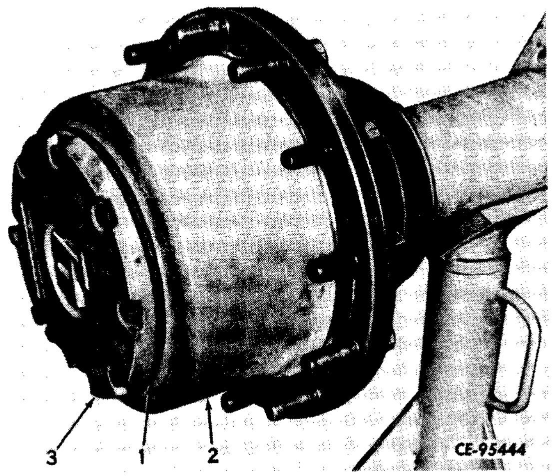

Figure 6-21

Rotate planetary hub until "OIL LEVEL" line is horizontal. Remove drain and fill plug and fill planetary hub to level of plug hole with recommended lubricant (refer to "LUBRICANTS AND CAPACITIES" under "SERVICE INFORMATION"). Install and tighten plug.

Rotate axle until the differential input yoke is horizontal. Install the drain plug with a new "O" ring. Tighten securely. Remove the filler plug and fill the bowl to the level of the plug hole with the recommended lubricant (refer to "LUBRICANTS AND CAPACITIES" under "SERVICE INFORMATION"). Install and tighten plug.

Install assembled axles on the tractor. Install wheels and tires.

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DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - FRONT AXLE

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.

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 backlash of ring gear and pinion before disassembly. This measurement will be used during assembly.

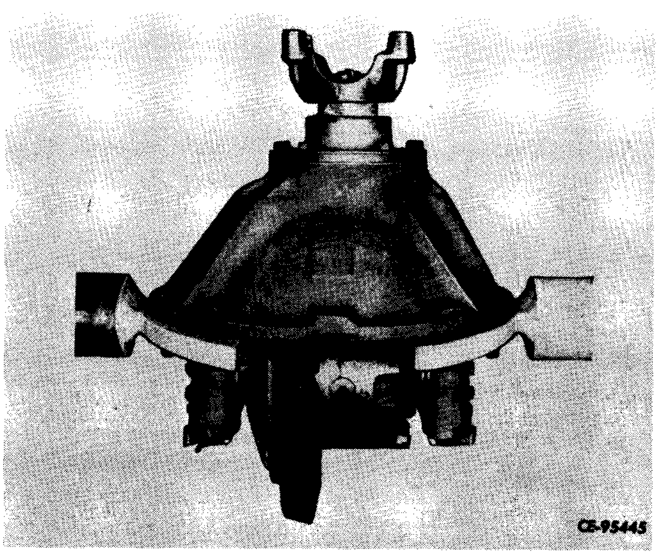

Figure 6-22

To measure backlash, position dial indicator as shown in Fig. 6-23. Secure yoke and rotate ring gear back and forth. Indicated movement is backlash (clearance) between teeth. A predetermined amount of backlash is necessary and should not be altered to any great extent.

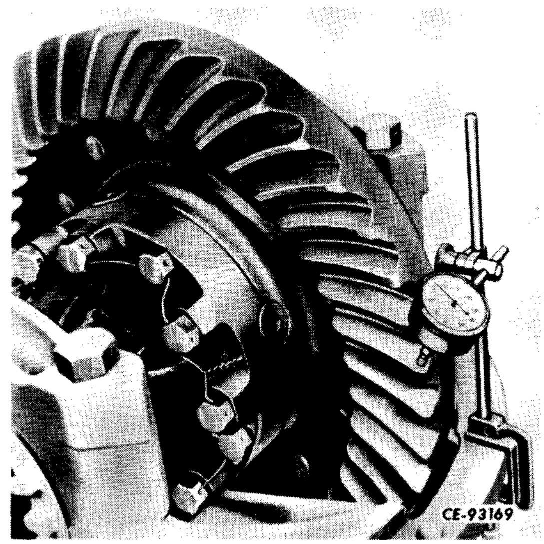

Figure 6-23

Remove adjuster lock (1, Fig. 6-24) by removing cotter pin (2).

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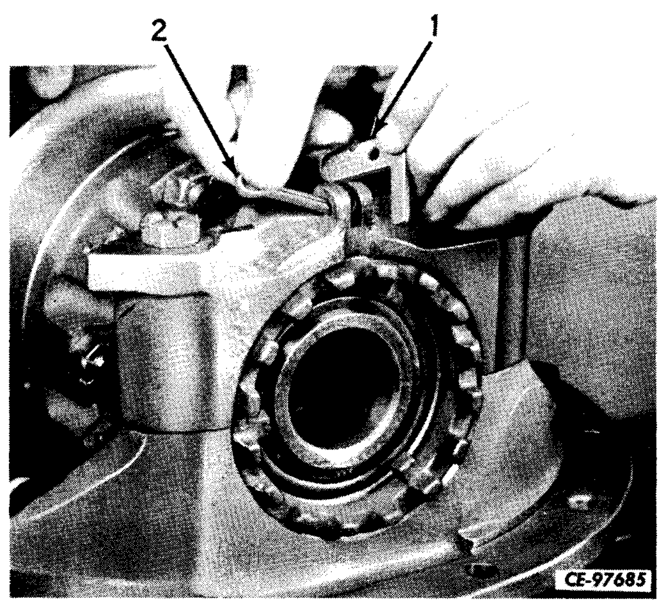

Figure 6-24

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - FRONT AXLE

DISASSEMBLY - Continued

Bearing caps (2, Fig. 6-25) and carrier legs (3) are marked at factory to assure correct assembly. If original identification marks are not clear, mark one bearing cap and carrier leg with a center punch or chisel to identify for correct assembly (5).

Remove cap screws (1). Using a fiber hammer, tap the bearing caps enough for removal. Remove bearing adjusters (4).

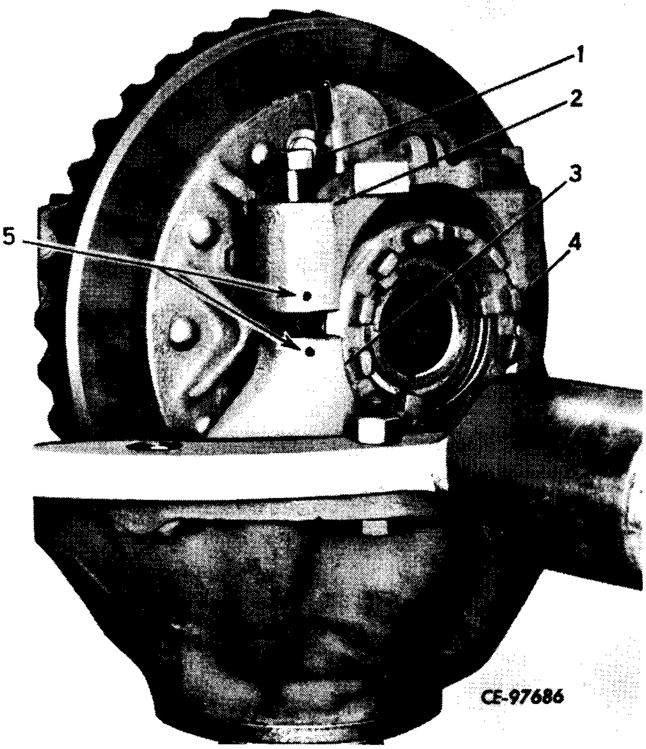

Figure 6-25

Lift differential assembly (1, Fig. 6-26) from case, tipping it slightly so ring gear (3) clears pinion shaft bearing boss (4). Remove both carrier bearing cups (2) and tag for identification on assembly.

If necessary, remove carrier bearing cones with a standard bearing puller. Be sure force is exerted on inner race, and not bearing cage.

NOTE: Rear differential is equipped with a No SPIN spider assembly. Refer to "DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - REAR AXLE" for information on service procedures.

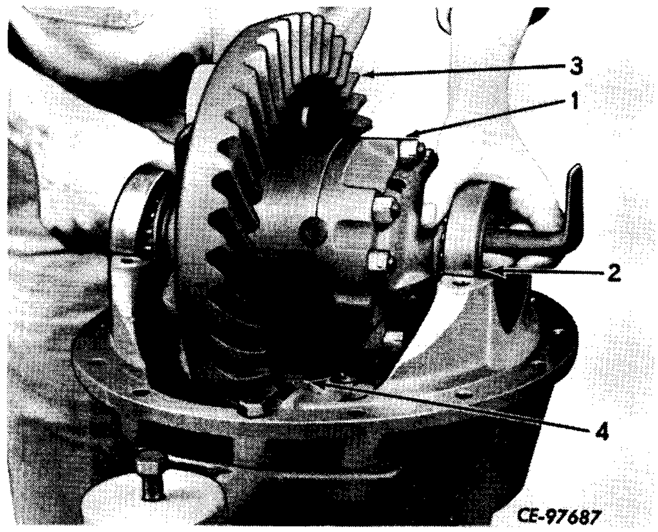

Figure 6-26

If original identification marks are not clear, mark differential case halves with a punch or chisel to insure correct alignment during assembly (Fig. 6-27).

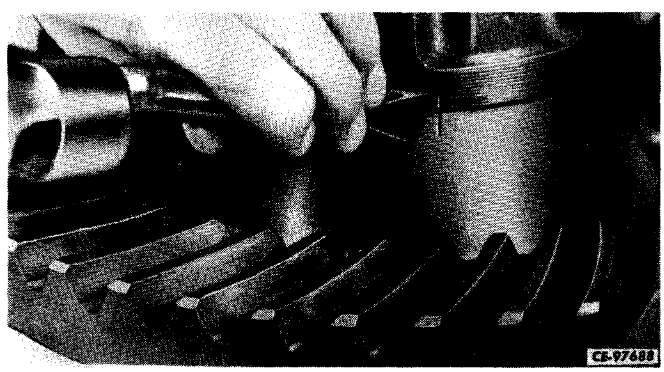

Figure 6-27

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - FRONT AXLE

Remove cap screws and nuts that retain differential case halves and remove plain half (1, Fig. 6-28). Remove side gear (2).

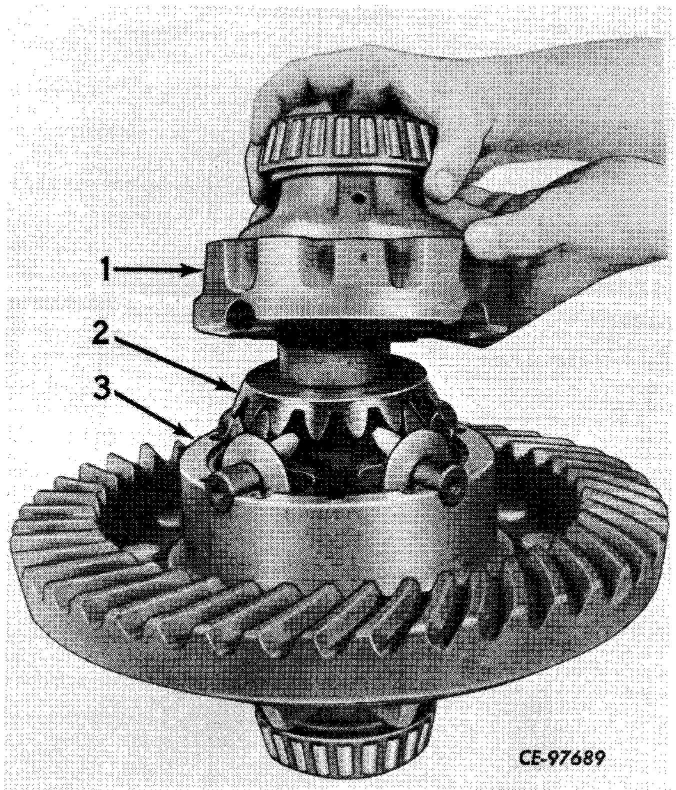

Figure 6-28

To remove differential bearings, use a suitable bearing puller or a shop press (Fig. 6-29). Be sure force is exerted on inner race, not bearing cage.

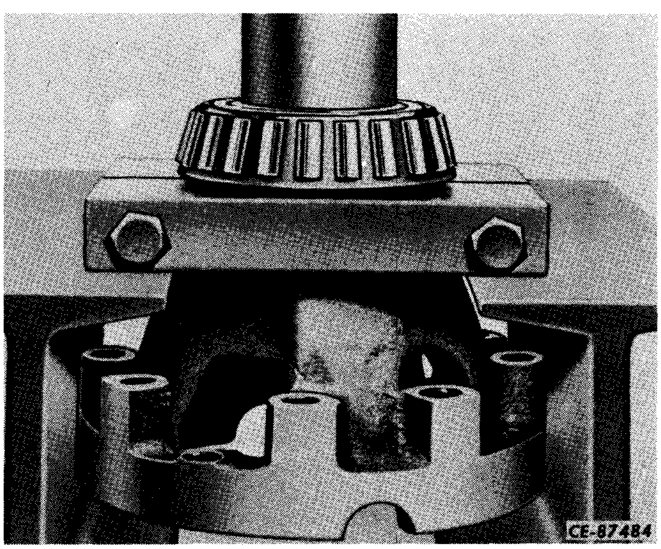

Figure 6-29

Remove thrust washer (6, Fig. 6-30), side gear (7), and spider (1) with spider gears (2) and thrust washers (3). Spider may be installed four ways and need not be marked before removal. Remove side gear (5) and thrust washer from ring gear assembly (4).

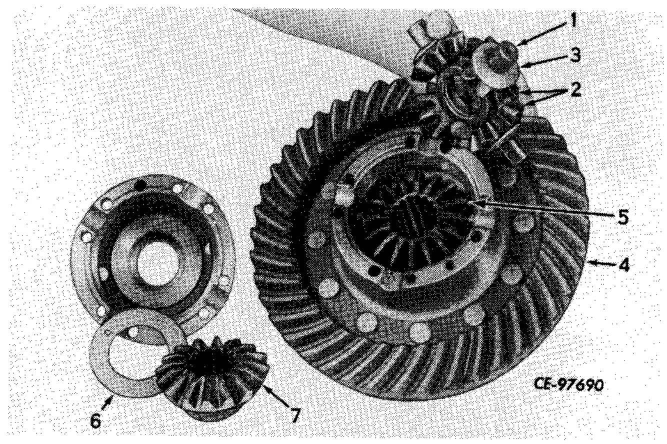

Figure 6-30

If removal of the ring gear is necessary (Fig. 6-31), carefully center-punch the rivets in the center of the head. Use a drill 1/32-inch smaller than the body of the rivet to drill through the head. Press out the rivets and separate the gear from the case.

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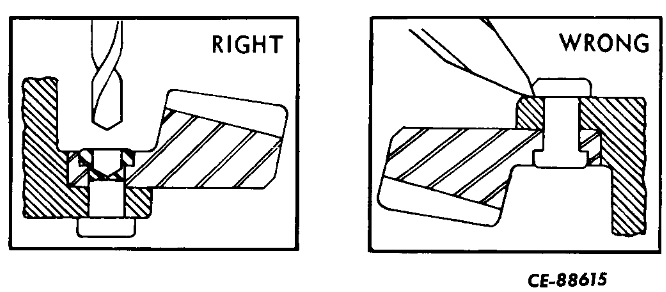

Figure 6-31

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - FRONT AXLE

DISASSEMBLY - Continued

Remove cap screws and lock washers that secure pinion assembly (1, Fig. 6-32) to carrier assembly (2). Using a brass drift, drive out pinion. Remove and tag shims (3) for adjustment during assembly.

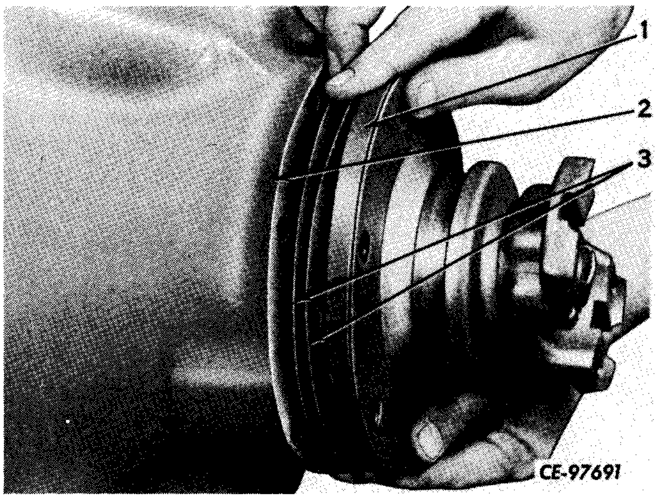

Figure 6-32

Hold pinion (Fig. 6-33) shaft yoke in a vise and remove cotter pin and nut. Remove drive yoke using a suitable puller.

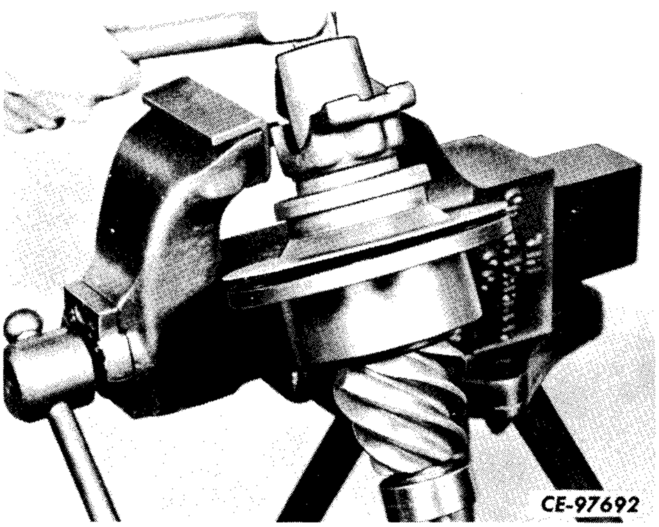

Figure 6-33

Support pinion cage (1, Fig. 6-34) with blocks and press out pinion shaft. If necessary, remove bearing cups (2) from cage using a suitable puller.

NOTE: If pinion bearing assembly is to be reused, it will be necessary to retain the same relationship between the cup and cones because of the established wear pattern. Proper identification of parts should be made when disassembling.

The bearing rear cone (5) and bearing spacer (4) are removed with pinion shaft (3). Slide bearing spacer off pinion shaft. If necessary, remove bearing rear cone (5) from the pinion shaft by pressing shaft out of bearing.

Using a suitable puller, remove pilot bearing (6) from pinion shaft (3).

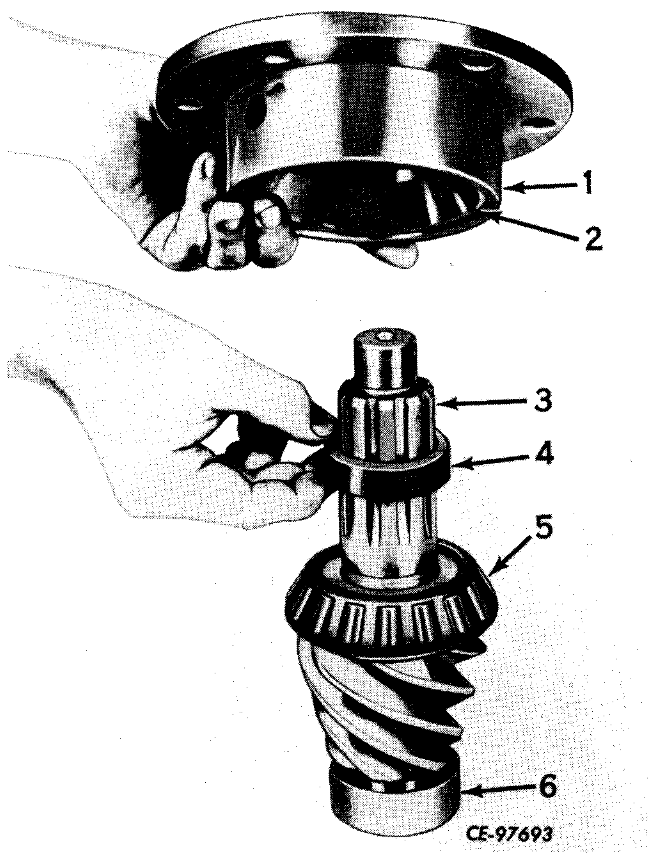

Figure 6-34

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - FRONT AXLE

CLEAN, INSPECT AND REPAIR

CLEAN

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.

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.

(Continued on next page)

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - FRONT AXLE

CLEAN, INSPECT AND REPAIR - Continued

REPAIR - Continued

The burrs caused by lock washers at the spot surface of stud holes of gauges 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 are installed, press smaller cup (2, Fig. 6-35) and larger cup (1) in their corresponding bores and firmly against pinion bearing cage (3) shoulders.

Lubricate bearing cups and cones with light machine oil.

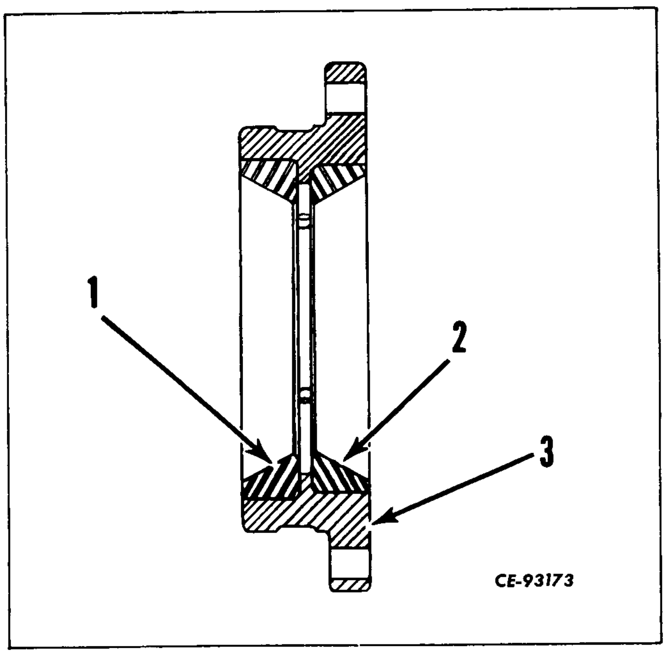

Figure 6-35

Press inner thrust bearing (2, Fig. 6-36) on pinion shaft (3). Be sure bearing cone bottoms on gear shoulder. Press pilot bearing (1) on pinion shaft. Install retaining snap ring. Be sure snap ring bottoms in groove in pinion shaft.

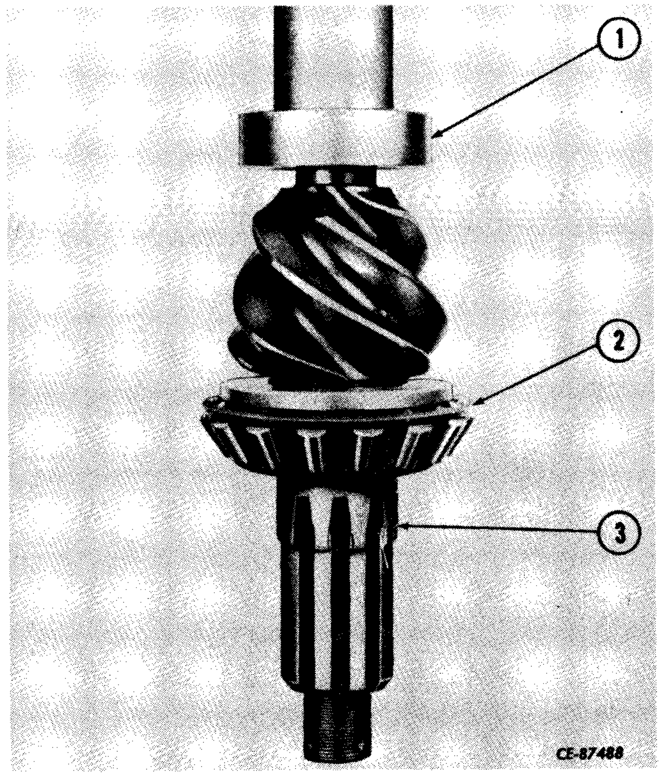

Figure 6-36

After installing pilot bearing (1, Fig. 6-37) on end of pinion shaft, stake in six equidistant spaces as shown in figure 6-37).

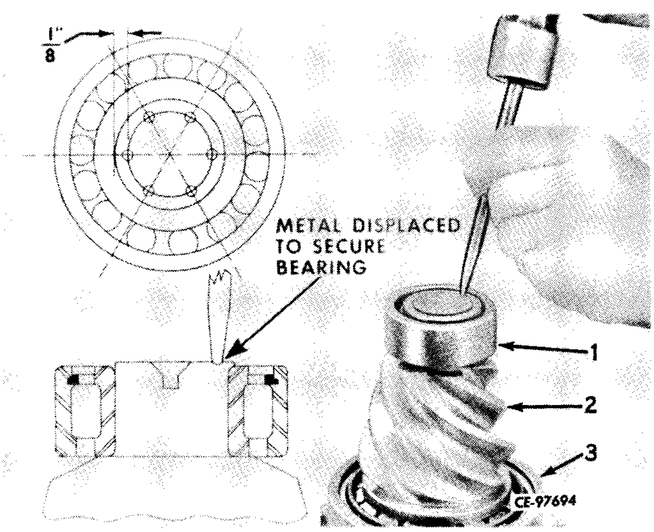

Figure 6-37

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - FRONT AXLE

Press cups (3, Fig. 6-38) firmly against shoulders in cage assembly (2). Install a new cork seal (1) in groove of pinion cage.

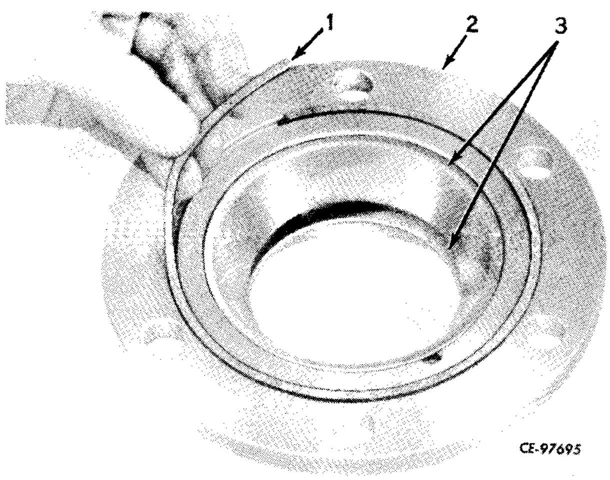

Figure 6-38

Install spacer (5, Fig. 6-39) 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.

Remove assembly from press. Install yoke, without seal retainer and seal. Install washer and nut and tighten to recommended torque. Refer to "SPECIAL TORQUES").

Torque: __________

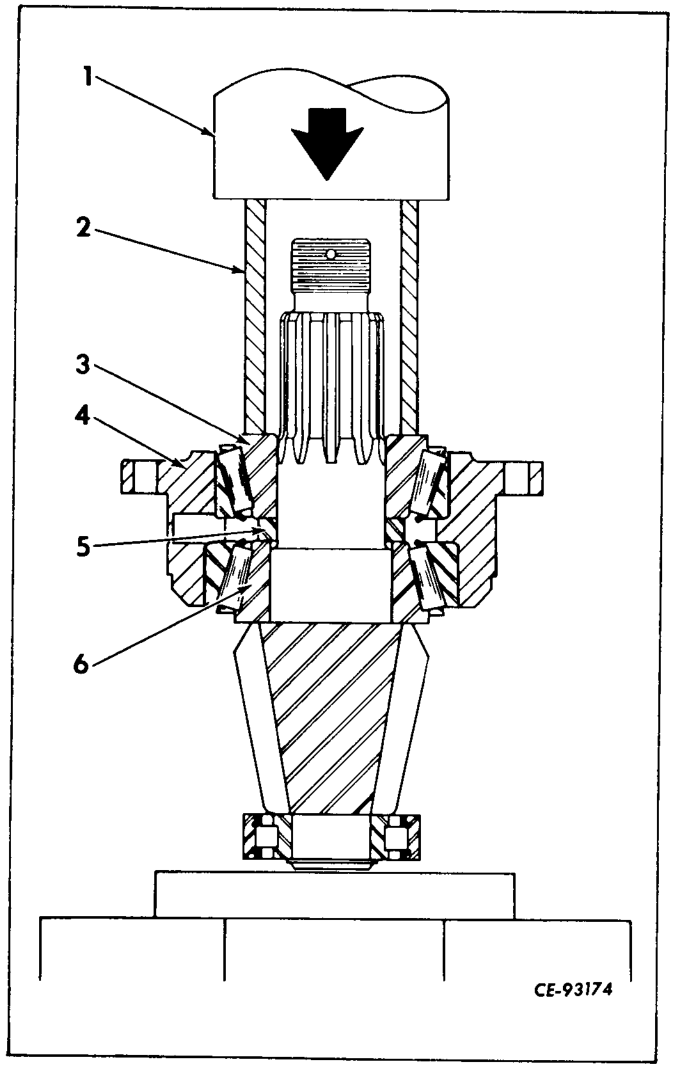

Figure 6-39

1. Press ram.
2. Suitable sleeve.
3. Outer thrust bearing.
4. Bearing cage.
5. Spacer.
6. Inner thrust bearing.

(Continued on next page)

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - FRONT AXLE

ASSEMBLY - Continued

Wrap soft iron wire around cage (Fig. 6-40) 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: ____________

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).

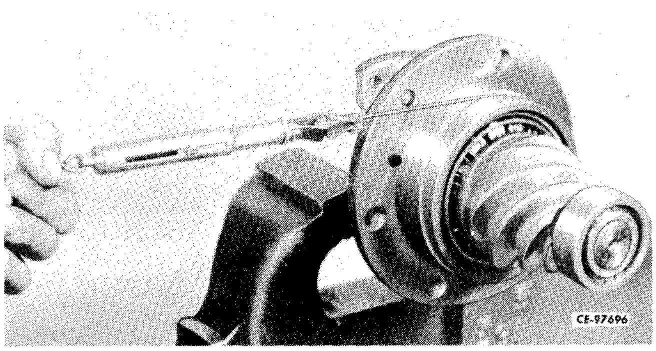

Figure 6-40

Lubricate pinion shaft oil seal (1, Fig. 6-41). Coat O.D. of seal body with a non-hardening sealing compound. Install seal in 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.

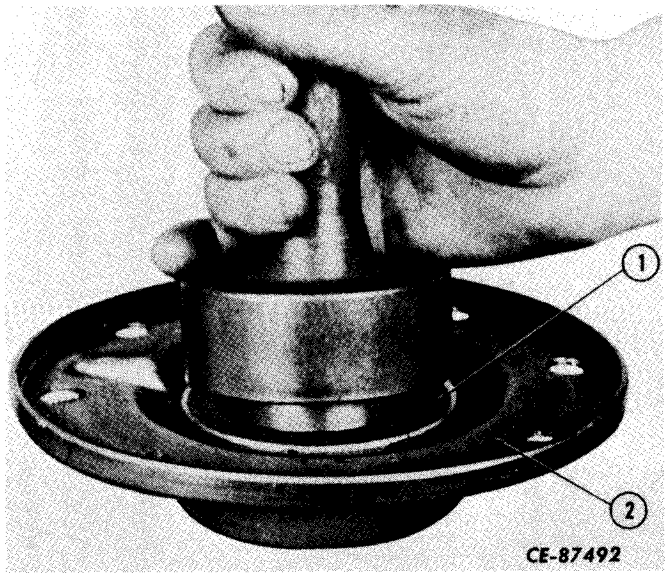

Figure 6-41

Position retainer assembly on cage. Install the yoke, washer, and nut. Tighten nut to recommended torque. Refer to "SPECIAL TORQUES").

Torque: ____________

Install cotter pin.

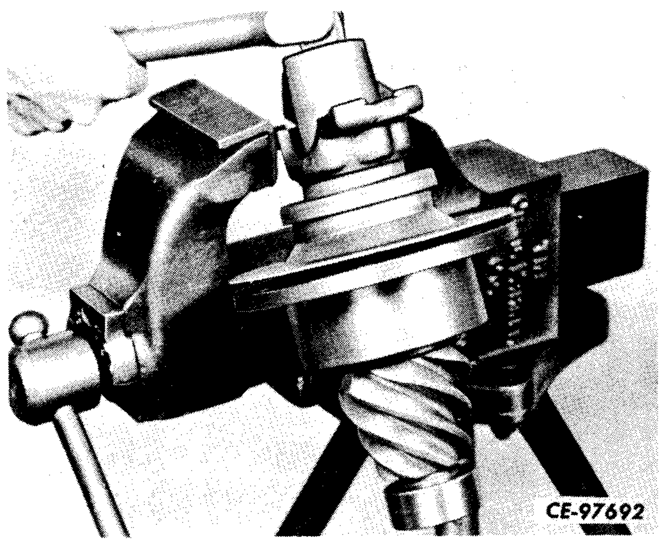

Figure 6-42

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - FRONT AXLE

Position a shim pack (3, Fig. 6-43) of the same thickness as those removed. Assemble pack with the thinner shims on both sides for maximum sealing ability. Install cage and retainer assembly (1) aligning cap screw holes while tapping with a small mallet. Install cap screws and lock washers. Tighten to recommended torque. Refer to "SPECIAL TORQUES."

Torque: ________

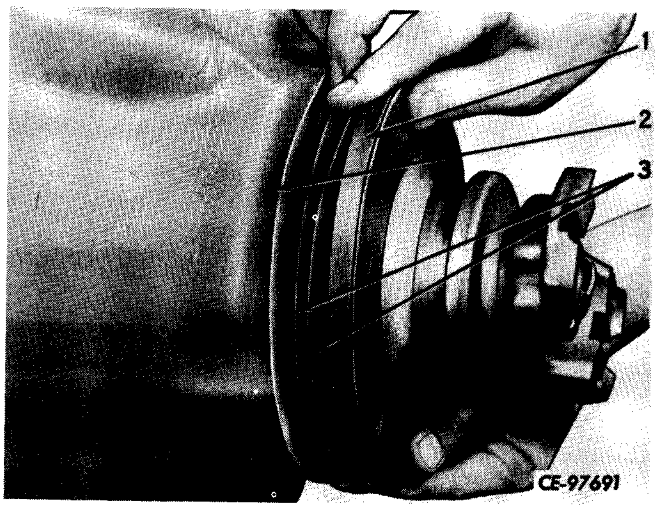

Figure 6-43

Rivet ring gear to case half with new rivets.

If a new gear or case is to be used, rivet holes in gear and case should be checked for alignment and line reamed if necessary. Gear must be tight on case pilot and riveted flush with differential case flange. Check with a .002" feeler gauge.

Rivets should not be heated, but should be upset cold. When correct rivet and rivet set is used, head being formed will be at least 1/8" larger in diameter than rivet hole.

The head will be approximately the same height as the preformed head. Excessive pressure will cause distortion of case holes and result in gear eccentricity. Refer to "TOLERANCES" for recommended press tonnage.

Press Tonnage: ________

Final pressure should be held for approximately one minute to be sure rivet has filled hole.

Install bearing cones on differential case halves. Lubricate differential case inner walls and all component parts with lubricant recommended in "LUBRICANTS AND CAPACITIES."

Position thrust washer and side gear (5, Fig. 6-44) in flanged case (4).

Install pinions (2) and thrust washers (3) on spider (1). Install spider assembly in flanged case.

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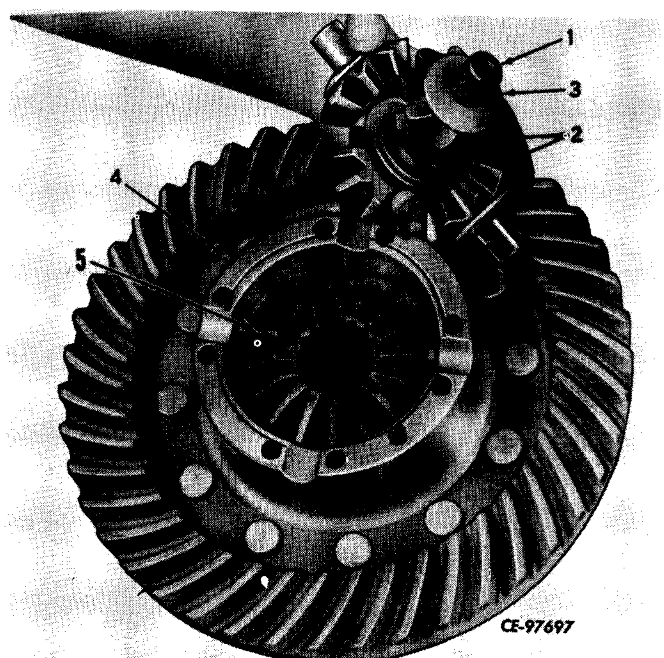

Figure 6-44

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - FRONT AXLE

ASSEMBLY - Continued

Install remaining side gear (3, Fig. 6-45) and thrust washer (2). Align halves, matching marks made during disassembly and secure 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").

Torque: __________

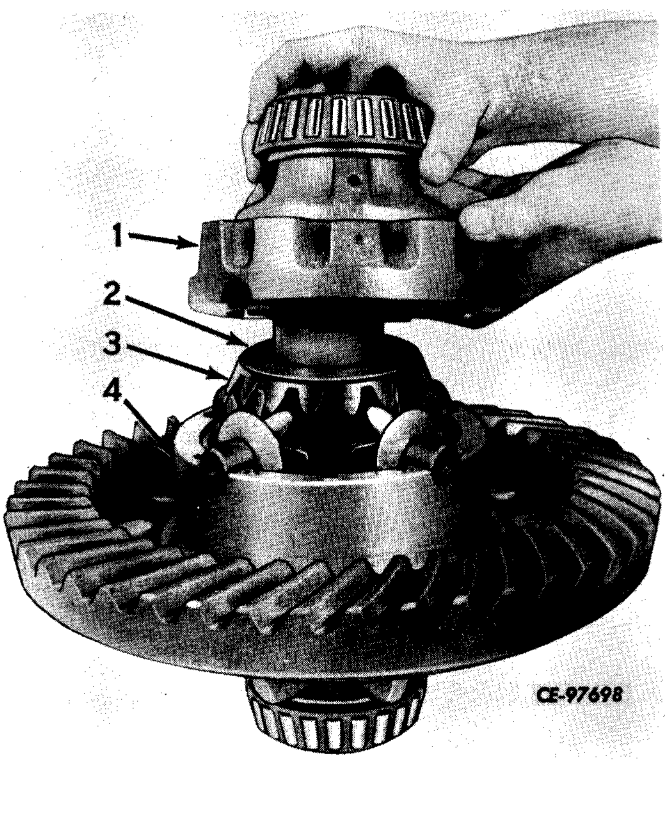

Figure 6-45

Lubricate bearings with new axle lubricant.

If differential assembly will not be installed in axle housing immediately, cover complete assembly with a plastic cover to eliminate entrance of dirt.

Temporarily install bearing cups (1, Fig. 6-46) and bearing caps (3). Tighten bearing cap retaining cap screws (2) to recommended torque (refer to "SPECIAL TORQUES").

Torque: __________

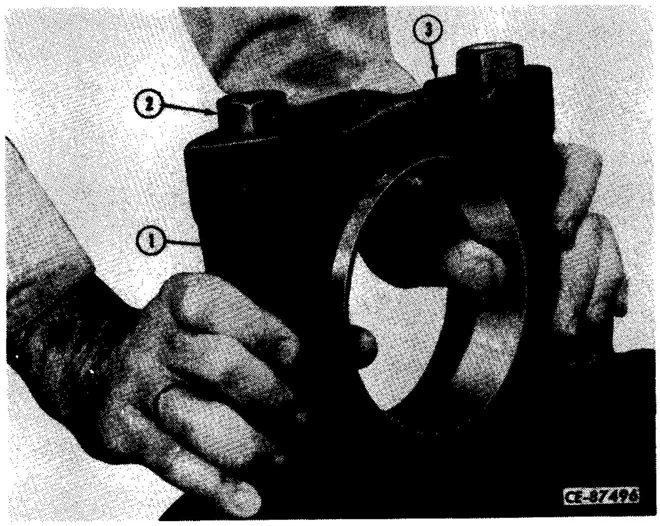

Figure 6-46

NOTE: Observe reference punch marks (Fig. 6-25) when installing bearing caps.

Bearing cups (1, Fig. 6-46) 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 guage and check fit often. When cups fit properly, remove bearing caps.

Coat differential bearing cones and cups with new axle lubricant.

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - FRONT AXLE

Place bearing cups over differential bearing cones and position differential assembly in carrier (Fig. 6-47).

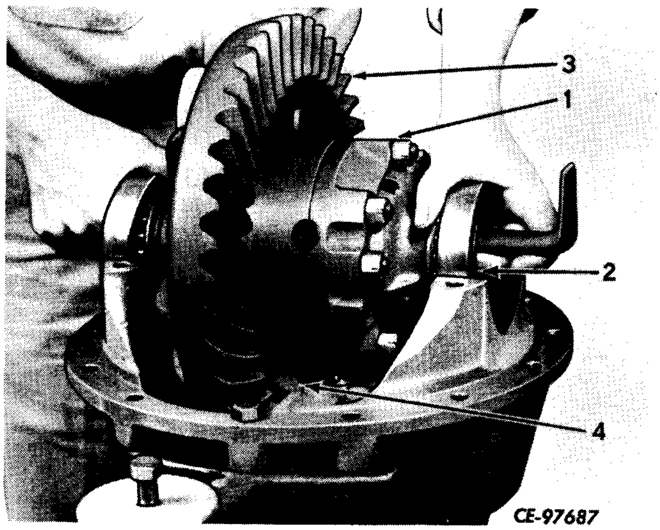

Figure 6-47

Install bearing caps (2, Fig. 6-48), matching respective caps and tap caps lightly into position.

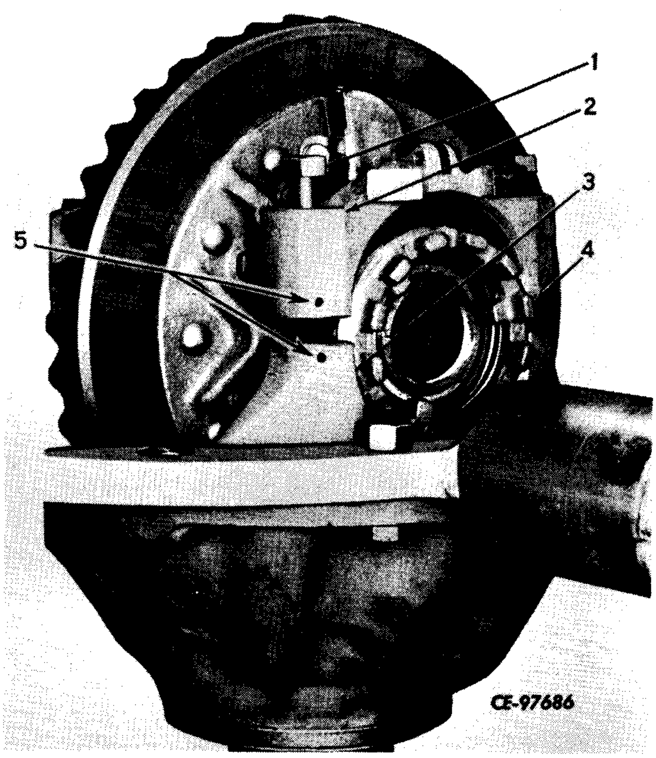

Figure 6-48

NOTE: If the bearing caps do not position properly, the adjusters may be cross threaded. Remove caps and reposition adjusters (4). Do not force bearing caps into position on carrier housing (3) or caps will be damaged.

Install cap screws (1) to recommended torque. (Refer to "SPECIAL TORQUES").

Torque: __________

Using a dial indicator on back face of ring gear (Fig. 6-49) loosen bearing adjusting nut on side opposite gear teeth just enough to notice end play on indicator.

Tighten 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 adjusting nuts one notch each to preload differential bearings.

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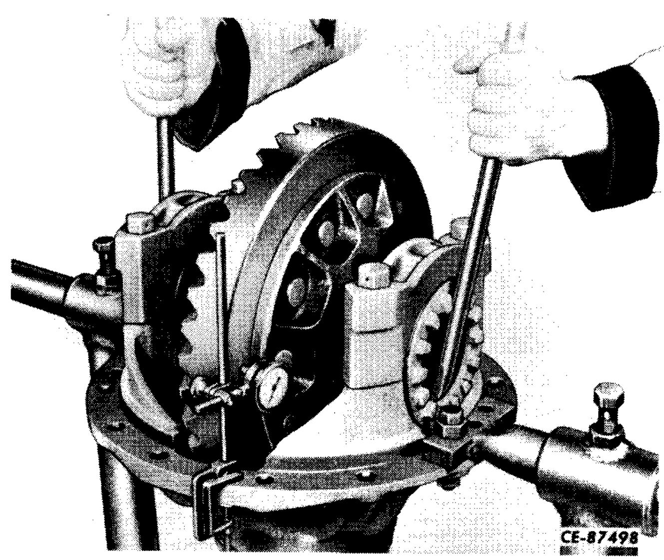

Figure 6-49

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - FRONT AXLE

ASSEMBLY - Continued

If ring and pinion gears were not replaced, backlash dimension (Fig. 6-50) recorded before disassembly should be used.

If gear set was replaced the recommended backlash setting for new gears (refer to "TOLERANCES") should be adhered to.

Initial Backlash - New Gears: __________

Backlash is adjusted by backing off one lock ring and advancing opposite ring same amount.

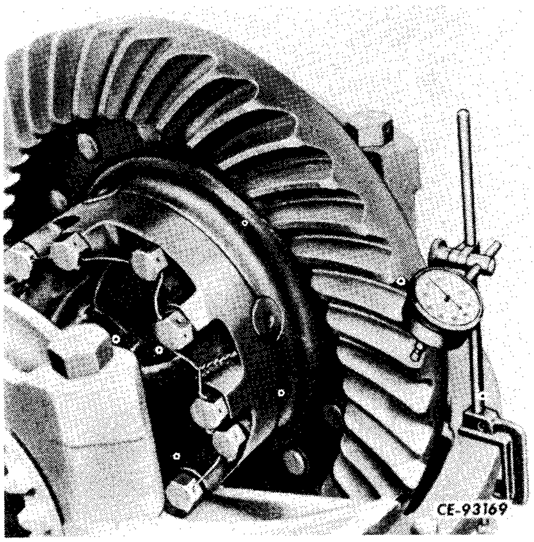

Figure 6-50

Apply oiled red lead (Fig. 6-51) to ring gear teeth. When pinion is rotated red lead is squeezed away by contact of teeth leaving an imprint the exact size, shape and location as contact.

Sharper impressions may be obtained by applying a small amount of resistance to ring gear with a steel bar and using a wrench to rotate pinion. When marking adjustments, check drive side of ring gear teeth. Coating approximately 12 teeth is sufficient to check tooth contact.

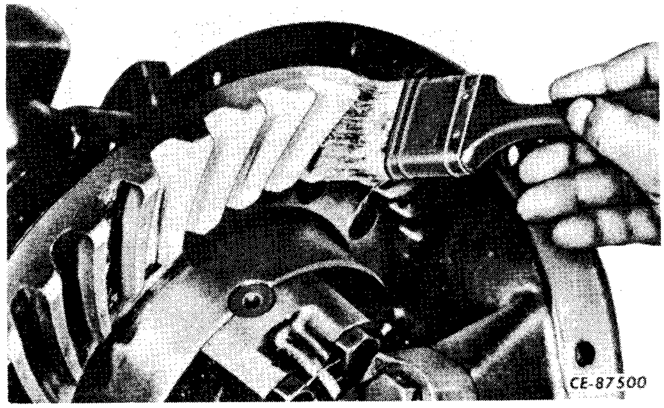

Figure 6-51

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: __________

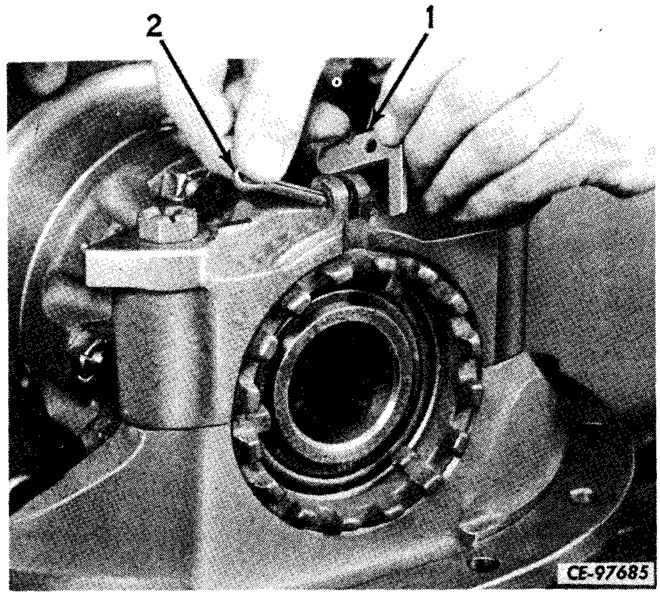

Figure 6-52

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - FRONT AXLE

A high backlash setting can be used to keep contact from starting too close to toe. A low backlash setting can be used to keep contact from starting too far from toe.

After establishing correct tooth contact, install adjusting nut locks (1, Fig. 6-52).

With adjustments properly made, contacts shown in Fig. 6-53) will be obtained. The area of contact favors the toe and is centered between top and bottom of tooth.

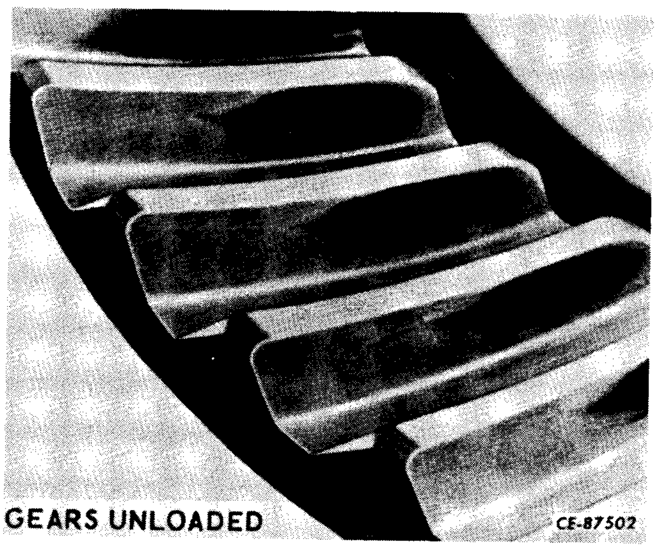

Figure 6-53

The hand rolled pattern shown in Fig. 6-54 will result in a pattern centered in the length of the tooth when gears are under load. The loaded pattern will be almost full length and top of the pattern will approach top of gear tooth.

Pattern on the coast side of the teeth will appear the same width as drive side; however the overall length will be centered between toe and heel of 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 toe end of wear pattern.

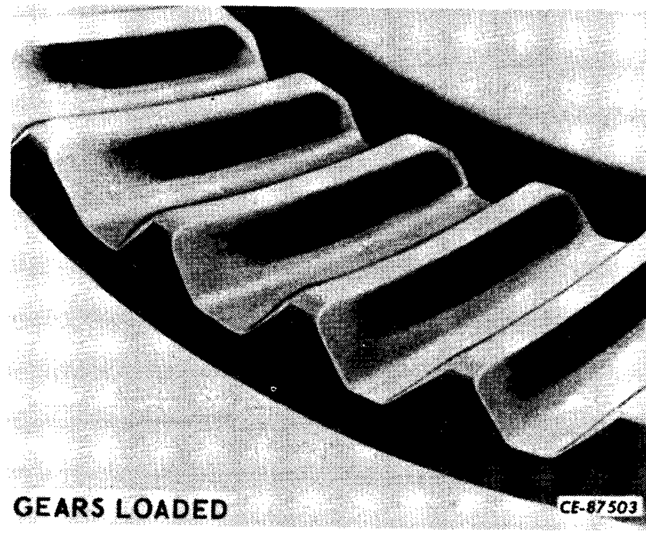

Figure 6-54

A high contact (Fig. 6-55) indicates the pinion is too far out. Set pinion to correct depth by removing shims under pinion cage. A slight outward movement of ring gear may be necessary to maintain correct backlash.

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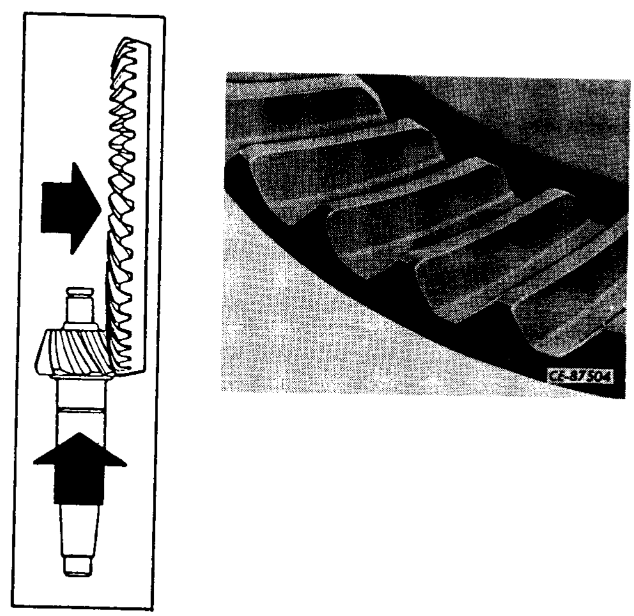

Figure 6-55

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - FRONT AXLE

ASSEMBLY - Continued

A low contact (Fig. 6-56) indicates pinion is too deep. Set pinion to correct depth by adding shims under pinion cage. Slight inward movement of ring gear may be necessary to maintain correct backlash.

Remove carrier from holding fixture. Position assembly with back face of the ring gear upward.

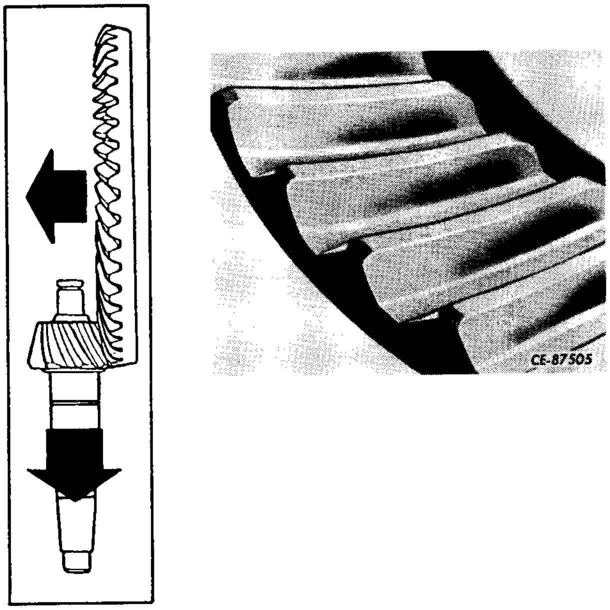

Figure 6-56

When gear adjustments are correct, secure the bearing adjusters in position with locks (3, Fig. 6-57) and cotter pins (2).

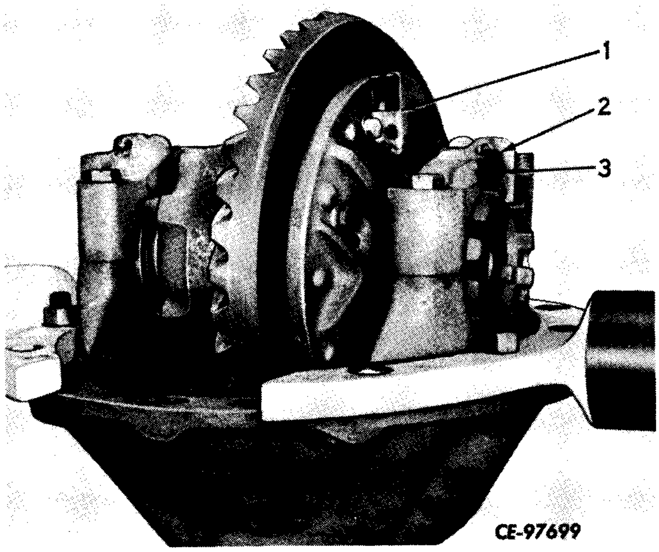

Figure 6-57

Install the lubricator (1) on the flanged case.

Refer to "AXLE DISASSEMBLY AND ASSEMBLY") for installation of differential into axle housing.

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - REAR AXLE

DESCRIPTION

The NoSPIN differential is used in the rear axle of the PAY logger, in place of the conventional spider, side gears, and pinion.

The differential locking unit consists of the following parts:

1. The spider and center cam assembly (5, Fig. 6-58) consists of the spider, center cam, and snap ring. The spider has drive teeth located on either side to drive the clutch members. The internal diameter (I. D.) has a snap ring groove in the center, and keys which limit the rotation of the center cam. The center cam, mounted within the spider, is held in position by a snap ring, which permits the cam to be rotated a predetermined amount, but does not permit lateral movement. The center cam is symmetric, having the same number of cam lifts on each side as there are driving teeth on the spider. External key slots index with the keys of the spider.

2. Identical driven clutch members (4, Fig. 6-58) are located on either side of the spider

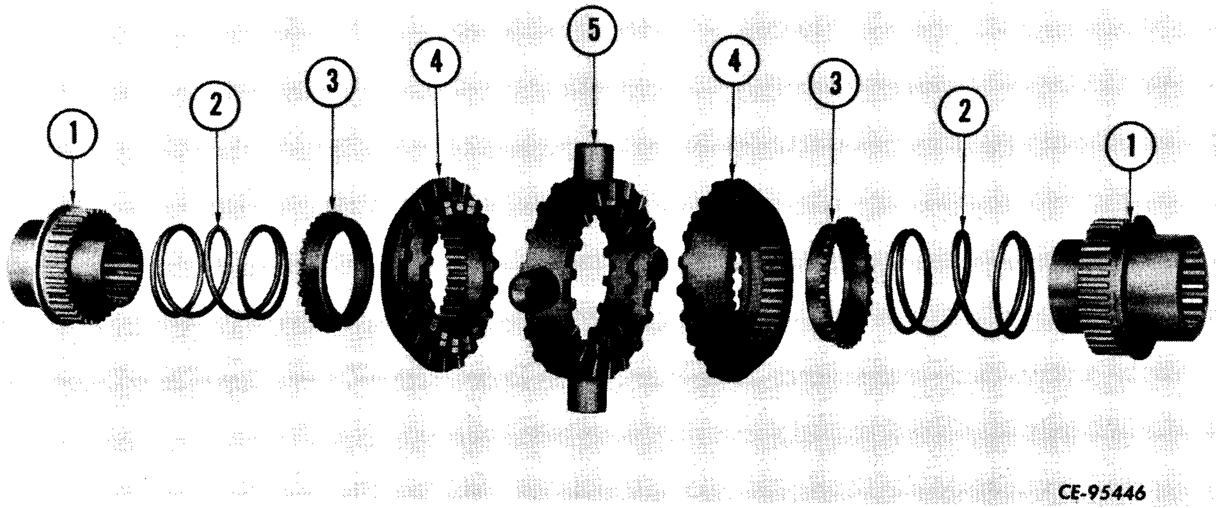

Figure 6-58

assembly. Each has a set of driven teeth which match the drive teeth, and fixed cams which mesh with the cams of the center cam assembly (5). A rotatable "hold-out" cam ring is mounted over the diameter of the fixed cam ring on each driven clutch member. The gap between the ends of the "hold-out" ring indexes with the long tooth or key of the spider, when assembled. The internal circumference of the driven clutch members is splined to engage with the external splines of the side members.

3. The spring retainers (3, Fig. 6-58) are inserted into the outer ends of the driven clutch member (4). The bowl side of the retainers are mounted first through the outer side of the members. The flanged portion of the spring retainers passes through the internal splines to rest on the mating flanges of the driven clutch members. The springs (2) are installed against the inner cupped ends of the spring retainers.

4. The two side members (1, Fig. 6-58), taking the place of conventional side gears, are splined internally to accept the axle shafts. The external splines engage the internal splines of the driven clutch members (4) on each side of the completed assembly. The inner hubs are inserted into the springs (2).

OPERATION

When the PAY logger is being driven in a straight forward direction, the clutch teeth (1, Fig. 6-59) on both sides of the spider assembly are fully engaged with the clutch teeth (2) on each driven clutch member. Likewise, the ramps of the center cam and the driven member cam are fully meshed.

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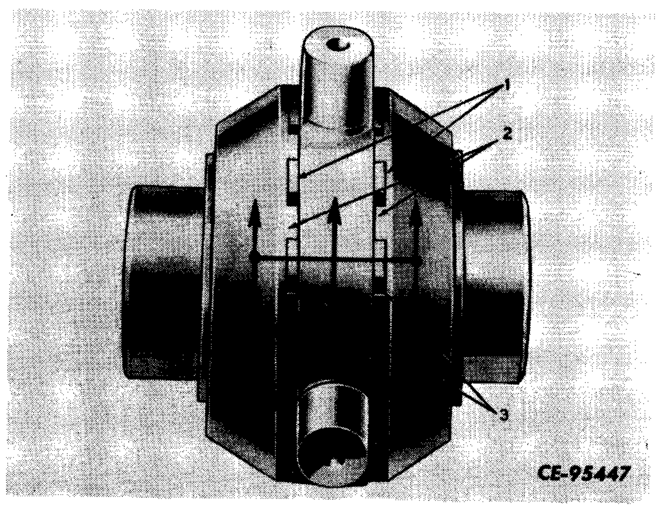

Figure 6-59

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - REAR AXLE

OPERATION - Continued

Positive engagement of the driving and driven clutch teeth is assured by spring pressure and by the positive locking action developed by the mating undercuts (3) on the faces of the clutch teeth.

In this condition, equal torque is delivered to each axle shaft, causing them to rotate at ring gear speed.

When making a turn, differential action is required in order to permit the outside wheel to travel a greater distance, and faster, than the inside wheel. The NoSPIN differential allows either wheel to turn faster than the ring gear, but does not permit either wheel to turn slower than ring gear speed when power is applied. The inside wheel driven clutch teeth (1, Fig. 6-60) remain fully engaged with the spider drive clutch teeth (2) to propel the tractor. The outside wheel, driven by the traction of the road surface, turns faster and in turn causes its driven clutch (3) to turn faster than ring gear speed.

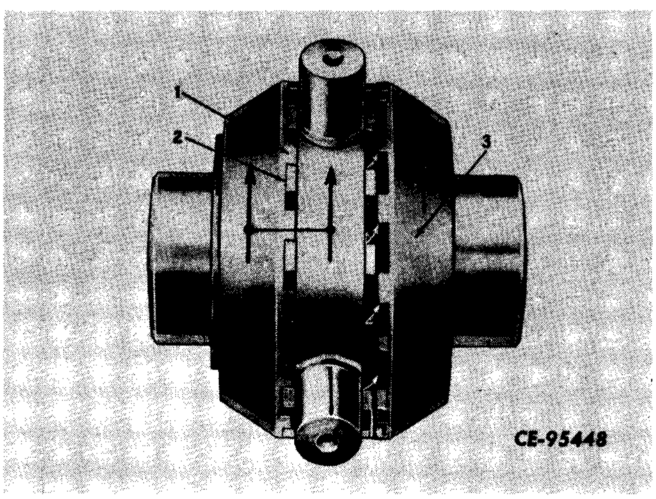

Figure 6-60

The driven clutch cams (4, Fig. 6-61) raise on the center cam (5) and disengage the clutch teeth (2) from the spider (1). The holdout cam (3) rotates slightly to hold the driven clutch disengaged, allowing the outside wheel to overrun the spider.

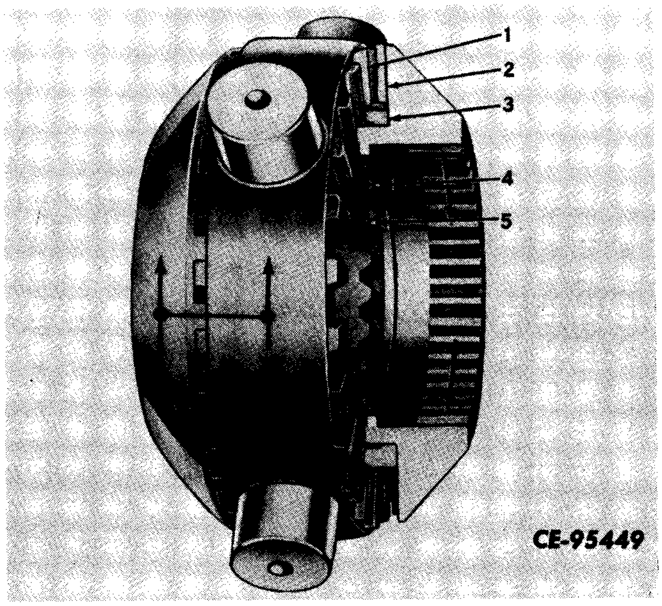

Figure 6-61

When this overrunning movement ceases and the relative speed of the spider and driven clutch member become the same, there is a slight reversal of torque which causes the holdout cam (3) to return to its original position. This allows the driven clutch member, under spring pressure, to return to full engagement with the spider drive clutch teeth.

When the drive wheels have unequal traction (e. g. one wheel on ice), both wheels rotate at the same speed as the ring gear, whether the tractor is moving straight or in a curved path.

The wheel having the traction will propel the tractor.

During a turn there may be an occasional click in the NoSPIN differential as the clutches reengage. Noises and vibration originating in the transmission, drive lines, planetaries and tires are often attributed to the differential. These sources of noise should be investigaged before deciding that the differential is at fault.

DISASSEMBLY

The procedure for disassembly of the differential is the same as used for the conventional differential (refer to "DIFFERENTIAL DISASSEMBLY AND ASSEMBLY").

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DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - REAR AXLE

◆ CAUTION: TO PREVENT ANY POSSIBLE INJURY DURING DISASSEMBLY OF THE NoSPIN DIFFERENTIAL, INSERT A BOLT (1, FIG. 6-62) THROUGH THE CENTER OF THE NoSPIN UNIT, WITH A FLAT WASHER (2) ON EACH END. SECURE WITH A NUT (3) INSTALLED FINGER TIGHT.

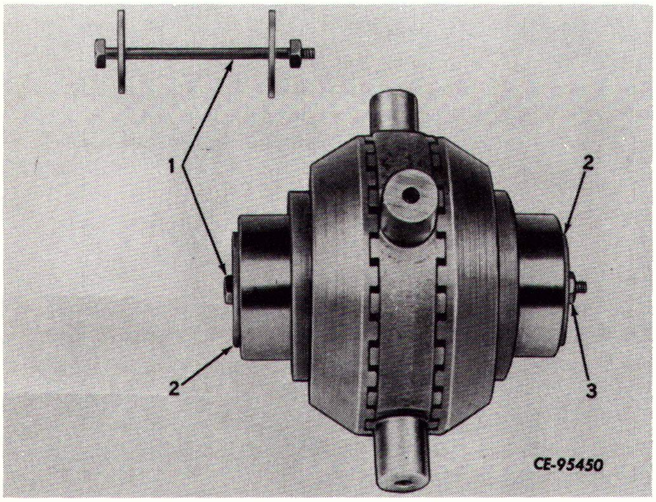

Figure 6-62

Remove the differential case bolts and nuts. Lift out NoSPIN unit and mount in a suitable press (Fig. 6-63). Apply enough pressure on head of bolt to release spring pressure against nut. Remove nut and slowly release press, allowing unit to expand until spring pressure is fully released.

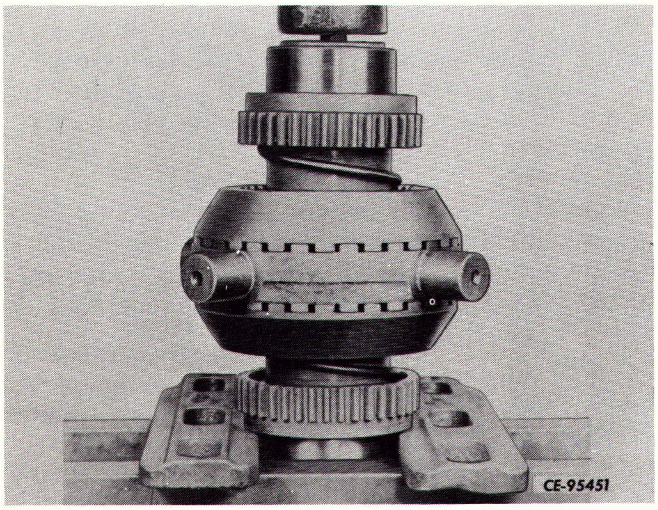

Figure 6-63

Remove unit from press. Remove splined side members, spring retainers and driven clutch members. Center cam and spider is serviced as an assembly and should not be disassembled. If center cam teeth (1, Fig. 6-64) or spider teeth (2) are chipped or excessively worn, replace the assembly.

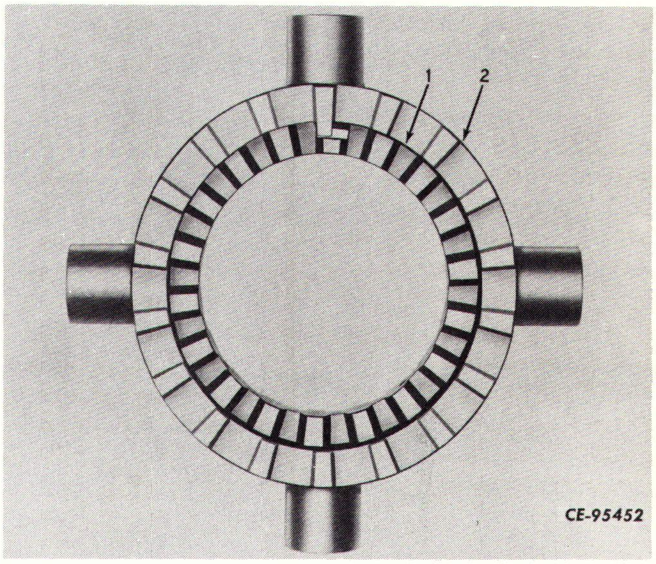

Figure 6-64

If rotatable holdout cam (1, Fig. 6-65) must be removed from driven clutch (2), use a snap ring pliers to expand and remove cam. The fixed cam (3) is welded to the driven clutch. If weld is broken, it will be possible to rotate the cam ring by lightly tapping the cams. If clutch teeth or cam teeth are chipped or worn excessively, the driven clutch assembly must be replaced.

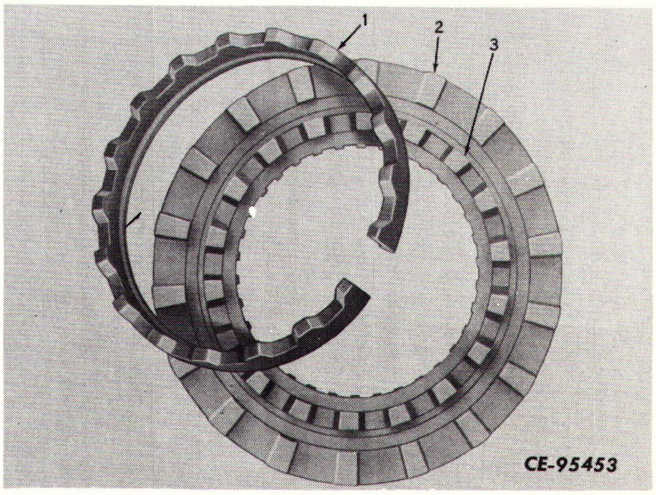

Figure 6-65

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - REAR AXLE

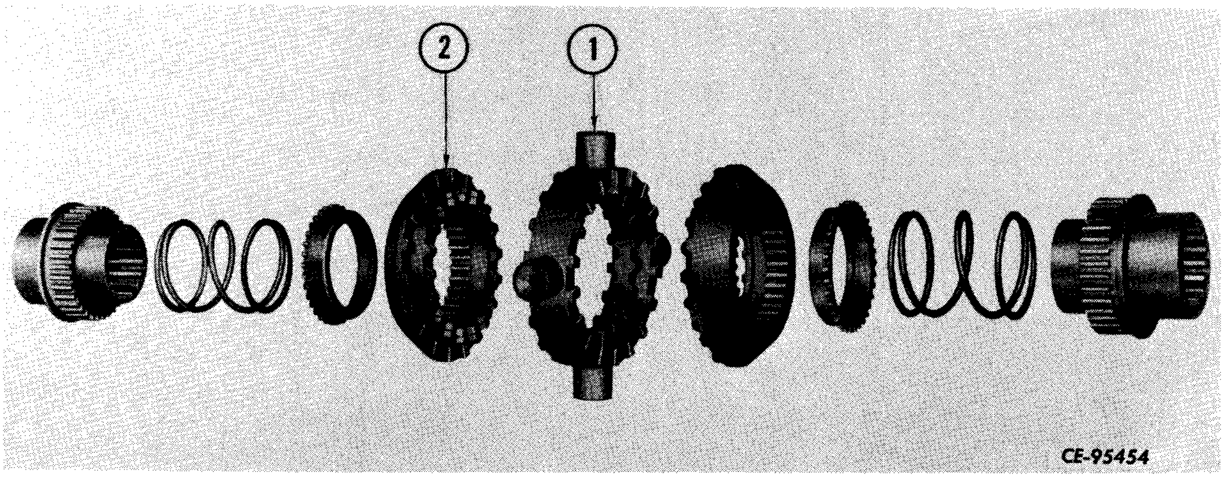

Figure 6-66

CLEANING AND INSPECTION

Wash all parts thoroughly with a cleaning solvent. Inspect all mating surfaces and teeth for possible wear or damage. Replace all worn or damaged parts before assembly. If a part is replaced due to chipped teeth, always replace the mating part as it may have invisible fractures.

ASSEMBLY

Assembly is essentially the reverse of disassembly. Lubricate all parts with SAE-30 oil during assembly. Be sure the indexing tooth on spider assembly (1, Fig. 6-66) is matched with gaps (2) in "holdout" rings.

Hold assembled unit together with bolt, flat washers and nut. Place unit in the differential case and install differential case bolts (refer to Fig. 6-45).

Assembly from this point is the same as conventional differential described in "DIFFERENTIAL DISASSEMBLY AND ASSEMBLY - FRONT AXLE."

OPERATIONAL TEST

After the NoSPIN differential is installed in the axle and prior to putting the PAY loader to work, test the operation of the NoSPIN installation as follows:

1. Raise rear axle from floor. Place transmission in gear. With the aid of an assistant, rotate both wheels in a forward direction as far as possible. Hold left wheel firmly and rotate right wheel rearward to test for free operation. There should be no noise present, and only a slight indexing sound when wheel is rotated forward again.

2. Rotate both wheels rearward as far as possible. Hold left wheel firmly and rotate right wheel forward to test for free operation. This gives a check for proper operation forward and rearward on the right side of NoSPIN differential.

3. Repeat procedure described above for remaining wheel. This insures proper operation of differential. If any excessive noise is noticed, inspect differential to determine cause.

PLANETARY DISASSEMBLY AND ASSEMBLY

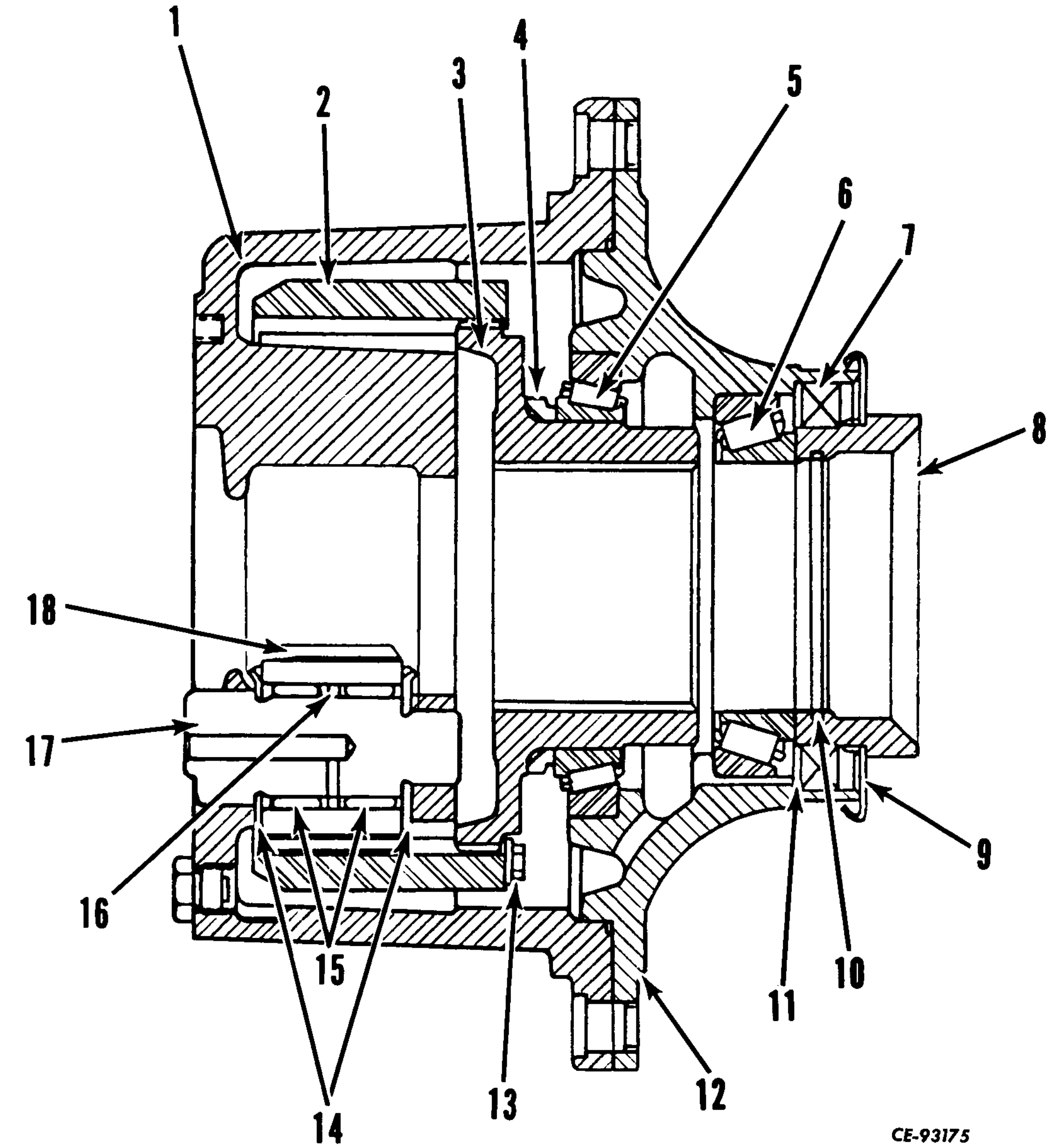

Figure 6-67
Planetary Drive - Cross Section.

1. Planetary carrier.
2. Ring gear.
3. Ring gear hub.
4. Spacer.
5. Outer wheel hub roller bearing.
6. Inner wheel hub roller bearing.
7. Oil seal.
8. Seal retainer.
9. Oil scavenger.
10. "O" ring.
11. Spacer.
12. Wheel hub.
13. Lock plate with cap screw.
14. Thrust washer.
15. Bearing.
16. Spacer.
17. Planetary pinion shaft.
18. Pinion gear.

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.

CARRIER DISASSEMBLY

Press out planet pinion shafts (8, Fig. 6-68) from small end of shafts using a shop press. Remove thrust washers (1, 6), pinions (2), bearings (3, 5) and spacer (4).

Remove and inspect bearings and spacers from within pinion gears. Check gear bore. Check shafts for wear, nicks or flaking. If worn or damaged, replace as needed.

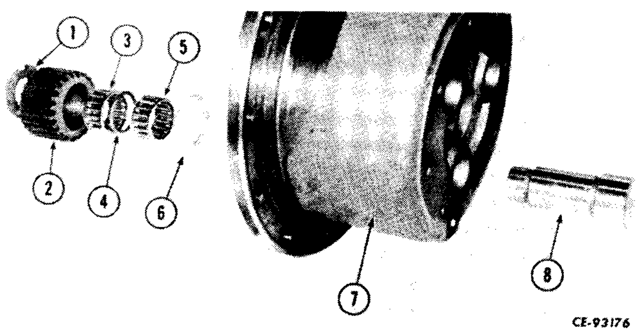

Figure 6-68

ASSEMBLY PREPARATION

Assembly preparation should include:

a. Cleaning all parts thoroughly in solvent. Dry parts with compressed air.

> CAUTION: NEVER dry bearings by spinning with compressed air.

b. Inspect all bearings.

c. Inspection of pinions for wear or damage. Pinions showing wear or damage should be replaced.

d. Inspection of pinion shafts for wear or ridging.

e. 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.

f. Obtain a sufficient amount of dry ice to chill the pinion shafts.

Pinion shafts must be packed in dry ice for at least 30 minutes to shrink them sufficiently for easier 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.

CARRIER ASSEMBLY

Assemble planetary pinions, bearings, spacers and thrust washers. Install pinion assemblies (1, Fig. 6-69) in carrier (2) in their approximate positions. All three pinions must be positioned before any shafts are installed. Be sure thrust washer tabs are aligned with indentation in carrier.

PLANETARY DISASSEMBLY AND ASSEMBLY

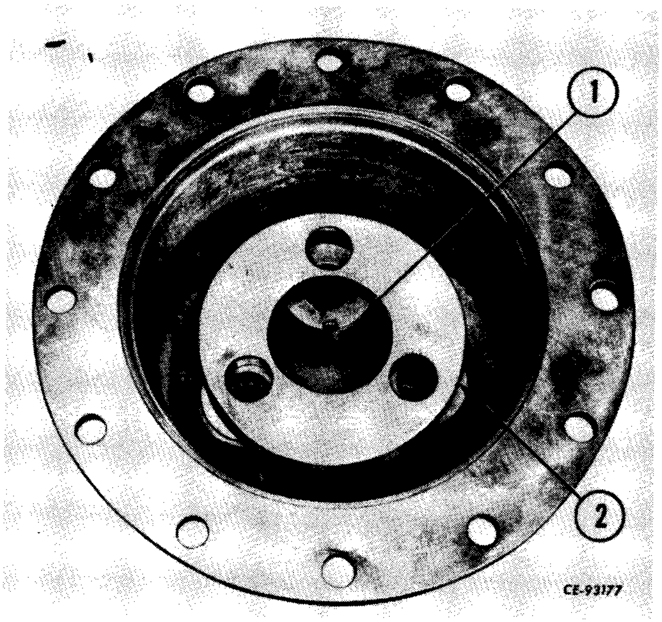

Figure 6-69

Pack pinion pins (1, Fig. 6-70) in dry ice for at least 30 minutes to shrink them sufficiently for easier installation.

Press in a planet pinion shaft (1) small diameter first. Be sure flats on side of shaft are to outside of planet carrier. This provides clearance for cover and properly locates shaft lubricating hole. Press pin in until shoulder fits against thrust washer. Similarly install remaining two planet pinion shafts.

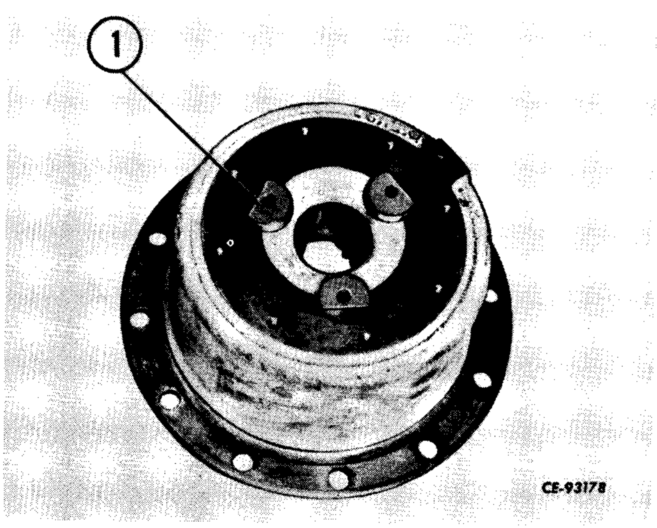

Figure 6-70

RING GEAR AND HUB DISASSEMBLY

Remove cap screws (2, Fig. 6-71) and lockplates (3) that secure ring gear (1) to ring gear hub (4). Remove ring gear.

Using a suitable puller, remove bearing cone (6) and spacer (5) from ring gear hub (4).

Wash all parts in cleaning solvent. Inspect splines and gear teeth for wear or damage. Inspect bearing cone for wear or flat spots. Replace damaged or excessively worn parts.

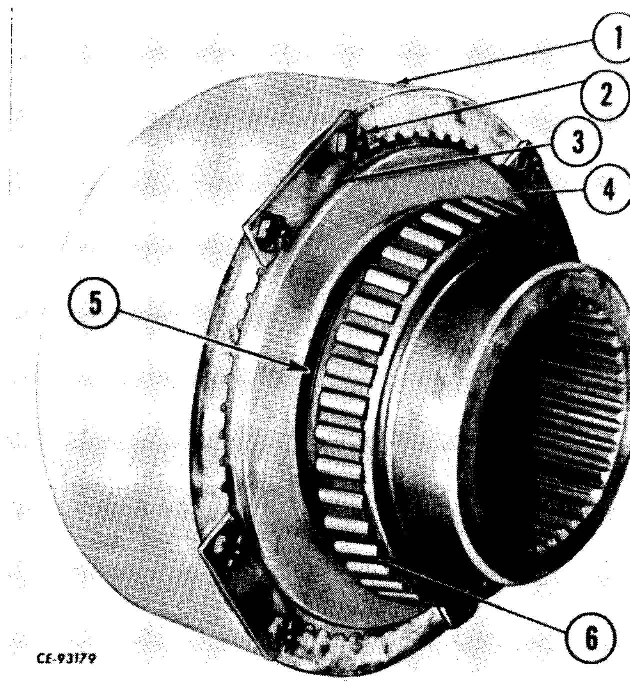

Figure 6-71

RING GEAR AND HUB ASSEMBLY

Install spacer (5, Fig. 6-71) on ring gear hub (4).

Chill ring gear hub and install bearing cone (6) against spacer.

Position ring gear (1) on the hub; secure with lock plates (3) and cap screws (2). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:

PLANETARY DISASSEMBLY AND ASSEMBLY

WHEEL HUB AND SEAL RETAINER DISASSEMBLY

Remove and discard "O" ring (7, Fig. 6-72) from groove in seal retainer (8). Pry out and discard hub seal (6). Remove spacer (5).

Remove bearing cone (4) from hub (2). Mark bearing cup and cone so pair can be rematched if they are reused. Examine cone and cups for wear or damage. Check rollers for flat or worn spots.

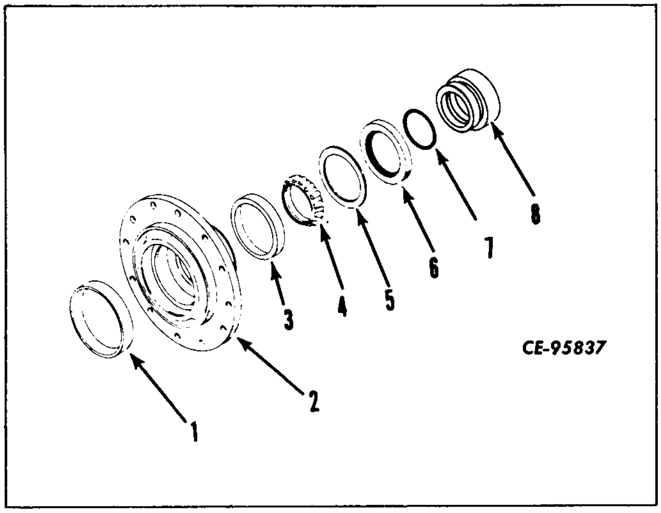

Figure 6-72

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 other damage. If cup or cone is damaged replace complete bearing. If replacement is required, press the damaged cup(s) (1, 3, Fig. 6-72) from the hub.

WHEEL HUB AND SEAL REAL RETAINER ASSEMBLY

If bearing cup(s) (1, 3, Fig. 6-72) were removed, press new cups in hub (2). Be sure cups bottom on shoulder of hub. Lubricate bearing cone (4) with new axle lubricant (refer to "LUBRICANTS AND CAPACITIES") and install it in bearing cup (3) in hub.

Install spacer (5) against hub shoulder.

Coat O. D. of a new seal (6) with MAR-SEAL or equivalent sealant. Press new seal in hub against spacer. Seal lip must face in toward bearing cone (4).

Install new "O" ring (7) in groove in bore of seal retainer (8).

TROUBLE SHOOTING

GENERAL

Noise and vibration, originating in the transmission, drive shaft 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.

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TROUBLE SHOOTING

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.
	DIFFERENTIAL	
Noise when turning.	1. Worn spider gears or side gears.	1. Replace gears.
Loss of lubricant.	1. Worn drive pinion oil seal.	1. Replace oil seal.
	2. Scored or worn differential drive yoke.	2. Replace drive yoke and drive pinion oil seal.
Differential overheats.	1. Incorrect lubricant or level too low.	1. Check level; fill with correct grade and type of lubricant. Check differential housing for leaks.
	2. Pinion or ring gear bearing worn.	2. Replace worn bearings.
	3. Gear teeth excessively worn or damaged.	3. Replace gears.
	4. Unmatched pinion and ring gear.	4. Replace with a new matched pinion and ring gear.

(Continued on next page)

TROUBLE SHOOTING

TROUBLE SHOOTING CHART - Continued

COMPLAINT	PROBABLE CAUSE	REMEDY
DIFFERENTIAL - Continued		
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. 2. Worn thrust washers.	1. Replace damaged gears. Check drive axle for alignment and examine other gears and bearings for possible damage and replace as needed. 2. Replace 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 bearings for possible damage. Clean out housing and fill with correct grade and type of lubricant.

TROUBLE SHOOTING

COMPLAINT	PROBABLE CAUSE	REMEDY
Gear scored. - Continued	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.

SERVICE INFORMATION

SPECIFICATIONS

AXLE

Overall Length . . . . 79"
Track - With Standard Wheels . . . . 74"
Approximate Weight . . . . 760 lbs.

RATIOS

Differential 4.88:1
Planetary 5.2:1
Total 25.38:1

LUBRICANTS AND CAPACITIES

Capacity		Lubricant			
Differential (each)	22 pts.	IH 135H EP OR	GL-5	Above 32°F . .	140
Planetaries (each)	2 pts.	MIL-L-2105B		Below 32°F . .	90

SERVICE INFORMATION

TOLERANCES

Press Tonnage - Ring gear to flanged case rivets	22 tons
Ring Gear Runout - Maximum	.008"
Initial Backlash - New ring and pinion gear set	.010"
Backlash Alteration Limitations - Permissible during adjustment	.005"-.015"

SPECIAL TORQUES

(Threads lubricated with oil or grease)

Axle housing-to-differential housing flange cap screws	53-60 ft. lbs.
Axle mounting cap screws	315 ft. lbs.
Bearing Adjusting Nut	300 ft. lbs.
Wheel Stud Retaining Nut	290-320 ft. lbs.
Differentials:	
Bearing cap bolts	115-130 ft. lbs.
Case half cap screws	45-50 ft. lbs.
Mounting cap screws	92-118 ft. lbs.
Pinion bearing cage-to-housing cap screws	27-35 ft. lbs.
Pinion shaft nut	175-250 ft. lbs.
Planetary carrier cover cap screws	3/8 x 16-32 29-35 ft. lbs.
Planetary ring gear hub-to-ring gear cap screws	13-20 ft. lbs.
Wheel stud nuts	*440 ft. lbs.

* Wheel stud nuts must be torqued dry.

SPECIAL TOOLS

AXLE REMOVAL AND INSTALLATION TOOL

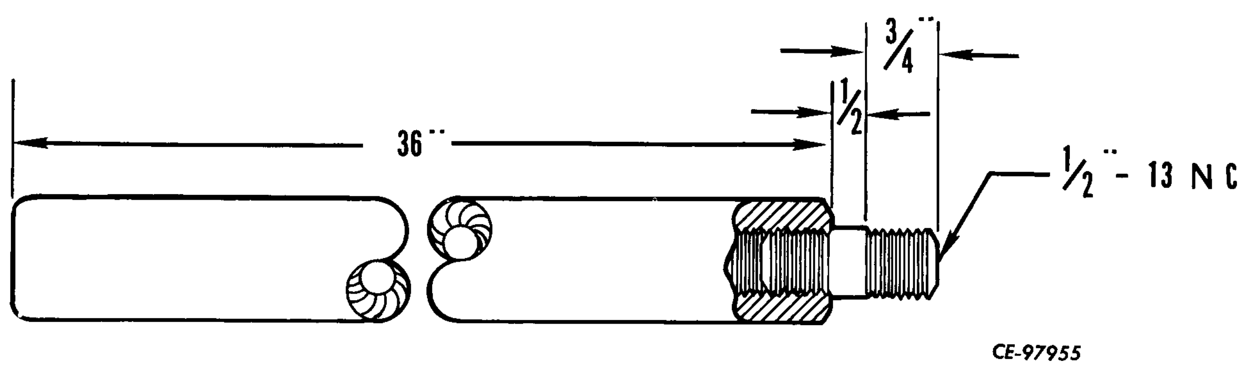

Figure 6-73

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SERVICE INFORMATION

DIFFERENTIAL HOLDING FIXTURE

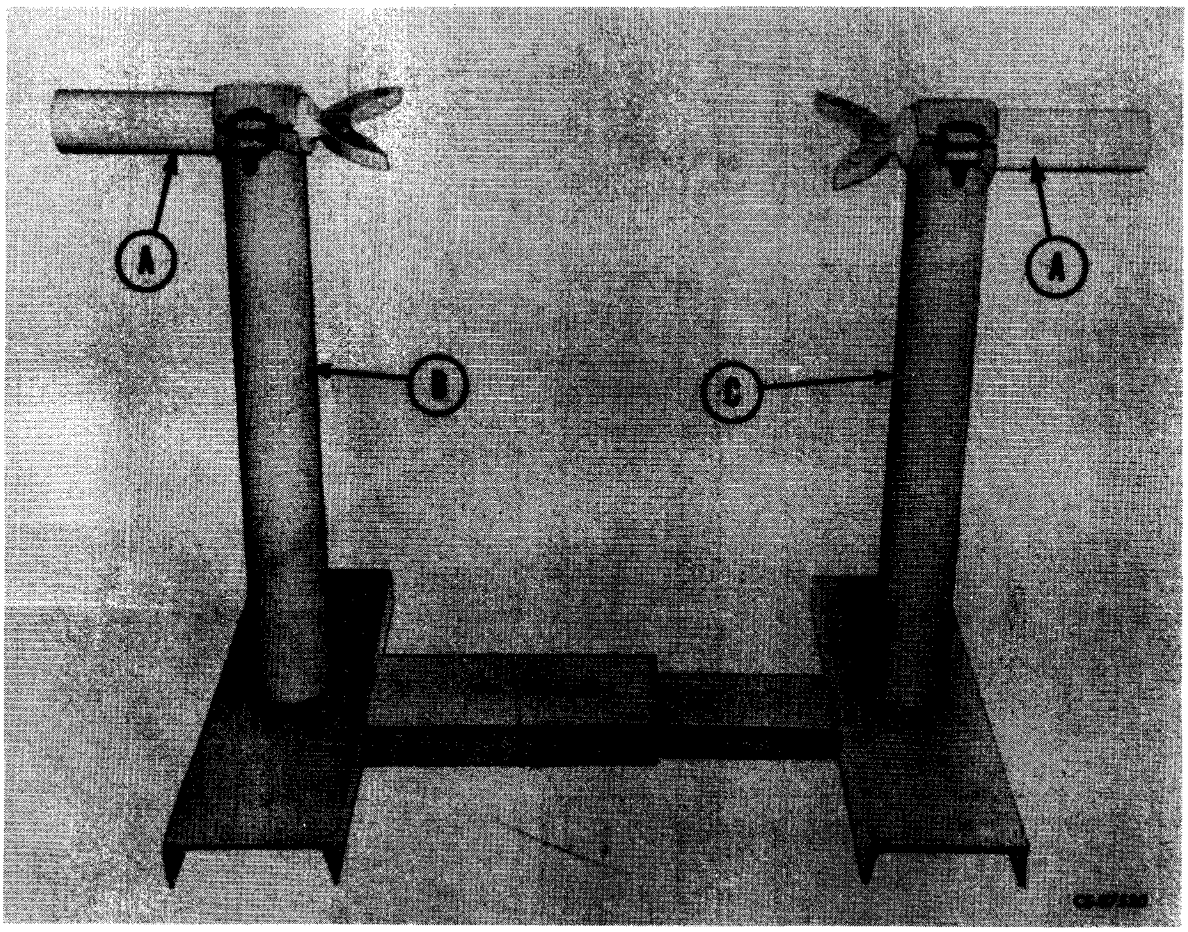

Figure 6-74
Assembled Differential Holding Fixture.

A. Swivel weldment (Fig. 6-75).

B. Stand weldment - left hand (Fig. 6-76).

C. Stand weldment - right hand (Fig. 6-77).

(Continued on next page)

SOLID AXLES

SERVICE INFORMATION

SPECIAL TOOLS - Continued

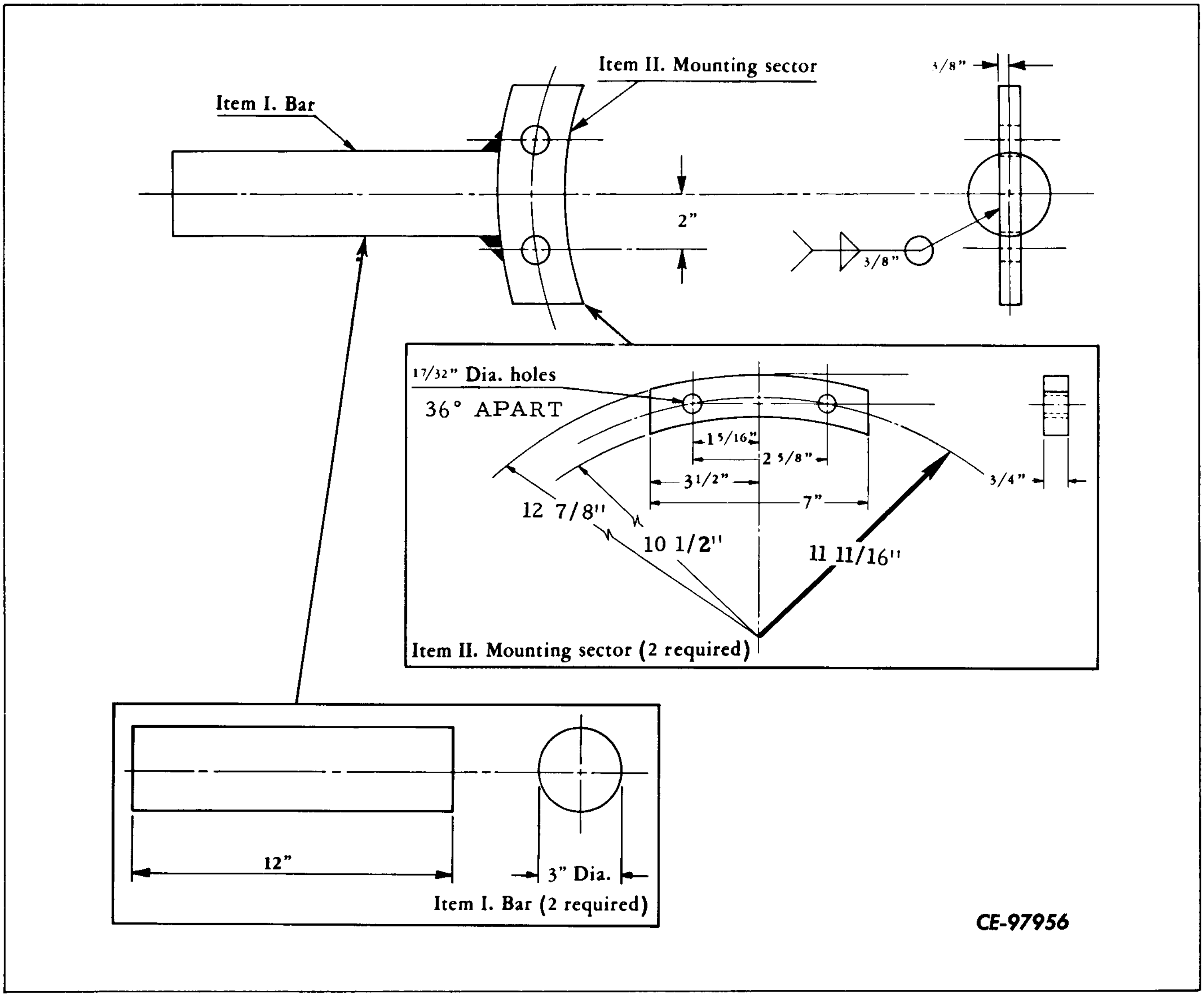

Figure 6-75
A. Swivel Weldment (2 Required).

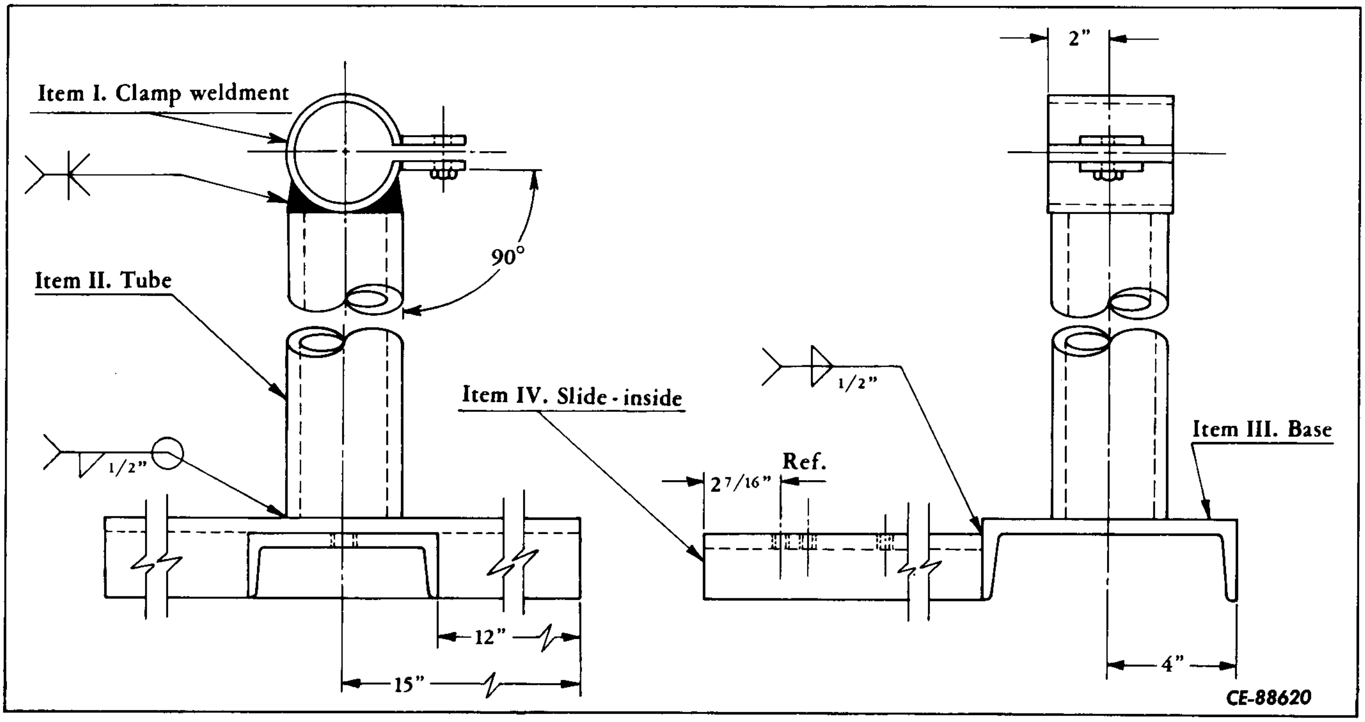

Figure 6-76
B. Stand Weldment Assembly - Left Hand (1 Required).
(Details Shown in Figures 6-78, 6-79, 6-80 and 6-81)

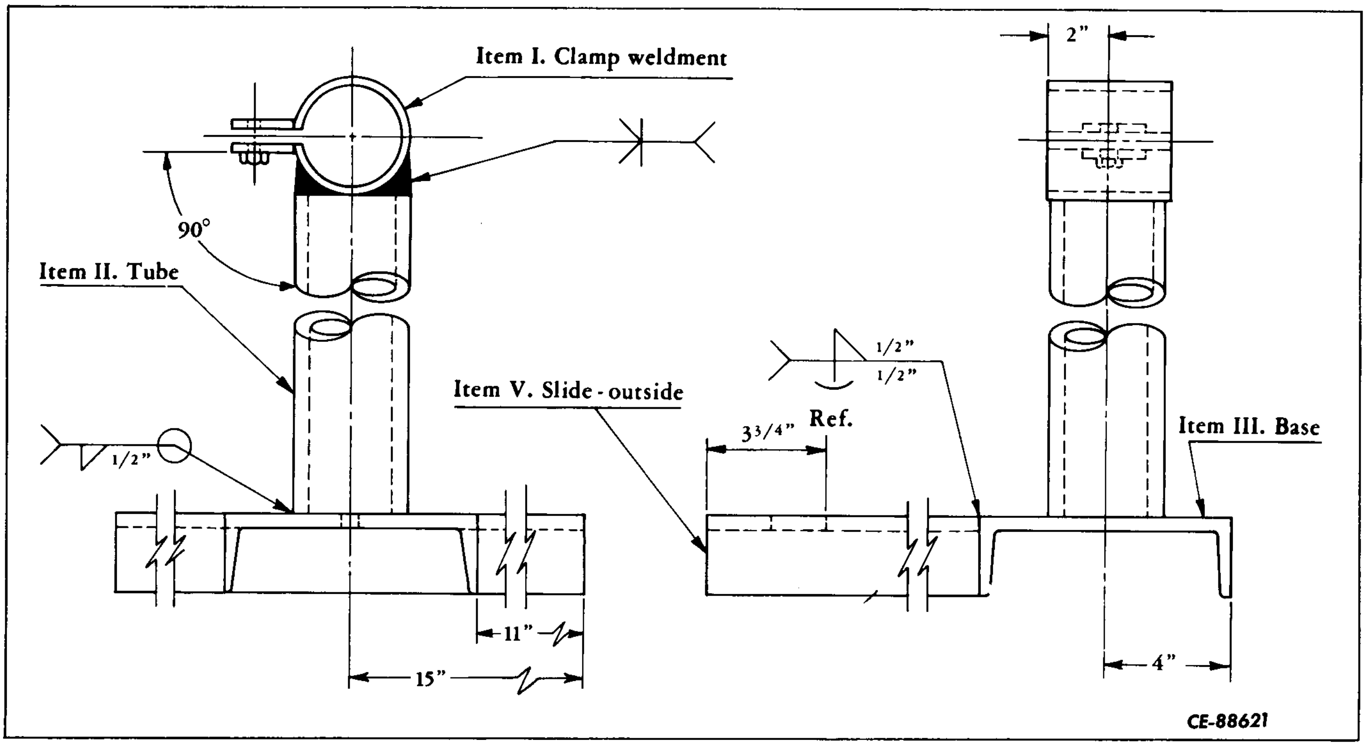

Figure 6-77
C. Stand Weldment Assembly - Right Hand (1 Required).
(Details Shown in Figures 6-78, 6-79, 6-80 and 6-82)

(Continued on next page)

SERVICE INFORMATION

SPECIAL TOOLS - Continued

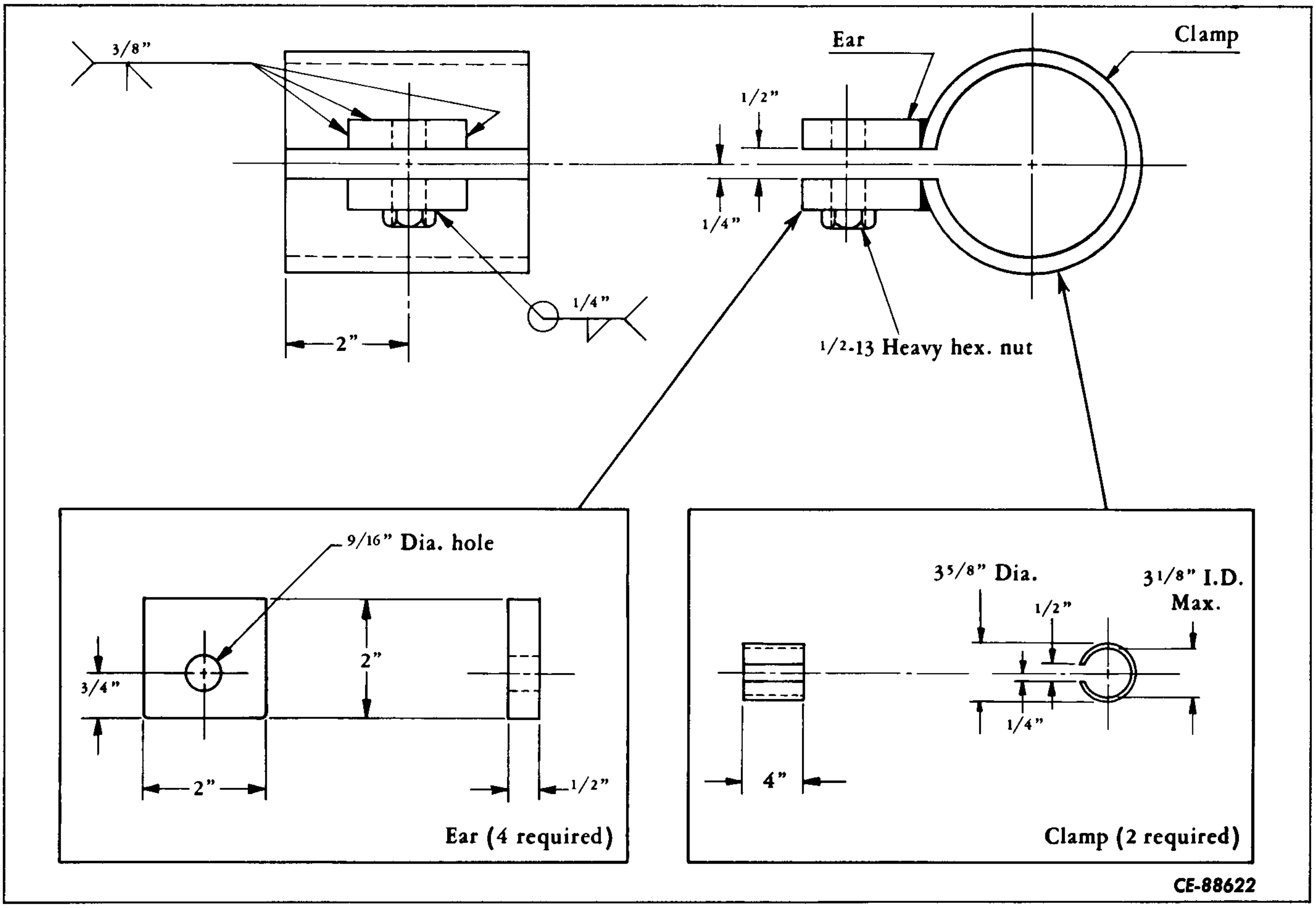

Figure 6-78
Item I. Clamp Assembly (2 Required).

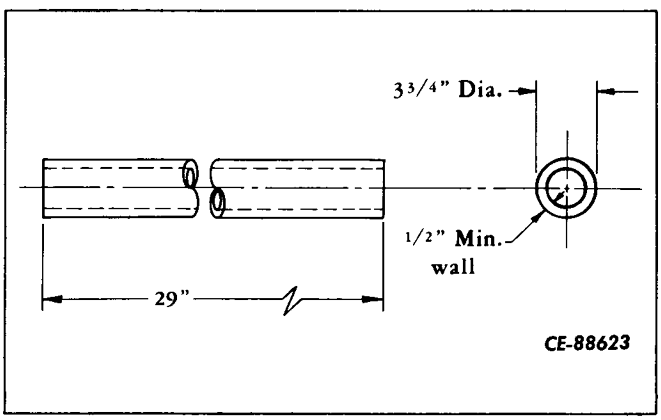

Figure 6-79
Item II. Tube (2 Required).

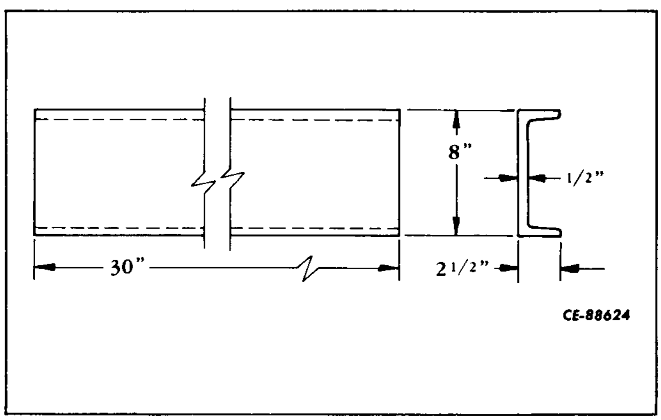

Figure 6-80
Item III. Base (2 Required).

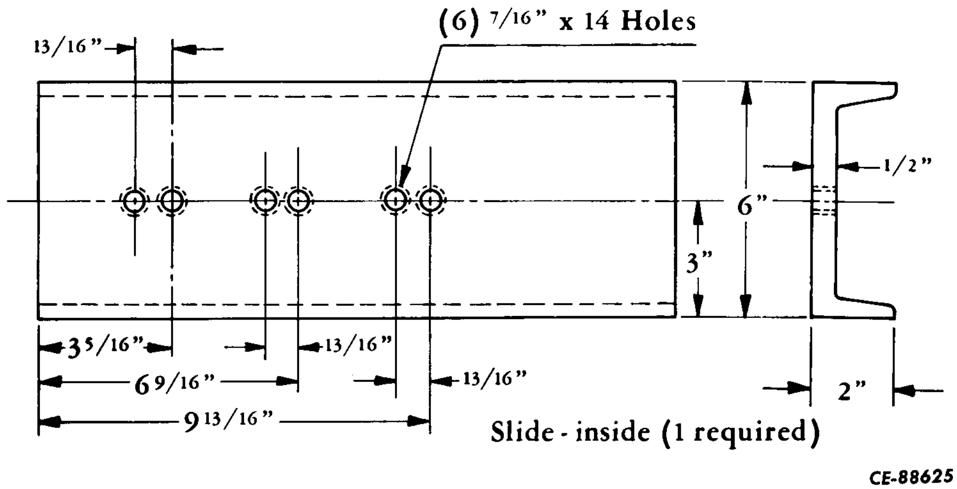

Figure 6-81
Item IV. Slide-Stand Weldment (Left Hand).

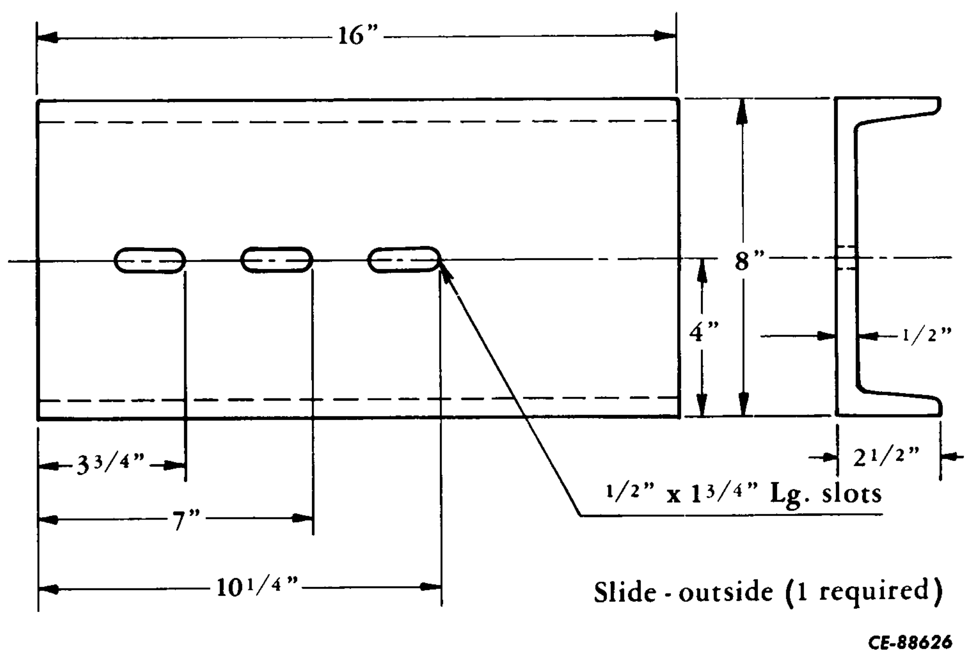

Figure 6-82
Item V. Slide-Stand Weldment (Right Hand).

SERVICE INFORMATION

NUMBER	DATE	SUBJECT	CHANGES

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SECTION VII
STEERING AXLE

Not Applicable

SECTION VIII
STEERING GEAR

Page

SECTION VIII STEERING GEAR

DISASSEMBLY AND ASSEMBLY

DISASSEMBLY

The steering gear consists of a steering wheel (4, Fig. 8-1) keyed to the steering gear shaft (11). With a limited movement of the steering gear shaft the steering valve is actuated to desired spool position. When the wheel is released, the spring loaded valve spool centers the steering wheel.

Remove steering gear from the operator's compartment by disconnecting linkage between the steering shaft (11) and control valve. Remove cap screws and nuts disconnecting the steering gear from the mounting position on the instrument panel.

To disassemble the steering gear assembly, place gear in vise and remove nut (1, Fig. 8-1) and flat washer (2). Remove set screw (3) and using a suitable puller, remove steering wheel (4) from shaft (11). Remove thrust washer and seal ring (5). Loosen hose clamps (9) and slide sleeve (10) back exposing stop bolt (8). Remove stop bolt (8) and pull shaft (11) from column (6). Check the condition of the teflon bushings inside the ends of the steering column (6). If bushings are worn or damaged replace with new bushings.

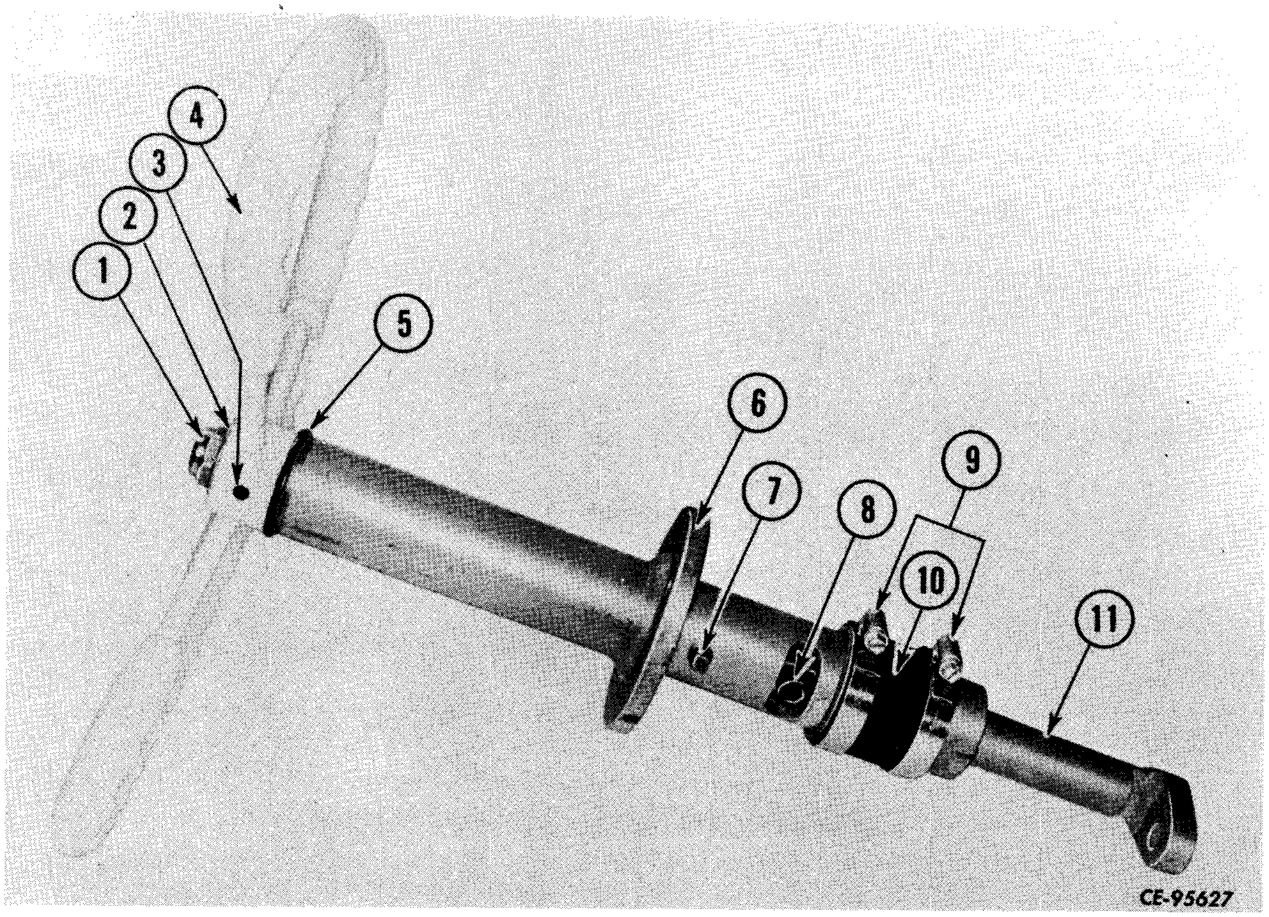

Figure 8-1
Steering Gear.

1. Steering wheel nut.
2. Flat washer.
3. Set screw.
4. Steering wheel.
5. Seal ring.
6. Steering column.
7. Plug.
8. Stop screw.
9. Hose clamps.
10. Sleeve.
11. Steering gear shaft.

DISASSEMBLY AND ASSEMBLY

ASSEMBLY

Inspect all thrust washers (10, 6, Fig. 8-2), and teflon bushings on the ends of the steering column (9). If these parts are worn or damaged, replace with new parts.

Place steering column (9) in vise and insert shaft (12) with thrust washer (10) and a new seal ring (11) in place. Install remaining thrust washer (6) and new seal ring (7) on end of shaft (12). Place key (5) in groove on shaft (12) and install steering wheel (4) on shaft (12). Install flat washer (2) and nut (1) on end of shaft. Tighten nut until a slight drag between the shaft (12) and steering column (9) exists. Install and tighten set screw (3) in center of steering wheel.

NOTE: Hand pack steering column (9) with chassis greases (NLGI-Grade 2) before installation of steering shaft (12).

Install and tighten allen head stop bolt (8) through steering column to shaft (12). Slide sleeve (14) over steering column stop bolt and tighten hose clamps (13).

Install assembled steering gear in instrument panel using cap screws and nuts.

Connect the linkage between the steering gear and steering valve spool (refer to "STEERING LINKAGE," Section IX).

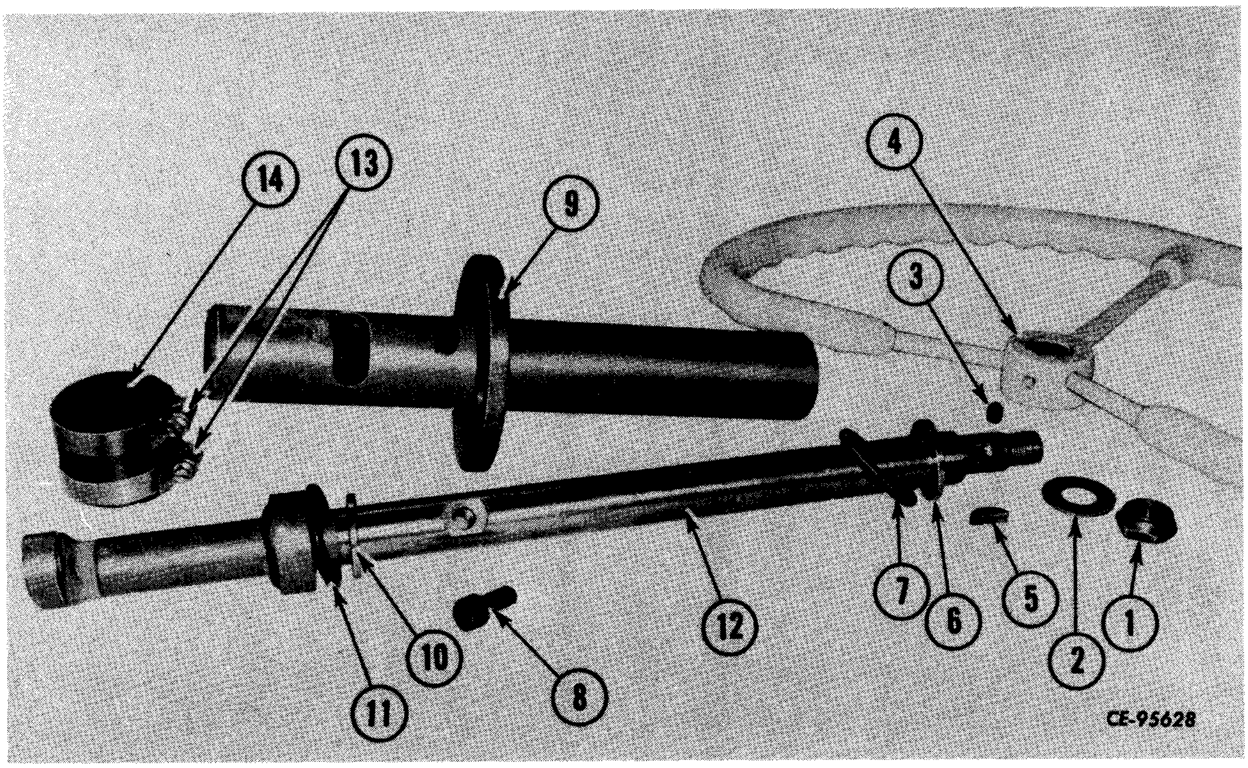

Figure 8-2

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SECTION IX
LINKAGE

Page

SECTION IX LINKAGE

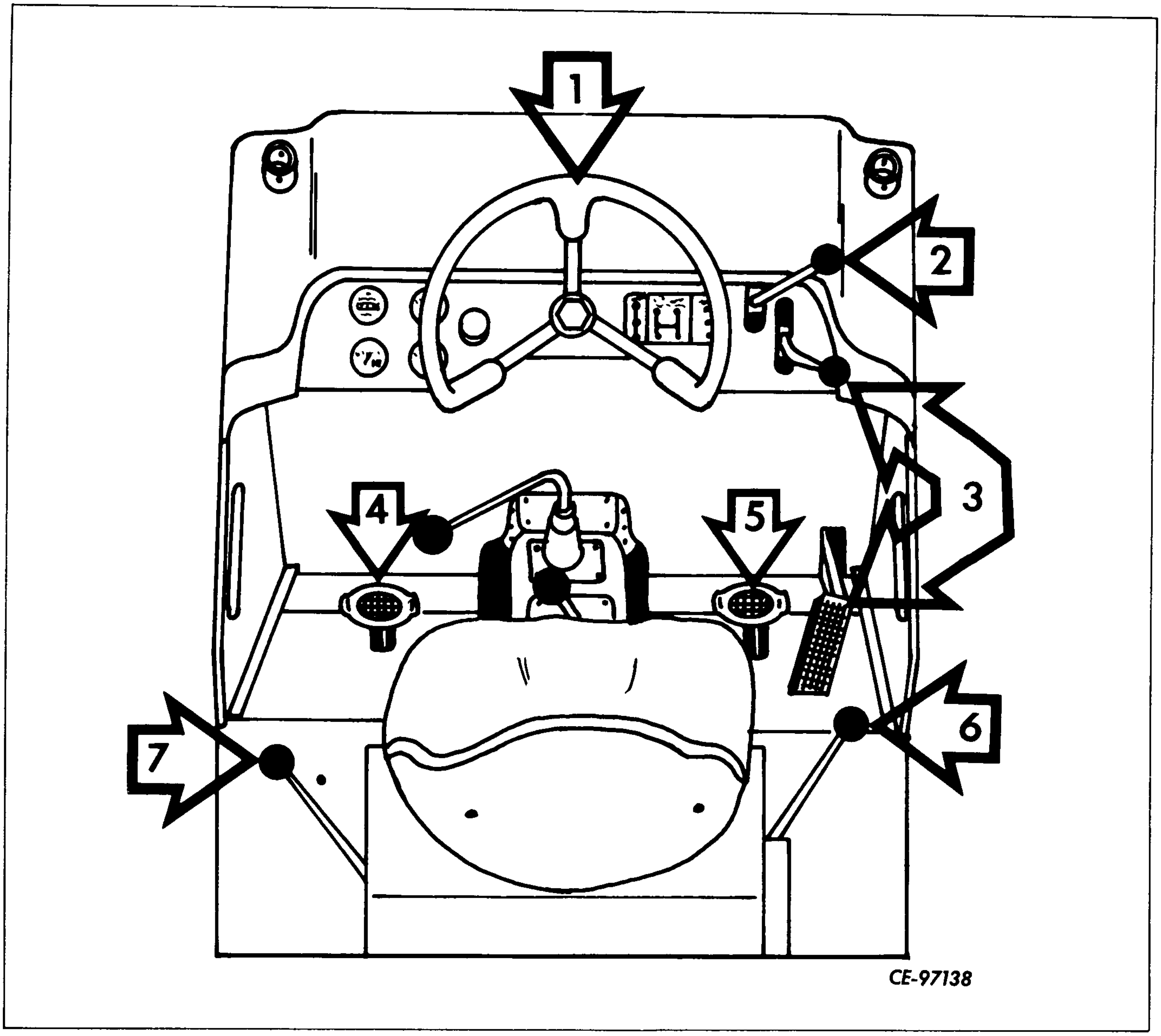

Figure 9-1

1. STEERING LINKAGE
2. BLADE CONTROL LINKAGE
3. ACCELERATOR LINKAGE
4. CLUTCH LINKAGE
5. SERVICE BRAKE LINKAGE
6. WINCH CONTROL LINKAGE
7. TRANSFER CASE LINKAGE

LINKAGE

CLUTCH LINKAGE

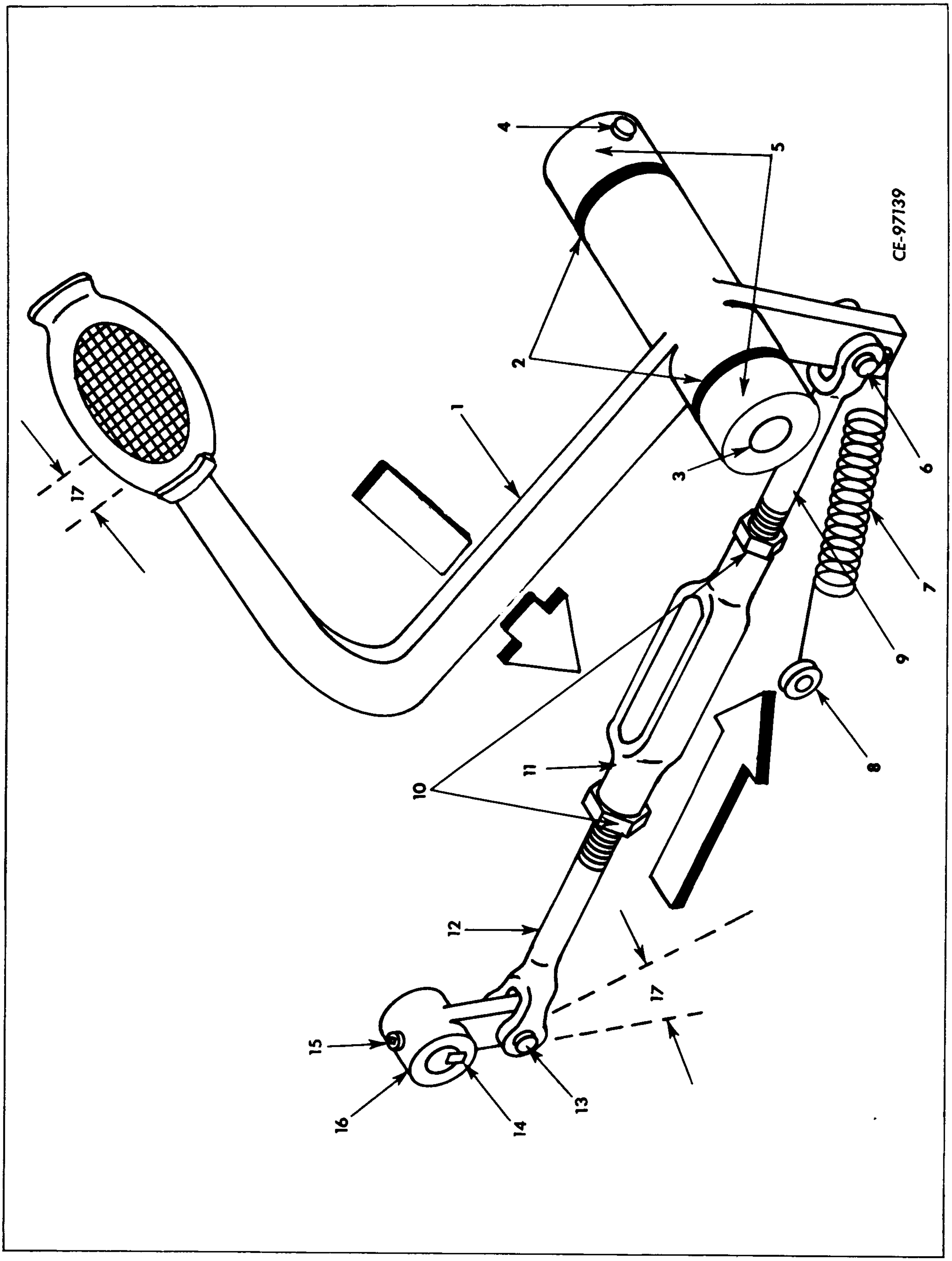

Figure 9-2
Clutch Linkage.

CLUTCH LINKAGE

Legend for Figure 9-2

1. Clutch pedal and bushings.
2. "O" rings.
3. Pivot pin.
4. Roll pin.
5. Mounting brackets.
6. Clevis pin and cotter pin.
7. Return spring.
8. Mounting bracket.
9. Rod and clevis.
10. Jam nuts.
11. Turnbuckle.
12. Rod and clevis.
13. Clevis pin and cotter pin.
14. Woodruff key.
15. Set screw.
16. Clutch arm.
17. "Free-play."

DISASSEMBLY

Remove right hand floor panel directly below clutch pedal by removing cap screws and lock washers.

Disconnect pedal return spring (7, Fig. 9-2). Remove clevis pins and cotter pins (6, 13) disconnecting pedal (1) and clutch arm (16).

Drive roll pin (4) out through mounting bracket (5) and pivot pin (3). Drive pivot pin (3) out through mounting brackets (5) and hub of pedal (1). Inspect condition of teflon bushings inside hub of clutch pedal. Replace bushings if worn or damaged.

Loosen set screw (15) and using a suitable puller, remove clutch arm (16).

ASSEMBLY

Position woodruff key (14) between clutch shaft and clutch arm (16) and drive clutch arm on. Tighten set screw (15).

NOTE: Hand pack clutch pedal hub with chassis grease (NLGI - Grade 2).

Position clutch pedal (1) and new "O" rings (2) between mounting brackets (5) and drive pivot pin (3) through pedal hub and hub of mounting brackets. Align bore in mounting bracket with pivot pin bore and drive roll pin (4) in.

Assemble rod and clevises (9, 12) with jam nuts (10) and turnbuckle (11) and connect the assembled rods between clutch arm (16) and pedal (1). Install clevis pins and cotter pins (6, 13).

Refer to "ADJUSTMENT" for proper clutch pedal adjustment.

Position floor panel on its mounting brackets and install and tighten cap screws and lock washers.

ADJUSTMENT

5/8 inch clutch pedal "free-play" is required to allow operating clearance between clutch release bearing and clutch release levers. Lack of clutch "free-play" causes undue wear on the clutch facings and bearings.

To obtain proper clutch "free-play" loosen jam nuts (10) and rotate turnbuckle (11) counter-clockwise to reduce and clockwise to increase "free-play."

With proper pedal "free-play" obtained, tighten jam nuts (10).

TRANSFER CASE LINKAGE

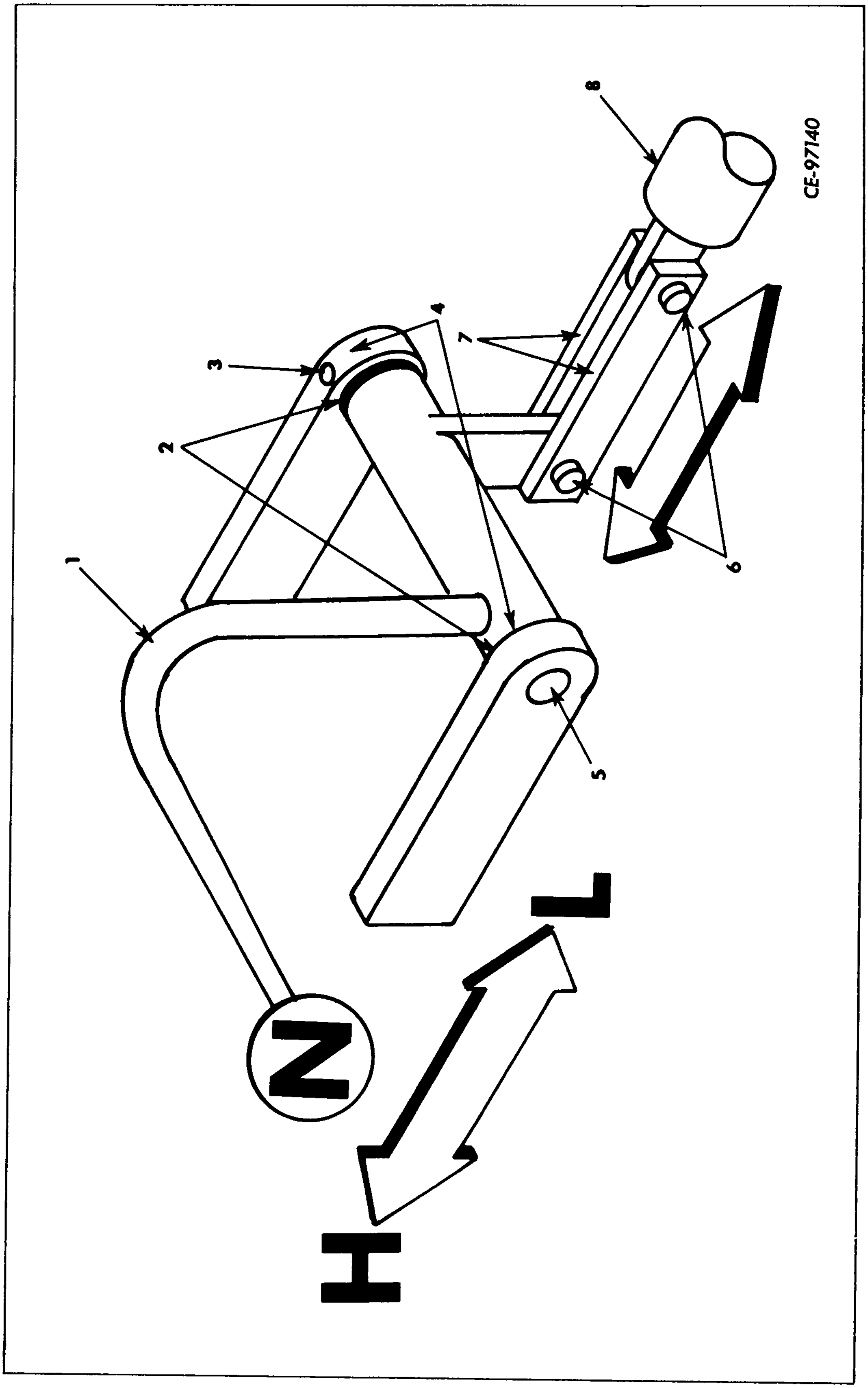

Figure 9-3
Transfer Case Linkage.

1. Control lever and bushings.
2. "O" rings.
3. Roll pin.
4. Mounting bracket.
5. Pivot pin.
6. Clevis pins and cotter pins.
7. Links.
8. Valve spool.

TRANSFER CASE LINKAGE

DISASSEMBLY

Remove operator's seat from seat base by removing cap screws and lock washers.

Disconnect control lever (1, Fig. 9-3) from valve spool (8) by removing cotter pins and clevis pins (6).

Drive roll pin (3) out through mounting bracket (4) and pivot pin (5). Inspect bushings inside control lever hub for wear or damage. Replace if necessary.

ASSEMBLY

Hand pack hub of control lever (1) with chassis grease (NLGI - Grade 2). Position control lever (1) and "O" rings (2) between mounting brackets (4) and drive pivot pin (5) through control lever hub and hub of mounting brackets. Align bore in mounting bracket (4) with pivot pin bore (5) and install roll pin (3).

Connect control lever to valve spool by installing links (7), clevis pins and cotter pins.

Position operator's seat on seat base and install and tighten cap screws and lock washers.

STEERING LINKAGE

DISASSEMBLY

Refer to Section 8, "STEERING" for disassembly and assembly of steering column assembly.

Disconnect rod ends (4, 6, Fig. 9-4) between steering column and valve spool (8) by removing cap screws, lock washers and nuts (3, 7).

Inspect rod end bearings for wear or damage. Replace if necessary.

ASSEMBLY AND ADJUSTMENT

Assemble rod ends (4, 6) and jam nut (5). Position end of rod end (6) in line with valve spool (8) and install and tighten cap screw, lock washer and nut (7). With jam nut (5) loose, rotate rod end (4) until bore of rod end is in alignment with center position of steering wheel (1). Install and tighten cap screw, lock washer and nut (3). Tighten jam nut (5).

STEERING LINKAGE

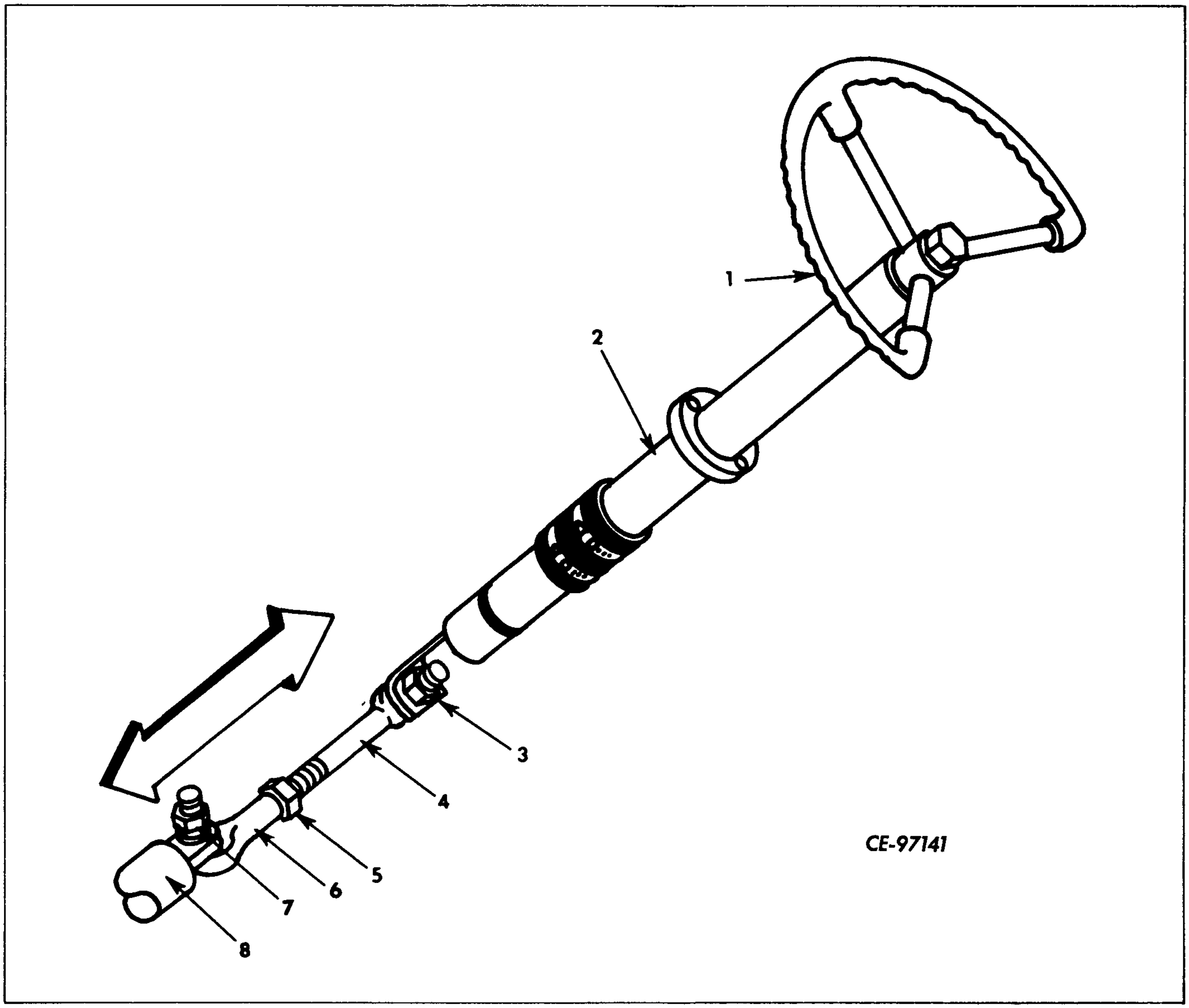

Figure 9-4
Steering Linkage.

1. Steering wheel.
2. Steering column.
3. Cap screw, washer and nut.
4. Rod end.
5. Jam nut.
6. Rod end.
7. Cap screw, washer and nut.
8. Valve spool.

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ACCELERATOR LINKAGE

DISASSEMBLY

Disconnect rod and clevis (33, Fig. 9-5) from foot pedal lever (31) and cross shaft (22) by removing cotter pins and clevis pins (32, 34).

Remove lever (31) from foot pedal by removing nuts and lock washers (28). Remove foot pedal (26) from the floor panel by removing cap screws and lock washers (27).

Remove return spring (37) from cross shaft (22) and eye bolt (38).

Disconnect rod (17) from cross shaft by removing cotter pin and clevis pin (20). Rod (17) rides free inside of tube and clevis (3) and will slide out when rod is disconnected.

Disconnect rod and clevis (14) between the cross shaft and throttle lever (10) by removing cotter pins and clevis pins (11, 15).

Remove cap screws, lock washers and nuts (24). Remove support bearing (25) and cross shaft (22) from mounting bracket (23). Remove remaining support bearing (21) by removing cap screws, lock washers and nuts.

Remove tube and clevis (3) from shaft and lever (1) by removing cotter pin and clevis pin (2). Disassemble hand throttle lever assembly by removing nut (9), flat washer (8), spring (7), throttle lever (6) and friction plate (5) from shaft and lever (1). Remove remaining friction plate (4), shaft and lever (1) from mounting bracket.

ASSEMBLY

Install shaft and lever (1, Fig. 9-5) through friction plate (4) and mounting bracket. Install friction plate (5), throttle lever (6), spring (7), washer (8) and nut (9) to shaft and lever (1). DO NOT TIGHTEN. Install tube and clevis (3) to arm of shaft and lever (1) by installing clevis pin and cotter pin (2).

Install support bearing (21) to mounting bracket (16) by installing cap screws, lock washers and nuts. Install end of cross shaft (22) into mounted support bearing (21) and install support bearing (25) to end of cross shaft. Install and tighten cap screws, lock washers and nuts (24).

Connect cross shaft (22) to throttle lever (10) by installing rod and clevis (14), jam nut (13) and clevis (12). Install clevis pins and cotter pins (11, 15).

Install return spring (37) to cross shaft (22) and eye bolt (38).

Insert end of rod (17) into tube and clevis (3) and install jam nut (18) and clevis (19). Install clevis pin and cotter pin (20).

Install foot pedal lever (31) to accelerator pedal (26). Install and tighten nuts and lock washers (28).

Position accelerator pedal (26) on the floor panel and install and tighten lock washers and cap screws (27).

Connect foot pedal lever (31) to cross shaft (22) by installing rod and clevis (33) jam nut (36) and clevis (35). Install clevis pins and cotter pins (32, 34).

ADJUSTMENT

NOTE: Before accelerator linkage adjustment is made apply the brake lock lever, position the transmission in "NEUTRAL" and using the safety bar and pins, lock the tractor halves in the straight lock position.

Check the amount of tension on return spring (37, Fig. 9-5) to be certain it has enough to properly return the linkage. Tension adjustment can be accomplished by removing spring (37). Loosen jam nut (39) and rotate eye bolt in either direction depending on the adjustment needed. Install return spring (37) and tighten jam nut (39).

Loosen jam nut (30) and remove pedal stop cap screw (29).

Loosen nut (9) enough to allow throttle lever (6) to be loose during adjustment procedure.

(Continued on page 9)

ACCELERATOR LINKAGE

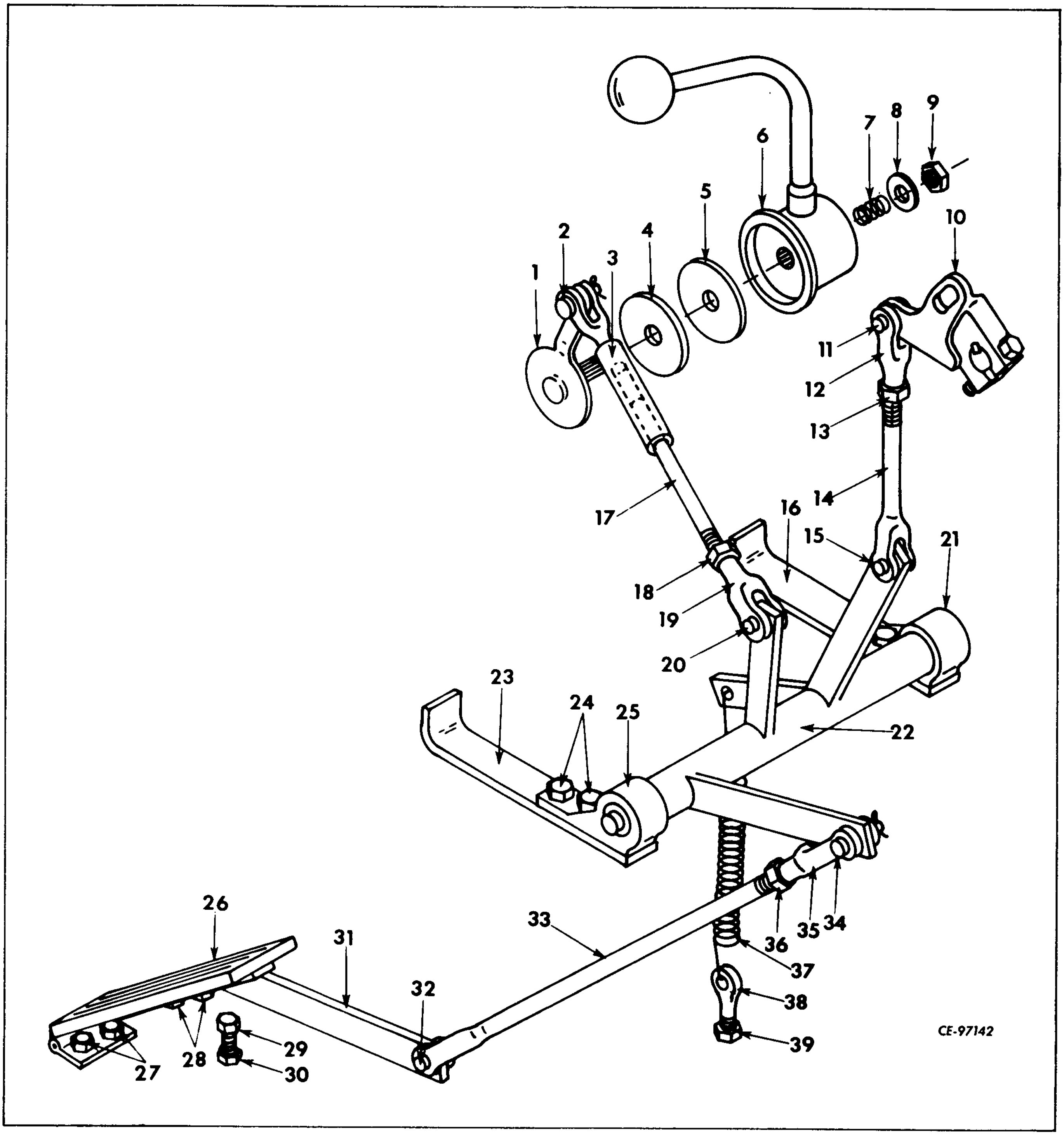

Figure 9-5
Accelerator Linkage.

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ACCELERATOR LINKAGE

Legend for Figure 9-5

1. Shaft and lever.
2. Clevis pin and cotter pin.
3. Tube and clevis.
4. Friction plate.
5. Friction plate.
6. Hand throttle lever.
7. Spring.
8. Washer.
9. Nut.
10. Throttle lever.
11. Clevis pin and cotter pin.
12. Clevis.
13. Jam nut.
14. Rod and clevis.
15. Clevis pin and cotter pin.
16. Mounting bracket.
17. Rod.
18. Jam nut.
19. Clevis.
20. Clevis pin and cotter pin.
21. Support bearing.
22. Cross shaft.
23. Mounting bracket.
24. Cap screws, lock washers and nuts.
25. Mounting bearing.
26. Accelerator pedal.
27. Lock washers and cap screws.
28. Nuts and lock washers.
29. Pedal stop cap screws.
30. Jam nut.
31. Foot pedal lever.
32. Clevis pin and cotter pin.
33. Shaft and lever.
34. Clevis pin and cotter pin.
35. Clevis.
36. Jam nut.
37. Return spring.
38. Eye bolt.
39. Jam nut.

ADJUSTMENT - Continued

With the aid of a tachometer adjust the engine to the recommended low idle RPM's. Refer to Section 2, "ENGINE SPECIFICATIONS."

Accelerate engine to maximum recommended RPM's. If linkage adjustment is needed to obtain maximum RPM's, remove cotter pin and clevis pin (11), loosen jam nut (13) and rotate clevis (12). Connect linkage by installing clevis pin and cotter pin (11) and re-check for maximum engine RPM's.

Install jam nut (30) and pedal stop cap screw (29) to the floor panel. Press down on accelerator to maximum engine RPM and adjust cap screw (29) to come in contact with accelerator pedal in this position. Tighten jam nut (30).

Adjust shaft and lever (1) positioning tube and clevis (3) tight against rod (17). While holding shaft and lever (1) position throttle lever (6) to the idle position in relation with the dash panel. Tighten nut (9) enough to allow throttle lever (6) to move and hold desired idle position.

Start the engine and check the complete accelerator linkage adjustment. Refer to adjustment procedure if additional adjustment is required. Tighten all jam nuts.

BLADE CONTROL LINKAGE

DISASSEMBLY

Disconnect links (2, Fig. 9-6) between valve spool (3) and blade control lever (1) by removing cotter pins and clevis pins (4).

Remove cap screw (8), lock washer (7), spacer (6), "O" rings (5) and lever (1). Inspect teflon bushings inside hub of control lever (1). Replace if damaged or worn.

ASSEMBLY

Position control lever (1), with new "O" rings (5) on each end, and install cap screw (8), lock washer (7), spacer (6) through the hub of control lever. Tighten cap screw enough to allow movement of control lever.

Install links (2) between valve spool (3) and control lever arm and install clevis pins and cotter pins (4).

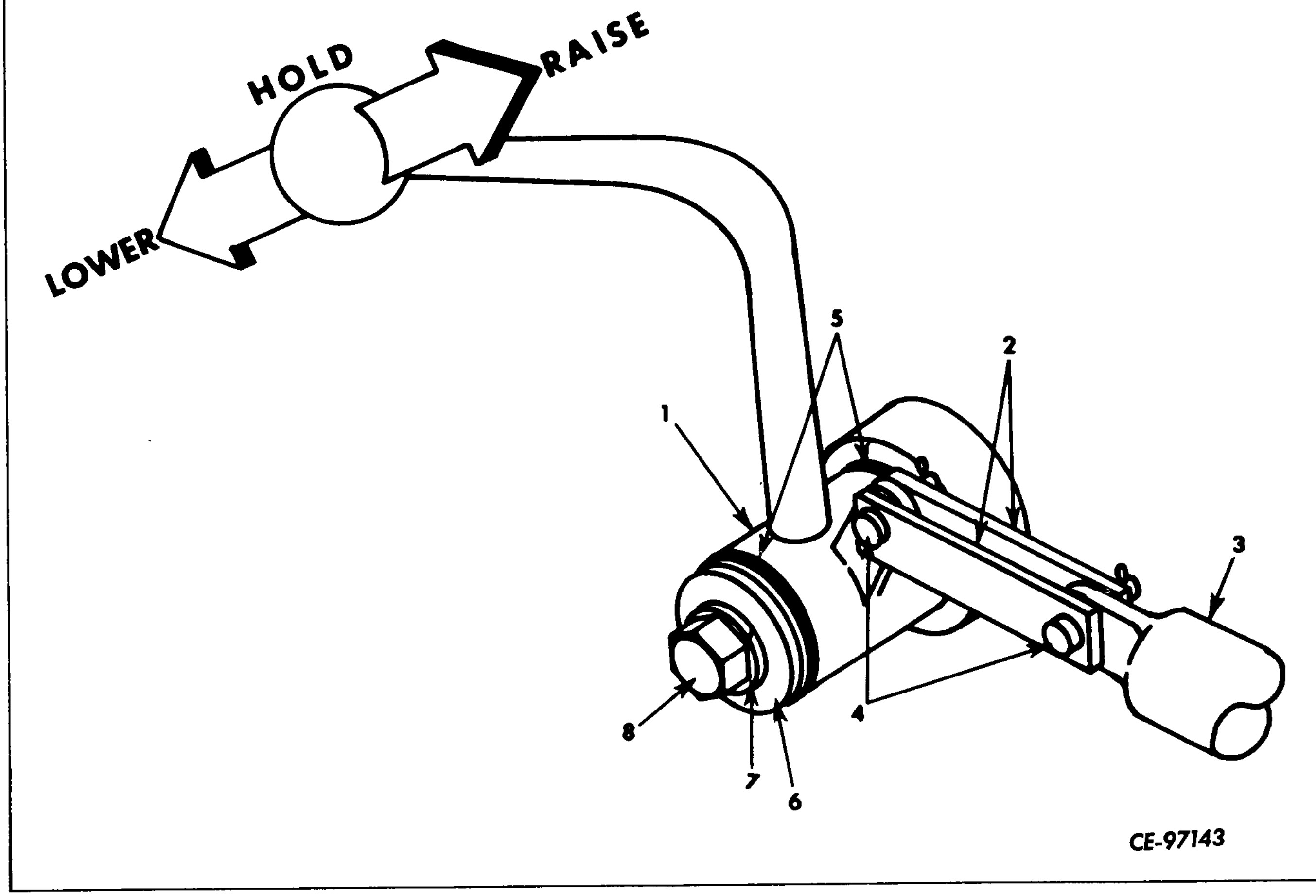

Figure 9-6
Blade Control Linkage.

1. Blade control lever.
2. Links.
3. Valve spool.
4. Clevis pins and cotter pins.
5. "O" rings.
6. Flat washer.
7. Lock washer.
8. Cap screw.

WINCH CONTROL LINKAGE

DISASSEMBLY

Disconnect control lever (1, Fig. 9-7) from valve spool (3) by removing cotter pins, clevis pins (5) and links (4). Remove nut and cap screw (6). Remove control lever mounting bracket (7) from control valve (8) by removing socket head cap screws and lock washers (2).

ASSEMBLY

Position control lever mounting bracket (7) on end of control valve (8) and install and tighten socket head cap screws (2).

Position end of control lever (1) between mounting brackets (7). Install and tighten cap screw and nut (6). Connect control lever to valve spool with links (4), clevis pins and cotter pins (5).

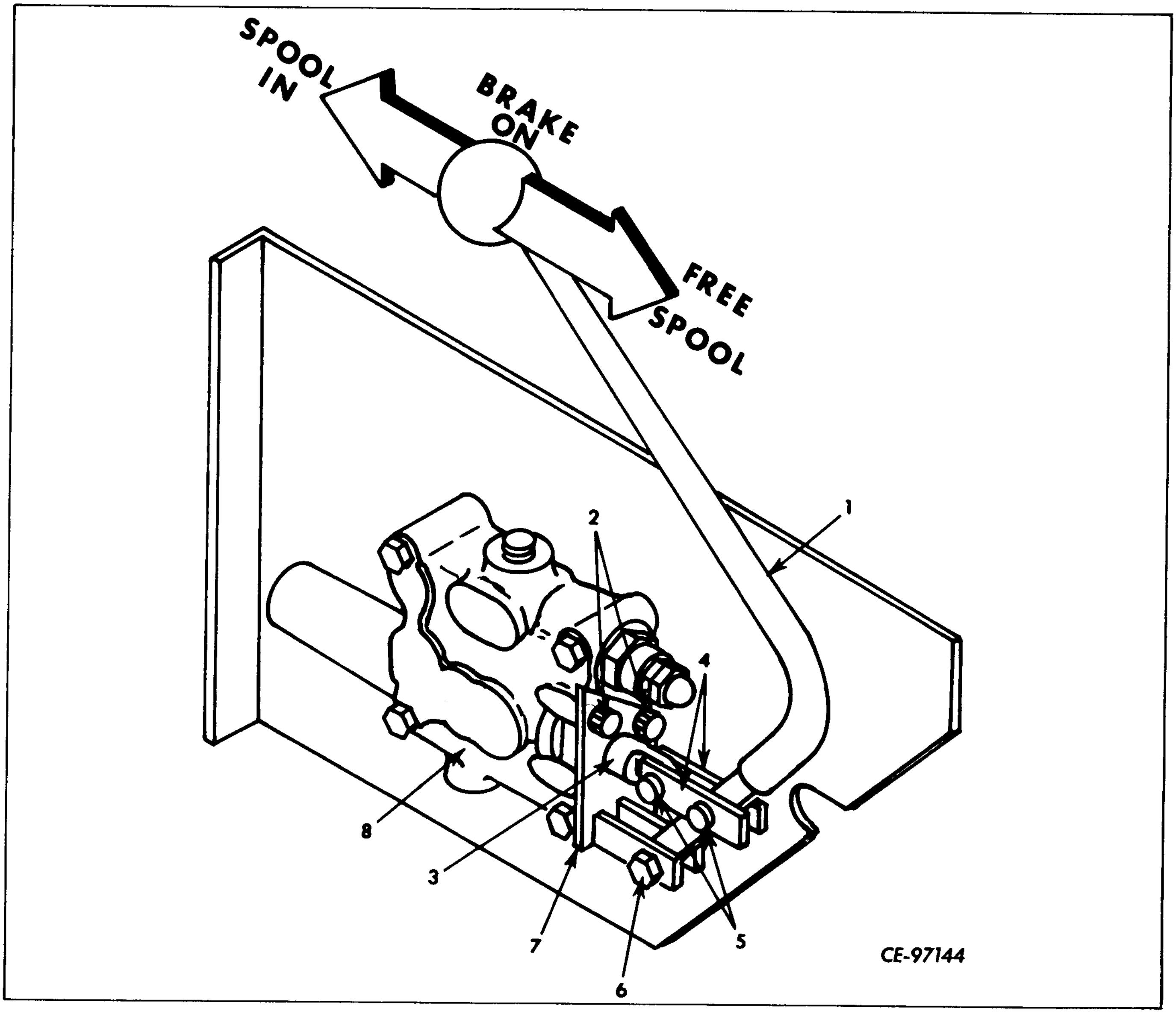

Figure 9-7
Winch Control Linkage.

1. Winch control lever.
2. Socket head cap screw and lock washer.
3. Valve spool.
4. Links.
5. Clevis pins and cotter pins.
6. Cap screws.
7. Mounting bracket.
8. Control valve.

LINKAGE

SERVICE BRAKE LINKAGE

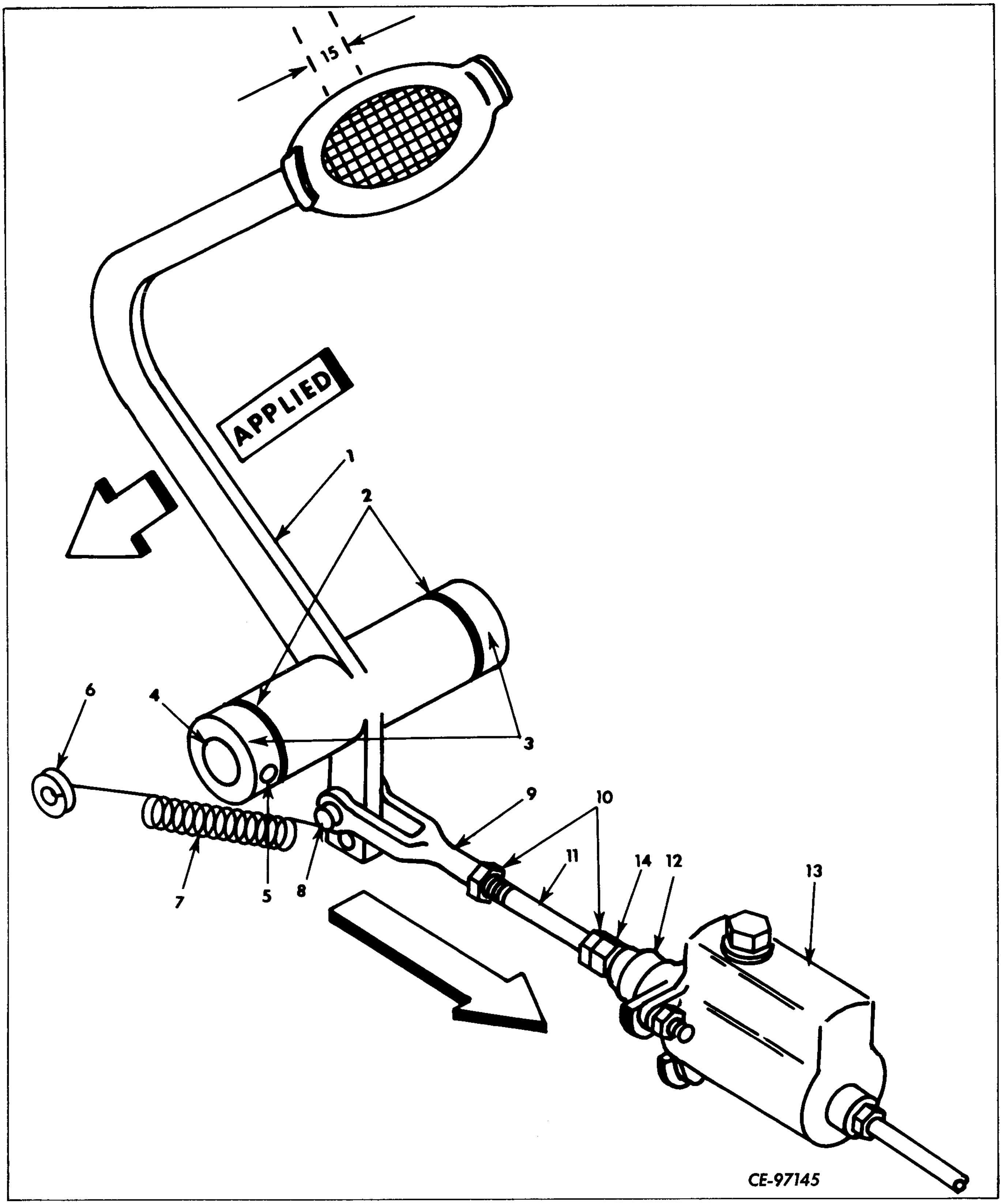

Figure 9-8
Service Brake Linkage.

SERVICE BRAKE LINKAGE

Legend for Figure 9-8

1. Brake pedal and bushings.
2. "O" rings.
3. Mounting bracket.
4. Pivot pin.
5. Roll pin.
6. Mounting bracket.
7. Return spring.
8. Clevis pin and cotter pin.
9. Clevis.
10. Jam nuts.
11. Brake rod.
12. Boot.
13. Master cylinder.
14. Nut.
15. "Free-play."

DISASSEMBLY

Remove return spring (7, Fig. 9-8) from mounting bracket (6) and brake pedal arm (1).

Disconnect the master cylinder brake rod (11, Fig. 9-8) from brake pedal (1) by removing cotter pin and clevis pin (8).

Using a suitable punch, drive roll pin (5) out through mounting bracket (3) and pivot pin (4). Drive pivot pin (4) out through mounting brackets (3) and hub of brake pedal (1). Inspect teflon bushings for wear or damage. Replace if necessary.

For disassembly procedures of the master cylinder (13) refer to Section 13, "BRAKE SYSTEM."

ASSEMBLY

If brake pedal bushings have been removed, press in new bushings. Press bushings flush with open ends of brake pedal hub. Hand pack brake pedal hub with chassis grease (NLGI - Grade 2).

Position brake pedal (1, Fig. 9-8) and "O" rings (2) between mounting brackets (3) and insert pivot pin (4). Install pivot pin (4) aligning roll pin bore with bore in mounting bracket.

Install roll pin (5) through mounting bracket and pivot pin.

Connect master brake cylinder rod (11) to brake pedal arm by installing clevis pin and cotter pin (8).

Install return spring (7) to mounting bracket (6) and brake pedal arm (1).

ADJUSTMENT

Check and correct fluid level before final adjustment. Inability to maintain the proper fluid level usually indicates a system leak. Adjustment of the brake pedal travel must be done from under the right hand floor panel by shortening or lengthing rod (11) between the master cylinder and brake pedal arm (1).

Loosen jam nuts (10) on each end of rod (11) holding nut (14), rotate rod (11) in either direction depending upon the required adjustment.

Proper adjustment is to obtain a 1/4 - 1/2 inch of "free-play" at the beginning of pedal travel. Lack of "free-play" will block bypass port in master cylinder and after several brake applications, brake shoes will drag against brake disc. Excessive "free-play" will decrease usable stroke of master cylinder piston.

Once proper adjustment is accomplished tighten jam nuts (10). Check to be sure that pedal return spring (7) is properly installed and is capable of holding pedal assembly in full release position. Install right hand floor panel.

LINKAGE

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

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SECTION X
HYDRAULIC LINES AND FITTINGS

Material Included in Section XI

SECTION XI
HYDRAULIC SYSTEM

Page

SECTION XI HYDRAULIC SYSTEM

GENERAL INFORMATION

DESCRIPTION

This section refers to the maintenance and repair of the hydraulic reservoir, pump valves and cylinders used in the dozer, winch and steering systems. A general description is provided on each component circuit.

PREVENTIVE MAINTENANCE

GENERAL

Cleanliness, the correct type of oil and an adequate supply for the system are the most important maintenance requirements.

1. Oil of the correct viscosity should be used according to ambient temperatures. Oil added to the system should be of the same type and viscosity of the oil already in the system.

2. 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.

3. Oil level in the hydraulic system reservoir should be kept to "H" mark on dipstick at all times.

4. System oil and filter should be changed at regular intervals, depending upon the type of operation, ambient temperature and working conditions.

5. System pressures should be checked at regular intervals - at least once per month or at the first indication of a system problem.

Fittings, "O" rings, hoses and cap screws should be checked often.

a. All connections should be checked for possible leaks and "O" rings replaced if damaged. All cap screws kept tightened.

b. Reservoir dipstick should be kept closed and tightened at all times. Do not use a substitute covering.

c. Cover on valve adjusting screws should be tightened and "O" rings checked to prevent dirt from entering.

A LOOK IN THE RESERVOIR
CAN PROVE INTERESTING!

ESPECIALLY IF YOU HAVEN'T
CHANGED FILTERS LATELY.

Figure 11-1

REQUIRED TOOLS

Standard Mechanics Hand Tool Set

Hose - 3500 psi minimum working pressure rating.

Gage - In excess of 3000 psi minimum working pressure rating.

Connectors - Sufficient to attach gage and hose to following pressure ports:
1/8" NPT steering pressure port
1/8" NPT hydraulic blade pressure port
1/8" NPT winch pressure port

Torque wrench - 0-500 ft. lbs. rating

COMPONENT CIRCUITS

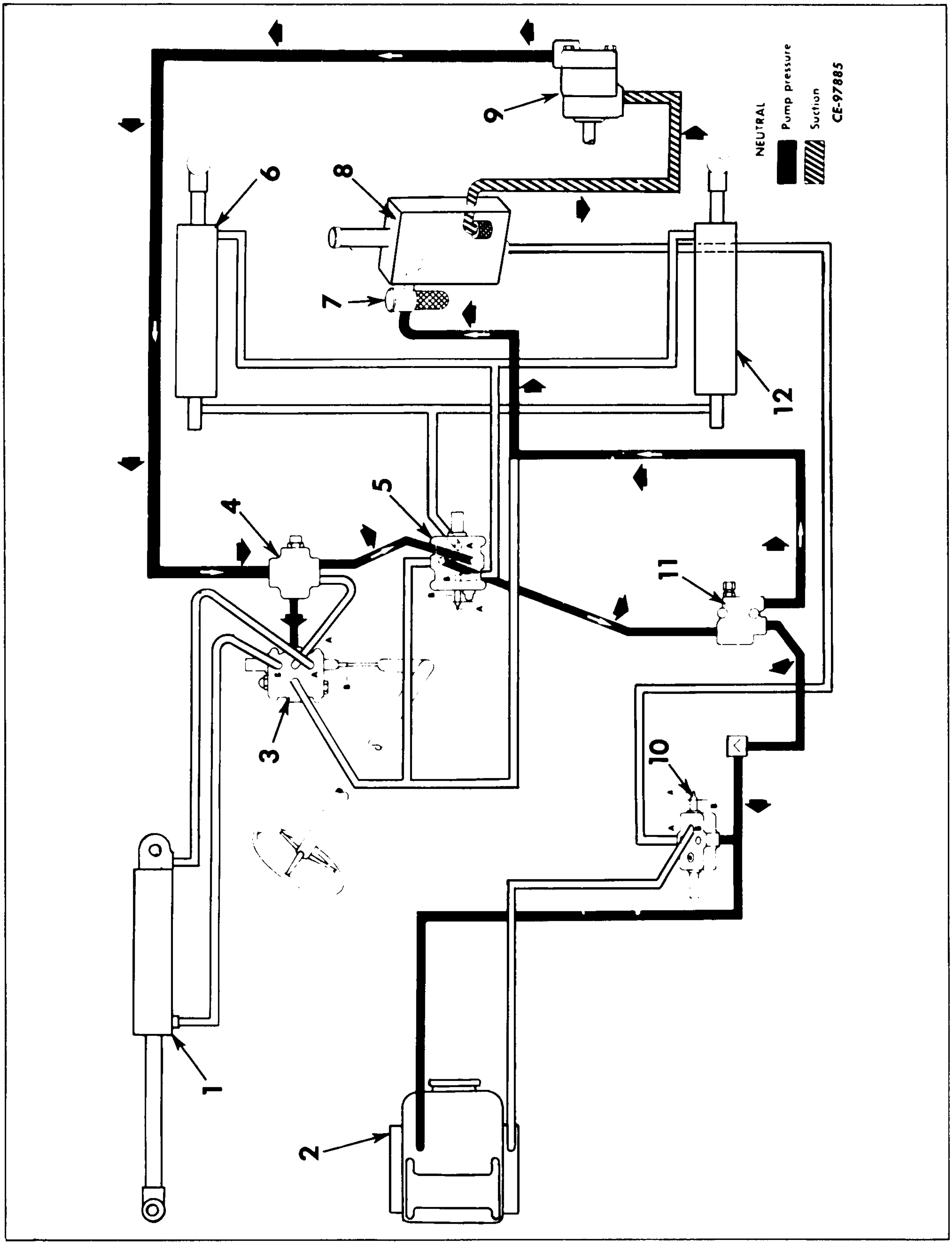

Figure 11-2
Hydraulic System.

COMPONENT CIRCUITS

Legend for Figure 11-2

1. Hydraulic steering cylinder.
2. Winch.
3. Steering control valve.
4. Diverter valve.
5. Dozer blade control valve.
6. Blade cylinder.
7. Hydraulic system filter.
8. Hydraulic reservoir.
9. Hydraulic pump.
10. Winch control valve.
11. Flow divider.
12. Blade cylinder.

OVERALL SYSTEM

The hydraulic system begins with the storage of hydraulic fluid in the reservoir (8, Fig. 11-2). From the reservoir fluid is directed to an engine driven gear pump (9) which produces a flow of oil to operate the steering circuit, dozer circuit and winch circuit.

Oil from the hydraulic pump is piped to a diverter valve (4). From the diverter valve, oil is directed to the steering circuit.

NOTE: The diverter valve on later models was designed to allow the valve to supply some oil to the winch circuit while the majority of the oil is being directed to the steering circuit. This method allows the operator to operate the winch at the same time the tractor is being steered. For information regarding reworking early diverter valves, refer to Service Bulletin No. S-2045.

A pilot line between the steering control valve (3) and diverter valve (4) assures positive steering. When resistance is created within the steering circuit, the resulting pressure is directed through the pilot line causing the diverter valve spool to shift and directing the maximum amount of oil available to the steering circuit. NOTE: Refer to the above note describing the rework of the diverter valve.

When the steering circuit is idle, the diverter valve directs all oil to the dozer circuit with the exception of the metered flow described in Service Bulletin S-2045 to operate the winch. Operating the dozer circuit permits oil from the dozer control valve (5) to flow to the blade cylinders (6, 12). Oil expelled from the low pressure end of the cylinders, returns through the control valve to the reservoir.

The flow control valve (11) directs a metered flow to the winch which is available if needed. When the winch is operated, the control valve (10) directs oil to the winch brake or clutch cylinders. All oil flow in excess of the set amount is returned through a hydraulic oil filter (7) to the hydraulic reservoir.

STEERING CIRCUIT

The steering circuit is composed of a control valve (3, Fig. 11-3) and one double acting hydraulic cylinder (1). Hydraulic oil enters the steering circuit from the diverter valve (6). As the steering wheel is turned the control valve spool is moved directing oil to either side of the double acting cylinder, depending on the direction of turn. The ends of the cylinder are mounted to the two tractor halves. As the cylinder expands or contracts, the tractor's valves pivot in the middle, changing the direction of travel. Hydraulic oil expelled from the low pressure side of the cylinder flows through the control valve to the reservoir.

The limit of the pressure within the steering circuit is controlled by a relief valve located in the steering control valve. Anytime the pressure within the circuit exceeds the predetermined maximum, the relief valve opens and oil is returned to the reservoir.

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COMPONENT CIRCUITS

STEERING CIRCUIT - Continued

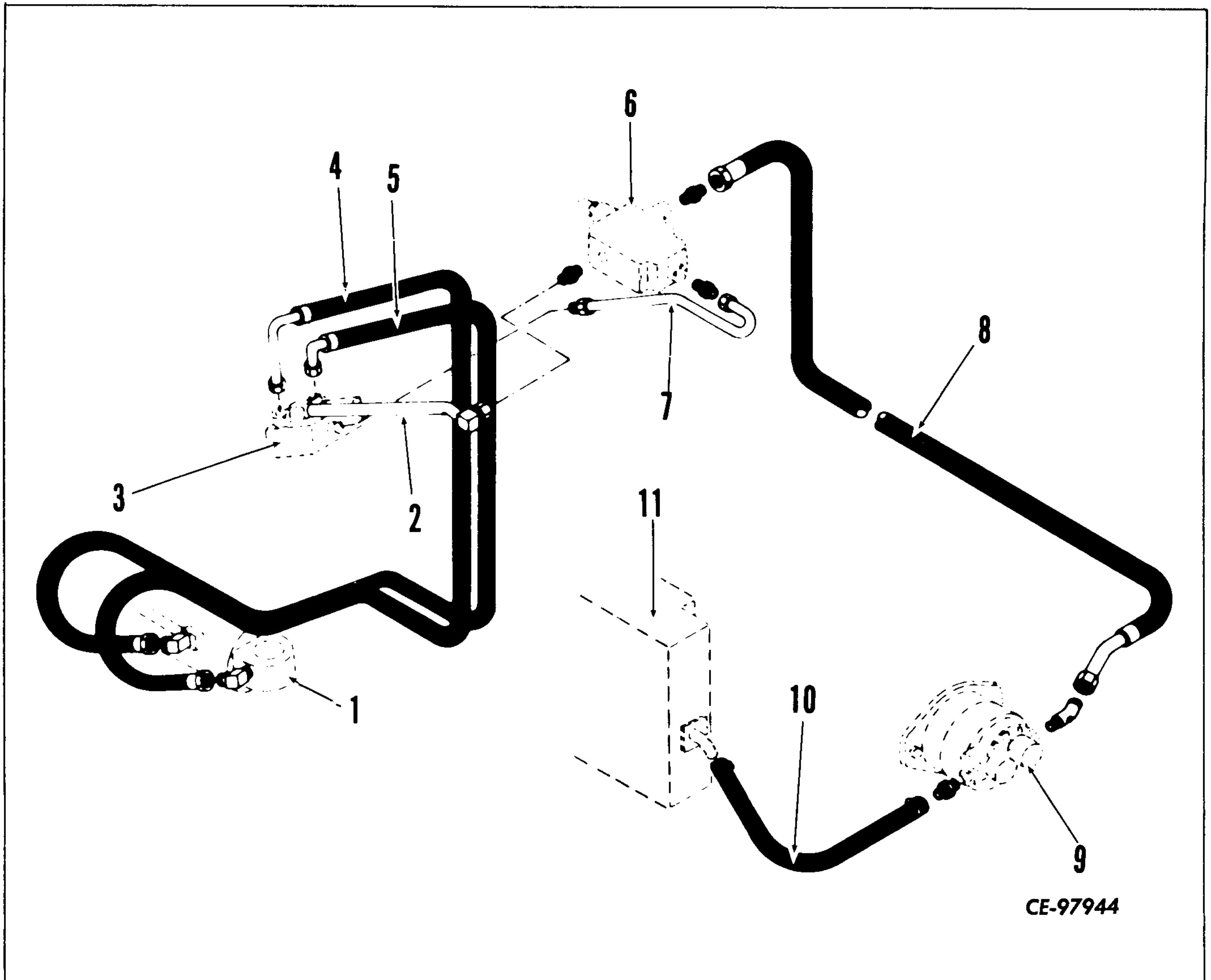

Figure 11-3
Steering Circuit.

1. Steering cylinder.
2. Diverter valve to steering valve supply line.
3. Steering valve.
4. Hose.
5. Hose.
6. Diverter valve.
7. Pilot line.
8. Hose.
9. Pump.
10. Hose.
11. Reservoir.

COMPONENT CIRCUITS

DOZER CIRCUIT

Hydraulic oil from the pump satisfies the demands of the steering and winch circuit first. If the steering circuit is idle the diverter valve (2, Fig. 11-3) directs oil to the dozer control valve (4). As the dozer control lever is moved, the control valve directs oil to either side of the double acting blade cylinders (9, 10). Hydraulic oil expelled from the low pressure side of the cylinders flows through the control valve to the hydraulic reservoir (7).

The limit of the pressure within the dozer circuit is controlled by a relief valve located in the dozer control valve. Anytime the pressure within the circuit exceeds the predetermined maximum, the relief valve opens and returns oil to the reservoir.

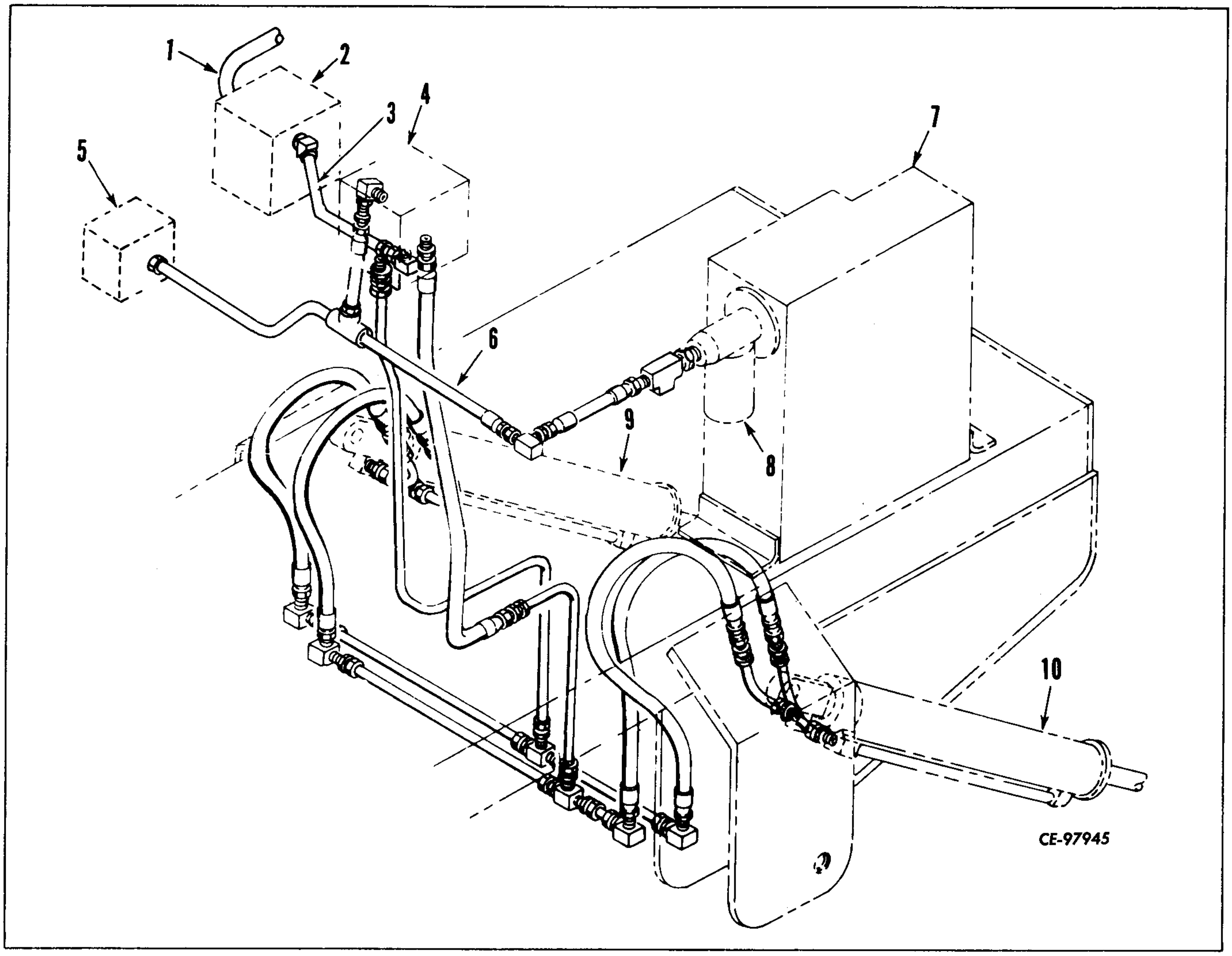

Figure 11-4
Dozer Circuit.

1. Supply line.
2. Diverter valve.
3. Diverter to dozer supply line.
4. Dozer valve.
5. Steering control valve.
6. Steering and dozer circuits return line.
7. Hydraulic reservoir.
8. System filter.
9. Dozer blade cylinder.
10. Dozer blade cylinder.

COMPONENT CIRCUITS

WINCH CIRCUIT

The winch circuit operates on a small portion of the complete amount of hydraulic flow of oil created by the hydraulic pump. The diverter valve is designed to divert a sufficient flow of oil to operate the winch at the same time the steering circuit is in operation. Under these conditions the operator can winch and steer at the same time.

If the dozer is operated, all flow to the winch circuit is cut off.

A flow control valve (8, Fig. 11-5) meters a set amount of oil to the winch control valve (5).

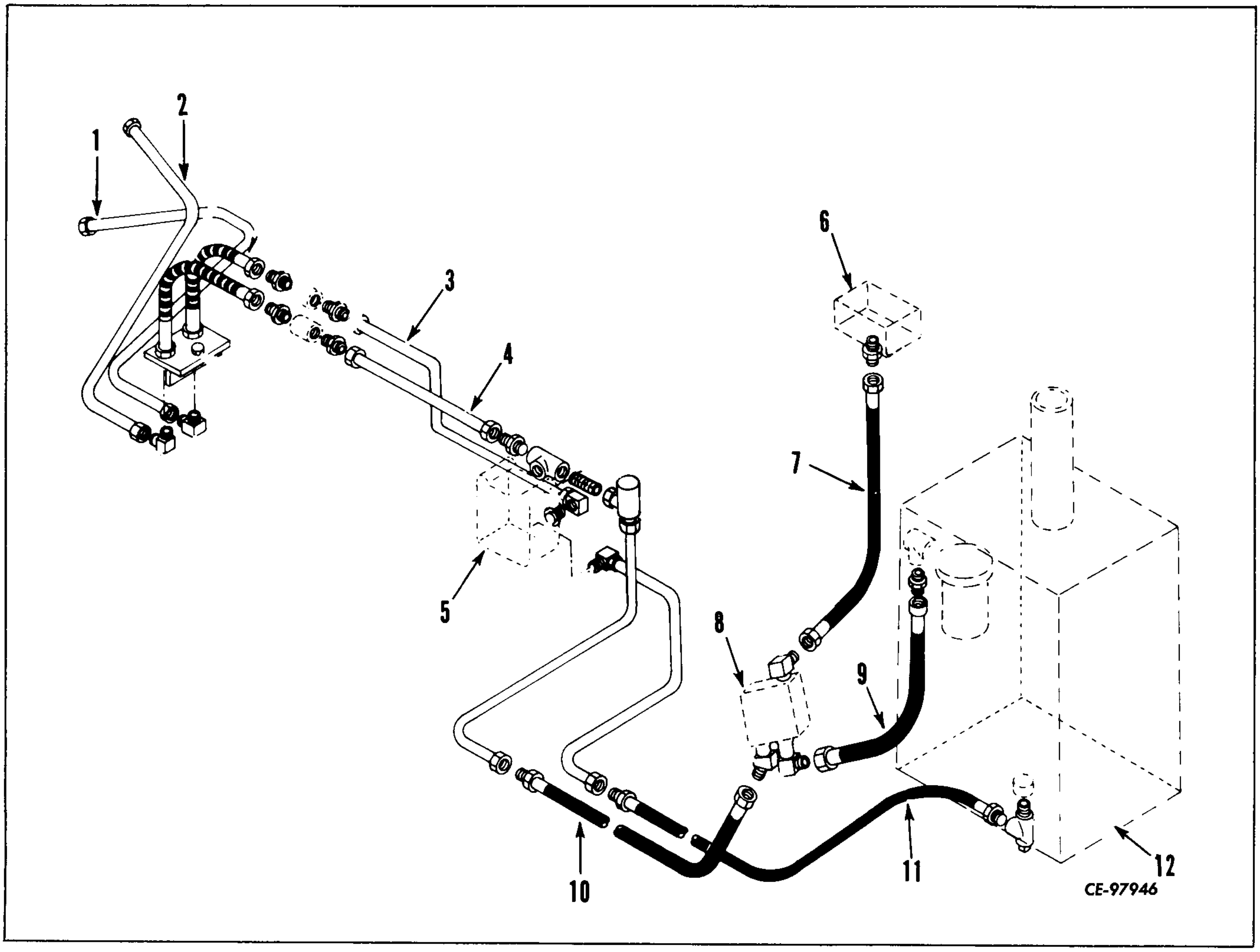

Figure 11-5
Winch Circuit.

1. Winch hydraulic oil line.
2. Brake hydraulic oil line.
3. Line from valve to frame.
4. Line from valve to frame.
5. Winch control valve.
6. Dozer control valve.
7. Oil supply line.
8. Flow control valve.
9. Line from flow control valve to reservoir.
10. Oil supply line from flow control valve to winch control valve.
11. Winch to reservoir return line.
12. Reservoir.

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COMPONENT CIRCUITS

As long as the spool in the control valve (5) is in its center or "BRAKE-ON" position, the winch drum is held by the spring loaded brake band. To release the band the control valve spool is moved. The resulting flow of oil offsets the force of the spring allowing the drum to "FREE-SPOOL."

The clutch band in the winch is spring loaded and when the control valve spool is moved to "SPOOL-IN" position oil is directed to the clutch and brake cylinders applying the clutch band and releasing the brake band.

The limit of the pressure within the winch circuit is controlled by a relief valve located within the control valve. When the pressure within the circuit exceeds a set maximum pressure, the relief valve opens and oil returns to the reservoir.

DISASSEMBLY, INSPECTION AND ASSEMBLY

HYDRAULIC RESERVOIR

GENERAL

The hydraulic reservoir (5, Fig. 11-6) supplies oil to the pump which in turn creates a flow of oil for the steering, dozing and winching circuits. The reservoir is located inside the engine compartment and can be serviced without removing it from its mountings.

All oil returned to the reservoir passes through a filter element (2). Oil leaving the reservoir must pass through a screened filter outlet (8).

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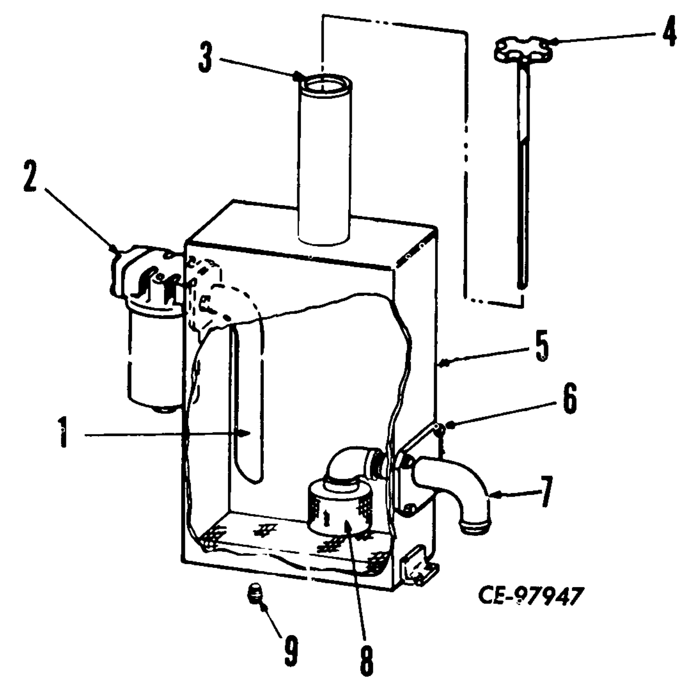

Figure 11-6
Hydraulic Reservoir.

1. Pipe.
2. Filter assembly.
3. Filler tube.
4. Cap and dipstick.
5. Reservoir.
6. Nut and lock washer.
7. Cover and tube.
8. Screen.
9. Drain plug.

DISASSEMBLY, INSPECTION AND ASSEMBLY

HYDRAULIC RESERVOIR - Continued

GENERAL - Continued

If the filter element becomes clogged or during cold weather the viscosity of the hydraulic oil rises to a point where the flow through the filter is too slow to supply the demands of the system, a check valve in the filter head (2) will open. With the valve open, oil will bypass the filter and flow directly to the reservoir. While the valve is open, unfiltered oil is passed to the reservoir. A strict adherence to filter element replacement intervals will keep the function of this valve to a minimum.

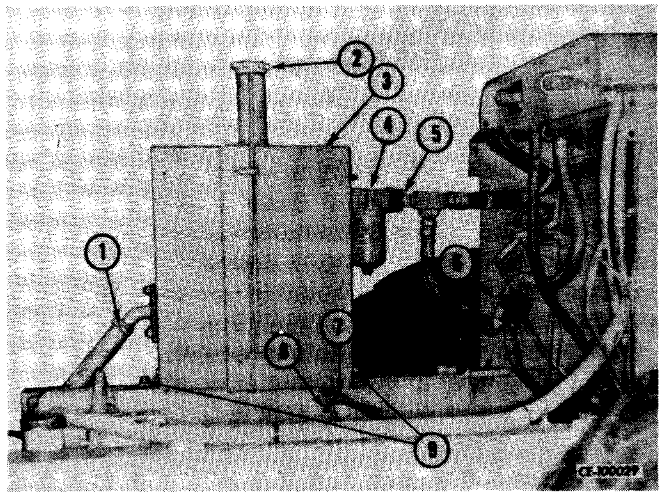

Figure 11-7

The combination filler cap and dipstick (4) is located on top of the reservoir and accessible through a hole on top of the tractor hood. When checking oil level, loosen the filler cap gradually to bleed off any pressure that might be in the reservoir.

NOTE: When checking the oil level be sure the tractor is on level ground.

Perform the following operations before disassembling the reservoir for replacement and servicing of internal parts.

1. Start the engine and operate the hydraulic control levers several times until the system oil becomes warm. Stop engine. Lower blade to ground.

2. Loosen the reservoir filler cap gradually to bleed off reservoir pressure before removing cap completely.

3. Position a clean container under the reservoir drain. Use a clean container so samplings of the used oil can be made. Remove plug from drain valve.

4. When flow of oil stops replace drain plug and tighten.

REMOVAL

The side panels and hood must be removed in order to gain access to the reservoir.

Disconnect the return line from the filter housing (4, Fig. 11-7) by removing allen head cap screws (5).

Disconnect the reservoir to pump outlet line by loosening hose clamp (1). Disconnect winch circuit return line (7) from the bottom of the reservoir. Remove cap screws, lock washers and nuts (9). With the aid of a suitable hoist, remove reservoir from the tractor frame.

CLEANING AND INSPECTION

Check the parts for wear and deterioration. Replace if in doubt.

Clean the exterior of the reservoir with a spray of clean solvent. Rinse the inside with a warm flushing solution made of four parts clean diesel fuel oil to one part clean lubricating oil. Dry interior with filtered compressed air.

Clean screen (8, Fig. 11-7) thoroughly.

NOTE: Do not use steam or caustic soda when cleaning inside of reservoir or any of the internal parts.

NOTE: Before assembly, check the drained hydraulic oil for harmful deposits. Examine the used filter elements to determine the condition of other hydraulic system components.

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DISASSEMBLY, INSPECTION AND ASSEMBLY

INSTALLATION

With the aid of an overhead hoist, position hydraulic reservoir on the frame, install and tighten cap screws, lock washers and nuts (9, Fig. 11-7).

Position pump supply on pipe of reservoir and tighten hose clamp (1).

Connect reservoir return line to filter (4). Before assembly, install new "O" rings in the filter head. Install and tighten allen head cap screws (5).

Install winch circuit return line (7) to the bottom of the reservoir. Install and tighten drain plug (8).

Add fresh oil to the reservoir through the dipstick opening in the reservoir. Refer to "LUBRICANTS AND CAPACITIES" for the type and quantity of hydraulic oil.

Filter 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 and purge air from the system. Check the reservoir connections for possible leaks. Check reservoir oil level frequently and add fresh oil as needed to keep the level at the proper full mark.

Install hood and side panels.

HYDRAULIC PUMP

GENERAL

The hydraulic pump converts mechanical energy into hydraulic energy.

The pump is the unit responsible for activating the circuit. As long as the pump is rotating (and assuming other components of the system are in working order) hydraulic energy is available to perform work. The pump converts the mechanical energy of its driving force (i.e. the tractor engine) into hydraulic energy. Later in the circuit this hydraulic energy will be returned to its mechanical form; however, within the confines of the tractor, the best medium of transmitting energy is hydraulics. The ease with which hydraulics are routed make other types of power transmission undesirable.

REMOVAL

Drain the hydraulic system or using a suitable plug, loosen hose clamp (4, Fig. 11-8) and remove supply line (5). It is mandatory to drain the hydraulic reservoir and change filters when the hydraulic pump is serviced.

Disconnect and plug output line (3). Remove cap screws (1) and hydraulic pump (2).

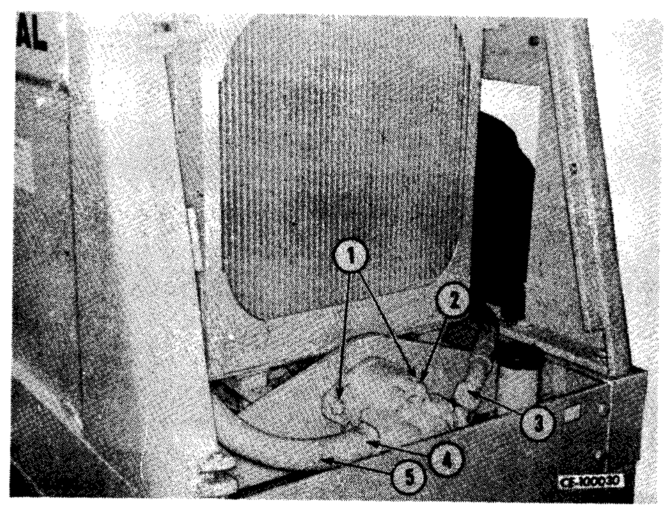

Figure 11-8

DISASSEMBLY

Using a petroleum solvent, excluding gasoline, clean the outside of the pump thoroughly. Place pump in a vise, shaft up.

Scribe index marks across the front plate, body and back plate. This will assure proper assembly. Remove cap screws (1, 5, Fig. 11-9) and copper crush washers.

(Continued on page 11)

DISASSEMBLY, INSPECTION AND ASSEMBLY

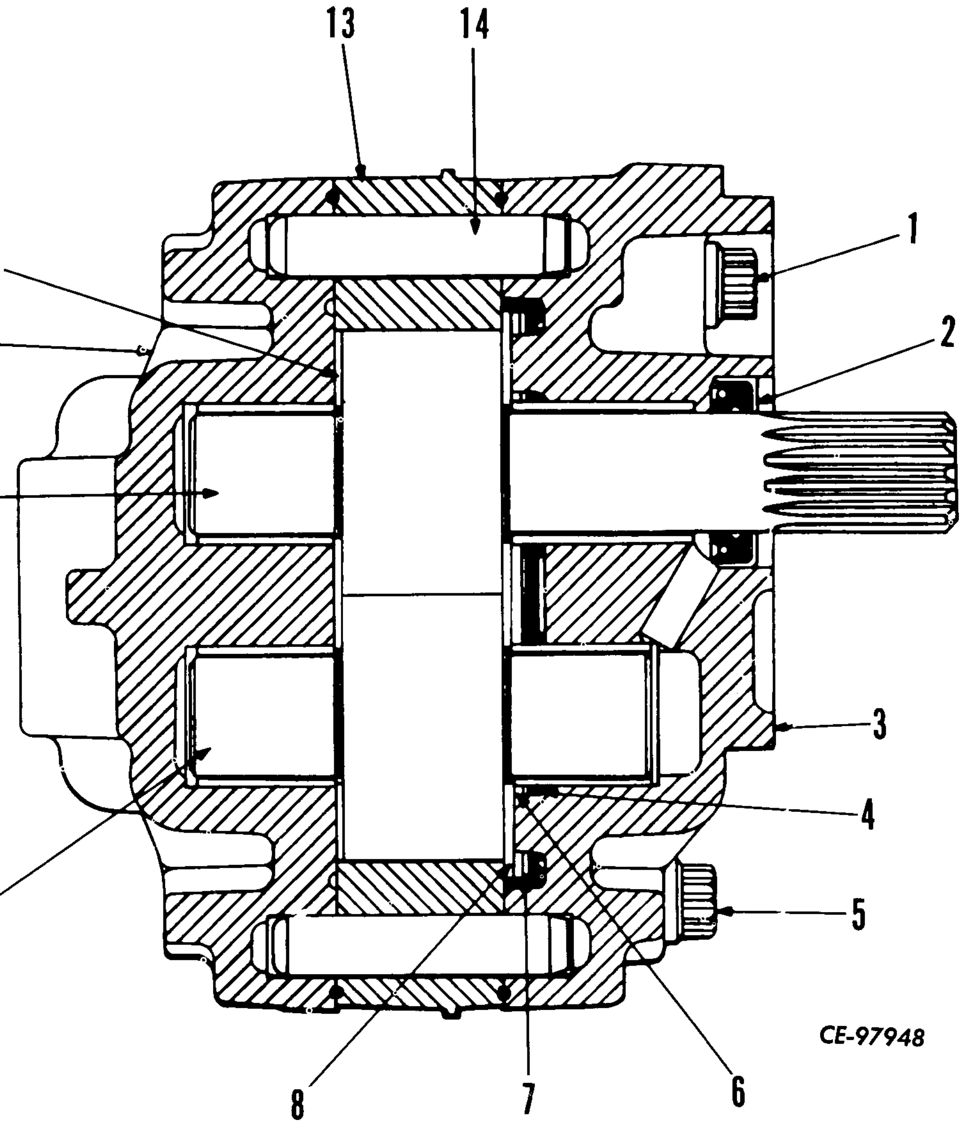

Figure 11-9
Hydraulic Pump.

1. Cap screws.
2. Shaft seal.
3. Front plate assembly.
4. Diaphragm seal.
5. Cap screw.
6. Back up gasket.
7. Protector gasket.
8. Diaphragm.
9. Idler gear.
10. Drive gear.
11. Back plate assembly.
12. Thrust plate.
13. Body and dowels.
14. Dowel pins.
15. "O" rings.

DISASSEMBLY, INSPECTION AND ASSEMBLY

HYDRAULIC PUMP - Continued

DISASSEMBLY - Continued

Remove pump from vise and using a mallet, bump end of shaft, separating the front plate from the back plate. Body will remain with either plate assembly.

To separate body, place drive gear (10) in bearing and tap protruding end with a plastic mallet. Remove thrust plate (12).

Remove diaphragm (8) from front plate (3) by prying it loose with a sharp tool.

Lift springs and steel balls (not illustrated) located between the diaphragm (8) and front plate (3) from the front plate.

Remove back-up gasket (6) and protector gasket (7) from front plate.

Lift diaphragm seal from front plate.

CLEANING, INSPECTION AND REPAIR

Clean and dry all parts. Remove nicks and burrs from all parts with emery cloth.

Inspect drive gear shaft for broken keyway. Inspect both drive gear and idler gear shafts at bearing points and seal areas for rough surfaces and excessive wear.

NOTE: Drive gear or idler gear can be replaced separately.

Check that snap rings on shaft are in groove. If edge of teeth are sharp, break edge with emery cloth.

Check oil grooves in bearings in both front and back plates. They should be in line with dowel pin holes and 180 degrees apart. This positions oil grooves closest to the respective dowel pin holes.

Bearings in front plate should be flush with island in the groove pattern. If excessive wear is found in the face of the back or inside gear pockets, the body and back plate should be replaced.

ASSEMBLY

Tuck diaphragm seal (4, Fig. 11-9) into groove in front plate with the open part of the "V" section down (use a dull tool).

Press protector (7) and back-up gasket (6) into diaphragm seal (4).

Position steel balls into respective seats in front plate (3) and place springs on top of steel balls.

Position diaphragm (8) on top of back-up gasket (6), bronze face up.

NOTE: Entire diaphragm must fit inside the raised rim of the diaphragm seal (4).

Dip gear assemblies into hydraulic oil and install into front plate bearings.

Apply a thin coat of heavy grease to both milled faces of the body and install "O" rings into grooves on each side of body (13). Slip body over gears onto front plate. Half moon port cavities in body must face away from front plate. Note small drilled hole in one of the cavities. This hole must be in the pressure side of pump.

Install thrust plate (12), bronze face toward gears, side with mid section cut away must be on suction side of pump. Thrust plate must fit inside of gear pockets.

Slide back plate over gear shafts until dowel pins are engaged.

Install new copper crush washers on the cap screws (1, 5) and tighten.

Coat lip of seal and shaft of drive gear with oil and work shaft seal (2) over gear shaft taking care not to cut rubber sealing lip.

Seat seal into end plate. Rotate pump shaft by hand. Pump shaft will have a small amount of drag, but should turn freely after a short period of time.

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

HYDRAULIC PUMP - Continued

INSTALLATION

Install hydraulic pump (2), inserting end of pump shaft into drive shaft, into mounting bracket.

Install and tighten cap screws (1).

Install input hose (5) and tighten hose clamp (4). Connect output hose (3).

Check hydraulic fluid level and repair as necessary. Check in "SPECIFICATIONS" for type and quantity.

STEERING, DOZER AND WINCH CONTROL VALVES

GENERAL

The disassembly and assembly procedures of the steering, dozer and winch control valves are similar except as indicated in Fig. 11-18, involving the check valve poppet used only in the dozer and winch control valves.

REMOVAL

STEERING CONTROL VALVE - The steering control valve (3, Fig. 11-10) is located under the dash panel. Disconnect, plug and tag all hydraulic lines. Disconnect linkage (5) between steering wheel and control valve. Remove cap screws and nuts (4).

DOZER CONTROL VALVE - The dozer control valve (6, Fig. 11-10) is located under the dash panel. Disconnect and tag all hydraulic lines. Plug ends of all open hydraulic lines. Disconnect linkage between the dozer control lever and control valve. Remove mounting cap screws.

WINCH CONTROL VALVE - The winch control valve is located on the right side of the operator's seat under a protective panel (2, Fig. 11-11). The operator's seat must be removed in order to remove the mounting cap screws (1). Disconnect winch control lever (3) from control valve. Disconnect, plug and tag all hydraulic lines from the inside of the seat base. Remove cap screws, nuts (1), protective panel (2) and control valve.

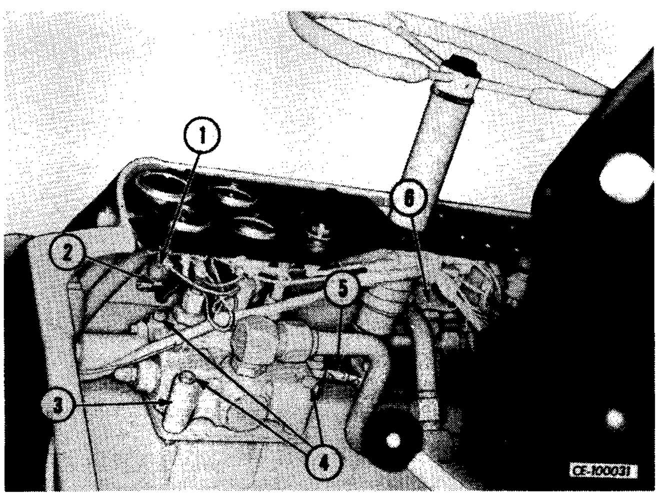

Figure 11-10

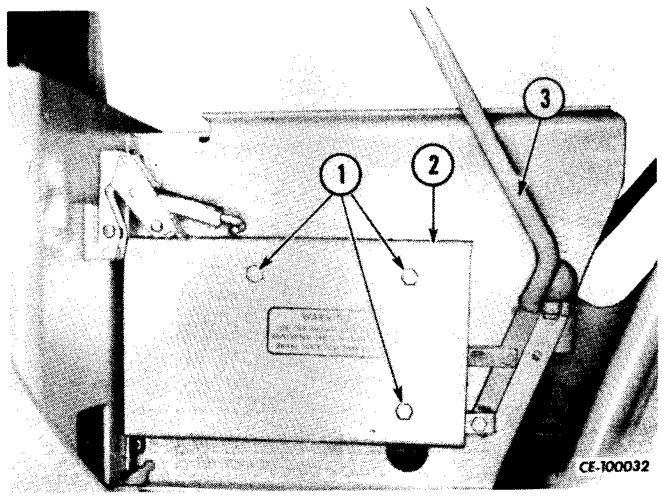

Figure 11-11

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DISASSEMBLY, INSPECTION AND ASSEMBLY

DISASSEMBLY

Remove bolts (1, Fig. 11-12) and plunger cap (2).

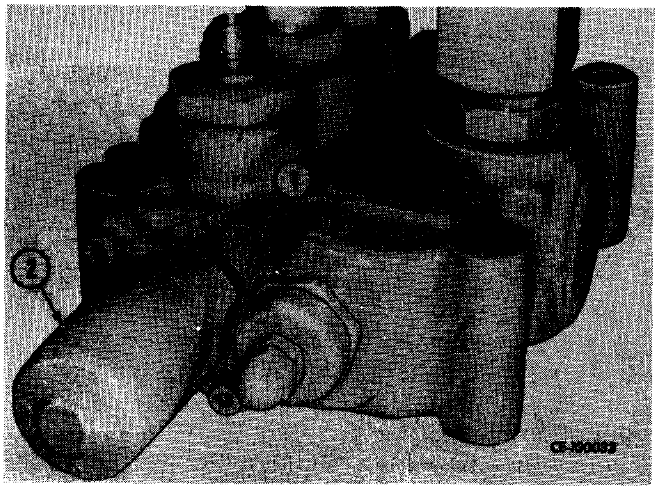

Figure 11-12

Pull valve spool assembly (1, Fig. 11-13), wiper (2) and "O" ring (3) out of control valve.

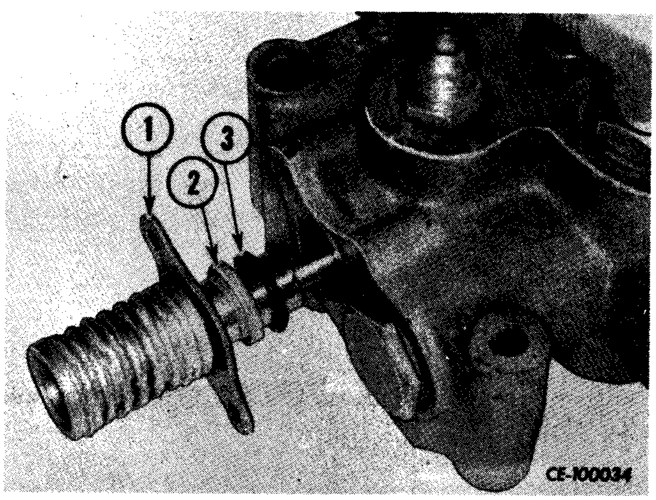

Figure 11-13

Disassemble valve spool assembly by removing special bolt (8, Fig. 11-14), spring seats (5, 7), spring (6), seal plate (4) wiper (3) and "O" ring (2) from spool (1).

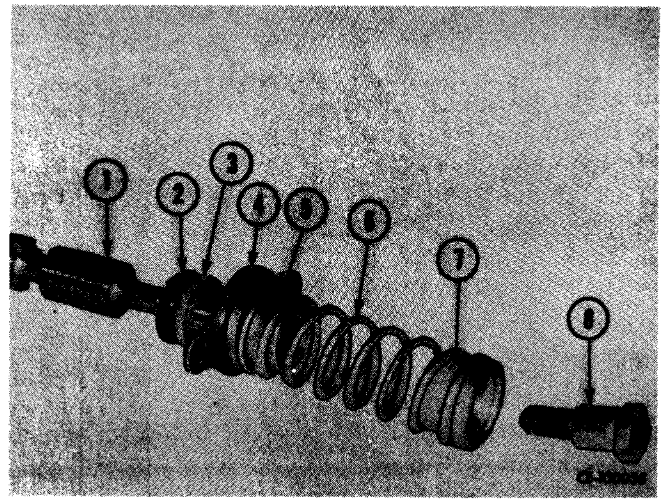

Figure 11-14

Remove relief valve (1, Fig. 11-15) from valve body.

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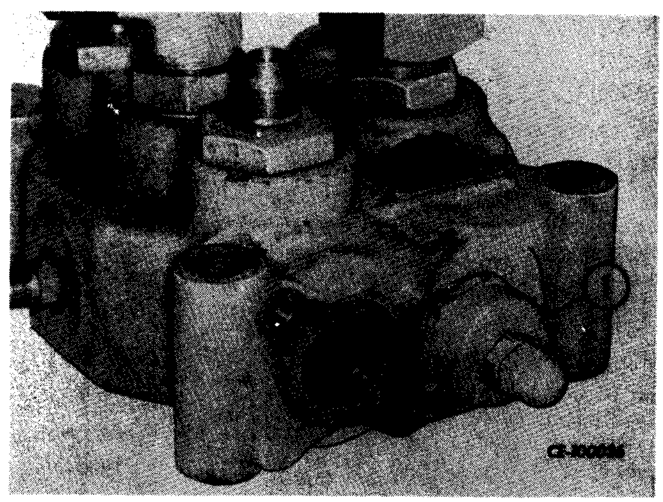

Figure 11-15

DISASSEMBLY, INSPECTION AND ASSEMBLY

STEERING, DOZER AND WINCH CONTROL VALVES - Continued

DISASSEMBLY - Continued

Remove acorn nut, jam nut and adjusting screw (1, Fig. 11-16). Pull poppet (6) out through adjustment end of relief valve. Remove and discard "O" ring (3), back-up ring (4) and "O" ring (5) from relief valve.

Remove spring (7), piston (8), and poppet (9) from sleeve (12). Remove and discard "O" ring (10) and back-up ring (11) from poppet (9).

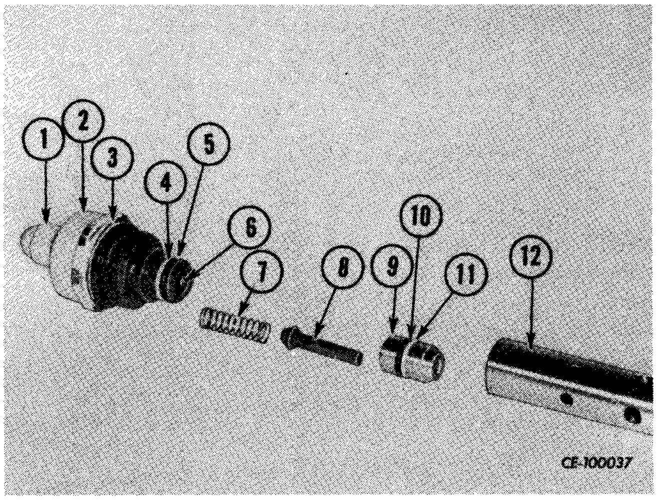

Figure 11-16

Remove round head screws (1, Fig. 11-17) and plate (2) from end of valve.

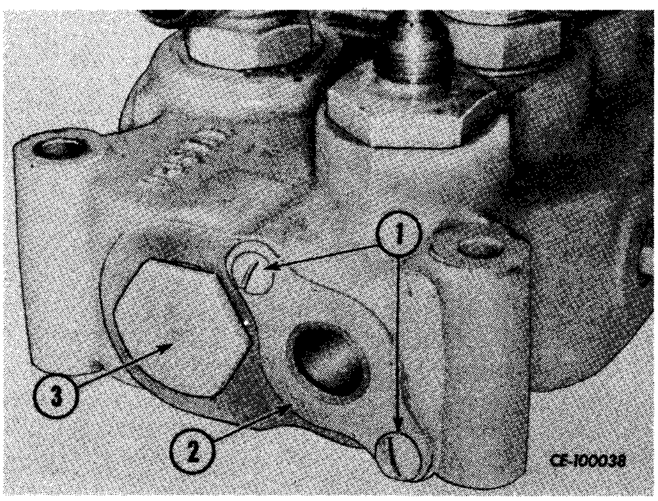

Figure 11-17

Remove wiper (1, Fig. 11-18) and "O" ring (2) from bore in end of valve body.

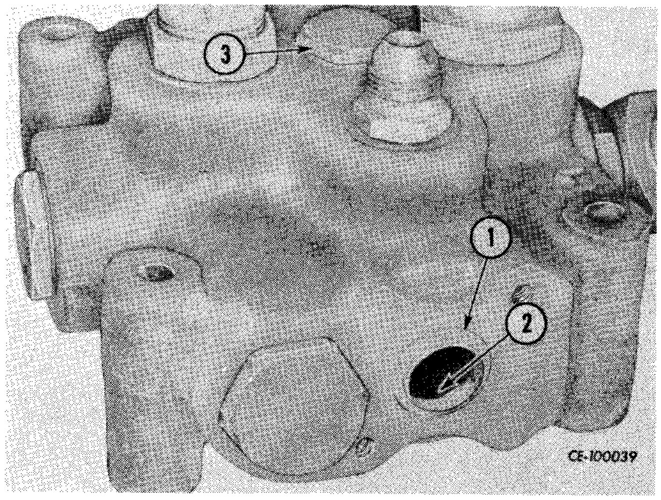

Figure 11-18

WINCH AND DOZER VALVE ONLY: Remove plug (3) and pull check valve spring and poppet out.

CLEANING AND INSPECTION

Thoroughly wash all parts in a clean mineral oil solvent. Dry with 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.

DISASSEMBLY, INSPECTION AND ASSEMBLY

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 moulding 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.)

f. Care in handling of parts and hydraulic system cleanliness cannot be over stressed.

g. Use ONLY the oil type and viscosity ranges specified in the current Operator's Manuals.

ASSEMBLY

Refer to disassembly illustrations as indicated by the text during assembly of the control valves.

Install check valve poppet and check valve spring into top of the winch or dozer valve. Install new "O" ring on plug (3, Fig. 11-18). Install and tighten plug (3).

Lubricate "O" ring (2) and wiper (1) with petroleum jelly and install into bore of valve body. Wiper (1) should be installed with lip facing out.

Install plate (2, Fig. 11-17) and round head screws (1). DO NOT TIGHTEN.

Install a new "O" ring on plug (3) and install and tighten plug (3) into end of control valve.

Install poppet (7, Fig. 11-19), spring (6) and adjusting screw (5) in plug (8). Install washer (4), jam nut (3), washer (2) and acorn nut (1). Refer to "ADJUSTMENTS" for pressure setting.

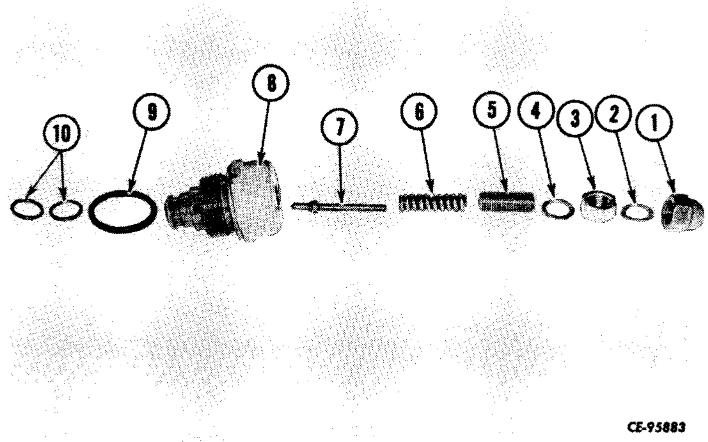

Figure 11-19

Install "O" ring (10, Fig. 11-16) and back-up ring (11) on poppet (9) and insert poppet in sleeve (12). Insert piston (8) and spring (7) into sleeve (12). Install "O" ring (3), back-up ring (4) and "O" ring (5) on relief valve (2) and install end of relief valve into sleeve (12).

Insert end of spool into valve body and tighten relief valve (1, Fig. 11-15).

Install wiper (3) and "O" ring (2) on end of spool (1). Position plate (4, Fig. 11-14), spring seat (5), spring (6), spring seat (7) and install and tighten special screw (8).

Install assembled spool into valve body. Insert "O" ring (3) and wiper (2) into bore of valve. Wiper (2) should be installed with lip of wiper facing out.

Install cap (2, Fig. 11-12) over end of valve spool. Install and tighten allen head cap screws (1). Complete tightening round head screws (1, Fig. 11-17).

INSTALLATION

STEERING CONTROL VALVE - Position steering control valve (3, Fig. 11-10) on mounting bracket and install cap screws and nuts (4).

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

STEERING, DOZER AND WINCH CONTROL VALVES - Continued

INSTALLATION - Continued

Connect all hydraulic lines to control valve. Connect linkage (5) between valve and steering gear. Check and repair hydraulic fluid level in the reservoir.

DOZER CONTROL VALVE - Position dozer control valve (6, Fig. 11-10) on mounting bracket; install and tighten cap screw. Connect all hydraulic lines to control valve. Connect linkage between the control valve and control lever. Check and repair hydraulic fluid level in the reservoir.

WINCH CONTROL VALVE - Position control valve on mounting bracket. Install protective cover (2, Fig. 11-11), and cap screws (1). Install nuts on cap screws (1) and tighten. Connect control lever (3) to control valve. From inside the seat base connect all hydraulic lines to control valve. Install operator's seat to base. Check and repair hydraulic fluid level in the reservoir.

DIVERTER VALVE

REMOVAL

The diverter valve (1, Fig. 11-10) is located under the dash panel. It is recommended that the steering control valve (3) be removed to aid in diverter valve removal. Disconnect and tag all hydraulic lines. Plug all open hydraulic lines. Remove cap screws (2) and control valve (1).

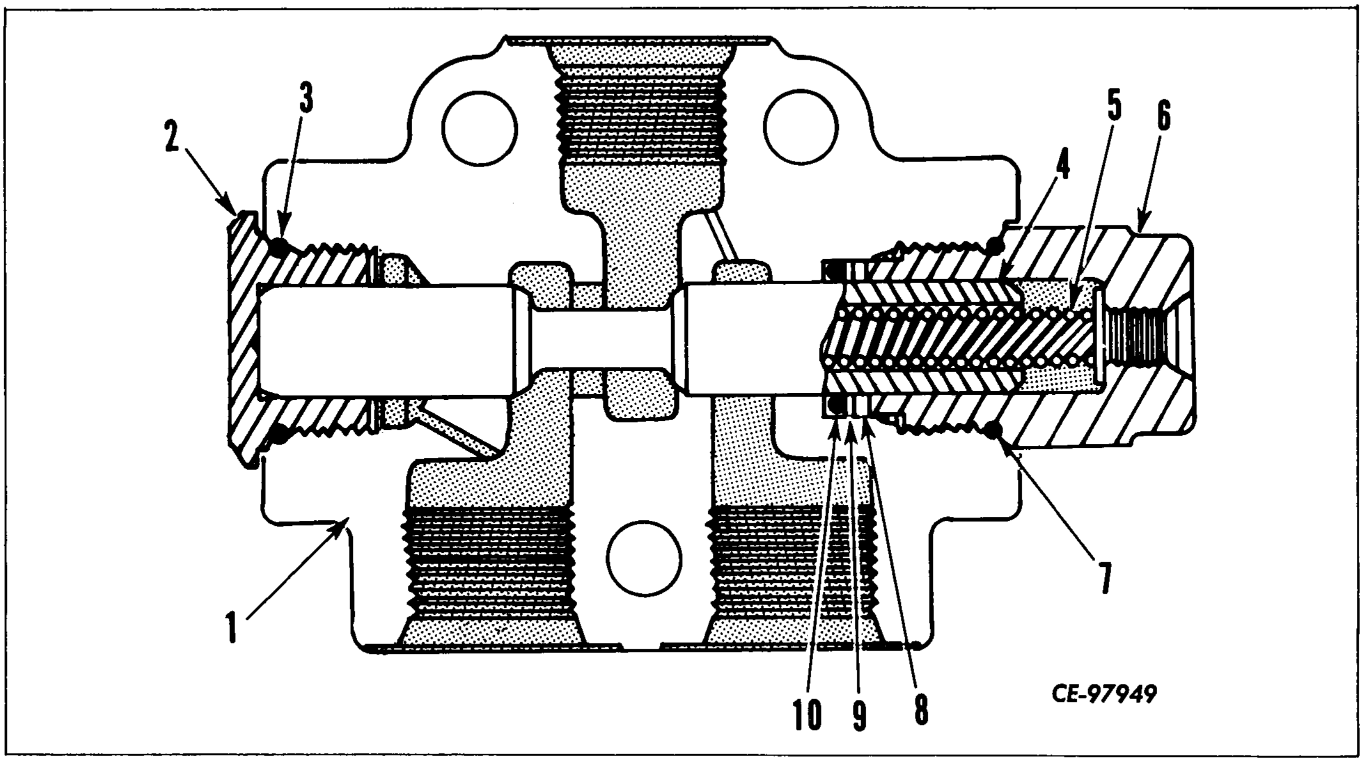

Figure 11-20
Diverter Valve.

1. Valve housing.
2. Plug.
3. "O" ring.
4. Plunger.
5. Spring.
6. Plug.
7. "O" ring.
8. Ring.
9. Back-up ring.
10. "O" ring.

DISASSEMBLY, INSPECTION AND ASSEMBLY

DISASSEMBLY

Remove plug (6, Fig. 11-20) from end of valve and discard "O" ring (7). Remove spring (5).

Remove plug (2) and discard "O" ring (3). Push valve spool (4) out of valve body.

Remove and discard ring (8), back-up ring (9) and "O" ring (10).

CLEANING AND INSPECTION

Refer to "CLEANING AND INSPECTION" under "WINCH CONTROL VALVE."

ASSEMBLY

Install a new "O" ring (3, Fig. 11-20) on plug (2). Install and tighten plug (2).

Insert a new "O" ring (10), back-up ring (9) and ring (8) inside of valve body. Lubricate all rings with petroleum jelly.

Install plunger (4) into valve body.

Install a new "O" ring on plug (6). Install spring (5) and install and tighten plug (6).

INSTALLATION

Position diverter valve (1, Fig. 11-10) on mounting bracket, and install and tighten cap screws (2). Connect all hydraulic lines to diverter valve.

Install steering control valve to its mounting bracket.

Check level in hydraulic reservoir and add fluid as required.

FLOW DIVIDER VALVE

REMOVAL

From inside the engine compartment disconnect and tag all hydraulic lines from flow divider (6, Fig. 11-7). Plug ends of all open hydraulic lines. Remove mounting cap screws and nuts. Remove flow divider.

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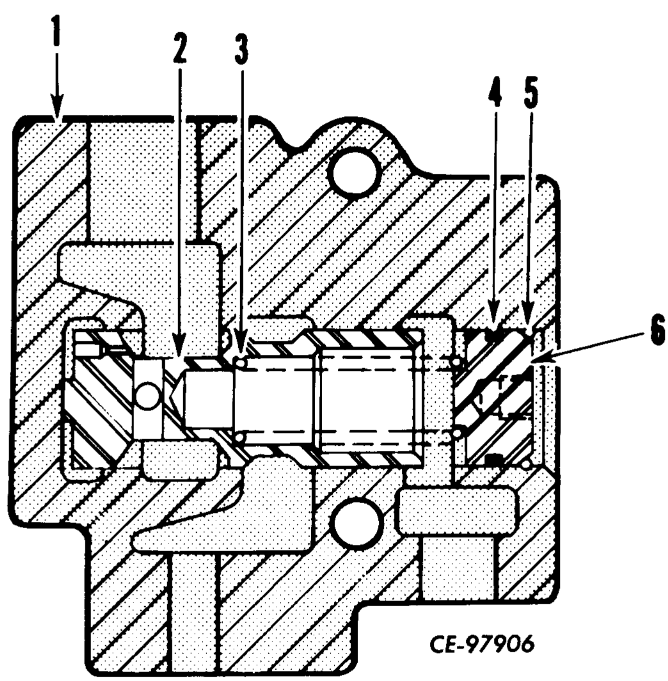

Figure 11-21
Flow Divider.

1. Valve body.
2. Piston.
3. Spring.
4. Seal "O" ring.
5. Retainer ring.
6. End cap.

DISASSEMBLY, INSPECTION AND ASSEMBLY

FLOW DIVIDER VALVE - Continued

DISASSEMBLY

Remove retainer ring (5, Fig. 11-21) from end cap (6) and install a cap screw into bore of end cap. Remove end cap from valve body.

Remove spring (3) and piston (2).

CLEANING AND INSPECTION

Refer to "CLEANING AND INSPECTION" under "WINCH CONTROL VALVE."

ASSEMBLY

Install piston (2, Fig. 11-21) into valve body. Install spring (3) into bore of piston.

Lubricate seal "O" ring (4) with petroleum jelly and install on end cap (6). Install end cap (6) in valve body and install retainer ring (5).

INSTALLATION

Position flow divider (6, Fig. 11-7) on side panel; install and tighten cap screws and nuts. Connect all hydraulic lines to flow divider. Check level in hydraulic reservoir and add fluid as required.

HYDRAULIC CYLINDERS

GENERAL

Three hydraulic cylinders are used on the "PAY® logger." Two in conjunction with the dozer blade system and one with the steering system.

The hydraulic cylinders are composed of a steel sleeve of uniform inside diameter, closed at one end by a cast steel welded plug. A removable cap is center bored and allows the piston rod to move "in" or "out." As the circuit valve directs oil flow to either end of the cylinder, the piston at the end of the rod creates a restriction and moves in the direction needed to accomplish the operator's intended job.

REMOVAL - BLADE CYLINDERS

Disconnect hydraulic lines from the end of the hydraulic blade cylinders (3, Fig. 11-22). Plug all open hydraulic lines.

Remove cap screws (1), on each end of cylinder, and remove pin locks (2). Discard all cord rings and replace grease fitting.

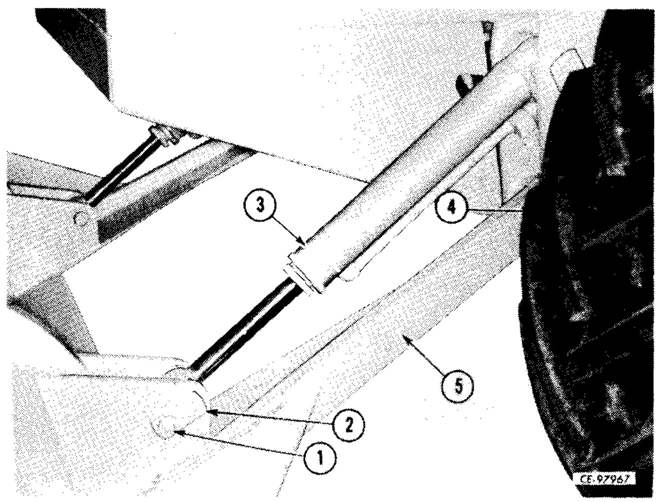

Figure 11-22

REMOVAL - STEERING CYLINDER

Install safety bar and pin locking the two tractor halves together.

The steering cylinder is located directly under the left side of the operator's compartment. To gain access to the steering cylinder, remove cap screw and lock washers (1, Fig. 11-23) and remove floor panel (2).

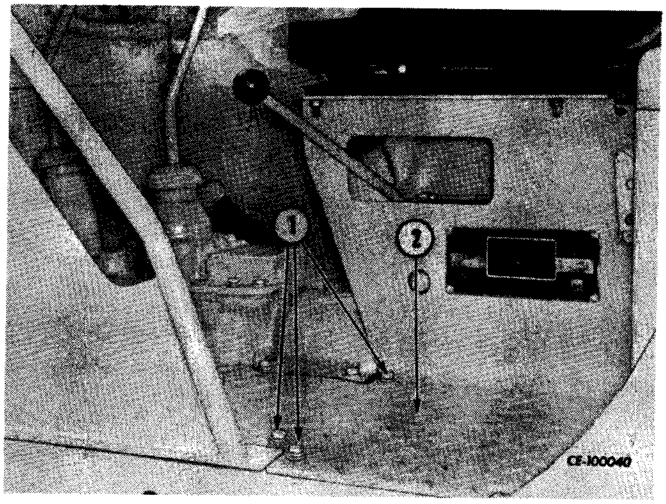

Figure 11-23

Remove cap screw (3, Fig. 11-24) and pull pin lock (2). Remove end of cylinder rod (4) from the mounting brackets and discard cord rings (1). Start engine and move steering wheel in direction needed to draw rod into cylinder. This will aid in cylinder removal.

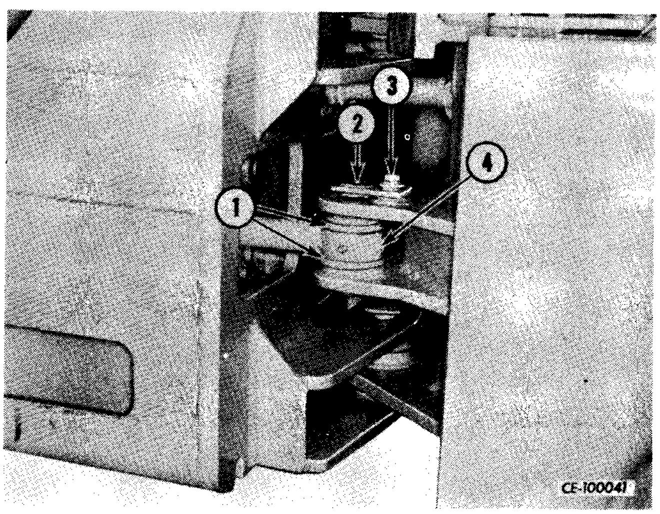

Figure 11-24

Disconnect and tag hydraulic lines (4, 5, Fig. 11-25). Plug all open hydraulic lines.

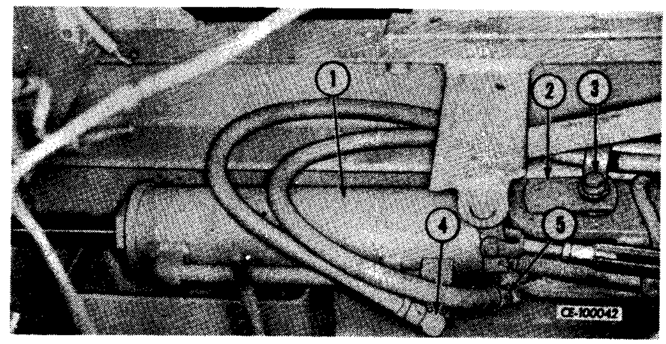

Figure 11-25

Remove cap screw (3) and pin lock (2). Pull end of cylinder (1) out of mounting brackets and remove it from frame. Discard cord rings.

DISASSEMBLY

NOTE: The following disassembly procedure pertains to both the steering cylinder and blade cylinders. Fig. 11-26 illustrates the similarity between these cylinders.

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

HYDRAULIC CYLINDERS - Continued

DISASSEMBLY - Continued

Drain all hydraulic fluid from cylinder.

Remove rubber plug (9, Fig. 11-26) and using a wrench, rotate packing nut (14), which in turn will rotate cylinder cap (6) until bore in cap is aligned with plug bore.

Remove set screws (13) from packing nut (14). Insert a punch in the aligned holes and remove packing nut (14). Remove lock ring (12).

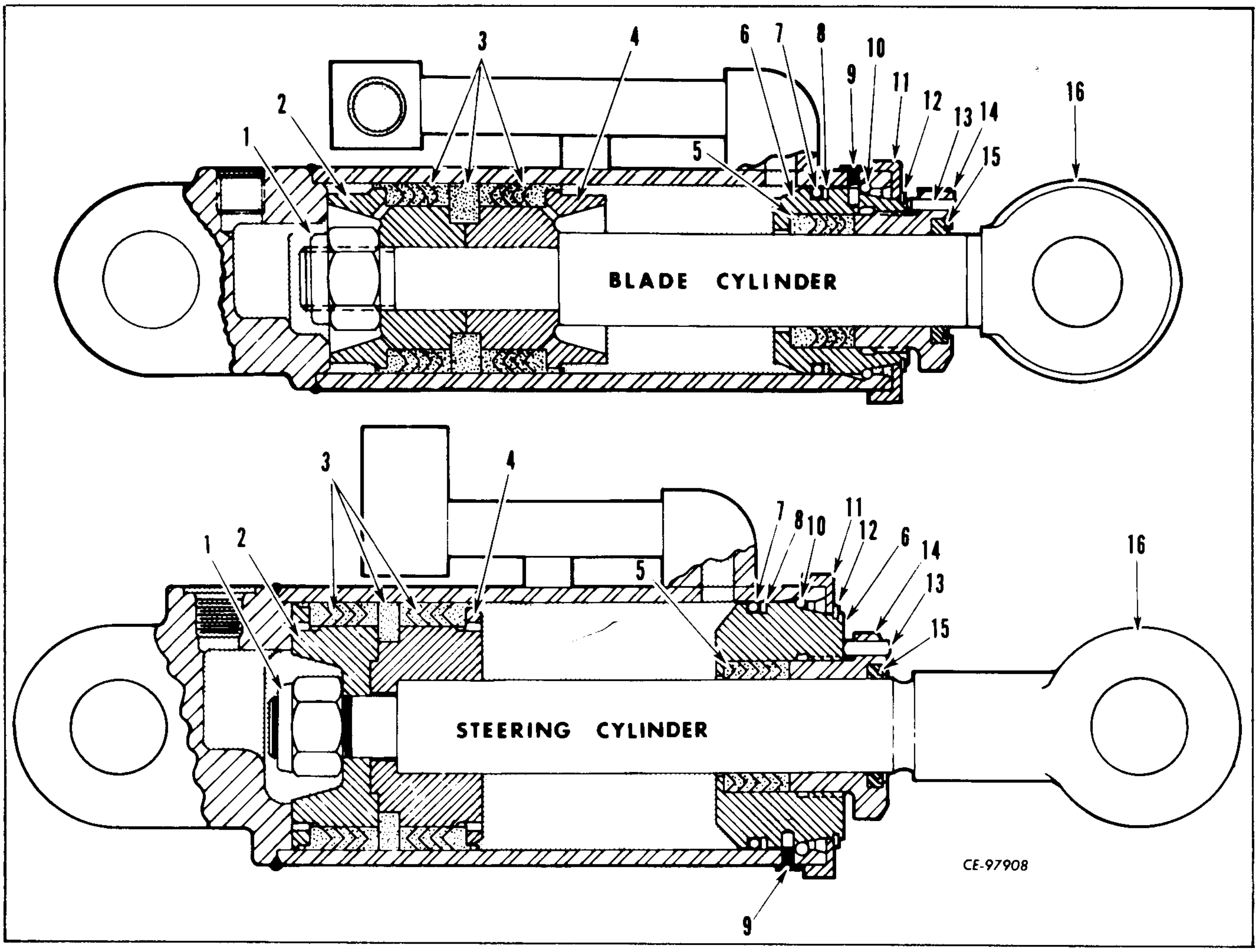

Figure 11-26
Hydraulic Cylinders.

1. Nut.
2. Piston half.
3. Rod packing.
4. Piston half.
5. Rod packing.
6. Cap.
7. "O" ring.
8. Back-up ring.
9. Rubber plug.
10. Lock ring.
11. Cylinder cap.
12. Lock ring.
13. Set screw.
14. Packing nut.
15. Wiper seal.
16. Piston rod.

DISASSEMBLY, INSPECTION AND ASSEMBLY

Draw piston rod (16) out of the cylinder and slide cylinder cap (11) down the rod.

Remove the two piece lock ring (10) by pushing cap assembly into cylinder far enough to remove lock rings.

Pull piston rod out of cylinder. Cylinder cap (6) and cover assembly (11) will come out with piston rod and assembly.

Loosen and remove nut (1) from end of cylinder rod (16) and slide off piston halves (2, 4) and rod packings (3). Slide cylinder cap (6), cover (11) and packing nut (14) from end of piston rod.

Remove and discard packings (3, 5) from the piston and cylinder cap. Remove and discard "O" ring (7) and back-up ring (8) from OD of cylinder cap.

CLEANING, INSPECTION AND REPAIR

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.

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

Dip new "O" ring (7, Fig. 11-26) and back-up ring (8) in fresh hydraulic oil and install in groove of cylinder cap (6). Dip rod packing (5) in fresh hydraulic oil and insert in ID of cylinder cap (6).

NOTE: Open end of "V" in rod packing (5) must face piston when cap is installed. (Refer to Fig. 11-26 for proper position.)

Install a new wiper seal (15) in packing nut. Lubricate lip of wiper seal with fresh hydraulic oil and install packing nut assembly on cylinder rod (16), seal end of nut first.

Install cylinder cap (11) on end of piston rod.

Carefully install cap (6) on piston rod. Rod packing can be damaged by careless installation.

Install piston half (4) on end of piston rod. Dip rod packings (3) in fresh hydraulic oil and install packings and piston half (2) on end of piston rod.

Install and tighten hex nut (1) to recommended torque. Refer to "SPECIAL TORQUES."

Torque: __________

Coat inside of piston with a film of fresh hydraulic oil and carefully install rod and piston into end of cylinder.

Slide the rod 2/3 of the way into the cylinder.

Carefully push cap (6) into cylinder. Check position of "O" ring (7) and back-up ring (8). "O" ring should enter cylinder first, refer to Fig. 11-26.

Push cap (6) into end of cylinder far enough to install two piece lock ring (10).

Manually pull the rod and piston sharply against the cap several times seating the two piece lock ring with the cap and cylinder.

Rotate cap by hand until hole in cylinder is aligned with hole in the cap.

Install cylinder cap (11) over end of cylinder and install lock ring (12).

Insert a punch into aligned holes in the cylinder and cap and install packing nut (14). Tighten packing nut lightly.

NOTE: Final adjustment of the packing nut must be made after installation. Refer to "SERVICE INFORMATION," this section for "CYLINDER ROD PACKING" adjustment.

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

HYDRAULIC CYLINDERS - Continued

INSTALLATION - STEERING CYLINDER

Lower steering cylinder (1, Fig. 11-25) down into tractor frame. Install cylinder end, with two new cord rings, one on each side of cylinder between mounting bracket and drive pin lock (2) through mounting brackets and cylinder. Install and tighten cap screw, lock washer and hose bracket (3).

Remove plugs from ends of hydraulic lines and connect lines to their respective cylinder ports.

Install rod end of cylinder (4, Fig. 11-24) with two new cord rings (1), between mounting brackets. Drive pin lock (2) through mounting brackets and rod. Install and tighten cap screw (3).

Start engine, remove safety bar and pin, and slowly turn steering wheel each way until the cylinder is filled with hydraulic fluid. Check level in hydraulic reservoir and add fluid as required.

From within the frame, adjust rod packing nut on cylinder rod. Refer to "SERVICE INFORMATION," this section for "CYLINDER ROD PACKING" adjustment.

Once proper adjustment is accomplished, position floor panel (2, Fig. 11-23). Install and tighten cap screws (1).

INSTALLATION - BLADE CYLINDERS

Install cylinder end (3, Fig. 11-22) with two new cord rings, one on each side of cylinder, between mounting brackets on tractor frame. Drive pin lock through mounting brackets and cylinder.

Remove plugs from ends of hydraulic lines and connect lines to their respective cylinder ports.

Install rod end of cylinder, with two new cord rings, one on each side of rod, between mounting brackets on dozer blade.

Drive pin lock (2) through mounting brackets and cylinder rod. Install and tighten cap screw (2).

Start engine, and slowly move blade control lever until cylinder is filled with hydraulic fluid. Check fluid level in reservoir and add fluid as required.

Adjust rod packing nut on cylinder rod. Refer to "SERVICE INFORMATION," this section for "CYLINDER ROD PACKING" adjustment.

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. Internal crack.	5. Replace valve assembly.
	6. Plungers not in full stroke.	6. Check movement and linkage.

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TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Poor hydraulic system performance or failure. (Cont)	7. Reservoir low on oil. 8. System filters clogged. 9. Restrictions in lines.	7. Add oil. Fill to level indicated on dipstick. 8. Replace filter elements and clean reservoir. 9. Check lines. Remove obstruction or replace line.
Excessive oil foaming.	1. Improper type or viscosity oil. 2. Excessive by-passing of oil over relief valves.	1. Drain entire hydraulic system and refill with proper oil. 2. Adjust relief valves per recommendation if pressure adjustment is too low. Repair damaged relief valves. 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. 2. Incorrect viscosity or type of oil. 3. Worn hydraulic pump.	1. Correct method of operation to eliminate long periods of maximum pressure operation. 2. Drain entire hydraulic system and fill with correct oil. 3. Replace or rebuild pump per recommendation in this manual.
Foreign material in reservoir screen.	1. Lint - Worn, frayed or damaged cylinder packing. 2. Chips - Worn pump or damage in cylinders.	1. Replace packing. 2. Disassemble system components, inspect and repair.
Insufficient pressure build-up.	1. System relief valves set too low. 2. Worn pump components causing internal leakage.	1. Adjust relief valves according to specifications. Refer to "ADJUSTMENTS." 2. Replace pump.

(Continued on next page)

TROUBLE SHOOTING

GENERAL - Continued

COMPLAINT	POSSIBLE CAUSE	REMEDY
Low pressure in blade circuit.	1. Damaged, worn or improperly adjusted relief valve.	1. Refer to "BLADE CONTROL VALVE" for disassembly and inspection procedures. Refer to "BLADE RELIEF VALVE" under "ADJUSTMENT."
	2. By-pass in cylinders.	2. Replace worn packing and repair as necessary. Refer to "HYDRAULIC CYLINDERS."
	3. Hydraulic pump worn.	3. Repair or replace hydraulic pump. Refer to "HYDRAULIC PUMP."
Low pressure in steering circuit.	1. Damaged, worn or improperly adjusted steering circuit relief valve.	1. Refer to "STEERING CONTROL VALVE" for disassembly and inspection procedures.
	2. By-pass in steering cylinder.	2. Inspect cylinders and rebuild if necessary.
	3. Worn pump.	3. Repair or replace hydraulic pump.

CONTROL VALVES

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 tighten evenly.
	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.

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TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Unable to move plunger in or out.	1. Dirt in valve. 2. Plunger cap full of oil. 3. Bind in linkage.	1. Clean and flush system. 2. Replace seals. 3. Free-up linkage.
Detent control fails to hold.	1. Worn detent cam. 2. Springs deformed. 3. Excessive vibration. 4. Plunger stroke restricted.	1. Replace worn parts. 2. Replace damaged parts. 3. Locate source of vibration and correct. 4. Check linkage.
Blade will not hold.	1. Cylinder leaking or worn. 2. Oil by-passing valve plunger.	1. Check cylinders. 2. Replace valve assembly.
Leaking seals.	1. Paint on or under seal. 2. Excessive back pressure. 3. Dirt under seal. 4. Scored plunger. 5. Loose seal plates. 6. Cut or scored seal.	1. Remove and clean. 2. Open line to reservoir. 3. Remove and clean. 4. Replace valve. 5. Clean and tighten. 6. Replace faulty parts.

PUMP

Pump does not deliver fluid.	1. Shaft sheared or disengaged. 2. Reservoir-to-pump intake pipe restricted. 3. Fluid viscosity too heavy to pick up prime. 4. Relief valve stuck open.	1. Disassemble the pump and check the shafts for damage. Replace necessary parts. 2. Check all strainers and filters for foreign material. Clean if necessary. 3. Completely drain the system. Add new filtered fluid of the proper viscosity. 4. Remove relief valves from hydraulic control valves. Inspect components and repair or replace as necessary.

(Continued on next page)

TROUBLE SHOOTING

PUMP - Continued

COMPLAINT	POSSIBLE CAUSE	REMEDY
Pump making noise.	1. Low oil supply.	1. Fill reservoir to level mark.
	2. Cavitation in hydraulic pump.	2. Clear obstruction to pump oil supply. Clean tank strainer 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 "FOAMING OIL."
	5. Vortex or spiral in oil circulating in reservoir.	5. Check installation and condition of suction screen. Check oil level.
	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 misalignment.	9. Check shaft seal, bearings, etc., for damage. Replace parts as required. Align pump components correctly.

SERVICE INFORMATION

LUBRICANTS AND CAPACITIES

LUBRICANTS

TEMPERATURE	TYPE REFILL AND SERVICE		
	SAE	API	MILITARY SPECIFICATIONS
Below 20° F. Above 20° F.	10W/30 20-20W	**MS DM DS	SUP. 1**, MIL-L-2104B, SERIES 3

** MS wear test sequence

CAPACITIES

Reservoir capacity . . . . 20 qts.
System capacity . . . . 16 qts.

Total Hydraulic System capacity . . . 36 qts.

SYSTEM PRESSURES

Dozer blade relief valve . . . . 1900 psi
Steering relief valve . . . . 1900 psi
Winch relief valve . . . . Refer to Section 14, "WINCH"

All pressure checks are at High Idle

SPECIAL TORQUES

HYDRAULIC CYLINDERS
Hydraulic cylinder piston nut. . 450-500 lb./ft.

ADJUSTMENTS

BLADE RELIEF VALVE

In addition to the regular periodic system pressure checks and checks to detect system problems, the hydraulic blade relief valve must be pressure checked and adjusted if it has been completely disassembled or if repairs have been made to the blade circuit.

Adjust the relief valve as follows:

NOTE: Do not attempt relief valve adjustment without a reliable pressure gage. Insufficient or excessive pressure will result in damage to the system.

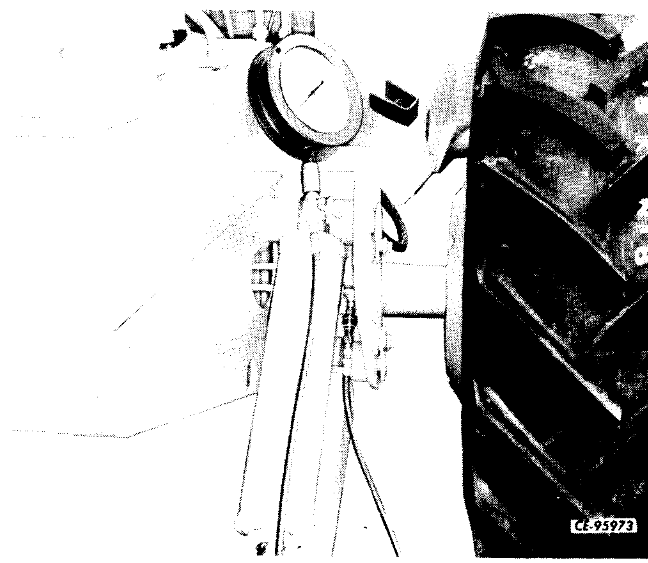

Figure 11-27

Stop tractor engine. Cycle all hydraulic controls to be sure no pressure remains in the system.

Install gage of 0 to 3000 psi range in the top of the blade cylinder hydraulic line.

Remove acorn nut from relief valve adjusting screw located on top of the control valve.

Start engine and place blade control lever in "Raise" position. Read indicated pressure on gage. Refer to "SYSTEM PRESSURES" for recommended pressure.

Blade Circuit Pressure:__________

(Continued on next page)

ADJUSTMENTS - Continued

BLADE RELIEF VALVE - Continued

If pressure is incorrect, lossen jam nut on adjusting screw, at the control valve, and turn screw counterclockwise to reduce pressure or clockwise to increase pressure.

When a correct pressure reading is obtained, lock adjusting screw with jam nut and install acorn nut.

Recheck the pressure reading.

Stop engine. Cycle all hydraulic controls to be sure no pressure remains in the system. Remove gage and install plug.

STEERING RELIEF VALVE

Adjust the relief valve as follows:

NOTE: Do not attempt relief valve adjustment without a reliable pressure gage. Insufficient or excessive pressure will result in damage to the system.

Stop tractor engine. Cycle all hydraulic controls and steering controls to be sure no pressure remains in the system.

Install gage of 0 to 3000 psi range in the front of the steering cylinders hydraulic line.

From inside the engine compartment, remove acorn nut from the relief valve adjusting screw located on the opposite end of the steering valve linkage.

Start the engine and rotate the steering wheel into a full lock turn position. Read pressure gage. Refer to "SYSTEM PRESSURES" for correct pressure reading.

Steering Circuit Pressure:__________

WARNING: Before turning machine be sure all personnel are moved from the area.

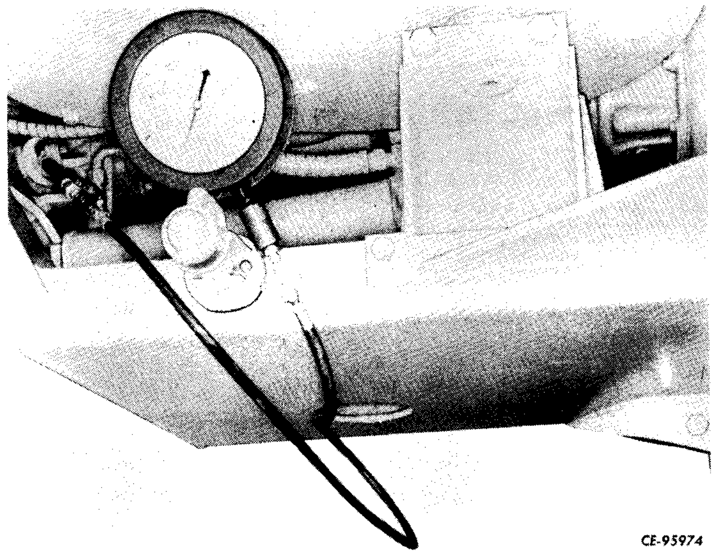

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Figure 11-28

If pressure is incorrect, loosen jam nut on adjusting screw, at the control valve, and turn screw counterclockwise to reduce pressure or clockwise to increase pressure.

When a correct pressure reading is obtained, lock adjusting screw with jam nut and install acorn nut.

Recheck the pressure reading.

Stop engine. Cycle all hydraulic controls and steering controls to be sure no pressure remains in the system. Remove gage and install plug.

WINCH RELIEF VALVE

Refer to Section 14, "WINCH."

CYLINDER ROD PACKING

(Refer to Fig. 11-26 for reference to the following text.)

If a steering or dozer blade cylinder is leaking hydraulic fluid an adjustment of the packing nut (14, Fig. 11-26) is required. Tightening the packing nut will compress the rod packing and increase its pressure on the rod (16).

SERVICE INFORMATION

Correct adjustment of packing nut allows a thin film of oil to cover surface of rod. No leak must be in evidence. Excess tightening will damage both packing and rod.

To adjust, remove rubber plug (9) and using a wrench rotate packing nut (14) until the hole in the cap (6) is aligned with plug hole in cylinder.

Loosen set screws (13). Insert a suitable punch into aligned holes of cap and cylinder and tighten packing nut (14) lightly.

Tighten set screws (13) and install rubber plug (9).

Start the engine and cycle the cylinder several times. Stop and check the cylinder rod for the film of oil.

If rod packing still requires adjustment, repeat the above procedure. If the packing nut cannot be tightened, packing (5) must be replaced. Refer to Disassembly and Assembly of hydraulic cylinder.

NOTE: Do not over-tighten packing nut. Serious damage to the packing and rod will result.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SECTION XII
ELECTRICAL SYSTEM

Page

SECTION XII ELECTRICAL SYSTEM

DESCRIPTION OF SYSTEM

GENERAL

The electrical circuit used on the S-7C series tractor is a 12 volt, negative ground system. Electrical energy stored in the batteries, is available upon demand to the system components. These components, including the instruments, and cranking motor, are dependent upon battery energy until the engine drives the AC 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, twelve volt batteries are wired in parallel. The batteries are housed directly behind the operator. A hinged top on the battery box provides 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.

PRECAUTIONS

NOTE: Since the AC generator and regulator are designed for use on only one polarity system, the following precautions must be observed when working on the charging circuit. Failure to observe these precautions will result in serious damage to the electrical equipment.

a. When installing a battery, always be absolutely sure the ground polarity of the battery and the ground polarity of the AC generator are the same.

b. When connecting a booster battery, be certain to connect the negative battery terminals together and the positive battery terminals together.

c. When connecting a charger to the battery, connect the charger positive lead to the battery positive terminal and the charger negative lead to the battery negative terminal.

d. Never operate the AC generator on open circuit. Be absolutely certain all connections in the circuit are secure.

e. Do not short across or ground any of the terminals on the AC generator or regulator.

f. Do not attempt to polarize the AC generator.

g. Disconnect the battery ground wire before welding on any part of the tractor.

ELECTRICAL SYSTEM

DESCRIPTION OF SYSTEM

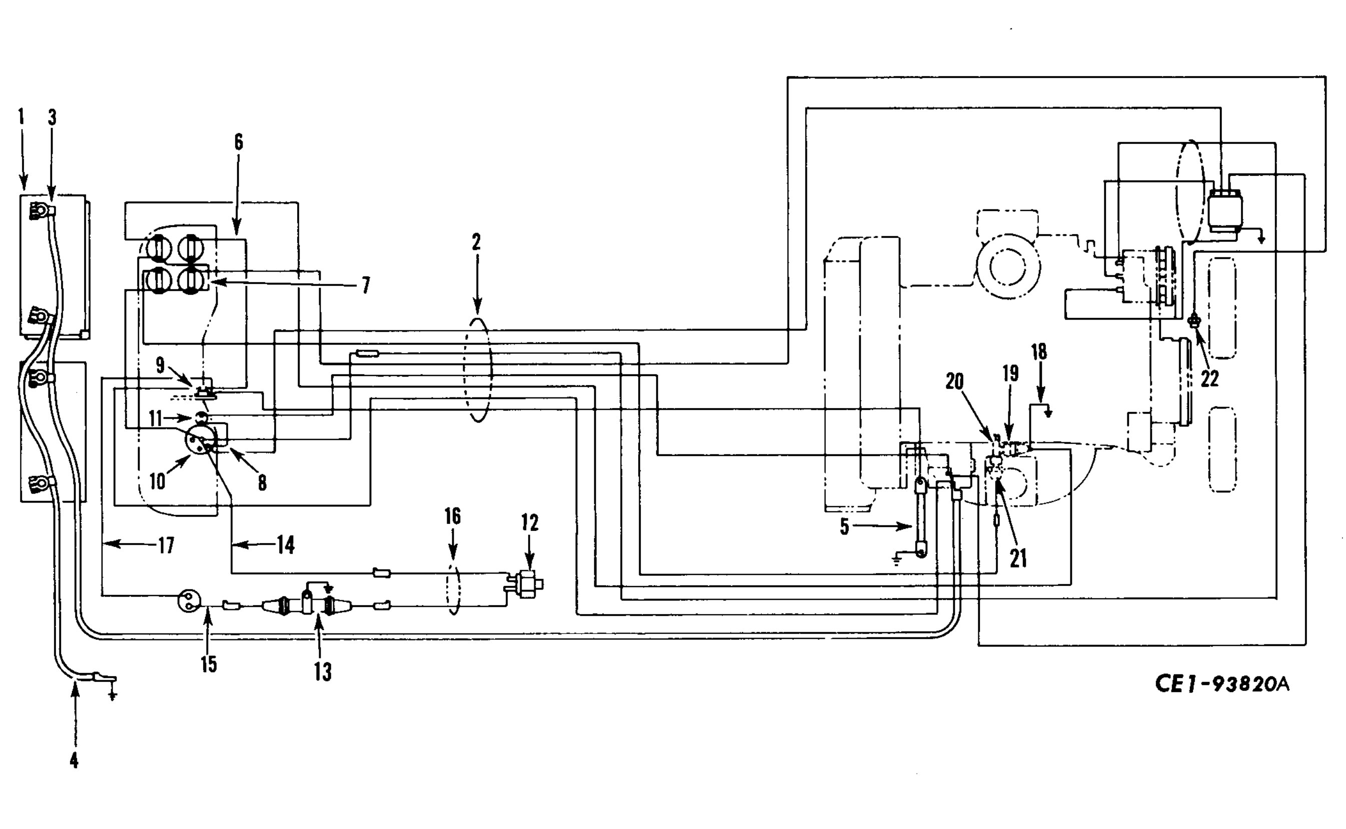


Figure 12-1
Wiring Diagram.

1. Battery.
2. Main harness.
3. Battery-to-starter cable.
4. Battery-to-ground cable.
5. Ground strap.
6. Circuit breaker-to-ammeter cable.
7. Ignition-to-gauges and hourmeter cable.
8. Ignition to push button cable.
9. Circuit breaker.
10. Ignition switch.
11. Push button switch.
12. Brake switch.
13. Warning indicator flasher light.
14. Ignition switch-to-gauges cable.
15. Flasher-to-warning light wire.
16. Brake switch harness.
17. Brake warning-to-ground wire.
18. Pressure switch-to-ground wire.
19. Pressure switch.
20. Tee
21. Oil pressure sender.
22. Engine temperature sender.

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.

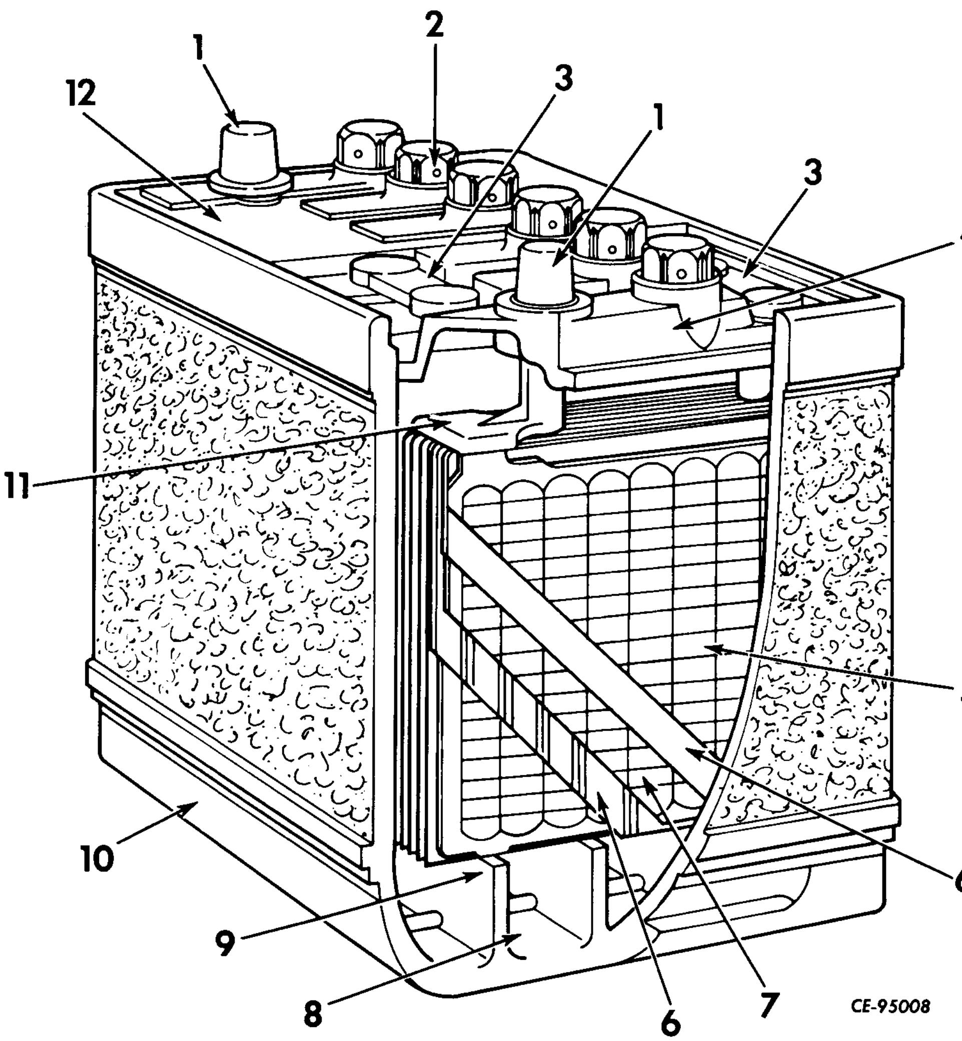


Figure 12-2
Typical 12 Volt Storage Battery.

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.

BATTERIES

OPERATION

A twelve volt battery is composed of one large case (Fig. 12-3) divided into six equal compartments called cells.

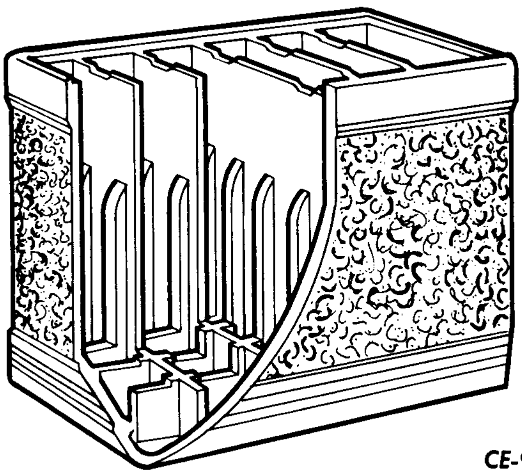


Figure 12-3
Battery Case.

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 boding. 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. 12-5); that is one negative and one positive post strap per cell.

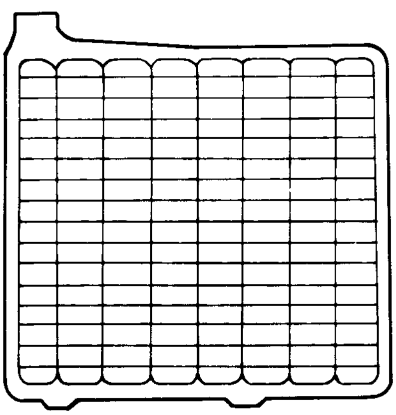


Figure 12-4
Battery Plate.

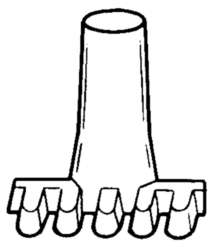


Figure 12-5
Post Strap.

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.

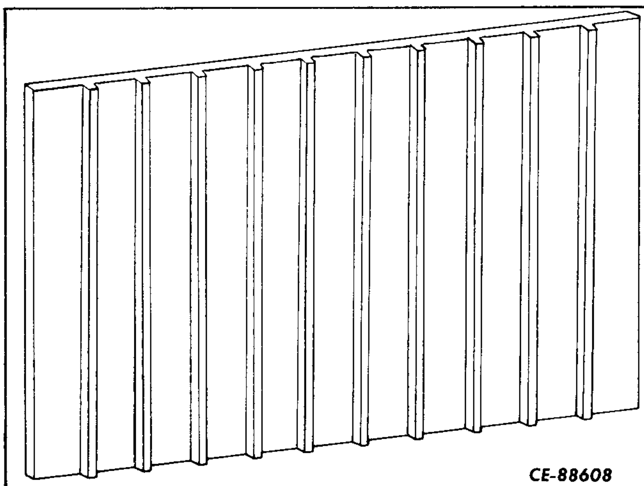


Figure 12-6
Separator Plate.

BATTERIES

In addition to insulating one plate from the other, the separator must be porus 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.

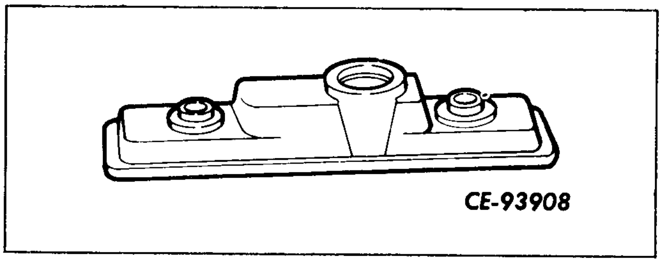


Figure 12-7
Cell Cover.

Battery covers (Fig. 12-8) provide 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.

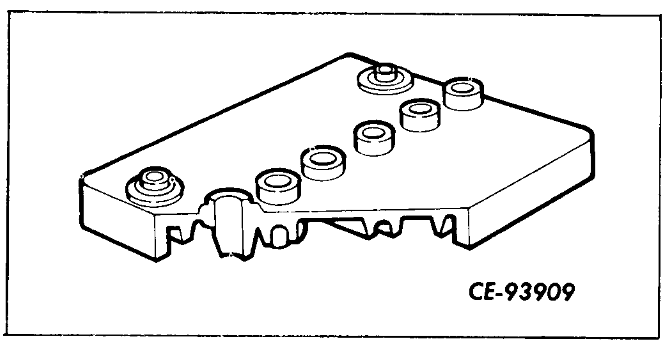


Figure 12-8
Battery Cover.

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 three cells connected in series, a battery capable of generating six 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.

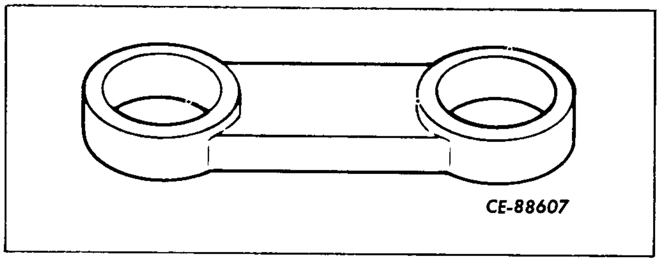


Figure 12-9
Cell Connector.

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.

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 jelly. 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 accurage 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.

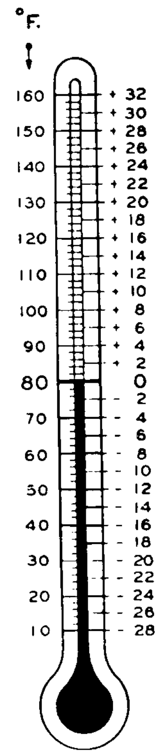
The temperature of the electrolyte has a definite effect on the specific gravity reading. To compensate for each 10°F. change above 80°F. add four (.004) gravity points. For each 10°F. drop below 80°F. subtract four (.004) gravity points.

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.

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).



EXAMPLE No. 1 —

Temperature above 80°F.

Hydrometer Reading 1.235
Acid Temperature 100°F.
Add .008 Sp. Gr.
Corrected Sp. Gr. is 1.243

EXAMPLE No. 2 —

Temperature below 80°F.

Hydrometer Reading 1.250
Acid Temperature 20°F.
***Subtract* .024 Sp. Gr.**
Corrected Sp. Gr. is 1.226

CE-88605

Figure 12-11
Temperature Correction Scale.

BATTERIES

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. Temperatures 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.

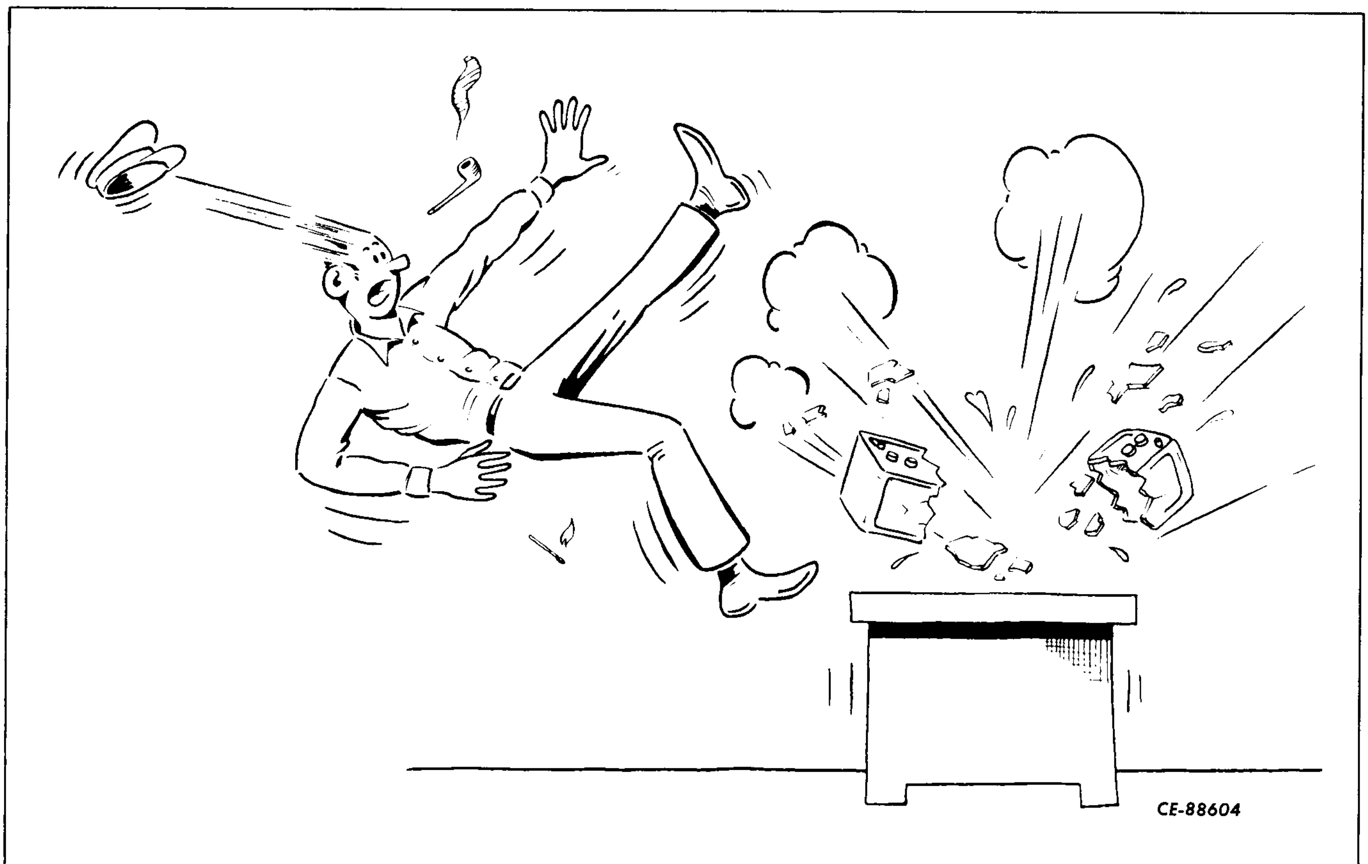


Figure 12-12

AC GENERATOR

DESCRIPTION AND OPERATION

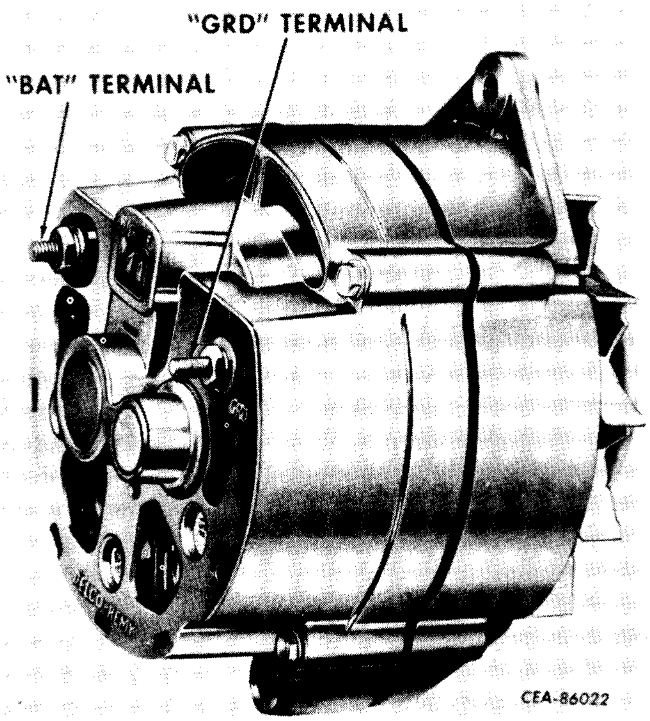


Figure 12-13
Typical Diode Rectified AC Generator.

The AC generator (sometimes called an alternator) is an electrical energy producing unit designed to meet the increased demand for electrical energy during low speed operation or at idle engine operation. It is also designed to give long periods of service with a minimum of maintenance. The rotor is mounted on a ball bearing at the drive end and a roller bearing at the slip ring end. Each bearing has a grease supply which eliminates the need for periodic lubrication. Two brushes are used to carry current through the two slip rings to the field coil which is mounted on the rotor. Brushes are extra long and under normal operating conditions will provide long service.

Stator windings are assembled on the inside of a laminated core that forms part of the AC generator frame. Six rectifier diodes are mounted in the slip ring end frame and are connected to the stator windings. On the AC generator the diodes change AC voltages to DC voltage available at the "BAT" terminal on the generator.

An external view of the diode rectified AC generator is shown in Fig. 12-13. A cross sectional view giving internal details is illustrated in Fig. 12-14.

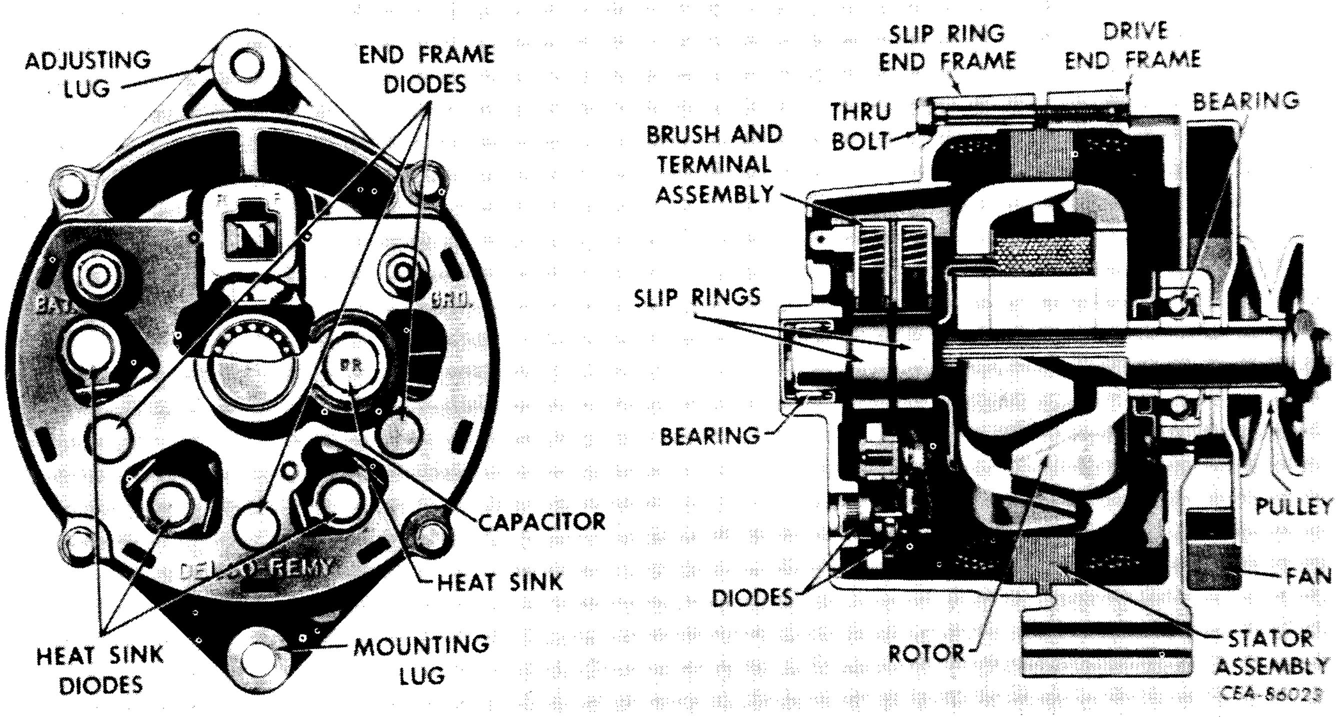


Figure 12-14
Diode Rectified Alternator Generator - Cross Sectional View.

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AC GENERATOR

From the description given above, it is obvious that the make up of this unit is different from the conventional DC generator. A comparison is made between the AC and DC type generator in the following steps:

a. The AC generator has but one field coil and this is located on the rotor shaft. In the DC generator there may be two or more field coils and these are attached to the generator frame. Note this big difference: The AC generator field coil rotates while the DC generator field coils are stationary.

b. The stationary or "stator" windings in the AC generator are attached to the generator frame and carry output current. They perform the same function as the rotation windings in the armature of a DC generator.

c. The brushes in the AC generator are connected in series with the field coil and carry only a low field current. In the DC generator the brushes are connected through the commutator to the armature windings and carry the total generator output. Since low current is carried by the brushes in the AC generator, their life is greatly improved over those in the conventional DC unit.

REGULATORS: To prevent the AC generator from producing too much voltage and thus burning out the accessories and overcharging

(Continued on next page)

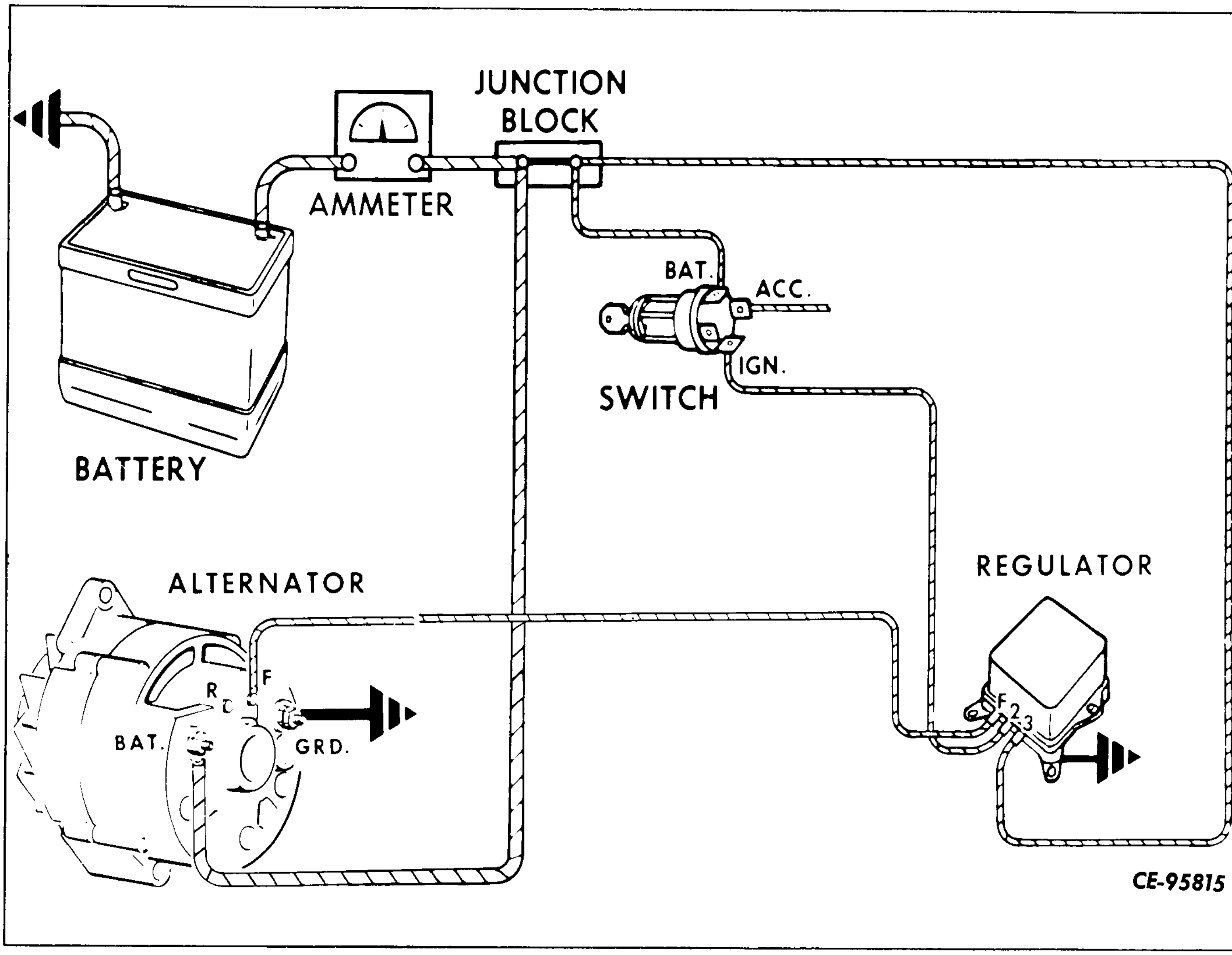

Figure 12-15
Typical Charging System.

AC GENERATOR

DESCRIPTION AND OPERATION - Continued

the battery, its voltage must be limited. For this function a regulator is necessary in the charging system (Fig. 12-15). While the regulator for an AC generator performs the same function as does the regulator for a DC generator, there are also differences in its make up. These are covered in under "REGULATOR."

The AC generator uses the same basic principles of electricity and magnetism that makes the DC generator possible. When a current is passed through a wire, a magnetic field is created around the wire. By bending the wire into a series of loops or coils a stronger magnetic field is produced. When an iron core is placed inside the coil and current is passed through the coil, an electromagnet is formed (Fig. 12-16).

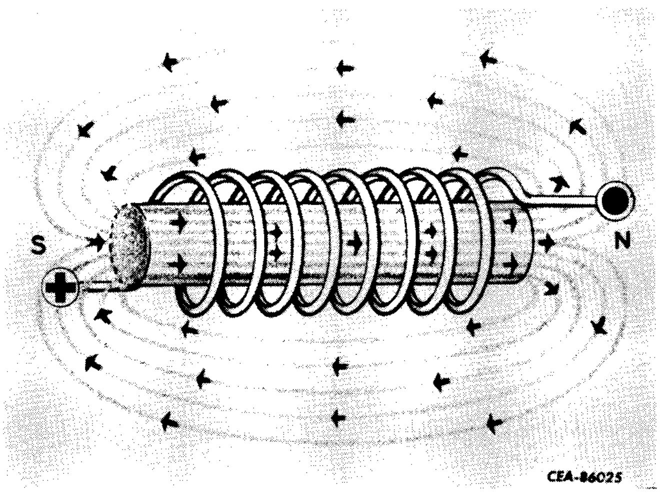

Figure 12-16
Principles of Magnetism.

This is the principle that is used in the design of the AC generator rotor. To form the rotor a wire is first wound around an iron spool which is then placed over the rotor shaft. The pole pieces or rotor segments are then placed around the field coil assembly. The connecting ends of the coil are fastened to the slip rings on the rotor to complete the assembly (Fig. 12-17).

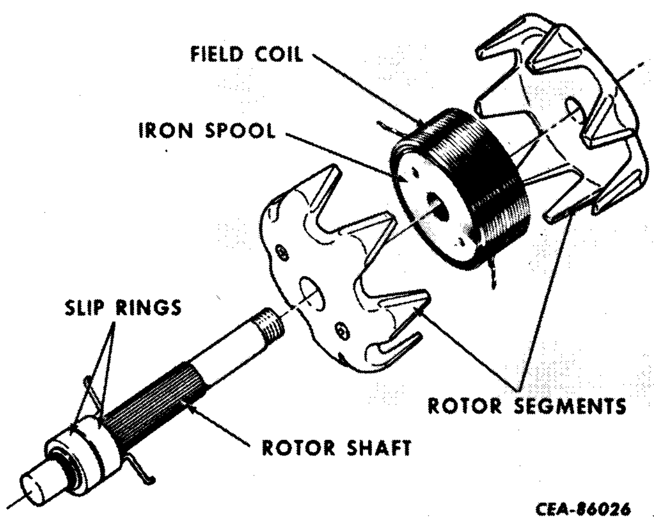

Figure 12-17
Components, AC Generator Rotor.

When battery current flows through the field coil on rotor a strong electromagnet is formed with a North magnetic pole in each pole of one rotor segment and a South magnetic pole at each pole of the other segment. As the rotor turns a spinning magnetic field is produced (Fig. 12-18).

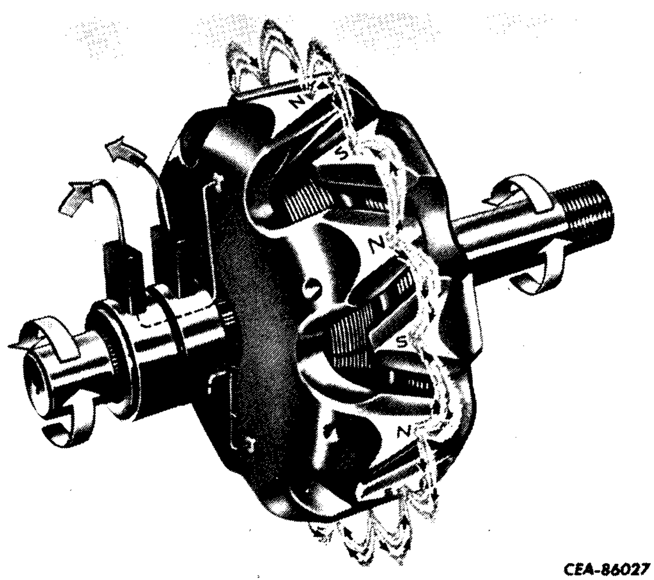

Figure 12-18
Magnetic Field Spinning with Rotor.

AC GENERATOR

STATOR

The stator or stationary winding in the AC generator is made up of many loops of wire (Fig. 12-19). As the alternate North and South poles of the revolving rotor pass each loop of the stator winding, a voltage and current output of a designed value is obtained.

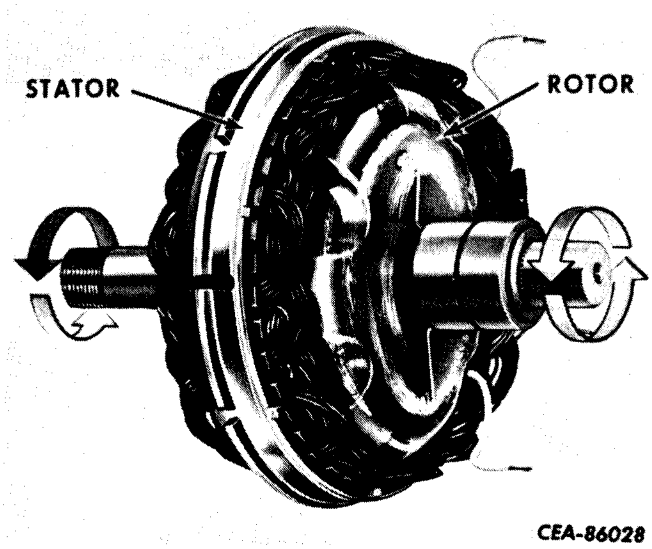

Figure 12-19
Rotor and Stator.

A simplified rotor and the most basic type of stator which is a single loop of wire is shown in Fig. 12-20. As the magnetic field from the spinning rotor cuts across this wire, an electrical pressure or voltage is produced in the wire loop. The faster the rotor turns, the greater the voltage. More loops in the stator winding also increases the voltage.

Since stator windings are influenced alternately by North and South poles of the spinning magnetic fields, an oscillating voltage is produced. This oscillating voltage causes the current in the stator windings to flow first in one direction and then the other. This type of flow is called "alternating current" or simply AC current. Similarly the voltage that produces this type of current is called an AC voltage.

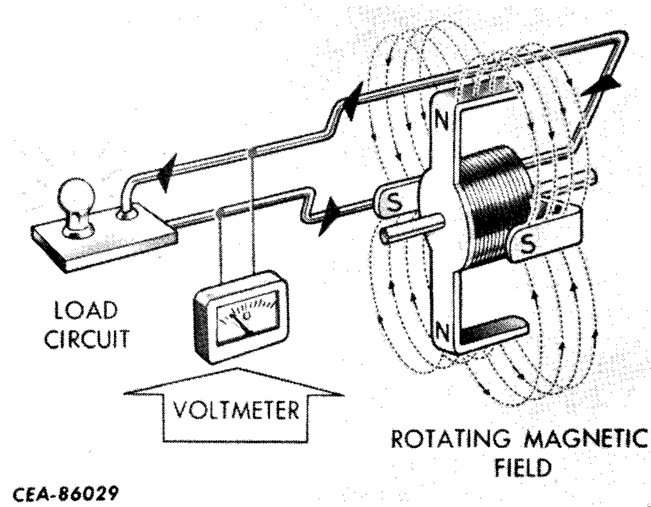

Figure 12-20
Simple AC Generator.

DIODES

The battery and other electrical accessories in the electrical system operate on direct current which flows in one direction only. For this reason it is necessary to change the AC current to DC current. This function is performed by rectifying diodes (Fig. 12-21).

A diode is an electrical device which changes or rectifies alternating current (AC) to direct current (DC) by allowing current to pass through

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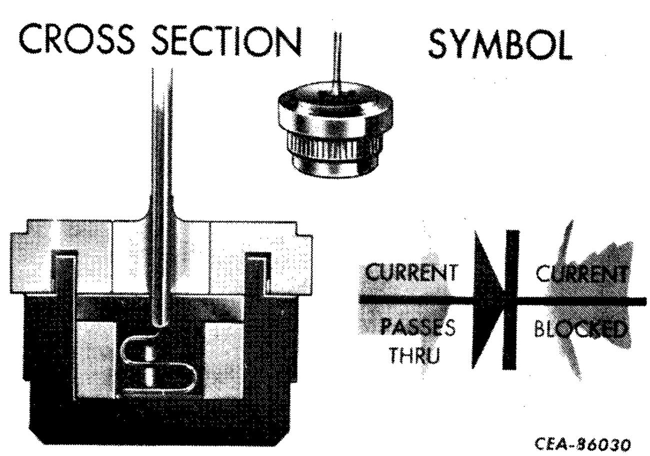


Figure 12-21
Cross Section of Rectifying Diode.

AC GENERATOR

DESCRIPTION AND OPERATION - Continued

DIODES - Continued

it freely in one direction but not in the other. It thus acts much like an electrical check valve or the commutator on a DC generator.

The six diodes (three positive and three negative) (Fig. 12-22) are mounted in the end frame of the AC generator. These diodes change the AC current from the stator windings to a flow of DC current which will be available at the output terminal of the AC generator.

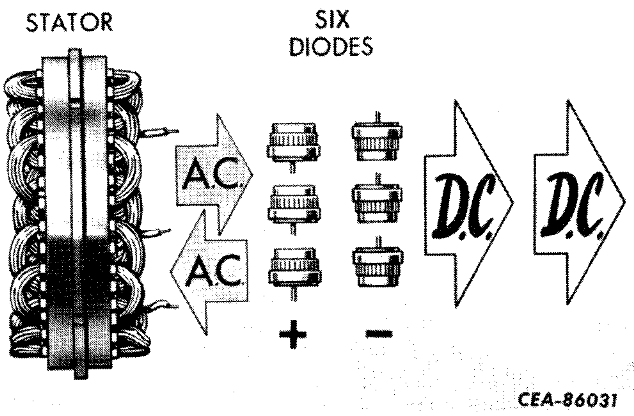


Figure 12-22
Function of Diode in the AC Generator.

HEAT SINK

The heat sink, as its name implies, provides for dissipation of heat which is built up around the diodes while the AC generator is operating.

CAPACITOR (CONDENSER)

The capacitor mounted in the end frame serves two purposes. First it limits the transient voltage across the diodes thereby protecting them from damaging charges. Second it provides radio interference suppression.

SERVICE

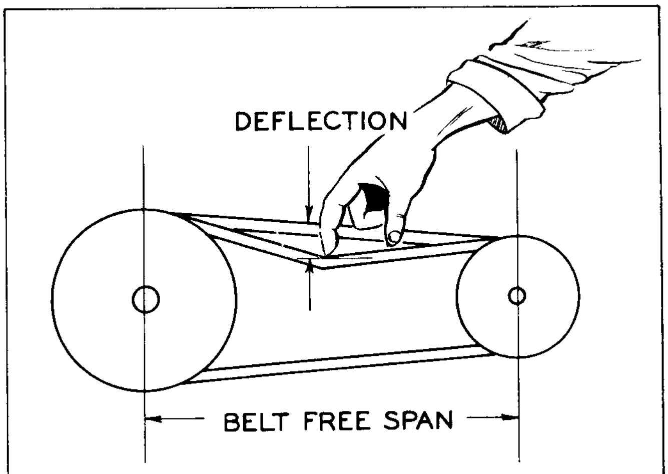
DRIVE BELT TENSION - Neglect or improper care of the generator drive belt may result in undercharged batteries, short belt life and/or worn bearings. Overly tight belts place an additional strain on pulleys, bearings and the belts themselves. Loose belts slip, overheat and wear rapidly.

Check belt tension by depressing belt midway between drive and driven pulleys (Fig. 12-23). 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.

OVERHAUL - For overhaul information and/or service contact your Delco-Remy distributor.



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 12-23

REGULATOR

DESCRIPTION AND OPERATION

A typical double contact regulator is shown in Fig. 12-24. This regulator has four terminals and is used in circuits with an ammeter.

The terminals are of the slip-connection type, and a special connector body on the vehicle wiring harness is keyed to mating slots in the regulator base to insure proper connections. Also, a projection on the connector body serves to latch the assembly together. This prevents disconnections due to vibration. The assembly can be disconnected by lifting the latch slightly (Fig. 12-24).

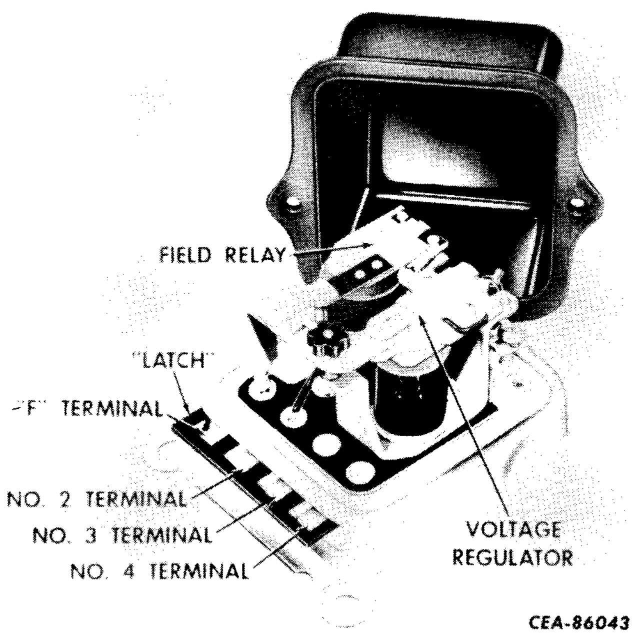


Figure 12-24
Typical Two-Unit Regulator.

A double contact voltage regulator unit and a field relay unit make-up the regulator assembly. The voltage regulator unit operates to limit generator voltage to a pre-set value, whereas the field relay connects generator field winding and regulator winding directly to the battery.

This model regulator is designed for use on a single polarity system. Note the marking on the regulator base, or refer to specifications to determine if polarity of the regulator is negative or positive.

IMPORTANT: On electrical systems using these regulators, the polarity of the regulator, generator and battery must be the same. When installing any one of these three units, do not make any connections without first checking polarities.

A typical wiring diagram showing internal circuits of the regulator used with an ammeter is shown in Fig. 12-25.

On some circuits, a condenser may be connected to the No. 4 regulator terminal. If a condenser is not used, neither is the No. 4 terminal.

NOTE: Do not connect anything to the No. 4 terminal other than a condenser.

Following is a brief description of the operating principles of the units in this type of circuit. When the switch is closed, the field relay winding in the regulator is connected directly to the battery. The magnetism created in the winding attracts the relay armature toward the core, causing the contacts to close. This connects the generator field winding directly to the battery, allowing field current to flow from the battery to the regulator No. 3 terminal, through the field relay contacts and then through the voltage regulator lower or series contacts. Current continues to flow to the regulator "F" terminal, and then through the generator field winding to ground.

When the generator begins to operate, AC voltages are generated in the stator windings, and these voltages are then changed or rectified to a DC voltage which appear at the "BAT" or output terminal on the generator.

As the speed of the generator increases, the voltage at the "BAT" terminal of the generator also increases. This impresses a higher voltage through the field relay contacts and across the voltage regulator shunt winding. The increased magnetism created by the higher voltage across the winding causes the lower contacts to separate, and field current then flows through a resistor resulting in reduced field

(Continued on next page)

REGULATOR

DESCRIPTION AND OPERATION - Continued

current. This reduced field current causes the generator voltage to decrease, which decreases the magnetic pull of the voltage regulator shunt winding. The spring causes the contacts to re-close, and the cycle then repeats many times per second to limit the generator voltage to a pre-set value. As the generator speed increases even further, the resistor connected across the contacts is not of sufficiently high value to maintain voltage control on the series contacts. Therefore the voltage increases slightly causing the upper or shorting contacts to close. When this happens, the generator field winding is shorted and no current passes through the winding. With no current in the field winding, the generator voltage decreases, which also decreases the magnetism in the shunt winding and the upper or shorting contact points open. With these points open, field current flows through the resistor and the field winding. As the voltage increases, the contacts re-close. This cycle then repeats many times per second to limit the generator voltage to a pre-set value at high generator speeds. The voltage regulator unit thus operates to limit the value of generator voltage throughout the generator speed range. Consequently the electrical accessories are protected from too high voltage which would damage them.

SERVICE

For service and/or overhaul information contact your local Delco-Remy distributor.

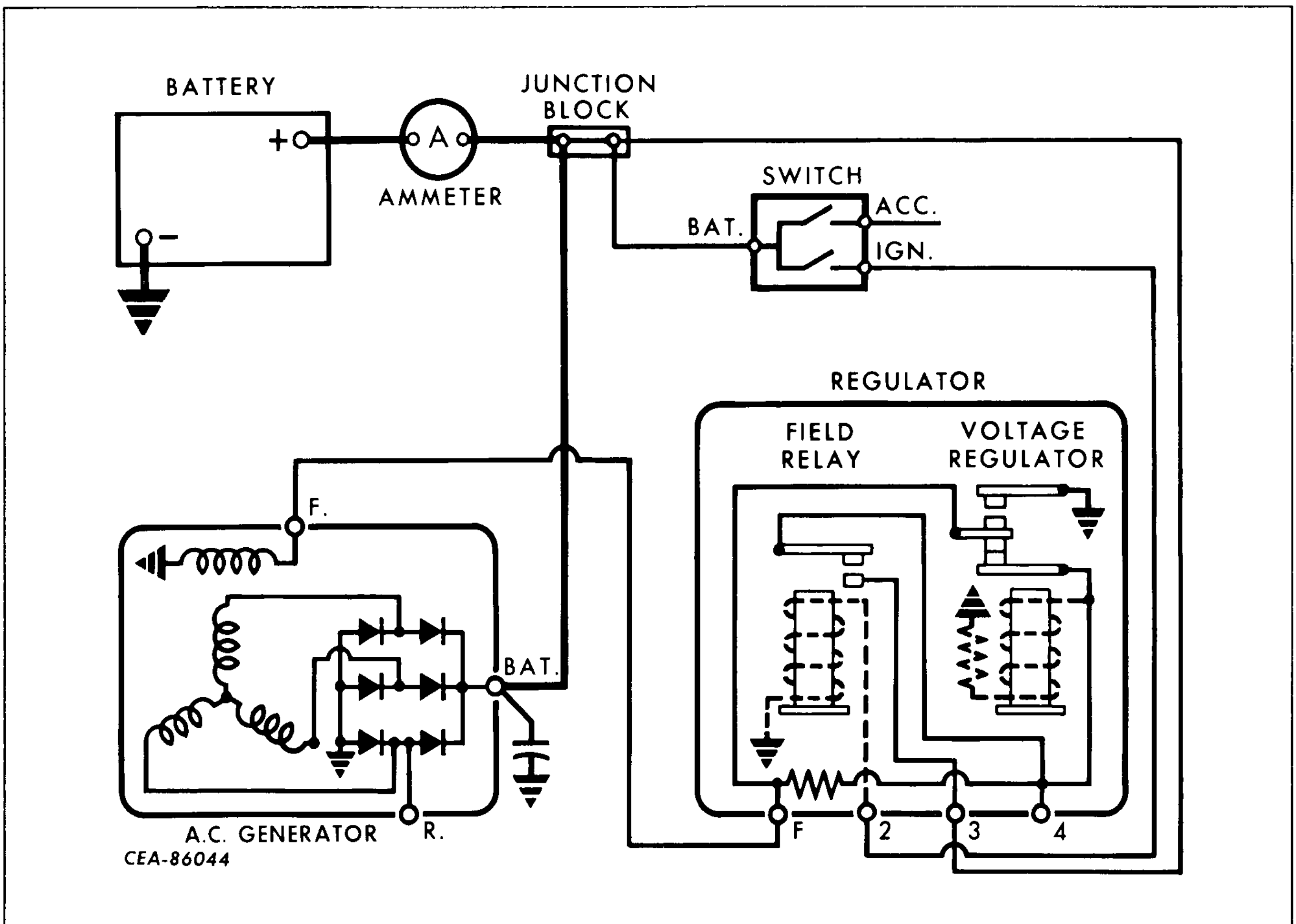


Figure 12-25
Typical Wiring Diagram with Ammeter Showing Internal Circuits.

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 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.

The cranking motor employed on the H-60B 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. 12-26) 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 sprag 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. 12-26). 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.

CRANKING MOTOR

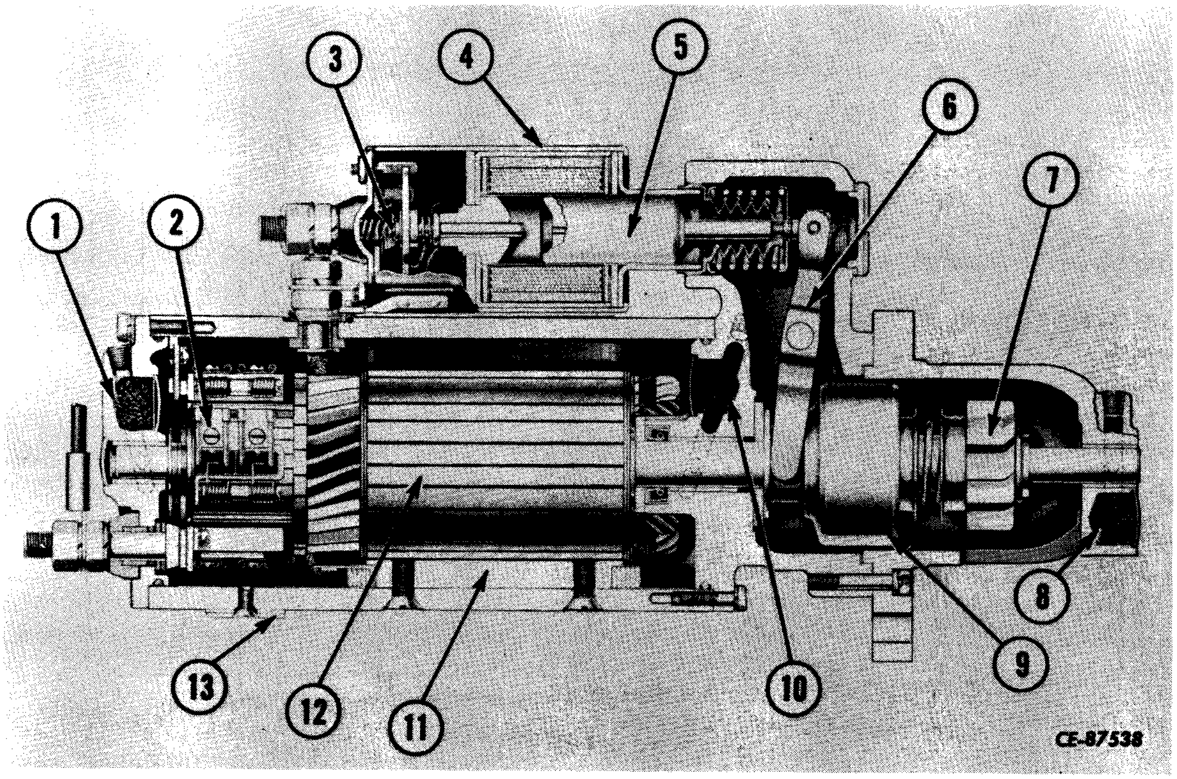


Figure 12-26
Diesel Engine Cranking Motor - Cross Section.

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.

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 directly in front of the operator are self explanatory. Each indicates the immediate condition of the system to which it is connected. With the exception of the hydraulic pressure gauge, transmission pressure gauge and the air pressure gauge, the units 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.

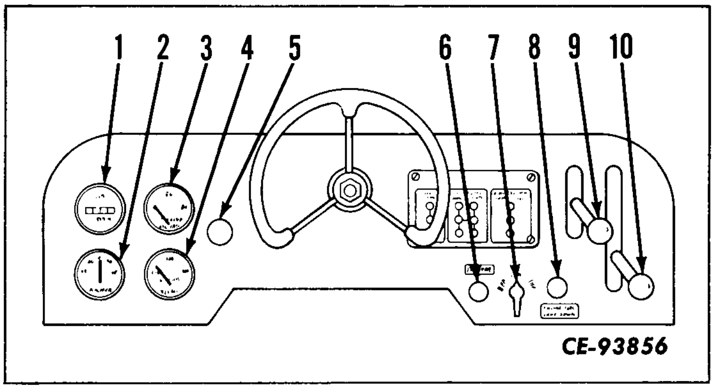


Figure 12-27
Instrument Panel.

1. Hourmeter.
2. Ammeter.
3. Engine oil pressure.
4. Engine temperature.
5. Dash lamp.
6. Starter button.
7. Main switch.
8. Engine shut-down cable.
9. Blade control lever.
10. Hand throttle.

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 alternator drive belt. 3. Defective alternator. 4. Malfunctioning regulator.	1. Replace battery. 2. Adjust drive belt. 3. Repair or replace alternator. 4. Adjust or replace regulator.
Charge too high; over-charged battery.	1. Malfunctioning regulator. 2. Incorrect pulley used on alternator.	1. Adjust or replace regulator. 2. Replace with pulley of correct size.

(Continued on next page)

TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Battery uses an excessive amount of water.	1. Charging rate too high. 2. Incorrect pulley used on alternator.	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.
Lights dim.	1. Batteries low. 2. Poor ground. 3. Loose connections.	1. Charge batteries. 2. Provide a clean, tight ground. 3. Tighten all connections.
One electrical gauge not operating.	1. Bad connection at gauge, connector plug or sender. 2. Sender defective. 3. Gauge defective.	1. Make a positive connection. 2. Replace. 3. Replace.
Ignition "ON" - no gauges or lights working.	1. Dead battery. 2. Loose connection from battery to ammeter. 3. Broken wire between battery and ammeter.	1. Recharge or replace. 2. Tighten or correct. 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. 2. Bad light switch.	1. Tighten. 2. Replace.

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 electrolmagnet.
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

The brake system consists of three components; master cylinder, brake lock valve and the brake caliper. All three components make up the service brake system.

The brake pedal is connected to the master brake cylinder. When the pedal is depressed, hydraulic brake fluid is directed under pressure to the brake caliper. The caliper is mounted on the transfer case and when actuated, two pistons press brake shoe pads against a steel disc which is mounted to the output shaft of the transfer case and rotates between the brake caliper.

For winching operations the brake system can be locked momentarily by depressing the brake pedal and turning the lock lever to "ON." This locks hydraulic brake fluid between the lock valve and brake caliper. A warning light is actuated by this operation and will remain on until the brake lock lever is turned to "OFF."

NOTE: The brake lock is used for winching operations only. Do not use it as a Parking Brake. When not using the brake lock make sure it is in the "OFF" position.

PREVENTIVE MAINTENANCE

CHECK FLUID LEVEL

The level of hydraulic brake fluid in the master cylinder should be kept within 1/2 to 3/8 inch of the top of the filler hole. This will eliminate the possibility of air entering the hydraulic brake system. Clean the area around the power cluster hole before removing fill cap. Refer to "SPECIFICATIONS" for type fluid when correcting fluid level in the brake system.

DISASSEMBLY, INSPECTION AND ASSEMBLY

MASTER CYLINDER

For information pertaining to the Brake Pedal and Brake Adjustments, refer to Section 9, "LINKAGE."

NOTE: Before servicing brake system, position tractor on a level surface, preferably in an enclosure. Block tractor wheels and lower dozer blade to ground. Shut engine off.

REMOVAL

To service master cylinder (1, Fig. 13-2) or brake pedal linkage, remove cap screws (3) and floor panel (2).

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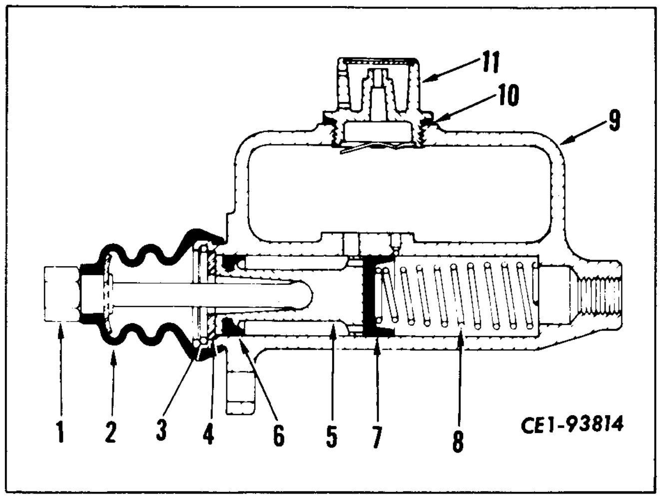

Figure 13-1
Master Cylinder.

1. Push rod.
2. Boot.
3. Lock wire.
4. Piston stop plate.
5. Piston assembly.
6. Secondary cup.
7. Primary cup.
8. Spring.
9. Master cylinder.
10. Gasket.
11. Filler cap

DISASSEMBLY, INSPECTION AND ASSEMBLY

MASTER CYLINDER - Continued

REMOVAL - Continued

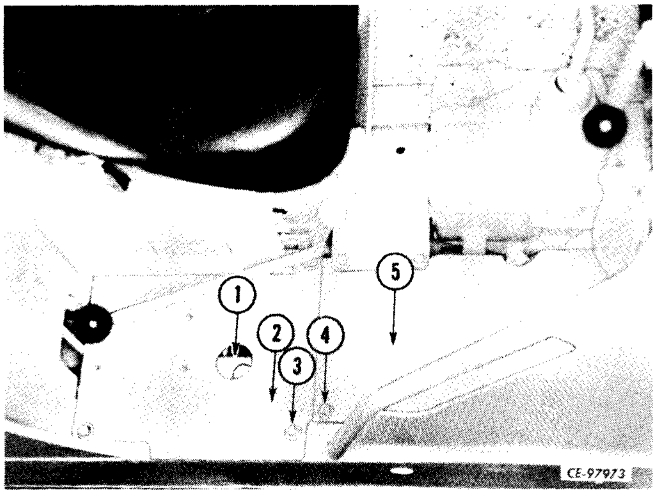

Figure 13-2

To remove master cylinder (6), remove cotter pin and clevis pin (2). Remove cap screws and nuts (5).

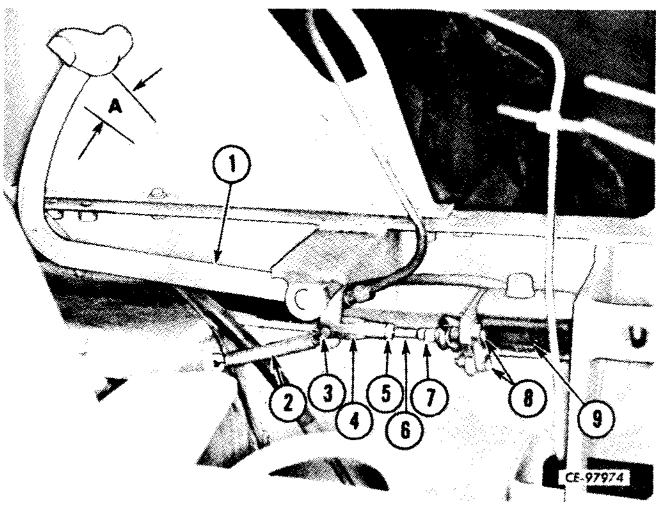

Figure 13-3

DISASSEMBLY

Remove filler cap (1, Fig. 13-4) from master cylinder (2). Drain all fluid.

Separate boot and push rod assembly (1, Fig. 13-5) from cylinder body (2). Discard boot.

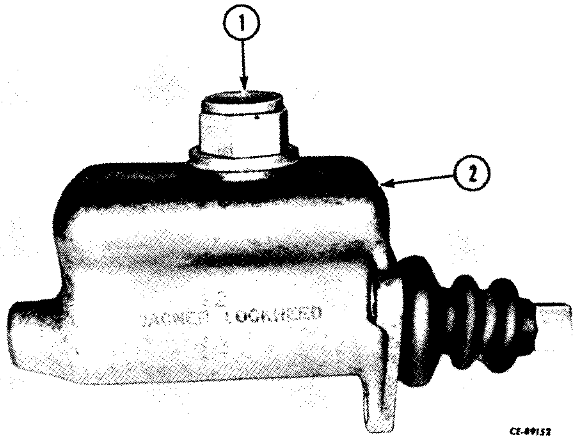

Figure 13-4

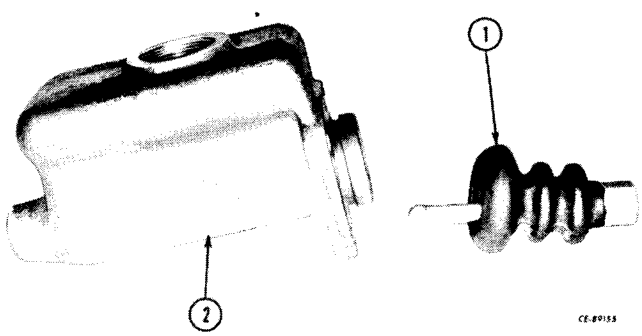

Figure 13-5

Remove lock ring (7). Slide piston stop plate (6), piston (4), primary cup (3) and piston return spring (2) out of body (1). Discard primary cup (3) and secondary cup (5).

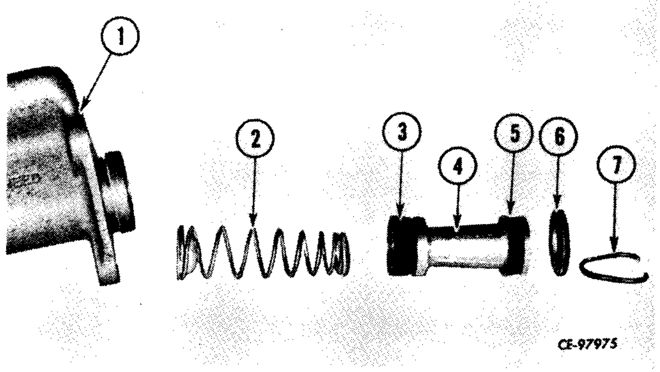

Figure 13-6

DISASSEMBLY, INSPECTION AND ASSEMBLY

CLEAN, INSPECT AND REPAIR

Clean and inspect the master cylinder as follows:

Clean the master cylinder parts in clean solvent. Rinse thoroughly in denatured alcohol or brake fluid.

Inspect the cylinder bore to be certain it is smooth and free of scores and/or pitting. Some scoring may be removed by honing lightly. This honing must not materially increase the diameter of the cylinder bore (refer to "SPECIFICATIONS" under "SERVICE INFORMATION" for cylinder bore. Refer to "TOLERANCES" under "SERVICE INFORMATION" for honing tolerance.

Cylinder Dia: __________

Max. Dia. after Honing: __________

After honing cylinder wash it thoroughly in clean denatured alcohol. Pass a soft copper wire through the ports in the bottom of the reservoir to be certain they are clear.

Be sure a honed cylinder has no burr at the bypass port. A burred port will damage the piston cup lip. Remove the burr with a deburring tool.

Inspect all parts for wear or damage and replace as necessary.

Replace all rubber components.

ASSEMBLY

Before assembly, dip all master cylinder parts in clean brake fluid.

Install a new secondary cup (5, Fig. 13-6) into groove of piston (4). Place a new cup (3) on opposite end of spring and install spring and cup into body (1). Install piston (4), cup end first, into body. Install stop plate (6) and lock ring (7).

Attach a new boot (1, Fig. 13-5) to push rod and install it on cylinder body (2).

Fill master cylinder with new brake fluid (refer to "LUBRICANTS AND CAPACITIES" under "SERVICE INFORMATION" for recommended brake fluid. Press piston through one full stroke. Repeat piston stroking until fluid is forced out of outlet port. This leaves master cylinder filled with fluid before installation on tractor.

INSTALLATION

Position master cylinder (1, Fig. 13-3) on mounting bracket (2) and install and tighten cap screw and nuts. Install clevis (3) to brake pedal arm and install clevis and cotter pin.

Bleed brake system (refer to "ADJUSTMENTS" under "SERVICE INFORMATION").

Install floor panel (2, Fig. 13-2) and cap screws (3).

BRAKE CALIPER

REMOVAL

> NOTE: Before servicing brake system, position tractor on a level surface preferably in an enclosure. Block tractor wheels and lower dozer blade to ground. Shut engine off.

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

BRAKE CALIPER - Continued

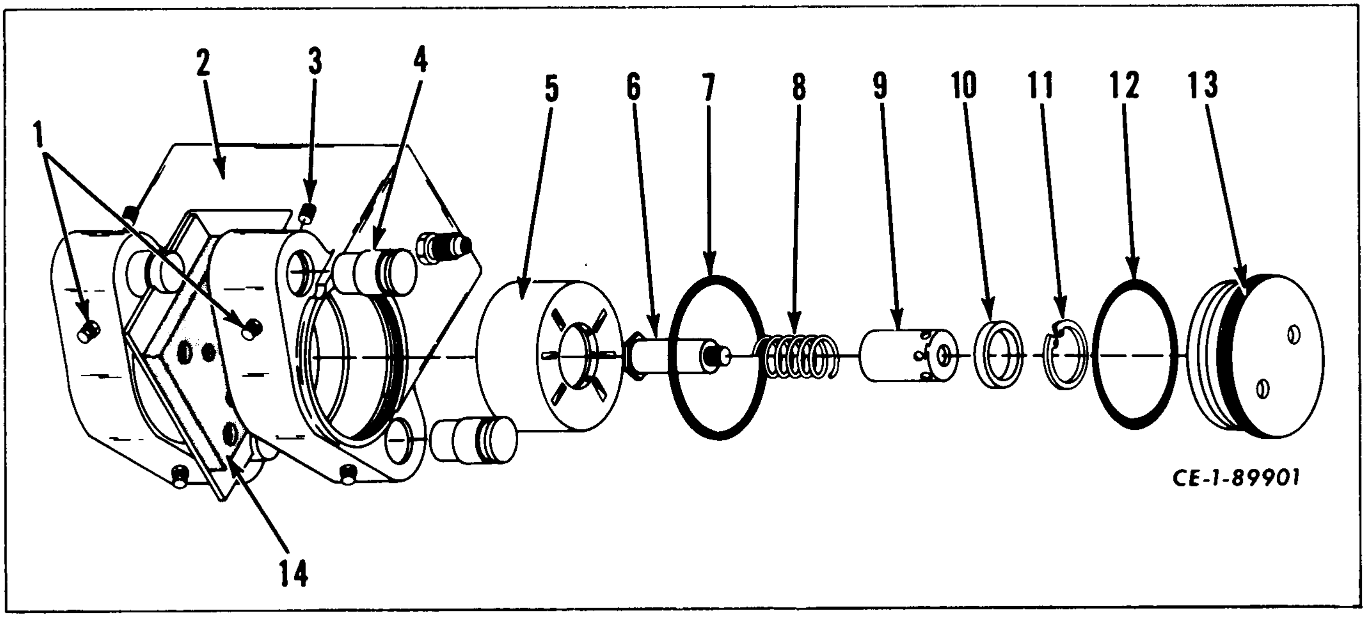

Figure 13-7
Brake Caliper.

1. Bleeder screws.
2. Housing.
3. Setscrew.
4. Guide pins.
5. Piston.
6. Shoulder screw.
7. Packing.
8. Spring.
9. Guide.
10. Washer.
11. Snap ring.
12. Packing.
13. Plug.
14. Brake block.

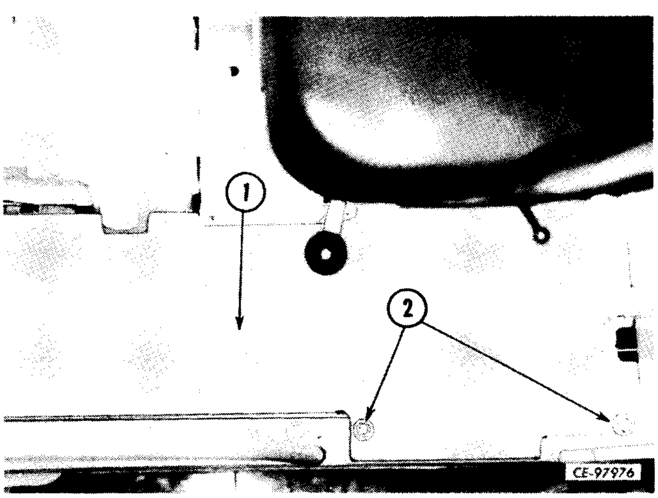

Figure 13-8

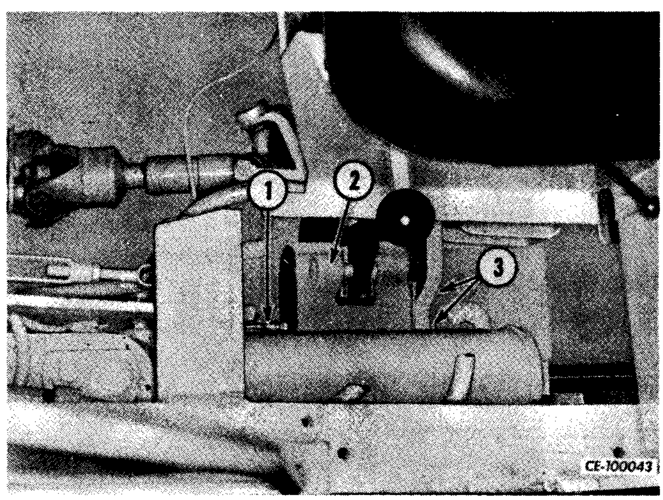

Figure 13-9

DISASSEMBLY, INSPECTION AND ASSEMBLY

REMOVAL - Continued

To gain access to brake caliper, floor panels must be removed. Remove cap screws (2, Fig. 13-8) and floor panel (1).

Disconnect and plug hydraulic brake line (1, Fig. 13-9). Remove cap screws (3) disconnecting brake caliper (2) from transfer case mounting bracket. Remove and tag shims for assembly.

DISASSEMBLY

Remove lining carriers (2, Fig. 13-10) from guide pins (1).

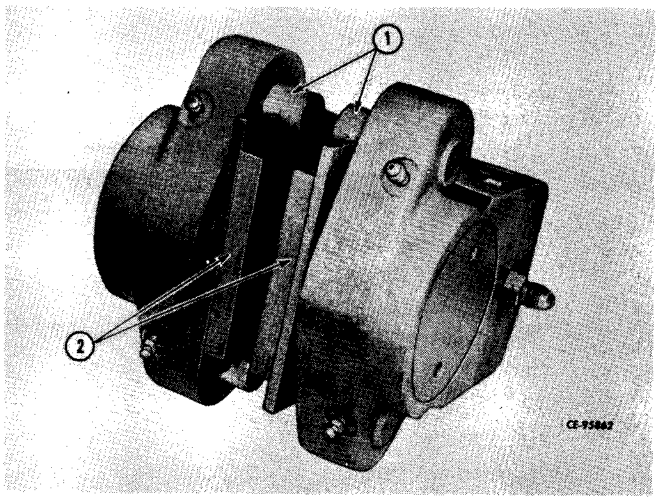

Figure 13-10

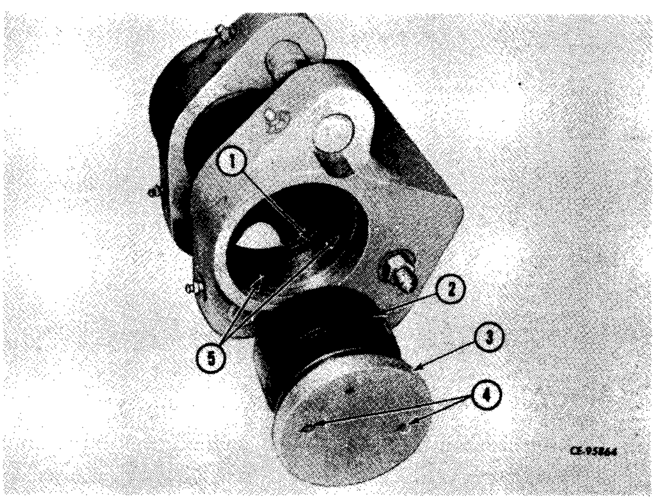

Figure 13-11

Remove plugs (3, Fig. 13-11) and pistons (2) using a suitable spanner wrench in plug holes (4). Remove and discard "O" ring (1).

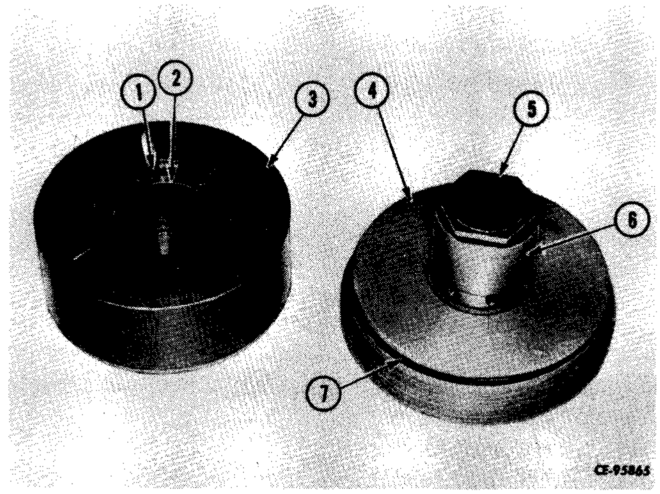

Figure 13-12

Separate piston (3, Fig. 13-12) using a shop press. Remove snap ring (1) and washer (2) from piston. Remove cap screw (5), guide and spring (6). Remove and discard "O" ring (7).

Remove set screw (2, Fig. 13-13) in housing to release carrier guide pins (1). Remove pins.

(Continued on next page)

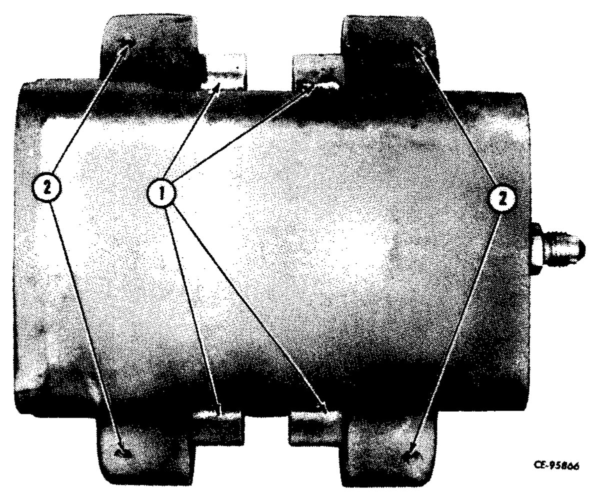

Figure 13-13

DISASSEMBLY, INSPECTION AND ASSEMBLY

BRAKE CALIPER - Continued

CLEAN, INSPECT AND REPAIR

Wash all parts (with exception of lining and carrier assemblies) thoroughly in clean, denatured alcohol. Pass a soft copper wire through ports (5, Fig. 13-11) in piston bores to be certain they are clear. Check bores, pistons and plugs for nicks, burrs and scratches. If these abrasions are too deep to be repaired part will have to be replaced.

ASSEMBLY

Install carrier guide pins (1, Fig. 13-13) in their housing bores and secure with set screws.

Install spring and guide (6, Fig. 13-12) in plug (4). Secure with bolt (5). Prior to bolt installation, apply a light coat of "LOCTITE-C" to bolt threads. Install new "O" ring (7). Refer to "INTRODUCTION," Fig. I-1, for correct "O" ring installation. Install washer (2) in piston (3) and secure with snap ring (1).

Using a suitable shop press, press plug and guide assembly into piston until it bottoms.

Install a new "O" ring (1, Fig. 13-11) inside piston bore. "O" ring must seat in groove naturally, not rolled or twisted. Lubricate all "O" rings well with brake fluid. Install piston (2) and plug (3) assembly. Install and tighten plugs (3) with a suitable spanner wrench using holes (4).

Install new lining carriers (2, Fig. 13-10) on guide pins (1).

INSTALLATION

Position brake caliper (2, Fig. 13-9) and shims on transfer case bracket and install and tighten cap screws (3). Refer to Section 4, "TRANSFER CASE" for information on installing brake caliper on the transfer case. Tighten cap screws (3) to recommended torque. Refer to "SPECIAL TORQUES," Service Information.

Brake disc must be centered in housing. Measure distance between brake disc and inner face of guide pin boss (housing) on both sides of disc. The two distances may not exceed recommended maximum (refer to "TOLERANCES").

Max. allowable variation between measurements: ________

If measured distances exceed recommended maximum, add or subtract shims until desired measurement is obtained. Mounting cap screws (1) must be correctly torqued at time of measurement.

Connect hydraulic brake line (1, Fig. 13-9) to brake caliper. Bleed the brake system. Refer to "BLEED HYDRAULIC BRAKE CIRCUIT."

Position floor panels (1, Fig. 13-8), and secure with cap screws (2).

BRAKE LOCK VALVE

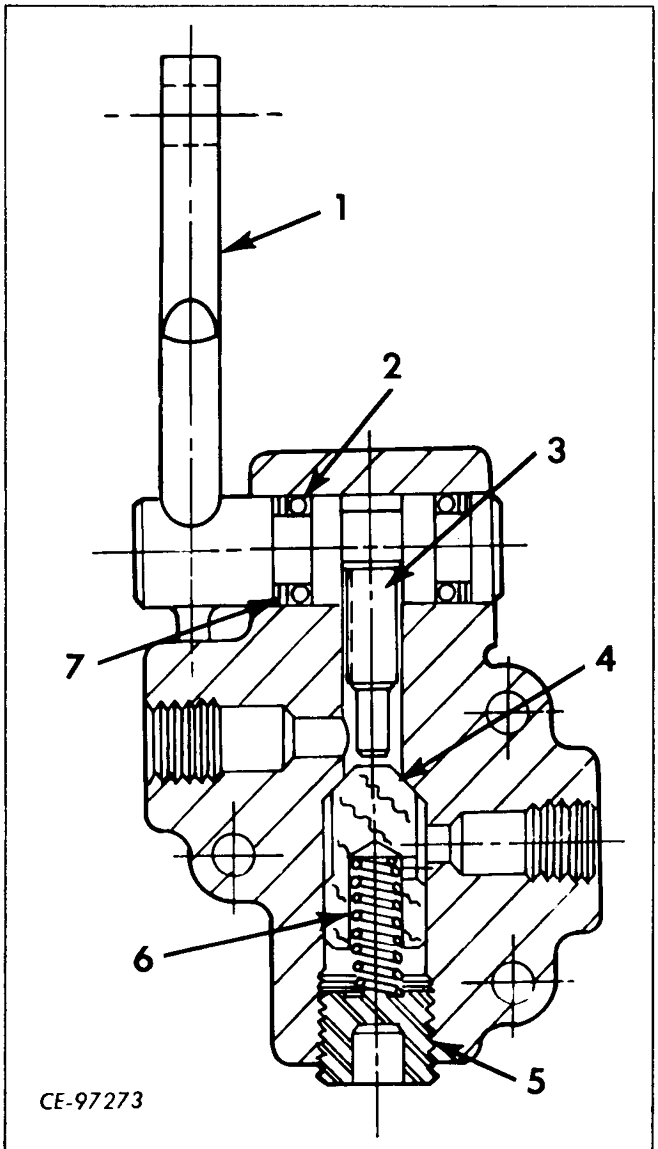

Figure 13-14
Brake Lock Valve.

DISASSEMBLY, INSPECTION AND ASSEMBLY

Legend for Figure 13-14

1. Control lever.
2. "O" ring.
3. Cam follower.
4. Poppet.
5. Plug.
6. Spring.
7. Back-up washer.

REMOVAL

To gain access to brake lock valve (3), operator's seat (1, Fig. 13-15) must be removed. Remove nuts and lock washers (2) on each side and remove seat.

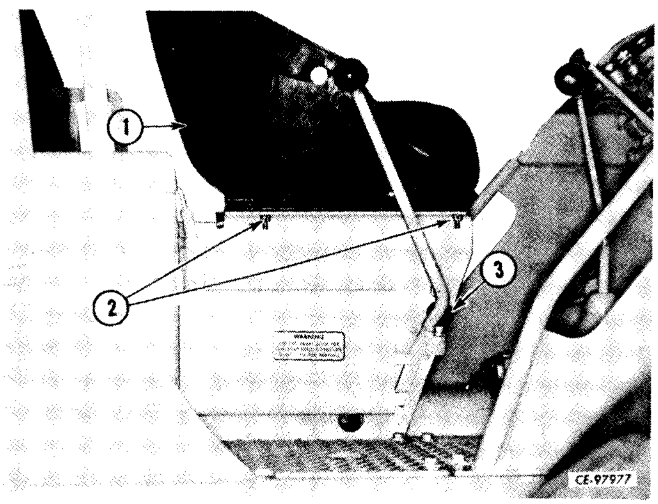

Figure 13-15

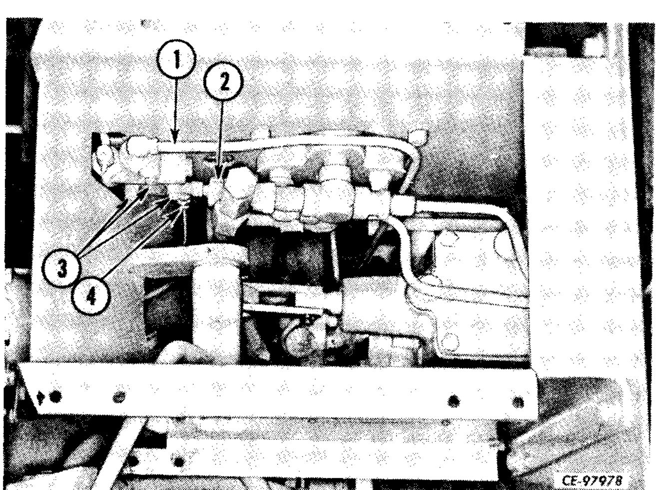

Figure 13-16

Disconnect and plug line (1, Fig. 13-16) between master cylinder and valve and line (4) between valve and brake caliper. Remove electrical lead from sender (2). Remove nuts (3) and brake lock valve.

DISASSEMBLY

Remove plug (5, Fig. 13-14) from base of housing. Remove spring (6), poppet (4) and cam follower (3) from valve bore.

Pull lever (1) from its bore at top of housing. Remove and discard "O" rings (2) and back-up washers (7).

INSPECTION

Wash all parts thoroughly in clean solvent. Dry with compressed air.

Inspect lever shaft, cam follower, poppet and housing bores for scratches or excessive wear. Replace parts if in doubt.

ASSEMBLY

Install new back-up washers (7, Fig. 13-14) and "O" rings (2) in groove in lever shaft. Be sure "O" rings are not rolled or twisted.

Lubricate lever shaft, "O" rings and lever shaft bore in housing with clean, new oil. Install lever shaft in housing.

Install lubricated cam follower (3), poppet (4) and spring (6) in housing bore. Install plug (6) in bore and tighten securely. Check lever (1) for smooth movement throughout its entire arc.

INSTALLATION

Position valve on seat bracket and install and tighten cap screws, lock washers and nuts (3, Fig. 13-16). Connect lines (1, 4). Connect electrical wire to sender (2).

Bleed brake system. Refer to "BLEED HYDRAULIC BRAKE CIRCUIT."

Position operator's seat (1, Fig. 13-15) on seat bracket, install and tighten lock washers and nuts (2).

TROUBLE SHOOTING

SERVICE BRAKE

The chart below contains trouble shooting information for the brake system. Each complaint 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 complaints.

COMPLAINT	POSSIBLE CAUSE	REMEDY
Sudden total failure.	1. Brake fluid. a. Lowered fluid boil point resulting in vapor lock. b. Overheated brakes causing vapor lock. 2. Fluid loss. a. Pressure failure at cups. b. Ruptured tube. 3. Frozen piston. a. Broken stop lockwire. b. Effect of rust, corrosion, frozen link, bind or interference.	1. Correct condition found. a. Use type fluid recommended. b. Use correct type lining. 2. a. Overhaul cylinder. b. Replace. 3. Correct condition found. a. Replace. b. Free, clean, replace defective parts.
Low pedal.	1. Worn lining. 2. Excess pedal lash. 3. Air in fluid.	1. Adjust or reline. 2. Adjust. 3. Bleed system.
Pedal drops or fades.	1. Fluid seepage past master cylinder primary cup. 2. Fluid leak at caliper cylinders. 3. Fluid seepage at hydraulic lines under pressure.	1. Overhaul cylinders. 2. Overhaul caliper cylinder. 3. Replace defective lines.
"Spongy" or "springy" pedal.	1. Fluid low in master cylinder reservoir. 2. Fluid leaks at tubes, connections and caliper cylinders.	1. Add make-up fluid. 2. Tighten connections and replace defective parts.
Brake drags or locks.	1. Swollen cup blocking by-pass port in master cylinder. 2. Dirt and/or corrosion. 3. No pedal free travel. 4. Pedal linkage binds upon release.	1. Replace defective part. 2. Flush system and clean affected parts. 3. Adjust pedal linkage. 4. Correct linkage condition.

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TROUBLE SHOOTING

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

HYDRAULIC BRAKE FLUID

Type . . . . IH Heavy Duty
SAE J-1703a

TOLERANCES

Master cylinder diameter . . . . 1.0625"
Maximum diameter of master cylinder bore after honing . . . . 1.0632"

Brake disc:
Maximum variation in measurements-disc-to-guide pin boss (housing) . . . . . .023"-.033"
Maximum disc out of round . . . . .025"

SPECIAL TORQUES

Brake pedal caliper to mounting bracket . . . . 25-30 ft. lbs.

SERVICE INFORMATION

ADJUSTMENTS

PEDAL ADJUSTMENT

Check and correct fluid level before final adjustment. If any part of brake system has been serviced, system must be bled. Refer to "BLEED HYDRAULIC BRAKE CIRCUIT." Inability to maintain proper fluid level usually indicates a system leak. Adjustment of brake pedal travel must be done from under right hand floor panel (Refer to Fig. 13-2) by shortening or lengthening rod (7, Fig. 13-17) between master cylinder and brake pedal arm (2).

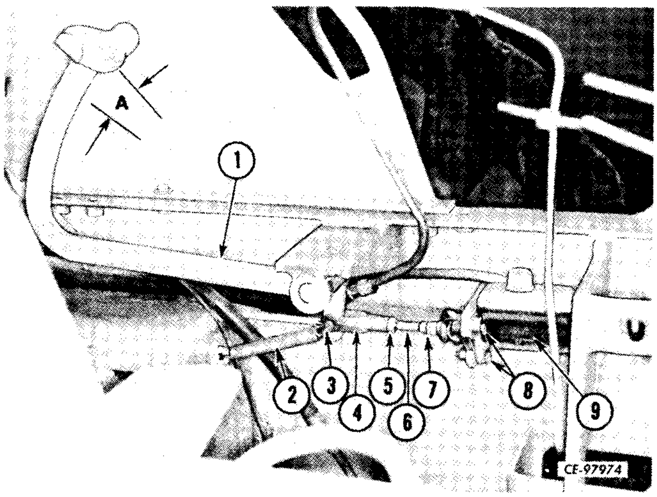

Figure 13-17
Brake Pedal Assembly.

Loosen jam nuts (6, 8) on each end of rod (7) holding nut (9), rotate rod (7) in either direction depending upon the required adjustment.

Proper adjustment is to obtain a 1/4-1/2 inch of "FREE-PLAY" (1) at beginning of pedal travel. Lack of "FREE-PLAY" will block bypass port in master cylinder and after several brake applications, brake lining carriers will drag against the brake disc. Excessive "FREE-PLAY" will decrease the usable stroke of the master cylinder piston.

Once proper adjustment is accomplished, tighten jam nuts (6, 8). Check to be sure that the pedal return spring (3) is properly installed and is capable of holding the pedal assembly (2) in the released position. Install right hand floor panel.

BLEED HYDRAULIC BRAKE CIRCUIT

Air trapped in the hydraulic lines will decrease or eliminate the tractors braking effort. To insure safe operation, the hydraulic brake line should be bled whenever it is suspected that air or gas is trapped in the system. Air is most likely to enter the brake system through a leak; when the line is disconnected or when there is an insufficient amount of brake fluid in the reservoir.

Whenever air is trapped in the system, the feel at the brake pedal is "spongy" and full braking pressure cannot be developed. Pressure bleeding of the brake system is preferable, but since bleeder tanks are not always available, the system can be manually bled. The proper sequence for bleeding the system requires starting at the master cylinder and then moving to the caliper brake assembly.

Bleed the system as follows:

1. Remove accumulated dirt from master cylinder filler cap area. Remove the cap and fill the reservoir to within 1/2" of the top of the hole. Use only new brake fluid of the recommended type (refer to "SPECIFICATIONS"). Keep the reservoir filled during and after bleeding operations.

2. With all bleed screws closed, depress the brake pedal, slowly and repeatedly until a pressure is built up in the system. Using an end wrench loosen the brake line fitting at the point where it attaches to the master cylinder. When the brake pedal reaches the full down position, hold the pedal stationary and tighten the fitting.

NOTE: Do not allow the pedal to rise until the fitting is tight. To do so would allow air to enter the system.

Repeat the operation until only fluid free of bubbles emerges from the fitting. Tighten the fitting securely. Check the fluid level in the reservoir. Add fluid as required.

NOTE: To perform step 3 the floor panels will have to be removed.

3. Bleeding the brake caliper remains. Note the point at which the brake line joins the caliper housing. Bleed the screw highest and farthest from this point first (1, Fig. 13-18). The remaining high screw (2) is next. Procedure is the same; build up pedal pressure; open screw; close screw when pedal is at bottom of stroke. Repeat procedure at each bleed screw until fluid, free of bubbles, is ejected from the screw. Check fluid level in reservoir often.

NOTE: Do not allow the pedal to rise until bleed screw is closed tight. To do so would allow air to enter the system.

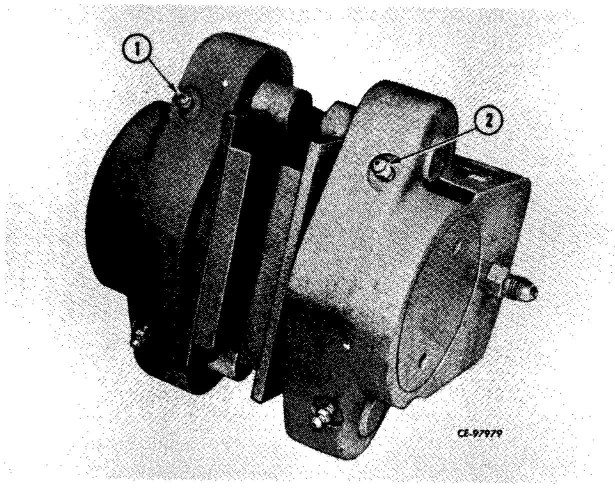

Figure 13-18

BRAKE SYSTEM

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SECTION XIV
WINCH

Page

SECTION XIV WINCH

GENERAL

The winch used on the PAY logger is a single drum, single speed unit, mechanically driven and hydraulically controlled, designed specifically for installation on the PAY logger.

The winch is controlled by a single lever that actuates three operating conditions: "Winch-in," "Brake-on," and "Brake-off" ("Free-spool"). The winch control can be operated in any of the three positions while the tractor is in motion thus permitting winching "on-the-fly."

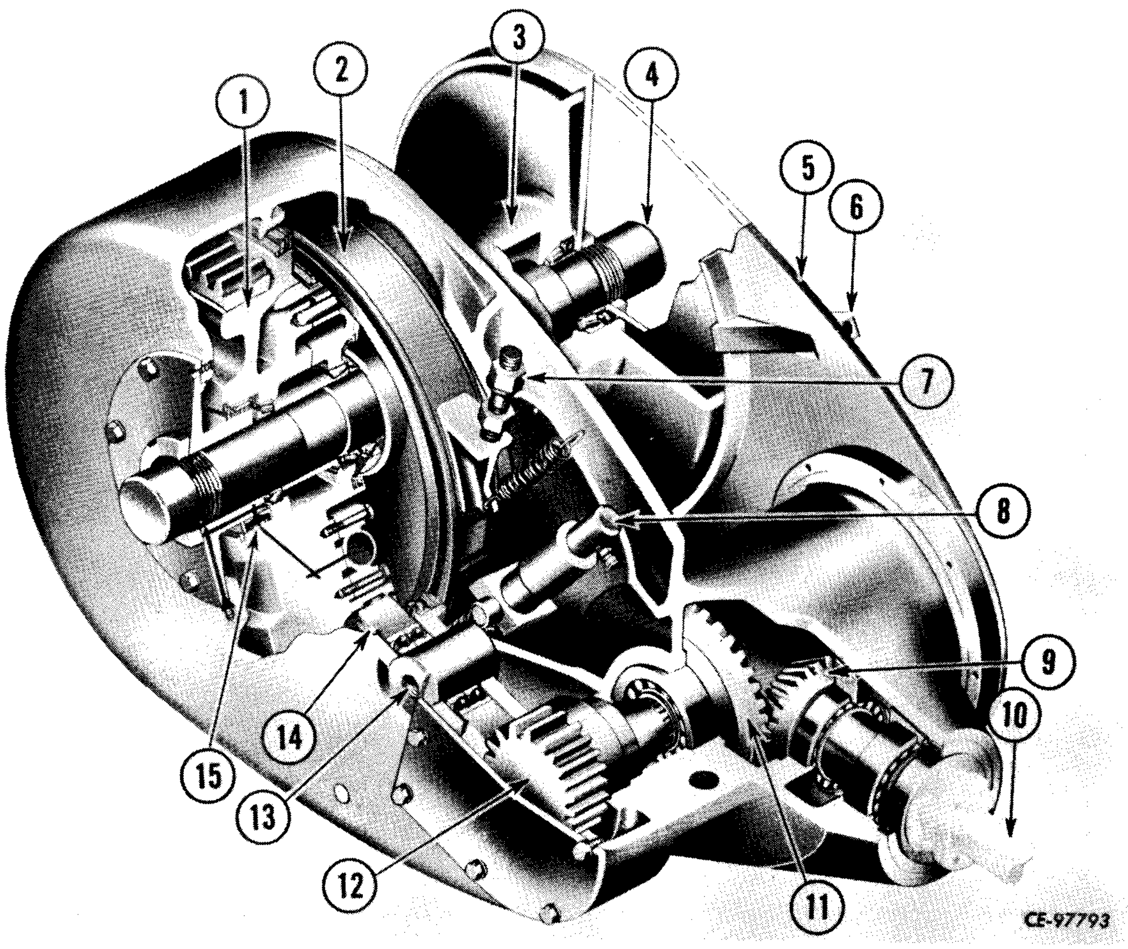

Figure 14-1

1. Clutch assembly.
2. Clutch band.
3. Cable drum.
4. Drum shaft.
5. Side plate.
6. Free spool adjustment screw.
7. Brake band adjuster.
8. Brake cylinder assembly.
9. Bevel gear pinion.
10. Input drive shaft.
11. Bevel gear.
12. Bull pinion.
13. Idler shaft.
14. Idler gear.
15. Rotary seal group.

DESCRIPTION AND OPERATION

HYDRAULIC CIRCUIT

Hydraulic fluid is drawn from the hydraulic reservoir by the hydraulic pump. Hydraulic fluid is directed under pressure to the winch control valve, and depending on the position of the control valve, oil goes either to the winch or returns to the reservoir.

CLUTCH OPERATION

The winch clutch is released and the brake is applied when the control lever is in the center or "BRAKE-ON" position. Moving the control lever "back" releases the brake to power in the wire rope. When the control lever is released it will return to the "BRAKE-ON" or center position.

BRAKE OPERATION

The external double wrap, self-energizing brake band is applied by spring pressure when the winch control lever is in the center position. When the control lever is moved forward, oil under pressure is directed to the winch brake cylinder, compressing the spring to release the brake thus permitting the drum to "free-spool" for removal of the wire rope.

A detent holds the control valve spool in the "BRAKE-OFF" or "free-spool" position. Once the valve spool offsets the detent the control lever will return to the center position and the brake is applied by the brake spring.

COLD WEATHER OPERATION

When operating in cold weather perform the following operation at the end of each work shift to keep the brake band from freezing to the brake drum. This procedure should also be used when the winch or tractor is stored for an extended period of time.

With the tractor engine running, position the winch control lever in the lower or "BRAKE-OFF" position. The valve spool is detented and will hold in the "BRAKE-OFF" position.

Insert a 3/8" diameter pin or bolt through the cross drilled hole in the end of the brake spring rod (Fig. 14-2).

Return the control lever to the center or "BRAKE-ON" position.

To resume operation:

With the tractor engine running, position the winch control lever in the lower or "BRAKE-OFF" position. The valve spool is detented and will hold in the "BRAKE-OFF" position.

Remove the pin or bolt from the brake spring rod.

Return the control lever to the center or "BRAKE-ON" position.

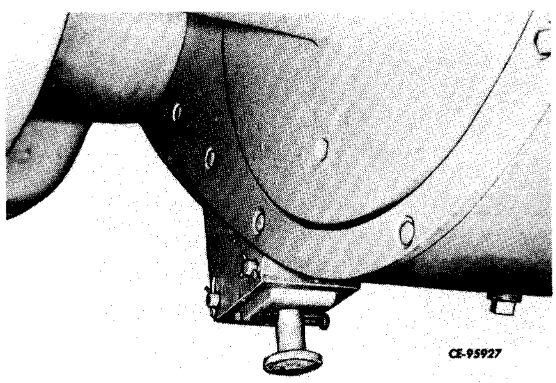

Figure 14-2

DISASSEMBLY AND ASSEMBLY

REMOVAL

Before winch removal be sure to thoroughly clean parts to be removed and adjacent areas to prevent entry of dirt and water into the winch. Plug or cap the openings to prevent entry of dust, moisture, or other foreign material. Protect all exposed hydraulic ports and fittings with caps or plugs to prevent contamination of the hydraulic system. Remove wire rope from winch drum.

If hydraulic pressure is available, position winch control lever in the "Brake-off" position. Insert a 3/8" diameter pin or bolt through the cross drilled hole on the bottom of the brake spring rod. This will hold the brake in a released position during winch disassembly (Fig. 14-2).

Remove cap screw (1, Fig. 14-3) and brake adjusting cover (2) from winch housing.

DISASSEMBLY AND ASSEMBLY

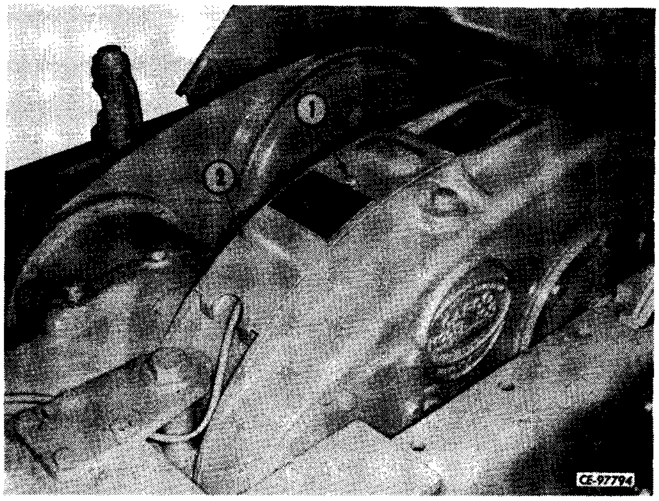

Figure 14-3

If hydraulic pressure is not available to release brake, loosen jam nut (2, Fig. 14-4) and tighten brake adjusting screw (1), using an allen wrench, until hole in bottom of the adjusting screw is exposed. Insert a 3/8" diameter pin or bolt and loosen adjusting screw until end of screw (1) is 1-1/2" above jam nut (2).

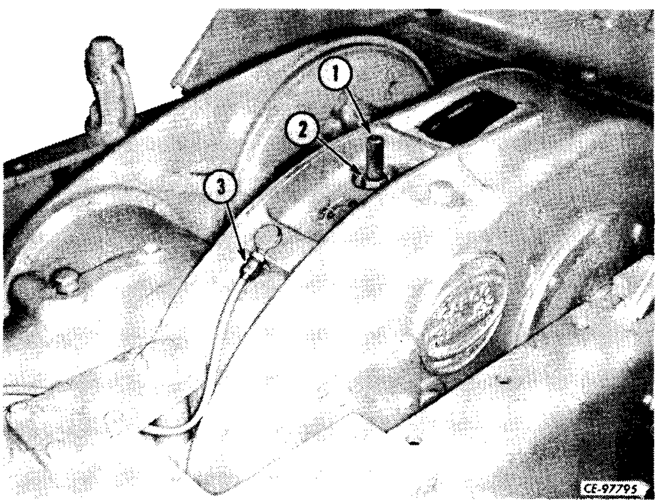

Figure 14-4

NOTE: Be sure jam nut (1) is loosened only enough to allow brake adjusting screw to turn.

Remove and plug the brake hydraulic line (3) from the brake cylinder.

Disconnect drive shaft from the winch P. T. O. coupling by removing cap screws. Refer to Section 5, "DRIVE SHAFTS" for information on the drive shafts.

Disconnect and plug clutch hydraulic line (1, Fig. 14-5).

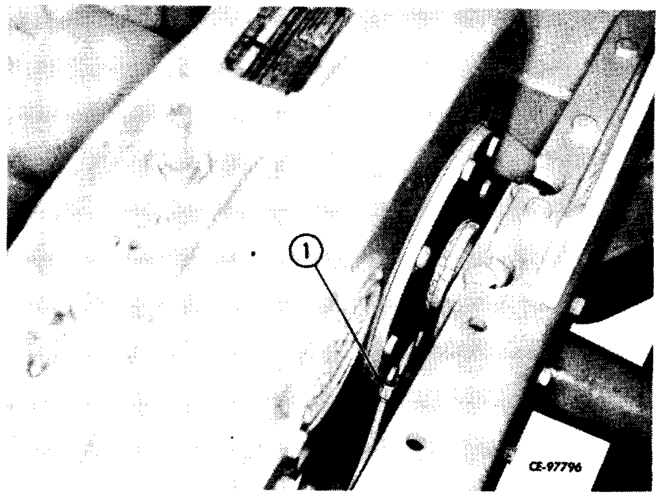

Figure 14-5

Remove cap screws (4, 6, Fig. 14-6), lock washers and pillow blocks (3, 5). Remove cap screws, lock washers and nuts (7) seperating front mount from frame. Position a suitable sling and using a hoist, remove all slack.

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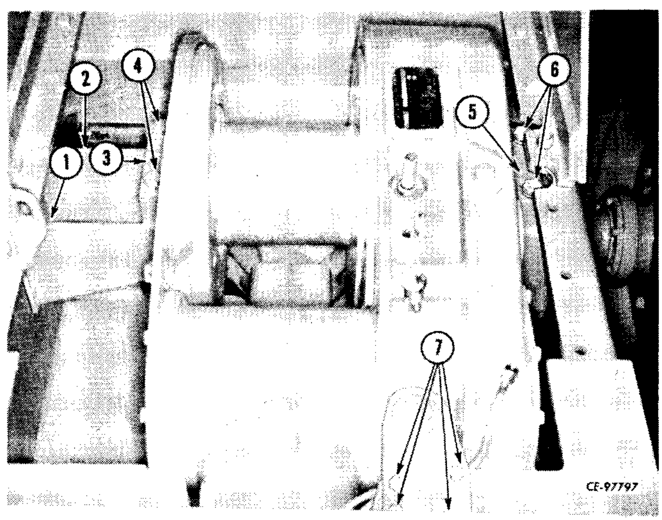

Figure 14-6

DISASSEMBLY AND ASSEMBLY

REMOVAL - Continued

Remove cap screws, lock washers and nuts (1) disconnecting winch mounting bracket (2). Remove winch from frame.

With winch supported in hoist, drain winch housing by removing drain plug directly below check plug in bevel gear assembly housing. Remove rear drain plug located directly below clutch assembly housing. After draining is complete, install and tighten drain plugs.

> NOTE: Do not run engine after winch hydraulic lines are removed unless lines are securely capped.

Position winch on floor using wooden blocks to support and protect winch during disassembly. Position winch with side plate facing up.

DISASSEMBLY

The following disassembly procedure begins with drum removal. This enables inspection and servicing of the clutch and brake assemblies and permits replacement of the clutch or brake bands.

This procedure also includes complete clutch assembly removal including the drum shaft from the winch case for inspection of the felt dust seal or oil seal in the winch case.

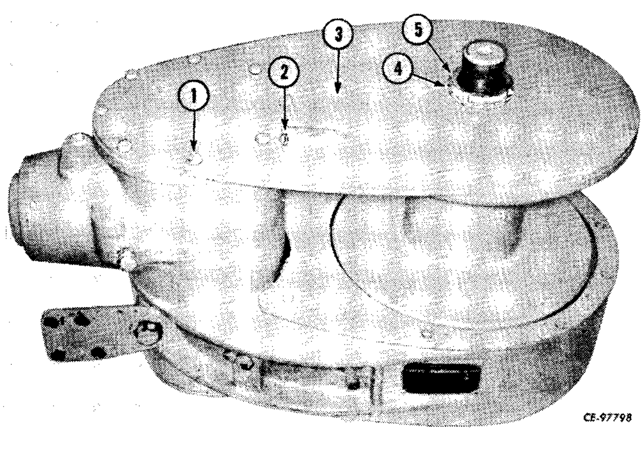

Figure 14-7

Unlock lock washer (4, Fig. 14-7) and using a spanner wrench, remove shaft nut (5). Using an allen wrench, remove set screw (2), spring and friction rod from side plate. Remove cap screws (1) and side plate (3) from winch housing.

Install three eye bolts to the cable drum and using an overhead hoist, lift drum off of drum shaft.

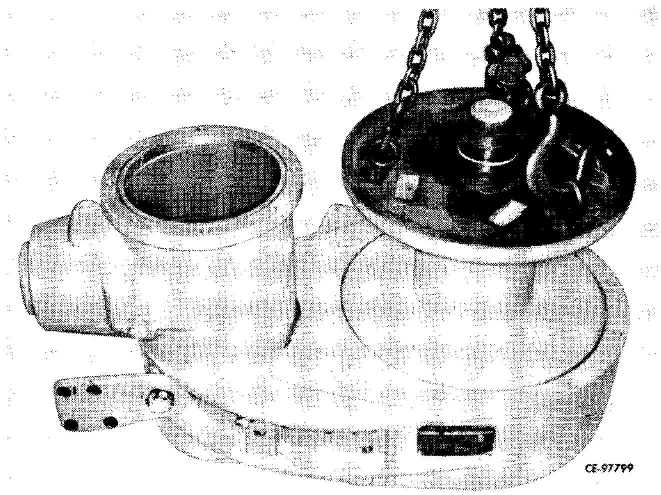

Figure 14-8

Loosen clutch adjuster (1, Fig. 14-9). Remove cotter pin (3) and clevis pin (2). Remove clutch band (5). Three steel balls will be released from their mountings (4) when the clutch band is removed.

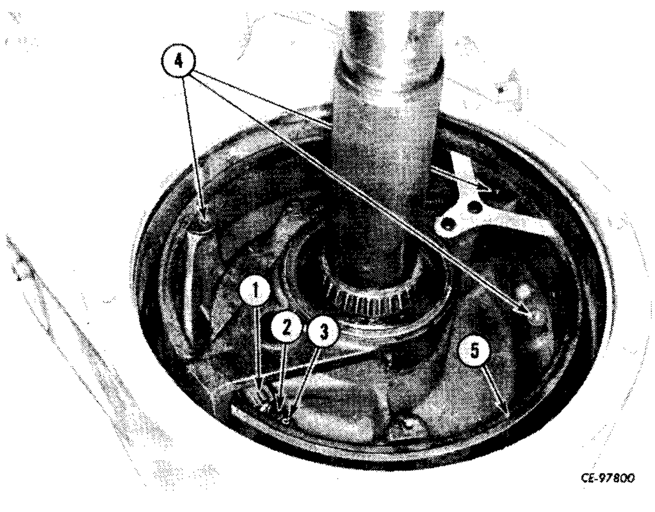

Figure 14-9

DISASSEMBLY AND ASSEMBLY

NOTE: Be sure clutch band is not distorted during removal or subsequent handling.

Pull clutch adjuster (3, Fig. 14-10) out through adjustment pin (2). Adjustment pin and lock spring will loosen.

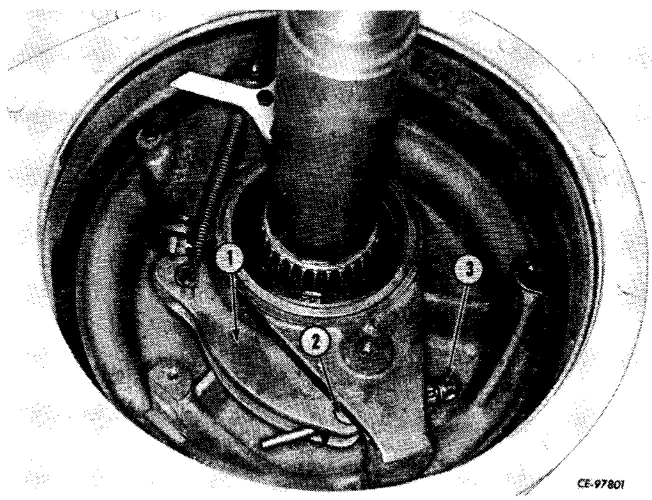

Figure 14-10

Disconnect clutch lever return spring (1, Fig. 14-11) from lever (2). Remove snap ring (4) and lever pin (3). Remove clutch lever (2).

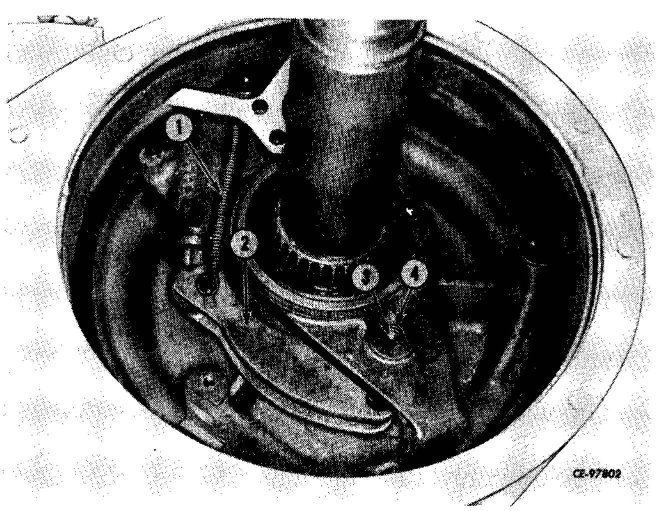

Figure 14-11

Remove cap screws (2, 4, Fig. 14-12), clutch band retainer (3) and clutch cylinder (1). Return spring (5) will loosen. Remove and discard "O" ring from under clutch cylinder.

NOTE: Mark position of clutch cylinder before removal as cylinder will assemble on either side.

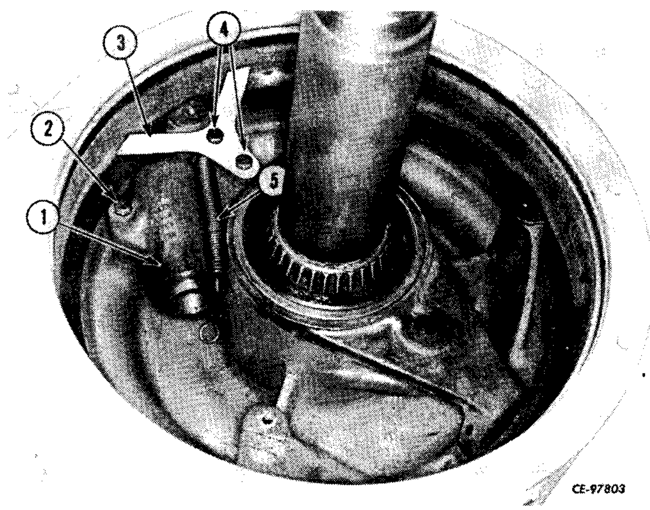

Figure 14-12

NOTE: To service the dust seal or oil seal in the winch housing or the rotary seal group inside the clutch hub the clutch assembly must be removed from the winch housing.

Unlock lock washer (1, Fig. 14-13) and using a spanner wrench, remove spanner nut (2) from end of drum shaft (3).

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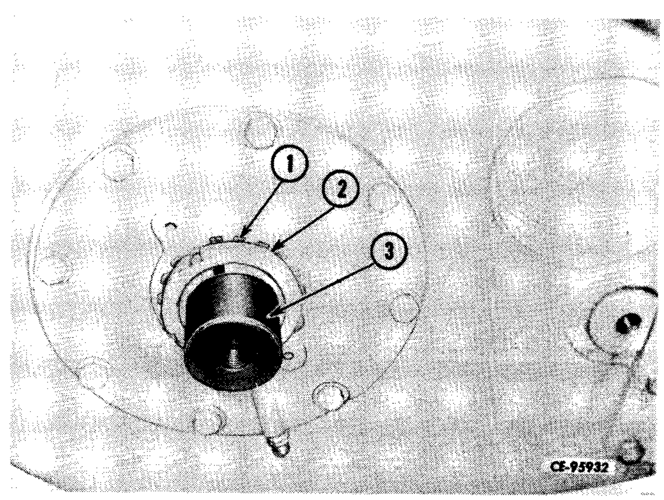

Figure 14-13

DISASSEMBLY AND ASSEMBLY

DISASSEMBLY - Continued

Install eye bolt (1, Fig. 14-14) into end of drum shaft (2) and with the aid of an overhead hoist, lift drum shaft from winch housing (3).

> ◆ CAUTION: DURING REMOVAL OF THE DRUM SHAFT KEEP LEGS AND TOES AWAY FROM UNDER THE DRUM SHAFT.

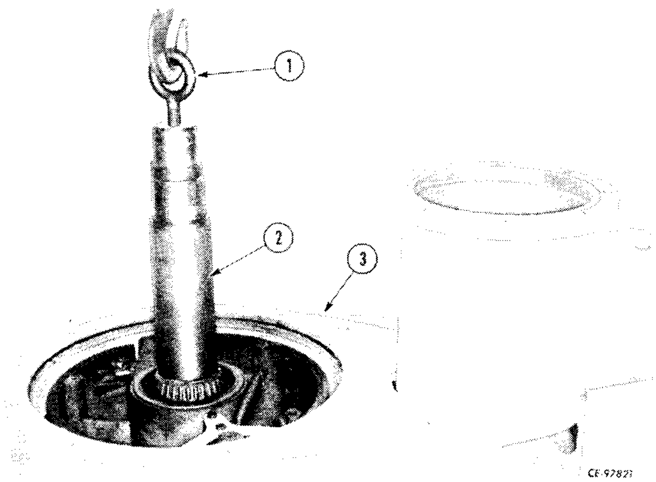

Figure 14-14

Inspect condition of the dust seal (2, Fig. 14-15) and the oil seal (3). If replacement is necessary, remove old dust seal and oil seal and install new seals. When installing dust seal use a suitable cement to cement new dust seal in place. Be sure joint (dust seal end) is positioned at top of case.

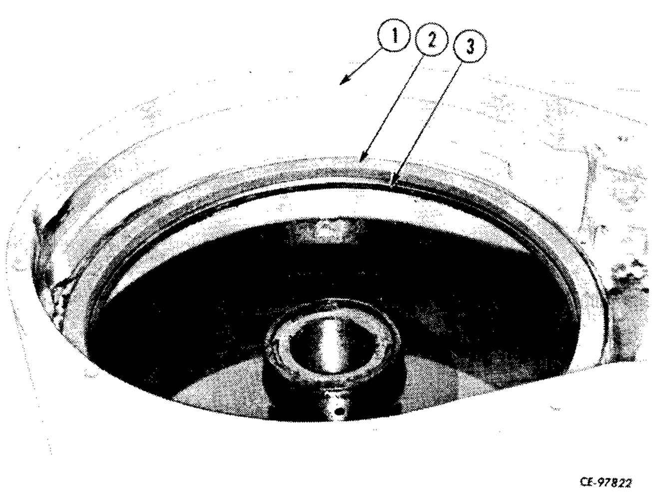

Figure 14-15

Position a piece of wood (3, Fig. 14-16) under drum shaft (1) and pry down on clutch assembly (2) driving clutch hub outer bearing from drum shaft (1).

Remove bearing adjusting shims from shaft or bearing, and tag for proper location during assembly. Remove bearing spacer from shaft.

Remove and replace shaft bearings as needed.

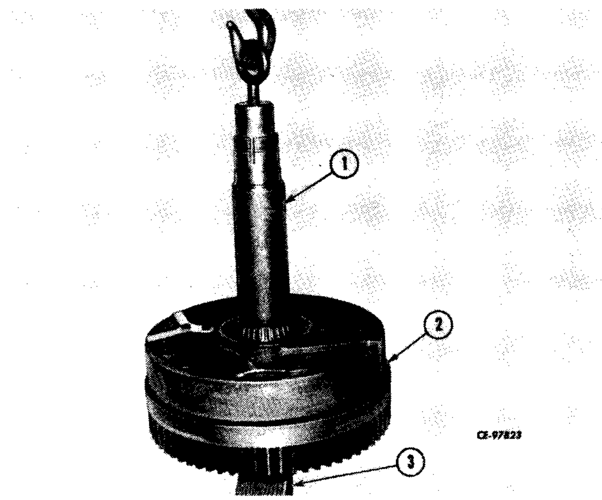

Figure 14-16

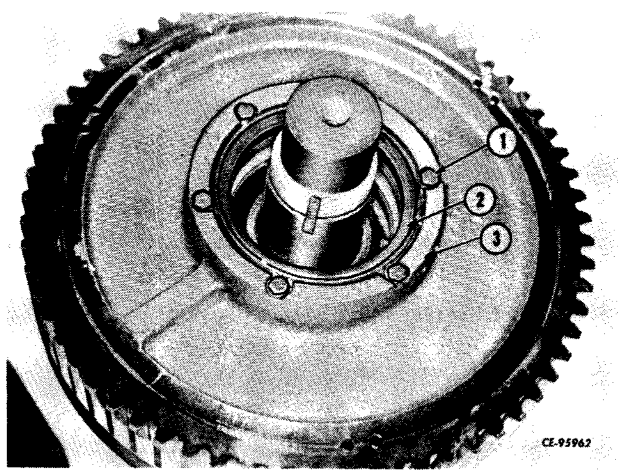

Figure 14-17

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DISASSEMBLY AND ASSEMBLY

Using wooden blocks for protection of the bevel gear teeth, lay shaft and clutch assembly down exposing bottom.

Remove cap screws (1, Fig. 14-17) and washers securing rotary seal assembly (2) in hub. Remove rotary seals.

NOTE: Care must be taken not to damage the rotary seals on oil port inside of hub during seal removal.

DISASSEMBLY-BRAKE ASSEMBLY

Remove winch drum as outlined in Fig. 14-7 and 14-8.

Remove cover cap screws (1, Fig. 14-18) and brake cover (2) from winch housing.

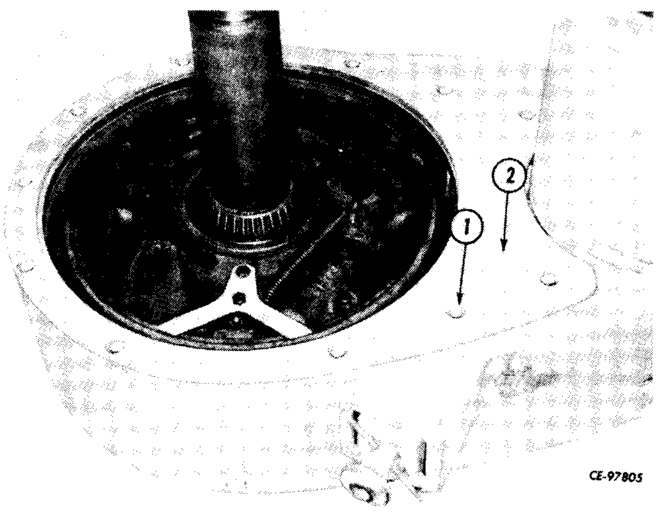

Figure 14-18

Remove cotter pins and spring retainer pins (1, Fig. 14-19). Remove brake spring assembly (2) from winch housing.

◆ CAUTION: WHEN REPLACING BRAKE SPRING ASSEMBLY IT IS RECOMMENDED THAT THE COMPLETE ASSEMBLY BE REPLACED. THE SPRING IN THE ASSEMBLY IS TRAPPED UNDER PRESSURE AND WOULD BE DANGEROUS TO REMOVE IT.

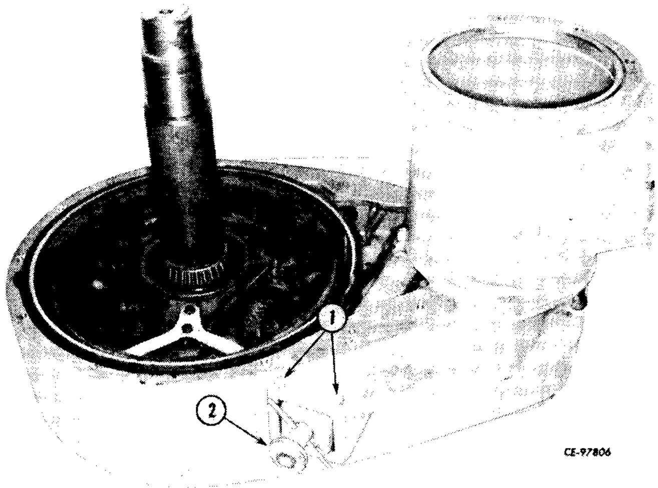

Figure 14-19

Disconnect spring (1, Fig. 14-20) from the brake band (3). Remove yoke (2) and band (3). Be sure brake band is not distorted during removal or subsequent handling.

(Continued on next page)

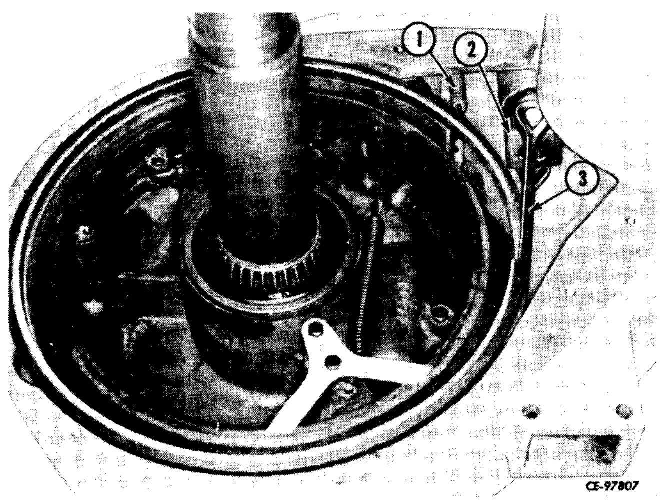

Figure 14-20

DISASSEMBLY AND ASSEMBLY

DISASSEMBLY - BRAKE ASSEMBLY - Continued

Remove brake cylinder (1, Fig. 14-21) from winch case by removing cylinder inlet fitting.

Disassemble brake cylinder and inspect "O" ring, wiper ring, cylinder and piston for wear or damage. Cylinder and piston must be free of burrs, grooves and scores. Replace as required.

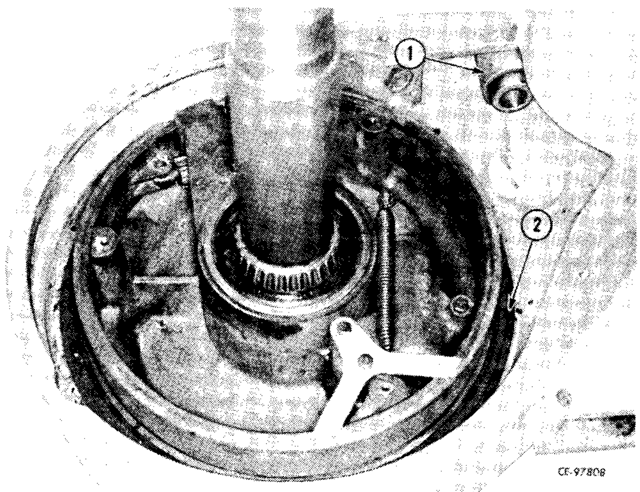

Figure 14-21

DISASSEMBLY - BEVEL GEAR AND FINAL REDUCTION ASSEMBLIES

Remove and drain winch as outlined in winch removal.

Using adequate blocking, position winch on floor in same position as mounted in tractor.

Remove side plate (30, Fig. 14-22) by removing cap screws (31). Remove bull pinion cover (10) and gasket (11) by removing cap screws (9).

Remove cap screw (16), bevel gear retainer (15) and bearing adjustment shims (14) from bevel gear end of bull pinion shaft (7). Tag and mark shims (14) for reassembly.

Using a slide hammer, remove idler shaft (2) from the winch case. Remove bull pinion (7) and idler gear (5) from winch housing. Remove bevel gear (17).

Remove cap screw (21), coupling retainer (22), bearing adjustment shims (20) and coupling (24) from end of bevel pinion (26). Tag and mark bearing adjustment shims for assembly. Remove bevel pinion (26).

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DISASSEMBLY AND ASSEMBLY

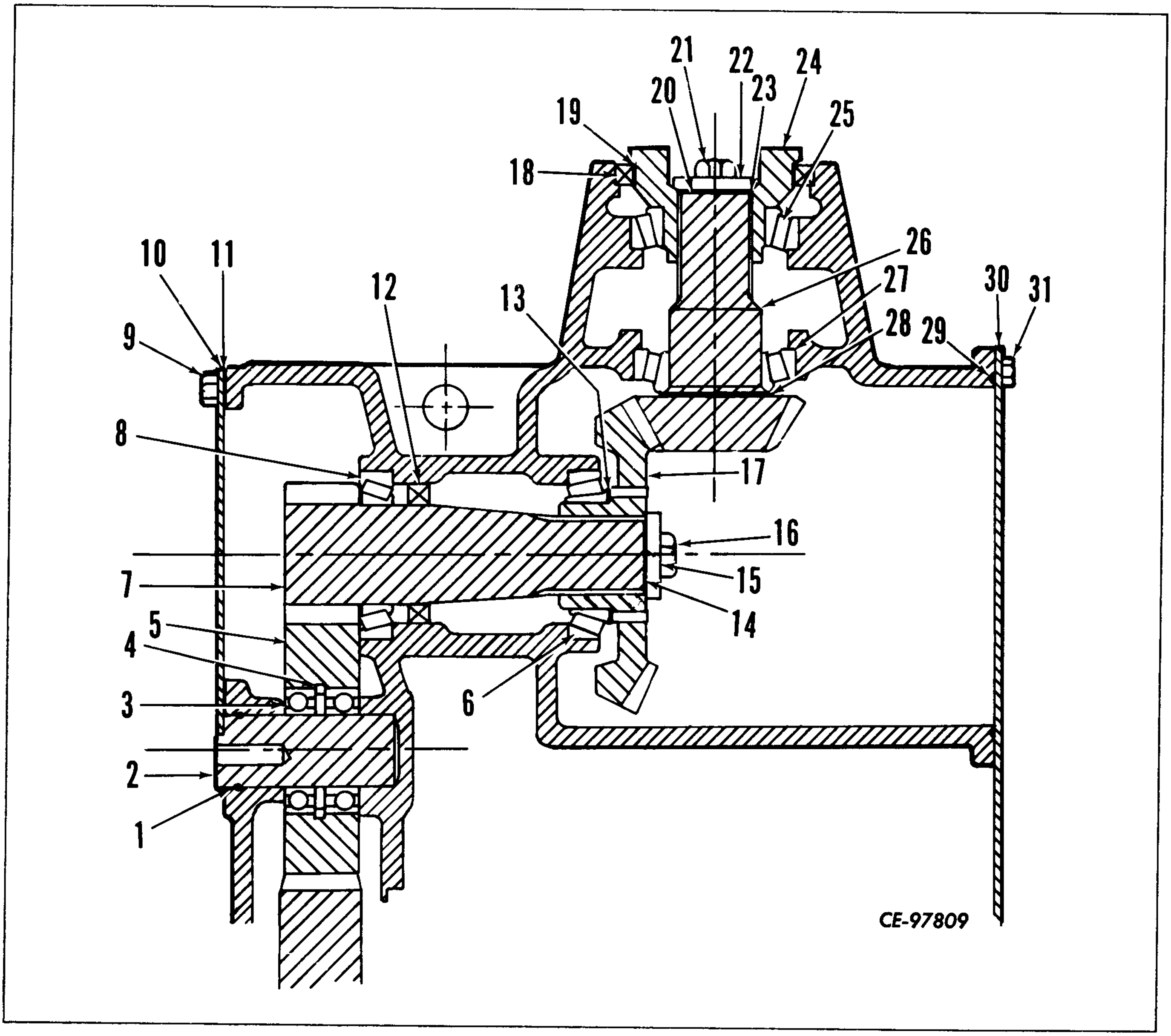

Figure 14-22
Bevel Gear and Final Reduction Assemblies.

1. "O" ring.
2. Idler shaft.
3. Ball bearings.
4. Snap ring.
5. Idler gear.
6. Tapered roller bearings.
7. Bull pinion.
8. Tapered roller bearings.
9. Cap screw.
10. Bull pinion cover.
11. Gasket.
12. Oil seal.
13. Bevel gear adjustment shims.
14. Bearing adjustment shims.
15. Bevel gear retainer.
16. Cap screw.
17. Bevel gear.
18. Oil seal.
19. Seal sleeve.
20. Bearing adjustment shims.
21. Cap screw.
22. Coupling retainer.
23. "O" ring.
24. Coupling.
25. Tapered roller bearing.
26. Bevel pinion.
27. Tapered roller bearing.
28. Pinion adjustment shims.
29. "O" ring.
30. Side plate.
31. Cap screw.

DISASSEMBLY AND ASSEMBLY

ASSEMBLY - BEVEL GEAR AND FINAL REDUCTION ASSEMBLIES

NOTE: If either the bearings or the bevel gear set is disassembled or replaced the bevel gear set must be readjusted for gear set tooth contact and backlash.

DETERMINING BEARING HEIGHT

Prior to installing bearing cones and cups, measure bearing (A, Fig. 14-23). Use any type of clamping arrangement similar to that shown in the illustration to determine bearing measurement.

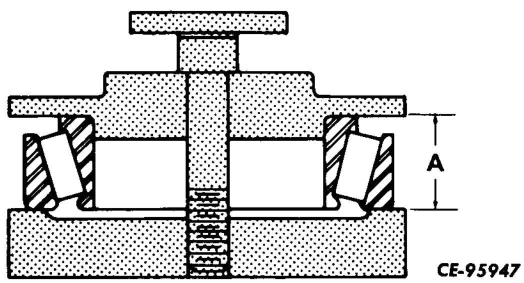

Figure 14-23
Bearing Height Measurement.

Rotate gage top plate and bearing cone while screw (clamp) is tighten to insure proper bearing alignment. Do not over tighten screw (clamp). Measure bearing height at four places, 90° apart.

NOTE: When installing bearings in aluminum case, use LOCTITE Bearing Mount Compound. Be sure excess compound is not left on bearing and gear running surfaces. Press bearings in case evenly to avoid damage to case bores.

POSITIONING BEVEL PINION

To determine thickness of shims required between bearing cone and back face of pinion gear, subtract dimension (4, Fig. 14-24) (etched on pinion) and dimension (5) bearing height (Refer to "Bearing Height Measurement") from dimension (6), stamped on winch case (7). Dimension (6) minus dimension (4) minus dimension (5) equals thickness of shims required.

Place shims (28, Fig. 14-22) on pinion (26). Press bearing cone (27) on pinion. Press pinion bearing cups in winch case.

Install pinion (26) in winch case. Install coupling (24), new "O" ring (23), coupling retainer (22) and bearing adjustment shims (20). Install and tighten cap screw (21). Shim pack (20) should be selected to adjust bearing .001" tight to .001" loose.

POSITIONING BEVEL GEAR

Install snap ring (4, Fig. 14-22) inside of idler gear (5) and press ball bearings (3) into idler gear. Position idler gear loose, inside of winch case.

Select bevel gear adjustment shims by subtracting dimension (1, Fig. 14-24) (etched on bevel gear) and the bearing height (Refer to "Bearing Height Measurement") dimension (2) from dimension (3), stamped on winch case (11). Dimension (3) minus dimension (1) minus dimension (2) equals thickness of bevel gear adjustment shims (12).

Position shims (13, Fig. 14-22) on bevel gear (17) and press bearing cone (6) on gear (17). Press bearing cups (6, 8) into case and bearing cone (8) on bull pinion (7). Install bull pinion oil seal (12) inside case bore. Lubricate oil seal. Install bevel gear (17) in winch housing and carefully guide bull pinion (7) through oil seal and bevel gear. Install bearing adjustment shims (14) and bevel gear retainer (15). Install and tighten cap screw (16). Shim pack (14) should be selected to adjust bearing .001" tight to .001" loose.

NOTE: As cap screw (16) is tightened, rock bevel gear or bevel pinion back and forth to be sure there is backlash between the gear and pinion. Refer to "GEARSET BACKLASH".

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DISASSEMBLY AND ASSEMBLY

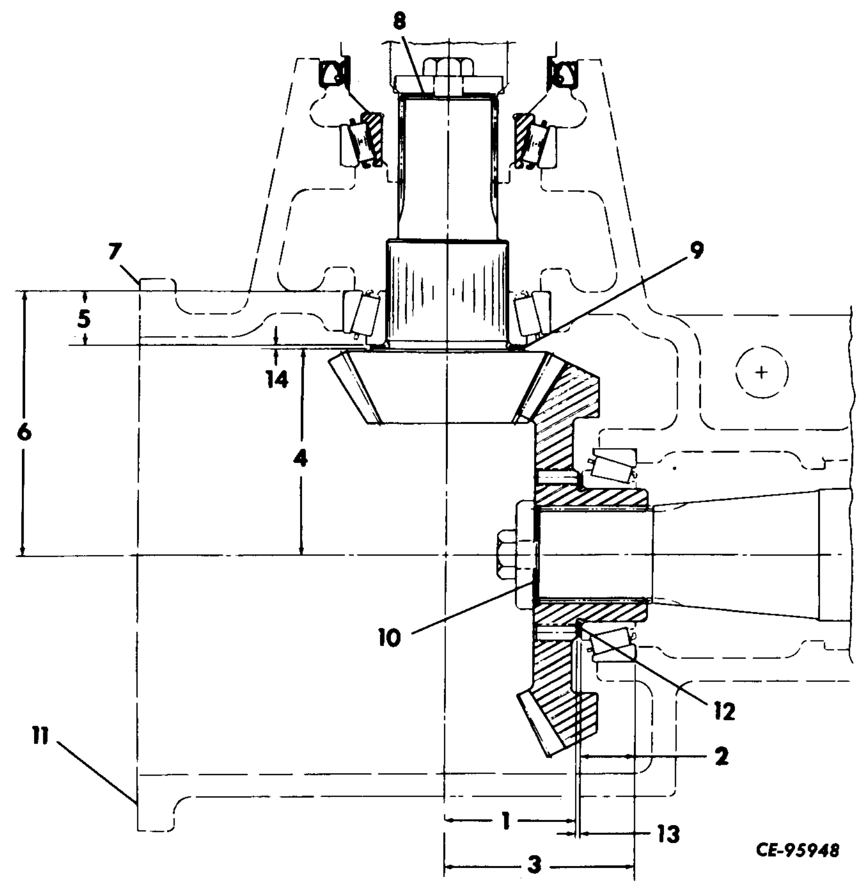

Figure 14-24
Bevel Gearset Adjustment.

After gearset backlash and proper gear tooth contact pattern has been obtained, install idler gear shaft (2). Install a new "O" ring (1) on shaft and while positioning idler gear, install idler shaft into winch case. Be sure recess in end of idler shaft is aligned with case cover. Position bull pinion cover (10) and gasket (11) on winch case. Install and tighten cap screws (9).

GEARSET BACKLASH

Be sure bevel gear and pinion bearings are properly positioned and adjusted before checking backlash.

Use a reliable dial indicator to read backlash at bevel pinion teeth. Block bevel gear in a manner which will ensure it will not move while reading backlash. Check backlash readings with bevel gear in at least four positions 90° apart. Position dial indicator to allow plunger to be as close as possible to parallel with direction of tooth travel. Backlash should be .007" - .012".

NOTE: If bevel gear adjustment shims are added to decrease backlash or removed to increase backlash, add or subtract same amount of bearing adjustment shims to maintain correct bearing adjustment.

(Continued on next page)

DISASSEMBLY AND ASSEMBLY

ASSEMBLY - BEVEL GEAR AND FINAL REDUCTION ASSEMBLIES - Continued

GEAR TOOTH CONTACT PATTERN

Fig. 14-25 shows correct and incorrect tooth contact patterns. Use a suitable marking compound such as Prussian Blue to check gear tooth pattern and compare it with the examples shown.

If adjustment is required to correct the pattern be sure proper gearset backlash is maintained. As a general rule, when the bevel pinion and bevel gear are moved the same amount, the existing backlash will remain unchanged.

For example, if a .010" shim is added to the pinion, remove a .010" shim from the bevel gear to maintain approximately the same backlash. Always recheck backlash before taking new pattern reading.

Whenever gear or pinion adjustment shims are added or removed, the same amount of bearing adjustment shims must be added or removed to ensure correct bearing adjustment. In the above example .010" bearing adjustment shim would be added to the pinion and .010" bearing adjustment shim would be removed from the bevel gear.

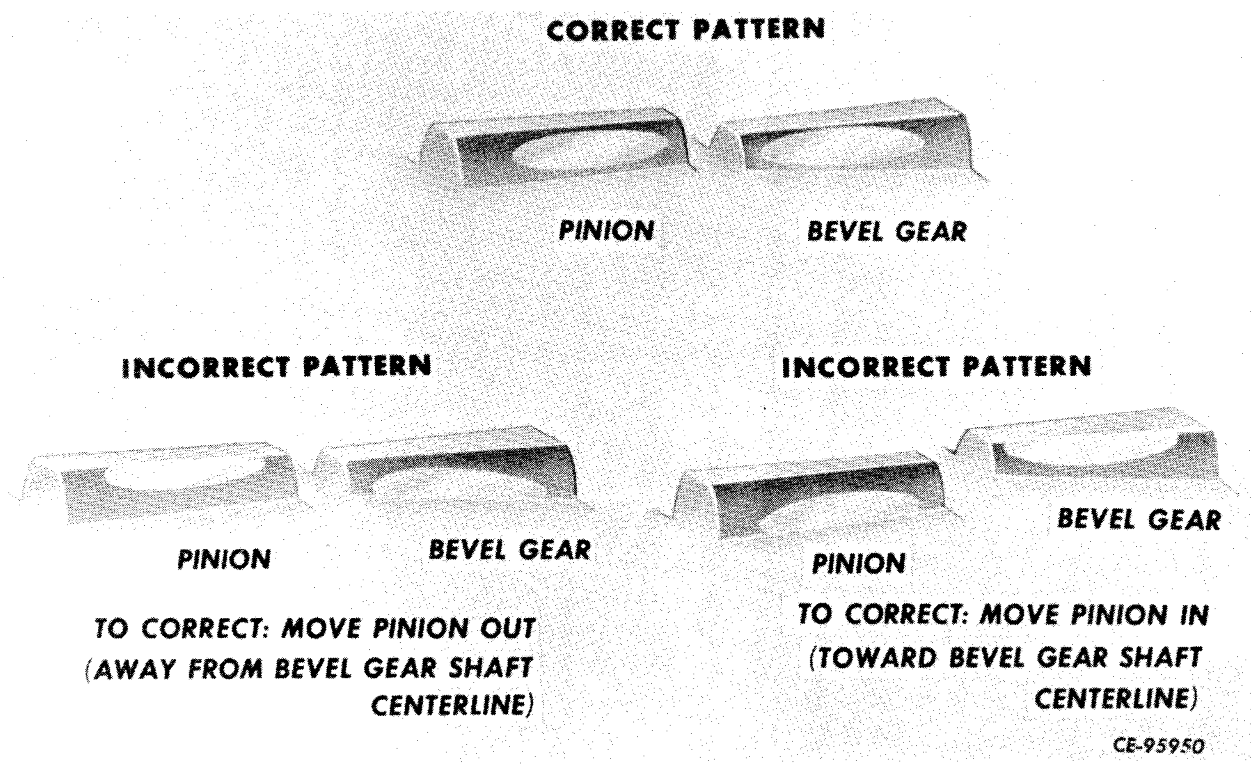

Figure 14-25
Gear Patterns.

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DISASSEMBLY AND ASSEMBLY

ASSEMBLY - BRAKE ASSEMBLY

NOTE: During assembly, coat threads of all cap screws with LOCTITE Screw Lock Sealant. Take care to prevent excess LOCTITE compound from entering the winch case or hydraulic system.

NOTE: Care must be exercised to avoid cross threading or over tightening when installing cap screws in aluminum threads. Do not exceed torque values as recommended in "SPECIAL TORQUES" in Service Information.

Install brake cylinder (1, Fig. 14-21) in case. Install a new hydraulic fitting on brake cylinder.

Position brake band (3, Fig. 14-20) in case and attach brake band spring (1). Install yoke (2) in brake band eyes with flat side of yoke facing the brake cylinder.

Install brake spring assembly (2, Fig. 14-19), engaging rod with brake band yoke and brake cylinder piston. Install retaining pins and cotter pins (1).

Position brake cover (2, Fig. 14-18). Install and tighten cap screws (1) to recommended torque. Refer to "SPECIAL TORQUES."

Torque: __________

CLUTCH ASSEMBLY

Install new bearings in hub of clutch and on drive shaft. Install drum shaft and clutch assembly.

Lubricate and install inner seal (6, Fig. 14-26) in clutch hub. Lubricate new "O" rings (4, 5) and position them on spacer (3). Install spacer with "O" rings in hub and work spacer into inner seal (6). Use fingers to set inner "O" rings (4) into seal (6) about its entire diameter. Make constant checks until seals are properly seated. Lubricate outer seal (2) and install evenly into hub and over "O" rings.

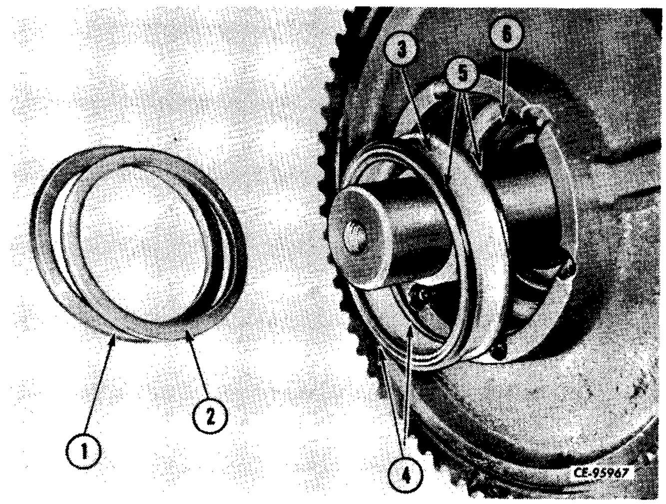

Figure 14-26

NOTE: Use petroleum jelly only to lubricate rotary seal during assembly. Lubricants with E. P. additives will cause seal leakage. Seal material is brittle and can be damaged if not handled carefully.

Position seal retainer (1, Fig. 14-27) on hub and install two cap screws (2) with washers, 180° apart. Tighten cap screws evenly; finger tight.

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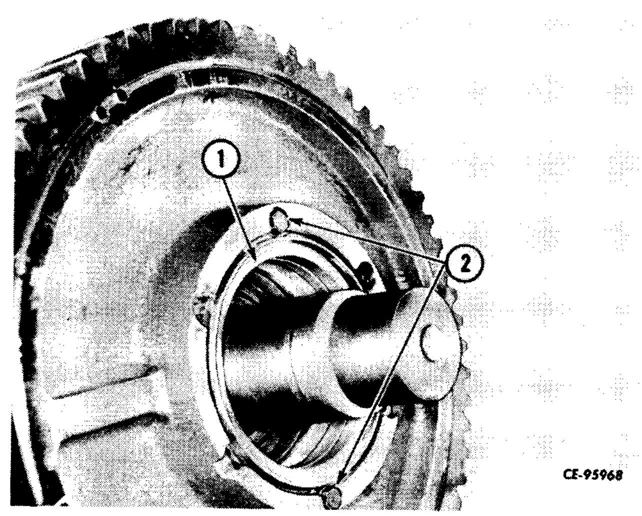

Figure 14-27

DISASSEMBLY AND ASSEMBLY

CLUTCH ASSEMBLY - Continued

Use light hand pressure to force retainer (1) into position as cap screws are tightened alternately one turn at a time.

NOTE: As cap screws are tightened, run fingers around the I. D. of seals in hub to make sure "O" rings move into seals properly. If "O" rings are improperly installed, remove and replace. Check outer seal for damage. Replace if necessary.

nstall and tighten remaining cap screws and vashers. Tighten cap screws to recommended torque. Refer to "SPECIAL TORQUES."

Torque:__________

If the oil seal (3, Fig. 14-15) has been removed, press a new seal tight into case groove. Coat outside diameter of seal with sealant before installing. Install new felt dust seal (2), using a suitable cement, in case. Install felt dust seal with joint meeting on top of case. Lubricate large winch case oil seal. DO NOT LUBRICATE FELT DUST SEAL.

Using an eye hook lift up on drum shaft (1, Fig. 14-16) and install shaft and clutch assembly into winch case.

Install lock washer (1, Fig. 14-13) and spanner nut (2) on end of drum shaft (3) and using a spanner wrench, tighten nut to recommended torque. Refer to "SPECIAL TORQUES." Lock lock washer (1) to spanner nut (2).

Install a new small "O" ring on clutch assembly, between the clutch cylinder and clutch assembly.

Position clutch cylinder (1, Fig. 14-12), with return spring (5) attached, on clutch assembly. Install clutch band retainer (3) and cap screws (4). Install cap screw (2).

NOTE: Install clutch cylinder (1) in the same position it retained prior to removal.

Install clutch lever (2, Fig. 14-11) and insert lever pin (3). Install snap ring (4). Install return springs (1) to clutch lever (3).

Install clutch band adjuster (3, Fig. 14-10) with adjuster lock spring against flat side of adjustment pin (2). Lock spring leaf must be positioned on the clutch band side of adjusting nut.

Install support balls in mounting brackets (4, Fig. 14-9) and install clutch band (5). Align hole in adjuster (1) with hole in clutch band by loosening or tightening adjuster and install clevis pin (2). Install cotter pin (3). Install adjustment screws (6).

If bearings have been replaced on the drum shaft, install new bearing cones in drum.

Install shim pack on end of drum shaft and with the aid of an overhead hoist, lower drum down on drum shaft (Fig. 14-8).

NOTE: Take care to be sure shims are evenly aligned on shaft shoulder to avoid possible damage to them.

Install bearing cone, seal sleeve, and drum shaft nut.

NOTE: Do not install drum shaft oil seal until after drum bearing adjustment is completed. Be sure both drum shaft nuts are tightened before making drum bearing adjustment.

Use a dial indicator to measure drum end play. Add or subtract shims as needed to adjust bearings .001" tight to .002" loose.

When bearing adjustment is completed, remove drum shaft nut and seal sleeve. Install oil seal in drum with lip of seal away from bearing. Lubricate oil seal and install oil seal sleeve.

Adjust winch clutch. Refer to "ADJUSTMENTS."

Install a new "O" ring on winch case and position side plate (3, Fig. 14-7). Install and tighten cap screws (1). Install lock washer (4) and spanner nut (5) on end of drum shaft. Tighten spanner nuts on each end of drum shaft to the recommended torque. Refer to "SPECIAL TORQUES."

Torque:__________

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DISASSEMBLY AND ASSEMBLY

Install friction rod (1, Fig. 14-28), spring (2) and set screw (3) in cover. Refer to "ADJUSTMENTS" for brake adjustment procedure.

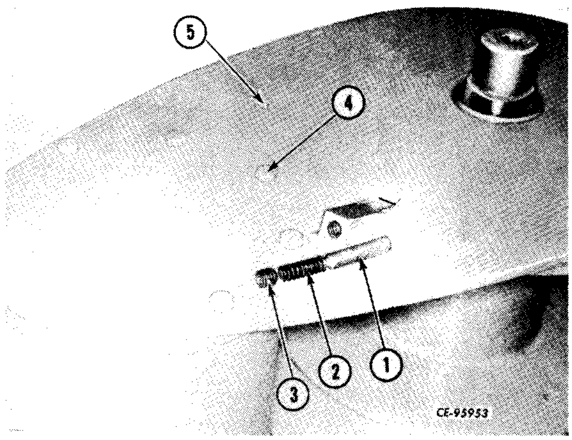

Figure 14-28

INSTALLATION

Using a suitable sling and hoist, lift winch into tractor frame. Position mounting bracket (2, Fig. 14-6) inside frame before lowering winch.

NOTE: Pillow block (5) must be installed before mounting bracket (2) is installed.

With winch suspended from hoist and pillow block (5) installed, position mounting bracket (2). Install and tighten cap screws and lock washers (1). Lower winch onto mounting brackets. Install pillow block (3).

Install and tighten cap screws and lock washers (4, 6). Install and tighten cap screws, lock washers and nuts (7).

Connect clutch hydraulic line (1, Fig. 14-5).

Connect drive shaft to winch P. T. O. coupling. Refer to Section 5, "DRIVE SHAFTS" for information on drive shaft.

Connect brake hydraulic line (3, Fig. 14-4) to brake cylinder fitting. Refer to "ADJUSTMENTS" for brake adjustment procedure.

Position brake adjusting cover (2, Fig. 14-3) and install and tighten cap screw (1).

Remove both fill plugs and fill the clutch gear housing and the gear reduction housing until fluid runs out of check plugs. Install and tighten plugs.

Check hydraulic reservoir level and correct as needed.

TROUBLE SHOOTING

PRELIMINARY PROCEDURES

If winch does not operate correctly, perform a visual inspection for obvious faults, such as leaking oil, unusual noise, and loose, damaged, or broken parts. If cause of trouble is not readily apparent, check operation of winch in each of the three positions, as described in the following operating test, and determine the trouble. The numbers following the trouble refer to item numbers in the TROUBLE column of the Trouble Shooting Chart. When the trouble has been isolated, use the chart to determine the cause and correction procedures. Procedures given in the CORRECTION column are covered under "ASSEMBLY AND DISASSEMBLY" unless otherwise stated.

TROUBLE SHOOTING

OPERATING TEST

BRAKE-ON

Normal Conditions: Brake applied, clutch released.

Operating Problems:

1. Brake does not hold

   A. Oil on brake band 4
   B. Brake band adjustment too loose . . 2
   C. Inadequate brake spring pressure . . 5
   D. Brake cylinder receiving pressure . 9
   E. Brake cylinder or spring assembly jammed in released position 3

2. Winch winds in wire rope

   A. Clutch adjustment too tight 15
   B. Clutch cylinder receiving pressure . 14
   C. Clutch cylinder or linkage jammed in applied position 17

BRAKE-OFF

Normal Conditions: Brake released, clutch released.

Operating Problems:

1. Winch does not free spool

   A. Low pressure in hydraulic system . 1
   B. Brake band adjustment too tight . . 6
   C. Brake cylinder or spring assembly jammed in applied position 7
   D. Cable drum bearings seized 19
   E. Free spool drag adjustment too tight 8

2. Winch winds in wire rope

   A. Clutch adjustment too tight 15
   B. Clutch cylinder receiving pressure 14
   C. Clutch cylinder or linkage jammed in applied position 17
   D. Clutch cylinder return spring pressure inadequate 16

3. Tractor engine stalls

   A. Clutch assembly bearings seized . . 18
   B. Defective bearings or gears in winch transmission 20

WINCH-IN

Normal Conditions: Brake released, clutch applied.

Operating Problems:

1. Winch does not pull

   A. Low pressure in hydraulic system . 1
   B. Clutch adjustment too loose 11
   C. Oil on clutch band 13
   D. No input to winch from tractor drive-train 10
   E. Clutch cylinder or linkage jammed in released position 12

2. Winch pulls, brake overheats

   A. Low pressure in hydraulic system . 1
   B. Brake band adjustment too tight 6
   C. Brake cylinder or spring assembly jammed in applied position 7

3. Tractor engine stalls

   A. Low pressure in hydraulic system . 1
   B. Brake band adjustment too tight 6
   C. Brake cylinder or spring assembly jammed in applied position 7
   D. Clutch assembly bearings seized . . 18
   E. Cable drum bearings seized 19
   F. Defective bearings or gears in winch transmission 20

TROUBLE SHOOTING

TROUBLE	CAUSE	CORRECTION
1. Low pressure in hydraulic system.	Relief valve incorrectly adjusted.	Adjust. Refer to ADJUSTMENT, RELIEF VALVE.
	Relief valve seized open.	Inspect hydraulic oil for contamination. Clean or replace filter elements. Clean and adjust relief valve.
	Relief valve spring broken or weak.	Replace spring. Refer to Section 11, HYDRAULIC SYSTEM.
	Pump drive coupling broken.	Replace defective parts. Refer to Section 11, HYDRAULIC SYSTEM.
	Suction or pressure filter dirty.	Replace or clean filters as required.
	Low oil level in reservoir.	Fill to proper level with oil specified.
	Air leaks in suction side of hydraulic system.	Inspect all hoses and fittings. Replace or repair as required.
	Defective pump.	Replace or repair.
	Internal leak in winch pressure system:	
	Inner rotary seal.	Check vent in drum shaft carrier for oil leak.
	Outer rotary seal.	Check for excessive oil in final reduction compartment.
	Brake cylinder.	Remove brake cover to check.
	Clutch cylinder.	Remove plugs from cable drum flange to check.
		Refer to DISASSEMBLY AND ASSEMBLY OF WINCH for repair instructions.
	Control valve worn or damaged.	Repair or replace as required.

(Continued on next page)

TROUBLE SHOOTING

TROUBLE	CAUSE	CORRECTION
2. Brake band adjustment too loose.	Brake lining worn.	Adjust. Refer to BRAKE ADJUSTMENT.
	Brake adjustment loosens with use.	Be certain adjustment lock nut is properly set.
3. Brake cylinder or spring assembly jammed in released position.	Piston seized in cylinder.	Replace or repair cylinder.
	Hydraulic oil trapped in cylinder.	Inspect hoses and oil passages for restrictions.
	Brake release lock pin not removed from brake spring rod.	Release brake and remove pin. Refer to COLD WEATHER OPERATION.
	Brake spring rod seized or damaged.	Repair as required.
4. Oil on brake band.	Oil leak in brake compartment.	Remove brake cover and inspect for brake cylinder or oil seal leaks. Repair as required.
5. Inadequate brake spring pressure.	Broken or weak spring.	Replace brake spring. Refer to DISASSEMBLY AND ASSEMBLY OF WINCH.
6. Brake band adjustment too tight.	Incorrect adjustment.	Adjust. Refer to ADJUSTMENT, BRAKE. Be sure hydraulic pressure is properly adjusted. Brake will not release completely if pressure is low.
7. Brake cylinder or spring assembly jammed in applied position.	Piston seized in cylinder.	Repair or replace as required.
	Hydraulic oil trapped in brake cylinder.	Inspect hoses and oil passages. Inspect control valve. Repair or replace defective parts.
	Brake spring rod seized or damaged.	Repair as required.
8. Free spool drag adjustment too tight.	Incorrect adjustment.	Adjust.
	Foreign material jammed between friction rod and cable drum flange.	Remove foreign material and adjust free spool drag.
	Free spool drag assembly damaged.	Repair as required.

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TROUBLE SHOOTING

TROUBLE	CAUSE	CORRECTION
9. Brake cylinder receiving pressure.	Return line from winch control valve restricted.	Inspect hoses and ports for restrictions.
	Control valve spool improperly positioned.	Inspect control valve and repair or replace, as required.
10. No input to winch from tractor.	Failure of PTO shaft.	Repair as required.
	Failure in tractor drive to PTO.	Refer to Section 4, TRANSMISSION.
11. Clutch adjustment too loose.	Clutch lining worn.	Adjust clutch. Refer to ADJUSTMENT, CLUTCH.
	Clutch adjustment loosens with use.	Be certain adjustment lock spring functions properly.
12. Clutch cylinder or linkage jammed in release position.	Piston seized in cylinder.	Repair or replace as required.
	Hydraulic oil blocked from entering clutch cylinder.	Inspect hoses and oil passages. Inspect control valve. Repair or replace defective parts.
13. Oil on clutch band.	Oil leak in clutch compartment. Clutch cylinder or oil seal.	Remove plugs from cable drum flange to inspect clutch compartment. Remove brake cover to inspect for oil seal leak.
14. Clutch cylinder receiving pressure.	Control valve return line is restricted.	Inspect hoses and oil passages for restriction.
NOTE: Pressure to clutch must not exceed 10 PSI when the clutch is released.	Control valve spool improperly positioned.	Inspect control valve and repair or replace as required.
15. Clutch adjustment too tight.	Incorrect adjustment.	Adjust. Refer to ADJUSTMENT, CLUTCH.
16. Clutch cylinder return spring pressure inadequate.	Broken or weak springs.	Replace spring. Refer to DISASSEMBLY AND ASSEMBLY OF WINCH.
17. Clutch cylinder or linkage jammed in applied position.	Piston seized in cylinder.	Repair or replace as required.
	Hydraulic oil trapped in cylinder.	Inspect hoses and oil passages for restrictions. Inspect control valve for improper spool positioning.

(Continued on next page)

TROUBLE SHOOTING

TROUBLE	CAUSE	CORRECTION
18. Clutch assembly bearings seized.	Improper lubrication.	Refer to LUBRICATION.
	Improper adjustment.	Refer to ADJUSTMENT, CLUTCH.
	Defective bearings.	Replace bearings.
19. Cable drum bearings seized.	Improper lubrication.	Refer to LUBRICATION.
	Improper adjustment.	Refer to DISASSEMBLY AND ASSEMBLY OF WINCH.
	Defective bearings.	Replace bearings.
20. Defective bearings or gears in winch transmission.	Improper oil or low oil level.	Refer to LUBRICANTS AND CAPACITIES.
	Winch overloaded.	Refer to specifications for winch capacity.
	Defective gears or bearings.	Drain oil and inspect for metal particles. Remove side plate and bull pinion cover for inspection. Refer to DISASSEMBLY AND ASSEMBLY OF WINCH.

SERVICE INFORMATION

SPECIFICATIONS

Winch Model . . . . Carco Model 100
Winch Make . . . Pacific Car and Foundry Co.
Winch Type . . . . single drum, single speed unit, mechanically driven and hydraulically controlled

LUBRICANTS AND CAPACITIES

Below 0°F . . . . SAE 10 engine oil
0° - 90°F . . . . SAE 90 Gear Oil (MPL)
Above 90°F . . . . . SAE 140 Gear Oil (MPL)
Use high quality non-foaming oils.

Change oil in winch every 600 hours or three months of operation, which ever occurs first.

NOTE: High humidity and wide ranges of temperature may cause condensation within the winch. Remove magnetic drain plugs and drain water from bottom of case periodically before starting days operation to prevent corrosion and rusting of internal parts.

NOTE: Approximate oil capacity of each gear case is stamped on the nameplate.

SERVICE INFORMATION

Whenever cable drum is removed, clean and repack bearings with high temperature ball and roller bearing grease as follows:

Operating Temperature	Grease Specification
-25°F and above	NLGI Consistency 1 or 2 for operating temp. -30°F to +225°F.
-25°F and below	Special low temperature grease for operating temp. -65°F to +225°F.

TOLERANCES

Hydraulic system relief valve	415-420 psi
Clutch lining thickness	
new	5/16 inch
min.	1/16 inch
Brake lining thickness	
new	1/4 inch
min.	1/16 inch
Bevel gear assembly bearing adjustment	.001" tight to .001" loose
Clutch hub bearing adjustment	.000" to .003" tight
Cable drum bearing adjustment	.001" tight to .002" loose
Bevel gearset backlash	.007-.012 inch

SPECIAL TORQUES

Bevel gear retaining cap screw (5/8")	160-170 ft/lb.
Bevel pinion retaining cap screw (5/8")	160-170 ft/lb.
Drum shaft nuts	150-300 ft/lb.
Pillow block cap screws	630-710 ft/lb.
Front mounting cap screw	290-320 ft/lb.

CAP SCREW TORQUE

GR. 5 Cap Screws in Aluminum Threaded Case

(UNC Threads)

SIZE	TORQUE
5/16"	17-19 ft/lb.
3/8"	32-35 ft/lb.
1/2"	65-70 ft/lb.

ADJUSTMENTS

CLUTCH

Do not adjust clutch unless it slips. Do not allow clutch to slip or drag over extended periods of time.

Remove drum plugs (1, Fig. 14-29) from cable drum flange periodically and inspect condition of clutch lining. If clutch slips, check for oil or water on band before changing adjustment.

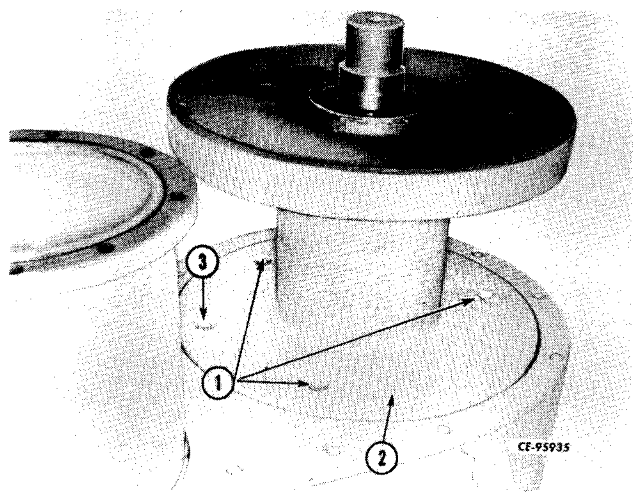

Figure 14-29

CAUTION: BE SURE DOZER BLADE IS LOWERED TO GROUND LEVEL AND SAFETY BAR INSTALLED BEFORE PROCEEDING WITH ADJUSTMENT.

Adjust clutch as follows:

Start tractor engine and position winch control lever in "BRAKE-OFF" position. Insert a 3/8" diameter pin or bolt (Fig. 14-2) through cross drilled hole in brake spring rod. Return winch control lever to "BRAKE-ON" position and turn engine off. Apply parking brake and block the tires.

CAUTION: DO NOT ATTEMPT CLUTCH ADJUSTMENT WITH TRACTOR ENGINE RUNNING.

(Continued on next page)

ADJUSTMENTS - Continued

CLUTCH - Continued

To be sure brake does not drag while clutch is being adjusted, loosen jam nut (1, Fig. 14-4) and turn brake adjusting screw (2, Fig. 14-4) two to three turns counterclockwise.

Loosen free spool drag adjustment by partially removing set screw (2, Fig. 4-7).

Remove wire rope from winch drum.

Remove plugs (1, Fig. 14-29) from drum flange and align holes with clutch adjusting set screws. Tighten set screws with an allen wrench until screws become tight. Back set screws off one full turn.

Align drum plug (3, Fig. 14-29) with clutch band adjuster. Using adjuster spoon, tighten adjuster until band drags heavily. Then loosen until band no longer drags when drum is rotated.

Tighten free spool drag by turning in on set screw (2, Fig. 14-7).

Install plugs in flange of winch drum. Start engine and position winch control lever to "BRAKE-OFF" and remove 3/8" pin or bolt from brake adjusting rod. Return control lever to "BRAKE-ON."

BRAKE

Adjust brake when the winch does not hold the rated load or when brake band drags excessively. Do not allow brake to slip or drag excessively over extended periods of time. If brake slips, check for oil or water on lining before changing adjustment.

Adjust winch brake as follows:

Remove or loosen free spool drag assembly by removing set screw (2, Fig. 14-7).

Start tractor engine and position winch control lever to "BRAKE-OFF." Loosen brake adjusting screw jam nut (2, Fig. 14-4) and tighten brake adjusting screw (1, Fig. 14-4) until brake band is tight enough to stop cable drum from rotating.

NOTE: When adjusting brake, loosen jam nut only enough to allow adjusting screw to rotate.

Loosen adjustment screw until drum rotates with the desired amount of freedom. A slight amount of brake drag will help keep the drum from "FREE-SPOOLING" too easily; thus avoiding excess wire rope slack and "bird-nesting."

When adjustment is satisfactory, tighten jam nut (2, Fig. 14-4) and replace brake adjustment cover.

RELIEF VALVE

Relief valves are adjusted at the factory and should not require further adjustment. If relief valve is overhauled or if incorrect pressure is suspected, proceed as follows:

> NOTE: Do not attempt relief valve adjustment without a reliable pressure gage. Insufficient or excessive pressure will result in damage to the winch.

Stop tractor engine. Cycle all hydraulic controls to be sure no pressure remains in the system.

Disconnect clutch and brake hydraulic lines located behind operator's compartment at pivot point. Install pressure gages of 0-500 psi range in ends of both lines.

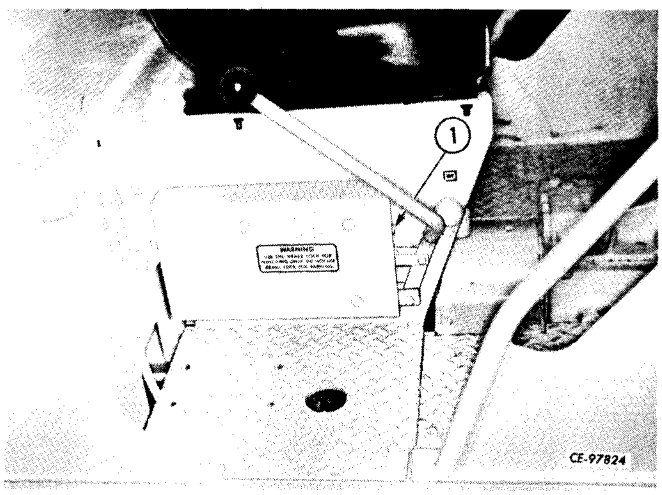

Figure 14-30

SERVICE INFORMATION

Remove acorn nut (1, Fig. 14-30) from relief valve adjusting screw.

Start tractor engine and position winch control lever in "BRAKE-OFF" position. Refer to "TOLERANCES" for recommended pressure.

To correct pressure setting, loosen jam nut and turn adjustment screw counterclockwise to reduce pressure or clockwise to increase pressure.

When correct pressure reading is obtained, lock adjusting screw with jam nut and install acorn nut (1).

Recheck pressure in "BRAKE-OFF" position.

NOTE: Do not over tighten jam nut or acorn nut. Damage to the adjusting screw will result and pressure adjustment may change.

Stop engine. Cycle all hydraulic controls to be sure no pressure remains in the system. Remove gage and reinstall plug.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

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SECTION XV
ADJUSTMENTS

Page

SECTION XV ADJUSTMENTS

BRAKE ADJUSTMENTS

PEDAL ADJUSTMENT

Check and correct fluid level before final adjustment. If any part of brake system has been serviced, system must be bled. Refer to "BLEED HYDRAULIC BRAKE CIRCUIT." Inability to maintain proper fluid level usually indicates a system leak. Adjustment of brake pedal travel must be done from under right hand floor panel (refer to Fig. 13-2) by shortening or lengthening rod (7, Fig. 15-1) between master cylinder and brake pedal arm (2).

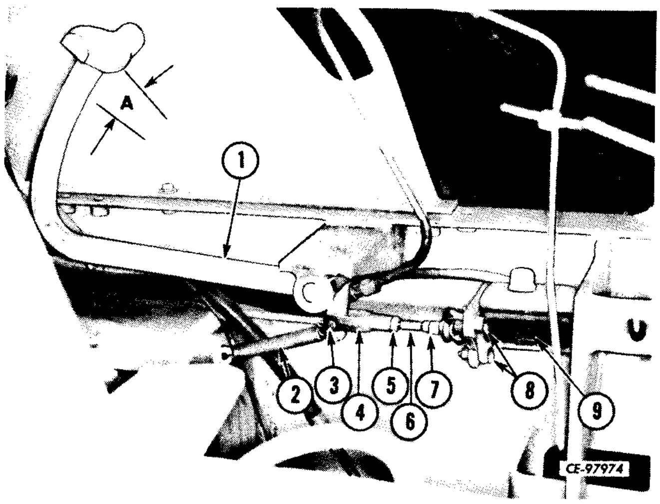

Figure 15-1
Brake Pedal Assembly.

Loosen jam nuts (6, 8) on each end of rod (7) holding nut (9), rotate rod (7) in either direction depending upon the required adjustment.

Proper adjustment is to obtain a 1/4-1/2 inch of "FREE-PLAY" (1) at beginning of pedal travel. Lack of "FREE-PLAY" will block bypass port in master cylinder and after several brake applications, brake lining carriers will drag against the brake disc. Excessive "FREE-PLAY" will decrease the usable stroke of the master cylinder piston.

Once proper adjustment is accomplished, tighten jam nuts (6, 8). Check to be sure that the pedal return spring (3) is properly installed and is capable of holding the pedal assembly (2) in the released position. Install right hand floor panel.

BLEED HYDRAULIC BRAKE CIRCUIT

Air trapped in the hydraulic lines will decrease or eliminate the tractors braking effort. To insure safe operation, the hydraulic brake line should be bled whenever it is suspected that air or gas is trapped in the system. Air is most likely to enter the brake system through a leak; when the line is disconnected or when there is an insufficient amount of brake fluid in the reservoir.

Whenever air is trapped in the system, the feel at the brake pedal is "spongy" and full braking pressure cannot be developed. Pressure bleeding of the brake system is preferable, but since bleeder tanks are not always available, the system can be manually bled. The proper sequence for bleeding the system requires starting at the master cylinder and then moving to the caliper brake assembly.

Bleed the system as follows:

1. Remove accumulated dirt from master cylinder filler cap area. Remove the cap and fill the reservoir to within 1/2" of the top of the hole. Use only new brake fluid of the recommended type (IH heavy duty, SAE J-1703a). Keep the reservoir filled during and after bleeding operations.

2. With all bleed screws closed, depress the brake pedal, slowly and repeatedly until a pressure is built up in the system. Using an end wrench loosen the brake line fitting at the point where it attaches to the master cylinder. When the brake pedal reaches the full down position, hold the pedal stationary and tighten the fitting.

NOTE: Do not allow the pedal to rise until the fitting is tight. To do so would allow air to enter the system.

Repeat the operation until only fluid free of bubbles emerges from the fitting. Tighten the fitting securely. Check the fluid level in the reservoir. Add fluid as required.

(Continued on next page)

BRAKE ADJUSTMENTS

BLEED HYDRAULIC BRAKE CIRCUIT - Continued

NOTE: To perform step 3 the floor panels will have to be removed.

3. Bleed the brake caliper. Note the point at which the brake line joins the caliper housing. Bleed the screw highest and farthest from this point first (1, Fig. 15-2). The remaining high screw (2) is next. Procedure is the same; build up pedal pressure; open screw; close screw when pedal is at bottom of stroke. Repeat procedure at each bleed screw until fluid, free of bubbles, is ejected from the screw. Check fluid level in reservoir often.

NOTE: Do not allow the pedal to rise until bleed screw is closed tight. To do so would allow air to enter the system.

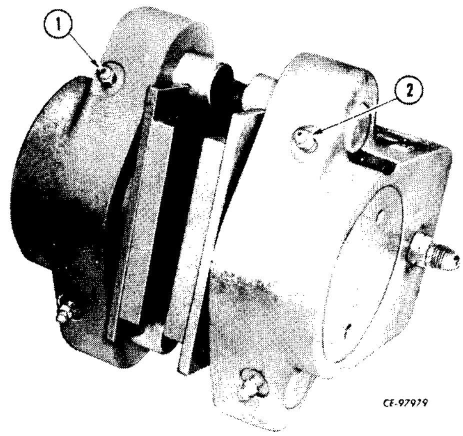

Figure 15-2

ENGINE CLUTCH PEDAL ADJUSTMENTS

5/8 inch clutch pedal "free-play" is required to allow operating clearance between clutch release bearing and clutch release levers. Lack of clutch "free-play" causes undue wear on the clutch facings and bearings.

To obtain proper clutch "free-play" loosen jam nuts (10, Fig. 15-3) and rotate turnbuckle (11) counterclockwise to reduce and clockwise to increase "free-play."

With proper pedal "free-play" obtained, tighten jam nuts (10).

ENGINE CLUTCH PEDAL ADJUSTMENTS

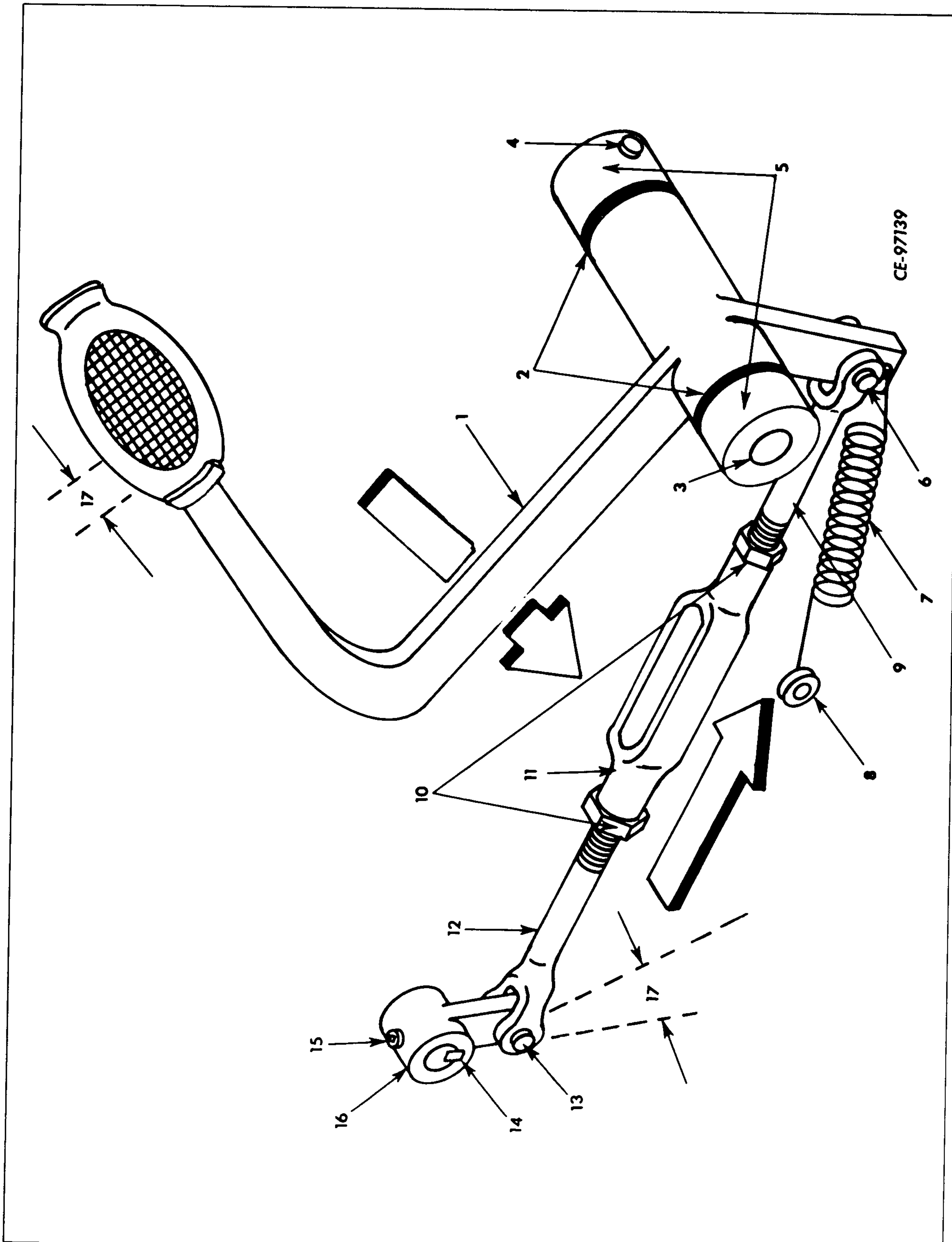

Figure 15-3

ACCELERATOR LINKAGE ADJUSTMENTS

NOTE: Before accelerator linkage adjustment is made apply the brake lock lever, position the transmission in "NEUTRAL" and using the safety bar and pins, lock the tractor halves in the straight lock position.

Check the amount of tension on return spring (37, Fig. 15-4) to be certain it has enough to properly return the linkage. Tension adjustment can be accomplished by removing spring (37). Loosen jam nut (39) and rotate eye bolt in either direction depending on the adjustment needed. Install return spring (37) and tighten jam nut (39).

Loosen jam nut (30) and remove pedal stop cap screw (29).

Loosen nut (9) enough to allow throttle lever (6) to be loose during adjustment procedure.

With the aid of a tachometer adjust the engine to the recommended low idle rpm's. Refer to "NORMAL GAUGE READINGS" table.

Accelerate engine to maximum recommended rpm's. If linkage adjustment is needed to obtain maximum rpm's, remove cotter pin and clevis pin (11), loosen jam nut (13) and rotate clevis (12). Connect linkage by installing clevis pin and cotter pin (11) and re-check for maximum engine rpm's.

Install jam nut (30) and pedal stop cap screw (29) to the floor panel. Press down on accelerator to maximum engine rpm and adjust cap screw (29) to come in contact with accelerator pedal in this position. Tighten jam nut (30).

Adjust shaft and lever (1) positioning tube and clevis (3) tight against rod (17). While holding shaft and lever (1) position throttle lever (6) to the idle position in relation with the dash panel. Tighten nut (9) enough to allow throttle lever (6) to move and hold desired idle position.

Start the engine and check the complete accelerator linkage adjustment. Refer to adjustment procedure if additional adjustment is required. Tighten all jam nuts.

Legend for Figure 15-4

1. Shaft and lever.
2. Clevis pin and cotter pin.
3. Tube and clevis.
4. Friction plate.
5. Friction plate.
6. Hand throttle lever.
7. Spring.
8. Washer.
9. Nut.
10. Throttle lever.
11. Clevis pin and cotter pin.
12. Clevis.
13. Jam nut.
14. Rod and clevis.
15. Clevis pin and cotter pin.
16. Mounting bracket.
17. Rod.
18. Jam nut.
19. Clevis.
20. Clevis pin and cotter pin.
21. Support bearing.
22. Cross shaft.
23. Mounting bracket.
24. Cap screws, lock washers and nuts.
25. Mounting bearing.
26. Accelerator pedal.
27. Lock washers and cap screws.
28. Nuts and lock washers.
29. Pedal stop cap screws.
30. Jam nut.
31. Foot pedal lever.
32. Clevis pin and cotter pin.
33. Shaft and lever.
34. Clevis pin and cotter pin.
35. Clevis.
36. Jam nut.
37. Return spring.
38. Eye bolt.
39. Jam nut.

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ACCELERATOR LINKAGE ADJUSTMENTS

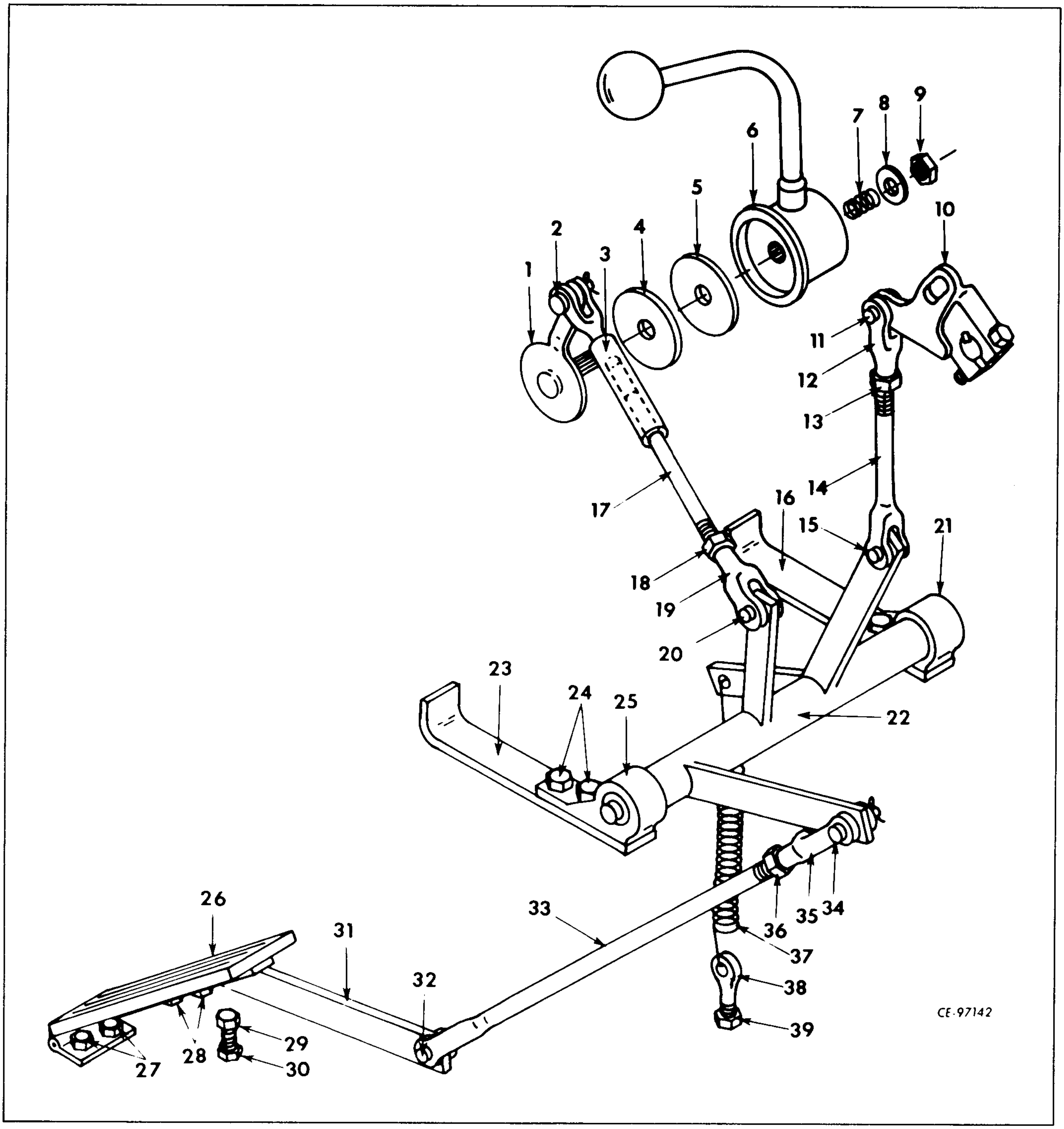

Figure 15-4
Accelerator Linkage.

ACCELERATOR LINKAGE ADJUSTMENTS

NORMAL GAUGE READINGS

SYSTEM	GAUGE	DETROIT DIESEL 3-53	
		MIN.	MAX.
Cooling	Water Temperature (Degrees Fahrenheit)	177°	202°
Lubrication	Oil Pressure (psi)		40
Engine Speed	Low Idle (rpm)		675
	High Idle (rpm)		2800
	Governed Speed (rpm)	2600	

HYDRAULIC SYSTEM ADJUSTMENTS

LUBRICANTS

TEMPERATURE	TYPE REFILL AND SERVICE		
	SAE	API	MILITARY SPECIFICATIONS
Below 20°F. Above 20°F.	10W/30 20-20W	**MS DM DS	SUP. 1**, MIL-L-2104B, SERIES 3

** MS wear test sequence

CAPACITIES

Reservoir capacity . . . . 20 qts.
System capacity . . . . 16 qts.

Total Hydraulic System capacity . . . . 36 qts.

SYSTEM PRESSURES

Dozer blade relief valve . . . . 1900 psi
Steering relief valve . . . . 1900 psi
Winch relief valve . . . . Refer to Section 14, "WINCH"
All pressure checks are at High Idle

SPECIAL TORQUES

HYDRAULIC CYLINDERS
Hydraulic cylinder piston nut. . 450-500 lb./ft.

BLADE RELIEF VALVE ADJUSTMENT

In addition to the regular periodic system pressure checks and checks to detect system problems, the hydraulic blade relief valve must be pressure checked and adjusted if it has been completely disassembled or if repairs have been made to the blade circuit.

HYDRAULIC SYSTEM ADJUSTMENTS

Adjust the relief valve as follows:

NOTE: Do not attempt relief valve adjustment without a reliable pressure gage. Insufficient or excessive pressure will result in damage to the system.

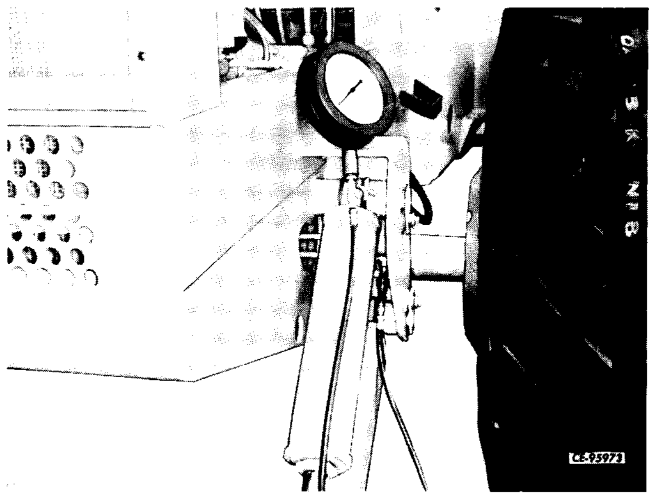

Figure 15-5

Stop tractor engine. Cycle all hydraulic controls to be sure no pressure remains in the system.

Install gage of 0 to 3000 psi range in the top of the blade cylinder hydraulic line.

Remove acorn nut from relief valve adjusting screw located on top of the control valve.

Start engine and place blade control lever in "Raise" position. Read indicated pressure on gage. Refer to "SYSTEM PRESSURES" for recommended pressure.

Blade Circuit Pressure:__________

If pressure is incorrect, loosen jam nut on adjusting screw, at the control valve, and turn screw counterclockwise to reduce pressure or clockwise to increase pressure.

When a correct pressure reading is obtained, lock adjusting screw with jam nut and install acorn nut.

Recheck the pressure reading.

Stop engine. Cycle all hydraulic controls to be sure no pressure remains in the system. Remove gage and install plug.

STEERING RELIEF VALVE ADJUSTMENT

Adjust the relief valve as follows:

NOTE: Do not attempt relief valve adjustment without a reliable pressure gage. Insufficient or excessive pressure will result in damage to the system.

Stop tractor engine. Cycle all hydraulic controls and steering controls to be sure no pressure remains in the system.

Install gage of 0 to 3000 psi range in the front of the steering cylinders hydraulic line.

From inside the engine compartment, remove acorn nut from the relief valve adjusting screw located on the opposite end of the steering valve linkage.

Start the engine and rotate the steering wheel into a full lock turn position. Read pressure gage. Refer to "SYSTEM PRESSURES" for correct pressure reading.

Steering Circuit Pressure:__________

WARNING: Before turning machine be sure all personnel are moved from the area.

If pressure is incorrect, loosen jam nut on adjusting screw, at the control valve, and turn screw counterclockwise to reduce pressure or clockwise to increase pressure.

When a correct pressure reading is obtained, lock adjusting screw with jam nut and install acorn nut.

Recheck the pressure reading.

(Continued on next page)

HYDRAULIC SYSTEM ADJUSTMENTS

STEERING RELIEF VALVE ADJUSTMENT - Continued

Stop engine. Cycle all hydraulic controls and steering controls to be sure no pressure remains in the system. Remove gage and install plug.

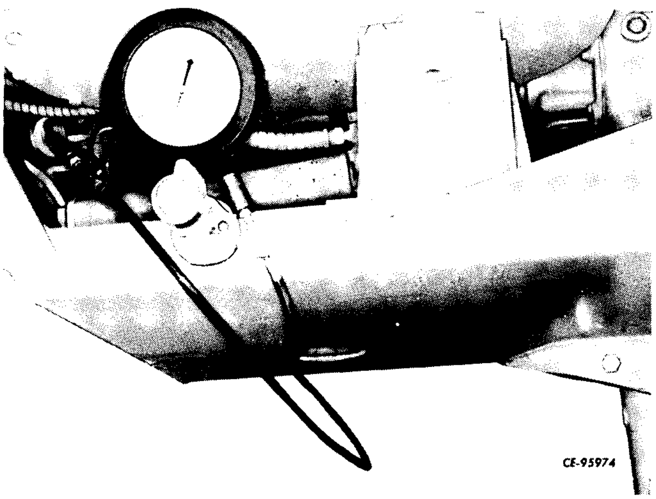

Figure 15-6

CYLINDER ROD PACKING ADJUSTMENT

(Refer to Fig. 11-26 for reference to the following text.)

If a steering or dozer blade cylinder is leaking hydraulic fluid an adjustment of the packing nut (14, Fig. 11-26) is required. Tightening the packing nut will compress the rod packing and increase its pressure on the rod (16).

Correct adjustment of packing nut allows a thin film of oil to cover surface of rod. No leak must be in evidence. Excess tightening will damage both packing and rod.

To adjust, remove rubber plug (9) and using a wrench rotate packing nut (14) until the hole in the cap (6) is aligned with plug hole in cylinder.

Loosen set screws (13). Insert a suitable punch into aligned holes of cap and cylinder and tighten packing nut (14) lightly.

Tighten set screws (13) and install rubber plug (9).

Start the engine and cycle the cylinder several times. Stop and check the cylinder rod for the film of oil.

If rod packing still requires adjustment, repeat the above procedure. If the packing nut cannot be tightened, packing (5) must be replaced. Refer to Disassembly and Assembly of hydraulic cylinder.

NOTE: Do not over-tighten packing nut. Serious damage to the packing and rod will result.

WINCH

LUBRICANTS AND CAPACITIES

Below 0°F . . . . SAE 10 engine oil
0° - 90°F . . . . SAE 90 Gear Oil (MPL)
Above 90°F . . . . . SAE 140 Gear Oil (MPL)
Use high quality non-foaming oils.

Change oil in winch every 600 hours or three months of operation, whichever occurs first.

NOTE: High humidity and wide ranges of temperature may cause condensation within the winch. Remove magnetic drain plugs and drain water from bottom of case periodically before starting days operation to prevent corrosion and rusting of internal parts.

NOTE: Approximate oil capacity of each gear case is stamped on the nameplate.

Whenever cable drum is removed, clean and repack bearings with high temperature ball and roller bearing grease as follows:

Operating Temperature	Grease Specification
-25°F and above	NLGI Consistency 1 or 2 for operating temp. -30°F to +225°F.
-25°F and below	Special low temperature grease for operating temp. -65°F to +225°F.

TOLERANCES

Hydraulic system relief valve . . 415-420 psi
Clutch lining thickness
new . . . . 5/16 inch
min. . . . . 1/16 inch
Brake lining thickness
new . . . . 1/4 inch
min. . . . . 1/16 inch
Bevel gear assembly bearing
adjustment . . . .001" tight to .001" loose
Clutch hub bearing adjustment . . . . .000" to .003" tight
Cable drum bearing adjustment . . . . . . .001" tight to .002" loose
Bevel gearset backlash . . . . .007-.012 inch

SPECIAL TORQUES

Bevel gear retaining cap screw (5/8") . . . . 160-170 ft/lb.
Bevel pinion retaining cap screw (5/8") . . . . 160-170 ft/lb.
Drum shaft nuts . . . . 150-300 ft/lb.
Pillow block cap screws . . . . 630-710 ft/lb.
Front mounting cap screw . . . 290-320 ft/lb.

CAP SCREW TORQUE

GR. 5 Cap Screws in Aluminum Threaded Case

(UNC Threads)

SIZE	TORQUE
5/16"	17-19 ft/lb.
3/8"	32-35 ft/lb.
1/2"	65-70 ft/lb.

CLUTCH ADJUSTMENT

Do not adjust clutch unless it slips. Do not allow clutch to slip or drag over extended periods of time.

Remove drum plugs (1, Fig. 15-7) from cable drum flange periodically and inspect condition

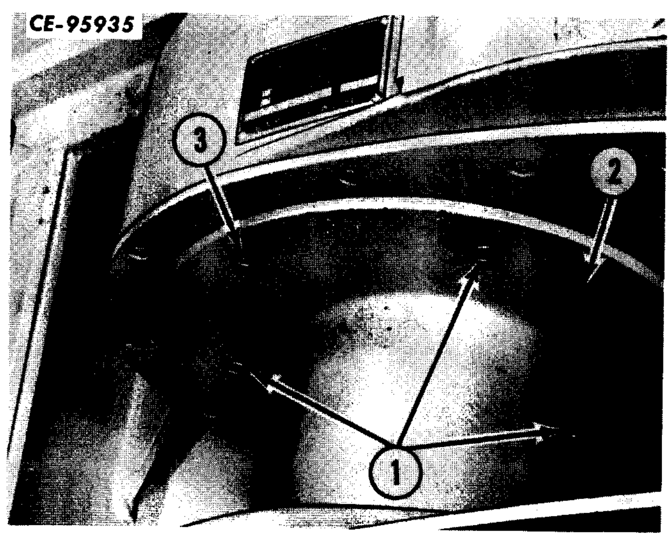

Figure 15-7

(Continued on next page)

WINCH

CLUTCH ADJUSTMENT - Continued

of clutch lining. If clutch slips, check for oil or water on band before changing adjustment.

CAUTION: BE SURE DOZER BLADE IS LOWERED TO GROUND LEVEL AND SAFETY BAR INSTALLED BEFORE PROCEEDING WITH ADJUSTMENT.

Adjust clutch as follows:

Start tractor engine and position winch control lever in "BRAKE-OFF" position. Insert a 3/8" diameter pin or bolt (Fig. 14-2) through cross drilled hole in brake spring rod. Return winch control lever to "BRAKE-ON" position and turn engine off. Apply parking brake and block the tires.

CAUTION: DO NOT ATTEMPT CLUTCH ADJUSTMENT WITH TRACTOR ENGINE RUNNING.

To be sure brake does not drag while clutch is being adjusted, loosen jam nut (1, Fig. 14-4) and turn brake adjusting screw (2, Fig. 14-4) two to three turns counterclockwise.

Loosen free spool drag adjustment by partially removing set screw (2, Fig. 14-7).

Remove wire rope from winch drum.

Remove plugs (1, Fig. 15-7) from drum flange and align holes with clutch adjusting set screws. Tighten set screws with an allen wrench until screws become tight. Back set screws off one full turn.

Align drum plug (3, Fig. 15-7) with clutch band adjuster. Using adjuster spoon, tighten adjuster until band drags heavily. Then loosen until band no longer drags when drum is rotated.

Tighten free spool drag by turning in on set screw (2, Fig. 14-7).

Install plugs in flange of winch drum. Start engine and position winch control lever to "BRAKE-OFF" and remove 3/8" pin or bolt from brake adjusting rod. Return control lever to "BRAKE-ON."

BRAKE ADJUSTMENT

Adjust brake when the winch does not hold the rated load or when brake band drags excessively. Do not allow brake to slip or drag excessively over extended periods of time. If brake slips, check for oil or water on lining before changing adjustment.

Adjust winch brake as follows:

Remove or loosen free spool drag assembly by removing set screw (2, Fig. 14-7).

Start tractor engine and position winch control lever to "BRAKE-OFF." Loosen brake adjusting screw jam nut (2, Fig. 14-4) and tighten brake adjusting screw (1, Fig. 14-4) until brake band is tight enough to stop cable drum from rotating.

NOTE: When adjusting brake, loosen jam nut only enough to allow adjusting screw to rotate.

Loosen adjustment screw until drum rotates with the desired amount of freedom. A slight amount of brake drag will help keep the drum from "FREE-SPOOLING" too easily; thus avoiding excess wire rope slack and "bird-nesting."

When adjustment is satisfactory, tighten jam nut (2, Fig. 14-4) and replace brake adjustment cover.

RELIEF VALVE ADJUSTMENT

Relief valves are adjusted at the factory and should not require further adjustment. If relief valve is overhauled or if incorrect pressure is suspected, proceed as follows:

NOTE: Do not attempt relief valve adjustment without a reliable pressure gage. Insufficient or excessive pressure will result in damage to the winch.

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WINCH

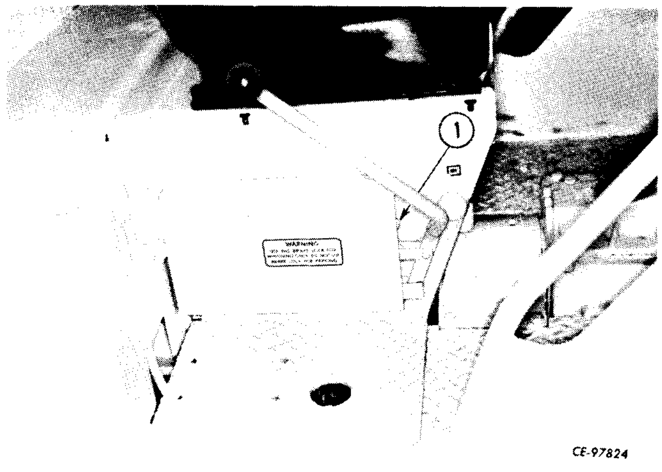

Figure 15-8

Stop tractor engine. Cycle all hydraulic controls to be sure no pressure remains in the system.

Disconnect clutch and brake hydraulic lines located behind operator's compartment at pivot point. Install pressure gages of 0-500 psi range in ends of both lines.

Remove acorn nut (1, Fig. 15-8) from relief valve adjusting screw.

Start tractor engine and position winch control lever in "BRAKE-OFF" position. Refer to "TOLERANCES" for recommended pressure.

To correct pressure setting, loosen jam nut and turn adjustment screw counterclockwise to reduce pressure or clockwise to increase pressure.

When correct pressure reading is obtained, lock adjusting screw with jam nut and install acorn nut (1).

Recheck pressure in "BRAKE-OFF" position.

NOTE: Do not over tighten jam nut or acorn nut. Damage to the adjusting screw will result and pressure adjustment may change.

Stop engine. Cycle all hydraulic controls to be sure no pressure remains in the system. Remove gage and reinstall plug.

NOTE: If severe fluctuation occurs, remove the relief valve assembly and check for dirt. Persistent fluctuation can be lessened by grinding the spring at approximately 5 degrees to its centerline, on the end next to the wall.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SERVICE BULLETIN RECORD

Important: Information in this manual section is subject to change or supplementing from time to time as a result of field experience and engineering modifications. As Service Bulletins are received, record them on this page for handy reference whenever this manual is to be used. . .Print entries in ink.

Bulletin No.	Date Issued	Book No.	Topic or part of machine involved.

1st in service

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