Due to a continuous program of research and development, some procedures, specifications and parts may be altered in a constant effort to improve machines.

Periodic revisions may be made to this publication and mailed automatically to distributors. It is recommended that customers contact their distributor or dealer for information on the latest revision.

MODEL H-30B

PAY® LOADER

FORM

SM-H30B-1

NOVEMBER, 1969

(Supersedes ISSUE SM-H30B dated 9-62)

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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 Models H-30B, H-30F and H-30R PAY loaders.

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

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

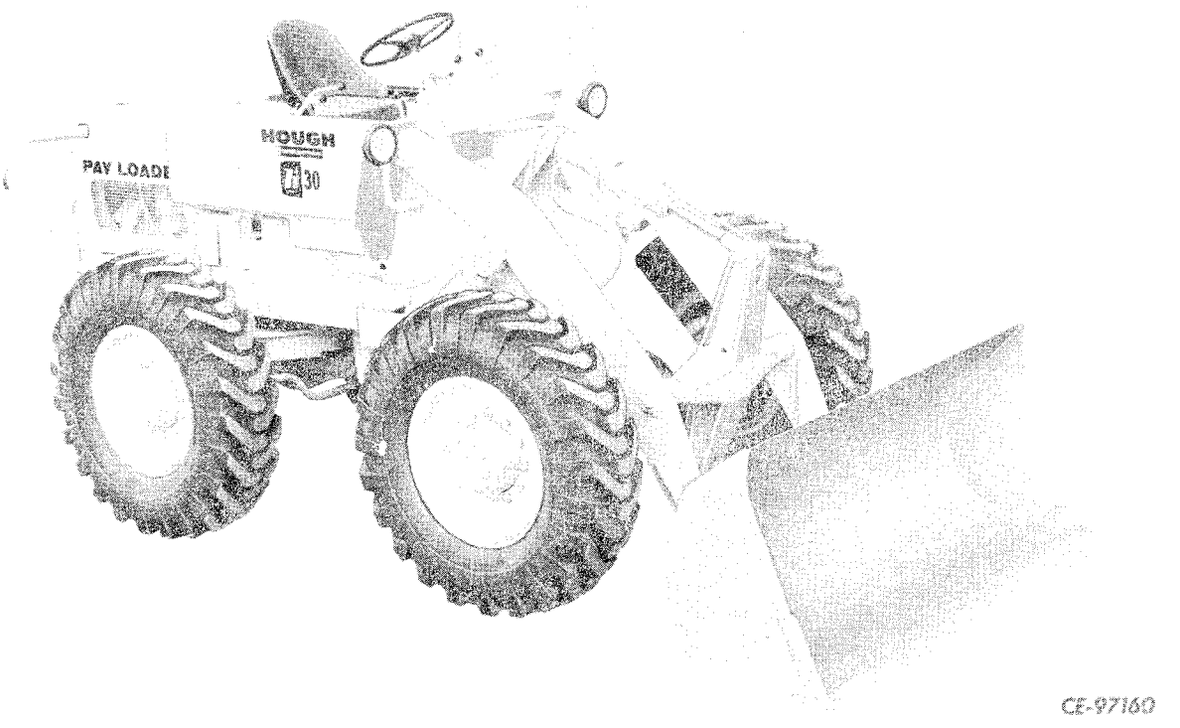

Figure I-1
Model H-30B PAY loader.

INTRODUCTION

GENERAL

Figure I-2
Model H-30F PAY loader.

Figure I-3
Model H-30R PAY loader.

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LUBRICATION

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

SERVICE PARTS

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

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

SERIAL NUMBERS

The tractor serial number plate is located on the front panel to the right of the steering column.

The IH Gasoline Engine serial number is stamped on a pad on the right hand side of the engine block just below and to the right of the distributor.

The IH Diesel Engine serial number is stamped on a pad on the right hand side of the engine block just to the left of the crankcase breather pipe.

The Detroit Diesel Engine serial number is attached to the rocker arm cover on top of the engine.

ENGINE

The Model H-30B PAY loader may be equipped with an IH G-263 Gasoline, IH D-236 Diesel or a Detroit Diesel 3-53 Diesel Engine. Instructions for removal and installation of the engines are covered in this manual. For detailed information on overhauling and adjusting the IH G-263 Gasoline Engine and the IH D-236 Diesel Engine, refer to Service Manual ISS-1040.

WARRANTY

International Harvester and Hough make no warranty in respect to the Detroit Diesel engine in the Model H-30B PAY loader. The engine is warranted by the Detroit Diesel Engine Division, General Motors Corporation, Detroit, Michigan. Servicing of the engine during the warranty period is to be handled by the General Motors Corporation distributor or dealer in your locality.

DIESEL FUEL SYSTEM

If detailed information on the fuel system of the IH D-236 Diesel Engine is desired, refer to the Injection Pump Manual, ISS-1042.

SERVICE TOOLS

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

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" and "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-4). Do not stretch the "O"-ring any more than is required for proper installation.

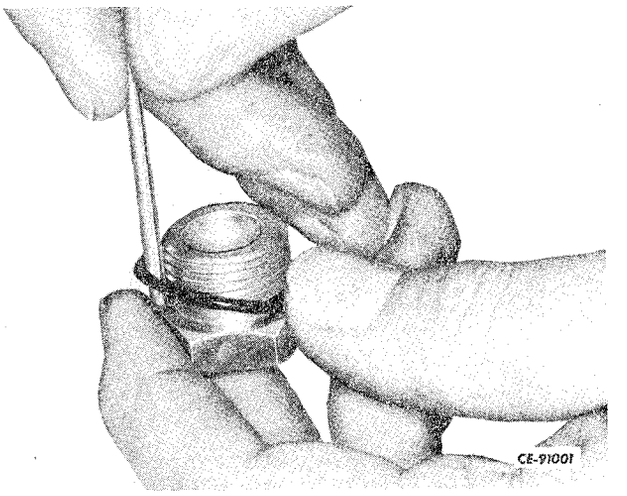

Figure I-4
Correct "O" - Ring Installation.

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.

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RECOMMENDED BEARING PROCEDURES

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.

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.

RECOMMENDED BEARING PROCEDURES

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 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-5) 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.

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RECOMMENDED BEARING PROCEDURES

Do not keep the bearing in the oil or oven after the correct temperature has been reached.

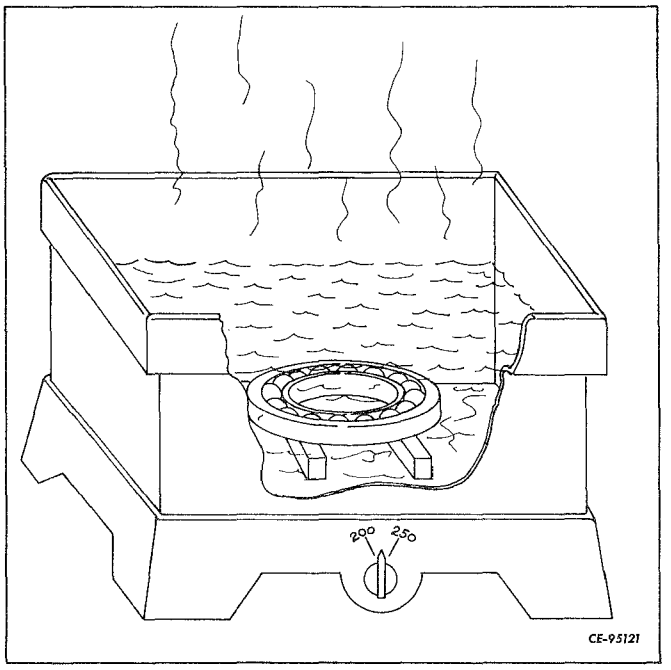

Figure I-5
Expanding Bearing in Heated Oil.

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

ADJUSTMENT

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

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

LUBRICATION

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

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

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

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

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

Be sure to inspect seals and vents regularly.

LOCTITE AND LOCQUIC DATA

LOCTITE

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

LOCQUIC

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

LOCTITE RECOMMENDATION

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

1. Exhaust pipe mounting hardware.
2. Elastic stop nuts.
3. When lock washers are used.
4. When bolt or nut retaining lock plates are used.
5. On items requiring frequent service (500 hours or less), such as filler caps, adjusting screws, wheel stud clamp retaining nuts, etc.
6. On brass pipe plugs and fittings in air systems and all other pipe fittings.
7. All stud applications.

PART PREPARATION FOR LOCTITE

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

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

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° 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.

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

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

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

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

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

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

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

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

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

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

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

SPECIFICATIONS

GENERAL

	H-30B	H-30F	H-30R
Height (overall)	7'1"	7'1"	7'1"
Length with bucket on ground	16'8"	16'8"	16'8"
Ground clearance (minimum)	1'3"	1'3"	1'3"
Wheel base			
Width at front tires	6'8"	6'8"	6'5-1/2"
Width at rear tires	6'8"	6'5-1/2"	6'8"
Total rear axle oscillation (included angle)	18°	18°	18°

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SPECIFICATIONS

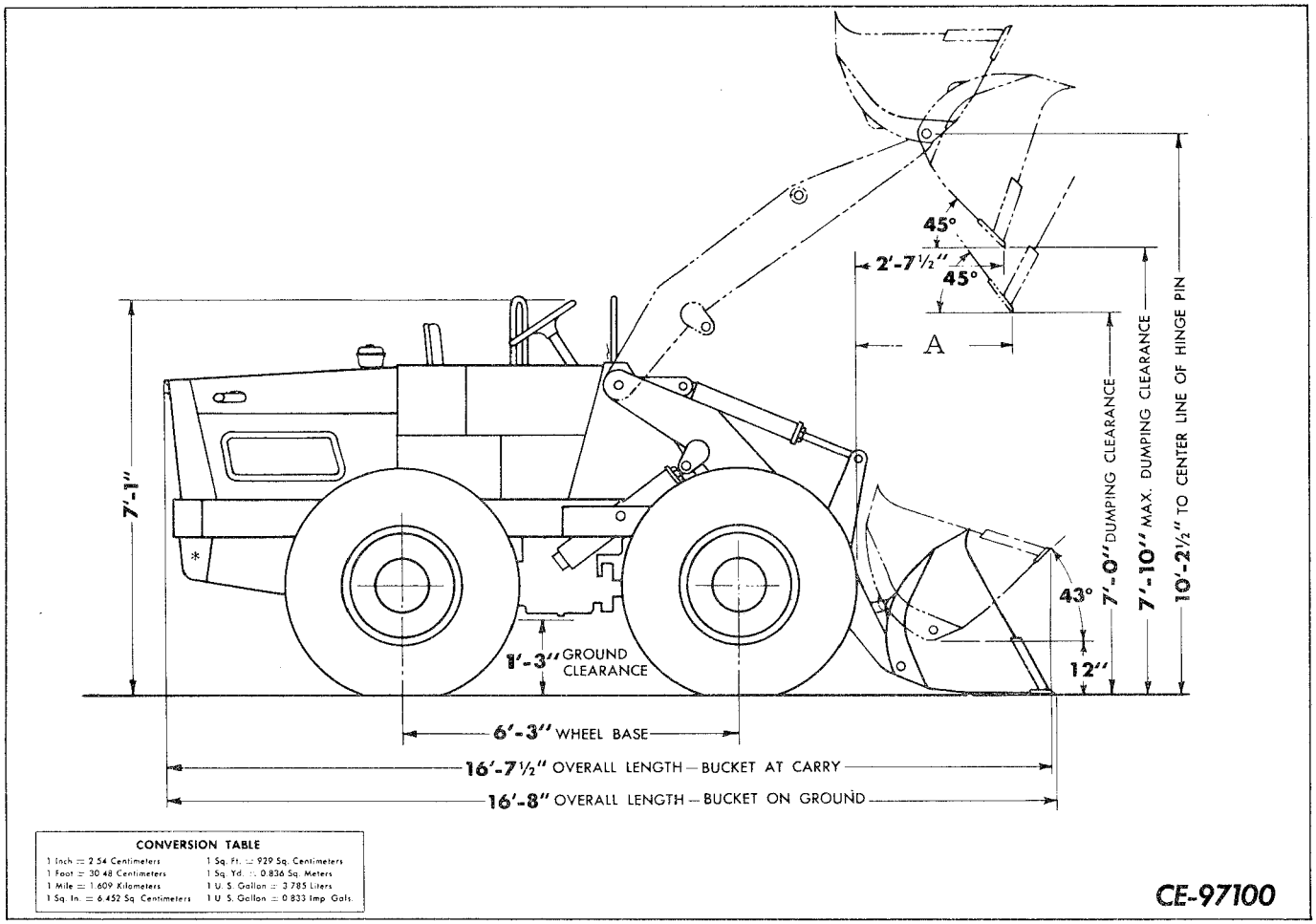

Figure I-6
Dimension Diagram.

GENERAL - Continued

	H-30B	H-30F	H-30R
Turning radius:			
To outside of rear wheel	18'4"	10'11"	9'10"
To outside bucket corner at carry	17'10"	10'5"	15'9-3/4"
Tread:			
Front	5'6"	5'6"	5'10-1/2"
Rear	5'6"	5'10-1/2"	5'6"
Maximum dump angle at maximum dump height	45°	45°	45°
Maximum dump angle at 7'-0" dump height	54°	54°	54°
Maximum reach at maximum dump height (A)	3'5"	3'5"	3'8-1/2"

WEIGHT

I. H. Gasoline engine (lbs. approx.)	11,475	10,580	10,560
I. H. Diesel engine (lbs. approx.)	11,650	10,590	10,570
Detroit Diesel engine (lbs. approx.)	11,650	10,630	10,610

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STANDARD TORQUE DATA

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

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

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

NOTE: Multiply standard assembly torques by the following factors:

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

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

BOLT SIZE	TYPE 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	3 RADIAL LINES Quenched and tempered medium carbon steel.	
4	8	6 RADIAL LINES Quenched and tempered special carbon or alloy steel.	

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

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CHASSIS

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GENERAL INFORMATION

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

The forward portion of the rigid frame contains the operator's compartment providing the operator with all-around visibility at all times.

The rear section provides a mounting platform for the engine and grille.

The front axle is fastened directly to the forward portion of the frame. The rear axle is connected to a cradle which in turn is fastened by two pins to the frame. This permits the axle to oscillate on uneven terrain.

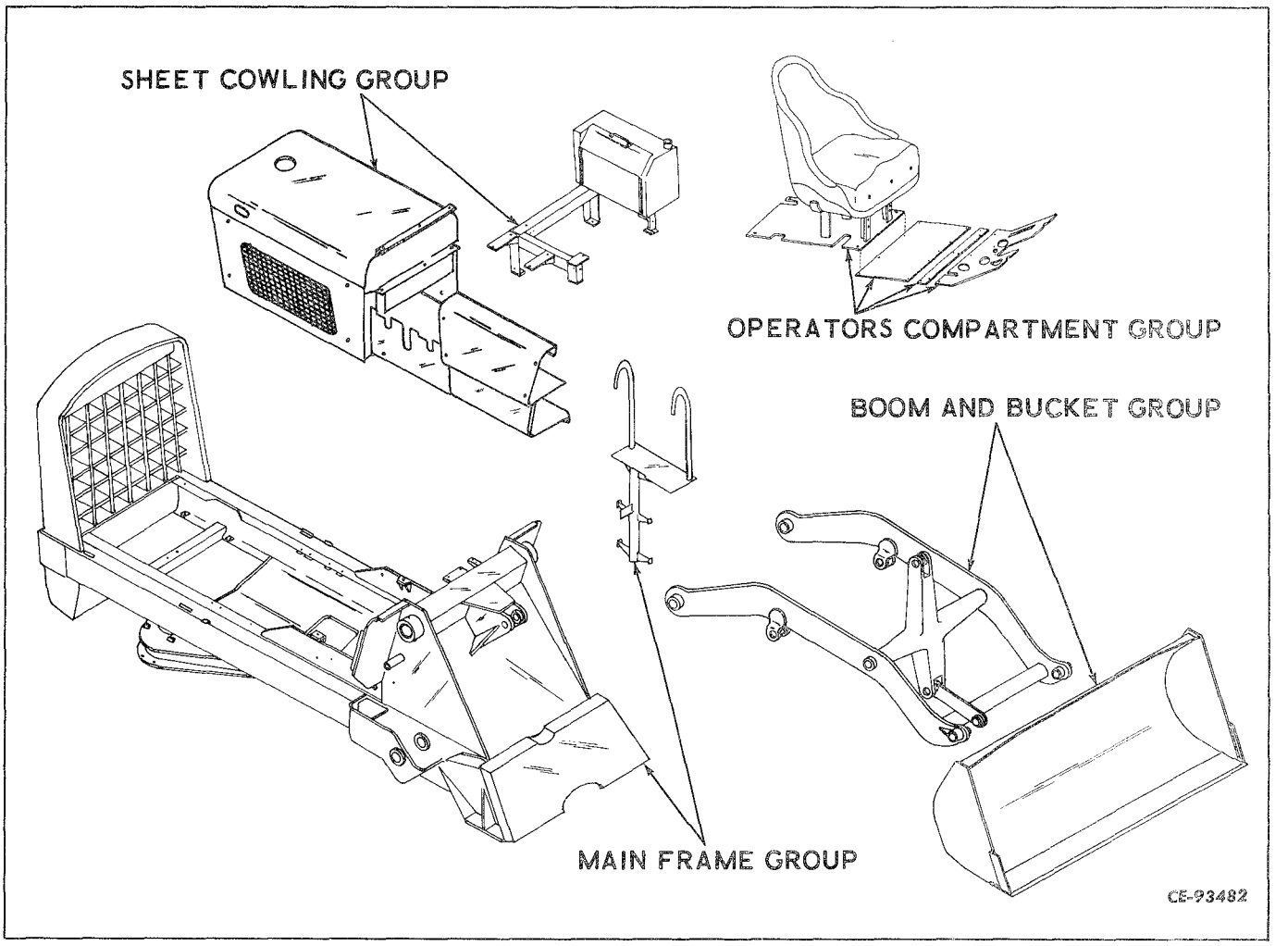

Figure 1-1
Chassis Components.

CHASSIS

MAIN FRAME

DESCRIPTION

The main frame (2, Fig. 1-2) elements are composed of many smaller items welded together to form a single rigid assembly. Bushings are pressed into bores at pivot points.

The grille is bolted to the rear of the frame. The rear axle cradle is connected to the rear of the frame by pin and bushing arrangement.

SERVICE

BOLSTER ADJUSTMENT

Add an equal amount of shims between the front and rear of the bolster and the outer frame support plates to eliminate play.

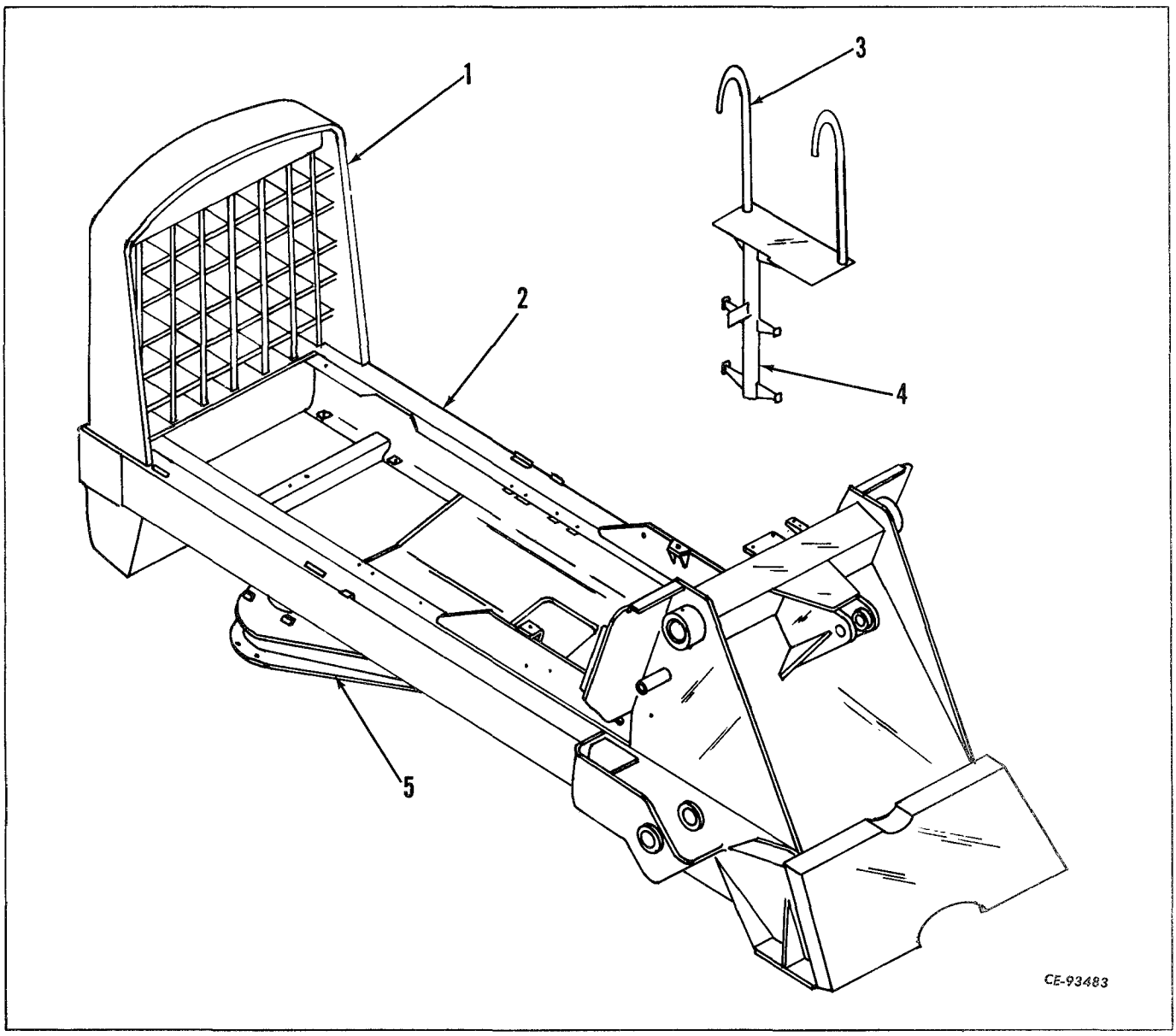

Figure 1-2
Main Frame.

1. Grille.
2. Main frame.
3. Handrail.
4. Ladder.
5. Cradle.

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MAIN FRAME

INSPECTION

A periodic inspection of the chassis should be made to detect weld cracks, broken welds, or damaged brackets. Check seals, bushings, and pins for wear and damage. To keep rust and corrosion to a minimum, periodic painting of abrasions and bare metal is recommended.

WELDING

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

To acquaint the service man with the technique required to produce successful repairs it is recommended that the manual entitled "Welding Maintenance, " form SM-WELD be obtained through your local International and Hough Construction Equipment Dealer.

SHEET COWLING

DESCRIPTION

The sheet cowling, as in the case of the main frame, is made primarily by joining various weldments. The support (2, Fig. 1-3), assisted by the grille (1, Fig. 1-2) of the main

(Continued on next page)

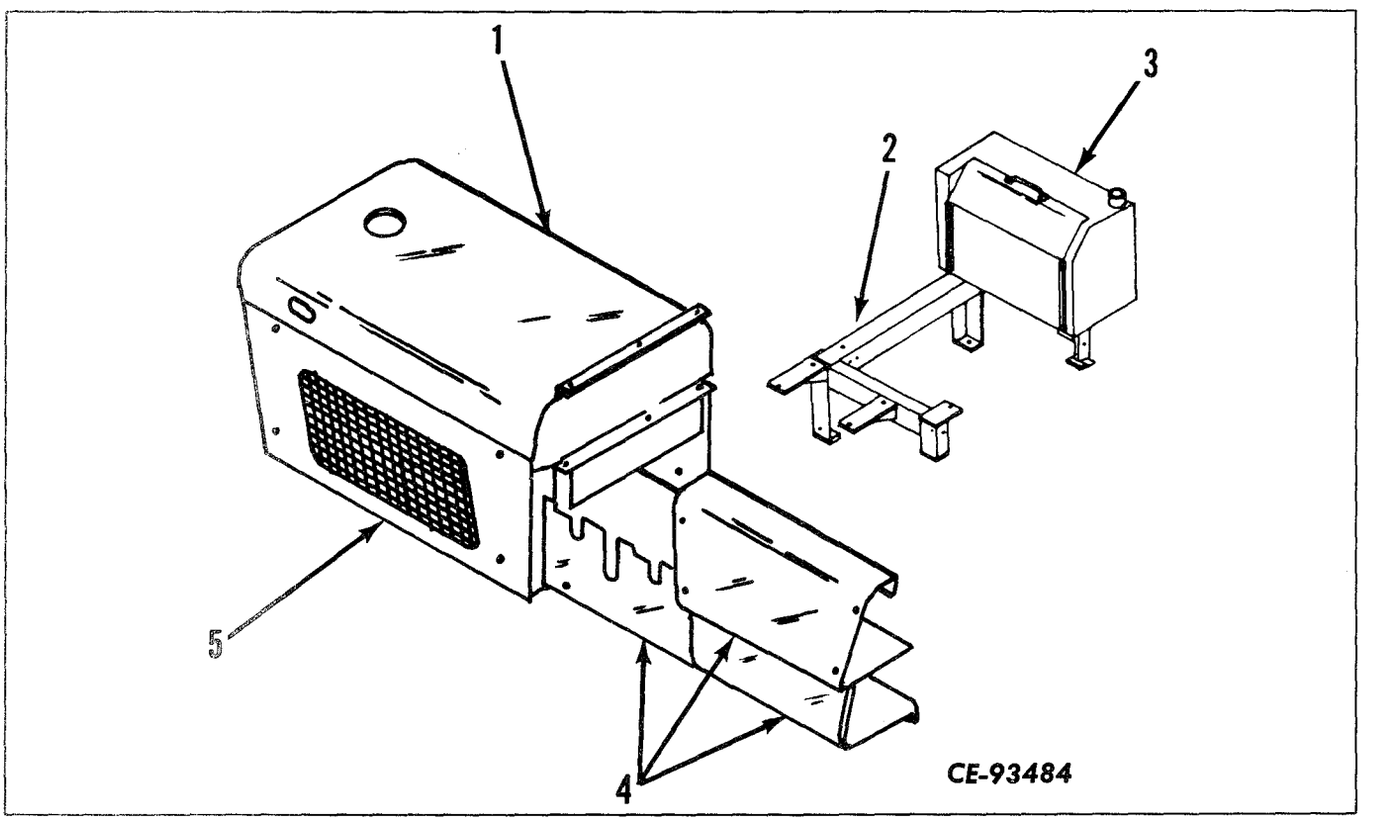

Figure 1-3
Sheet Cowling.

1. Hood.
2. Support.
3. Battery box.
4. Side panels.
5. Hood side panel.

CHASSIS

SHEET COWLING

DESCRIPTION - Continued

frame group forms a backbone for the sheet cowling. The hood (1, Fig. 1-3), connected to the support (2) and grille provides the suspension member for the hood side panels (5).

The battery box is located to the left of the operator and also houses the instrument panel.

SERVICE

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

Oil battery box hinges occasionally to prevent rusting.

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

OPERATOR'S COMPARTMENT

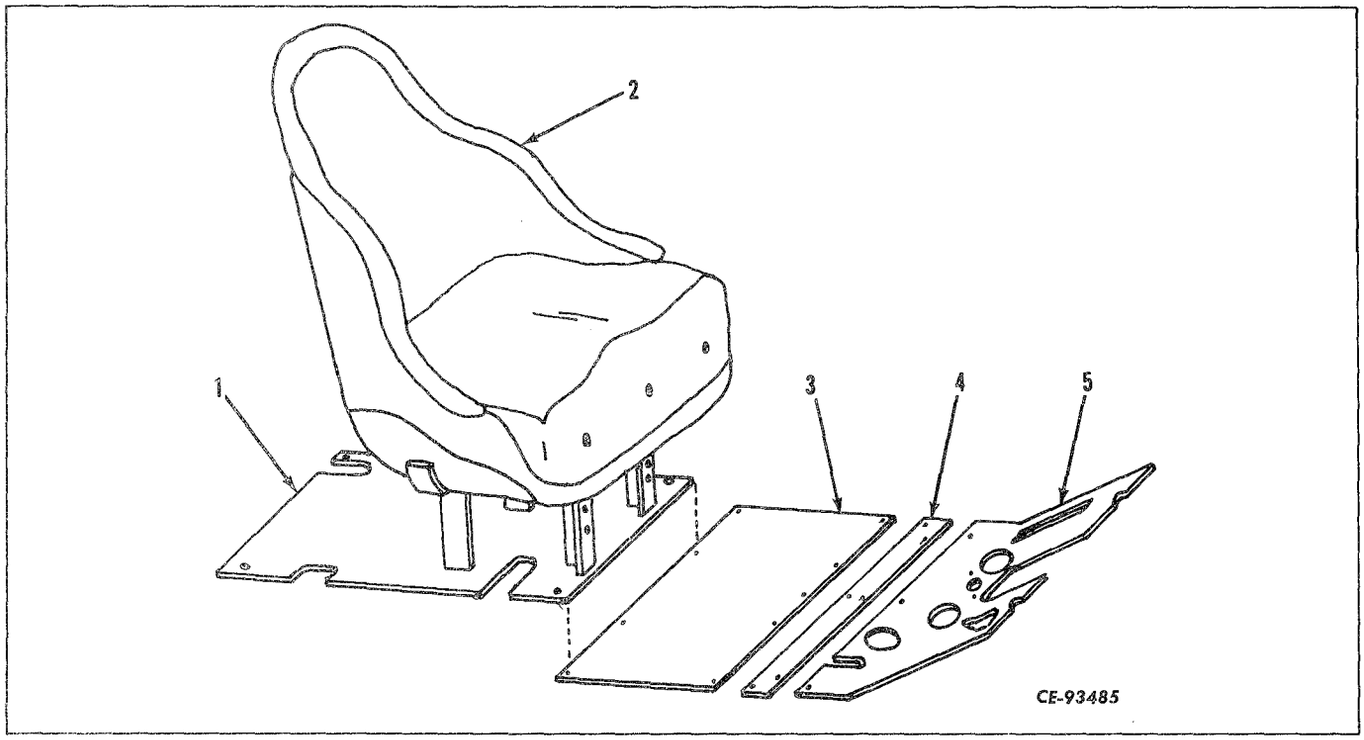

Figure 1-4
Operator's Compartment.

1. Seat mounting.
2. Seat.
3. Rear floorboard.
4. Mounting strip.
5. Front floorboard.

OPERATOR'S COMPARTMENT

DESCRIPTION

The operator's compartment, located in the front portion of the main frame (2, Fig. 1-2), is enclosed on the sides by the battery box and hydraulic reservoir. It consists of the operator's seat assembly (2, Fig. 1-4), seat mounting (1), floor boards (3 and 5) and mounting strip (4).

The seat height is controlled by the mounting brackets on the seat frame and seat mounting (1). Directional movement of the seat is controlled by a spring loaded ratchet device. A handle to operate the locking mechanism is provided.

The loader control levers are mounted on the hydraulic reservoir directly above the control valve and to the right of the operator.

The two brake pedals and accelerator pedal are mounted on the front floor board and the parking brake cable, transmission control levers and steering gear shaft, pass through it.

The instrument panel is located in the battery box, to the left of the operator's seat. All wires leading to the instrument panel pass through a common connector at the base of the battery box.

The hydraulic control valve is fastened to the hydraulic reservoir in the right rear corner of the enclosure.

BOOM AND BUCKET

DESCRIPTION

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

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

SERVICE

BUCKET REMOVAL

Place bucket on ground, bottom sheet parallel to ground. Place loader controls in neutral ("HOLD") position. Securely block rear of

(Continued on next page)

BOOM AND BUCKET

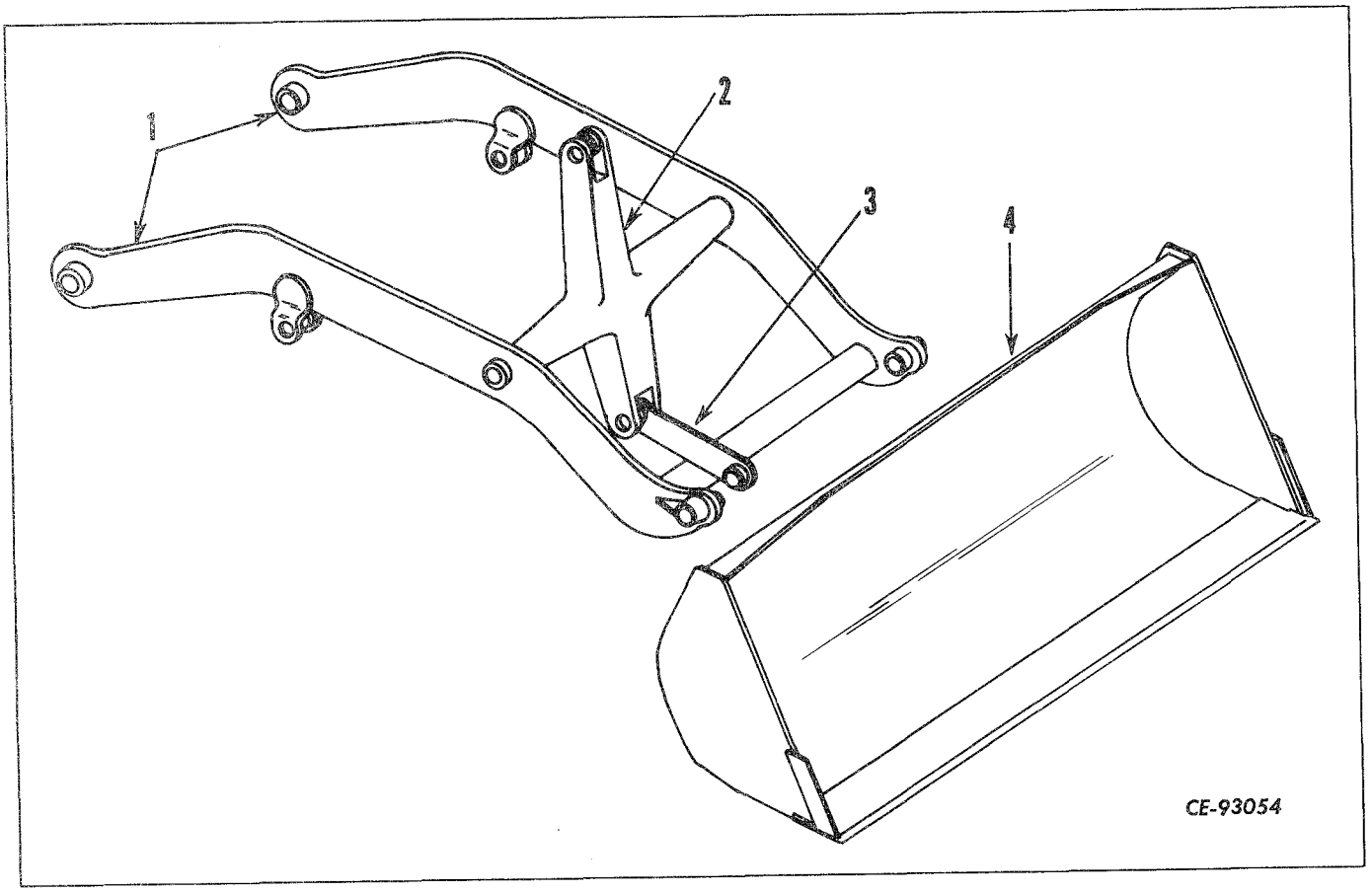

Figure 1-5
Boom and Bucket.

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

SERVICE - Continued

BUCKET REMOVAL - Continued

bucket to prevent it from rolling back when bucket is separated from linkage assembly.

Remove the pin locking cap screws (2, Fig. 1-6) with lock washers and flat washers. Remove the pin (1) that attaches the bucket link to the bucket.

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

Retain cord rings.

Using a heavy gauge wire, wire the bucket link to the top of the bellcrank as shown in Fig. 1-8.

BOOM AND BUCKET

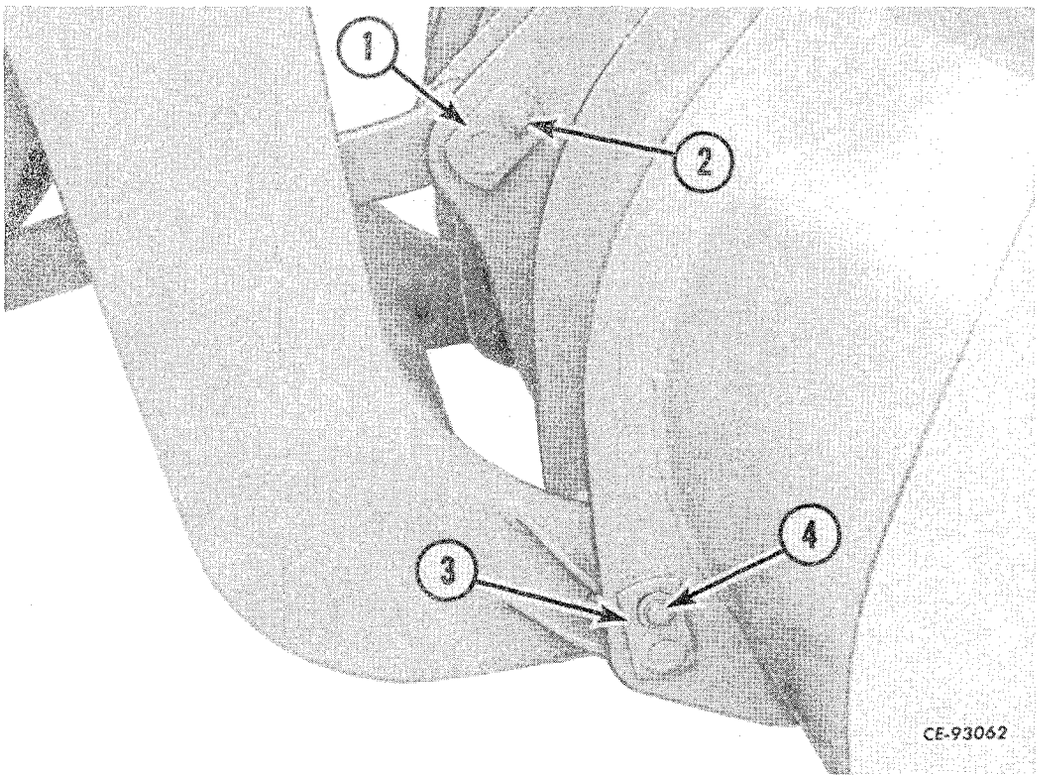

Figure 1-6
Bucket Removal.

1. Bucket link pin assembly.
2. Cap screw.
3. Boom pin assembly.
4. Cap screw.

Remove cap screws (4) with lock washers and flat washers. Remove pins (3) that secure the boom arms to the bucket. Place the boom control lever in "FLOAT" position allowing the boom arms to drop away from the bucket. Retain cord rings. Back tractor away from bucket.

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

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

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

Using a heavy gauge wire, wire the bucket link to the top of the bellcrank as shown in Fig. 1-8.

Start the engine. With the engine running slowly, raise the boom arms as the tractor is allowed to creep forward (Fig. 1-7). This will roll the bucket over allowing it to rest on the cutting edge and spillguard.

(Continued on next page)

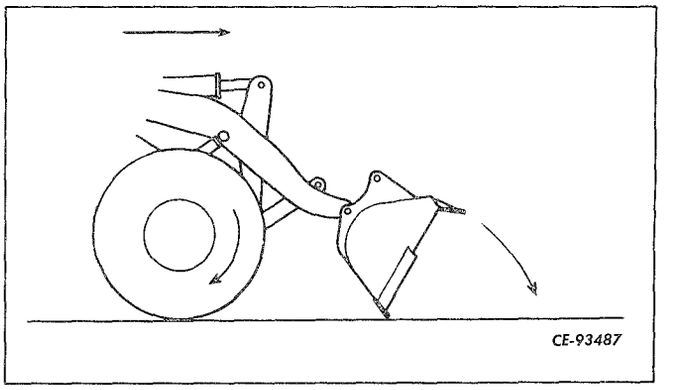

Figure 1-7
Rolling Bucket with Bucket Link Disconnected.

BOOM AND BUCKET

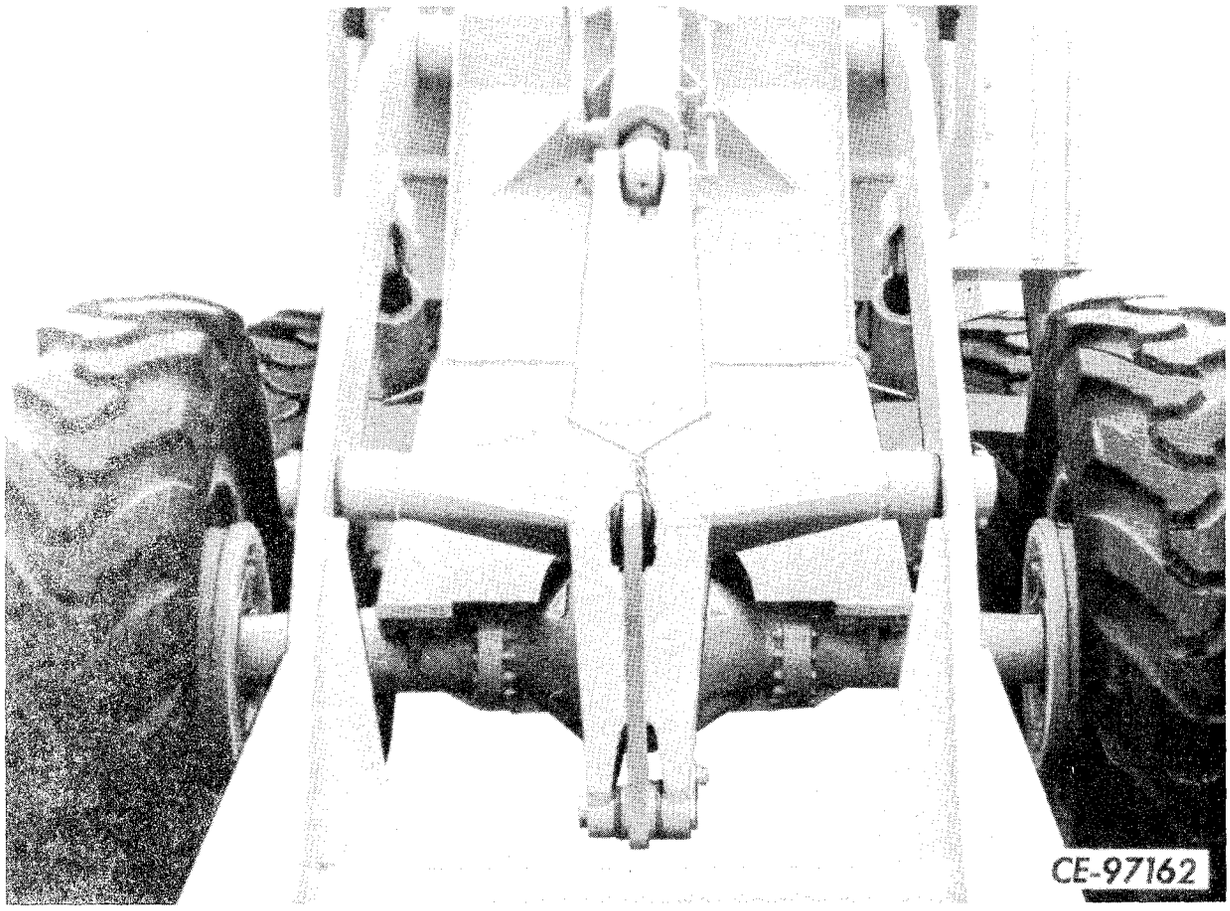

Figure 1-8
Bucket Link Wired Up.

SERVICE - Continued

BUCKET REMOVAL - Continued

Place boom control lever in "HOLD" position. Remove boom pins (3, Fig. 1-6) and back tractor away from bucket.

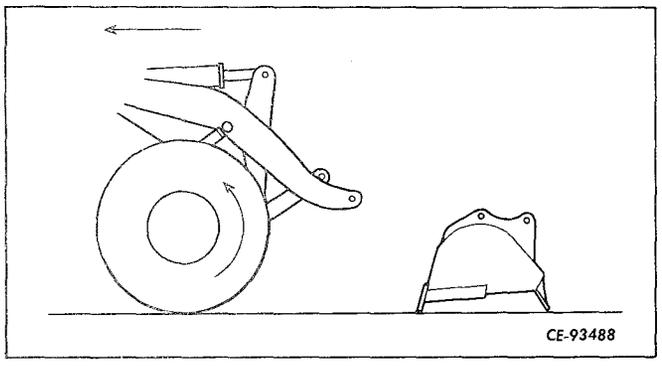

Figure 1-9
Backing Away from Bucket.

Retain all cord rings.

To prevent loss of parts, install pins (1, 3, Fig. 1-6) in their respective bucket bores, looping cord rings over pins as they are installed. Thread locking cap screws (2, 4, Fig. 1-6) with lock washer and flat washers through pin-lock and into respective bores. Coat all pin shanks with a heavy, waterproof grease to prevent rusting.

To install bucket, reverse procedures described previously, being sure to install cord rings. Refer to "ADJUSTMENT OF PIVOT POINTS."

CUTTING EDGE TIP REPLACEMENT

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

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BOOM AND BUCKET

Replace tip as follows:

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

Tack weld a brace in the center of the bucket to hold straightened cutting edge (Fig. 1-10).

Clamp a stout piece of stock, having a straight edge, along the weld, joining the tip and backing plate. Cut off front of tip at upper weld with cutting torch. Use clamped straight edge as guide for torch (Fig. 1-11).

Remove weld at rear of cutting edge tip and on bottom of backing plate (Fig. 1-12). Use air carbon arc process. Keep heat penetration (heat build-up) in backing plate to a minimum to control plate warpage.

Dress backing plate along forward face and lower surface to receive replacement tip (Fig. 1-13).

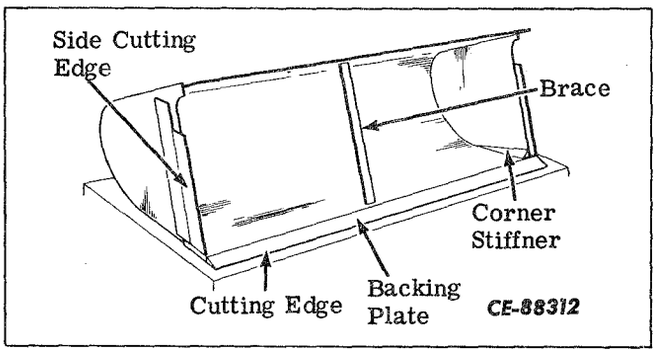

Figure 1-10

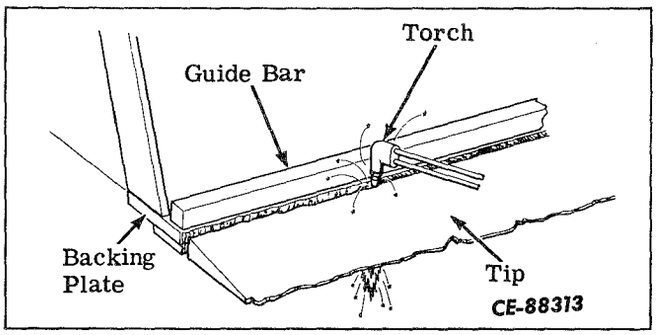

Figure 1-11

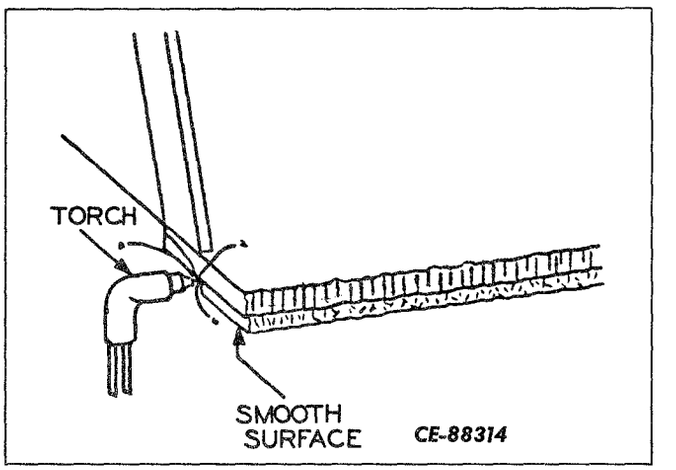

Figure 1-12

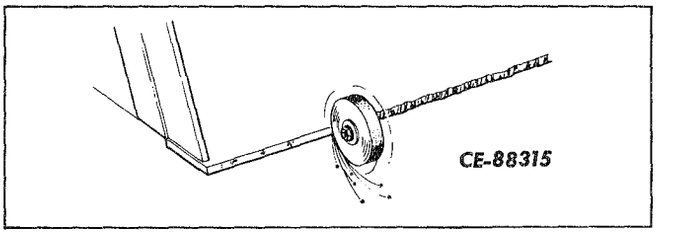

Figure 1-13

Position new cutting edge tip on backing plate. Tack weld tip to backing plate at front of plate and along back of tip (Fig. 1-14). Start tacks at center of tip and work alternately between front edge of plate and rear of tip toward both ends. Fix tip ends with firm welds.

Best results will be obtained by preheating the tip and backing plate to 200°F. to 300°F. Use a

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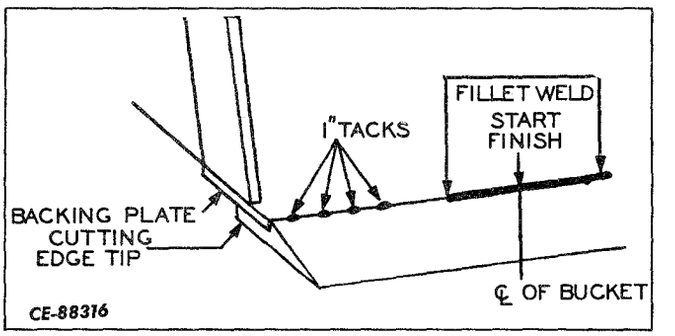

Figure 1-14

SERVICE - Continued

CUTTING EDGE TIP REPLACEMENT - Continued

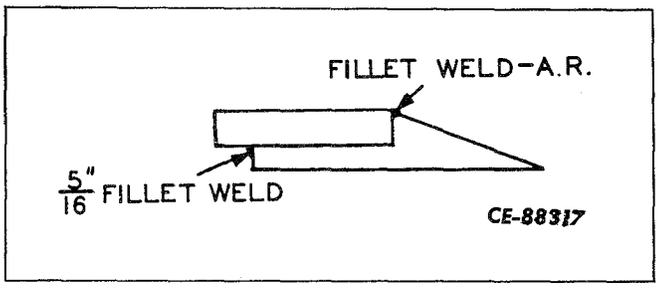

Figure 1-15

5/16" fillet weld to join the rear of tip to bottom of backing plate. Start a weld six inches on either side of tip center and work alternately toward the center. Skip six inches from previous welds and work back. Continue to backstep welds alternately on either side of tip center until weld is completed at bucket side plates. Join front tip to front of backing plate in same manner. Remove tack welded brace.

ADJUSTMENT OF PIVOT POINTS

Measure the clearance at each pivot point and refer to the chart for the quantity of shims to install.

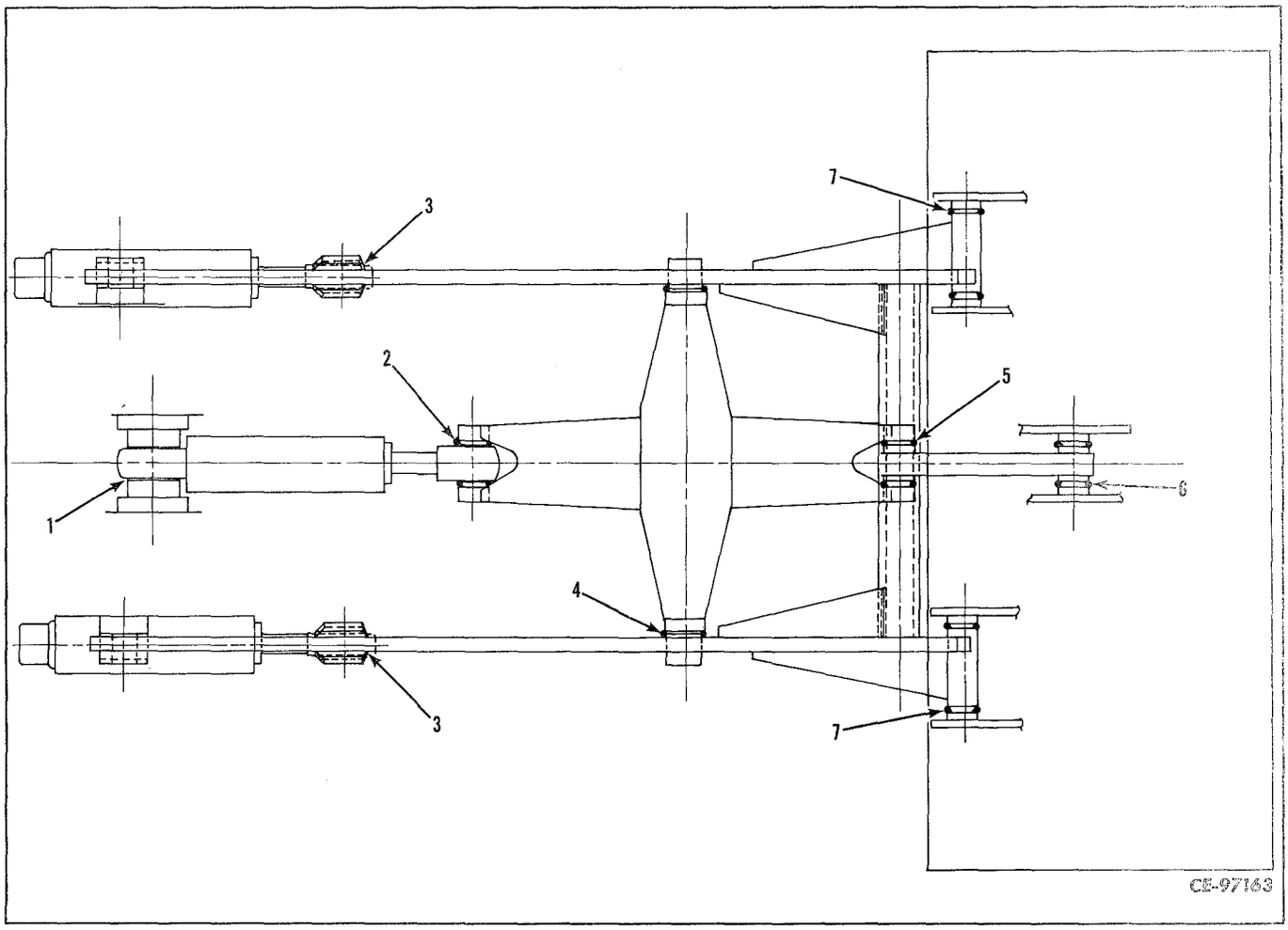

Figure 1-16
Pivot Points.

1. Cylinder end to frame.
2. Rod end to bellcrank.
3. Rod end to boom arms.
4. Bellcrank to boom arms.
5. Bellcrank to bucket link.
6. Bucket link to bucket.
7. Boom arm to bucket.

BOOM AND BUCKET

Pivot point	If measured clearance is	Total shims to use	Each side
All	.18 - .31 .31 up	2 4	1 2

CHASSIS

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

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ENGINE

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ENGINE REMOVAL AND INSTALLATION

GENERAL

Similar procedures are used in removing the International Harvester and Detroit Diesel engines from the tractor frame.

The exhaust stack, hood, grille, radiator and oil cooler must be removed in order to remove the engine and torque converter, as a unit, from the tractor. The hydraulic system must be drained before the removal of the oil cooler.

Before disassembly, position the unit under an overhead crane to aid in engine removal. Position the bucket on the ground and apply the parking brake. Turn the ignition switch to the "OFF" position.

ENGINE REMOVAL

Disconnect battery cables (1, 2, Fig. 2-1) by removing cable clamps from battery posts, ground cable first.

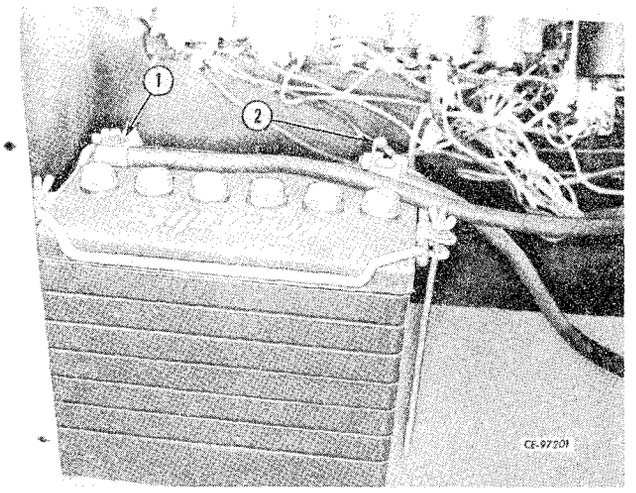

Figure 2-1

Loosen choke cable clamps (4 and 6, Fig. 2-2) and pull cable loose from tube (1).

Loosen hose clamps (3) on each end of tube (1) and remove tube.

Disconnect throttle linkage by removing nut (2) from throttle arm.

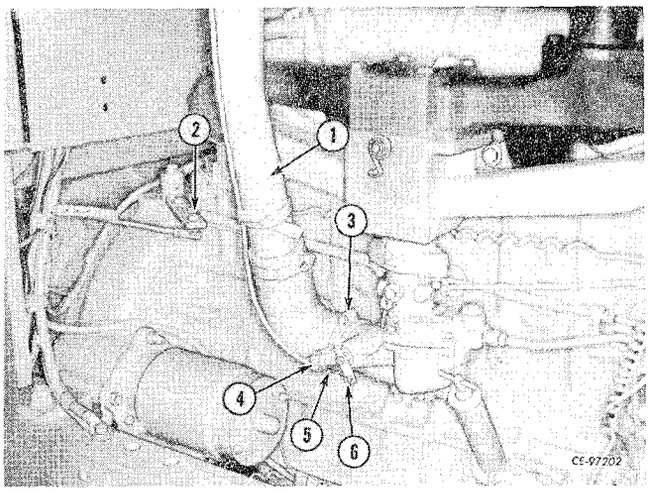

Figure 2-2

Remove muffler clamps (1, 2, Fig. 2-3). Disconnect radiator support bracket from radiator by removing cap screw (3) on each side.

NOTE: Muffler must be removed from engine while removing hood.

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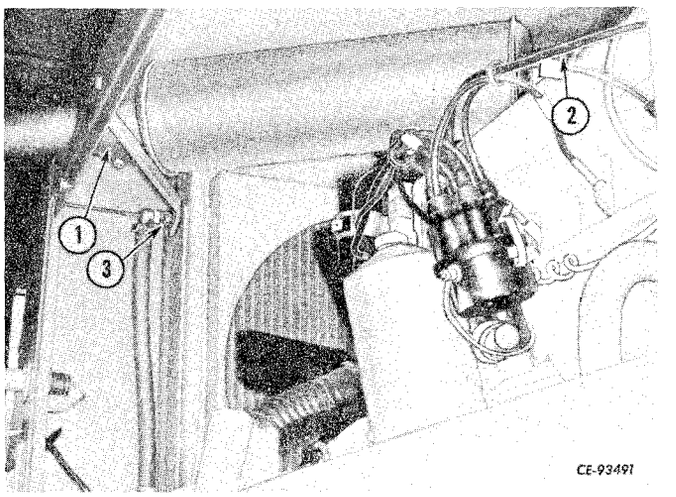

Figure 2-3

ENGINE REMOVAL AND INSTALLATION

ENGINE REMOVAL-Continued

Disconnect electrical loom ends (3, Fig. 2-4). Remove cap screws (1, 2) and remove hood. Remove muffler while removing hood.

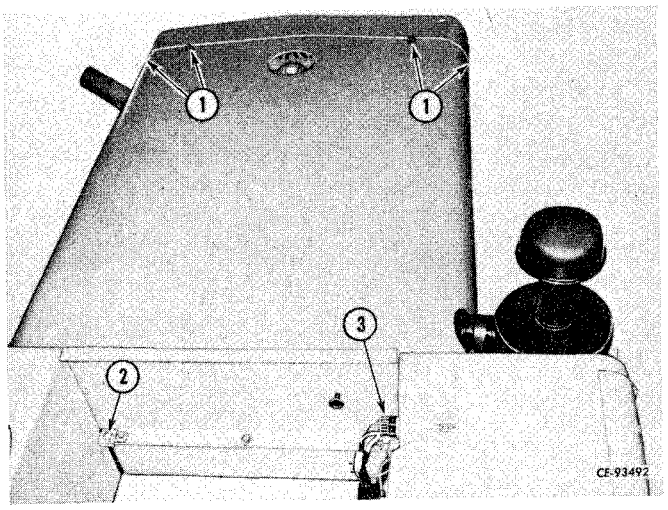

Figure 2-4

Disconnect and tag electrical wires (1, 2, Fig. 2-5) from rear driving light and tail light and pull wires through grille.

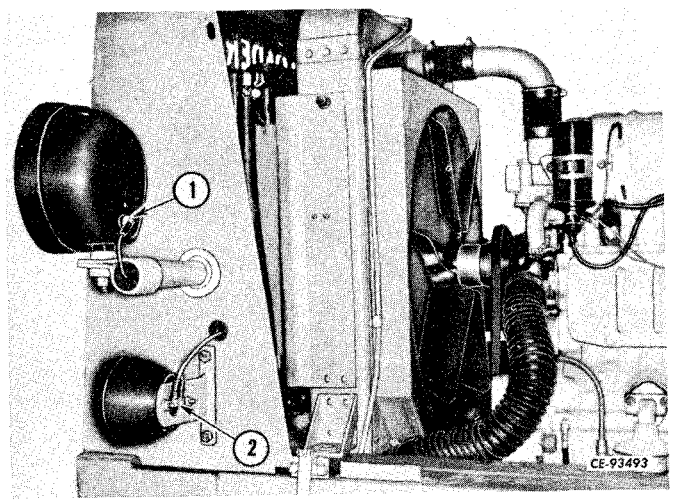

Figure 2-5

Remove cap screws (1, Fig. 2-6) and lift grille from tractor frame.

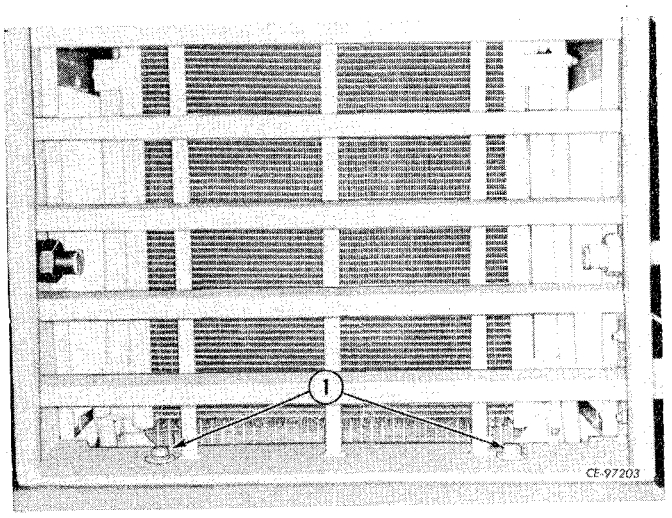

Figure 2-6

Drain radiator by opening pet cock (7, Fig. 2-7). Loosen radiator cap during draining. Loosen hose clamps (1, 2) and remove tube assembly (3). Loosen hose clamps (4, 5) and remove hose (6).

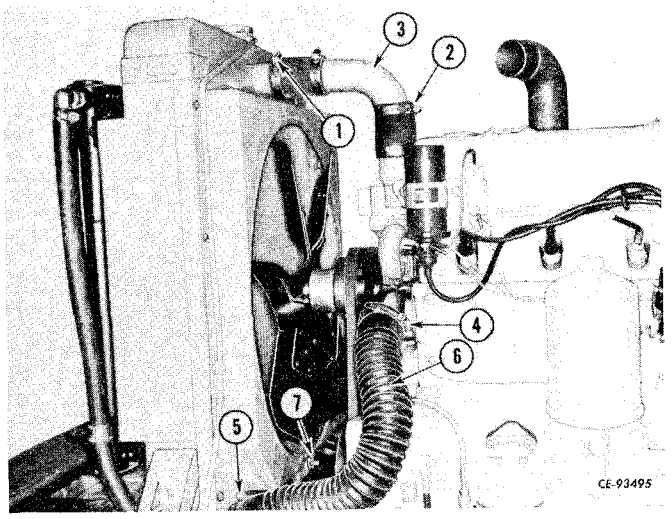

Figure 2-7

ENGINE REMOVAL AND INSTALLATION

Disconnect oil cooler lines by loosening hose clamps (3, 1, Fig. 2-8). Remove hose clamp (2). Remove cap screws and nuts (4, 5) and remove radiator and oil cooler from tractor frame.

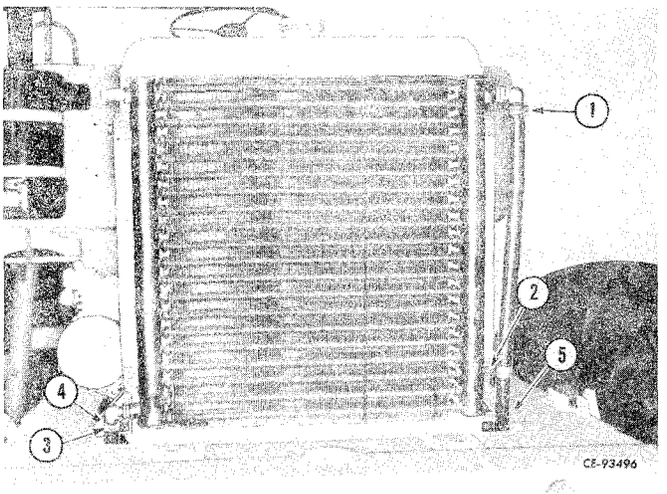

Figure 2-8

Disconnect battery ground cables from the frame (1, Fig. 2-9) and engine (2). Remove and tag electrical wires from starter solenoid (3 and 4).

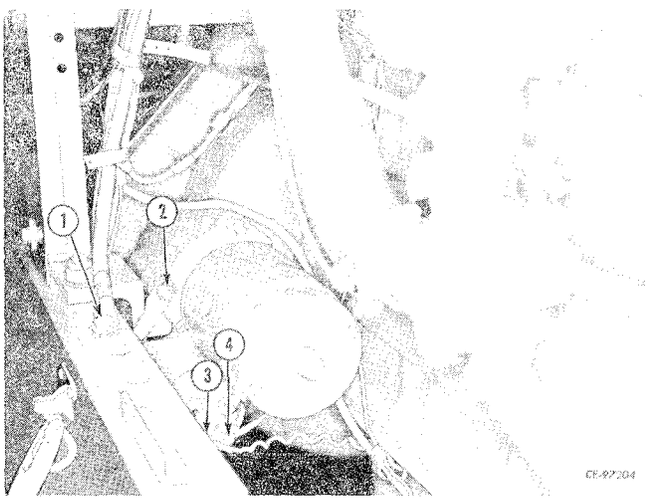

Figure 2-9

Disconnect gas inlet line (1, Fig. 2-10). Disconnect and tag fuel level sender wire.

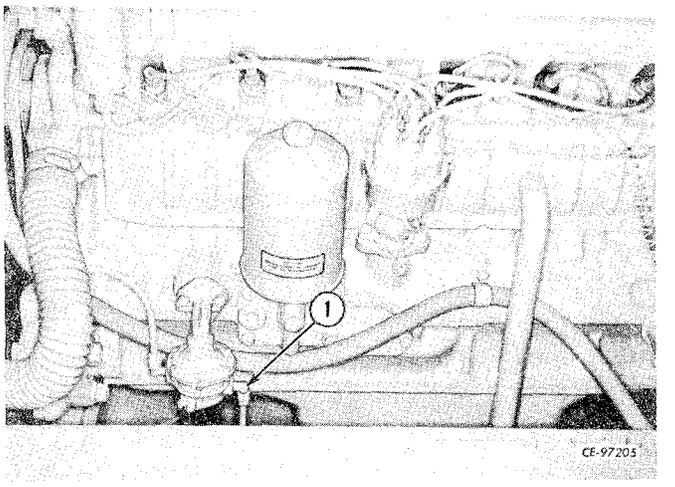

Figure 2-10

Remove floorboard from tractor frame by removing cap screws (1, Fig. 2-11).

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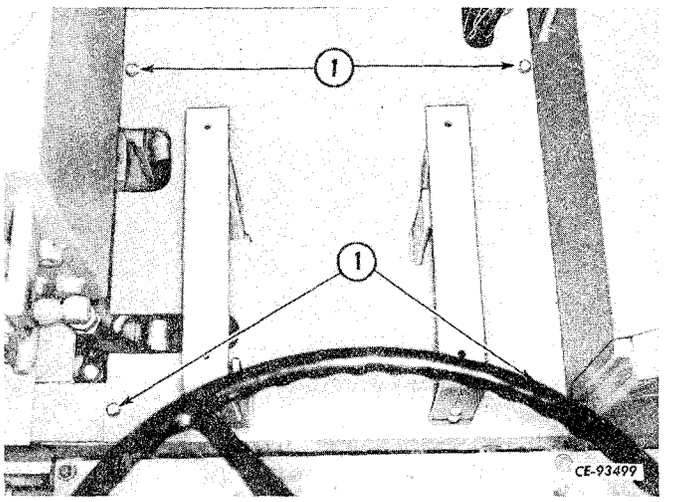

Figure 2-11

ENGINE REMOVAL AND INSTALLATION

ENGINE REMOVAL-Continued

Open drain plug (1, Fig. 2-12) and drain hydraulic reservoir. Disconnect hydraulic hose (3) from reservoir and wire to side of engine.

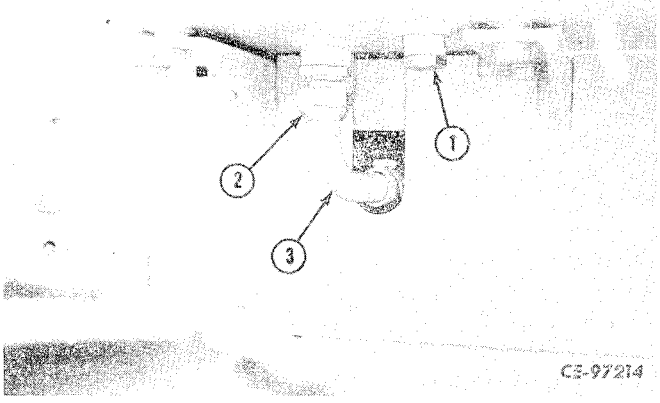

Figure 2-12

Disconnect hydraulic and transmission lines in numerical order including the drive shaft. (Refer to Fig. 2-13.)

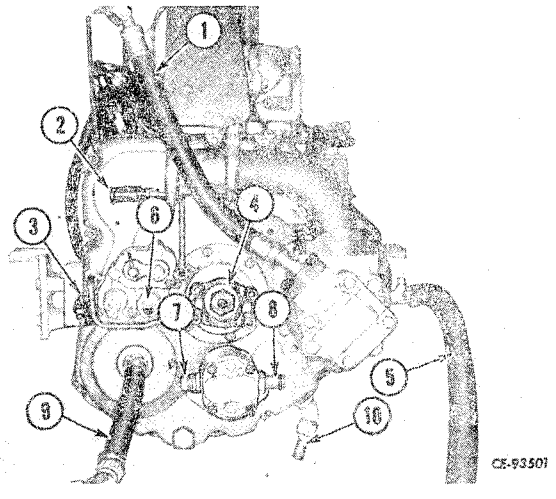

Figure 2-13

Remove cap screws and nuts (1, 2, Fig. 2-14) from engine mounts and tractor frame.

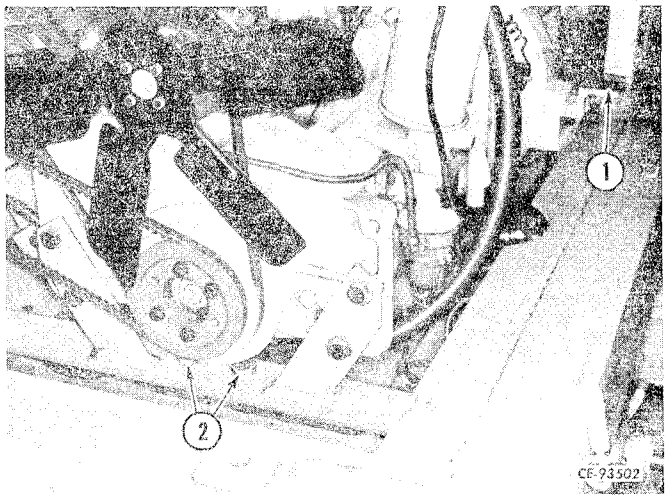

Figure 2-14

Remove engine from tractor frame and install engine in suitable engine stand.

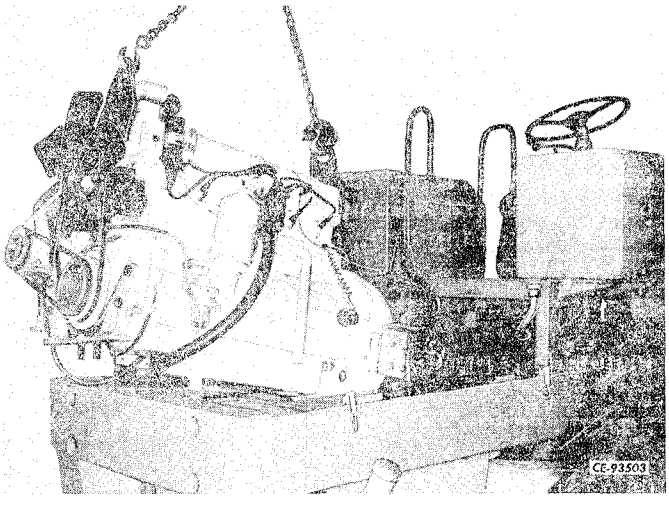

Figure 2-15

ENGINE REMOVAL AND INSTALLATION

ENGINE INSTALLATION

Install engine in tractor frame (Fig. 2-15). Remove lifting brackets.

Install and torque cap screws and nuts (1, 2, Fig. 2-14) securing engine to tractor frame (refer to "SPECIAL TORQUES").

Torque:_____

Connect hydraulic and torque converter lines in reverse numerical order, including drive shaft. (Refer to Fig. 2-13.)

Connect hydraulic hose (3, Fig. 2-12) to reservoir and tighten end of hose (2). Tighten drain plug (1).

Connect gas line (1, Fig. 2-10) to fuel pump. Connect level sender wire.

Install battery ground cables to frame (1, Fig. 2-9) and engine (2). Install electrical wires to starter solenoid (3, 4).

Install radiator and oil cooler in tractor frame Install and tighten cap screws and nuts (4, 5, Fig. 2-8). Connect oil cooler lines (1, 3) by tightening hose clamps. Install hose clamp (2).

Install tube assembly (3, Fig. 2-7) and tighten hose clamps (1, 2). Install hose (6) and tighten hose clamps (4, 5). Close radiator pet cock (7).

Install grille (2, Fig. 2-6) on tractor frame.

Install and snug up cap screws (1). DO NOT TIGHTEN CAP SCREWS UNTIL HOOD HAS BEEN INSTALLED.

Connect electrical wires (1, 2, Fig. 2-5) to rear driving light and stop light.

Position hood on tractor frame and grille. Install and tighten cap screws and nuts (1, 2, Fig. 2-4). Join electrical loom connecting blocks (3). With hood mounted to grille tighten grille to tractor frame. Installation of muffler must be done in conjunction with the hood installation.

Install and tighten muffler clamps (1, 2. Fig. 2-3). Install and tighten cap screw (3) securing radiator support bracket.

Position tube assembly (1, Fig. 2-2) between air cleaner and carburetor position, and tighten hose clamps (3). Install choke cable (5) to carburetor and tighten cap screws (4, 6). Connect accelerator linkage to throttle arm and install and tighten nut (2).

Connect battery cables (1, 2, Fig. 2-1) to battery posts and tighten cable clamps.

Fill engine radiator with clean, fresh coolant. Fill hydraulic reservoir with new fluid. Refer to "SERVICE INFORMATION" for type and quantity.

Start engine and check for leaks at the radiator and torque converter areas. Stop engine. Install floorboard on frame. Install and tighten cap screws (1, Fig. 2-11).

ENGINE

RADIATOR AND OIL COOLER

REMOVAL

Disconnect and tag electrical wires (1, 2, Fig. 2-16) from rear driving light and tail light. Remove cap screws and nuts (3).

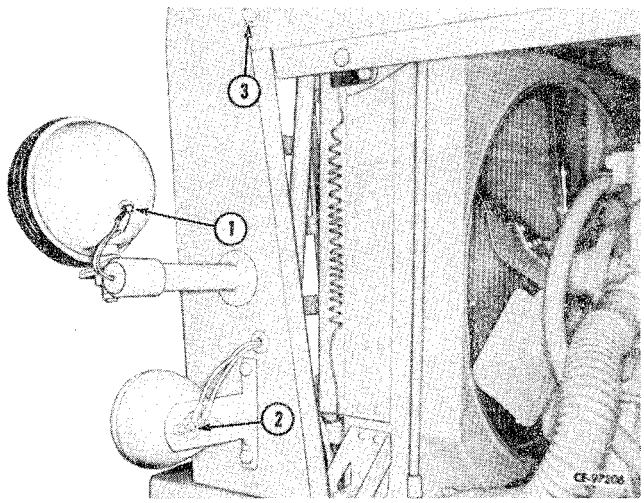

Figure 2-16

Remove cap screws and lock washers (1, Fig. 2-17) and remove grille (2).

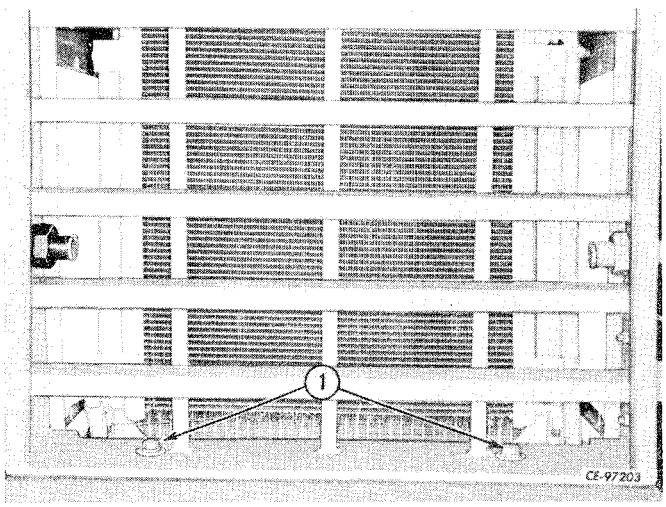

Figure 2-17

Drain radiator by loosening pet cock. Loosen hose clamps (1, 2, Fig. 2-18) and remove tube assembly (3). Loosen hose clamps (4, 5) and remove hose (6).

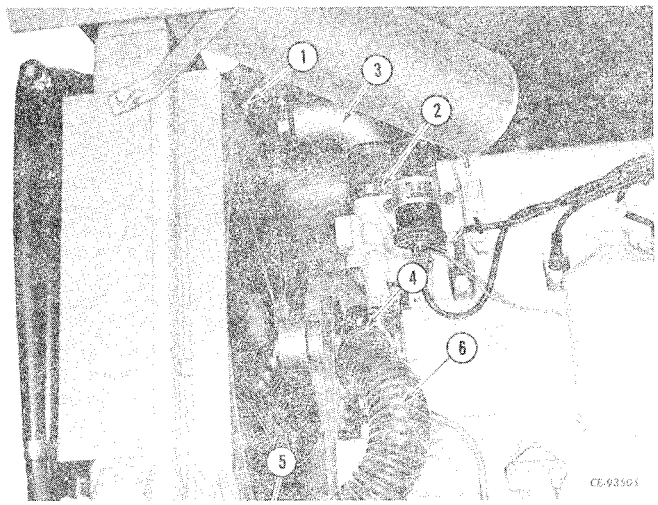

Figure 2-18

OIL COOLER REMOVAL ONLY

Loosen hose clamps (3, 7, Fig. 2-19) and disconnect lines. Remove cap screws (5). Remove oil cooler.

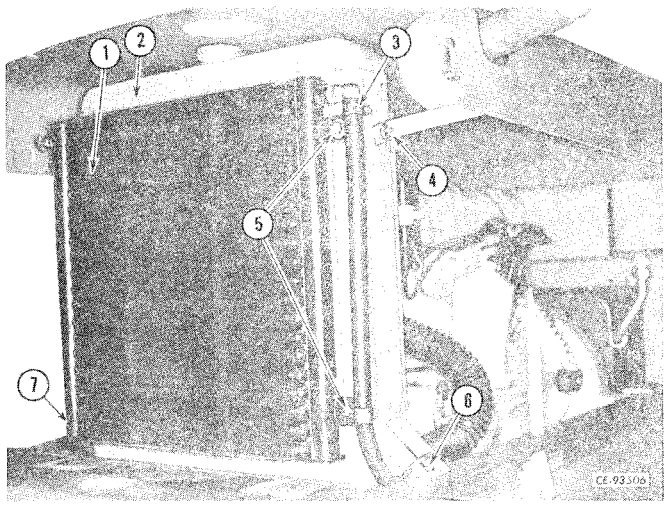

Figure 2-19

RADIATOR AND OIL COOLER

RADIATOR REMOVAL

Loosen hose clamps (3, 7, Fig. 2-19) and disconnect lines. Disconnect radiator support brackets by removing cap screws (4). Remove cap screws and nuts (6) and remove radiator and oil cooler.

INSTALLATION

OIL COOLER INSTALLATION ONLY

Secure oil cooler to radiator by installing and tightening cap screws (5, Fig. 2-19). Install oil cooler lines and tighten hose clamps (3, 7).

RADIATOR INSTALLATION

Install oil cooler on radiator and position assembly in engine compartment. Install and tighten cap screws (6, Fig. 2-19). Install oil cooler hoses; tighten hose clamps (3, 7) securely. Install and tighten cap screws (4) securing radiator to support brackets.

Install hoses (3, 6, Fig. 2-18) between radiator and engine. Tighten hose clamps (1, 2, 4, 5). Close pet cock. Fill radiator with clean or fresh coolant. Refer to "SERVICE INFORMATION" for type and quantity.

Position grille (2) on frame and install and tighten cap screws (1, Fig. 2-17).

Install and tighten cap screws and nuts (3, Fig. 2-16) that secure the hood to the grille. Connect electrical wires (1, 2) to rear driving lights and tail light. Start the engine and check for leaks.

AIR CLEANER SYSTEM

INTERNATIONAL HARVESTER GAS AND DIESEL

DISASSEMBLY AND ASSEMBLY

Disassemble in numerical order (Fig. 2-20).

Remove items 2 and 3 only, for daily service.

Clean and inspect parts. Replace all punctured or worn tubes or hoses. Inspect all connections for tightness. Be sure cleaner outlet pipe is not fractured. If cleaner has been dented or damaged, check all connections immediately. If, in the case of leakage, adjustment fails to correct the problem, replace the necessary parts. Refer to Fig. 2-22 for "Cleaning and Inspection."

Replace item 19.

Assemble in reverse order.

DETROIT DIESEL

DISASSEMBLY AND ASSEMBLY

Disassemble in numerical order (Fig. 2-21).

Remove items 2 and 3 only, for daily service.

Clean and inspect parts. Replace all punctured or worn tubes or hoses. Inspect all connections for tightness. Be sure cleaner outlet pipe is not fractured. If cleaner has been dented or damaged, check all connections immediately. If, in the case of leakage, adjustment fails to correct the problem, replace the necessary parts. Refer to Fig. 2-22 for "Cleaning and Inspection."

Replace item 17.

Assemble in reverse order.

ENGINE

AIR CLEANER SYSTEM

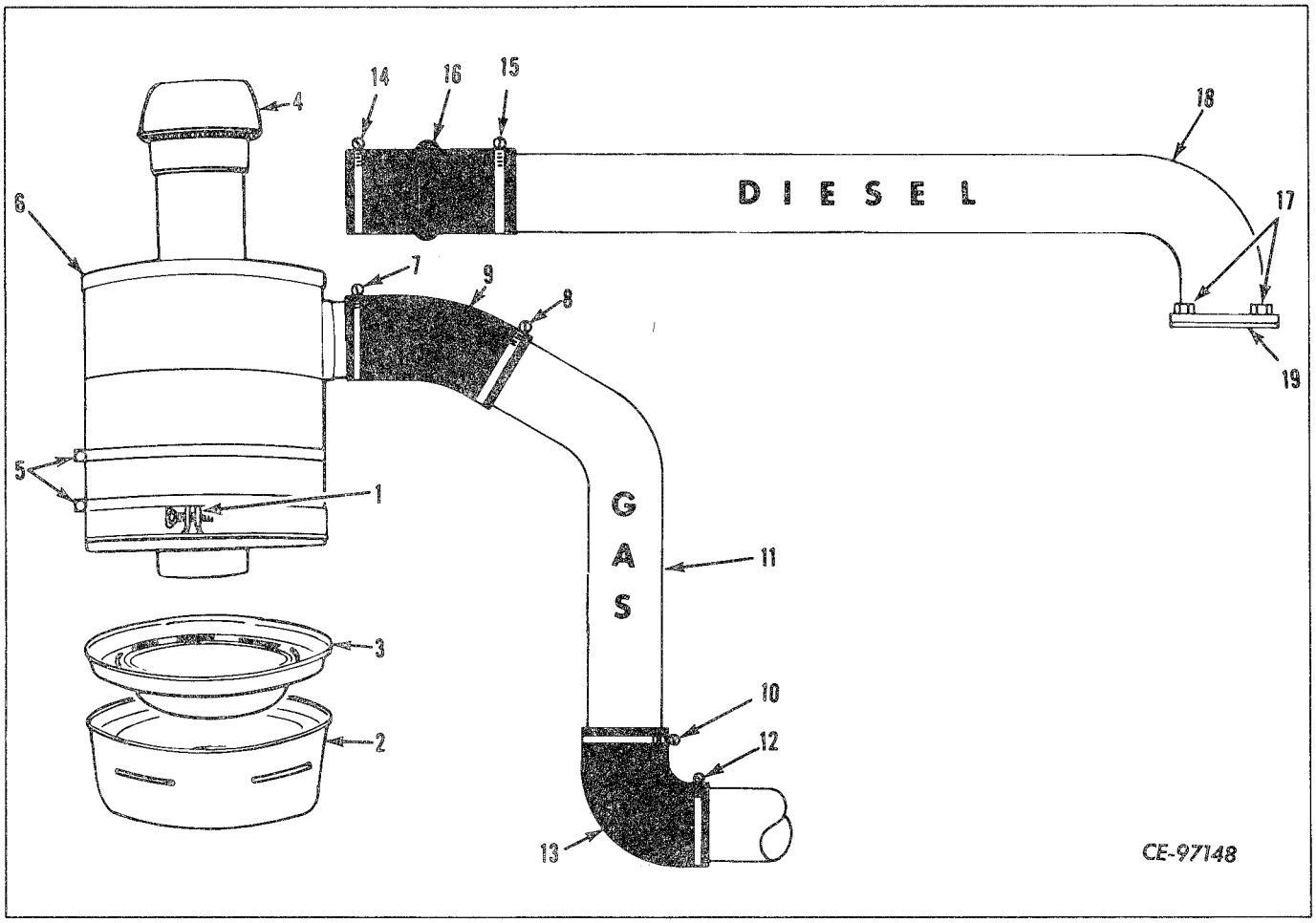

Figure 2-20
Air Cleaner System - I.H. Gas and Diesel.

1. Clamp assembly.
2. Outer oil cup.
3. Inner oil cup.
4. Cap.
5. Cap screw, lock washer and nut.
6. Air cleaner.
7. Hose clamp.
8. Hose clamp.
9. Hose.
10. Hose clamp.
11. Tube.
12. Hose clamp.
13. Hose.
14. Hose clamp.
15. Hose clamp.
16. Hose.
17. Cap screws.
18. Tube.
19. Gasket.

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AIR CLEANER SYSTEM

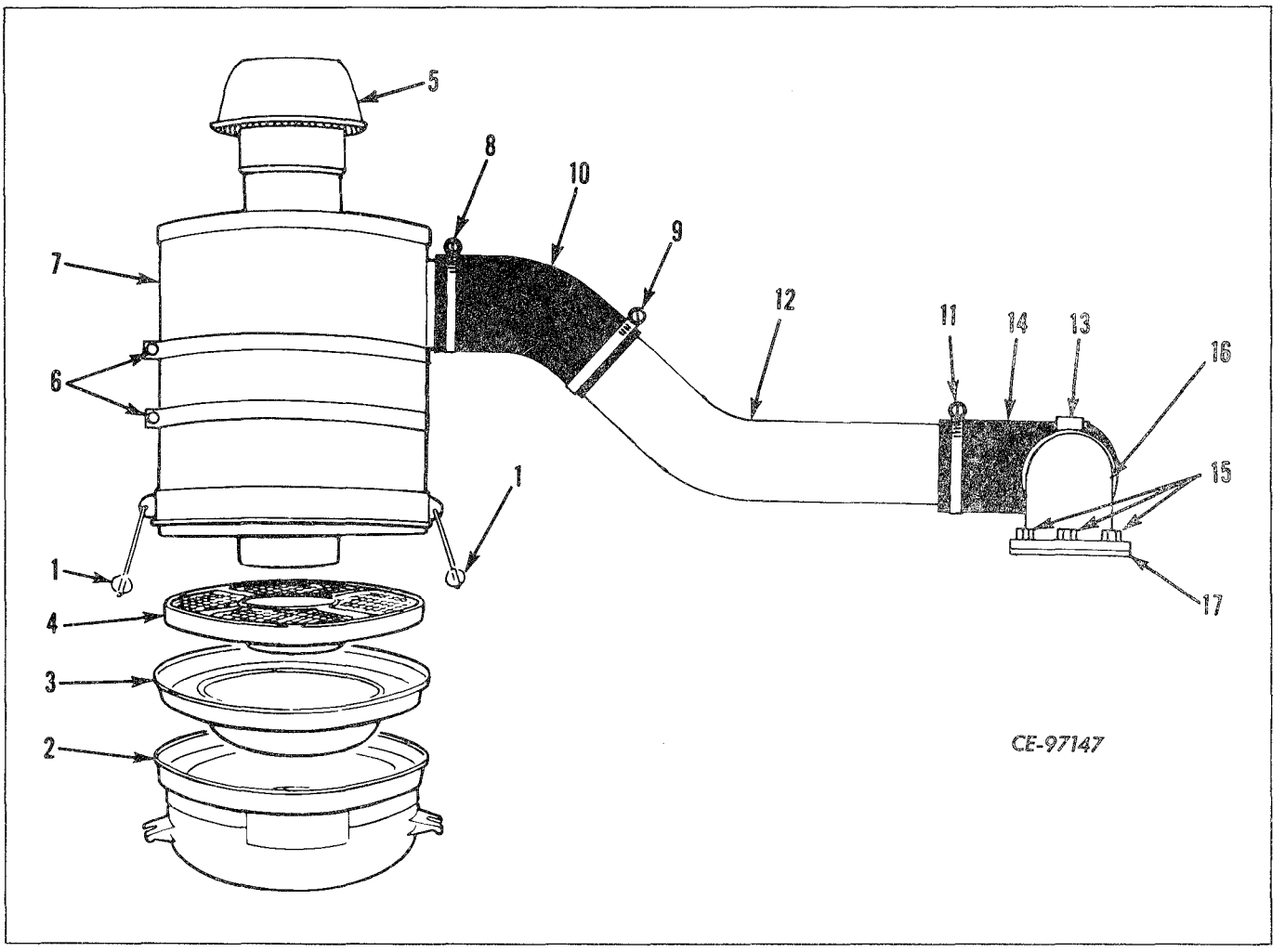
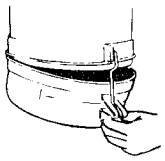


Figure 2-21
Air Cleaner System - Detroit Diesel.

1. Side clamps.
2. Outer oil cup.
3. Inner oil cup.
4. Element.
5. Cap.
6. Cap screw, lock washer and nut.
7. Air cleaner body.
8. Hose clamp.
9. Hose clamp.
10. Hose.
11. Hose clamp.
12. Tube.
13. Hose clamp.
14. Hose.
15. Cap screws and lock washers.
16. Tube.
17. Gasket.

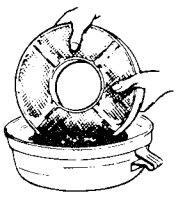
ENGINE

AIR CLEANER SYSTEM



Service the inner and outer oil cup daily or when 1/2" of dirt has collected in bottom of either cup. Severe operating conditions may require several inspections daily. Excessive engine wear is possible if operated with 1/2" of residue.

1



DETROIT DIESEL (ONLY)
Upon detaching side clamps and removing bottom portion of unit, lift the removable element assembly from the oil cup.

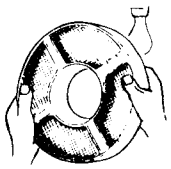
2

Pour out the oil, remove inner cup, from outer cup, remove sludge and wipe clean.

3

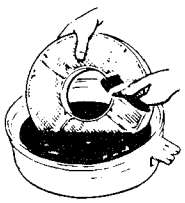
Reassemble inner cup in outer cup and refill both cups to indicated oil level. (Use SAE #10 oil for temperatures below 32° F. and SAE #30 oil for temperatures above 32° F.)
CAUTION: DO NOT OVER OR UNDER-FILL THE CUPS. Over filling means loss of capacity. Under filling means lack of efficiency.

4

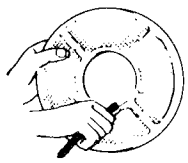


DETROIT DIESEL (ONLY)
Hold removable element up to a strong light. An even, bright pattern of light through the wire element means it is clean.

5



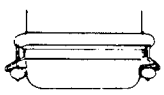
DETROIT DIESEL (ONLY)
If element is even partially plugged with dirt, lint or chaff, wash thoroughly with solvent. Then blow out with compressed air.



6

Inspect lower portion of body assembly and outer tube each time oil cup is serviced.

7



Reassemble removable element assembly (Detroit Diesel) to serviced oil cups and to air cleaner body. Be sure the oil cup is tight to body assembly.

8

CE-93509

Figure 2-22
Air Cleaner - Cleaning and Inspection.

FUEL SYSTEM

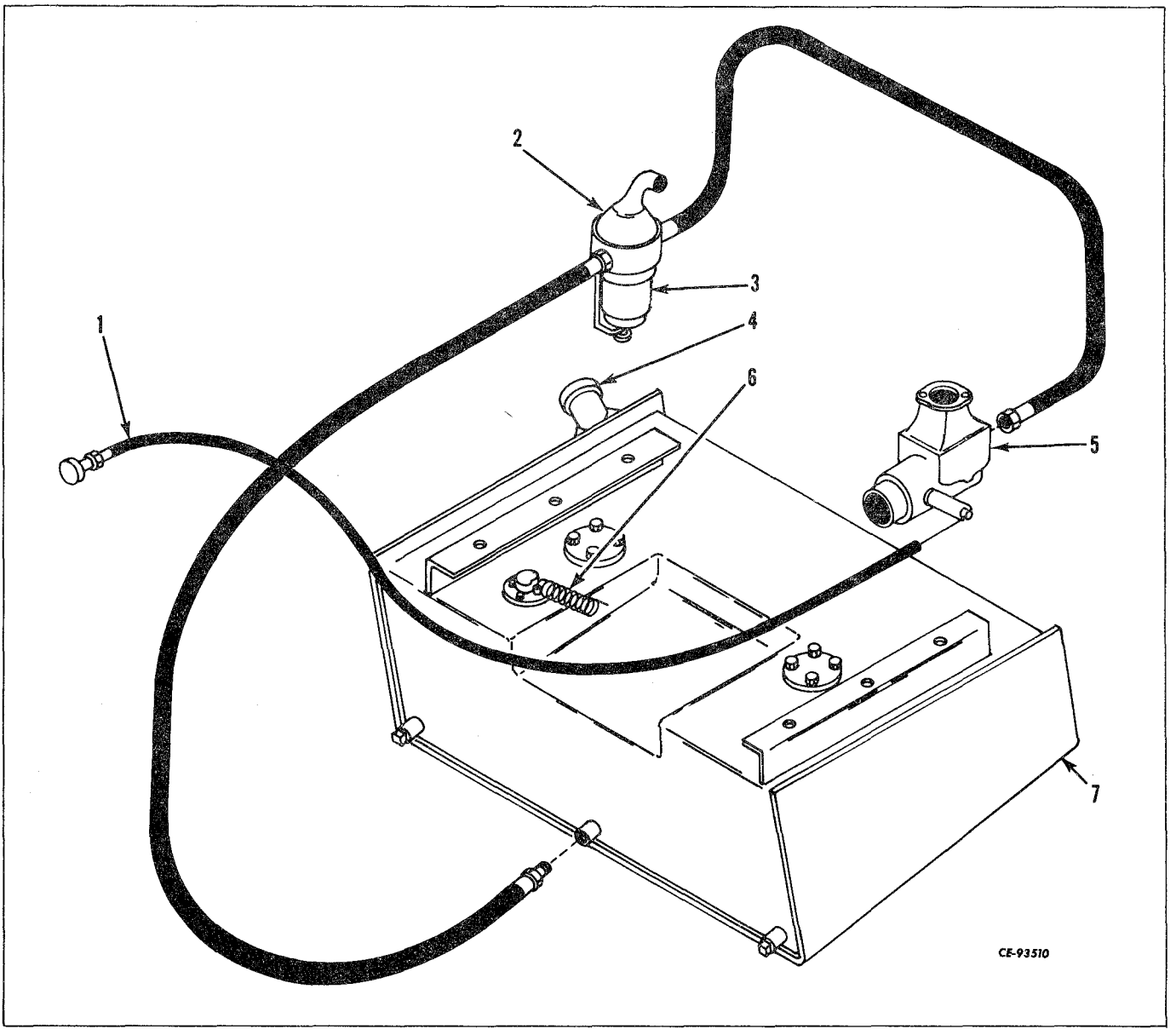


Figure 2-23
Fuel System - I.H. Gas.

1. Choke cable.
2. Fuel pump.
3. Fuel filter.
4. Fill cap.
5. Carburetor.
6. Fuel level sender.
7. Fuel tank.

FUEL SYSTEM

FUEL TANK REMOVAL

Fuel tank removal procedure is similar for all engines. Drain the fuel tank before the tank is removed. To drain, remove the drain plugs from the front bottom portion of the fuel tank. After tank is completely drained, install drain plugs.

Disconnect the fuel outlet line and fuel return line (if used) from the fuel tank. Disconnect wire from the fuel level sender. Disconnect engine crankcase drain hose from side of fuel tank.

Install hydraulic jack in position and properly block tight against tank. From inside the engine compartment, remove cap screws, washers and nuts from frame and fuel tank mounting brackets. With cap screws loose, gently lower fuel tank from the tractor frame.

FUEL TANK INSTALLATION

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

Connect the fuel lines to the fuel tank. Connect electrical wire to the fuel level sender. Install crankcase drain line to the side of the fuel tank. Fill tank with fuel and start the engine. Check for fuel leaks.

NOTE: Before filling fuel tank, check and secure drain plugs in fuel tank.

SERVICING FUEL PUMP FILTER - I. H. GAS

Disassemble filter by loosening screw (5, Fig. 2-24) at the bottom of the bowl (6) to relieve the tension on the retainer (3).

Remove the filter (2) and spring (4) from the bowl. Separate the spring and filter. The filter should not be re-used. Drain the bowl. Remove the bowl gasket from the filter head and discard.

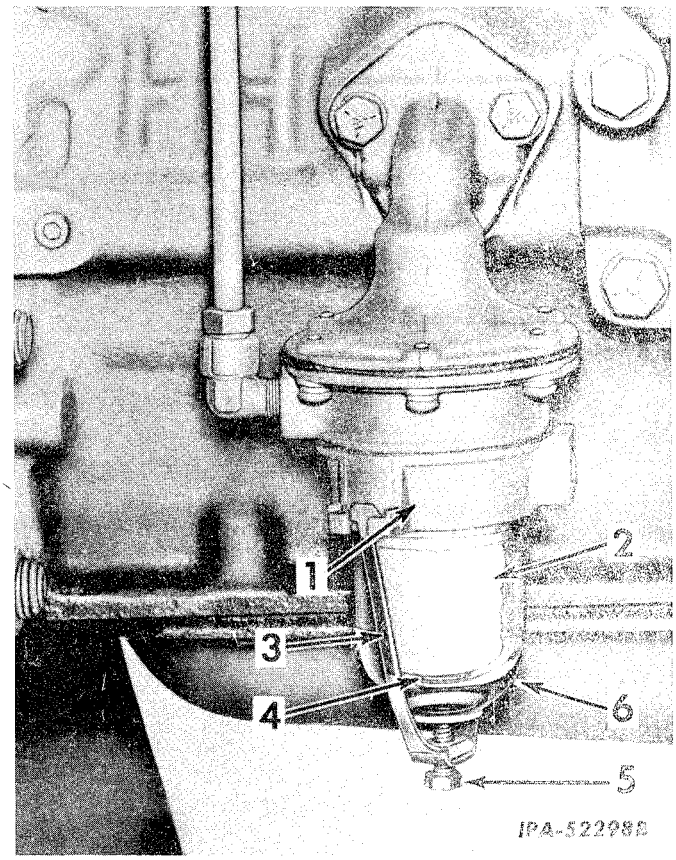


Figure 2-24
Fuel Pump and Filter.

1. Head, filter.
2. Filter.
3. Retainer, bowl (with screw).
4. Spring, filter.
5. Screw (part of retainer).
6. Bowl.

Wash bowl (6) and spring (4) in a commercial carburetor cleaning solvent. Thoroughly dry these parts using compressed air.

Install spring (4) in bowl. Install a new ceramic filter (2), fitting the spring into the recess in the bottom of the filter.

Place a new bowl gasket in the filter head (1). Position the bowl (6) in the filter head. Be sure the bowl and the gasket make an air-tight seal at the filter head. Tighten the retainer screw (5) finger tight.

FUEL SYSTEM

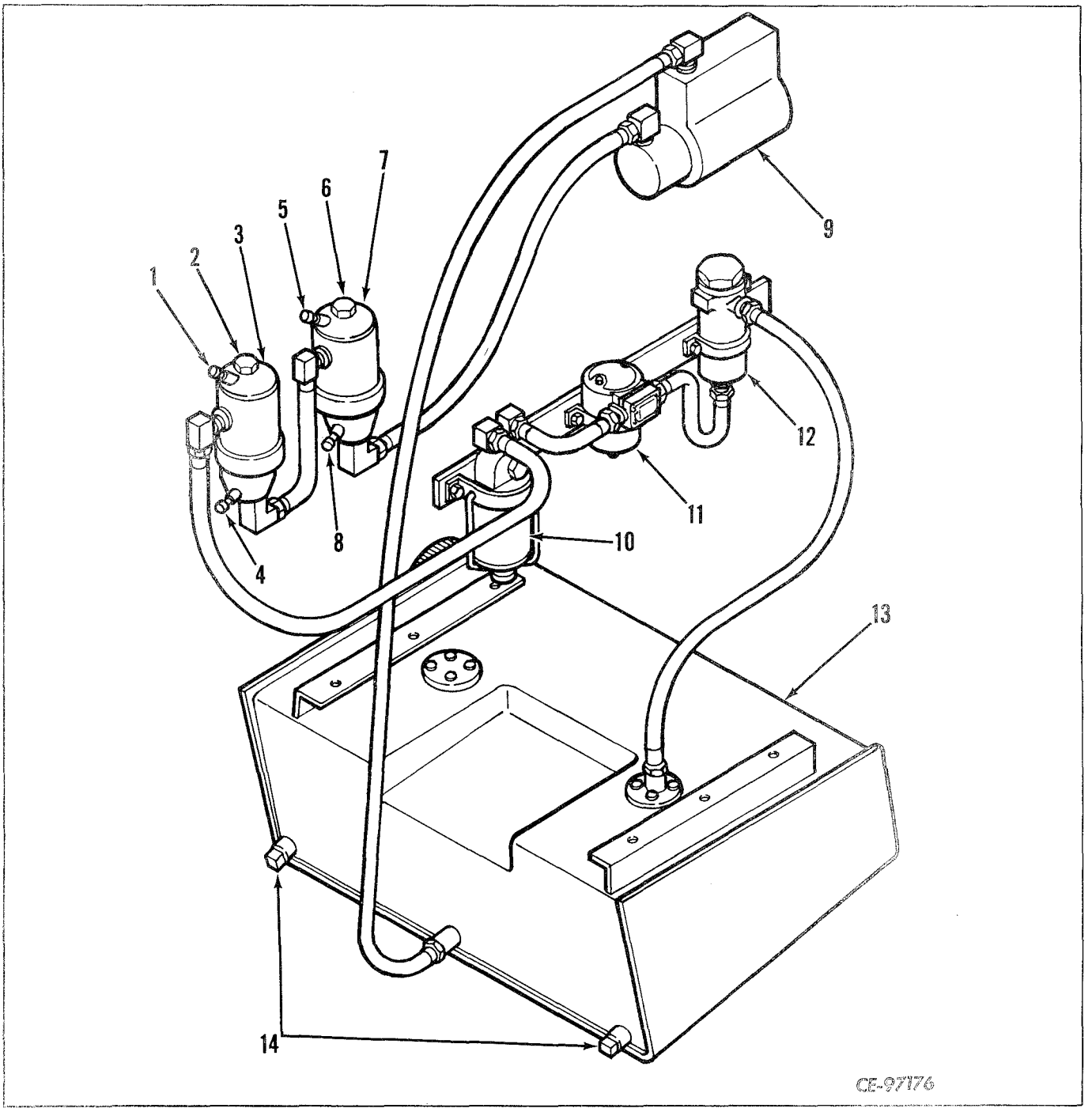


Figure 2-25
Fuel System - I.H. Diesel.

1. Vent valve.
2. Retaining screw.
3. Primary filter.
4. Drain plug.
5. Vent valve.
6. Retaining screw.
7. Final filter.
8. Drain plug.
9. Fuel injection pump.
10. Water trap.
11. Fuel transfer pump.
12. Strainer.
13. Tank.
14. Drain plugs.

SERVICING WATER TRAP - I. H. DIESEL

Loosen thumb nut under glass bowl and remove bail, bowl and screen (Fig. 2-26).

Wash bowl and screen in kerosene to remove all dirt and sediment.

Position a new gasket and install glass bowl, screen and bail; tighten the thumb nut by hand.

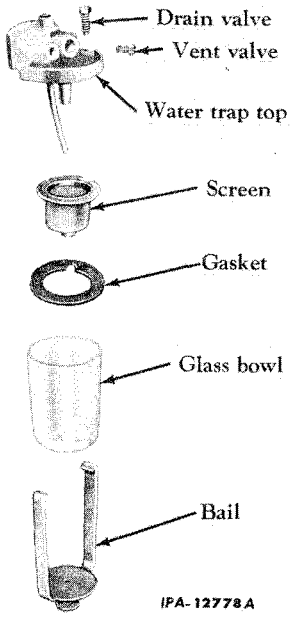


Figure 2-26
Water Trap.

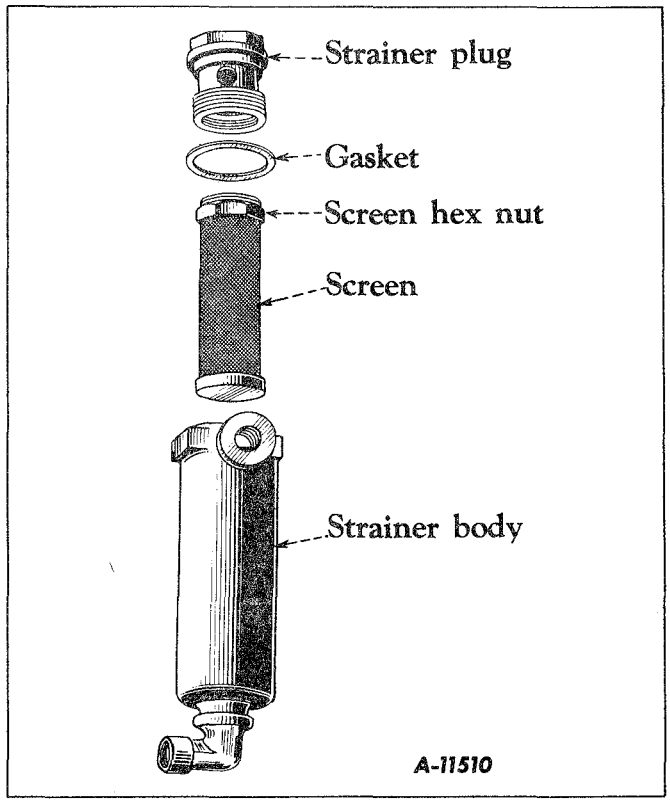


Figure 2-27
Fuel Transfer Pump Strainer Disassembled.

1. Strainer plug.
2. Gasket.
3. Screen hex nut.
4. Screen.
5. Strainer body.

SERVICING FUEL STRAINER (I.H. AND DETROIT DIESEL)

Loosen and remove strainer plug (1, Fig. 2-27) from strainer body (5). Remove screen (4) from end of plug (1).

Wash this screen (4), strainer plug (1) and body (5) in kerosene or clean diesel fuel.

Install clean screen to end of plug (1) and install plug and gasket to strainer body.

PRIMING AND VENTING FUEL SYSTEM - I.H. DIESEL

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

An engine in operation runs out of fuel.

A new engine is being started for the first time.

FUEL SYSTEM

Fuel filters have been serviced or filter elements replaced.

Fuel piping has been disconnected or loosened.

If air has entered the fuel system, vent the system as follows:

Check that there is adequate supply of fuel in the fuel tank.

Position the ignition switch to "ON," this in turn will actuate the fuel transfer pump (11, Fig. 2-25). Open vent valve (1) on top of the primary fuel filter (3). When clear fuel, with no appearance of air, flows from the valve, close it.

Open vent valve (5) on top of the final fuel filter (7). Close it after clear fuel flows from it with no appearance of air.

At this point start the engine and resume operation or turn the ignition switch to "OFF."

FUEL FILTER ELEMENT SERVICE

Fuel filter elements cannot be cleaned and must not be disturbed except when it becomes necessary to replace them.

The primary filter (3, Fig. 2-25) element is cotton thread type with a controlled density to avoid premature plugging. This element is the first in the system to filter the fuel as it comes from the tank.

NOTE: Never use the cotton type element in the final filter.

The final filter (7, Fig. 2-25) element is the paper pleated type. This element will need replacement less often than the primary filter if proper primary element service and water draining procedures are followed.

Replace filter elements when loss of power or misfiring of the engine may indicate the fuel filters have become restricted.

Before replacing the primary filter element, drain the water and sediment from the fuel tank and water trap. If the engine still shows loss of power, replace the primary filter element. If, after replacing the primary filter, the engine still shows loss of power, replace its final filter element.

Cleanliness cannot be overemphasized. Be careful not to allow dirt, water and other foreign materials to get on the new element. Keep new elements in the original package until ready for installation.

Before loosening the filter case retaining bolts, thoroughly clean the outside of the filter case and cover with kerosene or diesel fuel to prevent dirt or foreign material from entering the filter case when the cover is removed.

REPLACING FILTER ELEMENTS

Keep the new element in the package until it is ready for installation. Clean the outside of the filter case and cover before removing the cover.

Drain the water and sediment from the fuel tank by removing drain plugs (14, Fig. 2-25) from the front of the fuel tank.

Close the fuel tank drain plugs.

Open vent valve (1 and 5) on top of filter case and remove drain plug (4 or 8). Allow the fuel to drain completely.

Unscrew the retaining screw (2 or 6) and remove the cover. Remove and discard the cover gasket and element. Thoroughly clean the inside of the cover and case with diesel fuel or kerosene.

Install new element into case. Place new gasket into the cover and install cover on case. Tighten the retaining screw; do not "spin" the cover on, this may shift the cover gasket. Install the drain plug (4 or 8) and close the vent valve (1 or 5). Vent the fuel system as described in "PRIMING AND VENTING THE FUEL SYSTEM."

ENGINE

FUEL SYSTEM

FUEL STRAINER SERVICE - DETROIT DIESEL

The fuel strainer (4, Fig. 2-28) consists of a cover, shell and replaceable element.

Keep the new element in the package until ready for installation. Clean the outside of the filter case and cover before removing the filter case.

With the engine shut down, place a suitable container under the fuel strainer and open the drain cock (5). The fuel will drain freely if the cover nut (2) is loosened slightly.

Support the shell, unscrew the cover screw and remove the shell and element. Remove and discard the element and gasket. Clean the shell

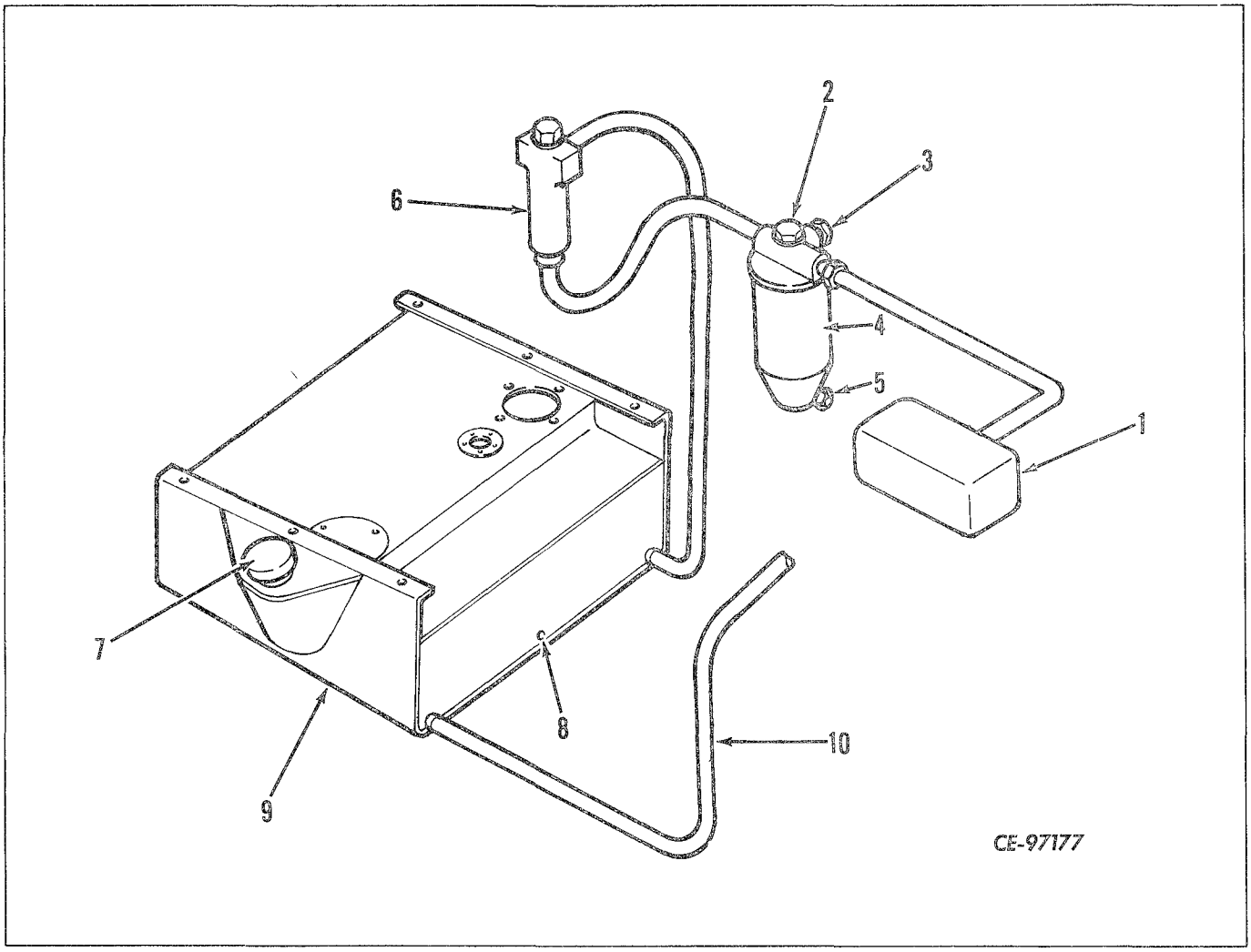


Figure 2-28
Fuel System - Detroit Diesel.

1. Fuel injection pump.
2. Cover nut.
3. Vent valve.
4. Fuel strainer.
5. Drain valve.
6. Fuel strainer.
7. Fill cap.
8. Drain plug.
9. Fuel tank.
10. Fuel return line.

FUEL SYSTEM

with fuel oil and dry with a cloth or compressed air.

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

Install a new shell gasket and place the shell and element into position under the cover and start the retaining cap screw into the shell. Tighten the cap screw only enough to prevent fuel leakage.

Open the vent valve (3) in the filter head and fill shell with clean fuel. Start and operate the engine. Check for fuel system leaks.

SERVICE INFORMATION

SPECIFICATIONS

ENGINE

	TYPE OF ENGINE		
ENGINE MAKE	GAS INTERNATIONAL HARVESTER	DIESEL INTERNATIONAL HARVESTER	DETROIT DIESEL
MODEL	G-263	D-236	GM-3-53
TYPE	Four Stroke Cycle, Spark Ignited	Four Stroke Cycle, Diesel	Two Stroke Cycle, Diesel
MAXIMUM HORSEPOWER (2200 RPM)	81.5	71.5	78
MAXIMUM TORQUE (1700 RPM)	198 ft. lbs. at 1300 rpm	185 ft. lbs. at 1600 rpm	202 ft. lbs. at 1500 rpm
NUMBER OF CYLINDERS	6	6	3
BORE	3-9/16	3-11/16	3-7/8
STROKE	4-3/8	3-11/16	4-1/2
DISPLACEMENT	263 cu. in.	236 cu. in.	159 cu. in.

SERVICE INFORMATION

LUBRICANTS AND CAPACITIES

ITEM	TEMP RANGE °F	TYPE REFILL & SERVICE SAE	API	MIL. SPEC.	APPROX. REFILL CAPACITY	OPERATION PERIOD (Hrs. Oper.) CHECK	CLEAN	ADD OR CHANGE
Chassis Lubrication	All	IH 251H EP Multi-Purpose NLGI Grade 2 Lithium Base		MIL-G-10924				10
Engine Crankcase Gasoline I. H.	Above 32 32 to 0 Below 0	30 10W 5W or 5W - 20	MS	Series 3 or MIL-L-2104B	7 qts w/o filter 8 qts w/filter	D	AR	100
Engine Crankcase Diesel I. H. Detroit Diesel (See Note)	120 to 32 60 to -10 10 to -25	30 10W	DS	Series 3 or MIL-L-45199B	IH 7 qts w/o filter 8 qts w/ filter Detroit Diesel (see Note)	D	AR	100
Cooling System	Above 32 Below 32	Water and 5% Corrosion Inhibitor Solution Ethylene Glycol		O0A-548a	22 qts IH-G 24 qts IH-D 24 qts D. D.	D	1000	Seasonal
Diesel Fuel Syst. Normal Services Extended Idling or	to 10 Below 10	Grade 2D Grade 1D		ASTM D-975	30 gals	D	AO	AR
Batteries		Distilled Water			AR	100	100	AR

NOTE: See Detroit Diesel engine manual for ambient temperature and capacity recommendation.

AR - As Required
AO - At Overhaul
D - Daily

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SERVICE INFORMATION

NORMAL GAUGE READINGS

SYSTEM	GAUGE	TYPE OF ENGINE					
		INTERNATIONAL HARVESTER G-263		INTERNATIONAL HARVESTER D-236		DETROIT DIESEL 3-53	
		Min.	Max.	Min.	Max.	Min.	Max.
ENGINE	Water Temperature (degrees fahrenheit)	158°	163°	170°	190°	158°	168°
	*Oil Pressure (psi)		30	38	46		30
CONVERTER	Temperature (degrees fahrenheit)		150°		150°		150°
	*Charging Pressure (psi)		60		60		60
TRANSMISSION	Temperature (degrees fahrenheit)		150°		150°		150°
	**Clutch (psi)		170**		170**		170**
	Lube (psi)	10	30	10	30	10	30
HYDRAULIC	*Main Hydraulic Pressure (psi)		1800 psi		1800 psi		1800 psi
	Steering Pressure (psi) (See Note 1)		1000 psi		1000 psi		1000 psi
TACHOMETER (See Note 2)	Low Idle (rpm) (No Load)	625	675	625	675	500	550
	High Idle (rpm) (No Load)	2380	2430	2380	2430		2420
	Governed Speed (rpm) (Full Load)	2200		2200		2200	
	Converter Stall (rpm)	1875		1875		1930	
	Hydraulic Stall (rpm)	2100		1900		2150	
	Full Stall (rpm)	1283		1260		1400	

* HIGH IDLE NOTE 1. An rpm tolerance of plus or minus 50 rpm is acceptable.

** AT STALL NOTE 2. Steering psi not to exceed 780 at high idle.

SPECIAL TORQUES

Flywheel housing brackets-to-engine cap screws . . . . . 80 lbs. ft.
Fan end bracket-to-engine cap screws . . . . . 165 lbs. ft.
Fan end bracket-to-frame cap screws . . . . . 90 lbs. ft.
Flywheel housing brackets-to-frame cap screws . . . . . 165 lbs. ft.

ENGINE

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

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SECTION III
TORQUE CONVERTER

Page

SECTION III TORQUE CONVERTER

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Oil Level Check and Change Periods 1
Converter Stall Check 1

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Removal 3
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Cleaning and Inspection 9
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Installation 16

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TORQUE CONVERTER

GENERAL

The torque converter, bolted to the engine flywheel, couples the power of the engine to the transmission hydraulically. There is no mechanical connection between the two units. Specifically, the torque converter does not increase engine horsepower but increases its output of torque. Torque is foot pounds of twisting force developed in a driving shaft.

Because the engine and transmission are not mechanically connected the necessity of "kicking out the clutch" before the load stalls the engine is done away with. Due to its design, the converter increases torque multiplication as the load increases so that at stall the converter is producing the maximum torque output.

Whenever the engine is running the converter is kept full of fluid by a small charging pump (5, Fig. 3-1). At high idle speed the converter is under a nominal pressure to eliminate voids and bubbles.

The housing provides an enclosure for the power take-off gears. These gears drive the converter charging pump and the main hydraulic pump for the tractor loader.

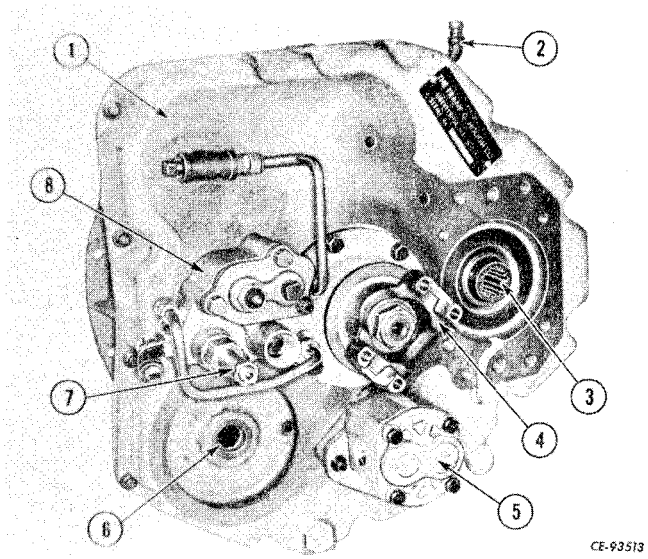

Figure 3-1
Torque Converter - Front View.

1. Housing.
2. Breather.
3. Loader hydraulic pump coupling.
4. Output yoke.
5. Converter charging pump.
6. Filter line port.
7. Pressure regulating valve.
8. Pressure regulating valve body.

PREVENTIVE MAINTENANCE

OIL LEVEL CHECK AND CHANGE PERIODS

The torque converter and transmission share a common sump (fluid reservoir) located at the bottom of the transmission housing. For level check and oil change periods refer to "SECTION IV, TRANSMISSION."

CONVERTER STALL CHECK

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

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

A stall check is made by:

Attaching a tachometer to the engine tachometer drive receptacle.

(Continued on next page)

TORQUE CONVERTER

PREVENTIVE MAINTENANCE

CONVERTER STALL CHECK - Continued

I. H. engines have tachometer drive located on oil pump drive (distributor drive).

Detroit Diesel engine has the tachometer drive located on left hand camshaft cover at flywheel end of engine.

Be sure engine and converter are at normal operating temperature.

Apply hand brake. Lower bucket to ground. Block wheels.

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

Shift transmission to either forward or reverse fourth range.

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

CAUTION: Do not exceed 250°F. maximum converter temperature.

If the stall speed is less than specified, the engine and/or the converter may not be performing properly. Low stall speeds may be caused by:

Low engine output.

Excessive converter input pump wear.

Excessive oil in the converter housing which can be caused by either a worn converter seal or a restricted converter housing drain.

Low transmission oil level.

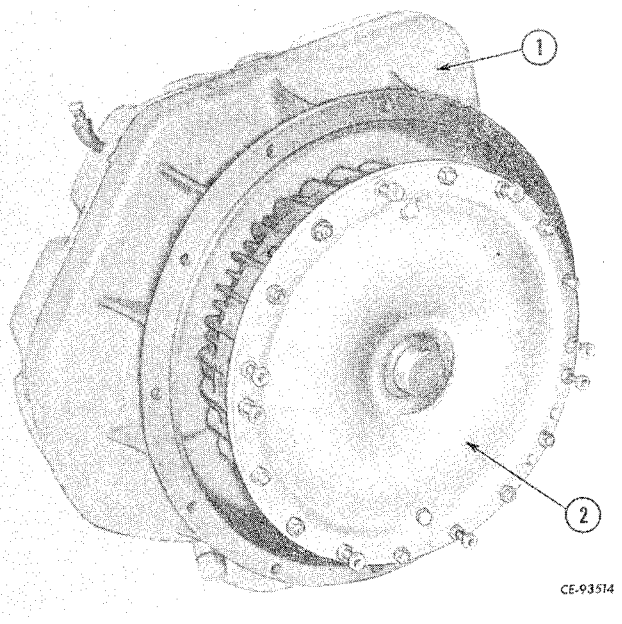

Figure 3-2
Torque Converter - Rear View.

1. Housing. 2. Converter assembly.

Check the engine air cleaner and air intake system. It should be clean and free of all obstructions. Other causes contributing to low engine output are:

Low quality fuel.

Leaks in suction side of fuel system.

Restricted fuel lines.

Dirty injectors.

Defective fuel pump.

High-speed governor set too low.

Injectors out of adjustment.

Incorrect valve and injector timing.

DISASSEMBLY, INSPECTION AND ASSEMBLY

REMOVAL

Removal of the battery box (1, Fig. 3-3), hydraulic reservoir (2, Fig. 3-4) and support (2, Fig. 3-5) assembly is required to gain access to the converter.

Remove the hood (1, Fig. 3-4), upper panel (3), lower panel (4), rear panel (5, Fig. 3-4 and 5, Fig. 3-3), engine side panels (4, Fig. 3-3 and 6, Fig. 3-4), ladder (5, Fig. 3-3), rear floorboard (6), seat deck (7) and front panel (4).

Drain the hydraulic reservoir. Disconnect all tubing (8, Fig. 3-3) from control valve.

Be sure to plug and cap all open lines and bores to prevent the entrance of dirt. Tag all lines for identification to simplify assembly.

Disconnect the reservoir-to-pump line (1, Fig. 3-5).

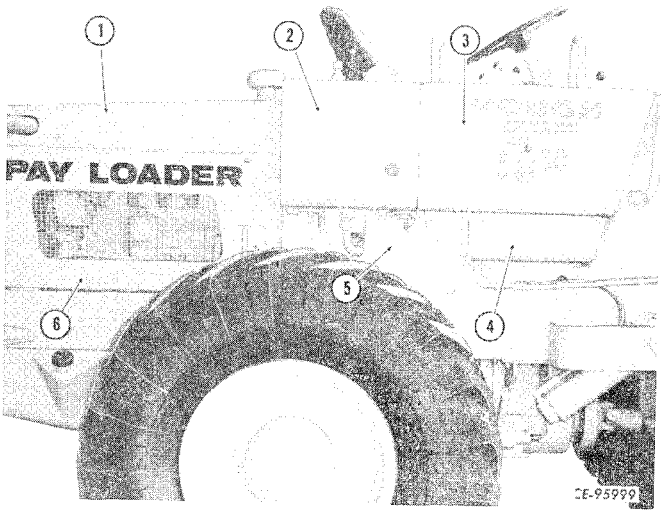

Figure 3-4
Hydraulic Reservoir Area.

1. Engine hood.
2. Hydraulic reservoir.
3. Upper panel.
4. Lower panel.
5. Center panel.
6. Engine side panel.

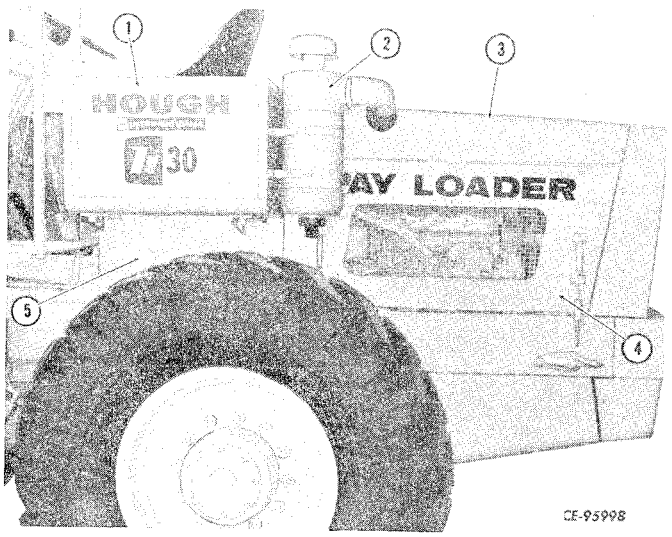

Figure 3-3
Battery Box Area.

1. Battery box.
2. Air cleaner.
3. Engine hood.
4. Engine side panel.
5. Lower panel.

Disconnect batteries, ground cable first. Disconnect electrical leads where they enter battery box.

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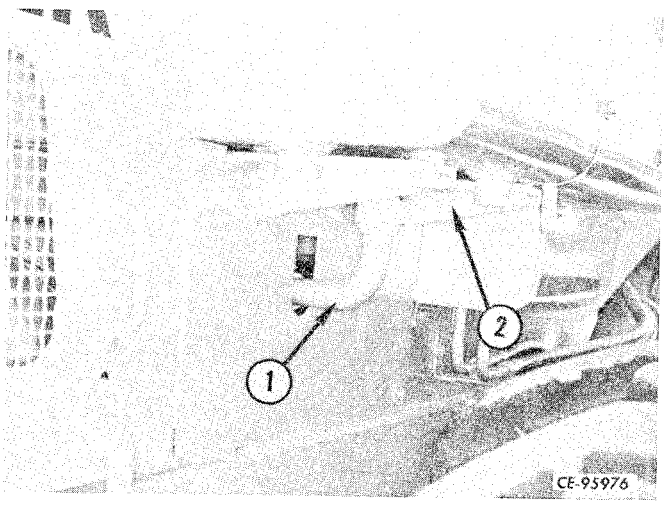

Figure 3-5

DISASSEMBLY, INSPECTION AND ASSEMBLY

REMOVAL - Continued

Disconnect any engine control linkage that passes through or is attached to the support assembly.

Attach a suitable sling and hoist to the support assembly (2, Fig. 3-5) and raise the hoist slowly to take up slack in sling.

Remove the cap screws and hex nuts that secure the support assembly and slowly raise the assembly from the tractor. Carefully check the support assembly as it is being raised to be sure that no wires, tubes, hoses or controls are still attached.

With the support assembly removed, the converter is accessible for removal. Remove all attached cables, tubes and hoses. Cap and tag all these items. Disconnect drive shaft and remove converter.

DISASSEMBLY

Remove the cap screws (2, Fig. 3-6) that retain the converter charging pump (1) and remove the pump. The pump adapter plate (3) need not be removed unless it is damaged or its gasket is leaking.

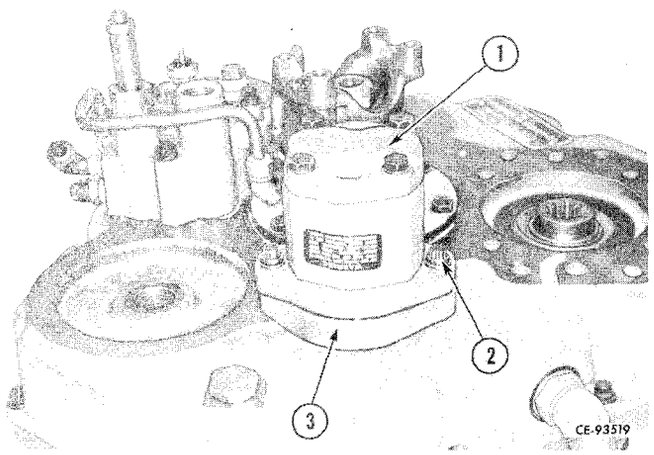

Figure 3-6

Remove the tubing (2, 4, Fig. 3-7). Remove cap screws (1) that retain the pressure regulating valve body (3) and remove the body, base gasket and "O" rings on valve body base and converter housing. Discard gasket and "O" rings.

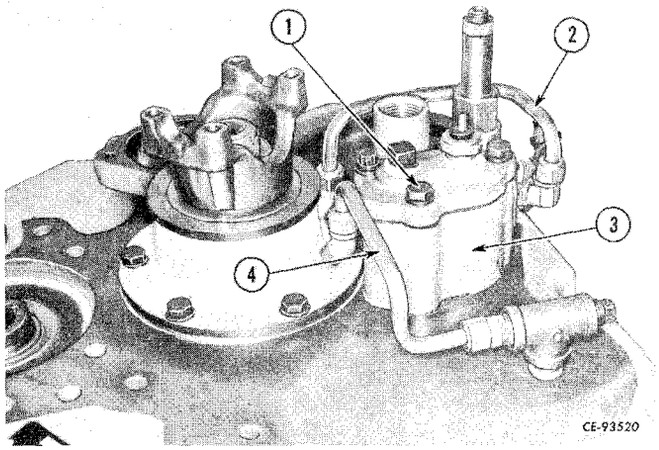

Figure 3-7

Lightly punch mark position of stator shaft assembly (1, Fig. 3-8) on front housing (2). Remove the cap screws at the base of the stator shaft assembly. With a hoist attached to the output shaft, raise the entire converter assembly (2) approximately an inch above the work

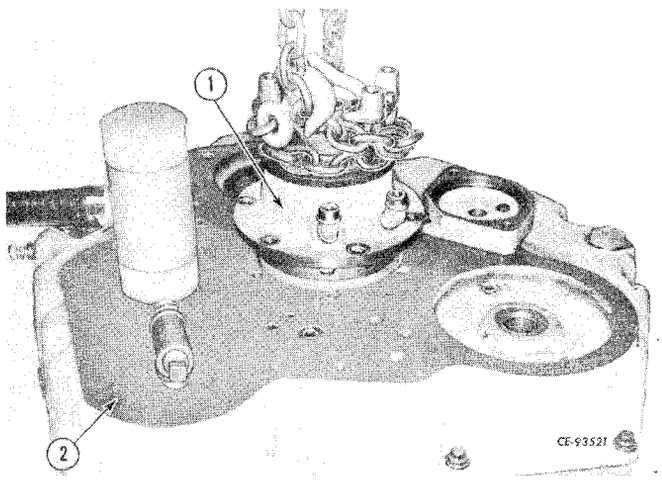

Figure 3-8

DISASSEMBLY, INSPECTION AND ASSEMBLY

bench. Strike the face of the converter housing in several places with a plastic mallet to free the shaft assembly.

NOTE: Do not raise the assembly above an inch. Provide a wood base beneath the converter assembly to eliminate damage.

Hold the output yoke (1, Fig. 3-9) in a vise and remove the hex nut (3) and flat washer (2). Remove yoke.

(Continued on next page)

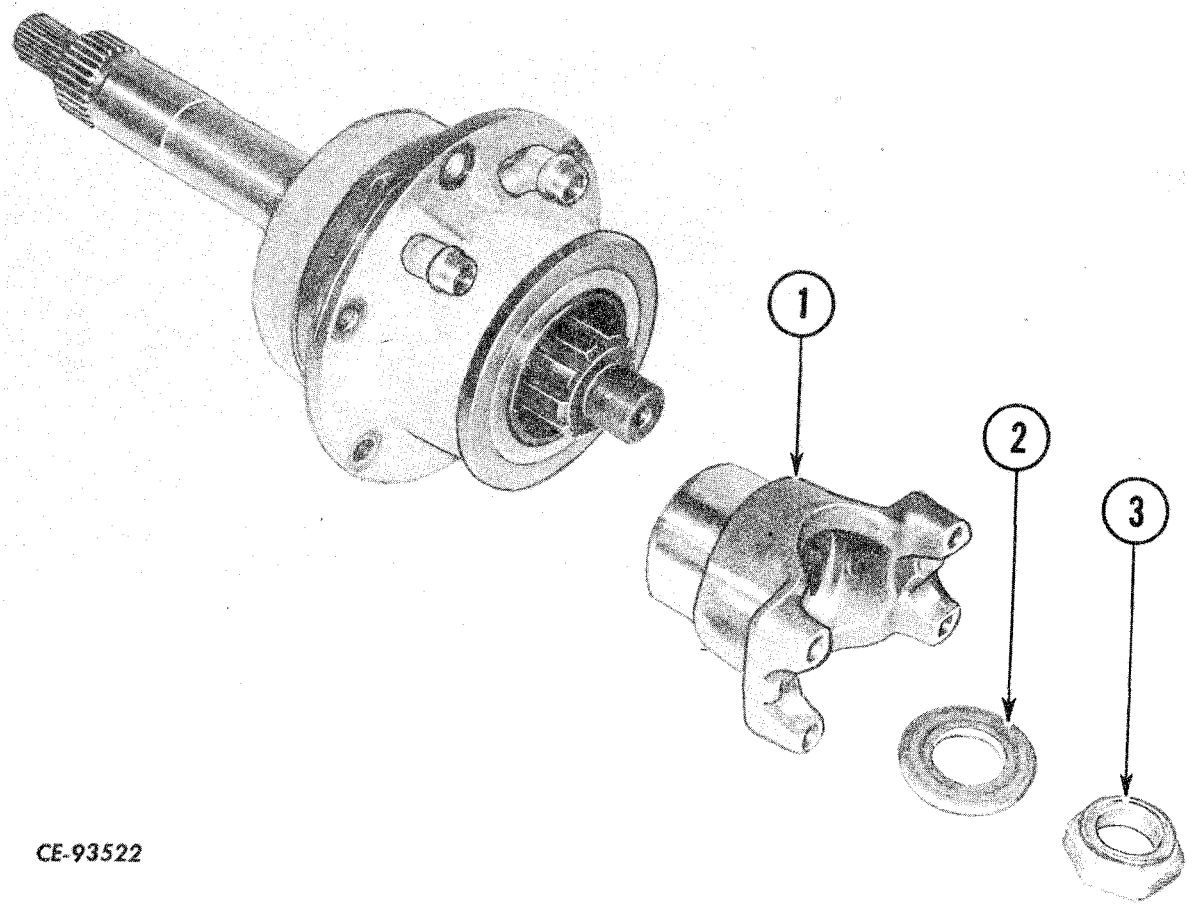

Figure 3-9

DISASSEMBLY, INSPECTION AND ASSEMBLY

DISASSEMBLY - Continued

Use a soft drift to tap the seal retainer (4, Fig. 3-10) from the stator shaft hub (1). Remove the seal (5) from the retainer and discard seal.

Remove the snap ring (2) from the bearing bore and remove the shaft and bearing assembly (3).

Remove and discard the hook-type seal ring (2, Fig. 3-11). With a screwdriver, open the two piece lock ring (3) and separate the halves. Remove the bearing (4) from the shaft (1).

Remove the cap screws that join the front (1, Fig. 3-12) and rear (2) housings. Using a hoist and lifting eyes, raise the assembly approximately one inch. Strike the lower housing at several points with a plastic mallet to separate the housings.

NOTE: Do not raise the assembly more than one inch. Provide a wood base beneath the converter assembly to eliminate damage.

Discard the gasket after separating the housings. Remove the large spur gear shaft seal (Loader pump drive) from the front housing. Do not remove the bearing retaining snap ring unless replacement is necessary.

Remove the small spur gear (5, Fig. 3-13). Remove and discard the lock-type seal ring (2). Remove the snap ring (1) from the impeller hub

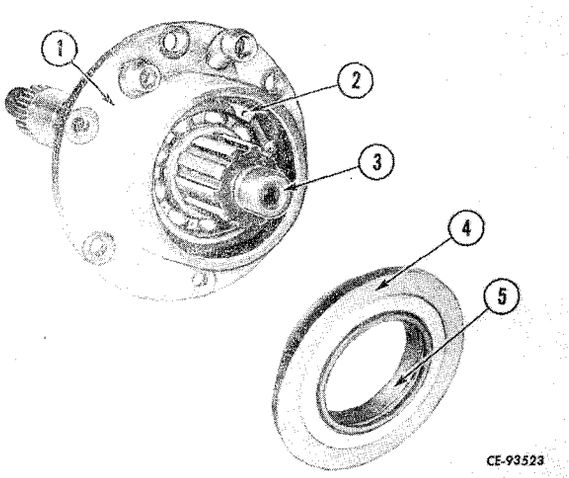

Figure 3-10

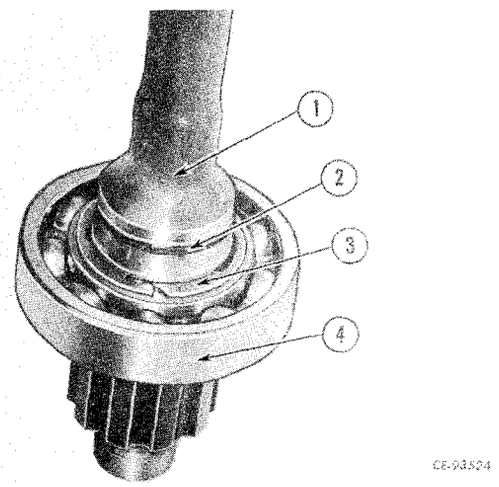

Figure 3-11

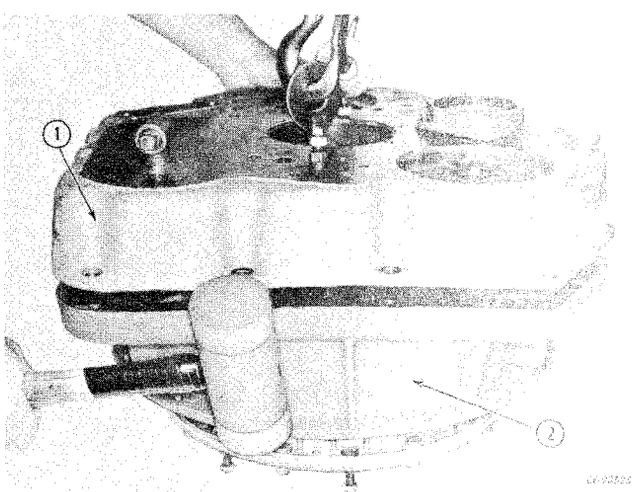

Figure 3-12

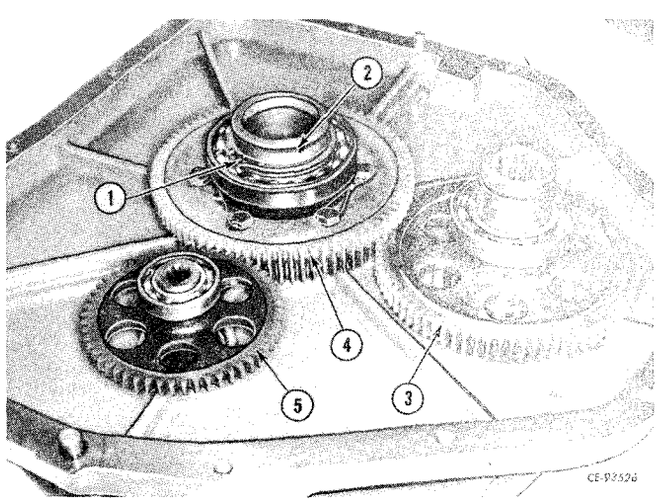

Figure 3-13

and slide off the double spur gear assembly (4). Remove the large spur gear (3).

Using a sling and hoist remove the rear housing section (4, Fig. 3-14) from the converter assembly (3). With a suitable puller, remove the bearing assemblies (1, 2).

Remove the impeller hub seal (1, Fig. 3-15) from the bore of the housing.

Provide identification on converter cover (1, Fig. 3-16) and impeller (2) with light file or punch marks to insure these parts will be assembled in the same relative position. This is important because the converter is a balanced unit.

Remove the cap screws and hex nuts that secure the converter cover (1) to the impeller (2).

NOTE: Mark the position of the long cap screws (3) so that they may be assembled in the same holes.

Carefully invert the converter assembly and lift the impeller (1, Fig. 3-17) from the cover (2). Do not allow the stator (3) to drop when removing the impeller. Remove the thrust washer (4).

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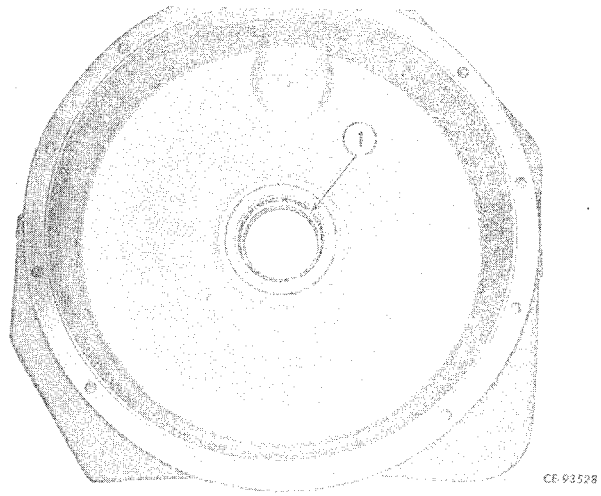

Figure 3-15

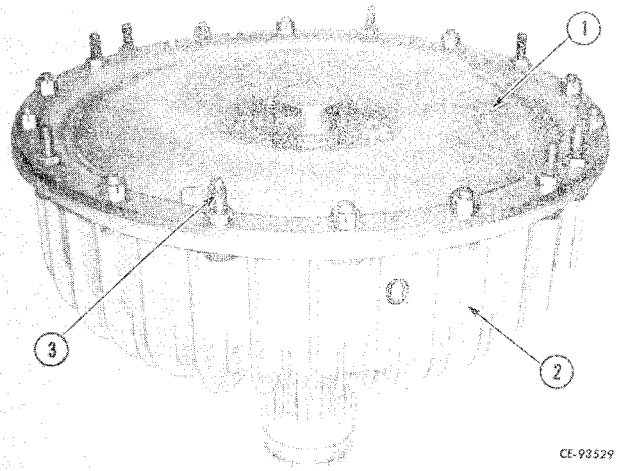

Figure 3-16

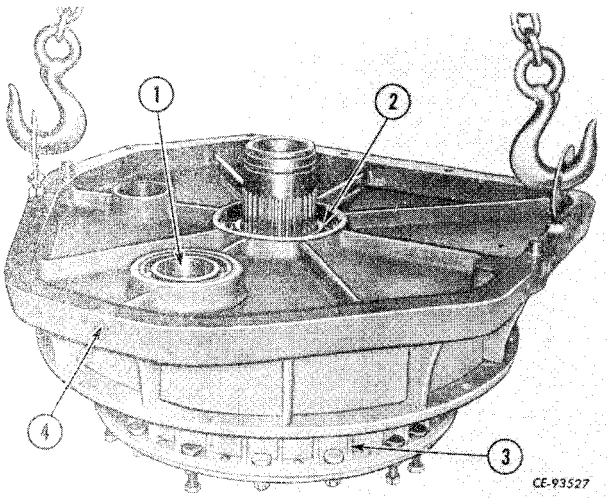

Figure 3-14

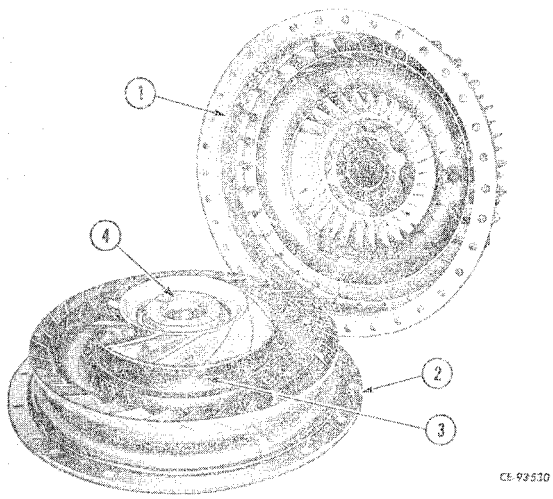

Figure 3-17

TORQUE CONVERTER

DISASSEMBLY, INSPECTION AND ASSEMBLY

DISASSEMBLY - Continued

Lift the stator (1, Fig. 3-18) from the turbine (4). The word "FRONT" in raised letters (2) appears on the lip of the stator facing the turbine. This must be assembled in the same manner. Remove the turbine (3).

Remove the flat washer (2, Fig. 3-19). Remove and discard the "O" ring gasket (1).

Remove the snap ring (1, Fig. 3-20) from either end of the stator bore. Slide out the thrust washer (2).

Slide the hub (2, Fig. 3-21) from the stator bore. Slide out the remaining thrust washer (1). The remaining snap ring need not be removed unless replacement is required.

Remove the cap screws (2, Fig. 3-22) that secure the impeller hub (1) to the impeller (3).

Withdraw the impeller hub (2, Fig. 3-23) from the impeller (1). Remove and discard the seal ring (3).

Remove the cover (2, Fig. 3-24) from the pressure regulator valve body. Discard the gasket (3). Remove and discard the "O" ring (1) at the base of the pressure regulator valve bore.

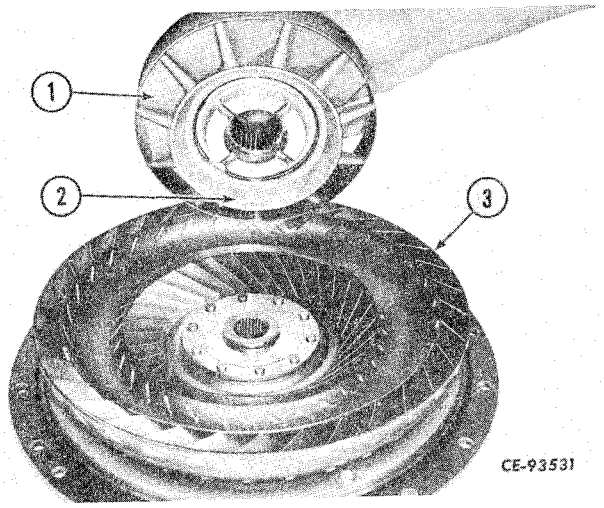

Figure 3-18

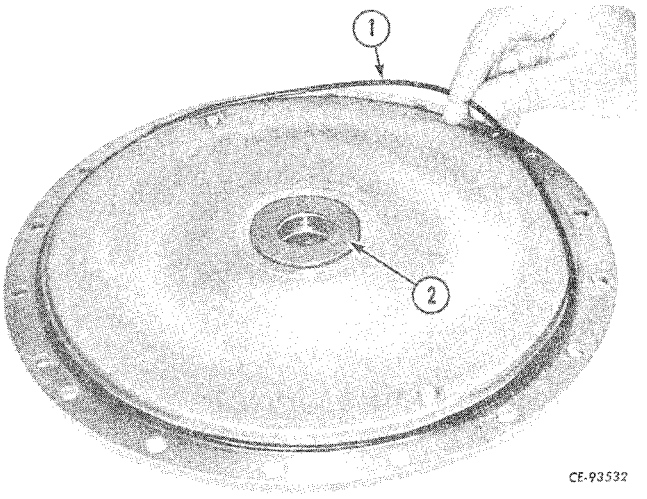

Figure 3-19

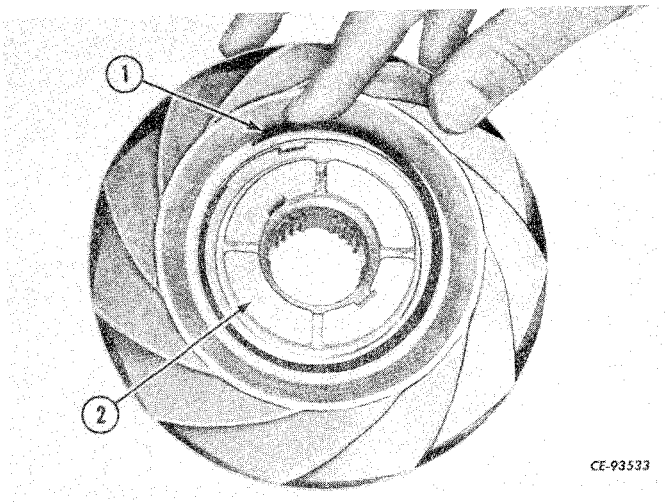

Figure 3-20

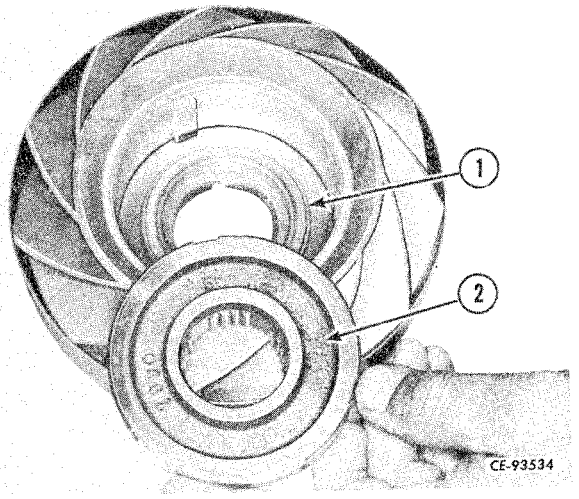

Figure 3-21

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DISASSEMBLY, INSPECTION AND ASSEMBLY

CLEANING AND INSPECTION

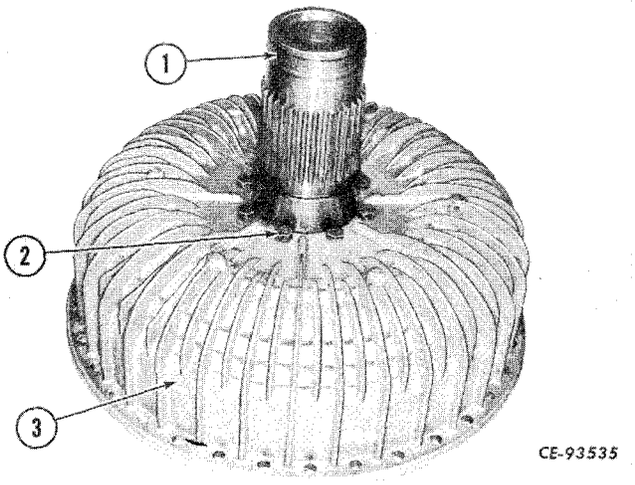


Figure 3-22

Clean all parts in cleaning solvent and dry with compressed air. Lubricate all machined surfaces with clean new transmission fluid.

Inspect all parts for wear or damage. Check the converter and rotating housings for cracks. Inspect the bearing bores and mounting faces for wear, grooves or scratches. Remove burrs and scratches with a crocus cloth. Inspect all splined parts for worn, twisted, chipped or burred splines. Remove burrs with a soft stone.

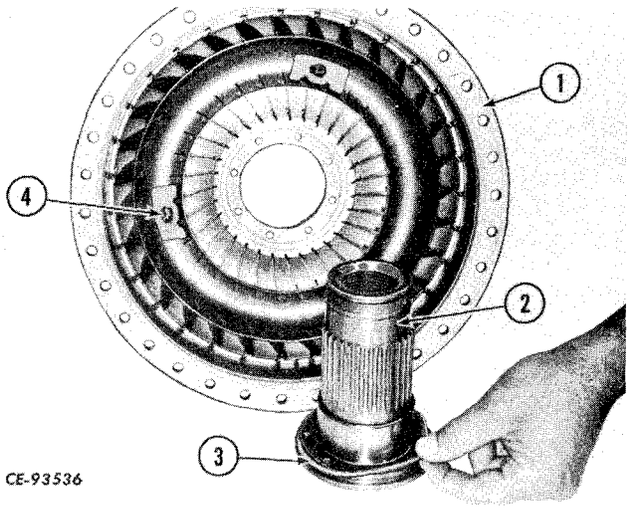


Figure 3-23

Check the turbine, impeller, stator and cover for cracks or flaking. Inspect the welds on the cap screws (4, Fig. 3-23) that secure the impeller shroud. If spot weld is cracked or broken measure size of weld. Clean all weld from cap screw and retaining plate. Install cap screw and retaining plate and tighten screw to recommended torque.

Torque:_____

Spot weld screw to retaining plate.

NOTE: New weld must be of identical size and location as original to preserve balance of unit.

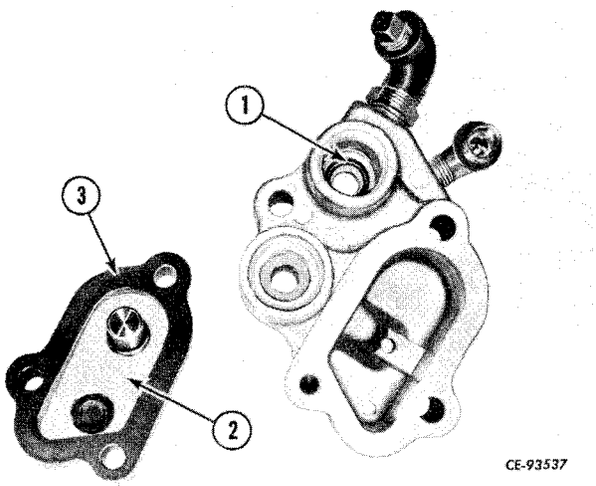


Figure 3-24

Check the lock wire on the cap screws that secure the two halves of the double spur gear. Check all bearing assemblies for nicks, spalling and pitting.

Discard all old oil seals, "O" rings and gaskets.

NOTE: Special Torques, Pressures, etc. recommendations are listed under "SERVICE INFORMATION."

DISASSEMBLY, INSPECTION AND ASSEMBLY

ASSEMBLY

Position the flat washer (2, Fig. 3-25) on the converter cover. Lubricate a new "O" ring gasket (1) with new, clean transmission fluid and install on shoulder of cover.

Install thrust washer (1, Fig. 3-26) against snap ring in stator (see Note). Install hub (2) in stator.

Install remaining thrust washer (2, Fig. 3-27) in stator bore (see Note). Secure the assembly by installing the second snap ring (1).

NOTE: Refer to Figure 3-28 for correct thrust washer installation.

Install turbine (3, Figure 3-29) on converter cover. Install stator assembly (1) in turbine with lip of stator marked "FRONT" (2) facing turbine.

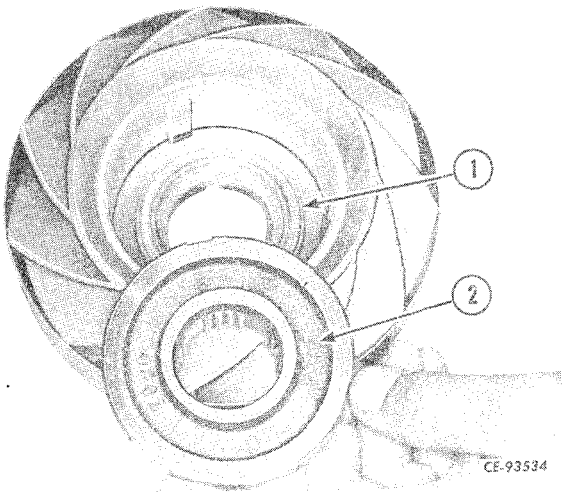


Figure 3 26

Install new seal ring (3, Fig. 3-31) on impeller hub (2) and install hub in impeller (1). Secure with cap screws and tighten to recommended torque.

Torque:_____

(Continued on page 12)

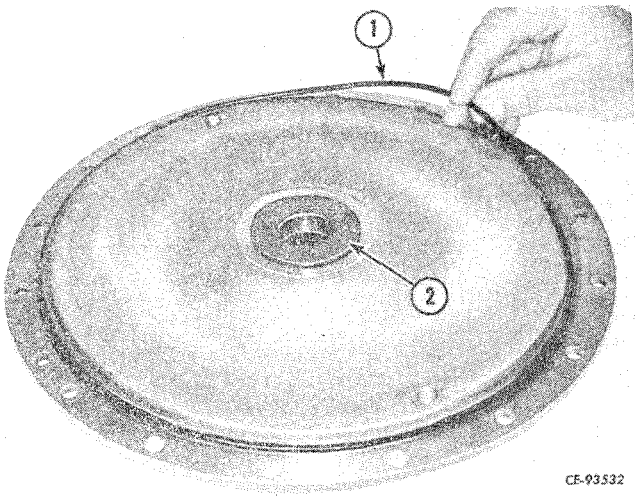


Figure 3-25

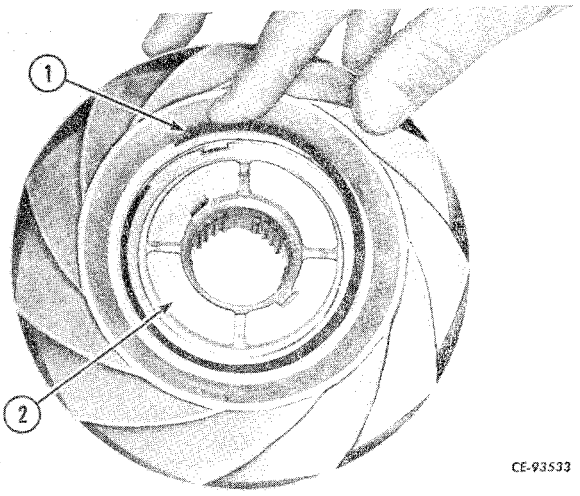
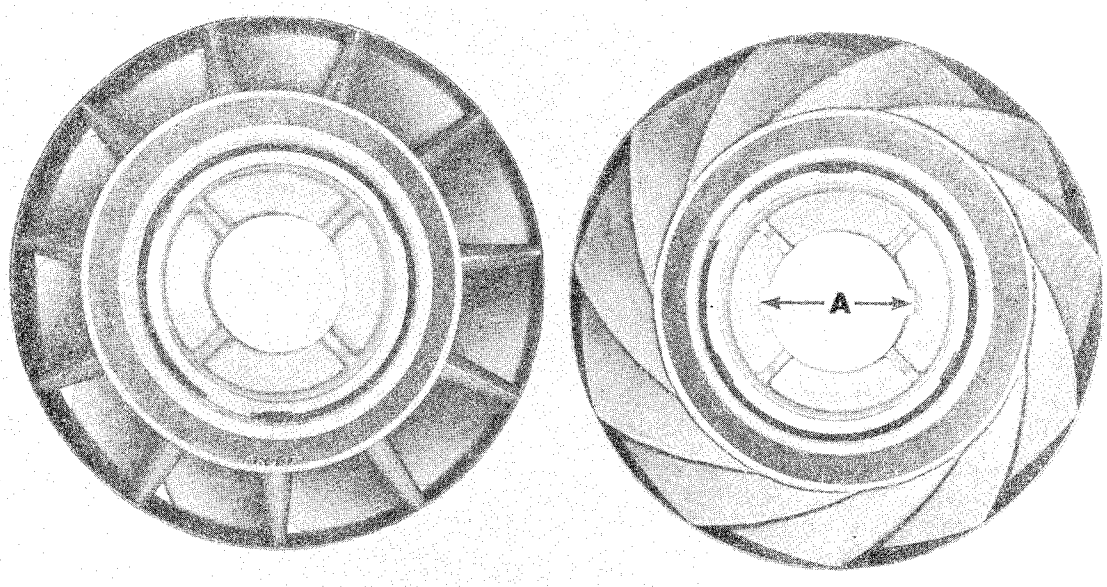


Figure 3-27

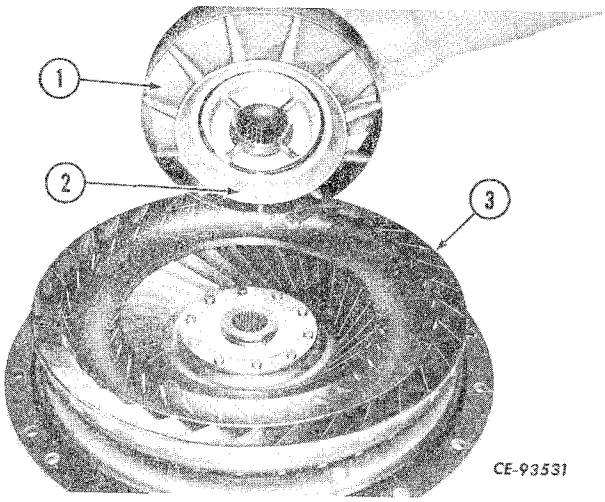


THRUST WASHER WITHOUT EXTRA NOTCHES GOES ON SIDE OF STATOR MARKED "FRONT".

THRUST WASHER WITH EXTRA NOTCHES "A" GOES ON PLAIN SIDE OF STATOR.

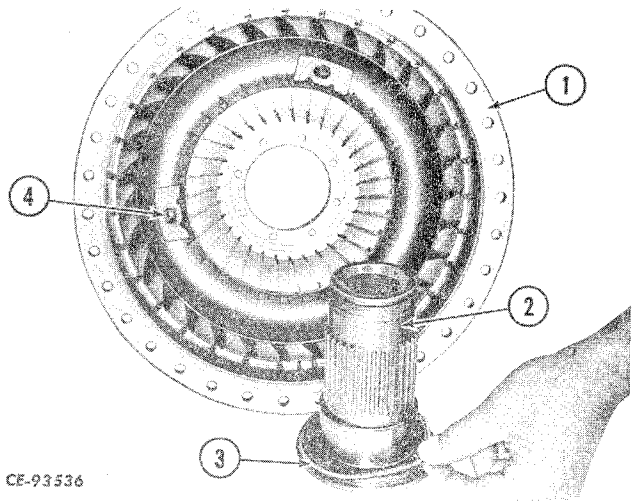
CE-93538

Figure 3-28



CE-93531

Figure 3-29



CE-93536

Figure 3-30

DISASSEMBLY, INSPECTION AND ASSEMBLY

ASSEMBLY - Continued

Position small thrust washer (4, Fig. 3-31) on stator (3) with tabs engaging notches on large stator thrust washer. Lubricate small thrust washer with transmission fluid.

Install impeller and hub assembly (1) on cover (2), being sure the "O" ring gasket is correctly positioned. Carefully invert assembly.

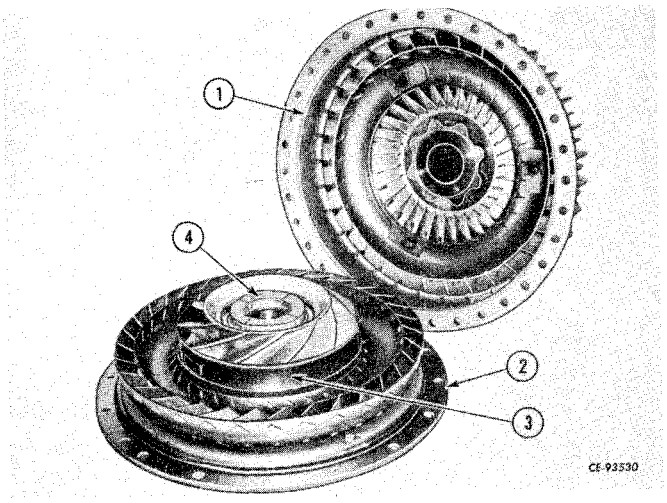


Figure 3-31

Install cap screws and hex nuts that secure cover (1, Fig. 3-32) to impeller housing(2). Be sure to install long cap screws in correct holes (previously marked during disassembly).

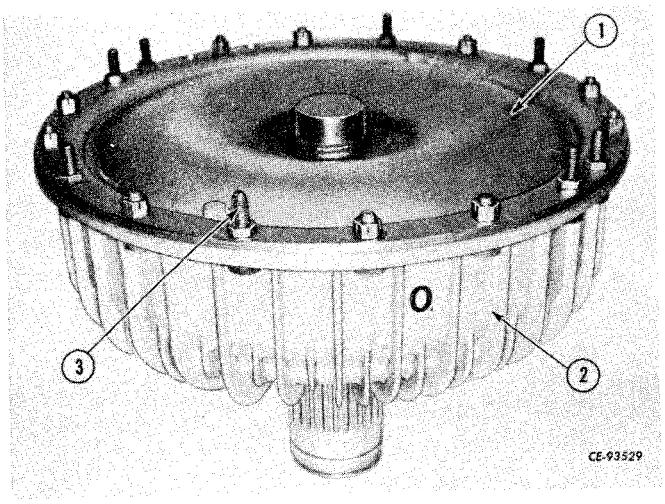


Figure 3-32

This will insure correct alignment with flywheel. Tighten hex nuts to recommended torque.

Torque:_____

Coat the O. D. of a new impeller hub seal (1, Fig. 3-33) with Mar-Seal or equivalent sealant and press seal into center bore of the rear housing with lip of seal facing toward adjacent ball bearing.

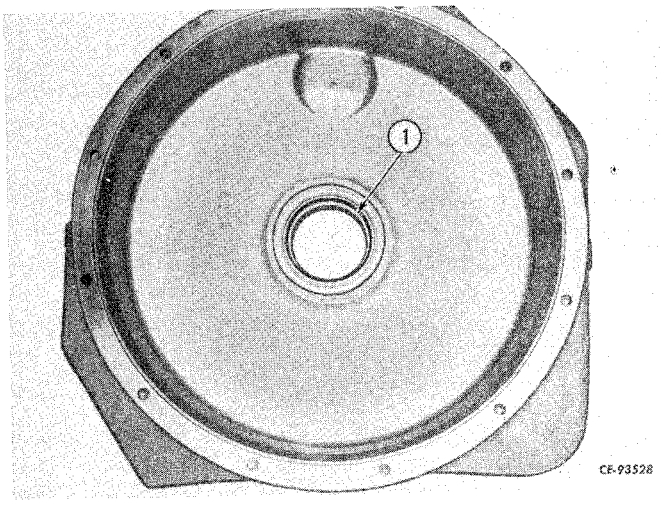


Figure 3-33

Install large spur gear bearing (1, Fig. 3-34) and impeller hub bearing (2) in rear housing (4).

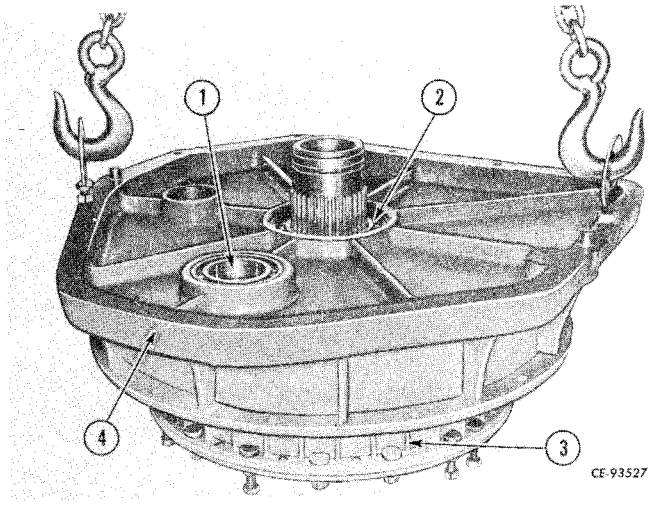


Figure 3-34

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Using a suitable hoist and sling, lower the rear housing (4) onto the converter assembly (3).

Inspect the expansion plug (1, Fig. 3-35) in the short end of the large spur gear shaft to be sure it is tight and in good condition.

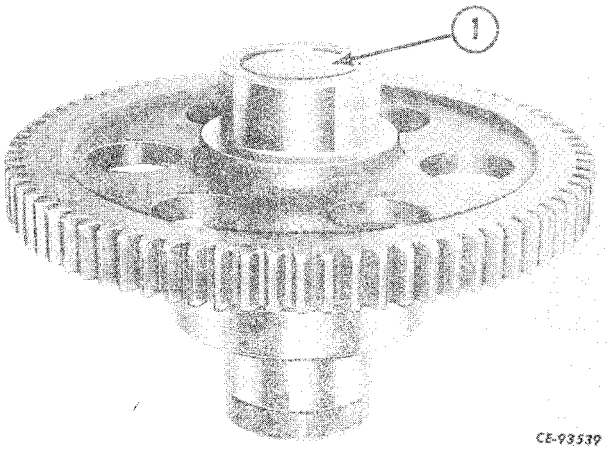

Figure 3-35

Install the large spur gear (3, Fig. 3-36) in the rear housing assembly. Install the double spur gear (4), bearing, snap ring (1) and hook-type seal ring (2) on impeller hub. Install the small spur gear and bearing assembly (5).

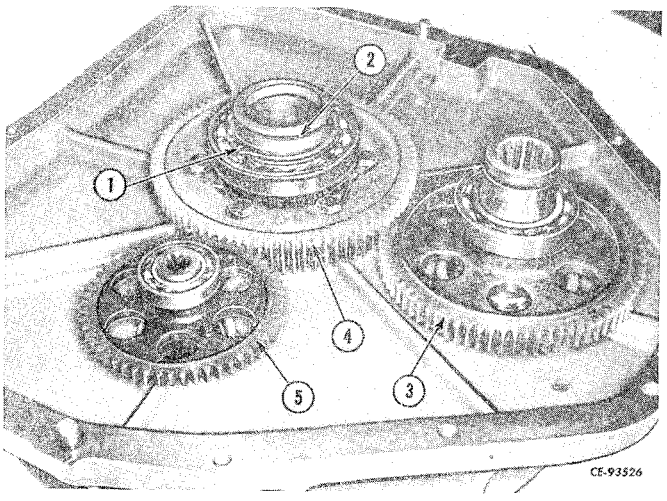

Figure 3-36

Position a new gasket on the rim of the rear housing (3, Fig. 3-37). Lower the front housing (2) into position on the rear housing and secure with cap screws and lock washers (4).

Tighten the cap screws to the recommended torque.

Torque:_____

Coat the O. D. of a new shaft seal with Mar-Seal or equivalent sealant and press seal in large spur gear shaft bore (1). Press seal flush with housing face. Lip of seal must face in toward spur gear.

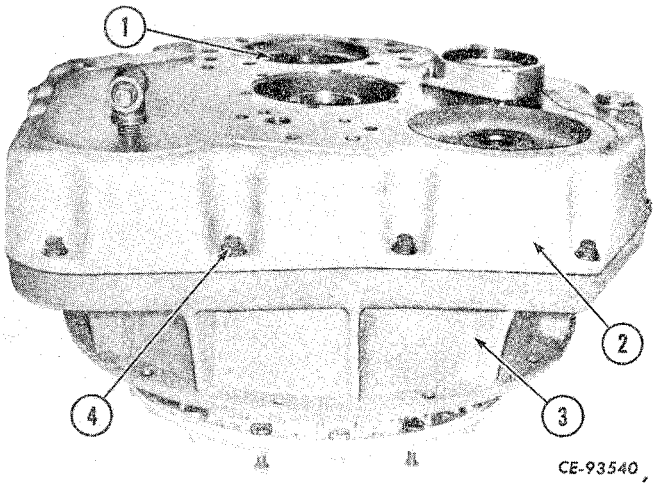

Figure 3-37

Press bearing (4, Fig. 3-38) on converter output shaft (1). Be sure the pressure is exerted on the inner bearing race to avoid damage to the bearing. Install the retaining ring (3) and hook-type seal ring (2). Lubricate entire assembly with new clean transmission fluid.

(Continued on next page)

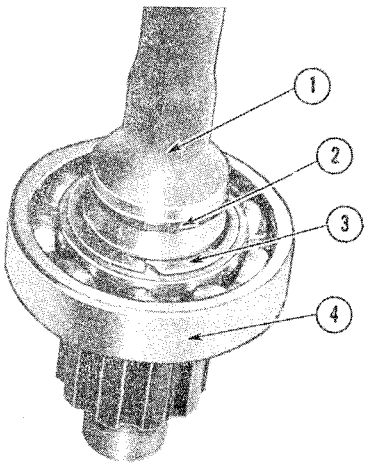

Figure 3-38

ASSEMBLY - Continued

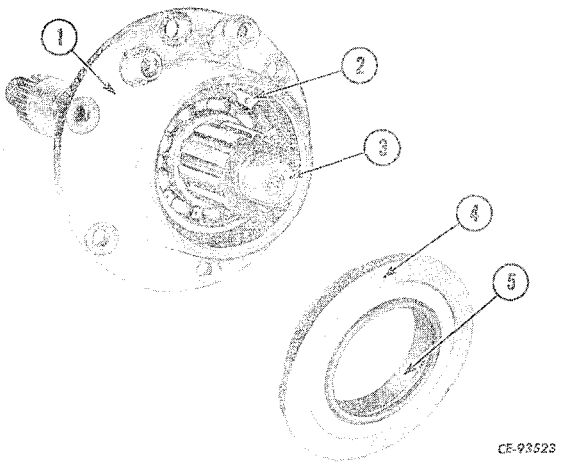

Figure 3-39

Install the shaft and bearing assembly (3, Fig. 3-39) in the stator shaft (1) and secure with retaining ring (2).

Coat the O. D. of a new yoke seal (5) with Mar-Seal or equivalent sealant and using a suitable seal driver install the seal in the retainer (4). The lip of the seal must face in toward the bearing. Coat the mating surface of the retainer with Mar-Seal or equivalent sealant and install seal and retainer assembly in stator shaft hub. Be sure retainer is flush against hub shoulder around its entire circumference.

Install yoke (1, Fig. 3-40) on output shaft and secure with flat washer (2) and new lock nut (3). Tighten lock nut to the recommended torque.

Torque: _____

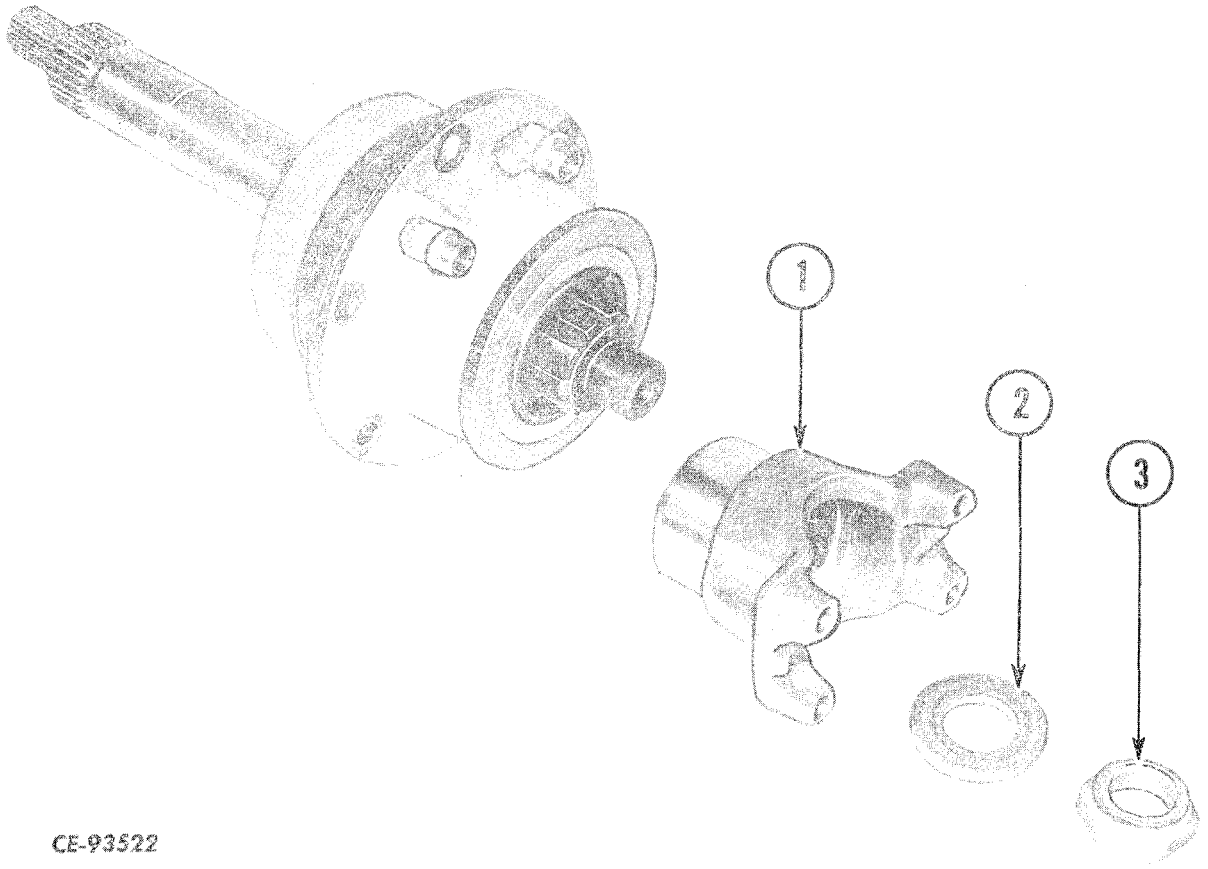

Figure 3-40

Install the shaft and hub assembly (1, Fig. 3-41) in the converter carefully meshing all splines (output shaft to turbine and stator shaft to stator). A pair of headless guide bolts will help in this operation. Be sure the assembly is installed in the position marked prior to disassembly. Install retaining cap screws and tighten to recommended torque.

Torque:_____

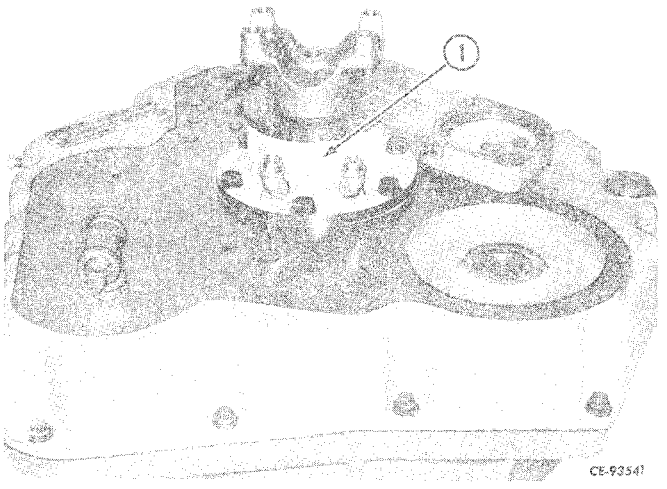

Figure 3-41

Position a new "O" ring (1, Fig. 3-42) at the base of the regulator valve bore. Install the valve in its bore in the housing. Using a new gasket (3), install the cover (2) on the housing.

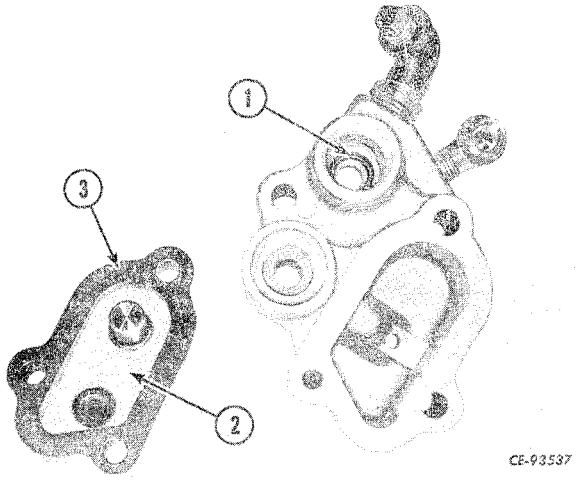

Figure 3-42

Install new "O" rings (1, Fig. 3-43) in recesses in mating face of valve. Retain the "O" rings with petroleum jelly.

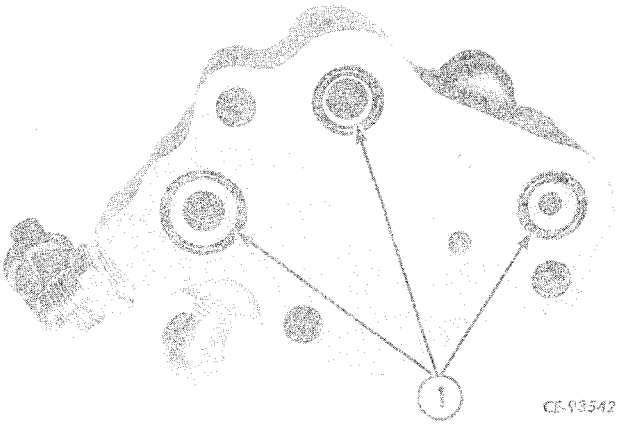

Figure 3-43

Install a new "O" ring (3, Fig. 3-44) in position in the groove of the front housing (2). Retain the "O" ring with petroleum jelly. Position a new gasket (1) on the housing.

(Continued on next page)

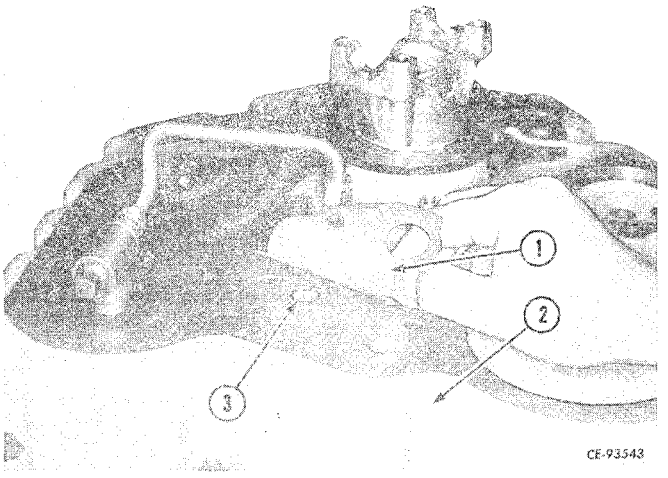

Figure 3-44

DISASSEMBLY, INSPECTION AND ASSEMBLY

ASSEMBLY - Continued

Install the regulator valve assembly (3, Fig. 3-45) on the converter housing and secure with cap screws. Tighten cap screws to recommended torque.

Torque:_____

Install tubes (2, 4) and tighten connections securely.

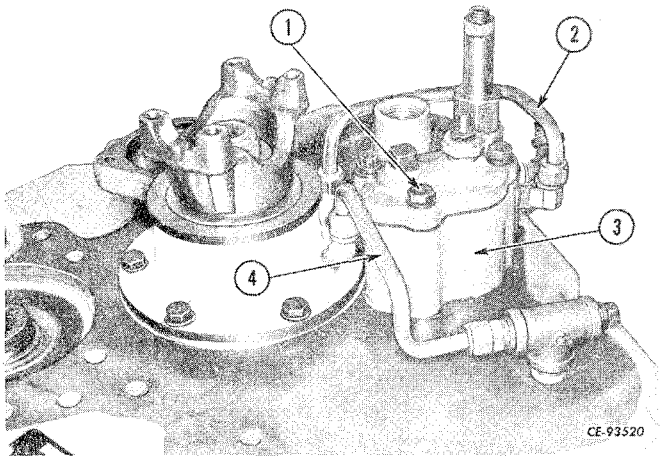

Figure 3-45

Install the charging pump (1, Fig. 3-46) on the adapter (3) and secure with cap screws (2). Tighten cap screws to recommended torque.

Torque:_____

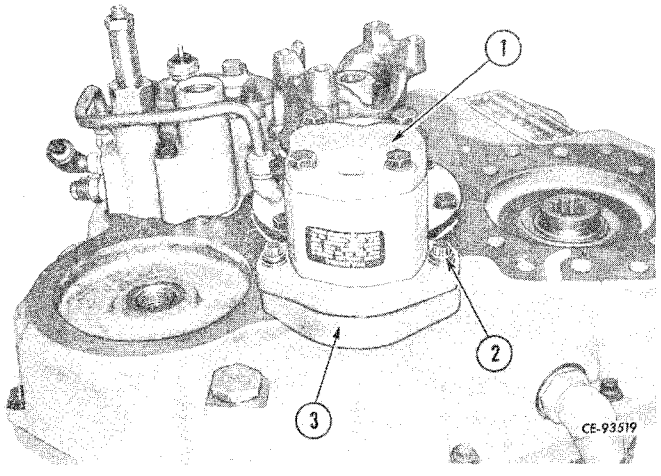

Figure 3-46

CONVERTER CHARGING PUMP

Overhaul the pump only in a clean, dust-free location, using clean tools and equipment. Dirt or grit will damage the highly machined surfaces and will result in leakage or premature failure of the pump.

Scribe a match mark on the body and front and rear covers to insure that the pump will be reassembled in exactly the same manner as it was shipped from the factory. If any of the scribed parts are replaced during overhaul, scribe a match mark on the new part in exactly the same location as the match mark of the part it replaces.

Wash bearings, gears, body, and cover carefully in clean solvent. Blow dry.

Replace the sealing rings, the gasket seal, and the shaft seal each time the pump is overhauled.

Lubricate each part with clean, fresh, SAE No. 10 oil at reassembly.

When installing the shaft seal apply a light coat of Mar-Seal or equivalent sealant to the seal bore in the front cover before pressing the seal into place. Seal lip must face in toward pump gears. Stake the seal securely to the bore in three places.

Tighten the cap screws to the recommended torque.

Torque:_____

After overhaul, run in the pump for 30 minutes at 2000 rpm and 0 psi.

INSTALLATION

Install the converter assembly on the engine flywheel housing. Attach all hoses, tubes and wires according to tagged instructions. Install the drive shaft.

Using sling and hoist, position the support assembly with battery box and hydraulic reservoir on the tractor frame.

Install the cap screws that secure the support assembly to the tractor frame and tighten securely.

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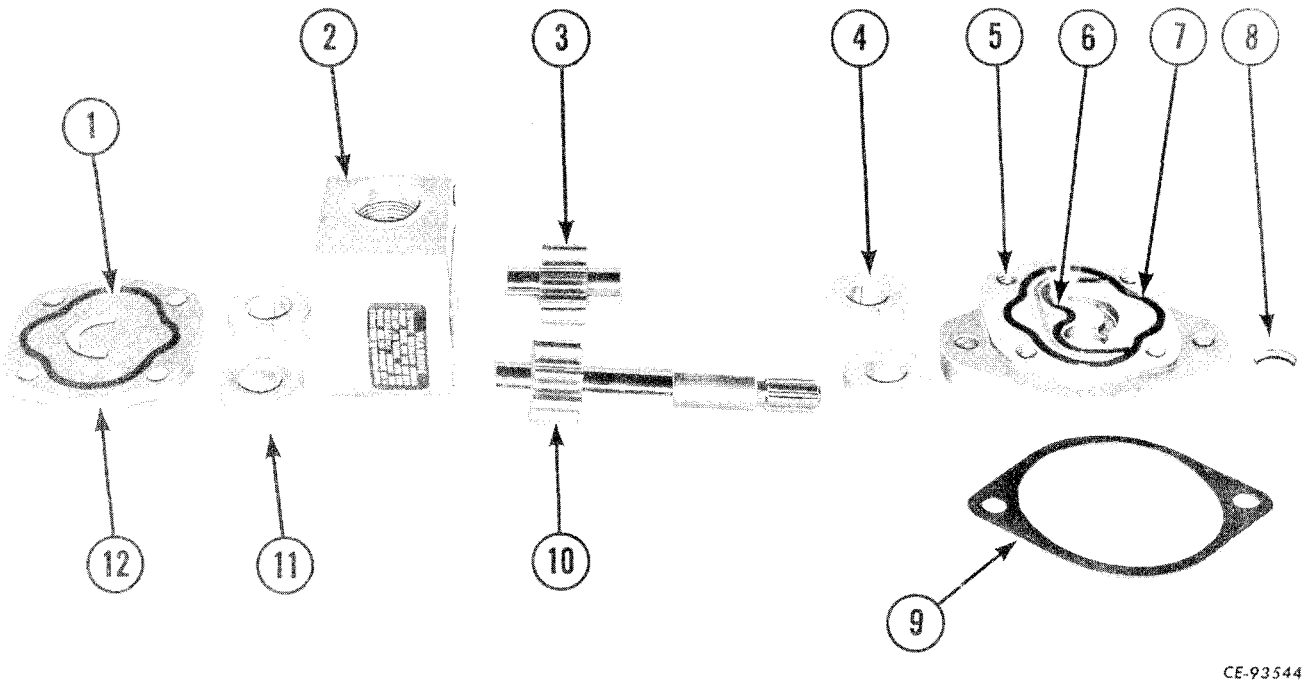

Figure 3-47
Converter Charging Pump.

1. Rear cover.
2. Pump body.
3. Driven gear.
4. Bearing (bevel must face gear).
5. Front cover.
6. Half seal ring.
7. Seal ring.
8. Shaft seal.
9. Pump-to-adapter gasket.
10. Drive gear.
11. Bearing (bevel must face gear).
12. Seal ring.

Connect engine control linkage.

Connect electrical leads where they enter battery box. Connect battery cables, ground cable last.

Connect the reservoir-to-pump line (1, Fig. 3-48).

Connect all tubing to control valve on reservoir.

Install all sheet metal; hood, side panels, seat deck, floorboard, etc.

Refill hydraulic reservoir (refer to "SECTION XI, HYDRAULIC SYSTEM").

Refill transmission (refer to "SECTION IV, TRANSMISSION").

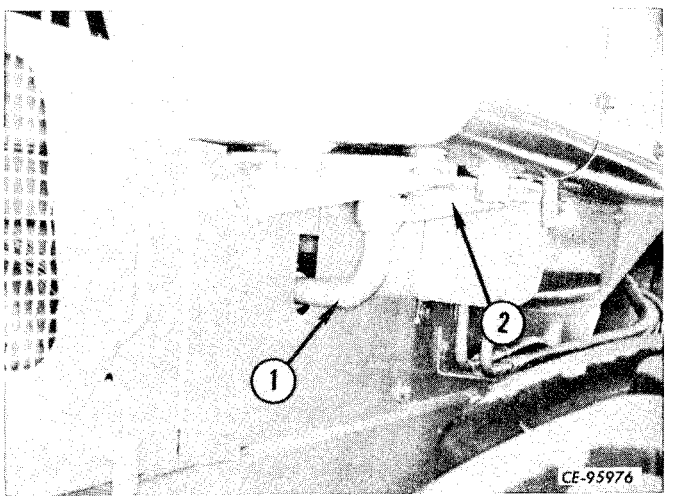

Figure 3-48

TORQUE CONVERTER

TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
High torque converter oil temperature.	1. Working in a range too high for work load.	1. Let engine run several minutes with transmission in neutral, then down shift one range.
	2. Low oil level.	2. Add oil as required.
	3. Clogged cooler.	3. Clean core exterior with air. Flush core interior. Do not exceed 60 psi.
	4. Externally clogged radiator.	4. Blow out area between core fins.
	5. Faulty temperature sending unit or gauge.	5. Replace as required.
	6. Faulty converter.	6. If engine speed drops 300 rpm below stall speed, disassemble converter and inspect for broken or worn parts.
Sudden increase in engine speed and converter oil temperature during stall check.	1. Low oil level.	1. Add oil as required.
	2. Oil foaming.	2. Drain system. Refill with recommended transmission fluid.
	3. Air in system.	3. Bleed system at cooler petcock.
	4. Blocked oil passage to converter.	4. Clean out system.
Lack of power.	1. Low oil level.	1. Add required oil.
	2. Low lube and clutch pressure.	2. Adjust relief valve.
	3. Faulty charging pump.	3. Replace pump.
	4. Low engine rpm.	4. Adjust.
	5. Faulty converter.	5. Overhaul if stall speed is 300 rpm below recommended speed.

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SERVICE INFORMATION

SPECIFICATIONS

CONVERTER TYPE

Single stage, single phase, three element.

TORQUE MULTIPLICATION AT STALL

Ratio 2.57:1
Stall speed:
I.H. Gas . . . . . 1875 rpm
I.H. Diesel . . . . . 1875 rpm
Detroit Diesel. . . . . 1930 rpm

OIL SYSTEM

Integrated with transmission.
Charging pump . . . . Positive displacement, gear type.
Input pump capacity . . . . . 7 gpm at 2000 rpm and 0 psi.

CONVERTER CHARGING PRESSURE

At high idle . . . . . 60 psi min.

OIL TEMPERATURE

150°F. Minimum
250°F. Maximum safe continuous duty.

OIL FILTER

Full flow . . . . . Remote mounted.

OIL COOLER

Remote mounted.

WEIGHT

Converter (less accessories). . . . . 219 lbs.

LUBRICANTS AND CAPACITIES

Refer to "SECTION IV, TRANSMISSION."

SPECIAL TORQUES

Impeller shroud retaining cap screws (torque prior to spot weld).	5-7 lbs. ft.
Impeller hub-to-impeller cap screws	8-10 lbs. ft.
Impeller-to-cover cap screws	22 lbs. ft.
Front housing-to-rear housing cap screws	33-37 lbs. ft.
Output shaft yoke	200 lbs. ft.
Pressure regulator-to-front housing cap screws	33-37 lbs. ft.
Charging pump-to-adapter cap screws.	33-37 lbs. ft.
Charging pump assembly cap screws	28-32 lbs. ft.

TORQUE CONVERTER

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

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SECTION IV
TRANSMISSION

Page

SECTION IV TRANSMISSION

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NOTE: Service Instructions are given for the P-600 and P-601 transmissions as used on machines equipped with 4-wheel drive (H-30B). Assembly and disassembly of transmissions in 2-wheel drive machines (H-30F, H-30R) is identical with few exceptions. These variations are noted in the text. The notations will be coded as follows:

H-30B, 4-wheel drive = B
H-30F, 2-wheel front drive = F
H-30R, 2-wheel rear drive = R

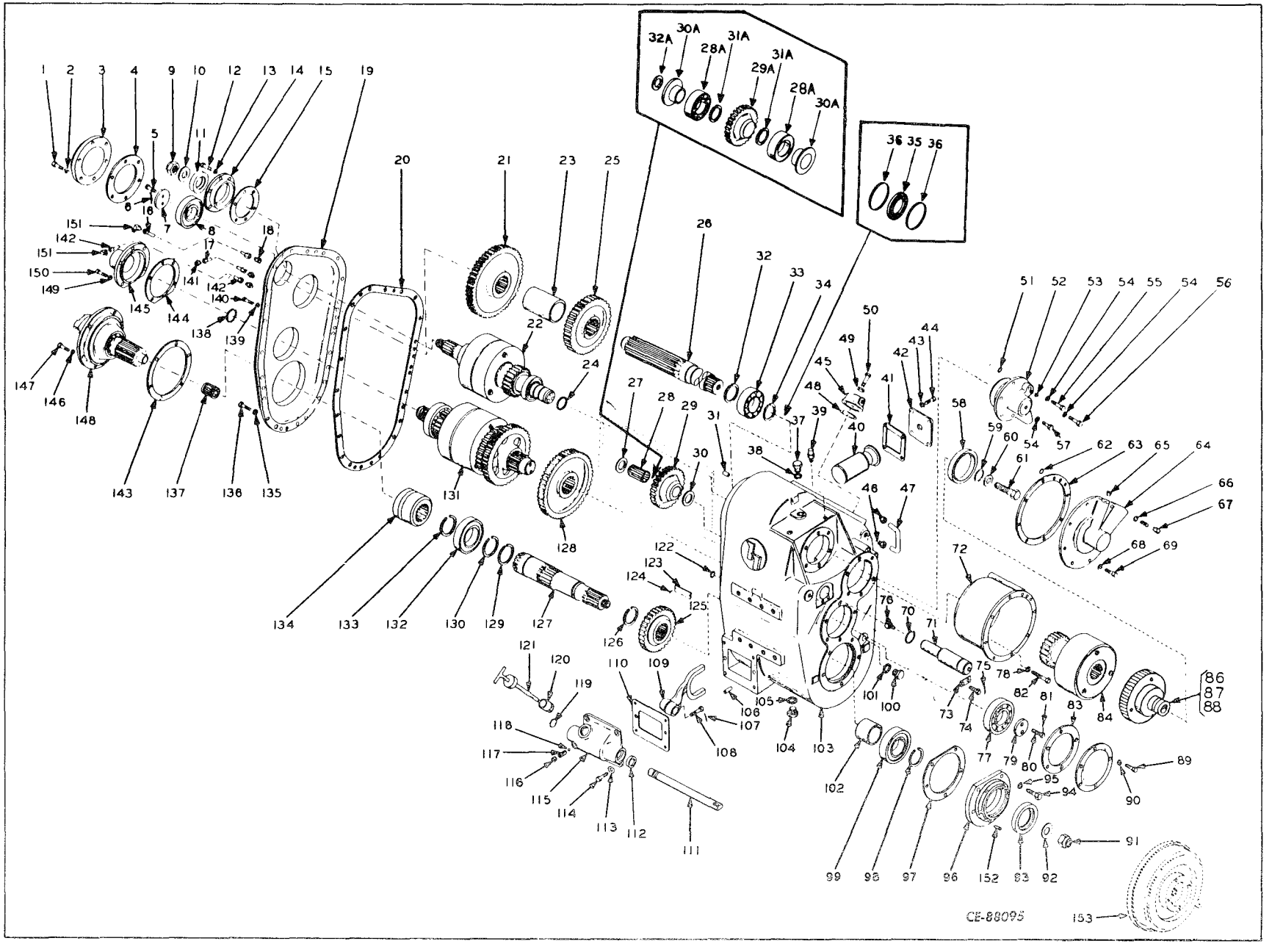

Figure 4-1
Exploded View of Transmission.

TRANSMISSION

DESCRIPTION

Legend for Figure 4-1

1. Cap screw.
2. Lock washer.
3. Countershaft cap.
4. Cap gasket.
5. Cap screw.
6. Lock wire.
7. Retaining washer.
8. Ball bearing.
9. Nut.
10. Flat washer.
10A. Retaining ring.
11. Seal.
12. Cap screw.
13. Lock washer.
14. Input shaft cap.
15. Cap gasket.
16. 3rd gear tube.
17. 2nd gear tube.
18. Straight adapter.
19. Transmission cover.
20. Gasket.
21. Spur gear, 55 teeth.
22. Forward and reverse clutch assembly.
23. Spacer.
24. Seal ring.
25. Spur gear, 37 teeth.
26. Upper countershaft.
27. Flat washer (P-600), Gear assembly (P-601).
28. Roller bearing (P-600).
28A. Bearing outer race (P-601).
29. Idler gear, 30 teeth (P-600).
29A. Reverse idler gear (P-601).
30. Flat washer (P-600).
30A. Inner bearing race (P-601).
31. Dowel pin.
31A. Retaining ring (P-601).
32. Retaining ring.
32A. Spacer (P-601).
33. Ball bearing (P-600).
34. Retaining ring.
35. Thrust bearing (P-601).
36. Thrust race (P-601).
37. Plug.
38. Washer.
39. Breather.
40. Sump strainer element.
41. Cover gasket.
42. Strainer retainer.
43. Lock washer.
44. Cap screw.
45. Manifold and relief valve assembly.
46. Straight adapter.
47. Tube.
48. "O" ring.
49. Washer.
50. Cap screw.
51. "O" ring.
52. Cap.
53. Pipe plug.
54. Washer.
55. Cap screw.
56. Cap screw.
57. Cap screw.
58. Roller bearing.
59. Seal ring.
60. Lock washer.
61. Cap screw.
62. "O" ring.
63. Gasket.
64. 1st gear gear cover.
65. Pipe plug.
66. Lock washer.
67. Cap screw.
68. Lock washer.
69. Cap screw.
70. "O" ring.
71. Reverse idler shaft.
72. Clutch housing.
73. Lock plate.
74. Cap screw.
75. Lock wire.
76. Elbow (P-600).
77. Roller bearing.
78. Lock washer.
79. Retaining washer (P-600).
80. Cap screw.
81. Lock wire (P-600).
82. Cap screw.
83. Gasket.
84. 1st gear clutch assembly.
85. Cap.
86. Cylinder and sleeve assembly.
87. Race.
88. Sleeve.
89. Cap screw.
90. Washer.
91. Nut.
92. Flat washer.
93. Seal.
94. Cap screw.
95. Washer.
96. Cap.
97. Adapter gasket.
98. Retaining ring.
99. Ball bearing.
100. Plug.
101. Flat washer.
102. Spacer.
103. Main housing.
104. Magnetic plug.
105. Flat washer.
106. Pin.
107. Lock wire.
108. Lock screw.
109. Shifting fork.
110. Gasket.
111. Shifting rail.
112. Seal.
113. Lock washer.
114. Cap screw.
115. Shifter housing.
116. Set screw.
117. Spring.
118. Ball bearing.
119. Expansion plug.
120. Dipstick pipe.
121. Dipstick.
122. "O" ring.
123. Identification plate.
124. Drive screw.
125. Gear, 30 teeth.
126. Retaining ring.
127. Output shaft.
128. Gear, 53 teeth.
129. Retaining ring.
130. Retaining ring.
131. 2nd and 3rd gear clutch assembly.
132. Ball bearing.
133. Retaining ring.
134. Sliding sleeve clutch.
135. Lock washer.
136. Cap screw.
137. Roller bearing.
138. Seal ring.
139. Lock washer.
140. Counter bore cap screw.
141. Straight adapter.
142. 2nd and 3rd lube tube.
143. Gasket.
144. Gasket.
145. Cap.
146. Lock washer.
147. Cap screw.
148. Rear output shaft assembly.
149. Lock washer.
150. Cap screw.
151. Elbow.
152. Pin.
153. Parking brake.

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DESCRIPTION

The P-600 and 601 full-power shift transmissions are designed to increase the useful range of the torque converter. A countershaft design with hydraulically actuated clutches is employed. First range increases power for starting, and as the demand on the converter diminishes, the transmission may be progressively shifted into higher ranges.

The transmissions have three speeds in both forward and reverse, and full-power shift in all ranges.

The transmissions are of countershaft design. This design employs shafts parallel to, and driven by, the input shaft. Gears mounted on the parallel shafts run free unless "clutched" to the shaft.

Only a small volume of oil is needed to fill the clutch cavity and apply the clutch. Large, high volume pumps are unnecessary in this design.

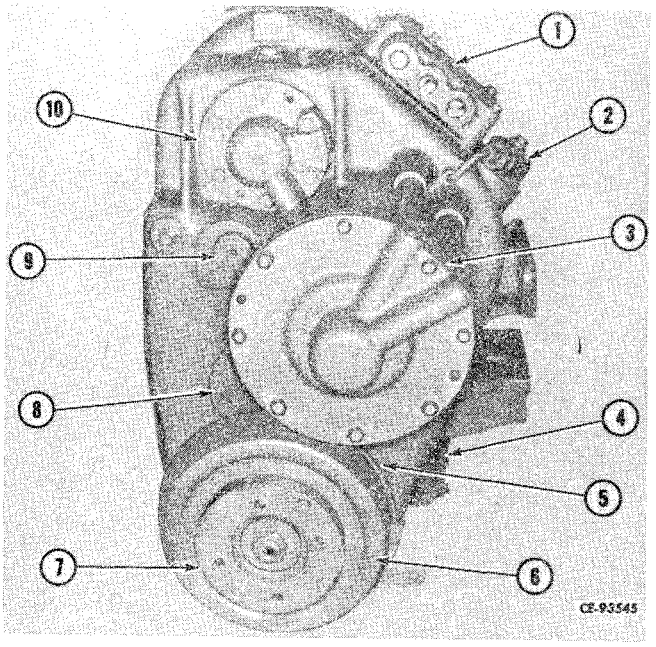

Figure 4-2
Front Side of Transmission.

1. Control valve.
2. Lube manifold.
3. First gear clutch cover.
4. Sump strainer cover.
5. Level check plug.
6. Parking brake.
7. Front output flange.
8. 2nd and 3rd pack bearing retainer cap.
9. Reverse idler shaft.
10. Fwd. and Rev. oil supply cover.

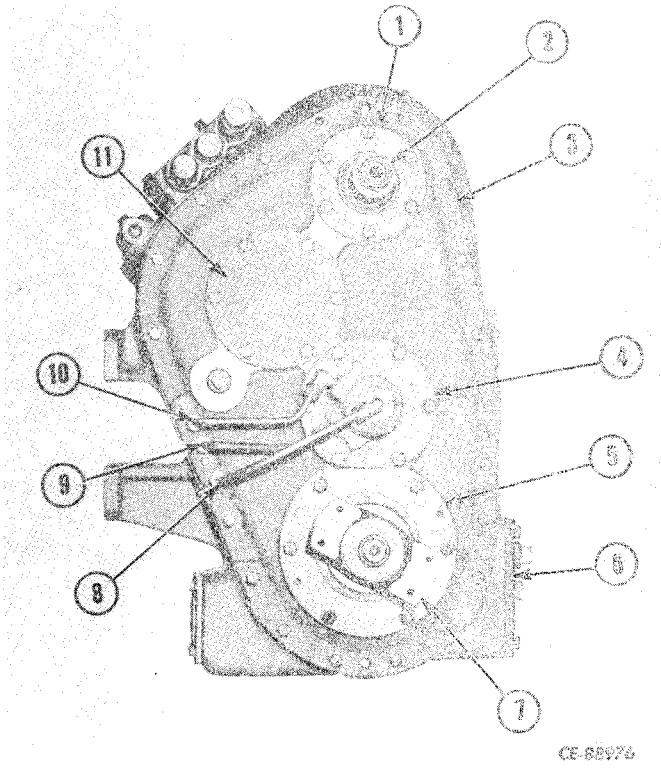

Figure 4-3
Rear Side of Transmission.

1. Input bearing retainer cap.
2. Input shaft.
3. Cover.
4. 2nd and 3rd gear oil supply cap.
5. Rear output bearing retainer.
6. Cover.
7. Rear output yoke.
8. 2nd and 3rd gear lube supply tube.
9. 2nd gear oil supply tube.
10. 3rd gear oil supply tube.
11. Countershaft cover.

TRANSMISSION

PREVENTIVE MAINTENANCE

OIL

Description: Dexron automatic transmission fluid.

Quantity for original fill: Refer to "SPECIFICATIONS."

CHANGE PERIOD

1. Oil change - 1000 hours of operation.

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

3. Change transmission filters - 500 hours of operation.

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

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

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

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

OIL LEVEL CHECK

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

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

PRE-START CHECK

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

HOT OIL CHECK

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

OPERATING TEMPERATURE

Normal operating temperature - Refer to "SPECIFICATIONS."

Maximum operating temperature - Refer to "SPECIFICATIONS."

The operating temperature of the oil is registered as oil leaves the converter and is read on the temperature gauge on the vehicle dash. Converter "OUT" temperature check point (1, Fig. 4-4) is located on the converter outlet line going to the cooler.

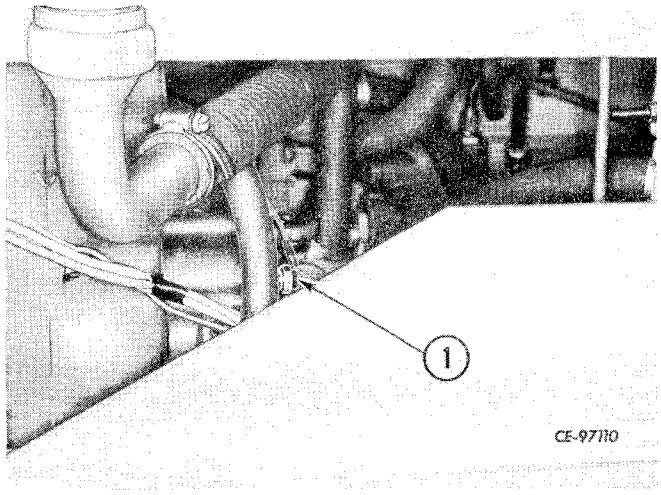

Figure 4-4

To cool the oil, shift transmission into neutral, apply parking brake and accelerate engine to 900 to 1000 rpm. The temperature of the oil should drop to a safe operating range.

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PREVENTIVE MAINTENANCE

OPERATING PRESSURES

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

Pressure checks should be made at full power stall.

Clutch Pressure at Stall:

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

b. Pressure may be read on dash gauge.

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

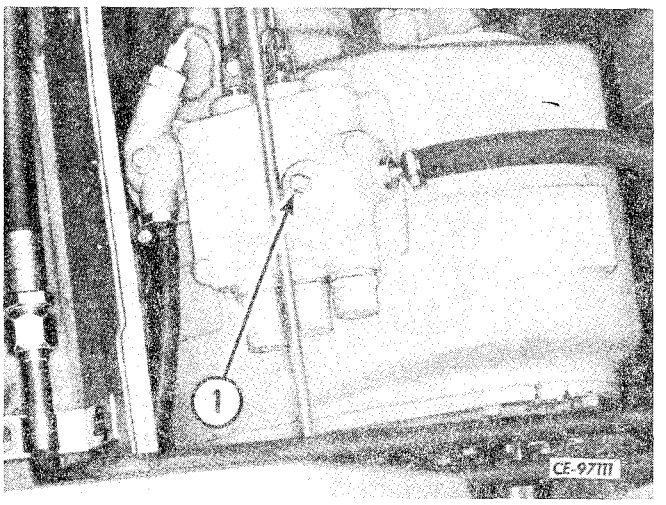

Figure 4-5

CONVERTER "OUT" PRESSURE (HIGH IDLE)

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

b. Service gauge may be attached to converter "OUT" tap (1, Fig. 4-6) on pump to valve high pressure line at the pump end.

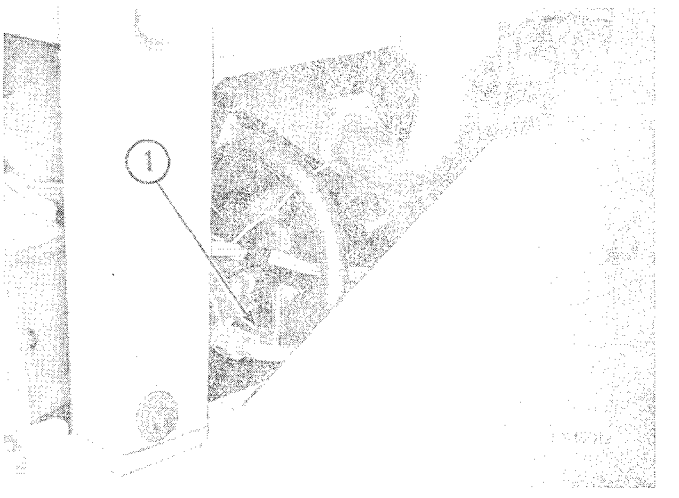

Figure 4-6

LUBE PRESSURE (HIGH IDLE)

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

b. Service gauge may be attached to lube pressure tap (1, Fig. 4-7) on oil supply cap.

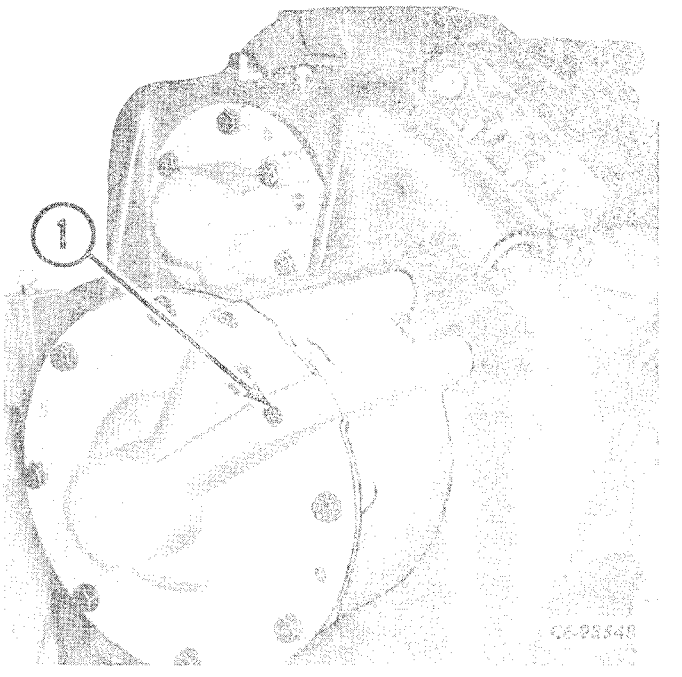

Figure 4-7

PREVENTIVE MAINTENANCE

CONVERTER STALL CHECK

Refer to TORQUE CONVERTER, SECTION III for stall check procedure.

LINKAGE ADJUSTMENT

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

NOTE: Never position between detents.

EXTERNAL LINES

All external lines should be inspected periodically for:

1. Loose fittings that allow oil or air leaks.
2. Damaged, collapsed or worn hose.

WIRING

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

DISASSEMBLY, INSPECTION AND ASSEMBLY

DISASSEMBLY PREPARATION

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

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

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

A suitable hoist.

The following tools:

a. Low bench for disassembly.

b. Mechanical gear and bearing puller set.

c. Standard set of mechanics tools.

d. Special tools (see "SPECIAL TOOLS").

e. Shop press.

REMOVAL

Drain the transmission fluid. Remove cap screws (1, Fig. 4-8) that attach rear floorboard (2) to frame.

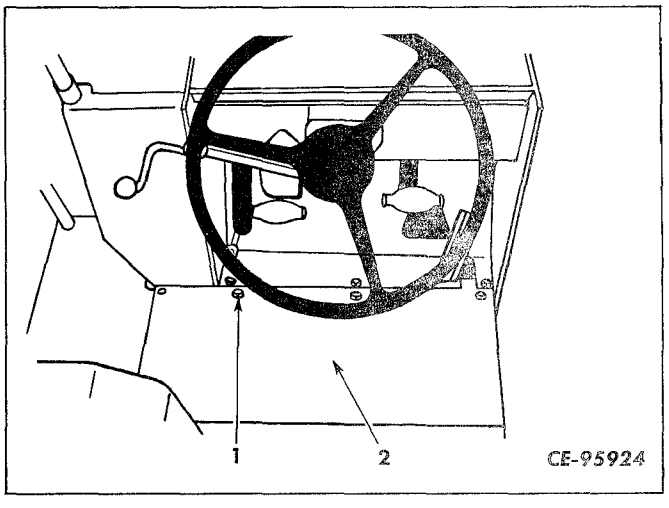

Figure 4-8

DISASSEMBLY, INSPECTION AND ASSEMBLY

Remove pedal bellcrank (2, Fig. 4-9). Refer to Section IX, "LINKAGE."

Disconnect transmission control linkage (1) from valve spools. Disconnect the main supply line (3) from valve (4). Disconnect hose (5) from lube manifold (6).

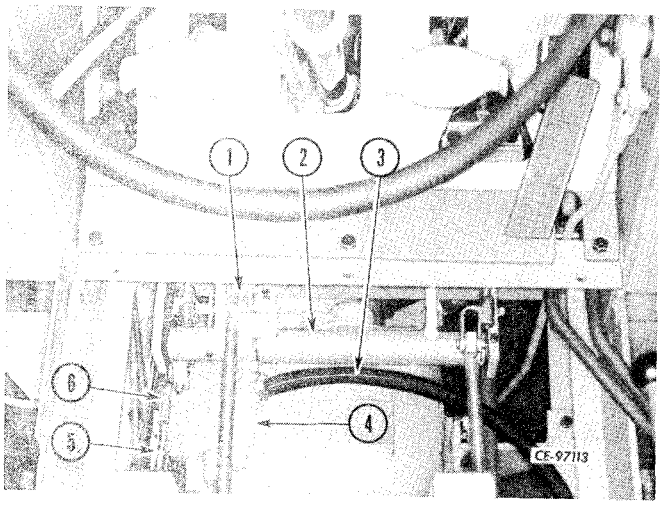

Figure 4-9

Remove torque converter-to-transmission drive shaft (1, Fig. 4-10) from torque converter.

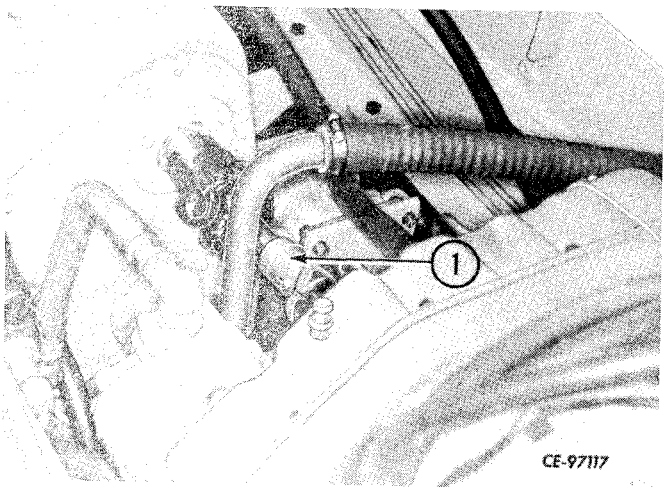

Figure 4-10

Disconnect strainer-to-pump hose (3, Fig. 4-11) at transmission. Disconnect overflow-to-transmission hose (1) at transmission.

B and R only:
Remove lower rear drive shaft (2, Fig. 4-11) from transmission.

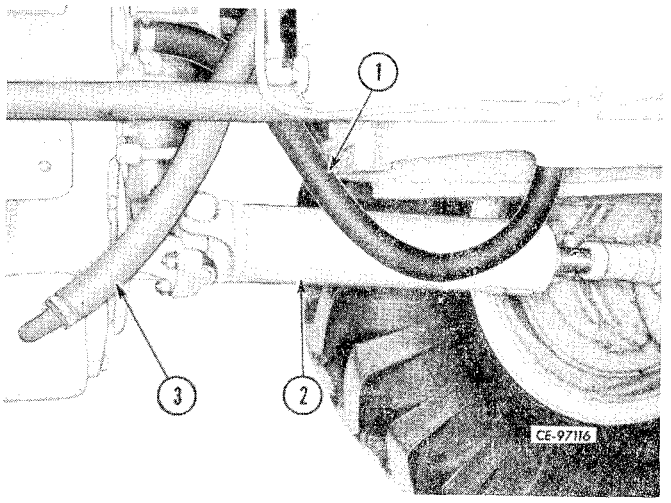

Figure 4-11

All:

Disconnect linkage (3, Fig. 4-12) from parking brake (2).

B and F only:
Remove lower front drive shaft (1, Fig. 4-12) at transmission.

(Continued on next page)

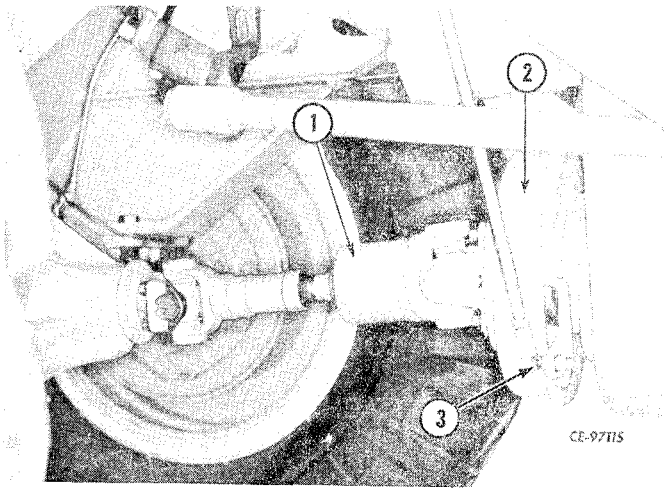

Figure 4-12

REMOVAL - Continued

B only:

Remove rear axle disconnect from right hand transmission mount (1, Fig. 4-13) by removing cotter pin and pin (3) from shifter rail (2) and bolt (4) from mount.

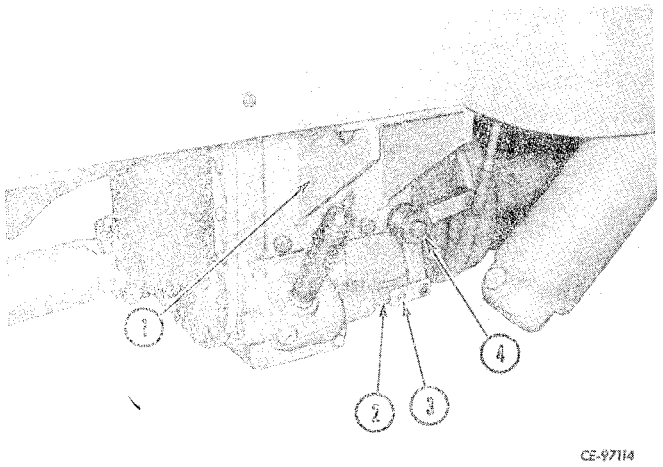

Figure 4-13

P-600 series only:

Disconnect converter-to-transmission relief valve hose (2, Fig. 4-14) from transmission (1).

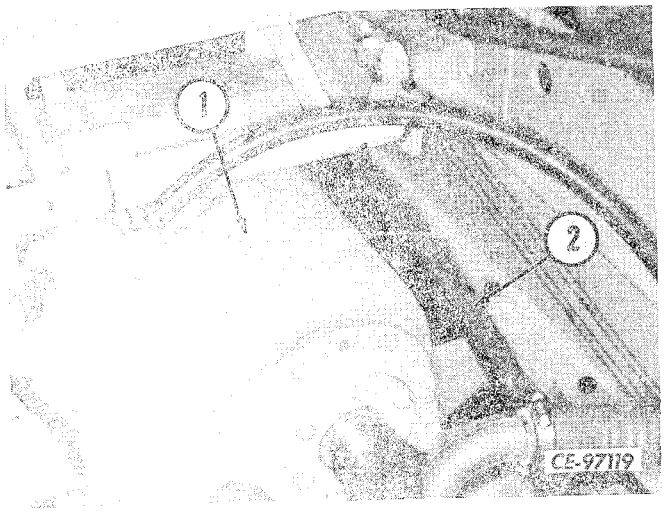

Figure 4-14

All:

Install lifting eye (2, Fig. 4-15) in tapped hole on top of transmission. Attach chain hoist (1) to eye and take up slack. Disconnect right hand and left hand transmission mounts (4) at frame, by removing cap screws (5 and 3). Lower transmission from machine and move to disassembly area.

Remove transmission mounts from transmission.

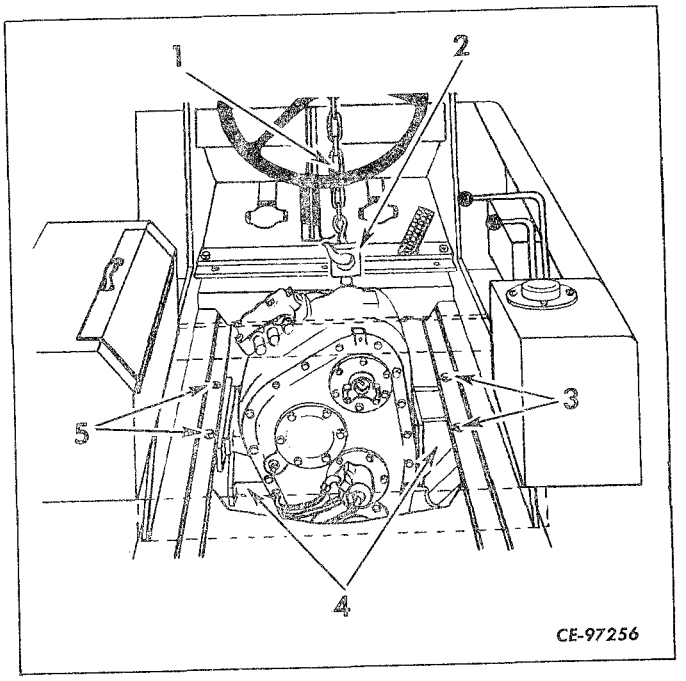

Figure 4-15

DISASSEMBLY

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

Remove the cap screws and lock washers that secure the cover (1, Fig. 4-16) to the first speed pack housing (2). Install two jack screws (3) in the tapped holes in the cover and remove the cover. Remove the "O" rings sealing main pressure and lube pressure between the cover and housing.

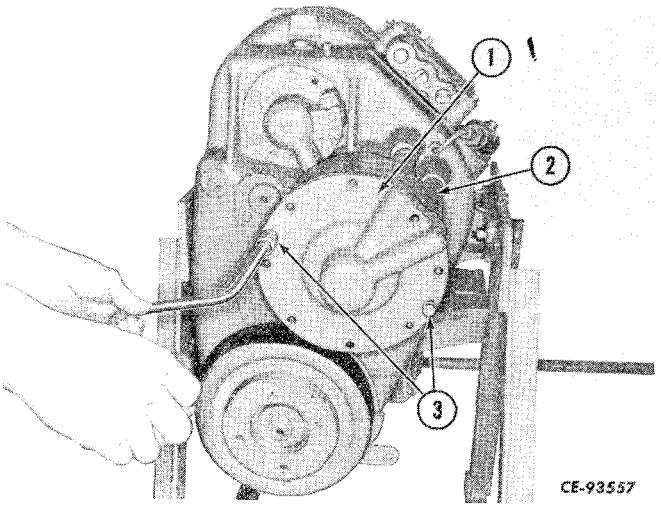

Figure 4-16

Remove the internal cap screws (2, Fig. 4-18) holding the housing (3) to the transmission case. Remove the main pressure and lube pressure "O" rings (1) from the case.

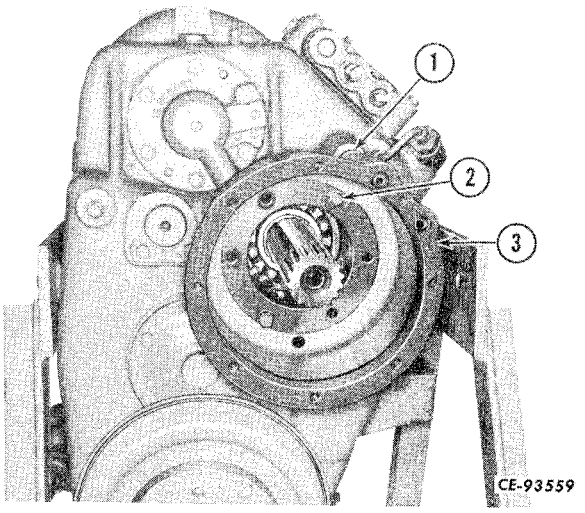

Figure 4-18

Remove the cap screw (1, Fig. 4-17) and washer (2) holding the clutch pack (4) to the countershaft. If necessary, install a cap screw in the tapped hole (3) and pry against it to remove the pack.

Refer to clutch packs.

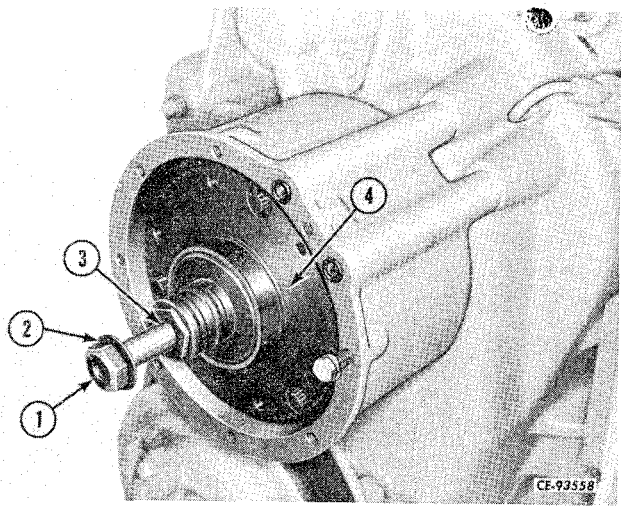

Figure 4-17

P-601 series only:

Remove the inner roller bearing (2, Fig. 4-19) and the thrust washer assembly (1) from the shaft (3).

(Continued on next page)

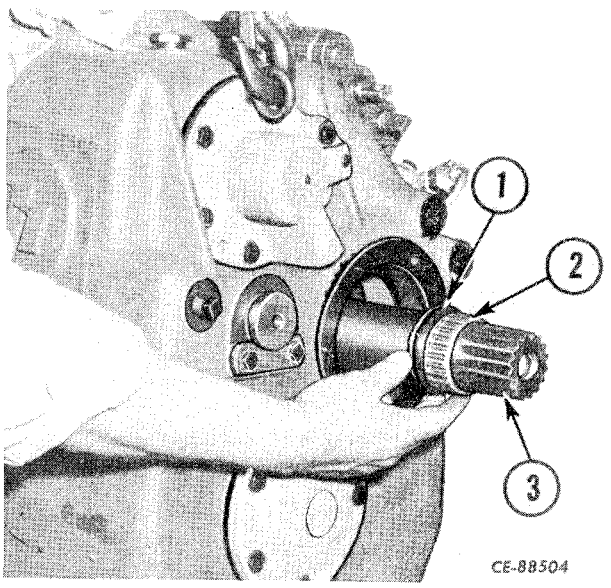

Figure 4-19

DISASSEMBLY, INSPECTION AND ASSEMBLY

DISASSEMBLY - Continued

All:

Hold the output flange and brake drum assembly (1, Fig. 4-20) and remove the hex nut (2) and flat washer (3). Remove the output flange and brake drum assembly (use a puller if necessary).

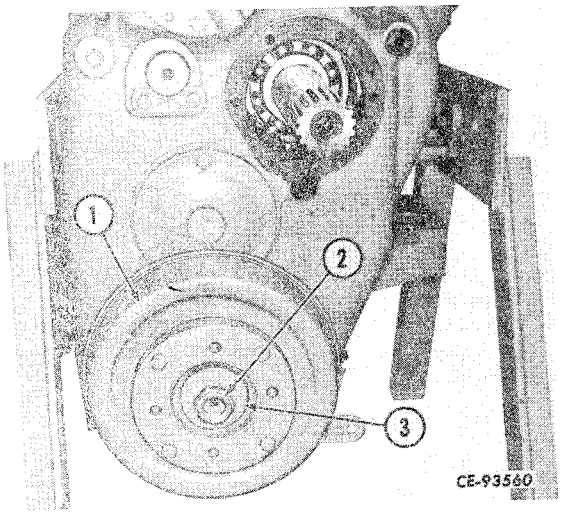

Figure 4-20

Remove brake shoe springs (1, Fig. 4-21) and shoes (3). Remove lever (2) from backing plate (4).

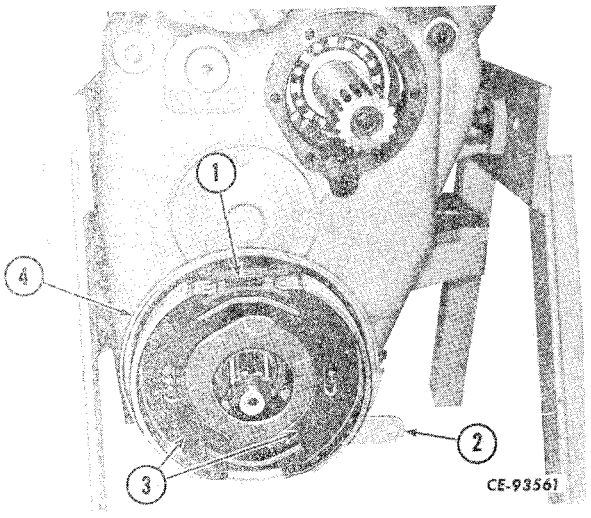

Figure 4-21

Remove cap screws (1, Fig. 4-22) that secure backing plate (2) to transmission. Remove backing plate.

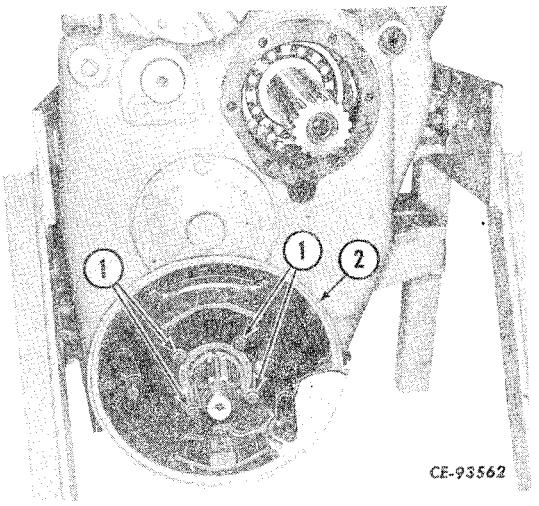

Figure 4-22

Remove the cap screws that hold reverse idler shaft lock (3, Fig. 4-23) in place. Remove the lock. Remove cap screws (2) that secure forward and reverse oil supply cover (1). Use cap screws in jack screw holes to remove cover.

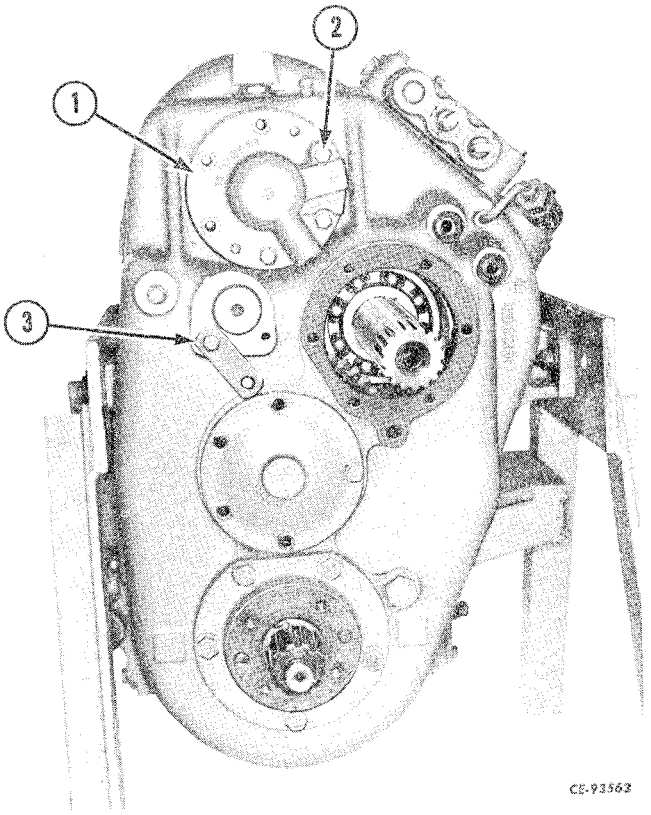

Figure 4-23

DISASSEMBLY, INSPECTION AND ASSEMBLY

Remove cap screws that secure 2nd and 3rd speed cover (1, Fig. 4-24) to housing. Remove cover. Remove retaining ring (2) from output shaft. Remove cap screws (3) that secure front bearing retainer cap (4) to housing. Remove cap.

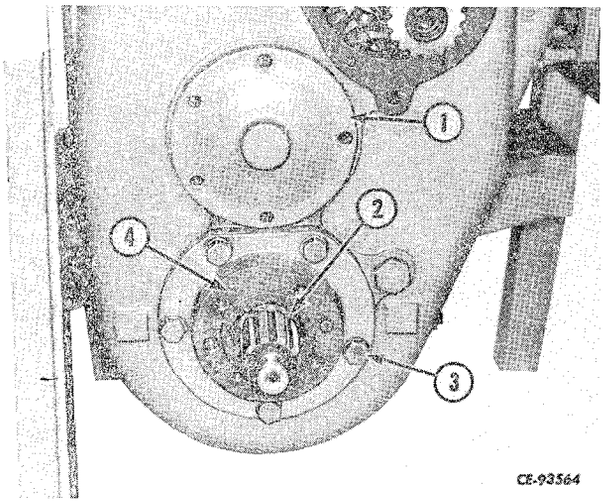

Figure 4-24

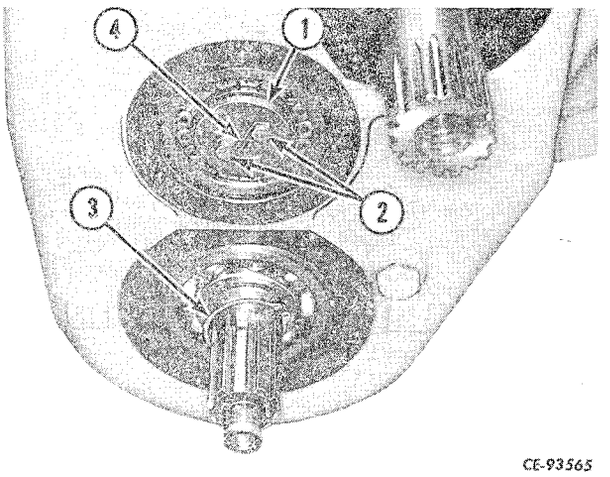

Figure 4-25

P-600 series only:
Remove retaining washer (1, Fig. 4-25) from 2nd and 3rd speed shaft by removing lock wire (4) and cap screws (2). Remove retaining ring (3) from output shaft.

P-601 series only:
Remove retaining ring from 2nd and 3rd speed shaft.

B only:
Remove shifter housing (2, Fig. 4-26) from transmission by removing cap screws (1).

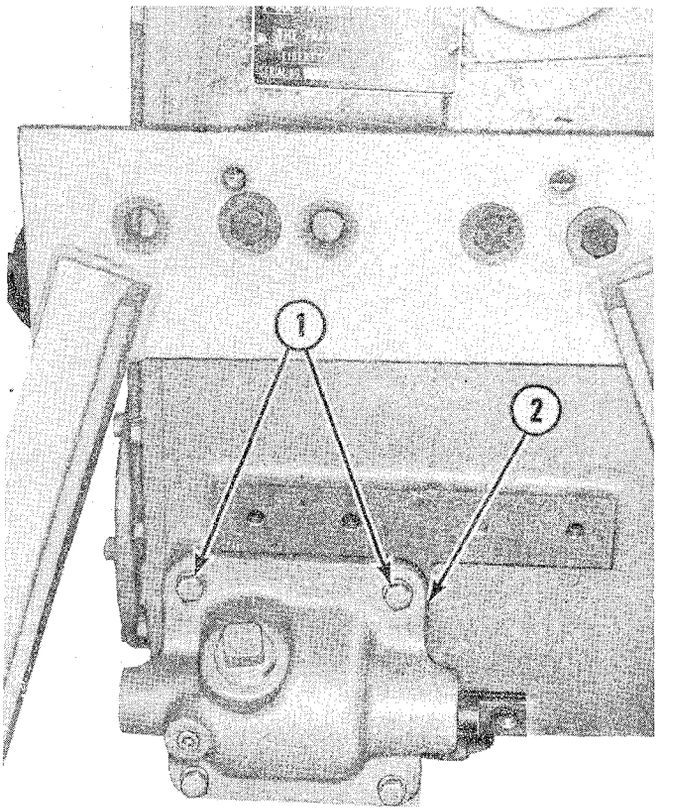

Figure 4-26

All:
Place transmission in stand (see "SPECIAL TOOLS") so the cover end is up. Remove the suction strainer retainer (3, Fig. 4-27) gasket (1) and strainer (2).

(Continued on next page)

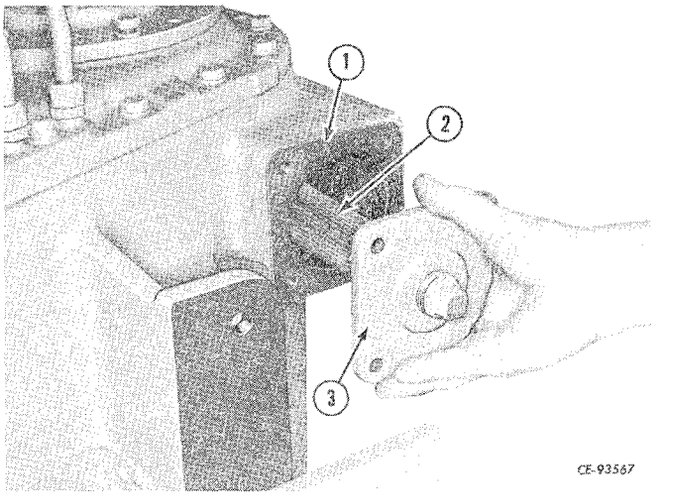

Figure 4-27

DISASSEMBLY - Continued

B only:
Remove the cap screws and lock washers (2, Fig. 4-28) that secure rear output cap and shaft assembly (1) to housing (3). Use cap screws in jack screw holes to remove assembly and sliding clutch.

NOTE: R ONLY.

Remove yoke first followed by retainer as they are separate parts.

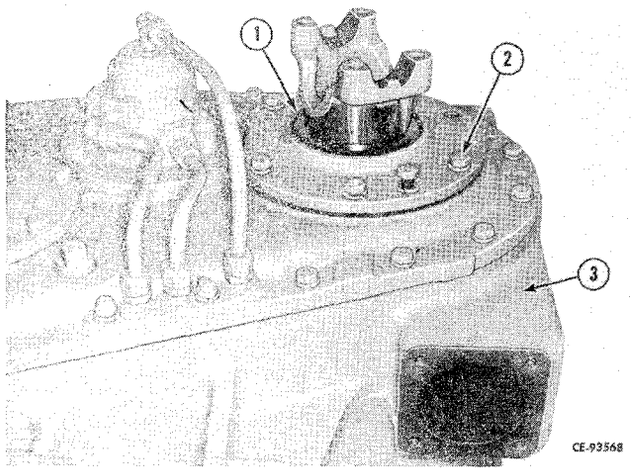

Figure 4-28

All:
Remove the input yoke lock nut (3, Fig. 4-29), washer (4) and "O" ring (2). Remove the input yoke (5) from the countershaft (1). Remove the snap ring (6).

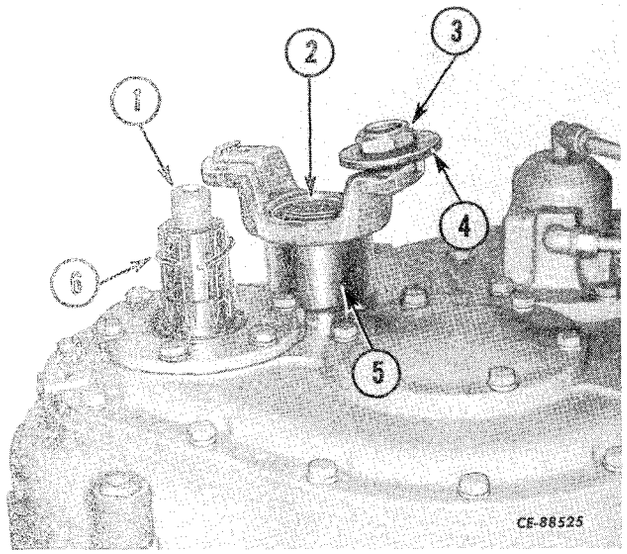

Figure 4-29

Remove the 2nd and 3rd speed manifold (3, Fig. 4-30) with lube lines. Remove the countershaft cap (2) and the input shaft seal retainer (1). Remove the gaskets (4).

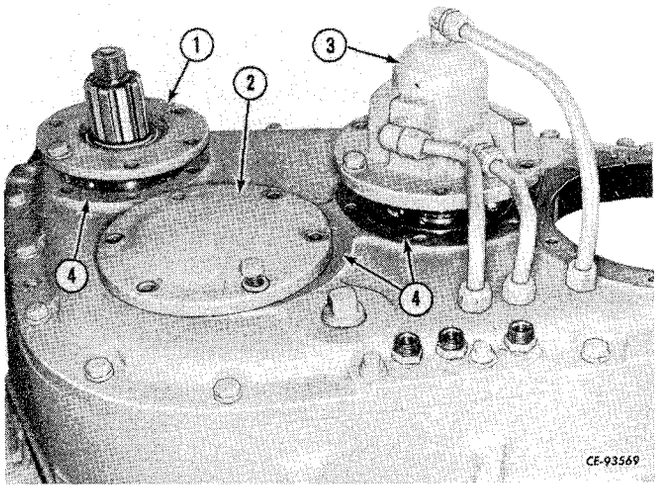

Figure 4-30

Remove the snap rings (1, Fig. 4-31) from the bearings on the input and countershaft. Remove the cover cap screws and lock washers (4). Install 3 of the cap screws (2) in the jack screw holes provided in the cover (3). Remove the cover and cover gasket.

Remove the lock wire (5) and cap screws (6) that secure end plate (7) to countershaft.

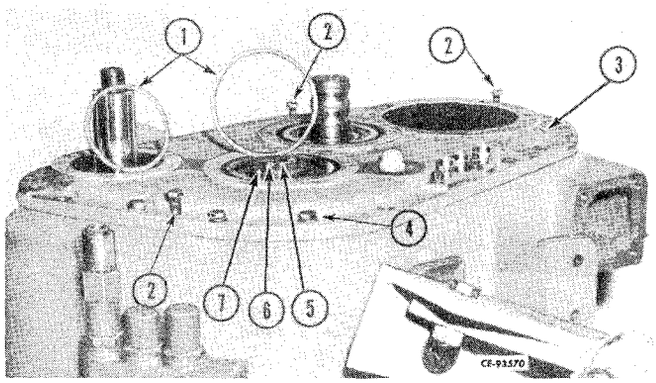

Figure 4-31

DISASSEMBLY, INSPECTION AND ASSEMBLY

With a suitable bearing puller (1, Fig. 4-32), remove the bearing (2) from the countershaft.

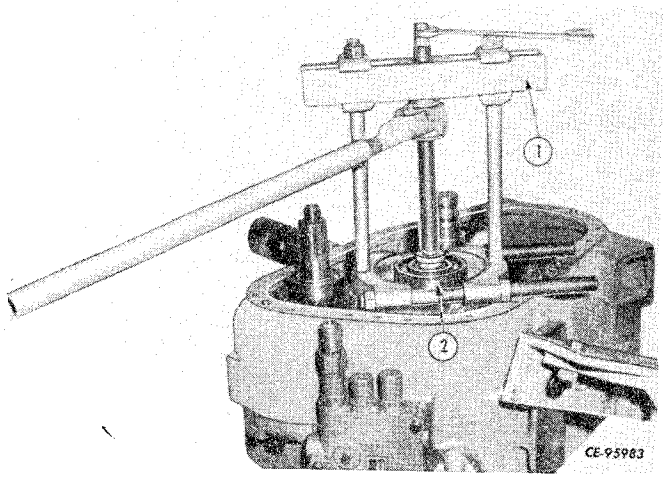

Figure 4-32

Remove the forward driven gear (1, Fig. 4-33) and the spacer (2) from the countershaft.

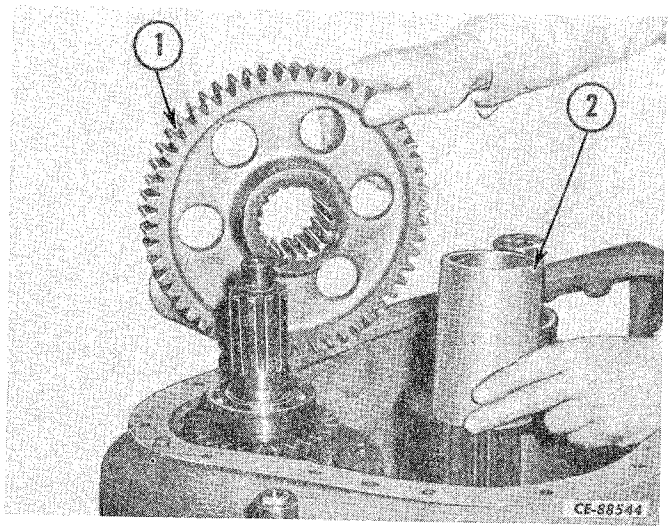

Figure 4-33

Using a drift as shown, remove the reverse idler shaft (1, Fig. 4-34). Use care to prevent the shaft from falling to the floor.

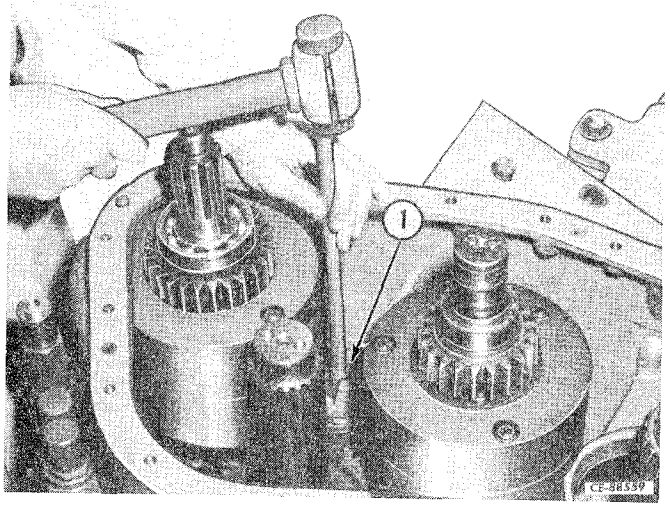

Figure 4-34

Remove the forward and reverse clutch pack assembly (Fig. 4-35).

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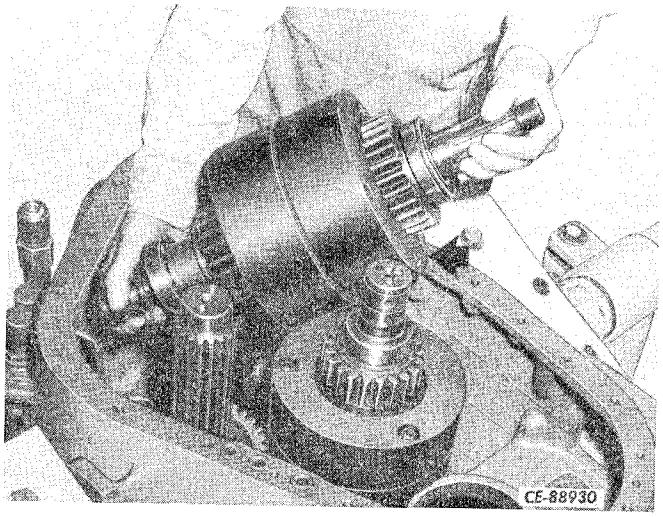

Figure 4-35

DISASSEMBLY - Continued

P-601 series only:

Remove the reverse idler gear (1, Fig. 4-36) and bearing assembly (2).

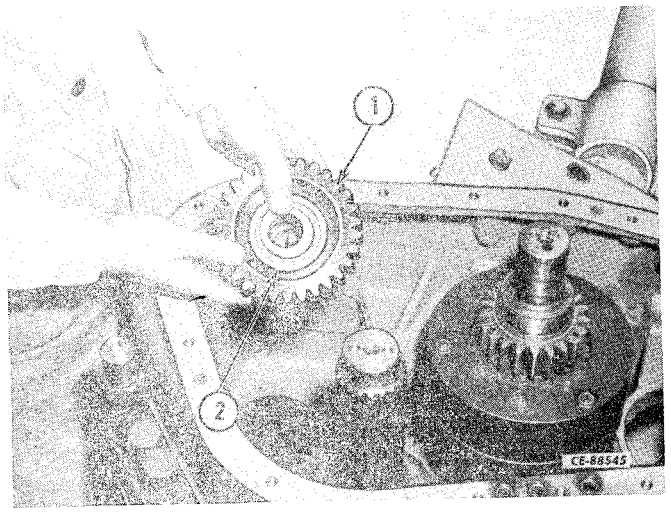

Figure 4-36

P-600 series only:

Remove the reverse idler gear (1, Fig. 4-37) roller bearing (2) and washers (3).

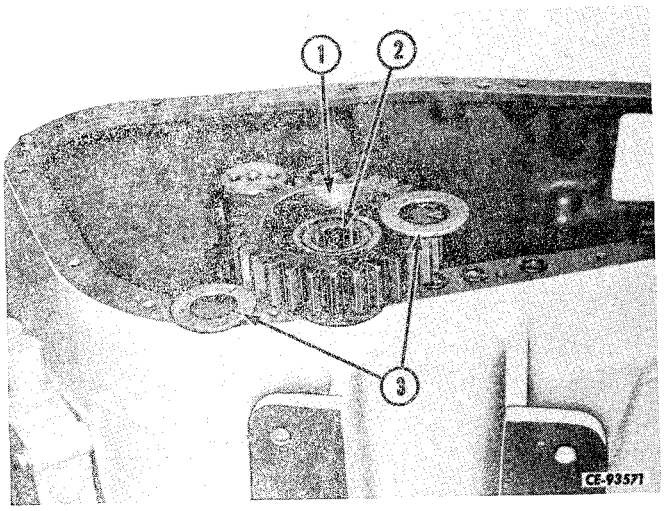

Figure 4-37

All:

To remove the 2nd and 3rd speed pack (1, Fig. 4-38), place a jack under the pack shaft. Raise the jack until one leg of the stand is about 1-1/2" off the floor. Drive down on the large first speed driven gear with a drift and mallet to free the shaft from lower bearing.

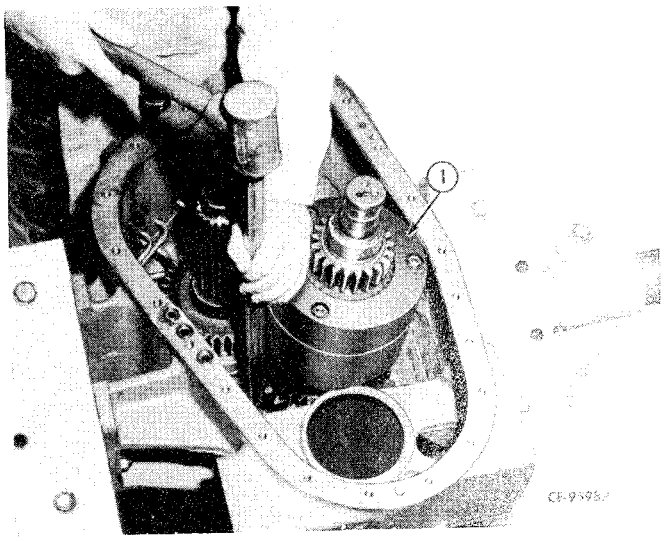

Figure 4-38

Tilt the 2nd and 3rd speed pack (1, Fig. 4-39) toward the bottom of the transmission and remove the reverse driven gear (2) from the countershaft.

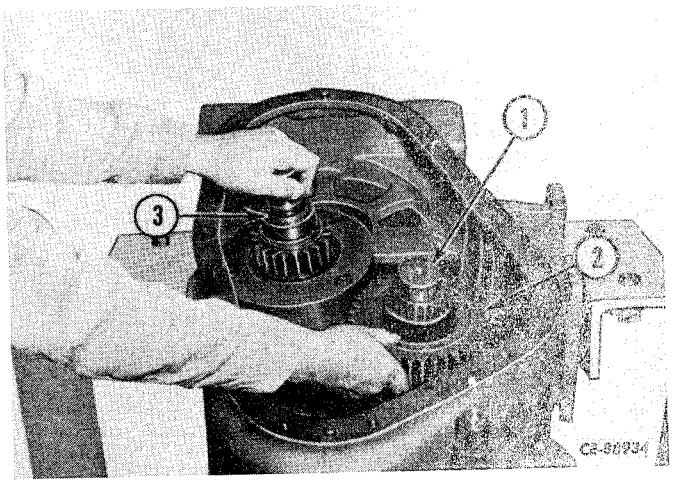

Figure 4-39

Remove the 2nd and 3rd speed pack (1, Fig. 4-40) with the 2nd speed drive gear (2) and the output drive gear (3). Refer to clutch packs.

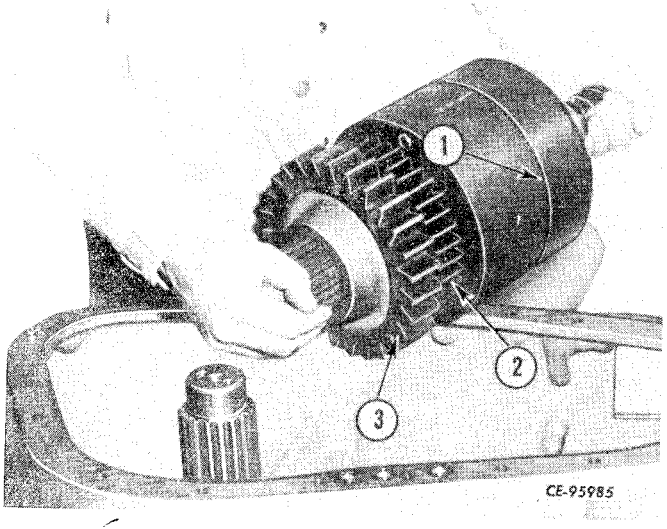

Figure 4-40

Remove the first speed driven gear from the transmission housing (Fig. 4-41).

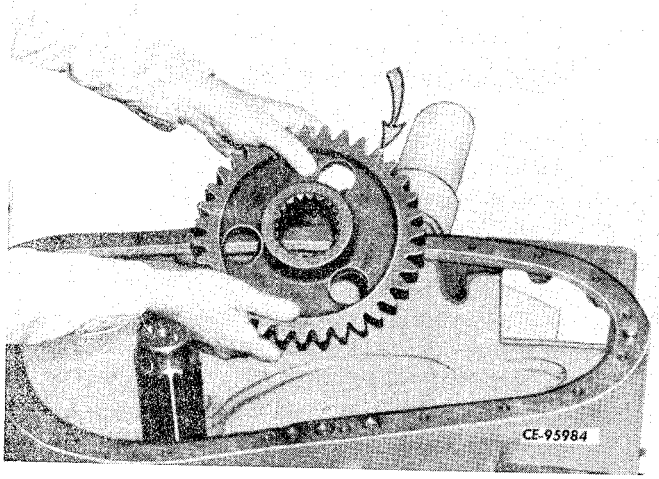

Figure 4-41

B and F only:

Place a jack under the output shaft (2, Fig. 4-42) and raise until one leg of stand is off the floor. Tap the transmission case with a mallet to free output shaft bearing from the housing. Remove output shaft with bearing (3) and roller bearing (1).

NOTE: F units
F units are not equipped with roller bearing (1, Fig. 4-42).

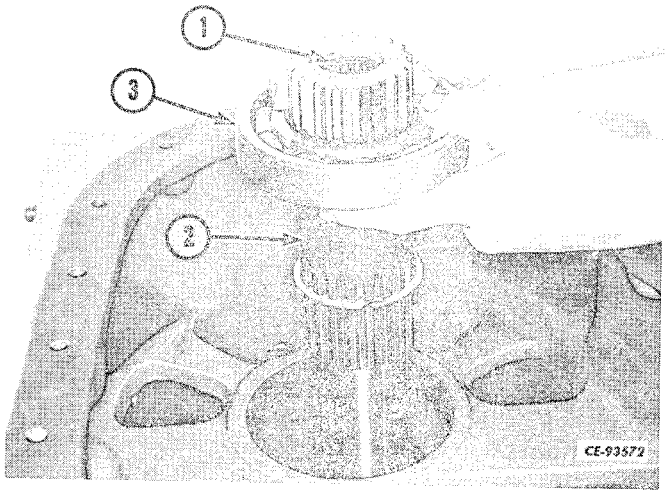

Figure 4-42

All:
Remove gear (1, Fig. 4-43) and spacer (2) from housing.

Drive bearing out of housing end using a drift and mallet.

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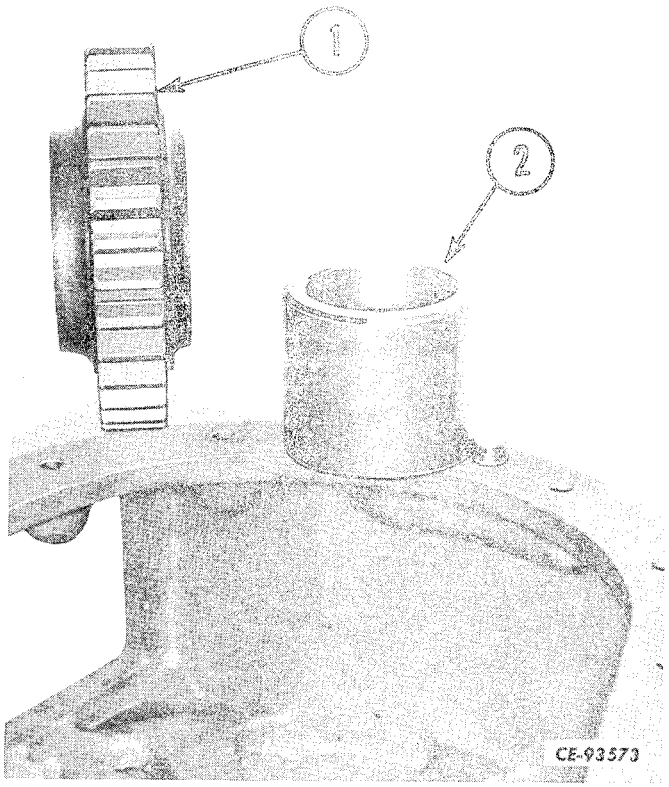

Figure 4-43

DISASSEMBLY - Continued

Place a jack (2, Fig. 4-44) under the countershaft (1) and raise until one leg of the stand is off the floor. Tap the transmission case with a mallet to free the countershaft bearing from the case.

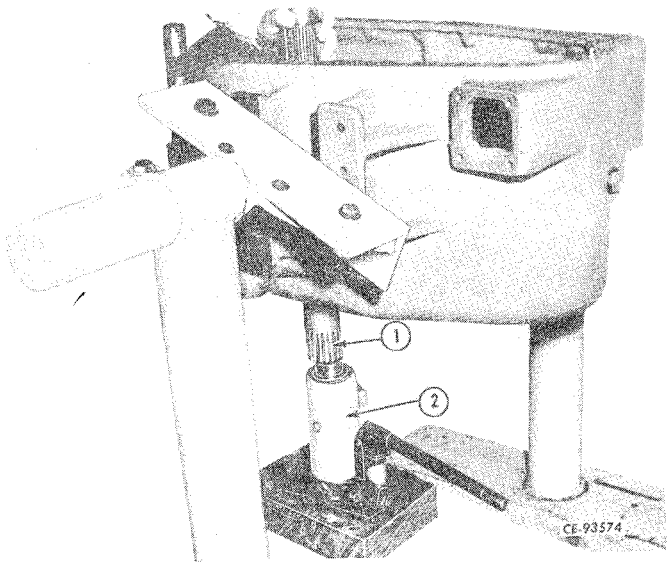

Figure 4-44

Remove the countershaft (1, Fig. 4-45) with bearing (2) from the transmission case.

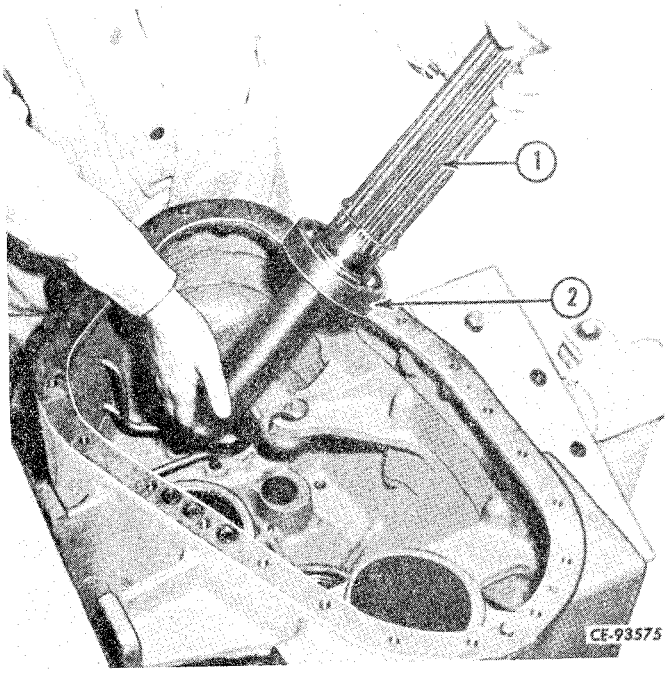

Figure 4-45

Remove the cap screws (2, Fig. 4-46) that secure the main control valve (1) and lube manifold (3) to the transmission case. Remove the valve and manifold. Refer to "CONTROL VALVE."

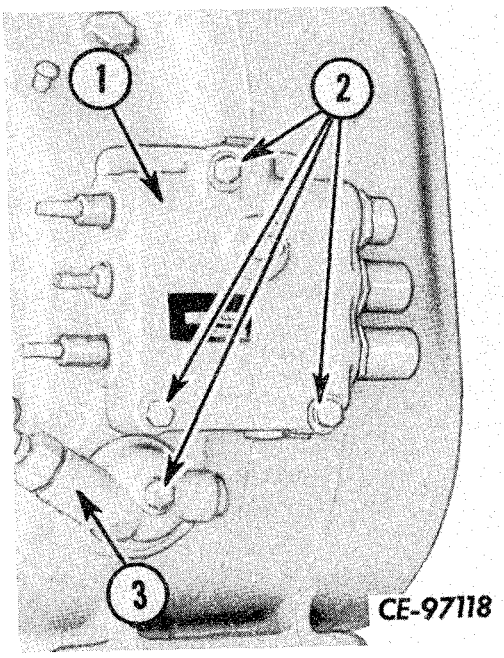

Figure 4-46

The oil supply tubes in the transmission are secured at each end in a bushing (4, Fig. 4-47). There is a gasket (1) under the bushing and an "O" ring (2) around the tube (3). If any of the tubes are damaged, they should be replaced. Install the new tube thru the bushing and expand the tube end with a large center punch to prevent pressure from pushing the tube out.

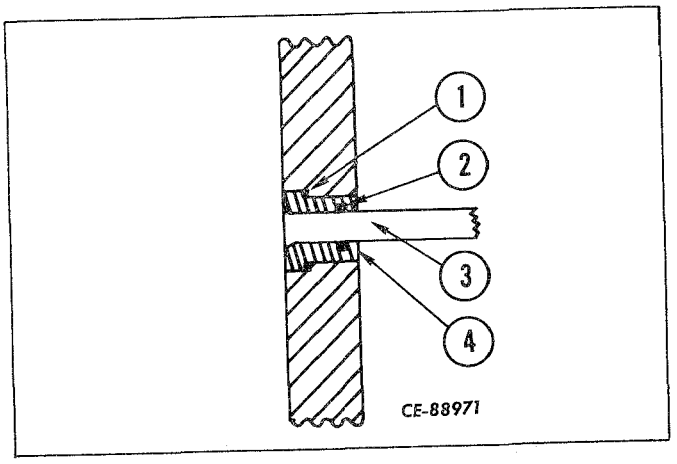

Figure 4-47

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NOTE: To replace some tubes, it may be necessary to remove other tubes due to forming bends and lack of flexibility in the tube. Follow the sequence shown for all tube replacement. (Fig. 4-48).

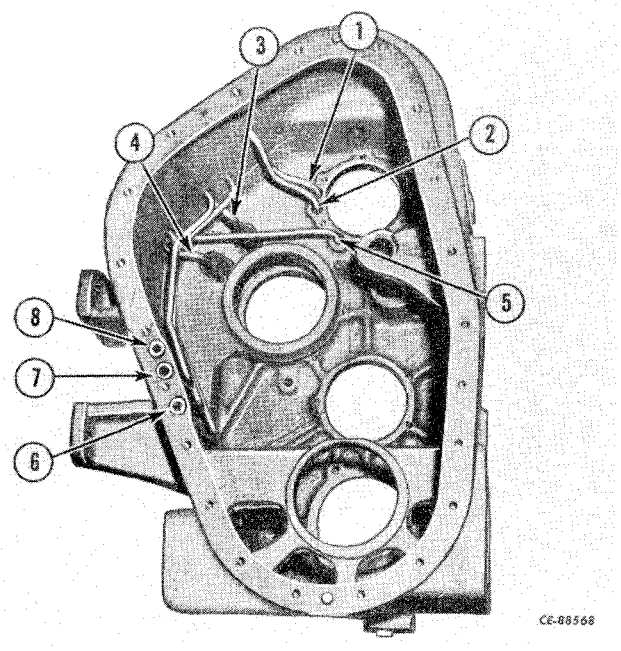

Figure 4-48

Inspect the output shaft (1, Fig. 4-49) and bearing (2) for wear or damage. If replacement of either part is necessary, press the bearing off the shaft.

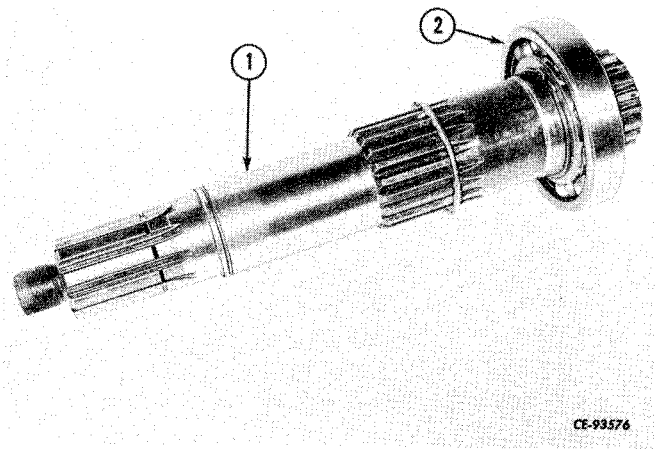

Figure 4-49

NOTE: R units
R units have a one piece, full length output shaft.

Inspect the countershaft (1, Fig. 4-50) and bearing (2) for signs of wear or damage. If either parts require replacement, remove the bearing retaining ring (3) and press the shaft out of the bearing.

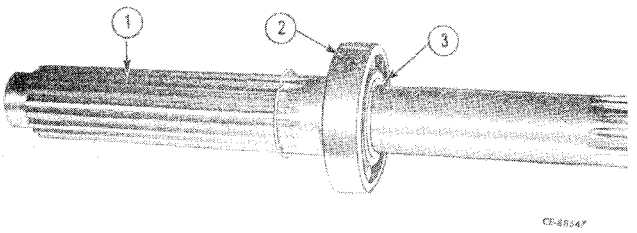

Figure 4-50

P-600 series only:

Inspect the reverse idler gear (2, Fig. 4-51) and roller bearing (1) for wear or damage. Replace if necessary.

(Continued on next page)

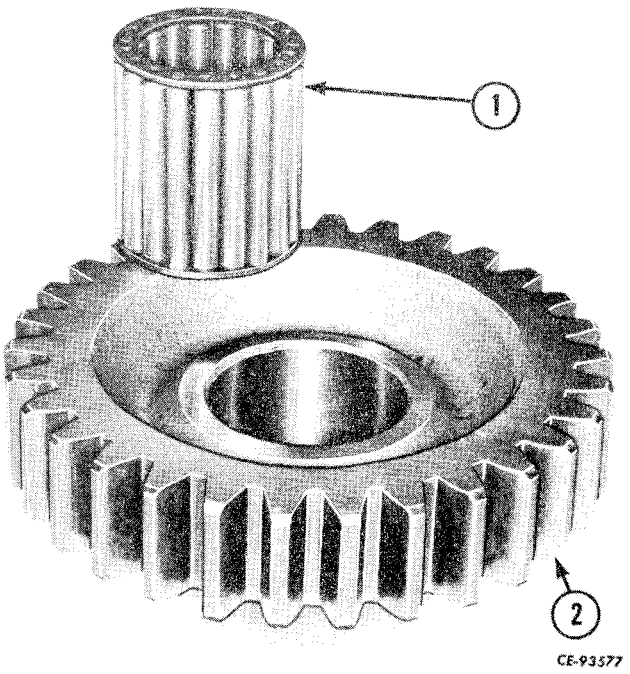

Figure 4-51

DISASSEMBLY - Continued

P-601 series only:

Inspect the reverse idler gear (1) and bearing (2, Fig. 4-52) assembly for wear or damage. If any parts must be replaced, disassemble the assembly as described below.

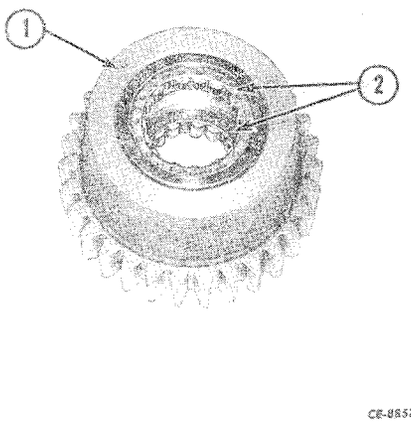

Figure 4-52

Use a soft metal drift to tap the gear side bearing out of the idler gear (Fig. 4-53).

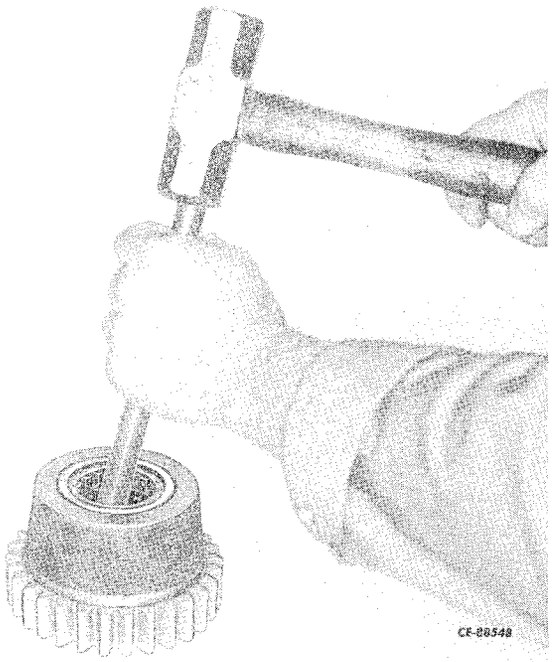

Figure 4-53

Remove the bearing retaining rings (1, Fig. 4-54) from the grooves in the inside of the idler gear (2).

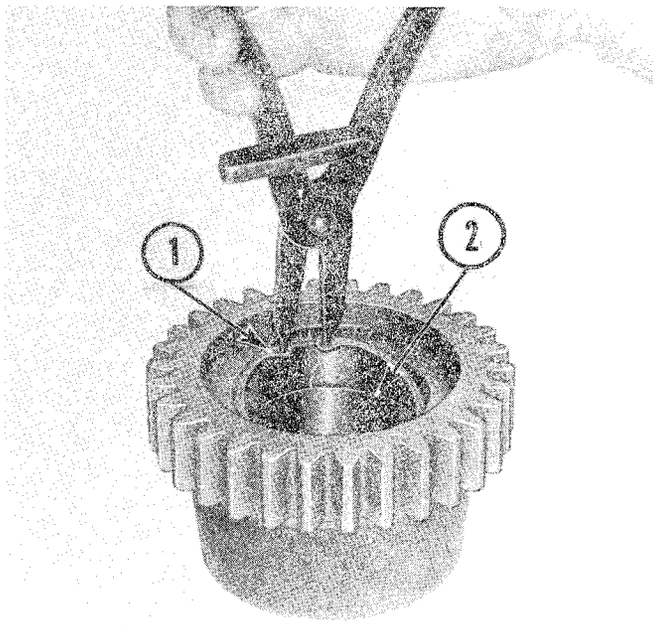

Figure 4-54

Press the opposite bearing out of the idler gear with a shop press as shown (Fig. 4-55).

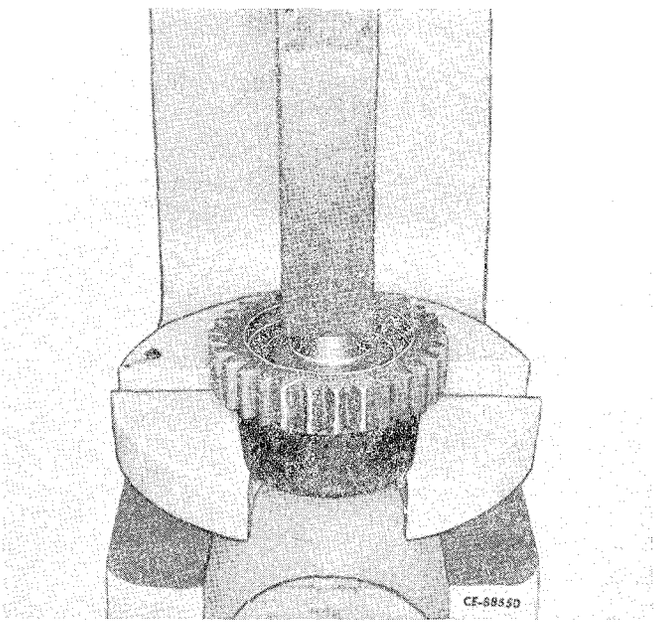

Figure 4-55

All:

Press the oil seals out of the input shaft cap and the output shaft cap as shown (Fig. 4-56).

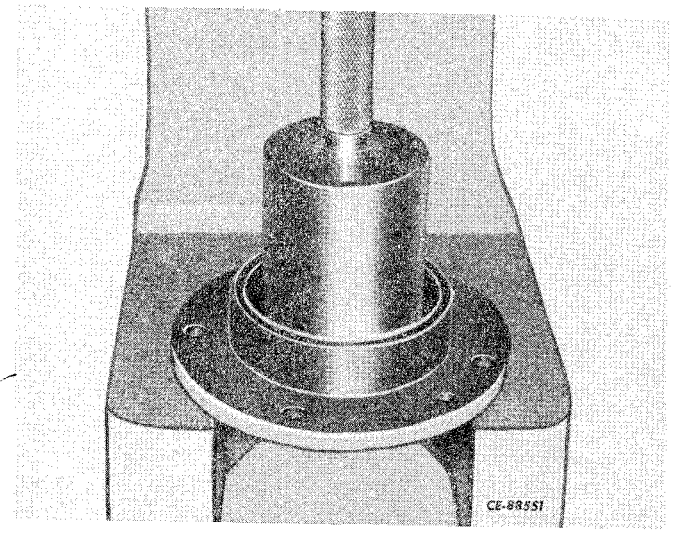

Figure 4-56

B units only:

Disassemble rear output shaft assembly (Fig. 4-57) in numerical order.

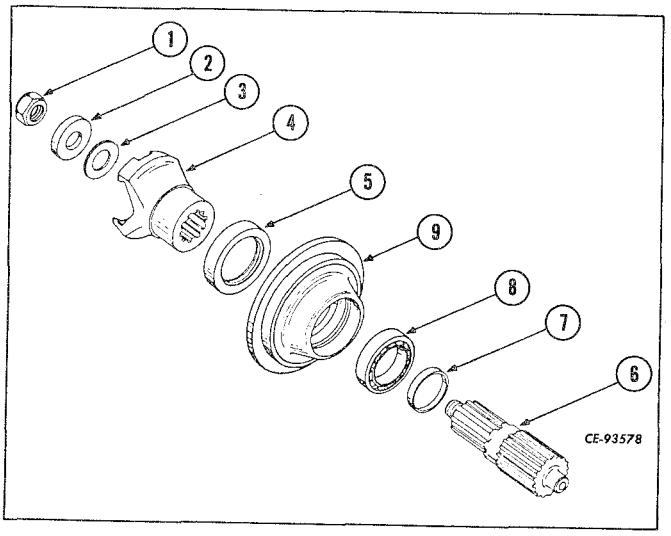

Figure 4-57

Replace item 5.

Assemble in reverse order.

Torque item 1 (refer to "SPECIAL TORQUES").

Torque:_____

CLEAN, INSPECT AND REPAIR

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

a. Cleaning all parts thoroughly in solvent or plain steam. (Do not use caustic soda). Use compressed air to dry parts. If steam is used to clean parts, oil immediately thereafter. Carefully inspect all parts for excessive wear, cracks and for breakage.

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

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

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

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

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

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

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

Press a new oil seal (1, Fig. 4-58) into the housing end output shaft cap (2) with the lip of the seal toward the bearing in the housing. Press the seal to the depth shown.

Press a new oil seal into the input shaft cap flush with the outside surface of the cap.

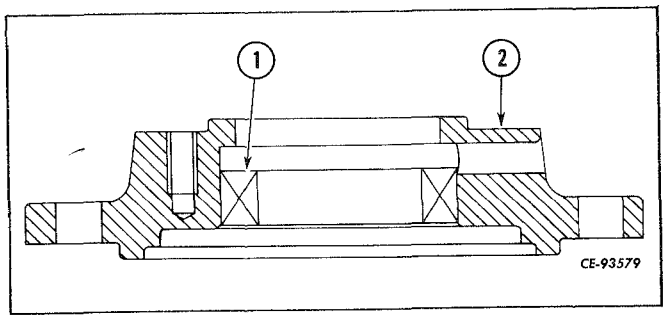

Figure 4-58

P-601 series only:

Install the bearing retaining rings (1, Fig. 4-59) in the grooves in the reverse idler gear (2).

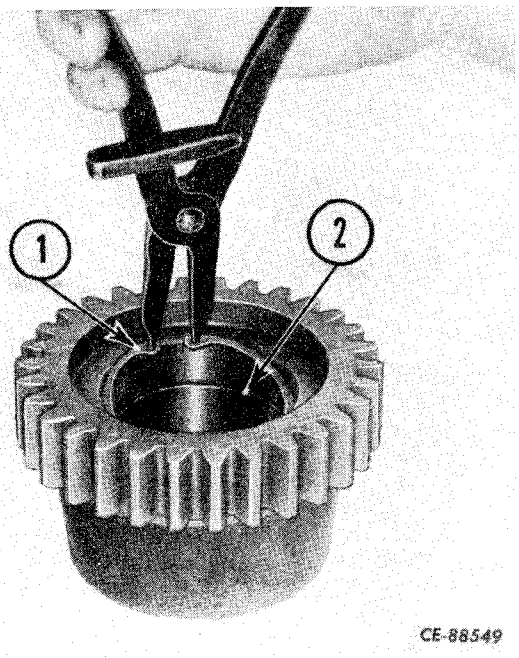

Figure 4-59

Press the bearings (1, Fig. 4-60) into the idler gear (2) until they bottom against the retaining rings.

P-600 series only:

Press roller bearing into the idler gear until it is flush with outside surface of gear.

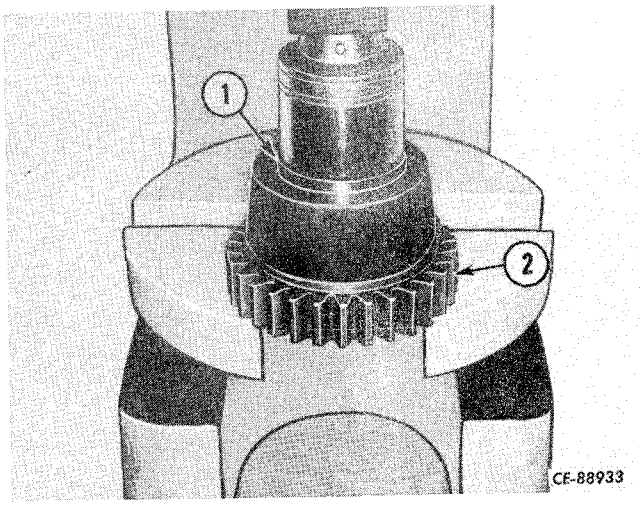

Figure 4-60

All:

If the bearing (1, Fig. 4-61) was removed from the countershaft (2) press a new bearing into the shaft. Install the bearing retaining rings in the grooves in the shaft.

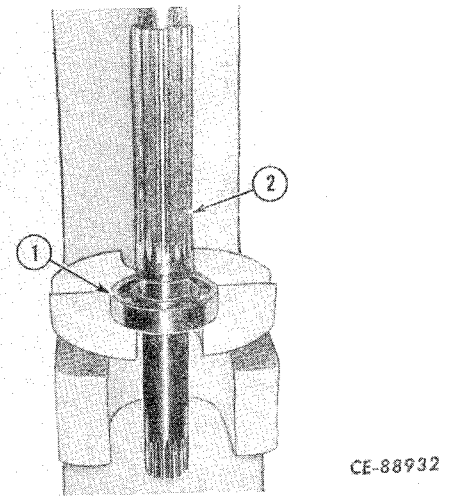

Figure 4-61

If the bearing (2, Fig. 4-62) was removed from the output shaft (1), press the bearing into the shaft until it seats against the retaining ring (3) on the shaft. Install remaining retaining ring.

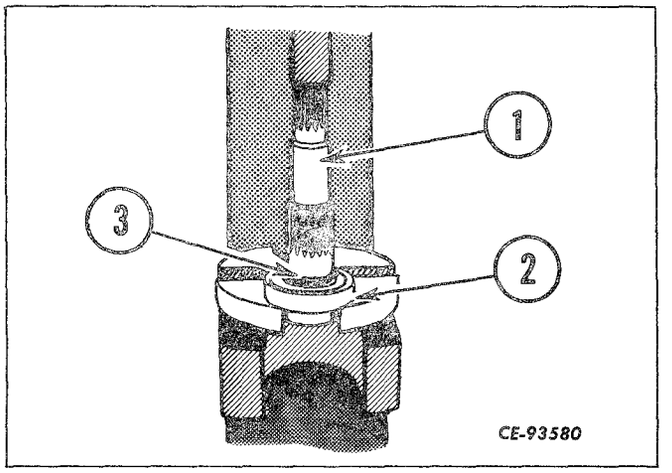

Figure 4-62

Install the main control valve, (1, Fig. 4-63) on the transmission and secure it with cap screws (2). Be certain to install new "O" rings at the pressure ports between the valve and the housing. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

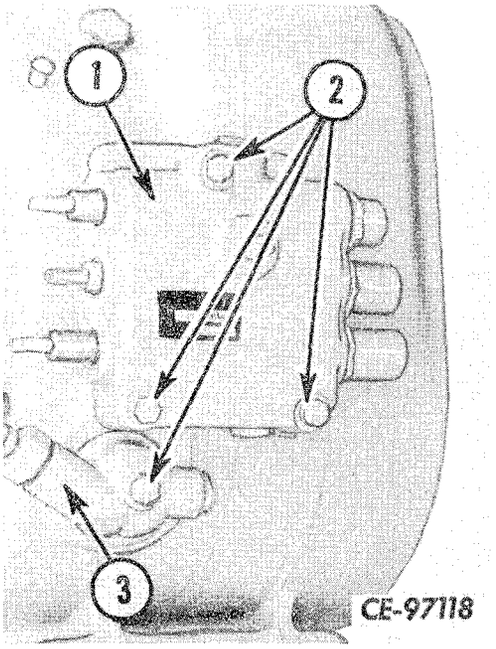

Figure 4-63

Install the lube manifold (3) and tighten the cap screw (2) to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Place the output driven gear in position in the housing with the ring groove toward the cover (upward) (Fig. 4-64).

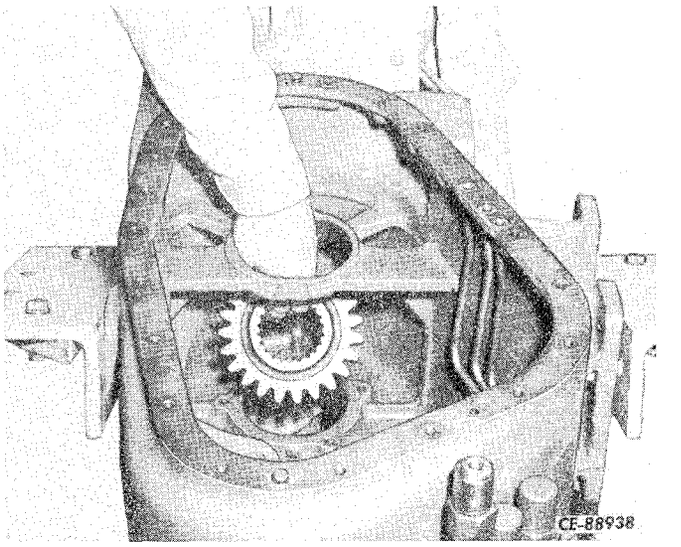

Figure 4-64

Install the 2nd and 3rd speed pack assembly (1, Fig. 4-65) with all gears on the shaft, but without the bottom bearing on the shaft (bearing will be installed later). Hold lower gear (2) from sliding on the shaft while tipping assembly to clear the internal structure of the case.

(Continued on next page)

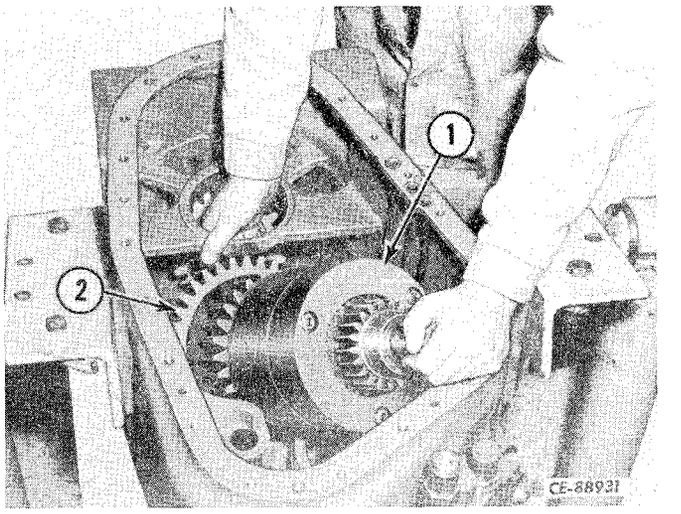

Figure 4-65

ASSEMBLY - Continued

Install the countershaft (1, Fig. 4-66) and bearing (2) in housing and bearing bore (3). Use a soft mallet to carefully drive the shaft down until bearing is flush with bearing bore. The snap ring (4) will locate the reverse driven gear in proper position.

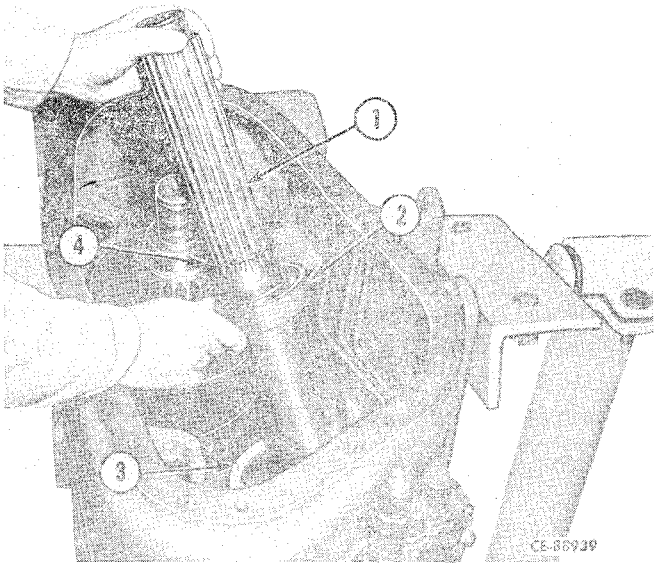

Figure 4-66

Install the reverse driven gear (2, Fig. 4-67) on the countershaft (1) with counterbore in gear hub to index with snap ring on countershaft. Tilt the 2nd and 3rd clutch pack (3) away from the countershaft while installing gear.

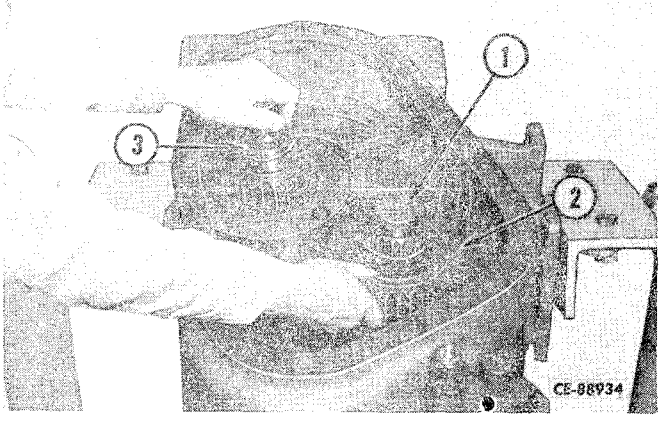

Figure 4-67

P-600 series only:

Start reverse idler shaft part way up from bottom of housing. Place one washer (3, Fig. 4-68) on shaft with grooves up (toward gear). Install reverse idler gear (1) with roller bearing (2) over washer and shaft with gear end up. Position the other washer (3) on top of gear with grooves down (toward gear).

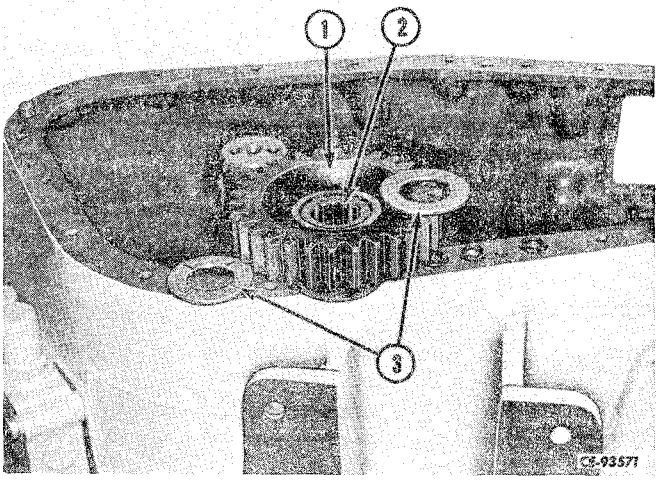

Figure 4-68

P-601 series only:

Place a bearing race (3, Fig. 4-69) in the hub side of the reverse idler gear assembly (1). Position the reverse idler gear in the trans-

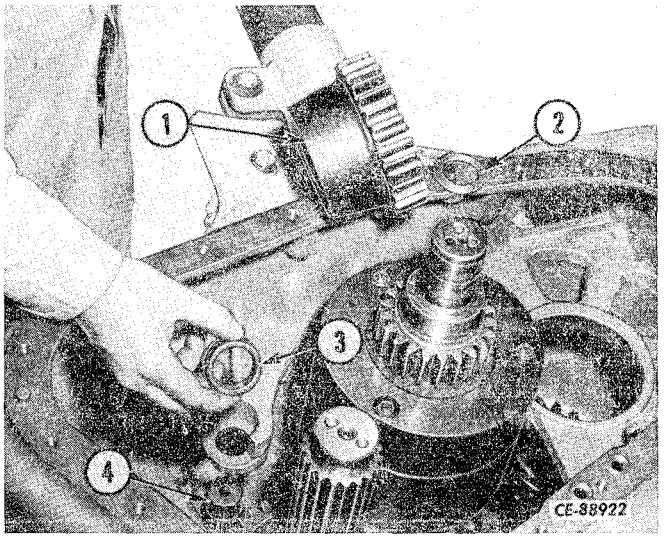

Figure 4-69

mission with the gear end up. Install the gear and bearing race. Position the spacer (2) on top of the gear assembly. The reverse idler shaft (4) with "O" ring in place can now be started up through idler gear assembly.

All:

Partially install the reverse idler shaft (1, Fig. 4-70). Use a soft mallet to drive shaft.

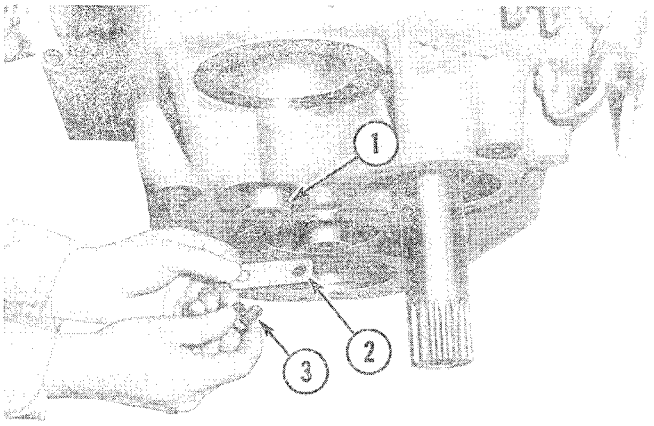

Figure 4-70

Do not drive shaft flush at this time as it may interfere with forward and reverse pack installation. Tap shaft in just far enough to allow the lock plate (2) to be installed with a one or two thread pick-up on the cap screws (3).

Install forward and reverse pack assembly complete with bearings, but less shaft seal rings. Start seal end of assembly in first (Fig. 4-71).

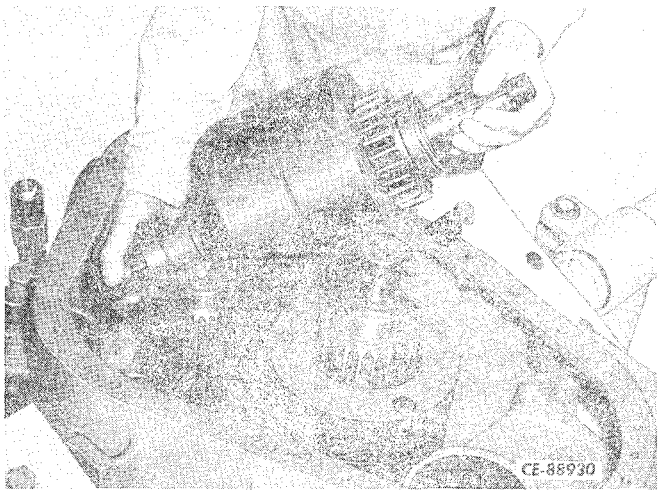

Figure 4-71

Install the spacer (2, Fig. 4-72) and the forward driven gear (1) on the countershaft (3). The extended hub side of the gear should be toward the spacer.

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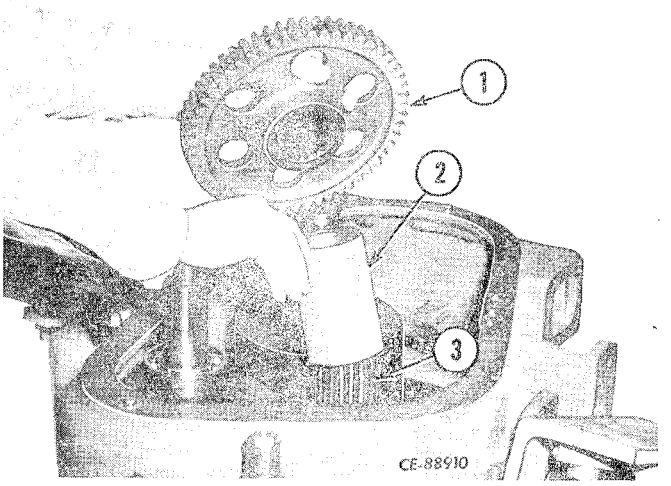

Figure 4-72

ASSEMBLY - Continued

Heat the countershaft cover bearing (1, Fig. 4-73) in an oven or hot oil to approximately 250°F. Install the bearing on the countershaft with the snap ring groove up. Install the end plate (3) and cap screws (2). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Lockwire cap screws.

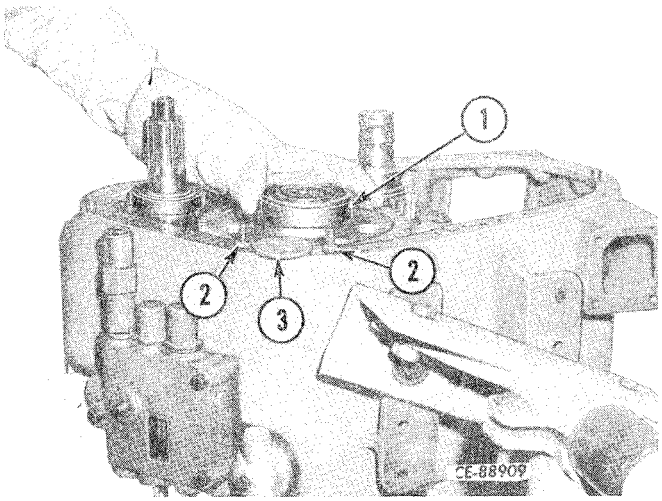

Figure 4-73

B and F units only:

Install output shaft (2, Fig. 4-74) with bearing (3) through driven gear in housing.

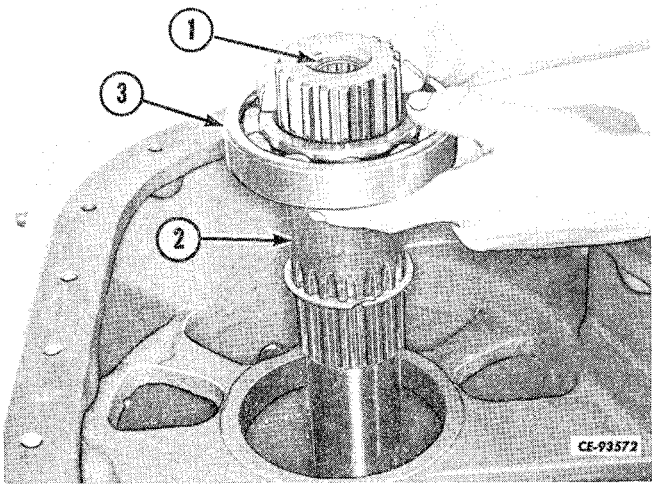

Figure 4-74

B units only:

Install roller bearing (1, Fig. 4-74) in top of shaft.

B and F units only:

After shaft has been installed, place sliding clutch in position on top of shaft.

NOTE: R units
R units have a one piece, full length output shaft.

All:

Install the cover gasket (3, Fig. 4-75) and "O" rings (2) at pressure ports. Place the cover (1) in position and tap in place with a soft mallet. Install cap screws and tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

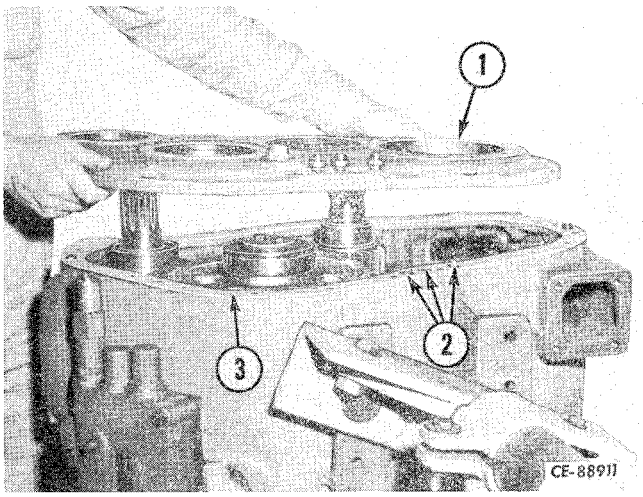

Figure 4-75

Install the input shaft bearing snap ring (1, Fig. 4-76) and the countershaft bearing snap ring (2). Install the 2nd and 3rd speed clutch pack shaft seal rings (4). Position the gaskets (3) on the cover.

Install the 2nd and 3rd speed oil supply cap with the oil supply tubes. Connect the tubes to the fittings on the cover (Fig. 4-77). Install cap screws and tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

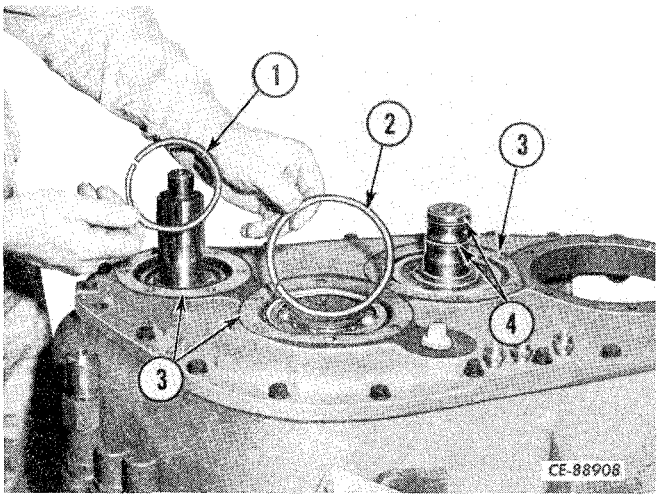

Figure 4-76

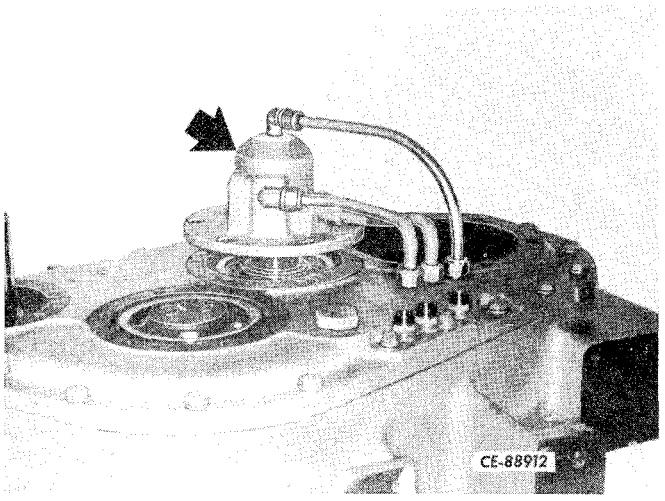

Figure 4-77

Install the input shaft cap (1, Fig. 4-78) and the countershaft cap (2). Install cap screws that secure caps to cover. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

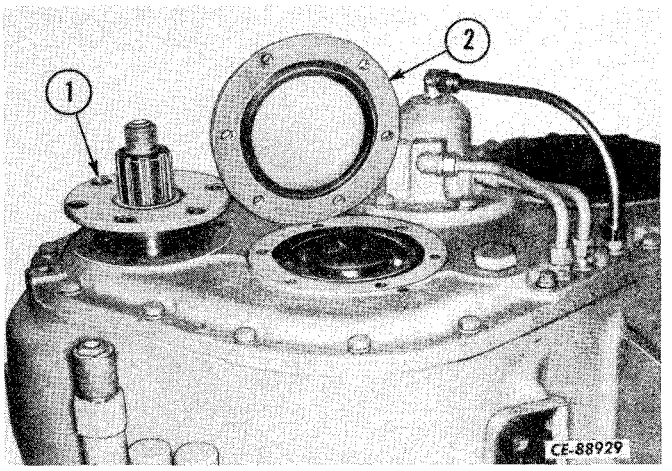

Figure 4-78

B units only:

Install output cap and shaft and cap assembly (1, Fig. 4-79) and secure transmission (3) with cap screws (2).

R units only:

On R units install retainer first, then yoke and nut. Tighten nut to recommended torque (Refer to "SPECIAL TORQUES").

Torque:_____

(Continued on next page)

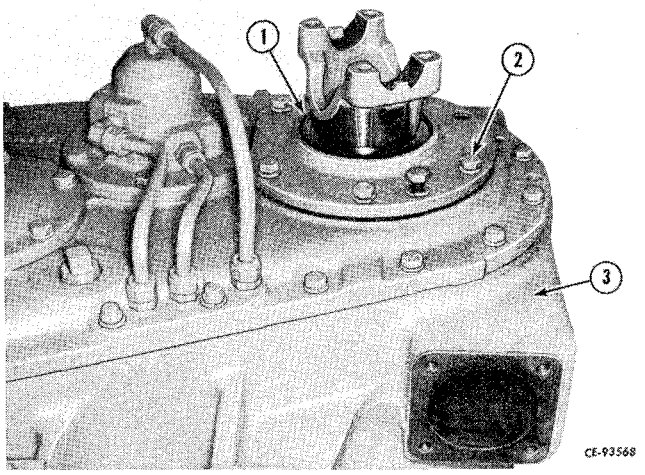

Figure 4-79

ASSEMBLY - Continued

P-601 series only:

Turn transmission over and install the 2nd and 3rd speed bearing assembly. Heat the bearing inner race (1, Fig. 4-80) in oil or an oven to approximately 250°F and tap in place on clutch shaft (2) with a soft drift.

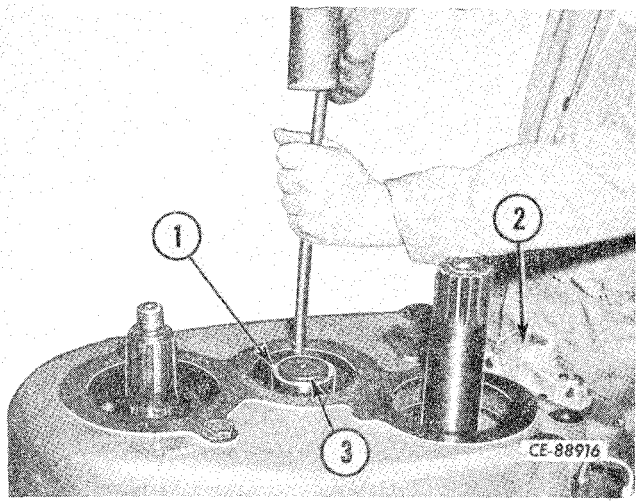

Figure 4-80

Tap the 2nd and 3rd speed bearing outer race (1, Fig. 4-81) in place and secure with snap ring (2).

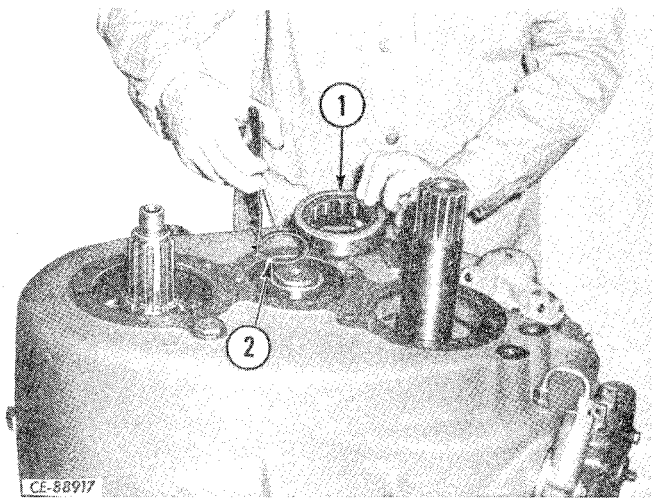

Figure 4-81

P-600 series only:

Turn transmission over and install 2nd and 3rd speed bearing assembly. Heat the bearing (1, Fig. 4-82) in oil or an oven to approximately 250°F and tap in place on clutch shaft until it bottoms against 1st speed driven gear.

Install the end plate (5) and secure with cap screws (2) and lock wire (6).

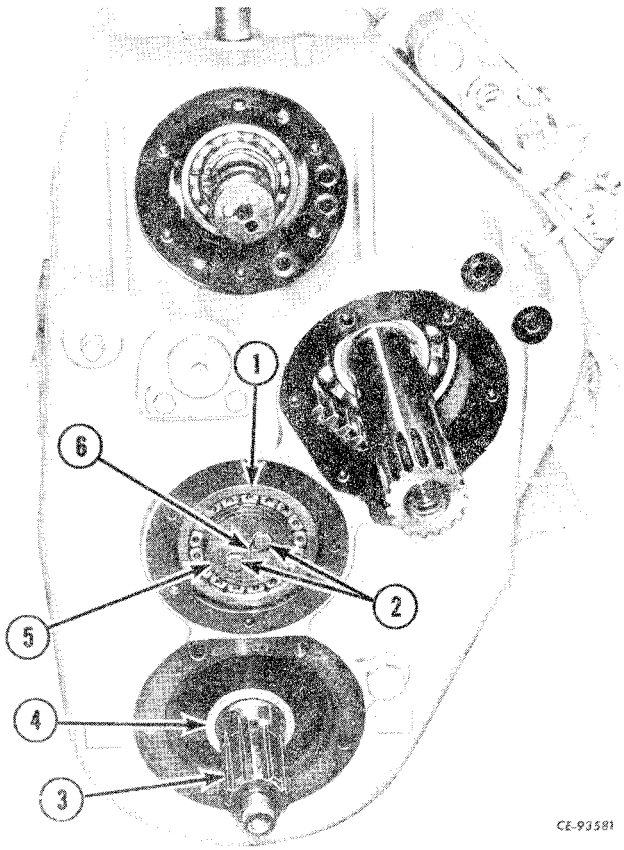

Figure 4-82

All:

Install spacer (4) on output shaft (3).

Install the output shaft bearing (1, Fig. 4-83) on output shaft (2). Heating the bearing in oil or in an oven to 250°F will facilitate assembly. Tap the bearing in until it bottoms against spacer (3). Secure bearing with snap ring.

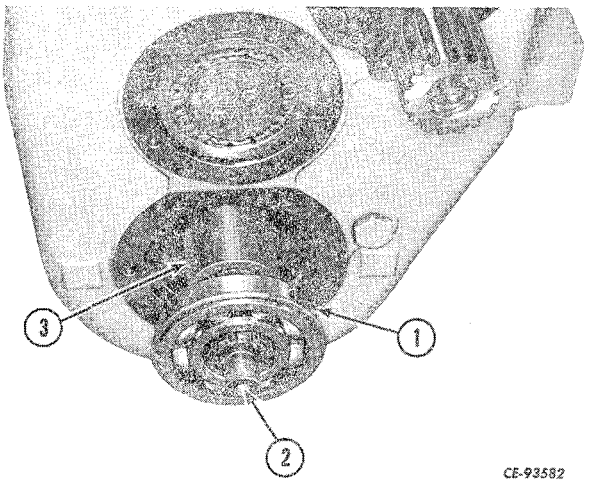

Figure 4-83

Install 2nd and 3rd speed bearing gasket and cover (1, Fig. 4-84). Install cap screws with lock washers and tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Install output shaft end cap (4) and gasket. Secure with lock ring (2) lock washers and cap screws (3). Tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

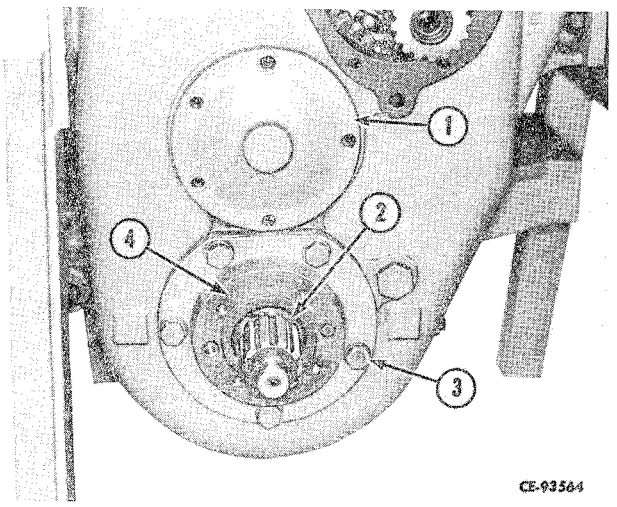

Figure 4-84

Tighten lock plate cap screws (4, Fig. 4-85) at this time and secure with lock wire (3). Install the seal rings on the forward and reverse shaft. Position the oil supply cover (1) over the shaft (use plastic gasket to seal cover to housing) and install the lock washers and cap screws (2). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

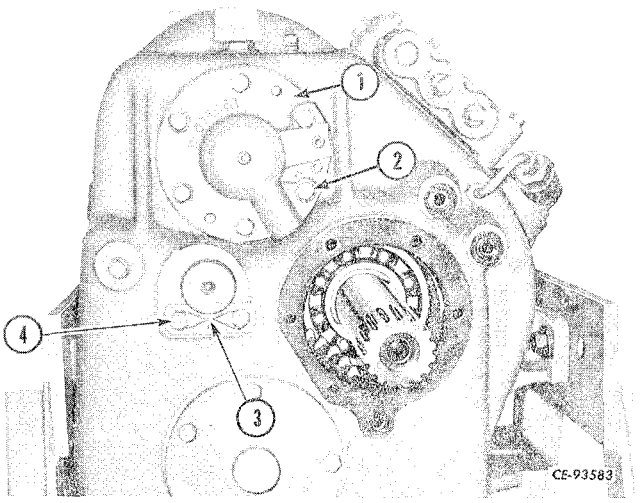

Figure 4-85

Install backing plate (2, Fig. 4-86) and secure to output shaft end cap with cap screws (1).

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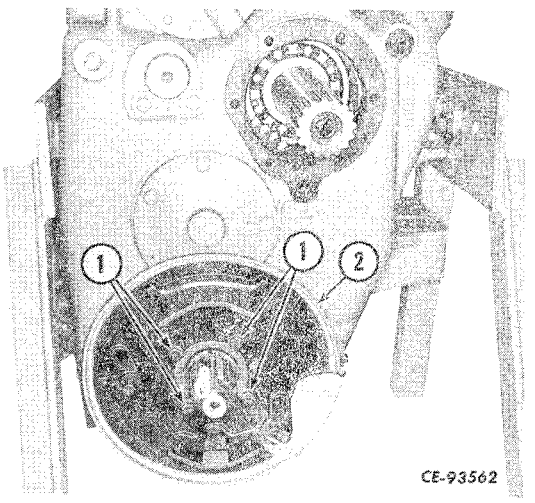

Figure 4-86

ASSEMBLY - Continued

Install lever (2, Fig. 4-87) on backing plate (4), be certain roller is installed on the right hand pawl and rides on top of lever. Left hand pawl is inserted in hole of lever. Install brake shoes (3) and secure with springs (1).

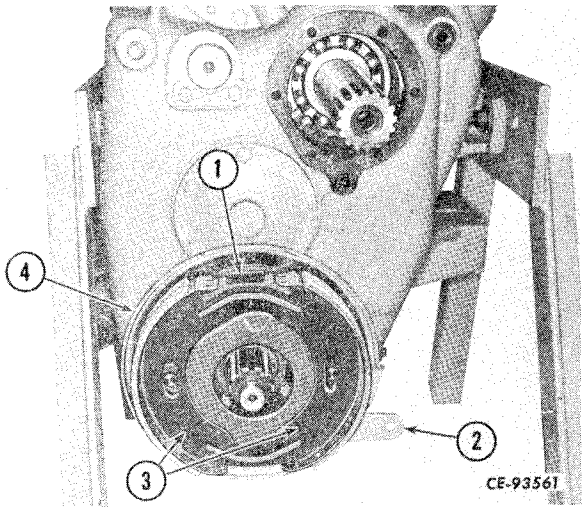

Figure 4-87

Install yoke and drum assembly (1, Fig. 4-88) and secure with washer (3) and lock nut (2). Tighten lock nut to the recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

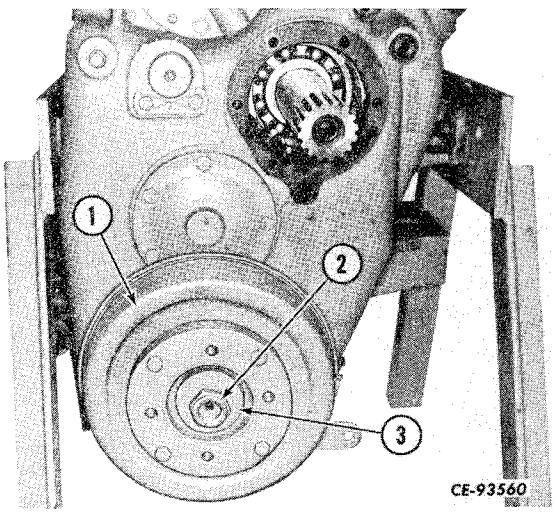

Figure 4-88

Attach a new strainer (2, Fig. 4-89) to the retainer (3). Position the gasket (1) and strainer in the housing. Install cap screws with lock

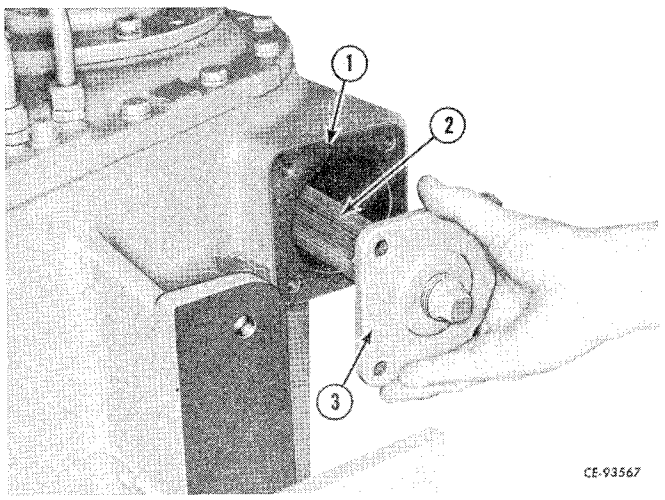

Figure 4-89

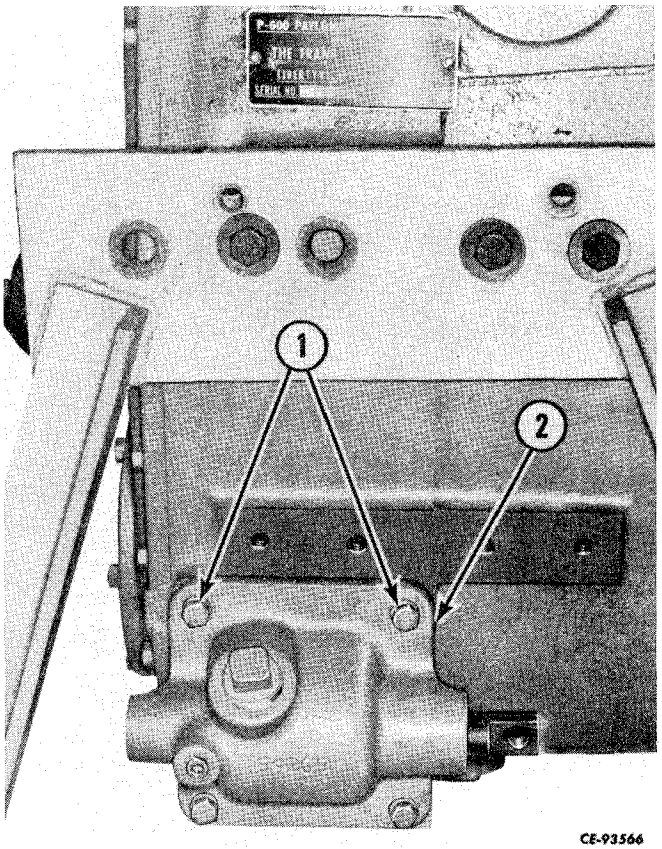

Figure 4-90

washers and tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

B units only:

Install shifter housing (2, Fig. 4-90), be certain shifting fork is inserted in the slot of the sliding sleeve clutch, secure with cap screws (1). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

P-601 series only:

Place the thrust washer assembly (1, Fig. 4-91) and the inner roller bearing (2) on the countershaft (3).

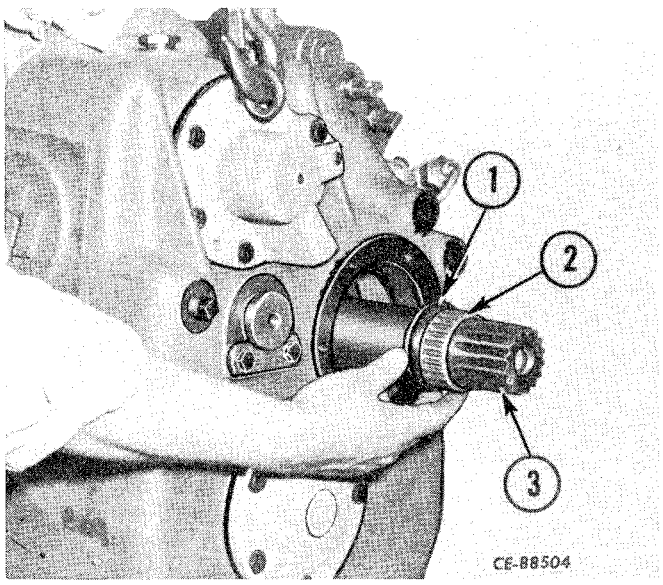

Figure 4-91

All:

Apply plastic gasket to the mounting surfaces on the 1st speed clutch housing (3, Fig. 4-92) and the transmission housing. Install new "O" rings (1). Place the 1st speed housing on the transmission and secure with the internal cap screws (2). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

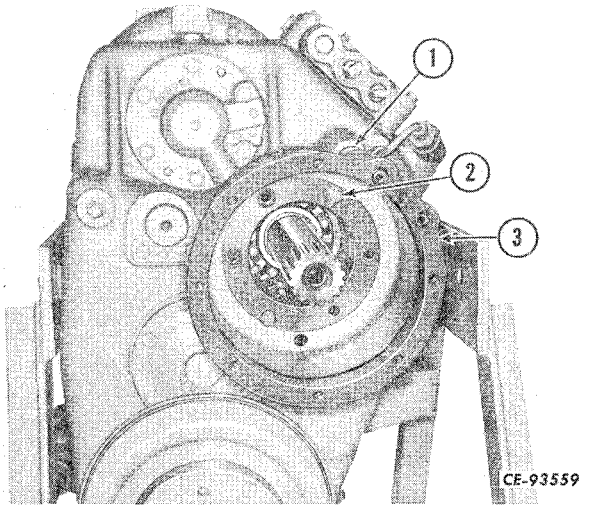

Figure 4-92

Install the 1st speed clutch pack assembly (1, Fig. 4-93) in the housing (2).

(Continued on next page)

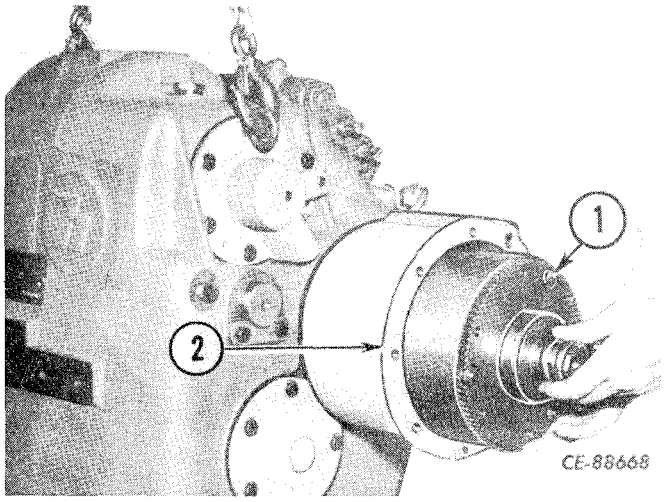

Figure 4-93

ASSEMBLY - Continued

Install the cap screw (1, Fig. 4-94) and washer (2) that secure the clutch pack (4) to the countershaft. Torque the cap screw (refer to "SPECIAL TORQUES").

Torque:_____

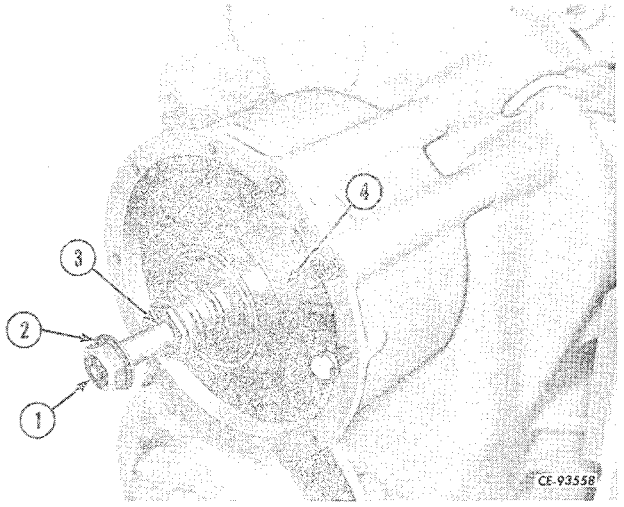

Figure 4-94

Bend the washer (2) over the cap screw (1) and the hexagon (3) on the pack to lock the cap screw in place.

Position a new gasket on the 1st gear housing (2, Fig. 4-95) and new "O" rings at the pressure ports. Install the cover (1) and secure with the cap screws (3) and lock washers. Torque the cap screws (refer to "SPECIAL TORQUES").

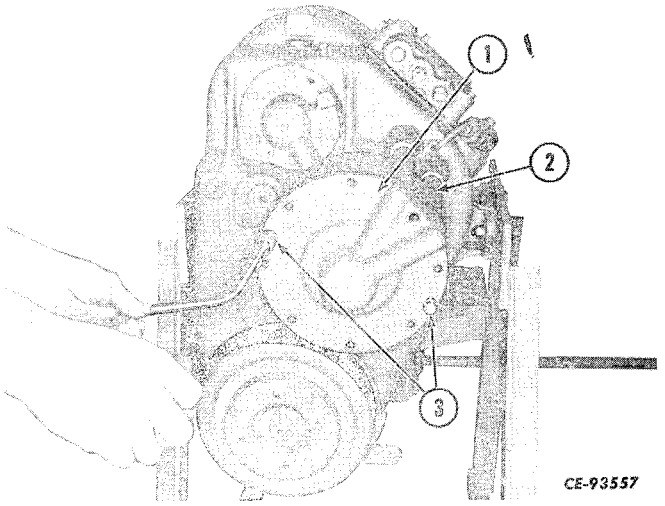

Figure 4-95

Torque:_____

INSTALLATION

Install mounts (4, Fig. 4-96) on transmission. Place transmission under machine. Attach chain hoist (1) to lifting eye (2) and raise transmission into position. Secure transmission mounts to frame with cap screws (5 and 3). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

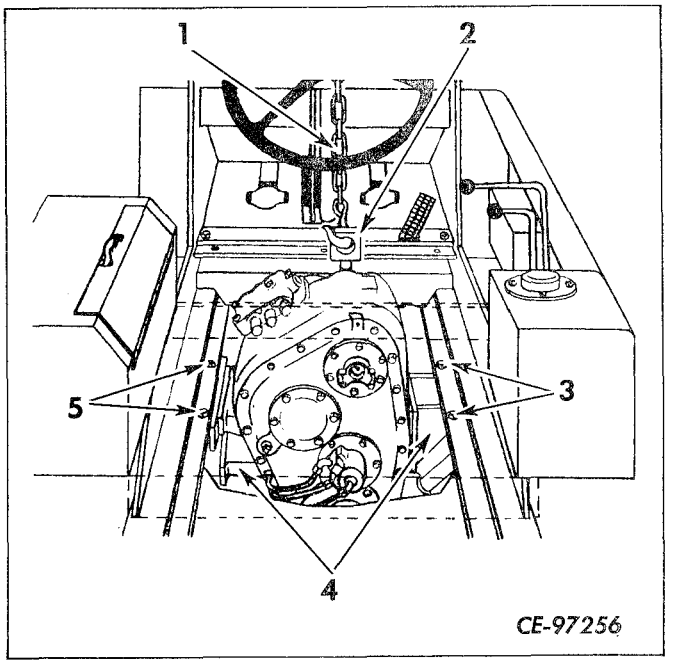

Figure 4-96

P-600 series only:

Attach converter-to-transmission relief valve hose (2, Fig. 4-97) to transmission (1).

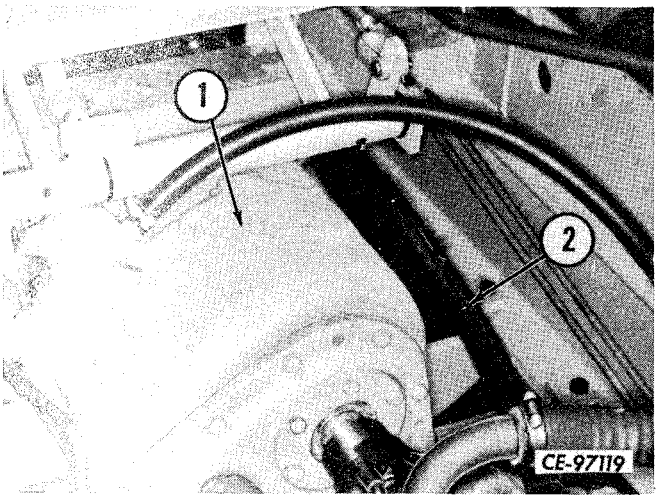

Figure 4-97

Connect parking brake linkage (3, Fig. 4-99) to parking brake (2). Install lower front drive shaft (1) to transmission.

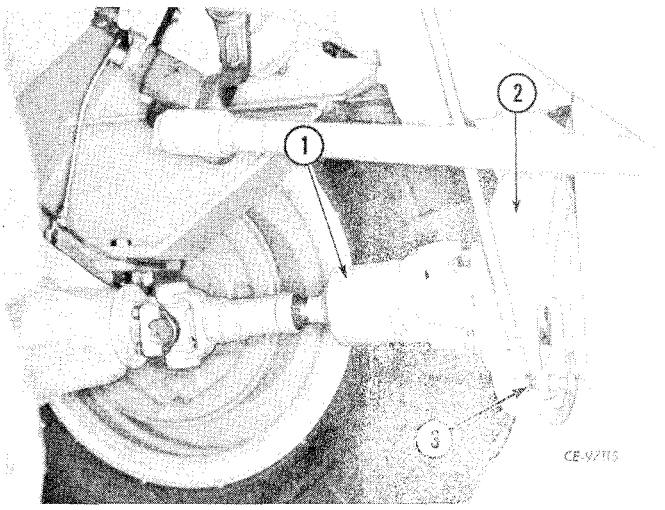

Figure 4-99

Connect axle disconnect linkage to RH transmission mount (1, Fig. 4-98) by installing pin and cotter (3) through shifter rail (2) and bolt (4) through mount.

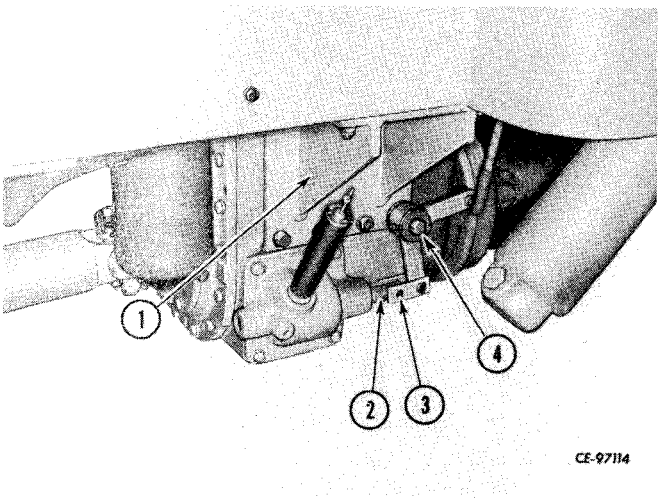

Figure 4-98

Connect strainer-to-pump hose (3, Fig. 4-100) to transmission. Connect overflow to transmission hose (1). Install lower rear drive shaft (2).

(Continued on next page)

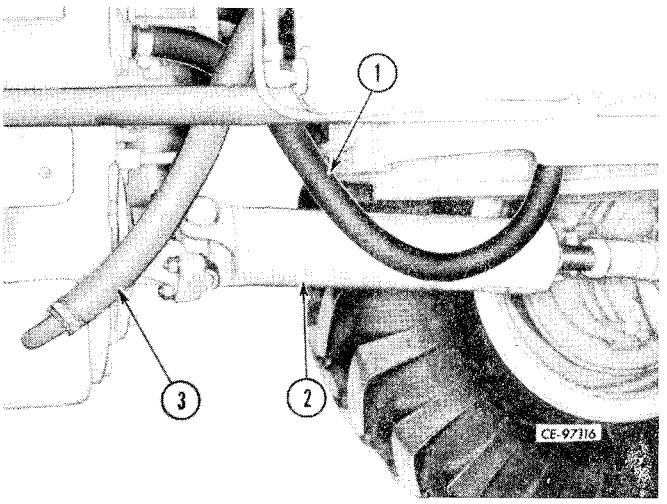

Figure 4-100

INSTALLATION -Continued

Install torque converter to transmission drive shaft (1, Fig. 4-101).

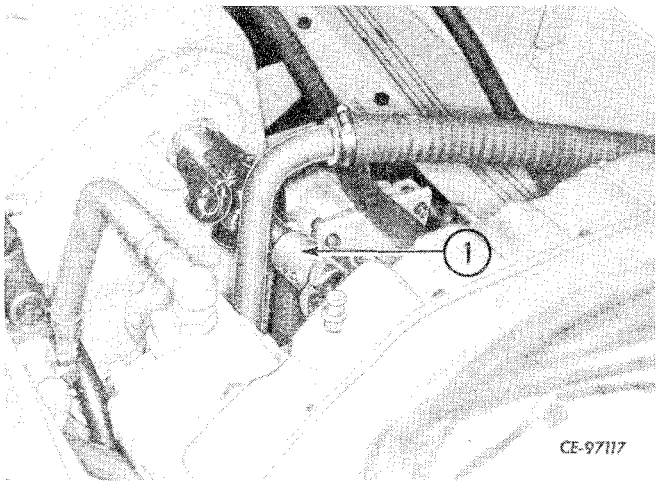

Figure 4-101

Connect transmission control linkage (1, Fig. 4-102) to valve spools. Connect the main supply line (3) to valve (4). Connect hose (5) to lube manifold (6).

Install pedal bellcrank (2, Fig. 4-102). Refer to Section IX, "LINKAGE."

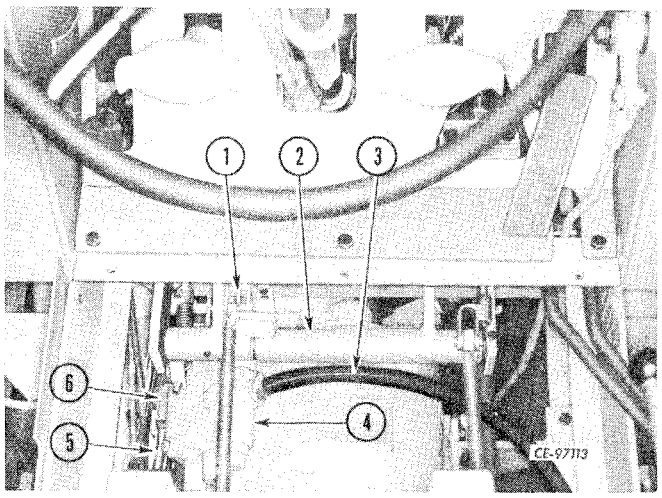

Figure 4-102

Install rear floorboard (2, Fig. 4-103) to frame and secure with cap screws (1).

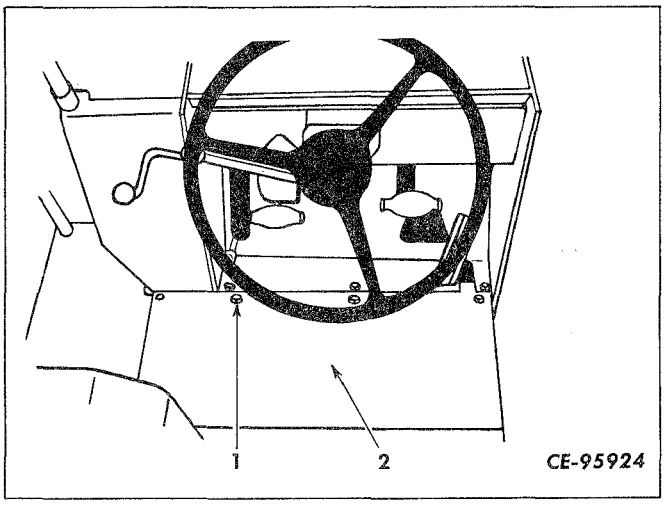

Figure 4-103

Refill transmission with fluid (refer to "LUBRICANTS AND CAPACITIES").

CLUTCH PACKS

NOTE: Service instructions are given below for the 2nd and 3rd speed clutch assemblies used in the P-600 and P-601 transmissions. Assembly and disassembly are common to both series except for variations that are indicated in the text. The forward and reverse packs are serviced similar to the 2nd and 3rd speed packs. The 1st speed packs serviced similarly to half of the 2nd and 3rd speed packs.

REMOVAL

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

Place the clutch pack assembly on a clean work bench. For best working conditions use a bench with a hole large enough to receive the clutch pack shaft.

DISASSEMBLY, INSPECTION AND ASSEMBLY

DISASSEMBLY

P-600 only:

Remove retaining ring (1, Fig. 4-104). Use a suitable puller to remove bearing (2).

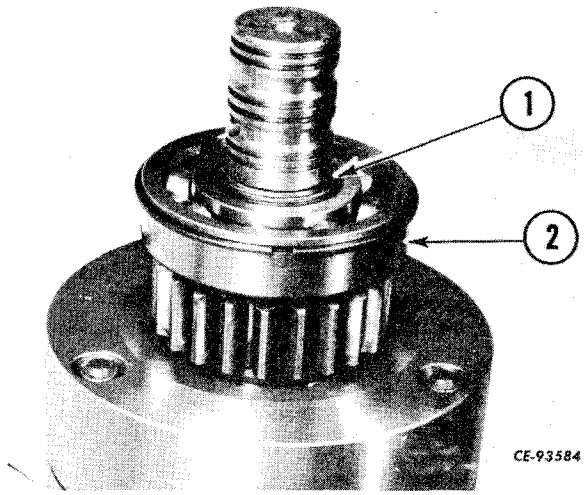

Figure 4-104

All:
Remove the seal rings (3, Fig. 4-105) from the shaft (4). Discard the seal rings.

P-600 only:
Remove washer (2, Fig. 4-105) and 3rd speed drive gear (1) from shaft (4).

P-601 only:
Place the clutch pack in a vertical position with the seal ring end down.

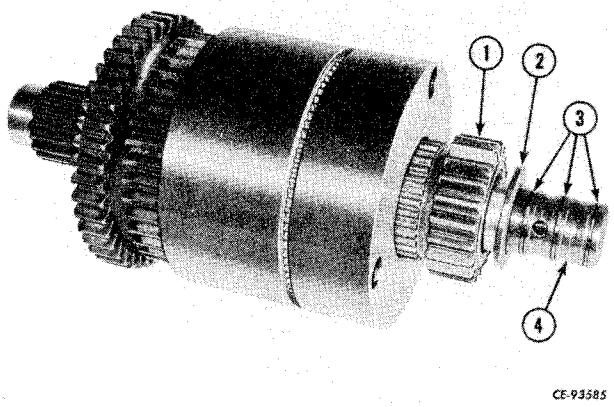

Figure 4-105

Remove the output drive gear (1, Fig. 4-106) from the shaft (4). Remove the two thrust washers (2) and thrust bearing (3) that make up the thrust bearing assembly.

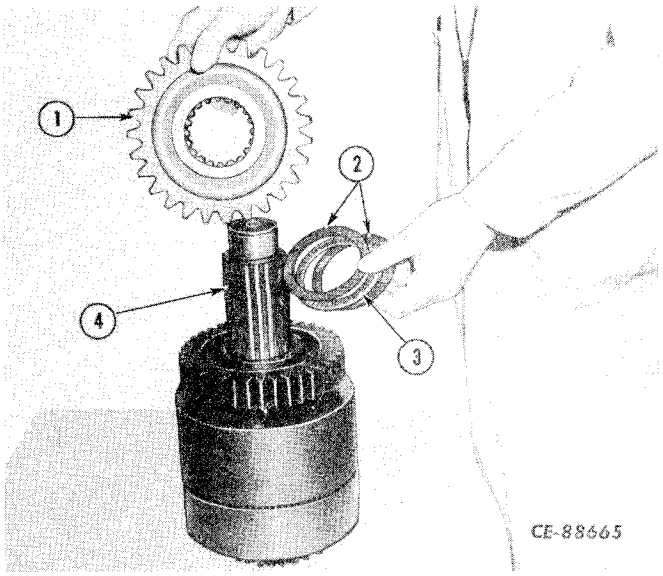

Figure 4-106

For P-600 only:
Place the clutch pack in a vertical position with the seal ring end down.

Use pry bars to remove output drive gear (1, Fig. 4-107) from lock ring (2). Remove washers (3) from shaft (4).

(Continued on next page)

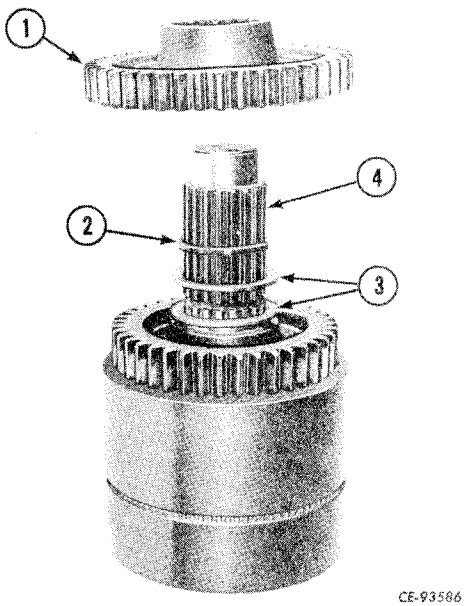

Figure 4-107

CLUTCH PACKS - Continued

DISASSEMBLY - Continued

Remove the 2nd speed drive gear (1, Fig. 4-108) with roller bearings (P-601) in hub from the shaft (2). P-600 has bushings in hub.

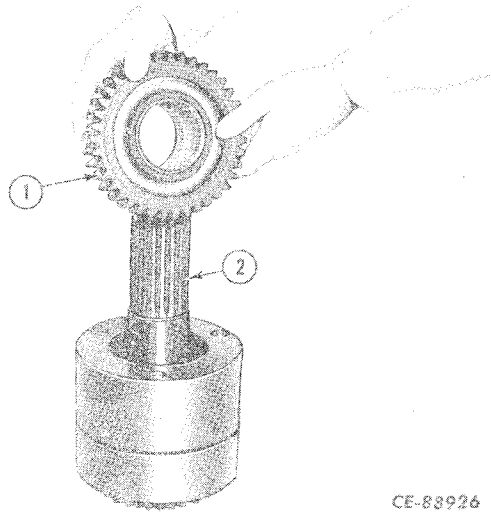

Figure 4-108

All:

Use "C" clamps as shown to hold the backing plates (1, 2, Fig. 4-109) together. Remove the lock nuts at one end of the studs that hold the backing plates. An offset screw driver or a thin walled socket are best for holding the nut at the opposite end of the stud.

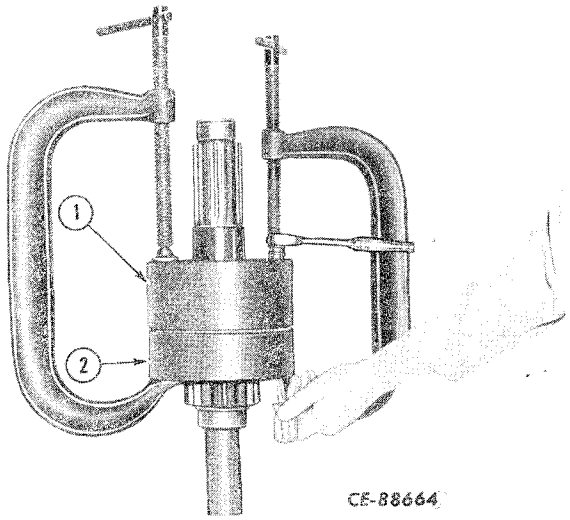

Figure 4-109

Remove the studs, or socket head cap screws, (3, Fig. 4-110) and slowly loosen the "C" clamps to release the spring tension on the backing plates (1 and 2). Before removing the backing plate (1), chalk-mark both backing plates and the cylinder (4) for timing at assembly. (There are also punch marks on the backing plates and cylinder splines for timing if the chalk-marks are rubbed off.)

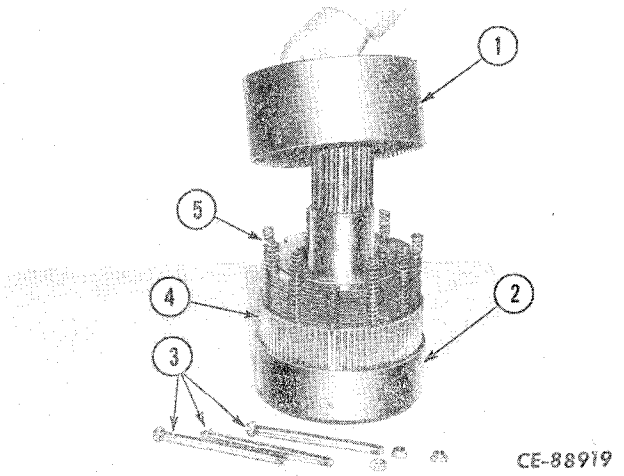

Figure 4-110

Remove the springs (5, Fig. 4-110) from the spring guides (2, Fig. 4-111). Remove the clutch discs (1).

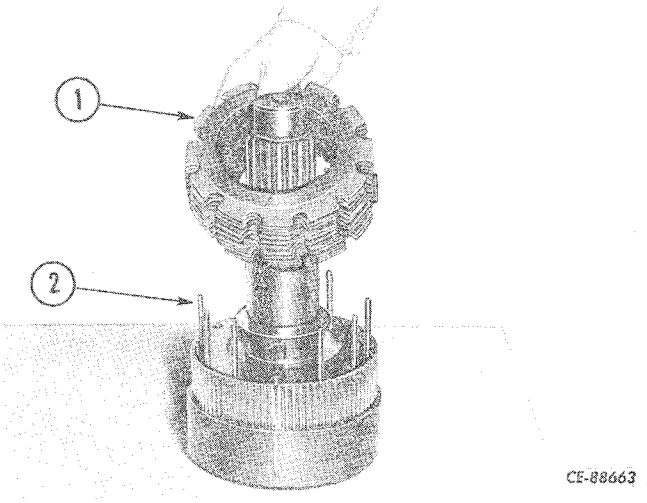

Figure 4-111

P-601 only:

Remove the thrust washers (2, Fig. 4-112) and thrust bearing (1) that make up the thrust bearing assembly. Remove the spring retaining plate (3).

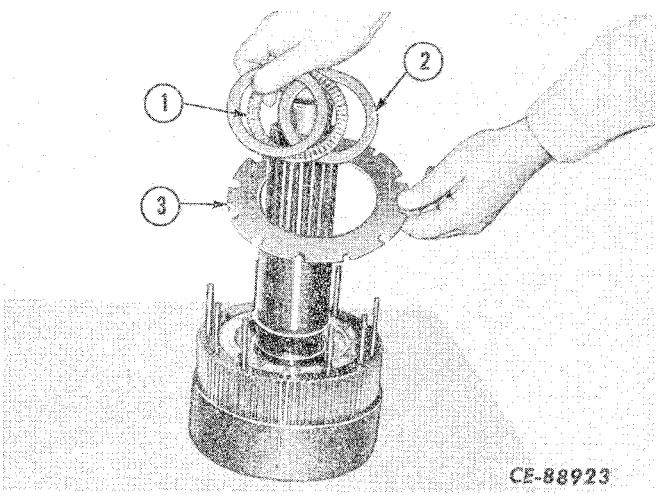

Figure 4-112

Remove the locating snap ring (1, Fig. 4-113) from the groove in the shaft (2).

P-600 has a washer slipped on the shaft. Remove the washer.

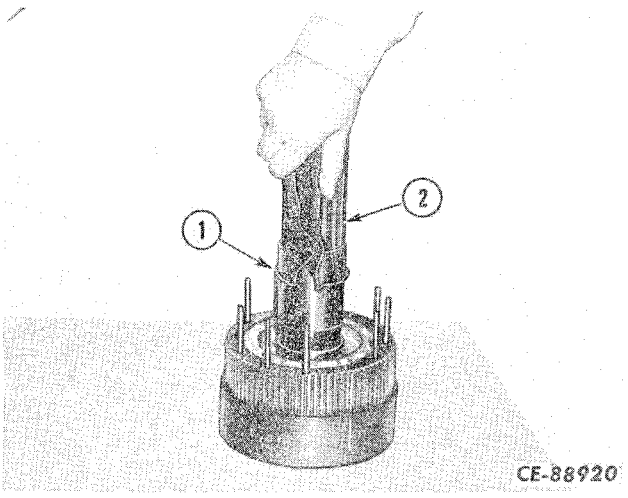

Figure 4-113

All:

Turn the clutch assembly over so that the seal ring end is up. Remove the backing plate (1, Fig. 4-114) from the cylinder (2).

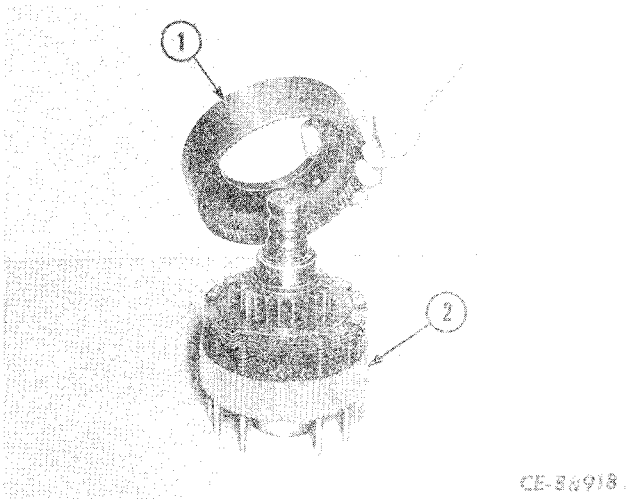

Figure 4-114

Remove the discs (1, Fig. 4-115) and springs (2).

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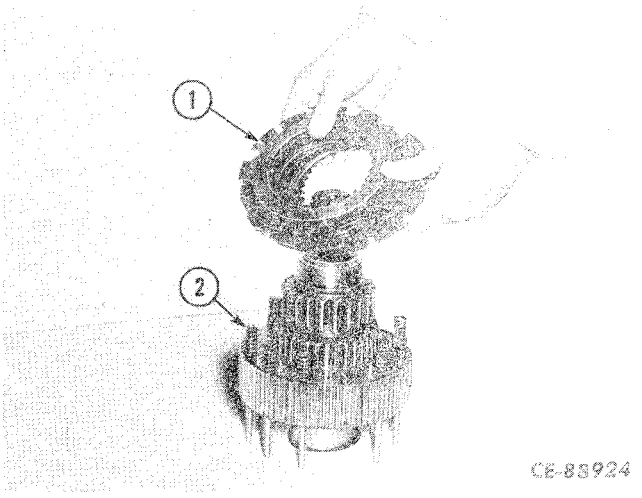

Figure 4-115

CLUTCH PACKS - Continued

DISASSEMBLY - Continued

Remove the spring retaining plate (1, Fig. 4-116) from the cylinder (2).

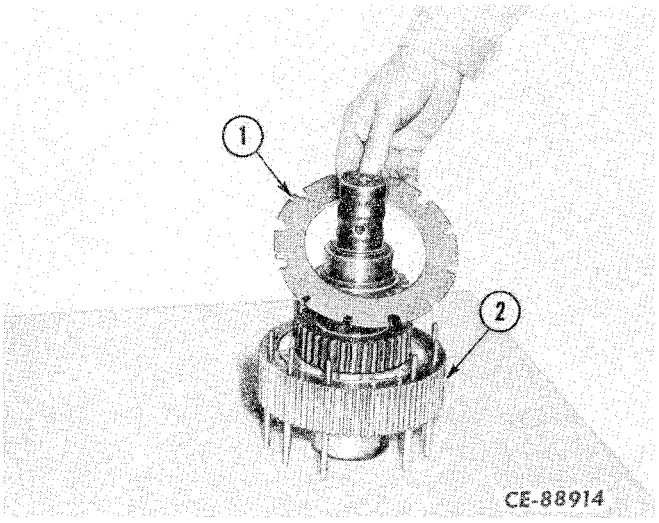

Figure 4-116

P-601 only:

Remove the bearing retainer snap ring (1, Fig. 4-117) from the groove in the shaft (2).

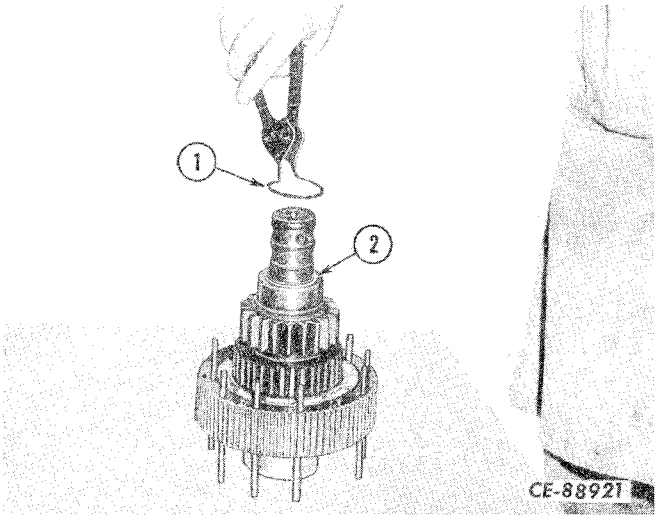

Figure 4-117

Using a bearing puller (1, Fig. 4-118) under the 3rd speed drive gear (2). Remove the bearing race (3).

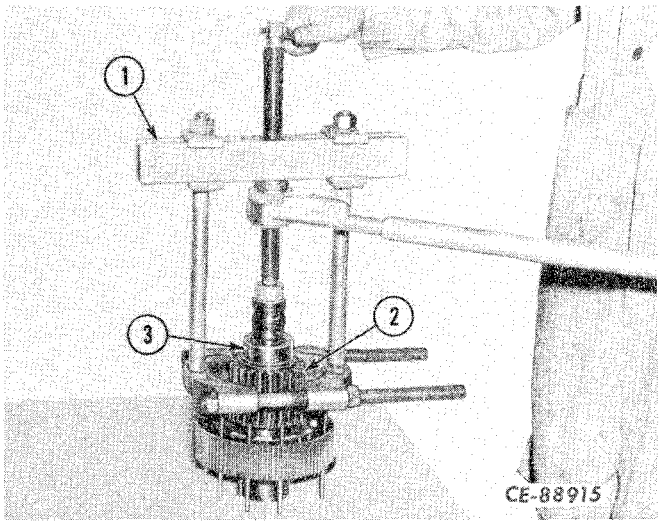

Figure 4-118

Remove the thrust bearing assembly (1, Fig. 4-119), the 3rd speed drive gear (3), and thrust bearing assembly (2).

All:

Remove retaining ring (4, Fig. 4-119).

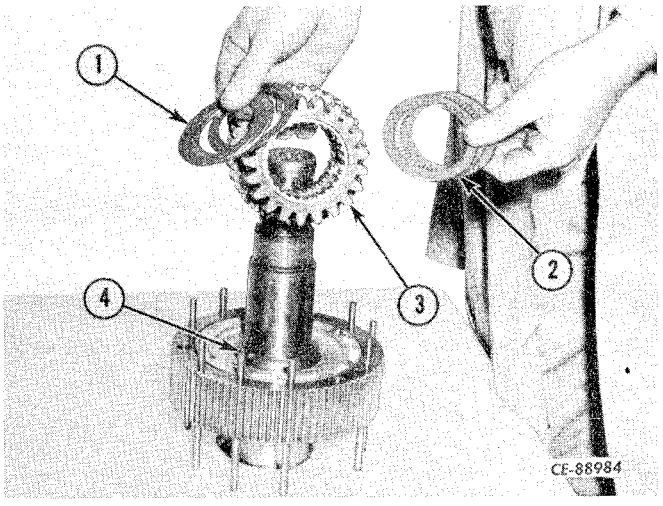

Figure 4-119

P-600 only:

A washer must be removed that is positioned over the bearing retainer snap ring (4, Fig. 4-119).

All:

Insert a rubber-tipped air nozzle (2, Fig. 4-120) in the oil supply passages and apply a light charge of air pressure to remove the pistons (1) from the cylinder (3). Remove the "O" rings (4) from the outer and inner grooves of the pistons.

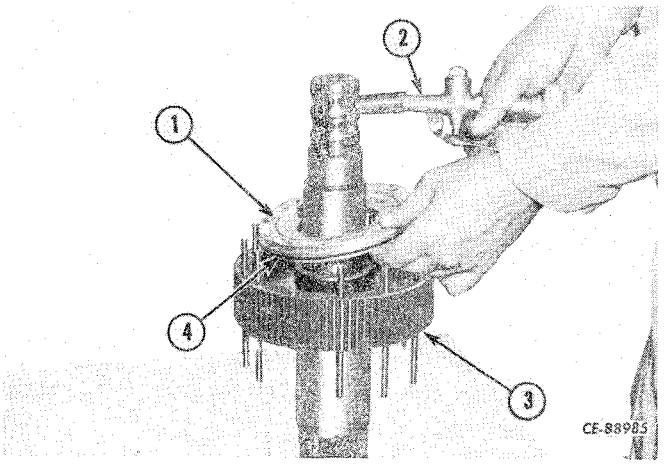

Figure 4-120

Using a soft mallet, tap the cylinder (1, Fig. 4-121) from the shaft (3). If the spring guide pins (2) are to be removed, they can be tapped out of the cylinder.

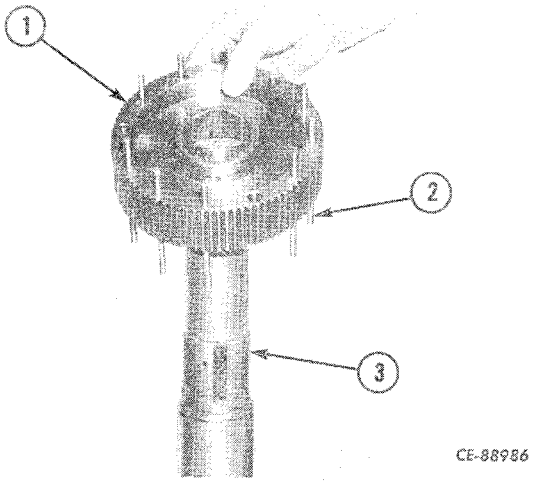

Figure 4-121

CLEAN, INSPECT AND REPAIR

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

a. Cleaning all parts in solvent or plain steam. (Do not use caustic soda). Use compressed air to dry parts. If steam is used to clean parts, oil immediately thereafter.

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

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

d. Inspection of bearing inner races for pits and spalled areas.

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

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

g. Inspect the relief orifice in the pistons to be certain they are open.

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.

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

CLUTCH PACKS - Continued

ASSEMBLY

All:

If the spring guide pins (2, Fig. 4-122) were removed, install them in the cylinder (1) with a soft mallet. If new pins are used, check them with old to be certain they are the same length. Tap the cylinder onto the shaft (3). Be certain that the holes in the cylinder and the shaft are aligned. The shallow side of the cylinder should be towards the seal ring end of the shaft.

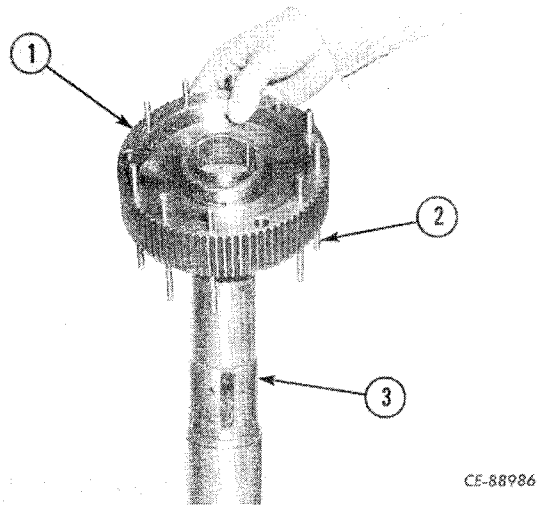

Figure 4-122

Install new "O" rings in the piston (4, Fig. 4-123). Install the piston in the cylinder (3). (The thin piston goes on the seal ring end.) Install the bearing retainer snap ring (1) in the groove in the shaft (2).

P-600 only:
Install washer over bearing retainer snap ring (1, Fig. 4-123).

All:
Position the spring retainer (1, Fig. 4-124) on the cylinder (2). Align the small cuts in the retainer with the spring guide pins and the large cuts with the stud holes.

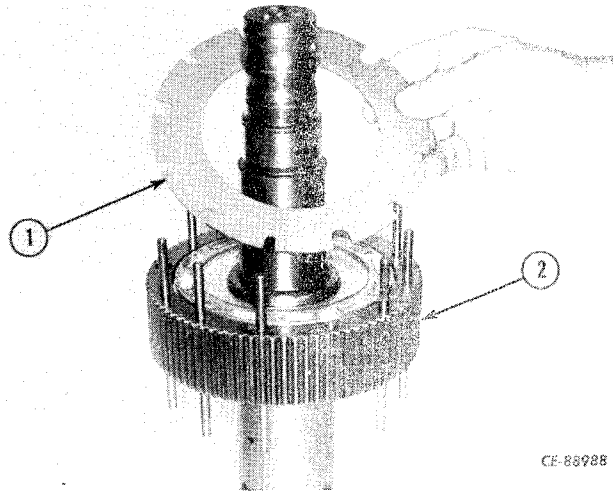

Figure 4-124

P-601 only:

Position the lower thrust bearing assembly (1, Fig. 4-125) on the clutch shaft (2).

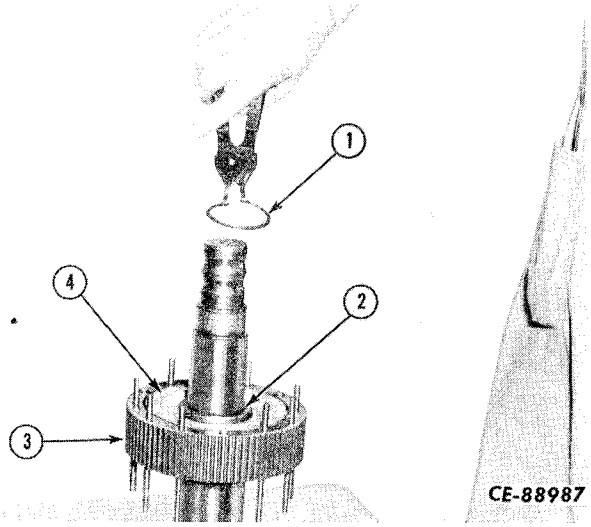

Figure 4-123

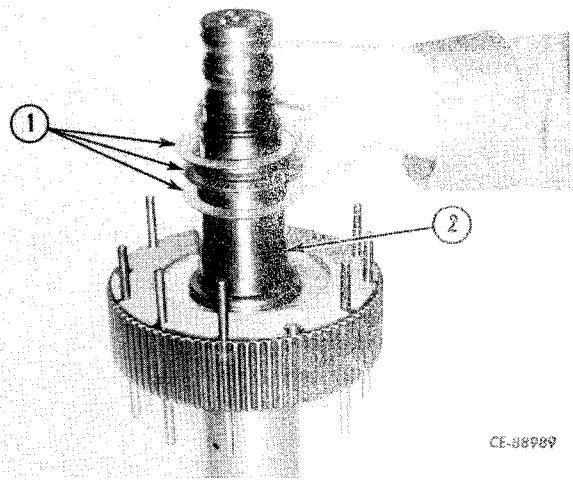

Figure 4-125

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DISASSEMBLY, INSPECTION AND ASSEMBLY

All:

Install the return springs (1, Fig. 4-126) on the spring guides. Install the steel and bronze discs. Start and end with a bronze disc. Be certain the proper number of discs are installed in each pack (refer to PARTS CATALOG). Use two studs (2) to properly align the steel discs.

NOTE: The bronze discs should be soaked in automatic transmission fluid, Type "A" for two to five minutes before installation.

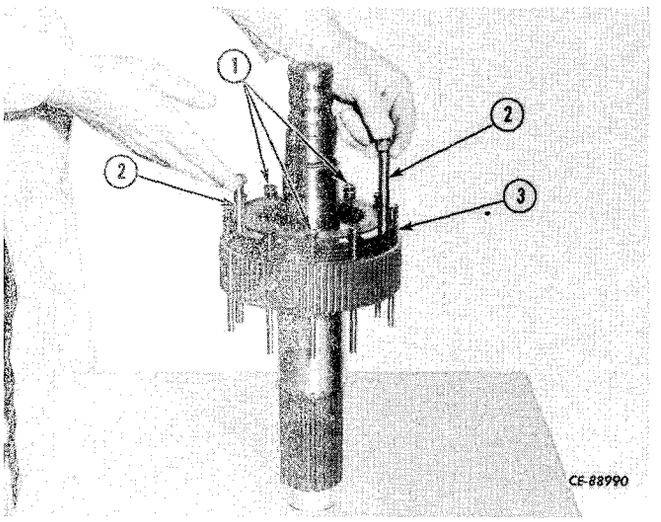

Figure 4-126

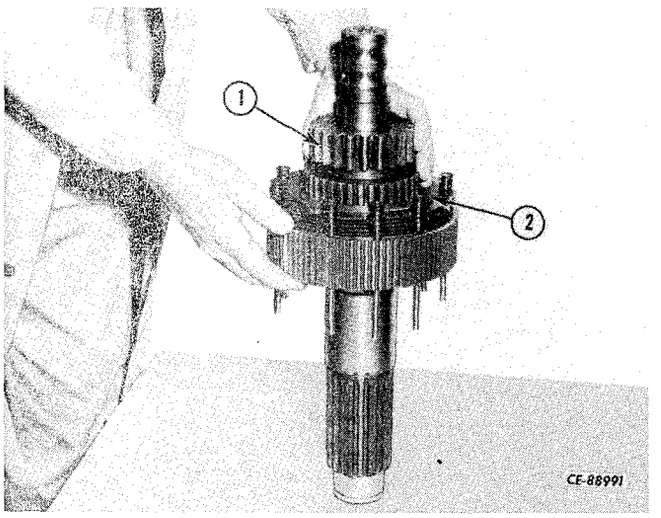

Figure 4-127

P-601 only:

Position the inner roller bearings and spacer in the 3rd speed drive gear (1, Fig. 4-127). Install the gear so it indexes with all the bronze discs (2).

Position the upper thrust bearing assembly (1, Fig. 4-128) on the gear (2).

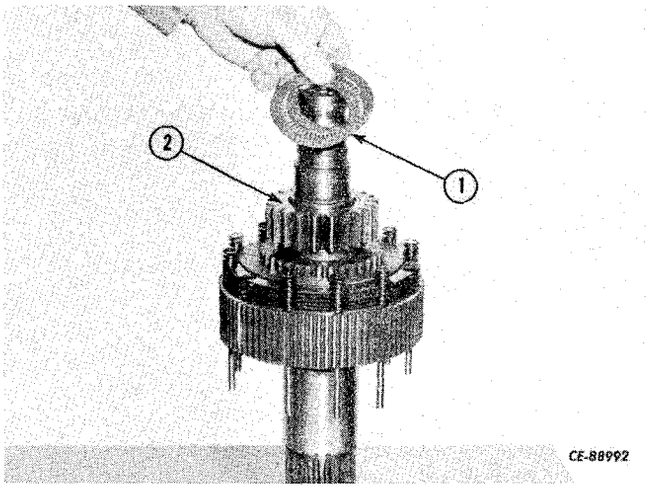

Figure 4-128

Heat the bearing inner race (1, Fig. 4-129) to approximately 250°F. in oil or an oven. Place it on the clutch shaft (2). Use a mallet and a soft drift to tap it into place.

(Continued on next page)

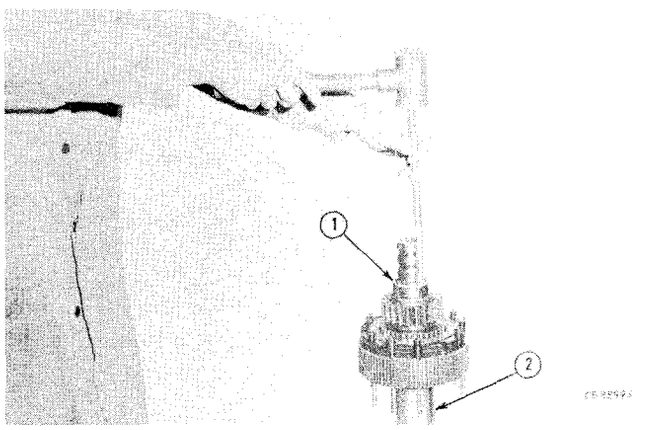

Figure 4-129

CLUTCH PACKS - Continued

ASSEMBLY - Continued

Check for clearance at the snap ring groove (1, Fig. 4-130). Do not preload the thrust bearings. With the snap ring (2) in place, check the free travel of the drive gear. Free travel must not be less than the recommended minimum. (Refer to "TOLERANCES.")

Minimum Free Travel:_____

Install snap ring.

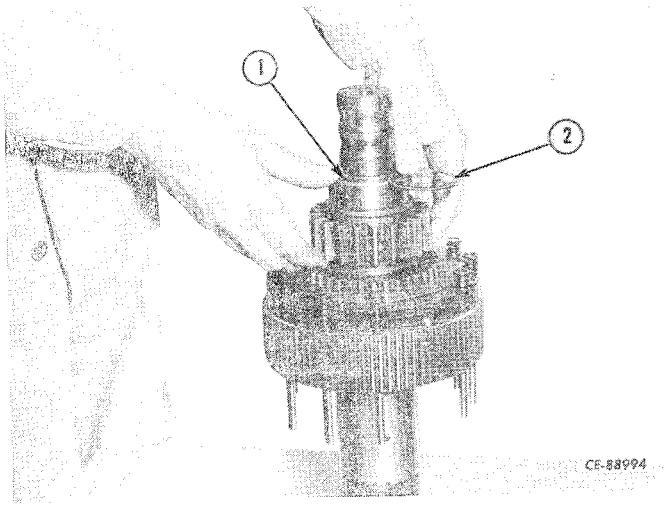

Figure 4-130

All:
Install the backing plate (1, Fig. 4-131) on the clutch cylinder (2) matching the timing marks made during disassembly.

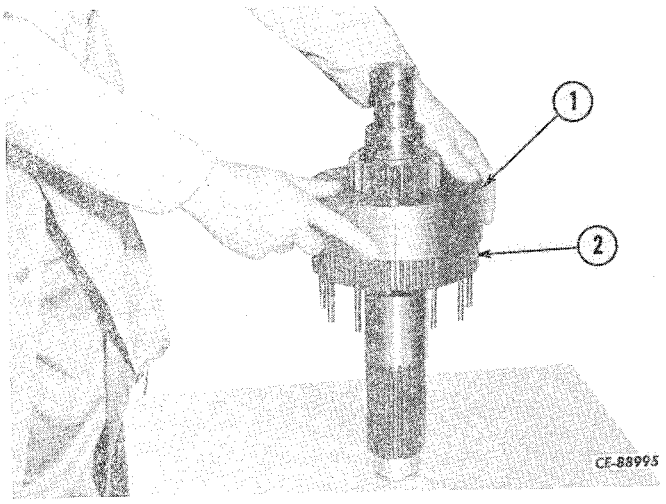

Figure 4-131

Install the studs (4, Fig. 4-132) through the backing plate and cylinder (3). Turn the clutch assembly over. Install new "O" rings on the piston (5) and install the piston in the cylinder.

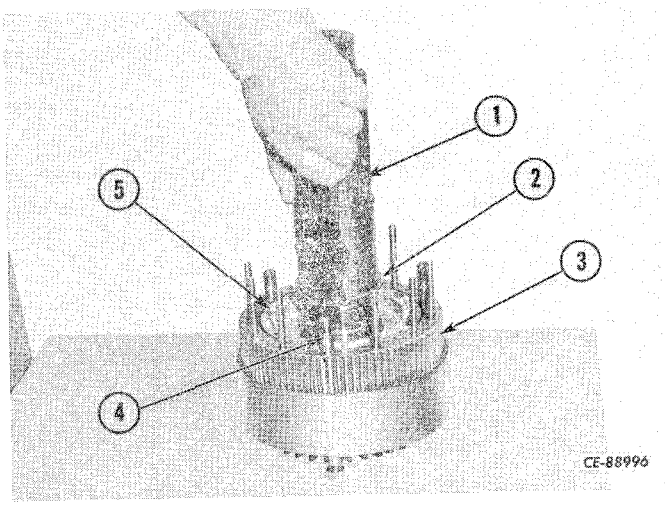

Figure 4-132

P-601 only:
Install the locating snap ring (2, Fig. 4-132) in the groove in the shaft (1).

P-600 only:
Install washer in place of snap ring (2, Fig. 4-132).

All:
Position the spring retainer plate (1, Fig. 4-133) on the cylinder (2), aligning the grooves in the plate with the studs and spring guides.

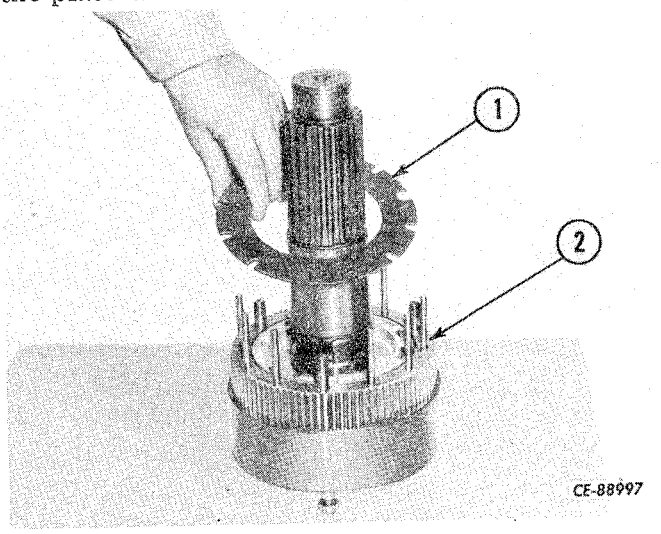

Figure 4-133

Install the bronze and steel discs (2, Fig. 4-134) starting with a bronze and ending with a bronze. Install the clutch return springs (3).

P-601 only:

Install lower thrust bearing assembly (1, Fig. 4-134).

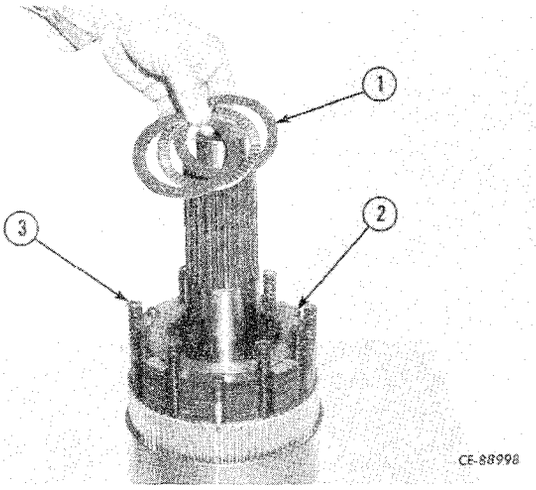

Figure 4-134

All:

Install the backing plate (4, Fig. 4-135) on the cylinder, aligning the punch marks made during disassembly. Use "C" clamps (1) to compress the springs. With the studs (3) and nuts (2) free of oil and dry, apply a small amount of Loctite Type "A" to the lock nut threads. Using a light torque wrench, record the frictional drag of the lock nuts. Torque the lock nuts to the recommended amount over the frictional drag. (Refer to "SPECIAL TORQUES.")

Torque:_____

Stake the lock nuts.

Install the 2nd speed drive gear with roller bearings (P-601) or bushings (P-600) in the hub. Be certain to index all bronze discs (Fig. 4-136).

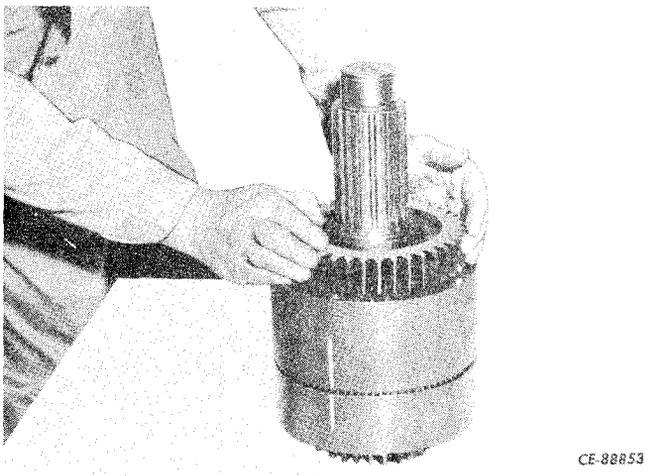

Figure 4-136

P-601 only:

Install the upper thrust bearing assembly (2, Fig. 4-137) on the shaft (3). Install the output drive gear (1) with the extended hub towards end of shaft.

(Continued on next page)

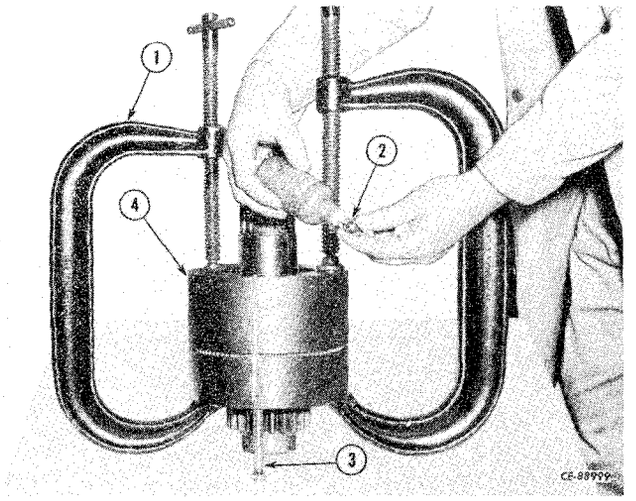

Figure 4-135

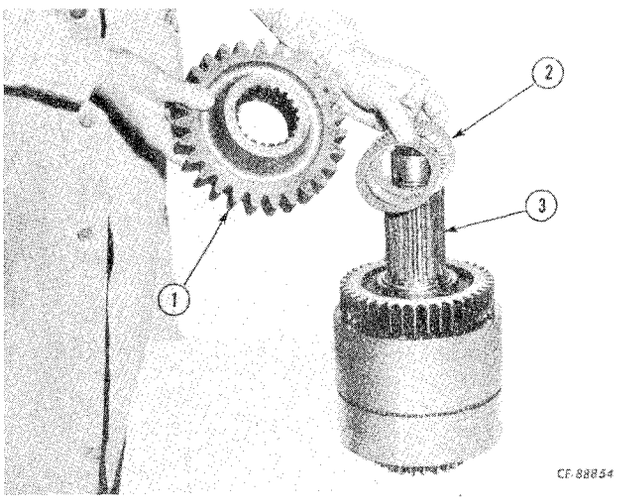

Figure 4-137

DISASSEMBLY, INSPECTION AND ASSEMBLY

CLUTCH PACKS - Continued

ASSEMBLY - Continued

P-600 only:

Install washers (3, Fig. 4-138) on shaft (4) with grooves toward gears. Insert lock ring (5) in lock ring compressor (1) (refer to "SPECIAL TOOLS") and install in groove (2).

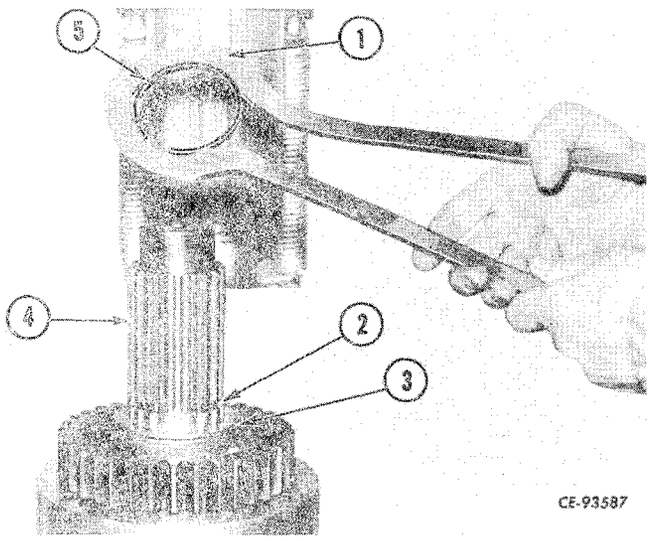

Figure 4-138

Drive gear down until it just catches lock ring. Remove special tool and seat gear on washer (Fig. 4-139).

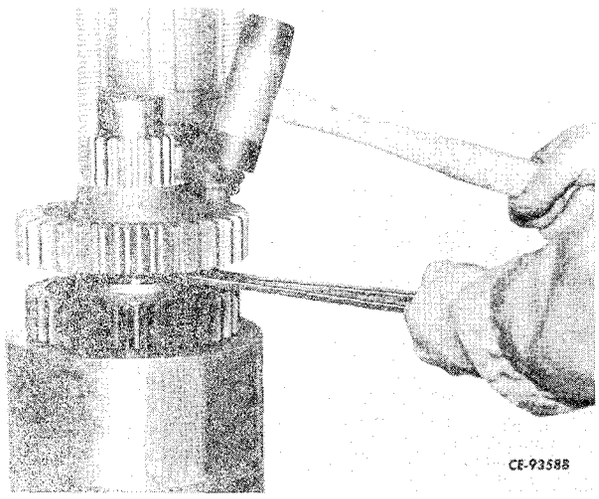

Figure 4-139

If special tool is not available, place a hose clamp (2, Fig. 4-140) over lock ring on shaft (3). Install washers (1) grooves toward gears.

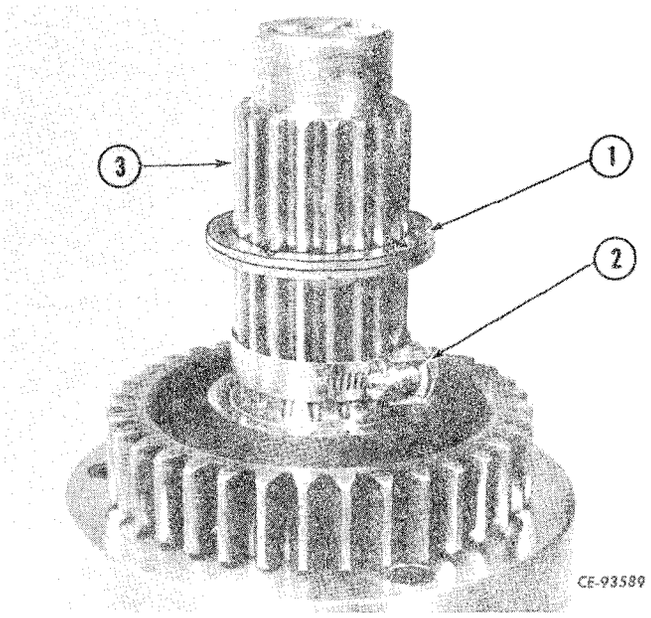

Figure 4-140

Drive 2nd intermediate gear (1, Fig. 4-141) down until washer just catches lock ring. Remove hose clamp (2) and drive gear down until it bottoms over lock ring.

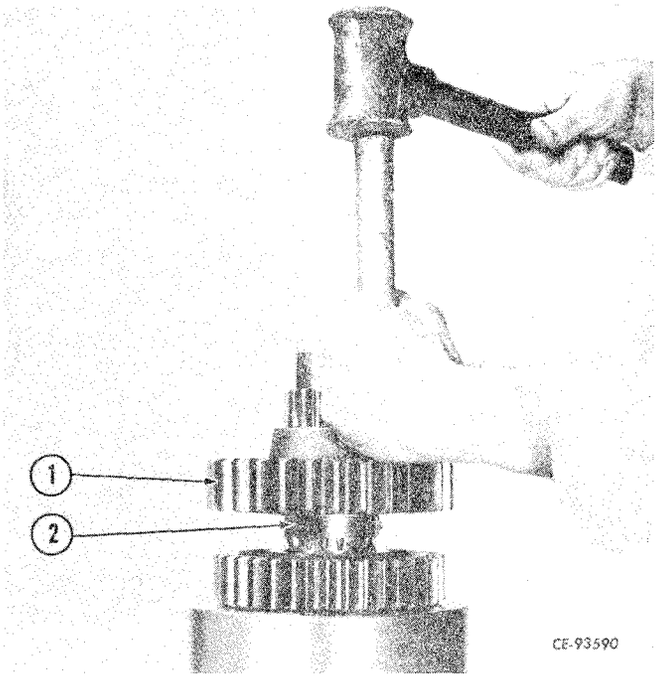

Figure 4-141

Install 3rd speed drive gear (1, Fig. 4-142) washer (2) and new seal rings (3) on shaft (4).

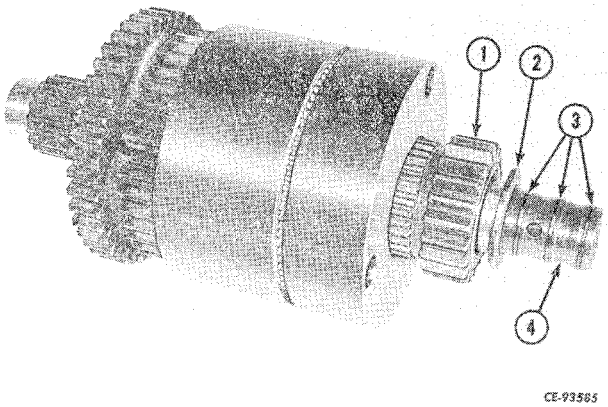

Figure 4-142

P-600 only:

Turn the clutch assembly over. Press on bearing (1, Fig. 4-143).

Check end-play of each pack gear (refer to "TOLERANCES"). Be certain feeler strips (2, Fig. 4-143) are 180° apart and are inserted between the bottom of the washer and top of gear. Test disc action with air. Remember to place pack in vertical position so that piston being tested has to move upward.

Gear End-Play:_____

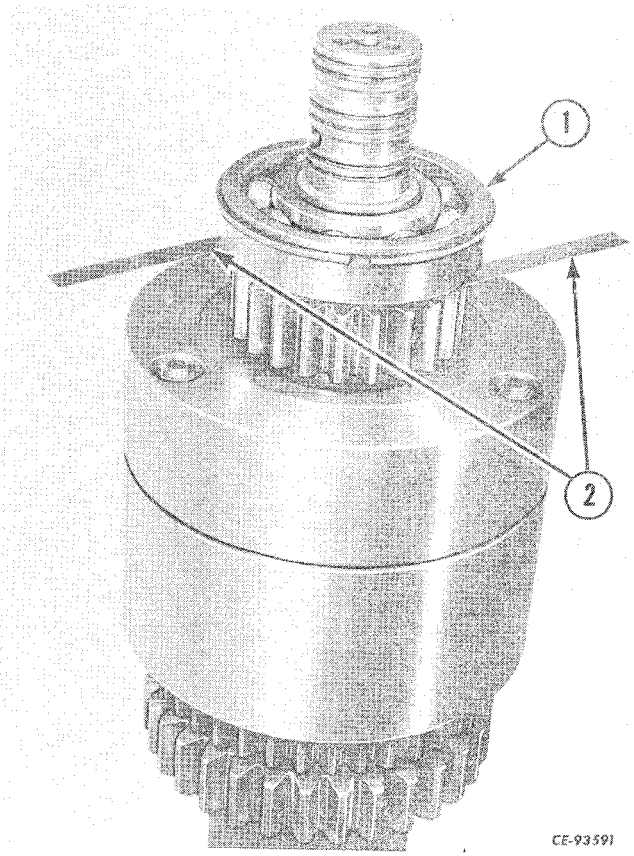

Figure 4-143

INSTALLATION

Follow the necessary steps described under "TRANSMISSION, ASSEMBLY" in this section to install the clutch pack in the transmission.

DISASSEMBLY, INSPECTION AND ASSEMBLY

CONTROL VALVE

REMOVAL

Follow the necessary steps described under "DISASSEMBLY" in this section to remove control valve from the transmission.

Place the control valve on a clean work bench.

DISASSEMBLY

a. Remove the plug (4, Fig. 4-144) and "O"-ring (3) from the side of the valve housing.

b. Remove the detent plug (17) and at the same time push brake plunger (11) through housing (15) so plug and plunger come out as an assembly. Remove and discard "O" ring (16). Do the same procedure for the range and directional plungers.

c. Slide the plug (17) off the brake plunger (11) being careful not to scratch the polished areas of the plunger. Remove spring (13) and retaining ring (12) from plunger.

d. To disassemble the range and directional plungers, wrap the detent plug and corresponding end of plunger in a clean cloth. Pull plunger out of the detent plug.

NOTE: Detent plug end must be well wrapped to avoid losing detent balls as they are ejected from the plug.

e. Carefully open the cloth and remove the detent cam (5), spring (6), plunger plug (7), detent balls (8) and plug(s) (1 and 2). Remove retaining rings (12) from plungers (9 and 10).

f. Using a long nosed pliers, remove the oil seal (14) from each plunger bore in the valve body.

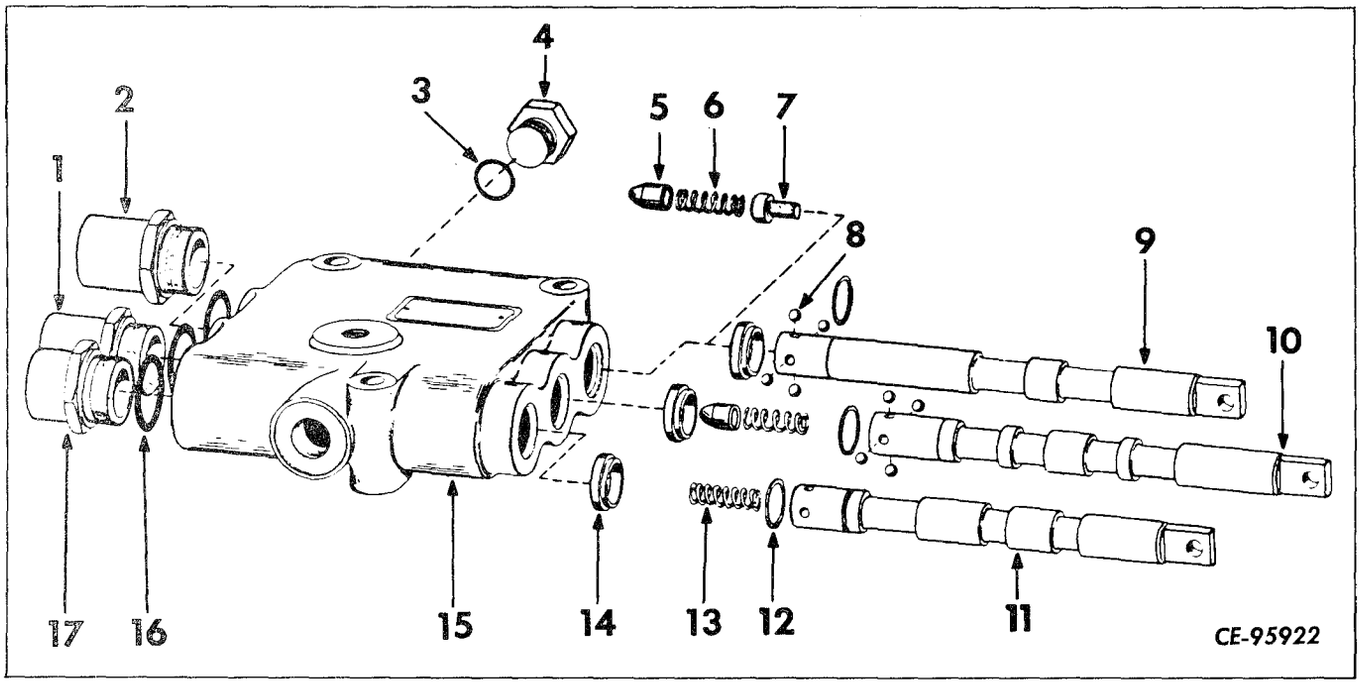

Figure 4-144
Transmission Control Valve, Exploded View.

1. Detent plug.
2. Detent plug.
3. "O"-ring.
4. Plug.
5. Detent cam.
6. Spring.
7. Plunger plug.
8. Bearing ball.
9. Range plunger.
10. Directional plunger.
11. Brake plunger (transmission disconnect).
12. Retaining ring.
13. Plunger spring.
14. Oil seal.
15. Valve housing.
16. "O" ring.
17. Detent plug.

DISASSEMBLY, INSPECTION AND ASSEMBLY

CLEAN, INSPECT AND REPAIR

a. Clean all metallic parts in an approved solvent; dry thoroughly with compressed air.

b. Check the plungers for nicks, burrs, scratches, and scoring. Polish minor defects with crocus cloth.

c. Check all parts for cracks, nicks, burrs and other damage.

d. Replace all "O" rings. Replace all other unserviceable parts.

e. Use a liberal amount of clean, new transmission oil on plungers during assembly.

ASSEMBLY

a. Install plug (4, Fig. 4-144) and a new "O" ring (3) in housing (15). Install new retaining rings (12) on plungers.

b. Apply a thin coating of grease to new oil seals and install in seal groove of each bore. Recessed face of seal faces inside of valve body.

c. To assemble detent balls in detent plug, install plunger plug (7) (range only), spring (6) and cam (5) in bore of plunger. Using a suitable small rod depress the cam until two opposing detent balls (8) can be inserted in their respective holes. Depress cam far enough to allow balls to be completely retracted within plunger. Retain the two inserted balls by applying pressure to them with the thumb and index finger. Remove rod and install the remaining balls in their holes. Align the plunger with the bore in the detent plug and thrust the plunger within the plug.

NOTE: Do not mix plungers and plugs.

d. Repeat above operation for directional plunger.

e. Install spring (13) in brake plunger and thrust the plunger within the detent plug.

f. Lubricate plunger (9) with clean, new transmission oil. Install plunger in range bore of valve housing (15). Thread plug in bore and tighten securely.

Repeat above procedure for the remaining plungers (10 and 11).

g. Check each of the installed plungers for freedom of movement and proper operation. The plungers should move without binding or catching. The range plunger (9) and directional plunger (10) should locate positively in any of the three detent positions, and should move from one position to another without excessive effort. The brake plunger (11) should move smoothly throughout its range of motion.

INSTALLATION

Follow the necessary steps described under "TRANSMISSION, ASSEMBLY" in this section to install control valve in the transmission.

TROUBLE SHOOTING

DIAGNOSTIC CHECKS

a. Transmission sump oil level.
b. Cleanliness of oil and oil filter.
c. Air flow through oil cooler.
d. Condition of all oil lines and fittings.
e. Condition of all wiring and connections.
f. Engine-converter stall speed.
g. Proper linkage positioning of all valves and levers.
h. Converter and transmission oil pressures.
i. All drive lines and mounting brackets for tightness.

TRANSMISSION

TROUBLE SHOOTING

TROUBLE SHOOTING CHART

COMPLAINT	POSSIBLE CAUSE	REMEDY
High oil temperature.	1. Low transmission sump oil level.	1. Add oil to proper level.
	2. High transmission sump oil level.	2. Drain oil to proper level.
	3. Foamed oil.	3. (a) Check oil level. (b) Air leaks in suction lines.
	4. Clogged oil cooler.	4. Clean oil cooler.
	5. Low converter "IN" pressure.	5. See low converter "IN" pressure.
	6. Improper vehicle operation.	6. (a) Operate in correct range. (b) Downshift into lower range. (c) Remaining in stall too long.
	7. Stator assembled in converter backwards.	7. (a) Check converter stall. (b) Disassemble converter and check stator.
	8. Low oil flow thru converter.	8. Check input pump for excessive wear.
Slow or erratic clutch engagement.	1. Low transmission sump oil level.	1. Add oil to proper level.
	2. Clogged oil filter screen.	2. Remove and clean.
	3. Foamed oil.	3. Eliminate air leak into pump suction line.
	4. Improper linkage adjustment.	4. (a) Free linkage and adjust. (b) Check selector valve positioning.
	5. Low clutch pressure.	5. See low clutch pressure.
	6. Clutch pressure regulator valve stuck.	6. (a) Clean and inspect valve body bore. (b) Inspect valve spring.
	7. Transmission disconnect valve sticking.	7. (a) Clean and inspect valve body bore. (b) Inspect valve spring.

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TROUBLE SHOOTING

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

(Continued on next page)

TROUBLE SHOOTING

TROUBLE SHOOTING CHART - Continued

COMPLAINT	POSSIBLE CAUSE	REMEDY
Low converter "IN" pressure.	1. Low transmission sump oil level.	1. Add oil to proper level.
	2. Low clutch pressure.	2. See low clutch pressure.
	3. External oil leak.	3. Check external lines for leaks.
	4. Converter regulator valve sticking.	4. (a) Clean and inspect valve body bore. (b) Inspect valve spring.
	5. Internal oil leak.	5. Overhaul converter.
Low lube pressure.	1. Low oil level.	1. Correct oil level.
	2. Worn input pump.	2. Overhaul input pump.
	3. Stuck lube pressure regulator valve.	3. (a) Clean and inspect valve body bore. (b) Inspect valve spring.
	4. Internal leaks.	4. Overhaul transmission.
High lube pressure.	1. Stuck lube pressure.	1. (a) Clean and inspect valve body bore. (b) Inspect valve spring.
Loss of power.	1. Low engine output.	1. See low engine speed at converter stall.
	2. Stator assembled backward.	2. Disassemble converter and check stator.
	3. Low converter "IN" pressure.	3. See low converter "IN" pressure.
	4. Direction or range selector valves inoperative.	4. (a) Check linkage. (b) Disassemble valve bodies and inspect.
	5. Improper vehicle operation.	5. Operate in proper range for load and terrain.
	6. Parking brake dragging.	6. (a) Adjust linkage to allow full release. (b) Release brake.

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TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Loss of power. (Continued)	7. Foaming oil.	7. (a) Correct oil level. (b) Check for air leak in suction line. (c) Oil used not meeting specifications.
	8. Slipping clutches.	8. See low clutch pressure.
	9. Vehicle brakes dragging.	9. (a) Adjust brakes. (b) Check brake linkages.
Vehicle drives in one direction and creeps in that direction in neutral but stalls when shifted to the opposite direction.	1. Failed directional clutch.	1. Overhaul transmission.
Vehicle drives in one range but stalls when shifted to another range.	1. Failed range clutch.	1. Overhaul transmission.
All range pressures normal in one direction but all low in opposite direction.	1. Directional selector valve linkage out of adjustment.	1. Adjust linkage.
	2. Internal oil leaks in forward or reverse clutch.	2. Overhaul transmission.
Low clutch pressure in one range clutch in either direction.	1. Linkage out of adjustment.	1. Adjust linkage.
	2. Internal oil leaks in clutch.	2. Overhaul transmission.

SERVICE INFORMATION

SPECIFICATIONS

GENERAL

Transmission Model . . . . . P-600 & P-601

Transmission Make . . . Hough Division of I. H.

Transmission Type . . . . . Three speed, constant mesh, full reversing.

Road Speeds

	Forward		Reverse	
	P-600	P-601	P-600	P-601
Speed Range				
1	0-3.63	0-3.673	0-3.02	0-3.059
2	0-1.66	0-1.661	0-1.31	0-1.382
3	0-.601	0-.601	0-.5	0-.501

(Continued on next page)

SERVICE INFORMATION

SPECIFICATIONS - Continued

GENERAL - Continued

Clutch Type . . . . . Multiple disc, pressure balanced, oil cooled.

Filtration . . . . One replaceable pleated wire mesh type element.

Cooler . . . . . Oil-to-air type heat exchanger.

OPERATING RANGES

Torque converter charging pressure . . .*50-70 psi.

Clutch Apply Pressure . . . . . **170-190 psi.

Lube Pressure . . . . . .*10 psi.

*High idle. ** At stall.

Engine Temperature Range
I. H. Diesel . . . . . .170° - 190° F.
I. H. Gas . . . . . .158° - 163° F.
Detroit Diesel . . . . . .158° - 168° F.

Transmission Temperature . . . 150° F. Max.

LUBRICATION

Type lubricant . . . . . Dexron automatic transmission fluid.

Initial Fill. . . . . .24 qts.

Refill (Approx.) . . . . . .14 qts.

TOLERANCES

Minimum end play of clutch pack gears . . 010"

SPECIAL TORQUES

Parking brake backing plate cap screws	33 ft. lbs.
Transmission control valve mounting cap screws	33 ft. lbs.
Transmission control valve plug	30 ft. lbs.
Lube manifold mounting cap screws	33 ft. lbs.
Countershaft bearing end cap mounting cap screws	33 ft. lbs.
Transmission cover cap screws	33 ft. lbs.
Oil supply cap mounting cap screws	33 ft. lbs.
2nd and 3rd speed bearing cover mounting cap screws	33 ft. lbs.
Forward and reverse oil supply cover mounting cap screws	33 ft. lbs.
Output shaft and cap mounting cap screws	
Housing end	80 ft. lbs.
Cover end	32 ft. lbs.
Output shaft yoke nuts	200 ft. lbs.
Strainer mounting cap screws	33 ft. lbs.
1st speed housing mounting cap screws	33 ft. lbs.
1st speed clutch retainer cap screw	100-150 ft. lbs.
1st speed cover mounting cap screws	33 ft. lbs.
Transmission brackets-to-trans. cap screws	80 ft. lbs.
Transmission brackets-to-frame cap screws	80 ft. lbs.
Front drive shaft attaching cap screws	90 ft. lbs.
Rear drive shaft attaching cap screws	37 ft. lbs.
Rear drive shaft lock nuts	37 ft. lbs.
Upper drive shaft nuts	37 ft. lbs.
Clutch pack stud lock nuts	
Torque recommended in excess of frictional drag	15 ft. lbs.
Mounting bracket-to-transmission cap screws	90 ft. lbs.
Mounting bracket-to-tractor frame cap screws	90 ft. lbs.

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SERVICE INFORMATION

SPECIAL TOOLS

TRANSMISSION STAND

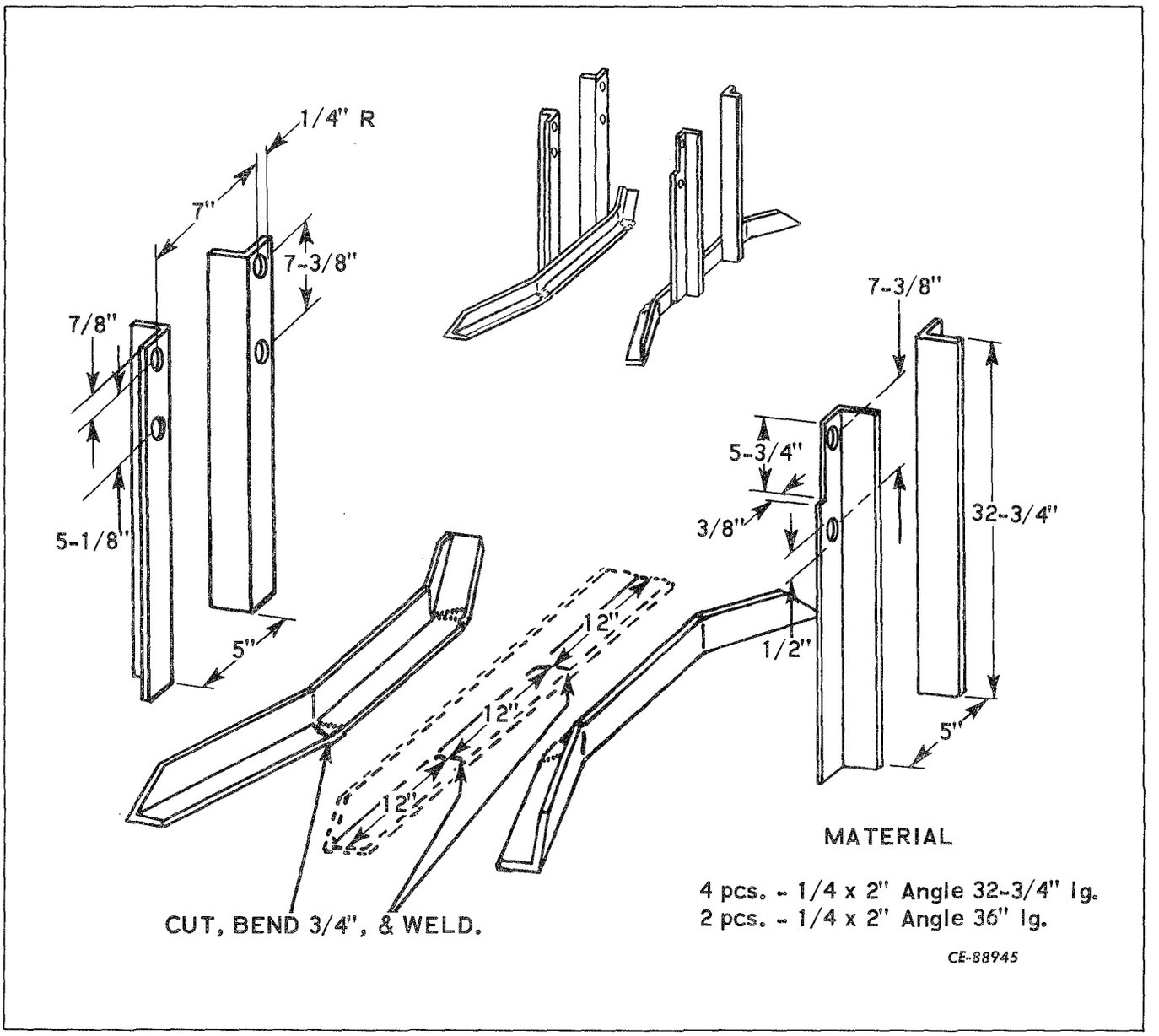

Figure 4-145
Transmission Stand.

(Continued on next page)

SPECIAL TOOLS - Continued

LIFTING EYE

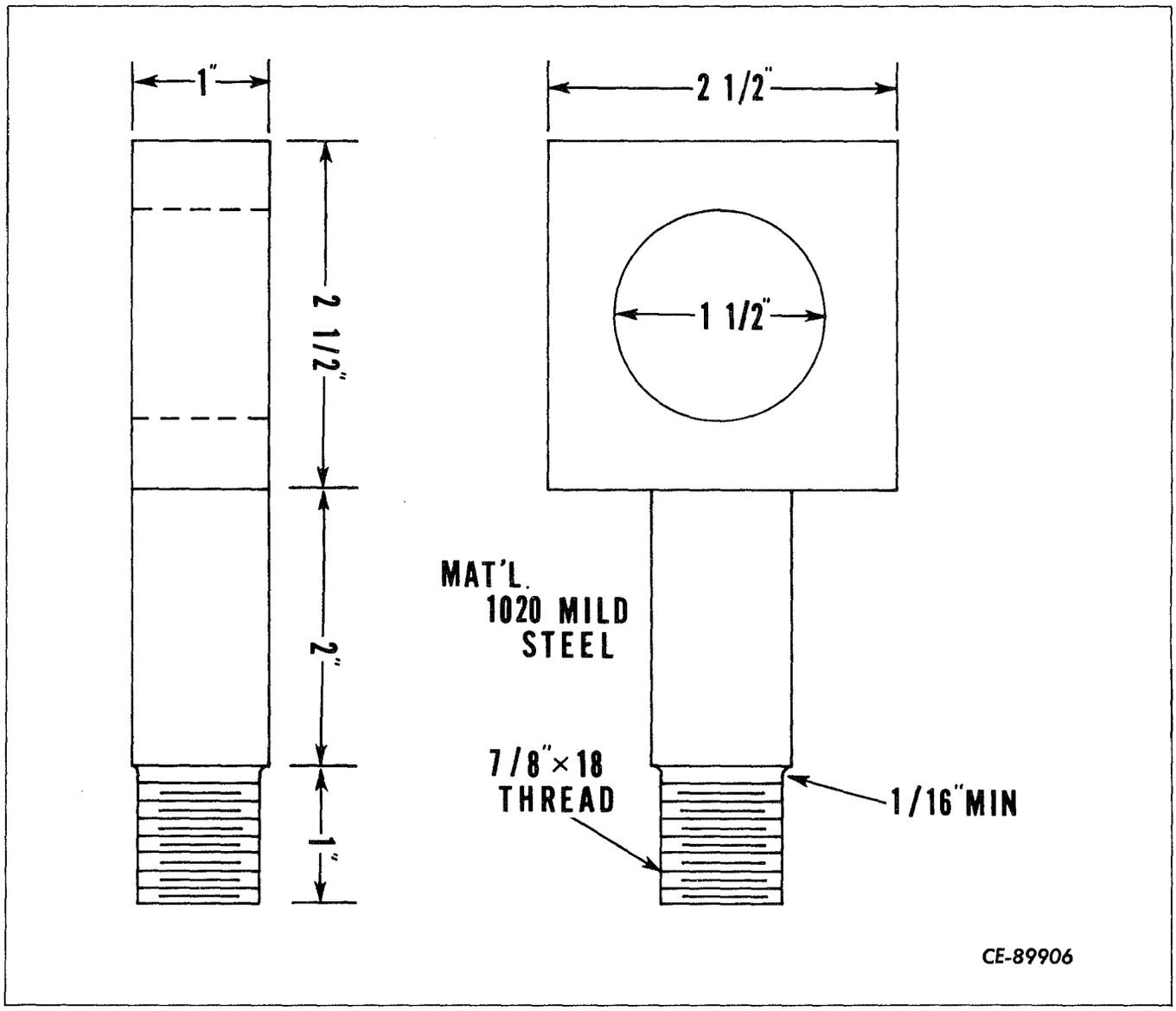

Figure 4-146
Lifting Eye.

SERVICE INFORMATION

LOCK RING COMPRESSOR

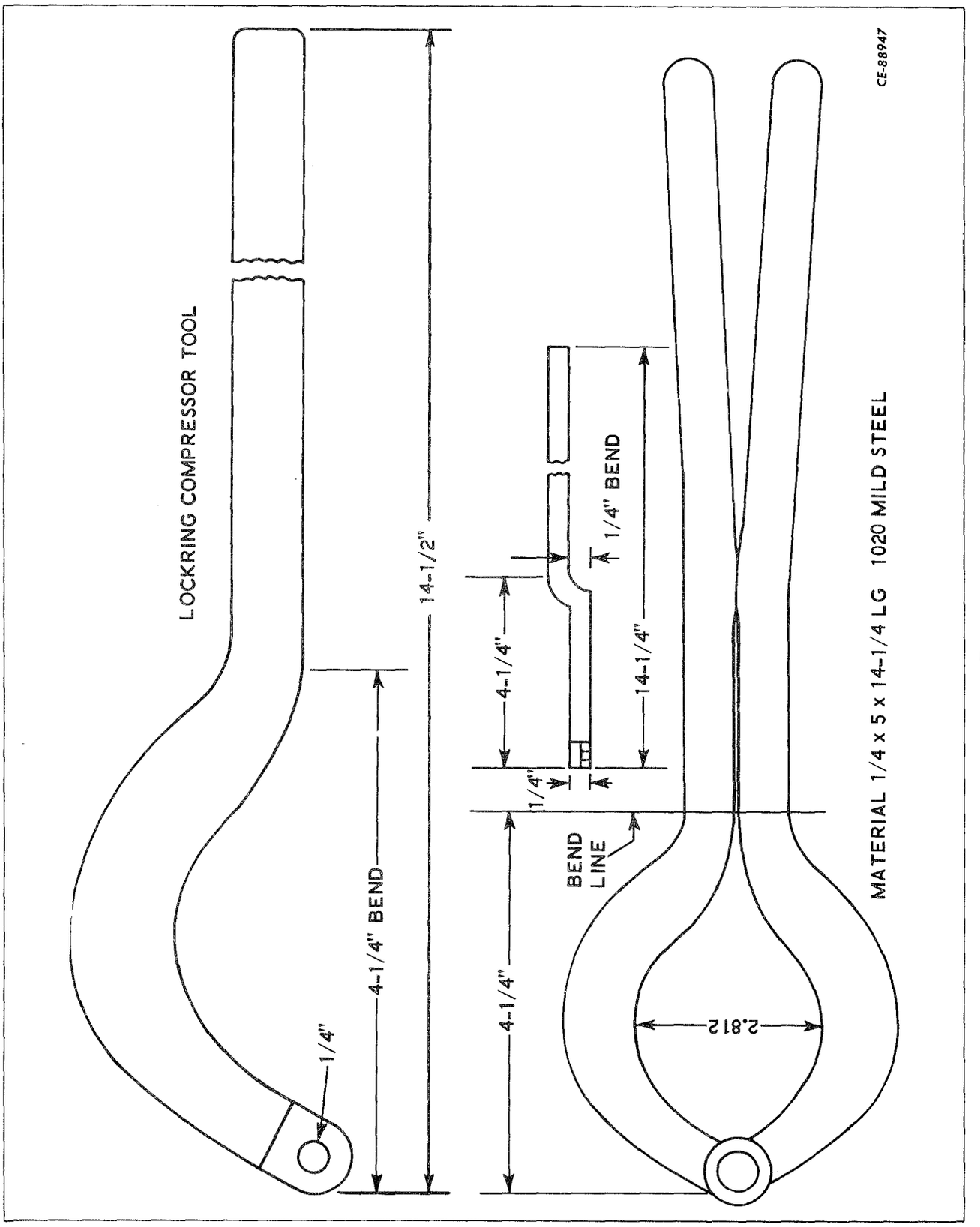

Figure 4-147
Lock Ring Compressor.

TRANSMISSION

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

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SECTION V

DRIVE SHAFTS

Page

SECTION V DRIVE SHAFTS

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Preventive Maintenance 1

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Removal 2
Disassembly 2
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Assembly 3
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Trouble Shooting 4
General 4
Trouble Shooting Chart 5

Service Information 5
Specifications 5
Lubricants and Capacities 6
Special Torques 6

Service Bulletin Reference 7

GENERAL INFORMATION

DESCRIPTION

The purpose of the drive shafts is to transmit power. All the drive shafts on the tractor are similar in construction. (Fig. 5-1). There is a universal joint located at each end of the shaft to permit pivoting in all directions and accommodate any misalignment. A slip joint is provided to allow the shaft to telescope, to compensate for changes in the distance between the connected components. During normal operation, the rear axle undergoes considerable axial movement due to surface irregularities and varying axle loads. Each time these conditions are encountered, a proportional change in the overall length of the drive shaft occurs. The slip joint accomodates these variations by telescoping. This eliminates the forces of tension that would be present in a shaft not so equipped.

PREVENTIVE MAINTENANCE

After each 100 hours of tractor operation and after overhaul, apply the proper type lubricant (see "SPECIFICATIONS") to the drive shaft grease fittings.

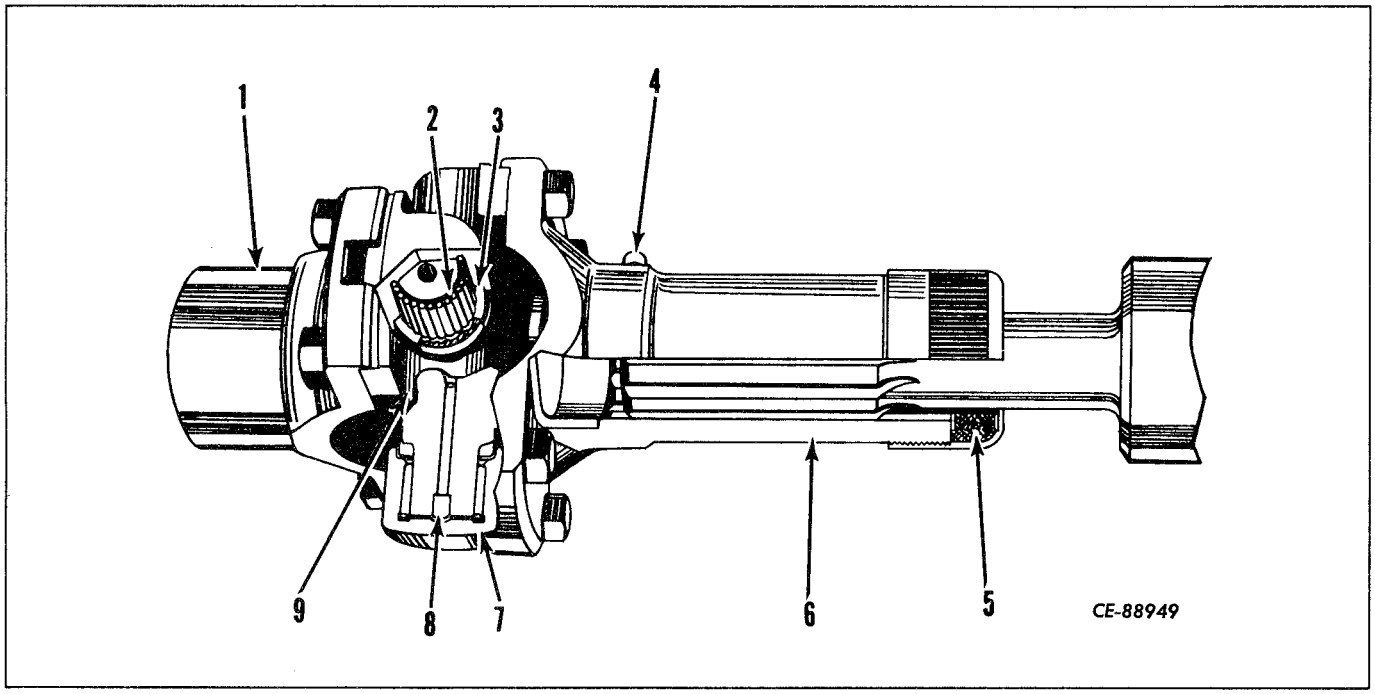

Figure 5-1
Typical Drive Shaft Universal Joint.

1. Yoke.
2. Roller bearing.
3. Grease seal.
4. Grease fitting.
5. Grease seal.
6. Slip yoke.
7. Bearing cap.
8. Lube channel.
9. Spider.

DRIVE SHAFTS

DISASSEMBLY, INSPECTION AND ASSEMBLY

REMOVAL

UPPER DRIVE SHAFT - Remove the nuts and U-bolts that secure the shaft universals to the torque converter and transmission. Remove the shaft.

LOWER REAR DRIVE SHAFT - Remove the nuts and U-bolts that secure the shaft universals to the transmission and differential. Remove the shaft.

LOWER FRONT DRIVE SHAFT - Remove the cap screws, nuts and U-bolts that secure the shaft universals to the differential and parking brake flange on the transmission.

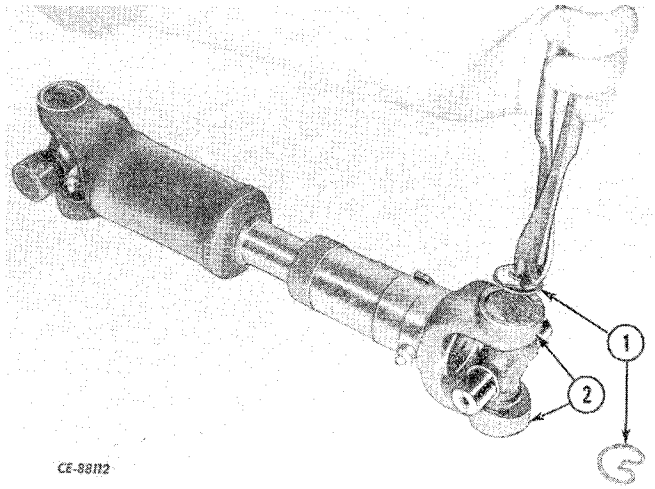

Figure 5-3

DISASSEMBLY

Place the drive shaft on a clean work bench.

Remove the two bearings (2, Fig. 5-2) from the spider (1).

Remove the snap rings (1, Fig. 5-3) from the grooves in the yoke ends (2).

Remove grease fitting (1, Fig. 5-4) from the slip joint housing and grease fitting (2) from universal spider.

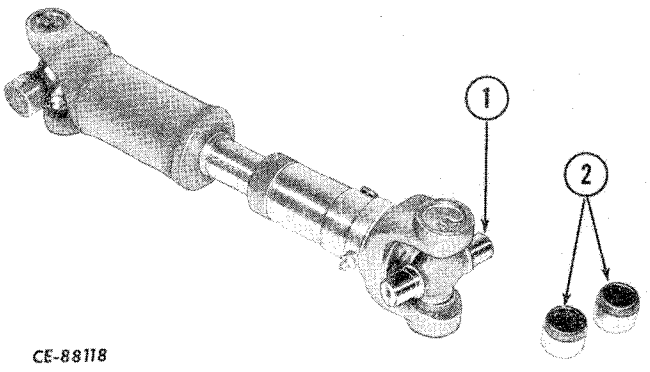

Figure 5-2

Place drive shaft in a shop press and press against the bearing (1, Fig. 5-5) and spider (2) to force the opposite bearing (3) out of the universal yoke.

Turn drive shaft over and press on spider (1, Fig. 5-6) and remove remaining bearing (2).

Disassemble opposite universal assembly in a similar manner.

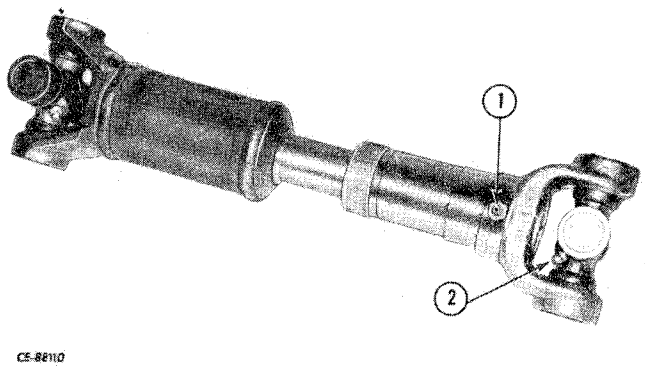

Figure 5-4

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DISASSEMBLY, INSPECTION AND ASSEMBLY

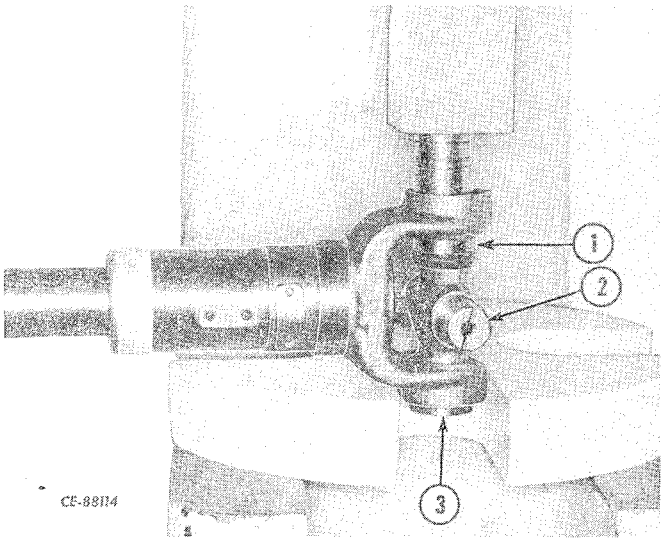

Figure 5-5

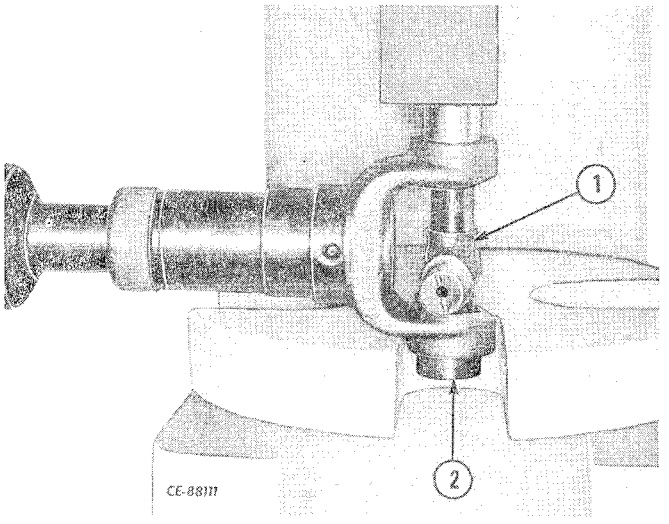

Figure 5-6

Loosen dust cap (1, Fig. 5-7) and separate the shaft halves (4 and 5). Remove steel washer (2) and cork washer (3).

NOTE: Before separating shaft halves, mark both halves to assure proper alignment at assembly.

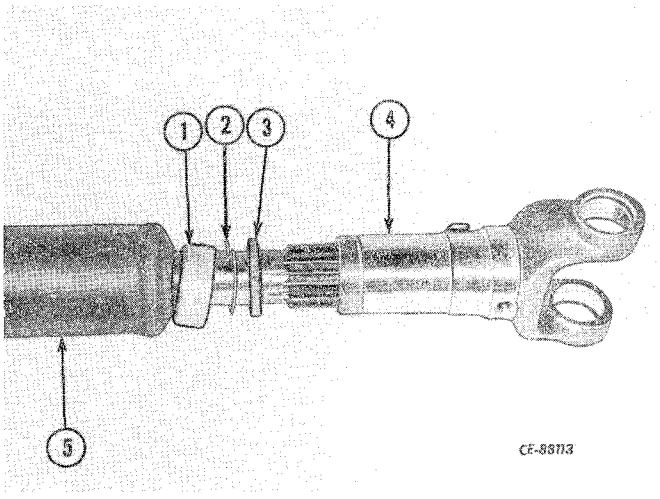

Figure 5-7

CLEANING AND INSPECTION

Clean all parts in solvent. Remove all burrs and rough spots from the yoke flanges and from slip joint splines. Use a fine tooth file or an India stone. Do not disassemble the bearing assemblies. Clean them with a brush and dry with compressed air.

Inspect the drive shaft for signs of torsional fractures or other indications of impending failure.

Parts that are to be assembled immediately should be coated with light oil to prevent corrosion. If parts are to be stored, coat them with a good grade rust preventive, and wrap them in paper treated to prevent corrosion.

Replace all seals and packings.

Place the bearing assemblies on the spider and check for wear. If they are worn, replace the complete spider and bearing assembly.

ASSEMBLY

Place dust cap (1, Fig. 5-7), steel washer (2), on cork washer (3) on the splined shaft half (5). Insert splined shaft half into the yoke (4) aligning the mark made at disassembly. Tighten dust cap hand tight.

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

ASSEMBLY - Continued

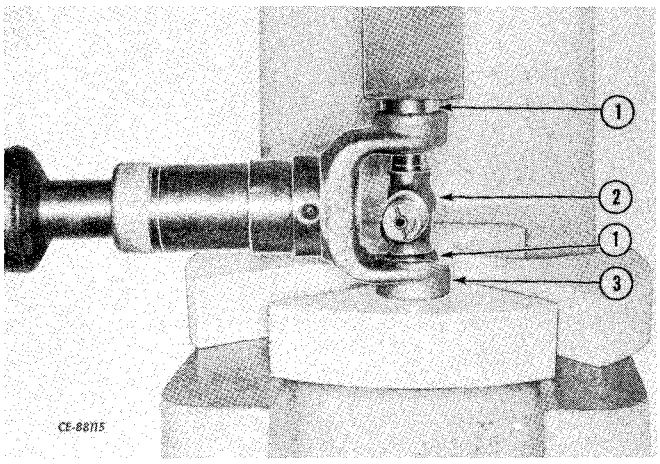

Figure 5-8

Install the spider (2, Fig. 5-8) and bearings (1) in the yoke (3). Use a shop press to press the bearings into the yoke as shown.

Install the bearing retaining snap rings (1, Fig. 5-3) in the grooves in the yoke (2).

Install the grease fittings (1 and 2, Fig. 5-4) in the slip yoke and spiders.

INSTALLATION

UPPER DRIVE SHAFT - Install the shaft and secure it to the torque converter and transmission with the U-bolts and nuts. Torque the nuts (refer to "SPECIAL TORQUES").

Torque:_____

LOWER REAR DRIVE SHAFT - Install the shaft and secure it to the transmission and differential with the U-bolts and nuts. Torque the nuts (refer to "SPECIAL TORQUES").

Torque:_____

LOWER FRONT DRIVE SHAFT - Install the shaft and secure it to the differential and parking brake flange on the transmission with the cap screws, nuts and U-bolts. Torque the cap screws and nuts (refer to "SPECIAL TORQUES").

Torque:_____

TROUBLE SHOOTING

GENERAL

Drive line failures are usually indicated by noise or vibrations. The noise or vibration may come and go as different speeds are reached.

The trouble shooting chart below will help to identify and isolate the cause of trouble in the drive line components.

Inspect the areas of the tractor around the drive shafts for signs of grease that may have been thrown out by the universal joint or slip joints. If grease is found in the area of the universal joints, replace the grease seals on the spider and bearing assemblies. If grease is found in the area of the slip joint, tighten the slip joint seal retainer. If the leakage continues, replace the slip joint grease seal. Refer to "DRIVE SHAFTS" for service instructions for the drive shaft assemblies.

Check the drive yokes on the torque converter, transmission and differentials for looseness. If the yokes can be moved back and forth any appreciable amount, disconnect the drive shaft at the yoke and tighten the yoke mounting nuts or cap screws. Torque the nuts or cap screws as directed under "SPECIAL TORQUES." Before tightening the yoke, check for backlash. Backlash indicates that the yoke splines are worn and the yoke should be replaced.

Check the universal joint spider and bearing assemblies for excessive play. If excessive play is found, the spider and bearing assemblies on the drive shaft should be replaced as described under "DRIVE SHAFTS."

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TROUBLE SHOOTING

TROUBLE SHOOTING CHART

COMPLAINT	POSSIBLE CAUSE	REMEDY
Noise.	1. Lack of lubricant.	1. Check grease seals in slip joints and universals.
	2. Back lash due to worn universal spider or bearings.	2. Replace spider and bearing assembly.
	3. Mounting 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 - TORQUE CONVERTER TO TRANSMISSION (IH Engines)

Make . . . . . Dana-Spicer Corp.

Model 901722-1

Length compressed (bearing center to bearing center) . . . . . 7-19/32"
Length extended (bearing center to bearing center) . . . . . 8-11/32"

DRIVE SHAFT - TORQUE CONVERTER TO TRANSMISSION (Detroit Diesel Engine)

Make . . . . . Dana-Spicer Corp.

Model 204096-11

Length compressed (bearing center to bearing center) . . . . . 15-5/16"
Length extended (bearing center to bearing center) . . . . . 17-7/16"

(Continued on next page)

DRIVE SHAFTS

SERVICE INFORMATION

SPECIFICATIONS - Continued

DRIVE SHAFT - TRANSMISSION TO FRONT DIFFERENTIAL

Make . . . . . Dana-Spicer Corp.

Model 205928-2

Length compressed (bearing center to bearing center) . . . . . 11-3/4"
Length extended (bearing center to bearing center) . . . . . 13-3/4"

DRIVE SHAFT - TRANSMISSION TO REAR DIFFERENTIAL

Make . . . . . Dana-Spicer Corp.

Model 206685-1

Length compressed (bearing center to bearing center) . . . . . 8"
Length extended (bearing center to bearing center) . . . . . 9-1/2"

LUBRICANTS AND CAPACITIES

ITEM	TYPE LUBRICANT				CAPACITY
	I. H.	API	SAE	MILITARY SPECIFICATION	
Drive Shafts	IH 25IH EP	Multi-purpose NLGI Grade 2 Lithium base		MIL-G-10924B	AR

AR - As Required.

SPECIAL TORQUES

Differential yoke U-bolt nuts . . . . . 32-37 ft. lbs.
Torque converter yoke U-bolt nuts . . . . . 20-24 ft. lbs.
Transmission flange yoke cap screws . . . . . 90 ft. lbs.
Transmission yoke U-bolt nuts
Upper . . . . . 20-24 ft. lbs.
Lower . . . . . 32-37 ft. lbs.

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SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

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SECTION VI

SOLID AXLE

Page

SECTION VI SOLID AXLE

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GENERAL INFORMATION

DESCRIPTION

The solid driving axle has 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, the axle uses a minimum of parts to accomplish its many functions. This simplicity of design increases reliability and provides easy servicing.

The axle is a full-floating, double reduction type. The axle is rigidly attached to the main frame at the front of the tractor.

Each wheel revolves on two tapered roller bearings mounted on the axle spindle. The axle is 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.

PREVENTIVE MAINTENANCE

LUBRICANT

Quantities and recommended lubricant are listed under "SERVICE INFORMATION" in this section.

OIL CHANGE INTERVALS

Axle lubricant should be changed at regular intervals of 1000 hours. Drain while the assembly is warm to allow contaminates to flow out with the draining lubricant. Refill the assembly with the specified lubricant. Check the lubricant level after each 100 hours of operation.

LEVEL CHECK

Check the level of the lubricant in the differential at the oil level plug in the differential carrier.

The lubricant should be even with the level of the plug hole.

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

Prior to checking the level of the lubricant in each planetary hub, rotate the wheel until the oil level mark on the planetary cover is horizontal and below the center line of the wheel and hub assembly. The lubricant should be even with the level of the plug hole.

BRAKE ADJUSTMENT

Refer to "SECTION XIII, BRAKE SYSTEM" for correct adjustment procedure.

DIFFERENTIAL ADJUSTMENT

The differential gears should be checked for backlash and correct tooth pattern 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.

SOLID AXLE

AXLE DISASSEMBLY AND ASSEMBLY

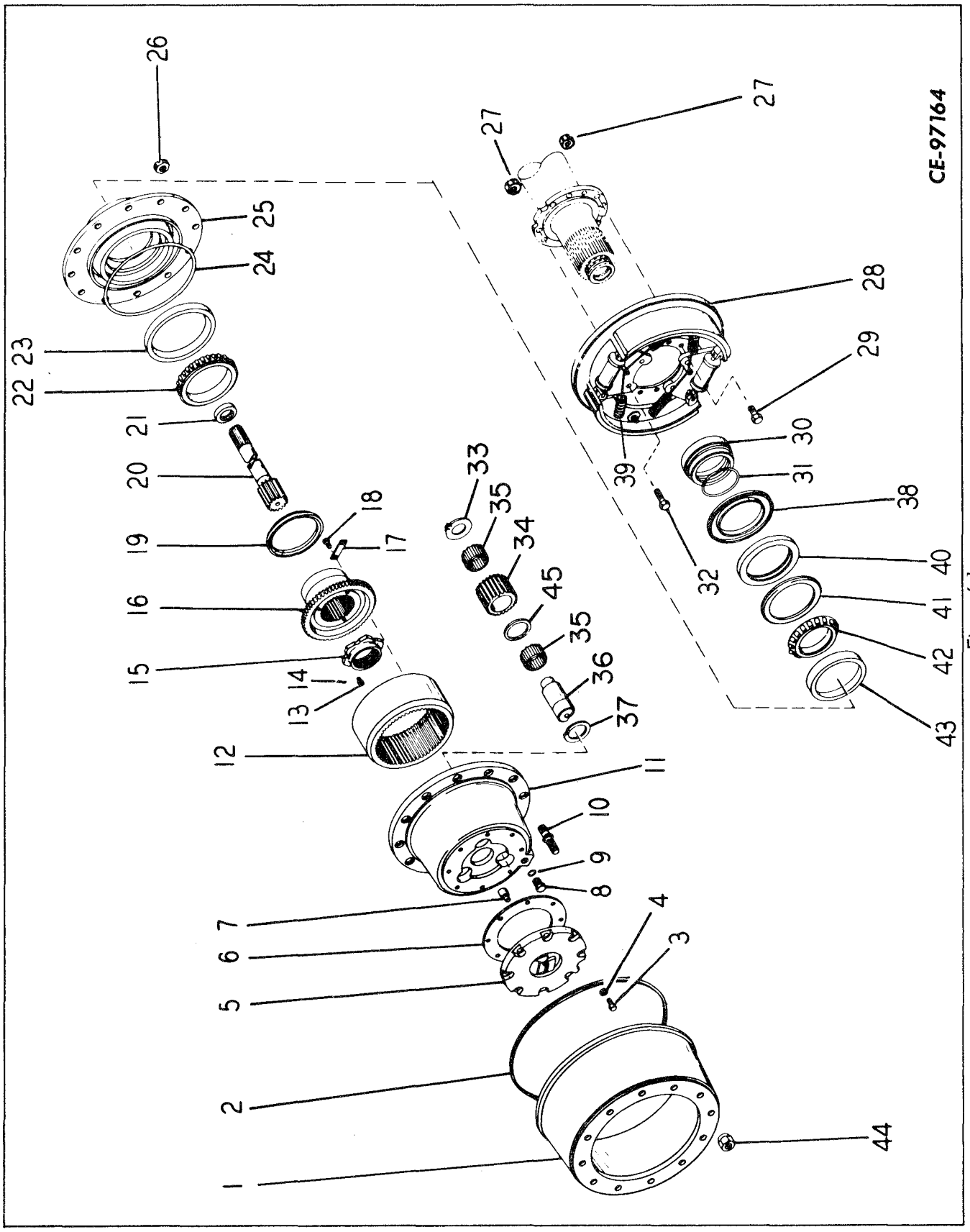

Figure 6-1
Solid Axle - Shaft and Hub.

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AXLE DISASSEMBLY AND ASSEMBLY

Legend for Figure 6-1

1. Brake drum.
2. Felt seal.
3. Cap screw.
4. Sealing washer.
5. Planetary cover.
6. Gasket.
7. Thrust button.
8. Drain/fill plug.
9. "O"-ring.
10. Shouldered stud.
11. Planetary carrier.
12. Ring gear.
13. Cap screw (recessed head).
14. Cotter pin.
15. Bearing adjusting nut.
16. Ring gear hub.
17. Lockplate.
18. Cap screw.
19. Spacer.
20. Axle shaft.
21. Shaft seal.
22. Bearing cone.
23. Bearing cup.
24. "O"-ring.
25. Wheel hub.
26. Stud nut.
27. Nut.
28. Brake assembly.
29. Cap screw.
30. Seal retainer.
31. "O"-ring.
32. Shoulder bolt.
33. Thrust washer.
34. Planetary pinion gear.
35. Bearing.
36. Pinion shaft.
37. Thrust washer
38. Oil scavenger.
39. Brake return spring.
40. Lip type seal.
41. Spacer.
42. Bearing cone.
43. Bearing cup.
44. Lug nut.
45. Spacer.

PREPARATION

Axle disassembly preparation should include:

Removing wheels and tires.

Disconnecting drive shaft and brake lines at the axle.

Removing the axle from the tractor.

Using plain steam (no caustic soda) to clean the exterior of the axle, planetary hubs and brake drums.

Preparing a clean work area.

Providing a hoist and suitable sling to lift component parts.

Raise the axle assembly from the floor and support on suitable stands. Be sure axle will not tip or roll.

Drain the planetary hubs by rotating them until the drain/filler plugs (8, Fig. 6-1) are at the bottom. Remove the plugs and "O" rings (9) and drain the lubricant.

DISASSEMBLY

Remove brake drum (1, Fig. 6-1) from axle assembly using a suitable sling and hoist.

Remove cap screws (3, Fig. 6-1) and sealing washers (4) that secure planetary cover (5) to carrier assembly (11).

Remove cover and discard gasket.

Inspect thrust button (7, Fig. 6-1) in planetary cover. Replace if worn.

Thread axle removal tool (refer to "SPECIAL TOOLS") in tapped pilot hole or axle shaft (20, Fig. 6-1). Remove shaft from housing.

Remove studs (10, Fig. 6-1) and nuts (26) that secure planetary carrier to hub.

Remove planetary carrier assembly (11, Fig. 6-1) using a suitable sling and hoist.

For carrier assembly overhaul refer to "PLANETARY DISASSEMBLY AND ASSEMBLY."

Remove cotter pin (14, Fig. 6-1) and cap screw (13) that lock bearing adjusting nut (15) in position. Remove adjusting nut. Slide ring gear and hub assembly (12, 16) from axle housing splines. Refer to "PLANETARY DISASSEMBLY AND ASSEMBLY" for ring gear and hub overhaul.

(Continued on next page)

SOLID AXLE

AXLE DISASSEMBLY AND ASSEMBLY

DISASSEMBLY - Continued

Remove wheel hub assembly (25, Fig. 6-1) from axle housing. Remove and discard "O" ring (24). Refer to "PLANETARY DISASSEMBLY AND ASSEMBLY" for wheel hub overhaul.

Remove brake shoe return springs (39, Fig. 6-1). Carefully slide off oil scavenger (38) and seal retainer (30) assembly.

NOTE: Do not damage oil drain tube attached to scavenger during removal of assembly.

Remove and discard "O" ring seal (31, Fig. 6-1) from inner bore of retainer (30). Do not separate oil scavenger and seal retainer assembly unless replacement of either item is required. If replacement is required items must be pressed apart. When scavenger is pressed on seal retainer, be sure scavenger bottoms all around retainer shoulder.

Remove and discard axle shaft seal (21, Fig. 6-1) from inner bore of spindle.

If removal of brake assembly (28, Fig. 6-1) is required, refer to "SECTION XIII, BRAKE SYSTEM."

Remove drain plug (5, Fig. 6-2) and "O" ring (4) from the differential bowl of axle housing and drain lubricant. When completely drained, rotate housing until differential yoke is vertical.

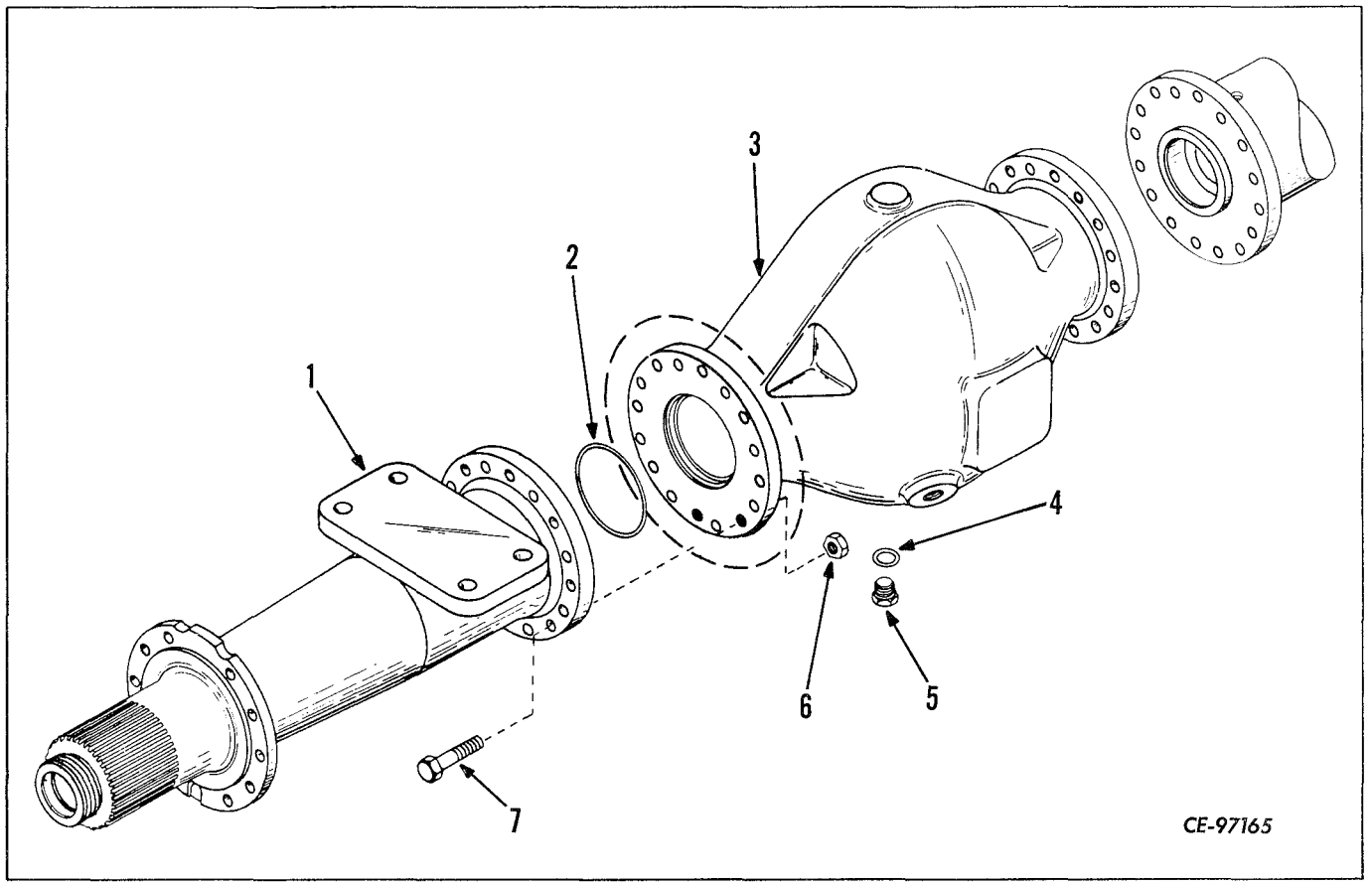

Figure 6-2
Solid Axle Housing.

1. Axle housing.
2. "O"-ring.
3. Axle bowl.
4. "O"-ring.
5. Drain plug.
6. Nut.
7. Cap screw.

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AXLE DISASSEMBLY AND ASSEMBLY

Remove cap screws and lock washers that attach differential assembly to axle bowl. Using a suitable hoist, pull differential assembly from housing.

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

If a section of axle housing requires removal, index the two flanges to be separated with a chisel or two punch marks to insure correct assembly.

Remove cap screws (7, Fig. 6-2) and hex nuts (6) that secure axle housing (1) and axle bowl (3). Separate housings and discard "O" ring seal (2).

CLEANING AND INSPECTION

CLEAN

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.

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.

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

CAUTION: NEVER dry bearings by spinning with compressed air.

INSPECTION

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.

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

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

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.

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

Assembling the following tools and supplies:

Torque wrench - 500 ft. lb. capacity.
Axle shaft tool - Refer to "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.

AXLE DISASSEMBLY AND ASSEMBLY

ASSEMBLY

Install a new "O" ring (2, Fig. 6-2) in position on axle housing (1) boss. Align identification marks on the two housing flanges (1, 3) and secure with cap screws (7) and hex nuts (6).

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

Torque: _____

Be sure mating surfaces of differential carrier and axle bowl are absolutely clean. Install new gasket on housing with holes in correct alignment.

Lower differential assembly into housing, aligning holes. Lightly coat retaining cap screw threads with Mar-Seal or equivalent sealant and install with lock washers. Tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

If removed, install brake backing plate assembly (refer to "SECTION XIII, BRAKE SYSTEM").

Coat a new axle seal (21, Fig. 6-1) with Mar-Seal or equivalent sealant and install in axle housing bore. Be sure seal bottoms squarely on shoulder of bore.

Coat "O" ring seal (31, Fig. 6-1) in bore of seal retainer (30) with petroleum jelly. Install oil scavenger-seal retainer assembly (38, 30) on axle housing spindle. Be careful not to damage drain tube on oil scavenger during installation. Seal retainer must bottom on axle housing flange.

Install brake shoe return springs (39, Fig. 6-1).

Lubricate oil seal contact area of seal retainer and lip of seal (40, Fig. 6-1) in wheel hub (25) with a light grease.

Install wheel hub assembly on axle housing spindle being careful not to damage seal. Be sure inner race of hub inner bearing bottoms on seal retainer.

Lubricate a new "O" ring seal (24, Fig. 6-1) with a light grease and install on hub (25) shoulder.

Slide assembled ring gear (12, Fig. 6-1) and hub (16) on axle housing splines being sure outer hub bearing (22) bottoms in its outer race (23) in wheel hub (25).

Install bearing nut (15, Fig. 6-1) on axle spindle. Tighten nut to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Back off adjusting nut and retighten to recommended torque. Rotate hub (25, Fig. 6-1) during both torquing operations.

Back off nut until one of its notches is in alignment with one of the cap screw holes. Install cap screw (13, Fig. 6-1) and tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Secure cap screw (13, Fig. 6-1) with a cotter pin (14).

Be sure new seal ring (24, Fig. 6-1) is correctly positioned on shoulder of wheel hub (25). Using a suitable sling and hoist, position pinion carrier assembly (11) over ring gear (12) and align stud holes.

Install wheel studs (10, Fig. 6-1) through carrier (11) and wheel hub (25) and secure with nuts (26). Tighten nuts to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

NOTE: Studs are installed with short end toward brake shoes.

Use axle removal and installation tool (refer to "SPECIAL TOOLS") to install axle (20, Fig. 6-1) in axle housing. Using tool as a lever, 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 gears.

(Continued on page 8)

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AXLE DISASSEMBLY AND ASSEMBLY

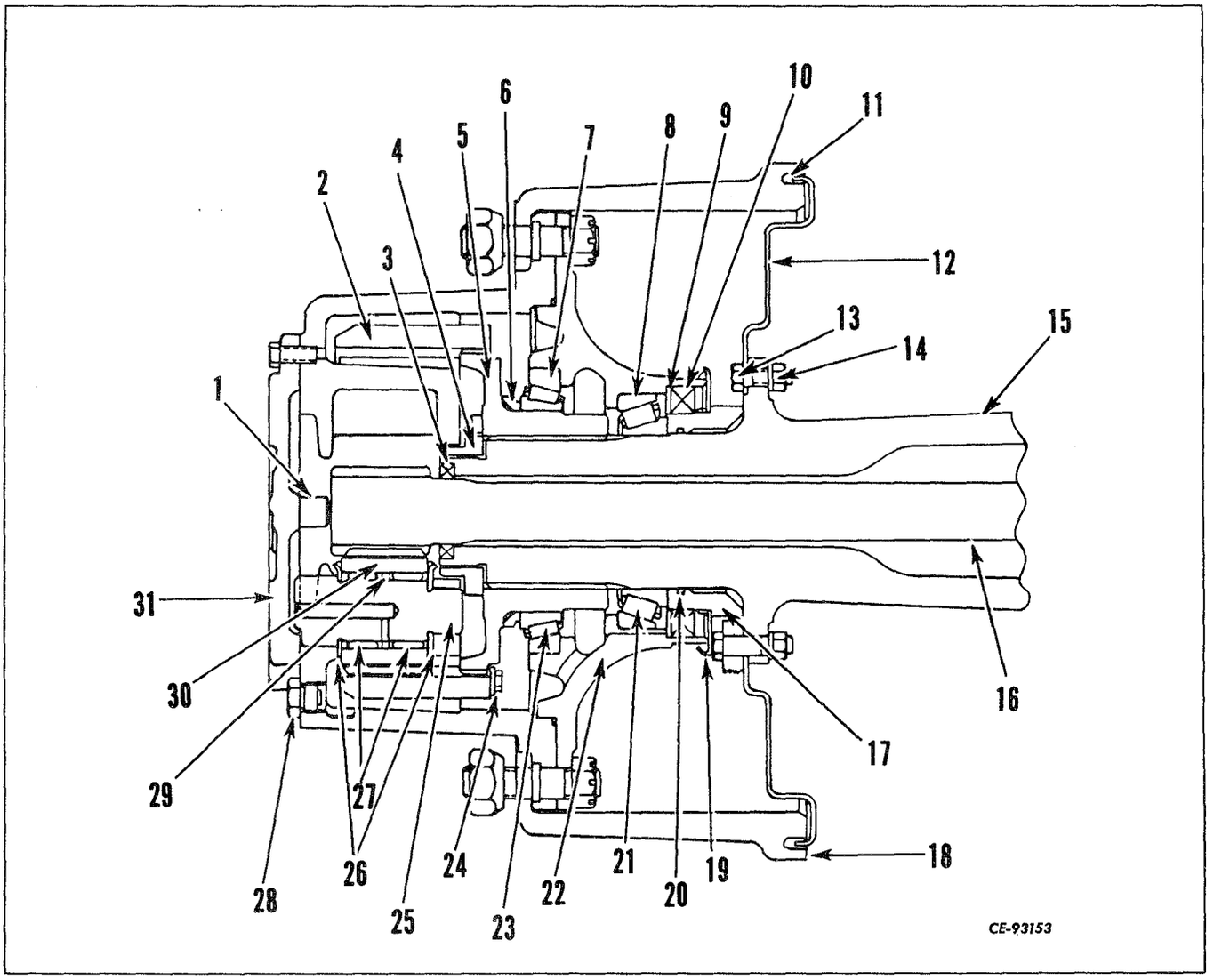

Figure 6-3
Planetary Hub Assembly.

1. Thrust button.
2. Ring gear.
3. Oil seal.
4. Bearing adjusting nut.
5. Ring gear hub.
6. Spacer.
7. Bearing cup.
8. Bearing cup.
9. Spacer.
10. Oil seal.
11. Felt brake seal.
12. Brake assembly.
13. Cap screw.
14. Lock nut.
15. Axle housing.
16. Axle shaft.
17. Seal retainer.
18. Brake drum.
19. Oil scavenger.
20. "O" ring.
21. Bearing cone.
22. Wheel hub.
23. Bearing.
24. Lock plate with cap screw.
25. Planetary pinion shaft.
26. Thrust washer.
27. Bearing.
28. Filler plug.
29. Spacer.
30. Planetary pinion gear.
31. Planetary cover.

AXLE DISASSEMBLY AND ASSEMBLY

ASSEMBLY - Continued

If thrust button (7, Fig. 6-1) is worn or damaged, replace with a new unit.

Using a new gasket (6, Fig. 6-1) and sealing washers (4), install planetary cover (5). Tighten cap screws (3) evenly to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Install new felt seal (2, Fig. 6-1) in groove in outer circumference of brake drum (1). Install brake drum, being sure felt seal is properly seated.

Rotate planetary hub until "OIL LEVEL" line on the planetary cover (5, Fig. 6-1) is horizontal. Remove drain and fill plug (8) with "O" ring (9) and fill planetary hub to level of plug hole with recommended lubricant (refer to "LUBRICANTS AND CAPACITIES"). Install plug with new "O" ring.

Rotate axle until differential input yoke is horizontal. Install drain plug (5, Fig. 6-2) with a new "O" ring (4). Tighten plug securely. Remove filler plug in the side of the differential carrier and fill differential to level of the plug hole with recommended lubricant (refer to "LUBRICANTS AND CAPACITIES").

After mounting axle in tractor with wheels and tires installed, adjust each brake assembly and bleed brakes (refer to "SECTION XIII, BRAKE SYSTEM").

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

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.

DISASSEMBLY

Place differential assembly in a suitable holding fixture (refer to "SPECIAL TOOLS"). If initial inspection indicates that drive gears will not be replaced, record the backlash of the ring and pinion gears before disassembly. This measurement will be used during assembly.

To measure backlash, attach a dial indicator fixture to the differential carrier (Fig. 6-4). Secure the input yoke (1, Fig. 6-6) and rotate the ring gear back and forth. The indicated movement is the backlash (clearance) between the teeth. A predetermined amount of backlash is necessary and should not be altered to any great extent.

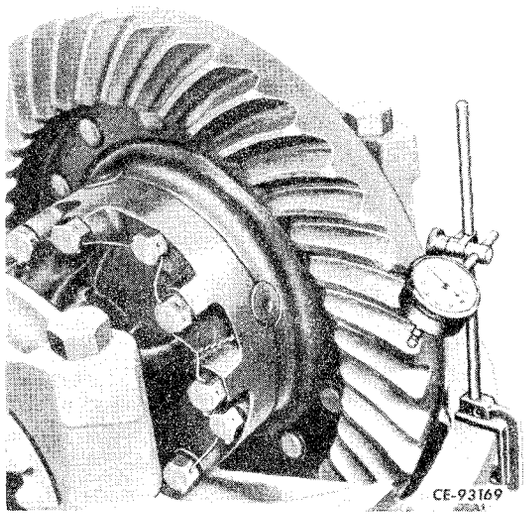

Figure 6-4
Measuring Backlash.

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DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

Bearing caps (6, Fig. 6-7) and carrier housing legs (9) are marked at the factory to assure correct assembly. If original identification marks are not clear, mark one bearing cap and carrier leg with a center punch (8) or chisel to identify for correct assembly.

Remove cotter pins (4, Fig. 6-5) and lock wire (3) from bearing caps. Remove bearing cap bolts (2, 5) and flat washers (6) that secure bearing caps (7) to carrier housing legs (8). Tap bearing caps with a fiber hammer to loosen and remove caps from carrier bearings. Remove bearing adjuster (1).

Lift differential assembly just high enough to remove carrier bearing cups (9, Fig. 6-6). Tag cups to identify them for correct assembly.

If factory-made identification marks on differential case halves (17, 24, Fig. 6-6) are not clear, punch mark case for correct alignment during assembly.

Cut lock wire and remove cap screws (16, Fig. 6-6). Separate case halves (17, 24). If a side gear (19) is removed with plain case half (11) be sure it does not fall.

Remove spider (18, Fig. 6-6) with pinion gears (20) and thrust washers (21). Spider may be installed four ways and need not be marked before removal. Remove remaining side gear and thrust washer.

If removal of ring gear (22, Fig. 6-6) is required, carefully center punch rivets (23) in center of their heads. Use a drill bit 1/32 inch smaller than body of rivet to drill through head. Press out rivets and separate gear from case.

CAUTION: Do not chisel off rivet heads.

To remove differential bearing cones (11, Fig. 6-6) use a suitable bearing puller or shop press. Be sure force is exerted on inner bearing race, not bearing cage.

NOTE: If the differential case bearings are to be reused it will be necessary to retain the same relationship between the cups and cones because of the established wear pattern. Proper parts identification should be made during disassembly.

Hold input yoke (1, Fig. 6-6) and remove hex nut (29). Remove flat washer (30) and yoke-slinger combination. A suitable puller may be required. Using a fiber mallet or soft drift, tap pinion shaft (6) from differential carrier.

CAUTION: Do not allow pinion shaft assembly to fall.

Do not lose shims (28, Fig. 6-6). These will be used during assembly.

With a shop press or suitable puller, remove large bearing cone (8, Fig. 6-6) from pinion shaft (6). If replacement of either pinion shaft bearing is required, drive its cup (5, 7) from carrier housing using a drift. Retain shim(s) (26). They will be used during assembly.

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.

(Continued on next page)

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

CLEAN, INSPECT AND REPAIR - Continued

CLEAN - Continued

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.

INSPECT

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 soft iron locking wire to eliminate wire breakage.

The burrs caused by lock washers at the spot surface of stud holes of gages and covers, should be removed to assure easy assembly.

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

ASSEMBLY

If large pinion shaft bearing (8, Fig. 6-6) was removed, press a new bearing cone on shaft. Be sure it bottoms on gear shoulder.

(Continued on page 12)

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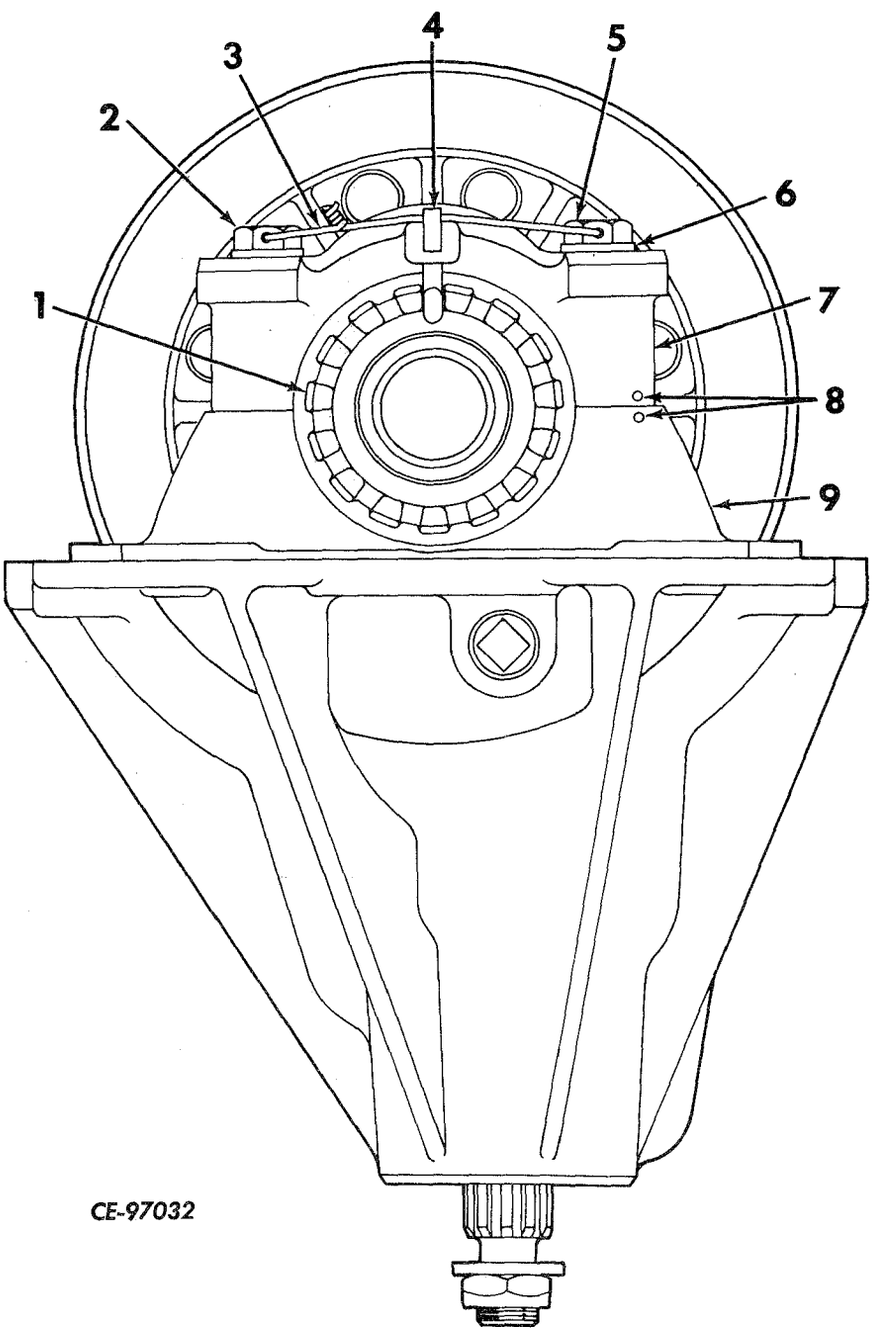

Figure 6-5
Differential Assembly - Side View.

1. Adjuster.
2. Bearing cap bolt.
3. Lock wire.
4. Cotter pin adjuster lock.
5. Bearing cap bolt.
6. Washer.
7. Bearing cap.
8. Punch marks.
9. Carrier leg.

SOLID AXLE

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

ASSEMBLY - Continued

Position original shims (26, Fig. 6-6) in carrier (27) and press in new bearing cup (7). Be sure cup and shims are bottomed against shoulder in carrier bore. If shims were damaged during removal of bearing cup, replace them with shims of equal thickness. Press a new bearing cup (5) in carrier bore being sure it bottoms on bore shoulder.

Position original shim pack (28, Fig. 6-6) on pinion shaft (6) and install shaft in carrier bore. Install small pinion shaft bearing (4) on shaft. Coat the O.D. of a new lip type seal (3) with Mar-Seal or equivalent sealant and press seal in carrier bore. Seal lip must face in toward bearing. Be sure seal bottoms on shoulder of housing bore.

Lubricate lip of seal (3, Fig. 6-6) and the lip contact surface of input yoke (1) with a light coating of petroleum jelly or clean, new axle lubricant. Install yoke/slinger assembly (1, 2) on pinion shaft and secure with washer (30) and hex nut (29).

Hold input yoke (1, Fig. 6-6) and tighten hex nut (29) to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Using a suitable socket, attach an inch-pound torque wrench to pinion shaft nut (29, Fig. 6-6). Rotate shaft with wrench and note the rotating (preload) torque.

NOTE: Do not use starting torque. Use rotating torque only.

The rotating (preload) torque should fall within recommended limits (refer to "TOLERANCES").

Rotating Torque: _____

An alternate method of checking rotating torque consists of wrapping several turns of soft iron wire around shank of input yoke (1, Fig. 6-6). Attach a spring scale to loose end of wire and pull yoke through several turns. Note amount of pull on spring scale required to keep shaft turning. Do not record the starting effort. Compute rotating torque as follows:

Assuming the diameter of the yoke at the point of the wrapped wire is 2-1/2 inches, the radius would equal 1-1/4 inches. Eight pounds pull on the spring scale would equal 10 inch pounds of rotating (preload) torque. Be sure to exclude starting torque. If preload torque is too high, add shims (28, Fig. 6-6). If torque is too low, subtract shims. Be sure hex nut (29) is correctly torqued before rechecking preload torque.

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, the head being formed will be at least 1/8" larger in diameter than the rivet hole.

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

Press Tonnage: _____

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

Position thrust washer (15, Fig. 6-6) and side gear (19) in ring gear and case half assembly (22, 24) after lubricating parts with new axle lubricant (refer to "LUBRICANTS AND CAPACITIES").

Lubricate spider (18, Fig. 6-6), pinion gears (20) and thrust washers (21) with new axle lubricant.

Place spider, pinion gears and thrust washers in position in flanged case half (24, Fig. 6-6).

(Continued on page 14)

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DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

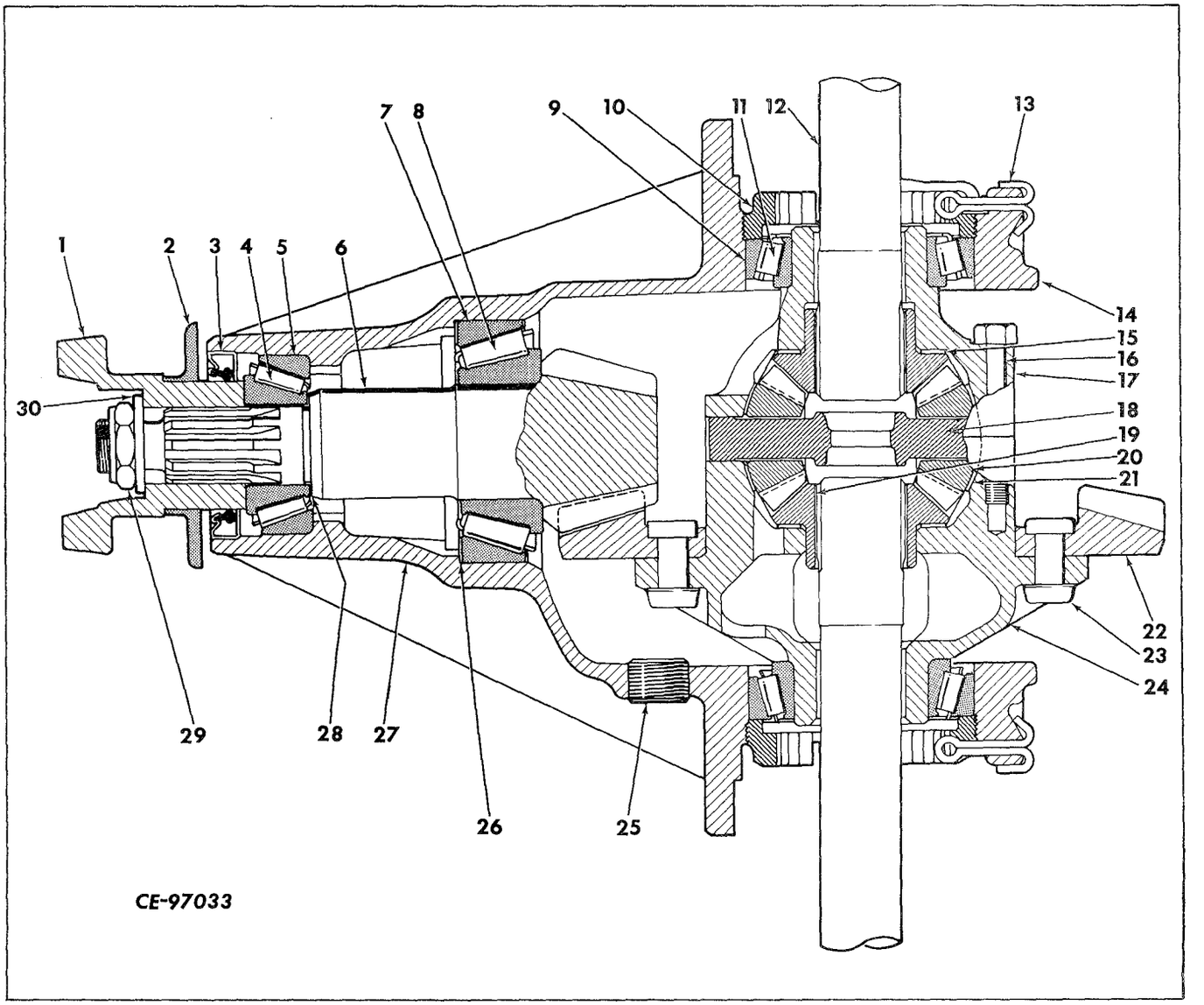

Figure 6-6
Differential Assembly - Cross Section.

1. Input yoke.
2. Slinger.
3. Lip type seal.
4. Bearing cone.
5. Bearing cup.
6. Pinion shaft.
7. Bearing cup.
8. Bearing cone.
9. Bearing cup (2).
10. Adjuster (2).
11. Bearing cone (2).
12. Axle shaft (2).
13. Cotter pin adjuster lock (2).
14. Bearing cap (2).
15. Flat washer (2).
16. Cap screw.
17. Case - plain half.
18. Spider.
19. Side gear (2).
20. Pinion gear (4).
21. Thrust washer (4).
22. Ring gear.
23. Rivet.
24. Case - flanged half.
25. Level plug.
26. Shim (selective).
27. Differential carrier.
28. Shim (selective).
29. Nut.
30. Washer.

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

ASSEMBLY - Continued

Install remaining side gear (19, Fig. 6-6) and thrust washer (15) after lubricating with new axle lubricant.

Align mating marks on case halves and secure assembly with four equally spaced cap screws and hex nuts.

Check assembly for free rotation of differential gears. Correct if necessary.

Install remaining cap screws and hex nuts. Tighten all differential case cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Lock wire case retaining cap screws.

Press bearings (11, Fig. 6-6) squarely on case halves being sure they bottom on case shoulders. Use a suitable sleeve and press only on bearing inner race.

Lubricate bearings with new axle lubricant.

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

Temporarily install bearing cups (9, Fig. 6-6) and bearing caps (14). Tighten bearing cap retaining cap screws (2, Fig. 6-5) to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

NOTE: Observe reference punch marks (8, Fig. 6-5) when installing bearing caps.

Bearing cups (9, Fig. 6-6) must be a hand push fit in their respective bores. If cups are too tight, bores must be reworked with emery cloth until a push fit is obtained. Use a blued bearing cup as a gauge and check the fit often. When cups fit properly, remove bearing caps.

Coat differential bearing cones and cups with new axle lubricant.

Place bearing cups over differential bearing cones and position differential assembly in carrier (27, Fig. 6-6).

Install bearing adjusting nuts (1, Fig. 6-5). Hand turn them against bearing cups.

Install bearing caps (7, Fig. 6-5) on their respective sides (refer to identification marks (8)) and tap lightly into position.

If caps do not position properly, adjusting nuts may be cross threaded. Remove caps and reposition the adjusting nuts.

NOTE: Do not force caps into position.

Install flat washers (6, Fig. 6-5) and cap screws (2). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Using a dial indicator on back face of ring gear (Fig. 6-4) loosen bearing adjuster on side opposite gear teeth just enough to notice end play on indicator.

Tighten the same adjuster just sufficient to obtain .000 end play.

Check ring gear for runout. If runout exceeds recommended maximum (refer to "TOLERANCES") remove differential and determine cause.

Max. Runout: _____

From the .000 end play setting, tighten adjusters one notch each to preload differential bearings.

If ring and pinion gears were not replaced, the backlash dimension 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: _____

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DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

Backlash is adjusted by backing off one adjuster and advancing the opposite one the same amount.

Apply oiled red lead to ring gear teeth. When pinion is rotated the red lead is squeezed away by the contact of the 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 the ring gear with a steel bar and using a wrench to rotate the pinion. When making adjustments, check the drive side of the ring gear teeth. Coating approximately 12 teeth is sufficient to check tooth contact.

After a satisfactory tooth contact is obtained, especially in relation to the top and bottom of the tooth, the backlash may be altered within recommended limits (refer to "TOLERANCES" under "SERVICE INFORMATION") to obtain a better contact position relative to the length of the tooth.

Backlash Alteration Limits: _____

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

With adjustments properly made, the contacts shown in Fig. 6-7 will be obtained. The area of contact favors the toe and is centered between the top and bottom of the tooth.

The hand rolled pattern shown in Fig. 6-8 will result in a pattern centered in the length of the tooth when the gears are under load. The loaded pattern will be almost full length and the top of the pattern will approach the top of the gear tooth.

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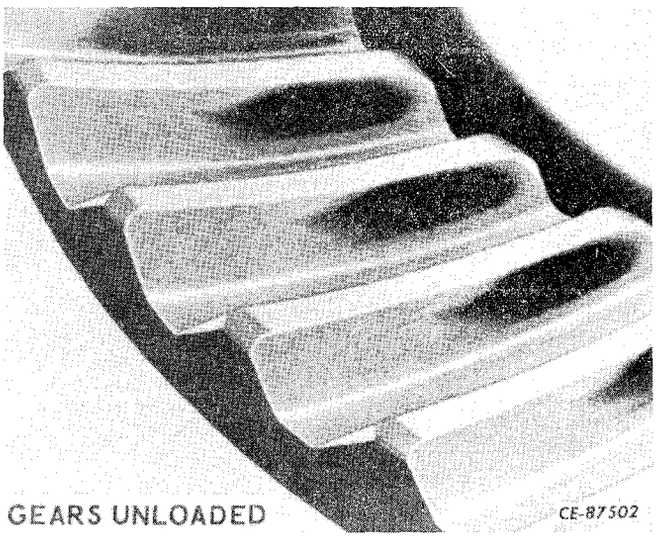

Figure 6-7

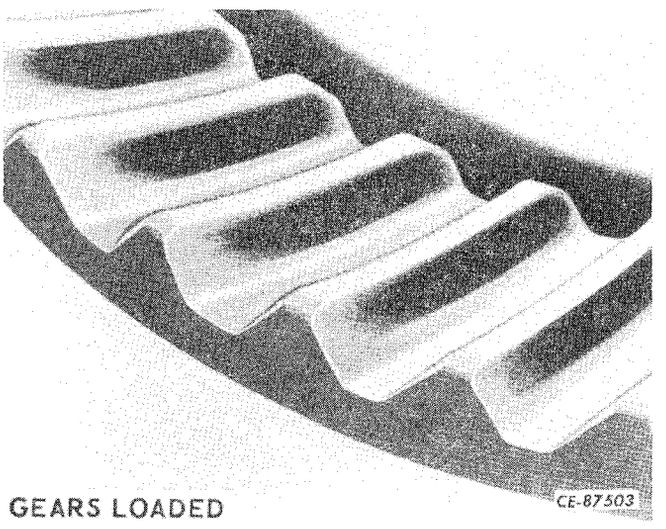

Figure 6-8

DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

ASSEMBLY - Continued

The pattern on the coast side of the teeth will appear the same width as the drive side; however the over-all length will be centered between the toe and heel of the gear tooth.

Set used gears to have tooth contacts to match the established wear pattern. Hand rolled patterns of used gears will be smaller in area and should be at the toe end of the wear pattern.

A high contact (Fig. 6-9) indicates the pinion shaft is too far out. Set the pinion to the correct depth by removing shims (26, Fig. 6-6) from beneath the large pinion bearing cup (7). A slight outward movement of the ring gear may be necessary to maintain correct backlash.

A low contact (Fig. 6-10) indicates the pinion shaft is too deep. Set the pinion to the correct depth by adding shims (26, Fig. 6-6) beneath the large pinion bearing cup (7). Slight inward movement of the ring gear may be necessary to maintain correct backlash.

After establishing correct tooth contact, install adjuster locks (4, Fig. 6-5). Lock wire (3) bearing cap retaining cap screw (5).

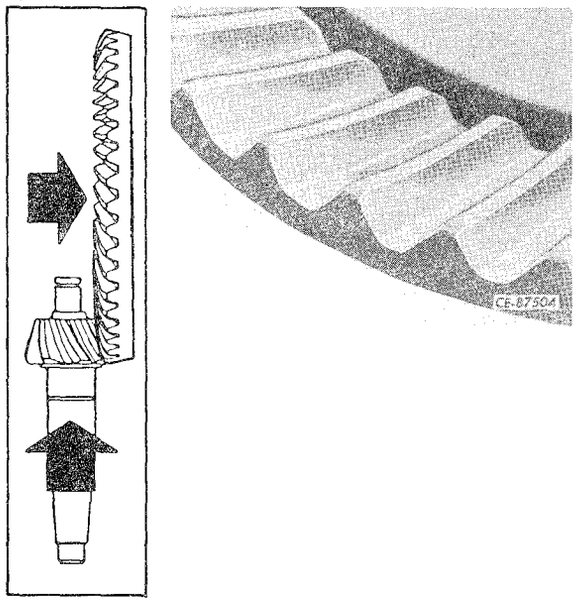

Figure 6-9
High Contact.

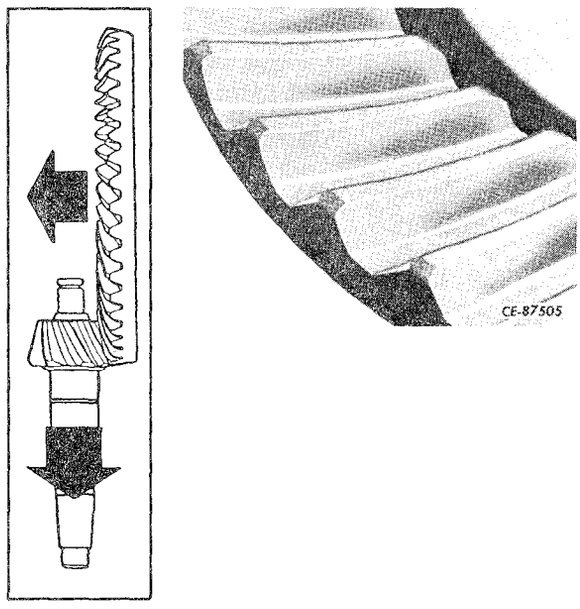

Figure 6-10
Low Contact.

PLANETARY DISASSEMBLY AND ASSEMBLY

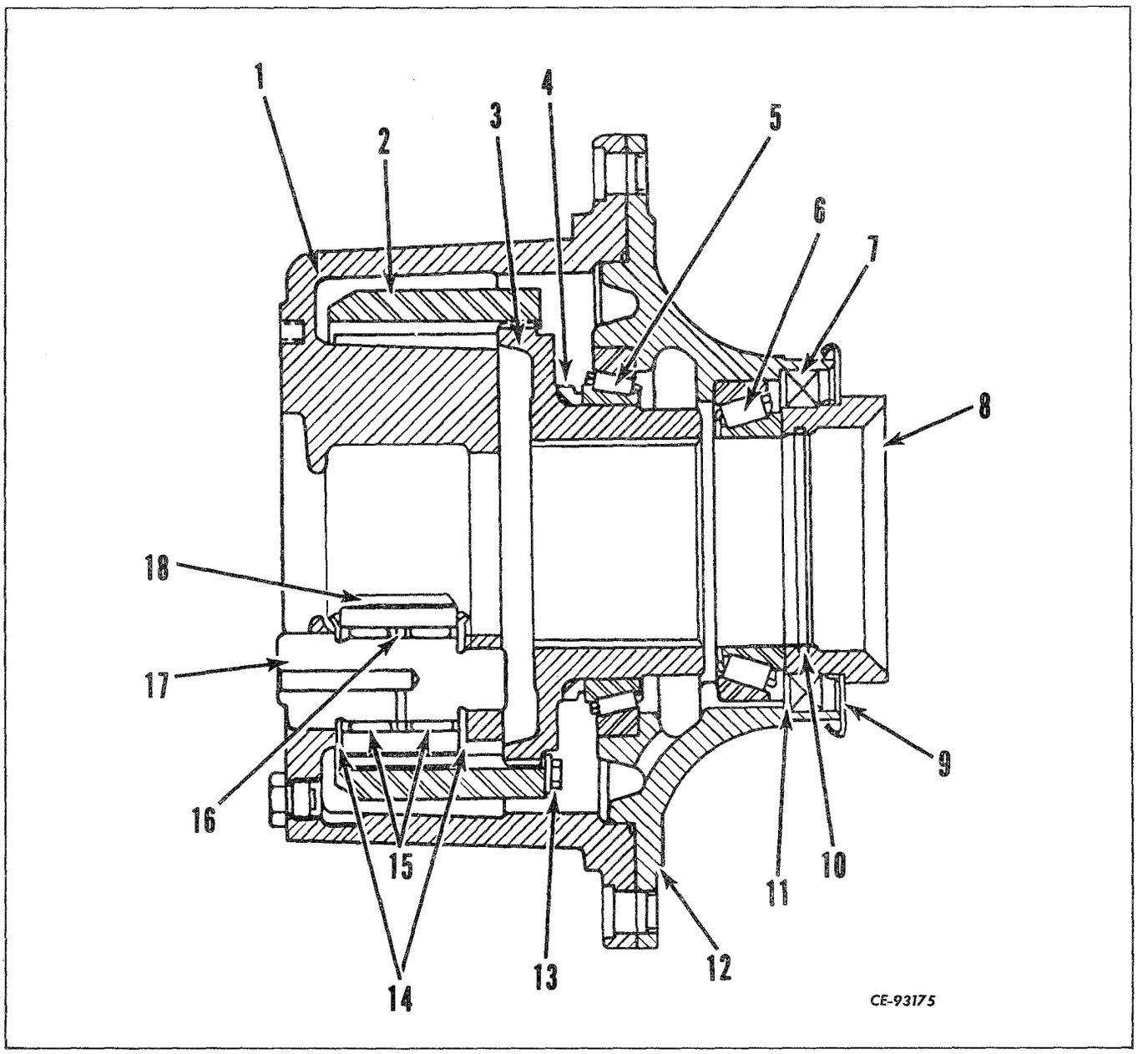

Figure 6-11
Planetary Drive - Cross Section.

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

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 (17, Fig. 6-11) from small end of shafts using a shop press. Remove thrust washers (14), pinions (17), bearings (15) and spacer (16).

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

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 (18, Fig. 6-11), bearings (15), spacers (16) and thrust washers (14). Install pinion assemblies into carrier (1) in their approximate positions. All three pinions must be installed before any shafts are installed. Be sure thrust washer tabs are aligned with indentation in carrier.

Pack pinion pins (17, Fig. 6-11) in dry ice for at least 30 minutes to shrink them sufficiently for easier installation.

Press in a planet pinion shaft (17), small diameter first. Be sure flats on the 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.

RING GEAR AND HUB DISASSEMBLY

Remove cap screws (13, Fig. 6-11) and lock plates that secure ring gear (2) to ring gear hub (3). Remove ring gear.

Using a suitable puller, remove bearing cone (5) and spacer (4) from ring gear hub (3).

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.

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PLANETARY DISASSEMBLY AND ASSEMBLY

RING GEAR AND HUB ASSEMBLY

Install spacer (4, Fig. 6-11) on ring gear hub (3).

Chill ring gear hub and install bearing cone (5) against spacer.

Position ring gear (2) on hub; secure with lock plates and cap screws (13). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

WHEEL HUB AND SEAL RETAINER DISASSEMBLY

Remove and discard "O" ring (10, Fig. 6-11) from groove in seal retainer (8). If repair or replacement is required, press oil scavenger (9) from seal retainer. Pry out hub seal (7) and spacer (11). If bearing replacement is required, drive bearing cups from wheel hub with a suitable drift.

Wash all parts in fresh cleaning solvent. Dry with compressed air.

CAUTION: NEVER dry bearings by spinning with compressed air.

Dip bearing 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 damaged cup(s) (1, 3, Fig. 6-71) from hub.

WHEEL HUB AND SEAL RETAINER ASSEMBLY

If bearing cup(s) were removed, press new cups in hub (12, Fig. 6-11). Be sure cups bottom on shoulder of hub. Lubricate bearing cone (6) with new axle lubricant (refer to "LUBRICANTS AND CAPACITIES" under "SERVICE INFORMATION") and install it in bearing cup in hub.

Install spacer (11) against hub shoulder.

Coat O.D. of a new seal (7) with Mar-Seal or equivalent sealant. Press a new seal in hub against spacer. Seal lip must face in toward bearing cone (6).

If oil scavenger/seal retainer assembly (8, 9) was separated, press scavenger on retainer being sure scavenger bottoms on shoulder of retainer. Install new "O" ring (10) in groove in bore of seal retainer.

SOLID AXLE

TROUBLE SHOOTING

Noise and vibration, originating in the transmission, drive shafts or tires is often attributed to an axle. The source of noise should be investigated before deciding that the cause is in the axle.

Axle noise may be isolated within the axle by jacking up the tractor so the tires clear the ground. If the noise is in one axle, disconnect the drive shaft of the opposite axle at the transmission. Now the noise may be isolated with only the noisy axle turning. Run the engine at a moderate speed with the transmission in first gear. Both wheels must be off the ground to prevent damage to the differential.

CAUTION: If a failure should occur in the differential, the tractor must not be operated under its own power. If the tractor must be moved, disconnect or remove the drive shaft leading to the noisy axle. Drain both planetary hubs of the noisy axle, remove the planetary covers and pull the axle shafts to prevent further damage. When shafts are removed, install planetary covers and fill hubs before moving tractor. The tractor may be driven a short distance with one axle if the drive shaft and axle shafts are removed from the noisy axle or differential.

TROUBLE SHOOTING CHART

COMPLAINT	PROBABLE CAUSE	REMEDY
	AXLE	
Noise	1. Incorrect lubricant or level too low.	1. Check level; fill with correct 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.
	5. Brakes dragging.	5. Disassemble planetary hub and repair.
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(s) on axle housing (oil leak from behind wheel into brake compartment).	4. Replace oil seal(s).
	5. Worn or broken axle shaft 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.

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TROUBLE SHOOTING

COMPLAINT	PROBABLE CAUSE	REMEDY
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.
Noise when driving	1. Incorrect lubricant or level too low.	1. Check level; fill with correct type of lubricant. Check differential housing for leaks.
	2. Pinion and ring gear adjustment too tight.	2. Readjust pinion and ring gear backlash.
Noise when coasting	1. Pinion or ring gear bearings damaged.	1. Replace bearings.
	2. Pinion and ring gear adjustment too loose.	2. Readjust pinion and ring gear backlash.
NOTE: The following problems can be checked when the differential has been removed and disassembled.		
Side gear broken at hub	1. Misaligned or bent drive axle.	1. Replace damaged gears. Check drive axle for alignment and examine other gears and bearings for possible damage and replace as needed.
	2. Worn thrust washers.	2. Replace damaged gears. Examine other gears and bearings for possible damage. Replace all thrust washers.

(Continued on next page)

TROUBLE SHOOTING CHART - Continued

COMPLAINT	PROBABLE CAUSE	REMEDY
	DIFFERENTIAL	
Gears scored	1. Incorrect lubricant or level too low.	1. Replace scored gears. Inspect all gears and bearing for possible damage. Clean out housing and fill with correct grade and type of lubricant.
	2. Excessive wheel spinning.	2. Replace scored gears. Inspect all gears, pinion bores and shafts for scoring. Inspect bearings for possible damage and replace as needed.
Pinion and/or ring gear tooth breakage	1. Improper pinion and ring gear adjustment (backlash). 2. Excessive shock loading of gears.	1. Replace gears with new matched set. 2. Inspect remaining parts for possible damage and replace as needed.
	PLANETARY	
Noise	1. Planetary gears or ring gear teeth worn, chipped or broken. 2. Bearings in planetary gears worn or broken.	1. Replace planetary gears or ring and pinion gears. 2. Replace gear shafts and bearings.

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SERVICE INFORMATION

SPECIFICATIONS

AXLE

Overall Length	79-1/2"
Track - With Standard Wheels	63-1/2"
Approximate Weight	958 lbs.

RATIOS

Differential	4.375
Planetary	5.2
Total	22.75

BRAKES

Diameter of Brake Drum	15"
Width of Brake Shoes	3"
Brake Cylinder Diameter	1-3/8"

LUBRICANTS AND CAPACITIES

	Capacity		Lubricant	
Differential	11 pts.	IH-135H EP or MIL-L-2105B	GL-5	Above 32° -- 140 Below 32° -- 90
Planetaries (each)	2 pts.	IH-135H EP or MIL-L-2105B	GL-5	Above 32° -- 140 Below 32° -- 90

TOLERANCES

Preload Torque Limits - Differential pinion cage	5-15 lbs. in.
Press Tonnage - Ring gear to flanged case rivets	30 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

(All Threads Oiled)

Axle Housing-to-Bowl Housing:	
Cap Screws and Nuts - 1/2"-20	65-70 lbs. ft.
Cap Screws and Nuts - 5/8"-18	125-135 lbs. ft.
Wheel Hub Bearing Adjusting Nut	300 lbs. ft.
Locking Cap Screw - Bearing Adjusting Nut	19-21 lbs. ft.

(Continued on next page)

SERVICE INFORMATION

SPECIAL TORQUES - Continued

Wheel Stud Retaining Nuts (carrier-to-hub)	290-320 lbs. ft.
Planetary Cover Cap Screws	33-37 lbs. ft.
*Wheel Lug Nuts	350 lbs. ft.
Differential:	
Pinion Shaft Nut	175-250 lbs. ft.
Case Half Cap Screws	45-50 lbs. ft.
Bearing Cap Bolts	160-180 lbs. ft.
Mounting Cap Screws	53-60 lbs. ft.
Planetary Ring Gear Hub-to-Ring Gear Cap Screws	13-20 lbs. ft.
Axle Mounting Cap Screws	367 lbs. ft.

*Wheel lug nuts must be installed dry.

SPECIAL TOOLS

AXLE REMOVAL AND INSTALLATION TOOL

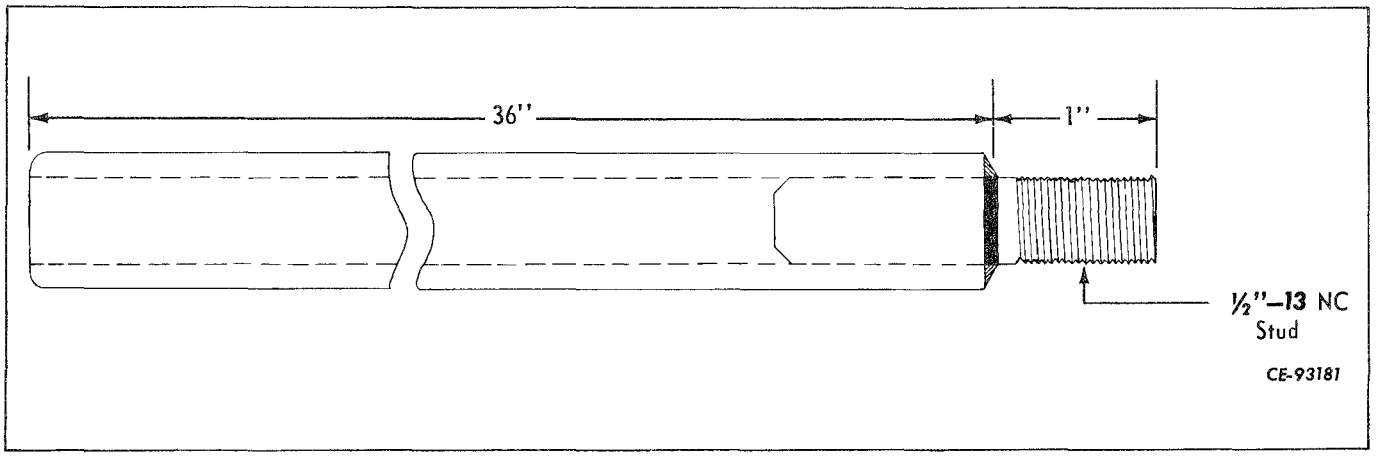

Figure 6-12

DIFFERENTIAL HOLDING FIXTURE

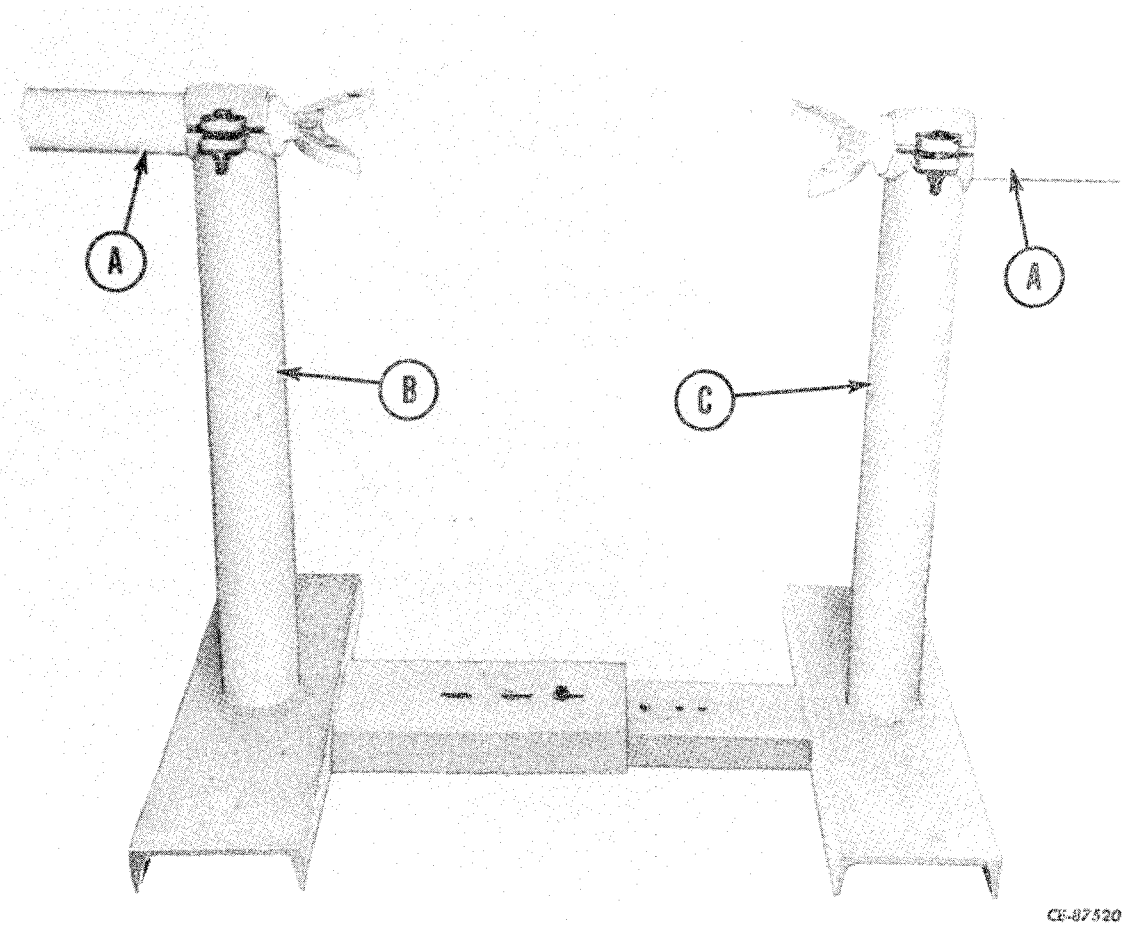

Figure 6-13
Assembled Differential Holding Fixture.

A. Swivel weldment (Fig. 6-14).

B. Stand weldment - left hand (Fig. 6-15).

C. Stand weldment - right hand (Fig. 6-16).

(Continued on next page)

SPECIAL TOOLS-Continued

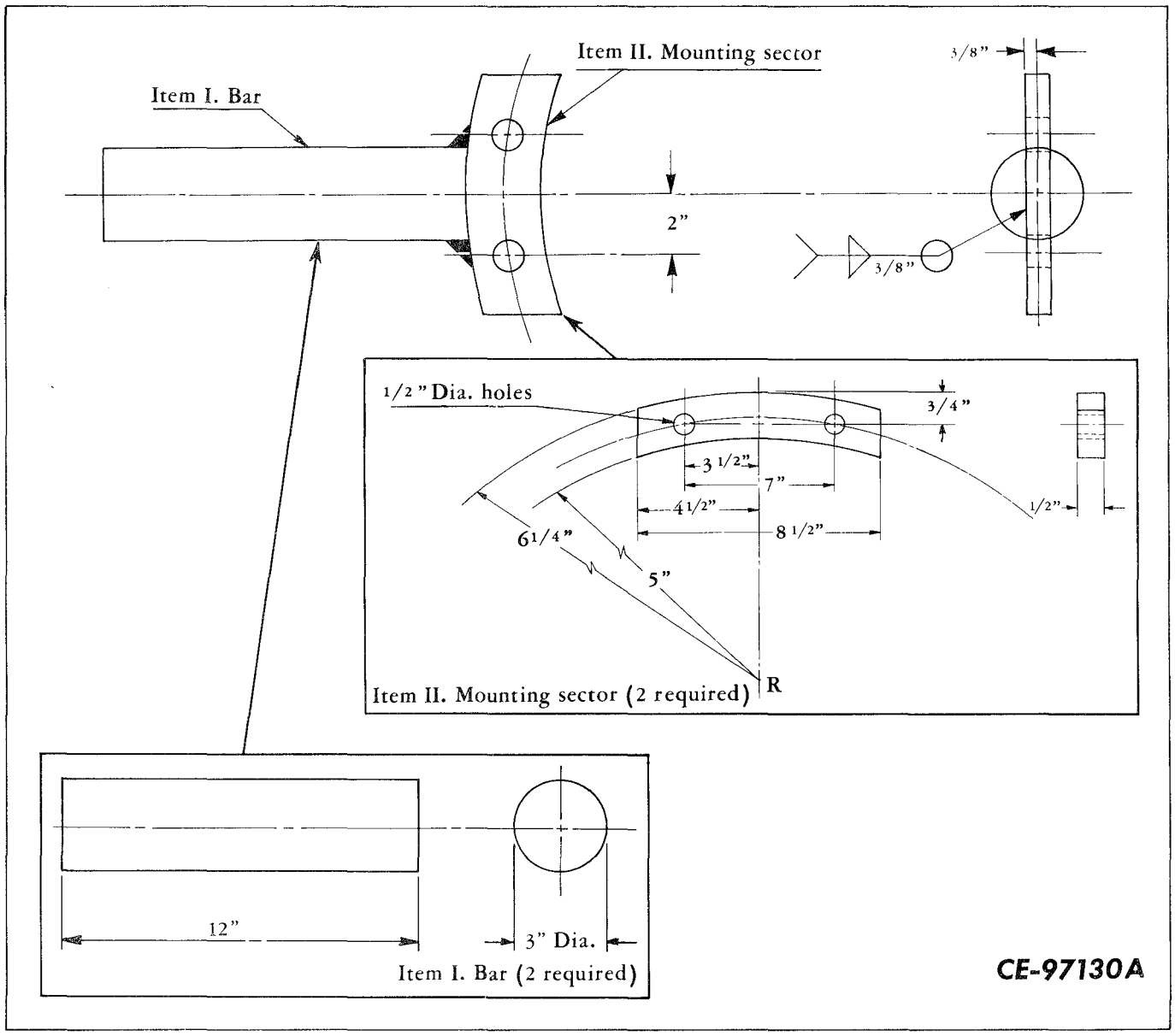

Figure 6-14
A. Swivel Weldment (2 Required).

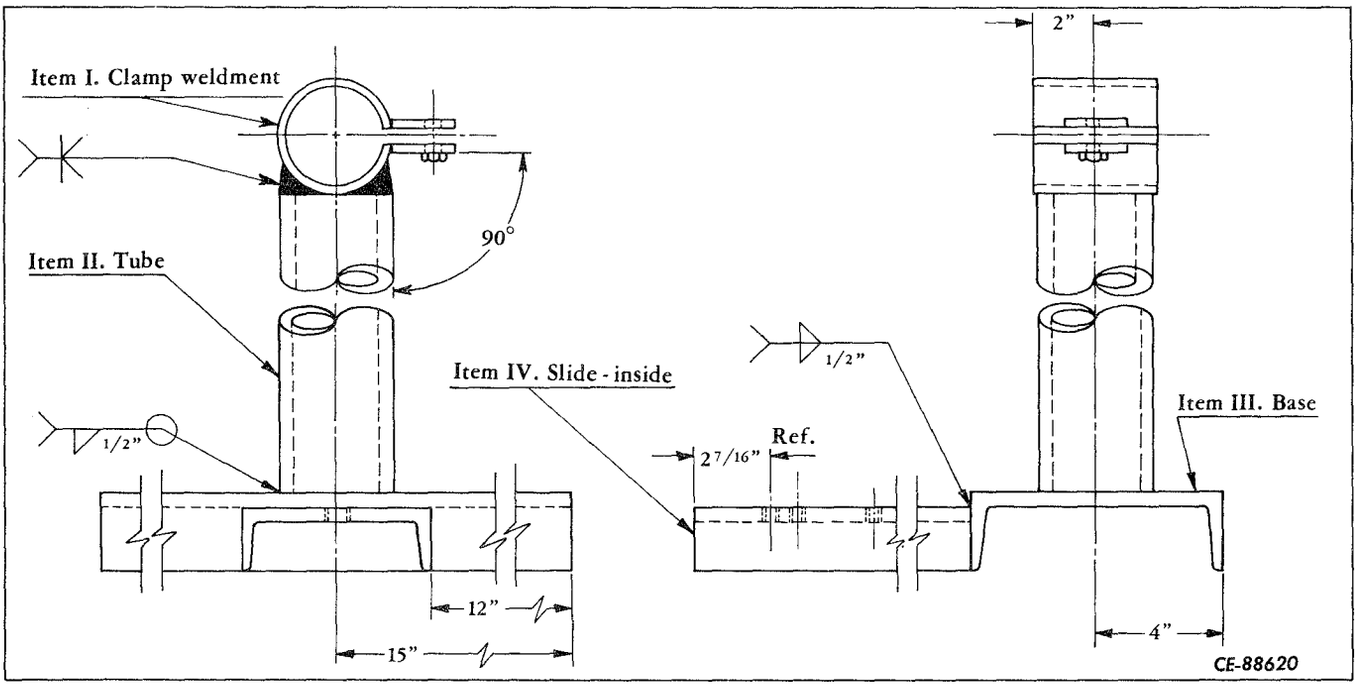

Figure 6-15
B. Stand Weldment Assembly - Left Hand (1 Required).
(Details Shown in Figures 6-17, 6-18, 6-19 and 6-20.)

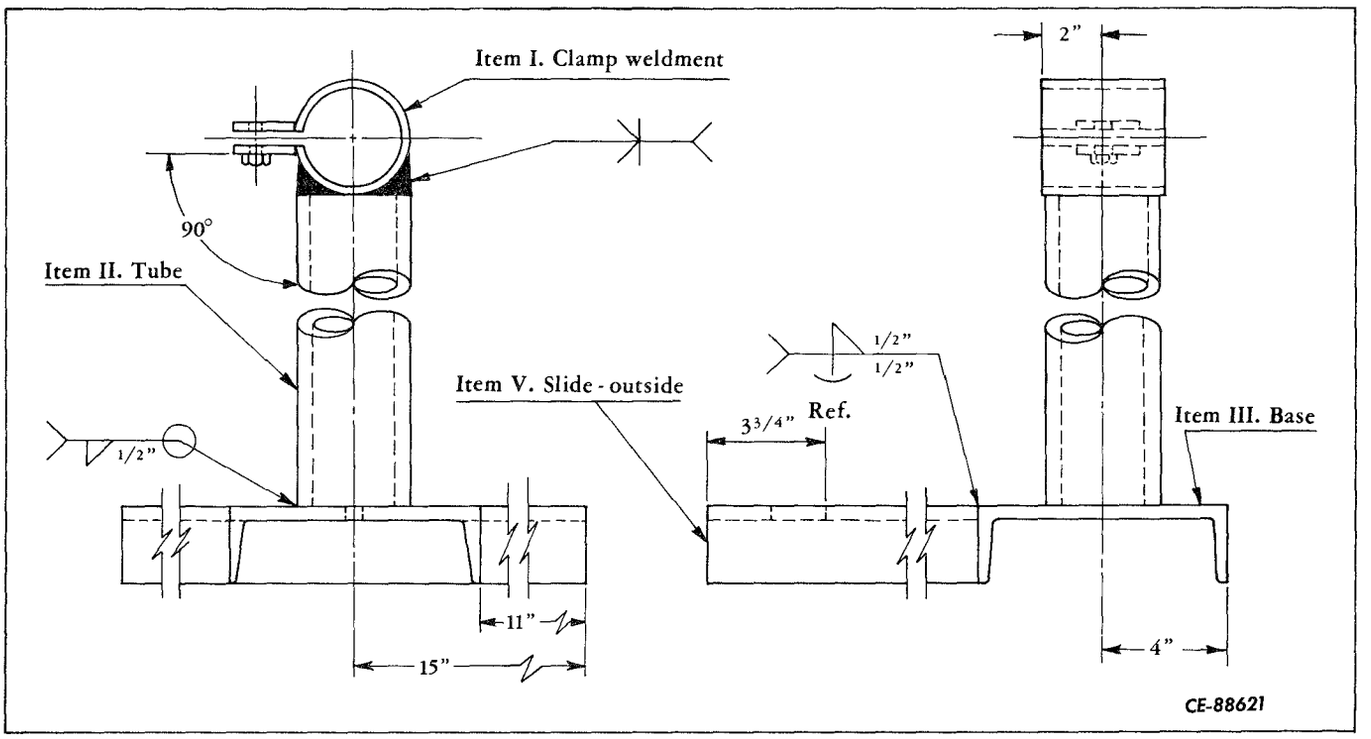

Figure 6-16
C. Stand Weldment Assembly - Right Hand (1 Required).
(Details Shown in Figures 6-17, 6-18, 6-19 and 6-21.)

(Continued on next page)

SPECIAL TOOLS - Continued

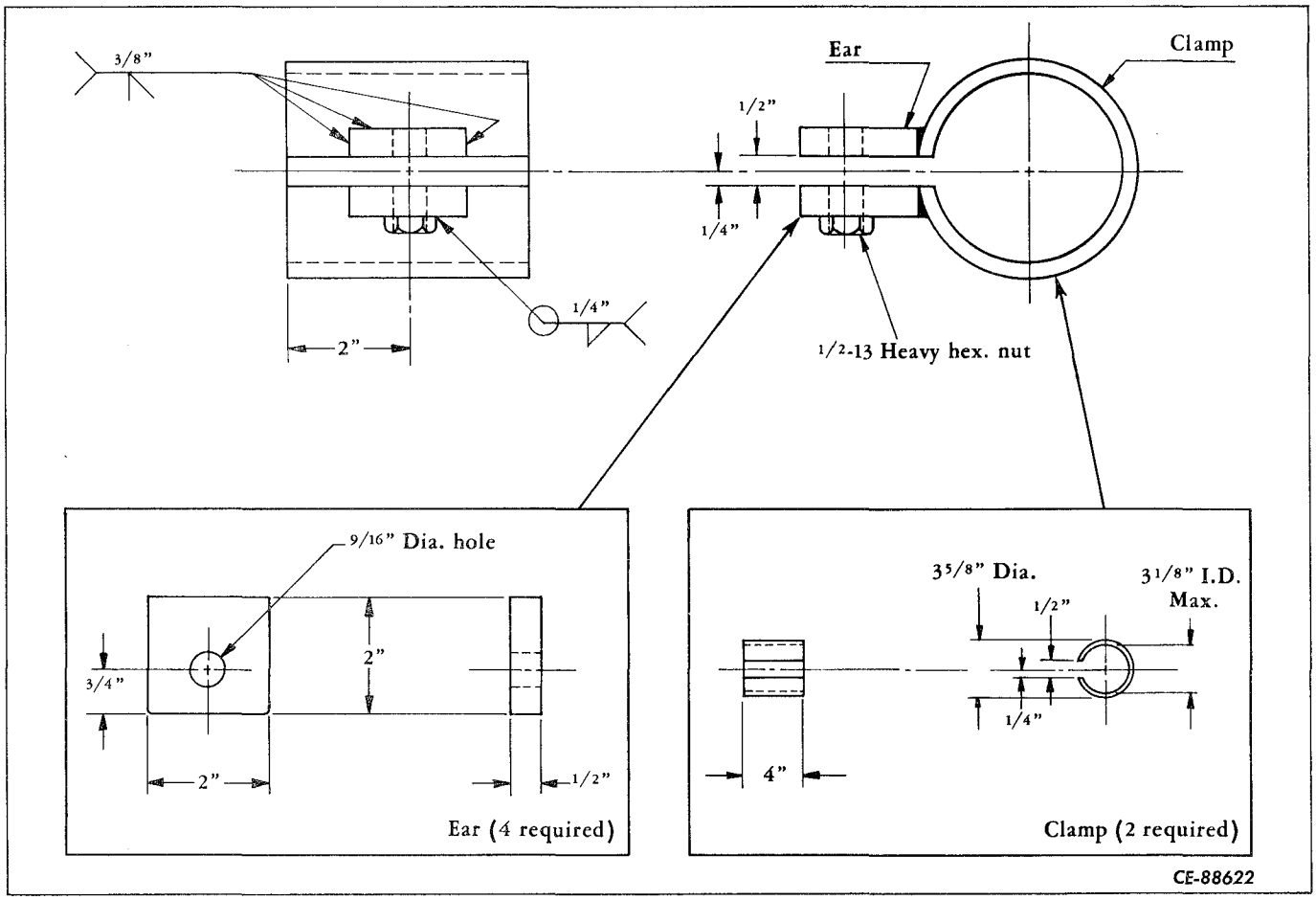

Figure 6-17
Item I. Clamp Assembly (2 Required).

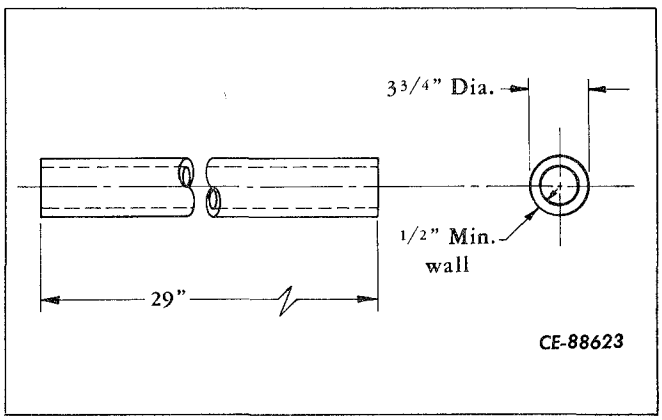

Figure 6-18
Item II. Tube (2 Required).

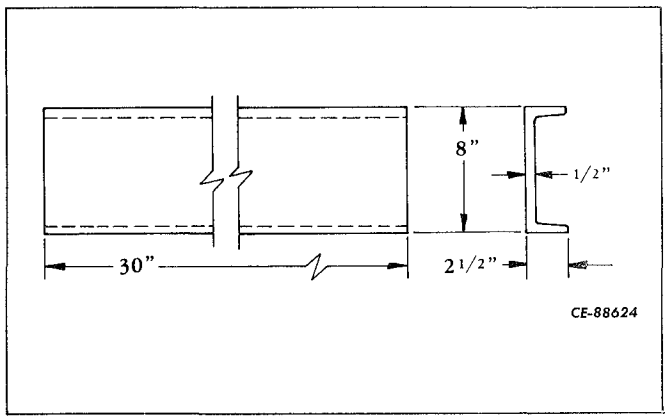

Figure 6-19
Item III. Base (2 Required).

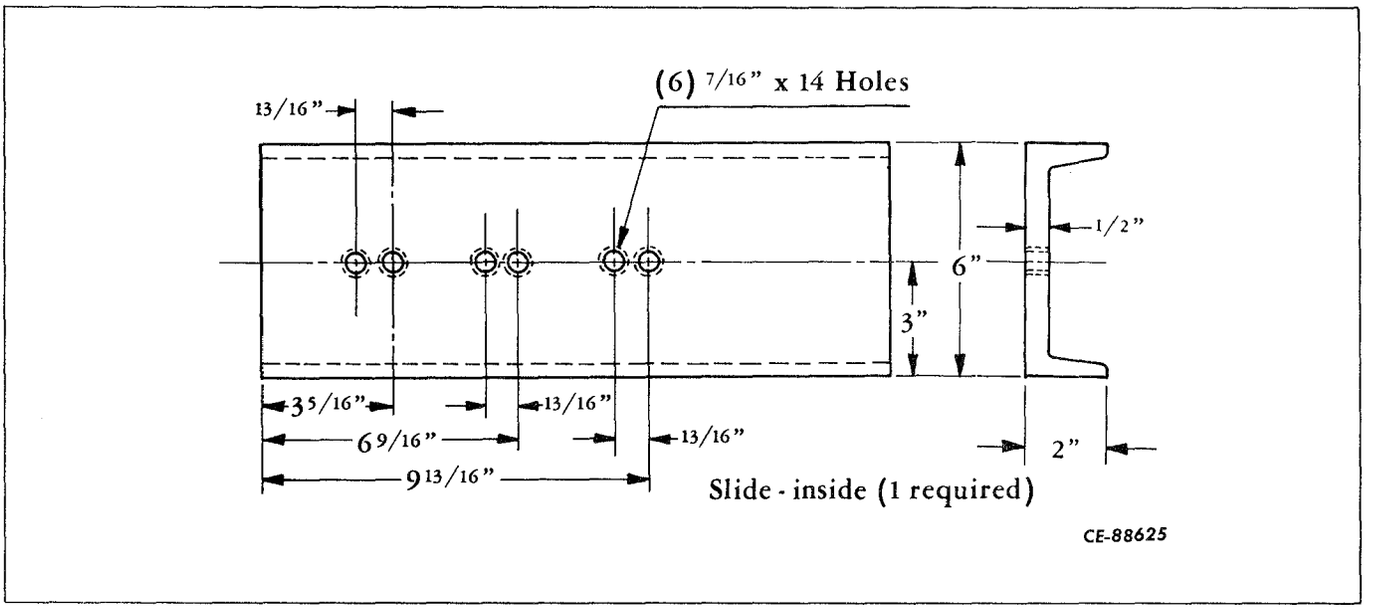

Figure 6-20
Item IV. Slide-Stand Weldment (Left Hand).

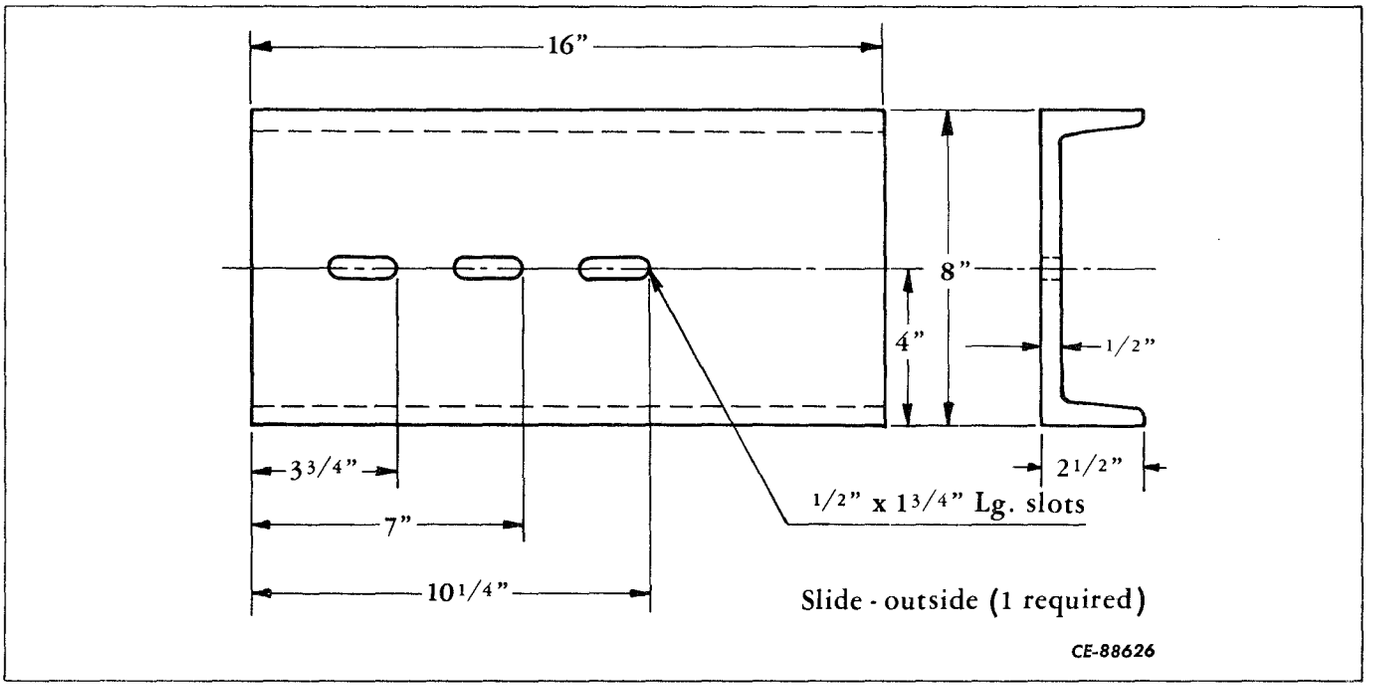

Figure 6-21
Item V. Slide-Stand Weldment (Right Hand).

SOLID AXLE

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

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SECTION VII

STEERING AXLE

DRIVING TYPE

Page

SECTION VII STEERING AXLE - DRIVING TYPE

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Cleaning and Inspection 6
Assembly 6

Differential Disassembly and Assembly 9
(Refer to SECTION VI.)

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STEERING AXLE - DRIVING TYPE

GENERAL INFORMATION

DESCRIPTION

In addition to transmitting a multiplied torque to the wheels, and providing a wheel mounting assembly, the steering axle includes a steering mechanism. This mechanism allows power to be delivered to the wheels even while they are in a turn. The steering mechanism is primarily a pair of split axle shafts with universal joints joining the sections at the point of oscillation.

The axle is a full-floating, double reduction type. The axle is rigidly attached to a cradle called a "bolster." The bolster in turn is pinned to the tractor main frame. This pinning or hinging allows the rear axle to oscillate in rough terrain, assuring the tractor great stability.

Each wheel revolves on two tapered roller bearings mounted on the axle spindle. The axle is 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 housings.

PREVENTIVE MAINTENANCE

LUBRICANTS

Quantities and recommended lubricant are listed under "SERVICE INFORMATION" in this section.

LUBRICATION INTERVALS

The universal joint assemblies in the steering knuckles should be lubricated with recommended lubricant after each 100 hours of operation. Insert a grease gun (hand operated type) through the opening in the knuckle end of the axle housing.

It may be necessary to rotate the axle shaft until the lube fitting on the universal is in line with the opening in the housing. Lubricate the universal until new grease is visible at the needle bearing caps.

Lubricate the upper and lower trunnion bushings in the steering knuckle assemblies (16-58, Fig. 7-2) after each 10 hours of operation. Use three shots of a hand grease gun or approximately 1 ounce of grease per fitting.

OIL CHANGE INTERVALS

Axle lubricant should be changed at regular intervals of 1000 hours. Drain while the assembly is warm to allow contaminates to flow out with the draining lubricant. Refill the assembly with the specified lubricant. Check the lubricant level after each 100 hours of operation.

LEVEL CHECK

Check the level of the lubricant in the differential at the oil level plug in the side of the differential carrier.

The lubricant should be even with the level of the plug hole.

> NOTE: Be sure the machine is on level ground before checking the lubricant level.

Prior to checking the level of the lubricant in each planetary hub, rotate the wheel until the oil level mark on the planetary cover is horizontal and below the center line of the wheel and hub assembly. The lubricant should be even with the level of the plug hole.

BRAKE ADJUSTMENT

Refer to "SECTION XIII, BRAKE SYSTEM" for adjustment procedure.

DIFFERENTIAL ADJUSTMENT

The differential gears should be checked for backlash and correct tooth pattern after overhaul. If differential trouble is suspected, check these adjustments before overhaul to determine whether adjustment will correct the trouble. Refer to "SECTION VI, SOLID AXLE" under "DIFFERENTIAL DISASSEMBLY AND ASSEMBLY" for correct adjustment procedure.

STEERING AXLE - DRIVING TYPE

AXLE DISASSEMBLY AND ASSEMBLY

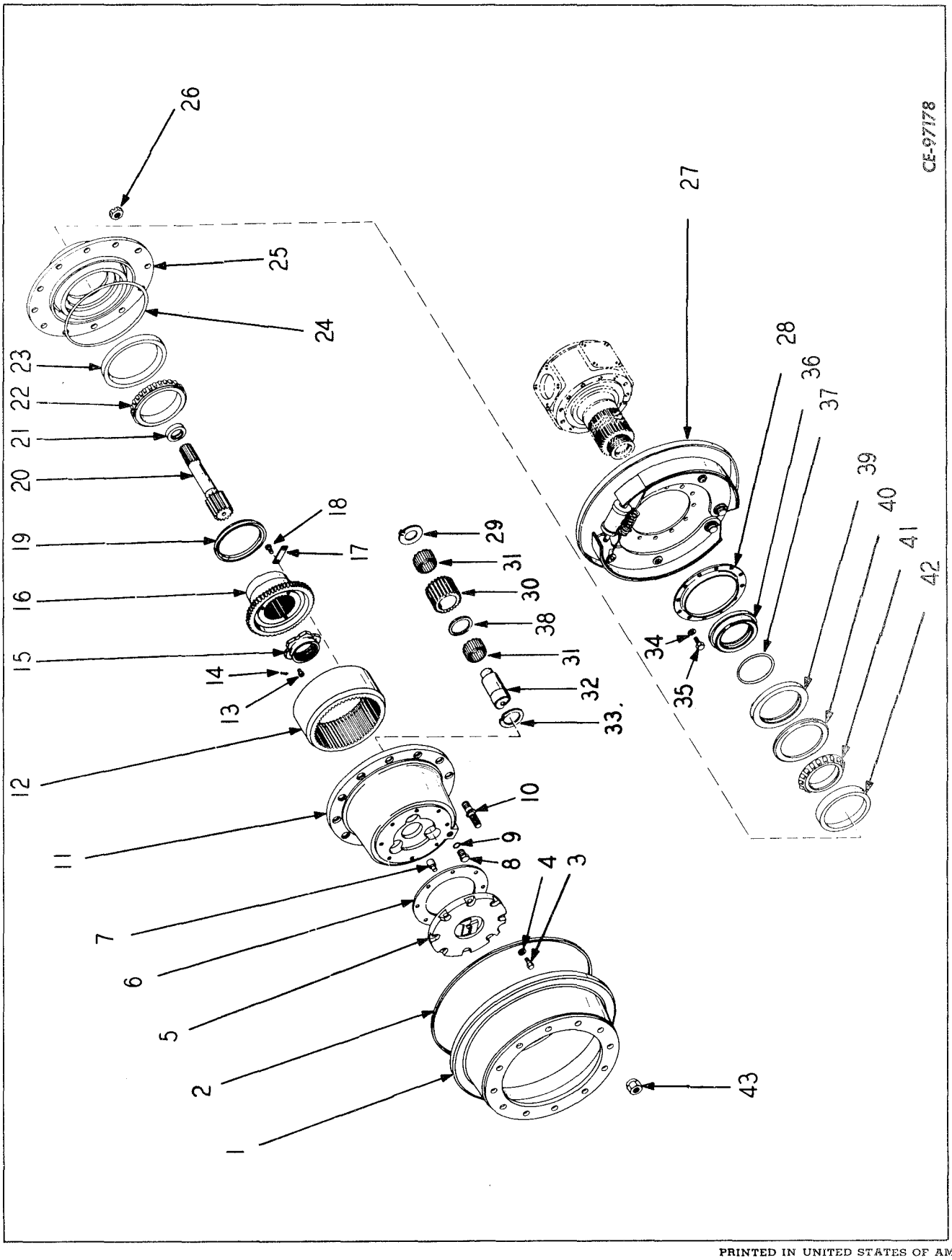

Figure 7-1
Steering Axle - Shaft and Hub.

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AXLE DISASSEMBLY AND ASSEMBLY

Legend for Figure 7-1

1. Brake drum.
2. Felt brake seal.
3. Cap screw.
4. Washer.
5. Planetary cover.
6. Gasket.
7. Thrust button.
8. Drain/fill plug.
9. "O" ring.
10. Shouldered stud.
11. Planetary carrier.
12. Ring gear.
13. Cap screw.
14. Cotter pin.
15. Bearing adjusting nut.
16. Ring gear hub.
17. Lock plate.
18. Cap screw.
19. Spacer.
20. Axle shaft.
21. Lip type seal.
22. Bearing cone.
23. Bearing cup.
24. "O" ring.
25. Wheel hub.
26. Nut.
27. Brake assembly.
28. Oil scavenger.
29. Thrust washer.
30. Planet pinion.
31. Needle bearing.
32. Planet pinion shaft.
33. Thrust washer.
34. Lock washer.
35. Cap screw.
36. Seal retainer.
37. "O" ring.
38. Spacer.
39. Oil seal.
40. Flat washer.
41. Bearing cone.
42. Bearing cup.
43. Lug nut.

PREPARATION

Axle disassembly preparation should include:

Removing wheels and tires.

Disconnecting drive shaft and brake lines at the axle.

Disconnecting drag link from steering arm on trunnion cap.

Disconnecting steering cylinder lines from cylinders. Tag lines for identification. Cap and plug open lines and ports. Remove steering cylinders from axle assembly after axle is removed from tractor.

Removing the axle from the tractor.

Using plain steam (no caustic soda) to clean the exterior of the axle, planetary hubs and brake drums.

Preparing a clean work area.

Providing a hoist and suitable sling to lift component parts.

Raise the axle assembly from the floor and support on suitable stands. Be sure axle will not tip or roll.

Drain the planetary hubs by rotating them until the drain/filler plugs (8, Fig. 7-1) are at the bottom. Remove the plugs and "O" rings and drain the lubricant. Discard "O" rings.

DISASSEMBLY

Remove brake drum (1, Fig. 7-1) from axle assembly using a suitable sling and hoist.

Remove cap screws (3, Fig. 7-1) and sealing washers (4) that secure planetary cover (5) to carrier assembly (11).

Remove cover and discard gasket.

Inspect thrust button (7, Fig. 7-1) in planetary cover. Replace if worn.

Remove studs (10, Fig. 7-1) and nuts (26) that secure planetary carrier to hub.

Remove planetary carrier assembly (11, Fig. 7-1) using a suitable sling and hoist.

For carrier assembly overhaul refer to "SECTION VI, SOLID AXLE" under "PLANETARY DISASSEMBLY AND ASSEMBLY."

Remove cotter pin and cap screw (13, 14, Fig. 7-1) that lock bearing adjusting nut (15) in position. Remove adjusting nut. Slide ring gear assembly (12, 16) from axle housing splines. Refer to "SECTION VI, SOLID AXLE" under "PLANETARY DISASSEMBLY AND ASSEMBLY" for overhaul procedure.

Remove wheel hub assembly (25, Fig. 7-1) from axle housing. Remove and discard "O" ring (24). Refer to "SECTION VI, SOLID AXLE"

(Continued on next page)

STEERING AXLE - DRIVING TYPE

AXLE DISASSEMBLY AND ASSEMBLY

DISASSEMBLY - Continued

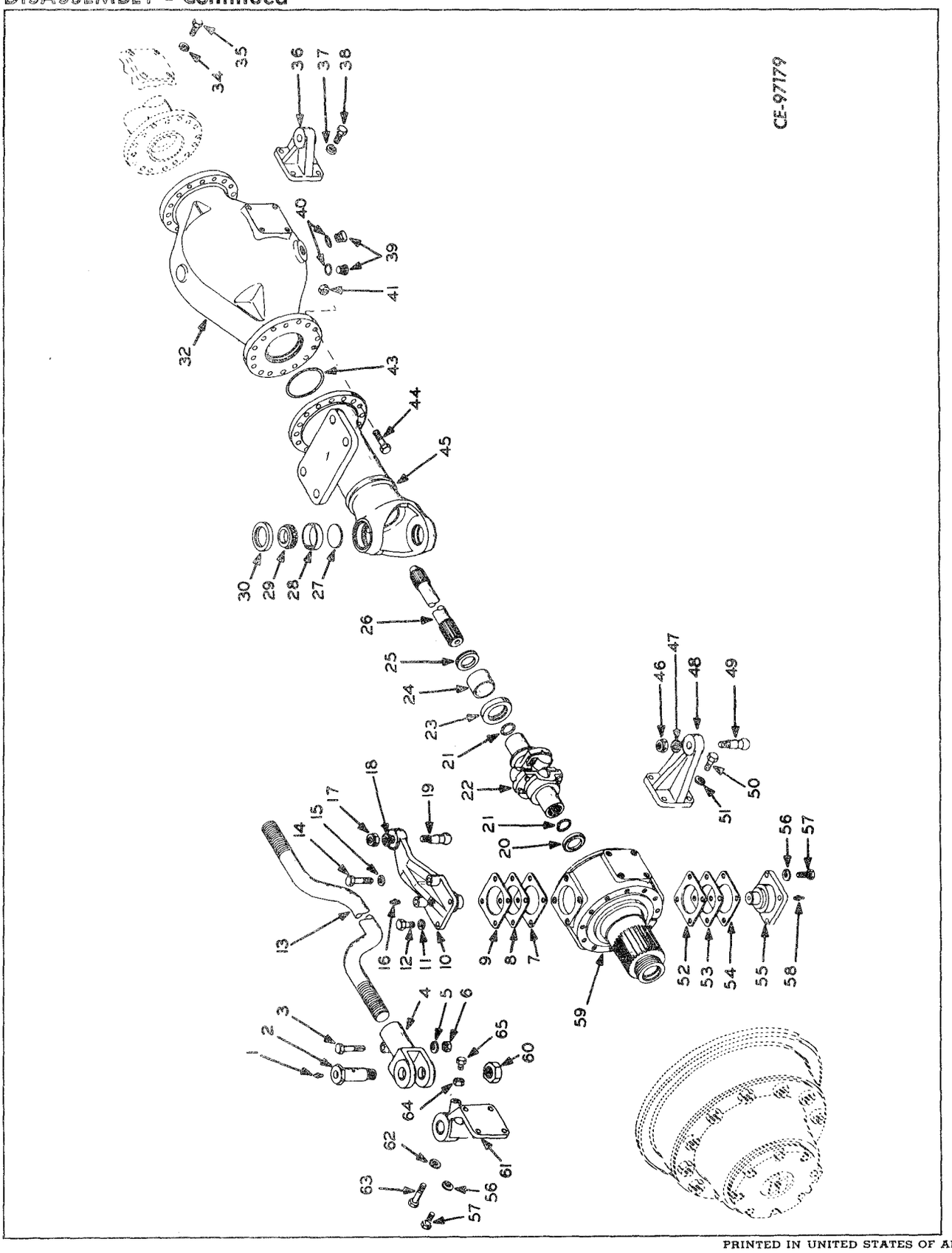

Figure 7-2
Steering Axle Housing.

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AXLE DISASSEMBLY AND ASSEMBLY

Legend for Figure 7-2

1. Grease fitting.
2. Pin.
3. Cap screw.
4. Rod end clevis.
5. Lock washer.
6. Hex nut.
7. Shim.
8. Shim.
9. Shim.
10. Steering arm.
11. Lock washer.
12. Cap screw.
13. Tie rod.
14. Cap screw.
15. Lock washer.
16. Grease fitting.
17. Nut.
18. Washer.
19. Stud.
20. Flat washer.
21. Retaining ring.
22. Universal joint.
23. Lip type seal.
24. Sleeve bearing.
25. Flat washer.
26. Axle shaft.
27. Grease retainer.
28. Outer race.
29. Inner race.
30. Lip type seal.
32. Axle bowl.
34. Lock washer.
35. Cap screw.
36. Steering cylinder anchor.
37. Lock washer.
38. Cap screw.
39. Plug.
40. "O" ring.
41. Nut.
43. "O" ring.
44. Cap screw.
45. Axle housing.
46. Nut.
47. Washer.
48. Steering arm.
49. Ball stud.
50. Cap screw.
51. Lock washer.
52. Shim.
53. Shim.
54. Shim.
55. Top steering bearing cap.
56. Lock washer.
57. Cap screw.
58. Grease fitting.
59. Steering knuckle.
60. Nut.
61. Tie rod arm.
62. Lock washer.
63. Cap screw.
64. Nut.
65. Cap screw.

under "PLANETARY DISASSEMBLY AND ASSEMBLY" for overhaul procedure.

Remove brake assembly by removing mounting cap screws (35, Fig. 7-1) and oil scavenger (28).

Remove sun gear shaft (20, Fig. 7-1) with a quick jerking motion. Steering arms (48, Fig. 7-2) need not be removed unless their replacement is required. Inspect tie rod arm bushings. If bushing is worn, replace arm assembly (61, Fig. 7-2).

Remove cap screws that secure the steering arm (10, Fig. 7-2) or upper steering bearing cap and remove cap and shim pack (7, 8, 9). Tie shim pack together and tag for correct location during assembly.

Remove lock wire and cap screws (57, Fig. 7-2) that secure lower steering bearing cap (55) to steering knuckle (59). Remove bearing cap and shim pack (52, 53, 54). Tie shim pack together and tag for correct location during assembly (45). Remove steering knuckle (59) from axle assembly. Remove and discard axle shaft seal (21, Fig. 7-1). Remove washer (20, Fig. 7-2) from knuckle inner bore.

Pull out universal and axle shaft assembly. Refer to "DRIVE SHAFT DISASSEMBLY, ASSEMBLY" for universal overhaul information. Remove and discard shaft seal (23, Fig. 7-2). Remove and discard seals (30) from steering bearing bores. Inspect bushings (24) in shaft bore and those in steering bearing bores to determine if removal and replacement is required.

Drain differential housing. Rotate housing until differential yoke is vertical. Remove cap screws and lock washers that attach differential assembly to axle bowl (32, Fig. 7-2). Using a suitable hoist, pull differential assembly from housing.

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

If a section of axle housing requires removal, index the two pieces to be separated with a chisel or two punch marks (1, 3, Fig. 7-3) to insure correct assembly.

Remove cap screws and hex nuts that secure axle housing (3, Fig. 7-3) and axle bowl (1). Separate housings and discard "O" ring seal (2).

STEERING AXLE - DRIVING TYPE

AXLE DISASSEMBLY AND ASSEMBLY

CLEANING AND INSPECTION

CLEAN

Clean all parts thoroughly. Rough parts such as casting or all metal parts without finished, ground or polished surfaces may be cleaned in a hot solution of mild alkali. Parts should remain in the tank until thoroughly clean and heated through.

> ◆ WARNING: EXERCISE CARE TO AVOID SKIN RASHES AND INHALATION OF VAPORS WHEN USING ALKALI CLEANERS.

Clean 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.

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

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

INSPECTION

Inspect all bearings, cups and cones, including those not removed from the axle. Replace any parts that are worn, pitted or damaged in any way. Remove parts needing replacement with a puller or press, using suitable arbors. Avoid the use of drifts or hammers.

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

Inspect axle shafts for signs of torsional fractures or other indications of impending failure.

Coat parts that are to be assembled immediately with light oil to prevent corrosion. If parts are to be stored for any length of time or if they are not to be assembled immediately, coat them with a good grade of rust preventive and wrap in paper, treated to prevent corrosion.

Replace all seals, gaskets, "O" rings and retaining rings.

Assemble the following tools and supplies:

Torque wrench - 500 ft. lb. capacity.
Axle shaft tool - Refer to "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 a new "O" ring (2, Fig. 7-3) in position on axle housing boss. Align identification marks on the two housings (1, 3) and secure with cap screws and hex nuts.

> NOTE: In some cases flat washers are used beneath the nuts of the two top flange bolts on either side of the axle housing. These bolts are installed with their heads toward the outer ends of the axle assembly.

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

Torque: _____

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AXLE DISASSEMBLY AND ASSEMBLY

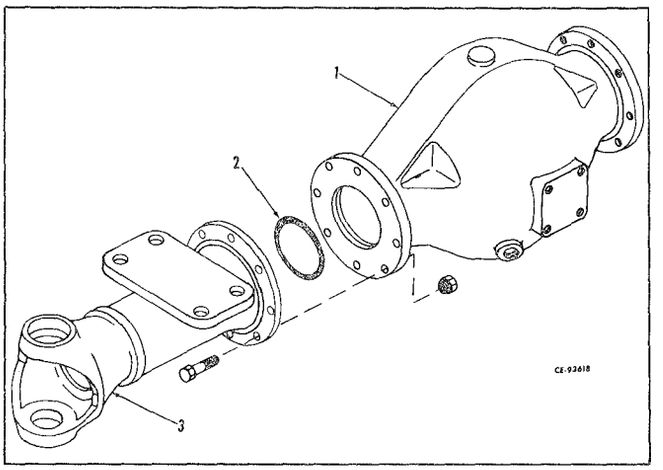

Figure 7-3

Be sure mating surfaces of differential carrier and axle bowl are absolutely clean. Install a new gasket on housing with holes in correct alignment.

Lower differential assembly into housing, aligning holes. Coat retaining cap screw threads with Mar-Seal or equivalent sealant and install with lock washers. Tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

If steering cylinder anchor (39, Fig. 7-2) was removed from rear of differential housing bowl, threads of retaining cap screws must be coated with Mar-Seal or equivalent sealant before assembling.

If bushings (24, Fig. 7-2) were removed from axle bore or outer races (28) from steering bearing bores press new bushings into place. Be sure flat washer (25) is installed in axle shaft bore before pressing bushing (24) in place. In addition, grease retainer discs (27) must be installed in steering bearing bores prior to installing outer races (28).

Coat O.D. of a new shaft seal (23, Fig. 7-2) with Mar-Seal or equivalent sealant and install in axle shaft bore. In a similar manner coat O.D. of two new steering seals (30) and install them in steering bearing bores. Lip of shaft seal must face in toward differential. Lips of steering seals must face each other.

Install axle shaft (26, Fig. 7-2) and universal assembly (22) in axle housing. Splines on shaft must engage splines in differential side gear.

NOTE: Axle shaft universal joint assembly must be installed with grease fitting pointing toward center of axle.

Install washer (20, Fig. 7-2) in knuckle bearing bore; retain with grease. Position knuckle (59) on axle housing (45) and install lower steering bearing cap assembly (55, Fig. 7-2) and its corresponding shim pack (52, 53, 54). Snug up cap screws (57) but do not tighten at this time.

Install the steering arm (10, Fig. 7-2) or upper steering bearing cap and its corresponding shim pack (7, 8, 9). Snug up retaining cap screws. Swing knuckle from side to side to be sure no bind is present. If assembly swings freely tighten cap screws (12, 57) in upper and lower bearing caps to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Using a dial indicator record the amount of vertical movement of steering knuckle. Add or subtract shims in equal amounts at top and bottom caps until recommended play is obtained (refer to "TOLERANCES").

Steering Knuckle Vertical Play:_____

NOTE: When adjustment is complete, shim packs beneath upper and lower bearing caps should be equal.

Lock wire lower bearing cap bolts.

Coat the O.D. of a new shaft seal (21, Fig. 7-1) with Mar-Seal or equivalent sealant and install in spindle bore. Metal edge of seal with manufacturer's identification mark must face out. Lubricate lips of seal with a light grease.

(Continued on next page)

AXLE DISASSEMBLY AND ASSEMBLY

ASSEMBLY - Continued

Install sun gear shaft (21, Fig. 7-1) in spindle bore after lubricating splines with "Lubriplate" or equivalent grease. Be sure shaft bottoms against snap ring in universal joint.

If steering arm(s) (48) is replaced, tighten retaining cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Be sure oil drain groove at bottom of steering knuckle bolt face is clean and free of debris.

Install brake backing plate assembly (27, Fig. 7-1) on housing flange and retain with oil scavenger (28, Fig. 7-1) and cap screws (35) and lock washers (34). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Lubricate lip of seal (39, Fig. 7-1) in bore of wheel hub (25) and seal contact area on spindle with a light grease.

Install wheel hub assembly (25, Fig. 7-1) on axle housing spindle being careful not to damage seal. Be sure inner hub bearing (41) bottoms against spindle shoulder.

Lubricate a new "O" ring (24, Fig. 7-1) with light grease and position it on hub shoulder.

Slide assembled ring gear (12, 16, Fig. 7-1) on axle housing splines being sure outer hub bearing (22) bottoms in its outer race (23) in hub (25).

Install bearing nut (15) on axle spindle and tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Back off adjusting nut and retighten to recommended torque. Rotate hub during both torquing operations.

Install locking cap screw (13, Fig. 7-1) in ring gear hub. If necessary, adjusting nut may be backed off slightly to nearest hole. Tighten cap screw to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Secure cap screw with a cotter pin (14, Fig. 7-1).

Be sure new "O" ring (24, Fig. 7-1) is correctly positioned on shoulder of wheel hub. Using a suitable sling and hoist, position pinion carrier assembly (11, Fig. 7-1) on ring gear and align stud holes.

Install wheel studs (10, Fig. 7-1) through carrier (11) and wheel hub (25) and secure with nuts (26). Tighten nuts to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

NOTE: Studs are installed with short end toward brake shoes.

If thrust button (7, Fig. 7-1) was worn or damaged, replace with a new unit.

Using a new gasket (6, Fig. 7-1) and sealing washers (4), install planetary cover (5). Tighten cap screws (3) evenly to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Install a new felt seal (2, Fig. 7-1) in groove in outer circumference of brake drum (1, Fig. 7-1). Install brake drum being sure felt seal is properly seated.

Rotate planetary hub until "OIL LEVEL" line is horizontal. Remove drain and fill plug (8, Fig. 7-1) with "O" ring (9) and fill planetary hub to level of plug hole with recommended lubricant (refer to "LUBRICANTS AND CAPACITIES"). Install plug with new "O" ring.

Rotate axle assembly until differential input yoke is horizontal. Install drain plug (39, Fig. 7-2) with a new "O" ring (40). Tighten plug securely. Remove filler plug on the side of the differential carrier and fill differential to level of plug hole with recommended lubricant (refer to "LUBRICANTS AND CAPACITIES").

After mounting axle in tractor with wheels and tires installed, adjust each brake assembly and bleed brakes (refer to "SECTION XIII, BRAKE SYSTEM").

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DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

(Refer to SECTION VI.)

PLANETARY DISASSEMBLY AND ASSEMBLY

(Refer to SECTION VI.)

TROUBLE SHOOTING

TROUBLE SHOOTING CHART

COMPLAINT	POSSIBLE CAUSE	REMEDY
Turning radius not equal in both directions.	1. Steering gear not centered.	1. Check that gear pitman arm is properly positioned on gear. Refer to "SECTION VIII, STEERING GEAR."
	2. Axle housing stop screws out of adjustment.	2. Adjust.
Toe-in or toe-out.	1. Tie rod not properly adjusted.	1. Adjust to zero toe-in.
Steering gear bottoms before steering cylinders.	1. Steering cylinders not properly adjusted.	1. Adjust so cylinders bottom before gear.
	2. Steering gear not centered.	2. Check that pitman arm is properly positioned on gear.
Excess play at steering wheel.	1. Loose linkage.	1. Tighten adjusting plugs to remove play.
	2. Wear at ball studs in linkage.	2. Replace worn parts.
	3. Steering gear lash adjustment off.	3. Adjust gear.
	4. Worn steering gear.	4. Overhaul. Refer to "SECTION VIII, STEERING GEAR."

For additional items refer to "SECTION VI, SOLID AXLE" under "TROUBLE SHOOTING."

STEERING AXLE - DRIVING TYPE

SERVICE INFORMATION

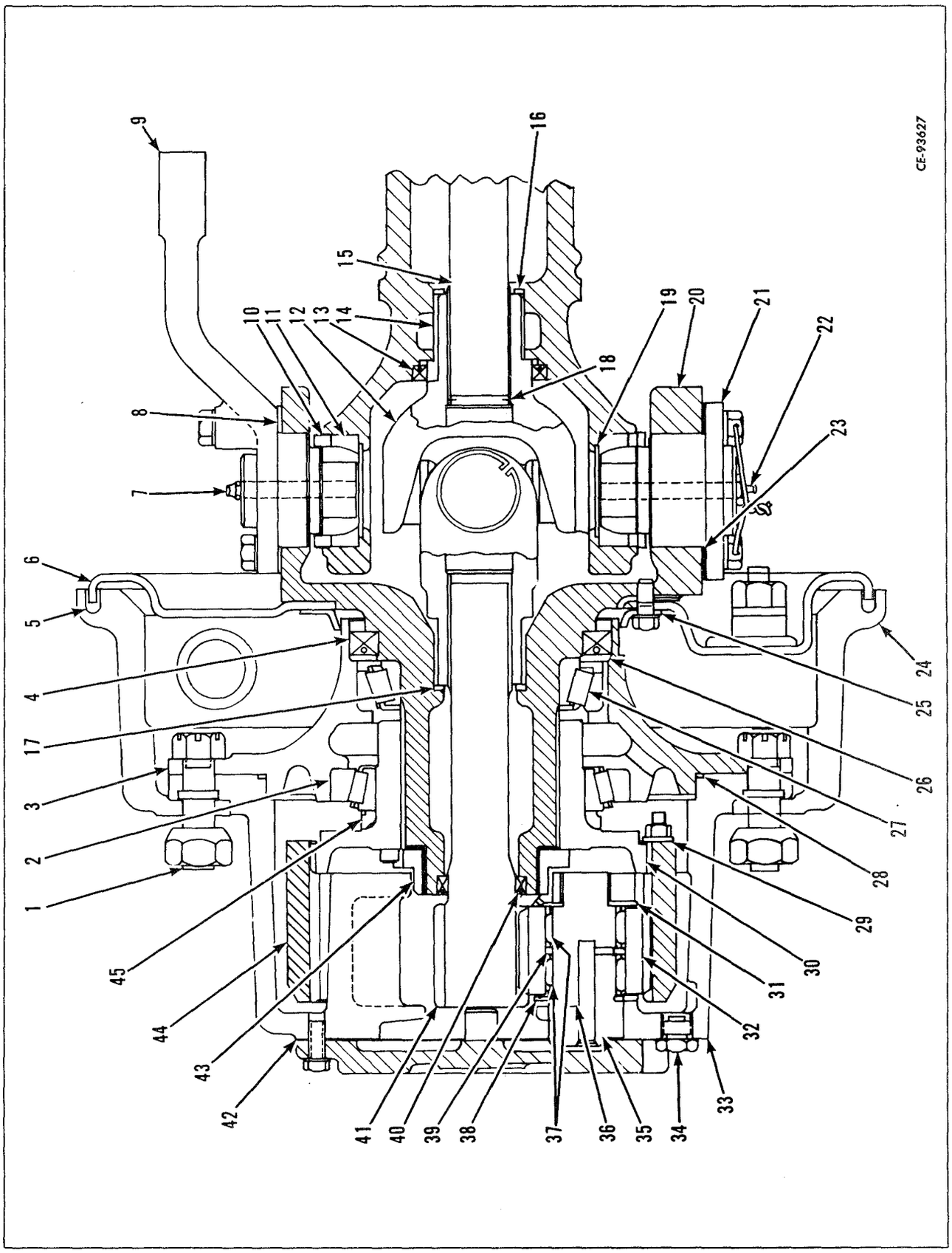

Figure 7-4
Driving Steering Axle - Cross Section.

Legend for Figure 7-4

1. Wheel stud.
2. Outer wheel hub bearing.
3. Wheel hub.
4. Hub seal.
5. Felt seal.
6. Brake backing plate.
7. Lube fitting - upper trunnion bearing.
8. Shims.
9. Steering arm.
10. Seal.
11. Outer race.
12. Universal joint.
13. Axle housing oil seal.
14. Bushing.
15. Axle shaft - long.
16. Washer.
17. Washer.
18. Retaining ring.
19. Grease retainer.
20. Steering knuckle.
21. Lower steering bearing cap.
22. Lube fitting - lower trunnion bearing.
23. Shims.
24. Brake drum.
25. Oil scavenger.
26. Spacer.
27. Inner wheel hub bearing.
28. "O" ring.
29. Lock plate.
30. Ring gear hub.
31. Thrust washer.
32. Pinion gear.
33. Planetary carrier.
34. Drain/fill plug and "O" ring.
35. Planetary carrier cover.
36. Pinion shaft.
37. Needle bearings.
38. Thrust washer.
39. Spacer.
40. Oil seal.
41. Sun gear shaft.
42. Gasket.
43. Bearing adjusting nut.
44. Ring gear.
45. Spacer.

STEERING AXLE - DRIVING TYPE

SERVICE INFORMATION

SPECIFICATIONS

Overall Length	79-1/2"
Track - With Standard Wheels	63-1/2"
Approximate Weight	1085 lbs.

RATIOS

Differential	4.375
Planetary	5.2:1
Total	22.75

BRAKES

Diameter of Brake Drum	16"
Width of Brake Shoes	2-1/4"
Brake Cylinder Diameter	1-1/4"

LUBRICANTS AND CAPACITIES

	Capacity	Lubricant	
Differential	10 pts.	MIL-L-2105A EP	Above 32°F - 140 Below 32°F - 90
Planetaries (each)	2 pts.	MIL-L-2105A EP	Above 32°F - 140 Below 32°F - 90

TOLERANCES

Steering Knuckle Vertical Play ..... .0 - .005 loose (no preload)

Steering Cylinder Length:

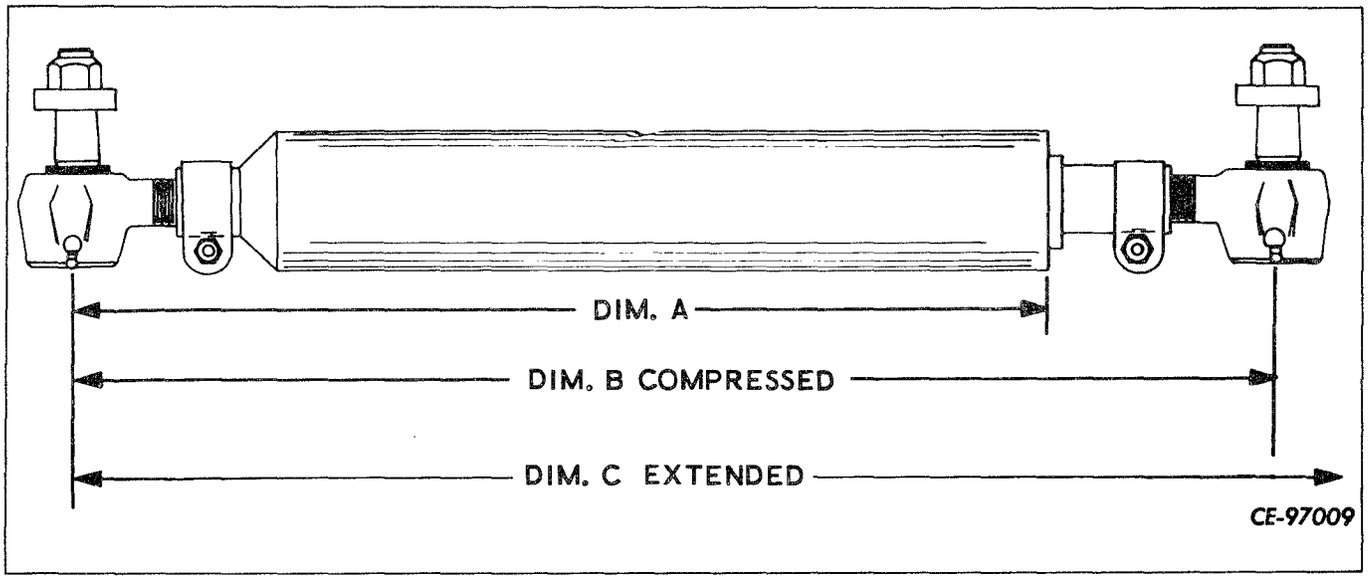

Figure 7-5

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SERVICE INFORMATION

H-30B	
A	18"
B	21-7/8"
C	31-7/8"

Wheels, Steering Axle - Degrees of Turn
Inside Wheel . . . . . 28°
Outside Wheel . . . . . 25°

Axle Stop Bolt Clearance . . . . . 1/8" with piston stopped against steering cylinder head.

SYSTEM PRESSURE

Steering System Pressure . . . . . 1000 PSI at low idle.

SPECIAL TORQUES

(All Threads Oiled)

Axle Housing-to-Bowl Housing:
Cap Screws and Nuts - 1/2" - 20 . . . . . 65 - 70 lbs. ft.
Cap Screws and Nuts - 5/8" - 18 . . . . . 125 - 135 lbs. ft.

Differential Carrier-to-Bowl Housing Cap Screws . . . . . 53 - 60 lbs. ft.

Steering Knuckle Bearing Cap Bolts:
1/2" x 1-3/8" . . . . . 80 - 90 lbs. ft.
5/8" x 1-3/8" . . . . . 160 - 180 lbs. ft.

Steering Arm Retaining Cap Screws:
1/2" Cap Screws . . . . . 65 - 70 lbs. ft.
5/8" Cap Screws . . . . . 125 - 135 lbs. ft.

Brake Backing Plate Retaining Cap Screws . . . . . 33 - 37 lbs. ft.

Wheel Hub Bearing Adjusting Nut . . . . . 300 lbs. ft.

Locking Cap Screw - Bearing Adjusting Nut . . . . . 19 - 21 lbs. ft.

Wheel Stud Retaining Nuts (Carrier-to-Hub) . . . . . 290 - 320 lbs. ft.

Planetary Cover Cap Screws . . . . . 33 - 37 lbs. ft.

*Wheel Lug Nuts . . . . . 350 lbs. ft.

Tie-Rod Clevis Pin Nuts . . . . . 105 lbs. ft.

Steering Cylinder Stud Nuts . . . . . 105 lbs. ft.

Axle-to-Bolster Mounting Cap Screws . . . . . 365 lbs. ft.

*Lug nuts must be torqued dry.

STEERING AXLE - DRIVING TYPE

SERVICE INFORMATION

ALIGNMENT AND ADJUSTMENT

After assembly and prior to installing axle assembly in tractor the wheel alignment should be checked and adjusted if required. This procedure will be divided into three steps.

WHEEL ALIGNMENT

Position hubs and drums in straight ahead position. Using brake backing plates as reference points, check measurements at "A" and "B" (Fig. 7-6). For correct alignment distance "A" and "B" must be equal. When an adjustment is required, lengthen or shorten tie rod (3) to compensate. To insure equal adjustment at both ends of drag link, loosen clamp bolts (2, 4), remove either clevis pin (1 or 5) and swing tie rod clear of differential. Hold disconnected clevis and rotate tie rod to lengthen or shorten it. Shortening rod will increase distance "B." Lengthening will increase distance "A." After adjustment replace clevis pin and tighten nut to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

STEERING CYLINDER INSTALLATION

Adjust static length of dimension "A" (Fig. 7-5) first. When dimension is obtained tighten clamp (3, Fig. 7-7) to secure adjustment. Make adjustment for dimensions "B" and "C" (Fig. 7-5) with ball socket (8, Fig. 7-7) on rod end of cylinder assembly. Snug clamp (6) but do not tighten.

Install steering cylinder (2, Fig. 7-8) on axle assembly. Tighten stud nuts (3) on steering cylinder anchor to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Install remaining stud nut (1, Fig. 7-8) snugly but do not torque.

Install axle in tractor. Tighten axle-to-bolster cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Connect brake lines and bleed brakes. Adjust brake shoes (refer to "SECTION XIII, BRAKE SYSTEM").

Connect lines to power steering cylinder. Connect drag link to axle steering arm.

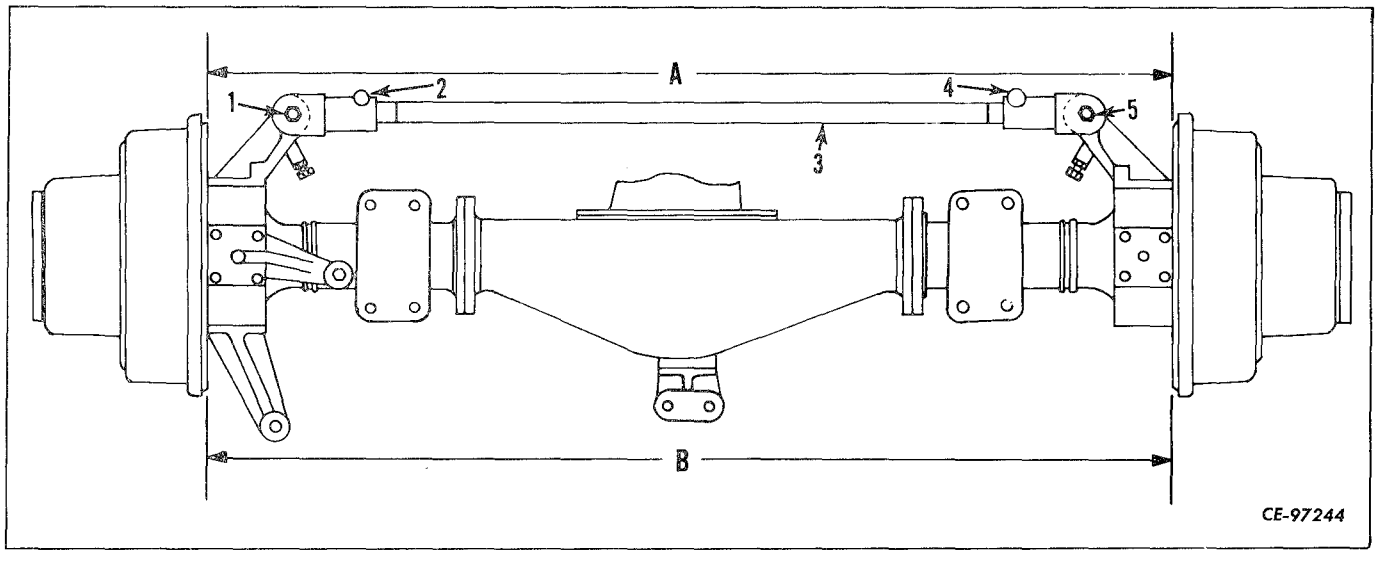

Figure 7-6

SERVICE INFORMATION

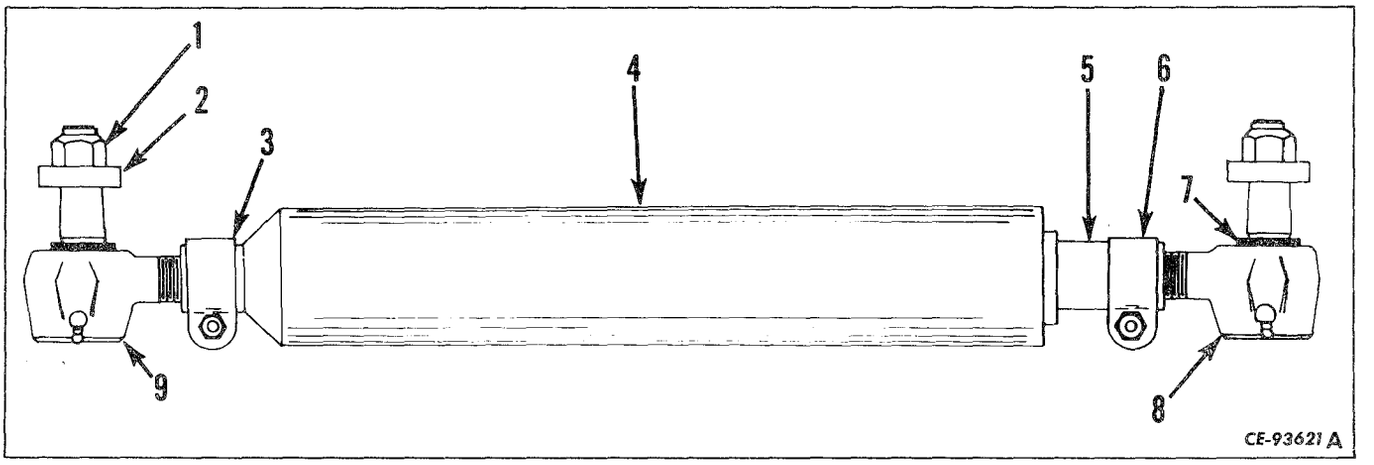

Figure 7-7

1. Stud nut.
2. Hardened washer.
3. Clamp.
4. Cylinder.
5. Piston rod.
6. Clamp.
7. Grease seal.
8. Ball socket.
9. Ball socket.

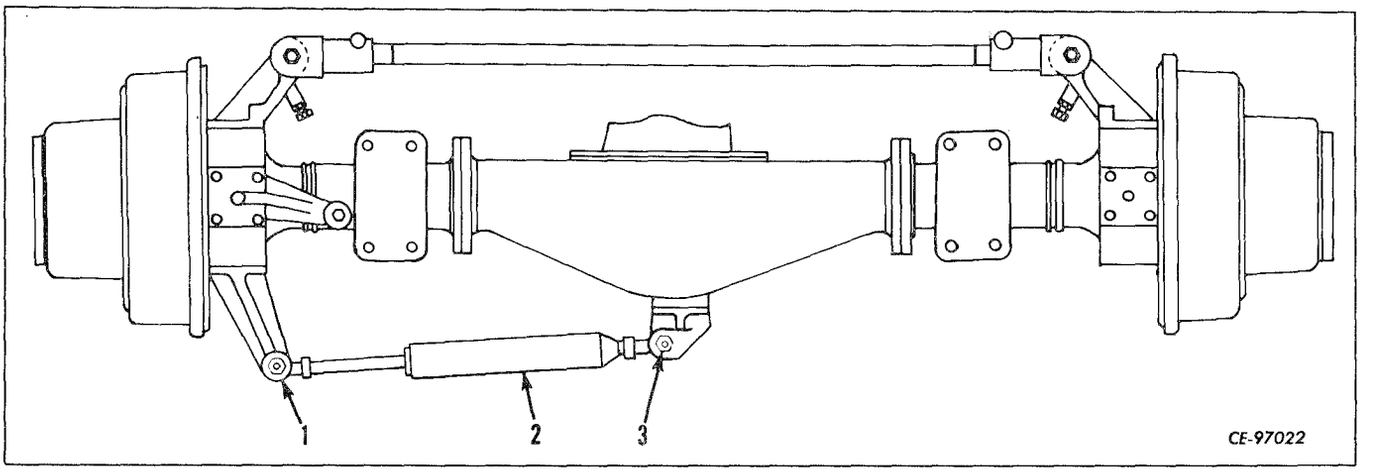

Figure 7-8

STEERING LIMIT ADJUSTMENT

NOTE: All adjustments must be made on a level surface.

With engine running, back tractor up slowly making a tight left turn (steering wheel at end of travel). After 180° of turn stop engine and apply parking brake. While operator continues to hold steering wheel against stop an assistant measures horizontal angle between inner side of

(Continued on next page)

STEERING AXLE - DRIVING TYPE

SERVICE INFORMATION

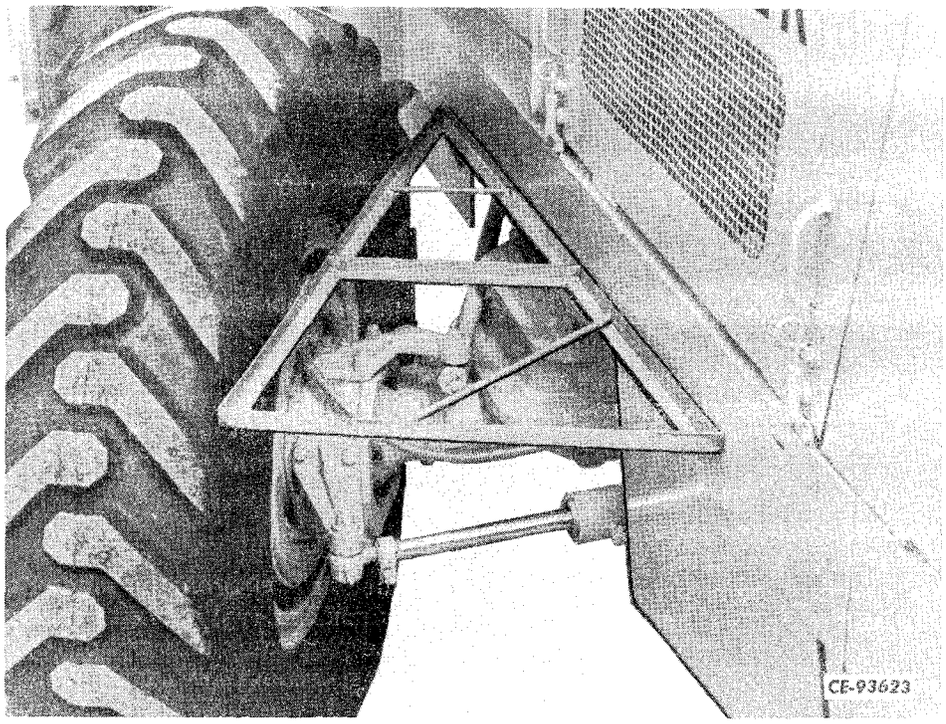

Figure 7-9

ALIGNMENT AND ADJUSTMENT - Continued

STEERING LIMIT ADJUSTMENT - Continued

left rear tire and outside of tractor frame (Fig. 7-9) using limit gauge (refer to "SPECIAL TOOLS").

If necessary, adjust steering cylinder stroke to get recommended maximum wheel turn angle (refer to "TOLERANCES").

Maximum Turn Angle:
Inside Wheel:_____
Outside Wheel:_____

When recommended maximum turn angle is obtained continue to hold wheel in full turn position. Adjust axle stop bolt (1, Fig. 7-10) for correct clearance (refer to "TOLERANCES").

Axle Stop Bolt Clearance:_____

Tighten stud nut (1, Fig. 7-8) to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

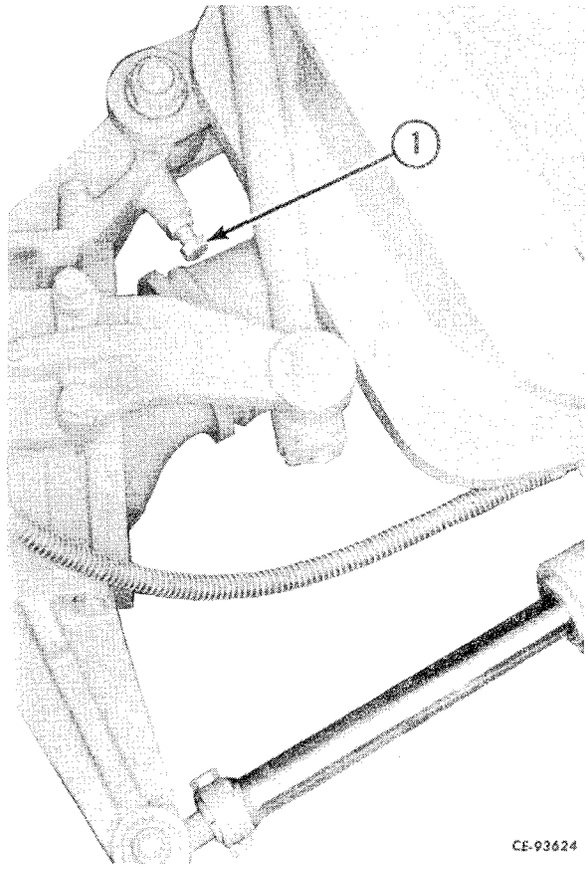

Figure 7-10

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SERVICE INFORMATION

Repeat entire limit adjustment procedure with tractor in a right turn.

STEERING PRESSURE CHECK

Install a "T" and a test gauge at end of steering cylinder. Refer to "SYSTEM PRESSURES" for recommended limits.

System Pressure:
Low Idle:_____
Max. High Idle:_____

CAUTION: Install or remove test gauge only after depressurizing system. Do not leave test gauge installed during work periods.

Refer to "SECTION XI, HYDRAULIC SYSTEM," for steering system relief valve adjustment procedure.

SPECIAL TOOLS

WHEEL LIMIT GAUGE

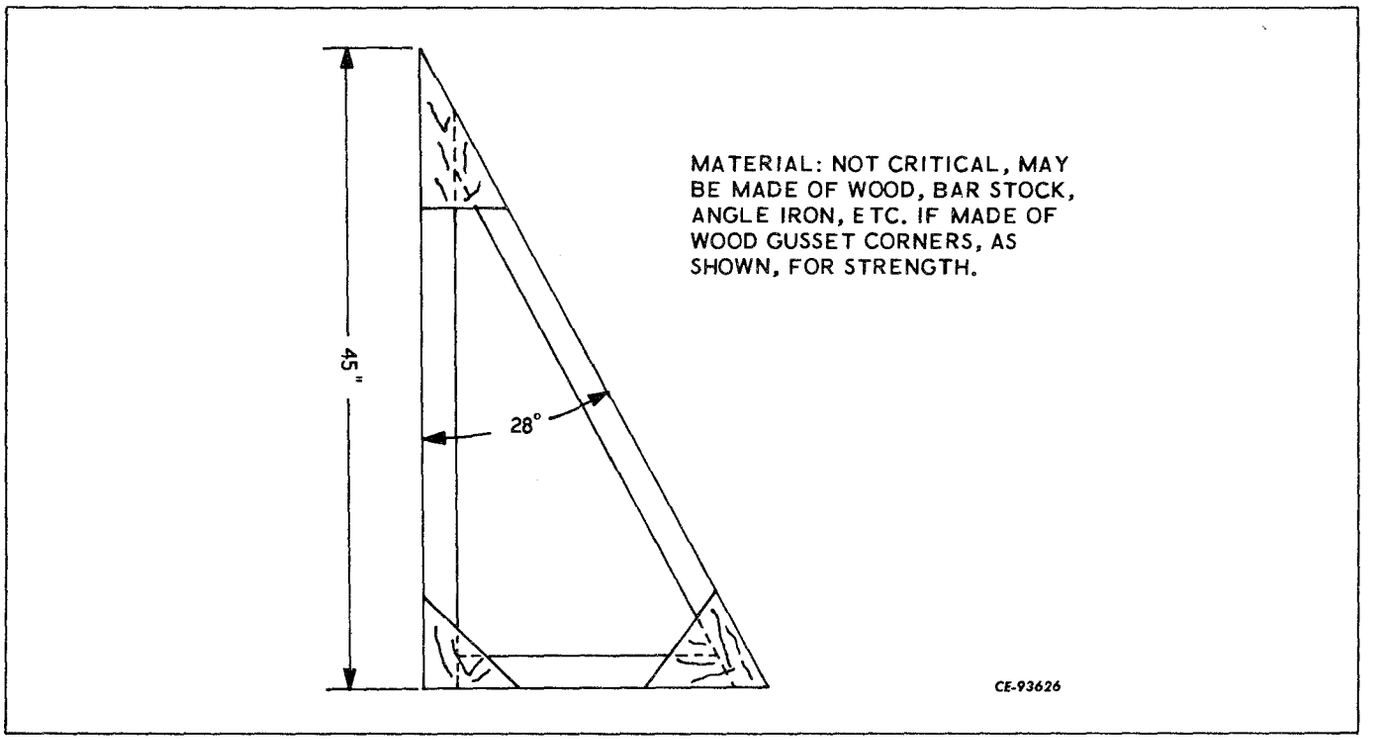

Figure 7-11

STEERING AXLE - DRIVING TYPE

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

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SECTION VII

STEERING AXLE

NON-DRIVING TYPE

Page

SECTION VII STEERING AXLE - NON-DRIVING TYPE

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Axle Disassembly and Assembly 21
Removal 21
Disassembly 21
Clean, Inspect and Repair 23
Assembly 23
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Special Torques 27
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GENERAL INFORMATION

DESCRIPTION

The non-driving steering axle is mounted at the front of the H-30R and at the rear of the H-30F. This type of axle substantially reduces the turning radius of the machine. It is therefore particularly adapted to work in municipalities where street widths make a short turning radius a must.

When mounted at the rear (H-30F) the axle oscillates on a bolster to assure machine stability. When mounted in the front it bolted directly to the main frame as a rigid unit.

MAINTENANCE

Lubricate king pins bushings during each 10 hour chassis lubrication. Repack wheel bearings after every 500 hours of operation.

AXLE DISASSEMBLY AND ASSEMBLY

REMOVAL

Raise the end of the tractor from which the axle will be removed, to a convenient height and block securely. Do not place blocks under axle.

Disconnect the drag link (1, Fig. 7-12) from the bellcrank (15) assembly. Disconnect the hydraulic lines to the steering cylinder. Cap the open lines and cylinder ports to prevent the entrance of dirt.

Place a suitable floor jack under the axle assembly; remove the axle mounting cap screws and lower the assembly to the floor. Pull the axle assembly from beneath the tractor.

DISASSEMBLY

Disconnect tie rods (2, 17, Fig. 7-12) from steering arms (6, Fig. 7-13) at outer ends and from bellcrank (15, Fig. 7-12) at inner ends. Tie rod ball socket assemblies (19) may be replaced if required, by loosening clamp (18) and unscrewing socket from rod. Discard grease seals (16). Disconnect power steering cylinder from axle and bellcrank (15, Fig. 7-12). Refer to "HYDRAULIC SYSTEM" for cylinder overhaul.

Remove retaining ring (3, Fig. 7-12) and dust cover (4) from bellcrank bore. Remove nut (5), flat washer (6) and small bearing cone (7) from bellcrank bore. Remove bellcrank (15) from swivel pin (11). Remove large bearing cone (12) and grease seal (9) from bellcrank bore. Discard grease seal.

Remove cap screws, lock washers and nuts that secure bellcrank swivel pin (11, Fig. 7-12) to mounting pad (10) on axle. Drag link ball stud (8) need not be removed unless replacement is required.

Remove hub cap (1, Fig. 7-13), cotter pin (2), nut (22), washer (21), collar (3) and outer bearing cone (20). Remove wheel hub (4) and inner bearing cone (19) from spindle (18).

Remove nut (14, Fig. 7-13) and lock washer (8) from steering arm (6). Remove steering arm from spindle (18). It may be necessary to start steering arm out of spindle with a soft drift and

(Continued on next page)

STEERING AXLE - NON-DRIVING TYPE

AXLE DISASSEMBLY AND ASSEMBLY

DISASSEMBLY - Continued

hammer. Remove key (5) and collar (7) from arm.

Remove nut, washer and king pin keeper (13) from keeper bore in axle assembly (12). Remove lock ring (9), seal retainer (10) and seal (11) from pin bore in spindle (18). Using a suitable drift, drive king pin (15) from its bore in spindle (18), and axle (12). This will automatically eject welsh plug (17). Separate spindle and thrust bearing (16) from axle.

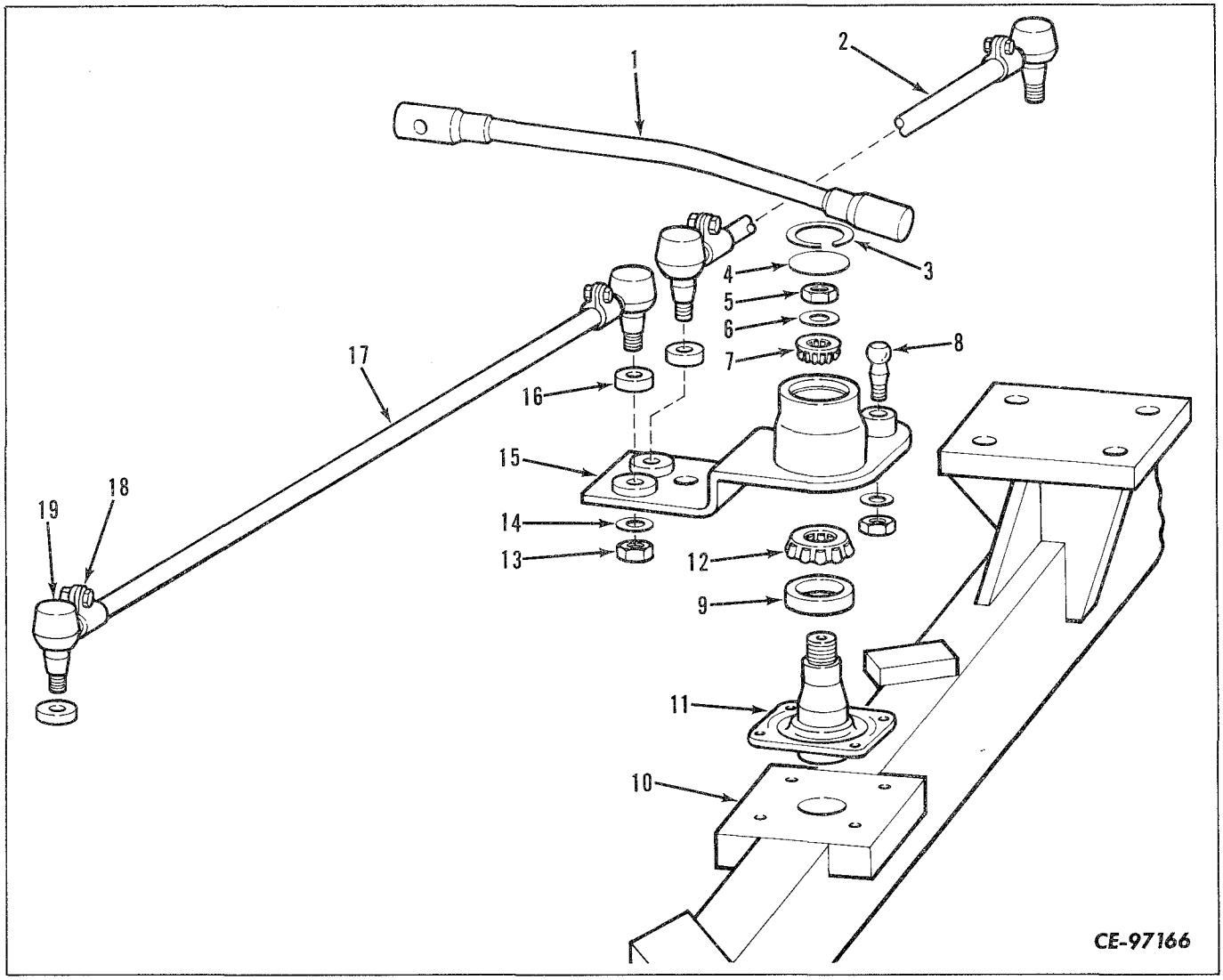

Figure 7-12
Steering Linkage.

1. Drag link.
2. Tie rod.
3. Retaining ring.
4. Dust cover.
5. Nut.
6. Flat washer.
7. Bearing cone - small.
8. Ball stud.
9. Grease seal.
10. Mounting pad.
11. Bellcrank swivel pin.
12. Bearing cone - large.
13. Nut.
14. Washer.
15. Bellcrank.
16. Grease seal.
17. Tie rod.
18. Clamp.
19. Ball socket.

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AXLE DISASSEMBLY AND ASSEMBLY

CLEAN, INSPECT AND REPAIR

CLEAN

Wash all parts thoroughly in clean solvent.

NOTE: DO NOT wash thrust bearings (16, Fig. 7-13) in solvent. Using a clean cloth, remove all dirt from bearing exterior.

Dry all parts with clean, dry compressed air.

CAUTION: NEVER dry bearings by spinning with compressed air.

INSPECT

Inspect king pins (15, Fig. 7-13) for excessive wear, pitting or ridging.

Inspect the spindle (18, Fig. 7-13) bearing surfaces for wear, ridging, spalling or discoloration. Check threads for damage.

Pack all bearings with the recommended lubricant (refer to "LUBRICANTS AND CAPACITIES" under "SERVICE INFORMATION") and check them for smooth wear free operation. Replace any bearing that is doubtful. If wheel hub bearings must be replaced drive the bearing cups out of the wheel hub with a drift or shop press.

REPAIR

If king pin bushing is spindle bore and require replacement, drive out old bushings and press in new ones. Lube hole in each bushing must be aligned with lube hole in spindle. Bushings must be pressed flush with inner edges of spindle bores. Ream new bushings to recommended diameter (refer to "TOLERANCES" under "SERVICE INFORMATION").

Spindle Bushing
Reamed Diameter:_____

NOTE: After rebushing spindles, use new king pins and thrust bearings.

During assembly, replace all seals and welsh plugs. Disassemble collar (3, Fig. 7-13) and discard seal portion. Press new seal on spacer to recondition collar.

ASSEMBLY

Position thrust bearing (16, Fig. 7-13) on lower ear of spindle (18), centered over king pin bore. Position spindle on axle (12) and install king pin. Center notch in pin in keeper bore and install king pin keeper (13). Secure with nut and lock washer.

Install new welsh plug (17, Fig. 7-13) in lower end of pin bore and seat it securely by driving in on center of plug. Install new seal (11), seal retainer (10), and lock ring (9) in upper end of pin bore.

Install collar (7, Fig. 7-13) and key (5) on steering arm (6). Install arm assembly in spindle (18) and secure with lock washer (8), and nut (14).

If wheel bearings (19, 20, Fig. 7-13) are to be replaced press new bearing cups in wheel hub (4). Be sure cups bottom on shoulder in hub bore. Install pre-greased bearings in hub and install hub assembly on spindle (18). Install collar (3), flat washer (21) and nut (22). Snug up nut to seat bearings. Loosen nut and retighten to eliminate all bearing end play. Rotate hub while tightening nut. Back off nut to nearest cotter pin hole and install cotter pin (2). Install hub cap (1).

Secure bellcrank swivel pin (11, Fig. 7-12) to mounting pad (10) with cap screws, lock washers and nuts. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

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STEERING AXLE - NON-DRIVING TYPE

AXLE DISASSEMBLY AND ASSEMBLY

ASSEMBLY - Continued

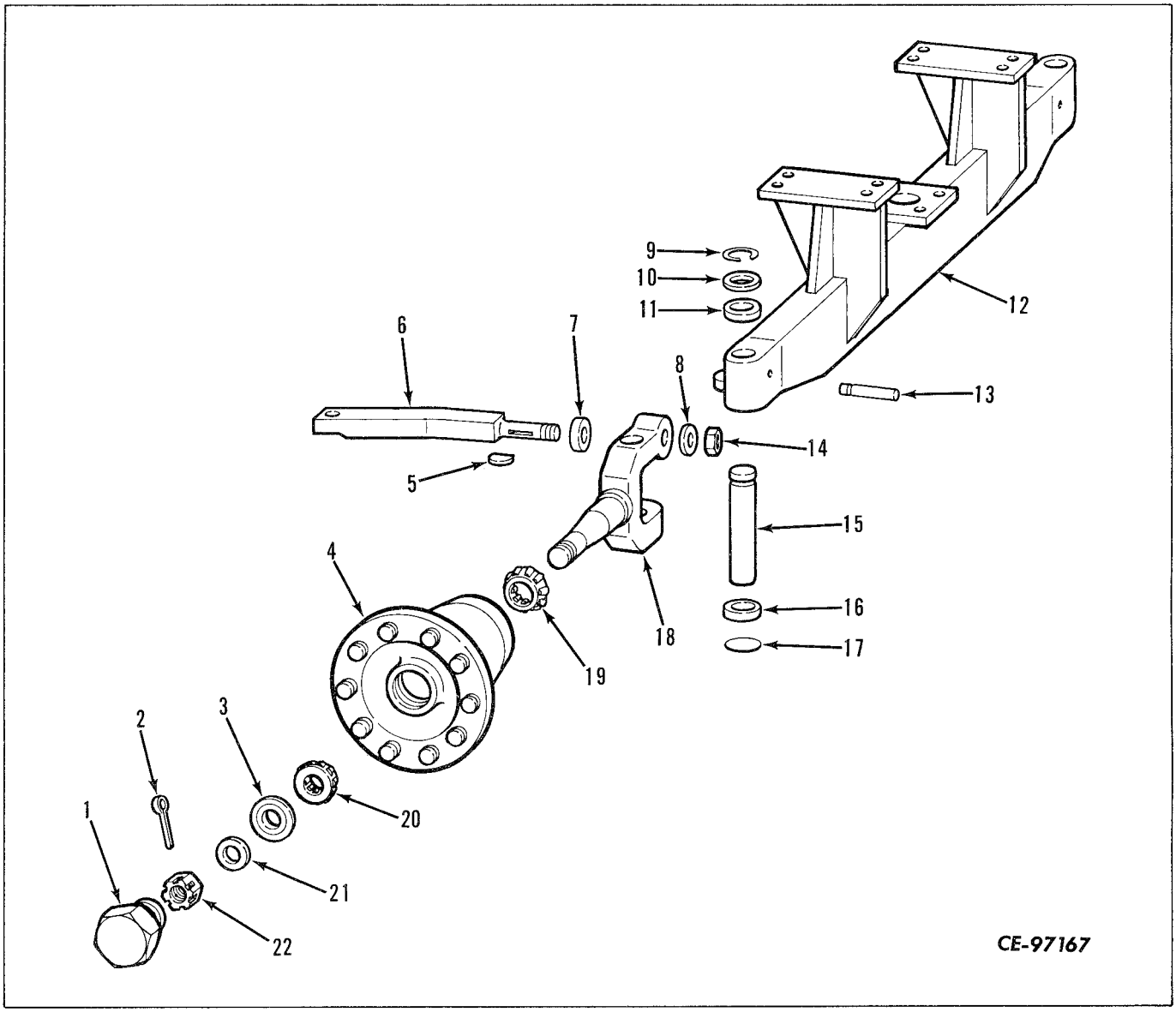

Figure 7-13
Non-Driving Steering Axle Assembly.

1. Hub cap.
2. Cotter pin.
3. Collar.
4. Wheel hub.
5. Key.
6. Steering arm.
7. Collar.
8. Lock washer.
9. Lock ring.
10. Seal retainer.
11. Seal.
12. Steering axle.
13. King pin keeper.
14. Nut.
15. King pin.
16. Thrust bearing.
17. Welsh plug.
18. Spindle.
19. Inner bearing cone.
20. Outer bearing cone.
21. Washer.
22. Nut.

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AXLE DISASSEMBLY AND ASSEMBLY

Install large bearing cone (12, Fig. 7-12) and new grease seal (9) in bellcrank bore. Position bellcrank assembly on swivel pin (11); install small bearing cone (7), flat washer (6) and nut (5). Tighten nut snugly while moving bellcrank back and forth to seat bearings. Back off nut and retighten to eliminate all bearing end play. A slight preload is more desirable than noticeable end play.

Install dust cover (4, Fig. 7-12) and secure with retaining ring (3).

Position steering cylinder on axle assembly with its ball socket studs installed in bores in axle and bellcrank. Use new grease seals between socket and axle and socket and bellcrank. Install lock washers and nuts and tighten nuts to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Install tie rods (2, 17, Fig. 7-12) in steering arms (6, Fig. 7-13) and bellcrank (15, Fig. 7-12) using new grease seals (16). Secure tie rods with lock washers (14) and nuts (13). Tighten nuts to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

INSTALLATION

Using a suitable floor jack, position axle under tractor. Raise axle aligning bolt bores in axle mounting pads and frame or bolster. Install axle mounting bolts and tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Attach drag link (1, Fig. 7-12) to drag link ball stud (8). Screw adjusting plug in end of drag link until all end play between stud and drag link is removed. Align plug slot with nearest cotter pin holes and install cotter pin.

Connect hydraulic lines to steering cylinder ports after removing caps and/or plugs from lines and cylinder ports.

Start tractor and turn steering wheel through several complete cycles to be sure steering lines and cylinder are full of fluid. Check level in hydraulic reservoir and add fluid as required (refer to "LUBRICANTS AND CAPACITIES" under "SECTION XI, HYDRAULIC SYSTEM"). Lubricate all grease fittings with recommended lubricant (refer to "LUBRICANTS AND CAPACITIES").

STEERING AXLE - NON-DRIVING TYPE

TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Hard steering	1. Lack of lubrication. 2. Low tire pressure. 3. Low hydraulic pressure. 4. Excessive preload on bellcrank bearings.	1. Lube all points with grease fittings. 2. Check and correct. 3. Check pressure. 4. Loosen bearing adjusting nut and set correctly. Disconnect all linkage from bellcrank when adjusting bearings.
Shimmy in steering wheel	1. King pin bushings worn. 2. Steering linkage loose or worn. 3. Excessive toe-in or toe-out. 4. Wheel bearings loose or worn. 5. Wheel lug nuts loose.	1. Replace. 2. Repair as required. 3. Adjust. 4. Repair as required. 5. Torque lug nuts. Replace worn studs and nuts. If stud bore in wheel is wallowed out, replace wheel.
Bellcrank hits stops on axle	1. Linkage and/or steering cylinder out of adjustment.	1. Adjust.
Uneven tire wear	1. Excessive toe-in or toe-out.	1. Adjust.

SERVICE INSTRUCTIONS

SPECIFICATIONS

Width over Tires . . . . . 6' 5-1/2"
Axle Oscillation (H-30F) . . . . . 18°
Tread . . . . . 5' 10-3/4"
Standard Tire Size . . . . . 9 X 20 - 10 PR

LUBRICANTS AND CAPACITIES

I.H.	S.A.E.	A.P.I.
IH 25IH EP	Multi-Purpose Chassis Lube	NLGI Grade 2 Lithium Base

Wheel bearings hand packed. Swivel pin bearings hand packed on initial installation. King pin bushings, swivel pin bearings and linkage joints lubricated at recommended interval (refer to "Operator's Manual") with grease gun.

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SERVICE INSTRUCTIONS

TOLERANCES

Spindle Bushing Reamed Diameter ..... $\frac{1.359"}{1.360}$

Steering Cylinder Length:

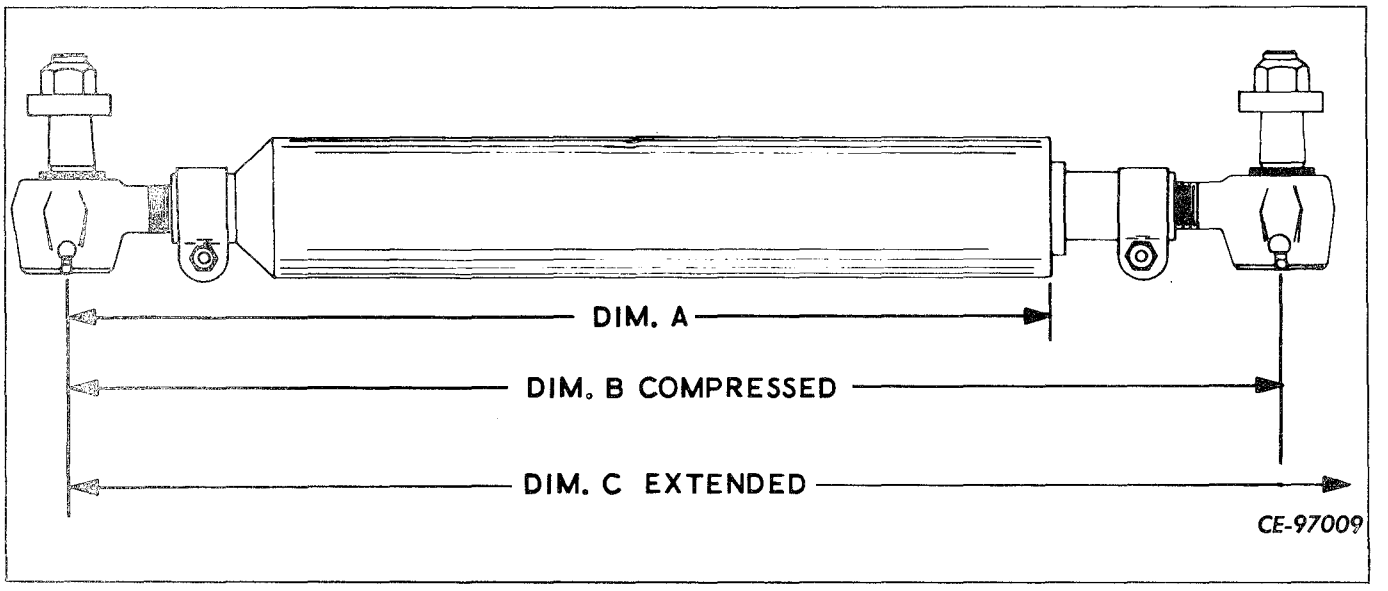

Figure 7-14

MODEL	H-30BR	H-30BF
A	18"	18-5/16"
B	22"	22"
C	32"	32"

SPECIAL TORQUES

(Threads Lubricated with Oil)

Bellcrank Swivel Pin Mounting Cap Screws ..... 80-90 ft. lbs.
Steering Cylinder Ball Socket Nuts ..... 105 ft. lbs.
Tie Rod Ball Socket Nuts ..... 105 ft. lbs.
Axle Mounting Bolts ..... 365 ft. lbs.
Steering Cylinder Ball Socket Nuts ..... 105 ft. lbs.

STEERING AXLE - NON-DRIVING TYPE

SERVICE INSTRUCTIONS

ADJUSTMENTS

TOE-IN

Position the machine on a level surface, with the wheels in the straight ahead position. Measure the distance between the forward edge of the wheels and the frame and the rear edge of the wheels and the frame. All four measurements should be equal. If the two forward measurements are equal but do not equal the rear measurements a toe-in or toe-out condition exists. If forward measurements are smaller than rearward measurements a toe-in condition is present. If measurements are reversed the condition is toe-out. To correct these conditions, disconnect the steering cylinder at the bellcrank. Loosen the clamps (18, Fig. 7-12) on the tie rods (2, 17) and rotate the rods to lengthen or shorten them. Be sure to turn each rod an equal amount in the same direction. When all four measurements are equal, tighten the clamps.

With the wheels straight ahead the steering bellcrank (15, Fig. 7-12) should be centered between the stops on the axle.

If the bellcrank is off center, block the wheels so they cannot move. Loosen the tie rod clamps (18, Fig. 7-12). Remove the tie rod ball sockets from the bellcrank. Center the bellcrank (15) between the stops on the axle. Adjust the length of the tie rods (by holding the inner ball socket and rotating the rod) until the ball socket studs are in direct alignment with their bores in the bellcrank. Install ball sockets in bellcrank and secure with lock washers (14) and nuts (15). Tighten nuts to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Install power steering cylinder on bellcrank. Tighten nut to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

STEERING WHEEL

After adjusting toe-in (wheels must be straight ahead and measurements at all four points mentioned above equal), disconnect the drag link (1, Fig. 7-12) from the steering gear arm. Rotate the steering wheel as far as it will go in one direction, then rotate it as far as it will go in the opposite direction, counting the number of turns. Turn the wheel back half of the number of turns counted. The wheel is now centered. At this point the drag link socket should be in direct alignment with the ball stud on the steering arm. If it is not, remove the arm (using a suitable puller) and position it on the shaft with the ball stud in direct alignment with the drag link socket. Secure steering arm with retaining nut and tighten to recommended torque (refer to "SECTION VIII, STEERING GEAR").

Torque: _____

Install the drag link on the steering arm ball stud. Tighten the plug in the drag link socket as far as it will go; then back off to the nearest cotter pin hole. Install cotter pin.

STEERING CYLINDER

A properly adjusted steering cylinder will bottom at each end of its stroke. At each point of bottoming there should be 1/8 inch clearance between the bellcrank (15, Fig. 7-12) and the steering stops on the axle. If adjustment is required remove the cylinder from the axle assembly. Loosen the clamp at the head end of the cylinder. Adjust the static length of the cylinder (refer to DIMENSION "A," Fig. 7-14 under "TOLERANCES") using the head end ball socket. When the correct static length (DIMENSION "A") is obtained, tighten the clamp to secure the adjustment.

Make the adjustments for DIMENSIONS "B" and "C" (Fig. 7-14 under "TOLERANCES") using the ball socket at the rod end of the cylinder. Snug clamp but do not tighten.

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Install the steering cylinder on the axle assembly. Tighten the stud nut on the steering cylinder anchor to the recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Connect the hydraulic lines to the steering cylinder. Tighten securely.

Start the engine and rotate the steering wheel through several full turns in both directions. Be sure piston bottoms in cylinder at end of each turn and that there is at least 1/8 inch clearance between bellcrank (15, Fig. 7-12) and bellcrank stops on axle.

Tighten remaining ball socket stud on rod end of cylinder to correct torque (refer to "SPECIAL TORQUES").

Torque:_____

Tighten clamp on rod end of cylinder securely.

Check fluid level in hydraulic reservoir and add as required.

STEERING AXLE - NON-DRIVING TYPE

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

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SECTION VIII

STEERING GEAR

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SECTION VIII STEERING GEAR

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STEERING GEAR

GENERAL INFORMATION

DESCRIPTION

The steering gear is a semi-integral hydraulic steering gear incorporating a hydraulic control valve on a single stud cam and lever mechanical steering gear. Steering effort applied to the steering wheel actuates the valve which, in turn, directs hydraulic fluid from a pump to a power cylinder located in the linkage.

PREVENTIVE MAINTENANCE

Sufficient clean lubricant of the correct type (refer to "LUBRICANTS AND CAPACITIES" under "SERVICE INFORMATION") is the primary maintenance requirement. Lubricant level should be checked after each 500 hours of operation.

STEERING GEAR

DISASSEMBLY, INSPECTION AND ASSEMBLY

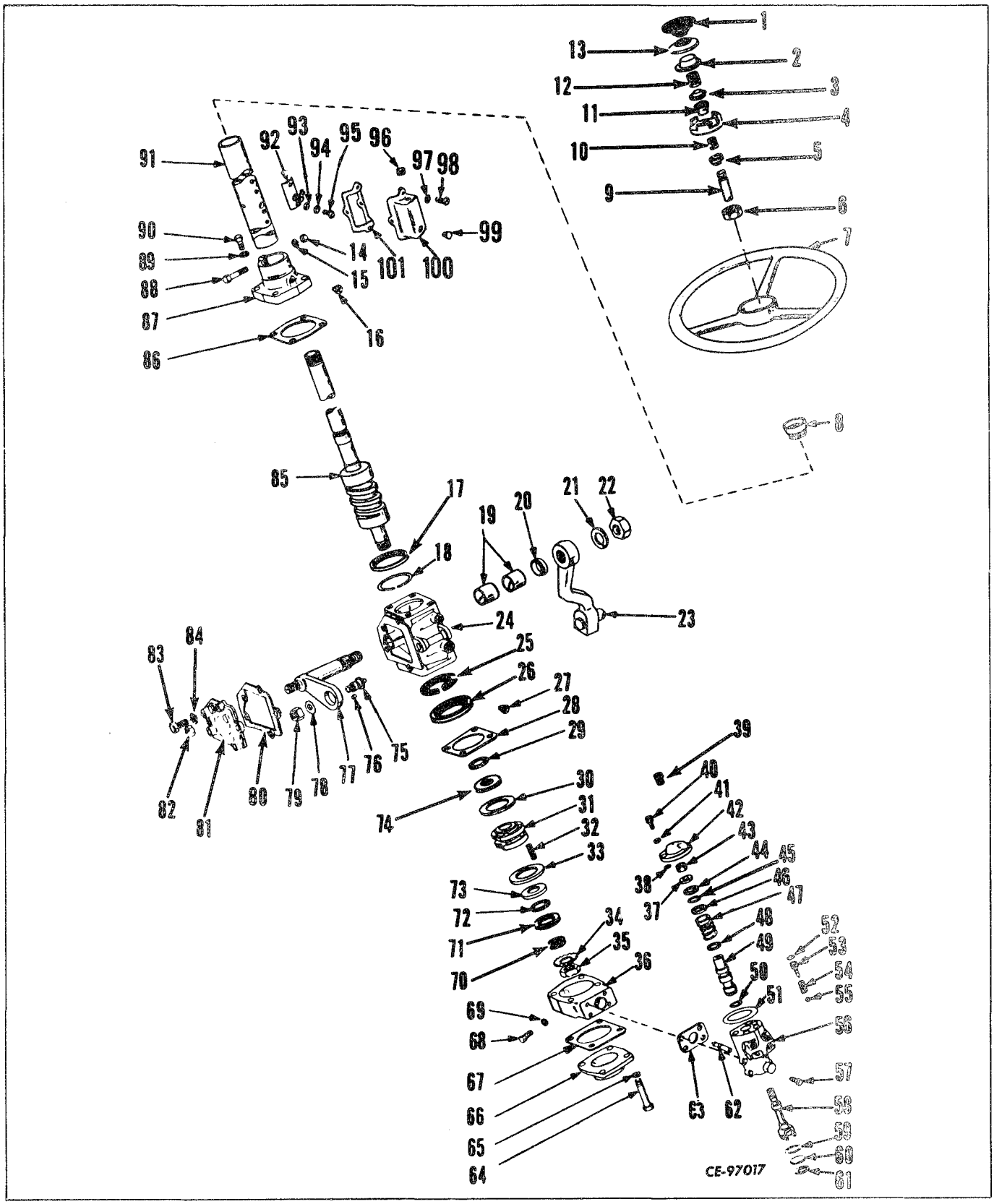

Figure 8-1
Typical Steering Gear - Exploded View.

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DISASSEMBLY, INSPECTION AND ASSEMBLY

Legend for Figure 8-1

1. Horn button cover.
2. Contact cup.
3. Contact cap.
4. Base plate.
5. Contact washer.
6. Steering wheel nut.
7. Steering wheel.
8. Tube bearing.
9. Cable.
10. Contact spring.
11. Insulation ferrule.
12. Horn button spring.
13. Horn button.
14. Nut.
15. Lock washer.
16. Plug.
17. Cam bearing.
18. Bearing retainer.
19. Bushings.
20. Oil seal.
21. Lock washer.
22. Nut.
23. Steering arm.
24. Housing.
25. Bearing retainer.
26. Cam bearing.
27. Plug.
28. Gasket.
29. Thrust bearing.
30. Centering washer.
31. Actuator.
32. Actuator spring.
33. Centering washer.
34. Lock washer.
35. Lock nut.
36. Actuator housing.
37. Washer.
38. "O" ring.
39. Relief fitting.
40. Cap screw.
41. Lock washer.
42. Cover.
43. Nut.
44. Centering washer.
45. "O" ring.
46. Centering washer.
47. Spring.
48. Centering washer.
49. Spool.
50. "O" ring.
51. "O" ring.
52. "O" ring.
53. Plug.
54. Spring.
55. Ball.
56. Valve housing.
57. Cap screw.
58. Flexure rod.
59. "O" ring.
60. Plate.
61. Retaining ring.
62. Actuating lever.
63. Gasket.
64. Cap screw.
65. Flat washer.
66. End cover.
67. Gasket.
68. Screw.
69. Washer.
70. Tongued washer.
71. Thrust washer.
72. Thrust bearing.
73. Thrust washer.
74. Thrust washer.
75. Bearing assembly.
76. Roller.
77. Levershaft.
78. Washer.
79. Nut.
80. Gasket.
81. Side cover.
82. Adjusting nut.
83. Cap screw.
84. Washer.
85. Cam and wheel tube assembly.
86. Gasket.
87. Upper cover.
88. Screw.
89. Flat washer.
90. Cap screw.
91. Jacket and tube assembly.
92. Brush.
93. Flat washer.
94. Lock washer.
95. Machine screw.
96. Rubber grommet.
97. Lock washer.
98. Machine screw.
99. Rubber plug.
100. Contact cover.
101. Gasket.

STEERING GEAR

DISASSEMBLY, INSPECTION AND ASSEMBLY

REMOVAL

Disconnect the hydraulic lines at the control valve. Tag to identify parts each connects to (Fig. 8-2). Allow the lines and the steering control valve to drain into a suitable container. Plug all parts to keep out dirt. Cap all lines.

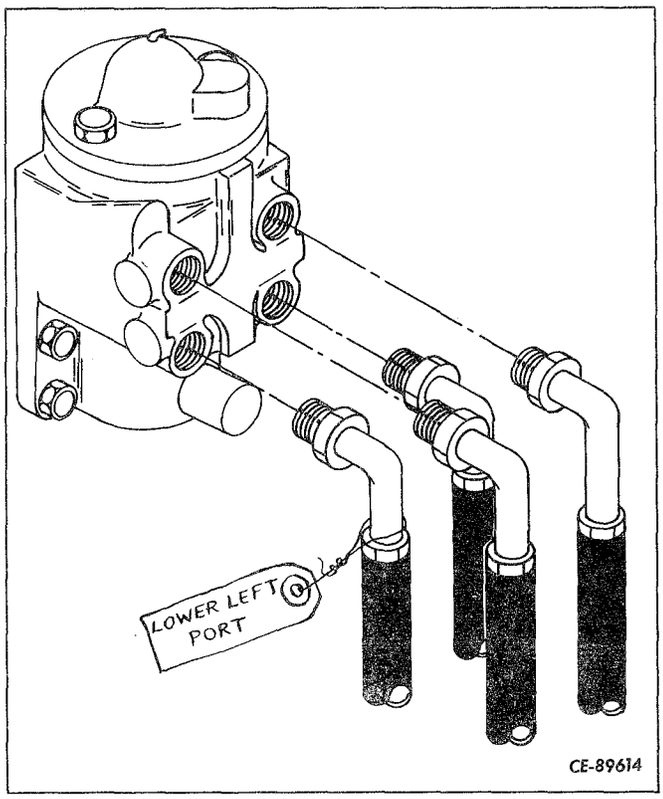

Figure 8-2

Disconnect the transmission disconnect linkage (if equipped) and accelerator linkage. Remove the front floorboard.

Remove transmission shift linkage from steering column jacket (refer to "SECTION IX, LINKAGE").

Disconnect horn wire at bottom of steering gear.

Remove horn button (1, Fig. 8-3) from steering wheel (4) by gripping with a firm downward pressure of fingers and twisting either right or left. Remove contact cup (2), spring (6), contact cap (5) and base plate (3) from steering wheel.

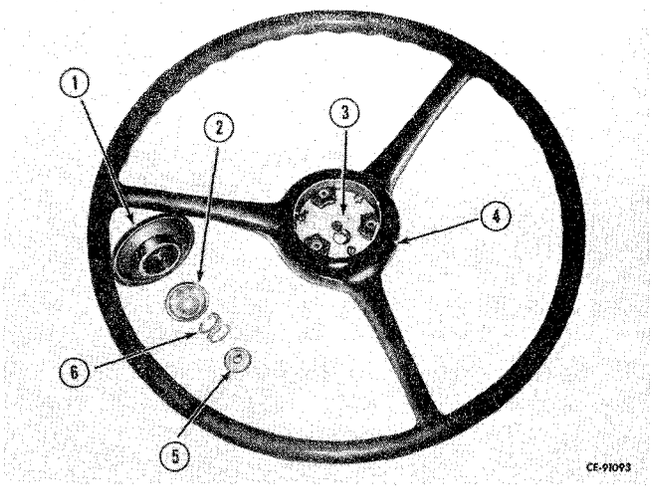

Figure 8-3

Remove steering wheel nut (1, Fig. 8-4). Remove wheel (2) using a wheel puller.

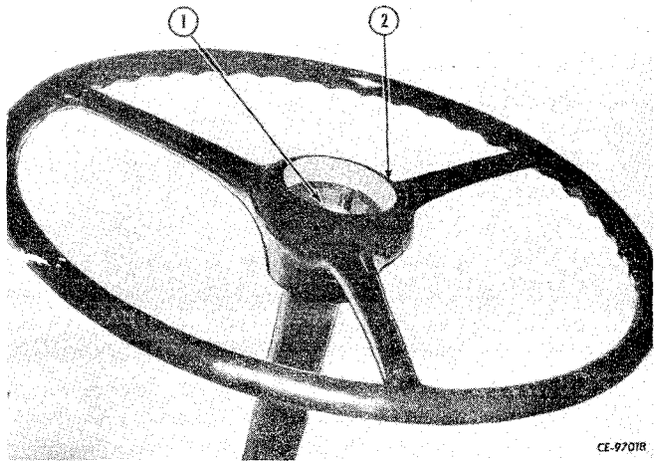

Figure 8-4

Remove cap screws that secure steering gear to lower part of frame. Remove "U"-bolt from upper support bracket. Disconnect steering arm from draglink and remove gear from machine.

DISASSEMBLY, INSPECTION AND ASSEMBLY

DISASSEMBLY

Remove steering arm (2, Fig. 8-5) from steering gear (1) using a suitable puller. Do not hammer off arm without using support against the end of the shaft and use light blows as they are more effective.

NOTE: To simplify assembly, mark the position of the steering arm on the lever shaft with a file, punch or Prussian blue.

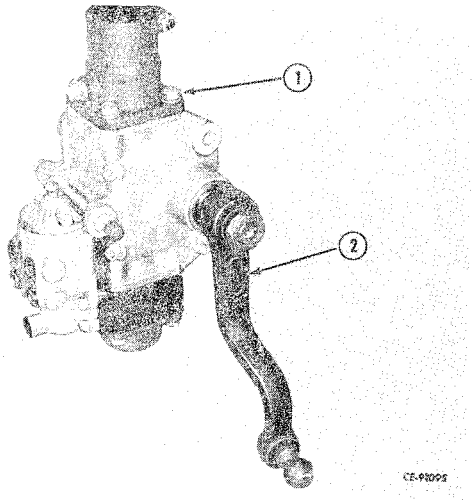

Figure 8-5

Remove the screws (8, Fig. 8-6) and lock washers (7) that secure the cover (6) to the jacket and tube (1); remove the cover and gasket (5). Remove the grommet (10) and rubber plug (10) from the cover. Remove the screws (4), lock washers and washers (3) that secure the contact brush (2) to the jacket and tube; remove the brush. Pull horn wire up thru jacket and tube.

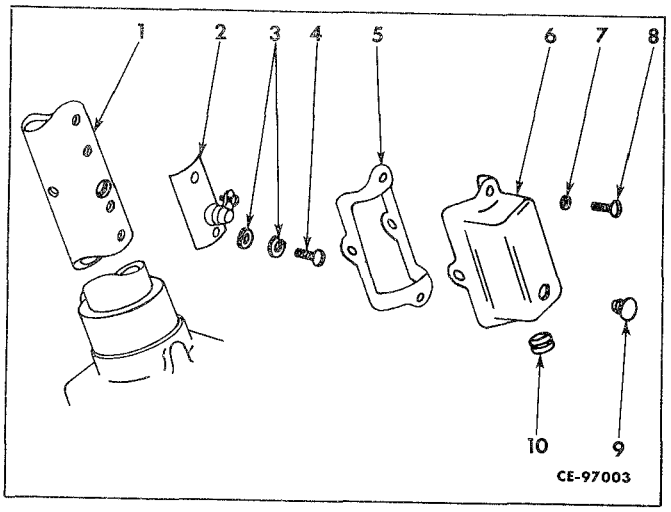

Figure 8-6

Remove cap screws (3, Fig. 8-7) and lock nut (1) that secure side cover (4) to housing (2).

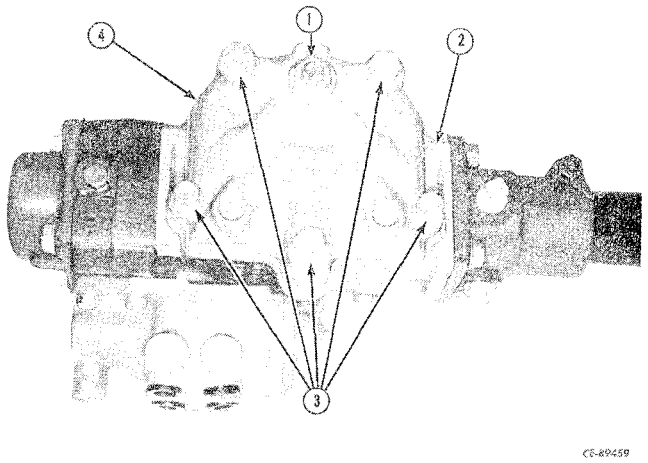

Figure 8-7

Screw in adjusting screw (1, Fig. 8-8) until cover (2) and gasket (3) can be removed from housing (4). Discard gasket.

(Continued on next page)

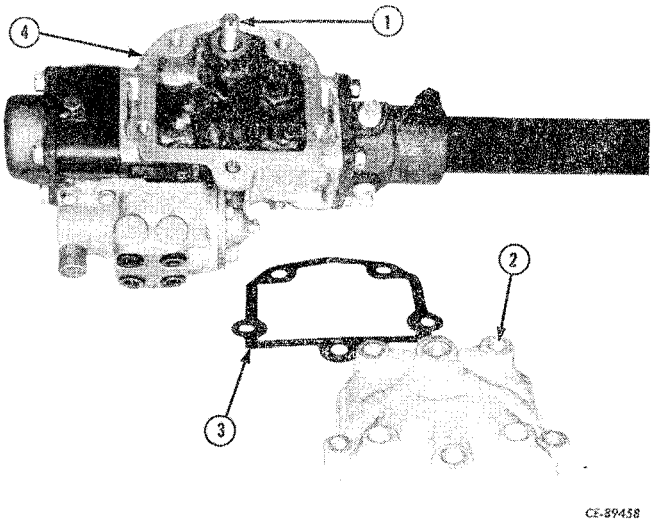

Figure 8-8

DISASSEMBLY, INSPECTION AND ASSEMBLY

DISASSEMBLY - Continued

Slide lever shaft (1, Fig. 8-9) from housing (4) having first made sure there are no burrs on the outer end of the shaft to damage the bushings (3). If bushings are damaged, press out of housing.

Remove and discard levershaft seal (2) from housing bore.

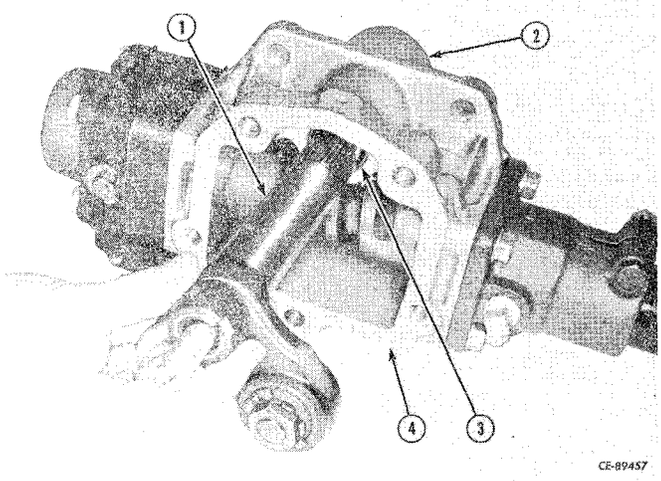

Figure 8-9

Remove nut (6, Fig. 8-10), pronged washer (5) and flat washer (4) from levershaft (1). Disassemble roller bearing unit (3) to replace damaged rollers (2).

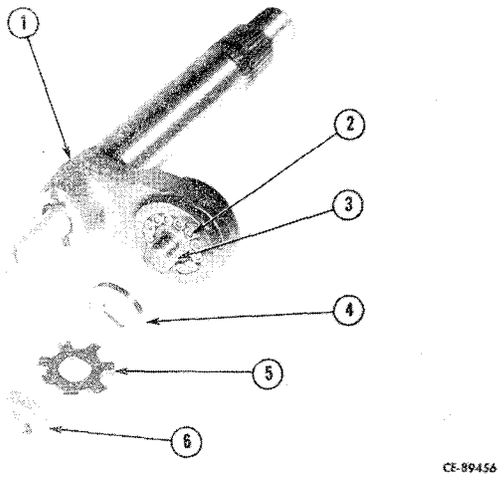

Figure 8-10

Remove cap screws (3, Fig. 8-11) that secure valve (2) to actuator housing (1) and remove valve and gasket (5). Discard gasket. Remove actuator lever (4).

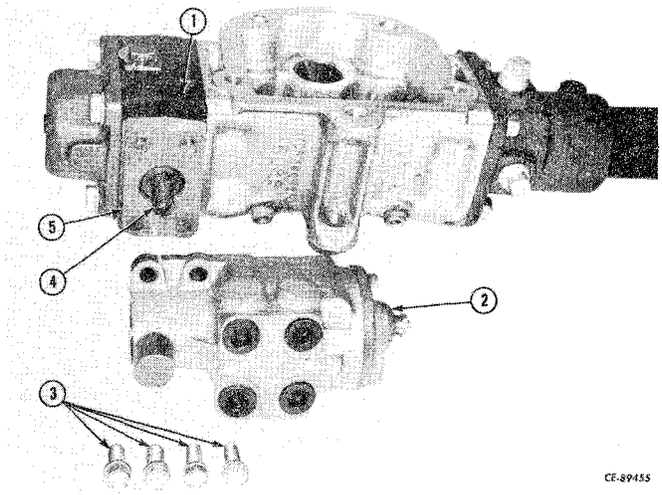

Figure 8-11

Using a snap ring pliers, remove snap ring (4, Fig. 8-12) end plate (3), and "O" ring (2) from control valve (1).

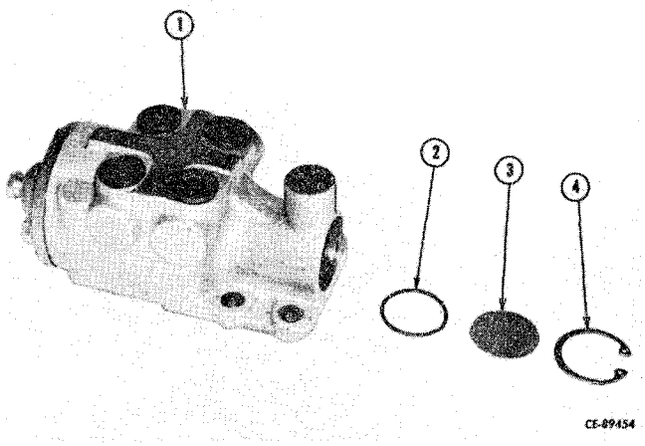

Figure 8-12

DISASSEMBLY, INSPECTION AND ASSEMBLY

Remove cap screws (3, Fig. 8-13) and end cover (2) from housing (1). Remove large "O" ring (4) from groove in cover, and 2 small "O" rings (5) from housing. Discard "O" rings.

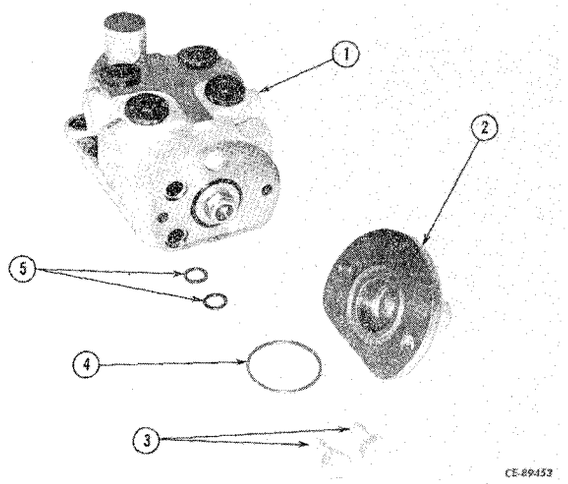

Figure 8-13

Remove nut (5, Fig. 8-14) from flexure rod (7). Remove washer (4), centering washers (6), "O" ring (3), spring (2) and rod from housing (1). Discard "O" ring.

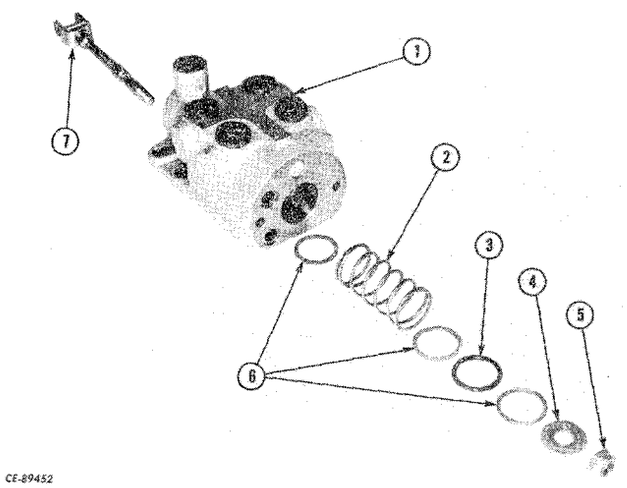

Figure 8-14

Slide spool (2, Fig. 8-15) out of housing (1). Remove "O" ring (3) from groove in spool. Discard "O" ring.

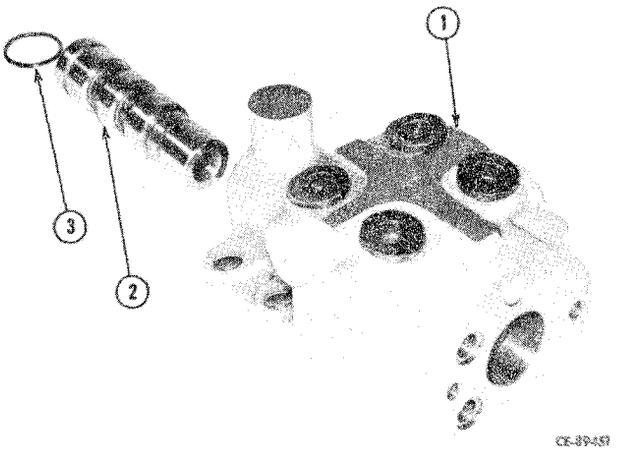

Figure 8-15

Remove cap screws (4, Fig. 8-16), upper cover (6), gasket (2) and jacket (3) from housing (1). Remove nut and cap screw (5) and separate jacket from cover. Remove bearing from steering wheel end of jacket. Remove cap screws (8), gasket (10) and end cover assembly (9) from actuator housing (7). Discard gaskets (2, 10).

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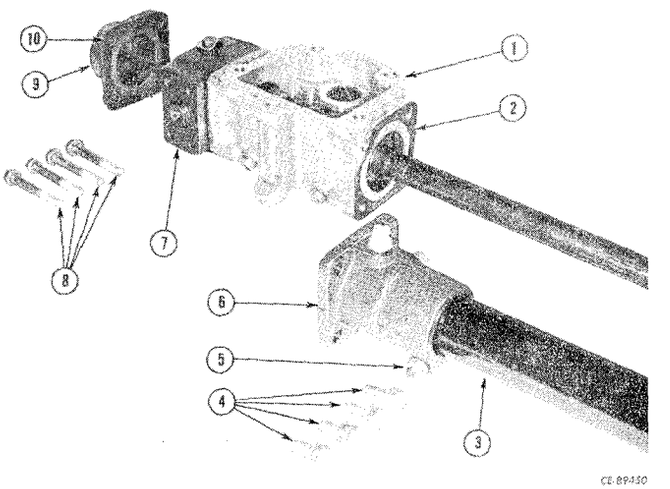

Figure 8-16

STEERING GEAR

DISASSEMBLY, INSPECTION AND ASSEMBLY

DISASSEMBLY - Continued

Unlock actuator retainer screw (1, Fig. 8-17) and remove actuator housing (7) and gasket (6). Slide out cam and actuator (3) from actuator end of housing (2). Remove retaining rings (4) and press out bearings (5) if damaged. Discard gasket (6).

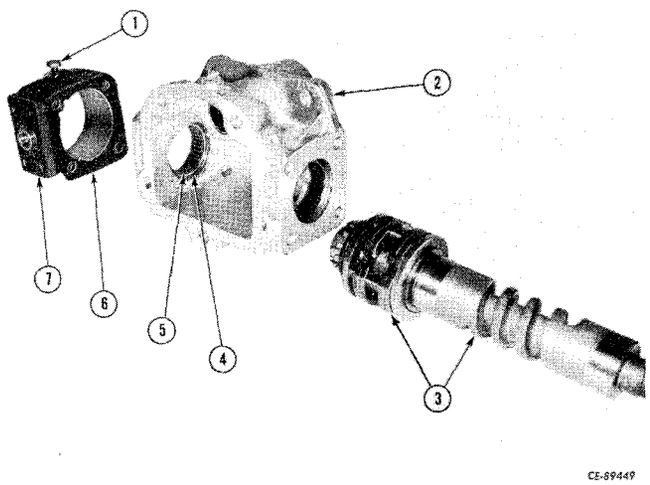

Figure 8-17

Using spanner wrench remove lock nut (1, Fig. 8-18), lock washer (2), washer (3), thrust washers (4 and 8), thrust bearings (5 and 9), centering washers (6) and actuator (7) from cam (10).

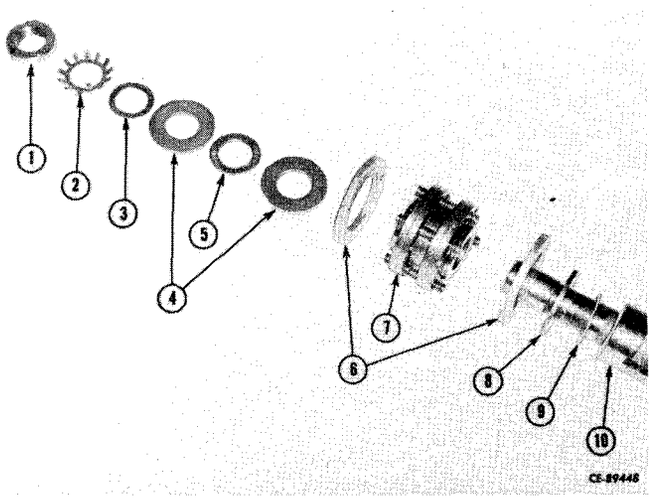

Figure 8-18

Slide springs (2, Fig. 8-19) out of actuator (1) noting the holes they were removed from. A simple diagram will aid in remembering the spring installation position.

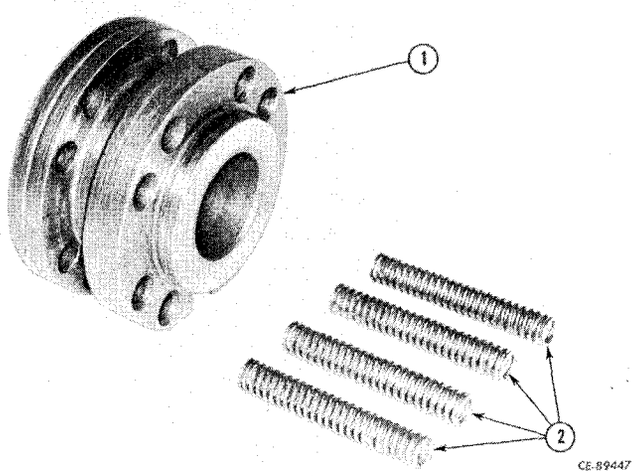

Figure 8-19

CLEAN, INSPECT AND REPAIR

CLEAN

Cleanliness is of paramount importance.

Clean all parts with a solvent type cleaner such as petroleum solvents, excluding gasoline.

CAUTION: Do not steam clean hydraulic steering gear.

Clean machined parts individually to avoid damage due to "bumping" together of parts.

Use lint free cloths, dipped in the cleaning agent to clean all machine surfaces.

After parts are cleaned, dry the parts, except bearings, with dry compressed air.

NOTE: Some cleaning solvents or volatile mineral spirits will deteriorate rubber parts.

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DISASSEMBLY, INSPECTION AND ASSEMBLY

INSPECT

Careful visual inspection of the steering gear parts is very important. These visual checks may uncover conditions not evident during operation.

a. Cam and Shaft

Check the cam groove for chipping, scoring or brinelling. (The cam is copper plated for initial service. The operation of the stud in the cam groove will wear away the copper plating. This is a normal condition.)

Check condition of bearing surface on O.D. at each end of cam.

Check condition of splines and threads on tube.

b. Levershaft

Check for burrs on splines, twisted splines, wear on bearing surfaces.

Check levershaft stud for nicks, flat spots or spalling.

Check adjustment of stud roller bearing.

c. Housing

Check for strain at mounting flanges.

Check condition of needle bearing in each end of housing.

Check fit of cam in needle bearings.

Check bushings in housing for wear or out-of-round.

NOTE: The valve is the control center of the hydraulic system. The major parts, which are the body and spool, are machined to very close limits and with precision machined edges. The spool and valve body are selectively fitted at the factory according to size of O.D. of spool and I.D. of body, therefore, these two parts are not separately replaceable. If either needs replacing, the whole valve assembly must be replaced. Good performance of power steering is not assured if "mis-matched" spool and body are used.

Care should be exercised in the handling of the parts to prevent damage. Sealing edges of the valve sleeve and the spool should not be broken. The result would be excessive leakage and reduced hydraulic power.

REPAIR

a. Replace all gaskets, seals and any defective parts.

b. If needle bearings in ends of housing have been removed, replace them. Take care not to press bearing too hard against retaining ring.

ASSEMBLY

Install springs (2, Fig. 8-20) in actuator (1). Be sure to install springs in proper bore as noted during disassembly.

(Continued on next page)

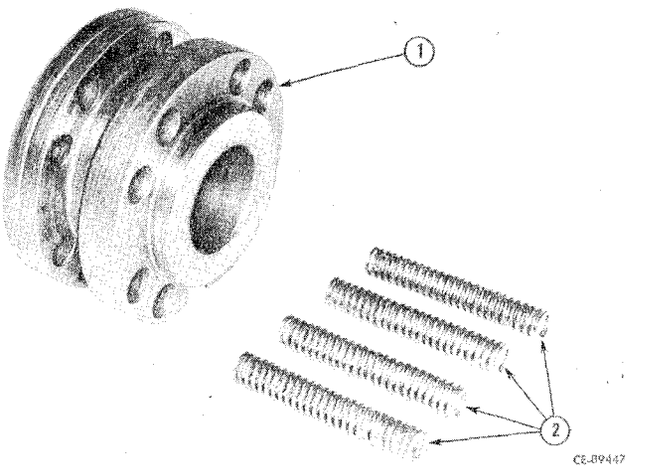

Figure 8-20

ASSEMBLY - Continued

Install thrust bearings (5, 9, Fig. 8-21), thrust washers (4 and 8), centering washers (6), actuator (7), washer (3), lock washer (2) and lock nut (1) on cam (10). Tighten lock nut to required torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

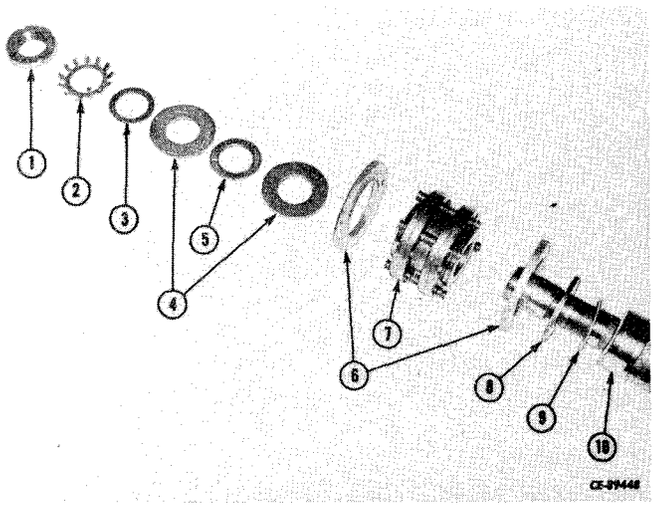

Figure 8-21

Press in bearing (5, Fig. 8-22) and install snap ring (4). Slide actuator and cam (3) into actuator end of housing (2). Install new gasket (6), actuator housing (7) and secure with retainer screw (1).

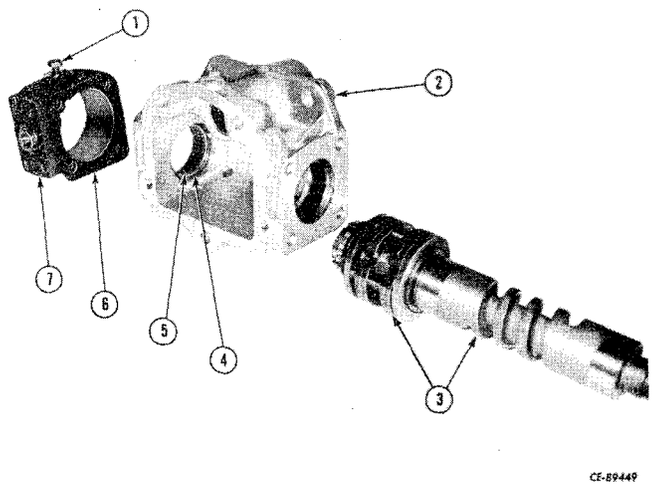

Figure 8-22

Install end cover assembly (9, Fig. 8-23) and new gasket (10). Secure with cap screws (8) and flat washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

Install jacket (3) in upper cover (6) and secure with cap screw, lock washer and nut (5). Install bearing in steering wheel end of jacket (3). Install new gasket (2) and upper cover assembly on housing (1) and secure with cap screws (4) and flat washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

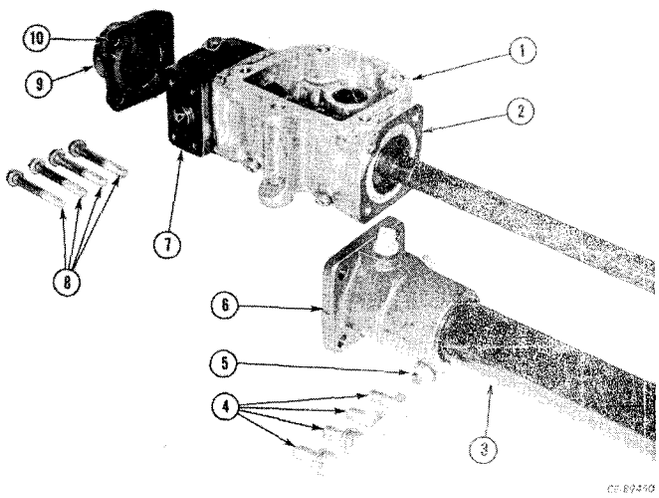

Figure 8-23

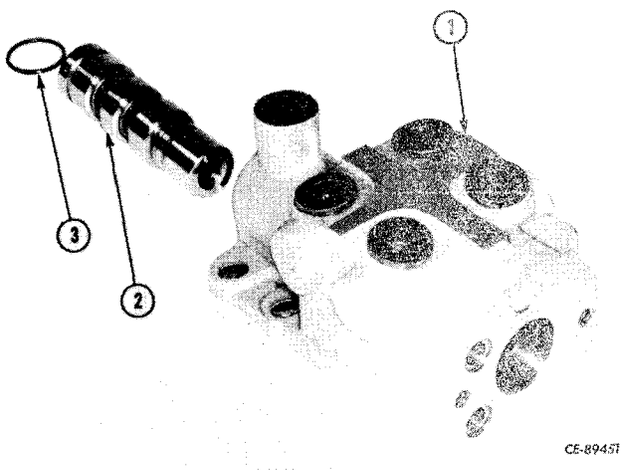

Figure 8-24

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DISASSEMBLY, INSPECTION AND ASSEMBLY

Install new "O" ring (3, Fig. 8-24) on spool (2) and insert spool in housing (1). Install carefully; do not jam in housing bore.

Install centering washers (6, Fig. 8-25), spring (2), new "O" ring (3) and washer (4) in housing (1). Insert flexure rod (7) through housing and install nut (5). Tighten nut to recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

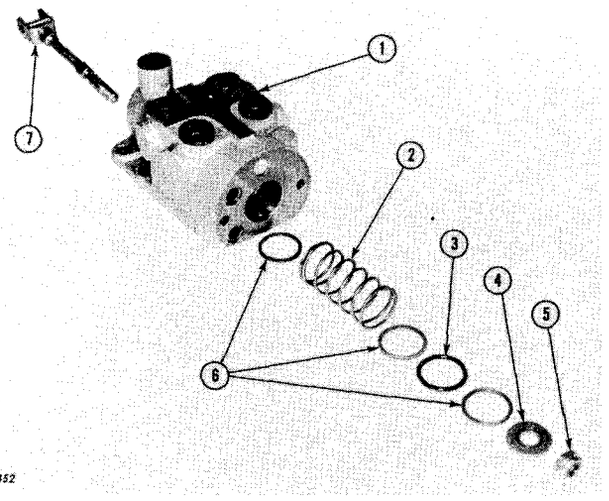

Figure 8-25

Install new "O" rings (5, Fig. 8-26) in housing (1) and new "O" ring (4) in groove of end cover (2). Install cover on housing and secure with cap screws (3). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

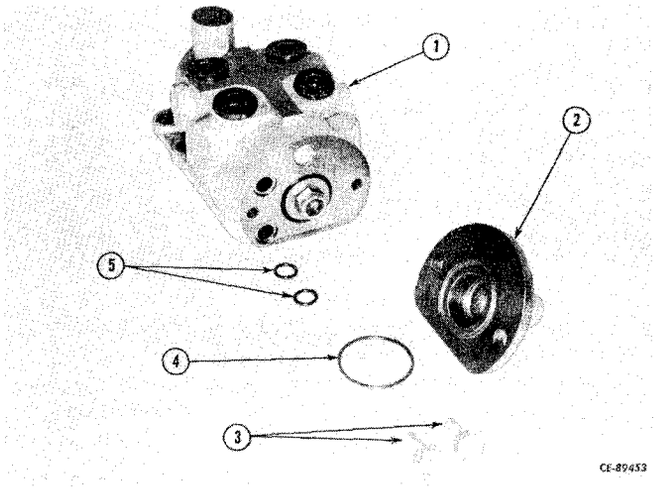

Figure 8-26

Install new "O" ring (2, Fig. 8-27) and end plate (3) in housing (1). Using a snap ring pliers, install snap ring (4).

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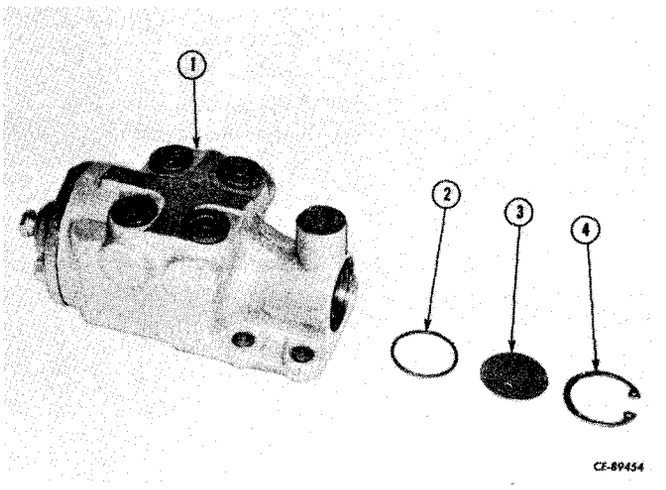

Figure 8-27

DISASSEMBLY, INSPECTION AND ASSEMBLY

ASSEMBLY - Continued

Assemble actuator lever (4, Fig. 8-28) in actuator housing (1) being sure stud end of lever seats in groove of actuator (1, Fig. 8-20). Position slot in other end of lever so that pin in clevis of flexure rod (7, Fig. 8-23) will fit freely into it when mounting the valve (2, Fig. 8-28).

Mount the valve (2) with a new gasket (5) on actuator housing (1) being sure clevis pin fits freely into slot of actuator lever. Start cap screws (3) and tighten lightly in rotation before final torquing. Tighten the cap screws to the recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque:_____

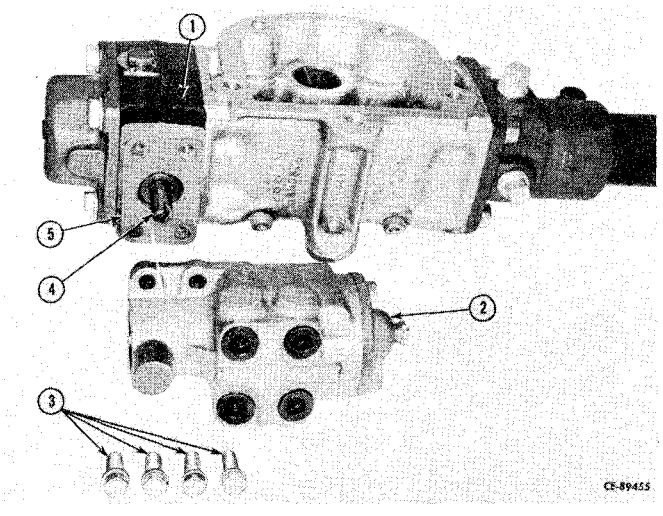

Figure 8-28

NOTE: Careless tightening may cause valve spool to be pulled off center by actuator lever interference with clevis pin.

Be sure spool actuates (moves axially in both directions) before assembling end covers. This may be done as follows:

Place steering gear arm on lever shaft.

Place steering wheel on wheel tube.

Turn steering wheel to move steering arm against a stop.

Apply sufficient effort to actuate spool.

Reverse arm against opposite stop to actuate spool in opposite direction.

Check valve spool movement for minimum tolerance (refer to "TOLERANCES" under "SERVICE INFORMATION").

Minimum Spool Travel:_____

Replace any damaged rollers (2, Fig. 8-29) and assemble roller bearing unit (3) in levershaft (1). Install flat washer (4), pronged washer (5) and nut (6). Tighten nut to recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque:_____

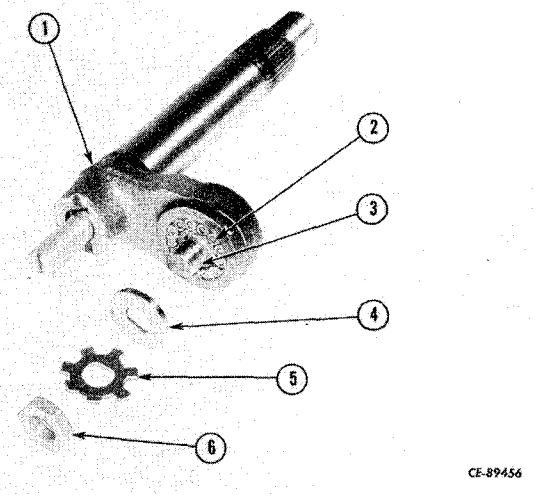

Figure 8-29

If bushings (3, Fig. 8-30) have been removed, press in new bushings from either end of levershaft bore in housing. Press bushing into bore until outer edge of bushing is even with small diameter of bore chamfer.

Press a new seal (2) in levershaft bore with lip of seal toward shaft bushing (3). Install levershaft (1) in housing bore.

DISASSEMBLY, INSPECTION AND ASSEMBLY

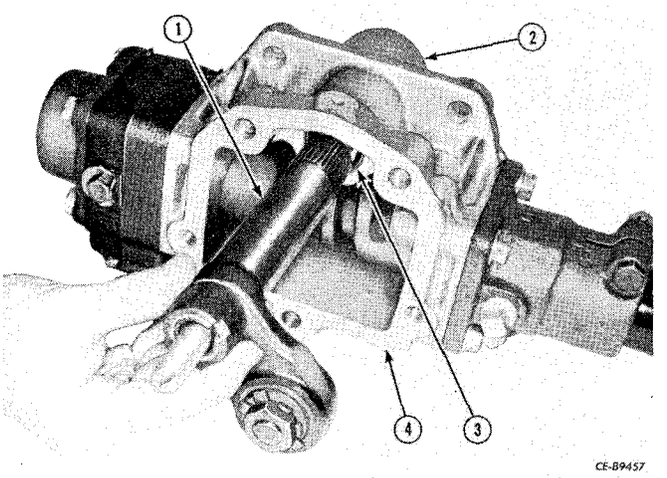

Figure 8-30

NOTE: If shims were present between lever shaft and housing during disassembly, refer to "ADJUSTMENTS," "LEVERSHAFT" under "SERVICE INFORMATION" before installing levershaft in housing.

Install a new gasket (3, Fig. 8-31) and cover (2). Screw adjusting screw (1) to the left until cover is seated on housing (4).

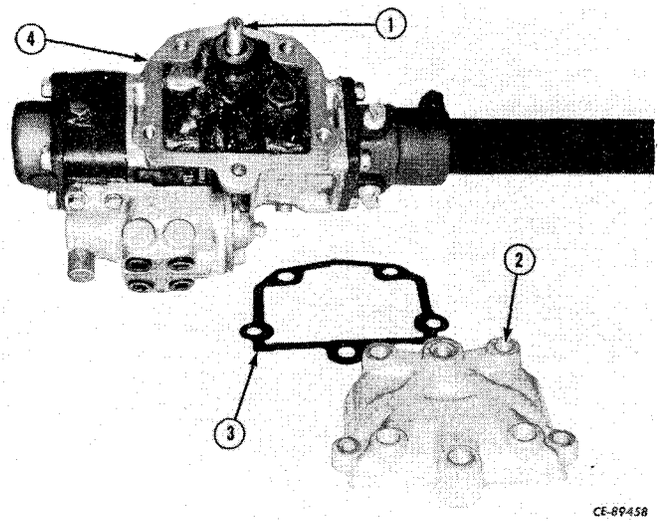

Figure 8-31

Insert horn wire down thru jacket and tube (1, Fig. 8-32) and out thru contact brush (2) and grommet (10). Install grommet and rubber plug (9) in cover (6). Secure contact brush to jacket and tube with screws (4) lock washers and washers (3). Install gasket (5) and cover and secure with lock washers (7) and screws (8).

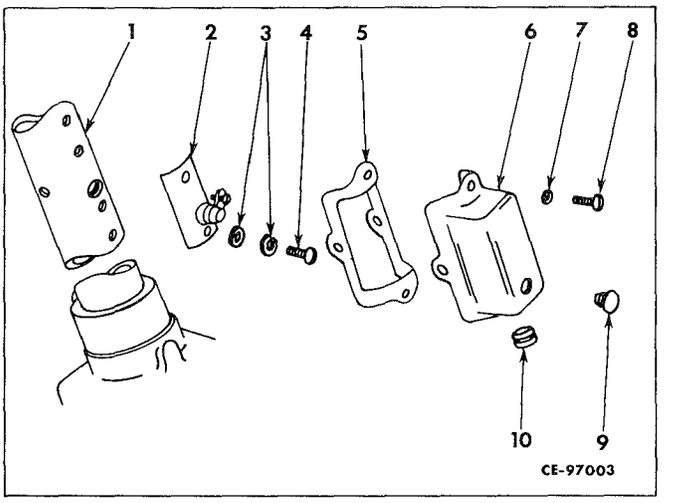

Figure 8-32

Secure cover (4, Fig. 8-33) to housing with cap screws (3), flat washers and nuts. Do not install long cap screw at top of gear box at this time. Tighten the cap screws to the recommended torque according to their diameter (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque:
Large Dia.:_____
Small Dia.:_____

Adjust levershaft backlash (refer to "ADJUSTMENTS" under "SERVICE INFORMATION").

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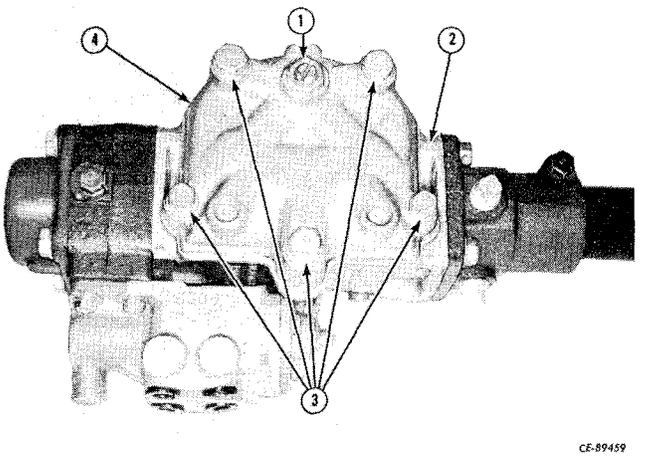

Figure 8-33

DISASSEMBLY, INSPECTION AND ASSEMBLY

ASSEMBLY - Continued

Install the steering arm (2, Fig. 8-34) on lever-shaft using position marks made during disassembly. Install the steering arm nut and tighten to the recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

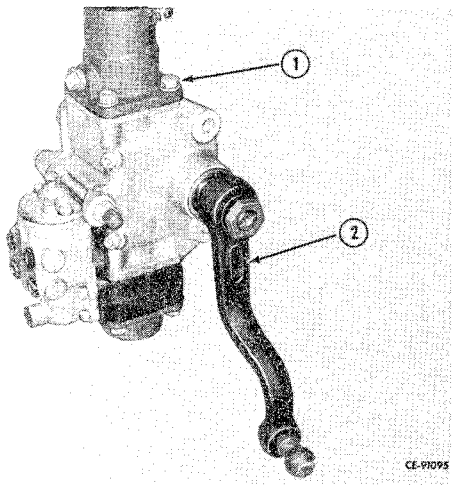

Figure 8-34

INSTALLATION

Install steering gear in tractor and secure gear box to frame with cap screws (3, Fig. 8-35),

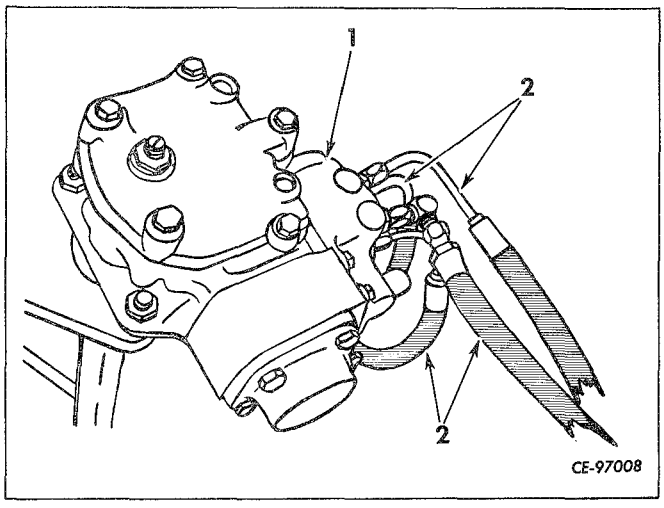

Figure 8-35

lock washers and hex nuts. Install upper jacket "U"-bolt to support bracket. Torque all cap screws and hex nuts (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque:
Long Cap Screw - Top of Gear Box: _____
Short Cap Screw - Bottom of Gear Box: _____
"U"-bolt - Upper Jacket: _____

Install front floor board and accelerator linkage (for assembly and adjustment of the above items refer to Section IX, "LINKAGE").

NOTE: Alignment of the column is of paramount importance. THE STEERING COLUMN MUST NOT BE SPRUNG IN ANY DIRECTION FROM ITS FREE POSITION. A bind in the wheel tube, due to column misalignment, will prevent centering the control valve in neutral position. It can cause jacket failure due to bending stresses.

Connect the hydraulic lines (2, Fig. 8-35) at the control valve (1).

Connect the transmission disconnect linkage (if equipped). Connect transmission shift linkage to steering column jacket (refer to "SECTION IX, LINKAGE").

Install steering wheel (2, Fig. 8-36), and tighten retaining nut (1) to recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

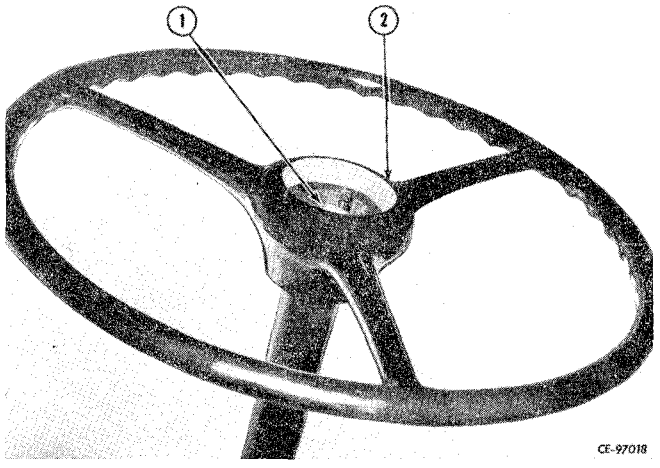

Figure 8-36

DISASSEMBLY, INSPECTION AND ASSEMBLY

Install base plate (3, Fig. 8-37), contact cap (5), spring (6) and contact cup (2) in steering wheel (4). Install horn button (1) by gripping with a firm downward pressure of fingers and twisting either right or left.

Connect horn wire at bottom of steering gear.

Connect drag link (1, Fig. 8-38) to steering arm (2). Refer to SECTION IX, "LINKAGE" for adjustment of steering gear linkage.

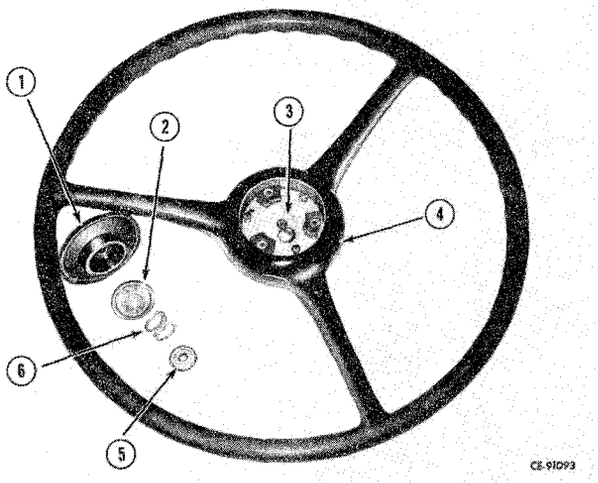

Figure 8-37

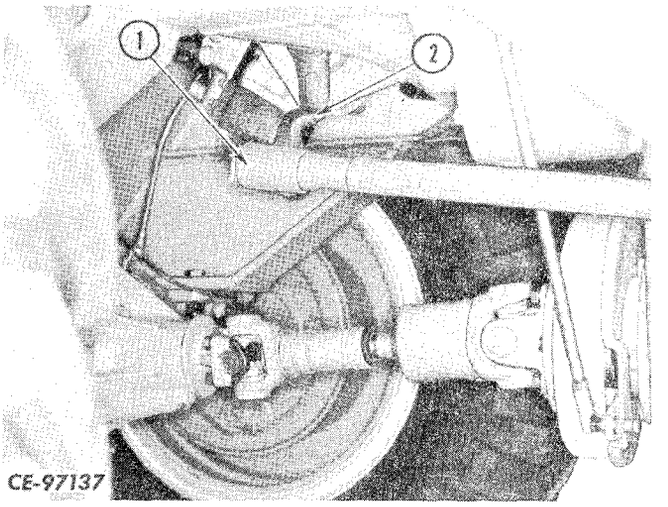

Figure 8-38

TROUBLE SHOOTING

Listed below, in chart form, are complaints involving the tractor steering and their possible causes and remedy. Included in this list are some items concerning the steering linkage.

If a problem is traced to the linkage, refer to SECTION IX, "LINKAGE" for information on the removal, inspection, repair and installation of the steering linkage.

COMPLAINT	POSSIBLE CAUSE	REMEDY
Turning radius not equal in both directions.	1. Steering gear not centered.	1. Check that gear pitman arm is properly positioned on gear shaft.
	2. Tie rods not equally adjusted.	2. Adjust.
Toe-in or toe-out.	1. Tie rods not properly adjusted.	1. Adjust for equal toe-in at each wheel.
Steering gear bottoms before steering cylinder.	1. Steering gear not centered.	1. Check that pitman arm is properly positioned on gear.

(Continued on next page)

STEERING GEAR

TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Excess play at steering wheel.	1. Loose linkage.	1. Tighten adjusting plugs to remove play.
	2. Wear at ball studs in linkage.	2. Replace worn parts.
	3. Steering gear lash adjustment off.	3. Adjust gear.
	4. Worn steering gear.	4. Overhaul.
Lost motion at steering wheel.	1. Loose ball socket connections or other linkage connections.	1. Tighten ball sockets until parts are compressed solid then back off to nearest lockpoint.
	2. Loose thrust bearing adjustment.	2. See "ADJUSTMENTS" under SERVICE INFORMATION.
	3. Excessive back lash of taper stud in cam groove.	3. See "ADJUSTMENTS" under SERVICE INFORMATION.
	4. Steering wheel loose on wheel tube.	4. Tighten wheel nut.
	5. Pitman arm loose on levershaft.	5. Tighten levershaft nut.
Noise.	1. Low level of hydraulic oil.	1. Check for leaks; maintain proper level of oil.
	2. Air in system.	2. Check all connections for tightness. Operate several minutes to bleed from system.
	3. Dirt and sludge in pump.	3. Drain system and clean.
	4. Pump worn.	4. Replace or repair.
Hard steering.	1. Steering linkage lacks lubrication.	1. Apply lubricant to all fittings. Clean fitting before lubricating.
	2. Insufficient pump pressure.	2. Check pump pressure with gauge. If insufficient, check for cause -- sticky relief valve or flow divider, defective pump.
	3. Sticky relief valve or flow divider. (Prevents pressure build up.)	3. Replace relief valve - May require total replacement.

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TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Hard steering. - Continued	4. Low fluid level. (Loss of hydraulic oil due to leaks or damaged lines.)	4. Repair to eliminate leaks and refill system and reservoir.
	5. Spool in valve sticking.	5. Disassemble valve and inspect for sticking. Clean. Reassemble valve or replace and reinstall on gear, check adjustment of thrust bearings. Check for equal amount of an end movement of spool each way from center.
	6. Wear of actuator lever in bushing of actuator housing or valve mounting bracket.	6. Replace actuator lever and possibly bracket with bushing or actuator with bushing.
	7. Bind of cam in needle bearings.	7. Eliminate cause of bind.
	8. Wheel tube bent or sprung.	8. Replace bent parts and correct column alignment.
	9. Bind in wheel tube bearing.	9. Eliminate cause of bind.
	10. Improper steering alignment.	10. Align to specifications.
	11. Taper stud or bearing assembly adjusted too tight in cam groove.	11. Adjust per adjustment.
	12. Broken piston or piston rings in power cylinder.	12. Replace cylinder.
	13. Lack of steering gear lubricant.	13. Add lube to proper level.
	14. Valve loose on mounting.	14. Tighten.
	15. Low tire pressure.	15. Inflate to proper pressure.
No recovery from turn to straight-ahead.	1. Steering linkage lacks lubrication.	1. Apply lubricant to all fittings. Clean fitting before lubricating.

(Continued on next page)

STEERING GEAR

TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
No recovery from turn to straight-ahead. - Continued	2. Tight ball socket connections and other linkage connections.	2. Tighten ball sockets until parts are compressed solid, then back off to nearest lock point. Lubricate.
	3. Tight steering axle spindles.	3. Make free.
	4. Bind in wheel tube (prevents centering of valve.)	4. Eliminate bind.
	5. Bind in wheel tube bearing (Prevents centering of valve.)	5. Eliminate cause of bind such as a bracket clamped tight over jacket tube where bearing is located.
	6. Bind of cam in needle bearings. (Prevents centering of valve.)	6. Eliminate cause of bind.
	7. Spool in valve sticking (prevents centering of valve.)	7. Disassemble valve and inspect for sticking. Clean. Reassemble valve or replace and reinstall on gear. Check adjustment of thrust bearings. Check for equal amount of end movement of spool each way from center.
	8. Taper stud adjusted too tight in cam groove.	8. Adjust per adjustment.
Shimmy.	1. Loose ball socket connections or other linkage connections.	1. Tighten ball sockets until parts are compressed solid, then back off to nearest lock-point.
	2. Badly worn and unevenly worn tires.	2. Replace. Align steering.
	3. Looseness in steering gear.	3. Adjust gear, and/or repair gear.

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SERVICE INFORMATION

SPECIFICATIONS

Make	Ross Gear and Tool Co.
Type	Mechanical cam and lever hydraulic assisted
Control valve	Integral with steering gear housing

Steering Circuit Pressure 1000 PSI at low idle

LUBRICANTS AND CAPACITIES

LUBRICANT

The steering gear housing should be kept full of lubricant. Lubricate through filler plug in top of steering gear housing.

The lubricants used must meet the following requirements:

IH 135H EP, A. P. I. GL-5, SAE 90, MIL-L-2105B

CAPACITY

Steering gear housing - 1.0 pints.

TOLERANCES

Minimum control valve spool travel . . . .065"

SPECIAL TORQUES

Cam and Tube Adjusting Lock Nut . 10 Lbs. Ft.
End Cover-to-Gear Housing Cap Screws . . . . . 33-37 Lbs. Ft.
Upper Cover-to-Housing Cap Screws . . . . . 33-37 Lbs. Ft.
Flexure Rod Nut . . . . . 125-150 Lbs. Inch
Valve End Cover-to-Valve Housing Cap Screws . . . . . 9-10 Lbs. Ft.
Valve Housing-to-Actuators Housing Cap Screws . . . . . 10-15 Lbs. Ft.
Roller Bearing (Taper Stud) Nut . . . . . 2-1/2 Lbs. Inch
Cover-to-Housing Cap Screws:
Large (7/16") Cap Screws . . 53-60 Lbs. Ft.
Small (3/8") Cap Screws . . . 33-37 Lbs. Ft.
Steering Arm-to-Lever Shaft Nut .120 Lbs. Ft.
Steering Gear Mounting Fasteners:
Long (7/16") Cap Screws . . . . 53-60 Lbs. Ft.
Short (1/2") Cap Screws . . . . 80-90 Lbs. Ft.
"U"-Bolt; Jacket-to-Bracket . 16-19 Lbs. Ft.
Steering Wheel Retaining Nut . . 33-37 Lbs. Ft.

ADJUSTMENTS

When making adjustments, free the steering gear of all load, preferably by disconnecting the drag link from the steering gear arm and, loosen the instrument board bracket clamp on steering gear column to make sure the steering column is not binding, which prevents the valve from centering.

NEEDLE THRUST BEARINGS

It is preferable to have the gear removed from the machine, but if the gear is readily accessible on the machine it is only necessary to remove the end cover so that the adjusting nut on the cam shaft is accessible.

Before adjusting thrust bearings turn gear off its center position to free the stud in the cam groove.

Remove steering wheel.

Remove cap screws that secure lower cover to housing.

Reassemble cap screws in actuator housing with 3/8" thick spacers under heads of screws. This is to hold the actuator and cam assembly in the gear when making the adjustment.

Straighten prong of lock washer. Remove adjusting nut, tongued washer, and upper thrust washers and thrust bearing.

Insure that the threads of the nut and cam shaft are free of interference by running the nut onto the cam shaft using only the fingers to drive the nut. If the nut cannot be driven all the way with finger-torque, the threads are fouled and must be cleared with a thread file or other means until the nut goes on freely.

(Continued on next page)

ADJUSTMENTS - Continued

NEEDLE THRUST BEARINGS - Continued

Reassemble thrust washers and thrust bearings, (washer and pronged washer with external prongs), and adjusting nut (refer to Fig. 8-23).

Adjust as follows:

Drive on nut and tighten to 10 foot pounds torque. Back off nut 10° - 20° which can be done by moving the nut relative to the pronged washer approximately 1-1/2 width of a lug. Observe lug nearest in alignment with a notch in the adjusting nut and bend the lug tight against the notch root.

If torque wrench is not available, adjustment may be made with 10" multi-slip joint pliers. Avoid use of long handled wrench as too much torque can easily be applied. This adjustment is similar to a wheel bearing adjustment and should provide a light preload of the needle thrust bearings without lash or heavy drag.

Remove spacers, replace end cover and secure with cap screws. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque:_____

BACKLASH

(Tapered bearing stud in cam groove.)

Backlash of the stud (12, Fig. 8-39) in the cam groove shows up as backlash at the steering wheel and at ball stud on steering arm.

The groove of the cam (2) is purposely cut shallower, therefore, narrower in the mid-position range of stud travel to provide close adjustment where the straight ahead driving action takes place.

Adjust through mid-position to the high spot. Do not adjust in the end position. Backlash in the end position is normal and not objectionable.

To Adjust: Turn the adjusting screw (10, Fig. 8-39) in the side cover until a very slight drag (high spot) is felt when turning the gear through mid-position.

After making this adjustment lock the adjusting screw with the lock nut (11). Turn the gear through full travel (extreme left turn to extreme right turn or vice versa) to check adjustment.

After this adjustment, connect the gear at all points loosened prior to making the adjustment. Before clamping the upper column bracket refer to "COLUMN ALIGNMENT" instructions. Also check tightness of mounting flange bolts and nuts, steering arm (5) on lever shaft (3) and nut on lever shaft.

TAPER STUD ROLLER BEARING

The foregoing adjustments will suffice in nearly every instance, but in some cases it may be necessary to adjust the taper stud-roller bearing unit in the levershaft (3, Fig. 8-39). In order to make this adjustment the shaft must be removed from the gear.

The roller bearing (1) should be preloaded at all times. Adjust to a noticeable drag.

Used or replacement roller bearing units should be set at the same inch pound torque as the new factory adjusted units (refer to "SPECIAL TORQUES").

NOTE: Operation of a correctly adjusted unit may feel rough to the hands but under steering load it will be smooth. The stud should be rotated several full turns and reversed before checking rolling torque.

Wash all bearing components in clean solvent and lubricate with new, clean steering gear lubricant.

Should any roller (1) be damaged or lost, replace with a complete new set. Do not make a partial replacement.

Use a new locking washer (14). (If old washer must be used, break off bent prong to prevent reuse.)

Tighten nut (13) to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

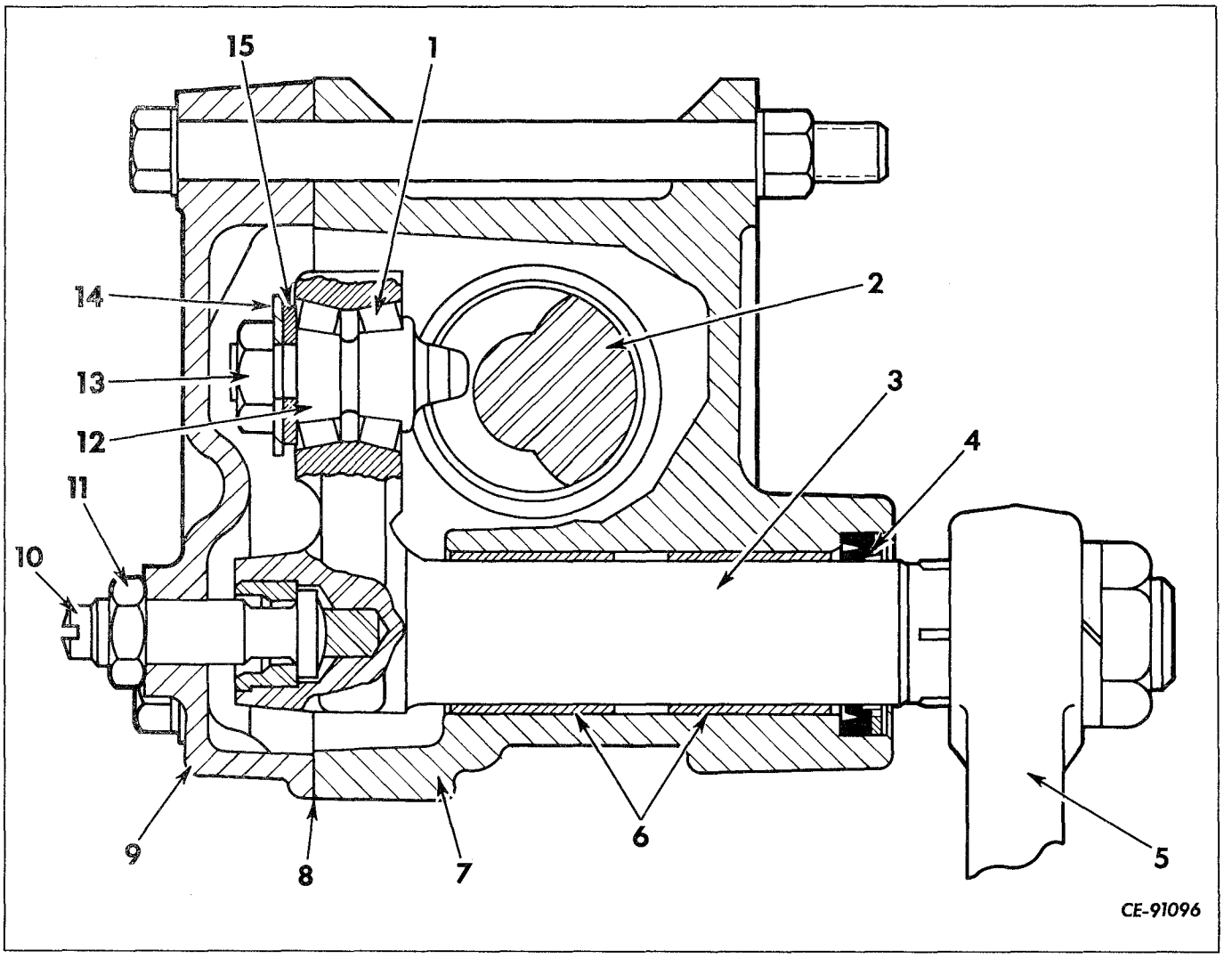

Figure 8-39
Steering Gear - Cross Section.

1. Bearing roller.
2. Cam and wheel tube.
3. Lever shaft.
4. Oil seal.
5. Steering arm.
6. Bushings.
7. Gear housing.
8. Gasket.
9. Housing cover.
10. Adjusting screw.
11. Lock nut.
12. Taper stud.
13. Hex nut.
14. Locking washer.
15. Flat washer.

Hold stud from turning by using a small spanner wrench or equivalent on locking washer (14).

Revolve the stud (12) several complete turns and reverse and test adjustment.

Lock adjustment by bending over locking washer prong that is at right angles to a flat on the nut. DO NOT use the washer twice unless the used prong has been removed.

Lubricate the assembly with new, clean steering gear lubricant (refer to "LUBRICANTS AND CAPACITIES").

(Continued on next page)

STEERING GEAR

SERVICE INFORMATION

ADJUSTMENTS - Continued

CONTROL VALVE

There is no control valve adjustment, however, when clamped to the actuator housing the valve spool must not be pulled off center. See control valve (2, Fig. 8-28) installation under "ASSEMBLY" for correct mounting procedure.

COLUMN ALIGNMENT

a. Install gear in chassis and fasten securely.

Do not spring column to upper bracket. Free alignment of the column is of paramount importance. Column must be mounted to the instrument panel bracket in free position. Do not force column into a position of misalignment. This will cause binding of the wheel tube and prevent centering of the control valve. Cam and actuator assembly must be free to oscillate axially. Column misalignment can also cause wheel tube failure due to bending stresses.

b. Center steering gear. Count number of turns of steering wheel from extreme left turn to extreme right turn, or vice versa. Turn the wheel back half this number of turns to the mid-position.

c. Set front wheels straight ahead, parallel with the frame rails. Measure from each rail to a corresponding point on each tire and make sure this dimension is the same on both sides.

d. Connect drag link to ball on steering arm.

SYSTEM PRESSURE CHECK

Refer to SECTION XI, "HYDRAULIC SYSTEM."

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SECTION IX

LINKAGE

Page

SECTION IX LINKAGE

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Neutral Safety Switch Adjustment 4

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TRANSMISSION CONTROL LINKAGE

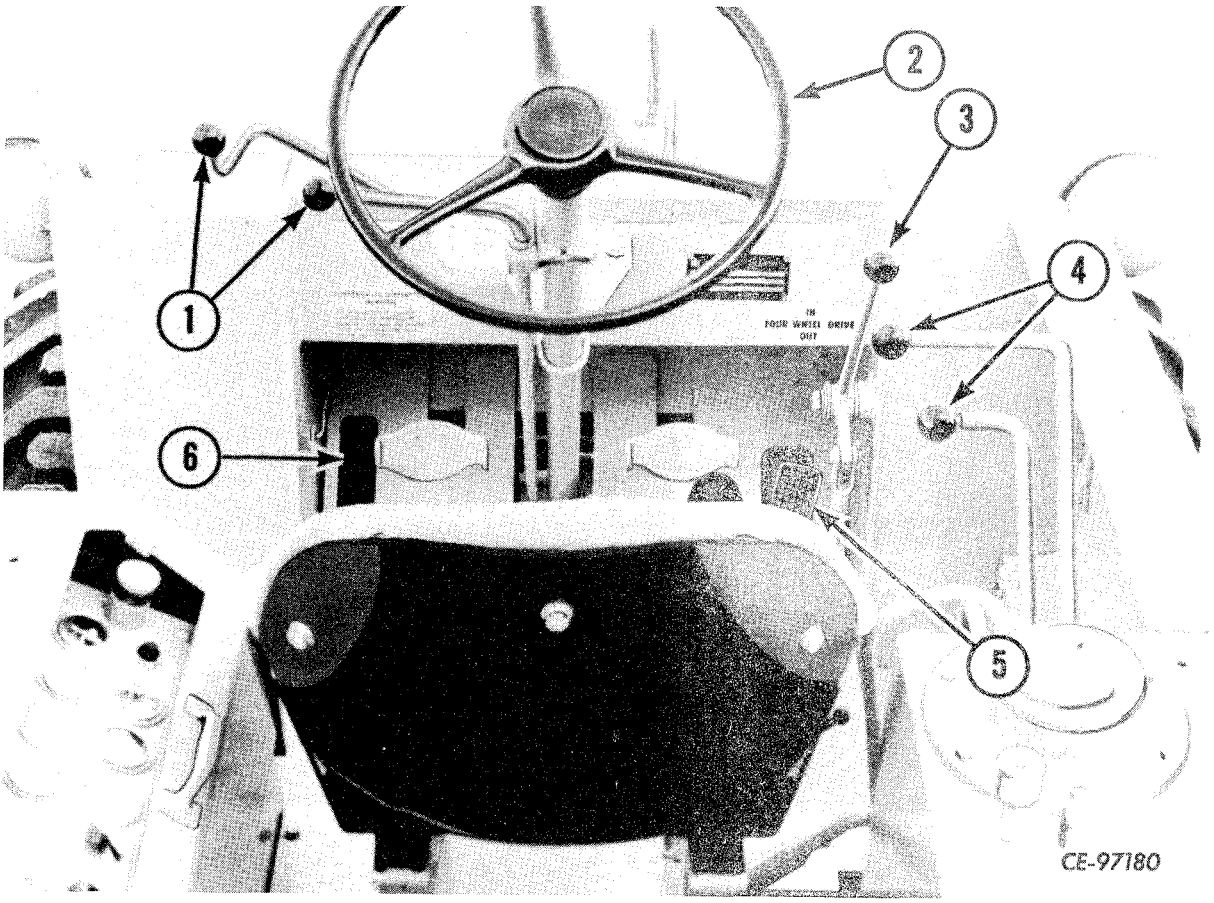

Figure 9-1

1. TRANSMISSION CONTROL LINKAGE.
2. STEERING LINKAGE (REFER TO SECTION 7).
3. REAR AXLE DISCONNECT LINKAGE.
4. LOADER CONTROL VALVE LINKAGE.
5. ACCELERATOR LINKAGE.
6. PARKING BRAKE LINKAGE.

LINKAGE

TRANSMISSION CONTROL LINKAGE

REMOVAL

Removal of the transmission control linkage from the steering column or frame mounting brackets can be accomplished by removing the connecting rods (20, Fig. 9-2) and disconnecting the neutral safety switch.

Disconnect the neutral safety switch clevis (39) by removing cotter pin and clevis pin (40).

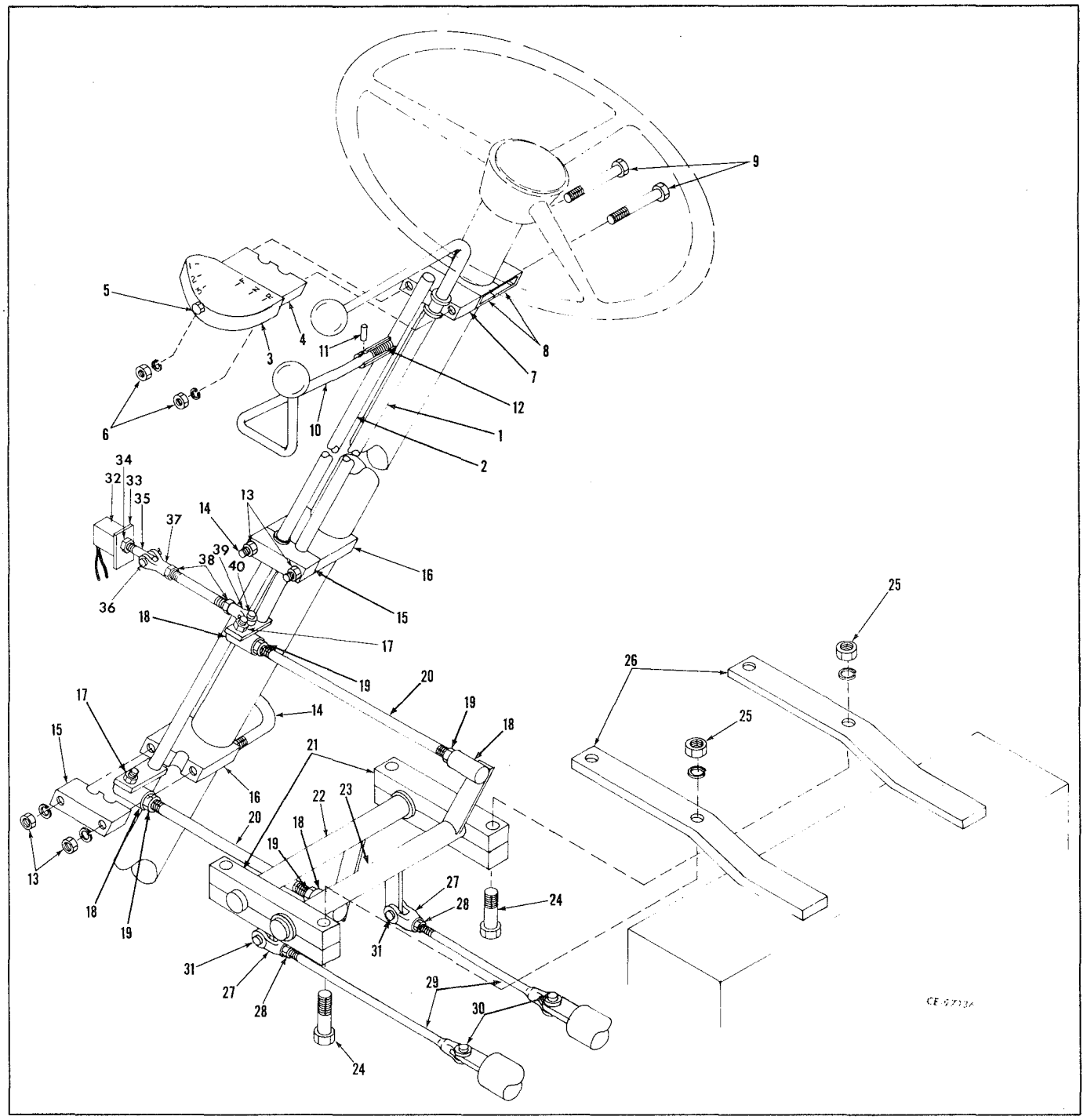

Figure 9-2

TRANSMISSION CONTROL LINKAGE

Legend for Figure 9-2

1. Directional control lever.
2. Range control lever shaft.
3. Quadrant.
4. Bearing block half.
5. Cap screw, lock washer and nut.
6. Lock washer and nut.
7. Bearing block half.
8. Saddle clamps.
9. Cap screws.
10. Range control lever.
11. Roll pin.
12. Spring.
13. Lock washers and nuts.
14. "U" bolt.
15. Bearing block half.
16. Bearing block half.
17. Lock washer and nut.
18. Ball joint.
19. Jam nut.
20. Rod.
21. Bearing block halves.
22. Range pivot bellcrank.
23. Directional pivot bellcrank.
24. Cap screws.
25. Lock washer and nut.
26. Bellcrank mounting brackets.
27. Clevises.
28. Jam nut.
29. Rod and clevises.
30. Cotter pins and clevis pins.
31. Cotter pins and clevis pins.
32. Neutral safety switch.
33. Mounting bracket.
34. Adjusting nut.
35. Switch spool.
36. Clevis pin and cotter pin.
37. Clevis.
38. Jam nut.
39. Clevis.
40. Clevis pin and cotter pin.

Disconnect rods (20) by removing nuts and lock washers (17). Disassemble rods by removing ball joints (18) and jam nuts (19).

Remove control levers (1, 2) from the steering column by removing bearing block halves. Remove nuts and lock washer (13) and bearing block halves (15). Remove "U" bolts (14) and bearing block halves (16). Remove range control lever assembly (2).

Separate range control lever shaft (2) from lever (10) by driving roll pin (11) from control lever (10) and removing spring (12).

Disassemble top bearing block halves by removing nuts and lock washers (6). Remove quadrant (3) and bearing half (4). Remove directional control lever (1), bearing block half (7), saddle clamps (8) and cap screws (9).

Disconnect bellcranks (22, 23) from valve control spools by removing cotter pins and clevis pins (30, 31). Disassemble rods (29) by removing clevises (27) and jam nuts (28).

Remove bearing block halves (21) from frame mounting brackets (26) by removing nuts and lock washers (25). Remove bearing block halves (21) and bellcranks (22, 23).

INSTALLATION AND ADJUSTMENT

Assemble the range control lever (2) by inserting spring (12) into bore on end of control lever. Position lever (10) in bore and drive roll pin (11) into lever.

Assemble middle bearing block halves (15, 16) to steering column by positioning bearing block half (16) against steering column and install the range and directional control levers (1, 2). Install bearing block (15), insert "U" bolt (13) through bearing blocks and install lock washers and nuts (13). With control levers in proper position, tighten nuts (13).

Assemble top bearing block halves to steering column by installing saddle clamps (8) and bearing block halves (4, 7). Insert cap screws (9) through saddle clamps, bearing block halves and quadrant (3) and install lock washers and nuts (6). With control levers in proper position, tighten nuts (6).

Assemble lower bearing block halves to steering column by installing bearing block (16) between steering column and range control

(Continued on next page)

TRANSMISSION CONTROL LINKAGE

INSTALLATION AND ADJUSTMENT - Continued

lever (2). Insert "U" bolt through bearing block half, install bearing block half (15), lock washer and nut (13). With bearing block halves in the proper position, tighten nuts (13).

Assemble bearing block halves (21) and bellcranks (21, 23). Secure bearing block halves to mounting brackets (26) by installing and tightening cap screws (24), lock washers and nuts (25).

Position jam nuts (28) and clevises (27) on rods (29). Secure ends of rods to valve spools by installing clevis pins and cotter pins (30). Position valve spools in the middle position. (NEUTRAL and 2nd). Adjust jam nuts (28) and clevises (27) on rods (29) to fit the bellcrank levers (22, 23) in a vertical position. Install clevis pins and cotter pins (31). Tighten jam nuts (28).

Assemble rods (20) by installing jam nuts (19) and ball joints (18). Install one end of rods (20) to bellcranks (22, 23) and install and tighten lock washer and nut (17). Position control levers (1, 2) in NEUTRAL and 2nd position, and adjust jam nuts (19) and ball joints (18) to fit control levers. Install and tighten lock washers and nuts (17).

Install neutral safety switch clevis (39) to directional control lever (1) and install clevis pin and cotter pin (40).

NEUTRAL SAFETY SWITCH ADJUSTMENT

The neutral safety switch should be adjusted whenever the transmission control linkage has been readjusted, repaired or when it malfunctions.

The neutral safety switch is designed to safe guard all concerned during the starting of the tractor. If the switch is not working properly, repair and adjust switch linkage as follows:

Disconnect the switch linkage by removing cotter pin and clevis pin (40, Fig. 9-2).

Adjust the transmission linkage as outlined in Transmission Control Linkage Installation and Adjustment.

Position the directional control lever (1) in "NEUTRAL." Turn the ignition switch on and have an assistant press the starting button. Move the switch spool (35) in and out of the switch (32) until the engine starts to crank. Stop cranking.

Adjust clevis (39) to fit the directional control lever arm in the neutral position by rotating the clevis and jam nut in direction needed to align clevis with arm. Install clevis and cotter pin (40). Recheck the adjustment.

ACCELERATOR LINKAGE

Legend for Figure 9-3

1. Cap screw.
2. Lock washer and nut.
3. Ball joint, lock washer and nut.
4. Jam nut.
5. Ball joint.
6. Jam nut.
7. Rod.
8. Support bracket.
9. Cotter pin and clevis pin.
10. Clevis.
11. Jam nut.
12. Pedal pin.
13. Cap screw.
14. Accelerator pedal.
15. Cap screws and lock washers.
16. Support bearing.
17. Cross shaft.
18. Cap screws and lock washers.
19. Support bearing.
20. Spring.
21. Lock washer and nut.
22. Ball joint.
23. Jam nut.
24. Rod.
25. Jam nut.
26. Coupling.
27. Jam nut.
28. Jam nut.
29. Rod guide.
30. Rod and spring.
31. Cotter pin and clevis pin.
32. Cotter pin and clevis pin.
33. Clevis.
34. Jam nut.
35. Clevis.
36. Jam nut.
37. Rod.

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ACCELERATOR LINKAGE

INTERNATIONAL HARVESTER GAS

DISASSEMBLY

Disassemble linkage in numerical order (Fig. 9-3).

CLEAN AND INSPECT

Clean and inspect all parts. Repair or replace worn components as required.

(Continued on next page)

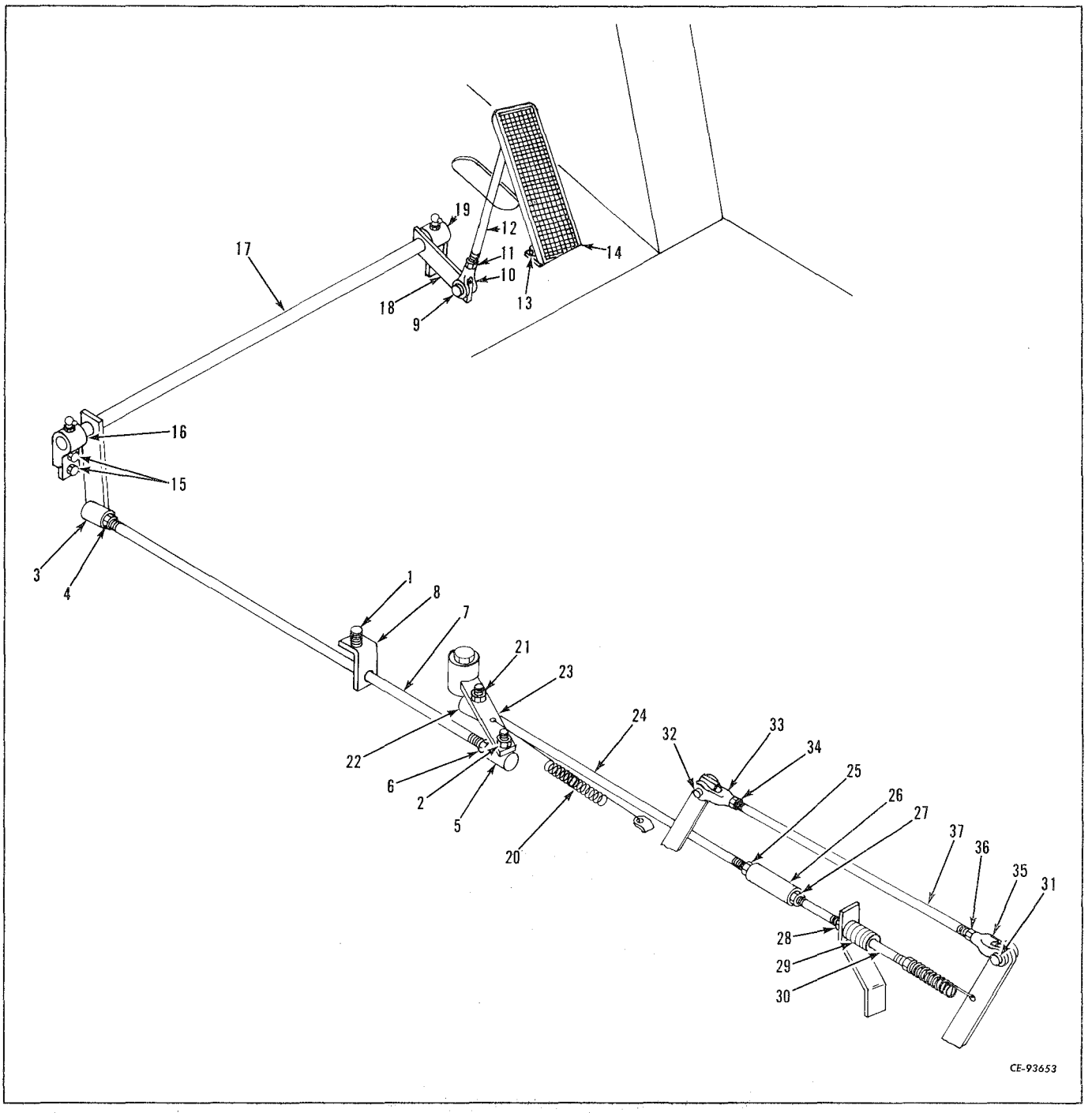

Figure 9-3
Accelerator Linkage - I.H. Gasoline.

LINKAGE

ACCELERATOR LINKAGE

INTERNATIONAL HARVESTER GAS - Continued

ASSEMBLY

Assemble linkage in reverse order of disassembly.

ADJUSTMENT

For adjustment of the pedal pin (12) and rod (7) proceed as follows:

With linkage assembled depress accelerator pedal to its full length of travel. The carburetor lever should also be at maximum travel.

Disconnect ball joints and clevis from the various levers and rotate ball joints or clevis in direction required to obtain proper linkage travel.

Connect ball joints and clevis to levers and install and tighten lock washers and nuts or clevis pin and cotter pin. Tighten jam nuts and bend over cotter pin.

MECHANICAL GOVERNOR ADJUSTMENT

With the engine stopped, adjust the carburetor connecting rod as follows:

Disconnect clevis (4, Fig. 9-4) from the lever (6). Place the levers (1 and 6) in the "wide open" throttle position.

Adjust length of rod (2) so the pin bore in clevis (4) is in line with pin bore in lever (6). Lengthen the clevis one additional turn. Connect clevis to lever (6) with pin (5).

Start and operate the engine until normal operating temperature is reached.

Pull rod (10) back against the stop. Loosen the adjuster lock nut (9).

Rotate the adjuster (3) in or out to produce the required governor fast idle speed. Refer to SERVICE INFORMATION for recommended engine settings.

NOTE: Rotate the adjuster (3) "out" to increase engine speed and "in" to decrease engine speed.

Check the governor action by suddenly moving the rod (10) back against the stop. If the governor surges more than twice, turn in on screw (8) just enough to stop excessive surging. Lock the screw with the jam nut.

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ACCELERATOR LINKAGE

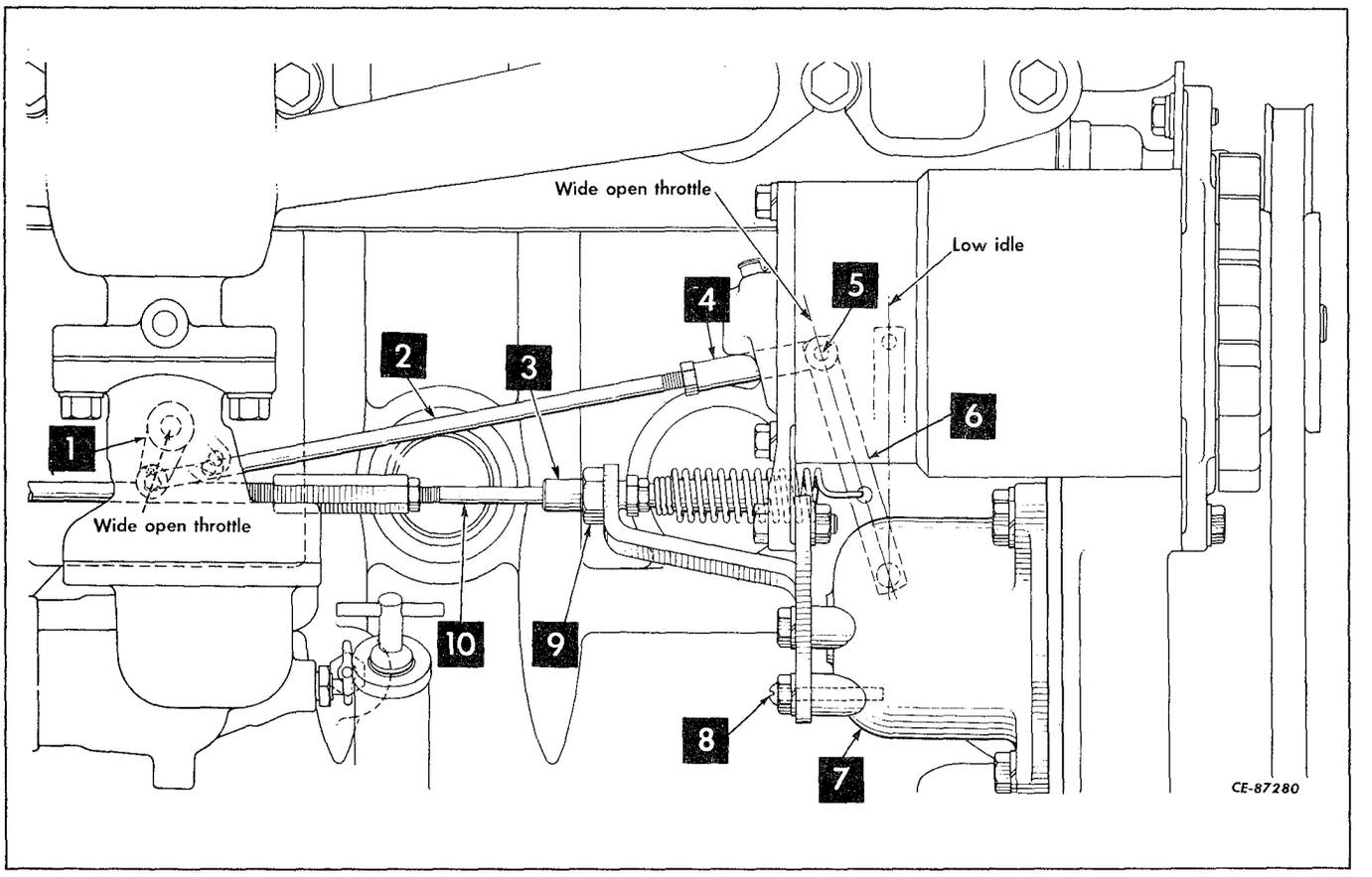

Figure 9-4
Governor Adjustment.

1. Lever, carburetor throttle.
2. Rod, governor to carburetor.
3. Adjuster, governor spring.
4. Clevis.
5. Pin, clevis.
6. Lever, governor control.
7. Governor.
8. Spring, bumper.
9. Nut, governor spring adjuster lock.
10. Rod, governor spring retainer.

LINKAGE

ACCELERATOR LINKAGE

INTERNATIONAL HARVESTER DIESEL

DISASSEMBLY

Disassemble linkage in numerical order.

CLEAN AND INSPECT

Clean and inspect all parts. Repair or replace all worn components as required.

ASSEMBLY

Assemble linkage in reverse order of disassembly.

ADJUSTMENT

With linkage completely assembled, depress accelerator pedal to its full length of travel. The fuel injection pump lever should also be at maximum travel.

To accomplish the required linkage travel, rods (13) and (8) can be rotated in either direction depending on the adjustment needed.

Disconnect ball joints and clevises from the various levers and rotate ball joints or clevis in direction required to obtain proper linkage travel.

Connect ball joints or clevis to the levers and install and tighten nuts, lock washers and/or clevis pins and cotter pins. Tighten jam nuts and bend over cotter pin.

Legend for Figure 9-5

1. Cap screw.
2. Spring.
3. Lock washer and nut.
4. Lock washer, nut and ball joint.
5. Jam nut.
6. Ball joint.
7. Jam nut.
8. Rod.
9. Support bracket.
10. Cotter pin and clevis pin.
11. Clevis.
12. Jam nut.
13. Pedal pin.
14. Cap screw, lock washer and nut.
15. Accelerator pedal.
16. Cap screws and lock washers.
17. Support bearing.
18. Cross shaft.
19. Cap screws and lock washers.
20. Support bearing.

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ACCELERATOR LINKAGE

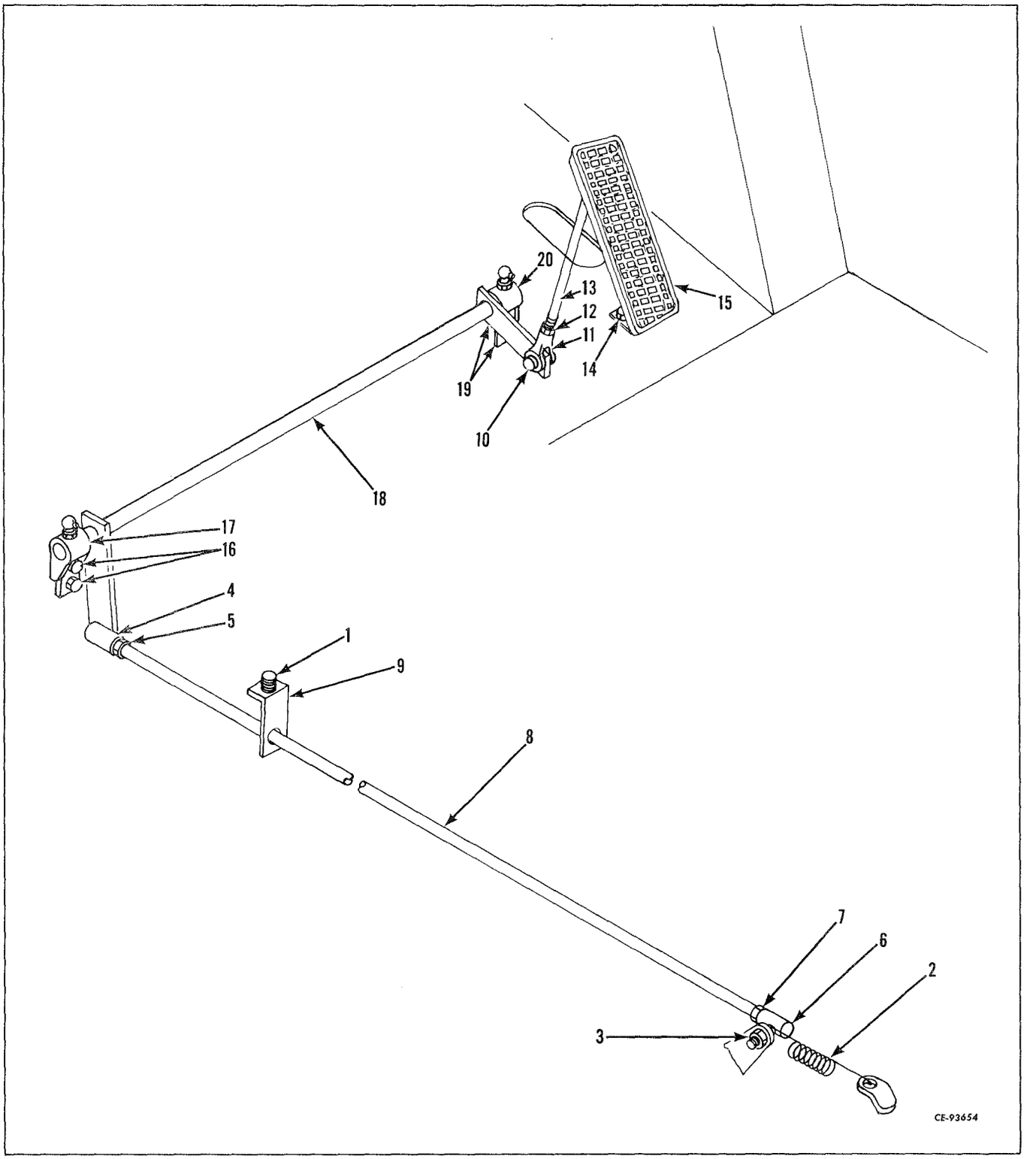

Figure 9-5
Accelerator Linkage - I.H. Diesel.

LINKAGE

ACCELERATOR LINKAGE

DETROIT DIESEL

DISASSEMBLY

Disassemble in numerical order

CLEAN AND INSPECT

Clean and inspect all parts. Repair or replace all worn components as required.

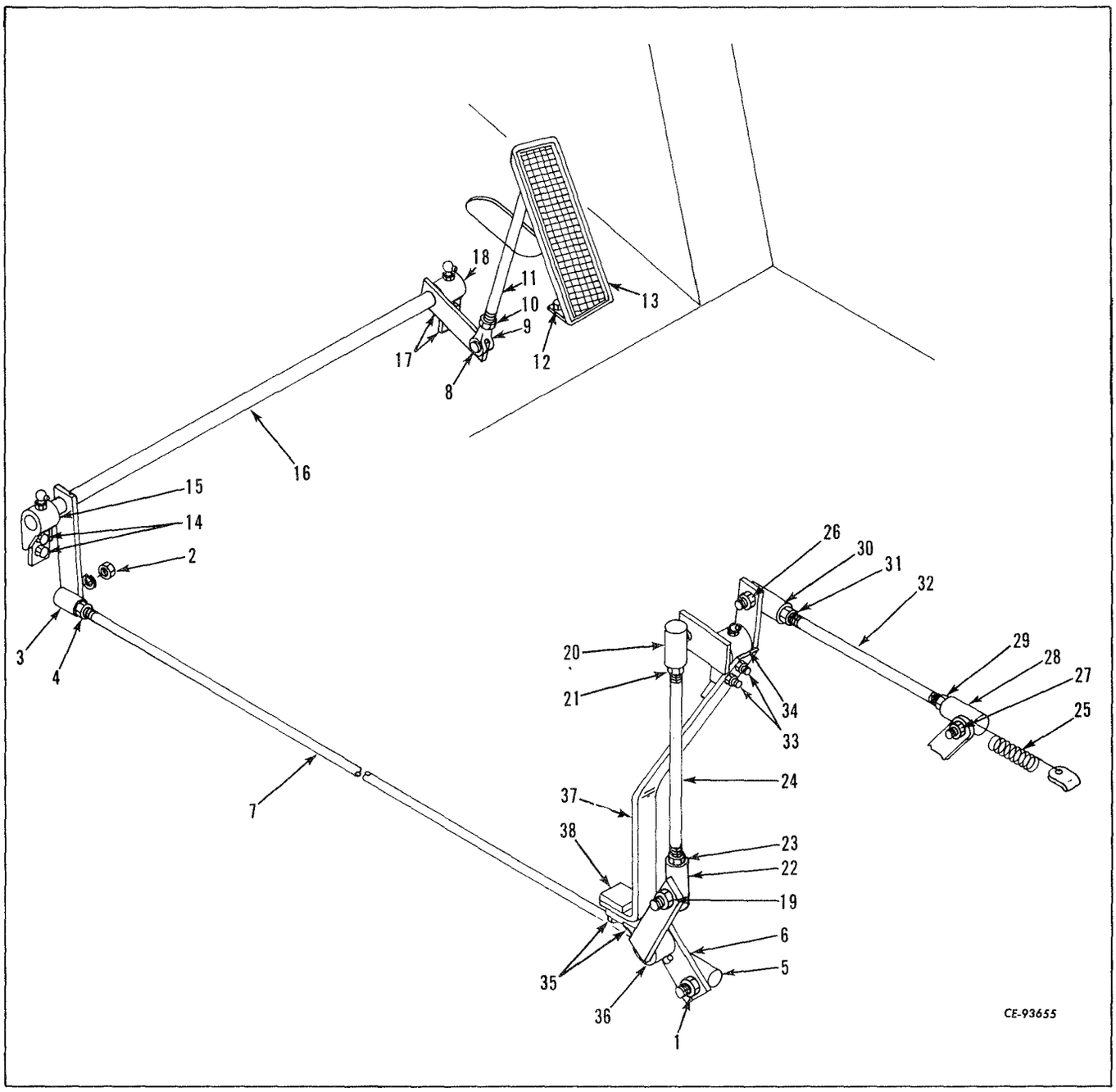

Figure 9-6
Accelerator Linkage - Detroit Diesel.

ACCELERATOR LINKAGE

Legend for Figure 9-6

1. Lock washer and nut.
2. Lock washer and nut.
3. Ball joint.
4. Jam nut.
5. Ball joint.
6. Jam nut.
7. Rod.
8. Cotter pin and clevis pin.
9. Clevis.
10. Jam nut.
11. Pedal pin.
12. Cap screws, lock washers and nuts.
13. Accelerator pedal.
14. Cap screw and lock washer.
15. Support bearing.
16. Cross shaft.
17. Cap screws, lock washers and nuts.
18. Support bearing.
19. Nut and lock washer.
20. Ball joint, lock washer and nut.
21. Jam nut.
22. Ball joint.
23. Jam nut.
24. Rod.
25. Spring.
26. Nut and lock washer.
27. Nut and lock washer.
28. Ball joint.
29. Jam nut.
30. Ball joint.
31. Jam nut.
32. Rod.
33. Cap screws, lock washers and nuts.
34. Bell crank.
35. Cap screws, lock washers and nuts.
36. Bell crank.
37. Support bracket.
38. Spacer.

ASSEMBLY

Assemble in reverse order of disassembly.

ADJUSTMENT

With linkage completely assembled, depress accelerator pedal to its full length of travel. The fuel injection lever should also be at maximum travel.

To accomplish the required linkage travel, rods (11), (7), (24) and (32) can be rotated in either direction depending on the adjustment required.

Remove nuts and lock washers disconnecting ball joints from various levers and rotate ball joints and jam nuts in direction required to obtain proper linkage travel.

Reinstall ball joints to levers. Install and tighten ball joint nuts and lock washers. Tighten jam nuts.

PARKING BRAKE LINKAGE

DISASSEMBLY

Disassemble in numerical order.

Remove item 7 only if necessary.

CLEAN AND INSPECT

Clean and inspect all parts. Repair or replace all worn components as required.

ASSEMBLY

Assemble in reverse order.

ADJUSTMENT

A minor parking brake adjustment may be made by rotating the adjusting cap (A, Fig. 9-7), mounted on top of the parking brake lever. To increase tension, turn cap clockwise. If adjustment is at its maximum, major adjustment is necessary.

A major adjustment is made by removing the control cable from the lever assembly. Remove the cotter pin, flat washer and clevis pin (1). Turn adjusting cap (A) counterclockwise until cap adjustment is at a minimum. Back off jam nut (5) and rotate rod and clevis (3) in required direction until clevis pin enters bores in clevis and link freely. Install clevis pin, flat washer and cotter pin (1). Check adjustment.

If the adjustment within the brake linkage has been taken up several times, it is advisable to check for brake lining wear and roughness of the parking brake drum.

PARKING BRAKE LINKAGE

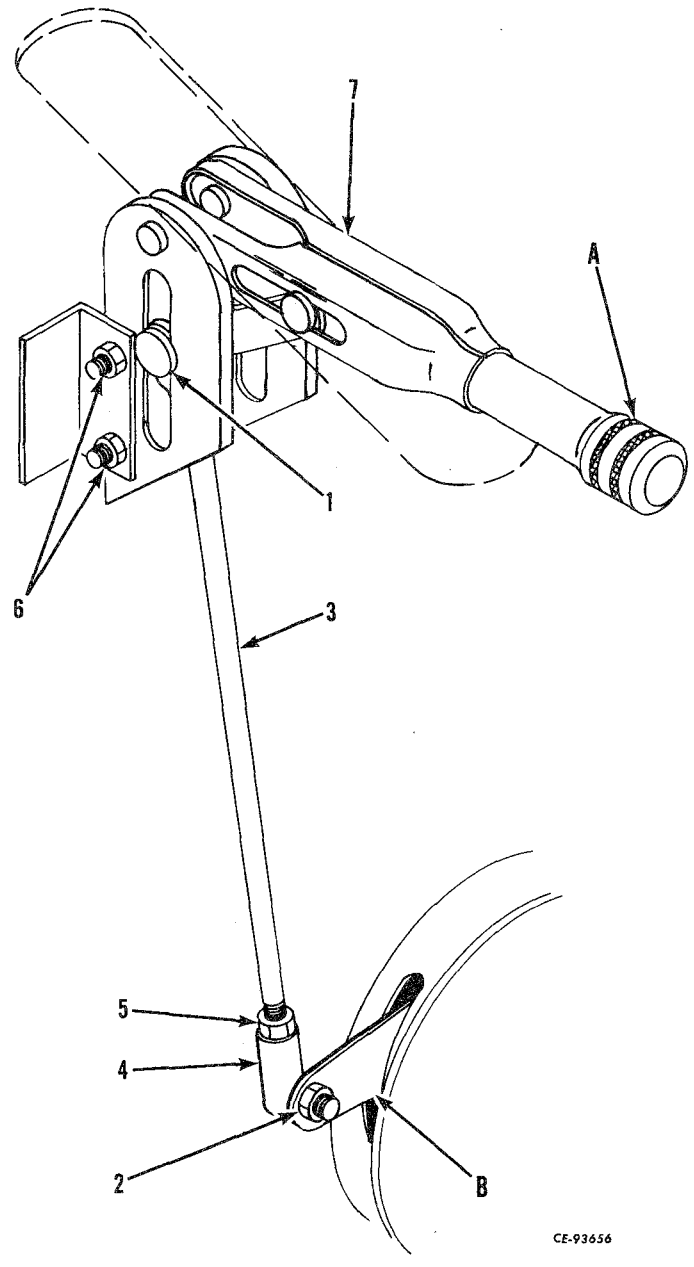

Figure 9-7
Parking Brake Linkage.

1. Clevis pin and cotter pin.
2. Nut and lock washer.
3. Rod and clevis.
4. Ball joint.
5. Jam nut.
6. Cap screws, lock washers and nuts.
7. Parking brake assembly.

A = ADJUSTING KNOB CAP
B = PARKING BRAKE DRUM LEVER

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LOADER CONTROL VALVE LINKAGE

DISASSEMBLY

Disassemble in numerical order.

Remove item 10 only if worn or damaged.

CLEAN AND INSPECT

Clean and inspect all parts thoroughly. Repair or replace all worn components as required.

Replace part 9.

ASSEMBLY

Assemble in reverse order.

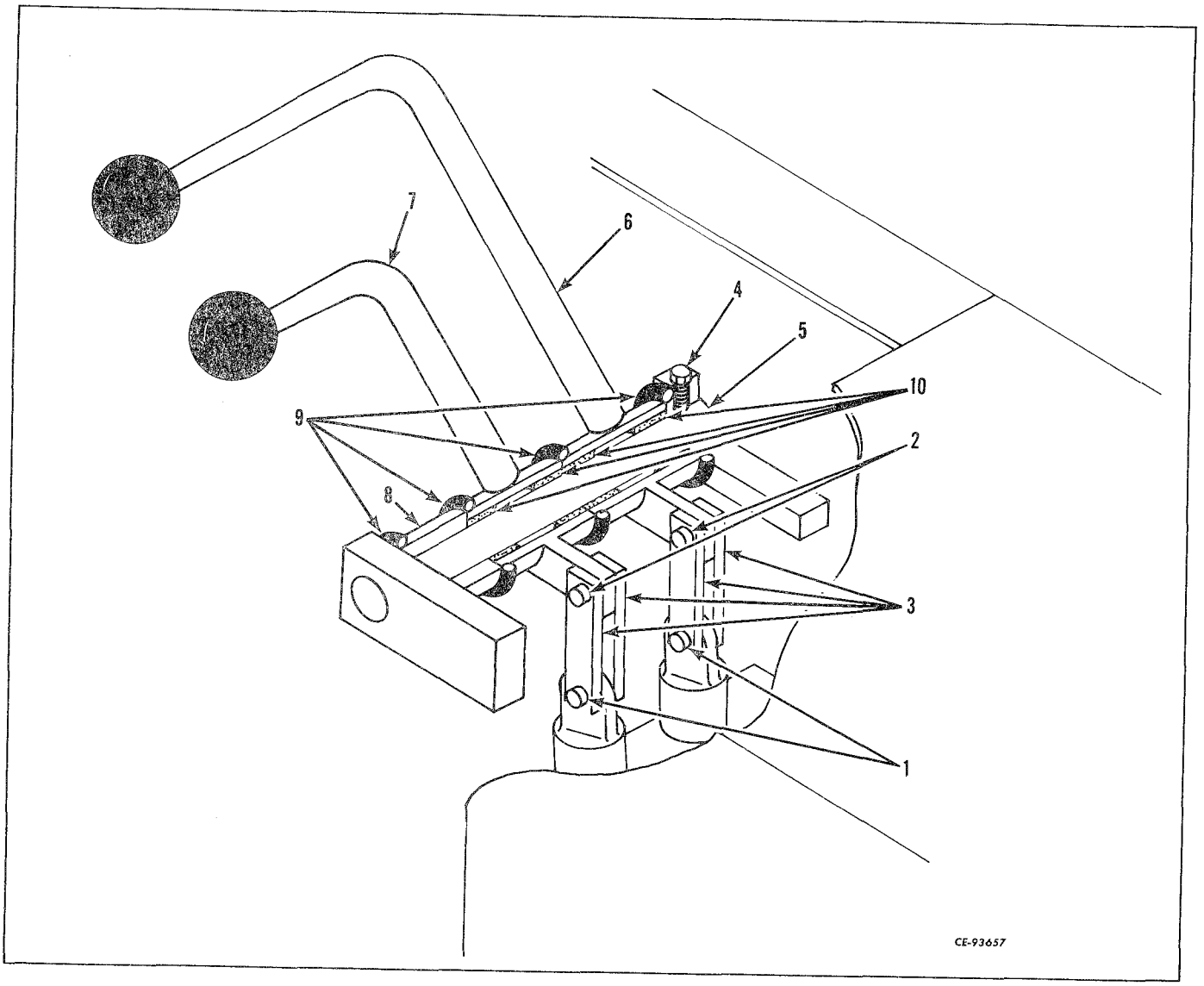

Figure 9-8
Loader Control Valve Linkage.

1. Cotter pins and clevis pins.
2. Cotter pins and clevis pins.
3. Links.
4. Cap screw, lock washer and nut.
5. Pivot pin.
6. Boom control lever.
7. Bucket control lever.
8. Spacer.
9. "O" rings.
10. Bushings.

LINKAGE

REAR AXLE DISCONNECT LINKAGE

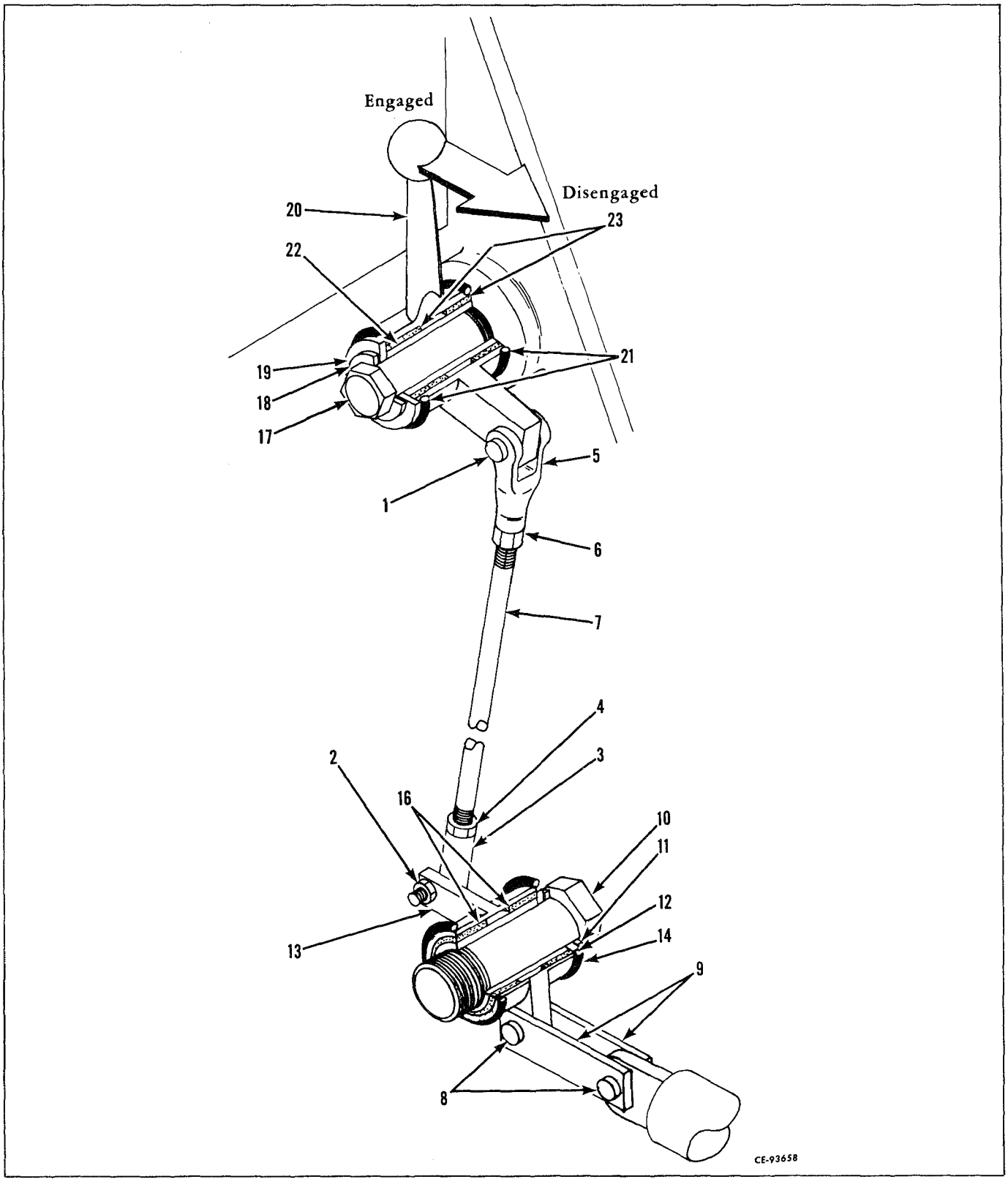

Figure 9-9
Rear Axle Disconnect Linkage.

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REAR AXLE DISCONNECT LINKAGE

Legend for Figure 9-9

1. Clevis pin and cotter pin.
2. Nut and lock washer.
3. Ball joint.
4. Jam nut.
5. Clevis.
6. Jam nut.
7. Rod.
8. Clevis pins and cotter pins.
9. Links.
10. Cap screw.
11. Lock washer.
12. Flat washer.
13. Bell crank.
14. "O" rings.
15. Bell crank pivot tube.
16. Bushings.
17. Cap screw.
18. Lock washer.
19. Flat washer.
20. Lever.
21. "O" ring.
22. Lever pivot tube.
23. Bushings.

DISASSEMBLY

Disassemble linkage in numerical order.

Remove items 16 and 23 only if worn or damaged.

CLEAN AND INSPECT

Clean and inspect all parts thoroughly. Repair or replace all worn components as required.

Replace parts 14, 21.

ASSEMBLY

Assemble in reverse order.

ADJUSTMENT

Position rear axle disconnect spool in the four wheel drive position, (spool all the way forward). Position rear axle disconnect lever in the proper position, close to the tractor cowling.

Adjust rod (7) to fit between axle disconnect spool and control lever. Install clevis pin and cotter pin.

NOTE: This adjustment can be made without disconnecting rod (7) from bellcrank (13). Tighten jam nut (6) and bend over cotter pins.

LINKAGE

SERVICE BRAKE LINKAGE

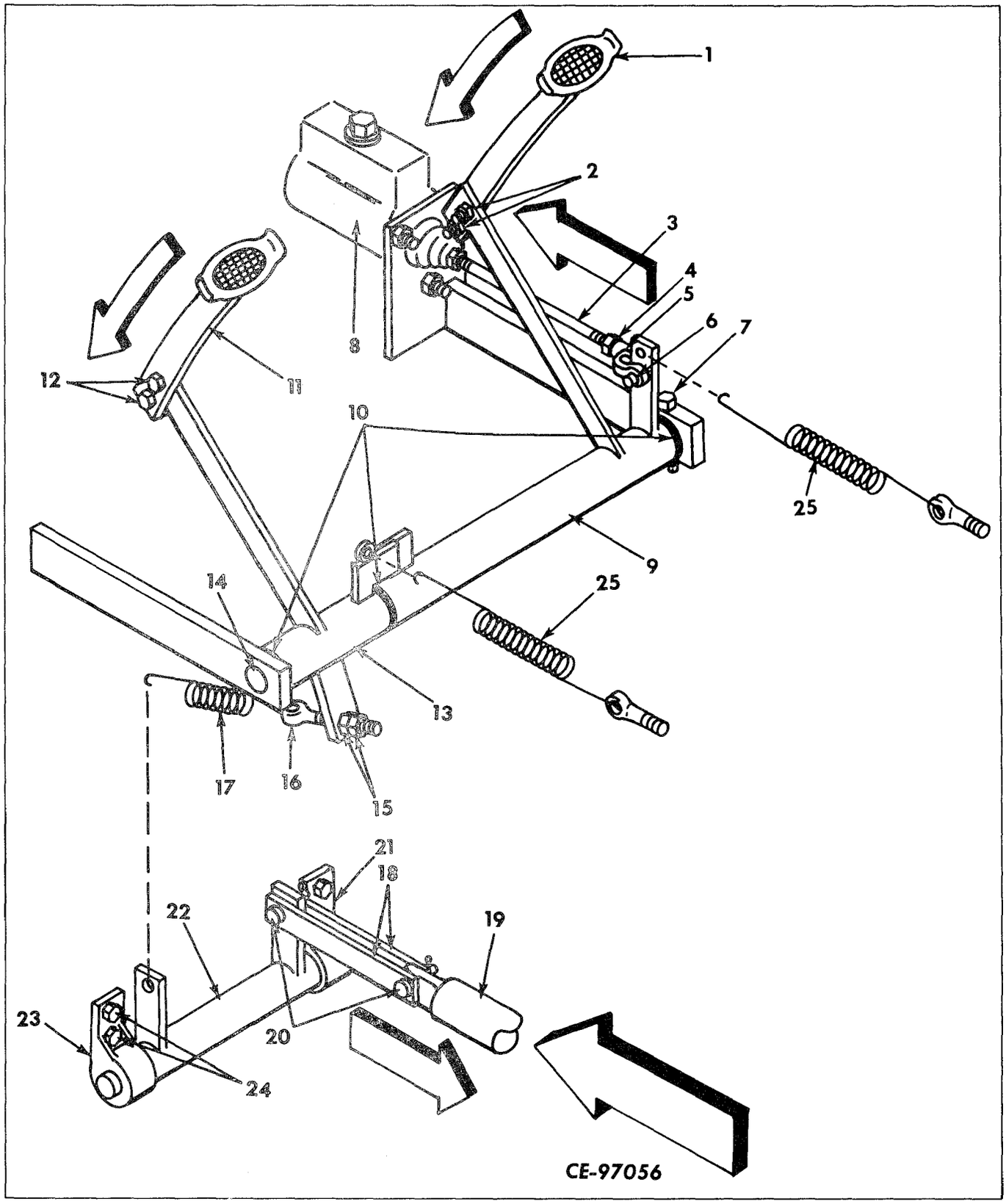

Figure 9-10

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SERVICE BRAKE LINKAGE

Legend for Figure 9-10

1. Brake pedal.
2. Cap screws, lock washers and nuts.
3. Rod end.
4. Jam nut.
5. Offset clevis.
6. Clevis pin and cotter pin.
7. Cap screw, lock washer and nut.
8. Master cylinder.
9. Brake pedal bellcrank.
10. "O" rings.
11. Brake pedal.
12. Cap screw, lock washer and nut.
13. Transmission disconnect and brake pedal bellcrank.
14. Pivot shaft.
15. Jam nuts.
16. Eyebolt.
17. Spring.
18. Links.
19. Transmission disconnect spool.
20. Clevis pins and cotter pins.
21. Support bearing.
22. Bellcrank.
23. Support bearing.
24. Cap screws, lock washers and nuts.
25. Pedal return springs.

DISASSEMBLY

Remove the brake pedal return springs (25, Fig. 9-10) and transmission disconnect spring (17). Disconnect rod end (3) from pedal bellcrank arm, (9) by removing cotter pin and clevis pin (6). Remove cap screw, lock washer and nut (7). Using a suitable tool, drive pivot pin (14) out through the mounting brackets. Disconnect pedal bellcranks (9, 13). Discard "O" rings (10). Check bushings in bellcrank hubs for wear or damage. Replace if necessary. Remove cap screws, lock washers and nuts (2, 12) disconnecting brake pedals (1, 11) from bellcranks (9, 13).

Remove cotter pins and clevis pins (20) disconnecting links (18) between the transmission disconnect spool (19) and bellcrank (22). Remove cap screws, lock washers and nuts (24) and support bearing (23). Remove bellcrank (22).

ASSEMBLY

Position bellcrank (22, Fig. 9-10) into the mounted support bearing (21) and install support bearing (23). Install and tighten cap screws, lock washers and nuts (24). Position links (18) between bellcrank (22) and transmission disconnect spool (19) and install clevis pins and cotter pins (20).

Install brake pedals (1, 11) to bellcranks (9, 13) by installing and tightening cap screws, lock washers and nuts (2, 12).

Position brake pedal bellcranks (9, 13), with "O" rings (10) in position, between the mounting brackets and install pivot pin (14). Install pivot pin (14) with cap screw bore aligned with bore in mounting bracket. Install and tighten cap screw, lock washer and nut (7).

Position rod end (3) of the master cylinder (8) at bellcrank arm and install clevis pin and cotter pin (6).

Install pedal return springs (25). Install transmission disconnect spring (17) and tighten jam nuts (15). Tighten jam nuts (15) so that spring (17) becomes tight immediately after the pedal is applied. The spring should not be over tightened to actuate the disconnect spool when the pedal is in a "NEUTRAL" or non applied position.

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 should be done from beneath the floorboard by shortening or lengthening rod end (3, Fig. 9-10) between master cylinder (8) and brake pedal bellcrank (9).

Loosen jam nut (4) and rotate rod end (3) in either direction, depending upon the required adjustment.

When properly adjusted a 1/4 - 1/2 inch of "free play" is present at the beginning of pedal travel. Lack of "free play" will block the bypass port in the master cylinder and after several brake applications, the brake shoes will drag against the brake drums. Excess "free play" will decrease the usable stroke of the master cylinder piston.

Once the proper adjustment is accomplished, tighten jam nut (4) against clevis (5). Check to be sure that the pedal return springs (25) are properly installed and are capable of holding the pedal assemblies in the full release position.

LINKAGE

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

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SECTION X

HYDRAULIC LINES AND FITTINGS

(This Material Included in Section XI)

SECTION XI
HYDRAULIC SYSTEM

Page

SECTION XI HYDRAULIC SYSTEM

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GENERAL INFORMATION

DESCRIPTION

The hydraulic system; a closed fluid circuit, is the medium that transforms the power of the engine into the driving force behind the tractors loader mechanism. A portion of this fluid power is used to operate the power steering system.

Engine driven pumps pressurize the system with fluid drawn from the reservoir. Circuit selection is provided by a loader control valve. In addition, this valve contains a pressure relief valve to reduce excessive circuit pressures and protect the system.

A flow divider valve is in reality a priority valve that diverts the pressurized flow of fluid from the pump to the steering and loader control valves with the steering having priority over the loader valve. When the requirements of the steering system are met the flow is diverted to the loader system.

PREVENTIVE MAINTENANCE

Cleanliness, the correct type of oil and sufficient oil supply for the system is the most important maintenance requirement.

a. The correct viscosity oil should be used according to ambient temperature. Oil added to the system should be of the same type and viscosity.

b. Proper oil storage will eliminate the possibility of contamination. Improper storage and handling of oil will encourage failures. It is easier to keep foreign material out of the oil before it is used than it is to remove it once it is in the hydraulic system.

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

d. Reservoir oil and filter should be changed at regular intervals, to be determined by type of operation, ambient temperature and work conditions.

e. System pressures should be checked at regular intervals at least once per month and at the first suspicion of a system problem.

A LOOK IN THE RESERVOIR CAN PROVE INTERESTING!

ESPECIALLY IF YOU HAVEN'T CHANGED FILTERS LATELY.

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

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

b. Reservoir dipstick should be kept tightened at all times. No other means of covering opening or different type dipstick should be used.

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

GENERAL INFORMATION

REQUIRED TOOLS

Standard Mechanics Hand Tool Set

Hose - 3500 PSI minimum working pressure rating.

Gauge - In excess of 3000 PSI minimum working pressure rating.

Connectors - Sufficient to attach gauge and hose to following pressure ports:

7/8-14 straight thread-steering pressure port on flow divider
7/8-14 straight thread-bucket cylinder pressure port adapter

Torque wrench - 0-500 ft. lbs. rating

DISASSEMBLY, INSPECTION AND ASSEMBLY

HYDRAULIC RESERVOIR

GENERAL

All components of the hydraulic reservoir may be serviced or removed without removing the reservoir from the tractor.

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

a. Start the engine and operate the hydraulic control levers several times until the system oil becomes warm.

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

c. Place a clean container with approximately 15 gallon capacity under the reservoir drain. Use a clean container so samplings of the used oil can be made. Remove the plug and drain the oil.

REMOVAL

Remove the right hand side panels. Remove the lines from the bottom of the reservoir. Cap the lines to prevent the entry of dirt. Identify each line to insure proper installation. Remove the cap screws and lock washers that attach the valve to the reservoir. Remove the valve control levers. Remove the cap screws and lock washers that attach the reservoir to the tractor. The reservoir can then be lifted free of the tractor.

DISASSEMBLY

Disassemble the reservoir in numerical order (Fig. 11-1).

Clean and inspect parts. Refer to "INSPECTION" in this section.

Replace Parts: 4, 15, 22, 26, 28.

INSPECTION

Check the parts for wear and deterioration. Replace if necessary.

Clean the reservoir as follows:

Clean the reservoir exterior, screen and sediment traps with a spray of clean solvent. Rinse the inside of the reservoir with a warm flushing solution made of four parts clean diesel fuel oil to one part clean lubricating oil. Dry the reservoir interior with compressed air and cover the large opening.

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

(Continued on page 4)

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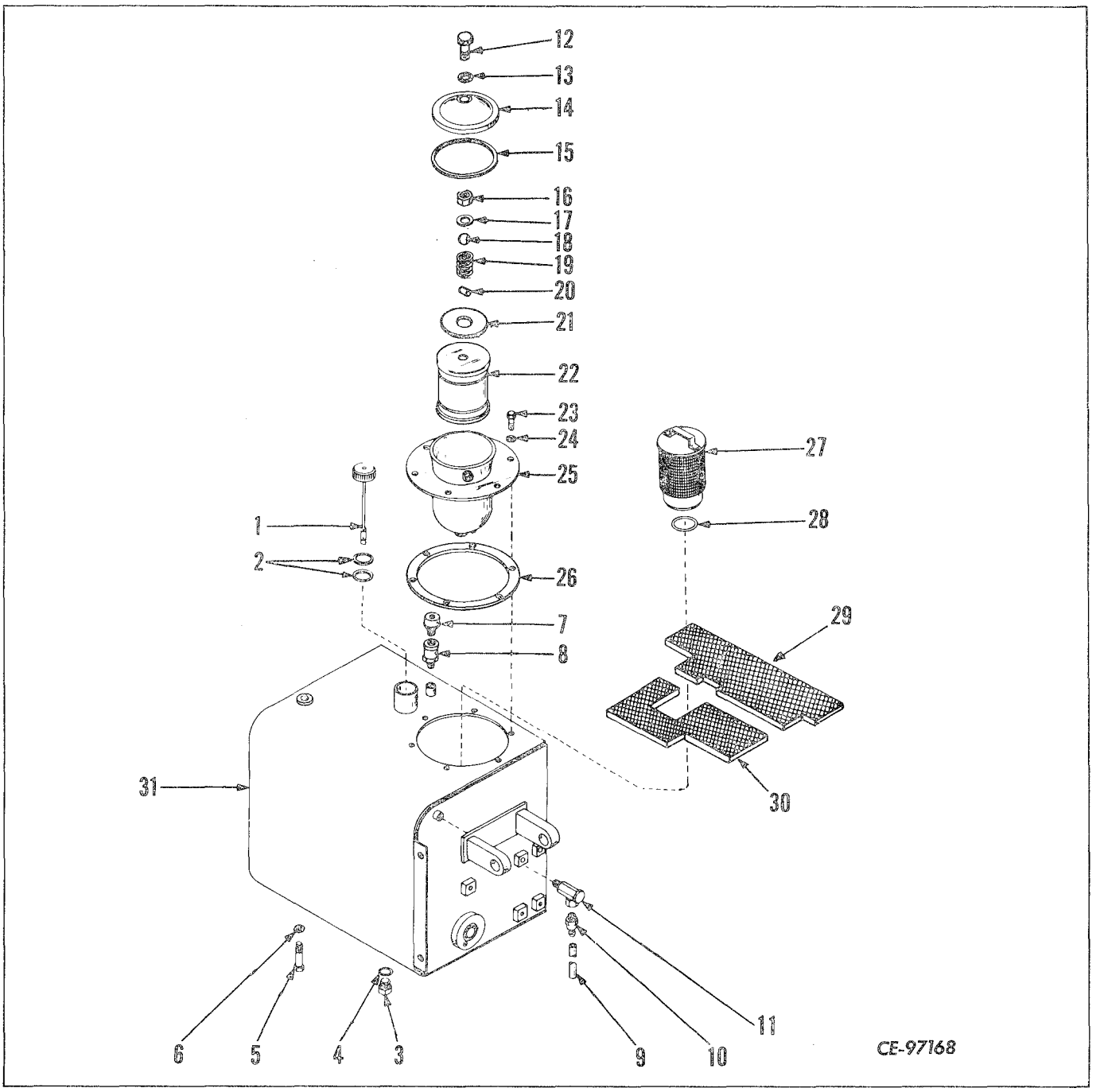

Figure 11-1
Hydraulic Reservoir.

1. Dipstick.
2. Dipstick seal (2).
3. Drain plug.
4. "O" ring.
5. Cap screw (4).
6. Lock washer (4).
7. Breather.
8. Vacuum breaker.
9. Hose.
10. Coupling.
11. Check valve.
12. Cap screw.
13. Washer.
14. Cover.
15. Gasket.
16. Nut.
17. Washer.
18. Ball.
19. Spring.
20. Pin.
21. Plate.
22. Element.
23. Cap screw (6).
24. Washer (6).
25. Tank.
26. Gasket.
27. Screen.
28. "O" ring.
29. Sediment trap (LH).
30. Sediment trap (RH).
31. Reservoir.

DISASSEMBLY, INSPECTION AND ASSEMBLY

HYDRAULIC RESERVOIR - Continued

ASSEMBLY

Assemble reservoir in reverse order. Install the reservoir on the tractor and attach with the cap screws and lock washers. Attach the valve to the reservoir with the cap screws and lock washers. Connect the lines to the reservoir. Install the valve control levers. Install the RH side panels.

Add oil to the reservoir through the dipstick opening in the reservoir. Refer to "SERVICE INFORMATION" for the type oil to use according to expected work and ambient temperature conditions.

Filter the oil, added to the reservoir, through a fine-mesh screen. Continue filling the reservoir until the "H" mark is reached on the dipstick. Start and run the engine at a reduced speed. Operate the hydraulic controls to circulate oil through the circuits. Purge air from the system. Check the reservoir oil level frequently and add fresh oil as needed to keep the level in the reservoir at the "H" mark on the dipstick.

Stop the engine, lower the boom and place the bucket flat on ground. Recheck oil level.

MAIN PUMP

REMOVAL

Remove the pump as follows:

a. Remove the rear floorboard.

b. Remove, cap and tag the connecting lines.

c. Remove the cap screws and lock washers that secure the pump. Remove the pump.

DISASSEMBLY AND ASSEMBLY

Disassemble the pump in numerical order (Fig. 11-2).

Clean and inspect parts. Refer to "MAIN PUMP, INSPECTION".

Replace Parts: 7, 10, 11, 12, 13, 14, 15, 17.

Assemble in reverse order.

Cap screw torque (refer to "SPECIAL TORQUES").

Items 1 and 3 _____ ft. lbs.

INSPECTION

Clean and dry all parts.

Remove nicks and burrs from all parts with emery cloth.

Inspect drive gear shaft for damaged splines.

Inspect both the drive gear and idler gear shafts at bearing points and seal areas for rough surfaces and excessive wear. Inspect the gear faces for scoring and excessive wear. One gear assembly may be replaced separately, but neither the shafts or gears are furnished separately and are available as assemblies only.

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

DISASSEMBLY, INSPECTION AND ASSEMBLY

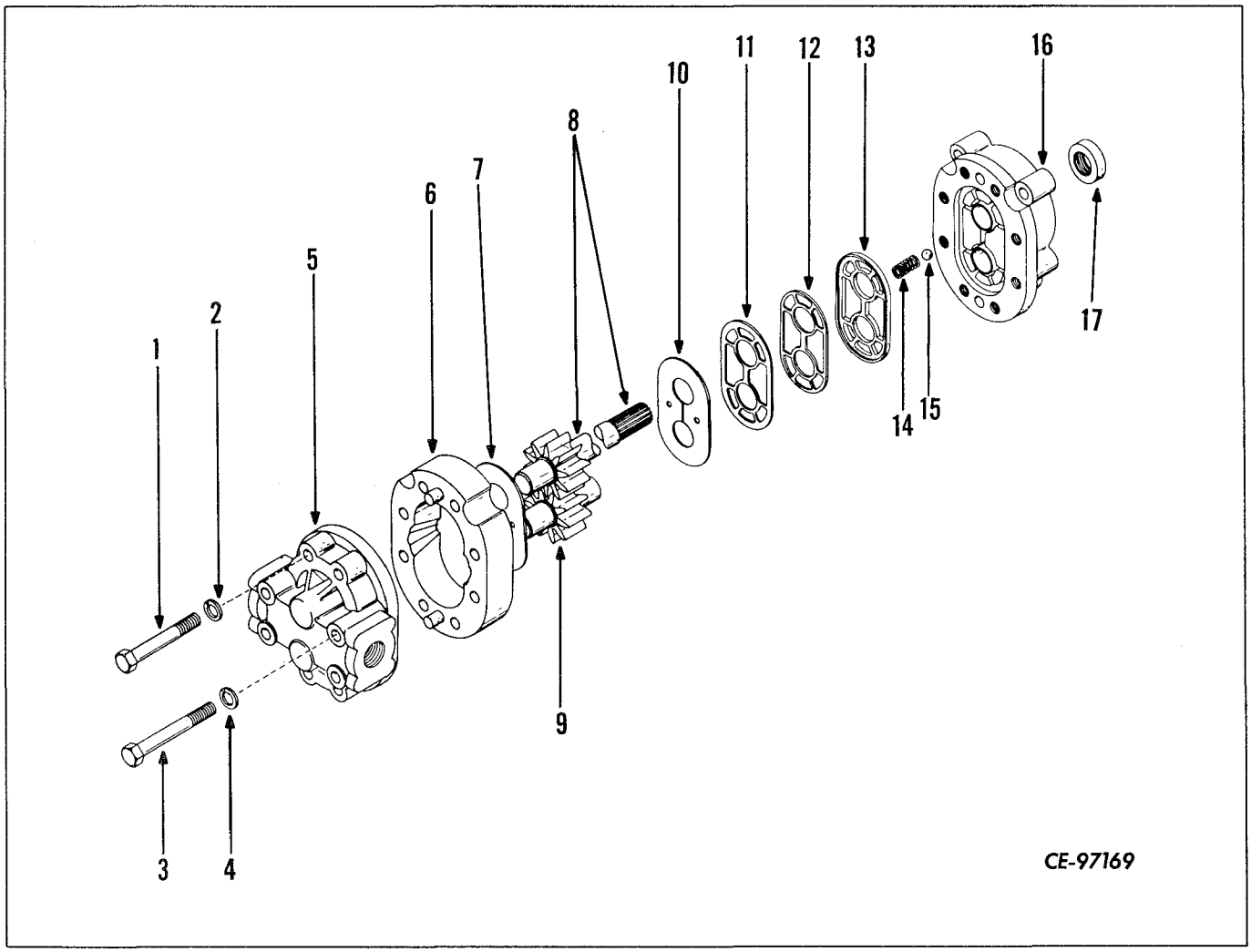

Figure 11-2
Main Pump.

1. Cap screw (short).
2. Lock washer.
3. Cap screw (long).
4. Lock washer.
5. Back plate.
6. Body.
7. Thrust plate.
8. Drive gear.
9. Idler gear.
10. Diaphragm.
11. Protector gasket.
12. Back-up gasket.
13. Diaphragm seal.
14. Spring.
15. Ball.
16. Front plate.
17. Seal.

HYDRAULIC SYSTEM

DISASSEMBLY, INSPECTION AND ASSEMBLY

MAIN CONTROL VALVE

REMOVAL

Remove the valve as follows:

a. Disconnect the control valve linkage from the valve.

b. Remove, cap and tag the connecting lines.

c. Remove the cap screws and washers that secure the valve to the reservoir. Remove the valve.

DISASSEMBLY AND ASSEMBLY

Disassemble the seal groups in numerical order (refer to Fig. 11-4).

Clean and inspect parts. Refer to "MAIN CONTROL VALVE, INSPECTION."

Replace Parts: 3, 4.

Assemble in reverse order.

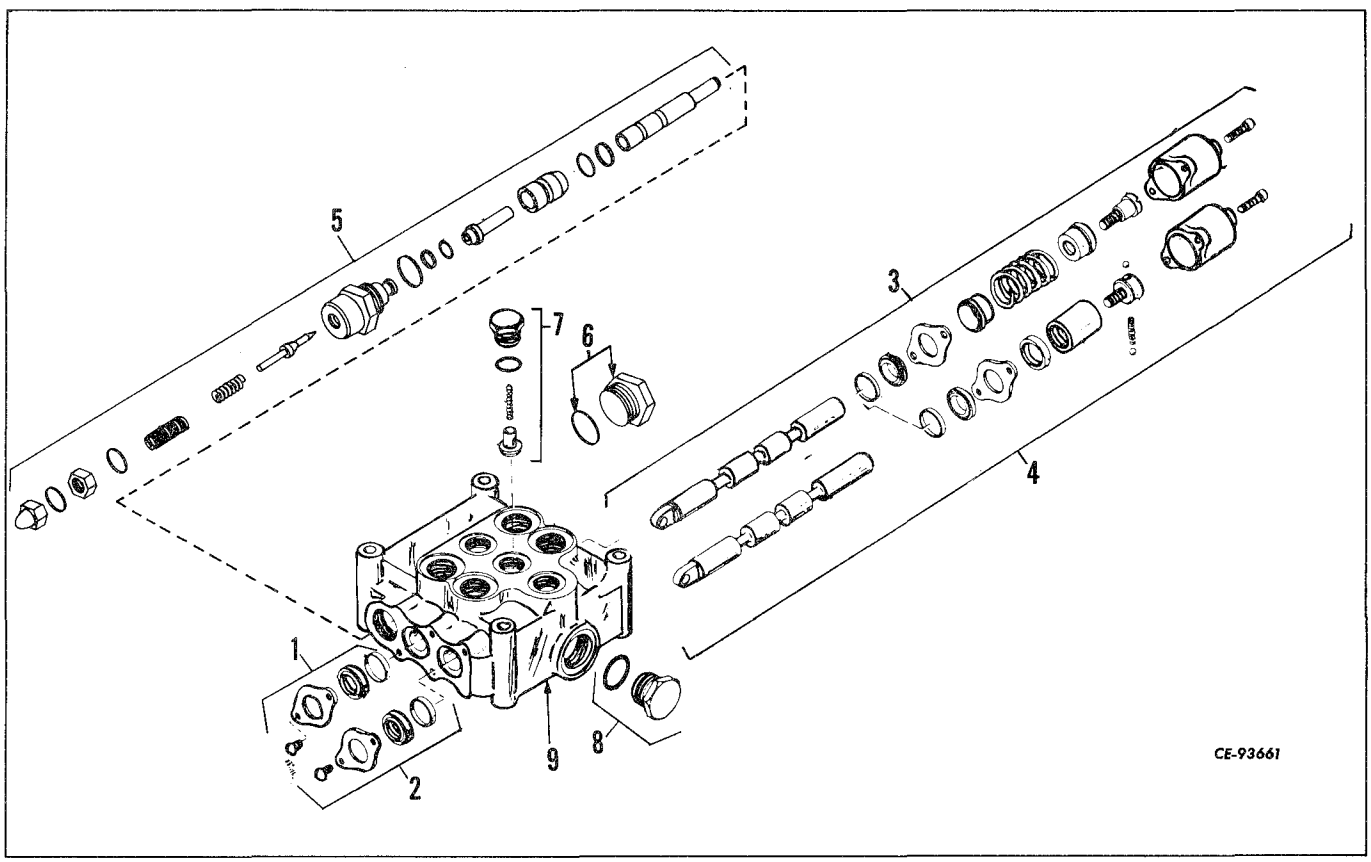

Figure 11-3
Main Control Valve.

1. Bucket plunger seal group - refer to Fig. 11-4.
2. Boom plunger seal group - refer to Fig. 11-4.
3. Bucket plunger group - refer to Fig. 11-5.
4. Boom plunger group - refer to Fig. 11-6.
5. Relief valve group - refer to Fig. 11-7.
6. Relief valve plug group - refer to Fig. 11-7.
7. Check valve group - refer to Fig. 11-8.
8. Plug group.
9. Valve body.

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DISASSEMBLY, INSPECTION AND ASSEMBLY

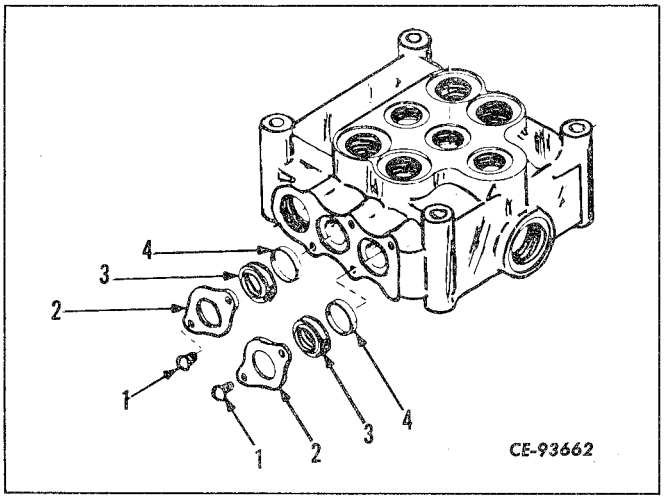

Figure 11-4
Bucket and Boom Plunger Seal Groups.

1. Screw (2).
2. Seal plate.
3. Packing.
4. Seal ring.

Disassemble the bucket plunger group in numerical order (refer to Fig. 11-5).

* After removal of item 2, plunger group may be withdrawn from valve body.

** Secure the eye end of item 4 in a vise. Unscrew item 3 from item 4.

Clean and inspect parts. Refer to "MAIN CONTROL VALVE, INSPECTION."

Replace Parts: 9, 10.

Assemble in reverse order.

(Continued on next page)

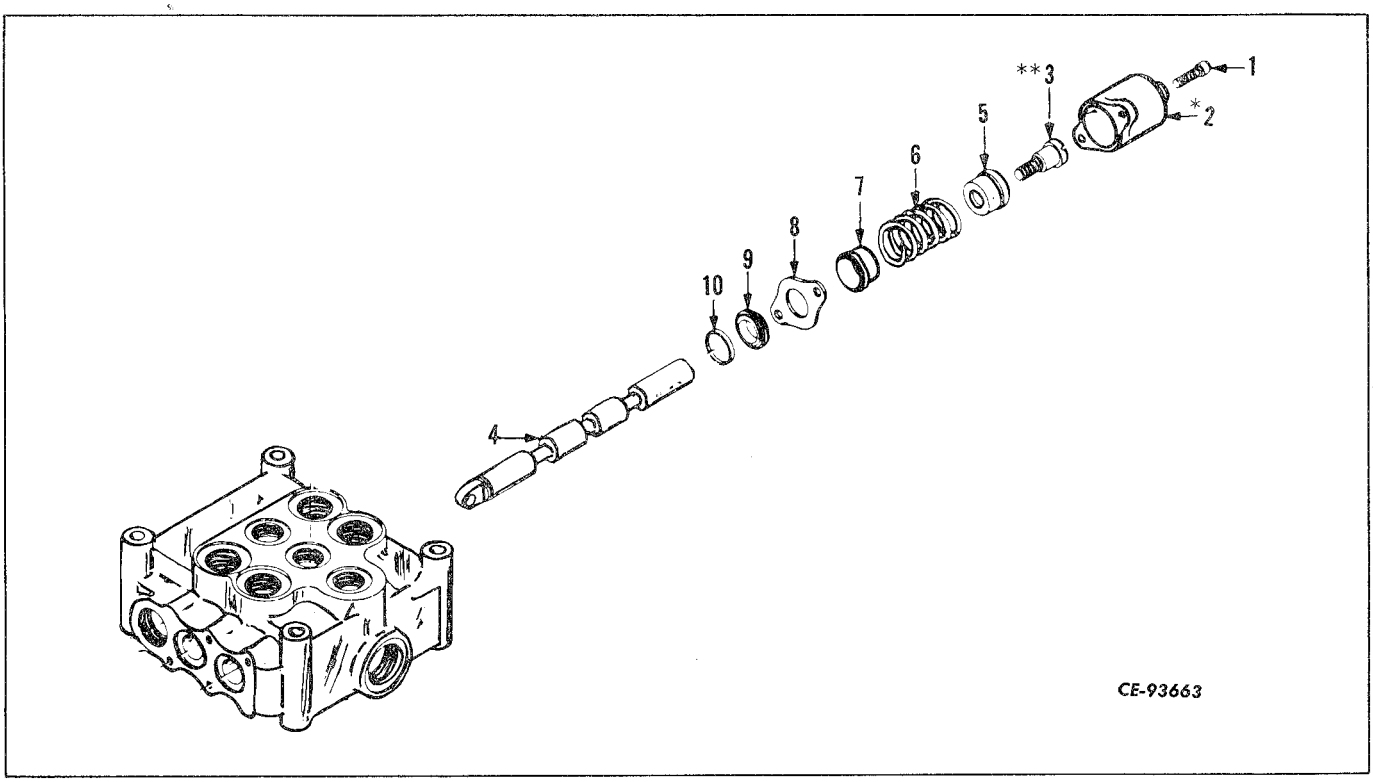

Figure 11-5
Bucket Plunger Group.

1. Screw (2).
2. Cap.
3. Bolt.
4. Plunger.
5. Spring seat.
6. Plunger spring.
7. Spring seat.
8. Seal plate.
9. Packing.
10. Seal ring.

HYDRAULIC SYSTEM

DISASSEMBLY, INSPECTION AND ASSEMBLY

MAIN CONTROL VALVE - Continued

DISASSEMBLY AND ASSEMBLY - Continued

Disassemble the boom plunger group in numerical order (Fig. 11-6).

*After removal of item 2, plunger group may be withdrawn from valve body.

** Use caution to prevent loss of item 3(2) during removal.

+ Secure the eye end of item 6 in a vise. Insert a rod in the detent ball holes of item 5 and unscrew item 5 from item 14.

Clean and inspect parts. Refer to "MAIN CONTROL VALVE, INSPECTION."

Replace Parts: 10, 11.

Assemble in reverse order.

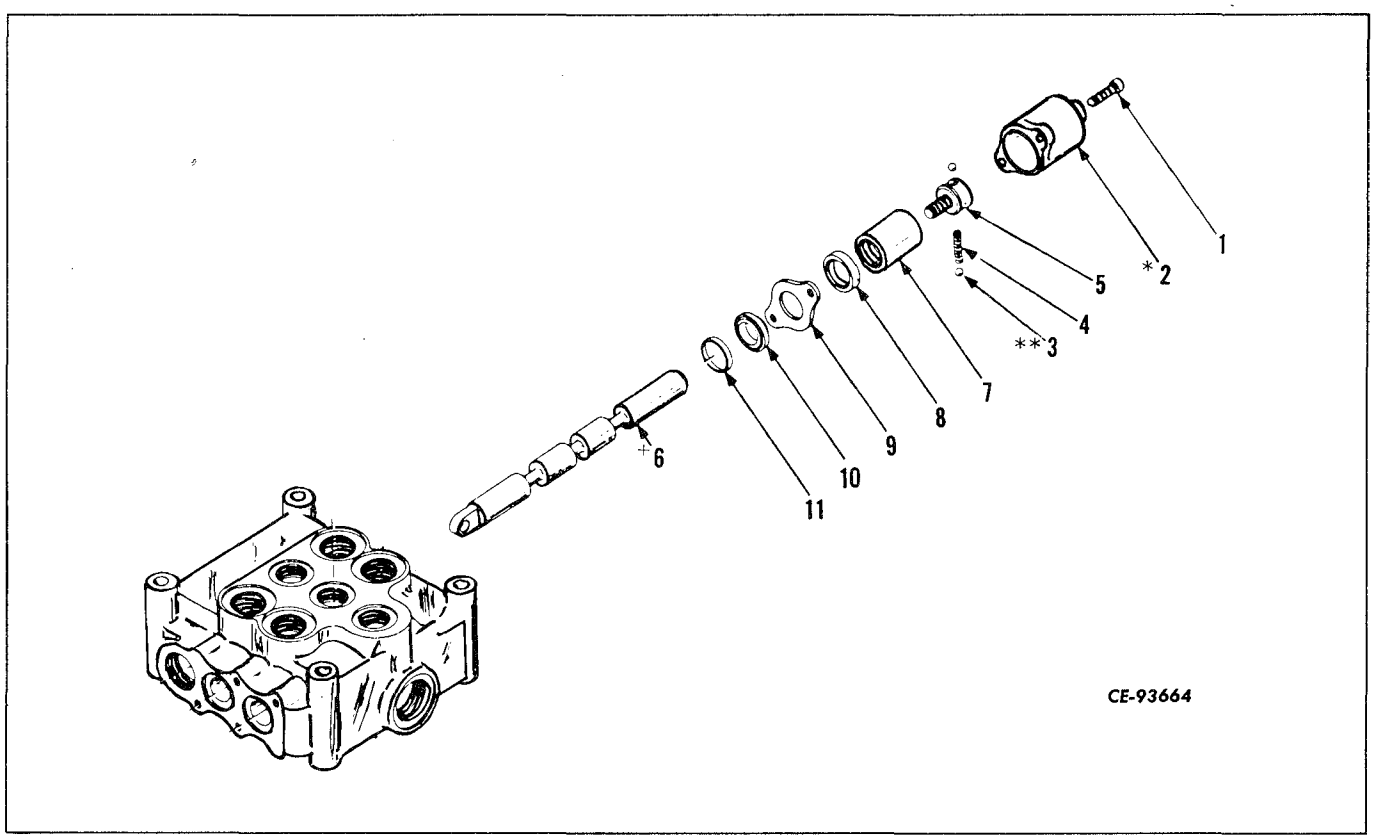

Figure 11-6
Bucket Plunger Group.

1. Screw (2).
2. Cap.
3. Detent balls (2).
4. Spring.
5. Detent pin.
6. Plunger.
7. Detent sleeve.
8. Detent spacer.
9. Seal plate.
10. Packing.
11. Seal ring.

DISASSEMBLY, INSPECTION AND ASSEMBLY

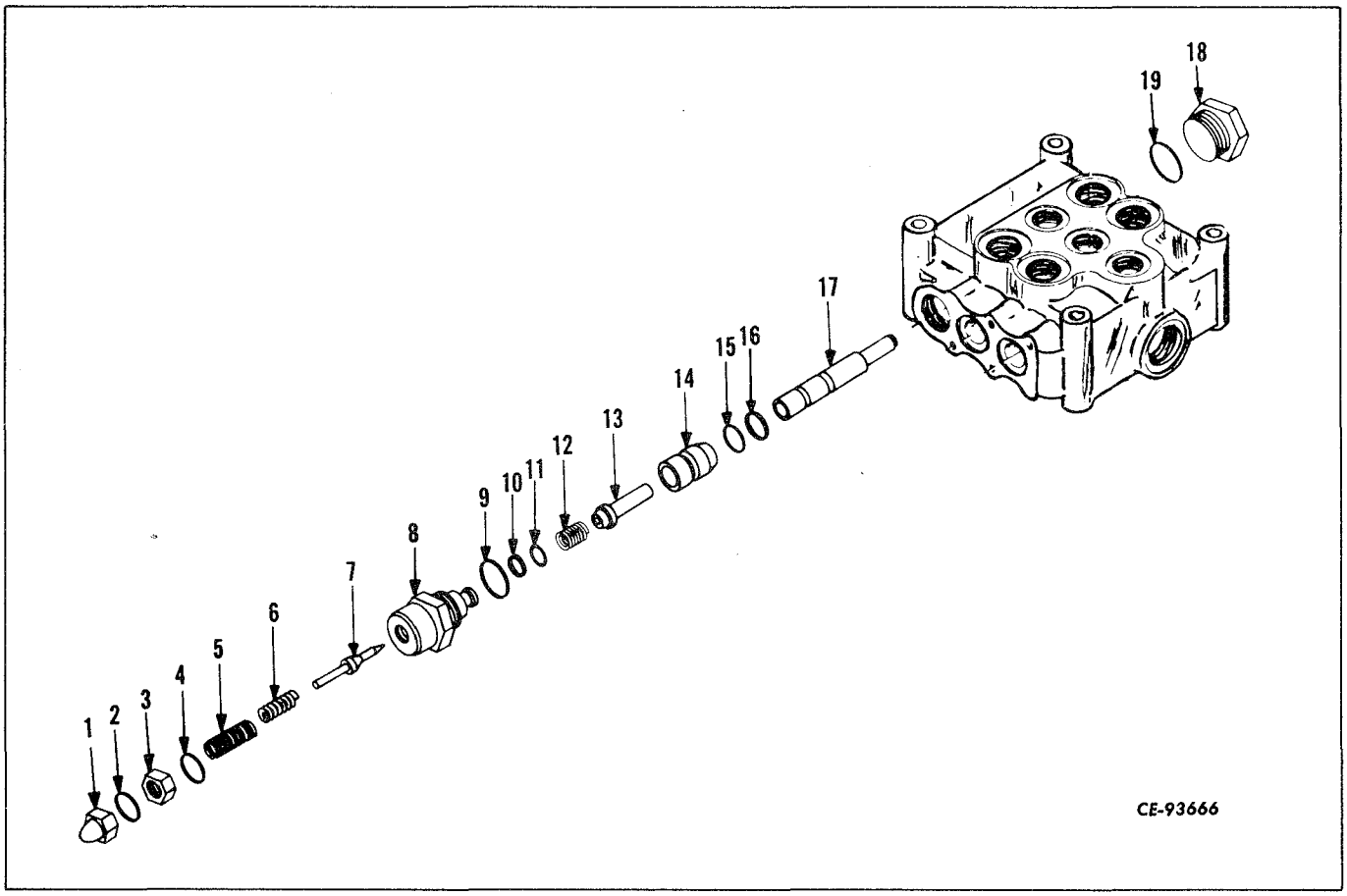

Figure 11-7
Relief Valve and Plug Group.

1. Acorn nut.
2. Washer.
3. Jam nut.
4. Washer.
5. Adjusting screw.
6. Spring.
7. Poppet.
8. Plug.
9. "O" ring.
10. Back-up ring.
11. "O" ring.
12. Spring.
13. Piston.
14. Poppet.
15. "O" ring.
16. Back-up ring.
17. Sleeve.
18. Plug.
19. "O" ring.

Disassemble the valve and plug group in numerical order (refer to Fig. 11-7).

Clean and inspect parts. Refer to "MAIN CONTROL VALVE, INSPECTION."

REPLACE PARTS: 9, 10, 11, 15, 16, 19.

Assemble in reverse order.

Refer to "SERVICE INFORMATION, ADJUSTMENTS" for adjustment procedure.

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DISASSEMBLY, INSPECTION AND ASSEMBLY

MAIN CONTROL VALVE - Continued

DISASSEMBLY AND ASSEMBLY - Continued

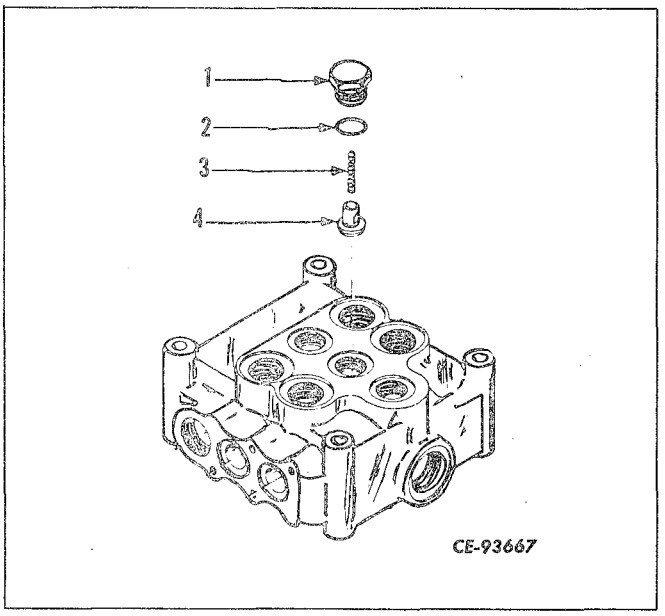

Figure 11-8
Check Valve Group.

1. Plug (3).
2. "O" ring (3).
3. Spring (3).
4. Poppet (3).

Disassemble the valve in numerical order (refer to Fig. 11-8).

Clean and inspect parts. Refer to "MAIN CONTROL VALVE, INSPECTION."

Replace Part: 2.

Assemble in reverse order.

INSPECTION

Thoroughly wash all parts in a clean mineral oil solvent. Dry with filtered compressed air and place on clean paper for inspection.

Inspect all surfaces for burrs, scratches, nicks, scores and other abrasions. Stone or lap all burrs. If scoring is deep enough to produce excessive leakage, replace valve assembly. Stone or use crocus cloth on small scores.

All parts with sliding fit must move freely in their bores. All grooves and passages must be free of foreign matter.

Replace springs if they are broken or distorted.

Replace detent balls that are worn or deformed.

Replace all "O" rings and back-up rings.

Listed below are instructions that must be followed to insure correct installation and effective sealing of "O" rings.

a. Seal counter bores must be thoroughly cleaned.

b. "O" rings, plungers, and counter bores must be lubricated on assembly.

c. "O" rings must be free of molding defects and handling damage.

d. "O" RINGS MUST NOT BE STRETCHED beyond the yield point. (Wrap a stiff paper around plunger to protect the "O" ring passing over the sharp machined edges.)

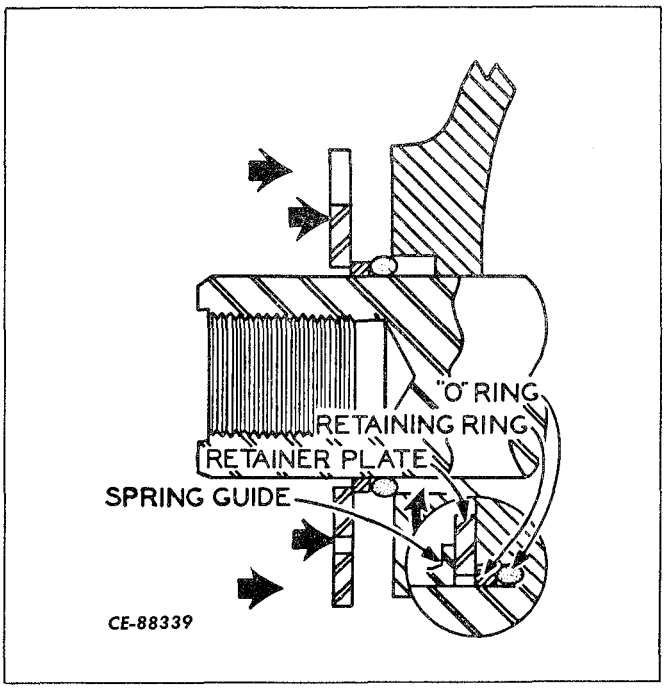

Figure 11-9

DISASSEMBLY, INSPECTION AND ASSEMBLY

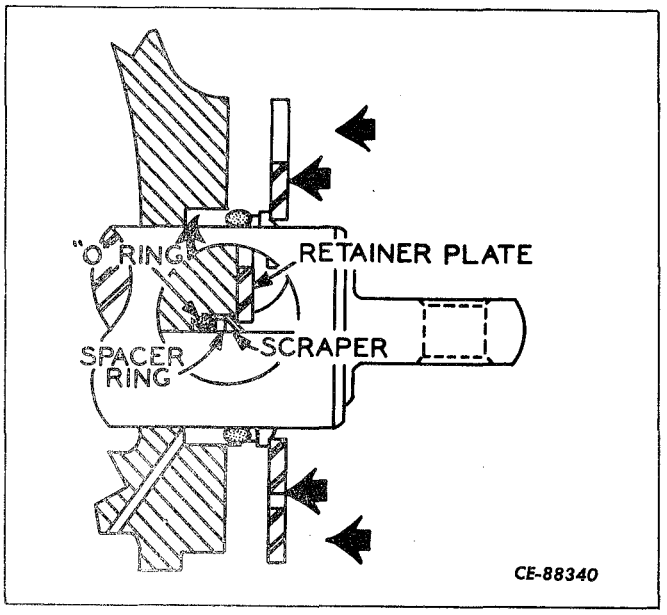

Figure 11-10

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.)

NOTE: Refer to Fig. 11-9 and 11-10 for proper "O" ring installation.

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

g. Use ONLY the oil type and viscosity ranges specified under "SERVICE INFORMATION."

HYDRAULIC CYLINDERS- BUCKET AND BOOM

GENERAL

Replace cylinder packing when excessive leakage occurs.

To replace packing, the cylinder must be disassembled. Drain the cylinder to be removed as much as possible. Tape, plug and tag the disconnected lines to protect and identify them for assembly. Do not damage the pivot bushings or port flanges during removal.

DISASSEMBLY

Disassemble the cylinder in a clean area as follows:

Loosen the set screws (5, Fig. 11-11) and remove the rubber plug (2).

Rotate the cylinder cap (3) until the hole in the cap is aligned with the hole in the cylinder (1). Insert a punch in the holes and remove the packing nut (4). Remove the retaining ring (3).

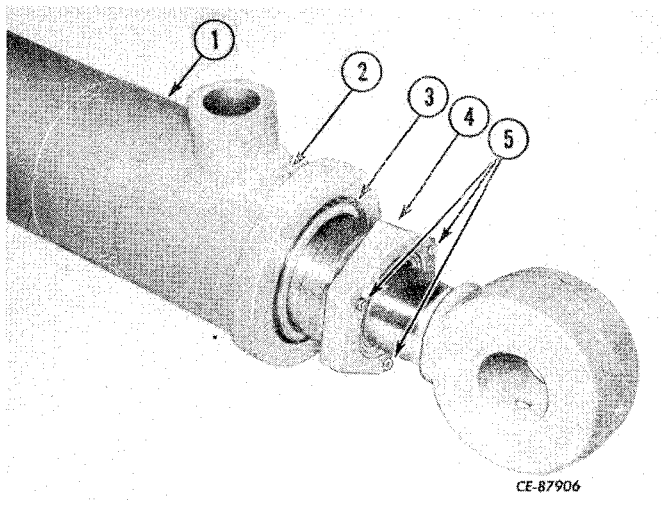

Figure 11-11

Extend the rod (3, Fig. 11-12) and slide the end cover (2) down the rod. Push the cap assembly (1) in slightly and remove the three piece ring (4).

(Continued on next page)

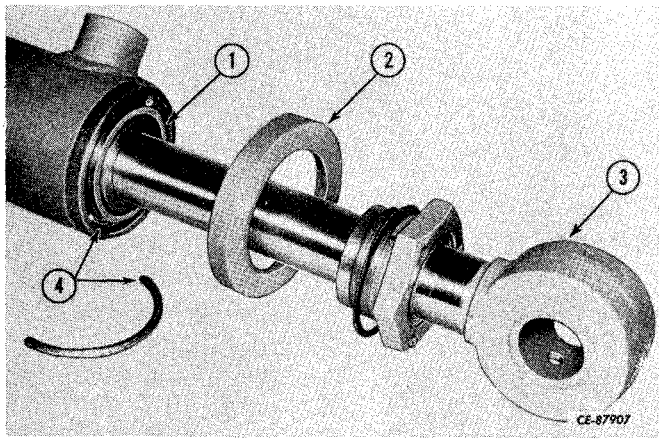

Figure 11-12

DISASSEMBLY, INSPECTION AND ASSEMBLY

HYDRAULIC CYLINDERS- BUCKET AND BOOM - Continued

DISASSEMBLY - Continued

Pull the rod free of the cylinder. The cylinder cap and cover assemblies will come out with the rod and piston. (Fig. 11-13).

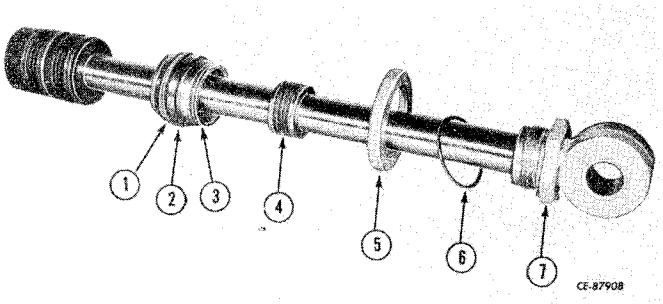

Figure 11-13

Loosen and remove the nut (7, Fig. 11-14). Slide the piston half (6), packing (5), spacer (4), packing (3) and piston half (2) from the rod (1). Discard the packing and nut.

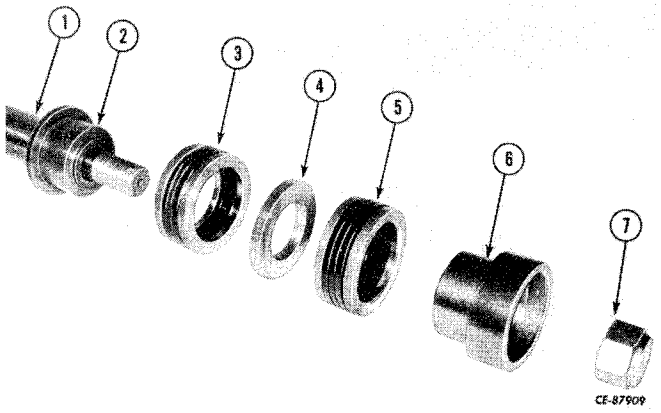

Figure 11-14

Remove and discard the "O" ring (1, Fig. 11-13), back-up ring (2) and packing (4) from the cylinder cap (3).

INSPECTION

Wash all metal parts including the cylinder in solvent. Dry all parts with filtered compressed air. Protect the components with a light film of oil. Flush the cylinder with oil to remove all traces of solvent and protect the cylinder walls from oxidation.

Check the cylinder bore and rod surface for scratches and/or abrasions thay may have been caused by grit deposits in the cylinder packings. Carefully remove small rough or sharp surfaces with a fine grained stone. The closer these surfaces are to a mirror finish, the more efficiently the new packing will operate.

ASSEMBLY

Assemble the cylinder as follows:

Install a new back-up ring (2, Fig. 11-13) and "O" ring (1) in the groove of the cylinder cap (3). Install a new rod packing (4) in the cylinder cap. Cross section of packing ring is "V" shaped. Packing must be installed so that open end of "V" faces piston when cap assembly is installed on rod. Coat the packing with a film of oil. Install the packing nut (7), retaining ring (6) end cover (5) and cap assembly (3) on the rod.

Install the piston half (2, Fig. 11-14) on the rod (1). Install a new piston packing (3). Cross section of packing ring is "V" shaped. Open end of "V" must face piston half (2). Install spacer (4) and new piston packing (5). Open end of "V" must face piston half (6) when installed. Install piston half (6) with new hex nut (7). TIGHTEN HEX NUT TO RECOMMENDED TORQUE (REFER TO "SPECIAL TORQUES").

Torque: _____

DISASSEMBLY, INSPECTION AND ASSEMBLY

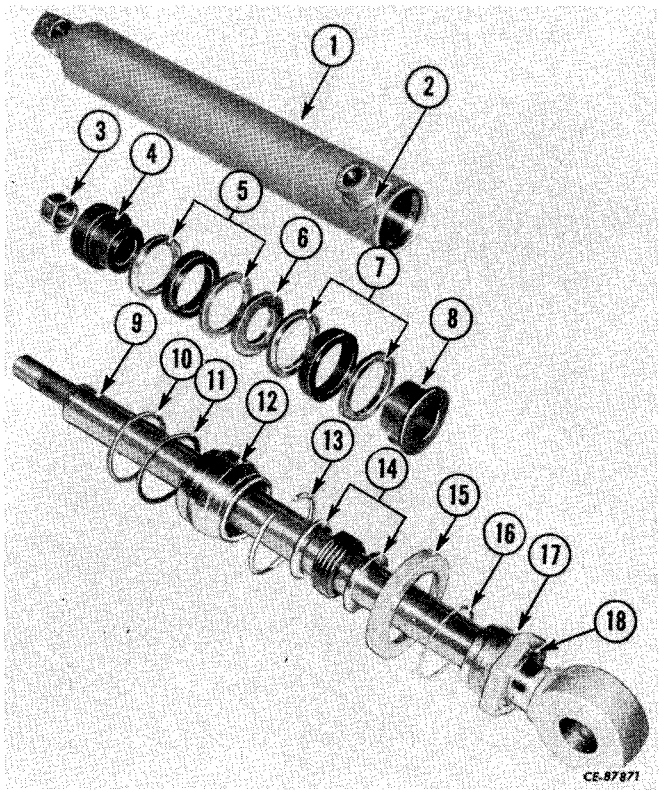

Figure 11-15
Boom and Bucket Cylinder.

1. Cylinder.
2. Rubber plug.
3. Nut.
4. Piston half.
5. Piston packing.
6. Spacer.
7. Piston packing.
8. Piston half.
9. Piston rod.
10. "O" ring.
11. Back-up ring.
12. Cylinder cap.
13. Lock ring.
14. Rod packing.
15. End cover.
16. Retaining ring.
17. Packing nut.
18. Set screw.

Coat the piston with a film of oil and insert the piston and rod assembly into the cylinder.

Slide the cap assembly (1, Fig. 11-12) into the cylinder. Be sure the "O" ring and back-up ring on the outside of the cap are correctly positioned. Install the three piece ring (4). Manually extend the rod sharply several times, driving the piston against the cap assembly. The cap should in turn, seat the two piece lock ring. Slide the end cover (2) on the end of the cylinder.

Install the retaining ring (3, Fig. 11-11) in the groove in the cylinder cap. Rotate the cylinder cap until the hole in the cylinder and cap are aligned. Insert a punch in the holes and install the packing nut (4). Tighten the nut snugly. Tighten the set screws (5) securely and install the rubber plug (2).

DISASSEMBLY, INSPECTION AND ASSEMBLY

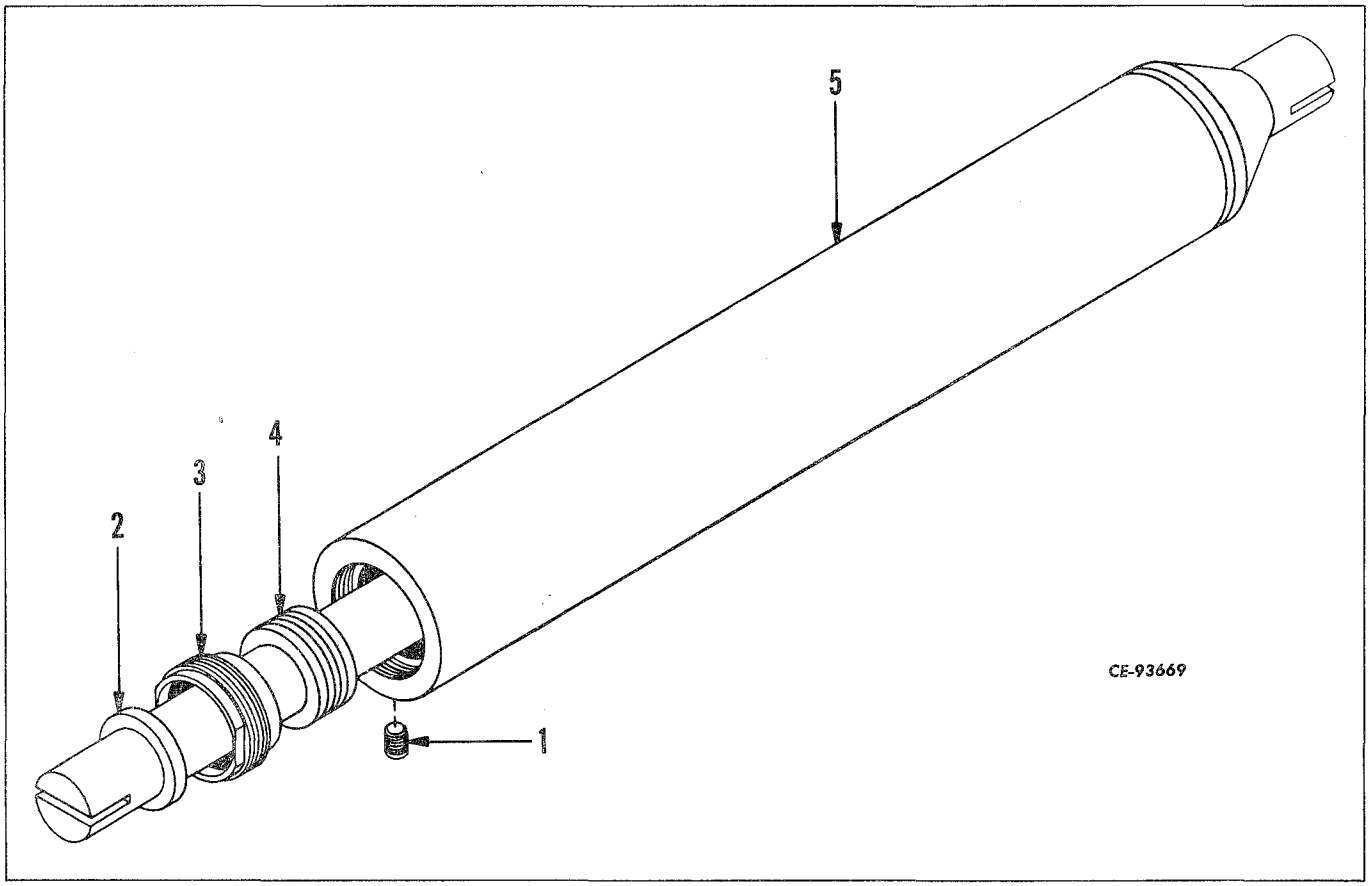

Figure 11-16
Steering Cylinder.

1. Set screw.
2. Wiper seal.
3. Gland nut.
4. Packing.
5. Cylinder.

HYDRAULIC CYLINDERS - STEERING

DISASSEMBLY AND ASSEMBLY

Disassemble the cylinder in numerical order (refer to Fig. 11-16).

Replace Parts: 2, 4.

Assemble in reverse order.

FLOW DIVIDER

REMOVAL

Remove the rear floorboard.

Remove, cap and tag the connecting lines.

Remove the cap screws, lock washers and nuts that secure the flow divider to the frame. Remove the divider.

DISASSEMBLY AND ASSEMBLY

Disassemble the divider in numerical order (Fig. 11-17).

NOTE: The relief valve, item 9, is serviced as a complete assembly only.

Clean and inspect parts. Refer to "FLOW DIVIDER, INSPECTION."

Replace Parts: 2, 8, 10.

Assemble in reverse order.

DISASSEMBLY, INSPECTION AND ASSEMBLY

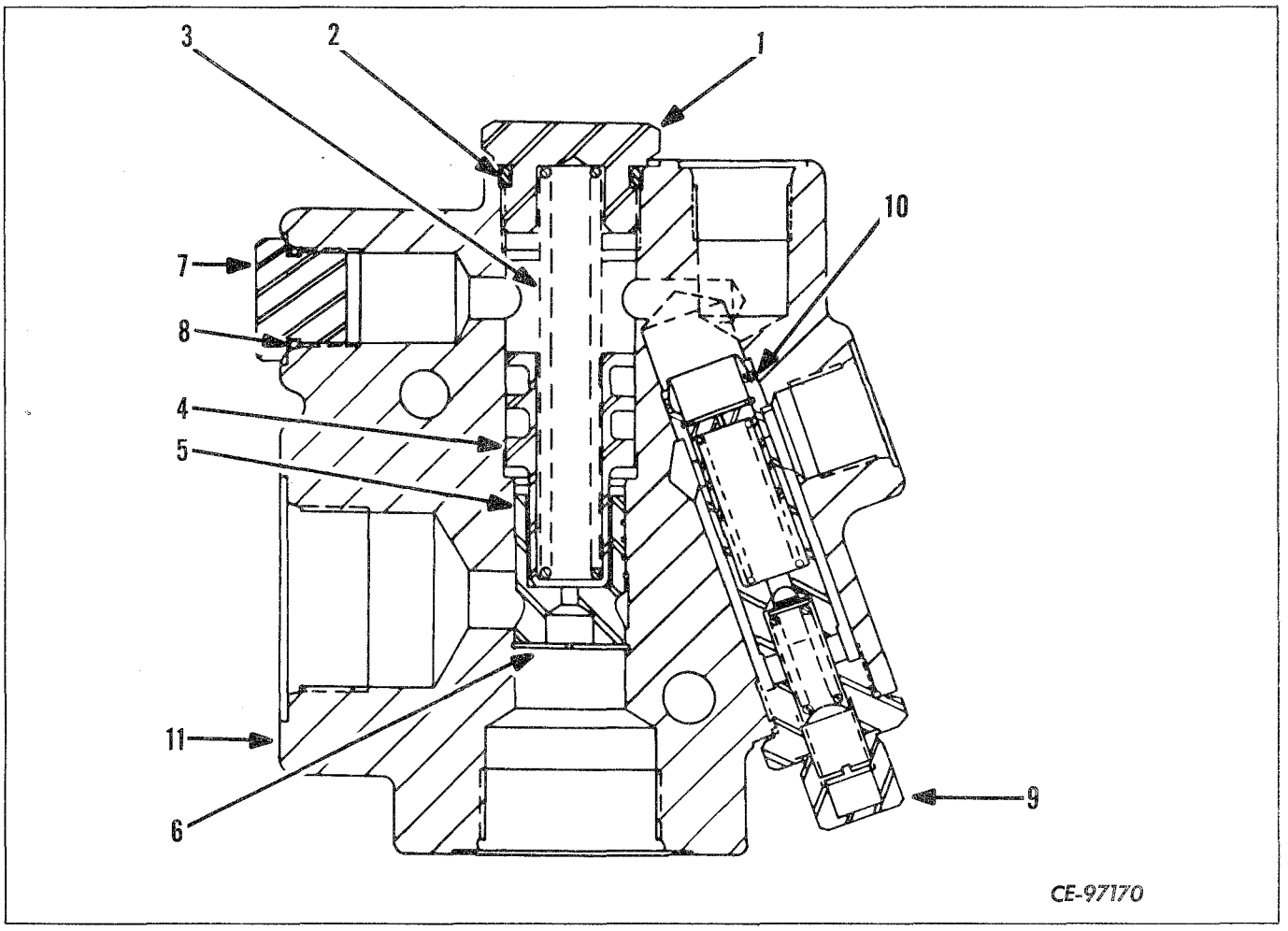

Figure 11-17
Flow Divider.

1. Plug.
2. "O" ring.
3. Spring.
4. Piston.
5. Piston.
6. Retaining ring.
7. Plug.
8. "O" ring.
9. Relief valve assembly.
10. Back-up ring.
11. Body.

Refer to "SERVICE INFORMATION ADJUSTMENTS" for adjustment procedure.

INSPECTION

Thoroughly wash all parts in a clean mineral oil solvent. Dry with filtered compressed air and place on clean paper for inspection.

Inspect all surfaces for burrs, scratches, nicks, scores and other abrasions. Stone or lap all burrs. If scoring is deep enough to produce excessive leakage, replace divider 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 the spring if it is broken or distorted.

Replace all "O" rings and back-up rings.

HYDRAULIC SYSTEM

TROUBLE SHOOTING

GENERAL

COMPLAINT	POSSIBLE CAUSE	REMEDY
Poor hydraulic system performance or failure.	1. Defective pump.	1. Repair or replace pump.
	2. Dirt in relief valve.	2. Disassemble and clean.
	3. Relief valve defective.	3. Disassemble, repair and adjust.
	4. Worn cylinders.	4. Repair or replace.
	5. Load too heavy.	5. Check line pressure.
	6. Internal crack.	6. Replace valve assembly.
	7. Plunger not in full stroke.	7. Check movement and linkage.
	8. Reservoir low on oil.	8. Add oil. Fill to level indicated on dipstick.
	9. System filters clogged.	9. Replace filter elements and clean reservoir.
	10. Restrictions in lines.	10. Check lines. Remove obstruction or replace line.
Excessive oil foaming.	1. Improper type or viscosity oil.	1. Drain entire hydraulic system and refill with proper oil.
	2. Excessive by-passing of oil over relief valves.	2. Adjust relief valve per recommendation if pressure adjustment is too low. Repair damaged relief valve. Change operating methods to eliminate long periods of maximum pressure operation.
Excessive oil temperature.	1. Sustained maximum pressure operation with by-passing of oil over relief valves.	1. Correct method of operation to eliminate long periods of maximum pressure operation.
	2. Incorrect viscosity or type of oil.	2. Drain entire hydraulic system and fill with correct oil.
	3. Worn hydraulic pump.	3. Replace or rebuild pump per recommendations in this manual.

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TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Foreign material in reservoir screen.	1. Lint - Worn, frayed or damaged cylinder packing.	1. Replace packing.
	2. Chips - Worn pump or damage in cylinders.	2. Disassemble system components, inspect and repair.
Insufficient pressure build-up.	1. System relief valve set too low.	1. Adjust relief valve according to specifications. Refer to main "Main Control Valve."
	2. Worn pump components causing internal leakage.	2. Replace pump cartridge.
Low pressure in boom circuit.	1. Damaged, worn or improperly adjusted hydraulic relief valve.	1. Refer to " Main Control Valve" for disassembly and inspection procedures.
	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 "Main Pump."
Low pressure in bucket circuit.	1. Refer to causes 1, 2 and 3 in "Boom Circuit" above.	1. Refer to remedy 1, 2 and 3 in boom circuit above.
Low pressure in steering circuit.	1. Flow divider relief valve out of adjustment.	1. Adjust relief valve. Refer to "Steering Relief Valve."
	2. By-pass in steering cylinder.	2. Inspect cylinder and rebuild or replace if necessary.

HYDRAULIC SYSTEM

TROUBLE SHOOTING

MAIN CONTROL VALVE

COMPLAINT	POSSIBLE CAUSE	REMEDY
Difficult operation or sticking of control valve plungers.	1. Over-heated hydraulic oil.	1. Refer to "Excessive Oil Temperature."
	2. Dirt in valve bores, plungers and/or oil.	2. Change oil, clean valve and entire system.
	3. Valve warped from incorrect mounting procedure.	3. Loosen mounting cap screws and torque correctly. Refer to "Special Torques."
	4. Fittings too tight.	4. Loosen fittings and retighten.
	5. Excessively high pressure in valve.	5. Check pressures on inlet and outlet lines.
	6. Linkage binding.	6. Free-up linkage.
	7. Plunger bent.	7. Replace valve assembly.
	8. Detent or return spring damaged.	8. Replace necessary parts.
	9. Spring or detent cap binding.	9. Loosen cap, recenter and retighten.
	10. Valve not at thermal equilibrium.	10. Allow system to warm up.
Unable to move plunger in or out.	1. Dirt in valve.	1. Clean and flush system.
	2. Plunger cap full of oil.	2. Replace seals.
	3. Bind in linkage.	3. Free-up linkage.
Detent control fails to hold.	1. Worn detent cam.	1. Replace worn parts.
	2. Spring or ball broken or deformed.	2. Replace damaged parts.
	3. Excessive vibration.	3. Locate source of vibration and correct.
	4. Plunger stroke restricted.	4. Check linkage.
Load drops when plunger moved from neutral.	1. Dirt in check valve.	1. Disassemble and clean.
	2. Scored check valve poppet or seat.	2. Replace poppet or lap poppet to seat.

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TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Load will not hold.	1. Cylinder leaking or worn.	1. Check cylinders.
	2. Oil by-passing valve plunger.	2. Replace valve assembly.
Leaking seals.	1. Paint on or under seal.	1. Remove and clean.
	2. Excessive back pressure.	2. Open line to reservoir.
	3. Dirt under seal.	3. Remove and clean.
	4. Scored plunger.	4. Replace valve.
	5. Loose seal plates.	5. Clean and tighten.
	6. Cut or scored seal.	6. Replace faulty parts.

MAIN CONTROL VALVE-PRESSURE RELIEF VALVE

No pressure.	1. Large poppet, check valve poppet or pilot poppet stuck open or dirt under valve seat.	1. Check for foreign material between poppets and their mating members. Members must slide freely. Clean all parts thoroughly.
Erratic pressure.	1. Pilot poppet seat damaged. Small poppet sticking in large poppet.	1. Replace damaged parts. Thoroughly clean all parts and remove surface marks.
Pressure setting incorrect.	1. Wear due to dirt. Jam nut and adjusting screw loose.	1. Refer to "Service Information, Adjustments."
Leaks.	1. Damaged seats, worn "O" rings.	1. Replace worn or damaged parts. Check for free movement of components.
	2. Parts sticking due to dirt.	2. Check seats for scratches, nicks or foreign material.

PUMP

Pump does not deliver fluid.	1. Shaft sheared.	1. Disassemble the pump and check the shaft for damage. Replace necessary parts.
	2. Reservoir-to-pump intake pipe restricted.	2. Check all strainers and filters for foreign material. Clean if necessary.

(Continued on next page)

TROUBLE SHOOTING

PUMP - Continued

COMPLAINT	POSSIBLE CAUSE	REMEDY
Pump does not deliver fluid. (Continued)	3. Fluid viscosity too heavy to pick up prime.	3. Completely drain the system. Add new filtered fluid of the proper viscosity.
	4. Relief valve stuck open.	4. Remove relief valve from loader valve. Inspect components and repair or replace as necessary.
	5. Worn pump gears.	5. Disassemble the pump and replace defective parts.
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 "Lubricant."
	5. Vortex or spiral in oil circulating in reservoir.	5. Check installation and condition of suction screens. 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.

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SERVICE INFORMATION

SPECIFICATIONS

RESERVOIR

Type:
Closed system with controlled pressure and vacuum relief.

Construction:
Rectangular shape with 3/16 inch wall thickness, 14 inch wide x 16-1/2 inch high x 18 inch long and removable filter.

Vacuum valve setting . . . . . .25 psi max.
Pressure relief valve setting . . . . . 15 psi

Filters:
One replaceable, pleated paper, radial fin type rated at 15 microns.
Strainer #40 square mesh wire cloth.
Capacity, "H" mark on dipstick - 12 gals., reservoir only.
Spring force:
Element hold down spring: 4 inches free length; 4-1/2 lbs. force @ 2-1/2 inch length.

PUMP

Manufacturer: Cessna.
Type: Positive displacement gear.
Rotation: Counterclockwise as viewed from shaft end.
Capacity: 27 gpm @ 2,200 rpm.
Rating: 2,000 psi.

LOADER VALVE

Manufacturer: Husco.

Type:
Two spool, balanced spool design with integral pilot operated relief valve.

Relief valve setting:
1800 psi at high idle engine speed.

Plunger movement between detents: 5/16 inch.

Spring forces:

Check valve spring: 1-3/8 inches free length; .65 lbs. force @ 9/16 inch length.

Detent spring: 7/8 inch free length; 6 lbs. force @ 39/64 inch length.

Plunger spring: 3-1/16 inches free length;
38.3 lbs. force 1-3/8 inch length;
45.4 lbs. force 1-1/16 inch length.

Piston spring: 1 inch free length; .35 lbs. force @ 9/16 inch length.

Poppet spring: 1.150 inches free length; 116 lbs. force @ 1.027 inch length.

FLOW DIVIDER

Manufacturer: Webster Electric.
Type: Adjustable, spring loaded ball.
Circuit pressures: Refer to "SYSTEM PRESSURES."
Spring force:
Piston spring: 45 lbs. force @ 3-1/2 inch length.

HYDRAULIC CYLINDERS

STEERING CYLINDERS

Type: Double acting.
Diameter of bore: 2-1/2 inches.
Stroke: 10 inches.
Extended length: 28-15/16 inches.
Retracted length: 18-15/16 inches.
Rod packing: "V" ring design. Combination cotton duck and Buna N compound.

BUCKET CYLINDER

Type: Double acting.
Diameter of bore, 4 inches.
Stroke (pin C/L to pin C/L), 16-1/4 inches.
Extended length (pin C/L to pin C/L), 46-1/2 inches.
Retracted length (pin C/L to pin C/L), 30-1/4 inches.
Rod (chrome plated) diameter, 2 inches.
Rod pin bore, 1-1/2 inches.
Cylinder pin bore, 1-1/2 inches.
Piston packing: "V" ring design. Combination cotton duck and Buna N compound.
Rod packing: "V" ring design. Combination cotton duck and Buna N compound.

(Continued on next page)

SERVICE INFORMATION

SPECIFICATIONS - Continued

HYDRAULIC CYLINDERS - Continued

BOOM CYLINDERS

Type: Double acting.
Diameter of bore, 4 inches.
Stroke (pin C/L to pin C/L), 27 inches.
Extended length (pin C/L to pin C/L), 45-1/2 inches.
Retracted length (pin C/L to pin C/L), 18-1/2 inches.
Rod (chrome plated) diameter, 2 inches.
Rod pin bore, 1-1/2 inches.
Cylinder pin bore, 1-1/2 inches.
Piston packing: "V" ring design. Combination cotton duck and Buna N compound.
Rod packing: "V" ring design. Combination cotton duck and Buna N compound.

LINKAGE RATE OF TRAVEL

Boom raises, empty, 7.1 sec.
Boom lowers, empty (float position), 5.5 sec.
Bucket retracts, empty, 2.0 sec.
Bucket dumps, empty, 1.5 sec.

LUBRICANTS AND CAPACITIES

LUBRICANT

TEMPERATURE	TYPE REFILL AND SERVICE		
	SAE	API	MILITARY SPECIFICATIONS
Below 20° F.	10W/30	**MS DM	SUP. 1 MIL-L-2104B, SERIES 3
Above 20° F.	20-20W	DS	

** MS Wear test sequence.

CAPACITY

Initial fill (dry system) . . . . . 66 quarts
Refill (approx) . . . . . 48 quarts

SPECIAL TORQUES

MAIN PUMP

Back plate mounting cap screws . 60-70 ft. lbs.

CYLINDERS

Boom cylinder piston nut . . . . 450-500 ft. lbs.
Bucket cylinder piston nut . . . 450-500 ft. lbs.

SYSTEM PRESSURES

Main relief valve . . . . . 1800 psi at high idle
Steering relief valve (in flow divider) . . . . . 1000 psi at low idle
Reservoir vacuum valve . . . . . .25 psi
Reservoir pressure relief valve . . . . 15 psi

ADJUSTMENTS

MAIN CONTROL VALVE

In addition to the regular periodic system pressure checks and checks to detect system problems, the main relief valve must be pressure checked and adjusted if it has been completely disassembled or if repairs have been made to the hydraulic system.

The pilot section of the relief valve may be removed without disturbing the valve setting.

By loosening and removing the plug (6, Fig. 11-18) the pilot section may be lifted from the main control valve body.

NOTE: DO NOT MOVE STEERING WHEEL WHILE ADJUSTING HYDRAULIC SYSTEM MAIN RELIEF VALVE.

Adjust the relief valve as follows:

a. Disconnect the bucket cylinder hose at the cylinder end and install a tee. Reconnect the hose.

b. Connect the test hose and test gauge to the tee.

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SERVICE INFORMATION

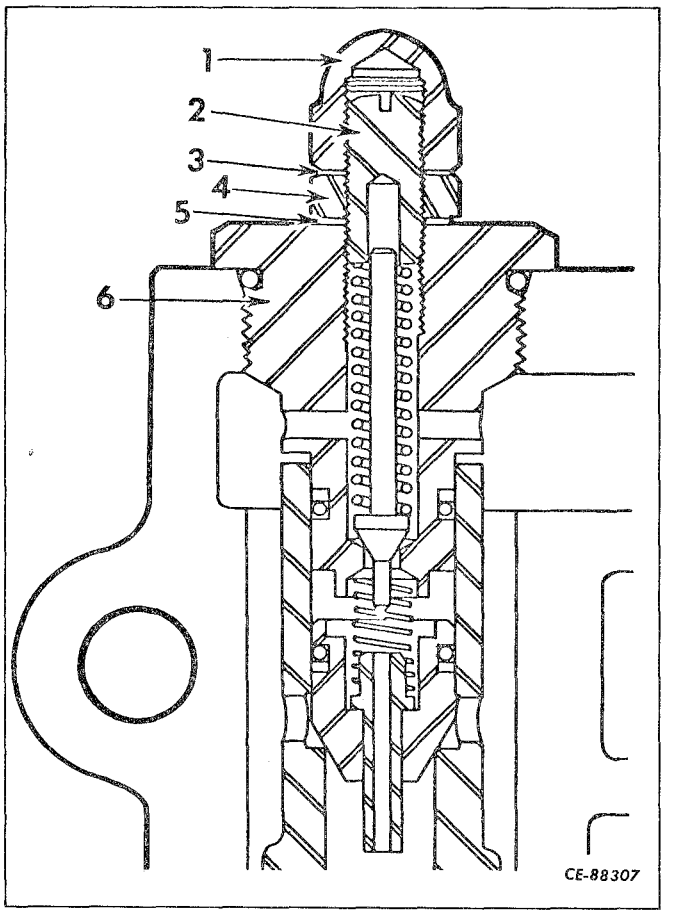

Figure 11-18
Main Relief Valve.

c. Start the engine and check for leaks around the relief valve. The plugs at either end of the relief valve bore must be tight.

d. Remove the acorn nut (1) from the adjusting screw (2). It will be necessary to hold the jam nut (4) while removing the acorn nut.

e. Accelerate the engine to "High Idle" and hold the bucket control lever in the "Rolled Back" (retracted) position. Note the indicated pressure on the gauge.

f. Idle the engine. If the indicated pressure was not within the recommended limits, adjustment is necessary. Refer to "SYSTEM PRESSURES" for recommended setting.

g. Hold the adjusting screw (2) and loosen the jam nut (4). To adjust the pressure hold the jam nut and rotate the adjusting screw clockwise to increase and counterclockwise to decrease pressure. Recheck the indicated pressure. When the correct pressure is obtained, hold the adjusting screw and tighten the jam nut.

h. Be sure the copper washer (3) is in good condition and install the acorn nut (1).

i. Stop the engine. Remove the test gauge, hose and tee. Connect the bucket cylinder hose.

STEERING RELIEF VALVE

Adjust the relief valve as follows:

a. Remove the rear floorboard.

b. Remove the plug (1, Fig. 11-19) from the upper rear of the flow divider.

c. Connect the test hose and test gauge to the port in the flow divider.

(Continued on next page)

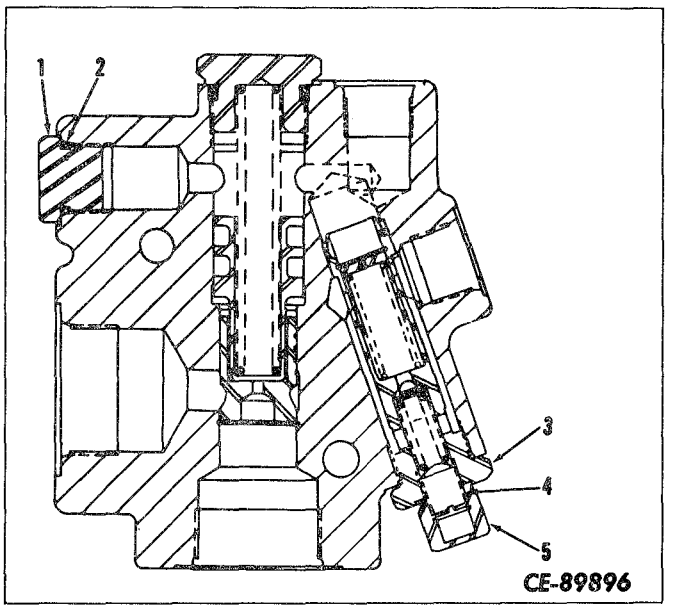

Figure 11-19
Steering Relief Valve (In Flow Divider).

ADJUSTMENTS - Continued

STEERING RELIEF VALVE - Continued

d. Start the engine and run it at "High Idle."

e. Turn the steering wheel and note the indicated pressure on the gauge.

f. Idle the engine. If the indicated pressure was not within the recommended limits, adjustment is necessary. Refer to "SYSTEM PRESSURES" for recommended setting.

g. Remove the cap nut (5) and with the engine running at "High Idle", turn the adjusting screw (4) clockwise to increase the pressure and counterclockwise to decrease the pressure. Be sure that the valve nut (3) remains stationary while the adjusting screw is being turned.

h. When the relief valve is correctly adjusted, install the cap nut.

i. Stop the engine. Remove the test gauge and hose. Install the plug (1). Install the floorboard.

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SECTION XII

ELECTRICAL SYSTEM

Page

SECTION XII ELECTRICAL SYSTEM

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DESCRIPTION OF SYSTEM

The electrical circuit employed in the H-30B series tractor is a negative ground system. Twelve volts are used in the gasoline engine machines and 24 volts in the diesel. Electrical energy stored in the battery(ies), is available upon demand to the system components. These components, which include the instruments, headlights, back-up light, stop and tail lights and cranking motor, are dependent upon battery energy until the engine drives the generator at a speed sufficient to carry the electrical load. At this speed (which varies with the electrical load) energy produced by the A.C. 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.

The battery(ies) is housed in the battery box located on the left hand side of the tractor. A hinged door on the 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 battery(ies).

ELECTRICAL SYSTEM

DESCRIPTION OF SYSTEM

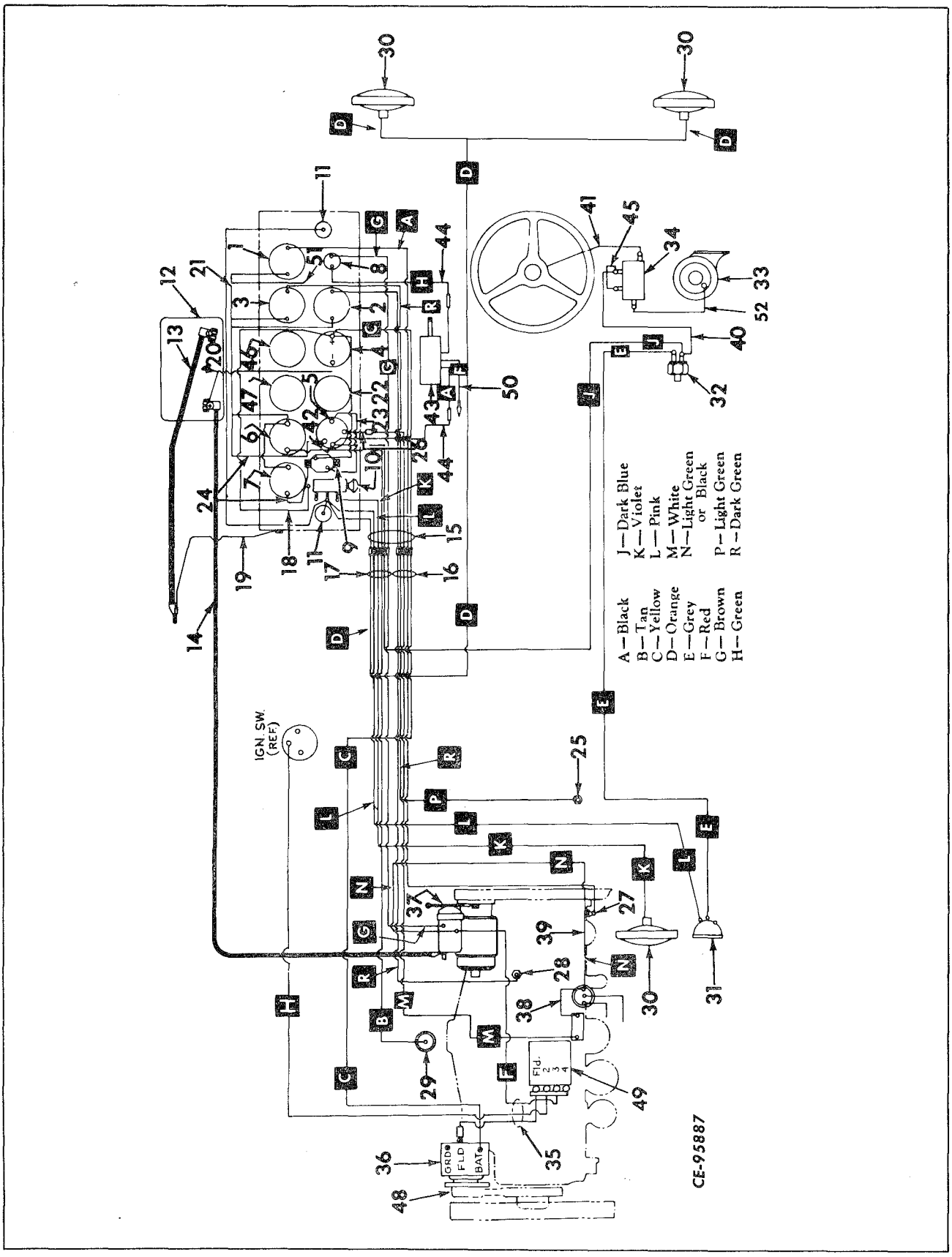

Figure 12-1
Wiring Diagram - I.H. Gas Engine.

Legend for Figure 12-1

1. Gauge, engine oil pressure.
2. Gauge, engine temperature.
3. Gauge, torque converter temperature.
4. Ammeter.
5. Switch, ignition.
6. Gauge, fuel.
7. Hourmeter.
8. Switch, starter.
9. Circuit breaker.
10. Switch, light.
11. Dash lamps.
12. Battery.
13. Cable, battery ground.
14. Cable, battery to starter.
15. Loom, instrument panel.
16. Wiring harness.
17. Wiring harness.
18. Wire, ammeter to light switch.
19. Wire, ground, instrument panel.
20. Wire, battery to ammeter.
21. Wire, instrument jumper.
22. Wire, ammeter to circuit breaker.
23. Wire, ignition switch to circuit breaker.
24. Wire, hourmeter ground.
25. Sender, torque converter temperature.
26. Wire, instrument loom to ignition switch.
27. Sender, oil pressure.
28. Sender, engine temperature.
29. Sender, fuel.
30. Driving lights.
31. Rear combination lights.
32. Switch, stop light.
+33. Horn.
+34. Relay, horn.
35. Wiring harness generator to regulator.
36. A. C. generator.
37. Cable, starter to ground.
38. Wire, coil to resistor.
39. Wire, coil to starter.
+40. Wire, stop light switch to horn relay.
+41. Wire, horn relay to steering gear.
42. Wire, jumper.
43. Switch, neutral safety.
44. Cable.
+45. Wire, jumper.
*46. Gauge, transmission, clutch pressure.
*47. Gauge, hydraulic, oil pressure.
48. Belt, generator.
49. Regulator, voltage.
50. Wire, (taped back).
51. Wire, (taped back).
52. Wire - horn to relay.

\+ Early Type

* Optional Gauges

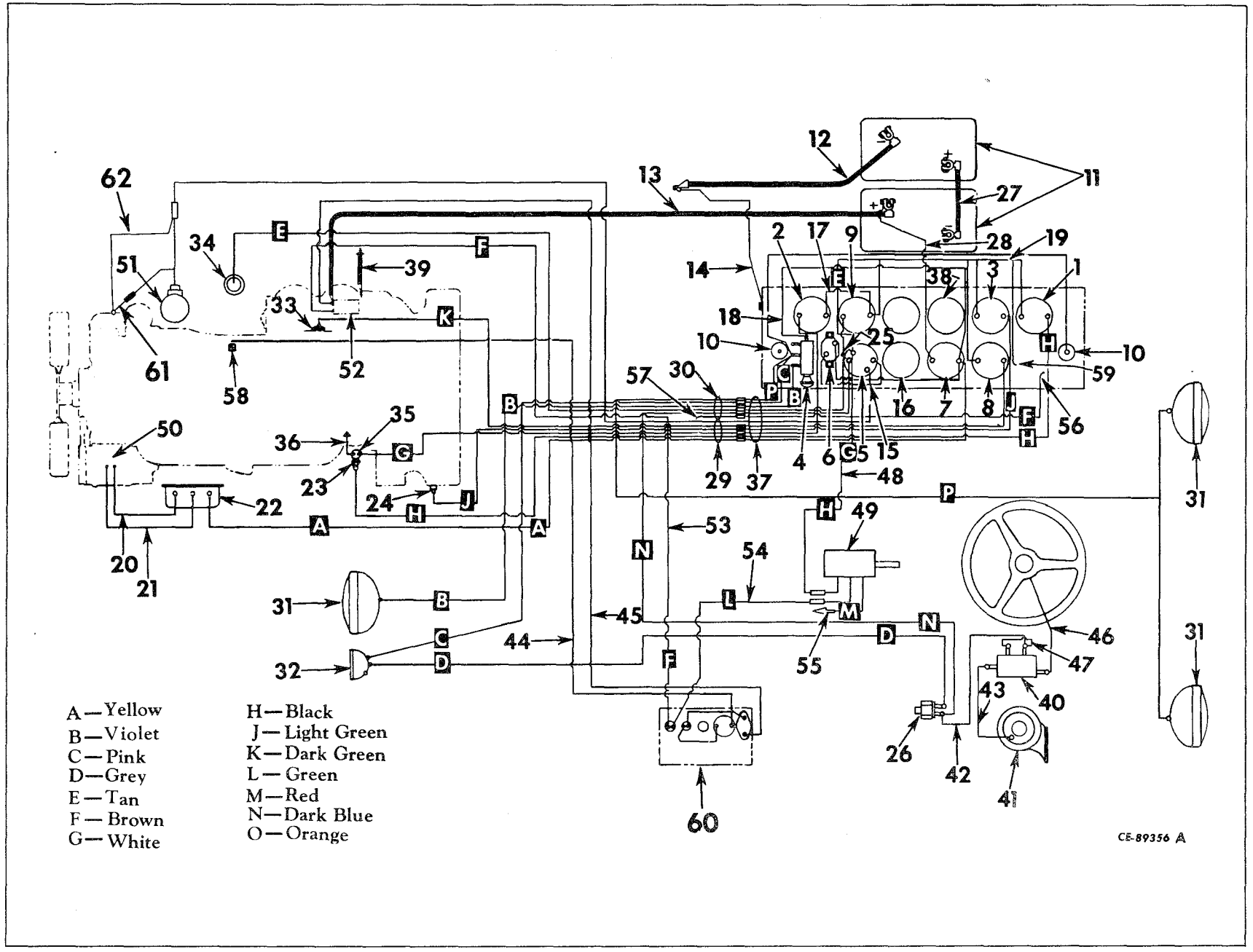

Figure 12-2
Wiring Diagram - I.H. Diesel Engine.

DESCRIPTION OF SYSTEM

Legend for Figure 12-2

1. Gauge, engine oil pressure.
2. Hourmeter.
3. Gauge, torque converter temperature.
4. Switch, light.
5. Switch, ignition.
6. Breaker, circuit.
7. Ammeter.
8. Gauge, engine temperature.
9. Gauge, fuel.
10. Lamps, dash.
11. Battery.
12. Cable, battery ground.
13. Cable, battery to starter solenoid.
14. Wire, panel ground.
15. Wire, ignition switch to circuit. breaker
16. Wire, ammeter to circuit breaker.
17. Wire, hourmeter jumper.
18. Wire, ammeter to light switch.
19. Wire, instrument jumper.
20. Wire, (field), generator to regulator.
21. Wire, (arm), generator to regulator.
22. Regulator, voltage.
23. Pressure sender, oil.
24. Sender, torque converter temperature.
25. Wire, jumper, ignition switch.
26. Switch, stop light.
27. Cable, jumper.
28. Wire, battery to ammeter.
29. Harness, wiring.
30. Harness, wiring.
31. Lights, driving.
32. Lights, combination rear.
33. Sender, engine temperature.
34. Sender, fuel tank.
35. Switch, pressure.
36. Wire, pressure switch ground.
37. Harness, wiring.
*38. Gauge, transmission clutch pressure.
39. Cable, starter ground.
+40. Relay, horn.
+41. Horn.
+42. Wire, stop light switch to relay.
+43. Wire, relay to horn.
44. Wire, circuit breaker to glow plug.
45. Wire, to starter solenoid.
+46. Wire, horn relay to steering gear.
+47. Wire, jumper.
48. Cable.
49. Switch, neutral safety.
50. Generator.
51. Fuel pump.
52. Solenoid.
53. Wire.
54. Wire.
55. Wire (taped back).
56. Wire (taped back).
57. Wire (taped back).
58. Glow plug.
59. Wire (taped back).
60. Cold weather starting unit (option).
61. Wire.
62. Wire.

\+ Early Type

* Optional Gauges

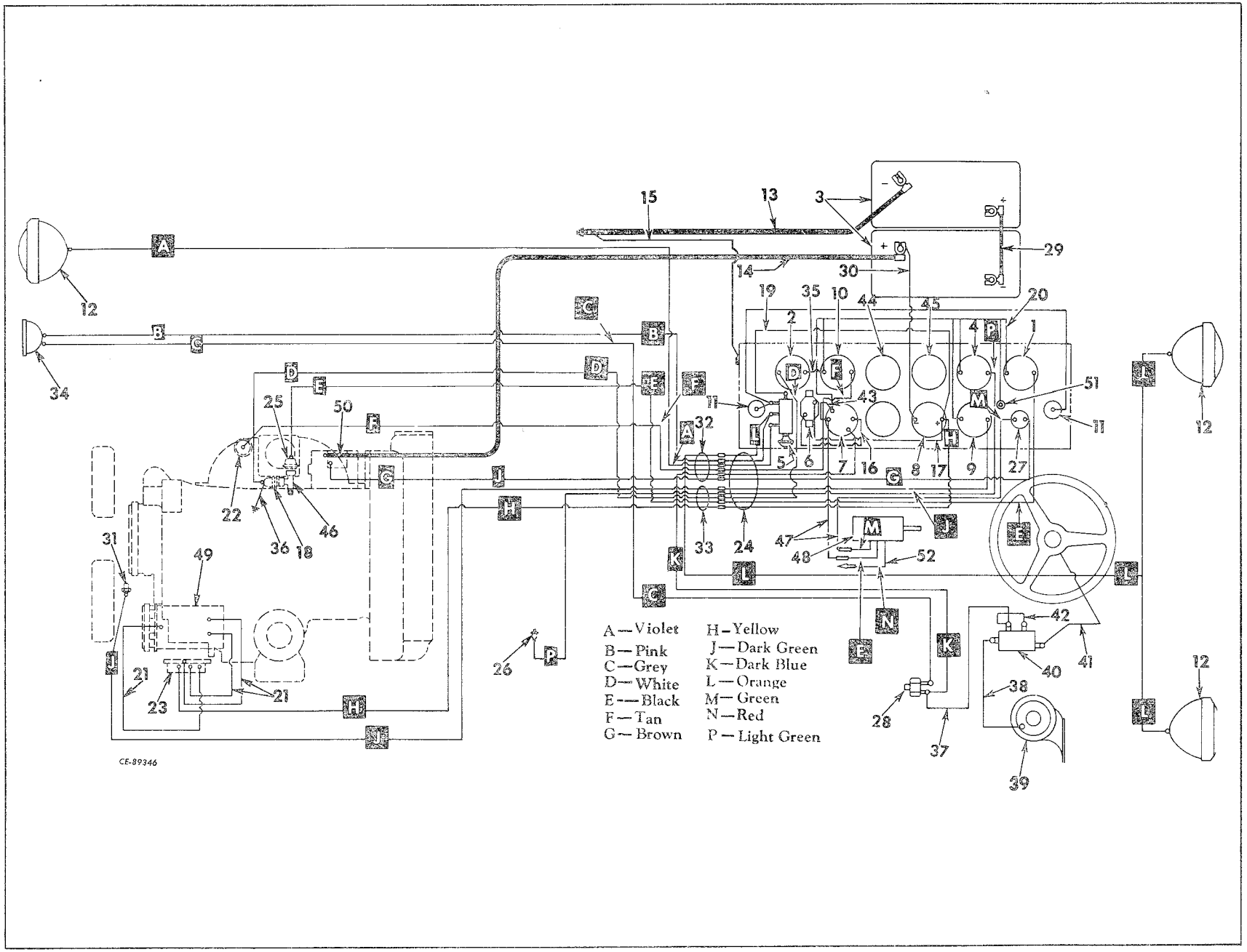

Figure 12-3
Wiring Diagram - Detroit Diesel Engine.

Legend for Figure 12-3

1. Gauge, engine oil pressure.
2. Hourmeter.
3. Battery.
4. Gauge, torque converter temperature.
5. Switch, light.
6. Breaker, circuit.
7. Switch, ignition.
8. Ammeter.
9. Gauge, engine temperature.
10. Gauge, fuel.
11. Lamp, dash.
12. Lights, driving.
13. Cable, battery ground.
14. Cable, battery to cranking motor.
15. Wire, panel ground.
16. Wire, ignition switch to circuit breaker.
17. Wire, ammeter to light switch.
18. Switch, pressure.
19. Wire, ammeter to circuit breaker.
20. Wire, instrument jumper.
21. Wire, voltage regulator to generator.
22. Sender, fuel.
23. Regulator, voltage.
24. Harness, instrument.
25. Sender, oil pressure.
26. Sender, torque converter temperature.
27. Push button, starter.
28. Switch, stop light.
29. Cable, battery jumper.
30. Wire, battery to ammeter.
31. Sender, engine temperature.
32. Harness, wiring.
33. Harness, wiring.
34. Lights, combination rear.
35. Wire, hourmeter jumper.
36. Wire, pressure switch ground.
+37. Wire, stop light switch to horn relay.
+38. Wire, relay to horn.
+39. Horn.
+40. Relay, horn.
+41. Wire, relay to steering gear.
+42. Wire, jumper.
43. Wire, jumper, ignition switch.
*44. Gauge, hydraulic oil pressure.
*45. Gauge, transmission clutch pressure.
46. Tee.
47. Cable.
48. Neutral safety switch.
49. Generator.
50. Motor, cranking.
51. Wire (taped back).
52. Wire (taped back).

\+ Early Type

* Optional Gauges

ELECTRICAL SYSTEM

BATTERIES

DESCRIPTION

A lead-acid storage battery of the type used in the electrical system of the tractor, contrary to popular belief, does not store electricity. The hard rubber case stores the chemical ingredients necessary to produce electrical energy. This energy is produced only when a circuit to which the battery is connected is completed. During periods of inactivity, when no electrical energy is being supplied, a slow chemical breakdown or discharge is taking place. If the period of idleness is of sufficient length a condition known as a permanent sulfation will develop. Once permanently sulfated, a battery cannot be restored to its normal maximum capacity. Routine battery service greatly extends the useful life of the battery.

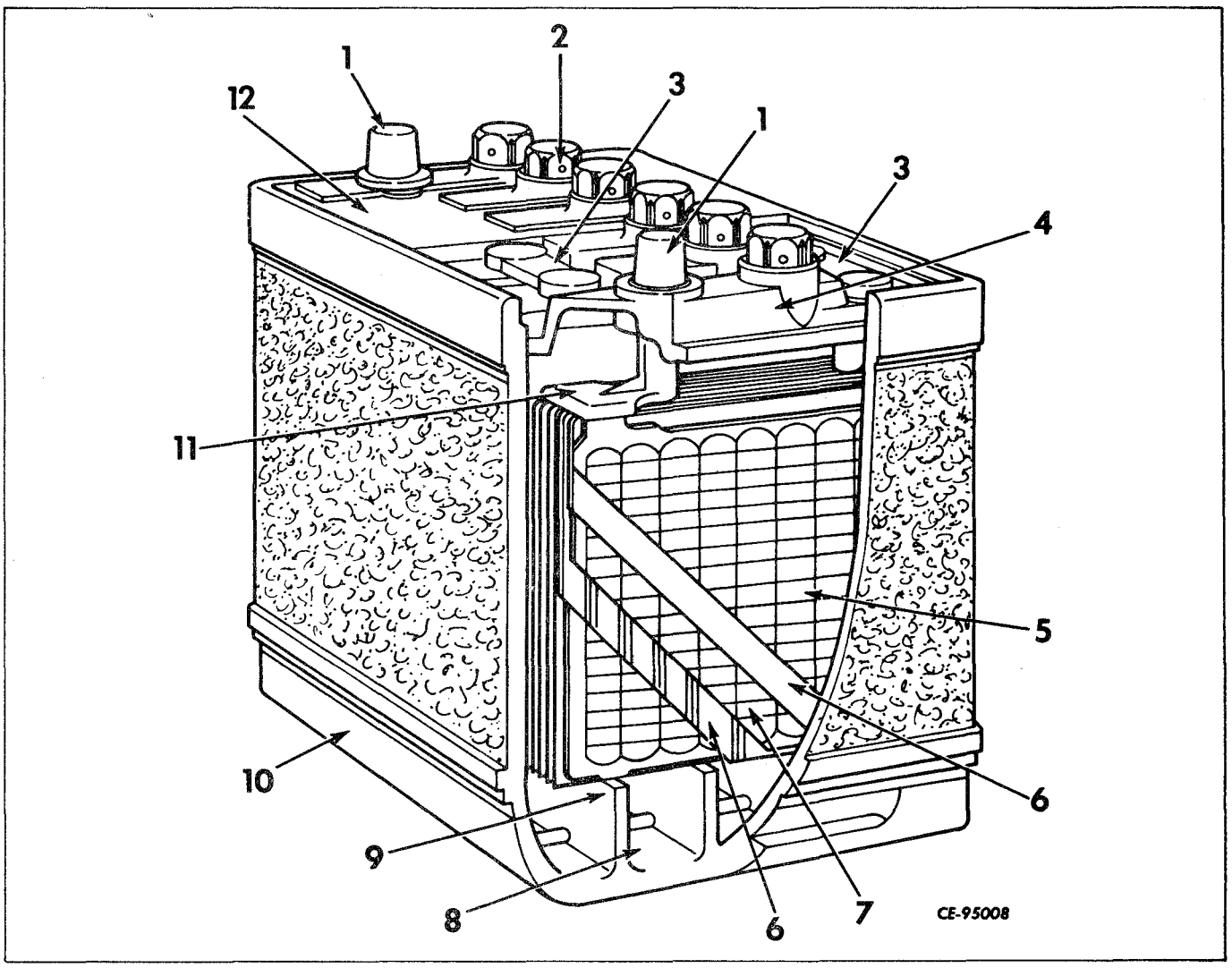

Figure 12-4
Typical 12 Volt Storage Battery.

1. Terminal post.
2. Vent plug.
3. Cell connector.
4. Cell cover.
5. Negative plate.
6. Separator.
7. Positive plate.
8. Sediment space.
9. Element rest.
10. Case.
11. Post strap.
12. Sealing compound.

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BATTERIES

OPERATION

A twelve volt battery is composed of one large case (Fig. 12-5) divided into six equal compartments called cells.

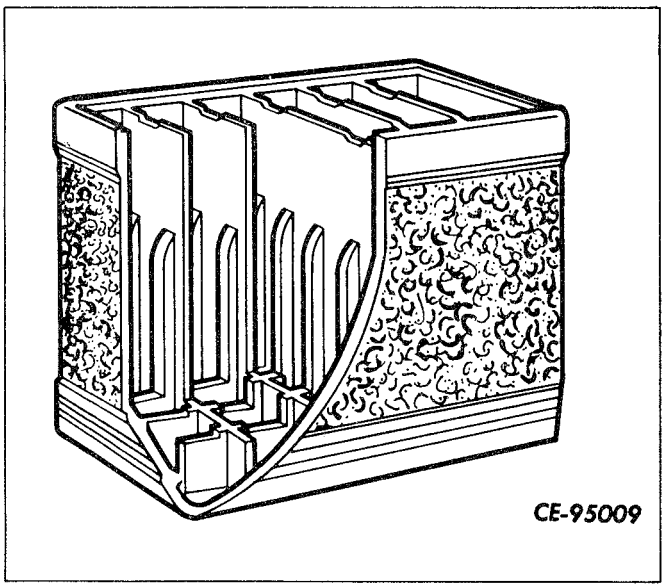

Figure 12-5
Battery Case.

Within each cell are a series of plates (Fig. 12-6) containing the active chemical material used in producing the electrical energy. The plates are immersed in a fluid called electrolyte. The plate frame is a grid design and the active material is attached by a process of pasting and bonding. Depending upon the material attached to the grid, some plates are classed as negative plates while the others are considered positive plates. Within each cell these plates are alternately spaced with each group being connected to its own common post strap (Fig. 12-7) that is one negative and one positive post strap per cell.

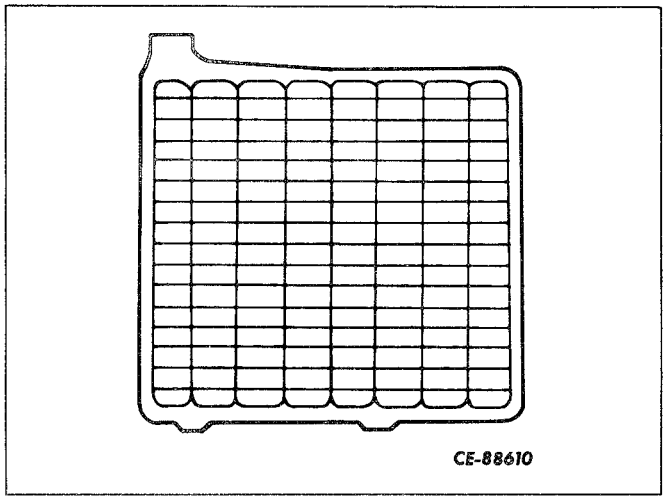

Figure 12-6
Battery Plate.

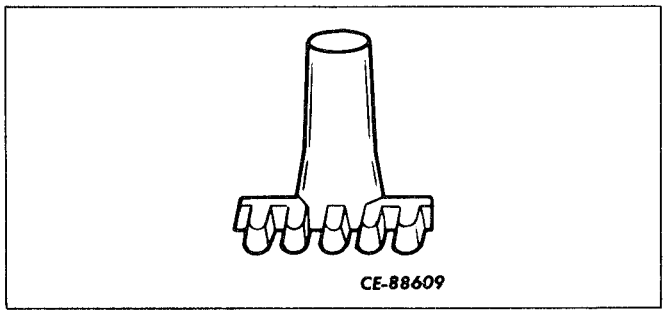

Figure 12-7
Post Strap.

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. 12-8) always face the positive plates to provide a greater acid volume at this point with resulting improved efficiency.

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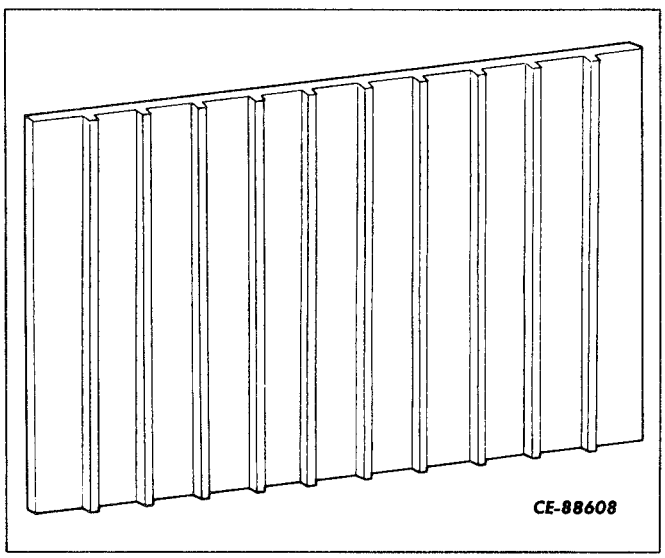


Figure 12-8
Separator Plate.

BATTERIES

OPERATION - Continued

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. 12-9) are also provided with vent openings of various construction.

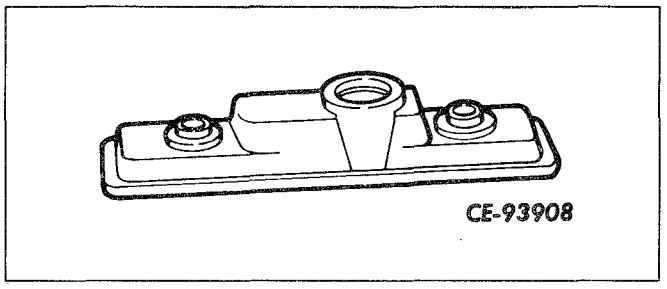


Figure 12-9
Cell Cover.

Battery covers (Fig. 12-10) 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.

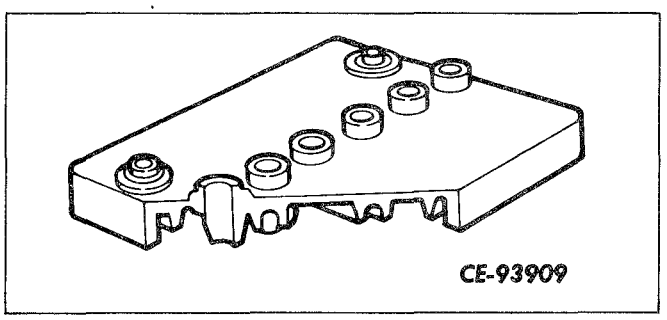


Figure 12-10
Battery Cover.

The cells are joined by heavy metal straps called cell connectors (Fig. 12-11). The positive plates of one cell are connected to the negative plates of the adjoining cell and so on. With six cells connected in series, a battery capable of generating twelve 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.

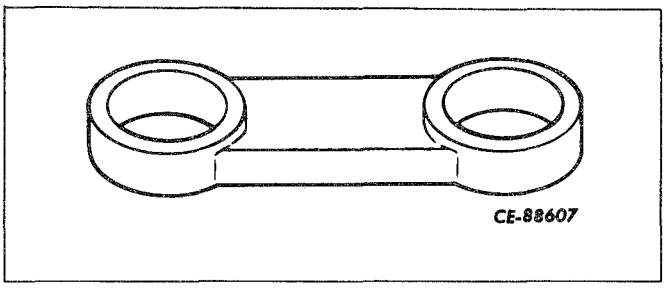


Figure 12-11
Cell Connector.

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 can 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 jell. Tighten cable clamps securely.

c. Visual Inspection - Inspect the battery case exterior for cracks or leaking electrolyte solution. Check top for cracked or missing sealing compound. Be sure battery hold-down is snug. Do not overtighten hold-down as this may result in distorting and cracking the battery case.

In addition to the above service procedures the specific gravity of the electrolyte should be checked to observe the battery state of charge. A battery hydrometer is used to check specific gravity. Use a hydrometer equipped with a thermometer, drawing the electrolyte into the tube and expelling it several times to stabilize the temperature. To obtain an accurate reading the hydrometer must be held so that the eye is on a level with the liquid surface. Draw just enough electrolyte into the hydrometer to allow the glass float to float freely in the tube. The float must not touch the top, bottom or side of the tube.

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 12-12
State of Charge Scale.

The temperature of the electrolyte has a definite effect on the specific gravity reading. To compensate for each 10° F. change above 80° F. add four (. 004) gravity points. For each 10° F. drop below 80° F. subtract four (. 004) gravity points. For example; a specific gravity reading of

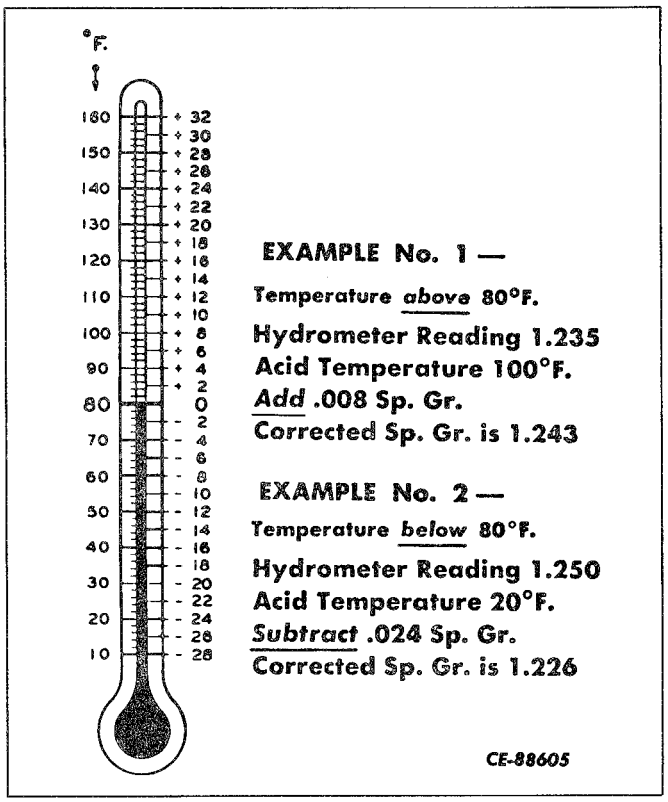


Figure 12-13
Temperature Correction Scale.

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).

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.

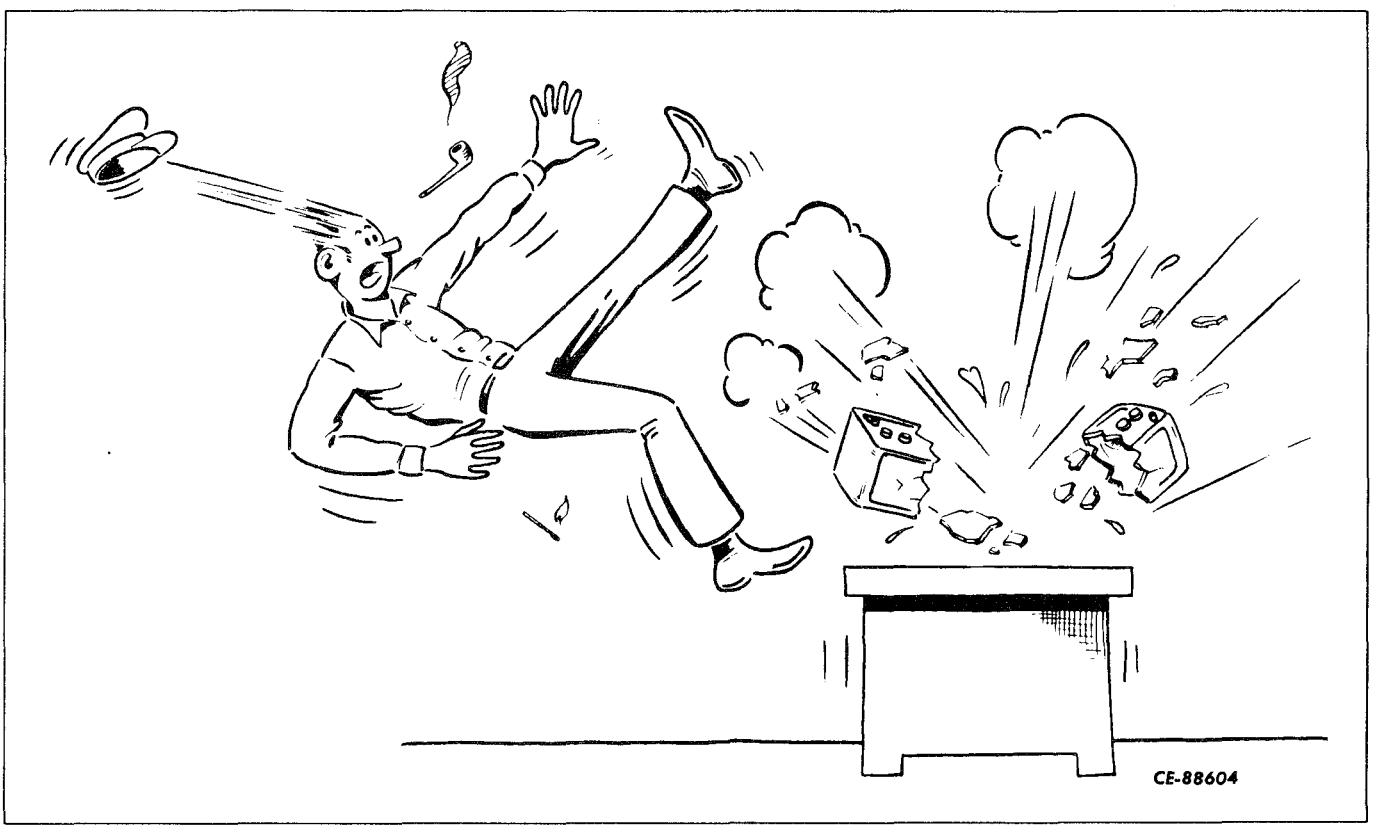


Figure 12-14

AC GENERATOR

DESCRIPTION AND OPERATION

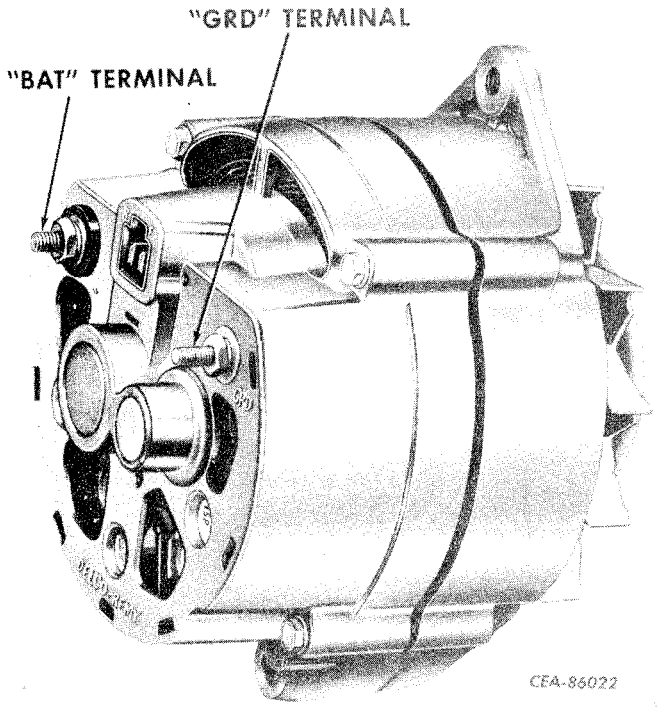


Figure 12-15
Typical Diode Rectified, AC Generator.

The AC generator (sometime 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 minumum 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. 12-15. A cross sectional view giving internal details is illustrated in Fig. 12-16.

(Continued on next page)

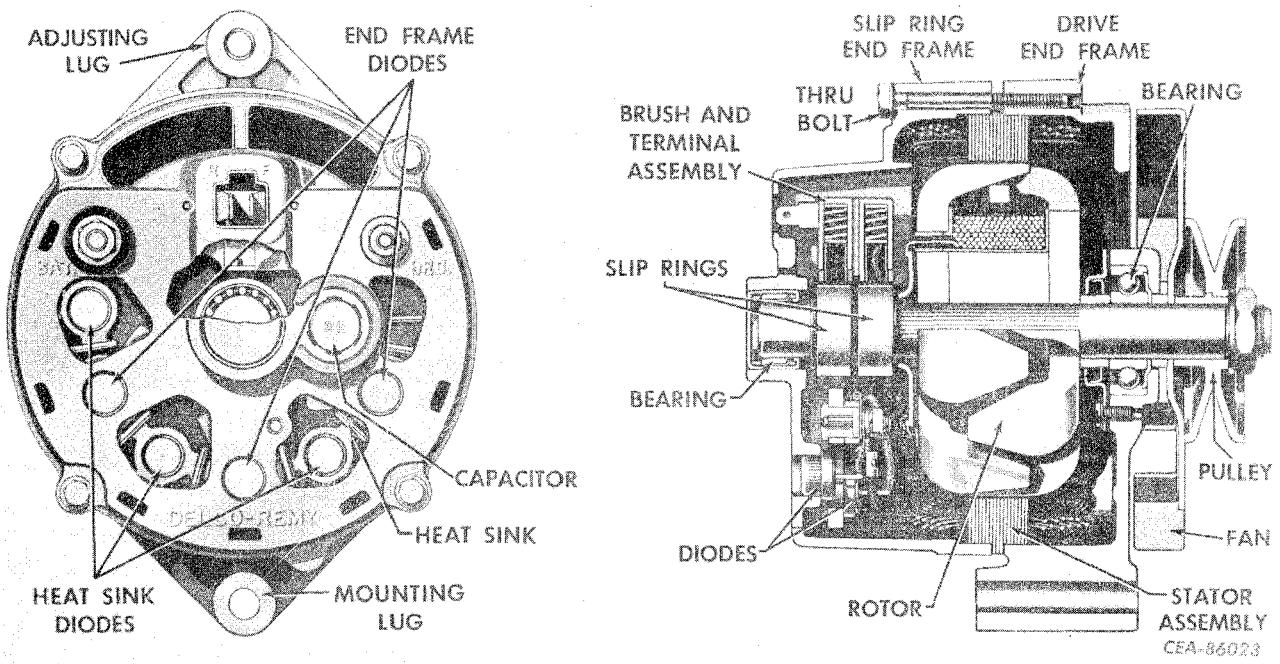


Figure 12-16
Diode Rectified, Alternating Current Generator - Cross Sectional View.

AC GENERATOR

DESCRIPTION AND OPERATION - Continued

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 the battery, its voltage must be limited. For this function a regulator is necessary in the

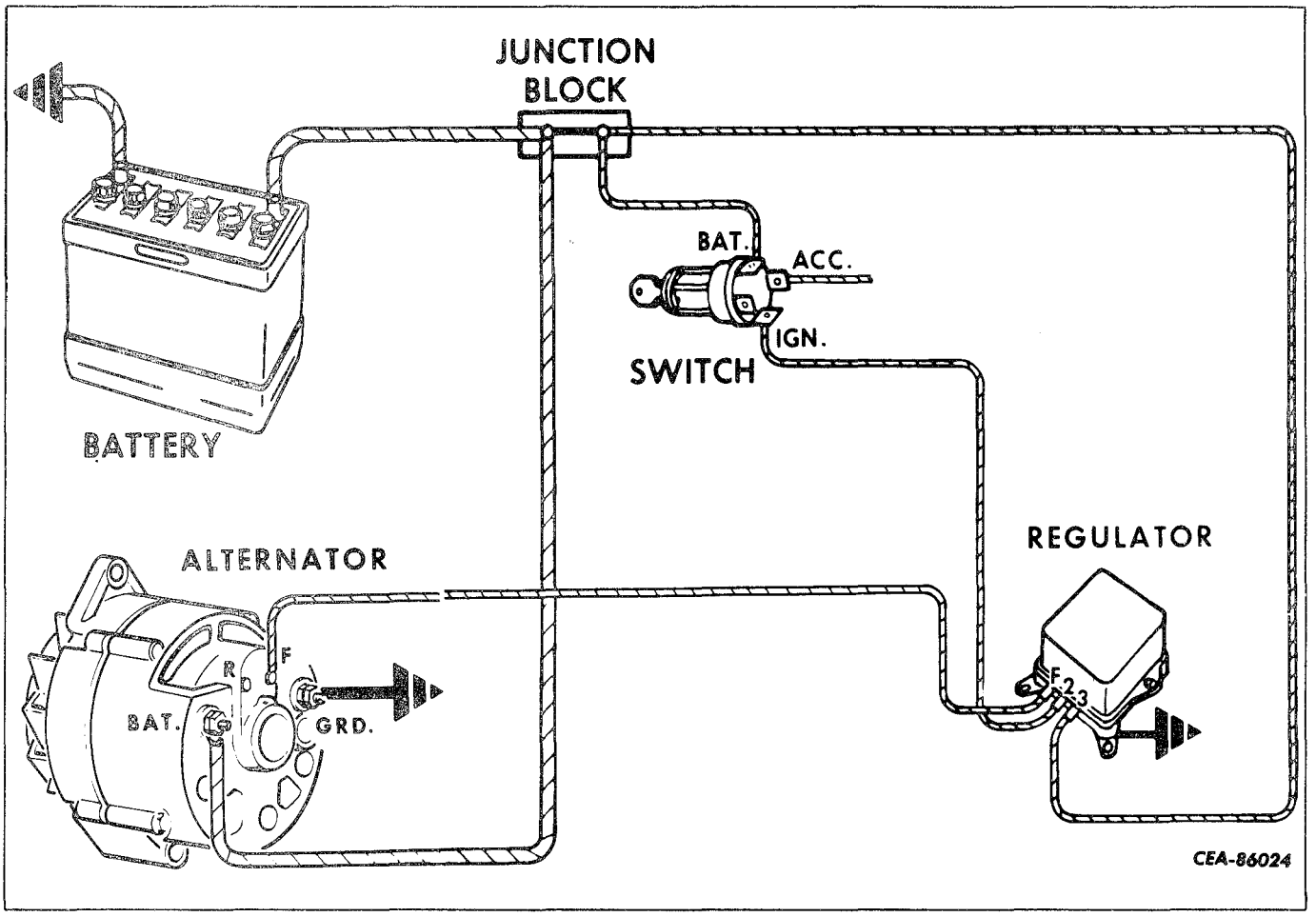


Figure 12-17
Typical Charging System.

AC GENERATOR

charging system (Fig. 12-17). 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 this section 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, and electromagnet is formed (Fig. 12-18).

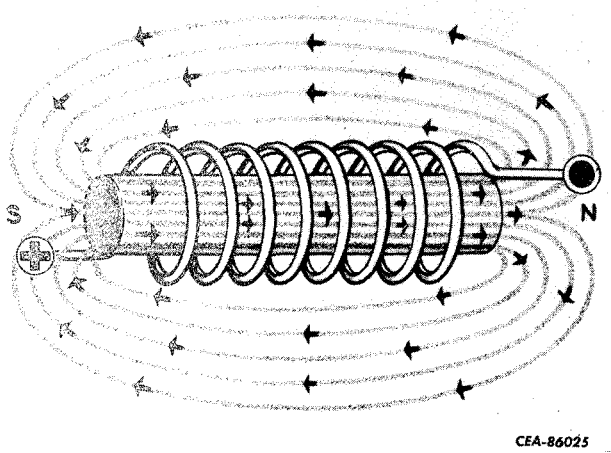


Figure 12-18
Principles of Magnetisum.

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. 12-19).

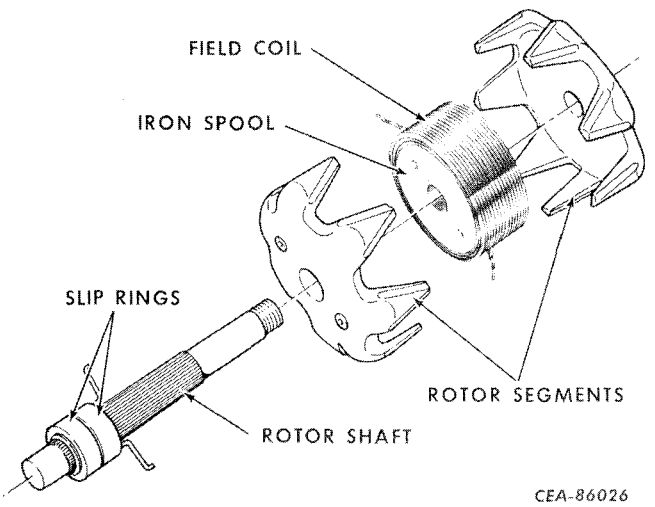


Figure 12-19
Components, AC Generator Rotor.

When battery current flows through the field coil on the 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. 12-20).

(Continued on next page).

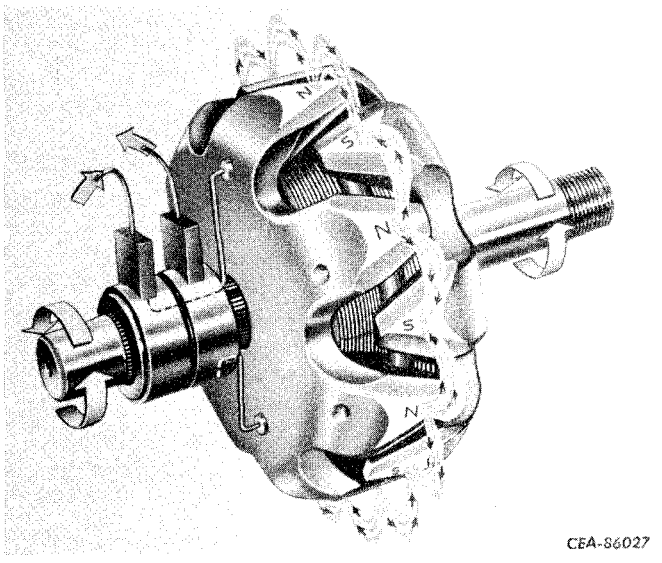


Figure 12-20
Magnetic Field Spinning with Rotor.

AC GENERATOR

DESCRIPTION AND OPERATION - Continued

STATOR

The stator or stationary winding in the AC generator is made up of many loops of wire (Fig. 12-21). 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.

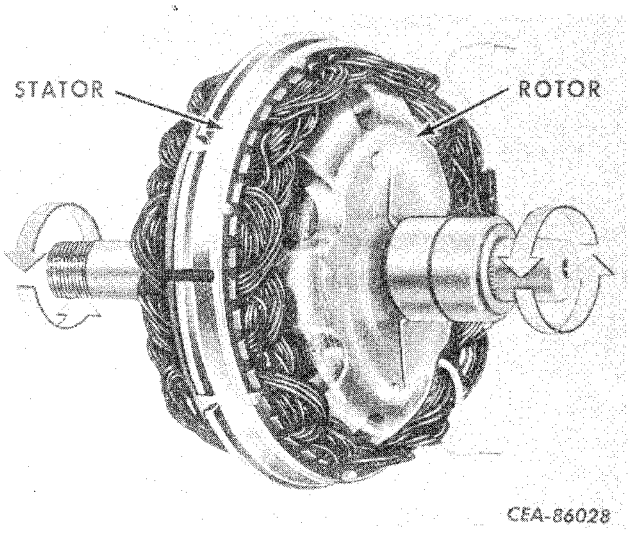


Figure 12-21
Rotor and Stator.

A simplified rotor and the most basic type of stator which is a single loop of wire is shown in Fig. 12-22. 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 produced this type of current is called an AC voltage.

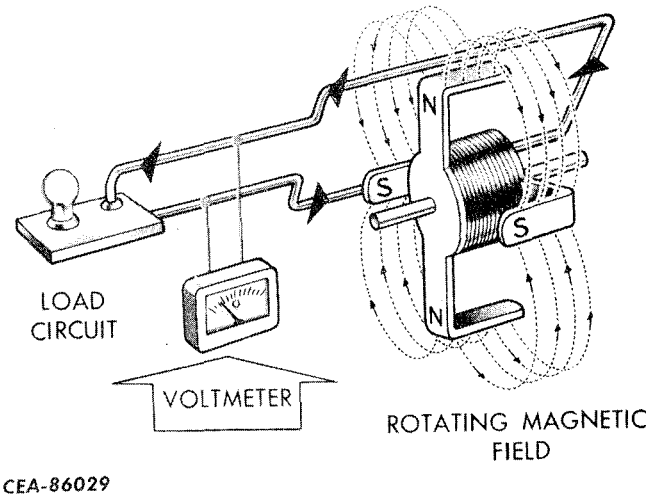


Figure 12-22
Simple AC Generator.

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. 12-23).

A diode is an electrical device which changes or rectifies alternating current (AC) to direct

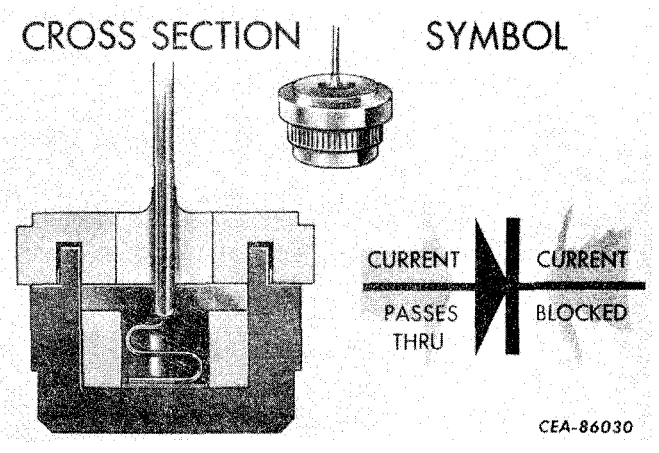


Figure 12-23
Cross Section of Rectifying Diode.

AC GENERATOR

current (DC) by allowing current to pass through 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. 12-24) 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.

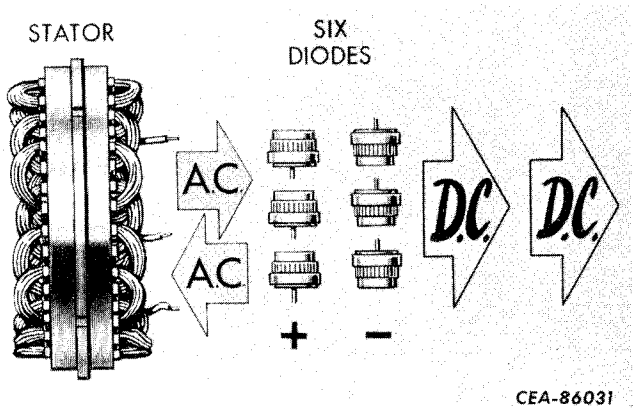


Figure 12-24
Function of Diode in the AC Generator.

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

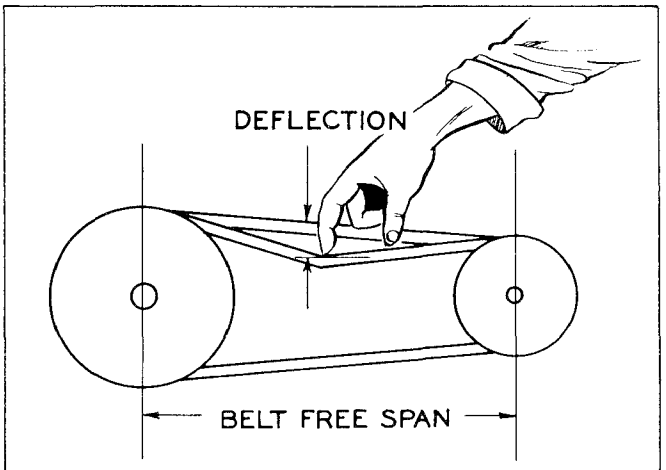
DRIVE BELT TENSION - Neglect or improper care of the alternator drive belt may result in undercharged batteries, short belt life and/or worn bearings. Overly tight belts place an additional strain on pulleys, bearings and the belts themselves. Loose belts slip, overheat and wear rapidly.

Check belt tension by depressing belt midway between drive and driven pulleys (Fig. 12-25). 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 12-25

REGULATOR

DESCRIPTION AND OPERATION

A typical double contact regulator is shown in Fig. 12-26. 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. 12-26).

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.

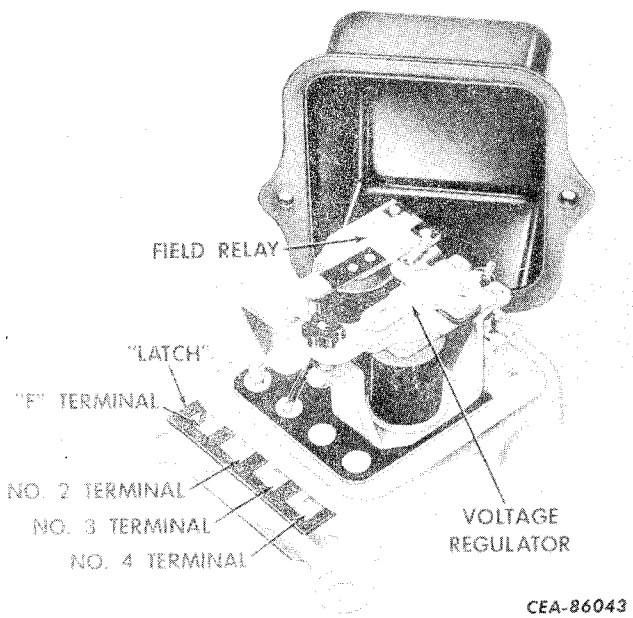


Figure 12-26
Typical Two-Unit Regulator.

This model regulator is designed for use on only one 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. 12-27.

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.

REGULATOR

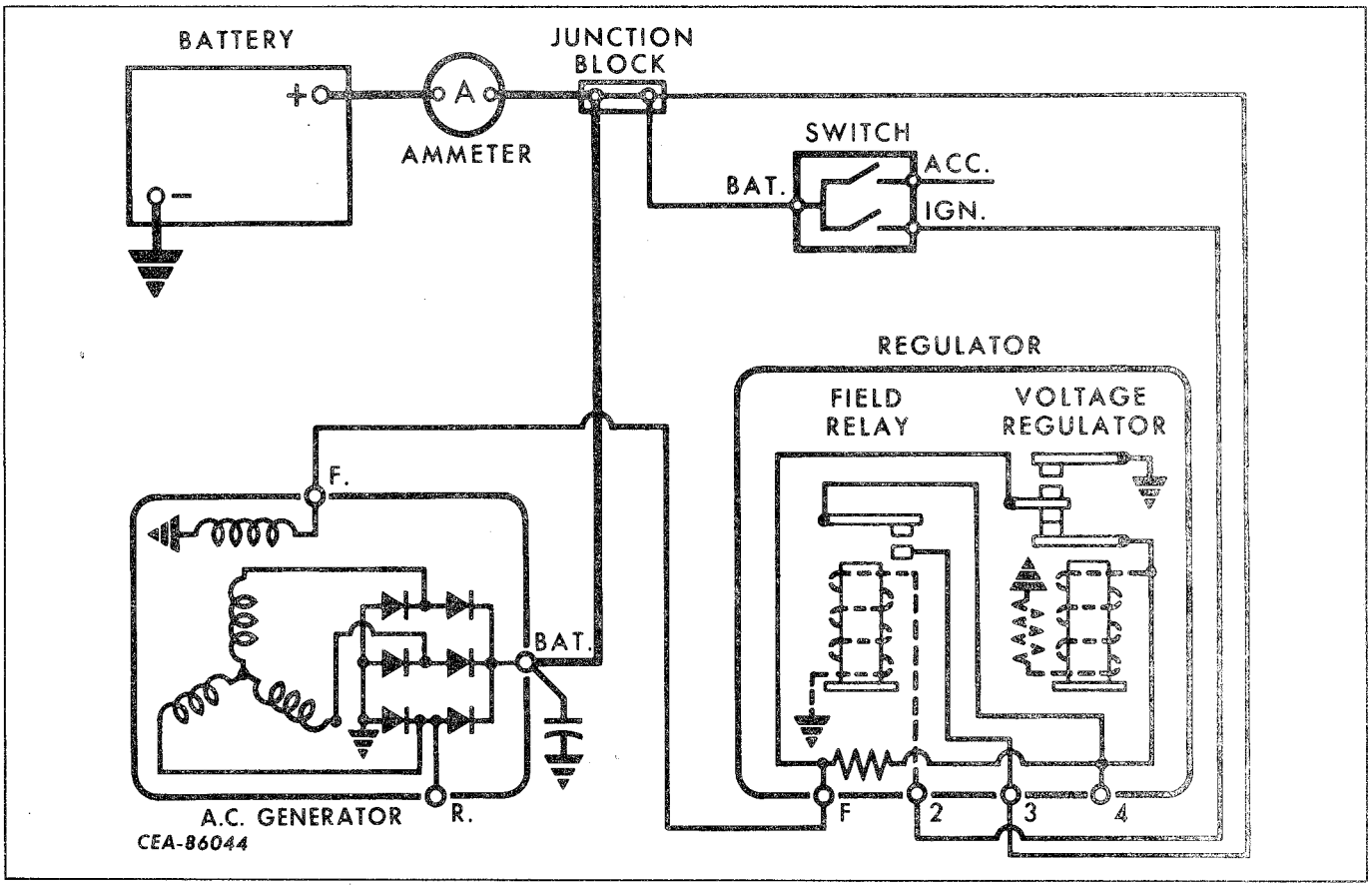


Figure 12-27
Typical Wiring Diagram with Ammeter Showing Internal Circuits.

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 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 reclose, 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.

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.

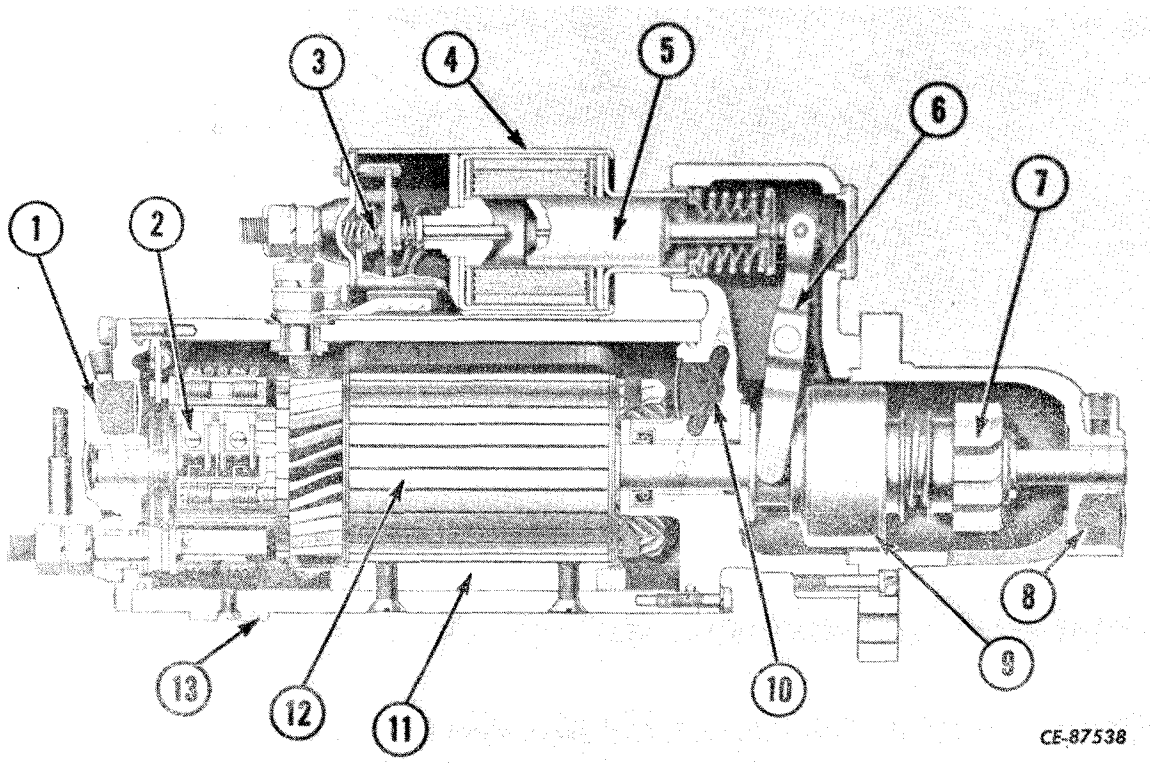


Figure 12-28
Cranking Motor - Cross Section.

1. Oil reservoir.
2. Brushes.
3. High amperage switch.
4. Solenoid housing.
5. Solenoid plunger.
6. Pivoting shift lever.
7. Pinion gear.
8. Oil reservoir.
9. Sprag clutch.
10. Oil reservoir.
11. Field winding.
12. Armature.
13. Brush inspection plate.

CRANKING MOTOR

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 motors employed on the H-30B's are equipped with overrunning clutch drive mechanisms. 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. 12-28). 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 releaves 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. 12-28). When the plunger moves to the right the shift lever draws the pinion assembly from the engage position. At the same time the plungers movement to the right breaks the contact at the high amperage switch, stopping armature rotation.

SERVICE

At 200 hour intervals the housing cover plates should be removed and accumulated dust and dirt blown out with a jet of compressed air. At the same time inspect the brushes to be sure they are in good condition and capable of another 200 hours of service.

For further service and overhaul information contact your local Delco-Remy distributor.

INSTRUMENTS

The instruments, housed in the panel and battery box assembly to the left 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 guage is proven to be defective it should be replaced.

ELECTRICAL SYSTEM

INSTRUMENTS

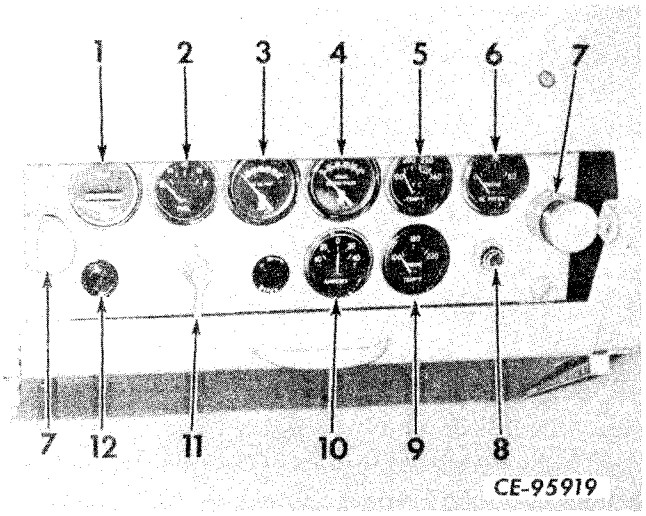


Figure 12-29
Instrumental Panel.

Legend for Figure 12-29

1. Hourmeter.
2. Fuel gauge.
*3. Hydraulic oil pressure
*4. Transmission clutch pressure.
5. Torque converter temperature.
6. Engine oil pressure.
7. Dash lamp.
8. Starter push button.
9. Engine water temperature.
10. Ammeter.
11. Ignition switch.
12. Light switch.

* Optional

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.

TROUBLE SHOOTING CHART

COMPLAINT	POSSIBLE CAUSE	REMEDY
Charge too low or no charge at all.	1. Defective battery. 2. Slipping generator drive belt. 3. Defective generator. 4. Malfunctioning regulator.	1. Replace battery. 2. Adjust drive belt. 3. Repair or replace generator. 4. Adjust or replace regulator.
Charge too high; overcharged battery.	1. Malfunctioning regulator. 2. Incorrect pulley used on generator.	1. Adjust or replace regulator. 2. Replace with pulley of correct size.
Battery uses an excessive amount of water.	1. Charging rate too high. 2. Incorrect pulley used on generator.	1. Check and adjust or replace regulator. 2. Check pulley size.
Rapid burn out of light bulbs.	1. Charging rate too high.	1. Check and adjust or replace regulator. Check pulley size.

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TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Cranking motor operates slowly or not at all.	1. Battery discharged.	1. Recharge battery.
	2. Defective cranking motor.	2. Repair or replace cranking motor.
	3. Corroded, loose or defective cables.	3. Clean, tighten or replace cables.
	4. Defective solenoid.	4. Replace solenoid.
Low or intermittent generator output.	1. Dirty or worn generator slip rings.	1. Clean or replace slip rings.
	2. Brush(es) sticking.	2. Clean brush holders thoroughly. Replace brushes if necessary.
	3. Weak brush springs.	3. Replace springs.
	4. Slipping drive belt.	4. Adjust drive belt.
	5. Malfunctioning regulator.	5. Adjust or replace regulator.
Lights dim.	1. Batteries low.	1. Charge batteries.
	2. Poor ground.	2. Provide a clean, tight ground.
	3. Loose connections.	3. Tighten all connections.
One electrical gauge not operating.	1. Bad connection at gauge, connector plug or sender.	1. Make a positive connection.
	2. Sender defective.	2. Replace.
	3. Gauge defective.	3. Replace.
Ignition "ON" - no gauges or lights working.	1. Dead battery.	1. Recharge or replace.
	2. Loose connection from battery to ammeter.	2. Tighten or correct.
	3. Broken wire between battery and ammeter.	3. Repair or replace.
Ignition "ON" - no electrical gauges working or lights operating.	1. Bad connection between ammeter, circuit breaker or ignition switch to gauges.	1. Make a positive connection.
All electrical gauges working. No lights.	1. Loose connection between ammeter and switch.	1. Tighten.
	2. Bad light switch.	2. Replace.

ELECTRICAL SYSTEM

DEFINITIONS

AMPERE - The electrical current produced by one volt acting through a resistance of one ohm.

AMPERE HOUR - A unit of measure for battery capacity, obtained by multiplying the current flow in amperes by the time in hours during which the current flows. For example, a battery delivering 3 amperes for 20 hours is rated at 60 ampere hours.

CIRCUIT - The complete path of an electrical current including, usually, the generating device. The complete path is referred to as a closed circuit. If the continuity is broken it becomes an open circuit.

FIELD - The lines of force set up by a permanent or electromagnet.

GROUND - The conducting body used as a common return for an electric circuit.

OHM - The resistance of a circuit in which a potential difference of one volt produces a current of one ampere.

POLARITY - The particular state, either positive or negative with regard to electrification.

RESISTANCE - The opposition offered by a substance or body, to the passage through it of an electric current.

VOLT - The electromotive force which steadily applied to a conductor whose resistance is one ohm, will produce a current of one ampere.

WATT - The work done by one ampere of current under one volt of pressure.

WATT-HOUR - The unit of electrical energy obtained by multiplying the ampere hour output by the average voltage during the discharge. Watt-hours = volts x amperes x hours.

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SECTION XIII

BRAKE SYSTEM

Page

SECTION XIII BRAKE SYSTEM

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GENERAL INFORMATION

DESCRIPTION

The loader hydraulic brake system (Fig. 13-1) includes the master brake cylinder, wheel cylinders and interconnecting tubing. The master cylinder responds to the amount of controlling manual force applied at the brake pedal and supplies hydraulic pressure through the connecting lines to the wheel cylinders.

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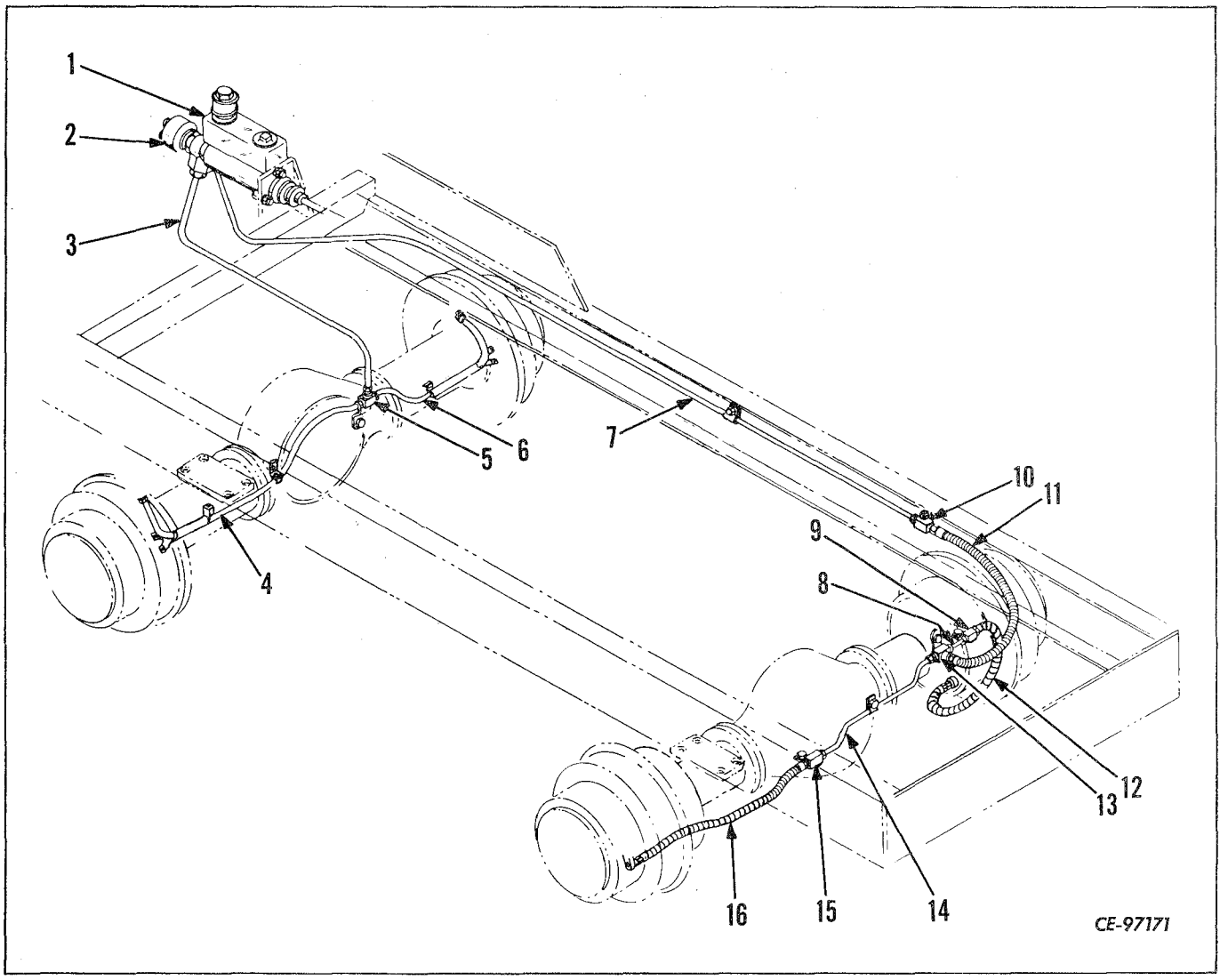

Figure 13-1
Brake System (Four Wheel Drive Shown).

1. Brake master cylinder.
2. Stop light switch.
3. Cylinder-to-tee tube.
4. Tee-to-wheel cylinder tube.
5. Tee.
6. Tee-to-wheel cylinder tube.
7. Cylinder-to-coupling tube.
8. Tee-to-coupling tube.
9. Coupling.
10. Coupling.
11. Coupling-to-tee hose.
12. Coupling-to-wheel cylinder hose.
13. Tee.
14. Tee-to-coupling tube.
15. Coupling.
16. Coupling-to-wheel cylinder hose.

BRAKE SYSTEM

GENERAL INFORMATION

DESCRIPTION-Continued

Unless a connecting line is blocked, the pressure rise is equal throughout the hydraulic system because of the natural movement of incompressible brake fluid in the sytem. Hydraulic pressure exerted at the wheel cylinders, forces the cylinder pistons apart and causes the brake shoes to press against the wheel brake drums.

Any air bubbles trapped in the sealed system will absorb this fluid movement by compressing when under pressure. The result is a "spongy pedal" feel. When this condition exists the brake system must be bled to remove air or other gases. A solid column of brake fluid must exist throughout the system to maintain proper service brake operation.

PREVENTIVE MAINTENANCE

CHECK FLUID LEVEL IN MASTER CYLINDER

Hydraulic brake system maintenance requires frequent checking of the brake fluid level in the master cylinder. Inability to maintain the proper fluid level usually indicates a system leak. Be sure that the brake fluid level is within 1/2 inch of the bottom of the filler hole. If make up fluid must be added, use the type hydraulic fluid indicated in "LUBRICANTS AND CAPACITIES" under "SERVICE INFORMATION."

Brake fluid should be changed if, in comparison to fresh fluid, it is darker, has a watery feeling, is almost oderless and lacks a thin lubricating film when rubbed between the fingers. Drain and flush the system when the fluid is no longer suitable for further use.

BRAKE SYSTEM FLUSHING

Drain the system by opening the bleeder screw at each wheel in turn and pump the brake pedal slowly until fluid is no longer forced from the system.

Remove the master cylinder filler cap and fill the reservoir with clean denatured alcohol. Pump the flushing agent through the lines, as in draining, by pumping the pedal slowly. Open each wheel cylinder bleeder screw, in turn, until the passage of clean fluid indicates the lines are clean. Repeat this process with clean brake fluid to force all the alcohol from the system. Fill the master cylinder reservoir with fresh brake fluid and bleed air from the service brake system.

BRAKE CARE

The wheel brake assemblies should be cleaned, inspected, lubricated and adjusted each time the wheel hubs and brake drums are removed.

BRAKE ADJUSTMENT

Refer to "ADJUSTMENTS" under "SERVICE INFORMATION."

CHECK PARKING BRAKE FOR WEAR

The parking brake should always be adjusted to draw up tight when it is applied. Minor adjustments can be made with the cap on the parking brake lever in the operator's compartment.

REQUIRED TOOLS

Standard Mechanics Hand Tool Set.
Torque Wrench - 0-500 ft. lbs. rating.

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DISASSEMBLY, INSPECTION AND ASSEMBLY

BRAKE MASTER CYLINDER

DISASSEMBLY AND ASSEMBLY

Disassemble the cylinder in numerical order.

Clean and inspect parts. Refer to "Inspection" in this section.

Replace parts: 6, 9, 12, 13, 14, 15, 21, 22, 23.

* - Serviced as a complete assembly only.

Assemble in reverse order.

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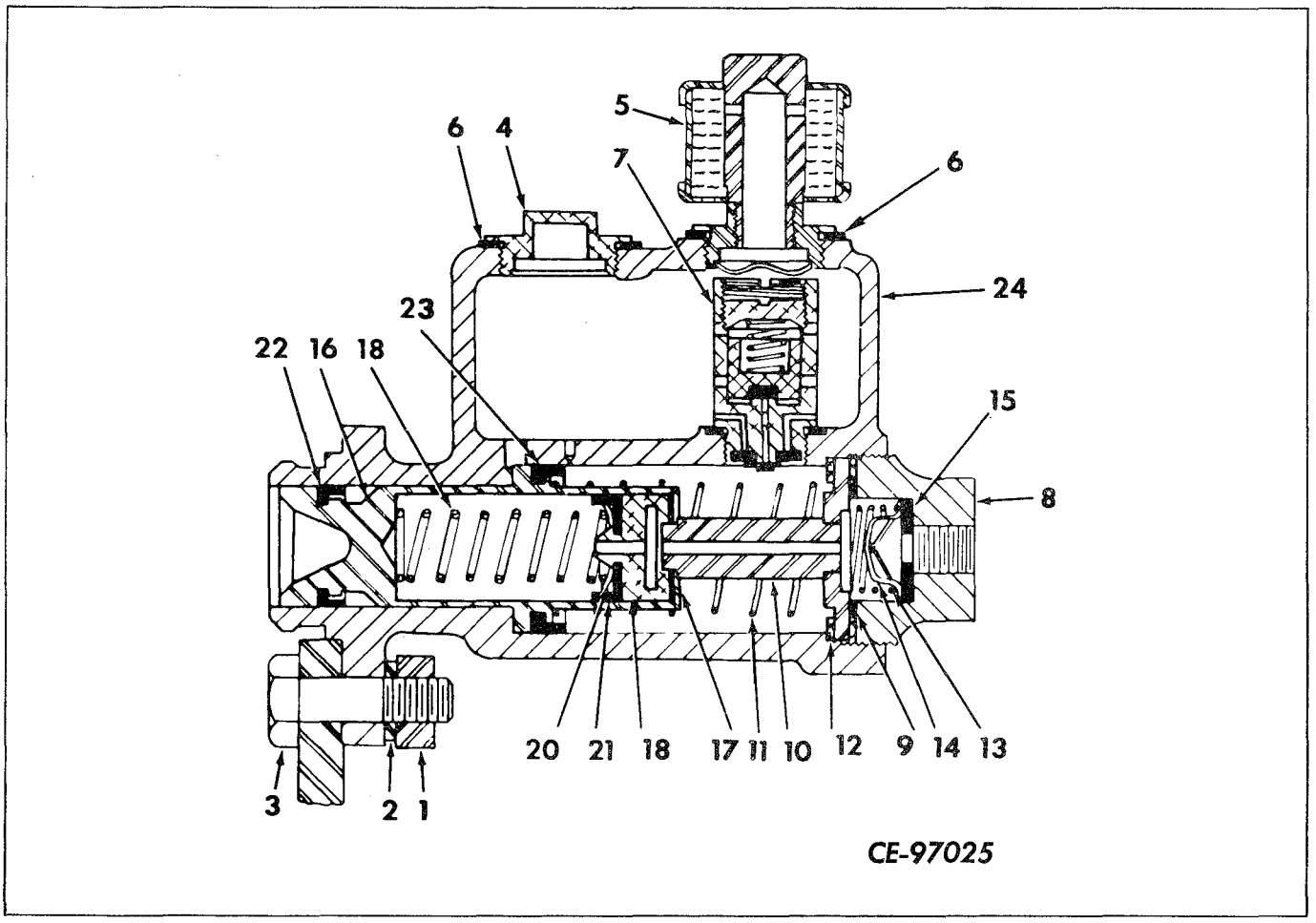

Figure 13-2
Brake Master Cylinder.

1. Nut (3).
2. Lock washer (3).
3. Cap screw (3).
4. Filler plug.
5. Filter plug assembly.
6. Nonmetallic washer (2).
7. Relief valve assembly.
8. End plug.
9. Nonmetallic washer.
10. Primary piston.
11. Spring.
12. Gasket (2).
13. Spring.
14. Check valve.
15. Check valve seat.
16. Secondary piston.
17. Retaining ring.
18. Floating valve.
19. Spring.
20. Cup retainer.
21. Primary cup.
22. Secondary cup.
23. Secondary cup.
24. Master cylinder body.

DISASSEMBLY, INSPECTION AND ASSEMBLY

BRAKE MASTER CYLINDER- Continued

INSPECTION

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.

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.

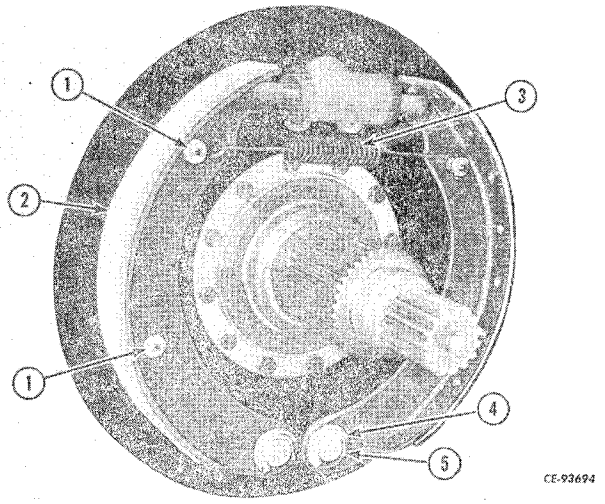

Figure 13-3

Remove the retainer (1, Fig. 13-4), felt washer (2), flat washer (3), flat washer (6) and spring (7). Remove the cap screws (4) securing the oil scavenger (5) and backing plate (8) to the axle. Remove the scavenger and plate.

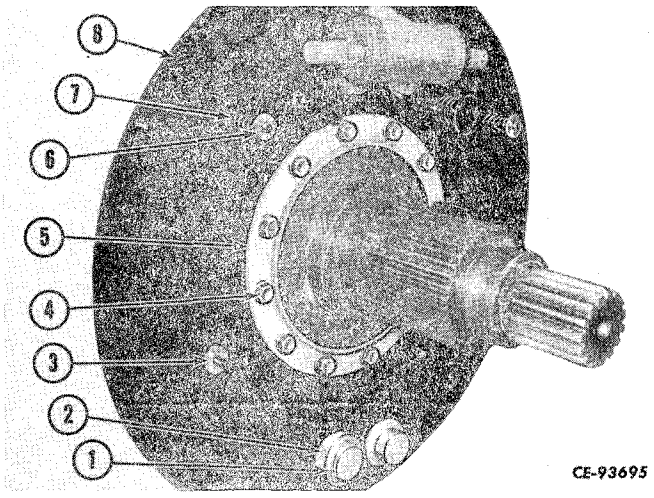

Figure 13-4

WHEEL BRAKES- SINGLE CYLINDER TYPE

REMOVAL

Disassemble the axle as far as necessary to remove the brake components. Disconnect the hydraulic line from the wheel cylinder.

DISASSEMBLY

With a brake spring pliers, remove the brake shoe return spring (3, Fig. 13-3). Remove the "C" washers (5) and flat washers (4). Remove the "C" washers (1) and flat washers. Remove the brake shoes (2).

Remove the nut (1, Fig. 13-5) and unscrew the anchor pin (2). Remove the cap screws (3) that secure the cylinder (4) to the backing plate.

DISASSEMBLY, INSPECTION AND ASSEMBLY

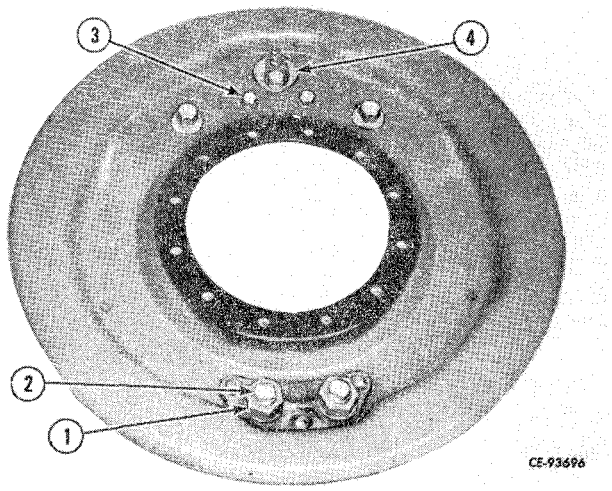

Figure 13-5

Remove the rods (1, Fig. 13-6) and boots (2). Slide the pistons (3) cups and spring (6) from the cylinder (5).

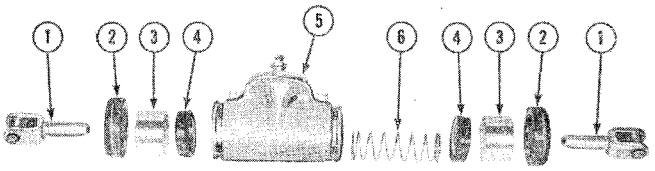

Figure 13-6

INSPECTION

Clean and inspect the brake assembly parts as follows:

a. Clean all metal parts in a good grade cleaning solvent. Use compressed air to dry parts.

b. Inspect the wheel cylinder cups and pistons for signs of wear or cracking. Replace any defective parts.

c. Inspect the wheel cylinder for scoring or damage. Hone the cylinder if scored.

d. Inspect the boot. Replace if defective.

e. Inspect the anchor pins for wear or misalignment. Inspect the brake shoes for wear at the anchor pin holes.

f. Inspect the lining and drums for wear. Replace worn linings as described under "BRAKE RELINING."

BRAKE RELINING

Reline the brake shoes as follows:

a. Punch out rivets and remove linings from shoes.

NOTE: Lining and shoe contact faces should be clean before clamping lining in position. Rivets of the correct body diameter, head size and shape, length, and material must be used.

b. Clamp the lining to the brake shoe with C-clamps so the rivet holes in both pieces are in alignment.

c. Make certain the lining is firmly clamped to the shoe, locating the C-clamps as close to the rivet holes as possible.

d. Using a rivet press, install the rivets in Fig. 13-7 following the sequence shown.

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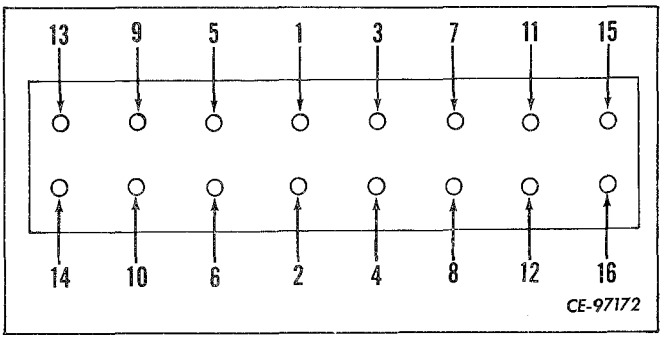

Figure 13-7

DISASSEMBLY, INSPECTION AND ASSEMBLY

WHEEL BRAKES- SINGLE CYLINDER TYPE - Continued

ASSEMBLY

Dip the wheel cylinder cups, pistons and spring in hydraulic brake fluid before assembly.

Slide the spring (6, Fig. 13-6), cups (4) and pistons (3) into the bore of the cylinder (5). Install the boots (2) and rods (1).

Install the cylinder (4, Fig. 13-5) on the backing plate and secure with the cap screws (3). Install the anchor pins (2) and secure with the nut (1).

Install the backing plate (8, Fig. 13-4) and oil scavenger (5) on the axle and secure with the cap screws (4). Install the spring (7), flat washer (6) flat washer (3), felt washer (2) and retainer (1).

Torque: _____

Install the brake shoes (2, Fig. 13-3). Install the washers (4) and "C" washers (5). Install the washers (1) and "C" washers. Using a brake spring pliers, install the spring (3).

INSTALLATION

Connect the hydraulic line to the wheel cylinder. Assemble the axle components. Bleed the hydraulic brake circuit as described under "ADJUSTMENTS." Adjust the brake lining to drum clearance as described under "ADJUSTMENTS."

WHEEL BRAKES-DOUBLE CYLINDER TYPE

REMOVAL

Disassemble the axle as far as necessary to remove the brake components. Disconnect the hydraulic line from the top wheel cylinder.

DISASSEMBLY

Remove the lock wires (1, Fig. 13-8), nuts (2), washers (3) and cap screws. Remove the shoe and lining assemblies (4).

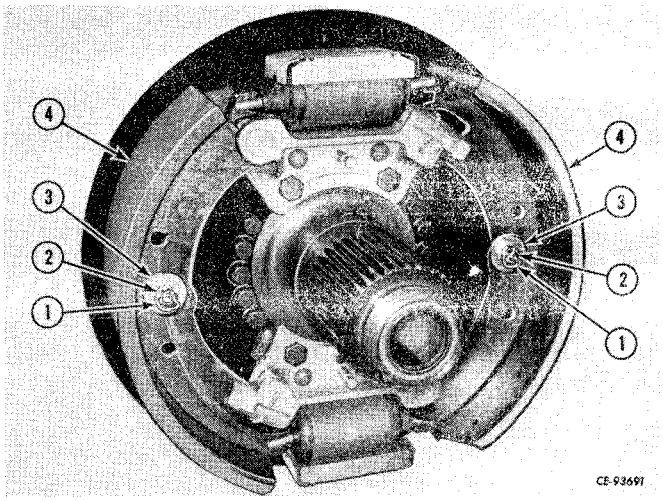

Figure 13-8

Remove the screw (6, Fig. 13-9) and spring (4). Slide adjusting screw (5) out and remove the adjusting wheel (3). Remove the cap screws and lock washers securing the cylinder (2). Remove the anchor pins (1).

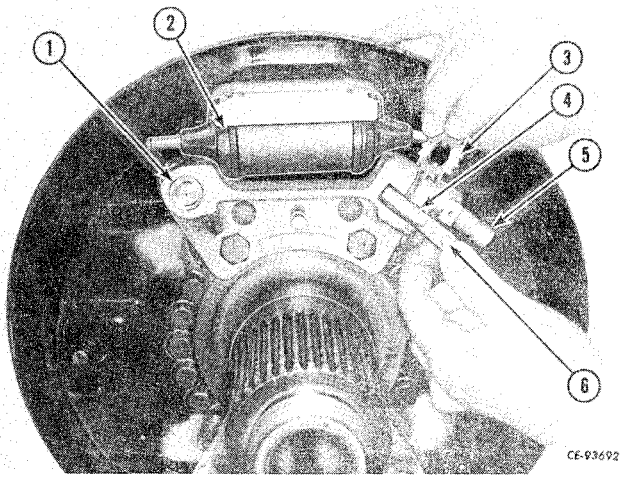

Figure 13-9

Remove the cover (5, Fig. 13-10), rods (1) the boots (2). Slide the pistons (3), cups (4) and spring (7) from the cylinder (6).

DISASSEMBLY, INSPECTION AND ASSEMBLY

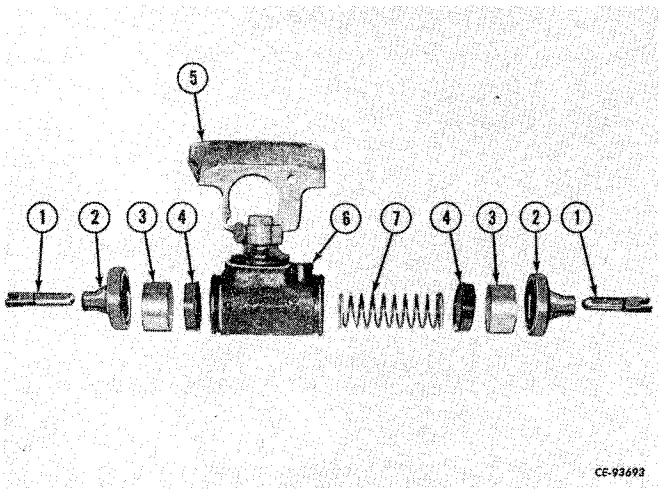

Figure 13-10

INSPECTION

Clean and inspect the brake assembly parts as follows:

a. Clean all metal parts in a good grade cleaning solvent. Use compressed air to dry parts.

b. Inspect the wheel cylinder cups and pistons for signs of wear or cracking. Replace any defective parts.

c. Inspect the wheel cylinder for scoring or damage. Hone the cylinder if scored.

d. Inspect the boot. Replace if defective.

e. Inspect the anchor pins for wear or misalignment. Inspect the brake shoes for wear at the anchor pin holes.

f. Inspect the lining and drums for wear. Replace worn linings as described under "BRAKE RELINING."

BRAKE RELINING

Reline the brake shoes as follows:

a. Punch out rivets and remove linings from shoes.

NOTE: Lining and shoe contact faces should be clean before clamping lining in position. Rivets of the correct body diameter, head size and shape, length, and material must be used.

b. Clamp the lining to the brake shoe with C-clamps so the rivet holes in both pieces are in alignment.

c. Make certain the lining is firmly clamped to the shoe, locating the C-clamps as close to the rivet holes as possible.

d. Using a rivet press, install the rivets in Fig. 13-11 following the sequence shown.

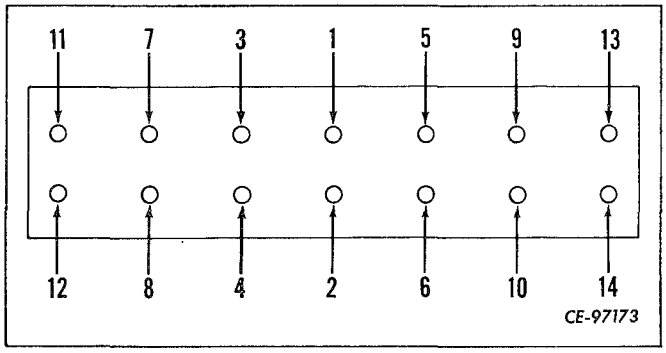

Figure 13-11

ASSEMBLY

Dip the wheel cylinder cups, pistons and spring in hydraulic brake fluid before assembly.

Slide the spring (7, Fig. 13-10) cups (4) and pistons (3) in to the bore of the cylinder (6). Install the boots (2), rods (1) and cover (5).

Install the cylinder (2, Fig. 13-9) and secure with the cap screws and lock washers. Install the anchor pins (1). Install the wheel (3) and slide the adjusting screw (5) into the wheel. Install the spring (4) and secure with the screw (6).

Install the brake shoes (4, Fig. 11-8) and secure with the cap screws, washers (3), nuts (2) and lock wires (1).

(Continued on next page)

DISASSEMBLY, INSPECTION AND ASSEMBLY

WHEEL BRAKES-DOUBLE CYLINDER TYPE - Continued

INSTALLATION

Connect the hydraulic line to the top wheel cylinder. Assemble the axle components. Bleed the hydraulic brake circuit as described under "ADJUSTMENTS." Adjust the brake lining to drum clearance as described under "ADJUSTMENTS."

BRAKE LINES AND ACCESSORIES

The brake hydraulic lines should be inspected periodically for signs of wear or damage. Inspect the tube fittings for leakage. Replace any lines or fittings found to be defective. Care should be taken when installing brake lines that they are not crimped or bent too sharply.

PARKING BRAKE

GENERAL

Prepare the tractor for disassembly of the parking brake as follows:

a. Park the tractor on a level surface.

b. Block the tractor wheels to prevent the tractor from rolling.

DISASSEMBLY

Remove the cap screws that secure the transmission-to-differential drive shaft to the transmission (if equipped).

Disconnect the parking brake linkage from the operating cam lever.

Hold the output flange and brake drum assembly (3, Fig. 13-12) and remove the hex nut (2) and flat washer (1). With a suitable puller, remove the output flange and brake drum assembly.

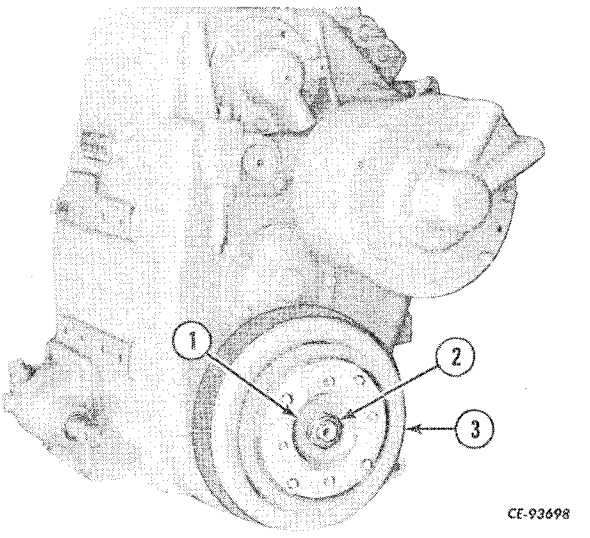

Figure 13-12

With brake spring pliers, remove the brake return springs (5, Fig. 13-13). Remove the brake shoes (1 and 2).

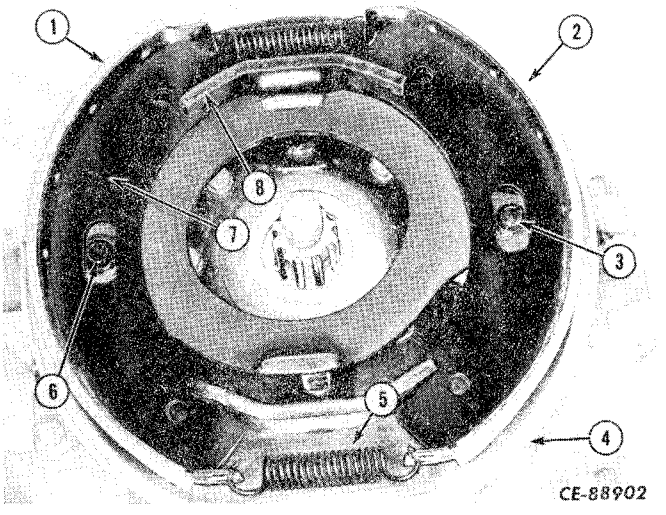

Figure 13-13

Remove the brake actuating lever (3, Fig. 13-14) and roller (2).

DISASSEMBLY, INSPECTION AND ASSEMBLY

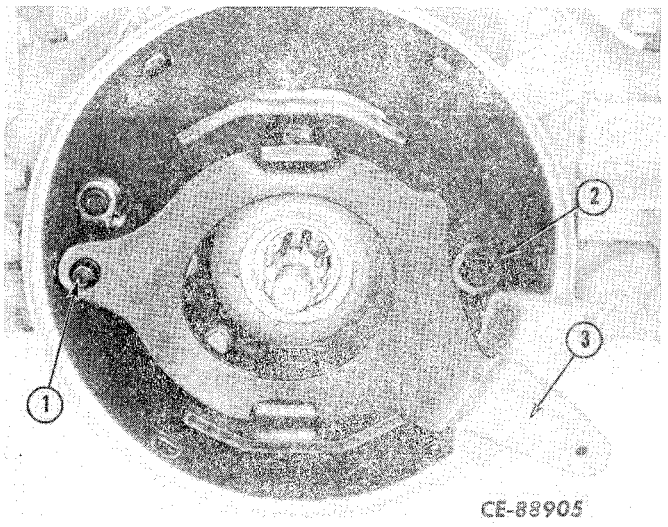

Figure 13-14

Remove the roller (3, Fig. 13-15). Remove the cap screws and lock washers that retain the brake backing plate (1). Remove the plate.

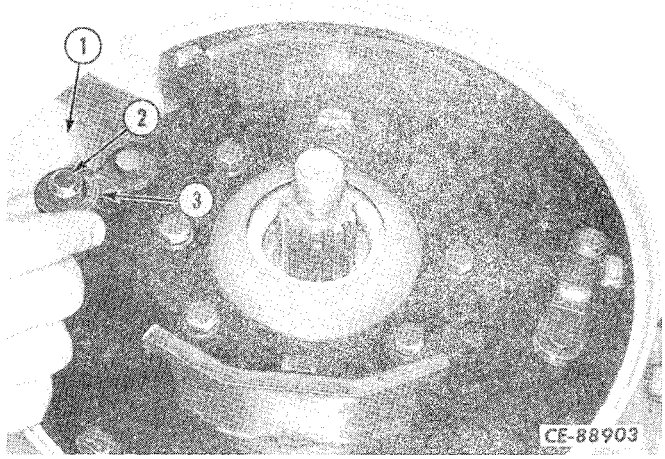

Figure 13-15

INSPECTION

Clean and inspect all parts as follows:

a. Inspect the brake linings and drum for wear. Replace worn linings as described under "BRAKE RELINING."

b. Clean all parts in solvent. Use compressed air to dry parts.

c. Lubricate the actuating parts of the brake (operating cam lever, roller, pawls) with chassis grease.

d. Inspect the parking brake parts for signs of wear or damage. Replace any parts found to be defective.

BRAKE RELINING

Reline the parking brake shoes as follows:

a. Punch out the rivets and remove the old lining from the shoe.

b. Clamp the new lining to the shoe so that the rivet holes in both pieces are in alignment. Use a C-clamp and locate it as near the rivet holes as possible.

NOTE: The lining and shoe contact faces should be clean before assembling. Rivets of the correct size and shape must be used.

c. Drive the rivets squarely into the holes with a flat head punch.

d. Form the rivets heads with the correct rivet set, following the sequence shown in Fig. 13-16.

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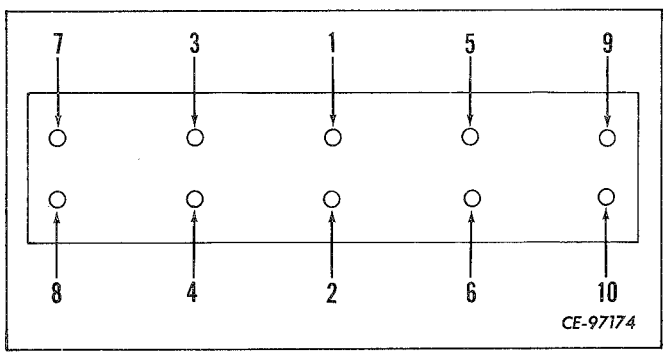

Figure 13-16

DISASSEMBLY, INSPECTION AND ASSEMBLY

PARKING BRAKE - Continued

ASSEMBLY

Position the backing plate (1, Fig. 13-15) on the transmission and secure with the cap screws and lock washers. Tighten the cap screws to the recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

Place the roller (3) on the brake pawl (2) nearest the cutout in the backing plate (1).

Install the parking brake actuating lever (3, Fig. 13-14). Position lever on left hand brake pawl (1). Roller (2) on right hand pawl must ride on upper edge of lever.

Position brake shoes (1, 2, Fig. 13-13) on pawl pins (3, 6) with web of shoes (7) under guide brackets (8).

With brake spring pliers, install brake return springs (5). Install springs in brake shoe holes nearest backing plate (4).

Install the output flange and drum assembly (3, Fig. 13-12) on the output shaft splines and secure with the washer (1) and nut (2). Tighten nut to recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

Connect the parking brake linkage to the operating cam lever.

Install the transmission to differential drive shaft and secure with the cap screws.

Adjust the parking brake linkage as described under "PARKING BRAKE LINKAGE" in the "LINKAGE" section.

TROUBLE SHOOTING

The following chart 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.

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TROUBLE SHOOTING

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. Effect of rust, corrosion, frozen link, bind or interference.	1. Correct condition found. a. Use type fluid recommended under "Lubricants." b. Use correct type lining. 2. a. Overhaul cylinder. b. Replace. 3. Correct condition found. a. Free, clean, replace defective parts.
Low pedal (reserve).	1. Worn lining. 2. Excess pedal lash. 3. Air or gas 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 wheel cylinders. 3. Fluid seepage at hydraulic lines under pressure.	1. Overhaul cylinders. 2. Overhaul wheel cylinder. 3. Replace defective lines.
"Spongy" or "springy" pedal.	1. Fluid low in master cylinder reservoir. 2. Fluid leaks at tubes, connections and wheel cylinders.	1. Add make-up fluid. 2. Tighten connections and replace defective parts.
Brake(s) drags or locks at all wheels.	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.

(Continued on next page)

BRAKE SYSTEM

TROUBLE SHOOTING

COMPLAINT	POSSIBLE CAUSE	REMEDY
Brake(s) drags or locks at one wheel.	1. Excess internal wheel cylinder friction caused by swollen cup.	1. Replace.
	2. Seized wheel cylinder piston.	2. Overhaul, replace defective part.
	3. Rust and corrosion.	3. Flush system.
	4. Wheel cylinder leaking.	4. Overhaul or replace wheel cylinder.
	5. Worn wheel bearings.	5. Replace defective parts.
Severe stops sensitive pedal, "grab," "dive." ("Grab" may be noticed if only one brake is affected.)	1. Shoe linings friction too high.	1. Correct condition.
	2. Condensation due to effect of moisture overnight.	2. Apply brakes several times under light load to dry out linings.
	3. Improper new lining fit.	3. Correct.
	4. Wheel cylinder leaking.	4. Repair or replace cylinder.
	5. Improper shoe alignment due to loose or distorted backing plate or anchor. Weak retraction springs or hold-downs.	5. Inspect brake assemblies. Replace defective parts.
	6. Brake drums out-of-round or out-of-square.	6. Check brake drums.

PARKING BRAKE

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.

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SERVICE INFORMATION

SPECIFICATIONS

WHEEL BRAKES

Make	Wagner Electric
System Type	Sealed, Hydraulic, Adjustable
Brake Type	Two Shoe, Internal Expanding
Diameter	
Single cylinder type	16 in.
Double cylinder type	15 in.
Lining Width	
Single cylinder type	2-1/4 in.
Double cylinder type	3 in.

MASTER CYLINDER

Make	Minnesota Automotive
Type	Hydraulic, Piston

PARKING BRAKE

Make	Rockwell Standard
Type	Mechanical
Lining Width	1-1/2 in.

LUBRICANT

Hydraulic Brake Fluid	IH Heavy Duty or SAE 70R3

SPECIAL TORQUES

Brake backing plate mounting	
7/16" nuts	35 ft-lbs.
3/8" cap screws	33-37 ft-lbs.
Parking brake backing plate mounting cap screws	33-37 ft-lbs.
Transmission output shaft nut	300 ft-lbs.
Wheel cylinder-to-backing plate	
5/16" cap screws	19-21 ft-lbs.
3/8" cap screws	33-37 ft-lbs.

SERVICE INFORMATION

ADJUSTMENTS

BLEED HYDRAULIC BRAKE CIRCUIT

Air trapped in the hydraulic lines will decrease the loader braking effort. To ensure safe operation, the hydraulic brake lines should be bled whenever it is suspected that air or gas is trapped in the lines. Air is most likely to enter the brake system through a leak, when a line is disconnected or when there is an insufficient amount of brake fluid.

Whenever air is trapped in the system, the feel at the brake pedal is "spongy" and full braking pressure cannot be applied. 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 is to start at the master cylinder and then bleed the wheel cylinders.

The following general procedure may be used:

a. Remove accumulated dirt from the master cylinder cap, remove the cap and fill the cylinder reservoir to within 1/2 inch of the filler hole. Use fresh brake fluid and keep the reservoir filled during bleeding operations.

b. Install a bleeder hose, if available, on a wheel cylinder bleeder screw.

NOTE: Start with the wheel cylinder farthest from the master cylinder. The wheel cylinder closest to the master cylinder should be last.

Submerge the loose end of the bleeder hose in a clear glass jar containing brake fluid.

c. Open the bleeder screw one turn and slowly depress the brake pedal the full limit of its stroke. Repeat this procedure until no bubbles escape from the bleeder hose. Then close the bleeder screw. If a bleeder hose is not used, close the bleeder screw before releasing the pedal.

d. Repeat this procedure for the remaining wheels.

Continually check the fluid level in the master brake cylinder. The cylinder must be kept at least half full of brake fluid at all times while bleeding. After bleeding the system, make sure the cylinder is filled to within 1/2 inch of the filler hole.

BRAKE PEDAL

Adjust the brake pedal at the clevis on the master cylinder push rod to obtain a 1/4 - 1/2 inch "free-play" at the beginning of pedal travel. Refer to Fig. 13-17. Lack of "free-play" in the pedal assembly will block the by-pass port in the master brake cylinder and, after several brake applications, the brake shoes will drag against the brake drums. Additional "free-play" will decrease the usable stroke of the master cylinder piston.

Loosen the clevis lock nut and thread the push rod into or out of the clevis as required to secure the correct adjustment at the pedal. Be careful not to damage the rubber boot. Check that the pedal return spring is properly installed and is capable of holding the pedal assembly in the full release position.

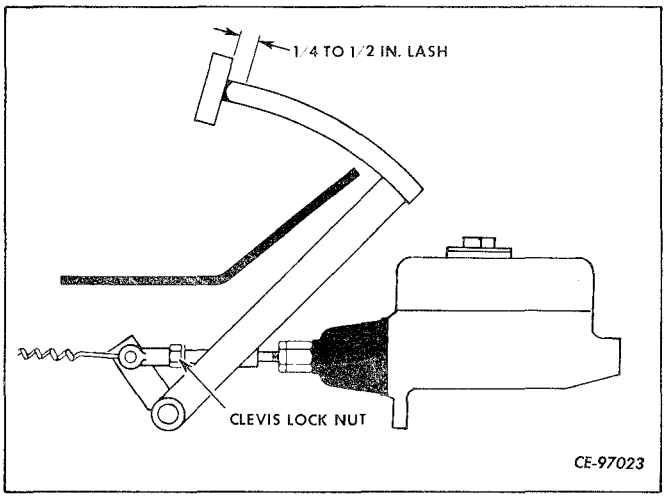

Figure 13-17

SERVICE INFORMATION

WHEEL BRAKES - STAR WHEEL TYPE

Block the wheels and axle cradle. Raise the end of the tractor so the wheels clear the ground.

Remove the adjusting slot covers (Fig. 13-18) on a brake backing plate.

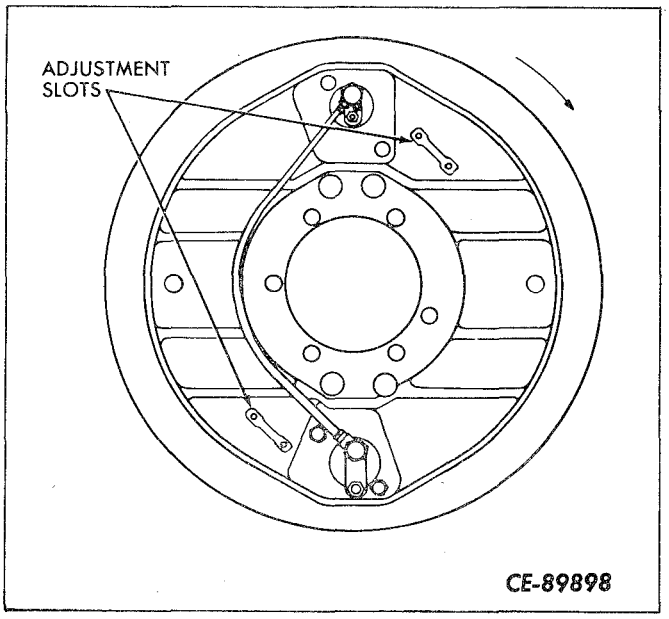

Figure 13-18

Adjust one shoe at a time. Rotate the wheel being adjusted. Adjust brake by means of the star wheel through the open slot. Insert a screwdriver in the slot so it engages the teeth of the star wheel. Move the screwdriver handle toward the axle housing to move the star wheel. Turning the star wheel in this direction causes the brake shoe to move out against the brake drum.

When the lining drags against the rotating brake drum, relieve the drag by moving the screwdriver handle away from the axle. The star wheel should be backed off three notches if the brake lining is worn. Each notch can be identified by a distinct click. If new linings were installed, back off five notches to relieve brake lining drag.

WHEEL BRAKES - CAM TYPE

Apply the parking brake and disengage the rear axle.

Block front wheels.

Place blocks between rear axle cradle and the tractor frame to prevent axle oscillation. Jack up the rear of the tractor so the rear wheels are off the ground. Place adequate shoring under the axle to support the tractor.

Adjust each shoe individually. Adjust the eccentric cam (Fig. 13-19) to bring the lining into contact with the brake drum. Then rotate the anchor pin to relieve the drag.

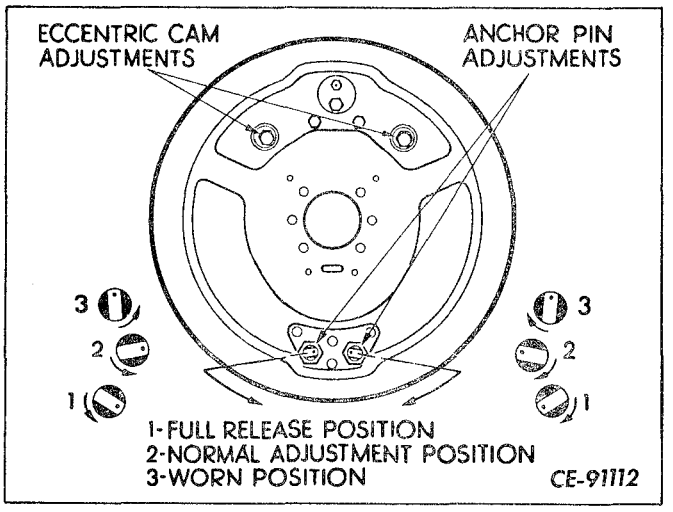

Figure 13-19

Repeat step d. until additional rotation of the anchor pin no longer relieves the drag.

Lock the anchor pin lock nut and back off the cam slightly to permit the wheel to turn freely.

Repeat this adjusting procedure for the second shoe assembly.

BRAKE SYSTEM

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

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