116SHO3100

SHOP MANUAL

(FOR ENGINE DETAILS REFER ENGINE SHOP MANUAL)

BD80

BULLDOZER

(WITH BEML BS6D125-1 ENGINE)

BEML LIMITED

INDIA

FOREWORD

This MANUAL is published for the information and guidance of shop personnel entrusted with the task of servicing the BEML BD80 Bulldozer and provides instruction to be adhered to in disassembling and re-assembling of the machines of this model in the shop. The instructions are given mainly in the form of procedures and, in each section of the manual are preceded by an outline description of each major component in respect of mechanical construction, functions and other pertinent items.

TERMINOLOGY

Effort has been made in the preparation of this manual to use the most common shop terms in order to avoid ambiguity and equivocation. Some key terms used however, require explanation in advance as to their meanings. The major key terms used in this manual have the following meanings

Clockwise (C.W.) and Counterclockwise (C.C.W.)

A circular direction, C.W. or C.C.W., is in the mind of the viewer standing in front and ahead of the machine, except when a driven component is discussed. Such a component as the oil pump the component is considered singly and as viewed from its driving side.

Terms of Servicing Criteria

BASIC SIZE: This term is universally defined as the theoretical or nominal standard size(diameter, length, thickness, etc) from which variations are made, and is used in this sense throughout.

ASSEMBLY STANDARD: *This is a dimensional value or a range of dimensional values to be adhered to in assembling components. An assemblage is required to satisfy the assembly standard specified for it.*

STANDARD CLEARANCE: *This refers to a clearance range, within which a distance of separation occurring in a full assembly or sub-assembly of replacement parts must take its value. Such an assembly or subassembly is permitted to be installed or mounted in place only when this requirement is satisfied.*

CLEARANCE LIMIT: *(maximum allowable clearance): A running clearance between a shaft and its hole, for instance, will increase as the shaft or hole wears progressively. A clearance limit is provided for each critical or important clearance and, if such a clearance is found to have increased upon disassembling beyond the clearance limit specified for it, the parts associated with that clearance must be corrected to take a value within the limit.*

SERVICE LIMIT: *An extra stock is provided in some parts subject to wear, so that these parts may be repaired upon disassembling. There are many such parts that can be reused repeatedly until their extra stock is used up by grinding, cutting etc. A service limit is the minimum or the maximum dimension (thickness, diameter, etc.) specified for such a part. Any part found to have exceeded its service limit is not repairable: its serviceability has ended and a replacement part must be used in re-assembling.*

CONTENTS

SPECIFICATION

Index

	Operating Weight			21,550 kg (47,512 lb)
Chassis	Flywheel horsepower			180HP(134kW) @ 1850 rpm
	Drawbar horsepower			148HP(110kW) @ 1850rpm
	Max. drawbar pull			19,800 kg (43,651 lb)
	Ground pressure			0.65 kg/cm² (9.1 PSI)
	Travel Speeds	Forward	1st	2.4 km/h (1.5 MPH)
			2nd	3.4 (2.1 MPH)
			3rd	5.2 (3.2 MPH)
			4th	7.4 (4.6 MPH)
			5th	10.0 (6.2 MPH)
		Reverse	1st	3.1 (1.9 MPH)
			2nd	4.5 (2.8 MPH)
			3rd	6.7 (4.2 MPH)
			4th	9.6 (6.0 MPH)
	Overall length			5890 mm (231.9")
	Overall width			4260 mm (167.7")
	Overall height (top of exhaust pipe)			3060 mm (120.5')
	Ground clearance (excl. grouser)			400 mm (15.7")
	Drawbar height above ground (excl. grouser)			470 mm (18.5")
	Track gauge			2000 mm (78.7")
	Lift above ground			1260 mm (49.6')
	Drop below ground			530 mm (20.9")
	Tilting adjustment			500 mm (19.7")

Specifications

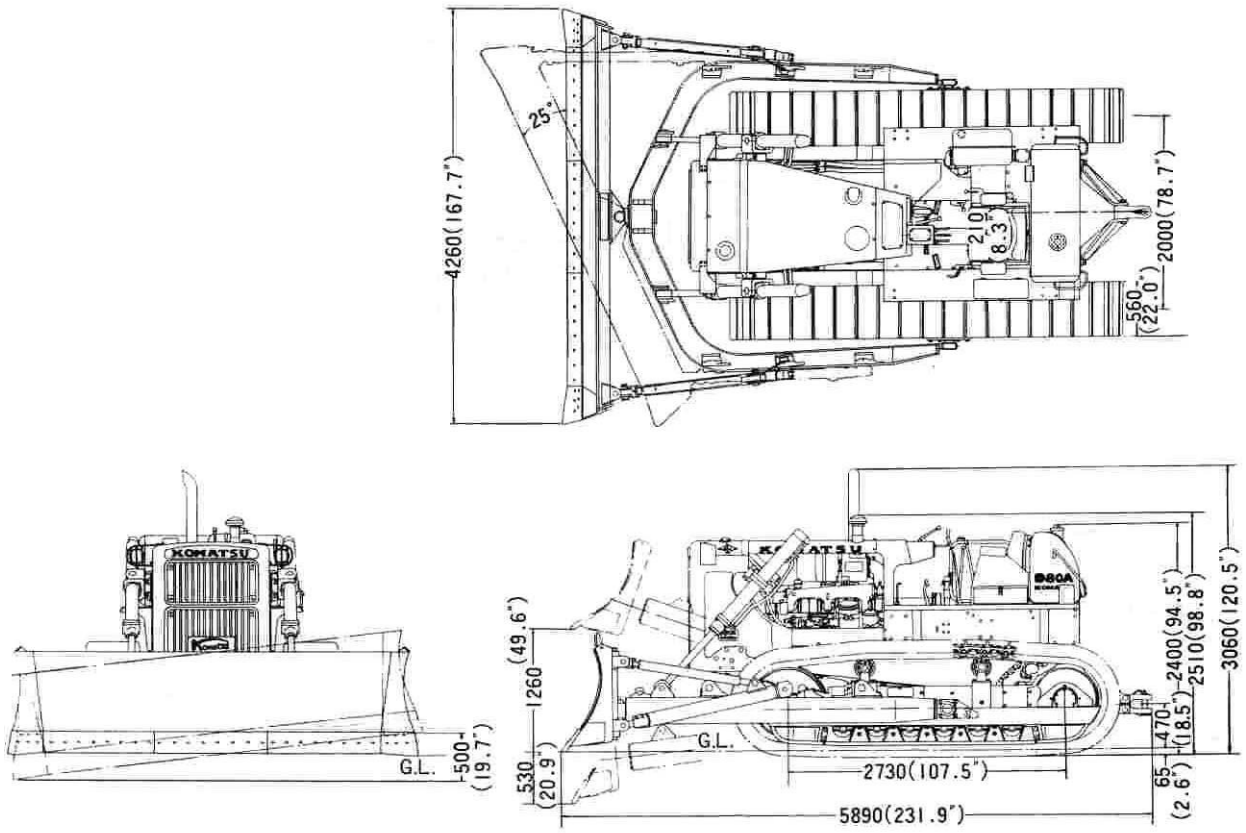
Engine	Model	BS6D125-1
	Type	Water cooled, 4, cycle, turbo charged direct Injection diesel engine.
	Starting method	By starting motor
	NO. of cylinders - bore X stroke	6 - Ø125 x 150 mm
	Piston displacement	11000 cc
	Dry weight (excl. radiator)	1523 kg (3,358 lb)
	Flywheel horsepower	180 FHP
	Rated RPM	1850 RPM
	Max. torque	80 kg-m (579 ft-lb)/1100 rpm
	Specific Fuel consumption	227 gm/kwh
	Air cleaner	Dry, horizontal type. (with Precleaner and dust indicator)
Fuel tank Capacity		420 ltr.
Radiator type		Continuous finned flat tube type
Clutch	Type	Wet, multi-disc, over center engagement
Transmission	Type	Constant-mesh
	Gear shift	F5- R4
Bevel gear	Type	Spiral bevel gear, single reduction
	Lubrication	Splash lubrication
Steering clutch	Type	Wet, multiple disc hydraulic w/spring type
	Control	w/Hydraulic booster, hand operated
Steering brake	Type	Wet, contracting band, foot operated
Final Drive	Type	Spur gear double reduction

Undercarriage	Suspension	Semi-rigid, equalizer bar
	No. of carrier rollers (upper)	2 (each side)
	No. of track rollers (lower)	6 (each side)
	Shoe type	Single grouser
	No. of shoes	38 (each side)
	Shoe width (std.)	560 mm (22.0")
	Grouser height	65 mm (2.6")
	Pitch	216 mm (8.5")
	Width of optional shoe	610 mm (24.0")
Drawbar	Type	Pin, fixed type
	Pin dia.	57 mm (2.24")
Blade	Blade width	4260 mm (167.7")
	Blade height	1060 mm (41.7')
	Blade capacity	3.55 m^3
	Max. lift above ground	1260 mm (49.6")
	Max. drop below ground	530 mm (20.9")
	Angling adjustment	25° (each side)
Blade cylinder	Cylinder bore X O.D.	120 mm X 136 mm (4.724" X 5.3543")
	Stroke x rod dia.	1014 mm X 65 mm (39.92" X 2.56")
	Pressure setting	140 kg/cm^2 (2,000 PSI)
Accelerator lever	Idle -Full	8.4 kg (19 lbs)
	Full Idle	9.8 kg (22 lbs)

Specifications

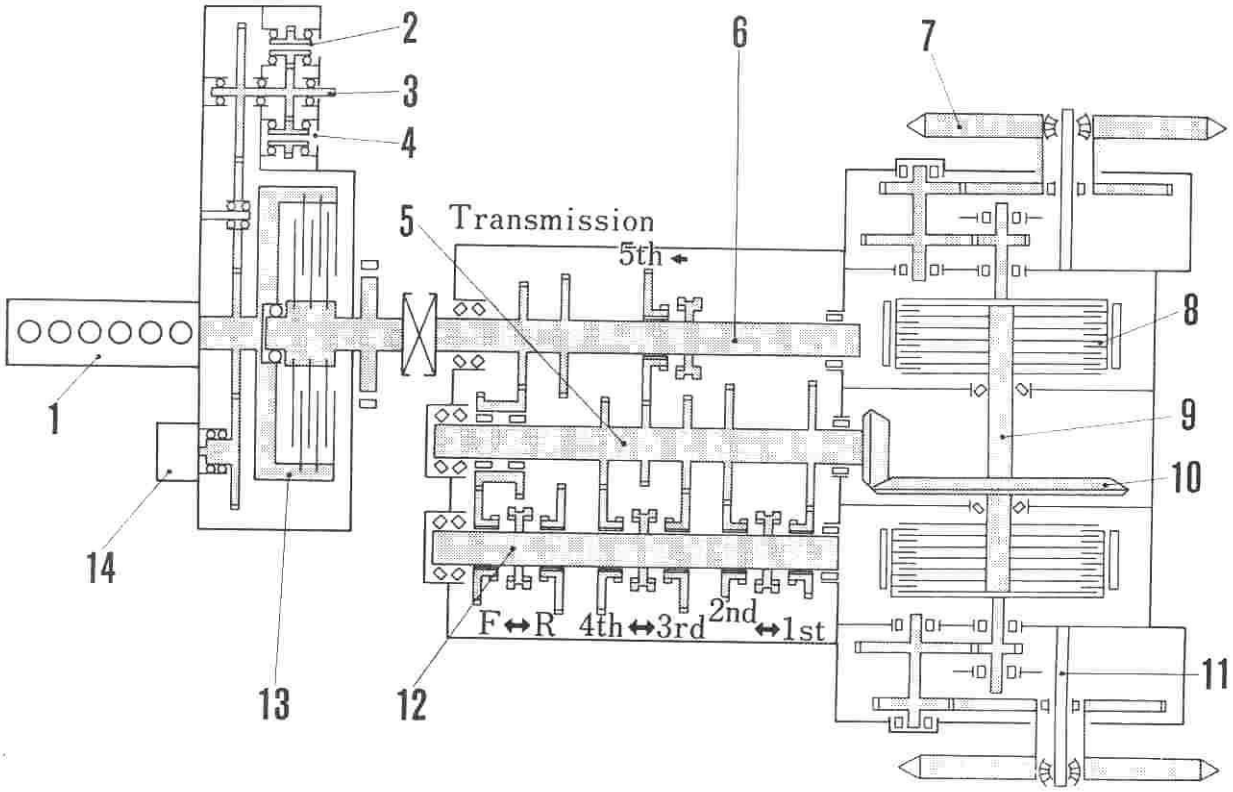
Transmission lever	Gear shift force	5.3-6.5 kg (12-14 lbs)
	Forward-Reverse lever force	4.8-5.9 kg (11-13 lbs)
Steering lever		0.7-4.2 kg (1.5 ~ 9.2 lb)
Brake pedal		23-27 kg (51 ~ 60 lbs)
Main clutch lever		5-6 kg (11 ~ 13 lbs)
Control valve	Location	built-in hydraulic tank
	Valve type	Spool
	Valve positions	Raise, hold lower, float
Hydraulic Tank	Type	Equipped with built in control valve
	Capacity	105 litres
	Location	On R.H. fender
	Hydraulic oil	Engine oil
Capacities	Cooling water	65 ltr.
	Fuel tank	420 ltr.
	Main clutch	25 ltr.
	Transmission (incl. steering case)	75 ltr.
	Final drive (each)	36 ltr.
	Recoil spring case	10 ltr.
	Undercarriage (each side)	3 ltr.

Specifications



BD80 BULLDOZER

POWER TRAIN



1. *Engine*
2. *Hydraulic oil pump drive gear*
3. *RPCU drive shaft*
4. *Main clutch oil pump drive*
5. *Counter shaft*
6. *Main shaft*
7. *Sprocket*
8. *Steering clutch*
9. *Bevel gear shaft*
10. *Bevel gear*
11. *Final drive*
12. *Intermediate shaft*
13. *Main clutch*
14. *Steering oil pump*

GENERAL INSTRUCTIONS

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General Description

The BEML BD80 Bulldozer is a semi-rigid crawler machine designed specifically for heavy duty services, The BS6D125-1 Diesel Engine is used to power this bulldozer and is electrically started to ensure easy start.

The main clutch is of the wet, multiple disc type being power assisted to reduce operator's fatigue. The transmission is of the constant mesh type, of varying size and design being in constant mesh helical gears and rotating at all times to eliminate crashing of the gears. The main clutch is interconnected with the interlocking device that prevents the transmission gear from jumping out of place during operation- as well as making the engagement of the main clutch impossible while the transmission is half-positioned..

The steering clutch are the wet, multiple disc type.- each being power assisted to reduce operator's fatigue.

The final drives are of the spur gear, double reduction type that is lubricated by splash. The BD80; Bulldozer uses Hydraulic oil as a means of operating the blade equipment - Raise. Hold, Lower and Float positions.

BD80 BULLDOZER

General Instructions

INSTRUCTIONS FOR DISASSEMBLING WORK

1. Before starting to disassemble any part of the machine, study the parts book and service manual, giving particular attention to the servicing criteria and standards Indicated in these publications to gain a full understanding of the mechanical component to be disassembled. Knowledge of the construction and functions of the component is an essential factor for successful servicing work.

2. When draining out lubricants and hydraulic oil, be sure to take note of the colour, viscosity and cleanliness with which the oil comes out. Oil In service often suggests the condition of the parts served, particularly when the oil lubricates gears or bearings.

3. It is advisable and often mandatory to put matching marks across mating joint lines before separating or removing parts, and to scribe identification marks on identical parts such as pistons and valves in the engine. This provision that you make at the time of disassembling will greatly facilitate your reassembling work.

4. Disassembly requires that you carefully note the orientation or position of each part, as necessary, and the sequence of taking one part after another from the machine. What you have so noted at the time of disassembling will be an assurance of your restoring or re-assembling the parts correctly.

5. Be sure to use the special disassembling tool wherever its use specified in the procedure. If the special tool is not available, some tool similar to it should be used. Use of the special tool is prescribed where common tools can cause damage of one type or another to the parts Involved.

6. Tapered parts or press-fitted parts are expected to be tight in place and not to yield easily to hand pulling. If such a part Is noted to be loose, be sure to inspect it for wear with greater care.

7. Parts taken off after disassembling should be washed clean and set aside in an order making proper provision to protect them against dust. Use two kinds of washing fluid one for removing dirt and one for clean washing. Filters, magnetic plugs and breathers are the parts that must be cleaned particularly and carefully.

8. Make shim stock available in all thick-nesses far use at the time of re-assembling.

INSTRUCTIONS FOR RE-ASSEMBLING WORK

1. Before starting to assemble, make sure all parts are clean. Replacement parts are usually coated with an anti-rust compound; remove the compound by wiping or-washing.

2. Installation of bearings, bushes, oil seals and the like require the use of special driving-in or forcing out tools In most cases. Driving such a part Into its position by directly hitting It with a hammer is a bad practice: always use a piece of wood or soft metal to transmit the hammer blow to the part.

3. Spring, plain tongue or toothed washers, cotter pins and locking wires are highly Important parts but, because of their small size,

liable to be forgotten at the time of re-assembling. When fitting such fastening parts as bolts and nuts, check to be sure whether locking means are specified or not for the fastening parts.

4. Use a torque wrench wherever its use is prescribed or a torque limit is specified. When securing a cover or similar part having many bolts, be sure to adhere to the standard shop practice of tightening the securing bolts gradually to distribute the pressure evenly.

5. Matching marks are not marks for identifying mating parts: they are meant to be indexed and aligned as accurately as possible. Ignoring this fact may result in a costly major repair.

6. Clean tools, clean work benches and tables are keys to successful assembling work, cleanliness saves working time and promotes accurate assembling.

INSTRUCTIONS FOR ADJUSTING WORK

1. Most of the assembling operations are completed with adjusting work. Be sure to check your list so that none of such components will be left unadjusted. Track tension and control Linkage play is typical items of adjustment that demand your greater attention in re-assembling work.

INSTRUCTIONS FOR USE OF HAND TOOLS

1. Use good and correct hand tools. Use of defective or wrong hand tools would lead to improper assembling or damage of the parts.

2. Never use any special tool or purposes other than the one for which It Is Intended, or you will damage the machine or the tool.

INSTRUCTIONS FOR HANDLING BEARING IN DISASSEMBLING/RE-ASSEMBLING WORK

1. Dust is one of the 'common enemies' of all bearings. Dust can often be a cause of bearing noise and accelerates deterioration of the lubricating oil in service.

2. When replacing a bearing, unpack the replacement bearing only when all preparatory steps for bearing installation have been completed.

3. While installing a bearing be sure to position it properly, forcing it all the way against the wall (stepped shoulder or seat).

4. Use of proper type of bearing puller (some of which serve also as Installers) is involved in general disassembling/re-assembling work. Be sure to use these tools where their use is specified. DRIVING a bearing in with a HAMMER is. In most cases, the same thing as driving a sure cause of trouble into the machine.

5. For the washing fluid to be used in cleaning bearings, Benzene or Benzoyl is recommendable. Kerosene and diesel fuel oil may be used If compressed air is available for blowing dust off, but with the oils alone fine dust entrapped within a bearing Is hard to remove.

6. After washing and cleaning bearings, and pending their Installation, coat them lightly with grease.

7. Spherical roller bearings should be Installed with particular attention to the positioning. Secure them correctly to eliminate excessive clearance at either end face, or the bearings will wear off prematurely in service.

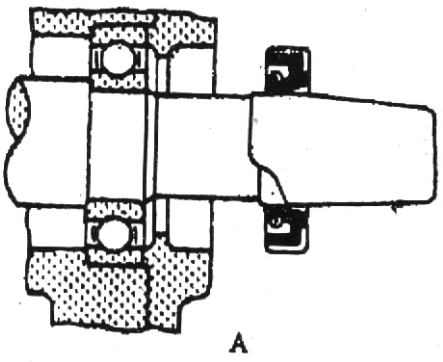
INSTRUCTIONS FOR HANDLING OIL SEALS

1. While installing an oil seal, make sure the oil seal is so positioned as to bring its lip to the correct side.

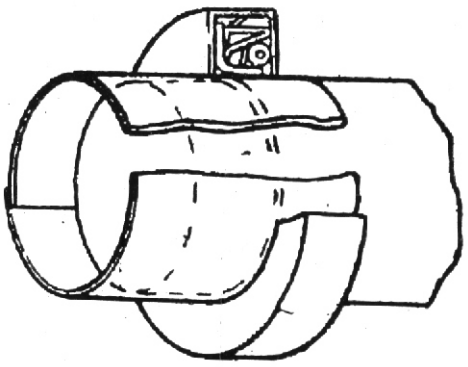
2. The lip of an oil seal in place is required to present a sharp tip angle for satisfactory sealing action. Thus it is highly essential to handle all seals carefully, In order to protect their lips against damage. For Instance, winding the wire of tag around an oil seal is a bad protect and should never be attempted.

Oil the seal just before forcing it into the bore at the time of Installing it, or the seal might become scarred due to the friction of dry rubbing faces during initial operation.

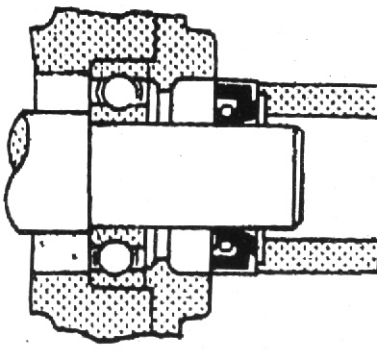
Use a guide to slip the seal into bore when installing it as shown in Fig. A. If such a guide is not available, prepare a makeshift guide with a sheet of brass, as shown In fig. B. Use of the guide is particularly necessary where the shaft has a keyway or a shoulder.



A



B



C

Snap Rings, Gasket etc.

3. Fig. C Illustrates the proper way of forcing the oil seal into the bore, 'Note that an adapter is used to apply pressure uniformly to the, end face of the seal. The forcing adapter should be 0.5-1 mm smaller In diameter than the bore, and its end should be shaped to take blows from a mallet or hammer. The surface of the shaft, upon which the seal is mounted, must be smooth and free of -any scratch mark.

INSTRUCTIONS FOR HANDLING SNAP RINGS

1. While handling a snap ring be careful not to twist it nor to deform its corners and ends. Try to preserve its springiness: never expand and contract it successively. After fitting it to the shaft, check to be sure the ring is properly seated.

2. Always use the ring expander in removing and installing sharp rings.

INSTRUCTIONS FOR HANDLING GASKETS AND PICKINGS

1. A copper packing removed from the machine should not be re-used. However, a packing of this type, found to be in good condition after it is annealed, may be re-used.

2. Sealing sheets pickings gaskets and the like are not to be re- used.

3. Leather pickings, before installation, should be soaked in oil so that they will become pliable.

4. Protect the surfaces of "O" rings and "V" pickings against damage. Winding wire directly around them is a bad practice.

5. A gasket should be fitted at the time of re-assembling, with both its surfaces coated with a bonding agent.

WEIGHT DATA

Item	Weight	
GROSS VEHICLE WEIGHT	20710 kg	(45665.550lb)
NET VEHICLE WEIGHT (tare weight)	19970 kg	(44033.850lb)
TRACTOR WEIGHT	16990 kg	(37462.950lb)
Cooling water fuel oil, etc.	640 kg	(1411.200lb)
Engine (incl. P.T.O.)	1620 kg	(3572.100lb)
Radiator	240 kg	(529,200 lb)
Fuel system	190 kg	(418.950lb)
Electrical system	210 kg	(463.050lb)
Main clutch (incl. universal joint)	200 kg	(441.000lb)
Transmission	670 kg	(1477.350lb)
Steering clutches	2000 kg	(4410.000lb)
Final drives	1700 kg	(3748.500.lb)
Brakes	160 kg	(352.800lb)
Track frames	4140 kg	(9128.700lb)
Track shoes	3110 kg	(6857.550lb)
Control system	290 kg	(637.450lb)
Suspension system	370 kg	(815,850 lb)
Outfitting's	1200 kg	(2646.000.lb)
Operator's seat	80 kg	(176400lb)
Drawbar	170 kg	(374.850lb)
Hydraulic system (incl. 110 lit. of oil)	1020 kg	(2249,100 lb)

WEIGHTS OF MAJOR ASSEMBLIES

Assembly or component		
Cross-drive case + main frame	1560 kg	(3439.800lb)
Clutch assembly (Brake drum discs, plates	120 kg	(264,600lb)
pressure plate, Inner drum, pistons) (each)	170 kg	(374.850lb)
Sprocket	200 kg	(441,000 lb)
Equalizer bar	330 kg	(727.650lb)
Framework	60 kg	(132,300lb)
Radiator undercover	150 kg	(330.750 lb)
Engine undercover (incl. hook)	150 kg	(330,750lb)
Transmission undercover	170 kg	(374,850lb)
Fender right	160 kg	(352.800 lb)
Fender left	170 kg	(374.850lb)
Blade cylinder stay	220 kg	(485.100lb)
Hydraulic oil tank (incl. valve)	110 kg	(242.550lb)
Blade cylinder (each)		

ENGINE REMOVAL AND INSTALLATION

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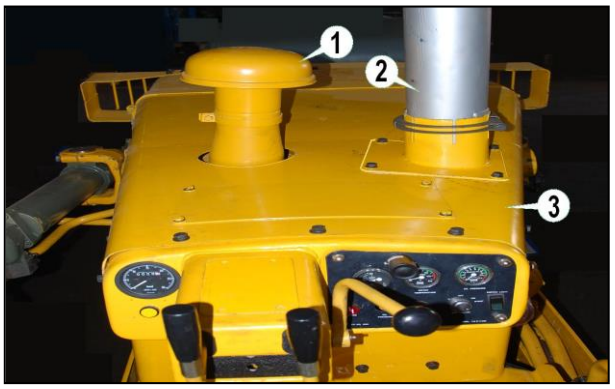
Engine Removal & Installation

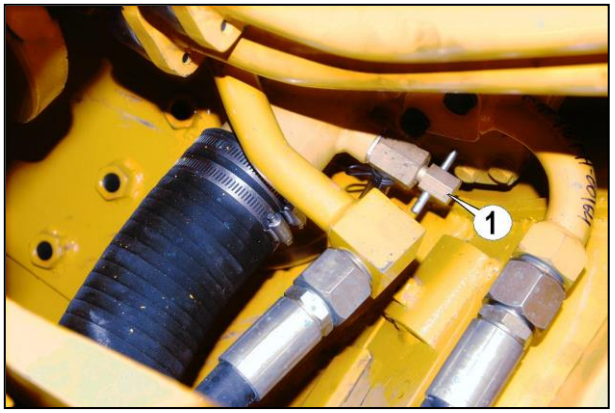
Radiator

REMOVAL

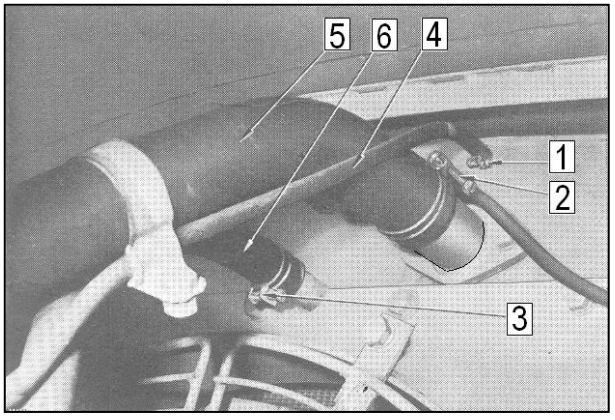
1. *Dismount the pre-cleaner (1), exhaust pipe (2) and engine hood (3).*



2. *Open the drain valve (1) to drain out cooling water.*

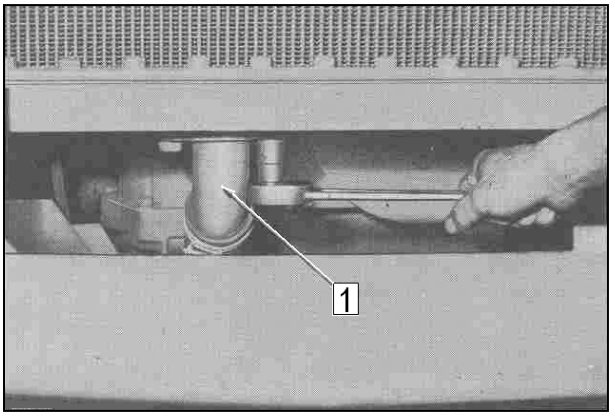


3. *Remove the clips (1) (2) (3), and disconnect the rubber hoses (4) (5) (6).*



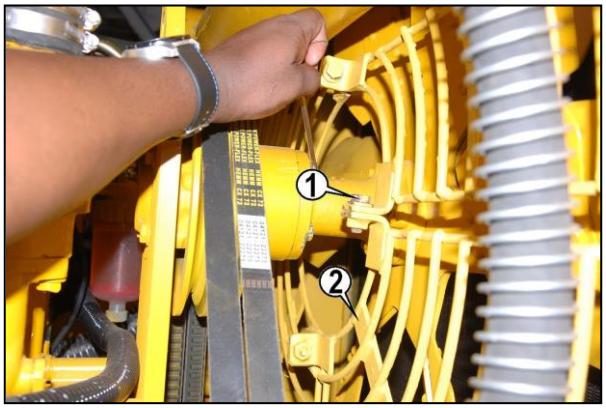
4. *Remove the radiator guards (1) (2).*

5. *From the bottom side of the radiator disconnect the pipe (1) leading to the water pump.*

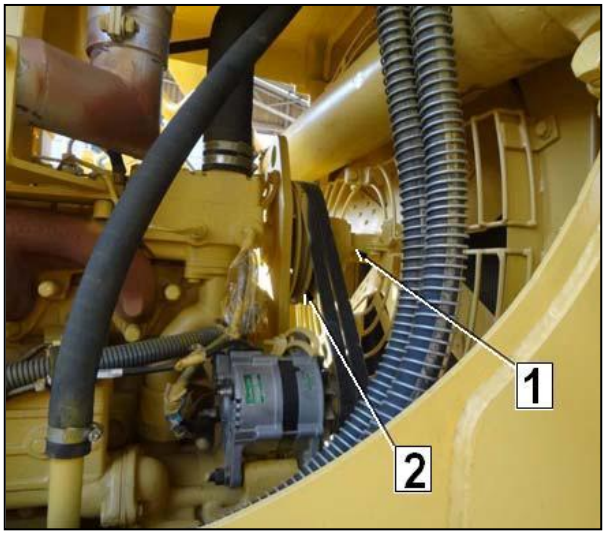


Removal

6. *Loosen the bolts (1) and detach the fan guard (2).*



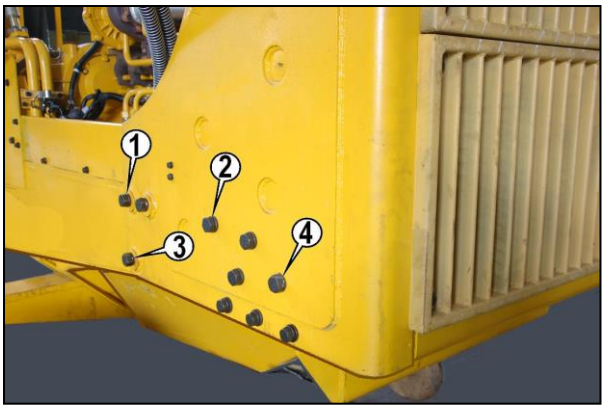
7. *Remove nuts (1) and take out the fan from the pulley (2).*



8. *Remove the stays and hydraulic cylinders· (by referring to "REMOVAL OF STAYS AND HYDRAULIC CYLINDERS").*

9. *Disconnect the 'headlight wiring at each side of the machine.*

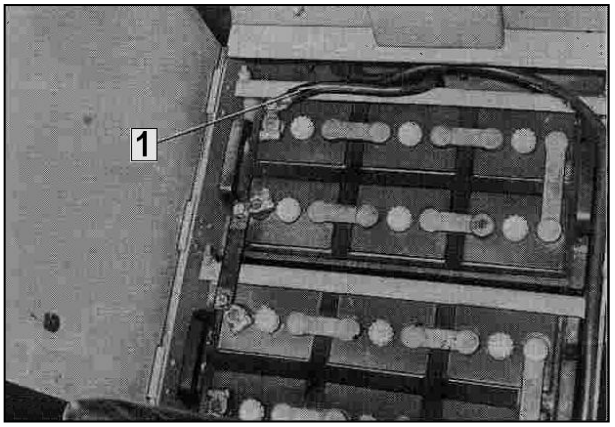
10. *At each side, loosen the bolts (1) (2), drive out the dowel pins (3) (4) and suspend the radiator assembly by using an overhead lifting device.*



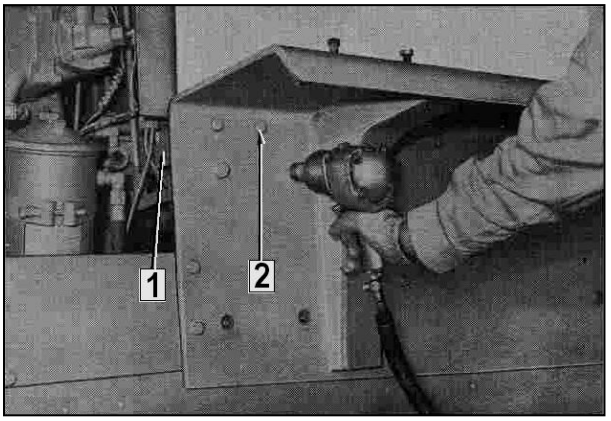
Engine

REMOVAL

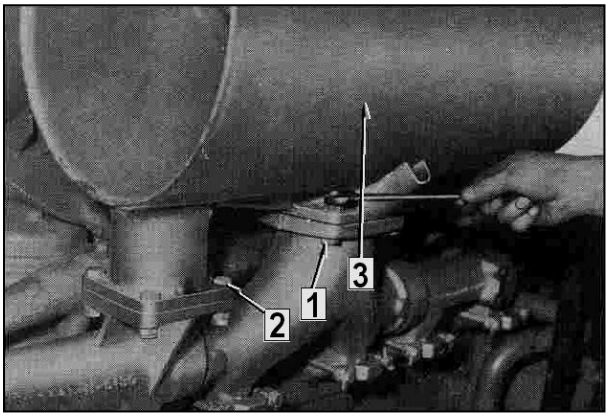
1. *Dismount the air cleaner exhaust pipe and engine hood.*
2. *Close the fuel valve under the fuel tank.*
3. *Drain oil in the hydraulic oil tank.*
4. *Remove all floor plates.*
5. *Disconnect control link rods for brakes and steering clutches.*
6. *Disconnect all pipes from the hydraulic oil tank.*
7. *Remove the step board support at each side.*
8. *Remove the slays and hydraulic cylinders (by referring-to "REMOVAL OF STAYS AND HYDRAULIC CYLINDERS").*
9. *Disconnect all tubes from the engine. These tubes lead to the radiator.*
10. *Disconnect the battery cable (1).*



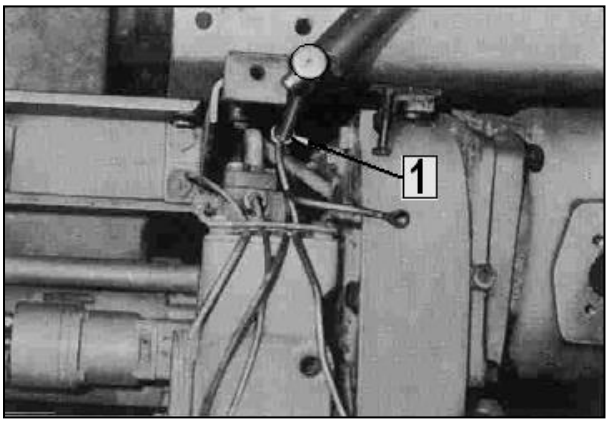
11. Remove bolts (2) securing the step board support (1).



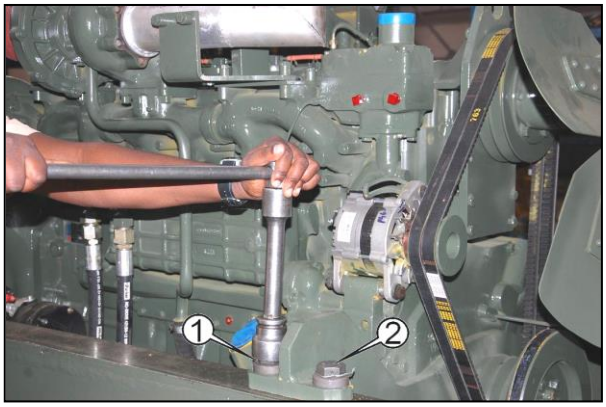
12. Remove the bolts and nuts (1) (2) and dismount the muffler (3).

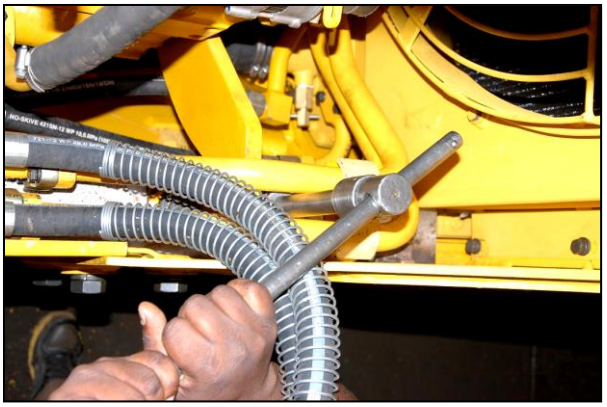


13. Remove the engine mounting bolts (1) at the rear end of the engine.



14. *Remove the engine mounting bolts (1) (2) at the front end of the engine.*





15. *Attach the lifting gear to the engine and lift the assembly of engine, PTO, main clutch assembly and Instrument panel out of the chassis and place it on the floor.*

Notes : 1. EXERCISE UTMOST CARE IN LIFTING THE ENGINE ASSEMBLY OFF THE CHASSIS. SO AS NOT TO DAMAGE ANY PART OF THE ENGINE AS WELL AS OTHER PARTS. ADHERE TO THE FOLLOWING RULES IN THIS. LIFTING OPERATION:

2. MAKE SURE THE LIFTING CABLE IS FREE OF TWISTS, RUST OR BREAK IN ANY STRAND.

3. TAKE OUT THE ADJUSTING SHIMS THAT WILL COME OUT FROM EACH ENGINE SUPPORT, AND MARK THEM CLEARLY SO THAT THEY CAN BE PUT BACK IN THE SAME PLACE FROM WHERE THEY HAVE BEEN REMOVED.

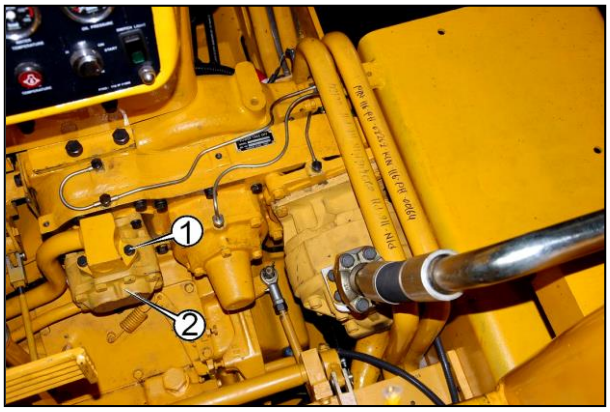
4. AFTER PLACING THE ENGINE ASSEMBLY ON WOODEN BLOCKS LAID ON THE FLOOR, MAKE SURE THAT THE ENGINE IS SUPPORTED PROPERLY BEFORE SLACKENING THE LIFTING CABLE.

5. CARRY OUT THE STEPS (1) (11) FOR REMOVAL AS OUTLINED IN "RADIATOR REMOVAL". REFER TO "HYDRAULIC TANK REMOVAL FOR STEPS (3) (7).

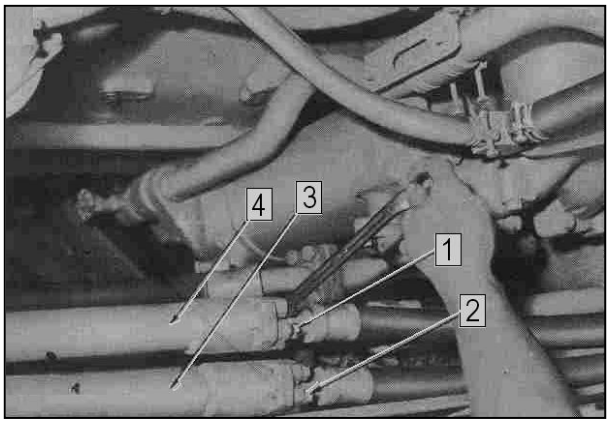
P.T.O. System

REMOVAL

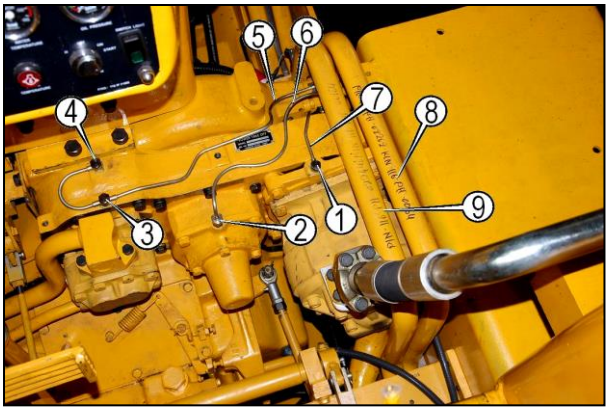
1. *Drain the hydraulic oil tank, and disconnect all pipes from this tank (by referring to "HYDRAULIC TANK REMOVAL").*
2. *Remove all floor plates.*
3. *Disconnect oil pipes from the hydraulic oil pump.*
4. *Remove the bolts (1) and take off the pump (2).*



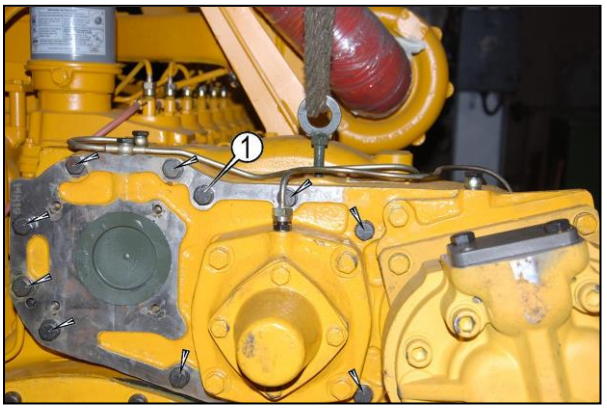
5. *Remove the bolts (1) (2) and disconnect the pipes (3) (4).*



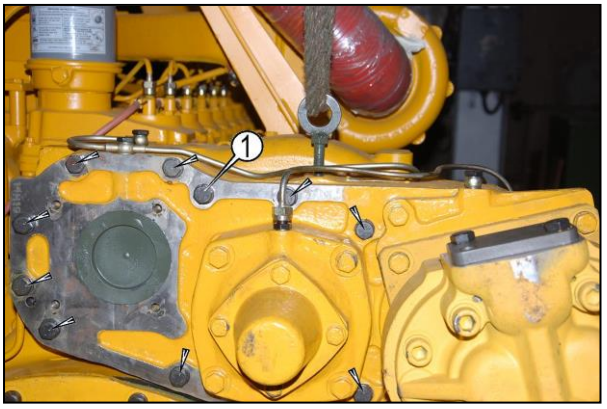
6. *Remove the nipples (1) (2) (3) (4) (5) and take out the pipes (6) (7) (8) and (9) (10).*



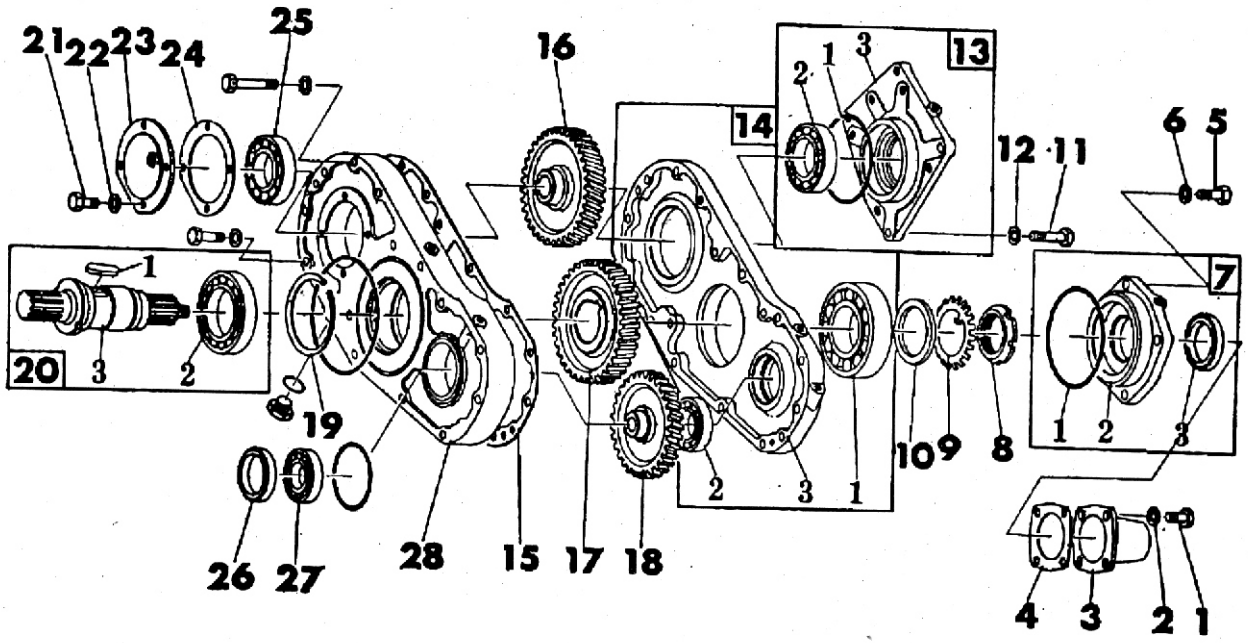
7. *Remove the bolts (1) and detach the PTO device by levering.*



8. *Hitch a lifting sling to the PTO as shown and remove it.*



DISASSEMBLING



PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1.	*Bolt*	*8.*	*Nut*	*14-2.*	*Bearing*	*20-3.*	*Shaft*
2.	*Spring washer*	*9.*	*Lock*	*14-3.*	*Case*	*21.*	*Bolt*
3.	*Cover*	*10.*	*Collar*	*15.*	*Gasket*	*22.*	*Spring washer*
4.	*Gasket*	*11.*	*Bolt*	*16.*	*Gear*	*23.*	*Cover*
5.	*Bolt*	*12.*	*Spring washer*	*17.*	*Gear*	*24.*	*Gasket*
6.	*Spring washer*	*13-1.*	*O-ring*	*18.*	*Gear*	*25.*	*Bearing*
7-1.	*O-ring*	*13-2.*	*Bearing*	*19.*	*Snap ring*	*26.*	*Ring*
7-2.	*Cover*	*13-3.*	*Bearing .cage*	*20-1.*	*Key*	*27.*	*Bearing*
7-3.	*Oil seal*	*14-1.*	*Bearing*	*20-2.*	*Bearing*	*28.*	*Case*

CLEANING AND INSPECTION

1. Clean all parts Inspect gear teeth for wear.

2. Inspect shaft splines and oil seals for wear.

ASSEMBLING

1. Build up the P.T.O. system completely on the bench and secure the assembly to the flywheel case.

Engine Removal

Installation - Engine Centering

INSTALLATION

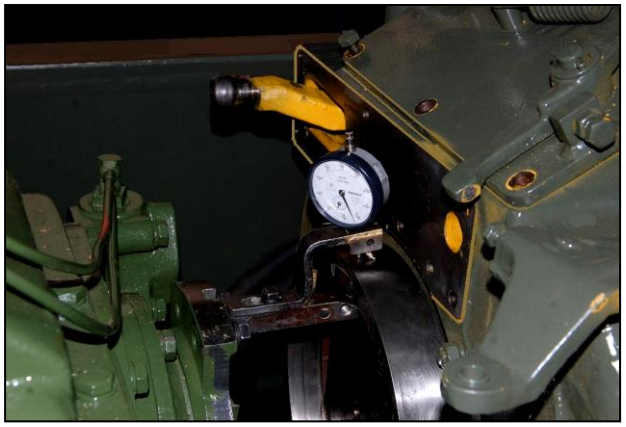
To re-mount the engine, reverse the removal procedure outlined above adhering to the following rules:

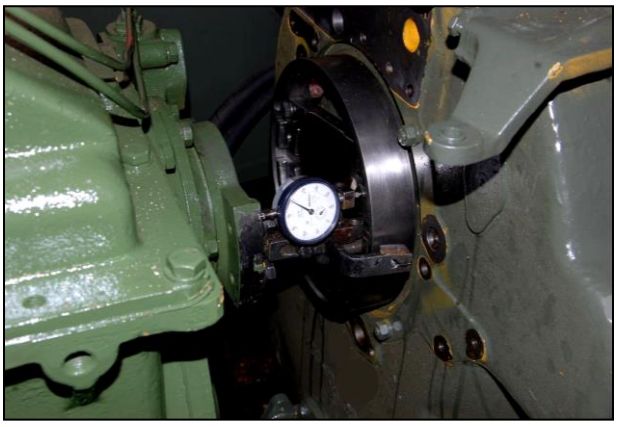
1. *Be sure to restore the adjusting shims to the engine mountings Place the mounting brackets tentatively on the frame and check their geometrical arrangement to be sure, roughly, that the engine will center itself properly when it is positioned over the mounting.*
2. *After the engine unit is secured to the main frame, center the main-clutch to the transmission by referring to the transmission main shalt.*
3. *Tighten the engine mounting bolts equally and gradually, passing the wrench from one mounting to another and completing the tightening by torqueing each bolt up to the specified torque value.*

ENGINE CENTERING

Fix a dial gauge to rear end of Inertia brake and; with the gauge spindle pointed against the coupling on transmission main shaft rotate the latter shaft to read two run outs face (gauge spindle held against the end face of coupling) and radial (gauge spindle held against the peripheral face of coupling).

The engine may be considered to be properly centered if the two run outs measured are within 0.25mm if not, re- position the engine in place by increasing or decreasing the adjusting shims used in engine mountings



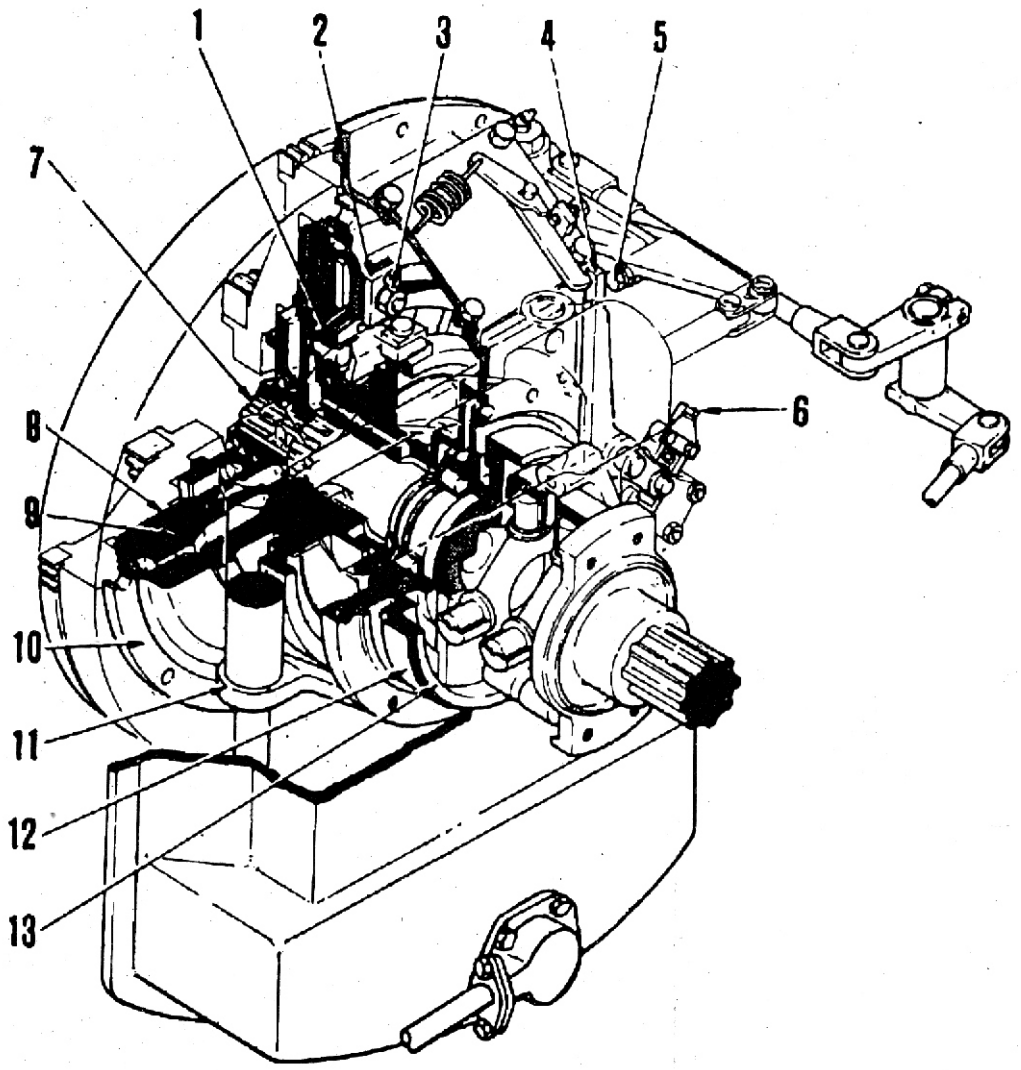


MAIN CLUTCH

INDEX

Main Clutch

DESCRIPTION



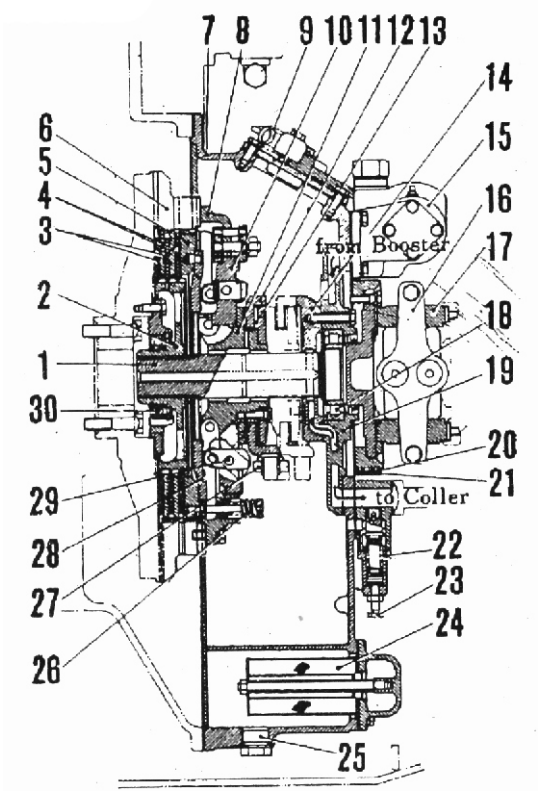
MAIN CLUTCH

1.	*Adjusting ring*	*6.*	*Adjust bolt*	*11.*	*Release yoke*
2.	*Lock plate*	*7.*	*Clutch shaft*	*12.*	*Brake lining, inertia*
3.	*Lock nut*	*8.*	*Disc*	*13.*	*Brake drum, inertia*
4.	*Brake lever*	*9.*	*Pressure plate*		
5.	*Set bolt*	*10.*	*Clutch cover*		

Main Clutch

Description

The main clutch is a multi-disc over-centre wet type having toggle links for pressing together the discs and plates. It is secured to the engine flywheel and housed in the main clutch casing bolted to the flywheel casing. A hydraulic booster is provided on the clutch to minimize the effort required at the clutch control lever. The booster is mounted on the upper part of the clutch casing.



1. *Main clutch shaft*
2. *Hub*
3. *Disc*
4. *Plate*
5. *Pressure plate*
6. *Flywheel*
7. *Clutch case*
8. *Clutch cover bracket*
9. *Spring*
10. *Adjusting ring*
11. *Collar*
12. *Release collar*
13. *Plate*
14. *Bearing cup*
15. *Hydraulic booster*
16. *Coupling flange*
17. *Joint cup*
18. *Bearing*
19. *Bearing cage*
20. *Brake lining*
21. *Brake band*
22. *Relief valve*
23. *Adjusting bolt*
24. *Strainer*
25. *Magnet plug*
26. *Return spring*
27. *Release yoke*
28. *Hub (pressure plate)*
29. *Link assembly*
30. *Bearing*

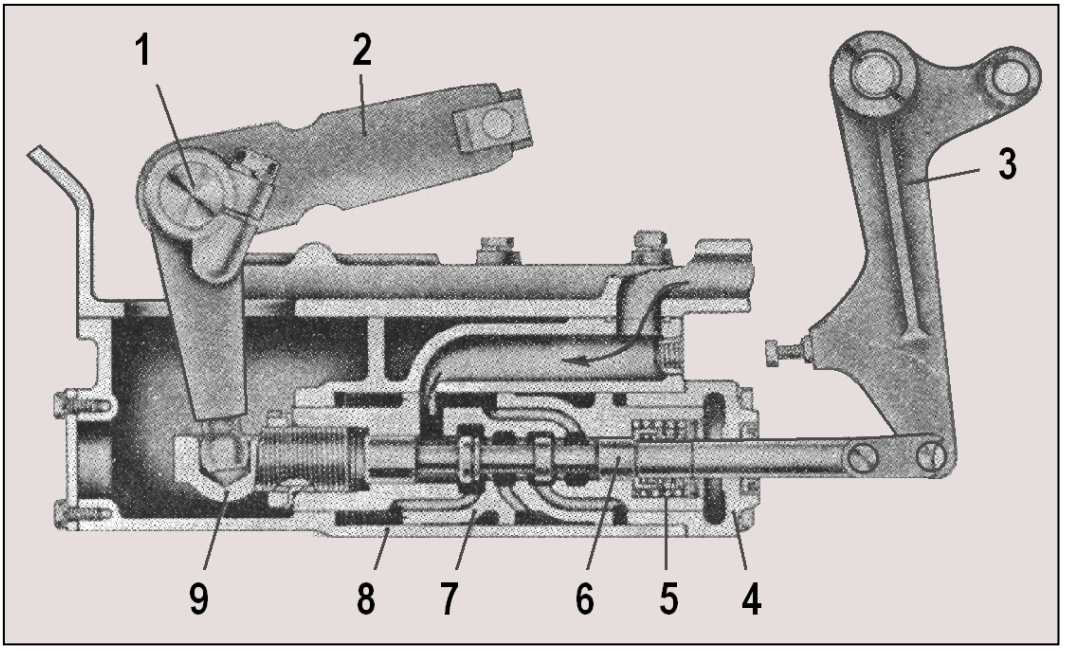
Hydraulic oil, supplied to the booster and circulated by force feeding through the running parts of the main clutch, comes from a gear pump driven from the P.T.O. located above the clutch casing.

An inertia brake, consisting of a drum and band, provided next to the flanged end of the main clutch shaft. This brake, positioned just outside the clutch casing, brakes and stops the shaft quickly on clutch disengagement. By this feature, transmission shaft is prevented from coasting, and the grating of gears in each shifting operation.

The main clutch assembly and its associated components are so designed and positioned as to permit easy access and to facilitate inspection and servicing.

Two plates (driving) and three discs (driven) are alternately stacked between flywheel and pressure plate. Driving plate and the pressure plate engage by sliding in the flywheel which is having formed teeth in it. The driven discs are similarly meshed with the hub by means of their internal teeth. The hub is splined to the forward end of the clutch shaft. Thus, the driving plates and pressure plate rotate with the engine and the driven discs with the clutch shaft. The main clutch transmits drive when its plates and discs are pressed together.

The flanged end of the clutch shaft is supported by a roller bearing. An oil seal is provided on this bearing to protect it from external dust and dirt and to prevent leakage of oil from the clutch housing. A universal joint is placed between the flanged end and the transmission main shaft. There are two spiders in the universal joint. The forward end of the clutch shaft is splined to the hub, which is supported by the bearing; fitted in the central bore of the flywheel.



MAIN CLUTCH BOOSTER

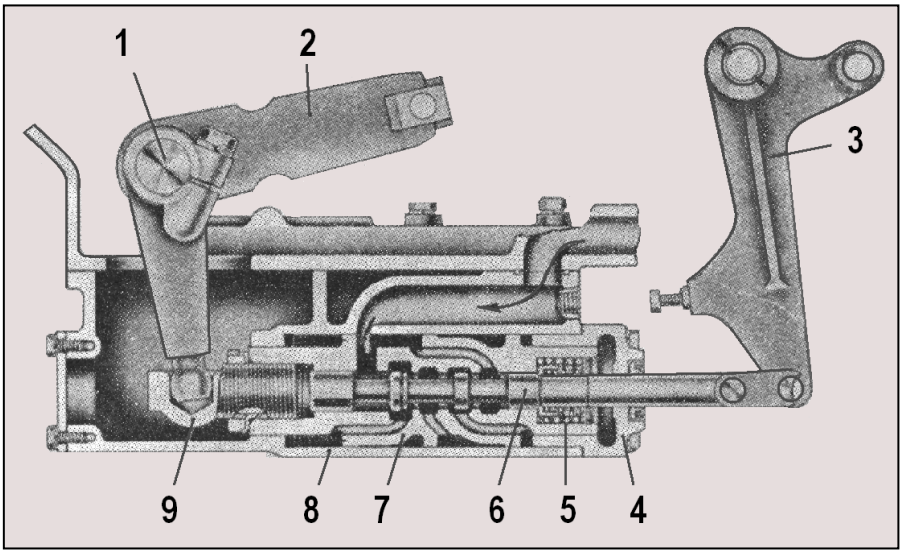
1.	*Yoke shaft*	*4.*	*Cover*	*7.*	*Piston*
2.	*Yoke*	*5.*	*Springs*	*8.*	*Valve body*
3.	*Lever*	*6.*	*Spool*	*9.*	*Coupling*

Main Clutch

Description

The gear pump, secured to the P.T.O. case, lifts oil in the main clutch casing through an oil strainer located at the bottom of the casing and pumps it to the hydraulic booster. Through the ferrule and oil passage of the booster, the oil enters its valve body, wherein it acts on the piston in either direction, depending on the position of the spool relative to the piston.

The booster is primarily a means of multiplying the push or pull (applied from the clutch control lever to the extending end of the booster spool through an Intermediate lever). The linkage from the clutch control lever through the booster spool to the release collar within the main clutch is a continuous, mechanically connected line capable of directly transmitting the effort to the collar even in the absence of hydraulic pressure. With the hydraulic pressure available to the booster the effort is greatly assisted by the booster so that a far less effort is required of the operator to operate the clutch control lever for engagement and disengagement of the main clutch.



Oil leaving the booster is led to the oil cooler, from which it returns to the main clutch, wherein it flows first in the Internal oil passage provided through the axis of the clutch shaft, comes out of the forward end of the shaft, and then spills off through the disc-carrying hub to cool and lubricate the surfaces of the plates and discs by radially flowing along the grooves cut on these surfaces. By centrifugal force, the oil Is flung outward to lubricate the peripheral teeth of the plates and drips down by gravity to the bottom of the clutch casing.

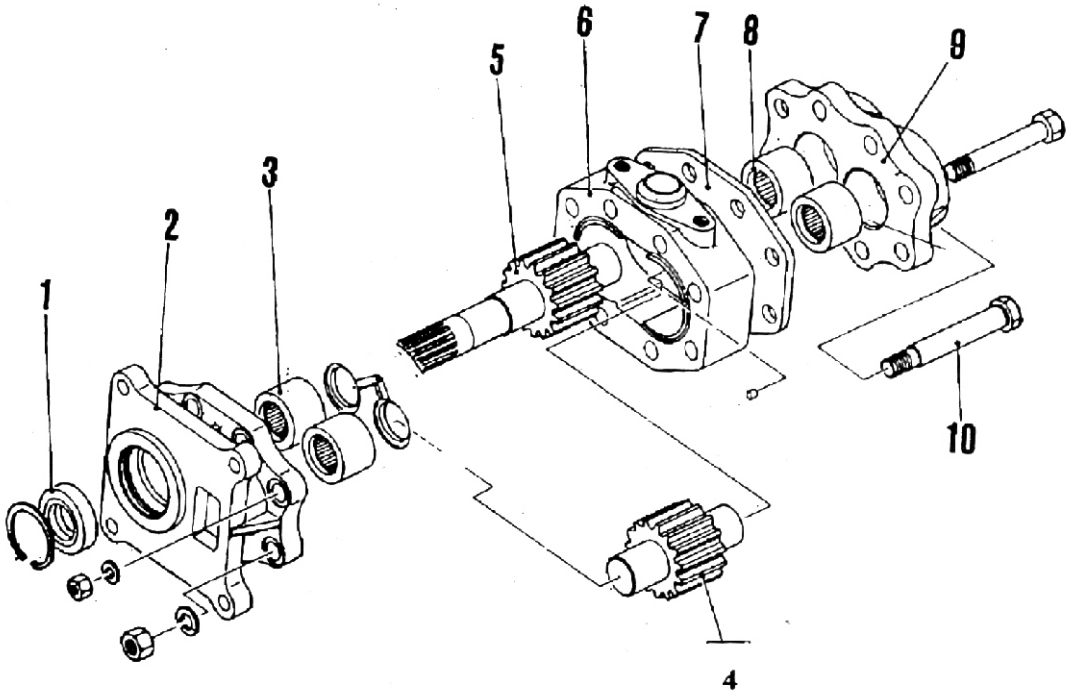
The pressure plate is pressed forward by return coil springs in the direction of releasing or loosening the plates and discs. The force for keeping the clutch engaged is applied by 5 sets of toggle links positioned around the clutch shaft,

each consisting of a weight link, two rollers, a link and pins and forming a radially oriented toggle mechanism. The outer end of each toggle is pinned to the adjusting ring, and the inner end to the collar, which is complete with another collar (release collar) and mounted, slid ably on the clutch shaft. The two rollers are at the knee of the toggle. Moving the collar toward flywheel causes the knee rollers of each toggle to push against the pressure plate and thereby press the plates and discs together against the flywheel. Pulling the collar backward releases the force and the return springs assist the plates and discs to separate resulting interruption of the flow of drive.

Main Clutch

Description

OIL PUMP



MAIN CLUTCH OIL PUMP

1.	*Oil seal*	*5.*	*Drive gear*	*9.*	*Housing*
2.	*Bracket*	*6.*	*Gear case*	*10.*	*Reamer bolt*
3.	*Needlr bearing*	*7.*	*Spacer*		
4.	*Driven gear*	*8.*	*Needle bearing*		

The oil pump is a gear type pump with precisely machined components. It is located on the left rear face of the P.T.O. case above the flywheel casing, and is driven by a gear (forward of the flywheel) on the engine crankshaft through a train of gears in the P.T.O. Thus, the pump runs with the engine and delivers pressurized oil to the booster and other running parts of the main clutch as long as the engine is running.

Part of the all delivered by it goes back to the P.T.O. to lubricate the P.T.O. gears.

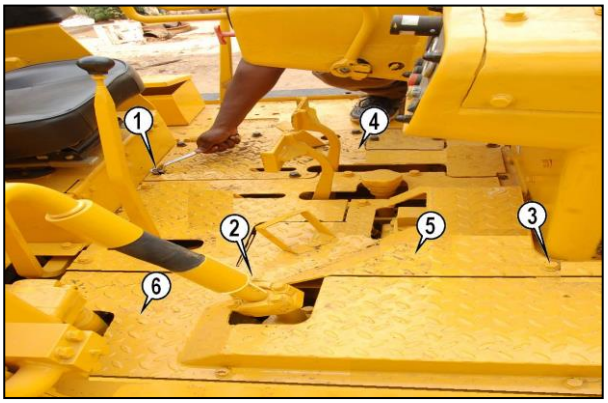
Moving the clutch control lever to engage or disengage the clutch results in a momentary interruption of oil flow to the clutch. During this short duration, the pressure of the oil is fully utilized in actuating the piston within the booster valve body.

Main Clutch

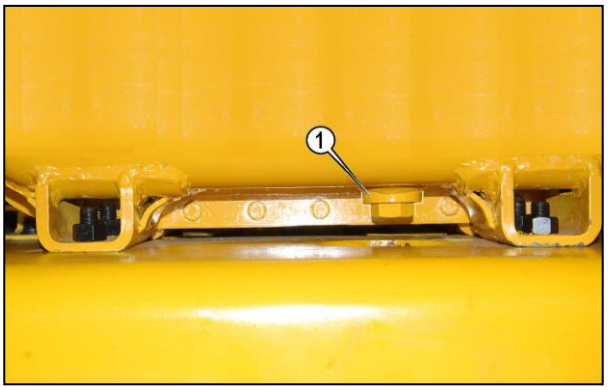
REMOVAL

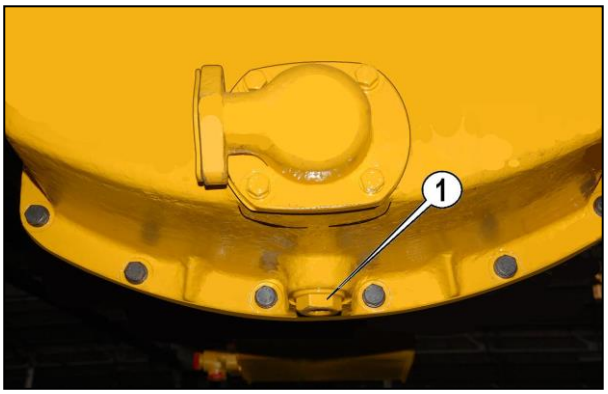
MAIN CLUTCH REMOVAL

1. *Remove the bolts (1) (2) (3) and floor plates (4) (5) (6)*



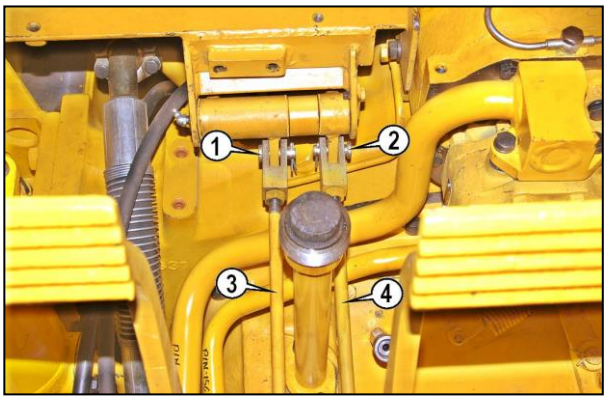
2. *Remove the engine under guard.*
3. *Take out the plug (1) by unscrewing it with a wrench, and drain the hydraulic oil tank.*



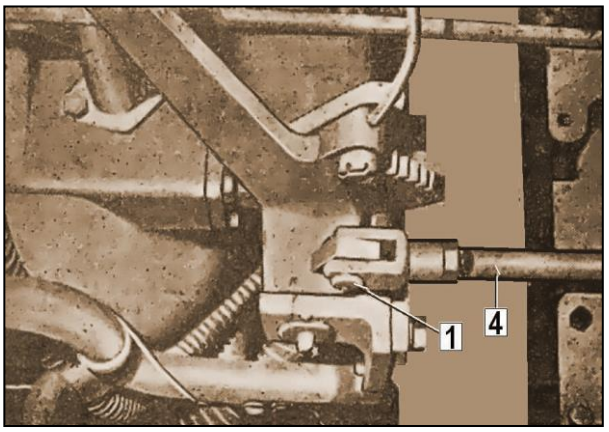


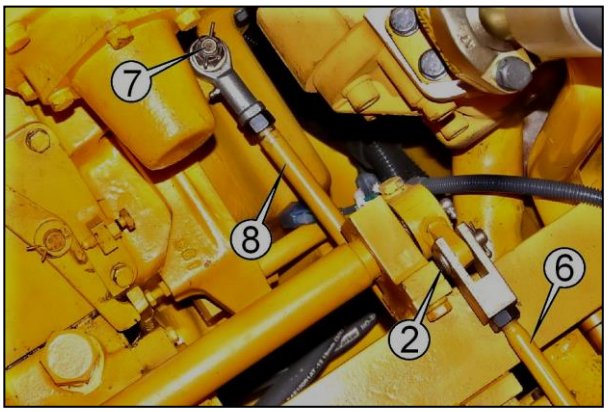
4. *Drain the main clutch housing by removing the plug 1.*

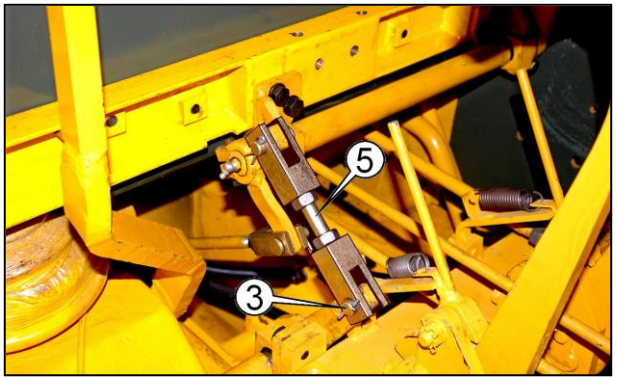
5. *Draw off the pins (1) (2) from the steering clutch control rods (3) (4). Disconnect these rods on the steering case side.*



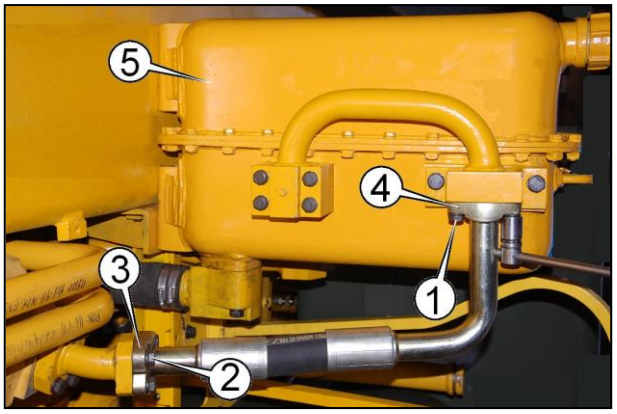
6. *Draw off the pins (1) (2) (3) and take down the brake control rods (4) (5) and main clutch control rod (6). Remove the nut (7) and remove the main-clutch control rod (8).*



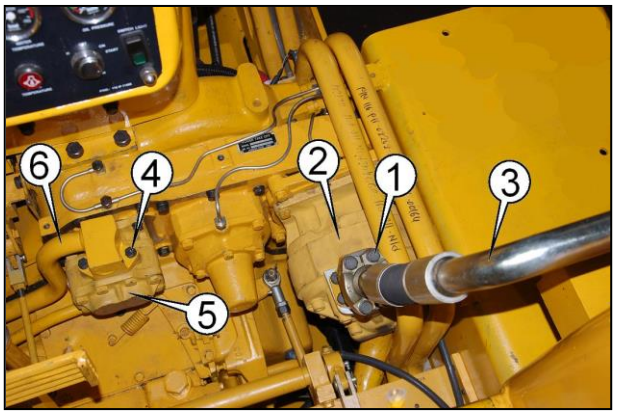




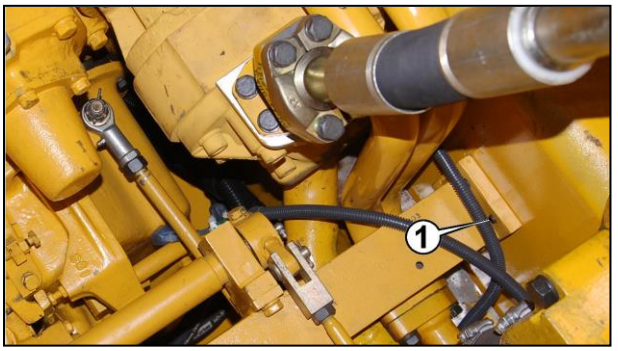
7. *Remove the bolts (1) (2) and detach the flange (3) (4) from the hydraulic tank (5).*



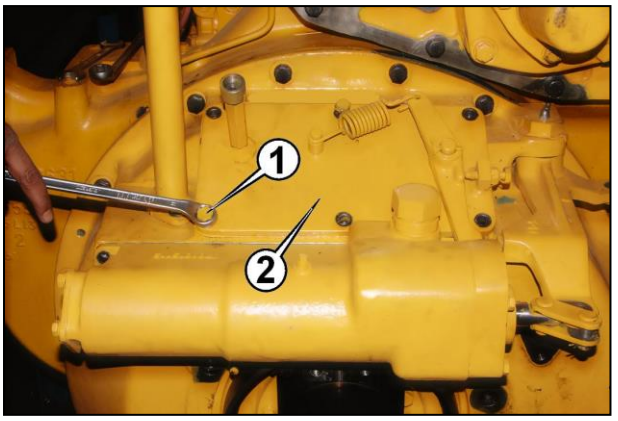
8. *Remove the bolts. (1) and disconnect the hosepipe (3) from the pump (2). Remove the bolts (4) and take out the pipe (6) from the pump (5).*



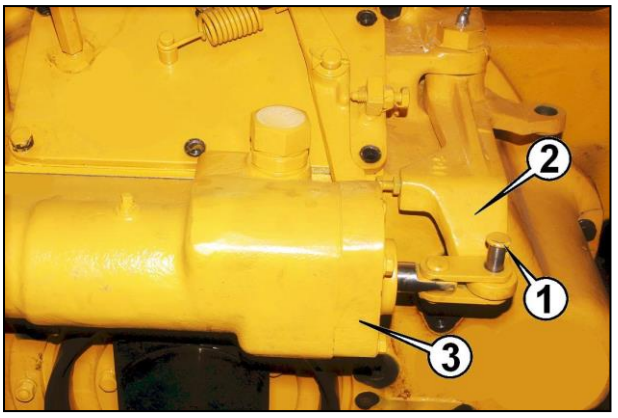
9. *Remove the brake support beam by removing the bolts (1) on both sides.*



10. *Remove the bolts (1) and take out the main clutch housing cover plate (2').*



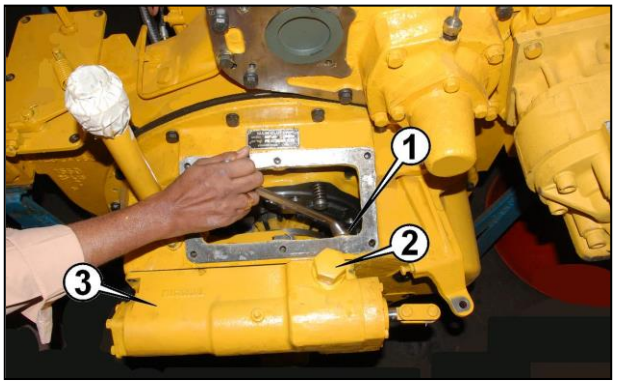
11. *Remove the pin (1) to disconnect the main clutch control lever (2) from the booster rod (3).*



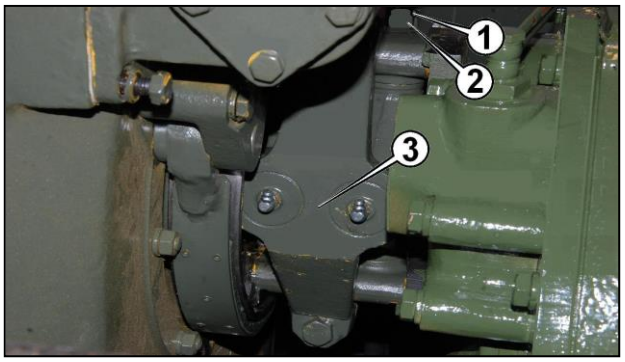
Main Clutch

REMOVAL

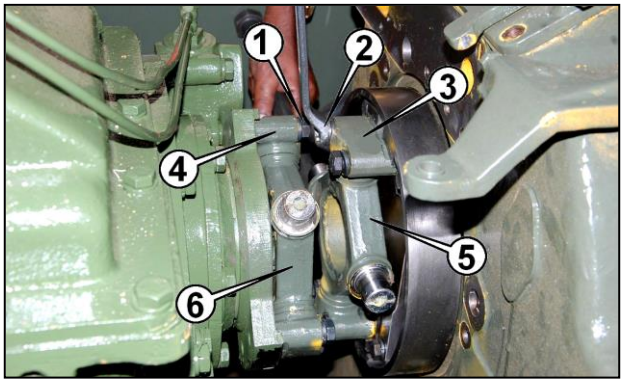
12. *Take down the main clutch booster (3) by removing the bolts (1) (2),*



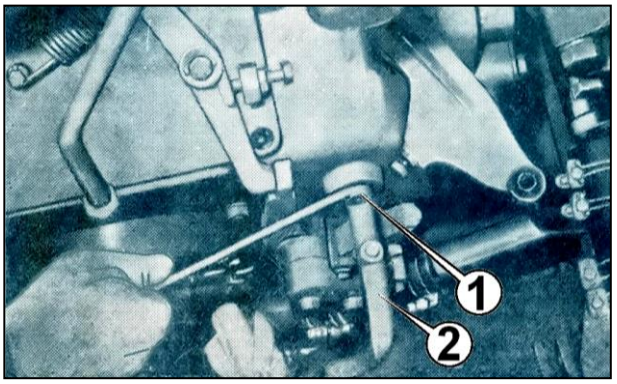
13. *Remove the nuts (1) and bolts (2) and take out the flange (3).*



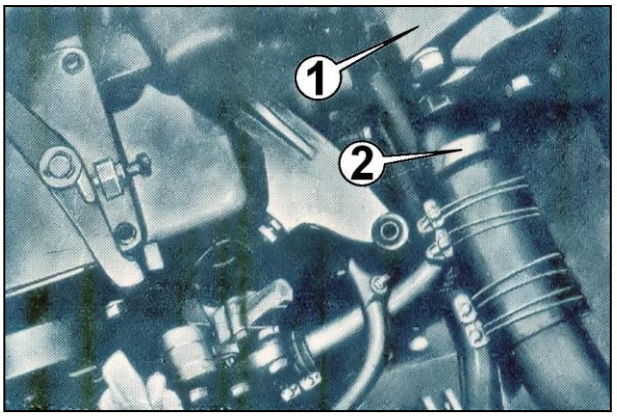
14. *Remove the bolts (1) (2), and remove the caps (3) (4) and spiders (5) (6).*

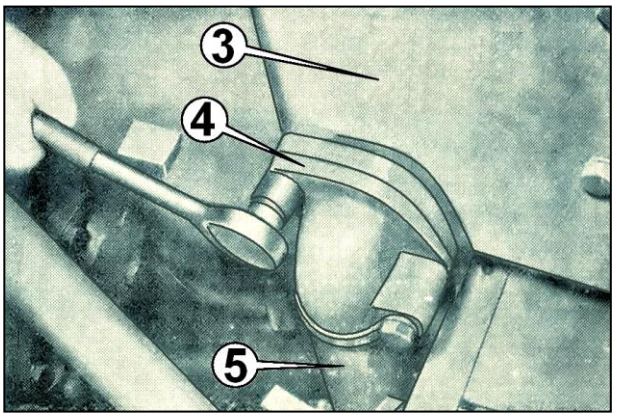


15. *Disconnect the pipe (2) by removing the bolts (1).*



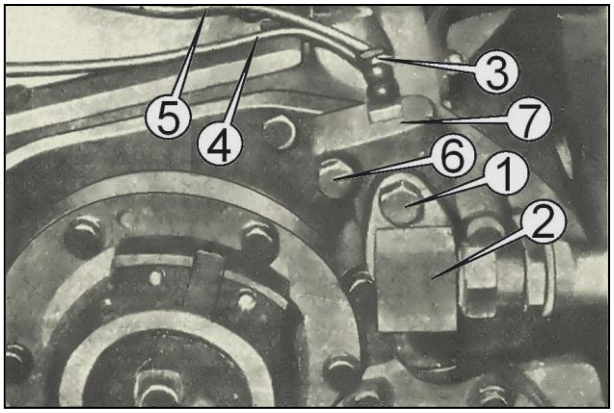
16. *Disconnect the flange of the pipe (2) from the pump (1). Remove the flange (4) from the hydraulic tank (3). Remove the pipe (5) .*



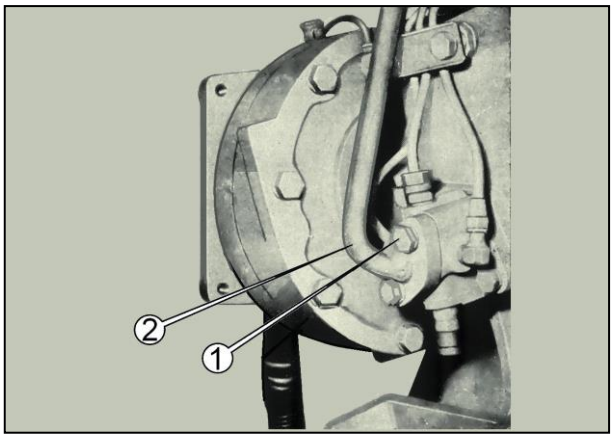


REMOVAL

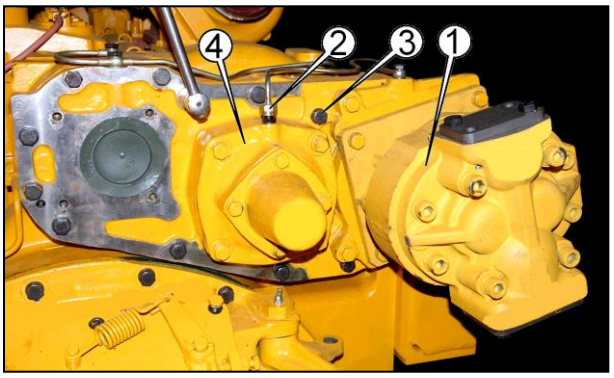
17. *Remove the bolts (1) to detach the flange (2). Disconnect joint (3) to remove the pipes (4) (5). Remove the bolts (6) and valve (7).*



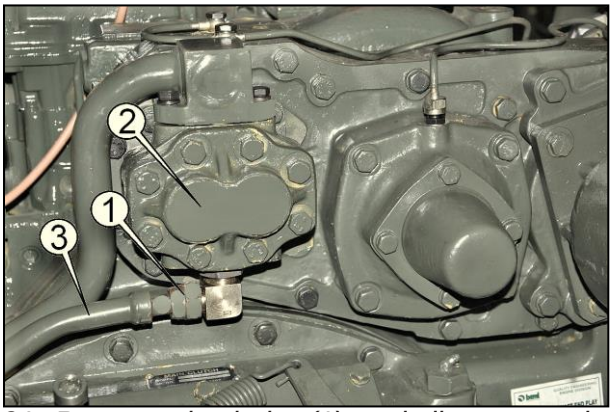
18. *Remove the bolts (1) and disconnect the pipe (2)*



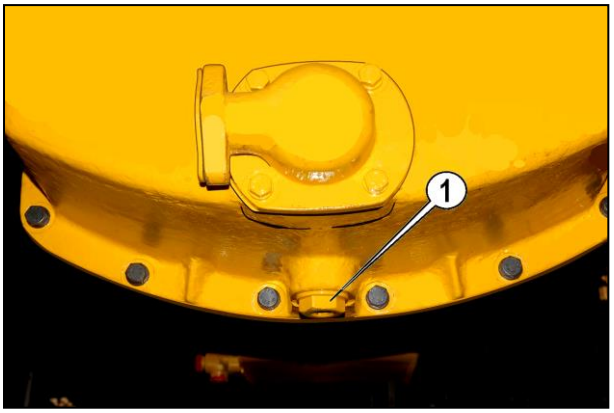
19. *Take down the pump (1). Disconnect the joint (2). Remove the bolts (3) and Cover (4).*



20. *Disconnect the joint (1) and pipe (3) from the pump (2).*



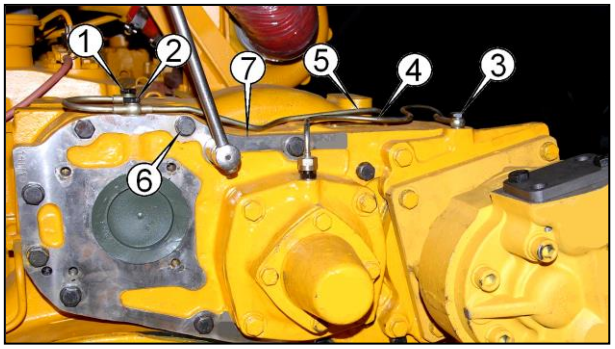
21. *Remove the bolts (1) and disconnect the pipe from the clutch oil strainer.*



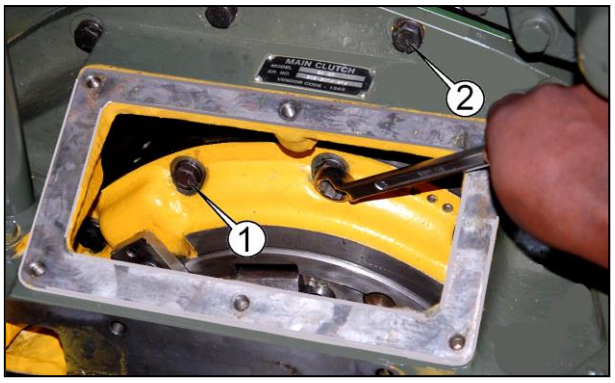
Main Clutch

REMOVAL

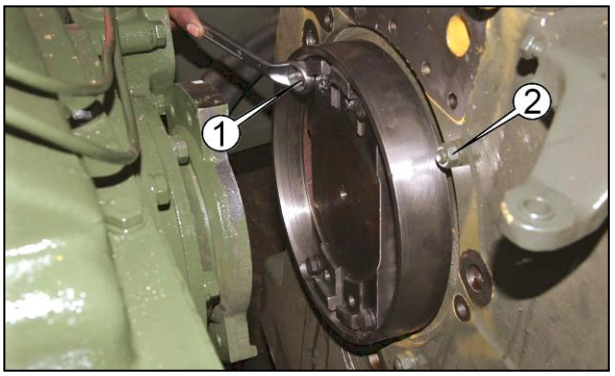
22. *Disconnects joints (1) (2) (3), remove the bolt and tubes (4) (5). Remove the bolts (6) and take out the P.T.O. assembly (7).*



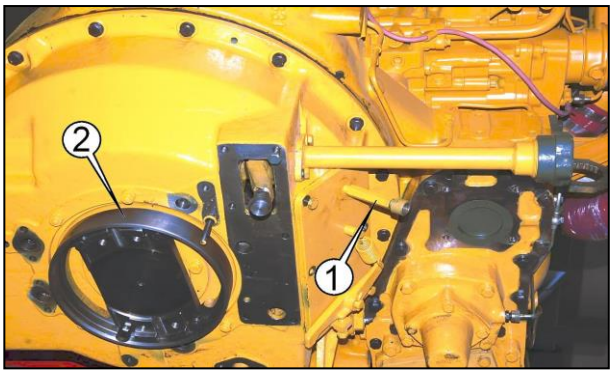
23. *Remove the bolts (1) securing the clutch: turn the clutch and remove these bolts one after another. Remove the nuts (2) securing the clutch housing.*



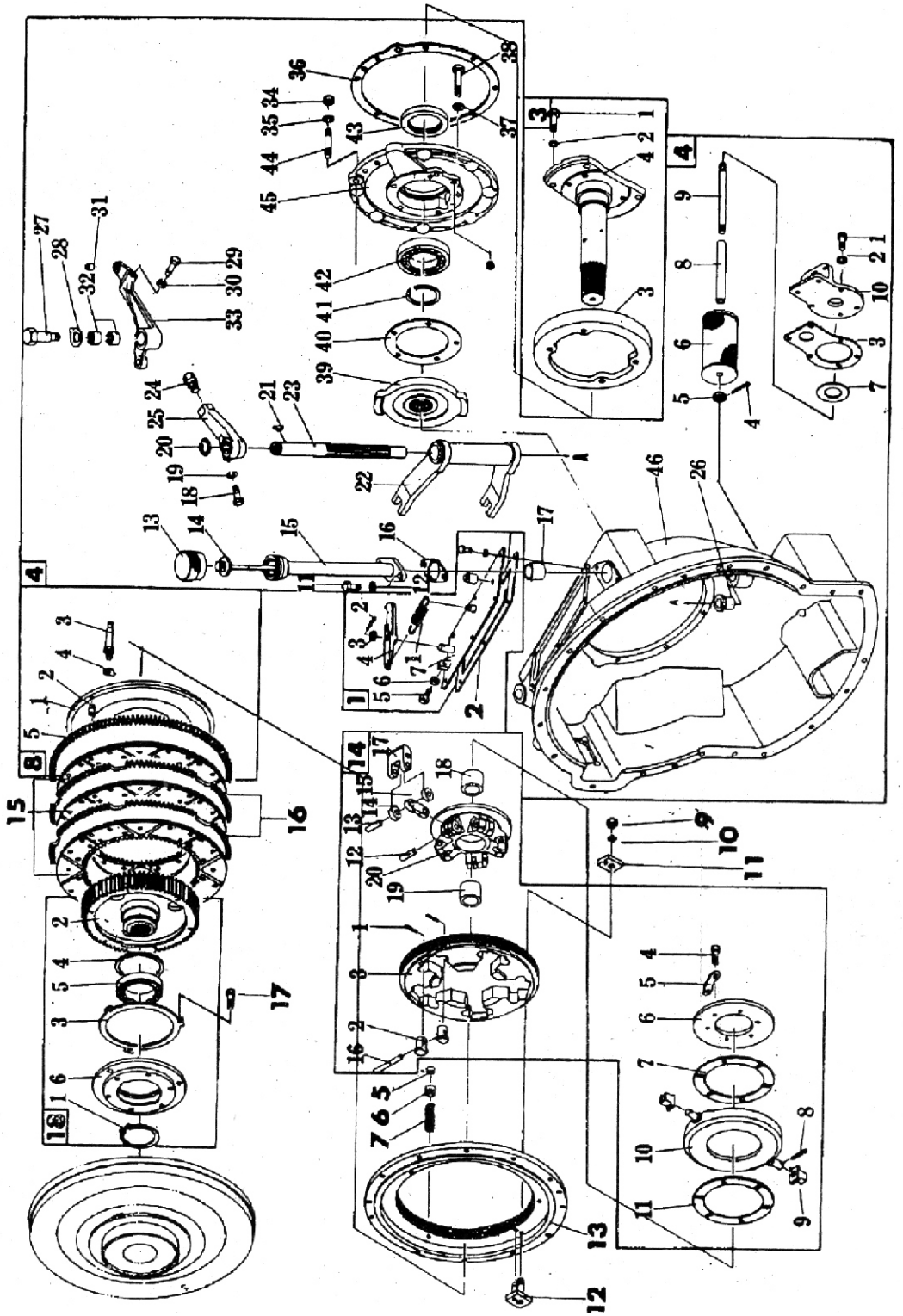
24. *Remove the bolts (1) and flange (2).*



25. *Screw the bolt (1) into clutch housing and take a hitch on the housing by hooking the lifting sling to this bolt. While drawing out the clutch shaft (2), detach the clutch assembly and lift it out by operating the hoist.*



DISASSEMBLING



MAIN CLUTCH

Disassembling

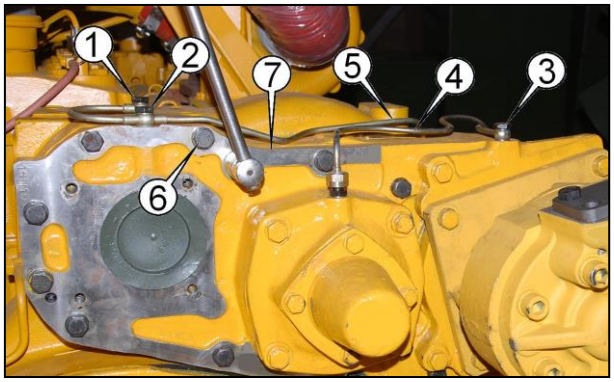
PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1-1. Spring
1-2. Cotter pin
1-3. Washer
1-4. Lever
1-5. Bolt
1-6. Nut
1-7. Cover
2. Gasket
3-1. Bolt
3-2. Spring Washer
3-3. Drum
3-4. Drive shaft
4-1. Bolt
4-2. Spring washer
4-3. Gasket
4-4. Cotter pin
4-5. Nut
4-6. Screen
4-7. Gasket
4-8. Spacer
4-9. Stud
4-10. Cover
4-11. Bolt
4-12. Spring Washer
4-13. Cap
4-14. Oil Gauge
4-15. Tube
4-16. Gasket
4·17. Bush
4-18. Bolt
4-19. Spring washer
4-20. Snap ring
4·21. Key
4-22. Yoke
4-23. Shaft
4-24. Ball
4-25. Lever
4-26. Bush
4-27. Pin
4-28. Lock
4-29. Bolt
4-30. Nut
4-31. Bush
4-32. Bearing
4-33. Lever
4-34. Nut
4-35. Spring washer
4-36. Gasket
4-37. Bolt
4-38. Spring washer
4-39. Retainer
4-40. Gasket
4-41. Snap ring
4-42. Bearing
4-43. Oil seal
4-44. Stud
4-45. Cover
4-46. Clutch case
5. Lock
6. Collar
7. Spring
8-1. Hub
8-2. Dowel pin
8-3. Guide
8-4. Washer
B-5. Pressure plate
9. Nut
10. Spring washer
11. Lock
12. Lock
13. Bracket
14-1. Cotter pin
14-2. Bush
14-3. Ring
14-4. Bolt
14-5. Lock
14-6. Plate
14-7. Plate
14-8. Cotter pin
14-9. Block
14-10. Collar
14-11. Plate
14-12. Pin
14-13. Link pin
14-14. Roller
14-15. Link
14-16. Pin
14-17. Link weight
14-18. Bush
14-19. Bush
14-20. Collar
15. Disc
16. Plate
17. Bolt
18-1. Snap ring
18-2. Hub
18-3. Lock
18-4. Snap ring
18-5. Bearing
18-6. Retainer

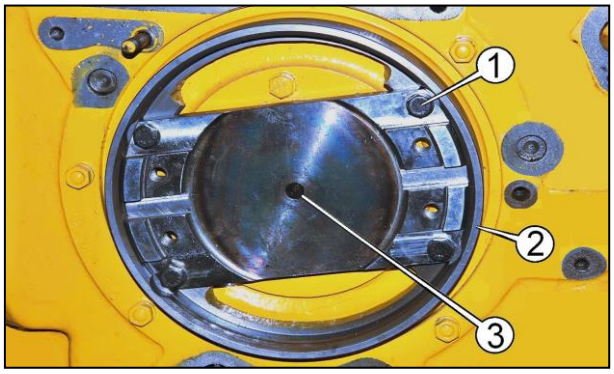
Main Clutch

Disassembling

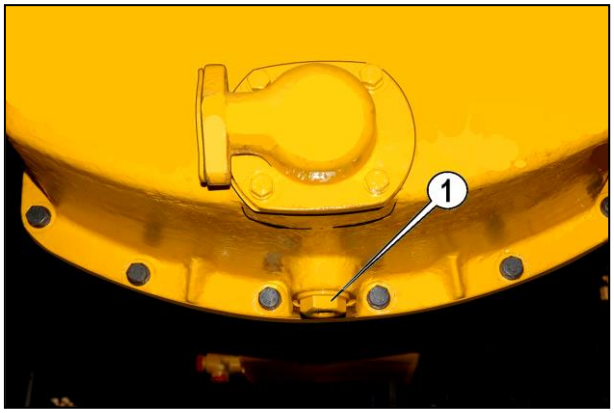
1. *Take out spring (1), and remove the cotter pin (2). lever (3). bolt (4) and nut (5) from the cover (6).*



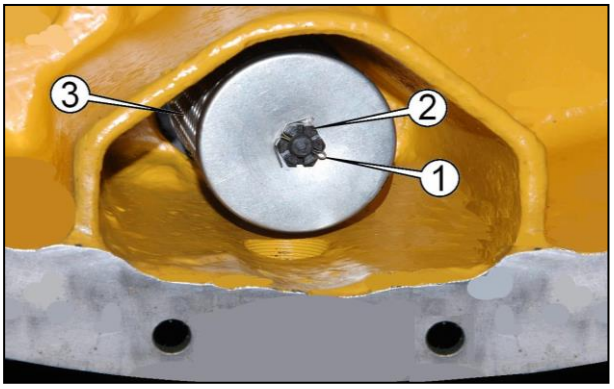
2. *Remove the bolts (1) and draw off the drum (2) and drive shaft (3).*



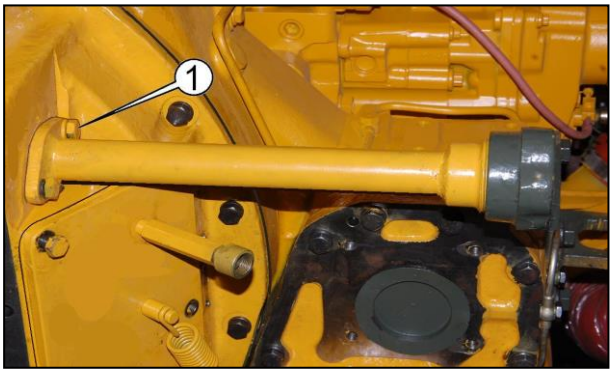
3. *Remove the bolts (1) and take out the oil strainer.*



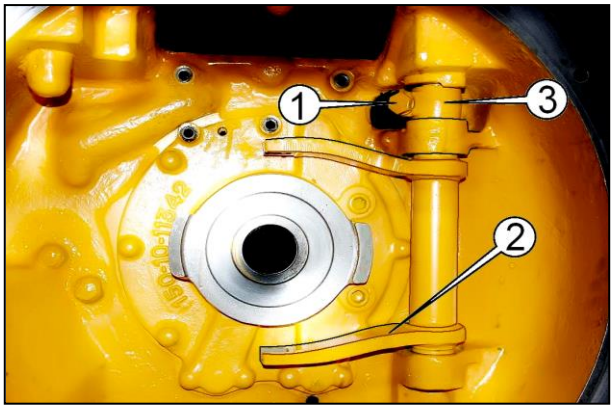
4. *Pull off the cotter pin (1) remove the nut (2) and take out the screen (3)*



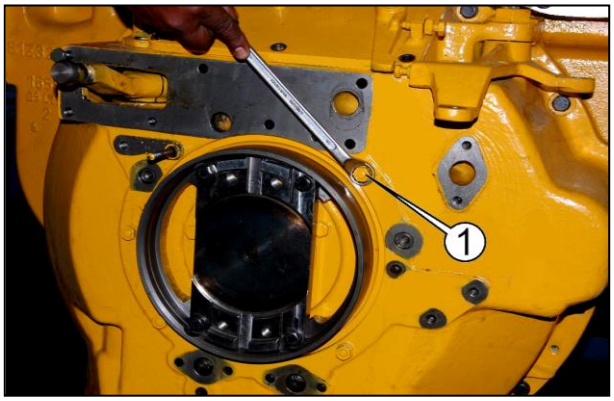
5. *Remove the bolts (1) and take out the oil gauge assembly.*



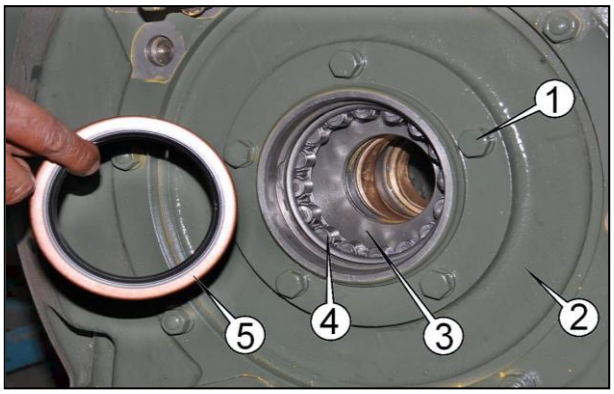
6. *Remove the bolt (1). yoke (2) and lever (3) while drawing out the shaft.*



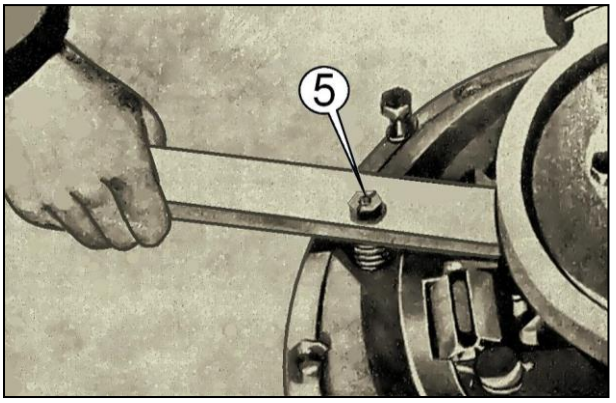
7. *Remove the nuts (1) and detach the cover assembly.*



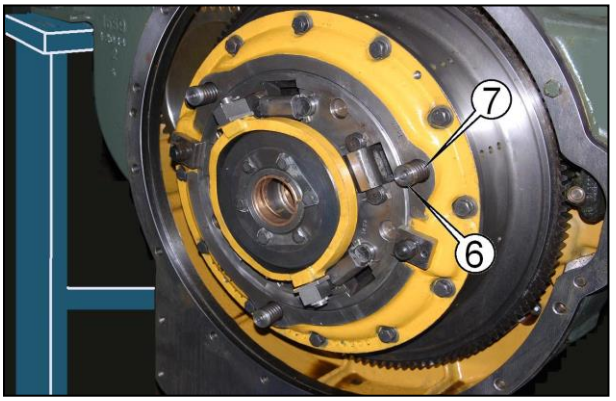
8. *Remove the bolts (1) and take out the cover (2), retainer (3), bearing (4) and seal (5).*



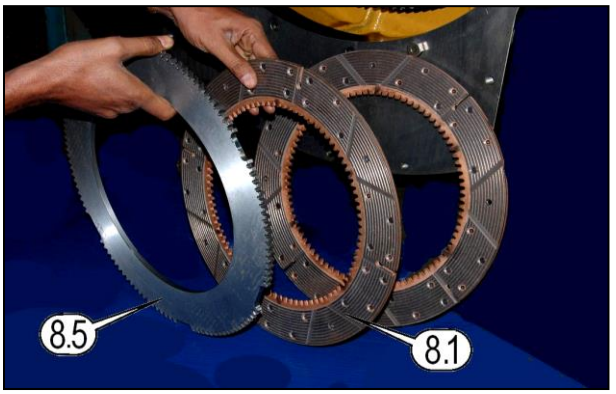
9. *Depress the spring, using the spring compressing tool, and remove the lock (5).*



10. *Remove the collars (6) and springs (7).*



11. *Remove the hub (8-1) and pressure plate (8-5).*

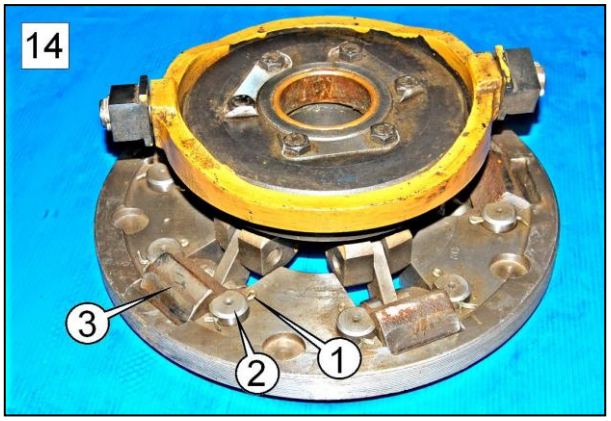


Main Clutch

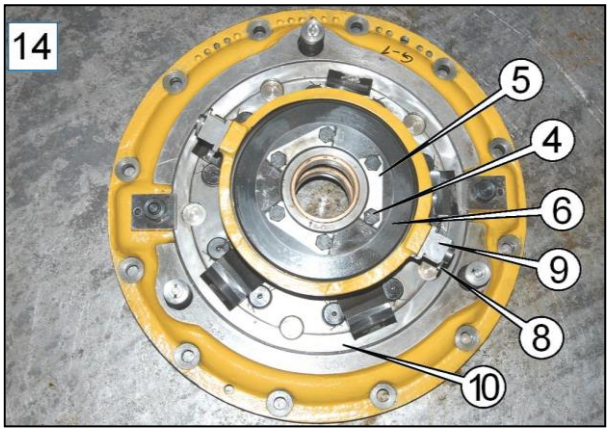
Disassembling

12. *Remove the nut (9), and lock (11)*

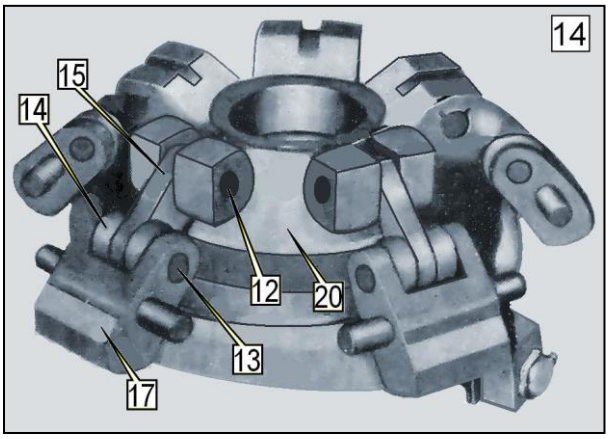
13. *Extract the cotter pin (14-1), draw out the bush (14-2) to the underside and take out the ring (14-3).*



14. *Remove the bolts (14-4) and locks (14-5) detach the plate (14-6), Pull off the cotter pin (14-8), slide out the block (14-9), remove the collar (14-10).*



15. *At each toggle mechanism, drive out the pin (14-12) and link pin (1-13), and remove the rollers (14-14), link (14-15) and link weight (14-17) from the collar (14-20).*



16. *Slide out the clutch plates and discs remove the bolts (17) and draw off the hub assembly.*

Main Clutch

Assembling

CLEANING AND INSPECTION

1. *Clean the clutch discs and plates. Check each part for distortion and inspect the friction surfaces for score marks, uneven wear or stepped wear.*

   Determine if each part is re-usable after repairing.

2. *Inspect the teeth, internal and external, associated with clutch plates and discs for wear or damage.*

3. *Inspect the ball end of the yoke actuating the lever for wear or damage.*

4. *Check the yoke actuating lever for distortion or any defective condition.*

5. *Check the bush on yoke actuating lever for wear or damage.*

6. *Inspect the block acted on by the yoke for wear or damage.*

7. *Inspect the toggle parts, checking the pins and link pins for distortion and rollers for wear or damage.*

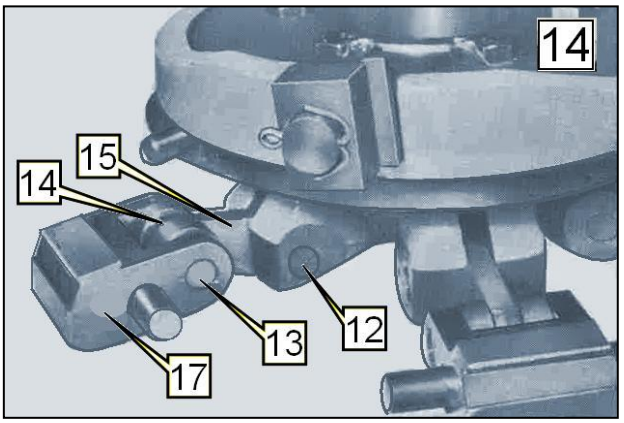
8. *Check the clutch springs for wear or signs of fatigue.*

9. *Inspect the oil seal for condition. Examine that part of drive shaft where the oil seal is located and see it the shaft is excessively worn or not.*

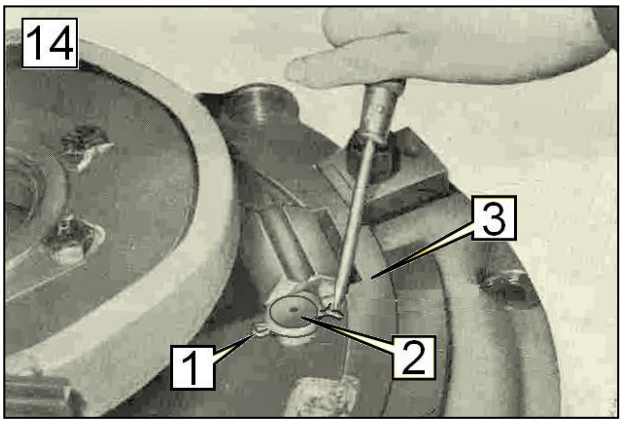
10. *Inspect, the internal surfaces of the flywheel for any signs of abnormal condition.*

ASSEMBLING

1. *Connect each assembly of the link pin (14-13), rollers (14-14) link (14-15) and link weight (14-17) to the collar (14-20) by inserting the pin (14-12). Be sure to punch on the pins to lock them in place.*



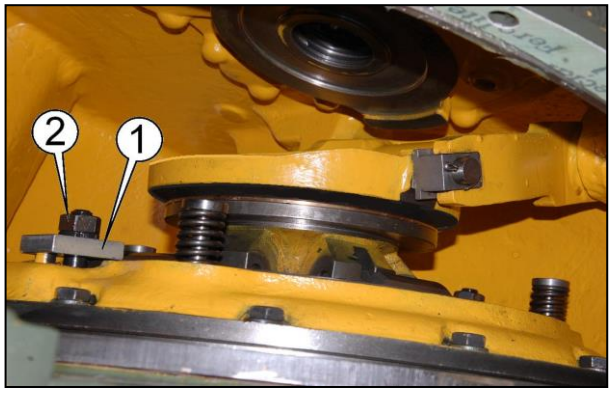
2. *Insert the bushes (14-2) into the rings (14-3), and lock each bush by inserting the cotter pin (14-1). Be sure to bend the pin legs around bush.*



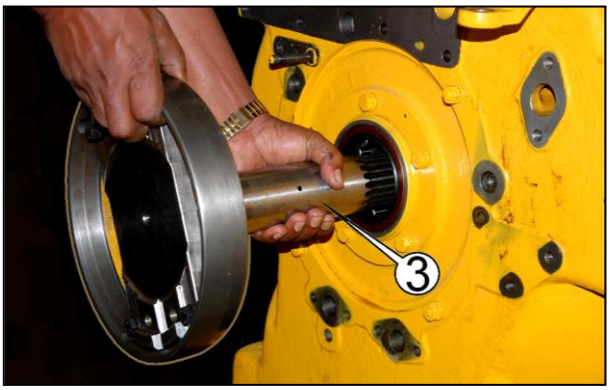
Assembling

3. *Secure the main clutch assembly to the flywheel by tightening the bolts (1): the installing procedure is the reverse of the removal step (23). Turn the collar to bring the block to top and bottom positions.*

4. *Before inserting the drive shaft, check to be sure that the blocks for securing the clutch case are correctly engaged with the yoke*



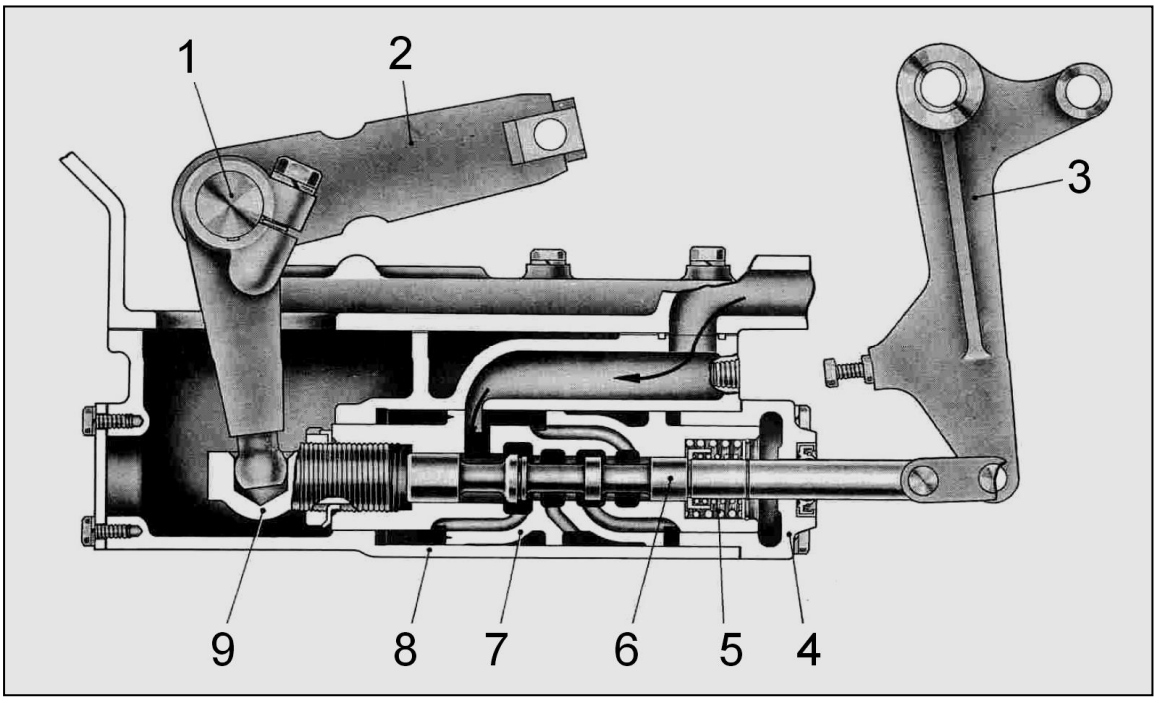
5. *Grease the drive shaft (3) as shown, so that it will not damage the oil seal and, just before the splined forward end of it reaches the hub, turn the shaft, by hand to be sure it will rotate smoothly. Thereupon, gently push in the drive shaft to feed its splined end into the hub.*



6. *Install the main-clutch booster.*
7. *Install the P.T.O. and restore the pipes and other parts.*

Description

HYDRAULIC BOOSTER



MAIN-CLUTCH BOOSTER

1. *Yoke shaft*
2. *Yoke*
3. *Lever*
4. *Cover*
5. *Spring*
6. *Spool*
7. *Piston*
8. *Valve body A, B, C, D Valve parts*
9. *Coupling*

The hydraulic booster is composed of the parts such as: the valve body or case secured to the main clutch casing; the piston capable of sliding axially in the bore of the valve body and having four valve ports (A) , (B), (C) and (D) in its bore; the spool fitted with a very small sliding clearance in the bore of the piston and connected with a linked lever at its extended end two springs interposed between piston and spool a coupling screwed into the output end of the piston; and a built-in safety valve.

The coupling serves as a seat for the ball end of the lever whose other end is keyed to the yoke shaft. The release collar in the main clutch is actuated coupling end of the booster piston through the yoke.

Absence of hydraulic pressure to the booster does not nullify the effect of the linkage between the control lever and release collar. The relationship between spool and piston in the valve body, moving the control lever will actuate the release collar; though a greater operating effort is required in such a case.

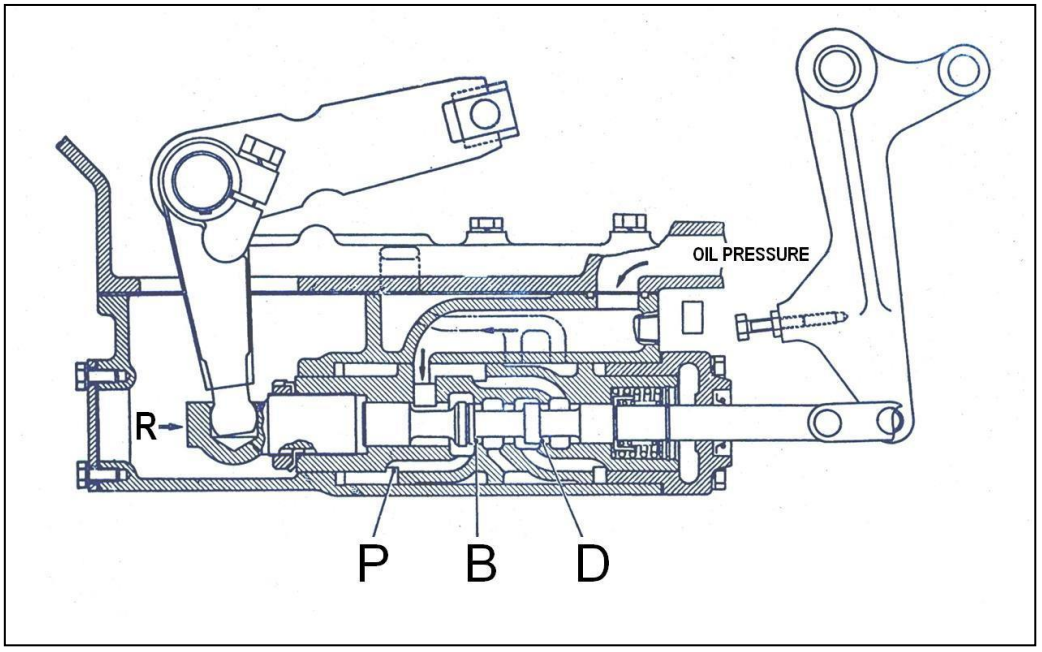
With the booster in neutral slate, the springs hold the spool in hydraulically balanced condition.

ENGAGING OPERATION

Pulling the clutch lever towards operator causes the spool to move against the springs slightly towards the right from Its neutral position, thereby closing ports (B) and (D). Hydraulic oil flows into the annular space (P) around the piston to push It In the direction of (R). This movement forces the release collar towards the flywheel to press the plates and discs together In the main clutch.

The amount of spool displacement is equal to the amount of piston movement. In other words, the piston follows the spool whenever the latter is made to move.

When the main clutch has been engaged, with the piston having followed the spool all the way, the internal valve parts open to balance the hydraulic forces acting on the piston, releasing the control lever under this condition removes the pull on the spool, and allows the pool to move slightly towards the coupling side by spring force, thus opening the valve ports fully.



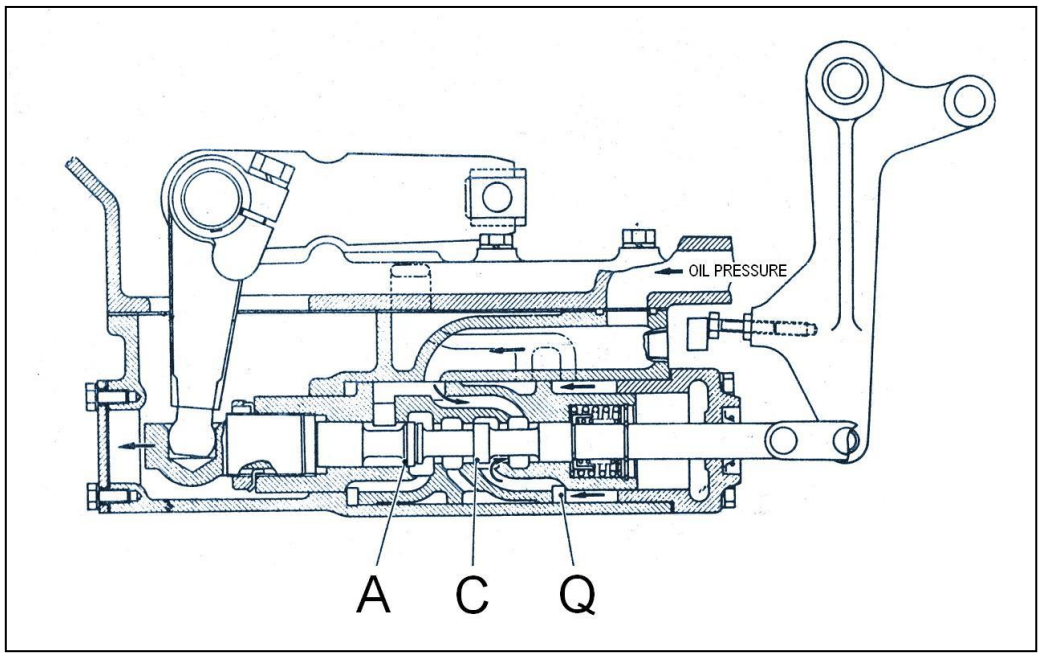
CLUTCH "ON"

Description

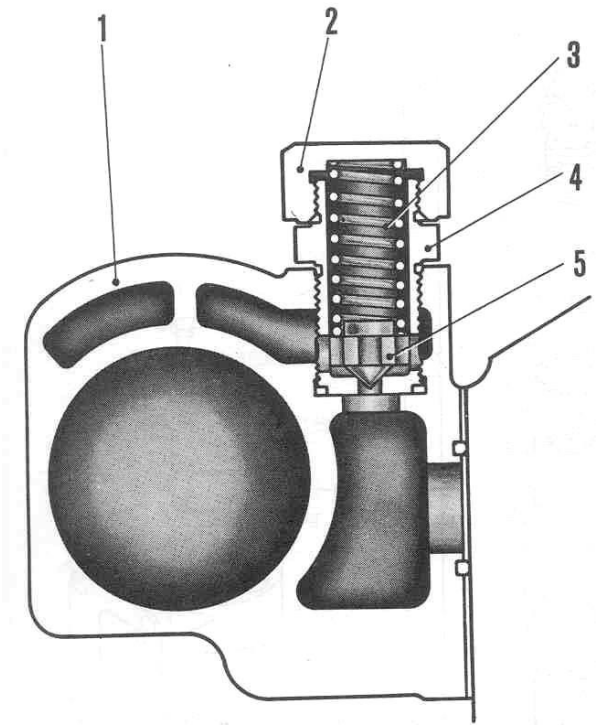
DISENGAGING OPERATION

As the clutch control lever is pushed away. the spool compresses the spring slightly and moves towards the left, closing ports (A) and (C). This admits hydraulic pressure into the space (Q) to move the piston towards the left and disengage the clutch. In this case too the piston moves by an amount equal to the spool displacement. As the clutch becomes disengaged the piston moves back just a little to open the ports and balance the hydraulic forces acting on it.

Whenever the piston is hydraulically moved by the pressure applied inside the space (Q), the oil trapped in the other space escapes through the outlet port and flows towards the main clutch.



CLUTCH "ON"



1. *Valve body*
2. *Cap*
3. *Spring*
4. *Valve seat*
5. *Needle valve*

Relief Valve

This valve is built in the booster case. It is a spring loaded piston valve set to pop open at about 14 kg/cm² of rising pressure and has its piston head exposed to the inlet oil passage of the booster.

The need of a relief valve for the booster inlet line will be seen in the light of the' fact that if the clutch control lever is kept pulled after the main clutch has been engaged, for instance the spool in the booster would hold the internal valve ports in closed condition to block up the discharge line of the oil pump.

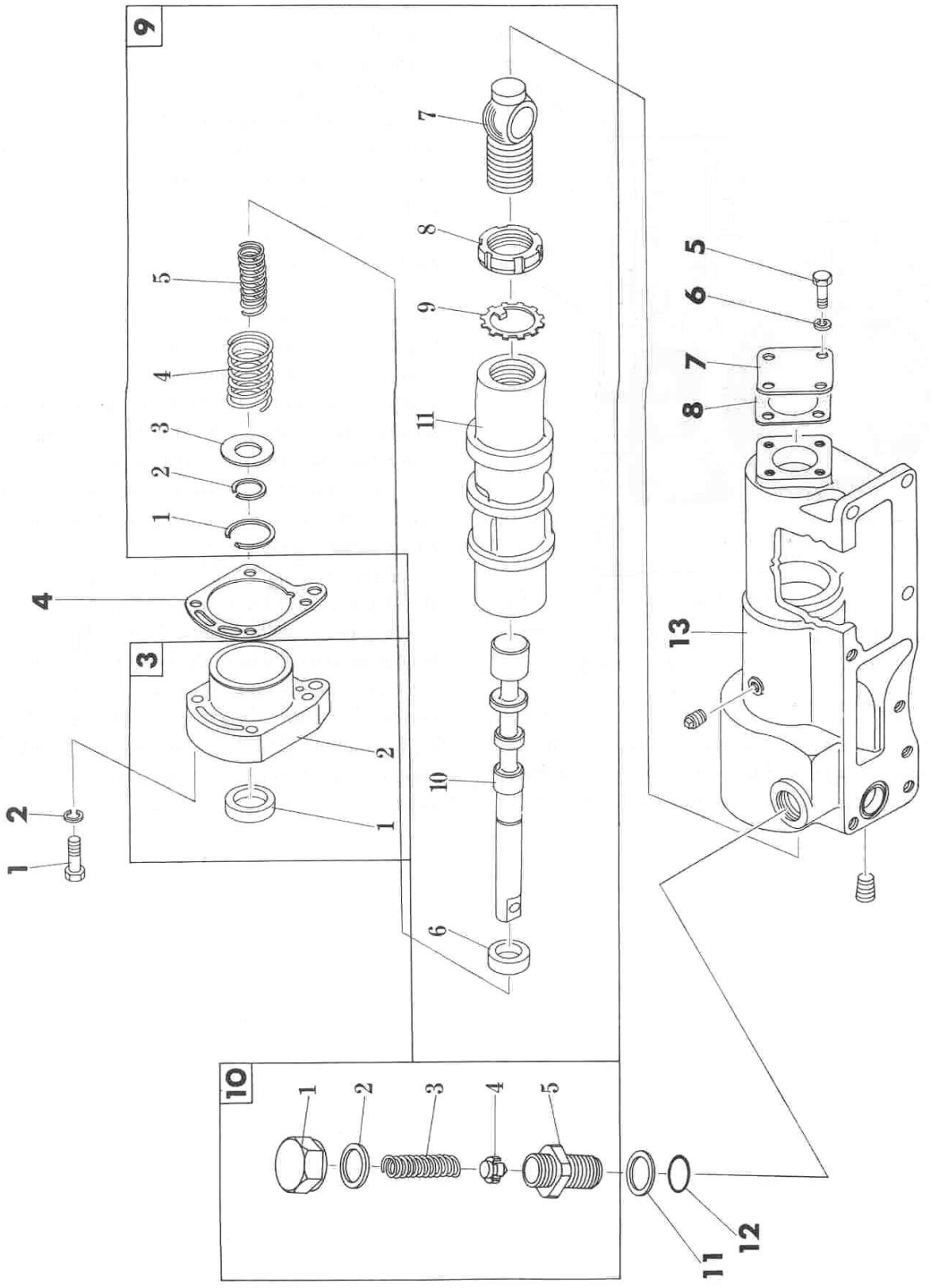
The pump, being a positive displacement type, needs some oil flow as long it is running. If the flow is so stopped the pressure in the line will build up rapidly and the booster or the pump will be damaged.

The relief valve checks such a pressure rise within a safe limit. Oil led out through the relieving action of the relief valve flows into the line connecting the booster outlet to the cooler. In addition to this led-out oil, a small amount of oil is constantly spilled towards the main clutch through an oil outlet provided in the right-hand section of the valve, even when the operator happens to keep the clutch control lever pushed or pulled fully.

Description

The constant spillage curbs the speed of pressure buildup to some extent in the event of the condition outlined above, so that safety valve will not be forced to open if the pressure rise is moderate or, in the case of disengaging operation, until the inertia brake begins to act on a coating clutch shaft.

DISASSEMBLING



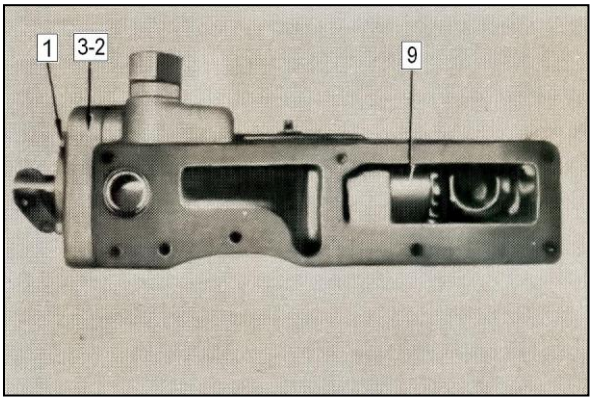
HYDRAULIC CLUTCH BOOSTER

PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1.	*Bolt*	*9-2.*	*Snap ring*	*10-1.*	*Nut*
2.	*Spring washer*	*9-3.*	*Washer*	*10-2.*	*Packing*
3-1.	*Oil seal*	*9-4.*	*Spring*	*10-3.*	*Spring*
3-2.	*Cover*	*9-5.*	*Spring*	*10-4.*	*Needle valve*
4.	*Gasket*	*9-6.*	*Spacer*	*10-5.*	*Valve seat*
5.	*Bolt*	*9-7.*	*Coupling*	*11.*	*Gasket*
6.	*Spring washer*	*9-8.*	*Nut*	*12.*	*O-ring*
7.	*Cover*	*9-9.*	*Lock washer*	*13.*	*Valve body*
8.	*Gasket*	*9-10.*	*Valve*		
9-1.	*Snap ring*	*9-11.*	*Piston*		

1. *Loosen the bolts (1) and remove the cover (3-2). Remove the cover (7). Draw out the valve assembly (9).*

2. *Take out the relief valve assembly (10). (Refer illustration)*



CLEANING AND INSPECTION

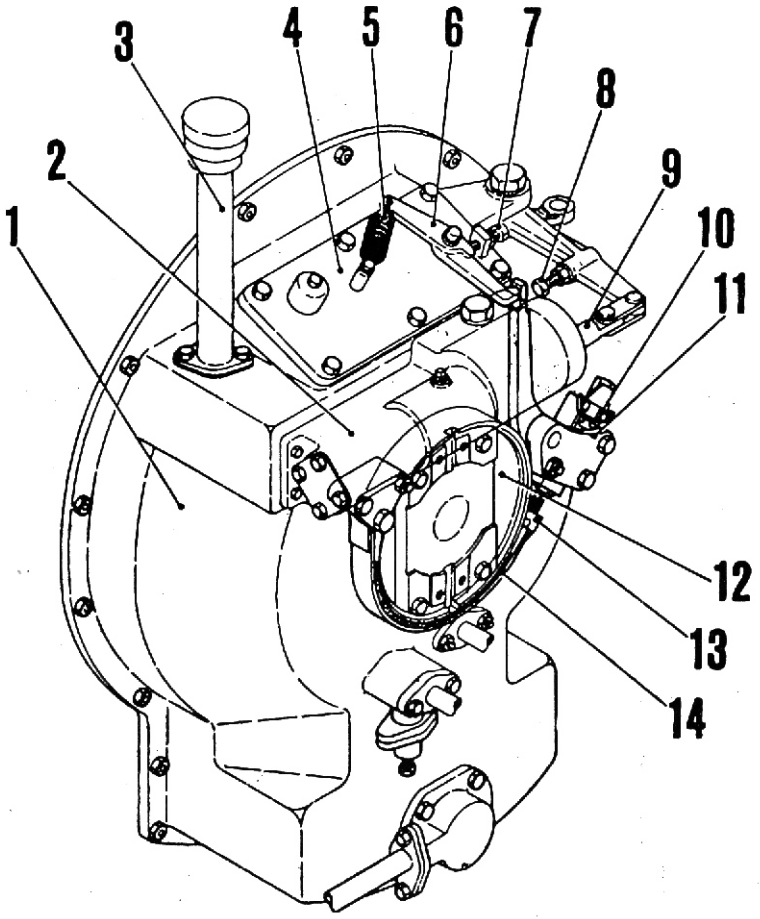
1. *Clean all parts thoroughly by washing in solvent.*
2. *Inspect the sliding surfaces of the valve for wear or any scratches.*
3. *Inspect the sliding surfaces, of the piston and valve body for wear or damage, giving particular attention to that part of the valve body In which the piston is inserted.*
4. *Inspect the socket seat of the coupling for the ball end of the lever, and see for excessive wear of the seat.*
5. *Inspect the relief valve; and needle valve for wear of the valve seat.*
6. *Check the springs for signs of fatigue or damage.*

INERTIA BRAKE

The inertia brake band is held by the brackets secured to the main clutch casing and presses the bottom half of the drum.

The band lining, secured to the band by riveting, is made of a thermally strong heat conductive material which possesses a high coefficient of friction.

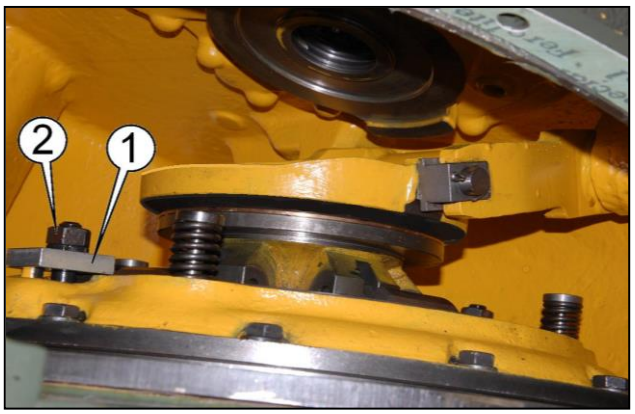
The vertical brake lever has its bottom part pivoted on the clutch casing and bottom end engaged with the free end of the brake band at a bracket. The top end is Interconnected to the main clutch control linkage in such a way that the brake will apply when the clutch is made to disengage.



INERTIA BRAKE

1. *Main clutch case*
2. *Main clutch booster*
3. *Oil filler*
4. *Main clutch cover*
5. *Inertia brake lever spring*
6. *Inertia brake lever*
7. *Brake lever adjust bolt*
8. *Booster lever adjust bolt*
9. *Main clutch booster valve*
10. *Inertia brake adjust bolt*
11. *Brake lever*
12. *Main clutch drive shaft*
13. *Brake band*
14. *Brake lining*

CLUTCH ADJUSTMENT



Shut down the engine and keep the decompression lever In "START" position. Remove the cover of the inspection access opening. Shift the transmission to a speed position so that the main clutch shaft will not turn during the adjustment.

Loosen nut (2) and lock plate (1). Turn the flywheel 180', and loosen the other lock plate. Turn the adjusting ring in place with a wrench or bar applied to a weight link.

Turning the adjusting ring clockwise (as viewed from rear side) will tighten the clutch, and vice versa.

Note: 1. THERE ARE TWO LOCK PLATES, WHICH ARE LOCATED DIAMETRICALLY OPPOSITE TO EACH OTHER. THE ADJUSTING RING MAY BE TURNED IN PLACE WHEN BOTH LOCK PLATES ARE LOOSENED. BE CAREFUL NOT TO DROP THE NUTS WHILE LOOSENING THESE PLATES.

2. THE STARTING MOTOR MAY BE USED TO TURN THE FLYWHEEL TO BRING THE LOCK PLATE TO THE OPENING OF THE CLUTCH HOUSING. THIS METHOD OF TURNING IS POSSIBLE ONLY WHEN THE ENGINE IS IN DECOMPRESSED POSITION.

3. WHEN TURNING THE ADJUSTING RING IN PLACE, BE CAREFUL NOT TO MAR OR NICK THE SIDE OF THE CAM.

Criteria for adjustment:

(a) The force required for operating the clutch (under the condition of the engine in shutdown) should not exceed 45-50 Kg. The adjusting ring is the means of meeting this requirement.

(b) After repositioning the adjusting ring, be sure to secure the two lock plates reliably and to tighten bolts fully.

INERTIA BRAKE ADJUSTMENT

1. Disengage the main clutch by releasing the control lever. After the disengaging the clutch the clutch control lever would move back just a little. This movement is due to booster piston returning to its neutral position under the force of return spring. The inertia brake comes Into force when the piston has completed this return movement.

The adjusting screw (2) is to be used with reference to the position of the clutch control lever.

2. Loosen the lock nut, and tighten the adjusting screw (2) to obtain a clearance between the two levers (1) and (5).

3. Loosen the lock nut, and tighten the adjusting screw (3) so as not to touch the brake lever (5).

4. Lightly push the brake lever to make the brake lining barely touch the drum. While holding the lever in this position, turn back the adjusting screw (2) until the two levers (1) and (5) contact, and then turn in the screw 1.2 rotations.

5. Turn the screw (3) until it advances far enough to touch the brake lever (5). Turning the screw back 1.2 rotations from that position

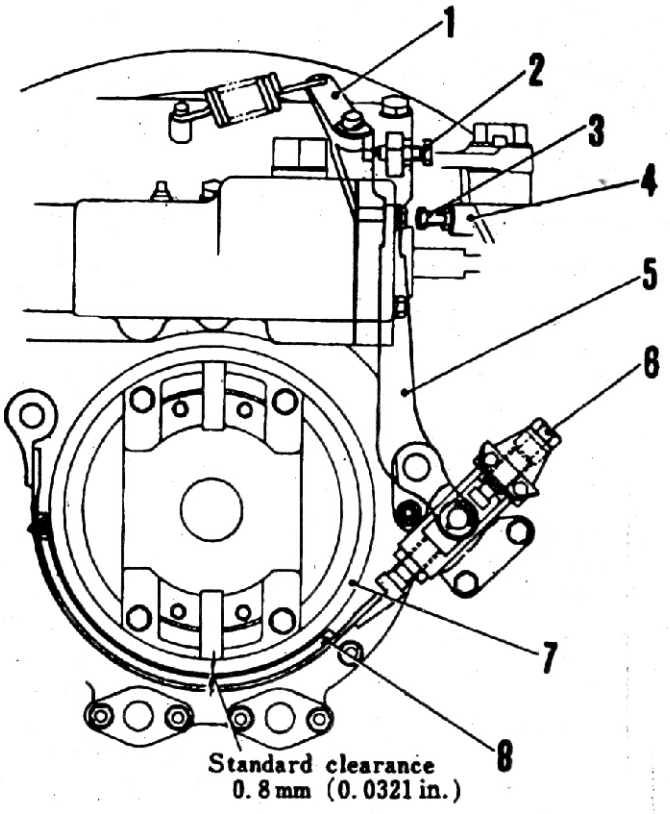
should result in contact of the brake lever at its both faces with screw (3) and lever (1). After the adjustment has been completed, check to be sure that the clearance between the drum and the brake lining is 0.8 mm.

6. Tighten the lock nuts good and hard.

Note: ADJUSTING SCREWS (2) (6) WILL BE EFFECTIVE AS LONG AS THE WEAR IN THE BRAKE IS NOT ADVANCED TOO FAR IF EITHER ADJUSTING SCREW IS FOUND INEFFECTIVE IN THE ABOVE PROCEDURE, OR WHEN THE BRAKE LINING HAS BEEN RENEWED, ADOPT THE FOLLOWING PROCEDURE.

Extra Step

After completing the steps 1,2 and 3, loosen the lock nut and tighten the adjusting screw (6) until the brake lever assumes a nearly vertical position with the brake lining coming into contact with the drum. Tighten the lock nut fully, and proceed the remaining steps 4.5 and 6 accordingly.

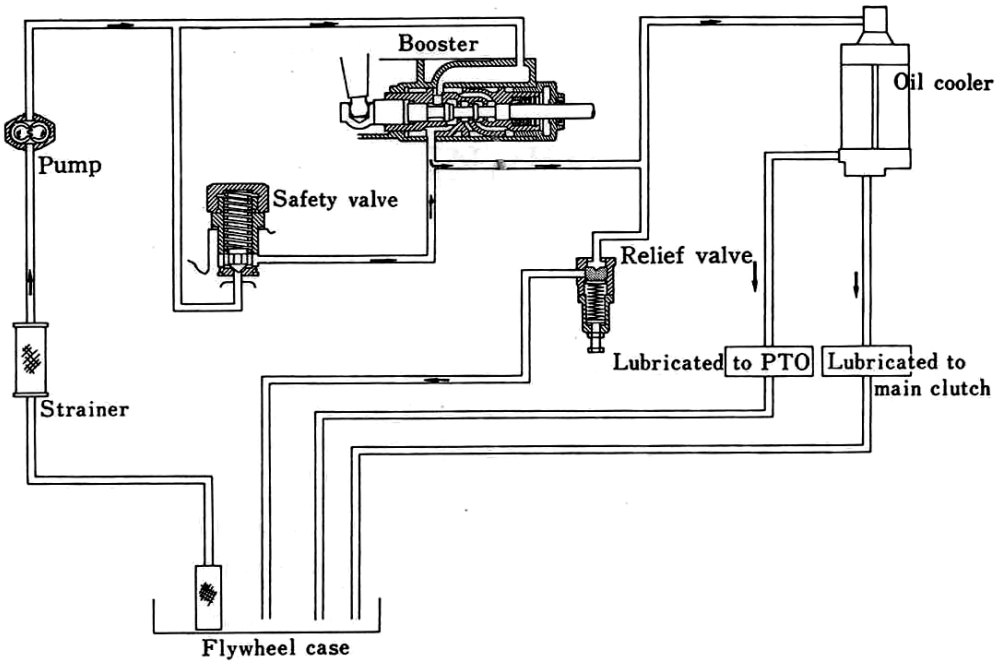


INERTIA BRAKE

1. *Return lever*
2. *Adjust screw*
3. *Bolt*
4. *Lever*
5. *Brake lever*
6. *Adjust screw*
7. *Brake drum*
8. *Brake lining*

LUBRICATION SYSTEM

LUBRICATION OF MAIN CLUTCH AND P.T.O.



MAIN CLUTCH OIL CIRCUIT

The main clutch oil pump mounted on the P.T.O case above the engine flywheel casing sucks the oil from the flywheel casing through the strainer located within the casing and supplies pressurized oil ,to the hydraulic booster on the main clutch casing. From the booster, oil flows through the oil cooler and enters the main clutch to lubricate and cool the running parts of the clutch. Part of the cooled oil flows into the P.T.O. to lubricate the P.T.O. gears.

A relief valve is provided in the oil line from the booster to the oil cooler. The relieved oil from relief valve is led into the flywheel casing.

TRANSMISSION

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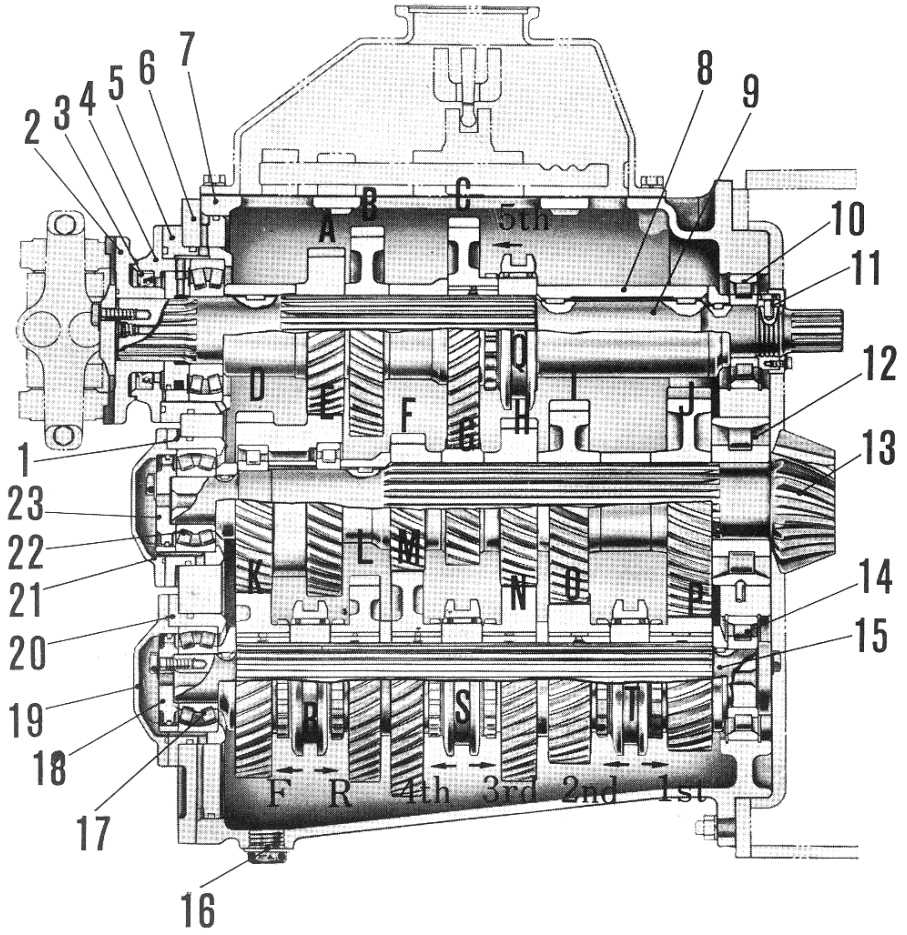
Transmission



TRANSMISSION

1. *Bearing cage*
2. *Coupling ring*
3. *Oil seal*
4. *Main 'shaft cover*
5. *Bearing cage*
6. *Front cover*
7. *Transmission case*
8. *Collar*
9. *Main shaft*
10. *Bearing*
11. *Nut*
12. *Bearing*
13. *Countershaft (bevel pinion)*
14. *Bearing*
15. *Intermediate shaft*
16. *Drain plug (magnet)*
17. *Bearing*
18. *Holder*
19. *Intermediate shaft cover*
20. *Bearing cage*
21. *Countershaft cover*
22. *Bearing*
23. *Holder*

A. Main shaft gear
B. Main shaft reverse gear
C. Main shaft 5th speed gear
D. Countershaft gear
E. Countershaft gear
F. Countershaft 4th gear
G. Countershaft 5th speed gear
H. Countershaft 3rd speed gear
I. Countershaft 2nd sped gear
J. Countershaft 1st speed gear
K. Intermediate forward gear
L. Intermediate reverse gear
M. Intermediate 4th speed gear
N. Intermediate 3rd speed gear
O. Intermediate 2nd speed gear
P. Intermediate 1 st speed gear
Q. Forward 5th speed clutch gear
R. Forward reverse clutch gear
S. Forward reverse 3rd and 4th speed gear
T. Forward reverse 1st and 2nd speed gear

Transmission

Description

DESCRIPTION

The transmission is of a constant-mesh type consisting of three clusters of helical gears on shafts - Main shaft, Counter shaft with a bevel pinion and intermediate shaft - all assembled in a single separate case. The transmission assembly as a unit can be removed from the machine without affecting any other components.

Controlled by two shift levers, the transmission provides 5 forward and 4 reverse speeds. One of the shift levers is for actuating the shifter forks within to select the speeds. The other lever is for selecting FORWARD or REVERSE. The gears on the shafts are of two kinds constant mesh helical gears and clutch gears. Some constant-mesh helical gears are mounted over roller bearings or splined to the shaft.

Each clutch gear consists of an outer ring with internal teeth and an inner ring (or boss) which is externally toothed and internally splined to run with the shaft. The outer ring is clutched by a shifter fork and slid ably meshed with its inner ring or hub so that the clutch gear as a whole runs with the shaft. In operation, the outer ring is actuated axially (along the shaft) by the fork to slide onto the mating external teeth formed on an adjacent constant-mesh gear. This displacement couples that constant-mesh gear to the shaft, thereby transmitting drive from shaft to gear or from gear to shaft, depending on which clutch gear is moved.

How these constant-mesh gears are selectively coupled with respective shaft to form a specific train of gears will be noted in the chart which follows:

DIRECTION	SPEED	DRIVE TRANSMITTING GEAR TRAIN	
FORWARD	1st	A-E-D-K	P - J
	2nd		O - I
	3rd		N - H
	4th		M - F
	5th	C-G	
REVERSE	1st	B-L	P - J
	2nd		O - I
	3rd		N - H
	4th		M - F

FLOW OF DRIVE

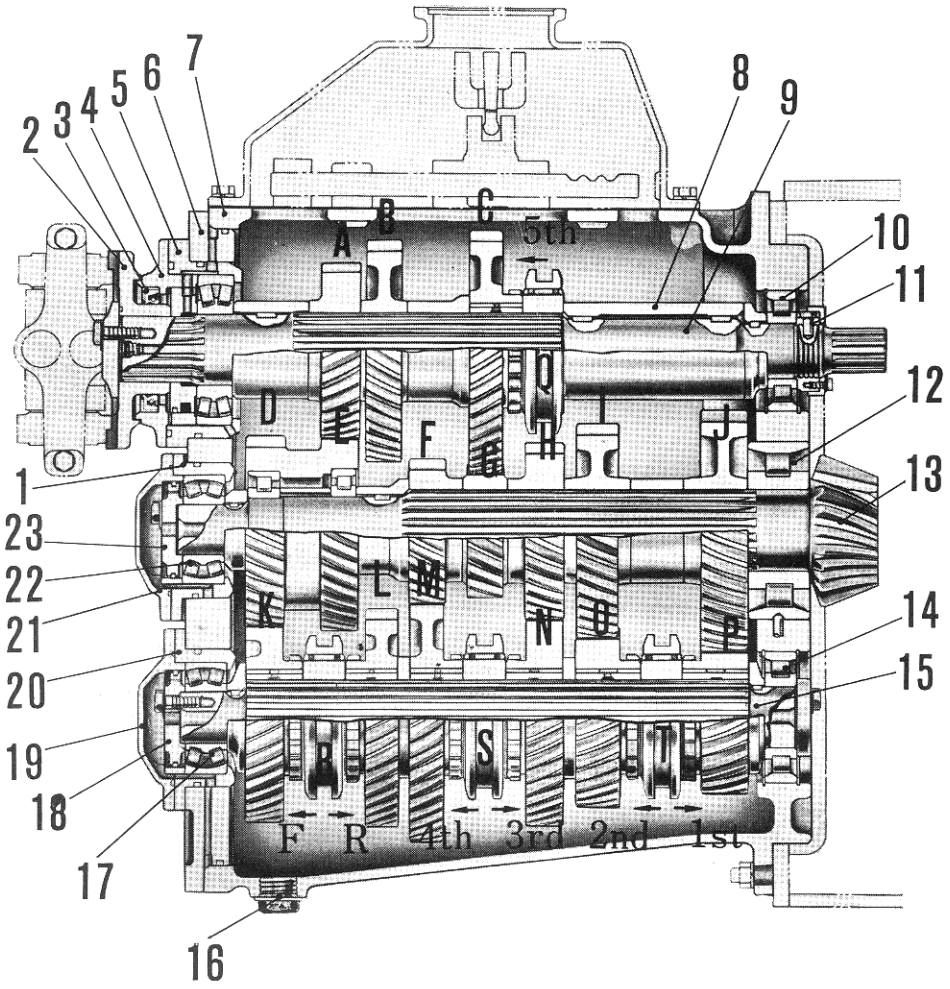
How drive flows through the transmission will be seen In the following description of the control operation for FORWARD FIRST taken as an example:

Shifting the FORWARD-REVERSE lever to (F) position (for forward drive) causes F-R clutch gear on intermediate shaft to mesh with FORWARD gear (K). Next, shifting the SPEED lever to FIRST causes FIRST clutch gear on intermediate shaft to engage with adjacent gear (P) which is in constant mesh with gear (J)

splined to counter shaft. Under this condition, drive is transmitted from main shaft through gears (A),(E),(D),(K) and (P) to gear (J). Gear (A) runs with main shaft. Gears (E), (D) merely spin around countershaft and serve as an idler between gear (A) and gear (K). The F-R clutch gear couples gear (K) to intermediate shaft for forward drive. The FIRST (SECOND) clutch gear couples intermediate shaft to gear (P) to drive countershaft through gear (J).

The power for driving the work attachment is taken from the rear end of the main shaft.

The axial position of the countershaft is set by the shim (standard: 0.3 mm) located at its forward end. For adjustment of the backlash and tooth-contact pattern in the bevel gear drive, countershaft is to be axially displaced by increasing or decreasing the amount of shim and the bevel gear too is to be similarly displaced along the axis of bevel gear shaft in the steering clutch-case.



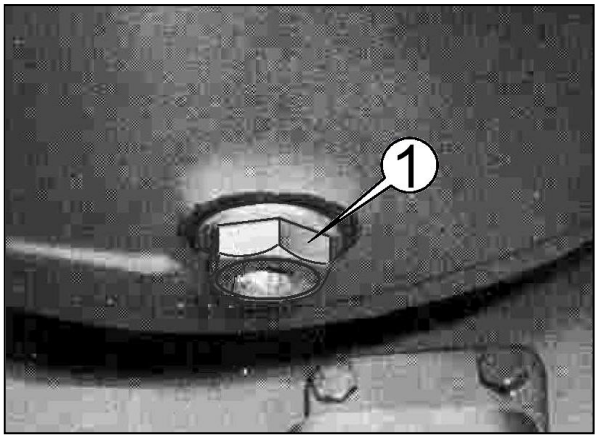
Removal

1. *Remove the floor plates.*

2. *Drain oil in hydraulic tank.*

3. *Remove the transmission under guard.*

4. *Drain the oil in transmission case removing the drain plug (1).*



5. *Disconnect the steering clutch control rods.*

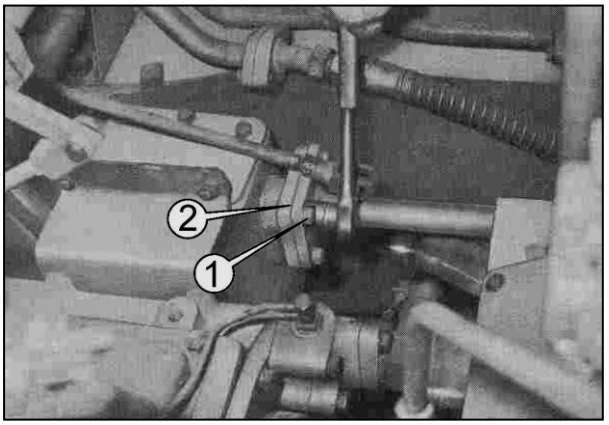
6. *Disconnect the brake control rods and main-clutch control rods.*

7. *Remove all pipes standing in the way of the brake pedal support being' removed and remove the support.*

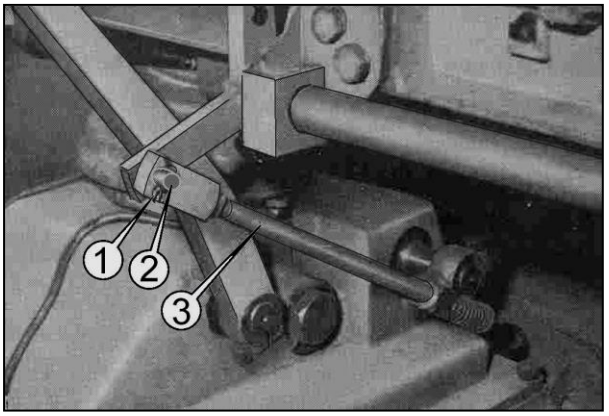
8. *Remove the main-clutch booster.*

9. *Disconnect and remove the universal joint.*

10. *Remove the bolts (1) and detach the flange (2) for the oil strainer.*



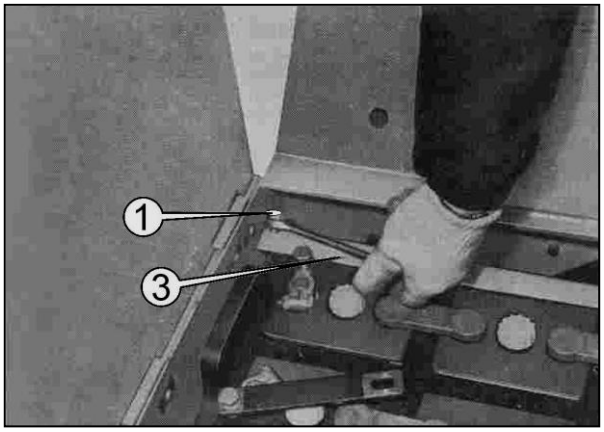
11. *Pullout the cotter pin (1) and remove the pin (2) disconnecting the forward-reverse lever rod (3).*

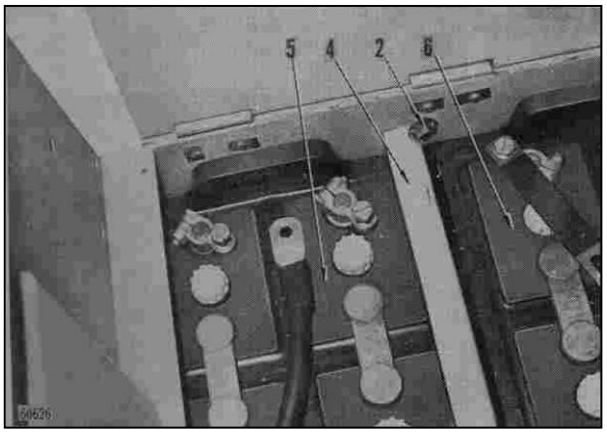


Transmission

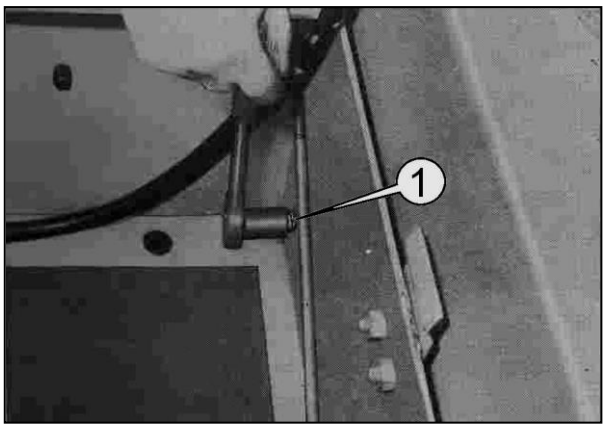
Removal

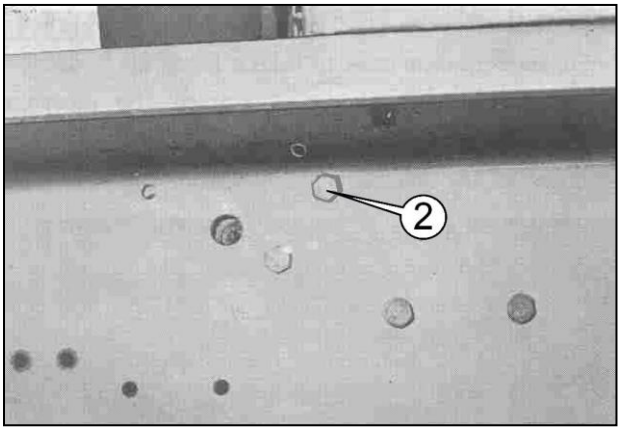
12. *Disconnect the battery cord remove the (1) (2), take out the side frames (3) (4) and remove the batteries (5) (6).*

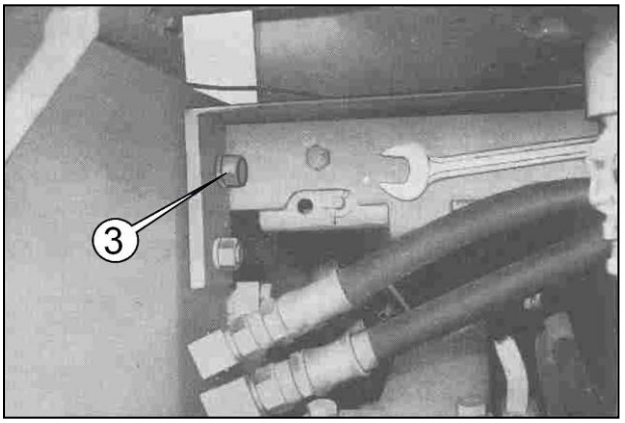




13. *Remove the bolts (1) inside the battery box. Remove the bolts (2) (3) securing the operator's seat support, and take out the seat by lifting It with a hoist.*



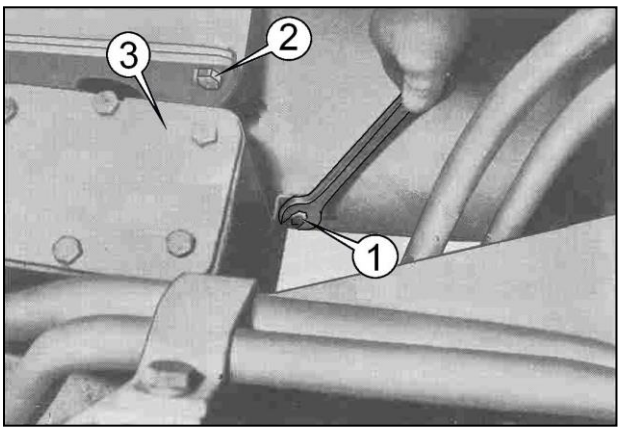




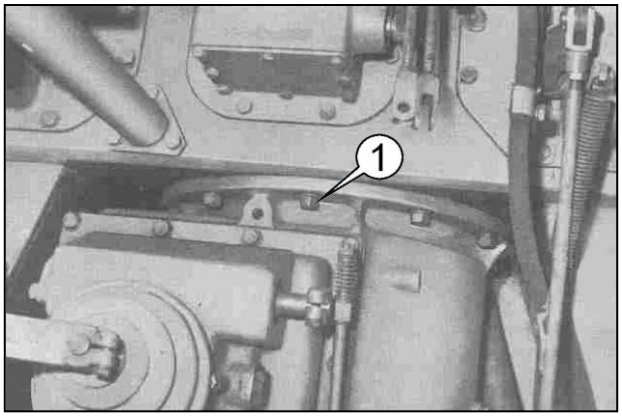
14. *Remove the transmission case valve.*

15. *Remove the flange for connection with the universal joint,*

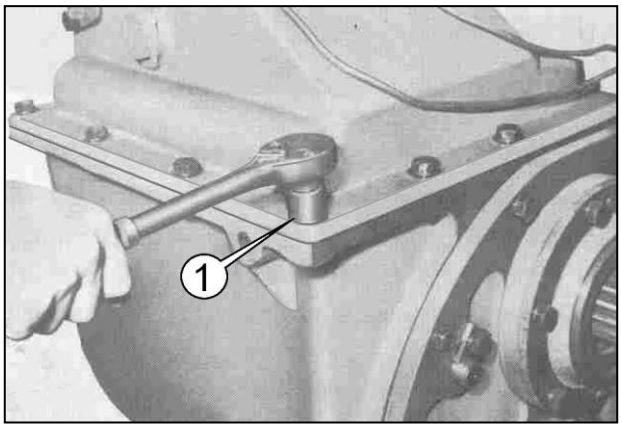
16. *Remove the bolts (1) (2) and take out the strainer (3).*



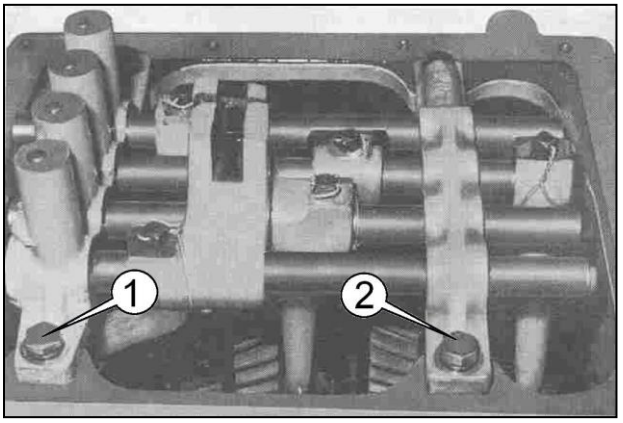
17. *Remove nuts (1). Pass the lifting sling under the transmission case to take a hitch on it, detach the case keeping in suspension from the steering case. Move the case slightly forward and carry it out of the machine by operating the crane.*



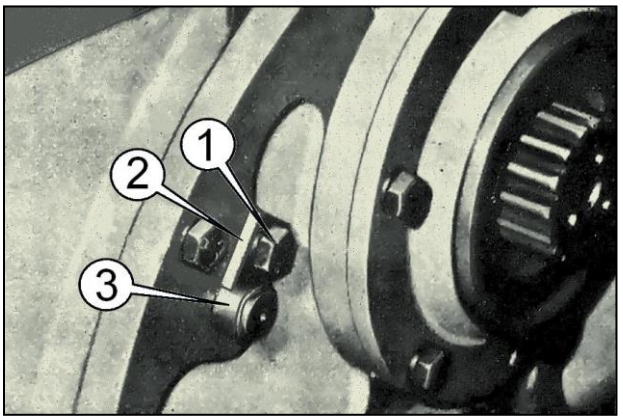
18. *Remove bolts (1) and remove the cover (shifter housing) from the transmission case. Use the hoist and lifting sling to remove the cover.*

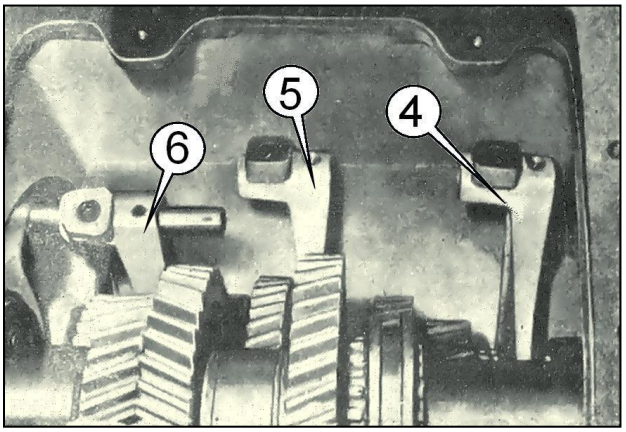


19. *Remove bolts (1) (2) securing the fore and rear brackets, and take out the shifter fork assembly.*



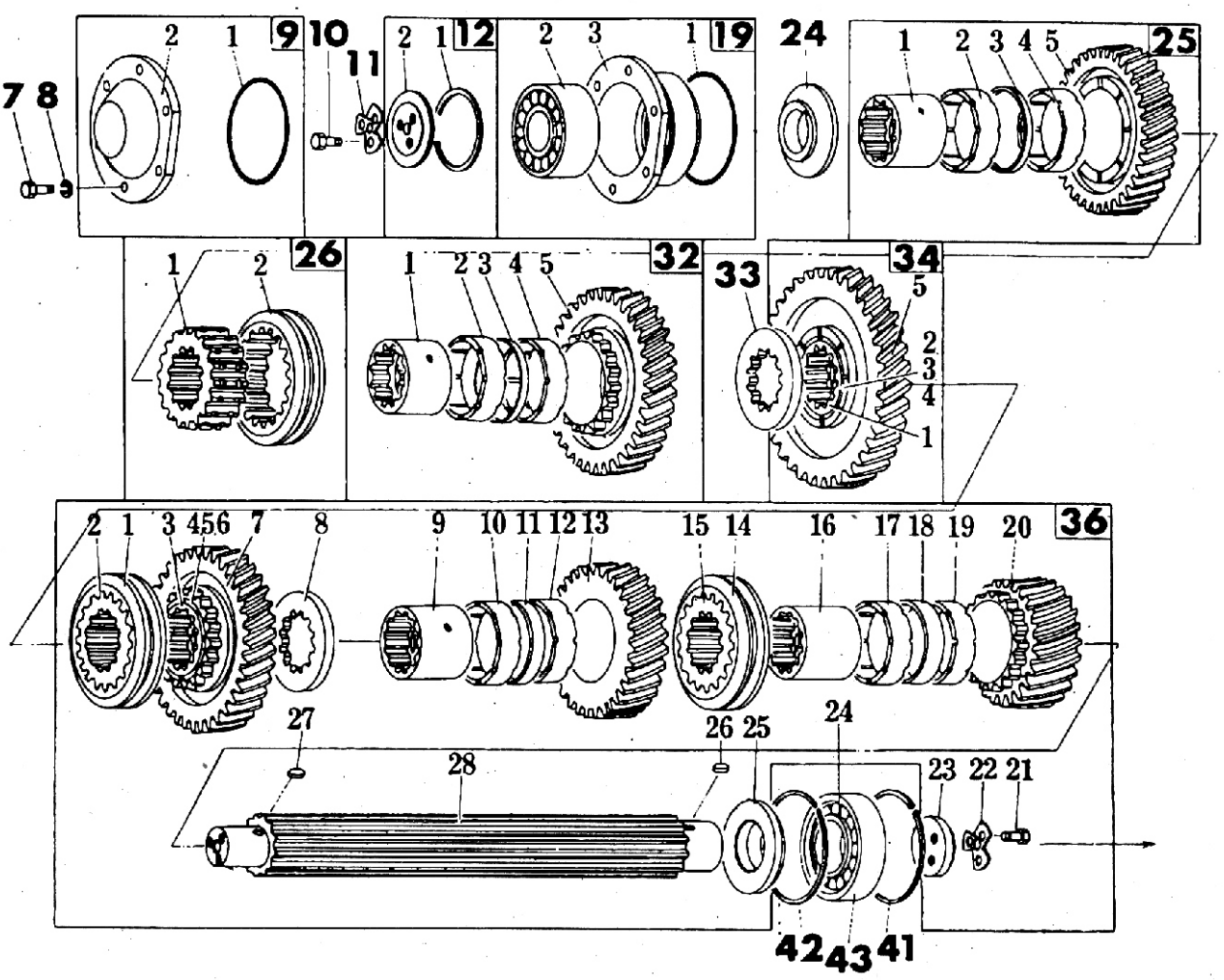
20. *Remove bolt (1) and remove lock plate (2). Slowly take out shaft. (3) and take out shifter forks (4) (5) (6) one by one as the shaft comes out.*



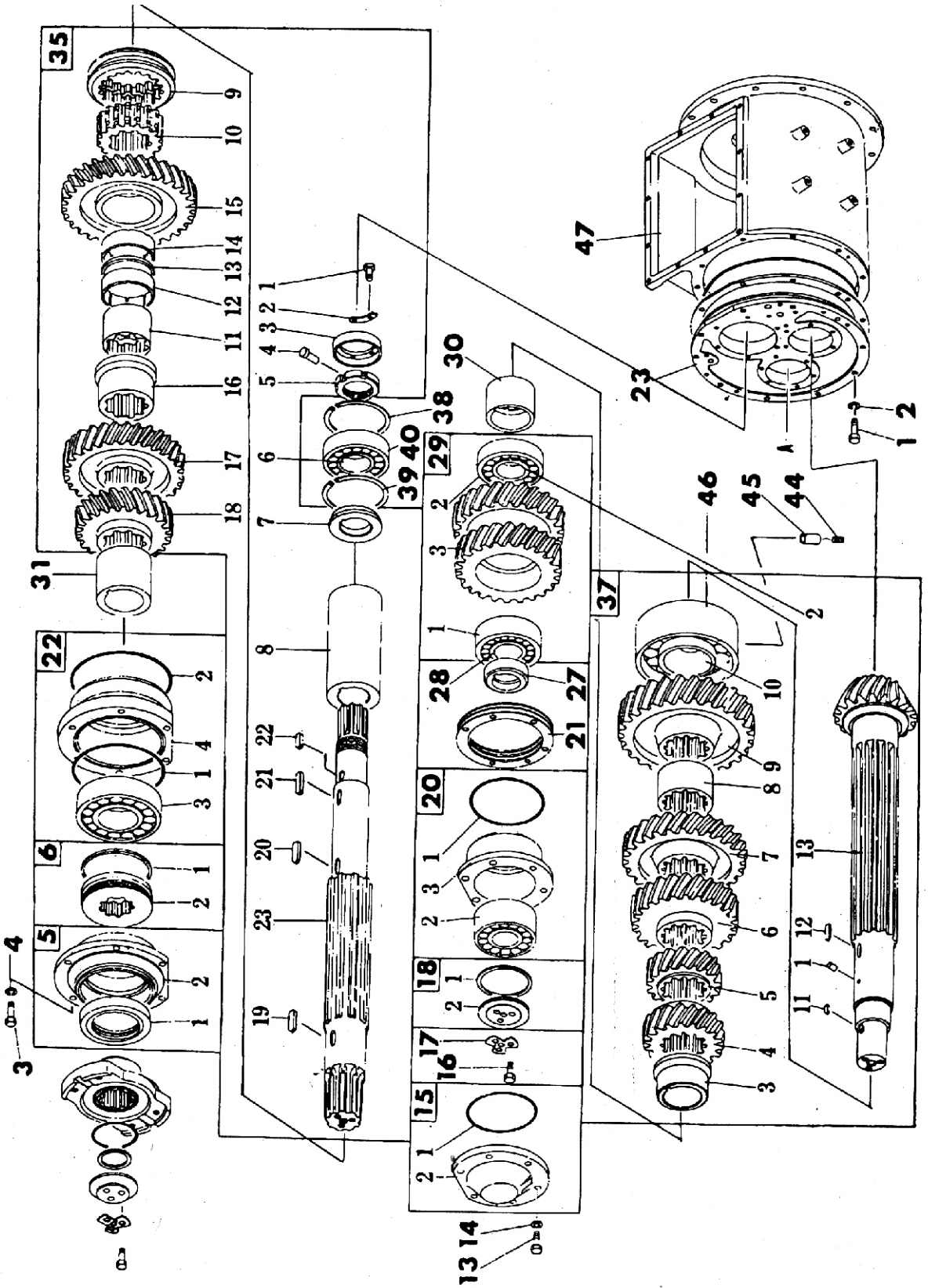


Note: *STEPS - (1) ~ (3) (5) ~ (9) (14)(15) ARE OUTLINED IN DETAIL IN CORRESPONDING STEPS OF MAIN-CLUTCH REMOVAL PROCEDURES.*

Disassembling



DISASSEMBLING



PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1. Bolt
2. Spring washer
3. Bolt
4. Spring washer
5-1. Oil seal
5-2. Cage
6-1. Seal ring
6-2. Holder
7. Bolt
8. Spring washer
9-1 O-ring
9-2. Cover
10. Bolt
11. Lock
12-1. Seal ring
12-2. Holder
13. Bolt
14. Spring washer
15-1. O-ring
15-2. Cover
16. Bolt
17. Lock
18-1. Seal ring
18-2. Holder
19-1. O-ring
19-2. Bearing
19-3. Bearing cage
20-1. O-ring
20-2. Bearing
20-3. Bearing cage
21. Shim
22-1. O-ring
22-2. O-ring
22-3. Bearing
22-4. Cage
23. Cover
24. Collar
25-1. Inner race
25-2. Bush
25-3. Collar
25-4. Bush
25-5. Driven gear
26-1. Guide gear
26-2. Coupling gear
27. Collar
28. Bearing inner race
29-1. Bearing outer race
29-2. Bearing outer race
29-3. Gear
30. Collar
31. Collar
32-1. Inner race
32-2. Bush
32-3. Collar
32-4. Bush
32-5. Gear
33. Spacer
34-1. Inner race
34-2. Bush
34-3. Collar
34-4. Bush
34-5. Gear
35-1. Bolt
35-2. Lock
35-3. Stopper
35-4. Pin
35-5. Nut
35-6. Bearing inner race
35-7. Collar
35-8. Collar
35-9. Coupling gear
35-10. Guide gear
35-11. Inner race
35-12. Bush
35-13. Collar
35-14. Bush
35-15. Gear
35-16. Collar
35-17. Gear
35-18. Gear
35-19. Key
35-20. Key
35-21. Key
35-22. Key
35-23. Main shaft
36-1. Coupling gear
36-2. Guide gear
36-3. Inner race
36-4. Bush
36-5. Collar
36-6. Bush
36-7. Gear
36-8. Spacer
36-9. Inner race
36-10. Bush
36-11. Collar
36-12. Bush
36-13. Gear
36-14. Coupling gear
35-15. Guide gear
35-16. Inner race
36-17. Bush

Transmission

Disassembling

36-18. Collar

36-19. Bush

36-20. Gear

36-21. Bolt

36-22. Lock

36-23. Holder

36-24. Bearing inner race

36-25. Collar

36-26. Key

36-27. Key

36-28. Intermediate shaft

37-1. Dowel pin

37-2. Bearing inner race

37-3. Collar

37-4. Gear

37-5. Gear

37-6. Gear

37-7. Gear

37-8. Collar

37-9. Gear

37-10. Bearing inner race

37-11. Key

37-12. Key

37-13. Countershaft

38. Snap ring

39. Snap ring

40. Bearing outer ring

41. Snap ring

42. Snap ring

43. Bearing outer ring

44. Set screw

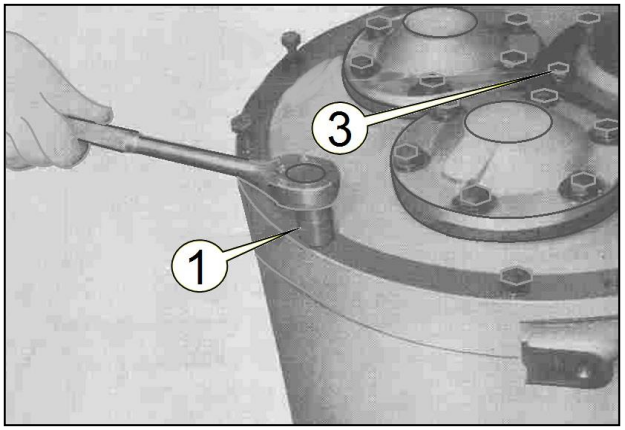
45. Dowel pin

46. Bearing outer race

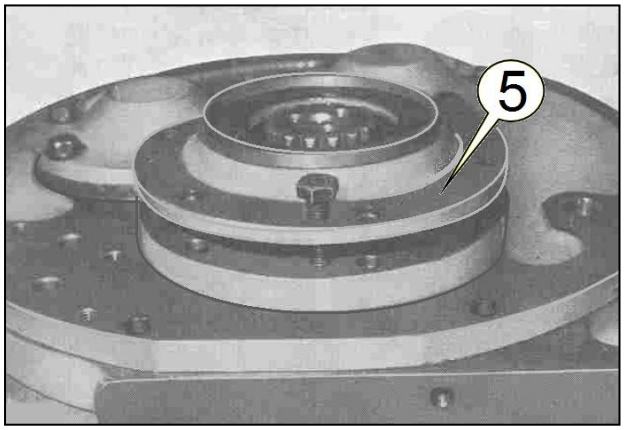
47. Transmission case

Disassembling

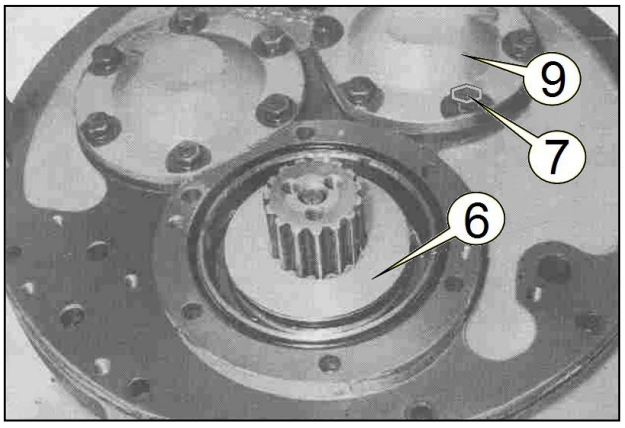
1. *Place the transmission on a stable support, setting it up on its end as shown. Remove bolts (1) and cage securing bolts (3) .*



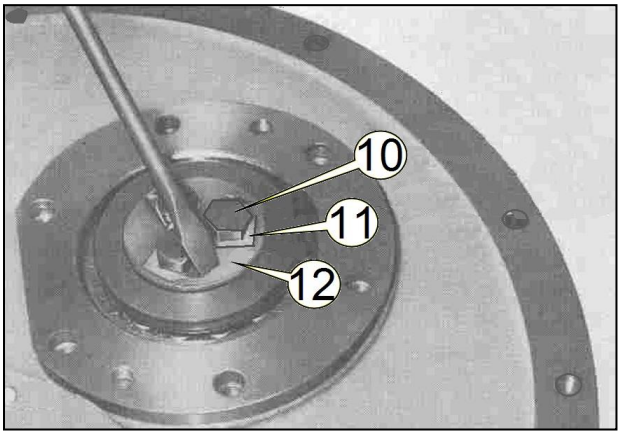
2. *Using jacking bolts, detach and remove cage (5).*



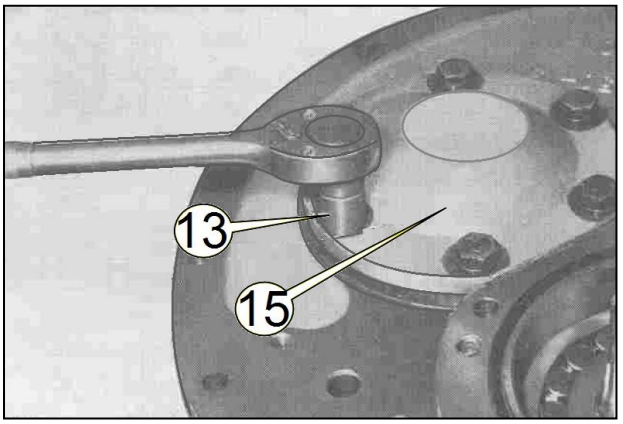
3. *Take out holder (6). Remove bolts (7) and remove cover (9).*



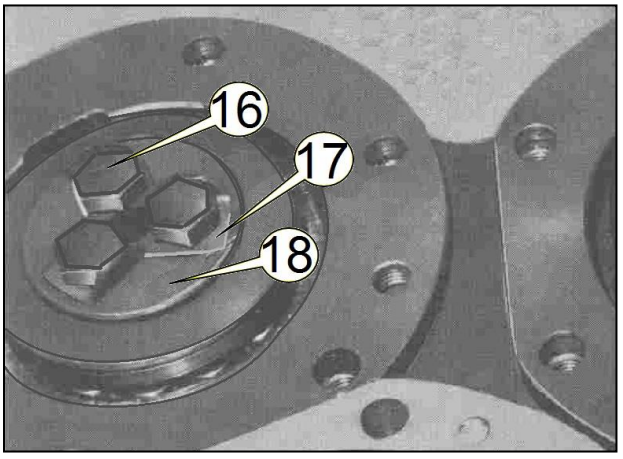
4. *Straighten the lock plate (11), remove bolts (10) and remove holder (12) and lock plate.*



5. *Remove bolts (13) and remove cover (15)*



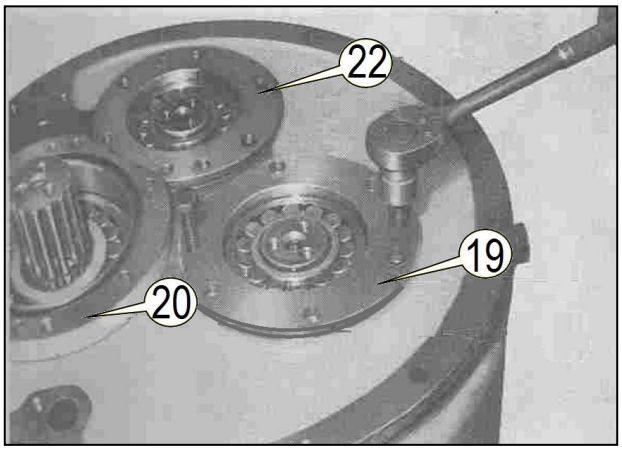
6. *Straighten the lock plate, remove bolts (16) and remove holder (18) and lock plate (17) .*



Transmission

Disassembling

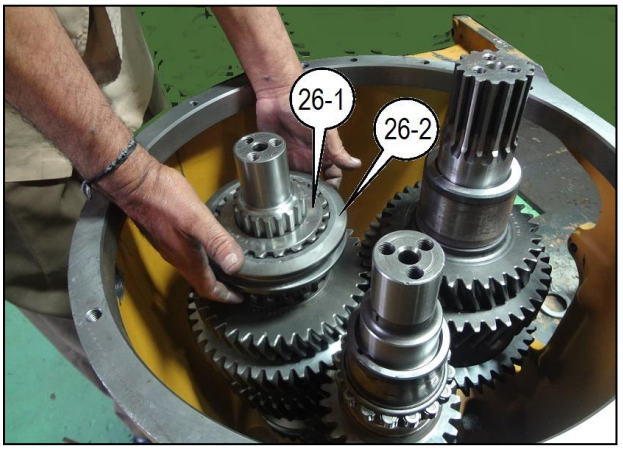
7. *Using jacking bolts; extract bearing cage (19). Similarly force out cages (20) (22).*



8. *Lift the Cover (23) off the transmission case.*

9. *Remove collar (24) and take out gear (25).*

10. *Take out guide gear (26-1) & coupling (26-2).*



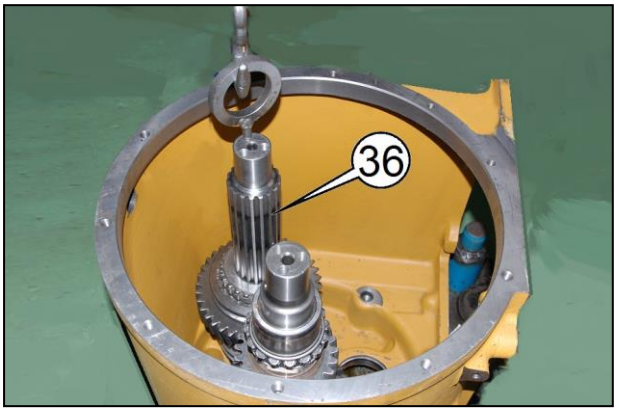
11. *Mount the gear extractor as shown, and take out gear (29).*

12. *Take out: collar (27), bearing rollers and inner race (28) and gear (29), in that order.*

13. *Take out collar (30) and collar (31). ·Remove gear (32).*

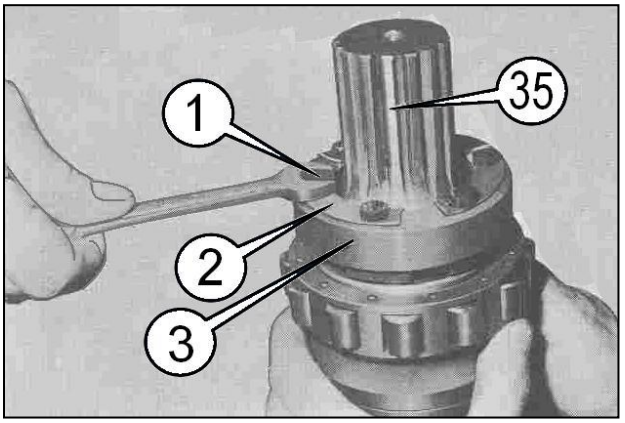
14. *Screw an eye bolt into the end face of the main shaft and take up the weight of the main shaft assembly (35) with a hoist Take out gear (34), and lift the shaft assembly out of the transmission case.*

15. *Screw an eye bolt Into the end face of the Intermediate shaft, and lift the shaft assembly (36) out of the transmission case.*



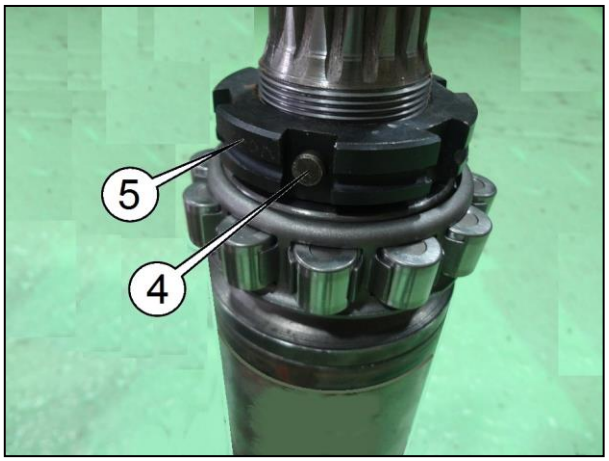
16. *Screw an eye bolt Into the end face of the countershaft, and lift the shaft assembly (37) out of the case.*

17. *Remove bolts (1) on the main shaft assembly (35), and remove lock (2) and stopper (3)*

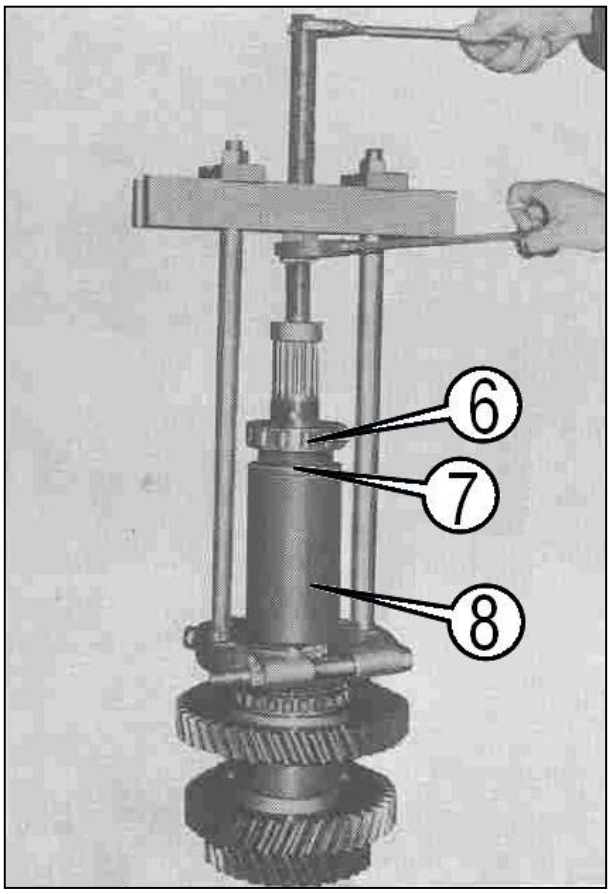


Disassembling

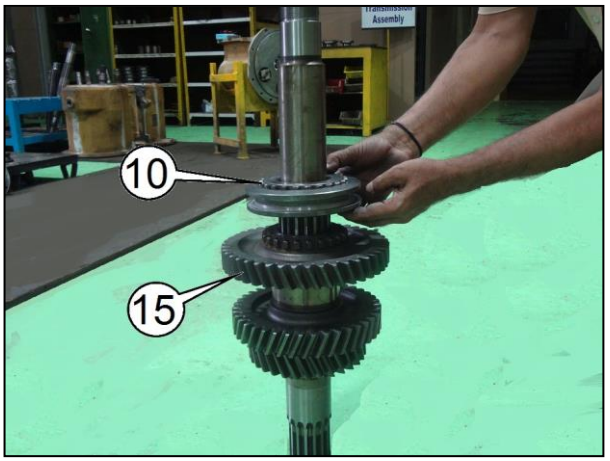
18. *Pullout pin (4) and remove nut (5).*



19. *Mount the bearing remover on the main shaft assembly removed. By operating the remover, draw out bearing (6), collar (7) and collar (8).*

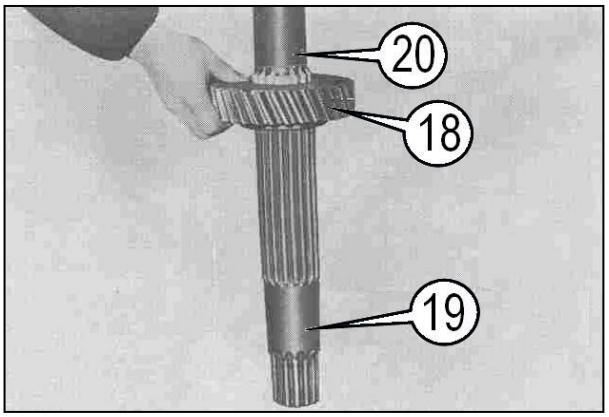


20. *Slide out guide gear (10) and gear (15).*

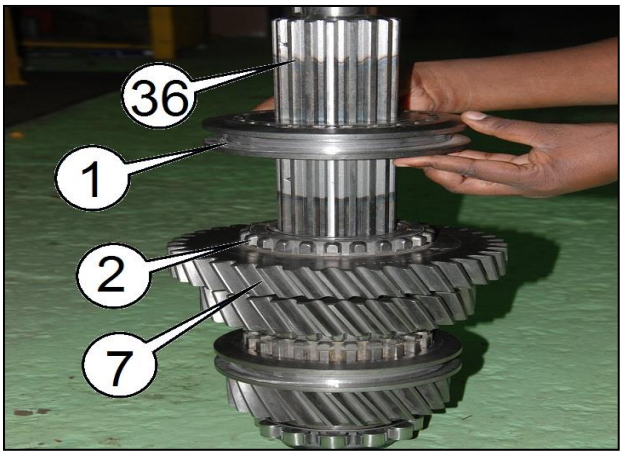


21. *Take collar (16) off the shaft .and remove gear (17).*

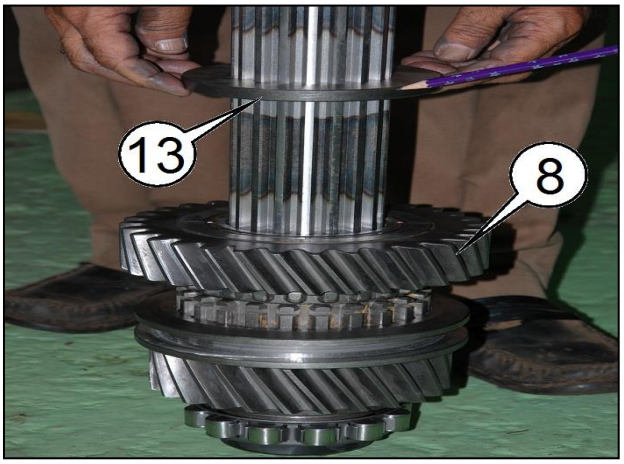
22. *Remove gear (18) and recover keys (19) (20) (21) (22) from the shaft.*



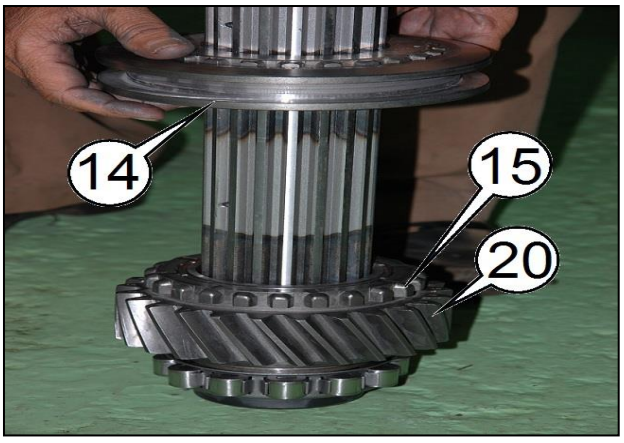
23. *From the intermediate shaft (36), slide out coupling gear (-1) guide gear (-2) and gear (-7).*



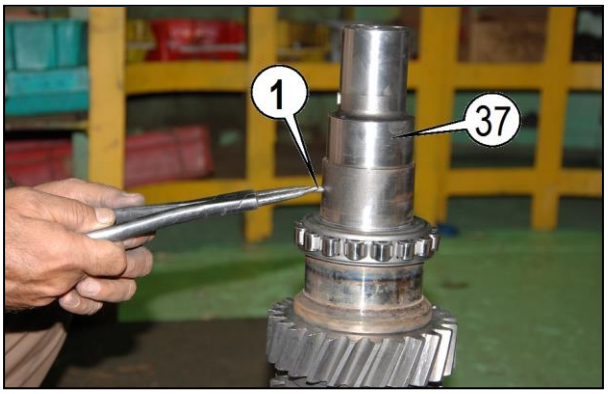
24. *Take off spacer (8) and gear (13).*



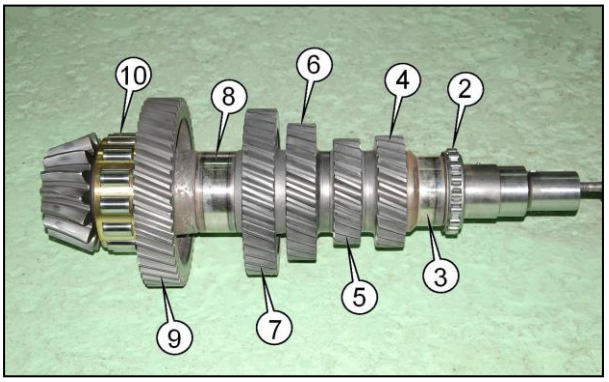
25. *Draw out coupling gear (14), guide gear (15) and gear (20) from the intermediate shaft.*



26. *Using pliers, draw dowel pin(1) off the counter shaft (37).*



27. *Remove from the counter shaft the following parts: Bearing (2) collar (3) gear (4), gear (10) gear (6), gear (7), collar (8), gear (9) and bearing (10), in that order.*



CLEANING AND INSPECTION

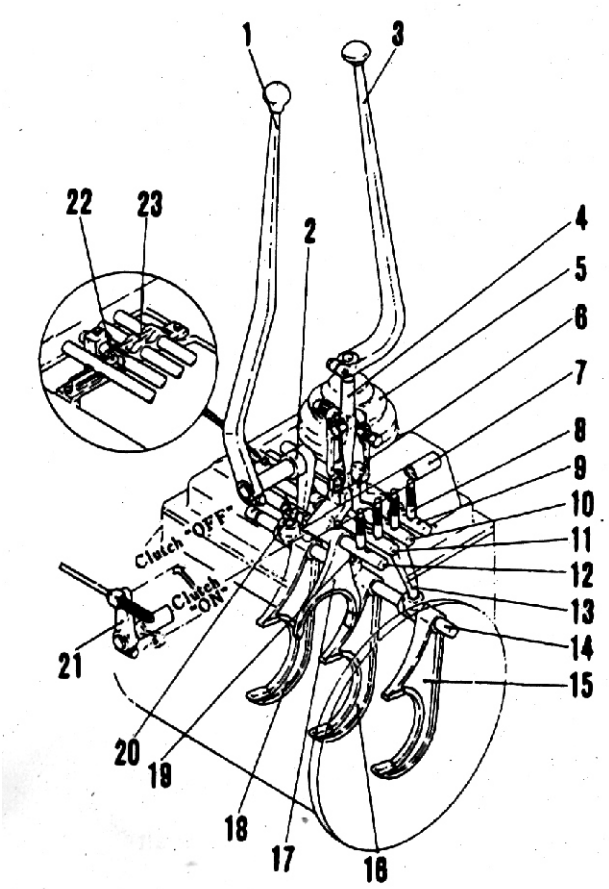
1. *Clean all parts thoroughly by washing.*
2. *Inspect gear teeth and splines for wear or damage.*
3. *Check the tips of shifter forks for wear or damage.*
4. *Inspect oil seals for damage.*
5. *Inspect the parts of the shafts where oil seals are located, and see If the surfaces are excessively worn or otherwise damaged.*

ASSEMBLING

Observe the following instructions in assembling the transmission:

1. *The three shaft assemblies are to be inserted into the transmission case in the order of countershaft, intermediate shaft and main shaft. Build up each assembly to the extent of the completeness in which it was removed in disassembling.*
2. *Be sure to discriminate one coupling gear from another, and to match the guide gears correctly to the respective coupling gears. Install the case cover (23) after all these gears have been put in.*
3. *Use three long bolts in fitting the bearing cages (19)(20)(22) into the case cover, and secure each cage by tightening its Securing bolts. Be sure to insert a proper amount of shim between cage (22) and cover (23) to obtain a proper mesh on each gear.*
4. *When securing the shifter fork brackets, check to the sure the tips of each fork are correctly riding on its coupling gear and then tighten the bolts on the brackets.*
5. *After all the shaft assemblies are installed, turn each gear by hand to see if it rotates smoothly or not.*
6. *After the shifter housing (case) is put on, operate the control levers to be sure the shifter forks will move properly and then secure the case in place by tightening the securing bolts.*

TRANSMISSION SHIFT MECHANISM



1. *Forward-Reverse selector lever*
2. *Forward-Reverse shifter lever*
3. *Gearshift lever*
4. *Lever*
5. *Boot*
6. *Gate*
7. *Interlock shaft*
8. *Plunger*
9. *1st-2nd shift fork shaft*
10. *3rd·4th shift fork shaft*
11. *Forward and Reverse shift fork shaft*
12. *5th shift fork shaft*
13. *1st and 2nd shift fork lever*
14. *Gear fork sub-shaft*
15. *1st and 2nd shift fork*
16. *3rd and 4th shift fork*
17. *5th shift fork*
18. *Forward and reverse shift fork*
19. *3rd and 4th shift fork lever*
20. *Forward and Reverse shift fork leave*
21. *Lever*
22. *Dowel pin*
23. *Front bracket*

DESCRIPTION

The shift transmission has four shifter forks. Three of them are controlled by the gearshift lever extending straight up through the cowl part of the shifter housing, the fourth one (FORWARD- REVERSE fork) being controlled by the other lever located by the side of the gearshift lever.

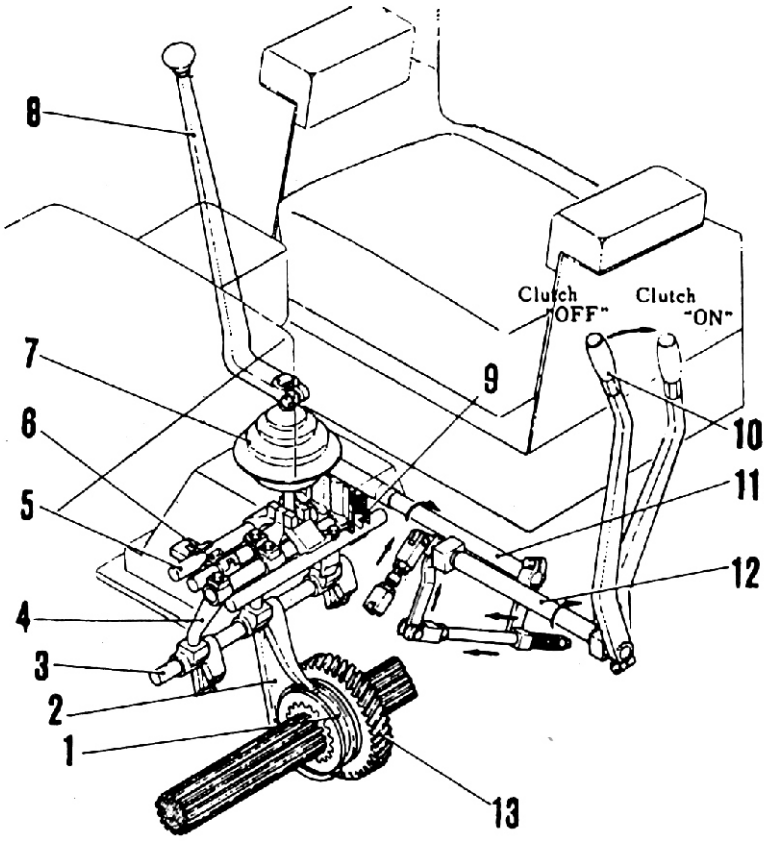
An interlock system is included in this mechanism to allow shifting of gears only when the main clutch is disengaged.

The bottom portion of the gearshift lever is pivoted in a box- like gate, which is in turn pivoted with pins to the housing. The gate determines the lateral position of the lever, allows the lever to move only one shift fork at a time, and urges the lever towards its centre position.

The cowl or top part of the housing is enclosed with a rubber boot to prevent entry of dust or water into the transmission.

TRANSMISSION SHIFT MECHANISM

Description



INTERLOCK SYSTEM

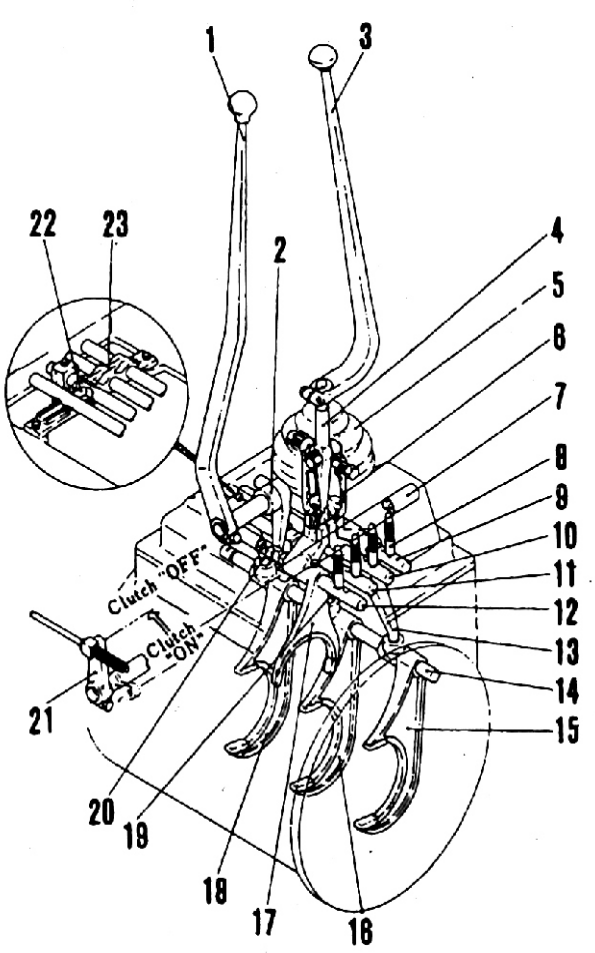
1. *Clutch gear*
2. *Fork*
3. *Sub-fork shaft*
4. *Gearshift fork*
5. *Gearshift fork shaft*
6. *Dowel pin*
7. *Boot*
8. *Gearshift lever*
9. *Plunger*
10. *Main clutch lever*
11. *Interlock shaft*
12. *Main clutch shaft*
13. *Gear*

The system consists of four interlocking plungers, each loaded with a coiled spring, and a recessed Interlocking shaft interconnected to the main clutch control lever, the point of interconnection being at the shifter housing.

The plungers are arranged In a row and slide in vertical holes provided in a bracket, which Is bolted to the top of the transmission case and located within the shifter housing. The four shifter fork shafts extend through this bracket, one shaft under one Interlocking plunger. That portion of each shaft under the plunger Is dented at two (FIFTH SPEED shaft) or three (other three shafts) adjacent places such that the tip of the plunger drops into one of these dents arresting the shafts.

The recessed Interlocking shaft Is directly above the row of plungers and limits the upward movement of these plungers except when the shaft turns and thereby allow each plunger to

rise and slide out of the dent. By this arrangement, the shifter fork shafts are locked in their arrested positions as long as the main clutch is engaged. To say it in other words, the main clutch has to be disengaged first in order to shift the transmission to any speed position or back to neutral.



Disengaging the main clutch causes the interlocking shaft to turn to the unlocking position mentioned above. The Interlocking system also prevents the clutch gears within the Transmission from slipping off due to tooth wear to excessive angling of the machine in traveling condition or to a sudden change of load.

One more interlocking arrangement comprising a dowel pin, a point dent on FIFTH SPEED shaft and a long dent on FORWARD-REVERSE shaft is provided In the shift mechanism. It is located at the forward end of FIFTH SPEED shaft and interlocks this shaft to FORWARD-REVERSE shaft for the purpose of eliminating fifth reverse speed in the transmission.

The dowel pin is slid ably contained in a hole provided in the fore bracket, through which the four shifter fork shafts extend forward. The pin is positioned between FORWARD-REVERSE shaft and FIFTH SPEED shaft and has Its one end riding on and within the long dent and other end riding on FIFTH-SPEED shaft.

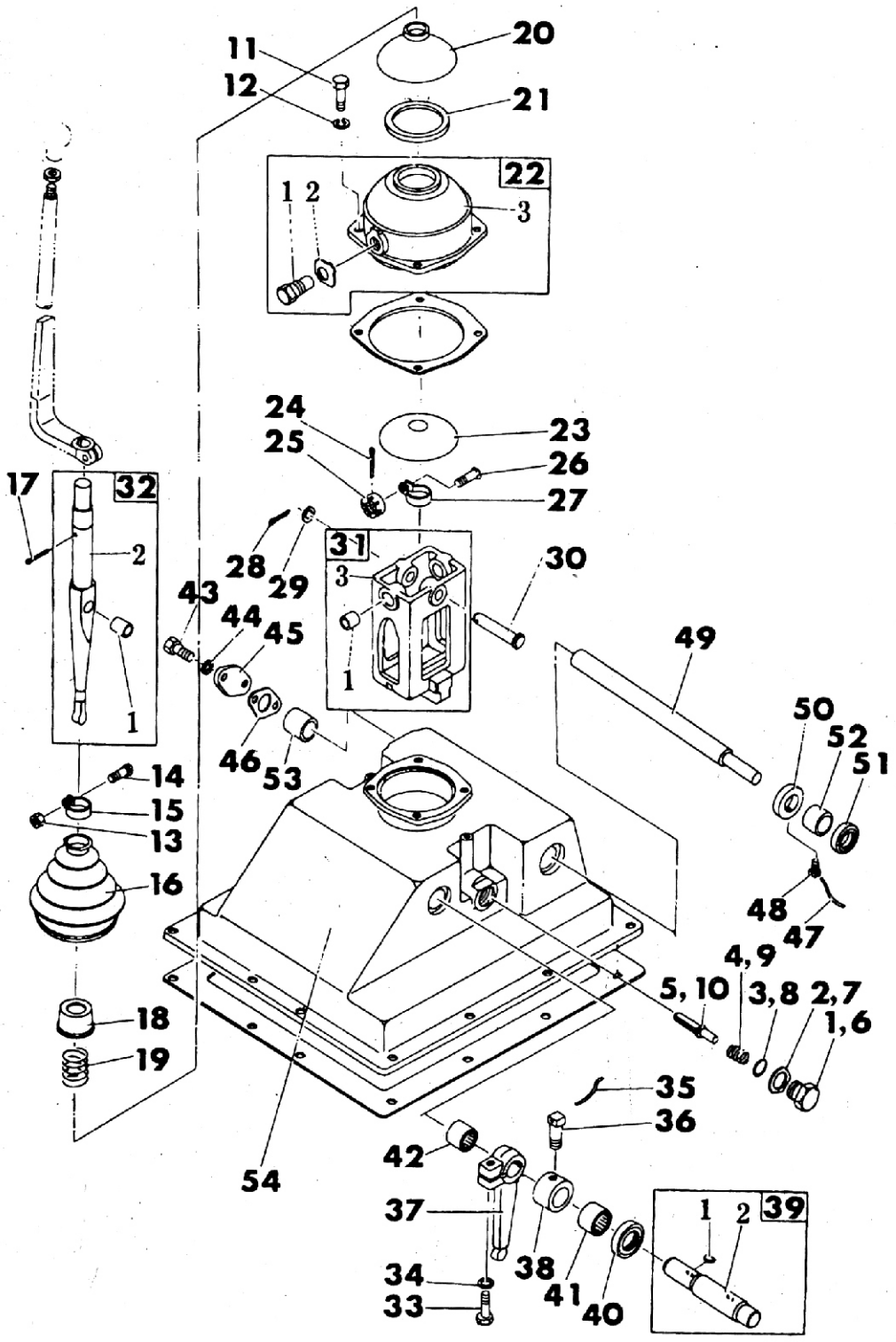
FORWARD-REVERSE shaft can be moved forward (for forward drive) or backward (for reverse drive) and this stroke corresponds to the length of its long dent.

On the other hand, FIFTH-SPEED shaft can be moved forward, causing the dowel pin to ride out of its point dent, only If the other end of the pin is near the rear end slope of the long dent this shaft will not move forward if the pin is up against the fore end slope of the long dent, simply because, under such condition, it cannot force the pin to ride out of the point dent.

Thus, with FORWARD-REVERSE shaft in reverse position, the speed lever will not move into the position for FIFTH-SPEED.

GEARSHIFT LEVER

DISASSEMBLING



GEARSHIFT LEVER

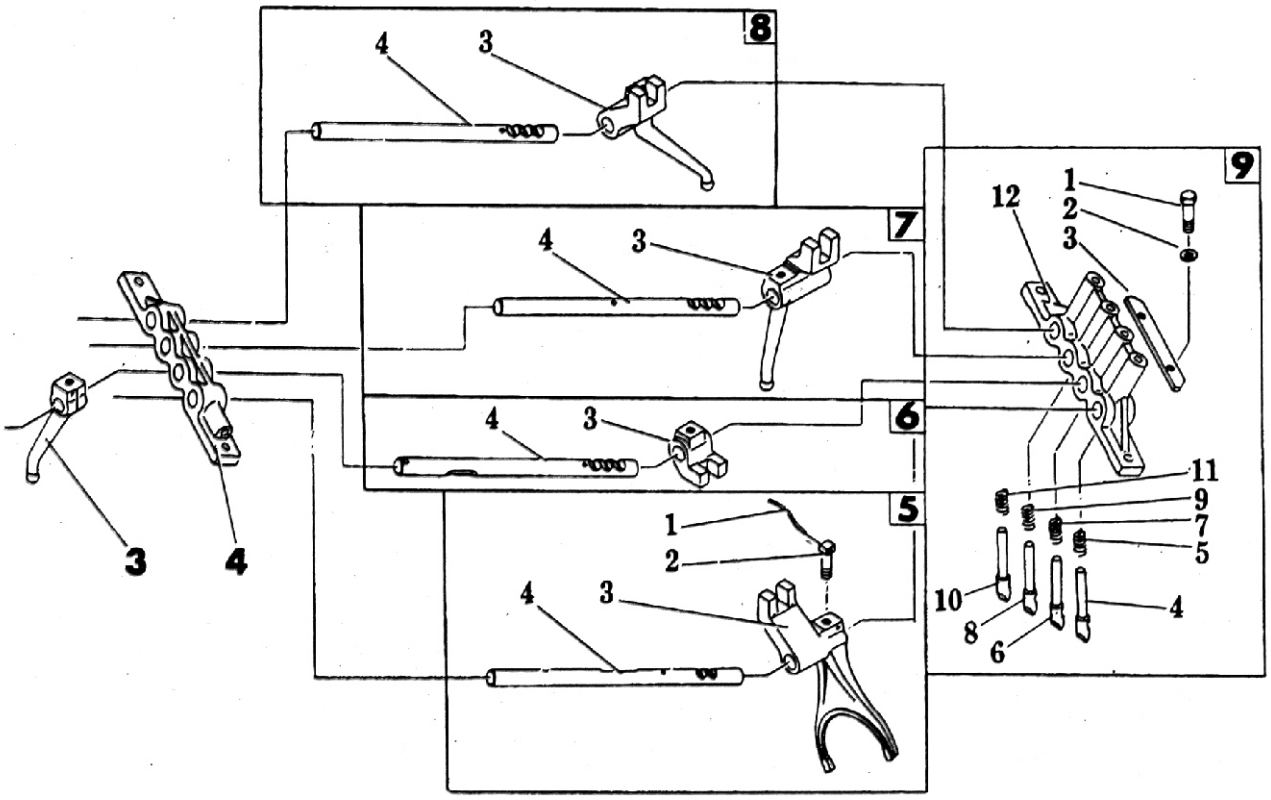
Disassembling

PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1. Nut
2. Lock
3. O-ring
4. Spring
5. Stopper
6. Nut
7. Lock
8. O-ring
9. Spring
10. Stopper
11. Bolt
12. Spring washer
13. Nut
14. Screw
15. Clamp
16. Boot
17. Cotter pin
18. Cover
19. Spring
20. Cover
21. Gasket
22-1. Pin
22-2. Lock washer
22-3. Adapter
23. Cover
24. Cotter pin
25. Nut
26. Screw
27. Clip
28. Cotter pin
29. Washer
30. Pin
31-1. Bush
31-2. Bush
31-3. Gate
32-1. Bush
32-2. Lever
33. Bolt
34. Spring washer
35. Lock wire
36. Screw
37. Lever
38. Collar
39-1. Key
39-2. Shaft
40. Oil seal
41. Bearing
42. Bearing
43. Bolt
44. Spring washer
45. Cover
46. Gasket
47. Lock wire
48. Screw
49. Shaft
50. Collar
51. Oil seal
52. Bush
53. Bush
54. Case

Gearshift Fork

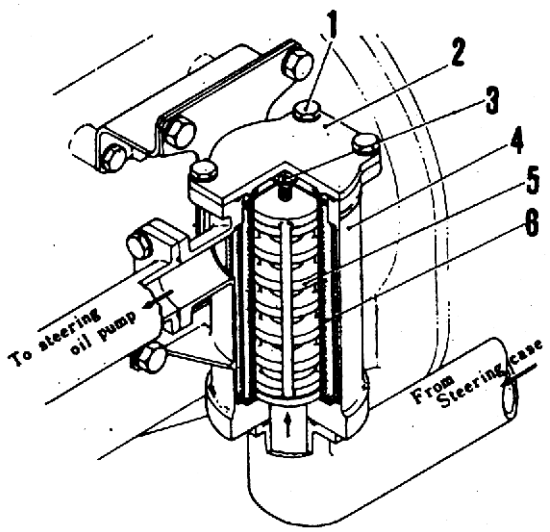
DISASSEMBLING



PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

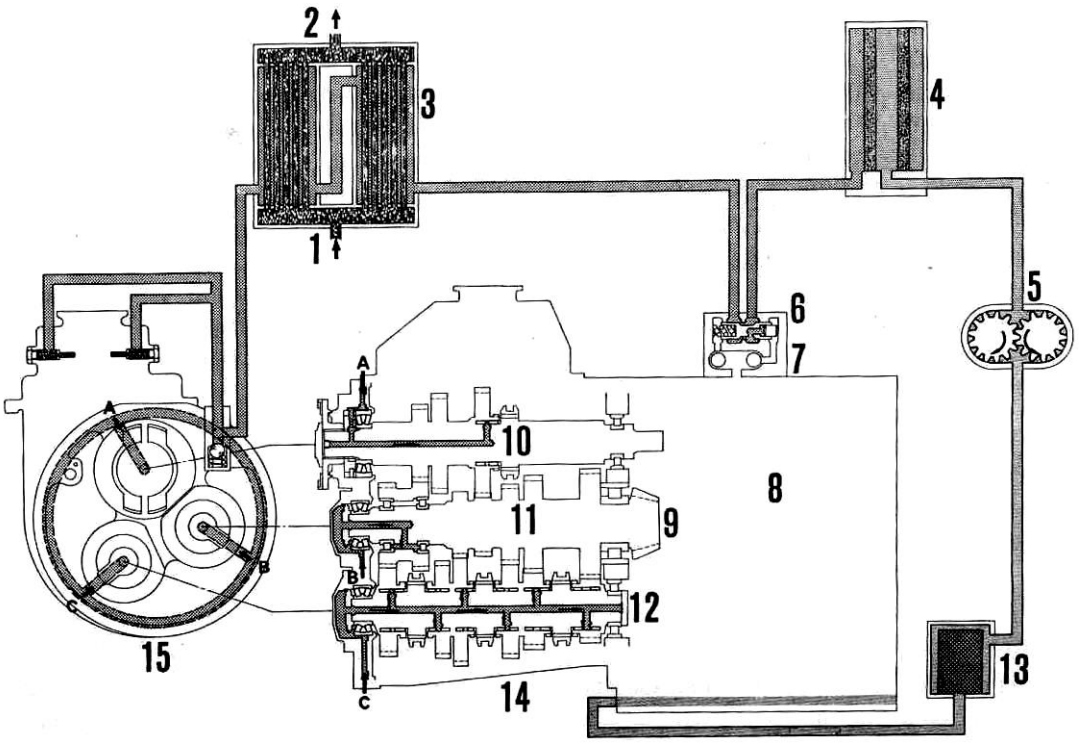
*1.*н *Lock wire*
н*2. Screw*
3. Lever
4. Fore bracket
5-1. Lock wire
45-2. Screw
5-3. Fork
5-4. Shaft
н*6-1. Lock wire*
н*6-2. Lock wire*
6-3. Boss
6-4. Shaft
н*7-1. Lock wire*
н*7-2. Screw*
7-3. Lever
7-4. Shaft
н*8-1. Lock wire*
н*8-2. Screw*
8-3. Lever
8-4. Shaft
9-1. Bolt
9-2. Lock washer
9-3. Plate
9-4. Plunger
9-5. Spring
9-6. Plunger
9-7. Spring
9-8. Plunger
9-9. Spring
9-10. Plunger
9-11. Spring
9-12. Rear bracket

н *Not shown in the illustration*



1. *Bolt*
2. *Cover*
3. *Nut*
4. *Strainer case*
5. *Magnet*
6. *Screen*

STEERING OIL STRAINER



TRANSMISSION LUBRICATING SYSTEM

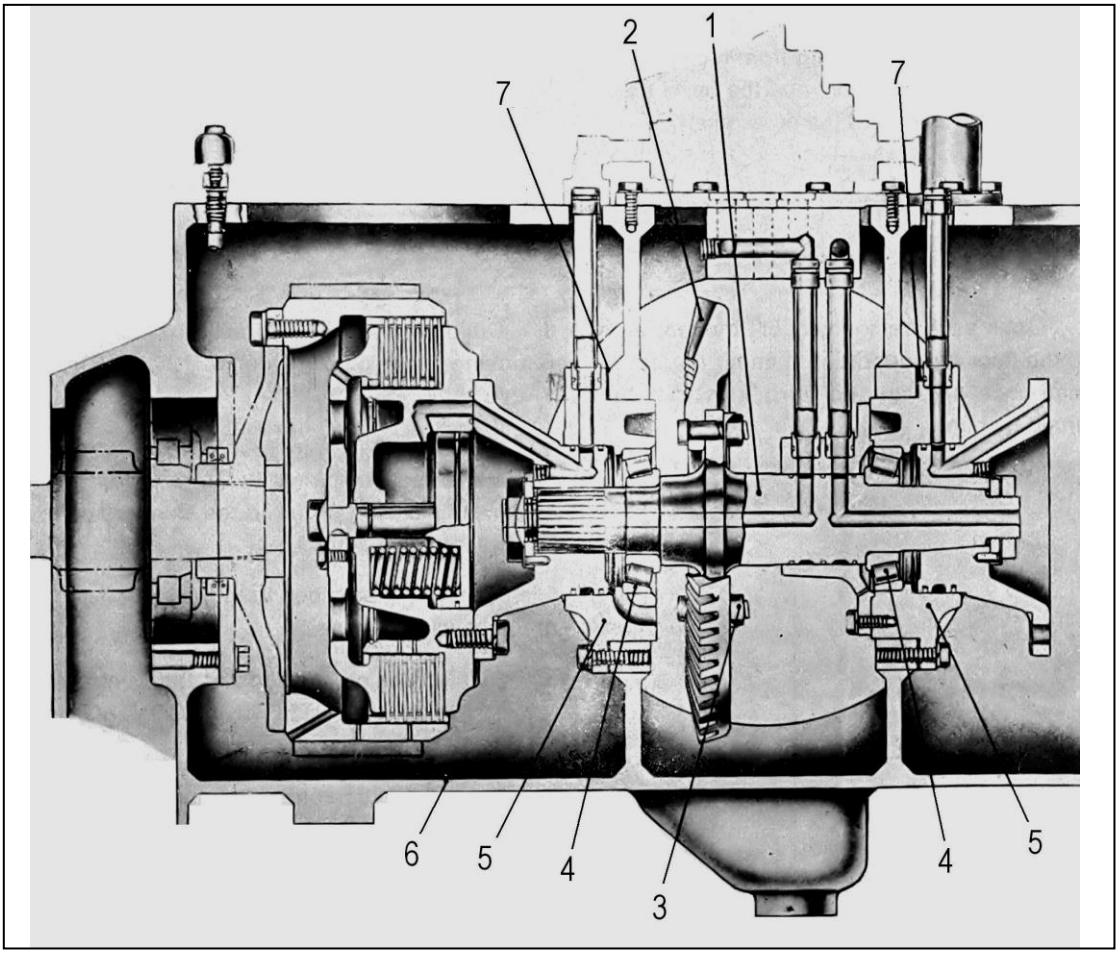
1. *Water inlet (From radiator)*
2. *Water outlet (To engine)*
3. *Oil cooler*
4. *Oil filter*
5. *Steering oil pump*
6. *Relief valve*
7. *Steering control valve*
8. *Steering case*
9. *Bevel pinion gear*
10. *Main shaft*
11. *Counter shaft*
12. *Intermediate shaft*
13. *Steering oil strainer*
14. *Transmission*
15. *Transmission front end*

BEVEL GEAR AND BEVEL GEAR SHAFT

INDEX

Bevel Gear and Bevel Gear Shaft

DESCRIPTION



BEVEL GEAR SHAFT COMPARTMENT

1. *Bevel gear shaft*
2. *Bevel gear*
3. *Reamer bolt*
4. *Tapered roller bearing*
5. *Bearing cage*
6. *Bevel gear case*
7. *Shim*

Bevel Gear and Bevel Gear Shaft

Description
Removal

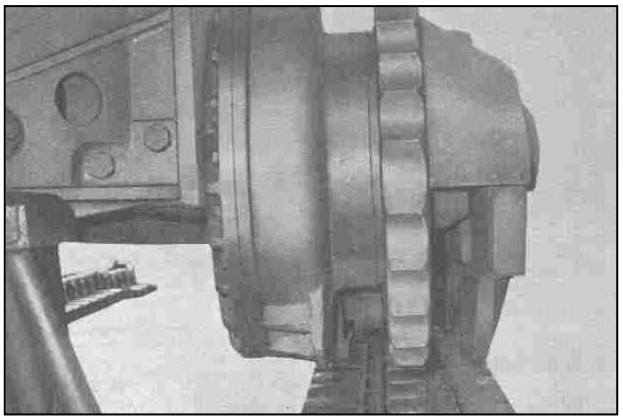
The bevel gear drive is that part of the drive line where the output of the transmission is divided into two crosswise directions toward the right and the left, for driving the Sprocket wheels through steering clutches and final drive gear trains. Its major components are the bevel pinion, extending from the counter shaft of the transmission, and the bevel gear (2) mounted rigidly on the cross shaft (bevel gear shaft) (1).

Bevel gear (2) is secured to the flanged portion of shaft (1) by 8 reamer bolts (3). Shaft (1) is supported in Journals in tow cages (5), right and left, by tapered roller bearings (4). The assembly of these components is housed in the steering case (6).

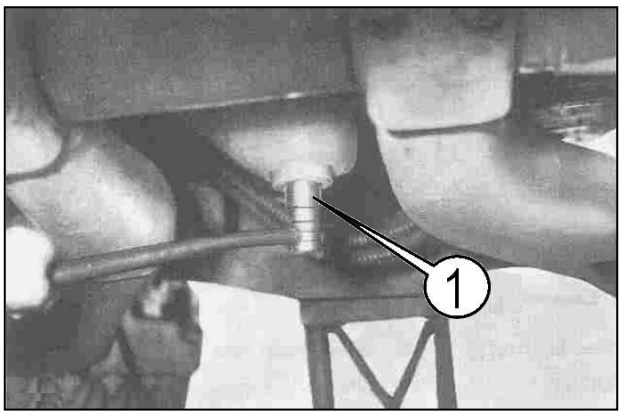
The backlash between bevel gear and pinion is specified. Backlash adjustment can be effected by reducing or increasing the thickness of shims (7) on each bearing case (5) to reposition the cage in place.

REMOVAL

1. *Open each track chain. Lift the rear end off the floor by supporting it under the bevel gear case so that the sprockets can be turned by hand.*

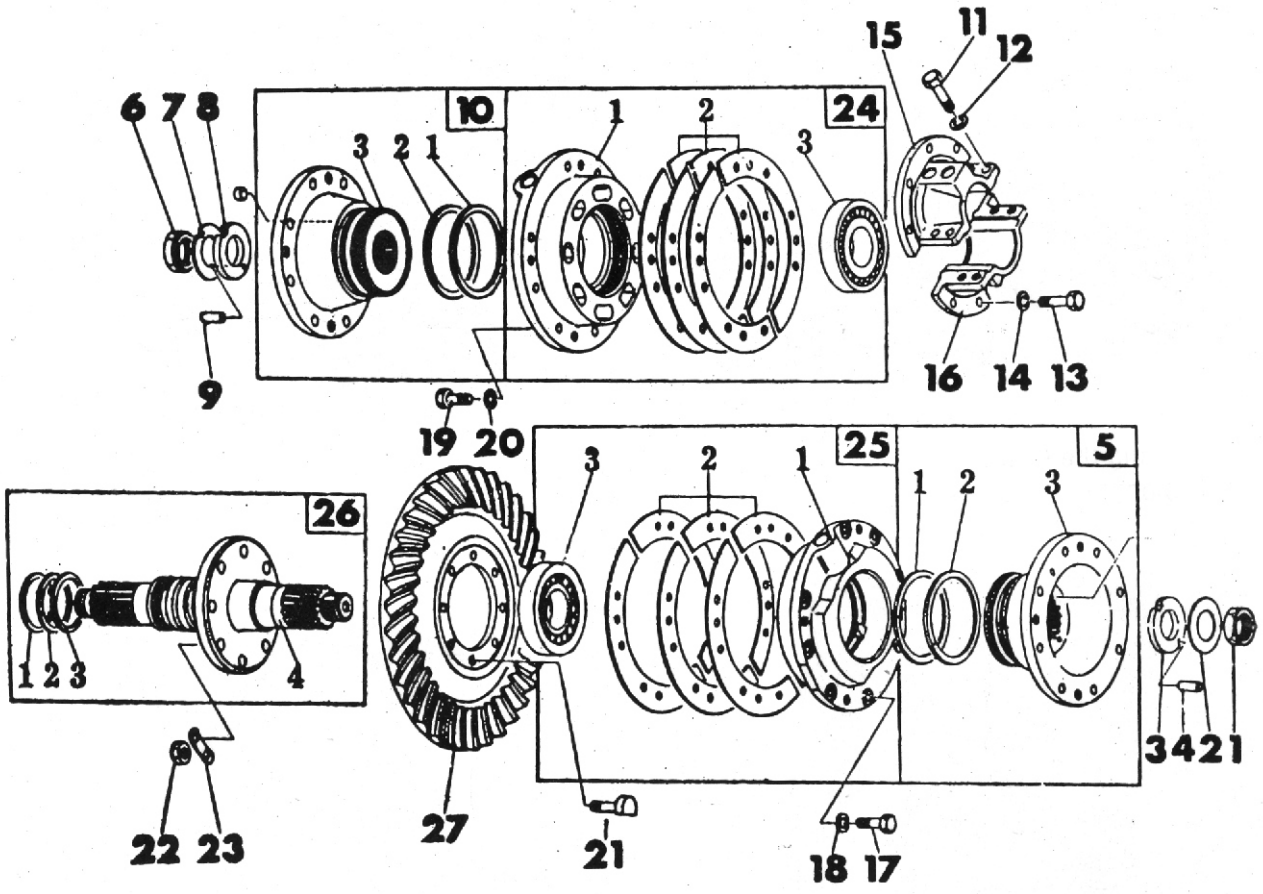


2. *Drain oil from the bevel gear shaft compartment by removing the plug (1) at the bottom*



3. *Drain oil from the hydraulic oil tank by removing drain-plug. (Refer to "CONTROL VALVE".)*
4. *Remove the step board assembly, operator's seat, batteries, fuel tank, oil filter, and hydraulic tank. (Refer to the chapters on removal of these items.)*
5. *Disconnect all pipes from the top Cover of the bevel gear case.*
6. *Disconnect all the rods of the control lever. (Refer to "STEERING CONTROL REMOVAL")*
7. *Disconnect the control link rod, for braking, and steering clutches on each side. (Refer to "STEERING CONTROL REMOVAL").*
8. *Remove the control valve off from its place.*
9. *Take off the cover of the bevel gear case.*
10. *Remove the steering clutches and brake bands. (Refer to "STEERING CONTROL LEVER").*

Disassembling



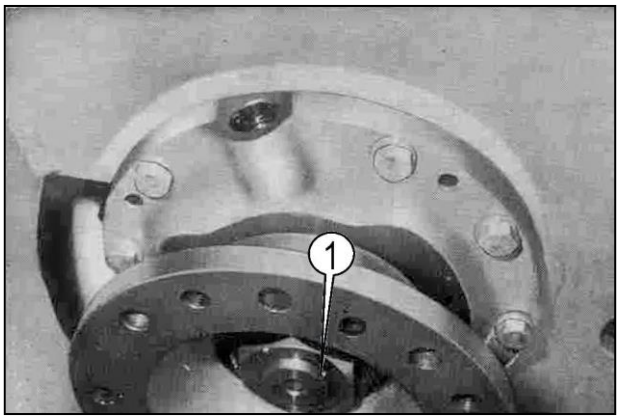
PARTS ARE TO BE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1. Nut
2. Washer
3. Collar
4. Dowel pin
5-1. Seal ring
5-2. Seal ring
5-3. Hub
6. Nut
7. Washer
8. Collar
9. Dowel pin
10-1. Seal ring
10-2. Seal ring
10-3. Hub
11. Bolt
12. Washer
13. Bolt
14. Washer
15. Flange
16. Flange
17. Bolt
18. Spring washer
19. Bolt
20. Spring washer
21. Reamer bolt
22. Nut
23. Lock washer
24-1. Bearing cage
24-2. Shim
24-3. Bearing outer race
25-1. Bearing cage
25-2. Shim
25-3. Bearing outer race
26-1. Seal ring
26-2. Seal ring
26-3. Seal ring
26-4. Bevel gear shaft
27. Bevel gear

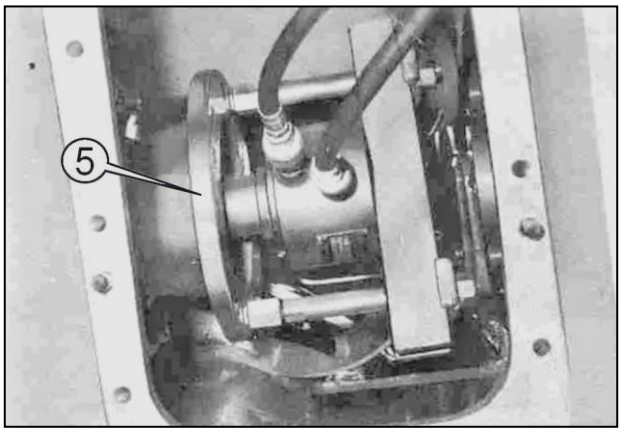
Bevel Gear and Bevel Gear Shaft

Disassembling

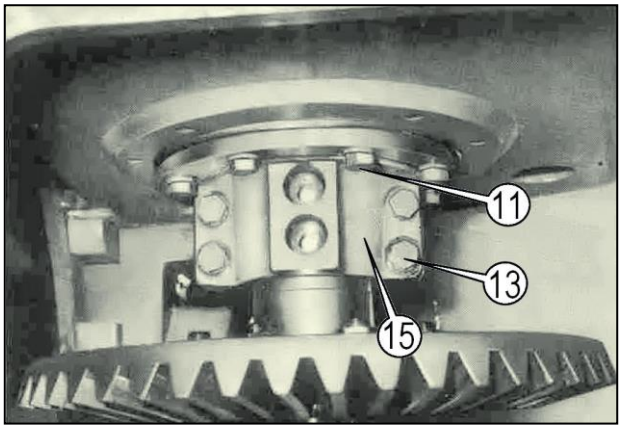
1. *Remove the nut. (1)*



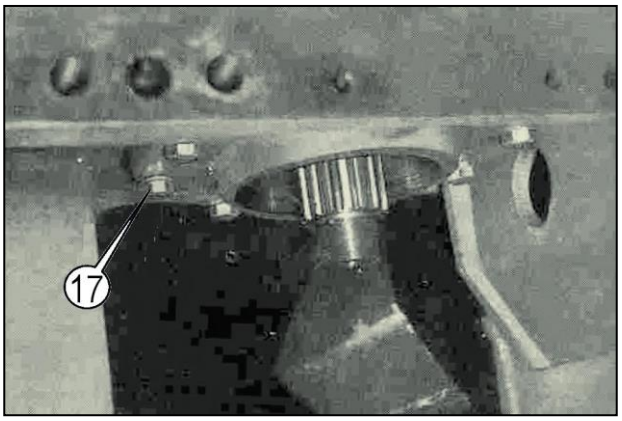
2. *Using the special tool (No. 09780-00000) as shown pull out the hub (5).*



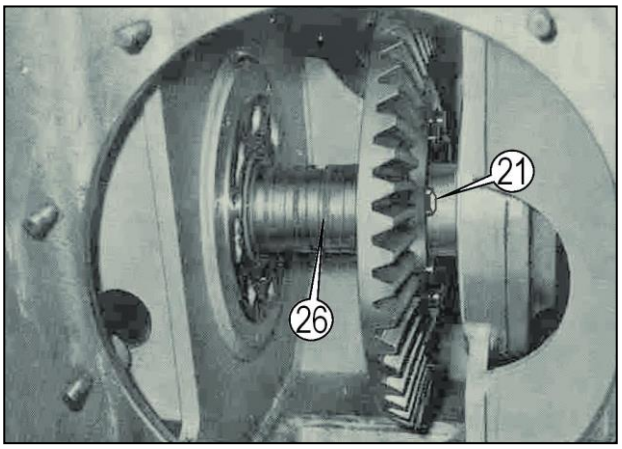
3. *Remove the bolts (11) (13) securing the flange (15), and detach the flange.*



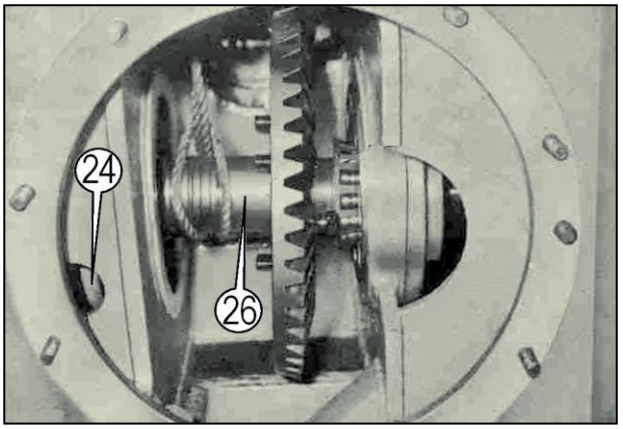
4. *Remove the bolts (17).*



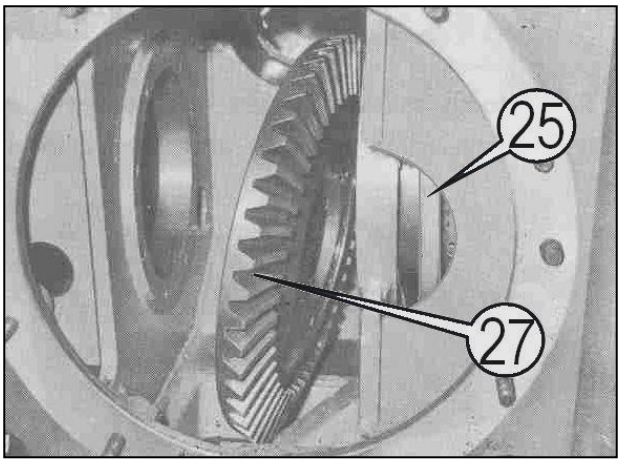
5. *Back off the reamer bolts (21) and detach bevel gear shaft (26) white suspending the bevel gear.*



6. *Remove the bearing cage (24) and bevel gear shaft (26).*



7. *Detach the bearing cage (25) and bevel gear (27).*



INSPECTION

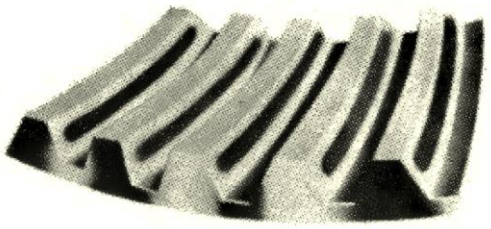
1. *Clean the bevel gear and check it for gear tooth wear, spalling or any other damage.*
2. *Inspect the fit of bevel gear shaft for any damage. Also examine the seal ring contacting surface for condition.*

ASSEMBLING

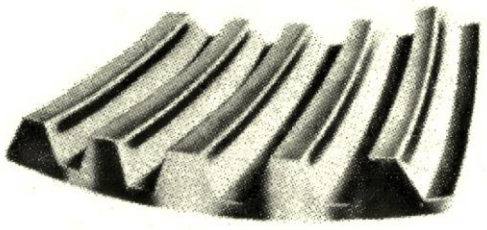
1. *Before building up the bevel gear group at the time assembling, thoroughly clean the steering clutch cases and bevel gear case.*
2. *Assemble the bevel gear group by reversing the procedure for disassembling.*
3. *After assembling, check and adjust the gear backlash and tooth contact in the bevel gear drive.*

TOOTH CONTACT ADJUSTMENT

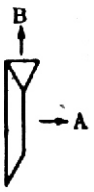
Roll a tooth contact pattern on the bevel gear and pinion using red-lead paste, to determine whether or not the gear and pinion are properly positioned relative to each other.



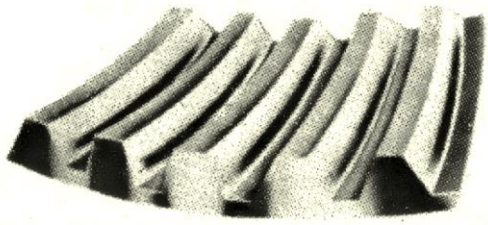
Tooth contact pattern is uniform and extends about 80% of the tooth face from the toe.



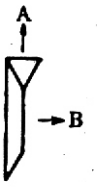
High Contact



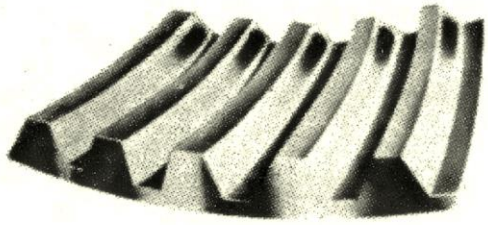
Move pinion closer to gear. - Backlash will decrease. Increase the backlash by moving gear away from pinion Move pinion away from gear.



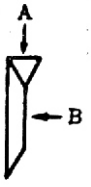
Low Contact



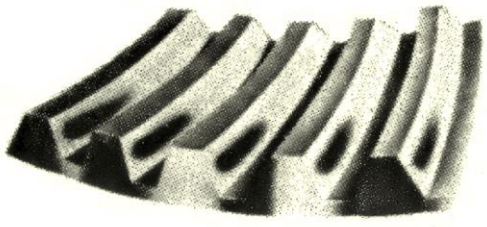
Move pinion away from gear. Backlash will Increase. Decrease the backlash by moving gear closer to pinion.



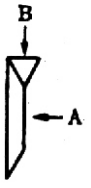
Toe Contact



Move gear away from pinion. Backlash will increase. Decrease the backlash by moving pinion closer to -gear.



Heel contact



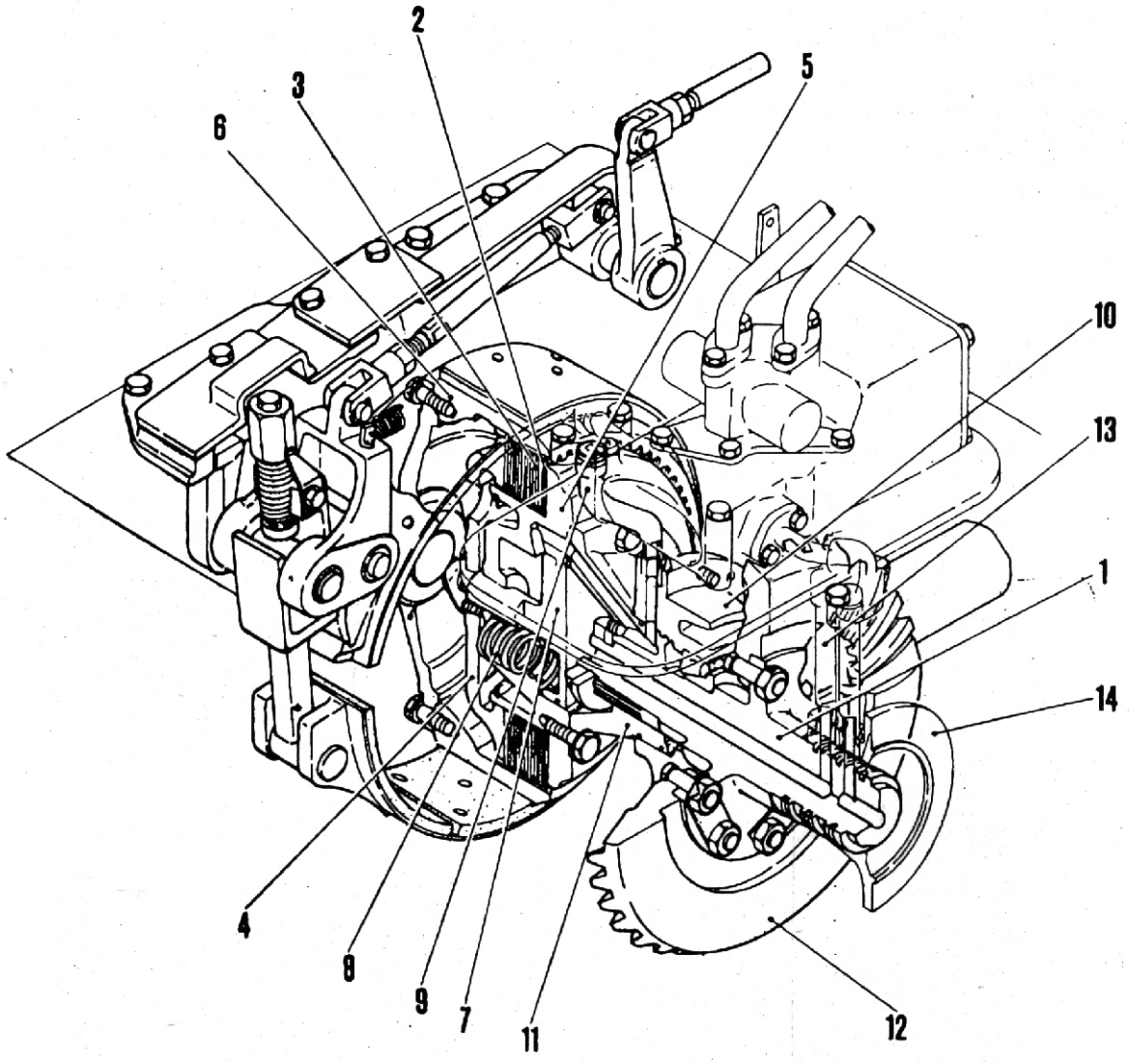
Move gear closer to pinion. Backlash will decrease. Increase the backlash by moving pinion away from gear.

STEERING SYSTEM

INDEX

STEERING SYSTEM

STEERING CLUTCHES



STEERING SYSTEM

1.	*Bevel gear shaft*	*6.*	*Brake drum*	*11.*	*Hub*
2.	*Disc*	*7.*	*Piston*	*12.*	*Bevel gear*
3.	*Plate*	*8.*	*Spring*	*13.*	*Tube*
4.	*Pressure plate*	*9.*	*Tube*	*14.*	*Flange*
5.	*Inner drum*	*10.*	*Cage*		

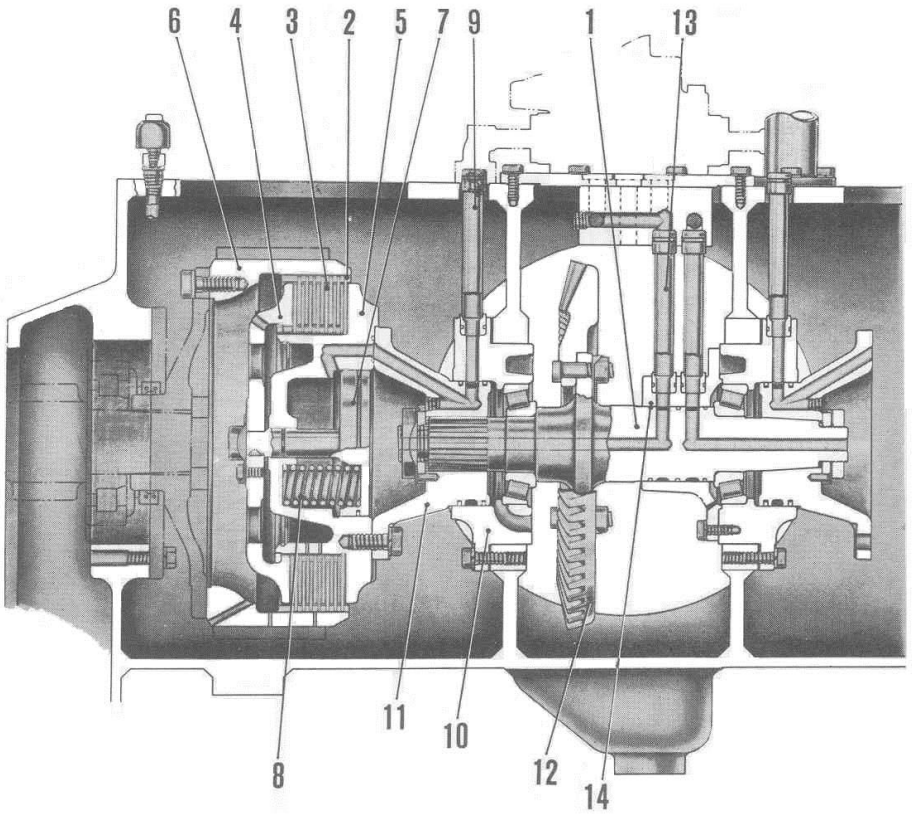
DESCRIPTION

The steering system consists of two steering clutches, and two brake drums with the brake hand on either side of the bevel gear; hydraulic control valve, hydraulic pump etc.

The two steering clutch assemblies, one at each end of cross shaft (1), are identical in all respects except for one being a right-hand clutch and the other being a left-hand clutch.

Each clutch assembly is a combination of a drum type brake and a multi-disc wet type clutch, consisting of discs (2), plates (3), pressure plate (4), Inner drum (5). brake drum (6), piston (7) and spring (8).

Springs (8) are so loaded as to keep the clutch engaged that is, to clamp discs (2) and plates (3) together and thereby transmit drive from shaft (1) to the final drive gear train. The clutch in this engaged condition is tight enough only to transmit drive for standing start or towing. It is the hydraulic pressure supplied to the clutch .at 10Kg/cm² that holds the clutch engaged or disengaged for earth moving work.



STEERING CLUTCH

1.	Bevel gear shaft	6.	Brake drum	11.	Hub
2.	Disc	7.	Piston	12.	Bevel gear
3.	Plate	8.	Spring	13.	Tube
4.	Pressure plate	9.	Tube	14.	Flange
5.	Inner drum	10.	Cage		

STEERING CLUTCHES

1. Steering Clutch in Engaged Position.

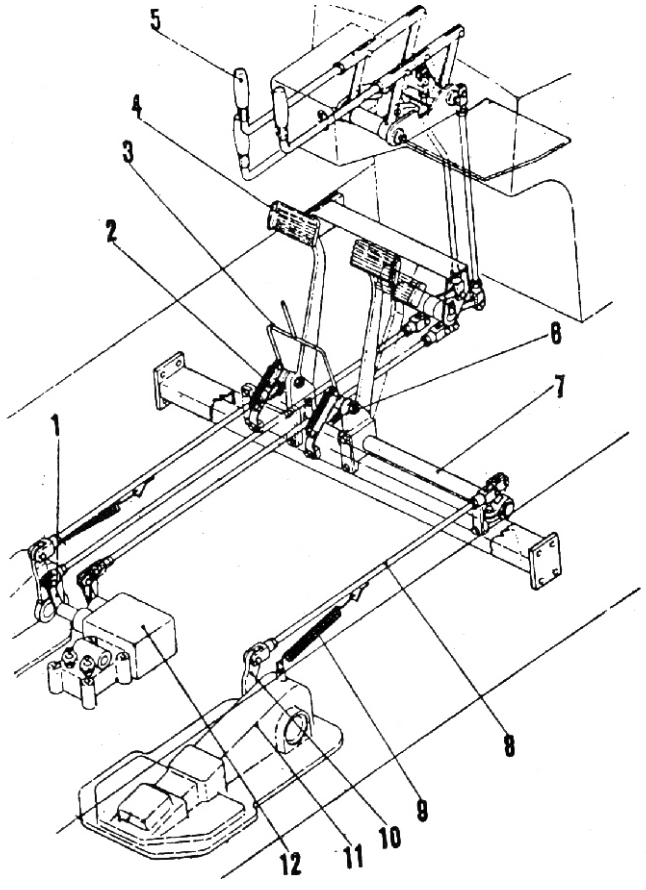
In the normal condition of the clutch, that is, in the hydraulically engaged condition, the steering clutch lever is in released a position and hydraulic pressure is applied from the control valve through tube (9), cage (10), hub (11) and inner drum (5) having an oil passage, to piston (7).

Piston (7) pushes the pressure plate (4) toward the bevel gear (12) side and holds the stack of discs (2) and plates (3) tight. The cumulative surface friction in the stack, so compressed tight, makes the stack behave like a solid body and transmit drive to the final drive gear train.

As piston (7) moves towards bevel gear side the oil on the other side of it, flows back to the control valve and is spilled into the drain line. The relief valve provided in the control valve, from which hydraulic pressure is directed to the clutch, is set for 10.3 Kg/cm^2.

2. Steering Clutch In disengaged position

Pulling the steering clutch lever to disengage the clutch, causes the hydraulic pressure to take a new course. The new course is through tube (13), flange (14) and oil passage provided in the cross shaft (1), to piston (7). With the pressure being transmitted through this course, piston (7) pushes the pressure plate from opposite direction i.e. away from bevel gear (12) side, and release the stack of discs (2) and plates (3) from engaging. The oil in the space between piston and inner drum (5) becomes displaced and flows back to the control valve, from which it passes into the drain line.



1. *Steering control valve lever*
2. *Spring*
3. *Brake lock lever*
4. *Brake pedal*
5. *Steering lever*
6. *Lock plate*
7. *Brake shaft pedal*
8. *Rod*
9. *Spring*
10. *Lever (Steering brake)*
11. *Steering brake Cover*
12. *Steering control valve assembly*

STEERING LINKAGES

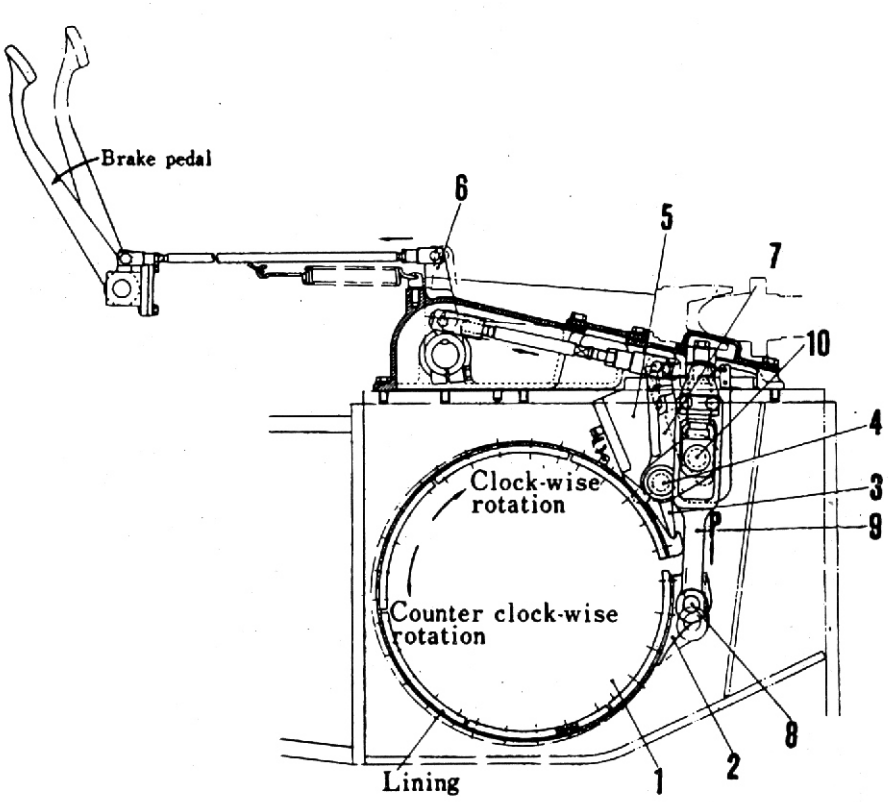
Steering System

Description

Steering Brakes

The two band-and-drum steering brakes are controlled by the respective brake pedals. The brake band has its inner face fitted with a lining. This lining is secured to the band by riveting.

The anchored point of the brake band shifts automatically when the drum changes its direction, as will be noted in the following illustration of the brake operation.



1. *Brake Drum*
2. *Brake band*
3. *Pawl*
4. *Pin*
5. *Bracket*
6. *Lever*
7. *Lever*
8. *Pin*
9. *Rod*
10. *Pin*

STEERING BRAKES

1. Forward crawling

Suppose the tractor is rolling forward and consider one of the brake drums to be rotating counter clockwise (for the purpose of illustration). As the brake pedal is depressed just a little, the friction between the drum (1) and band (2) causes the band to rise pushing pin (4) through pawl (3) Into the groove provided in the bracket (5).

Depressing the brake pedal further will pull lever (6) in the direction (P) to move lever (7) in the same direction as (P) with pin (4) acting as the pivot. This applies a pull to one end of the brake band by its pin (8) so that the band encloses the drum with full braking force.

2. Reverse Crawling

Suppose the same brake and directional designation as above, the brake drum now turns clockwise as the tractor rolls backward. Depressing the brake pedal just a little causes

band (2) to displace itself in clockwise direction due to the friction between brake and drum. A downward pull acts on pin (8) and this applies a pull to pin (10) through the rod, forcing the pin into the groove of bracket (5).

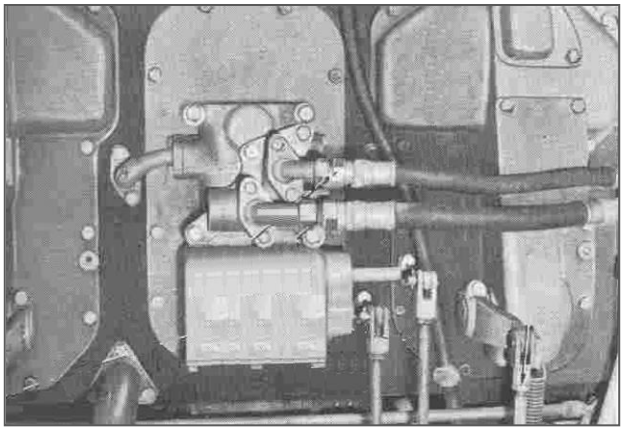
REMOVAL

While removing and replacing the steering system, be sure to handle the complete assembly of the clutch and brake band as unit.

1. Dismount the fuel tank and operator's seat. (Refer to "FUEL TANK REMOVAL" and "OPERATOR'S SEAT REMOVAL")

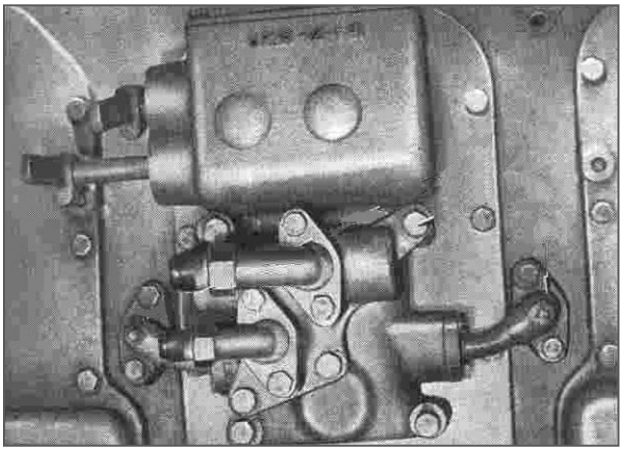
2. Take out all floor plates

3. Disconnect oil lines (1) (2), and separate rubber hoses (3) (4). Disconnect the steering control rods (5) (6) and brake control rods (7) (8), respectively.

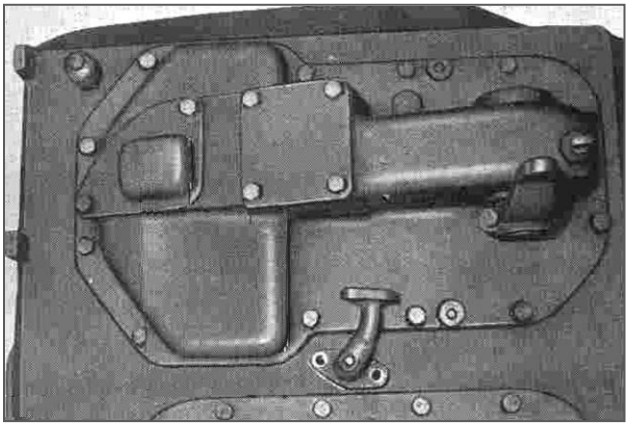


Depressing the pedal further will pull lever (6) in the direction (P), making lever (7) pivot around pin (10) and move in the same direction. As a result, pawl (3) pushes the end of the downward to apply braking force to the drum.

4. Remove the bolts (1) (2) and take out the control valve assembly (3).

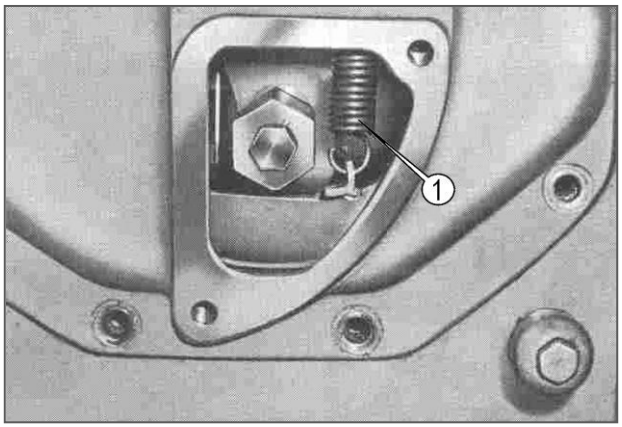


5. Remove the bolts (1) and take off the cover (2). Remove the bolts to take off the cover (4).

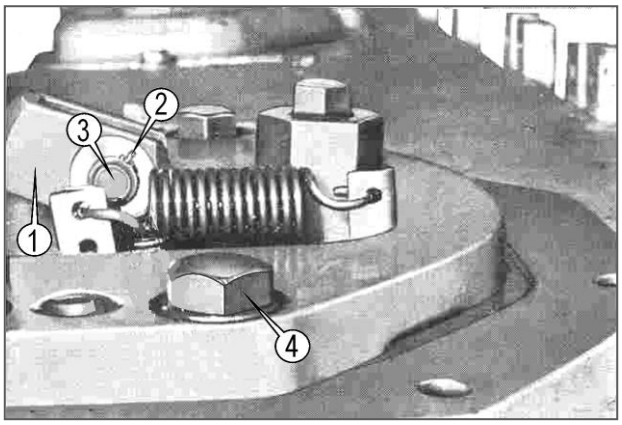


Removal

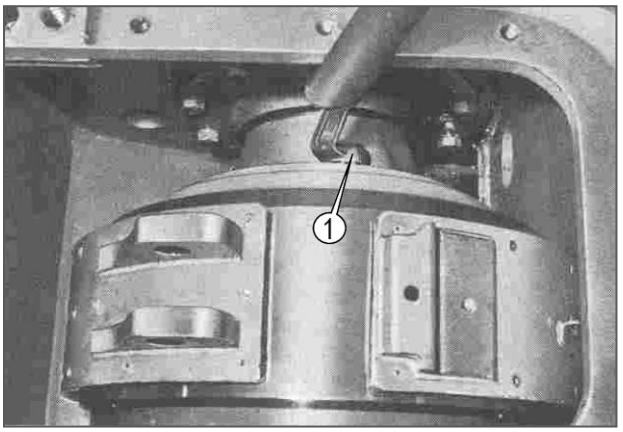
6. *Remove the Cover (1) and take out the spring (2).*

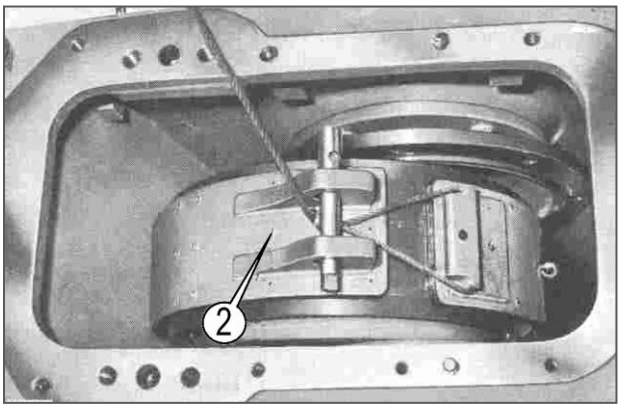


7. *Pull out the cotter pin (2) on the pin (3). Pull out the pin (3) and remove the yoke (1). Remove the bolts (4) and dismount the brake link assembly.*

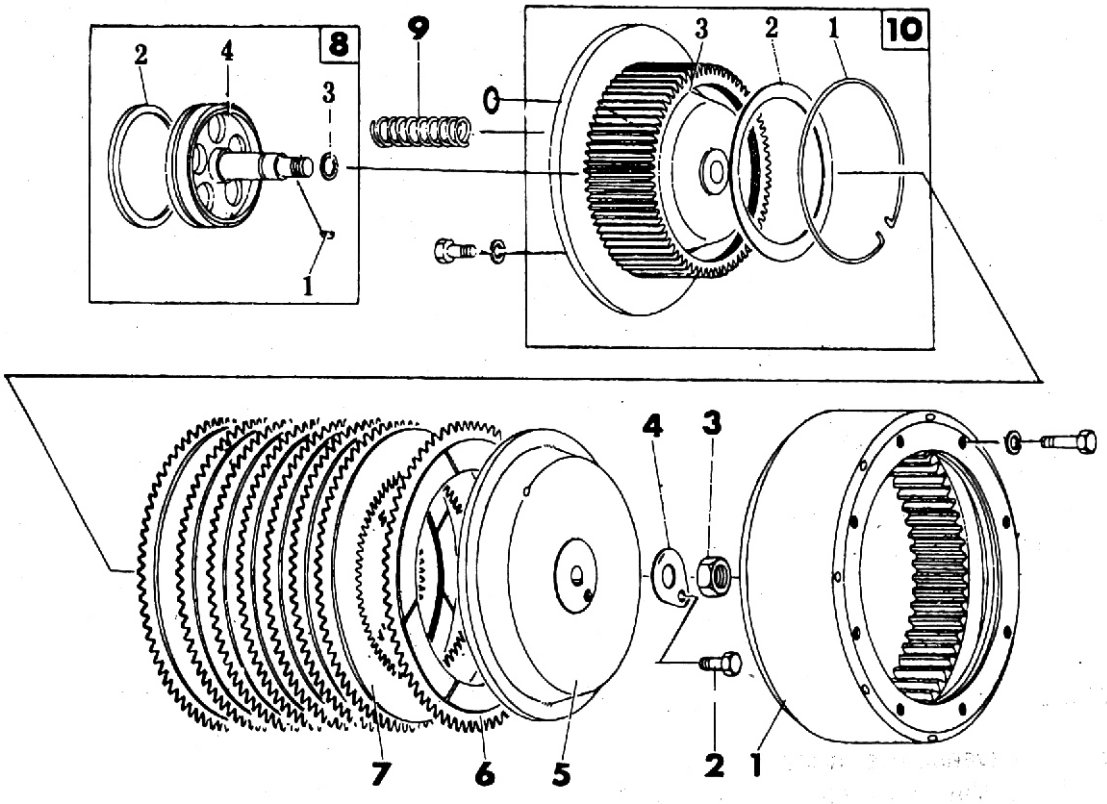


8. *Remove the clutch mounting bolts (1) on both sides one at time, by gradually rotating the sprocket until all bolts are removed. Using an overhead crane take out the clutch assembly (2) with the brake band.*





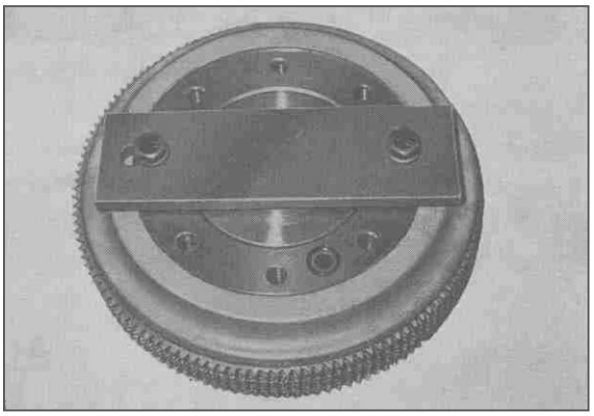
DISASSEMBLING



PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1.	*Brake drum*	*6.*	*Disc*	*9.*	*Spring*
2.	*Bolt*	*7.*	*Plate*	*10-1.*	*Snap ring*
3.	*Nut*	*8-1.*	*Key*	*10-2.*	*Ring plate*
4.	*Lock plate*	*8-2.*	*Seal ring*	*10-3.*	*Clutch drum*
5.	*Pressure plate*	*8-3.*	*Seal ring*		
		8-4.	*Piston*		

Note: *WHILE REMOVING NUTS (3) IN PLACE, BE SURE TO PLACE A RETAINER SO AS NOT TO ALLOW SPRING (9) TO POP UP FROM THE CLUTCH DRUM.*



CLEANING AND INSPECTION

1. *Inspect the clutch linings for wear or contact pattern.*
2. *Examine the clutch plates and discs for wear, deformation, erratic wear patter, including stepped or uneven wear, or scar or groove marks. Clean these parts thoroughly.*
3. *Examine the teeth of drums, plates and discs for wear or damage.*
4. *Inspect the adjusting bolts for wear or damage.*
5. *Inspect the brake linings for contact pattern or wear and check the lining rivets for tightness.*
6. *Inspect the brake bands for damage*
7. *Examine the friction surfaces of the brake drums for wear or damage.*
8. *Examine the pistons, particularly the piston ring grooves, for wear or damage.*
9. *Check the clutch piston seal rings for wear.*
10. *Examine the friction surfaces of clutch inner drums and the pistons for wear or damage.*
11. *Inspect the brake control linkages for wear or damage.*

ASSEMBLING

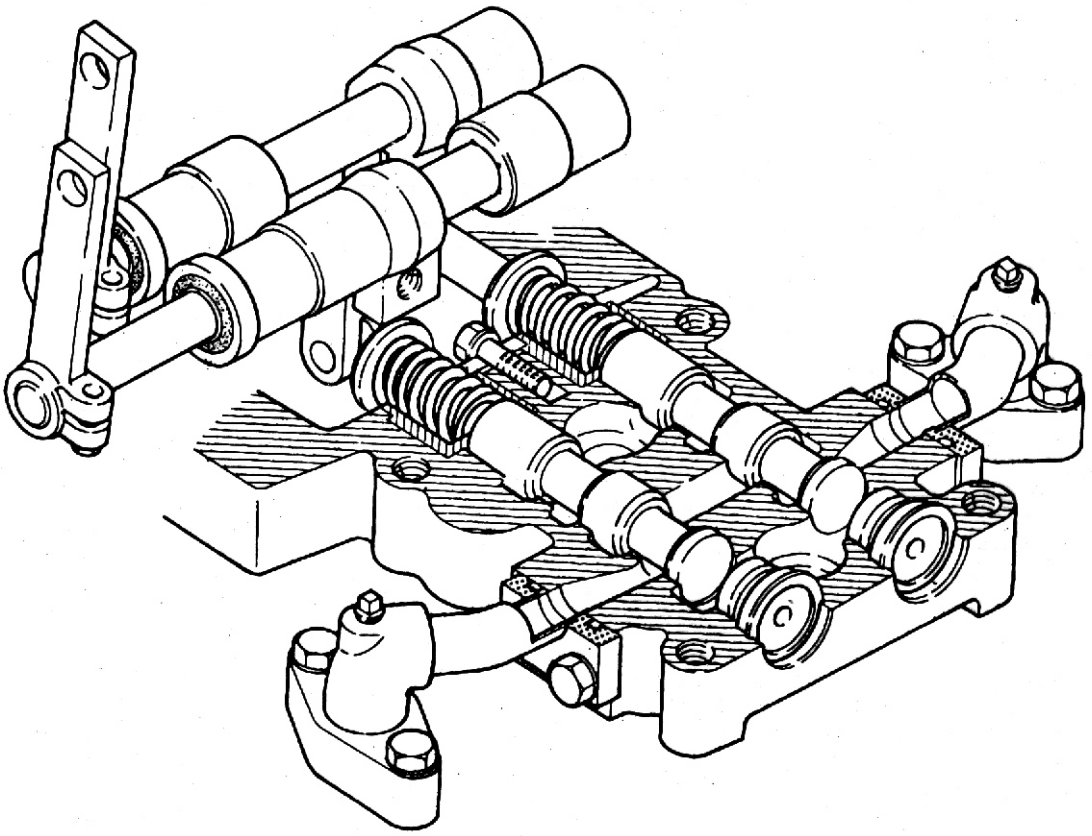
Note: *REVERSE THE PROCEDURE OF DISASSEMBLING WHEN SECURING THE PISTON (FOR THE CLUTCH) TO THE PLATE, BE SURE TO LOCK THE SECURING NUTS IN PLACE.*

MOUNTING

Replace in position the steering clutch brake assembly by adhering to the following note:

Note: *IN CASE WHEN THE CLUTCH COUPLING BEARING HUB AND FINAL DRIVE FLANGE HAVE BEEN REPLACED BY T HE NEW ONES, THE STEERING CLUTCH ASSEMBLY SHOULD BE MOUNTED IN PLACE ONLY AFTER THESE TWO PARTS HAVE BEEN ALIGNED PROPERLY.*

Steering Control Valve



STEERING CONTROL VALVE

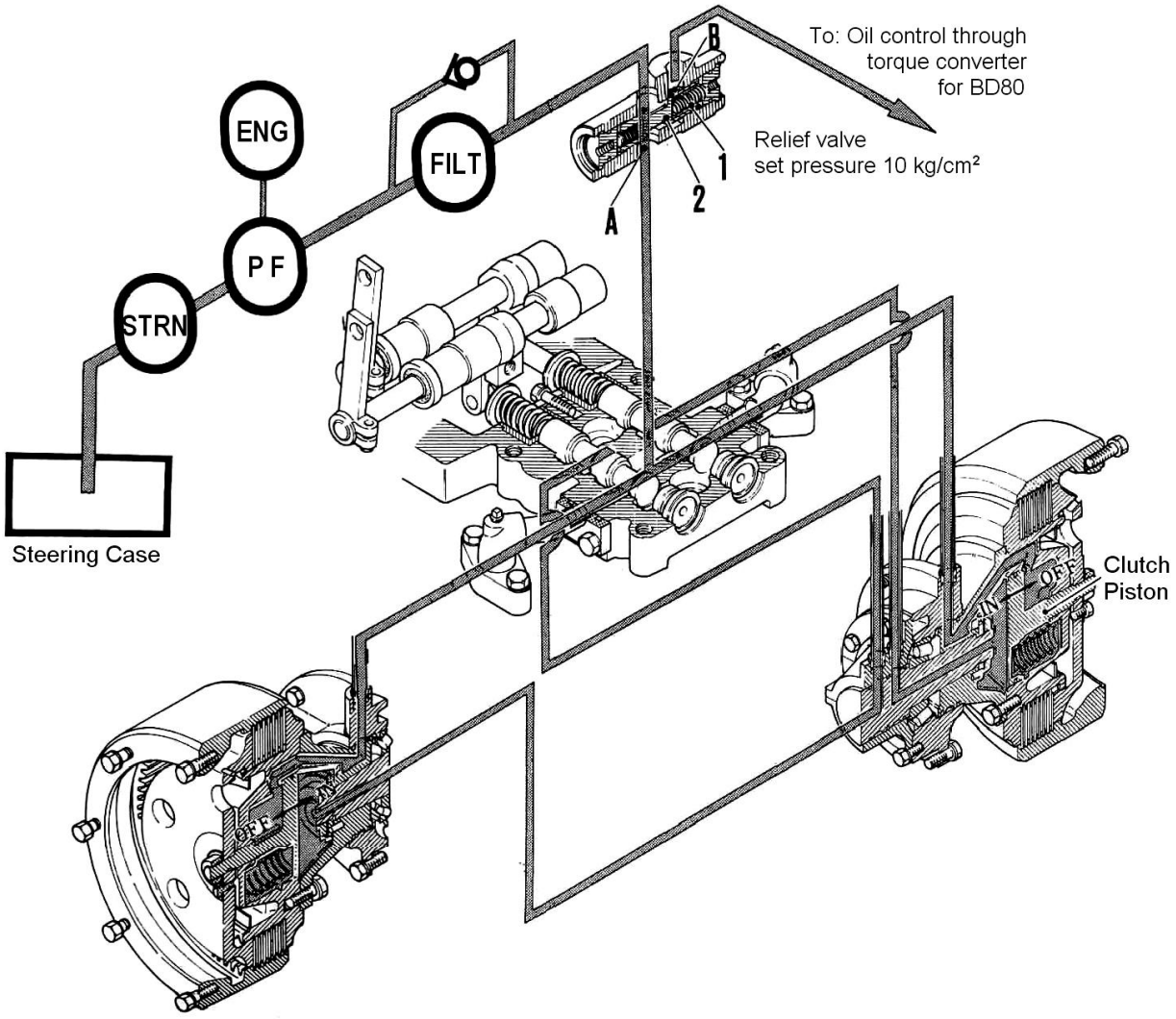
This valve Is located below the operator's seat and mounted on the top of the steering case. It Is an assembly of valves two control valves of spool type and relief valve of spring-loaded piston type. These valve elements are built In a single body the relief valve being a separate element mounted top of the body.

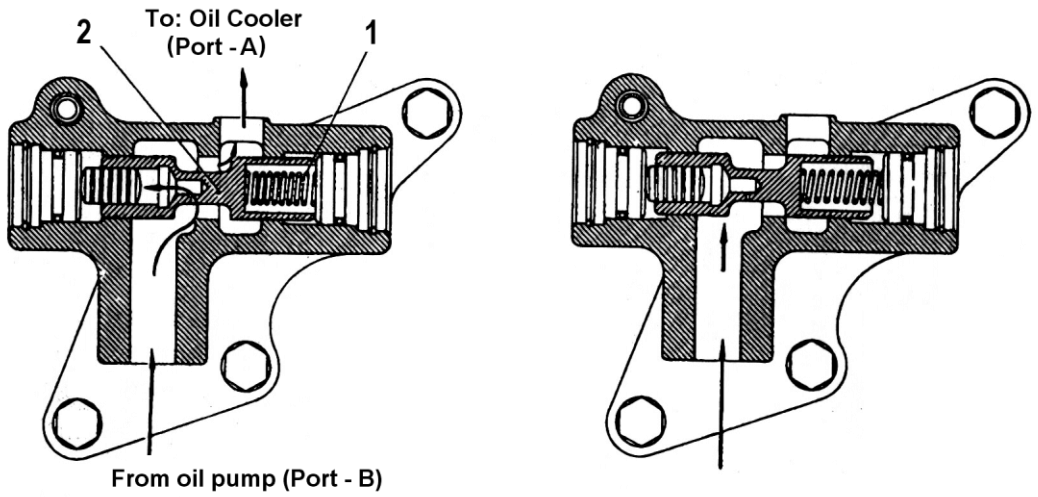
Two levers (steering clutch levers) one for each spool, are provided, to operate the spools manually and thus change the course of hydraulic pressure transmission for controlling the respective steering clutch.

The relief valve is on the upstream side of the-two control valves and limits the pressure being applied from a gear pump through a filter. The specified pressure setting is 10.3 Kg/cm². The Inlet port is designated as "A".

A relatively large amount of oil is supplied by the gear pump so that the relief valve is normally in relieving condition, under which its spring (1) is compressed by oil pressure within spool (2) while this spool itself is in a displaced position keeping the relieving port (B) open.

STEERING SYSTEM

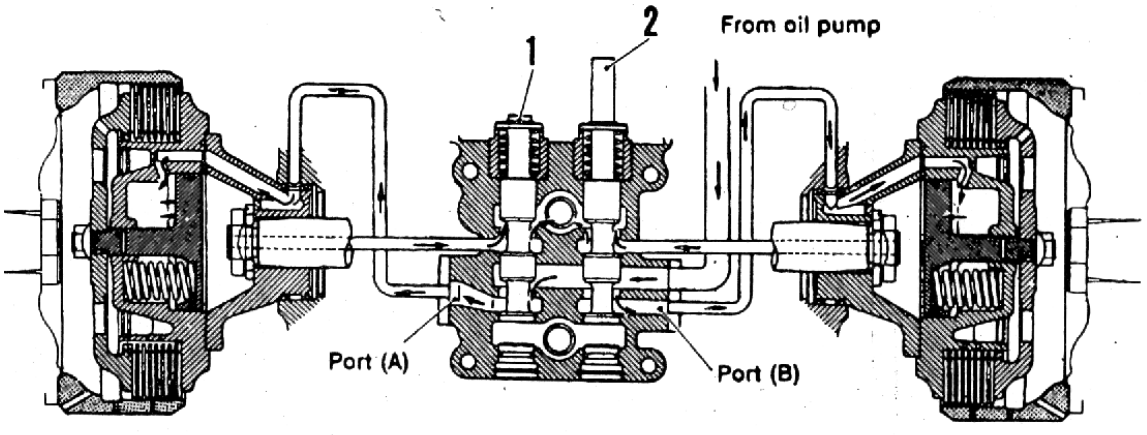




RELIEF VALVE

1. Spring *2. Spool*

1. Left steering clutch "ON" - Right steering clutch "ON".



L.H. Clutch "ON" *R.H. Clutch "ON"*

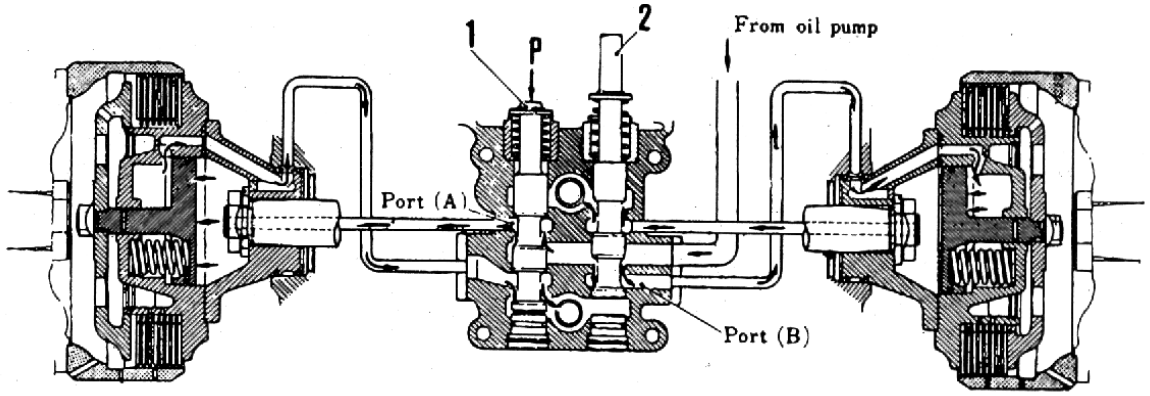
STEERING CONTROL VALVE SYSTEM

STEERING CONTROL VALVE

Description

When the steering clutch levers are in normal position (corresponding to the engaged position) hydraulic oil passes through Spools (1) (2) and enters the right and left lines for keeping the right-hand and left-hand steering clutches engaged.

2. Left steering clutch "OFF" - Right Steering clutch "ON".

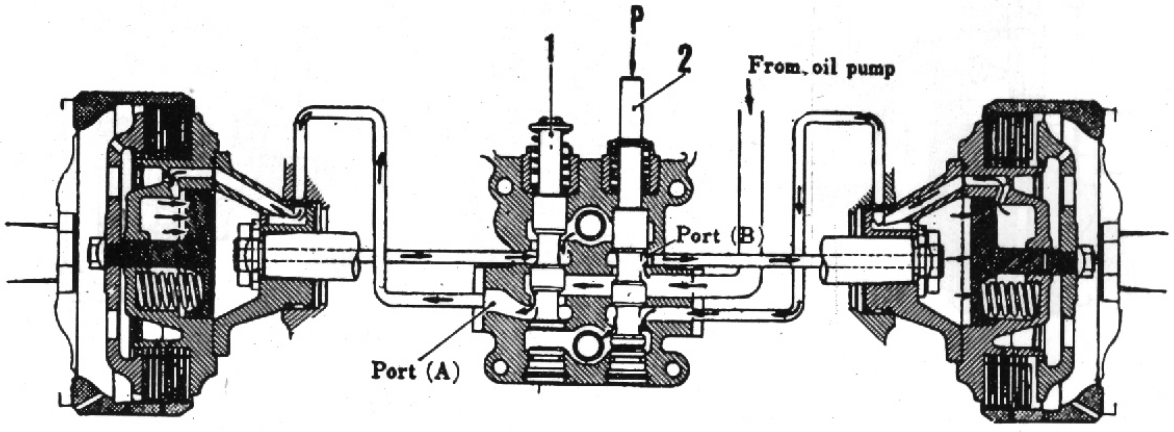


L.H. Clutch "OFF" *R.H. Clutch "ON"*

Pulling the left steering clutch lever move spool (1) in direction (P) to open port (A) communicating to the disengaging side of piston in the left steering clutch, and disengaging L.H. Steering clutch position, Port (B) is open and hydraulic oil is supplied through this port which communicates to the engaging side of piston in the right-hand steering clutch, causing the R.H. steering clutch engaged.

With the right steering clutch in released

3. Left steering clutch "ON" - Right steering clutch "OFF".

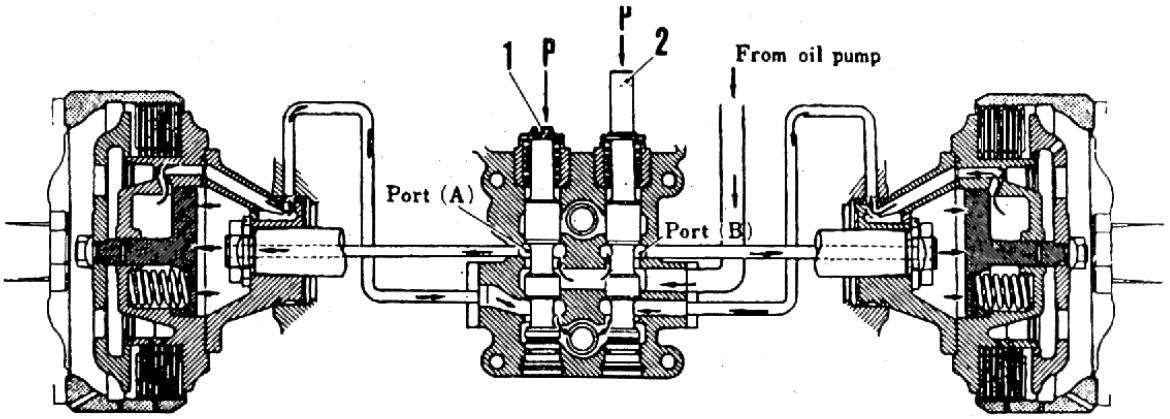


L.H. Clutch "ON" *R.H. Clutch "OFF"*

Pulling the right clutch lever moves spool (2) in the direction (P) to open port (B), which causes the disengagement of R.H. clutch.

With the left steering clutch lever released, port (A) is open. The L.H. clutch would be engaged.

4. Left steering clutch "OFF" - Right steering clutch “OFF”



L.H. Clutch "OFF" *R.H. Clutch "ON"*

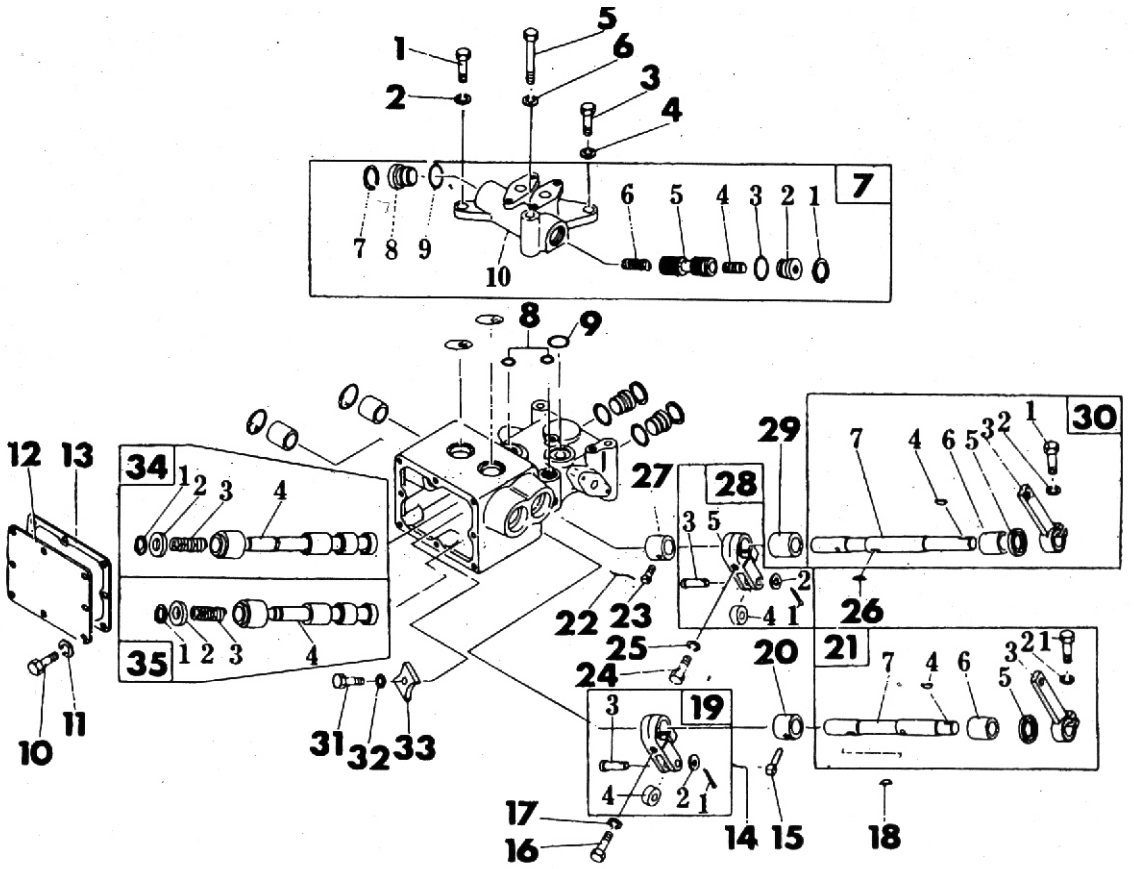
With both steering clutch levers pulled into disengaging position spools (1) (2) remain displaced in the direction (P), keeping both ports (A) (B) open to apply pressure to the disengaging side of piston In each steering clutch. The steering clutches on both sides would be disengaged.

Steering System

Description

DISASSEMBLING

Before removing the steering control valve, refer to "STEERING SYSTEM" for details.



PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1. Bolt
2. Spring washer
3. Bolt
4. Spring washer
5. Bolt
6. Spring washer
7-1. Snap ring
7-2. Stopper
7-3. O-ring
7-4. Piston
7-5. Relief valve
7-6. Spring
7-7. Snap ring
7-8. Stopper
7-9. O-ring
710. Housing
8. O-ring
9. O-ring
10. Bolt
11. Spring washer
12. Cover
13. Gasket
14. Lock wire
15. Set screw
16. Bolt
17. Spring washer
18. Key
19-1. Cotter pin
19-2. Washer
19-3. Pin
19-4. Roller
20. Collar
21-1. Bolt
21-2. Spring washer
21-3. Lever
21-4. Key
21-5. Oil seal
21-6. Bushing
21-7. Shaft
22. Lock wire
23. Set screw
24. Bolt
25. Spring washer
26. Key
27. Collar
28-1. Cotter pin
28-2. Washer
28-3. Pin
28-4. Roller
28-5. Lever
29. Collar
30-1. Bolt
30-2. Spring washer
30-3. Lever
30-4. Key
30-5. Oil seal
30-6. Bushing
30-7. Shaft
31. Bolt
32. Spring washer
33. Plate
34-1. Snap ring
34-2. Washer
34-3. Spring
34-4. Spool
35-1. Snap ring
35-2. Washer
35-3. Spring
35-4. Spool

INSPECTION

1. *Examine the sliding surface of the spools for rusting or signs of improper sliding contact.*
2. *Inspect the valve body for cracks or any other damage, and check running clearance around each spool in the bore.*
3. *Check springs for elastic property by measuring the free length, as-Installed length and the preload. Also Inspect each spring from damage.*

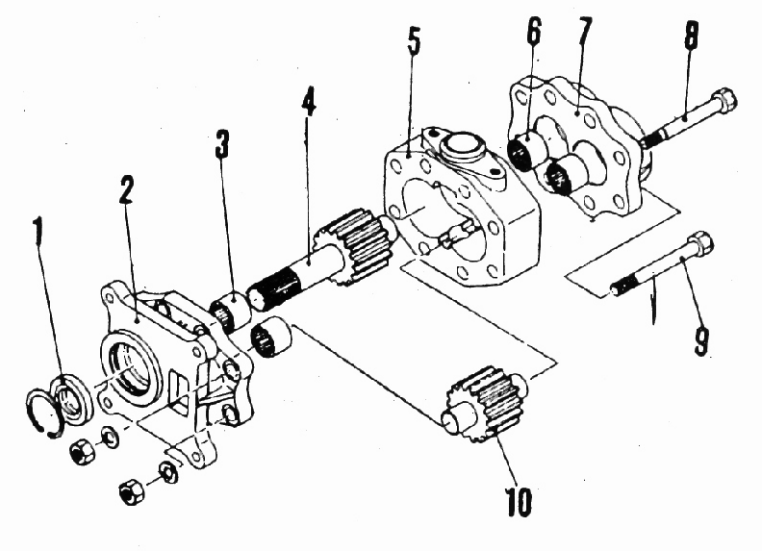
ASSEMBLING

To build up the steering control valve, observe the following Instructions:

1. *When assembling a valve, body, make sure that the valve moves smoothly into the bore of the valve body.*
2. *When fitting the oil seals in place, take care not to damage or form scratches on them.*

Description

Gear Pump



STEERING OIL PUMP

1.	*Oil seal*	*6.*	*Needle bearing*
2.	*Bracket*	*7.*	*Housing*
3.	*Needle bearing*	*8.*	*Reamer bolt*
4.	*Drive gear*	*9.*	*Bolt*
5.	*Gear case*	*10.*	*Driven gear*

The steering oil pump, located on the left side of the engine, on the flywheel housing, is a gear pump. It is driven by the crankshaft through a gear train.

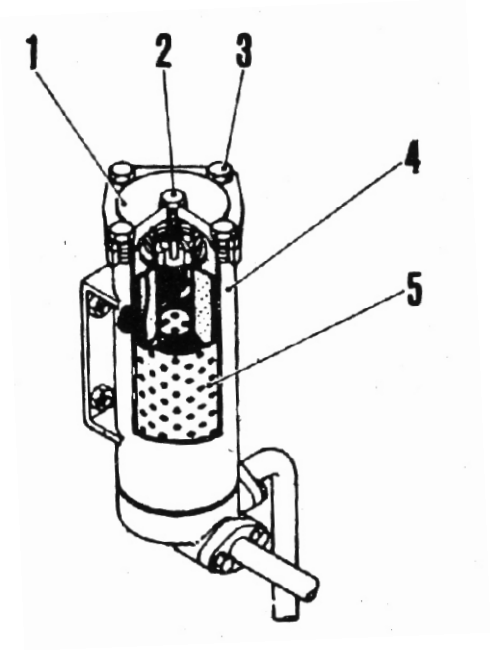
It draws oil from the steering case through the strainer and delivers pressurised oil to the steering control valve as long as the engine is running.

This gear pump, like any other gear pump, is a precisely finished device, with its pumping gears, bores and side plates machined to much looser tolerances.

The figure indicates various component parts of pump. For full details of parts please refer to parts catalogue.

Filter

STEERING CONTROL OIL FILTER



1. *Cover*
2. *Air vent plug*
3. *Bolt*
4. *Filter case*
5. *Element*

The filter is mounted on the side frame, on the-left side of the flywheel housing. It filters the oil discharged by the steering oil pump.

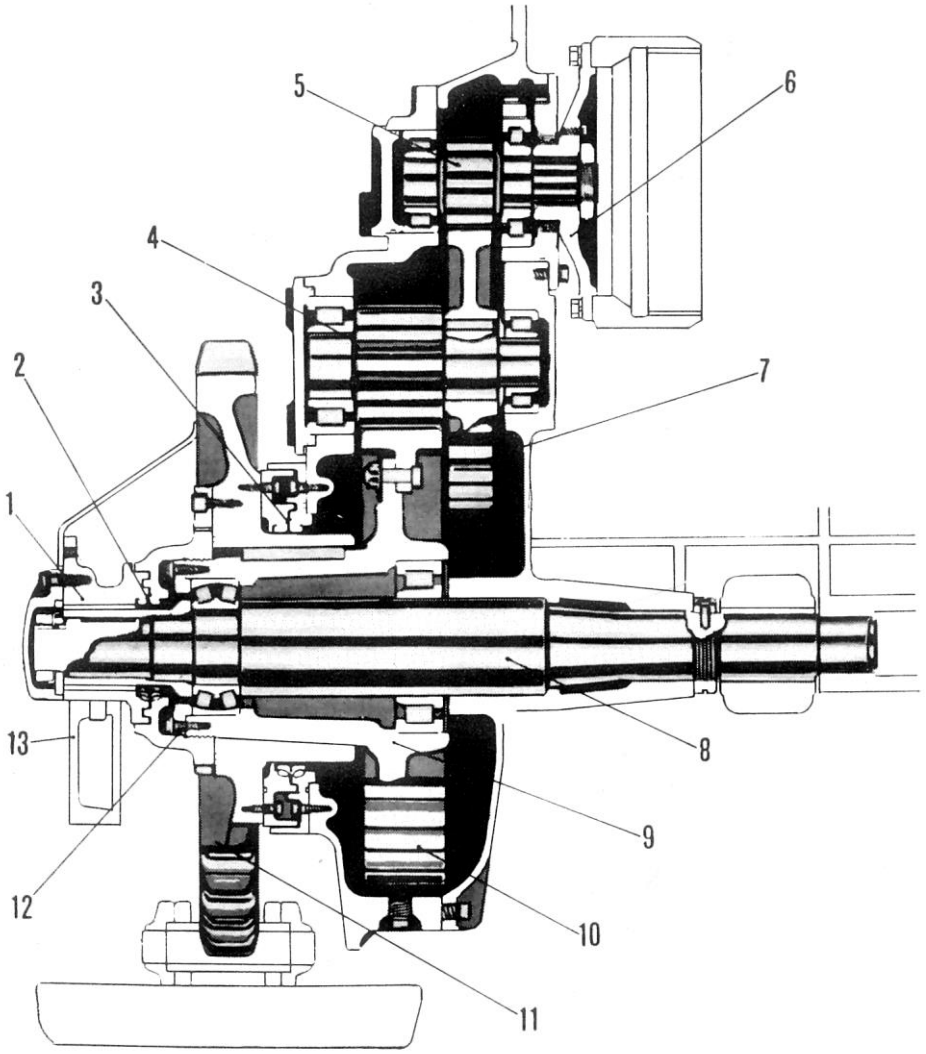
The element used for filtering oil is of paper type.

FINAL DRIVE

INDEX

Final Drive

DESCRIPTION



FINAL DRIVE

1.	*Bearing*	*6.*	*Flange*	*11.*	*Sprocket*
2.	*Floating seal*	*7.*	*Gear*	*12.*	*Nut*
3.	*Floating seal*	*8.*	*Sprocket shaft*	*13.*	*Track frame*
4.	*Second pinion*	*9.*	*Hub*		
5.	*1st pinion*	*10.*	*Second gear*		

Final Drive

Description

The final drive gear train is in two-stage reduction with two spur gears and two pinions, all housed in a case bolted to the steering case.

No. 1 pinion has the Inner end of its shank inserted into the Involute-splined hub of the brake drum flange and the outer end held in the final drive case. No.1 gear, meshed with No. 1 pinion, keyed to the shank of No.2 pinion to form a built-up gear member. No.2 gear, meshed with No.2 pinion, is bolted to the flanged part of the sprocket wheel hub. This hub is mounted over the roller bearings on the sprocket wheel shaft, and the sprocket wheel is bolted to the flanged portion of this hub with 6 keys.

The pinion bearings are of roller type. The bearings by which the assembly of the hub and sprocket wheel rotate around the sprocket wheel are of the spherical type.

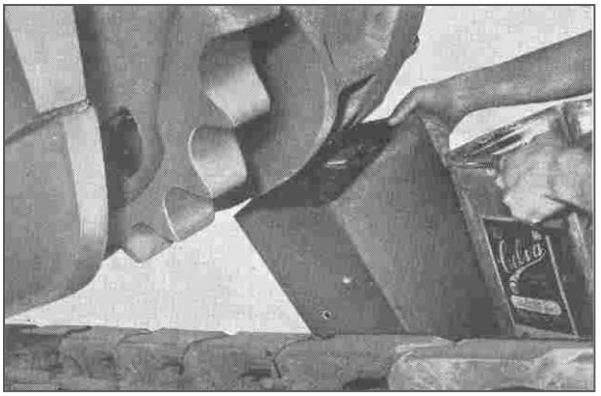
The sprocket wheel shaft, extending through the final drive case, is press-fitted through the steering case and has its inboard end rigidly gripped and secured to the mio-section underside of the steering case, while its outboard end Is connected to the track frame by means of support bracket doweled and bolted to the top of this frame. Thus the rear section of the tractor chassis loads on the track frames, right and left through the two sprocket wheel shafts.

The running clearance between the final drive case and the sprocket wheel complete with the hub is provided with a floating seal mechanism, which positively keeps off dirt and water to protect the oil within the final drive case.

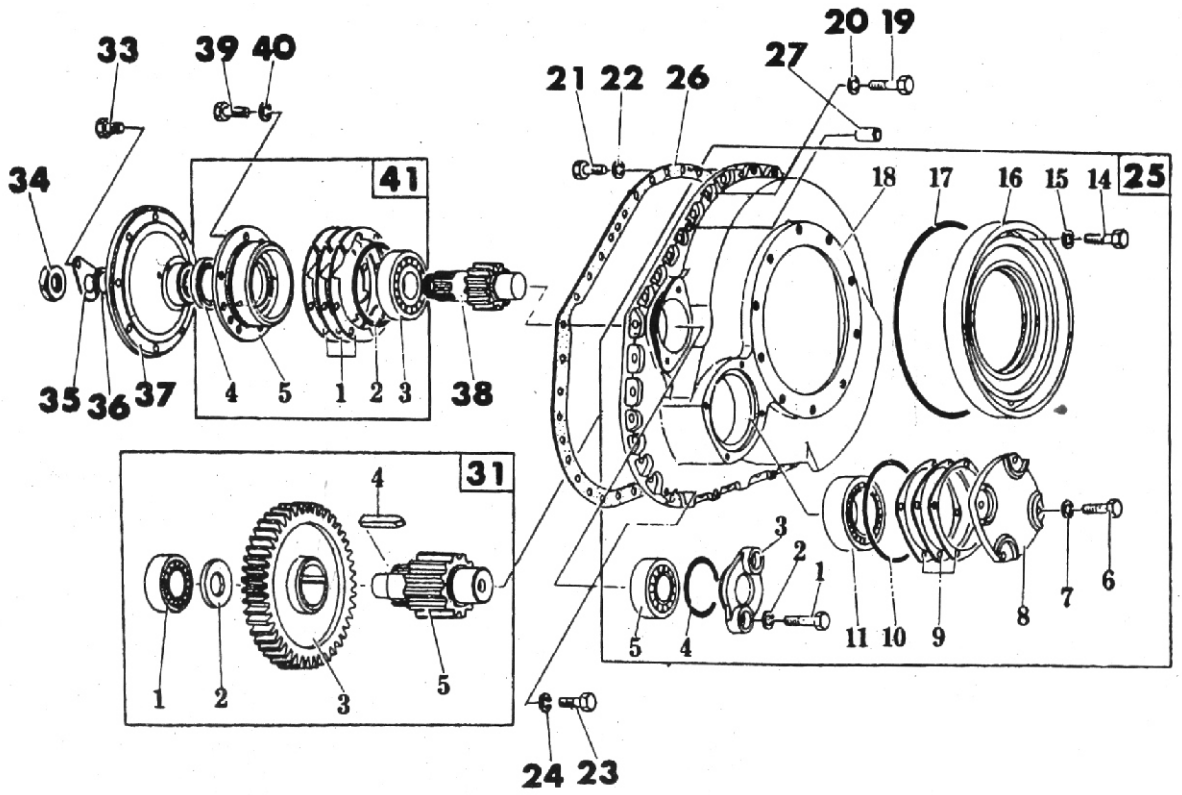
The bottom section of the case forms an oil bath, from which oil is splashed up to lubricate the internal running members including the roller bearings.

REMOVAL

1. *Open the tracks. Disassemble the track frame. (Refer to "TRACK REMOVAL" and "TRACK GROUP REMOVAL").*
2. *Remove the steering clutches and brake assemblies.*
3. *Remove oil in each final drive case by draining.*

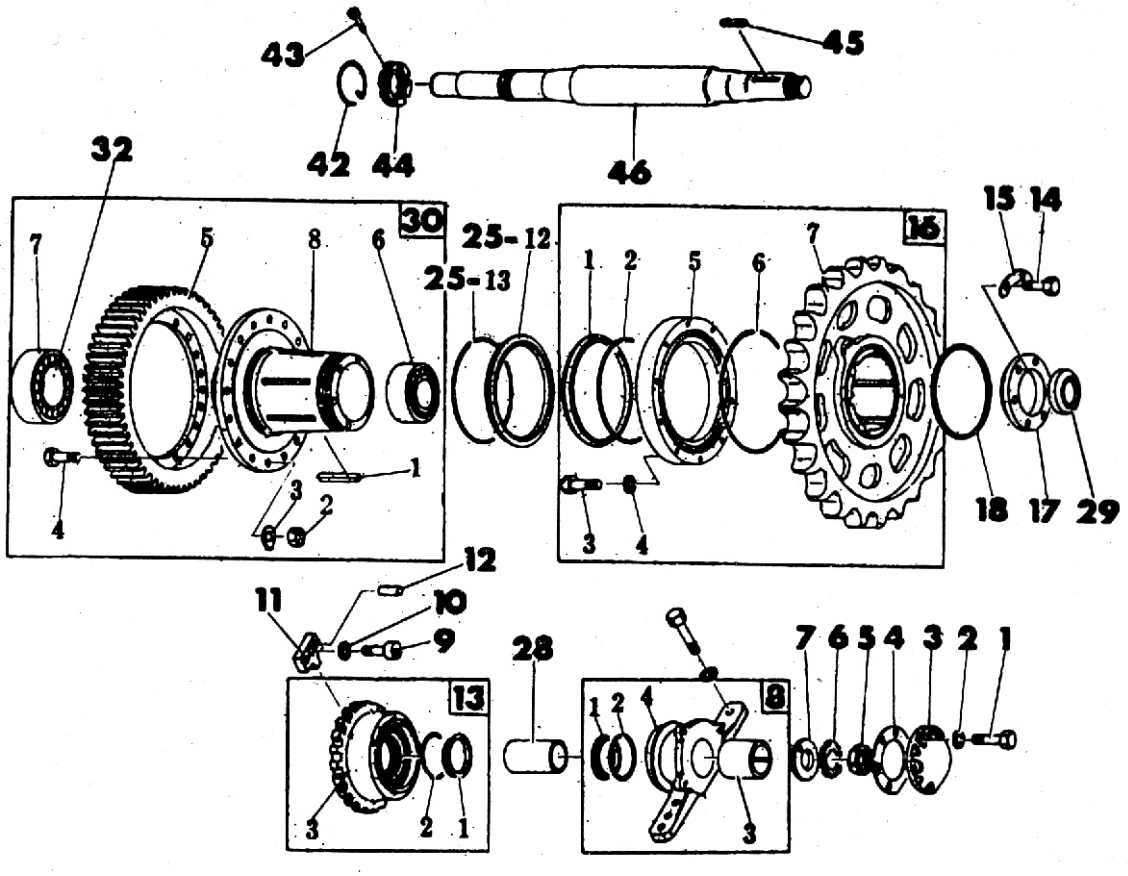


DISASSEMBLING



Final Drive

Disassembling

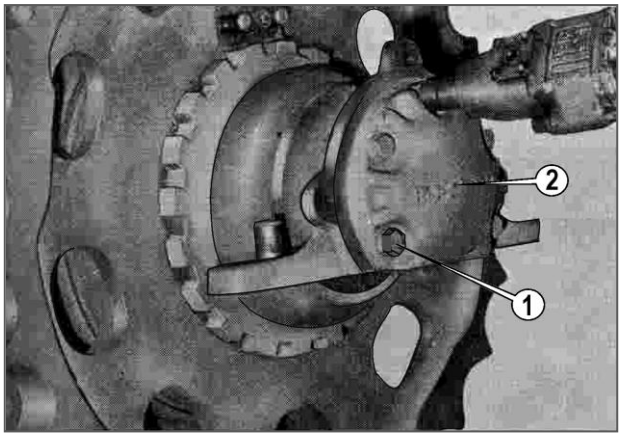


PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

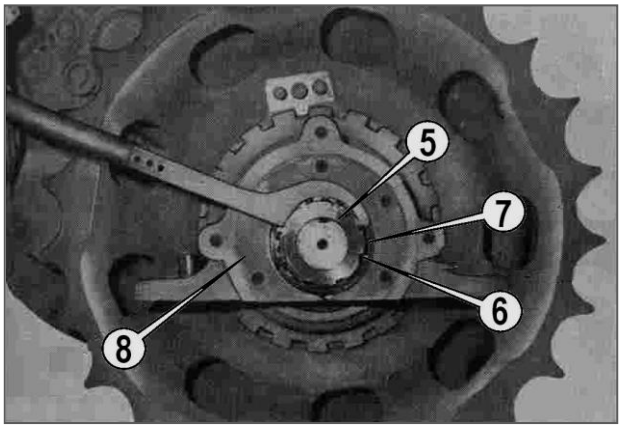
1. Bolt
2. Spring washer
3. Cover
4. Gasket
5. Nut
6. Lock
7. Spacer
8-1. Seat ring
8-2. O-ring
8-3. Bushing
8-4. Support
9. Bolt
10. Spring washer
11. Stopper
12. Dowel pin
13-1. Seal ring
13-2. O-ring
13-3. Nut
14. Bolt
15. Lock washer
16-1. Seal ring
16-2. O-ring
16-3 Bolt
16-4. Spring washer
16-5. Cover
16-6. O-ring
16-7. Sprocket
17. Retainer
18. O-ring
19. Bolt
20. Spring washer
21. Bolt
22. Spring washer
23. Bolt
24. Spring washer
25-1. Bolt
25-2. Spring washer
25-3. Bracket
25-4. O-ring
25-5. Bearing
25-6. Bolt
25-7. Spring washer
25-8. Cover
25-9. Shim
25-10. O-ring
25-11. Bearing
25-12. Seal ring
25-13. O-ring
25-14. Bolt
25-15. Spring washer
25-16. Cover
25-17. O-ring
25-18. Case
26. Gasket
27. Dowel pin
28. Spacer
29. Seal

30-1. Key
30-2. Nut
30-3. Lock
30-4. Reamer bolt
30-5. Gear
30-6. Bearing
30-7. Bearing
30-8. Sprocket hub
31-1. Bearing inner race
31-2. Washer
31-3. Gear
31-4. Key
31-5. Pinion
32. Bearing. inner race
33. Bolt
34. Nut
35. Lock
36. Spacer
37. Flange
38. Pinion
39. Bolt
40. Spring Washer
41-1. Shim
41-2. O-ring
41-3. Bearing
41-4. Oil seal
41-5. Bearing cage
42. Ring
43. Lock pin
44. Nut
45. Key
46. Shaft

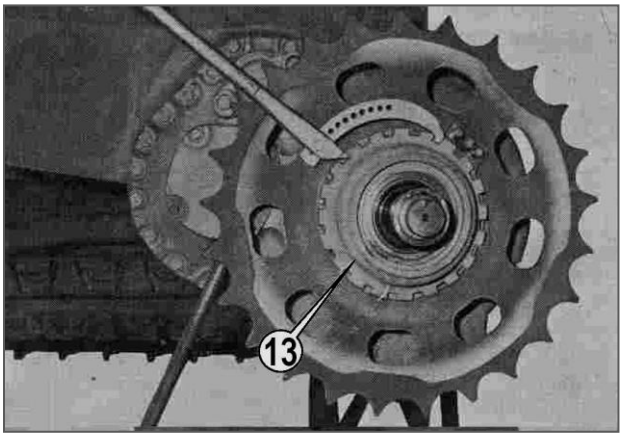
4. Remove the bolts (1), and take off the cover (2) and gasket.



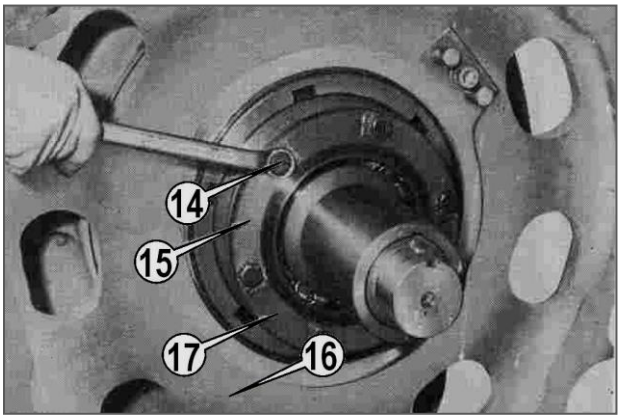
5. Remove the nut (5), take off the lock (6) and spacer (7). Dismount the support assembly (8). This removal involves parts 8-1 thru. 8-4.



6. Remove the nut (13). Parts 13-1 thru. 13-3 are to be removed.



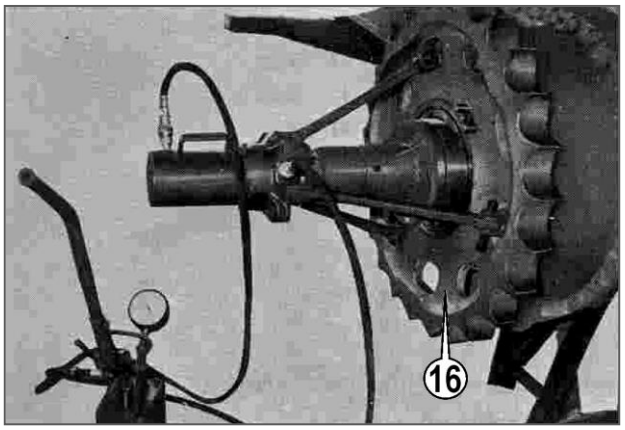
7. Remove the bolts (14), take off the lock (15) and draw off the sprocket assembly (16) complete with the retainer (17).



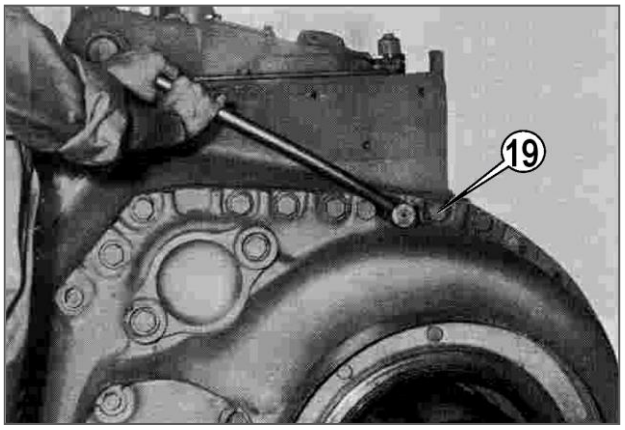
Final Drive

Disassembling

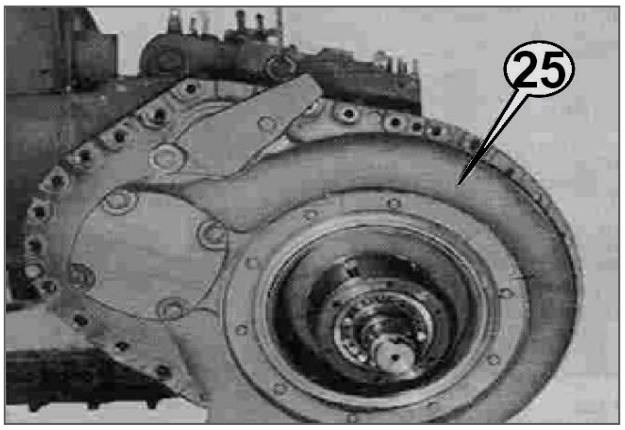
8. *Draw the sprocket (16) off the hub with a special tool (No. 09713-00000). Parts 16-1 thru 16-7 are to be removed.*



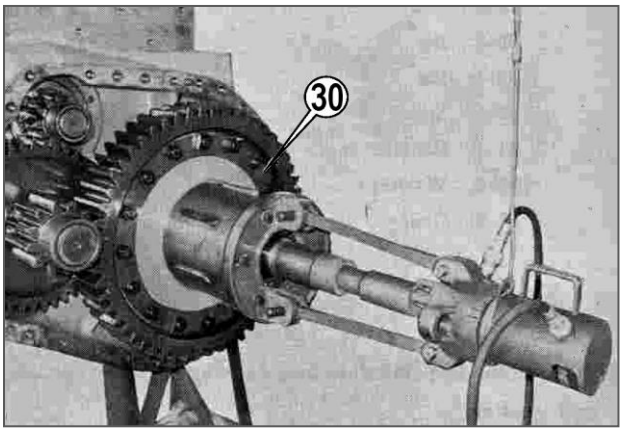
9. *Remove the bolts (19) (21) and spring washer (23).*



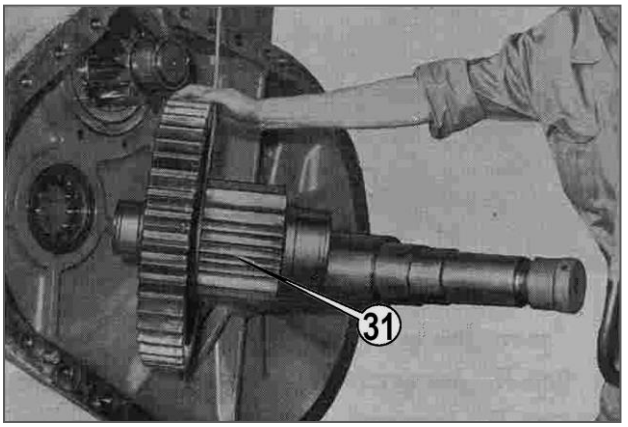
10. *With an overhead crane, hang the case (25). Parts 25-1 thru. 25-18 are to be removed.*



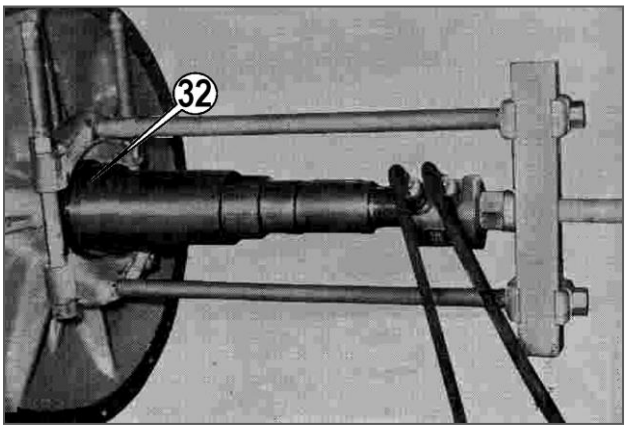
11. *Draw off the gear (30) with a special tool (No. 09703-00000). Parts 30-1 thru 30-8 are to be removed.*



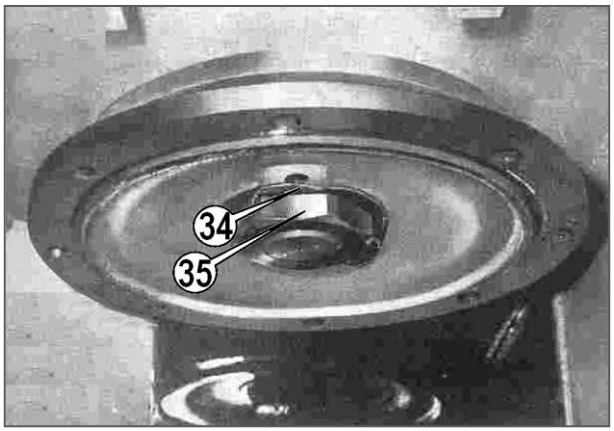
12. *Draw out the gear and pinion (31) Parts 31-1 thru 31-5 are to be removed.*



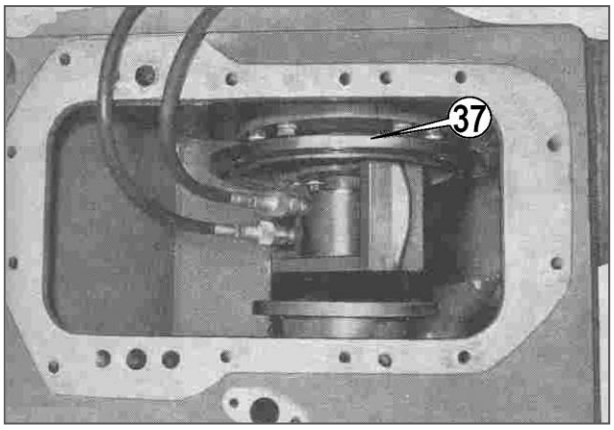
13. *With a puller, remove the bearing inner race (32) from the shaft.*



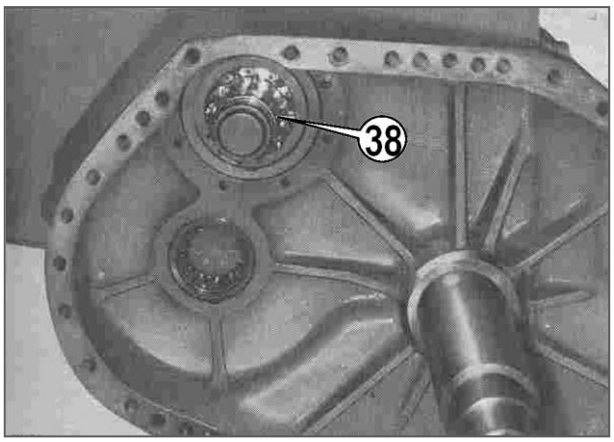
14. *Flatten the lock (35) and remove the nut (34).*



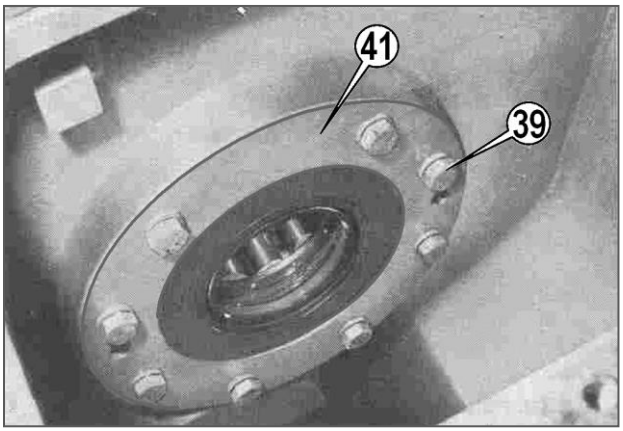
15. *Take out the flange (37) with a Puller (No.09710-00000).*



16. *Draw out the pinion (38).*

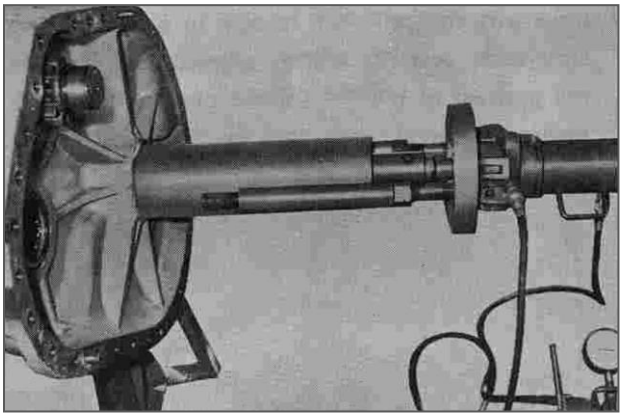


17. *Remove the bolts (39) and the bearing case (41) by using jacking screws. Parts 41-1 thru 41.5 are to be removed.*



18. *With a special tool (No.09717-00000), draw out the sprocket shaft (46). (Normally this shaft need not be removed).*

Note: *UNLESS. IT IS NECESSARY DON'T REMOVE THE SHAFT.*



Final Drive

Cleaning and Inspection, etc.

CLEANING AND INSPECTION

1. *Wash all removed parts clean, and dry them with compressed air if available.*
2. *Inspect each final drive case for cracks or any other damage. Repair or replace the case if necessary.*
3. *Check the gear teeth for wear. Inspect the gear teeth for contact pattern.*
4. *Check wear of the reamer bolts, with which the last gear is secured to the sprocket hub.*
5. *Check the sprocket shaft for straightness. Repair or replace the shaft if necessary.*
6. *Check the teeth of the sprocket for radial wear by using the contour gauge. Measure the tooth width to determine the extent of lateral wear. Repair the teeth, or replace the sprocket as necessary.*

ASSEMBLING

Instructions to be followed in assembling and mounting the final drive groups are as follows:

1. *Before installing the final drive case in place make sure that the gasket between this case and the steering case is of the prescribed thickness.*
2. *Where a replacement final drive case is to be installed, tentatively build the final drive gear train with the replacement case in place making sure each gear is properly aligned, an then fix the position of the final drive case anew with respect to the steering case by dowelling.*
3. *When mounting sprocket wheels center the wheel relative to the sprocket shaft and push the wheel slowly onto the sprocket hub so as not to disturb the seal rings in the place.*
4. *Use extreme care in handling floating seals not to drop the on the floor.*
5. *Before fitting the floating seal rings, make sure that rings are all clean. Apply oil to the faces of rings just before putting them in the place.*
6. *Apply grease to the oil seals and O-rings before fitting them in the place.*

CONTROL SYSTEM

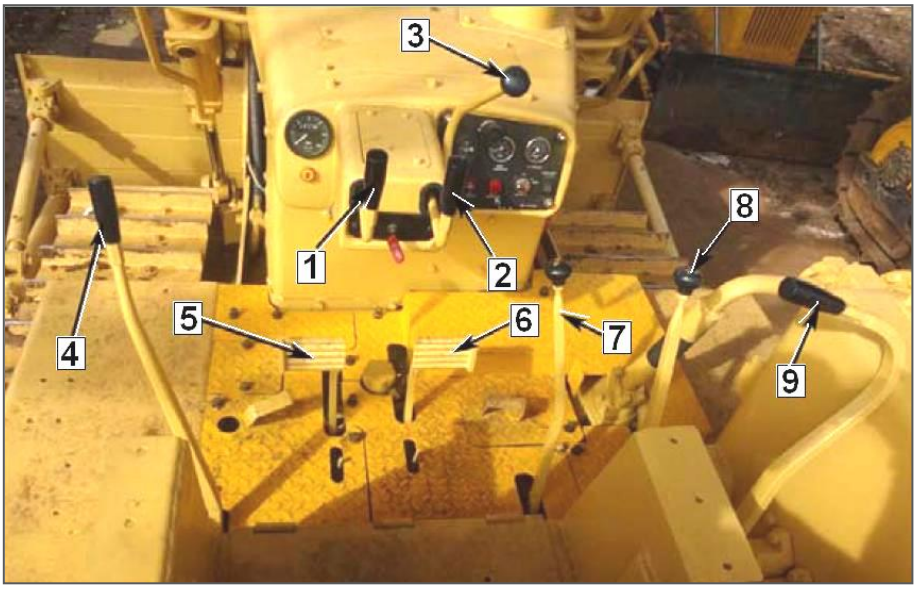
INDEX

Control System

The Operator's seat is located on the rear side of the Tractor. Tractor speed change levers and the hydraulic blade control lever for dozer blade operation are located on the right side of the Operator's seat.

The two steering clutch levers right and left are located in front of the Operator's seat. The corresponding brake pedals are positioned on the floor board along with pedal locking levers for the purpose of parking.

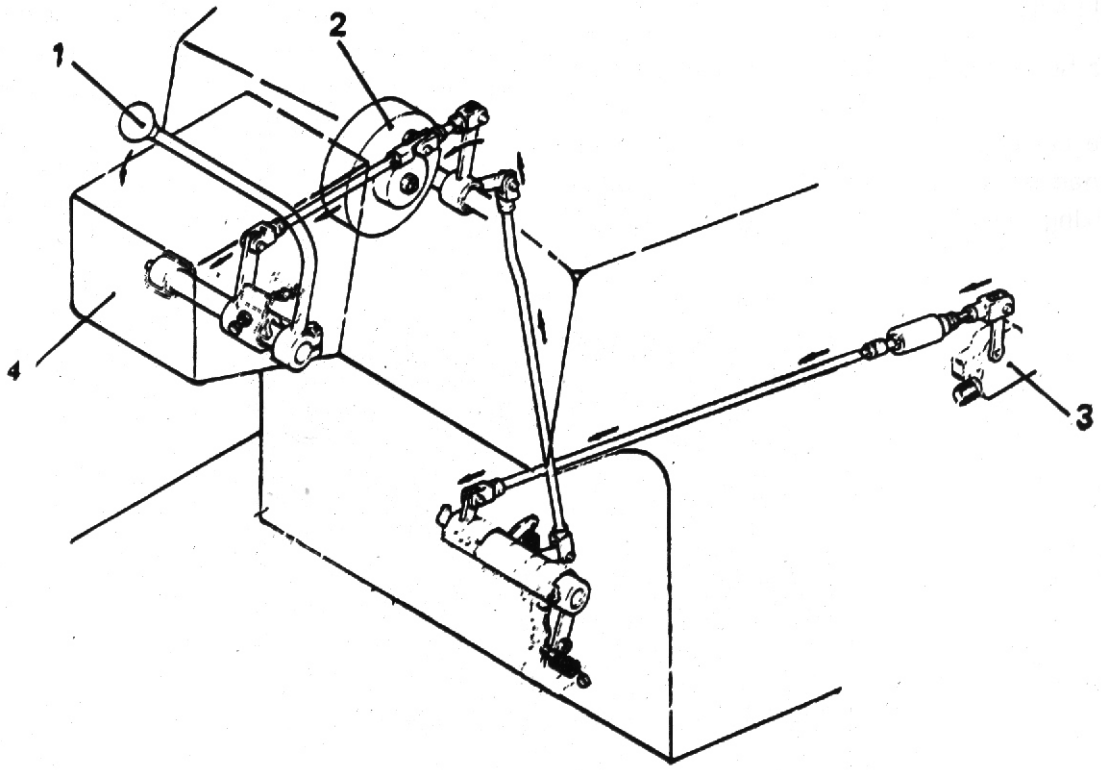
Fuel control lever is on the right side of the steering clutch levers. Pulling down the fuel control lever allows a higher quantity of the fuel injected and the engine runs at full speed. The rotary disc of the fuel control lever is spring loaded, so that by the friction of this disc, the lever is forced to stay in any position selected within its range. The Engine idles with the lowest idling speed if the lever is pushed all the way up against its stopper.



1. *Steering clutch lever (L.H.)*
2. *Steering clutch lever (R.H.)*
3. *Fuel Control lever*
4. *Main Clutch lever .*
5. *Brake Pedal (LH.)*
6. *Brake Pedal (R.H.)*
7. *Forward and Reverse lever*
8. *Gear Shift lever*
9. *Hydraulic blade control lever*

Description

Fuel Control Lever



FUEL CONTROL LEVER

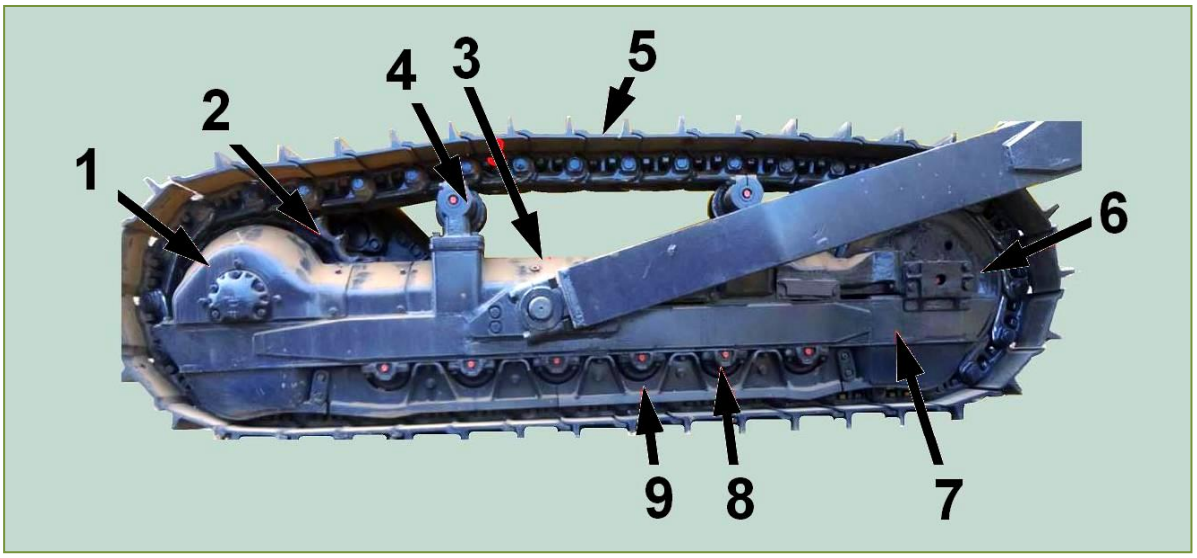
1. *Fuel control lever*
2. *Clutch*
3. *Governor*
4. *Dashboard*

UNDER CARRIAGE

INDEX

UNDERCARRIAGE

General



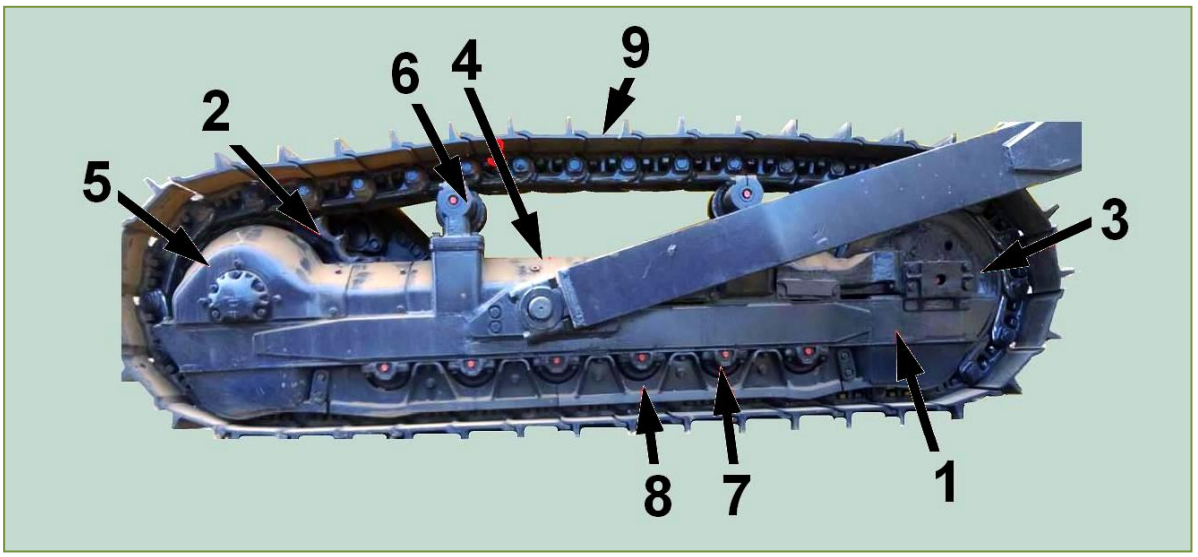
UNDERCARRIAGE

1.	*Sprocket cover*	*4.*	*Carrier roller*	*7.*	*Track frame*
2.	*Sprocket*	*5.*	*Track shoe*	*8.*	*Track roller*
3.	*Removal spring housing*	*6.*	*Idler*	*9.*	*Track roller guard*

Each track group consists of a track frame on which the sprocket wheel, idler wheel, carrier rollers and track rollers are mounted, and includes a track, that is a looped chain complete with shoes.

The sprocket wheel is driven from No.2 spur gear in the final drive and pulls the track by its sprockets or teeth. By reaction occurring in this pulling action, the sprocket wheel exerts forward or backward thrust to the track frame, depending on the direction of its rotation. The track frame with its track rollers riding on the track, moves forward or backward relative to the ground, thus propelling the tractor as a whole. The carrier rollers support the upper span of the track and the idler keeps the track in proper tension and, with its recoil spring absorbs shocks occurring when it comes across with the obstacles during operation.

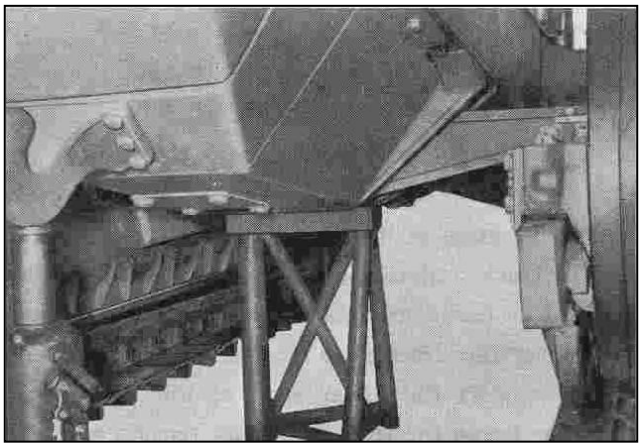
REMOVAL

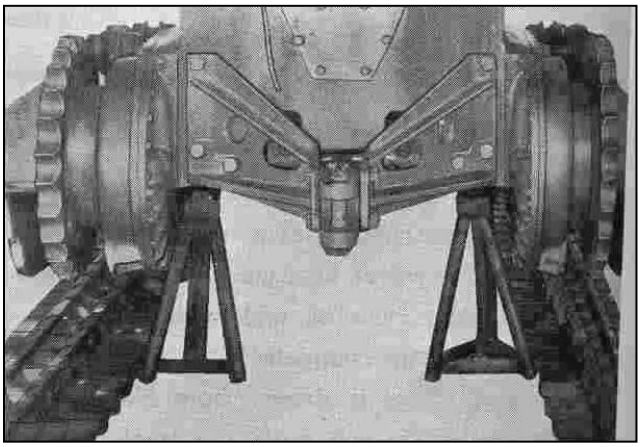


1.	*Track frame*	4.	*Recoil spring housing*	7.	*Track roller*
2.	*Sprocket*	5.	*Sprocket cover*	8.	*Guard, Track rollers*
3.	*Idler*	6.	*Carrier- roller*	9.	*Track shoe*

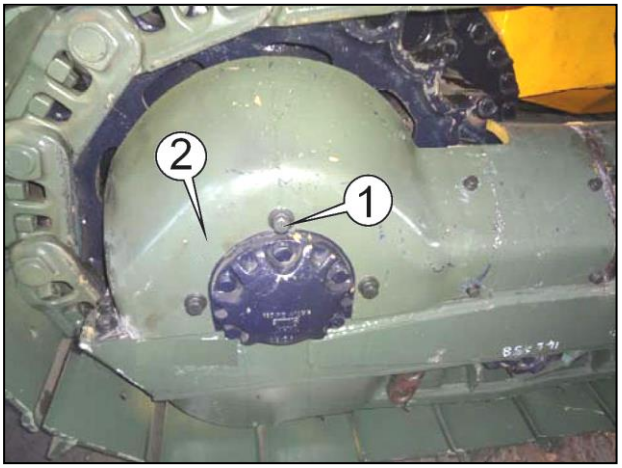
1. *Open the tracks. (Refer to "TRACK REMOVAL").*

2. *Lift the chassis off the floor with hydraulic jacks or an overhead crane, and block up the chassis. The blocks are to be placed against the embossed parts of steering case through which sprocket shafts extend (rear end) on.*

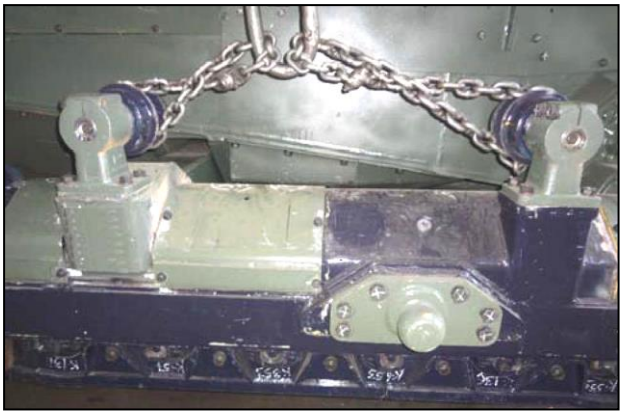




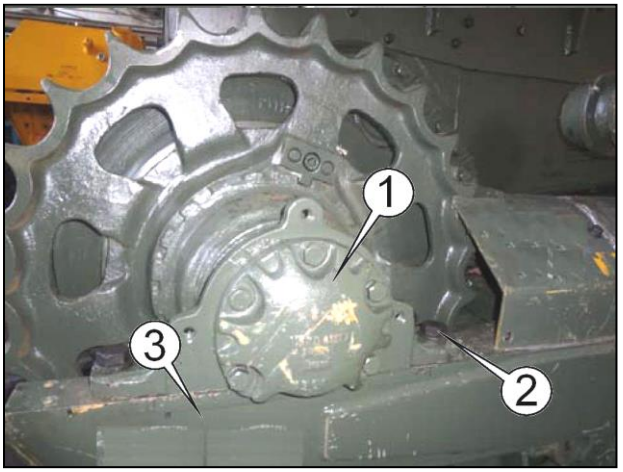
3. *Remove the bolts (1) and the sprocket side cover (2).*



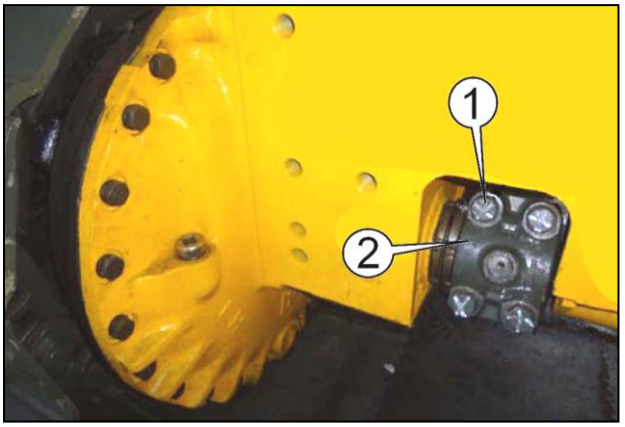
4. *Lift the track frame assembly from above by hitching a lifting cable to the carrier rollers.*



5. *Remove the bolts (2) to detach the track frame (3) from the-sprocket bearing (1).*



6. *Remove the bolts (1) and the diagonal brace cap (2). The track frame assembly is now ready to be carried away in suspension.*



MOUNTING

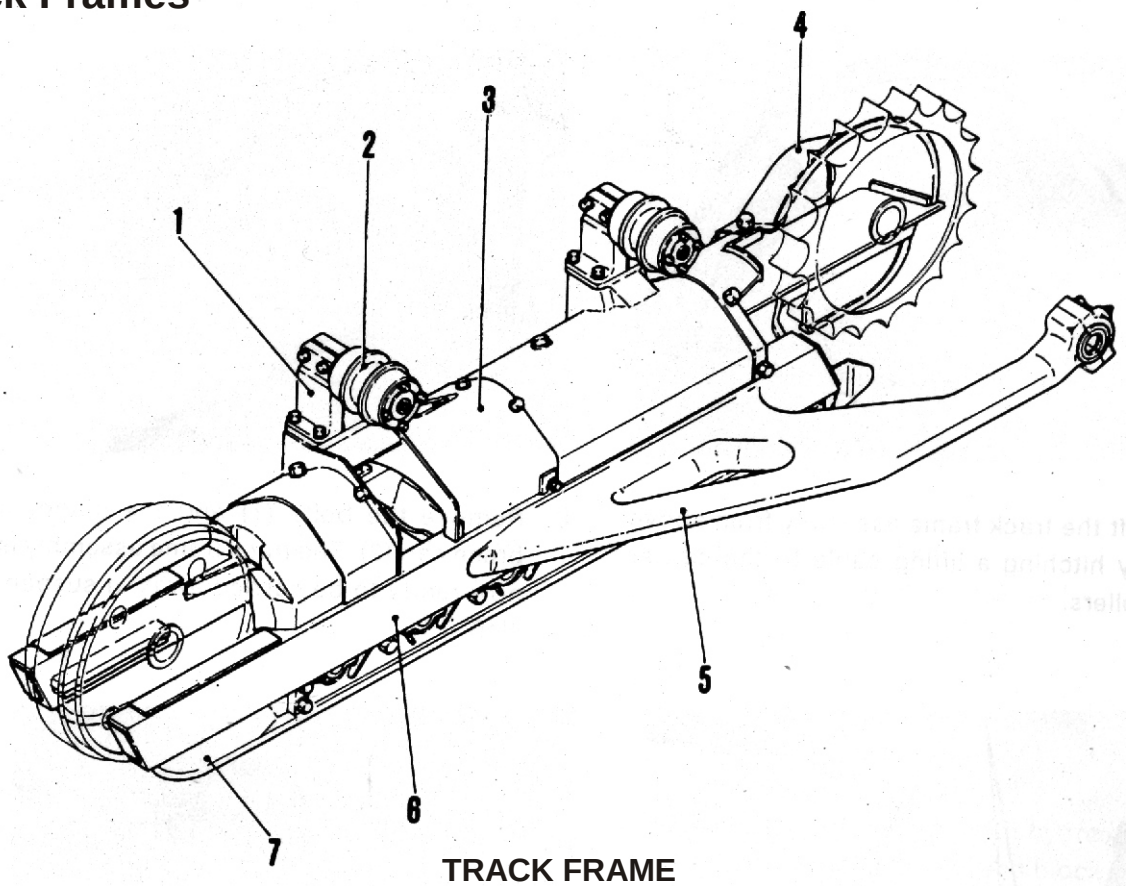
To mount the track frame to the chassis, reverse the removal procedure, adhering to the following Instructions :

1. *Before mounting the track assembly, make sure that the equalizer bar is correctly positioned in its place.*

2. *Torque limits are specified for the bolts securing the diagonal brace caps and the sprocket shaft bearings to track frames.*

3. *Before securing the sprocket shaft bearings in the place, check the centre-to-centre distance between the front idlers as 2000 ± 8 mm.*

Track Frames



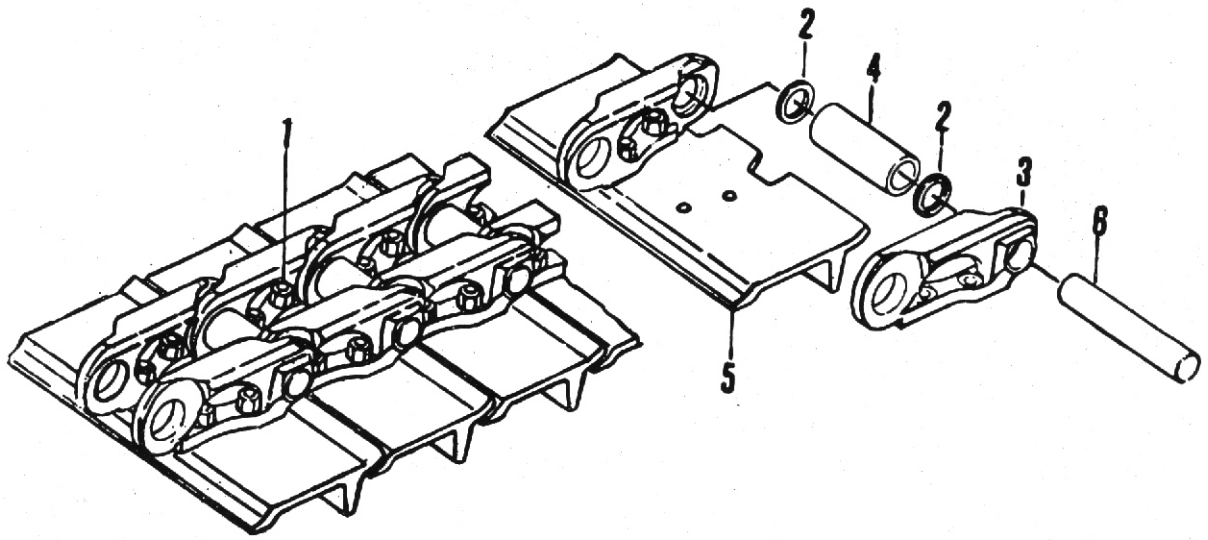
TRACK FRAME

1. *Carrier roller bracket*
2. *Carrier roller*
3. *Recoil spring cover*
4. *Sprocket cover*
5. *Diagonal brace*
6. *Track frame*
7. *Track roller guard*

The track frame is a built-up steel structure shaped to present a box-like construction in cross section and fabricated with steel plates by welding. It is designed particularly strong to withstand the severe shock loads to which it is subjected during duty operation or under traveling condition.

The diagonal brace whose inner end-is rotatably connected to the sprocket wheel shaft below the steering case, is welded to inside of the track frame so that the brace holds the frame in proper geometrical relationship with respect to the main frame and permits the frame to rock around the sprocket shaft. With this arrangement, Idler is capable to move up-and-down.

Tracks



1.	*Shoe bolt*	3.	*Track link*	5.	*Shoe*
2.	*Dust seal*	4.	*Bushing*	6.	*Pin*

DESCRIPTION

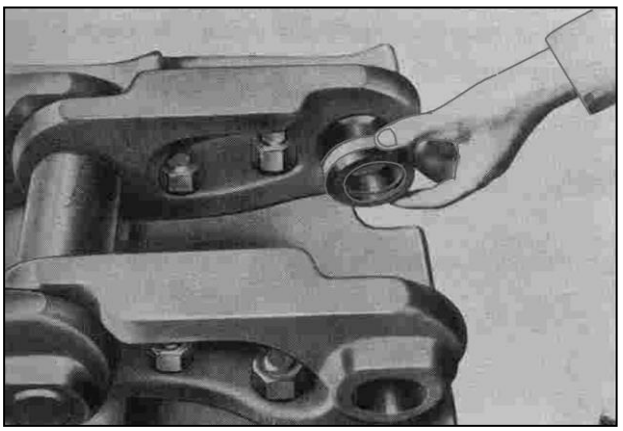
DUST SEAL

The track is an endless chain of-Identical segments, each segment being composed of two rail links, right-hand and left- hand a pin for connecting two segments, a bush for spacing the two rail links apart, and a shoe bolted to the links,

The trailing link ends of one segment are overlapped on the leading link ends of the following segment, the former end coming on the inner side of the latter end. Two rails are formed by the links so linked up.

The trailing ends are capable of turning around the pin, awhile the leading ends are press-fitted to the pin. A dust seal is fitted in the counter bore of the pin hole of each leading end. This seal is located between two overlapped link ends and keeps off dust, dirt and grits to protect the running clearance between the pin and bush. If the seals are not provided, the tracks, would rapidly stretch in service to result in the fast wear between the sprockets and roller flanges.

Two master pins are provided in each track. A connection made with a master pin and bush can be more easily undone. Whenever the track has to be opened, the chain should be opened at the master pin. The master pin and bush are different from other pins and bushes. The ends of each master pin are stepped for identification .

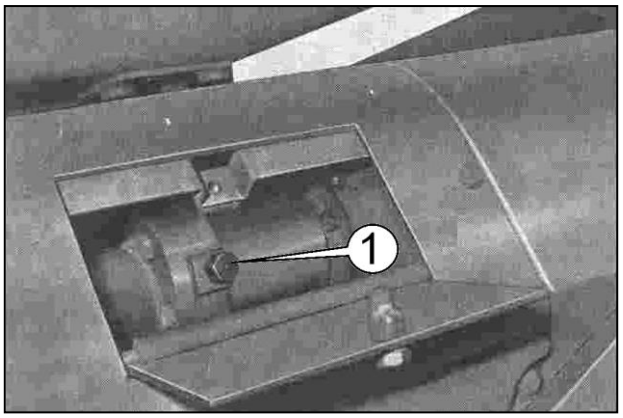


Removal

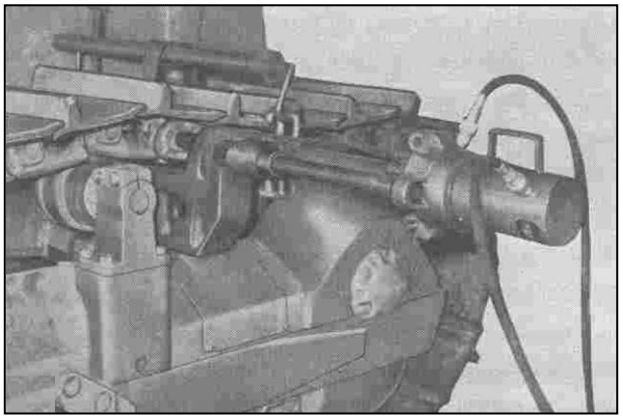
REMOVAL

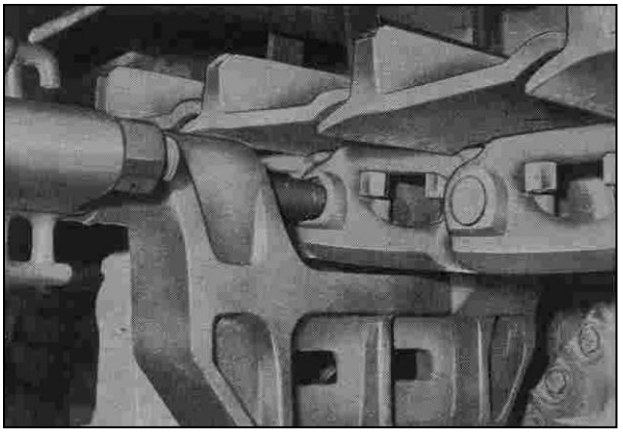
1. Loosen plug(1) to relieve the pressure (grease) in the grease cylinder in order to slacken the tracks.

Note: *IF NO GREASE BLEEDS OUT, DRIVE THE MACHINE BACK AND FORT GIVING A JERK. THIS WILL FORCE OUT SOME GREASE AND SLACKEN THE TRACK CHAIN.*



2. With a hydraulic jack press, remove, the master pin out to open the links. After both track links have been opened, drive the machine to lay the tracks down on the floor. Be sure to use a special tool (No. 09731800000) to open the tracks.

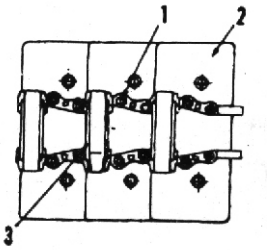




3. *Where the existing tracks are to be replaced by another set of tracks, line up the replacing tracks on the floor to form extensions of the ones to be replaced, and drive the machine over to the new tracks.*

DISASSEMBLING

1. Remove the shoe bolts (1) and remove shoe (2). Repeat this step to remove all shoes.

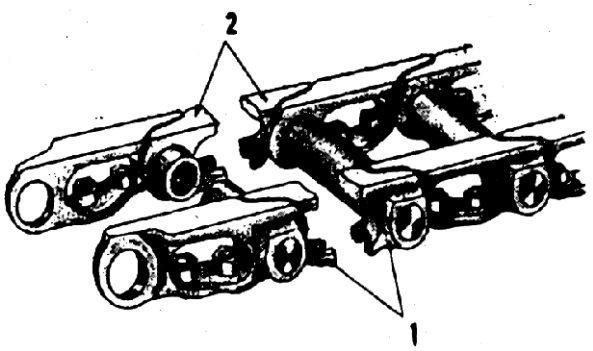


2. Using the press, force out one pin after another, starting from the end where master bushing (3) is located. Adhere to the following Instructions.

Note : *1. BEFORE PUSHING EACH PIN OUT, MAKE SURE IT WILL SLIDE OUT WITHOUT GALLING THE BORE IN THE LINK,*

2. IF THE PRESS FOR DISASSEMBLING TRACKS IS NOT AVAILABLE, THE TRACK MAY BE CUT WITH A CUTTING TORCH TO REMOVE ANY PORTION OF THE TRACK FOR RENEWAL. THE FLAME CUTTING PROCEDURE IS AS FOLLOWS:

(i) CUT THE PAIR OF LINKS IN



THE MIDDLE.

(ii) REMOVE A 15-MM LONG MID-PORTION OF EACH BUSHING BY FLAME CUTTING.

(iii) TO REMOVE THE HALF PIN FROM THE PRECEDING LINK, APPLY FLAME TO THE EMBOSSED END OF THE LINK AND DRIVE THE HALF PIN OUT.

(iv) REMOVE OTHER HALF LINKS (1) (2) FROM THE FOLLOWING LINKS.

(v) WHEN CONNECTING NEW LINKS TO TAKE THE PLACE OF THE PAIR REMOVED BY FLAME-CUTTING, BE SURE TO USE DUST SEALS AT BOTH END OF EACH NEW BUSHING.

INSPECTION

1. Inspect each track shoe for cracks or wear of Its grouser.

2. Inspect the links, bushings and dust seals for wear, and check the link height and bushing O.D. Also check the overall stretch, if any, in each track chain.

3. Check the shoe mounting bolts for tightness. Replace excessive worn bolts

ASSEMBLING

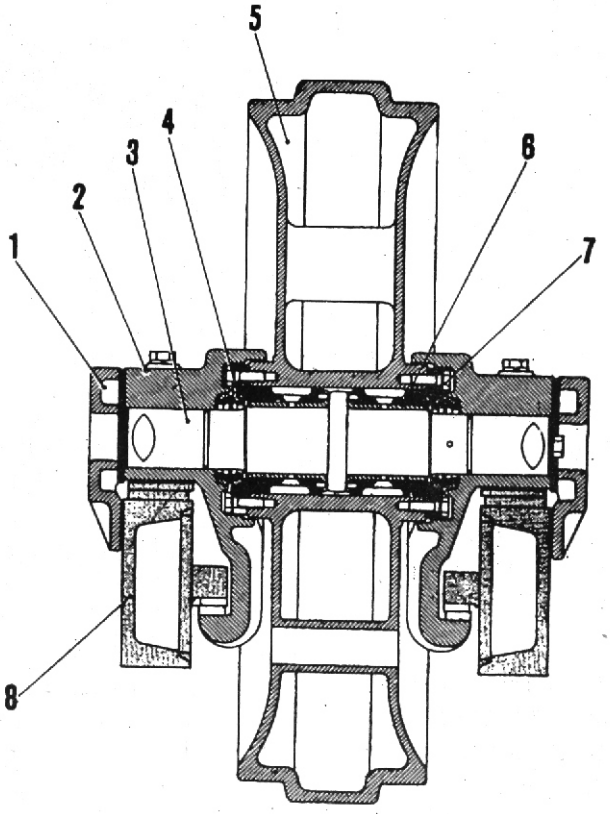
Reverse the disassembling procedure, by adhering to the following rule :

1. Apply oil to the bushings and pins before press-fitting them into the links.

MOUNTING

While mounting the tracks on the track frames, move the machine back and forth so as to connect the tracks at front idlers master pins.

Idlers



IDLER

1. *Guide plate*
2. *Idler bracket*
3. *Idler shaft*
4. *Floating seal*
5. *Idler*
6. *Idler bearing*
7. *Idler bearing*
8. *Track frame*

DESCRIPTION

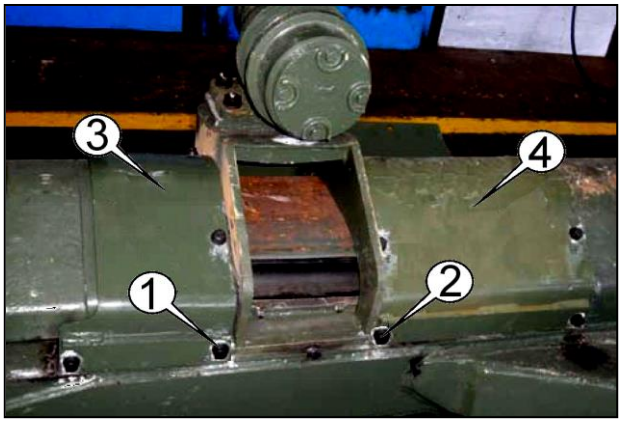
The idler is made of High tensile Alloy Steel Casting present a box-like shape in its radial cross-section. It is rotating on the idler shaft. The idler shaft, extending through the bushed bore of the idler hub, is fitted at its two ends in the two sliding brackets, to which a yoke is bolted.

The running clearance between Idler shaft and bush is filled with oil. This oil is hermetically contained by two floating seals.

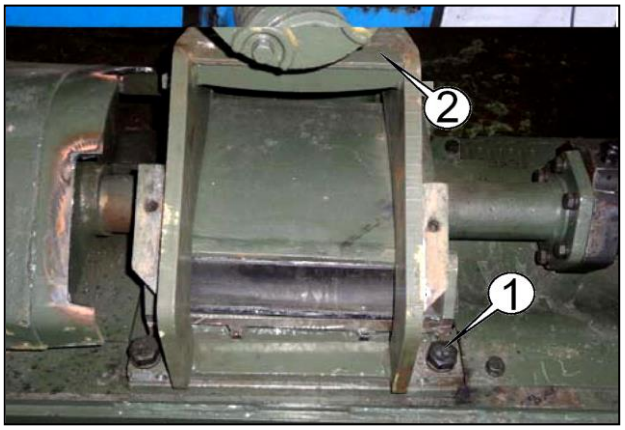
The brackets are held to the track frame by the two spring-loaded guide plates and slide on the top of the track frame in fore-aft direction along the guideways.

REMOVAL

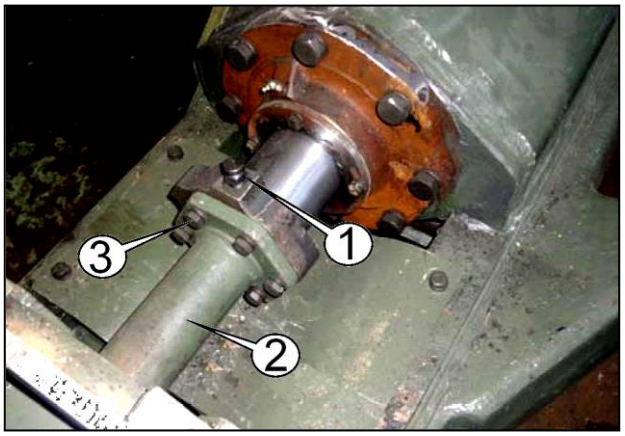
1. *Open the tracks. (Refer to "TRACK REMOVAL").*
2. *Remove the bolts (1) (2) and take off covers (3) (4).*



3. *Remove the bolts (1) and dismantle the carrier roller and bracket (2) as an assembly*

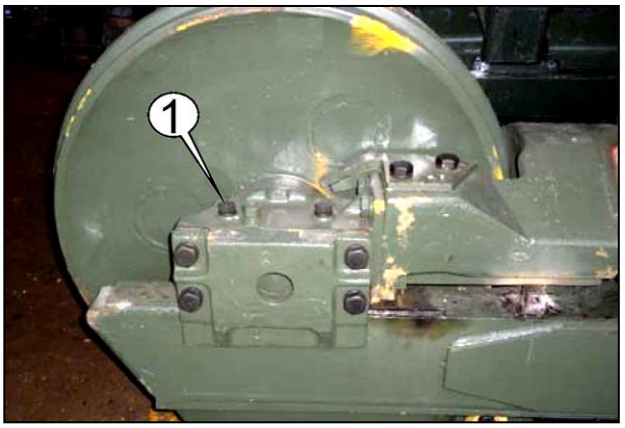


4. *Remove the bolts (3) on the flange to disconnect the cylinder (1) and rod (2).*

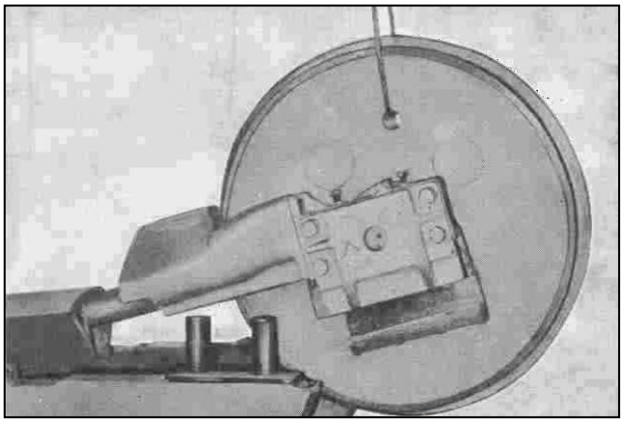


5. *Remove two rubber pads (1).*

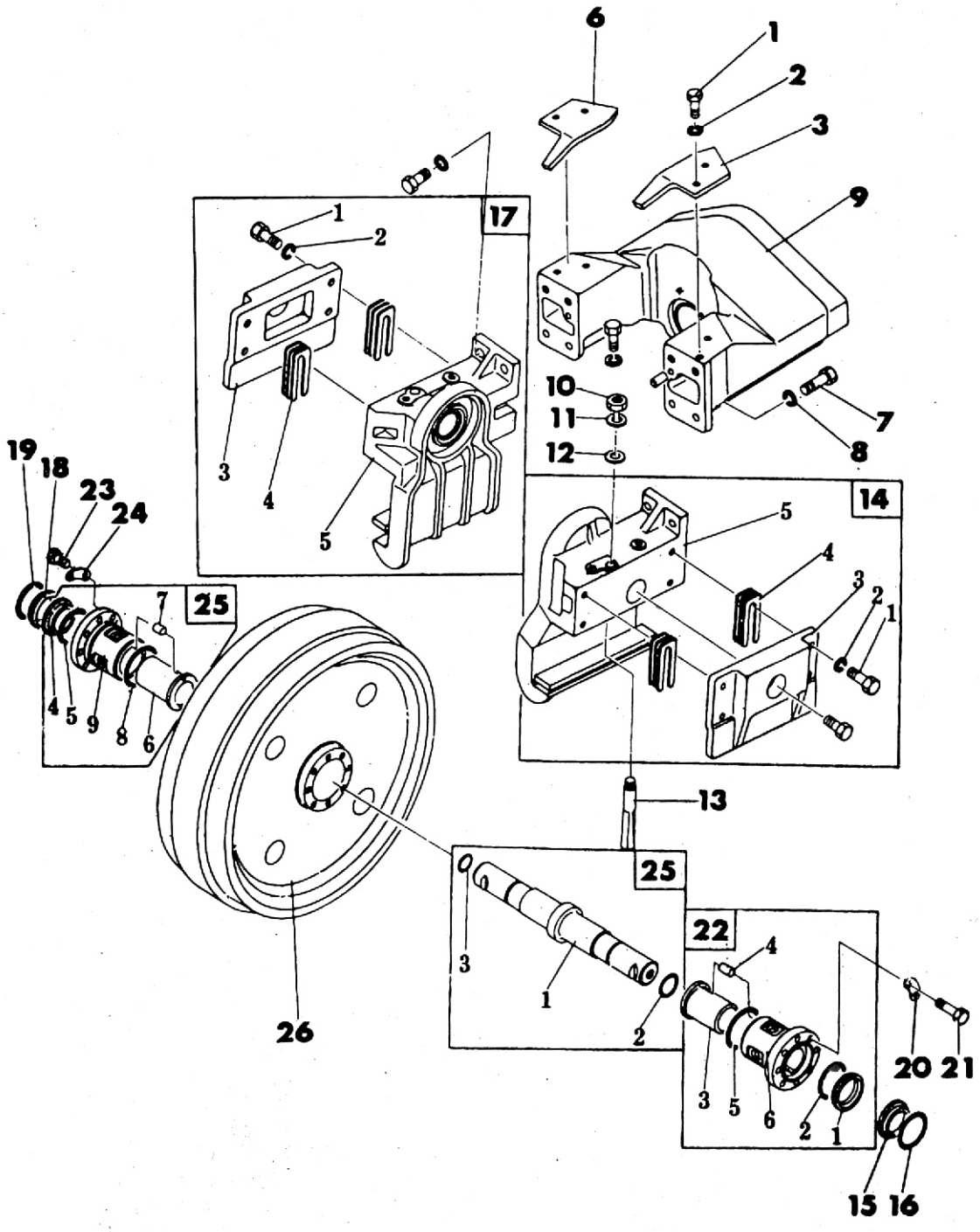
6. *Remove the bolts (1) securing the idler guide In the place.*



7. *Lift up the equalizer bar seat complete with the idler assembly, using an overhead crane.*



DISASSEMBLING



PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING.

1. Bolt
2. Spring washer
3. Scraper (L.H.)
4. Bolt
5. Spring washer
6. Scraper (R.H.)
7. Bolt
8. Spring washer
9. Yoke
10. Nut
11. Spring washer
12. Washer
13. Bolt centering
14-1. Bolt
14-2. Spring washer
14-3. Guide plate
14-4. Shims
14-5. Bracket (R.H.)
15. Seal ring
16. O-ring
17-1. Bolt
17-2. Spring washer
17-3. Guide plate
17-4. Shims
17-5. Bracket (L.H.)
18. Seal ring
19. O-ring
20. Bolt
21. Lock washer
22-1. Seal ring
22-2. O-ring
22-3. Bearing
22-4. Dowel pin
22-5. O-ring
22-6. Bearing
23. Bolt
24. Lock washer
25-1. Shaft
25-2. O-ring
25-3. O- ring
25-4. Seal ring
25-5. O-ring
25-6. Bearing
25-7. Dowel pin
25-8. O-ring
25-9. Bearing
26. Idler

CLEANING AND INSPECTION

1. Inspect the idler for cracks or any other damage. Check its O.D and the width of its peripheral land to determine the amount of wear.

2. Check the shaft O.D and bearing I.D to determine the amount of wear. Check also the shaft for runout (deflection). Clean and clear the oil holes and grooves of the shaft by blowing with compressed air.

3. Check wears on the thrust surfaces of the shaft bearing flange and bushing.

ASSEMBLING

To assemble the idlers, reverse the disassembling procedure, adhering to the following instructions:

1. *The bushings of the idlers are to be pressed into the bore with the use of the same press for the track roller removal.*
2. *When fitting the idler bushings, first position each bushing with its bolt holes aligned to those in the idler and then start pushing them into the bore. Of the two bushings for each idler, one is to be forced in from the outer side and the other from inner side.*
3. *Before installing the idler shaft set bolts apply LOCK TIGHT to these bolts, and tighten them to the specified torque limits.*

MOUNTING

MOUNTING

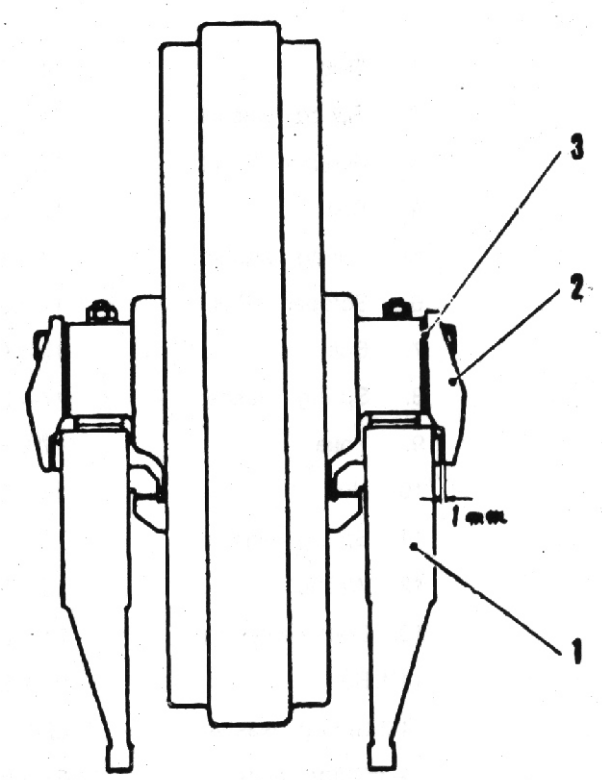
To mount the idlers, reverse the removal procedure by adhering to the following instructions.

1. *Adjust the thickness of shim (3) to obtain a clearance of not more than 1 mm between the idler shaft guide (2) and the track frame (1) .*

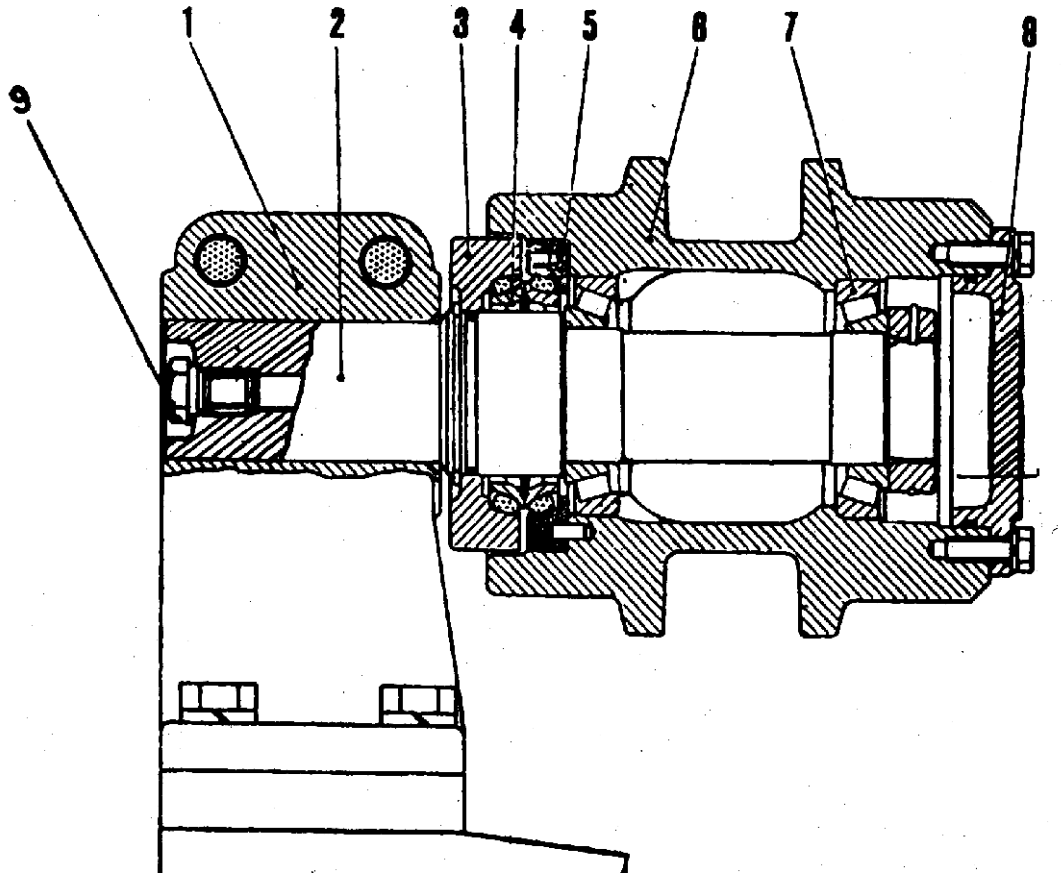
2. *Each idler shaft is to be so positioned as to bring its lubricant-charging end to outer side of the following track frame.*

   R.H. track frame outer side

   L.H. track frame outer side



Carrier Rollers



1.	Carrier roller bracket	4.	Floating seal	7.	Taper roller bearing
2.	Carrier roller shaft	5.	Seat	8.	Cover
3.	Seal guide	6.	Carrier roller	9.	Oil plug

Two carrier rollers are provided in each track group to support the upper span of the track between the idler and the sprocket wheel.

Each carrier roller rotates on its shaft whose one end is gripped in a bracket and other end extend like a cantilever. The bracket is bolted to the top of the track frame. Two tapered roller bearings are positioned between the shaft and the roller. At each end of the roller in place, a floating seal is provided to hermetically contain the lubricating oil in the cavity around the shaft.

The floating seal used on the carrier rollers are basically similar to other floating seals in design. Sealing action Is accomplished in these seals by a number of successive annular sliding contacts interposed between two end members one being stationary and the other being rotary. The sliding speed of each contact is but a fraction of the rotating speed of the rotary member relative to the stationary member.

Removal

Floating Seal

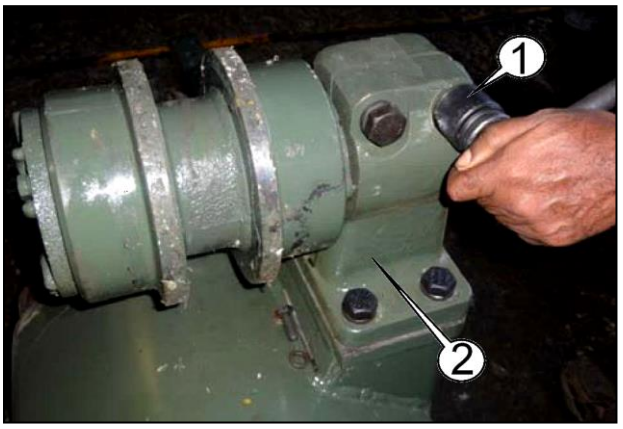
Specifically the floating seal of a carrier roller consists of the seal support, two seal rings mating to each other by precisely finished faces, two a-rings each provided on a seal ring, and additional O-ring. Because of the low sliding speed the wear of these sliding parts of the seal is greatly minimized.

REMOVAL

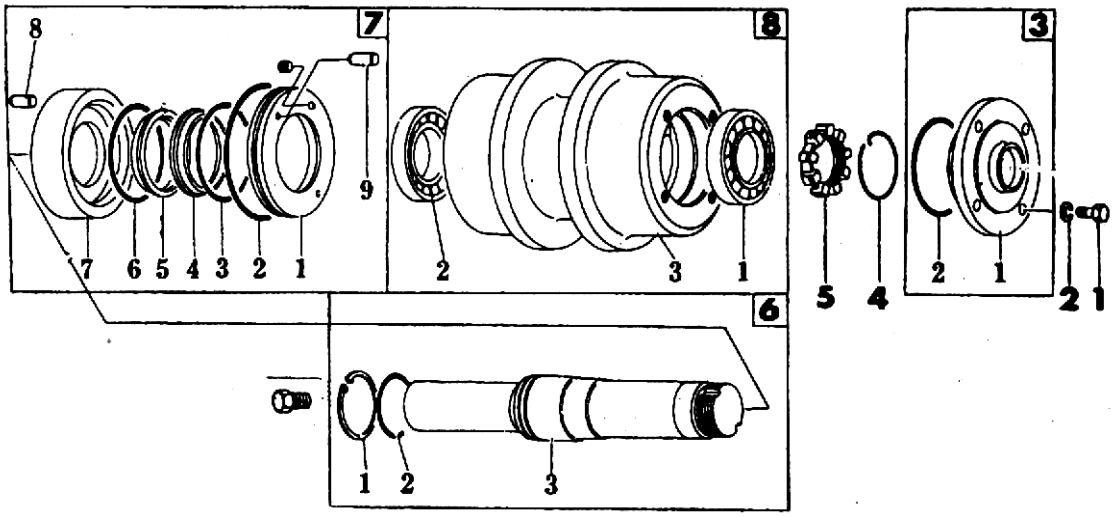
1. Open the tracks. (Refer to "TRACK REMOVAL").

2. Remove the bolts (1) securing the roller shaft, and remove the roller assembly from support (2). If the shaft does not come off the support easily, (lightly tap on the bearing side to shake the shaft loose).

3. The carrier roller can be removed without the removal of the track chain. This can be done by slackening the track as much as possible and by jacking up the upper span of track from bottom, with hydraulic Jack on the recoil spring cover.



DISASSEMBLING



PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1.	*Bolt*	*6-2.*	*O-ring*	*7-6.*	*O-ring*
2.	*Spring washer*	*6-3.*	*Shaft*	*7-7.*	*Seal guide*
3-1.	*Cover*	*7-1.*	*Seat*	*7-8.*	*Dowel pin*
3-2.	*O-ring*	*7-2.*	*O-ring*	*7-9.*	*Dowel pin*
4.	*Snap ring*	*7-3.*	*O-ring*	*8-1.*	*Bearing*
5.	*Nut*	*7-4.*	*Seal ring*	*8-2.*	*Bearing*
6-1.	*Snap ring*	*7-5.*	*Seal ring*	*8-3.*	*Carrier roller*

INSPECTION

1. Check the track and flange faces of each carrier roller for wear.

2. Inspect the bearing for any sign of wear.

3. Check the roller shaft for wear or any other abnormalities.

4. Check the bracket support for cracks, distortion or any; other abnormalities.

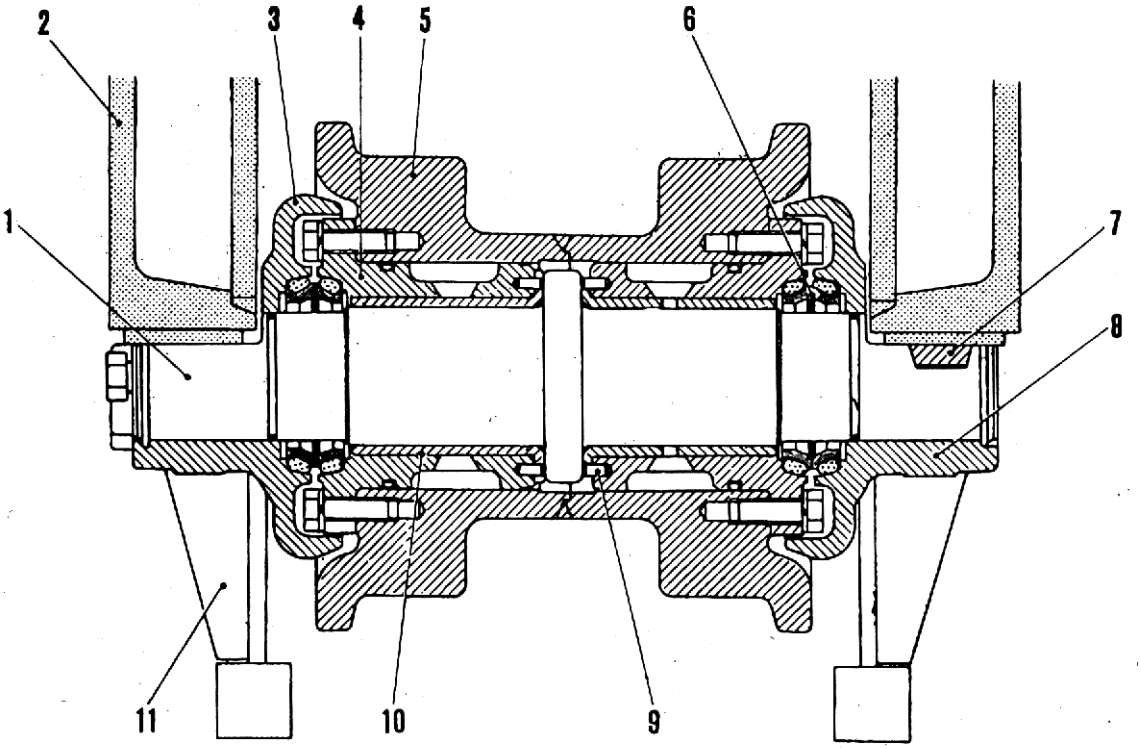
ASSEMBLING AND MOUNTING

Reverse the removal and disassembling procedure by adhering to the following instructions:

1. Take care in installing the bearing not to damage it.

2. When mounting the carrier roller on the support, position the roller shaft by correctly aligning the support and the seal guide at the dowel pin hole. Insert the pins and tighten the bolts on the support with the roller shaft held in that position.

Track Rollers



PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1.	*Track roller shaft*	*5.*	*Track roller*	*9.*	*Dowel pin*
2.	*Track frame*	*6.*	*Floating seal*	*10.*	*Bush*
3.	*Track roller shaft collar*	*7.*	*Thrust key*	*11.*	*Guard*
4.	*Bearing*	*8.*	*Track roller shaft collar*		

Six track rollers are distributed along at the bottom of the track frame there being a total of 12 track rollers for the tractor. These rollers ride on the rail links of the track and support the weight of the tractor.

Some of these track rollers are of single flange type while the remaining are of the double-flange type. The centre flange serves to take up the lateral thrust in either direction.

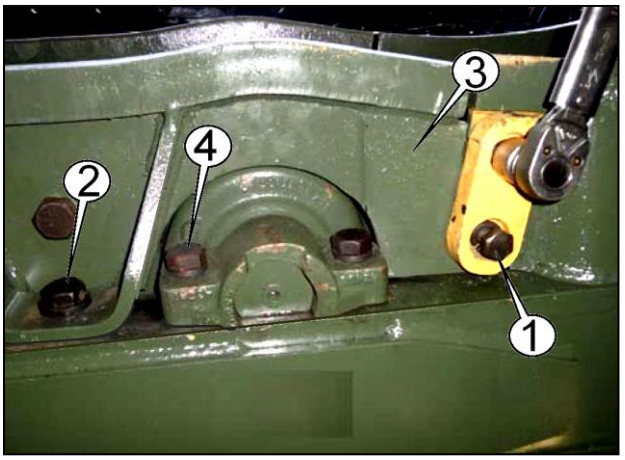
Taking the track rollers one by one according to the type of flanges, from the front end toward the rear, the six are arranged in the order of SINGLE, DOUBLE, SINGLE, SINGLE, DOUBLE AND SINGLE.

The end clearance of the track roller is predetermined and does not lead to adjustment . A floating seal is provided at each end of the roller for preventing dirt, grit or water from entering the running clearance between the roller and its shaft.

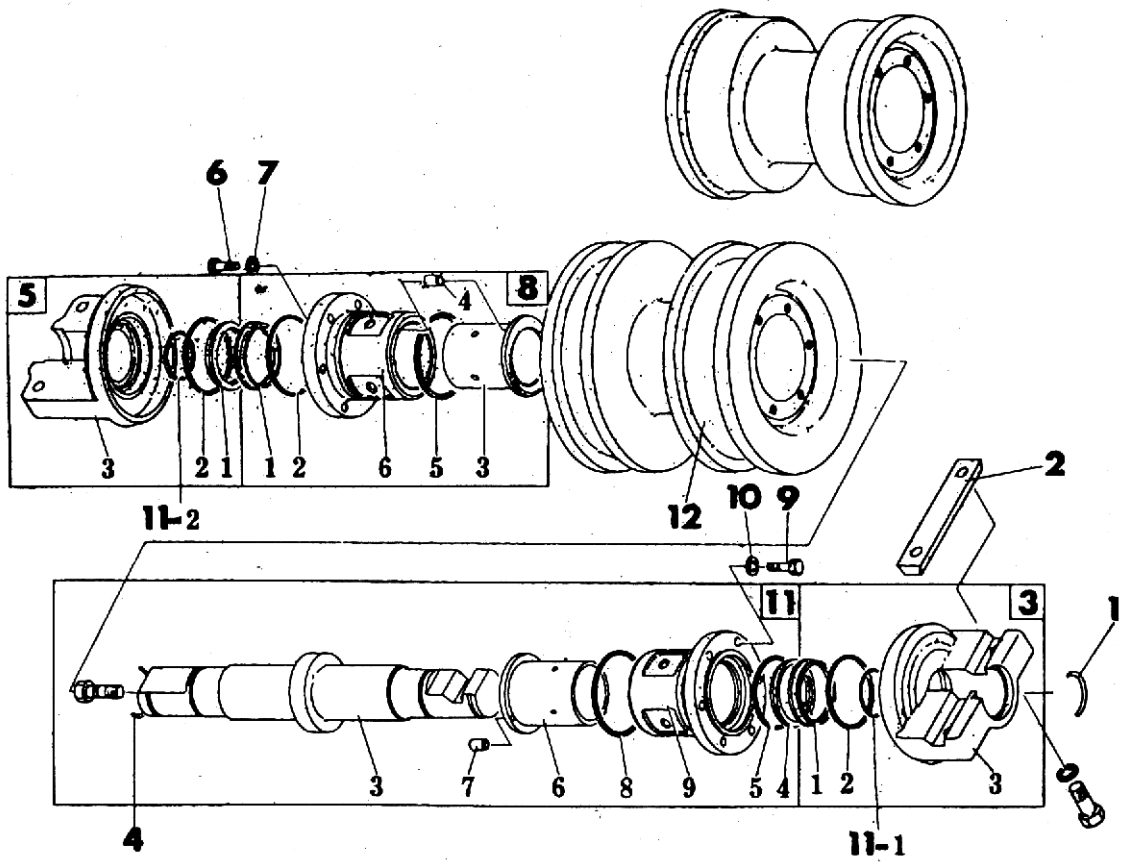
REMOVAL

1. Open the tracks. Detach each track frame from the chassis. Set the removed track frame upside down on the floor.

2. Remove the bolts (1) (2) and guard (3) on each side: Remove each track roller assembly from the track frame by removing its securing bolts (4).



DISASSEMBLING



PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1.	*Snap ring*	*7.*	*Spring washer*	*11-2.*	*O-ring*
2.	*Thrust key*	*8-1.*	*Seal ring*	*11-3.*	*Shaft*
3-1.	*Seal ring*	*8-2.*	*O-ring*	*11-4.*	*Seal ring*
3-2.	*O-ring*	*8-3.*	*Bushing*	*11-5.*	*O-ring*
3-3.	*Bracket*	*6-4.*	*Dowel pin*	*11-6.*	*Building*
4.	*Snap ring*	*8-5.*	*O-ring*	*11-7.*	*Dowel pin*
5-1.	*Seal ring*	*8-6.*	*Bearing*	*11-8.*	*O-ring*
5-2.	*O-ring*	*9.*	*Bolt*	*11-9.*	*Bearing*
5-3.	*Bracket (collar)*	*10.*	*Spring washer*	*12.*	*Roller*
6.	*Bolt*	*11-1.*	*O-ring*		

INSPECTION

1. Check the wear of each track roller by measuring the collar O.D. at the track faces and flanges.

2. Inspect the track roller shaft for damage, distortion or any other defects.

3. Measure the shaft O.D., bushing I.D. and thickness of the centre flange (of the shaft) to determine the amount of wear. Clean the shaft and roller, and clear the oil passage through the shaft with compressed air.

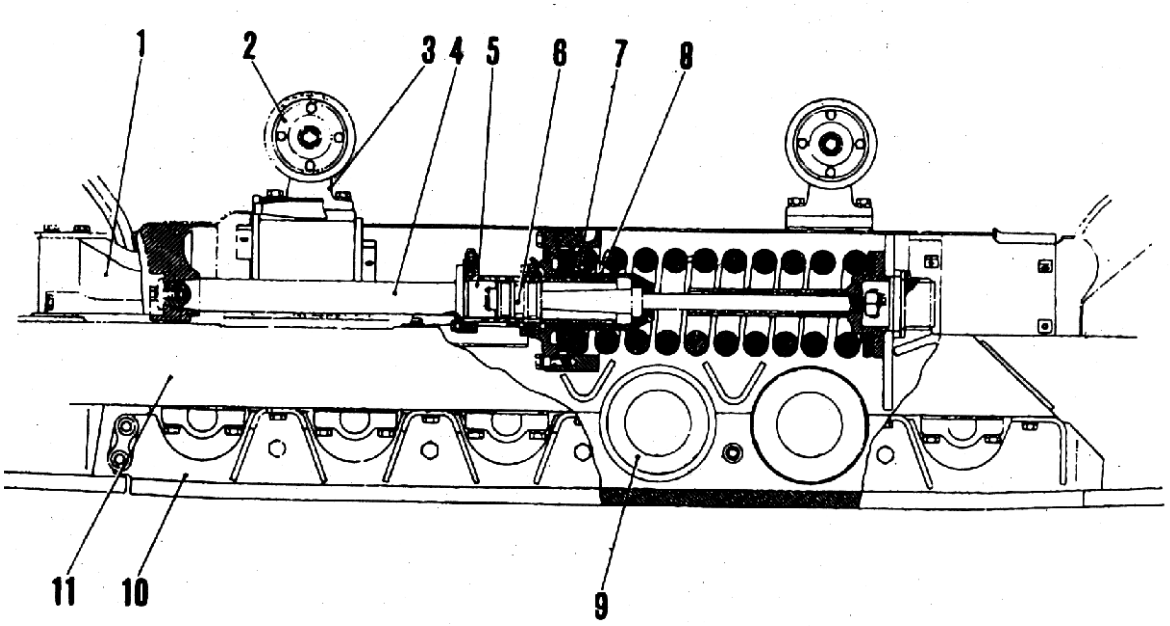
4. Inspect the roller shaft collars for wear.

ASSEMBLING

To assemble the track roller, reverse the removal and disassembling procedures by adhering to the following instructions:

1. *Use the press to install the bushings in the track roller, being sure to align the bore of the track roller with the bushing bore.*
2. *After the bushing is securely pressed in place, insert the track roller shaft in the roller. In the same manner as outlined above, install the bushing on the other side.*

Recoil Spring



RECOIL SPRING

1.	*Idler yoke*	*5.*	*Idler adjusting cylinder*	*9.*	*Track roller*
2.	*Carrier roller*	*6.*	*Piston*	*10.*	*Guiding guard*
3.	*Carrier roller bracket*	*7.*	*Recoil spring*	*11.*	*Track frame*
4.	*Rod*	*8.*	*Recoil spring cylinder*		

The recoil spring assembly, located at the middle of the track frame and enclosed in a housing, serves to provide a cushion back in the idler through the yoke, rod and grease filled cylinder, Its "recoiling" action - yielding to an opposing force and bouncing back upon renewal of the force - occurs when the idler encounters an obstacle or load during operation.

Track tension depends on the static force the recoil spring applies to the idler and can be varied for adjustment by increasing or decreasing the amount of grease in the Idler adjustment cylinder, which is a part of the recoil spring assembly.

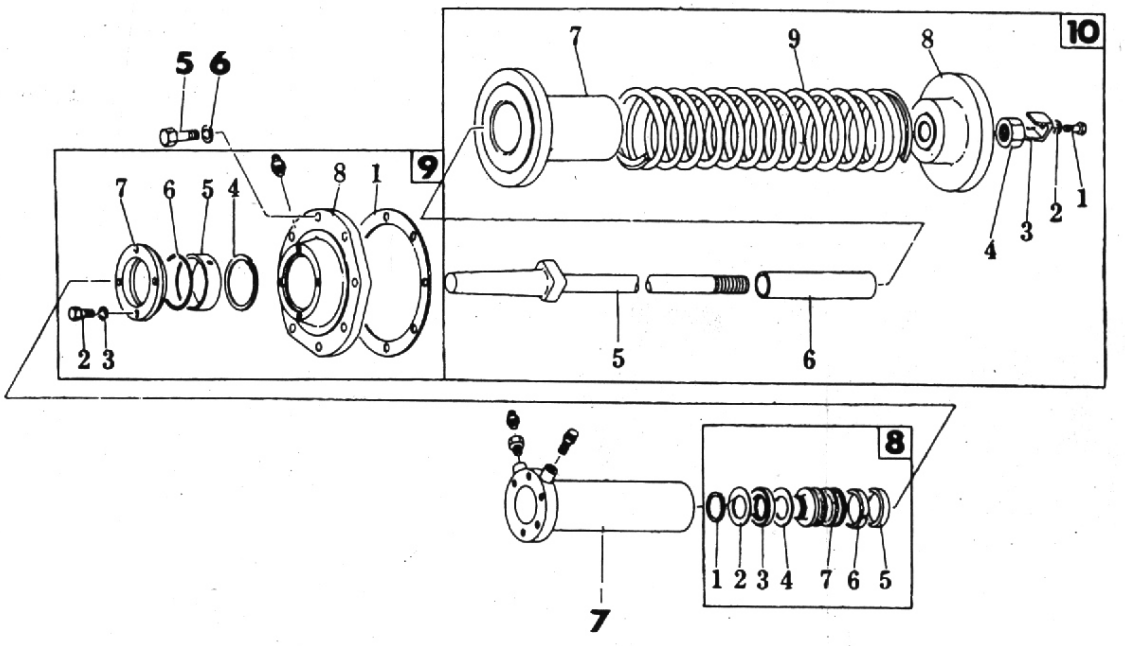
Removal

1. Stretch the tracks. (Refer to "TRACK REMOVAL").

2. Separate the track frame groups from the chassis. (Refer to "REMOVAL OF TRACK FRAME GROUP")

3. Remove the plug, and pump out the oil in the recoil spring housing, if the recoil spring housing contains the oil. Otherwise it is not necessary.

DISSEMBLING



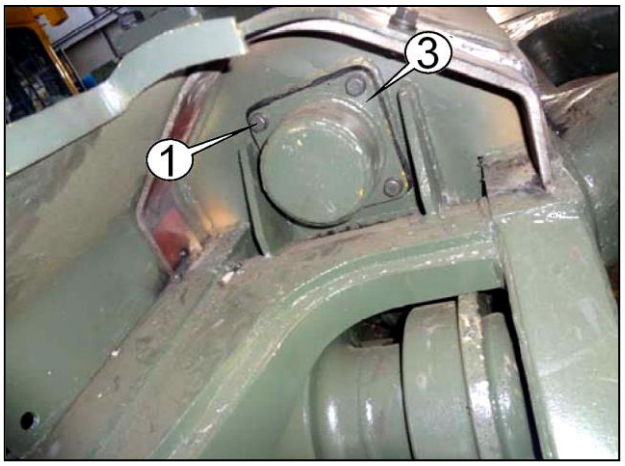
PARTS ARE ENUMERATED IN THE SEQUENCE OF DISSEMBLING

**1. Bolt*
**2. Spring washer*
**3. Cover*
**4. Gasket*
5. Bolt
6. Spring washer
7. Cylinder
8-1. Ring
8-2. Ring
8-3. Gasket
8-4. Back-up ring
8-5. Seal
8-6. Seal
8-7. Piston
9-1. Gasket
9-2. Bolt
9-3. Spring washer
9-4. Snap ring
9-5. Bushing
9-6. O-ring
9-7. Cover
9-8. Cover
10-1. Bolt
10-2. Spring washer
10-3. Lock
10-4. Nut
10-5. Rod
10-6. Stopper
10-07. Pilot
10-8. Seat
10-9. Spring

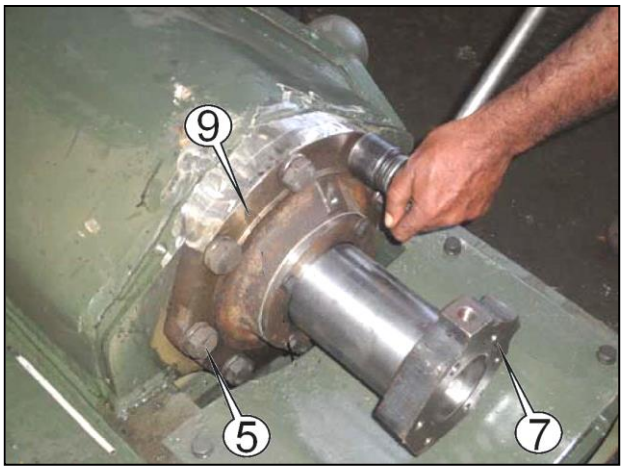
** Not shown in the figure*

Disassembling, etc.

1. Remove the bolts (1) securing the cover (3) in the place lift out the cover and gasket.



2. Remove the bolts (5), lift out the cylinder (7) and the cover (9) in the place, and drive out the spring assembly to the front.



3. When removing the recoil spring from the pilot, use the press (or special tool No.09730-00000) to compress the spring and, after taking down the nut, gradually release the press to detach the spring and pilot

INSPECTION

1. Inspect each recoil spring for damage, and check its free length and any sign of cracks.

2. Inspect the adjusting cylinder for wear or damage on its internal and external surfaces.

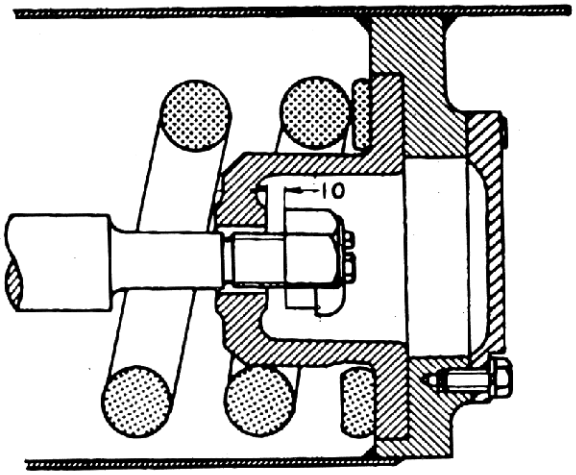
3. Check the bushings inside the recoil spring housing for wear.

4. Check the pistons and seal rings for wear, or any sign of damage.

INSTALLATION

Build up each recoil spring assembly on the track frame according to the following instructions :

1. *Use a press to assemble the recoil spring and seat. After the spring has been installed inside the spring housing as shown in the figure below make sure if there is a clearance of 10 mm between the spring seat and the nut.*



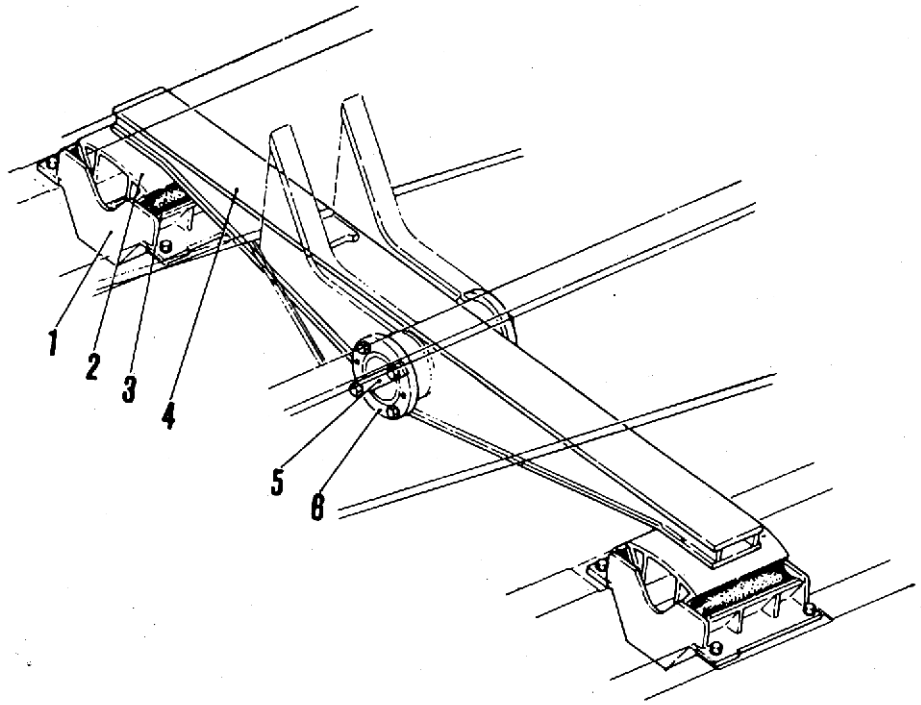
2. *When positioning the grease fittings on the adjusting cylinders, have the cylinders packed with a proper amount of grease and apply also grease to the sliding face of the pistons and to the cylinder bores. The piston rings must be positioned in such a way that the ring gaps should not falling in one time.*

3. *Before inserting the piston into the bore of the cylinder, have the direction of its nipple toward the inspection opening provided on the cover so as to make the nipple accessible for charging grease through the opening.*

4. *After the recoil spring has been assembled in the place on the track frame, and approx. 3 quarts of engine oil into its spring housing. This oil will prevent the spring from rusting.*

Note: *IF THE GREASE WAS APPLIED ON THE RECOIL SPRING FOR RUST PREVENTION INSTEAD OF THE OIL IN THE HOUSING; APPLY ONLY GREASE TO THE RECOIL SPRING AFTER CLEANING AND INSPECTION BEFORE INSTALLATION IN THE HOUSING.*

Equalizer System



EQUALIZER SYSTEM

1.	*Support*	*3.*	*Rubber pad*	*5.*	*Centre pin*
2.	*Seat*	*4.*	*Equalizer bar*	*6.*	*Bush*

The equalizer system is a means of distributing the weight of the front portion of the tractor chassis equally to the two track groups. It consists of a beam whose centre point is pivoted to the cross bar of the chassis.

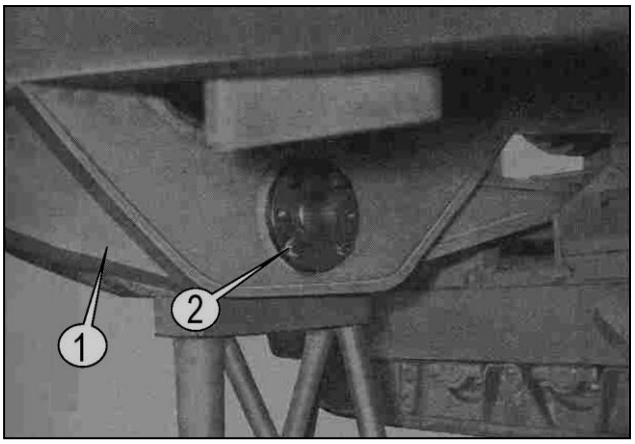
The beam ends rise on the curved surface of seat pieces which rest in the cradles (support brackets) bolted to the top of the track frames. Two steel-faced rubber pads are interposed between the seat and the support cradle.

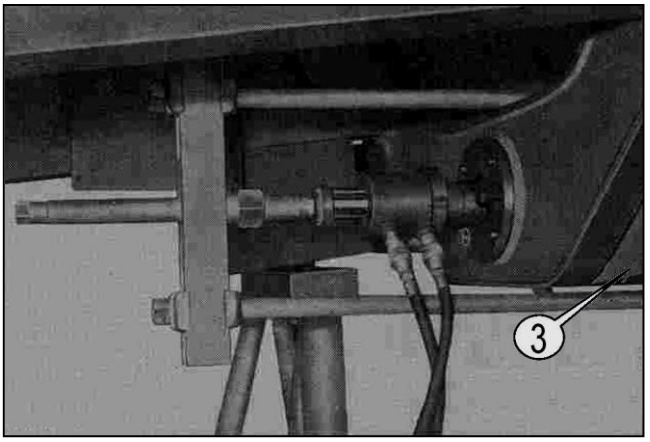
The equalizer beam is capable of rocking around its centre pin, so that the updown motion of one track frame with respect to the other track frame, as when the tractor crawls on rough ground will not tilt or pitch the front end of the tractor chassis. Track frame vibrations during travelling are ab: sorbed by the rubber pads for improved comfort of the operator.

The centre pin is equipped with a dust seal and designed to require no periodical lubrication. This pin is to be lubricated at the time of overhaul.

REMOVAL

1. *Detach the engine underguard and transmission underguard. (Refer to "ENGINE REMOVAL.")*
2. *Open the tracks. Separate track frame group from the chassis. (Refer to "TRACK REMOVAL" and "REMOVAL OF TRACK FRAME GROUP".)*
3. *Suspend one end of equalizer bar (1) with the cable sling. Remove the bolts (2)*
4. *Press out the pin (1) with the special tool as shown. Remove bushing. Lower the end of the equalizer bar suspended (3) and carry it out of the machine.*





INSPECTION

1. *Inspect the equalizer bar for cracks, damage or any sign of fatigue.*
2. *Check the centre pin and bushing for wear.*
3. *Inspect the resting surface at each end of the equalizer bar for wear or galling.*

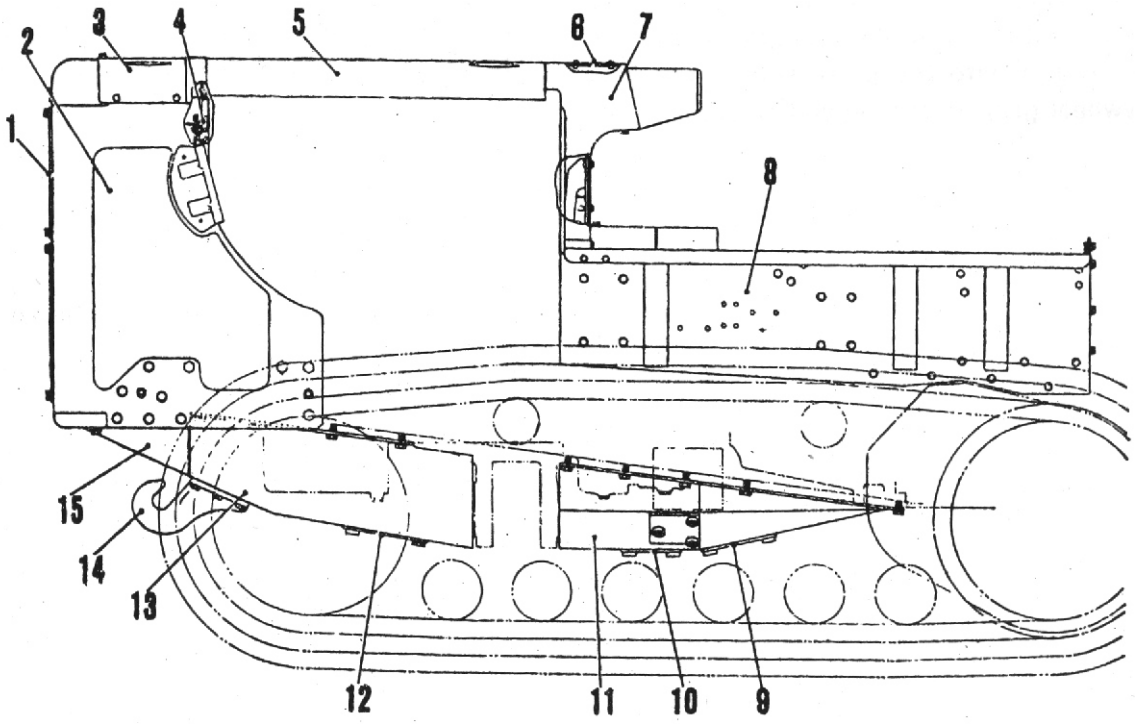
MISCELLANEOUS MOUNTINGS

INDEX

Miscellaneous Mounting

Outer Fittings

DESCRIPTION



1.	*Radiator mask*	6.	*Cover*	11.	*Transmission case underguard*
2.	*Radiator guard*	7.	*Dash board*	12.	*Cover plate*
3.	*Radiator cover*	8.	*Side Fender*	13.	*Engine underguard*
4.	*Engine hood catch*	9.	*Cover plate*	14.	*Hook*
5.	*Engine hood*	10.	*Cover plate*	15.	*Front cover*

The major outer fittings are the engine hood and its associated parts the backboard or bulkhead complete with the dashboard; the anti-slip floorboard assembly providing a floor at the control area, the side fenders for the operators convenience in mounting and dismounting the tractor; the radiator mask and bottom plate; the engine underguard assembly extending all the way to the steering case and protecting the engine and transmission against damage.

Miscellaneous Mounting

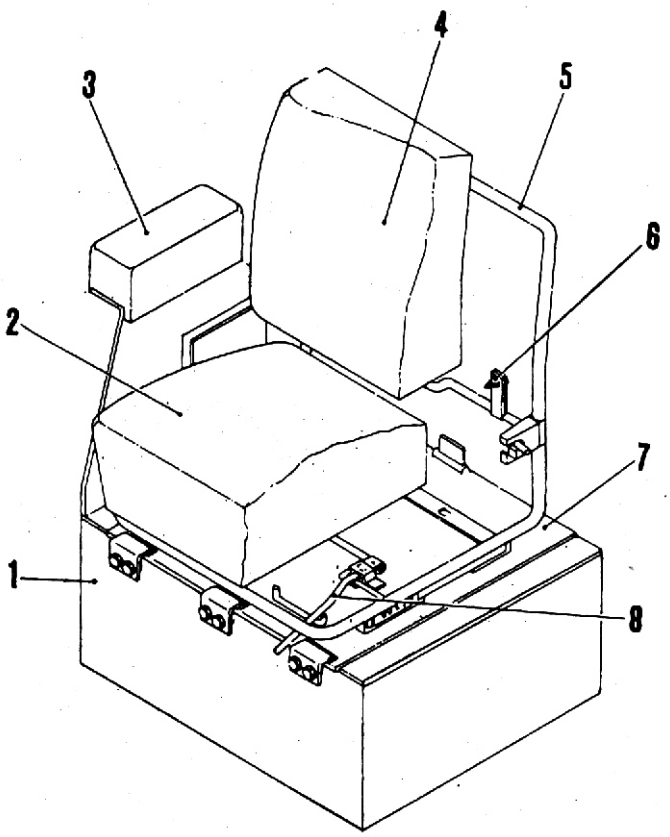
Description

The solenoid switch which is an Integral part of the Starter, operates in two stages. In first stage the solenoid switch contacts close and a small current passes through the auxiliary field winding causing the armature to rotate slowly. Simultaneously, the complete armature assembly Is drawn towards the driving end of the machine by the magnetic field set upon the windings and pinion is brought into the mesh with the engine flywheel gear. In the second stage the contacts close the circuit to the main series winding. The Starter then exerts full torque on the engine. The auxiliary windings are arranged so as to hold the pinion in mesh until the starting switch is released.

The Starter is also fitted with an overload clutch interposed in the drive between armature and pinion, to safe-guard the pinion teeth against damage due to excessive- load.

Operators Seat

DESCRIPTION



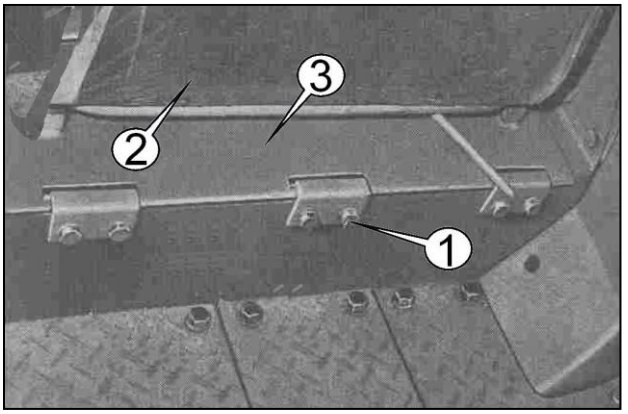
OPERATORS SEAT

1.	*Frame and Battery box*	*4.*	*Back seat*	*7.*	*Plate*
2.	*Seat*	*5.*	*Frame*	*8.*	*Adjusting lever*
3.	*Arm rest*	*6.*	*Couch screw*		

The seat is of a single-seating arm chair type with heavily padded comfort parts a seat a back and two arm rests.

REMOVAL

1. Remove the bolts (1) and dismount the seat (2) and plate (3) as an assembly



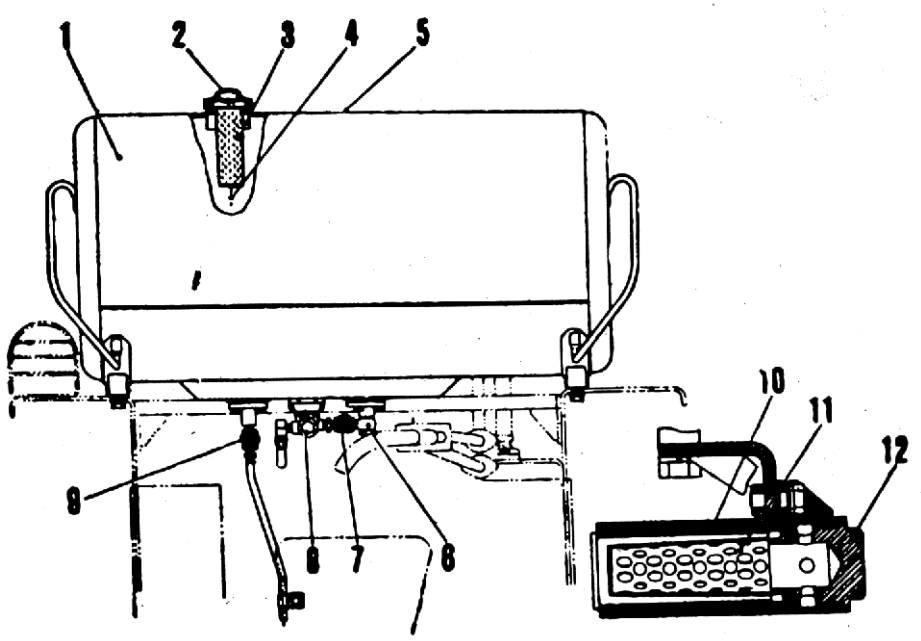
INSPECTION

1. Inspect the cushion seat, back rest and arm rests for damage.

2. Check the seat positioning mechanism for locking action, and inspect the parts of this mechanism for any damage.

Fuel tank

DESCRIPTION



FUEL TANK

1.	*Fuel tank*	*5.*	*Plug*	*9.*	*Drain valve*
2.	*Cap body*	*6.*	*Joint*	*10.*	*Strainer case*
3.	*Strainer*	*7.*	*Fuel shut-off valve*	*11.*	*Strainer*
4.	*Level guage*	*8.*	*Strainer ass'y*	*12.*	*Strainer cap*

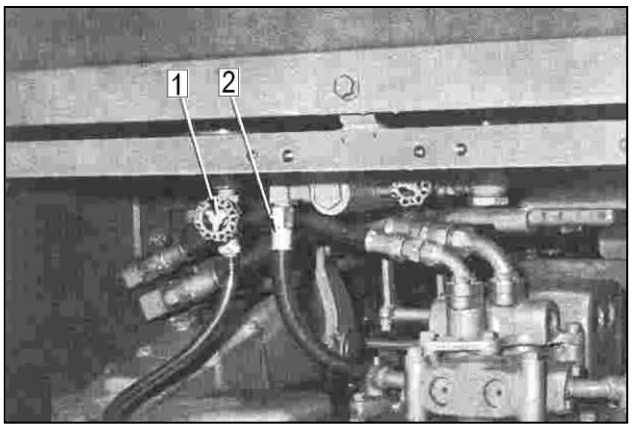
The fuel tank Is located behind the operators seat and mounted on the tank base, secured to the steering case. Two wheel valves are provided under the tank one is in the line to the fuel P .T. pump through the float tank, and the other is in the drain line.

The oil filler, located at the tank top, has a strainer and a cap complete with a guage stick. A small orifice is provided in this cap for allowing the tank to breathe. The cap is so designed that water such as rain drops will not enter through this orifice.

Removal

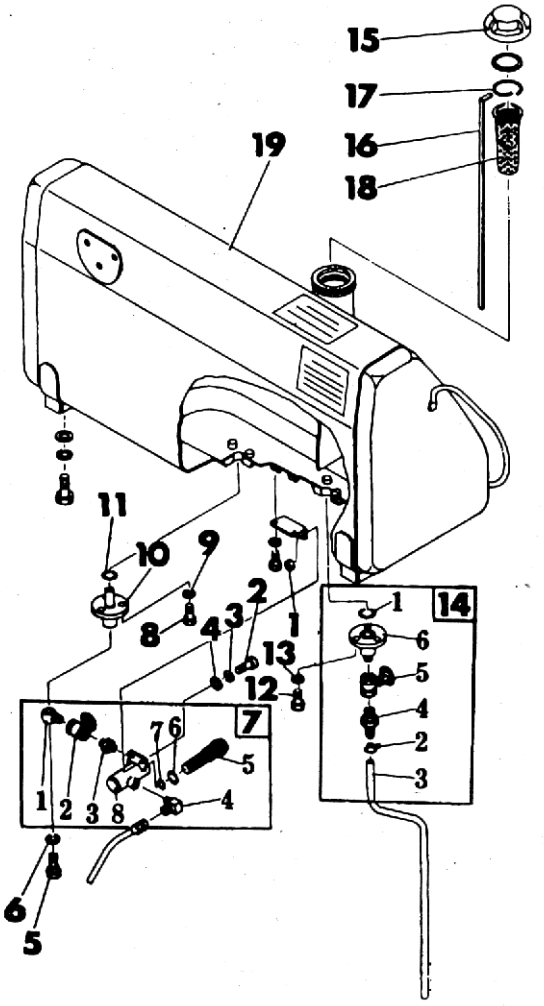
REMOVAL

1. Open the drain valve (1) at the bottom of the fuel tank to drain the fuel tank. Disconnect Joints (2).



2. Remove the tank mounting bolts. Using an overhead crane lift the fuel tank off the machine.

DISASSEMBLING



PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1.	*Nut*	*7-6.*	*O-ring*	*14-3.*	*Tube*
2.	*Bolt*	*7-7.*	*O-ring*	*14-4.*	*Sleeve*
3.	*Spring washer*	*7-8.*	*Strainer case*	*14-5.*	*Valve*
4.	*Washer*	*8.*	*Bolt*	*14-6.*	*Flange*
5.	*Joint Bolt*	*9.*	*Spring washer*	*15.*	*Cap*
6.	*Gasket*	*10.*	*Flange*	*16.*	*Level guage*
7-1.	*Eye joint*	*11.*	*O-ring*	*17.*	*Ring*
7-2.	*Valve*	*12.*	*Bolt*	*18.*	*Strainer*
7-3.	*Nipple*	*13.*	*Spring washer*	*19.*	*Fuel tank*
7-4.	*Elbow*	*14-1.*	*O-ring*		
7-5.	*Strainer*	*14-2.*	*Clip*		

CLEANING AND INSPECTION

1. Check the fuel tank for cracks or damage. Thoroughly clean the interior of the tank.

2. Thoroughly clean strainers.

ASSEMBLING

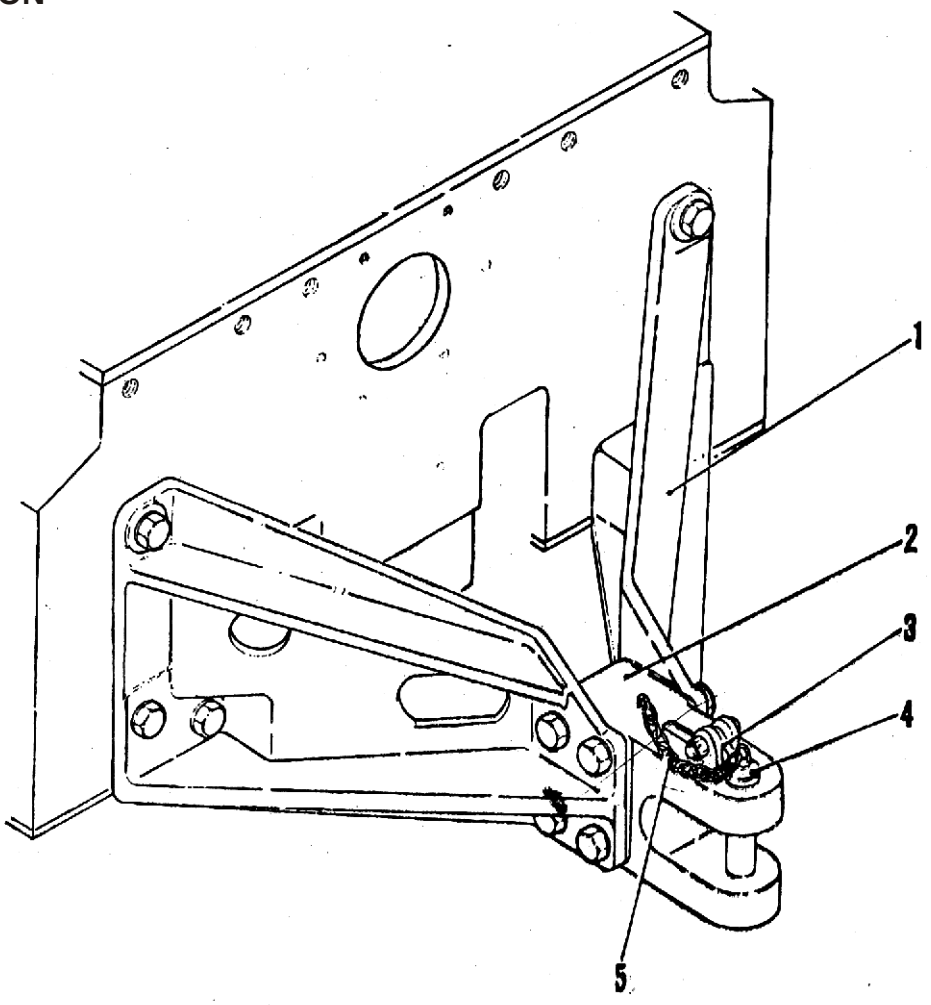
Build up the fuel tank by adhering to the following Instructions:

1. Renew gaskets and O-rings at the time of assembly.

2. Before Installing the flange, strainers and Joints in the place, make sure these parts are thoroughly cleaned in a clean solvent and free from any foreign particles.

DRAWBAR

DESCRIPTION



DRAWBAR

1.	*Bracket*	*3.*	*Latch*	*5.*	*Chain*
2.	*Drawbar*	*4.*	*Pin*		

The drawbar assembly is secured to the rear-face of the steering case and positioned at the lower part of this face, It is fixed in place and consists of two brackets a bar and a pin and lock,

The lock consists of a bolt and nut with a cotter pin and prevents the drawbar pin from jumping out of its place.

ELECTRICAL SYSTEM

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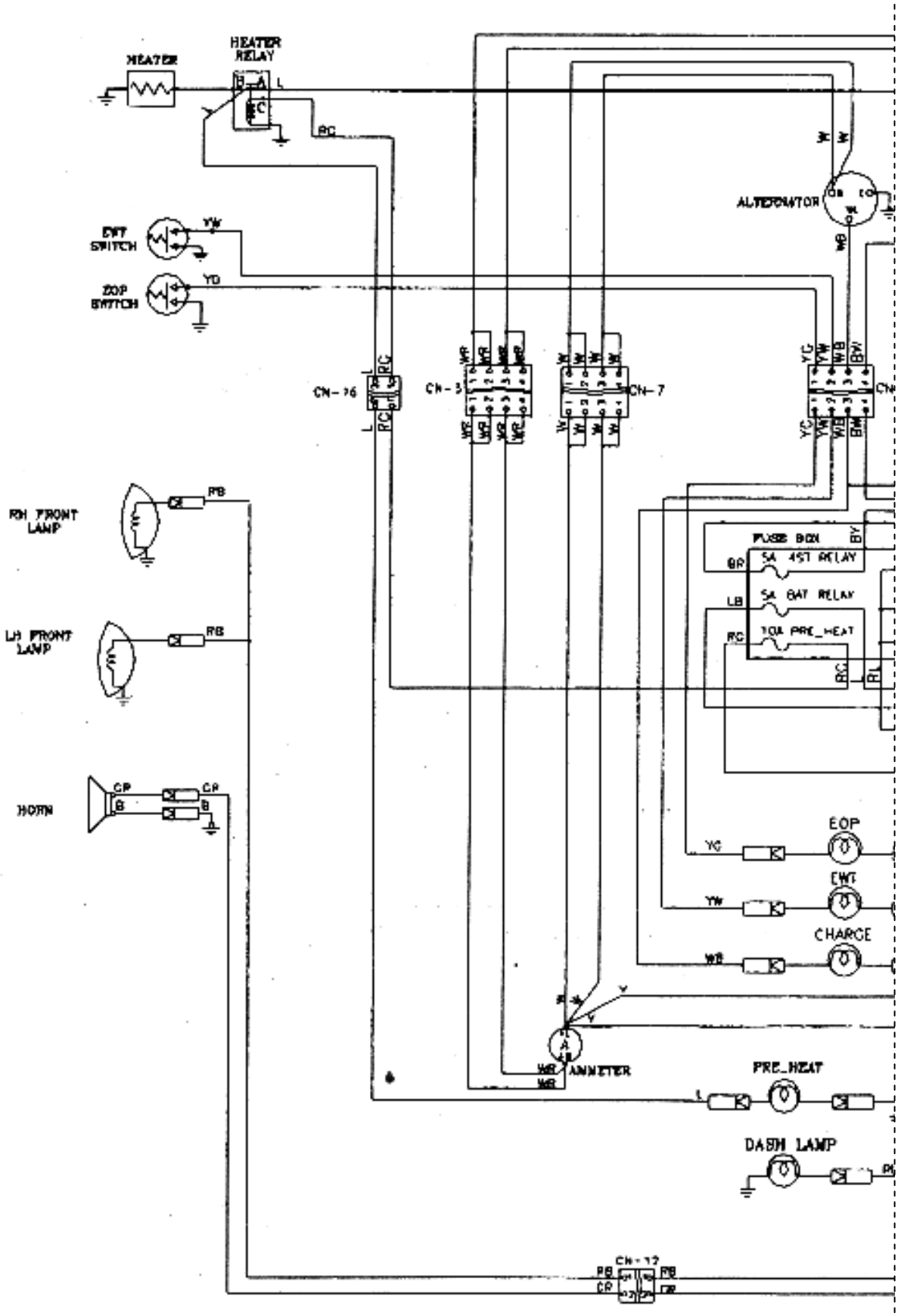
ELECTRICAL SCHEMATIC DIAGRAM WITH BEML (BS6D125) ENGINE SL. NO.: 14288 & UP



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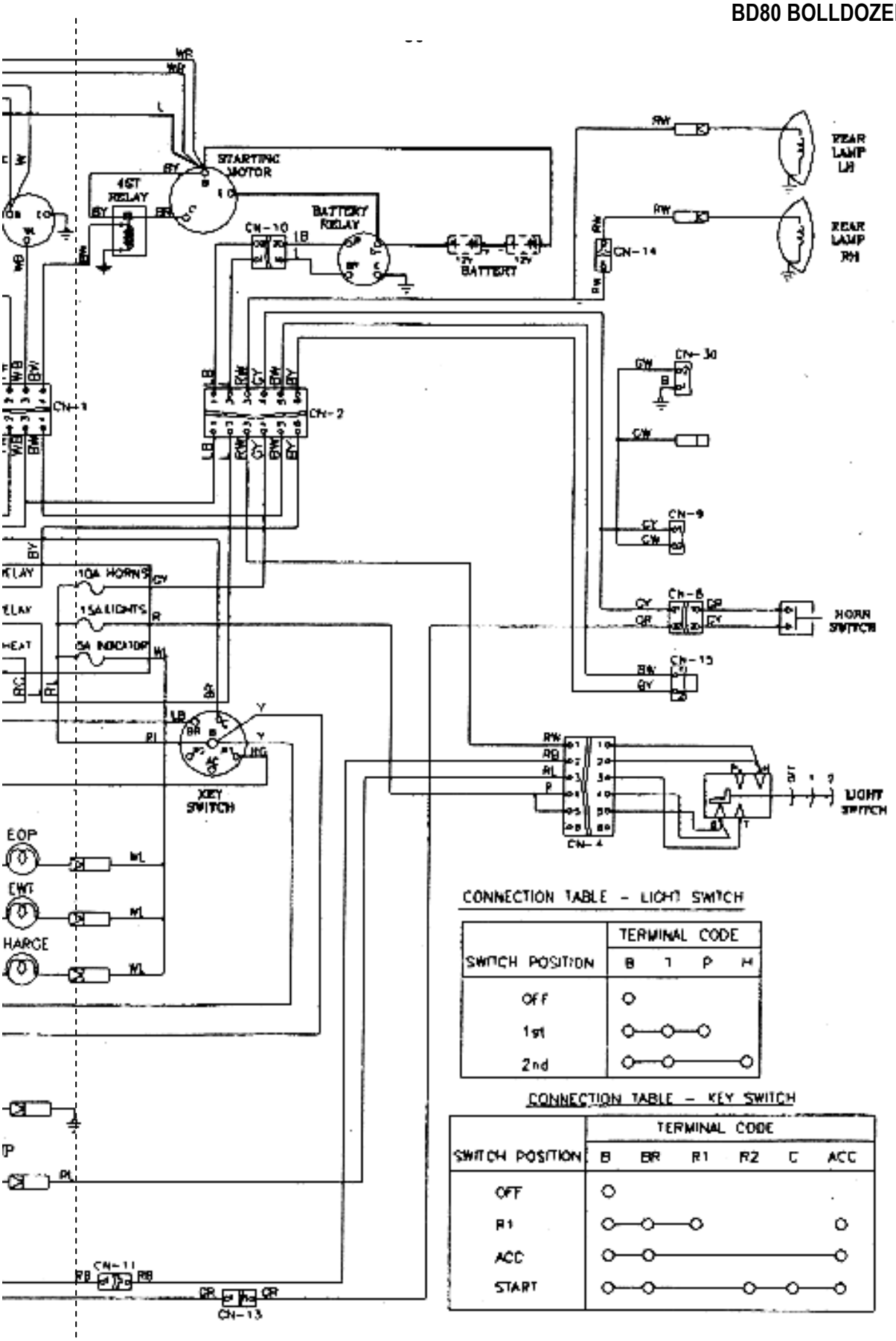

CONNECTION TABLE - LIGHT SWITCH

SWITCH POSITION	TERMINAL CODE B	1	P	H
OFF	○			
1st	○	○	○	
2nd	○	○		○

CONNECTION TABLE - KEY SWITCH

SWITCH POSITION	TERMINAL CODE B	BR	R1	R2	C	ACC
OFF	○					
R1	○	○	○			○
ACC	○	○				○
START	○	○		○	○	○

HYDRAULIC SYSTEM

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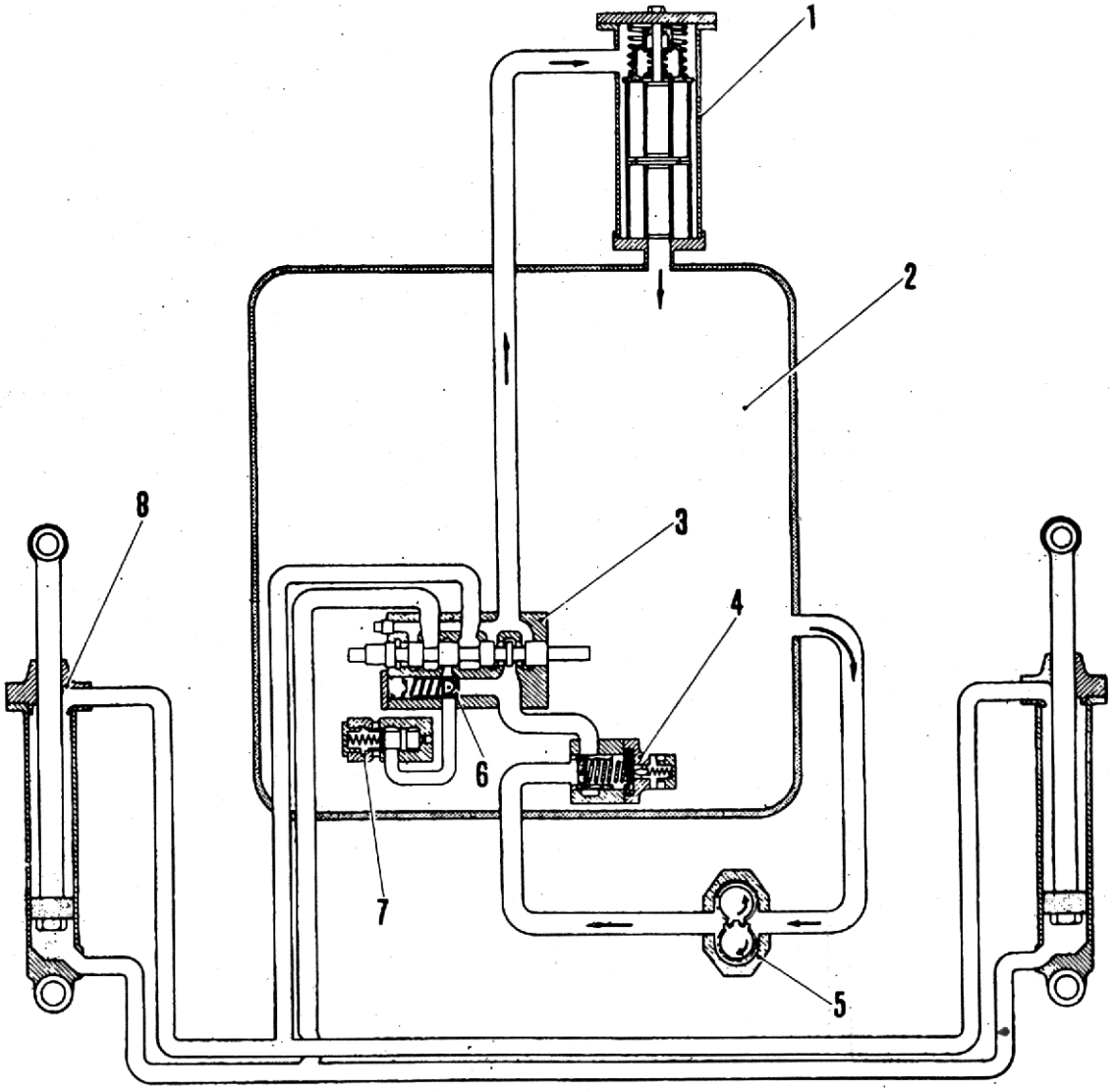
Hydraulic System



1.	*Hydraulic of filter*	*4..*	*Relief valve*	*7.*	*Suction valve*
2.	*Hydraulic oil tank*	*5.*	*Gear pump*	*8.*	*Blade lift cylinders*
3.	*Control valve*	*6.*	*Check valve*		

Hydraulic System

Description

DESCRIPTION

The hydraulic system is the means of making hydraulic power available for actuating the earth moving attachments such as angle dozer etc. The major components of hydraulic system are:

Hydraulic Oil Tank located on the right side of the Operators seat, which consists of control valve assembly; the Gear Pump mounted on the Flywheel housing and driven by the Power Take Off gears; the Hydraulic cylinders for moving the blade; filter, oil pipings control levers, valves etc.

The hydraulic oil In the Oil Tank is drawn by the Gear Pump and supplied to the Control Valve within the Oil Tank. A Relief Valve is provided in the circuit for limiting the line pressure to the specified value.

The Oil Tank holds hydraulic oil and houses Control Valve, Check Valve, Suction Valve and Strainer.

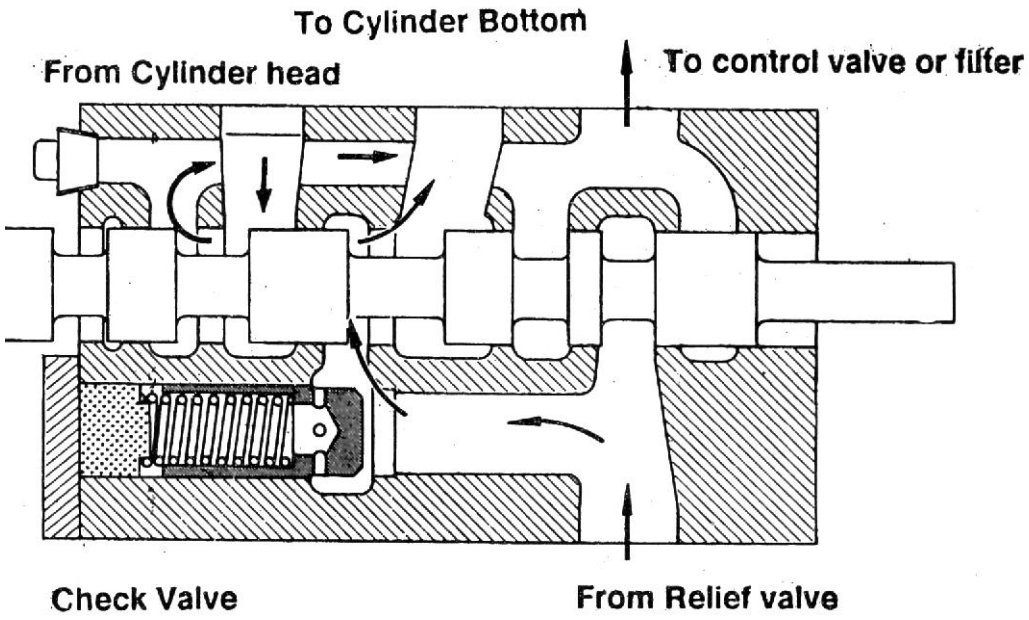
The Strainer is provided in the filler at the top of the Tank. The Filler cap is complete with the gauge stick.

HYDRAULIC OIL PIPING

Strong tubes capable of withstanding high internal pressure of the system are used throughout together with high pressure flexible tubing for connecting the metal tubes to the hydraulic cylinders.

Joints in the pipings are provided with O-rings for ensuring perfect tightness against oil leakage and against entry of air and dust into lines.

CONTROL VALVE



DESCRIPTION

The Control Valve is a single spool, multiport type. The spool and bore are finished to very close tolerances.

The spool for actuating the cylinders is controlled by a control lever located on the right-side of the Operators seat, which provides four operations for the blade viz. RAISE, LOWER, HOLD, FLOAT.

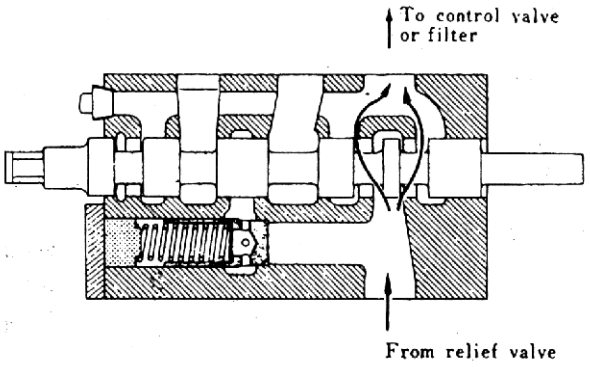
A Check Valve is built in the Control Valve assembly which prevents reverse flow of oil. The pressurised oil is directed to the cylinders in the desired direction by the spool positioned by the Control lever.

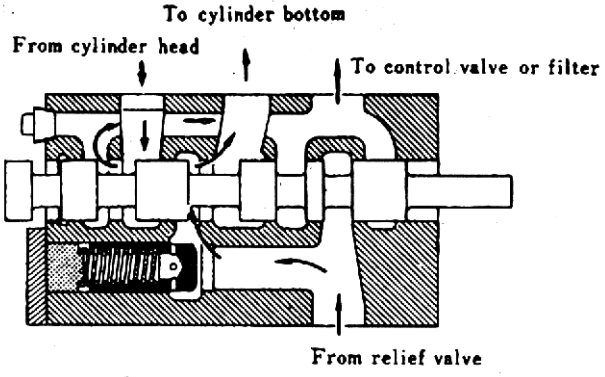
A Section Valve is also provided within the Hydraulic Tank. This Valve operates whenever vacuum is created in the hydraulic cylinder and thereby allows the oil in the tank to be sucked through the Control Valve into the cylinders so that the piston in the cylinders will be free from vacuum pressure, which would interfere with the smooth movement of the piston. The vacuum in the cylinders would be created when the blade is moving down with its own way in lowering and floating operations.

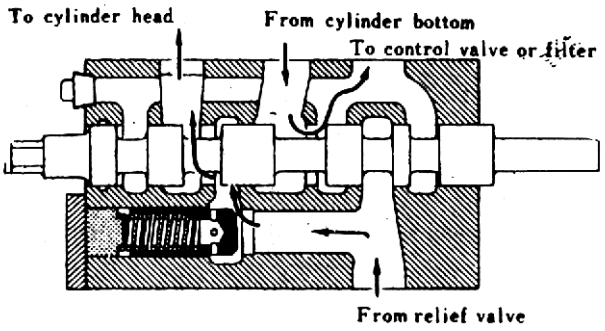
The oil returning from the cylinders, flows into the tank through the filter.

Description

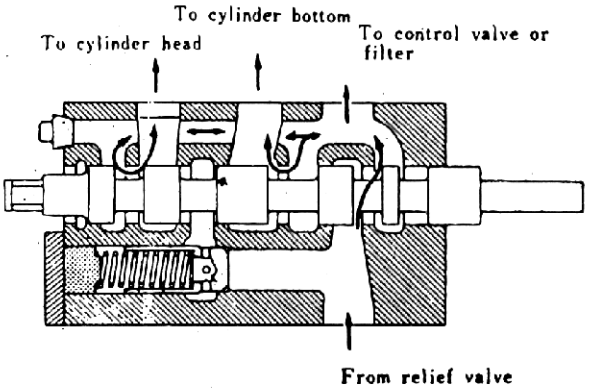
Pulling or pushing the lever from HOLD position switches spool into RAISE or LOWER position, respectively, in that order. Releasing the lever in RAISE or LOWER position allows it to snap back into HOLD position because of a return spring acting on the lever.





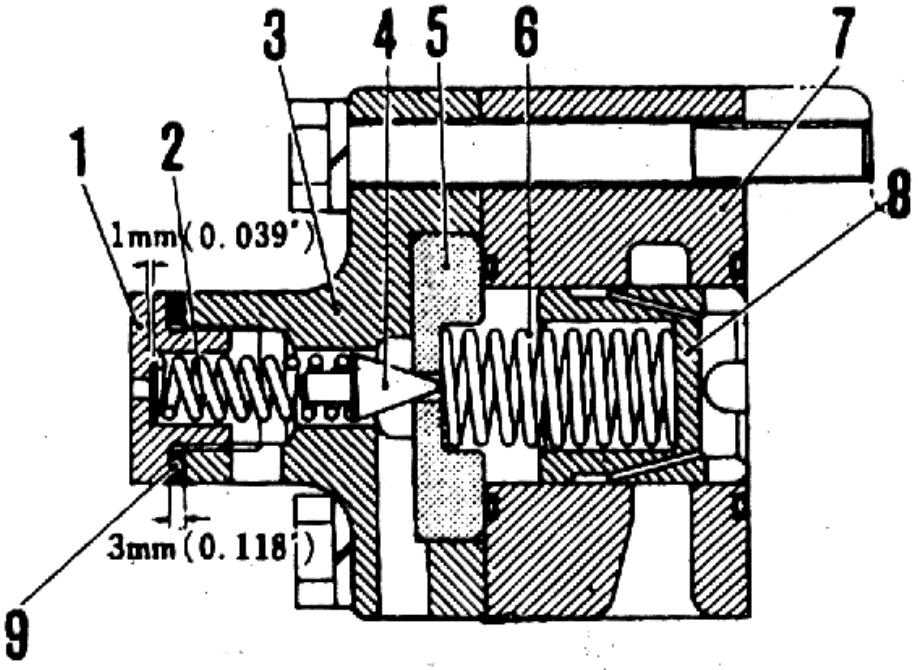


Pushing the lever farther from LOWER position shifts it into FLOAT position and arrest the lever in this position. Under this condition, the cylinders receive no hydraulic force for the oil merely circulates through the control valve back to the oil tank.



In the case of a twin-spool or triple-spool control valve the FLOAT position mentioned above is eliminated by means of a return spring set in such a way as to prevent the lever from moving into that position. This feature is provided-because, in a machine equipped with a ripper or a tilt dozer, the floating action of the blade is not called for.

RELIEF VALVE



1.	Plug	4.	Puppet	7.	Valve body
2.	Spring	5.	Valve seat	8.	Valve
3.	Case	6.	Spring	9.	Shim

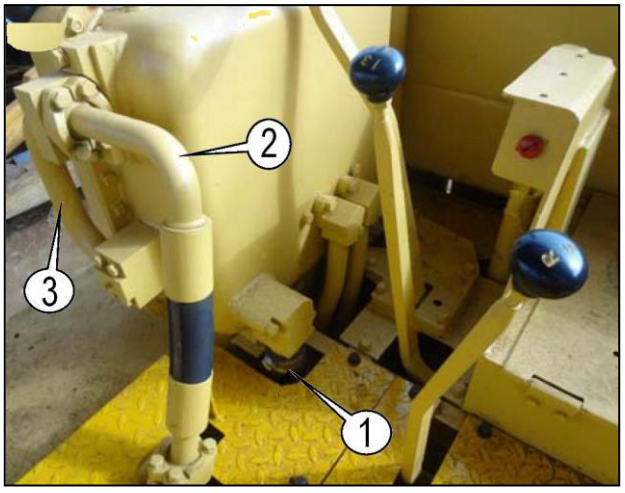
The Relief Valve is provided in the hydraulic circuit between the pump and the control valve. It consists of a puppet type pilot valve an main valve with a balance hole in it.

The Relief Valve is set at 140 kg/cm^2. The pressure setting is Increased or decreased by removing or adding the shims at the adjusting nut. The standard shim thickness is 3 mm (1 mm of this thickness corresponds to 25.6 kg/cm^2).

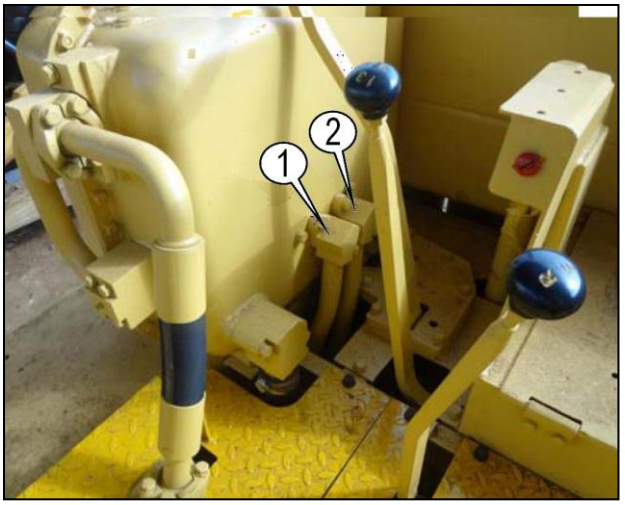
REMOVAL

1. Drain the hydraulic oil tank by removing the drain plug (1).

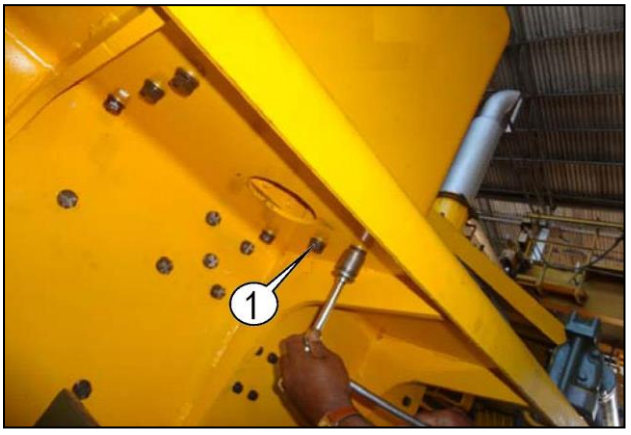
2. Disconnect the oil pipes (1)(2) and control linkage at (3) from the hydraulic oil tank.



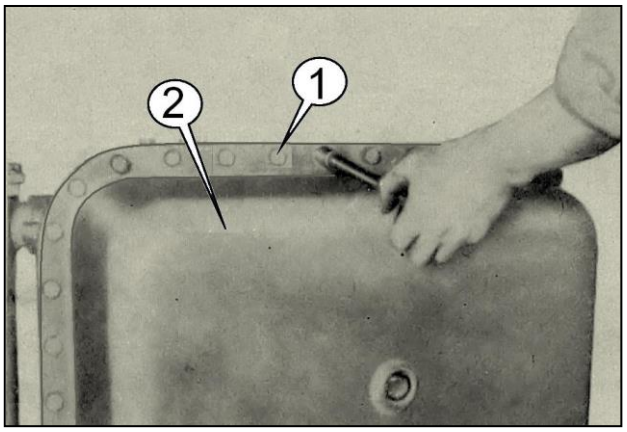
3. Disconnect the pipes (1) (2) and (3) from the hydraulic Oil tank.



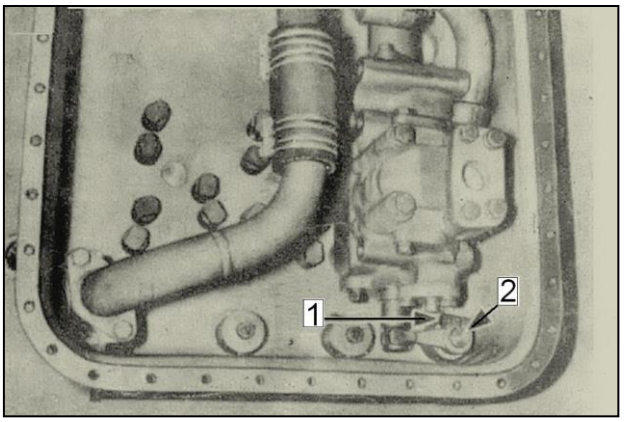
4. Remove the mounting bolts, (1) and move the tank to the floor with a crane.



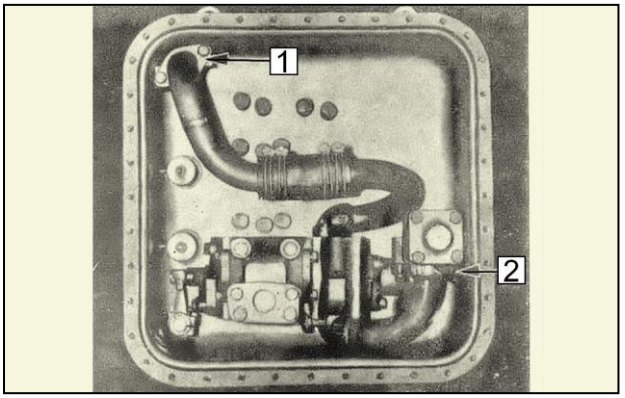
5. Remove the bolts (1) joining the two tank halves together, and remove the outer half (2).



6. Remove the bolts (1) and clips (2),

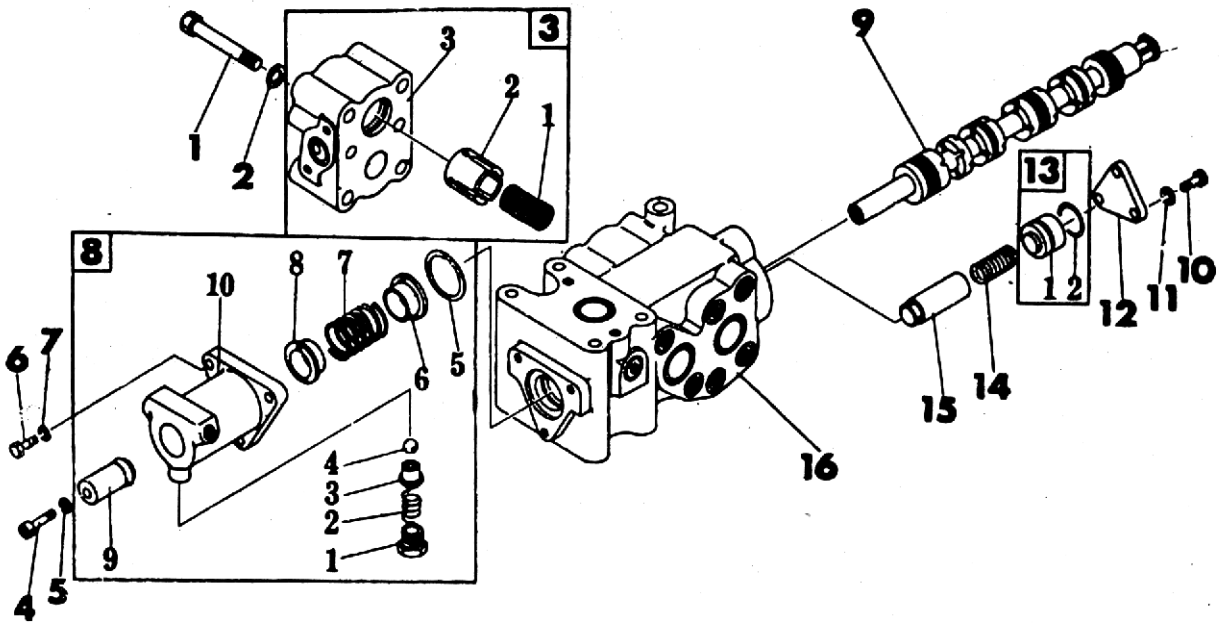


7. Disconnect the flanges (1) (2). Remove the bolts securing the control valves to the tank, and detach the valves.



Disassembling

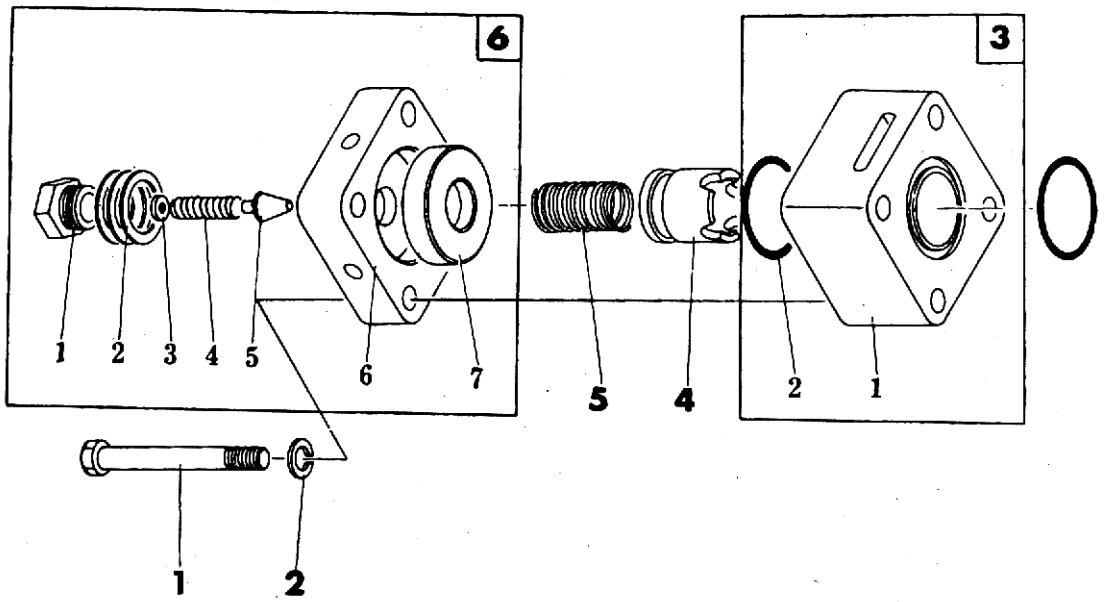
CONTROL VALVE



PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1.	*Bolt*	*8-2.*	*Spring*	*10.*	*Bolt*
2.	*Spring washer*	*8-3.*	*Guide*	*11.*	*Spring washer*
3-1.	*Spring*	*8-4.*	*Ball*	*12.*	*Cover*
3-2.	*Valve*	*8-5.*	*Snap ring*	*13-1.*	*Spacer*
3-3.	*Valve body*	*8-6.*	*Collar*	*13-2.*	*O-ring*
4.	*Bolt*	*8-7.*	*Spring*	*14.*	*Spring*
5.	*Spring washer*	*8-8.*	*Collar*	*15.*	*Valve*
6.	*Bolt*	*8-9.*	*Detent*	*16.*	*Valve body*
7.	*Spring washer*	*8-10.*	*Cover*		
8-1.	*Plug*	*9.*	*Valve*		

Relief Valve



RELIEF VALVE

1.	*Bolt*	*5.*	*Spring*	*6-5.*	*Puppet*
2.	*Spring washer*	*6-1.*	*Plug*	*6-6.*	*Case*
3-1.	*Valve body*	*6-2.*	*Shim*	*6-7.*	*Valve seat*
3-2.	*O-ring*	*6-3.*	*Shim*		
4.	*Valve*	*6-4.*	*Spring*		

INSPECTION

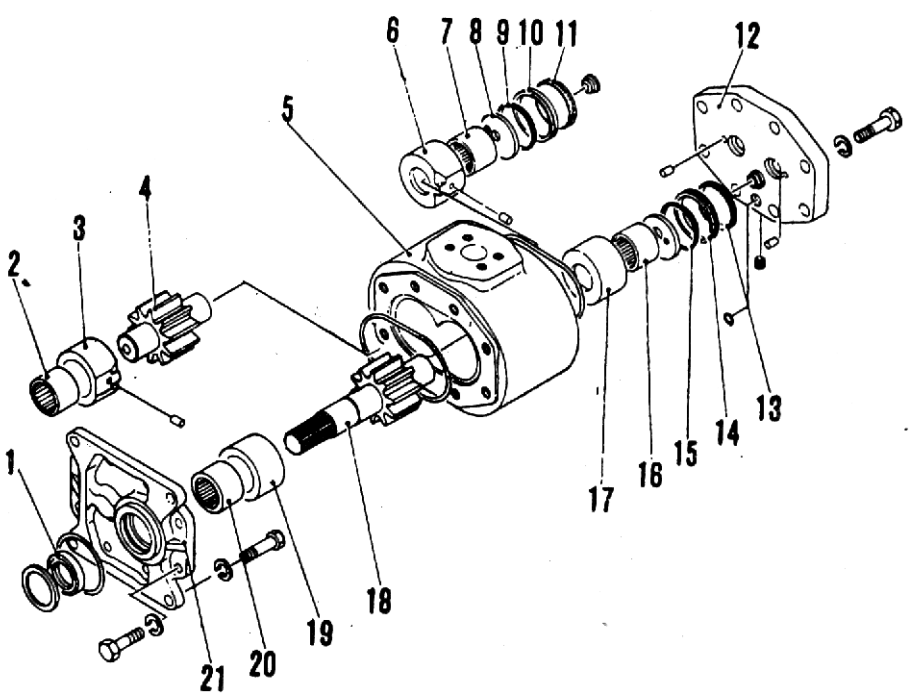
1. Examine the spools for the condition of sliding surfaces, giving particular attention to any signs of erratic contact or of rusting.

2. Inspect the valve body for cracks or damage, and check the clearance around the spool in the bore.

3. Measure the free length, as-installed length and preload of the valve springs, and inspect them for defects.

4. Check valve element for seating contact pattern.

Gear Pump

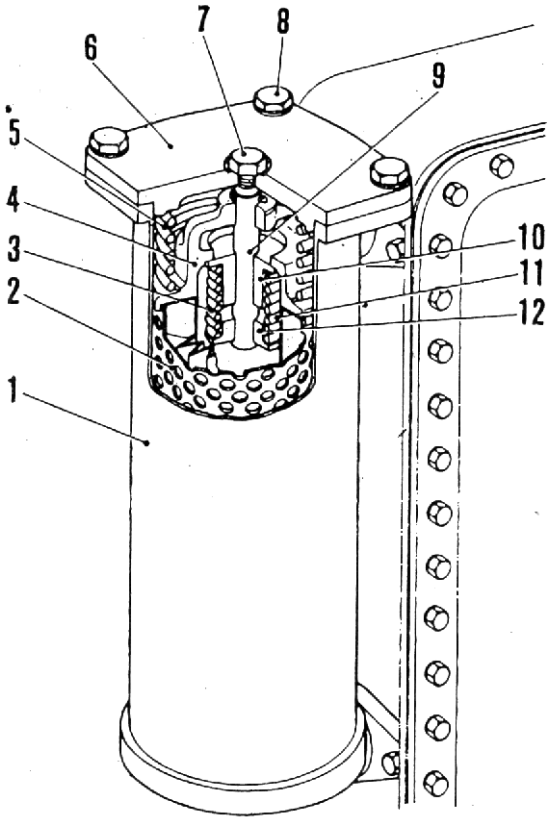


HYDRAULIC OIL PUMP

1.	*Oil seal*	*8.*	*Seal plate*	*15.*	*Backup ring*
2.	*Needle bearing*	*9.*	*Backup ring*	*16.*	*Needle bearing*
3.	*Bush*	*10.*	*U-ring*	*17.*	*Bush*
4.	*Driven gear*	*11.*	*Backup ring*	*18.*	*Drive gear*
5.	*Gear case*	*12.*	*Cover*	*19.*	*Bush*
6.	*Bush*	*13.*	*Backup ring*	*20.*	*Needle bearing*
7.	*Needle bearing*	*14.*	*U-ring*	*21.*	*Bracket*

The gear pump is installed on the power take-off located on the right-hand upper part of the flywheel housing. It is driven by P.T.O gears. It draws oil from the hydraulic oil tank and pumps it to the control valve in the tank.

Hydraulic Oil Filter



HYDRAULIC OIL FILTER

1.	*Filter housing*	*5.*	*Spring*	*9.*	*Rod*
2.	*Filter element*	*6.*	*Cover*	*10.*	*Valve*
3.	*Spring*	*7.*	*Air vent plug*	*11.*	*Spring*
4.	*Valve*	*8.*	*Bolt*	*12.*	*Seat*

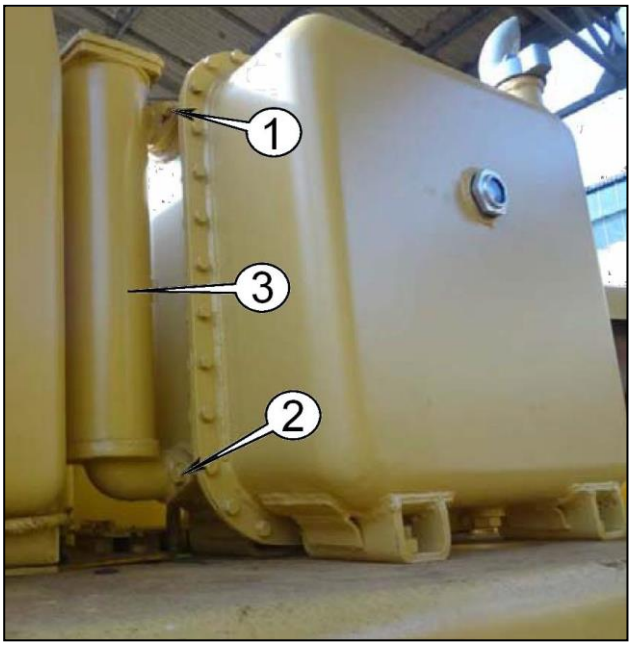
This filter is of paper element type. It is located behind the hydraulic tank. The oil leaving the Control Valve passes through the filter, from out to inside and flows back to tank.

It is provided with a by-pass valve, which by-passes oil to the tank, when the filter element is clogged.

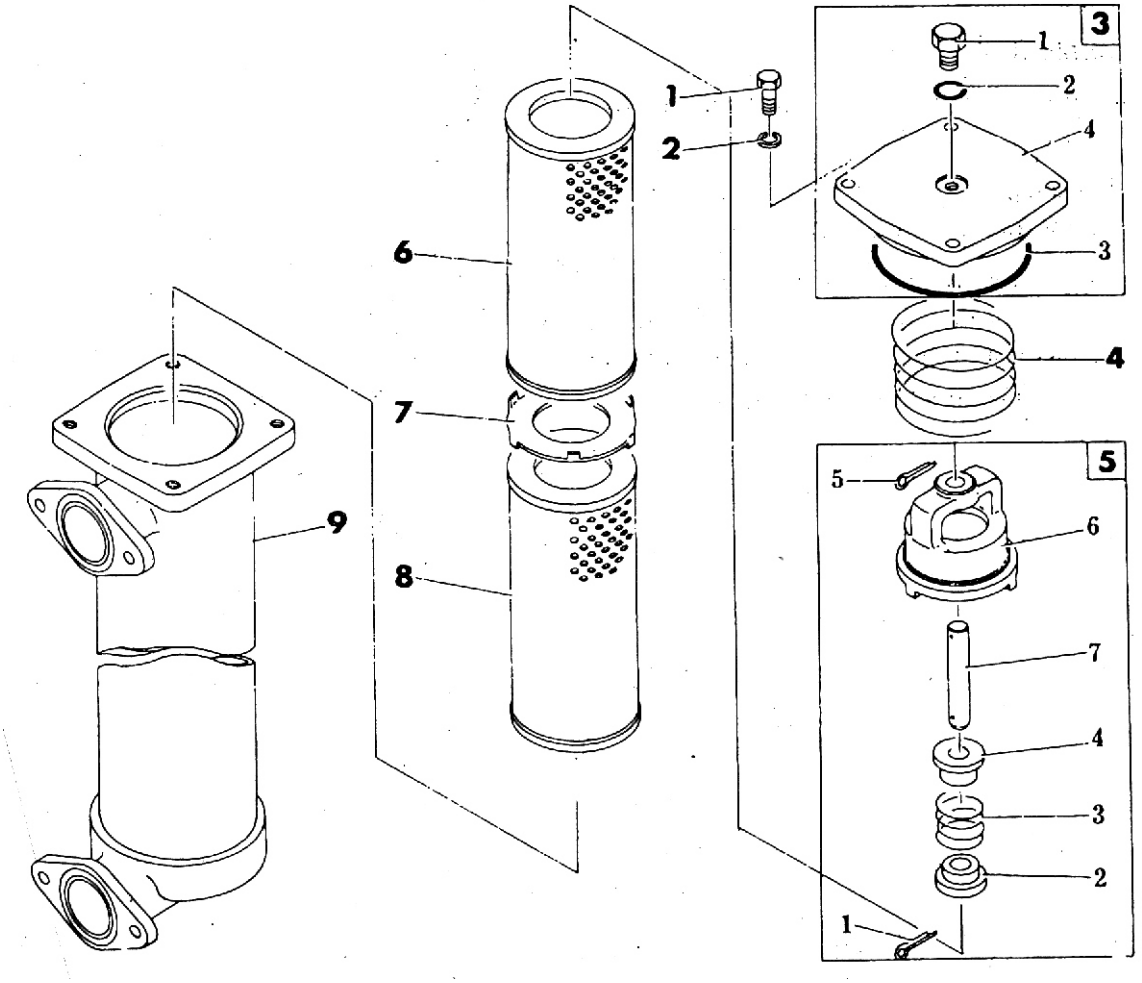
REMOVAL

1. Remove the drain plug and drain the hydraulic tank. (Refer to "HYDRAULIC TANK REMOVAL".)

2. Remove the bolts (1) (2) securing the hydraulic filter (3) to the hydraulic tank, and remove the filter.



DISASSEMBLING



PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1.	*Bolt*	*5-1.*	*Cotter pin*	*6.*	*Filter element*
2.	*Spring washer*	*5-2.*	*Seat*	*7.*	*Joint*
3-1.	*Plug*	*5-3.*	*Spring*	*8.*	*Filter element*
3-2.	*O-ring*	*5-4.*	*Valve*	*9.*	*Filter housing*
3-3.	*O-ring*	*5-5.*	*Cotter pin*		
3-4.	*Cover*	*5-6.*	*Valve*		
4.	*Spring*	*5-7.*	*Rod*		

CLEANING AND INSPECTION

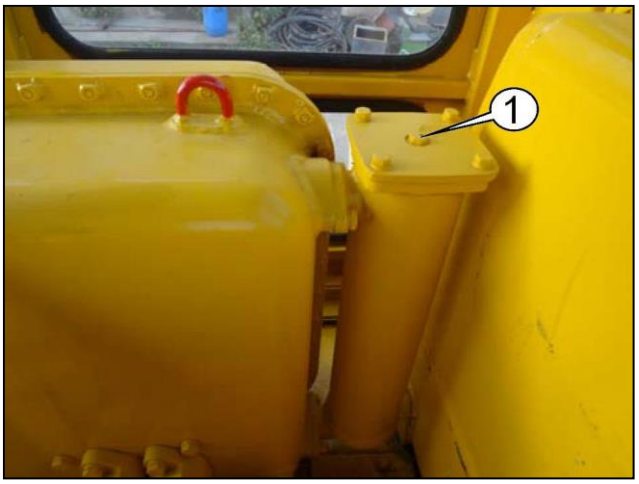
Inspect the valve, noting the condition of sliding and setting contacts and examine the valve internal faces for signs of rusting.

ASSEMBLING

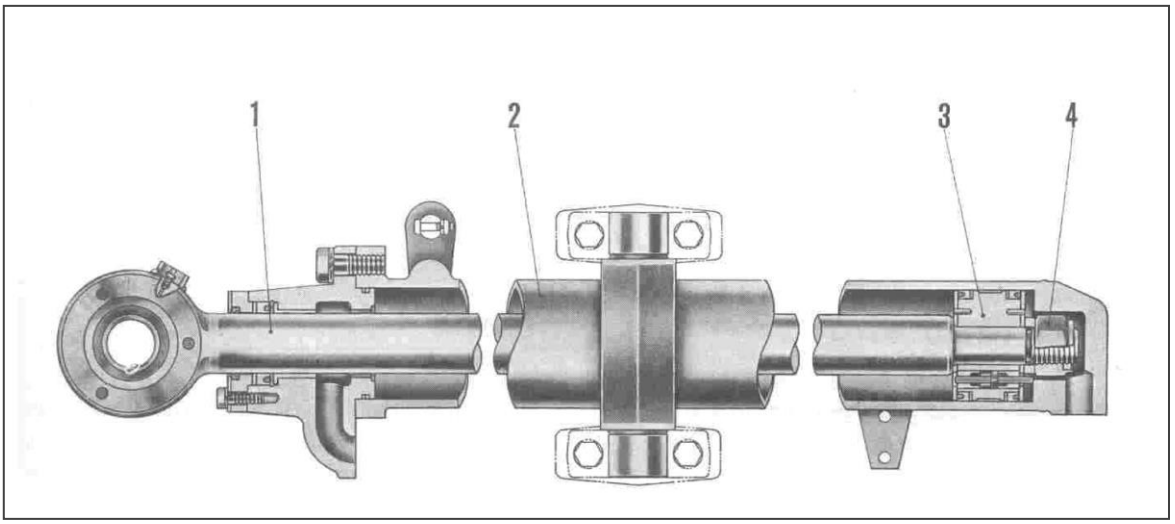
Build up the filter by adhering to the following instructions:

1. When putting the filter cover on, be sure to apply grease to the O-Ring.

2. After the oil filter is installed, fill the hydraulic tank with oil completely, driving all air out of the filter through its vent hole which is normally closed with bolt (1).



Cylinders



HYDRAULIC CYLINDER

1.	*Piston rod*	*3.*	*Piston*
2.	*Cylinder*	*4.*	*Nut*

Description
Removal

Two cylinders for holding the blade in suspension are anchored to the sides of the radiator guard.

In cylinders the piston rod is plated with hard chrome for increased resistance to wear, and the piston is equipped with piston rings and U-ring to positively seal the sliding clearance.

The Hydraulic cylinders are provided with a Quick Drop Valve at the head end of the cylinder. The purpose of this Quick Drop Valve is to increase the lowering speed of the blade. The oil passing from the bottom end of the cylinder flows to the top of the cylinder through the Quick Drop Valve and thereby increasing the lowering speed of the blade.

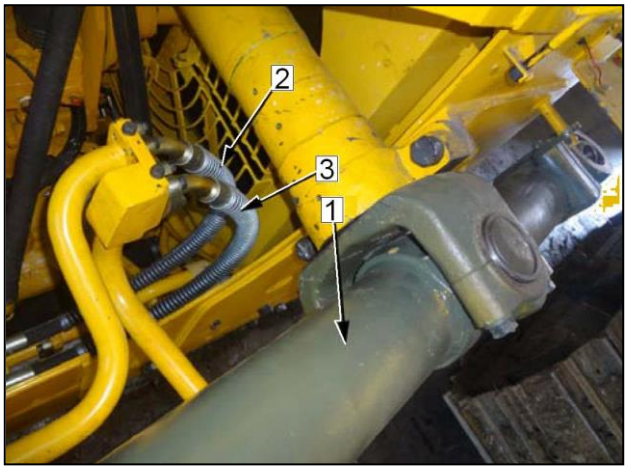
Hydraulic Cylinder

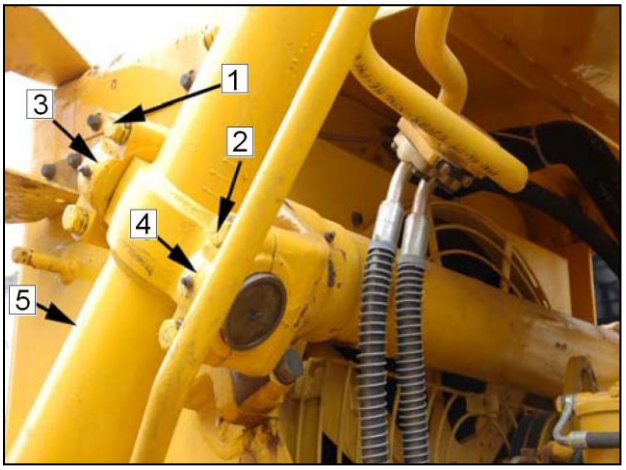
REMOVAL

1. Disconnect the cylinder piston rods from the blade. (Refer to "DOZER EQUIPMENT REMOVAL".)

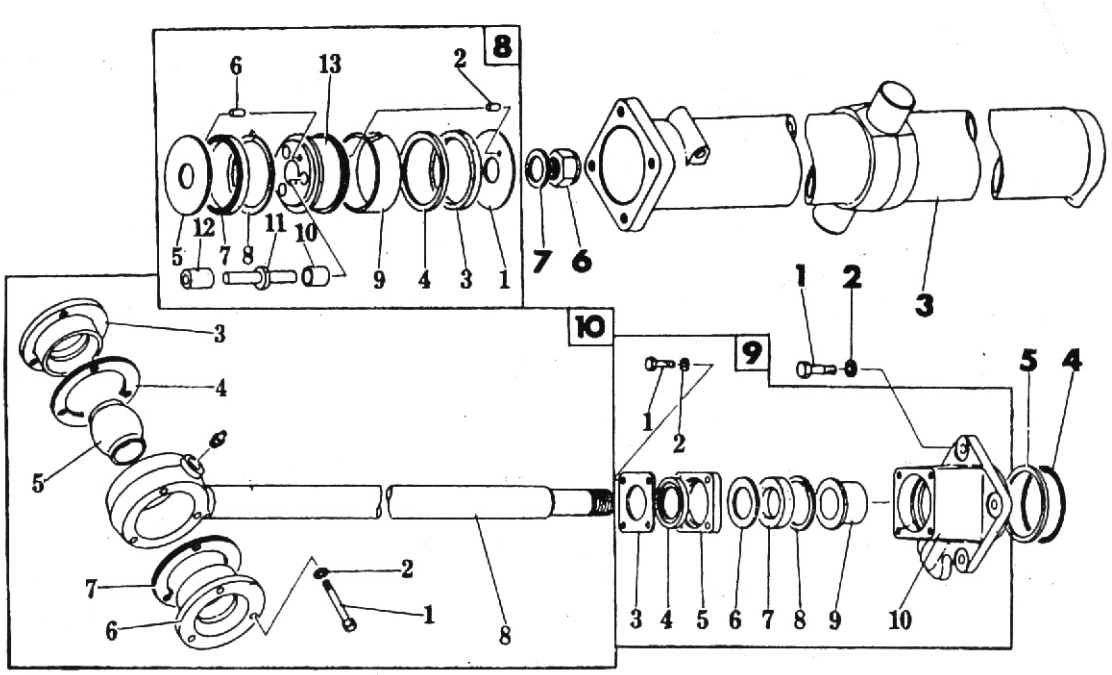
2. Disconnect the rubber hoses (2)(3) from the cylinder (1).

3. Remove the bolts (1) (2) securing bearing caps (3) (4) to the cylinder support yoke and detach the caps. Dismount the cylinder as an assembly (5) from the machine.





DISASSEMBLING



PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1. Bolt
2. Spring washer
3. Blade cylinder
4. O-ring
5. Back-up ring
6. Nut
7. Spacer
8-1. Plate
8-2. Dowel pin
8-3. U-Ring
8-4. Ring support
8-5. Plate
8-6. Dowel pin
8-7. O-ring
8-8. Ring support
8-9. Piston ring
8-10. Sleeve
8-11. Valve
8-12. Sleeve
8-13. Piston
9-1. Bolt
9-2. Spring washer
9-3. Plate
9-4. Dust seal
9-5. Box
9-6. Back-up ring
9-7. U-packing
9-8. Snap ring
9-9. Bushing
9-10. Cylinder head
10.1. Bolt
10-2. Spring washer
10-3. Blushing
10-4. Shim
10-5. Ball bearing
10-6. Bushing
10-7. Shim
10-8. Rod
11. Quick drop valve

CLEANING AND INSPECTION

1. Clean the cylinder bore, piston and piston rod.

2. Inspect the piston, piston rod and other parts for wear or any damage.

3. Do not disassemble the valves within the pistons unless absolutely necessary.

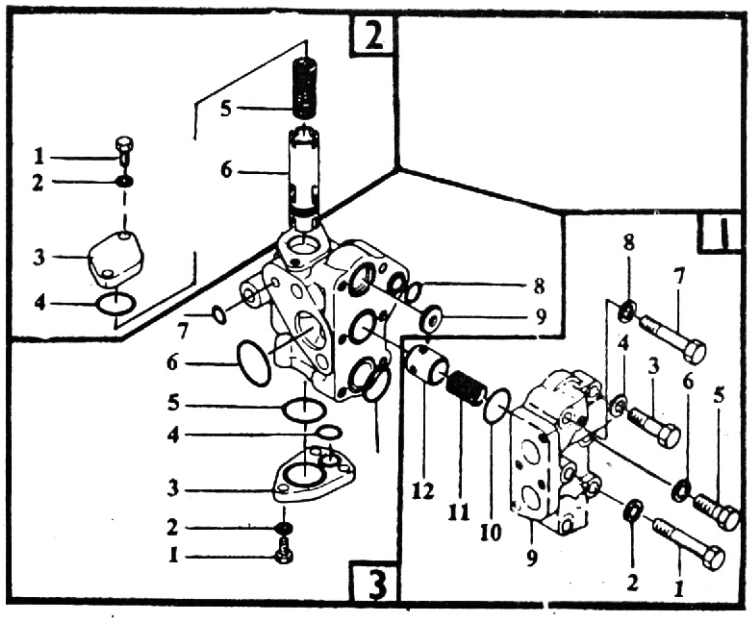
ASSEMBLING

Build-up the cylinder by adhering to the following instruction:

1. When Inserting the piston into the cylinder bore make sure if the U-rings slide in smoothly Without folding back or cocking.

QUICK DROP VALVE

DISASSEMBLING



PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1-1.	*Bolt*	*1-10.*	*O-Ring*	*3-1.*	*Bolt*
1-2.	*Washer spring*	*1-11.*	*Spring*	*3-2.*	*Washer*
1-3.	*Bolt*	*1-12.*	*Valve*	*3-3.*	*Flange*
1-4.	*Washer spring*	*2-1.*	*Bolt*	*3-4.*	*O-Ring*
1-5.	*Bolt*	*2-2.*	*Washer*	*3-5.*	*O-Ring*
1-6.	*Washer spring*	*2-3.*	*Flange*	*36.*	*O-Ring*
1-7.	*Bolt*	*2-4.*	*O-Ring*	*3-7.*	*O-Ring*
1-8.	*Washer spring*	*2-5.*	*Spring*	*3-8.*	*O-Ring*
1-9.	*Elbow*	*2-6.*	*Valve*	*3-9.*	*Orifice*

INSPECTION

1. Examine the spools for the condition of sliding surfaces, giving particular attention to any signs of erratic contact or of rusting.

2. Inspect the valve body for cracks or damage, and check the clearance around the spool in the bore.

3. Measure the free length as installed length and preload of the valve springs, and inspect them for defects.

4. Check valve element for seating contact pattern.

Cylinder Stay

REMOVAL

1. Disconnect the cylinder rod from the blade (Refer to "DOZER EQUIPMENT REMOVAL".)

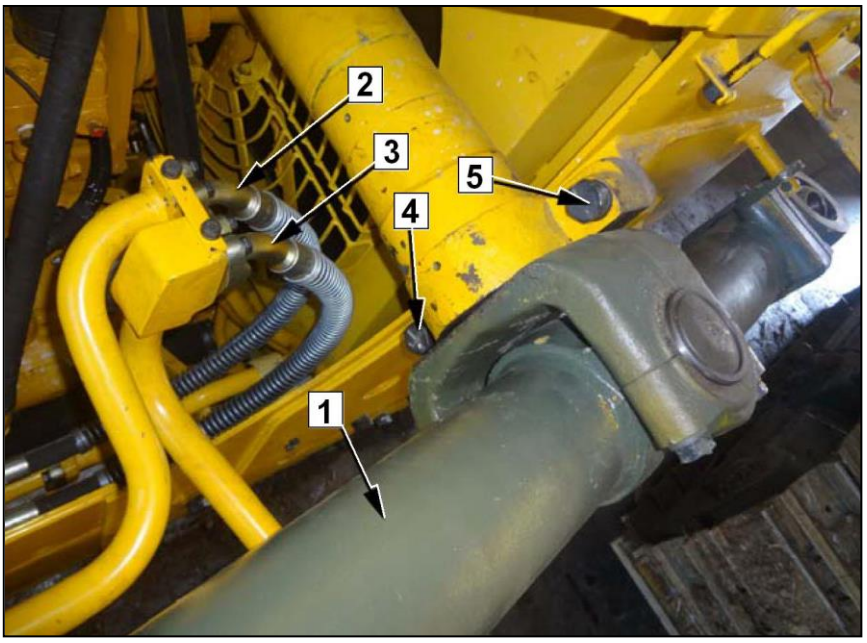
2. Lift out the engine hood from the machine. (Refer to "ENGINE AND RADIATOR REMOVAL".)

3. Disconnect all rubber hoses running between the engine and the radiator.

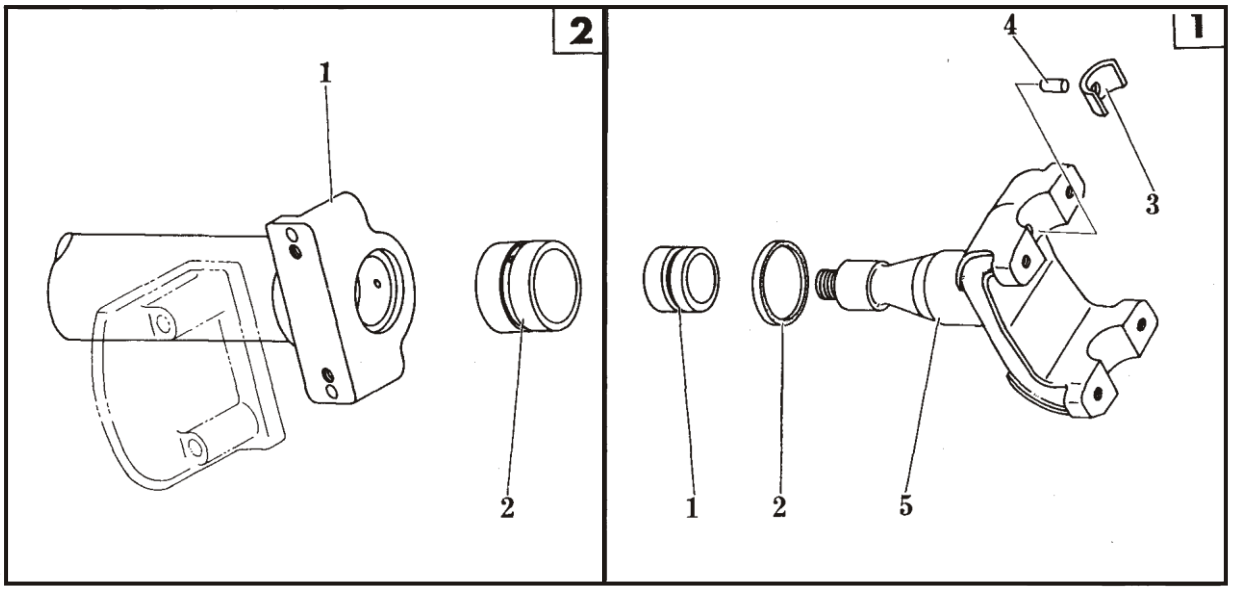
4. Disconnect the pipes (1) (2) from the hydraulic cylinder on each side of the machine.

5. Carefully hold the stay with an overhead hoist and a cable. Remove the stay securing bolts (4)(5) on each side of the machine, and separate each stay assembly from the machine.

6. Dismount the cylinder as an assembly on each side by removing bolt (6). (Refer to "HYDRAULIC CYLINDER REMOVAL").



DISASSEMBLING



PARTS ARE ENUMERATED IN THE SEQUENCE OF DISASSEMBLING

1-1. Bushing	*1-4. Dowel pin*	*2-1. Stay*
1-2. Seal	*1-5. Yoke*	*2-2. Bushing*
1-3. Bushing		

CLEANING AND INSPECTION

1. Clean all parts thoroughly and inspect for wear or any sign of damage.

2. Replace the seals whenever they are disassembled for reconditioning or servicing:

3. Visually inspect the yoke and stay for any worn threads and damage.

4. Examine worn or damaged bushings.

ASSEMBLING

Assemble the stay in the reverse sequence of disassembling by adhering to the following note:

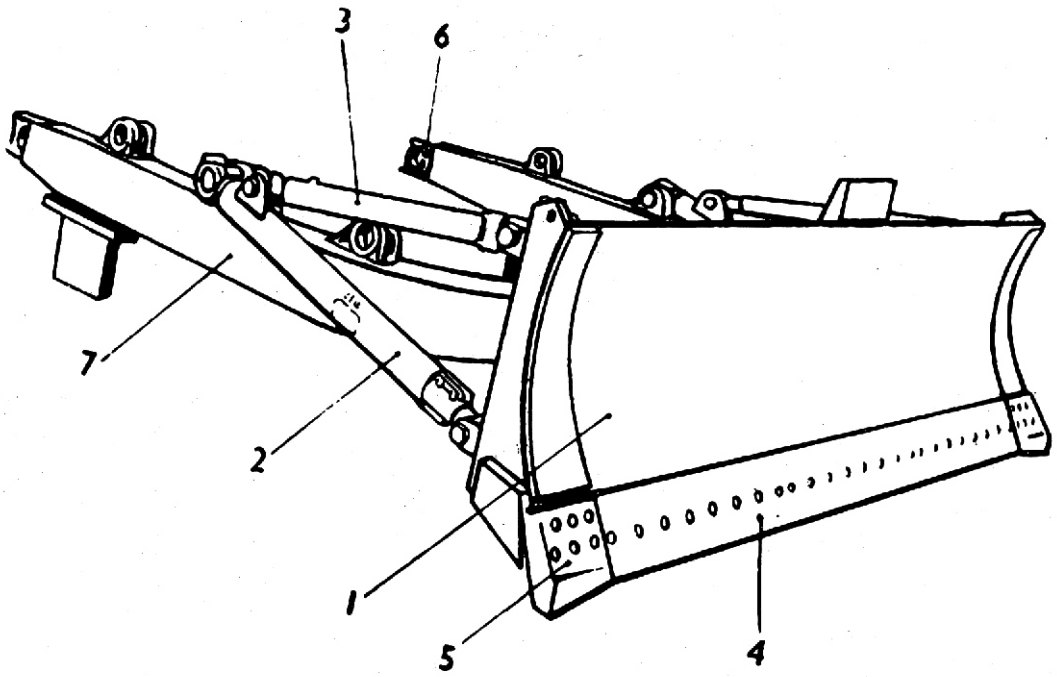
BEFORE ASSEMBLING THE YOKE IN POSITION, MAKE SURE THERE EXISTS A 5 TO 6 MM CLEARANCE BETWEEN THE YOKE AND THE STAY.

DOZER ATTACHMENT

INDEX

Dozer Attachment

DESCRIPTION



HYDRAULIC ANGLE DOZER

1.	*Blade*	*3.*	*Side arm*	*6.*	*Turning cap*
2.	*Brace*	*4.*	*Centre cutting edges*	*7.*	*'C' Frame*
		5.	*End bits*		

Dozer Attachment

Description

The blade is a welded structure of steel plates reinforced with ribs.

The bottom part of the blade is fitted with two numbers replaceable cutting edges and two end bits on either side. These edge pieces are made of high-strength alloy steel and secured in place by special wear resistance bolts and nuts. The centre cutting edges are having double edges. When one side is worn off, the other side edge can be used by turning the cutting edge. This provides new wearing surface for another life of this cutting edge.

The blade is mounted on a 'C' frame with a centre pin and arms and blades on either side of the 'C' frame. The arms are secured with pins to the blade at the front and to the 'C' frame at the rear.

The blade can be angled upto 25° on either side by changing the position of the arms to any of the three brackets provided at both sides of 'C' frame.

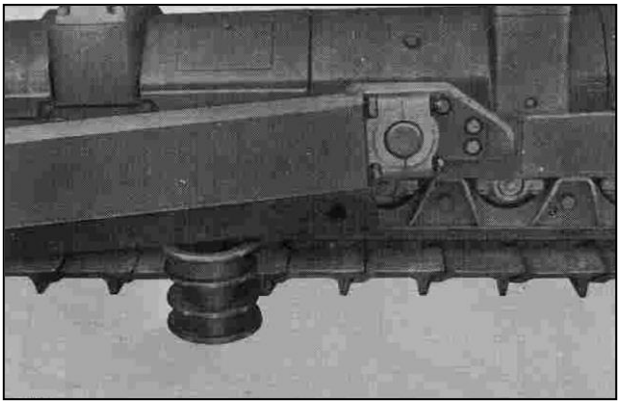
The 'C' frame is welded box section having ample strength to withstand shock-loads encountered by this size of the machine.

The ends of the 'C' frame are pivoted at the trunnions provided on either side track frames.

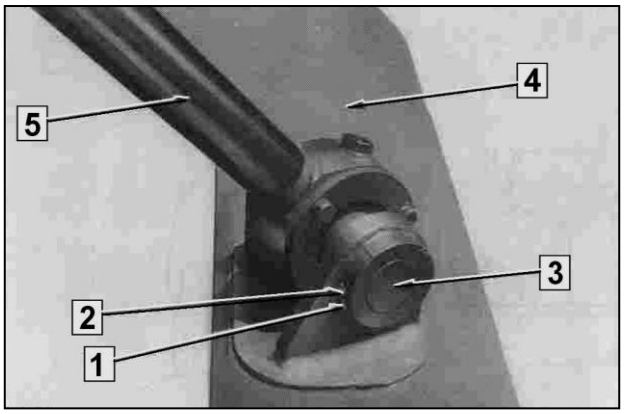
The power cylinders are located at both sides of the yoke to raise or lower the 'C' frame.

REMOVAL

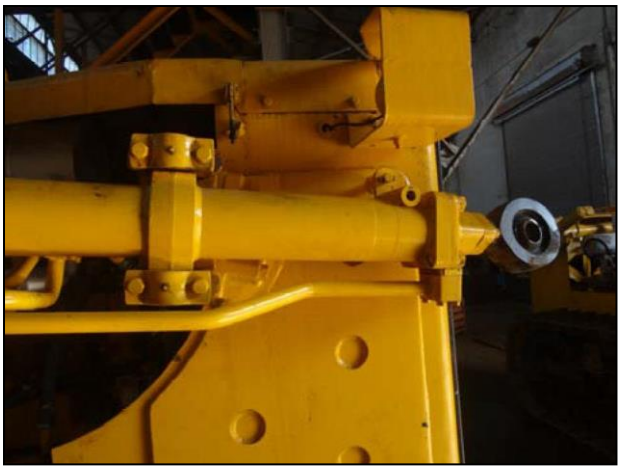
1. *Lower the blade to the ground securely, placing blocks of proper size under the frame as shown.*



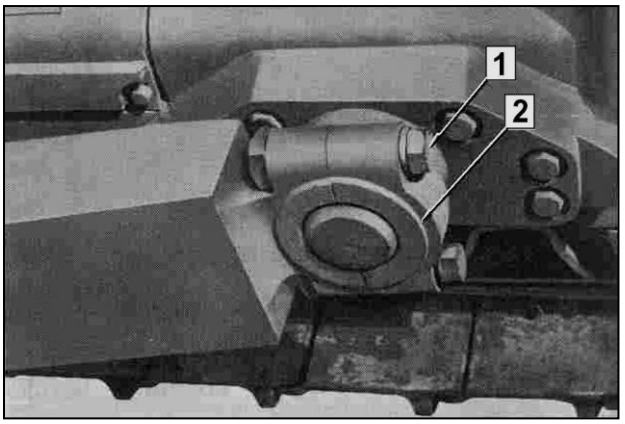
2. *Remove the split pin (1) and pull out the lock pin (2). Drive out the pin (3) to disconnect the 'C' frame (4) from the hydraulic cylinder rods (5), on each side of the machine.*



3. *Retract the piston rods to its the end of stroke in the cylinder, and secure them to the cylinder hooks to the pins (1) Located on the radiator guard, clamp them so that the cylinder is properly placed in that Position.*



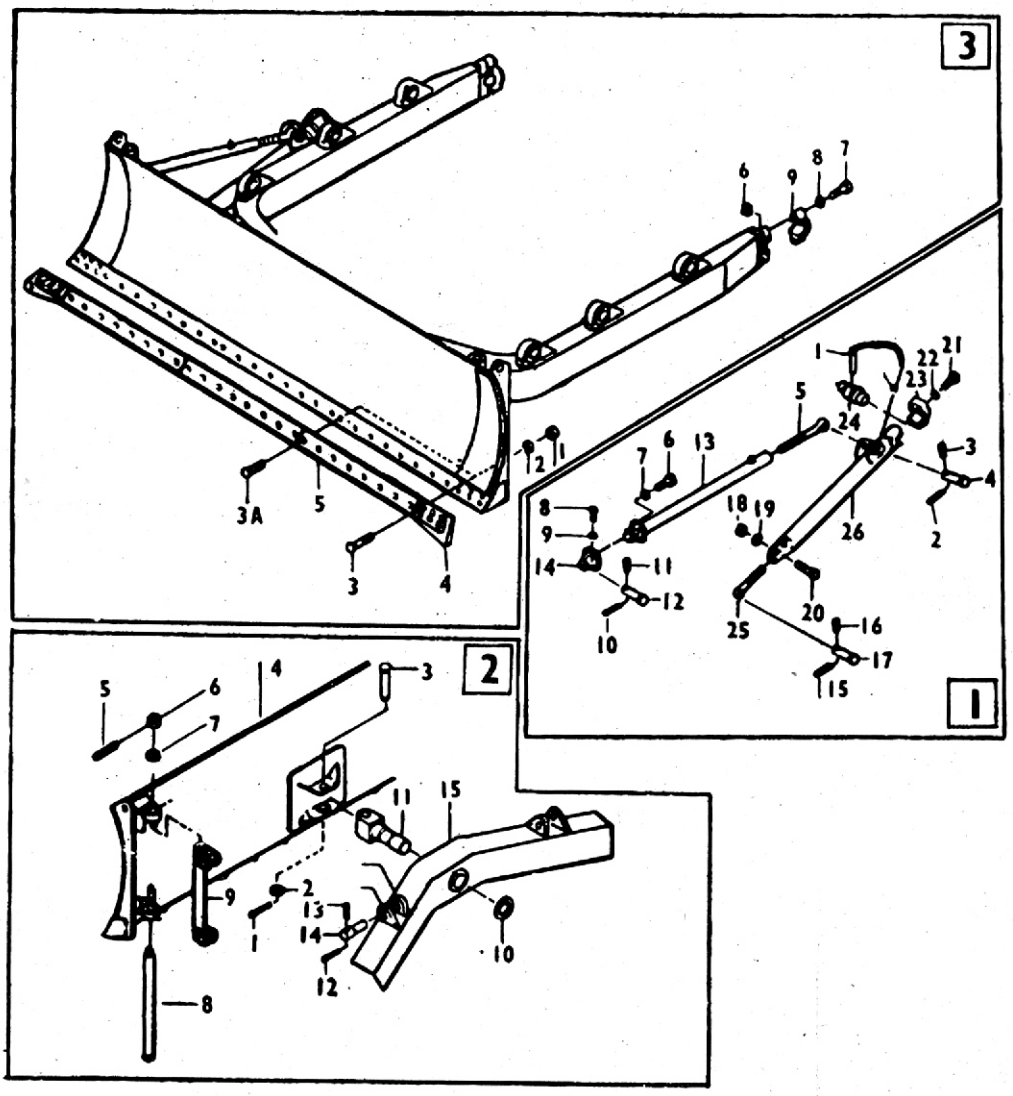
4. *Remove the bolts. (1) securing the caps (2) to the main frame, detach the caps, blade and frames resting on the floor.*



Dozer Attachment

Description

DISASSEMBLING



PARTS ARE ENUMERATED IN THE ORDER OF DISASSEMBLING

1-1. Pin
1-2. Pin cotter
1-3. Pin
14. Pin
15. Screw
16. Bolt
17. Washer, spring
18. Bolt
19. Washer, spring
1-10. Pin, cotter
1-11. Pin
1-12. Pin
1-13. Brace
1-14. Bracket
1-15. Pin cotter
1-16. Pin
1-17. Pin
1-18. Nut
1-19. Washer, spring
1-20. Bolt
1-21. Bolt
1-22. Washer, spring
1-23. Cap
1-24. Shaft
1-25. Screw
1-26. Arm
2-1. Pin , cotter
2-2. Washer
2-3. Pin
2-4. Blade, Angle
2-5. Pin, cotter
2-6. Nut
2-7. Washer
2-8. Shaft
2-9. Holder
2-10. Bushing
2-11. Joint
2-12. Pin, cotter
2-13. Pin
2-14. Pin
2-15. C Frame Assy.
3-1. Nut
3-2. Washer, spring
3-3. Bolt
3-3A. Bolt
3-4. Bit end
3-5. Edge, cutting
3-6. Nut
3-7. Bolt
3-8. Washer, spring
3-9. Cover

Note: MINOR ITEMS SUCH AS THE PINS AND CAPS SHOULD BE REPLACED TO THEIR ORIGINAL POSITIONS TO PREVENT THEM FROM MISSING UPON DISASSEMBLY OF THE DOZER AND FRAMES.

CLEANING AND INSPECTION

1. *Examine the blade for wear, deformation, defective and also its welded portions for cracks.*
2. *Check the pins and holes for wear or damage.*
3. *Check the cutting edges and end bits for wear. Also examine mounting bolts for wear, breakage.*
4. *Check both stud ball head and blade ball bore for wear or any sign-of damage.*
5. *Check if there is a proper clearance between the trunnion bushing and frame bushing.*
6. *Check for bending and any defect in the arm.*
7. *Check other parts such as the pins and pin holes for wear or damage.*

ASSEMBLING

1. *Install the arm assembly on the blade securely. Adjust the clearance between the stud ball and the blade ball by adding or removing shims.*
2. *Secure the blade to the frame. Adjust the length of each arm equally and secure the arms to the frame.*
3. *Adjust the brace until equal length is obtained. Install the brace to the frame. Stud, ball-to-blade ball clearance may be adjusted properly by adding or removing shims.*

MOUNTING

To mount the dozer equipment to the machine, reverse the sequence of removal as outlined in the instructions above.

MAINTENANCE STANDARDS

CONTENTS

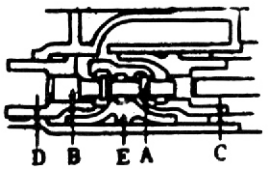
Maintenance Standards

Unit : mm (in)

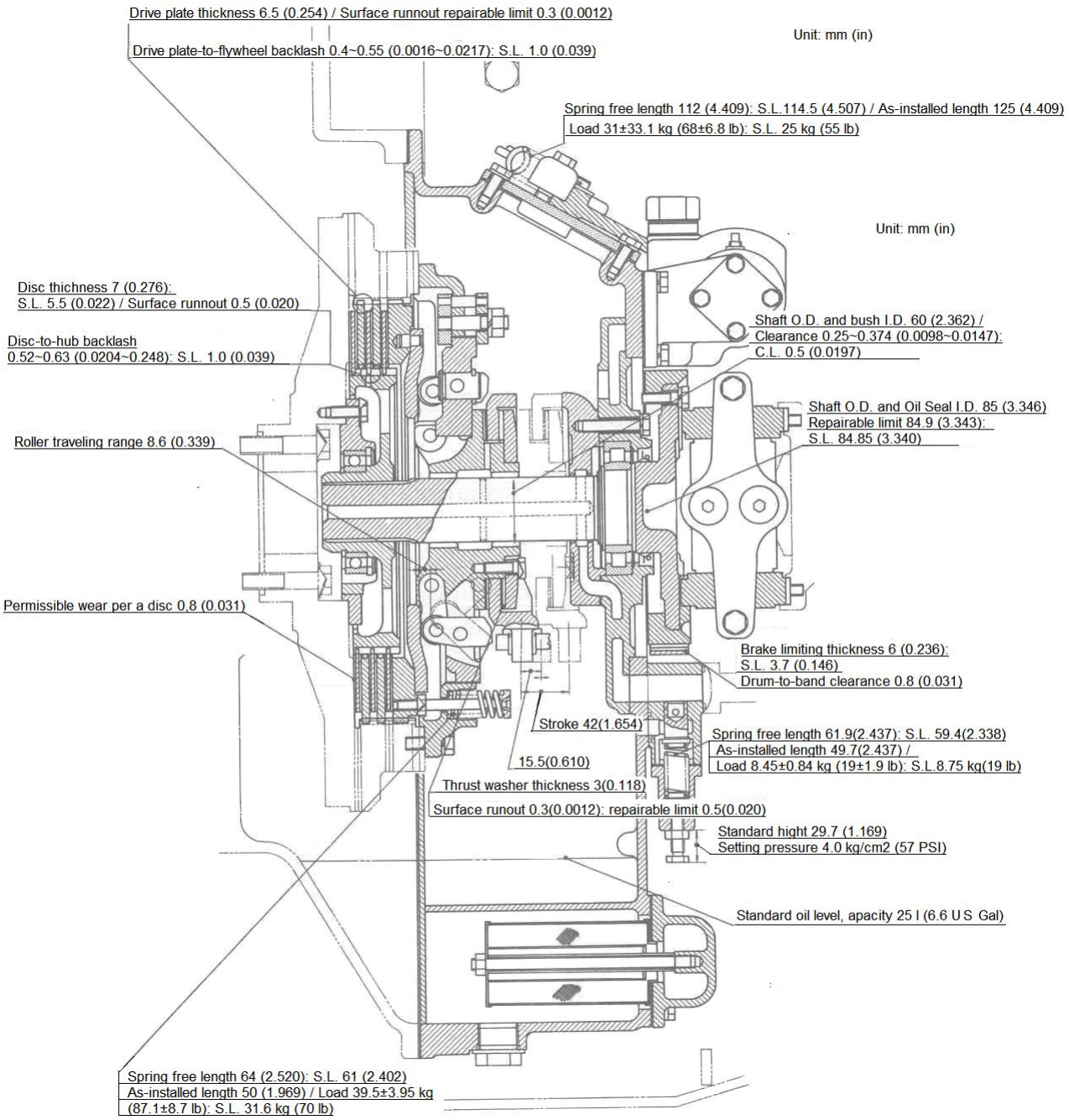
System	Item		Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
MAIN CLUTCH	Bearing 06040-06015	Hub O.D.	75 (2.953)	+ 0.012(0.000472) -0.007(0.000276)			
		Retainer I.D.	115 (4.491)	-0.010(0.00039) -0.045(0.001772)			
	Bearing 06042-00214	Shaft O.D.	70 (2.756)	+ 0.039 (0.000 1535) + 0.020(0.000787)			
		Cover I.D.	125 (4.884)	-0.012(0.000472) -0.055(0.0002165)			
	Bush	Shaft O.D.	60 (2.362)	-0.25(0.00984) -0.30(0.01181)			
		Bush (as assembled) I.D.	60 (2.362)	+0.074(0.002913)			
		Clearance		0.25~0.374 (0.0098~0.0147)		0.5 (0.020)	
	Shaft O:D and Oil seal I.D.		85 (3.3464)	-0.087(0.003425)	84.9 (3.3425)	84.85 (3.340)	
	Disc	Thickness	7 (0.276)	± 0. 1 (0.0039)		5.5 (0.022)	
		Face runout		0.3(0.00118)		0.5 (0.197)	
	Drive plate	Thickness	6.5 (0.254)	+0.3(0.00118)			
		Face runout		0.00591 (0.15)		0.3 (0.00118)	
	Disc-to-hub backlash			0.52~0.63 (0.0204 ~ 0.0248)		1.0 (0.039)	
	Drive plate-to-flywheel backlash			0.4~0.55 (0.0016 ~ 0.0217)		1.0 (0.039)	
	Thrust washer 141-10-11451	Thickness	3 (0.118)	-0.10(0.00394) -0.15(0.00591)			
		Face runout		0.3(0.0012)		0.5 (0.020)	
	Spring 150-10-11221	Free length	64 (2.520)			61 (2.402)	
		As-installed length	50 (1.969)				
		Load kg (lb)	39.5 (87.1)	±3.95(8.7)		31.6 (70)	
	Spring 175-10-12651	Free length	61.9 (2.437)			59.4 (2.338)	
		As-installed length	49.7 (1.957)				
		Load kg (lb)	8.45 (18.632)	± 0.84 (1.8522)		8.75 (19.251)	
	Spring 170-10-12210	Free length	112 (4.409)			114.5 (4.507)	
		As-installed length	125 (4.884)				
		Load kg (lb)	31 (68.335)	± 3.1 (6.8355)		25 (55.125)	
	Brake band lining	Thickness	6 (0.236)			3.7 (0.1457)	

Maintenance Standards

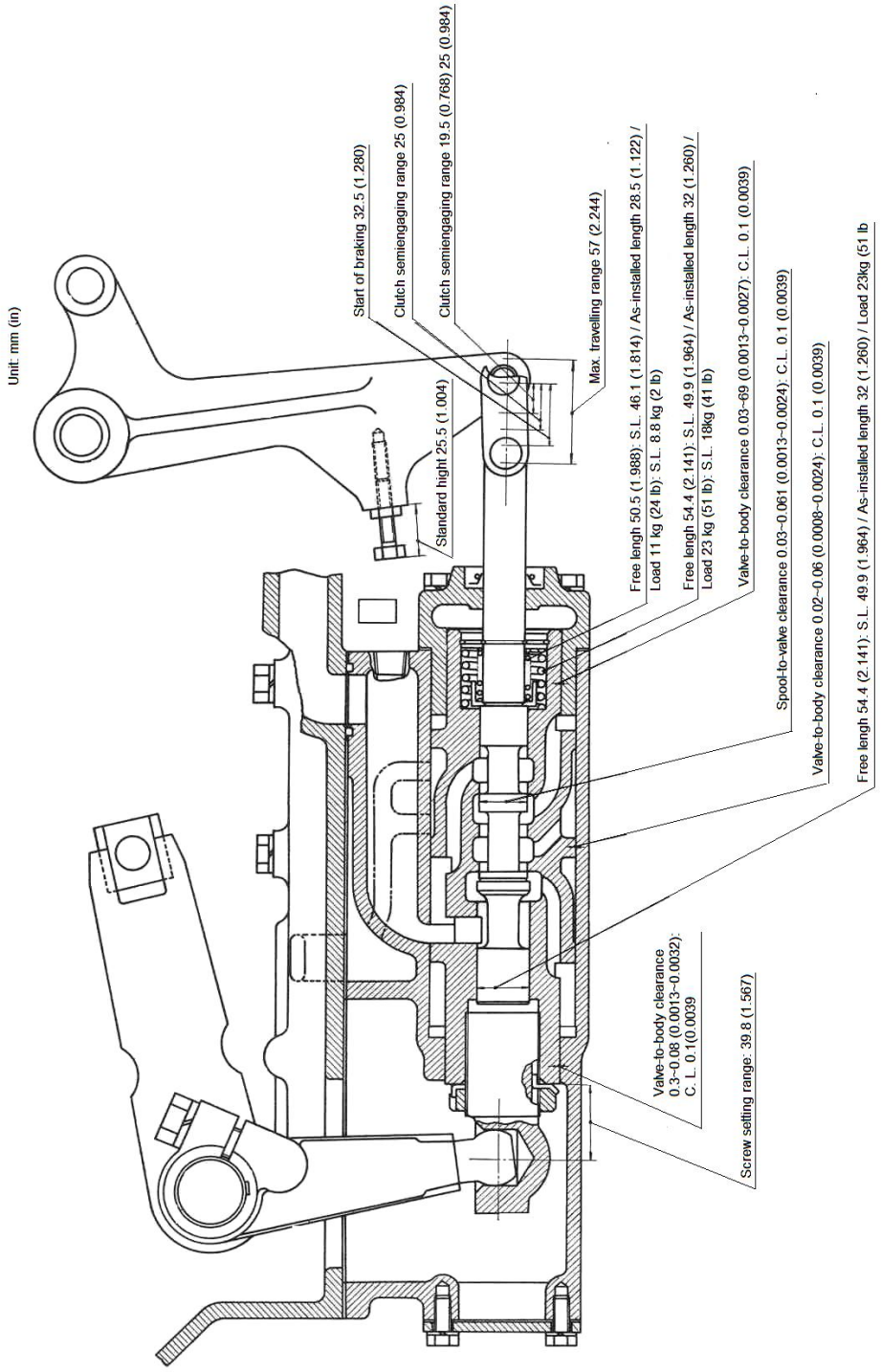
Unit : mm (in)

System	Item		Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
BOOSTER	Spool-to-valve clearance	A		0.030~0.061 (0.0013~ 0.0024)		0.1 (0.0039)	
		B		0.030~0.061 (0.0013~0.0024)		0.1 (0.0039)	
	Valve-to-cover clearance	C		0.030.0.069 (0.0013.0.0027)		0.1 (0.0039)	
	Valve-to-body clearance	D		0.030.080 (0.0013~0.0032)		0.1 (0.0039)	
		E		0.020~0.060 (0.0008~0.0024)		0.1 (0.0039)	
	Spool O.D. and Oil seal I.D.		22 (0.866)	-0.007(0.000027) -0.028(0.000110)			

MAIN CLUTCH


Drive plate thickness 6.5 (0.254) / Surface runnout repairable limit 0.3 (0.0012)
Drive plate-to-flywheel backlash 0.4~0.55 (0.0016~0.0217): S.L. 1.0 (0.039)
Unit: mm (in)
Spring free length 112 (4.409): S.L.114.5 (4.507) / As-installed length 125 (4.409)
Load 31±33.1 kg (68±6.8 lb): S.L. 25 kg (55 lb)
Unit: mm (in)
Disc thichness 7 (0.276):
S.L. 5.5 (0.022) / Surface runnout 0.5 (0.020)
Disc-to-hub backlash
0.52~0.63 (0.0204~0.248): S.L. 1.0 (0.039)
Shaft O.D. and bush I.D. 60 (2.362) /
Clearance 0.25~0.374 (0.0098~0.0147):
C.L. 0.5 (0.0197)
Shaft O.D. and Oil Seal I.D. 85 (3.346)
Repairable limit 84.9 (3.343):
S.L. 84.85 (3.340)
Roller traveling range 8.6 (0.339)
Permissible wear per a disc 0,8 (0.031)
Brake limiting thickness 6 (0.236):
S.L. 3.7 (0.146)
Drum-to-band clearance 0.8 (0.031)
Stroke 42(1.654)
Spring free length 61.9(2.437): S.L. 59.4(2.338)
As-installed length 49.7(2.437) /
Load 8.45±0.84 kg (19±1.9 lb): S.L.8.75 kg(19 lb)
15.5(0.610)
Thrust washer thickness 3(0.118)
Surface runout 0.3(0.0012): repairable limit 0.5(0.020)
Standard hight 29.7 (1.169)
Setting pressure 4.0 kg/cm2 (57 PSI)
Standard oil level, apacity 25 l (6.6 U S Gal)
Spring free length 64 (2.520): S.L. 61 (2.402)
As-installed length 50 (1.969) / Load 39.5±3.95 kg
(87.1±8.7 lb): S.L. 31.6 kg (70 lb)

HYDRAULIC BOOSTER



Maintenance Standards

Unit : mm (in)

System	Item		Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
	Spring 170.10-15262	Free length	54.4 (2.141)			49.9 (1.964)	
		As-Installed length	32 (1.260)				
		Load Kg (lb)	23 (51)	±2.3(5.1)		18.4 (41)	
	Spring 170-10-15272	Free length	50.5 (1.988)			46.1 (1.814)	
		As-Installed length	28.5 (1.122)				
		Load Kg (lb)	11 (24.255)	± 1.1 (2.4255)		8.8 (19.404)	
	Spring 170-10-15340	Free length	75 (2.953)			73.2 (2.881)	
		As-Installed length	51 (2.008)				
		Load Kg (lb)	14 (30.870)	± 0.6(1.3230)		13.0 (28.665)	
	Needle bearing, 150.11-13322	Pin O.D.	22 (0.866)	-0.013(0.0000512)			
		Lever I.D.	30 (1.181)	+0.012(0.0000472) -0.009(0.000035)			
	Bush 170-10-18111	Pin O.D.	12 (0.472)	-0.016(0.000063) -0.043(0.00169)			
		Bush I.D. (assembled)	12 (0.472)	+0.018(0.000709)			
		Clearance		0.016-0.061 (0.00063 - 0.00240)		0.15 (0.00591)	
	Socket I. D. and Ball dia.			0.3-0.5 (0.0118 -0.0197)		1.0 (0.039)	
	Bush 170.10-16120	Shaft O.D.	34 (1.339)	-0.025(0.00009)			
		Bush I.D. (assembled)	34 (1.339)	+0.064(0.00025) + 0.025 (0.00009)			
		Clearance		0.025-0.089 (0.00009 -0.00035)		0.15 (0.0059)	
	Bush 175-10-12230	Shaft O.D.	27 (1.063)	-0.020(0.00007) -0.041 (0.0016)			
		Bush I.D. (assembled)	27 (1.063)	+0,021 (0.00082)			
		Clearance		0.020-0.062 (0.00007-0.0024)		0.15 (0.0059)	
	Side Clearance	Gear case width	38 (1.496)	+0.035(0.00137) +0.025(0.00098)			Selection assembly
		Gear width (each)		-0.020(0.00078) - 0.030(0.00118)		(0.0118) -0.3	
		Gear-to-case side clearance		0.045-0.055 (0.00177~0.00217)	0.080 (0.00314)		
		End play	0.020~ 0.025 (0.00078~ 0.0009)				

Maintenance Standards

Unit : mm (in)

System	Item		Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
MAIN CLUTCH PUMP	Gear-to-housing clearance	Bore dia. (each)	53.3 (2.0984)	+0.095(0.0037) +0.080(0.0031)		+ 0.25 (0.0098)	Distance between centre line of gears
		Gear O.D. (each)		-0.060(0.00236) -0.075(0.0029)			
		Inlet side		0.09~0.10 (0.0035 - 0.0039)			
		Top or bottom side		0.07~0.08 (0.0028~0.0031)			
		Outlet side		0.05~0:06 (0.0019~0.00236)		+ 0.18 (0.0070)	

Unit : mm (in)

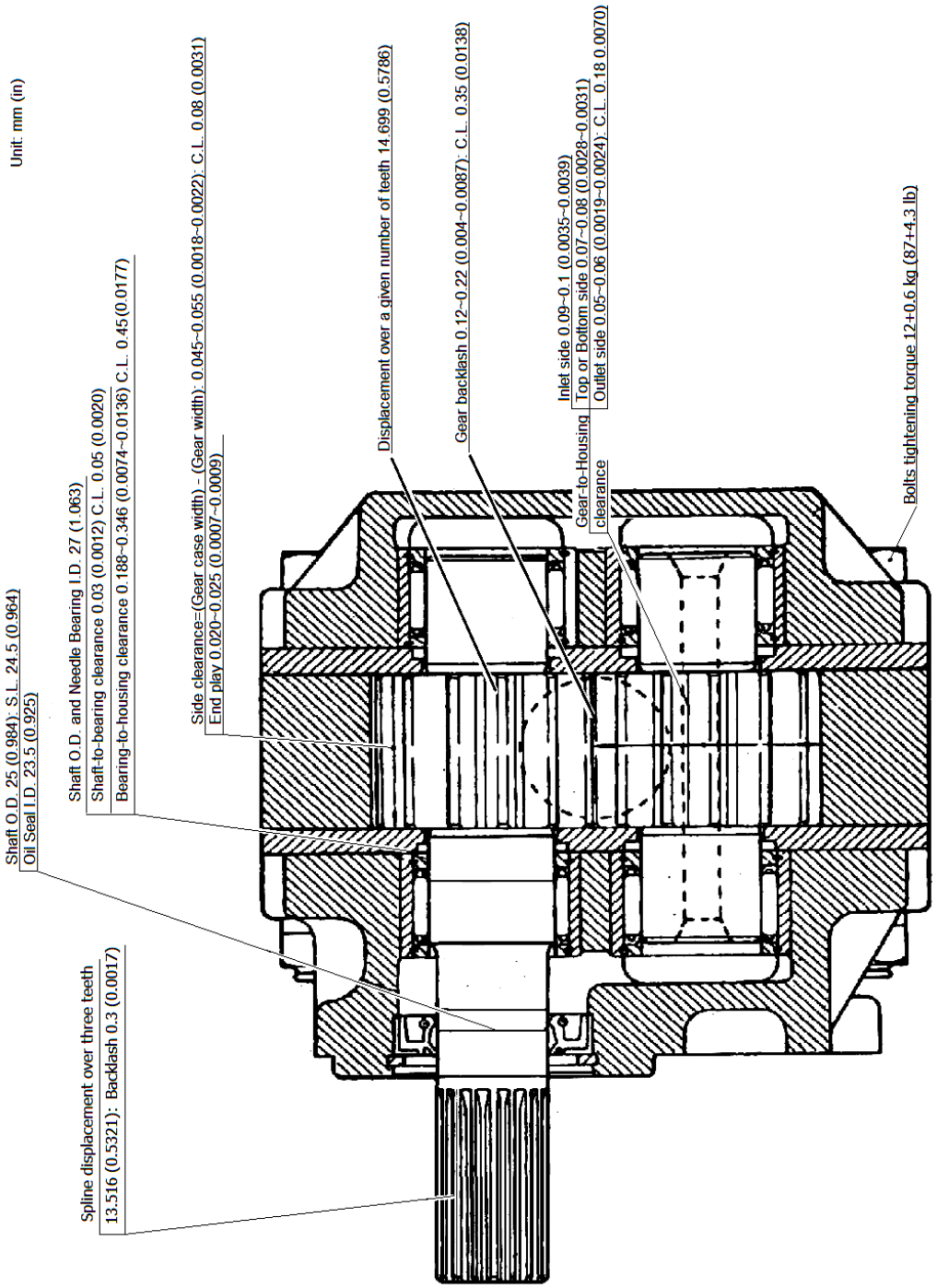
System	Item		Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
MAIN CLUTCH PUMP	Needle bearings	Bearing to housing circumference clearance		0.188 ~ 0.346 (0.0074~0.0136)	0.45 (0.0177)		Measure the clearance at eccentricized bearing outer race
		Bearing I.D.	27 1.063)	+0.033(0.00129) + 0.020(0.00078)			
		Shaft O.D.		+0 -0.009(0.00035)			
		Shaft to bearing clearance	0.020 (0.00078) ~0.042 ~(0.00016	0.030(0.00118)	0.056 (0.00196)		Selection assembly
	Gears	Module X No. of teeth	3(0.118) X 15				
		Displacement over a given number of teeth (2 teeth)	14.699 (0.5786)	-0.06(0.00023) -0.11 (0.0043)			
		Backlash		0.12~0.22 (0.0047 ~ 0.00866)	0.35 (0.01377)		
	Oil seal	Shaft dia.	25 (0.984)	+0 -0.052(0.00020)	24.5 (0.964)		
		Oil seal I.D.	23.5 (0.9251)				
	Spline	O.D. X teeth X module	25 x 13 x 1.667 (0.9842 x 13 x 0.0656)				Backlash 0.3(0.01181)
		Displacement over a given number of teeth (3 teeth)	13.516 0.5321	-0.087 (0.00342) - 0.129 (0.00507)			
	Tightening torque kg. m (ft-lb)		12 (87 ft-lb)	± 0.6(4.3 ft-lb)			
	Discharge flow		Discharge pressure : 4 kg/cm²(640 PSI), Oil temp : 50°~55°C (122°~131°F)				

Performance criteria

Pressure	rpm	Efficiency (%)
45 kg/cm² (640 PSI)	2000	50%
45 kg/cm² (640 PSI)	1200	

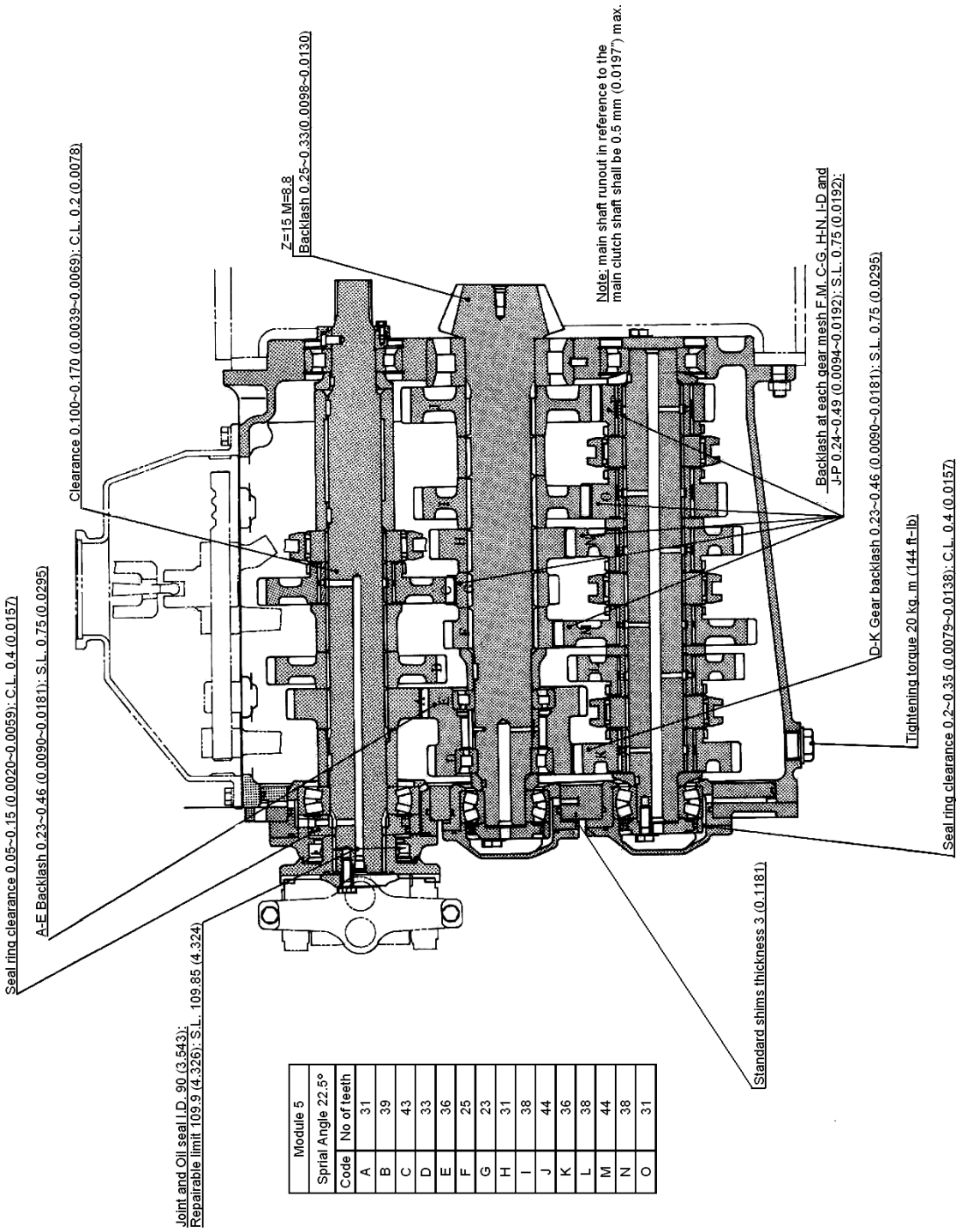
TRANSMISSION	Centering the engine	Runout		0.5 (0.017685)max.			With dial guage
		Face runout		0.5 (0.017685)max.			
	Gear backlash	116 TM 51353 116 TM 51742		0.23 – 0.46 (0.0090 – 0.0181)			
		150-15-12630 & 116 TM 51078		0.23 – 0.46 (0.0090 – 0.0181)		(0.02952)	
		Other gears		0.24 – 0.49 (0.0094 – 0.0192)		0.75 (0.02952)	

MAIN CLUTCH PUMP



1. Insert the oil seals and needle bearing so as to set the surface on which their serial numbers are stumped to outside. Cost the inside of oil seal grease before inserting.
2. Before tightening the bolts, adjust the gear side clearances to 0.055~0.060 mm (0.0022~0.0024).

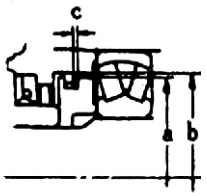
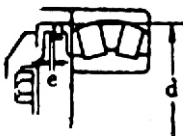
TRANSMISSION



Module 5	
Sprial Angle 22.5°	
Code	No of teeth
A	31
B	39
C	43
D	33
E	36
F	25
G	23
H	31
I	38
J	44
K	36
L	38
M	44
N	38
O	31

Maintenance Standards

Unit : mm (in)

System	Item			Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
TRANSMISSION	Bearing 116 TM 91335	Shaft O.D.		70 (2.765)	+0.039 (0.00153) + 0.020 (0.0007)			Mounted on main shaft
		Cage I.D.		150 (5.909)	-0.012 (0.00047) -0.052 (0.00204)			
	Bearing 06041-00311	Shaft O.D.		55 (2.165)	+0.039 (0.00153) +0.020 (0.0007)			
		Cage I.D.		120 (4.72)	-0.010 (0.00003) -0.045 (0.00177)			
	Bearing 116 TM 91854	Shaft O.D.		50 (1.969)	+0.033 (0.00012) +0.017 (0.00006)			Mounted on counter shaft and inter mediate shaft.
		Cage I.D.		110 (4.330)	-0.010 (0.00003) -0.045 (0.00177)			
	Bearing 06041-00312	Shaft O.D.		60 (2.362)	+0.039 (0.00153) + 0.020 (0.0007)			Mounted on counter shaft
		Case I.D.		130 (5.118)	-0.012 (0.00047) -0.052 (0.00204)			
	Bearing 116 TM 91757	Shaft O.D.		65 (2.559)	+0.030 (0.00118) +0.11 (0.00043)			Mounted on Inter-mediate shaft
		Gear I.D.		120 (4.727)	-0.010 (0.00039) -0.045 (0.00177)			
	Bearing 116 TM 92862	Shaft O.D.		70 (2.75)	+0.030 (0.00118) +0.011 (0.00043)			
		Gear I.D.		125 (4.884)	-0.012 (0.00047) -0.052(0.0020)			
	Bearing 116 TM 92907	Shaft O.D.		85 (3.346)	+ 0.045 (0.00177) + 0.023 (0.00090)			
		Case I.D.		180 (7.086)	-0.120 (0.00047) -0.052 (0.00204)			
	Joint dia. and Oil dia			90 (3.543)	-0.087 (0.00342).	109.85 (4.324)	109.9 (4.326)	 
	Bush 116 TM 11777	Inner race O.D.		88 (3.465)	-0.100 (0.00393) -0.135 (0.00531)			
		Bush I.D. (assembled)		88 (3.465)	+ 0.035 (0.00137)			
		Clearance			0.100-0 170 (0.003937 0.00669)		0.2 (0.0078)	
	Seal ring 116 TM 91302	Holder O.D.	a	125 (4.884)	-0.2(0.0078) -0.3(0.0118)			
		Cage I.D.	b	125 (4.884)	+0.15(0.00590) +0.10(0.00393)			
		CleArance	c		0.05 ~ 0.15 (0.0020 ~ 0.0059)		0.4 (0.0157)	
	Dialing 116 TM 91546	Cover I.D.	d	95 (3.740)	+0.054(0.00212)			
		Clearance	e		0.2 ~ 0.35 (0.00787~0.01377)		0.4 (0.0157)	
	Spring 113 BR 11914	Free length		51.8 (2.039)			47.4 (1.866)	
		As-installed length		30 (1.181)				
		Load Kg (lb)		3 (6.615)	±0.3(0.6615)		2.4 (5.2920)	

Unit : mm (in)

System	Item		Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
SHIFTER	Shaft-to-inlerlock bracket clearance			0.020~0.074 (0.00078 ~ 0.00291)		0.1 (0.0039)	
	Shaft-to-shift forks clearance			0.040 ~ 0.094 (0.001574 ~ 0.003700)			
	Bush 116 TM 92875	Shaft O.D.	24 (0.945)	-0.040(0.001572) -0.061 (0.0024)			
		Bush I.D. (as assembled)	24 (0.945)	+0.021 (0.000826)			
		Clearance		0.040 ~ 0.082 (0.00157 ~ 0.00328)		0.1 (0.0039)	
	Spring 116 TM 12416	Free length	45 (1.772)			43.0 (1.692)	
		As-installed length	34.6 (1.362)				
		Load Kg(lb)	18 (39.690)	± 1.8(3.9690)		14.4 (31.7520)	
	Bush 116 TM 2315	Shaft O.D.	32 (1.260)	-0.025(0.00098) -0.064(0.00251)			
		Bush I.D. (as assembled)	32 (1.260)	+ 0.039(0.001535)			
		CLEARANCE		0.025 ~ 0.103 (0.000984 ~ 0.004055		0.15 (0.0059)	
	Shaft-to-oil seal clearance		32 (1.260)	-0.025 (0.00098) -0.064(0.00251)		1.253 (31.85)	
	Needle bearing 06120-02520	Shaft O.D.	30 (1.181)	-0.013(0.00051)			
		Case I.D.	37 (1.457)	-0.008(0.00031) -0.033(0.00129)			
	Needle bearing 0612002520	Shaft O.D.	25 (0.984)	-0.013(0.00051)			
		Casel.D.	32 (1.260)	-0.008(0.00031) -0.033(0.00129)			
	Shaft-to-oil seal clearance		30 (1.181)	-0.013(0.00051)		29.85 (2.4251)	
	Spring 116 TM 12295	Free length	64 (2.520)			61.6 (1.1751)	
		As-installed length	52 (2.047)				
		Load Kg (lb)	6 (0.591)	± 0.6(1.3230)		4.8 (10,584)	
	Bush 116 TM 12246	Pin O.D.	15 (0.591)	-0.016(0.00062) -0.034(0.001338)			
		Bush I.D. (as assembled)	15 (0.591)	+0.027(0.00106)			
		Clearance		0.016~0.061 (0.00062~0.00240)		0.1 (0.00393)	
	Bush 116 TM 92275	Pin O.D.	14 (0.551)	-0.032(0.001259) -0.059(000232)			
		Bush I.D. (as assembled)	14 (0.551)	+0.027(0.00106)			
		Clearance		0.032 ~˜ 0.086 (0.001259 ˜ 0.00338)		0.1 (0.00393)	

Maintenance Standards

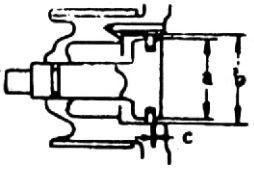
Unit : mm (in)

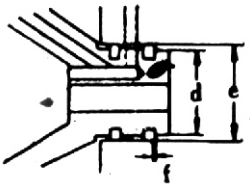
System	Item		Basic Size	Standard Clearance or Assembly Standard	Repaira-ble Size Limit	Clearance Limit or Service Limit	Remarks
SHIFTER	Spring 110 TM 11536	Free length	35 (1.378)			32.6 (1.283)	
		As installed length	23 (0.906)				
		Load Kg (lb)	3 (6.615)	±0.3(0.615)		2.4 (5.2920)	
MAIN CLUTCH LEVER	Needle bearing 06120-02520	Shaft O.D.	25 (0.984)	-0.013 (0.0005)			
		Bearing I.D.	32 (1.260)	-0.008(0.000031) -0.033 (0.00129)			
	Shaft dia. and	Oil seal dia.	25 (0.984)	-0.013(0.00005)		24.85 (0.9783)	
	Spring 150.43.12380	Free length	68 (2.677)			64.4 (2.535)	
		As installed length	50 (1.969)				
		Load Kg (lb)	15 (33.075)	± 1.5(3.3075)		12 (26.460)	

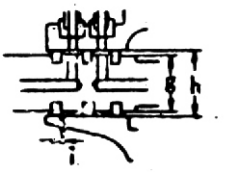
Maintenance Standards

Unit : mm (in)

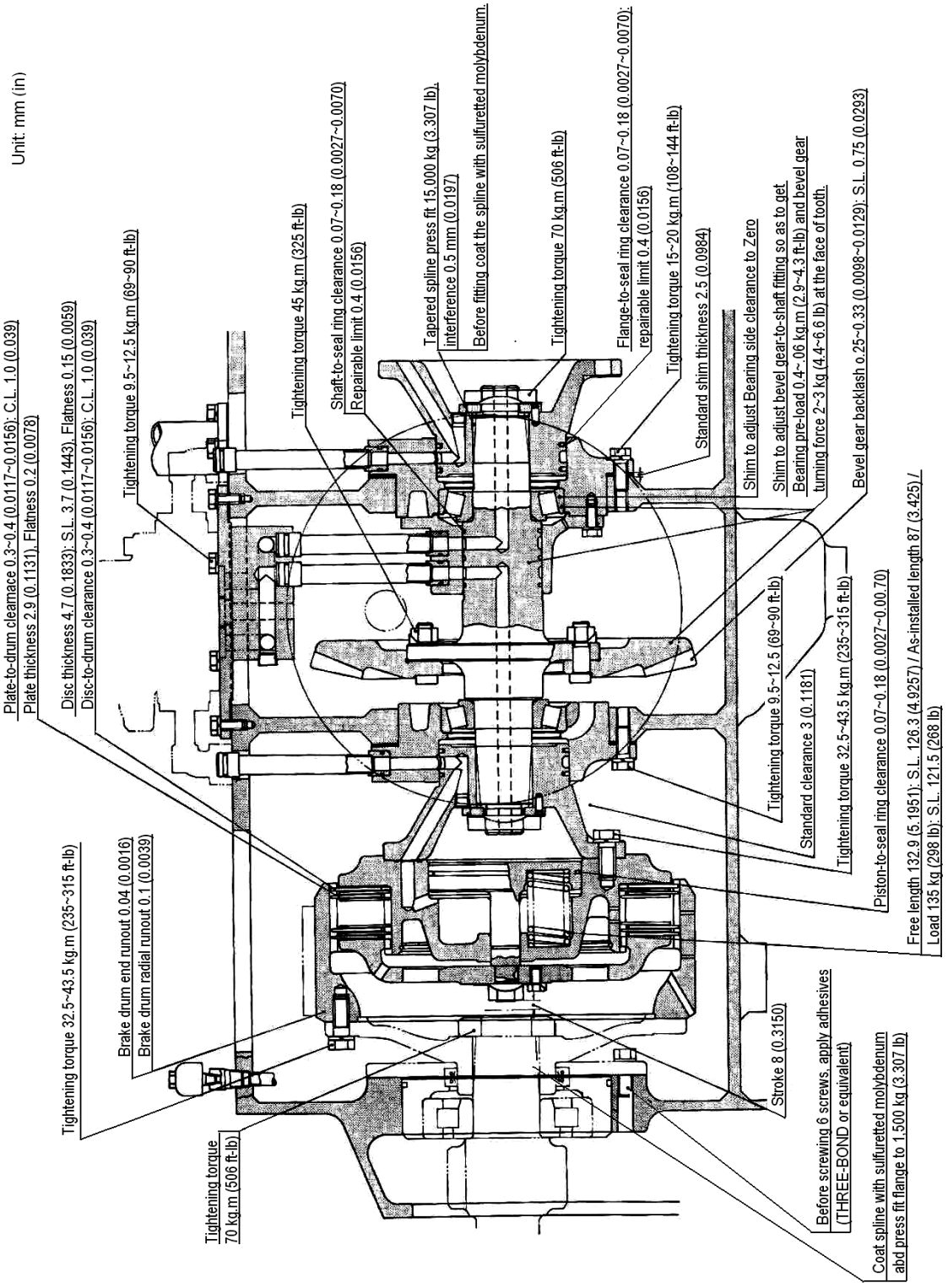
System	Item		Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
PTO	Bearing 06040 ~ 06314	Gear shaft O.D.	70 (2.756)	+0.039(0.001521) +0.020(0.00078)			
		Case I.D.	150 (5.869)	-0.012(0.000468) -0.052(0.002028)			
	Bearing 06041~01016	Gear shaft O.D.	80 (3.150)	+0.039(0.001521) + 0.020 (0.00078)			
		Case I.D.	125 (4.884)	-0.012(0.000468) -0.052(0.002028)			
	Bearing 06040 ~ 06212	Gear O.D.	60 (2.362)	+0.039(0.001521) +0.020(0.00078)			
		Case I.D.	110 (4.294)	-0.010(0.00039) -0.045(0.001755)			
	Bearing 06040 ~ 06209	Gear O.D.	45 (1.772)	+ 0.033(0.001287) +0.017(0.000663)			
		Case I.D.	85 (3.345)	-0.010(0.00039) -0.045(0.001755)			
UNIVERSAL JOINT	Needle bearing 116 UJ 11024	Spider O.D.	25.486 (1.002954)	-0.021 (0.000819)			
		Bearing I.D.	30.22 (1.18958)	+0.021 (0.000819)			
STEERING CLUTCHES	Bevel gear backlash			0.25~0.33 (0.00915 ~ 0.0 1287)		0.75 (0.02925)	M = 8.8 ratio (numbers of teeth) 49/15
	Tapered roller bearing	Shaft O.D.	65 (2.559)	+ 0.039(0.001521) +0.020(0.00078)			
		Cage I.D.	140 (5.475)	-0.012(0.000468) -0.052(0.002028)			
	Disc	Thickness	4.7 (0.1833)	± 0.1 (0.0039)		3.7 (0.1443)	
		Flatness		0.15(0.00585)			
	Drive plate	Thickness		-0.15(0.00585)			
		Flatness		0.2(0.0078)			
	Disc to brake drum clearance			0.3~0.4 (0.0117 ~0.0156)		1.0 (0.039)	
	Drive plate to drum clearance			0.3~0.4 (0.0117 ~ 0.0156)		1.0 (0.039)	
	Brake drum face runout			0.04(0.00156)			
	Brake drum radial runout			0.1 (0.0039)			
	Piston O.D.	a	170 (6.656)	-0.45(0.01755) -0.55(0.02145)			
	Drum I.D.	b	170		+0.063 (0.002457)		
	Piston-to-seal ring clearance	c		0.07~0.18 (0.00273 -0.00702			
	Flange O.D.	d	144.5 (5.6515)	0 -0.1 (0.0039)			
	Bearing cage I.D.	e	145 (5.632)	+ 0.063(0.002457)			







STEERING CLUTCHES



Maintenance Standards

Unit : mm (in)

System	Item		Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
STEERING CLUTCHES	Flange-to-seal ring clearance	f		0.07 ~ 0.18 (0.00273 ~ 0.00702)	0.4 (0.0156)		
	Shaft O.D.	g	89 (3.504)	-0.1 (0.0039)			
	Flange I.D.	h	90 (3.543)	+0.054(0.002106)			
	Shaft-to-seal ring clearance	i		0.07 ~ 0.18 (0.00273 ~ 0.00702)	0.4 (0.0156)		
	Spring 175-22-11180	Free length	132.9 (5.1951)			126.9 (4.9257)	
		As-installed length	87 (3.425)				
		Load	135 kg (298 lb)	± 13.5 kg (29.8 lb)		121.5 kg (268 lb)	

Maintenance Standards

Unit : mm (in)

System	Item		Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
STEERING OIL PUMP	Spool in valve body			0.04~0.05 (0.00156~0.00195)			
	Valve to housing clearance			0.02~0.03 (0.00078~0.00117)			145-14-23710 & 154-21-15210
	Spring 170-43-22240	Free length	60.15 (2.3679)			58.7 (2.3103)	
		As-installed length	53 (2.087)				
		Load	10 kg (22lb)	± 1.0 kg (2.2 lb)		8 kg (18 lb)	
	Spring 154-21-15220	Free length	42 (1.654)				
		As-installed length	40 (1.575)				
		Load	5.23 kg (11.5lb)	± 0.5 kg (1.1 lb)		4.2 kg (9.3lb)	
	Lever shafl dia. and oil seal I.D.		25 (0.984)	-0.020 (0.00078) -0.041 (0.001599)		24.85 (0.97815)	
	Lever to plunger clearance	J					
	Side clearance			0.075 ~ 0.085 (0.0029 ~ 0.0033)		0.115 (0.0045)	Side clearance = gear case width-gear width
	Shaft-to-needle bearing clearance (after press fitting)		25 (0.984)	0.008 ~ 0.051 (0.00031 ~ 0.0020)		0.081 (0.0032)	
	Top clearance			0.075 ~ 0.090 (0.002925 ~ 0.00351)		0.120 (0.0047)	Top clearance = (gear I.D.-gear O.D.)/2
	Gear backlash			0.12 ~ 0.21 (0.0047 ~ 0.0082)		0.33 (0.0129)	
	Gear	O.D.	53.3 (2.098)	-0.070(0.00275) -0.085(0.003315)			
		Face width	42 (1.654)	-0.050(0.00195) -0.060(0.00234)		-0.160 (0.0062)	
		Shaft dia.	25 (0.984)	-0.009(0.000351)		-0.039 (0.001521)	
	Gear case	Bore dia.	53.3 (2.0987)	+ 0,095(0.003705) + 0.080(0.00312)	+ 0.155 (0.006045)		
		Width	42 (1.654)	+0.035(0.001365) + 0.025(0.000975)			
	Spline displacement over three teeth		13.516 (61 ft. lb)	-0110(0.00429) -0.166(0.006474)	Backlash 0.3 (0.0117)		Backlash 0.3 (0.0017)
	Tightening torque kg.m (ft. lb)		8.5 (61 ft. lb)	± 0.5(3.6ft. lb)			
	Capacity:		Discharge pressure	30 kg/cm² (427 PSI); Oil temperature 50 ~ 55°C (122 ~131°F)			

Performance criteria

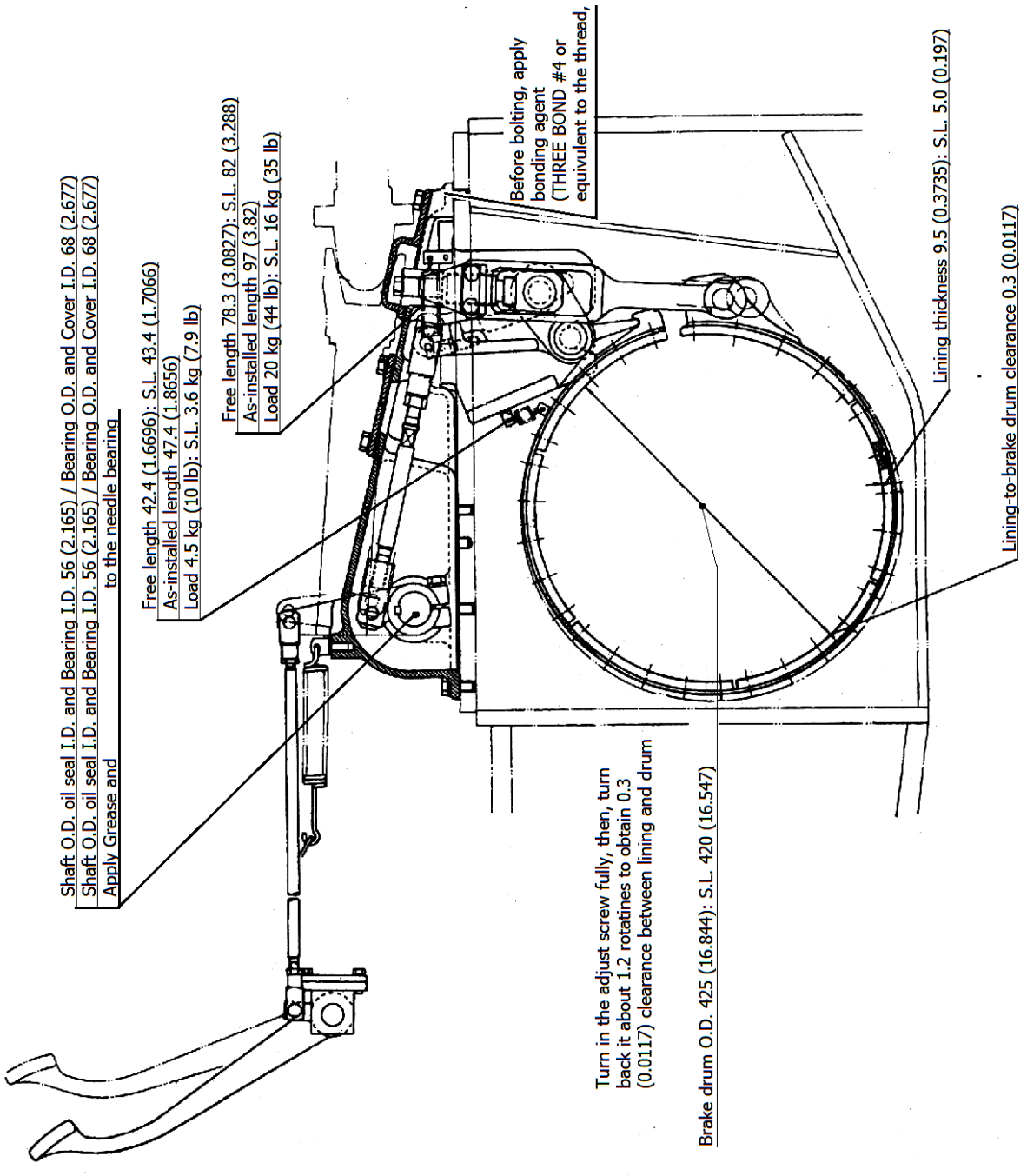
Pump RPM	Actual capacity 4m	Calculated capacity 4m	Volumetric efficiency %
1150	37.7 min.	46.0	82 min.
2300	82.6 min.	92.0	90 min.
Service limit			
1150			60
2300			75

Maintenance Standards

Unit : mm (in)

System	Item		Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
BRAKES	Brake-band lining thickness		9.5 (0.3735)			5.0 (0.197)	
	Brake drum O.D.		425 (16.844)			420 (16.547)	
	lining to brake drumclearance			0.3(0.0117)			
	Shalt dia. and oil seal I.D.		55 (2.165)	-0.019(0.00741)			
	Shaft dia. and oil seal I. D.		40 (1.575)	-0.016(0.000624)			
	Needle bearing 154-33-11360	Shaft O.D.	55 (2.165)	-0.019(0.000741)			
		Cover I.D.	68 (2.677)	-0.009(0.000351) -0.039(0.001521)			
		Shaft O.D.	40 (1.575)	-0.0016(0.000624)			
		Cover I.D.	47 (1.850)	-0.008(0.000312) 0.033(0.001287)			
	Spring 150-33-12171	Free length	78.3 (3.0827)			82 (3.228)	
		As-Installed length	97 (3.82)				
		Load	20 Kg (44 lb)	+ 1.6 kg (3.5 lb)		16 Kg (35 lb)	
	Spring 100-33-13120	Free length	42.4 (1.6696)			43.4 (1.7086)	
		As-Installed length	47 (1.8656)				
		Load	4.54 kg. (10 lb)	± 0.5 kg (1.1lb)		3.6 kg (7.916)	
BRAKE PEDALS	Needle bearing 06120-03520	Shaft O.D.	35 (1.378)	-0.016(0.000624)			
		Pedal I.D.	42 (1.654)	-0.008(0.000312) -0.033(0.001287)			
	Needle bearing 06120-03520	Shaft O.D.	35 (1.378)	-0.016(0.000624)			
		Bearing I.D.	42 (1.654)	-0.008(0.000312) -0.033(0.001287)			
	Shaft to oil seal		35 (1.3780)	-0.018(0.000702)			
	Spring 154-44-11820	Free length	274 (10.793)			278 (10.951)	
		As-installed length	290 (11.423)				
		Load	29.9 kg (66 lb)	+ 2.4 kg (5.3 lb)		23.9 kg (53 lb)	
		Free length	79 (3.110)			81 (3.189)	
		As-Installed length	85 (3.346)				
		Load	5.36 kg (12 lb)			3.6 kg (8 lb)	

STEERING BRAKE

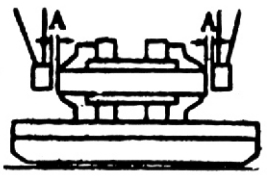
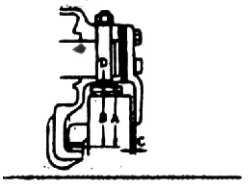


Unit : mm (in)

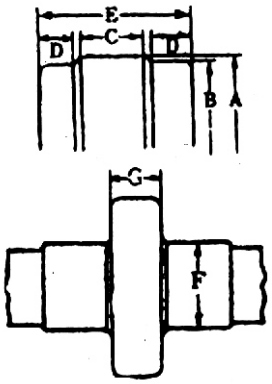
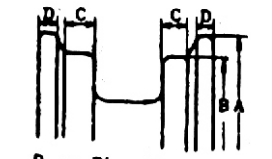
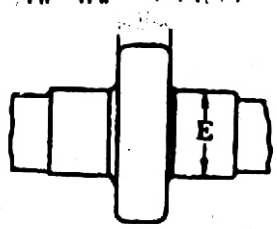
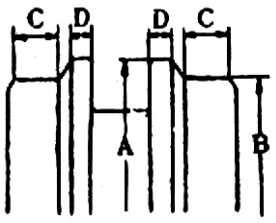
System	Item		Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
STEERING LEVER	Needle bearing 06120-02520	Shaft O.D.	25 (0.984)	-0.013(0.000507)			
		Lever I.D.	32 (1.260)	-0.008 (0.000312) -0.033 (0.001287)			
	Shaft to oil seal fit		25 (0.984)	-0.013(0.000507)			
TRANSMISSION CONTROL LEVER	Needle bearing 06120-02520	Shaft O.D.	25 (0.984)	-0.013(0.000507)			
		Lever I.D.	32 (1.260)	-0.008(0.000312) -0.033(0.001287)			
	Needle bearing 06120-02520	Shaft O.D.	25 (0.984)	-0.013(0.000507)			
		Bracket I.D.	32 (1.260)	-0.008(0.000312) -0.033(0.001287)			
	Shaft to oil seal fit		25 (0.984)	-0.01.3(0.000507)			
	Spring 154-44-12460	Free length	79 (3.110)			81 (3.189)	
		As-Instlled length	85 (3.346)				
		Load	5.36 kg (12 lb)			3.6 kg (8 lb)	
ACCELERATOR LEVER	Needle bearin 06120-02520	Shaft O.D.	25 (0.984)	-0.013(0.000507)			
		Lever I.D.	32 (1.260)	-0.008(0.000312) -0.033(0.001287)			
	Needle bearing 06120-02520	Shaft O.D.	25 (0.984)	-0.013(0.000507)			
		Bracket I.D.	32 (1.260)	-0.008(0.000312) -0.033(0.001287)			
	Shaft to oil seal fit		25 (0.984)	-0.03(0.000507) -0.013(0.000507)			
	Governor lining thickness		2.5 (0.0984)			2.0 (0.078)	
	Spring 150-43-14421	Free length	53.5 (2.1065)			51.2 (2.0158)	
		As-Installed length	42 (1.654)				
		Load	56 kg (123 lb)	± 5.6kg (12.34587lb)		45 kg (99 lb)	
	Spring 150-43-1495(	Free length	43.2 (1.7008)				
		As-installed length	35 (1.378)			41.4 (1.6296)	
		Load	8 kg. (18 lb)			6.4 kg (14lb)	
	Spring 154-44-1246(	Free length	79 (3.110)			81 (3.189)	
		As-Installed length	85 (3.346)				
		Load	5.36 kg (12 lb)			3.6 kg (8 lb)	

Maintenance Standards

Unit : mm (in)

System	Item		Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
TRACK	Link pitch		216 (8.510)	± 0.1 (0.0039)	*219 (8.628)	227 (8.943)	 Note : *When maximum value is reached, repair by inverting pin and bush. Other worn parts can be repaired by depositing
	Single-grouser height	A	65 (2.559)	±1 3(0.118)	25 (0.984)	20 (0.787)	
	Link height		123 (4.846)	±0.1	115.5 (5.2195)	113 (4.412)	
	Bush O.D.		71 (2.795)	+ 0.314 (0.0 12246) +0.174(0.006786)	*68 (2.667)	59 (2.323)	
	Bush to link fit			0.102~ 0.314 (0.003978 ~ 0.012246)			
	Pin to link fit	Pin	47 (1.850)	0.138~ 0.3 (0.005382~ 0.117)			
		Link	46.8 (1.8422)				
	Pin to bush clearance			0.1~ 0.7 (0.0039 ~ 0.0273)			
	Master bush to link fit			0.102 -0.314 (0.003978 - 0.0 12246)			
	Master pin to link fit			0.078~ 0.17 (0.003042 ~ 0.00663			
	Master pin to master bush clearance			0.3 ~ 0.8 (4.0117~ 0.0312)			
	Shoe bolt torque limit		87 kg.m (629.271 ft.lb)	±7 kg.m (50.631 ft.lb)			
TRACK FRAME GROUP	Track center-to-center distance		2000 (78.8)			15 (0.591)	per 1000mm (39.4 in) of length
	Track frame distortion					7 (0.276)	per 300mm (11.82
	Track frame twist					3 (0.118)	
	Idler-side track frame opening					5 (0.197)	
	Guard to track pin clearance	A		12(0.472)		20 (0.787)	
	Guide width	A	134 (5.279)			140 (5.475)	
	Guide width	B	132 (5.200)				
	Guide-to-track frame clearance	C		0.5(0.0195)	*3 (0.118)	3 (0.118)	
	Guide to-track frame clearance	D		2(0.078)			

Unit : mm (in)

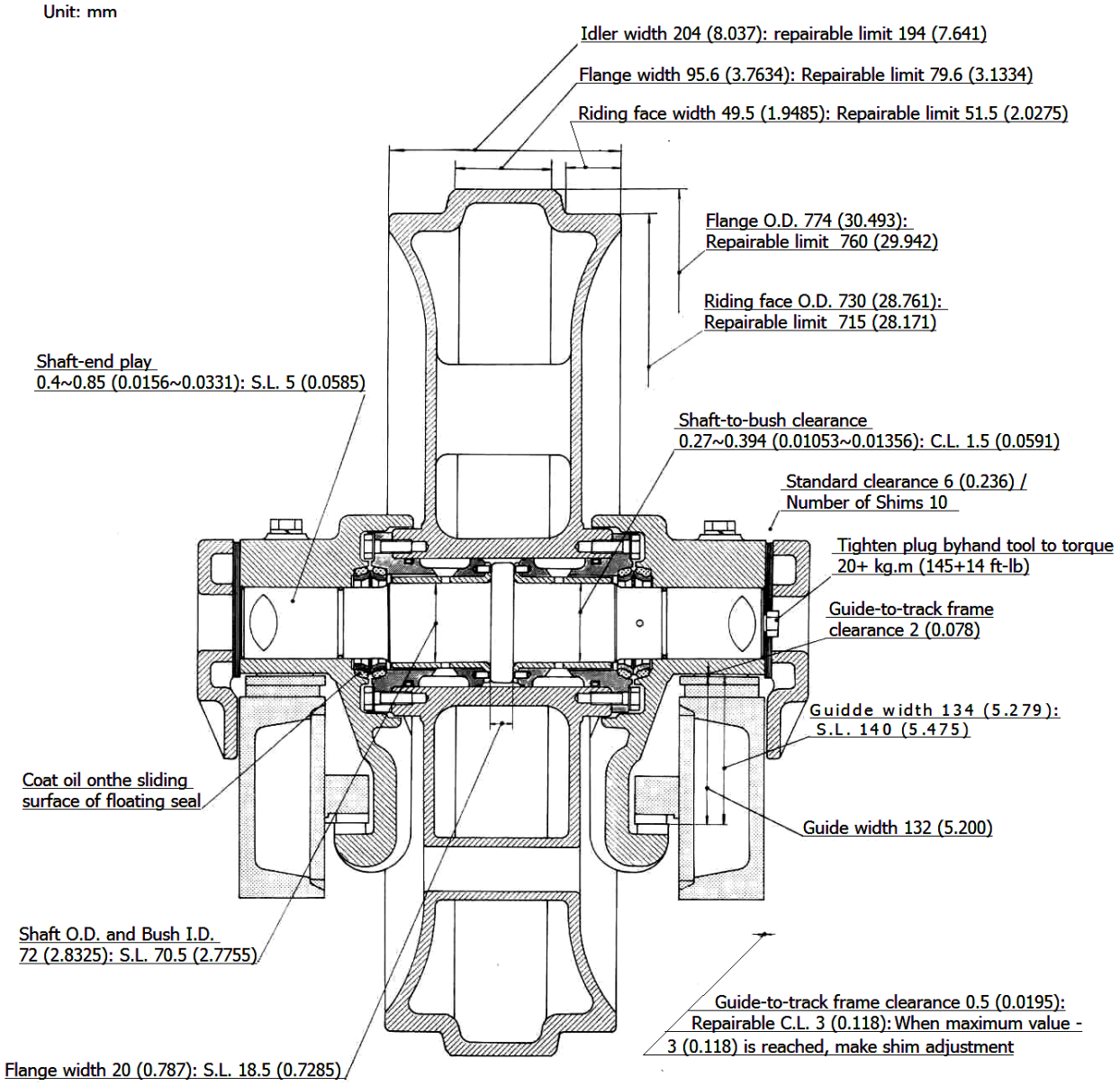
System	Item			Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
TRACK FRAME GROUP	Idler	Flange O.D.	A	774 (30.493)		760 (29.942)		
		Riding face O.D.	B	730 (28.761)		715 (28.171)		
		Flange width	C	95.6 (3.7634)		79.6 (3.1334)		
		Riding face width	D	49.5 (1.9485)		51.5 (2.0275)		
		Idler width	E	204 (8.037)		194 (7.641)		
		Shaft end play			0.4 ~ 0.85 (0.0156~0.0331)		1.5 l (0.0591)	
		Shaft to bush clearance			0.27~0.394 (0.01053~0.015366		1.5 (0.0591)	
		Shaft O.D.	F	72 (2.835)	-0.21 (0.000819) -0.26(0.01014)		70.5 (2.7755)	
		Shaft flange width	G	20 (0.787)	-0.05(0.00195)		18.5 (0.7285)	
	Track Roller	Flange O.D.	A	257 (10.1124)	±0.5(0.0195)	247 (9.730)		
			A	249 (9.809)		239 (9.415)		
		Riding face O.D.	B	222 (8.746)	±0.5(0.0195)	207 (8.156)		
		Riding face width	C	55.6 (2.188)		66.6 (2.6214)		
			C	51.6 (2.244)		68.6 (2.7004)		
		Flange width	D	17.3 (0.6811)		6 (0.236)		
			D	18.2 (0.7168)		6 (0.236)		
		Shaft end play			0.4 ~ 0.85 (0.0 156 ~ 0.03315)		1.5 (0.0591	
		Shaft-to-bush clearance			0.27~0.394 (0.01053 ~ 0.01536)		1.5 (0.0591)	
		Roller-to-bush clearance			0.017 ~ 0.15 (0.0066 ~ 0.0059)			
		Shaft O.D.	E	70 (2.756)	-0.21(0.00819) -0.26(0.01014)		68.5 (2:6965)	
		Shaft flange width	F	20 (0.787)	-0.05(0.00195)		18.5 (0.7285)	
	Carrier Roller	Flange O.D.	A	200 (7.88)		190 (7.483)		
		Riding face O.D.	B	168 (6.577)		155 (6.105)		
		Ridlng face width	C	57 (2.244)		66 (2.598)		
		Flange width	D	16 (0.630)		7 (0.276)		
		Roller end play			0.1 ~ 0.13 (0.0039 ~ 0.00507)			
		Tapered roller bearing	Shaft O.D.	55 (2.165)	+0.021 (0.000819) + 0.002(0.00078)			
			Roller I.D.	100 (3.9)	-0.024(0.000936) -0.059(0.002301)			

Maintenance Standards

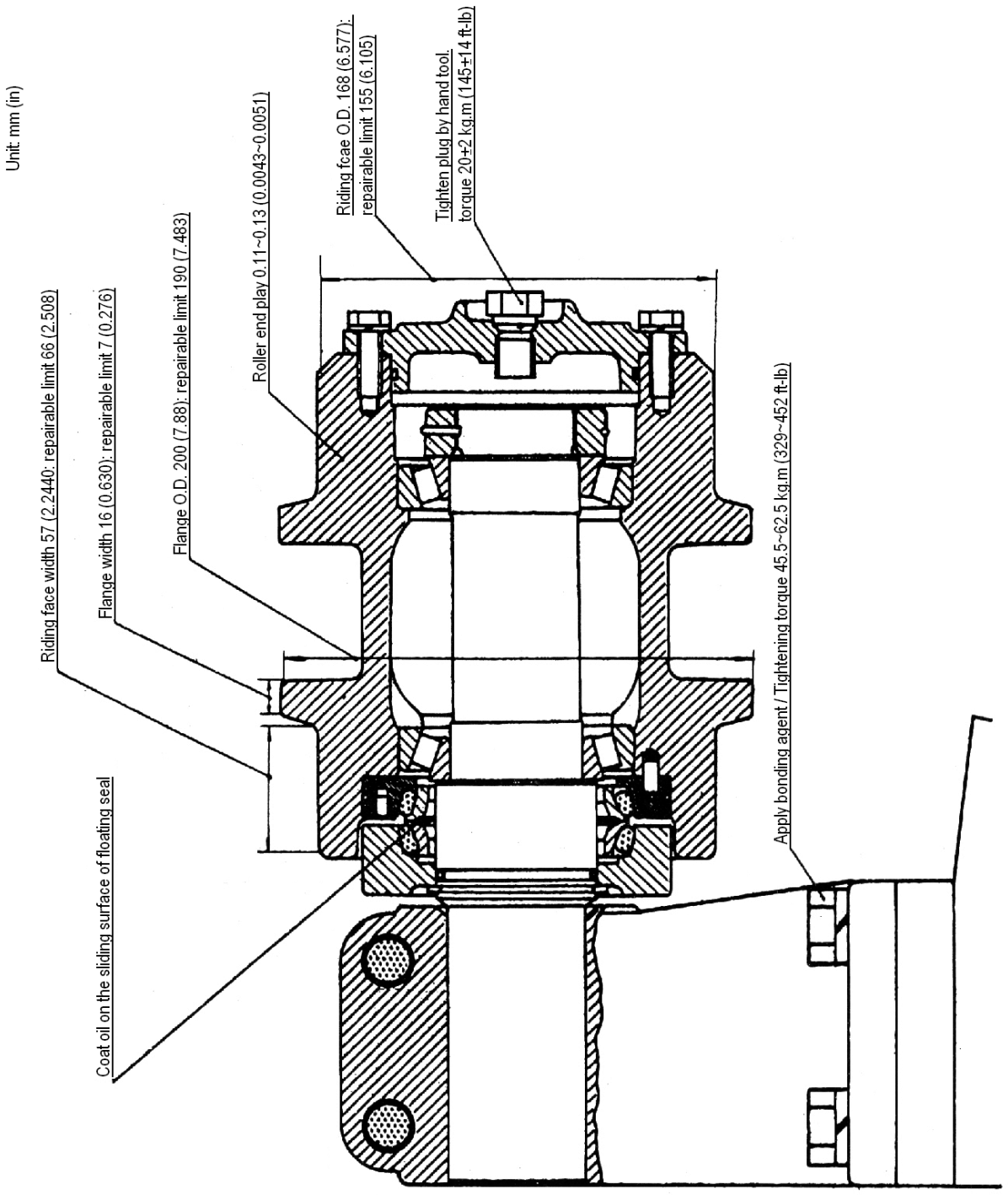
Unit : mm (in)

System	Item		Basic Size	Standard Clearance or Asembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
TRACK FRAME GROUP	Floating Seal	Step in mating face	0.7 (0.0273)	± 0.2(0.0078)			
		Surface roughness		0.2 ~ 5(max) (0.0078 ~ 0.197)			
	Recoil spring	Free Length	823 (32.426)			803 (31.638)	
		As-installed Length	675 (26.593)				
		Load	14050 kg (30974lb	± 1125 kg (2480 lb)		12250 kg (27006 lb)	
		Adjusting cylinder-to-bush Clearance	100 (3.94)	0.086 ~ 0.21 (0.00335 ~ 0.00819)		0.5 (0.0195)	
		Clearance between sprocket wheel Shaft and diagonal brace bush	90 (3.543)	0.036 ~ 0.106 (0.001404 ~ 0.004134		0.5 (0.0195)	

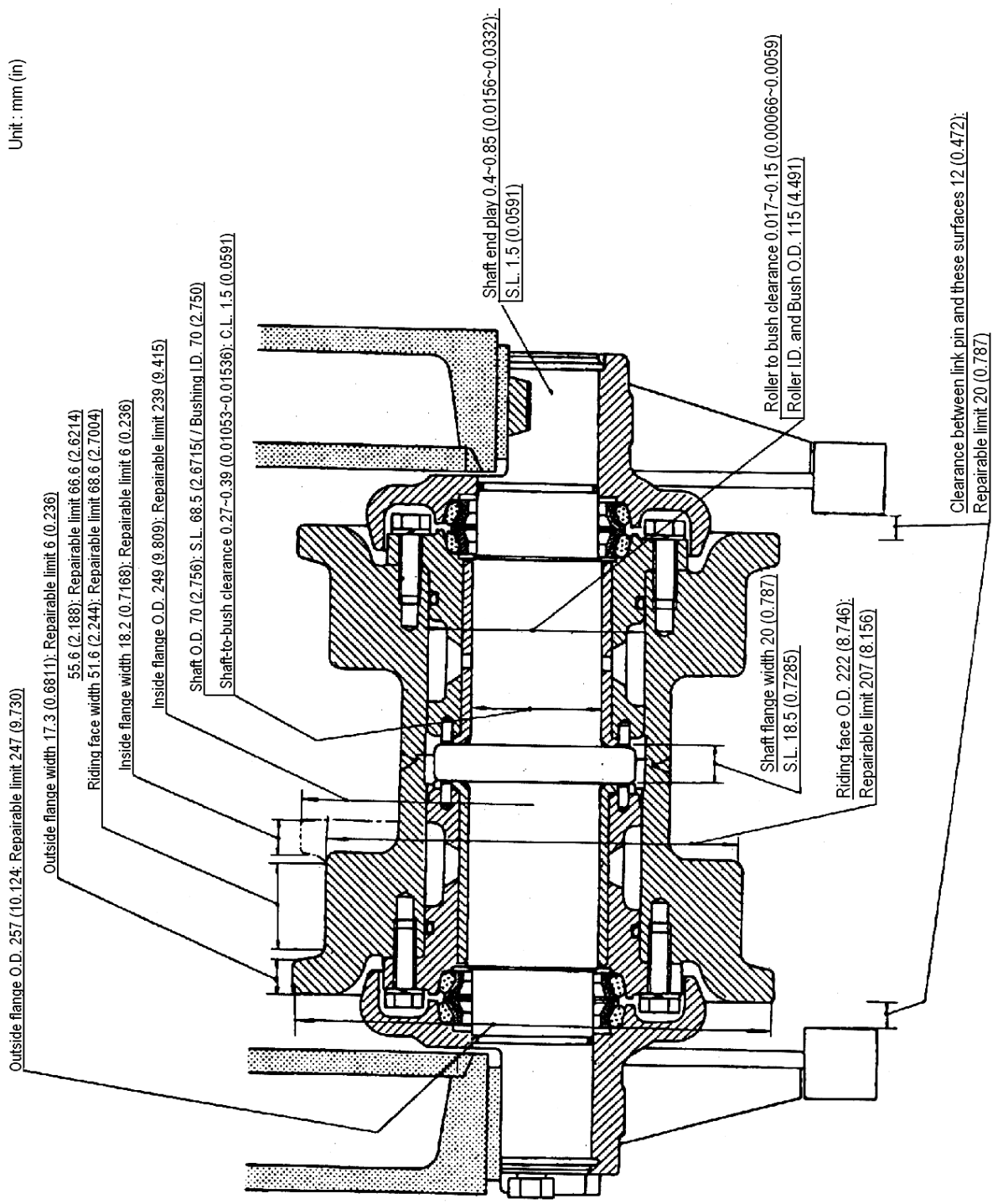
IDLER


Unit: mm
Idler width 204 (8.037): repairable limit 194 (7.641)
Flange width 95.6 (3.7634): Repairable limit 79.6 (3.1334)
Riding face width 49.5 (1.9485): Repairable limit 51.5 (2.0275)
Flange O.D. 774 (30.493):
Repairable limit 760 (29.942)
Riding face O.D. 730 (28.761):
Repairable limit 715 (28.171)
Shaft-end play
0.4~0.85 (0.0156~0.0331): S.L. 5 (0.0585)
Shaft-to-bush clearance
0.27~0.394 (0.01053~0.01356): C.L. 1.5 (0.0591)
Standard clearance 6 (0.236) /
Number of Shims 10
Tighten plug byhand tool to torque
20+ kg.m (145+14 ft-lb)
Guide-to-track frame
clearance 2 (0.078)
Guidde width 134 (5.279):
S.L. 140 (5.475)
Coat oil onthe sliding
surface of floating seal
Guide width 132 (5.200)
Shaft O.D. and Bush I.D.
72 (2.8325): S.L. 70.5 (2.7755)
Guide-to-track frame clearance 0.5 (0.0195):
Repairable C.L. 3 (0.118): When maximum value -
3 (0.118) is reached, make shim adjustment
Flange width 20 (0.787): S.L. 18.5 (0.7285)

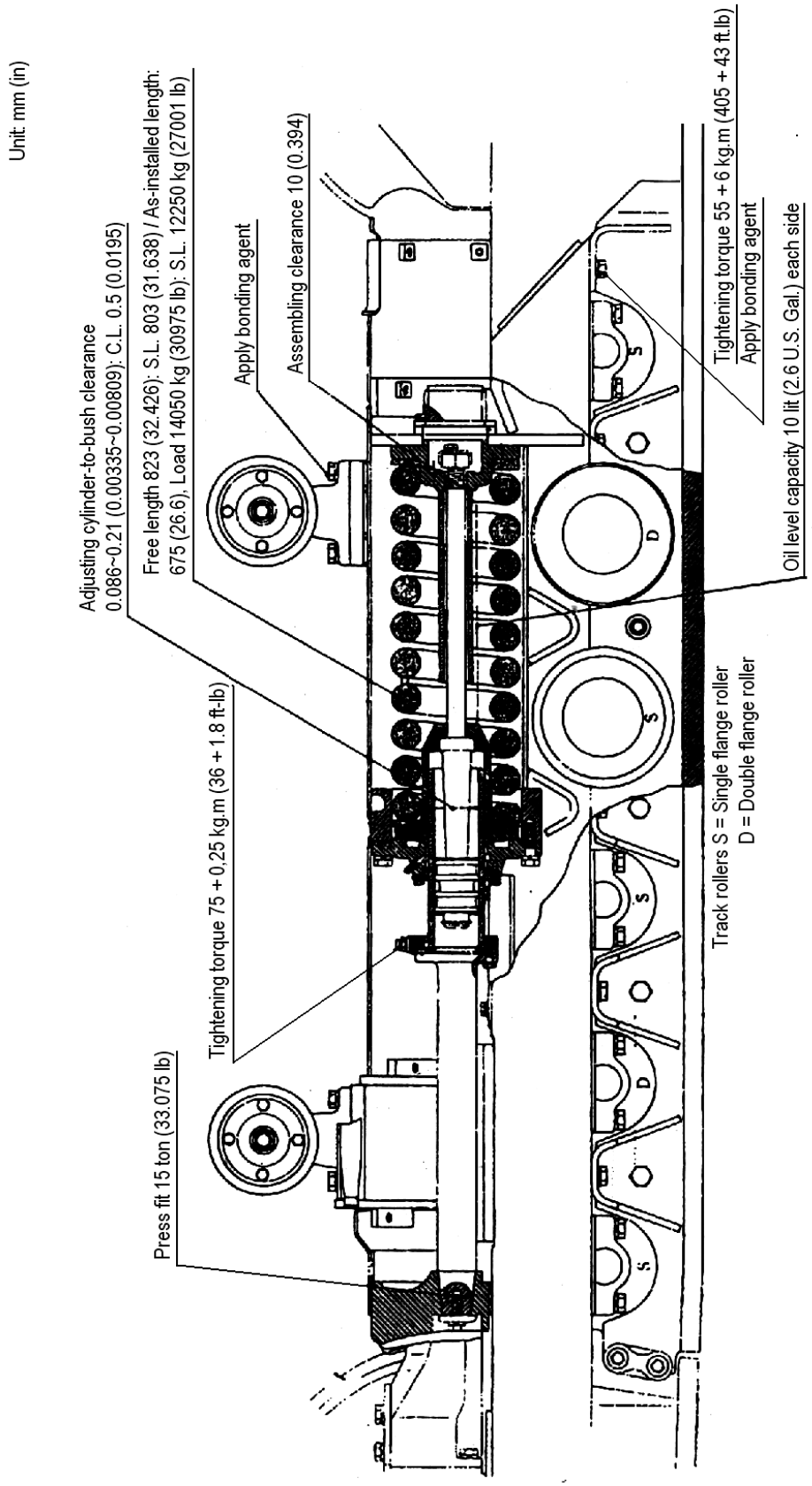
CARRIER ROLLER



TRACK ROLLERS



TRACK FRAME GROUP



Unit : mm (in)

System	Item		Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
HYDRAULIC STYSTEM	Blade Lift Cylinder	Piston O.D. A	120 (4.727)	-0.4(0.0156) -0.8(0.0312)			Piston ring 
		Piston ring O.D. B	120 (4.727)	-0.12(0.00468) -0.26(0.01014)			
		Piston to piston ring clearance C		0.14 ~ 0.68 (0.00546 ~ 0.02652)		0.1 (0.0039)	
		Piston rod O.D. and bush I.D. (1.969)	65 (2.559)	0.155 ~ 0.249 (0.006045 ~ 0.009711)		1 (0.039)	
		Ball bearing I.D. and pin O.D.	50 (1.969)	0.050 ~ 0.151 (0.00195 ~ 0.005889)		1 (0.039)	
		Cylinder trunnion to bush fit	65 (2.559)	0.100 ~ 0.220 (0.0039 ~ 0.00858)		1 (0.039)	
		Yoke to bush (large) fit	115 (4.531)	0.072 ~ 0.180 (0.002808 ~ 0.00702)		1 (0.039)	
		Yoke to bush (small) fit	76 (2.992)	0.060 ~ 0.152 (0.00234 ~ 0.(0.05928)		1 (0.039)	
	Control Valve	Spool to valve body fit	45 (1.772)	0.020 ~ 0.025 (0.00078 ~ 0.000975)	0.035 (0.001365		
		Check valve to valve body fit	38 (1.496)	(0.025 ~ 0.089 (0.000975 ~ 0.003471			
		Relief valve to valve body fit	38 (1.496)	0.020 ~ 0.030 (0.00078 ~ 0.00117)	0.04 (0.00156)		
		Suction valve to valve body fit	44 (1.732)	0.020 ~ 0.030	0.04		
		Safety valve to valve body fit	24 (0.945)	0.015 ~ 0.020 (0.000585 ~ 0.00078)	0.030 (090117)		
		Safety valve to valve Bodyfit	7 (0.276)	0.012~0.025 (0.000468 ~ 0.000975)	0.035 (0.001365		
		Spring 154-60-11831	103 (4.058)			94.2 (3.7088)	
			72 (2.835)				
			12 kg (26lb)	± 0.5 kg (1.1 lb)		0.6 kg (2.1 lb)	
		Spring 980-78-14180	95.3 (3.7517)			91.5 (3.6025)	
			76 (2.992)				
			7.5 kg (17 lb)	± 0.7 kg (1.5 lb)		6.0 kg (13 lb)	
		Spring 154 60 11280	72.5 (2.8545			67.2 (2.6458)	
			46 (1.8)				
			13.76 kg (30lb)	± 0.6 kg (1.3 lb)		11.0 kg (24 lb)	
		Spring 110 eV 11132	44.4 (1.7476)			43.2 (1.7008)	
			38 (1.496)				
			24.8 kg (55 lb)	± 0.99 kg (2.2 lb)		20.0 kg (44 lb)	
		Spring 154-60-11930	94.2 (3.7088				
			50 (1.969)				
			1.32 kg (2.9 lb)	± 0.053 kg (0.11 lb)		1.2 kg 2.6 lb)	

Maintenance Standards

Unit : mm (in)

System	Item			Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
HYDRAULIC STYSTEM	Control Valve	Spring 141-60-12561	Free length	66.4 (2.6136)			65.5 (2.5785)	
			As-Installed length	60.25 (2.37175)				
			Load	23.35 kg (51 lb)	± 0.7 kg (1.5 lb)		20 kg (44 lb)	
		Spring 141-60-12570	Free length	69.4 (2.7326)			68.75 (2.70625)	
			As-installed length	66.25 (2.60775)				
			Load	8.82 kg (19 lb)	+0.4 kg (0.9 lb)		7.0 kg (15 lb)	
		Spring 154-60-12240	Free length	111.5 (4.3925)				
			As-installed length	50 (1.96)				
			Load	15 kg (33 lb)	± 0.5 kg (1.1lb)		12 kg (26 lb)	
	Ripper Cylinder	Piston ring O.D. and cylinder tube I.D.		150 (5.909)	-0.075 (0.002925) + 0.15(0.00585)		0.5 (0.0195)	
		Piston rod O.D. and bush I.D.		65 (2.559)	0.247-0.507 (0.009633 ~ 0.019773)		1 (0.0394)	
		Pin O.D. and bush I.D.		75 (2.953)	0.100 ~ 0.344 (0.0039 ~ 0.013416)		1 (0.0394)	
	Tilt Cylinder	Piston ring O.D. and cylinder tube I.D.		225 (8.858)	-0.096(0.0037) +0.15(0.0059)		0.5 (0.0195)	
		Piston rod and bush I.D.		90 (3.543)	- 0.120 ~ 0.261 (0.0047 ~ 0.01012)		1 (0.0394)	
		Pin O.D. and bush I.D.		60 (2.362)	0.5 ~ 0.8 (0,0195 ~ 0.0312)			
	Hydraulic Oil Pump	Gear-to-bush clearance			0.10 ~ 0.15 (0.0039 ~ (0.00585)		0.20 (0.0078)	Clearance as measure in this place 
		Case-to-bush clearance			0.050 ~ 0.070 (0.0020 ~ 0.0027)			
		Bush-to- bush clearance			0.03 ~ 0.05 (0.0012 ~ 0.0020)			
		Gear top clearance		84 (3.307)	0.090 ~ 0.120 (0.0035 ~ 0.0047)		0.135 (0.0052)	
		Depth of score mark on case bore			0 ~0.02(0.00078)			
		Fit on needle bearing	Bush	56.5 (2.2245)	-0.003(0.00012) -0.006(0.00023)			
			Shaft	38 (1.496)	0.025 ~ 0.051 (0.0010 ~ 0.0020)	0.10 (0.0039)		
		Gear	Backlash		0.19 ~ 0.31 (0.0074 ~ 0.0121)		0.45 (0.0176)	
		Full length of bush	Braket side	42.5 (1.673)	-0.020(0.00078)		42.1 (1.657)	
			Cover side	44.5 (1.752)	-0.020(0.00078)		44.1 (1.736)	
		Parts Dimensions	Shaft dia.	38 (1.496)	-0.010(0.00039)			
			Bush I.D.					
			Case bore dia.	84 (3.307)	+0.035 (0.001365) + 0.015 (0.000585)			

Unit : mm (in)

System	Item			Basic Size	Standard Clearance or Assembly Standard	Repairable Size Limit	Clearance Limit or Service Limit	Remarks
HYDRAULIC STYSTEM	Hydraulic Oil Pump	Parts Dimensions	Gear O.D.	84 (3.307)	-0.130(0.00507) -0.145(0.005655)			
			Spline displacement over three teeth	13.656 (0.53758)	-0.087(0.003393) -0.129(0.005031)			Backlash 0.30 (0.012)
		Bolt Tightening Torque Kg. m (ft. lb)		15 ~ 18 (108 ~ 130 ft. lb)				
		Capacity		Discharge pressure	140 kg/cm² (1991 PSI)	Oil temperature 45 ~ 55°C (113 ~ 131° F)		

Performance criteria

Pump RPM	Actual capacity l/min	Calculated capacity l/min	Volumetric efficiency %
1000	142.5 min.	162.0	88 min.
2000	301.0 min.	324.0	93 min.

Service limit

1000	113.5		70
2000	275.5		85

Notes