FIATALLIS

HD-7
HD-10
HD-14

crawler tractors

SERVICE MANUAL

complete

Form 70626143 English
1/90

SERVICE MANUAL

FOR

HD7-HD10-HD14

DIESEL TRACTORS

FOURTH EDITION — REVISED

JANUARY 1 - 1949

PROPERTY OF

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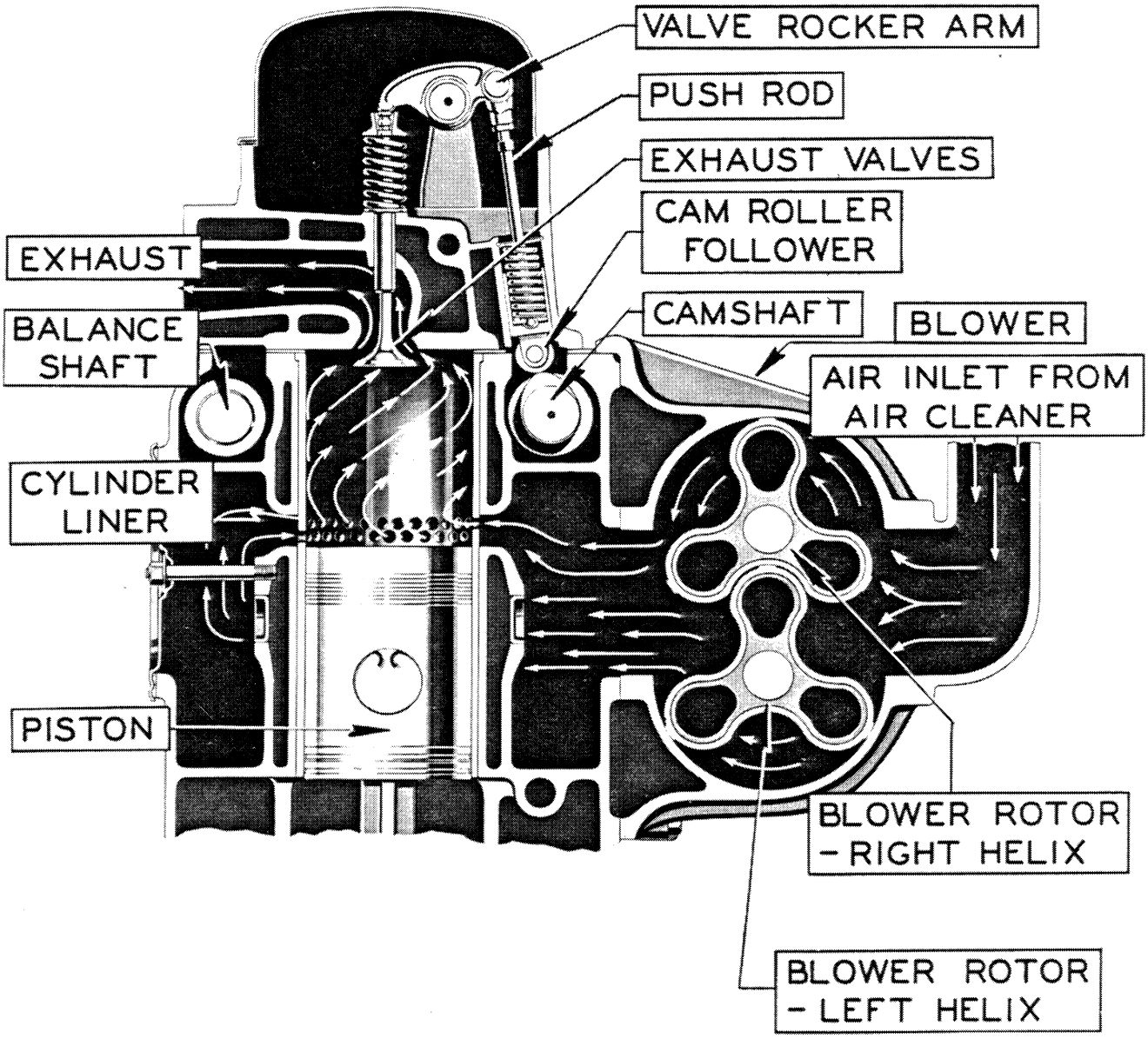
LITHO. IN U. S. A.

FRONT IDLERS			
Number on Each Side	1	1	1
Type of Seal	Positive	Positive	Positive
Type of Bearing	Tapered Roller	Tapered Roller	Tapered Roller
Lubrication Intervals	1000 hours	1000 hours	1000 hours
GENERAL DIMENSIONS			
Overall Length	10' 7¼"	12' 6-7/16"	13' 3"
Overall Height (without stacks)	5' 6-9/16"	6' 3⅛"	6' 8"
Overall Width—Narrow Tread	6' 10"	6' 10-11/16"	
Wide Tread	7' 9"	7' 10-11/16"	7' 7¾"
Ground Clearance	9-13/16"	11⅝"	13½"
Drawbar Height	11⅜"	14-5/32"	15⅝"
Lateral Drawbar Movement	19½"	32"	30"
CAPACITIES			
Cooling System	5¾ gal.	9¾ gal.	12 gal.
Crankcase	11 qts.	13 qts.	14 qts.
Transmission Case	26 qts.	28 qts.	40 qts.
Final Drive (each)	7 qts.	8 qts.	8 qts.
Fuel Tank	31 gal.	44 gal.	68 gal.
Track Release Spring Housing (each)	4 qts.	7½ qts.	13 qts.
Air Cleaner	2½ qts.	2 qts.	2½ qts.
POWER PULLEY			
Pulley Diameter	10 or 12"	13⅜"	18 or 20"
Pulley Width	8¾"	10"	15"
Pulley R.P.M.	889	412 and 929	405 and 650
Belt Speed—Foot Per Minute	2327 and 2793	1443 and 3253	2121 and 3400
Direction of Rotation (Viewed from life side of tractor)	Clockwise	Clockwise	Clockwise
STRAIGHT POWER TAKE-OFF			
Shaft R.P.M. at Rated Engine Speed	889	192 and 430	935 and 1500
Direction of Rotation (Viewed from rear of tractor)	Counter Clockwise	Counter Clockwise	Counter Clockwise
REVERSIBLE REDUCTION POWER TAKE-OFF			
Shaft R.P.M. at Rated Engine Speed	Clockwise 336 Counter Clockwise 269	Clockwise 191 & 430 Counter Clockwise 148 and 334	
NON-REVERSIBLE REDUCTION POWER TAKE-OFF			
Shaft R.P.M. at Rated Engine Speed	574		
Direction of Rotation (Viewed from rear of tractor)	Clockwise		

The Allis-Chalmers Manufacturing Company reserves the right to make changes in the above specifications or to add improvements at any time without notice or obligation.



AIR FLOW THROUGH ENGINE

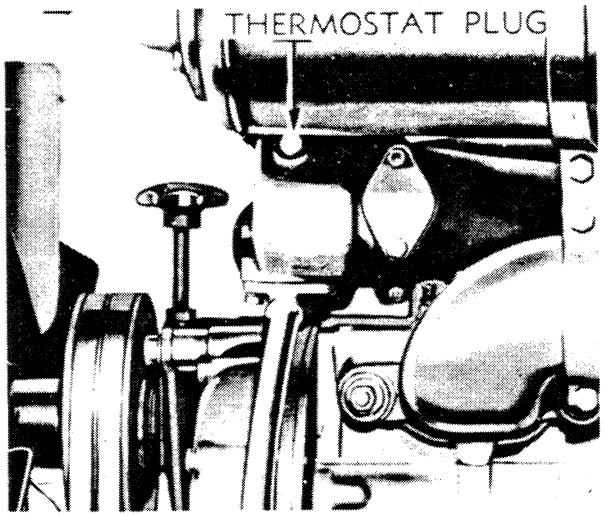


FIG. 7

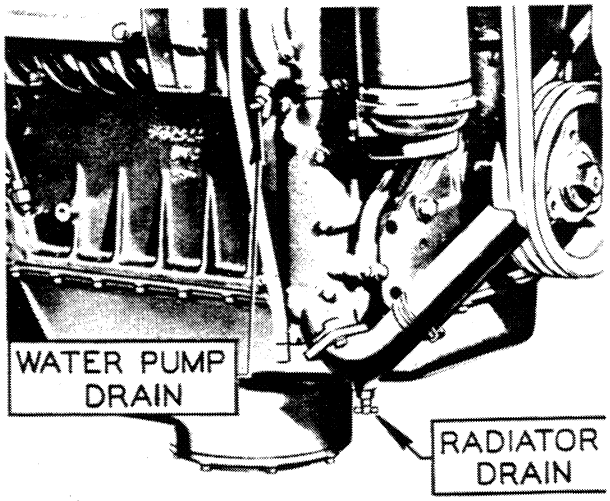


FIG. 9

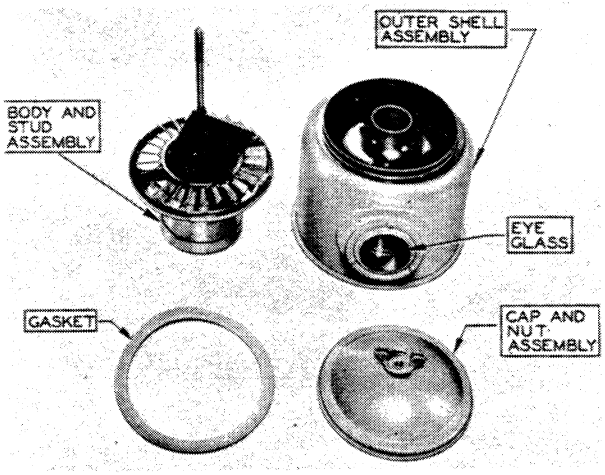


FIG. 8

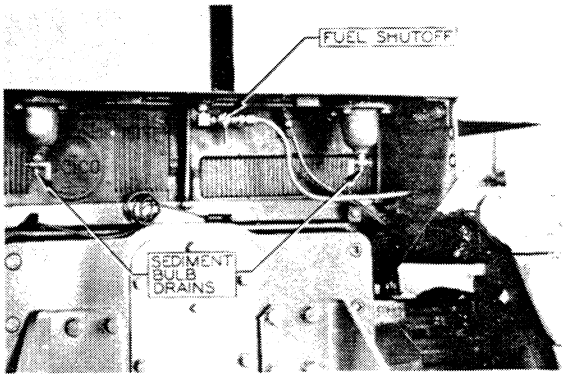


FIG. 10

lubricator which is included in the tool equipment.

Before lubricating the truck wheels, wash the ends of the shafts and the nozzle of the lubricator hose thoroughly. Before inserting the nozzle into the truck wheels, pump the lubricator plunger up and down several times to make sure that it is discharging the full amount of lubricant.

Remove the plug from the end of the truck wheel shaft and insert the nozzle into the shaft as far as it will go (approximately 6 inches). Holding the nozzle firmly in position, pump the lubricant slowly into the wheel. The plunger should be lifted slowly and to its full height so that the full amount of lubricant will be drawn into the plunger barrel.

Pump the new lubricant in slowly until all the old lubricant is removed and new lubricant can be seen coming out along the outside of the nozzle. This will indicate the wheel is full of clean lubricant.

CAUTION: Never put too much pressure on the lubricator handle because of the danger of developing extreme pressure which is injurious to the truck wheel seals. Immediately after injecting the lubricant into the wheel assembly, replace the plug and gasket to prevent the new lubricant from running out. The nozzle should always be inserted into the carrying handle when the lubricator is not in use to prevent dirt from entering the nozzle hose. Refer to Figure 2.

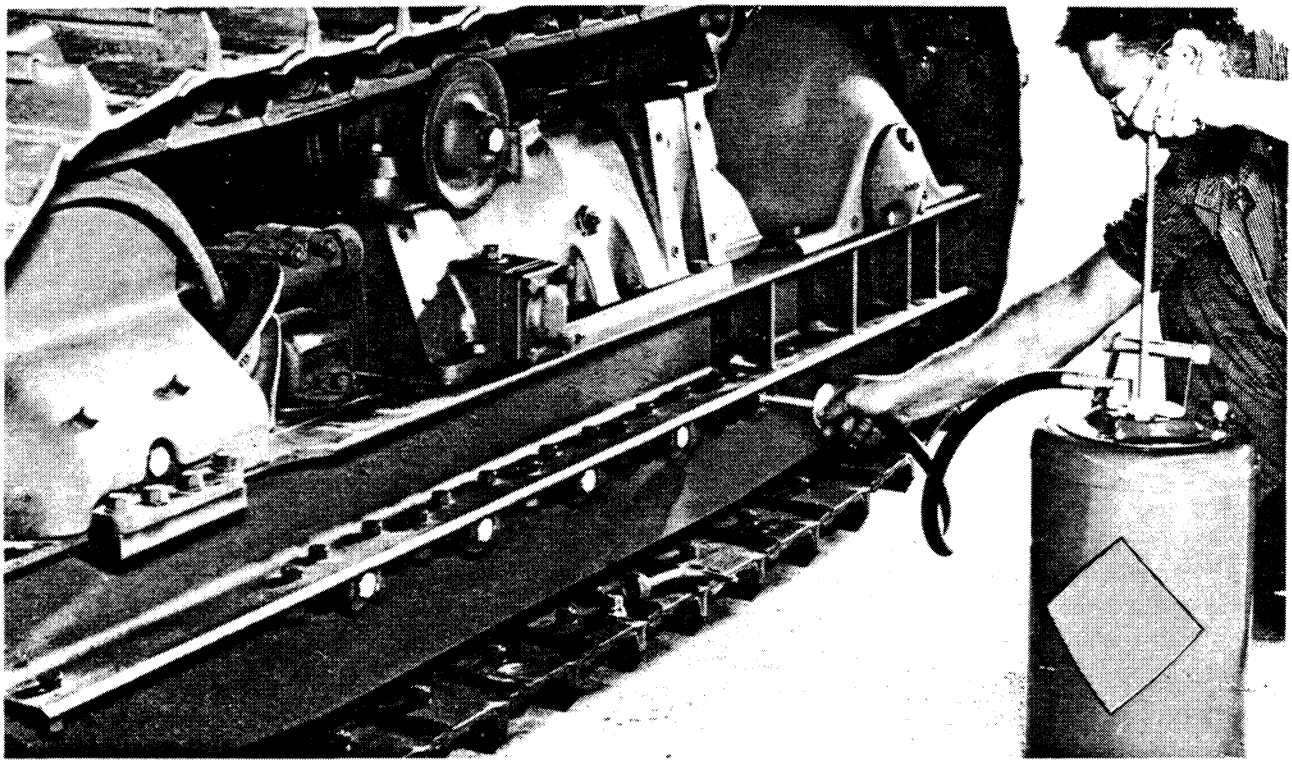


FIG. 2

Servicing Oil Truck Wheels

7 -- Front Idler Lubrication

The front idlers are positive sealed and are lubricated at the same time intervals, in the same manner, and with the same lubricant as the truck wheels.

8 -- Support Roller Lubrication

The support rollers are lubricated at the same time intervals, in the same manner, and with the same lubricant as the truck wheels and front idlers.

NOTE: Truck wheels, front idlers and support rollers that are being operated with oil can be grease-packed in the field without removal from the tractor, providing they are in good condition, however, customers preferring to continue to use oil may do so on assemblies containing oil. If oil is used, it should be a brand on our approved list and the interval should remain at 200 hours.

IMPORTANT: Be absolutely certain that the assembly is in good condition and that there is no excessive oil leakage before packing with grease in the field. Inspect the assembly for end play and any looseness. To inspect the truck

shutter should be adjusted so that an operating temperature of 175 to 185 F. is maintained at all times.

11. Inspect the oil pressure. At full governed speed and with the engine heated to normal operating temperature, the oil pressure should be between 25 and 35 on the gauge; at part throttle the reading may drop to about 5 on the gauge. If the oil is cold, no pressure may register for about 15 seconds after the engine starts, but if the pressure does not rise to between 25 and 35, the engine should be stopped and the cause determined.
12. Inspect the fuel oil pressure. The fuel pressure at full governed speed should be between 25 and 65 on the gauge.
13. Open the throttle to meet the operating conditions.
14. For extremely low temperatures 0 F. or lower use the Engine Pre-Heater. See Topic 47, "Engine Pre-Heater."
15. In cold weather (+32 F. to 0 F.) when it is necessary to use the Air Heater, proceed as stated above for the first eight operations. Then turn the dash light switch on, press on the air heater switch, pump the air heater pump handle slowly, and press on the starter pedal all at the same time. The air heater will heat the air box and aid starting. Then proceed as stated above.

WARNING: Do not operate the air heater before stepping on the starter pedal.

B. USE OF GEAR SHIFTING LEVERS

Two levers are used on the "HD 10" and "HD 14" to shift gears; only one lever is used on the "HD 7."

Both gear shift levers are provided with a locking device to hold them in the desired gear. The auxiliary shift lever must be moved sideways to the left to unlock it when shifting. The gear shift lever must be moved sideways away from the neutral position when it is desired to shift into another gear.

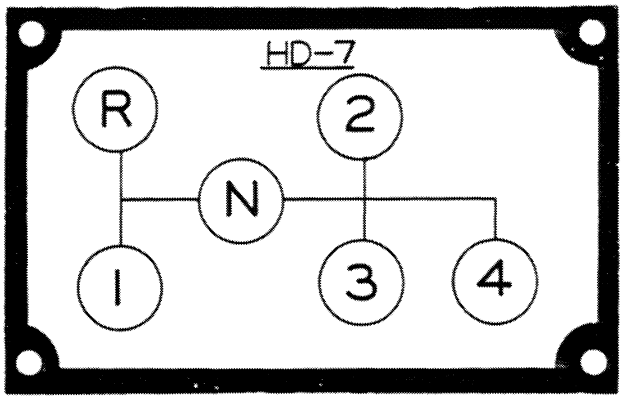
The following charts shows the positions of the gear shift levers to obtain any of the forward and reverse speeds:

Refer to the gear shift chart on dash of Tractor for the correct positions for the various speeds.

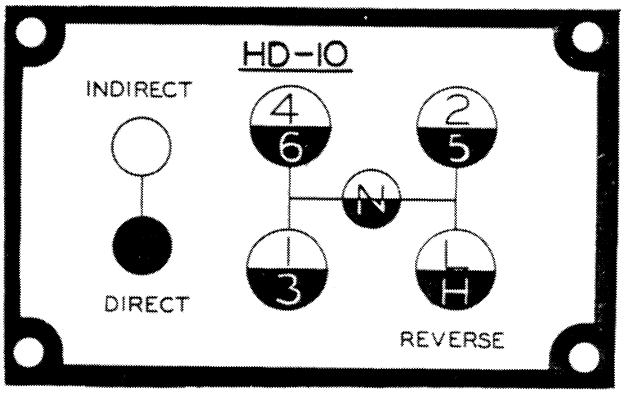
The "HD 7" has only one gear shift lever. The various gears are as follows:

Gear	*Gear Shift Lever*
First	Left and Back
Second	Right and Forward
Third	Right and Back
Fourth	Extreme Right and Back
Reverse	Left and Forward

HD-7 GEAR SHIFT CHART

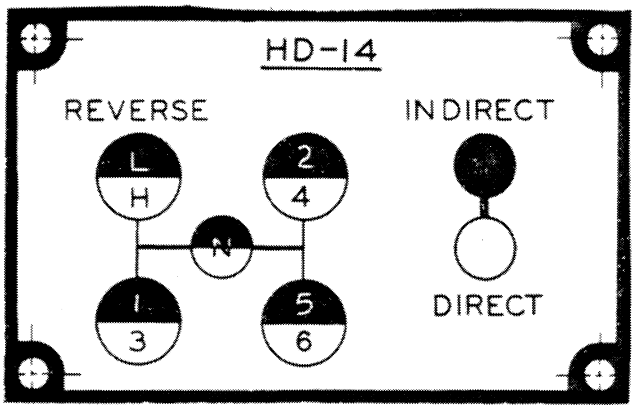


HD-10 GEAR SHIFT CHART



Gear	*Gear Shift Lever*	*Auxiliary Lever*
First	Left and Back	Indirect
Second	Right and Forward	Indirect
Third	Left and Back	Direct
Fourth	Left and Forward	Indirect
Fifth	Right and Forward	Direct
Sixth	Left and Forward	Direct
Low Reverse	Right and Back	Indirect
High Reverse	Right and Back	Direct

HD-14 GEAR SHIFT CHART



Gear	*Gear Shift Lever*	*Auxiliary Lever*
First	Left and Back	Indirect
Second	Right and Forward	Indirect
Third	Left and Back	Direct
Fourth	Right and Forward	Direct
Fifth	Right and Back	Indirect
Sixth	Right and Back	Direct
Low Reverse	Left and Forward	Indirect
High Reverse	Left and Forward	Direct

Diagnosis	Corrections	Refer to Topic No.
4. Motor runs too hot.	Normal operating temperature 175° to 185° F.	18
5. Restrictions in oil passages.	Clean all oil passages.	85-C
6. Crankshaft bearing journal rough or out of round.	Grind or replace crankshaft.	81
7. Crankshaft out of alignment.	Straighten or install new shaft.	81
8. Bent connecting rod.	Align rod or install new.	83
9. Low oil pressure.	Minimum, 5 pounds at low idle, 25 to 35 at high idle.	25-J
10. Bearing loose.	Install new bearing and tighten cap	82-83
11. Sprung bearing insert.	Install new insert.	82-83
G. BURNED VALVES AND SEATS		
1. Improper (too little) valve lash.	Adjust to .012" lash.	44
2. Weak valve springs.	Install new springs	78
3. Valves sticking in guides.	Clean stems and guides. Install new parts if necessary.	78
4. Valve seats too wide.	Reseat to correct width.	78
5. Overheating motor.	See "Cooling Systems."	18
6. Unsuitable fuel.	Use a fuel of recommended specifications.	1
7. Excessive carbon deposits around seat and valve heads.	Clean and replace; reseat if necessary. All valves must be lapped in.	78
8. Warped valve head.	Install new valve.	78
H. VALVES STICKING		
1. Motor runs too cold.	Operate at 175° to 185° F. temperature.	18
2. Insufficient clearance between valve stem and guide.	Ream guides for proper clearance.	78
3. Weak valve springs.	Install new springs.	78
4. Broken valve springs.	Install new springs.	78
5. Valve stems scored or carboned.	Clean, if necessary install new valve.	78
6. Gummy deposits from inferior fuel or oil.	Clean and use suitable fuel or oil.	1
7. Clogged muffler.	Replace muffler.	
I. EXCESSIVE OIL CONSUMPTION		
1. Piston rings worn or broken.	Install new rings.	83
2. Crankcase gasket leaking.	Install new gasket.	89
3. Rear crankshaft seal leaking.	Install new seal.	81
4. Crankshaft wick carrying too much oil through.	Install new wick.	81
5. Front crankshaft seal leaking.	Install new seal.	81
6. Leaking blower gasket.	Install new gasket.	79
7. Leaking blower seals.	Install new seals.	79

Diagnosis	Corrections	Refer to Topic No.
B. TRUCK WHEEL BEARING FAILURE		
1. Foreign material in lubricant because of carelessness when servicing.	Keep lubricant clean, use clean containers and be clean about servicing.	1
2. Not using an approved truck wheel lubricant.	See Allis-Chalmers approved list.	1
3. Truck wheel not lubricated frequently enough.	GREASE LUBRICATED WHEELS—Lubricate every 1000 hours of operation. OIL LUBRICATED WHEELS—Lubricate every 200 hours of operation.	2-3-4

37 -- Support Rollers

A. EXCESSIVE WEAR ON FLANGES		
1. Truck frame out of line.	Straighten or rebuild frame.	120
2. Front idler out of line.	Adjust idler.	61
3. Stabilizer crank and links worn or damaged.	Repair or replace worn or damaged parts.	112-113-114
4. Tracks run too loose.	Adjust tracks.	119
5. Final drive sprockets bearings out of adjustment.	Adjust bearings.	109-B
6. Track rail assembly badly worn.	Repair or install new track rail.	119
B. OIL LEAKS		
1. Damaged or worn seals.	Install new seals.	108-109-110
C. BEARING FAILURE		
1. Foreign material in lubricant because of carelessness when servicing.	Keep lubricant clean, use clean containers and be clean about servicing.	8
2. Not using an approved lubricant.	See Allis-Chalmers approved list.	1
3. Support roller not lubricated frequently enough.	GREASE LUBRICATED ROLLERS—Lubricate every 1000 hours of operation. OIL LUBRICATED ROLLERS—Lubricate every 200 hours of operation.	2-3-4

38 -- Front Idler

A. EXCESSIVE WEAR ON FLANGES		
1. Track frame out of line.	Straighten or rebuild frame.	120
2. Stabilizer crank and links worn or damaged.	Build up, or install new parts.	112-113-114
3. Final drive sprocket bearings out of adjustment.	Adjust bearings.	109-B
4. Track rail assembly badly worn.	Repair or install new track rail.	119
5. Tracks run too loose.	Adjust tracks.	119

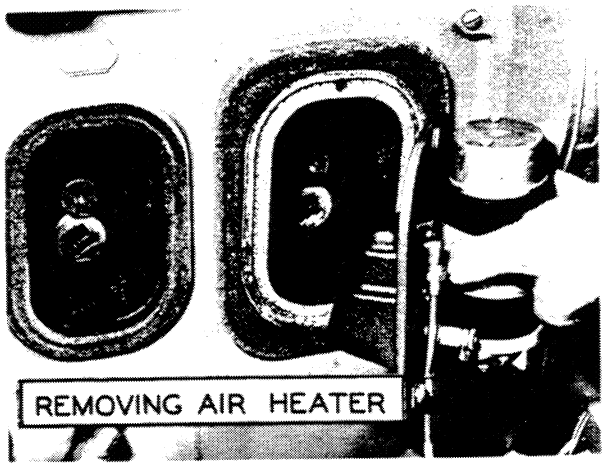


FIG. 3

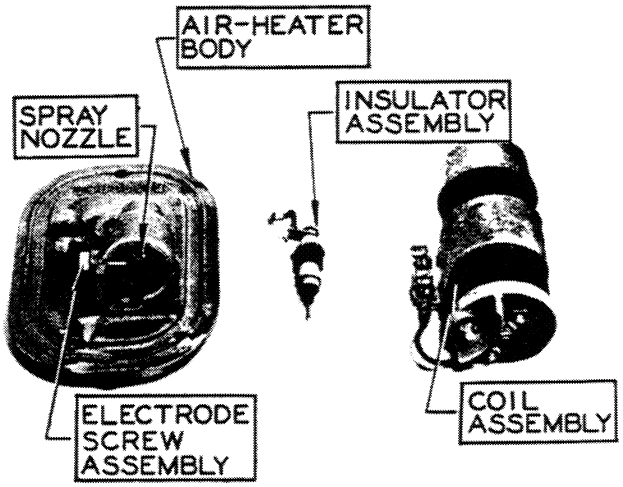


FIG. 4

has remained inoperative for a considerable period of time. It would be detected by a lack of pressure on the plunger when it is stroked. In this case, the leather must be replaced.

3. Pump leather worn or damaged. This also would be indicated by lack of pressure when the plunger is stroked and would require replacement of the leather. To install leathers, proceed as follows:
   a. Remove nut on outside of panel and withdraw plunger assembly.
   b. Remove retaining screw on end of plunger and remove leathers.
   c. Install new leathers and run retaining screw up tight. Use a few drops of oil to facilitate entering the assembly back into cylinder. Be careful that the edges of the entering leather are not torn or cracked in entering.
4. The inlet line to the heater pump may be loose or broken.

49 -- Dampener for Fuel Pressure Gauge

The dampener, installed on back of fuel pressure gauge, is designed to eliminate vibration of the recording hand of gauge.

HD Series Tractors manufactured prior to March 12, 1941 were not equipped with a fuel gauge dampener. Installation of this dampener can be easily made on tractors not so equipped.

For the HD-14 model, order #043952 dampener only.

For the HD-7 and HD-10, order the #043952 dampener and one each #907059 street ell and #040740 female coupling.

50 -- Generator Belt

To adjust the generator belt, loosen the capscrews in the generator adjusting link. Move the generator in or out as necessary to correct the adjustment and tighten capscrew. The adjustment is correct when the belt has about 1 inch slack measured halfway between the pulleys. Too tight a belt will cause bearing failure and undue wear on belt.

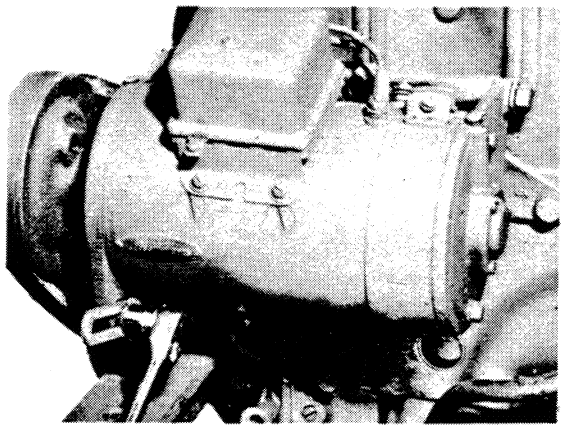


FIG. 1

64 -- Brake Irregularities and Corrections

A. BRAKE NOT HOLDING PROPERLY

1. Adjust brakes. Refer to Topics 57, 58 and 59.
2. Grease on lining. Wash out as outlined under steering clutch washing instructions.
3. Lining worn or torn off. Install new brake band assembly or reline band.
4. Pin out of brake band. Replace pin.

65 -- Track Irregularities and Corrections

A. TRACKS TOO LOOSE

1. Improper adjustment. Adjust so the track can be lifted 1½" to 2" off the track support roller.
2. Pins and bushings worn out. Remove track and install new pins and bushings.
3. Truck wheels worn out. Install new truck wheel or repair.
4. Front idler worn out. Install new idler, or repair.
5. Front idler out of alignment. Refer to Topic 61.
6. Stabilizer cranks and linkage worn. Refer to Topic 112, 113 and 114 "Stabilizer Crank Removal."
7. Sprung track frame. Rebuild as required.
8. Sprocket worn. Install new sprocket.

66 -- Adjustment on Hour Meter

The "fast" and "slow" adjusting screw on the back of the hour meter should never be turned more than ½ turn in either direction.

When the hour meter does not run at all it is advisable to inspect the ground. The later meters are grounded with a wire that fastens to the engine temperature gauge. The older meters are grounded through the meter case to the cowl without use of a wire.

If the meter is properly grounded and still does not run, connect the meter directly to the battery by shorting out the pressure switch. If the hour meter runs on this direct circuit, reconnect the hour meter through the pressure switch and adjust switch as follows:

1. Turn the idle adjusting screw on the governor tower back 1½ turns. Shut off motor.
2. Remove instrument panel being careful not to short the ammeter post on dash.
3. Remove seal, nut and cover on pressure switch.
4. Use a test light with two sharp probes on the end of the wires. (See sketch.) Insert one probe through wire from pressure switch to hour meter. Insert the other probe through black ground wire running from hour meter to temperature gauge on the 044902 meters, or ground probe to the meter case on the older meters. (Note: A test light is the most positive way to adjust switch; however, if the material for making one is not available the switch can be adjusted by observing the clock.)
5. Start the engine and run at low idle. Adjust contacts in pressure switch so that test light just lights at this engine speed,

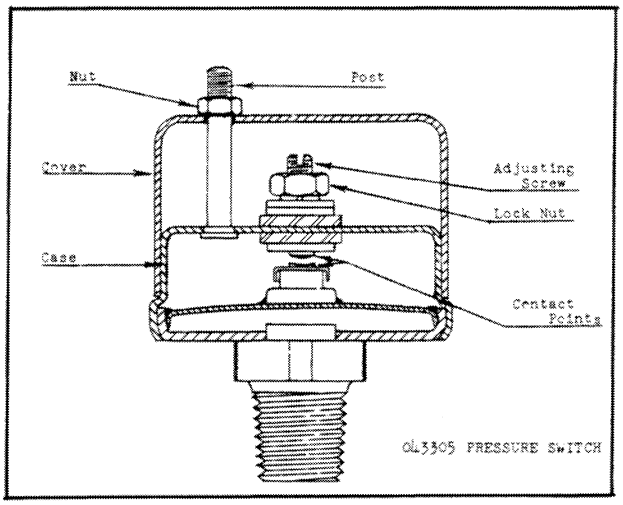


FIG. 1

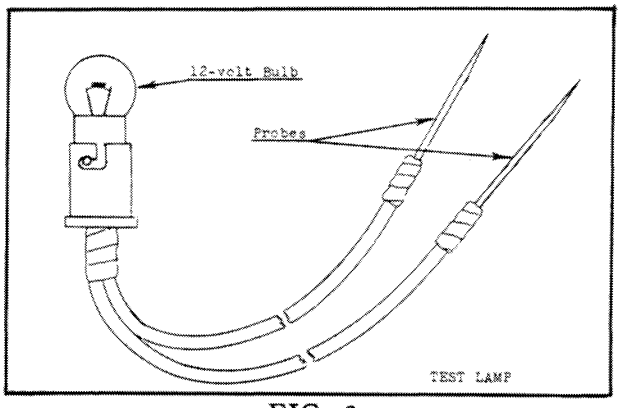
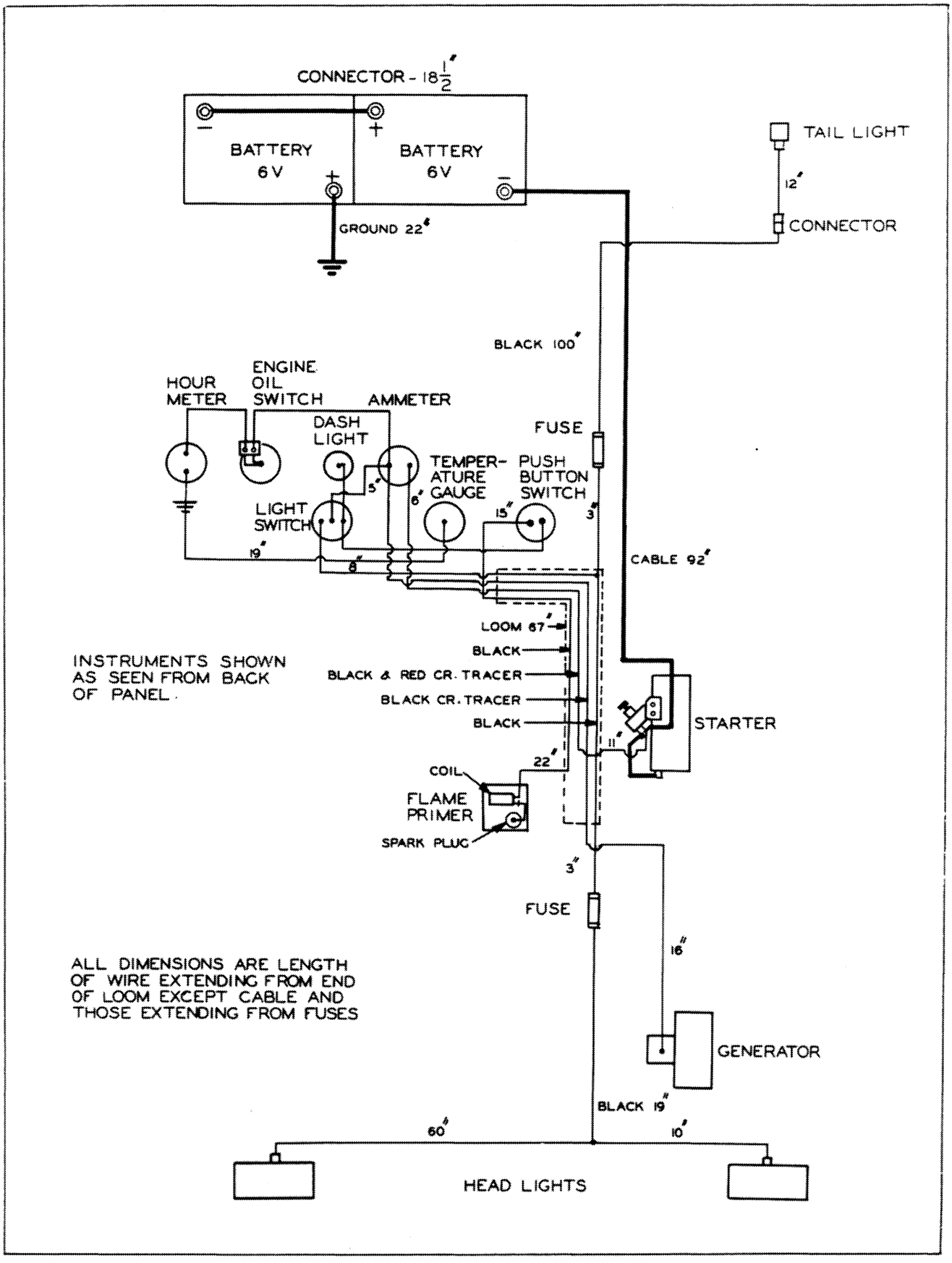


FIG. 2

or if test light is not used, so that hour meter just starts. Stop engine to make sure contacts break and test light goes off or hour meter stops. If no test light is

70 -- WIRING DIAGRAM "HD 7"



75 -- "HD 10" Motor Removal and Installation

It will be necessary to have the following equipment or its equivalent on hand in order to remove the motor from the tractor.

One ton hoist.

About ten feet of ½" cable or a section of ⅜" chain.

One motor stand or sufficient wood blocks to support motor.

Ample supply of cleaning fluid available in clean container.

At least 6 clean containers for holding nuts, bolts, capscrews, etc.

A. REMOVAL OF MOTOR FROM TRACTOR

1. Disconnect ground terminal connection from battery post.
2. Loosen clamp bolts and remove pre-cleaners.
3. Loosen bolts at each corner of hood and remove hood.

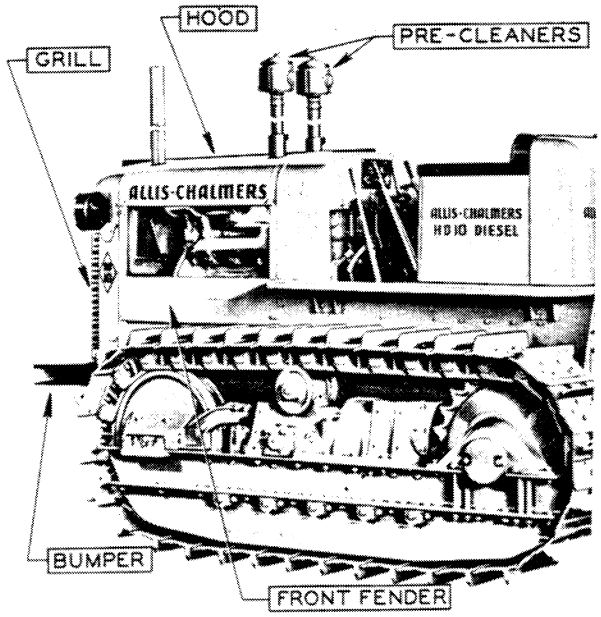


FIG. 1

4. Remove right and left hand fenders by removing 2 bolts, and 6 capscrews.
5. Remove radiator grill by taking out four T-bolts on each side.
6. Remove pin from radiator shutter control rod.
7. Drain cooling system by opening the two drain cocks.
8. Loosen upper and lower radiator hose connections.
9. Take out 3 capscrews from each side of radiator shell and 2 capscrews holding bumper. Now bumper can be removed. Then radiator and shell removed as a unit.
10. Shut off fuel supply under tank by turning shut-off cock handle. Fig. 3.
11. Disconnect fuel pressure gauge line at top of fuel filter, care must be taken not to twist flexible hose. Fig. 4.
12. Disconnect oil pressure gauge line at union at rear right side of motor. Fig. 4.
13. Loosen and remove temperature gauge tube at rear end of water manifold.

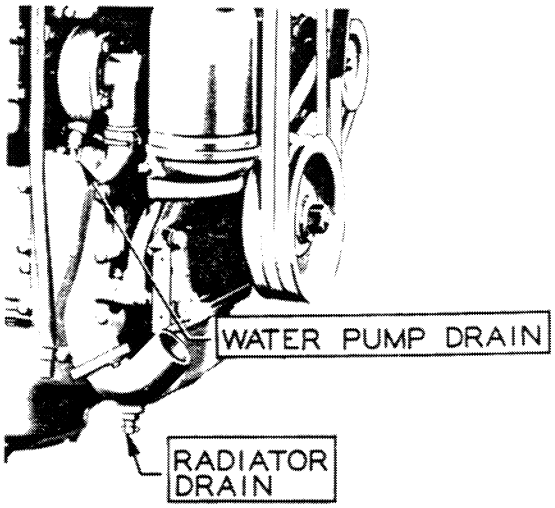


FIG. 2

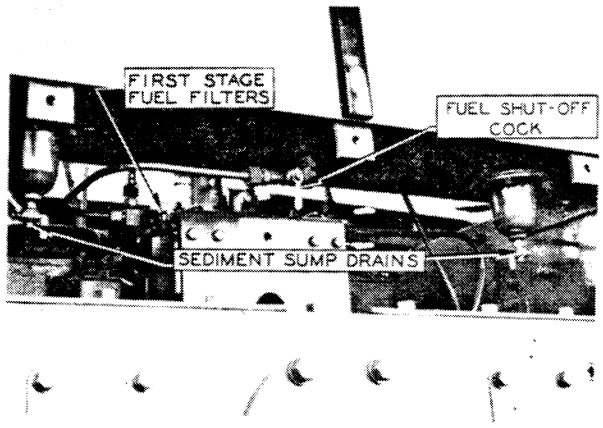


FIG. 3

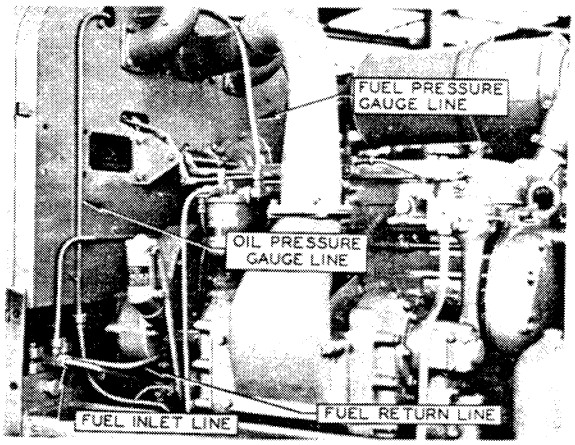


FIG. 4

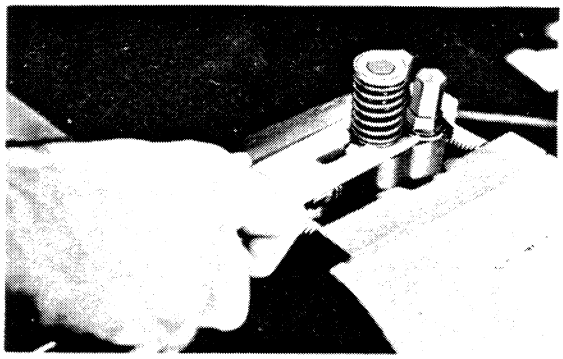


FIG. 8

and withdraw the follower stop.

3. Remove the plunger, follower guide, and follower pin from the injector body. Remove the follower pin from the follower guide and separate the parts.
4. Invert the injector in holding fixture. Clamp in vise and loosen (not remove) nut with special wrench as shown in Fig. 9.

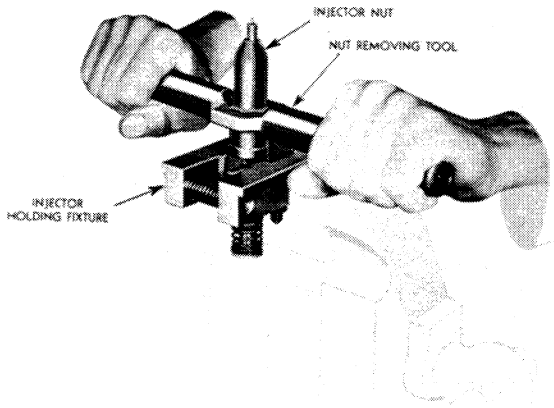


FIG. 9

5. Holding the injector in an inverted position, unscrew nut and lift away from the injector body, being careful not to dislodge the spray tip and the other small parts resting on the end of the plunger bushing.
6. Carefully lift the spray tip, spherical check valve, spherical valve spring, spring stop, flat check valve, check valve seat, and spherical valve seat away from the plunger bushing.
7. Jar the spill deflector from the nut.
8. Jar the spacer and gear from the inpector body.
9. Pull the rack from the injector body.
10. Remove the 2 fuel connections, 2 filters, and the 2 springs from the injector body.

NOTE: Should more than one injector be dismantled BE SURE that all parts for each injector are kept together.

C. INSPECTION

Many of the close fittings parts in the injector are very carefully lapped. If any of the internal working parts of the injector become scored these parts are unfit for further use and new parts must be installed.

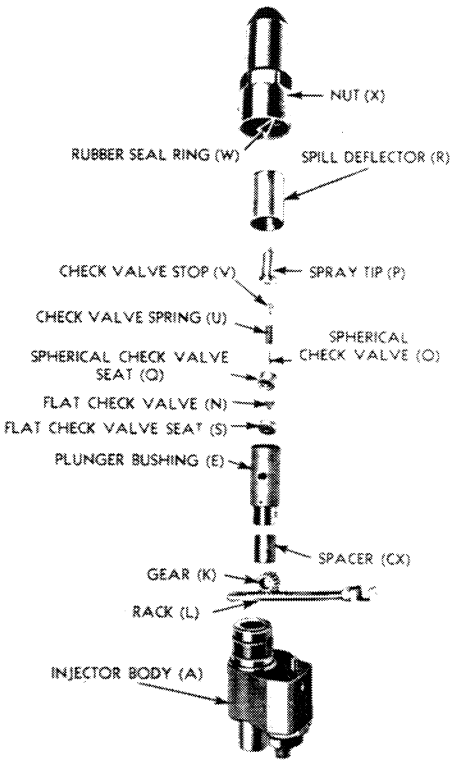


FIG. 10

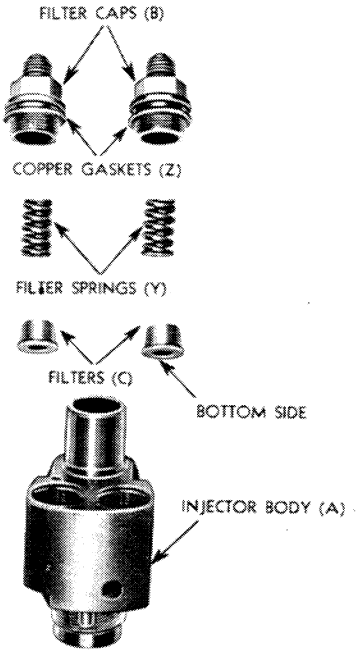


FIG. 11

be started in place true with counterbore in head.

6. See that cylinder head is perfectly clean, particularly the counterbore for inserts.
7. Immerse cylinder head for 30 minutes in water at temperature of 180 to 200 degrees F.
8. Cool inserts on dry ice for 45 minutes.
9. Place cylinder head bottom-side-up on bench, blow out counterbore for inserts with air, and lay one insert at each insert counterbore—valve side up.

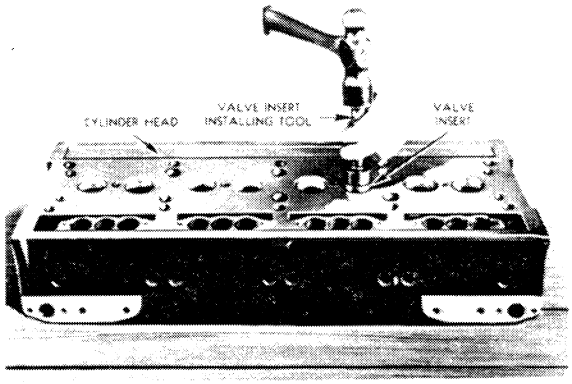


FIG. 17

10. Using special locating and driving tool, shown in Fig. 17, insert pilot end of driver into valve guide and drive insert down tight into counterbore.
    This operation must be done quickly, while the valve seat inserts are cold.
11. Inspect valve seat for concentricity with valve guide and, if necessary, recondition seats as directed.

H. RECONDITIONING VALVES AND VALVE SEATS

Before either a new or used valve is installed, the seat in the cylinder head for the valve should be examined for proper valve seating. Furthermore, if valve once used is to be installed again, the valve stem should be cleaned, and the seat reground to the recommended angle of 45 degrees. The valve guide should be thoroughly cleaned with reamer recommended in conjunction with other Diesel Engine tools. If bore in valve guide is worn oblong, or if valve heads are warped relative to the stem, new parts should be installed. The width of the valve seats in the cylinder head is 5/64". When new valve inserts are installed, or old inserts refaced, the work must be done with a grinding wheel. The ordinary method of reaming valve seats is ineffective for this operation because of the very hard valve insert material.

The complete equipment for valve seat grinding should include:

1. Eccentric valve seat grinder.
2. Dial gauge.

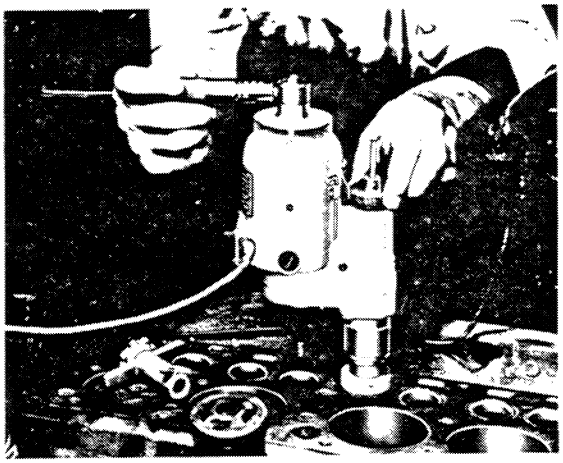


FIG. 18

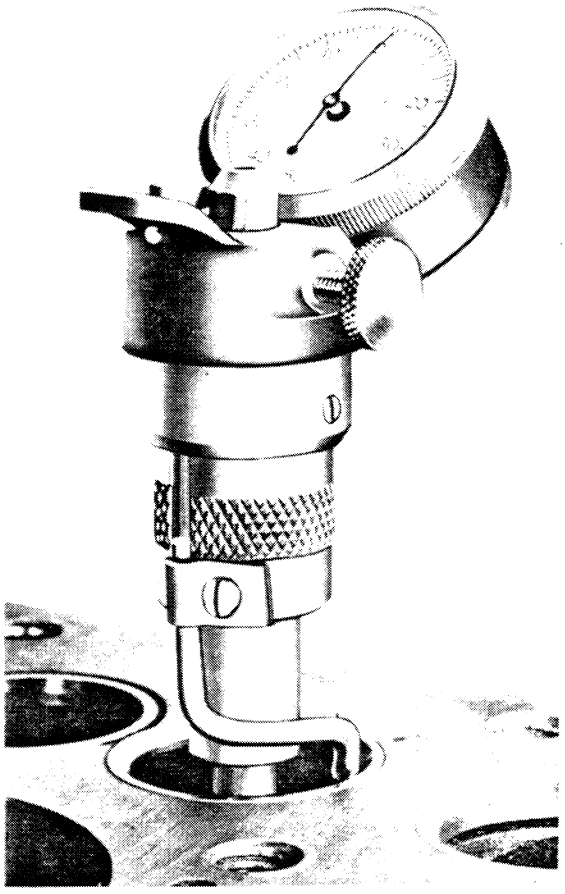


FIG. 19

3. Pilot.
4. 45 deg. grinding wheel.
5. 70 deg. grinding wheel.

The 45 deg. grinding wheel is used for refacing the valve seats, and the 70 deg. wheel is used for narrowing the seats to the standard 5/64" width. After the valve seats have been dressed with the grinding wheel, the dial gauge, shown in Fig. 19, is used to

the shafts with the serrations in registration. Rotors must be assembled with the omitted serrations toward top on both rotor shafts.

To avoid confusion when assembling, place the right-hand rotor and right-hand gear together on the bench; likewise the left-hand rotor and gear, as shown in Fig. 11.

NOTE: Effective on motors serial number 371-4353, 471-6022 and 671-11907. Rotors and gears are marked as follows: Upper rotor and upper gear are marked "Upper."

Lower rotor and lower gear are marked "Lower."

4. Assembling rotors into housing. With this in mind, as outlined in item (3).
   a. Install one oil seal pilot (F) over short end (non-splined) of each rotor shaft and with rotors in mesh and omitted serrations toward top of blower housing, slip rotors into housing. (See Fig. 12).
   b. Remove oil seal pilots.

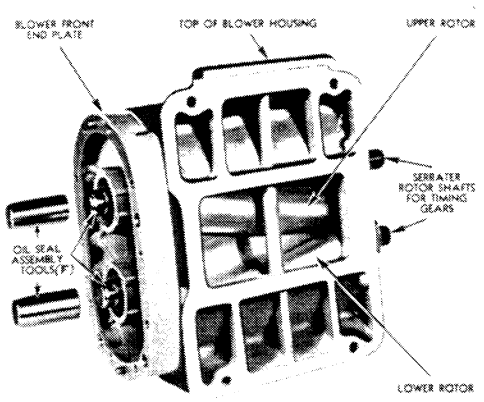


FIG. 12

5. Install blower rear end plate. With rotors positioned in housing as per item (4).
   a. Install one oil seal pilot (F) over serrated end of each rotor shaft.
   b. Identify top and bottom of end plate as described in item (2) and shown in

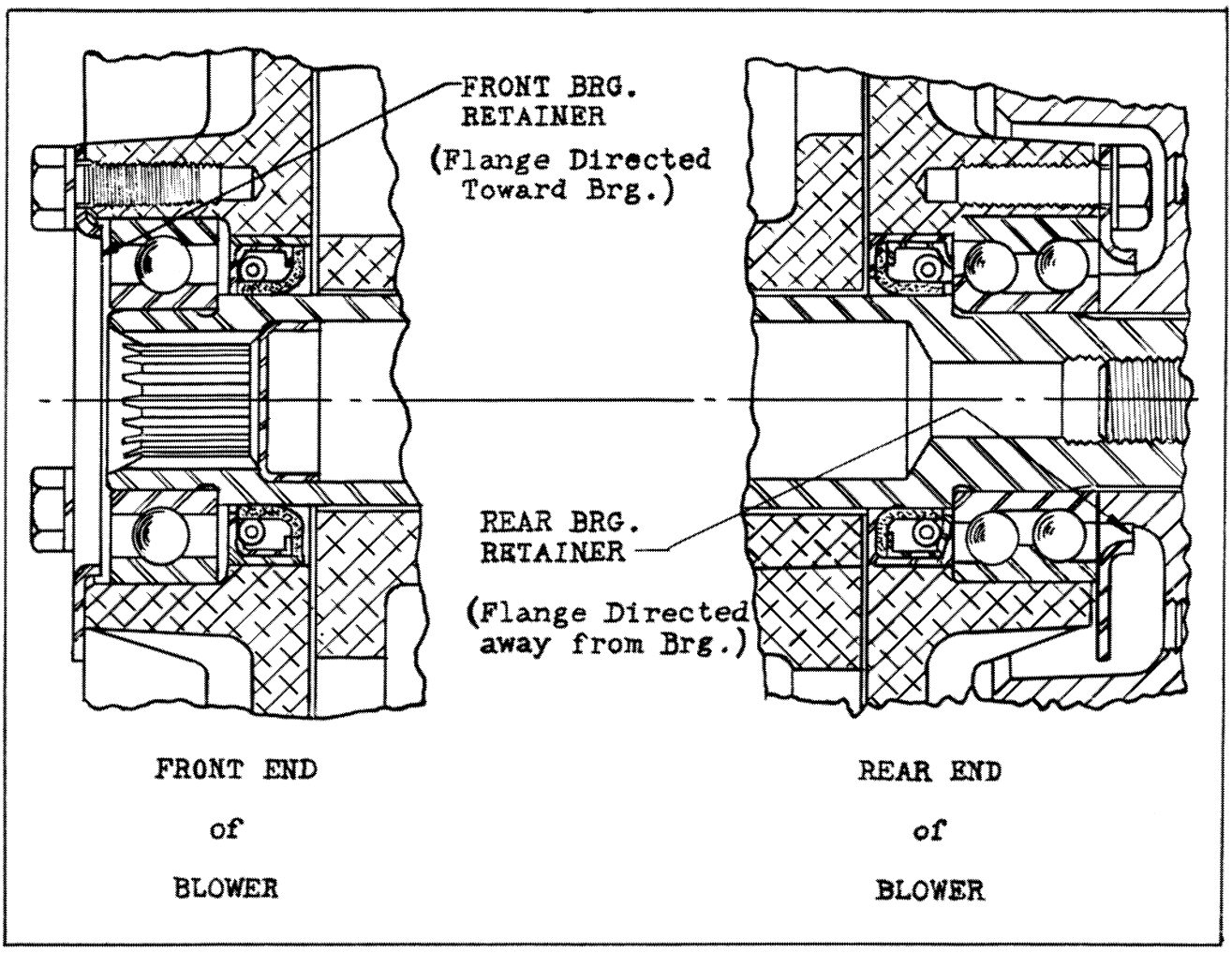


FIG. 13

into housing "B" from rear of housing.
2. Install locking ball "C" into gear hub and slide thrust washer "D" in place over ball, with large diameter flat face of washer next to thrust face of bushing.
3. Prevent hub from turning by inserting bolts in 2 holes in hub and holding with a bar. Install a new lockwasher "E" next to thrust washer and tighten lock nut "F." Bend the ears of lockwasher against flats on nut to prevent nut from loosening.
4. Tap gear "G" into place on hub with flat finish face of gear away from housing.
5. The outer end of flexible coupling "H" is counterbored for about ¼" on the inside diameter of the hub. With this counterbore away from face of gear, place the stamped steel shield "J" against outer face of coupling, with flange at center of shield pointing away from coupling, and lock in place with lockwashers and capscrews.
6. Install blower drive shaft ring either on shaft or inside of cam coupling and slide shaft into serrations of cam coupling.
7. Apply some engine oil at each thrust shoulder of bushing and again inspect end clearance, as shown in Fig. 3.

E. INSTALLING BLOWER DRIVE GEAR ASSEMBLY TO ENGINE

The blower drive gear assembly may be attached to front face of cylinder block rear end plate by sliding gear and hub through the hole in end plate with finished face of housing up against end plate, install a new paper gasket between end plate and housing. Then place oil line from gear bearing to cylinder block into its 2 connections.

Install the 2 capscrews next to engine. The 4 bolts will be put in place when flywheel housing is installed. The 2 capscrews specified for this position must be used. If the capscrews are too long and project inside of the gear housing they will interfere with the gears.

The blower may be installed at this time without interfering with any other work to be performed on the gear train.

F. REMOVAL OF IDLER GEAR ASSEMBLY

1. Remove the motor from the tractor as described in Topics 74, 75 and 76.
2. Drain the oil and remove oil pan.
3. Remove master clutch from flywheel.
4. Remove flywheel.
5. Remove the combination gear train cover and flywheel housing.
6. Remove the capscrew and lockwasher from center of idler gear hub and withdraw hub, and gear assembly from cylinder block rear end plate
7. If there is any need for doing so, the spacer and dowel assembly may also be removed at this time by removing the one center retaining capscrew and lockwasher.

G. INSPECTION OF IDLER GEAR AND HUB ASSEMBLY PARTS

Before the parts of idler gear assembly are put back in position, each part should be washed clean, inspected for wear and, if necessary, new parts installed.

1. Inspect the journal on gear hub for scoring and also for wear. Inspect inside diameter of gear bearing for scoring. The clearance between bearing in the gear and the journal should be from .002" to .003" and should not exceed .006". If the clearance exceeds .006", either the gear and bearing assembly or the gear hub or both should be changed, depending on which part or parts are worn.
2. Examine the face of the steel washer, the wearing face of the gear hub, both thrust faces and inside diameter of the gear bushings for scoring and wear. If necessary install new parts. The end play of the idler gear assembly is from .003" to .006" and should not exceed .008".

NOTE: The idler gear bushings are not removable; therefore, in case of bushing failure, a new idler gear assembly must be installed.

H. INSTALLATION OF IDLER GEAR ASSEMBLY

1. Having determined the relative positions of all parts, apply a small amount of cup grease to one face of the steel washer

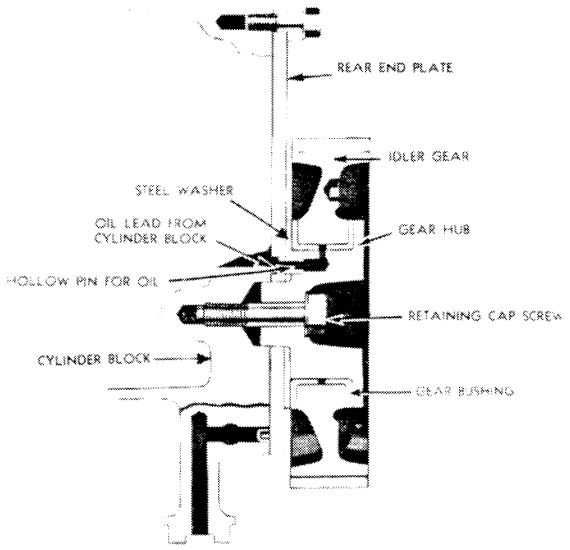


FIG. 5

½ inch wide feeler ribbon between the piston and cylinder liner. Fig. 4.

With a .006" clearance between piston and liner, a .005" feeler may be moved freely.

Since cylinder liners are furnished in standard size only, pistons are furnished in standard size only. The upper part of the piston (above the upper compression ring) is not tinplated and does not touch the cylinder wall. If this part of the piston shows any coating of hard carbon, the rings must be removed and the piston surface, as well as the ring grooves, thoroughly cleaned. The piston head should be absolutely clean outside as well as the cooling ribs inside. Any thick coating of carbon inside the piston head indicates failure of cooling oil supply and necessitates the cleaning of orifice at lower end of connecting rod, spray jet at upper end of connecting rod, oil passage in the connecting rod. Piston pin bushings in connecting rod may have become loose and worked toward each other, blocking oil supply.

Before disassembling the rings, they should be inspected for free fit in the grooves, side clearance, and wear. The presence of the original tool marks on the piston ring surfaces indicates the practical absence of wear. To avoid any breakage use special tool, Fig. 5 when removing or replacing piston rings. Care must be taken not to over-stress the piston rings by spreading the ends more than necessary to slip ring off and on the piston.

New piston rings should always be used with new pistons; furthermore, if the engine has been in service for some time, even though the same pistons are again used, it is advisable to use new rings.

NOTE: In some instances, replacement pistons and liners in the field have been improperly fitted, resulting in premature failure of these parts.

Pistons and liners are marked "A" - "AA" - "AAA" on the upper rim of each of these parts to denote their actual manufacturing limits, principally, to allow closer selection of correct parts in production. Even with these markings, it is production practice to use feeler checking across the pin and also at the thrust surface for the full length of the bore with liners installed and using the piston attached to the connecting rod inverted to insure proper fit before assembly. SERVICE SHOULD USE SAME METHOD TO INSURE PROPER FIT.

According to the markings of the pistons and liners, their use in the various mated sets would be approximately as listed below:

"A" Piston with "A" Liner — .0065" - .0075" Permissible

"A" Piston with "AAA" Liner—.0070" - .0080" Permissible

"AA" Piston with "A" Liner—.0055" - .0065" (Use only .006 or over)

"AA" Piston with "AAA" Liner — .0065" - .0075" Permissible

"AAA" Piston with "A" Liner—.0050" - 0060" Not Permissible

"AAA" Piston with "AA" Liner — .0055" - .0065" (use only .006 or over)

It is extremely important that PISTONS BE FITTED WITH NOT LESS THAN .006 RUNNING CLEARANCE. Bores in a tapered or out-of-round condition should be corrected by honing out the cylinder block slightly to insure loose fit of cylinder liners. A Sunnen hone or equivalent is recommended for this purpose since the stones can be adjusted, so removal of high spots is possible. Slightly scuffed liners, if usable, should be polished or lapped to remove surface irregularities. Pistons should not be fitted to cylinder bores with excessive out-of-round or taper. Do not confuse wear with out-of-round or taper. To obtain a satisfactory running clearance, pistons and liners should be selected for fit in the following manner

1. Clean cylinder block and assemble liner in place.
2. Clean pistons and bores thoroughly.
3. Place a ½" wide .005" thick feeler ribbon in cylinder bore. Feeler ribbon should extend full length of bore.
4. Assemble piston in running position in cylinder with piston pin boss axis parallel to crankshaft axis.
5. Pull on feeler ribbon must not exceed 6 lbs. at room temperature when properly used as indicated below.
   a. With feeler inserted in bore at 90° to axis of crankshaft and pistons located first at top then at bottom of bore.
   b. As above with feeler ribbon inserted in a position parallel to axis of crankshaft.
6. Mark piston and assemble in cylinder bore in which it has been fitted.

When checking with feeler, if bind exists in one place only when fitting piston in new liner, remove liner and rotate part 90°. Reassemble liner and check again. (Due to the thin wall, it is possible for liners to go slightly out of round while in stock. Liners should be stocked standing on end).

After assembly of pistons and liners, proper run in schedule should be followed to insure proper seating of parts.

Above procedure with .005 feeler provides an actual running clearance of .006. For an

A. CYLINDER BLOCK; IDLER GEAR OIL HOLES

1. To improve the oil seal at front and rear of cylinder blocks, special brass plugs ¼" dia. x 5/16", Part No. 5154319, are now installed in the oil holes of the two idler gear bosses at the front of the engine as well as in the oil hole of the idler gear boss at rear of engine, not used for the idler gear. This was effective starting with engine serial numbers 371833, 4711183 and 6177462.
2. The boss used for the idler gear, which of course is NOT plugged ,is always in the left-side of rear face for all Models.
3. The idler gear oil hole plugs may be installed in service, on engines built prior to serial numbers shown above. This can conveniently be done when engines are disassembled for inspection or overhaul.
4. To install idler gear oil hole plugs proceed as follows:
   a. Remove front and rear cylinder block end plates.
   b. Install a plug in both idler gear boss oil holes at front end of cylinder block.
   c. At rear end of cylinder block (gear train end) install a plug in the oil hole of the idler gear boss opposite that to which the idler gear hub is assembled. (Right hand side)

NOTE: Top of plugs must be below surface of cylinder block when installed. If the plugs project from the surface of the block, the end plates will be warped when attached to the block.

Cylinder block assembly replacements for service will have these plugs included in shipment as loose parts.

B. AIR BOX DRAIN TUBE

1. An improved air box drain tube became effective on Tractors HD-14, 1405, HD-10, 1711 and HD-7, 1343, to eliminate difficulty experienced in the field with air box drains clogging.
2. The improved air box drain tube may be installed on engines in the field by drilling and tapping air box as shown in Fig. 3.

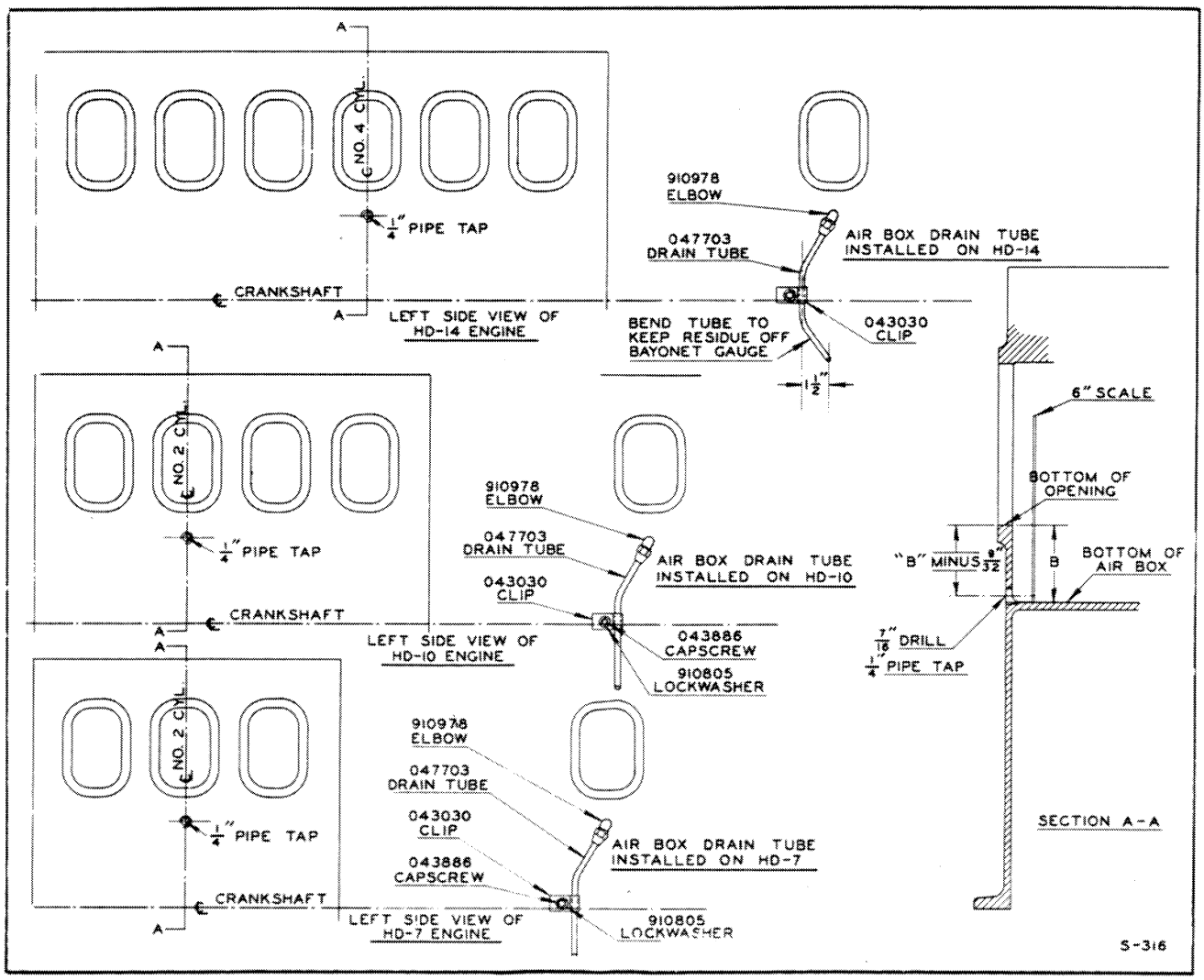


FIG. 3

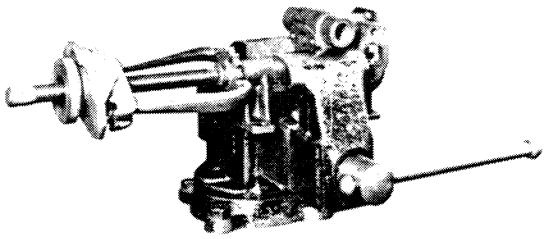


FIG. 5

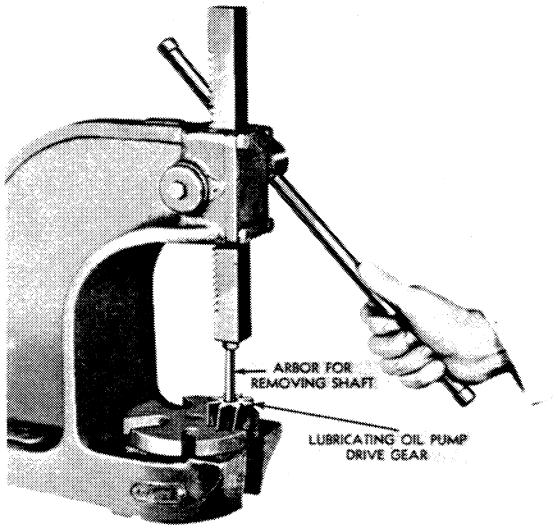


FIG. 6

3 AND 4-CYLINDER ENGINES

1. Steps 1 to 3 are the same as for the 6-cylinder engines.
4. Place pump body and drive-gear assembly on bed of arbor press, "cover side" up, and by means of arbor on gear end of pump shaft, press shaft through gear, removing gear and feather key from the shaft.

NOTE: Be careful not to cover keyway with arbor when removing gear, thereby preventing key from being removed with gear.

C. INSPECTION OF OIL PUMP PARTS

1. Wash all oil pump parts thoroughly before inspection.
2. The principle wearing parts are the gears of the oil pump. If the oil has been kept clean the wear on these parts will be very slow. If, however, dirt and sludge have been allowed to accumulate due to negligent oil filter servicing, wear on these gears will be rapid. This practice abuses not only the oil pump, but other parts of motor as well.
3. Inspect gears for wear and scored teeth; if worn or scored install new gears.
4. In an efficient pump, the gears will run freely with no perceptible looseness.
5. Inspect seat and ball of by-pass valve (first type); install new parts where necessary.
6. The second type by-pass valve is a sleeve type; inspect assembly, install new parts where necessary.

D. ASSEMBLE OIL PUMP

1. The oil pump operates in clockwise direction when viewed from sprocket end, and the intake will be located on left side. Relief valve will be on the same side of pump (toward blower side of engine).
2. The gear and pump drive shaft has a Keyway about 1-5 8" from end of shaft. If gear was removed, install Woodruff key and press gear on shaft with arbor, press until inner end of gear is $6\frac{3}{32}$" from sprocket end of shaft.
3. Lubricate the shaft and insert it into the pump body.
4. Install Woodruff key at the sprocket location and align the keyway with the key. Start sprocket on the shaft with flat face of sprocket facing pump body.
5. Support gear end of pump shaft on bed of arbor press and press sprocket on shaft to within .010" from pump body.
6. Lubricate stub shaft and install idler gear.
7. See that finished face of pump body is perfectly flat so that it will make a tight joint between cover and body as there is no gasket used at this joint.

NOTE: Observe Fig. 4 as to the position of the oil pump covers for the 3 and 4-cylinder engines. After pump is assembled, revolve shaft by hand to see if there is any bind. Pump shaft will turn freely when the pump is correctly assembled.

E. INSTALLATION OF OIL PUMP

With main bearing caps in place and the pump drive chain in position on the crankshaft sprocket, the lubricating oil pump may be installed as follows:

1. On the 6-cylinder, work sprocket on pump shaft under drive chain and secure pump assembly to main bearing caps with 4 lockwashers and capscrews.
   On the 3 and 4-cylinder, secure pump assembly to number two bearing cap, but dont tighten. If shims were remov-

94 -- Electrical Equipment Warranty and Adjustment Policy

Manufacturers of electrical equipment used on Allis-Chalmers tractors are responsible for the equipment they furnish. Any claim for defective or faulty equipment of this nature must be presented to the manufacturer of the equipment, not to Allis-Chalmers Mfg. Co. All suppliers of such equipment are represented by distributors in nearly all cities and are glad to make reasonable adjustments or replacements for their respective companies.

95 -- Starter Motor

Starter Motor and Dyer Drive—The Dyer Drive, which transmits the power of the starter motor to the engine flywheel, consists of the splined portion of the armature shaft, the shift sleeve, the pinion guide, the pinion, the pinion stop, washers, and springs. The thrust washers furnish a thrust bearing for the shift sleeve when it is in the returned position; the springs aid in the lock operation and in the engagement action. The entire drive is contained in the starter motor drive housing. The movement of the pinion is controlled by means of a shift lever which is connected directly to the shift sleeve. The Dyer Drive provides for positive engagement of the starter motor pinion with the engine flywheel before t he starter motor switch contacts are closed or the armature is rotated. The pinion is thrown out of mesh with the flywheel by the reversal of torque as the engine starts.

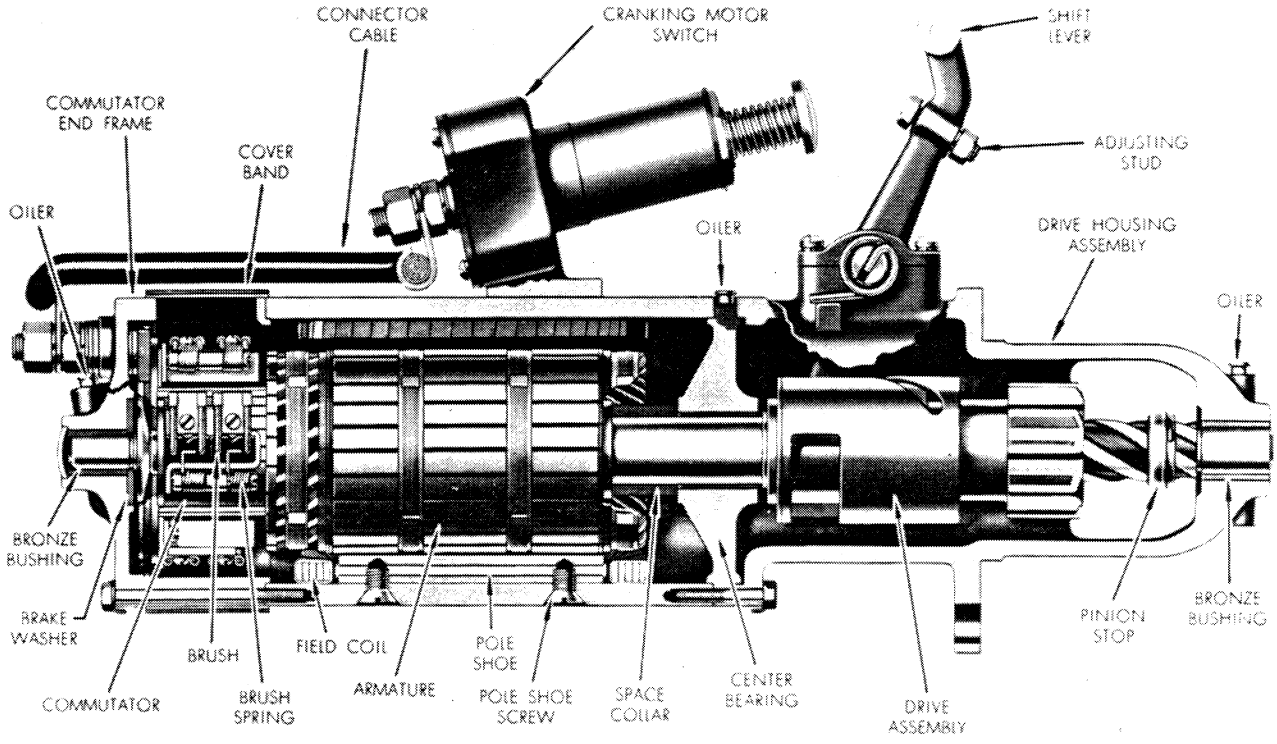


FIG. 1

A. STARTER SWITCH MAY BE FAULTY

After extended use, the contact surfaces of the starter switch may become burned or corroded so that either no current at all, or insufficient current for starting is transmitted to the motor. A faulty switch might be indicated by the engine cranking hard or difficulty in keeping the battery charged. The switch can easily be disassembled so that the burned or corroded surfaces may be reconditioned.

1. Disconnect battery cable at starting motor; tape the exposed end of the cable.
2. Remove bottom plate of switch by removing 4 capscrews.
3. Remove contact disc from plunger by removing castellated nut.
4. Clean and smooth contacting surfaces with a file or sandpaper. Be sure that

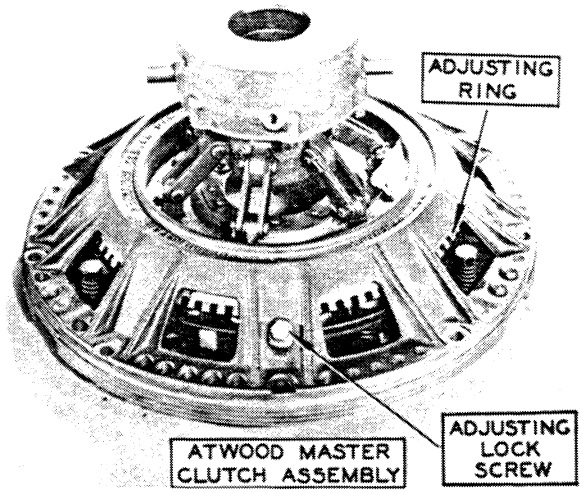


FIG. 3

When lock is free, turn adjusting ring clockwise to tighten.

Adjust clutch until lever pull is approximately 55 to 60 lbs. then lock adjusting ring by tightening adjusting lock screw.

Caution: When it is necessary to replace driven plate assembly, use #047126 Driven Plate Assembly only in the Atwood clutch. There is not enough clearance in the Atwood clutch to use #034902 Drive Disc Assembly.

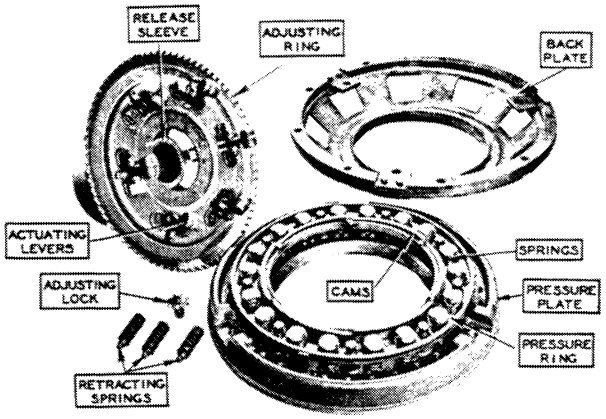
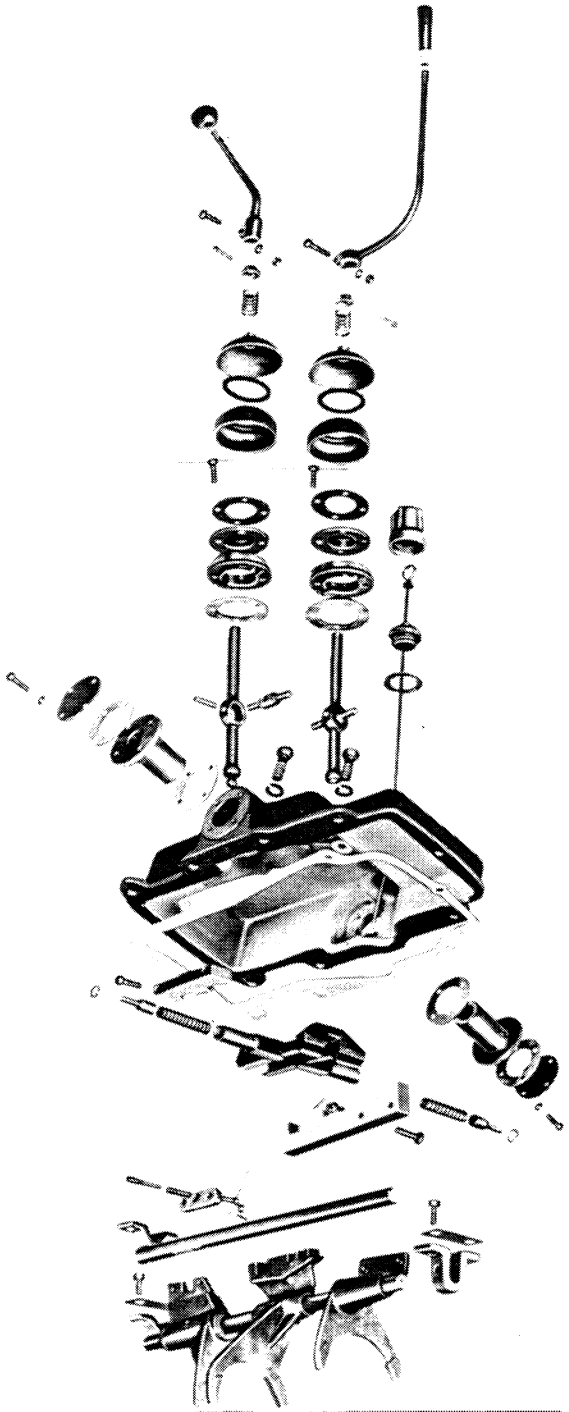


FIG. 4

These drive discs may be identified by length of Hub. "#047126 Drive Disc Hub is 2½", Atwood." "#034902 Drive Disc Hub is 2¾", Rockford."

C. INSTALLATION OF MASTER CLUTCH

1. To assemble master clutch reverse removal procedure.
2. Install clutch assembly on flywheel as outlined in Topic 76-B.
3. Install motor in tractor as described in Topic 76-B.



EXPLODED VIEW OF GEAR SHIFT HOUSING ASSEMBLY

FIG. 5

A. REMOVAL OF MASTER CLUTCH SHAFT

1. First, shift auxiliary lever in forward position.
2. Remove motor as described in Topic 75-A.
3. Remove 4 capscrews in bearing cage and pull shaft and gear from case, see Fig. 6.

B. INSPECTION

Inspect all parts; install new parts where necessary.

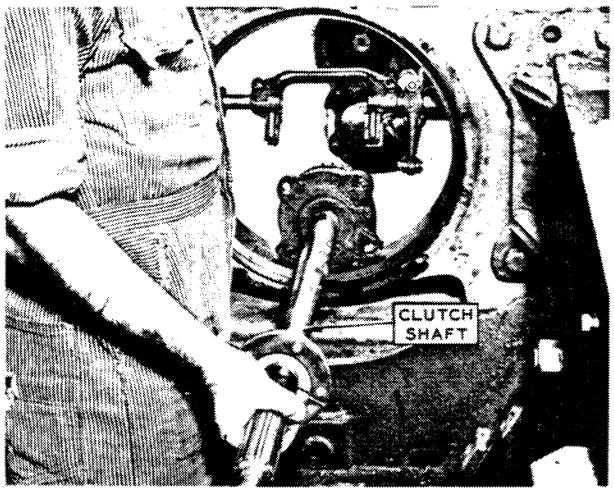


FIG. 6

C. INSTALLATION OF MASTER CLUTCH SHAFT

1. Reverse dismantling procedure, described in Topic 103-A.
2. To adjust master clutch brake engage the clutch and set the face of the brake $1\frac{7}{8}$" to $1\frac{1}{8}$" from the back of the release bearing carrier.

D. REMOVAL OF TOP SHAFT

1. Drain transmission.
2. Remove master clutch shaft, described in Topic 103-A.
3. Perform steps 1 to 14 inclusive in steering clutch removal, described in Topic 106-A.
4. Remove 2 capscrews in steering clutch lever stop.
5. Remove 6 capscrews in floor plate.
6. Remove pins from front end of brake rods on both sides.
7. Remove pin from lower end of master clutch lever.

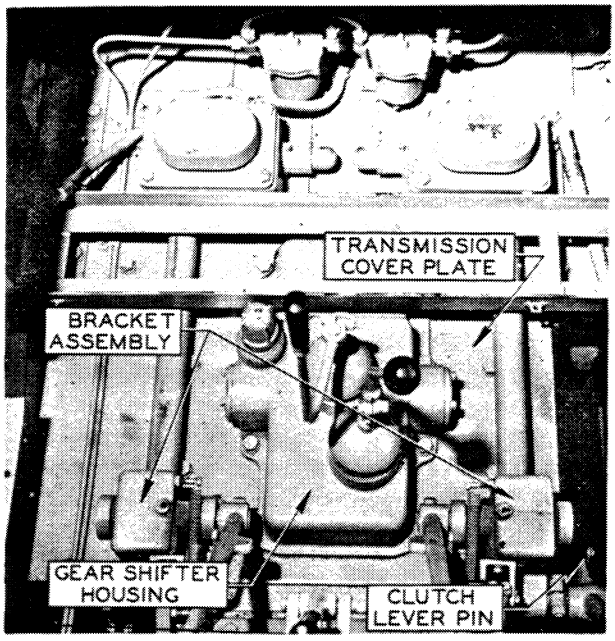


FIG. 7

4. Remove covers from outer end of pinion shaft by taking out 4 capscrews in each.
   NOTE: PULL PINIONS ON EACH SIDE USING SPECIAL PINION PULLER (Prior to HD 7—1132)
5. Screw adapter into end of pinion shaft and tighten thoroughly.
6. Loosen pinion shaft nut and back it off 3 or 4 threads.
7. Set puller pedestal between the sprocket spokes and directly over the adapter; screw puller bolt in place.
8. Tighten up on puller nut using a 4 ft. pipe or wrench handle, then use ram and jar pinion loose from driven hub.
9. Remove nut from end of pinion shaft.
10. Finish pulling pinion shaft from case.
11. Lift driven hub from clutch compartment.

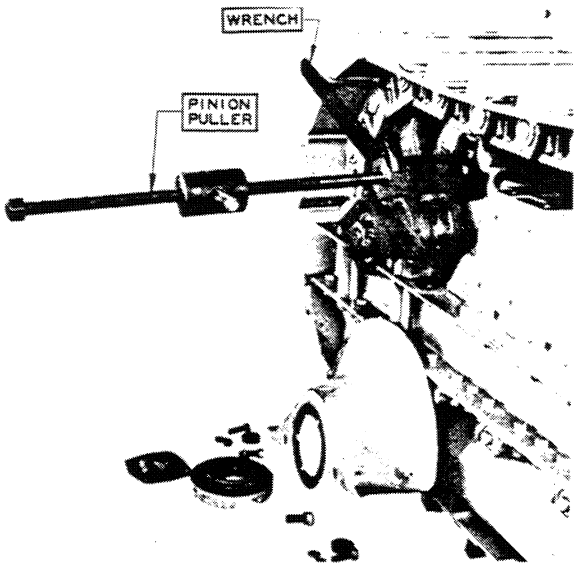


FIG. 6

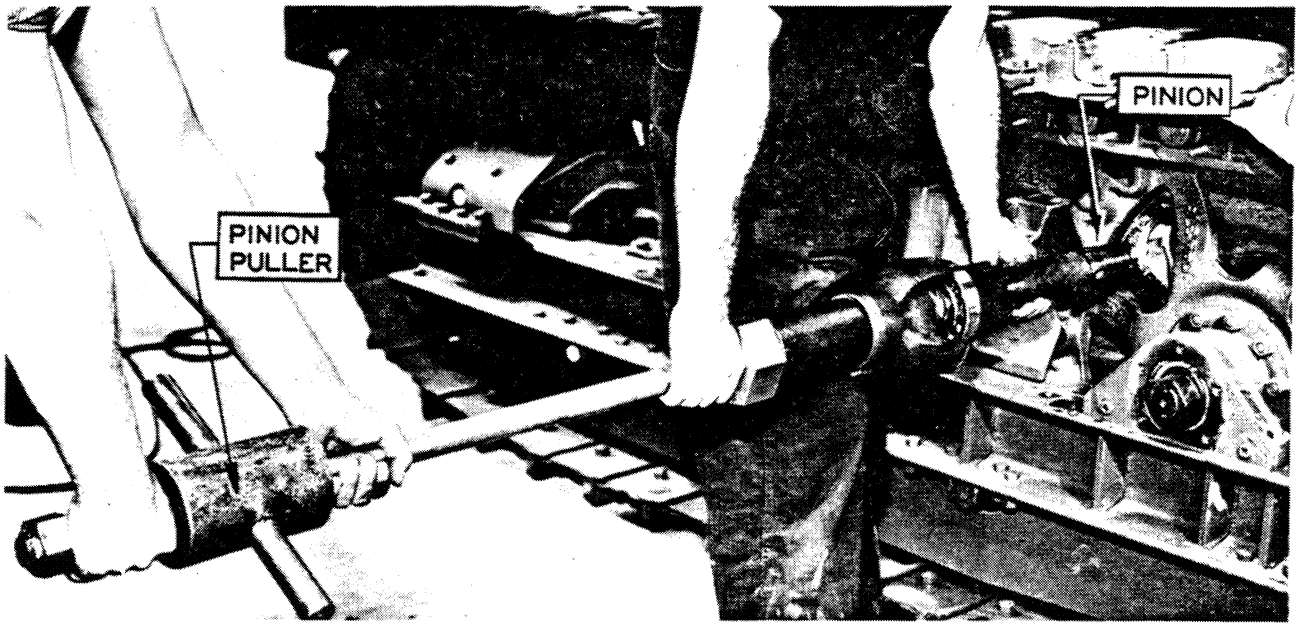


FIG. 7

C. REMOVAL OF STEERING CLUTCHES:

NOTE: REMOVAL OF STEERING CLUTCH SHAFT (Prior to HD-7-1132).

1. Remove brakes. Refer to Topic 105-A.
2. Remove final drive pinion. Refer to Topic 105-B.
3. Straighten lockwashers at each end of steering clutch shaft and remove nuts with special socket.
4. Push clutch shaft either way far enough to permit one clutch to be lifted out. Push shaft in opposite direction until the other clutch can be lifted out. The spacers between the clutch hub and bevel gear hub will drop into the case when the clutches are removed from the compartments. Be sure they are in place when reinstalling clutches.

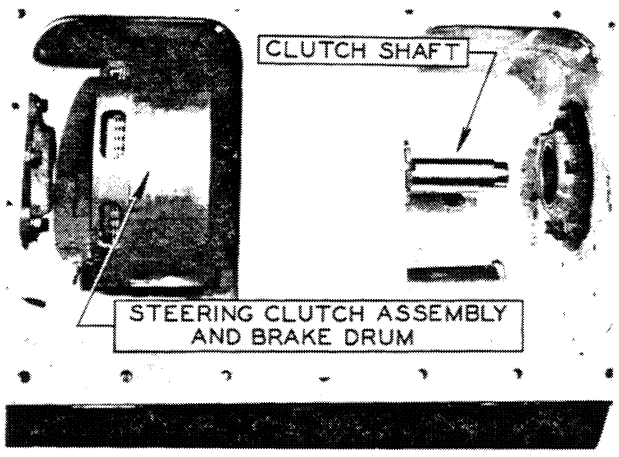
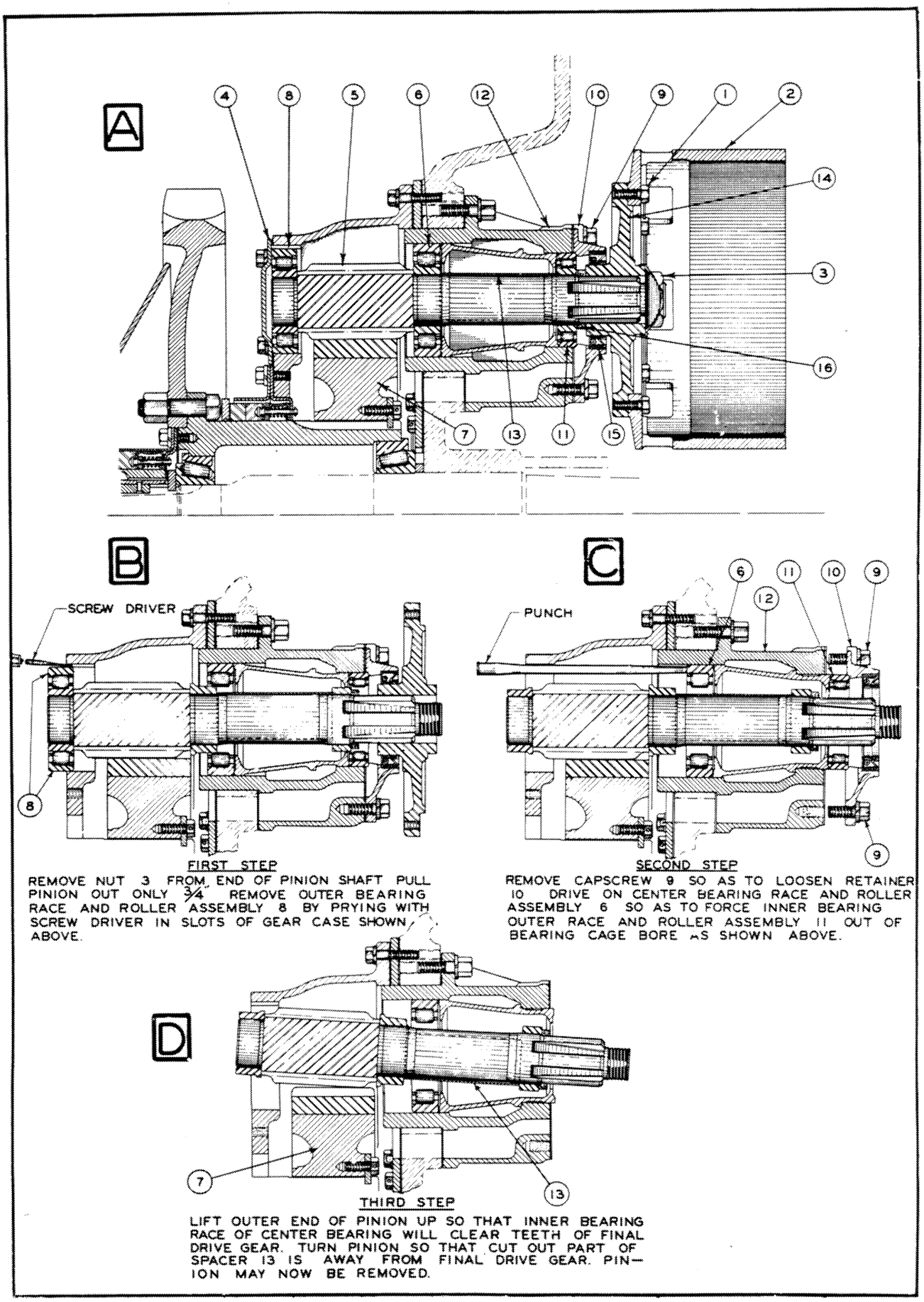


FIG. 8



FIRST STEP

REMOVE NUT 3 FROM END OF PINION SHAFT PULL PINION OUT ONLY 3/4" REMOVE OUTER BEARING RACE AND ROLLER ASSEMBLY 8 BY PRYING WITH SCREW DRIVER IN SLOTS OF GEAR CASE SHOWN ABOVE.

SECOND STEP

REMOVE CAPSCREW 9 SO AS TO LOOSEN RETAINER 10 DRIVE ON CENTER BEARING RACE AND ROLLER ASSEMBLY 6 SO AS TO FORCE INNER BEARING OUTER RACE AND ROLLER ASSEMBLY 11 OUT OF BEARING CAGE BORE AS SHOWN ABOVE.

THIRD STEP

LIFT OUTER END OF PINION UP SO THAT INNER BEARING RACE OF CENTER BEARING WILL CLEAR TEETH OF FINAL DRIVE GEAR. TURN PINION SO THAT CUT OUT PART OF SPACER 13 IS AWAY FROM FINAL DRIVE GEAR. PINION MAY NOW BE REMOVED.

FIG. 11

F. DISMANTLE STEERING CLUTCHES:
(Prior to "HD 14" # 2079)

1. Remove drum from clutch assembly taking care not to damage clutch disc teeth.
2. Remove lockwire and unscrew 3 of the 9 capscrews. Select 3 that are equally spaced.

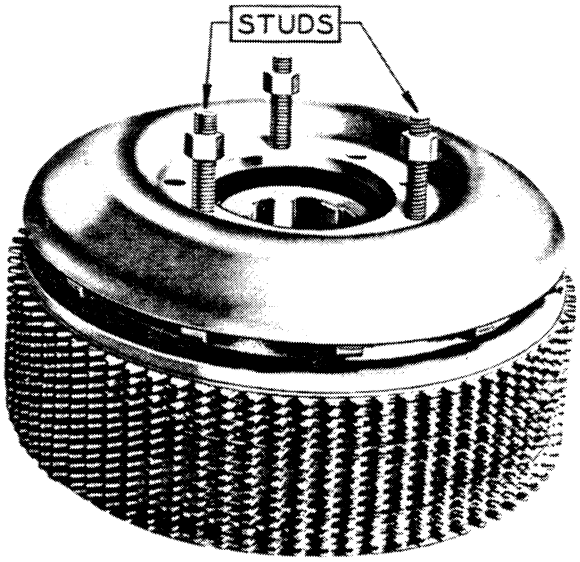


FIG. 11

3. Install 3—7" studs in these holes as shown. The studs should have 1" N.F. threads on one end and 2½" N. F. threads on the other end. Install 1" N.F. thread in the shifter plate.
4. Install nuts on studs and tighten down against pressure plate.
5. Remove remaining capscrews; then loosen the stud nuts evenly until all tension is taken off the clutch springs, and remove studs.
6. Remove the pressure plate. Remove the snap ring holding the fulcrum ring in place. Now the discs, springs, etc., can be disassembled.

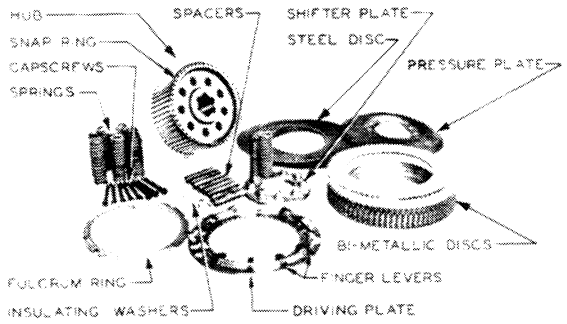


FIG. 12

G. INSPECTION OF STEERING CLUTCH AND BEVEL GEAR HUB PARTS:

When the clutches have been removed and dismantled inspect the following items:

1. BI-METALLIC FRICTION DISCS: These discs are made of a steel center with bi-metallic material bonded to the steel. Thickness when new is approx. $\frac{5}{32}$". Inspect discs for wear and metal flaking. If over-all thickness is less than ⅛" or if the metal has flaked off at any point a new disc should be installed.
2. HYCO FRICTION DISCS: These discs are made of a steel center, with wire mesh woven lining, bonded to the steel. Thickness when new is approx. $\frac{3}{16}$". In spect discs for wear and material coming loose. If over-all thickness of disc is less than $\frac{5}{32}$" or if the material has come loose at any point a new disc must be installed.
3. RAYBESTOS FRICTION DISCS: These discs are made of a solid piece, wire mesh and molded material. The over-all thickness when new is approx. $\frac{3}{16}$". Inspect discs for wear, condition of teeth, and oil saturation. If over-all thickness of disc is less than $\frac{5}{32}$", or if the teeth are in bad condition, new discs must be installed.
4. BRAKE DRUMS: Clean thoroughly and inspect. If drums are scored or grooved on the outer surface they can be chucked in a lathe and turned down. In doing this do not take off more than $\frac{1}{16}$" of material and extend the cut only to the ventilating holes. To remove any material from between the ventilating holes will materially weaken the drum.
5. BEVEL GEAR BEARINGS: Inspect for loose bearings observing play by prying on clutch shaft. When doing this be sure the hub packing is loosened or removed so that it does not prevent the detection of any play that may be present in the bearing. For bearing adjustment refer to Topic 104-L.
6. BEVEL GEAR HUB PACKING: (Prior to HD 14-612) Inspect for proper adjustment and serviceable condition. If packing leaks, tighten adjusting nuts only enough to stop leak. If packing is worn out, adjusting nuts will screw in all the way without stopping leaks; new packing must be installed.
7. BEVEL GEAR HUB SEALS: (HD 14-612 and above) This is a rawhide spring loaded seal, and cannot be adjusted. If this seal leaks oil, the bevel gear bearings must be inspected first for proper clearance, adjust if necessary and install new seals.
8. CLUTCH SPRINGS: (Prior to HD 14, 2079) Inspect tension of spring by measuring its "free height," that is, its height when standing upright with nothing compressing it. If this length is 5¼" or greater the spring can be re-

A. REMOVAL OF OUTER FINAL DRIVE SEAL

1. Uncouple the track by driving out master pin. Uncouple track. See Topic 119-A.
2. Drain final drive.

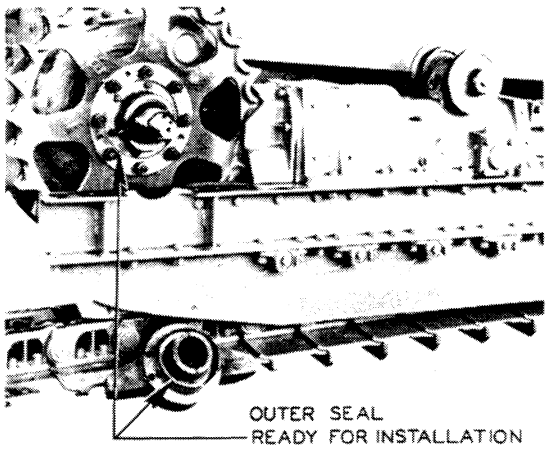


FIG. 2

3. Remove sprocket guard and end cover.
4. Remove rear axle bracket bolts.
5. Jack up rear end of tractor so rear axle bracket will clear truck frame.
6. Remove rear axle clamp nut.
7. Remove rear axle bracket and seal.
8. Remove seal parts from axle bracket and hub assembly.

B. INSTALLATION OF OUTER FINAL DRIVE SEAL:

1. Install both seal rings on axle bracket and make sure they turn freely. If not, dress bracket down until they turn freely.
2. Cement gasket to rear axle bracket. Fig. 3.
3. Cement seal ring to gasket on the bracket. Be sure the dowel in the axle bracket fits in the hole in seal ring. NOTE: New rings must be installed in pairs. Never install a new seal ring with a worn seal.

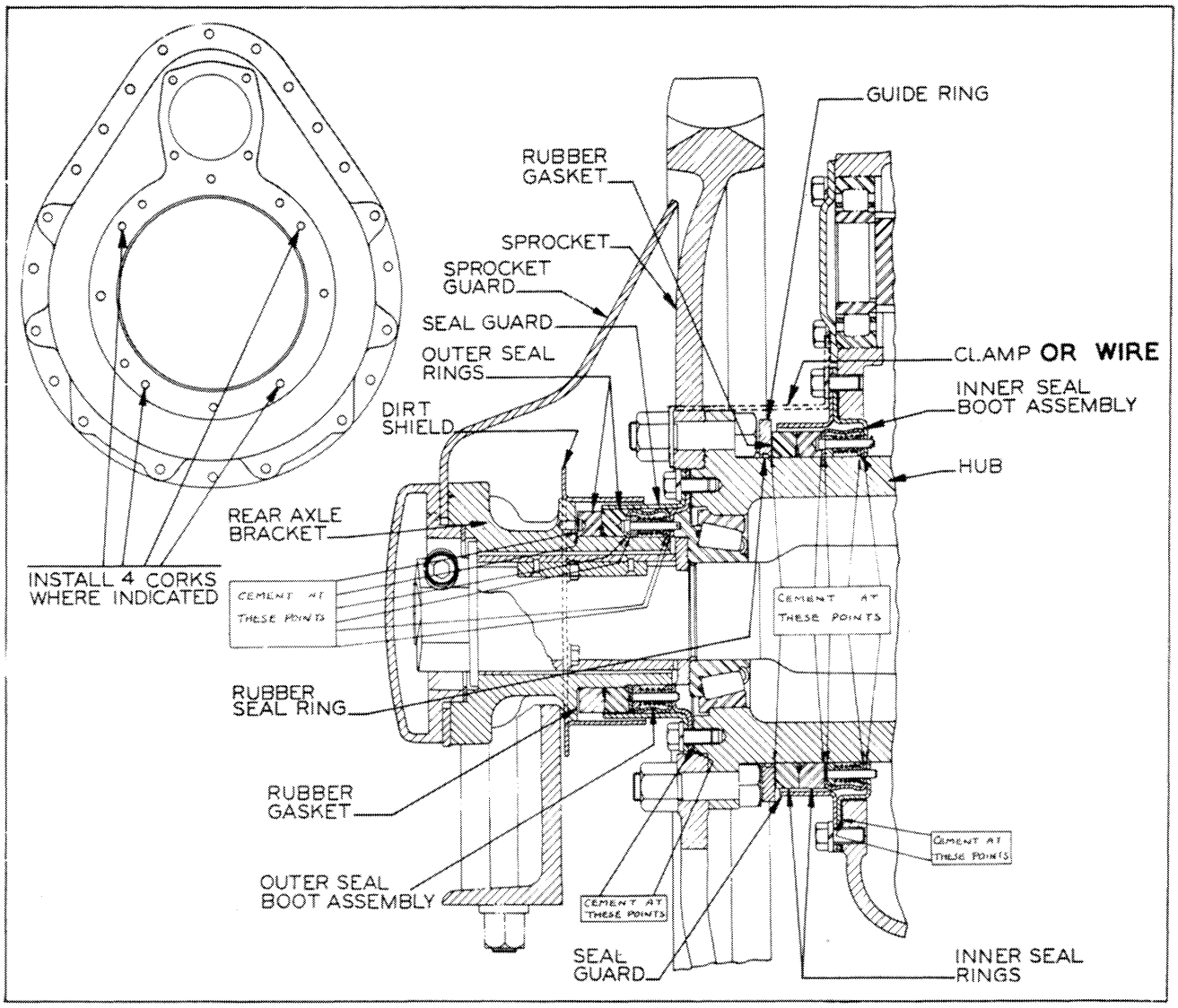


FIG. 3

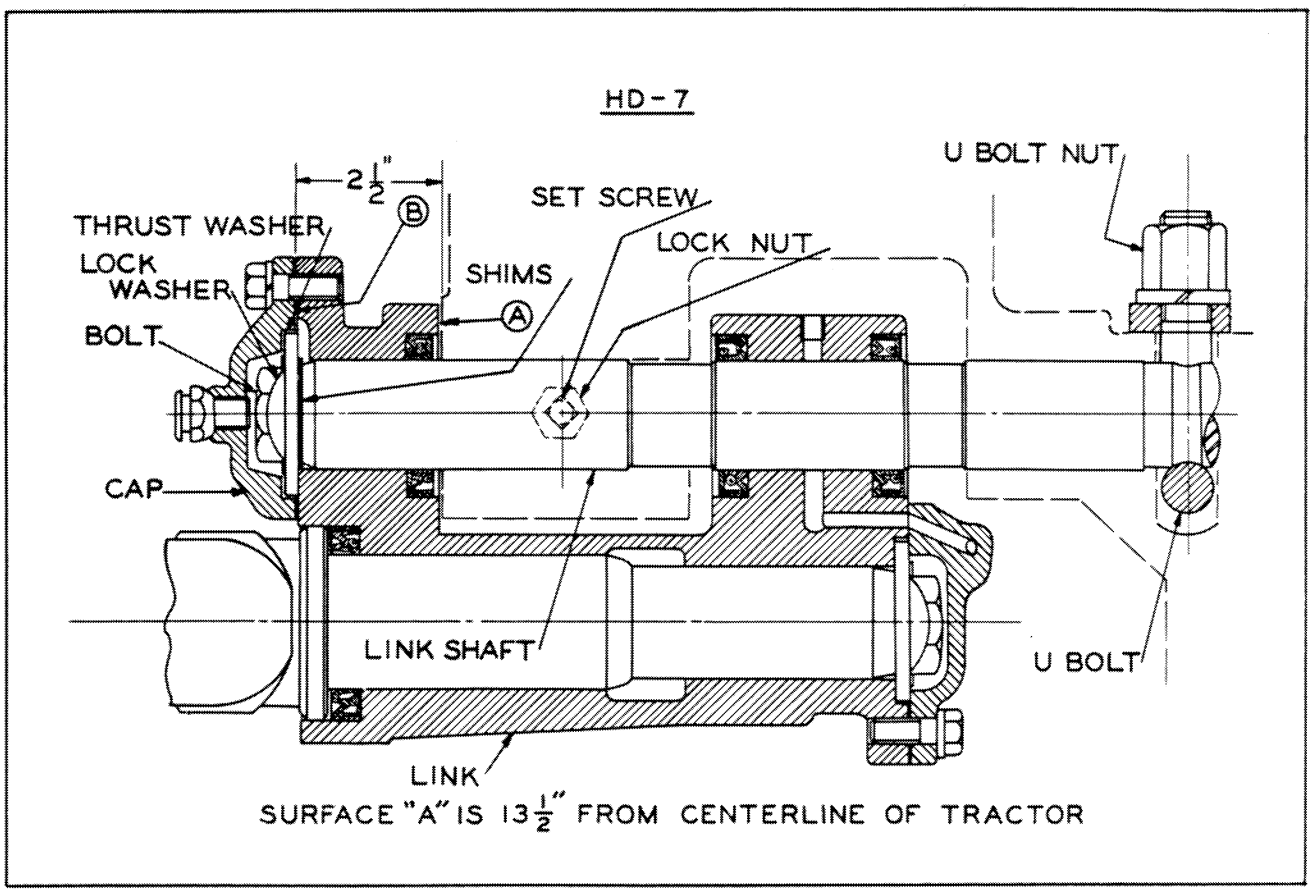


FIG. 5

c. Now with the two links in proper position with respect to the dimensions from surface "B" to "A" add shims (.010" and .030" furnished) to opposite end of link shaft until, the thrust washer is placed in position, the inside surface of the washer will be exactly flush with surface "B". CAUTION: On new type assemblies it may be necessary to add a .010" shim extra to provide clearance at surfaces "A" and "B" to prevent binding the links on the spacer.

d. With the proper total thickness of shims in position, install the thrust washer, lockwasher and bolt, tighten the bolt and lock it. Install the link shaft caps.

e. Securely tighten the U Bolt to hold the link shaft. Use a pry bar on end of the wrench to get the U bolt nuts tight.

f. As a further check, the surface "B" on one side must be 32" from the corresponding surface on the opposite side.

16. Thoroughly lubricate with a good grade of semi-fluid lubricant.

113--"HD 10" Stabilizer Assembly

A. REMOVAL OF STABILIZER ASSEMBLY:

1. Place jack under front of motor and raise as far as stabilizer spring will allow.
2. Remove 2 capscrews and remove track support roller.
3. Place block between front idler and truck frame to hold idler in place. Next loosen 2 clamp bolts holding track adjusting screw and loosen sufficiently to clear cross head.
4. Remove 4 capscrews on outside end of stabilizer crank cap and remove cap.
5. Straighten lock washer and remove 1¼" bolt from end of shaft, also remove lock washers and thrust washers.
6. Remove 10 capscrews holding track release housing to truck frame.
7. Track release housing may now be removed from truck frame.
8. Remove 4 capscrews from end of link shaft cap, on opposite side the track re-

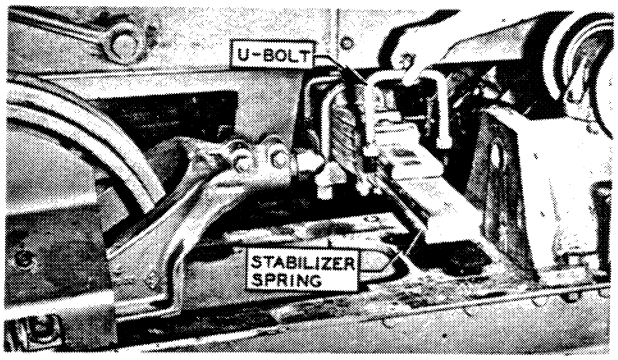
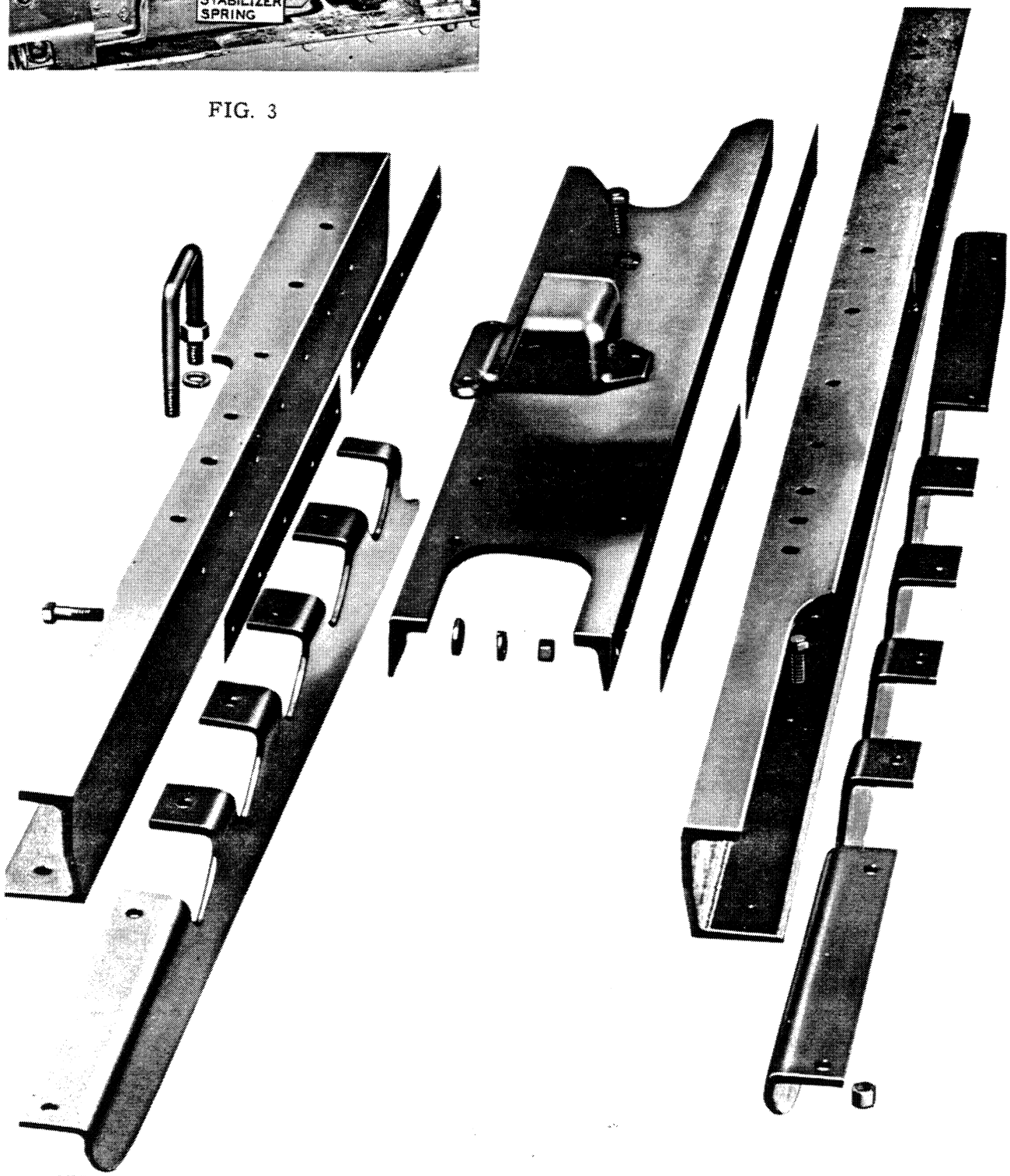


FIG. 3

11. Bolts holding the truck wheels to truck frame, and also the inner and outer guard may now be removed.
12. The truck frame is now free to be disassembled.

B. ASSEMBLE TRUCK FRAME:

Reverse the removal procedure.



EXPLODED VIEW OF TRUCK FRAME ASSEMBLY

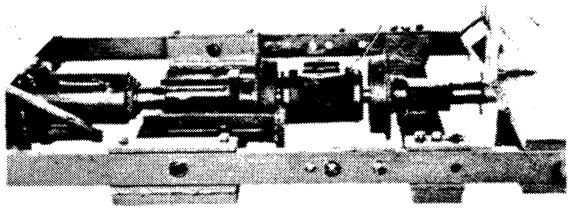


FIG. 5

3. After the bearing adjustment has been made and the retainer capscrews locked in place, install the oil seals in the retainers using the retainer lock chisel and hammer to drive them into place.
   NOTE: ALWAYS install oil seals with lip away from retainer or toward the roller flange.
4. Start the two flanges on the ends of the shaft and place support roller in the press as shown in Fig. 5. Block between one flange and the end-plate of the press and use an adapter between the jack and the other flange which will contact the flange rather than the shaft. Then press on both roller flanges until the flange hub faces are even with ends of shaft.

128 -- Gar Wood Scrapers, Bulldozers and Roadbuilders

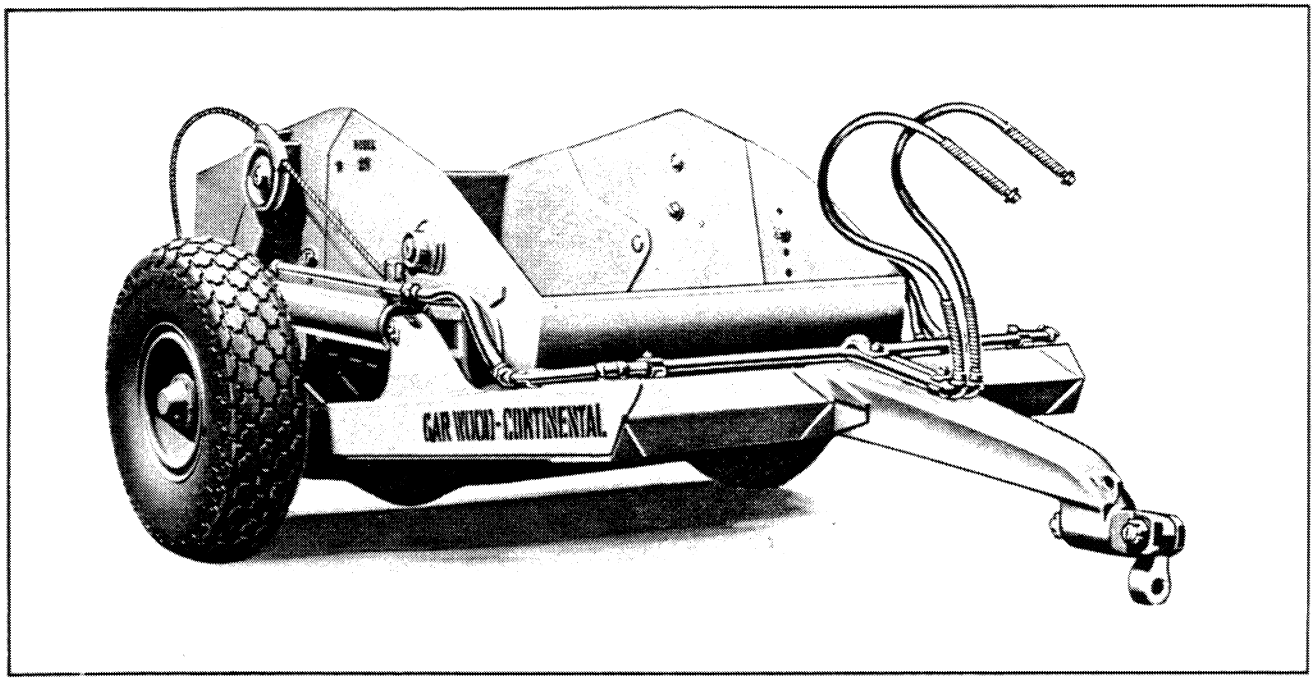


FIG. 1

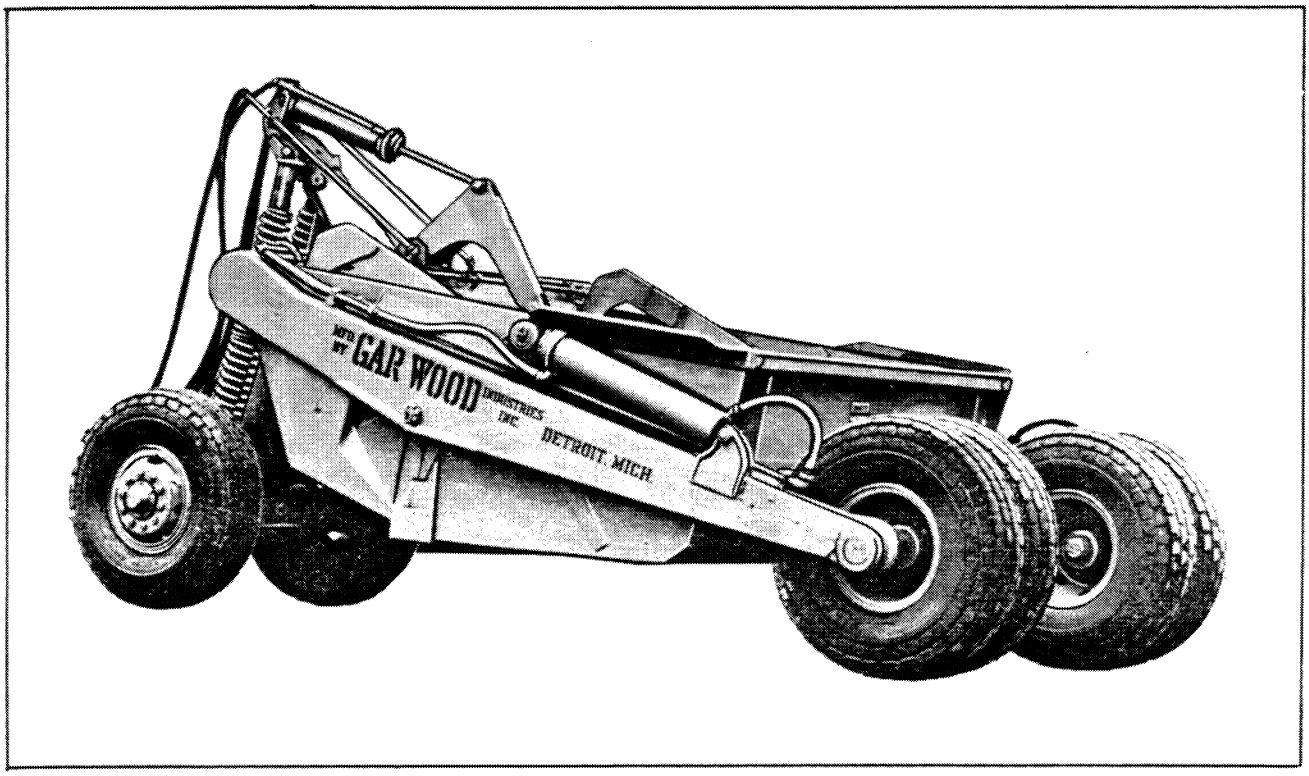


FIG. 1 A

A-SCRAPERS.

The type of scraper used on most of the construction work under progress at the present time is referred to as a four-wheel scraper. This is true, in spite of the fact that the rear wheels may cary dual tires.

Among the four-wheel scrapers, there are two general types, cable operated and hydraulic operated. In this case, too, both have their advantages and disadvantages, and it is largely the conditions under which the machines are to work that determines which is to be chosen. Also, our personal experience of the contractor is a great factor, and his choice may be

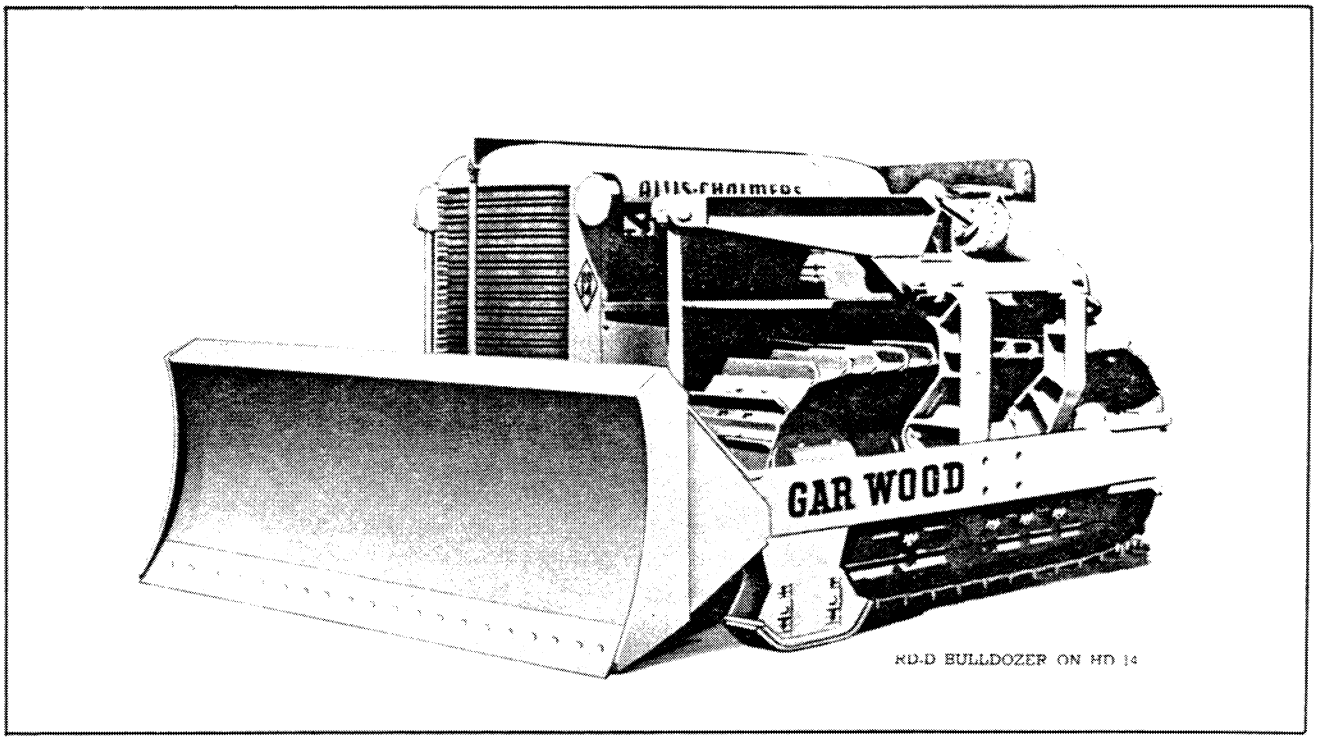


FIG. 9 A

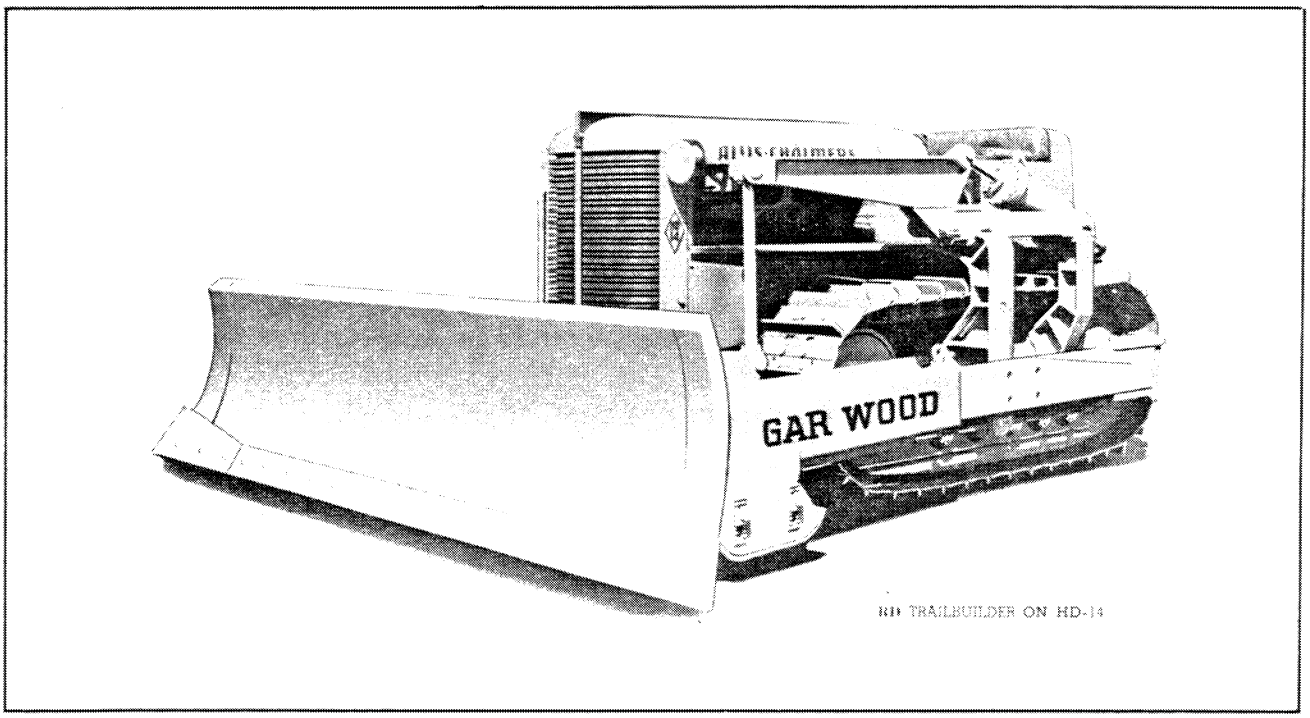


FIG. 9 B

great amount of the working time will be spent in building roads on side hills or "pioneer" roads. It is for this purpose that the angle dozer is particularly designed and best suited.

It may be well remembered, too, that an angle dozer by nature of its design has a much wider blade, and other things being equal, requires proportionately more power to operate. For this reason it is always advisable to choose a standard gauge tractor in preference to a wide gauge model to prevent overloading.

The majority of bulldozers built today are of the so-called track-mounted type, the lifting mechanism of which is mounted on brackets attached to the track frames, and the side members are pivoted to a trunnion which is also attached to the track assembly, in most cases directly opposite the extension of the sprocket shaft.

ors have "dubbed" this installation "Finger-tip Control" because of convenient location, ease and smoothness of operation.

6. When operating Bulldozers the first time after mounting on tractor, place control valve lever in hold position. Start motor with throttle slightly open. Operate bulldozer thru extreme range of cylinder UP and DOWN several times to work air out of hydraulic lines at same time check all connections for leaks. With moldboard raised to full height check hose. Turn fitting at either end of hose to give curve of greatest radius possible. (See photograph showing sweeping curves of hose.) Apply down pressure and fully collapse cylinders, check and adjust hose in this position. It may be necessary to repeat the above cycle two or three times to obtain best arrangement.

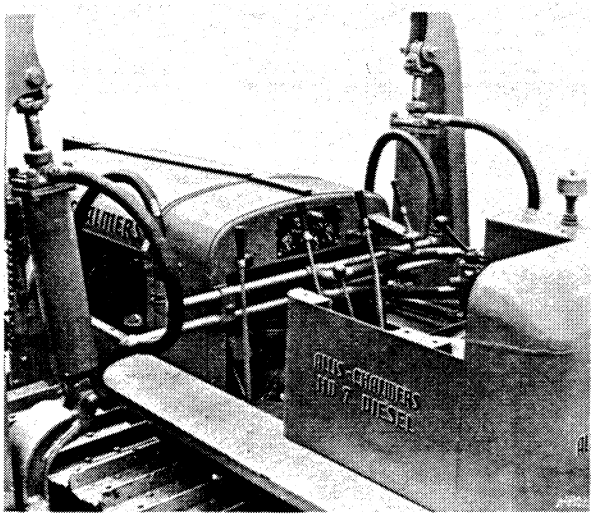


FIG. 3

IMPORTANT—When attaching or arranging hose DO NOT twist it. This may damage the wire braid or destroy bond between wire and lining. If there are any twists in hose after tightening be sure to remove them before operating.

7. Cutting edges—nose points—shoes and wear plates are designed in to the machines at points to absorb wear and can be easily replaced. The operator should check these parts each day, especially the cutting edge and nose points. Cutting edges should be reversed or replaced or built up by welding before wearing away enough to cause wear to take place on moldboard structure which supports the cutting edge. Wearing into the supporting structure may cause failure and costly repair.
8. IMPORTANT—When ordering repairs give MODEL and SERIAL NO. of machine. In case of hydraulic hose give additional information—diameter of hose and OVERALL length including threaded ends of pressed on fittings. DIAMETER of hose is determined by nominal pice size of fittings. Those used are—½"—¾"—1"—1¼" and 1½"

B. LUBRICATION

1. Use only CLEAN oil in the hydraulic system—dirty oil causes wear on the pump and valve parts.

Below 10° F.	S.A.E. 10
10° to 90° F.	S.A.E. 20
Above 90° F.	S.A.E. 30

2. Use straight mineral oil of a viscosity ranging between 150 and 250 sec. at 100 degrees. Oils in this range are suitable for operating at temperatures between 10 and 90 degrees, Fahrenheit. At lower temperatures use lighter oil and at temperatures above 90 a heavier oil may be used. After a pump has become worn, pressure may be increased to some extent by use of heavier oil, but it is recommended not to exceed an S.A.E. 40.
3. Drain old oil, flush entire system with kerosene and replenish with new oil every 300 hours of operation. Under extremely dusty conditions this should be done oftener.
4. Use a S. A. E. 90 oil during the winter and a S.A.E. 160 during the summer in the hydraulic pump drives and clutch cases.
5. High pressure grease fittings are provided at top and bottom of hydraulic cylinders and should be lubricated with regular tractor grease. In lubricating be sure to force enough grease in to bushings to force out old grease and dirt.

C. CARE OF HYDRAULIC PUMP

If the pump fails to deliver required pressure to the cylinders after continued service, the cause may be found in one or more of three places—Pump, Valve, or Cylinder.

1. Worn out cup leathers allow oil to flow past the piston and out the opposite end. This condition is usually accompanied by excessive temperature in continuous operation.
2. Any loss of oil from high pressure side of the valve to the low pressure side effects the operation of the cylinders and should be checked as outlined under "Care of Hydraulic Valve" before removing pump from tractor.
3. Should the cause not be found in the above sources, remove pump.

D. SERVICING PUMP

We recommend that pumps be returned to our plant for reconditioning. However,