





FORDSON

Fordson Dexta
Fordson Super Dexta
2000 Super Dexta
New Performance Super Dexta

Fordson Major Diesel (FMD)
Fordson Power Major (FPM)
Fordson Super Major (FSM)
New Performance Super Major (New FSM)
5000 Super Major

FORD

Fordson Dexta
Fordson Super Dexta
2000 Super Dexta
New Performance Super Dexta

SHOP MANUAL
FORDSON

FORDSON DEXTA, FORDSON SUPER DEXTA
FORD 2000 SUPER DEXTA
NEW PERFORMANCE SUPER DEXTA

Tractor serial number is stamped on left side of clutch housing flange and prefixed by model number. Engine serial number is stamped on left hand side of cylinder block.

INDEX (By Starting Paragraph)

CONDENSED SERVICE DATA

GENERAL

Engine Make	Perkins
Cylinders	3
Bore—Inches, Fordson Dexta	3.5
Bore—Inches, Fordson Super Dexta, Ford 2000 Super Dexta, New Performance Super Dexta	3.6
Stroke—Inches	5
Displacement—Cubic Inches, Fordson Dexta	144
Displacement—Cubic Inches, Fordson Super Dexta, Ford 2000 Super Dexta, New Performance Super Dexta	152.7
Compression Ratio (144 cu. in.)	16.5:1
152.7 cu. in.	17.4:1
Pistons Removed From:	Above
Main & Rod Bearings Adjustable	No
Cylinder Sleeves—Type	Dry
Generator & Starter Make	Lucas

TUNE-UP

Firing Order	1-2-3
Valve Tappet Gap—Intake & Exhaust	0.010 H
Valve Face Angle—Degrees	44
Valve Seat Angle—Degrees	45
Engine Low Idle—RPM	550
Engine High Idle—RPM (New Performance Super Dexta)	2450
Engine High Idle—RPM (All Other Models)	2200
PTO High Idle—RPM	See paragraph 47 or 48
Battery Terminal Grounded	Positive

SIZES—CAPACITIES—CLEARANCES

Crankshaft Journal Diameter	2.749
Crankpin Diameter	2.249
Camshaft Journals Diameter (Front)	1.87
(Center)	1.86
(Rear)	1.84
Piston Pin Diameter	1.25
Valve Stem Diameter, Intake	0.3115
Valve Stem Diameter, Exhaust	0.3115
Main Bearing Diametral Clearance	0.0025-0.0045
Rod Bearings Diametral Clearance	0.002-0.0035
Piston Skirt Clearance (144 cu. in. engine)	0.0035-0.0055
Piston Skirt Clearance (152 cu. in. engine)	0.0045-0.0065
Crankshaft End Play	0.002-0.010
Camshaft Bearing Diametral Clearance	0.004-0.008
Cooling System—Quarts	9
Crankcase—Quarts (with Filter)	8
Transmission—Quarts	14
Differential, Final Drive & Hydraulic Reservoir—Quarts	20.4
Steering Gear Housing	1 Pint

FRONT SYSTEM AND STEERING

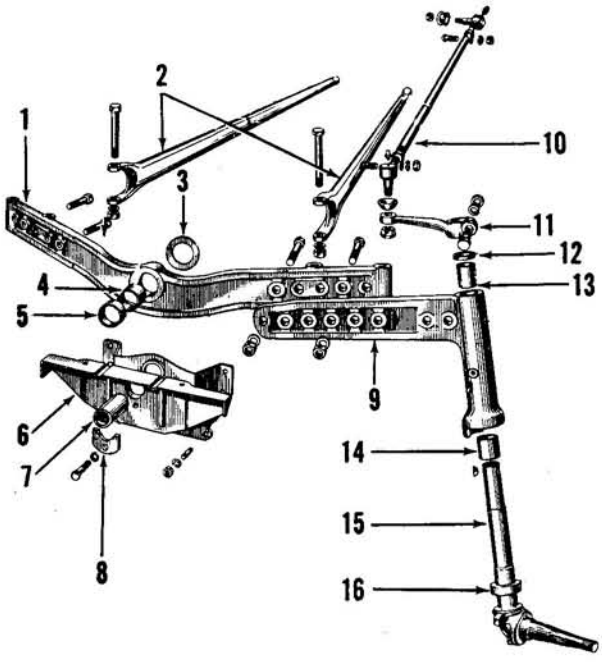

Fig. FO500—Exploded view of front axle and related parts used on the Fordson Dexta. Similarity to American produced Ford tractors will be noted.

1. Axle center member
2. Radius rod
3. Rear spacer
4. Pivot pin bushing
5. Front spacer
6. Front support
7. Pivot pin
8. Pivot pin retainer
9. Axle extension
10. Drag link
11. Steering arm
12. Dust seal
13. Upper bushing
14. Lower bushing
15. Spindle
16. Thrust bearing

SPINDLE BUSHINGS

1. To renew the spindle bushings, support front of tractor and disconnect steering arms from the wheel spindles. Slide spindle and wheel assemblies from axle extensions and remove old bushings using a cape chisel. Install new bushings using a piloted drift of the appropriate size. Internal diameter of new bushings are 1.2495-1.2515 for the upper bushing (13—Fig. FO500) and 1.3425-1.3445 for the lower bushing (14). Diameter of a new spindle (15) is 1.245-1.246 at the upper bearing surface and 1.338-1.339 for the lower.

AXLE CENTER MEMBER AND PIVOT PIN BUSHING

2. To remove the axle center member (1—Fig. FO500), support front of tractor and unbolt radius rods and axle extensions from the axle center member. Remove the axle pivot pin clamping bolt and retainer (8) and remove the pivot pin using a pilot bearing puller and slide hammer. Slide axle center member sideways out of front support (6).

Axle pivot pin bushing (4) can be renewed at this time and should be installed with a piloted drift. New

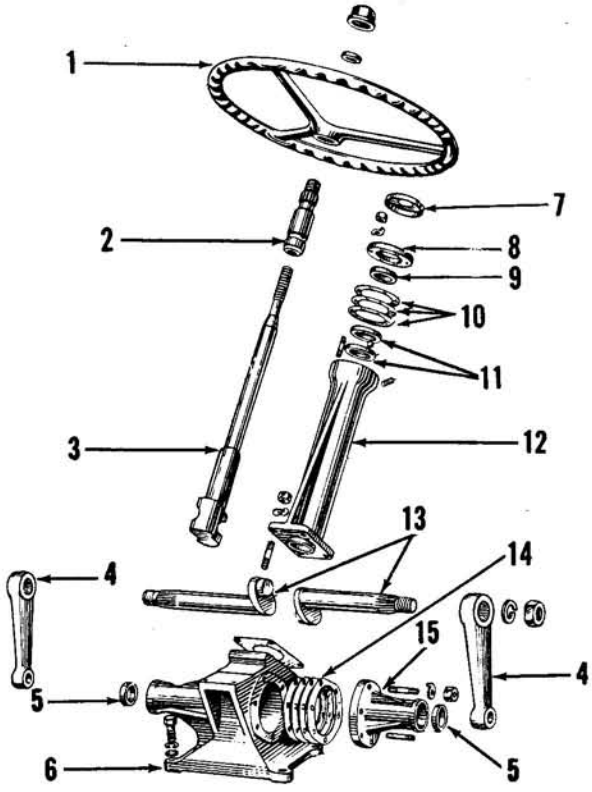

Fig. FO501 — Exploded view of worm and nut type steering gear. Rotary movement of the main nut (2) moves the worm shaft (3) vertically, rotating the two rocker shafts (13) in opposite directions.

1. Steering wheel
2. Steering gear main nut
3. Steering worm shaft
4. Steering arm
5. Oil seal
6. Main housing
7. Dust cap
8. Top cover plate
9. Oil seal
10. Shim pack
11. Ball bearings
12. Steering coulmn
13. Rocker shafts
14. Shim pack
15. Rocker shaft housing

bushing will require no final sizing if not distorted during installation. Make certain, however, that pivot pin has a free fit in the bushing before reinstalling the axle center member.

Tighten the pivot pin retaining cap screw to a torque of 75-85 ft.-lbs. and the front axle extension bolts to a torque of 100-110 ft.-lbs.

FRONT SUPPORT

3. To remove the front support (6—Fig. FO500), remove front axle as outlined in paragraph 2, drain cooling system and remove the hinged hood, grille assembly and radiator. Unbolt and remove the front support from the engine mounting bolts.

DRAG LINKS AND TOE-IN

4. Drag link ends are of the non-adjustable automotive type. The procedure for renewing the drag link ends is evident. Correct toe-in is ¼ to ½-inch. During original factory assembly, toe-in is correctly set and chisel marks are made on the spindle steering arms and axle extensions to mark the setting. In servicing the front end, make sure that each drag link is varied an equal amount to obtain the correct toe-in.

STEERING GEAR

5. The worm and nut type steering gear used on the Dexta tractor is of unique design. An examination of the exploded view shown in Fig. FO501 will assist in understanding the steering gear operation.

The steering gear main nut (2) is secured to the upper end of steering column (12) by the loose ball bearing (11) which controls both end and side thrust. The main nut ball bearing is adjusted by means of the cover plate (8) and adjusting shims (10). Rotation of the steering wheel acts on the worm shaft (3) to raise or lower the shaft in the steering column. The two rocker shafts (13) act directly in machined slides in the lower end of the worm shaft to rotate the steering arms (4) in the proper direction to perform the steering action. End float of the rocker shafts is controlled by shims (14) between the left shaft housing (15) and the main housing (6).

6. **ADJUSTMENT.** Both the rocker shaft end float and the main nut bearing should be adjusted to eliminate slack without applying preload. The steering shaft main nut bearing controls side play as well as end float. To check the main nut bearing adjustment, grasp the rim of the steering wheel and check for excessive rocking motion. If excessive motion is found, rig a dial indicator to contact the top of the steering wheel nut and measure the end float while moving the main nut back and forth with the steering wheel. To correct the bearing adjustment, first remove steering wheel nut and steering wheel, drive pin from the throttle lever and remove lever. Remove the four screws retaining upper instrument panel and move panel to the side out of the way. If necessary, the warning light bulb holders can be pulled out of their sockets. Bend back the locking tabs on the six cover plate retaining nuts and remove the nuts and cover plate. The cover plate oil seal can be renewed at this time. Remove shims corresponding in thickness to the measured end play and reinstall the cover plate and retaining nuts. Shims are available in thicknesses of 0.002, 0.004 and 0.010. Disconnect the steering drag links at the rear and check steering gear for free rotation before reassembling. Tighten the cover plate nuts to a torque of 10-15 ft.-lbs. and lock in place. Reassemble by reversing the disassembly procedure.

To check the end float of the rocker shafts, rig a dial indicator to bear on the end of the left rocker shaft and check for end float in the shaft by moving it back and forth with the steering arm. If end float is excessive, the steering gear should be removed and overhauled as outlined in paragraphs 7 and 8.

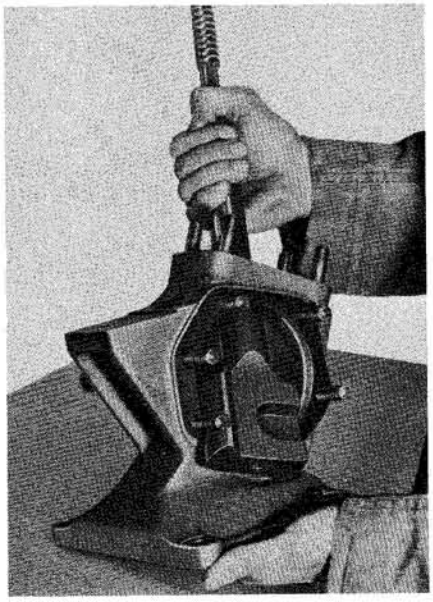

Fig. FO502—To remove the steering worm shaft from main housing, remove lower stud and withdraw shaft through side opening as shown.

7. **REMOVE AND REINSTALL.** To remove the steering gear assembly, first remove the hood, battery and steering housing lower side plates. Drain approximately ½ gallon of coolant from the radiator and remove the temperature indicator sending unit from the engine block. Remove the steering wheel, drive the pin from the throttle lever and remove lever. Remove the four screws retaining the upper instrument panel plate and remove the plate. Disconnect the fuel, primer and bleed back lines from the fuel tank and unbolt and remove the tank complete with upper instrument panel and temperature gage. Disconnect and remove the vertical throttle rod. Disconnect the drag links from the steering arms and unbolt and remove the steering gear assembly.

To reinstall, reverse the removal procedure. Secure the warning light bulb holders to the upper steering column with a piece of string before installing the fuel tank. Make sure the three rubber mounting pads are in place before fastening the fuel tank in place.

8. **OVERHAUL.** First remove the unit from the tractor as outlined in paragraph 7, then unstake and remove the six nuts retaining the steering gear top cover and remove the cover (8—Fig. FO501). Remove the main nut upper race and the fifteen loose balls and unscrew the main nut (2) from the steering worm shaft (3). Invert the steering assembly over a drain pan and drain the oil. Unstake and remove the four nuts retaining the steering column (12) to the main housing and remove the column. The main nut bearing lower race can be removed from the upper end of the steering column at this time by drifting it out from below with a suitable drift.

Unstake and remove the six nuts retaining the left rocker shaft housing (15) to the main housing and remove the housing and left rocker shaft (13). Keep the adjusting shims (14) together in a safe place to avoid damage to the shims. Remove the lower stud from the main housing and remove the steering worm shaft from the side opening as shown in Fig. FO502.

Clean the parts in a suitable solvent and examine. Renew those that are scored, worn or otherwise damaged. Always renew the oil seals when the steering gear is disassembled. The outer and inner rocker shaft bushings are serviced and should be sized after installation if necessary.

Assemble the steering gear by reversing the disassembly procedure. When installing the left rocker shaft and housing, omit the shim pack and tighten the six retaining nuts evenly finger tight. Measure the gap in several places as shown in Fig. FO503 and equalize the gap by adjusting the nuts. When the gap has been equalized, use a feeler gage to determine the thickness of shim pack necessary to remove all end float without binding. Steel shims are available in thicknesses of 0.005 and 0.030 and paper gaskets in thicknesses of 0.002 and 0.010. The 0.010 gasket will compress to approximately 0.007 when nuts are properly torqued. A paper gasket should be fitted on each side of the shim pack. Tighten the six retaining nuts to a torque of 55-65 ft.-lbs. and stake in place.

Reinstall the steering column and tighten the retaining nuts to a torque of 55-65 ft.-lbs.; then, install the steering nut, the fifteen bearing balls and upper race. Remove the shim pack (10—Fig. FO501) from the cover plate and install the plate and retaining nuts finger tight. Determine the thickness of the shim pack as outlined for the rocker shaft adjustment, remove the cover and install a shim pack of the proper thickness to just eliminate end float without causing any binding tendency. Tighten the six retaining nuts to a torque of 10-15 ft.-lbs. and stake in place. Center the steering worm shaft between the stops by counting the revolutions of the main nut and fill the steering gear with 90W lubricant as follows:

Remove the bleed plug in the upper end of the steering column and pour the lubricant down the center of the main nut until the upper end of the worm shaft is just covered. Reinstall the bleed plug and reinstall the steering gear on the tractor.

There are no master splines for the location of the steering arms on the rocker shafts. When correctly installed, both arms will incline to the rear approximately 7 degrees with the worm shaft half way between the stops. To aid in installing the arms, one chisel mark has been made on the outer end of the rocker shafts and two chisel marks are located on the outer face of the large boss on the steering arm. The chisel mark on the shaft should index with one of the marks on the steering arm, depending on which side of the tractor it is installed. If the chisel marks are in alignment and both arms incline to the rear an equal amount, the steering arms are properly installed.

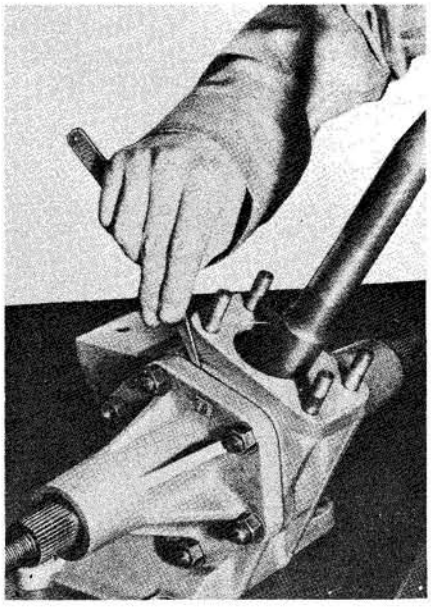

Fig. FO503—Rocker shaft and main nut bearing are adjusted to zero clearance by means of shims. Method of determining thickness of shim pack is shown, see text for details.

ENGINE AND COMPONENTS

The Fordson Dexta tractor is equipped with a three-cylinder diesel engine having a bore of 3.5 inches, a stroke of 5 inches and a piston displacement of 144 cubic inches.

The Fordson Super Dexta, Ford 2000 Super Dexta and New Performance Super Dexta are equipped with a three-cylinder diesel engine having a bore of 3.6 inches, a stroke of 5.0 inches and a piston displacement of 152 cubic inches.

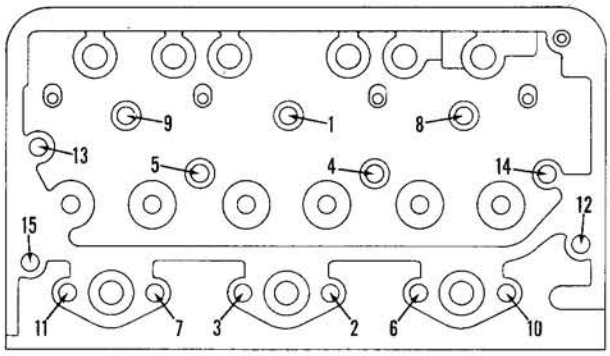

Fig. FO504 — Cylinder head nuts should be tightened to a torque 55-60 Ft.-Lbs. in the sequence shown. Cylinder head bolts on left side of engine extend to retain injectors; a deep socket is therefore required.

Both the 144 and 152 cubic inch engines are similarly constructed. Differences in the 144 cubic inch engine due to production changes and between the 144 and 152 cubic inch engines are noted in the text where service procedures and/or specifications are affected.

R&R ENGINE ASSEMBLY

9. To remove the engine and clutch assembly first drain the cooling system, remove hood and if the engine is to be disassembled, drain oil pan. Disconnect the radiator hoses, headlight wire and the grille braces from top water outlet. Disconnect the radius rods and steering drag links at rear, support the tractor under transmission housing and unbolt the front support assembly from engine. Roll the front axle, front support and radiator as an assembly away from tractor and block same in an upright position.

Shut off the fuel and disconnect the fuel primer and bleed back lines. Remove the battery, battery support and fire wall. Disconnect wires from the oil pressure warning light sender, generator, starter, cold starting unit and lights. Disconnect the tachometer cable, heat indicator sending unit, starter cable and starter control rod. Remove the air cleaner, throttle link or governor control rod, swing the engine from the two engine mounting hooks and unbolt engine from the transmission case.

CYLINDER HEAD

10. To remove the cylinder head, first drain cooling system and remove the hood. Loosen the injector lines at the pump and disconnect lines from injectors. Remove the bleed-back line. Immediately cap all exposed fuel line connections to protect the system from dirt and remove injectors. Remove the rocker arm cover and rocker arms assembly. Disconnect battery cables and remove battery. Remove the heat indicator sending unit and disconnect the water outlet casting from cylinder head. Disconnect the fire wall from the two brackets located on cylinder head, then disconnect the air cleaner mounting bolts and upper hose. Unbolt and remove the right fire wall bracket and rear engine lifting plate from the cylinder head. Disconnect the external oil feed line from the right rear corner of the cylinder head. Loosen the two bolts securing the fire wall to the clutch housing and rock the fire wall back enough to remove the clip attaching the governor vacuum line to the cylinder head. Disconnect the primer fuel line, governor vacuum line, heater unit electrical lead and throttle link from the intake manifold. Unbolt and remove the cylinder head.

The head gasket is marked "Top—Front." Coat the head gasket on both sides with an approved sealing compound before installing. Tighten the cylinder head nuts in the sequence shown in Fig. FO504 to a torque of 55-60 ft.-lbs. Make certain that the bores and seats for the injectors are clean and free from dirt and carbon. Install the injectors using a new copper sealing washer and tighten the injector holding nuts evenly to avoid cocking the injector. After restarting the engine, check the injectors for compression blow-by. Adjust the valve tappet clearance to 0.010 for each valve after the engine has been brought up to operating temperature.

VALVES AND SEATS

11. Exhaust and intake valves seat directly in the cylinder head. Valve heads and seat area of the cylinder head are numbered consecutively 1 to 6 from front to rear of engine. Valve seats for both the intake and exhaust valves should be ground to an angle of 45 degrees. A seat width of $\frac{1}{16}$-$\frac{3}{32}$-inch should be maintained, using appropriate narrowing stones. Valves should be ground to a face angle of 44 degrees. No more material than is necessary should be removed when regrinding valves and seats. After reinstalling the valves in their appropriate seats, the maximum clearance between the top of the valve head and the face of the cylinder head should be measured using a straight edge and feeler gage or special depth gage, as shown in Fig. FO505. If the clearance for any valve exceeds 0.140, the valve must be renewed. If clearance is less than 0.059, reface valve so that clearance is 0.059-0.087. Valve stem diameter is 0.311-0.312.

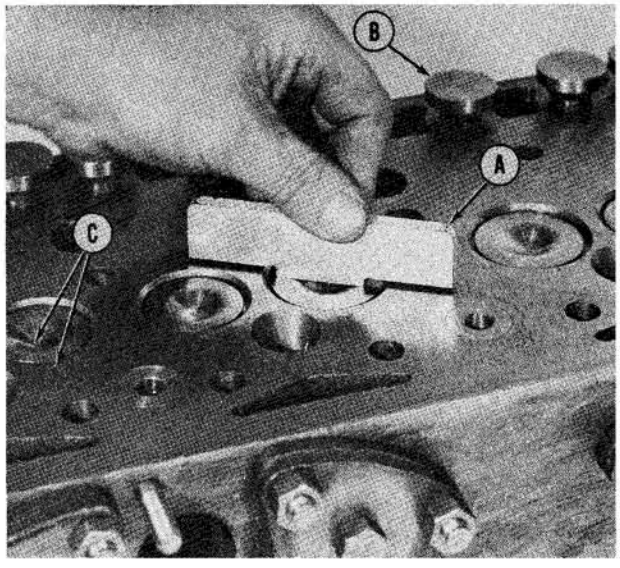

Fig. FO505 — Measuring valve head clearance with special depth gage. A straight edge and feeler gage may be used. If clearance exceeds 0.140, valve should be renewed.

VALVE GUIDES AND SPRINGS

12. Intake and exhaust valve guides are interchangeable and should be pressed from the cylinder head if renewal is required. New valve guides have an inside diameter of 0.314-0.3155 and a stem to guide clearance of 0.002-0.0045. Renew the guide and/or valve if the clearance is excessive. Valve guides on early Fordson Dexta models were pressed into cylinder head until machined shoulder on guides contacted top surface of head. Later production guides have no shoulder and must be installed so that they protrude 0.584-0.594 from top surface of cylinder head. It is recommended that a collar which is 0.584-0.594 wide be fitted around the guide and used as a stop when pressing new guides into cylinder head. Install guides with counterbored end down. New valve spring seat washers with smaller I.D. must be used with new type guides.

Springs, retainers and locks are interchangeable for the intake and exhaust valves. The valves are fitted with an inner and outer spring which may be installed on the valve with either end up. The inner spring has a free length of 1.365-1.405 and should test 21-25 lbs. when compressed to a length of 0.838. The outer spring has a free length of 1.783-1.803 and should test 48-52 lbs. at 1.151 inches compressed length. Valve springs should be renewed if they are discolored, distorted or fail to meet the test specifications given.

VALVE TAPPETS

13. The mushroom type valve tappets operate directly in machined bores in the cylinder head and are retained in the head by the adjusting screw lock nuts. The diameter of the tappet stem is 0.62225-0.62375, with a recommended clearance of 0.00075-0.0035 in the cylinder head bore. To remove the tappets, first remove the cylinder head; then, remove the adjusting screw and locknut and slide the tappets from the cylinder head bores.

Tappet gap should be set to 0.010 for both the intake and exhaust valves. The gap should be set with the engine at operating temperature. To adjust the tappet gap, open the timing cover on the left side of the flywheel housing and turn the engine until the TDC mark on the flywheel is aligned with the mark on the housing. If No. 1 cylinder is on the compression stroke (both valves closed), adjust the gap on valve Nos. 1, 2, 3 and 5 to the recommended 0.010 clearance. If both valves on No. 1 cylinder are partially open, adjust valve Nos. 4 and 6. Turn the engine one full revolution until the TDC mark is again aligned and adjust the remainder of the valves.

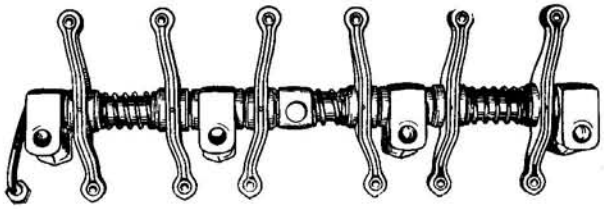

Fig. FO507 — Top view of rocker shaft assembly, showing proper positioning of rocker arms.

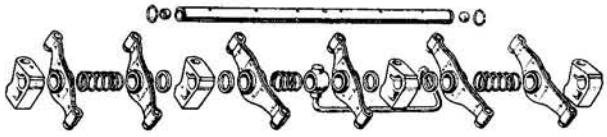

Fig. FO508 — Exploded view of rocker shaft assembly showing proper location of the various parts.

ROCKER ARMS AND SHAFT

14. To remove the rocker arms assembly, raise hood and remove the cover. Disconnect oil feed line from the cylinder head at rear of rocker arms shaft and unscrew the four retainer nuts evenly.

To disassemble, remove the snap ring at rear of shaft and withdraw parts from the shaft. The rocker arms are right hand and left hand assemblies and should be installed as shown in Fig. FO507. The rocker shaft has a diameter of 0.62225-0.62375 with a recommended diametral clearance of 0.00075-0.0035 between the rocker arm and shaft. If the clearance is excessive, renew the rocker arm or shaft as required. When reassembling the rocker shaft, refer to Fig. FO508 for the correct location of the parts.

Note: If sufficient lubricant does not reach the rocker shaft, check oil lines shown in Fig. FO512 for obstruction.

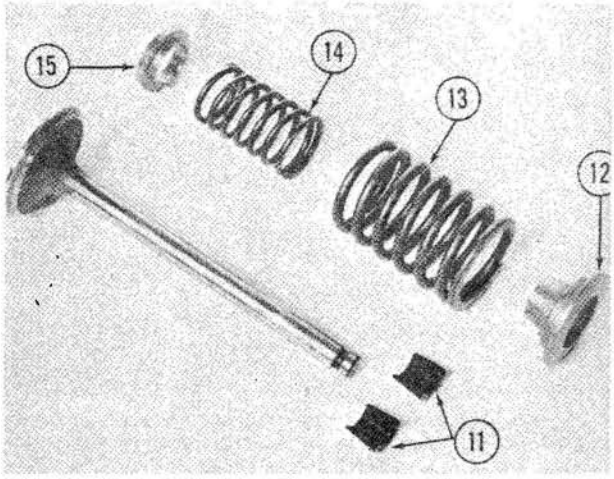

Fig. FO506 — Exploded view of valves & springs.

11. Spring keepers
12. Spring retainer
13. Outer spring
14. Inner spring
15. Spring seat

TIMING GEAR COVER AND GEARS

15. **GEAR COVER.** To remove the timing gear cover, first drain radiator, remove hood and disconnect the headlight wires. Disconnect the grille braces from water outlet on cylinder head and disconnect the radiator hoses. Disconnect radius rods and drag links at rear end, support tractor under flywheel housing, unbolt front support from engine and roll the assembly away from tractor.

Unbolt top water outlet from cylinder head, and water pump from timing gear cover; then, remove both units from the tractor as an assembly.

Remove the starting jaw and crankshaft pulley, then unbolt and remove the timing gear cover. The crankshaft front oil seal can be renewed at this time and should be installed with a suitable driver so that lip faces rear of engine.

16. **TIMING GEARS.** Before removing any gears in the timing gear train, first remove rocker arm cover and rocker arms assembly to avoid the possibility of damage to the pistons or valve train if either the camshaft or crankshaft should be turned independently of the other.

The timing gear train consists of the crankshaft gear, camshaft gear, pump drive gear and an idler gear connecting the other three gears of the train.

Timing gear backlash should be 0.003-0.006 between the idler gear and any of the other timing gears. Replacement gears are available in standard size only. If backlash is not within recommended limits, renew the idler gear, idler gear shaft and/or any other gears concerned.

Unstake and remove the idler gear retaining bolt and slip the gear off the idler shaft. The shaft has a light press fit in the engine block and is further positioned by the pin shown in Fig. FO509. Pry shaft from its place in the block if renewal is indicated.

The crankshaft gear is keyed in place and fits the shaft with 0.001 press fit to 0.001 clearance. If the old gear is a loose fit, it may be possible to pry it off the shaft with a heavy screwdriver or pry bar. If a puller is needed, it will first be necessary to remove the oil pan and lower timing gear housing.

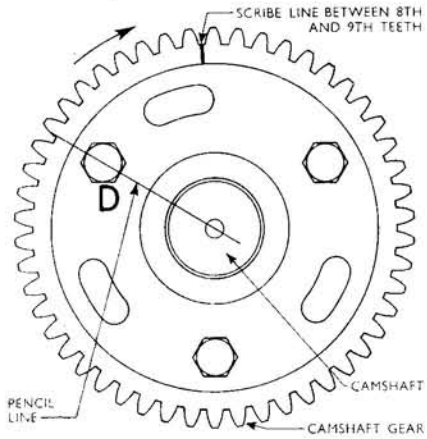

Fig. FO510—Suggested method for marking camshaft timing gear if replacement gear is unmarked. See text.

The camshaft gear and pump drive gear are identical and replacement gears may not be marked When renewing camshaft or pump drive gear, proceed as outlined in the appropriate following paragraph.

17. CAMSHAFT TIMING GEAR. The gear is attached to the camshaft by cap screws through the three round holes located in the gear face. Hole spacing is equal and the gear can be attached to the camshaft in any one of three positions; however, only one of these positions will permit correct timing of the engine. One of the round attaching holes is marked with a stamped letter "D" on the front face of the gear as shown in Fig. FO510. On later production tractors, the camshaft is marked with a stamped letter "D" on the front face of the hub center, slightly to one side. Install the gear on the camshaft so that the letter "D" on the camshaft is nearest the attaching hole marked "D" on the camshaft gear. Using a straight edge, draw a line from the center of the camshaft, through the center of the cap screw in the marked hole, to the outer rim of the gear as shown in Fig. FO510. Count 8 gear teeth clockwise from this marked line and scribe a timing mark between the eighth and ninth teeth as shown.

On older production tractors, where the stamped letter "D" is on gear flange camshaft, install the camshaft in its journals and rotate the shaft while applying pressure to the third tappet from the front of the engine. When the third tappet is raised to the top of its stroke, the uppermost hole in the camshaft flange should be marked to align with the stamped letter "D" on the camshaft gear. From this point, proceed as directed above for the timing mark location.

18. INJECTION PUMP DRIVE GEAR. The gear is attached to the adapter by means of cap screws through the three slotted holes in the face of the gear. The holes are not equally spaced and the gear can be

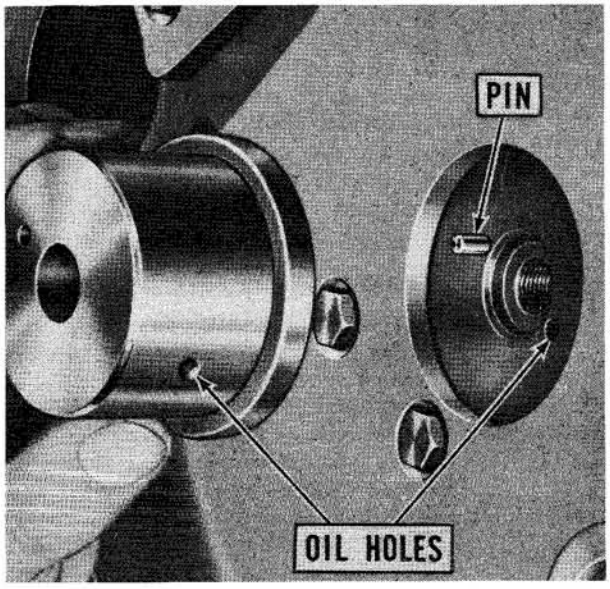

Fig. FO509—Idler gear shaft is a light press fit in block and is retained in place by idler gear bolt. Note timing gear oil feed hole in block and corresponding hole in shaft. Locating pin keeps oil feed holes aligned.

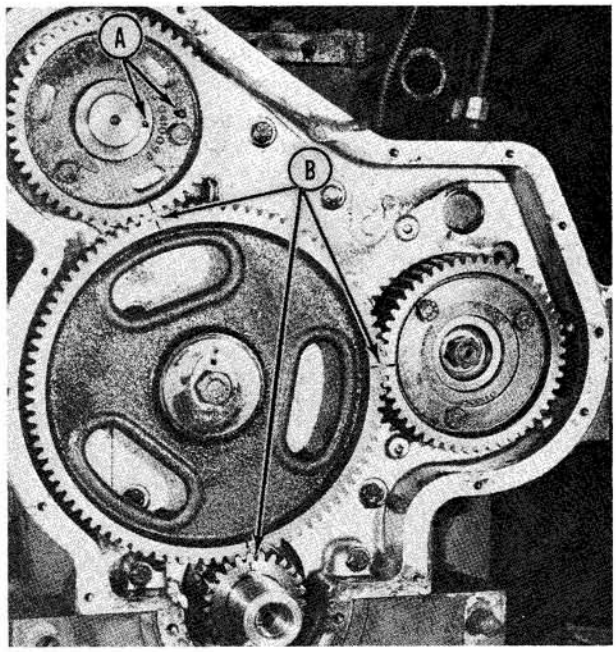

Fig. FO511—View of engine timing gears with marks properly aligned showing (A) camshaft and gear locating marks and (B) timing marks.

attached to the adapter in only one position. Before installing a new unmarked injection pump drive gear, first install and time the remainder of the gears as outlined in paragraph 19, and remove the timing window cover plate from the timing gear housing flange. Slip a socket wrench with a short extension through the hub of the gear and fit the socket over the nut securing the drive gear adapter to the injection pump camshaft. Rotate the injection pump clockwise until the timing line marked "S" on the gear adapter flange of pumps with vacuum governor; or timing line marked TC on gear adapter flange of pumps with mechanical governor, aligns with the timing mark on the housing. Slight pressure will be required on the wrench handle to keep the two marks in line. Install the gear on the adapter so that the three attaching cap screws can be installed approximately midway in the three slots. Install the retaining washer and three cap screws in the gear adapter and tighten securely. After the gear has been installed and tightened, affix a timing mark on the gear tooth which aligns with the mark on the idler gear.

19. TIMING THE GEARS. Due to the odd size of the idler gear, the timing marks will all be in alignment only once in 18 crankshaft revolutions. To time the engine, unstake and remove the idler gear attaching bolt and remove the idler gear. The rocker arm cover and rocker arms assembly should previously have been removed. Rotate the crankshaft until the keyway and timing mark are in a vertical position, rotate the camshaft until the timing mark aligns as nearly as possible with the center of the idler gear shaft, rotate the injection pump until the timing mark aligns with the center of the idler gear shaft. Pressure will need to be applied to hold the injection pump timing mark in alignment. Install the idler gear so that the three timing marks on the gear align with the timing marks on the crankshaft, camshaft and injection pump drive gears. The engine will then be in proper time. Reinstall the idler gear retaining bolt and washer and stake in place. Fig. FO511 shows the engine with the timing marks in proper alignment.

CAMSHAFT

20. To remove the camshaft, first remove the timing gear cover as outlined in paragraph 15, remove the rocker arm cover and rocker arms assembly, lift the tappets and withdraw the camshaft and gear.

Camshaft end thrust is controlled by means of a leaf type spring attached to the timing gear cover. Because of the spur type gears used in the timing gear train, camshaft end play does not present a problem.

The camshaft journals ride in three machined bores in the engine block. The center journal is pressure lubricated by means of an external oil line. Oil for lubrication of the rocker arms and valve train is metered by the center camshaft journal and fed to the rocker shaft by means of the second external oil line. Fig. FO512 shows the location of these two external lines. The front and rear camshaft bearing journals are gravity lubricated by the return oil from the rocker arms assembly.

Camshaft journal diametral clearance is 0.004-0.008 for all three journals. Journal diameter is as follows:

Front journal diameter....1.869-1.870
Center journal diameter...1.859-1.860
Rear journal diameter.....1.839-1.840

CONNECTING ROD AND PISTON UNITS

21. Connecting rod and piston units are removed from above after the cylinder head and oil pan have been removed. To remove the oil pan it is first necessary to remove the front end assembly as outlined in paragraph 15. Connecting rod and bearing caps are numbered to correspond to their respective bores. When installing the rod and piston units, make certain that the correlation numbers are in register and face away from the camshaft side of engine.

The connecting rod caps are secured with self locking nuts which should be renewed and tightened to a torque of 50-55 ft.-lbs. with cadmium plated nuts or 65-70 ft.-lbs. with unplated nuts.

PISTONS, RINGS AND SLEEVES

22. Three compression rings and two oil control rings are fitted to each piston. Fig. FO513 shows the arrangement of the rings on the piston. The top compression ring is chrome plated.

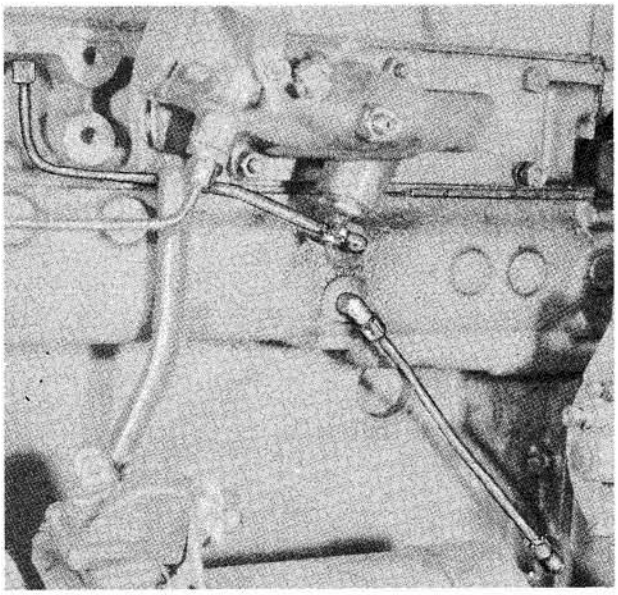

Fig. FO512 — Camshaft and valve train are lubricated by means of two external oil lines shown. Lower line feeds camshaft center bearing. Oil metered by camshaft center bearing is fed to rocker shaft through upper line. Front and rear camshaft journals are gravity lubricated by return oil from rocker shaft.

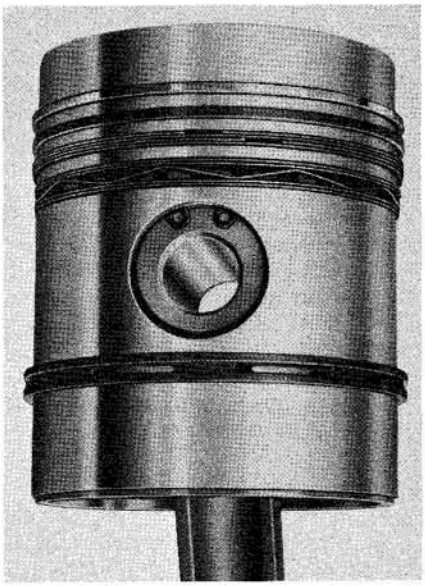

Fig. FO513—Engine piston, showing arrangement of the three solid and two segmented piston rings.

The third compression ring and the top oil control ring are of laminated steel construction. End gap of these rings should be as follows:

Third compression ring...0.008-0.010
Top oil control ring.....0.018-0.037

Installation of the first and second compression rings and the lower oil control ring is conventional. These rings should have 0.002-0.004 side clearance in the ring grooves and end gaps as follows:

First compression ring.....0.010-0.015
Second compression ring...0.009-0.013
Lower oil control ring.....0.009-0.013

The solid rings are non-directional and may be installed either side up.

The third compression ring consists of four spring steel segments which should be installed as illustrated in Fig. FO514. When the ring segments are installed, the end gaps should be positioned 180 degrees apart, and gaps should be above each end of piston pin.

To install the segmented oil control ring, first place the expander in the back of the groove and spiral in two of the segments. Next fit the center spring, then the other two segments. The last segment installed will require a slight pressure to overcome the action of the center spring. The gaps of the four segments should be positioned at equal distances around the piston with none of the gaps in line with the piston pin. The high silicon aluminum alloy piston is available in standard and 0.030 oversize. for 144 cubic inch engine and in standard size only for the 152 cubic inch engine. New piston should be fit with 0.0035-0.0055 clearance in the sleeve in 144 cubic inch engine and 0.0045-0.0065 clearance in 152 cubic inch engine when measured at the piston skirt.

The dry type cast iron cylinder sleeve is furnished as an unfinished sleeve only and must be bored to size after installation. The sleeve should have 0.002-0.004 press fit in the cylinder block in 144 cubic inch engines and 0.002-0.005 press fit in 152 cubic inch engines and should be pressed in until the top of the liner is flush with the top surface of the engine block.

Finish bore the cylinder sleeve to 3.501-3.502 for a standard piston or 3.531-3.532 for the oversize in 144 cubic inch engine and 3.600-3.601 for the standard piston in 152 cubic inch engine.

PISTON PINS

23. The floating type piston pin has an outside diameter of 1.24975-1.2500 and is retained in the piston by snap rings. Piston pin should have a clearance of 0.00025-0.0005 in the piston bosses and a clearance of 0.0005-0.00175 in the connecting rod bushing. These clearances will give a light thumb press fit in the piston and slightly looser fit in the connecting rod bushing.

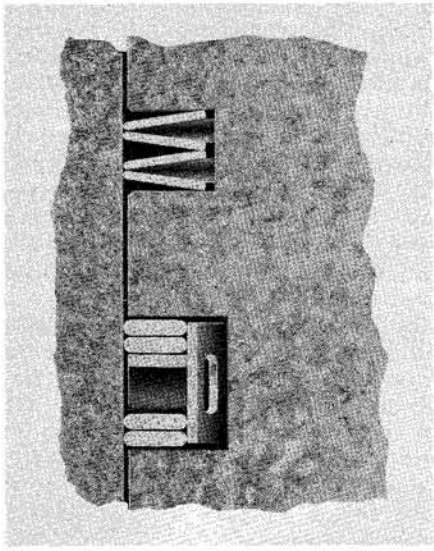

Fig. FO514 — Proper installation arrangement of segmented third compression and upper oil control rings. See text for details.

The connecting rod bushings are renewable and should be final sized after installation.

CONNECTING RODS AND BEARINGS

24. Connecting rod bearings are of the non-adjustable, precision type, renewable from below after the oil pan and connecting rod bearing caps have been removed. When installing new bearing shells, make certain that the projections engage the milled slot in the connecting rod and bearing cap and that the correlation numbers on the rod and cap face away from camshaft side of engine. Bearing inserts are available in 0.010, 0.020 and 0.030 undersize as well as standard.

Check the crankshaft rod journals and the rod liners against the values which follow:

Crankpin journal diameter 2.2485-2.249
Bearing diametral clearance 0.002-0.0035
Rod side play on crankshaft 0.0095-0.0133

Connecting rod center to center length is 8.999-9.001.

When reassembling, install new self-locking connecting rod nuts and tighten to a torque of 50-55 ft.-lbs. if nuts are cadmium plated or 65-70 ft.-lbs. if nuts are unplated.

CRANKSHAFT AND MAIN BEARINGS

25. The crankshaft is supported in four main bearings of the non-adjustable, precision type. Bearing inserts are available in 0.010, 0.020 and 0.030 undersizes as well as standard. Normal crankshaft end play of 0.00225-0.01025 is controlled by renewable flange type thrust washers located in the rear main bearing cap. Washers are available in standard and 0.0075 oversize.

NOTE: Several different types of main bearing inserts have been used and it is important that the type number (not Ford part number) stamped into the back of inserts be the same on both the top and bottom

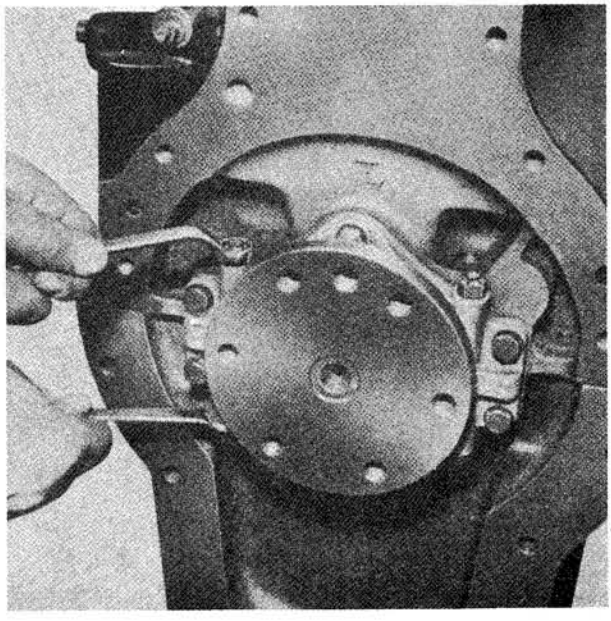

Fig. FO515 — Packing type crankshaft rear oil seal is housed in a two-piece retainer, bolted to engine block and rear main bearing cap as shown.

insert of any one bearing journal. It is recommended that the main bearing inserts be all of one type number. Also, the locking tab on the bottom (bearing cap) thrust washer has been changed in production at engine Serial No. 1449364 and the correct thrust washer must be used.

To remove the front main bearing cap, it is first necessary to remove the timing gear cover, lower timing gear housing and oil pump. To remove the rear main bearing cap, it is first necessary to remove the engine as outlined in paragraph 9 and remove the clutch, flywheel, adapter plate and rear oil seal retainer.

Check the crankshaft and main bearing inserts against the values which follow:

Crankpin diameter 2.2485-2.249
Main journal diameter...2.7485-2.749
Main bearing diametral clearance 0.0025-0.0045
Main bearing bolt torque .....90-95 ft.-lbs.

CRANKSHAFT OIL SEALS

26. The crankshaft front oil seal is mounted in the timing gear cover and may be renewed after the front cover is removed. Removal procedure for the timing gear cover is outlined in paragraph 15. Press the new seal into the cover with the lip to the inside.

The crankshaft rear oil seal can be renewed after detaching engine from clutch housing as outlined in paragraph 56 and removing the clutch, flywheel and engine adapter plate. The rear oil seal retainer is secured to the rear of the engine block and rear main bearing cap by six cap screws and the two halves of the retainer are held together by two long bolts and self-locking nuts as shown in Fig. FO515. The packing type seal halves should be soaked in clean engine oil for a period of one hour before installing in the retainer halves. Press the packings firmly in their retainers, leaving 0.010-0.020 of the packing ends protruding above the face of the retainer. Using new gaskets, fit the two halves of the retainer around the crankshaft and install and tighten the long bolts and self-locking nuts holding the retainer together; then, install and tighten the six cap screws securing the oil seal assembly to engine block and main bearing cap.

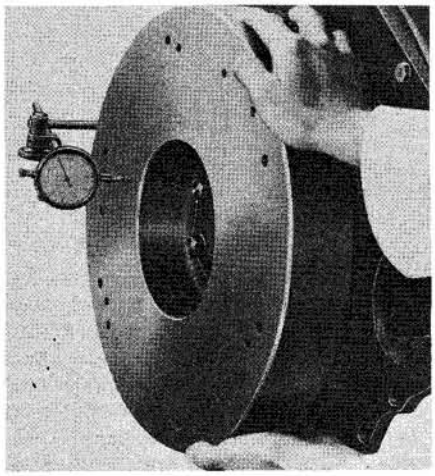

Fig. FO516—After installation of flywheel, runout should be checked as shown. Runout should not exceed 0.004.

FLYWHEEL

NOTE: The same flywheel part number is listed for all models. However, after introduction of the Simms "Minimec" fuel injection pump with a mechanical governor, two "SPILL" timing marks were placed on the flywheel. One mark at 26° BTDC is for use with fuel injection pumps having a vacuum governor and the second mark at 20° BTDC is for use with the mechanical governor type fuel injection pump. If a service flywheel having only one "SPILL" timing mark at 26° BTDC is being installed on a tractor equipped with a mechanical governor type fuel injection pump, a second "SPILL" timing mark at 20° BTDC must be located and stamped into the flywheel so that the pump may be timed. Refer to Fig. FO516A and proceed as follows: Scribe a mark on the flywheel in relation to established "TDC" and "SPILL" marks as shown in Fig. FO516A. Permanently mark flywheel along scribed mark with a sharp cold chisel and, using metal lettter dies, stamp "SPILL" and "20° BTDC" on flywheel. Also stamp "26° BTDC" on flywheel at original "SPILL" mark.

27. The flywheel can be removed after detaching the engine from the transmission case and removing the clutch assembly.

Caution: The flywheel is secured to the crankshaft flange by six cap screws which are safety wired. The flywheel or crankshaft flange are not fitted with locating dowels. Use care after removing the retaining screws to prevent the flywheel from falling from its place on the crankshaft and inflicting possible personal injury.

The starter ring gear is secured to the front of the flywheel by six cap screws and lock washers. Install a new ring gear with the rounded ends of the gear teeth to the front of the engine.

When reinstalling the flywheel, carefully clean the mating surfaces of the flywheel and crankshaft flange.

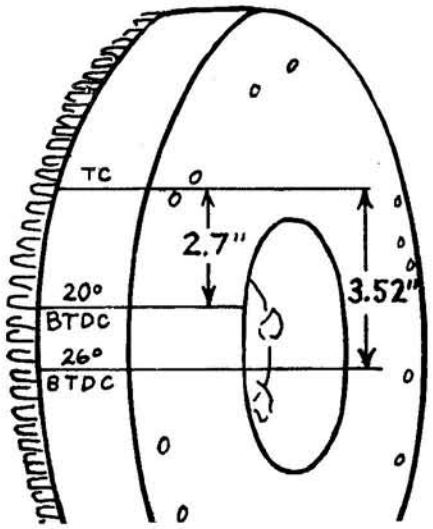

Fig. FO516A—If installing a flywheel having only the 26° BTDC timing mark in engine equipped with mechanical governor type fuel injection pump, locate and stamp the 20° BTDC timing mark on flywheel according to dimensions shown above. Measurements are made around circumference of flywheel.

Tighten the retaining cap screws to a torque of 75 ft.-lbs., affix a dial indicator to the adapter plate and check the flywheel runout as shown in Fig. FO516. Runout should not exceed 0.004 when measured 3¾ inches from the outside edge of the flywheel. A greater runout would indicate the presence of dirt or foreign matter between the flywheel and crankshaft flange, a sprung crankshaft or an improperly ground flywheel face.

NOTE: Prior to Fordson Dexta tractor Serial No. 957E-33407, models equipped with double clutch have spacer washers located between the clutch adapter plate and engine flywheel at each adapter plate retaining bolt. Spacer washers are not required with double clutch adapter plate used on later production tractors.

OIL PUMP AND RELIEF VALVE

28. The oil pump assembly is mounted to the front face of the front main bearing cap and secured to the cap by three screws. The pump is driven from the crankshaft timing gear through an idler gear mounted on the pump flange.

To remove the oil pump, first remove the timing gear cover as outlined in paragraph 15 then unbolt and remove the oil pan. Remove the pump suction and pressure lines and unbolt and remove the lower section of the timing gear housing. Remove the snap ring retaining the oil pump idler gear and lift off the gear. Remove the three cap screws retaining the oil pump to the main bearing cap and remove the pump from its doweled position on the cap.

Paragraph 28 (Cont'd.)

Disassemble the pump, clean the parts in a suitable solvent and examine for wear or broken parts. Reassemble the rotors in the pump body. CAUTION: When pressing drive gear on rotor shaft, support shaft, **do not** apply pressure against pump rotor. Clearance should not exceed 0.006. Check the clearance between the rotor and pump body as shown in Fig. FO519. Clearance should not exceed 0.010. Check the clearance between the top of the rotors and the surface of the pump body as shown in Fig. FO520. Clearance should not exceed 0.003. The drive and driven rotors are serviced as a matched assembly. Renew the front cover plate if the machined surface is worn or scored. The oil pump idler gear is fitted with a non-renewable bushing; idler gear should be renewed if shaft clearance is excessive. Late production pump bodies are fitted with a sealing ring at front cover plate.

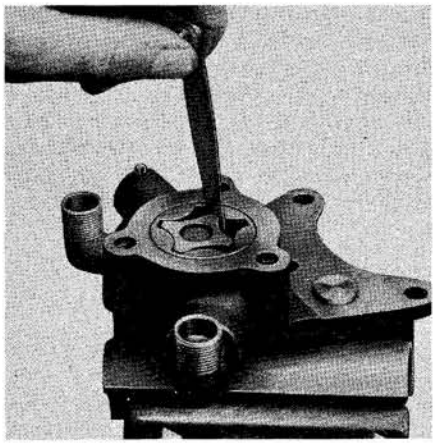

Fig. FO518 — Check clearance between rotors with a feeler gage as shown. Clearance should not exceed 0.006.

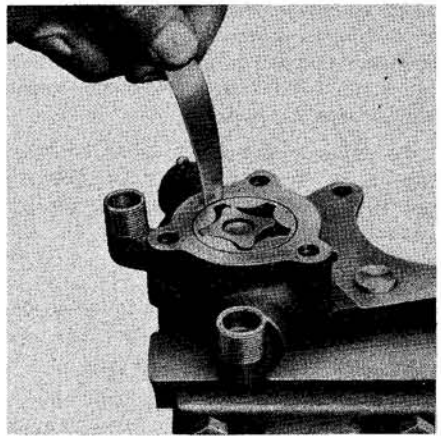

Fig. FO519 — Check clearance between outer rotor and pump body as shown. Clearance should not exceed 0.010.

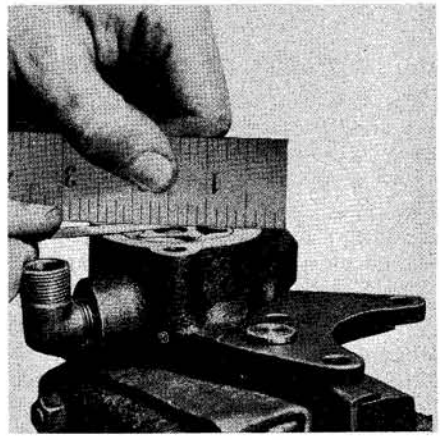

Fig. FO520 — Check clearance between top of rotors and body gasket surface as shown. Clearance should not exceed 0.003.

The opening pressure of the relief valve is pre-set at 60 psi and the normal operating pressure of the lubrication system is 40 psi. Relief valve is not adjustable. On later tractors the relief valve ball was replaced by a solid plunger type valve which was subsequently replaced by a hollow plunger type valve and longer spring. This latest type valve and spring is used to service all previous types. With the later plunger type valves, spring is retained by circular spring seat and cotter pin. The pressure switch connected to the lubrication warning light is designed to break connection when the engine oil pressure reaches 7-9 psi. The warning light should not come on at any time when the engine is running.

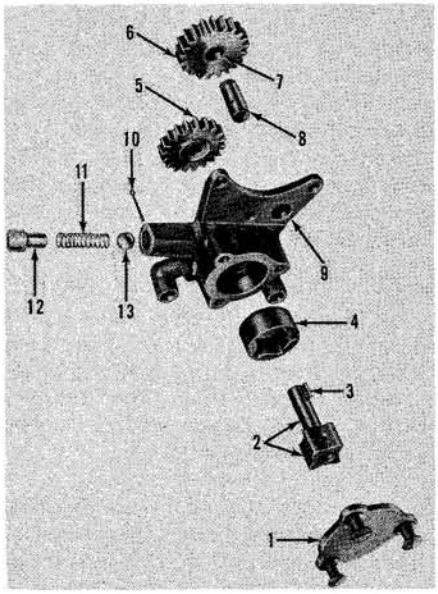

Fig. FO517—Exploded view of engine oil pump showing component parts.

1. Cover
2. Inner rotor
4. Outer rotor
5. Drive gear
6. Idler gear
7. Bushing
8. Idler shaft
9. Pump body
10. Cotter pin
11. Spring
12. Plunger
13. Relief valve

DIESEL FUEL SYSTEM

The diesel fuel system consists of three basic components: the fuel filters, injection pump and injection nozzles. Refer to Fig. FO521A. When servicing any unit associated with the fuel system, the maintenance of absolute cleanliness is of utmost importance. Of equal importance is the avoidance of nicks or burrs on any of the working parts.

Probably the most important precaution that service personnel can impart to owners of diesel powered tractors, is to urge them to use an approved fuel that is absolutely clean and free of foreign material. Extra precaution should be taken to make certain that no water enters the fuel storage tanks. This last precaution is based on the fact that all diesel fuels contain some sulphur. When water is mixed with sulphur, sulphuric acid is formed and the acid will quickly erode the closely fitting parts of the injection pump and nozzles.

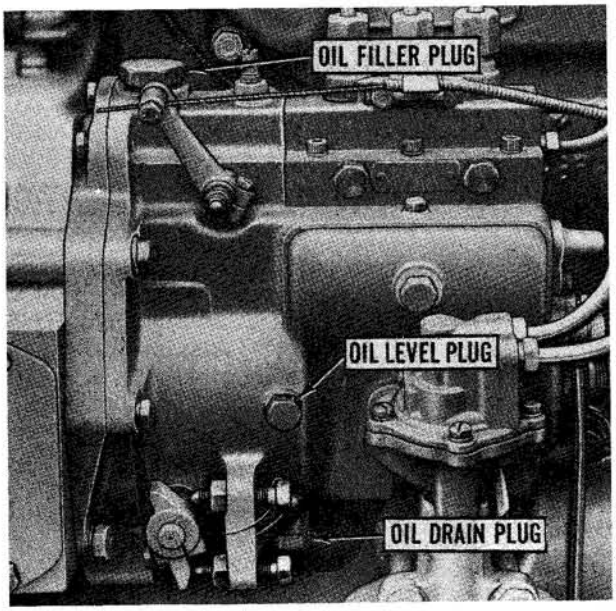

Fig. FO521 — Lubricating oil must be maintained at proper level and be changed at regular intervals on mechanical governor type fuel injection pumps. Drain, fill and oil level plug locations are shown. Refer to paragraph 29.

ROUTINE SERVICING

29. Due to the extremely delicate machining operations made necessary by the high injection pressures in a diesel engine, expense and delay associated with emergency repairs to the system increases the importance of routine preventive maintenance to operators of diesel equipment. If the tractor is supplied with clean fuel at all times, the injection pump should not require servicing between the periods of major engine overhaul.

In addition to regular maintenance of the fuel system and air cleaner normally performed by the operator, the manufacturer recommends that after every 200 hours of operation (more often under dirty conditions), the air filter (See Fig. FO-534) in the governor of vacuum governor type fuel injection pumps be removed, cleaned and coated with a light coating of engine oil.

Every 200 operating hours, on fuel injection pumps equipped with a mechanical governor, drain oil from the pump cambox and refill to the oil level plug with new SAE 30 motor oil in temperatures above 90° F., SAE 20 in temperatures between 20° F. and 90° F. or SAE 10 in temperatures below 20° F. Capacity is approximately ½-pint. Refer to Fig. FO521 for location of drain, oil level and filler plugs.

Every 600 operating hours, the fuel filter cartridge should be renewed, the injector assemblies removed, cleaned and adjusted, and the engine air cleaner removed from the tractor and completely cleaned.

Because of the fact that a diesel engine inducts a full charge of air at all times, regardless of the throttle setting or load imposed, the work load on the air cleaner is increased and greater attention in maintenance is required. A partially plugged air cleaner will immediately result in a loss of engine power and speed, increased fuel consumption and excessive smoking. This is especially true of the Fordson Dexta because the injection pump governor is operated from manifold vacuum. For this reason, the air cleaner screen, oil cup and center tube should be the first parts examined in complaints of loss of power or engine speed.

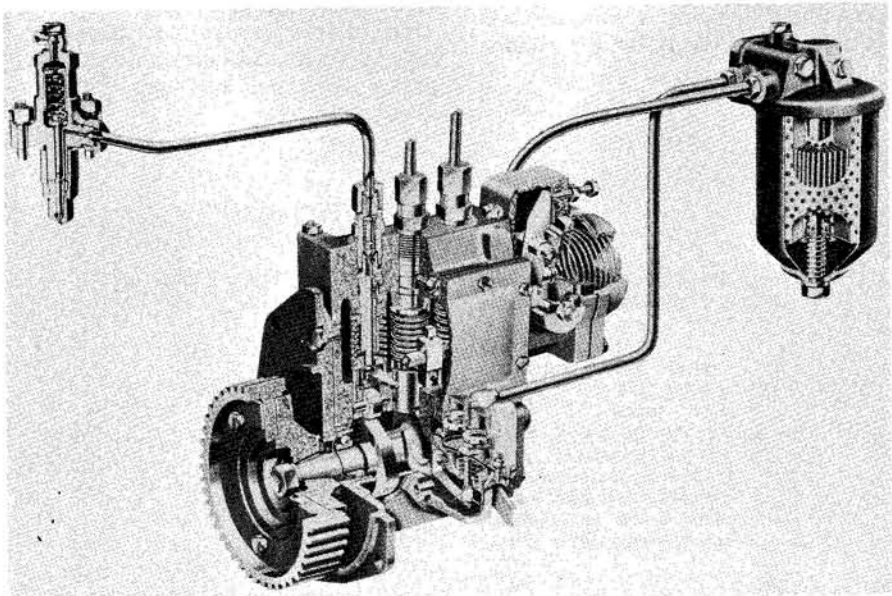

Fig. FO521A—Cutaway view of the Simms multiple plunger injection pump and injectors used on the Fordson Dexta. Injection pump used on Fordson Super Dexta and Ford 2000 Super Dexta is similar, but is equipped with a mechanical governor mounted on the pump camshaft.

TROUBLE SHOOTING

30. By following a logical sequence, trouble shooting on a diesel engine is more simple than for a gasoline or LP-Gas engine. The following trouble shooting paragraphs follow a logical pattern for locating the cause of the more common troubles encountered. The method of eliminating the cause, in most cases, is obvious.

31. **ENGINE WILL NOT START.** The most common causes are lack of fuel, insufficient compression pressure or improper timing. The starting motor is designed to turn the engine over at 200 rpm when the engine is warm; a cranking speed substantially lower, especially in cool weather, might contribute to difficult starting. If the recommended cranking speed is not approached, check for improperly charged battery, dragging starter motor or too heavy engine oil.

If starter action is lively and even, loosen the bleed plug at the top front of the injection pump body and activate the hand primer lever on the fuel lift pump. Fuel should flow freely from the injection pump bleed screw. If it does not, bleed the system

as outlined in paragraph 36. If proper fuel flow cannot be obtained by bleeding the system, check for plugged lines or filter or improperly operating lift pump. If adequate fuel flow was obtained from the injection pump bleed screw, tighten the screw and loosen the pressure lines at the three injector assemblies. Open the throttle for full fuel delivery and check the flow from the injector connections while turning the engine over with the starter. If fuel flow is adequate, the trouble is with the injectors, timing or compression. Check the timing as outlined in paragraph 45 and the injectors as outlined in paragraph 38. Check the compression while the injectors are out.

If no fuel flow was obtained through the loosened injector lines, but adequate flow was available at the pump, the trouble is in the injection pump. Remove the injection pump governor housing and diaphragm as outlined in paragraph 47A and check to see that the governor link and control rod moves freely back and forth in the injection pump body. If no binding is found, or if binding exists which cannot be corrected without further disassembly, the injection pump will need to be removed and returned to a qualified diesel service shop for servicing.

32. **LACK OF POWER.** First check the air cleaner thoroughly for plugging or restriction; then, check in the following order: full fuel delivery by loosening the injection pump bleed screw and operating the hand primer lever, injection pump timing (paragraph 45), injector condition (paragraph 38). Check the engine compression while the injectors are out. If all of the above checks have not eliminated the trouble, remove the injection pump and return it to a qualified diesel service station.

33. **ROUGH OR UNEVEN OPERATION.** Start the engine and operate at idle speed. Loosen each injection line connection in turn at the injector, and note the engine operation after loosening each connection. The one least affecting the engine operation, indicates a missing or partially missing cylinder. Remove the injector and check as outlined in paragraph 39, or install a spare injector. Check the engine compression while the injector is out. Uneven operation can also be caused by a sticking governor, or worn plunger or delivery valve in the injection pump.

34. **ENGINE KNOCKS.** To determine whether the knock is of fuel system or mechanical origin, speed the engine up to top idle speed and pull the stop control. If the knock immediately stops, it is due to the fuel system; if still audible, the cause of the knock is mechanical. Fuel knock is caused by improperly operating injectors, incorrect engine timing or a poor grade of diesel fuel.

FILTERS AND BLEEDING

35. To renew the fuel filter element, unscrew the filter body retaining bolt at the bottom of the fuel filter and remove the body, bolt and element. Discard the element, clean interior of filter body with a brush and clean fuel. Install the body with a new element and sealing ring in place and tighten the retaining bolt to a torque of 10 ft.-lbs. Bleed the fuel system as outlined in the following paragraph.

36. **BLEEDING.** To bleed the system, first make sure there is an adequate amount of fuel in the tank and that the fuel tank shut-off is turned on. Remove the two bleed screws (1 and 2—Fig. FO522) from top of filter body and operate the hand priming lever until air-free fuel flows from the bleed screw holes. Install and tighten first the inlet (1), then the outlet (2) bleed screw while continuing to actuate the hand priming lever. Loosen the bleed screw (3) on the fuel injection pump approximately three turns and operate the lift pump as before. Tighten the bleed screw when air-free fuel flows from the pump.

If the tractor does not start readily, loosen the injector lines at the injectors and turn the engine over with the starter until fuel flows from the connections. Retighten the connections and start engine.

INJECTOR ASSEMBLIES

37. **REMOVE AND REINSTALL.** To remove one or all of the injector assemblies, raise the hinged hood and remove the leak-off pipe from the three injectors and the rear connection. Disconnect the pressure lines at the injectors and loosen the connections on the injector pump.

Caution: On vacuum governor type pumps, because of the lighter torque on the injection pump delivery valve holders it is good practice to hold the delivery valves from turning in the pump body while loosening the lower ends of the lines.

Immediately cap all broken connections to avoid dirt entry into the fuel system and unbolt and remove the injector assemblies.

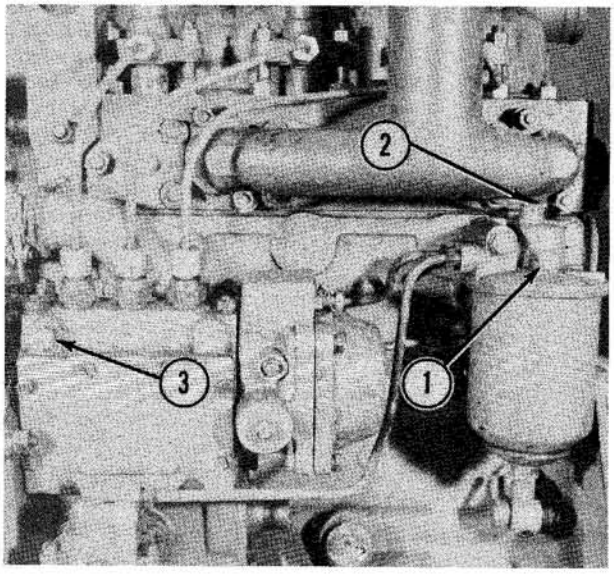

Fig. FO522 — Fuel system showing the location of the three bleed screws in the order of tightening. (1) Filter inlet bleed screws. (2) Filter outlet bleed screw. (3) Injection pump bleed screw. Vacuum governor pump is shown; refer to Fig. FO534A for location of bleed screw on mechanical governor type pump.

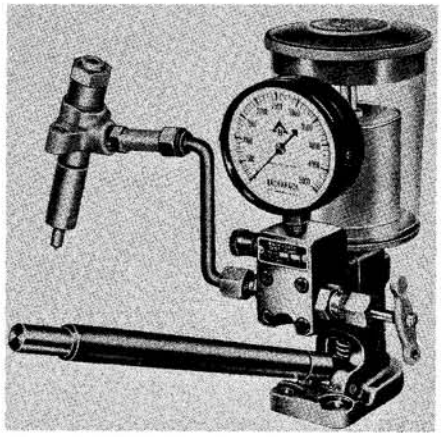

Fig. FO523—To completely test an injector nozzle requires the use of a tester as shown.

Make sure that the injector and the seating surface in the cylinder head are absolutely clean and always use new injector seat washers when reinstalling the injectors. Tighten the holding nuts down evenly to avoid cocking the injector assembly. Before releasing the tractor for service, check to make sure that the injectors are making a gas-tight seal in the cylinder head by running the engine for a short time. Stop any combustion leaks by slightly loosening one holding nut and tightening the other while the engine is running.

38. **TESTING AND LOCATING A FAULTY NOZZLE.** If the engine does not run properly and a faulty injector nozzle is indicated, such a nozzle can be located by loosening each pressure connection in turn at the injector. As in checking a spark plug in a spark ignition engine, the faulty unit is the one which, when its line is loosened, least affects the running of the engine.

WARNING: Fuel leaves the injection nozzle tips with sufficient force to penetrate the skin. When testing, keep your person clear of the nozzle spray.

The spray pattern of the suspected injector can be observed after removal, by reconnecting the injector to its pressure line with nozzle directed away from the tractor, loosening the other two lines so that the engine will not start, and observing the spray pattern while turning the engine over with the starter.

39. **NOZZLE TESTER.** A complete job of testing and adjusting the injector requires the use of a special tester such as shown in Fig. FO523. The nozzle should be tested for opening pressure, spray pattern, seat leakage and leak back.

WARNING: Fuel leaves the injection nozzle tips with sufficient force to penetrate the skin. When testing, keep your person clear of the nozzle spray.

To test a nozzle, operate the tester until oil flows from the connector pipe and attach the injector assembly to the connector. Close the tester valve and operate the tester handle a few quick strokes. If undue pressure is required to operate the lever, the nozzle valve is plugged and the injector should be disassembled and serviced as outlined in paragraph 44.

40. OPENING PRESSURE. After making sure that the nozzle valve is not plugged, open the tester valve slightly and observe the gage pressure at which the spray occurs. This pressure should be 2200-2350 psi. If the pressure is not as indicated and the spray pattern and leakage tests prove satisfactory, reset the opening pressure by loosening the cap nut, inserting a small screw driver through the leak-off pipe hole, and turning the adjusting nut until the correct pressure is obtained.

Note: After continued usage, injector valve spring will wear in at approximately the lower value of 2200 psi in an injector in perfect condition. When a new injector or spring is installed in a tractor with two used injectors, use the higher setting for the new injector and the lower figure for the used, serviceable injectors. After the new injector has been in use for a short period of time the pressures will be approximately equal. If three serviceable used injectors are installed set to an equal pressure within the range given.

If the correct opening pressure cannot be obtained, the injector must be overhauled as outlined in paragraph 44.

41. SPRAY PATTERN. Two spray holes are located in the nozzle tip. Both spray patterns should be symmetrical, well atomized and spread to a width of about two inches before breaking up into a very fine mist. If spray pattern is streaky, distorted, or not finely atomized the injector must be overhauled as outlined in paragraph 44.

42. SEAT LEAKAGE. Wipe the injector dry with clean blotting paper and bring the injector pressure up to 2200 psi. Hold the pressure at this level for one minute and apply a clean piece of blotting paper to the nozzle tip. The fuel oil stain should not exceed ½-inch in diameter. If the above conditions are not met, overhaul the injector as outlined in paragraph 44.

43. NOZZLE LEAK BACK. Operate the tester handle and bring the gage pressure back to 1850 psi. Note the length of time required for the pressure to drop from 1850 psi to 1350 psi. This time should be between six and 45 seconds.

If the elapsed time is not as specified, dirt, wear or scoring is indicated between the nozzle body and needle valve, and the nozzle should be disassembled and overhauled as indicated in paragraph 44.

Note: Leakage in the injector tester at the connections, gage or check valve will show up as a fast leak-back in this test. If all of the injectors tested show consistently faulty when this test is made, a faulty tester should be suspected.

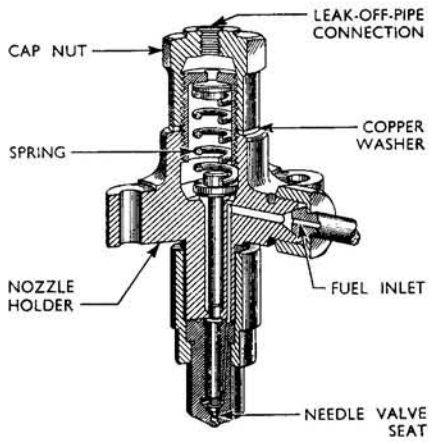

Fig. FO525—Cross sectional view of Simms injector used in all models. Two spray holes are located in the nozzle tip. Holes are 0.32 mm. diameter on New Performance Super Dexta and 0.35 mm. diameter on all other models.

44. **OVERHAUL.** Unless a suitably clean area and proper injector cleaning equipment is available, do not attempt to overhaul diesel nozzles. The tool set should include injector holding fixture, valve seat scraper, pressure chamber reamer and reverse flush adapter for Simms injectors as well as 0.012 spray hole cleaning wire for both 0.32 and 0.35 mm. spray holes.

Fig. FO525 shows a cross section of the Simms injector used in all models. Refer to this illustration if necessary, for assembly and disassembly sequence. The 0.32 spray hole nozzles for New Performance Super Dexta can be identified by number NH-389 stamped on nozzle.

Secure injector holding fixture in a vise and mount injector in the fixture. **Never** clamp the injector body in the vise. Remove the cap nut and back off the adjusting nut; then, lift off the spring seat, spring and spindle. Remove the nozzle retaining nut and withdraw the nozzle and valve. Nozzle bodies and valves are a lapped fit and must never be interchanged. Place all parts in clean diesel fuel or calibrating fluid as they are disassembled. It is good shop practice to keep the parts from each injector separate in a compartmented pan.

Immerse those parts of the injector assembly containing hard carbon deposits in a suitable solvent for a short period. When the carbon has softened remove with a brass wire brush. Ace-

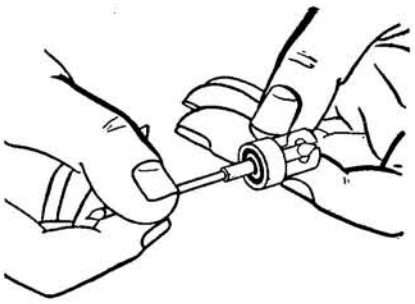

Fig. FO526—Clean the pressure chamber of the nozzle with special tool as shown.

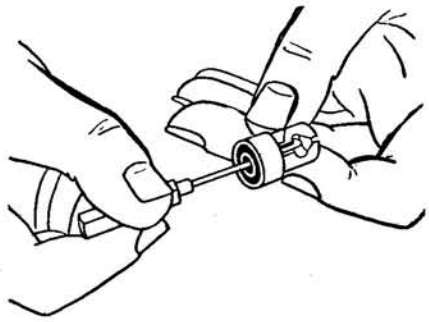

Fig. FO529—Pressure chamber scraper is used to clean lower pressure chamber and annular groove on top of nozzle.

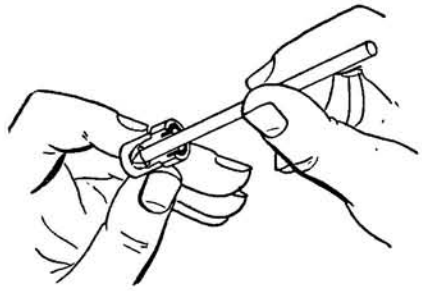

Fig. FO530—Use polishing stick and tallow to polish nozzle seat.

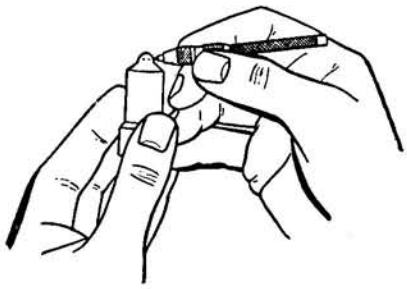

Fig. FO527—Cleaning orifices with 0.012 wire probe held in pin vise. Refer to text.

tone, or a commercial carbon solvent designed for this purpose should be used. **It must be remembered that acetone is a highly inflammable liquid and proper precautions must be taken.** Follow the manufacturers directions and do not leave the parts in the solvent long enough to corrode the metal surfaces. Rinse the parts in clean diesel fuel or light oil immediately after cleaning and place in a clean container of diesel fuel. Clean the pressure chamber of the nozzle body with the reamer as shown in Fig. FO526. Clean the spray holes of the nozzle body with the 0.012 probe held in a pin vise as shown in Fig. FO527. To prevent breakage, the wire probe should protrude from the pin vise only far enough to pass through the spray holes. Rotate the pin vise without applying undue pressure.

Clean the valve seats by inserting the small end of the valve seat scraper into the nozzle and rotating while applying light pressure. Reverse the scraper and clean the upper chamfer with the large end. Clean the annular groove in the top of the nozzle and the lower pressure chamber with the pressure chamber scraper as shown in Fig. FO529.

Thoroughly rinse all parts in clean diesel fuel to remove any dislodged carbon particles and polish the valve body seat with a wood polishing stick and a small amount of tallow.

If scratches are visible on the plunger piston, or if the plunger tends to stick in the nozzle body, the assembly can be remated by using a very small amount of special lapping compound mixed with tallow. Clamp the small upper end of the needle valve in a slow-speed electric drill and polish the large piston area of the valve with a small amount of the lapping compound on a piece of felt. An alternate method is to clamp the tip end of the nozzle body in the drill, apply a small amount of the lapping compound to the needle valve and insert in the nozzle body. Be sure to hold the needle valve up off the valve seat during the lapping operation to avoid damage to the seating surfaces.

Examine the mating surfaces of the nozzle body and injector body to make sure that they are clean and free from nicks or scratches which would prevent a perfect metal to metal seal.

Clean the nozzle body and needle valve thoroughly in clean fuel, insert the valve in the nozzle body, install the nozzle assembly in the back flush attachment and back flush thoroughly with the tester pump. Without removing the needle valve from the nozzle body, remove the assembly from the back flush attachment and position the nozzle assembly carefully on the injector body. Install the nozzle retaining nut and tighten to a torque of 60-75 ft.-lbs.

Note: Place injectors in holding fixture to tighten nut.

Install the spindle, spring, spring seat and spring adjusting nut. Tighten the adjusting nut until pressure from the spring is felt. Connect the injector to the nozzle tester and adjust the opening pressure to 2350 psi, use a new copper gasket and install the cap nut.

Retest the injector as outlined in paragraphs 40 through 43, and if injector fails to pass these tests renew the injector nozzle assembly.

Note: If injectors are to be stored, it is recommended that they be flushed with calibrating oil or other preservative oil similar in viscosity to diesel fuel—prior to storage. Diesel fuel in small amounts, such as that present in an injector assembly, tends to break down in storage. The resulting varnish deposits may cause the units to stick, making it necessary to reclean the injectors prior to use.

INJECTION PUMP

NOTE: Fordson Dexta tractors produced prior to April, 1962, were equipped with a Simms fuel injection pump, Part No. 957E-993101-A, which incorporated a vacuum (pneumatic) governor. Later production Fordson Dexta tractors, Fordson Super Dexta and Ford 2000 Super Dexta tractors are equipped with a Simms "Minimec" fuel injection pump, Part No. 957E-993101-D, which incorporates a mechanical governor. CAUTION: The "Minimec" fuel injection pump cannot be interchanged between a Fordson Dexta tractor (144 cubic inch engine) and a Fordson Super Dexta or Ford 2000 Super Dexta tractor (152 cubic inch engine) without first having the pump recalibrated for proper fuel delivery at an authorized service station. The New Performance Super Dexta is equipped with a Simms "Minemec" fuel injection pump, part No. 960E-993101.

The fuel injection pump is a self-contained unit which includes the engine speed governor, and pump components capable of delivering fuel in properly metered amounts. The pump is horizontally mounted on left side of engine and is driven by the timing gear train. The Simms injection pump proper is a sealed unit and service other than timing to the engine or limited governor service as outlined in paragraph 47A should not be attempted. Factory approved service on Simms injection pumps in this country is exclusively conducted by the Ford Tractor Operations, Ford Motor Co., and their dealers.

45. **TIMING.** Open the timing window on left side of the flywheel housing and remove the injection pump timing plate from the timing gear housing as shown in Fig. FO531. Turn crankshaft in the normal direction of rotation (clockwise) until number one piston is coming up on compression stroke and continue turning until the proper "SPILL" mark on the flywheel rim is in alignment with the notch on the flywheel housing. At this time, the lower of the two marks on the timing gear adapter, when viewed through the timing gear housing window, should be in alignment with the timing pointer cast on the injection pump mounting flange.

NOTE: "SPILL" mark on flywheel is at 26° BTDC on engines equipped with vacuum governor type fuel injection pump. Flywheels produced after introduction of "Minimec" mechanical governor type fuel injection pump have two "SPILL" timing marks; one mark is at 26° BTDC and a second mark is located at 20° BTDC. If a flywheel with two "SPILL" timing marks is encountered when timing a vacuum governor type fuel injection pump, be sure to use mark located at 26° BTDC on flywheel. When timing "Minimec" mechanical governor type fuel injection pump, be sure to use "SPILL" timing mark located at 20° BTDC. If a flywheel with only the 26° BTDC "SPILL' timing mark has been installed in a tractor that is equipped with a mechanical governor type fuel injection pump, the 20° timing mark must be located and stamped into the flywheel as outlined in note preceding paragraph 27 so that the pump may be accurately timed.

If the pump timing marks are not aligned, remove the inspection plate on the timing gear cover immediately in front of the pump drive gear and loosen the three cap screws securing the injection pump drive gear to the adapter. Fit a socket with a short extension over the nut attaching the adapter to the pump camshaft and turn the pump and adapter, within the drive gear, until the timing marks are in proper alignment. While applying slight pressure on the socket wrench to hold the marks in alignment tighten the three cap screws securing the drive gear to the adapter. Reinstall the inspection cover and the two timing plates.

46. **INJECTION PUMP R&R.** To remove the complete injection pump, first thoroughly clean all dirt from the pump, injector lines and supply lines. Remove the pump timing window and front inspection plate and loosen the timing plate on the flywheel housing. Turn the engine crankshaft clockwise until the proper "SPILL" mark (see note in paragraph 45) is aligned with the timing mark on the flywheel housing and the injection pump timing marks are in alignment.

Disconnect the proofmeter drive shaft, governor vacuum line on tractors with vacuum governor or throttle link on tractors with mechanical governor, fuel stop cable and fuel stop housing bracket from the pump. Shut off the fuel at the tank and disconnect the fuel supply lines from the primary pump and injection pump. While holding the delivery valve holders from turning, disconnect the injector lines from the pump and injectors. Immediately cap all open fuel line connections to avoid dirt entry into the system. Unbolt and remove the injection pump from the engine timing gear housing.

To reinstall the injection pump make sure the flywheel timing marks are properly aligned and install the pump so that lower timing mark on the adapter is in alignment with the mounting flange timing mark to the nearest tooth. If the alignment is exact, no further adjustment is necessary. If the alignment is not exact, retime the pump as outlined in paragraph 45. Reinstall the lines, shut-off stop, governor vacuum line or throttle link and proof meter cable and bleed the system as outlined in paragraph 36.

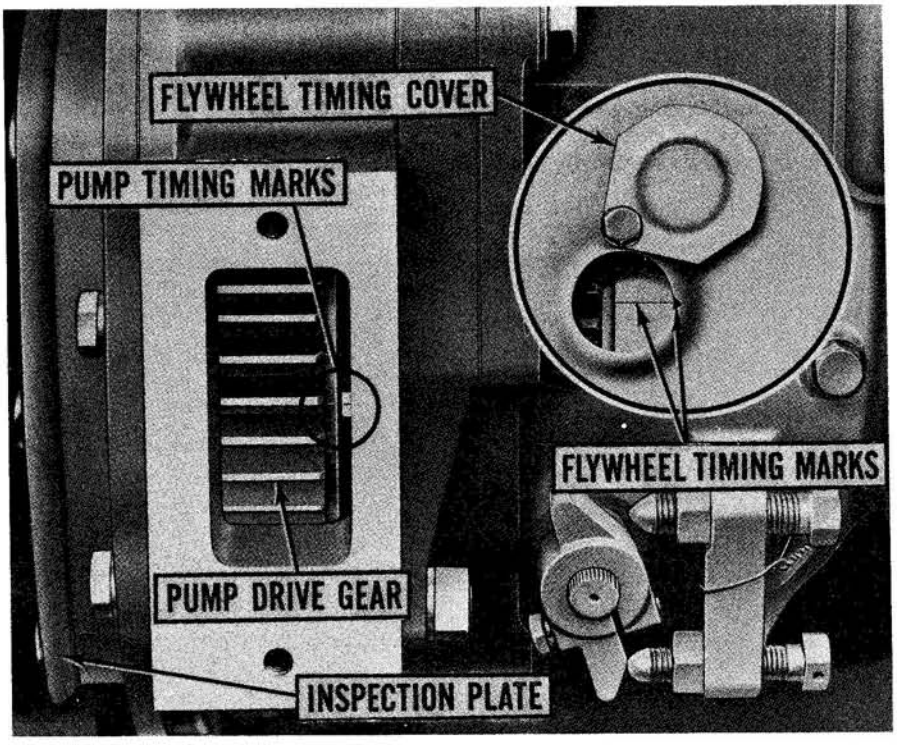

Fig. FO531 — View showing fuel injection pump timing marks on mechanical governor type pump. Inset shows flywheel timing window open and flywheel timing mark aligned with pointer. Timing marks on vacuum governor type fuel injection pumps are similar. Refer to paragraph 45 for timing procedures.

47. VACUUM GOVERNOR ADJUST. Before attempting to adjust the governed speed, first thoroughly inspect and clean the air cleaner and fill to the proper level with the correct grade of engine oil. Because the governor is operated by manifold vacuum, the condition of the air cleaner is of utmost importance in governor operation. After the air cleaner has been inspected and cleaned, reinstall the primary cleaner stack and check and retighten the air cleaner hose connections. To adjust the governor, start the tractor and bring engine to operating temperature. Position hand throttle lever for low idle speed which should be 550 rpm. If low idle speed is not as specified, loosen lock nut on idle adjusting screw (1—Fig. FO533) and reposition the stop screw until the correct speed is obtained.

Move hand throttle to wide open position and check high idle speed. If the high idle speed is not the recommended 2200 rpm, readjust the maximum speed stop screw (2) until the proper speed is obtained.

Engine speeds can be noted on the tractor proof meter or checked with a tachometer at the PTO shaft. On Fordson Dexta tractors prior to Serial No. 957E-63953, PTO RPM is 760 at 2200 engine RPM and 190 at 550 engine RPM. After this Serial Number and on prior units with new ratio PTO gears service installed, PTO RPM is 660 at 2200 engine RPM and 165 at 550 engine RPM.

47A. VACUUM GOVERNOR OPERATION AND SERVICING. The pneumatic governor used on the Fordson Dexta consists of a throttle unit in the intake manifold connected by a suction pipe to the spring loaded diaphragm mounted on the rear of the injection pump. Fig. FO534 shows a schematic view of governor assembly.

When the engine is stopped, the governor spring pushes the diaghragm inward, moving the control rod to the position of maximum fuel delivery. When the engine is started and the manifold throttle unit moved to the closed position, a high engine vacuum is created at the manifold end of the suction line which, acting through the diaphragm, moves the control rod in the direction of minimum fuel delivery. The balance of governor spring pressure and manifold vacuum tends to maintain a constant engine speed over the full governed speed range regardless of variations in engine load.

If there is reason to suspect the governor diaphragm of leakage, it can be tested as follows:

Disconnect the governor vacuum line from inner side of governor cover, and the stop cable from governor stop arm. While observing the usual standards of cleanliness, unbolt and remove the inspection cover from outside of injection pump body. Pull the stop lever

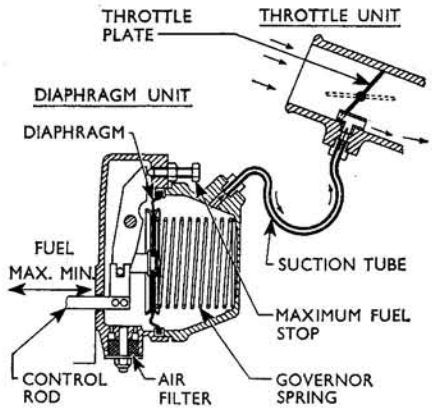

Fig. FO534 — Schematic view of vacuum governor and throttle mechanism showing component parts.

rearward to move the pump control rod to the shut-off position and place one finger over the vacuum connection in the governor cover. Release the stop lever and observe the pump control rod for movement towards the open position. If undue movement is noted, it will indicate a leak in the governor diaphragm which will interfere with proper governor operation.

To renew the diaphragm, unbolt and remove the governor cover and governor spring. Pull the diaphragm assembly outward from the governor body and remove the cotter pin securing the diaphragm to the control rod. When installing a new diaphragm, make sure that the slight protrusion on the diaphragm rim is located in the small recess in the governor body. Reinstall the spring and cover and test as before to make sure the new diaphragm is properly seated in the governor body.

NOTE: Diaphragm is made of leather which can become porous when dry and result in air leak through diaphragm. A diaphragm not otherwise defective can be reclaimed by coating the leather with a light grease such as vaseline and rubbing the grease into the diaphragm. A new diaphragm should also be treated in this manner before installation as it is likely that the leather may have dried out while in storage. Caution must be taken not to subject the diaphragm to solvent or oil that would shrink the leather material as this would limit the stroke of the governor and result in improper governor operation.

The governor spring should exert 3.81-4.06 lbs. when compressed to a length of 1.969 inches.

Reinstall the pump inspection cover and reconnect the stop cable and vacuum line. Caution: Under no circumstances should an attempt be made to move the control forks on the control rod while the inspection cover is off. Each pump plunger is calibrated individually and proper location of the forks is impossible without the use of a calibrating stand.

Normally, no adjustment of the throttle linkage is necessary. In case of damage to the linkage or renewal of parts, remove the battery and adjust the length of the rear throttle link until the throttle arm on the intake manifold moves fully to contact both stop screws.

48. "MINIMEC" MECHANICAL GOVERNOR, ADJUST. Refer to Fig. FO534A for location of speed adjustment screws. With hand throttle in slow idle position, adjust idle (lower) screw to obtain 550 engine RPM. Then, with hand throttle in wide open

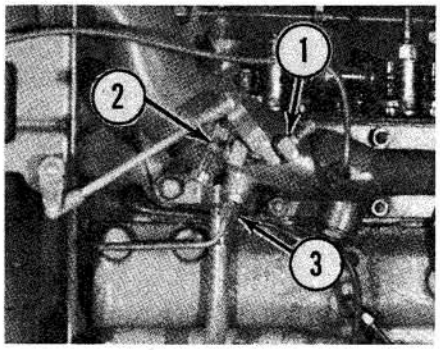

Fig. FO533—Intake manifold showing (1) idle speed stop screw, (2) high speed stop screw and (3) governor vacuum line connection.

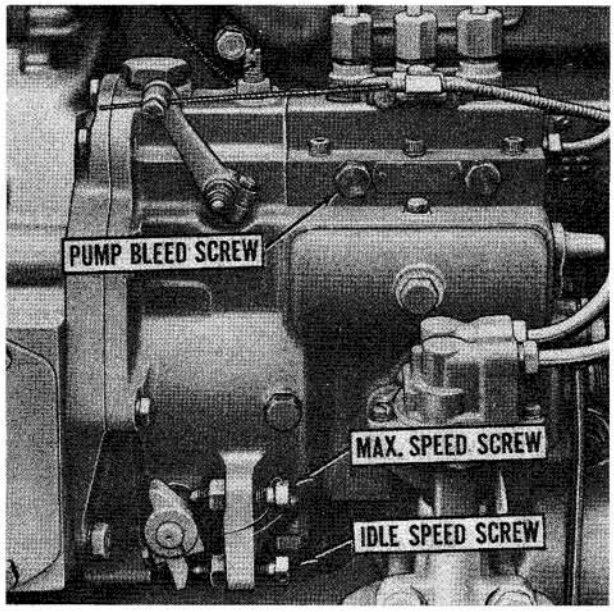

Fig. FO534A — View of mechanical governor type fuel injection pump showing location of speed adjustment screws.

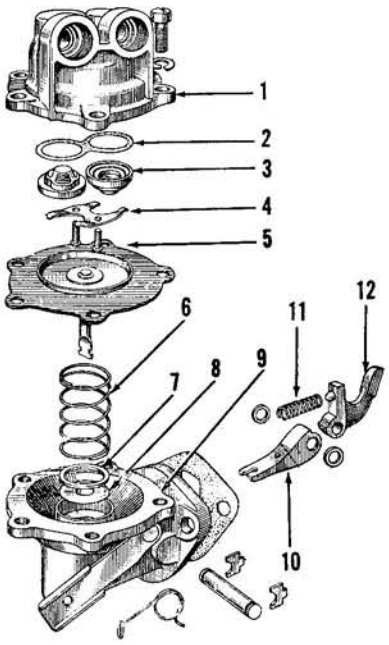

Fig. FO535—Exploded view of primary fuel pump. Pump is mounted on injection pump and driven by injection pump camshaft.

1. Upper body
2. Gasket
3. Fuel pump valve
4. Retainer
5. Diaphragm
6. Spring
7. Oil seal washer
8. Oil seal
9. Lower body
10. Diaphragm link
11. Return spring
12. Activating arm

position, adjust high speed (upper) screw to obtain 2200 engine RPM on Super Dexta models or 2425-2450 RPM on New Performance Super Dexta (tractor serial No. 09C-913383 and later). After proper speed adjustment has been obtained, be sure to tighten lock nuts on adjustment screws.

Engine speed can be observed on proof meter or checked at PTO shaft with tachometer. Power take-off RPM is 660 at 2200 engine RPM, 735 at 2450 engine RPM and 165 at 550 engine RPM. (Multiply power take-off RPM by 3.33 to obtain engine speed.)

As the mechanical governor is an integral part of the fuel injection pump, it is not recommended that governor repairs be attempted outside of an authorized injector pump repair station.

PRIMARY FUEL PUMP

49. The primary fuel pump is mounted on the outside of the injection pump and driven from a cam on the injection pump camshaft. The fuel pump is of the diaphragm type, the component parts of which are available for service.

To test the fuel pump, remove bleed screw from inlet side of fuel filter and operate the hand priming lever on the fuel pump. There should be a well defined surge of fuel through the filter bleed hole at each working stroke of the pump. Tap a pressure gage into the pump outlet line, bleed the system and check the outlet pressure by operating the engine through the normal engine speed range. Pressure reading should be 6-10 psi throughout the entire speed range.

Refer to Fig. FO535 if disassembly of the primary fuel pump is indicated. The outlet and inlet valves in the upper body are identical but reversed in their position in the body. The valves should be installed as shown. If renewal of the diaphragm is indicated, push down on the diaphragm and rotate 90 degrees to disconnect pull rod from the operating link. Procedure for further disassembly is evident. When reinstalling diaphragm in lower body, rotate diaphragm in the proper direction so that flange holes will align with holes in the diaphragm.

COOLING SYSTEM

The radiator is fitted with a pressure type cap which raises the boiling point of the coolant. The by-pass type thermostat starts to open at 156-165 degrees F. and is fully open at 185 degrees F.

RADIATOR

50. To remove the radiator, first remove hood and grille. Drain cooling system and disconnect radiator hoses; then, unbolt and lift radiator assembly from front support.

WATER PUMP

51. To remove the water pump, first remove the radiator as outlined in paragraph 50. Remove the fan blades and cap screws securing the top water outlet housing to the cylinder head. Loosen the by-pass hose at water pump and lift off the top water outlet and by-pass hose. Remove the nuts retaining water pump to timing gear front cover and lift off the pump.

To disassemble the pump, remove pulley from shaft using a split type bearing puller, then press shaft and bearing, seal and impeller from the housing as an assembly.

When reassembling, press the shaft and bearing unit in the housing from the front until front end of bearing race is flush with edge of housing. Use a 1½-inch length of 1-inch ID pipe, so that the pressure is applied to the outer race of the bearing. Reverse the housing and bearing assembly and refit the slinger on rear of shaft using a $\frac{11}{16}$-inch deep socket as a driver. Reinstall the shaft seal in housing and press the impeller on the shaft using a press and suitable adapter until 0.005-0.020 clearance is obtained between the front edge of impeller blades and the housing. This clearance can be measured with a feeler gage, working through the pump outlet neck. Support rear end of the shaft on a suitable adapter and press the pulley on the shaft until pulley hub is flush with front end of shaft. Check the water pump for binding and correct as necessary before reinstalling on engine.

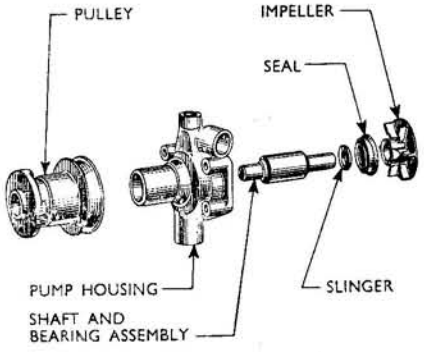

Fig. FO536—Exploded view of water pump used on Fordson Dexta tractor.

ELECTRICAL SYSTEM

GENERATOR AND REGULATOR

52. A Lucas two-pole shunt wound generator and Lucas regulator is used in the Fordson Dexta electrical system. British terminology is used on the generator and regulator markings A comparison of the symbols with those currently in use in this country is as follows: The five terminal posts on the regulator are marked E, D, F, A and A_1. The terminal E (earth) corresponds to G (ground); D (dynamo) to A (armature); F stands for field, as in American terminology; A corresponds to the "hot" wire B, on most American wiring diagrams. A_1 is a special current regulating terminal. The current from A, passes through the light switch giving a higher generator output when the tractor lights are used.

Service specifications of the generator and regulator are as follows:

Generator:

Renew brushes if shorter than	0.35
Field Draw	
Volts	13.5
Amperes	2.2
Output (Cold)	
Maximum amperes	14.0
Volts	16.0
RPM	1500

Regulator:

Cut-Out Relay	
Air gap	0.020
Point gap	0.020
Closing range	12.7-13.3
Voltage Regulator	
Air gap	0.015
Voltage range	15.6-16.0
Ground polarity	Positive

STARTING MOTOR

53. The 12-volt starting motor is equipped with a manually engaged starter drive incorporating an overrunning clutch. The drive mechanism must be adjusted so that the relay switch, mounted on starter housing, is activated at the time the starter pinion is almost fully engaged in the flywheel ring gear. Refer to Fig. FO537 and adjust as follows: Disconnect the starter leads and remove starter from tractor. Attach wires connected to a battery and light bulb to the two connections on the relay assembly so that bulb will light when the relay switch is closed. Depress the starter actuating lever until rear face of the starter pinion is $1\frac{25}{32}$ inches from the mounting flange as shown. At this point, the test light bulb should just flash on. Readjust as necessary by loosening the four screws securing the switch bracket to starter housing and shifting the switch and bracket as required.

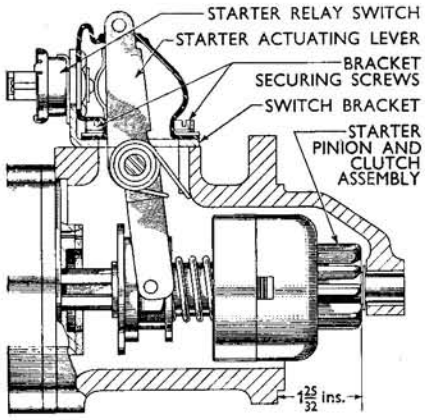

Fig. FO537 — Adjust starter actuating mechanism so that front face of pinion is advanced to 1 25/32 inches from starter mounting flange when electrical contact is made. Refer to text.

Service specifications for the starter motor are as follows:

Lock Test	
Amperes	450
Torque, ft.-lbs.	28
Normal cranking speed (engine), rpm	200

CLUTCH

Tractors may be equipped with either a single clutch, for models without live power take-off; or a dual clutch, for models with live power take-off. On models equipped with live power take-off, a single clutch pedal controls both tractor operation and power take-off operation. Depressing the clutch pedal through the first stage disengages the transmission clutch and stops the forward motion of the tractor. Depressing the pedal through the complete range of its travel disengages both the transmission and power take-off clutches; stopping the transmission of all power from the flywheel rearward.

CLUTCH PEDAL ADJUSTMENT

Single Clutch Models

54. Clutch pedal free play is adjusted by means of the adjusting clevis at front end of clutch pedal link. The adjustment is correct when 1¼ inches free play is obtained when measured at center of pedal as shown in Fig. FO538.

Double Clutch Models

55. On models equipped with the double clutch, pedal free play is adjusted by means of the stop screw (A —Fig. FO539). The adjustment is correct when 1¼ inches free play of the clutch pedal is obtained. Clutch pedal height on tractors equipped with the double clutch is adjusted by means of

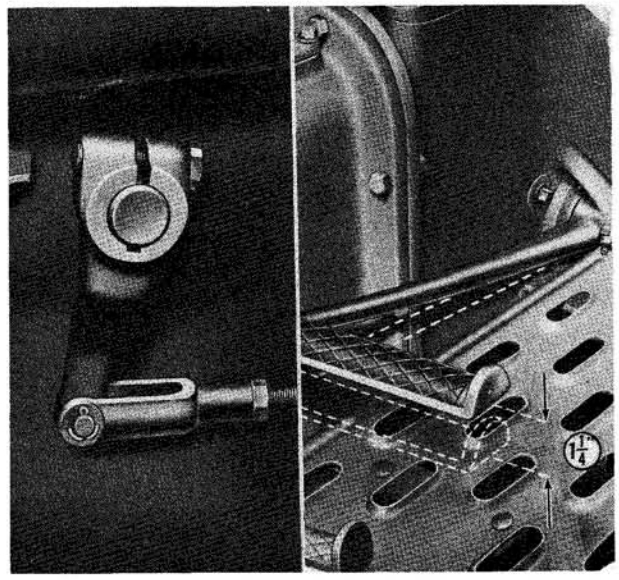

Fig. FO538 — On single clutch models, adjust release clevis until 1¼ inches free play exists when measured as shown.

the adjustable clevis at the front end of the pedal link. To make this adjustment, proceed as follows:

Attach the clutch release arm in the rear hole of the clevis on pedal link, engage the power take-off and adjust pedal height so that the clutch pedal contacts the step plate the moment the power take-off clutch is completely released.

Caution: If pedal linkage is too short, release bearing will bottom in the clutch assembly before the pedal contacts the step plate, resulting in possible damage to the clutch release bearing and/or clutch fingers.

After adjustment has been made as indicated in the preceding paragraph, move the clutch release arm to the forward hole in the clevis and check to be sure that the transmission clutch is fully released when clutch pedal is in contact with the step plate.

If both adjustments cannot be obtained, it will be necessary to readjust or overhaul the double clutch assembly as outlined in paragraph 58.

TRACTOR SPLIT

56. To obtain access to the clutch and flywheel, it will first be necessary to detach (split) engine from clutch housing as follows:

Unbolt and remove the hinged hood and disconnect and remove the tractor battery. Disconnect starter cable from starter and detach wiring harness from lights, generator, starter relay and cold starting unit. Disconnect throttle linkage and primer line from the intake manifold, disconnect upper air cleaner hose clamp and remove the bolts connecting air cleaner and firewall to bracket on engine block. Disconnect the steering drag links and radius rods at rear end. Disconnect the fuel and bleed back lines, proof meter cable, heat indicator sending unit and wire from the oil pressure sending unit. Remove the battery support and fire wall, support both halves of tractor independently, then unbolt and separate the units.

R&R AND OVERHAUL CLUTCH

Single Plate Models

57. Clutch disc and pressure plate are available only as assemblies. Service of the clutch will be confined to renewal of the units as indicated. The adjusting screws in the clutch release fingers are set and staked at the factory and adjustment in the field is not recommended.

Check the clutch release and pilot bearings while the clutch is out and renew as required. The clutch release shaft rotates in renewable bushings in the clutch housing and may be serviced at this time. During reassembly, pack the recess in inside of the clutch release bearing hub with a good grade of high melting point grease. The release bearing is of the pre-lubricated type.

Double Clutch Models

NOTE: Use of a special fixture is required when reassembling the double clutch unit so that both clutch disc hubs will be correctly aligned with each other and with flywheel pilot. Also, fixture is necessary for proper adjustment of clutch fingers.

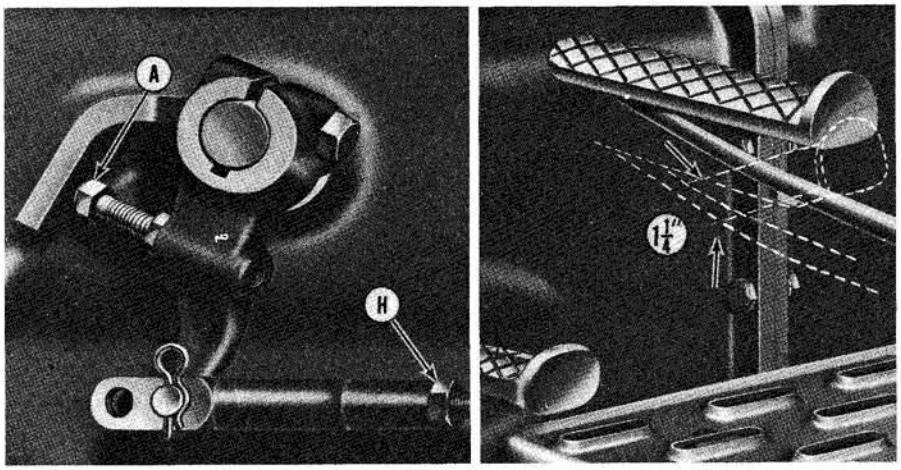

Fig. FO539—Adjust double clutch stop screw (A) until 1¼ inches pedal free play exists. Pedal height is adjusted by means of linkage adjustment (H), see text for details.

58. The dual clutch on tractor equipped with live pto is attached to the engine flywheel by means of an adapter plate which is doweled in place and secured with six cap screws. Before removal of the clutch, it is good shop practice to mark the relative position of the clutch on the flywheel so that it can be installed in the same position. Because of the heavier weight of the double clutch assembly, proper correlation of the component parts is more important to maintain proper balance. For most service operations, it is not necessary to remove the adapter plate from the flywheel. Remove the six cap screws attaching the clutch center drive plate to the adapter plate and remove the clutch assembly.

Before disassembling the clutch, punch-mark the center drive plate and the two pressure plates so that the unit can be reassembled in the same relative position. To disassemble the clutch unit, use a valve spring compressor as shown in Fig. FO540, compress the springs and remove the keepers, spring seats and springs. Remove the cap screws retaining cover to center drive plate and the three pins retaining the struts to the transmission pressure plate.

Separate and examine the assemblies. The two clutch discs can be renewed at this time. Renew any of the other parts which show signs of wear or damage. The spring retainers should be discarded and new ones installed during reassembly. Renew any spring that does not test 98-108 lbs. when compressed to a length of 1.670 inches.

NOTE: Although the Dexta series double clutch unit is similar to those produced in the U. S., the regular Nuday NDA-7502 clutch fixture used for U. S. produced Ford tractor clutch units must be modified slightly for use with the English Dexta series clutch units. Also, special Dexta spacers and gage block, obtainable from the Nuday Company, must be used. To adapt the Nuday NDA-7502 fixture for assembly and adjustment of Dexta clutches, proceed as follows: Cut down the transmission clutch disc pilot on the fixture spindle to a diameter of 0.862-0.864. Remove material from the pto disc pilot as shown in Fig. FO542A. Obtain new gage block, NDA-7502-5A, and three new spacers, NDA-7502-8A, from the Nuday Company.

The balance of individual clutch parts are checked at the factory and a spot of yellow paint is placed on the edge of the clutch center plate and pressure plates to indicate the

heavy point of each assembly. When reassembling the clutch, the paint marks should be placed as near to 120 degrees apart as possible to provide a balanced unit. If the paint marks are no longer visible, assemble the unit by aligning the correlation marks that were placed on the clutch prior to disassembly.

To reassemble the double clutch unit, proceed as follows: Place the transmission clutch pressure plate on the fixture and install the transmission clutch friction disc over the pilot diameter of the center spindle and with long hub of clutch disc down. Position the center driving plate on the fixture with yellow paint mark as near as possible to 120 degrees away from paint mark on the transmission pressure plate. Turn the assembly on the fixture until the pins on the fixture will enter the untapped holes in the center driving plate. Place the pto friction disc (with long hub up) on the fixture and insert the pto disc pilot with tapered end down in hub of disc as shown in Fig. FO542. Then install the pto pressure plate and clutch cover assembly with the three connecting links passing through the holes in the center driving plate and with the yellow paint mark as near as possible to 120 degrees away from the paint marks on the other two plates. NOTE: If paint marks are no longer visible, reassemble clutch by aligning correlation marks made prior to disassembly of clutch unit. Reinstall the cap screws securing cover to center drive plate. NOTE: If any of these cap screws are renewed, be sure that threaded end of cap screw does not protrude from front face of center drive plate.

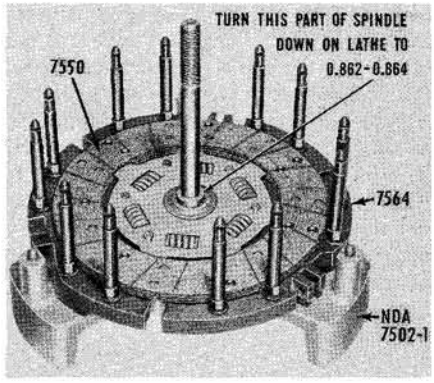

Fig. FO541 — Use the fixture tool to properly align and adjust the double clutch during reassembly. Refer to text.

Using a valve spring compressor, install the springs, spring retainers and new spring keepers. Close the open end of keepers. Pin and key the transmission pressure plate connecting links.

Install adjusting tool (NDA 7502-5A) over the fixture center spindle with large end down as shown in Fig. FO543. Install the flat washer and nut and tighten nut until the three adjusting spacers can be positioned against the lined discs between the pressure plates as shown. Make sure that spacers are positioned 120 degrees apart and installed with blocks marked "TOP" toward the clutch cover. Make sure also, that top portion of spacer is in completely against the pto clutch disc and between the **machined** portion of the pto pressure plate and the center drive plate. Invert tool No. NDA 7502-5A and reinstall it as shown in Fig. FO544. The highest machined surface of the tool is used

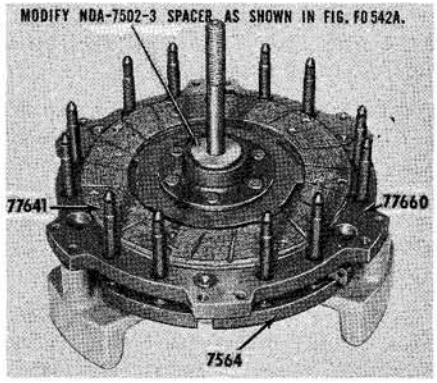

Fig. FO542 — Position center drive plate and pto clutch disc over fixture as shown. Be sure to align correlation marks or properly space balance marks as outlined in text.

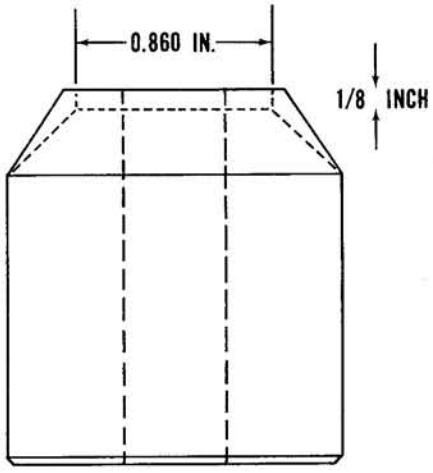

Fig. FO542A — To adapt regular Ford clutch pilot for use in assembling and adjusting Dexta double clutch units, remove material from pilot to dimensions shown by dotted lines. Do not remove material from end of pilot; length must remain the same.

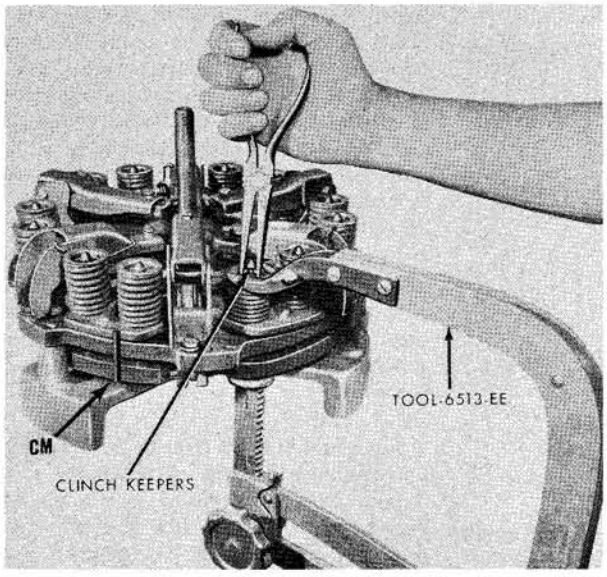

Fig. FO540 — Use valve spring compressor to disassemble and assemble double clutch as shown. (CM) Correlation marks.

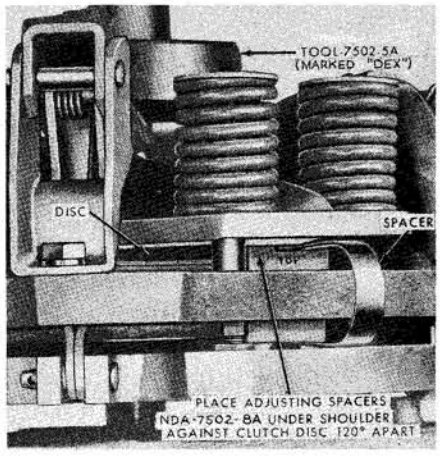

Fig. FO543 — Using adjusting spacers to adjust clutch fingers. Make certain the three adjusting spacers are top side up and are in contact with both clutch discs.

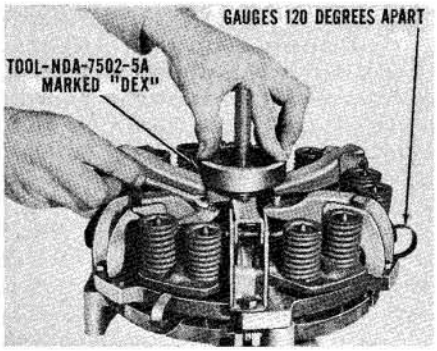

Fig. FO544 — Use gage block as shown to adjust each finger until 0.005 clearance exists between screw head and block.

to check and adjust the transmission release finger screws and the lowest machined surface to check and adjust the pto release finger screws.

While holding the adjusting tool firmly against the aligning spacer, adjust each finger in turn, until there is a clearance of 0.005 between head of adjusting screw and machined surface of adjusting tool.

NOTE: Be sure that pto disc pilot butts against shoulder of spindle and gage block is resting in pto disc pilot when making adjustments. Spindle must be tight in fixture.

After adjustment is completed and checked, invert the adjusting tool, install the flat washer and nut and tighten the nut until the three adjusting spacers can be removed. Lift the adjusted clutch assembly from the fixture and reinstall on tractor flywheel.

Before reconnecting the tractor, check the clutch pilot and release bearings and renew as required. Pack the recess in the center of the clutch release bearing hub with a good grade of high melting point grease before reassembly.

TRANSMISSION

NOTE: At tractor Serial No. 957E-63953, changes were made in the gear ratios of the Fordson Dexta transmission. Some of the old ratio gears are no longer available. If necessary to substitute a new ratio gear in a transmission prior to the above serial number, the mating gear or gears must also be renewed. The Ford Tractor Parts Catalog contains a chart which will identify the different gears and indicate which other gears are required when a substitution is made.

It would be advisable to check any gears being renewed in a transmission to be sure that the new and old gears are alike or that a mating gear set is being installed.

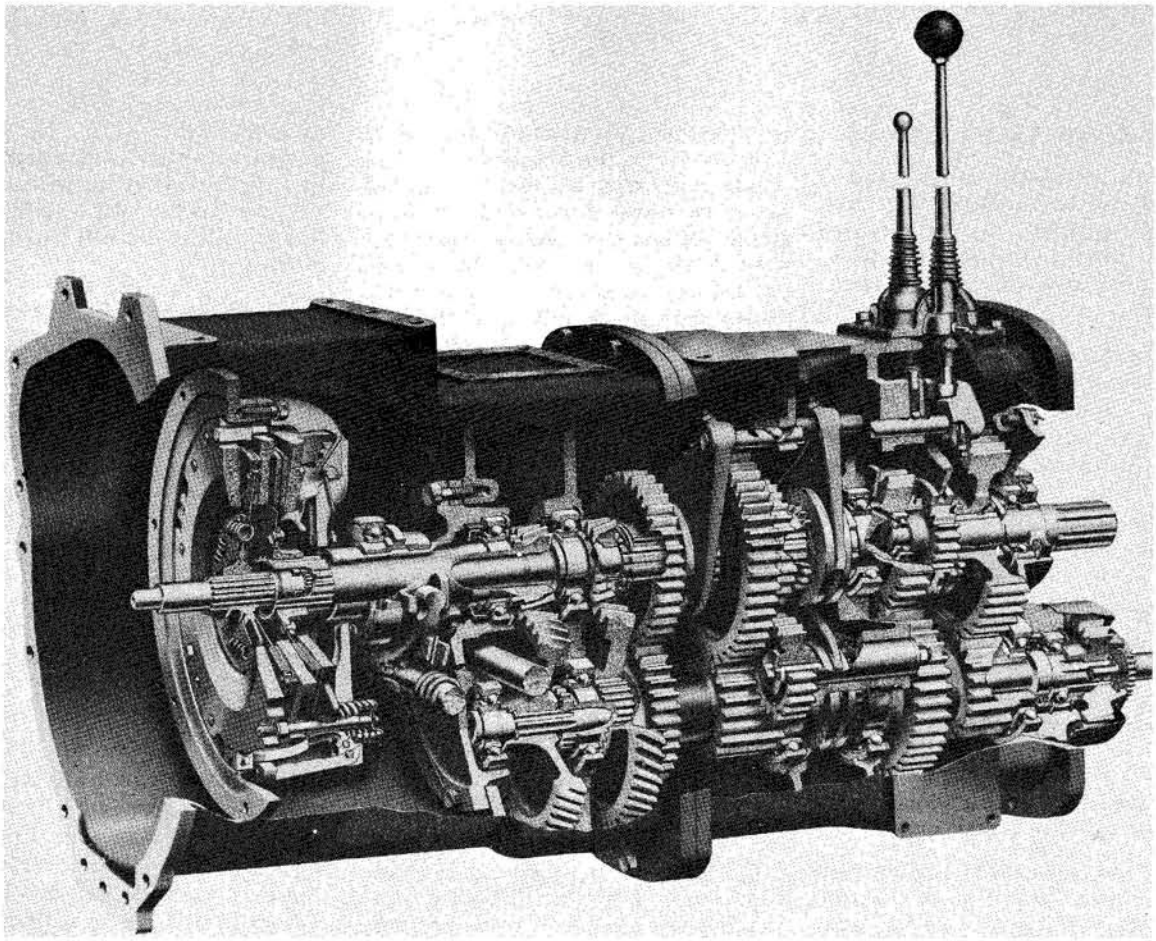

Fig. FO545—Cross-sectional view of transmission assembly with live pto.

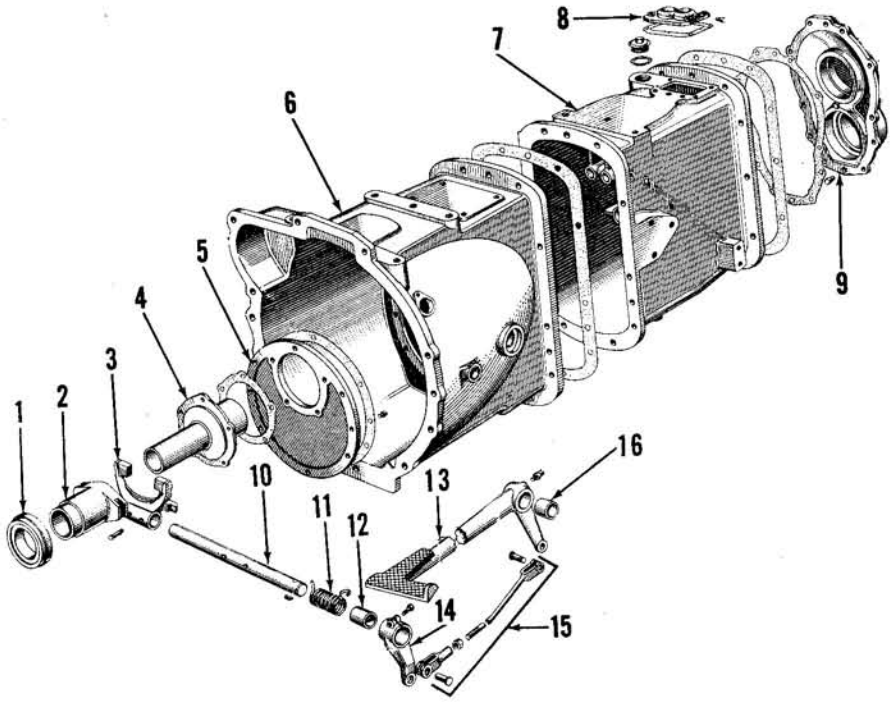

Fig. FO545A—Exploded view of transmission housing and clutch release mechanism.

1. Clutch bearing
2. Clutch release hub
3. Clutch release fork
4. Input shaft retainer
5. Adapter plate
6. Transmission front housing
7. Transmission housing
8. Shifter housing
9. Rear cover plate
10. Clutch release shaft
11. Clutch return spring
12. Bushing
13. Clutch pedal
14. Clutch release arm
15. Clutch release rod
16. Bushing

INPUT SHAFT SEAL RENEWAL

59. The transmission input (clutch) shaft seal can be renewed after first detaching (splitting) the engine from the cluch housing as outlined in paragraph 56. To renew the seals, proceed as follows:

Disconnect the clutch release rod (15—Fig. FO545A) from release shaft arm (14) and unhook return spring (11) from release fork. Rotate release shaft forward and withdraw clutch release bearing (1) and hub (2). Remove the two pins securing release fork (3) to shaft (10) and withdraw shaft, fork and return spring from housing.

Remove safety wire or straighten the locking tabs, remove the five cap screws securing input shaft retainer (4) to transmission housing and withdraw the retainer. On live pto models, the pto input shaft will be withdrawn with the retainer. On all models, the transmission input shaft will remain in the transmission.

On live pto models, remove the snap ring (7—Fig. FO547A) at rear of pto input shaft bearing and bump shaft (8) and bearing (6) rearward out of retainer. The input shaft retainer seal (4), and the seal (2) and needle bearing (3) in the forward end of pto input shaft can be renewed at this time. To install new needle bearing, press on lettered end of cage only. CAUTION: Do not press bearing cage in against shoulder in input shaft. When properly installed, front end of bearing cage should be 1.01 inches below flush with front end of input shaft.

On all models, install seal or seals with lip to rear and reverse the disassembly procedure, being careful not to damage lip of seal during installation. Note: The upper of the five securing cap screws passes through the adapter plate and threads into transmission housing. This screw is longer than the remaining four. Tighten the five cap screws to a torque of 40 ft.-lbs. and secure with safety wire or bend locking tabs against heads of cap screws.

REMOVE AND REINSTALL TRANSMISSION

60. To remove transmission assembly from tractor, first drain the transmission and hydraulic system and detach engine from clutch housing as outlined in paragraph 56. Remove closure panels from each side of steering gear housing. Remove the four cap screws securing steering gear housing to transmission case and the three bolts securing fuel tank rear support to transmission case and lift fuel tank, steering gear and instrument panel from tractor as a unit. Disconnect brake and clutch linkage and unbolt and remove step plates. Attach a hoist to transmission housing, support rear axle center housing separately, unbolt transmission from rear axle center housing and remove transmission assembly.

OVERHAUL

61. **FRONT HOUSING AND INPUT SHAFT.** To remove the transmission front housing (6—Fig. FO545A) and input (clutch) shaft, first detach (split) the engine from clutch housing as outlined in paragraph 56, and remove fuel tank, steering gear and instrument panel as outlined in paragraph 60. Disconnect clutch release rod (15—Fig. FO545A), unhook return spring (11) and rotate release shaft forward to remove release bearing (1) and hub (2). Remove the two pins securing release fork (3) to shaft (10) and withdraw fork, release shaft and return spring from the transmission housing. Remove the cap screws securing adapter plate (5) to the transmission front housing and withdraw adapter plate and input shaft retainer as a unit from the transmission. Note: Pto input shaft will be removed with adapter plate and retainer on live pto models.

On live pto models, remove snap ring (13—Fig. FO547A) from front of pto countershaft and remove bearing (14) using a suitable puller and knife edge adapter. On all models, support the transmission front housing with a suitable hoist and unbolt and remove the housing and transmission input shaft. On live pto models, slip pto countershaft drive gear (15) from pto countershaft (16) as the two housings are separated. During reassembly, make sure gear (15) is in place in transmission front housing, and that the splines of gear (15) and shaft (16) are engaged as the two housings are fitted together.

To remove the transmission input shaft from transmission front housing, remove snap ring (12) from rear of bearing and bump shaft (9) and bearing (11) rearward out of housing. The needle pilot bearing in the rear bore of transmission input shaft of Fordson Dexta models may be removed at this

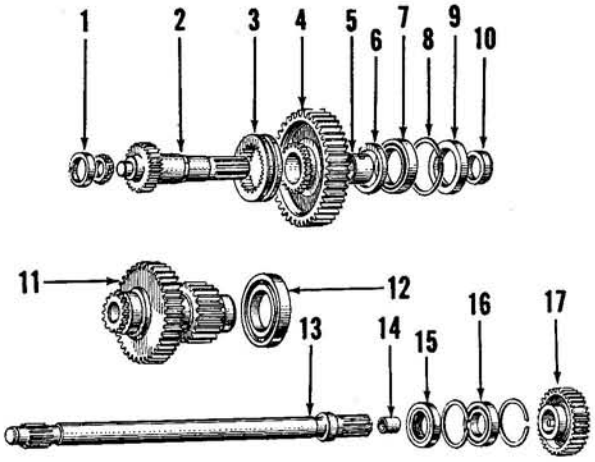

Fig. FO546—Exploded view of secondary transmission and pto counter shaft assembly.

1. Pilot bearing
2. Output shaft
3. High-low coupling
4. Gear
5. Bushing
6. Washer
7. Bearing
8. Snap ring
9. Seal
10. Seal sleeve
11. Secondary countershaft
12. Bearing
13. Pto countershaft
14. Bushing
15. Seal
16. Bearing
17. Pump drive gear

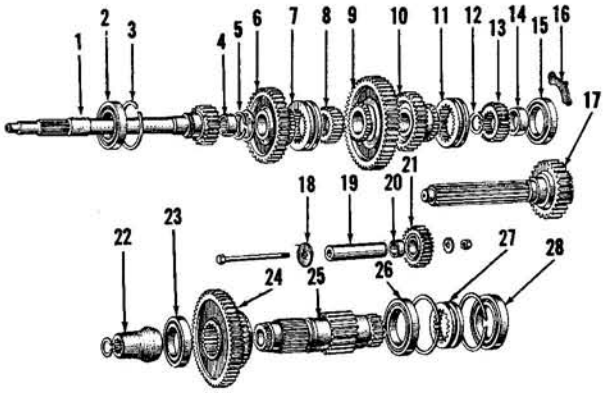

Fig. FO547—Exploded view of primary transmission on Fordson Dexta single clutch models. Fordson Super Dexta and Ford 2000 Super Dexta transmissions have a floating type roller bearing instead of needle bearing (4). Also, all models produced after Fordson Dexta Serial No. 957E-63953 have cap screw threaded into reverse idler shaft (19) to retain idler instead of long bolt, washer and nut shown.

1. Input shaft
2. Input bearing
3. Snap ring
4. Needle bearing
5. Washer
6. 2nd-5th gear
7. Coupling
8. Connector
9. 1st-3rd gear
10. Reverse gear
11. Coupling
12. Snap ring
13. Connector
14. Spacer
15. Bearing
16. Retainer
17. Main shaft
18. Thrust washer
19. Shaft
20. Bushing
21. Reverse idler
22. Pto coupler
23. Bearing
24. Countershaft gear
25. Countershaft
26. Bearing
27. Coupling
28. Bearing

time if renewal is indicated. When reinstalling, press the bearing into the bore until rear face of bearing is 0.090 beyond rear face of shaft. Fordson Super Dexta and Ford 2000 Super Dexta transmissions have a floating type roller bearing in the rear bore of the input shaft.

62. **PTO COUNTERSHAFT AND REAR COVER.** To remove the pto countershaft and transmission rear cover, first remove the transmission as outlined in paragraph 60 and the transmission front housing as outlined in paragraph 61. On models without live pto, remove the snap ring from the front of the pto countershaft and withdraw pto coupling (22—Fig. FO547). If the pto countershaft (13—Fig. FO546), pto countershaft rear bearing (16), seal (15) or hydraulic pump drive gear (17) are to be renewed, remove the gear shroud, the snap ring from rear of pto countershaft and withdraw the hydraulic pump drive gear. Unbolt and remove transmission rear cover plate (9—Fig. FO545A) with pto countershaft attached. If necessary, tap the transmission output shaft (2—Fig. FO546) forward as the plate is removed, to free bearing (7) from the rear cover. The output shaft and transmission countershaft, with rear carrier bearings attached, will remain in the transmission housing as the rear cover is removed.

The output shaft rear seal (9) can be renewed at this time. To renew the pto countershaft rear oil seal, first remove the pto countershaft from the rear cover plate by removing the snap ring at the rear of bearing (16) and bumping the shaft and bearing rearward out of cover. When installing seals (9 and 15) in the rear cover plate, make sure the main sealing lip is facing the transmission (front) side of plate. Using suitable adapters, drive output shaft seal (9) into rear of cover until seal seats against the snap ring in the cover. Pto rear oil seal is installed from front of cover and bottomed against snap ring.

The bushing in the bore at rear of pto countershaft is renewable. A new bushing has an inside diameter of 0.502-0.503 and should be installed with a suitable driver until rear face of bushing is 0.010 beyond rear face of pto countershaft.

During installation, tighten the rear cover plate retaining cap screws to a torque of 40 ft.-lbs.

63. **SECONDARY TRANSMISSION.** The secondary transmission can be disassembled after removing transmission as outlined in paragraph 60, and rear cover as outlined in paragraph 62. To disassemble, withdraw the secondary countershaft (11 — Fig. FO546) far enough to free the front carrier bearing from its location in the housing and lower the countershaft to the bottom of transmission housing. Withdraw the output shaft assembly (2)

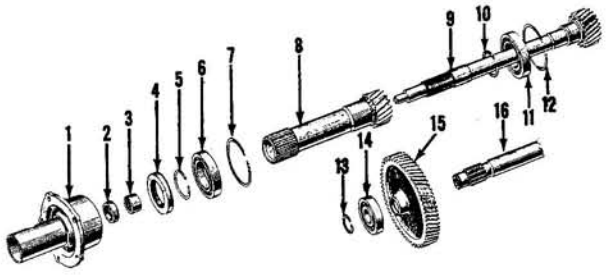

Fig. FO547A—Input shaft assembly used on tractors equipped with live pto. Input shaft (9) and pto countershaft (16) are identical on tractors with or without live pto.

1. Input shaft retainer
2. Oil seal
3. Needle bearing
4. Oil seal
5. Snap ring
6. Bearing
7. Snap ring
8. Pto input shaft
9. Transmission input shaft
10. Snap ring
11. Bearing
12. Snap ring
13. Snap ring
14. Bearing
15. Pto countershaft gear
16. Pto countershaft

from rear of transmission while retaining the high-low sliding coupling (3) in position in shifter fork. Remove the sliding coupling, then withdraw the secondary countershaft.

To disassemble the output shaft assembly, remove gear (4), bearing (7) and seal sleeve (10) at the same time, using a suitable puller. The output shaft gear is fitted with a 1.875-1.876 renewable bushing (5), which should have 0.001-0.003 diametral clearance on the shaft. During reassembly, note that thrust washer (6) has a flat machined into its inside diameter which must match a corresponding flat in the output shaft.

The output shaft (2) and high-low coupling (3) are serviced only as a matched assembly and must be installed with the locating marks in register. The self-aligning roller bearing (1), at the front end of output shaft, is matched with its outer race which is installed in the rear bore of the primary transmission main shaft, and the two must be renewed as an assembly. Renew the bearings if rough or excessively loose, and seal sleeve (10) if nicked or grooved at the oil seal contact area.

During reassembly, place the secondary countershaft in the housing and check locating marks on high-low coupling and output shaft. Reinstall coupling in shifter fork, move fork and coupling forward into the high position, and insert output shaft into coupling with locating marks in register. A coating of heavy grease on the rollers of the output shaft front bearing will hold them in place and assist in the entry of the bearing in its race. Reinstall the countershaft front bearing in its bore in housing and seat the bearing by bumping rear of shaft with a soft hammer; then, install the transmission rear cover plate.

64. **MAIN TRANSMISSION.** The main transmission can be disassembled after removing the transmission as outlined in paragraph 60, the transmission front housing as outlined in paragraph 61 and the secondary transmission as outlined in paragraph 63. To disassemble, insert a step plate of the proper size in the front end of the transmission countershaft and, using a suitable puller, remove the countershaft front bearing (23—Fig. FO547) and the countershaft cluster gear (24). Remove the snap ring from the front of transmission main shaft and withdraw the thrust washer (5) and second gear (6). Loosen the set screw in the shifter fork and remove fork, sliding coupling (7) and connector (8) from the main shaft. Rotate the countershaft until milled flat (see Fig. FO-547B) is at the top of the shaft and remove first gear (9—Fig. FO547) from the main shaft, followed by the reverse driven gear (10).

Loosen the set screw retaining the high-low shifter fork (2—Fig. FO548) to its rail, remove shifter housing (4) and withdraw the high-low shifter fork and rail. Unbolt and remove the main shaft rear bearing retainer (16—Fig. FO547) and remove main shaft (17), bearing (15) and reverse connector (13) by tapping shaft rearward with a soft hammer. Remove the retaining screw, withdraw reverse idler gear (21) from housing and remove countershaft (25) by bumping it forward out of the housing.

NOTE: Reverse idler on all models produced after Fordson Dexta tractor serial No. 957E-63953 is retained by cap screw threaded into front end of reverse idler shaft. On Fordson Dexta models prior to this Serial Number, reverse idler was retained by a bolt passing through hollow idler shaft as shown in Fig. FO547. Bolt was secured by self-locking nut and flat washer in rear transmission compartment.

To remove main shaft rear bearing (15) from the shaft, first remove snap ring (12), reverse coupler (13) and spacer (14). Remove bearing by using a split type puller and suitable press. To renew the output shaft front bearing race located in the rear bore of main shaft (17), first remove bearing (15) from shaft as indicated above and drive out the race with a suitable punch, through the holes provided.

The three idler gears (6, 9 and 10), on the transmission main shaft have an inside diameter of 1.801-1.802 and a diametral clearance of 0.0011-0.0026 on the main shaft splines. The reverse idler gear is fitted with a renewable bushing having an inside diameter of 1.1245-1.1255 and a diametral clearance of 0.0015-0.0035 on its shaft. When installed, the reverse idler gear should have an end play of 0.010-0.025. The reverse idler shaft is a press fit in the transmission housing and may be drifted out if renewal is indicated. Newer type threaded reverse idler shaft and cap screw may be used to renew hollow shaft, bolt and self-locking nut in early Fordson Dexta Models. Install the replacement shaft so that it extends 1.30-1.31 from the machined surface into the front transmission compartment. The reverse connector and coupler are serviced only as a matched assembly and should be installed on the main shaft so that the locating marks are in register.

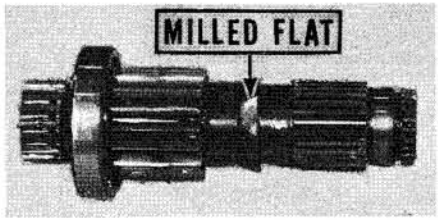

Fig. FO547B — Transmission countershaft showing milled flat which provides clearance for removing first gear from main shaft.

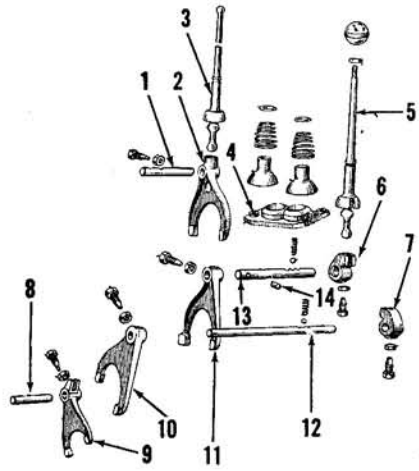

Fig. FO548—Exploded view of shifter rails and forks.

1. High-low rail
2. High-low fork
3. High-low lever
4. Lever housing
5. Main shift lever
6. Selector
7. Selector
8. 4th-6th rail
9. 4th-6th fork
10. 1st-3rd fork
11. Reverse fork
12. Rail, 1st-3rd
13. Rail, reverse
14. Interlock pin

NOTE: If less than 2500 lbs. force is required to press reverse idler shaft into housing, it is suggested that the shaft be removed and the following Fordson Major parts be installed: 1—E27N-7140 Shaft, 2—DKN-7717 Washers, 1—BB-5721-B Bolt and 1—34420-ES2C Nut. Install as follows: Press shaft into housing until it protrudes 1.30 - 1.31. Grind head of bolt to 3/16-inch thick. Grind ¼-inch from side of one washer. Place other washer on bolt with flat side against bolt head and install bolt and washer in shaft and gear from front. Install modified washer at rear with protrusion to front. Apply Loctite to bolt threads and tighten nut only enough to prevent front washer from turning. Check idler gear for 0.010-0.025 end play and be sure no interference exists when reassembling transmission.

65. **SHIFTER RAILS AND FORKS.** Renewal of the shifter rails and forks requires the disassembly of the complete transmission with the following exceptions:

The high-low shifter rail (1—Fig. FO548) and fork (2) may be removed after removal of the secondary transmission assemblies as outlined in paragraph 63, and the shifter levers and housing.

The first-third shifter fork (10) may be removed after removing the primary countershaft cluster gear and the transmission main shaft second gear as outlined in paragraph 64.

The fourth-sixth shifter fork (9) interlocks with the right hand finger of the reverse shifter fork as shown in Fig. FO549, and the two forks are shifted together by the same shifter rail. To remove the reverse shifter fork (11—Fig. FO548) and rail (13) after the remainder of the transmission has been disassembled, remove the set screws securing the fork and selector (6) to the rail, then withdraw the rail from the housing. Remove the fourth-sixth fork, loosen the retaining set screw and slide the rail out of fork and housing. Be sure to interlock the two forks during assembly. Remove the remaining shifter rail by removing the set screw in selector (7) and withdrawing the rail. An interlock pin (14) is installed in the housing between the two shifter rails at the front end. To remove the interlock pin, remove the rails as outlined above, remove the expansion plug on the left side of transmission housing and withdraw the interlock pin.

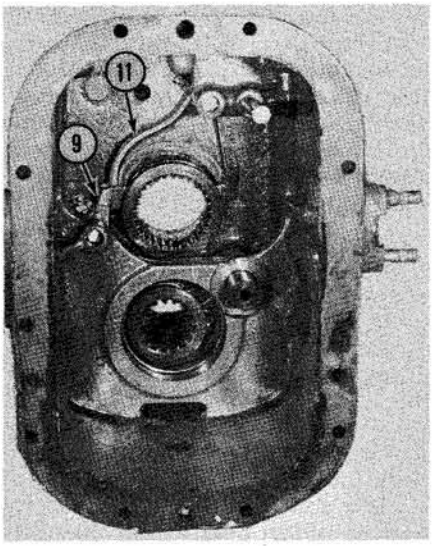

Fig. FO549—Front view of rear transmission housing with gears removed, showing interlocked reverse and 4th-6th shifter forks. These forks must be in place before any of the transmission gears can be installed.

DIFFERENTIAL, BEVEL GEARS AND REAR AXLE

DIFFERENTIAL

66. **REMOVE AND REINSTALL.** To remove the differential unit, first drain rear axle center housing and hydraulic reservoir and block up under the center housing to raise the rear wheels. Remove the left rear wheel and disconnect left brake linkage. Disconnect left hydraulic lift link from pivot stud. Unbolt left axle housing from center housing and remove assembly from tractor. Carefully remove and count the number of gaskets installed at the axle housing flange so that the same number can be installed during reassembly. Withdraw the differential unit from center housing.

Differential carrier bearing preload is established by the number of gaskets (A—Fig. FO550) installed between left axle housing and rear axle center housing during assembly. The maximum recommended preload on the differential carrier bearings is 30 in.-lbs. rolling torque. The allowable preload in terms of pinch on housings is 0.003 clearance to 0.003 preload.

The manufacturer recommends that whenever major repairs have been made to the differential assembly, bearings or axle housings, a check and adjustment of the preload be made as follows:

Detach rear axle center housing from transmission case and block the center housing up so that right axle housing is toward bottom and left hand side of center housing is uppermost. Locate the differential assembly in the cup of the right axle housing. Remove axle shaft from left hand axle housing and position the housing over the differential assembly with no gaskets installed. Rotate the differential assembly by hand to make sure that carrier bearings seat properly in their cups and position four retaining nuts equally around the left hand axle housing flange. Tighten the nuts finger tight and, using a feeler gage, adjust the nuts until the gap is equal at all points around the housing. Measure the gap and install the number of gaskets which, when compressed, will most nearly equal the measured gap. The gaskets supplied have a compressed thickness of 0.0065 (uncompressed thickness 0.009-0.012). After determining the correct number of gaskets to install, reassemble tractor in the normal manner.

An alternate method is to detach the rear axle center housing from the transmission housing, remove the drive pinion as outlined in paragraph 70, and remove the rear pto shaft from the center housing. Wrap a piece of heavy string around the differential case so that a pull rearward on the string will rotate the differential assembly in a forward direction. Install the differential assembly in the tractor and install the left axle housing with the number of gaskets removed prior to overhaul. Tighten the retaining nuts to a torque of 45-50 ft.-lbs. and, working through the pto opening in rear of center housing, attach a pull scale to the string. The preload is correct if a pull of 4½ lbs. is required on the pull scale to rotate the differential assembly.

67. **OVERHAUL.** After the differential unit has been removed from the tractor as outlined in paragraph 66, examine the two halves of the case and place correlation marks to aid in reassembly if they are not already present. If equipped with differential lock, remove the snap ring (1—Fig. FO550B), washer (2), sliding coupling (3), return spring (4) and coupling adapter (5). Remove the safety wire

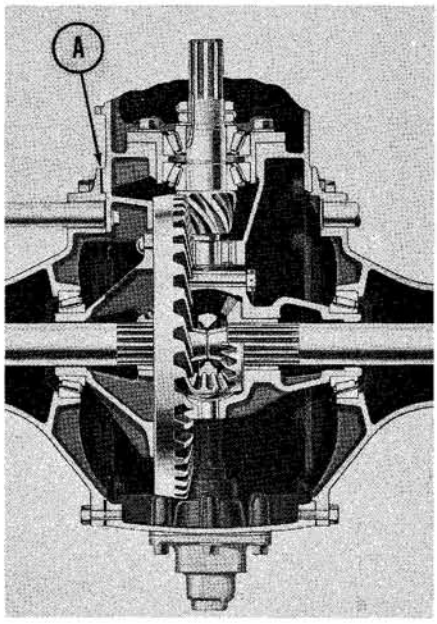

Fig. FO550—Cutaway view of final drive used on Dexta tractor without differential lock. Carrier bearing preload is adjusted by means of gasket pack (A).

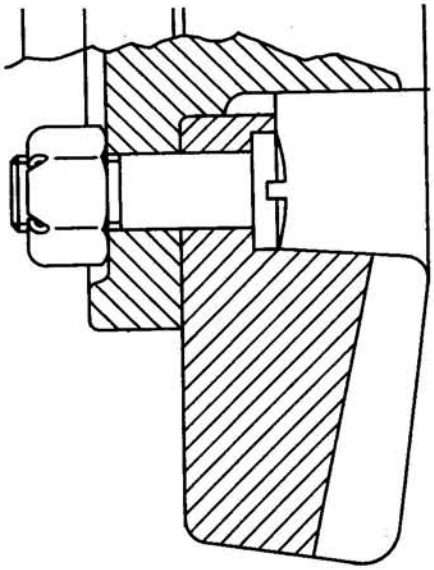

Fig. FO550A — Cross-sectional view of differential case and ring gear showing proper installation of slotted head bolts and self-locking nuts when renewing ring gear.

and remove the cap screws retaining the right half of the differential case. On models equipped with differential lock, the cap screws must be loosened equally as the right half of the differential case is removed due to interference with the large carrier bearing cone.

The bevel ring gear and bevel drive pinion are available only as a matched set, either with or without the differential case. To renew ring gear on differential case, proceed as follows: Center punch the upset (ring gear) end of each rivet in exact center of counterbore in ring gear. Then, using a $\frac{9}{16}$-inch drill, drill into each rivet until the upset end is cut off. Use suitable drift punch to remove rivets from assembly. Special bolts and self-locking nuts are available to attach new ring gear to differential case. Assemble with slotted heads of bolts to ring gear side of assembly and tighten the self-locking nuts to a torque of 50-60 ft.-lbs.

Examine the axle shaft splines, pinion gears, differential spider, thrust washers and the axle gear bushings and renew if necessary. When renewing the axle gear bushings, press the new bushings 0.600 below flush with inside face of differential case halves. The differential carrier bearings should be checked and renewed if necessary. If renewal is indicated for the carrier bearing cups, the axles must be removed from the axle housings and the right hand axle housing from the center housing to provide access for removal.

After reassembly, tighten the cap screws retaining the right half of the differential case to a torque of 70 ft.-lbs. On differential lock equipped models, the right hand carrier bearing cone must be removed to tighten the cap screws with a torque wrench if a special torque wrench adapter is not available. After tightening the cap screws, check the axle side gears to be sure there is no binding and in-

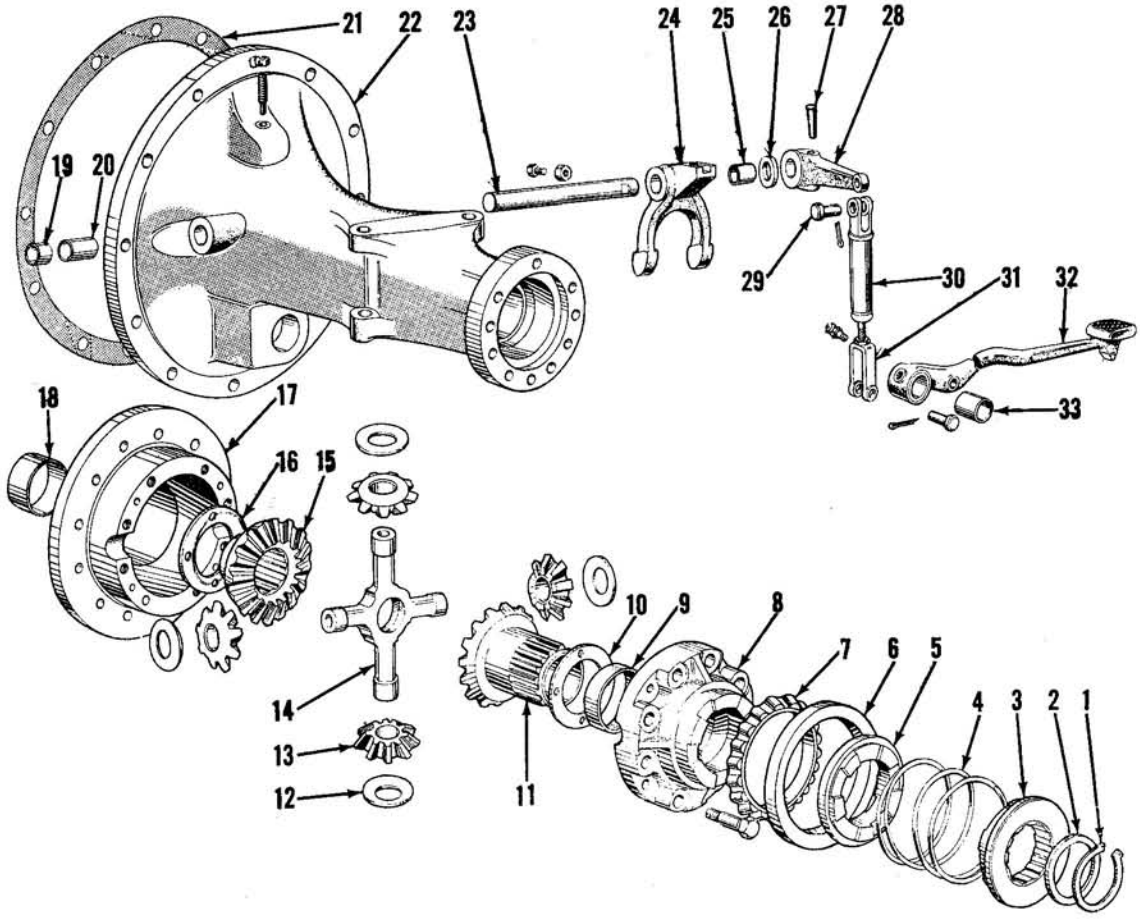

Fig. FO550B — Exploded view of differential lock and related parts.

1. Snap ring
2. Washer
3. Sliding coupling
4. Coil spring
5. Coupling adapter
6. Bearing cup
7. Cone & roller assy.
8. Differential case (R.H. half)
9. Bushing
10. Thrust washer
11. R. H. axle gear
12. Pinion thrust washer (4)
13. Pinion gears (4)
14. Differential spider
15. L. H. axle gear
16. Thrust washer
17. Differential case (L.H. half)
18. Bushing
19. Plug
20. Bushing
21. Gasket
22. R. H. axle housing
23. Shaft
24. Fork
25. Bushing
26. Seal
27. Pin
28. Lever
29. Pin
30. Operating link
31. Yoke
32. Foot pedal
33. Bushing

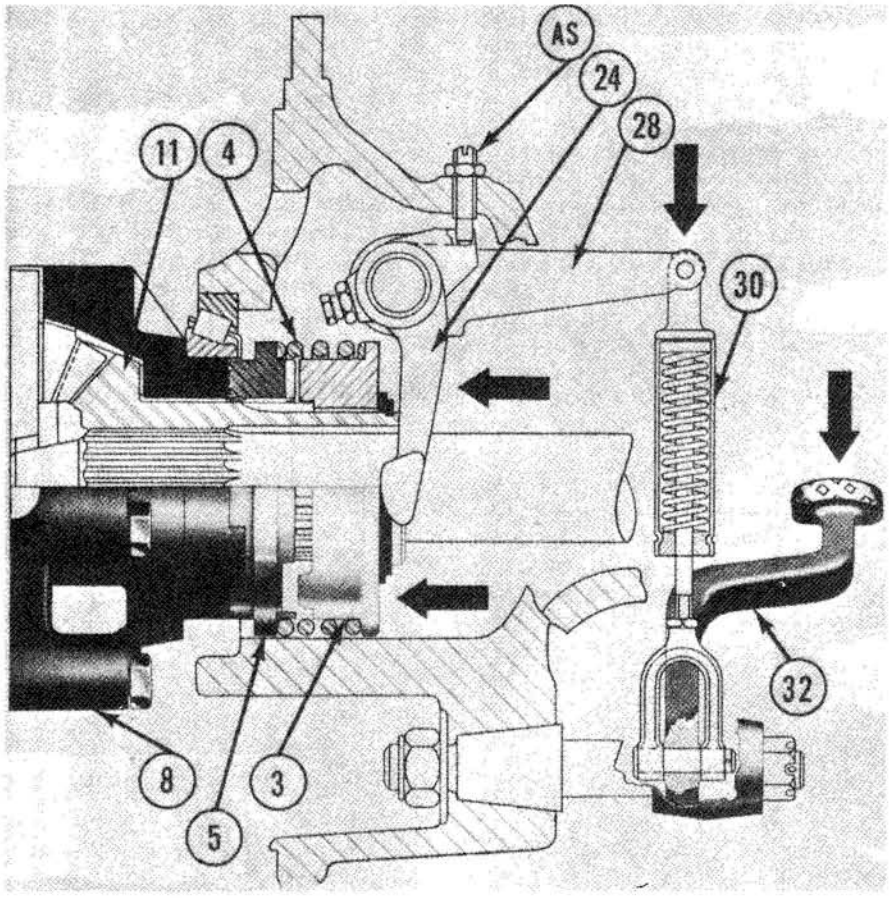

Fig. FO550C — Schematic view showing operating principles of differential lock. To engage lock, pressure is appled to sliding coupling (3) from foot pedal (32) through spring loaded link (30), lever (28) and fork (24). Spring loaded link will snap coupling to engaged position at instant dogs on sliding coupling and coupling adapter (5) are aligned. Lock will be disengaged by coil spring (4) whenever traction is equalized on rear wheels.

AS. Adjusting screw
3. Sliding coupling
4. Coil spring
5. Coupling adapter
8. Differential case
11. R. H. axle side gear
24. Operating fork
28. Operating lever
30. Spring loaded link
32. Foot pedal

stall new safety wire through drilled heads of cap screws. Reinstall the differential unit and check carrier bearing preload as outlined in paragraph 66.

DIFFERENTIAL LOCK

68. **DIFFERENTIAL LOCK OPERATION AND ADJUSTMENT.** The differential lock consists of a dog type coupling which can be engaged to lock the right hand axle gear (11—Fig. FO550B) to the differential case. This results in both rear wheels being turned at the same speed, regardless of any difference in traction of the rear wheels.

In operation, when one rear wheel starts to spin, the foot pedal (See Fig. FO550C) is depressed which applies spring pressure to the sliding coupling. When the dogs on the coupling are aligned with the notches in the coupling adapter, the spring pressure applied through the operating fork will snap the coupling into engaged position. The foot pedal can then be released and the differential lock will remain engaged until the traction on the rear wheels becomes equalized. As there will then be no side pressure on the coupling dogs, the coil spring between the sliding coupling and the coupling adapter will push the sliding coupling to disengaged position. If necessary to make a turn before the differential lock is automatically disengaged, the lock can be manually disengaged by momentarily depressing the transmission clutch pedal or applying the brakes on the wheel with least traction.

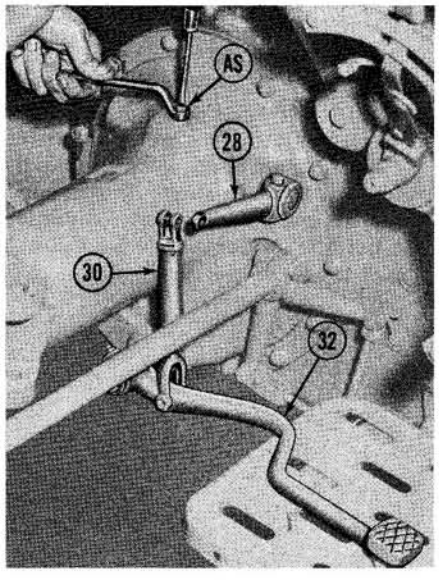

Fig. FO550D — Adjusting the differential lock. Refer to text for adjustment procedures.

AS. Adjusting screw
28. Operating lever
30. Operating link
32. Foot pedal.

Proper adjustment of the differential lock mechanism requires minimum clearance between the operating fork and face of sliding coupling when the lock is in disengaged position, and that the lock be fully engaged when the foot pedal is depressed until it strikes the right hand foot rest. Before attempting to adjust the differential lock, be sure that the foot rest is not bent out of position and there is nothing on the foot rest to prevent full travel of the foot pedal. To make adjustment, proceed as follows: Disconnect the spring loaded operating rod from operating lever as shown in Fig. FO550D. Back-off the locknut on adjusting screw in axle housing. Position operating lever so that operating fork just contacts face of sliding coupling. Turn adjusting screw in until contact is made with operating fork; then, back adjusting screw out ¼-turn and tighten locknut.

Block up right rear wheel and turn wheel while pushing down on operating lever to fully engage the differential lock. Hold operating lever in this position and with foot pedal against foot rest, adjust length of spring loaded operating rod so that pin can be inserted through operating rod yoke and operating lever. Then, shorten rod two turns, tighten locknut and reinstall pin connecting operating rod to operating lever.

69. **OVERHAUL DIFFERENTIAL LOCK.** The differential lock foot pedal pivots on an extended hydraulic lift lower link shaft. Pedal has renewable bushing; be sure to align grease hole in bushing with hole in pedal when renewing the bushing. The spring-loaded operating rod is renewable only as an assembly. The operating lever and fork shaft pivots in renewable bushings in the right axle housing. To renew the operating shaft, bushings, fork and/or pedal pivot shaft, remove right axle housing as

follows: Drain oil from differential and hydraulic lift compartments. Disconnect differential lock operating rod from operating lever and remove foot pedal and hydraulic lift lower link from pivot shaft. Block up under center housing and unbolt and remove right rear wheel, fender and axle assembly from axle housing. Be careful not to lose or damage shims located between axle housing and axle bearing support. Then, unbolt and remove axle housing from center housing. The differential lock sliding coupling, spring and coupling adapter can also be inspected and renewed at this time. See Fig. FO550E. If service of differential unit is indicated, remove left axle housing and differential as outlined in paragraph 66.

When reassembling tractor, install only one gasket between right axle housing and center housing and install the same number of shims between axle housing and axle bearing support as were removed during disassembly. Tighten axle housing to center housing retaining nuts to a torque of 50 ft.-lbs. and axle housing to axle support retaining nuts to a torque of 40-45 ft.-lbs. If adjustment of differential carrier bearing pre-load is indicated, refer to paragraph 66. To readjust axle end play, refer to paragraph 74.

MAIN DRIVE BEVEL PINION

70. To remove the main drive bevel pinion, first detach the rear axle center housing from the transmission housing and remove the hydraulic pump as outlined in paragraph 102. Remove the hydraulic lift cover as outlined in paragraph 91 and remove the left axle housing and differential assembly as outlined in paragraph 66. Remove the six mounting cap screws in the pinion carrier and remove the carrier and pinion assembly by using two $\frac{9}{16}$-NC jack screws as shown in Fig. FO-551. Disassemble pinion and bearings and renew worn or damaged parts.

When reassembling the bevel drive pinion, adjust the bearings until a rolling torque of 12-16 in.-lbs. is established. When checked with a spring scale as shown in Fig. FO553, the scale reading should be 16-21 lbs. When adjustment is completed, secure the adjusting nuts by bending the tabs on the lock washers.

NOTE: The heavier duty tapered roller bearings and bearing cups cataloged for Super Dexta bevel pinion shaft may be used to renew bearings and cups on Dexta pinion. Do not use the narrow Dexta pinion shaft tapered bearings in Super Dexta models.

The main drive bevel pinion is available for service only in a matched set with bevel ring gear, either with or without differential case assembly.

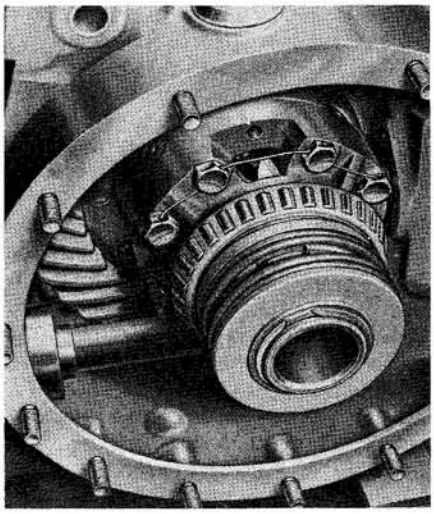

Fig. FO550E — Differential lock coupling can be inspected or renewed with R. H. axle housing removed as shown.

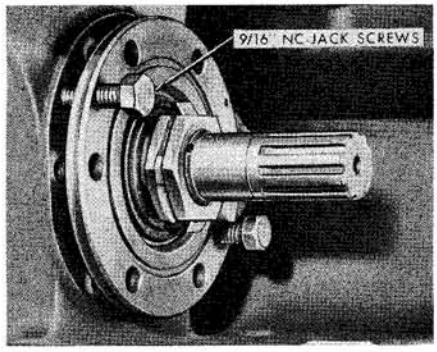

Fig. FO551 — View of rear axle center housing with lift cover removed, showing suggested method of pulling drive pinion. Differential unit must be removed to provide clearance for pinion pilot bearing.

REAR AXLE SHAFT, BEARINGS AND SEALS

74. **BEARING ADJUSTMENT.** The rear axle shafts are carried on one tapered roller bearing at the outer end of each shaft. The bearings are retained in their cups by contact of the inner ends of the two axle shafts in the differential assembly. The recommended end play of 0.004-0.012 is adjusted by means of shims placed between the axle side housings and the outer bearing retainer on each side of the tractor as shown in Fig. FO553A.

A quick check of the bearing adjustment can be made by supporting rear of tractor and removing the wheel and tire assemblies. To make the check, shift the transmission into neutral and rotate either axle shaft. If the opposite shaft rotates in the same direction, the bearing adjustment is too tight.

To accurately measure the bearing clearance, remove both brake drums and make sure one axle shaft bearing is fully seated in its cup by driving a wedge between the axle flange and bearing retainer as shown in Fig. FO-554. Push inward on the opposite axle flange and thread a long $\frac{3}{8}$-16 bolt in the brake drum retaining hole in the axle flange as shown in Fig. FO555. A lock nut installed on the bolt will assist in holding it in place. Thread the bolt into the axle flange until contact is just made with the bearing retainer flange while pressure is being applied inwardly on the axle. When the bolt has been adjusted as outlined above, wedge the axle outward and measure the clearance from the same position on the bearing retainer, as shown. If the measured clearance is not within the recommended range of 0.004-0.012, correct the adjustment by adding or removing shims (2—Fig. FO553A) between the bearing retainer and axle housing. Adjustment may be made on either axle shaft bearing but an effort

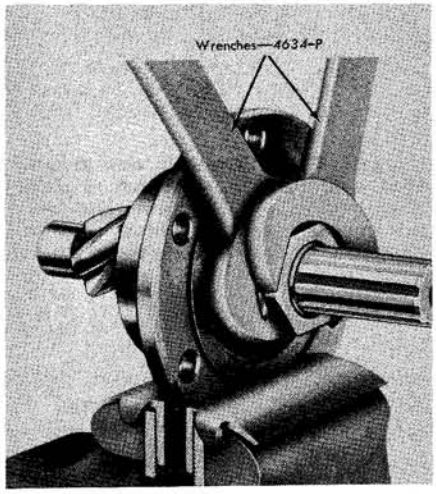

Fig. FO552—Adjusting main drive bevel pinion preload before final assembly.

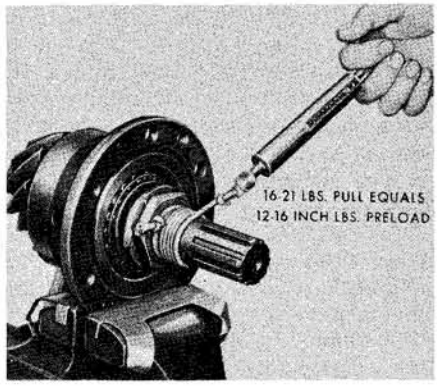

Fig. FO553—Suggested method of checking bearing pre-load with a pull scale. Scale should read 16-21 pounds.

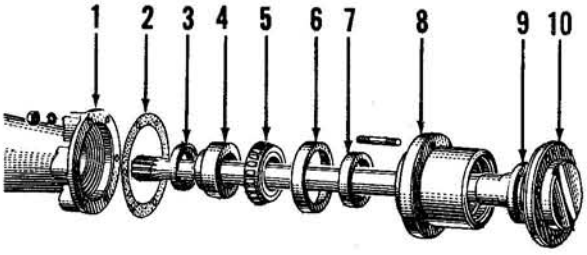

Fig. FO553A — Exploded view of rear axle assembly showing bearing, seals and shims. Later production uses self-locking nut instead of collar (7).

1. Axle housing
2. Shim pack
3. Inner seal
4. Collar
5. Bearing
6. Bearing cup
7. Spacer
8. Bearing retainer
9. Outer seal
10. Axle shaft

should be made to keep the total shim pack equally divided between both axle shafts. To add or remove shims it will be necessary to remove the axle shaft as outlined in the following paragraph:

75. R&R AXLE ASSEMBLY. To remove either rear axle shaft, support rear of tractor, disconnect the brake linkage and remove the wheel and tire assembly and brake drum. Unbolt the bearing retainer from the axle housing and withdraw the axle shaft, brake assembly and bearing retainer from the tractor. The axle bearing inner oil seal (3—Fig. FO553A) can be renewed at this time and should be installed with the lip toward the differential assembly. The shim pack (2) is located between the brake backing plate and axle side housing. Five thicknesses of shims are available ranging from 0.015 to 0.058. The minimum number of shims to obtain the proper bearing adjustment should be used.

When reassembling, adjust the end play as outlined in paragraph 74 and tighten the bearing retainer bolts to a torque of 40-45 ft.-lbs.

75A. **OVERHAUL AXLE ASSEMBLY (BEARING RETAINED BY STEEL COLLAR).** To renew the bearing, bearing cup, retainer, outer seal or axle shaft, drill through the steel collar as shown in Fig. FO556 and split the collar with a suitable chisel. Pull the bearing and bearing retainer from the axle shaft with a suitable puller or large press.

To reassemble, stand the axle, outer flange downward, on a wooden block to protect the wheel stud threads and install the bearing spacer with the tapered inside edge downwards. Fit the retainer, with bearing cup and outer seal in place, over the axle shaft and pack with wheel bearing grease. Install the bearing cone over the shaft and make sure the bearing is seated firmly against the spacer. Heat the collar evenly with a suitable torch until the color changes to a dark blue and immediately drop the collar over the axle shaft and seat firmly against the bearing using a piece of heavy pipe as a driver.

75B. **OVERHAUL AXLE ASSEMBLY (BEARING RETAINED BY SELF-LOCKING NUT).** Unscrew the self-locking nut from axle shaft. Pull the bearing and bearing retainer from axle shaft with suitable puller or large press. The axle outer oil seal may be renewed in bearing retainer without removing the bearing cup. If renewing bearing cup, be sure that new cup is driven into retainer until firmly seated against shoulder. Install new seal with lip of seal towards bearing cup.

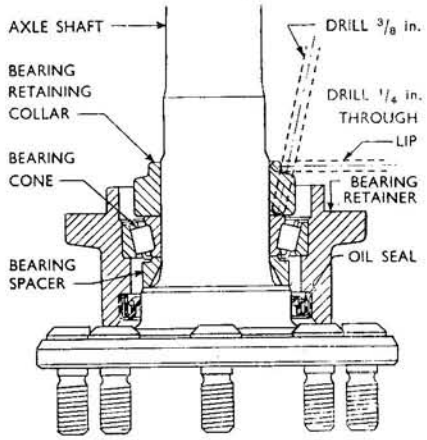

Fig. FO556—Remove shrunk fit bearing retaining collar from axle shaft by drilling through collar as shown, then cracking collar with chisel.

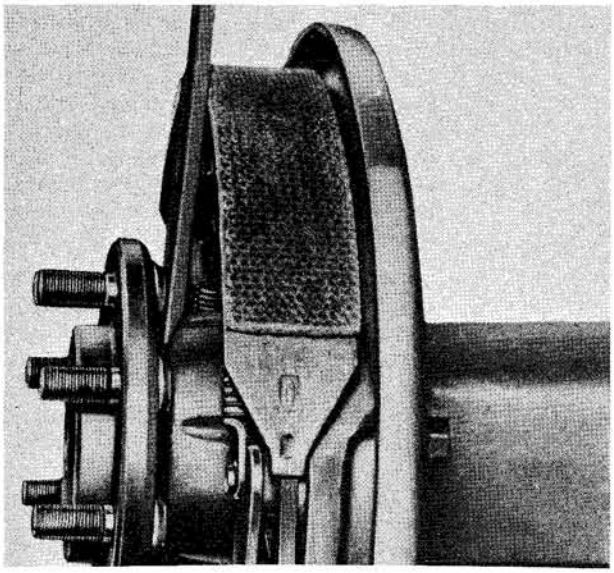

Fig. FO554—To accurately measure axle shaft end play, remove both wheels and brake drums, wedge one axle shaft outward as shown, and measure end float of opposite axle as shown in Fig. FO555.

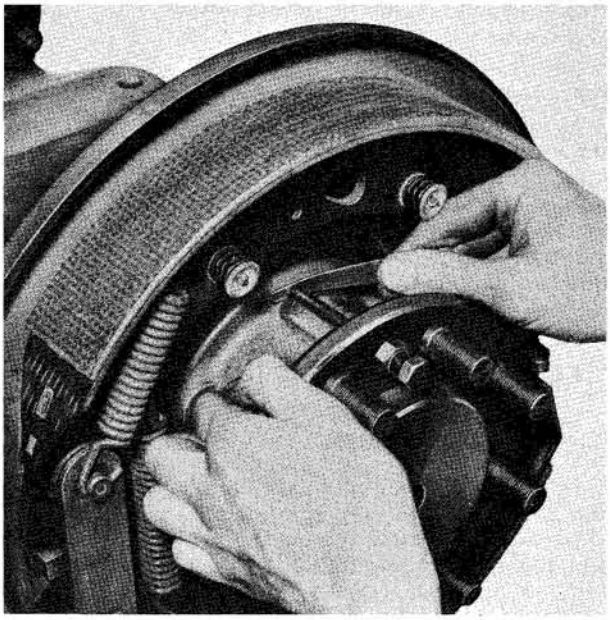

Fig. FO555—Using a long bolt and feeler gage as shown, measure the axle shaft end play as outlined in text.

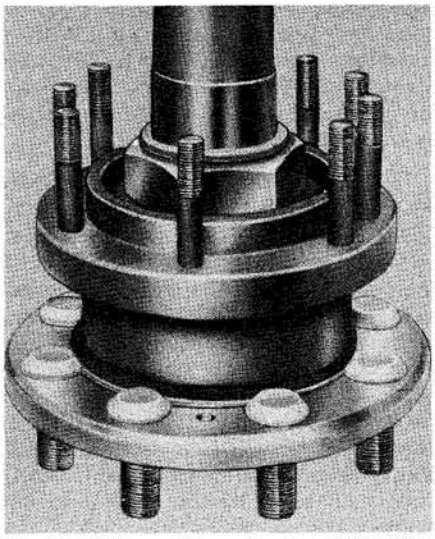

Fig. FO556A — View showing self-locking nut that is used to retain rear axle bearing on late production tractors. Always renew self-locking nut when reassembling axle unit.

To reassemble, stand axle on wood block to prevent possible damage to threads on wheel studs and install bearing spacer with tapered inside edge against shoulder on axle. Position bearing retainer over axle shaft and pack retainer with wheel bearing grease. Pack bearing cone and roller assembly with wheel bearing grease and drive cone into place against bearing spacer. Install **new** self-locking nut on axle shaft and tighten nut to a torque of 230-250 ft.-lbs. Install axle assembly in axle housing and adjust bearing end play as outlined in paragraphs 74 and 75.

NOTE: Set axle in wheel disc to hold axle while removing or installing nut. Use of Nuday Tool No. 4235-D is recommended. This special tool multiplies torque wrench reading by 2; therefore, 115 - 125 ft.-lbs. torque reading is required.

76. **AXLE HOUSINGS.** Procedure for renewal of the rear axle side housings is evident. When renewing housings, check and adjust the differential carrier bearings as outlined in paragraph 66 and the axle bearings as outlined in paragraph 74.

BRAKE SYSTEM

ADJUSTMENT

77. When disengaged, the brake shoes are held in proper alignment with the brake drum by means of adjustable steady posts (A—Fig. FO-556A), to prevent dragging. To adjust, loosen the lock nut on the upper and lower adjustable steady posts and back the posts out until they are free of the shoes. Firmly apply the brake and lock in the applied position with the parking lock. Screw the adjustable steady posts into the back plate until the end of the post just contacts the brake shoe and lock in place by tightening the lock nut.

To adjust the brake shoes, jack up rear wheels, open the adjusting hole cover on backing plate at rear of axle housing as shown in Fig. FO557 and turn the star wheel with a screw driver. Push forward on the screw driver handle to tighten the adjustment. Continue tightening until a slight brake drag is observed when turning the wheel, then back off until the shoe just clears the drum. Adjust the left brake clevis to equalize the pedals when the brakes are applied.

R&R BRAKE SHOES

78. Jack up rear end of tractor and remove the rear wheels and brake drums. Disconnect the two secondary springs from the brake shoe anchor pins and detach and remove the anchor plate. Force rear end of the two shoes apart and remove the adjuster unit and rear retracting spring. Remove the four hold down pins, springs and cups by compressing the spring and turning the outer cup 90 degrees in either direction to disconnect it from the pin. Lift off the shoes, together with the front retracting spring. If anchor pins are worn, they may be renewed by loosening the securing nut and driving the pin from backing plate. Brake shoes are interchangeable but tend to wear in to the drum when used. If the shoes are not to be renewed it is good shop practice to mark the shoes so that they may be reinstalled in the same location.

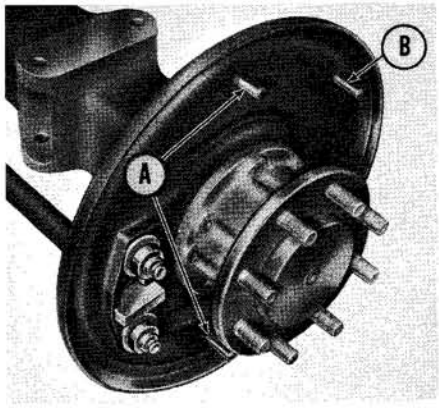

Fig. FO556A — Adjustable steady posts (A), located in brake back plate, are used to align the shoes with the brake drum. Stationary post (B) is built into plate and is not adjustable.

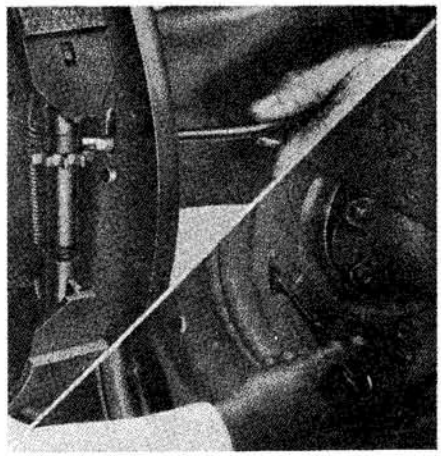

Fig. FO557 — Adjust each brake shoe as shown until shoes just clear drums.

POWER TAKE-OFF

Aside from the input shaft and gear at the front of the transmission assembly, the power take-off train on all models is identical whether or not the tractor is equipped with a live power take-off. Service procedures covering the input shaft and pto countershaft are included in the transmission section of this manual. The following paragraphs will cover the power take-off train from the shifter unit to the rear of the tractor. Fig. FO558 shows a sectioned view of the rear power take-off train.

OUTPUT SHAFT

79. To remove and/or overhaul the pto output shaft (5—Fig. FO558) first drain rear axle center housing and hydraulic system and remove the four cap screws retaining rear pto support cover to rear axle center housing. The output shaft and rear support assembly can now be withdrawn from the tractor.

To disassemble the unit, remove the snap ring retaining rear bearing to the support housing (10) and bump the shaft and bearing forward out of housing. The rear seal can be renewed at this time by driving it forward out of support housing. Using a suitable driver, install the new seal from the front of the support housing, lip up, until front edge of seal is ⅛-inch below the bearing locating shoulder.

To renew the pto output shaft, rear bearing or rear seal sleeve, first press the front collar forward off the shaft. This collar has a 0.0005-0.002 press fit

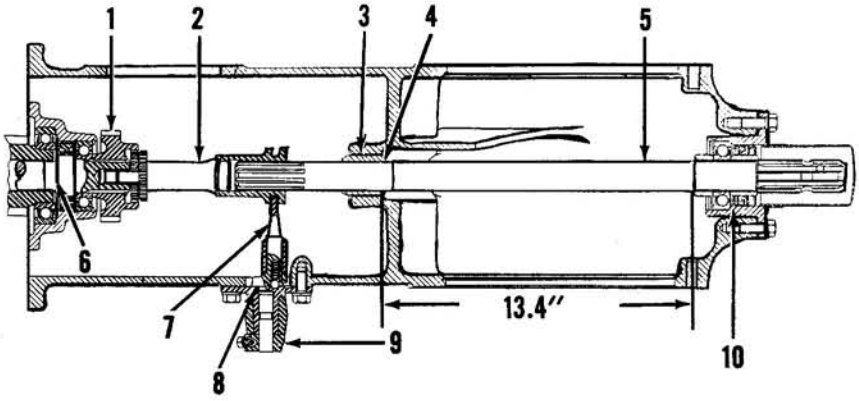

Fig. FO558—Sectional view of rear pto train. Sliding connector pilots in pto countershaft and meshes in internal splines in hydraulic pump drive gear when pto is engaged.

1. Pump drive gear
2. Sliding connector
3. Bushing
4. Front collar
5. Output shaft
6. Oil seal
7. Shifter fork
8. Oil seal
9. Shifter lever
10. Oil seal

on the shaft. The front bearing retaining collar is a shrunk fit on the output shaft and must be cracked with a suitable chisel before removing. After removing the front bearing retaining collar the rear bearing can be moved forward off the shaft. If renewal of the seal sleeve is indicated, press this sleeve forward off the shaft. The seal sleeve has a 0.0003-0.0018 press fit on the output shaft.

To reassemble the unit, press the seal sleeve, then the bearing on the shaft until the two units are firmly seated on the shoulder at the rear splines. Heat the bearing retaining collar evenly with a suitable torch until it reaches a dark blue color and immediately seat it over the shaft against the bearing. Press the front collar on the shaft with the chamfered edge forward until the rear edge of the front collar is 13.4 inches from the front edge of the bearing retaining collar as shown in Fig. FO558.

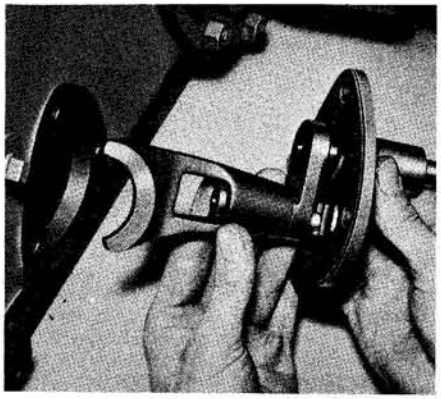

Fig. FO559—Shifter unit can be unbolted and removed from the outside if service is indicated.

SHIFTER UNIT

80. To remove the pto shifter unit, first drain the rear axle center housing, remove the left hand step plate and disconnect the clutch rod from the clutch pedal. Unbolt and remove the shifter unit as shown in Fig. FO559. Slip shifter fork from inner end of shifter crank, and remove the nut from the tapered lever retaining pin. Drive the pin from lever, remove the lever and slide the shifter crank from cover plate. When the shifter crank is removed from the cover plate, the detent ball and spring will be free to fall from the cover. Care should be used not to lose the ball or spring. The shifter lever oil seal may now be renewed. Install the new seal with lip towards inside of cover plate.

PTO SLIDING CONNECTOR

81. The front end of the pto sliding connector (2—Fig. FO558) pilots into a bushing fitted into a bore in rear end of the pto countershaft. The rear end of the sliding coupling splines over the front splines of the pto output shaft. When the pto coupling is engaged, external splines at the front end of the coupling engage in the internal splines machined into the rear face of the hydraulic pump drive gear. To remove the pto sliding connector, detach the rear axle center housing from the transmission housing, remove the shifter unit and withdraw the sliding coupling from the front.

The bronze bushing (3) supporting the center of the pto shaft may be renewed from the front after removing the pto output shaft. Press new bushing into its bore until front edge of the bushing is 0.022 to the rear of the front face of the housing boss.

BELT PULLEY

The belt pulley is supplied as extra equipment and may be mounted and operated in right or left horizontal position or in down vertical position.

82. Overhaul procedure is as follows:

Drain lubricant and remove housing cover plate (12—Fig. FO560). Straighten locking tabs and remove pulley shaft nuts (10). Remove the shaft (9), outer bearing (7) and seal (8) from the housing. Withdraw the

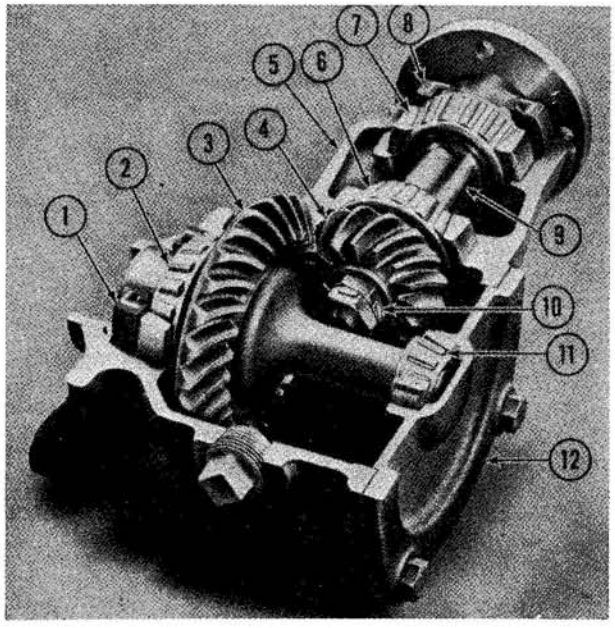

Fig. FO560 — Cut-away view of belt pulley unit showing gear arrangement.

1. Oil seal
2. Bearing
3. Drive gear
4. Shaft pinion
5. Housing
6. Inner bearing
7. Outer bearing
8. Oil seal
9. Pulley shaft
10. Adjusting nut
11. Bearing
12. Housing cover

pulley shaft pinion (4) and inner bearing (6). The drive gear (3) may now be lifted from the housing. To renew the drive gear shaft oil seal (1) it is first necessary to remove the large bearing cup from the housing and drive the seal to the inside. To renew the pulley shaft oil seal (8) pull the outer bearing from the shaft, fit a new seal over the shaft and reinstall it in the housing as the unit is reassembled. Adjust the pulley shaft end float to 0.002 by means of the adjusting nut (10) and lock in place with the locknut and tab washer. Adjust the drive gear shaft bearings to 0.002 end float by means of the aluminum shims under the cover plate (12).

HYDRAULIC LIFT SYSTEM

The hydraulic lift system incorporates automatic draft control and automatic implement position control. Fluid for the system is common with the rear axle final drive, but separated from the transmission by oil seals. Hydraulic power is supplied by a gear type hydraulic pump mounted in the rear axle center housing and driven by the power take-off shaft. The system is protected by a gauze type strainer on the intake side of the pump and a partial flow renewable element type filter on the system return line. Both filters are located in the oil reservoir in front part of the rear axle center housing.

NOTE: Production changes have been made from time to time in the Dexta series hydraulic system which will affect both parts procurement and service procedures. These changes will be noted in the text as well as information on identification and interchangeability of the different parts.

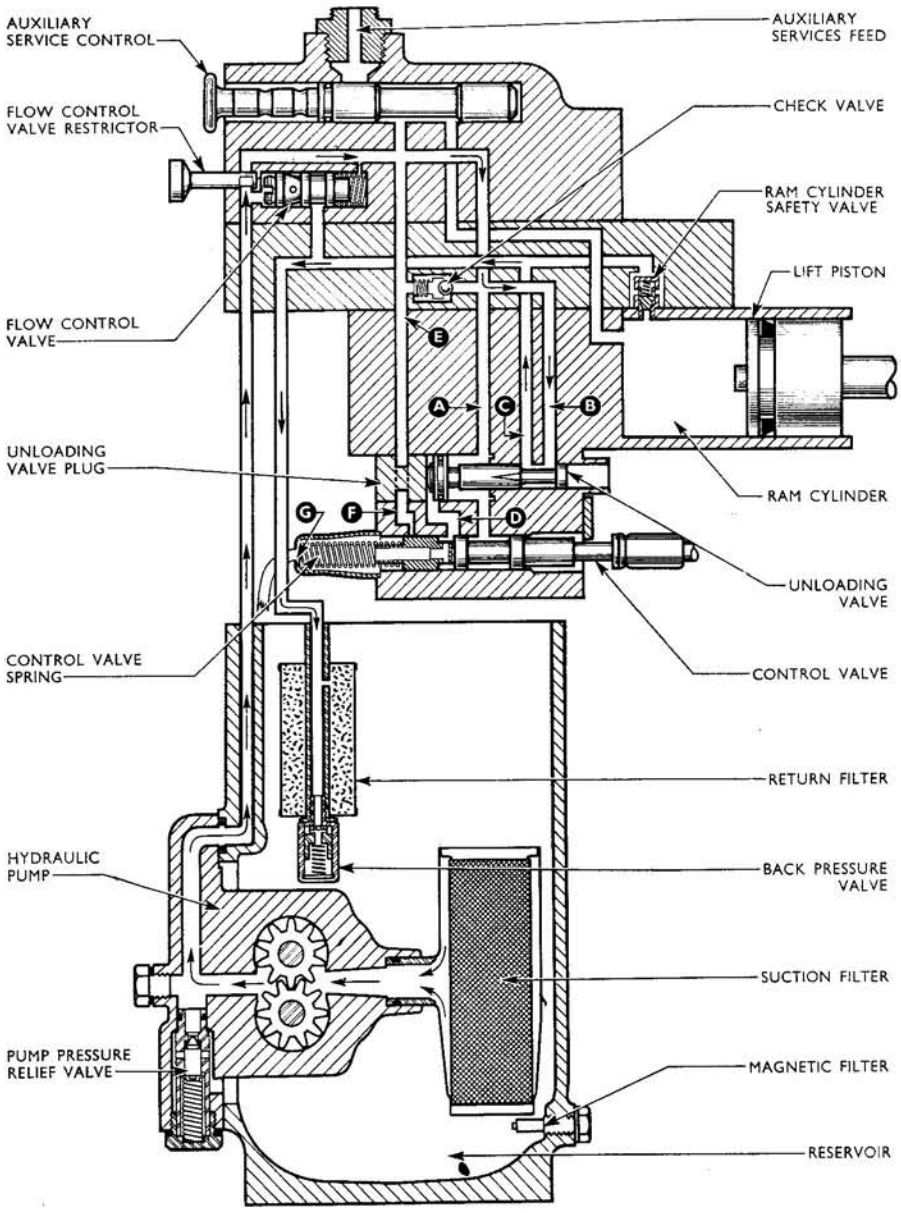

Fig. FO561 — Schematic view of oil flow with control valve in neutral position on late production hydraulic system. Oil flow in early production Fordson Dexta is similar except that rear land of control valve holds oil in lift cylinder instead of front land as shown in diagram. Moving the control valve to rear (right) will open passage (F) and allow cylinder to discharge oil to sump. Moving the control valve forward (left) will allow low pressure oil in passage (A) to both sides of unloading valve piston. Due to larger area of valve piston head, unloading valve will be forced to rear (right) blocking passage (C). Pump will then build up pressure in passage forcing check valve open and oil will flow to tractor lift cylinder or to auxiliary service port depending upon position of auxiliary service control valve. Rate of oil flow from pump may be varied by adjusting the flow control valve restrictor. The flow control valve will then bypass more or less oil to sump depending upon position of restrictor.

TROUBLE-SHOOTING

83. Trouble in the hydraulic lift system or malfunction of any of its parts will usually show up in: (a) failure to lift, (b) inability to hold implement in raised position without up and down bobbing motion, (c) over correction in draft control, (d) erratic action or overtravel or (e) a noisy pump. The probable causes of trouble and methods of checking to locate the source are outlined in the following paragraphs.

84. **WILL NOT LIFT.** First make sure that the system contains the proper amount of oil. An oil level plug is located on the left hand side of the rear axle center housing. Check the mechanical power train by engaging the pto shifter and checking for correct rotation of the pto output shaft. Move the touch control lever to the top of its quadrant and run the engine with the selector lever in both the down, and forward position. If the lift still fails to operate, move the auxiliary service knob on the acces-

sory plate or flow control valve to the out position and remove the plug from the top of the plate or flow control valve. Turn the engine over with the starter and observe if a flow of oil is pumped through the plug opening. If no flow is present, remove the lift cover and turn engine over with starter again. If oil flows from pressure tube in side of center housing, service the lift cover assembly as outlined in paragraphs 91 through 99. If no oil flows from pressure tube when turning engine over with starter, remove and overhaul the hydraulic pump as outlined in paragraphs 102 and 103.

Possible causes of failure to lift within the cover assembly would be improper adjustment of the control linkage, sticking or binding of the control valve, sticking safety valve, sticking back pressure valve, sticking unloading valve or broken ram cylinder, piston or seals.

Possible causes of failure to lift within the pump assembly would be shearing of the drive key or shaft, broken or extremly worn pump body or gears, plugged intake filter, ruptured seals in pump or sticking relief valve.

85. **BOBBING (HICCUPS).** Although usually caused by an internal leak in the lift cylinder hydraulic circuit, this condition may result from a springy implement causing a rebound in the control linkage. With hydraulic oil at operating temperature and a dead weight of approximately 1250 pounds on the lift arms, three or less corrections in a period of two minutes should be considered normal. If corrections, or bobbing, occurs at shorter intervals of time, service of the hydraulic lift is indicated.

To determine the cause of leakage, mount a heavy implement and raise the three-point linkage. Remove the hydraulic filler cap and visually check rear end of cylinder for leakage around piston. If a leak is noted, renew the piston seal.

If piston was not leaking, shut off engine with implement raised. If implement falls about 6-12 inches, then stops; or if rate of fall decreases noticeably after falling about one foot, renew the control valve and bushing as outlined in paragraph 95 or 96.

If implement falls all the way to ground at a steady rate and piston is not leaking, a leaking check valve or safety valve is usually indicated.

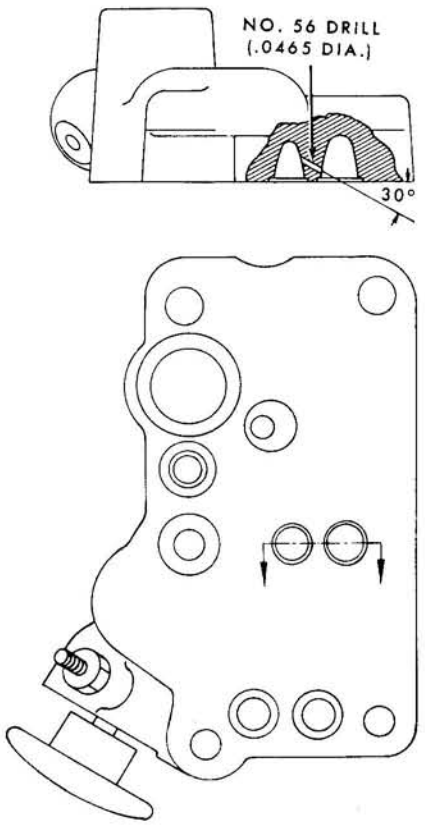

Fig. FO561A — On early Fordson Dexta tractors not equipped with flow control valve, pump flow may be reduced by carefully drilling hole in accessory plate as shown above.

Remove the accessory plate or flow control valve and renew the safety valve as outlined in paragraph 93; then repeat the test. If leak still occurs, renew the check valve and seat as outlined in paragraph 92.

Additional points to check are the "O" rings located between lift cylinder and cover and the fit of the unloading valve bore plug in the lift cylinder. While lift cover is off, make sure that valve linkage operates without binding.

85A. **OVER-CORRECTION IN DRAFT CONTROL.** Under some field conditions or implement applications, uneven depth control may result from excessive oil flow from the hydraulic pump which will cause the system to over correct for a change in draft. Later production Fordson Dexta, Fordson Super Dexta and Ford 2000 Super Dexta tractors are equipped with an adjustable flow control valve which is used to regulate the hydraulic pump output to meet different field conditions and implement requirements.

Where excessive pump output is causing over correction in draft control on early Fordson Dexta tractors, a by-pass hole may be drilled in the hydraulic accessory plate to reduce pump output as shown in Fig. FO561A. An alternate and preferable method of correcting this difficulty would be to install a flow control valve and associated linkage.

If adjusting the flow control valve on units so equipped does not change the rate of hydraulic lift, check the flow control valve plunger (52—Fig. FO564) to be sure it is not sticking or that the plunger spring (53) is not damaged or broken.

86. **ERRATIC ACTION.** Usually caused by binding of the control valve, back pressure valve, unloading valve or linkage. Before removing top cover, check to see that the rockshaft is properly adjusted so that the lift arms will drop of their own weight.

87. **NOISY PUMP.** Usually caused by a worn pump or plugged intake filter. May be caused by use of oil which foams excessively and allows air to enter pump.

CONTROL ADJUSTMENTS

88. **MAIN CONTROL SPRING.** This adjustment should be made before making adjustments on the internal valve linkage. To make the adjustment, rotate the control spring yoke (63 — Fig. FO563 or FO564) until a slight pre-load is placed on the spring. Preload is correct for normal operation when the control spring (62) can just be rotated when grasped by the finger and thumb of one hand. When heavy draft loads are encountered, it may be necessary to tighten the main control spring ½-turn over normal setting to obtain desired implement depth. Main control spring should be readjusted when returning to normal draft loads.

89. **DRAFT CONTROL.** Accurate and easy adjustment of the hydraulic linkage is not practical without the use of special Ford adjusting gages. If such gages are available, use the rockshaft locating arm designed for the model NAA Ford tractor (N—503), modified as shown in Fig. FO561B to clear the Dexta linkage. Use the adjusting gage NCA 502 designed for the model 600 and 800 Ford tractors

Fig. FO561B—Modify the Ford NAA locating arm by removing metal where indicated, until arm will clear Dexta linkage.

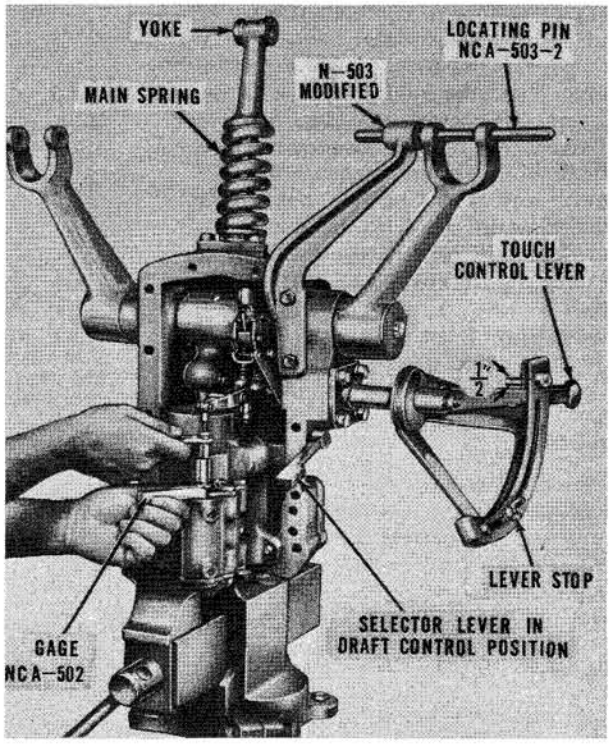

Fig. FO562 — Method of properly adjusting control valve for constant draft position, using Ford adjusting tools.

and proceed as follows: Clamp the hydraulic lift cover in a vise and affix the locating arm to the housing flange as shown in Fig. FO562. Move selector lever to the down, or "Draft" position and move the touch control lever until it is located exactly ½-inch from upper stop on quadrant. Use adjusting gage NCA 502, and with the small end, measure the clearance between the machined edge of the control valve land and the machined surface of the valve housing as shown. The gage should just enter this gap without any binding or side clearance. If adjustment is incorrect, make the proper correction by lengthening or shortening the valve linkage as shown. If the recommended adjusting gages are not available, clamp the cover assembly in a vise and locate the selector and touch control levers as recommended and proceed as follows:

Move the rockshaft in the lowering direction until front end of ram piston contacts the closed end of the cylinder. Measuring at the hole in the end of the lift arm, move the rockshaft back ½-inch and lock in position by tightening the cap screw on one end of the rockshaft (45—Fig. FO563 or FO564) until the shaft will maintain its position. (The rockshaft will be maintained in this position also, for the position control adjustment outlined in paragraph 90.) With the rockshaft, selector lever and touch control levers in the positions indicated, the clearance between the machined land on the control valve and the machined surface on the cylinder should be 0.396. The plate at rear of housing which retains the control valve is cut away to provide clearance for measurement.

After completing the position control adjustment as outlined in paragraph 90, and installing the lift cover on the tractor, readjust the rockshaft retaining cap screw until the lower links will just drop of their own weight.

90. **IMPLEMENT POSITION.** To make this adjustment, first adjust the main control spring as outlined in paragraph 88 and the draft control linkage as outlined in paragraph 89. Both of these adjustments must be made before the position control linkage can be adjusted. With cover mounted in vise and rockshaft correctly positioned as outlined in paragraph 89, move selector lever to position control (parallel to gasket surface of cover) and touch control lever against lower stop of quadrant as shown in Fig. FO562A.

90A. If adjusting gage NCA 502 is available, use thicker (Position) end of gage and measure clearance between control valve land and machined surface of cylinder housing. The gage should just enter the gap with no binding or side clearance. If clearance is not correct, loosen lock nut at upper end of position control rod (23—Fig. FO563 or FO564) and adjust rod length by turning the hexagon head of the rod until the correct clearance is obtained. Note: When loosening the lock nut, hold stamped nut (32) with a wrench to avoid shearing the locating pin in the position control arm (31). When correct clearance has been obtained, tighten lock nut and recheck the adjustment.

90B. If adjusting gage is not available, adjust the linkage as outlined in paragraph 90A until the clearance between the control valve land and the machined surface of the housing is 0.449.

NOTE: If in attempting to make position control adjustment, proper adjustment cannot be obtained as outlined in paragraph 90A or 90B, the hydraulic lift system linkage is either improperly assembled, damaged or worn, and the linkage must be serviced as outlined in paragraph 99.

LIFT COVER AND CYLINDER, OVERHAUL

The lift cover assembly includes the rock (lift) shaft, control quadrant, lift cylinder, main control valve, unloading valve, safety valve and check valve. The system relief valve is located in the hydraulic pump, and the back pressure valve is located at the lower end of system return line.

91. **REMOVE AND REINSTALL.** To remove the lift cover, disconnect lift arms (65—Fig. FO563 or FO564) from lift links and remove clevis pin from main control spring yoke (63). Remove tractor seat, push selector valve knob in, place touch control lever (27) in lowering position and place selector lever in draft control position; then, force the oil from the lift cylinder by pushing the lift arms to their lowermost position. Remove the cover re-

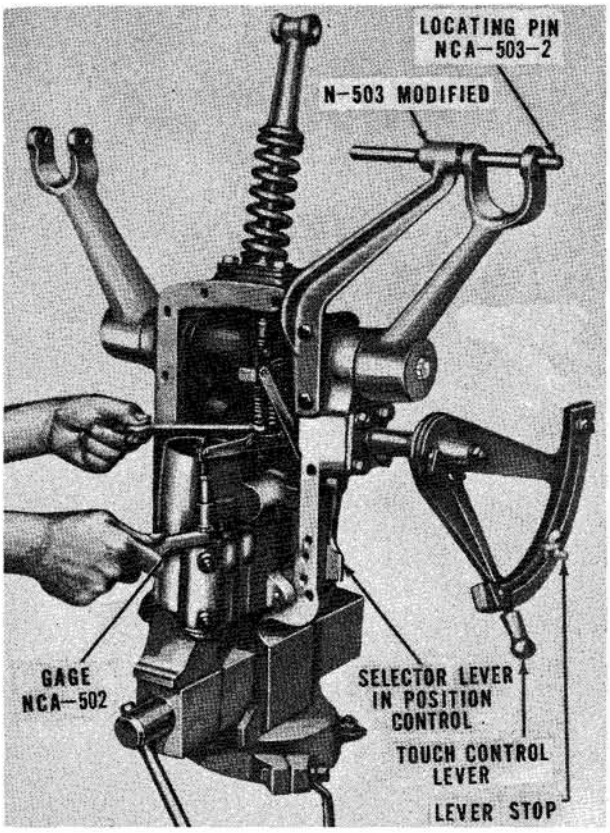

Fig. FO562A—Method of setting and adjusting the linkage for implement position control.

taining cap screws, attach a suitable hoist to cover and lift the assembly off the center housing.

When reinstalling the cover, use a new gasket and "O" rings and tighten the retaining cap screws to a torque of 30-35 ft.-lbs.

92. **CHECK VALVE AND SEAT.** To remove the check valve (41—Fig. FO-563 or FO564) first remove the plug (36) located in front flange of cover (44). With a pair of needle nose pliers, grasp the protruding end of pilot (37) and pull same from cover. The spring (39), spring seat (40) and ball (41) can then be withdrawn from cover. Examine the check valve seat (43), ball (41), spring (39) and "O" rings (38 and 42) and renew if they are chipped, worn or scored. The check valve seat should always have a sharp edge. To remove the valve seat (43) use Ford puller NCA997A, or a suitably threaded rod, nut and large washer as a puller. Oil passage in front of seat is threaded to receive the puller. Caution: When pulling the check valve seat, be extremely careful that the pulling screw remains centered in the bore. The hardened seat is extremely brittle, and misalignment may break the necked portion at the location of the hole.

93. **CYLINDER SAFETY VALVE.** If the cylinder safety valve (16—Fig. FO563 or FO564) only is to be removed, this can be accomplished without removing the lift cover from the tractor. To remove the valve, unbolt and remove the accessory plate (56—Fig. FO563) or flow control valve (54—Fig. FO564) exposing the safety valve. The valve can then be unscrewed from the cylinder using the correct size deep socket. Early production safety valve was factory preset at 2400 psi. The safety valve in all models after Fordson Dexta Serial No. 957E-59444 is factory pre-set at 2750-2850 psi. If service is indicated renew the valve assembly, preferably with the later 2750-2850 psi valve assembly.

93A. **ACCESSORY PLATE.** The accessory plate (56—Fig. FO563) furnished as standard equipment on Fordson Dexta models prior to tractor Serial No. 957E-68355 is equipped with a plunger type selector valve (48) and jack tapping threaded for ½-inch tapered pipe threads. To remove the selector valve or accessory plate, first place selector lever in draft control, push remote cylinder selector knob in and move hydraulic control lever to bottom of quadrant. After exhausting all oil from lift cylinder by pushing lift arms to bottom, unbolt and remove plate from lift cover. To remove valve, loosen locknut on locking plunger (49) in front of housing next to the selector knob. Back out the plunger assembly and withdraw selector valve (48). The selector valve is a selective fit in the accessory plate bore. Replacement plungers are 0.7482-0.7497 in diameter and are color coded green, white, blue, yellow, and orange; orange being the largest size. In fitting a new valve, use the largest size that will operate without binding. Screw the locking plunger (49) into the housing until detent can be felt, but so that the valve will still operate freely. Lock in place with the locknut.

93B. **FLOW CONTROL VALVE.** Fordson Dexta models after tractor Serial No. 957E-68355, Fordson Super Dexta and Ford 2000 Super Dexta tractors are equipped with a flow control valve to regulate hydraulic pump output instead of the accessory plate described in paragraph 93A. Although the flow control valve also incorporates a remote cylinder selector valve, the selector valve spool is not interchangeable with that used in the accessory plate. An exploded view of the flow control valve unit is shown in Fig. FO564. Turning the knob (51) in or out moves a restrictor valve (51B) between maximum and minimum flow positions. Restricting the flow of oil from the hydraulic pump causes the shuttle valve (52) to move against pressure of the spring (53) and also against hydraulic back pressure at the spring end of the valve plunger. Movement of the valve, which is related to the position of the restrictor valve, by-passes a varying amount of oil back to the sump and thereby regulates the amount of oil flowing to the tractor lift cylinder or remote cylinder. Marks "F" (fast) and "S" (slow) cast into the valve housing indicate maximum and minimum flow positions.

The main hydraulic control lever is equipped with a moveable spacer which, when moved to a position between the lever and flow control valve linkage, contacts the linkage and moves the valve to "F" (maximum flow) position whenever the control lever is moved to full raise position.

To remove the flow control valve assembly, first push the remote cylin-

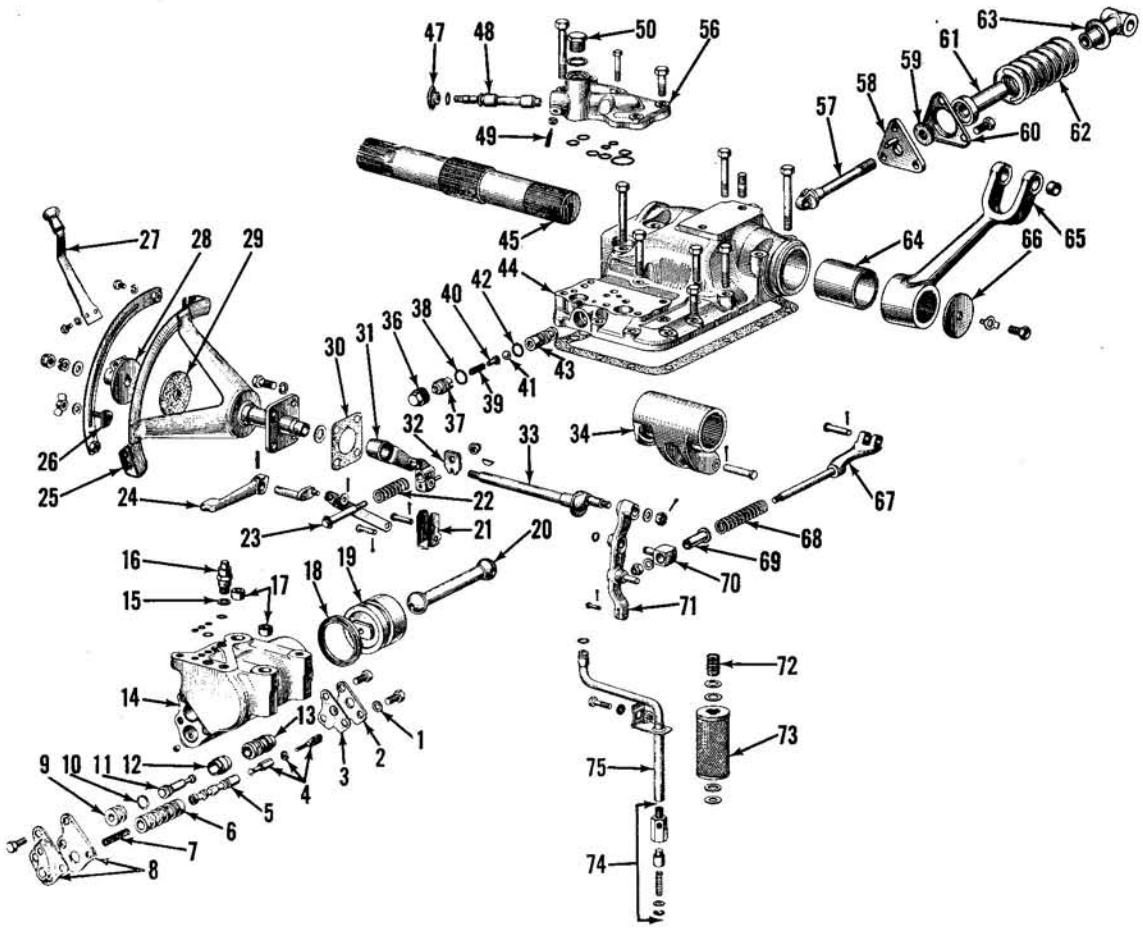

Fig. FO563 — Exploded view of early Fordson Dexta hydraulic lift cover, cylinder and linkage. Accessory plate (56) can be replaced with flow control valve (54—Fig. FO564) if complete valve and linkage are used. Although component parts are different, complete lift cylinder assembly (14) is interchangeable with later type complete lift cylinder assembly (14A — Fig. FO564).

1. Sealing washer
2. Rear cover
3. Gasket
4. Control valve link
5. Control valve
6. Control valve bushing
7. Control valve spring
8. Baffle plate
9. Unload valve plug
10. Unload valve "O" ring
11. Unload valve
12. Unload valve bushing (front)
13. Unload valve bushing (rear)
14. Lift cylinder
15. Copper gasket
16. Safety valve
17. Dowel pins
18. Piston seal
19. Piston
20. Piston rod
21. Control cam
22. Position control spring
23. Position control rod
24. Position control selector lever
25. Quadrant
26. Lever stop
27. Control lever
28. Friction plate
29. Friction disc
30. Gasket
31. Position control arm
32. Stamped adjusting nut
33. Control lever shaft
34. Ram lift arm
36. Check valve plug
37. Check valve pilot
38. "O" ring
39. Check valve spring
40. Check valve spring guide
41. Check valve
42. "O" ring
43. Check valve seat
44. Lift cover
45. Lift arm cross shaft
47. Remote cylinder selector knob
48. Selector valve spool
49. Detent assembly
50. Jack tapping plug
56. Accessory plate
57. Control spring plunger
58. Retaining plate
59. Felt seal
60. Seat support
61. Spring seat
62. Main control spring
63. Control spring yoke
64. Bushings (2)
65. Lift arm
66. Retaining washer
67. Draft control link
68. Over-ride spring
69. Bushing
70. Draft control swivel
71. Valve control lever
72. Spring
73. Oil filter element
74. Back pressure valve
75. Return tube

der selector knob (47) in, move the hydraulic control selector lever to draft control position and push the hydraulic control lever to bottom of quadrant. Exhaust all oil from tractor lift cylinder by pushing lift arms to bottom; then, unbolt and remove the flow control valve assembly from hydraulic lift cover.

Disassembly procedure for the flow control valve is evident after inspection of unit and reference to Fig. FO565. The flow control valve plunger (52) and remote cylinder selector spool (48A) are selective fit. When renewing a plunger or spool, select the largest size that will fit in the bore without binding. Sizes are color marked as follows:

	Flow Control Valve Color	Selector Valve Spool Color
Smallest Dia.	Red	Green
.....	Yellow	White
.....	Blue	Blue
.....	Green	Yellow
Largest Dia.	White	Orange

Lubricate all valve parts and reassemble using new "O" rings and gasket.

LIFT CYLINDER

94. **CYLINDER R&R AND INSPECT.** To remove work cylinder (14—Fig. FO563 or 14A—FO564) from lift cover, disconnect the control valve linkage pin and remove the link (4—Fig. FO563 or FO564). Remove the four cap screws retaining cylinder to lift cover and remove the cylinder and control valve housing. The piston (19) can be removed from cylinder with compressed air. Examine the piston and cylinder for wear or scoring and renew the piston seal (18) when reinstalling.

NOTE: The hydraulic lift cylinder was changed in production at Fordson Dexta tractor Serial No. 957E-68355 and, although the cylinder is interchangeable as a unit with prior production cylinders, the control valve, control valve bushing and certain other cylinder parts are not interchangeable. It is important therefore that the cylinders can be correctly identified when obtaining cylinder service parts. The early production cylinders can be identified by the valve retaining plate (2 and 8—Fig. FO563) at each end of

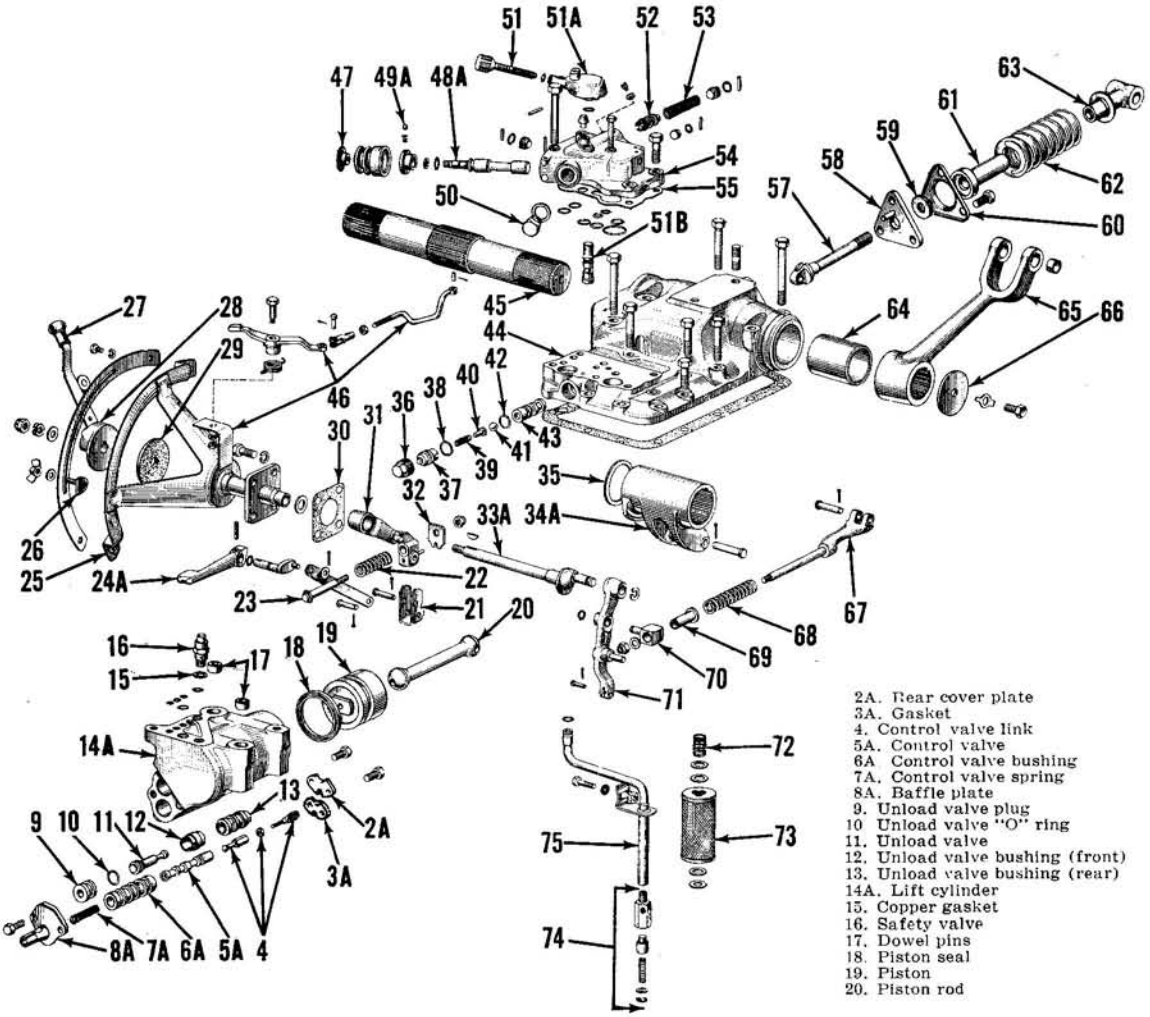

Fig. FO564 — Exploded view of late hydraulic lift cover, cylinder and linkage. Ram lift arm (34A) and spacer (35) may be used to replace early production lift arm (34—Fig. FO563). Control lever shaft (33A) and snap ring may be used to replace early production shaft (33—Fig. FO564), washer and nut.

21. Control cam
22. Position control spring
23. Position control rod
24A. Position control selector lever
25. Quadrant
26. Lever stop
27. Control lever
28. Friction plate
29. Friction disc
30. Gasket
31. Position control arm
32. Stamped adjusting nut
33A. Control lever shaft
34A. Ram lift arm
35. Spacer washer
36. Check valve plug
37. Check valve pilot
38. "O" ring
39. Check valve spring
40. Check valve spring guide
41. Check valve
42. "O" ring
43. Check valve seat
44. Lift cover
45. Lift arm cross shaft
46. Flow control valve linkage
47. Remote cylinder selector knob
48A. Selector valve spool
49A. Detent assembly
50. Jack tapping plug
51. Restrictor adjusting knob
51A. Restrictor control lever
51B. Restrictor valve
52. Flow control valve spool
53. Flow control valve spring
54. Flow control valve housing
55. Gasket
57. Control spring plunger
58. Retaining plate
59. Felt seal
60. Seat Support
61. Spring seat
62. Main control spring
63. Control spring yoke
64. Bushing (2)
65. Lift arm
66. Retaining washer
67. Draft control link
68. Over-ride spring
69. Bushing
70. Draft control swivel
71. Valve control lever
72. Spring
73. Oil filter element
74. Back pressure valve
75. Return tube

the cylinder being secured with three cap screws; whereas, the valve retaining plates (2A and 8A—Fig. FO564) on late production cylinders are secured with only two cap screws. Thus, if a cylinder has three valve retaining plate cap screws, order parts identified in Ford Tractor Parts Catalog as being used in year range 11/57/60/10; if two valve retaining plate cap screws are used, order parts identified for year range 10/60.

95. **R&R CONTROL VALVE AND BUSHING. (USED 11/57/60/10.)** To remove the control valve (5 — Fig. FO563) from the housing, remove the baffle plate (8) and spring (7) from front (closed) end of cylinder then remove the plate (2) and valve (5) from the open end. Note that the retaining cap screw directly above the control valve is fitted with a copper sealing washer. The hole into which this cap screw is threaded serves as a lateral oil drilling in the control valve body and must always be sealed with the sealing washer.

The control valve bushing (6) may be renewed by pressing it from the housing. Select a new bushing of the correct color code and press it into the housing in the same relative position. The end of the bushing containing the exhaust (small) hole is located at the rear (open) end of the cylinder and the front end of the bushing must be flush with the machined face of the front (closed) end of housing. Fig. FO566 shows the special Ford designed tool recommended by the manufacturer for removing and reinstalling the valve bushings.

The land at the rear end (end towards linkage) of the control valve covers the cylinder exhaust (lowering) port in the control valve bushing; wear on the valve and bushing at this location subjects the cylinder circuit to leakage which could cause bobbing (hiccups).

96. **R&R CONTROL VALVE AND BUSHING (USED 10/60/-).** To remove the control valve from the

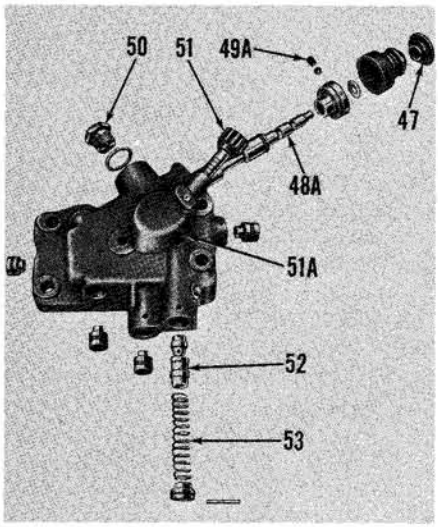

Fig. FO565 — Exploded view of flow control valve. Refer to Fig. FO564 for legend. Restrictor valve (51B) is not shown in above view.

housing, remove the baffle plate (8A —Fig. FO564) and spring (7A) from closed (front) end of cylinder and remove the plate (2A) and valve from rear of cylinder. A gasket is used between the rear plate and cylinder similar to prior production but the cap screw that was threaded into an oil passageway has been eliminated.

To renew the control valve bushing, press bushing out towards rear (open) end of cylinder. Select a new bushing of correct color code and press bushing into front (closed) end of cylinder. When in position, bushing must be flush with machined surface at front (closed) end of cylinder. End of bushing with deep counterbore must be to rear (open) end of cylinder.

The land on the front end of the control valve covers the cylinder exhaust (lowering) port in the control valve bushing; wear on the valve and bushing at this location subjects the cylinder circuit to leakage which could cause bobbing (hiccups).

97. **SELECTING PROPER SIZE OF CONTROL VALVE AND BUSHING.** When renewing the control valve and bushing, care must be taken that the proper size valve and bushing are selected due to the exceptionally close fit required of these parts. Good service procedure requires that both the valve and bushing be renewed whenever renewal of either is indicated.

Control valve bushings are sized in steps of 0.0002 from an outside diameter of 1.0000-1.0002 to 1.0014-1.0016. Color codes for each size range are as follows:

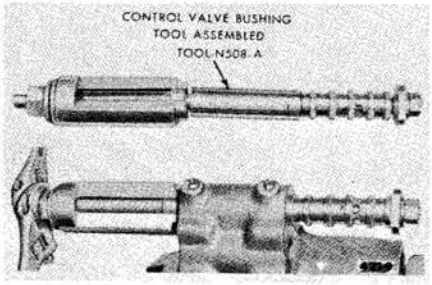

Fig. FO566—Threaded rod type push puller designed by Ford, for removing and installing valve bushings.

Blue/White.....Smallest dia.
White
Blue
Yellow
Green
Orange
Green/White
Red/White.....Largest dia.

The control valve bushing bore in each lift cylinder is measured at the factory and a spot (or spots) of paint is applied on the outside of the cylinder adjacent to the control valve bore to indicate the bore size. When renewing the control valve bushing, select a bushing having the same color code as appears on the lift cylinder. NOTE: Do not confuse the streak of paint near the control valve bore with the color code paint spot(s). The paint streak is marking applied for factory assembly only. Also, color code is applied on the cylinder near the unloading valve bore to indicate the size of the unloading valve bushing to use. The control valve bore and the unloading valve bore may or may not be of the same color code in a cylinder, so care must be taken that the correct color code mark is observed. The size code color mark will be a spot of paint as with blue color code, or two spots as with a blue/white color code.

Control valve spools are sized in steps of 0.0002 from a diameter of 0.5917-0.5919 to 0.5927-0.5928. Color codes for each size range are as follows:

White.....Smallest dia.
Blue
Yellow
Green
Orange.....Largest dia.

The correct size control valve spool can be selected only after the bushing is pressed into the lift cylinder. By trial and error, select a valve spool that will have a slight drag when moved back and forth in the bushing in its normal position, but without any binding or sticking tendency. Valve and bushing must be absolutely clean and lubricated with motor oil or hydraulic oil when checking fit of valve to bushing. As the color code indicates a size range only, it may occur that a valve will appear too tight or too loose when another valve of the same color code will fit properly. Also, if all valves on hand have been tried without finding one that fits and another bushing of the correct color code is available, install another bushing in the housing and try the fit of the control valves again. The inside diameter of the bushing is not related to the bushing color code.

98. **UNLOADING VALVE AND BUSHING.** The unloading valve (11—Fig. FO563 or FO564) can be removed after extracting the pressed in plug (9) at closed end of cylinder. Sealing between the unloading valve and the bushing is by means of an "O"-ring. If valve or bushings are eroded or scored, they should be renewed. The bushings (12 and 13) for the unloading valve can be removed using the same Ford threaded rod-type puller N508A used to extract and install the control valve bushing. The unloading valve front bushing (12) should be fitted with the two large notches against the rear bushing. The unload valve plug (9) seals the front end of the bushing except for the area of the small notch. Press unloading valve bushings out towards front (closed) end of cylinder. To install bushings press thin front bushing in with rear bushing. Shoulder on rear bushing must be flush with machined face of lift cylinder.

98A. **UNLOADING VALVE BUSHINGS, PLUG, VALVE AND "O" RING SIZE SELECTION.** The unloading valve bushings and the bore sealing plug are sized in steps of 0.0002 from an outside diameter of 1.0000-1.0002 to 1.0014-1.0016. Color codes for each size range are the same as outlined for the control valve bushing in paragraph 97. When renewing the unloading valve bushings or plug, select new parts of the same color code as appears on the lift cylinder adjacent to the unloading valve bore.

As the unloading valve functions as a flow director only, a close fit is not required between the unloading valve and bushings. Therefore, there is only one size unloading valve available and it should fit all bushings. However, it is very important that no binding condition is present when the valve is installed. After the two unloading valve bushings have been installed as outlined in paragraph 98, lubricate and install unloading valve **without** the sealing "O" ring. The valve should slide back and forth freely. Correct

any binding condition before proceed-further. Remove the unloading valve and install the sealing "O" ring; then, lubricate valve and reinstall it. A slight drag from the "O" ring should be noted. If not, or if valve then binds in bushings, select another "O" ring that will effectively seal valve to bushing without binding. CAUTION: Do not attempt to install an "O" ring of unknown quality at this location. Some materials used in "O" ring manufacture may shrink or swell when subjected to hydraulic oil and cause malfunction of the hydraulic system.

NOTE: It is possible that misalignment of the two unloading valve bushings may cause the unloading valve to bind. If binding condition cannot be eliminated by changing "O" rings or installing another valve, renew the unloading valve bushings as outlined in paragraph 98.

ROCK SHAFT AND CONTROL LINKAGE

99. The rock shaft (45 — Fig. FO-563 or FO564) and lift arms (65) can be removed from the lift cover by removing the retaining cap screw and washer (66) from one end of the rock shaft and sliding the shaft in the oposite direction out of lift cover. The loose rock shaft bushing (64) in one side of the cover will be removed with the shaft. The ram arm (34 or 34A) and two lift arms (65) on the rock shaft are fitted with a master spline and cannot be assembled in the wrong position. Ram arm (34) is interchangeable with late ram arm (34A) and washer (35). Unscrew the control spring yoke (63) from the rear of the control spring (62). Remove the three cap screws retaining the control spring seat (58) and remove the seat and retainer (60). Remove the nut or snap ring from the inner end of control lever shaft (33 or 33A) and remove the draft control linkage. If difficulty has been experienced getting or keeping the correct draft control adjustment, disassemble and remove the draft control link (67) and check the link against a new one. This link will sometimes become bent, and due to its shape, is very difficult to detect. Examine the remainder of the parts for breakage, bent parts or wear and renew if necessary. The self-locking nut at forward end of draft control link (67) on early models should be tightened until it bottoms on the link shoulder. Adjust the castellated nut at inner end of control lever shaft until the parts are free but no end play exists and install the cotter key. Late control lever shaft (33A) and snap ring are interchangeable with early control lever shaft (33), washer and self-locking nut. Readjust the hydraulic linkage as outlined in paragraphs 88, 89 and 90 before installing lift cover on the tractor.

RETURN LINE, FILTER AND BACK PRESSURE VALVE

100. The return line (75—Fig. FO563 or Fig. FO564), complete with filter (73) and back pressure valve (74), can be removed after lift cover is off, by removing the screw retaining return pipe to rear axle center housing. Lower the return line to clear the cover flange and withdraw the assembly from the housing.

The manufacturer states that the return line filter (73) will not need to be renewed except at times of major overhaul or when the oil has become contaminated. To renew the filter, unscrew the back pressure valve housing (74) from the lower end of the return line, remove the retaining washer and seal and withdraw the filter.

To disassemble the back pressure valve, remove the wire retainer from lower end of valve housing. The retaining plate spring and valve can now be withdrawn. The valve housing will not need to be removed from the return line for service on the valve. Examine the valve body and valve for scoring, sticking or wear and renew as required.

HYDRAULIC PUMP

101. **PRESSURE RELIEF VALVE.** The hydraulic pump pressure relief valve is located in the pump housing. To check the pressure, remove the pressure plug in the center of the pump mounting flange immediately above the right step plate and fit at least a 3000 psi pressure gage to the opening. Due to the design of the pressure relief valve, once the relief pressure of the valve has been reached and the valve unseated, it will remain unseated at low pressure until the hydraulic control valve is returned to neutral position. For this reason, the manufacturer recommends that a pressure line including a needle-type shut off valve be installed in the jack tapping on the accessory plate, the exhaust oil being returned to the reservoir as shown in Fig. FO567.

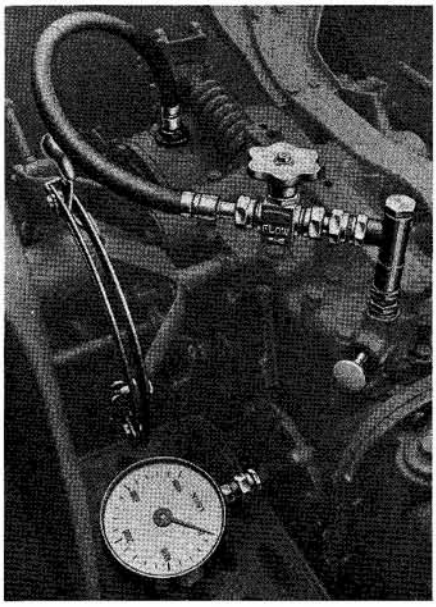

Fig. FO567 — Suggested arrangement for pump pressure testing. Shut off valve is to assist in slowly increasing pressure to relief valve setting. Relief valve is designed so that once valve is activated, system pressure drops, making actual relief pressure difficult to read.

NOTE: The pump relief pressure will depend upon whether the pump is fitted with the early type relief valve shown in Figs. FO568 and FO568A or the later type relief valve shown in Fig. FO568B. Although individual components are not interchangeable, the new type relief valve assembly shown in Fig. FO568B may be installed in prior production tractors to raise the pump relief pressure from 2100-2300 psi to 2450-2500 psi. Factory installation of the later type valve was effective at Fordson Dexta Tractor Serial No. 957E-49624.

To make the test, start the tractor engine and bring the speed up to 1550 rpm. Move the auxiliary control valve knob to the outer position, open the needle valve on the return hose and raise the touch control lever to top of quadrant. While observing the gage needle carefully, very slowly close the needle valve in the return hose and note the highest reading obtained before the relief valve opens. The maximum reading obtained at the time the relief valve opened should have been 2100-2300 psi with early type valve or 2450-2500 psi with late type valve. The pressure then should drop to approximately 600 psi with early type valve or 300 psi with late type valve and hold steady at that point.

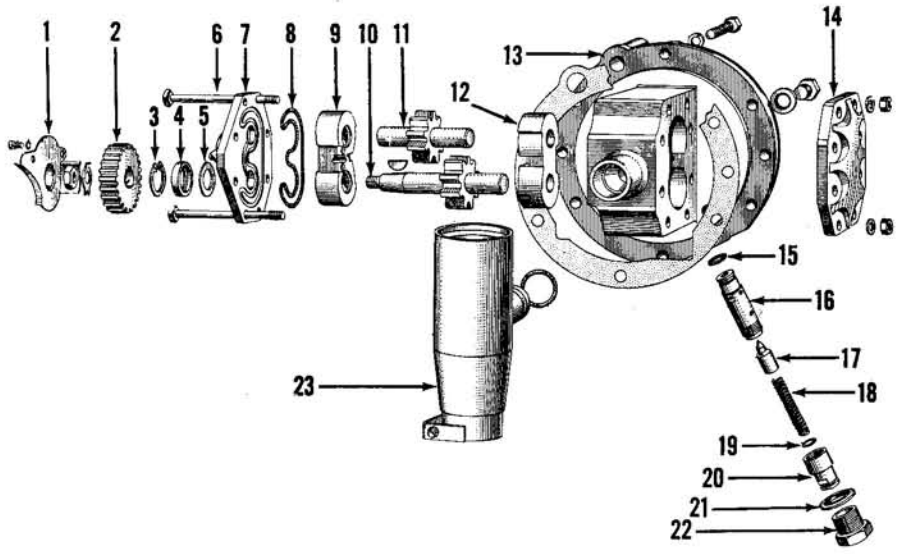

Fig. FO568—Exploded view of hydraulic pump assembly with intake strainer.

1. Shroud
2. Drive gear
3. Snap ring
4. Seal
5. Washer
6. Dowel bolt
7. Front cover
8. "O" ring
9. Front bearing
10. Pump drive shaft & gear
11. Driven gear
12. Rear bearing
13. Pump body
14. Rear cover
15. "O" ring
16. Relief valve body
17. Relief valve
18. Valve spring
19. Adjusting shim
20. Spring retainer
21. Sealing washer
22. Plug
23. Intake strainer housing

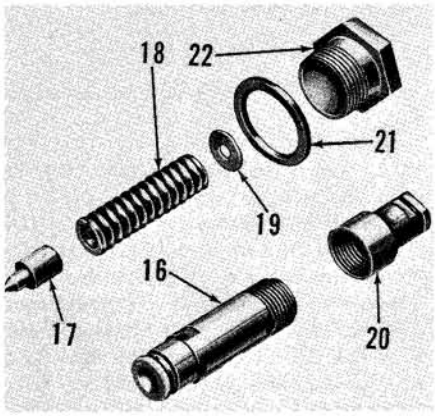

Fig. FO568A — Exploded view of early production pressure relief valve assembly. Refer to Fig. FO568 for legend.

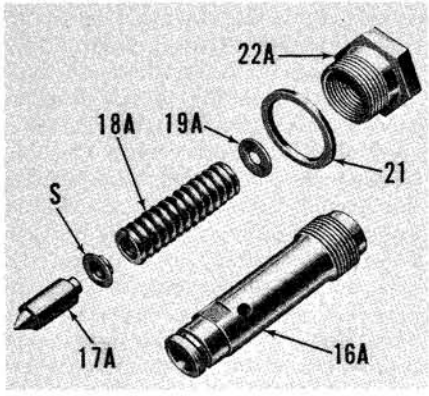

Fig. FO568B — Exploded view of late production pressure relief valve assembly.

S. Spring seat
16A. Valve body
17A. Valve
18A. Spring
19A. Shims
21. Sealing washer
22A. Plug

If the pressure hose and needle valve are not available, an accurate reading is very difficult to obtain. Due to the action of the unloading valve, feathering of the control valve is impossible. Once the control valve is moved to the raised position, the gage needle will flicker to the relief valve pressure and immediately drop. After observing the action several times a fairly accurate reading may be obtained.

To adjust the relief valve pressure, add or remove shims (19—Fig. FO568A or 19A—Fig. FO568B) as required. Shims are available in 0.005, 0.010, 0.015 and 0.025 thickness for early type valve and 0.010 and 0.025 for late type valve. Adding or removing 0.005 in shims will change the relief pressure approximately 50 psi. Note: Do not increase the total shim pack to more than the recommended 0.080.

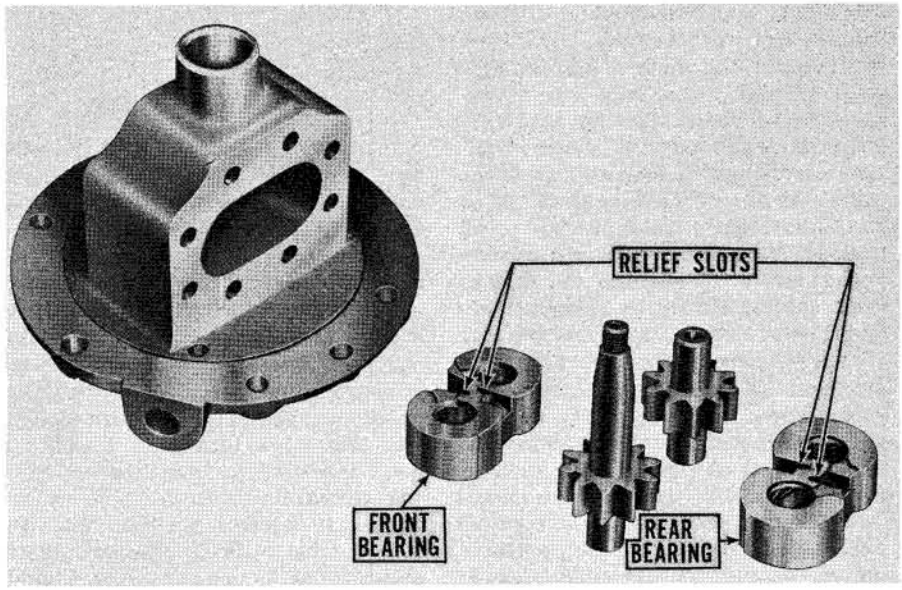

Fig. FO569 — When assembling pump, arrange parts in the order shown, so that front and rear bearings can be identified. Although bearings are very similar, position of relief slots differ in front and rear bearings.

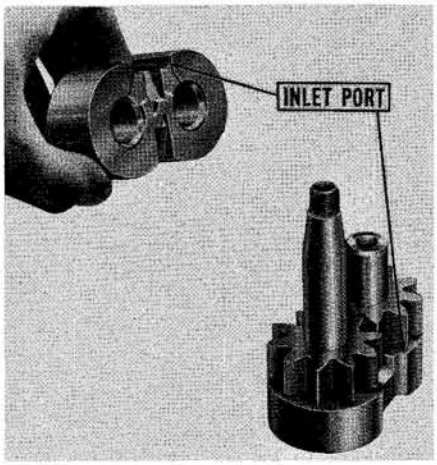

Fig. FO570 — Assembly procedure of the hydraulic pump gears and bearings. Note the large cut-out area of bearings which are to be installed to the inlet port side of the pump housing.

Reinstall the pressure relief valve and recheck the pressure before releasing the tractor for service.

102. **REMOVE AND REINSTALL.** To remove the hydraulic pump for service, first drain the hydraulic system and remove the lift cover as outlined in paragraph 91.

Note: If other service work required makes it necessary to detach the transmission from the rear axle center housing, the required operations can be done from the front of the housing, without removing the lift cover.

Unbolt and remove the right hand step plate and disconnect the right brake linkage. Remove the six cap screws retaining pump mounting flange to rear axle center housing and withdraw pump assembly.

The pump inlet strainer (23—Fig. FO568) is retained to left side of rear axle center housing by a dowel screw. When reinstalling the hydraulic pump, first clean the inlet strainer and make sure the strainer housing is properly located over the dowel screw. Renew "O" rings on inlet strainer and outlet passage of the pump mounting flange when reinstalling the pump. The design of the inlet housing makes it impossible to properly locate it in the center housing without having access through the top cover or housing front opening. Tighten the retaining cap screws to a torque of 30-35 ft.-lbs.

103. **OVERHAUL.** To disassemble the hydraulic pump, first remove drive gear shroud (1—Fig. FO568) and unbolt and remove the driving gear (2) from pump drive shaft (10) with a suitable puller. Remove the Woodruff key from the pump shaft, examine the shaft and remove any nicks or burrs which might damage the pump bearings. Remove nuts, washers and bolts retaining pump end plates (7 and 14) and remove the plates.

Note: The upper and lower bolts (6) nearest the mounting flange are special dowel bolts machined for a close fit in the plates and pump housing. These bolts are identified by a letter "D" stamped on the bolt head. During reassembly, these bolts must be reinstalled in the same two holes. If renewal is necessary, special dowel bolts must be obtained.

Remove and discard the sealing "O" rings in the two covers and renew the drive shaft seal (4) if it is worn or damaged.

Apply even pressure to the center of the rear pump bearing and slide the two bearings (9 and 12) with the pump gears from the housing as a unit. Examine the bearings for wear or scoring on their faces or shaft journals. If the bearing bores are worn out of round more than 0.001, they should be renewed. The bearings should always be renewed in pairs and must not be mixed. Although similar in appearance, bearings are not interchangeable.

Examine the pump housing (13) for wear in the gear running track. If track is worn deeper than 0.0025 on the pump inlet side, the housing, gears and bearings should be renewed.

Examine the pump gears (10 and 11) for wear or scoring on the gear faces or shafts. The gear width and diameter should be identical within 0.001 for the two gears and over the entire surface of each gear.

To correctly assemble the pump, lay the rear bearing (12) gear face up, on a clean shop towel. Position the bearing so that milled inlet (large) port is to the right and the outlet port to the left as shown in Fig. FO569. Note that the two shaft areas are relieved to the inlet side. The rear bearing can be identified by the fact that the relief slot from the gear mesh area to the inlet port will be at the bottom while the relief slot from the gear mesh area to the outlet port will be at the top of the bearing as shown. Position the driven gear, either end up in the upper bore of the rear bearing and the driving gear, long shaft up, in the lower bore, as shown in Fig. FO570. Place the front bearing over the gear shafts with inlet port to the right and insert the assembly in the pump housing so that pump drive shaft will be forward and to the bottom when pump is reinstalled on the tractor. The large inlet ports in both bearings should now align with the inlet port of the pump housing. Renew the sealing "O" rings in the cover plates and install them so that the straight side of the "O" rings is on the side nearest the pump mounting flange. Insert the two dowel retaining bolts in the upper and lower hole nearest the mounting flange and fit the remaining bolts in the other six holes and reinstall the lock washers and nuts. Tighten the nuts evenly to a torque of 40-50 ft.-lbs., reinstall the drive gear and shroud and fill the pump with a small quantity of hydraulic fluid to provide initial lubrication when starting the tractor.

NOTES

FORD

Fordson Major Diesil (FMD)
Fordson Power Major (FPM)
Fordson Super Major (FSM)
Nwe Performance Super Major (New FSM)
5000 Super Major

SHOP MANUAL

FORD

MODELS
FORDSON MAJOR DIESEL (FMD)
FORDSON POWER MAJOR (FPM)
FORDSON SUPER MAJOR (FSM)
NEW PERFORMANCE FORDSON SUPER MAJOR (New FSM)
FORD 5000 SUPER MAJOR (Same As New FSM)

This manual provides service procedures and specifications on the Fordson Major series of tractors manufactured in England and imported to the United States, beginning with approximately tractor Serial No. 1260402.

On early tractors the serial (engine) number is stamped on the flange of the flywheel housing near the starter mounting.

Effective with tractor (engine) Serial No. 1380939, the serial number is located on a pad at the front right hand side of the engine cylinder block.

In November, 1961, the serial number designation was changed from a 7 digit number to a six digit number with prefix and suffix. (Note: When this new numbering system was introduced, only the six digit number was stamped on the tractor; later a "Z" was stamped in front of the prefix, but was deleted after a short time.)

As the Fordson Major Tractor Parts List indicates parts usage by month and year of tractor production instead of serial number or model range, the following list indicating month and year of production by serial numbers is presented below:

FORDSON MAJOR TRACTOR SERIES SERIAL NUMBERS

The following list of serial numbers for the Fordson Major series of tractors represents the serial number of the first tractor built on the first working day of each month from beginning of production in January, 1952, to end of production in October, 1964.

Month/Year	Starting Serial No.
1/52	12171[illegible]
2/52	121785[illegible]
3/52	1219501
4/52	1222168
5/52	1225184
6/52	1228560
7/52	1231013
8/52	1232538
9/52	1235064
10/52	1239010
11/52	1242232
12/52	1244823
1/53	1247381
2/53	1249734
3/53	1252374
4/53	1255494
5/53	1257474
6/53	1259074
7/53	1260753
8/53	1262438
9/53	1264418
10/53	1267672
11/53	1271038
12/53	1273713
1/54	1276857
2/54	1280461
3/54	1284114
4/54	1288616
5/54	1292616
6/54	1296979
7/54	1301371
8/54	1304721
9/54	1308341
10/54	1312911
11/54	1316276
12/54	1319466
1/55	1322525
2/55	1326304
3/55	1330197
4/55	1335206
5/55	1339093
6/55	1343610
7/55	1348338
8/55	1351565
9/55	1355435
10/55	1359668
11/55	1363538
12/55	1367817
1/56	1371418
2/56	1375378
3/56	1379563
4/56	1384154
5/56	1388054
6/56	1392039
7/56	1395222
8/56	1398262
9/56	1400956
10/56	1403907
11/56	1406790
12/56	1409843
1/57	1412409
2/57	1416126
3/57	1420047
4/57	1424724
5/57	1429067
6/57	1434128
7/57	1438156
8/57	1441861
9/57	1444787
10/57	1448456
11/57	1452136
12/57	1455496
1/58	1458381
2/58	1461911
2/58	1461811
3/58	1464968
4/58	1468222
5/58	1471551
6/58	1475102
7/58	1478284
8/58	1481013
9/58	1483139
10/58	1485781
11/58	1488927
12/58	1491814
1/59	1494448
2/59	1497684
3/59	1501006
4/59	1504869
5/59	1509598
6/59	1512807
7/59	1517042
8/59	1520046
9/59	1522832
10/59	1526968
11/59	1531041
12/59	1534587

Month/Year	Starting Serial No.
1/60	1538065
2/60	1541957
3/60	1545719
4/60	1550185
5/60	1554240
6/60	1558530
7/60	1562473
8/60	1565448
9/60	1569090
10/60	1573528
11/60	1576812
12/60	1580199
1/61	1583906
2/61	1588413
3/61	1592205
4/61	1596773
5/61	1601150
6/61	1605704
7/61	1609222
8/61	1613013
9/61	1615674
10/61	1619437
11/61	08A-300001-M
12/61	08A-302578-N
1/62	08B-741001-A
2/62	08B-744763-B
3/62	08B-748538-C
4/62	08B-752790-D
5/62	08B-756397-E
6/62	08B-760604-F
7/62	08B-763854-G
8/62	08B-765817-H
9/62	08B-769002-K
10/62	08B-771608-L
11/62	08B-775046-M
12/62	08B-778355-N
1/63	08C-781470-A
2/63	08C-945000-B
3/63	08C-948667-C
4/63	08C-952584-D
5/63	08C-956290-E
6/63	08C-960302-F
7/63	08C-964121-G
8/63	08C-967835-H
9/63	08C-970815-K
10/63	08C-974950-L
11/63	08C-979533-M
12/63	08C-982803-N
1/64	08D-940000-A
2/64	08D-950495-B
3/64	08D-954150-C
4/64	08D-957597-D
5/64	08D-961347-E
6/64	08D-964662-F
7/64	08D-967990-G
8/64	08D-970624-H
9/64	08D-973017-K
10/64	08D-975956-L

INDEX (By Starting Paragraph)

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CONDENSED SERVICE DATA

GENERAL

Engine Make	Own
No. Cylinders	4
Bore, Inches	3.937-3.938
Stroke, Inches	4.524-4.528
Displacement, Cubic Inches	220.35
Compression Ratio	16:1
Pistons Removed From:	Above
No. Main Bearings	5
Cylinder Sleeves, Type	Wet
Forward Speeds	6
Reverse Speeds	2
Starter & Generator Make	Lucas
Injection Pump & Injector Make	Simms

TUNE-UP SPECIFICATIONS

Firing Order	1, 2, 4,3
Valve Gap Intake	0.015-H
Exhaust	0.012-H
Valve Face Angle, Degrees	29½
Valve Seat Angle, Degrees	30
Injection Timing	See Index
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Engine High Idle RPM:	
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All Other Models	1900
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Crankshaft Main Journal Diameter	3.0002-3.0010
Crankpin Journal Diameter	2.4997-2.5005
Camshaft Journal Diameter	2.0595-2.0600
Piston Pin Diameter:	
Prior To Serial No. 1425097	1.250
After Serial No. 1425096	1.375
Intake Valve Stem Diameter	0.373-0.374
Exhaust Valve Stem Diameter	0.3723-0.3733
Camshaft Cam Lift:	
Prior to Serial No. 1425097	0.258
Serial No. 1425097 To 1481090	0.305
Serial No. 1481091 To 1609838	0.258
After Serial No. 1609838	0.255
Piston Ring Width:	
Compression Rings	0.0933
Oil Rings	0.187
Piston Ring End Gap, All Rings	0.011-0.016
Ring Side Clearance In Groove:	
Compression Rings	0.0014-0.0034
Oil Rings	0.0015-0.0035
Crankshaft End Play	0.002-0.010
Max. Runout At Flywheel Clutch Face	0.005
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Gears Retained By 3 Cap Screws	0.003-0.008
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Piston Skirt Clearance	See Paragraph 77
Camshaft Bearing Running Clearance	0.002-0.0035
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Transmission Lubricant Capacity	5.4 Gallons
Final Drive Lubricant Capacity	10.8 Gallons
Hydraulic Fluid	Uses Final Drive Lubricant

TIGHTENING TORQUES (In Ft.Lbs.)

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Cylinder Head	85-90
Auxiliary Driveshaft Nut	60-70
Camshaft Gear Cap Screws:	
Single Cap Screw	95-100
Three Cap Screw	18-21
Main Bearing Cap Screws:	
With ½-Inch Cap Screws	70-75
With 9/16-Inch Cap Screws	95-100
With ⅝-Inch Cap Screw	115-120
Flywheel Cap Screw	80-90
Front Mounting Plate	See Paragraph 54

FRONT SYSTEM, AXLE TYPE

WHEEL ASSEMBLY

1. **BEARING ADJUSTMENT.** Wheel bearings should be adjusted with clamp bolt (3—Fig. 1) removed from nut (2). Tighten nut while rotating wheel until a drag is noticeable. Then, back off until wheel turns free, insert cotter pin through nut and spindle and install and tighten the clamp bolt.

SPINDLES

2. **R&R SPINDLES.** To renew spindle, proceed as follows: Support front end of tractor and remove wheel, hub and bearing cones. Remove clamp bolt from steering arm (16 or 26—Fig. 1) and remove arm. Withdraw spindle from axle extension.

Install new thrust bearing (11) if worn or rough. Renew spindle bushings as outlined in paragraph 3 if spindle to bushing clearance exceeds 0.013. Insert spindle in axle extension, install dust seal (15) and steering arm. While holding all end play from spindle, adjust clearance between steering arm and axle extension to 0.002-0.007 if a felt dust seal is used, or to 0.025-0.035 if late type rubber seal is installed. (Felt and rubber dust seals are interchangeable.) Note: It may be necessary to grind a wider bolt slot in steering spindle to obtain the specified clearance. Install steering arm clamp bolt and tighten securely. Reinstall wheel, hub and bearings assembly using a new felt seal (9). Adjust wheel bearings as outlined in paragraph 1.

3. **SPINDLE BUSHINGS.** Spindle bushings can be renewed after removing spindle as outlined in paragraph 2. Remove old bushings with cape chisel and install new bushings with OTC T-810 Bushing Driver and 815 Driving Mandrel or equivalent tools. After installing bushings, ream to 1.500 with standard 1½ inch adjustable reamer. NOTE: Upper and lower bushings are not alike; install upper bushing with blind end of lubrication groove up.

Spindle diameter (new) is 1.498-1.499 providing 0.001-0.003 clearance in the 1.500-1.501 diameter bushings. Maximum allowable spindle to bushing clearance is 0.013.

AXLE EXTENSIONS

4. Axle extension (13 or 27—Fig. 1) can be renewed after removing spindle as outlined in paragraph 2. When installing extension, be sure that one retaining bolt is placed in the outer hole in center member and the other two bolts at each side of the radius rod bolt.

AXLE CENTER MEMBER, PIVOT PIN AND BUSHING

5. To renew the axle center member (beam) or pivot pin (trunnion) bushing, support tractor under front end of transmission housing and proceed as follows: Remove bolts from tie rod clamps (24—Fig. 1), unbolt axle extensions from center member and remove wheels, axle extensions, steering arms and tie rod ends as units. Remove radius rod (refer to paragraph 7), then remove pivot pin (29) and lower axle center member from front support (cross member).

On "FMD" and "FPM" models, pivot pin (29) is retained by a cotter pin at each end and thrust washers are used at front and rear of axle center member. On "FSM" models, the pivot pin is of larger diameter, no thrust washers are used and pivot pin is retained in front support by two roll pins (see Fig. 2) or by a ½-inch diameter clevis pin and cotter pin. When reinstalling pivot pin with ⅜-inch hole, be sure to install roll pins as shown in Fig. 2. Only the latest type pivot pin with ½-inch hole will be serviced; to install this pin in early "FSM," enlarge retaining pin hole in front support to ½-inch and retain with clevis pin and cotter pin.

To renew pivot pin bushing (30—Fig. 1), remove old bushing with cape chisel and drive new bushing in flush with axle center member. Bushing should not require reaming if carefully installed. Bushing is not interchangeable between "FSM" and earlier models.

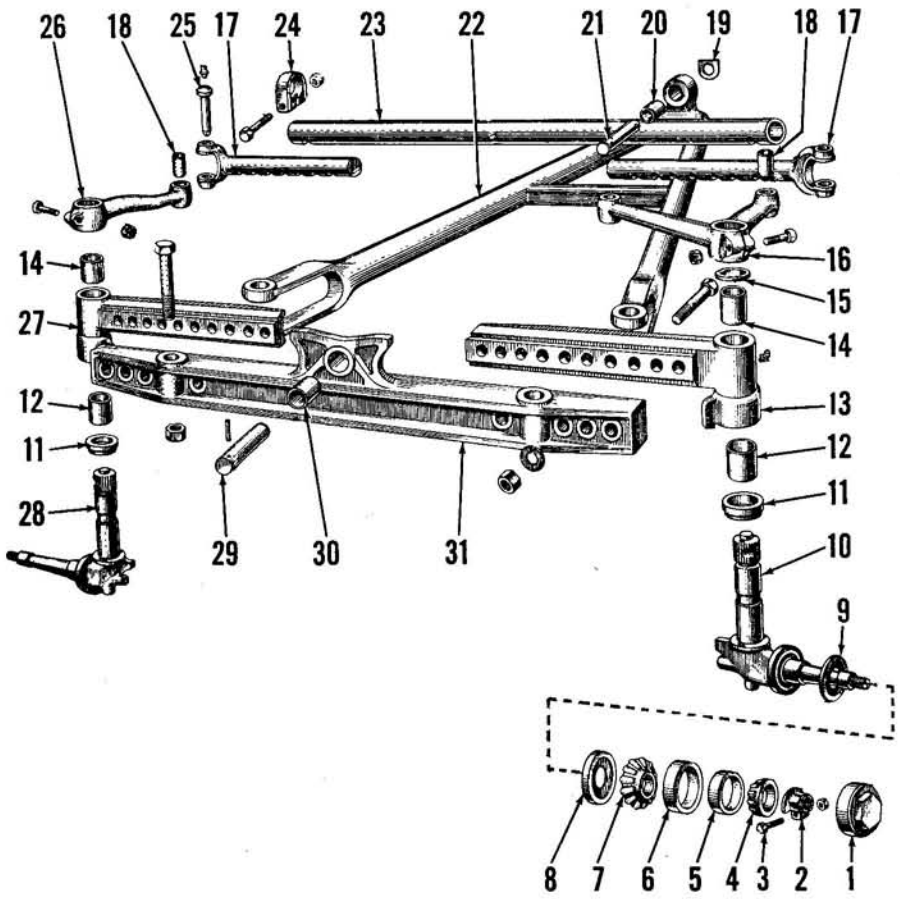


Fig. 1—Exploded view of adjustable front axle, radius rod, tie rod and steering arms for models "FSM" and "New FSM". Front axle assembly for earlier models "FMD" and "FPM" is similar except thrust washers are used on trunnion (29) at each side of axle center member (31) and thrust washer (19) is not used on radius rod pivot pin (21).

1. Hub cap
2. Nut
3. Clamp bolt
4. Bearing cone
5. Bearing cup
6. Bearing cup
7. Bearing cone
8. Seal retainer
9. Felt seal
10. Spindle, L.H.
11. Thrust bearing
12. Bushing, lower
13. Axle extension, L.H.
14. Bushing, upper
15. Dust seal
16. Steering arm, L.H.
17. Tie rod ends
18. Bushings
19. Thrust washer
20. Bushing
21. Pivot pin
22. Radius rod
24. End clamps
25. End pins
26. Steering arm R.H.
27. Axle extension, R.H.
28. Spindle, R.H.

TIE ROD AND TOE-IN

All Models

6. The tie rod assembly, except for tread width adjustment, is non-adjustable. Toe-in should be correct at each tread width adjustment unless tie rod or steering arms are bent or excessive wear has occured. Zero toe-in (no toe-in or toe-out) is specified.

Pins (25) are a press fit in the tie rod ends (17) and bushings (18) are a press fit in the steering arms (16 and 26).

RADIUS ROD, REAR PIVOT PIN AND BUSHING

7. The radius rod (22—Fig. 1) pivots on a pin (21) retained in bosses on the bottom of engine oil pan (sump). Radius rod is fitted with a renewable, pre-sized steel bushing (20).

Due to increased diameter of pivot pin, radius rod, bushing, pivot pin and engine oil sump are not interchangeable between the "FSM" models and earlier models.

To remove radius rod, remove pivot pin and the bolts through radius rod and front axle center member. Slide radius rod to either side of tractor until clear of oil sump, then remove from tractor. Remove bushing with cape chisel and drive new bushing in until flush. Reinstall rear pivot retaining roll pins, if so equipped, as shown in Fig. 2.

FRONT SUPPORT

8. To renew the front support (cross member), first drain radiator, then proceed as follows:

Remove engine hood, disconnect headlight wiring and remove radiator shell from front support. Disconnect both radiator hoses and remove radiator from front support. Support tractor under front end of transmission and remove front axle pivot pin (trunnion). Unbolt and remove side rail from right side of tractor. Unbolt front support from left engine side rail, move support to right until clear of channel, then lift front support from tractor. Install new front support by reversing removal procedure.

Due to increased diameter of front axle pivot pin (trunnion), front support is not interchangeable between "FSM" models and earlier models.

NOTE: Due to change in radiator mounting, it may be necessary to relocate radiator mounting holes in new front support; refer to paragraph 134 and Fig. 88 in COOLING SYSTEM section.

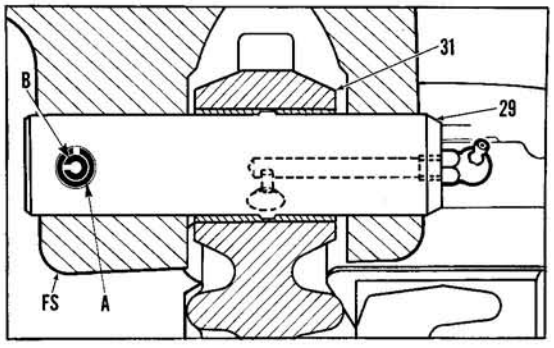


Fig 2—Cross-sectional drawing showing front pivot pin (29) installation on model "FSM" wide front axle. Note proper installation of inner (B) and outer (A) retaining roll pins. Front support is (FS), axle center member is (31).

FRONT SYSTEM, TRICYCLE

LUBRICATION

9. Oil level should be maintained at bottom of cover plate opening in front support (cross member) as shown in Fig. 3. Capacity is 4½ pints of SAE 90 gear lubricant. When refilling, remove bleed plug from upper front side of pintle housing (12) and add oil until oil flows from plug opening. Then reinstall plug and fill to proper level.

ADJUSTMENTS

10. **PINTLE BEARINGS.** Pintle shaft tapered roller bearings (11 & 14—Fig. 3) are adjusted by tightening nuts at top end of pintle (13). Straighten tap of washer located between the two nuts and loosen top nut. Adjust lower nut to remove all end play from pintle shaft without causing binding. Then, while holding lower nut from turning, securely tighten top nut and bend tabs of washer against flats on nuts.

11. **BEVEL GEAR BACKLASH.** With pintle bearings properly adjusted as outlined in paragraph 10, vary number of shims (10—Fig. 3) located between cross shaft bearing (5) and front support (23) to remove all possible backlash between the bevel gears (3 and 4) without binding at any point in turning range of gears.

WHEEL ASSEMBLY

12. To remove wheel hub from axle, follow conventional procedure except unbolt seal retainer (20) from hub (21) before pulling hub from axle. Seal and retainer can be removed from axle after removing inner bearing cone and roller assembly. Reinstall by reversing removal procedure.

Adjust front wheel bearings on tricycle models as outlined for adjustable axle models in paragraph 1. Lubricate wheel bearings with pressure gun and multi-purpose grease; fill wheel hub with grease until grease appears from seal retainer.

AXLE SHAFT

13. To renew axle shaft (17—Fig. 3), support front end of tractor and remove front wheels, hubs, bearings and seals. Remove cotter pin and castellated nut from lower end of pintle (13) and pull axle from pintle. Renew key (18) if damaged. Install new axle and tighten retaining nut securely, then install cotter pin. Check for any end play or binding condition of pintle shaft and, if necessary, adjust pintle shaft bearings as outlined in paragraph 10.

PINTLE AND HOUSING

14. **R&R ASSEMBLY.** To remove pintle and housing with front wheels as an assembly, support front end of tractor and proceed as follows:

Remove bleed plug from upper front side of pintle housing and drain as much oil as possible. Reinstall plug, unbolt pintle housing from front support (cross member) and remove assembly from tractor.

When reinstalling, renew pintle housing to front support gasket and be sure that side of gear (3—Fig. 3) having the two punch marked teeth is to left side of tractor. Single punch marked tooth on cross shaft gear (4) must mesh between the two punch marked teeth on gear (3). Steering arm (9) should be nearly vertical when gears are properly meshed and wheels are in a straight ahead position. Refer to paragraph 9 for lubrication information.

15. **OVERHAUL PINTLE AND HOUSING UNIT.** Support front end of tractor and remove front wheels then, remove pintle, pintle housing and axle assembly as a unit following procedures outlined in paragraph 14. Turn unit upside down to drain oil from pintle housing.

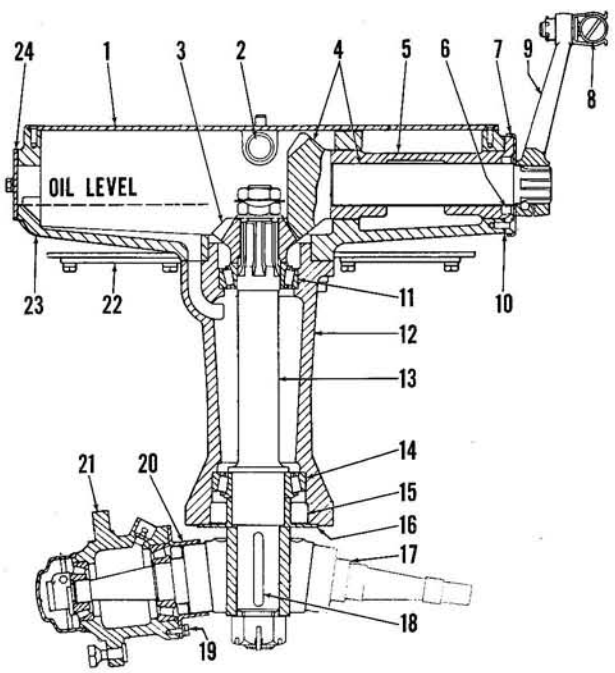
Straighten tabs of washer located between the two nuts at top end of pintle and remove the nuts, washer and bevel gear (3—Fig. 3). Remove pintle housing from pintle and withdraw upper bearing cone and roller assembly from housing. Remove cotter pin and castellated nut from lower end of pintle and remove pintle from axle shaft (17). Remove key (18) from pintle, then remove pintle housing cover (16), seal (15) and lower bearing cone and roller assembly. Remove upper and lower bearing cups from housing (12) if renewal of bearings is indicated.

Renew oil seal (15) and other parts as necessary. Reassemble by reversing disassembly procedure. Align the two punch marked teeth of gear (3) with punch marked spline on pintle (13). If mark on spline is not visible, install gear with punch marked teeth 90 degrees to left of key (18). Securely tighten castellated nut and install cotter pin at bottom end of pintle, then tighten nuts at top of pintle to properly adjust pintle bearings as outlined in paragraph 10. Reinstall the assembly as outlined in paragraph 14.

CROSS SHAFT AND FRONT SUPPORT

16. **RENEW CROSS SHAFT BEARING AND/OR SEAL.** Remove bleed plug from upper front side of pintle shaft housing and drain oil level down below the cross shaft bearing. Remove clamp bolt from steering arm and remove arm from cross shaft, leaving arm attached to steering drag link. Remove oil seal retainer (7—Fig. 3) and bearing (5), taking care not to lose or damage shims (10) located between bearing and front support. Remove old seal from bearing and install new seal with lip to inside. Using the removed shim pack or one of equal thickness, carefully install bearing (5) to avoid damage to seal (6). Reinstall seal retainer and steering arm. Check and readjust bevel gear backlash as outlined in paragraph 11.

17. **RENEW CROSS SHAFT AND/OR FRONT SUPPORT.** Drain radiator and proceed as follows: Remove pintle shaft, housing, axle and front wheels assembly as outlined in paragraph 14. Remove engine hood, radiator shell and radiator. Disconnect steering arm from cross shaft and unbolt and remove front support from engine side rails. Remove top cover plate. Remove seal retainer and "O" ring from around crank extension shaft at front of support (cross member). Remove cotter pin from crank extension shaft inside the front support and withdraw the shaft from rear of support. Unbolt and withdraw the cross shaft bearing as outlined in paragraph 16, then remove cross shaft from front support. If front support casting is to be renewed, remove the mud guard from old casting and install on new part.



1. Top cover plate
2. Cranking extension shaft
3. Bevel gear
4. Cross-shaft
5. Cross-shaft bearing
6. Cross-shaft seal
7. Seal cover
8. Drag link
9. Steering arm
10. Shims
11. Upper pintle bearing
12. Pintle housing
13. Pintle
14. Lower pintle bearing
15. Pintle seal
16. Pintle housing cover
17. Axle
18. Key
19. Cap screws
20. Seal retainer
21. Wheel hub
22. Mud guard
23. Cross-member
24. Cover plate

Fig. 3—Drawing showing cross-sectional view of tricycle front pedestal (cross-member and pintle). Oil level is checked by removing plate (24). Wheel bearing detail is similar to that shown for adjustable front axle in Fig. 1, except that seal retainer (20) is secured to inner side of hub (21) by cap screws (19).

Reassemble by reversing disassembly procedure. Renew cover plate gasket, crank extension shaft "O" ring and cross shaft seal. Be sure that the punch marked tooth on cross shaft gear meshes between the two punch marked teeth on pintle shaft gear.

STEERING GEAR

All Models

18. **ADJUSTMENT.** Steering gear adjustment is usually not required unless necessary to renew steering gear component parts. When overhauling steering gear assembly, adjust steering shaft and rocker shaft during reassembly as outlined in following paragraphs 19 and 20.

19. STEERING SHAFT. Steering gear adjustment is correct when, with steering retaining nuts tightened, steering shaft turns freely without binding and there is no noticeable end play in shaft.

To adjust steering shaft, refer to Fig. 4 and add or remove shims (20) as required to obtain proper adjustment. A gasket (19) should be placed on each side of shim stack. Be sure that holes (H) in gaskets and shims are aligned with oil holes in steering column and gear housing.

20. ROCKER SHAFT. Rocker shaft adjustment is correct when, with cover retaining bolts tightened, there is no noticeable end play in rocker shaft in mid (straight ahead) position. There will be some end play in rocker

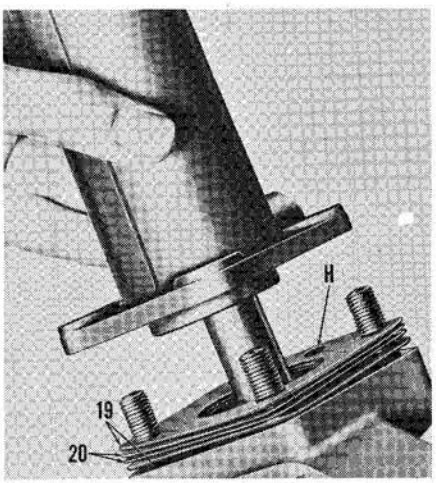


Fig. 4—Shims are used between steering column and gear housing to adjust worm-shaft bearings. A gasket (19) should be placed each side of shim stack (20). Be sure oil holes (H) in shims and gaskets are aligned with oil holes in housings.

shaft when at either side of mid position.

To adjust rocker shaft, refer to Fig. 6, be sure shaft (4) is in mid-position and that roller (6) is in place, then install cover (1) with shims as required to eliminate shaft end play. A gasket (3) should be on each side of shim stack. Note that roller (6) engages slot (S) in cover.

21. **R&R STEERING GEAR UNIT.** To remove the steering gear unit, first turn front wheels to mid (straight ahead) position, remove engine hood and steering wheel, then proceed as follows:

On models "FPM" and "FSM", disconnect battery ground cable and drain cooling system. Remove temperature gage bulb from engine and disconnect wiring to instrument panel at connectors on wiring harness. Remove pin or clamping screw from throttle control lever and remove the lever. Remove screws retaining instrument panel and remove the panel, disconnecting proofmeter (tachometer) cable as panel is lifted from fuel tank. On all models shut-off fuel supply valve and disconnect fuel supply and excess fuel return lines, unbolt fuel tank from supports and lift fuel tank from supports and steering column.

Remove the nut retaining steering (drop) arm to steering gear rocker shaft and using gear pullers, remove arm from shaft. Then, unbolt and remove steering gear assembly from transmission.

When reinstalling steering gear assembly, be sure gasket surfaces are clean and apply thin coat of gasket sealer to gear housing and transmission mating surfaces. Install new gasket on top of transmission, then reinstall steering gear assembly. Turn gear unit to mid position and reinstall steering arm to rocker shaft. Complete the reassembly of tractor by reversing disassembly procedure and bleed the diesel fuel system as outlined in paragraph 107.

22. **OVERHAUL STEERING GEAR UNIT.** With steering gear unit removed as outlined in paragraph 21, drain lubricant from gear housing and proceed as follows:

Remove the side cover plate (1—Fig. 6) and roller (6), then withdraw rocker shaft (4) from housing. Retain shims (2) for reassembly. The rocker shaft seal can be renewed at this time. On early models, refer to Fig. 7 and pry the seal (21) out of groove between bushing (13) and retainer (22). On later models, pry the lip type seal from shaft bore.

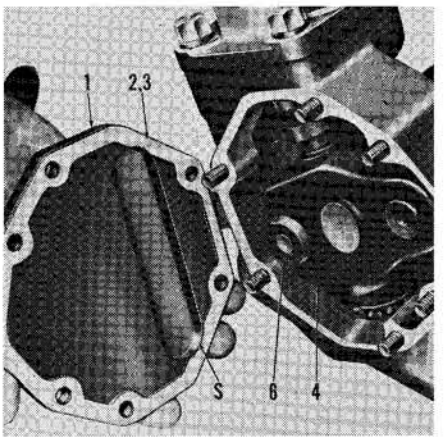


Fig. 6—Slot (S) in cover plate (1) guides roller (6) and ball nut in straight line parallel with wormshaft. Vary shims (2) as required to eliminate end play of rocker shaft (4).

Refer to Fig. 4, and unbolt and remove steering column from gear housing and steering shaft. Lift steering shaft up far enough to remove upper bearing race (15—Fig. 5) and the ten loose steel balls (14). Remove steering shaft and ball nut assembly from side opening in housing and remove the ten loose steel balls of lower bearing from housing. If necessary to renew lower bearing race, remove plug (11) and drive race upward. Unscrew ball nut (9) fom worm on steering shaft and remove the 14 recirculating balls.

Inspect rocker shaft journals and bushings. If necessary to renew bushings on early models, refer to Fig. 7 and carefully remove the staking and seal retainer (22). On all models,

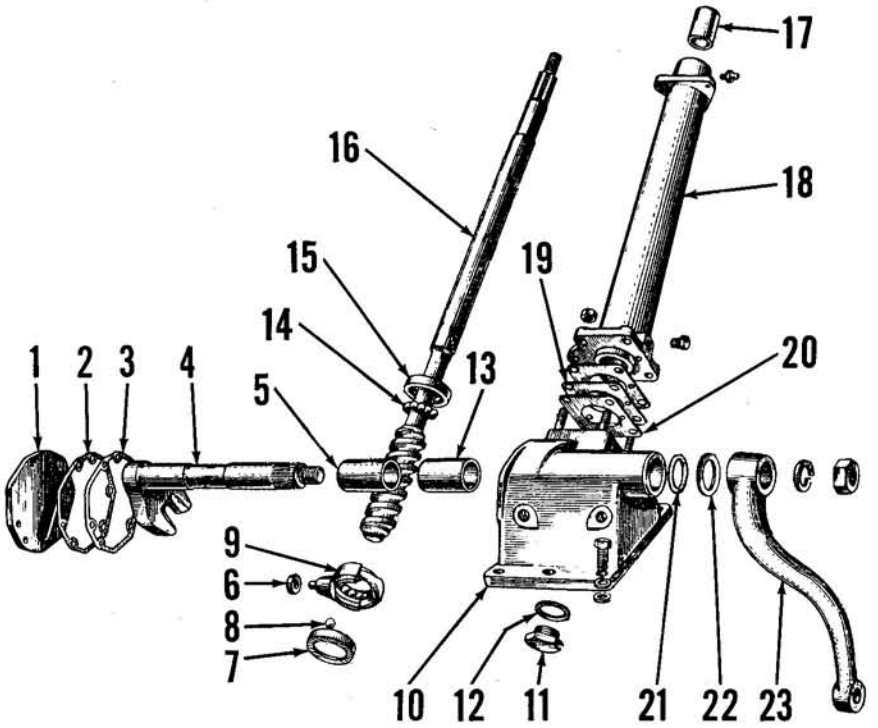


Fig. 5—Exploded view of typical steering gear assembly for adjustable front axle models. Tricycle steering gear is same as that shown except that a different drag link is used. Steering column (18) for "FMD" models does not have instrument panel support and different wormshaft (16) is required. Late production oil seal (21) does not require retaining ring (22).

1. Cover
2. Shims
3. Gasket
4. Rocker shaft
5. Bushing
6. Roller
7. Bearing race
8. Steel balls
9. Main nut assy.
10. Housing
11. Plug
12. Seal ring
13. Bushing
14. Steel balls
15. Bearing race
16. Wormshaft
17. Bushing
18. Steering column
19. Gaskets
20. Shims
21. Oil seal
22. Retainer
23. Steering arm

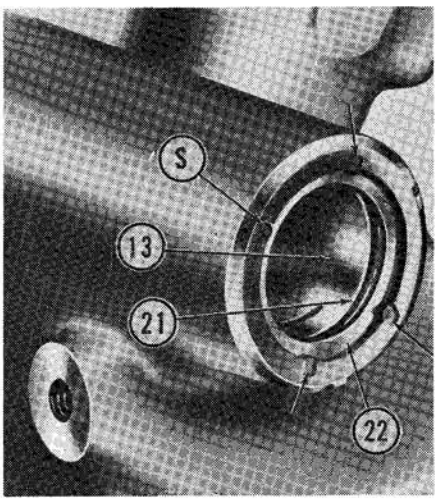


Fig. 7—Seal retainer (22) (not used on late models) is retained in gear housing by staking (S) as shown. Oil seal (21) can be renewed without removing retainer.

drive or press bushings from housing. When installing outer bushing (13) be sure open end of oil groove is to inside of housing. Bushings are presized and should not require reaming if carefully installed. On early models, install oil seal retainer and carefully stake in position, then insert "O" ring in groove between bushing and retainer. On late models, drive seal into housing with lip to inside.

Renew steering shaft and ball nut assembly if shaft or nut are damaged. To reinstall shaft and ball nut assembly, stick the 14 steel balls in nut with heavy grease and thread nut onto shaft. Install new lower race if necessary and stick ten steel balls into race. Insert shaft up through side opening and seat into lower bearing assembly. Stick ten steel balls into upper race, invert the bearing and install over steering shaft. Install new bushing (17—Fig. 5) in upper end of steering column, then install column over steering shaft with two gaskets and proper number of shims as outlined in paragraph 19. Lubricate rocker shaft and seal, then carefully install shaft through bushings and seal. Place roller (6) on ball nut, then install side cover with two new gaskets and proper number of shims as outlined in paragraph 20. Refill steering gear housing to filler plug opening with SAE 90 gear lubricant and lubricate steering column bushing with pressure grease gun.

POWER STEERING

The power steering system consists of a belt driven hydraulic pump which furnishes pressurized oil, through flexible hoses, to a combined power cylinder and control valve assembly. The system utilizes the standard steering gear assembly which allows the operator to steer the tractor manually should the loss of power occur.

With the exception of the power cylinder, the component parts of the power steering system used on four wheel adjustable axle tractors and tricycle tractors remain the same. Since the power requirement of the tricycle models is less than that of four wheel tractors, the bore of the power cylinder for tricycle tractors is 1¾ inches compared to 2 inches for four wheel tractors.

FLUID AND BLEEDING

All Models

23. To bleed the system, turn front wheels to the right against stop. Fill reservoir to "full" mark on dip stick (see Fig. 9) with good quality SAE 10W oil. Note: If temperature is consistently below 10 degrees F. use S.A.E. 5W oil. Start engine and run at a fast idle; then, turn front wheels full left and full right and observe return oil for bubbles and turbulence. Continue until the returning oil is free of bubbles and turbulence, then turn front wheels to the straight ahead position and refill reservoir to the "full" mark on dip stick.

SYSTEM OPERATING PRESSURE

All Models

24. A pressure test of the power steering circuit will disclose whether the pump, relief valve or some other unit in the system is malfunctioning; proceed as follows:

Connect a pressure test gage and shut-off valve in series with the pump pressure line and be sure that the pressure gage is connected in the circuit between the shut-off valve and the pump. Open the shut-off valve and run the engine at slow idle speed until the working fluid is warmed to normal operating temperature. Advance the engine speed to high idle rpm, close the shut-off valve and retain in the closed position only long enough to observe the gage reading.

NOTE: Pump may be seriously damaged if valve is left in closed position for more than a few seconds. If the gage reading is 720-800 psi, with the shut-off valve closed, the pump and relief valve are O.K. and any trouble is located in the control valve, power cylinder and/or connections.

If the gage pressure is more than 800 psi, the relief valve is probably stuck in the closed position. If the gage pressure is less than 720 psi, renew the relief valve spring (25—Fig. 10) and recheck the pressure reading. If the gage pressure is still too low, it will be necessary to overhaul the pump as outlined in paragraph 26.

PUMP AND RESERVOIR

All Models

25. **REMOVE AND REINSTALL.** To remove the power steering pump proceed as follows: Remove the reservoir cover and withdraw as much oil as possible from the reservoir with a suction gun. Disconnect hoses from pump pressure and return line fittings and secure the hoses in a raised position to prevent oil drainage. Loosen

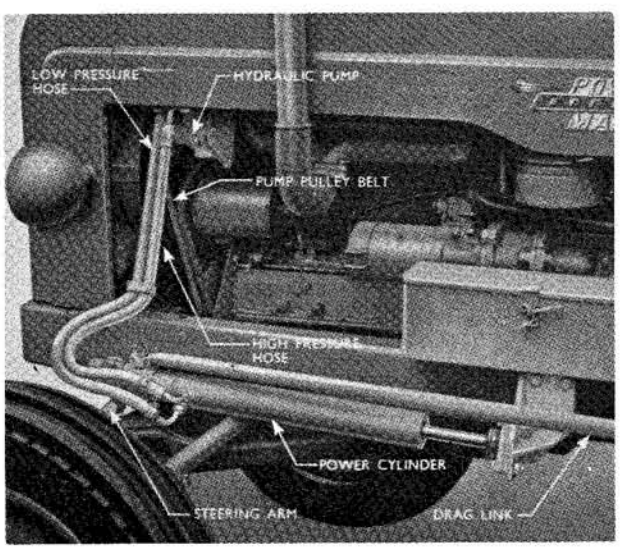


Fig. 8 — View showing power steering components on model "FPM" with wide adjustable front axle. Power steering systems for other models (including tricycle front end) are similar.

Fig. 9—Maintain fluid level to full mark on level indicator (dipstick) attached to pump reservoir filler cap.

the pump drive belt adjusting bolts and remove belt. Withdraw bolts and lift pump from tractor.

After pump is reinstalled, fill and bleed the system as in paragraph 23.

26. **OVERHAUL.** With pump removed from tractor as outlined in paragraph 25, refer to Fig. 10 and proceed as follows: Remove the reservoir spring and filter assembly, then clean the pump assembly. Remove the reservoir retaining cap screws and the reservoir stud (11), then lift reservoir and reservoir retaining plate (13) from pump body. Remove and discard the two "O" rings which are between reservoir and pump body. Remove the nut and lockwasher retaining pulley to pump shaft and using a suitable puller, remove pulley. Remove the four cap screws which retain pump cover (33) and separate pump cover and pump body (28). Remove and discard the two "O" rings from their grooves in pump body. Remove the pump rotors (23) and rotor drive key from pump shaft. Remove snap ring (16) retaining rotor shaft bearing in pump body and press bearing and shaft assembly from pump body. Bearing (18) can be removed from shaft after removing snap ring (17).

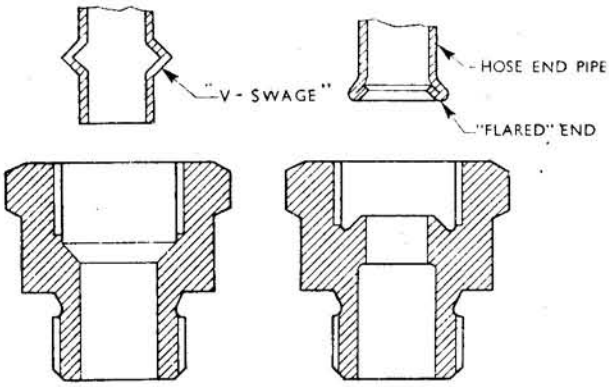


Fig. 10A—View showing early "V" swage hose end, late flared end hose fitting and related adaptors.

Remove the pump outlet adapter (38) from pump body. Remove flow control valve spring (37) and flow control valve (24). If necessary, use a piece of hooked wire to pull flow control valve from housing. Remove the snap ring retaining the pressure relief valve (35) in the flow control valve and remove the pressure relief valve and spring (25).

27. Wash all parts EXCEPT the rotor shaft bearing in a suitable solvent and inspect. If the bushing and/or pump cover is worn, renew the cover and bushing assembly. If the bushing and/or the pump body is worn, renew the pump body and rotor sub-assembly. (Bushings are not available separately.) If the drive or driven rotors show evidence of wear or damage, renew the pump body and rotor assembly.

Check clearances as follows: Insert rotor shaft and bearing into housing until bearing is in position. Install key, drive rotor and driven rotor and check clearance at tooth ends as

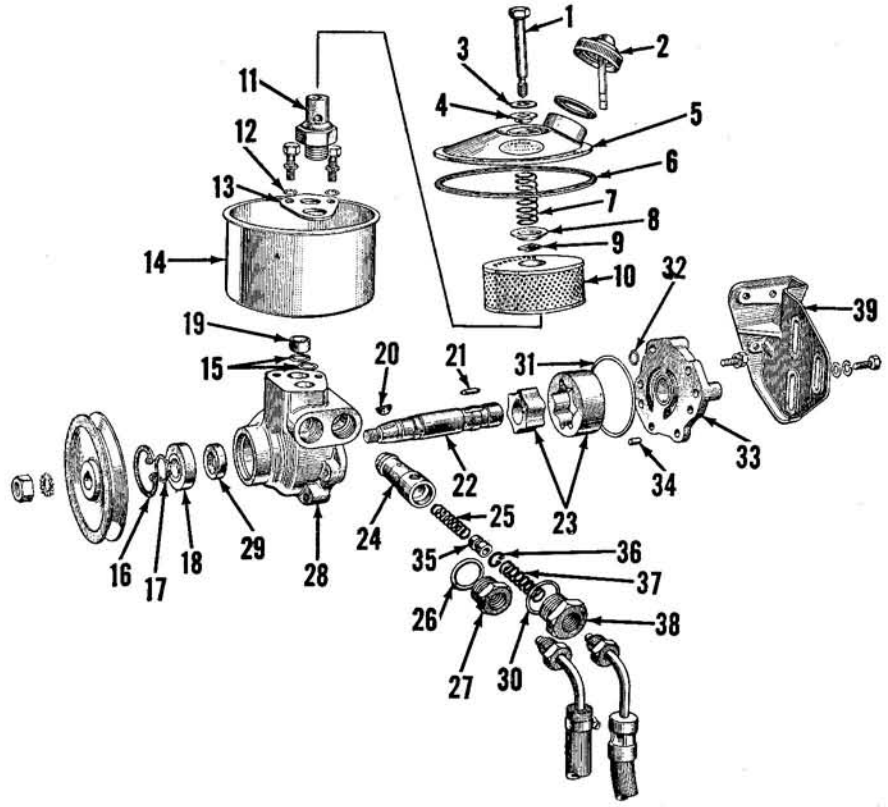


Fig. 10—Exploded view of the power steering pump and reservoir assembly. Pump bracket (39) for early models is different than shown.

1. Cover bolt
2. Filler cap
3. Washer
4. Gasket
5. Cover
6. Gasket
7. Spring
8. Retainer
9. Clip
10. Filter
11. Stud
12. "O" rings
13. Reinforcement
14. Reservoir
15. "O" rings
16. Snap ring
17. Snap ring
18. Bearing
19. Retainer
20. Woodruff key
21. Rotor key
22. Pump shaft
23. Rotor set
24. Flow control valve
25. Relief valve spring
26. Seal
27. Adaptor
28. Pump body
29. Oil seal
30. Seal
31. "O" ring
32. "O" ring
33. Pump cover
34. Dowel pin
35. Relief valve
36. Snap ring
37. Flow control valve spring
38. Adaptor

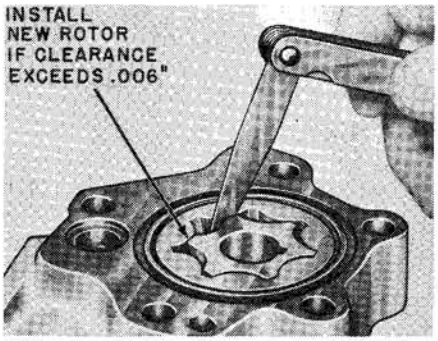


Fig. 11—Measuring drive rotor to driven rotor tooth clearance. Renew rotor set if clearance exceeds 0.006.

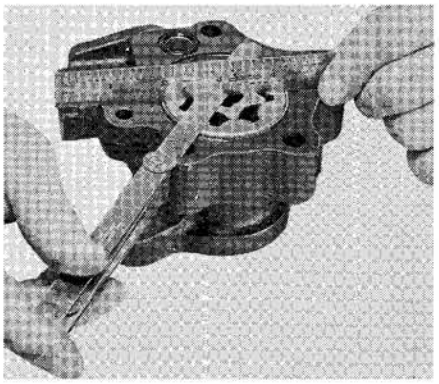


Fig. 12—Measuring rotor end clearance with straight edge and feeler gage. Maximum allowable clearance is 0.0025.

shown in Fig. 11. If clearance exceeds 0.006, renew pump body and rotor assembly. Check clearance between top of rotors and surface of pump body with a straight edge and feeler gage as shown in Fig. 12. If clearance exceeds 0.0025, renew pump body and rotor assembly. Check clearance between driven rotor and insert in pump body as shown in Fig. 13. If clearance exceeds 0.008, renew pump body and rotor assembly. The flow control valve spring should exert 16-18 pounds when compressed to a height of 1.2 inches. The pressure relief valve spring should exert 30-33 pounds when compressed to a height of 1.18 inches. Renew springs if they do not meet specifications.

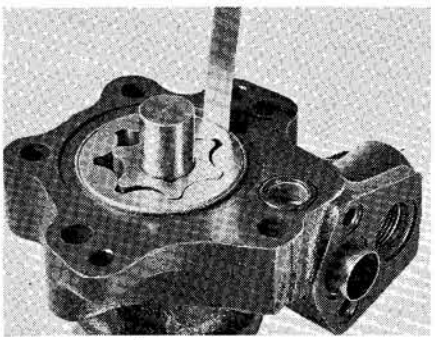


Fig. 13—Measuring driven rotor to pump body clearance. If clearance exceeds 0.006, renew rotor set and/or pump body.

Thoroughly dry relief valve and bore of flow control valve; then insert relief valve and make sure it moves freely in bore of flow control valve. If necessary to remove any burrs, use crocus cloth. Check freedom of movement of flow control valve in pump cover bore in the same manner.

Before assembly, coat all parts with a light film of oil. If a new rotor shaft seal is used, coat lip of same with Lubriplate or its equivalent, and be sure it is installed with lip toward pump rotors. Always use new "O" rings. Reassemble by reversing the disassembly procedure.

CYLINDER AND CONTROL VALVE ASSEMBLY

28. **REMOVE AND REINSTALL.** Disconnect hoses from power cylinder and allow fluid to drain from reservoir. Disconnect drag link from control valve actuating ball stud and disconnect front ball stud from steering arm on pedestal (tricycle models) or on front wheel spindle (four-wheel models). Unbolt piston rod anchor ball cap from abutment bracket taking care not to lose shims from between clamp and ball seat, then remove cylinder assembly from tractor.

When reinstalling unit, tighten ball stud nuts to a torque of 100-110 Ft.-Lbs. Reconnect piston rod anchor end with sufficient shims (61—Fig. 14 or 15) between clamp (59) and seat (62) to preven anchor ball from binding, yet be without end play. Shims are available in thicknesses of 0.002, 0.005 and 0.010. Tighten anchor ball clamp bolts to a torque of 60-65 Ft.-Lbs. Reconnect cylinder hoses as shown in Fig. 8, then refill and bleed system as in paragraph 23.

NOTE: Pump to cylinder hoses with two different type ends have been used; refer to Fig. 10A. Early "V-swage" type hose end and adapter is shown at left; later flared type hose end and adapter fitting is

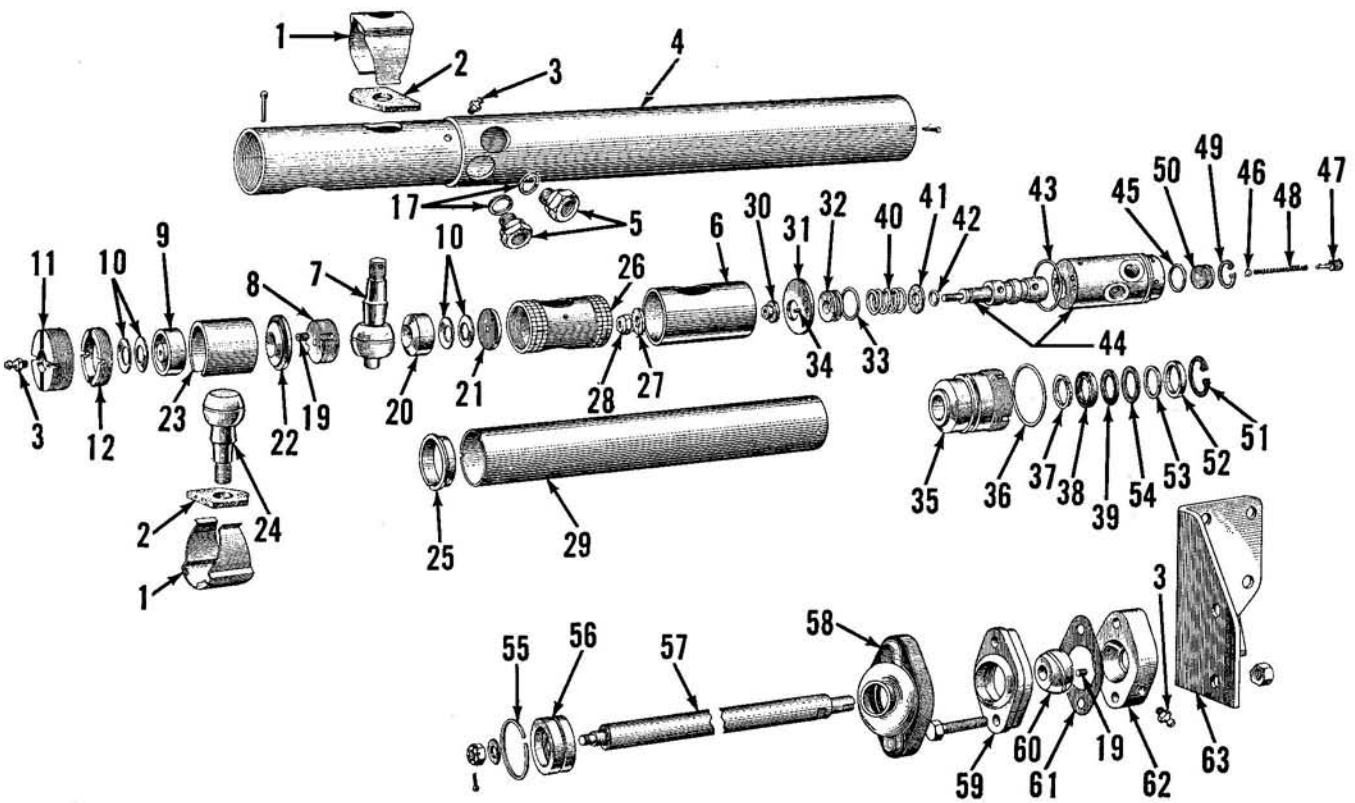


Fig. 14—Exploded view of early production power steering control valve and cylinder assembly. Refer to Fig. 15 for exploded view of later unit. Unit shown is for wide adjustable front axle models; cylinder on tricycle model is smaller in diameter.

1. Spring cover
2. Grease retaining pad
3. Grease fittings
4. Outer tube
5. Hose adapters
6. Locating sleeve
7. Manual ball pin
8. Manual ball pin cup
9. Power ball pin cup
10. Belleville washer
11. End cover
12. Lock ring
17. Seals
19. Set screw
20. Manual pin ball cup
21. Back-up washer
22. Power ball pin cup
23. Spacer
24. Power ball pin
25. Locating collar
26. Operating sleeve
27. Washer
28. Self-locking nut
29. Inner tube
30. Collar
31. Spacer
32. Reaction ring
33. "O" ring
34. Dowel pin
35. Bearing assembly
36. "O" ring
37. Gland seal spacer
38. Vellumoid washer
40. Reaction spring
41. Washer
42. "O" ring
43. "O" ring
44. Valve body & spool
45. "O" ring
46. Relief valve ball
47. Relief valve plug
48. Relief valve spring
49. Snap ring
50. End plug
51. Snap ring
52. Washer
53. Scraper
54. Washer
55. Piston ring
56. Piston
57. Piston rod
58. Rubber cover
59. Abutment cap
60. Anchor ball
61. Shim
62. Abutment spacer
63. Abutment bracket

shown at right. Only the late type hose with flared ends are available for service. When renewing early type hose with "V-swage" ends, it will also be necessary to install new adapter fittings in pump and cylinder.

29. **OVERHAUL.** The cylinder and control valve components are clamped together within the outer tube (4—Fig. 14 or Fig. 15) by the plug (11) and lock ring (12) in front end of tube and by the piston rod bearing (35—Fig. 14) (early units) or bearing retainer (35B—Fig. 15) (late production) in rear end of tube. The control valve spool is connected to inner sleeve (26—Fig. 14 or Fig. 15) and valve actuating ball stud (7) is clamped into inner sleeve by the threaded ball cap (8—Fig. 14) or plug (8A—Fig. 15).

To disassemble unit, clamp outer tube lightly in vise and remove front plug (11), spring washers (10) and ball cap (9), then remove lock ring (12), sleeve (23), ball stud (24) and ball stud seat (22). On early units, remove grub screw (19—Fig. 14) and unscrew ball stud cap (8); on later units, remove spring clip (19A—Fig. 15), unscrew plug (8A) and remove ball stud cap (8B). Then, on all units, remove ball stud (7) and unscrew adapters (4) from unit.

On early units, refer to Fig. 14 and unscrew bearing (35) from rear end of tube, then withdraw piston rod (57) and piston assembly. With a wood dowel inserted from front end of tube against ball stud seat (20), drive the control valve unit and inner tube (29) out rear end of outer tube.

On late units, refer to Fig. 15 and unscrew bearing retainer (35B) from rear end of tube, then, insert wood dowel from front end of tube against ball stud seat (20) and drive the control valve and cylinder components from outer sleeve. Note: On late production units, an "O" ring is moulded inside outer tube; be careful not to damage this "O" ring as it is not serviced separately from outer tube.

On all units, proceed as follows: Separate inner tube from control valve body and if not already removed, remove piston rod, piston and bearing from inner tube. On four-wheel units, it is not necessary to remove collar (25) or dowel pins from rear end of control valve body. Pull inner sleeve and control valve spool from valve body and remove nut (28) to disassemble this unit. Remove snap ring (49) and push end plate (50) from rear end of valve body. Remove piston (56) from front end of piston rod then slide bearing and seal assembly from rod. Remove scraper (if fitted) and snap ring (51) from piston rod bearing, then remove seal components from bearing.

Carefully clean and inspect all parts for scoring, undue wear or other damage. Remove any burrs with crocus cloth. Take care not to remove any sharp edges from lands of control valve spool. Renew any parts which are questionable and reassemble unit as follows:

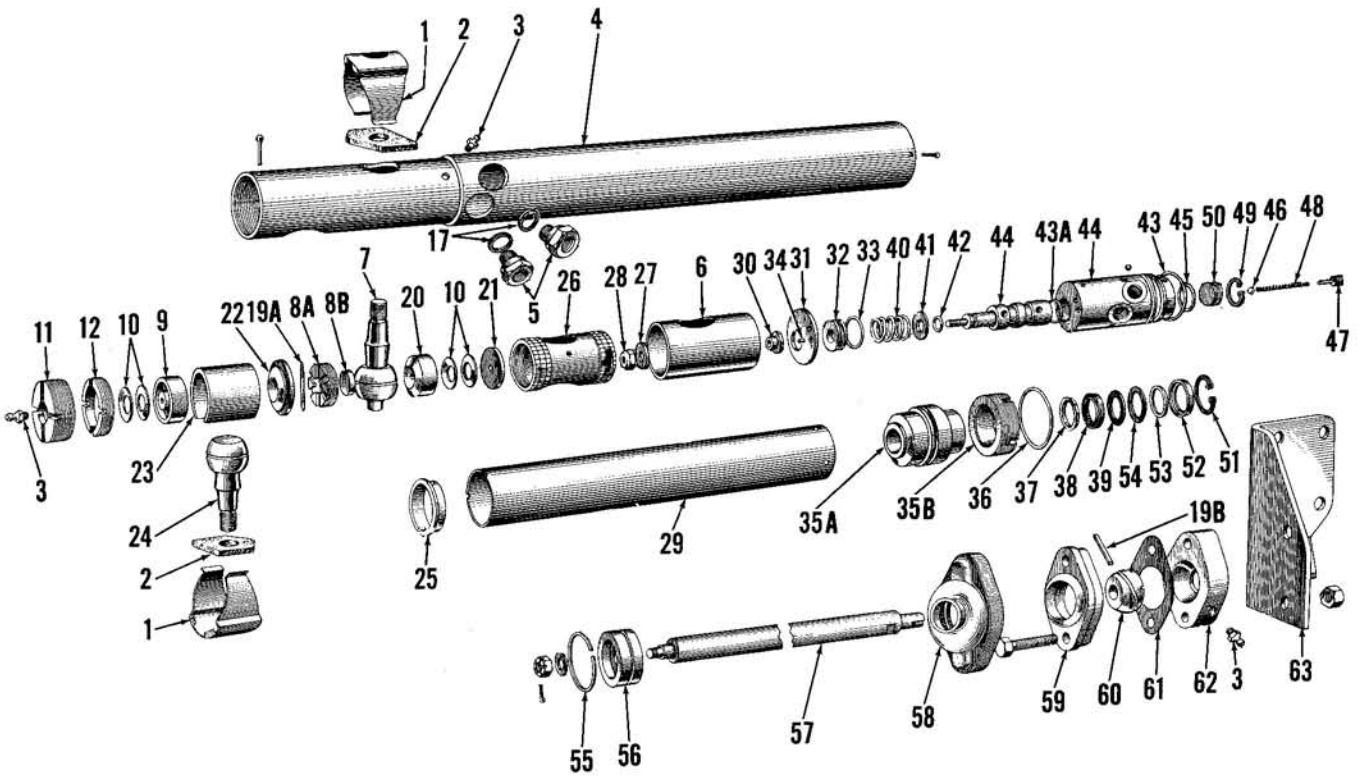


Fig. 15—Exploded view of later production power steering cylinder and control valve assembly for wide front axle models; cylinders for tricycle models are similar but are smaller in diameter. Refer to Fig. 14 for exploded view of earlier production unit.

1. Spring cover
2. Grease retaining pad
3. Grease fittings
4. Outer tube
5. Hose adapters
6. Locating sleeve
7. Manual ball pin
8A. Cup retainer
8B. Manual ball pin cup
9. Power ball pin cup
10. Belleville washer
11. End cover
12. Lock ring
17. Seals
19A. Retainer
19B. Pin
20. Manual ball pin cup
21. Back-up washer
22. Power ball pin cup
23. Spacer
24. Power ball pin
25. Locating collar
26. Operating sleeve
27. Washer
28. Self-locking nut
29. Inner tube
30. Collar
31. Spacer
32. Reaction ring
33. "O" ring
34. Dowel pin
35A. Bearing assembly
35B. Bearing retainer
36. "O" ring
37. Gland seal spacer
38. Gland seal
39. Vellumoid washer
40. Reaction spring
41. Washer
42. "O" ring
43. "O" ring
43A. "O" ring
44. Valve body & spool
45. "O" ring
46. Relief valve ball
47. Relief valve plug
48. Relief valve spring
49. Snap ring
50. End plug
51. Snap ring
52. Washer
53. Scraper
54. Washer
55. Piston ring
56. Piston
57. Piston rod
58. Rubber cover
59. Abutment cap
60. Anchor ball
61. Shim
62. Abutment spacer
63. Abutment bracket

30. Install new "O" rings (33 and 42) on reaction ring (32) and control valve spool, then lubricate component parts and reassemble washer (41), centering spring (40), reaction ring, spacer (31), collar (30) and inner sleeve (26) on spool and secure with washer (27) and nut (28). Note: Nut (28) on early units is self-locking; later units have castellated nut with cotter pin and access hole in inner sleeve (26) for installing pin. Tighten the nut to a torque of 10-16 Ft.-Lbs. and install cotter pin if so fitted. Be sure that the dowel pin is properly fitted in spacer (31) and inner sleeve. Install new "O" ring (43A) inside rear end of valve body (this "O" ring is not shown in Fig. 14), lubricate valve spool and bore and insert spool through valve body. Install check valve (46), spring and screw if removed from valve body.

Renew the piston rod (57) and anchor ball (60) as a unit if either part is damaged. Slide clamp (59) and rubber boot (58) over front end of rod, then refer to Fig. 16 for correct placement of seal components in piston rod bearing and proceed as follows: Install spreader (37) in bore of bearing, then use suitable sleeve to drive seal (38) into place. Slide scraper (DS), snap ring (51), seal seat (52), square seal (53), metal washer (54) and fiber washer (39) onto piston rod in proper order. Lubricate rod and inner bore of bearing, slide bearing onto rod and install seal components into bearing. Install piston and tighten retaining nut to a torque of 35-45 Ft.-Lbs.

Reassemble components into units as they were removed and install into outer tube. Be careful not to damage "O" rings on valve body and bearing as they are installed past threads on inside diameter of tube. Thread piston rod bearing or bearing retainer into rear end of tube until hose ports on control valve body are aligned with holes in outer tube. Reinstall components into front end of unit by reversing removal procedure. Spring washers (10) are installed in pairs with convex (rounded out) faces together. Tighten lock ring (12) to clamp all units together, then install ball stud cup, spring washers and front end plug. Secure end plug and bearing or bearing retainer with cotter pins. Note: Ball stud tension is adjusted by turning plug (11 and 8 or 8A) in tight, then backing off ¼ turn. Secure plug with cotter pin and grub screw or spring clip as fitted.

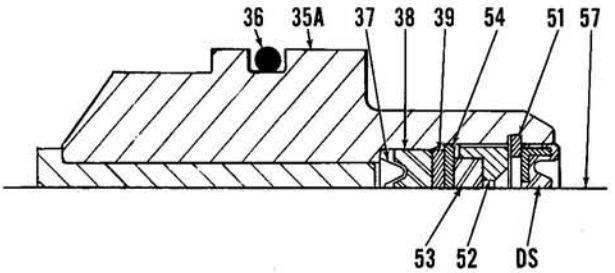


Fig. 16 — Cross-sectional view of late type bearing assembly (35A—Fig. 15) showing seal installation and also outer dust seal (DS) not shown in Fig. 15. Refer to Fig. 15 for remainder of legend.

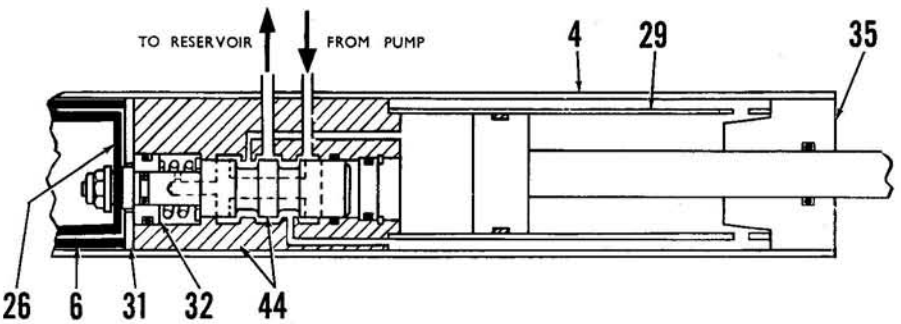


Fig. 17—Cross-sectional view of cylinder and control valve assembly. Refer to Figs. 14 and 15 for legend.

ENGINE AND COMPONENTS

R&R ENGINE AND CLUTCH ASSEMBLY

All Models

35. To remove engine, first drain cooling system and, if engine is to be disassembled, drain oil pan. Remove air pre-cleaner, vertical exhaust muffler and the rear hinge for hood, then lift hood from tractor. Disconnect radiator hose. Remove the battery or batteries. Remove tool box from left side frame and, if so equipped, remove horizontal (underneath) exhaust pipe and muffler. Disconnect air cleaner to intake manifold hose and, on later production, the air cleaner to rocker arm cover hose. Disconnect starter motor actuating rod at starter. Disconnect wiring from starter motor, generator, oil pressure switch (late production) and headlights, remove wiring loom clips and roll wiring back out of way. Remove water temperature gage bulb from cylinder head, release tube clips and coil bulb and tube back out of way. Disconnect proofmeter drive cable, if so equipped, at auxiliary drive or from rear of fuel injection pump. Shut off fuel supply valve and disconnect line to fuel pump. Disconnect oil pressure gage tube (early production) from cylinder block, excess fuel return line from cylinder head, throttle control rod from cross-shaft (early production) or from injection pump (late FSM) and disconnect engine stop cable from injection pump. Unbolt radiator top brace (not used on "FSM"). Remove radiator shutter operating rod on early "FMD."

If engine is being overhauled, remove engine oil filter, starter, generator, fuel filter(s), fuel lift pump, fuel injection pump, intake manifold and vacuum governor tubes and the exhaust manifold. Note: Late "FSM" has fuel injection pump with integral mechanical governor.

On manual steering models, disconnect drag link at either end. On power

steering models, disconnect drag link from steering gear arm, remove steering cylinder bracket from side frame, disconnect steering cylinder from spindle arm and unbolt pump and reservoir assembly from engine. This removes the power assist steering system without disconnecting lines or draining system.

On wide front axle models, proceed as follows: Drive wedges between front axle and front support. Block up under transmission and attach hoist to engine. Remove fan blades from water pump. Unbolt engine and side frames from transmission; be sure to remove the engine to transmission bolts located under each side frame. Roll engine and front axle unit forward until clear of transmission. Support front axle and right side frame and remove left side frame from engine and front support. Remove radius rod to oil pan pivot pin. Unbolt engine front plate from right side frame, move engine to left until clear of radius rod, lift engine higher and roll the front axle, radiator and right side frame unit forward. Mount engine on work stand.

On tricycle models, proceed as follows: Block up under transmission and attach hoist to front pedestal and side frames. Unbolt side frames from transmission and engine front plate and loosen side frame to pedestal bolts. Roll the pedestal, radiator and side frame unit forward until clear of tractor and lower rear end of side frames to floor. Attach hoist to engine, then unbolt and remove engine and clutch assembly from transmission.

CYLINDER HEAD

All Models

36. **REMOVE AND REINSTALL.** To remove cylinder head, first drain cooling system, remove air pre-cleaner, vertical exhaust muffler and rear hood hinge, then lift engine hood from tractor. Disconnect upper radiator hose, unbolt radiator upper brace and remove thermostat housing. Disconnect air tube from between rocker arm cover and intake manifold or inlet pipe of air cleaner. Remove decompressor lever at front end of rocker arm cover if so equipped. Note: Decompressor lever seal in rocker arm cover may be renewed at this time. Remove rocker arm cover. On any valves that are closed, push rocker arms aside and withdraw push rods. Turn engine so that remaining valves are closed and remove push rods in similar manner.

If early model "FMD" with compressor lever in rear end of cylinder head is encountered, disconnect compressor lever at rear end of rocker arm shaft.

Unbolt and remove rocker arm assembly. Remove fuel filter and disconnect excess fuel return line from cylinder head and immediately cap all openings. Although not required for cylinder head removal, it is good procedure to remove fuel injector assemblies. Disconnect the excess fuel return (leak-off) line from each injector and at connection to cylinder head, then remove line. Remove injector retaining cap screws and lift fuel injectors from cylinder head with screwdriver.

Note: Be careful not to drop leak-off line or injector retaining cap screws inside engine.

On models with vacuum governor, disconnect the governor tubes from intake manifold and injection pump, then remove the tubes. Disconnect throttle control rod from throttle shaft arm on intake manifold.

On all models, unbolt and remove intake and exhaust manifolds from cylinder head, then unbolt and remove cylinder head from block. CAUTION: If fuel injectors have not been removed, be sure to lift cylinder head straight up from block and handle the removed head with care in order not to damage the injector tips that protrude through bottom face of head.

Prior to reinstalling cylinder head, check cylinder liner (sleeve) protrusion as outlined in paragraph 79 and shim sleeves to proper height if necessary. Place new rocker shaft oil passage seal ring in recess in face of cylinder block. Refer to paragraph 38 for proper cylinder head gasket to use and proceed as follows: If installing copper faced gasket, lightly coat both sides of gasket with sealer to within $\frac{3}{16}$-inch of gasket openings; do not apply gasket sealer to composition gasket. Use guide studs (S—Fig. 19) or ring dowels (D) to locate gasket, install cylinder head and tighten retaining cap screws to a torque of 85-90 Ft.-Lbs. in sequence shown in Fig. 18. Reinstall injectors, if removed, as outlined in paragraph 131. Tighten manifold bolts to torque of 20-25 Ft.-Lbs. Note: A joint sealing compound was used to seal manifolds to cylinder head during factory production of some models; however, gaskets are available for service installation of manifolds.

Complete reassembly by reversing removal procedure. Adjust valve gap cold to 0.015 on intake valves and 0.012 on exhaust valves. Bleed diesel

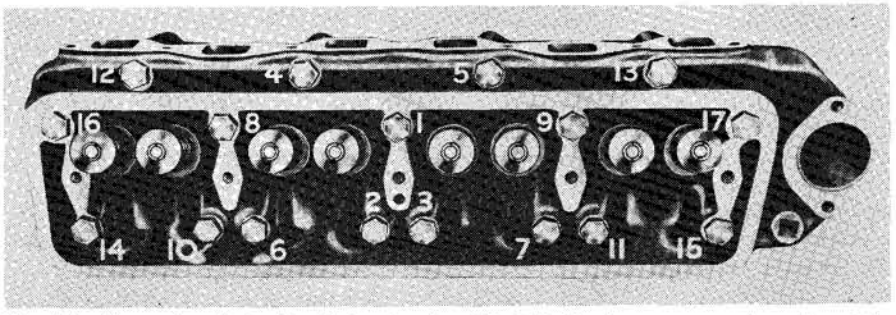


Fig. 18—View of cylinder head showing head bolt tightening sequence for all models. When removing cylinder head, bolts should be loosened in reverse of sequence shown; that is, loosen No. 17 first and No. 1 last.

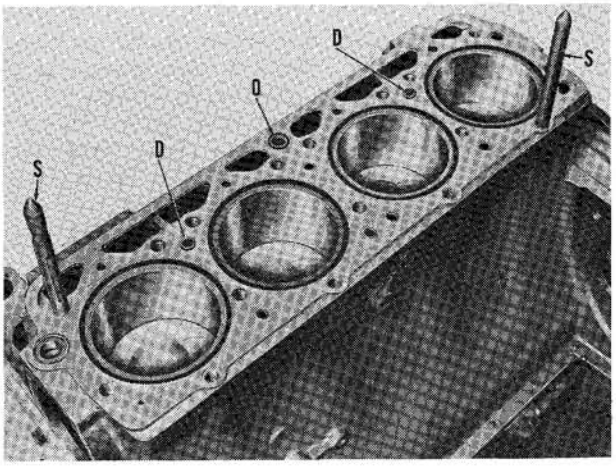


Fig. 19—Prior to fitting cylinder head gasket to cylinder block, be sure to install new sealing ring (O) in recess in top face of block at rocker arm shaft oil feed hole. Align gasket on dowels (D) and use guide studs (S) so that cylinder head will set down squarely over the dowels. Note: Dowels not used on model "FMD" and early "FPM".

fuel system as outlined in paragraph 107, start engine and run until coolant temperature is 180° F. Then, retighten cylinder head cap screws to a torque of 85-90 Ft.-Lbs. and readjust valve gap hot to 0.015 on intake valves and 0.012 on exhaust valves.

37. RENEW CYLINDER HEAD. Early type cylinder head with decompressor lever at rear is no longer available. To renew with later production cylinder head, a later rocker arm cover and front mounted decompressor lever must be installed. Refer to current Ford tractor parts catalog for list of necessary parts.

Only two cylinder heads will be serviced. One cylinder head, Ford part No. E1ADDN-6052-S, is used to service all early engines with sealed crankcase ventilation system and offset intake and exhaust ports in head and manifolds. Another cylinder head, Ford part No. E1ADDN-6052-J, is used to service all engines with oil bath breather on timing gear cover and suction pipe between rocker arm cover and inlet pipe of air cleaner. This later type cylinder head has intake and exhaust ports in line.

38. **CYLINDER HEAD GASKET.** Three different cylinder head gaskets are available for service. Recommended usage is as follows:

A 0.6 mm. (0.0236 in.) thick composition gasket, Ford part No. E1ADDN-6051-D, is available for use with plain top sleeves and low crown pistons (more than 0.008 below face of block).

A 1.0 mm. (0.039 in.) thick composition gasket, Ford part No. E1ADDN-6051-E, is available for use with cylinder sleeves having small diameter spigot (extension) and/or high crown pistons.

A thick copper faced gasket, Ford part No. E1ADDN-6051-C, is for installation with cylinder sleeves having large diameter spigot (extension), but can be used instead of composition gasket with any sleeve. Refer also to paragraphs 76 and 79.

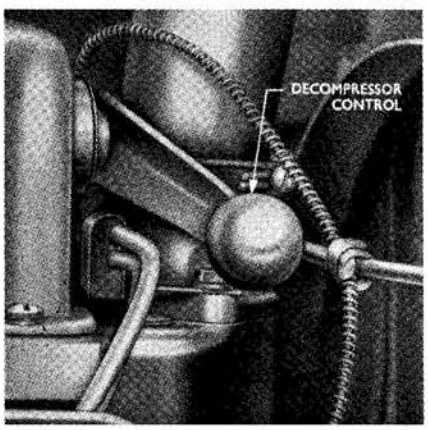


Fig. 20 — Decompressor control lever at front end of rocker arm cover must be removed before removing rocker arm cover.

ROCKER ARMS AND SHAFT

All Models

39. **R&R ROCKER ARM SHAFT ASSEMBLY.** To remove rocker arm shaft and rocker arms assembly, proceed as follows: With right side of hood lifted, disconnect vacuum tube from rocker arm cover and intake manifold on early "FMD" or from rocker arm cover and inlet pipe of air cleaner on later models. Remove decompressor lever at front end of rocker arm cover if so equipped, then remove cover from cylinder head. On all valves that are closed, push rocker arms aside and lift push rods from engine. Turn engine by hand to that remaining valves are closed and remove remaining push rods in same manner. On early production model "FMD" with decompressor handle in rear end of cylinder head, disconnect handle from lever at rear end of rocker shaft. Then, on all models, unbolt and remove the rocker arm assembly. Note: On models with decompressor lever at front of rocker assembly, be careful not to lose the detent ball and spring from between front support and the control plate while handling the assembly.

To reinstall rocker arm and shaft assembly, proceed as follows: Install the assembly with the five cap screws and lock tab washers or lock washers. Tighten the cap screws evenly and securely and if lock tab washers are used, bend tabs against cap screw head. Reconnect rear mounted decompressor lever to handle if so equipped. Push the rocker arms aside, insert push rods in engine, seat rocker arm ball socket in push rod and move rocker arm back over valve. Note: Turn engine slightly by hand, if necessary, to bring camshaft lobe to correct position to slide rocker arm over valve stem. Adjust valve gap cold to 0.015 on intake valves and 0.012 on exhaust valves. Start engine and run until coolant temperature reaches 180° F., then readjust valve gap hot to 0.015 on intake valves and 0.012 on exhaust valves. Reinstall rocker arm cover and if so equipped, front mounted decompressor lever.

40. **OVERHAUL ROCKER ARM SHAFT ASSEMBLY.** With rocker arm shaft assembly removed as outlined in paragraph 39, proceed as follows:

On models without decompressor, remove the jam nuts and set screws from intermediate rocker arm supports. On late model "New FSM", slide the rocker arm supports, rocker arms and springs from shaft. On earlier models, first remove securing pin and plug from end of shaft.

On models with decompressor, each pair of rocker arms ride on an eccentric sleeve that is keyed to the shaft. On models with front mounted decompressor lever, set shaft assembly on rear end, push down the front rocker arm shaft support and remove the detent ball, spring and pin as shown in Fig. 21. Refer to Fig. 22 for exploded view of assembly. Early model FMD with rear mounted decompressor can be disassembled in similar manner.

Check rocker arm shaft, rocker arms, eccentrics (models with decompressor) and springs against the following values:

Models Without Decompressor

Shaft diameter	0.743-0.744
Clearance between rocker arm and shaft	0.001-0.003
Spring free length	1.51
Pressure @ 1.06 inches	4-5 Lbs.

Models With Decompressor

Clearance between eccentric and shaft	0.0005-0.0035
Clearance between rocker arms and eccentric	0.0007-0.0029
Spring free length	1.89
Pressure @ 1.06 inches	4-5 Lbs.

Renew rocker arms, shaft and/or eccentrics if excessively worn or scored and renew the springs if rusted, distorted or if they do not meet specifications.

Rocker arms for early model "FMD" engines (prior to serial No. 1481091) are $\frac{3}{16}$-inch longer on adjusting screw end than later engines and arms are not interchangeable. Later

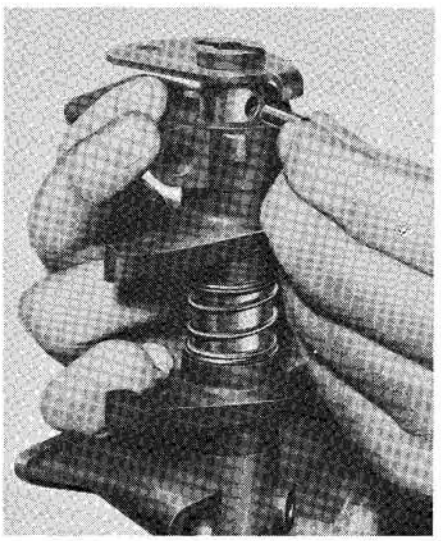


Fig. 21—To disassemble rocker arm assembly, set rocker arm on end and push front support down to allow removal of pin.

type eccentric sleeve with identification dimple on outside diameter may be used with early engines, but early type sleeves without identification dimple can be used only on engines prior to serial No. 1481091.

VALVES AND VALVE SEATS

All Models

41. Intake and exhaust valves seat on renewable seat inserts in cylinder head. Face angle for all valves on all models is 29½ degrees and seat angle is 30 degrees resulting in a ½ degree interference angle. Seat width should be 3/64 to 1/16-inch.

Standard intake valve seat outside diameter is 1.8900-1.8905 and seat thickness is 0.2175-0.2195. Intake valve seats are available in 0.010 oversize outside diameter as well as standard size.

Standard exhaust valve seat outside diameter is 1.7020-1.7025 and seat thickness is 0.2175-0.2195. Exhaust valve seats are available in 0.010 oversize outside diameter with standard seat thickness and in 0.020 oversize outside diameter with 0.010 oversize thickness as well as in standard size.

Both the intake and exhaust valve seats should have an interference fit of 0.0045-0.0060.

Valve stem diameter (new) is 0.373-0.374 for intake valves and 0.3723-0.3733 for exhaust valves. Valve stem to guide clearance should be 0.001-0.003 for intake valves and 0.0017-0.0037 for exhaust valves. Maximum alowable clearance is 0.006 for intake valves and 0.008 for exhaust valves.

When renewing exhaust valves on early models, note groove for spring retainer collets (keepers) in valve stem. If lower shoulder is tapered, new spring retainer, collets and rotor cap must be installed as only late type exhaust valve with square lower shoulder on collet groove is available for service. Refer to Figs. 23 and 24.

NOTE: At serial No. 1425097, diameter of the exhaust valve rotor cap was increased to 0.575-0.580 and exhaust valve spring retainer and collets were changed to accomodate the larger diameter rotor caps. Therefore, if necessary to renew an exhaust valve spring retainer, collets or rotor cap, the correct mating retainer, collets and/or rotor cap must be installed. Part numbers for late parts are as follows:

Rotor cap DDN-6550-B
Retainer DDN-6514-B
Collets DDN-6518-B

After renewing valve and/or valve seats, the protrusion of the valve face above machined surface of cylinder head should be checked. If valve protrudes more than 0.034, the valve should be refaced or the valve seat reground to bring valve protrusion below 0.034.

VALVE GUIDES

All Models

42. Valve guide I.D. should be 0.375-0.376. Renew the valve guides if excessively worn. Press old guides out towards bottom of cylinder head and new guides in from top of cylinder head to dimension shown in Fig. 25 for intake and Fig. 26 for exhaust valves.

Service intake and exhaust valve guides are identical although early exhaust guides were shorter than the intake valve guides.

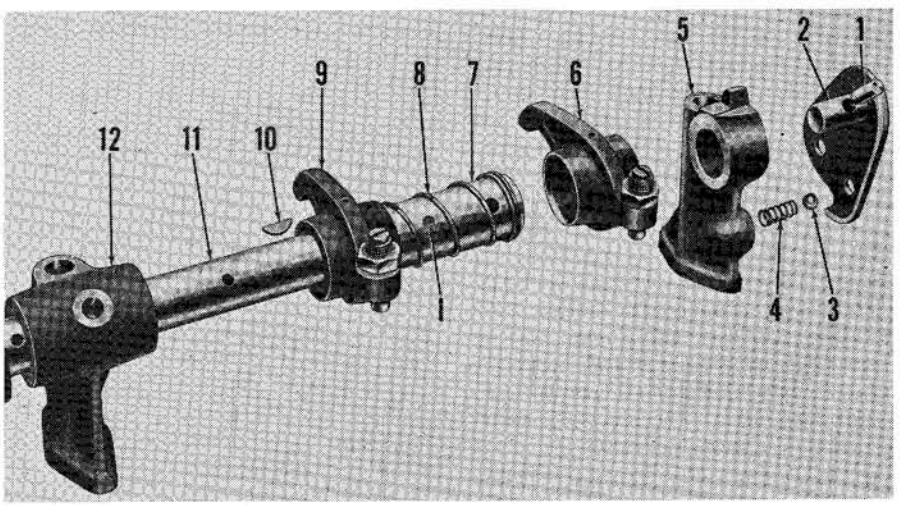


Fig. 22—Exploded view of rocker arm assembly on models with front mounted decompressor lever. Late model "New FSM" will have rocker arms with self-locking adjusting screws instead of screw and lock nut shown. Eccentrics (7) with indent (1) can be used on all models with decompressor; earlier models had higher eccentric.

1. Pin
2. Detent plate
3. Detent ball
4. Detent spring
5. Front support
6. Rocker arm, R.H.
7. Eccentric
8. Spacer spring
9. Rocker arm, L.H.
10. Woodruff key
11. Rocker arm shaft
12. Intermediate support

VALVE STEM SEALS

All Models

43. New umbrella (cup) type valve stem seals (Ford part No. EOTA-6571-C) should be installed on both the intake and exhaust valve stems before installing valve springs and retainers.

EXHAUST VALVE ROTATORS

All Models

44. Refer to Figs. 23 and 24. The exhaust valves are fitted with free spin type valve rotator caps which will not function unless there is a gap between end of valve stem and inside face of rotator cap when the open end of cap contacts the spring retainer collets (keepers) as shown. Desired gap is 0.001-0.003. The gap can be measured wtih special micrometer gages or as follows:

45. Cut from 0.010 thick shim stock, a disc that will fit into rotaor cap.

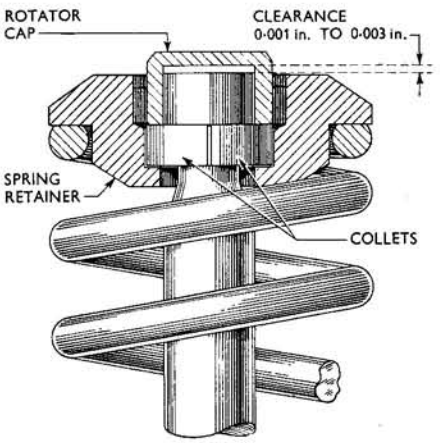


Fig. 23 — Cross-sectional view of earlier type exhaust valve spring retainer, rotator cap and collets. Clearance between end of stem and inside of rotator cap should be 0.001-0.003.

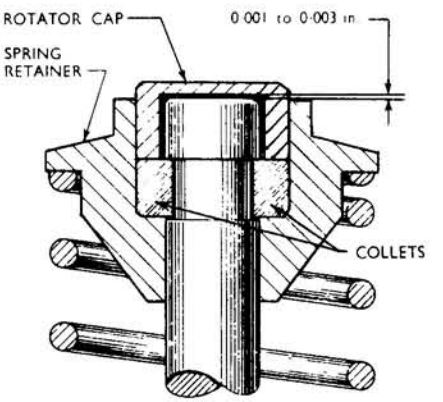


Fig. 24—Cross-sectional view of late type exhaust valve spring retainer, rotator cap and collets. Note square lower shoulder in valve stem versus tapered lower shoulder of valve stem groove in Fig. 23. Clearance between valve stem and rotator cap should be 0.001-0.003.

With disc (G) installed as shown in Fig. 24A, place the spring retainer collets (keepers) in groove of valve stem and measure the gap (x) between collets and rotor cap with feeler gage while pressing down against the collets. Subtracting the measured gap from shim thickness (0.010) will give rotor to valve stem gap. If gap is less than 0.001, grind end of valve stem squarely to obtain desired 0.001-0.003 clearance. If gap is more than 0.003, lap open end of cap to reduce the clearance.

VALVE SPRINGS

All Models

46. Intake and exhaust valve springs are interchangeable; however, two different valve springs will be encountered. Specifications are as follows:

Part No. DKN-6513-B (Early):

Spring color ..... Silver gray
Number of coils 8.8
Free length, inches 2.48
Lbs. force exerted @ length of 1.98 inches 45-50

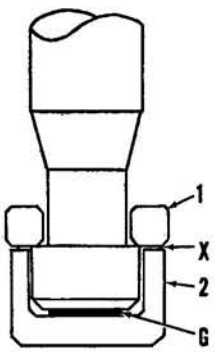


Fig. 24A—Feeler stock method of checking end clearance between rotator cap and end of valve stem. Preferred method utilizes a special micrometer.

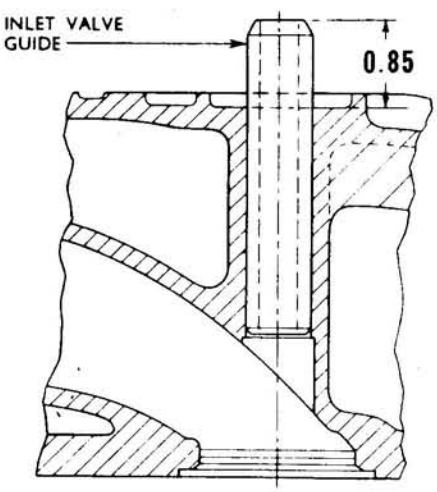


Fig. 25—Press intake (inlet) valve guide into cylinder head so protrusion above machined spring seat is 0.85 inch as shown.

Part No. DDN-6513 (Late):

Spring color ..... Black
No. of coils 7.5
Free length, inches 2.31
Lbs. force exerted @ length of 1.98 inches 62-68

If the late spring (Part No. DDN-6513) is used for intake valves on earlier cylinder head, spring seat in head must be re-machined and a larger spring retainer installed to accommodate the larger diameter spring. Also, when used to renew earlier exhaust valve spring, larger exhaust valve spring spacer and retainer must be installed. Refer to paragraph 47.

When a camshaft with late type cam profile (refer to paragraph 56) is installed in an engine prior to serial No. 1609839, the late type valve spring and corresponding parts should also be installed.

EXHAUST VALVE SPRING SPACERS

All Models

47. Spacers are fitted under the exhaust valve springs. With smaller diameter early type spring (Ford part No. DKN-6513-B), use Ford part No. E1-CP-9. With late spring (part No. DDN-6513), a hardened spacer of larger diameter (part No. 510E-6515) is used. Spacers can be identified as shown in Fig. 27.

TIMING GEAR COVER

All Models

48. To remove timing gear cover, proceed as follows: Drain cooling system, remove vertical exhaust muffler pre-cleaner and engine hood. Disconnect radiator hoses and headlight wiring and, except on late models, disconnect radiator shell brace from engine. Disconnect radiator shutter control if so equipped. Drive wedges between front axle and front support. Unbolt radius rod from front axle, remove pivot pin from radius rod and oil pan and bump radius rod to one side until it clears pan. Disconnect steering drag link. Support front end of tractor under engine and unbolt side rails from engine front plate and at rear end, then roll the front assembly forward. Loosen the power steering drive belt on models so equipped, then remove generator and belts. Unscrew crankshaft pulley retaining cap screw (ratchet) from crankshaft, then remove crankshaft pulley. Unbolt and remove the timing gear cover.

With the timing gear cover removed, the crankshaft front oil seal can be renewed as outlined in paragraph 90.

To reinstall timing gear cover, reverse removal procedure. Tighten cover retaining cap screws to a torque of 12-15 Ft.-Lbs.

TIMING GEARS

All Models

49. The timing gear train consists of four gears; the crankshaft gear, camshaft outer gear which mates with crankshaft gear, the camshaft inner gear which drives the auxiliary driveshaft gear and the auxiliary driveshaft (fuel injection pump drive) gear. Desired backlash of any two gears is 0.003-0.004.

Due to production and service changes, it is necessary to consider several factors affecting parts procurement when renewing any timing

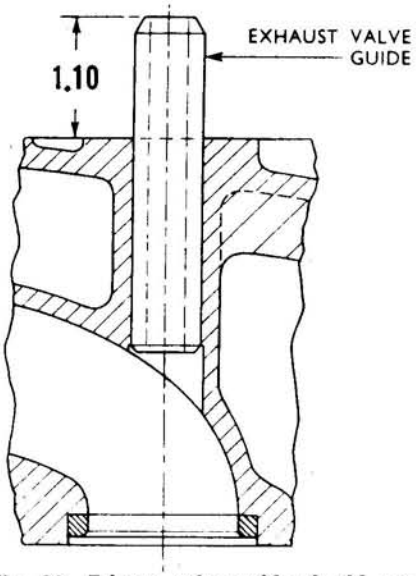


Fig. 26—Exhaust valve guide should protrude 1.10 inch above cylinder head as shown. Note: Intake and exhaust valve guides are alike but are installed to different protrusion above cylinder head.

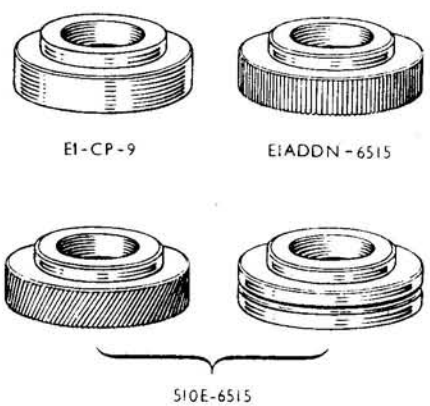


Fig. 27 — Views of the different exhaust valve spring spacers used. Latest spacer (part No. 510E-6515) is identified by diagonal knurling or by groove. Spacers without knurling or groove (part No. E1-CP-9) are used with small diameter spring. Spacers with straight knurling (DDN-6515) are no longer used.

gear. Refer to the paragraphs 50 through 53 for parts procurement information and service procedures.

CAUTION: Latest production camshaft gears are retained by a single cap screw and plate; when loosening this cap screw, torque must not be transmitted through the gear teeth. Hold the camshaft gears by applying a suitable spanner to the gear spokes while loosening or tightening the cap screw.

Also, it is very important that neither the camshaft or crankshaft are turned after removing camshaft gears on any model. The fuel pump lobe on camshaft may contact the No. 4 connecting rod causing serious damage.

To prevent damage to gears or shafts, the auxiliary driveshaft gear and the camshaft gears should be heated for installation. Gears can be heated by immersing in boiling water for approximately one minute, or by marking the gear with a 200° F. temperature indicating crayon and then heating gear by other means until crayon mark liquifies.

50. TIMING GEAR WIDTH. Two different widths of timing gears have been used. Mating gears must be of the same width; as only wider gears are available for service, it will be necessary when renewing a narrow gear to install a wider mating gear. Refer to the following for identification of timing gears by width:

TIMING GEAR WIDTH

Gear	Previous Width	Current Width
Crankshaft	0.808-0.818	0.920-0.930
Camshaft Outer	0.807-0.817	0.928-0.938
Camshaft Inner	0.810-0.815	0.935-0.940
Auxiliary Driveshaft	0.810-0.815	0.925-0.930

NOTE: Other factors besides gear width will affect parts procurement and service procedures, refer to the following paragraphs:

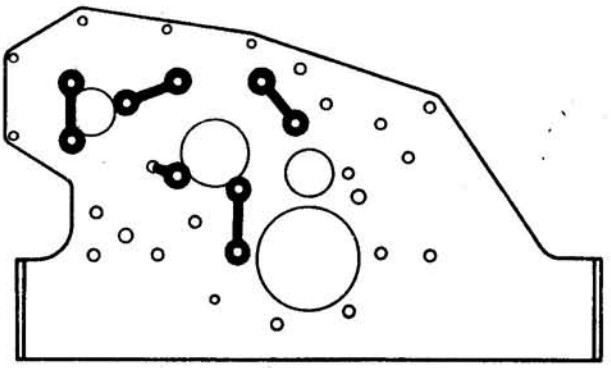


Fig. 29—When reinstalling engine front plate, place new cap screw locks in position shown. Refer to Fig. 30 for tightening torque sequence and to Fig. 31 for tightening torque values.

51. CRANKSHAFT GEAR. The wide crankshaft gear is available with two bore diameters: Latest crankshaft (Ford Part No. DDN-6303-F) is stepped at front end and requires large bore gear (Ford Part No. DDN-6306-B). All prior crankshafts will require smaller ID gear (Ford Part No. DDN-6306-A).

On all models, crankshaft gear is a press fit on shaft and is keyed; be sure new gear is installed with timing mark out. Refer to paragraph 50 for gear selection.

52. CAMSHAFT GEAR. Wide camshaft gears are available in two hub types. Early gears were located by a dowel pin as shown in Fig. 33, and retained to camshaft by three cap screws and a locking plate. On late models, gears are keyed to shaft and retained by a single cap screw as shown in Fig. 34. Camshaft and gear hub was changed at "FSM" serial number 1599502. Because camshaft may have been renewed in earlier models, note gear type before ordering parts.

When installing wide gear set in place of narrow outer gear, it may be necessary on some models to install a new auxiliary driveshaft oil slinger (Ford Part No. E45-CG-9) to eliminate interference with the wide camshaft gear.

On models with three retaining cap screws, be sure hardened locking plate (Ford Part No. DDN-6258) and hardened cap screws (Part No. 118844-ESB) are used, tighten cap screws to a torque of 18-21 Ft.-Lbs. and secure with locking wire. Refer to paragraph 50 for gear selection.

On models with keyed hub, heat gears as outlined in paragraph 49 for easier installation. Hold camshaft gear from turning, using a suitable spanner, and tighten the single cap screw to a torque of 95 - 100 Ft.-Lbs. CAUTION: Do not transmit tightening torque through gear teeth.

53. AUXILIARY DRIVESHAFT GEAR. The wide auxiliary driveshaft gear is available with two hub bore diameters: The large bore gear (Ford Part No. E84-CP-9) is a service gear for use instead of the narrow production gear on models before "FSM" serial number 1599502. The small bore gear was installed in production, effective with the given serial number.

On all models, heat gear as outlined in paragraph 49 for easier installation, and tighten shaft nut to a torque of 60-70 Ft.-Lbs. Refer to paragraph 50 for gear selection.

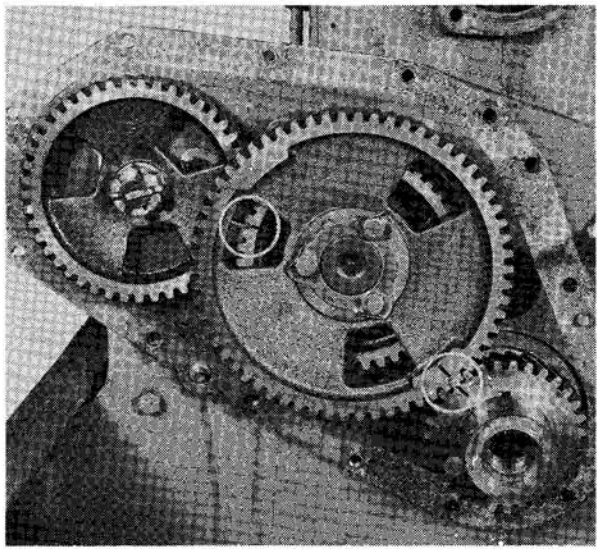


Fig. 28 — View showing location of timing marks on timing gears. Early model "FMD" is shown; however, timing marks are alike for all models.

ENGINE FRONT PLATE

All Models

Where necessary to renew the engine front plate, correct new plate must be selected by camshaft usage and serial number range.

On model "FMD" prior to serial No. 1425097, use part No. DKN-6030-C if engine is equipped with camshaft having gears retained by three cap screws and a dowel pin; if camshaft gears are retained by key and single cap screw, use front plate part No. DDN-6030-B.

On model "FPM" and model "FSM" prior to serial No. 1599502, use part No. DKN-6030-D if equipped with

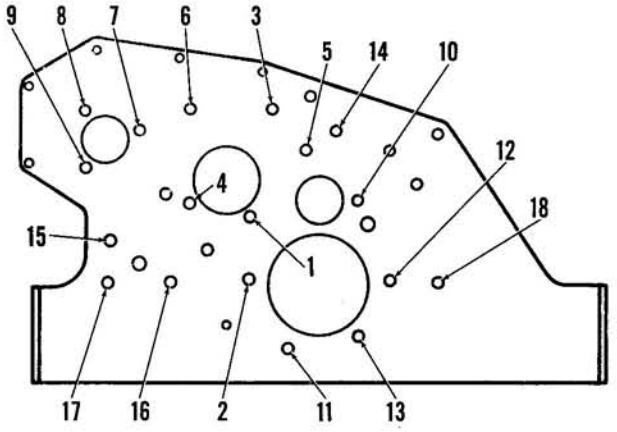


Fig. 30 — Tightening torque sequence for engine front plate retaining cap screws. Note that bolts numbered in sequence from 10 through 18 are tightened after timing gear cover is installed as they are also cover retaining cap screws. Tightening sequence of un-numbered timing gear cover retaining cap screws is unimportant after tightening 10 through 18.

camshaft having gears retained by three cap screws and a dowel pin; if camshaft gears are retained by key and single cap screw use front plate part No. DDN-6030-A.

On model "FSM" serial No. 1599502 and later and on model "New FSM," use front plate part No. DDN-6030-A.

54. **R&R ENGINE FRONT PLATE.** The engine front plate can be unbolted and removed after removing the timing gear cover as outlined in paragraph 48, the camshaft gears as outlined in paragraph 52, the auxiliary driveshaft gear as in paragraph 53 and the generator front bracket. It is not necessary to remove crankshaft gear.

It should be noted that there are two types of oil pan (sump) front packing strips and four types of engine front plate gaskets. A different front plate gasket is required according to type of camshaft gear retention and the latest types of camshaft gear retention and the latest gasket of each type extends below the front packing strip. Thus, packing strip used with later gaskets must be thinner as the strip contacts the rear side of the gasket instead of extending forward far enough to contact rear face of engine front plate. Only the later type thin packing strip (part No. DDN-6707) can be used with the later type gaskets (part No. DDN-6K000-A if camshaft gears are retained by three cap screws or part No. DDN-6K000-C if gears are retained by single cap screw).

When installing front plate on model "FMD" prior to serial No. 142-5097 equipped wtih camshaft having gears retained by single cap screw, note that the shouldered cap screws (133637-ES2) are used in position shown at (2—Fig. 31). On all model "FMD" tractors prior to serial No. 1425097, tighten cap screws in sequence shown in Fig. 30 and to a torque of 15-17 Ft.-Lbs.

On model "FMD" serial No. 1425097 and later, tighten cap screws at position shown at (2—Fig. 31) to a torque of 22-24 Ft.-Lbs. and all other cap screws to a torque of 15-17 Ft.-Lbs. Be sure to tighten cap screws in sequence shown in Fig. 30.

NOTE: Be sure to install new locking plates for the engine front plate retaining cap screws as shown in Fig. 29 and bend plates against cap screw heads after they are properly torqued.

CAM FOLLOWERS (VALVE TAPPETS)

All Models

55. The mushroom type tappets ride directly in unbushed bores in cylinder block and can be removed after removing engine camshaft as outlined in paragraph 59. Chilled cast tappets were used after serial No. 1358273; refer to Fig. 32 for identification of the early non-chilled tappets and the later chilled cast tappets. Tappet diameter (new) is 0.6070-0.6075; desired clearance is 0.0015-0.003 with wear limit of 0.005.

CAMSHAFT AND BEARINGS

A number of changes have been made in both production and service camshafts and related parts. As many early production engines may have been modified by installation of later parts, it is necessary to be able to identify camshaft and related parts in order to follow correct servicing procedure on a particular engine.

Model "FMD"

56. At serial No. 1358273, a camshaft with chilled lobes and chilled cast tappets (cam followers) were introduced. Refer to Fig. 32. When renewing early model "FMD" camshaft; early type tappets must be renewed using the later type. Check for interference between rounded portion of tappets and cylinder block and grind material from cylinder block if necessary. A new camshaft must not be installed with the early type tappets; only the late type chilled tappets are available for service.

At serial No. 1425097, a "high lift" camshaft was introduced.

To renew camshaft in engine prior to serial No. 1425097, use Ford part No. DDN-6251-C unless engine has been previously modified by installing camshaft with gears retained by key and single cap screw; use Ford part No. DDN-6250-D in modified engine. Refer to note following paragraph 58 regarding valve springs.

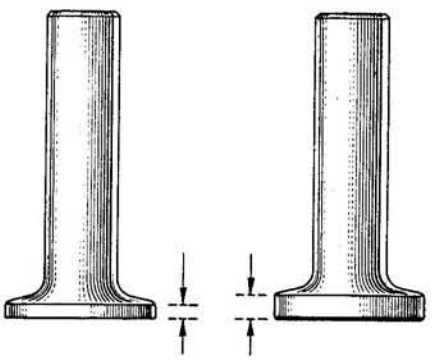


Fig. 32—If early type tappets (left) with 0.150-0.170 thick foot are encountered when renewing camshaft, the tappets must also be renewed using chilled cast tappets (right) with 0.197-0.217 thick foot.

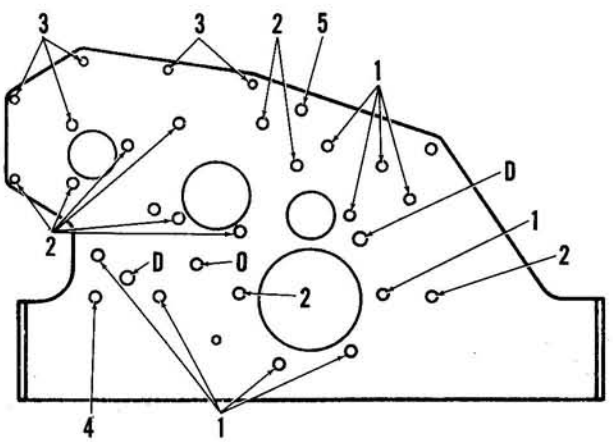


Fig. 31 — Prior to serial No. 1425097 (model "FMD"), tighten all cap screws to a torque of 15-17 Ft.-Lbs. On later models and service blocks having ⅜-inch diameter cap screws at locations marked (2), tighten the ⅜-inch cap screws only to a torque of 22-24 Ft.-Lbs. and all other (1, 3, 4 and 5) to a torque of 15-17 Ft.-Lbs. Dowel pins are located at (D); oil orifice or oil pressure relief valve is at (O). Cap screws (1) are 1⅛ inch long; (2, 3 and 4) are ¾-inch long and (5) is 1½ inches long.

To renew camshaft in model "FMD" engine serial No. 1425097 and up, use Ford part No. 528E-6251-C unless engine has been previously modified by installing camshaft with gears retained by key and single cap screw; use Ford part No. 528E-6250-D in modified engine. Refer to note following paragraph 58 regarding valve springs.

NOTE: For a period of time, camshaft to be used with timing gears retained by three cap screws and a dowel pin (see Fig. 33) was not available for service making it necessary to modify engine by installing later camshaft (see Fig. 34) with gears retained by key and single cap screw. As a special service camshaft and improved "three bolt" camshaft gears are now available for service, it is not necessary to modify engine for later type camshaft. However, if conversion to later type camshaft and gears is desired, parts required are listed in the "Fordson Major Tractor Parts List."

Model "FPM"

57. With the introduction of the model "FPM" at serial No. 1481090, camshaft used in early model "FMD" engine was reinstated and rocker arm length was decreased approximately $\frac{3}{16}$-inch at adjusting screw end to compensate for the decreased cam lift.

To renew camshaft in model "FPM" engine, use Ford part No. DDN-6251-C unless engine has been previously modified by installation of camshaft with gears retained by key and single cap screw; use Ford part No. DDN-6250-D in modified engine. Refer to note following pararagraph 58 regarding valve springs.

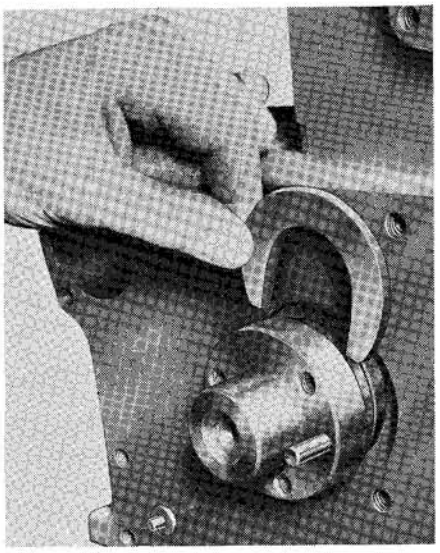


Fig. 33—Timing gears were retained to earlier type camshaft with three cap screws and dowel pin and camshaft end thrust was taken by split or horseshoe type washer fitted into groove in camshaft. Refer to Fig. 34 for later camshaft and timing gear arrangement.

Model "FSM"

58. Early model "FSM" engine was equipped with same camshaft as previous model "FPM" engine; refer to paragraph 57.

At serial No. 1599502 a new camshaft was introduced, with gears retained by key and single cap screw. At the same time, method of controlling camshaft end play was changed requiring a new engine front plate. Also, the auxiliary driveshaft, driveshaft gear, front bearing and fuel injection pump drive coupling flange were changed. The new timing gears were wider than previous gears; refer to paragraph 50.

At serial No. 1609839, the camshaft lobe profile was changed to an improved form. Camshafts installed in factory production between serial numbers 1699502 and 1609839 are either identified by the words "Old Form" stamped on rear end of shaft or by the letters "O. F." stamped on front end of shaft to denote old type cam profile. This type camshaft was never available for service installation.

To renew the camshaft in all models after serial No. 1599502, use Ford part No. DDN-6250-D. On model "FSM" prior to serial No. 1599502, use Ford part No. DDN-6251-C unless engine has been modified by installing late type camshaft with gears retained by key and single cap screw; use part No. DDN-6250-D in engines so modified. On engines prior to serial No. 1609839, refer to following note regarding valve springs.

NOTE: New valve springs (Ford part No. DDN-6513) and exhaust valve spring spacers (part No. 510E-6515) were introduced along with the new type camshaft lobe profile at serial No. 1609839. As all camshafts now available for service incorporate the late cam profile, it is very important to check the valve springs and install the latest type, if not already installed, when renewing camshaft. On some early engines, it may be necessary to rework the cylinder head around the intake valve guides. Refer to paragraphs 46 and 47 for valve spring and exhaust valve spring spacer identification and installation.

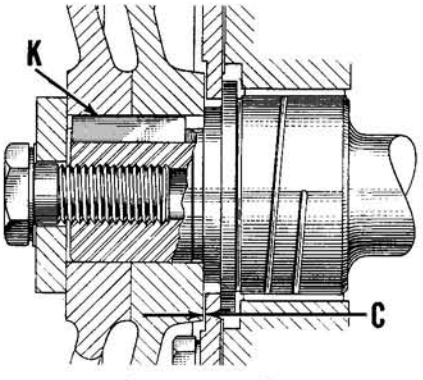


Fig. 34—Timing gears on later type camshaft are retained by cap screw, lock washer, plate and key (K). Camshaft end thrust is controlled by engine front plate which fits between rear camshaft gear and shoulder on camshaft. Clearance (C) should be 0.005-0.021.

All Models

59. **R&R CAMSHAFT.** To remove camshaft, remove the engine as outlined in paragraph 35, then, with fuel lift pump, push rods and engine front plate removed, invert engine to allow tappets (cam followers) to fall away from camshaft. Withdraw camshaft from front end of engine.

The camshaft can be removed without removing engine by the following procedure: Remove the fuel injection pump assembly as outlined in paragraph 113 or 122, then unbolt and remove push rod cover from side of crankcase. With the push rods removed as outlined in paragraph 39, lift each tappet with a magnet and retain in lifted position with a suitable clip. Remove fuel lift pump from side of crankcase and engine front plate as outlined in paragraph 54, then withdraw camshaft from front of engine.

60. With introduction of camshaft having gears retained by key and single cap screw, method of controlling camshaft end thrust was also changed. On early camshaft, end thrust was controlled by either a split type washer or a horseshoe shaped thrust plate (see Fig. 33). On new type camshaft, a thrust flange is integral with

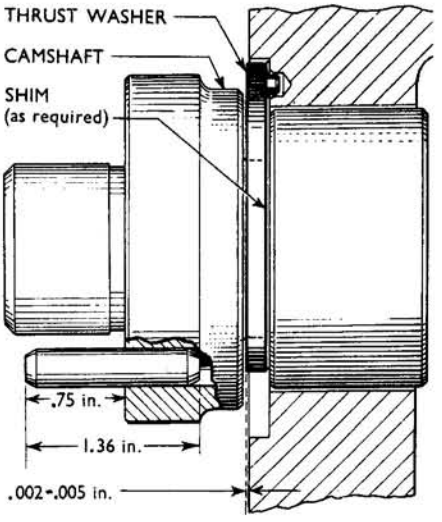
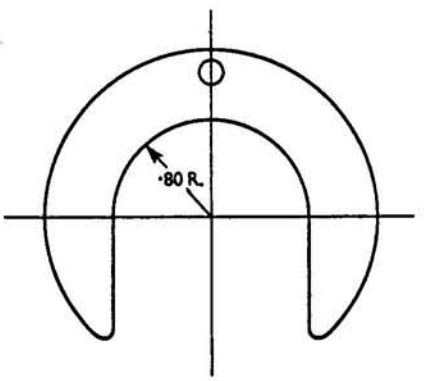


Fig. 35—Thrust washer used with early type camshaft should protrude 0.002-0.005 from front face of cylinder block; shims are available to increase protrusion. Refer also to Fig. 36.

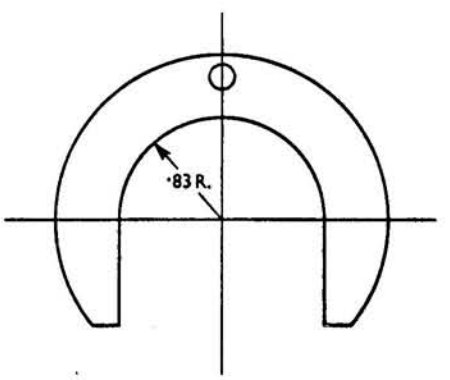
shaft and end thrust is taken by the engine front plate which fits between hub of camshaft inner (rear) gear and thrust flange on camshaft as shown in Fig. 34.

61. On early type camshaft, the thrust plate shold protrude 0.002-0.005 from front face of crankcase as shown in Fig. 35. Shims 0.003 and 0.005 thick are available for installation behind thrust plate to obtain desired protrusion. If pre-cut shims are not available, cut shim stock to fit. Note: The latest thrust plate can be used with all early camshafts; however, if using early thrust washer or plate with currently available service camshaft, it may be necessary to remove some material from inner diameter of thrust washer or plate to fit camshaft. Desired clearance of thrust washers or plate in groove of camshaft (camshaft end play) is 0.003-0.008.

62. On late type camshaft with gears retained by key and single cap screw, camshaft end play should be 0.005-0.021. If end play is excessive, check for wear at camshaft inner (rear) gear hub, engine front plate or flange on camshaft.



PREVIOUS TYPE



CURRENT TYPE

Fig. 36 — Currently available camshaft thrust washer (see Fig. 35) has larger inside radius. When using previous washer with currently available early type camshaft, it may be necessary to rework washer to fit shaft.

63. New camshafts have a black phosphate coating to reduce wear when installed in unbushed bores in cylinder block. If camshaft is being installed in cylinder block fitted with bushings, the phosphate coating must be removed with crocus cloth or fine emery paper and the abrasive particles thoroughly cleaned from camshaft before installing the new shaft. However, **do not** remove the phosphate coating if camshaft is being installed in unbushed bores. Be sure to thoroughly lubricate the camshaft thrust surfaces before installing engine front plate as outlined in paragraph 54. Install camshaft gears as outlined in paragraph 52 and auxiliary driveshaft gear as in paragraph 53. Complete the ressembly of tractor by reversing disassembly procedure.

64. **CAMSHAFT BEARINGS.** The five journal camshaft is supported in unbushed bearing bores or renewable type bearing liners (bushings). Camshaft journal diameter is 2.0596-2.0600. Desired journal to bore bushing clearance is 0.002-0.0035 with maximum wear limit of 0.006.

If cylinder block is not fitted with bushings and camshaft bores are excessively worn, bushings can be installed after line boring all five bearing bores in crankcase to a diameter of 2.188-2.189.

Some engine originally fitted with camshaft bushings may have 0.020 oversive bores for the bushings and oversize outside diameter bushings (bearing liners) are available for this purpose.

The pre-sized bushings must be installed with a closely piloted arbor to avoid any damage to the bushings. The four rear bushings are alike; front bushing is wider and has a notch in forward end. When reinstalling front bushing, be sure the notch is aligned with oil-way in front face of bearing bore. On the four rear bushings, be sure oil holes in bushings are aligned with oil-way in front face of bearing bore. On the four rear bushings, be sure oil holes in bushings are aligned with oil passages in cylinder block. Check for proper oil hole alignment after bushings are pressed into place; alignment is satisfactory if a $\frac{3}{16}$-inch diameter steel pin can be inserted through drilling between crankshaft and camshaft bores and pass through oil hole in the bushings. Also, on number 3 and number 4 bearings, be sure that second oil hole in bushing is aligned with rocker arm oil supply hole.

NOTE: New camshafts have a black phosphate coating; when installing camshaft in cylinder block fitted with camshaft bushings, the phosphate coating must be removed from the crankshaft journals. Do not remove the coating if installing camshaft in unbushed bearing bores.

65. **CAMSHAFT REAR BEARING PLUG.** An expansion plug is fitted in rear face of cylinder block to close the rear camshaft bearing bore. Usually, the plug does not need to be disturbed except in case of oil leakage or when renewing camshaft bushings. The expansion plug is accessible after removing flywheel. Plugs are available in three different diameters; 2 5/64 inches, 2 13/64 inches and 2 7/32 inches.

AUXILIARY DRIVESHAFT

All Models

66. The auxiliary driveshaft is mounted in two ball bearings in right front corner of engine crankcase. A gear on front of shaft is driven by the camshaft inner (rear) gear. A gear integral with shaft drives the engine oil pump and, on some models, the Proofmeter (tach-hourmeter). A coupling attached to rear end of auxiliary driveshaft drives the fuel injection pump.

67. **R&R AUXILIARY DRIVESHAFT.** To remove the auxiliary drive shaft, first remove the oil pan as outlined in paragraph 96 and the oil pump as outlined in paragraph 93, the engine front plate as outlined in paragraph 54 and fuel injection assembly as in paragraph 113 or 122.

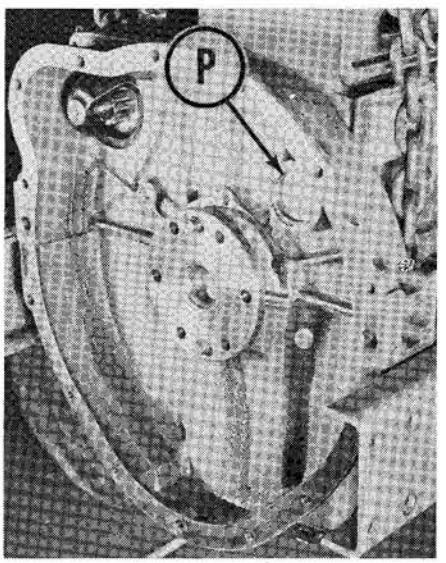


Fig. 37—Expansion plug (P) at rear end of camshaft is accessible after removing flywheel. Plug is available in three different sizes; refer to text.

Then, with the injection pump drive coupling and key removed from rear of shaft, bump shaft forward out of engine crankcase. Drive the oil seal out to rear. Note: It is possible to renew the oil seal after removing fuel injection pump and drive coupling from rear end of shaft, then prying seal from bore in crankcase. Remove the ball bearings from each end of auxiliary driveshaft.

If necessary to renew the auxiliary driveshaft and/or bearings, refer to paragraph 68. Install the shaft and bearings as follows:

By pressing on inner bearing race only, install the small bearing on rear end of shaft and the large bearing on front (threaded) end of shaft so that bearing inner races are tight against shoulders on shaft. Insert shaft and bearing assembly in bore of crankcase from front and bump the assembly rearward until front bearing outer race is seated against shoulder in crankcase. Using a seal protector or shim stock, install seal over rear end of shaft, then remove seal protector and using suitable sleeve, drive seal into bore until seated against snap ring. Reassemble tractor by reversing disassembly procedure.

68. **RENEW AUXILIARY DRIVESHAFT AND/OR BEARINGS.** Several production changes affect the auxiliary driveshaft and related parts. As these changes may be incorporated in prior models, the following should be noted if necessary to renew the auxiliary driveshaft and/or bearings:

To renew auxiliary driveshaft on models equipped with Simms Minemec (mechanical governor) fuel injection pump, use part No. E92-CP-5.

On models with Simms fuel injection pump with vacuum governor and camshaft gears retained with key and single cap screw, use part No. E94-CP-5.

On prior models with original type engine camshaft having gears retained to shaft with three cap screws, use part No. E96-CP-9. NOTE: If drive gear on engine oil pump does not have either part No. E1ADDN-6652 or 528E-6652 stamped on gear, it will also be necessary to renew the oil pump drive gear when installing new auxiliary drive shaft. Refer to paragraph 95.

If changing from early type camshaft having gears retained by three cap screws to late type camshaft having gears retained by key and single cap screw (refer to paragraph 52), it is also necessary to install a new fuel injection pump drive coupling flange (Ford part No. DDN-993186-B) along with the new auxiliary drive shaft (part No. E94-CP-5).

When renewing auxiliary driveshaft front bearing, use part No. E80-CP-9 if crankcase is counterbored as shown in Fig. 39, or part No. DKN-66618-A on models without counterbore.

CONNECTING RODS AND PISTONS

All Models

69. Connecting rod and piston assemblies are removed from above after removing cylinder head, oil pan, oil suction tube and inlet screen and the connecting rod caps. Note: Be sure that rod and cap have cylinder number or other marks to pair rod and cap before removing the caps.

When reassembling piston and pin to connecting rod, be sure that the valve recesses in top face of piston are to the same side of the assembly as the notches in lower end bore of rod for the bearing insert tangs. Assembly of piston pin through piston will be aided by warming the piston in boiling water.

When reinstalling connecting rod and piston assembly, be sure that word "FRONT" or arrow on top of piston is towards front of engine.

If necessary to renew connecting rod bolts and/or nuts, it should be noted that there are two different type nuts and three different type bolts that may be encountered. If the bolt hole in rod and cap has "broken through" the bearing bore when bolt hole was drilled, a special "waisted" (necked down) bolt (Ford part. No. DKN-6215-A) must be used. At engine serial No. 1509598, length of the connecting rod bolt was increased from 2.87 inches to 2.99 inches and thickness of the nut was increased from 0.462 to 0.530. The longer bolt can be used with connecting rods originally equipped with the shorter bolts; however, the smaller nut must be used with the earlier rods as the spot face of cap will not allow the larger nut to seat. CAUTION: The shorter bolt must not be used in connecting rods originally equipped with long bolt.

Connecting rod bolt tightening torque for all models is 55-60 Ft.-Lbs. Note: Be sure that cap is installed with machined notch for bearing tang to same side of assembly as bearing tang notch in connecting rod.

PISTON PINS AND BUSHINGS

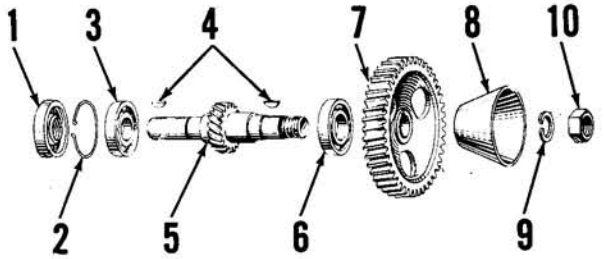
All Models

70. Piston pins are fully floating and are retained in pistons by snap rings.

Engines prior to serial No. 1425097 were equipped with 1.250 inch diameter piston pins. Later model engines are equipped with 1.375 inch diameter hollow piston pins. Refer to the following specifications for servicing piston pin and bushings:

Prior to Serial No. 1425087:

Piston pin diameter 1.2497-1.2500
Bushing inside diameter 1.2501-1.2504*
Pin to bushing clearance,
desired 0.0001-0.0007
Wear limit 0.0015
Pin to piston clearance,
desired ..... 0.001 interference to 0.0001 loose
Wear limit 0.0010



1. Oil seal
2. Snap ring
3. Rear bearing
4. Woodruff keys
5. Auxiliary driveshaft
6. Front bearing
7. Driving gear
8. Oil slinger
9. Lockwasher
10. Hex nut

Fig. 38 — Exploded view of late production auxiliary driveshaft assembly. Outside diameter of oil slinger (8) used with wide camshaft front gear is smaller so that it will clear the gear.

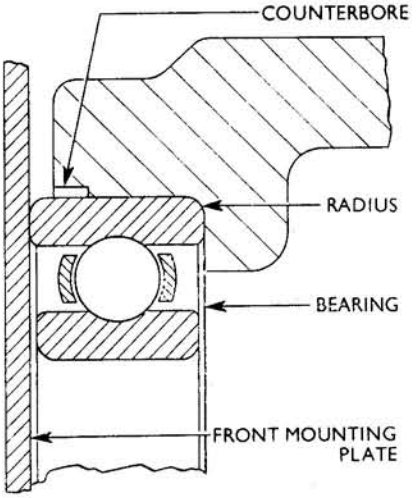


Fig. 39—Latest auxiliary driveshaft front bearing (6—Fig. 38) can be used only with cylinder block incorporating counterbore. Early bearing (part No. DKN-66618-A) can be used with all cylinder blocks.

Serial No. 1425097 & Up:

Piston pin diameter 1.3747-1.3750
Bushing inside diameter 1.3751-1.3754*
Pin to bushing clearance,
desired 0.0001-0.0007
Wear limit 0.0015
Pin to piston clearance, desided....0.0001 interference to 0.001 loose
Wear limit 0.0010

*NOTE: Bushing must be reamed to fit pin after installation in connecting rod.

CONNECTING RODS AND BEARINGS

All Models

71. **CONNECTING RODS.** Two different connecting rods are used. Prior to serial No. 1425097, piston pin diameter is 1.375. Refer to paragraph 69 concerning connecting rod cap bolts and nuts. Connecting rod specifications are as follows:

Width at crankpin end.. 1.655-1.657
End play on crankpin,
desired 0.003-0.009
Wear limit 0.012

72. **BEARING INSERTS.** Several different factors must be considered in renewing crankpin bearing inserts; refer to the following paragraphs 73 through 75.

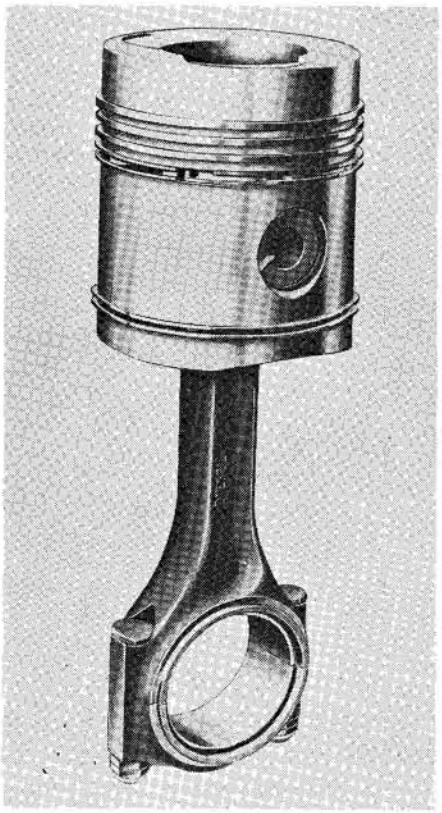


Fig. 40—When reassembling piston to the connecting rod, be sure valve recesses in piston head are to same side of assembly as crankpin bearing insert tang notches in rod.

73. **BEARING TYPE.** Three different types of crankpin bearing inserts have been used. Each type will be identified by stampings on the back of the insert. The letter "V.P." entwined and enclosed in a circle will indicate one type, the letter "G" enclosed in a square will indicate a seconed type and the third type will have the letter "AL" stamped in back of insert along with the letter "G" enclosed in a square. These three types of bearing inserts are interchangeable, but must be used in pairs (the top and bottom inserts of any one connecting rod must be of the same type).

74. BEARING WIDTH. Effective with serial No. 1483140, crankshafts were modified by increasing the fillet radius between the crankshaft webs and journals, and the crankpin bearing inserts were reduced in width to accommodate the increased radius. Service crankshafts and inserts also incorporate this change. Previous crankpin bearing inserts were 1.37-1.38 wide; later inserts are 1.33-1.34 wide. Narrow bearing inserts can be used with either crankshaft.

75. UNDERSIZE BEARING INSERTS. Bearing inserts are available in undersizes of 0.010, 0.020, 0.030 and 0.040 as well as in standard size. Standard crankpin bearing journal diameter is 2.4997-2.5005; desired bearing insert to journal clearance is 0.002-0.0035 with maximum allowable clearance of 0.005. Crankshaft crankpin should be reground to next standard undersize if clearance is excessive, if taper exceeds 0.001 or out-of-round exceeds 0.0015.

PISTONS AND RINGS

All Models

76. Pistons for all models are of aluminum alloy and have a combustion chamber machined in their crown. Three compression rings and one oil control ring are fitted above the piston pin and a second oil ring is located below the pin. Piston pin is fully floating and is retained by a snap ring at each end of pin bore in piston.

Engines prior to serial No. 1425097 are equipped with pistons having a 1.250 piston pin bore. Early engines in this series were equipped with pistons having combustion chambers offset from center of piston while later engines were equipped with pistons having the combustion chamber centered in top of piston. Only the pistons having centralized combustion chambers are available for service. Therefore, if an early engine with pistons having offset combustion chambers is encountered and it is necessary to renew one or more pistons, a complete set of four later type pistons must be installed. "Spigoted" cylinder sleeves (see paragraph 79) and a copper-asbestos head gasket should be used with these pistons.

Engines after serial No. 1425097 and prior to serial No. 1518654 were equipped with pistons having a 1.375 diameter piston pin bore and a crown height (center of piston pin bore to top face of piston) of 2.783-2.785. All later engines were also equipped with pistons having a 1.375 diameter piston pin bore, but with crown height of 2.793-2.795 (0.010 higher crown than previous pistons). Both types of pistons are available for service. The earlier (low crown height) pistons should be used with non-spigoted cylinder sleeves (see paragraph 79) and a 0.6 mm thick composition head gasket. Later (high crown height) pistons should be used with spigoted cylinder sleeves and either the copper-asbetos or 1.0 mm thick composition head gasket. Low crown height pistons can be identified by part No. E1ADDN-6110E cast inside skirt (standard size piston) or by the letter "F" stamped on top of piston (0.0025 oversize piston). High crown height pistons can be identified by letter "L" stamped on top of standard piston or by letter "M" stamped on top of 0.0025 oversize piston.

NOTE: High crown height pistons should not be used in engines where more than 0.010 has been machined from top face of cylinder block. If in doubt, refer to paragraph 38 and

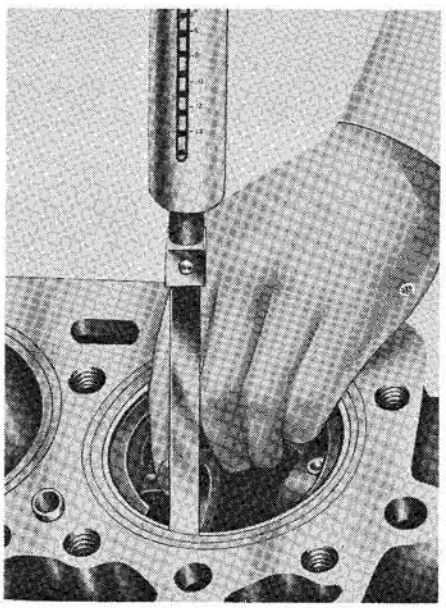


Fig. 41—Checking piston to cylinder sleeve fit with feeler gage strip and pull scale; refer to text for specifications.

measure piston height. Valve face protrusion from cylinder head should also be checked as outlined in paragraph 41.

77. **FITTING PISTONS.** To check piston fit, refer to Fig. 41 and proceed as follows: Position the piston in cylinder bore as shown, with top face towards crankshaft and valve recesses in top face away from camshaft side of engine, and with a ½-inch wide 0.004 thick feeler strip inserted between piston and sleeve on camshaft side of engine. Piston fit is correct when a pull of 2 to 4 pounds is required to remove the feeler strip. If pull required is less than 2 pounds with standard size piston, check fit of the 0.0025 oversize piston available for service. Cylinder sleeves should be renewed if the 0.0025 oversize piston cannot be properly fitted.

78. **PISTON RINGS.** Piston rings are available in standard size and 0.0025 oversize. When renewing piston rings, refer to the following specifications:

Maximum allowable cylinder out-of-round 0.003
Maximum allowable cylinder taper 0.007
Ring side clearance in groove (all rings):
Desired 0.002-0.004
Wear limit 0.005
Ring end gap (all rings):
Desired 0.011-0.016
Wear limit 0.040

Top compression ring is marked "H & T TOP" and ring must be installed with this marking up. Second and third compression rings are marked "TOP" on one face and must be installed with this mark up. The two oil control rings are interchangeable and reversible.

A "2-in-1" chrome re-ring set (Ford part No. EPN-6149-A) is also available and can be used in some instances where cylinder sleeve wear or taper will not permit use of standard type rings. Installation instructions and specifications are packaged with each ring set.

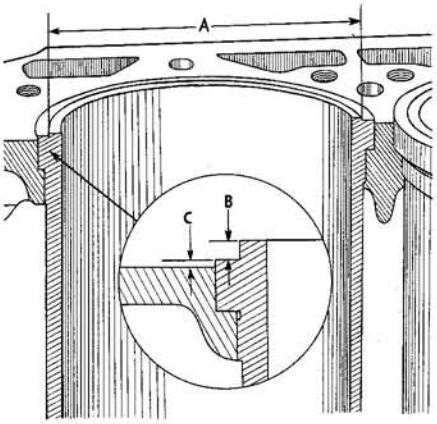


Fig. 42—Cross-sectional drawing of spigoted" cylinder sleeve installed in cylinder block. Spigot diameter is "A" and height is "B". Sleeves should protrude 0.002-0.004 (dimension "C") above cylinder block.

CYLINDER SLEEVES

All Models

79. Engines for all models are equipped with wet type cylinder sleeves. On early production engines (prior to Serial No. 1591023), sleeves were sealed at bottom by an "O" ring and at the top by cylinder head gasket and also by sealer applied to under side of sleeve flange. On later engines, cylinder sleeves are sealed at top and bottom by "O" rings in grooves in cylinder block. In conjunction with change in method of sealing, cylinder sleeves are of larger outside diameter than cylinder sleeves for prior production engines.

NOTE: Some engines built during the changeover period from small to large outside diameter sleeves will require the large O.D. sleeves, but do not have an "O" ring groove at top of bore in cylinder block. As a means of identification, any engine with $\frac{9}{16}$-inch or ⅝-inch diameter main bearing cap retaining bolts will require the large O.D. sleeves. Engines built prior to this change have ½-inch diameter main bearing cap bolts.

For early engines requiring sleeves with small outside diameter, two different types of cylinder sleeves (spigoted and plain) are available; refer to Fig. 42. The non-spigoted (plain top) cylinder sleeves should be used with pistons of low crown height (refer to paragraph 76) and with the 0.6 mm thick cylinder head gasket (refer to paragraph 38). The spigoted cylinder sleeves should be used with pistons of high crown height and with either the 1.0 mm thick composition type head gasket or the copper asbestos type head gasket.

For later engines requiring the large outside diameter cylinder sleeves, sleeves are available in spigoted type only and pistons of high crown height should be used. Although the 1.0 mm thick composition head gasket is recommended, the copper-asbestos gasket can be used.

NOTE: On some engines, the bores in the cylinder block for cylinder sleeves may be 0.020 oversize and require oversize outside diameter cylinder sleeves.

On early models without "O" ring at top of cylinder sleeve, the sleeve flange must protrude 0.002-0.004 above top surface of cylinder block. Fig. 43 shows one method of checking sleeve protrusion. If sleeve does not protrude at least 0.002, install shims(s) under sleeve flange as required to bring protrusion within limits of 0.002 to 0.004. Note: Where cylinder sleeves would not otherwise be removed and are not disturbed from their installed position, a protrusion of 0.001 or more is acceptable. Shims are not available for the large outside diameter sleeves used in later model engines.

CRANKSHAFT AND MAIN BEARINGS

All Models

80. **R&R CRANKSHAFT.** With engine removed from tractor as outlined in paragraph 35, proceed as follows:

Remove clutch assembly, flywheel, oil pan, oil suction tube and inlet screen, timing gear cover, timing gears and the engine front support plate. Be sure the main bearing caps are identified according to location, then unbolt and remove the connecting rod caps and bearing inserts and the main bearing caps and bearing inserts. Center main bearing cap is fitted with thrust washer lower halves, do not drop or damage thrust washers as cap is being removed. Lift the crankshaft from engine. Remove the upper main bearing inserts and keep them with their respective bearing caps. Remove the two upper thrust washer halves.

To reinstall crankshaft, proceed as follows: Install new rear oil seal as outlined in paragraph 91. Using thin film of grease, stick the thrust washer upper halves to recesses at center main bearing journal making sure oil

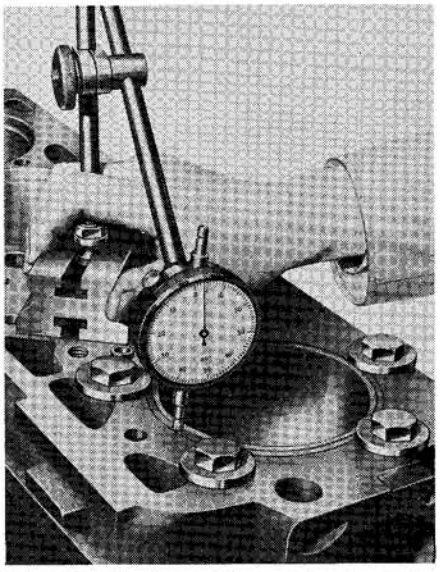


Fig. 43—Checking cylinder sleeve protrusion with dial indicator. A straight edge and feeler gage can also be used for this purpose. Note the four cap screws and washers used to clamp sleeves into position while checking protrusion. Refer to text.

grooves in face of thrust washers are out (away from cylinder block). Place the upper main bearing inserts in cylinder block, lubricate the inserts and carefully place crankshaft in block. Place bearing insert in center main bearing cap and using light film of grease, stick thrust washer lower halves in recesses of cap. Make sure that the oil groove faces of thrust washers are out (away from main bearing cap). Install center main bearing cap with word "REAR" embossed on cap towards rear of engine. Place bearing inserts in remaining bearing caps and install caps in their respective locations. Install front cap with flat face forward; install other caps with word "REAR" on cap towards rear of engine. Install bearing cap retaining bolts (cap screws) with new locking plates and before tightening the cap screws, bump crankshaft back and forth to be sure the center main bearing cap thrust faces are properly aligned with cylinder block.

Three different sizes of main bearing cap bolts (cap screws) have been used. Diameter of cap screws should be checked to determine proper tightening torque. Tightening torques are as follows:

MAIN BEARING TIGHTENING TORQUES

Cap Screw Size	Ft.-Lbs. Torque
½-inch	70-75
9/16-inch	95-100
⅝-inch	115-120

NOTE: On late model "New FSM" with ⅝-inch diameter main bearing cap screws, the two cap screws with 0.40 thick heads are installed in the front main bearing cap. Cap screws with 0.50 thick heads are used in the remaining bearing caps.

81. **MAIN BEARING CAPS.** Bearing caps are not interchangeable, however, service bearing caps are available and can be installed where the bearing bores are of standard size. Note: Some engines may already have oversize bearing bores, thus a service bearing cap cannot be installed and the block must be renewed. Standard bore diameter is 3.167 inches; oversize bearing bore will measure 3.182 inches.

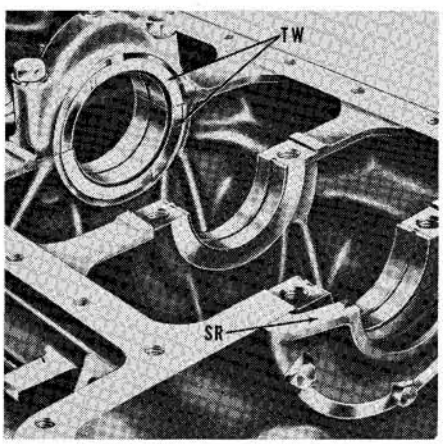


Fig. 44—Crankshaft end thrust is controlled by split type thrust washers (TW) at each side of center main bearing cap. Crankshaft upper rear oil seal retainer is (SR).

To install a service bearing cap, install the new cap in desired position, install the remaining bearing caps in their proper locations and tighten retaining cap screws as outlined in paragraph 80; then, line bore all bearing bores to 0.0015 oversize, or to a diameter of 3.1815-3.1820. If any attempt is made to bore only one new cap, misalignment and crankshaft failure could occur.

If the center main bearing cap is being renewed, the recess in cylinder block and cap for the thrust washers must be machined to produce a continuous bearing surface (R—Fig. 45) within the limiting dimensions (W) of 1.589-1.591. Mount the center main bearing cap on block so that one of its thrust faces (F) is in line with the corresponding cylinder block thrust face (F) within 0.005. The thrust faces should then be machined square with centerline of crankshaft within 0.002 total indicator reading and the recess bore within 0.006 of being concentric with the bearing bore. An equal amount should be machined from each thrust face to give a distance between thrust faces of 1.589-1.591. File the thrust washer tab slots (S) in cap back flush with thrust surface.

82. **MAIN BEARING INSERTS.** Several different factors must be considered when renewing crankshaft main bearing inserts. Refer to the following paragraphs 83 through 87 for information concerning bearing inserts.

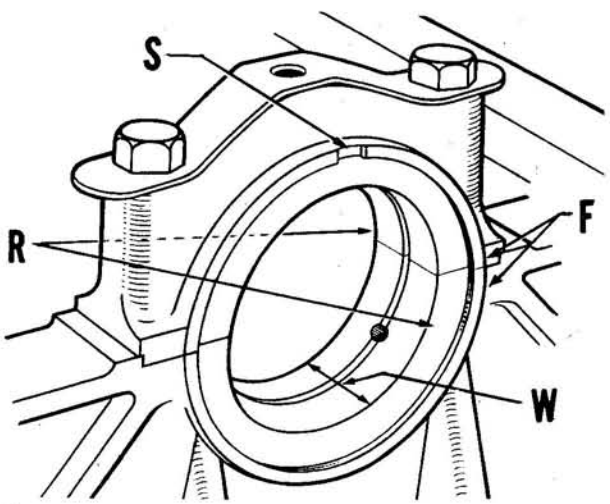


Fig. 45—When renewing center main bearing cap, mount cap so that faces (F) of cap and block are flush within 0.005, then machine recesses (R) to provide a continuous bearing surface on each side of cap and so that width (W) is 1.589-1.591. All bearing bores must then be line bored to 0.015 oversize. File slot (S) flush with recess (R).

83. **BEARING TYPE.** Three different types of main bearing inserts have been used. Each type will be identified by stampings on the back of the insert. The letters "V.P." entwined and enclosed in a circle will indicate one type, the letter "G" enclosed in a square will indicate a second type, and the third type will have the letters "AL" stamped in the back of the insert along with the letter "G" enclosed in a square. These three types of bearing inserts must be used in pairs (the top and bottom inserts of any one bearing must be of the same type).

84. BEARING WIDTH. Effective with serial No. 1483140, crankshafts were modified by increasing the fillet radius between the crankshaft webs and journals, and the main bearing inserts were reduced in width to accommodate the increased radius. Service crankshafts and liners also incorporate this change. Previous front and intermediate bearing inserts were 1.12-1.13 wide; later inserts for front and intermediate bearings are 1.04-1.05 wide. Previous center and rear bearing inserts were 1.495-1.505 wide while later type inserts for center and rear bearings are 1.415-1.425 wide. The later type narrow bearing inserts can be used with all crankshafts whereas the early wide type inserts cannot be used with late crankshaft. Thus, the narrow type bearing inserts should be used for service.

85. UNDERSIZE BEARING INSERTS. Bearing inserts are available in undersizes of 0.010, 0.020, 0.030 and 0.040 as well as in standard size. Standard main bearing journal diameter is 3.0002-3.0010; desired bearing insert to journal clearance is 0.0025-0.004. Crankshaft main bearing journal should be reground to next undersize if clearance is exces-

sive, if journal taper exceeds 0.001 or if out-of-round exceeds 0.0015.

86. OVERSIZE BEARING INSERTS. When a service main bearing cap has been installed and the main bearing bore diameter has been line bored to 0.015 oversize, bearing inserts of 0.015 oversize outside diameter are available for service. The oversize bearing inserts are available in inside diameter undersizes of 0.010, 0.020, 0.030 and 0.040 as well as standard size. Note: Some factory production engines will have 0.015 oversize main bearing inserts; these engines will be identified by the marking "O/S" stamped on oil pan face of cylinder block; also, later engines will have an "X" suffix to serial number (such as 08C-999999X) to indicate 0.015 oversize main bearing inserts.

As an engine may require 0.015 oversize main bearing inserts without being so marked, the main bearing bores should be measured prior to renewing the bearing inserts. Bearing bore for standard inserts will measure 3.167 inches; bore requiring oversize inserts is 3.182 inches.

87. **CRANKSHAFT THRUST WASHERS.** Renewable thrust washers are fitted at the center main bearing to control crankshaft end play. Desired crankshaft end play is 0.002-0.010. Thrust washers are available in kits containing two upper and two lower halves and in standard thickness as well as oversize thicknesses of 0.0025, 0.005, 0.0075, 0.010, 0.015 and 0.020. The oversize thicknesses of 0.010, 0.015 and 0.020 are for use when a new center main bearing cap has been installed and thrust faces of block and cap have been machined; refer to paragraph 81. Use of the oversize thickness thrust washers will also allow regrinding of the center crankshaft journal thrust faces where worn or scored. Standard center journal width is 1.799-1.801.

In conjunction with the increased fillet radius of the crankshaft and decreased bearing insert width at serial No. 1483140 (refer to paragraph 84), inside diameter of the thrust washers was increased from 3.215-3.225 to 3.315-3.325. The later thrust washers with large inside diameter can be used for service in all engines.

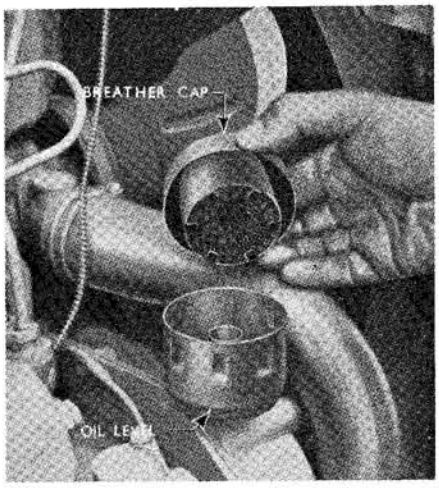


Fig. 46—The breather cap should be removed, the filter element cleaned and the cup refilled with clean oil each 50 hours of operation, or more often in extremely dusty conditions.

CRANKCASE VENTILATION SYSTEM

Early Model "FMD"

88. Tractors prior to Serial No. 1425097 are equipped with a closed crankcase ventilation system. A pipe connects engine rocker arm cover to intake manifold, thus the crankcase is subjected to intake manifold vacuum. With this system, it is very important that a perfect seal be obtained at all gasket and seal points throughout the engine. Any air leakage into engine will result in entry of dirt and improper operation of the vacuum governor.

To check for proper sealing, remove oil filler cap from rocker arm cover with engine running at slow idle speed. A noticeable effect should occur on governor by change in intake manifold vacuum. With oil filler cap removed and engine running, cover filler opening with palm of hand; a definite suction should be noted. If these conditions are not encountered, air leakage into engine is occuring at one or more gasket or seal joints and must be corrected.

Late Model "FMD", Models "FPM", "FSM" and "New FSM"

89. Tractors starting with Serial No. 1425097 are equipped with an open type crankcase ventilation system. Air enters crankcase through an oil bath air cleaner located on top of timing gear cover and is withdrawn from engine through a tube connecting rocker arm cover to inlet pipe of engine air cleaner.

It is important that the breather air cleaner (refer to Fig. 46) be serviced at frequent intervals. It is recommended that the complete assembly be removed from timing gear cover, disassembled, cleaned, refilled to proper lever with clean oil and reinstalled each 50 hours of normal service. In extremely dusty conditions, service should be more frequent.

Early breather air cleaner assemblies were a push fit into tube on timing gear cover and were sealed by an "O" ring; see Fig. 47. If difficulty is encountered with unit shaking loose, a bracket should be fabricated as shown in Fig. 49 and the breather secured with a clamp (Ford part No. 204E-9628-B) as shown in Fig. 48.

Late breather assemblies are retained to tube on timing gear cover by a clamp; refer to Fig. 50. Early and late breather assemblies are not interchangeable.

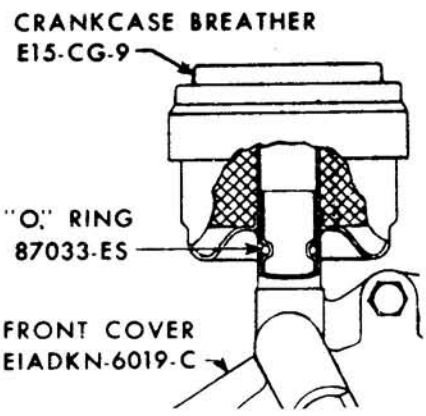


Fig. 47—Early breather assembly was push fit on pipe in timing gear (front) cover and is sealed with "O" ring. It is recommended that the breather be secured with clamp and bracket; refer to Figs. 48 and 49.

CRANKSHAFT OIL SEALS

All Models

90. **FRONT OIL SEAL.** Crankshaft front oil seal can be renewed after removing timing gear cover as outlined in paragraph 48.

Drive old seal out towards rear (inside) of cover. If installing leather type seal, soak seal in oil for fifteen minutes prior to installing in timing

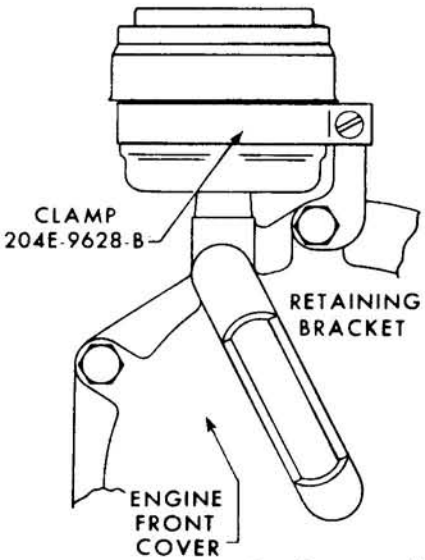


Fig. 48—Early style breather assembly should be secured with clamp and bracket. Refer to Fig. 49 for dimensions for fabricating bracket.

gear cover; soaking in oil is not required with rubber lip type seal. Using a suitable driver, install new seal with lip to inside of timing gear cover. NOTE: At serial No. 1308977, crankshaft pulley hub diameter was increased from 2.5 inches to 2.625 inches. Seals for the early engines with 2.5 inch diameter pulley hub will have an approximate internal sealing diameter of 2.44 inches while seals for the later 2.625 inch diameter pulley hub will have an internal sealing diameter of approximately 2.56 inches. Be sure the correct oil seal is installed. Renew the crankshaft pulley if seal contact surface is excessively scored or rough; minor imperfections should be removed with emery cloth.

91. **REAR OIL SEAL.** The lower half of two piece rear oil seal is carried in a groove in the cast iron oil pan and upper half of seal is carried in a groove in retainer bolted to rear end of cylinder block. To renew the rear oil seal, first remove engine from tractor and remove the oil pan, clutch assembly and engine flywheel; then, proceed as follows:

Unbolt and remove the upper seal retainer from rear of cylinder block and remove the old seal and gasket. If stake marks are not already present, use a center punch to stake bottom of seal groove in retainer in two places at either end of groove. Firmly fit a new graphite coated seal half in retainer, then trim ends of seal so that they protrude 0.015-0.025 from the retainer. Although the graphite type seal does not need to be oil soaked, the surface that contacts crankshaft should be lightly oiled. Reinstall retainer with new gasket and locking plate. Firmly fit lower half of seal in groove of oil pan, trim the seal ends so they protrude 0.015-0.025 from oil pan, then reinstall oil pan as outlined in paragraph 96.

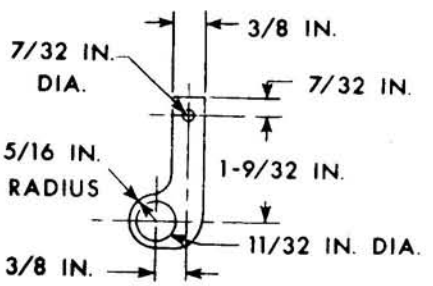


Fig. 49—Dimensions for fabricating breather bracket. Refer to Figs. 47 and 48.

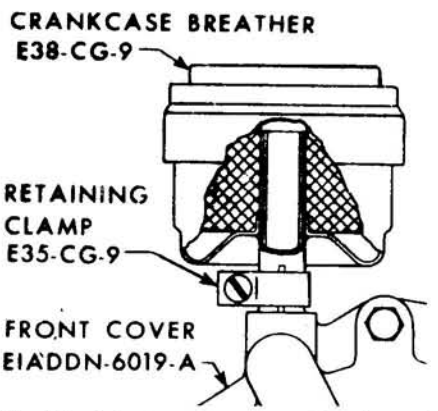


Fig. 50—Late breather element is clamped to tube in timing gear (front) cover. Early and late style breathers are not interchangeable as tubes in early and late front covers are different.

ENGINE OIL FILTER

All Models

92. A number of different makes and types of oil filter assemblies have been used. To service the different filters, two special oil filter kits are available through Ford Tractors parts departments. For all model "FMD" tractors, use filter element kit Ford part No. EPN-6731-A. For all model "FPM", "FSM" and "New FSM" tractors, use element kit Ford part No. EPN-6731-B. Note: These part numbers are not listed in the Fordson Major Tractor Parts List as they are produced and available only in the U.S.

CAUTION: **Be sure** to closely follow instructions packaged with the filter element kit and install filter according to filter make; trade name (make) of filter will be found on filter head (base).

OIL PUMP AND RELIEF VALVE

All Models

93. **R&R OIL PUMP.** To remove oil pump, first remove oil pan (sump) as outlined in paragraph 96, remove the oil suction tube and filter screen, then unbolt and remove oil pump from lower face of cylinder block.

To reinstall, reverse the removal procedure and reinstall oil pan as outlined in paragraph 96.

94. **RELIEF VALVE.** On engines prior to serial No. 1425097, the oil pressure relief valve assembly is threaded into engine front plate and can be removed after removing timing gear cover as outlined in paragraph 48. The relief valve is serviced as a complete assembly only. When installing valve assembly, tighten to a torque of 20-25 Ft.-Lbs.; valve can be distorted causing malfunction if overtightened. On all later models, the oil pressure relief valve is located in the oil pump cover; refer to paragraph 95. Oil pressure on all models should be 40-50 psi with engine running at 1500 RPM.

95. **OVERHAUL PUMP.** On later type pumps with relief valve in cover, remove the cotter pin, spring retainer, spring and relief valve plunger. Unbolt and remove cover on all pumps and withdraw idler gear from shaft and pump body. Press helical drive gear from upper end of driveshaft, then withdraw shaft and driven gear from pump body. If necessary to renew driven gear and shaft is serviceable, press gear from shaft. Note: If necessary to renew shaft, a new driven gear should be assembled to shaft as the sintered metal gear tends to lose its interference fit once it is removed from shaft. If idler shaft is worn and pump body is serviceable, press shaft from body. Carefully inspect all parts and compare with the following specifications and information:

Driveshaft to pump body bore clearance and idler gear to idler shaft clearance should be 0.001-0.0035. Gear end clearance in pump body should be 0.001-0.0045.

At serial No. 1595085 changes were made in the material used in the oil pump helical drive gear and the gear on auxiliary driveshaft to increase life of the gears. Later changes were made wherein the width of the oil pump drive gear and auxiliary driveshaft gear were increased from ½ to $\frac{19}{32}$-inch, the upper end of oil pump driveshaft was scrolled to permit oil passage to the helical drive gear and

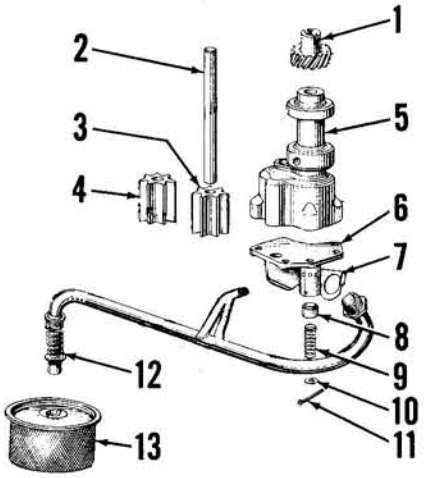


Fig. 51—Exploded view of typical oil pump assembly. Early model "FMD" pump did not have oil pressure relief valve (8) as valve was fitted in engine front plate; refer to Fig. 53. Refer to Fig. 52 for cross sectional view of latest pump.

1. Drive gear
2. Driveshaft
3. Driven gear
4. Idler gear
5. Pump body
6. Cover
7. Lock plate
8. Relief valve
9. Valve spring
10. Retainer
11. Cotter pin
12. Suction tube
13. Suction screen

the gear was drilled to allow oil to lubricate the gear teeth. Refer to cross-sectional view of latest type oil pump body, shaft and gear assembly in Fig. 52.

Ther latest type wide, drilled gear (Ford part No. 528E-6652) and scrolled shaft (part No. 528E-6609) may be installed in previous pump assemblies to gain benefit of the oil feed to the gears. However, in installing the gear in engines prior to serial No. 1595085, a new auxiliary driveshaft of the improved material must also be installed; refer to paragraph 68. Note: Oil pump helical drive gears of the improved material can be identified by a spot of white paint or the part No. E1ADDN-6652 or part No. 528E-6652 stamped on the gear; part No. E1ADDN-6652 does not incorporate the increased width and oil drilling, however.

In late production oil pumps, the relief valve plunger is longer than in earlier pumps, a cylinder type spring retainer is used instead of a flat disc and the relief valve spring is of an improved material. All three parts are individually interchangeable, but should be installed in prior pumps as a set to improve relief valve performance. The new spring (Ford part No. 528E-6654) can be identified by a yelow paint band on the spring coils. Part number of longer valve plunger is DDN-6663-B; cylinder type retainer part number is DDN-6653-B.

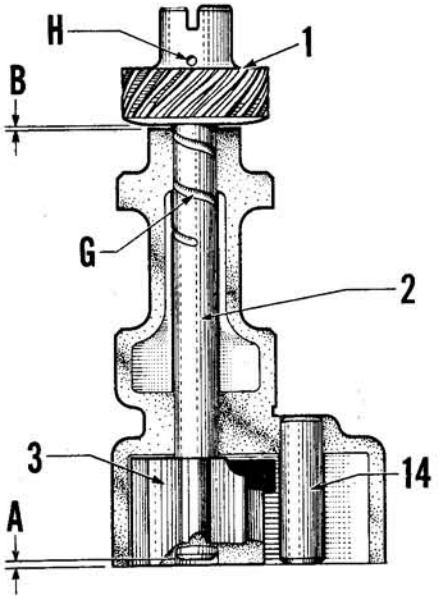


Fig. 52—Cross-sectional view of late type pump showing driveshaft with spiral groove (G) at upper end and drive gear (1) with oil hole (H). Refer to text for installation of idler shaft (14) and for drive shaft to driven gear assembly dimension (A) and drive gear to body clearance (B).

Refer to paragraph 94 for relief valve on model "FMD" prior to serial No. 1425097.

To improve oil pump efficiency, late pump gears have chamfer at one end of teeth only instead of at both ends as on previous gears. If installing gear with chamfer at one end only, be sure the gear is installed with chamfer up and with square end of teeth towards pump cover. The early and late gears are completely interchangeable.

To reassemble pump, proceed as follows: Press idler shaft into pump body so that lower end of the shaft is 0.005 below flush with lower face of pump body. Press driveshaft into chamfered end of gear (early type gears have chamfer at each end) so that lower end of shaft is 0.080-0.090 below flush with lower face of gear if scrolled shaft is being installed, or 0.200 below flush with lower face of gear if early type plain shaft is being installed. Insert driveshaft and driven gear assembly into pump body and install helical drive gear as follows:

On early "FMD" with plain pump cover (relief valve in front support plate), support lower end of driveshaft and press helical gear onto upper end of shaft so that distance from machined lower face of pump body to lower edge of helical gear teeth is 5.200-5.202 inches; minimum clearance between helical gear hub and pump body (shaft end play) is 0.010.

On later type pumps with relief valve in pump cover, press helical drive gear onto drive shaft so that clearance between gear hub and pump body (shaft end play) is 0.010-0.036 if plain shaft and gear are being installed, or 0.007-0.012 if scrolled shaft and drilled gear are being installed.

Insert idler gear, chamfered end first, into pump body and install pump cover. Install relief valve plunger, spring, spring retainer and cotter pin in cover of pumps so equipped. Be sure that pump turns freely and is well lubricated before reinstalling in engine.

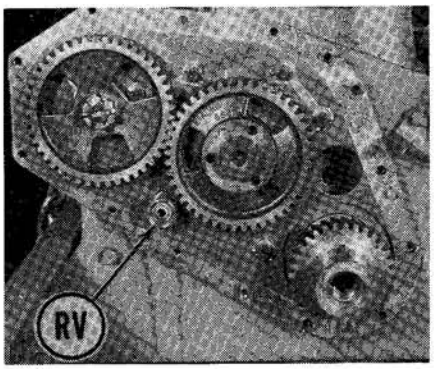


Fig. 53—Camshaft front (outer) gear removed to show oil pressure relief valve (RV) location on model "FMD" prior to serial No. 1425097.

OIL PAN (SUMP)

All Models

96. On tricycle front wheel models, the engine oil pan can be unbolted and removed without removing any other components.

To remove oil pan on wide front axle models, unbolt radius rod from front axle center member and remove the pivot pin from radius rod and oil pan. Bump the radius rod to one side until clear of pan, then remove radius rod from tractor. Remove the connecting rod from front wheel spindle arms. The oil pan can then be unbolted and removed from tractor.

On model "FMD" prior to serial No. 1425097, oil pan was fitted with removable plate on bottom of pan so that oil pump suction screen could be cleaned without removing oil pan. On all models after "FMD" serial No. 1425096, a one-piece oil pan is used. On model "FSM" and "New FSM", bore for radius rod pivot pin is larger than for prior models and on late production "New FSM", oil pan is retained to crankcase by 20 cap screws of $\frac{3}{8}$-inch diameter and two cap screws of $\frac{5}{16}$-inch diameter instead of the 22 cap screws of $\frac{5}{16}$-inch diameter used on all prior production engines.

When renewing oil pan on model "FMD" prior to serial No. 1425097, it will be necessary to modify the oil pump suction screen cover as shown in Fig. 55 as only the later type one-piece oil pan is available for service.

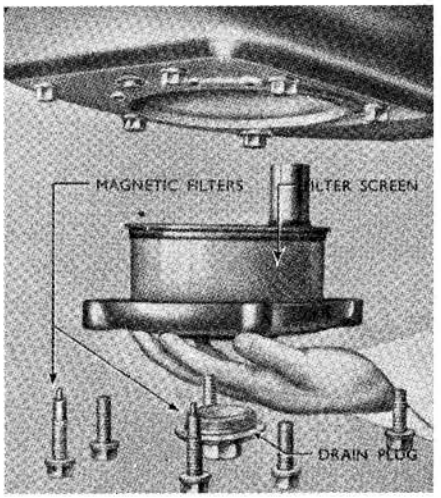


Fig. 54—Early model "FMD" oil pan has removeable plate, thus filter screen can be removed and installed without removing oil pan. As this type pan is no longer available, renewing pan requires modification of screen cover; refer to Figs. 55 and 56.

To install oil pan, proceed as follows: If installing later type oil pan on early "FMD, retain suction screen cover on oil pump tube with a spring clip (Ford part No. E120-Z-9), then install screen in cover and secure with spring as shown in Fig. 56. Be sure that retaining spring is parallel with crankshaft to avoid interference between oil pan and cover. On all later models, install oil screen assembly on oil pump tube and turn screen ¼-turn to retain it on tube. Note: On early "FMD" with original type oil pan, the oil pump screen can be installed after pan is reinstalled on engine.

Using gasket sealer, fit the two side gaskets and the sump front packing strip to engine. Note: Type of sump front packing will depend upon type of front support plate to engine gasket used; refer to paragraph 54. Firmly fit new graphite coated rear oil seal lower half in groove at rear of oil pan and trim ends of seal so that they protrude 0.015 to 0.025 from pan. Lubricate the rear oil seal, then lift pan into place with floor jack. Install the retaining cap screws, then tighten cap screws alternately and evenly. Reinstall connecting rod and radius rod on wide front axle models.

FLYWHEEL

All Models

97. **R&R FLYWHEEL.** Flywheel can be unbolted and removed after splitting tractor between engine and flywheel housing as outlined in paragraph 149 and removing the single clutch assembly as outlined in paragraph 154 or 155, or the dual ("Live PTO") clutch assembly as outlined in paragraph 157. Refer to paragraph 98 for starter ring gear and to paragraph 99 for clutch (transmission input) shaft pilot bearing.

On model "FMD" prior to serial No. 1308977, flywheel is positioned by two equally sized dowel pins, thus the flywheel can be installed in either of two positions. On later models the two dowel pins are of different size and the flywheel can be installed in one position only. Three different flywheels are currently available for servicing models with 12 inch single plate clutch (flywheel part No. DDN-6375-D), 13 inch single plate clutch (flywheel part No. DDN-6375-F) or with dual ("Live PTO") clutch (flywheel part No. DDN-6375-E). To install the later type flywheel (part No. DDN-6375-D) on early tractor, a new dowel pin (Ford part No. DKN-6387-B) must be obtained and installed as follows:

Position the crankshaft so that No. 1 throw (crankpin) is up and position flywheel to crankshaft so that timing marks on outside diameter of flywheel are at the "4 O'clock" position as viewed from rear; then install dowel pins in crankshaft to correspond with proper size dowel holes in flywheel.

When installing flywheel on all models, use new locking plates for cap screws, tighten the cap screws to a torque of 80-90 Ft.-Lbs. and bend locking plates up against flats on cap screw heads.

Flywheel runout should not exceed 0.005 at either the clutch friction surface on single disc clutch models or at outside diameter (periphery) of flywheel.

98. **STARTER RING GEAR.** Starter ring gear is attached to front face of flywheel with six countersunk head cap screws, thus it is necessary to remove flywheel to renew starter ring gear.

On late models, starter ring gear cap screws are secured with "Loctite" instead of with lock washers. "Loctite" can be used on prior models if desired. To install starter ring gear, be sure that chamfered edge of gear teeth is towards front side of flywheel. If using "Loctite", be sure threads in flywheel and on cap screws are clean, apply a drop or two of "Loctite" on threads of each cap screw and tighten the cap screws alternately and evenly. Proper tightening torque is 12-15 Ft.-Lbs.

99. **PILOT BEARING.** Two different types of clutch (transmission input) shaft pilot bearings have been used and are interchangeable.

Early type ball bearing (Ford part No. DKN-7600) should be packed with a high melting point grease prior to assembly and installed with shielded side to rear (out).

When installing the later type sintered bronze pilot bearing (Ford part No. DDN-7600), be careful not to damage it in any way. Note: If necessary to remove a sintered bronze bearing from flywheel, it should be discarded and a new bearing installed on reassembly. Lightly coat surface of the bronze bearing prior to reassembling tractor.

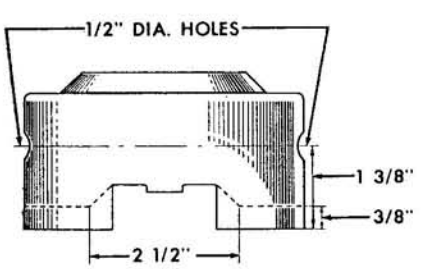


Fig. 55—When renewing early type oil pan (see Fig. 54), oil filter screen must be modified by cutting off material as indicated by dotted line and cutting two holes as shown above.

DIESEL FUEL SYSTEM

The diesel fuel system consists of three basic components; the fuel filter(s), fuel injection pump and fuel injection nozzles. When servicing any unit associated with the fuel system, the maintenance of absolute cleanliness is of utmost importance. Of equal importance is the avoidance of nicks or burrs on any of the working parts.

Probably the most important precaution that service personel can impart to owners of diesel powered tractors is to urge them to use an approved fuel that is absolutely clean and free from foreign material. Extra precaution should be taken to make certain that no water enters the fuel storage tanks.

TROUBLE SHOOTING

All Models

100. If the engine will not start, is hard to start or does not run properly, refer to the following appropriate paragraph:

101. **ENGINE WILL NOT START.** If the engine will not start or is difficult to start, check the following:

1. Fuel tank empty.
2. Fuel supply valve closed.
3. Filters clogged or air in filters.
4. Fuel lift pump faulty.
5. Air in fuel injection pump or fuel injector lines.
6. Air cleaner dirty.
7. Low engine compression.
8. Pump installed out of time.

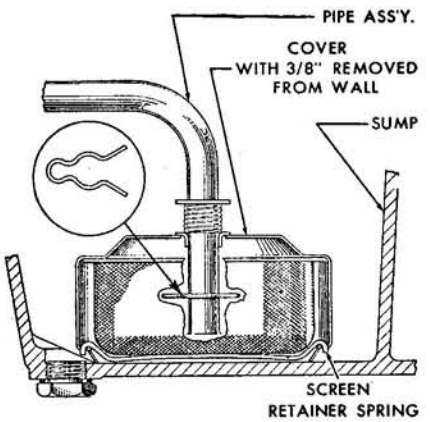


Fig. 56—When installing late type oil pan on early "FMD" engine, modify screen cover as shown in Fig. 55 and position cover and screen with retainer spring lengthwise with pan (parallel with crankshaft) as shown above.

9. Pump control rod stuck in closed position.
10. Throttle plate in intake manifold not opening (vacuum governed models only).
11. Starter not turning engine fast enough.
12. Faulty injectors.

102. **ENGINE STARTS, THEN STOPS.** If the engine will start, but will not continue running, check the following.

1. Air in filters or in fuel injection pump.
2. Filter clogged
3. Lift pump faulty.
4. Fuel injection pump control rod sticking.
5. Governor not properly adjusted (vacuum governed models only).

103. **ENGINE LACKS POWER.** If the engine will not develop sufficient (rated) power, check the following:

1. Air in fuel injection system.
2. Fuel filters clogged.
3. Air cleaner dirty or restricted hose connections.
4. Low engine compression.
5. Pump out of time.
6. Throttle plate in intake manifold not fully opening (vacuum governed models only).
7. Faulty governor.
8. Engine governed speed too low.
9. Engine overheating.
10. Engine not running hot enough.
11. Faulty injectors.

104. **ENGINE EMITS EXCESSIVE SMOKE.** If the engine emits excessive smoke, check the following:

1. Excess fuel delivery (starting) device stuck in excess fuel position.
2. Pump out of time.
3. Engine compression low.
4. Air cleaner dirty.
5. Faulty injectors(s).
6. Engine not running hot enough.
7. Injection pump not properly calibrated for correct fuel delivery under load.
8. Faulty vacuum governor.

105. **ENGINE KNOCKS.** In addition to normally encountered knocking due to engine wear, check the following:

1. Faulty injectors(s).
2. Pump out of time.
3. Injection pump not properly calibrated for correct fuel delivery under load.

FILTERS AND BLEEDING

All Models

106. **FILTER MAINTENANCE.** A single stage fuel filter was used on early models. Late models are fitted with a water separator filter in addition to the fuel oil filter previously used. Prior model "FSM" and "New FSM" may be converted to the dual filter system if desired.

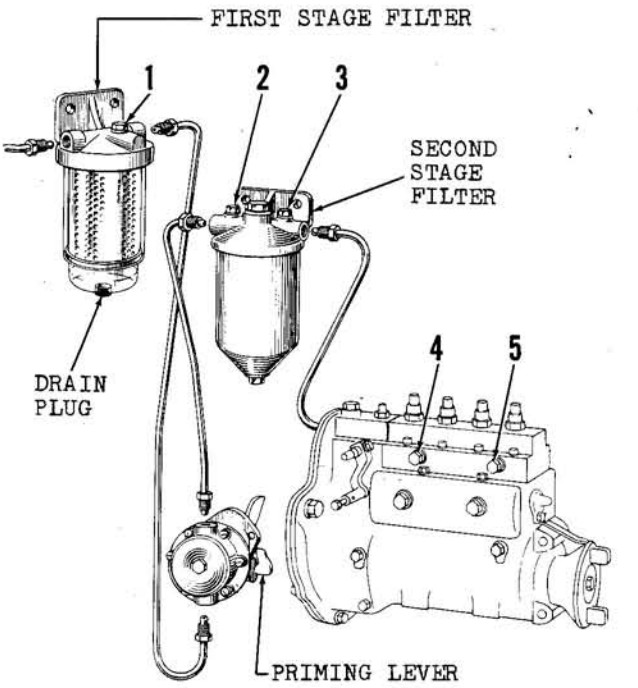


Fig. 57—View showing dual filter assembly used with Simms Minimec (mechanical governor) fuel injection pump assembly. Bleed plugs are numbered in rotation they should be opened when bleeding fuel system.

On models with single stage filter, the filter element should be renewed after each 600 hours of operation.

On models with dual filter unit, the water separator element should be renewed after each 600 hours of use and the second stage element should be renewed after each 1000 hours of use. In addition, any water noted in the clear shell of the primary (water separator) filter should be drained. To drain the water, shut off fuel supply valve, then open filter element drain plug until filter is drained. Close the drain plug, open bleed screw on top of filter head, then open fuel supply valve. When fuel runs free of bubbles from the bleed hole, close the bleed screw and then bleed remainder of system in normal manner.

A special filter element kit (Ford part No. EPN-99162-A) is available for renewing element in single stage filter or for renewing element in sec-

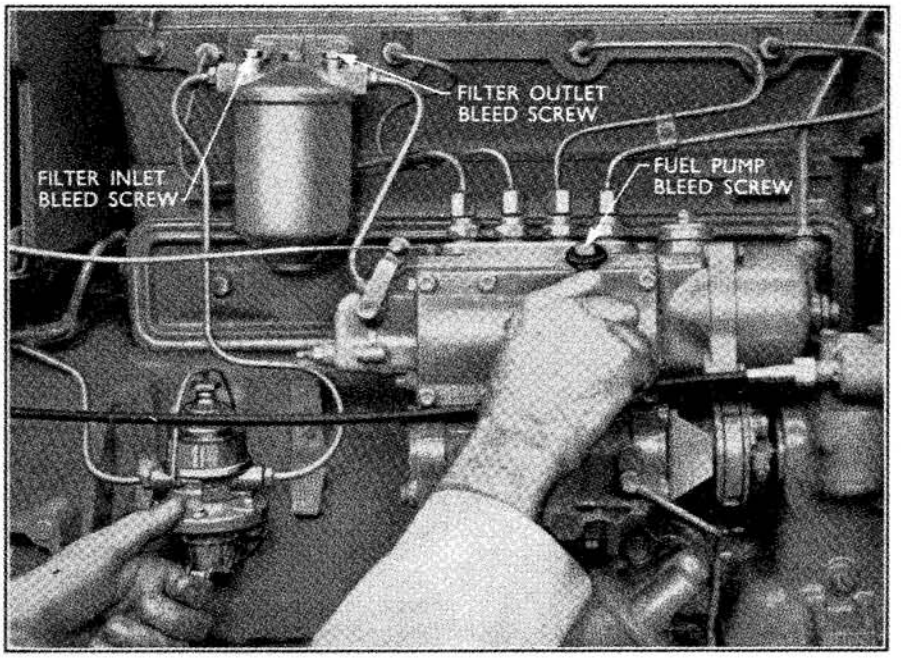


Fig. 58—Bleeding fuel system with vacuum governor fuel injection pump and single stage filter. In some instances, it may be necessary to crank engine over to different position so that fuel lift pump can be operated with primer lever.

ond stage filter on models with dual filter unit. As several different makes of filter units have been used, instructions packaged with filter kit should be closely followed to install the filter element according to trade name of filter which will be found on filter head (base).

Another element kit (Ford part No. DDN-99162-C) is available for renewing the element in the first stage (clear shell) filter unit on models with dual filter.

107. **BLEEDING.** On models with dual filter unit, refer to Fig. 57, open the fuel supply valve at fuel tank, then open the bleed screw (1) on first stage filter. When fuel flows freely without air bubbles, close the bleed screw. Procedure for further bleeding of models with dual filter unit and complete bleeding procedure for models with single filter is as follows:

With fuel supply valve open, open the filter inlet bleed screw (Fig. 58 or 2—Fig. 57) and actuate the primer lever on fuel lift pump until fuel flows from bleed screw opening free of any air bubbles. Note: If primer lever will not actuate the fuel lift pump, turn engine so that fuel pump cam on camshaft is away from fuel pump lever. When fuel flows freely without air bubbles, close the filter inlet bleed screw and open the filter outlet bleed screw (Fig. 58 or 3—Fig. 57). Again actuate the primer lever on fuel lift pump until fuel flows from bleed screw free of any air bubbles and close the screw. Open the fuel pump bleed screw (Fig. 58 or 4 and 5—Fig. 57) and continue to actuate the fuel lift pump primer lever until fuel flows freely without air bubbles from the open bleed screw(s). Close the bleed screws, then loosen the injector pressure line connecting nuts at the injectors, be sure fuel shut-off button is pushed in and crank engine until fuel flows free of air from the loosened connections. Tighten the fuel injector line connections and crank engine.

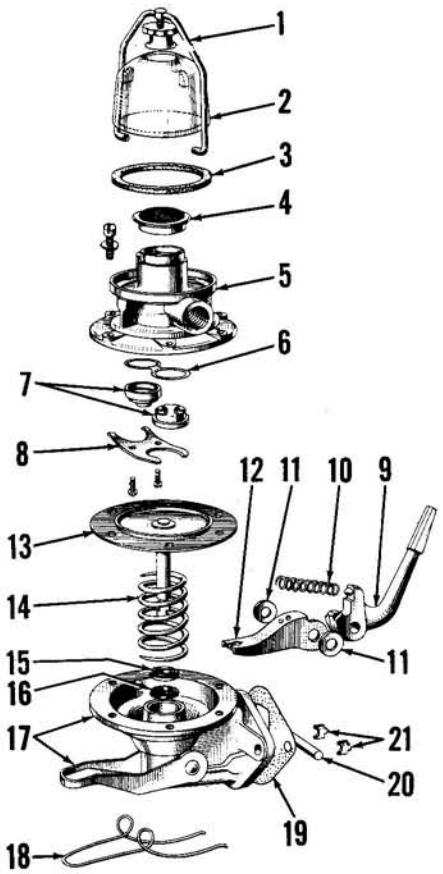


Fig. 59—Exploded view of typical fuel lift pump used with vacuum governor type fuel injection pump. On earlier lift pump, pivot pin (20) extended through pump body (17) and was staked in place.

1. Clamp
2. Bowl
3. Gasket
4. Screen
5. Valve body
6. Gasket
7. Valves
8. Clamp
9. Cam lever
10. Spring
11. Washers
12. Diaphragm lever
13. Diaphragm
14. Spring
15. Retainer
16. Seal
17. Body & priming lever assy.
18. Priming lever spring
19. Gasket
20. Pivot pin
21. Retainers

FUEL LIFT PUMP

All Models

108. Refer to Fig. 59 for exploded view of fuel lift pump used on models "FMD", "FPM" and "FSM" with fuel injection pump having vacuum governor and to Fig. 60 for exploded view of fuel lift pump used on late model "FSM" and "New FSM" having Minemec (mechanical governor) fuel injection pump.

Overhaul of the fuel lift pump is conventional. Fuel delivery pressure should be from 1½ to 3½ psi. Bleed the fuel system as outlined in paragraph 107 after reinstalling pump assembly to engine.

FUEL INJECTION PUMP

Models With Vacuum Governor

109. Models "FMD" and "FPM" and model "FSM" prior to serial No. 08B-756398 were equipped with Simms model SPE-4A fuel injection pumps having a vacuum governor. The different pumps used can be identified by a number on the injection pump cambox cover. Refer to the following cross reference chart for the different pumps used:

Ford Part Number	Simms Pump Number
DDN-993100-A	SPE 4A 70S 296
DDN-993100-B	SPE 4A 70S 380
DDN-993100-C	SPE 4A 75S 498
DDN-993100-D	SPE 4A 75S 527
DDN-993100-F	SPE 4A 75S 647

On model "FMD" tractors prior to serial No. 1425097, the fuel injection pump (Part No. DDN-993100-A or B) had 7.0 mm diameter plungers; all later pumps have 7.5 mm diameter plungers. In an emergency, pumps with 7.0 mm. plungers may be used in later model tractors providing the pump to engine timing is properly adjusted; refer to paragraph 110. However, pumps with 7.5 mm. diameter plungers must not be installed on model "FMD" engines prior to serial No. 1425097.

In some instances when renewing a fuel injection pump, it will be necessary to install a different pump than original equipment. When this oc-

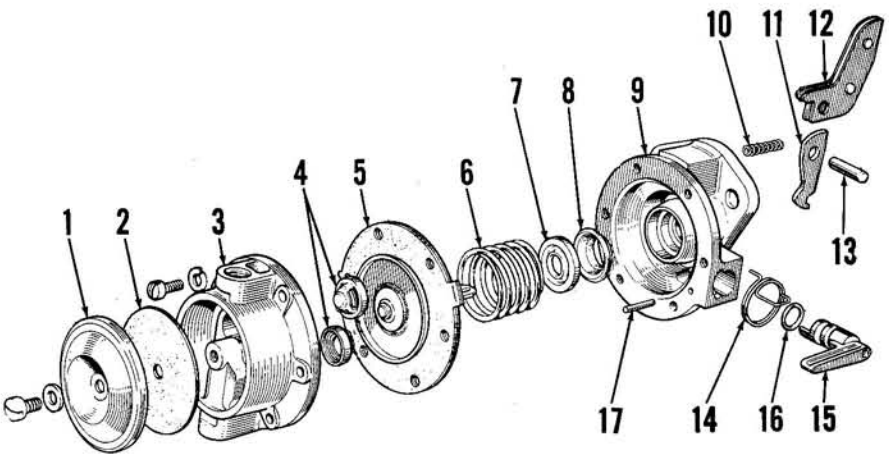


Fig. 60—Exploded view of fuel lift pump assembly used on models "FSM" and "New FSM" with Simms Minimec fuel injection pump.

1. Cover
2. Pulsator diaphragm
3. Valve body
4. Valves
5. Diaphragm
6. Spring
7. Retainer
8. Seal
9. Pump body
10. Spring
11. Diaphragm lever
12. Cam lever
13. Pivot pin
14. Primer lever spring
15. Primer lever
16. "O" ring
17. Lever retaining pin

curs, it may be necessary to change other related parts which will be listed in the Fordson Major Tractor Parts List.

110. **PUMP TIMING.** Pump to engine timing will depend upon tractor model, serial number range and, in some instances, engine modifications. Refer to the following paragraphs:

MODEL "FMD" PRIOR TO SERIAL NO. 1308977. To check pump timing, turn engine until No. 1 piston is coming up on compression stroke (this can be checked by removing oil filler cap and observing rocker arm action), then continue turning engine slowly until the notch in rear flange of crankshaft pulley is aligned with pointer attached to engine front plate. Refer to Fig. 61. The chisel mark on pump drive coupling should then be aligned with mark on timing plate attached to fuel injection pump as shown in Fig. 62. If mark on coupling is not aligned with mark on plate, loosen the two cap screws (7), turn pump camshaft until marks are aligned, then retighten the cap screws. Note: If engine has been modified by installation of later type oil pan with timing hole and flywheel with timing marks, refer to following paragraph and timing chart.

ALL MODELS EXCEPT "FMD" PRIOR TO SERIAL NO. 1308977. Remove the timing plate from lower right rear corner of oil pan (see Fig. 63). Remove the oil filler cap so that rocker arm action can be noted and actuate the compression release if engine is so equipped. Turn engine until No. 1 piston is coming up on compression stroke, then continue to turn engine slowly until the proper degree timing mark (see TIMING CHART) is aligned with pointer. The chisel mark on fuel injection pump drive coupling flange should then be exactly aligned with mark on timing plate as shown in Fig. 62. If not, loosen the two cap screws (7) and turn pump camshaft to align the marks and retighten the cap screws.

TIMING CHART
(VACUUM GOVERNOR)

Tractor Model	Serial No. Range	Degrees BTDC On Flywheel	
"FMD"	Prior to 1308977	29	(1)
"FMD"	1308977-1425096	26	
"FMD"	1425097-1481090	19	(2)
"FPM"	1481091-1578885	23	(3)
"FSM"	1578886-08B756397	23	(4)

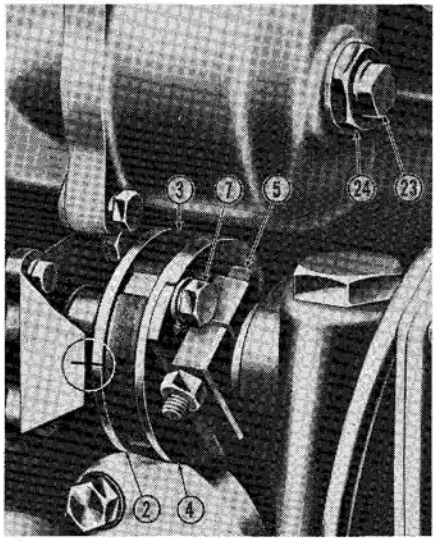


Fig. 62—View showing timing mark on fuel injection pump drive coupling flange (2) aligned with mark on timing plate (both marks are circled). If necessary to adjust timing, loosen the two cap screws (7) and rotate pump camshaft.

2. Drive coupling flange
3. Fiber drive block
4. Driving flange
5. Clamp bolt
7. Cap screws (claw bolts)
23. Dampening valve
24. Lock nut

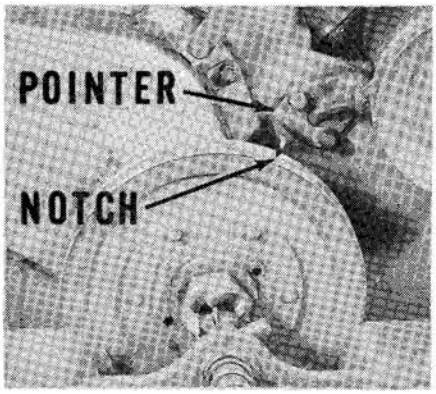


Fig. 61—To time early model "FMD" (prior to serial No. 1308977), turn engine so that No. 1 cylinder is on compression stroke and pointer can be pushed down into notch in crankshaft pulley. Pump timing marks should then be aligned as shown in Fig. 62.

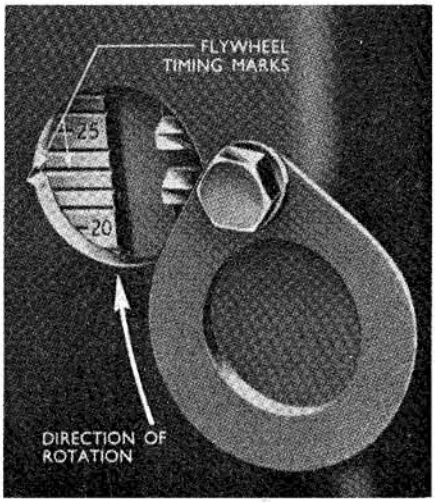


Fig. 63—View with timing cover moved aside showing timing marks on engine flywheel and notch in engine pan. Refer to text for timing specifications and to Fig. 62 for fuel injection pump timing marks.

Note: Refer to paragraph 119 for models with mechanical governor.

(1) Use timing pointer on engine front plate and notch in crankshaft pulley unless engine has been modified by installation of later type oil pan and flywheel.

(2) When fitted with original fuel injection pump (Part No. DDN-993100-C) and thin steel cylinder head gasket (no longer available). If earlier type fuel injection pump (Part No. DDN-993100-A or -B) is installed with thin steel cylinder head gasket, set timing at 22 degrees BTDC. If thick cylinder head gasket is installed with original type pump, adjust timing to 23 degrees BTDC. If both thick head gasket and earlier type pump are installed, set timing to 26 degrees BTDC.

(3) If earlier type fuel injection pump (Part No. DDN-993100-A or -B) has been installed, set timing at 26 degrees BTDC.

(4) Equipped with vacuum governor type fuel injection pump (Simms SPE 4A).

111. **EXCESS FUEL (STARTING) CONTROL.** The fuel injection pump is equipped wtih an excess fuel delivery control (see Fig. 64) which will permit excess fuel to be injected for easier engine starting. Pushing the control button in (or pulling fuel shut-off lever out on early model "FMD") allows governor spring to push fuel metering rack in pump past the maximum fuel delivery stop. As soon as engine starts, the excess fuel control button (or fuel stop lever on early model "FMD") should return to normal position. If control remains in excess fuel delivery position after engine starts, the pump should be removed and sent to authorized service shop for repairs. CAUTION: Do not fasten the control button or fuel stop lever in excess fuel delivery position.

112. **ENGINE SPEED ADJUSTMENTS.** Engine slow idle speed should be 540-560 RPM and high idle no-load speed should be 1900 RPM.

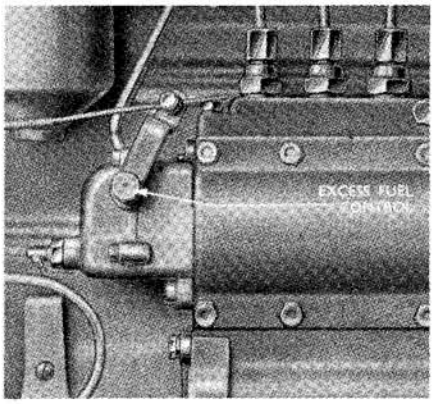


Fig. 64—View of fuel injection pump showing the excess fuel control button. On early model "FMD", the fuel stop lever is pulled out to engage the excess fuel device for starting.

To check and/or adjust engine speed, first start engine and bring to normal operating temperature, then proceed as follows:

NOTE: Anything that interferes with normal intake manifold vacuum will cause governor malfunction. Do not attempt to adjust engine governed speed with the pre-cleaner removed from top of air cleaner or with the air cleaner disconnected. Renew air pre-cleaner if the spiral fins have been removed or damaged. Be sure that the air cleaner (including pre-cleaner and hose connections) is properly serviced and is in good condition. On early model tractors with closed crankcase ventilation system, a leaking engine gasket will cause governor malfunction; refer to paragraph 88.

Move throttle lever to slow idle speed position and check engine speed. If not within the range of 540-560 RPM, refer to Fig. 65 and adjust idling screw as required. If engine surges at idle speed, refer to Fig. 66 and adjust governor dampening valve to eliminate or reduce surge as much as possible. Readjust engine slow idle speed if necessary. Note: If engine surges excessively, refer to paragraph 116.

Move throttle lever to wide open throttle position and check engine high idle, no load speed. If high idle speed is not approximately 1900 RPM, refer to Fig. 65 and adjust the maximum speed screw as required.

NOTE: If tractor is not equipped with Proofmeter (tachometer), or to check accuracy of Proofmeter, engine speed can be checked at belt pulley or PTO output shaft if tractor is so equipped. At 1900 engine RPM, belt pulley speed with transmission in high range will also be 1900 RPM; PTO output shaft speed will be 855 RPM when equipped with standard PTO or 641 RPM if equipped with raised PTO.

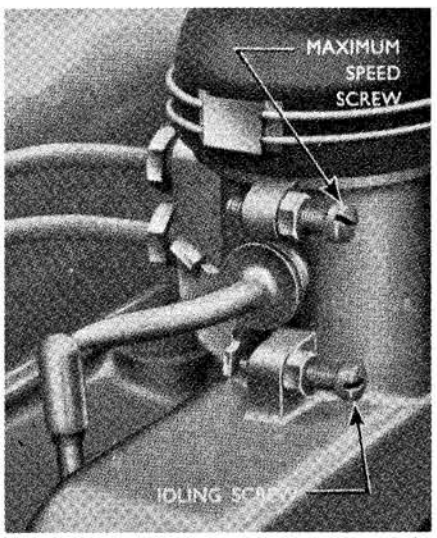


Fig. 65—Engine governed speed is adjusted by the maximum speed screw (top) and idling screw (bottom).

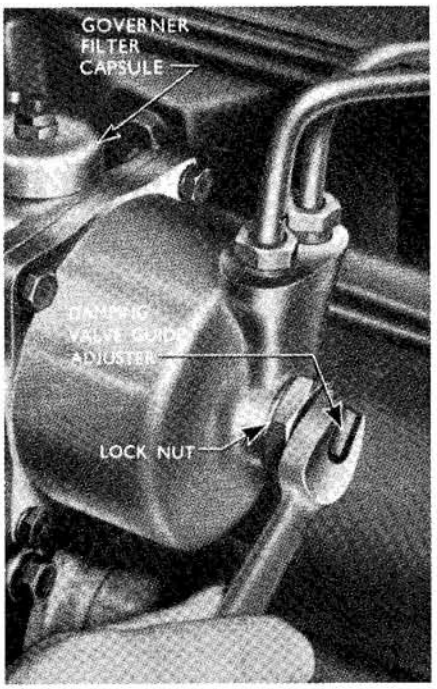


Fig. 66—If engine surges at idle speed, or at a slow engine speed at which engine must be run for certain operations, loosen lock nut and slowly turn damping valve guide adjuster back and forth to find position that will most effectively reduce surge.

113. **R&R FUEL INJECTION PUMP.** To remove the fuel injection pump, first thoroughly clean the pump and surrounding area, then shut off the fuel supply valve and proceed as follows:

Remove the two vacuum pipes from between pump governor housing and engine intake manifold. Remove the fuel injector pipes and the fuel supply pipe from filter to pump and immediately cap all openings. Disconnect the stop control wire and then unbolt and remove pump assembly from mounting bracket.

To reinstall pump, set timing position as outlined in paragraph 110, then reinstall pump with timing mark on pump drive coupling aligned with mark on timing plate as shown in Fig. 62. Reconnect stop wire so that stop button is out about ⅛-inch when stop control lever on fuel injection pump is fully forward. Reinstall the governor pipes, fuel supply pipe and fuel injector pipes, leaving the injector pipes loose at upper (injector) ends. Using a pump type oil can, fill pump cam box to level of leak-off pipe opening with clean, new engine oil, then install leak-off pipe. Bleed the diesel fuel system as outlined in paragraph 107. CAUTION: Do not attempt to start engine without the governor pipes installed.

114. **PUMP OVERHAUL.** Other than servicing the governor as outlined in paragraph 116 or renewing drive coupling parts as outlined in paragraph 115, overhaul and/or adjustment of the fuel injection pump should not be attempted unless in a fully equipped injection service shop.

115. PUMP DRIVE COUPLING. Refer Fig. 67 for exploded view of the fuel injection pump drive coupling. Do not attempt to renew the timing plate (1) or drive coupling flange (2) on fuel injection pump as timing marks must be placed on the flange in a diesel pump service shop.

Renewal of the fiber drive coupling block (3), driving flange (4) or adapter (6) can be accomplished after removing fuel injection pump as outlined in paragraph 113. Remove the two cap screws (7) to unbolt flange from adapter. Remove the clamping bolt (5), then pull adapter from accessory shaft.

At serial No. 1599502, width of keyway in auxiliary driveshaft and pump drive adapter was increased from $\frac{5}{32}$-inch to $\frac{3}{16}$-inch. As some earlier models may have the later shaft and adapter, it will be necessary to measure key width before obtaining a new adapter and key.

When reinstalling adapter, leave clamping bolt loose until after fuel injection pump has been reinstalled. With the adapter to driving flange cap screws snug, but not tight, move adapter on accessory driveshaft to obtain a 0.010 end float of the fiber

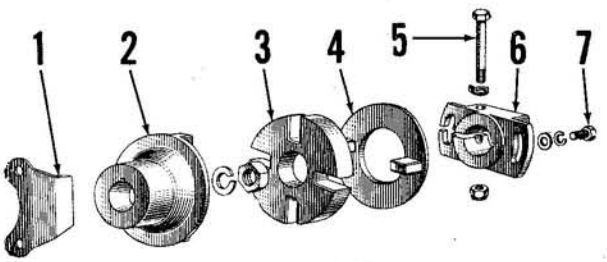


Fig. 67—Exploded view of pump drive coupling. The timing plate (1) and drive coupling flange (2) should not be removed from the pump as timing marks must be affixed to new parts at pump repair station.

1. Timing plate
2. Drive coupling flange
3. Fiber drive block
4. Driving flange
5. Clamp bolt
6. Adapter
7. Cap screws (claw bolts)

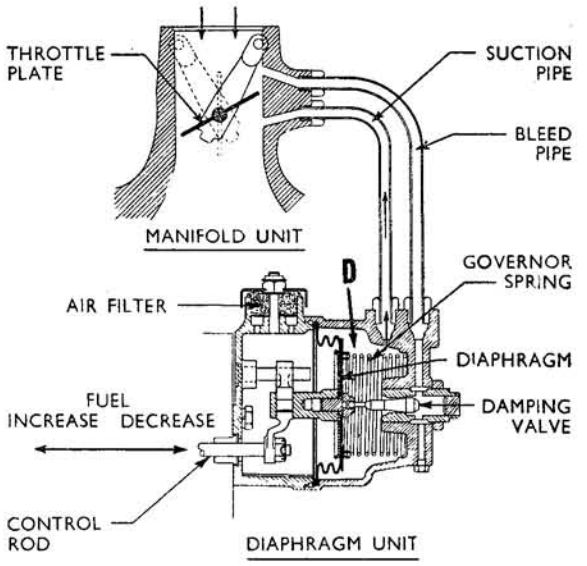


Fig. 68—Schematic view of the vacuum governor unit incorporated in the Simms fuel injection pump used prior to model "FSM" serial No. 08B-756397. Suction pipe is connected to intake manifold at point below throttle plate and bleed pipe is connected to intake manifold above the throttle plate. Vacuum in diaphragm chamber (D) acts against governor spring to move the pump control rod and increase or decrease fuel injected in engine according to relative vacuum above and below throttle plate in intake manifold.

drive block, then tighten adapter clamping bolt. Set pump to engine timing accurately as outlined in paragraph 110, then tighten the adapter to driving flange cap screws.

116. VACUUM GOVERNOR. Refer to Fig. 68 for schematic view showing vacuum governor operation and to Fig. 69 for exploded view of governor unit. Service of the governor unit can be performed without use of special equipment. Refer to the following procedures.

The governor filter element (see Fig. 70) should be removed and cleaned after each 200 hours of operation. The filter element should be lightly oiled with clean engine oil before being reinstalled on top of fuel injection pump housing.

To check governor diaphragm for air leaks, proceed as follows: Remove the governor housing to intake manifold air pipes, rotate stop lever at rear end of pump as far to rear as possible and tightly cover the two openings in governor housing. If the governor spring returns the pump rack to normal position, the diaphragm is leaking.

To renew the governor diaphragm and/or the dampening valve, proceed as follows: Refer to Fig. 70 and remove the governor assembly from fuel injection pump, then refer to Fig. 69 and disassemble governor unit as follows: Hold the governor spring compressed by pushing diaphragm plate inward and remove the wire ring (10) and retaining plate (11); then, remove the diaphragm and dampening valve assembly and the governor spring. Unscrew the diaphragm guide (12) and lock nut (13), then separate the diaphragm plate (15), diaphragm (14), spring retainer plate (16) and dampening valve (17).

Inspect dampening valve for wear at ball joint or at front end of valve where it rides in the bushing (22) in dampening valve adjusting screw (23). Renew the valve and bushing if wear is noted. Note: Bushing is available separately from adjusting screw, but new adjusting screw includes new bushing. Refer to Fig. 71 for identification of two of the dampening valves and bushings that have been used. A later valve has a 7 degree taper and is used with the same "flush bushing" as the 20 degree taper valve; later 7 degree taper valve can be identified by annular groove cut on valve.

If difficulty with engine surging at about 1000 RPM is encountered on model "FPM" and surging cannot be satisfactorily corrected by turning the dampening valve adjusting screw, use of later 7 degree taper dampening valve (Ford part No. DDN-993113-C) along with smaller ($\frac{3}{16}$-inch O.D.) governor to intake manifold suction pipe (part No. DDN-993139-D) is recommended. Note: Fuel injection pumps with Simms identification "SPE 4A-75S-647" on cambox cover will have the later 7 degree taper valve.

Later type governor spring has free length of 6 inches. Free length of early

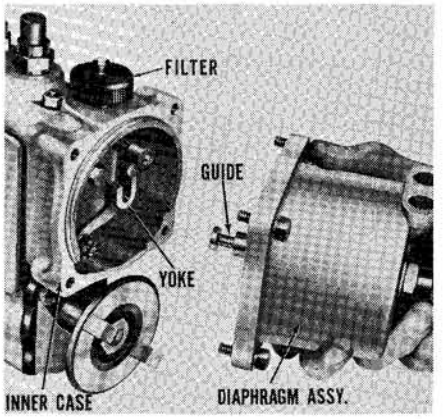


Fig. 70—View showing vacuum governor (diaphragm) assembly being removed from fuel injection pump. Note governor breather filter which should be serviced regularly. Lubricate guide and yoke with multi-purpose grease prior to reassembly.

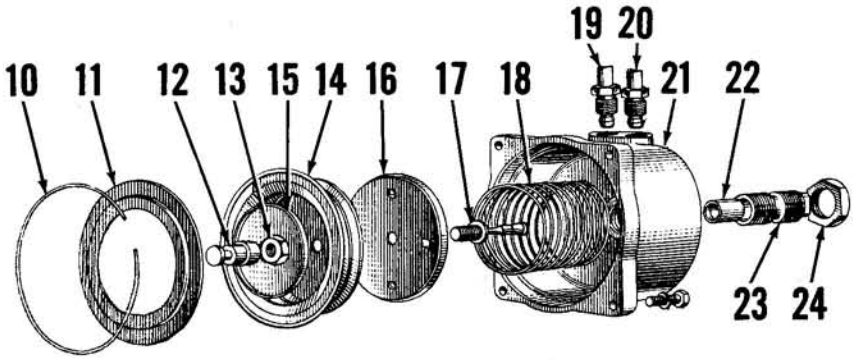


Fig. 69—Exploded view of the fuel injection pump vacuum governor assembly. Gap in retaining ring (10) should be installed adjacent to ejector hole in housing (21).

10. Retaining ring
11. Retainer plate
12. Diaphragm guide
13. Lock nut
14. Diaphragm
15. Diaphragm plate
16. Spring locating plate
17. Dampening valve
18. Governor spring
19. Suction pipe
20. Bleed pipe
21. Governor housing
22. Bushing
23. Adjusting screw
24. Lock nut

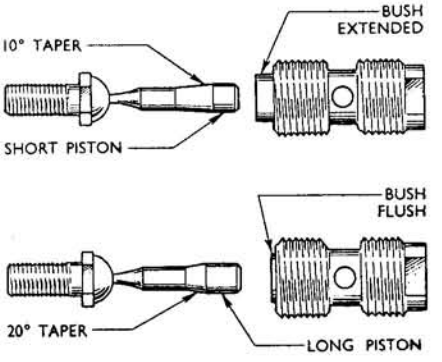


Fig. 71—View showing 10 degree taper and 20 degree taper dampening valves and their mating bushings. Latest 7½ degree taper valve is not shown, but can be identified by an annular groove on valve. Latest valve is used with same bushing as 20 degree taper valve.

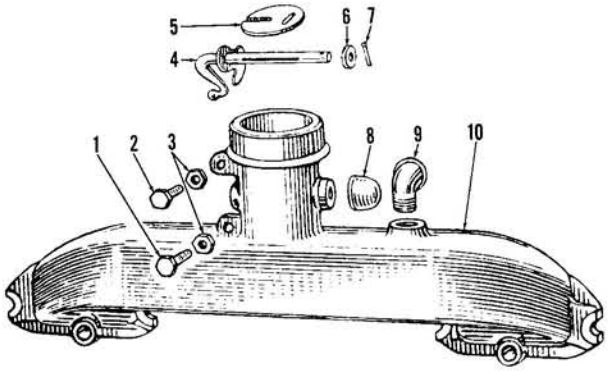


Fig. 72—View showing throttle plate and shaft removed from intake manifold. Wear on throttle shaft and in shaft bore of intake manifold is possible cause of dust entry and excessive engine wear.

1. Slow idle speed screw
2. Maximum speed screw
3. Lock nuts
4. Throttle shaft
5. Throttle plate
6. Washer
7. Cotter pin
8. Cover
9. Ventilation connector (early "FMD" only)
10. Intake manifold

spring was 7.16 inches. Early (long) spring should exert a force of 3 lbs., 8 ounces to 3 lbs., 13½ ounces when compressed to a length of 1.97 inches; later spring should exert force of 3 pounds to 3 pounds, 5 ounces, when compressed to same length. In conjunction with change in governor spring, the external diameter of diaphragm plate and internal diameter of spring retainer plate were reduced from 2.48 inches to 2.09 inches. The springs and plates are interchangeable; however, both the latest diaphragm plate (15—Fig. 69) and spring retainer plate (16) must be installed as a pair.

When reassembling governor, lightly oil the ball joint of dampening valve. Using Fig. 69 as a guide, reassemble diaphragm and dampening valve assembly. Set spring in housing being sure outer end is properly located in housing, then set the valve and diaphragm assembly on inner end of spring so that the inner end of spring is seated in the spring retainer plate. Push unit down into housing making sure dampening valve enters bushing. Fit outer edge of diaphragm in housing and secure with retaining plate and wire ring. Gap in ring should be adjacent to ejector hole in housing. Lightly grease the groove in end of dampening valve guide, then reinstall the governor unit as in Fig. 70. Be sure governor air pipes are correctly installed before attempting to start engine.

117. INTAKE MANIFOLD THROTTLE. Refer to exploded view of intake manifold in Fig. 72. Throttle shaft (4) can be removed after removing cover (8), cotter pin (7) and flat washer (6). Check throttle shaft and shaft bore in intake manifold for wear. Renew shaft and/or intake manifold if wear is sufficient to allow dust entry into air intake system.

Crankcase ventilation connector (9) is not used except on early "FMD" prior to serial No. 1425097 with closed crankcase ventilation system. Refer to paragraph 88.

Models With Mechanical Governor Type (Minimec) Fuel Injection Pump

118. At serial No. 08B-756398 of model "FSM" production, a fuel injection pump with integral mechanical governor (Simms "Minimec") was introduced. Other than adjusting engine governed speed as outlined in paragraph 121 or renewing the fiber drive coupling block, no service to the pump assembly should be attempted outside an authorized Simms or Ford diesel pump repair station.

119. **PUMP TIMING.** To check fuel injection pump to engine timing, first

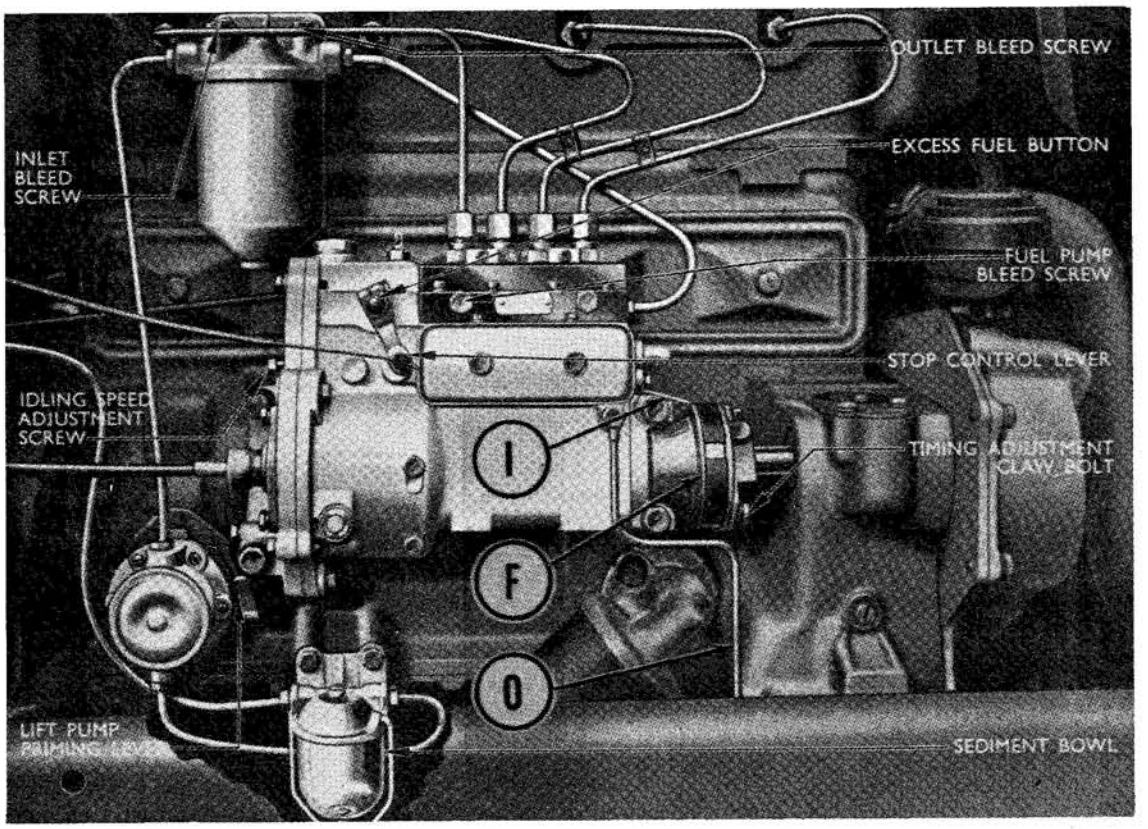


Fig. 73—View of Simms Minimec (mechanical governor) fuel injection pump on Fordson Super Major. Refer to Fig. 74 for view showing oil filler, level and drain plugs and to Fig. 75 for speed adjustment screws. Timing mark on drive coupling flange (F) must be aligned with mark on timing indicator (1) when No. 1 piston is coming up on compression stroke and 21 degree BTDC mark on flywheel (see Fig. 63) is aligned with notch in timing hole.

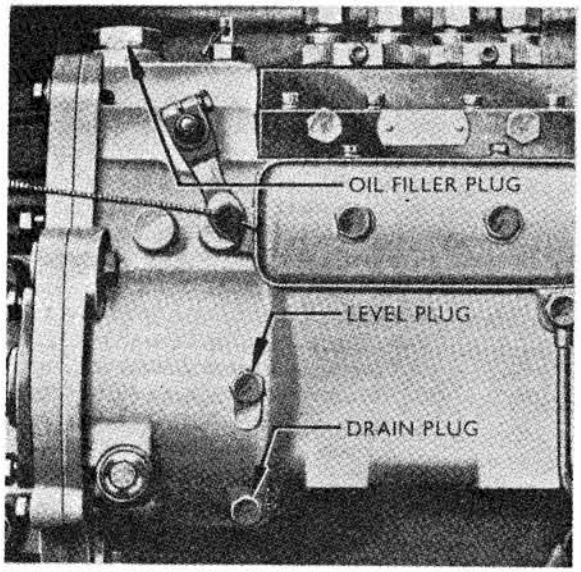


Fig. 74—Every 200 hours of operation, fuel injection cambox should be drained and refilled to level plug with clean engine oil. Oil drain plug, level plug and filler plug locations are shown.

actuate the compression release, remove timing cover from right rear side of oil pan and remove oil filler cap from rocker arm cover so that action of rocker arms can be observed. Turn engine until No. 1 piston is coming up on compression stroke, then continue turning until the 21 degree BTDC timing mark on flywheel is aligned with notch in timing hole of oil pan. The timing mark on fuel injection pump drive coupling flange should then be exactly aligned with mark on pointer attached to pump. If not, loosen the two cap screws clamping driving coupling front flange to adapter, turn pump camshaft until marks are aligned, then tighten the two cap screws. Turn engine through two revolutions and recheck timing.

120. **LUBRICATION.** Refer to Fig. 74 for location of fuel injection pump oil filler, oil level and oil drain plugs.

When installing a new or rebuilt fuel injection pump, be sure to fill pump to level plug with new, clean engine oil. After each 200 hours of operation, the pump should be drained and refilled wih new, clean oil. Use same weight oil as used in engine crankcase. As there will be some fuel leakage past the pump plungers, the oil level will rise and some of the fuel-oil mixture will be lost out the overflow pipe (O—Fig. 73). This is only normal and the greatest overflow will be noted after the engine has been stopped.

121. **ENGINE SPEED ADJUSTMENT.** Engine governed speed is controlled by the movement of governor control lever; refer to Fig. 75. The maximum speed screw is usually adjusted on a fuel injection pump calibration stand; however, it should be readjusted if engine high idle (no-load) speed is not within the range of 1800-1825 RPM on model "FSM" or 1925 RPM on model "New FSM".

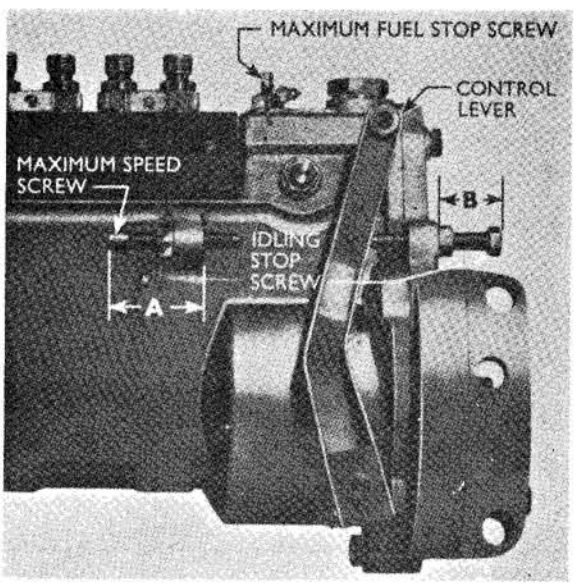


Fig. 75—View of fuel injection pump removed from engine to show maximum speed screw and idling stop screw. Adjustment of the maximum fuel stop screw should not be attempted unless pump is mounted on fuel injection pump calibrating machine.

Note: The maximum speed screw is wired and sealed; breaking of the seal by other than Ford authorized service personnel may void the warranty on new tractors.

Engine slow idle speed should be approximately 550 RPM on all models equipped with Simms Minimec fuel injection pump.

122. **R&R FUEL INJECTION PUMP.** To remove the fuel injection pump, first shut off the fuel supply valve and thoroughly clean pump and surrounding area, then, proceed as follows:

Disconnect the proofmeter (tachometer) drive cable and the stop control cable from injection pump. Remove the fuel filter to pump supply pipe and the four fuel injector pipes and immediately cap all openings, then, unbolt and remove the pump assembly from engine.

When reinstalling pump, remove oil filler cap from rocker arm cover so that rocker arm action can be observed, then turn engine until No. 1 piston is coming up on compression stroke. Refer to Fig. 63, remove the timing cover and slowly turn engine in normal direction of rotation until the 21 degree BTDC mark on flywheel is aligned with notch in timing hole in oil pan. Turn pump camshaft so that timing mark on coupling flange (F—Fig. 73) is aligned with timing indicator (I), then, attach pump to engine in reverse of removal procedure.

123. **PUMP OVERHAUL.** Other than renewing the drive coupling fiber block, driving flange and/or adapter as outlined in paragraph 115, overhaul of the fuel injection pump should not be attempted. Return the pump to authorized Simms or Ford fuel injection pump repair station for adjustment, rebuilding or exchange.

INJECTION NOZZLES

All Models

All models are equipped with Simms fuel injection nozzles. The nozzles have four orifices each with a spray angle of 150 degrees. Engines between serial No. 1425-097 and 1481090 were equipped with nozzles having 0.011 diameter orifices. All other models were equipped with nozzles having 0.010 diameter orifices. The two different nozzles can be identified after disassembly of the fuel injector. The nozzles having 0.010 diameter orifices will have "NL 123" etched on upper part of nozzle body and nozzles having 0.011 diameter orifices will have "NL 141" etched on upper part of body. The different size orifice nozzles should not be individually interchanged, but can be interchanged as set

of four without seriously affecting engine operation.

CAUTION: Fuel leaves the injector nozzle with sufficient force to pentrate the skin. When testing nozzles, keep your person clear of the spray.

124. **TESTING AND LOCATING A FAULTY NOZZLE.** If engine does not run properly and a faulty injection nozzle is indicated, such a faulty nozzle can be located as follows: With engine running, loosen the high pressure line fitting on each nozzle holder in turn, allowing fuel to escape at the union rather than enter the injector. As in checking for faulty spark plugs in a spark ignition engine, the faulty unit is the one which, when its line is loosened, least affects the running of the engine.

125. **NOZZLE TESTER.** A complete job of testing and adjusting the fuel injection nozzle requires use of a special tester such as shown in Fig. 76. The nozzle should be tested for opening pressure, spray pattern, seat leakage and leak back.

Operate the tester until oil flows and then connect injection nozzle to tester. Close the valve to tester gage and operate tester lever to be sure nozzle is in operating condition and not plugged. If oil does not spray from all four spray holes in nozzle, if tester lever is hard to operate or other obvious defects are noted, remove nozzle from tester and service as outlined in paragraph 132. If nozzle operates without undue pressure on tester lever and fuel is sprayed from all four spray holes, proceed with following tests:

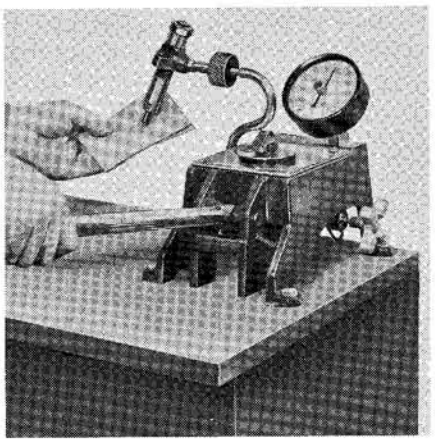


Fig. 76—Checking nozzle seat leakage on injector nozzle test stand. Refer to text for procedure.

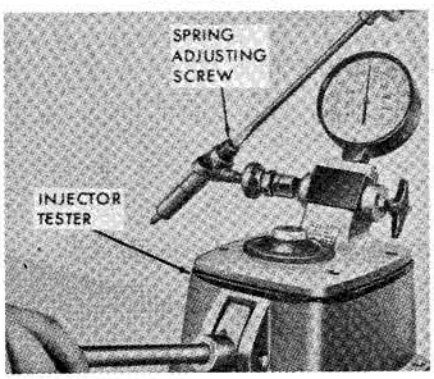


Fig. 77—Adjusting injector opening pressure.

126. OPENING PRESSURE. While slowly operating tester lever with valve to tester gage open, note gage pressure at which nozzle spray occurs. Pressure should be 2720-2794 psi. If gage pressure is not within these limits, remove cap nut and turn adjusting screw (See Fig. 77) as required to bring opening pressure within specified limits. If opening pressure is erratic or cannot be properly adjusted, overhaul nozzle as outlined in paragraph 132. If opening pressure is within limits, check spray pattern as outlined in following paragraph.

127. SPRAY PATTERN. Operate the tester lever slowly and observe nozzle spray pattern. All four (4) sprays must be similar and spaced at approximately 90° to each other in a nearly horizontal plane. Each spray must be well atomized and should spread to a 3 inch diameter cone at approximately 8 inches from nozzle tip. If spray pattern does not meet these conditions, overhaul nozzle as outlined in paragraph 132. If nozzle spray is satisfactory, proceed with seat leakage test as outlined in following paragraph:

128. SEAT LEAKAGE. Close valve to tester gage and operate tester lever quickly for several strokes. Then, wipe nozzle tip dry with clean blotting paper, open valve to tester gage, push tester lever down slowly to bring gage pressure to 200 psi. below nozzle opening pressure and hold this pressure for one minute. Apply a piece of clean blotting paper (see Fig. 76) to tip of nozzle; the resulting oil blot should not be greater than one-half inch in diameter. If nozzle tip drips or blot is excessively large, overhaul nozzle as outlined in paragraph 132. If nozzle seat leakage is not excessive, proceed with nozzle leak back test as outlined in following paragraph.

130. NOZZLE LEAK BACK. Operate tester lever to bring gage pressure to approximately 2300 psi., release lever and note time required for gage pressure to drop from 2200 psi to 1500 psi. Time required should be from ten to forty seconds. If time required is less than ten seconds, nozzle is worn or there are dirt particles between mating surfaces of nozzle and holder. If time required is greater than forty seconds, needle may be too tight a fit in nozzle bore. Refer to paragraph 132 for disassembly, cleaning and overhaul information.

NOTE: A leaking tester connection, check valve or pressure gage will show up in this test as excessively fast leak back. If, in testing a number of injectors, all show excessively fast leak back, the tester should be suspected as faulty rather than the injectors.

131. **REMOVE AND REINSTALL INJECTORS.** To remove the injectors, first remove the rocker arm cover, then proceed as follows: Disconnect the fuel leak off pipe from the top of each injector and at rear end of cylinder head and remove the pipe. Remove the fuel injector pressure pipes, being sure to hold delivery valve from turning while removing nut at injection pump end of pipe. Remove the injector after unscrewing the two retaining cap screws. CAUTION: Take care not to drop any of the return line or injector cap screws down into the engine. If injector is tight in its bore, remove with pry bar or injector lifting bar. Immediately cap all openings.

Prior to reinstalling injectors, check the injector seats in cylinder head to be sure they are clean and free of any carbon deposit. Old copper sealing washers, if stuck in bore, can be removed by tapping a screwdriver blade down through washer, then twisting washer loose. Install a new copper washer in each seat, then insert injector assemblies into cylinder head. Tighten the retaining cap screws of each injector alternately and evenly

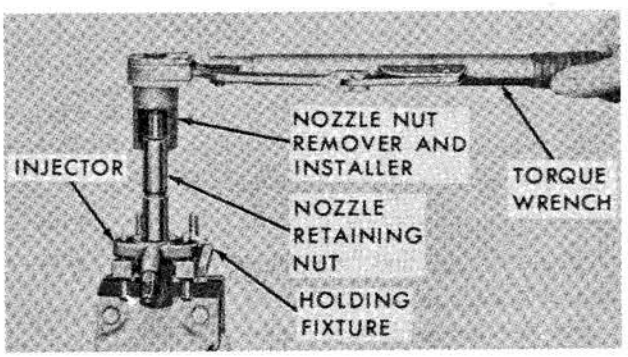


Fig. 78 — Nozzle holder (injector) should be mounted on holding fixture for removing or installing nozzle retaining nut. Install nut using torque wrench.

to a torque of 10-15 Ft.-Lbs. Reinstall leak off pipe to tops of injectors and reconnect pipe at rear end of cylinder head. Check fuel injector pipe connections to be sure they are clean and reinstall pipes, tightening at injection pump end only. Crank engine until a steady stream of fuel is pumped out each pipe, then tighten the connections. Start and run engine to be sure there are no leaks, then reinstall rocker arm cover.

132. **OVERHAUL INJECTORS.** Unless complete and proper equipment is available, do not attempt to overhaul diesel nozzles. Equipment recommended by Ford is Kent-Moore J-8666 Injector Nozzle Tester and J-8537 Injector Nozzle Service Tool Set. This equipment is available from the Kent-Moore Organization, Inc., 28635 Mound Road, Warren, Michigan.

Refer to Fig. 78 and proceed as follows: Secure injector holding fixture (J8537-11) in a vise and mount injector assembly in fixture. **Never** clamp the injector body in vise. Remove the cap nut and back-off adjusting screw, then lift off the upper spring disc, injector spring and spindle. Remove the nozzle retaining nut using nozzle nut socket (J8537-14), or equivalent, and remove the nozzle and valve. Nozzles and valves are a lapped fit and must never be interchanged.

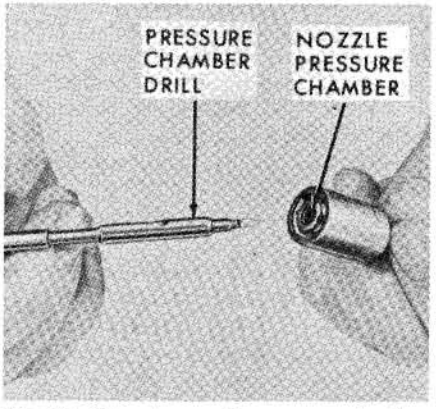


Fig. 79—Cleaning nozzle pressure chamber.

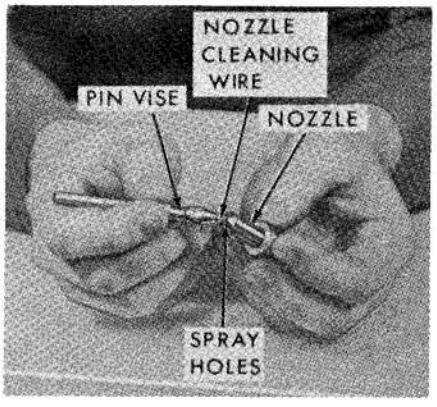


Fig. 80—Cleaning nozzle spray hole.

Place all parts in clean fuel oil or calibrating fluid as they are disassembled. Clean injector assembly exterior as follows: Soften hard carbon deposits formed in the spray holes and on needle tip by soaking in a suitable carbon solvent, then use a soft wire (brass) brush to remove carbon from needle and nozzle exterior. Rinse the nozzle and needle immediately after cleaning to prevent carbon solvent from corroding the highly finished surfaces. Clean the pressure chamber of nozzle with a 0.043 reamer (J8537-4) as shown in Fig. 79. Clean spray holes with the proper size wire probe held in a pin vise (J4298-1) as shown in Fig. 80. To prevent breakage of wire probe, the wire should protrude from pin vise only far enough to pass through the pin holes. Rotate pin vise without applying undue pressure. Use a 0.009 wire probe (Kent-Moore part No. J8537-2) with nozzle having "NL 123" etched on upper part of nozzle body or a 0.010 diameter wire probe with nozzle having "NL 141" etched on upper part of body.

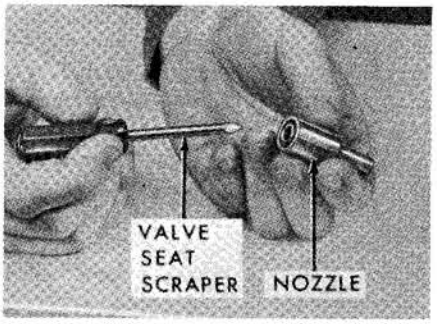


Fig. 81—Removing carbon from valve seat in nozzle.

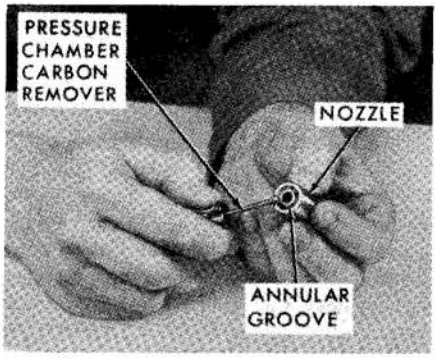


Fig. 82—Clean annular groove in top of nozzle using pressure chamber tool as shown.

The valve seats in nozzle are cleaned by inserting the valve seat scraper (J-8537-18) into nozzle and rotating scraper. Refer to Fig. 81. The annular groove in top of nozzle and the pressure chamber are cleaned by using the pressure chamber carbon remover tool (J-8537-15) as shown in Fig. 82.

When above cleaning is accomplished, back flush nozzle and needle by installing reverse flushing adapter (J-8537-6) on nozzle tester and inserting nozzle and needle assembly tip end first into the adapter. Secure with knurled nut. Rotate the needle in nozzle while operating tester lever. After nozzle is back flushed, the seat can be polished by using a small amount of tallow (J-8537-28) on end of a polishing stick (J-8537-21), rotating stick in nozzle as shown in Fig. 84.

If the leak back test time was greater than 40 seconds (refer to paragraph 130), or if needle is sticking in bore of nozzle, correction can be made by lapping the needle and nozzle assembly. This is accomplished by using a polishing compound (Bacharach No. 66-0655 is suggested) as follows: Place small diameter of nozzle in a chuck of a drill having a maximum speed of less than 450 RPM. Apply a small amount of polishing compound on barrel of needle taking care not to allow any compound on tip or beveled seat portion, and insert needle in rotating nozzle body. Refer to Fig. 85. Note: It is usually necessary to hold upper pin end of needle with vise-grip pliers to keep the needle from turning with the nozzle. Work the needle in and out a few

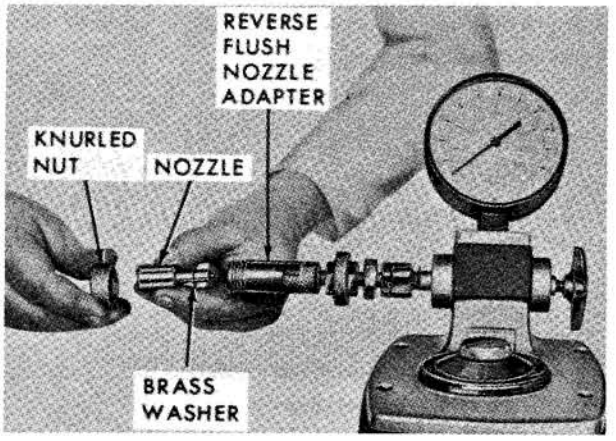


Fig. 83 — View showing proper positioning of nozzle in reverse flush adapter for back-flushing nozzle on injector test stand.

times taking care not to put any pressure against seat, then withdraw the needle, remove nozzle from chuck and thoroughly clean the nozzle and needle assembly using back flush adapter and tester pump.

Prior to reassembly, rinse all parts in clean fuel oil or calibrating fluid and assemble while still wet. The injector inlet adapter (Simms only) normally does not need to be removed. However, if the adapter is removed, use a new copper sealing washer when reinstalling. Position the nozzle and needle valve on injector body and be sure dowel pins in body are correctly located in nozzle as shown in Fig.

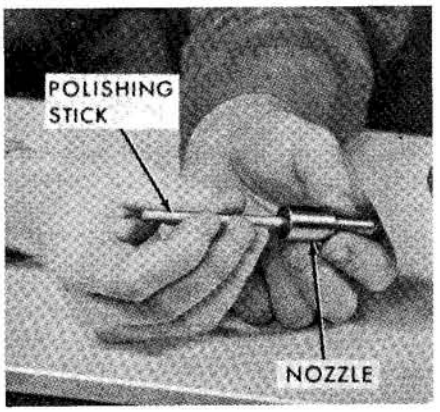


Fig. 84—Nozzle seat can be polished by using a small amount of tallow on a polishing stick and rotating stick in nozzle as stand.

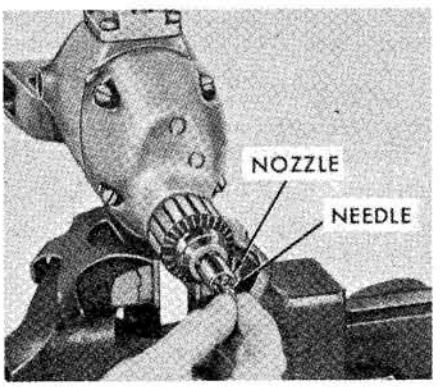


Fig. 85—Nozzle and needle can be lapped by using a slow speed electric drill. Refer to text.

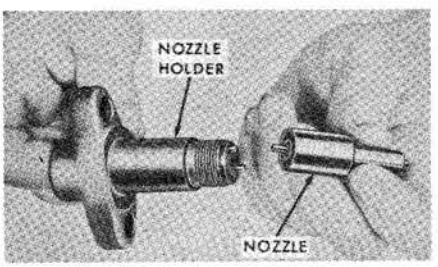


Fig. 86 — When positioning nozzle and needle on injector body, be sure that dowel pins are correctly aligned in nozzle.

86. Install the ⅜-inch shim washer (See Fig. 87) and nozzle retaining nut and tighten nut to a torque of 50 Ft.-Lbs. Note: Place injector in holding fixture (J8537-11) and tighten nut with socket (J8537-14). Install the spindle, spring, upper spring disc and spring adjusting screw. Connect the injector to tester and adjust opening pressure as in paragraph 126. Use a new copper washer and install cap nut. Recheck nozzle opening pressure to be sure that installing nut did not change adjustment. Retest injector as outlined in paragraphs 127 through 130; renew nozzle and needle if still faulty. Note: If the injectors are to be stored after overhaul, it is recommended that they be thoroughly flushed with calibrating fluid prior to storage.

COOLING SYSTEM

RADIATOR

All Models

133. Three different types of radiators may be encountered in service. Early model "FMD" were equipped with radiators having 10 fins per inch. All later radiators have five fins per inch but can be used for service installation to renew the earlier type radiator. Late production model "FSM" (Serial No. 08B767403 and later) and model "New FSM" have radiator mounting bolt holes 10¼ inches apart instead of 18⅛ inches apart as on earlier production. To install late production radiator on earlier tractor, it will be necessary to drill new mounting holes in tractor front support; refer to Fig. 88. Also, if installing later type front support on earlier tractor, it will be necessary to drill radiator mounting holes in the front support as shown in Fig. 88 to adapt the earlier radiator. A kit (Ford part No. DDN-8K004) is available for mounting the late type radiator (with mounting holes 10¼ inches apart) in earlier type front support where new mounting holes have been drilled.

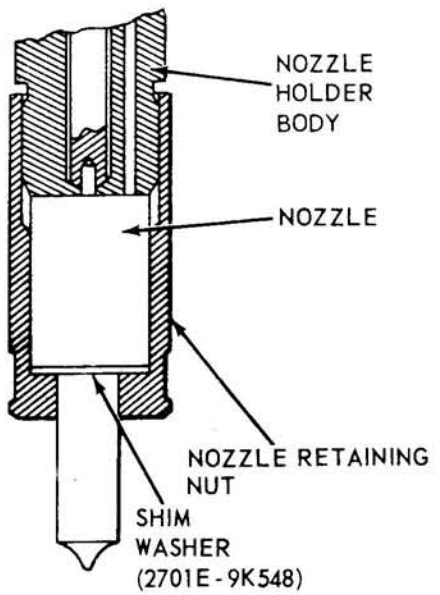


Fig. 87—A shim washer (part No. 2701E-9K548) installed between nozzle and retaining nut will help in preventing dowels from being sheared as nozzle retaining nut is tightened.

134. **R&R RADIATOR.** To remove radiator, proceed as follows: Drain cooling system, remove air pre-cleaner and vertical exhaust muffler, then remove engine hood. Disconnect radiator hoses and, when so equipped, the flexible filler hose. Remove the two half-sections of radiator grille and disconnect headlight wiring. On "FSM" and "New FSM", unbolt and

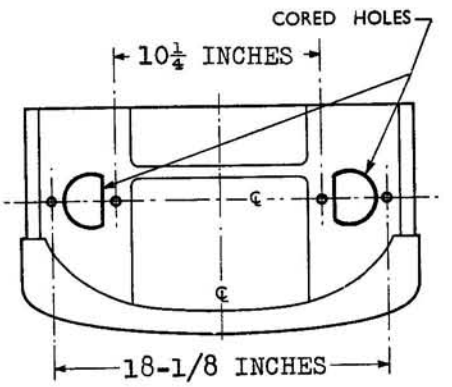


Fig. 88 — When installing early radiator with late front support or late radiator with early production front support, new mounting holes must be drilled according to above dimensions.

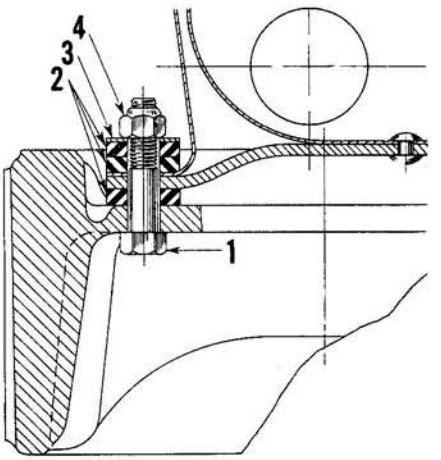


Fig. 89—Cross-sectional view showing early type radiator mounting.

1. Bolt
2. Insulators
3. Washer
4. Self-locking nut

remove the headlight assemblies. Unbolt the radiator support brace (to cylinder head or radiator shell). Unbolt and remove radiator shell, then unbolt and remove radiator assembly from front support.

When reinstalling radiator, refer to Fig. 89 or to Fig. 90 for placement of rubber insulating washers on radiator mounting bolts. Note: If renewing radiator or front support, it may be necessary to modify the front support; refer to Fig. 88.

THERMOSTAT

All Models

135. Two different types of thermostats have been used; refer to Fig. 91. The "non-shrouded" type was used in early model "FMD" (prior to Serial No. 1425097). Cylinder heads for later model "FMD" (Serial No. 1425-097 and up) and all model "FPM", "FSM" and "New FSM" require a "shrouded" type thermostat. Although the later "shrouded" type thermostat may be used in earlier engines, it is very important that only the "shrouded" type (Ford part No. 204-E-8575) be used in the later engines. The design of the shrouded thermostat is such that as the engine reaches operating temperature, the thermostat opens and gradually closes off the by-pass opening; refer to Fig. 92. A restricted flow of hot coolant is then circulated through the radiator until, when the thermostat is fully open, an unrestricted flow is obtained.

Either type of thermostat should start to open at 170-179° F., and be fully open at 199° F. When installing thermostat, it is important that the thermostat flange protrude 0.005-0.028 above cylinder head as shown in Fig. 92. If protrusion is less than 0.005, install a 0.018-0.021 shim (Ford part No. E9-CJ-9) between thermostat flange and cylinder head.

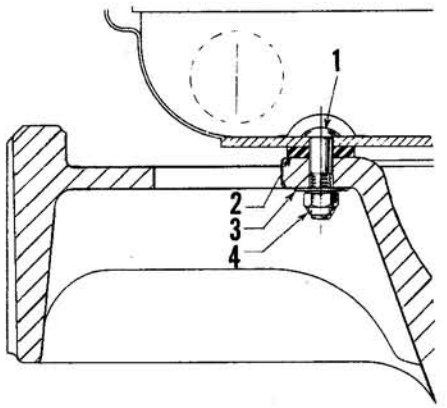


Fig. 90—Cross-sectional view showing late type radiator mounting.

1. Bolt
2. Insulator
3. Washer
4. Self-locking nut

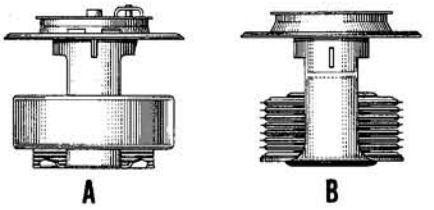


Fig. 91—A shrouded type thermostat (A) must be used in all models except early production "FMD" which can be equipped with non-shrouded thermostat (B).

WATER PUMP

All Models

136. **R&R PUMP ASSEMBLY.** Drain cooling system and disconnect radiator hose from pump. If equipped with power steering, loosen power steering pump mounting bolts and slide pump downward to loosen drive belt. Loosen generator mounting bolts and push generator inward to loosen fan belt. Unbolt and remove the fan blades and belts, then unbolt and remove water pump assembly.

NOTE: At serial No. 1425097, water pump passages were changed in pump body and cylinder block. If installing new pump assembly, be sure correct pump and mounting gasket are obtained.

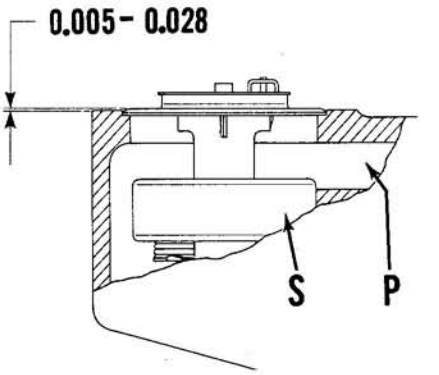


Fig. 92—On all models, thermostat must protrude 0.005-0.028 from cylinder head as shown. Except on early "FMD," thermostat shroud (S) controls flow of water through by-pass passage (P) in cylinder head.

To reinstall pump assembly, reverse removal procedures.

137. **OVERHAUL PUMP.** Using suitable pullers, remove pulley hub and, on power steering models, fan pulley from front end of water pump shaft. Pry the bearing retaining clip from slot in pump housing. Adequately support the water pump housing and press the shaft and bearing assembly with impeller out towards rear of housing. Using suitable pullers, remove impeller from shaft.

Carefully inspect all parts and install new seal or repair kit as follows: Press slinger sleeve, flange end first, onto rear (long) end of shaft so that flange is same distance from bearing as slinger flange was on shaft and bearing assembly removed from pump. Press shaft and bearing into pump body from front until retainer groove in bearing race is aligned with slot in pump housing, then install the retaining clip. Place new seal assembly over shaft with carbon ring out (towards impeller) and fit the seal into proper position. Press impeller onto rear end of shaft so that there is 0.030 clearance between impeller vanes and rear face of pump body. Supporting rear end of shaft, press the pulley hub onto front end of shaft (pulley and hub assembly on models with power steering). Recess in front of hub should be flush with front end of shaft.

NOTE: Due to changes in the by-pass passages of both the water pump and cylinder block, early "FMD" pump assemblies (prior to serial No. 142097) require a different pump body than later models. However, all other parts and service procedures are the same for all models.

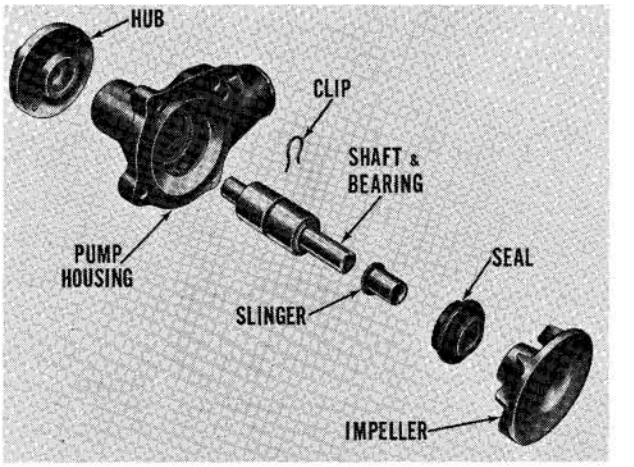


Fig. 93—Exploded view of typical water pump assembly.

FAN BLADES

All Models

138. Various sizes of fan blades have been used and are available for service. The original production installed fan blade for tractors shipped to U.S. are for temperatures below 90° F.

If overheating is experienced in hot weather, the original type fan blade should be removed and the "tropical" fan installed. Conversely, if operating in cold weather and trouble is experienced in not being able to keep the engine up to normal operating temperature, a smaller fan should be installed.

Model "FMD" engines were originally equipped with a 15 inch diameter two blade fan (Ford part No. DDN-8607-A). Alternate "hot weather" fan for the model "FMD" engine is a two blade 18 inch diameter fan (Ford part No. 508E-8607).

Models "FPM", "FSM" and "New FSM" engines were originally equipped with a 17 inch diameter two blade fan (Ford part No. DDN-8607-B). Alternate "hot weather" fan for these engines is a four blade 17 inch diameter fan made by adding a second two blade fan (Ford part No. DDN-8606) to the original fan installation.

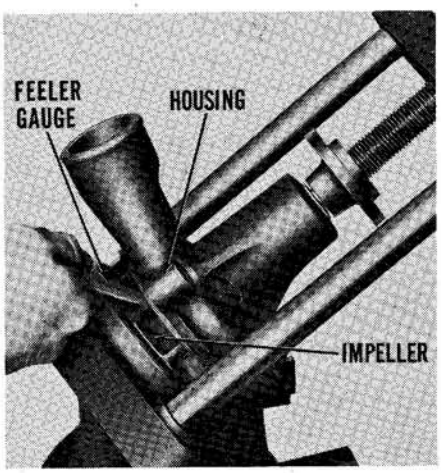


Fig. 94—Using feeler gage to check clearance between pump housing and impeller; refer to text.

ELECTRICAL SYSTEM

GENERATOR

All Models

139. Two different Lucas generators (Ford parts Nos. E27N-10001-D and E1ADN-10001) have been used and only the latest type is available for service. Note: The later generator (E1ADN-10001) is equipped with blade type connectors whereas the early unit (E27N-10001-D) had screw type post connectors. When installing new generator, it will be necessary to obtain two blade type connectors (part Nos. 114777-ESA and 114775-ESA) and two insulators (part Nos. 105E-14454-B and -C) to connect wiring to generator. The latest type generator will develop maximum current at lower engine speed than previous generator. Refer to following generator test procedure:

140. **GENERATOR TEST PROCEDURE.** Disconnect leads marked "D" and "F" from voltage regulator terminals and connect these leads together. Connect negative lead of voltmeter, which is calibrated to at least 30 volts, to the connected leads and connect positive lead of voltmeter to a good ground connection. Start engine and gradually increase engine speed to approximately 1000 RPM; voltmeter reading should rapidly rise to above 24 volts and remain steady. If reading is low, or if no reading can be obtained, check to see that generator leads are in good condition and that generator is polarized. Note: To polarize (magnetize) generator, disconnect wire from field ("F") terminal of regulator and momentarily touch this wire to the battery ("A") terminal of regulator. If generator will not develop the required voltage, follow normal overhaul procedures to repair or renew the generator. If generator checks OK, check voltage

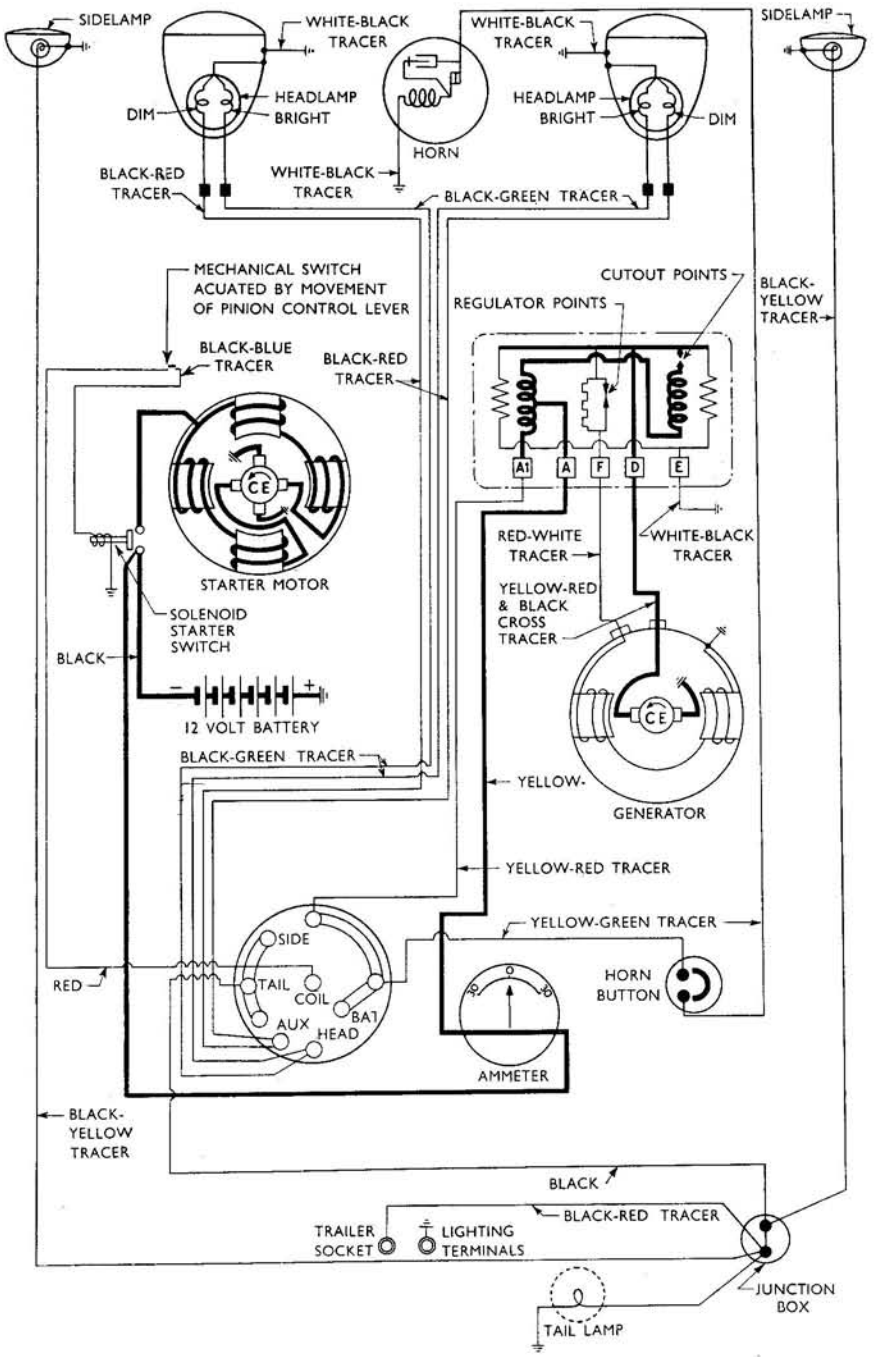


Fig. 95—Wiring diagram for model "FMD"; for other models, refer to Fig. 96. Note: Late production model "FMD" will have two 6-volt batteries connected in series instead of single 12-volt battery shown.

regulator as outlined in paragraph 142.

VOLTAGE REGULATOR

Model "FMD" and Early Model "FPM"

141. All model "FMD" and model "FPM" prior to serial No. 1542263 were equipped with Lucas adjustable voltage regulators with removable removable plastic covers. A Lucas model RB 106/1 (Ford part No. E27N-10505-E) regulator was used prior to serial No. 1426221 of model "FMD" production. Later model "FMD" and early model "FPM" prior to serial No. 1542263 were equipped with a Lucas model RB 106/2 regulator (Ford part No. E27N-10505-F). These regulators are interchangeable and due to service installations, may not be installed according to tractor serial number. However, they can be identified by Lucas identification (model) numbers stamped on bottom of regulator. Refer to following test and adjustment procedures:

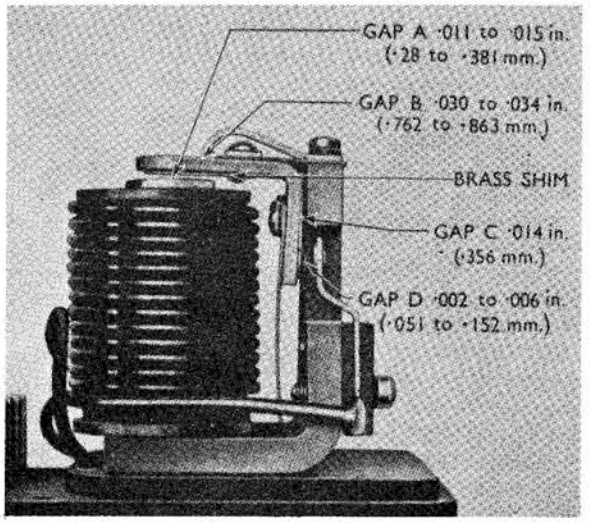


Fig. 97 — Adjustment points for Lucas model RB 106/1 regulator cut-out relay; refer to text.

142. **REGULATOR TEST PROCEDURE.** To check the voltage regulator, disconnect the leads from regulator terminals marked "A" and "A1" and connect them together. Connect the negative lead of a test voltmeter to "D" terminal of voltage regulator and connect positive lead of test voltmeter to a good ground connection. Start engine and gradually increase speed until voltmeter needle "flicks", then steadies. The voltmeter reading should then be within the limits given in the VOLTAGE REGULATOR SETTING CHART according to approximate temperature of the regulator unit (air temperature if engine has been started cold).

VOLTAGE REGULATOR SETTING CHART

Lucas Model RB 106/1

TEMPERATURE, DEGREES F.	VOLTAGE READING
50°	15.9-16.5
68°	15.6-16.2
86°	15.3-15.9
104°	15.0-15.6

Lucas Model RB 106/2

TEMPERATURE, DEGREES F.	VOLTAGE READING
50°	15.7-16.1
68°	15.6-16.0
86°	15.5-15.9
104°	15.0-15.6

If the reading is not between the limits given in the VOLTAGE REGULATOR SETTING CHART, the regulator is in need of adjustment. Increase engine speed to maximum speed; the voltmeter reading should not rise more than one-half volt above the tabulated readings at 1000 RPM.

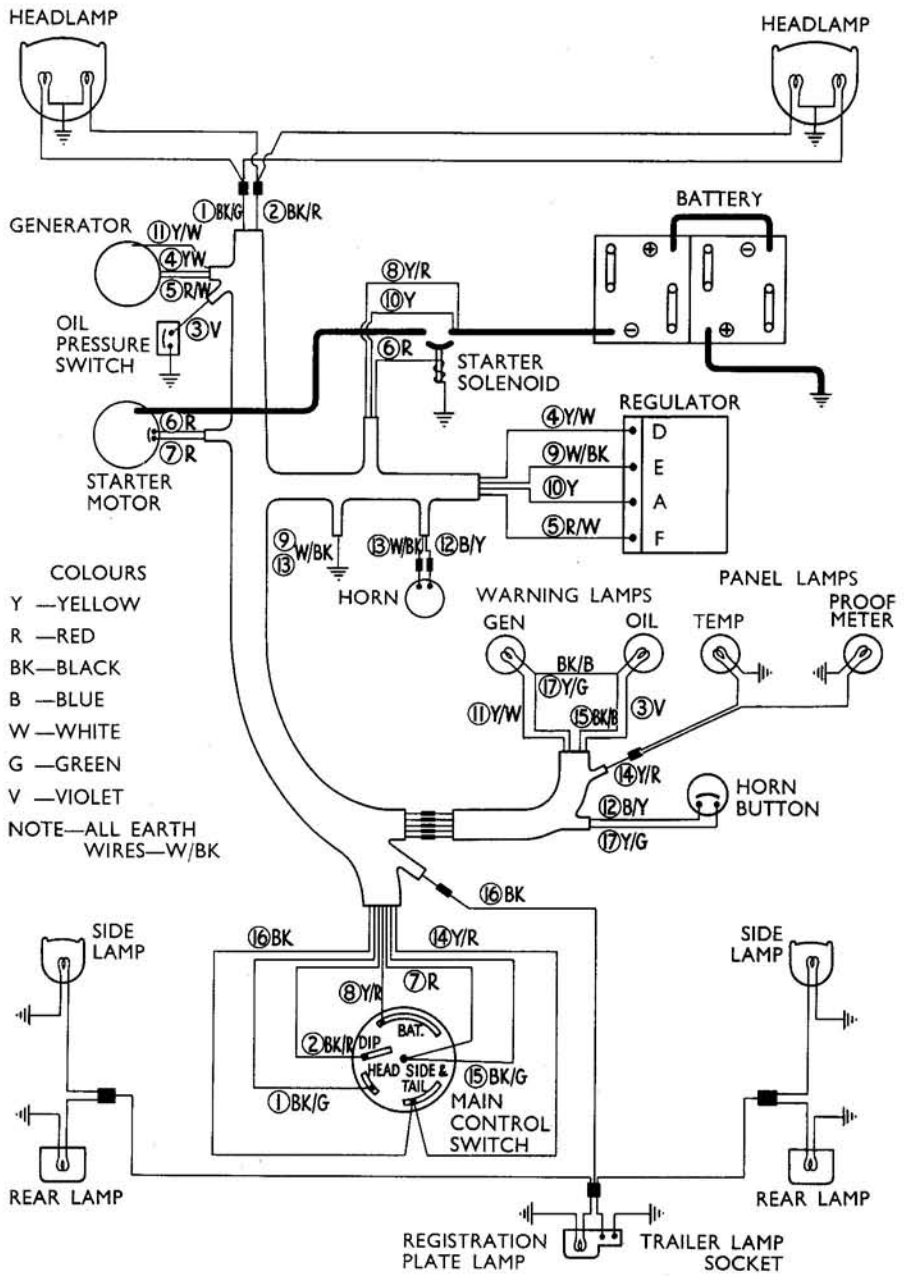


Fig. 96—Wiring diagram for all models except "FMD". Refer to Fig. 95 for "FMD" wiring diagram.

If voltmeter reading continues to rise as engine speed is increased, renew the regulator.

To adjust voltage regulator, shut off engine and remove regulator cover. Loosen lock nut on regulator adjusting screw (see Fig. 97 or 99) and turn screw clockwise to raise setting or counter-clockwise to lower setting. Turn the screw only a fraction of a turn at a time, then start engine and test as before. Note: Adjustment of regulator open-circuit voltage should be completed in 30 seconds; otherwise, heating of windings will cause false settings to be made. A generator run at high speed on open circuit will build up a high voltage, thus when adjusting regulator, increase speed slowly until regulator operates. After adjusting regulator, reconnect wires to regulator "A" and "A1" terminals. Leave voltmeter connected between "D" terminal and ground and check cut-out relay as follows: Gradually increase engine speed and note voltage reading immediately before the cut-out relay points close. This voltage should be between 12.7 and 13.3. If not, loosen locknut on cut-out adjusting screw and turn screw clockwise to increase cut-out closing voltage or counter-clockwise to decrease closing voltage.

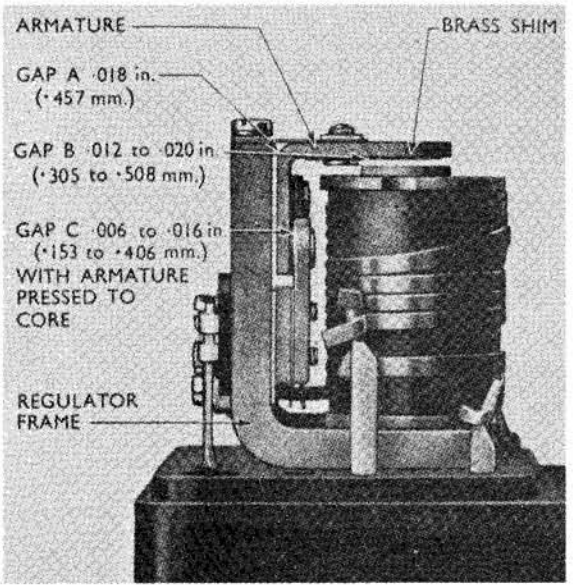


Fig. 98 — Adjustment points for voltage regulator armature on Lucas model RB 106/1 regulator; refer to text.

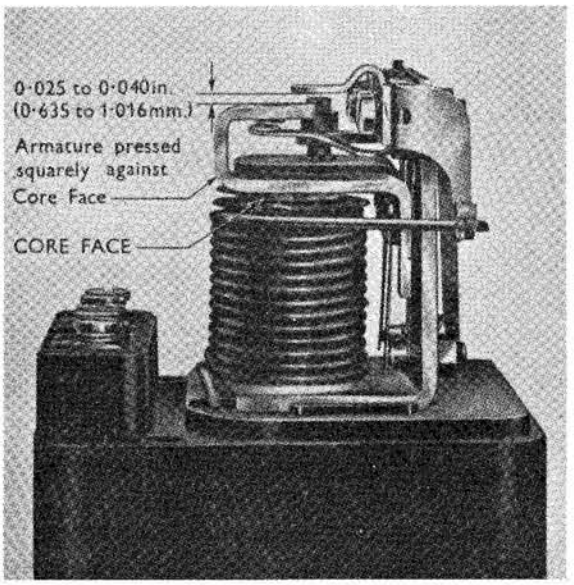


Fig. 99—Adjustment on Lucas model RB 106/2 cut-out relay; refer also to Fig. 100 and text.

143. **CLEAN AND ADJUST REGULATOR CONTACT POINTS.** The voltage regulator can be disassembled and the contact points cleaned if not burned. Use carborundum paper or crocus cloth in a circular movement and wash away all dirt or abrasive with alcohol. Reassemble, but prior to tightening screws, loosen the locknuts on the voltage regulator and cut-out adjusting screws and back the screws out. Then, adjust as follows:

144. ADJUST LUCAS MODEL RB 106/1. Refer to Fig. 97 and clamp a 0.011-0.015 thick gage between armature and core (GAP A) and a 0.014 thick gage between armature and frame (GAP C) of cut-out relay and tighten armature spring retaining screws. With the 0.011-0.015 gage still clamped between armature and core (GAP A), bend armature stop so that it clears armature (GAP B) from 0.030 to 0.034 and adjust point gap (GAP D) to 0.002-0.006. Remove the gage from cut-out relay and adjust regulator points as follows:

Refer to Fig. 98 and insert a 0.018 thick gage between armature and frame (GAP A) and clamp a 0.012-0.020 thick gage between armature and coil core (GAP B), then tighten armature spring retaining screws. Remove

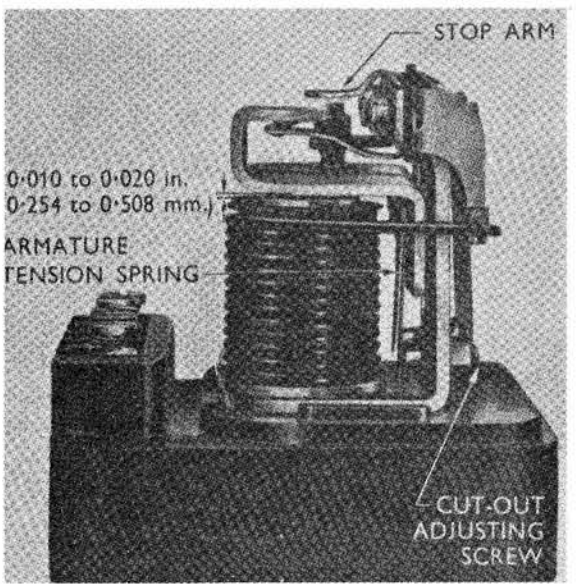


Fig. 100—After making adjustments shown in Fig. 99, refer to text and continue with cut-out relay adjustment shown.

the feeler gages and push armature down against coil core; regulator point gap should then be 0.006-0.016; if not, add or remove shims between contact point base and regulator frame as required. Take care that the shims do not short out the contact base to frame.

With armature and point gap adjusted for both the regulator and cut-out relay, adjust the voltage regulator setting and cut-out closing voltage as outlined in paragraph 142.

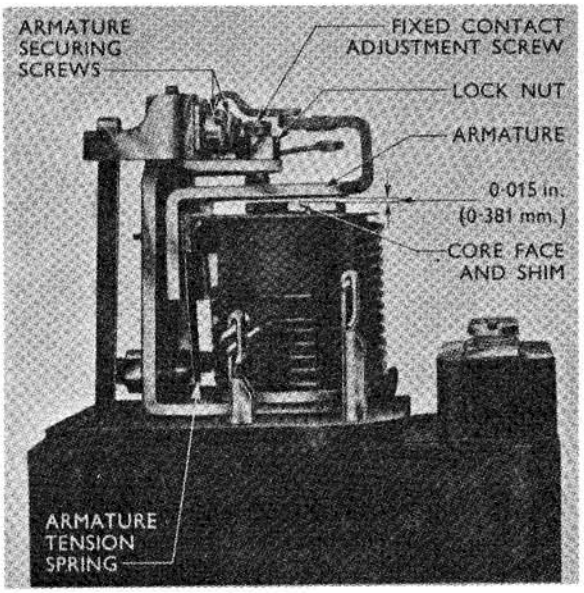


Fig. 101—View of voltage regulator of model RB 106/2 Lucas regulator assembly; refer to text for adjustment procedure.

145. ADJUST LUCAS MODEL RB 106/2. Refer to Fig. 99 and push the cut-out armature down against coil core, then tighten armature retaining screws. While still holding armature down against coil core, bend armature stop so that it clears armature by 0.025-0.040. Insert a 0.010-0.020 thick gage between armature and coil core (see Fig. 100), clamp down on gage and set the fixed contact by bending contact arm so that points are just touching.

Refer to Fig. 101 and insert a 0.015 thick feeler gage between armature and core face shim and press armature down against gage. Tighten the two armature retaining screws while holding down on armature and with gage still in position, turn the point (fixed contact) screw down until points just touch and tighten locknut.

With voltage regulator and cut-out points adjusted, refer to paragraph 142 and adjust the voltage regulator setting and cut-out closing voltage.

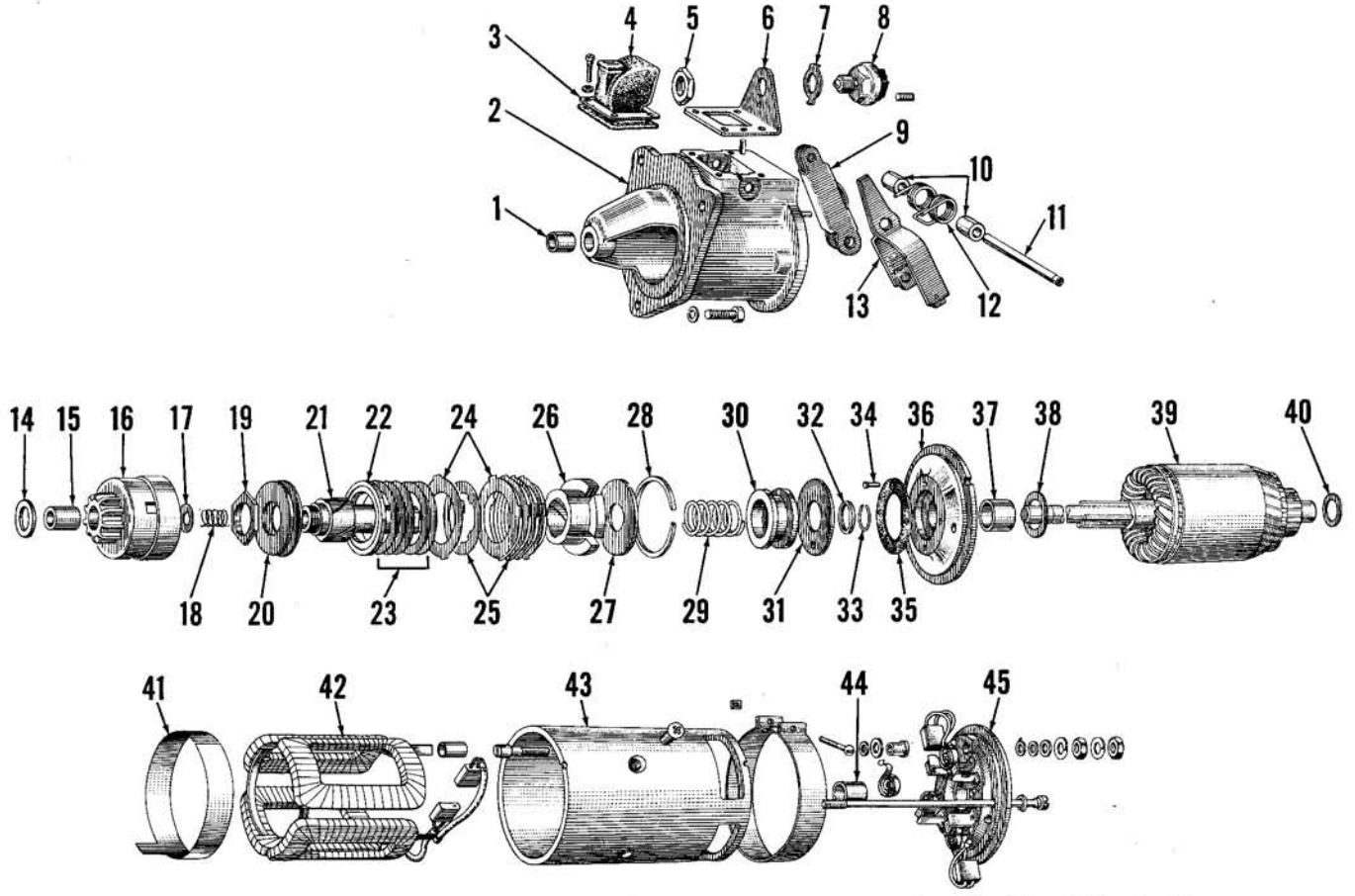


Fig. 102—Exploded view of starting motor assembly as used on all models. Refer also to Figs. 103 and 104.

1. Bushing
2. Housing
3. Retainer
4. Cover
5. Nut
6. Bracket
7. Lockwasher
8. Relay switch
9. Actuating lever
10. Spacers
11. Pin
12. Spring
13. Lever & shoe assy.
14. Thrust washer
15. Spring guide
16. Pinion
17. Washer
18. Spring
19. Nut
20. Plate
21. Sleeve
22. Ring
23. Shims
24. Driven plates
25. Driving plates
26. Sleeve
27. Washer
28. Snap ring
29. Spring
30. Collar
31. Brake plate
32. Retaining clip
33. Lock ring
34. Rivets
35. Brake lining
36. Bearing plate
37. Bushing
38. Washer
39. Armature
40. Washer
41. Insulator
42. Field coils
43. Frame
44. Bushing
45. End plate assy.

Late Model "FPM" and Models "FSM" and "New FSM"

146. At serial No. 1542263 of model "FPM" production, and on all later models, the voltage regulator is a sealed unit. If the regulator does not meet the test specifications in paragraph 142 for voltage regulator setting (as given for Lucas Model RB 106/2) or cut-out closing voltage, the unit should be renewed.

STARTING MOTOR

All Models

147. Refer to Fig. 102 for exploded view of the Lucas starter motor used on all models. The starter motor incorporates a manually shifted drive pinion assembly which includes both an over-running and a torque limiter clutch. When the drive pinion is in engaged position, the actuating lever contacts the relay switch which engages the solenoid switch. Releasing starter lever engages the brake plate (31) with friction disc (35) attached to center bearing support plate (36) to stop motor.

Current draw at normal cranking speed of 200 engine RPM is 450 amperes. Lock torque is 28 Ft.-Lbs.

Use Fig. 102 as disassembly and reassembly guide. The torque limiting clutch should be reassembled with sufficient thickness of shims (25) so that clutch will slip when a torque of 65-80 Ft.-Lbs. is applied; refer to Fig. 103 for suggested method for checking clutch slipping torque. Shims are available in thicknesses of 0.004, 0.005, 0.006, 0.009 and 0.020. Adding shim thickness will increase slip torque.

When starter is reassembled, refer to Fig. 104 and proceed as follows to check starter relay switch adjustment: Connect a battery and test light in series to the relay switch terminals, then slowly move starter actuating lever forward until test light just goes on (switch contacts close). At this time, distance between mounting face of starter housing and rear face of pinion should be exactly $1\frac{7}{16}$ inches as shown in Fig. 104. If not, loosen switch bracket retaining screws and shift the bracket on housing so that relay switch makes contact when starter drive pinion is in position shown, then tighten the bracket retaining screws.

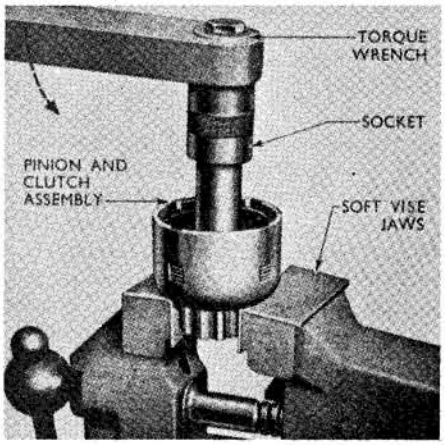


Fig. 103—Checking clutch assembly for proper slip torque; refer to text for procedure and specifications.

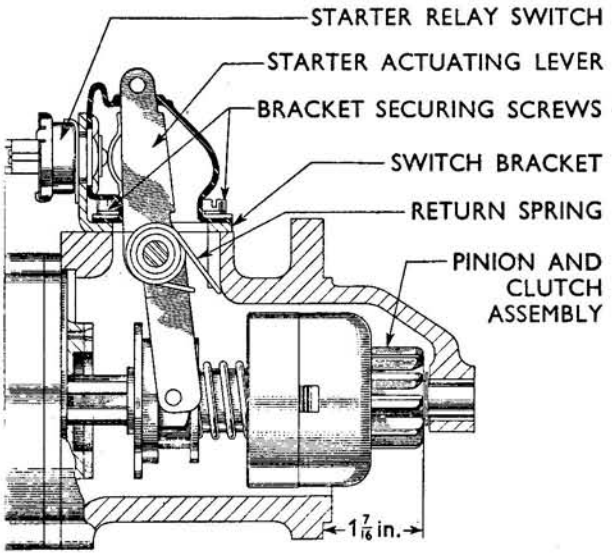


Fig. 104—Adjusting relay switch position; refer to text.

CLUTCH

148. Tractor may be equipped with either a 11 or 13 inch single clutch or with a dual disc clutch having 12 inch friction discs for both the transmission and PTO input shafts. To service the clutch, first split tractor between flywheel and transmission housings as follows:

TRACTOR SPLIT

All Models

149. To separate tractor for service of clutch assembly, proceed as follows: Drain cooling system, remove air precleaner and vertical exhaust muffler, then remove engine hood. Disconnect proofmeter drive cable at engine end. Disconnect stop control cable at fuel injection pump. Disconnect throttle control rod from cross-shaft through the engine (early "FMD") or at cross-shaft at rear of engine (later models). Turn off the fuel supply valve and disconnect fuel line to fuel lift pump. Disconnect excess fuel return line at rear end of cylinder head. Disconnect hose from air cleaner to intake manifold and, except on early "FMD", disconnect air cleaner to rocker arm cover hose. Disconnect battery ground cable and wiring from starter relay switch, generator, oil pressure sending switch on models with electric pressure gage, and wiring from headlights. Disconnect starter operating rod at starter and, on early "FMD", disconnect radiator shutter operating rod. Remove temperature gage bulb from cylinder head and coil tube back out of way. Remove tool box and disconnect drag link from steering gear arm. Remove horizontal exhaust if so equipped. Drive wood wedges between front axle and stops on front axle support. Place a jack or stand under front end of transmission and support rear end of engine with moveable hoist or rolling floor jack. Unbolt side rails and flywheel housing from transmission housing. Note: There are flywheel housing to transmission housing bolts located behind the side rails. Roll engine forward away from transmission.

To reconnect tractor at flywheel housing to transmission housing, reverse procedure used to separate trac-

tor. After reconnecting fuel lines, bleed the diesel fuel system as outlined in paragraph 107.

LINKAGE ADJUSTMENT

Single Clutch, All Models

150. Clutch pedal free travel should be 1½ to 2 inches and adjustment is made by varying the length of clutch operating rod; refer to Fig. 105.

Dual Clutch, Models "FMD" and "FPM"

151. Free pedal adjustment is made by turning the adjusting screw in clutch pedal arm (see Fig. 106) in or out to obtain a free pedal of ½-inch. Note: Do not adjust length of clutch operating rod to obtain free pedal; if adjustment cannot be made by turning adjusting screw, proceed as follows:

Loosen locknut on pedal adjusting screw and turn screw into pedal (shorten screw) as much as possible. Check length of clutch operating rod; if not 15 inches from center-to-center of hole at each end of rod, remove rod from balance arm, loosen locknut and turn clevis end as required to obtain this adjustment. Reconnect operating rod, but do not tighten locknut or secure clevis pin at this time. With pedal stop pin in lower hole in bracket, engage PTO, start engine and slowly depress clutch pedal. Note: If equipped with raised PTO, be sure both PTO shift levers are engaged. The PTO shaft should stop turning just before the clutch pedal contacts stop pin. If this condition is not obtained, shorten the clutch operating rod as required. Note: Take care not to shorten rod to extent that release mechanism in clutch assembly bottoms before pedal contacts stop pin. Move stop pin to top hole in stop bracket, start engine and check to see that transmission can be shifted satisfactorily when clutch pedal is depressed against stop pin. If transmission cannot be shifted without "clashing" gears, continue to shorten the clutch operating rod until transmission can be shifted satisfactorily. Move stop pin back to the bottom hole of stop bracket and check to be sure that clutch assembly release mechanism does not bottom before clutch pedal contacts stop pin in the lower position. Note: If release mechanism bottoms at this point, overhaul clutch assembly. When the adjustment of operating rod is completed, tighten operating rod locknut and secure clevis pin with cotter pin. Turn adjusting screw to obtain ½-inch free pedal and tighten adjusting screw locknut. If operation of both the PTO and transmission clutch is desired, install stop pin in lower hole and secure with cotter pin. Place stop pin in upper hole in stop bracket when operation of PTO clutch is not desired.

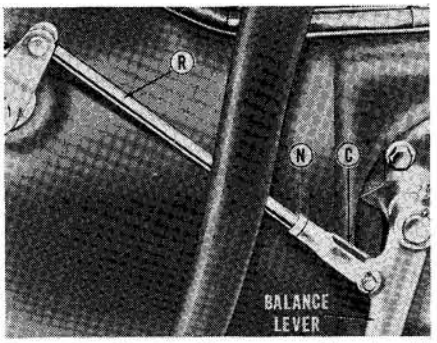


Fig. 105—Clutch adjustment points for all models with single clutch and models "FSM" and "New FSM" with dual clutch. Refer to Fig. 106 for models "FMD" and "FPM" with dual clutch. Refer to text for adjustment procedure and specifications.

C. Clevis end
R. Clutch release rod
N. Nut

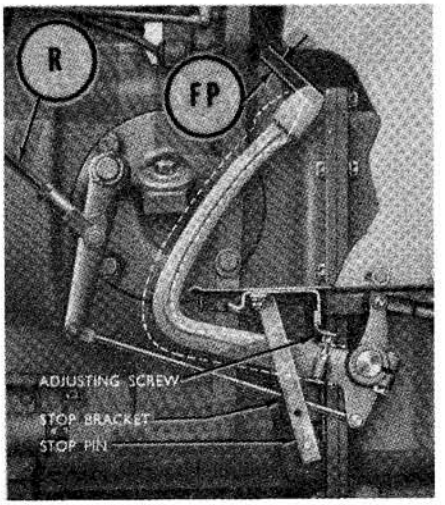


Fig. 106—Adjustment points for models "FMD" and "FPM" with dual clutch. Refer to text for adjustment procedure and specifications.

Dual Clutch, Model "FSM"

152. Clutch pedal free travel should be 1½ to 2 inches and adjustment is made by varying the length of clutch operating rod; refer to Fig. 105. After adjusting operating rod, make the following checks:

153. Remove stop pin from stop bracket, engage PTO, start engine and depress clutch pedal to bottom of stop bracket. If PTO shaft continues to turn with pedal fully depressed, shorten operating rod as required so that depressing clutch against bottom of stop bracket will stop shaft. Install the stop pin in lower hole of stop bracket, depress the clutch pedal against stop pin and check to see that transmission can be shifted. If transmission cannot be satisfactorily shifted with pedal against pin, continue to shorten operating rod until this condition is met. Check to see that sufficient free pedal travel remains and that with stop pin removed, clutch mechanism does not bottom before clutch pedal contacts bottom of stop bracket; overhaul clutch if either of these conditions are not found. Store the stop pin in top hole of stop bracket if operation of both the PTO and transmission clutches is desired. If operation of PTO clutch is not desired, install stop pin in lower hole of stop bracket.

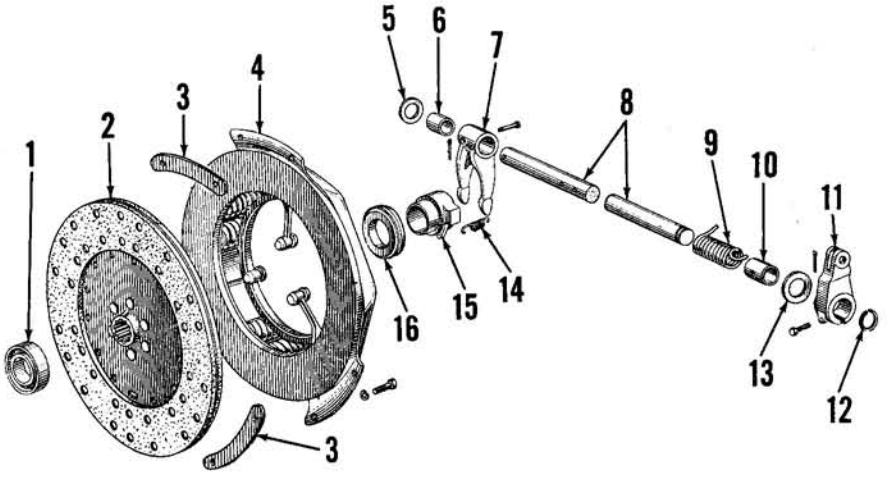


Fig. 107—Exploded view of 11-inch diameter single clutch assembly. Spacers (3) are used between cover (4) and flywheel when heavy duty friction disc assembly is installed.

1. Pilot bearing
2. Friction disc
3. Spacers
4. Cover & pressure plate assy.
5. Washer
6. Bushing
7. Release fork
8. Cross-shaft
9. Return spring
10. Bushing
11. Cross-shaft arm
12. Snap-ring
13. Washer
14. Return spring
15. Release bearing hub
16. Release bearing assy.

R&R AND OVERHAUL

Models With 11 Inch Single Clutch

154. With tractor split between flywheel and transmission housings as outlined in paragraph 149, alternately and evenly loosen the clutch cover to flywheel cap screws to remove the cover and pressure plate assembly. Note: Most models will have three spacers (3—Fig. 107) located between cover and flywheel; be careful not to lose spacers where used.

The clutch cover and pressure plate assembly is serviced as a complete unit only (Ford part No. 8MTH-7563-A) which is interchangeable with Ford truck assembly of same part number. Original production assembly and/or service parts are not available in the U.S. Renew the cover and pressure plate assembly if inspection reveals any part unfit for further service.

The clutch friction disc (2) is serviced as either a standard duty (Ford part No. DKN-7550-A) or a heavy duty (Ford part No. DKN-7550-B) assembly and either unit may be used. However, if renewal of friction disc assembly is indicated, use of the heavy duty disc assembly is recommended.

To install clutch assembly, proceed as follows: Using suitable pilot, position friction disc assembly on flywheel with long hub away from flywheel. If installing standard friction disc, attach cover and pressure plate assembly to flywheel with 25/32-inch long shouldered cap screws (Ford part No. 350433-S) and lockwashers. If installing heavy duty friction disc, insert a spacer (Ford part No. DKN-77596) at each of the three bolting points between cover and flywheel and attach cover and pressure plate assembly to flywheel using 0.85 long shouldered cap screws (Ford part No. 355599-ES) and lockwashers. Tighten cap screws to a torque of 12-15 Ft.-Lbs.

NOTE: Model FPM tractors after Serial No. 1418861 originally equipped with 11 inch clutch can be converted to 13 inch clutch by installing new flywheel, friction disc, cover assembly, release bearing and related parts. Tractors before this Serial number cannot be converted to 13 inch clutch due to location of release (cross) shaft in transmission housing. Consult Ford tractor parts department for all necessary conversion parts.

Models With 13 Inch Single Clutch

155. **REMOVE AND REINSTALL.** With tractor split between flywheel and transmission housings as outlined in paragraph 149, alternately and evenly loosen cover to flywheel cap screws to remove the clutch assembly. Note: Some models may have spacers located between clutch cover and flywheel; be careful not to loose these spacers, if so equipped, when removing clutch assembly.

Service parts for the 13-inch clutch cover and pressure plate assembly are available for service. Refer to paragraph 156 for overhaul procedure.

Two different 13 inch diameter friction disc assemblies or a 12 inch friction disc assembly may be used. A 0.33 thick 12 inch diameter cushioned disc (Ford part No. DDN-7550-C) or a 0.33 thick 13 inch diameter solid disc (Ford part No. DDN-7550-B) can be used with early type 13 inch cover and pressure plate assembly (Ford part No. DDN-7563-B) which can be identified by drive straps (S—Fig. 108) of two laminations (layers). A 0.52 thick disc (Ford part No. DDN-7550-D) is used with later type cover and pressure plate assembly (Ford part No. DDN-7563-C) which can be identified by drive straps (S) made of three laminations.

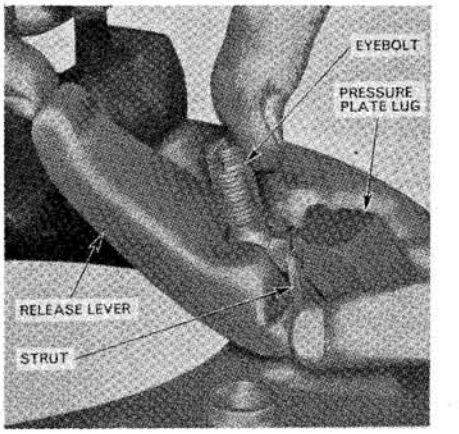


Fig. 109—Assembling release lever, strut, lever pin and eyebolt to clutch pressure plate.

To install clutch and friction disc assembly, proceed as follows: Using a suitable pilot, position the friction disc on flywheel with long hub of disc away from flywheel. If disc is 0.33 thick, align dowel holes in cover with proper size dowels in flywheel and attach cover and pressure plate assembly with 1 inch long shouldered cap screws (Ford part No. 20388-S2) and lockwashers. If installing a 0.52 thick friction disc, align dowel holes in cover with proper size dowels in flywheel, insert a spacer (Ford part No. E117-GC9) at each bolting point between cover and flywheel and attach cover and pressure plate assembly with 1⅛ inch long cap screws (Ford part No. 20408-S7) and lockwashers. Tighten cap screws to a torque of 12-15 Ft.-Lbs. Note: If installing a new clutch cover and pressure plate assembly, red painted spacers inserted between release levers and cover for shipping purposes will fall out of the assembly as the retaining cap screws are tightened. Be sure all of the spacers are removed from clutch and discarded.

156. **OVERHAUL.** To disassemble cover and pressure plate assembly, proceed as follows: Mark the plate, cover, release levers and release lever plate so that they can be reinstalled in the same relative positions. Remove

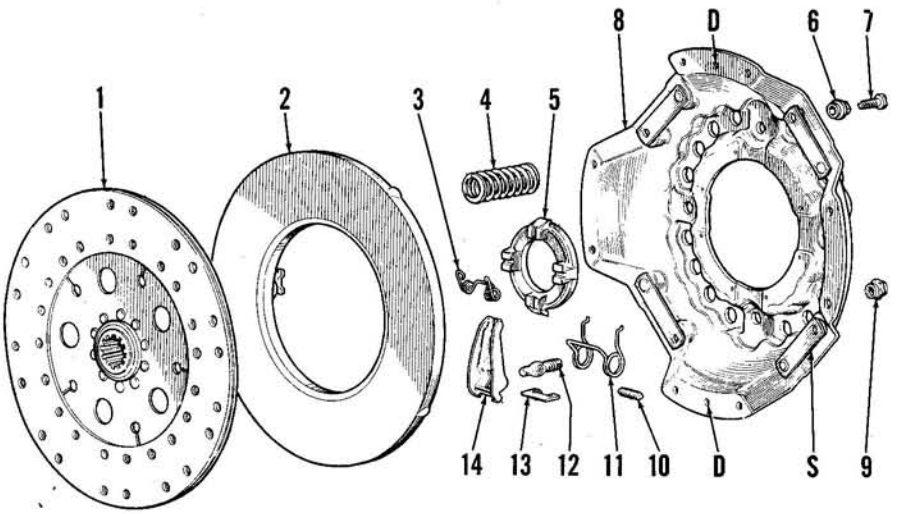


Fig. 108—Exploded view of 13-inch single clutch assembly. Refer also to Figs. 109 and 110.

D. Dowel holes
S. Straps
1. Friction disc
2. Pressure plate
3. Retaining springs
4. Pressure springs
5. Lever plate
6. Ferrules
7. Drive strap screws
8. Cover
9. Adjusting nuts
10. Lever pins
11. Anti-rattle springs
12. Eyebolts
13. Struts
14. Release levers

flywheel from engine and lay flywheel on bench with clutch friction surface up. Position three 0.329-0.331 thick by 3½ inch long flat spacers evenly around friction surface. Place cover and pressure plate assembly over the spacers with dowel holes in cover aligned with proper size dowel pins in flywheel and attach to flywheel with four of the cover retaining cap screws at alternate bolting positions. Note: Do not install clutch cover to flywheel spacers; it may be necessary to add flat washers under cap screw heads on models having spacers and 1⅛ inch cover retaining cap screws. In remaining four bolting points, install ⅜-inch—16 x 1½ inch long cap screws and turn these cap screws in until they bottom in flywheel.

Remove the release lever plate (5—Fig. 108) and the retaining springs (3). Using a punch, drive edge of ferrules (6) back away from drive strap cap screws (7), then remove the cap screws. Unscrew and remove adjusting nuts (9) from eyebolts (12); these nuts are staked and may be hard to turn. Evenly loosen the four short cover retaining cap screws until cover rises against heads of the long cap screws, then remove the four short cap screws and evenly loosen the long cap screws until all spring pressure is released. Remove cover from pressure plate. Remove the sixteen pressure springs. Holding release lever inner ends upward against eyebolts, move the struts until eyebolts and release levers can be removed from pressure plate. Withdraw the eyebolts from release levers, then remove the pivot pins.

Examine all parts thoroughly and renew any that are cracked, scored, excessively worn or that show signs of overheating. Note: Two different clutch cover and pressure plate assemblies have been used and it is important that the assembly being serviced is correctly identified. Inspect the four laminated drive straps (S) riveted to inner side of clutch cover (8). Drive straps of early assembly (Ford part No. DDN-7563-B) are made of two laminations (layers) whereas late cover and pressure plate assembly (Ford part No. DDN-7563-C) have drive straps made of three laminations.

The same pressure springs are used in both the early and late clutch assemblies. Check the sixteen springs against the following specifications:

Spring color ..... Yellow/Green
Free length ..... 2.665-2.711 inches
Pounds pressure @
1.69 inches 135-145

To reassemble, proceed as follows: Place three 0.329-0.331 thick spacers approximately 3½ inches long evenly around friction surface of engine flywheel. Place pressure plate on top of the spacers. Install pivot pins (10) through eyebolts (12) and insert threaded ends of eyebolts through release levers (14). Refer to Fig. 109, place struts under lugs on pressure plate and while holding inner ends of release levers against eyebolts, insert plain ends of eyebolts in bores of pressure plate and outer ends of release levers under the struts. Place the pressure springs on bosses of pressure plate. Install anti-rattle springs (11—Fig. 108) in clutch cover, then place cover down over the springs, release levers and pressure plate so that anti-rattle springs are over the release levers. Rotate the assembly so that dowel holes in clutch cover are properly aligned with correct size dowel pins in flywhel and move the spacers so that they are under each release arm. Also adequately support the pressure plate. Install the four 1½ inch long cap screws at alternate bolt holes and tighten them evenly until they bottom in flywheel. Install four of the cover retaining cap screws in the remaining bolt holes and tighten them evenly until cover is pulled down against flywheel. Use washers if necessary. Be sure that dowel pins in flywheel and eyebolts in levers enter proper holes in cover as cover is being pulled down. Remove the four long cap screws, install the remaining cover retaining cap screws and tighten all eight cap screws to a torque of 12-15 Ft.-Lbs.

Install **new** adjusting nuts on the release lever eyebolts, but do not tighten the nuts at this time. Insert **new** ferrules through the drive straps into counterbores in pressure plate and securely install the drive strap cap screws. Using a punch, drive the outer ends of drive strap ferrules against cap screw heads. Install release lever plate with the four retaining springs.

If possible, operate release levers several times to be sure all parts are fully seated. This can be accomplished by placing the flywheel and clutch unit in a press. CAUTION: Be sure not to bend release levers. Using a depth gage, measure distance (D—Fig. 110) between face of release lever plate and spacers. Turn the adjusting nuts down so that the measured distance is equal within 0.015 at all measuring points and is within the following specifications:

Ford Part No.	Release Plate Height
DDN-7563-B	2.449-2.521
DDN-7563-C	2.150-2.185

If possible, operate levers and recheck adjustment. With release levers properly adjusted, firmly stake adjusting nuts to eyebolts. Remove clutch assembly from flywheel, reinstall flywheel as outlined in paragraph 97 and the clutch assembly as outlined in paragraph 155.

Models With Dual ("Live PTO") Clutch

157. **REMOVE AND REINSTALL.** With tractor split between flywheel and transmission housings as outlined in paragraph 149, the dual clutch assembly can be unbolted and removed from engine flywheel. Support clutch assembly as it is being unbolted. Note: The clutch cover may move away from the center drive plate as the retaining cap screws are removed.

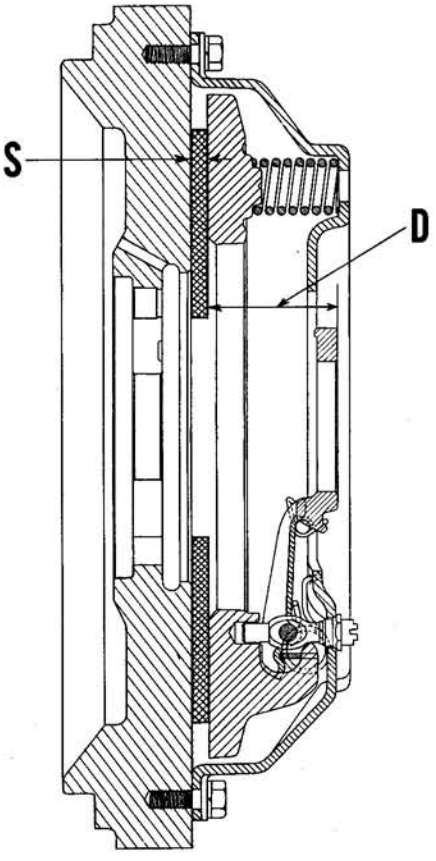


Fig. 110—Cross-sectional view of 13-inch clutch cover and pressure plate assembly mounted on flywheel with three spacers (S) between plate and flywheel for adjustment. Refer to text for thickness of spacer (S) and lever height dimension (D).

When reinstalling clutch assembly, tighten retaining cap screws evenly until clutch cover is pulled down against center drive plate, then tighten all cap screws securely.

158. **OVERHAUL.** To service the dual clutch assembly, a special adjusting fixture (Nuday tool No. NE-7502) is required for clutch disc alignment and release lever adjustment after clutch unit is reassembled. Note: Late production clutches will also require a new transmission clutch disc pilot (Nuday tool No. NE-7502-Detail 5B). If the special adjusting fixture is available, proceed as follows:

With clutch assembly on bench with cover up, place correlation marks on the cover (11—Fig. 111), PTO clutch pressure plate (7), center drive plate (5) and the main (transmission) pressure plate (2) so that if not renewed, the parts may be reinstalled in same relative position. Remove the pins that retain actuating struts (13) to main pressure plate (2). Remove snap rings from pins that retain PTO clutch release (short) levers (18) in pivots (20) on clutch cover, then remove the pins and release lever springs (19). Remove the adjusting screws from PTO release levers, move levers to vertical position and lift off clutch cover with transmission release levers and struts attached; refer to Fig. 112. Compress the pressure springs with an overhead valve spring compressor and remove spring retainers (11—Fig. 111) as shown in Fig. 113. Then lift off the spring seats, springs and insulating washers. CAUTION: Do not attempt to release springs by unscrewing the self-locking nuts from spring retainer pins. The pressure plates, center drive plate and the two clutch friction discs can now be separated.

Check all parts for signs of scoring, distortion or cracking due to overheating and for excessive wear. Clutch disc linings should be tight on disc and free from oil. If necessary to renew one disc, the other disc even though serviceable should also be renewed. Installing one new and one worn disc may cause difficulty in adjusting relative position of PTO and transmission clutch release levers.

If any of the spring retainer pins in transmission pressure plate are bent or broken, they must be renewed. Pressure plate (Ford part No. DKN-7566-B) in early production clutch assembly is equipped with pins having $\frac{5}{16}$-inch diameter threaded end. Improved retainer pins (Ford part No. E54-GC-9) are available for servicing this early pressure plate. To install the improved pins, a 0.040 deep 45 degree chamfer must be cut in friction side of pressure plate; refer to Fig. 114. Transmission pressure plate (Ford part No. DKN-7566-C) for late

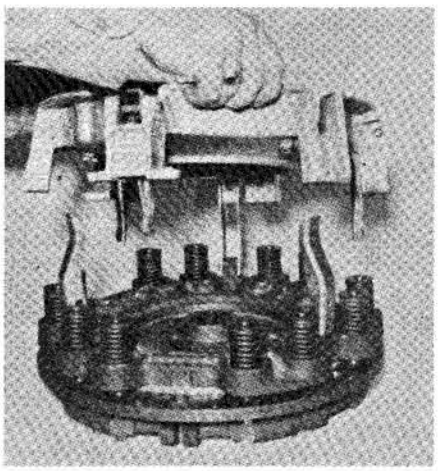


Fig. 112—Removing cover from dual clutch assembly.

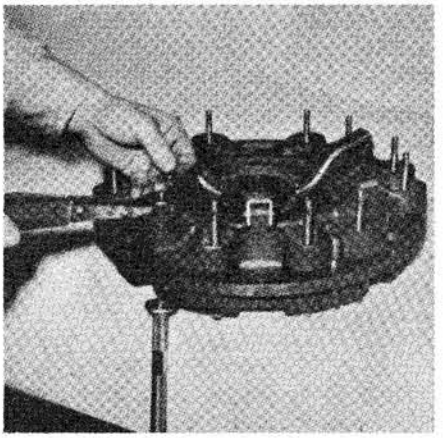


Fig. 113—Compress pressure springs with valve spring compresser to remove retainers.

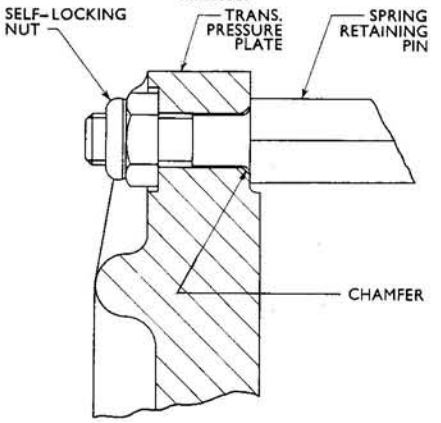


Fig. 114—Note chamfer required in transmission clutch pressure plate to allow installation of late type spring retaining pins.

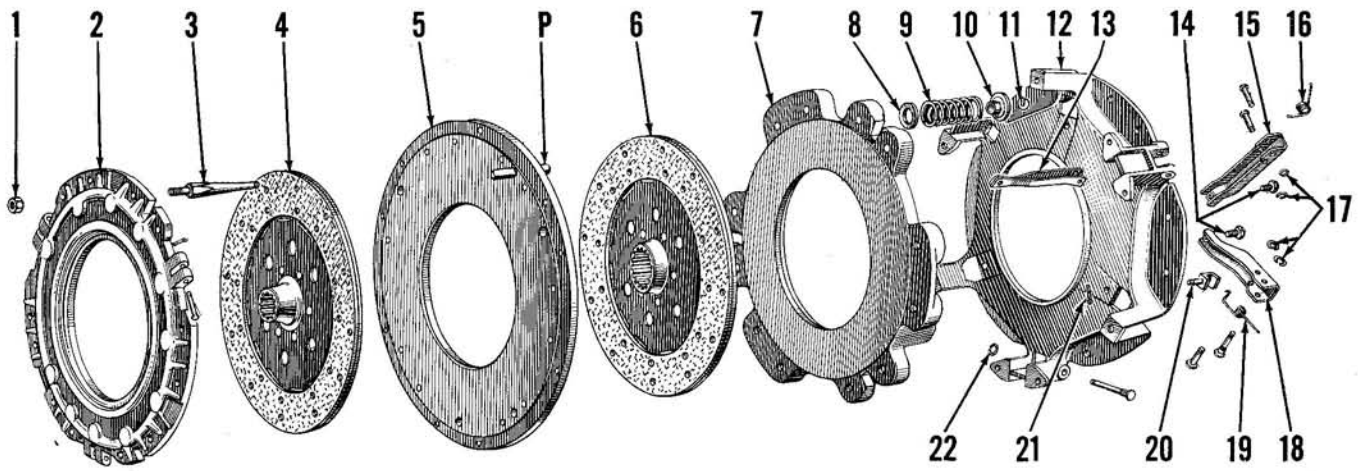


Fig. 111—Exploded view of typical dual ("live PTO") clutch assembly. When servicing unit, be sure that pins (P) are securely fastened in center plate (5).

P. Pins
1. Nuts
2. Pressure plate
3. Pins
4. Transmission disc
5. Center drive plate
6. PTO disc
7. Pressure plate
8. Insulating washer
9. Pressure springs
10. Spring retainers
11. Retainer locks
12. Clutch cover
13. Struts
14. Adjusting screws
15. Transmission release levers
16. Anti-rattle springs
17. Snap rings
18. PTO release levers
19. Anti-rattle springs
20. Yokes
21. Pins
22. Snap rings

production clutch assembly is fitted with spring retainer pins having ⅜-inch diameter threaded ends (Ford part No. E97-GC-9). When installing pins in pressure plate, **always** install **new** self-locking nuts. Tighten the $\frac{5}{16}$-inch nuts (Ford part No. 34443-ES2C) to a torque of 25-28 Ft.-Lbs. or the ⅜-inch nuts (Ford part No. 34420-ES2C) to a torque of 30-35 Ft.-Lbs.

Renew the center drive plate (5—Fig. 111) if warped, scored or overheated or if any of the three driving pins (P) are loose in plate.

Two different clutch pressure springs have been used. The early spring (Ford part No. DKN-7552-A) is no longer available for service. If springs are required for early clutch, the complete set of twelve springs should be renewed using the latest type spring (Ford part No. DDN-7552). Test specifications and spring identifications are as follows:

Ford part No. DKN-7552-A:

Free length	3.23 inches
Lbs. pressure @ 2 inches	92.5

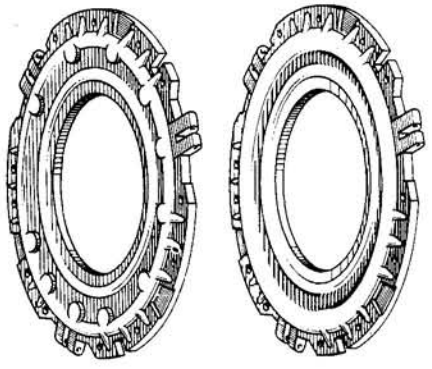


Fig. 115—View showing early (left) and late (right) production transmission clutch pressure plate (2—Fig. 111).

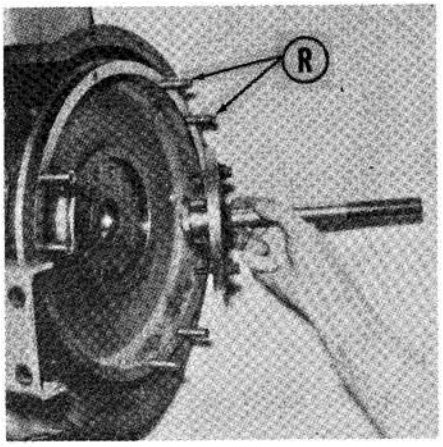


Fig. 116—Attaching spindle and risers (R) of clutch assembly and adjustment fixture to engine flywheel.

Ford part No. DDN-7552:

Color	Red
Free length	3.23 inches
Lbs. pressure @ 2 inches	109.5

The adjusting screws in clutch release levers should require a minimum torque of 5 Ft.-Lbs. to rotate screws in levers. Renew adjusting screws and/or levers as required to obtain the minimum turning torque.

To reassemble clutch, reverse disassembly procedure noting that long hub of transmission clutch disc (4) is towards pressure plate (2) and that long hub of PTO clutch disc (6) is towards PTO clutch pressure plate (7). Note: PTO clutch disc has larger splined hole in hub than does the transmission clutch disc. When clutch is assembled, bolt the cover to center drive disc using three bolts at evenly spaced bolting points and proceed as follows to adjust the assembly.

Engine flywheel has two $\frac{5}{16}$-inch tapped holes 180° apart which are used to attach clutch fixture base plate and spindle as shown in Fig. 116. Remove the pilot bearing, one pair of flywheel retaining cap screws and the locking plate covering one of the tapped holes, then install spindle as shown. Install the six risers (R) spaced as shown in Fig. 116. Mount assembled clutch unit on the six risers as shown in Fig. 117 and secure clutch to risers with six of the clutch to flywheel retaining cap screws. Refer to Fig. 118 and slide the transmission clutch disc pilot (T), PTO clutch disc pilot (P) and the gage block (B), with flat face of gage block towards release levers, onto the adjusting fixture spindle. Then install washer (W) and nut (N), tightening nut until the clutch discs are released. Refer to Fig. 119 and center the clutch discs with one screwdriver while pushing pilots

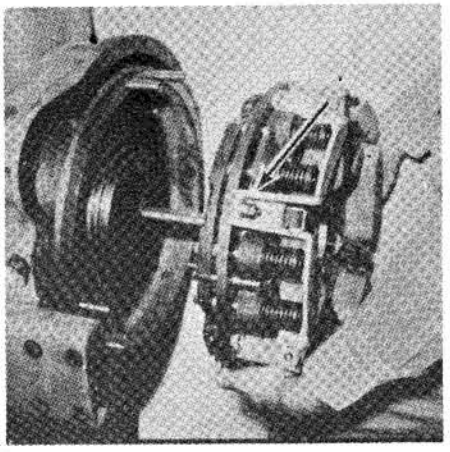


Fig. 117—Mounting dual clutch assembly on spindle and risers; refer to Fig. 116. Cover is bolted (arrow) to center driving plate at three equally spaced points.

into clutch disc hubs with second screwdriver inserted through opening in gage block. Install the three plate spacers (see Fig. 120) at equally spaced points around the clutch assembly and be sure that the spacers contact edges of both clutch discs. It may be necessary to tighten the spindle nut slightly in order to insert the spacers between the clutch pressure plates and center drive disc. Loosen and remove the nut and washer from adjusting fixture spindle, making sure that spacers stay in place as nut is loosened. Remove gage block from spindle and reinstall it in reversed position with stepped gage surfaces towards release levers. Using a 0.005 thick feeler gage, adjust the transmission clutch (long) release lever screws to the low step on gage block and the PTO clutch (short) release lever screws to the high step on gage block. CAUTION: In order to obtain proper adjustment, the transmission

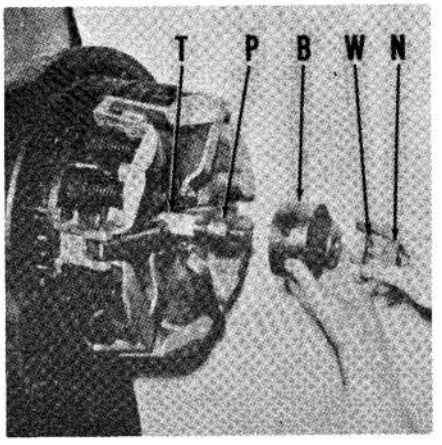


Fig. 118—Installing transmission disc pilot (T), PTO disc pilot (P), gage block (B), washer (W) and nut (N) to compress release levers.

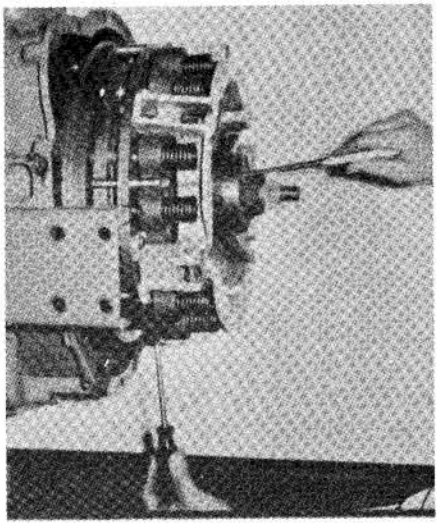


Fig. 119—With release levers compressed, align clutch friction discs with one screwdriver while pushing pilots (T and P—Fig. 118) into place with second screwdriver.

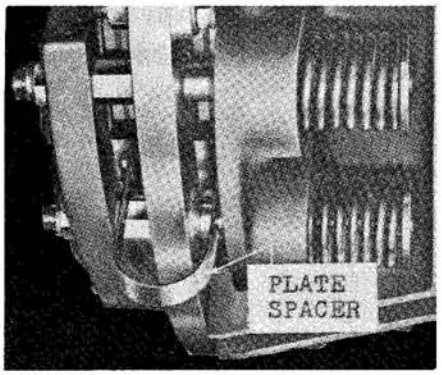


Fig. 120—With release levers compressed (Fig. 119), install plate spacers at equally spaced points making sure that blocks contact the friction discs before releasing levers.

clutch disc pilot must contact shoulder of spindle, the PTO disc pilot must contact transmission clutch disc pilot and the gage block must be held firmly against the PTO disc pilot.

With the release finger screws adjusted, remove clutch and fixture by reversing installation procedure. Reinstall pilot bearing and the two flywheel retaining cap screws and lock plate, tighten the cap screws to a torque of 80-90 Ft.-Lbs. and bend locking plate tabs against cap screw heads. NOTE: If late type sintered bronze pilot has been removed from flywheel, the pilot must be renewed. A sintered pilot bearing cannot be reused. Reinstall the serviced clutch assembly as outlined in paragraph 157.

AUTOMATIC CLUTCH RELEASE (ACR)

All Models So Equipped

159. **ACR OPERATING PRINCIPLES.** The automatic clutch release is a hydraulic cylinder with adjustable relief valve that is an integral part of the three-point hitch top link and connected through linkage to the clutch pedal release rod. When compression on the top link establishes a pressure within the cylinder that exceeds the relief valve setting, the top link and cylinder collapses and, through the connecting linkage, disengages the engine clutch. The purpose of the ACR is to stop the tractor when an implement mounted on the three point hitch strikes an obstruction such as a stump or rock.

To reset the collapsed cylinder (top link), proceed as follows: Shift transmission to neutral, depress the clutch pedal, actuate the release hand lever, re-engage the clutch and place the hydraulic lift in raised position. Tension on the top link will then extend and reset the hydraulic cylinder.

Refer to Fig. 121 for early release linkage, to Fig. 122 for later type release linkage and to Fig. 123 for exploded view of typical top link and hydraulic release cylinder assembly.

160. **ADJUST ACR RELIEF PRESSURE.** To adjust the automatic clutch release, refer to exploded view of the assembly in Fig. 123 and proceed as follows:

Disconnect the front end of the top link from tractor, then turn the swivel ball in front end (1) so that a screwdriver can be inserted through the end and swivel ball unit. Turn the adjusting screw (not shown) in or clockwise to increase pressure on relief valve spring (5), or out to decrease pressure.

161. **BLEED TOP LINK CYLINDER.** Air in the pressure side of the top link cylinder will result in spongy action of the unit and partial release of the engine clutch. Free movement of the cylinder should not exceed ⅛-inch after use or $\frac{1}{16}$-inch after being bled. To bleed the cylinder, proceed as follows:

Remove the filler plug (17) and fill reservoir with SAE 10W oil, then loosely reinstall plug. Tilt rear of top link up about 30° and loosen the bleed plug (25). Push in or tap on rear end (30) of cylinder to expel air, then tighten the bleed plug. Pull on rear end of link to reset the cylinder, then repeat bleeding operation as required to expel all air from cylinder. After bleeding is completed, hold the top link level and remove the oil level plug (31) and allow excess oil to drain from reservoir, then, tighten the filler and bleed plugs.

162. **OVERHAUL ACR CYLINDER ASSEMBLY.** Refer to Fig. 123 and proceed as follows:

Thoroughly clean outside of cylinder, remove filler plug and drain excess oil from unit. Remove top cover (19), front end and piston guide (22) and rear end (26). Remove set screw (11) and unscrew piston (12) from front end (1), then withdraw front end from guide (22). Further dis-

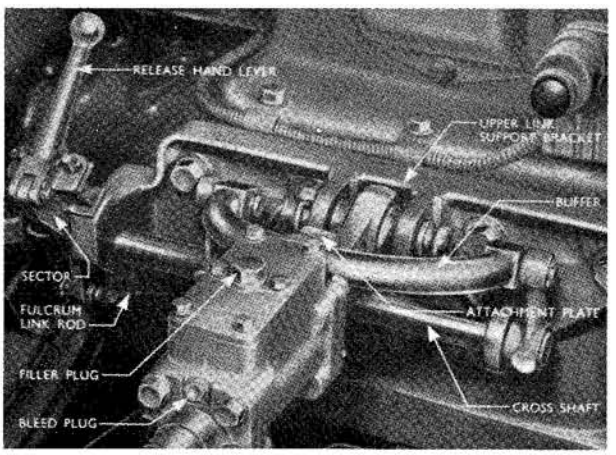


Fig. 121—View showing early production automatic clutch release (ACR) linkage. Refer to Fig. 122 for late production linkage.

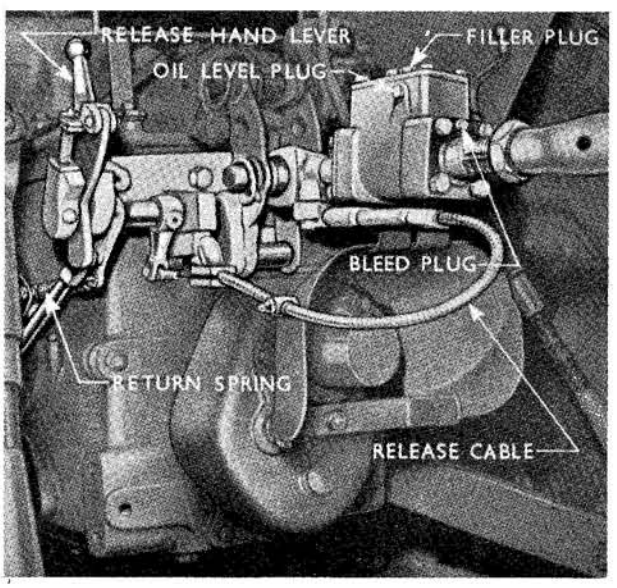
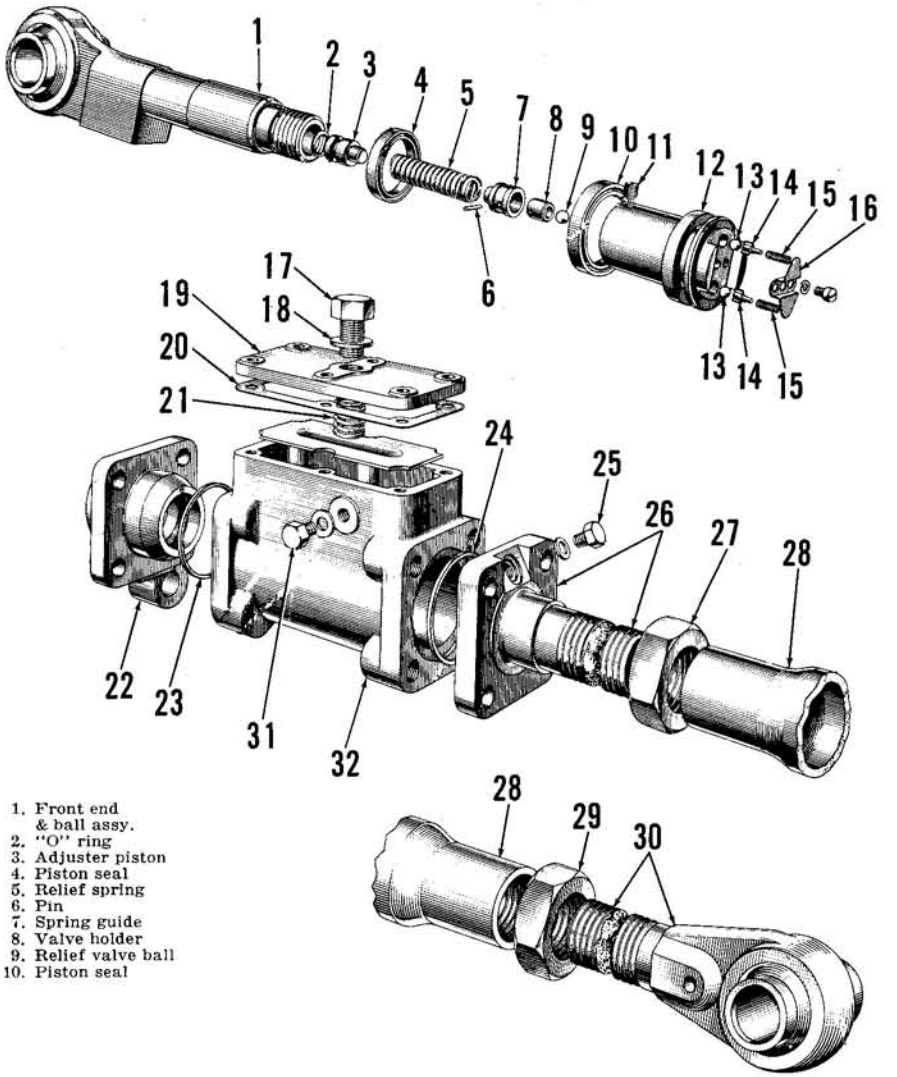


Fig. 122—View showing late production automatic clutch release (ACR) linkage. Early linkage is shown in Fig. 121.



1. Front end & ball assy.
2. "O" ring
3. Adjuster piston
4. Piston seal
5. Relief spring
6. Pin
7. Spring guide
8. Valve holder
9. Relief valve ball
10. Piston seal
11. Set screw
12. Piston
13. Check valves
14. Valve guides
15. Springs
16. Retainer
17. Filler plug
18. Gasket
19. Cover
20. Gasket
21. Spring
22. End plate
23. "O" ring
24. "O" ring
25. Bleed plug
26. End plate & screw
27. Lock nut
28. Turnbuckle
29. Locknut
30. End & ball assembly
31. Oil level plug
32. Cylinder

Fig. 123—Exploded view of typical automatic clutch release cylinder and three-point hitch top link assembly. Early units used leaf springs instead of coil springs (15) shown.

assembly is obvious from inspection of unit and reference to Fig. 123. Note: Early units may have leaf spring for the reset valves (13) instead of coil springs (15) shown; however, the coil spring can be used in all units.

Inspect cylinder bore and valve seats in piston and renew any broken or extensively worn parts. Reassemble by reversing disassembly procedure, refill with SAE 10W oil and bleed the unit as outlined in paragraph 161. Set relief pressure as outlined in paragraph 160 so that the top link will not collapse from normal operating compression on top link.

TRANSMISSION

The transmission for all models consists of a two-speed primary gearbox installed in front of the main three-speed transmission providing six forward and two reverse speeds. On models with standard power take-off, the PTO drive is taken from the primary gearbox lower gear. On models with "live PTO", the transmission and power-take-off input shafts are separate and PTO drive train gears are separate from transmission gears. A number of production changes have been introduced with greatest change at introduction of the New Performance Super Major ("New FSM"). Where service procedures or specifications vary because of type of transmission (standard or "live" PTO) or because of production changes, it will be noted in the text or will be covered by separate paragraphs.

LUBRICATION

All Models

163. Transmission lubricant capacity is approximately 20½ quarts for models without PTO or 21½ quarts for models with PTO. It is recommended that the transmission be drained, flushed and refilled with new lubricant after each six months of service. Recommended refill lubricant is SAE 80 Mild E.P. lubricant (Ford specification M-4864-A) for temperatures below 10° F., or SAE 90 Mild E.P. lubricant (Ford specification M-4864-B) for temperatures above 10° F.

TRANSMISSION BREATHER

All Models

164. A special long-headed bolt securing the front left hand fuel tank bracket to transmission housing functions as the transmission breather. If leakage of oil around transmission gaskets is experienced, this bolt should be checked to be sure the breather hole is not plugged.

SHIFTER MECHANISM

All Models

165. **PRIMARY (HIGH-LOW) SHIFT MECHANISM.** Refer to exploded view of primary gearbox shifter mechanism for single clutch models in Fig. 124. Mechanism for dual clutch models is similar except for shift rail (24—Fig. 134) and fork (23). Primary gearbox is in high range when shift lever (97—Fig. 124) is in "up" position on single clutch models or in "down" position on dual clutch models.

The shift arm (99) and rail (98) are mounted in the shifter housing (100) which also functions as the fuel tank rear support. To remove the shifter housing assembly, first remove the steering gear housing as outlined

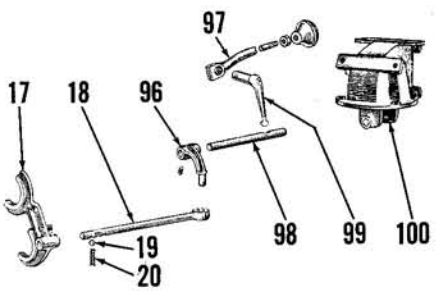


Fig. 124—Exploded view of primary gearbox shift mechanism for single clutch models. Dual clutch shift mechanism is similar except for shift rail and fork; refer to Fig. 134 (items 23 and 24).

17. Shift fork
18. Shift rail
19. Detent ball
20. Spring
96. Connector
97. Lever
98. Upper rail
99. Arm
100. Lever housing

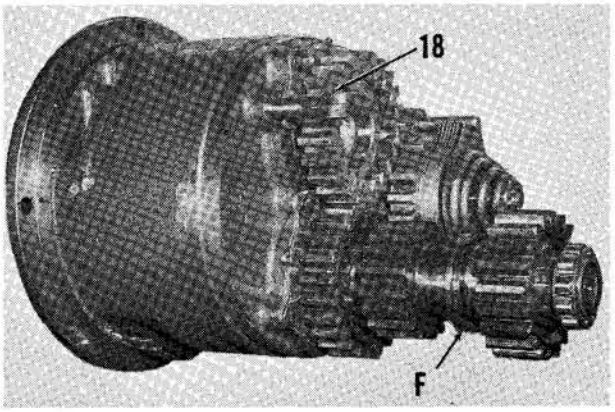


Fig. 125—View of rear end of primary gearbox assembly. When reinstalling main shift cover, be sure lower fork (70—Fig. 127) engages both gear flanges (F). Connector (96—Fig. 124) engages hole in shift rail (18).

in paragraph 21. The shift housing can then be unbolted and removed. When reinstalling the unit, be sure that connector arm (96) enters hole in rear end of gearbox shift rail (18); this can be observed through opening in transmission where steering gear unit was mounted.

To remove the primary gearbox shift rail, fork and detent, refer to paragraph 177 for single clutch models or to paragraph 182 for dual clutch models.

166. **MAIN TRANSMISSION SHIFT MECHANISM.** Refer to exploded view of the main transmission shifter mechanism in Fig. 126.

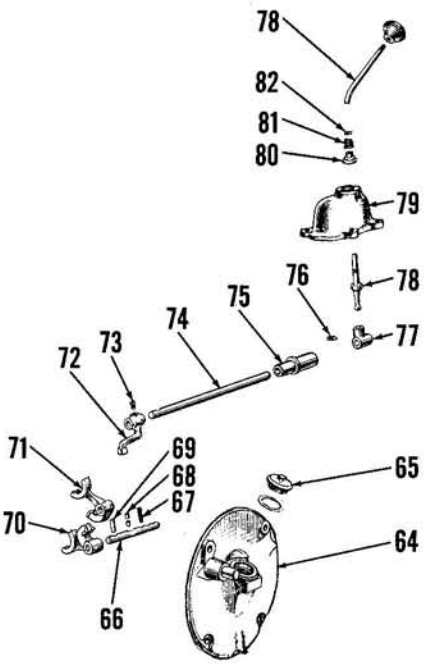


Fig. 126—Exploded view of main transmission shift mechanism. Refer to Fig. 127 for view showing inner side of plate (64).

64. Shift plate
65. Oil filler & level plug
66. Shift rail
67. Detent spring
68. Detents
69. Interlock pin
70. Lower shift fork
71. Upper shift fork
72. Selector arm
73. Set screw
74. Rail
75. Bearing & guide assy.
76. Set screw
77. Socket
78. Shift lever
79. Shift housing
80. Retainer
81. Spring
82. Snap ring

The shift lever housing (79) and lever assembly can be unbolted and removed from top of rear axle center housing without removing other components. To remove lever from housing, remove snap ring (82) and withdraw lever from lower side of housing. When reinstalling assembly, be sure lower end of shift lever enters socket in connector (77).

To remove shift cover (64) assembly from left side of transmission, first drain lubricant to below level of cover and disconnect clutch linkage from balance lever. Then, unbolt and remove cover assembly. Refer to Fig. 127 for view showing inner side of cover. To disassemble unit, remove the rivets or clevis pins retaining shift forks to rails. Push top shift rail out of cover and remove the shift fork, interlock pin (69), detent plungers and spring (see Fig. 128); then, remove lower shift rail and fork. To reassemble unit, reverse disassembly procedure. Note: Top and bottom shift rails are interchangeable; end of rails with single notch are installed to rear (interlock plunger) end of cover. The later clevis pins and cotter pins can be used to secure forks to rails on all models. Also, the later type detent plungers and spring can be used as a set to renew early type plungers and spring. When reinstalling assembly, be sure the flanges of the sliding gears are together and aligned, then reinstall assembly so that connector arm (72—Fig. 129) engages slots in forks and forks engage the flanges (F—Figs. 125 and 129) of both gears on main transmission upper and lower shifts. Note that the PTO shift lever pivots on the lower right cover retaining bolt.

To remove the connector (77—Fig. 126), shift rail (74) or bearing (75), the tractor must first be split between transmission housing and rear axle

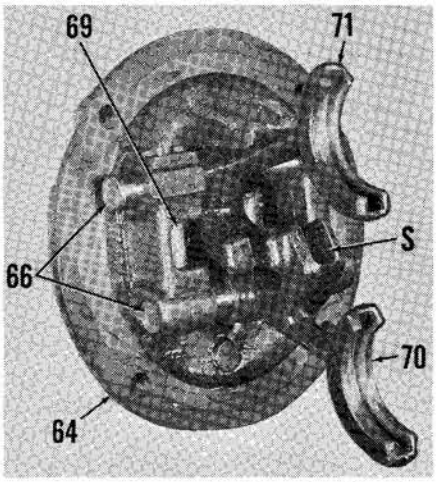


Fig. 127—View of inside of shift plate (64—Fig. 126). When installing assembly, be sure slot (S) engages selector arm (72—Fig. 126) and that shift forks (70 and 71) engage flanges (F—Figs. 125 and 129). Refer to Fig. 126 for legend.

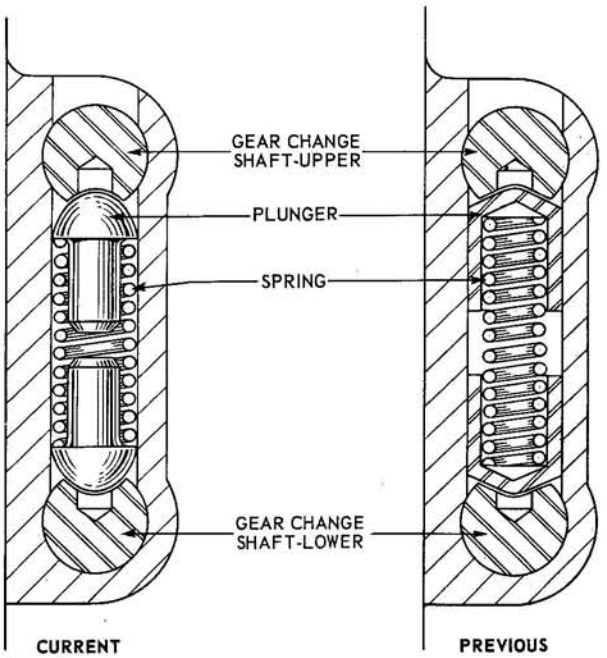


Fig. 128—View showing latest production main shift rail detents (left) and early production detents (right). Refer also to Figs. 126 and 127.

center housing as outlined in paragraph 197 and the shift cover assembly removed as outlined in preceding paragraph. Remove the set screw (73) and front connector arm (72), then slide rail out of rear end of transmission. The bearing (75) can then be removed and a new bearing installed if necessary. Early model "FMD" was fitted with an oil seal located in rear end of bearing; however, use of the seal has been discontinued for all models.

TRANSMISSION INPUT (CLUTCH) SHAFT

Models With Single Clutch

167. Transmission input (clutch) shaft and housing can be removed after splitting the tractor between engine and transmission housing as outlined in paragraph 149. To remove shaft and housing, proceed as follows: Disconnect clutch release rod from cross-shaft arm and remove clutch release bearing and hub assembly. Note: On models with 13 inch clutch, disconnect lubrication hose from release bearing hub or from housing. Remove the pins retaining clutch release fork to cross-shaft, withdraw shaft and remove fork and return spring. Cut cap screw locking wire, then unbolt and remove the transmission input (clutch) shaft housing (1—Fig. 131) and seal (3) assembly. Withdraw input shaft (7) and bearing (5) assembly from gearbox. Remove seal from housing. Remove snap ring (4), then remove bearing from input shaft. Remove outer race for roller bearing (8) from rear bore of input shaft if necessary to renew bearing.

Install new bearing outer race in rear bore of input shaft, then reinstall shaft so that it engages primary upper shaft dog coupling. Install new oil seal in shaft housing, then install the housing with new gasket and with clutch spring lug to bottom. Install the drilled head cap screws, tighten them securely, then install locking wire through the drilled heads.

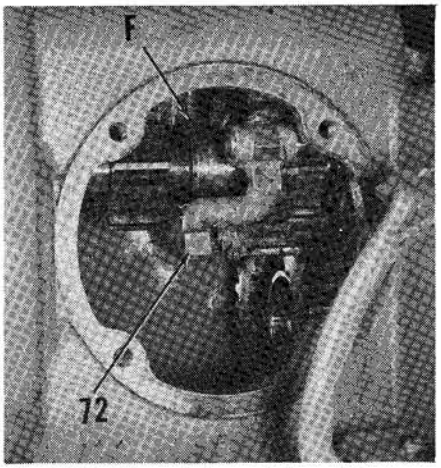


Fig. 129—View of transmission with planetary gearbox assembly (Fig. 125) and main shift plate assembly (Fig. 127) removed. Upper shift fork (71—Fig. 127) must engage flange (F) and slot (S—Fig. 127) must fit connector (72) when reinstalling shift plate assembly.

Models With Dual ("Live PTO") Clutch

168. After splitting tractor between engine and transmission housing as outlined in paragraph 149, disconnect clutch release rod from cross-shaft arm and remove clutch release bearing and hub assembly. Remove the pins retaining clutch release fork to cross-shaft, withdraw the shaft and remove fork and return spring. Cut locking wire and remove cap screws retaining input shaft housing (1—Fig. 134) to primary gear box, then remove the housing and seal (5) assembly. Withdraw transmission input shaft (10) and PTO input shaft (9) as a unit.

Early production units were fitted with a composition sealing ring and metal retainer instead of the oil seal (8); however, the oil seal (Ford part No. DDN-7052-A) can be used in all models. A new seal should be installed whenever the transmission input shaft is removed from PTO input shaft. Be sure that the bushing in front end of PTO input shaft is driven back flush with step in shaft bore when renewing early composition seal and metal sealing ring. Drive seal into shaft with spring loaded lip to rear and lightly bottom seal against front end of bushing. Liberally grease the seal and transmission input shaft and carefully insert transmission input shaft through the PTO input shaft and oil seal assembly.

R&R COMPLETE TRANSMISSION ASSEMBLY

Model "FMD"

169. With tractor split between engine and transmission as outlined in paragraph 149, proceed as follows: Remove steering wheel and the instrument control box. Unbolt fuel tank from supports and lift tank off over steering gear column. Remove the steering gear assembly from top of transmission. Drain lubricant from rear axle center housing and remove the PTO output shaft as outlined in paragraph 224 or raised PTO unit and driveshaft as outlined in paragraph 225. Disconnect wiring to rear lights. Remove right foot rest (step plate), disconnect brake cables and remove brake locking lever guide and the right foot rest bracket. Remove the left foot rest, clutch pedal stop and foot rest bracket. Disconnect clutch release rod at balance lever. Remove brake outer pedal, loosen clamp bolt on inner pedal and slide inner pedal out on shaft far enough to clear transmission rear flange. Remove main shift lever housing from top of rear axle center housing. Attach hoist to transmission, support rear unit under front end of rear axle center housing, then unbolt and remove the transmission assembly.

To reinstall transmission, reverse removal procedure.

Models "FPM", "FSM" and "New FSM"

170. With tractor split between engine and transmission as outlined in paragraph 149, proceed as follows:

Remove steering wheel, throttle control lever and the grease fitting from upper end of the steering column. Remove instrument panel retaining screws and disconnect wiring loom from horn (if so equipped), generator and oil pressure warning lights, starter and front lights. Disconnect proofmeter (tach-hourmeter) drive cable at upper end, free the water temperature gage tube and bulb, then remove the instrument panel assembly. Disconnect stop control cable housing from clamp on battery tray and the wiring loom from main switch, unscrew primary gearbox shift lever knob, then unbolt and remove shroud (sheet metal cover) from rear of fuel tank. Remove the fuel tank and the starter control lever. Unbolt and remove steering gear unit from top of transmission.

Drain lubricant from rear axle center housing and remove PTO output shaft as outlined in paragraph 224 or raised PTO unit and driveshaft as

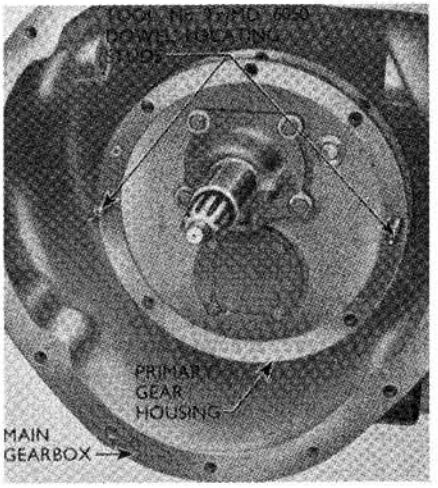


Fig. 130—Removal and installation of primary gearbox (housing) assembly is made easier by use of locating studs.

outlined in paragraph 225. Disconnect wiring to rear lights. Remove right foot rest (step plate), disconnect brake cables (on "FPM"), then remove brake locking lever guide ("FPM" only) and the right foot rest bracket. Remove the left foot rest, clutch pedal stop and foot rest bracket. Remove outer brake pedal and loosen clamp bolt on inner pedal, then slide inner pedal out far enough on shaft to clear transmission rear flange. Unbolt and remove the main shift lever assembly from top of rear axle center housing. Attach hoist to transmission, support rear unit under front end of rear axle center housing, then unbolt and remove the transmission assembly.

Reinstall transmission by reversing removal procedures.

R&R PRIMARY GEARBOX

All Models

171. First, split tractor between flywheel housing and transmission housing as outlined in paragraph 149, then proceed as follows:

Drain oil from transmission and if equipped with PTO, also drain rear axle center housing. Disconnect clutch release rod from cross-shaft arm and remove clutch release bearing and hub assembly. Remove clutch release fork to cross-shaft retaining pins and withdraw cross-shaft from transmission housing, then remove fork and return spring. Remove raised PTO unit if so equipped and partially withdraw extension shaft from rear of rear axle center housing. On models with standard PTO, unbolt PTO output shaft bearing retainer and partiall withdraw output shaft. Disconnect PTO engagement lever and remove PTO gearbox from bottom of transmission housing. Remove belt pulley unit if so equipped.

Disconnect clutch pedal to balance lever rod at balance lever, then unbolt and remove main transmission shifter plate assembly (see Fig. 126) complete with balance lever and release rod. Place primary gearbox lever in lower position on model with single clutch or in upper position on model with "live PTO" (dual clutch). Working through main transmission shifter plate opening, remove lockwire and square headed set screw retaining selector lever to primary gearbox upper shift rail. Move primary gearbox shift lever to opposite position and with locating studs threaded into right and left center gearbox retaining cap screw holes (see Fig. 130), slide primary gearbox forward about 2 inches. Slide connector lever from upper shift rail, remove lever from primary gearbox shift rail, then remove primary gearbox from transmission housing.

172. To reinstall primary gearbox, place new gasket on locating studs. Note: Gasket sealer should be applied to both sides of gasket between two lower bolt holes. Guide primary gearbox onto locating studs, fit connector lever to primary gearbox shift rail and slide over end of upper shift rail, then slide gearbox into position and secure with retaining cap screws. Wire the cap screw heads to prevent loosening. Complete reassembly of tractor by reversing disassembly procedure.

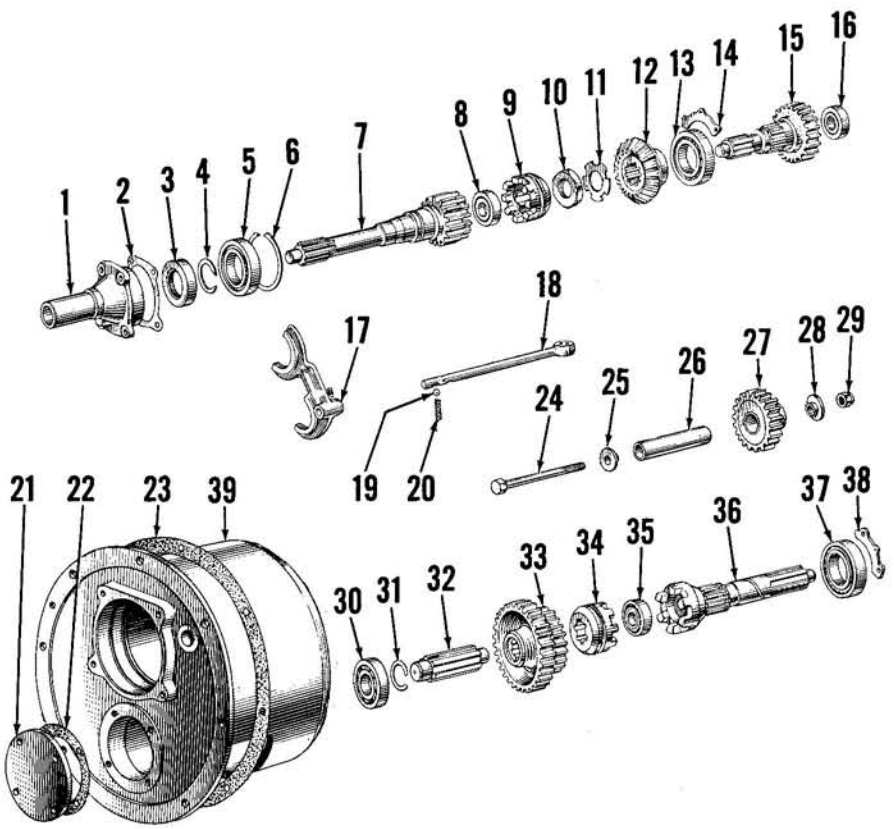


Fig. 131—Exploded view of primary gearbox assembly for single clutch models. Refer to Fig. 134 for gearbox used with dual clutch (Live PTO) models. Fig. 132 shows assembled view of gearbox.

1. Input shaft housing
2. Gasket
3. Oil seal
4. Snap ring
5. Bearing
6. Snap ring
7. Input shaft
8. Bearing
9. Coupling
10. Nut
11. Lockwasher
12. Bevel gear
13. Bearing
14. Locking plate
15. Shaft
16. Bearing
17. Shift fork
18. Shift rail
19. Detent ball
20. Spring
21. Plate
22. Gasket
23. Gasket
24. Bolt
25. Retainer
26. Idler shaft
27. Reverse idler
28. Retainer
29. Nut
30. Bearing
31. Snap ring
32. Lower shaft
33. Cluster gear
34. Coupling
35. Bearing
36. Lower main shaft
37. Bearing
38. Locking plate

OVERHAUL PRIMARY GEARBOX

Models With Single Clutch

173. With primary gearbox removed as outlined in paragraph 171 and transmission input shaft and housing removed from gearbox as in paragraph 167, proceed as follows:

174. **REVERSE IDLER.** Early model "FMD" was fitted with transmission brake unit as shown in Fig. 133 although tractors shipped to U.S. were not equipped with the hand lever and camshaft (95) required to operate the brake. On later model "FMD" and all subsequent models, a revised idler gear (27—Fig. 131), shaft (26), bolt (24) and retainers (25 and 28) are used, eliminating the brake components.

If early "FMD" with transmission brake unit is encountered, remove cotter pin retaining the nut (93—Fig. 133), then remove nut, spring (92), retainer plate (88), spring (86), the five rotating discs (91), the seven stationary discs (87) and the idler gear (90). Note: Seventh stationary disc is located between idler gear and primary gearbox housing. The bolt (84) can now be removed from inside of housing.

On models without transmission brake, unscrew nut (29—Fig. 131) and remove retainer (28) and idler gear (27), then remove bolt (24) and sec-

ond retainer (25) from inside of housing.

Idler shaft outside diameter (new) is 1.122-1.123 and idler gear inside diameter (new) is 1.124-1.125 resulting in a shaft to bushing clearance of 0.001-0.003. Renew shaft (26—Fig. 131 or 85—Fig. 133) if worn to a diameter of 1.120 or smaller and gear if inside diameter is worn to 1.127 or larger. Note: On early models with transmission brake unit, the stationary disc retaining pins (89—Fig. 133) can be removed, the brake components discarded and the later type reverse idler and components (items 24 through 29—Fig. 131) installed if so desired.

If necessary to renew idler gear shaft, press old shaft from housing and press new shaft into place. If early transmission brake components are being reinstalled, the shaft (85—Fig. 133) should protrude 1.20-1.23 inches from rear machined (brake) surface of housing. On models without brake, the shaft (26—Fig. 131) should protrude 1.30-1.31 inches from machined face of housing.

On early models with brake, reassemble as follows: Insert special bolt (84—Fig. 133) from inside of housing. Place a stationary disc on idler shaft so that it engages the retaining pins (89), then install idler gear with recess towards housing. Alternately place the stationary and rotating discs on idler shaft, install spring (86) on bolt, install retainer plate (88) and spring (92) and secure with nut (93). Adjust nut so that distance from mounting face of primary gearbox housing to rear face (end) of nut is 13.870-13.895 inches, then retain nut with cotter pin.

On models without transmission brake unit, insert bolt (24—Fig. 131) with retainer (25) through idler gear shaft from inside of housing, place idler gear on shaft with hub away from housing, then secure with second retainer (28) and self locking nut (29). Note: Be sure that small diameter of retainers are towards each other and enter bore of shaft. Tighten the nut securely and measure end play of gear on shaft. If end play is not within 0.010-0.025, press idler shaft into or out of housing as required to bring idler gear end play within limits.

175. **LOWER SHAFT AND GEARS.** The main transmission lower pinion gear (46—Fig. 140), reverse pinion (45) and lower shaft gear (43) are carried on the primary gear box lower rear shaft (36—Fig. 131). To remove the shaft and gears as an assembly, remove locking plate (38), then withdraw the unit from rear of primary gear box. Refer to paragraph 185 for service of the removed shaft and gears.

With shaft (36) removed, use suitable pullers to remove inner race and roller assembly of bearing (35) and remove front plate (21) from front face of primary gearbox housing. Select a pipe that will fit over rear end of shaft (32) and into recess of coupling gear (34). With unit supported on this pipe, use suitable drift punch to drive the shaft (32) out to rear of the assembly and into the pipe. With shaft out, remove the cluster gear (33) and thrust washer (31). Drive the front bearing (30) from bore in housing. The coupling gear cannot be removed from shifter fork (17); remove fork and gear as a unit as outlined in paragraph 177, then remove gear from fork.

To reassemble, be sure that shift fork (17) and gear (34) are in place with clutch teeth of gear to rear of housing. Then, reinstall shaft, thrust washer, cluster gear and bearing by reversing removal procedure. Reinstall front plate with new gasket and secure the cap screws with locking wire. NOTE: With introduction of model "New FSM" at serial No. 08C-960337, diameter of bearing journal on front end of primary gearbox lower shaft (32—Fig. 131) and inside diameter of bearing (30) were decreased to provide a larger capacity bearing. The new shaft (Ford part No. DKN-77112-B) and bearing (part No. DDN-7A452) can be used as service replacements for the prior shaft (part No. DKN-77112-A) and bearing (part No. BB-7065) in all prior models. When installing the late shaft and bearing in all models, a thrust washer (part No. 113435-ES) is placed between bearing (30) and gear (33).

Also, with introduction of model "New FSM", number of teeth of primary gearbox upper shaft gear (15—Fig. 131) was changed from 23 to 24 and number of teeth on lower mating gear (43—Fig. 140) was changed from 24 to 23. The new upper shaft (Ford part No. DDN-7024) and lower gear (part No. DKN-77103-B) can be installed as a pair in all prior models as a service replacement for prior upper shaft (part No. DKN-7024-A) and lower gear (part No. DKN-7103-A).

176. **UPPER SHAFT AND GEARS.** With reverse idler and lower shaft removed as outlined in paragraphs 174 and 175, proceed as follows:

Using suitable pullers, remove bearing (8—Fig. 131) inner race and roller assembly from front end of upper shaft (15). Straighten tab on locking washer (11), then hold shaft from turning while unscrewing nut (10), or hold nut and turn shaft as practical with available tools. Note: A suggested method of holding or turning shaft is to place clutch disc on front end of input shaft (7), engage rear end of input shaft with coupling (9), then hold or turn with the clutch disc.

With nut (10) off, remove locking plate (14) from rear face of gearbox and withdraw shaft (15) and bearing (13) from rear. Then, remove gear (12), tab washer, nut and coupling from the gearbox.

If necessary to remove outer race of bearing (16) from rear end of upper shaft, first remove the ball bearing (13), then drive outer race from rear end of shaft with punch inserted through holes in gear part of shaft. If necessary to renew upper shaft, refer to note following paragraph 175.

Reinstall by reversing removal procedure. Be sure to bend tab of washer against nut (10) and secure cap screws for locking plate (14) with wire.

177. **SHIFT RAIL AND FORK.** With the upper and lower primary shafts and gears removed as outlined in paragraphs 175 and 176, proceed as follows:

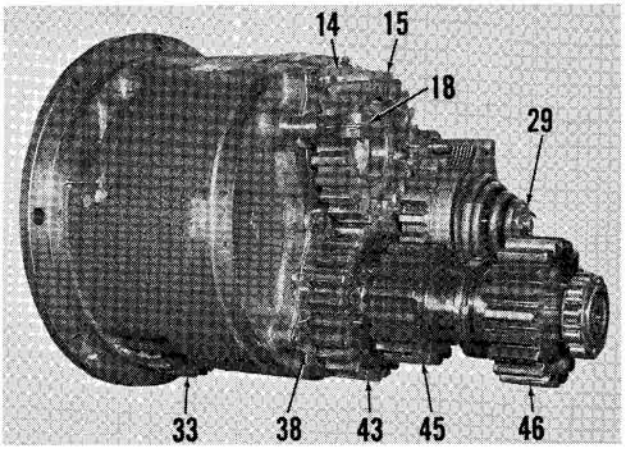


Fig. 132—View of primary gearbox assembly; refer to Figs. 131 and 140 for legend.

Cut the locking wire and remove set screw from fork (17—Fig. 131) and rail (18). Withdraw the shift rail, catching the detent ball and spring as rail is removed. The shift fork along wtih the lower shaft coupling gear (34) can be removed at this time. Remove plug from shift rail bore at front side of primary gearbox housing by driving plug forward out of bore.

To reinstall, insert coupling gear (34) in lower end of fork with coupling teeth to rear, then place fork and coupling gear in housing. Insert shift rail through rear bore and into shift fork. Insert detent spring and ball and hold the detent ball in depressed position as the shift rail is moved forward.

Coat outside of new shift rail bore plug (Ford part No. 115422-ES) with sealer, then drive the plug into bore with open end out. Note: Previous installation of plug was with open end towards shift rail. After plug is installed, stake around the plug bore in three positions to keep plug from moving forward out of bore.

Models With Dual Clutch

178. With primary gearbox removed as outlined in paragraph 171 and the transmission and PTO input shafts removed as in paragraph 168, proceed as follows:

179. **REVERSE IDLER.** Unscrew the nut (32—Fig. 134) and from bolt (27) and remove the retainer (31) and reverse idler gear (30) from shaft (29). Bolt and inner retainer (28) can be removed from inside of primary gearbox housing.

Outside diameter of idler shaft (29) is 1.122-1.123 (new) and idler gear inside diameter (new) is 1.124-1.125 resulting in a gear to shaft clearance of 0.001-0.003. Renew shaft if worn to a diameter of 1.120 or smaller and gear if inside diameter is worn to 1.127 or larger. Gear end play on shaft of 0.010-0.025 can be adjusted by pressing idler shaft into or out of primary gearbox housing as required.

When installing new idler shaft, press shaft into housing until it protrudes 1.30-1.31 inches from machined rear face of housing. Insert bolt with retainer (28) (small diameter away from bolt head) into shaft from inside housing. Place idler gear on shaft with hub away from housing, then install retainer (31) and self-locking nut (32). Note: Be sure small diameter of both retainers enter bore of shaft. Tighten the nut securely and check idler gear end play; press shaft into or out of housing as required to bring end play within limits of 0.010-0.025.

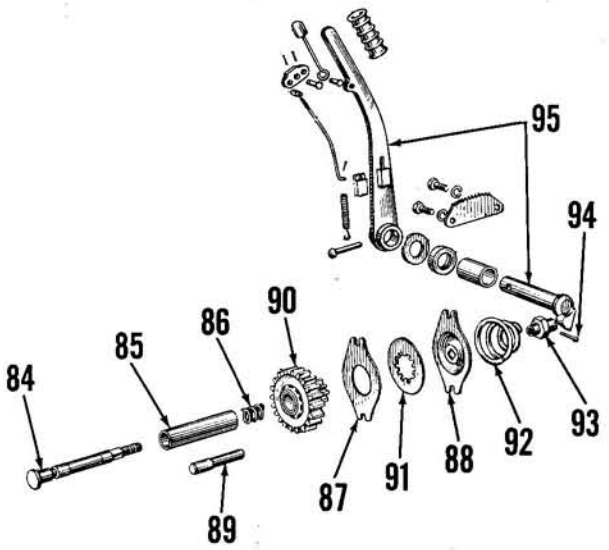


Fig. 133—Early model "FMD" primary gearbox is fitted with transmission brake assembly (items 84 through 94) although lever and actuating shaft (95) were not fitted on tractors shipped to United States.

84. Bolt
85. Idler shaft
86. Spring
87. Stationary discs
88. Retainer plate
89. Retaining pins
90. Reverse idler
91. Rotating discs
92. Spring
93. Nut
94. Cotter pin
95. Lever & shaft (not used)

180. **R&R MAIN TRANSMISSION LOWER SHAFT AND GEARS.** The main transmission lower pinion gear (46—Fig. 140), reverse pinion (46) and lower shaft gear (43) are carried on the primary gear box lower rear shaft (main transmission lower shaft) (40—Fig. 134). To remove the shaft and gears as an assembly, remove locking plate (42), then withdraw the unit from rear of primary gearbox. Refer to paragraph 184 for service information on the removed shaft and gears.

Reinstall shaft and gears as a unit as shown and secure the locking plate cap screws with wire.

181. **PRIMARY GEARBOX UPPER SHAFT AND GEARS.** With reverse idler removed as outlined in paragraph 179 and the transmission lower shaft and gears removed as in paragraph 180, proceed as follows:

Straighten the upper shaft locknut retainer (20—Fig. 134), then unscrew the nut (21). Note: A tool for removing and tightening the nut can be made by welding four pieces of square key stock to a suitably sized socket wrench.

Place shift rail (24) in outermost position and remove the locking plate (18). Withdraw the gear (19) and bearing (17) assembly from rear of gearbox. Place gearbox on its side and push shift rail to inner (forward) detent position. Separate the shaft (14) and sliding gear (12) from bevel gear (16), remove shaft and sliding gear through opening in side of gearbox, then remove the bevel gear.

The bearing (17) can be removed

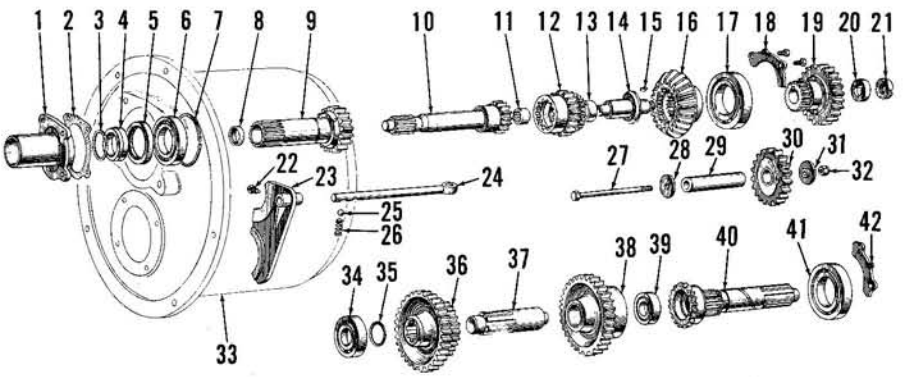


Fig. 134—Exploded view of primary gearbox assembly used on models with dual clutch (Live PTO). Refer to Fig. 131 for gearbox used with single clutch models.

1. Input shaft housing
2. Gasket
3. Snap ring
4. Sleeve
5. Oil-seal
6. Bearing
7. Snap ring
8. Oil seal
9. PTO input shaft
10. Transmission input shaft
11. Bearing
12. Sliding gear
13. Bushing
14. Upper shaft
15. Woodruff key
16. Bevel gear
17. Bearing
18. Locking plate
19. Upper gear
20. Retainer
21. Nut
22. Set screw
23. Shift fork
24. Shift rail
25. Detent ball
26. Detent spring
27. Bolt
28. Retainer
29. Reverse idler shaft
30. Reverse idler gear
31. Retainer
32. Nut
33. Housing
34. Bearing
35. Snap-ring
36. Cluster gear
37. Lower shaft
38. Sliding gear
39. Bearing
40. Main shaft
41. Bearing
42. Locking plate

from gear (18) with suitable pullers. Remove bearing cup from rear face of gear with a punch inserted through holes in gear. The sliding gear and bushing (13) are not serviced separately.

NOTE: At model "FMD" serial No. 1435545, the dog teeth on rear end of sliding gear (12) were increased in length and the distance between detent notches on shift rail (24) was decreased to compensate for longer gear teeth. Only the later type gear with longer teeth and the shift rail with shorter distance between detent notches are available for service. Thus, when servicing model "FMD" prior to serial No. 1435545, gear and shaft must be renewed as a matched pair. Late type gear can be identified by letter "B" stamped on external dog teeth (rear) end of gear and late type rail can be identified by letter "S" stamped on circular end of rail.

With introduction of model "New FSM" at serial No. 08C-960337, number of teeth on primary gearbox upper gear (19) was changed from 23 to 24 and number of teeth on main transmission lower gear (43—Fig. 140) was changed from 24 to 23. The new upper gear (part No. DDN-7102-B) and new lower gear (part No. DKN-77103-B) can be installed as a pair to renew the previous upper gear (part No. E84-GA-9) and lower gear (part No. DKN-77103-A) in prior models.

To reinstall upper shaft and gears, proceed as follows: Be sure that Woodruff key (15—Fig. 134) is placed in slot of shaft (14) and position sliding gear (12) on shaft with external dog teeth towards threaded end of shaft. Place bevel gear (16) in gearbox and push shift rail to inner position (forward). Place sliding gear and shaft in gearbox so that shift fork engages slot in gear and enter threaded end of shaft through the bevel gear. With bearing (17) installed on hub of gear (19), insert splined end of gear into splines of bevel gear so that slot in gear hub is correctly aligned with key (15) in shaft. Take care that the key is not pushed out of place as gear is pushed onto shaft. Install nut (21) with new retainer (20) and tighten nut to a torque of 100 Ft.-Lbs. Bend edges of retainer into all four slots in nut.

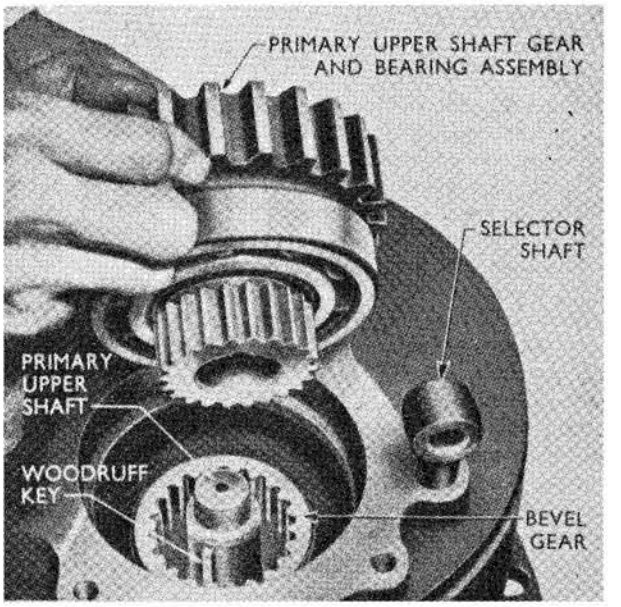


Fig. 136—Removing primary upper shaft gear (19—Fig. 134) and bearing (17) assembly from primary gearbox.

182. **SHIFT RAIL AND FORK.** With the primary gearbox upper shaft and gears removed as outlined in paragraph 181, proceed as follows:

Cut the locking wire and remove set screw (22—Fig. 134) from shift fork (23). Rotate the rail (24) away from detent ball (25) and withdraw rail from gearbox, catching the detent ball (25) and spring (26) as rail is removed. Rotate the shift fork (23) up out of slot in sliding gear (38), then remove fork from opening in side of gearbox. Drive the plug from shift rail bore at front side of gearbox.

To reinstall shift rail and fork, position the fork in slot of lower shaft sliding gear and insert rail from rear through gearbox and fork. Insert the detent spring and ball in their bore and hold detent ball depressed while pushing shift rail into position. Install set screw and secure with wire. Coat new shift rail bore plug with sealer and install plug with hollow side out. Stake the plug at three points to retain it in bore.

183. **LOWER SHAFT AND GEARS.** With upper shaft and gears removed as outlined in paragraph 181 and the shift rail and fork removed as in paragraph 182, proceed as follows:

Using suitable pullers, remove bearing (39—Fig. 134), inner race and rollers from rear end of lower shaft (37). Remove plate (see 21—Fig. 131) from front face of gearbox. Support unit on a piece of pipe that will fit over rear end of lower shaft and into the recess in sliding gear (38—Fig. 134). Then, using a suitable drift punch, drive shaft out of bearing (34)

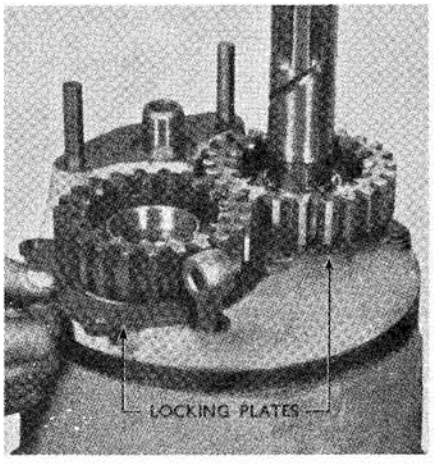


Fig. 135—Removing upper shaft locking plate (18—Fig. 134) from primary gearbox housing.

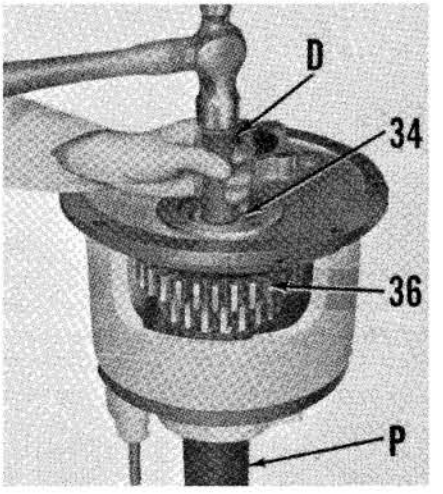


Fig. 137—Using suitable drift (D), drive lower shaft from bearing (34) and cluster gear (36). Use hollow pipe (P) to support gear.

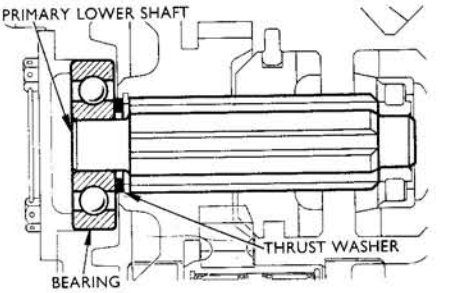


Fig. 138—When installing latest primary gearbox lower shaft and front bearing, a thrust washer is placed between bearing inner race and gear locating snap ring.

and gears (36 and 38) and into the pipe. Remove the gears out through hole in side of gearbox and remove bearing (34) from bore.

NOTE: At model "New FSM" serial No. 08C-960337, diameter of bearing journal on front end of lower shaft (37) and inside diameter of bearing (34) were decreased to provide a larger capacity bearing. The new shaft (Ford part No. DKN-77112-C) and bearing (part No. DDN-7A452), along with new thrust washer (part No. 113435-ES) can be used as service replacements for the prior shaft (E81-GA-9) and bearing (BB-7065) in all prior models.

To reinstall lower shaft and gears, proceed as follows: Install bearing (34) and retaining plate in front bore of gearbox, then turn gearbox front face down. Be sure that snap ring (35) is properly located in groove inside front hub of gear (36) and if late type lower shaft and bearing are being installed, stick thrust washer to front side of snap ring with heavy grease. Position sliding gear (38) inside gearbox, then place the gear (36) in gearbox with front face (or thrust washer) against bearing inner race and lower the sliding gear onto the cluster gear. Insert the shaft (37) through the gears and enter front journal of shaft into bearing. Tap rear end of shaft until shoulder of shaft contacts snap ring. Remove the retaining plate from in front of bearing (34) and support front end of shaft, then drive bearing (39) inner race and roller assembly onto rear end of shaft. Reinstall front plate with new gasket and secure retaining cap screws with wire.

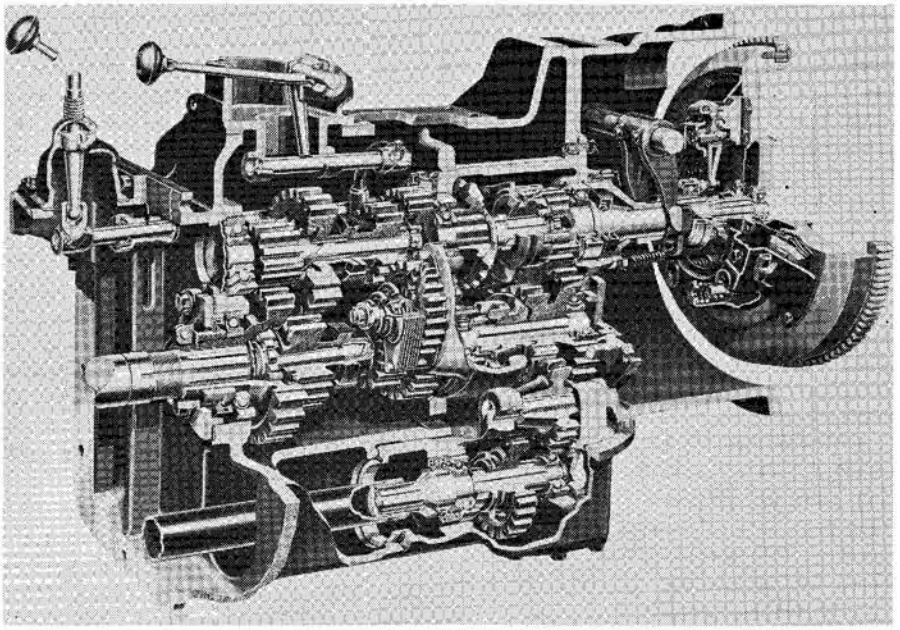


Fig. 139—Cut-away view of typical single clutch transmission. Refer to Fig. 131 for exploded view of single clutch primary gearbox; to Fig. 134 for exploded view of dual clutch primary gearbox; and to Fig. 140 for exploded view of main transmission gears.

MAIN TRANSMISSION

All Models

184. The main transmission lower shaft and gears can be serviced after being removed from the primary gearbox assembly as outlined in paragraph 175 for models with single clutch or in paragraph 180 for models with dual clutch (live PTO). For service of other main transmission components, the complete transmission assembly must be removed as outlined in paragraph 169.

185. **LOWER SHAFT AND GEARS.** The main transmission lower pinion gear (46—Fig. 140), reverse pinion (45) and lower shaft gear (43) are carried on the primary gearbox lower rear shaft (main transmission lower shaft (36 or 40). Remove the shaft and gears as in paragraph 175 for models with single clutch or as in paragraph 180 for models with dual clutch, then disassemble as follows:

Using suitable pullers, remove the inner race and roller assembly of bearing (47—Fig. 140) from rear end of shaft, then slide the lower pinion (46) and reverse pinion (45) from shaft. Remove the snap ring (44) from rear side of gear (43), then press the gear and bearing (37 or 41) assembly from the shaft. Using suitable pullers, remove bearing from gear and outer race of bearing (35—Fig. 131 or 39—Fig. 134) from the bore in front end of shaft.

NOTE: With introduction of model "New FSM" at serial No. 08C-960337, number of teeth on lower shaft gear (43—Fig. 140) was changed from 24 to 23 and number of teeth on the mating primary gearbox upper shaft gear was changed from 23 to 24. The latest gears can be installed as a pair in earlier model tractors; refer to note in paragraph 175 or 181.

To reassemble lower shaft and gears, proceed as follows: Press outer race of bearing (35—Fig. 131 or 39—Fig. 134) into front bore of shaft. Place

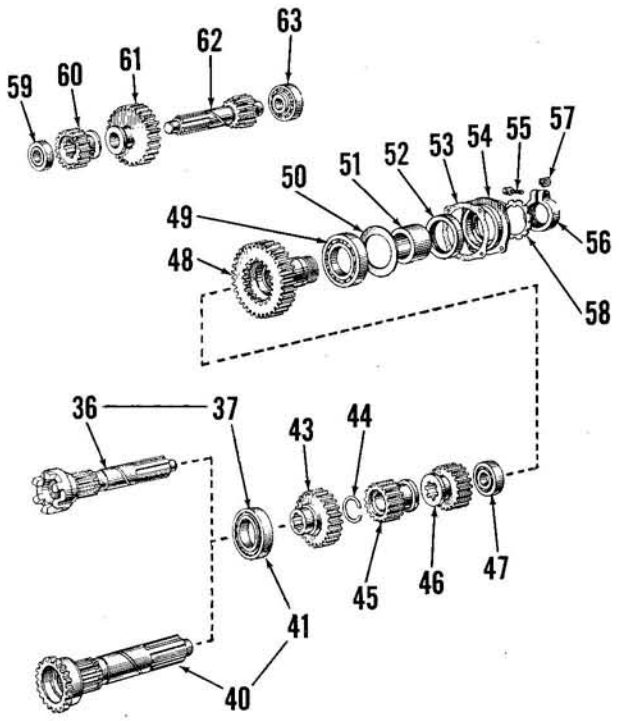


Fig. 140—Exploded view of main transmission unit. Refer to Fig. 139 for cross-sectional view.

36. Main-shaft (single clutch)
37. Bearing
40. Main shaft (dual clutch)
41. Bearing
43. Lower shaft gear
44. Snap ring
45. Reverse pinion
46. Lower pinion
47. Bearing
48. Output gear
49. Bearing
50. Oil baffle
51. Sleeve
52. Oil seal
53. Gasket
54. Retainer
55. Clamping bolt
56. Nut
57. Locking tab
58. Locking washer
59. Bearing
60. Upper pinion
61. Low gear
62. Upper shaft
63. Bearing

roller bearing assembly (37 or 41—Fig. 140) on shaft, then start gear (43) front hub onto large diameter splines on shaft. Place the unit in a press and push shaft into gear making sure that bearing starts onto hub of gear. Continue pressing shaft into gear until shoulder of shaft forces bearing inner race against shoulder on gear hub, then install snap ring (44). Install the reverse pinion (45) and lower pinion (46) on shaft, then press inner race and roller assembly of bearing (47) onto rear end of shaft. Reinstall the shaft and gear assembly as outlined in paragraph 175 or 180.

186. **UPPER SHAFT AND GEARS AND OUTPUT GEAR.** After removing primary gearbox from transmission as outlined in paragraph 171, proceed as follows to remove the upper shaft and gears and the transmission output (large) gear:

Remove the clamp bolt (55—Fig. 140 or 141) and the locking tab (57) from nut (56), then unscrew and remove nut and locking washer (58). Unbolt and remove the oil seal retainer (54), seal and sleeve (51). Push the output (transmission large) gear forward. As the gear is pushed forward, the upper shaft (62) and gear assembly must move forward until rear bearing (63) is clear of bore in transmission housing; otherwise, the output gear (48) will be forced against upper shaft gear (61). Remove the upper shaft and gears as soon as rear bearing is free of housing, then continue pushing output gear forward until free of bearing (49) in transmission. Remove bearing from rear of transmission.

NOTE: On model "FMD" and model "FPM" prior to serial No. 1531530, upper shaft rear bearing (63—Fig. 140) was a ball bearing; all later models are equipped with a roller bearing at this location which is the only bearing now used for service of all models.

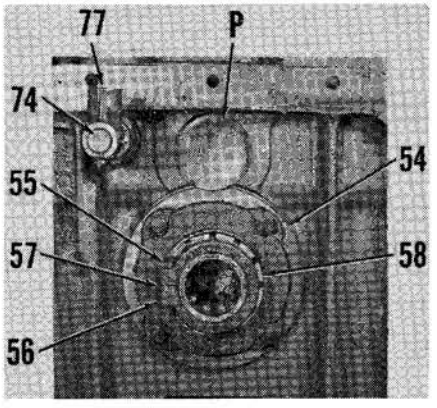


Fig. 141—View of rear end of main transmission showing plug (P) located behind upper shaft bearing (63—Fig. 140). Refer also to Fig. 143. Refer to Fig. 140 for legend.

Also, with introduction of model "New FSM" at serial No. 08C-960337, a new upper main shaft (62) with 11 teeth was introduced; previous shaft had 13 gear teeth. Along with the change in gear teeth, a new output (transmission large) gear with same number of teeth but having a different tooth form was introduced. The new gear can be identified by overall diameter of 7.368 inches compared with diameter of 7.135 inches for old gear. The internal dog teeth on rear of upper shaft low gear (61) was also changed from 13 to 11 to mesh with the new upper shaft gear. The new upper shaft (62), upper shaft low gear (61) and new output (transmission large) gear (48) can be installed in earlier models, but the gears are not individually interchangeable.

Remove the expansion plug (P—Fig. 141) and bearing cup for upper shaft rear (roller type) bearing (63—Fig. 140) if necessary. Note: Three different plugs have been used to seal bore at rear of upper shaft rear bearing (63). Early model "FMD" was fitted with a 3 $\frac{7}{32}$ inch diameter expansion plug (Ford part No. 119781-ES) which is installed from front after removing bearing. Later model "FMD", model "FPM" and early "FSM" are fitted with a cup type plug (part No. 119782-ES) installed with open side of cup towards bearing (front) as shown in Fig. 143. Later model "FSM" and model "New FSM" are also equipped with a cup type plug, but the bore in housing is 0.045 smaller than prior models and a different plug (part No. 115422-ES) is required. If in doubt as to which plug diameter is required, measure bore diameter in housing; if bore measures 2.880-2.882 inches, install large plug (part No. 119782-ES). Install small diameter plug (part No. 115422-ES) if bore measures 2.835-2.837.

Inspect the outer race of bearing (47—Fig. 140) in bore of output (large) gear (48); remove the bearing cup and expansion plug from bore of gear if necessary. Install new expansion plug, then install new bearing cup.

Using suitable pullers, remove upper shaft front bearing (59) inner race and rollers. Slide the pinion (60) and upper shaft low gear (61) from shaft. On latest shaft (62), shoulder is too large to permit removal of bearing (63) inner race and roller assembly with pullers. If necessary to renew bearing (63) and shaft is otherwise serviceable, remove old bearing as follows; Break the roller retainer and grind a flat on bearing inner race (track), then break inner race with chisel as shown in Fig. 142. The inner race can then be easily removed from shaft rear journal. Press new bearing inner race and roller assembly onto shaft.

To reassemble, proceed as follows: Install low gear (61) and pinion gear (60) on upper shaft with shifter flanges together and install front bearing (59) inner race and rollers. Install the new oil seal (52) in retainer (54) with lip to front (machined) side of retainer. Position the bearing (49) and oil baffle (50) in bore of transmission housing and secure with retainer (54) and new gasket (53). Start rear hub of output (large) gear (48) into bearing and bump gear rearward until about halfway through bearing. Position the upper shaft, gears and bearing assembly into rear bearing race, then continue driving output gear rearward until seated against bearing inner race. Insert sleeve (51) through oil seal, then install locking washer (58) and nut (56). Tighten nut securely so that slot in nut is aligned with notch in washer, then install locking tab (57) and clamping bolt (55).

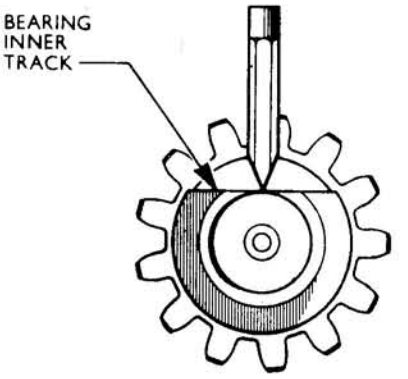


Fig. 142—Removing rear bearing from late type shaft (62—Fig. 140); refer to text.

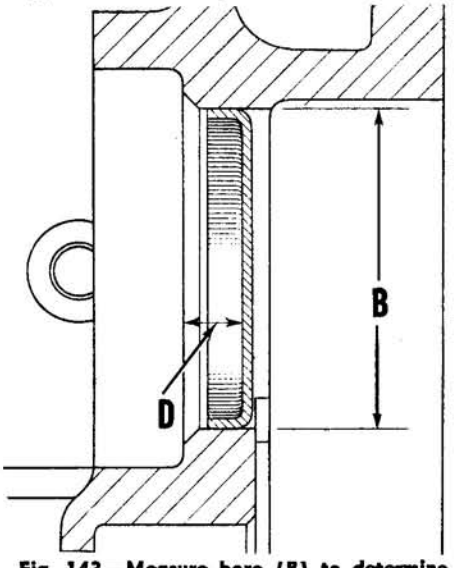


Fig. 143—Measure bore (B) to determine proper size of plug; refer to text for sizes. Plug depth (D) measured from shoulder of bearing bore to front face of plug should be 0.53 inch.

DIFFERENTIAL

CARRIER BEARING ADJUSTMENT

All Models

187. The differential carrier bearings will be properly adjusted when the total thickness of shims located between the rear axle center housing and both differential carrier bearing supports (bull pinion housings) is 0.016. Shims from one side of center housing may be shifted to opposite side to adjust bevel pinion backlash as outlined in paragraph 195; however, total installed thickness of 0.016 must be maintained.

R&R DIFFERENTIAL

Models "FMD" and "FPM"

188. To remove the differential and bevel ring gear assembly, first remove the left rear axle shaft as in paragraph 206, the left bull gear as in paragraph 205 and the left pull pinion and brake assembly as outlined in paragraph 202. Unbolt and remove ring gear thrust pad support (Fig. 152) and the oil deflector assembly (Fig. 144). Thread jack screws into the two tapped holes in differential carrier bearing support and remove the support taking care not to lose or damage shims located between support and rear axle center housing. The differential and bevel ring gear assembly can now be lifted from rear axle center housing.

When reinstalling differential assembly, be sure to reinstall the same shim thickness as was removed from between carrier bearing support and the rear axle center housing. Then, reinstall bull pinion and brake assembly and check bevel gear backlash. If backlash is not within limits of 0.004-0.018, remove both bull pinion and brake assemblies (refer to paragraph 202) and transfer shims from under right bearing carrier to under left bearing carrier to increase backlash, or from under left bearing carrier to under right bearing carrier to decrease backlash. Total thickness of shims under both bearing carriers must be 0.016.

When bevel gear backlash is properly adjusted, reinstall ring gear thrust pad and support assembly with proper number of gaskets so that clearance between thrust pad and back face of ring gear is 0.004-0.014. Reinstall oil deflector assembly and, if necessary, adjust clearance between scraper and ring gear to 0.004.

Reinstall bull gear, rear axle and hydraulic pump and refill rear axle center housing with lubricant. Reinstall hydraulic lift cover assembly.

Models "FSM" and "New FSM"

189. To remove the differential and bevel ring gear assembly, proceed as follows: Remove the left rear axle shaft as outlined in paragraph 206 and the left bull gear as in paragraph 205. Remove both brake assemblies and brake housings as in paragraph 216, then remove the left bull pinion and the right bull pinion and differential lock assembly. Unbolt and remove the ring gear thrust pad and support assembly (Fig. 152) and the oil deflector (Fig. 145). Thread jack screws into the left differential carrier bearing support (bull gear housing) and remove the support taking care that the shims located between bearing support and rear axle center housing are not lost or damaged. The differential and bevel ring gear assembly can now be lifted from rear axle center housing.

To reinstall differential and bevel ring gear assembly, proceed as follows: Position differential assembly in rear axle center housing and reinstall left carrier bearing support with same thickness of shims as was removed and reinstall both brake housings without the bull pinions. Check bevel ring gear to bevel pinion backlash and if not within the limits of 0.004-0.018, remove the brake housings and both carrier bearing supports and transfer shims from under right support to under left support to increase backlash, or from under left support to under right support to decrease backlash.

When bevel gear backlash is correct, remove the brake housings taking care not to disturb the differential carrier bearing supports (bull pinion housings), then install the bull pinions, brake housings and brake assemblies. Install the ring gear thrust pad and support assembly with proper number of gaskets to provide 0.004-0.014 clearance between thrust pad and back face of bevel ring gear. Reinstall the oil deflector and, if necessary, adjust deflector scraper to clear ring gear a distance of 0.004.

Reinstall bull gear, rear axle and hydraulic pump and refill rear axle center housing with lubricant. Reinstall hydraulic lift cover assembly.

OVERHAUL DIFFERENTIAL

Models "FMD" and "FPM"

190. Place correlation marks on differential case halves if not already present, then cut locking wire and

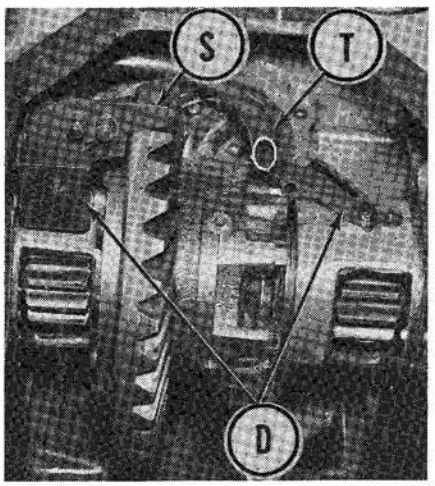


Fig. 144—On "FMD" and "FPM" models, oil deflector (D) attaches to both differential carrier bearing supports. Adjust scraper (S) to clear ring gear by 0.004. Oil tube (T) delivers oil from scraper to differential.

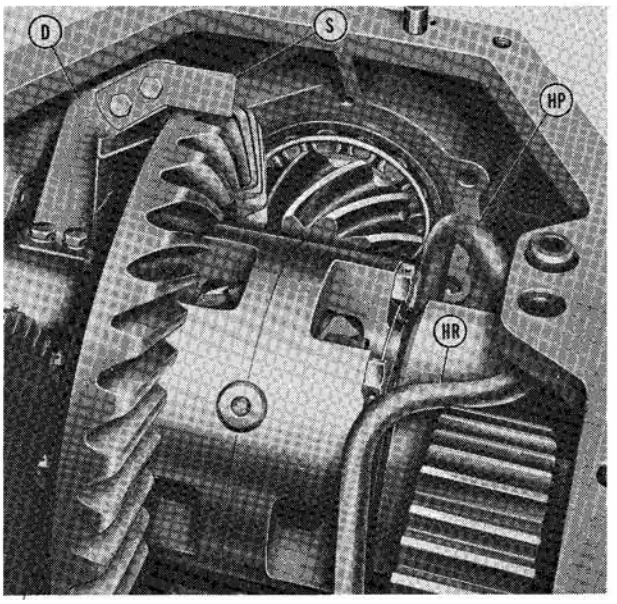


Fig. 145 — On models "FSM" and "New FSM", oil deflector (D) mounts on left differential carrier bearing support and delivers oil to bevel pinion bearings. Adjust deflector scraper (S) to ring gear clearance to 0.004. Hydraulic pump pressure tube is (HP); return tube is (HR).

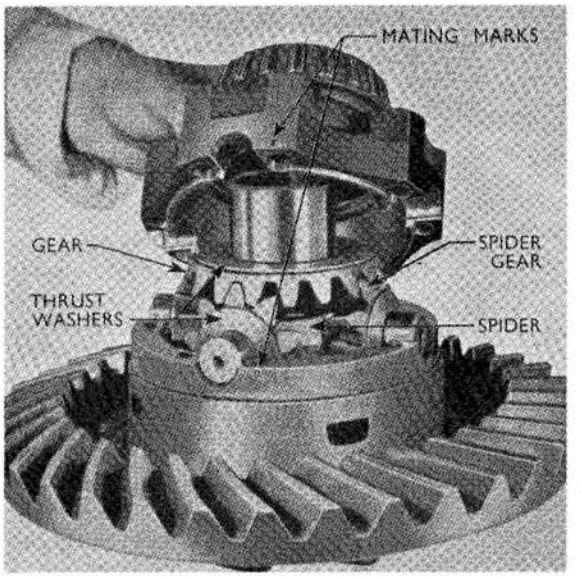


Fig. 146—Be sure mating marks are placed on differential case halves before disassembling unit.

remove cap screws retaining right case half to left half. Separate the case halves as shown in Fig. 146 and remove the spider, gears and thrust washers.

NOTE: On early "FMD", bores for the differential side gear hubs were unbushed. Diameter of the side gear hubs was later reduced and bushings installed in the differential case bores. At serial No. 1481091, number of teeth on side gears was changed from 18 to 20 and number of teeth on differential pinions was changed from 9 to 11. Only the latest type side gears and pinions are available for service. Thus, both new side gears and four new pinions must be installed if differential assembly is fitted with the early type gears. Also, if the differential case is unbushed, bushings must be installed or if the bores are worn excessively, a new differential assembly must be installed.

Inspect the differential spider, gears, thrust washers and bushings for excessive wear or breakage. If necessary to install new bushings in differential case, a closely fitting bushing driver should be used and the inside ends of bushing should be flush with bottom of chamfer on inside of housing. The bushings are pre-sized. The differential pinions and their bushings are serviced as assemblies only.

The bevel ring gear is riveted to the left differential case half during factory production; however, special bolts, spacers and nuts are available for service installation of gear to case. If necessary to remove a riveted ring gear, center punch the upset ends of rivets on ring gear side of the assembly, then using a ⅛-inch diammeter drill, drill pilot holes in each of the rivet heads. Using a ½-inch diameter drill bit, drill into the pilot holes until the hardened face of the ring gear is reached; then, using a ⅜-inch diameter drift punch, drive the rivets out of gear and case.

When installing ring gear to differential case, be sure the mating surfaces are clean and free of any burrs, then install ring gear with special bolts (Ford part No. 115605-ES), spacers (part No. E21-EB-9) and self-locking nuts (part No. 34447-ES). Tighten the nuts to a torque of 40-45 Ft.-Lbs.

When reassembling differential, be sure the correlation marks on case halves are properly aligned, install the eight cap screws and tighten them to a torque of 65-75 Ft.-Lbs. Wire the drilled heads of the cap screws securely.

Models "FSM" and "New FSM"

191. With the differential and bevel ring gear assembly removed as outliner in paragraph 189, proceed as folfows:

Place correlation marks on the the differential case halves if not already present, then cut locking wire and remove cap screws retaining right case half to left half. Separate the case halves as shown in Fig. 146 and remove the spider, gears and thrust washers.

The bushings in the differential case halves for the differential side gear hubs are renewable. New bushings should be driven into bores from inside of differential case so that inner ends of bushings are flush with the chamfer in case. The bushings are pre-sized and reaming should not be necessary if bushings are carefully installed.

Holes are provided in the differential case halves so that a punch may be inserted through the holes to drive the carrier bearing cone and roller assemblies from the case. When renewing bearing cones, the cups in

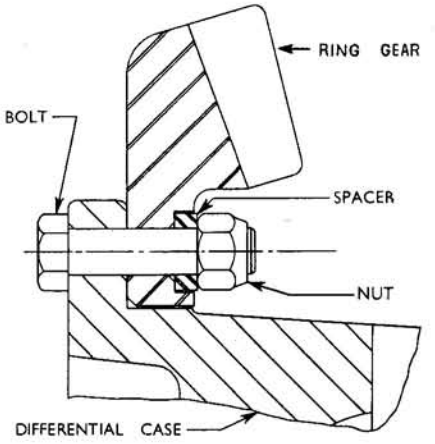


Fig. 147—Cross-sectional view of bevel ring gear showing proper installation of retaining bolts, spacers and nuts.

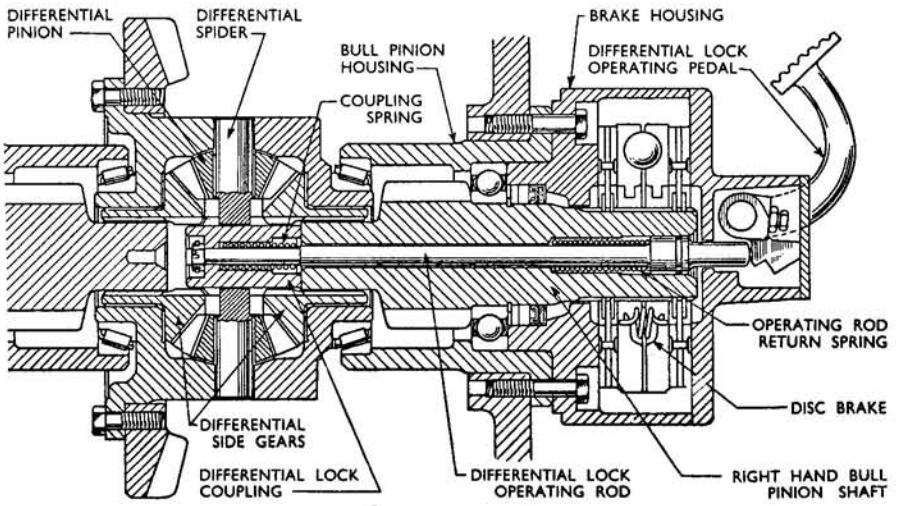


Fig. 148—Cross-sectional view of model "FSM" and "New FSM" differential, bull pinion and right brake unit showing operation of differential lock. Depressing operating pedal locks both differential side gears together.

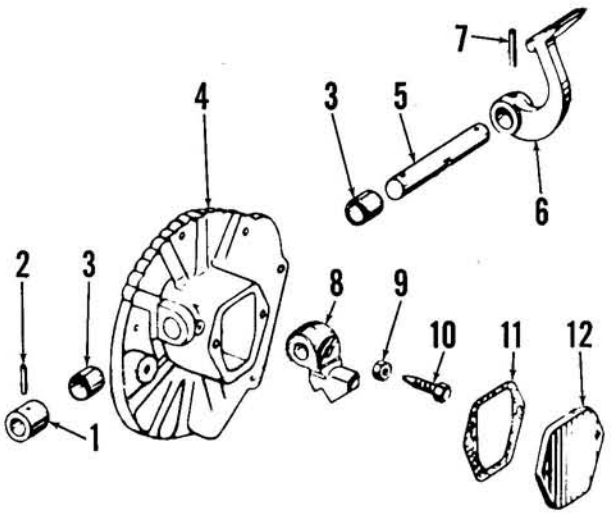


Fig. 149—Exploded view of differential lock operating pedal and disc brake cover assembly.

1. Collar
2. Pin
3. Bushings
4. Brake cover
5. Shaft
6. Operating pedal
7. Pin
8. Operating lever
9. Lock-nut
10. Set screw
11. Gasket
12. Cover plate

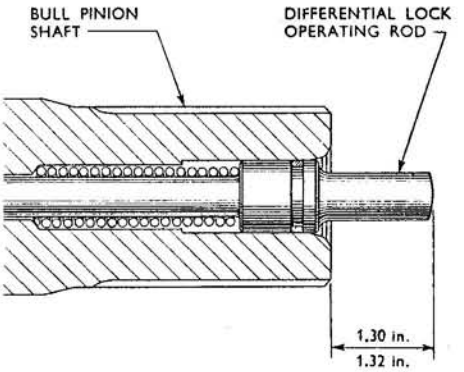


Fig. 151—Adjust nut (2—Fig. 150) so that differential lock operating rod protrudes 1.30-1.32 from bull pinion shaft.

carrier bearing supports (bull pinion housings) should also be renewed.

If necessary to renew the bevel ring gear or differential case separately, unbolt and remove the ring gear from left case half. When installing ring gear on differential case, be sure the mating surfaces are clean and free of any burrs, then install the ring gear with special bolts (Ford part No. 43068-ES), spacers (part No. E21-EB-9) and self-locking nuts (part No. 34447-ES). Note: Clean the bolts and nuts thoroughly in solvent, allow to dry, then apply a thin line of "Loctite" sealer along the threads of each bolt before installing nuts. Tighten the nuts to a torque of 50-55 Ft.-Lbs. and allow two hours for "Loctite" to set after tractor is assembled before driving the tractor.

Assemble differential case halves with correlation marks properly aligned, tighten cap screws to a torque of 65-75 Ft.-Lbs. and secure with locking wire through the drilled cap screw heads.

DIFFERENTIAL LOCK

Models "FSM" and "New FSM"

192. Refer to cross-sectional view in Fig. 148 for operation of the differential lock. Repair procedures are as follows:

193. **OPERATING PEDAL.** To disassemble the operating pedal and brake cover assembly, refer to exploded view of unit in Fig. 149 and proceed as follows: Remove cover (12), loosen locknut (9) and remove the set screw (10). Drive pin (2) from collar (1) and shaft, then withdraw the pedal and shaft from brake cover and remove operating lever (8). Drive pin (7) from pedal and remove pedal from cross-shaft. Remove cross-shaft bushings from brake cover.

To reassemble operating pedal and brake cover assembly, reverse disassembly procedure. Be sure that operating pedal is installed on correct end of shaft; this can be checked by noting position of dimple in shaft for the set screw (10). New pins should be used to secure pedal and collar to shaft.

194. **DIFFERENTIAL LOCK AND BULL PINION ASSEMBLY.** Refer to paragraph 204 to remove and reinstall bull pinion assembly. The differential lock and bull pinion assembly can be disassembled by removing the cotter pin and castellated nut from inner end of differential lock operating rod. Refer to exploded view in Fig. 150.

Install a new "O" ring on operating rod, lubricate "O" ring and reassemble the unit. Turn nut onto inner end of rod so that outer end protrudes 1.30-1.31 inches from outer face of bull pinion shaft as shown in Fig. 151 then secure nut in this position with new cotter pin.

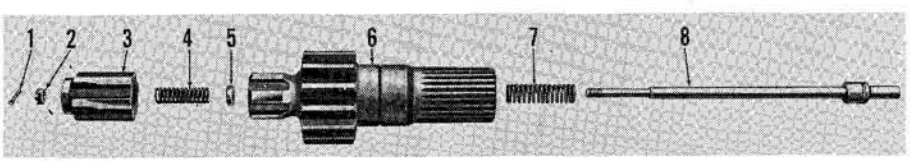


Fig. 150—Exploded view of right bull pinion and differential lock assembly. Protrusion of rod (8) is adjusted by nut (2); refer to Fig. 151.

1. Cotter pin
2. Nut
3. Coupling
4. Spring
5. Spring seat
6. Bull pinion
7. Spring
8. Operating rod

MAIN DRIVE BEVEL GEARS

BEVEL GEAR ADJUSTMENT

All Models

195. Bevel gear mesh position is non-adjustable and is maintained by installation of matched bevel ring gear and bevel pinion whenever renewal of either part is required.

Bevel gear backlash should be 0.004-0.018 and is adjustable by transfering shims located between rear axle center housing and differential carrier bearing supports (bull pinion housings). For proper adjustment of differential carrier bearings, the total shim thickness of both locations must be 0.016. Shims are available in thicknesses of 0.003 and 0.005; thus the total shim thickness must include two 0.003 thick and two 0.005 thick shims. Bevel gear backlash should be checked whenever installing differential assembly is outlined in paragraph 189.

RING GEAR THRUST PAD

All Models

196. A thrust pad (see Fig. 152) is provided to prevent bevel ring gear and pinion separation under heavy thrust loads. Clearance of 0.004-0.014 between thrust pad and back face of bevel ring gear should be maintained by varying number of the gaskets used between thrust pad support and rear axle center housing.

MAIN DRIVE BEVEL PINION

All Models

197. **REMOVE AND REINSTALL.** The bevel pinion assembly can be unbolted and removed from front of rear axle center housing after splitting the tractor between transmission and rear axle center housings as follows:

Drain the rear axle center housing lubricant and remove PTO output shaft as outlined in paragraph 224 or the raised PTO unit and driveshaft as outlined in paragraph 225. Disconnect wiring to rear lights. Remove the foot rests (step plates) from each side of tractor. On models "FMD" and "FPM", disconnect brake cables and remove the brake locking lever guide. Remove the outer brake pedal, loosen clamp bolt on inner pedal and slide inner brake pedal out far enough to clear the transmission flange. Disconnect clutch release rod at balance lever. Remove the main shift lever assembly from top of rear axle center housing.

If differential has been removed, attach suitable hoist to rear axle center housing and place a support under the transmission housing. On four wheel models, drive wood wedges between front axle and front support; adequately brace tricycle front end to keep from tipping.

Unbolt the rear axle center housing from transmission and separate the units. Remove retaining cap screws and withdraw bevel pinion assembly from front of rear axle center housing. If necessary to drive assembly from rear axle center housing, use proper size drift and drive on rear end of bearing carrier only; driving against rear end of pinion could damage pinion bearings.

If necessary to renew bevel pinion, refer to paragraph 190 or 191. Pinion and ring gear must be installed as a matched pair to maintain bevel pinion mesh position.

With differential and bevel ring gear assembly removed, reinstall bevel pinion assembly first and then adjust pinion bearing preload as outlined in paragraph 199. If differential and bevel ring gear assembly is not removed, clamp flange of bearing carrier in vise and adjust pinion bearing preload prior to reinstalling the assembly.

Using guide studs, install bevel pinion assembly in front face of rear axle center housing, then remove guide studs and securely install carrier bearing retainer cap screws. Rejoin the tractor by reversing split procedure.

198. **OVERHAUL BEVEL PINION ASSEMBLY.** With bevel pinion assembly removed as outlined in paragraph 197, proceed as follows: Lift up the bent sides of the locking washer, then loosen and remove the locking nut, locking washer, adjusting nut and thrust washer from front end of pinion. Withdraw the pinion and rear

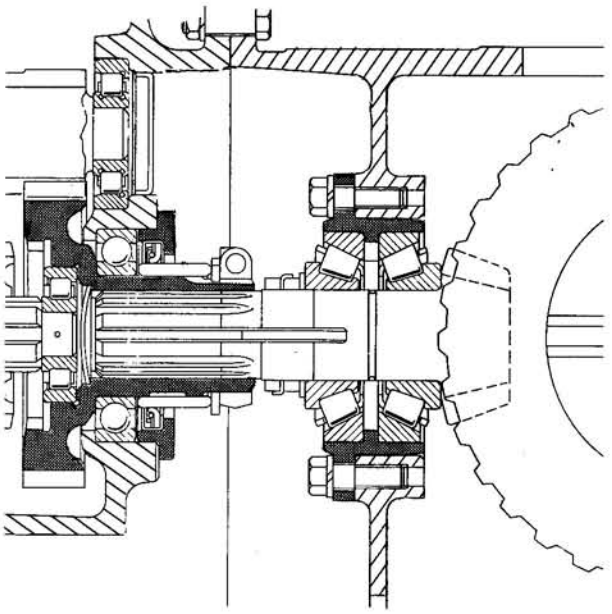


Fig. 153—Cross-sectional view showing bevel pinion mounting. Refer to Fig. 141 for view showing rear face of transmission housing and to Fig. 152 for view showing front face of rear axle center housing.

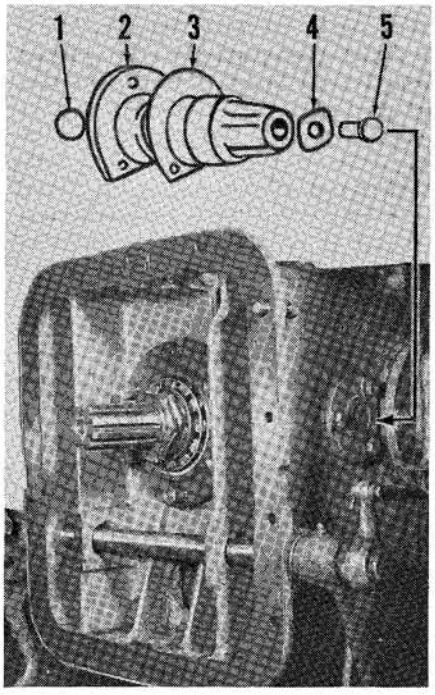


Fig. 152—View showing bevel ring gear thrust pad and support assembly.

1. Expansion plug
2. Support
3. Gaskets
4. Thrust pad
5. Rivet

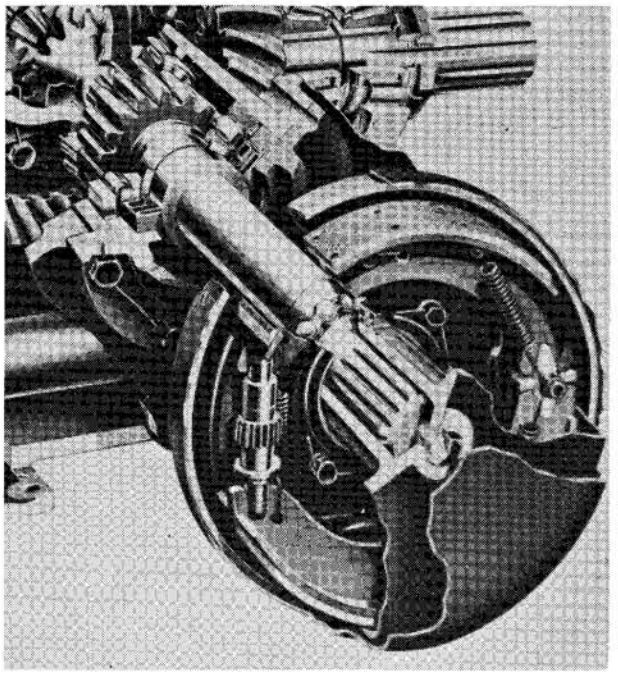


Fig. 154—Cut-away view of bull pinnon shaft and housing; refer to Fig. 155 for exploded view.

bearing cone and roller assembly from rear of carrier and remove front bearing cone and roller assembly from front of carrier. NOTE: The front and rear pinion bearing assemblies are alike; however, if bearings are to be reused, the bearing cone and roller assemblies must be kept with their mating cups due to established wear patterns.

Remove rear bearing cone and roller assembly from bevel pinion and remove the bearing cups from the carrier.

Drive rear bearing cone and roller assembly firmly against shoulder on bevel pinion and be sure that bearing cups are firmly seated in carrier. Install pinion in carrier, install front bearing cone and roller assembly and the thrust washer and adjusting nut. Adjust bearing preload as follows:

199. **ADJUST PINION BEARING PRELOAD.** Gradually tighten the adjusting (rear) nut until torque required to turn pinion in bearings is 12-16 inch-pounds. Turning torque may be measured with a torque wrench or with cord wrapped around the pinion shaft, then using pull scale and cord to steadily rotate shaft. Pull scale reading should be 12 to 16 pounds when bearings are properly adjusted. When correct torque or pull scale reading is obtained, place new locking washer on shaft and hold the adjusting nut while installing and tightening locknut. Recheck adjustment after locknut is tight, then bend locking washer down against flats on adjusting nut and locknut.

200. **RENEW BEVEL RING GEAR.** The bevel ring gear is either riveted or bolted to the differential housing. Refer to differential overhaul in paragraph 190 for models "FMD" and "FPM", or in paragraph 191 for models "FSM" and "New FSM".

FINAL DRIVE AND REAR AXLES

BULL PINIONS

Models "FMD" and "FPM"

201. Refer to cut-away view of the bull pinion and related parts in Fig. 154 and to the exploded view of bull pinion, pinion housing and differential carrier bearing support in Fig. 155. Bull pinion inner bearing (7) seats in outer end of differential carrier bearing support (8) and outer bearing (3) is located in outer end of brake support (4).

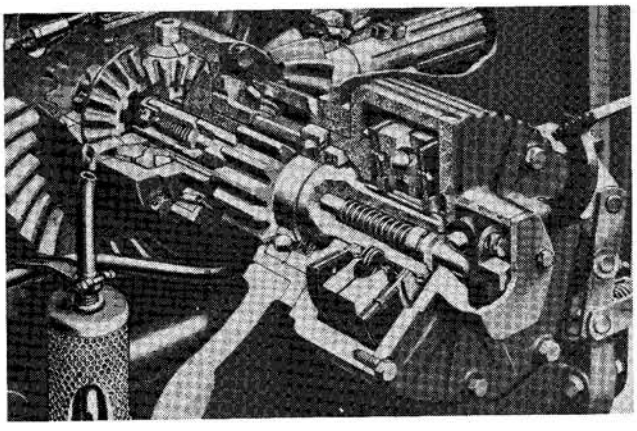


Fig. 156—Cut-away view of model "FSM" and "New FSM" disc brake, bull pinion and differential lock. Exploded view of the right bull pinion and differential lock assembly is shown in Fig. 150.

202. **R&R BULL PINION AND BRAKE ASSEMBLY.** To remove the bull pinion for access to differential or to adjust axle bearing preload, the bull pinion and brake assembly should be removed as a unit as follows:

If rear wheel is set close to fender, support rear end of tractor and remove wheel. Remove the fender and footrest as an assembly. Disconnect the brake cable from operating lever. Cut the locking fire and remove cap screws retaining brake support to rear axle center housing. Taking care not to dislodge the differential carrier bearing support (8—Fig. 155) and shims (9), remove the brake, brake support and bull pinion as an assembly.

When reinstalling the brake support and bull pinion assembly, tighten retaining cap screws securely, then install locking wire through holes in cap screw heads. Note: The two lower cap screws also retain the brake cable conduit support.

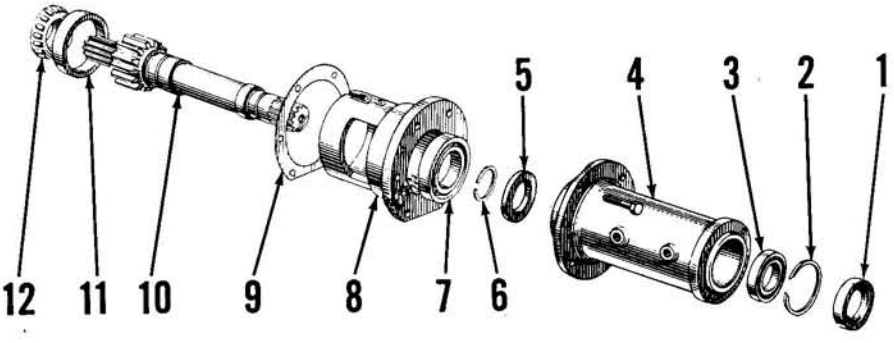


Fig. 155—Exploded view of model "FMD" and "FPM" bull pinion shaft and housings. Cut-away view is shown in Fig. 154.

1. Oil seal
2. Snap ring
3. Bearing
4. Brake support
5. Oil seal
6. Snap ring
7. Bearing
8. Bull pinion housing
9. Shims
10. Bull pinion
11. Differential carrier bearing race
12. Bearing cone & rollers

203. **RENEW BULL PINION.** To remove the bull pinion, remove the brake support and pinion assembly as outlined in paragraph 202, then proceed as follows: Remove brake drum cover and brake drum from outer end of bull pinion shaft. Cut the locking wire, then unbolt and remove brake backing plate assembly from outer end of brake support housing.

Press the bull pinion shaft out towards inner end of brake support housing. Remove snap ring (6—Fig. 155) from bull pinion, then press pinion from bearing (7). Pry oil seal (5) from inner end and oil seal (1) from outer end of housing (4). Remove snap ring (2), then remove bearing (3) from housing.

Reassemble by reversing disassembly procedure. Install oil seals (5 and 1) with lips toward inner end of brake support housing.

Models "FSM" and "New FSM"

204. **R&R BULL PINION.** To remove either bull pinion, first remove the disc brake housing as outlined in paragraph 216. Remove the oil baffle at outer side of bull pinion bearing.

The bull pinion and ball bearing assembly can then be withdrawn from bull pinion housing (differential carrier bearing support). To disassemble left bull pinion, remove the snap ring, then press bull pinion from ball bearing. On right bull pinion, the bearing is removed in same manner; however, refer to paragraph 192 for information concerning the differential lock assembly incorporated in the right bull pinion.

To reinstall bull pinion, reverse removal procedure.

BULL GEARS

All Models

205. To renew a bull gear or rear axle inner bearing, first remove axle shaft as outlined in paragraph 206. Remove hydraulic pump assembly from pedestal in bottom of rear axle center housing. The bull gear (or gears) can then be lifted from housing. Remove rear axle bearing cone and roller from outer hub of bull gear as shown in Fig. 158 and the bearing cup from inner end of axle housing; refer to Fig. 160.

NOTE: Bull gears used in late models have a different tooth form and are smaller in diameter than bull gears used in early models and the gears are not interchangeable. If in doubt, the gears can be identified by measuring their outside diameter. Bull gear (part No. E27N-4258-C) for models "FMD" and "FPM" measures 17.65-17.66 inches; whereas bull gear (part No. DDN-4258) for models "FSM" and "New FSM" measures 17.52-17.53 in diameter.

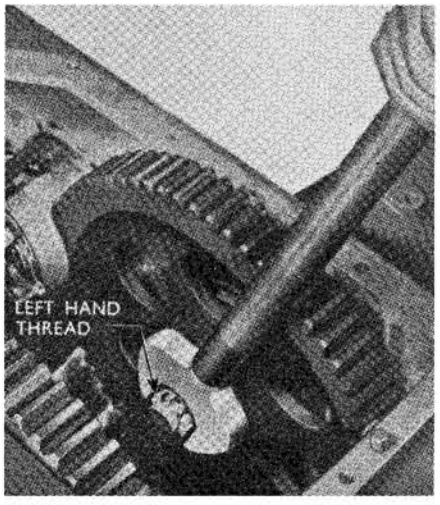


Fig. 157—Removing nut from inner end of rear axle. Note that both rear axles and bull gear retaining nuts have left hand threads. Axle shaft bearing preload is adjusted by nut; refer to paragraph 207.

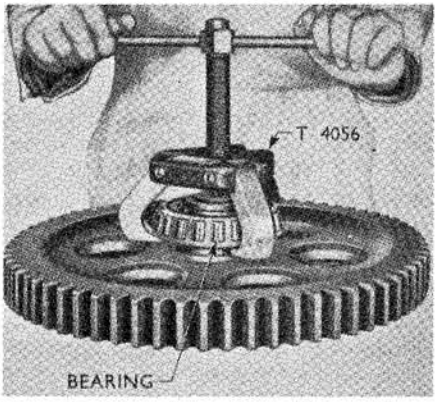


Fig. 158—Removing axle shaft inner bearing from hub of bull gear.

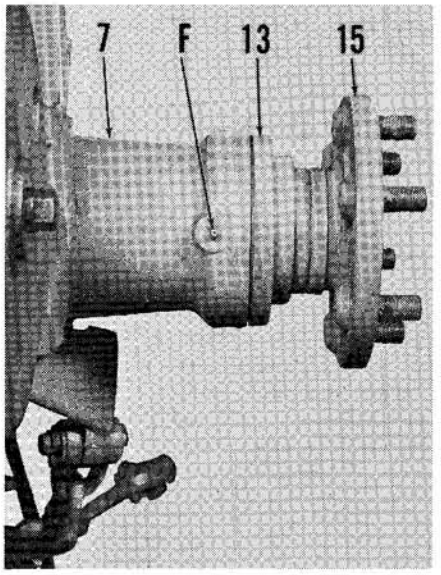


Fig. 159—Rear axle oil seal retainer (13) is staked into groove in rear axle housing (7). Axle outer bearing is lubricated from grease fitting (F). Refer to Fig. 160 for exploded view of rear axle (15), housing and related parts.

Drive bearing cone firmly against shoulder of bull gear and install cup in axle housing making sure cup is fully seated. Position bull gear in housing, then reinstall hydraulic pump and rear axle.

REAR AXLES AND HOUSINGS

All Models

206. **AXLE SHAFT, OUTER BEARING AND OIL SEAL.** To renew the axle shaft, outer bearing and/or axle shaft seal, proceed as follows:

Remove the hydraulic lift cover as outlined in paragraph 233 or 261. Drain rear axle center housing lubricant. Support rear of tractor and remove wheel. Refer to exploded view of the assembly in Fig. 160 and pry edge of seal retainer (13) out of groove (G) in outer end of rear axle housing. Refer also to Fig. 159. Remove the cotter pin (1—Fig. 160) and unscrew the axle shaft nut (2) at inner side of bull gear. Note: The axle shaft nut has left-hand threads. Withdraw axle, bearing and oil seal assembly from axle housing and bull gear.

Bend or cut oil seal retainer so that a bearing puller attachment can be fitted at outer side of bearing cone (9) and pull bearing from shaft. Remove bearing cup (8) from outer end of housing and oil seal retainer assembly from axle shaft.

Soak new felt (12) and oil seal (11) in oil, then install them in a new retainer (13) and place the retainer and seal assembly on axle shaft. Pack

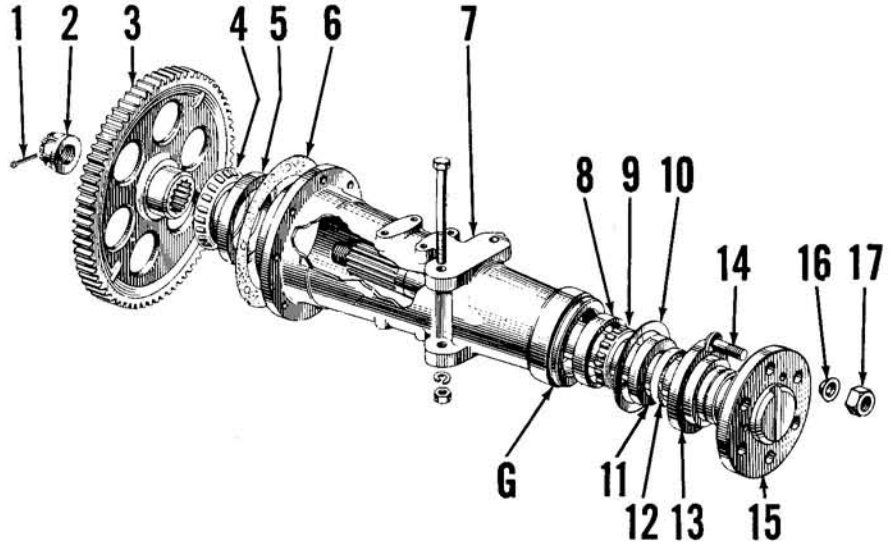


Fig. 160—Exploded view of rear axle, housing and related parts. On late production, rear wheel nuts (17) and tapered retainers (16) are made in one piece. Oil seal retainer fits over outer end of axle housing; refer to Fig. 159.

1. Cotter pin
2. Nut (L.H. threads)
3. Bull gear
4. Axle inner bearing
5. Bearing cup
6. Gasket
7. Axle housing
8. Bearing cup
9. Axle outer bearing
10. Gasket
11. Oil seal
12. Felt
13. Seal retainer
14. Wheel bolts
15. Axle shaft
16. Tapered retainers
17. Nuts

BRAKES

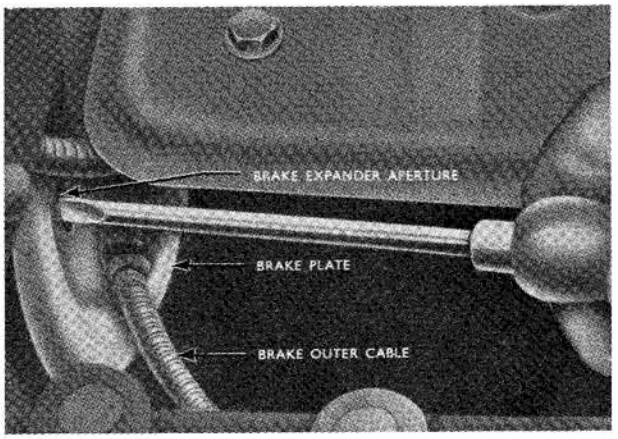


Fig. 161—Minor adjustment of model "FMD" and "FPM" brake shoes. Refer to text.

bearing cone and roller assembly with grease, then using a length of pipe, drive cone firmly against shoulder on shaft. Install bearing cup in outer end of axle housing.

207. To properly adjust axle shaft bearing preload, the bull pinion should first be removed as outlined in paragraph 202 or 204, then, install axle shaft and adjust bearing preload as follows:

Place new gasket (10—Fig. 160) in oil seal retainer and install axle shaft through housing and into bull gear. Drive the oil seal retainer over outer end of axle housing as shaft is moved into place, then stake edge of retainer down into groove in housing at diametrically opposite points. Install axle shaft nut and tighten nut so that a torque of 40-45 inch-pounds is required to turn axle shaft in bearings and oil seal. Secure the nut with new cotter pin when bearing preload is correct. Reinstall bull pinion as outlined in paragraph 202 or 204 and refill rear axle center housing with lubricant. Reinstall hydraulic lift cover as outlined in paragraph 233 or 261 and reinstall rear wheel.

208. **AXLE INNER BEARING.** The axle shaft inner bearing cone and roller assembly is pressed onto outside hub of the final drive bull gear and bearing cup is in inner end of axle housing. Refer to paragraph 205 for bull gear and/or bearing renewal.

209. **AXLE HOUSING.** With axle shaft removed as outlined in paragraph 206, disconnect wiring to fender mounted light, remove fender from axle and disconnect hydraulic lift lower link check chain. The axle housing can then be unbolted and removed from center housing.

Models "FMD" and "FPM"

210. Models "FMD" and "FPM" are equipped with expanding shoe type brakes with brake drums mounted on outer ends of the bull pinion shafts.

211. **MINOR ADJUSTMENT.** Remove the adjusting hole cover from backing plate (see Fig. 161) and rotate notched adjuster wheel towards front of tractor until shoes drag on drum, then back adjuster wheel off until shoes are free. If brakes do not hold satisfactorily after completing minor adjustment, proceed with major adjustment as outlined in following paragraph.

212. **MAJOR ADJUSTMENT.** To adjust the brake shoe anchor pin, proceed as follows: Remove brake drum cover. Loosen the anchor pin nut and turn adjuster wheel (see paragraph 211) forward until shoes are tightly expanded against drum. Tap against anchor pin nut to be sure shoes are centralized, then, if possible, tighten adjuster wheel further. Securely tighten anchor pin nut, then back off adjuster wheel until there is 0.008 clearance between drum and shoes around complete circumference of shoes. Clearance can be measured with feeler gage inserted through slots in brake drum.

213. **STEADY POST ADJUSTMENT.** The brake shoe hold down springs hold the shoes against adjustable steady posts; refer to Fig. 163. The steady posts should not require adjustment unless renewing or relining the brake shoes; refer to paragraph 214 for procedure.

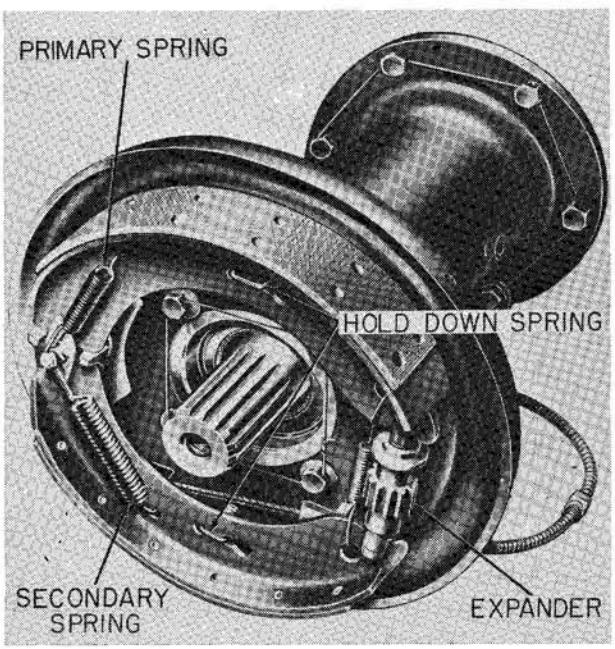


Fig. 162—View of model "FMD" and "FPM" brake assembly with brake drum cover and drum removed. Refer also to Fig. 163.

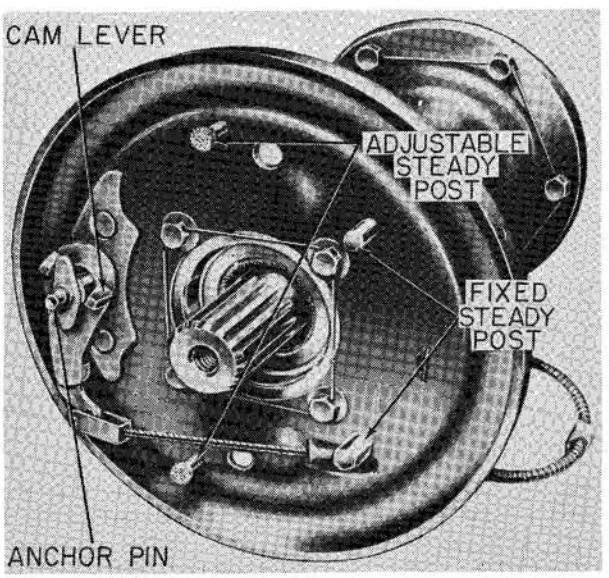


Fig. 163—View of brake backing plate assembly with brake shoes removed. Refer also to Fig. 162.

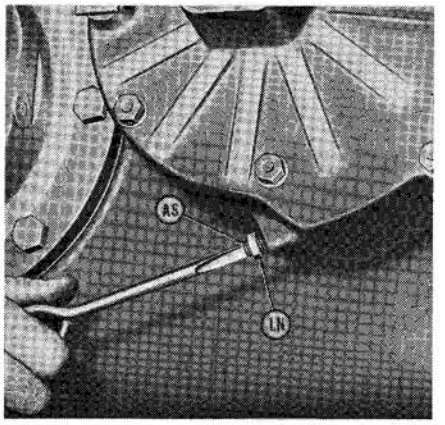


Fig. 164 — Adjusting model "FSM" and "New FSM" brakes. Refer to text and also to Fig. 165.

214. **OVERHAUL.** Remove tractor rear wheels, brake drum covers and brake drums. Unhook the shoe hold down springs from shoes and the two return springs from anchor post. Then, lift off the brake shoes, adjuster and retractor spring.

Brake linings and rivets are available for relining early type shoes with riveted linings or bonded shoe and lining assemblies are available for servicing all models with shoe type brakes. Upper and lower brake shoes are interchangeable.

Inspect the return, retracting and hold down springs and renew any that are broken, cracked, rusted or distorted. Inspect brake cables, cam levers, steady posts and anchor pins and renew as required. Note: Hole in backing plate for anchor pin is elongated to permit centralizing the brake shoes.

To install new or relined shoes, proceed as follows: Fit square ends of each shoe in adjuster slots, connect the retracting (orange) spring at adjuster ends of shoes, then place the assembly on backing plate as shown in Fig. 162. Connect the shoe hold down springs and anchor cups with long ends of springs in brake shoes. Connect the red (secondary) return spring with long end to anchor pin and short end in second hole in lower shoe. Connect the black (primary) return spring with long end over anchor pin and short end in first hole of upper shoe. Loosen the anchor pin nut, back off the adjusting screw (retract shoes) and install the brake drum. Turn adjuster forward to expand shoes tightly against the drum. Tap on anchor pin nut to center the shoes, then tighten adjuster further if possible. Tighten anchor pin nut, then back off adjuster until shoes just clear the drum. Loosen nuts on adjustable steady posts and slowly back the posts out until brake drum just drags on the brake shoes. Counting the turns, turn the steady posts in until brake drum just drags on shoes, then back steady posts out one-half number of turns counted and tighten the lock nuts.

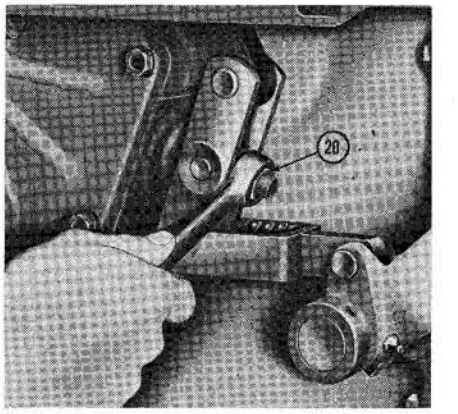


Fig. 165—Adjusting disc brake free pedal. Refer also to Fig. 164 and to text.

Reinstall brake drum covers and rear wheels when adjustment is completed.

Models "FSM" and "New FSM"

215. **ADJUSTMENT.** To adjust the disc type brakes, first refer to Fig. 164 and loosen the locknut (LN) on adjusting screw (AS) protruding from lower side of brake housing. Turn the adjusting screw in until brake is fully locked, then back screw out 1½ turns

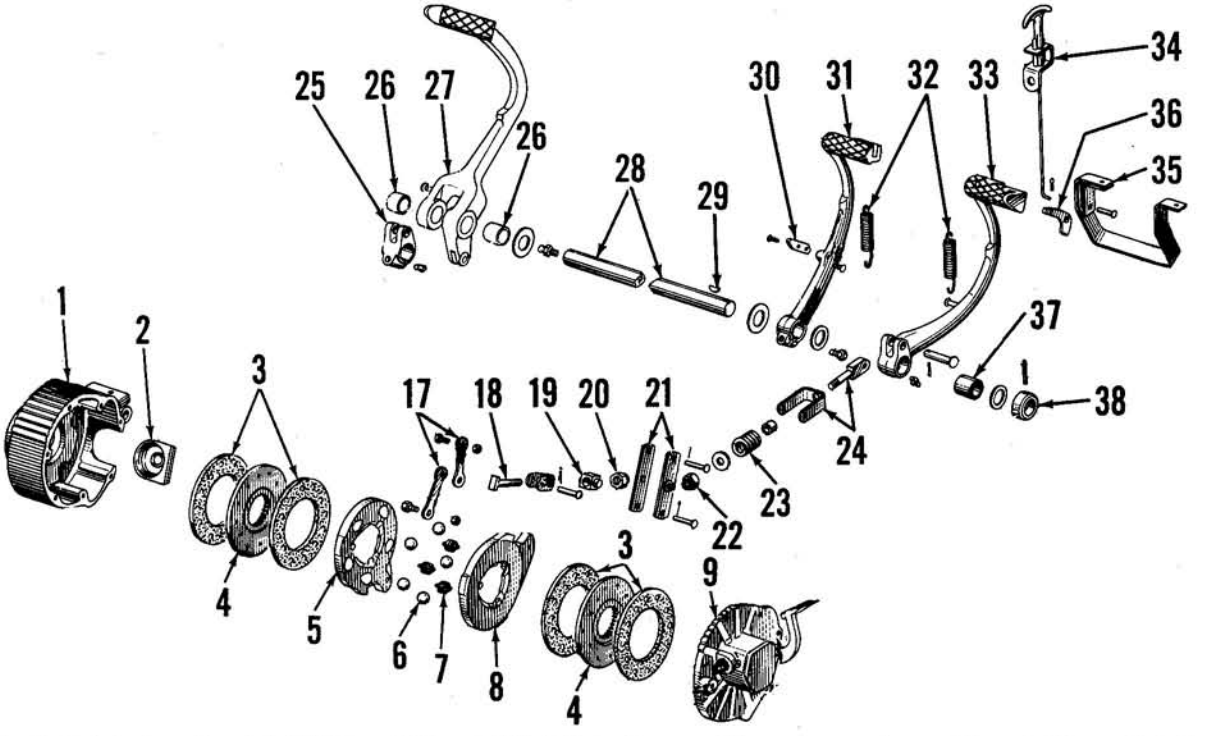


Fig. 166—Exploded view of model "FSM" and "New FSM" right brake assembly and actuating pedals and linkage. Left brake assembly is similar except that cover (9) does not contain differential lock operating linkage. Refer also to Figs. 163, 164 and 165.

1. Brake housing
2. Grommet
3. Friction linings
4. Brake disc
5. Actuating disc
6. Steel balls
7. Return springs
8. Actuating disc
9. Brake cover
17. Links
18. Pull rod
19. Pivot block
20. Adjusting nut
21. Operating levers
23. Spring
24. Rod and yoke
25. Cross-shaft lever
26. Bushings
27. Clutch pedal
28. Cross-shaft
29. Woodruff key
30. Latch
31. Left brake pedal
32. Pedal return springs
33. Right brake pedal
34. Parking lock
35. Pedal stop
36. Latch
37. Bushing
38. Collar

and while holding screw in this position, tighten locknut. Then, remove the brake return spring (32—Fig. 166). Refer to Fig. 165; tighten the pull rod nut (20) until brake pedal contacts upper stop, then back nut off 1½ turns. This should give a brake free pedal of 1½ inches measured at pedal pad. Reconnect brake pedal return spring and adjust opposite brake in similar manner.

216. **OVERHAUL DISC BRAKES.** To gain access to brakes, unbolt and remove the platform (foot rest) from brake housing and support bracket. On the left hand platform, it will also be necessary to disconnect clutch pedal return spring.

Unbolt and remove the brake housing cover; right hand brake housing cover (9—Fig. 166) and differential lock pedal, shaft and cam are removed as an assembly. Withdraw the outer friction disc assembly (3 & 4), disconnect and remove the actuating plate assembly complete with links, operating rod and dust cover. Then, withdraw the inner friction disc assembly. If necessary to remove brake housing, be careful not to disturb the bull pinion housing and shims.

To disassemble the actuating plate assembly, remove rubber dust cover (2), remove the bolts securing the links (17) to plates (5 & 8), then remove the three springs (7), separate the plates and remove the five steel balls (6). Thoroughly clean and inspect all parts and renew any parts which are excessively worn or damaged. To reassemble, lay one actuating plate with inner face up on bench, place the five steel balls in pockets on plate, then place the other plate face down on top of the steel balls. NOTE: **Do not** lubricate either the steel balls or their pockets in the actuating plates. Install the three plate return springs making sure that they are correctly located on lugs of plates. Otherwise the bull pinion shaft may rub against them when the assembly is reinstalled. Reconnect the links and pull rod (18). Stake the nuts to bolts that secure the links to actuating plates.

Brake disc linings (3) are available separately from discs (4) and the disc and linings are also available as an assembly. Renew the linings or disc assembly if excessively worn or oil soaked.

Check the oil seal in brake housing and if in doubt, renew the seal. Renew brake housing if friction surface is excessively worn or scored. Using a petroleum solvent, flush out the bolt holes in rear axle center housing and wash the brake housing retaining cap screws, then air dry the bolt holes and cap screws. Be sure that holes in shims behind the bull pinion housing flange are aligned with holes in housings, then reinstall brake housing. Apply a thin line of "Loctite" to each of the cap screw threads, then install and tighten the cap screws to a torque of 65-70 Ft.-Lbs.

Install inner friction disc, actuating plate assembly, outer friction disc and brake cover or cover and differential lock operating pedal assembly. Adjust brakes as outlined in paragraph 215.

If necessary to remove or overhaul the brake pedals, cross shaft and linkage, refer to exploded view in Fig. 166 as disassembly and reassembly guide. Note: In order to remove cross shaft, it is first necessary to drain the rear axle center housing lubricant to below shaft level and remove right rear wheel (unless wheel is mounted in extended position). It is possible to renew the cross shaft oil seals in rear axle center housing without removing the cross shaft.

BELT PULLEY

All Models So Equipped

217. **REMOVE AND REINSTALL.** First, either drain transmission to below level of belt pulley opening or tilt tractor so that level is below opening. Unbolt and remove belt pulley assembly from transmission housing.

Before reinstalling pulley, engage shift collar and check backlash in drive coupling by holding the bevel gear and turning pulley back and forth. Note backlash present at pulley rim, then reinstall the belt pulley assembly with sufficient number of gaskets between pulley housing and transmission to obtain an additional ⅛-inch backlash at pulley rim. Usually, one to three gaskets are required. The belt pulley shift collar should be kept in neutral position except when required to transmit power.

218. **OVERHAUL.** To disassemble belt pulley unit, refer to exploded view in Fig. 168 and proceed as follows: Remove pulley guard (6) and the shift lever (10). Remove nut from outer end of shaft (17), then remove pulley and hub assembly. Bump outer end of shaft to remove shaft, gear (20) and bearing (19) assembly from inner end of housing. Shift collar (18) can then be removed from housing. Remove pin (14) from lever (12), then remove lever, spring (15) and block (13) from inside of housing. Remove snap ring (22) and washer (21), then withdraw shaft (17) from gear (20). Bearing (19) can be removed by inserting punch through holes in inner end of gear and driving bearing from gear hub. Remove seal (7) and bearing (8) from outer end of housing. Remove hub (3) from pulley.

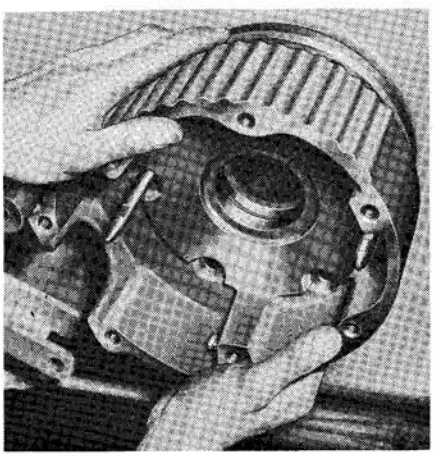


Fig. 167—Installing brake housing.

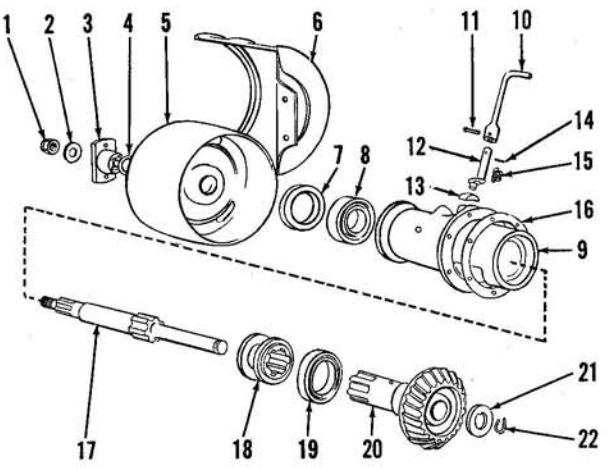


Fig. 168—Exploded view of belt pulley assembly.

1. Nut
2. Washer
3. Adapter
4. "O" ring
5. Pulley
6. Guard
7. Oil seal
8. Bearing
9. Housing
10. Shift lever
11. Pin
12. Shift arm
13. Thrust block
14. Pin
15. Spring
16. Gasket
17. Pulley shaft
18. Shift collar
19. Bearing
20. Bevel gear
21. Washer
22. Retaining clip

Inspect all parts and renew any that are excessively worn or damaged. Gear (20) is fitted with two renewable bushings. Shaft (17) should turn freely in bushings and there should be some end play of gear on shaft with thrust washer and retaining snap ring installed.

Reassemble unit as follows: Install outer bearing (8) in housing, then install new oil seal with lip of seal towards bearing. Install inner bearing on bevel gear, then insert shaft through gear and secure with thrust washer and snap ring. Install shift lever (12) and spring (15) in housing and secure with pin (14). Place block (13) on inner end of shift lever, then locate shift collar in housing with block engaged in groove of collar. Install shaft through collar and bump inner end of gear until bearing (19) is seated against shoulder in housing. Lubricate inner hub of belt pulley and install pulley on shaft. Install hub (3) with new gasket (4) and securely tighten nut (1) and hub retaining cap screws. Check to see that with shift collar disengaged, shaft will turn freely in bevel gear.

POWER TAKE-OFF

PTO DRIVE UNIT (GEARBOX)

All Models

219. **REMOVE AND REINSTALL.** Drain transmission and rear axle center housing and remove PTO output shaft as outlined in paragraph 224, or if so equipped, remove the raised PTO unit and driveshaft as outlined in paragraph 225. Disconnect shift lever link from shift rail (23—Fig. 170). Support the drive unit while unbolting it from bottom of transmission housing, slide the unit forward until "O" ring (13) boss is clear of bore in transmission housing, then lower drive unit from tractor.

When reinstalling drive unit, fit a new "O" ring (13) on rear end of housing and a new gasket on top face of housing. Lubricate the "O" ring, raise unit to bottom face of transmission housing, slide unit rearward into bore of housing and secure with the two dowel type cap screws in left and right center holes. Install plain cap screws in the remaining holes, then tighten all cap screws evenly and securely.

220. **OVERHAUL.** With unit removed as outlined in paragraph 219, proceed as follows:

221. IDLER GEAR. Remove cotter pin retaining idler gear shaft (12—Fig. 170) in housing (11), push shaft from housing and remove the idler gear and, on model "New FSM", the two "D" shaped thrust washers.

Idler gear for model "FMD" was fitted with two bushings. Renew bushings and/or shaft if clearance is excessive. Bushings are pre-sized and should not require reaming if carefully installed.

Model "FPM" and early model "FSM" idler gears were fitted with two caged needle roller bearing assemblies (8—Fig. 171). Late model "FSM" idler gear was fitted with retaining snap rings (7) to keep bearings from moving out of the gear. Model "New FSM" idler gear is fitted with thrust spacer (10) between the bearing cages. When renewing the caged needle bearings, drive or press on lettered end of bearing cage only; if lettering is not visible after installing bearing, renew the bearing. On idler gear without retaining snap rings, lettered end of bearing cage should be 13/64-inch below flush with end of gear. For gears with retaining rings, press bearing cages in just far enough to install the snap ring in groove of gear.

Latest (model "New FSM") gear and bearing assembly may be used to renew all model "FPM" and "FSM" gears, but the "D" shaped thrust washers cannot be used in the earlier housings. To install needle roller bearing idler gear and shaft in model "FMD" in place of the bushing type idler requires installing new housing.

To reinstall idler gear, place gear and bearing (or bushing) assembly in housing with long hub to rear. On model "New FSM", insert thrust washer at each side of idler gear. Insert shaft through the housing and gear and secure shaft with cotter pin. Note: If installing new idler gear, check for proper clearance between front hub of idler gear and cluster gear on primary gear box lower shaft after PTO drive housing assembly is reinstalled. Remove material from hub as necessary to obtain clearance at (C —Fig. 171).

222. SELECTOR COVER, SHAFT AND FORK. Unbolt and remove cover (22—Fig. 170) from housing. Cut locking wire and remove set screw (20), then remove shaft (23) from cover and fork. Take care not to lose detent ball (25) or spring (26) as shaft is being removed. Remove oil seal (24) from cover.

Shifter fork (19) is not interchangeable between model "New FSM" and earlier models. Inspect all parts and

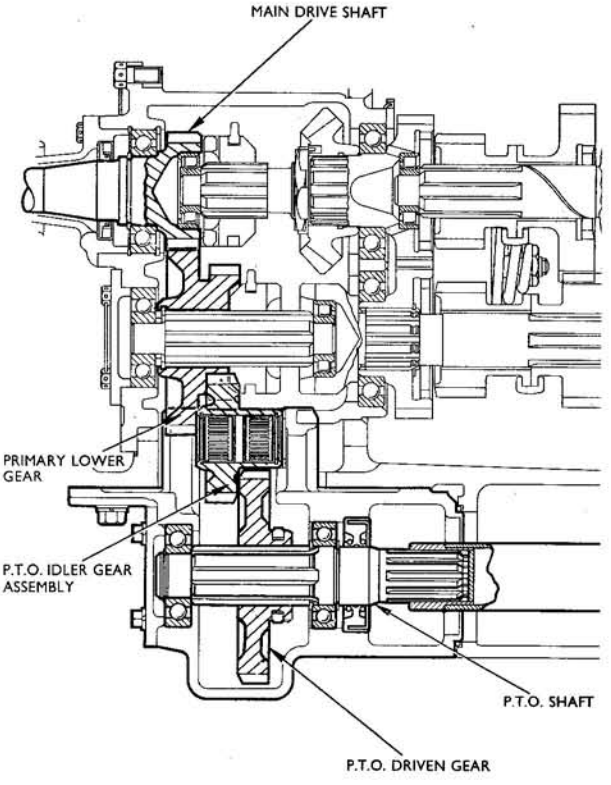


Fig. 169—Cross-sectional view showing PTO drive gear train. Single clutch model is shown; on dual clutch model, PTO input shaft is separate from transmission input (main drive) shaft.

renew any that are excessively worn or damaged. Reassemble using new oil seal as follows:

Drive new oil seal into bore of cover with metal face out. Position shifter fork with boss to front of cover (away from seal). Insert shaft through cover and fork, insert detent spring and ball in bore of shaft, then push shaft into place. Rotate shaft so that detent ball drops into place, then install set screw in fork and shaft and secure screw with lock wire. Reinstall cover, shaft and fork assembly with new gasket.

223. DRIVEN GEAR, SHAFT AND BEARINGS. With idler gear removed as outlined in paragraph 221 and selector cover assembly removed as in paragraph 222, proceed as follows:

Remove front bearing plate (1—Fig. 170) and bump shaft (17) forward until front bearing (4) is exposed. Remove snap ring (3) from front end of shaft and remove front bearing using suitable bearing puller. Bump the shaft, rear bearing (15) and oil seal (18) out towards rear of housing and remove driven gear (6). Remove oil seal from shaft. If necessary to renew shaft or bearing, remove snap ring (14) at front side of bearing and press bearing from shaft. Note: Model "New FSM" has retaining snap ring (16) at rear of bearing; earlier models retain bearing between snap ring (14) and shoulder on shaft.

With early production shaft (one snap ring), either a double lip seal (18) or two single lip seals may be used. When installing two single lip seals, lip of each seal must face away from other seal. The late type shaft (with two snap rings) may be used to renew early type shaft if corresponding oil seal is used. Model "New FSM" driven gear has 32 teeth; earlier models have gear with 26 teeth.

To reassemble, proceed as follows: On late type shaft, install rear snap ring (16). Then, on either shaft, press rear bearing (15) on from front end of shaft until it is tight against shoulder or rear snap ring. Install snap ring (14) at front side of bearing. On all models except "New FSM", install front bearing snap ring (5) in groove of bearing bore in housing. Press front bearing (4) into place against snap ring or, on model "New FSM", against shoulder in housing. Place driven gear (6) in housing with shifter groove rearward, then insert shaft through housing and gear. While supporting front bearing, press shaft and rear bearing into place and install snap ring (3) and cover (1) with new gasket (2). Using a seal protector or shim stock and suitable seal driver, install shaft seal or, on early models, the alternate two single lip seals.

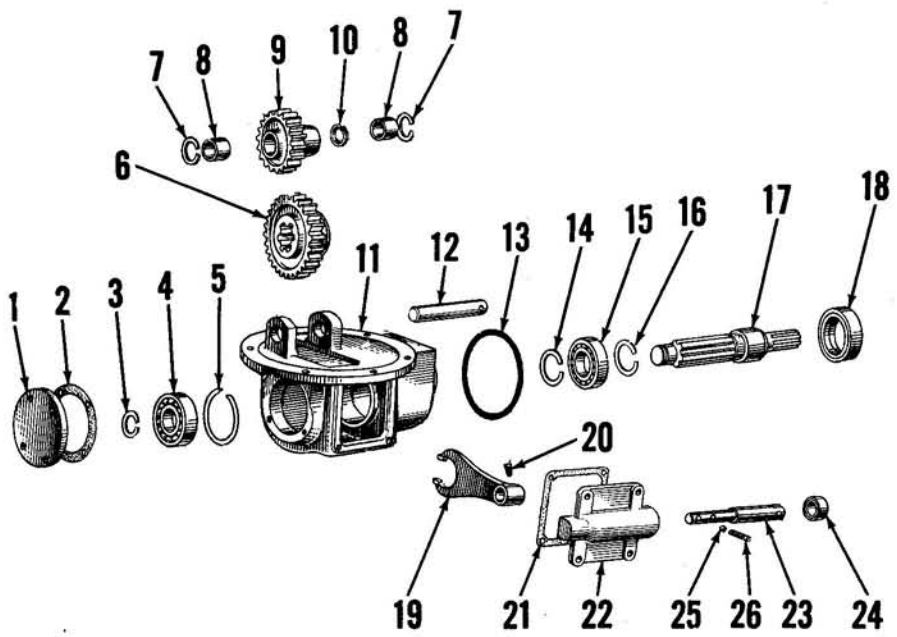


Fig. 170—Exploded view of PTO gearbox. Refer to Fig. 171 for cross-sectional view of latest type idler gear and bearing assembly and to Fig. 169 for cross-sectional view of complete drive gear train.

1. Cover plate
2. Gasket
3. Snap ring
4. Bearing
5. Snap ring
6. Driven gear
7. Snap ring
8. Bearing
9. Idler gear
10. Spacer
11. Housing
12. Idler shaft
13. "O" ring
14. Snap ring
15. Bearing
16. Snap-ring
17. PTO drive shaft
18. Oil seal
19. Shift fork
20. Set screw
21. Gasket
22. Shift cover
23. Shift rail
24. Seal
25. Detent ball
26. Detent spring

STANDARD PTO OUTPUT SHAFT

All Models

224. **REMOVE AND REINSTALL.** First, drain rear axle center housing lubricant, then remove cap screws retaining output shaft bearing support (40—Fig. 172) in rear axle center housing and withdraw the output shaft assembly.

Output shaft (34) for model "New FSM" has 2 ⅛ inch O.D. for increased torque capacity and can be used as service replacement for earlier shaft having 2 inch O.D.

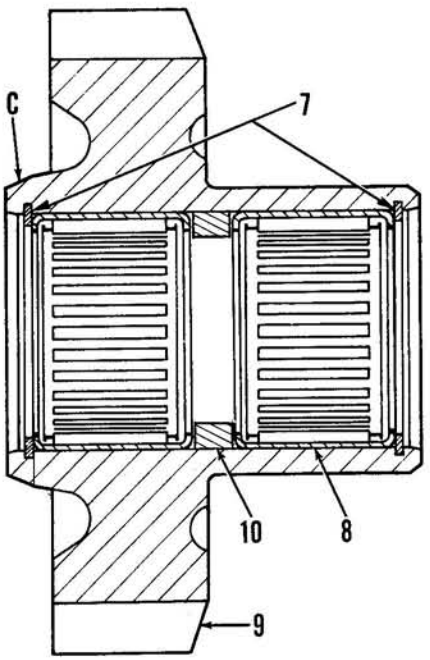


Fig. 171 — Cross-sectional view of latest type PTO idler gear and bearing assembly. Refer to Fig. 170 for exploded view. When installing gear in earlier models, it may be necessary to remove some material from gear hub at (C) for clearance. Refer to Fig. 170 for legend.

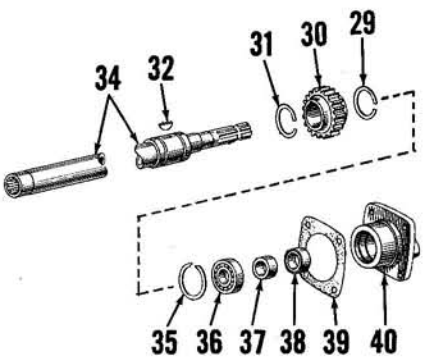


Fig. 172—Exploded view of standard PTO output shaft assembly.

29. Snap ring
30. Hydraulic pump drive gear
31. Snap ring
32. Woodruff key
34. Output shaft
35. Snap ring
36. Bearing
37. Sleeve
38. Oil seal
39. Gasket
40. Bearing support

Hydraulic pump drive gear (30) for model "New FSM" has 34 teeth whereas gear for earlier models has 33 teeth. To remove gear, remove front snap ring (31) and bump gear off front end of shaft.

To renew oil seal (38), remove snap ring (35) from front end of the bearing retainer (40) and bump retainer off rear end of shaft. Install new oil seal in retainer, then reinstall retainer and secure with snap ring.

If necessary to renew bearing (36), remove bearing retainer and oil seal. Grind the collar (37) thin enough that it can be cracked with chisel, then pull bearing and collar from rear end of shaft. Install new bearing, then heat collar to dull red (approximately 800° F.) and install on shaft next to bearing. After allowing collar to cool slowly, install bearing retainer.

When reinstalling the assembled output shaft, use new gasket (39). With PTO shift lever in engaged position, rotate shaft until splines are aligned and hydraulic pump gears are in mesh. then push shaft into place. Install and securely tighten the four retaining cap screws.

RAISED PTO OUTPUT UNIT

Purpose of the raised PTO unit is to raise the position of the PTO output shaft to meet ASAE specifications for distance of PTO output shaft above tractor drawbar. The unit also incorporates an additional engagement lever which allows the hydraulic pump to be driven by the PTO extension shaft from PTO gearbox without also turning the PTO output shaft. On model "New FSM", raised PTO output shaft turns at same speed as the PTO extension shaft (or standard PTO output shaft); on all earlier models, raised PTO output shaft speed to extension shaft speed ratio is 1:1.33.

All Models So Equipped

225. **REMOVE AND REINSTALL.** First, drain rear axle center housing lubricant and remove PTO output shaft guard. Remove the two lower retaining cap screws and lock washers, then unscrew the two upper cap screws and remove unit from tractor. NOTE: Do not remove the upper right cap screw (19—Fig. 174) as it also functions as the rail for shifter fork (17). If unit is not to be disassembled, retain cap screw with nut until unit is to be reinstalled.

With the raised PTO unit removed, the extension shaft (33), bearing and drive gear assembly (see Fig. 175) can be withdrawn from rear axle center housing.

To reinstall, proceed as follows: Insert extension shaft, bearing and drive gear assembly into rear axle center housing and rotate shaft to align splines and hydraulic pump drive gears, then push the assembly into place. Install the raised PTO unit using a new gasket (1—Fig. 174) and securely tighten the retaining cap screws. NOTE: Special rubber bonded washers must be used on the two upper cap screws.

226. **OVERHAUL.** With the raised PTO unit and extension shaft assembly removed as outlined in paragraph 225, proceed as follows:

To disassemble raised PTO unit, push down on shift lever and remove lever pivot bolt (7—Fig. 174), then withdraw the lever. Remove upper right cap screw (shift rail) (19) taking care not to lose detent ball (15) or spring (16) and remove shift fork (17). Drive idler gear shaft (21) out rear of housing and remove idler gear (20). Unbolt and remove output shaft bearing retainer (13) with gear (9) and bearings (8 and 10). Bump retainer from rear bearing and remove output shaft seal from retainer. Remove bearings from output shaft using suitable bearing puller.

On model "New FSM", extension shaft differs from that shown in Fig. 175 in that a bearing and retaining snap ring are fitted on rear end of shaft instead of the flat washer, nut and cotter pin. To disassemble extension shaft, remove the snap ring or cotter pin, nut and washer and pull drive gear from rear end of shaft. Remove the retaining snap ring (28—Fig.

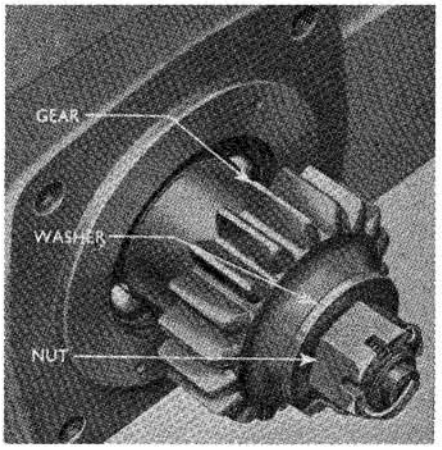


Fig. 175—View of PTO drive shaft and drive gear with raised PTO assembly removed. Latest shaft has gear retaining snap ring instead of nut.

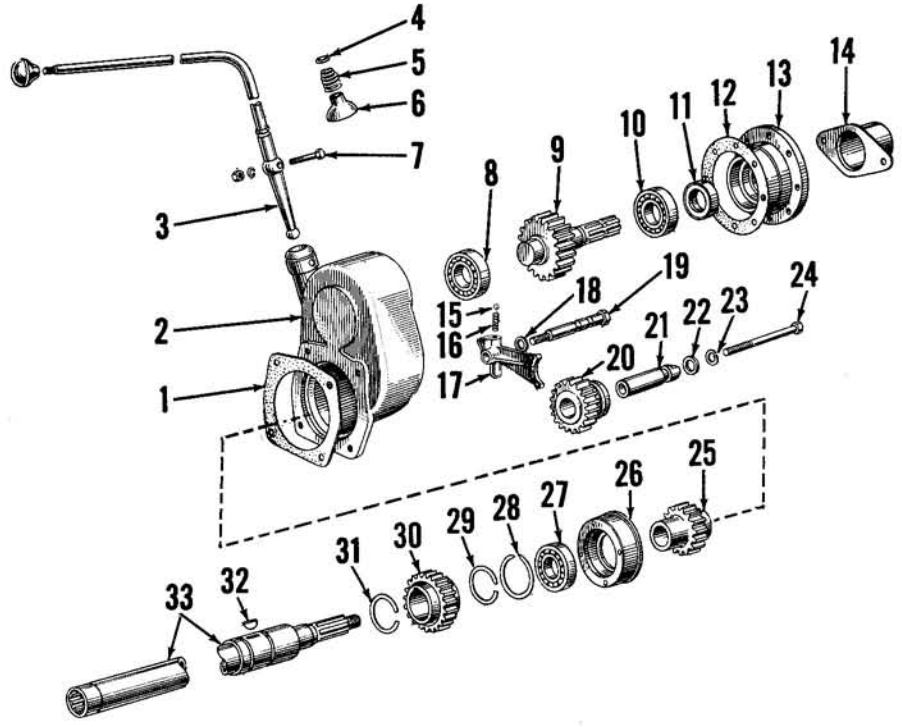


Fig. 174—Exploded view of typical raised PTO drive unit. Unit raises PTO output shaft to within ASAE specificatons as measured from drawbar hitch point.

1. Gasket
2. Housing
3. Shift lever
4. Snap ring
5. Spring
6. Cover
7. Pivot bolt
8. Bearing
9. Output shaft & gear
10. Bearing
11. Seal
12. Gasket
13. Bearing support
14. Output shaft cover
15. Detent ball
16. Detent spring
17. Shift fork
18. Seal
19. Shift rail
20. Idler gear
21. Idler shaft
22. Seal
23. Lock washer
24. Cap screw
25. Drive gear
26. Bearing support
27. Bearing
28. Snap ring
29. Snap ring
30. Hydraulic pump drive gear
32. Woodruff key
33. PTO drive shaft

174) and remove retainer (26), then remove snap ring and pull bearing (27) from rear end of shaft. The hydraulic pump drive gear (30) can be removed by first removing snap ring (31) and driving gear off front end of shaft without disturbing PTO drive gear or bearings if so desired.

NOTE: Late production service installed raised PTO units for earlier models (prior to "New FSM") have features of the later ("New FSM") unit except the 1:1.33 gear ratio is retained.

To reassemble, reverse disassembly procedure.

HYDRAULIC SYSTEM
(Models "FMD" & "FPM")

Hydraulic system for model "FMD" and "FPM" incorporates only lift, lower and hold control of the three-point hitch. An attachment is available to provide "position control" where any leak-down of the lift system will move the control lever to "raise" position until the lift arms are returned to set position. A remote cylinder port ("jack tapping") is provided in the control valve housing for remote control of single acting cylinder. To operate a cylinder from this port, the hydraulic system control lever is used and the three-point hitch lift arms are tied in raised position.

Differential and final drive lubricant is utilized for hydraulic fluid. Gear type hydraulic pump is mounted in rear axle center housing and is driven by a gear on the PTO output shaft. Production changes have been made from time to time and where changes affect parts procurement or service procedure, it will be noted in the text.

FLUID AND FILTERS
Models "FMD" and "FPM"

227. Rear axle and final drive lubricant is used for hydraulic fluid; capacity is 10.8 gallons. SAE 80 Mild E. P. (Ford specification M-4864-A) or SAE 90 Mild E. P. (Ford specification M-4864-B) gear lubricant is recommended. After each 12 months of operation, the rear axle center housing should be drained and flushed, the pump suction screen removed and cleaned and the system refilled with proper new lubricant. A dipstick located at left rear corner of the transmission housing is for checking final drive lubricant level.

TROUBLE-SHOOTING
Models "FMD" and "FPM"

228. **WILL NOT LIFT.** First, check oil level in final drive housing and be sure that the PTO output shaft is engaged and turning. Be sure that the lift arms will move up and down. Check the hydraulic system relief pressure as outlined in paragraph 231; if pressure is OK, check for broken ram cylinder piston rod or broken ram lift arm on lift shaft. If system relief pressure is low, or there is no pressure, check for worn or broken hydraulic pump, clogged pump suction filter, broken pressure pipes, broken lift cylinder, broken check (non-return) valve spring, broken pressure relief (unloading) valve spring or sticking valve.

229. **WILL NOT HOLD.** If the lift arms settle with control lever in neutral, or if implement gains depth when working in field, a leak is occuring in the lift cylinder or control valve unit. If the cylinder leaks down rapidly check for ruptured piston seal or for check (non-return) valve and/or pressure relief (unloading) valve not seating. If the cylinder leaks down slowly, piston seal may be nicked or worn, check (non-return) valve or seat may be damaged, pressure relief (unloading) valve or seat may be damaged or the control valve spool may be worn or fit too loosely.

230. **SLOW IN LIFTING.** If the lift arms raise slowly, but will remain in raised position with control valve in neutral, a worn or damaged hydraulic pump is indicated. Note: Leakage that will allow lift arms to fall rapidly will also cause slow rate of lift; refer to paragraph 228.

ADJUSTMENTS
Models "FMD" and "FPM"

231. **SYSTEM RELIEF PRESSURE.** Operate the tractor until final drive lubricant is at normal operating temperature. With the lift arms in lowered position, remove the remote cylinder (jack tapping) plug from left side of control valve body and connect a "Tee" fitting, 0-3000 psi pressure gage, shut-off valve and hose to the open port. Insert other end of hose in rear axle center housing filler cap at rear of hydraulic lift cover. With shut-off valve open and engine running at fast idle speed, hold the hydraulic control lever in raising position and slowly close the shut-off valve. The lift arms will raise to their uppermost position and pressure gage reading will raise. Continue to slowly close the shut-off valve until the relief (un-loading) valve unseats and the pressure gage reading drops. The highest gage reading obtained is the system relief pressure.

On model "FMD" (except very late production), the check valve will seat as the pressure relief valve opens and the lift arms will be held in raised position. However, flow of oil from the pump will hold the pressure relief (unloading) valve open as long as the control valve is in raising position and the pump pressure will drop to approximately 40 psi. In order to "reset" the relief valve, it will be necessary to return the control valve to neutral position.

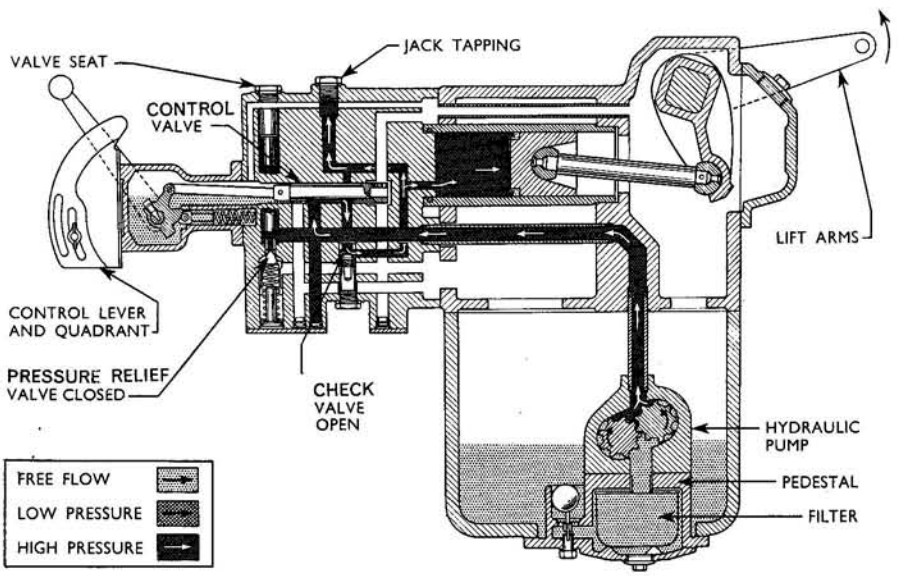


Fig. 176—Schematic diagram of model "FMD" and "FPM" hydraulic system in raising position.

On model "FPM" and some late production model "FMD" tractors, the design of the pressure relief valve and valve housing were changed and the pressure drop will be very slight when the relief valve is in open position. Therefore, pressure will be maintained in the lift cylinder circuit and the check (non-return) valve will not close until the control valve is returned to neutral position. At that time, the pressure gage reading will drop to approximately zero.

Recommended pressure relief setting for both models "FMD" and "FPM" is 2000-2200 psi. However, where operating conditions are abnormal or heavier than average implements are used, it is permissible to increase the pressure relief setting to 2500-2700 psi. This will be especially advantageous with model "FMD" tractors where shock loading will cause the relief (unloading) valve to "pop-off" before the implement is fully lifted. Note: On model "FMD" tractors, it will also help to reduce engine speed before attempting to lift heavy implements on the three-point hitch.

To adjust pressure relief setting, remove the left (opposite from control lever) plate from top side of control valve housing and remove the valve, spring, shim and adjuster assembly; refer to Figs. 178 and 180 for the three types of assemblies that may be encountered. Add or remove shims at location shown as necessary. Shims are available in thicknesses of 0.016 and 0.028. When reinstalling late type valve with ball at tip, stick ball to valve with heavy grease. Install new "O" ring on adjuster ("FMD") or on relief valve stop ("FPM"). Recheck relief pressure and readjust if necessary. If adding shims does not increase pressure reading, service the hydraulic pump. Refer to paragraph 242 for overhaul data.

232. RATE OF LOWERING (DROP) ADJUSTMENT. The control valve spool incorporates a series of five cylinder exhaust ports (early "FMD") or an annular recess on inner end of spool and a series of three cylinder exhaust ports (late "FMD" and all "FPM") as shown in Fig. 183. The farther the control valve lever is pushed down, the greater the exhaust port area and thus a faster implement drop is obtained by pushing the lever down farther past neutral position.

To adjust rate of lowering for a particular implement, start with the implement in raised position and the control lever in neutral position. Then,

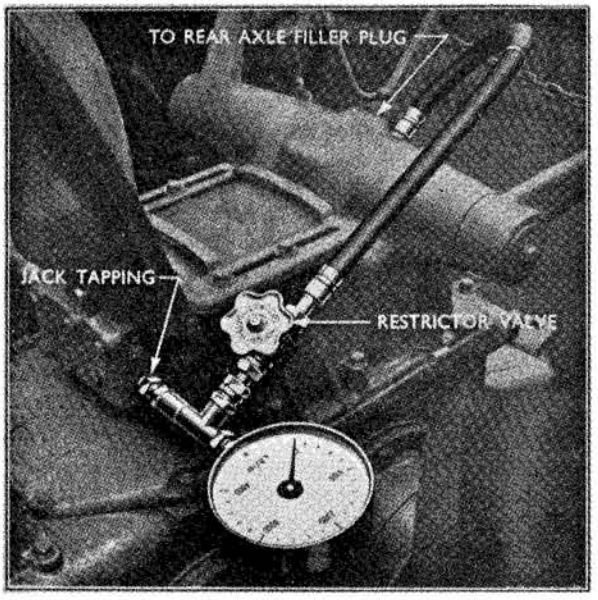


Fig. 177—Pressure gage, shut-off (restrictor) valve and return hose installed to check hydraulic relief pressure on model "FMD" or "FPM".

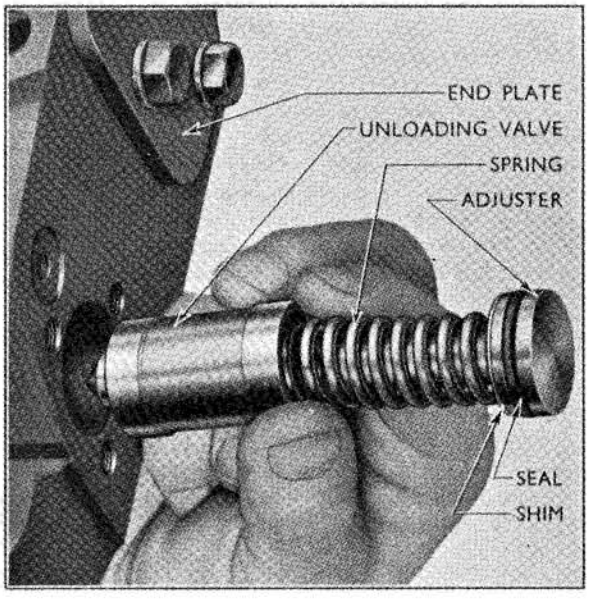


Fig. 178 — Early type pressure relief (unloading) valve assembly. Refer to Fig. 179 for relief valve seat and to Fig. 180 for later type valve assemblies.

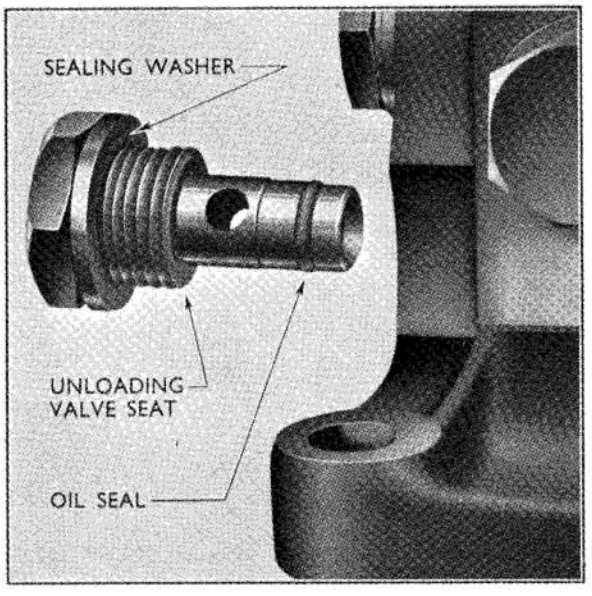


Fig. 179—View showing pressure relief (unloading) valve seat removed from bottom of valve housing.

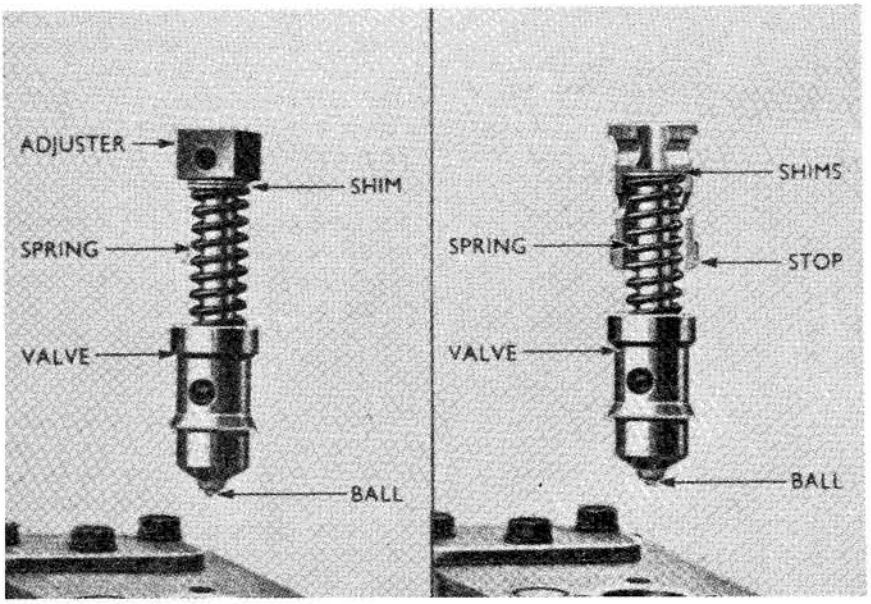


Fig. 180—Views showing earlier type (Left) and latest type (Right) pressure relief valve assemblies.

slowly push lever downward until desired rate of lowering is obtained and adjust the stop (43—Fig. 181) on control lever quadrant to this position.

OVERHAUL

Models "FMD" and "FPM"

233. **R&R LIFT COVER & CYLINDER ASSEMBLY.** Remove operator's seat and disconnect lift arms from lift links. Unbolt cover from rear axle center housing and remove with suitable hoist.

When reinstalling cover, renew the "O" rings on pump pressure pipe, then reinstall pipe in pump. Carefully lower cover into position so that pipe enters bore in cover.

Note: Most overhaul work can be accomplished without removing lift cover from tractor. Refer to following paragraphs:

234. **R&R CONTROL VALVE UNIT.** Lower the lift arms, then unbolt and remove control valve unit from front of hydraulic lift cover. Lift cylinder and piston may be removed with valve or may remain in lift cover.

To reinstall, first remove horizontal pressure pipe and fit a new "O" ring at each end of pipe, lubricate the "O" rings and reinstall pipe in lift cover. Reinstall lift cylinder and piston if removed with valve unit, fit a new "O" ring in inside diameter of cylinder and lubricate the "O" ring. Reinstall valve unit with new gasket, carefully placing unit casting over pressure pipe and into lift cylinder. Tighten retaining cap screws securely.

235. **CONTROL VALVE SPOOL AND LINKAGE.** To remove control valve, unbolt control lever support from valve housing and withdraw link and spool with support. The valve spool can then be removed from the link and the lever return spring and cam roller can be withdrawn from the lever support; refer to Fig. 181.

To disassemble lever, quadrant and support assembly, refer to exploded view in Fig. 184. Unbolt quadrant (33) and cover (42) from support (40) and remove set screw from valve lever (39). Then remove hand lever (31) and valve lever from support. When reassembling, renew the "O" rings (32) on hand lever shaft and install cover with new gasket (41).

The control valve spool (piston valve) is a select fit to the valve bore in housing. Valves are available in five different size ranges which are color coded as follows:

Color Code	Valve Diameter
Red	0.8685-0.8687
Yellow	0.8687-0.8689
Blue	0.8689-0.8691
Green	0.8691-0.8693
White	0.8693-0.8695

The largest diameter spool that will fit in the valve bore without binding should be selected. Note: When checking valve fit, the front cover of the valve housing should be installed and retaining cap screws tightened to a torque of 25-39 Ft.-Lbs. When installing a new valve housing, the valve bore in housing will be color coded to indicate correct size range of valve spool to be installed.

With proper size valve selected, attach the valve to control lever link, insert cam roller in bore of lever support and insert return spring in

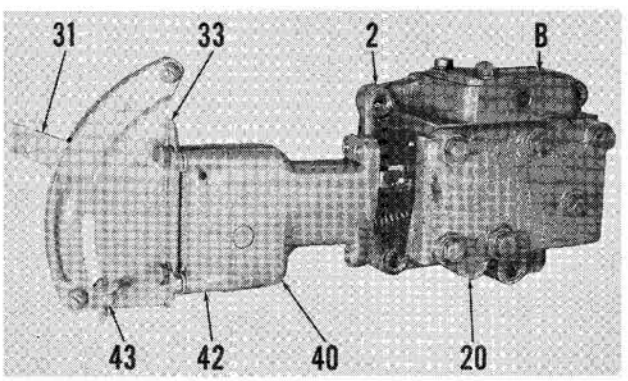


Fig. 181—View showing control valve lever support split from valve housing.

B. Relief valve bore
2. Valve housing
20. Cover plate
31. Control lever
33. Quadrant
40. Support
42. Cover
43. Rate of lower stop

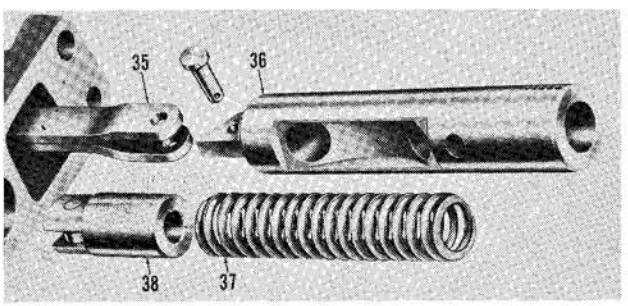


Fig. 182—Control valve spool (36) can be removed from link (35) after removing lever support as shown in Fig. 181. Lever return spring (37) and follower (38) fit in bore in support.

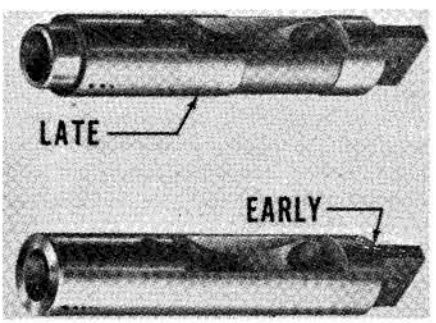


Fig. 183—View showing late and early type control valve spools.

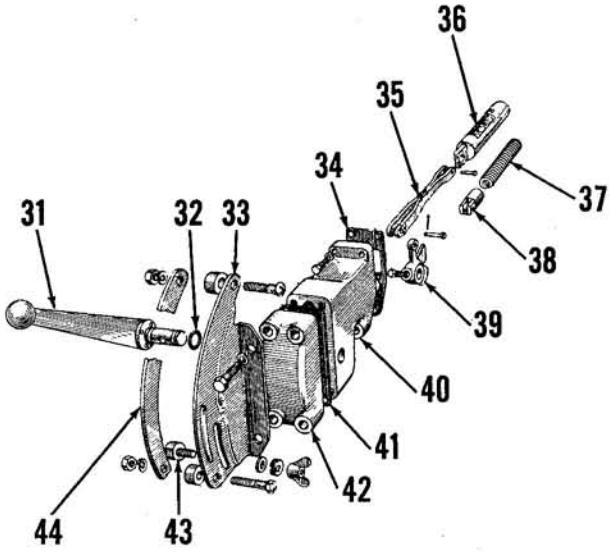


Fig. 184—Exploded view of control lever, support and control valve unit; refer to Fig. 181 for view showing unit split from valve housing.

31. Control lever
32. "O" ring
33. Quadrant
34. Gasket
35. Control link
36. Control valve spool
37. Lever return spring
38. Cam follower
39. Valve lever
40. Lever support
41. Gasket
42. Cover
43. Rate of lower stop
44. Lever guide

bore of valve housing. Then, reinstall the lever, support and valve assembly with new gasket between lever support and valve housing.

236. **RELIEF (UNLOADING) VALVE AND SEAT.** Three different types of pressure relief (unloading) valves may be encountered. Except for some late production units, model "FMD" systems were fitted with valve having tapered tip and adjuster with "O" ring seal as shown in Fig. 178. Early production model "FPM" and some late model "FMD" systems were fitted with a valve having a loose steel ball at the tip and a square adjuster as shown in left view in Fig. 180. To prevent the valve from raising high enough to allow the ball to become dislodged from the tip of valve, the adjuster was discontinued and a hollow valve stop was introduced in later production model "FPM" systems. If the square type adjuster is encountered, it should be renewed using the later type stop and small diameter adjusting shims. To renew the early "FMD" valve with tapered tip using the new steel ball tip valve, a new type valve housing is also required. Note: Only the late type valve housing will be available for service of both "FMD" and "FPM" systems.

For adjusting relief pressure, valve can be removed without removing valve housing from tractor. Remove the plate (7—Fig. 185) from left side of top face of valve housing, then remove the adjuster or stop, adjusting shims, spring and valve. Note: On models with steel ball at tip of valve, be careful not to lose the ball as it may stick to valve. If not removed with valve, extract the steel ball from valve bore.

With valve removed, carefully inspect valve bore for any deep score marks that would cause valve to stick and inspect valve seat for excessive wear or damage. To remove seat, first remove valve unit as outlined in paragraph 234, then unscrew seat from housing. To install seat, place new sealing ring on seat and install new "O" ring in groove on seat, then securely install seat in valve housing.

On late type relief valve, stick steel ball in tip of valve with heavy grease, then insert valve in bore. Install spring, adjusting shims and adjuster or stop. Install retaining plate with new gasket. Note: Refer to paragraph 231 for shim selection.

237. **CHECK (NON-RETURN) VALVE.** To remove the check (non-return) valve, first remove valve housing as outlined in paragraph 234, then remove the check valve assembly from bottom of housing. Refer to Fig. 187.

With check valve removed, carefully inspect valve seat. Seat should be renewed if excessively worn or damaged. Renew the check valve if grooved or damaged in any way. Renew spring if cracked, rusted or distorted, or if free height is not approximately equal to that of new spring.

Reinstall check valve assembly using a new sealing washer and securely tighten guide in valve housing.

238. **LIFT CYLINDER AND PISTON.** To remove lift cylinder and piston, first remove the valve housing as outlined in paragraph 234. If not removed with valve housing, withdraw cylinder and piston unit from

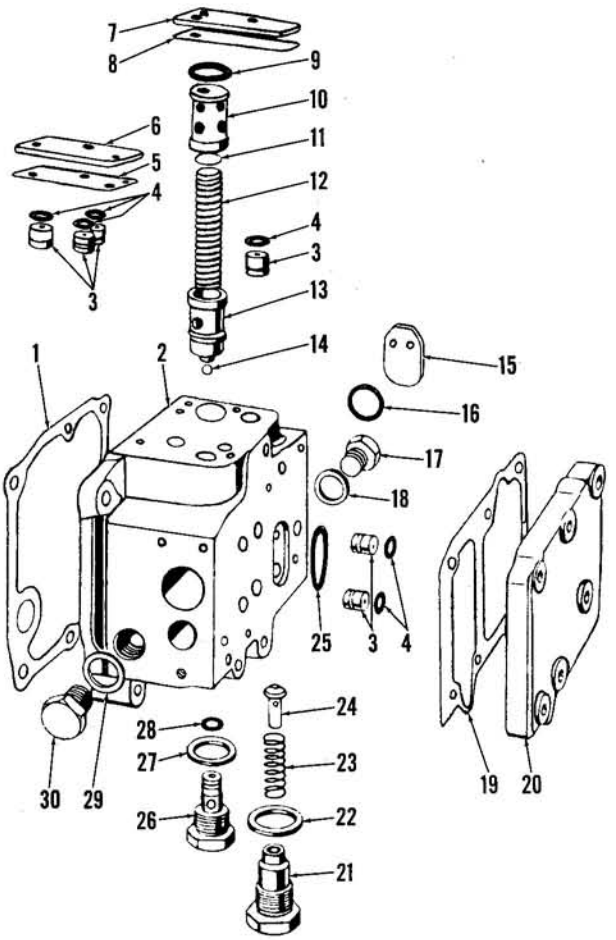


Fig. 185—Exploded view of valve housing assembly with control lever support and control valve assembly removed.

1. Gasket
2. Housing
3. Sealing plugs
4. "O" rings
5. Gasket
6. Retainer plate
7. Retainer plate
8. Gasket
9. "O" ring
10. Spring guide
11. Shims
12. Relief valve spring
13. Valve retainer
14. Relief valve ball
15. Retainer plate
16. "O" ring
17. Jack tapping (remote cylinder port)
18. Seal
19. Gasket
20. Cover plate
21. Check valve guide
22. Seal
23. Check valve spring
24. Check valve
25. "O" ring
26. Relief valve seat
27. Seal
28. "O" ring
29. Seal
30. Plug

lift cover. If difficulty is encountered, the rear access cover can be removed from lift cover and a drift can be used to bump cylinder forward out of bore in lift cover.

With cylinder and piston unit removed, push piston from rear end of cylinder. Renew cylinder if cracked, deeply scored or worn. Renew piston if deeply scored. To renew piston seal, straighten lock tab washer on front end of piston and remove cap screw, washer and seal retainer. Fit new seal over front end of piston and check to see that seal retainer fits evenly; install new retainer if bent or otherwise damaged. Using new lock tab washer, secure retainer to front end of piston with cap screw and bend tab of washer against screw head. Install sleeve in bore of lift cover, then lubricate piston and with "O" ring removed from bore of cylinder, install piston as shown in Fig. 188. Install new "O" ring in cylinder bore and reinstall valve housing assembly; refer to paragraph 234.

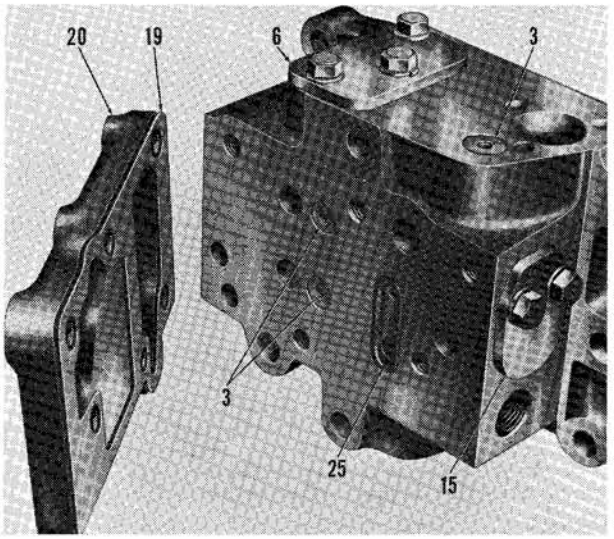


Fig. 186—View showing cover (20) removed from valve housing. Refer to Fig. 185 for legend.

Fig. 187—Removing check valve and guide assembly from bottom of valve housing.

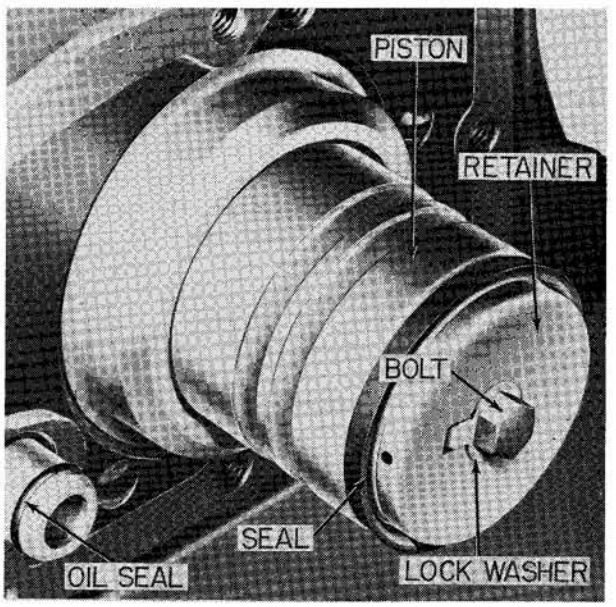


Fig. 188—View showing lift cylinder piston partially installed in cylinder. The "V" shaped seal is clamped to front end of piston by the retainer, bolt and lock washer.

239. **LIFT SHAFT AND ARMS.** To remove the lift shaft with lift cover installed, remove rear fender from one side of tractor. Also, depending on tire

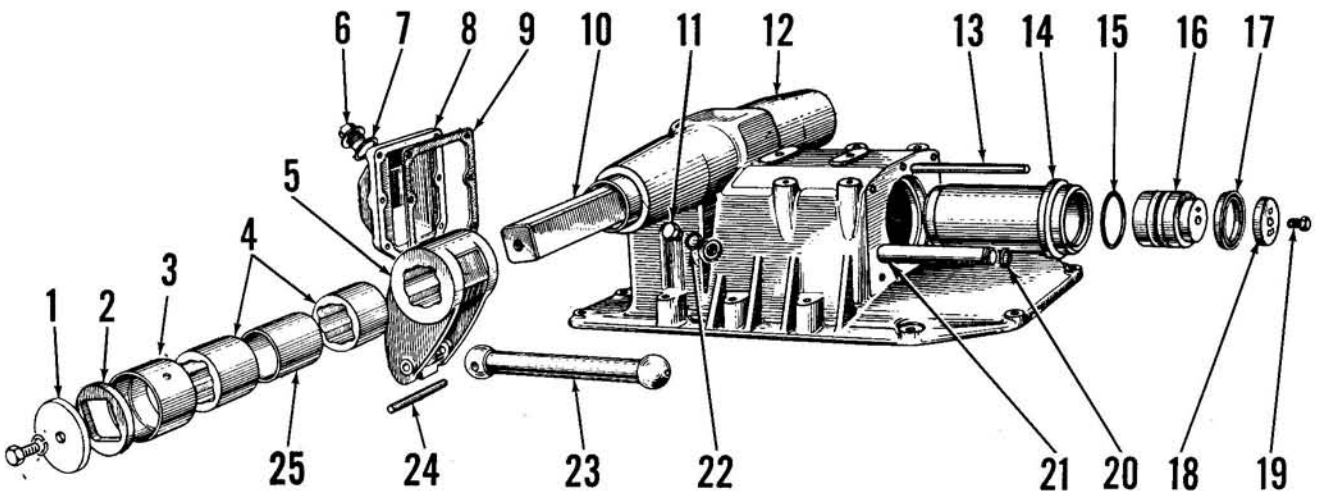


Fig. 189—Exploded view of model "FMD" and "FPM" hydraulic lift cover, cylinder, lift shaft and related parts. Refer to Fig. 184 and Fig. 185 for exploded views of valve housing and related parts that bolt to front face of lift cover (12).

1. Flat washer
2. Seal
3. Bushings
4. Bearings
5. Lift cylinder arm
6. Filler plug
7. Gasket
8. Cover
9. Gasket
10. Lift shaft
11. Oil passage plug
12. Lift cover
13. Return oil pipe
14. Cylinder
15. "O" ring
16. Piston
17. Seal
18. Retainer
19. Cap screw
20. "O" ring
21. Pressure pipe
22. Gasket
23. Piston rod
24. Pin
25. Spacer

size and/or wheel width setting, it may be necessary to remove rear wheel. Disconnect lift links from lift arms and remove lift arm from side of tractor opposite removed fender. Remove rear access cover from lift cover and remove the lift shaft and remaining lift arm from cover. Remove ram cylinder arm and connecting rod from rear opening and extract the two lift (cross) shaft bearings and spacers from each side of cover.

Inspect the four lift shaft bearing liners in lift cover and renew liners if excessively worn. Install new bearing liners using suitable bushing driver, making sure holes in liners are aligned with grease holes in lift cover. Bearing liners should not require reaming if carefully installed.

Place new shaft seal, outer bearing, spacer and inner bearing on lift shaft next to arm not removed. Place ram cylinder arm and piston rod assembly in lift cover through rear opening, then insert lift shaft through cover and ram cylinder arm. Insert inner bearing, spacer, outer bearing and lift shaft seal into lift cover bore over end of lift shaft, then reinstall lift arm and reconnect lift links. Reinstall rear cover on lift cover.

POSITION CONTROL ATTACHMENT

Models "FMD" and "FPM" So Equipped

240. A "position control" attachment is available for installation on models "FMD" and "FPM." Refer to exploded view of attachment in Fig. 190. The unit is mounted to right end of lift shaft instead of lift arm retaining washer and cap screw. Flange on plate (1) is placed below right hand lift arm and front end of spring loaded arm (8) is inserted through slot in quadrant below the control lever. Note: Early production units do not have slot in quadrant for lever; either install new quadrant or cut hole in quadrant according to directions packaged with attachment.

In operation, the lever (2) is clamped to plate (1) in position that spring loaded arm (8) will return control lever to neutral position when desired depth of implement is reached. Any required repairs are evident from inspection of unit and reference to Fig. 190.

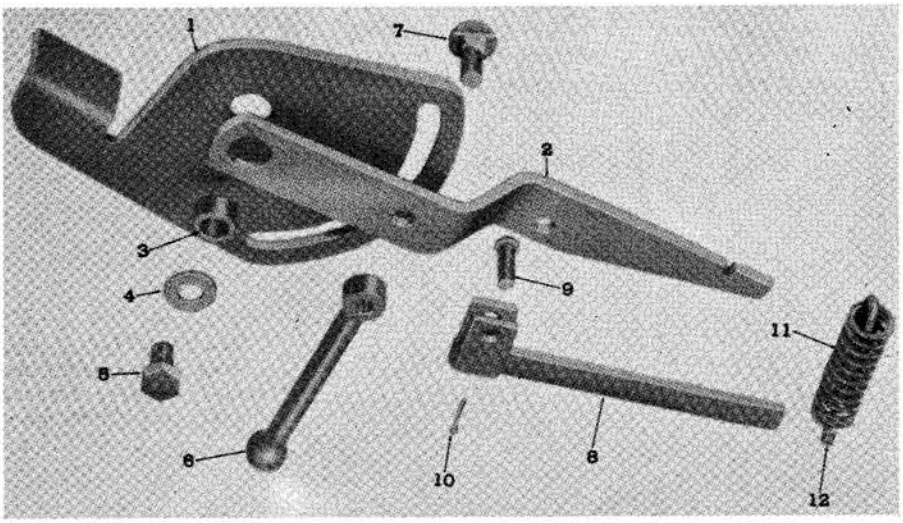


Fig. 190—Exploded view of position control attachment. Plate (1) is mounted on right end of lift shaft (10—Fig. 189) with projection on plate placed under lift arm. Downward movement of lift arm then moves spring loaded arm (8) upward returning control lever from lowering position to neutral position at desired lift arm height. Adjustment is made by clamping arm (2) to desired positon on plate (1).

1. Plate
2. Arm
3. Bushing
4. Flat washer
5. Cap screw
6. Handle nut
7. Carriage bolt
8. Spring loaded arm
9. Pin
10. Cotter pin
11. Spring
12. Retainer

HYDRAULIC PUMP

Models "FMD" and "FPM"

241. **REMOVE AND REINSTALL PUMP.** The hydraulic pump can be unbolted and remove from the pedestal after removing lift cover as outlined in paragraph 233, or can be removed as follows:

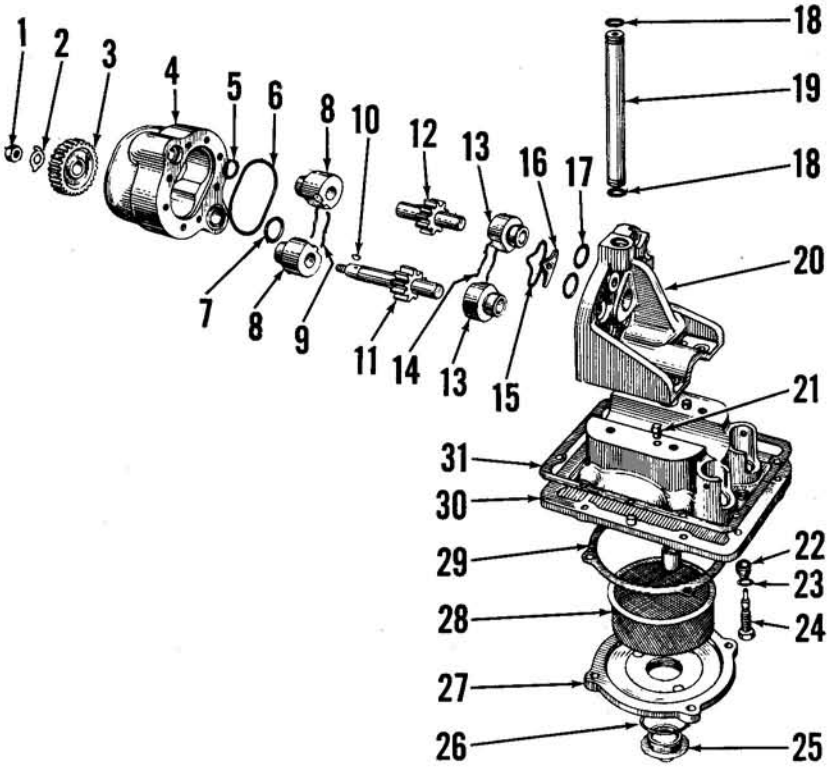


Fig. 191—Exploded view of model "FMD" hydraulic pump assembly. Pump is no longer available as a complete assembly; thus, some "FMD" or "FPM" tractors may be fitted with later type pump as shown in Fig. 216.

1. Nut
2. Locking washer
3. Gear
4. Housing
5. "O" ring
6. "O" ring
7. "O" ring
8. Rear bearings
9. Locking springs
10. Woodruff key
11. Drive gear
12. Driven gear
13. Front bearings
14. Locking springs
15. Seal ring
16. Relief plate
17. "O" rings
18. "O" rings
19. Pressure pipe
20. Mounting bracket
21. Dowel pins
22. Check ball (usually omitted)
23. "O" ring
24. Cap screw (magnet tip)
25. Drain plug
26. Gasket
27. Screen cover
28. Suction screen
29. Gasket
30. Pump base
31. Gasket

Drain rear axle center housing and remove PTO output shaft assembly as outlined in paragraph 224 or raised PTO unit and drive shaft as outlined in paragraph 225. Then, unbolt pump pedestal from bottom of rear axle center housing and lower the pedestal and pump assembly from tractor. Remove vertical pressure pipe from pump or lift cover. Unbolt and remove pump from pedestal.

To reinstall pump, proceed as follows: Install new "O" rings on the vertical pressure pipe, then insert pipe into pump front cover (bracket). Reinstall pump by reversing removal procedure and refill the rear axle center housing with proper lubricant as outlined in paragraph 227.

242. **OVERHAUL PUMP.** Note: A later model "FSM" pump may be installed; if pump has removable cover at drive gear end, refer to paragraph 275. If pump body is as shown in Fig. 191, proceed as follows:

Straighten lock tab washer on pump drive shaft, remove nut and washer, pull gear from shaft and remove the Woodruff key. Unbolt and remove bracket (front cover) from pump, then remove the "O" ring seals and relief plate. Bump pump drive shaft against wood block to remove front bearings. Note: Bearings are "locked" by two wire springs and tension is removed from springs when one bearing is moved about ¼-inch forward of other bearing. Remove the drive gears, then using suitable tool, push rear drive gear bearing forward to loosen spring tension and remove rear bearings.

Carefully inspect pump body for cracks, deep score marks or excessive wear. Maximum wear allowance for gear track at intake side of pump body is 0.0025. If body is not suitable for further service, the complete pump must be renewed using the later type pump used for model "FSM" tractors. To adapt the later type pump, a conversion kit is also required as the pressure outlet is located in different positions on the two pumps.

If pump body is suitable for further service, carefully inspect removed parts and renew as required. Lubricate all parts and using all new sealing rings, reassemble as follows:

The rear pump bearings can be identified by their wider flange. With the two rear bearings connected by their locking springs, insert them into pump body with one bearing slightly ahead of the other and push them into pump body. Turn the bearings clockwise, then push trailing bearing down into place to "lock" the bearings. Insert the drive and driven gears. With the two front bearings connected by their locking springs, insert them into pump body with one bearing slightly ahead of the other. When leading bearing is against gear, turn the bearings clockwise, then push trailing bearing down into place to "lock" the bearings.

If, when installed, the flanges of the front bearings are below flush with machined recess in pump body, measure distance between bearing flange faces and machined face of pump body with depth gage at several points, then install relief plate of thickness 0.003-0.0055 less than minimum measured distance. If bearing flange faces are above flush with machined recess, select a relief plate of thickness that will provide a minimum clearance of 0.003-0.0055 between plate and machined surface of pump body when measured with straight edge and feeler gage as shown in Fig. 192. Relief plates are available in four thicknesses: 0.1125-0.1130, 0.1150-0.1155, 0.1175-0.1180 and 0.120-0.1205.

Insert new body and oil passage sealing rings and place new sealing ring around relief plate. Taking care not to dislodge "O" rings, install pump cover (bracket) to bearings and pump body. Evenly and securely tighten cover retaining cap screws. Install Woodruff key, drive gear, new lock tab washer and nut, tighten nut and secure by bending tab of washer against nut. Fill pump with oil and turn it by hand to be sure it is free.

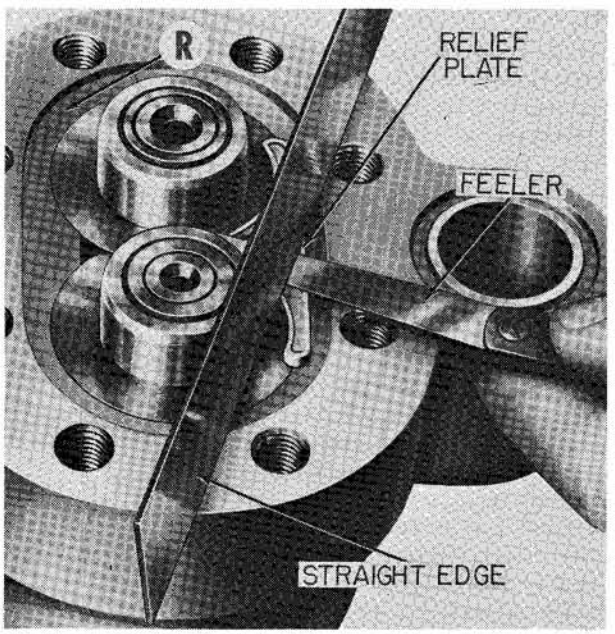


Fig. 192—Checking with feeler gage and straight edge for proper relief plate thickness. Refer to text.

HYDRAULIC SYSTEM

(Models "FSM" & "New FSM")

The Model "FSM" hydraulic lift system incorporates automatic draft control with compression on the top link of the three-point hitch; the Model "New FSM" provides automatic draft control with either tension or compression on the top link. Both models incorporate automatic implement position control. Fluid for either system is common with the rear axle final drive, but is separated from the transmission by oil seals. Hydraulic power is supplied by a gear type hydraulic pump mounted in the rear axle center housing and driven by a gear on the PTO shaft. Production changes have been made from time to time as well as a change in the control linkage between the models "FSM" and "New FSM". Where changes affect parts procurement and service procedure, it will be noted in the text.

FLUID AND FILTERS

Models "FSM" and "New FSM"

243. The rear axle differential and final drive lubricant is utilized for the hydraulic system fluid. Capacity is 10.8 gallons. Lubricant from factory is SAE 30 H.D. oil; however, SAE 80 Mild E.P. (Ford specification M-4864-A) or SAE 90 Mild E.P. (Ford specifictaion M-4864-B) gear lubricant is recommended for refill when the factory installed lubricant is drained. CAUTION. Do not mix SAE 80 or SAE 90 gear lubricant with the SAE 30 H.D. oil as the different type lubricants are not compatible.

A wire mesh screen suction filter is located in the pump pedestal and is accessible after draining rear axle center housing and removing cover from bottom of pedestal; refer to Fig. 191.

The rear axle center housing should be drained, the suction filter screen removed and cleaned, the housing flushed and the system refilled with new oil of the correct type after each 12 months or 2000 hours of service.

A replaceable element type filter (120—Fig. 210) is located on the hydraulic system sump return line. It is recommended that this filter be renewed whenever performing major overhaul of the differential, final drive or hydraulic system.

TROUBLE-SHOOTING

Models "FSM" and "New FSM"

244. Trouble in the hydraulic lift system will usually show up as (a), failure to lift; (b), inability to hold implement in raised position without excessive "corrections" (up and down bobbing motion); (c), over-correction (inability to maintain desired depth) in draft control; or (d), erratic action of the system. The possible causes of trouble and methods of checking to locate source are outlined in the following paragraphs.

245. **WILL NOT LIFT.** First, check to be sure the PTO output shaft is engaged and that the shaft turns when clutch is engaged. Check to see that system (rear axle center housing) contains proper amount of oil; a dipstick is located at left rear corner of transmission. Move the control lever to top of quadrant and check with the selector lever (see Fig. 194) in both the up (draft control) and forward (position control) positions. If the lift still fails to operate, move the auxiliary service control (selector valve) knob to out position, remove plug from front side of valve housing and turn engine with starter. If no oil flows from plug opening, remove lift cover and cylinder assembly, then again turn engine with starter. If no oil flows from pump pressure tube, remove and overhaul hydraulic pump. If oil flows from open pressure tube and pressure can be obtained by blocking tube opening, overhaul lift cover and cylinder assembly.

Possible causes of failure to lift within the pump assembly are shearing of drive key or shaft, broken or extremely worn pump body or gears, plugged intake screen, or ruptured seals in pump.

Possible causes of failure to lift within the cover assembly are improper adjustment of linkage, bent or broken linkage, sticking or binding of valves or broken ram cylinder, piston or connecting rod.

246. **OVER-CORRECTION IN DRAFT CONTROL.** Under some conditions, uneven depth control and over-correction may result from excessive oil flow from the hydraulic pump. Models "FSM" and "New "FSM" are equipped with an adjustable flow control valve which is used to regulate hydraulic pump output to meet varying field conditions and implement requirements.

If adjusting the flow control valve to minimum flow position does not change rate of hydraulic lift, check the flow control valve plunger (74—Fig. 210) to be sure that it is not sticking or that the plunger spring (75) is not damaged or broken.

247. **EXCESSIVE CORRECTIONS ("BOBBING" OR "HICCUPS" IN RAISED POSITION).** Leakage of oil in the hydraulic lift circuit will allow lift arms to fall, then automatically correct to raise back to set position. This is referred to as corrections in raised position. With hydraulic oil at normal operating temperature, engine running at 1600 RPM and approximately 1500 pounds on the lift arms, three or less corrections in two minutes is considered normal. The system will operate satisfactorily with up to

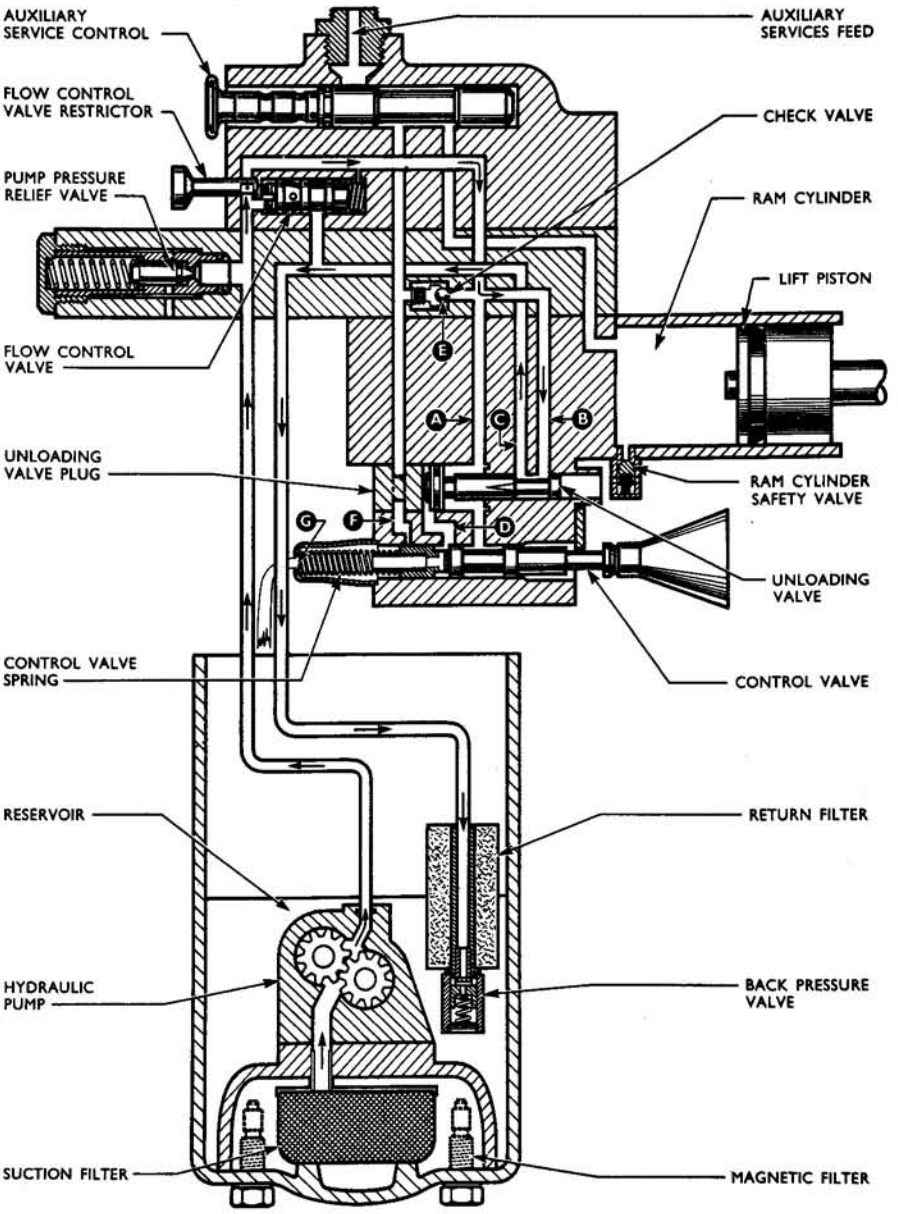


Fig. 193—Schematic diagram of model "FSM" hydraulic system in neutral position. Model "New FSM" system is similar except that a restrictor valve is incorporated in the return circuit (see Fig. 202) to control rate of lowering of the three-point hitch.

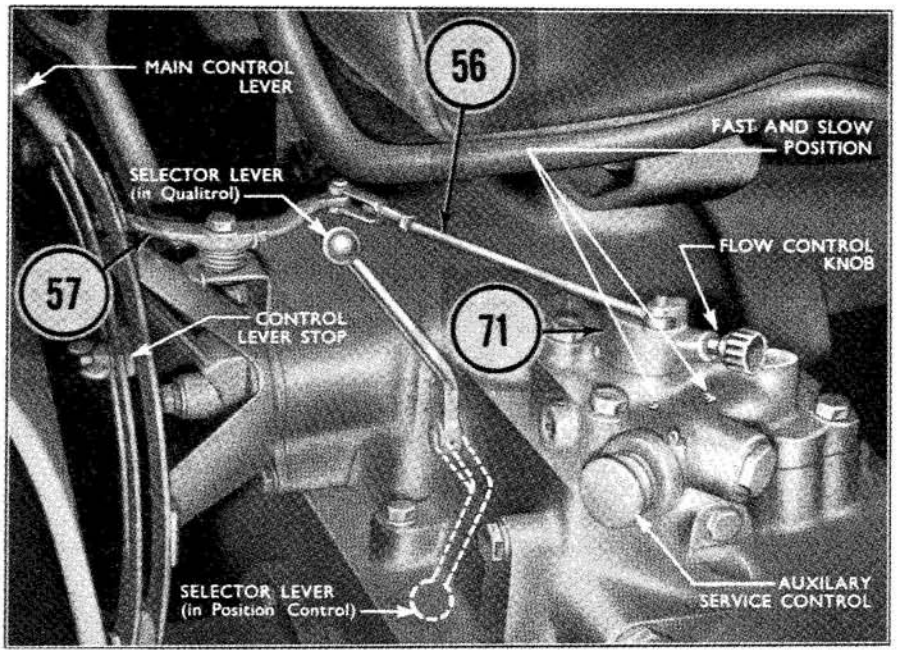


Fig. 194—View of controls on model "FSM" hydraulic system. Model "New FSM" controls are similar except for drop control knob shown in Fig. 201. Refer to Fig. 210 for legend.

30 corrections in a two minute period, however, if there is any sudden increase in number of corrections, service of the hydraulic lift is indicated.

To determine cause of leakage, mount a heavy implement on the three-point hitch and raise the implement, then, shut off engine. If implement falls steadily all the way to ground, a leaking piston seal, check valve or safety valve is indicated. Renew check valve as outlined in paragraph 263; if this does not correct trouble, remove lift cover and renew piston seal and, if necessary, the lift cylinder safety valve.

If implement falls only part way, then stops or rate of fall decreases noticeably, a leaking control valve is indicated and the valve and bushing should be renewed. Refer to paragraph 267.

Additional points to check are the "O" rings located between lift cylinder and cover and the fit of unloading valve bore plug in lift cylinder. While lift cover is off, make sure that control linkage operates without binding.

248. **ERRATIC ACTION.** Usually caused by binding of the control valve, back pressure valve, unloading valve, flow control valve or linkage. Before removing top cover, check to be sure that lift arms can be moved up and down.

SYSTEM RELIEF PRESSURE

Models "FSM" and "New FSM"

249. To check system relief pressure, first operate tractor until hydraulic fluid (differential and final drive lubricant) is at operating temperature, then proceed as follows:

Stop engine and remove filler cap from rear of lift cover and pressure port plug from right side of lift cover. Connect a 0-3000 psi pressure gage, shut-off valve and return tube to pressure port with return tube inserted in filler opening as shown in Fig. 195. With test gage shut-off valve open, start engine, lower the 3-point hitch lift arms, pull selector (auxiliary control) valve out and move lift control lever to top of quadrant. With engine running at high idle speed, gradually close test gage shut-off valve while observing pressure gage.

With early type pressure relief valve assembly (see Fig. 196), gage reading should gradually increase to system relief pressure as shut-off valve is closed, then drop to approximately 300 psi when relief valve opens.

On systems fitted with late type pressure relief valve (see Fig. 196), gage reading should gradually increase to slightly above system relief pressure as shut-off valve is closed, then drop to relief pressure when valve opens.

System relief pressure should be 2450-2500 psi with either pressure relief valve assembly. The only difference is that late valve will maintain system pressure while early valve will drop system pressure to approximately 300 psi when valve opens and control valve must be returned to neutral to reset the valve. Late type relief valve assembly may be installed in early production lift cover if desired.

To adjust system relief pressure, remove the relief valve assembly, refer to Fig. 196, and disassemble the unit.

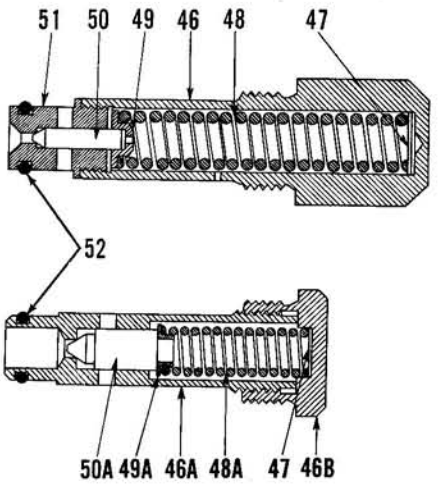


Fig. 196—Cross-sectional views of early type (bottom) and late type (top) pressure relief valve assemblies. Refer to text.

46. Valve housing
47. Shims
48. Relief-valve spring
49. Spring seat
50. Relief valve
51. Valve seat
52. "O" ring

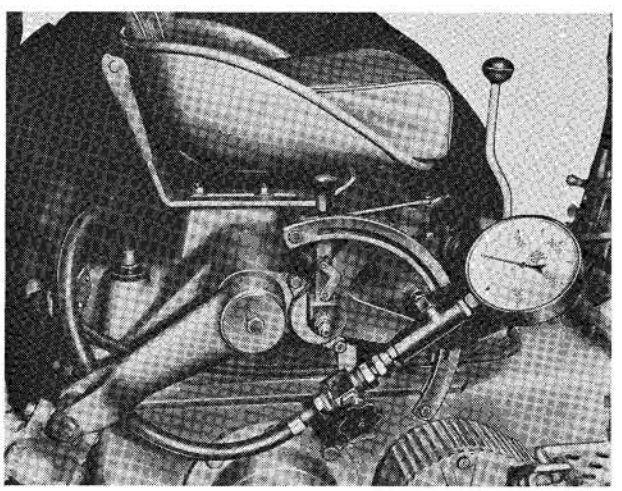


Fig. 195—View showing hydraulic pressure gage, shut-off valve and return hose installed on model "FSM" for hydraulic relief pressure check.

Inspect valve (50 or 50A) and seat (51 or 46A) for wear or damage and spring (48 or 48A) for cracks or distortion. If valve appears serviceable, add shims (47) to increase relief pressure or remove shims to decrease pressure. Shims are available in thicknesses of 0.010 and 0.025. Adding or removing shim thickness of 0.010 should change relief pressure approximately 100 psi. CAUTION: Do not install a total shim thickness of more than 0.080. If adding shims does not increase system relief pressure, overhaul pump assembly as outlined in paragraph 275.

SYSTEM ADJUSTMENTS

Model "FSM"

250. **ADJUST MAIN CONTROL SPRING.** To adjust main draft control spring, disconnect top link rocker from yoke, then turn yoke in until shoulder on yoke is flush with lift cover as shown by arrows in Fig. 197. As a functional check of main control spring adjustment, proceed as follows: Place selector lever in draft control and attach an implement to the lower links of the three-point hitch. With engine running at approximately 1600 RPM, move control lever slowly upward until the lift arms raise, then move lever back down the quadrant a distance of 1 inch. The lift arms should lower, then raise again when a force of 110 pounds is applied directly to the main control spring yoke. If required pressure exceeds 110 pounds, disconnect top link rocker from yoke and turn yoke out ½-turn at a time until adjustment is correct.

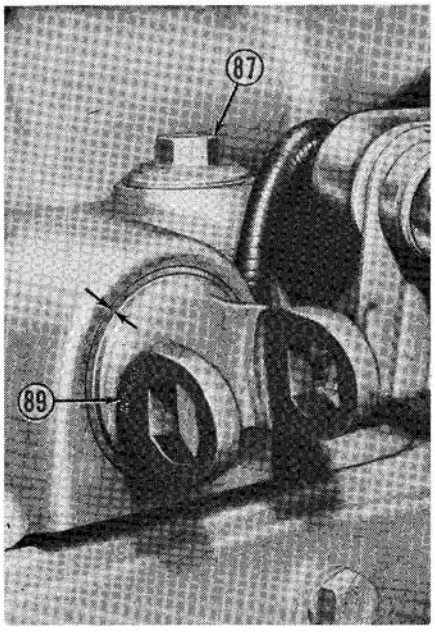


Fig. 197—Model "FSM" main spring adjustment requires that shoulder on yoke (89) be flush with rear face of lift cover as indicated by arrows. Filler plug is (87).

If required pressure is considerably less than 110 pounds, turn yoke in.

251. **ADJUST DRAFT CONTROL LINKAGE.** Adjustment of the hydraulic lift linkage should be made using special gages as follows:

With lift cover assembly removed as outlined in paragraph 261 and main draft control spring adjusted as in paragraph 250, attach locating arm (Nuday tool No. N-503-C) to lift cover and position lift arms with pin as shown in Fig. 198. Move selector lever to draft control position and control lever to ½-inch from top stop on quadrant. Using adjusting gage (Nuday tool No. N-502-B) (same gage as used for model "NAA" Ford tractor), measure gap between shoulder on control valve spool and machined face of valve housing with small (draft control) end of gage. Gage should just enter gap without any binding or side clearance. If adjustment is not correct, loosen jam nut on turnbuckle (102) and lengthen or shorten linkage as necessary. Recheck adjustment after tightening jam nut.

If special gages are not available, proceed as follows: With selector lever in draft control position and control lever at bottom of quadrant, move lift arms in lowering direction until piston contacts front end of lift cylinder; then, back upward ½-inch measured at pin hole in end of lift arms. Lock lift shaft in this position by tightening cap screws in ends of lift shaft. Move control lever to ½-inch from top stop on quadrant and measure gap between shoulder on control valve spool and machined face of valve housing. If distance is not 0.342, lengthen or shorten linkage as required to provide this measurement. Remeasure gap after tightening jam nut.

With draft control linkage adjusted, refer to paragraph 252 and adjust position control linkage.

252. **ADJUST POSITION CONTROL LINKAGE.** Before adjusting position control linkage, adjust draft control main spring and linkage as outlined in paragraphs 250 and 251, then proceed as follows:

With lift arms positioned as in paragraph 251, move control lever to bottom of quadrant and selector lever to position control; refer to Fig. 199. Using large (position control) end of adjustment gage (Nuday tool No. N-502-B), measure gap between shoulder of control valve spool and machined face of valve housing. If gage binds or fits loosely, refer to Fig. 210 and loosen jam nut (37) on position control adjustment screw (32), then turn screw in or out until gage fits without binding or side clearance. Recheck adjustment after tightening jam nut.

If special adjustment gages are not available, proceed as follows: With lift shaft locked in position described in paragraph 251, move control lever to bottom of quadrant and move selector lever to position control. Gap between shoulder on control valve spool and machined face of valve housing should then measure 0.432. If not, loosen jam nut (37—Fig. 210) and turn adjustment screw (32) as necessary to obtain this measurement. Remeasure gap after tightening jam nut. With position control linkage properly adjusted, loosen cap screws in ends of lift shaft until lift arms will fall of their own weight, then bend locking tabs against cap screw heads.

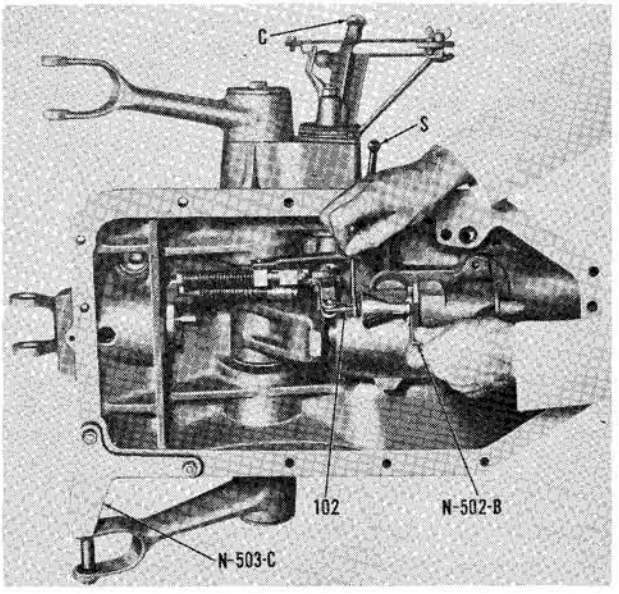


Fig. 198 — Adjusting model "FSM" draft control linkage. Refer to text.

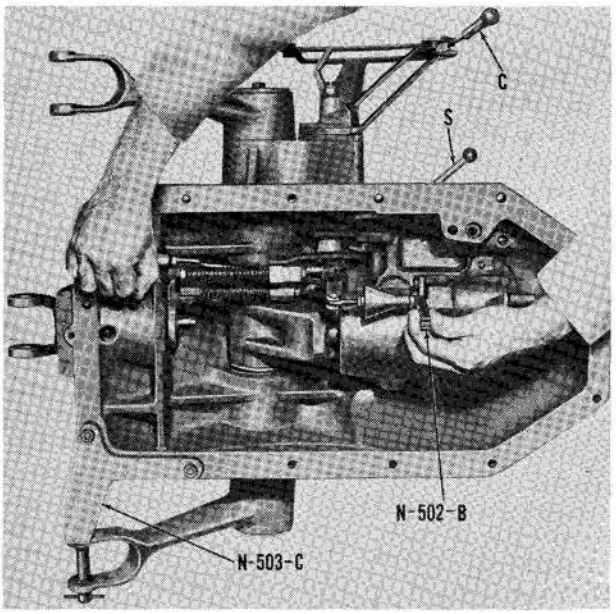


Fig. 199 — Adjusting model "FSM" position control linkage. Refer to text.

Model "New FSM"

253. **ADJUST MAIN CONTROL SPRING.** To adjust main draft control spring, disconnect top link rocker from spring yoke, then turn yoke in until snug against spring, back yoke out until pin hole in yoke is horizontal and reconnect top link rocker. NOTE: If any end play of yoke and spring can be noted when yoke is turned in against spring, the spring retainer nut should be re-shimmed as outlined in paragraph 254.

As a functional check of main control spring adjustment, proceed as follows: With implement or weight attached to the two lower links and with engine running at approximately 1600 RPM, move control lever upward until lift arms raise, then move lever back down quadrant a distance of 1 inch. The lift arms should lower, then raise again when a force of 250 pounds is applied directly to main control spring yoke.

254. **SHIM MAIN CONTROL SPRING NUT.** If the main control spring retainer nut and spring have been removed from lift cover, or if end play of spring can be noted when yoke is turned in tight against spring, re-shim retainer nut as follows:

With the spring inner seat (IS—Fig. 200), spring (88A) and outer seat (OS) installed in lift cover, install retainer nut without any shims between nut and lift cover and turn nut in until all end play is removed from spring and seats. Then, using a feeler gage, measure gap between flange on nut and face of lift cover. Remove the nut, install shims of thickness equal to measured gap and reinstall nut. Tighten nut to a torque of 80-85 Ft.-Lbs. Note: Each shim has a thickness of 0.008-0.012 and in selecting number of shims to be used, total thickness must be as near as possible to measured gap without exceeding this measurement. Adjust main control spring yoke as outlined in preceding paragraph 253.

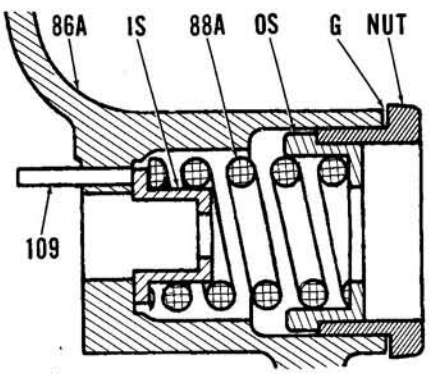


Fig. 200 — Cross-sectional view showing model "New FSM" main control spring. Refer to text for procedure to adjust spring.

G. Gap
IS. Inner spring seat
OS. Outer spring seat
86A. Lift cover
88A. Main control spring
109. Guide pin

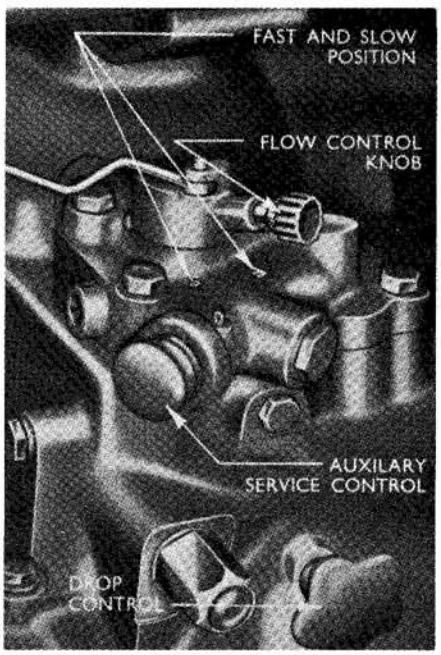


Fig. 201—View showing location of drop control valve knob on model "New FSM". Refer also to Fig. 202.

255. **ADJUST DROP CONTROL RESTRICTOR.** The model "New FSM" is fitted with a restrictor valve in the exhaust passage from the hydraulic lift cylinder and this restrictor valve should be adjusted according to the weight of the implement mounted on the three-point hitch.

To adjust the restrictor valve, refer to Fig. 201 and turn drop control knob fully in. Raise implement to fully raised position, then move control lever to lowering position. If the implement lowers too slowly, back drop control knob out until desired rate of lowering is obtained.

256. **ADJUST DRAFT CONTROL LINKAGE.** To adjust draft control linkage, remove lift cover assembly as outlined in paragraph 261, refer to Fig. 203 and proceed as follows:

Insert a 0.010 feeler gage between draft control plunger (110) and face of housing, then tighten main control spring yoke (89A) so that gage is held tightly. Move lift arms to raised position so that thrust pad on lift cylinder arm (97A) contacts draft control plunger. Move the control lever (20) beyond upper stop to extreme top end of quadrant. Move selector lever (29) up to draft control position. Loosen jam nut (37) on position control rod (32) and screw rod back out of way of control valve lever (99). Insert the thick (position control) end of adjustment gage (Nuday tool No.

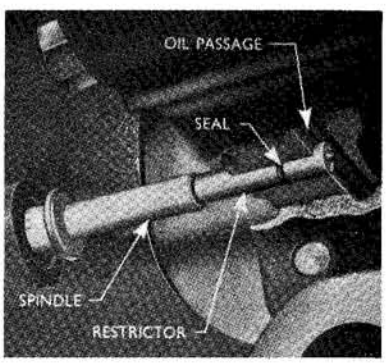


Fig. 202—Cut-away view of lift cylinder showing drop control restrictor valve. Refer also to Fig. 201.

N-502-B) or a 0.432 thick spacer between shoulder on control valve spool and face of valve housing. Loosen jam nut on turnbuckle (102) and lengthen or shorten turnbuckle as required to obtain a 0.200 gap between snap ring on front end of draft control plunger (107) and fork (105). Recheck gap after tightening jam nut on turnbuckle. With draft control linkage properly adjusted, refer to following paragraph 257 and adjust "knock-off" pin.

257. **ADJUST "KNOCK-OFF" PIN.** After the draft control linkage is properly adjusted as outlined in paragraph 256, it is important that the eccentric "knock-off" pin (see Fig. 204) in control valve actuating lever is properly adjusted.

With the control lever, selector lever and lift arms positioned as for draft control adjustment, with feeler gage inserted between draft control plunger and housing and with the 0.432 thick gage (Nuday tool No. N-502-B) inserted between shoulder of control valve spool and valve housing as outlined for draft control adjustment in paragraph 256, proceed as follows: Loosen lock nut on the "knock-off" pin and turn the pin so that eccentric is as far away from rear end of lift cylinder as possible. Remove the ram cylinder safety valve from front end of cylinder and using a suitable curved rod, push ram cylinder piston rearward as far as possible. Be sure that piston rod is properly seated in center of piston. Turn the eccentric "knock-off" pin so that it contacts skirt of piston and while holding pin in this position, tighten lock nut.

Remove the feeler gage from between draft control plunger and housing and proceed with position control linkage adjustment as outlined in following paragraph 258.

258. **ADJUST POSITION CONTROL LINKAGE.** First, adjust draft control linkage as outlined in preceding paragraph 256 and "knock-off" pin as in paragraph 257 then proceed as follows:

Refer to Fig. 199 and position lift arms with locating arm (Nuday tool No. N-503-B) or, if tool is not available, move lift arms until piston contacts front end of cylinder, move lift arms back up ½-inch from this position and tighten cap screws in each end of lift arm shaft to hold arms in this position. Move control lever to bottom of quadrant and selector lever to position control. Turn position control rod screw (32—Fig. 203) as necessary to obtain a gap of 0.432 between shoulder on control valve spool (17) and face of valve housing. Tighten jam nut (37) and recheck adjustment. If special adjustment gage (Nuday tool No. N-502-B) is available, use thick (position control) end to check gap between valve spool shoulder and housing.

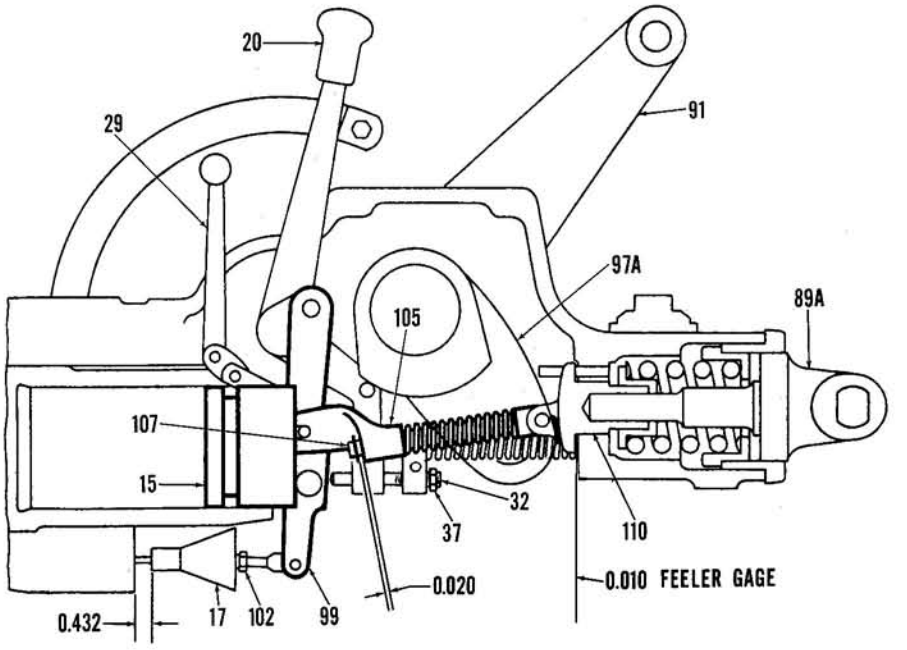


Fig. 203—Drawing showing linkage adjustment points for model "New FSM". Refer to text for procedure.

15. Lift piston
17. Control valve spool
20. Control lever
29. Selector lever
32. Adjusting screw
37. Lock nut
89A. Main spring yoke
91. Lift arms
97A. Lift cylinder arm
99. Control valve lever
102. Turnbuckle
105. Yoke
107. Draft control rod
110. Main spring plunger

Models "FSM" and "New FSM"

259. **ADJUST FLOW CONTROL VALVE LINKAGE.** With hydraulic lift cover and component parts fully assembled, proceed as follows: Disconnect adjustable rod (56—Fig. 205) from lever (57). Move stop on main control lever to front side of lever and move the control lever against top stop on the quadrant. Turn flow control fully out, hold lever (71) against slow ("S") stop and slowly turn knob in until lever starts to move away from "S" stop. Note: It is important that the knob not be turned past this position. Hold lever (57) against rear side of control lever (not against stop on lever) and lengthen or shorten adjustable rod (56) so that rod can be reconnected to lever without moving either lever (57 or 71). Move stop on control lever to rear side of lever and check operation of linkage.

FLOW CONTROL AND SELECTOR VALVE ASSEMBLY

Models "FSM" and "New FSM"

260. Models "FSM" and "New FSM" are equipped with a flow control and selector valve assembly. Refer to exploded view in Fig. 206.

A single acting remote cylinder can be connected to the hydraulic system by removing plug (81) from the valve housing (85) and connecting hose to that port. When the selector valve spool (65) is pushed in, hydraulic oil under pressure is directed to the three-point hitch lift cylinder; pulling selector valve spool out will direct oil pressure to the port in valve housing and operate the single acting remote cylinder with the hydraulic system control valve.

To regulate hydraulic pump output, turn knob (70) in or out to move

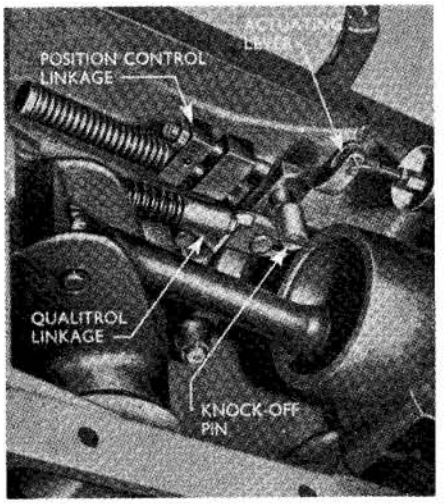


Fig. 204—View of model "New FSM" control linkage showing knock-off pin.

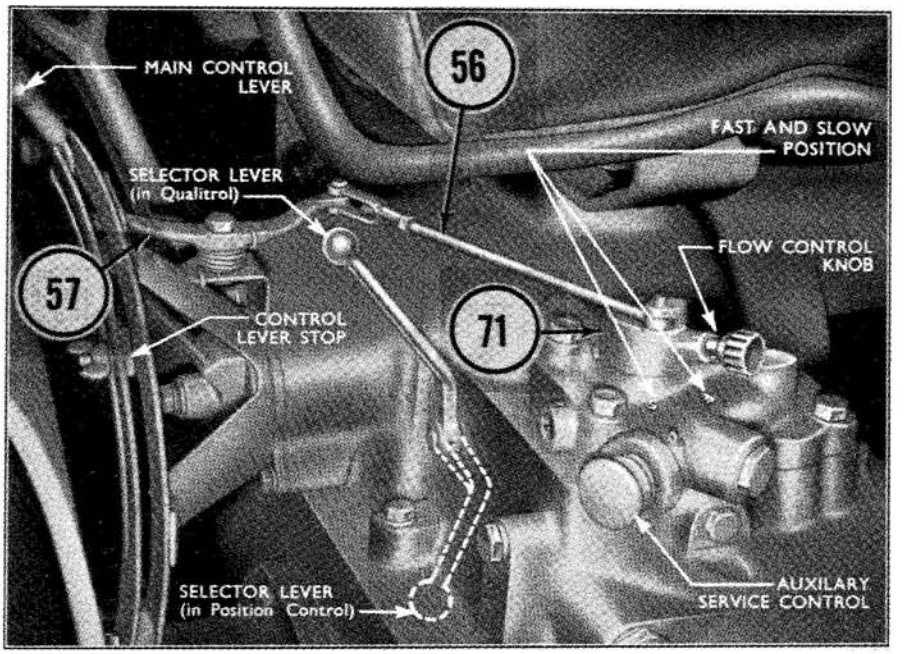


Fig. 205—View of controls on model "FSM" hydraulic system. Model "New FSM" controls are similar except for drop control knob; refer to Fig. 201. Refer to text for adjustment of linkage (56).

restrictor valve (82—Fig. 210) to minimum or maximum flow positions. Movement of the flow control valve (74) is related to the position of the restrictor valve; the flow control valve bypasses a certain amount of oil back to the hydraulic sump and thereby regulates amount of oil flowing to the tractor lift cylinder or remote cylinder. The main control lever (20) is equipped with a moveable spacer which, when moved to rear side of lever, contacts arm (57) when control valve is in raised position causing the restrictor valve to return to maximum flow position regardless of setting of knob (70).

To remove the flow control and selector valve assembly, first push selector valve (65) in, move hydraulic control lever to bottom of quadrant, selector lever (29) to draft control position and force lift arms downward to exhaust all oil from lift cylinder. Unbolt and remove valve assembly from top of hydraulic lift cover.

Disassembly procedure is evident from inspection of unit and reference to exploded view in Fig. 206. The flow control valve (74) and the selector valve spool (65) are a selective fit in bores of valve housing. If necessary to renew either valve spool, select the largest size that will fit in bore without binding when lubricated with hydraulic fluid. Usually, the required size will be of the same color code as the valve spool removed. Valve sizes are indicated by color code as follows:

Flow Control Valve Spool

Color Code	Valve Diameter
Red	0.6670-0.6672
Yellow	0.6672-0.6674
Blue	0.6674-0.6676
Green	0.6676-0.6678
White	0.6678-0.6680

Selector Valve Spool

Color Code	Valve Diameter
Green	0.7482-0.7485
White	0.7485-0.7488
Blue	0.7488-0.7491
Yellow	0.7491-0.7494
Orange	0.7494-0.7497

Lubricate all valve parts prior to reassembly and reassemble using all new "O" rings. Reinstall valve assembly using new gasket and "O" rings and tighten retaining bolts to a torque of 40-45 Ft.-Lbs.

LIFT COVER AND CYLINDER
Models "FSM" and "New FSM"

The lift cover assembly includes the lift (rock) shaft, control quadrant, lift cylinder, main control valve, unloading valve, system relief valve, check valve and safety valve. The system back pressure valve is located at the lower end of system fluid return line.

261. **R&R LIFT COVER AND CYLINDER ASSEMBLY.** To remove lift cover, first exhaust all oil from lift cylinder by placing control valve lever at bottom of quadrant, selector lever in draft control position and forcing oil from cylinder by pushing lift arms to their lowest position. Then, proceed as follows:

Disconnect lift links from lift shaft arms and top link rocker from draft control yoke. Remove operator's seat

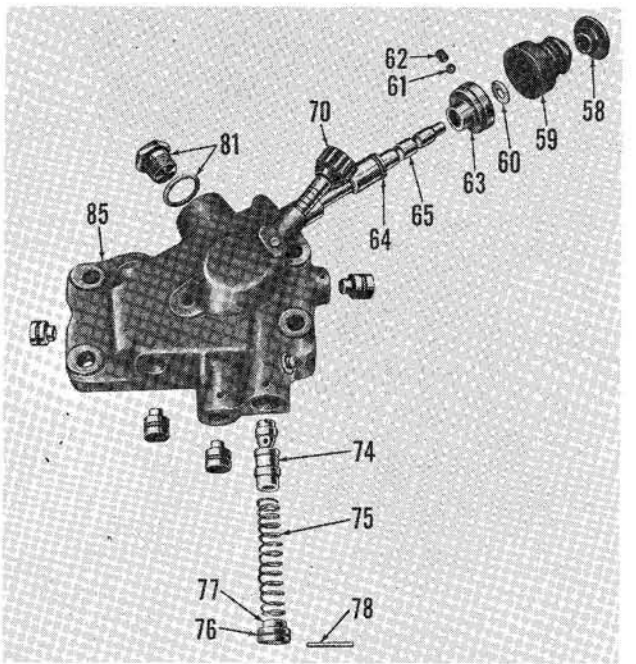


Fig. 206—Exploded view of flow contol and selector valve assembly; refer also to Fig. 210.

58. Knob
59. Cover
60. Washer
61. Detent ball
62. Detent spring
63. Cap
64. "O" ring
65. Selector valve
70. Adjuster knob
74. Flow control valve
75. Flow control spring
76. "O" ring
77. Plug
78. Retaining pin
81. Remote cylinder port plug
85. Valve body

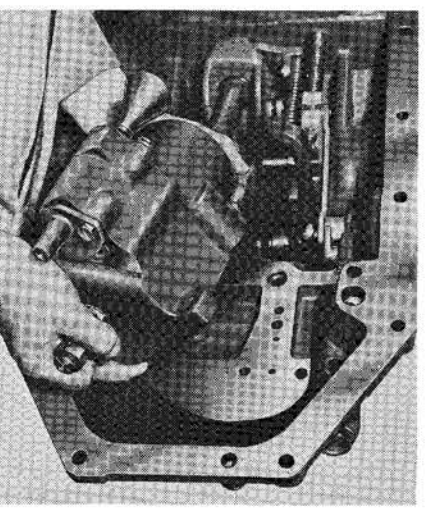


Fig. 207 — Removing lift cylinder from model "FSM" lift cover assembly.

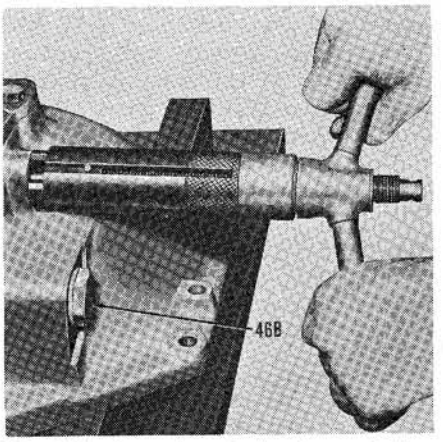


Fig. 208—Removing check valve seat; English tool is shown. Refer to text for procedure. Early type relief valve is (46B).

and the cap screws and nuts retaining lift cover to rear axle center housing. Attach suitable hoist to lift cover and remove the assembly from tractor.

When reinstalling lift cover, use new gasket and "O" rings and tighten the retaining cap screws and nuts to a torque of 40-45 Ft.-Lbs.

262. **R&R LIFT CYLINDER ASSEMBLY.** First, remove lift cover and cylinder assembly as outlined in paragraph 261, then proceed as follows: Unbolt and remove the flow control and selector valve assembly from top of lift cover, then remove the bolts retaining lift cylinder to cover and remove cylinder from bottom side of

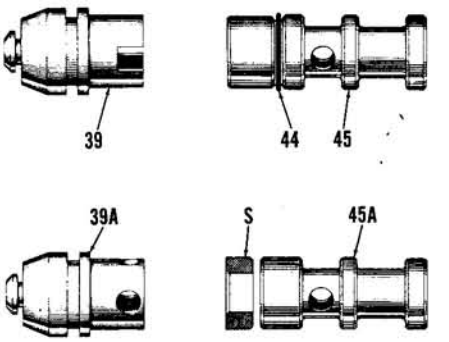


Fig. 209—View showing early type (top) and late type (bottom) check valve seat and pilot. Refer to text for interchangeability.

S. "Delrin" seat
39. Pilot
44. "O" ring
45. Check valve seat

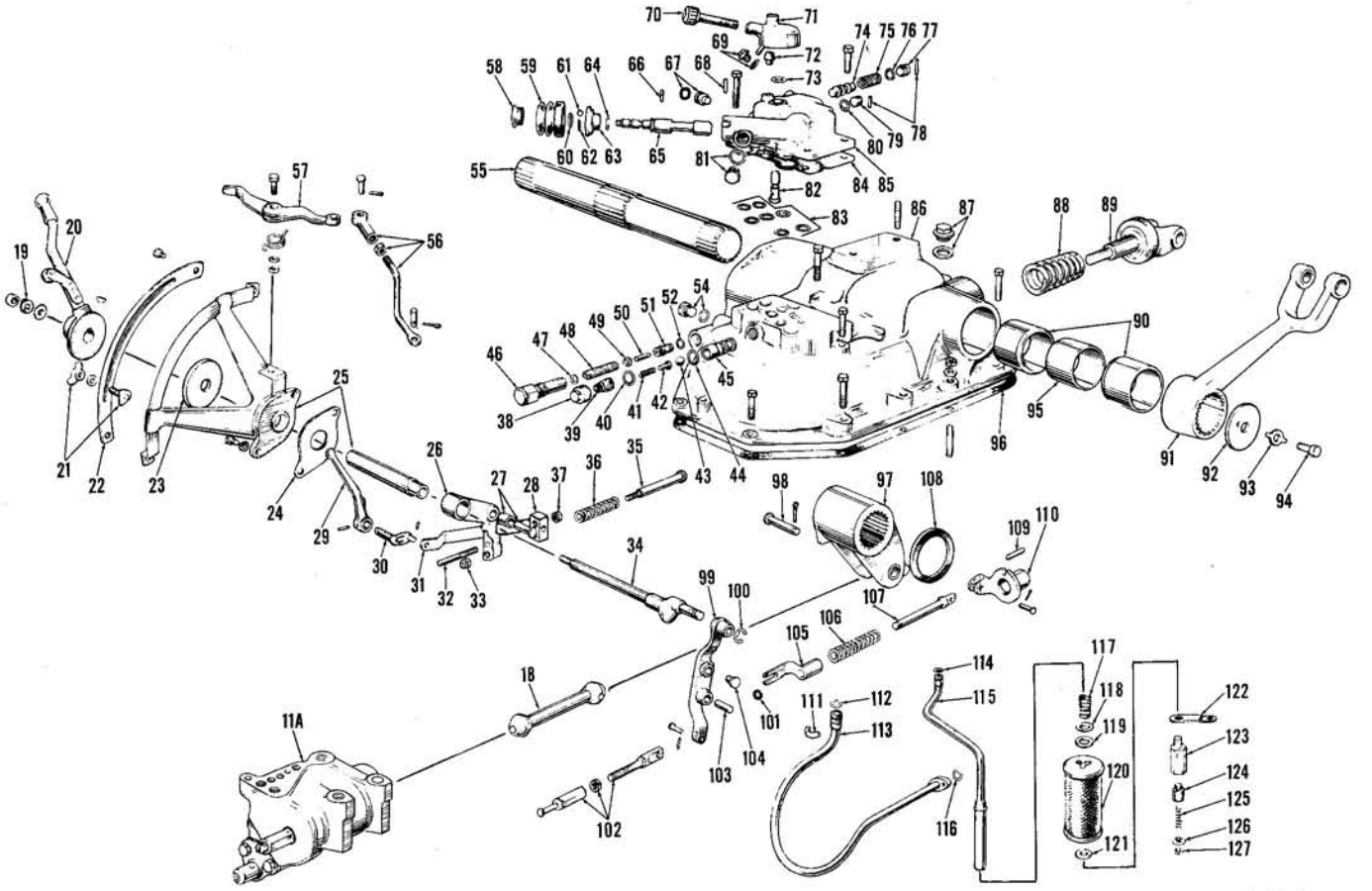


Fig. 210—Exploded view of model "FSM" lift cover assembly. Refer to Fig. 211 for exploded view of lift cylinder (11A). Refer to Fig. 203 for model "New FSM" linkage. Figs. 196 and 209 show production changes in pressure relief valve and check valve seats applicable to both models "FSM" and "New FSM."

11A. Cylinder assembly
18. Piston rod
19. Tension spring
20. Control lever
21. Stop bolt
23. Friction disc
24. Gasket
25. Quadrant
26. Position control arm
27. Pin and roller
28. Block
29. Selector lever
30. Selector arm
31. Link
32. Adjusting screw
33. Locknut
34. Control lever shaft
35. Spring guide
36. Spring
37. Lock nut
38. Retainer plug
39. Pilot
40. "O" ring
41. Spring
42. Spring guide
43. Check valve ball
44. "O" ring
45. Check valve seat
46. Relief valve body
47. Shims
48. Spring
49. Spring seat
50. Relief valve
51. Valve seat
52. "O" ring
54. Plug and seal
55. Lift shaft
56. Flow control rod
57. Actuating arm
58. Knob
59. Cover
60. Washer
61. Detent ball
62. Detent spring
63. Cap
64. "O" ring
65. Selector valve
66. Pin
67. Plug & seal
68. Pin
67. Plug & Seal
68. Pin
69. Plug & seal
70. Flow control knob
71. Flow control lever
72. Stop pin
73. "O" ring
74. Flow control valve
75. Spring
76. "O" ring
77. Plug
78. Pins
79. Plug
80. "O" ring
81. Plug & seal
82. Restrictor valve
83. "O" rings
84. Gasket
85. Flow control valve housing
86. Lift cover
87. Filler plug & gasket
88. Main control spring
89. Yoke
90. Bushings
91. Lift arm
92. Retaining washer
93. Locking washer
94. Cap screw
95. Spacer
96. Gasket
97. Lift-cylinder arm
98. Pin
99. Draft control arm
100. Snap ring
101. Snap ring
102. Turnbuckle
103. Pin
104. Pin.
105. Yoke
106. Spring
107. Draft control rod
108. Spacer
109. Guide pin
110. Draft control plunger
111. Retainer
112. "O" ring
113. Pump pressure pipe
114. "O" ring
115. Return pipe
116. "O" ring
117. Spring
118. Washer
119. Seal
120. Filter element
121. Seal
122. Bracket
123. Valve housing
124. Back pressure valve
125. Spring
126. Spring retainer
127. Snap ring

cover. Discard all "O" rings and gasket from between cylinder, flow control and selector valve assembly and cover.

Install cylinder to bottom side of lift cover using all new "O" rings and tighten retaining bolts to a torque of 50-55 Ft.-Lbs. Install flow control and selector valve assembly with new gasket and "O" rings and tighten retaining bolts to a torque of 40-45 Ft.-Lbs.

263. **CHECK VALVE AND SEAT.** The check valve and seat can be removed without removing lift cover and cylinder assembly. Unscrew the plug (38—Fig. 210) from front of lift cover. Using needle nose pliers, pull the pilot (39) from lift cover and extract spring (41), spring seat (42) and check valve ball (43).

Two different types of check valve seats have been used; refer to Fig. 209. Early production model "FSM" systems were equipped with a one-piece hardened steel seat (44). Late production models have a "Delrin" material seat (S) with an inner bushing (45A). A different pilot (39A) is required with the "Delrin" seat. The late pilot, seat and inner bushing are interchangeable as a group with the earlier pilot (39), "O" ring (44) and seat although the parts are not interchangeable individually.

To remove either the late or early seat, proceed as follows: Using special puller, Nuday tool No. NCA-997-A or equivalent, thread puller rod into check valve seat or inner bushing with late type seat and pull the bushing and/or seat from lift cover as shown in Fig. 208.

To install new early type seat, install new "O" ring (44—Fig. 209) on seat, lubricate bore, seat and "O" ring and install seat by threading puller into seat and driving the seat into housing until it contacts shoulder in bore.

To install new late type seat, thread inner bushing on puller rod, lubricate bushing and bore and drive bushing into bore until seated against shoulder. Tap the "Delrin" seat into place with chamfered seat out (away from inner bushing).

Insert check valve ball, spring seat and spring in bore. Install pilot with new "O" ring, then install retaining plug. With early type hardened steel check valve seat, tighten plug to a torque of 45-55 Ft.-Lbs. On late type "Delrin" seat, tighten plug to a torque of 25-30 Ft.-Lbs. CAUTION: Do not exceed recommended torque value when tightening plug with new type "Delrin" seat.

264. **SYSTEM RELIEF VALVE.** The system relief valve can be removed from front end of lift cover without removing cover from tractor; refer to (46B—Fig. 208). The relief valve is removed as an assembly.

Two different type relief valve assemblies have been used; refer to Fig. 196. Both type valves are adjusted as outlined in paragraph 249.

265. **CYLINDER SAFETY VALVE.** To remove the cylinder safety valve (9—Fig. 211), first remove the lift cover as outlined in paragraph 261. The valve can then be unscrewed from front end of cylinder.

The cylinder safety valve is adjusted at the factory to open at a pressure of 2750-2850 psi. If service is indicated, renew the complete valve assembly. Renew sealing ring (10) when installing valve in cylinder.

266. **DROP CONTROL VALVE (Model "New FSM" Only).** After the lift cylinder has been removed from lift cover as outlined in paragraph 262, the drop control restrictor valve (see Fig. 202) can be withdrawn from bore in front of lift cylinder casting. To remove spindle from lift cover, drive pin from knob and spindle, remove knob and unscrew spindle from inside of lift cover.

Install new "O" ring on restrictor valve, lubricate "O" ring and insert restrictor in bore of cylinder casting. Install new spindle seal in lift cover with lip outward, screw the spindle into cover from inside and install knob and retaining pin.

267. **CONTROL VALVE AND BUSHING.** With the lift cylinder removed as outlined in paragraph 262, proceed as follows: Remove baffle plate (1—Fig. 211) and control valve spring (7) from front end of cylinder casting. Unbolt plate (16) from rear (open) end of cylinder and remove the control valve spool (17) and plate. Using a suitable sleeve, press bushing (8) out towards front (closed) end of cylinder.

Inspect lands on control valve and renew valve spool **and** bushing if erosion or scoring is visible. Note: Late production control valve spools have an annular recess (see Fig. 212) in front land on spool. Early valve spools had a solid land and the change was made to correct valve sticking in raising position under heavy hydraulic loading. Early and late type spools are interchangeable, and the late type spool should be installed with new bushing if sticking of con-

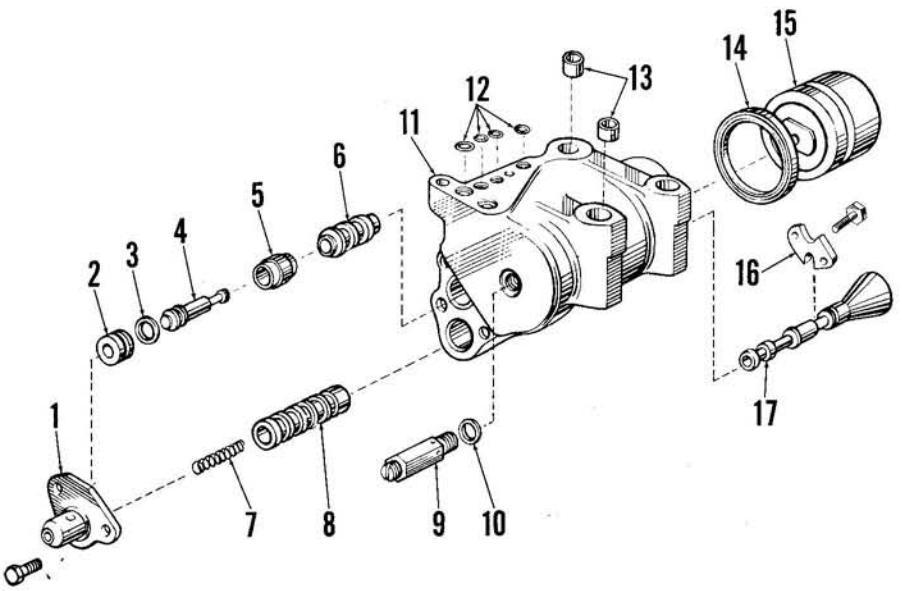


Fig. 211—Exploded view of lift cylinder assembly for model "FSM". Model "New FSM" is similar except for restrictor valve shown in Fig. 202.

1. Baffle
2. Plug
3. Valve "O" ring
4. Unloading valve
5. Front unloading valve bushing
6. Rear unloading valve bushing
7. Valve return spring
8. Control valve bushing
9. Safety valve
10. Seal
11. Lift cylinder
12. "O" rings
13. Hollow dowels
14. Piston seal
15. Piston
16. Retaining plate
17. Control valve spool

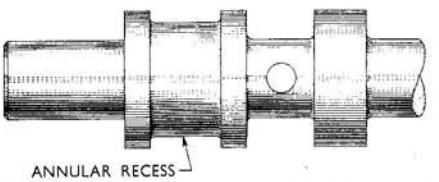


Fig. 212—Latest type control valve spool has annular recess in front land; refer to text.

trol valve with solid land is encountered.

The control valve bushing is available in eight different outside diameter size ranges which are color coded to indicate size. Always renew the bushing with new bushing having same color code. Color codes for each size range are as follows:

Control Valve Bushings

Color Code	Outside Diameter
Blue/White	1.0000-1.0002
White	1.0002-1.0004
Blue	1.0004-1.0006
Yellow	1.0006-1.0008
Green	1.0008-1.0010
Orange	1.0010-1.0012
Green/White	1.0012-1.0014
Red/White	1.0014-1.0016

To install new control valve bushing, insert end opposite that having widest annular recess into front (closed) end of cylinder, then press bushing in until front end of bushing is flush with front machined face of lift cylinder casting.

After bushing is installed, select fit a new control valve spool to bushing. Note: Valve cannot be fitted prior to installing bushing in cylinder casting. Lubricate valve spool and insert spool in normal position. A light drag should be felt as spool is moved within its normal range of travel. Valve spools are color coded for diameter size range as follows:

Control Valve Spools

Color Code	Diameter
White	0.5917-0.5919
Blue	0.5919-0.5921
Yellow	0.5921-0.5923
Green	0.5925-0.5926
Orange	0.5927-0.5928

It should be noted as that the color code indicates a size range only, a valve of one color code (size range) may fit correctly while another valve spool of the same color code may fit too tight or too loose. After installing valve, retaining plate, spring and baffle plate, check to see that spring will return valve quickly when valve is depressed and released; if not, valve is either too tight or foreign material is causing valve to bind.

268. **UNLOADING VALVE AND BUSHING.** After control valve spool has been removed as outlined in paragraph 267, thread an impact puller (slide hammer) adapter into bore plug (2—Fig. 211) and pull plug from front end of cylinder. Insert small rod or screwdriver into rear bushing (6) and push unloading valve out towards front. Remove and discard "O" ring (3) from valve (4). Using suitable sleeve or driver, press both bushings (5 and 6) out towards front end of cylinder.

The unloading valve bushings and bore plug are available in eight different size ranges and each size range is color coded. Always install the same size bushings as were removed from a lift cylinder casting. Usually, the bore plug will not need to be renewed but, in some instances, it may be necessary to fit a larger size bushing if one of the same color code does not fit tightly. Color codes and size ranges for the unloading valve bushings and plug are the same as listed for control valve bushing in paragraph 267.

When installing unloading valve bushings, note that one end of the front bushing (5) has a single notch while opposite end has two notches. End of bushing with single notch must be forward placing end with two notches against rear bushing (6). To install bushings, start front bushing into bore from rear (open) end of lift cylinder with single notched end forward, then press both bushings into place by pressing against rear bushing only. The rear face of rear land on bushing (6) must be flush with machined face of lift cylinder.

Renew the unloading valve if scored, excessively worn or otherwise damaged. Valve is available in one size only. Lubricate valve and insert in bushings without the "O" ring (3). Valve should be a free sliding fit in the bushings. If not, check to be sure that no foreign material is present, that front bushing is concentric with rear bushing and that the valve or bushings are not damaged. With a free sliding fit obtained, install new "O" ring on bushing, lubricate both parts and reinstall valve. The "O" ring should impart a slight drag when moving valve back and forth but should not cause valve to stick or bind. Install another "O" ring if valve moves freely as without "O" ring, or if binding occurs. CAUTION: Never install an "O" ring of unknown quality at this location as any shrinking or swelling of "O" ring will cause malfunction of hydraulic system.

Reinstall unloading valve bore plug with threaded hole in plug out. If plug fits loosely, it should be renewed.

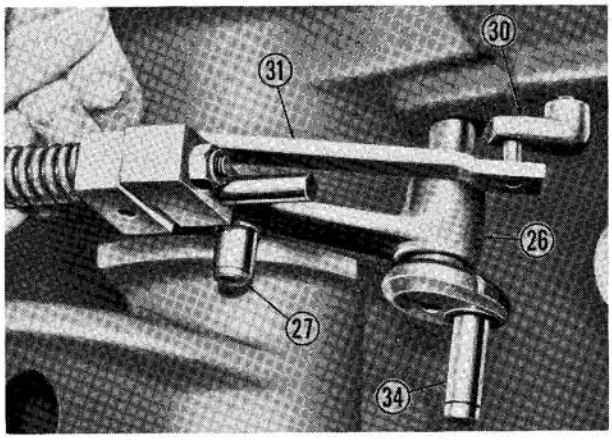


Fig. 213—Removing position control linkage and control lever shaft. Refer to Fig. 210 for legend.

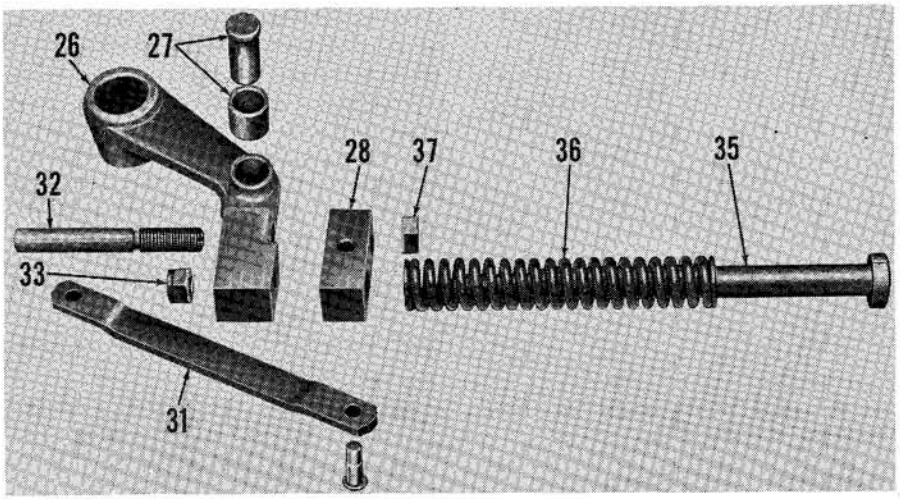


Fig. 214—Exploded view of model "FSM" position control linkage. Refer to Fig. 210 for legend.

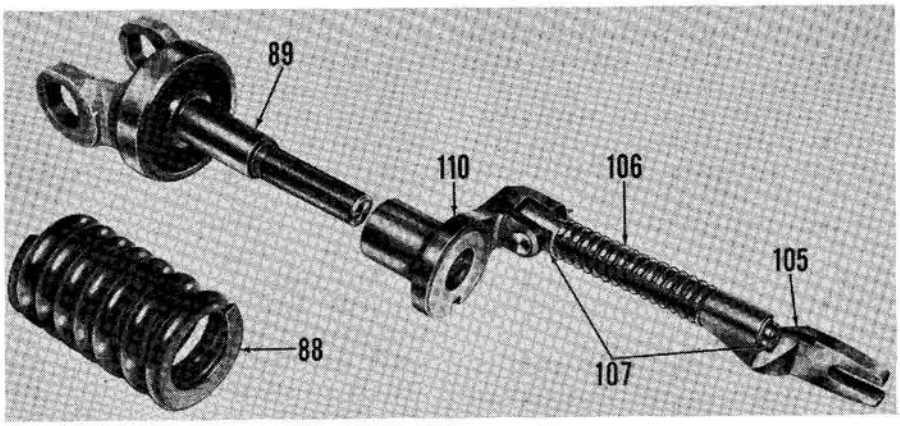


Fig. 215—Exploded view of model "FSM" main control spring and linkage. Refer to Fig. 200 for cross-sectional view of model "New FSM" main control spring assembly. Refer to Fig. 210 for legend.

In some instances, it may be necessary to select a plug one or two size ranges larger than original plug to obtain tight fit.

269. **LIFT CYLINDER PISTON.** After removing lift cylinder as outlined in paragraph 261, remove ram cylinder safety valve and insert rod through opening to push piston from cylinder. Inspect piston and cylinder for scoring, cracks or excessive wear and renew if necessary. Remove sealing ring from piston and install new ring with lip forward (toward closed end of piston). Lubricate piston, ring and cylinder bore and carefully install piston to avoid damaging lip of sealing ring. Reinstall ram cylinder safety valve with new sealing washer.

270. **LIFT ARMS, SHAFT AND BUSHINGS.** The lift arms, shaft and bushing can be removed from lift cover after removing cover and cylinder assembly as outlined in paragraph 261. Refer to Fig. 210 and proceed as follows: Straighten the locking tabs (93) and remove cap screws (94), tabs, spring washers (92) and lift arms (91) from each end of shaft. Then, withdraw shaft with the two bushings (90) and bushing spacer (95) from right (control lever) side of lift cover. Remove the two bushings and bushing spacer from opposite side of lift cover. To remove the ram cylinder arm, first remove control linkage as outlined in paragraph 271 or 272, then lift ram arm (97) and spacer (108) from cover.

To install shaft, be sure ram cylinder arm is properly placed, insert spacer washer (108) at left side of arm and insert lift shaft through cover and arm. Insert bushing, bushing spacer and second bushing into lift cover over shaft at each side. If lift cover has step cut at each side at lift shaft bushing bore, install new "O" rings around shaft and into stepped bore. Install the lift arms, spring washers, lock tabs and cap screws. On models with "O" ring seal, tighten one cap screw, back it out slightly and secure with lock tab. Tighten opposite cap screw to remove all end play from lift shaft, but so that lift arms and shaft can be rotated, and secure cap screw with lock tab. On models without "O" rings, tighten one cap screw fully, back this cap screw out one turn and secure with lock tab. Tighten opposite cap screw securely, back cap screw out, then retighten so that lift arms will just fall of their own weight and secure with lock tab.

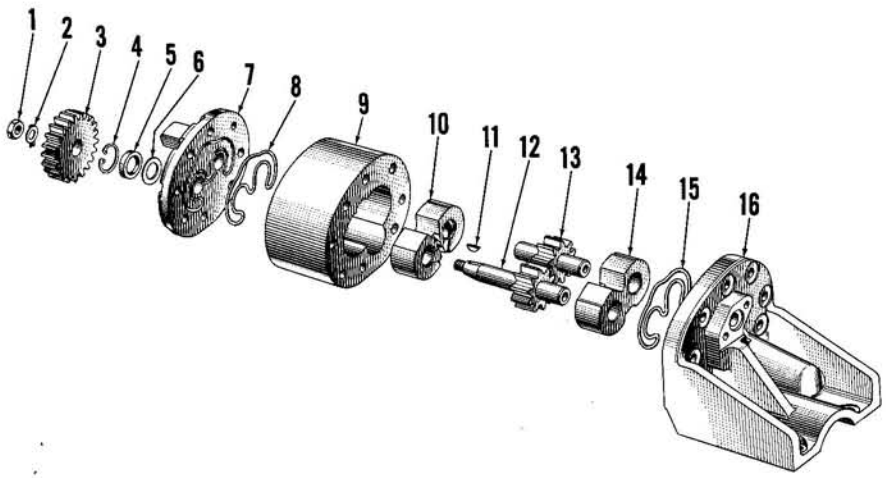


Fig. 216—Exploded view of model "FSM" and "New FSM" hydraulic pump assembly. An adapter kit is required to install this pump in model "FMD" or "FPM" due to different location of pressure outlet.

1. Nut
2. Locking washer
3. Drive gear
4. Snap ring
5. Seal
6. Washer
7. Rear cover
8. Sealing ring
9. Pump body
10. Rear bearing
11. Woodruff key
12. Drive-shaft & gear
13. Driven gear
14. Front bearing
15. Sealing ring
16. Mounting bracket

HYDRAULIC CONTROL LINKAGE

Model "FSM"

271. With the lift cylinder assembly removed as outlined in paragraph 262, proceed as follows: Remove quadrant (22—Fig. 210), then remove self-locking nut, spring (19) and flat washer from control lever shaft (34). Pull control lever (20) from shaft, remove the Woodruff key and friction disc (23), then unbolt and remove quadrant support and tube (25) from lift cover. Remove lift arms and cross shaft as outlined in paragraph 270. Unscrew main draft control spring yoke (89) and remove the spring (88). Slide fork (105) from pin on control valve actuating lever (99) and remove the fork, rod, spring and plunger as a unit (Fig. 215). Remove snap ring (100—Fig. 210) retaining actuating lever to control lever shaft (34) and remove actuating lever and turnbuckle (102). Remove pin from selector lever shaft (30) and remove the position control linkage and control lever shaft as a unit; refer to Fig. 213.

If necessary to perform further disassembly of linkage, refer to Fig. 210 for guide to disassembly and reassembly. After control linkage, lift shaft, lift arms and lift cylinder assembly are reinstalled on lift cover, adjust linkage as outlined in paragraphs 250, 251 and 252.

Model "New FSM"

272. Control linkage for Model "New FSM" is similar to that used on Model "FSM". Procedure as outlined in paragraph 271 for Model "FSM" can be followed for disassembly of linkage; however, refer to Figs. 200 and 203 as guide to reassembly.

After reinstalling linkage, refer to paragraphs 253, 256, 257 and 258 for adjustment procedure.

RETURN LINE, FILTER AND BACK PRESSURE VALVE

Models "FSM" and "New FSM"

273. The return line (115—Fig. 210), complete with filter (120) and back pressure valve (123 through 127) can be removed after removing lift cover and cylinder assembly as outlined in paragraph 261. Unbolt return line bracket, then push return line down far enough to clear lift cover flange of rear axle center housing, then remove unit from tractor.

The return filter will not need to be renewed except at times of major overhaul unless the oil has become contaminated. To renew the filter, unscrew the back pressure valve from lower end of return line, remove the retaining washer, filter and seals and install new filter element and seals.

To disassemble back pressure valve, remove snap ring (127), spring retainer (126), spring (125) and valve (124). The valve body (123) can be unscrewed from lower end of return line. Inspect valve body and valve for scoring, sticking or excessive wear and renew if necessary. Spring should exert a pressure of 2.64 to 2.92 pounds when compressed to a length of 0.74 inch.

HYDRAULIC PUMP

Models "FSM" and "New FSM"

274. **REMOVE AND REINSTALL.** To remove the hydraulic pump, first drain the hydraulic sump (rear axle center housing) and remove the hydraulic lift cover as outlined in paragraph 261. Unbolt the pressure line from pump front cover (mounting bracket), then unbolt and remove the pump from pump pedestal. Note: Pump front cover is secured to mounting bracket with three cap screws and two dowel pins.

When the pump is removed, pedestal cover should be removed from lower side of tractor and the pump suction screen cleaned.

To reinstall hydraulic pump, position the pump on the two dowel pins and securely install the three retaining cap screws. Use a new "O" ring and reconnect pressure tube to pump front cover. Reinstall lift cover as outlined in paragraph 261 and refill hydraulic system as outlined in paragraph 243.

275. **OVERHAUL PUMP.** With the hydraulic pump removed as outlined in paragraph 274, proceed as follows: Straighten the lock tab washer (2—Fig. 216) and remove nut (1), washer and pump gear (3) and extract Woodruff key (11) from shaft. Note: Use of a special gear remover (Nuday tool No. N-6306-B) is recommended to prevent damage to pump cover or other parts when removing gear. Remove the nuts, washers and bolts retaining the pump end covers. Note that the two bolts in line with the bolt holes for pressure line are machined dowel bolts and are identified by a "D" on the bolt head. Remove the covers and discard the sealing "O" type rings (8 and 15). Remove snap ring (4), seal (5) and washer (6) from shaft bore in rear cover (7). Remove the pump gears and bearing blocks as an assembly as shown in Fig. 217, then separate the gears and blocks.

Carefully inspect pump gears, bearing blocks and pump body (9—Fig. 216) for signs of seizure or scoring; light score marking can be removed by careful lapping with "O" grade emery paper and kerosene. Examine body for wear in gear running track; if track is worn deeper than 0.0025 on inlet side of body, renew the body. Run-out across gear face to tooth edge should not exceed 0.001. Face widths of each pair of gears must be within 0.001.

Early production bearing blocks had "run-out slots" (R—Fig. 219) and front bearing block (14—Fig. 216) is different from rear bearing block (10). When assembling early type pump, refer to Fig. 219 for view of rear bearing block; "run-out slots" in front block will be opposite to that shown. On later production pumps, the "run-out slots" have been eliminated and front and rear bearings are alike. Later type bearings can be used as a pair to renew early type front and rear bearings.

The groove for the "O" type sealing rings (8 and 15—Fig. 216) in pump covers (7 and 16) have been changed from that shown, requiring a differently shaped and heavier "O" ring. The early and late type covers are interchangeable providing the correct "O" type sealing rings are used.

To reassemble the pump, refer to Fig. 216 and lay out the component parts as shown. Note: Late type bearing blocks do not have the "run-out slots". Refer also to Fig. 218. Set the pump gears in the rear bearing, then invert front bearing over gear shafts. Be sure the intake side of both bearing blocks (sides with oil slot into bearing bore) are to the same side of the assembly. Insert the assembled bearing blocks and gears into pump body as shown in Fig. 217; refer to Fig. 216 for view of rear face of pump body.

Place washer (6) in drive shaft bore of rear cover (7), then using suitable driver, install new seal (5) with lip forward (to inside of pump). Lubricate the seal and install snap ring (4). Be careful when installing rear cover over drive gear shaft so as not to damage the seal. Install the two dowel bolts (identified with "D" on bolt heads) in holes that are in

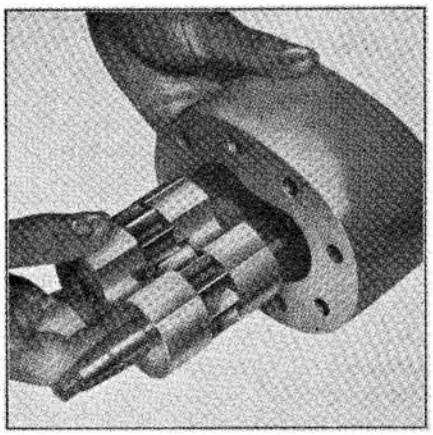


Fig. 217—Remove and install the pump gears and bearings as an assembly as shown.

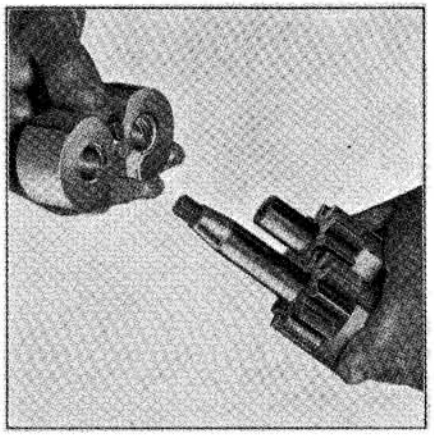


Fig. 218—Assembling rear bearing to pump gear shafts. On later pumps, both bearings are alike.

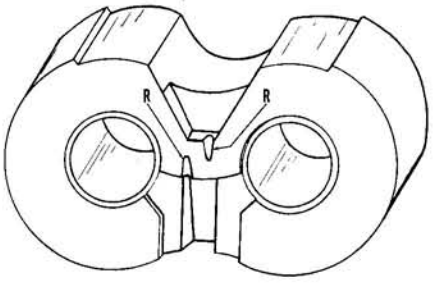


Fig. 219—On early bearings, front and rear bearings differ due to position or run-out slots (R). Rear bearing is shown. Latest bearings do not have the run-out slots and both bearings are alike.

line with pressure line adapter bolt holes. Install remaining cap screws, then evenly tighten all bolts until a final torque of 40-45 Ft.-Lbs. is reached. It is important that this torque specification be strictly adhered to.

Insert Woodruff key in pump drive shaft and install pump drive gear. Note: Drive gear for model "New FSM" has 18 teeth while gear for earlier models has 21 teeth. Tighten the gear retaining nut and secure with lock tab washer.

Pour oil into pump suction opening and turn gear until pump is thoroughly lubricated. Reinstall pump as outlined in paragraph 274.

NOTES

NOTES