Illust. 23. Schematic diagram of engine lubrication system.
H, Super H, & 4 Series
ENGINE LUBRICATION SYSTEM

Description (Illust. 23)

The oil capacity of this engine is 6 quarts.

Pump. The oil pump is attached to the bottom of the crankcase and is driven by a gear on the camshaft. It receives its oil through a screen which floats in order to obtain the cleanest oil.

The pump is of gear type and forces oil under pressure throughout the lubricating system. The pump is equipped with a plunger-type relief valve which bypasses oil back into the pump inlet when the pressure produced by the pump exceeds 60 to 70 pounds.

Circulation. From the pump oil is forced into the "gallery," a rifle-drilled passage extending the full length of the crankcase. Drilled passages leading from the gallery allow oil to be forced to (1) the crankshaft bearings, (2) the camshaft bearings, (3) the oil filter and (4) the operator's oil pressure indicator.

From the three crankshaft bearings oil is forced through drilled passages in the crankshaft to the four connecting rod bearings. Oil escaping from the sides of the connecting rod bearings is thrown up into the cylinders and into the pistons, thereby lubricating cylinder walls and piston pins.

In the center camshaft bearing is a slot. At every revolution of the shaft oil from the passage to the center camshaft bearing is forced through this slot into a drilled passage leading upward to the hollow valve lever shaft. This oil is forced through holes in the hollow shaft to each of the valve lever bushings. From here it passes to channel grooves on top of the valve levers, which supply oil to the valves (exhaust only) and the exhaust and intake valve pushrod sockets. Excess oil returns to the oilpan through the pushrod holes.

In the front camshaft bearing are a drilled hole and a slot. At every revolution of the shaft the drilled hole delivers oil to the camshaft thrust bearing between the camshaft and the camshaft gear. Excess oil supplied to this bearing provides lubrication to the timing gears. The slot in the front camshaft bearing allows oil to be intermittently forced to (1) the idler gear bushing and (2) the governor housing; excess oil from the idler gear bushing also provides additional lubrication to the timing gears.

Oil filter. A part of the oil delivered by the oil pump to the "gallery" is forced into the oil filter from where it returns as clean oil to the crankcase by gravity. The unit is equipped with a filter element which will give 120 hours of service, removing all injurious foreign materials under the most severe operating conditions. A metering hole on the oil filter controls the amount of oil filtered. When an element is left in operation for more than 120 hours it may begin to accumulate excessive amounts of foreign material which restrict the passage of oil and eventually prevent any oil being filtered.

The filter element consists of two large accordion-folded circular sheets of impregnated creped cellulose stitches together at the edges and carried at the center by a metal support. As shown in Illust. 25, oil entering the filter case completely envelops both the inside and outside surfaces of the filter element. The oil is forced through the filtering surfaces, flowing downward between them. Several layers of meshed screening inserted between the filtering material at the bottom of the element serve both to stiffen the element and to permit the proper flow of oil. From the element the oil passes through the drilled metering hole at the bottom of the filter case retaining bar and, finally, to the oil pan.
Oil travels up through the body to an opening between two finished diameters on top of the body, from where it enters drilled passages in the crankcase. Minimum clearance between the top of the body and the drive pinion is 1/32 inches.

The drive pinion is keyed and pinned to the shaft. The idler shaft, press fit in the body, is located 1/32 inches inside the bottom surface of the body. Backlash of gears can be .003 to .006 inches.

Gaskets between the body and cover are .006 inches thick; use these as shims to obtain .003 to .005-inch end play of the drive shaft when assembled. Idler shaft should be concentric with body bore and square with bottom of gear chamber within .001 inch.

The drive and idler gears should have .002-inch clearance between body bore and the O.D. of the gear. Use 1/2-inch-wide .002-inch feeler gage between the body and gear; turn pinion several revolutions when doing so. Drive shaft and gears should turn freely when assembled.

Lubricate the drive pinion when assembling a repaired pump to engine.

The floating oil screen should turn freely in the bottom cover; it takes the cleaner oil from the top of the sump.

Oil pressure relief valve (Illustr. 24). The plunger-type regulating valve is located in the oil pump body. The bottom cover of the pump holds the spring and valve in assembly. The valve spring maintains 60 to 70 pounds pressure. The valve O.D. is .900 - .901 inches and the bore is .905 - .906 inches, or clearance of valve in body is .004 - .006 inches. The pressure regulating spring has 3-19/32 inches free length. The spring should test 38.2 pounds at 2-3/32 inches. Be sure the valve slides freely and the spring does not cock the valve in the bore, seating improperly.
**Specifications**

Type ......................... Pressure system
Pump (all except T-6) ... Single stage, helical gear
Pump (T-6 only) ... Single stage plus auxiliary
Drive ......................... Gear driven from camshaft
Body gears, diameter clearance ... .004 to .006 in.
Body gears, end clearance ....... .003 to .005 in.
Body gears, teeth backlash ... .003 to .006 in.
Oil intake ........................ Floating screen
Pressure regulator valve ........ In pump body
Valve diameter ................ .300 to .301 in.
Valve diameter clearance ...... .004 to .006 in.
Valve spring free length ...... 3-49/64 in.
Test ... 42 lb. when compressed to 2-7/32 in.
Oil pressure at governed speed ... 60 to 70 lb.
Oil filter, replaceable element, "Umbrella" type
Filter material .............. Impregnated cellulose
Replacement interval ............ 120 hours
Crankcase oil capacity (all except T-6) ... 8 qt.
Crankcase oil capacity (T-6 only) ....... 9 qt.

**Description**

The engine lubricating oil is taken from the oil sump through a floating screened intake to the pump. This floating intake takes oil from near the surface of the oil in the pan; thus sediment or dirt which may have accumulated in the bottom of the pan is not picked up to be circulated by the pump. The floating intake is pivoted from the oil pump cover and must be free to move up and down. The oil pump used on the T-6 crawler tractor is provided with an auxiliary set of pump gears, which return oil from the shallow front end of the pan back to the sump, when the tractor is operated at extreme angles.

Pressure in the oil distribution lines, produced by the oil pump, is controlled
by a spring-loaded regulator valve in the pump body. Oil distribution lines leading from the oil pump consist of a drilled passage or gallery in the crankcase to the crankshaft, camshaft and to the oil filter base. A portion of the oil delivered to the filter passes through the filter element and back to the oil pan through a metering opening in the filter retaining bar.

From the crankshaft bearings oil is delivered through drilled passages in the shaft to the connecting rod bearings. Oil thrown from the connecting rod bearings and crankshaft lubricates the piston pins, cylinder walls and valve tappets.

From the camshaft center bearing a drilled passage leads up to the cylinder head, through the head to the valve lever shaft. The flow of oil is metered to the valve lever shaft by a slot in the camshaft journal which allows a small quantity of oil to flow each revolution of the camshaft.

The timing gears, governor and magneto drive shaft are lubricated from the front camshaft bearing, metered by a drilled passage and a slot in the front camshaft journal. Each revolution of the shaft the drilled passage delivers oil to the camshaft thrust plate between the camshaft and camshaft gear. Excess oil supplied to this point provides lubrication to the timing gears. The slot in the camshaft journal allows oil to be intermittently forced to the idler gear shaft and governor housing; excess oil from the idler gear shaft also provides additional lubrication to timing gears. Lubrication of the magneto drive is supplied by oil thrown by the timing gears.

Oil Pump

The oil pump is secured to the crankcase by two 7/16 inch cap screws and lock washers, and is driven from a spiral gear which is a part of the camshaft. The oil pump drive shaft extends down from the spiral driven pinion through the oil pump body to the base which incloses the two oil pump body gears, one of which is keyed to the drive shaft; the second body gear is an idler (see illust. 23A). Gaskets are used between the pump body and pump cover to secure the proper end clearance of the body gears.

The oil pump used in the engine of the T-6 crawler tractor is similar to the above description, with the addition of an auxiliary set of pump gears and housing which is assembled between the main pump body and the pump cover. The drive shaft and idler shaft are longer, extending through the auxiliary gears. Oil taken through the main floating screen passes up a tube directly to the main pump gears, and into the distribution lines. Oil taken through the auxiliary intake tube is delivered by the auxiliary gears to the pump cover, up through the hollow idler shaft and discharged through an opening in the body above the idler shaft. In this manner oil picked up at the front of the oil pan, when operating at extreme angles, is returned to the sump to insure a constant supply of oil to the engine.

To disassemble the oil pump, remove the cover from the pump body and thoroughly clean all parts. Inspect the idler shaft and gears and drive shaft and gears, for wear. Check the running clearance between the gear diameters and the body, also the end clearance between the gears and body cover. Gaskets are used between the body and cover to adjust this end clearance. In the T-6 crawler tractor, pump gaskets are provided be-
at 1450 r.p.m. This piston-type valve and its spring may also be inspected after removing the pump body cover (and auxiliary housing on T-6). The valve should slide freely in the body bore, and the spring should be straight so that the valve will not be cocked in the body bore or on its seat.

The free length of the pressure regulating valve spring will give some indication of its condition, however the best test to determine the spring tension is to load it with the weight specified and measure its length at that load. If this tension length test is under specifications, the spring should be replaced.

Oil Filter

The oil filter element is a "Puralator" renewable umbrella-type giving a large filtering area. The element consists of two large accordion-folded circular sheets of impregnated creped cellulose stitched together at the edges and mounted at the center on a metal support. As shown in Illust. 24A, oil entering the filter case completely envelops both inside and outside surfaces of the filter element. The oil is forced through the filtering sheets, flowing downward between them. A layer of meshed screen inserted between the filter sheets at the bottom of the element serves both to stiffen the element and to assist the flow of cleaned oil. From the outlets in the metal support, cleaned oil passes through the metering hole in the filter retaining bar and finally to the oil pan. A new element should be installed at each change of engine oil. The filter case is sealed against leakage by a copper gasket at the top on the retaining bar, and a composition gasket is inlaid in the base at the bottom of the case. A gasket is also found between the filter base and crankcase.

Crankcase Breather

The crankcase breather is incorporated in the push rod chamber side plate. An important part of the breather is a wire gauze filter element which prevents the entry of dust. This element should be cleaned or replaced at each engine tune-up. If the breather becomes clogged from neglect, leakage may occur at the crankshaft oil seals because of pressure built up in the crankcase.
66A. The gear type oil pump, which
is gear driven from a pinion on the
camshaft, is accessible for removal
after removing the engine oil pan.
Disassembly and overhaul of the pump
is evident after an examination of the
unit and reference to Fig. IH620

Gaskets between pump cover
and body can be varied to obtain the
recommended body gear end play.
Check the pump parts against the
values which follow:
Diametral clearance of gears in pump
body:
Series 300-300U-
350-350U ............... 0.005 - 0.008
Series 400-W400-
450-W450 ............... 0.004 - 0.006
Series 400D-W400D-
450D-W450D ............... 0.006-0.0075
Body gears end play .......... 0.003 - 0.006
Body gear backlash .......... 0.003 - 0.006

OIL PRESSURE RELIEF VALVE
Series 300-300U-350-350U-
400-400D-W400-W400D-
450-450D-W450-W450D

67. On all models, the spring loaded
plunger type oil pressure relief valve
is non-adjustable.

On diesel models, the valve is lo-
cated in the oil filter base as shown
in Fig. IH622. On non-diesel models,
the valve is contained in the oil pump
body as shown in Fig. IH620. Check
oil pressure and relief valve against
the values which follow:
Oil pressure - psi:
Non-diesels .................. 60-70
Diesels ...................... 38-46
Relief valve diameter .... 0.300-0.301
Relief valve clearance
in bore ................. 0.004-0.006
Relief valve spring test data:
Non-diesels .......... 42 lbs. @ 2 3/4 inches
Diesels ........... 27 lbs. @ 2 3/4 inches

Fig. IH620—Exploded view of oil pump
used on non-Diesel engines. Body gear end
play is controlled by the number of gaskets
(5). On some late models, shaft (12) is
carried in renewable bushings.

1. Pump body
2. Follower gear
3. Pressure relief
valve
4. Relief valve spring
5. Cover gaskets
6. Pump cover
7. Woodruff key
8. Woodruff key
9. Woodruff key
10. Pin
11. Driver gear
12. Drive shaft
13. Pin
14. Driven gear