Appendix 14 -- Engine Lubrication System

Oil is forced under pressure through the oil filter by a pump. Filtered oil is then forced through oil lines to the main bearings, and through drilled leads in the crankshaft to connecting rod bearings. The overflow of oil, which is forced out around connecting rod bearings, is caught by the revolving crankshaft and thrown to cylinder walls, bathing governor gears, camshaft, and other parts in the crankcase in oil. Oil is pumped to the tappet case to lubricate and cool valve stems, rocker arms and tappets. And an oil pressure gauge providing the real time reading is in plain view for the operator (from the John Deere Model "H" Restoration Guide, Chapter 3).

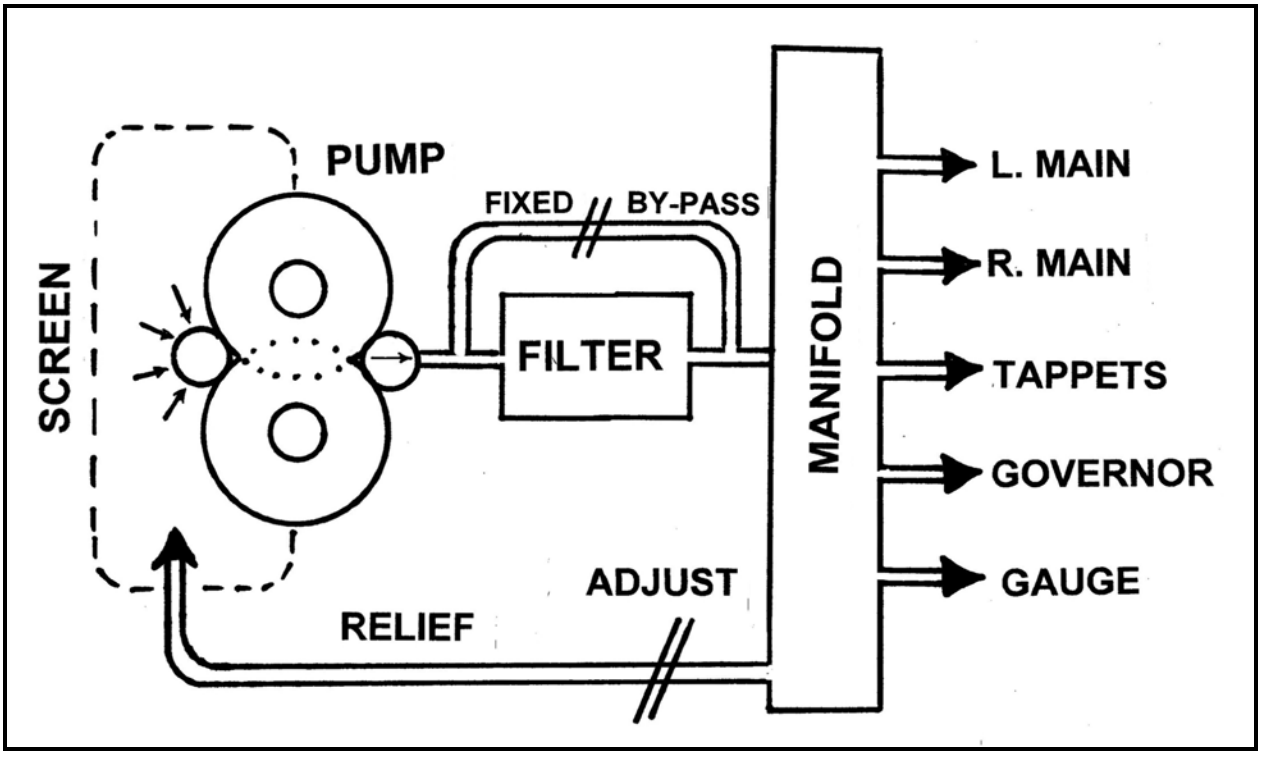

Figure 14-1, Schematic Diagram of Engine Oiling

John Deere two-cylinder tractors will employ a system similar to the schematic. The pump consists of a gear pair that simply and positively "grabs oil" and full-forces that oil through the filter and on to various destinations. Above we have the Model "H" schematic, others will be similar in principle, differing in design (leaf springs, spring-loaded plungers, etc.). Oil pressure is user-adjustable, the adjustment method varies among models, but the concept is the same. Without regulation, the amount of oil being pumped will vary with temperature and oil viscosity. At initial start-up when more oil is being pumped, excess oil is returned to the pump inlet section (Relief). This regulating scheme is a function of a relief spring held against a port of the manifold (Adjustment) under tension of another spring and adjustment screw. The end result is to be an oil pressure reading within a well-defined range of from 10 to 15 PSI (between M and H on the gauge). The pump is situated at the bottom of the crankcase. Oil drawn into the pump is screened, and oil pumped out to distant points of the engine returns to the crankcase. Note also an avenue for oil to bypass the filter. There is found another spring-tensioned gate, a "safety" in event the oil filter becomes totally blocked – allowing unfiltered oil to be pumped throughout the engine.

Figure 14-2 is a peek down into a JD-H crankcase, oil pump & pipes installed, but no crankshaft. Take note of the oil filter body and oil filter body head – nice and square in appearance.

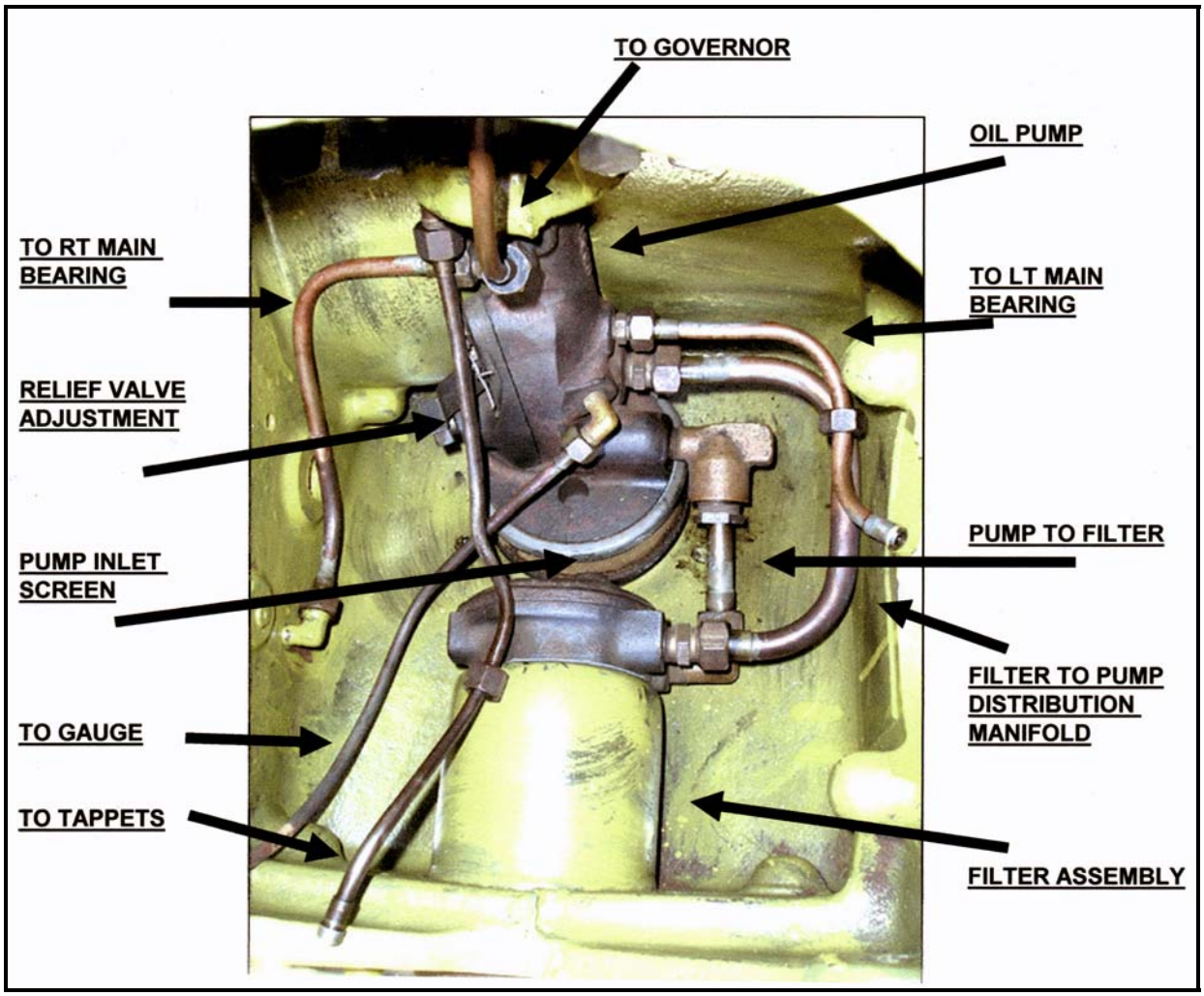

Figure 14-2. Oil Pump with Pipes

Pressure Regulation – Figure 14-3A illustrates the regulating part of the engine lubricating system. The adjust screw, when turned INWARD (CW) will exert pressure on the thin-looking relief spring by means of (unseen) a small coil spring – to increase oil pressure. The relief spring is pressed up against the sixth port of the manifold. Only when pressure exceeds a preset amount will the relief spring be pushed back to allow Relief oil (Fig 14-1) to return to the pump's input side.

For nearly all two-cylinder John Deere tractors, the oil pressure specification of from 10 to 15 PSI (between M & H) – this regardless of engine temperature or speed; even at slow idle! At least 10 PSI to ensure oil reaches intended destinations. And oil pressure shouldn't exceed 15 PSI because where pressure is too high, excessive amounts of oil are pumped, and this "excess oil" can cause an engine to use oil – the rings cannot scrape the excess oil away fast enough!

Figure 14-3A. John Deere "H" Oil Pressure Regulator Subassembly Unit
Figure 14-3B. The "Author's Choice" – Oil for Two-Cylinders Tractors

Engine Oil – Many ask what oil is best suited for the John Deere Model "H" and similar vintage two-cylinder tractors. At this writing, Figure 14-3B represents the "author's choice".

Pressure Regulation -- The Details -- In Figures 14-4 (A&B), you see illustrated the detail of the relief spring, of the small pilot or "pip" as some tend to call it, the coil spring and also the adjustment screw. For some models, this adjustment can be accessed from outside the main case – usually by removal of a pipe plug. For some models, this adjustment is accessible only by removing the crankcase cover. In any case, instructions will generally tell one to stop the engine before making any such adjustment. You should consult your tractor's service manual before adjusting.

Fig 14-4 (A&B), Relief Spring Set; flat relief spring with pilot, coil spring and adjustment screw

A System of Interacting Pressures -- Looking back at the schematic on page 1 for a moment, many factors come into play when setting oil pressure. Each of the manifold outputs is designed for certain volume, and the individual calculated circuit resistances come into play to determine overall resistance to oil flow. This is much like having four or five hoses connected to one hose bib on the side of the house – if one bursts, all will lose pressure. If one is plugged up, the pressure increases for the rest. This system is much the same. So if an output is clogged, like the governor line on a "B" tractor for instance, pressure will rise. If your tractor has worn out main bearings allowing much of the oil to slide back into the crankcase prematurely, pressure will be lower. The bottom line here is that any rather sudden rise or fall in oil pressure should be taken as a signal that your engine's oiling system needs attention.

If You Have No History with The Tractor – A high or a low oil pressure reading will not tell you much. In this case, you must methodically test each engine oiling section to determine the cause for the "out-of-spec" reading, and take remedial action in order to protect the engine.

Fixed By-Pass for the Oil Filter -- As visualized in figure 14-1, and briefly stated in the paragraph below figure 14-1, The oil filter head contains a "spring-tensioned gate" relief valve. Figure 14-5A illustrates the spring contained in the cap section. In figure 14-5B, we see the leaf spring with its pilot; the valve port being just below the pilot. This valve operates under a fixed tension, and is designed to permit the system to continue to oil the engine long after the oil filter has become clogged. When this happens, of course, unfiltered oil is lubricating the engine.

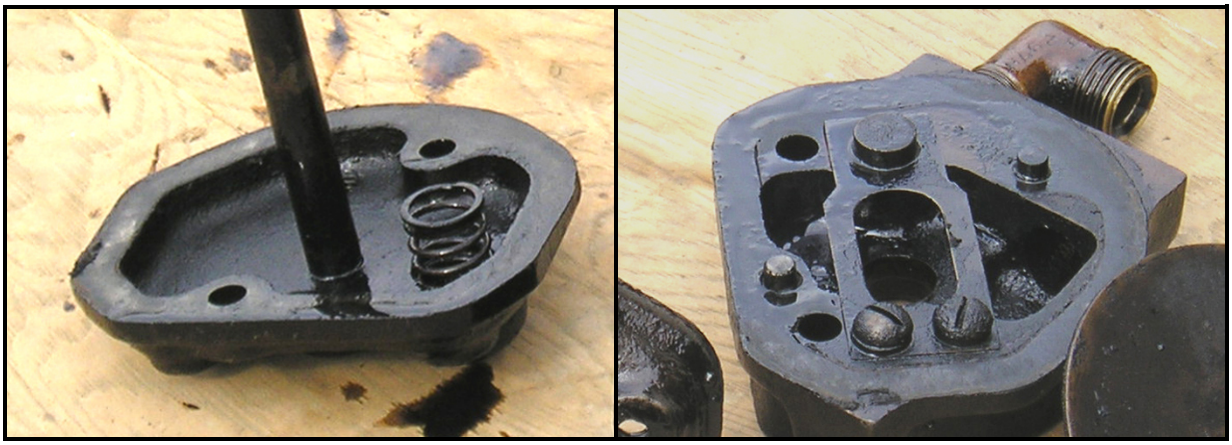

Figure 14-5 (A&B). Oil Filter Head, spring on left, relief spring & valve on right

Crushed Filter Body – Figure 14-6 -- Note the cave-in of the canister at the canister/filter head interface. This distortion, the drawing of the filter head too tightly into the filter body, was the result of applying excessive torque to the oil filter cap screw. Why? Men will apply added torque in attempts to stop oil leaking around the cap. The issue, however, is usually a hardened A519R filter cover gasket.

This tractor lost all oil pressure – because pumped oil escaped back into the crankcase without reaching the manifold, leaking out between filter body and filter head! The one single remedy is to renew the oil filter body (the canister); no easy task and special tooling is required! Consult your tractor's Service Manual. The lesson to be learned here is to renew the A519R oil filter cover gasket at least once per season. The most sound practice would be to renew this gasket with each oil filter change.

Fig 14-6. This oil filter body was removed from H-47511.

Finally, a peek down into the crankcase with the crankshaft installed reveals very limited access to the oil pump and its lines with only the C/C cover removed. The lesson here is to remove, and clean/overhaul both the oil pump and filter head assemblies when the crankcase is empty.

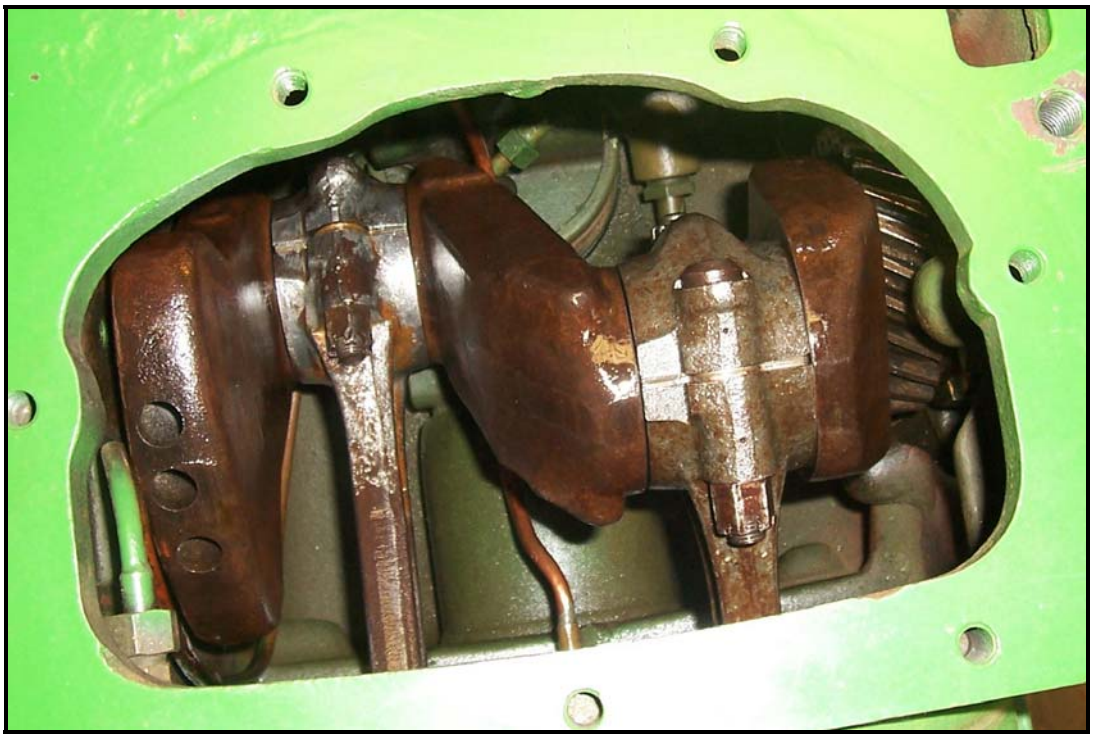

Fig. 14-7. Crankcase cover removed

Stories and Tales – I close with this section in the words of others. From the annals of data I have viewed, I recite what I and others have found or have heard of relating to either low oil pressure or none at all for Model "H" tractors. Some are told by "victims of the experimentation of others"; before they realized they were victims! In your travels, continue to be aware that five, six, or even seven decades have passed since your tractor was built. This leaves the machine subject to the wiles of many so-called "brave" folks more than willing to tear into one of these gems with nothing but "guts" to guide them. I caution that if one is spending the usually thousands dollars for a tractor, another $50 or $100 is a small price to pay for guidance!

1. I found the oil pressure sense line plugged and nearly blocked with sludge.

2. The gauge was not working when I pressure-tested it. One has to wonder how long it was like that.

2. Pump intake screen was nearly plugged with sludge.

3. The pilot (item # 39, PC304, page 3) became unattached to the relief spring (# 38) and was laying beside the H312R spring. This is equivalent to having the by-pass gate open all the time!

4. New pump gasket (item # 28, PC304, page 3) was homemade – too thick – allowing oil to "slip around" the pump gears.

5. The oil filter outlet (item # 11, PC304, page 4) was missing. (A finding, but would not cause loss of oil pressure).

6. The rod-to-crankpin clearance was about 0.010 instead of the specified 0.001 – 0.003.

7. The left-side main bearing found with 0.010 clearance instead of the specified 0.002 - .0004.

8. One of the oil pipe fittings was loose; the nut had completely backed off and slid to the other end of the line. Once reconnected and tightened, pressure was restored.

9. I drained the crankcase and found an abundant amount of small seeds, somehow carried into the crankcase by some animal, blocking the pump's intake screen.

10. Found the oil filter body distorted – a result of applying far too much torque to the filter cover nut to stop oil leak.

11. The <u>hypothetical causes</u> for poor oil pressure include a distorted or broken relief spring (38), missing pilot (39), or a broken spring (40). (See item numbers for PC304, page 3). A final such event would be that the adjust screw was backed all the way out and has fallen from position so that it cannot be restarted from outside the case.

12. For the JD-H, one person tended to suggest that the oil pressure regulating screw may be adjusted while the engine is running. I rather imagine that fellow would be in for a shock as he stuck his long flat bladed screwdriver in only to have the crankshaft mangle the stuffing out of it! ++++