## Tractor oil pump reliability improvements

Text and Graphics by Steve "Drippy" Yott

In the past several years numerous tractor motors have been disassembled or rebuilt at the Silver Lake Triumph Centre. With each example time has been spent looking at areas of excessive wear and the causes of part failure etc. One area of major concern lately is with the oil pump and especially failure of the spindle shaft.

The oil pump used in this engine is known as a "G" rotor design and is a common arrangement for older design engines. The pump is a simple unit containing basically three parts which are the pump body, the outer rotor and inner rotor or spindle. The inner spindle rotor has 4 vanes which rotate on the outer rotor which has 5 internal vanes. The odd vane in the outer rotor during rotation is either in a suction mode where it is pulling oil from the sump or in the pressure position where it is forcing oil under pressure into the oil galleys.

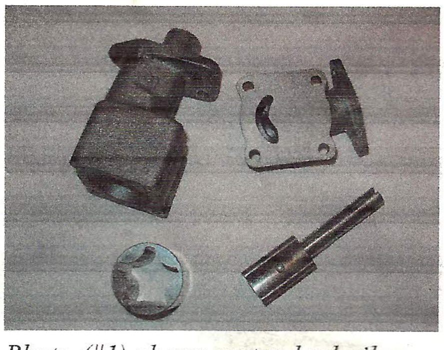


*Photo (#1) shows a standard oil pump disassembled as a reference.*

The dimensional tolerances of the internal parts are very tight usually in the .004 to .010 area for the various parts. The main area of concern observed as of late is the wear pattern of the spindle shaft in the pump body. One would think that a steel shaft running in a cast iron pump body would cause wear in the cast iron but further discussions with a few machinists have helped me understand that cast iron contains a lot of carbon which is very abrasive and will cause the steel shaft to wear under most circumstances. In nearly every pump disassembled wear is appearing on the lower bearing surface of the spindle shaft just above the rotor area. I have measured this wear from .005" to .030". In the more extremely worn pumps you can see where the inner rotor has actually worn into the pump end plate because of the tilting of the shaft within the pump body. In the worst catastrophic cases pump failure has occurred because the spindle has bound within the outer rotor and the drive tangs have broken off the spindle.

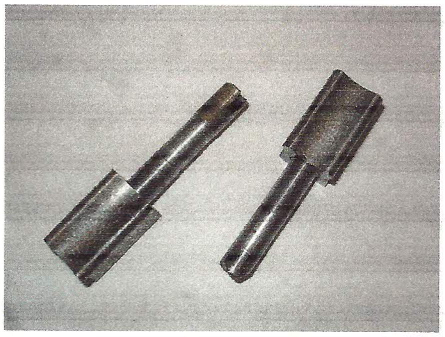


*Photo (#2) shows a typically worn shaft and also a shaft with severed drive tangs caused by this excessive wear.*

This is becoming a frequent problem recently and I think we are seeing this because of the poor quality of pump repair kits coming from the parts suppliers. The pump parts in these kits are not hardened and prone to severe wear in 20-30k miles. The racing community has also seen a large number of pump failures which has a very costly outcome! The race community has also seen failures with inner rotor separation from the spindle shaft. This is a two piece design where the rotor is pressed and pinned onto the shaft.

I have been working with a machine shop owned by two brothers who repair and rebuild one off and rare aircraft engines and parts. They also manufacture high tolerance surgical instruments which makes this a very knowledgeable and diverse shop! We have spent a number of hours looking over this pump design and the failure mode of the parts. Initially I went to them looking for a stronger, harder shaft but their analysis has ended up creating a whole new design which solves a number of issues as you will see.

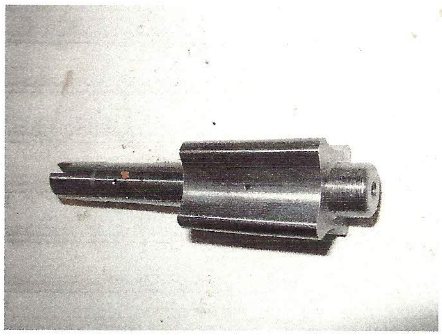


*Photo (#3) is of the newly designed one piece spindle/rotor assembly. Notice that this part has a stub shaft on the previously unsupported end of the spindle.*

The thinking here is that we are seeing excessive wear at the bearing surface just above the rotor because the internal pressures created in the pump are forcing the spindle to the case sides. This new spindle being supported by three bearing surfaces is a far better design and will not be able to exert sideways pressures as the original. In order to facilitate this new stub shaft the pump body end plate must be centrally located and pinned. It is then surfaced and bored to support the new shaft stub. There is plenty of material in the end plate to support this design. The end plate now being pinned makes it a unique part which is now associated with that pump body only and cannot be mixed as it could have been before. The new spindle/rotor is made in one piece and machined on a

CNC mill. This eliminates the potential of rotor/shaft separation! The new part is also "gun" drilled and oiling holes are drilled into the rotor and bearing surface areas. The principle here is that oil in the rotor area is under pressure and forced into the central oil channel of the spindle. This pressurized oil then exits through the holes in the end of the shaft into the bored hole in the end plate and also through the hole between the upper bearing surfaces of the spindle to pump body. In theory this design will prevent metal to metal contact during operation and solves all of the known problems we are experiencing.

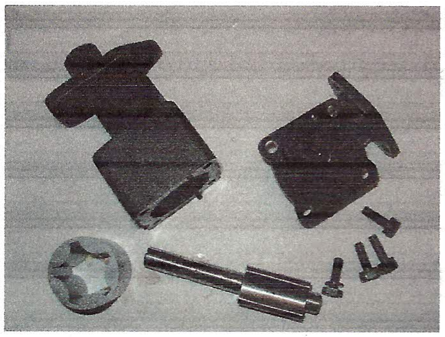


*Photo (#4) shows all of the parts of the new design ready for assembly; notice the pins in the pump body and locating holes in the end plate and also the pressure holes in the new spindle assembly.*

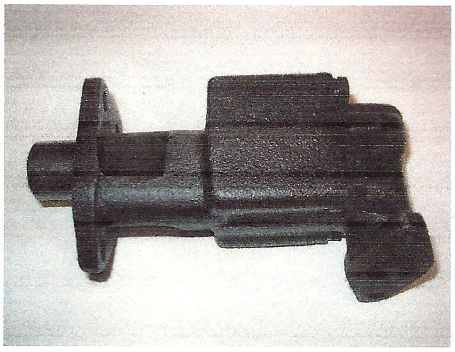
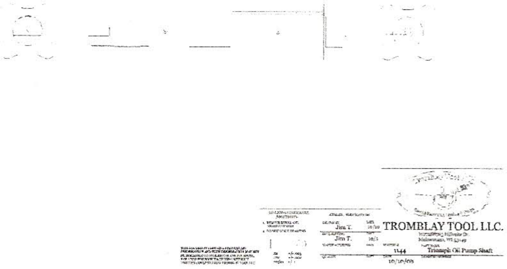


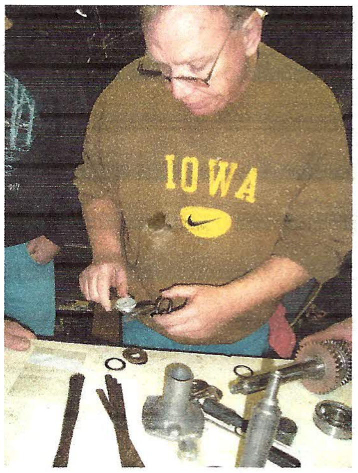
*Photo (#5) is of the completed new oil pump.*

*Drawing (#6), above left, is the technical drawing of the new spindle/rotor assembly from the CAD system.*




Ten of these new pumps were machined and assembled. We have two in operating vehicles at this time and the others are planned to be installed for the next driving season this spring. One pump has been sent to another engine builder /retailer for testing and another will be sent to a highly respected member of the racing community for analysis. At this time the cost of machining is high because of the nature of the parts and small quantities. To machine the parts and build a pump is in the area of $225.00 with a usable exchange pump. Without an exchange pump an outright pump would be in the area of $350.00.

More information will be available as testing continues and manufacturing capabilities are worked out. In the meantime please contact me for comments and ideas.

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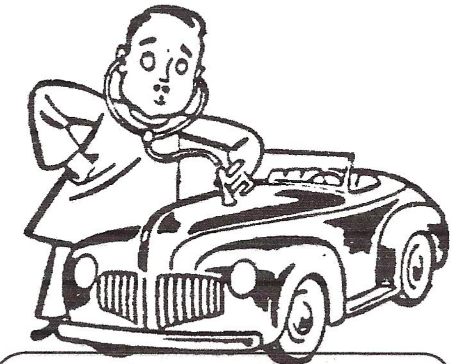

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