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MiscRes: Magazine Articles

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Not all mods stated will be/can be performed together.
The article is simply offering several ways of acheiving the same goal.

Mini Sump Your Sportster parts 1 & 2

MINI-SUMP YOUR SPORTSTER

PART 1

A detailed look at the 1977 Sportster oiling system and how it can apply to your older model

By Bud Wiser

The Sportster oiling system has undergone an almost total redesign on the 1977 models. The timed dry sump system had been virtually unaltered since it was first used on the 1952 K-model. Actually, in many respects, the same system first saw service in 1938 on the "four-five," and a very similar system was in use on the 1937 UL.

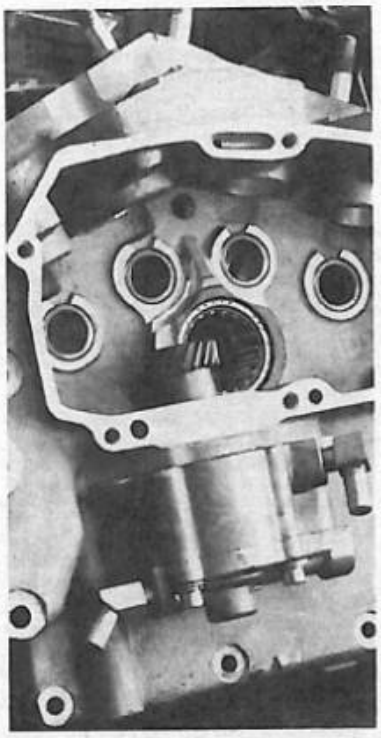
The old oiling system worked fine when it was timed correctly. So, why tamper with success? There are several reasons and all of them amount to more simplification and sophistication. But the change was prompted by a modification to the shift mechanism. How does a change in the transmission affect the engine's oiling system? We'll get into that as well as a full description of the mini-sump, followed by a discussion about how to update a pre-1977 Sportster, right now.

Rationale

In order to comply with Federal regulations regarding uniformity of controls, the 1975 Sportster's footshift was relocated to the left side. Only two weeks elapsed between the decision to switch sides and production. That's not a lot of time to go through all of the designing and tooling changes.

Unfortunately, the new shift mechanism reflected the rush nature of the changeover. The factory and the buying public had to live with the contraption until this year, when a well designed and smooth shifting mechanism could finally be produced.

The new design called for a transverse cross shaft running between the



engine and transmission sections. It had to be located almost smack-dab through the crankcase breather duct.

That presented a real problem, since the volume of the duct would not be adequate if it had to share space with the cross shaft. The factory engineers had been toying with the idea of the mini-sump for some time anyway, and now they became serious about it.

At times, the pre-1977 Sportster engine has been known to "wet-sump." That is, under certain conditions, notably after hard acceleration, oil scavenging was not sufficient to prevent an excess accumulation of oil to remain in the crankcase and cam case. I have seen this occur repeatedly at the drag strip. If nothing else the accumulated oil causes additional inertial drag on the lower-end parts, reducing power.

Another drawback to the early dry-sump system was that the engine had to be removed from the frame and partially disassembled if the oil pump required servicing. The cam cover was necessarily removed in order to facilitate re-timing the breather. It was a time consuming ordeal as any Sportster mechanic knows.

Priming the old pump after removal was sometimes another lengthy ordeal. Racing engines are equipped with a special "quarter-speed" pump, because oil cavitation is a likelihood at high rpm's with the old gear pump. By slowing down the gears' rotational speed with the ¼ speed pump, cavitation became a remote possibility. Trouble is, at low engine speeds, the racing pump moves only half the volume of oil the standard engine design calls for. Fortunately it is usually sufficient.

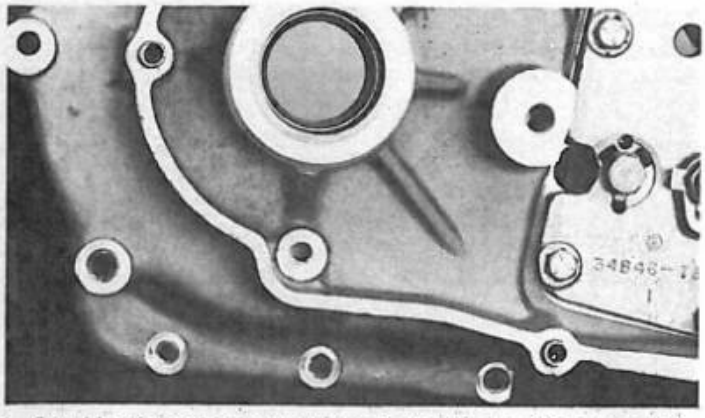
Another factor to consider was that for correct breather timing, only a small amount of inaccuracy could exist. Such accuracy was not easily maintained in a mass produced engine. Some engines, of course, were within timing tolerance, but many more were not. Since a slight loss in horsepower output was the only detrimental factor, no special attention was paid to this detail by the factory. The racing department's instruction booklets included instructions detailing methods of correcting the breather timing, but the general public remained largely oblivious of the fact.

The engineers saw the time was ripe to convert to the mini-sump system and while they were at it, they would make certain modifications which would permit oil pump removal without the usual accompanying hassle.

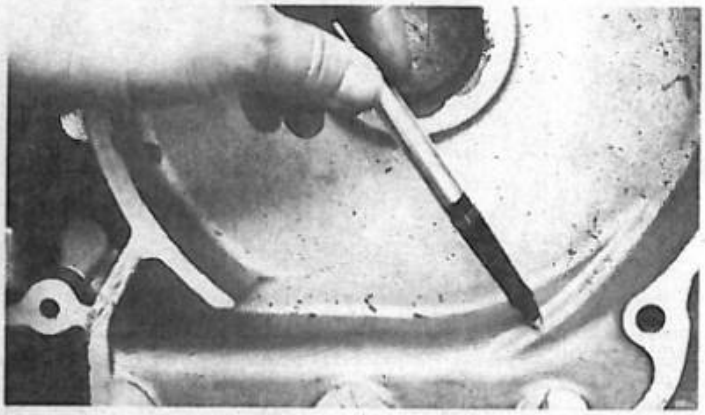
The Mini-Sump

Most of the factory mini-sump alterations are accomplished with crankcase casting modifications.

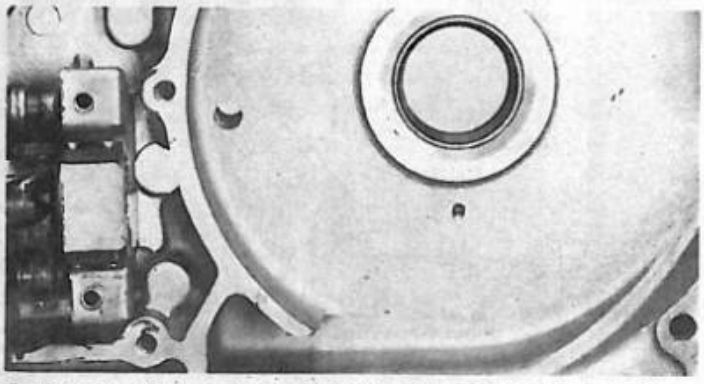
The engine oil is now isolated from the primary case/transmission (which share their own segregated splash oil system) by eliminating the transfer valve, previously located in the primary case wall (Fig. 1). The transmis-



1. Outside view of left crankcase half reveals mini-sump and absence of transfer valve. Cast boss, adjacent to transmission trap door is a foot peg mount, also new for 1977.



2. Inside view of left crankcase half. Pen points to a cast-in deflector, designed to reduce oil cling on outer sides of the flywheels. Notice the baffled rear section of the mini-sump.



3. The gear shift cross-shaft passes through the large hole located between the rear of the crankcase and the shifting pawl carrier. Interference with the crankcase breather duct prompted the mini-sump change.

sion is now vented to the atmosphere via the installation of a breather screw, similar to that used on a 74 transmission.

The scraper lip and breather duct are likewise eliminated. Prior to the mini-sump, engine oil was diverted from the flywheel edges aided by the scraper, through the breather and to the oil pump scavenge element for return to the oil tank. Now, oil is slung into the mini-sump, which is provided with a galley, connected directly to the oil pump. Scraper induced oil-drag is automatically eliminated.

Tests which involved an operational engine fitted with clear plastic windows in the crankcases, clearly indicated, at high rpm's, that oil clinging to the sides of the flywheels constituted a problem. A hydraulic condition exerted considerable pressure in both sideways directions. To alleviate the condition, angling deflectors are cast into the forward (leading edge) of the mini-sump. The deflectors are effectively designed to concentrate oil-cling toward the opening between flywheels, where there is ample room and therefore not conducive to a hydraulic action (Fig. 2).

In the process of case redesign, a baffle was formed in the rearward section of the mini-sump. The leading edge of the baffle may contribute to more efficient oil-cling removal from the flywheel edges. Certainly centrifugal force must be capable of nearly total oil transfer, so the baffle's role may be negligible. The baffle does provide a box-like trap for rearward rushing oil, still in the mini-sump, when the bike is accelerated. The trap prevents the oil from sloshing back into the crankcase.

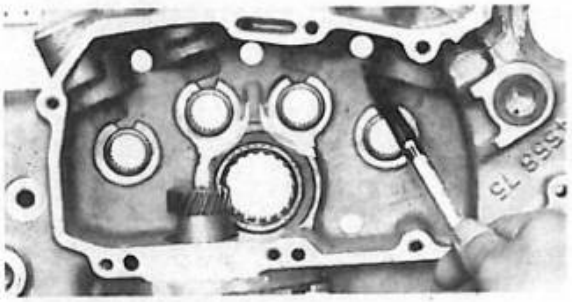
Rerouting the oil in this manner meant providing a new source of lubrication for the cams, since the cam case was now completely by-passed. This proved to be simple. Three vent holes, about 7/16 inches in diameter are provided in the cam case wall, plus an identical hole lower down, which acts as a drain for oil collecting in the cam case (Figs. 4 and 5). The cam case is lubricated by an oil mist, passing through the vent holes. This lubrication method has proved to be quite efficient.

The heart of the system is an all new gerator oil pump, and the cases were further modified in order to adapt it. It makes use of eccentric rotors (Fig. 8), rather than gears as found in the early pump. The rotor equipped pump replaces the gear pump mainly because of its greater life expectancy. Its capacity and operating pressure remains essentially identical to the gear pump it replaces.

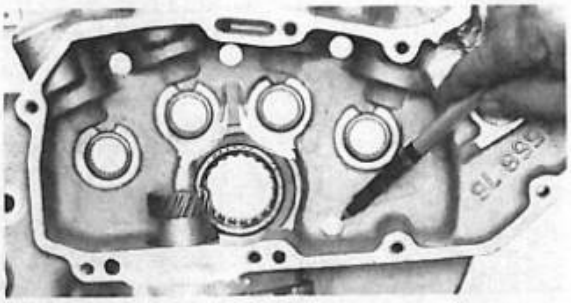
When the oil is warmed to operating temperature the new pump delivers it at three to six psi at idle, and about eight to twelve psi at 60 mph, just the same as the gear pump.

The gerator pump incorporates both supply and return elements, as did the Sportster and K-model gear pumps, but it does not include the rotary sleeve-valve found on earlier models. The valve was a timing device, necessary for the old oiling system, but now obsolete.

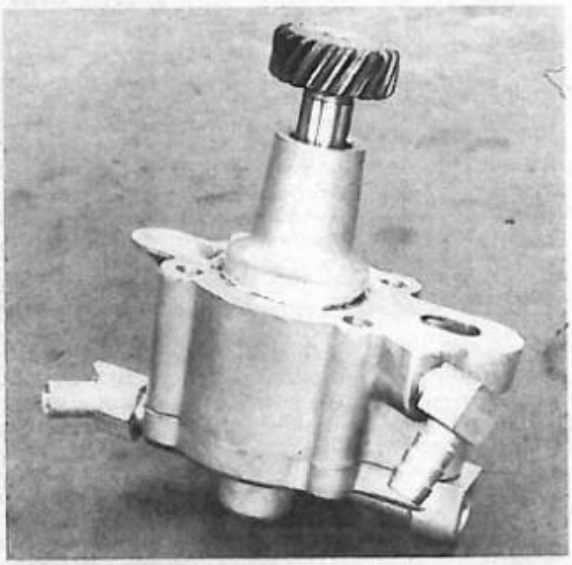
As is to be expected, the return, or scavenging rotor set is larger than the supply rotors. In this case though, the



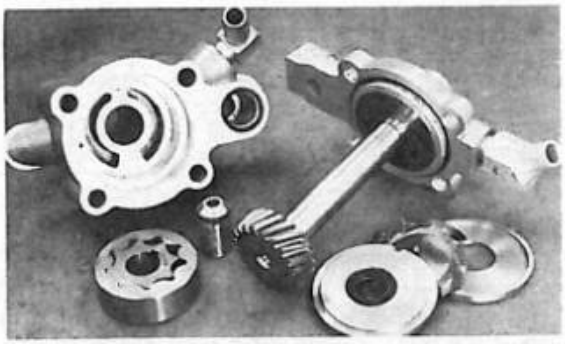
4. Three vent holes (one is indicated by the pen) permit an oil mist to lubricate the cams and gears in the cam case.



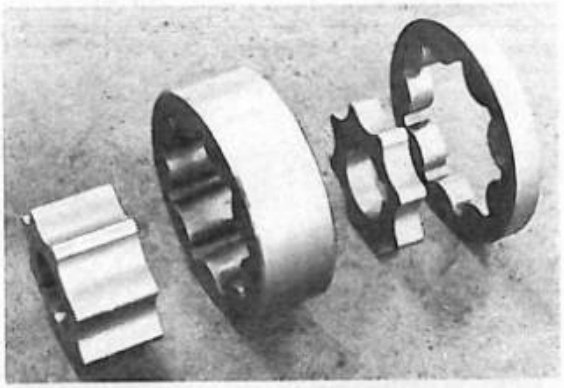
5. A fourth hole drains puddled oil back into the crankcase and down to the mini-sump.



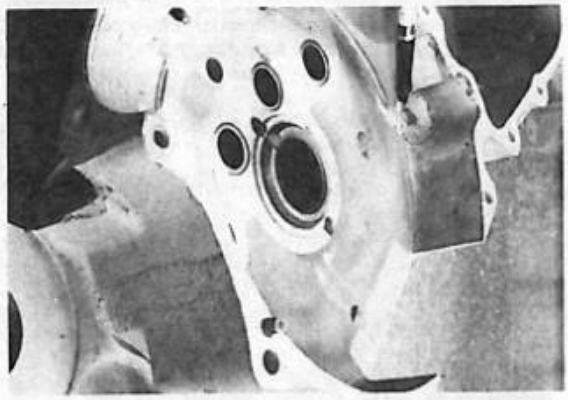
6. The all new gerator oil pump requires no timed rotary sleeve-valve (a feature incorporated on early pumps) with the mini-sump system.



7. Components of the pump reveal that it is a well built precision assembly. It was designed to outlive the early gear pump.



8. Inner and outer rotor sets for the new gerator oil pump. Return oil is scavenged by the fat rotors (left) with a capacity factor of 5:1 over supply rotors (right).



10. This right crankcase half was modified at the Harley factory during prototype development. The pen points to a weld plugging the breather duct.

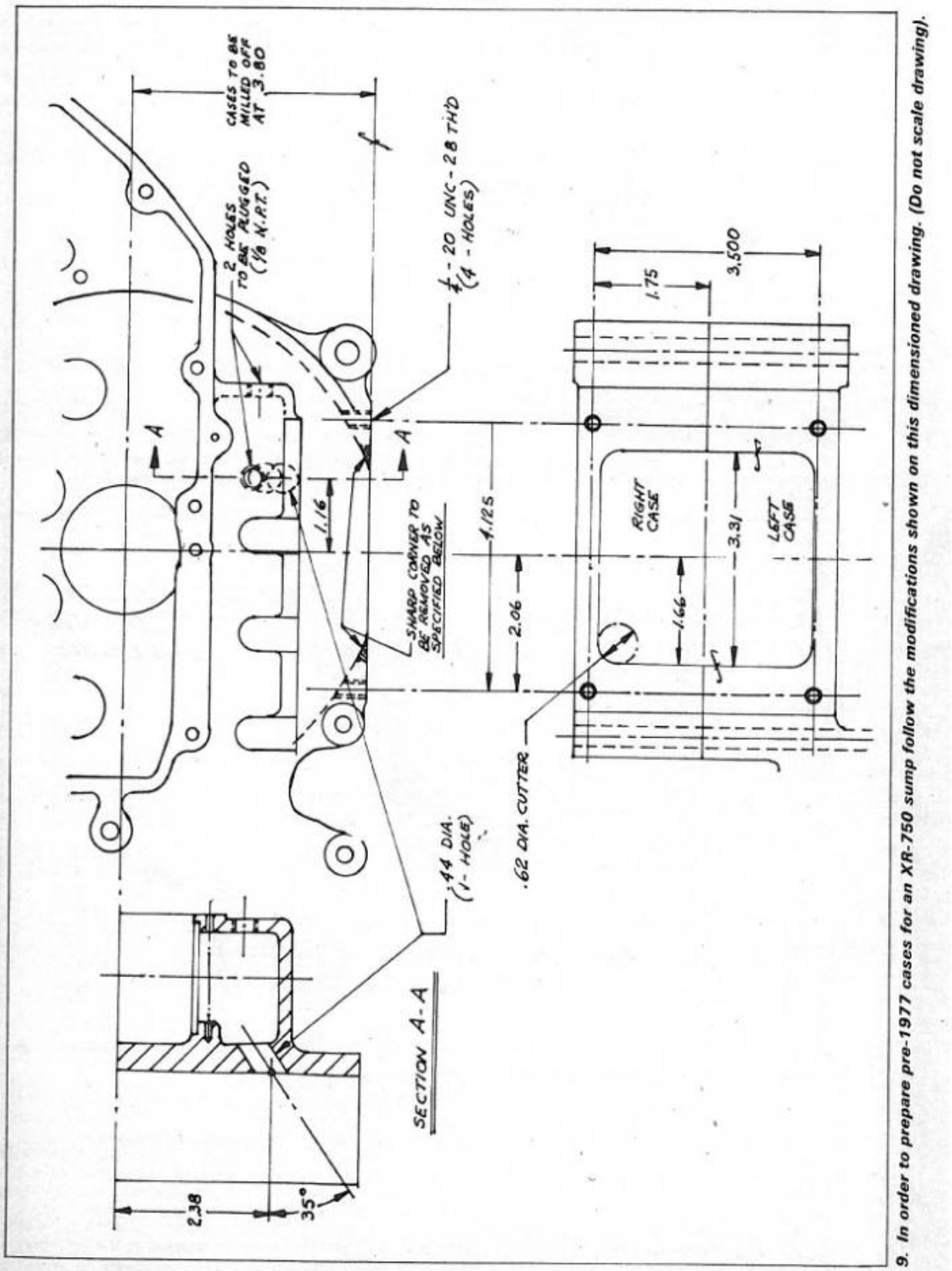
difference is great. The return capacity rate is in the neighborhood of five times more than the delivery rate, assuring a well scavenged mini-sump.

The pump's drive gear may be meshed in any position, since timing is no longer necessary, a feature elminating the removal of the cam cover during installation. The frame is flattened to provide clearance for removal, without disturbing the engine.

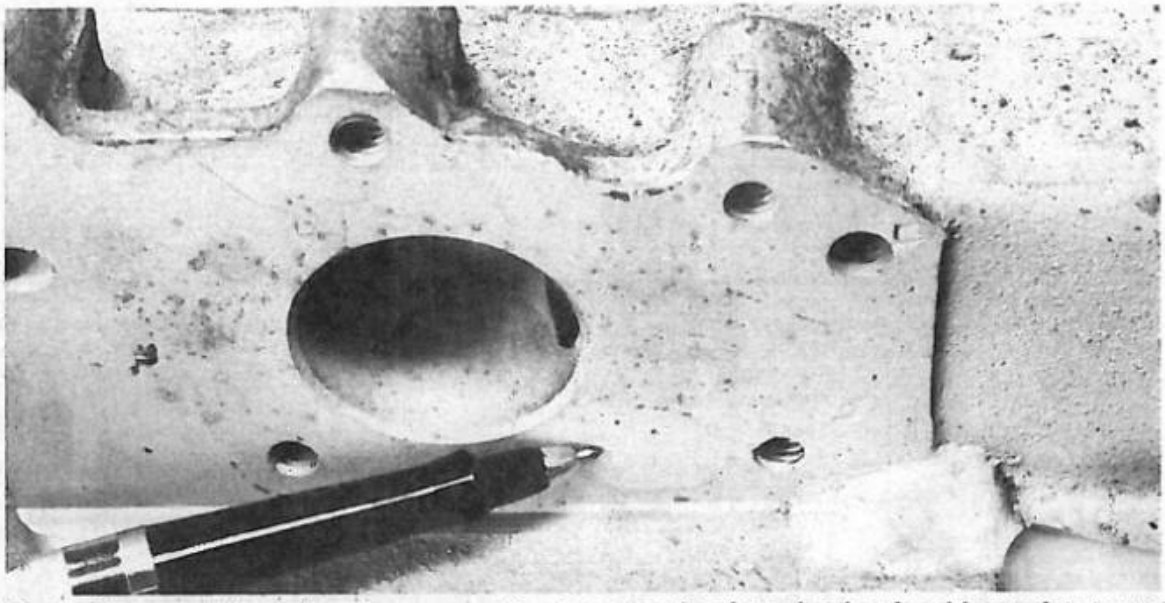
The Harley Racing Department is advising that XR-750 models in the field be converted to the mini-sump. They have even made a cast sump which can be bolted to the bottom of cases modified to accept it.

The Racing Department advocates the conversion only as an aid to expedite engine assembly. As you know, all racing engines are often apart for inspection, in the pits as well as the shop. Being able to speed up reassembly with the elimination of the breather timing is a blessing.

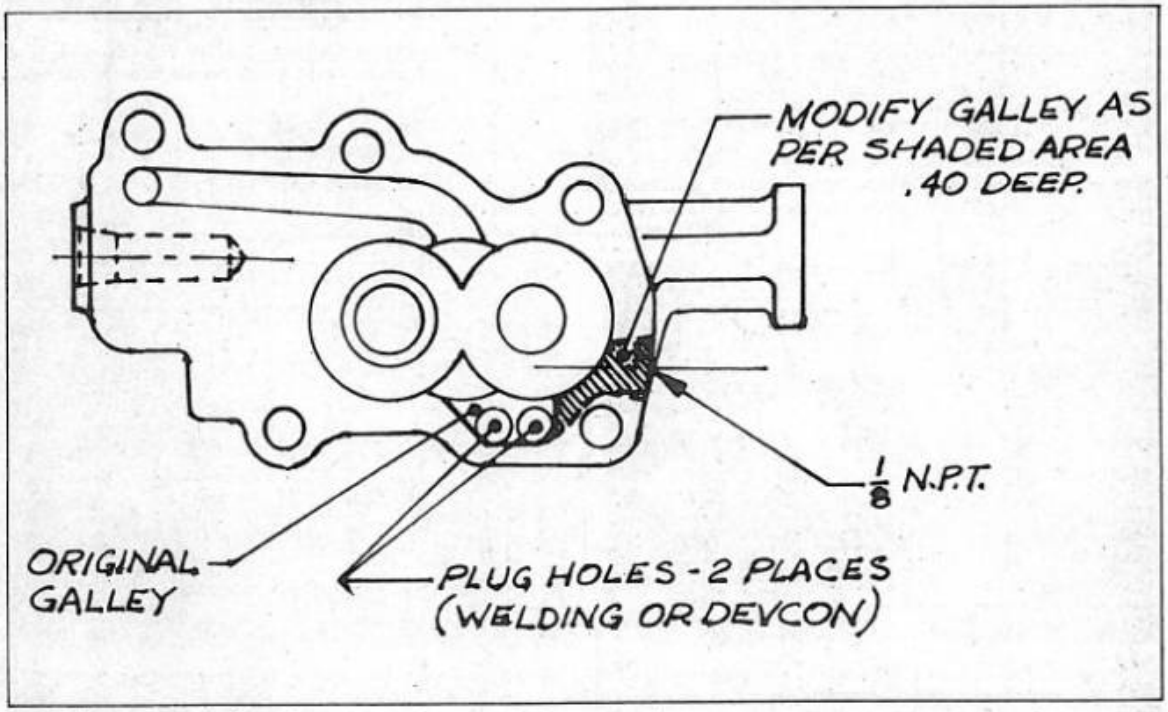
Dyno tests, conducted by both the Sportster Engineering and the Racing Departments indicate that even with obviously less oil drag, the mini-sump does not produce more horsepower



9. In order to prepare pre-1977 cases for an XR-750 sump follow the modifications shown on this dimensioned drawing. (Do not scale drawing).



11. An oil return galley in the oil pump mounting boss must be plugged and surfaced (pen points to spot). The finger indicates a weld buildup providing extra material around area of cam case drain hole.



12. Oil pump alterations for plan-A (see text). Do not scale.

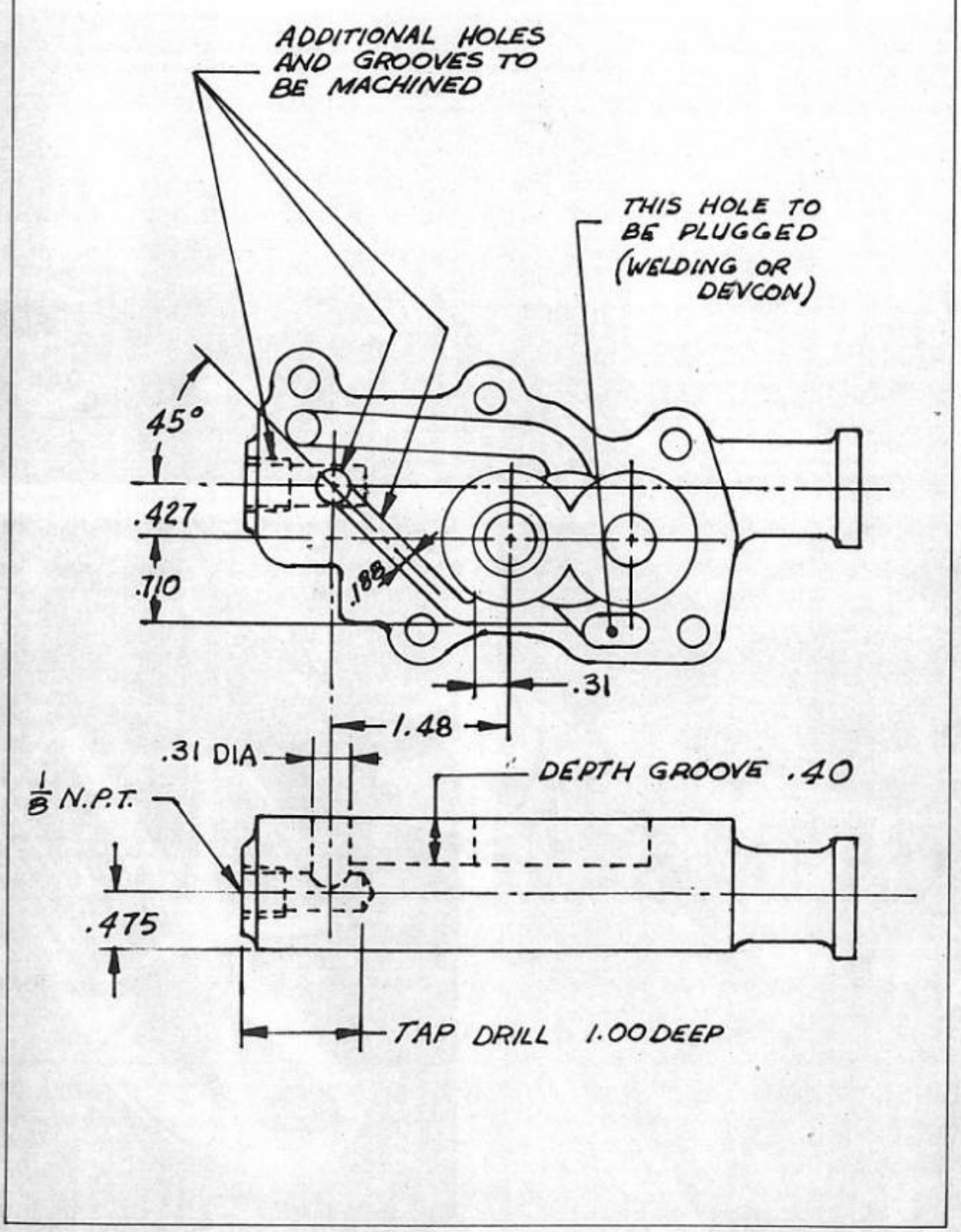
than a similar early engine with a properly timed breather. Yet factory test riders report a seat-of-the-pants reading of more response and smoothness when riding the '77 model.

How can experienced riders sense something that instrumentation cannot record? I'll venture a guess. Remember the dyno tests were conducted comparing the mini-sump to *properly timed* earlier systems. Yet relatively few engines have left the factory with properly timed breathers, yes even from the Racing Department. My guess is, the test riders, like most of us are familiar with the average Sportster, and all mini-sump models will out-perform the average early Sporty, with their out of sync breathers.

Altering Early Engines

During a trip to the Milwaukee plant, in June, I spent the entire day with the engineers and the racing geniuses, viewing the new model and trying to determine if the mini-sump could be adapted to the earlier mod-

Continued on page 66


ADDITIONAL HOLES AND GROOVES TO BE MACHINED
THIS HOLE TO BE PLUGGED (WELDING OR DEVCON)
45°
.427
.710
.188
.31
1.48
.31 DIA
DEPTH GROOVE .40
1/8 N.P.T.
.475
TAP DRILL 1.00 DEEP

Continued from page 30

els. I am happy to report that the idea is completely feasible, although it might require the assistance of a machinist of the caliber of Rick Bray, or Donny Rich.

The new oil pump is out. It could conceivably be adapted, but the effort and expense would far outweigh any benefit. Even the XR-750 racing engine conversion to the mini-sump is accomplished utilizing the gear pump.

Besides getting into a lot of welding which could easily wreck your cases due to warpage, and much additional machine work, other expensive factors preclude the use of the gerator pump.

For instance, the pumps turn in opposite directions. It seems, on the surface, that by simply changing pinion gears, the correct rotation can be established. Not so.

The splined section on the early pinion shaft consists of four splines, one of which is larger than the other three. The '77 has six equally spaced splines. The new pinion shaft will bolt into the 23900-75 flywheel, but then the fun begins. For one thing, the shaft is longer, necessitating a cam cover bushing modification. The main drawback though, concerns the new Torrington bearing in use on the mini-sump model. Additional machine work will be necessary to fit this bearing into early cases, and the early bearing will not fit the late pinion shaft.

So you see, while it is possible to use the new oil pump, it is not practical. But, why sweat it? Your old pump, with a few modifications will work as well.

Let's start with necessary case modifications and finish with the easy stuff. Since this will be a mini-sump engine when it is finished, we obviously need a sump. There are at least two ways to get a sump. One is to obtain an XR-750 sump and modify the Sportster cases to fit. The other is to fabricate a sump from scratch. Both alternatives offer advantages.

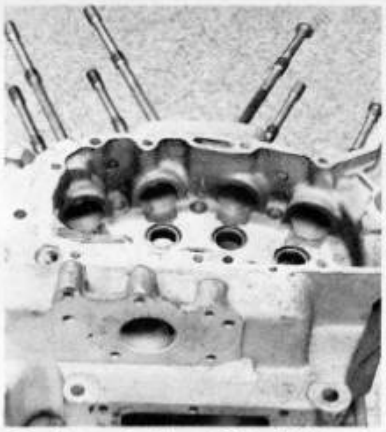
The XR-750 sump is available through your Harley dealer—that's an advantage. The sump's part number is 24996-74R. However, if you fabricate a sump it will be possible to incorporate angled deflectors as used in the Sportster mini-sump (not used in the XR-750 version) and any other design features you feel would be advantageous.

For simplicity through uniformity we will stick with the XR-750 sump for part one, at least of this article. Figure nine is a dimensioned drawing, indicating complete machining operations necessary to install the XR-750 mini-sump. Reference to it should permit you, or your machinist to prepare your cases.

The 35 degree hole indicated in section A-A of figure nine replaces the drain-back hole shown in figure five. Do not drill both holes. The hole should be drilled as in figure nine since the configuration of the right case half is different at this point between the mini-sump and earlier engines (see Figs. 5 and 9). It may be necessary to build up the area slightly with weld here (Fig. 11), but probably not.

Besides the drain hole, drill three .41 inch diameter vent holes in the areas indicated in figure four.

Most of the rest of the modifications are easy. The oil transfer valve in the left case half will have to be plugged, either by welding, or a threaded plug.



14. A rough idea of the finished modifications can be gained by studying this photo of mini-sumped early cases from a prototype engine.

The oil scrapers must be machined, or ground away. The breather duct can be easily plugged with weld as shown in figure ten. And that completes the case modification except for the plugging of an oil return galley located adjacent to the oil pump (Fig. 11). The plugged return galley must be surfaced flat or the oil pump gasket will leak.

The timing feature of the oil pump must be obliterated. There are a few ways to accomplish this. The Racing Department advises drilling a half inch hole through the timing slot in the pump body (outer sleeve), and continuing the hole clear through both sides of the valve (inner sleeve), for the similar XR-750.

By drilling this way the valve will

never be closed, no matter what position it is in.

Another way would be by turning a wide groove as wide as the timing slots on the valve (inner sleeve). The groove should be cut as deep as possible without physically weakening the part, as it must still be amply strong to drive the oil pump.

Another alternative would involve blocking the duct leading from the cam case to the breather valve. The entrance to the duct is located under the domed screen. With the screen removed, a sheet aluminum disc welded in place should seal off the breather nicely.

Rerouting the galleys in the oil pump body will complete the engine alterations.

Again, a couple of options are available. For the sake of discussion, let's call them plan-A and plan-B. Plan-A (Fig. 12) involves less machine work but may not permit as much oil to return as plan-B, however, it will probably allow a sufficient amount of flow. Care must be exercised not to cut the new groove into a mounting hole, but the groove should be enlarged as much as possible.

Both plans call for plugging the existing return galleys, a feat easily accomplished with Devcon.

Plan-B is the method suggested by the Racing Department for the XR-750's quarter speed pump, but I see no reason for it not to work well on a street or racing Sportster (Fig. 13).

A flexible tube can be connected to an outlet in the mini-sump, supplying return oil to the pump.

The alterations listed will prepare the engine for the mini-sump oiling system. Engine assembly will be straight-forward, except your oil pump will never have to be timed again. ***CB***

Goodies

Continued from page 15

RACER 1 RIDER GLOVE

Racer 1 complements its quality line of Cafe Racer Special Equipment and High Performance Touring Gear with a superb new Rider Glove.

The Racer 1 Rider Glove is manufactured in Spain of supple, black baby lambskin, with cherry red stretchable helenca side panels. The tight form-fitting rider glove conforms perfectly to your hand and offers the following benefits:

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5. Top quality hand dyed skins.
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