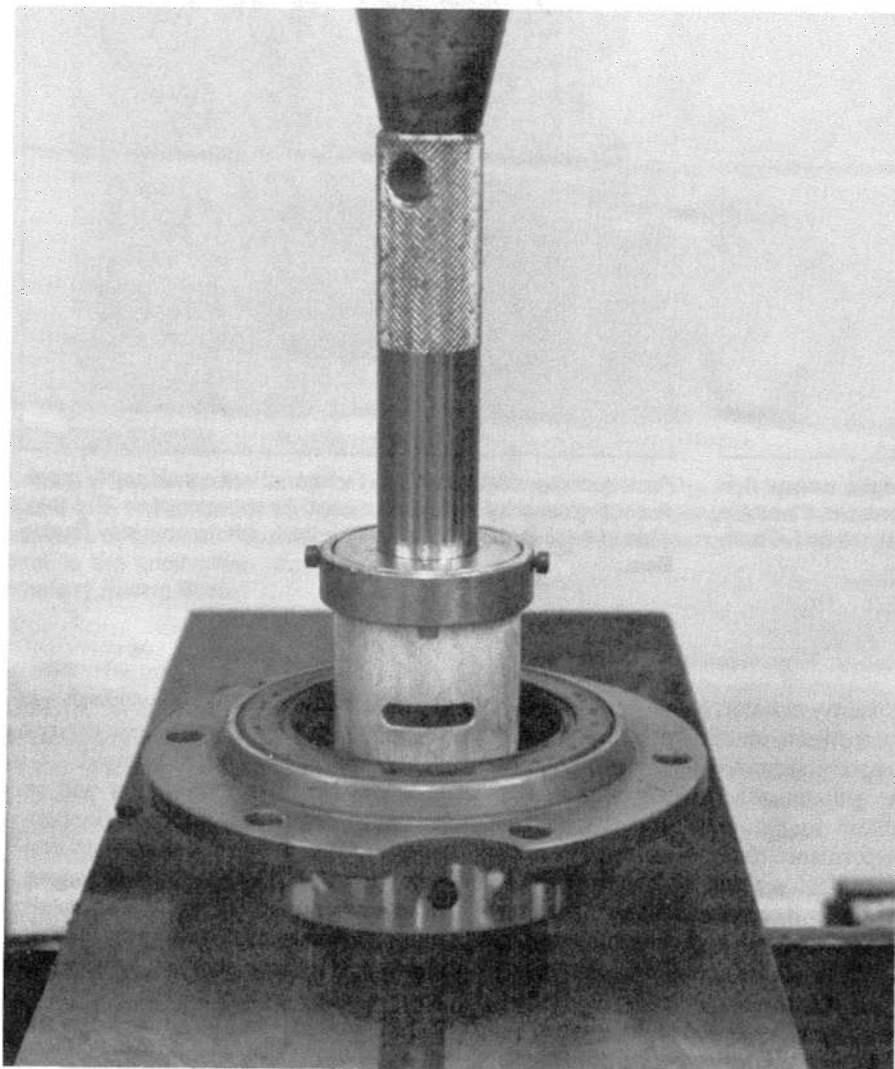


# BLUEPRINTING & ASSEMBLY

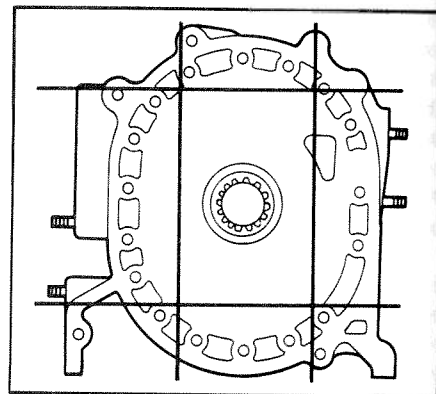


Assuming that existing rear stationary-gear bearing is in need of replacement, or that a new gear is being used, the first step is to press bearing into gear after carefully aligning bearing tab with slot in gear. Mazda puller and installer with adapter ring (part no. 49 0813 235) should be used. Shown is special three-window bearing and modified rear stationary gear. A new bearing should also be pressed into front stationary gear if required, using same tool.

Any photographer will gladly tell you that one picture is worth a thousand words. Writers, on the other hand, take exception to that and lawyers, having the capacity to use more words than even the most prolific writer, will argue ad nauseum in support of the worth of words.

With all due respect to both the journalism and legal professions, engine-assembly procedures are best illustrated with photographs that are supported by lucid captions. That makes for the best of both worlds—words and pictures. The following step-by-step photo sequence illustrates Rick Engman's procedure for assembling a high-performance rotary engine.

The parts shown in the following photographs belong to a 13B practice engine that is used in Jim Downing's Camel Lights Mazda/Argo. Although it is obviously a race engine, the assembly procedure would be the same for a high-performance street engine with a few obvious differences in parts selection, most notably the peripheral-port rotor housings and the oiling system.



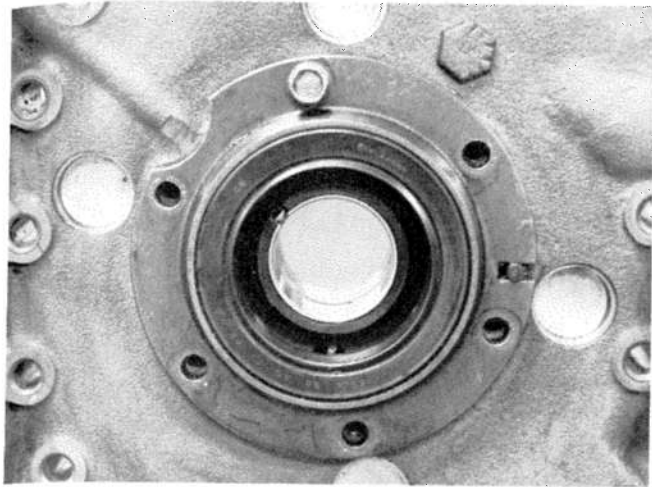
Before spending any time on front, intermediate or rear housings, machined surfaces should be checked for warpage with a straight edge and feeler gage at positions indicated. If warpage exceeds 0.04mm (0.0016 in.) housing should be replaced or resurfaced.



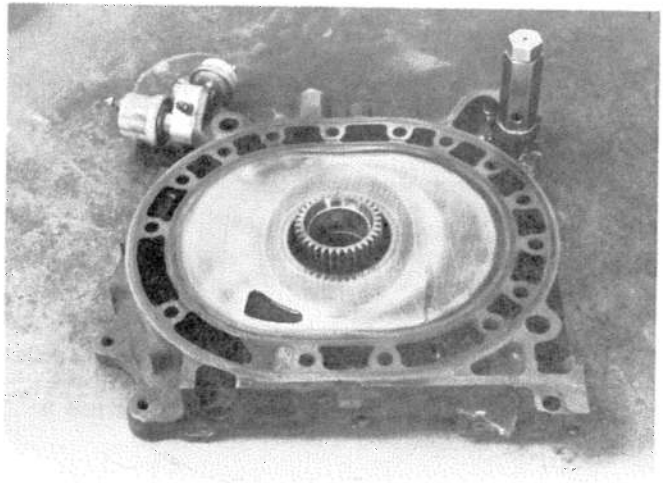
Stationary gear after alignment secured



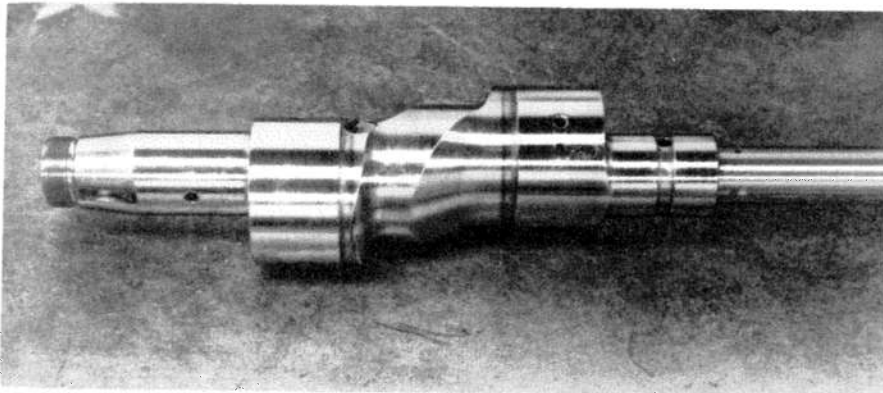
Check end shafts with a pair of feeler gages or less.



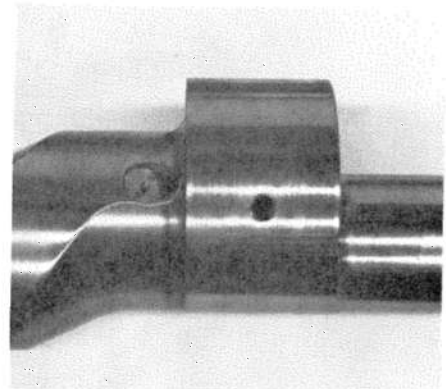
Stationary gears are inserted into their respective housings and, after aligning slot in gear flange with dowel in housing, bolted securely in place.



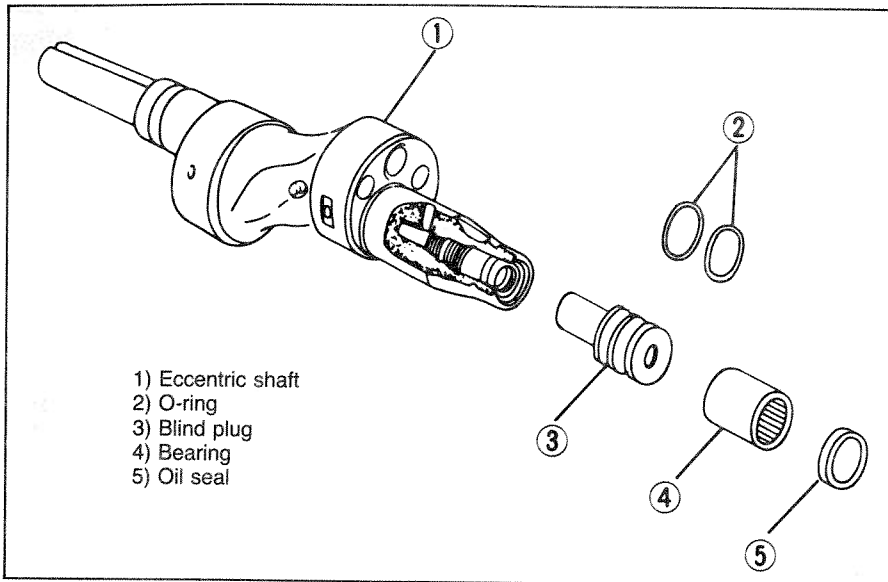
All acceptable housings should be thoroughly cleaned with solvent and set aside until needed. Rear oil-pressure regulator may be installed prior to assembly.



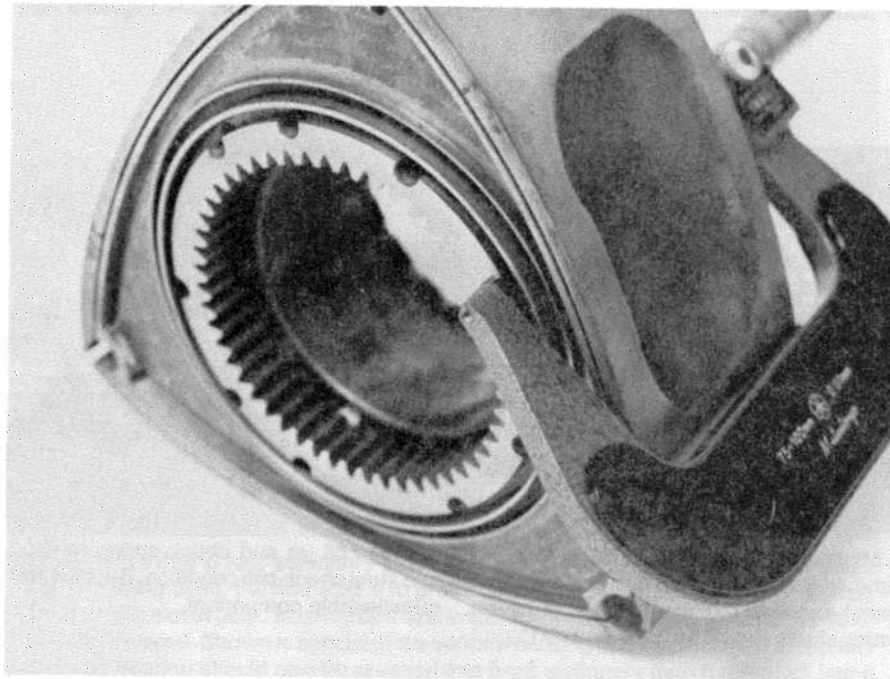
Check eccentric shaft for cracks and scratches. Minor scratches may be polished out, but shafts with cracks should be replaced. Runout should also be checked by mounting shaft in a pair of V-blocks. For street engines, if runout exceeds 0.06mm (0.0024 in.) shaft should be replaced. Runout of race engine eccentric shafts should be 0.03mm (0.0012 in.) or less.



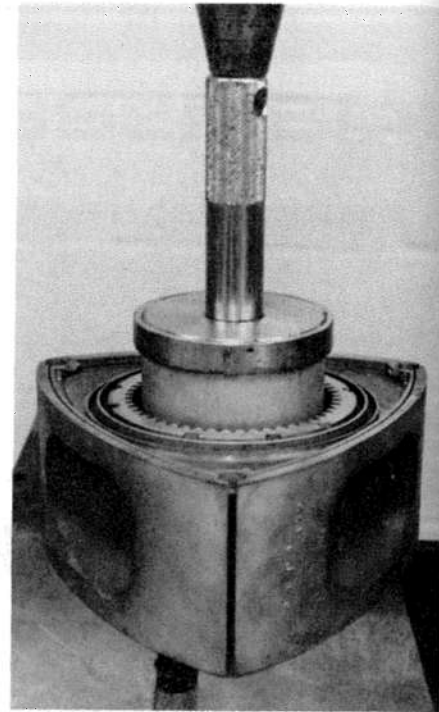
Remove oil jet and check spring tension and steel check-ball condition. Replace any questionable component.



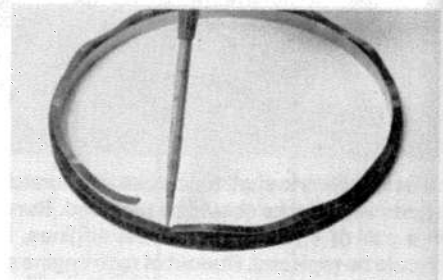
Check plug in rear of shaft, making sure it is tight and leak free. If leakage is apparent, replace O-rings. Remove plug with an Allen wrench.



Rotor width should be checked with a micrometer at three positions, measuring from gear face to land on opposite side. Rotor dimensions should match those provided in Chapter 7, page 75.



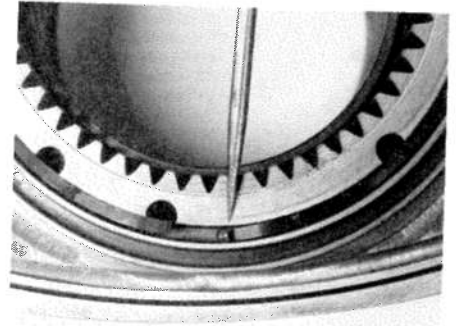
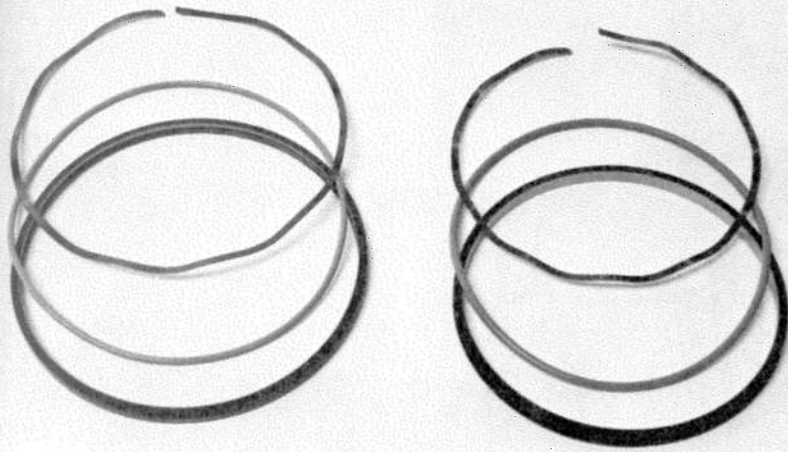
Assuming that rotor bearings must be installed or replaced, use Mazda puller and installer (part no. 49 0813 240) in a hydraulic press. Rotor-bearing clearance should be 0.08—0.10mm (0.003—0.004 in.) as determined by measuring bearing bore and eccentric-shaft rotor journal. To install new bearing, place rotor on press surface with gear facing upward. Be sure to align bearing tang with slot in rotor bore before pressing in bearing.



Note that there is a right and wrong way to install spring seals. Square tang fits into groove on oil seal; tapered tang engages relief in rotor.

Set three seals, preferably

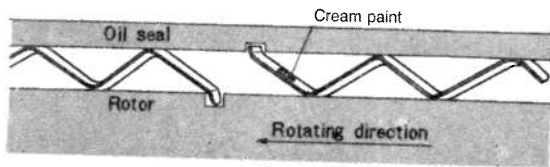
Oil-seal  
 tion. Sp  
 faces; t



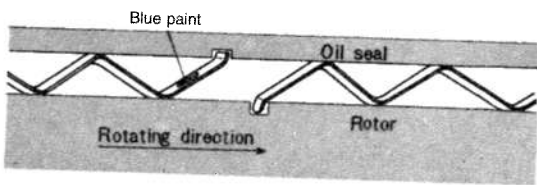
Before installing oil seal, tapered tang should be positioned in drilled relief as shown.

Set three pieces that comprise each oil seal in a group. Before installing O-rings on oil seals, place a spring in appropriate groove and place oil seal on top of it. Seal should rotate freely without binding in groove.

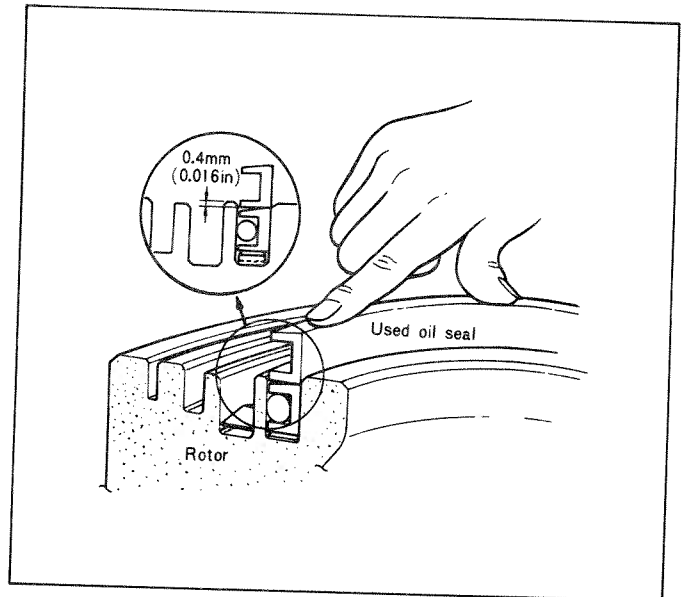
On front face of rotor



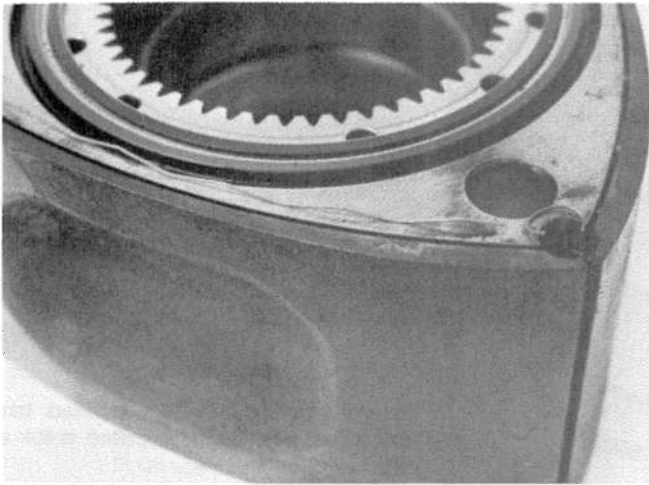
On rear face of rotor



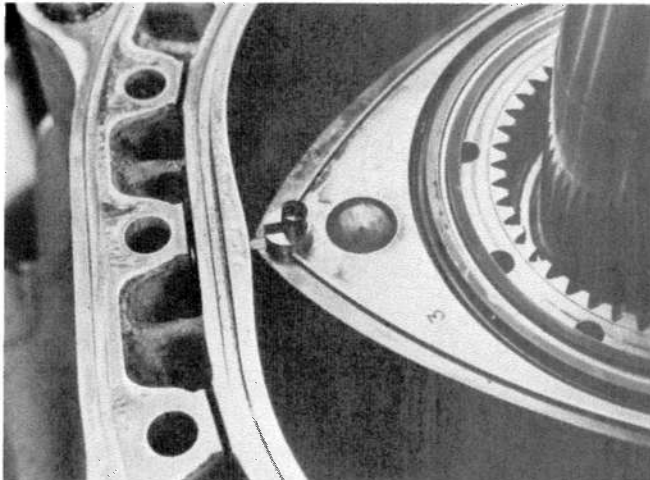
Oil-seal springs have color-coded paint markings to identify position. Springs with cream paint should be installed on front rotor faces; those with blue paint on rear rotor faces.



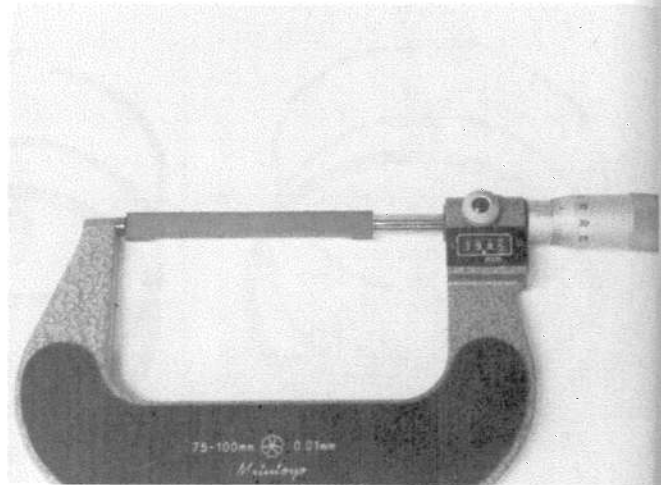
Old oil seal may be used to press new one into position. When handling oil seals, be careful not to deform them. Press seals into their respective grooves to depth indicated.



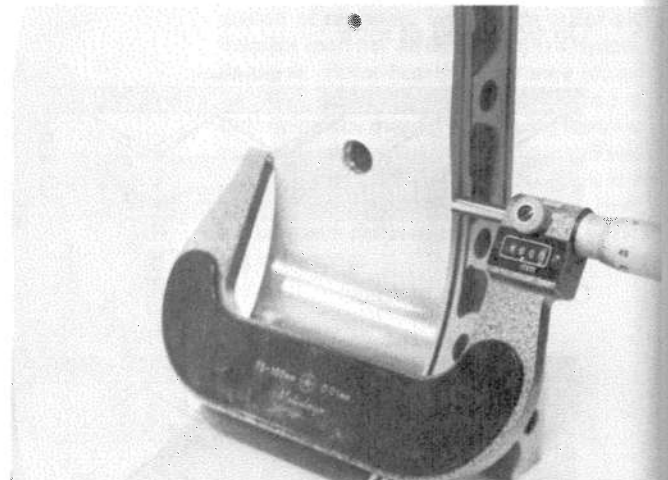
Install corner- and side-seal springs in their respective positions. Note numbers 1 and 5 stamped on rotor. These numbers are used to identify seal positions with 1, 3 and 5 on one side of rotor and 2, 4 and 6 on the other. Mazda offers a seal case (part no. 49 0813 250) that keeps seals properly organized.



Side and corner seals fit into place as shown. Clearances between side seals and corner seals and side seals and grooves are measured with feeler gages. Seals not providing correct clearances, page 71, should be replaced. Sometimes it's possible to move a side seal from one groove to another and obtain required clearance at corner-seal junction.



If using one-piece race apex seals, they should measure 79.85mm (3.143 in.) for a 13B and 69.85 (2.750 in.) for a 12A. Cut seals to length as described in Chapter 7, pages 70—71.



As with rotors, check rotor-housing width. 13B housings should measure 80.00mm (3.149-in.) wide; 12A housings 70.00mm (2.756 in.).

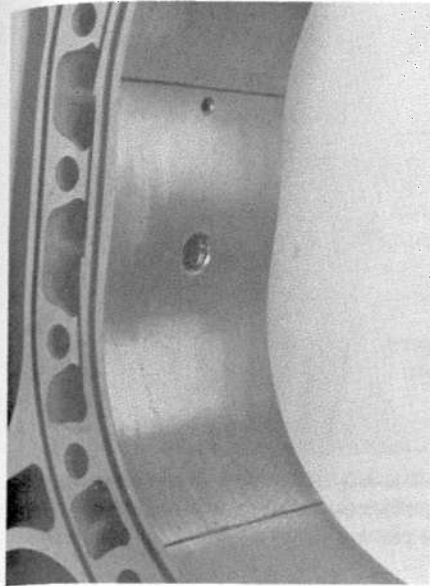


Check points. Or where he direct co checking marks as where co atures ar will shrink 0.06mm should be be check gage. If w greater e scrapped

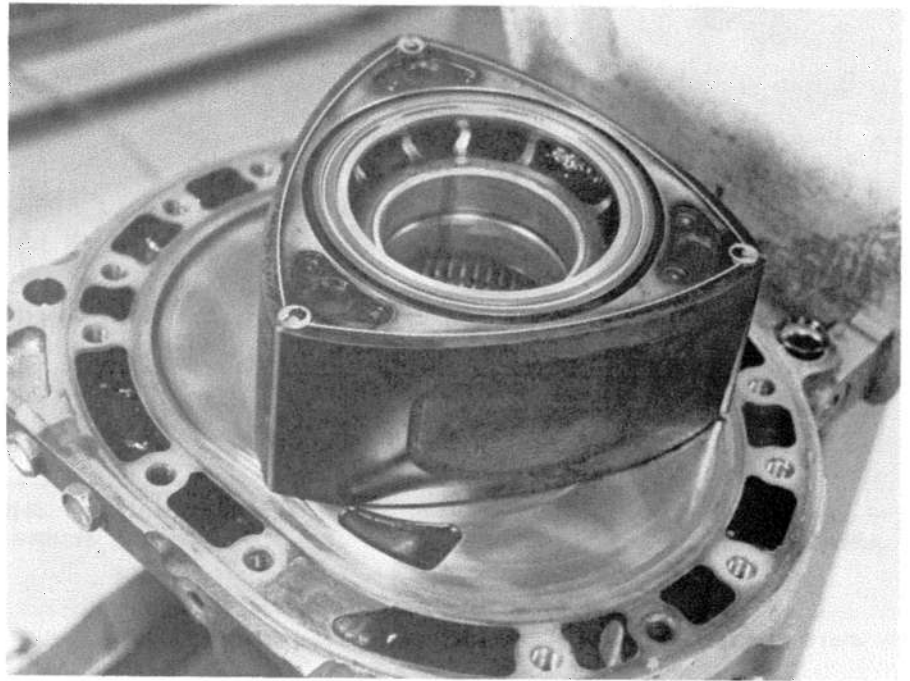


After light tric shaft

measure  
12A. Cut  
71.

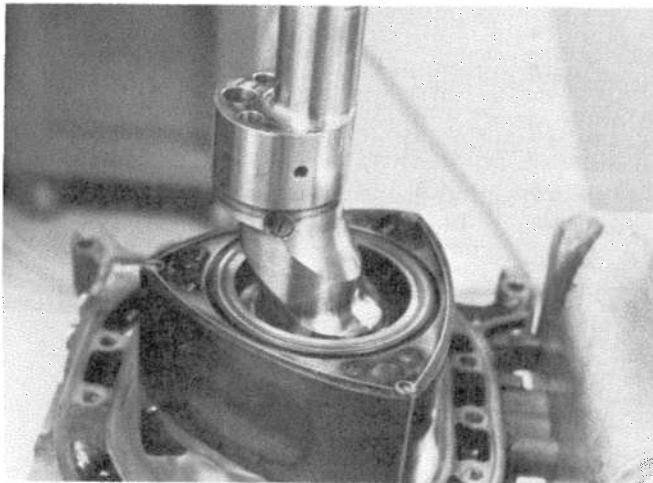


Check rotor-housing width at several points. One checking point should be at top where housing is subjected to very little direct combustion heat. Three additional checking points should be in area between marks as indicated on this housing. This is where combustion takes place and temperatures are highest. Sometimes housings will shrink in this area. If width difference is 0.06mm (0.0024 in.) or more, housing should be replaced. Housings should also be checked with a straight edge and feeler gage. If warpage is 0.04mm (0.0016 in.) or greater on a side, housing should be scrapped.

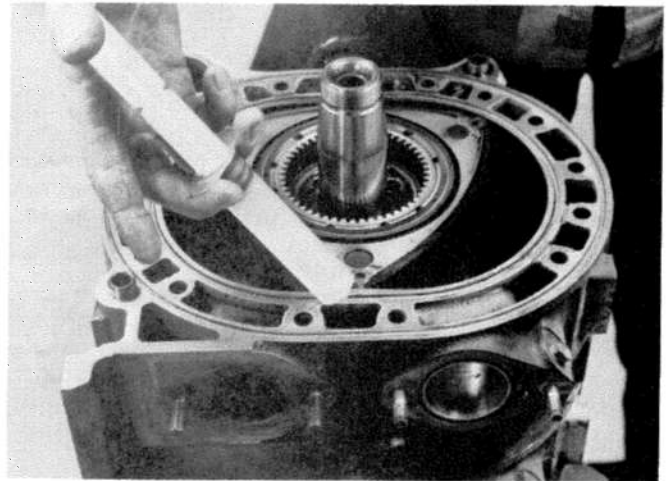


After all clearances are set, lightly smear motor oil over entire front side-housing surface. Mount housing on an engine stand using Mazda engine hanger (part no. 49 1114 005) or equivalent. Use dabs of petroleum jelly (Vaseline) to hold seals in position on rotor and to lubricate stationary and rotor gears, main bearings and rotor bearings. With all seals installed in rotor—install apex seals **WITHOUT** springs—set rotor on front side housing. Make sure gear engagement is correct and that rotor travels on correct path when turned. If rotor apex is positioned as shown, gear engagement will be correct.

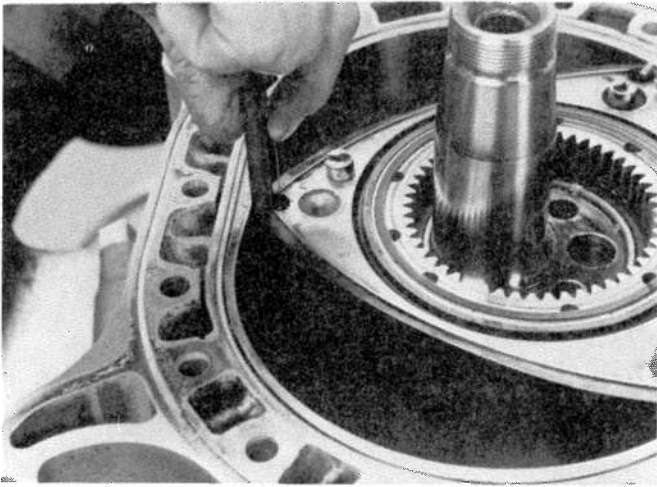
should  
0.00mm



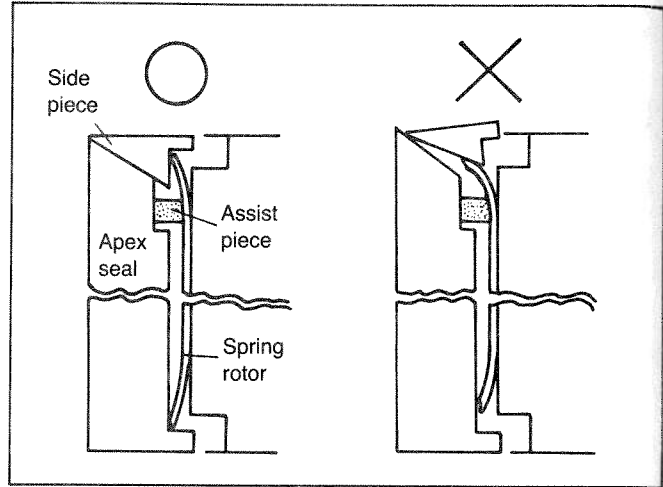
After lightly lubricating journals with petroleum jelly, slide eccentric shaft into place.



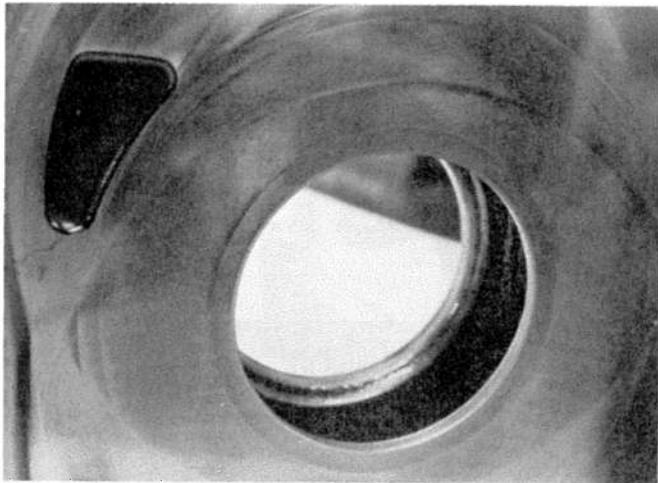
Light dab of petroleum jelly will hold water seals in place. Petroleum jelly can also be used to lubricate chrome rotor-housing surface. After installing water seals on bottom side of rotor housing, set it in place on side housing, being careful not to disturb rotor seals. Install remaining water seals.



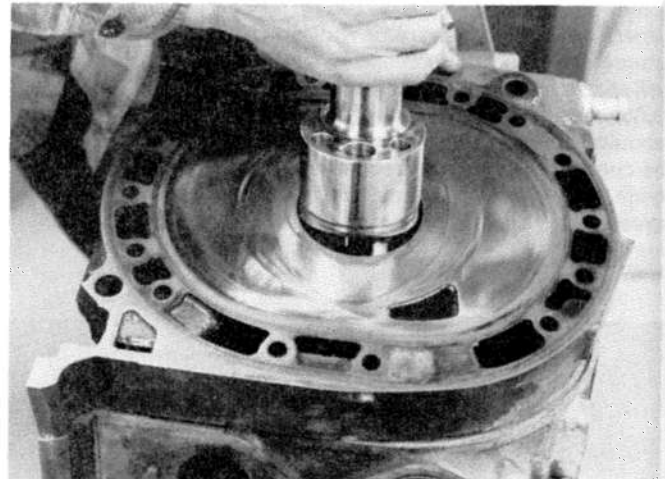
Pull corner seals out and slide apex seals up and out. Correctly position seal springs and reinstall apex and corner seals.



When using multi-piece stock seals, be sure that apex-seal spring correctly engages side piece.



Before intermediate housing is set in place, eccentric-shaft hole should be deburred. This will minimize possibility of scratching shaft.

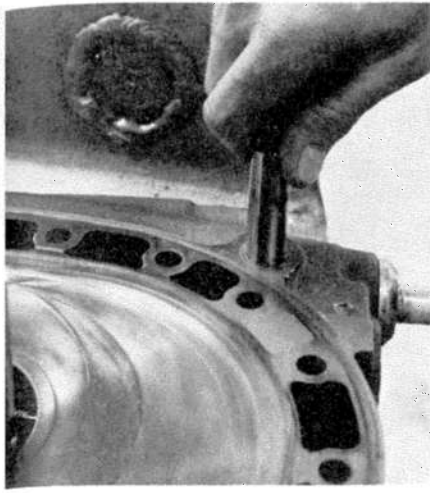


To install intermediate housing, lift eccentric shaft about 1 in. and slide housing into place on an angle. Do not lift shaft more than 1-1/2 in.

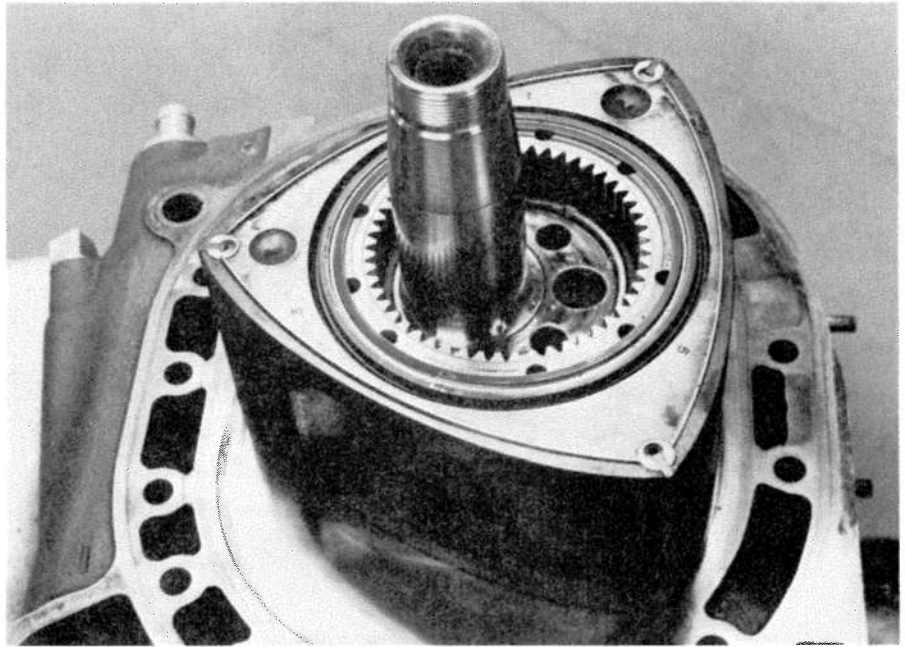


If every point, lig in place

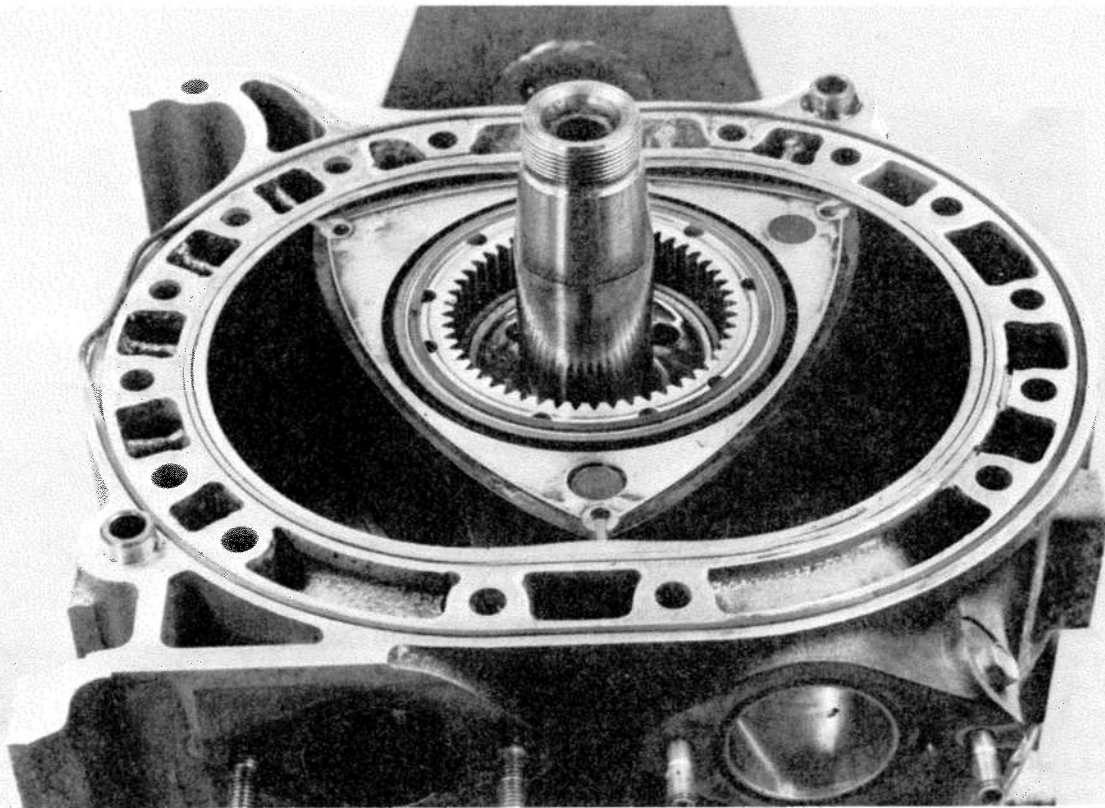
Followir cannot



If everything has gone together OK at this point, lightly lubricate dowels and set them in place.

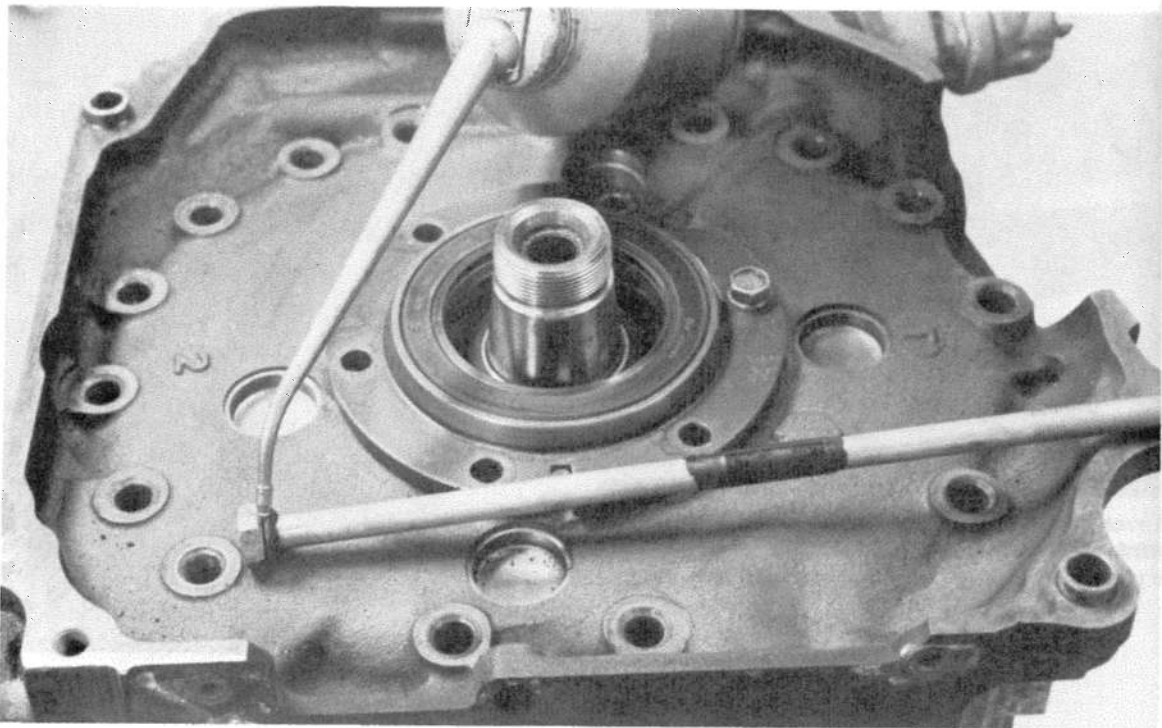


Following the same procedures used to assemble front rotor, install seals on rear rotor and set it in place on intermediate housing.

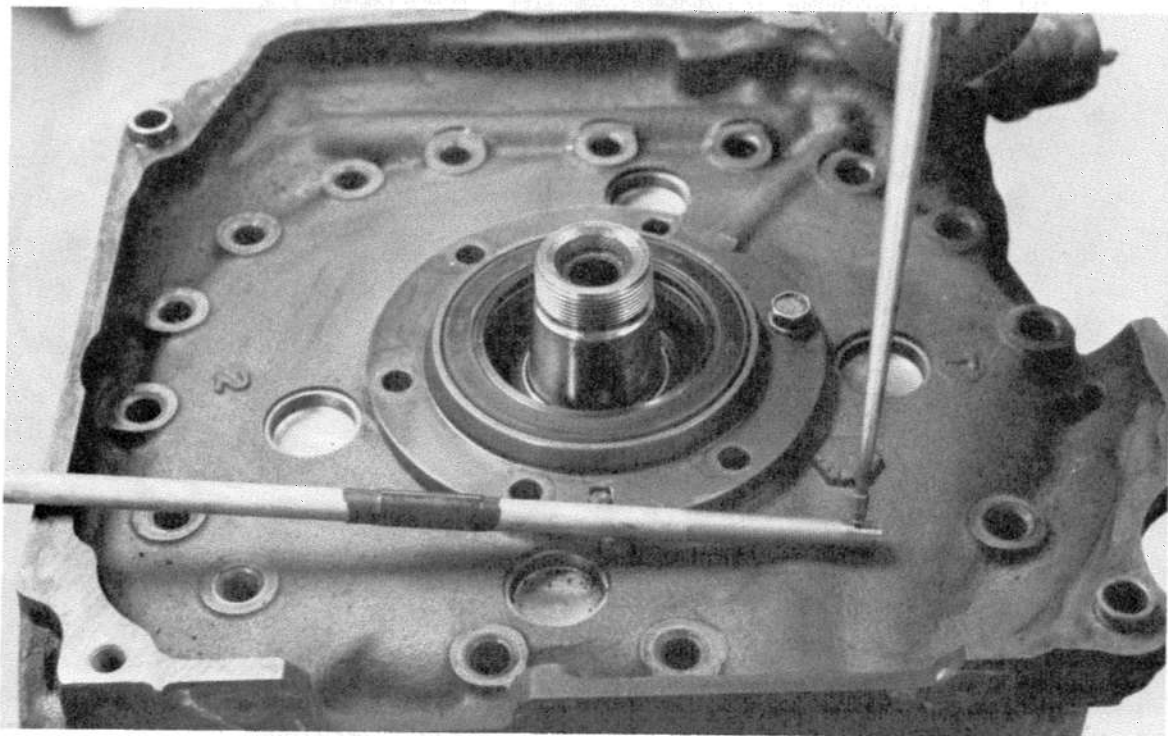


Following the same procedures used with front rotor housing, set rear rotor housing in place. Note water seal at upper left. Water seals cannot be reused because they stretch excessively.

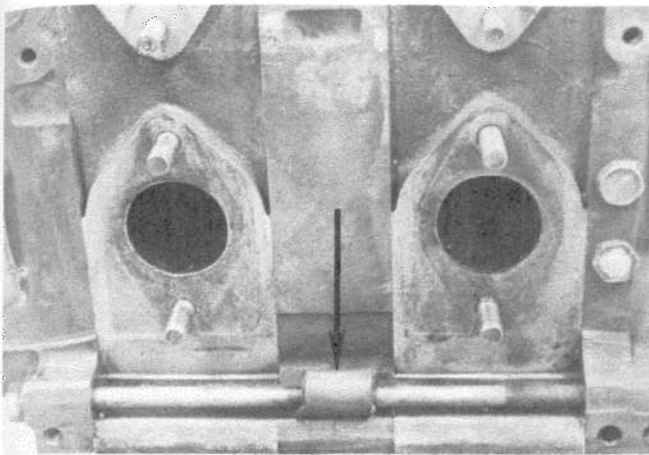




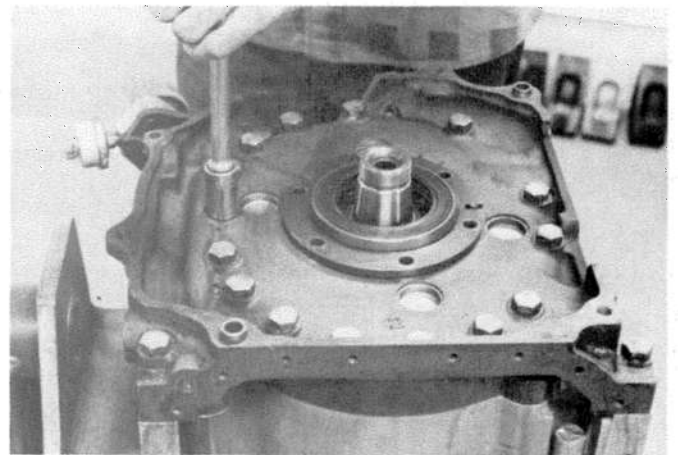
After lubricating rear side-housing machined surface with motor oil, set it in place. Then lightly lubricate seals under heads of tension bolts. Note rubber insulator at center of bolt. This should be in good condition as it damps bolt vibration, which would otherwise cause bolt breakage.



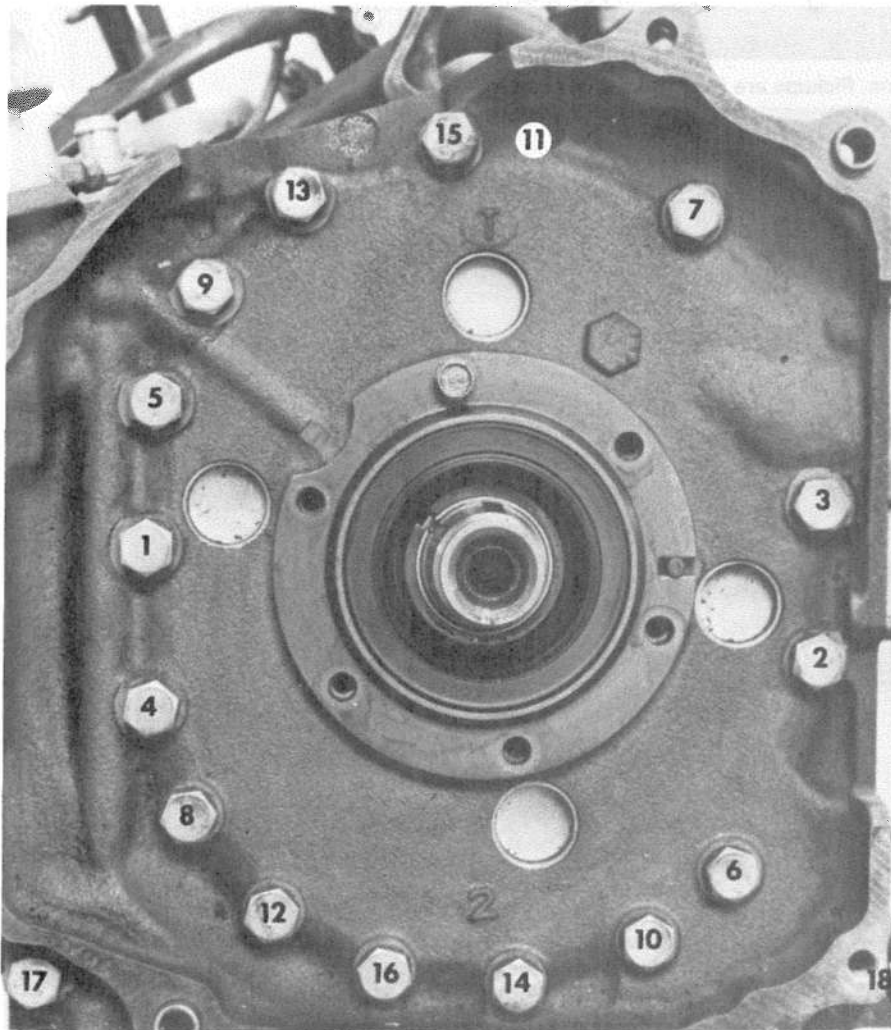
Also lubricate tension-bolt threads before installation.



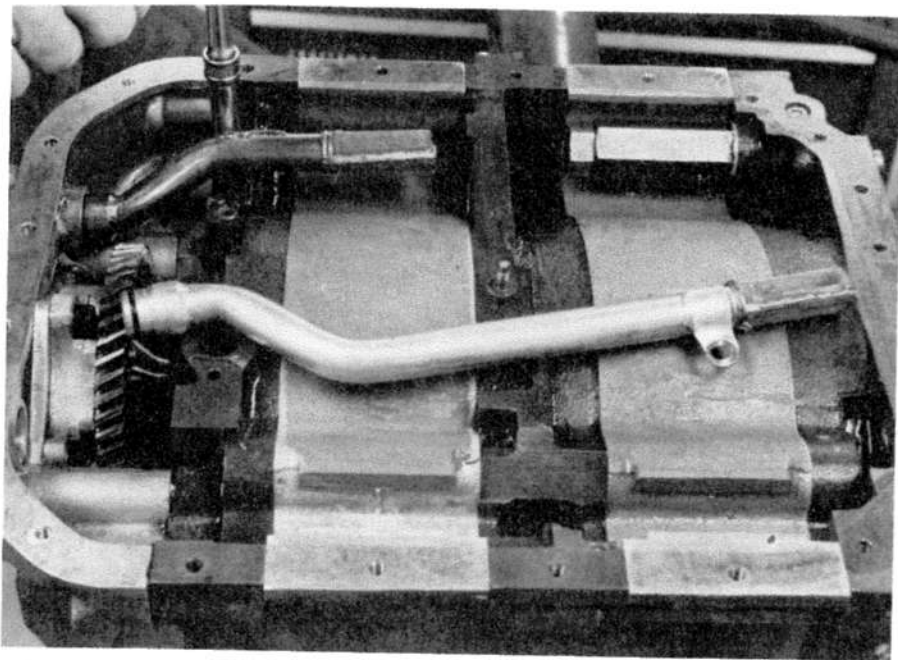
Outside tension bolt should have a small piece of rubber house positioned as shown (arrow). This is for vibration control.



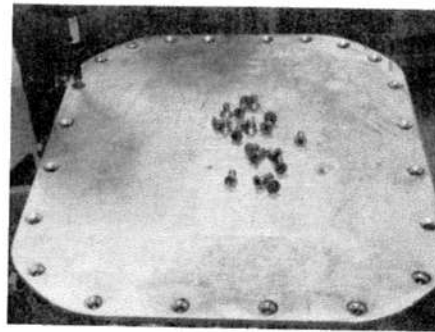
Once all tension bolts are in place, snug them slightly.



Torque tension bolts in sequence. On 13B engine, bolts should be torqued 23—29 ft-lb; on 12A engine, 23—27 ft-lb. Engines may have 17, 18 or 19 tension bolts, depending on year and model. Adjust sequence as required by following crisscross circular pattern as shown.



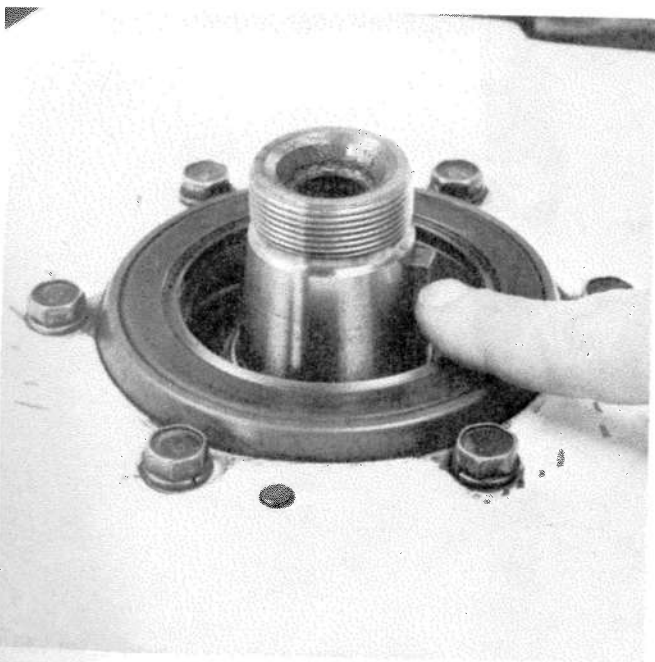
Install appropriate oil pickups in bottom of engine. Pickups are for dry-sump system.



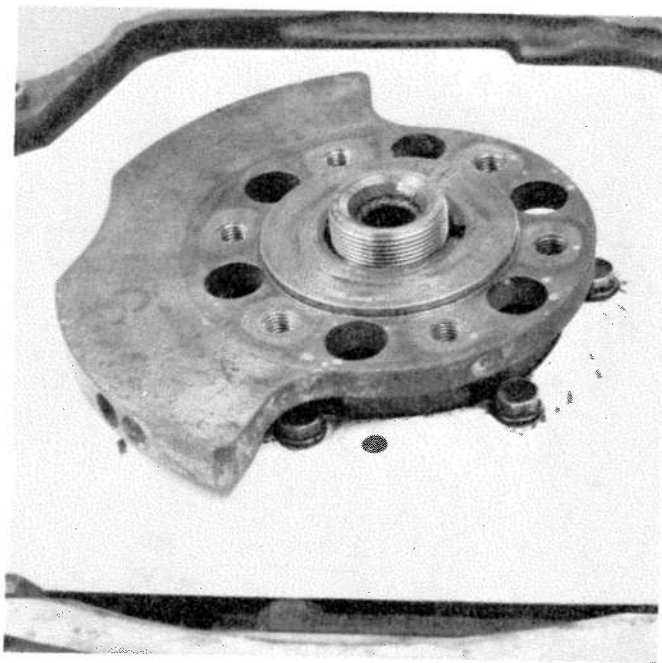
Install oil pan.



Thread fly shaft.



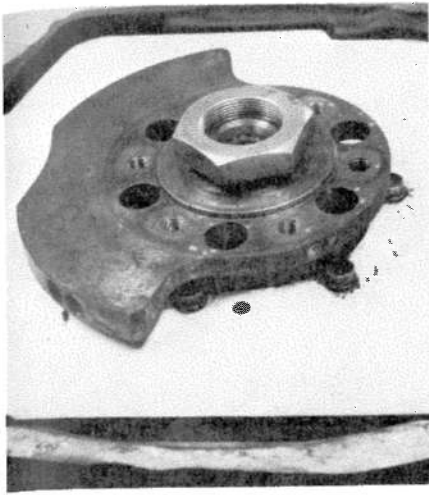
Install key in eccentric-shaft rear keyway.



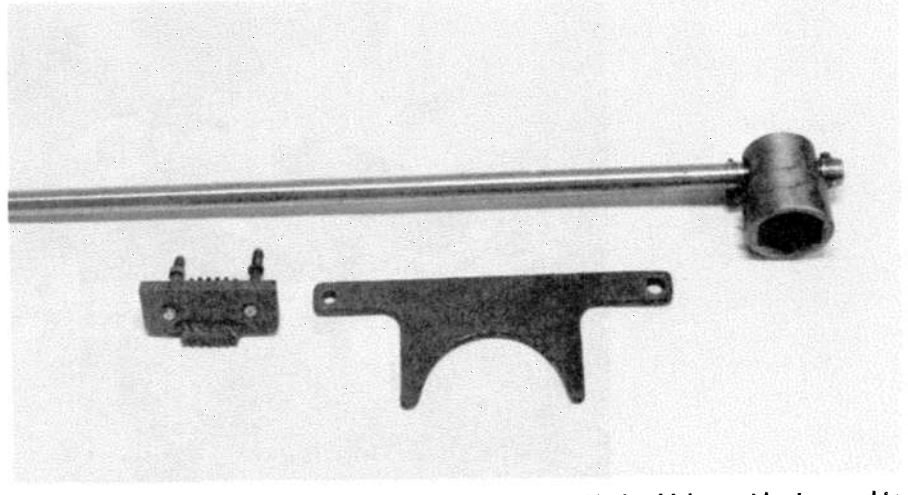
Install either a rear eccentric weight or flywheel over eccentric shaft, being careful not to dislodge key. White sheet-metal plate is a custom-made retainer for engine tension bolts. If a bolt should vibrate loose or break, it cannot back out and interfere with rear eccentric weight.



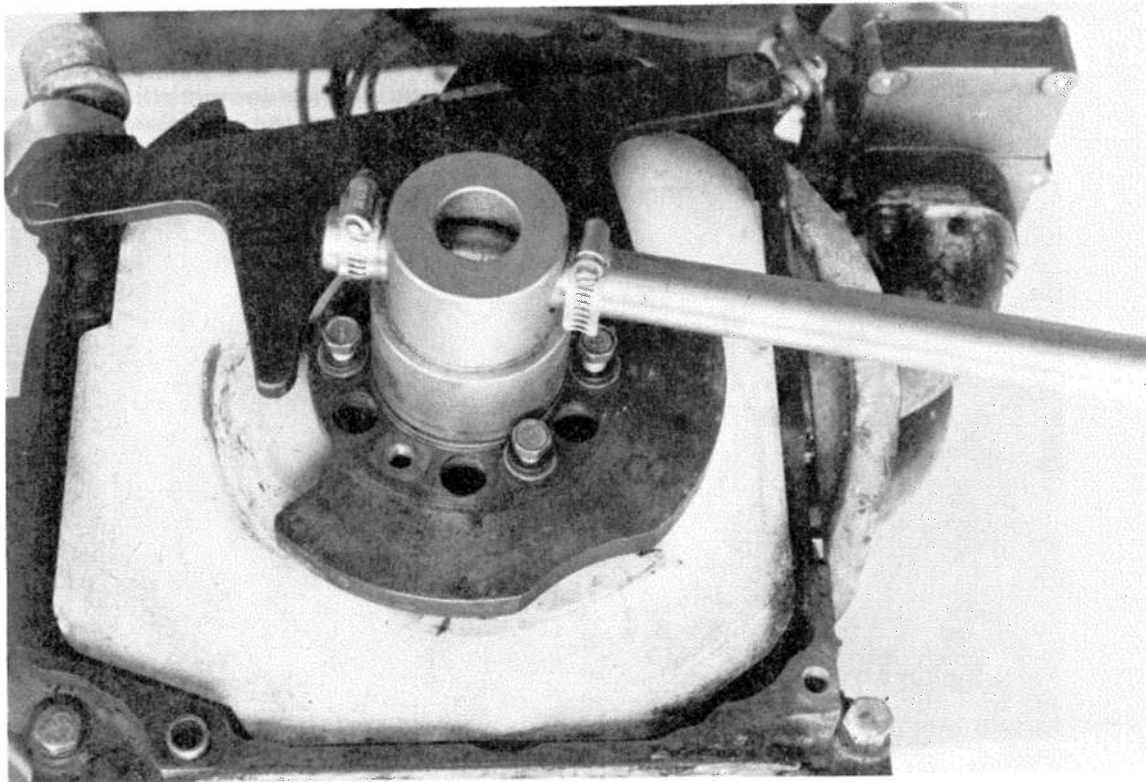
After eat flywheel



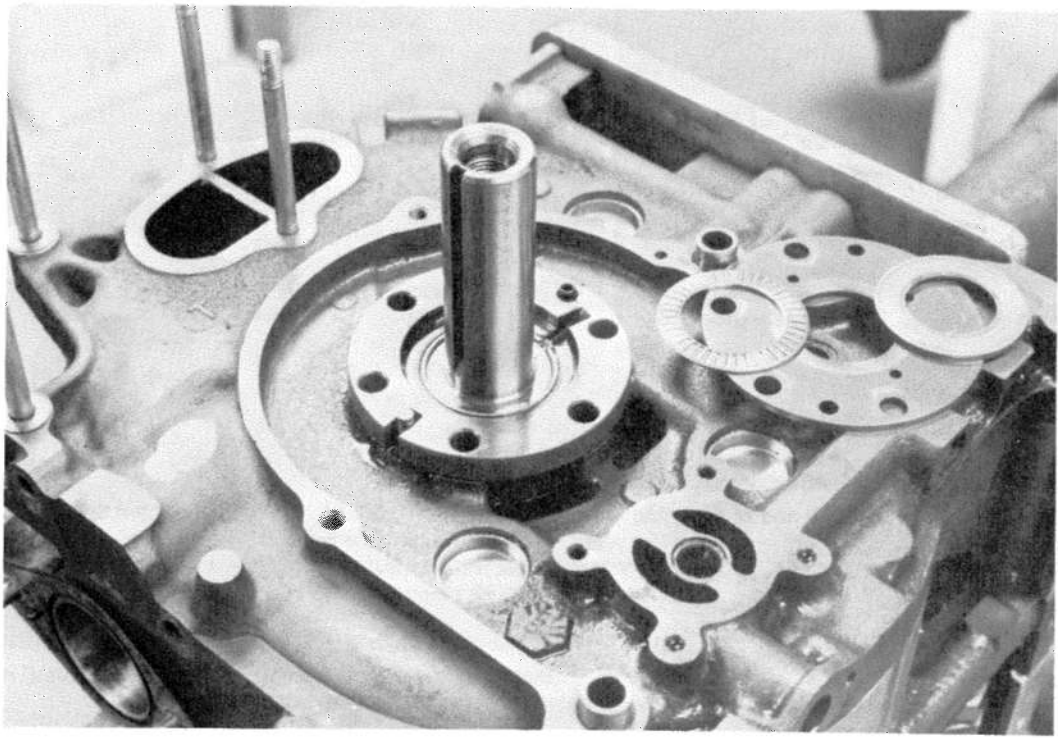
Thread flywheel nut onto end of eccentric shaft.



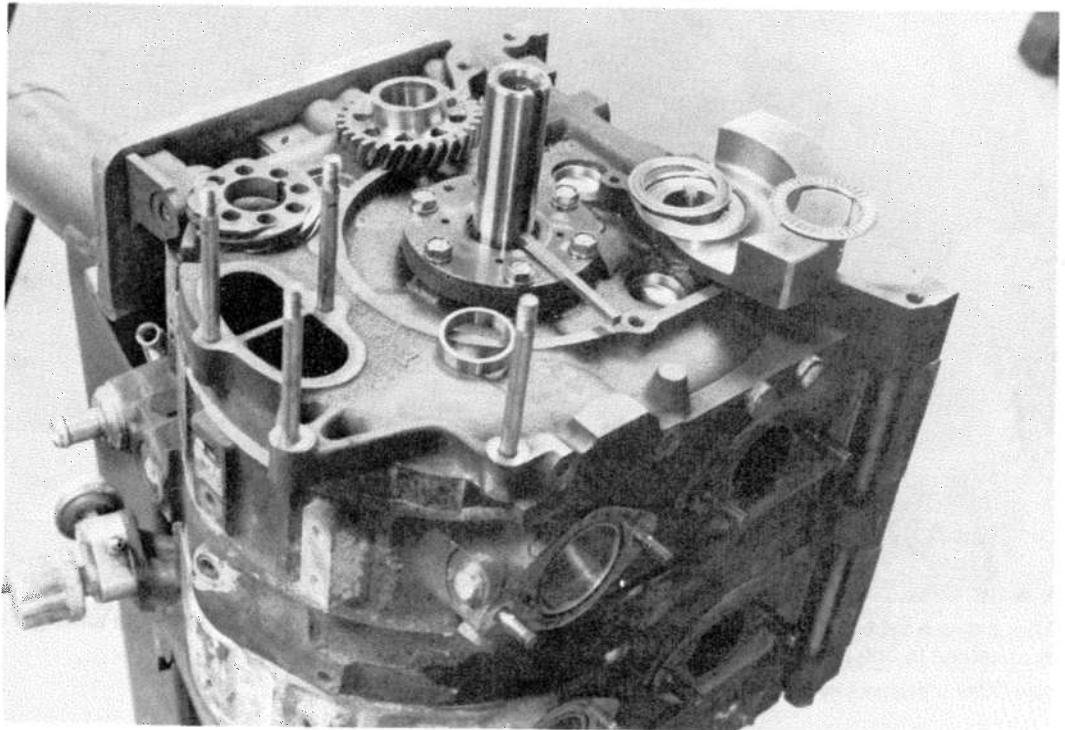
Industrial-strength wrench is required to tighten flywheel bolt which must be torqued to 360 ft-lb. Mazda offers a wrench (part number 49 0820 035) and an eccentric-weight holder (part no. 49 1881 055) for this purpose. Shown at lower left is a fabricated tool used to hold stock manual-transmission flywheel by engaging ring gear.



After eating a full box of Wheaties, install appropriate fixture to prevent eccentric shaft from turning and tighten flywheel nut to 360 ft-lb.



Place thrust washer over eccentric shaft with chamfered edge down, or toward engine. Then coat needle bearing with petroleum jelly and set it in place. Install bearing retaining plate and tighten bolts.



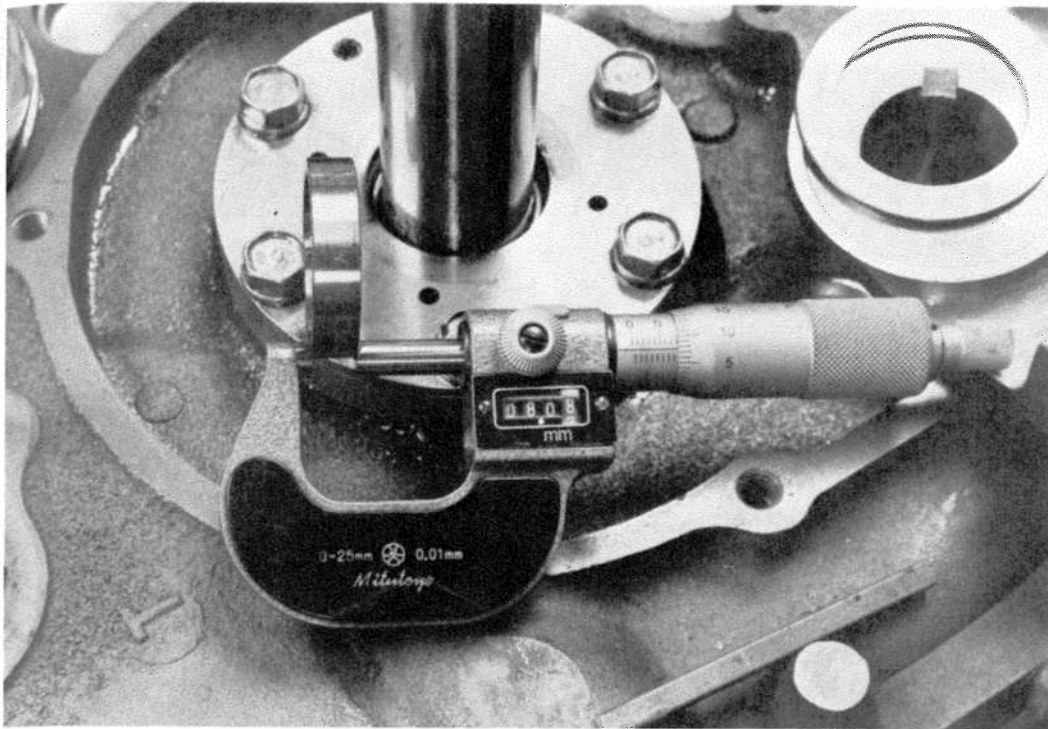
These are the remaining components to be installed on front of eccentric shaft. Gear closest to eccentric shaft drives dry-sump oil pump. Engines using standard oil pump will have sprocket that drives a chain that, in turn, drives oil pump.



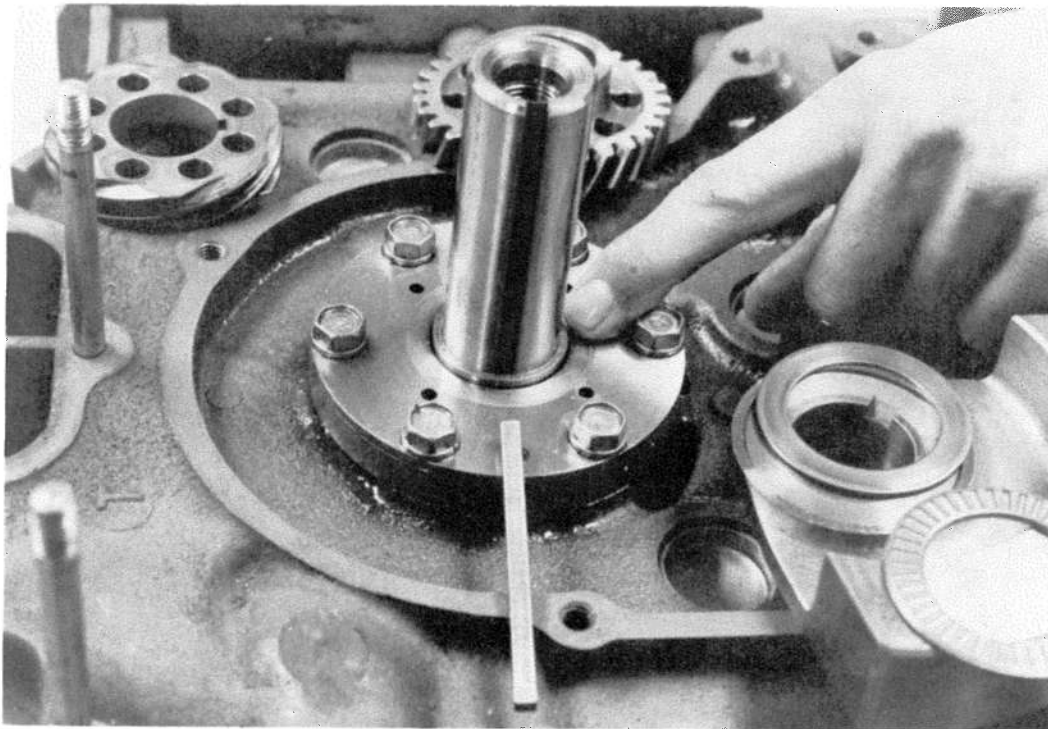
Spacer is identified Z for 8.0



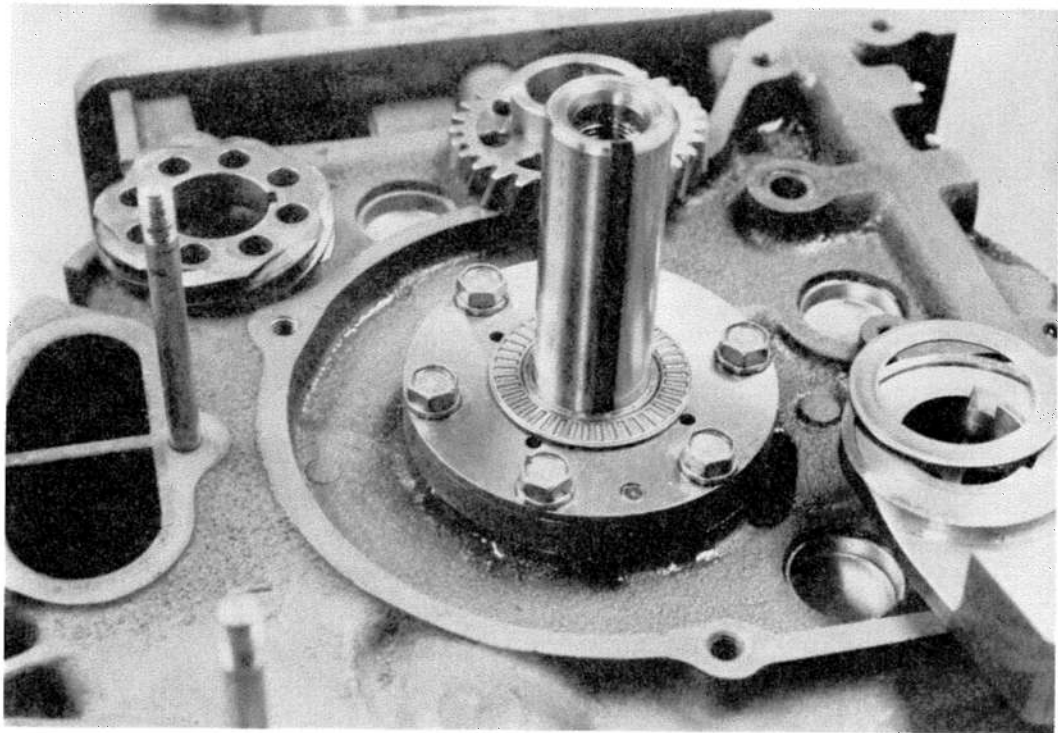
Spacer 1



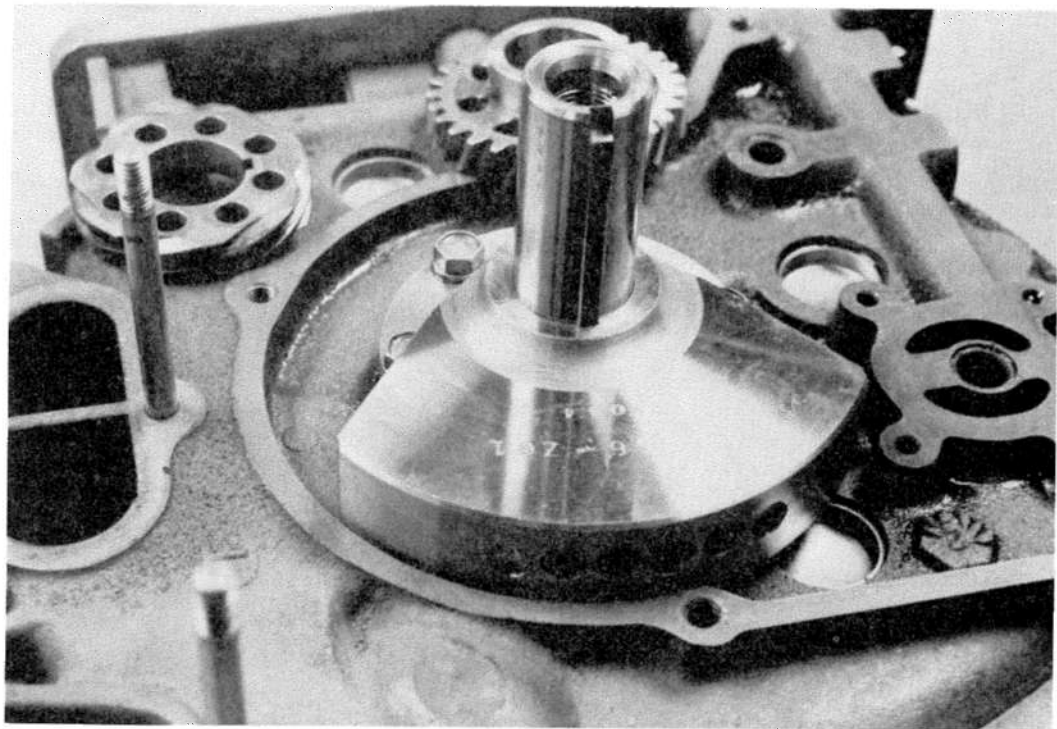
Spacer is used to adjust eccentric-shaft end play. Mazda offers spacers of various thicknesses which are identified by letters that relate to thickness: X for 8.80mm; K for 8.06mm; Y for 8.04mm; V for 8.02mm; and Z for 8.00mm. Spacers may also be sanded on a surface plate for minor thickness reductions.



Spacer fits over end of eccentric shaft.



Needle bearing is set in place and thrust washer is placed on top of it.



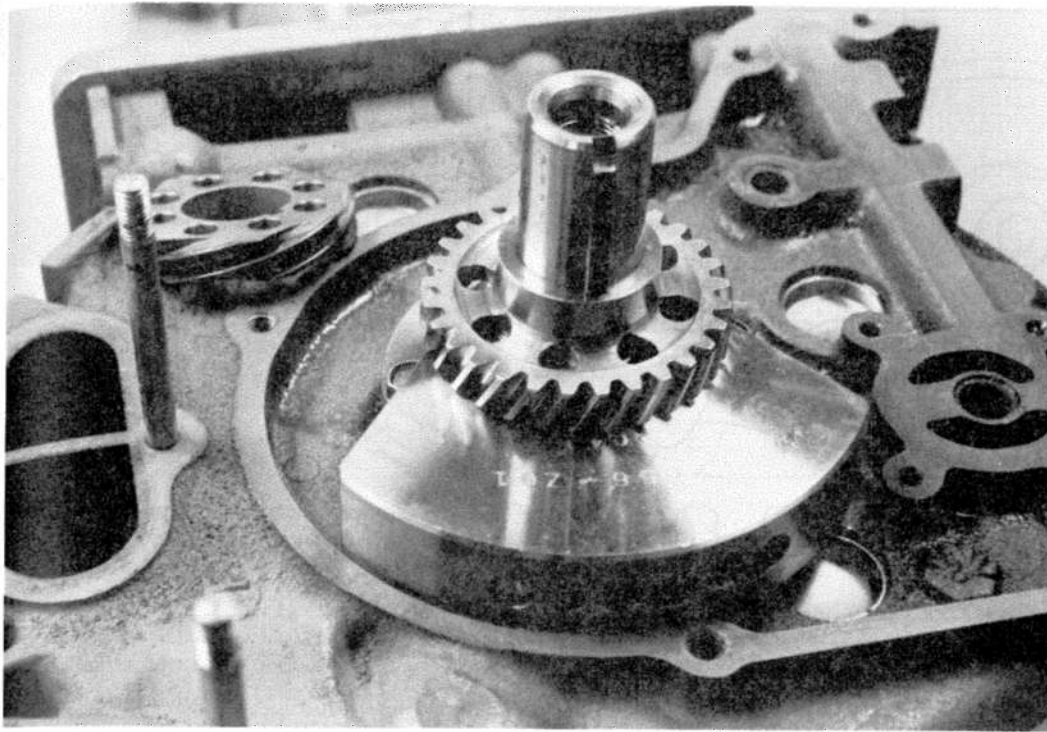
With key installed in eccentric-shaft keyway, install front counterweight as shown.



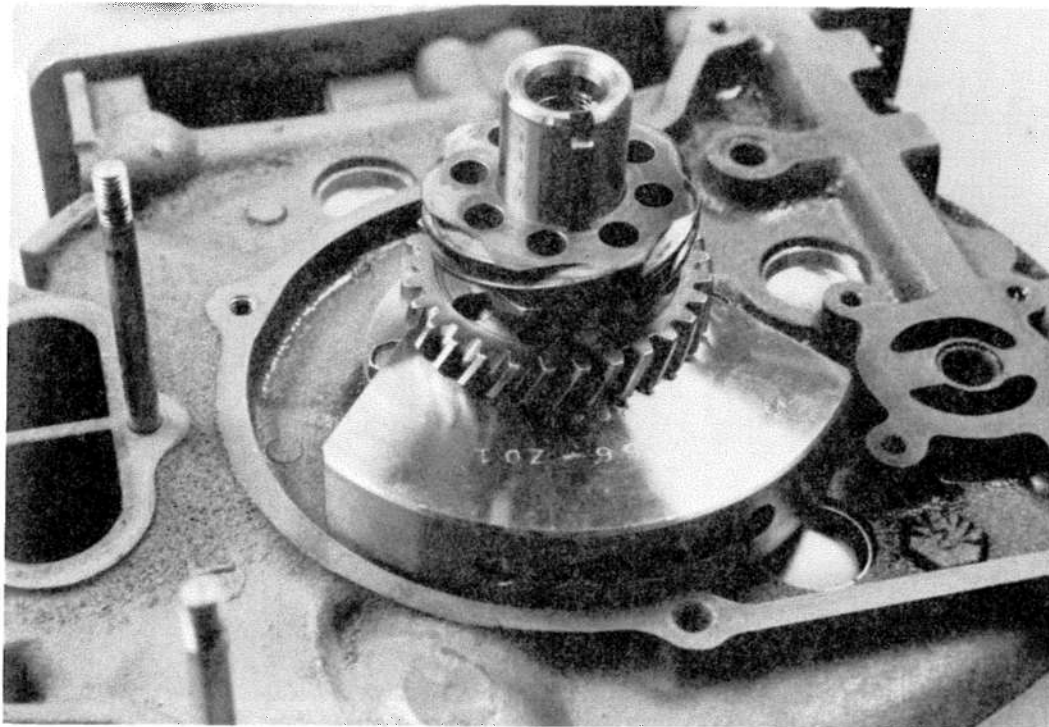
Place oil boss tha



Slide dist

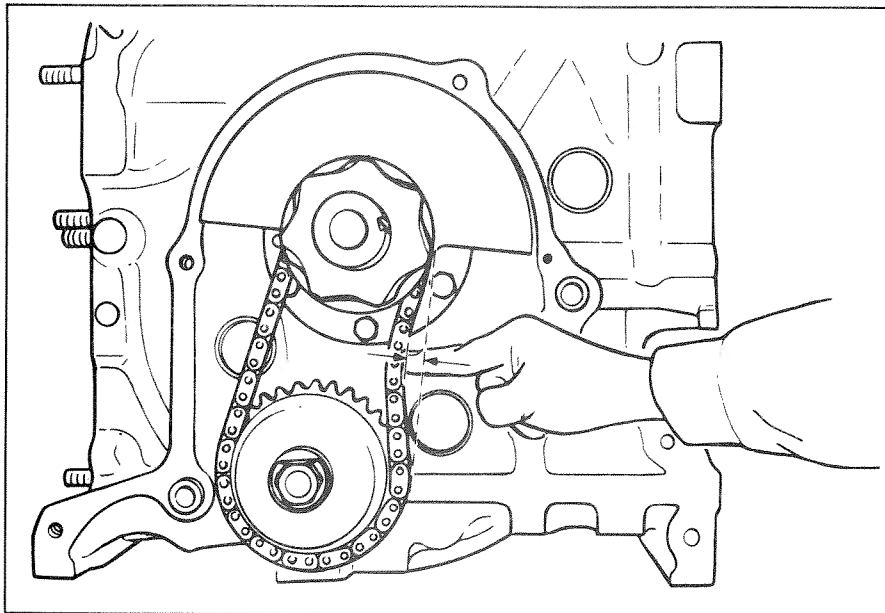


Place oil-pump drive gear or sprocket over end of eccentric shaft. Stock wet-sump oil pump mounts on boss that's immediately to right of counterweight.

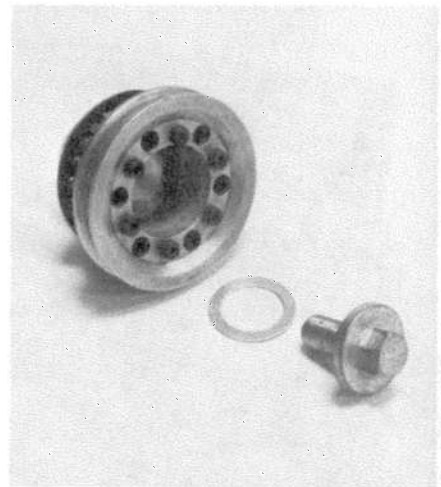


Slide distributor drive gear into position on shaft.

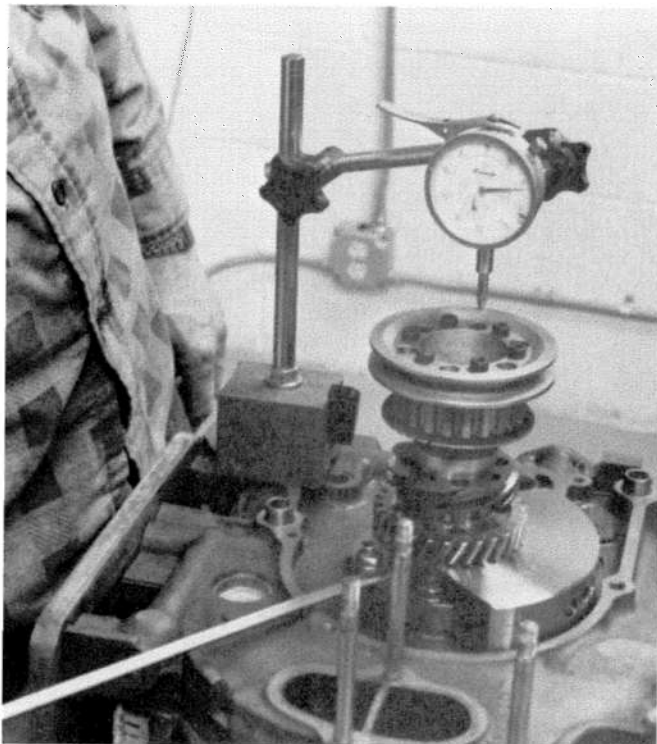




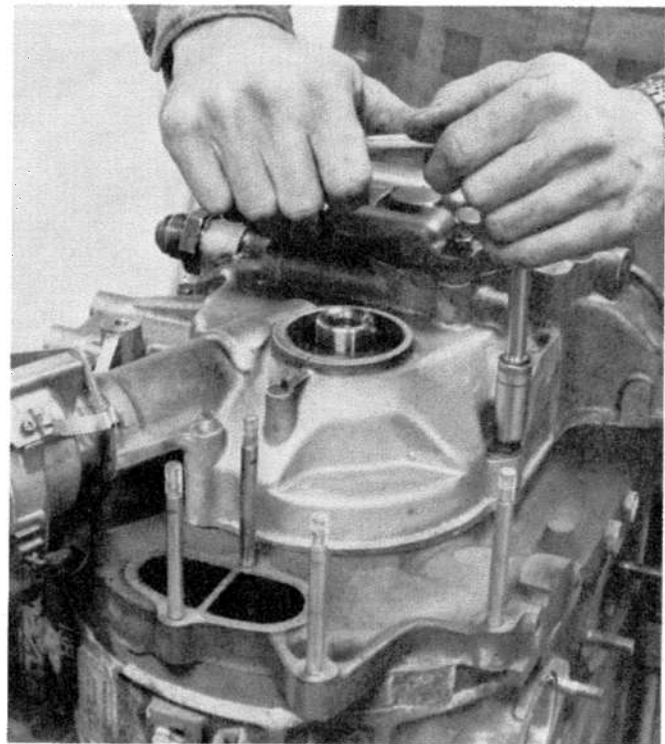
If stock oil pump is used, install pump and drive sprocket. Torque sprocket nut 23—34 ft-lb. Check chain for excessive slack. If chain can be easily moved 12mm (0.47 in.) or more, replace it.



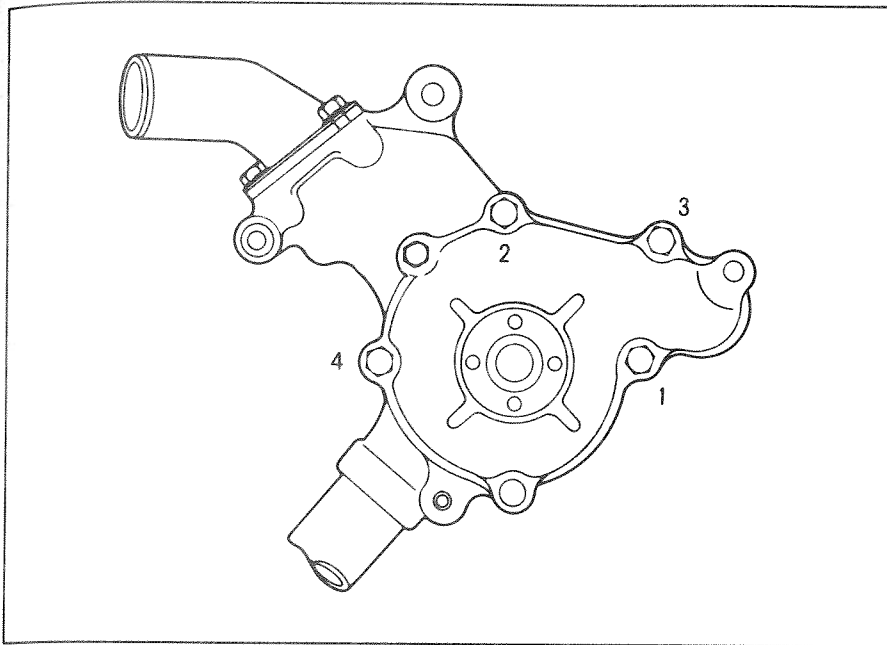
Front pulley is held in place with bolt and washer designed specifically for the purpose.



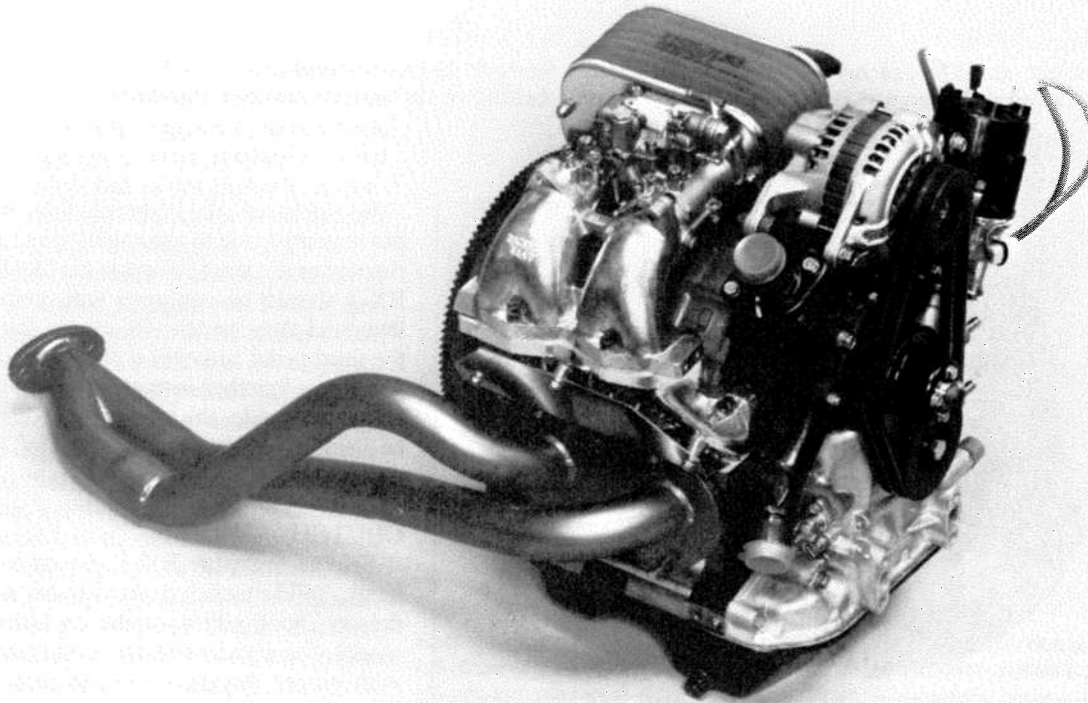
After tightening front pulley bolt, check end play by sliding a long screwdriver between front counterweight and bearing plate. Adjust spacer thickness as required to obtain end play of 0.04—0.06mm.



After correct end play is obtained, remove front pulley and install front cover. Reinstall front cover and pulley, and torque pulley nut 80—100 ft-lb, or torque as required to obtain correct end play as given at left. Recheck end play.



Install water pump and torque nuts in sequence 13—20 ft-lb.



Install intake, exhaust and ignition systems and you're ready to set engine in car and fire it—the engine, not the car.  
Photo courtesy Racing Beat.