



Amarillo®

SINGLE REDUCTION FAN DRIVES

INSTRUCTIONS FOR REPAIRING

Amarillo Single Reduction Fan Drives, if properly installed and maintained, should provide years of service with a minimum amount of maintenance. Repairs, when required, usually involve bearing or gear replacement. While the job is not difficult, it should only be performed in an adequately equipped shop by capable personnel. It should be noted that any repairs made outside the factory on new drives without the consent of the manufacturer will void the warranty.



Catalog SRR 7/09



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- ATTENTION -

Please note that gear drives with a serial number above 231989 have all joints sealed with Loctite Gasket Eliminator 515 instead of gaskets. Loctite 515 is a formed in place gasket material, which provides superior sealing over conventional gaskets. After disassembly for repair or inspection, we recommend resealing with Loctite 515. However, gaskets may still be used. If a gasket is utilized between the horizontal carrier and the gear case for a gear drive originally built with Loctite, the flange thickness of bearing bushing (20) or hardened washer (201), if applicable, will have to be changed to maintain the proper position of the horizontal gear. To correct the horizontal gear position, increase the horizontal spacer thickness by the thickness of the gasket. If Loctite is used to re-seal the gear drive then no changes are required to the horizontal spacer.

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1.0. General Disassembly Instructions

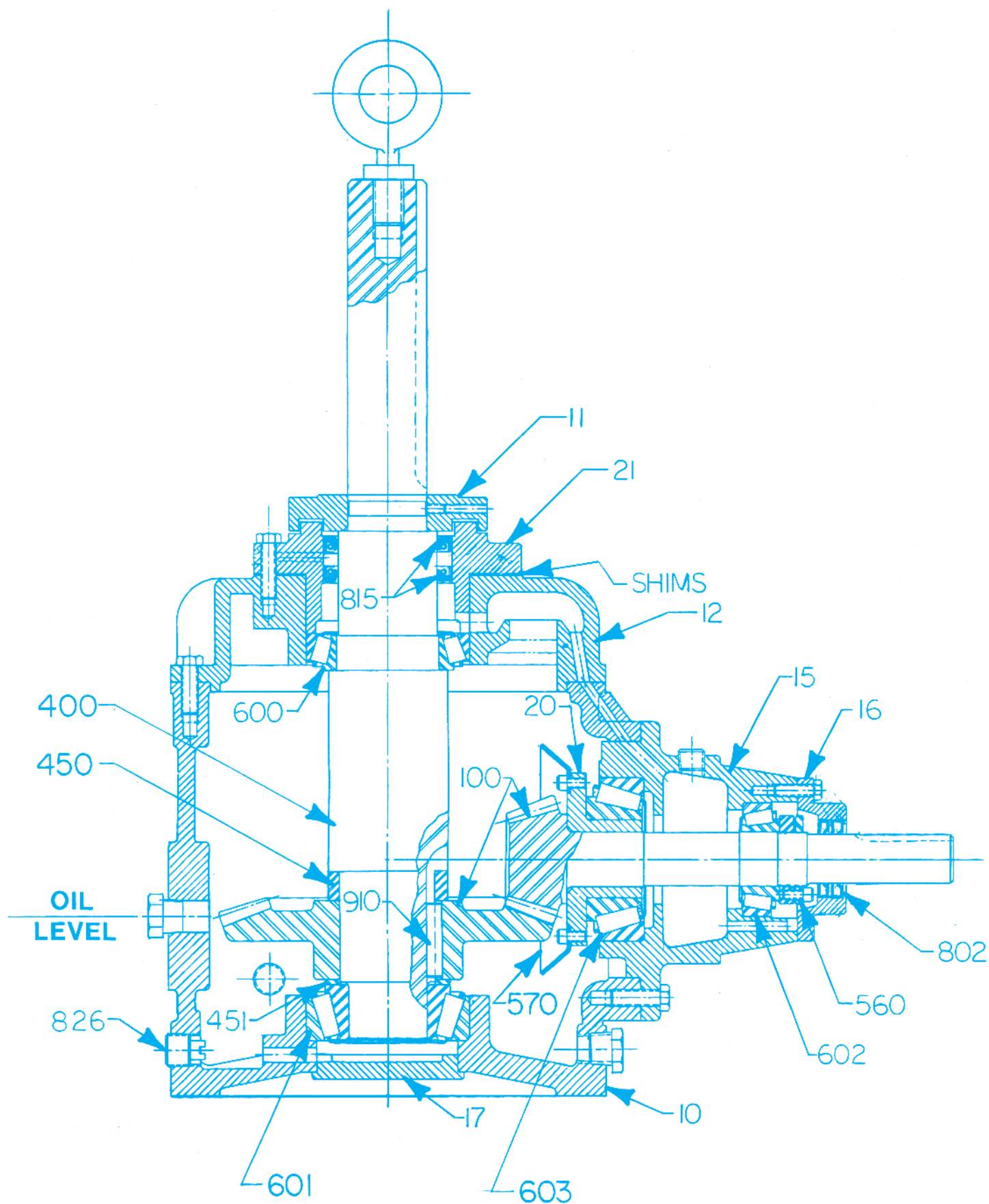
- 1.1. Refer to the appropriate cross sectional drawing during disassembly and assembly. See Fig. 1 or Fig. 2.
- 1.2. Drain and dispose of the oil.
- 1.3. Remove the upper seal plate (11) by removing the three set screws.
- 1.4. Remove the inspection plate.
- 1.5. Clean both the inside and outside of the drive. If steam is used inside the drive, be sure to disassemble the drive before it has time to rust.
- 1.6. Remove the oil seal plate (16) and loosen the horizontal locknut set (560) by removing the socket head cap screws. Remove the locknut set with a small drift punch or spanner wrench (it has right hand threads).
- 1.7. Match mark the horizontal shaft carrier (15) and the gear case (10). Remove the horizontal shaft carrier (15) from the gear case (10) (guide pins may be installed into the bolt holes, to help guide the carrier out of the gear case). A quick jerk up and down on the end of the horizontal shaft (100) will usually pull the horizontal carrier out of the register in the gear case. If this is not sufficient to remove the carrier, a sharp blow **with a soft mallet** against the side of the shaft will start the carrier moving and then it can be pried out of the register with two screwdrivers.
- 1.8. Match mark the vertical seal carrier (21) and the vertical carrier (12). Remove the vertical seal carrier (21) taking care not to damage the shim pack (located underneath the seal carrier).
- 1.9. Match mark the vertical carrier (12) and the gear case (10). Remove the vertical carrier (12) and the upper bearing cup (600).
- 1.10. Thread an eye bolt into the end of the vertical shaft (400) and lift it out of the gear case (10). **Caution:** Take care not to damage the roller cage of the lower bearing cone (601) when setting the shaft assembly on the work surface.
- 1.11. Press the bottom plug (17) out of the gear case (10).
- 1.12. Press the lower bearing cup (601) out of the gear case (10).

2.0. Disassembly of the Horizontal Shaft Assembly

- 2.1. Remove the shaft (100) with the inner bearing cone (603), bearing bushing (20) and oil slinger (570), by supporting the horizontal carrier (15) and pressing on the end of the shaft.
- 2.2. Remove the oil slinger (570) from the bearing bushing (20). **Note:** The position of the slinger for correct positioning during assembly.
- 2.3. Remove the bearing bushing (20), with the inner bearing cone (603), by supporting the bearing bushing and pressing on the end of the shaft (100). **Note:** On some ratios the bearing bushing is assembled with two pieces. If this is the case, proceed to step 14.0.
- 2.4. **Note:** On some ratios the pinion gear is not an integral part of the pinion shaft (100). If the pinion gear is part of the shaft, proceed to the next step. If not, proceed to step 16.0
- 2.5. Remove the inner bearing cone (603) from the bearing bushing (20) by using a drift punch through the holes provided in the bushing.
- 2.6. Remove the bearing cups, inner (603) and outer (602), from the horizontal carrier (15) with a brass punch or a bearing puller

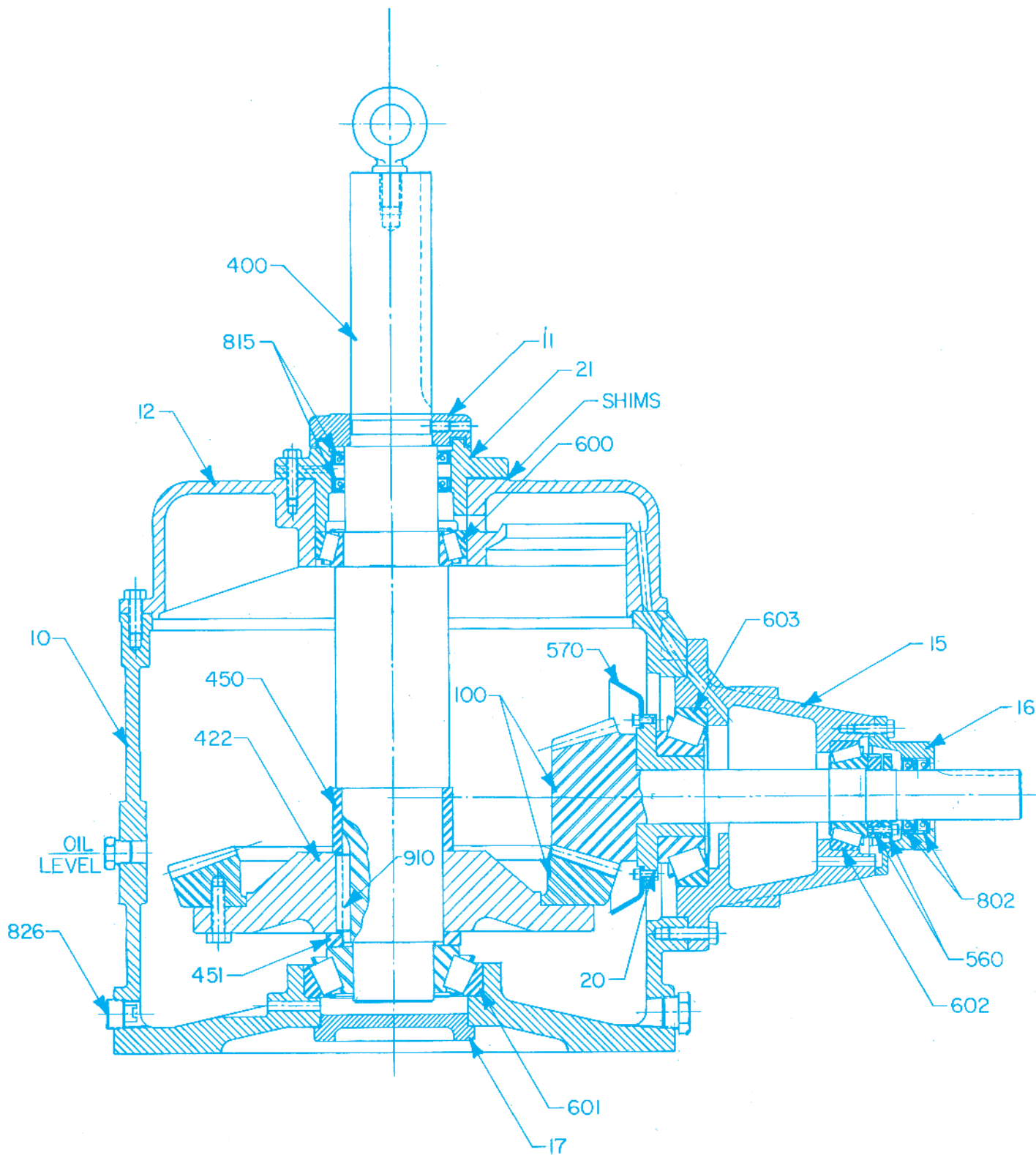
3.0. Disassembly of the Vertical Shaft Assembly

- 3.1. Remove hub type gears (100, Fig. 1) and lower bearing cone (601) by supporting the gear hub and pressing on the end of the vertical shaft (400). Remove ring type gears (100), Fig.2) in the same manner, but first remove the ring gear from the gear mount (422) by removing the cap screws and hitting lightly on the back of the gear **with a soft mallet**. **Note:** Most fan drives have spacers (450 and 451) located above and below the gear (100). **Do Not Interchange These Spacers at Assembly.**
- 3.2. Remove the gear key (910) and the above spacer (451).
- 3.3. Remove the upper bearing cone (600) by blocking under it and pressing the vertical shaft (400) down through it.



Models 85 and 110

FIGURE 1



Models 135, 155 and 175

FIGURE 2

4.0. General Assembly Instructions

- 4.1. Wash all disassembled parts and housings thoroughly with clean solvent.
- 4.2. Check the new gear set (if it is required) to make certain it is a matched set. Our gears are lapped in matched sets at the factory and must not be separated. Each set of gears is assigned a serial number which is etched on each member of a set. On the gear member, the serial number can be found on the back face just behind the heel of the tooth. On the pinion member, the serial number is etched on the pinion shaft between the bearing journals. Along with the serial number, the mounting distance of the particular member, its part number and the minimum amount of backlash required for the gear set is etched on the member.
- 4.3. Do not remove the bearings from their cartons until they are needed for use. Wash all used bearings in clean solvent. **Warning:** Do not spin dry bearings with pressurized air. Lubricate each bearing and roll the cone in its cup to check for any roughness. If the bearings are not going to be used immediately after cleaning, lubricate them and then cover each one to protect against contamination.
- 4.4. If new replacement parts have been purchased from the factory, make sure that there are no burrs on the shoulders that could cause problems in assembly.
- 4.5. When pressing **any** component on the shaft or into a housing, **always** use an antigalling compound.
- 4.6. The correct gear positions are obtained through the use of spacers (451 and 20). The required spacer lengths will vary with changes in the mounting distances (M.D.) of the gears. Spacer lengths should be corrected if the M.D. of the new set of gears differs more than 0.003 inch from the M.D. of the old set of gears. Usually bearing dimensions are consistent enough so that if they are replaced, spacer changes are not required. If the gear case (10) or the horizontal carrier (15) is ever replaced, the assembled castings will have to be remeasured and the spacers changed accordingly.

5.0. Assembly of Parts on the Vertical Shaft

- 5.1. Press the upper bearing cone (600) onto the shaft (400). **Note:** Take care not to damage the bearing roller cage. The bearing pusher **must not** bear against the cage or rollers.
- 5.2. Invert the shaft and slide on the above gear spacer (450).
- 5.3. Insert the gear key (910) and press on the vertical gear (100) or the gear mount (422), whichever is applicable.
- 5.4. Slide on the below gear spacer (451).
- 5.5. Press on the lower bearing cone (601). **Note:** Take care not to damage the bearing roller cage.
- 5.6. Double check to see that all parts are completely pressed together. Spacers should not turn on the shaft.
- 5.7. Install the ring gear (100) onto the gear mount, if applicable. Pull the gear onto the gear mount evenly and squarely. Make sure that the gear does not cock or bind and that it is fully seated on the gear mount.
- 5.8. Press the bottom plug (17) into the gear case (10).
- 5.9. Press the lower bearing cup (601) into the gear case (10).
- 5.10. Lower the vertical shaft assembly into the gear case (10) and rotate by hand a few turns so that lower bearing (601) seats properly.
- 5.11. Apply a 1/16 inch bead of Loctite Gasket Eliminator 515 (or equivalent) on the top flange of the gear case and install the vertical carrier (12). **Note:** the match marks on the carrier and the gear case must be aligned. **Warning:** Do not fill the oil ports with Loctite.
- 5.12. Slide the upper bearing cup (600) down against the upper bearing cone.
- 5.13. Lower the vertical seal carrier (21), without the shim pack or oil seals, down on top of the upper bearing cup (600). The shim pack is left out at this time so that the output shaft can be locked down with the seal carrier while checking backlash of the gears during final assembly. Do not lock the vertical shaft down at this time.

6.0. Assembly of Parts on the Horizontal Pinion Shaft

- 6.1. **Note:** On some ratios the pinion gear is not an integral part of the pinion shaft. If the pinion gear is part of the pinion shaft, proceed to the next step. If not, proceed to step 17.0.
- 6.2. Press the inner bearing cone (603) onto the bearing bushing (20).
- 6.3. Attach the oil slinger (570) to the bearing bushing (20). **Note:** The oil slinger must be replaced in the same position as noted during disassembly.
- 6.4. Press the bearing bushing (20), with the oil slinger (570) and inner bearing (603), onto the pinion shaft (100). **Note:** On some ratios the bearing bushing is assembled with two pieces. If this is the case, proceed to step 15.0.
- 6.5. Press the bearing cups, inner (603) and outer (602), into the horizontal carrier (15).

- 6.6. Insert the pinion shaft assembly into the horizontal carrier (15) and slide the outer bearing cone (602) onto the pinion shaft (100).
- 6.7. Press the outer bearing cone (602) onto the pinion shaft (100), leaving approximately 0.010 to 0.020 inch axial clearance between the cup and the cone. This clearance can be "felt" by lifting the horizontal carrier (15) while pressing the bearing cone into place.
- 6.8. Place the gasket, if used on the horizontal carrier (15). **Warning:** Do not place the gasket over the oil port.
- 6.9. Mark the teeth on the pinion gear (100) with a suitable marking compound.
- 6.10. Pull the horizontal assembly up to the gear case (10) with cap screws. Two guide pins, studs or headless bolts, turned into the tapped holes around the horizontal opening will greatly assist in installing the horizontal assembly. **Note:** Make certain the timing marks on the pinion are aligned with the timing marks on the gear. **Also, assure that match marks on the horizontal carrier and the gear case are aligned.**
- 6.11. Thread the thicker of the two locknuts (560) on the pinion shaft (100). **Note:** The thick member of the locknut set has one ground surface and one turned surface. The ground surface goes against the outer bearing cone (602).

7.0. Adjustment of Horizontal Bearings

- 7.1. Mount a dial indicator between the horizontal carrier (15) and the end of the pinion shaft (100) so that the axial movement of the pinion shaft can be measured.
- 7.2. Tighten the locknut (560), with a small drift punch or spanner wrench, until the in and out movement (bearing clearance) is from 0.001 to 0.002 inch T.I.R. **Note:** The pinion shaft should be rotated before each reading, so the bearing cones will remain seated in their cups.
- 7.3. Remove the dial indicator and thread the thinner portion of the locknut (560) on the pinion shaft (100) to within 1/32 to 1/16 inch of the thicker portion of the locknut set. Caution: Do not butt the two nuts together.
- 7.4. Align the holes in the locknut set and thread the cap screws into the set. Tighten until the outer nut deflects and almost touches the inner nut.

8.0. Backlash Check

Backlash is the amount of clearance between the mating teeth of a gear set and is obtained by measuring the amount of movement of one member at the pitch diameter, when the other member is held stationary. Backlash is very difficult to measure directly in an assembled gear drive. Following is an indirect method of measuring backlash.

- 8.1. While rotating the vertical shaft (400) back and forth, alternately tighten two of the cap screws on opposite sides of the seal carrier (21) until the shaft becomes hard to rotate by hand.
- 8.2. Place a key in the keyway in the pinion shaft (100) and retain with a C-Clamp, so there is no movement between the key and the shaft.
- 8.3. Place a dial indicator against the key and set to zero.
- 8.4. Measure the distance from the center of the pinion shaft to the point where the indicator contacts the key (see Fig. 3). This is the "r" value in the equation used in step 8.6. and will be used to obtain the backlash value.
- 8.5. Rotate the pinion shaft (100) back and forth and record the total indicator reading. This is the value "M" used in step 8.6. The vertical shaft (400) should still be locked down at this time. This measurement is not accurate if any movement is observed in the vertical shaft.
- 8.6. Calculate the backlash using one of the equations in Table 1, depending on which model is being repaired:

Model	Backlash	
85	$\left(\frac{4.25}{\text{ratio}} \right)$	$\left(\frac{M}{r} \right)$
110	$\left(\frac{5.5}{\text{ratio}} \right)$	$\left(\frac{M}{r} \right)$
135	$\left(\frac{6.75}{\text{ratio}} \right)$	$\left(\frac{M}{r} \right)$
155	$\left(\frac{7.75}{\text{ratio}} \right)$	$\left(\frac{M}{r} \right)$
175	$\left(\frac{8.75}{\text{ratio}} \right)$	$\left(\frac{M}{r} \right)$

Table 1

8.6.1. Example:

Model: 135

Ratio: 6.5:1

"r" is measured to be 1.12 inches.

"M" is measured to be 0.016 inches.

Therefore:

$$\text{Backlash} = \left(\frac{6.75}{\text{ratio}} \right) \left(\frac{M}{r} \right) = \left(\frac{6.75}{6.5} \right) \left(\frac{0.016}{1.12} \right) = 0.015''$$

- 8.7. The amount of backlash **must not** be less than the amount etched on the gear set. However, it can be as high as two times the etched value. **Note:** The correct position of the gear set is determined by the gear tooth contact pattern and the backlash. The tooth contact pattern should be checked and corrected before the backlash is corrected. Refer to step 19.0 after performing the Tooth Contact Pattern Check. **Never** run the gears without backlash.

9.0. Tooth Contact Pattern Check

- 9.1. Loosen the two cap screws in the vertical seal carrier (21) until the vertical shaft (400) rotates with a slight amount of drag.
- 9.2. Apply a suitable marking compound to the teeth of the gears (100) and rotate the input shaft.
- 9.3. Compare the tooth contact pattern to the patterns described in step 18.0.
- 9.4. If required, make adjustments to correct any error in the tooth contact pattern according to the instructions in step 18.0

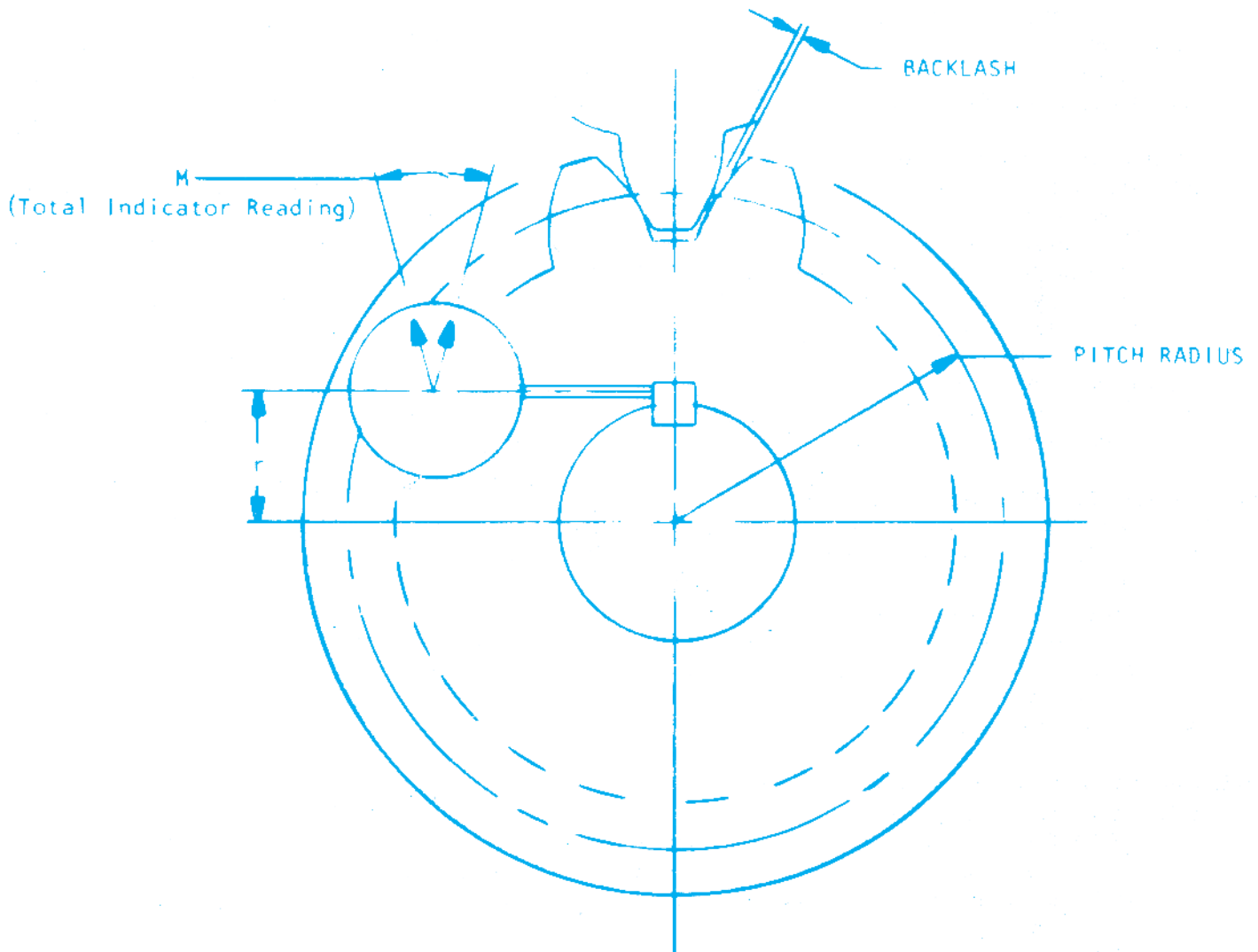


FIGURE 3

10.0. Installation of Horizontal Oil Seals

- 10.1. Press the oil seals (802) into the oil seal plate (16). Mount the seal front to back and pack with grease (refer to Addendum instructions on page 16). The springs on both seals are mounted so they are facing inside the case.
- 10.2. Slide the seal plate (16) with its gasket, if used onto the pinion shaft (100). **Note:** Put tape over the pinion shaft keyway to protect the seals from being cut by the edges of the keyway. **Warning:** Do not put the gasket over the oil drain port. The oil drain ports in the oil seal plate (16) and the horizontal carrier (15) must be aligned.
- 10.3. Center the oil seal plate on the pinion shaft and tighten the cap screws.

11.0. Adjustment of the Vertical Bearings

- 11.1. Remove the vertical seal carrier (21) and insert a shim pack. The thickness of the shim pack must be enough to allow the output shaft (400) to be raised when the seal carrier is bolted down.
- 11.2. Replace the seal carrier (21).
- 11.3. Tighten the bolts on the vertical seal carrier (21).
- 11.4. Mount a dial indicator between the output shaft (400) and the vertical carrier (12), so that the up and down movement of the shaft can be measured.
- 11.5. Rotate the shaft several revolutions to seat the bearings and thread an eye bolt into the top of the output shaft (400).
- 11.6. While watching the indicator, pull up on the output shaft. Record this measurement.
- 11.7. Remove the vertical seal carrier (21) and enough shims to decrease the measurement taken in step 11.6 to a maximum of 0.001 to 0.002 inch preload. 0.002 inches of shims removed will decrease the end play 0.002 inch. **Note:** The shims in a shim pack have different thicknesses.
 - 11.7. 1. Example:
If the indicator reads 0.006 inch, remove 0.007 to 0.008 inches of shims from the shim pack.
- 11.8. Replace the vertical seal carrier (21) with the shim pack and double check the measurement. **Note:** Make certain to rotate the shaft back and forth to properly seat the lower bearing (601) before taking any readings.
- 11.9. If any up and down movement is shown, repeat steps 11.7 and 11.8.

12.0. Installation of Vertical Oil Seals

- 12.1. Remove the vertical seal carrier (21) and press the vertical seals (815) into place (spring sides facing inside the gear drive) and pack with Mobil Grease SHC 220.
- 12.2. Replace the vertical seal carrier (21) with the vertical seals and correct shim pack. **Note: The match marks on the seal carrier (21) and the vertical carrier (12) must be aligned.**
- 12.3. Mount the upper seal plate (11) and tighten the three set screws. Check to make certain that it is not touching the vertical seal carrier (21).

13.0. Completion of Assembly

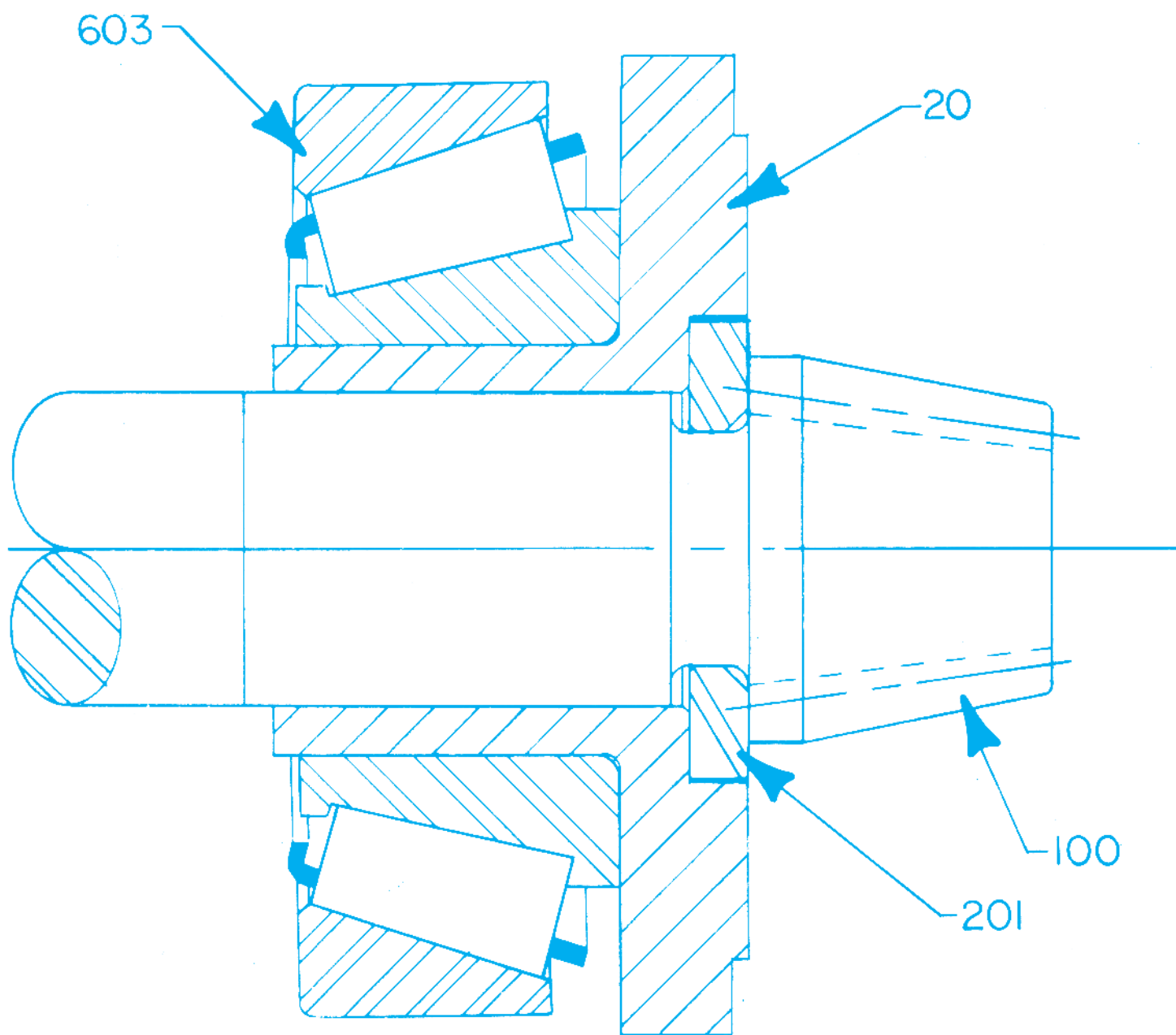
- 13.1. Fill the unit with the correct lubricant (see the Operating and Maintenance Instructions), affix the inspection plate and return the fan drive to service.

14.0. Disassembly of Two Piece Bearing Bushing

- 14.1. **Note:** The two piece bearing bushing is used on the model 135 7.5:1 and larger ratios and the models 155 and 175 9:1 and larger ratios. Refer to Fig. 4 and Fig. 5 during disassembly and assembly.
- 14.2. Remove the bearing bushing (20) by supporting the bushing and pressing on the end of the pinion shaft (100). **Note:** The inside diameter of the blocking ring **must clear** the washer (201).
- 14.3. Remove the washer (201) from the pinion shaft (100). **Note:** On the model 135, this washer is a split ring, which fits into a groove in the pinion shaft. On the models 155 and 175, the washer is one piece and will slide off the shaft.
- 14.4. Proceed to step 2.4.

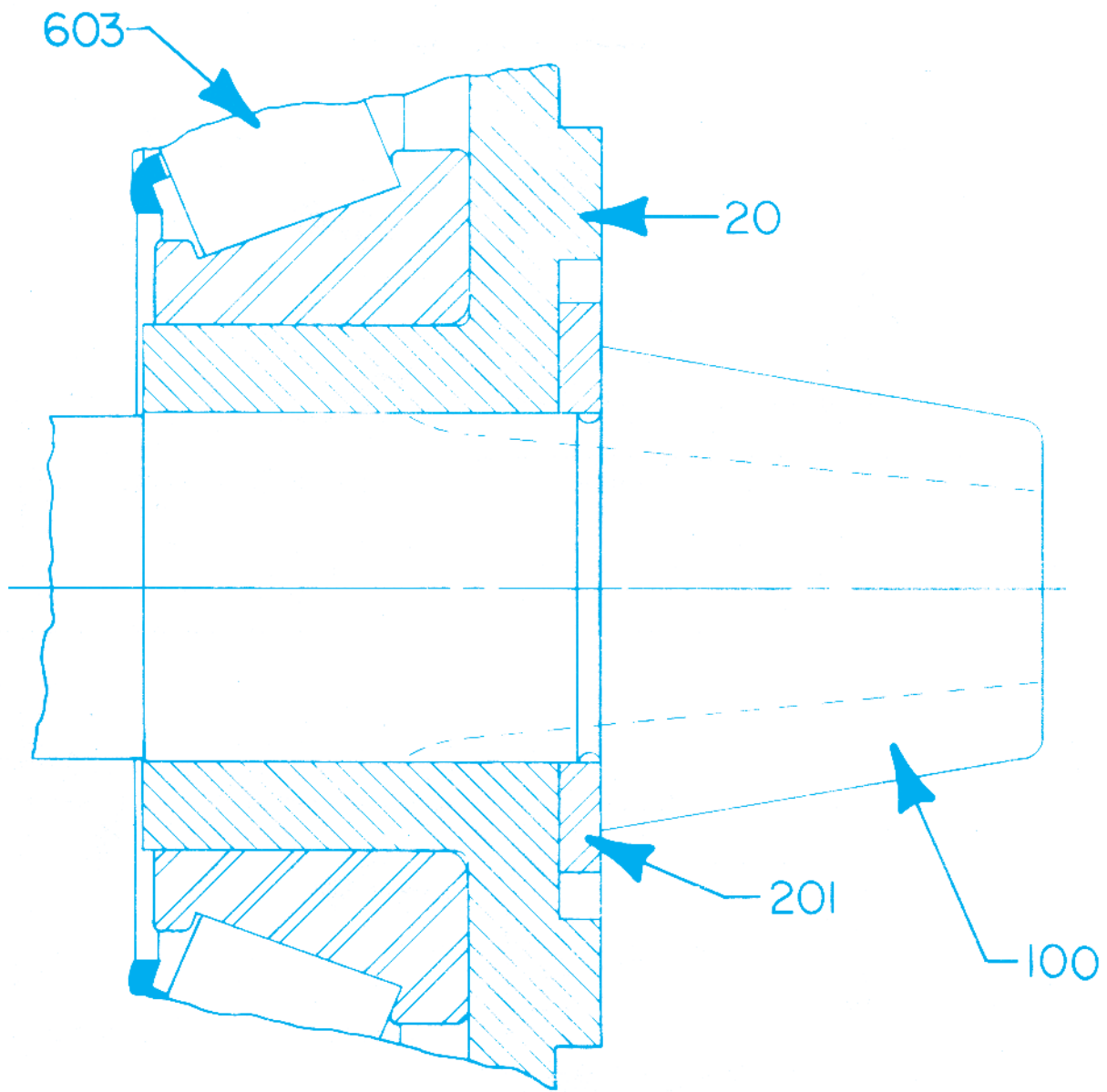
15.0. Assembly of Two Piece Bearing Bushing

- 15.1. Assembly for the Model 135 (Fig. 4):
 - 15.1.1. Press the bearing bushing (20) onto the pinion shaft (100) until there is just enough clearance between it and the pinion gear for the split ring washer pieces (201) to slide into the groove.
 - 15.1.2. Install the split ring washer (201) into the groove in the pinion shaft (100) and align with the bore in the bearing bushing (20).
 - 15.1.3. While holding the split ring washer in place, press the bearing bushing (20) until it starts over the washer.



Model 135

FIGURE 4



Models 155 and 175

FIGURE 5

15.1.4. Release the washer and check to make sure the bearing bushing is not binding on the washer.

15.1.5. Finish pressing the bearing bushing into place.

15.1.6. Proceed to step 6.5.

15.2. Assembly for the Models 155 and 175 (Fig. 5):

15.2.1. Slide the washer (201) onto the pinion shaft (100).

15.2.2. Press the bearing bushing (20) onto the pinion shaft (100) until it starts over the washer (201).

15.2.3. Check the washer to make sure it is flat against the back of the pinion gear (100) and that it is cleared by the bore in the bearing bushing (20).

15.2.4. Finish pressing the bearing bushing into place.

15.2.5. Proceed to step 6.5.

16.0. Disassembly of the Hub Type Pinion from the Pinion Shaft

16.1. **Note:** On some of the smaller ratios, i.e., 2:1, 3:1, etc., the pinion gear (100) is separate from the pinion shaft (500). See Fig. 6.

16.2. Invert the pinion shaft (500) and place in the press. Select a pressing ring which has an inside diameter that will just clear the shaft and an outside diameter which will fit inside the root of the pinion teeth, and press the pinion gear off the shaft.

16.3. Remove the pinion gear key (911).

16.4. **Note:** Some ratios require an inner spacer (550). Do not lose this spacer, as it will be required during assembly.

16.5. Proceed to step 2.5.

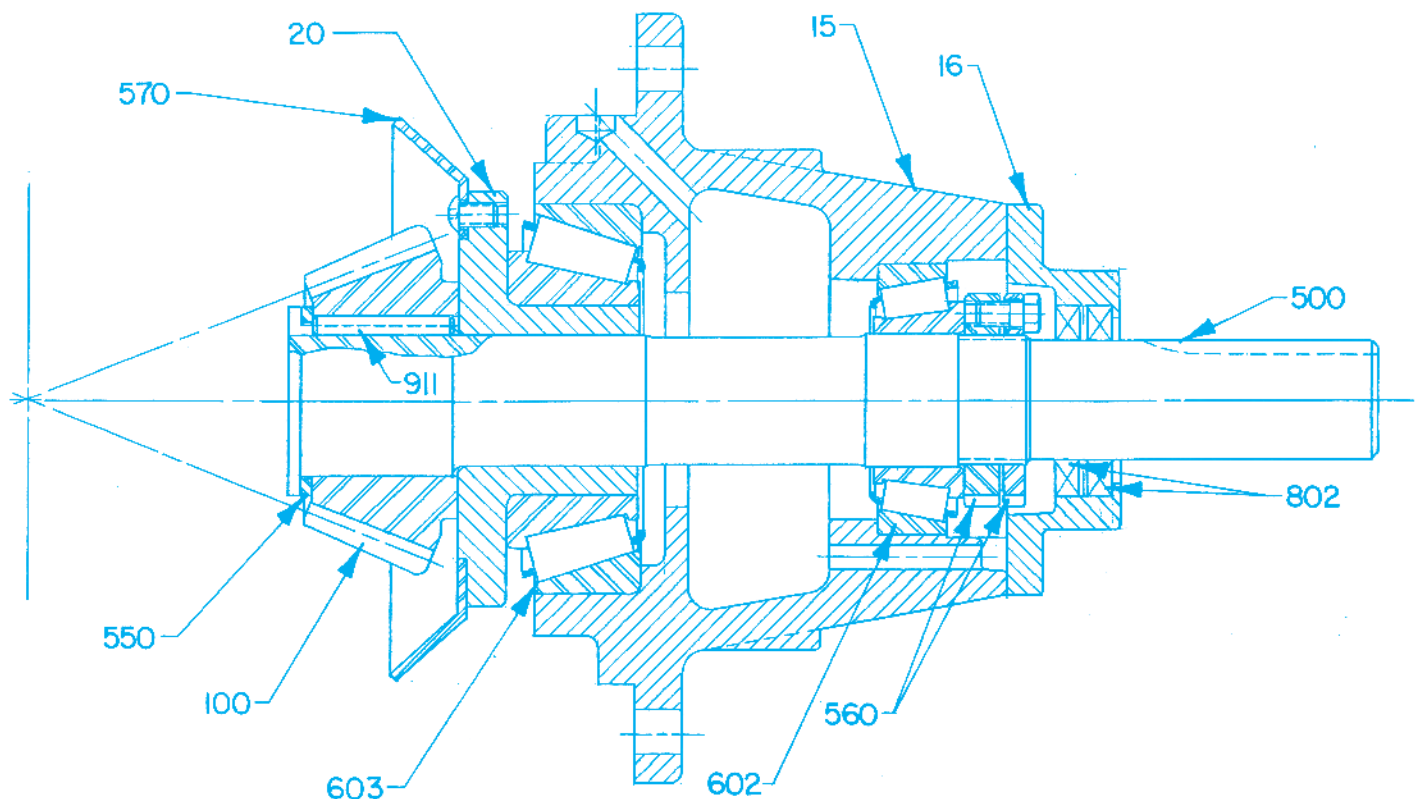
17.0. Assembly of the Hub Type Pinion onto the Pinion Shaft

17.1. Slide the inner spacer (550), if required, onto the pinion shaft (500). See Fig. 6.

17.2. Insert the pinion gear key (911) into the keyway in the pinion shaft.

17.3. Press the pinion gear (100) onto the pinion shaft (500). **Note:** Make sure that the pinion gear is pressed down tight against the end of the shaft or the inner spacer (550), whichever is applicable.

17.4. Proceed to step 6.2.



Horizontal Assembly

FIGURE 6

18.0. Tooth Contact Pattern and Adjustment

- 18.1. The tooth contact pattern must be checked and corrected, if needed, before the backlash is corrected. The correct tooth contact for a gear set is shown in Fig 7. If the tooth contact is correct, proceed to step 19.0.
- 18.2. Fig. 8 shows the two most common forms of incorrect tooth contact. When a tooth contact occurs as shown in Fig. 8A, the following items will have to be checked.
 - 18.2.1. Make sure the horizontal shaft carrier (15) is pulled up tightly to the gear case (10).
 - 18.2.2. Make sure that no more than one gasket, if used has been used between the horizontal carrier and the gear case.
 - 18.2.3. Make sure that the gasket, if used between the horizontal carrier and the gear case is 0.015" thick.
 - 18.2.4. If the above steps do not correct the tooth contact, the pinion must be moved toward the gear. The adjustment can be done by increasing the flange thickness of the bearing bushing (20) or thickness of hardened washer (201), if applicable. An increase of 0.001" will move the pinion toward the gear 0.001".
- 18.3. When a tooth contact occurs as shown in Fig. 8B, the following items will have to be checked.
 - 18.3.1. Make sure that a gasket, if used has been installed between the horizontal shaft carrier (15) and the gear case (10).
 - 18.3.2. Make sure that the gasket, if used between the horizontal carrier and the gear case is 0.015" thick.
 - 18.3.3. If the above steps do not correct the tooth contact, the pinion must be moved away from the gear. The adjustment can be done by decreasing the flange thickness of the bearing bushing (20) or thickness of hardened washer (201), if applicable. A reduction of 0.001" will move the pinion away from the gear 0.001". **Note:** Removal of stock **must be** done on a surface grinder or with the bearing bushing (20) mounted on a mandrel.
- 18.4. When a tooth contact occurs as shown in Fig. 9 of Fig. 10, refer to the following instructions.
 - 18.4.1. The most probable cause of cross contact or shaft angle error is that the horizontal carrier is cocked in the register of the gear case.
 - 18.4.2. To correct, remove the horizontal assembly and look for burrs, chips, a folded gasket or any condition that will prevent the horizontal housing from seating flat and square on the gear case. Contact the factory if the problem cannot be corrected.

19.0. Backlash Adjustment

After the correct tooth contact is obtained, the backlash must be rechecked according to the procedure described in step 8.0. If the backlash is within limits proceed to step 10.0.

- 19.1. If the backlash is less than the amount etched on the gear set, the vertical gear will have to be moved away from the pinion. This is done by removing stock from the below gear spacer (451). **Note:** Removal of stock from the spacer must be done on a surface grinder or on a lathe with the spacer mounted on a mandrel, to keep the ends of the spacer parallel to each other and perpendicular to the bore.
- 19.2. If the backlash is greater than twice the amount etched on the gear set, the vertical gear will have to be moved toward the pinion. This is done by increasing the length of the below gear spacer (451). **Note:** When making a new spacer, the ends of the spacer must be parallel to each other and perpendicular to the bore.
- 19.3. A change of 0.001" in the below gear spacer length will change the backlash approximately 0.001".
- 19.4. When the backlash is within limits, proceed to step 10.

SPIRAL BEVEL GEARS—Typical Preferred Tooth Contact (Pinion Member Left Hand in All Cases Shown)

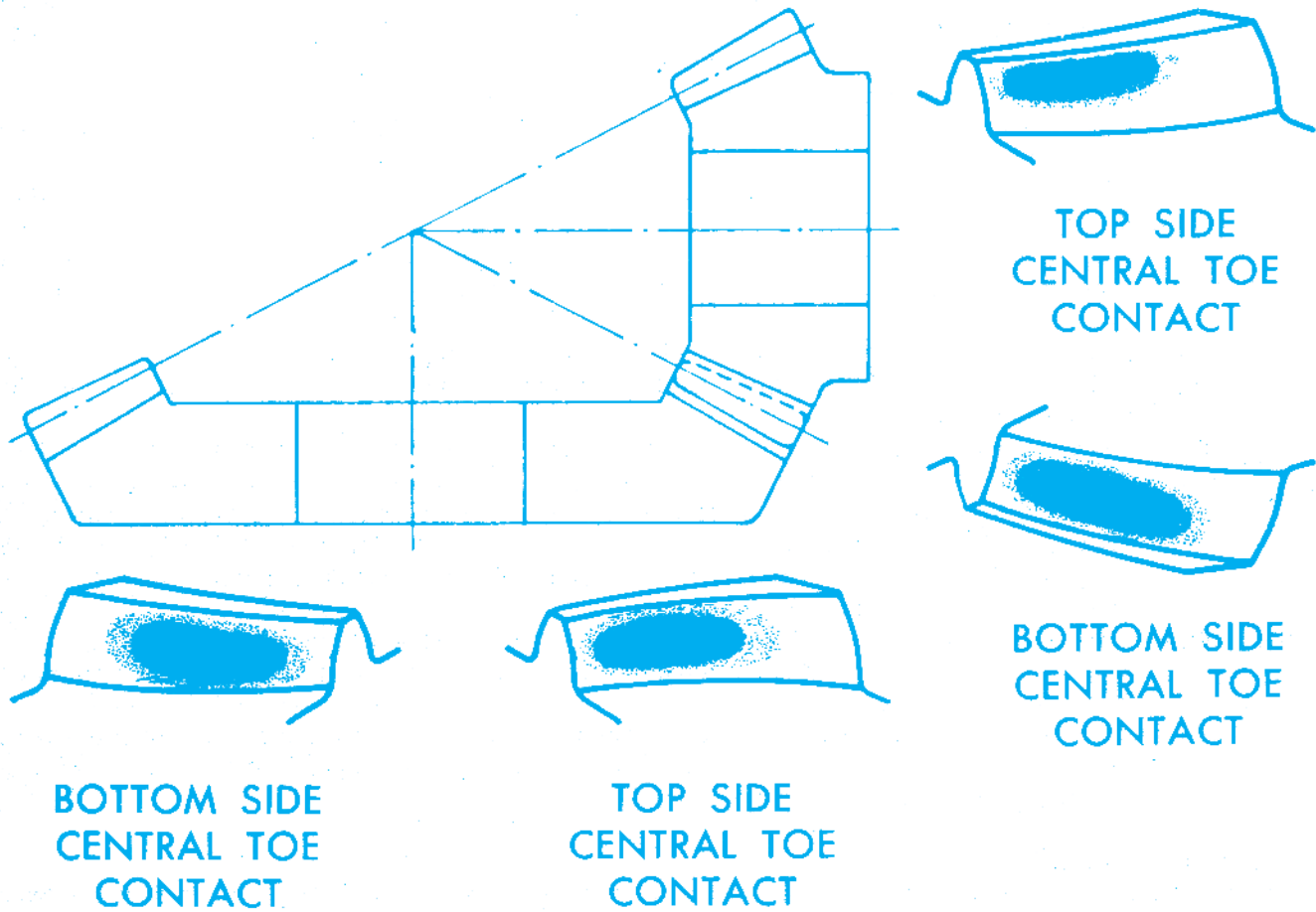


FIGURE 7

PROFILE ERROR—To Correct: move in on pinion cone.

PROFILE ERROR: To Correct: move out on pinion cone.

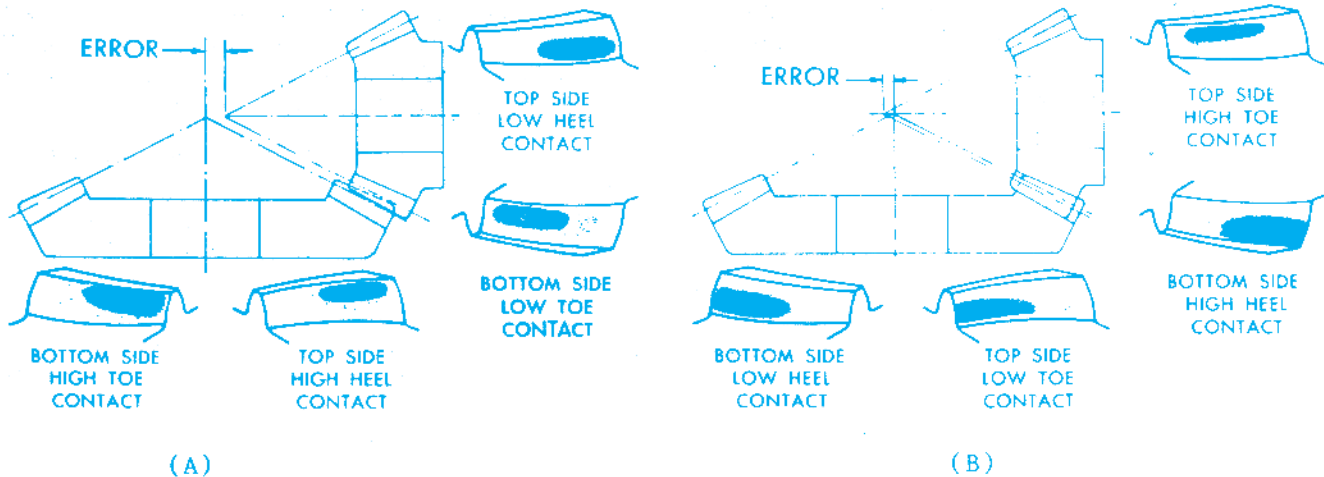
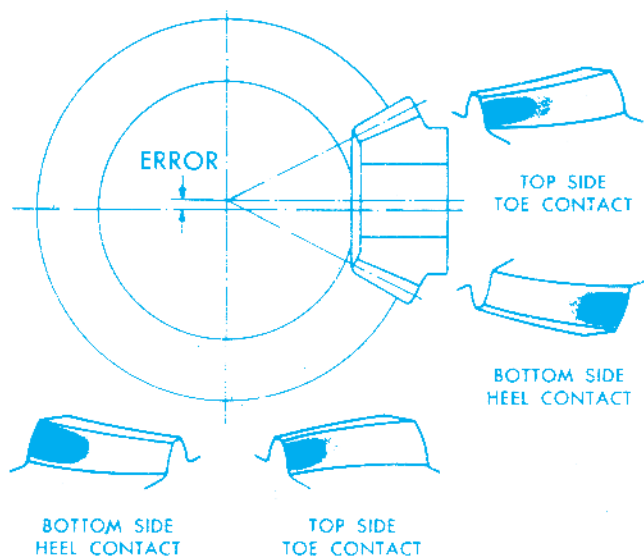


FIGURE 8

Proper profile contact and backlash must be obtained first before an attempt is made to correct for any of the following conditions if they should exist.

CROSS CONTACT-



CROSS CONTACT-

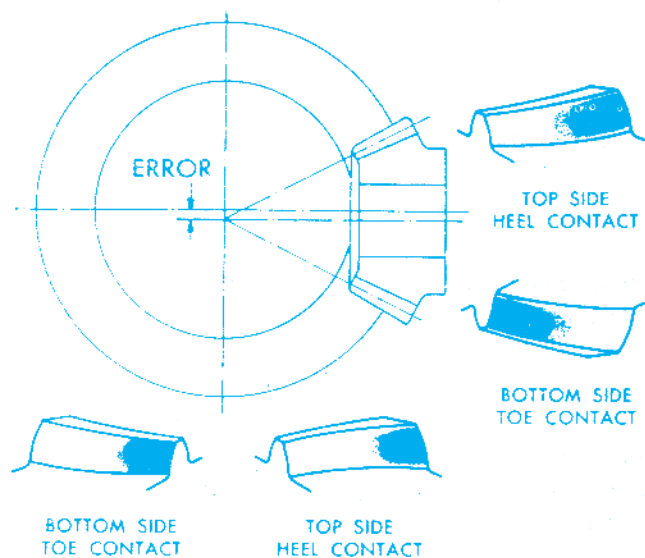
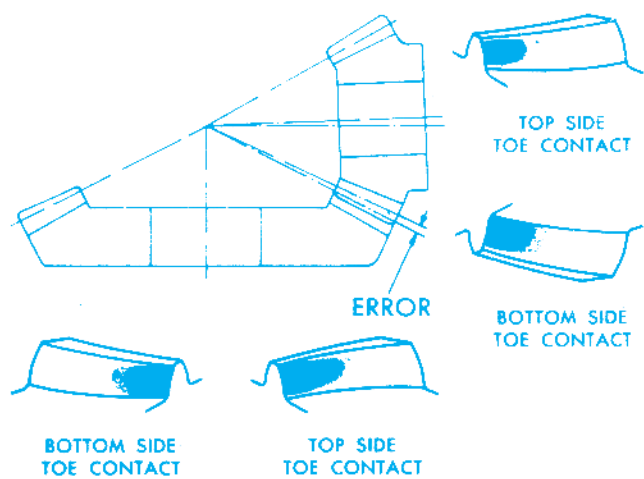


FIGURE 9

SHAFT ANGLE ERROR-



SHAFT ANGLE ERROR

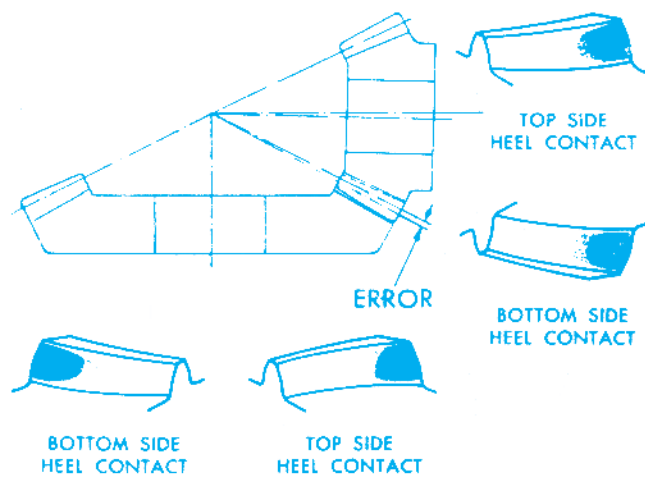


FIGURE 10

INSTALLATION PROCEDURES FOR GREASED FOR LIFE INPUT SHAFT SEALS

1.0 Refer to Figure 11 during installation

2.0 Install seals (802) in the oil seal plate (16) so the springs will be toward the gear drive.

3.0 Install Mobil Grease SHC 220 between the seals. Fill the lower 75% of the area between the seals. Apply a thin film of grease to the lips of the seals.

4.0 Install the seal plate (16) on the horizontal carrier (15). Use a shield to protect the seals from being cut by the keyway on the horizontal shaft (500). **Make sure** the match marks on the oil seal plate and the horizontal shaft carrier are aligned. The oil drain back notch in the seal plate must be located to the bottom.

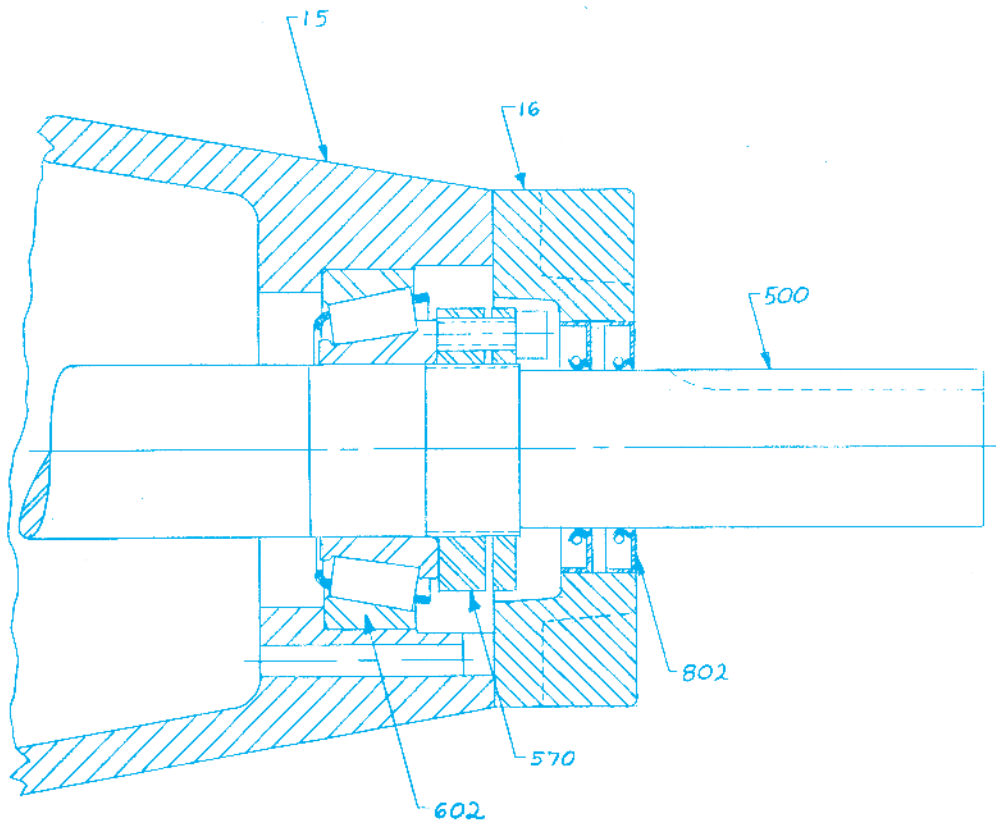


Figure 11

INSTALLATION PROCEDURES FOR GREASED FOR LIFE OUTPUT SHAFT SEALS

- 1.0 Refer to Figure 12 during installation.
- 2.0 Install seals (815) in the vertical seal carrier (21) so the springs will be toward the gear drive.
- 3.0 Install Mobil Grease SHC 220 between the seals. Apply a thin coat of grease to the lips of the seals.
- 4.0 Install the vertical seal carrier (21) on the cover (12). **Make sure** the match marks on the seal carrier and the cover are aligned.
- 5.0 Pack the area above the top seal up to the shoulder of the shaft with grease.
- 6.0 Apply a film of grease to the journal for the upper seal plate (11).
- 7.0 Install the upper seal plate (11) and tighten the set screw. Wipe off any grease that may have pushed out around the upper seal plate (11).

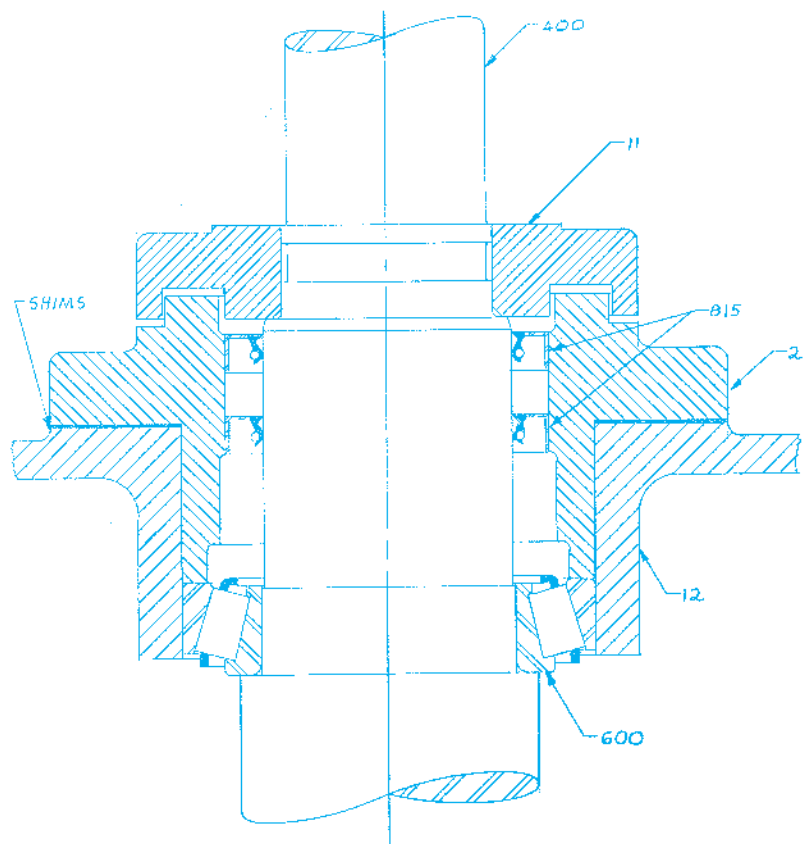


FIGURE 12

NOTES



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