Central® Tools, Inc.

6470

PINION DEPTH SETTING GAGE

Please read through this entire instruction sheet carefully before attempting to use the 6470 Pinion Depth Setting Gage.

These instructions are not intended to teach specifics of differential repair; they are merely intended to explain the use of the gage to technicians who are already familiar with the task of setting pinion depth.

The 6470 will provide an accurate reading of pinion depth, which is critical information necessary to choose shims. However it does not provide a *direct* indication of pinion shim requirements.

There are actually two distinctly different situations that may be encountered. One is use of OEM gearsets and the other is use of aftermarket gearsets. Please refer to the appropriate section below. OEM gearset instructions begin on Page 4 and aftermarket gearset instructions begin on Page 16.

IMPORTANT NOTES:

For more detail, please refer to the manufacturer's instructions for the specific vehicle. In the event of conflicting information, the vehicle manufacturer's information always takes precedence.

Mark the carrier bearing shims (if used) for re-installation in the original location. For threaded-type adjusters, mark the position. Also mark the carrier bearing caps.

If disassembling the ring gear from the carrier, ensure the proper torque is applied upon reassembly. Use care, as some models use a left-hand thread.

Ring and pinion gearsets are always replaced as a matched set. They are manufactured as a pair and must always be kept together.

Many differential assemblies use a "crush collar" or collapsible spacer on the pinion bearings to set preload. They can require relatively high torque (on the order of roughly 200 ft-lb) to begin collapsing. Once it begins to collapse, it will crush easily from that point. Work up to the proper preload in small progressive steps. Do not back off once the spacer is crushed.

To avoid the need to repeatedly press and remove pinion bearings while choosing shims, it may be useful to obtain a spare bearing and hone its ID to a slip-fit. Do not use this bearing upon final reassembly.

It is critical for proper reassembly to set ring gear backlash, pinion bearing preload, and carrier bearing preload. Ring-gear runout should also be checked. Consult manufacturer's specifications, or use a maximum runout of .005" as a rule of thumb. If larger, remove and remount the ring in a different position on the differential.

Use of the 6470 does not take the place of running a pattern after reassembly is complete.

Reassemble the cover using the proper seal materials, and refill to the proper level with the proper fluid per manufacturer specifications.

FOR USE WITH OEM GEARSETS:

OEM gearsets typically will not provide a specific pinion depth marked on the top of the pinion. This is because the OEM's assume use of their own special tool, and thus they will typically mark the pinion with nothing but a correction factor (which might appear for example as +1, -2 etc.). This is actually an adjustment to be made to the shim measurement provided by the OEM special tool. Take note of the markings on both the old and the new pinions.

The approach to using the 6470 in place of the OEM special tool is to **start by taking a measurement from the old pinion before removal,** then, using this dimension to choose shims for the new pinion. (This is a good time to check for pinion side play or end play which may indicate worn bearings, and may throw off the measurement.)

Refer to Figure 1 to help identify the names of the various parts of the 6470, shown in *italic type* when first mentioned in the instruction text.

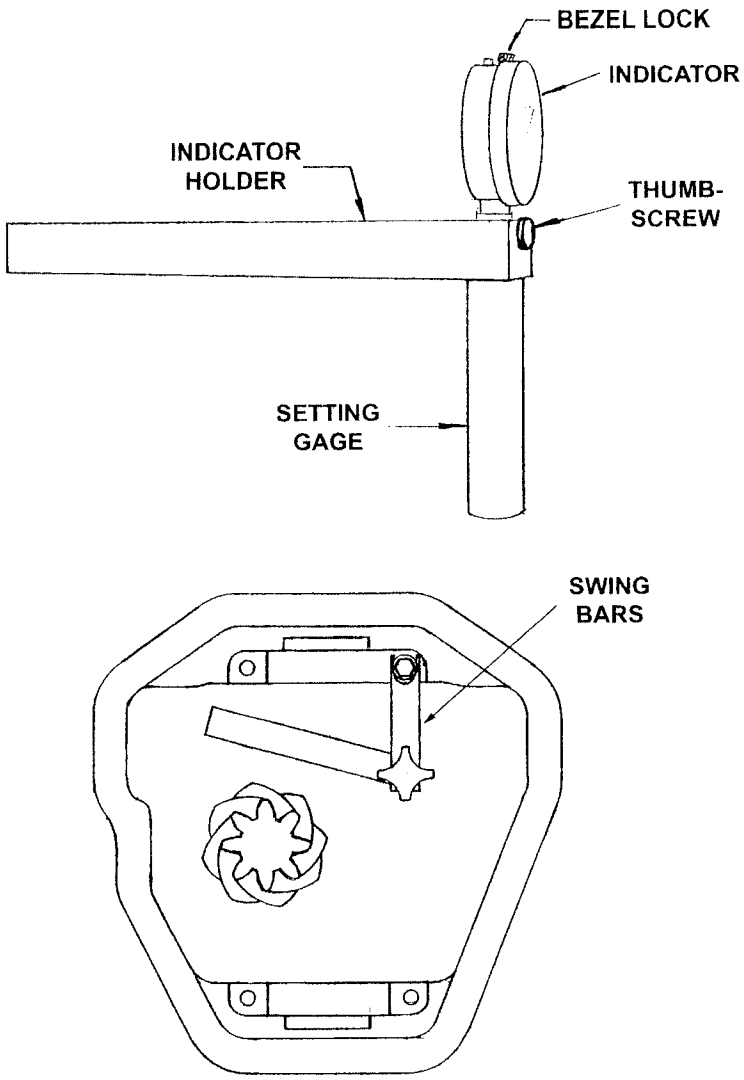

FIGURE 1

1. Observe the top of the old pinion for marking of correction factor, and if found, record in the worksheet as "X". If the number is "-1" for example, record (in thousandths of an inch) as "-.001" Do not ignore the negative sign, if any. Do the same for the new pinion and record as "Y". Subtract the old correction factor from the new correction factor to come up with the final value "Z". Be careful with the negative signs. If no marking is found on the pinion, this is the same as a zero correction factor.

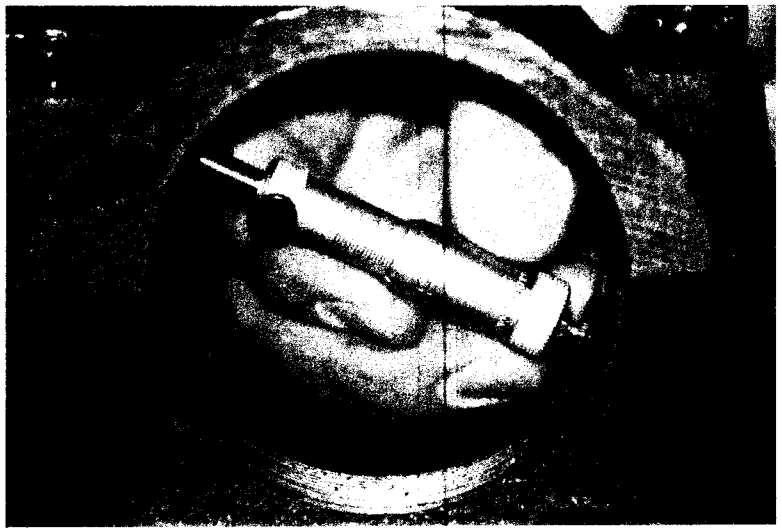

FIGURE 2

2. With the differential case, ring gear, and carrier bearings removed from the carrier, install a carrier bearing cap and torque to manufacturer's specification. Measure with an inside micrometer and record the bore dimension, "A" in the worksheet. See Figure 2 and Figure 7. This measurement can be taken with a dial caliper, however, accuracy is lower.

3. Divide "A" by 2 to obtain "B" shown in Figure 8.

4. Select a *Setting Gage* that is larger, but closest in size to "B", and record in worksheet.

5. Attach the appropriate number of tip extensions to the *Indicator*: if the selected Setting Gage is 2.000, use one extension. If the selected Setting Gage is 3.000, use two extensions. If the selected Setting Gage is 4.000, use three extensions.

6. Steps A thru E below will explain how to calibrate the indicator.

   A. As shown in Figure 3, with the Indicator on the *Indicator Holder*, and the proper number of tip extensions installed, place the tip of the Indicator down into the center hole of the Setting Gage.

   B. Loosen the *Thumbscrew.*, and adjust the position of the Indicator in the Indicator Holder by sliding it up or down so **the tip is making contact at the bottom of the Setting Gage, and the SMALL pointer is close to "0"**.

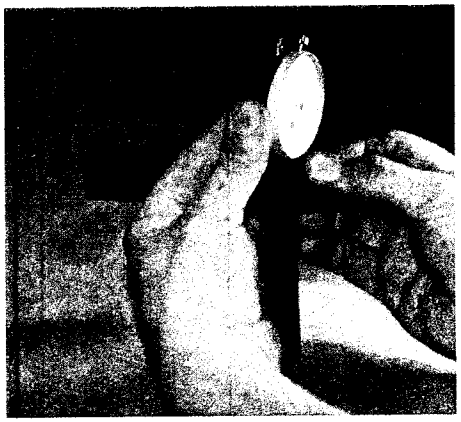

FIGURE 3

   C. Snug the Thumbscrew to secure the Indicator. Note that the Indicator may not be fully seated in the Indicator Holder - this is a normal condition.

   D. Rotate the bezel to align the LARGE pointer with zero, and snug the *Bezel Lock.*

   E. Lift the Indicator Holder out of the Setting Gage, and reinsert it, while observing the large pointer. Make sure it deflects by at least .010". If not, repeat step B-D.

7. Steps A thru C below will explain how to set up the *Swing Bars* in the housing. Be sure to check the flat surface where the caps fit, and remove any burrs, raised edges, or other imperfections. Imperfections in this area may have a serious impact on the accuracy of the 6470 since they tend to throw the Swing Bars out of true.

   A. Bolt the Swing Bars in place of the bearing cap as shown in Figure 5. Place the end of the outer Swing Bar adjacent to the other side of the bearing support.

   B. Install the contact point on the Indicator. Place the Indicator into the Indicator Holder and snug the Thumbscrew. Set the Indicator Holder directly onto the Swing Bar, depressing the Indicator tip. Rotate the Indicator bezel to "zero" the large pointer, and snug the bezel with the Bezel Lock screw.

   C. Next, keeping the Indicator Holder in contact with the Swing Bar, move so the Indicator tip is now resting on the other side of the bearing support. Ideally, if the Swing Arms are mounted true, the Indicator will read "0". If not, there is a misalignment somewhere, which must be found and corrected. This could be caused by burrs or raised edges on the parting line, a distorted housing, a nick or other damage to the Swing Bars or the Indicator Holder, debris captured under the Swing Arm, etc. It may be necessary to shim the Swing Bars where they bolt to the bearing support in order to achieve "0". Keep in mind that the Swing Bars provide the reference surface for the pinion depth measurement, and it is imperative that they be set up accurately. Do not move the short Swing Bar once it is shimmed in place.

8. Place the Indicator Holder firmly and squarely on the Swing Bar, and move the Indicator tip around in the carrier bearing bore (also referred to as the "saddle") to obtain the lowest Indicator reading as shown in Figure 4 and Figure 5. Read tenths of an inch with the small pointer, hundredths and thousandths with the large pointer. Record the Indicator reading.

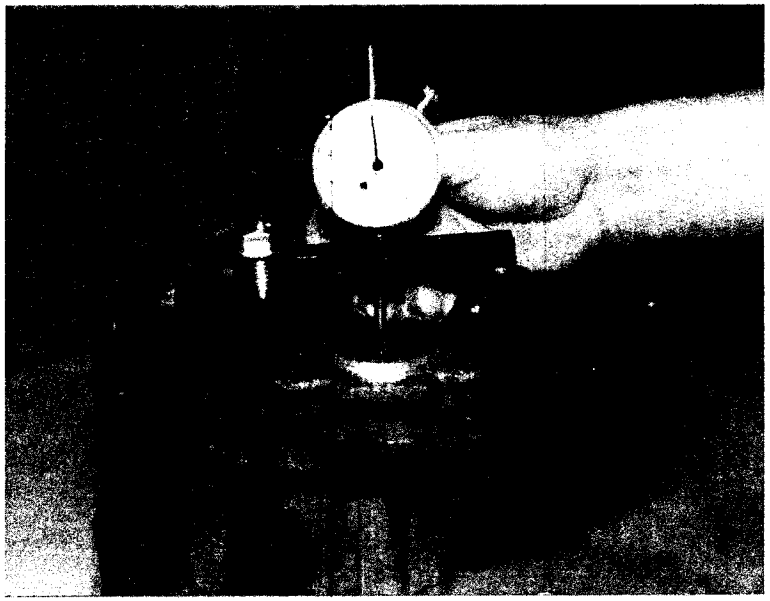

FIGURE 4

9. Subtract this reading from the size of the Setting Gage. The result is "C" in Figure 8.

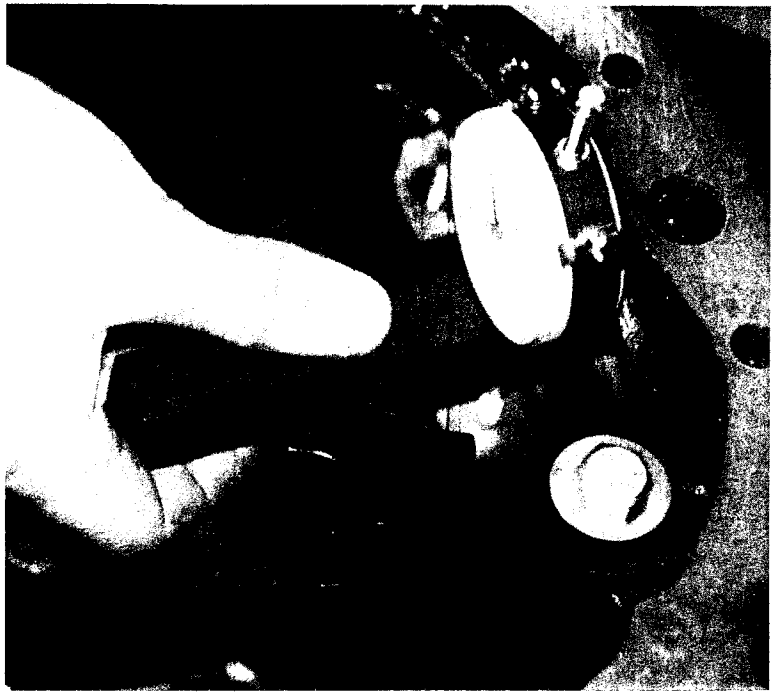

FIGURE 5

10. Subtract "C" from "B" to find "I" (B-C=I). **Important note:** Figure 8 is drawn with "C" smaller than "B"; in other words, the bearing cap parting line is below the centerline. However, in some cases, "C" will be larger than "B", meaning that the parting line is above the centerline. **Always use the formula B-C=I. If "C" is larger than "B", then "I" will be negative. Do not ignore the negative sign.**

11. Select the appropriate extension and setting gage to allow measurement of pinion depth, record in datasheet, and calibrate as in step 6.

12. Place the Indicator Holder firmly and squarely on the Swing Bar, and move the Indicator tip into position on the end of the pinion, as shown in Figure 6. Note: on a removable-carrier type such as 9" Ford, measure to the top of the pinion stub protruding through the pilot bearing. Record the Indicator reading. Read tenths of an inch with the small pointer, hundredths and thousandths with the large pointer.

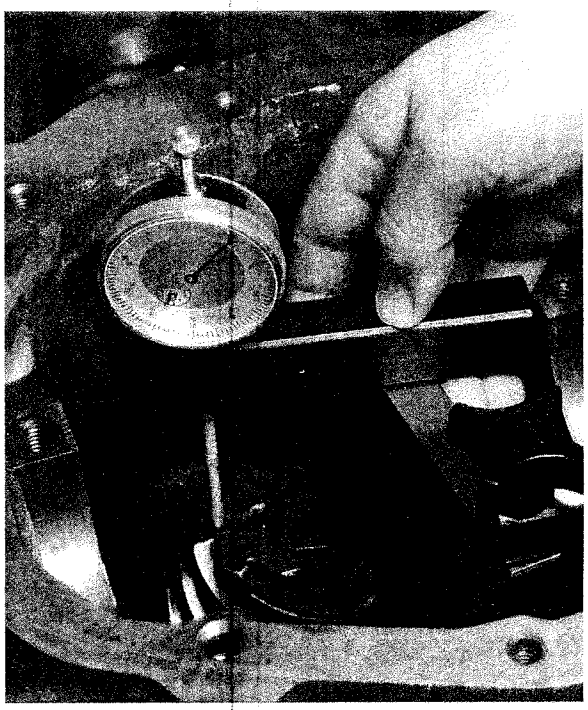

FIGURE 6

13. Subtract the Indicator reading from the dimension of the Setting Gage used in step 11 above (2.000, 3.000, or 4.000). Note, this result is not exactly the pinion depth - it is the "G" dimension in Figure 7.

14. Actual pinion depth is "H" in figure 7. Calculate H by adding G and I.

15. Complete disassembly, and proceed with re-assembly of new pinion.

16. The target pinion depth for the new pinion is the same as the "H" from the old pinion (Step 14) except it should be adjusted by the correction factor "Z" from Step 1. The way that "Z" is applied will depend on the situation . Keep in mind that "Z" applies to the shim pack, so that:

- A positive number for "Z" means a thicker shim pack, which gives a SMALLER pinion depth on integral-carrier differentials, and gives a LARGER pinion depth on removable-carrier (Ford 9") differentials.
- A negative number for "Z" means a thinner shim pack, which gives a LARGER pinion depth on integral-carrier differentials, and gives a SMALLER pinion depth on removable-carrier (Ford 9") differentials.

  Adjust the target "H" value for the new pinion according to the above.

17. Technique to measure the depth of the new pinion is identical to the old pinion.

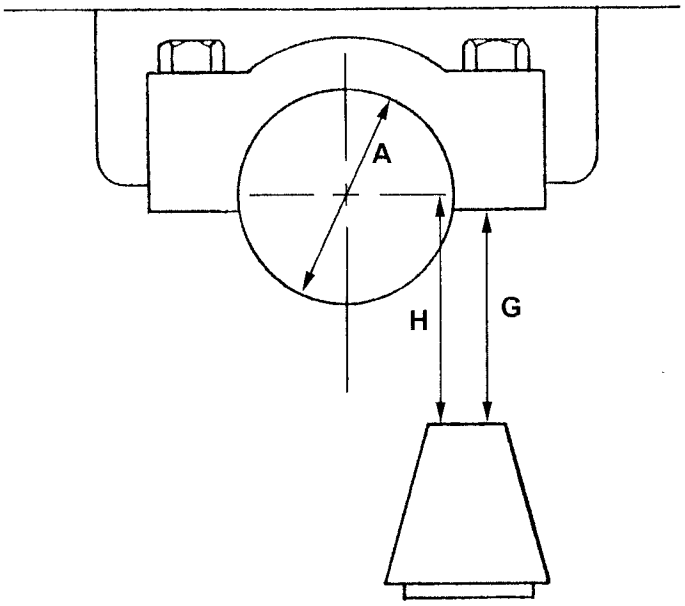

FIGURE 7

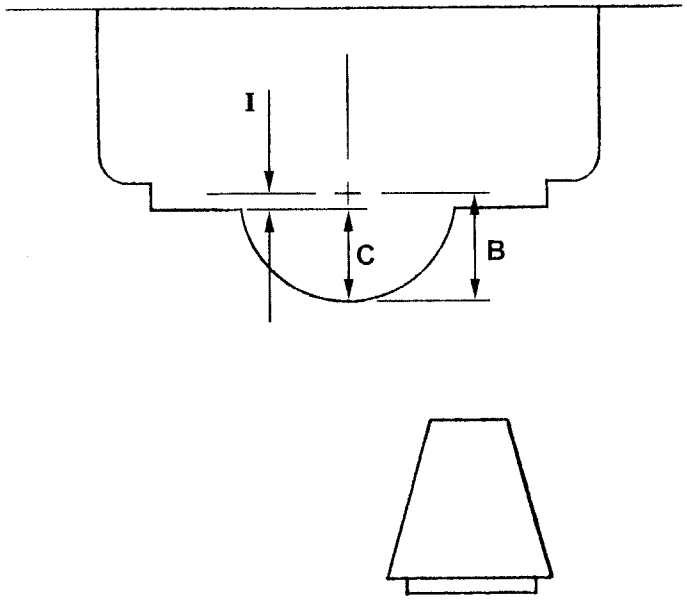

FIGURE 8

WORKSHEET:

(Step 1) Old pinion correction factor X _____
(Step 1) New pinion correction factor Y _____
(Step 1) Final correction factor Y-X=Z _____

(Step 2) Carrier bearing bore A _____
(Step 3) A / 2 = B _____

(Step 4) Selected setting gage (2.000, 3.000, 4.000, larger than and closest to B) _____
(Step 8) Indicator reading _____
(Step 9) Setting Gage - Indicator reading = C _____

(Step 10) B - C = I _____

(Step 11) Selected setting gage (2.000, 3.000, 4.000, larger than and closest to pinion depth) _____
(Step 12) Indicator reading _____
(Step 13) Setting Gage - Indicator reading = G _____

(Step 14) Actual Depth, old pinion G+I=H _____

(Step 16) Target depth for new pinion "H"(see text):
_____

(Step 17) Selected setting gage (2.000, 3.000, 4.000, larger than and closest to pinion depth) _____
(Step 17) Indicator reading _____
(Step 17) Setting Gage - Indicator reading = G _____
(Step 17) Actual depth, new pinion G+I=H _____

FOR USE WITH AFTERMARKET GEARSETS:

Aftermarket gearsets may provide a specific pinion depth marked on the top of the pinion. It would generally be a four-digit number, that appears for example like **1.234.** If this sort of information is provided, proceed with the instructions in this section.

If the aftermarket pinion is *not* marked with a specific depth, refer to the instructions for OEM gearsets.

Refer to Figure 1 to help identify the names of the various parts of the 6470, shown in *italic type* when first mentioned in the instruction text.

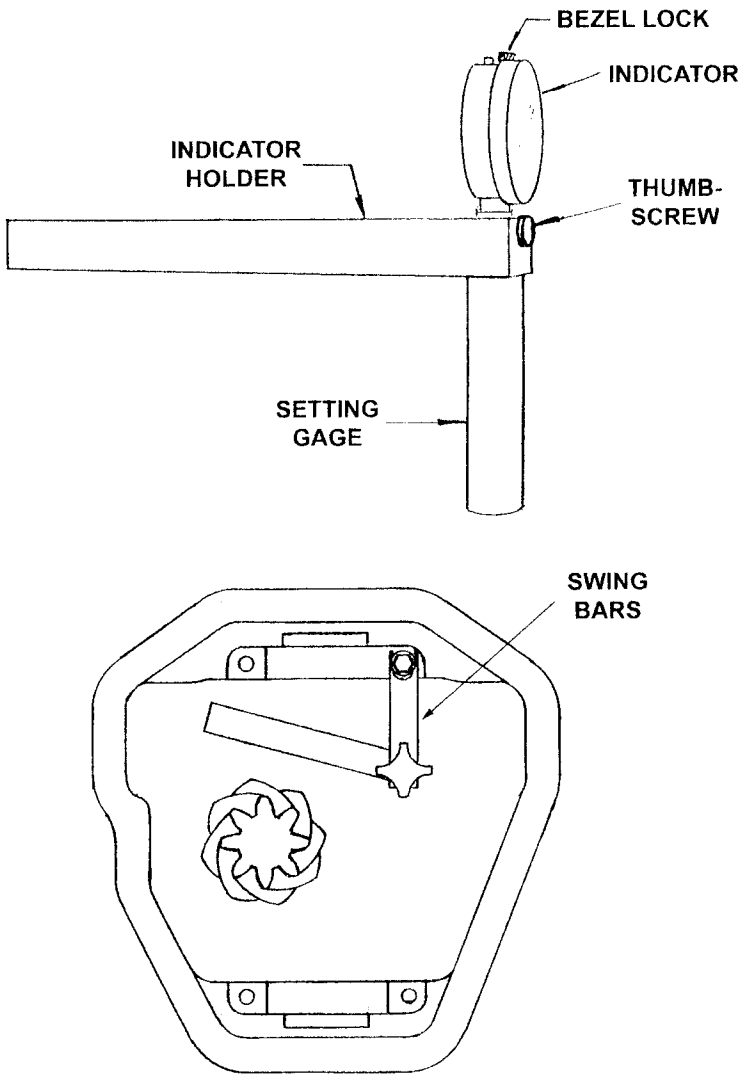

FIGURE 1

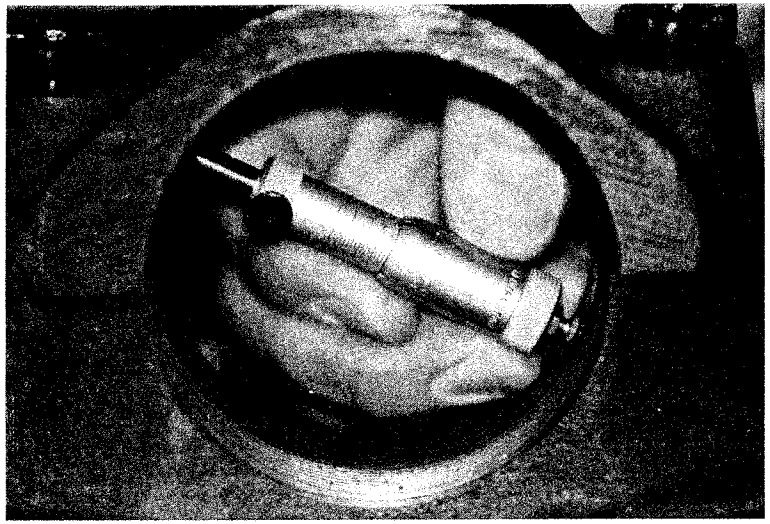

FIGURE 2

1. With the differential case, ring gear, and carrier bearings removed from the carrier, install a carrier bearing cap and torque to manufacturer's specification. Measure with an inside micrometer and record the bore dimension, "A" in the worksheet. See Figure 2 and Figure 7. This measurement can be taken with a dial caliper, however, accuracy is lower.

2. Divide "A" by 2 to obtain "B" shown in Figure 8.

3. Select a *Setting Gage* that is larger, but closest in size to "B", and record in worksheet.

4. Attach the appropriate number of tip extensions to the *Indicator*: if the selected Setting Gage is 2.000, use one extension. If the selected Setting Gage is 3.000, use two extensions. If the selected Setting Gage is 4.000, use three extensions.

5. Steps A thru E below will explain how to calibrate the indicator.

A. As shown in Figure 3, with the Indicator on the *Indicator Holder*, and the proper number of tip extensions installed, place the tip of the Indicator down into the center hole of the Setting Gage.

B. Loosen the *Thumbscrew.*, and adjust the position of the Indicator in the Indicator Holder by sliding it up or down so **the tip is making contact at the bottom of the Setting Gage, and the SMALL pointer is close to "0"**.

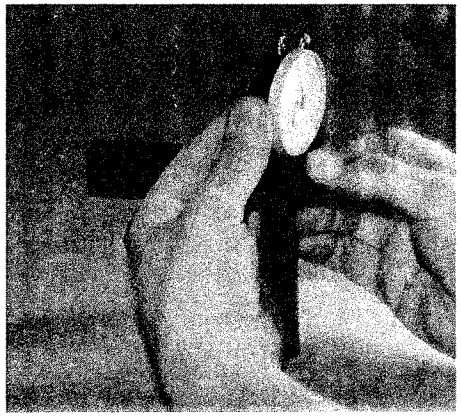

FIGURE 3

C. Snug the Thumbscrew to secure the Indicator. Note that the Indicator may not be fully seated in the Indicator Holder - this is a normal condition.

D. Rotate the bezel to align the LARGE pointer with zero, and snug the *Bezel Lock.*

E. Lift the Indicator Holder out of the Setting Gage, and reinsert it, while observing the large pointer. Make sure it deflects by at least .010". If not, repeat step B-D.

6. Steps A thru C below will explain how to set up the *Swing Bars* in the housing. Be sure to check the flat surface where the caps fit, and remove any burrs, raised edges, or other imperfections. Imperfections in this area may have a serious impact on the accuracy of the 6470 since they tend to throw the Swing Bars out of true.

A. Bolt the Swing Bars in place of the bearing cap as shown in Figure 5. Place the end of the outer Swing Bar adjacent to the other side of the bearing support.

B. Install the contact point on the Indicator. Place the Indicator into the Indicator Holder and snug the

Thumbscrew. Set the Indicator Holder directly onto the Swing Bar, depressing the Indicator tip. Rotate the Indicator bezel to "zero" the large pointer, and snug the bezel with the Bezel Lock screw.

C. Next, keeping the Indicator Holder in contact with the Swing Bar, move so the Indicator tip is now resting on the other side of the bearing support. Ideally, if the Swing Arms are mounted true, the Indicator will read "0". If not, there is a misalignment somewhere, which must be found and corrected. This could be caused by burrs or raised edges on the parting line, a distorted housing, a nick or other damage to the Swing Bars or the Indicator Holder, debris captured under the Swing Arm, etc. It may be necessary to shim the Swing Bars where they bolt to the bearing support in order to achieve "0". Keep in mind that the Swing Bars provide the reference surface for the pinion depth measurement, and it is imperative that they be set up accurately. Do not move the short Swing Bar once it is shimmed in place.

7. Place the Indicator Holder firmly and squarely on the Swing Bar, and move the Indicator tip around in the carrier bearing bore (also referred to as the "saddle") to obtain the lowest Indicator reading as shown in Figure 4 and Figure 5. Read tenths of an inch with the small pointer, hundredths and thousandths with the large pointer. Record the Indicator reading.

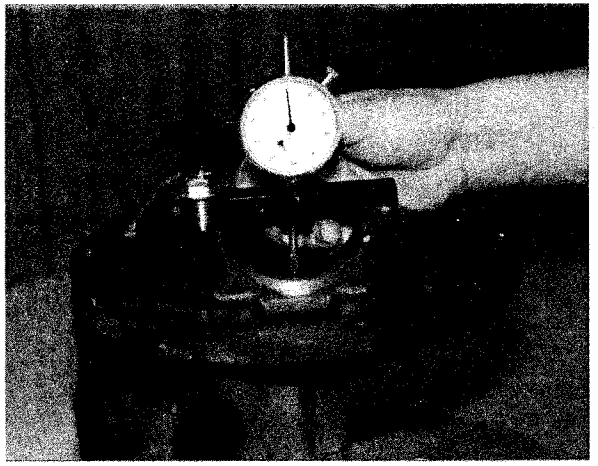

FIGURE 4

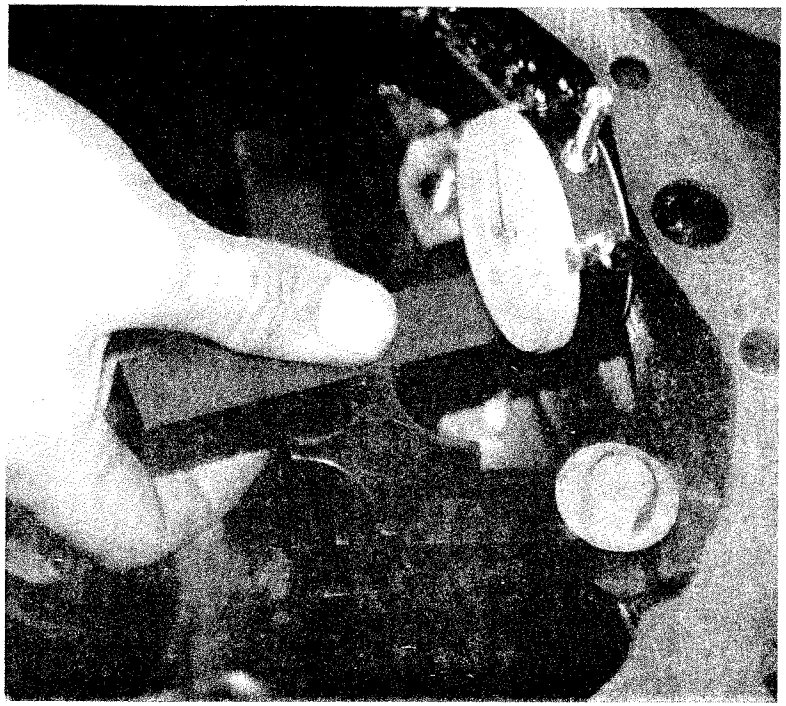

FIGURE 5

8. Subtract this reading from the size of the Setting Gage. The result is "C" in Figure 8.

9. Subtract "C" from "B" to find "I" (B-C=I). **Important note:** Figure 8 is drawn with "C" smaller than "B"; in other words, the bearing cap parting line is below the centerline. However, in some cases, "C" will be larger than "B", meaning that the parting line is above the centerline. **Always use the formula B-C=I. If "C" is larger than "B", then "I" will be negative. Do not ignore the negative sign.**

10. Select the appropriate extension and setting gage to allow measurement of pinion depth, record in datasheet, and calibrate as in step 6.

11. Place the Indicator Holder firmly and squarely on the Swing Bar, and move the Indicator tip into position on the end of the pinion, as shown in Figure 6. Note: on a removable-carrier type such as 9" Ford, measure to the top of the pinion stub protruding through the pilot bearing. Record the Indicator reading. Read tenths of an inch with the small pointer, hundredths and thousandths with the large pointer.

FIGURE 6

12. Subtract the Indicator reading from the dimension of the Setting Gage used in step 10 above (2.000, 3.000, or 4.000). Note, this result is not exactly the pinion depth - it is the "G" dimension in Figure 7.

13. Actual pinion depth is "H" in figure 7. Calculate H by adding G and I.

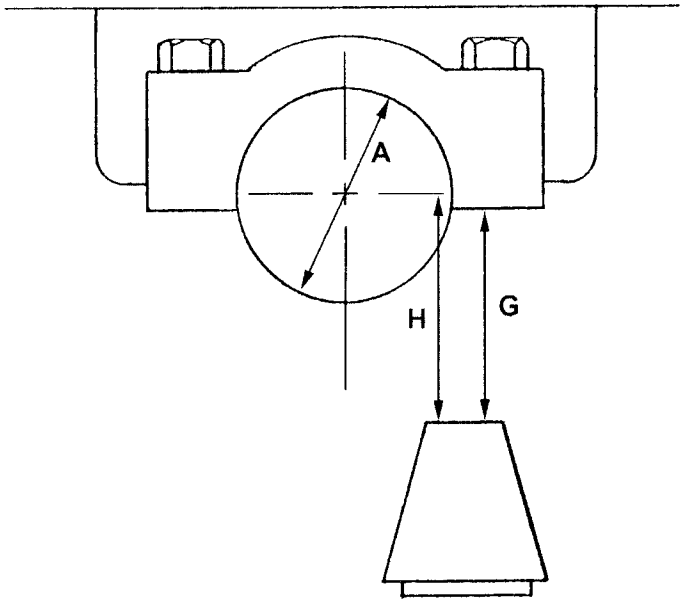

FIGURE 7

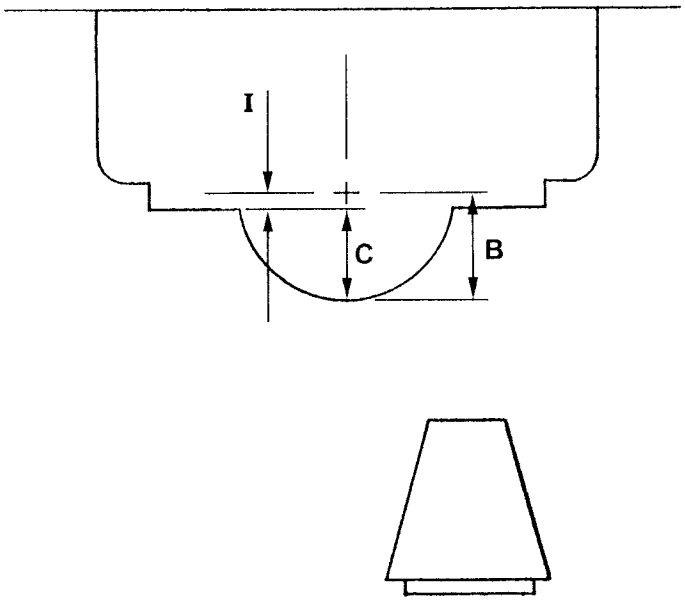

FIGURE 8

WORKSHEET:

(Step 1) Carrier bearing bore A _____
(Step 2) A / 2 = B _____

(Step 3) Selected setting gage (2.000, 3.000, 4.000, larger than and closest to B) _____
(Step 7) Indicator reading _____
(Step 8) Setting Gage - Indicator reading = C _____

(Step 9) B - C = I _____

(Step 10) Selected setting gage (2.000, 3.000, 4.000, larger than and closest to pinion depth) _____
(Step 11) Indicator reading _____
(Step 12) Setting Gage - Indicator reading = G _____

(Step 13) Actual Pinion Depth G+I=H _____