SUNNEN SHOP EQUIPMENT

LBB-1699 HEAVY DUTY HONING MACHINE

I-LBB-105
JULY, 1968

Operating and Maintenance Instructions

SUNNEN®

7910 Manchester Avenue, St. Louis, Missouri 63143
Sunnen Products Company, Ltd., Chatham, Ontario

FITTING PINS BY THE SUNNEN METHOD --- AND WHY A PRECISION FIT MUST BE "FREE"

More than 35 years ago Joe Sunnen said, "Fitting pins to a drag doesn't mean a thing". The poorer the job, the more out-of-line the bosses, the easier it is to obtain a uniform drag. But after the high spots are worn off the pin fit may have more clearance than you want.

Sunnen Honing produces a bearing surface so round, so straight and so geometrically perfect that if the hole is only one ten-thousandth of an inch (.0001") larger than the diameter of the pin, the fit will be absolutely free. There will be no "drag". Therefore a "feel" or "drag fit" in a Sunnen Honed hole can only indicate clearance of less than one "tenth".

It is significant that Sunnen was the first to insist on free fits with measured clearances, because Sunnen Honing produces essentially a "pre-run-in" bearing. And Sunnen is still the only method that uses a sensitive gage *to check the finished hole and guarantee the size to within a "tenth"*.

Less accurate methods can get by if they have a drag on the pin because the small percentage of bearing surface is expected to "wear in". Blade or cutter type equipment, acceptable for sizing cylinders where accuracy of half a thousandth is permitted, will not produce consistently accurate pin fits because a sharp tool tends to "dig in" and take out more metal than desired--and a dull tool tends to burnish the hole and not take out enough stock. Therefore the pin fit is often too loose or too tight. Such inaccurate pin fitting methods are often the cause of "comebacks".

Sunnen Honing produces an accurate pin hole with proper oil clearance--the perfect pin fit that assures customer satisfaction. Remember, a tight fit in a poor hole is no substitute for a free fit in a perfect hole.

Most late model engines use a press fit between the pin and connecting rod. The Sunnen pin fitting method guarantees the correct hole size, measured with respect to the pin that will be pressed into the hole.

Figure 1 represents an exaggerated cross section of a piston pin in a pin hole and shows clearly the difference between the Sunnen Method and less accurate methods.

Section "A" is an inaccurately finished hole. The high spots will make the pin "drag" or feel tight, but will quickly wear in and the pin may then be too loose.

Section "B" shows how the pin hole is finished by the Sunnen Method--perfectly round and free from high spots--assuring a full bearing surface for an unbroken oil film to add thousands of extra miles to the pin fitting job.

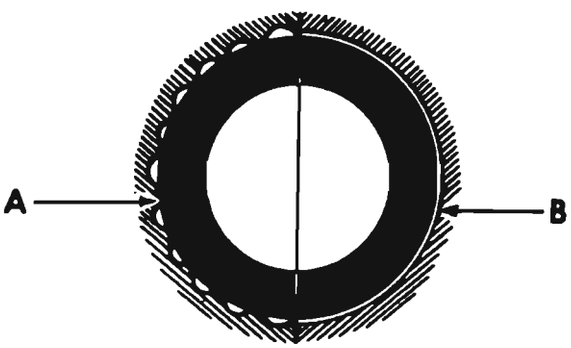

Fig. 1

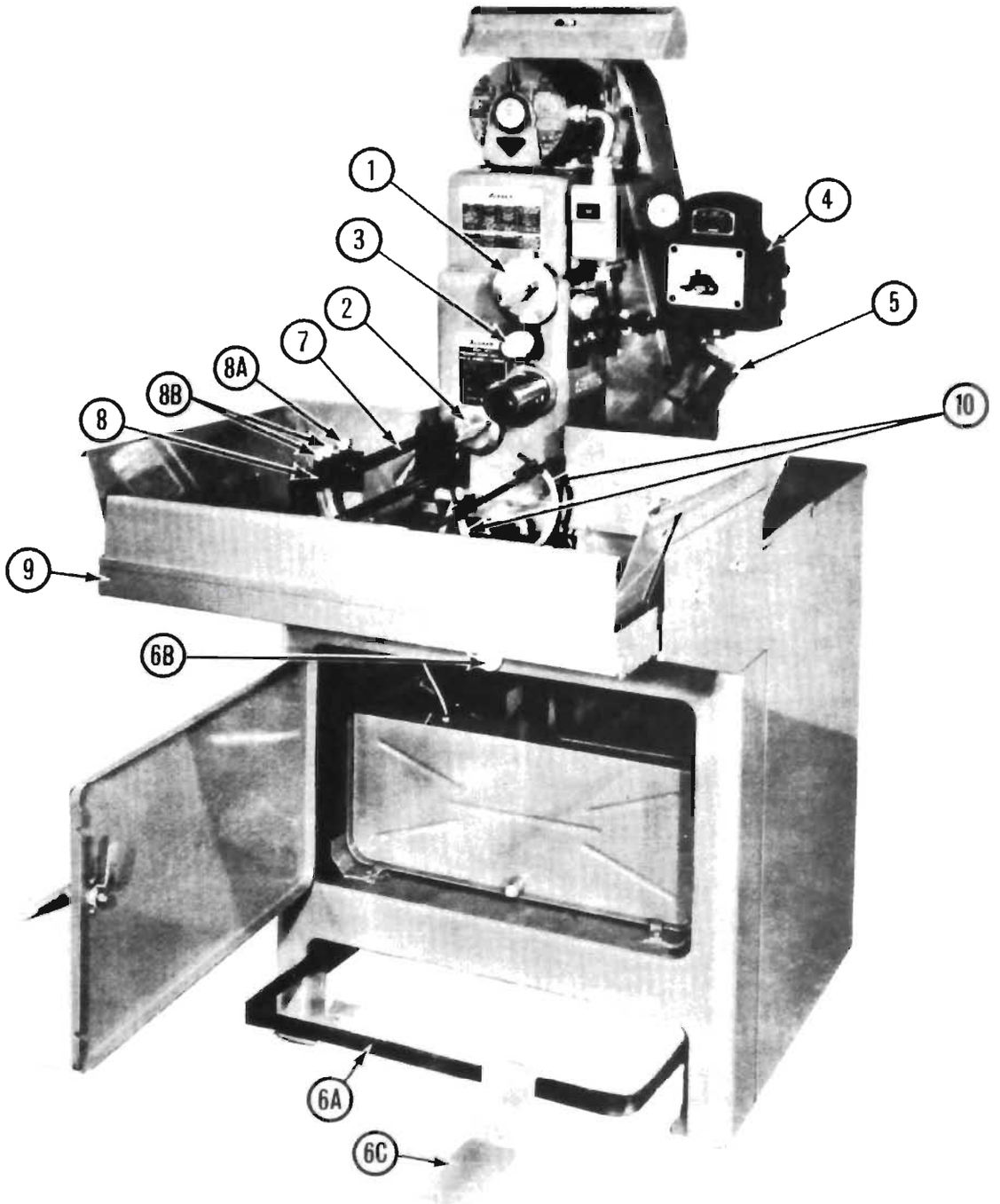

Fig. 2

1. FEED DIAL
2. CUTTING PRESSURE CONTROL
3. HONING DIAL
4. PRECISION GAGE
5. GAGE SETTING FIXTURE
6. PEDAL AND AUTOMATIC STONE FEED
   - A. ADJUSTABLE PEDAL BAR
   - B. PEDAL BAR TENSION CONTROL
   - C. PEDAL
7. ADJUSTABLE WORK SUPPORT
8. OIL FLOW CONTROL MANIFOLD
   - A. TOTAL VOLUME CONTROL VALVE
   - B. INDIVIDUAL OIL JET CONTROL VALVES
9. OIL RETURN PAN
10. ADJUSTABLE TWIN-JET HONING OIL SYSTEM

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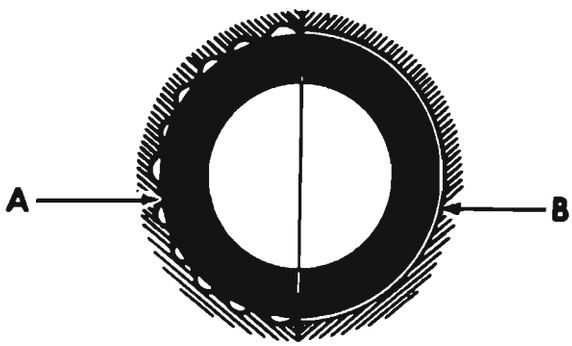
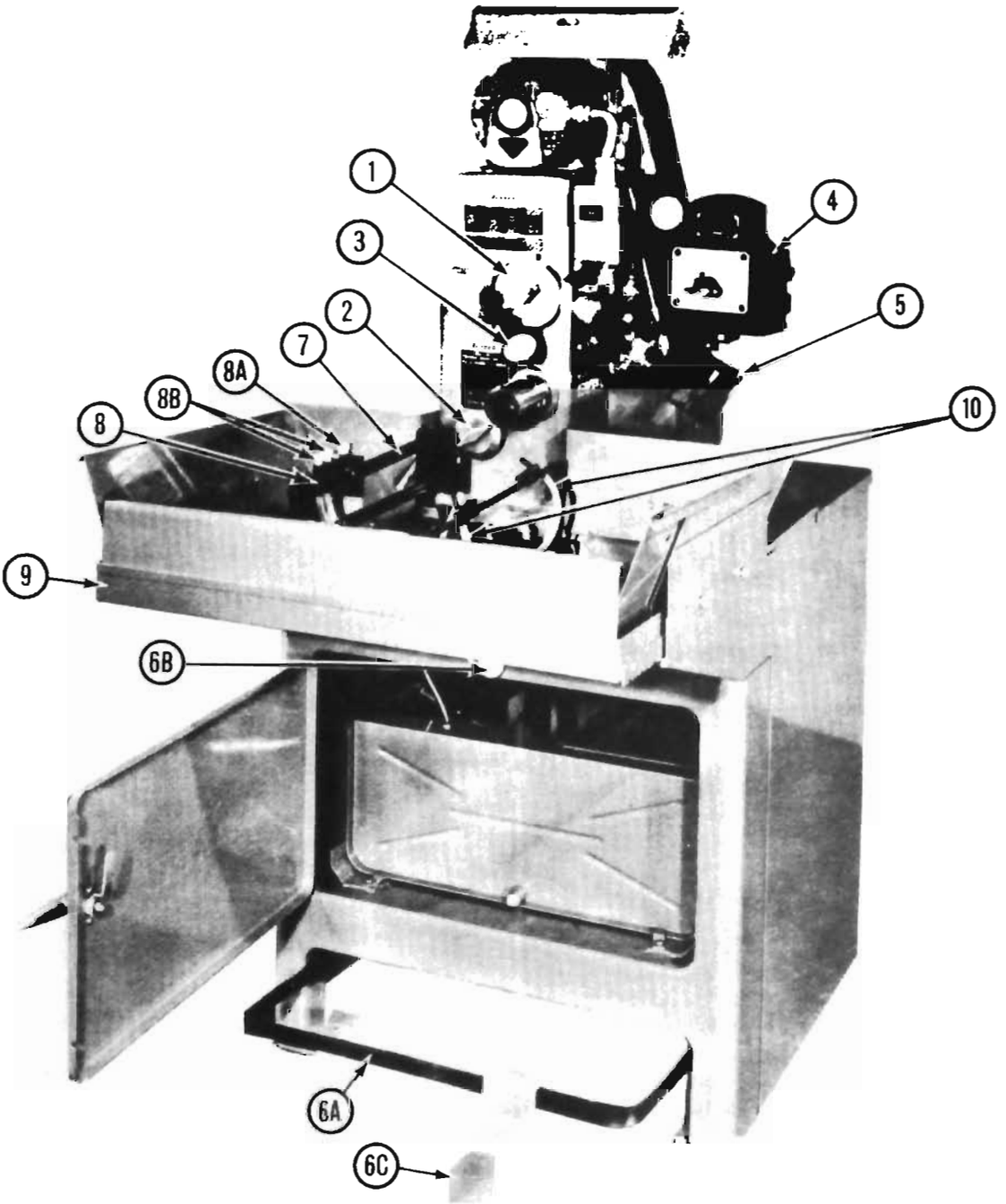


Fig. 1



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FUNCTIONS OF CONTROLS AND ACCESSORIES FOR THE SUNNEN HEAVY DUTY PRECISION HONING MACHINE

1. **FEED DIAL.** Expands or retracts the stone in the honing unit. The setting of this dial limits the maximum honing stone expansion, and allows the stone to feed out automatically during the honing operation until the pre-set point is reached. Actual stone expansion in thousandths depends upon the type of honing unit.

STONE EXPANSION PER DIAL NUMBER	HONING UNIT TYPE
.001"	AN-600, AL, ALH, LH, LJ, ML, PL, UL, SL-720 to SL-1600
.002"	CR, HB, KL, RL, RYY, SC, SL-480 to SL-660, SYY

Note: *This information is also on the machine nameplate.*

2. **CUTTING PRESSURE CONTROL.** Adjusts the cutting pressure of the honing stone against the part being honed. Works in conjunction with the Feed Dial and Honing Dial to insure maximum efficiency and fastest stock removal.

3. **HONING DIAL.** Works in conjunction with Feed Dial. With the part on the honing unit and Feed Dial set for the desired stock removal, the Honing Dial needle shows the amount of stock to be removed. During honing, movement of the needle shows action of the honing stone in removing stock. Hole need not be gaged until the needle reaches "zero".

4. **PRECISION GAGE.** Measures hole size to within a "tenth". See pages 4 thru 14 for complete instructions.

5. **GAGE SETTING FIXTURE.** Transfers pin size to the Precision Clearance Gage.

6. **PEDAL AND AUTOMATIC STONE FEED.** Pressing down on the Pedal starts the machine spindle (with the honing unit) turning and feeds the stone out against the part being honed. Releasing the Pedal stops the honing unit and allows the stone to retract.

   A. ADJUSTABLE PEDAL BAR. Length is adjustable for operator comfort and to correspond with position of Oil Return Pan. Pedal Bar may be operated directly with either foot or with the Pedal.

   B. PEDAL BAR TENSION CONTROL. Adjusts to provide desired pedal pressure.

   C. PEDAL. Fully adjustable for use with either right or left foot.

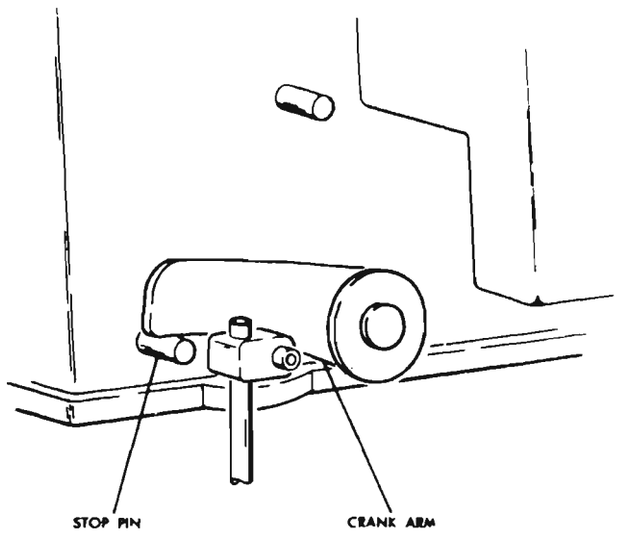


Fig. 3

When Pedal is held all the way down so the Crank Arm is down against the Stop Pin (Fig. 3), the stone will feed out automatically under the pressure set on the Cutting Pressure Control, and with limit as set on the Feed Dial.

Except when starting in new bushings or badly out-of-round holes, or when using the bushing expander, the machine should be operated with the Pedal fully depressed, and the Crank Arm against the Stop Pin.

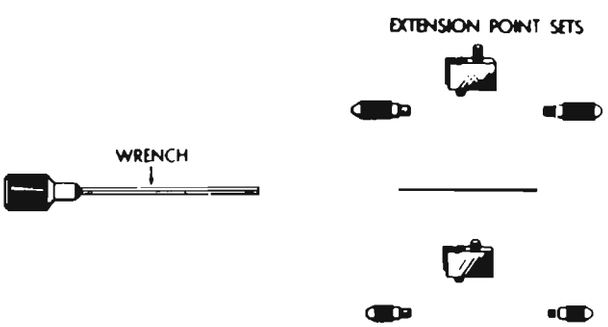
7. **ADJUSTABLE WORK SUPPORT.** Necessary when honing connecting rods or spindle bodies. Absorbs honing torque.

8. **OIL FLOW CONTROL MANIFOLD.** Provides independent regulation of oil flow to each jet through Total Volume Control Valve (8A) and individual Oil Jet Control Valves (8B). Total Volume Valve is used to turn oil on and off, eliminating readjustment of the Individual Control Valve settings. Manifold prevents back flow during "OFF" cycles.

9. **OIL RETURN PAN.** Adjustable to accommodate honing units and workpieces of varying lengths.

10. **ADJUSTABLE TWIN-JET HONING OIL SYSTEM.** Two independently controlled oil jets are easily positioned to assure an even flow of honing oil through the part being honed and over the full length of the mandrel.

INSTRUCTIONS FOR USING THE SUNNEN PRECISION GAGE FOR PIN FITTING AND ROD RECONDITIONING



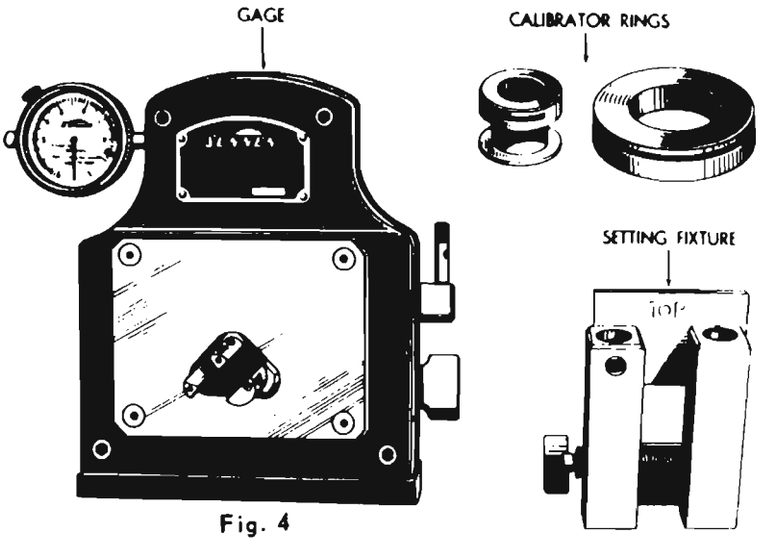


Fig. 4

DESCRIPTION OF GAGE

The AG-300 Precision Gage is a transfer or comparator type gage. Any desired diameter within the range can be transferred to the gage. The gage indicator dial then reads in tenths of a thousandth of an inch over or under the desired diameter.

This gage should always be used when fitting piston pins in modern automobile engines. With compression ratios and horsepower doubled over what they were just a few years ago, piston pin fits can no longer be guessed at.

This Precision Gage takes all the guesswork out of pin fits. It measures *the finished hole* to within a tenth, and therefore is suitable for both clearance fits and the newer press-fit type pin fit. It is excellent also for use in rod reconditioning and other work where accurate gaging is required. This gage is accurate to within a tenth throughout its range.

The AG-300 as shipped has three diameter ranges with a total of .720" to 2-11/16". The gage is shipped with standard range points installed. Two sets of extension points are furnished, for the medium and large ranges. A Midget Range set and an Extra Large Range extension point set are available on separate order.

Note: *The standard range points should not be removed when using the extension points.*

MIDGET RANGE	.375" - .750"
STANDARD RANGE	.720" - 1.530"
MEDIUM RANGE	1-1/2" - 2-1/4"
LARGE RANGE	1-15/16" - 2-11/16"
EXTRA LARGE RANGE	2-5/8" - 3-3/8"

For best results use each point set only for range intended.

Study Fig. 5. Identify the following parts.

1. **Dial Indicator** - Reads directly in tenths of thousandths of an inch. Numbers indicate thousandths.
2. **Gage Face Plate** - Accurately ground and polished.
3. **Centralizer Finger** - Properly positions hole to be measured.
4. **Standard Range Centralizer Point** - Contacts top of hole.
5. **Size Indicating Finger** - Transfers hole size to indicator dial.
6. **Adjustable Gaging Finger** - Adjusts for transferring desired hole size to gage.
7. **Standard Range Gaging Points** - Contact hole surface for measuring the diameter.
8. **Adjusting Knob** - Positions adjustable gaging finger for transferring desired hole size to gage.
9. **Locking Lever** - Locks gage size adjustment.
10. **Dial Clamp** - Locks dial indicator face in position.
11. **Adjustable Limit Marker** - Indicates finished hole size.

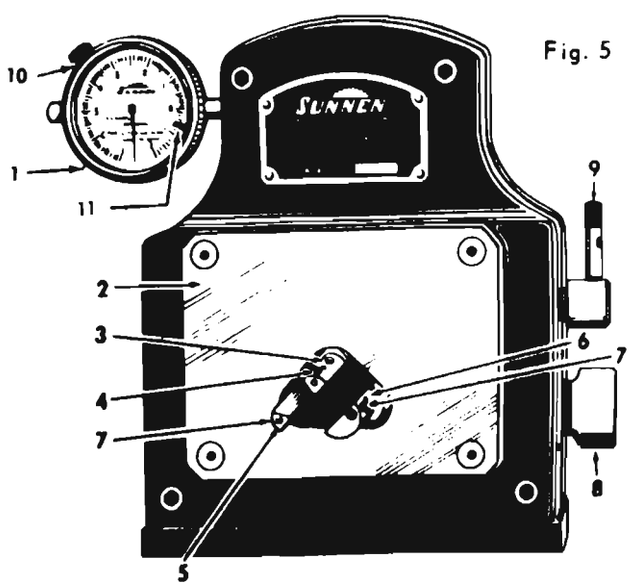


Fig. 5

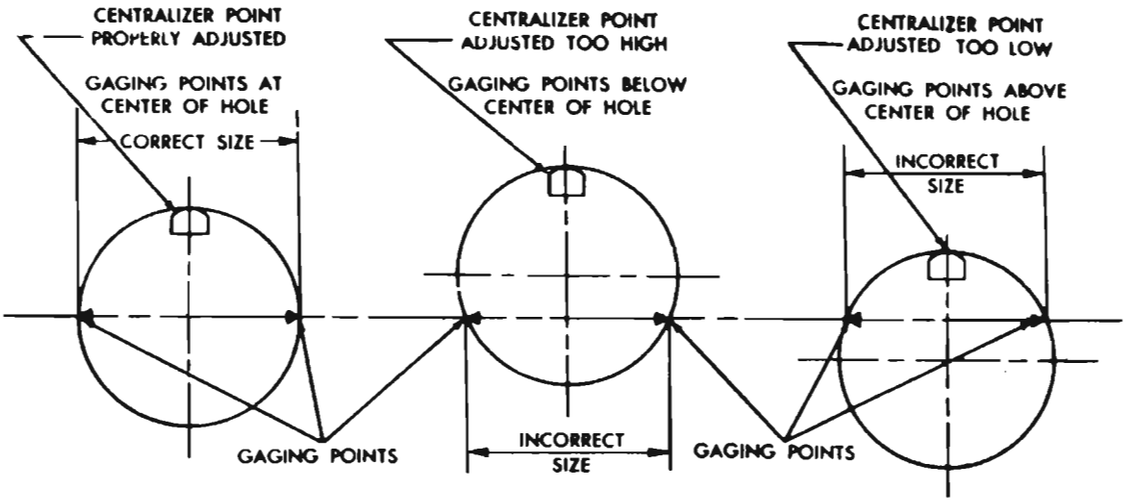


FIG. 6

CALIBRATION OF GAGE

NOTE: *The centralizer point must be checked and adjusted as explained below before the gage is put into use.*

When measuring the diameter of any hole the gaging points must be located on the center line of the hole to obtain its true diameter. See Fig. 6. The AG-300 gage is equipped with a centralizer arm and point which positions the hole being gaged so that the gaging points are always on the center line of the hole.

The centralizer point is adjustable for accurate calibration and to compensate for wear of the points. A calibrator ring is provided for accurately adjusting the centralizer point.

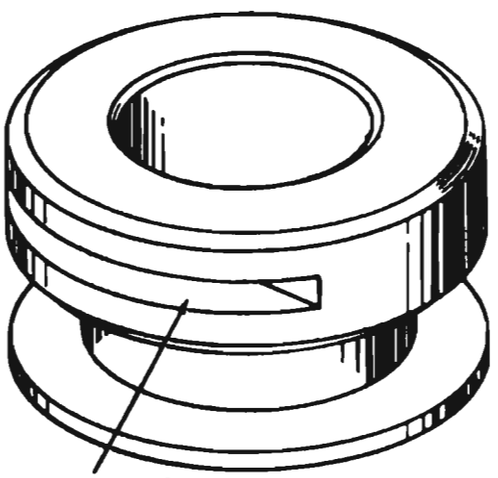


FIG. 7

TO CALIBRATE SMALL CENTRALIZER POINT

1. Clean centralizer arm, centralizer point, gaging fingers, face of gage and calibrator ring carefully.

2. Release size adjusting mechanism by turning locking lever (Fig. 5) counter-clockwise until lever is loose.

3. Turn adjusting knob to adjust gaging fingers to approximately 7/8" across points.

4. Place calibrator ring (Fig. 7) flat against face plate on gage as shown in Fig. 8 *with wrench slot at bottom and directly under centralizer point.*

5. While holding calibrator ring lightly against face of gage, expand the gaging fingers by turning adjusting knob counter-clockwise until dial indicator hand reaches approximately the 3 o'clock position.

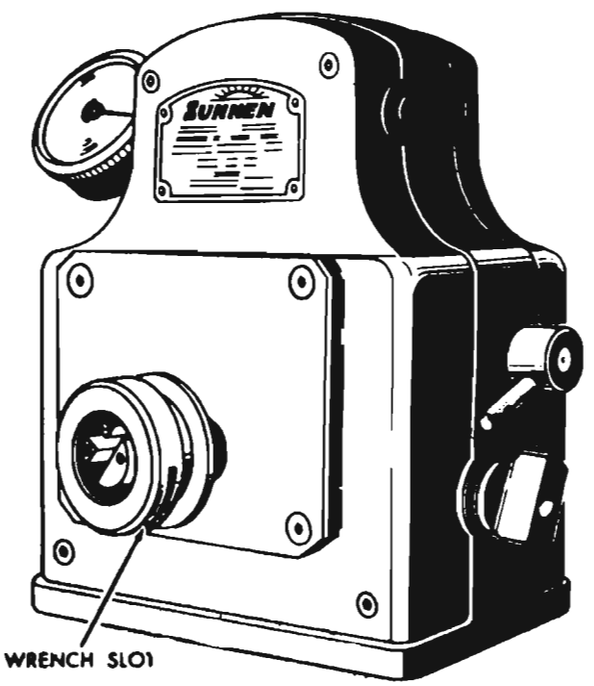


FIG. 8

6. Insert Allen wrench through slot in bottom of calibrator ring, and into hex socket in bottom of threaded centralizer point. While applying a very light downward finger pressure to top of calibrator ring, screw centralizer point up or down to obtain maximum clockwise position of indicator hand. NOTE: *Under normal conditions this adjustment will not require more than one full turn in either direction from the factory setting.* **CAUTION: Do not push upward with wrench.**

7. Gage is now ready for use.

SETTING THE GAGE FOR MEASURING HOLE DIAMETERS FROM .720" TO 1.530"

For piston pin fitting in piston and rods, two pins from the set being fitted are used with the setting fixture to enable you to set the gage to read the desired pin clearance or interference.

Only first quality pins should be used, to assure uniformity of size and absence of burrs or "build-up" on ends.

A. ASSEMBLING PISTON PINS IN SETTING FIXTURE (See Fig. 9)

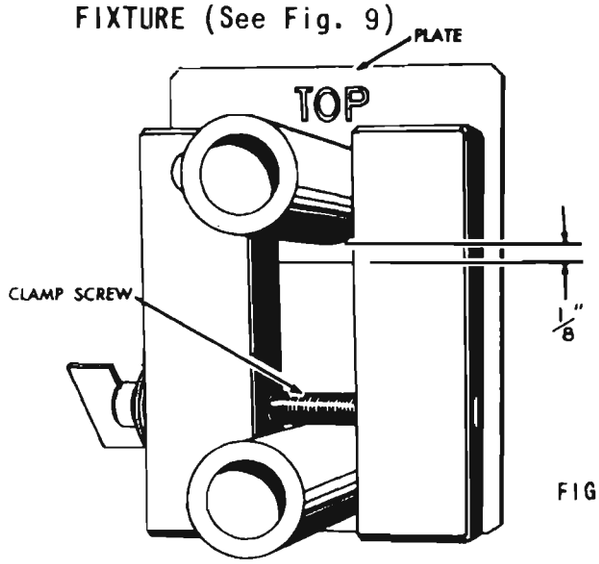


FIG. 9

1. Clean blocks and pins.
2. Insert one pin between setting blocks with end of pin against plate of setting fixture and side of pin against clamp screw.
3. Insert second pin between setting blocks parallel to first pin, with end of pin against plate and with side of pin approximately 1/8" from side of opening in plate of setting fixture.
4. Tighten thumb screw firmly using finger pressure only. Do not use pliers or wrench.
5. Then back off thumb screw 1/8 to 1/4 turn. This procedure eliminates the possibility of distortion in setting blocks or piston pins.

B. ADJUSTING GAGE TO READ PIN SIZE:

1. Unlock gage adjusting mechanism by turning locking lever counter-clockwise until lever is loose.
2. Retract gaging finger by turning adjusting knob clockwise, until points in gaging fingers will go between setting blocks.
3. With pins assembled in setting fixture, place on gage with "TOP" up (thumb screw handle on left), and only the brass wear buttons against face of gage. Allow setting fixture to rest on centralizer arm straight up and down. See Fig. 10. IMPORTANT: *If gaging fingers are bumped or jarred in set-up or gaging operation, be sure to check gage with setting fixture and with calibrator ring if necessary.*

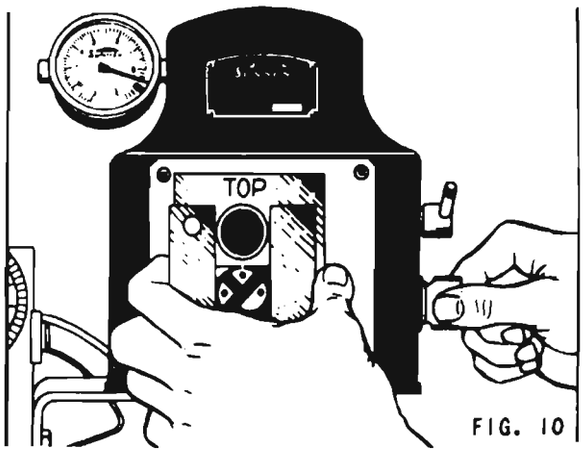


FIG. 10

4. Expand gaging fingers by turning adjusting knob counter-clockwise until gaging points just contact setting blocks, as indicated by a slight movement of the dial indicator hand. (NOTE: *Keep a very light pressure to the left, to prevent moving the sensitive gaging finger accidentally*). While rocking the setting fixture slightly clockwise and then counter-clockwise (see Fig. 11), further expand gaging points until the maximum counter-clockwise swing of indicator hand reaches approximately the *3 o'clock* position.

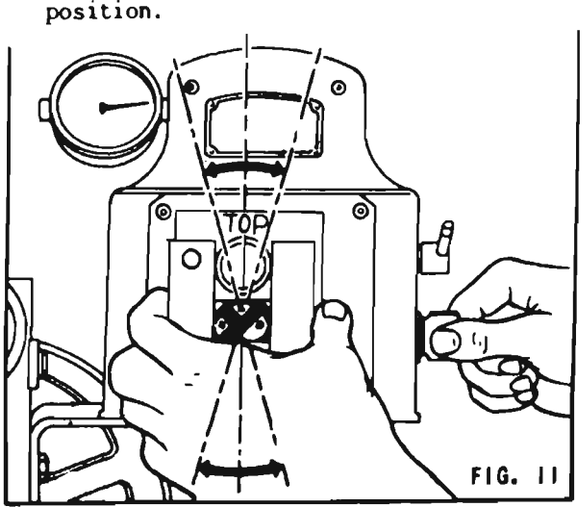


FIG. 11

5. Release adjusting knob tension by reversing rotation approximately 1/2 turn until knob is free. This prevents "creep" during gaging. Lock the gage adjusting mechanism by rotating the locking lever clockwise until finger tight. The indicator hand may move slightly when gage adjustment is locked but this movement will not affect the accuracy of the gage.
6. Again rock setting fixture as described above and when minimum indicator reading (maximum counter-clockwise movement of indicator hand) is determined, loosen dial clamp and *rotate indicator dial face to set "0" under the indicator hand.* Lock dial clamp. The minimum indicator reading obtained by rocking the setting fixture represents pin size.

C. SETTING GAGE TO DESIRED PIN CLEARANCE OR INTERFERENCE:

Rotate front bezel of indicator to set adjustable limit marker to maximum allowable pin clearance or interference. (Refer to Sunnen Pin-Fitting Chart.)

Example: A piston and pin are to be fitted with a clearance of 3 to 5 tenths. First, place pins in setting fixture. Then rock fixture on gage to obtain minimum indicator reading. Next, rotate dial face until the "0" lines up with the indicator hand at the minimum indicator reading. Zero now indicates pin size. Lock dial clamp. Set limit marker (by rotating outer dial bezel) to 5 tenths in the clearance (green) area of indicator dial. Hone piston pin hole until indicator hand stops in the clearance (green) area between 3 tenths and the limit marker. Piston and pin will now have the desired clearance.

Note: *A micrometer can be used on large pins, or when only one pin is available.*

EXTENSION POINT SETS

LARGE RANGE: 1-15/16" - 2-11/16"

MEDIUM RANGE: 1-1/2" - 2-1/4"

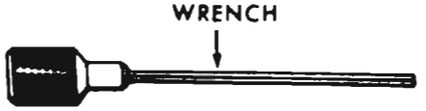


Fig. 12

USING EXTENSION POINTS FOR MEASURING HOLE DIAMETERS FROM 1-1/2" TO 2-11/16" (Fig. 12)

For measuring hole diameters from 1-1/2" to 2-1 1" use the medium range extension points, and for diameters from 1-15/16" to 2-11/16" use the large range extension points.

Note: *Always use the silver colored extension point with the silver colored gaging finger. These are colored for your convenience and will assure identical assembly of the extension points each time they are used.*

A. TO INSTALL EITHER THE MEDIUM RANGE OR LARGE RANGE EXTENSION POINTS

(CAUTION: *Do not remove the standard range gaging points.)*

1. Clean gaging fingers and centralizer finger carefully. Make sure tapped holes and counter-bored seats located behind standard range gaging points are clean.

2. Clean threads and seats of gaging points carefully; and screw into rear tapped holes in the gaging fingers until finger tight. (Fig. 13).

   Assemble proper centralizer block to centralizer arm--captive screw goes in center threaded hole. See Fig. 12 to identify proper centralizer block.

3. The extension centralizer point must now be calibrated before using the gage.

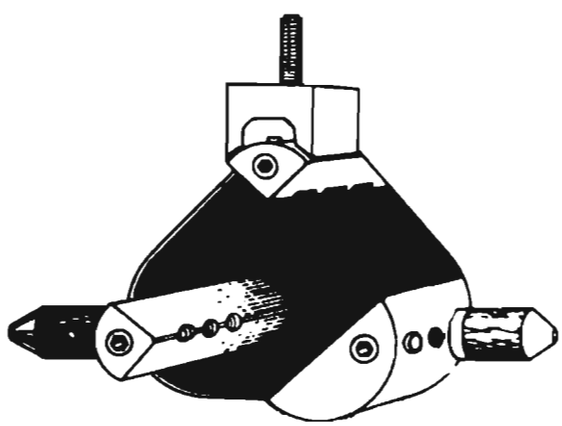


Fig. 13

B. TO CALIBRATE EITHER THE MEDIUM OR LARGE RANGE CENTRALIZER POINT

Use large calibrator ring. Set gaging points to approximately 1/8" less than the ring diameter, and follow same calibrating procedure used for

standard centralizer points (paragraphs 1, 2, 4, 5, 6, and 7 on page 3 and 4).

CAUTION: Always be sure calibrator ring is flat against face plate. If proper side is out, the wrench slot will be directly under the centralizer point being calibrated.

C. ADJUSTING GAGE FOR KNOWN SIZE

When using the extension points on the AG-300 gage, the setting fixture cannot be used to transfer a size to the gage because its range stops at 1-1/2". Several methods may be used to transfer a given size to the AG-300 gage.

1. A *micrometer* may be used as follows: (Fig. 14):

   Lock the micrometer at the desired size. Hold one anvil of the micrometer against extension point "A" and expand gage until extension gaging point "B" just contacts the other anvil of the micrometer. Hold micrometer steady against extension point "A", slowly move the second anvil of the micrometer across extension point "B" in all directions, and expand gage further until minimum indicator reading (maximum counter-clockwise movement of indicator hand) reaches approximately the 3 o'clock position.

   Hold micrometer in position and lock gage by turning locking lever clockwise until finger tight. Indicator hand may move slightly while locking the adjustment, but this will not affect the accuracy of the gage.

   Unlock dial clamp and rotate dial to set zero to minimum indicator reading (maximum counter-clockwise movement of hand). Indicator will now read directly in tenths of thousandths over and under the size set on micrometer.

2. Standard *gage blocks, ring gages, and parts with holes of known size* may also be used to transfer a given size to the AG-300 Gage.

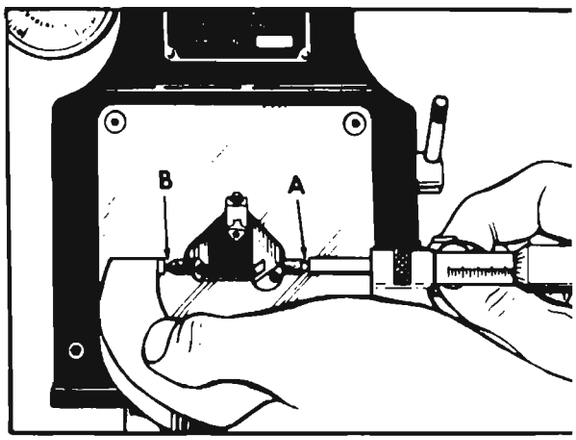


Fig. 14

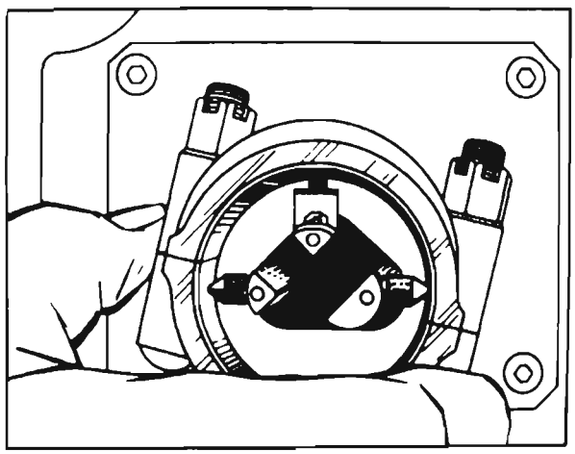


Fig. 15

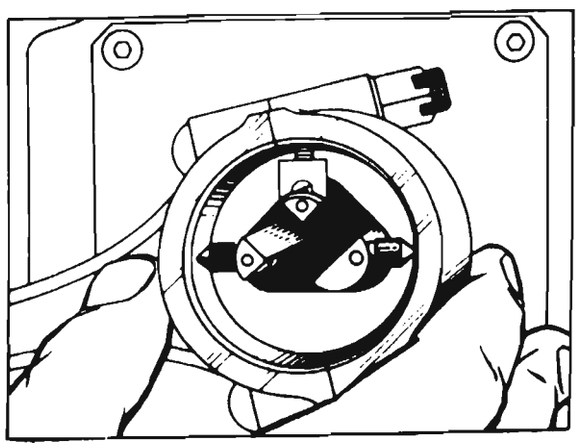


Fig. 16

D. GAGING HOLES FROM 1-1/2" TO 2-11/16" (Journal end of con-rods)

After the gage has been adjusted to a known size, place the hole to be gaged on the gaging points and hold the rod *flat against face plate of gage.* Allow the part being gaged to rest on the centralizer point.

When measuring the large ends of connecting rods, measure hole in one direction, then rotate rod approximately 1/4 turn to take a second reading across the hole. (Fig. 15 and 16). Be careful to see that the gaging points or centralizer point do not enter any oil holes or grooves.

USING THE MIDGET RANGE POINTS FOR MEASURING HOLE DIAMETERS FROM 3/8" TO 3/4"

AG-140 Midget Point Set on Gages with Serial numbers below 13,000.
AG-140-L Midget Point Set on Gages with Serial numbers 13,000 and up.

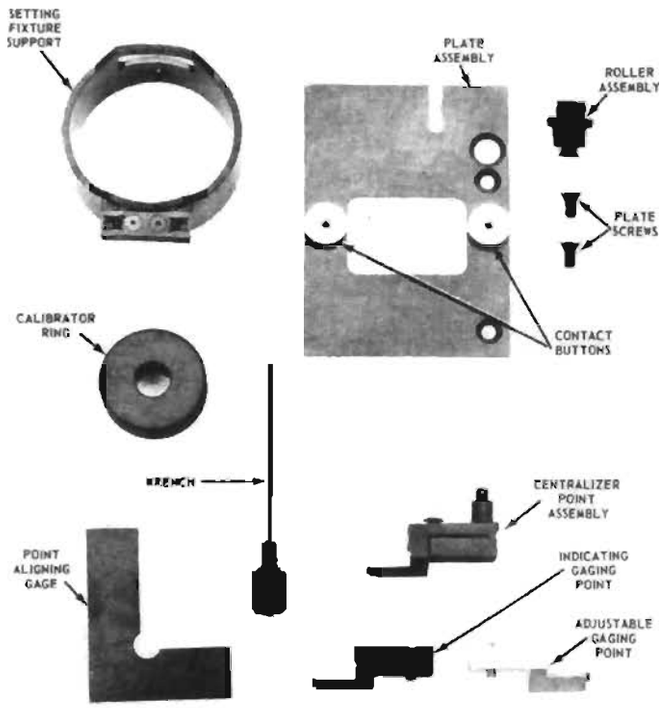


Fig. 17

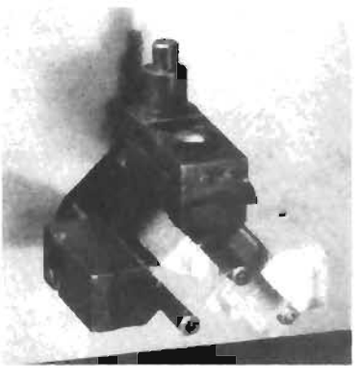


Fig. 18

A. TO INSTALL THE MIDGET RANGE POINTS

(CAUTION: *Do not remove the standard range gaging points.)*

1. Clean gaging fingers and centralizer finger carefully. Make sure tapped holes located behind standard range gaging points are clean and free of grit and oil.

2. Attach silver colored gaging point to silver colored adjustable (right hand) gaging finger (Fig. 18); captive screw in point goes in threaded hole in finger. Attach black gaging point to indicating (left hand) gaging finger in like manner. Place point aligning gage against silver colored gaging point as shown in Figure 19. Loosen attaching screw in black gaging point slightly and shift point until both gaging points contact point aligning gage. Tighten attaching screw. Attach centralizer point assembly to gage centralizer finger--captive screw in point goes in threaded hole in centralizer finger.

3. The Midget Range centralizer point must now be calibrated before using the gage.

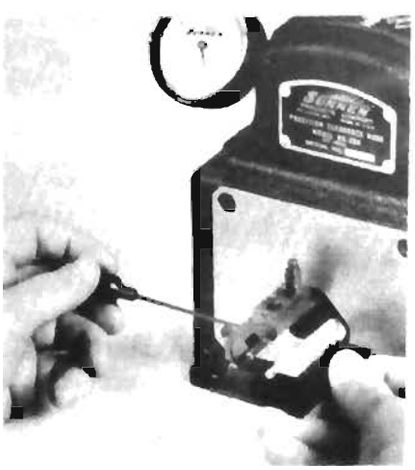


Fig. 19

B. TO CALIBRATE THE MIDGET RANGE CENTRALIZER POINT

1. Clean contacts and calibrator ring carefully.
2. Release AG-300 adjusting mechanism by turning locking lever counter-clockwise until lever is loose.
3. Turn adjusting knob to adjust gaging fingers to approximately 3/8" across points.
4. Place calibrator ring on points (Fig. 20) and while holding ring lightly against stop pads on points, expand the gaging fingers by turning adjusting knob counter-clockwise until dial indicator hand reaches approximately the 3 o'clock position.
5. Insert hex wrench in socket of centralizer adjusting screw (Fig. 21) (cap screw nearest calibrator ring). While applying a very light downward finger pressure to top of calibrator ring, adjust centralizer point up or down by turning hex wrench to right or to left to obtain maximum clockwise position of indicator hand.
6. Place setting fixture support on gage with round hole in support engaging shoulder pin on centralizer. (Fig. 22).
7. Gage is now ready for use.

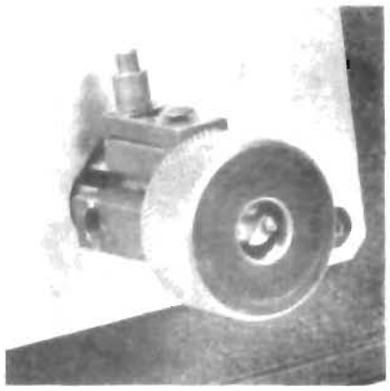


Fig. 20

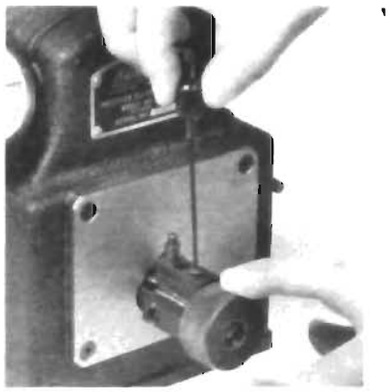


Fig. 21

C. CONVERTING YOUR SETTING FIXTURE FOR USE WITH MIDGET RANGE POINTS

1. Replace present plate assembly of setting fixture with new one included in Midget Point Set.
2. No contact buttons or shims are used with Midget Range Points. Remove contact buttons and shims from old plate assembly and save for use on new plate assembly when setting fixture is used with standard range points (3/4" to 1-1/2"). The old plate can be discarded.

Note: *New plate assembly is shipped with Midget Range Roller Assembly attached. It is necessary to use this roller assembly when using the setting fixture with the Midget Range Point Set. This roller assembly must be removed from the plate when fixture is used with standard range points. To remove roller assembly, grasp center knurled stud and unscrew far enough to allow removal. Screw is staked to prevent complete disassembly of roller unit.*

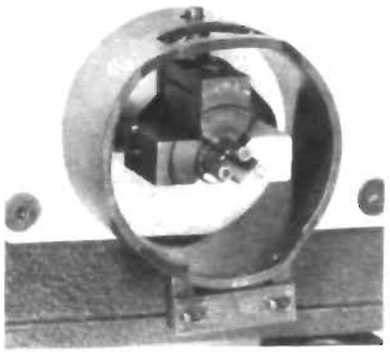


Fig. 22

D. ASSEMBLING SMALL PISTON PINS IN SETTING FIXTURE

1. Clean blocks and pins carefully to remove grit and dirt.
2. Insert pins between setting blocks with ends of pins against plate of setting fixture and *sides of pins even with ends of blocks.* (Fig. 23).
3. Tighten thumb screw firmly <u>using finger pressure only</u>. Do not use pliers or wrench.

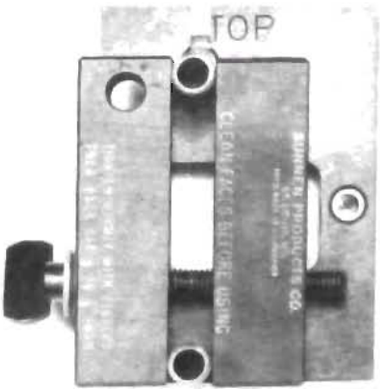


Fig. 23

4. Then back off thumb screw approximately 1/8 turn. This procedure eliminates the possibility of distortion in setting blocks or piston pins.

E. ADJUSTING GAGE TO READ PIN SIZE

1. Unlock gage adjusting mechanism by turning locking lever counter-clockwise until lever is loose.

2. Retract adjustable gaging finger by turning adjusting knob clockwise until gaging points will go between setting blocks.

3. With pins assembled in setting fixture, place against support with "TOP" up and with roller flange engaging slot in top of support. (Fig. 24).

4. Expand gaging points by turning adjusting knob counter-clockwise until gaging points just contact setting blocks, as indicated by a slight movement of the dial indicator hand. While using thumb on knurled roller to rock the setting fixture slightly clockwise and then counter-clockwise, further expand gaging points until the maximum counter-clockwise swing of indicator hand reaches approximately the 3 o'clock position. (Fig. 25).

5. Release adjusting knob tension. Lock the gage adjusting mechanism, finger-tight. The indicator hand may move slightly when gage adjustment is locked but this movement will not affect the accuracy of the gage.

6. Again rock setting fixture as described above and when minimum indicator reading (maximum counter-clockwise movement of indicator hand) is determined, loosen indicator dial clamp and rotate indicator dial face to set "0" under the indicator hand. Lock indicator dial clamp. The minimum indicator reading obtained by rocking the setting fixture represents pin size.

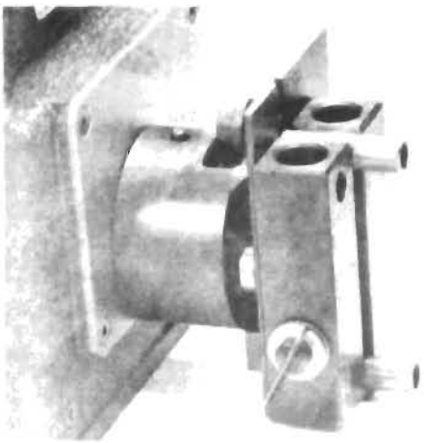


Fig. 24

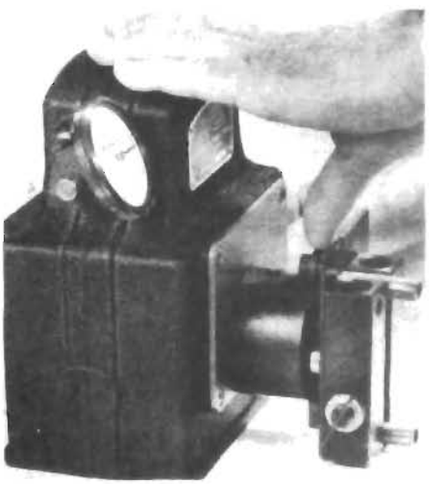


Fig. 25

F. SETTING GAGE TO DESIRERD PIN CLEARANCE OR INTERFERENCE

Rotate front bezel of indicator to set small RED adjustable limit marker to maximum allowable pin clearance or interference. (See individual engine manufacturer's specifications).

G. GAGING HOLE DIAMETERS FROM 3/8" TO 3/4"

Pin holes in small pistons and rods are gaged in same manner as with standard range points. Extra care must be taken to prevent damage to midget range fingers. In the event the fingers or gaging points are bumped, gage adjustments should be re-checked.
CAUTION: *Hole diameters greater than 3/4" should not be gaged with the Midget Range Point Set.*

USING THE AG-340 EXTRA LARGE EXTENSION POINTS FOR MEASURING HOLE DIAMETERS FROM 2-5/8" TO 3-3/8"

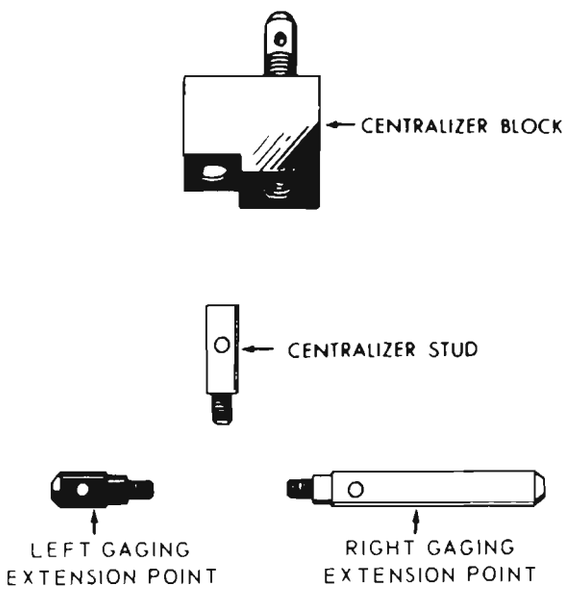


Fig. 26

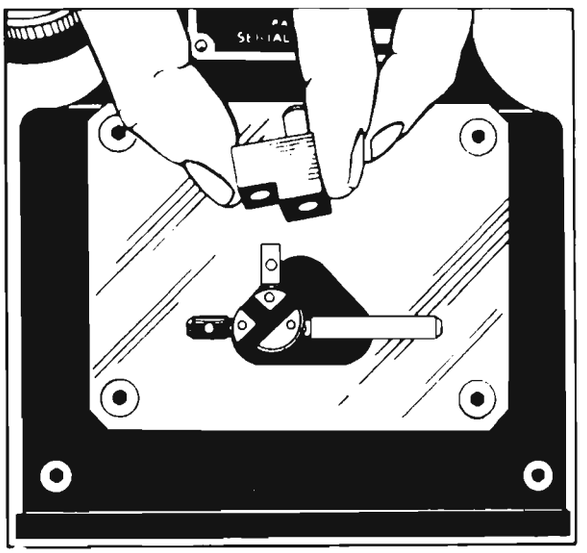


Fig. 27

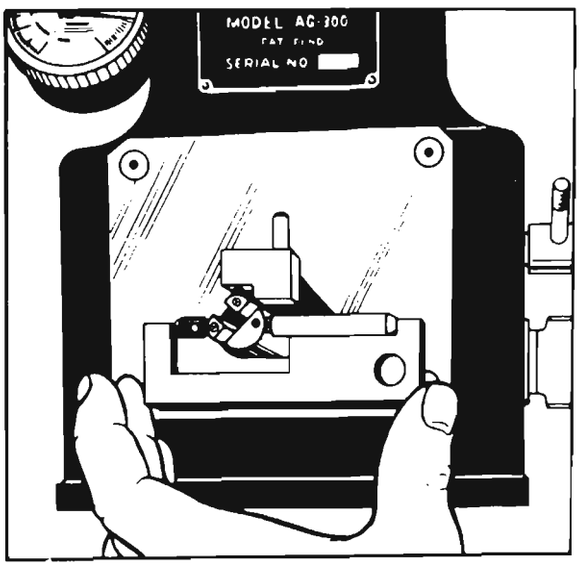


Fig. 28

A. TO INSTALL THE AG-340 EXTENSION POINTS

(CAUTION: *Do not remove the standard range gaging points.)*

1. Clean gaging fingers and centralizer finger carefully. Make sure tapped holes and counterbored seats nearest to gage body are clean and free of grit and oil.

2. Clean threads and seats of extension points carefully. (Fig. 27). Screw points and centralizer stud into tapped holes with counterbored seats in gaging fingers and centralizer finger. Insert point wrench (furnished with AG-300 gage) through cross-hole in points and stud, and tighten lightly. Slip centralizer block over stud with contact point to right as shown (block must rest solidly on centralizer finger).

B. TO CALIBRATE THE AG-340 EXTENSION POINTS

1. Clean contact points and calibrator carefully.

2. Release AG-300 adjusting mechanism by turning locking lever counter-clockwise until lever is loose. Expand gaging points with calibrator in place as shown. Rock the calibrator around the points to find minimum indicator reading, and adjust gaging points until this minimum reading is at the 3 o'clock position.

3. (Fig. 29). Place calibrator in position, flat against full width of centralizer block. Slip wrench through hole as shown and adjust threaded centralizer point while rocking it right and left until calibrator just touches at both AA and BB.

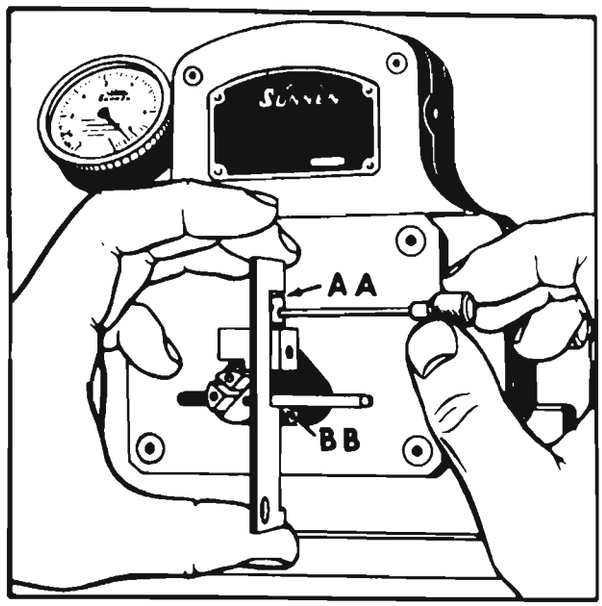


Fig. 29

C. ADJUSTING AG-300 GAGE FOR KNOWN SIZE

1. (Fig. 30). A micrometer may be used as follows: Lock the micrometer at the desired size. Hold one side of the micrometer against extension gage point "A" and adjust gage until extension gage point "B" just contacts the other side of the micrometer. Hold micrometer steady against extension point "A", slowly move the other side of the micrometer across extension point "B" in all directions, and adjust gage further until minimum indicator reading (maximum counter-clockwise movement of indicator hand) reaches approximately the 3 o'clock position. Release adjusting knob tension 1/2 turn.

   Hold micrometer in position and lock gage by turning locking lever clockwise until finger tight. Indicator hand may move slightly while locking the adjustment.

   Unlock dial clamp and rotate dial to set zero to minimum indicator reading (maximum counter-clockwise movement of hand). Indicator will now read directly in tenths of thousandths over and under the size set on micrometer.

2. Gage blocks, ring gages, and parts with holes of known size may also be used to transfer a given size to the AG-300 gage.

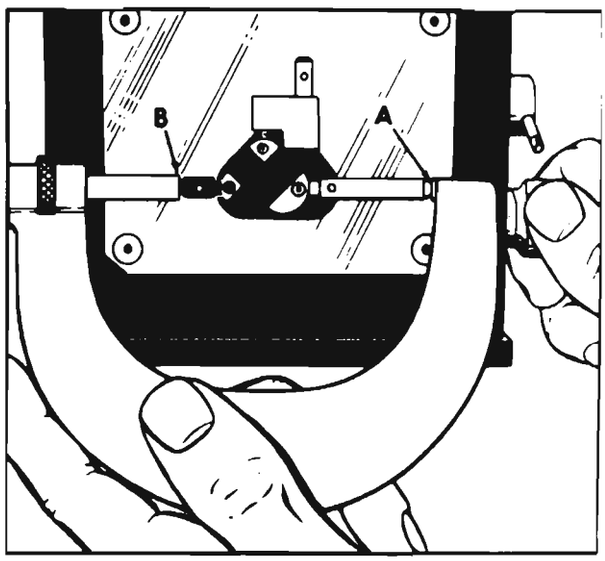


Fig. 30

D. GAGING HOLE DIAMETERS FROM 2-5/8" TO 3-3/8" (Journal end of con-rods)

1. After the gage has been adjusted to a known size, place the hole to be gaged on the gaging points and hold the rod flat against face of gage. Allow the part being gaged to rest on the centralizer point.

   When measuring the large ends of connecting rods, measure hole in one direction, then swing rod around points approximately 1/4 turn to take a second reading across the hole. Be careful to see that the gaging points or centralizer point do not enter any oil holes or grooves.

INSTRUCTIONS FOR USING THE SUNNEN HEAVY DUTY PRECISION HONING MACHINE

Detailed instructions for using your Sunnen Honing Machine are covered in the following sections. The sequence of steps is as follows, for getting ready to use the machine:

SUMMARY:

1. Select honing unit.
2. Assemble honing unit if necessary.
3. Insert honing unit in the machine.
4. Select and set spindle speed.
5. Set cutting pressure.
6. If necessary center honing unit (reduce run-out) using eccentric sleeve.
7. Stroking procedure.
8. True the stone and mandrel.
9. Adjust the stroking stop (if used).
10. Adjust the work support (if used).

1. SELECT HONING UNIT

For best results, always use the honing unit that is designed for the job to be done.

TYPE OF HONING UNIT	TYPE OF WORK
RYY, SL, SYY, LH, LJ, 3ML, 3PL	Pin fitting in pistons (both bushings at the same time)
KL, 1PL, RL	Pin fitting in con rods, and cylinder reconditioning in small bore engines.
3ML, 4ML, 5ML, 4PL, 5PL, LL	King pin fitting
HB, SC, RL	Reconditioning hydraulic brake cylinders
CR	Con-rod reconditioning

When fitting new piston pins in new standard bushings it is faster to use a roughing operation (with a coarse grit stone) to bring the bushings almost to size, then finish up with a finishing operation (with fine grit stone).

See page 11 for honing stone chart.

2. ASSEMBLE HONING UNIT

Be sure the mandrel, adapter (if any), shim (if any), wedge, and stone are assembled correctly according to the instructions.

3. INSERT HONING UNIT INTO THE SPINDLE CHUCK

a. Back off feed dial (counter-clockwise) all the way, then advance it clockwise four turns. (Fig. 31).

b. With stone in mandrel, pull wedge out as far as possible with wrench provided.

c. Install eccentric spindle sleeve if required.

Note: *For Type CR honing units pull eccentric sleeve out until it is free to rotate, and set arrow on sleeve to the correct size range as indicated on sides of mandrel body.*

(Fig. 32). Push eccentric sleeve back onto mandrel shank, engaging locating pin with notch in sleeve.

Example: When honing a connecting rod crank pin hole with a diameter of 2.043", use CR-1900 honing unit and set arrow on eccentric sleeve to "over 2.000".

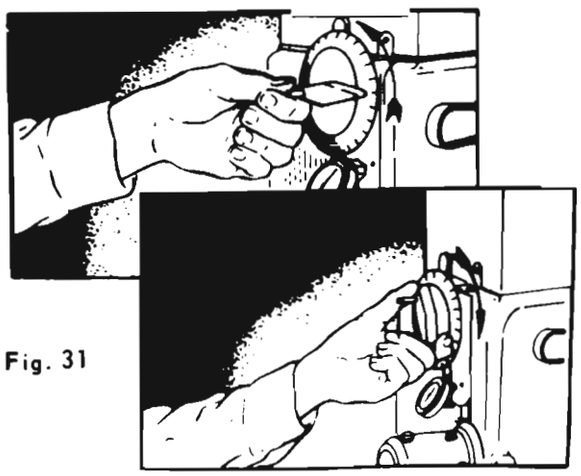


Fig. 31

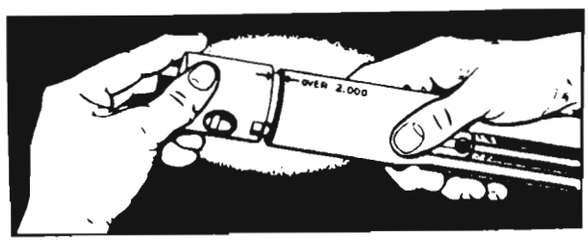


Fig. 32

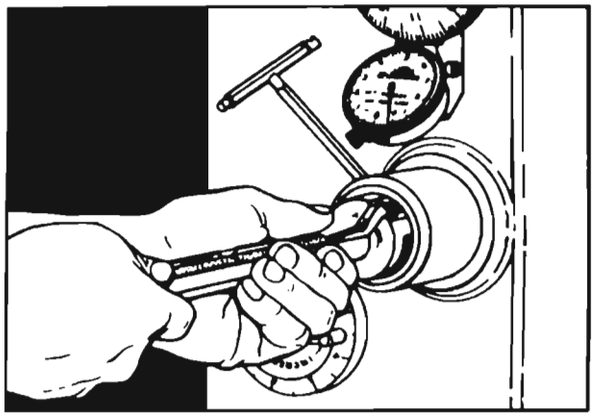


Fig. 33

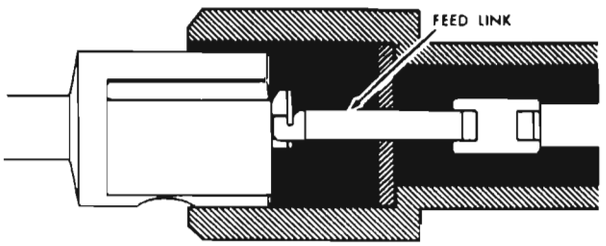


Fig. 34 *Honing Unit will butt against feed link as shown.*

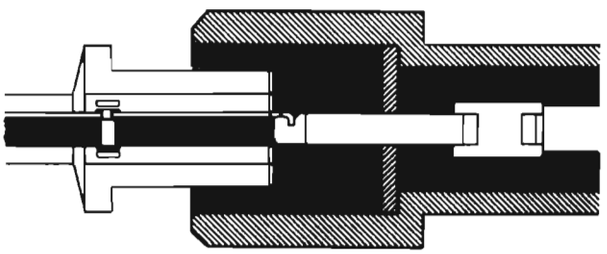


Fig. 35 *Wedge and feed link couple when honing unit is turned a quarter turn to the right.*

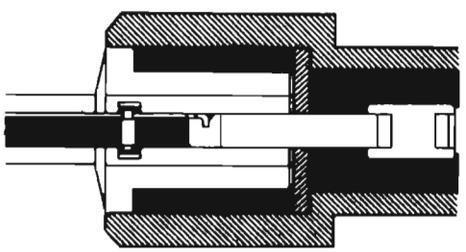


Fig. 36 *When honing unit "bottoms" in spindle chuck, mandrel adapter is flush with spindle chuck. Wedge is pushed forward in mandrel.*

d. Rotate spindle so that large set screw is at 11 o'clock position. With stone of honing unit turned a quarter turn to right of large set screw, insert honing unit in spindle as far as it will go (Fig. 33 and 34). Then rotate the honing unit a quarter turn clockwise and push unit in until it "bottoms" (Fig. 35 and 36). Tighten large set screw.

e. Check the set-up by depressing and releasing the Pedal or turning the Feed Dial in both directions. If wedge does not move forward and back, it did not engage with feed link. In that case, remove honing unit and repeat steps "b" and "d".

4. SELECT AND SET SPINDLE SPEED

To change speed, turn motor OFF and shift V-belt to groove providing desired speed. (Fig. 37). For easiest belt shifting always move belt to smaller diameter groove on either pulley first.

The following chart is a guide to use in selecting the proper speed. Condition of the bore and other variables may prompt you to try a faster or slower speed than that indicated in the chart--don't be afraid to do so.

DIAMETER OF HOLE TO BE HONED	SPINDLE SPEED
2" and over	200
1-1/2"	250
1"	320
7/8"	400
3/4"	500
1/2" and under	640

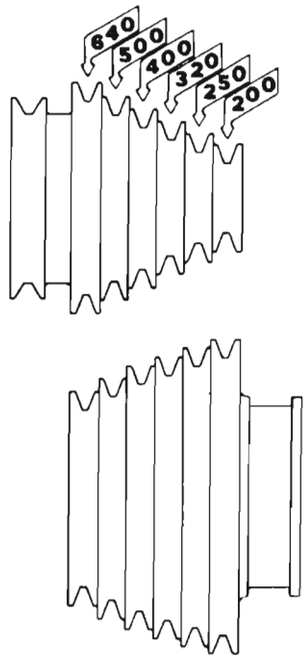


Fig. 37

5. SET CUTTING PRESSURE

The Cutting Pressure Control is for setting the pressure of the stone against the work, and is numbered 1 to 8 (Fig. 38). Turn dial to higher numbers to increase stone pressure against the work. Use lowest pressure that will give good cutting action and still stabilize the work on the honing unit. Generally, higher pressures are used for roughing operations, hard metals, and large holes. Until such time as experience dictates the best pressure settings, use position 2 or 2-1/2 for roughing and position 1-1/2 for finishing.

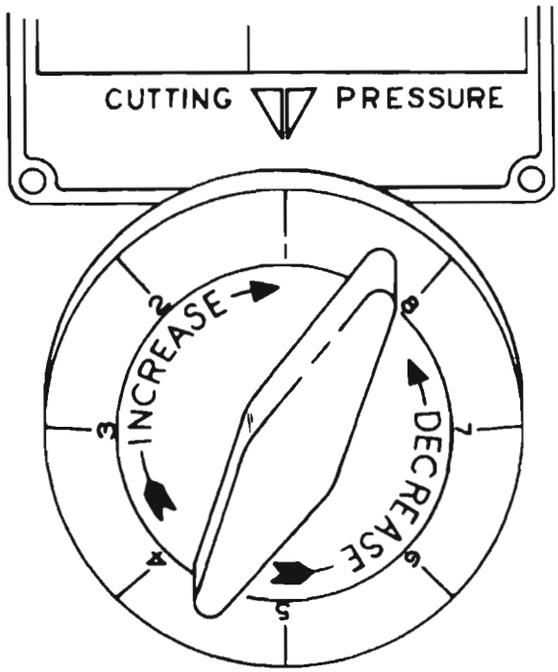


Fig. 38

6. REDUCE "RUNOUT" OF HONING UNIT

As mandrel shoes wear, and honing unit is used in upper end of its diameter range, the center of the honing unit may be offset with respect to the center of the spindle chuck. This will cause "run-out".

Although "run-out" is not objectionable for most applications, certain honing units are designed to be used with an eccentric sleeve (furnished with the machine). Rotating this sleeve one-half turn will reduce the "run-out" sufficiently (Fig. 39).

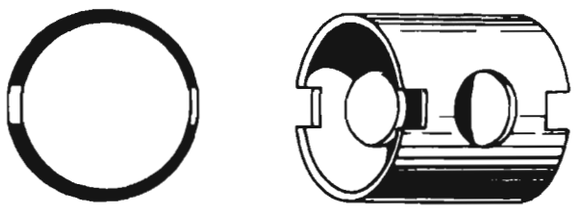


Fig. 39

7. STROKING PROCEDURE

Place the piston, rod, or other part on rear of honing unit as shown (Fig. 40). Depressing Pedal slowly, stroke the part forward and back on honing unit, at a rate of about one complete stroke each second. Release Pedal before removing part.

Length of stroke should be such that the part is stroked over the ends of the stone, by 1/3 to 1/2 the length of the hole (or piston boss if the part is a piston).

Proper stroking assures that the entire length of stone and guide shoe wears uniformly, keeps stone and shoes true, assures accuracy.

Reverse the work end for end frequently to help keep shoes and stone true.

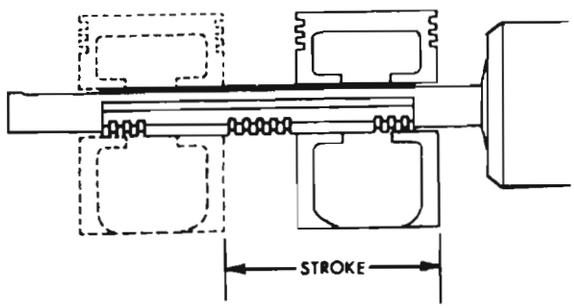


Fig. 40

8. TRUE THE STONE AND MANDREL

For accurate work the surfaces of the honing stone and the two guide shoes must be parallel. Therefore, when starting with a new honing unit, with new guide shoes, or with a new stone in a used honing unit, it is necessary to "true in" the stone and mandrel. The truing procedure is as follows:

a. Set the Cutting Pressure Control according to the following table, depending upon the size of the honing unit:

SIZE OF HONING UNIT	CUTTING PRESSURE FOR TRUING
3/8" - 1/2"	1
1/2" - 1"	1-1/2
1" up	2

b. Retract stone by turning Feed Dial counter-clockwise to end of range. Adjust oil line to direct oil down into drain pan. Apply honing oil sparingly to the stone, using brush or finger. Slide truing sleeve onto honing unit and depress Pedal.

Advance Feed Dial until Honing Dial needle reads 3 or 4 (Fig. 41). Release Pedal. Start motor, and while stroking truing sleeve forward and back on the mandrel, depress Pedal slowly until crank arm hits stop pin. Overstroke each end of the stone by 1/3 to 1/2 the length of the truing sleeve. Stone surface must be overstroked by same amount on each end (this is especially important on Type SL mandrels). Reverse truing sleeve frequently. Always release Pedal to stop rotation of honing unit before removing the truing sleeve. Whenever Honing Dial needle drops to zero, release Pedal and advance Feed Dial 3 or 4 numbers. If the Honing Dial needle does not move during the truing operation, increase the cutting pressure by one-half number. If the needle moves too fast, or if the honing torque is too great, decrease the cutting pressure by one-half number. Truing process is complete when stone and guide shoes are radiused and show contact over their full length. Shoes do not have to show contact across their full width.

c. Use the truing sleeve sparingly. Excessive use of the truing sleeve causes undue wear. After a few reversals of the sleeve, stop the machine and visually inspect the mandrels and stones. High spots on the stone will be "loaded" (Fig. 42). Use an abrasive dressing stick to remove high spots. High spots on guide shoes will be bright and shiny. A few light strokes with a file will true most guide shoes. Truing sleeve thus is used as a straightedge and will last longer. Truing time is reduced. Truing sleeve should be as near as possible to size of hole to be honed, so that curvature of shoes fits the curvature of the hole.

9. ADJUST THE STROKING STOP (Fig. 43)

This optional accessory is used to limit the length of stroke when honing blind holes such as some hydraulic brake cylinders. With motor "OFF", loosen thumb screw. Place work on honing unit, adjust stroking stop as needed for length of stroke, and turn it so that the cylinder or other part will contact it at machine end of stroke. Tighten thumb screw.

10. ADJUST THE WORK SUPPORT

The work support makes accurate work easier when honing long unbalanced parts such as connecting rods and spindle bodies. Bar should be placed approximately under center of gravity (balance point) of the work.

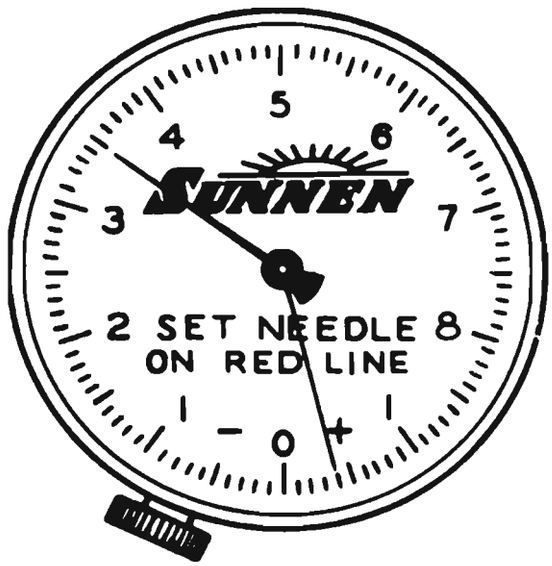


Fig. 41

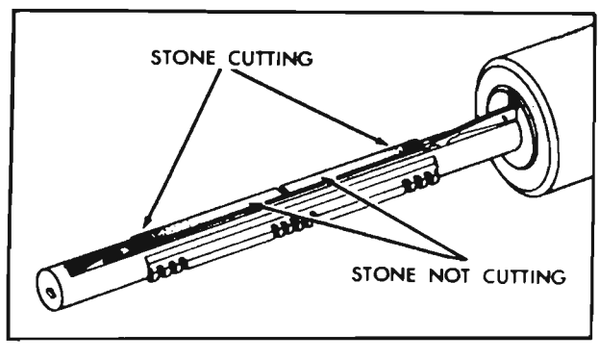


Fig. 42

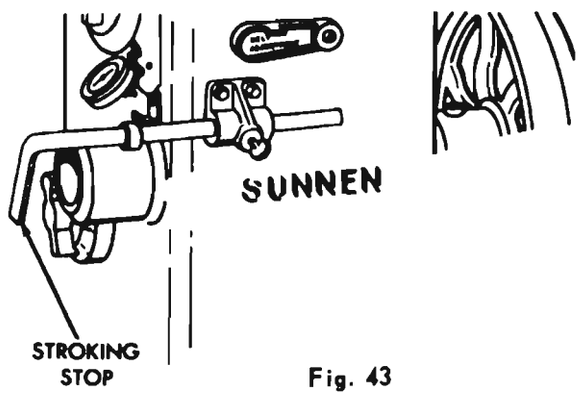


Fig. 43

And now let's put the Sunnen Honing Machine to Work

FITTING PINS IN PISTONS

The Sunnen pin fitting method permits definite control of clearances and produces holes that are round and straight and have a very fine surface finish. This assures full bearing contact and unbroken oil film, and gives long life to the parts.

Pins fitted by the Sunnen method will feel absolutely free even though the clearance may be only a "tenth". With such a superior pin fit it is very important to measure the fit on a gage like the Sunnen Precision Gage--because a "feel" fit in a Sunnen honed hole can only indicate clearance of less than .0001" (a "tenth"). This clearance is insufficient to maintain a proper oil film.

Except when fitting 3 or 5 thousandths oversize pins, there will usually be a considerable amount of stock to be removed from the bushings. It is generally faster to size the hole in two operations - rough honing for bringing the hole almost to size, followed by finish honing to remove the last two thousandths of stock and produce the proper surface finish.

ROUGH HONING

1. Set the Precision Gage as instructed for piston pin fitting (page 4).

2. Insert honing unit with roughing stones in honing machine and set cutting pressure dial between 2 and 2-1/2. (Fig. 44).

3. To gage the piston to see how much stock must be removed, hold piston lightly with thumb on edge of skirt and fingers under crown as shown in Fig. 45. Slip the piston first over adjustable gaging finger point, then slide it over the size indicating finger point, as shown in Fig. 46. Allow piston to hang from centralizer point, but do not contact face of gage with piston. Make certain that gaging and centralizer points clear oil holes or grooves in the bushing or pin boss.

(Continued)

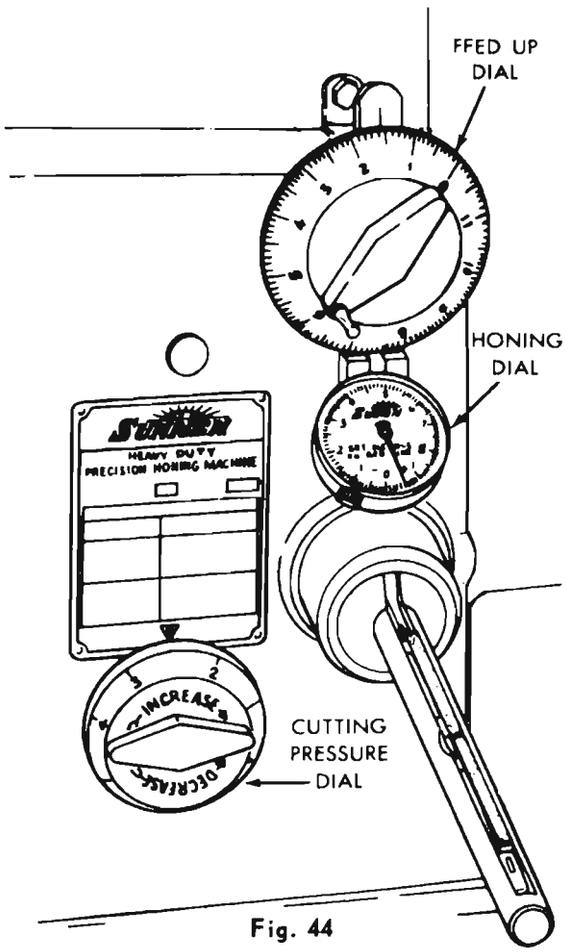


Fig. 44

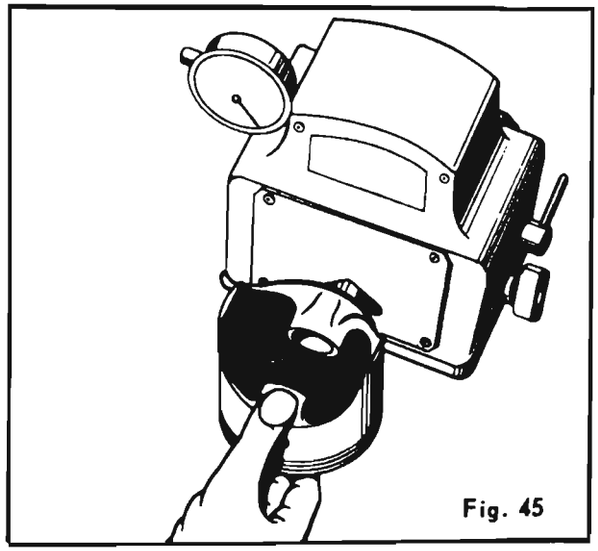


Fig. 45

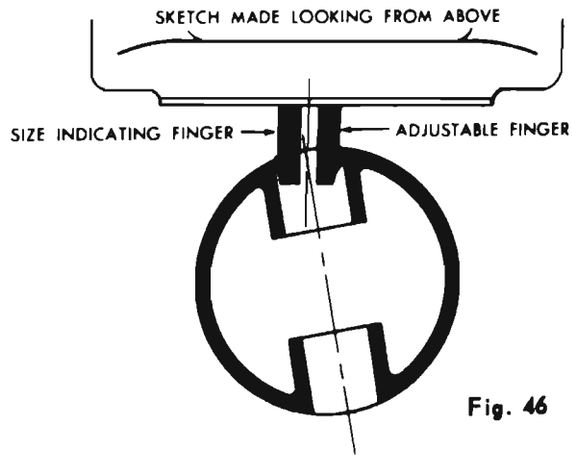
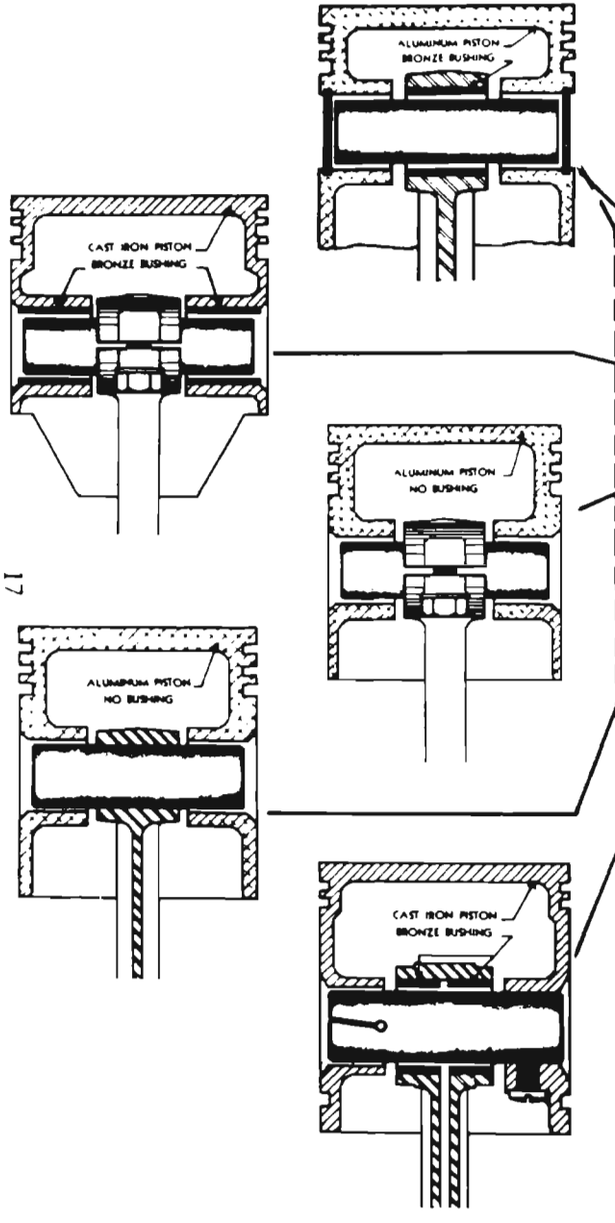


Fig. 46

SUNNEN®

RECOMMENDED PIN CLEARANCES



PRECISION PIN FITS ON ENGINES WITH ¾″ TO 1¼″ DIAMETER PINS

Description	Aluminum Piston	Cast Iron Piston	Connecting Rods
Full Floating	.0001″ to .0003″ clearance	.0003″ to .0005″ clearance	.0003″ to .0005″ clearance (all pressure feed, .0005″ to .0007″ clearance.)
Oscillating in bushed piston		.0003″ to .0005″ clearance	clamped in Rod
Oscillating in piston (no bushing)	.0003″ to .0005″ clearance	.0006″ to .0008″ clearance	clamped in Rod
Oscillating in piston —press fit in Rod	.0003″ to .0005″ clearance		—.0008″ to —.0012″ press fit
Set Screw Type Piston	Screw Side, —.0002″ to —.0003″ press fit	Screw Side, —.0001″ to —.0002″ press fit	When locked in piston, and all pressure feed: .0007″ to .0009″ clearance.
	Free Side, 0 to .0001″ clearance	Free Side, 0 to .0001″ clearance	

PRECISION PIN FITS ON ENGINES WITH 1¼″ AND 1½″ DIAMETER PINS*

Description		Aluminum Piston	Cast Iron Piston	Connecting Rods
Full Floating	1¼″ dia. pin holes	.0003″ to .0005″ clearance		.0007″ to .0009″ clearance (all pressure feed, .0009″ to .0011″ clearance.)
Full Floating	1½″ dia. pin holes	.0005″ to .0007″ clearance		.0010″ to .0012″ clearance (all pressure feed, .0013″ to .0015″ clearance)

This chart is to be followed only when piston pin holes are honed by the Sunnen method.

The clearances shown are not applicable when less accurate methods are used.

*On large diameter pins check Engine Manufacturers Manual for recommended clearances.

Hold piston level and rock it to right and left as shown in Fig. 47 to obtain maximum gage indicator reading (maximum counter-clockwise movement of indicator hand).

Important: Note that this rocking movement is from side to side in a horizontal plane, instead of a vertical plane as with the setting fixture.

Note: *Gage will show amount of stock under finished size, up to 7 thousandths. If bushing has more than 7 thousandths to be removed, do not force piston on gage, but hone out enough stock as in steps 4 through 11, until piston will fit on gage.*

FITTING NEW PINS TO NEW BUSHINGS

4. With honing machine motor turned OFF and Pedal fully depressed, back off Feed Dial until piston will go on honing unit. Position piston over rear stone (stone nearest machine).

5. With Pedal still fully depressed, advance Feed Dial until Honing Dial points to zero while rotating piston slightly in both directions to seat it on honing unit. From this position the Feed Dial should be advanced as needed for required stock removal.

6. When fitting standard pins to new bushings with excessive stock, advance Feed Dial until Honing Dial reads approximately 7, or as indicated by AG-300 Gage. (Pedal still fully depressed). (Automatic Stone Feed. With the part to be honed on the honing unit and the stone expanded to contact the hole, further turning of the Feed Dial actuates the automatic stone feed mechanism which then feeds out the stone during honing, to the limit as set on the Feed Dial.)

7. Release Pedal. Piston should now be free on honing unit. Do not remove piston.

8. Turn machine motor ON and adjust oil flow.

9. Place piston over rear stone, grasp it securely with both hands and slowly depress Pedal all the way, while stroking piston back and forth on honing unit. Reverse piston on mandrel occasionally to keep mandrel and stone true. Always start stroking from rear. Continue honing until Honing Dial reads zero. Never hone past zero.

10. Release Pedal and remove piston from honing unit.

11. Gage piston as in Step 3 (above).

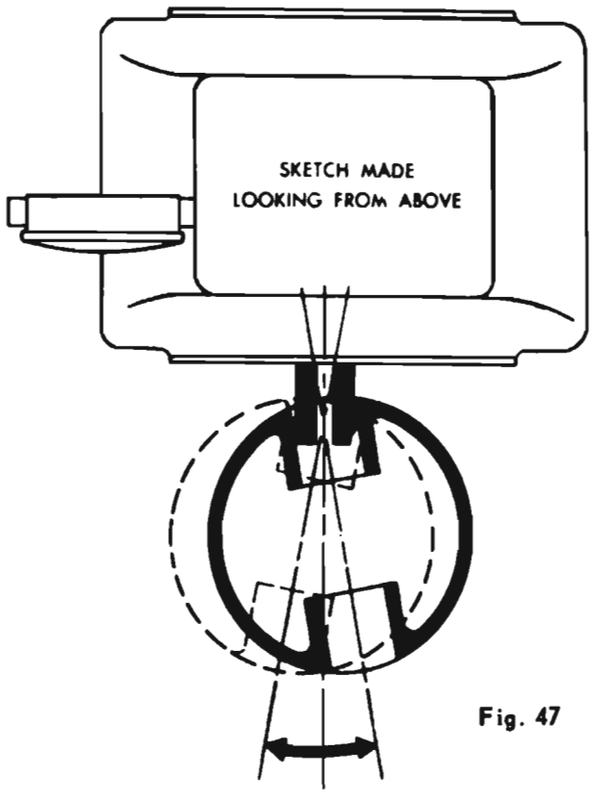


Fig. 47

12. Adjust Feed Dial by amount shown on the gage, less the 2 thousandths needed for the finishing operation.

    Example: If gage reads 5 thousandths undersize, advance Feed Dial 3 thousandths (three numbers when using piston type honing units--see machine nameplate).

13. Continue honing until Honing Dial again reads zero, and gage for size.

14. Gage will now show approximately 2 thousandths stock left for finishing operation.

    Note: *Because of stone wear, the amount of stock removed will not be exactly equal to the amount the Feed Dial was advanced.*

15. The machine now is properly set for roughing the remaining pistons, with no further adjustments necessary except to compensate for stone wear.

FINISH HONING

After all pistons have been rough honed, proceed with finish honing as follows:

16. Turn honing machine motor OFF, remove roughing mandrel and insert finishing mandrel. Set Cutting Pressure Dial to approximately 1-1/2.

17. Adjust machine as in Step 4 of ROUGH HONING.

18. Adjust Feed Dial as in Step 5 of ROUGH HONING.

19. Advance Feed Dial until needle of Honing Dial reads approximately the stock to be removed.

20. Same as Steps 7, 8, 9 and 10 of ROUGH HONING. Reverse piston on mandrel occasionally so the stones will wear evenly (be sure to stop mandrel by releasing Pedal before taking piston off mandrel).

21. Now place piston on gage as in roughing operation. If gage shows hole to be within recommended pin clearance size, piston is finished. If hole is still undersize, advance Feed Dial the amount the hole is undersize. Replace piston on mandrel and hone until Honing Dial again reads zero. Gage should now show pin hole to be within the recommended clearance.

22. Finish hone the remaining pistons. Gage each one and advancing Feed Dial as necessary to compensate for stone wear.

FITTING OVERSIZE PINS TO OLD BUSHINGS

When fitting oversize pins to old bushings, it is usually faster to first break the glaze on the bushing with a roughing stone to eliminate loading of the finishing stone, then go to the finish honing operation.

HONING AND GAGING PIN END OF CON RODS

Con rods are honed in the manner outlined for pistons, except always start and stop stroking in the middle of the stone. Also, use a con rod type of honing unit. Keep in mind that the stone in some honing units advances twice as fast as a stone in a piston type honing unit. Use same cutting pressure setting or 1/2 division higher setting than used for honing pistons.

Example: *To remove .003" stock with a con rod honing unit, advance the Feed Dial only one and a half dial numbers instead of three as with a piston type honing unit. See nameplate on honing machine for stone advance in various type honing units.*

Gaging is similar to that of pistons. Hang the rod freely from the gage centralizer point as shown in Fig. 48. Do not touch face of gage with rod. Rock the rod from side to side (Fig. 49) to determine hole size as shown by minimum indicator reading.

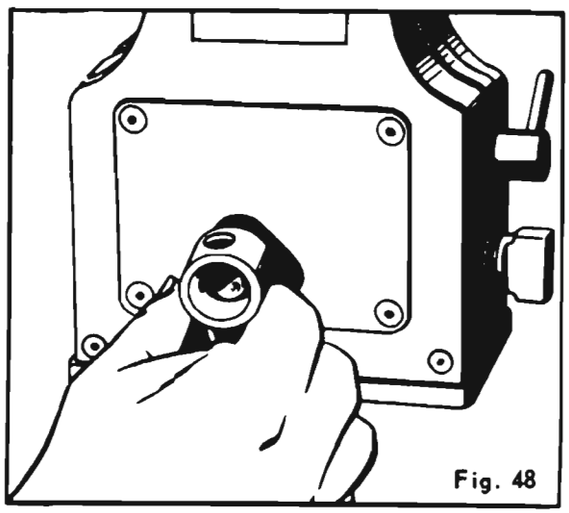


Fig. 48

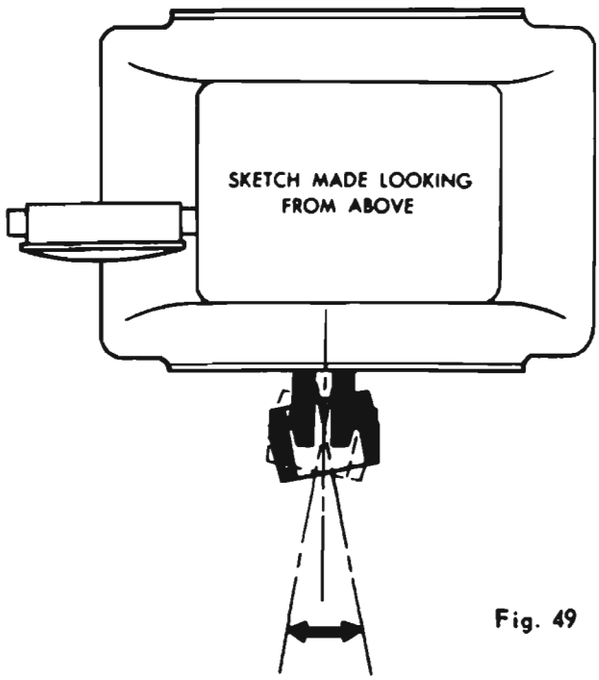


Fig. 49

HONING AND GAGING CON ROD WITH INTERFERENCE OR PRESS FITS

Most engines require the pin to have a press fit in the rod, and the exact interference fit is necessary.

Follow the same procedure outlined above. Set pin size to zero as in Step B, "Adjusting Gage to Read Pin Size" (Page 4). Rotate front bezel of indicator to set limit marker to desired amount of interference in "INTERFERENCE" (Red) area of indicator dial. Stop honing when indicator hand reaches limit marker.

HONING AND GAGING CRANK PIN END OF CON RODS

Note: *V-8 rods and rods with narrow bearings should be honed two at a time. (Fig. 52)*

1. Select proper size CR honing unit and insert it in spindle chuck as instructed in section 3, page 12.

2. Install correct extension points in AG-300 gage (Pages 3 to 11).

3. Set the cutting pressure between 2-1/2 and 3-1/2.

4. Rotate machine spindle by hand until mandrel shoes are on top. Loosen the four shoe clamp screws about 1/2 revolution with wrench provided. Place con rod vertically on mandrel at center of shoes (Fig. 50). Fully depress Pedal and keep it fully depressed until screws are tightened. Expand stone by turning Feed Dial clockwise until con rod is held firmly on honing unit. Slight tapping on end of con rod will aid in seating shoes. Tighten all four shoe clamp screws firmly, *making sure each shoe contacts inside surface of hole at two points, but do not overtighten screws*. Back off Feed Dial until Honing Dial reads zero with Pedal still fully depressed.

5. No truing is required; Type CR honing units, stones and shoes are self-truing (no Truing Sleeve is furnished).

6. Release Pedal. Set machine to proper speed. (Page 13).

7. Check rod bore to determine stock to be removed. This is done by using the Sunnen AG-300 Precision Gage. (Pages 5, 6, 10 and 11). (Fig. 51). With side of con rod against face of gage, exert a very little pressure on the rod downward and toward the left to obtain accurate measurement.

8. Turn motor ON. Be sure to use the Work Support. Start stroking and depress Pedal slowly until it is all the way down. While stroking the con rod over the stone, advance the Feed Dial to keep stone in contact with con rod.

   Because of the out-of-round condition of the rod at this stage, the Honing Dial may be inoperative. As the hole rounds up however, the Honing Dial may be used as in fitting piston pins.

   After the first rod has been sized, note the setting of the Feed Dial. Now, put the next rod on the honing unit, and hone until the Honing Dial needle is on zero, with Feed Dial returned to its previous setting. Gage the con rod and advance Feed Dial if necessary to compensate for stone wear. Hone to zero again and note position of Feed Dial.

   Repeat the procedure for additional rods in same set.

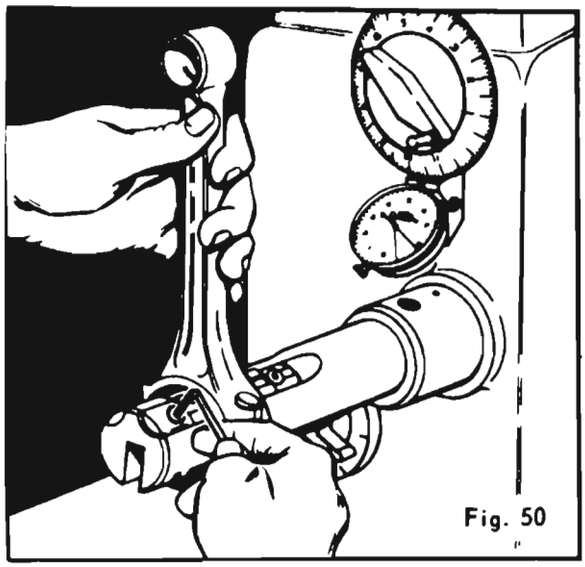


Fig. 50

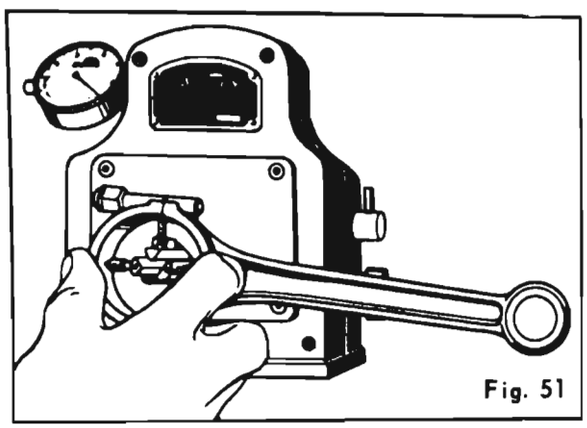


Fig. 51

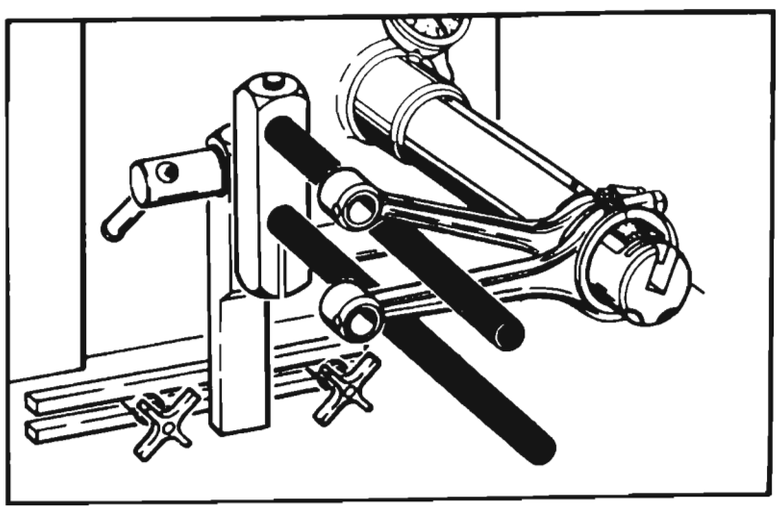


Fig. 52

EXPANDING BUSHINGS INTO RODS, PISTONS, SPINDLE BODIES

Select proper size AL or ALH mandrel for the bushing to be expanded. Assemble according to instructions on page 32, and insert expander unit in spindle chuck.

ADJUSTING THE MACHINE. Adjust belt for 400 RPM spindle speed. Turn Cutting Pressure Control to right as far as it will go. For con rods and spindle bodies, adjust Work Support to take the torque.

Direct a light stream of honing oil onto the mandrel. DO NOT USE DRY.

EXPANDING THE BUSHING. After the bushing has been pressed into the bore, place the part on the polished Expander Bit. With the motor OFF and the Pedal depressed, turn the Feed Dial to the right until the mandrel has expanded to the inside diameter of the bushing.

Turn the motor ON. Stroke the part over the Expander Bit, advancing the Feed Dial until the Bit can be felt as the bushing passes over it.

Advance the Feed Dial two to three numbers and slowly stroke the part across the Expander Bit several times to expand the bushing into the bore of the part (Fig. 53).

When expanding bushings that have large grooves or oil holes, make sure Expander Bit doesn't drop into the grooves or holes.

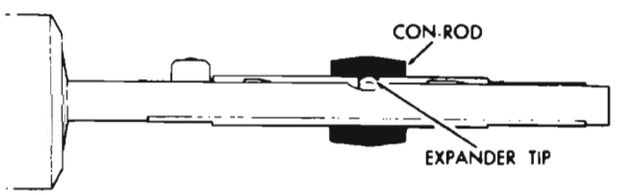


Fig. 53

Examine inside of bushing; if properly expanded most of the inside surface will be burnished by the Expander Bit. Otherwise, advance the Feed Dial a few thousandths and repeat the operation.

After the desired Expander setting has been found, all bushings of the same size may be expanded without further adjustments of the Feed Dial.

CARE MUST BE EXERCISED TO AVOID EXCESSIVE EXPANSION AS A SUFFICIENT AMOUNT OF MATERIAL MUST REMAIN FOR HONING TO FINISHED SIZE.

FACING CUTTER. During the expanding operation, some of the bushing metal may have been squeezed out past the end of the bore. After expanding the bushing, slide the part to the rear of the mandrel and trim off the extruded portion of the bushing with the Facing Cutter. Reverse the part on the mandrel and trim opposite end (Fig. 54).

The Facing Cutter is designed to trim soft bushing materials without cutting the rod. It is provided with a cutting edge on each end so that it can be turned around for additional service.

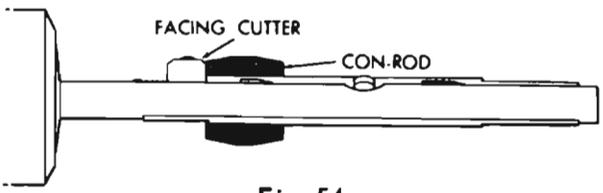


Fig. 54

FITTING KING PINS

Honing units for fitting king pins are extra long in order to get perfect alignment between bushings and to allow proper overstroking. If two bushings are used, hone both at once. If a needle bearing is used in one end, replace it with a king pin alignment bushing (See Catalog X-SP-6000) during the honing operation.

Adjust the Work Support to absorb the honing torque (Fig. 55). Use medium cutting pressure (2 or 3). See page 13 for spindle speed selection. As with other new bushings, depress Pedal slowly until initial roughness is removed.

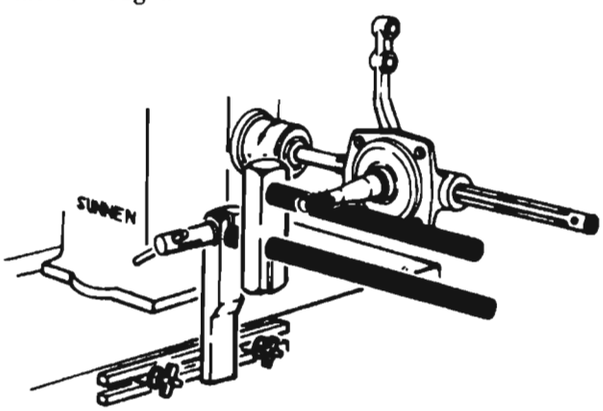


Fig. 55

HONING HYDRAULIC BRAKE CYLINDERS

Types SC, HB, and KB honing units are used for hydraulic brake cylinder work. Type KB units are used for Hi-Tork cylinders, and use a special hard tip stone in order to obtain the necessary accuracy in the blind hole.

It is best to use the Stroking Stop when honing blind or step hydraulic brake cylinders. Set the Stop so that the brake cylinder will contact it just before the end of the honing unit hits the end of the cylinder. If the stone were allowed to hit the end of the cylinder, the stone might be damaged.

Keep the stone wet with a flow of honing oil. Start honing with light cutting pressure and stroke the full length of the hole. Type HB and SC stones are spring loaded and will wear rapidly if cutting pressure is heavy enough to collapse the spring.

SIZING. To remove stock rapidly, use SC-7, HB-7, XSC-7, XHB-7, or KB-7 stone to remove deep scratches and true up the bore.

FINISHING. Use SC-13, HB-13, XSC-13, XHB-13, or KB-13 stone to produce the very fine finish needed in hydraulic brake cylinders. Stop stroking before you release Pedal to obtain circular pattern instead of crosshatch pattern.

CLEANING. Cylinders must be cleaned thoroughly after honing to remove all traces of grease or oil.

HONING STEERING SECTORS, SMALL BORE ENGINES, ETC.

Steering sector housings, small bore engines, air compressor cylinders, starter and generator bushings, and other jobs can be honed easily on the Sunnen Honing Machine. Select a honing unit of the proper size, with a stone from 2/3 to 1-1/2 times as long as the hole to be honed, and follow the general honing procedure as outlined for piston pin fitting. Select proper spindle speed (Page 13).

IF YOU ARE TROUBLED WITH...

BELLMOUTHING

A. Operator is not stroking work back and forth the full length of the stone. This causes the stone and mandrel shoes to become large at the ends, which causes bellmouthing (holes larger at the ends than at the middle). An untrue condition is easily determined by the "feel" of the work as it passes over the honing unit. Any high spots will feel tighter. Use the Truing Sleeve (Page 15).
B. Wedge may have become bent.
C. Mandrel may be worn out. (See "WHEN TO REPLACE MANDRELS" below).
D. Bellmouthing in rod bushings may be from using too heavy stone cutting pressure, or too much or too little overstroke.
E. Operator is pulling workpiece off mandrel before spindle stops rotating.

TAPERED HOLE

A. Operator is not reversing work often enough.
B. Use Truing Sleeve.
C. Make sure honing oil is distributed evenly on mandrel.
D. Operator is overstroking more at one end than at the other.

STONE NOT CUTTING

A. Stone may have become loaded or glazed. Break glaze by using stone dresser lightly, or sometimes glaze can be broken by a few very rapid strokes of the work across the stones. The most common cause of stone loading or glazing is the use of improper honing oil. Use only Sunnen Honing Oil.
B. Improper stone being used. See STONE CHART, (Page 41).
C. Too light cutting pressure.

EXCESSIVE STONE WEAR

A. Improper honing oil being used.
B. Too heavy cutting pressure.
C. Feed Dial advanced too much at a time.
D. Work may contain heavy burrs.
E. When honing out-of-round or very rough parts depress Pedal slowly to reduce stone wear.

WHEN TO REPLACE MANDRELS OR WEAR SHOES

It is essential that mandrels having integral shoes be replaced when the shoes are worn down to the mandrel body. Failure to replace a worn-out mandrel will result in inaccurate holes. Replace wear shoes on lifetime honing units when wear pads are worn and center of shoe is contacted.

Truing sleeves should be replaced when they are worn too large for the size indicated. Always start a new honing unit with a new truing sleeve.

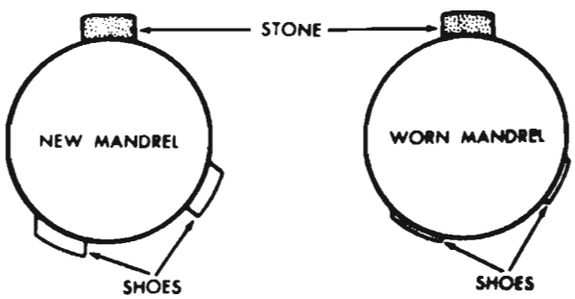


Fig. 56

DIAMETER RANGES OF MANDRELS AND HONING UNITS

CAUTION: DO NOT ORDER FROM THIS PAGE. See Sunnen Catalog X-SP-6000 for complete ordering Information.

FITTING PINS IN PISTONS

Honing Unit	Size Range (inches)
LH-370	.370 to .384
LH-432	.432 to .446
LJ-495	.495 to .525
LJ-526	.526 to .557
LJ-557	.557 to .587
LJ-619	.619 to .650
LJ-681	.681 to .713
SL-480	.480 to .540
SL-540	.540 to .600
SL-600	.600 to .660
SL-660	.660 to .720
SL-720	.720 to .780
SL-780	.780 to .840
SL-812	.812
SL-840	.840 to .900
SL-875	.875
SL-900	.900 to .960
SL-940	.940
SL-960	.960 to 1.020
SL-1000	1.000
SL-1020	1.020 to 1.080
SL-1080	1.080 to 1.140
SL-1140	1.140 to 1.200
SL-1200	1.200 to 1.300
SL-1300	1.300 to 1.400
SL-1400	1.400 to 1.500
SL-1500	1.500 to 1.600
SL-1600	1.600 to 1.700

Honing Unit	Size Range (inches)
3ML-750	.744 to .781
3ML-781	.775 to .812
3ML-812	.806 to .843
3ML-843	.838 to .875
3ML-875	.869 to .906
3ML-906	.900 to .937
3ML-937	.931 to .968
3ML-968	.962 to 1.000
3PL-1000	.990 to 1.062
3PL-1062	1.052 to 1.125
3PL-1125	1.115 to 1.187
3PL-1187	1.177 to 1.250
3PL-1250	1.230 to 1.375
3PL-1375	1.355 to 1.500
3PL-1500	1.480 to 1.625
3PL-1625	1.605 to 1.750
3PL-1750	1.730 to 1.875
3PL-1875	1.855 to 2.000
3PL-2000	1.980 to 2.125
3PL-2125	2.105 to 2.250
3PL-2250	2.230 to 2.375
3PL-2375	2.355 to 2.500
3PL-2500	2.480 to 2.625

KING PIN FITTING

Honing Unit	Size Range (inches)
3ML-625	.619 to .656
3ML-656	.650 to .687
3ML-687	.681 to .718
3ML-718	.713 to .750
4UL-781	.795 to .857
4UL-843	.858 to .920
4UL-906	.921 to .982
4UL-968	.983 to 1.070

Honing Unit	Size Range (inches)
4ML-718	.713 to .750
4ML-750	.744 to .781
4ML-781	.775 to .815
4ML-812	.806 to .843
4ML-843	.838 to .875
5ML-875	.869 to .906
5ML-906	.900 to .942
5ML-937	.931 to .968
5ML-968	.962 to 1.003
4PL-1031	1.021 to 1.094
4PL-1094	1.084 to 1.156
4PL-1125	1.115 to 1.187
4PL-1219	1.209 to 1.281
5PL-1312	1.292 to 1.375
5PL-1375	1.355 to 1.500
5PL-1562	1.542 to 1.625
5PL-1625	1.605 to 1.750
5PL-1750	1.730 to 1.875
5PL-1875	1.855 to 2.000
5PL-2000	1.980 to 2.125
5PL-2125	2.105 to 2.250
5PL-2250	2.230 to 2.375
5PL-2375	2.355 to 2.500
5PL-2500	2.480 to 2.625

FITTING PINS IN CON-RODS

Honing Unit	Size Range (inches)
KL-650	.650 to .680
KL-681	.681 to .712
KL-713	.713 to .743
KL-744	.744 to .774
KL-775	.775 to .805
KL-806	.806 to .837
KL-838	.838 to .868
KL-869	.869 to .899
KL-900	.900 to .930
KL-931	.931 to .961
KL-962	.962 to .993
KL-1000	.994 to 1.062
KL-1062	1.056 to 1.125
KL-1125	1.119 to 1.187
KL-1187	1.181 to 1.250
1PL-1000	.990 to 1.062
1PL-1062	1.052 to 1.125
1PL-1125	1.115 to 1.187
1PL-1187	1.177 to 1.250
1PL-1250	1.230 to 1.375
1PL-1375	1.355 to 1.500
1PL-1500	1.480 to 1.625
1PL-1625	1.605 to 1.750
1PL-1750	1.730 to 1.875
1PL-1875	1.855 to 2.000
1PL-2000	1.980 to 2.125
1PL-2125	2.105 to 2.250
1PL-2250	2.230 to 2.375
1PL-2375	2.355 to 2.500
1PL-2500	2.480 to 2.625

RECONDITIONING CON-RODS

Honing Unit	Diameter Range (inches)
CR-1450	1.450 to 1.600
CR-1600	1.600 to 1.750
CR-1750	1.750 to 1.900
CR-1900	1.900 to 2.100
CR-2100	2.100 to 2.300
CR-2300	2.300 to 2.500
CR-2500	2.500 to 2.700
CR-2700	2.700 to 2.900
CR-2900	2.900 to 3.190
CR-3100	3.100 to 3.300
CR-3300	3.300 to 3.500
CR-3500	3.500 to 3.700
CR-3700	3.700 to 3.900
CR-3900	3.900 to 4.100
CR-4100	4.100 to 4.300
CR-4300	4.300 to 4.500
CR-4500	4.500 to 4.700

BUSHING EXPANDERS

Expander Mandrel	Diameter Range (inches)
AL-720	.720 to .840
ALH-720	.720 to .840
AL-840	.840 to .900
ALH-840	.840 to .900
AL-900	.900 to .960
ALH-900	.900 to .960
AL-960	.960 to 1.080
ALH-960	.960 to 1.080
AL-1080	1.080 to 1.200
AL-1200	1.200 to 1.300
AL-1300	1.300 to 1.400
AL-1400	1.400 to 1.500
AL-1600	1.600 to 1.700

MANDRELS FOR PISTONS WITH WIDE SLOTS

Mandrel No.	Pin Diameter (inches)
RYY-875	.875 to .885
RYY-912	.912 to .922
SYY-927	.927 to .940
SYY-973	.975 to .980
SYY-989	.990 to 1.000
SYY-1094	1.094 to 1.104

HONING HYDRAULIC BRAKE CYLINDERS

Honing Unit	Cylinder Size (inches)
HB-1000	1″ to 1-1/4″
HB-1250	1-1/4″ to 1-3/8″
HB-1375	1-3/8″ to 1-5/8″
* HB-1250	1-5/8″ to 1-3/4″
* HB-1375	1-3/4″ to 2″
SC-1000	1″ to 1-1/4″
SC-1250	1-1/4″ to 1-3/8″
SC-1375	1-3/8″ to 1-5/8″
* SC-1250	1-5/8″ to 1-3/4″
* SC-1375	1-3/4″ to 2″

* Use Extension Stones see Chart Page 11.

HOW TO ASSEMBLE HONING UNITS

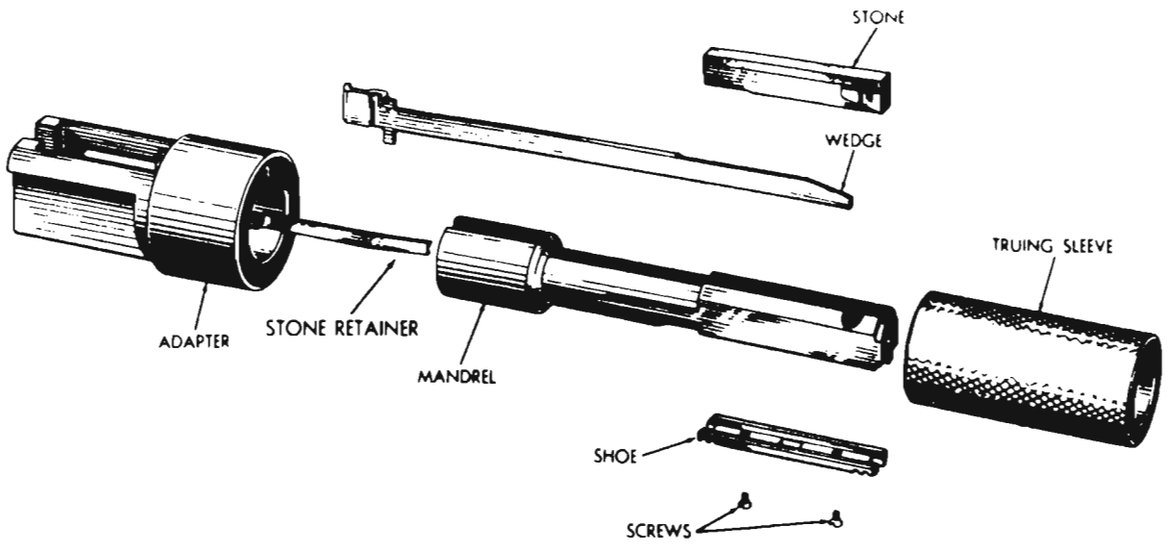


Fig. 57

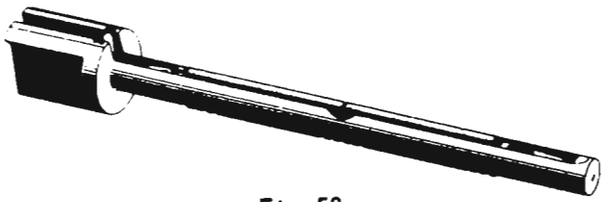


Fig. 58

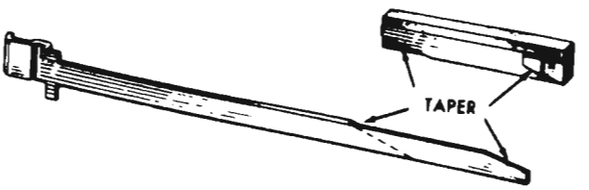


Fig. 59

The principal components of a honing unit are the adapter, mandrel (including shoes), wedge, honing stone, and truing sleeve (Fig. 57). The adapter and mandrel may be two separate parts (Type KL honing units, Fig. 57) or they may be made together in one piece (Type SL honing units, Fig. 58).

The stone has a lug at each end, on the side of the stone holder. The lugs are tapered on the bottom side (Fig. 59). The wedge has a matching taper on the top edge. As the wedge moves forward in the stone slot, the stone is pushed upward. This expands the diameter of the honing unit and causes the stone to contact the surface of the hole to be honed. The truing sleeve is used to make stone and shoe surfaces parallel.

1. TYPE SL HONING UNITS

A. RANGE .480" to .660"

TO INSTALL WEDGE

Insert wedge into stone slot from rear, on right side of stone retainer as shown (Fig. 60). Position end of wedge flush with end of adapter.

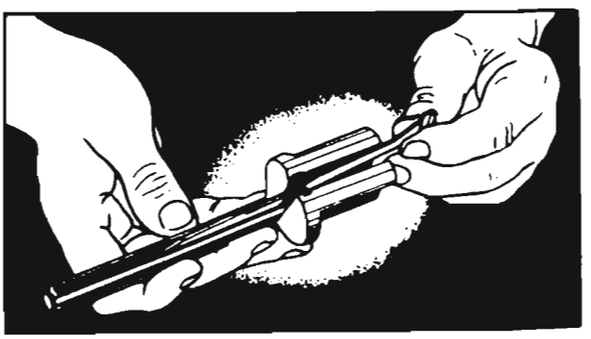


Fig. 60

TO INSERT STONE

Place end of stone holder against stone retainer spring as shown (Fig. 61). Push stone back against spring and down into slot.

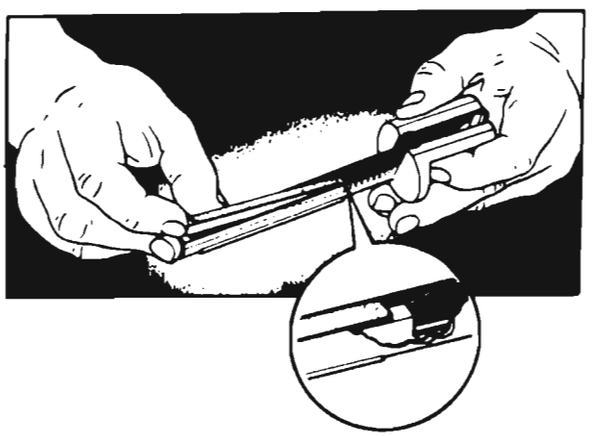


Fig. 61

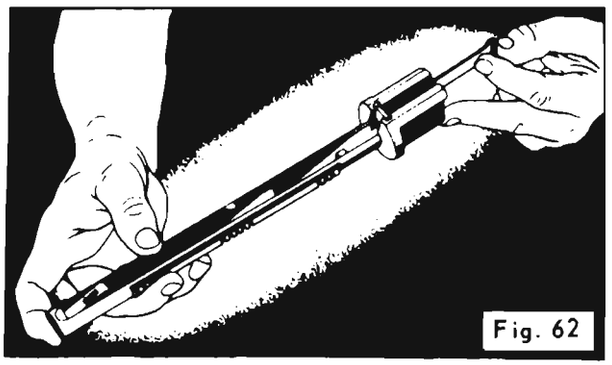


Fig. 62

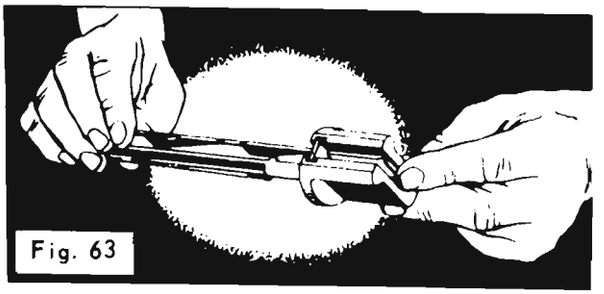


Fig. 63

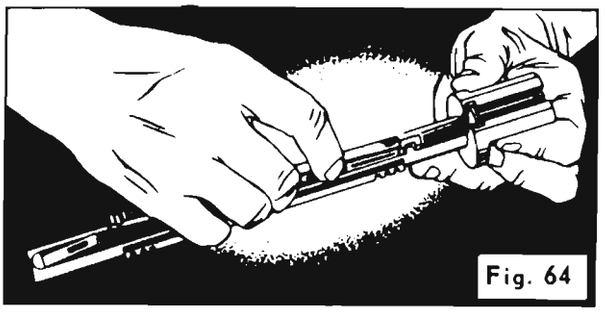


Fig. 64

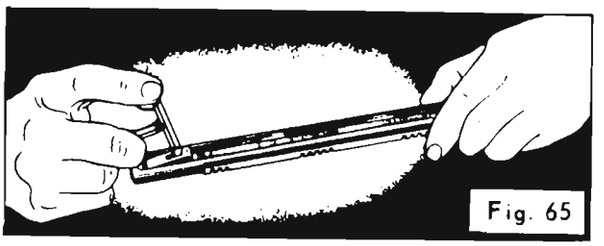


Fig. 65

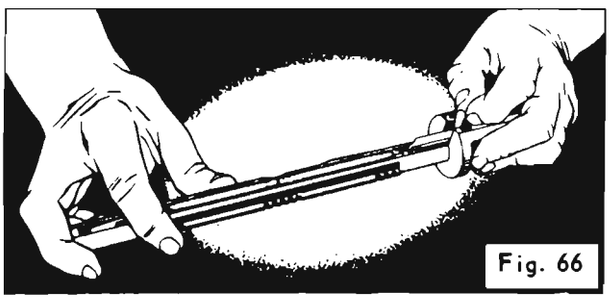


Fig. 66

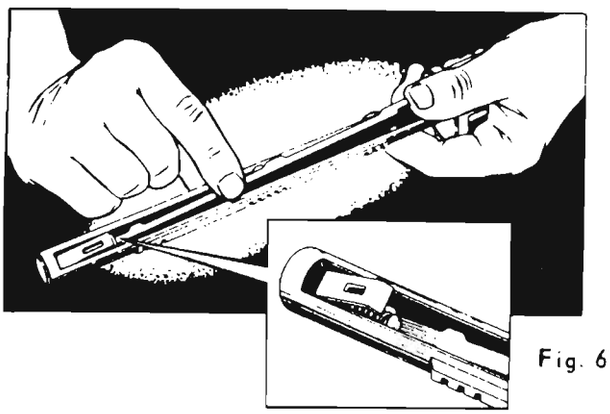


Fig. 67

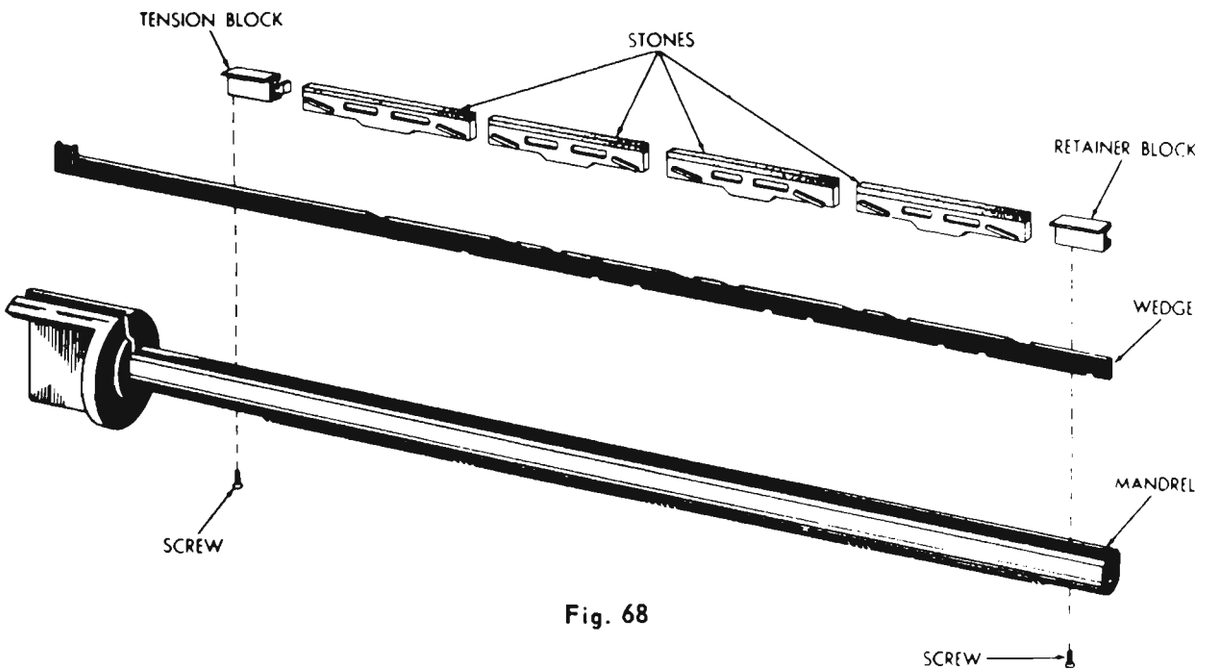


Fig. 68

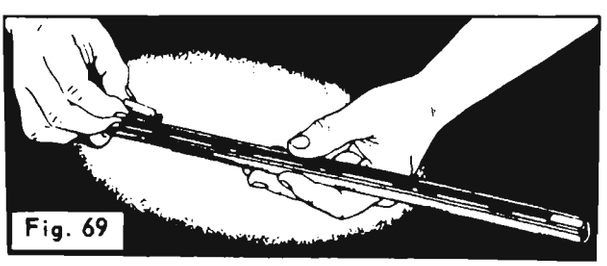


Fig. 69

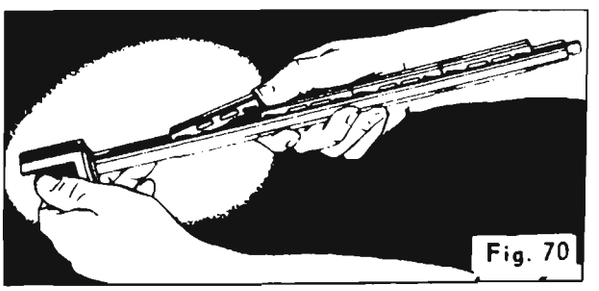


Fig. 70

B. RANGE .720" UP

TO INSTALL WEDGE

Insert wedge into stone slot from rear, through hole provided (Fig. 62). Position end of wedge flush with end of adapter (Fig. 63).

TO INSERT STONE

Insert stone into stone slot of mandrel with groove of stone holder fitting over tongue in side of stone slot (Fig. 64). Use chuck wrench to hook stone holder latch into notch in front end of stone assembly (Fig. 65). Replace spring clip at rear as shown, to hold stone in slot (Fig. 66).

TO INSTALL WEDGE SHIM

When stone and shoes are worn it may be necessary to use a wedge shim (furnished with each SL mandrel above .720") to reach maximum range of the honing unit.

To install shim, remove stone and wedge and clean stone slot in mandrel. With lugs of shim toward wedge side of stone slot, insert front end of shim (Fig. 67) under rivet head in front end of mandrel. Push shim forward until it will lie flat in bottom of stone slot. Replace wedge and stone.

2. TYPE UL (Fig. 68)

The mandrel, tension block, retainer block, and wedge are assembled at the factory. The following instructions, however, cover the complete assembly procedure.

TO INSTALL WEDGE

Place wedge against right hand side of stone slot of mandrel. Place retainer block in position over wedge in front end of mandrel, and tension block in position over wedge in rear of mandrel (Fig. 69). Fasten with screws through bottom of mandrel.

TO INSERT STONES

Push wedge all the way forward. Place first stone in forward end of stone slot, with stone holder lugs facing wedge. Put intermediate stones in place. Insert rear stone against tension block spring and press rearward until stone can be pushed down into position (Fig. 70). Press stones down firmly and pull wedge rearward to extreme position.

TO REMOVE STONES

To remove stones, remove honing unit from machine, push wedge all the way forward, and lift out stones.

Note: *If the stones are removed from the honing unit after it has been trued up and used, they should be marked so that re-assembly can be made in the same order.*

3. TYPE ML (Fig. 71)

A three stone honing unit (Type 3ML) is used to illustrate the detailed assembly. However, these instructions are applicable also to four and five stone honing units (Types 4ML and 5ML). The mandrel, tension block, retainer block, shoes, and wedge are assembled at the factory. The following instructions, however, cover the complete assembly procedure.

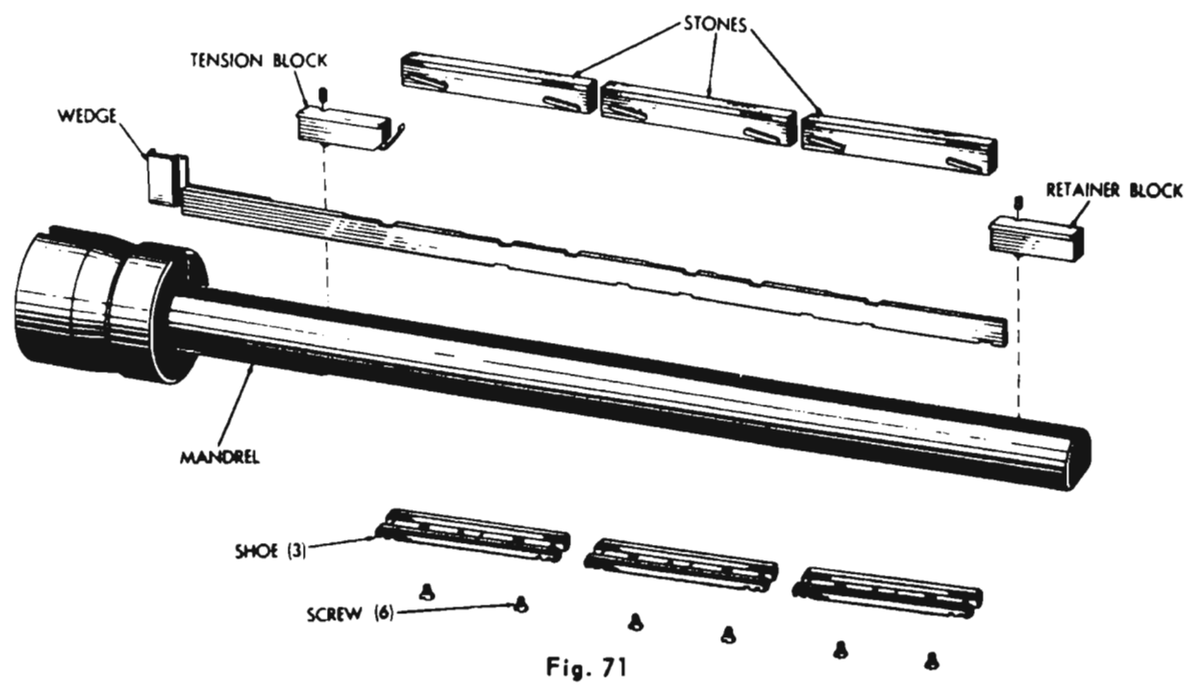


Fig. 71

TO INSTALL GUIDE SHOES

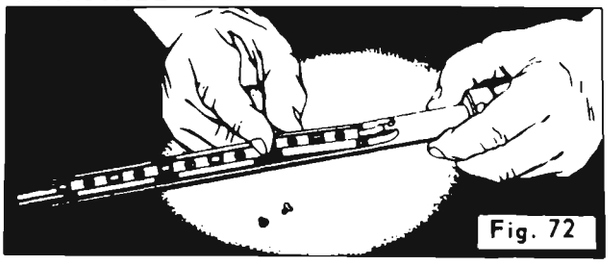


Fig. 72

Install guide shoes on mandrel directly opposite the stone slot included between the retainer and tension blocks. Shims are furnished with these honing units in order to get full life from the guide shoes. Shoe retaining screws must not protrude into stone slot of mandrel. Be sure to use a shoe opposite each stone (use as many shoes as you have stones).

Note: *Type ML mandrels below 3/4" do not have replaceable shoes.*

TO INSTALL WEDGE

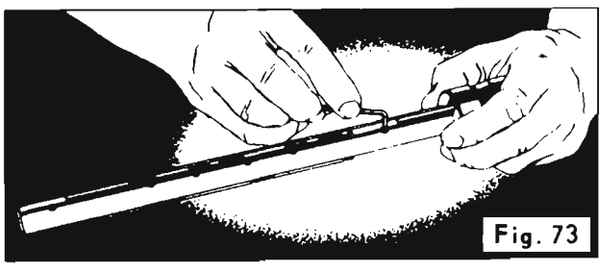


Fig. 73

Insert wedge in stone slot of mandrel. Place retainer block in position flush with front end of mandrel and tension block in extreme rear position. Insert and tighten set screws (Fig. 73).

TO INSERT STONES

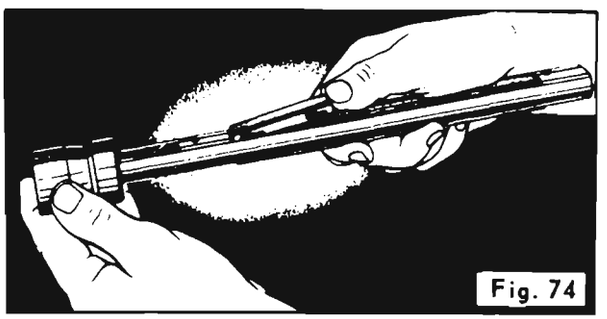


Fig. 74

Push wedge all the way forward. Insert stones in mandrel by placing the first stone in forward end of stone slot, and intermediate stone(s) directly behind first stone. Place rear stone in slot against the tension block spring, and press against spring until stone can be pushed down into position (Fig. 74). Press stones down firmly and pull wedge rearward to its extreme position.

TO REMOVE STONES

To remove stones, remove honing unit from machine, push wedge all the way forward, and lift out stones.

Note: *If the stones or shoes are removed from the honing unit after it has been trued up and used, they should be marked so that reassembly can be made in the same order.*

4. TYPE PL (Fig. 75)

A three stone honing unit (Type 3PL) is used to illustrate the detailed assembly. However, these instructions are applicable to four and five stone honing units (Types 4PL and 5PL), and to single stone units (Type 1PL). The mandrel, tension block, retainer block, shoes, and wedge are assembled at the factory. The following instructions, however, cover the complete assembly procedure.

TO INSTALL GUIDE SHOES (Fig. 76)

Install guide shoes on mandrel directly opposite the stone slot included between the retainer and tension blocks. Shims are furnished with these honing units in order to get full life from the guide shoes. Longer screws are provided where necessary, for use when shims are used. Screws must not protrude into the stone slot (they will keep the wedge from moving). Be sure to use a shoe opposite each stone (use as many shoes as you have stones).

TO INSTALL WEDGE

Insert wedge in stone slot of mandrel. Place retainer block in position flush with front end of mandrel, and place tension block in extreme rear position. Insert and tighten set screws (Fig. 77).

TO INSERT STONES

Push wedge all the way forward. Insert stones in mandrel by placing first stone in forward end of stone slot, and intermediate stone(s) directly behind first stone. Place rear stone in slot against the tension block spring, and press against spring until stone can be pushed down into position (Fig. 78). Press stones down firmly and pull wedge rearward to its extreme position.

TO REMOVE STONES

To remove stones, remove honing unit from machine, push wedge all the way forward, and lift out stones.

Note: *If the stones or shoes are removed from the honing unit after it has been trued up and used, they should be marked so that reassembly can be made in the same order.*

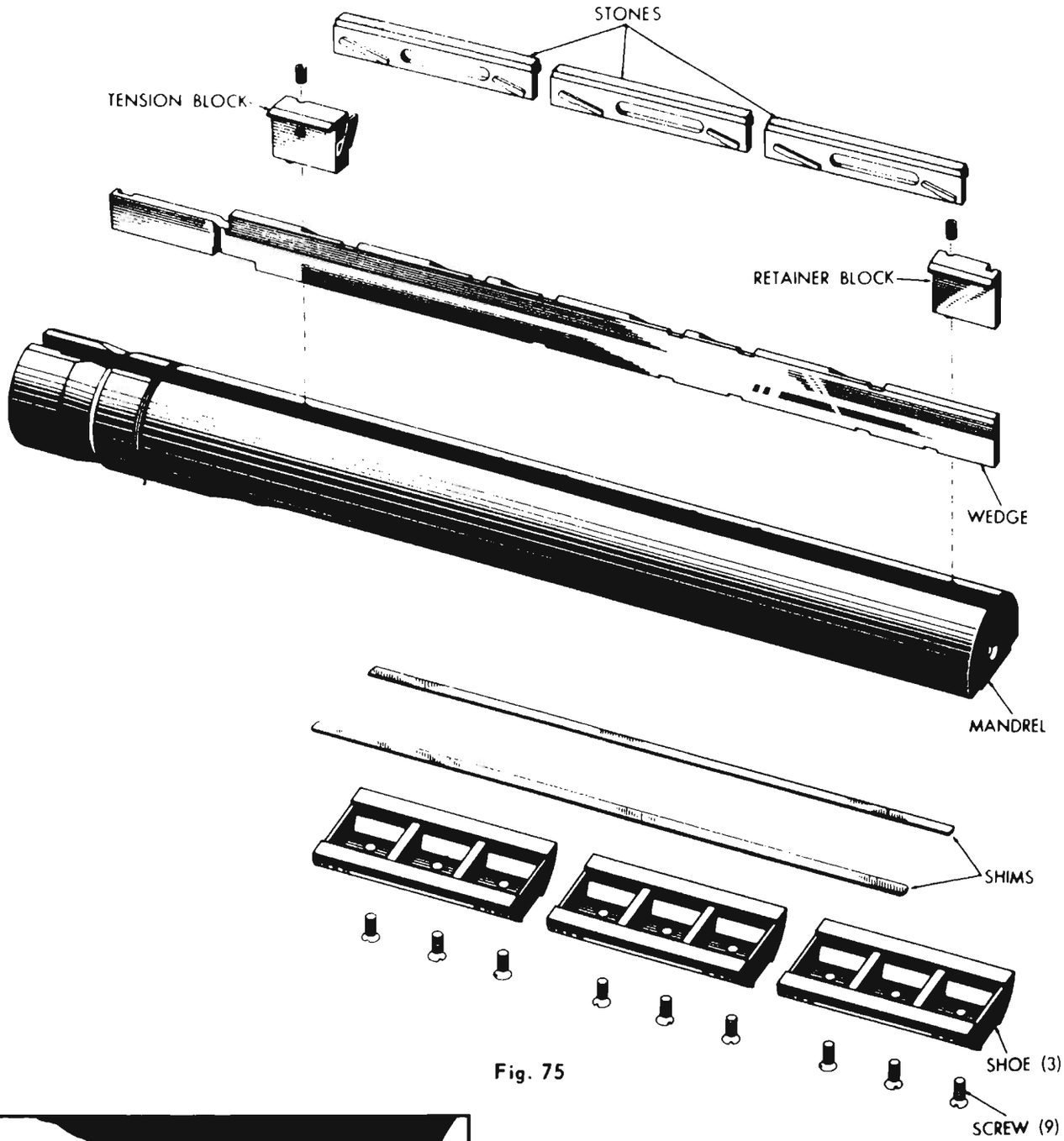


Fig. 75

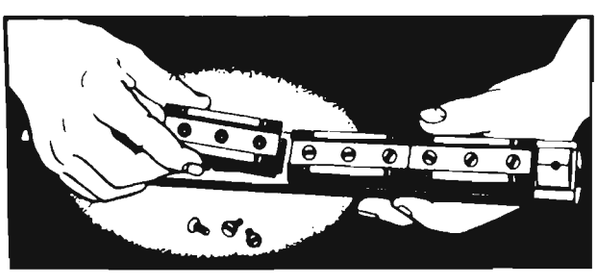


Fig. 76

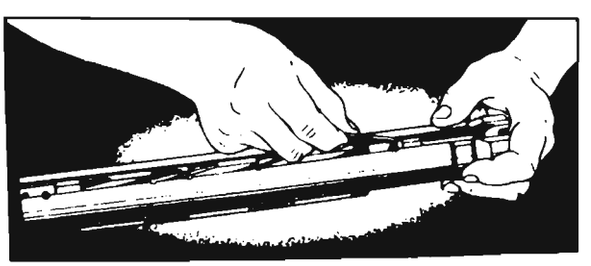


Fig. 77

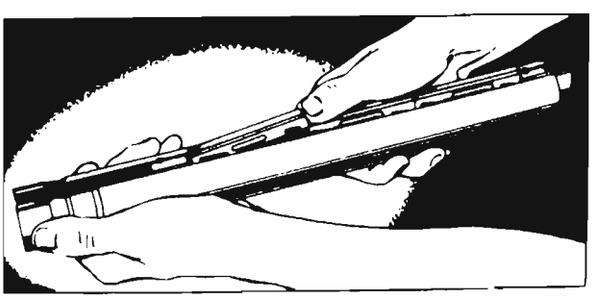


Fig. 78

SPECIAL INSTRUCTIONS FOR IPL HONING UNITS (single stone)

An additional tension block must be inserted in the stone slot, one stone length behind the retainer block, in position "B" (Fig. 79). Insert stone in slot against the tension block spring and press against spring until stone can be pushed down in position. Otherwise, assembly instructions are same as those above for other Type PL honing units.

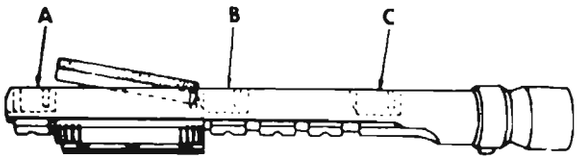


Fig. 79

5. TYPES KL, LH, LJ, (Fig. 80)

The mandrel, tension block, retainer block, shoes, and wedge are assembled at the factory. The following instructions, however, cover the complete assembly procedure.

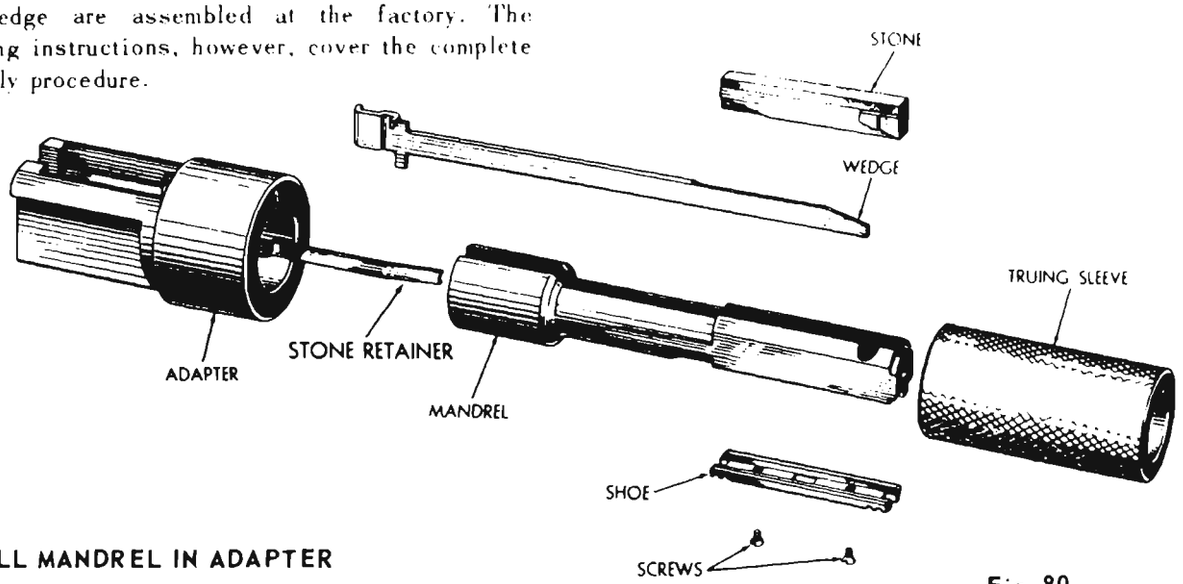


Fig. 80

INSTALL MANDREL IN ADAPTER

Install mandrel in adapter so that mandrel stone slot is aligned with stone retainer spring in adapter (Fig. 81). Make sure that end slot in mandrel shank engages the tongue in bore of adapter (in larger sizes, the set screw in the adapter engages a counter-sink in mandrel shank). When correctly assembled, end of mandrel shank will bottom in adapter. Tighten set screw.

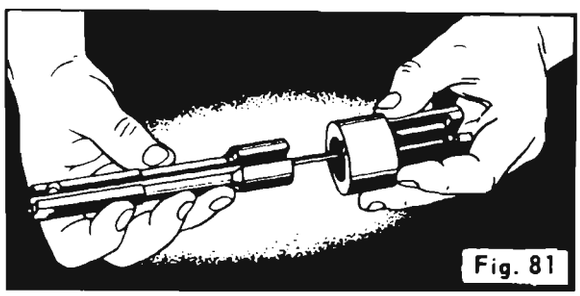


Fig. 81

INSTALL WEDGE

Insert wedge into stone slot from adapter end, on right-hand side of stone retainer (Fig. 82). Hold wedge down against bottom of stone slot in mandrel, and deflect wedge sidewise to clear the back stop lug in adapter while pushing wedge forward.

INSERT STONE IN MANDREL

Insert stone into stone slot of mandrel and push it back against stone retainer until lug on stone holder engages stone stop slot in mandrel (Fig. 83).

Press stone down in stone slot. When correctly assembled, surface of stone will be parallel with mandrel. *Make sure that stone retainer contacts back end of stone holder.*

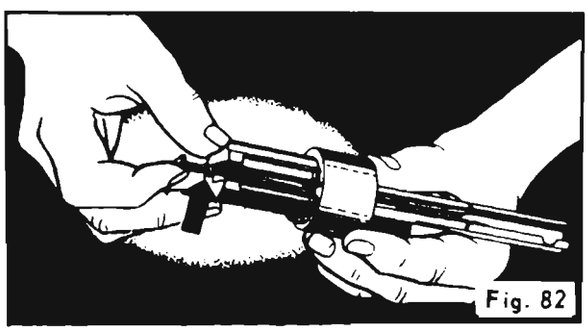


Fig. 82

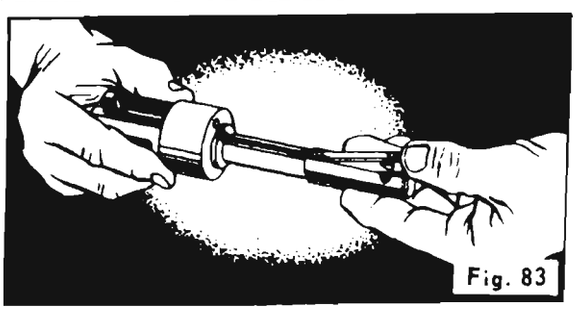


Fig. 83

Note: *KL-744 through KL-1187 honing units are furnished with replaceable guide shoes. (Fig. 84). Make sure that the screws do not protrude into stone slot.*

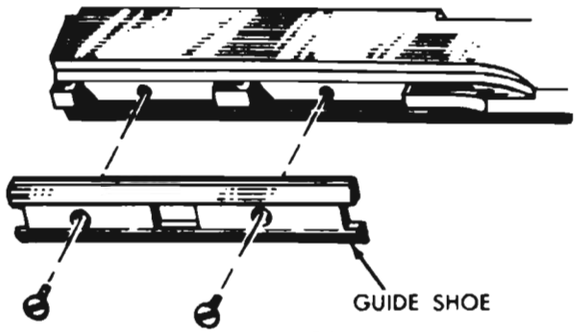


Fig. 84

6. TYPES HB and SC

TO INSTALL WEDGE

Position spring as shown (Fig. 85). Insert wedge from rear and position it flush with adapter end of mandrel.

TO INSERT STONE

Hold spring back, insert stone into stone slot of mandrel with tongue on stone holder engaging groove in side of stone slot (Fig. 86). Push stone down in slot and slip the spring into groove at rear of stone holder.

TO REMOVE STONE

To remove stone, push spring back and lift stone out of mandrel.

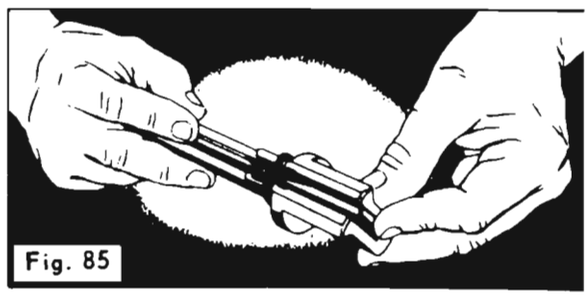


Fig. 85

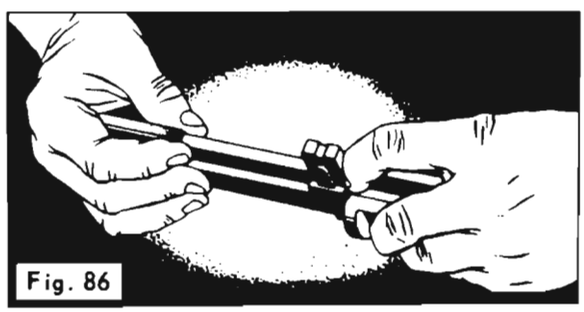


Fig. 86

7. TYPE CR (Fig. 87)

The mandrel, tension block, shoes, and wedge are assembled at the factory. The following instructions, however, cover the complete assembly procedure.

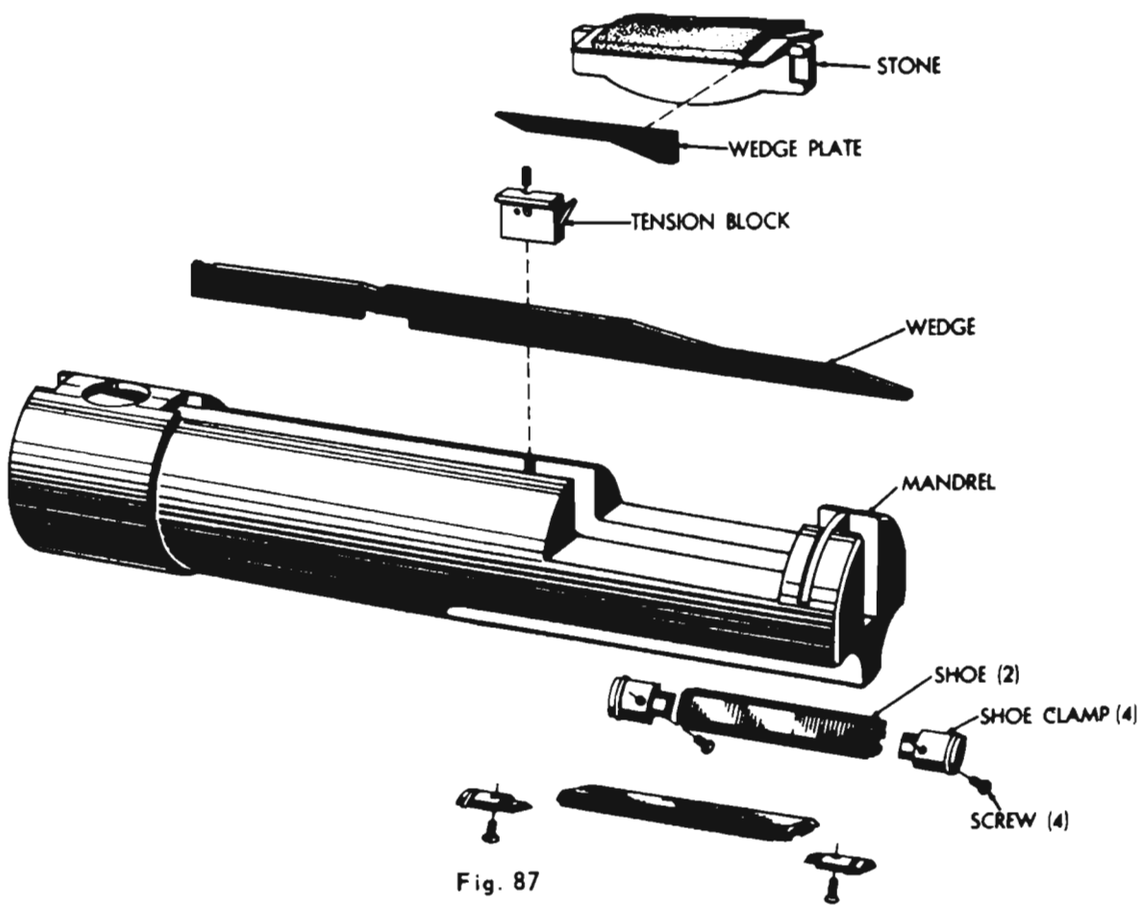


Fig. 87

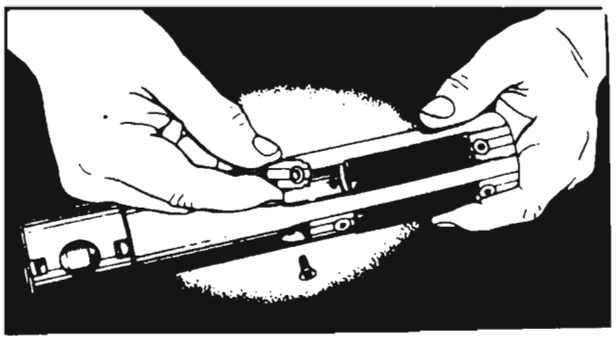


Fig. 88

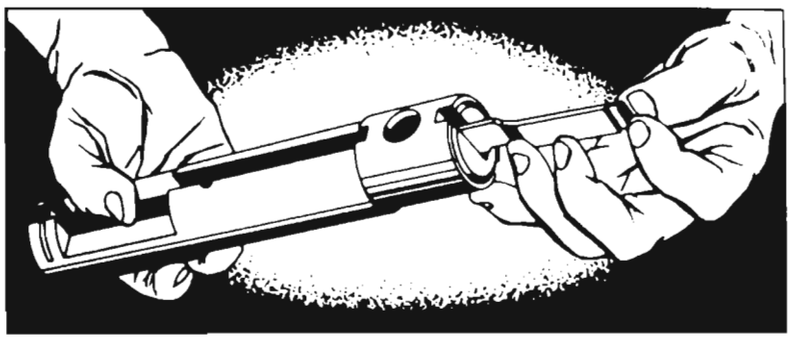


Fig. 89

Fig. 90

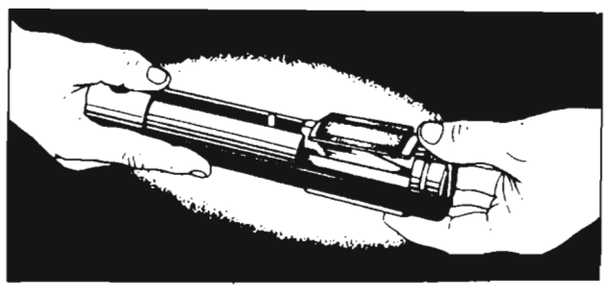


Fig. 91

TO ASSEMBLE GUIDE SHOES

Put guide shoes in place and fasten with screws in shoe clamps (Fig. 88). Do not tighten until later, when shoes are adjusted to fit curvature of con rod to be honed.

TO INSTALL WEDGE

Insert wedge from end as shown (Fig. 89), put tension block in place over wedge, and tighten set screw.

TO INSERT STONE

Attach wedge plate to stone assembly by inserting pin into hole in stone holder as shown. (Fig. 90).

Note: *Large wedge plate is used when stone is worn and it is necessary to hone diameters in upper range of honing unit.*

Insert stone assembly and wedge plate into stone slot of mandrel, with wedge plate over wedge and with stone holder against tension block spring (Fig. 91). Push against spring until entire assembly can be pressed down into mandrel slot.

TO REMOVE STONE

To remove stone, push stone and wedge plate back against tension block spring and lift out.

8. TYPE AL and ALH (Fig. 92)

Note: *These mandrels are for bushing expansion only. They* **CANNOT** *be used for honing, because the mandrel shoes are too short. Any attempt to use these mandrels for honing will result in inaccurate work and excessive stone wear.*

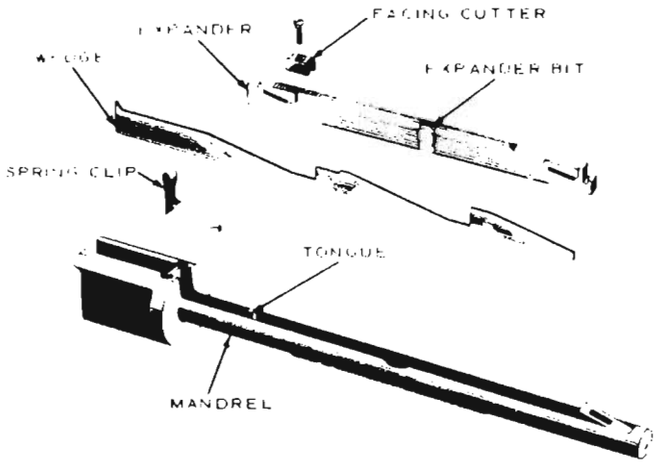


Fig. 92

TO INSTALL WEDGE

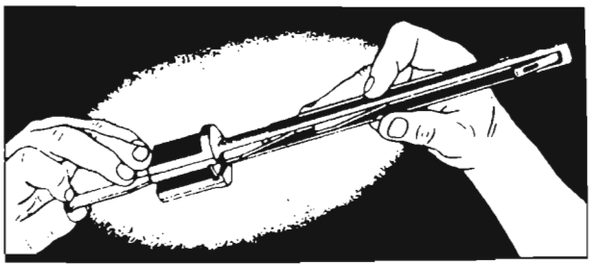


Fig. 93

Insert wedge into slot from rear, through hole provided (Fig. 93). Position end of wedge flush with end of adapter.

TO INSERT EXPANDER

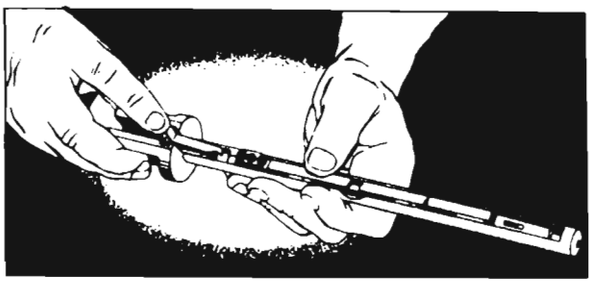


Fig. 94

Insert expander into slot of mandrel with groove of expander fitting over tongue in side of mandrel slot. Use chuck wrench to hook stone holder latch into notch in front end of expander. Replace spring clip at rear as shown, to hold expander in slot (Fig. 94).

9. TYPE RYY and SYY (Fig. 94A)

The mandrel, wedge, tension block, and honing stone are assembled at the factory. Assembly procedure is simple: place wedge in open slot of mandrel, put tension block in place over wedge, insert and tighten set screw. Push rear end of stone back against retainer spring, and snap stone down into slot (similar to type CR, Page 30).

It may be necessary to dress edges of a new stone to enter piston or new truing sleeve. Truing must be done with a sleeve that is within .010" of the piston pin hole diameter.

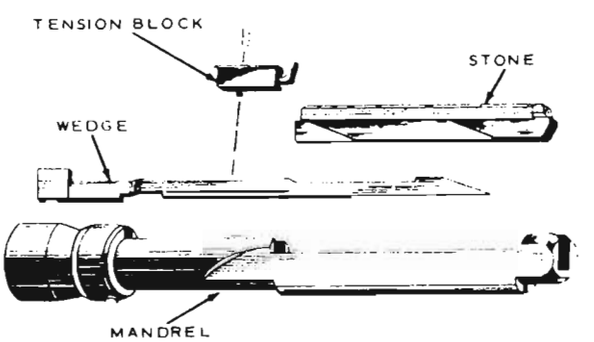


Fig. 94A

MAINTENANCE AND CARE OF MACHINE AND ACCESSORIES

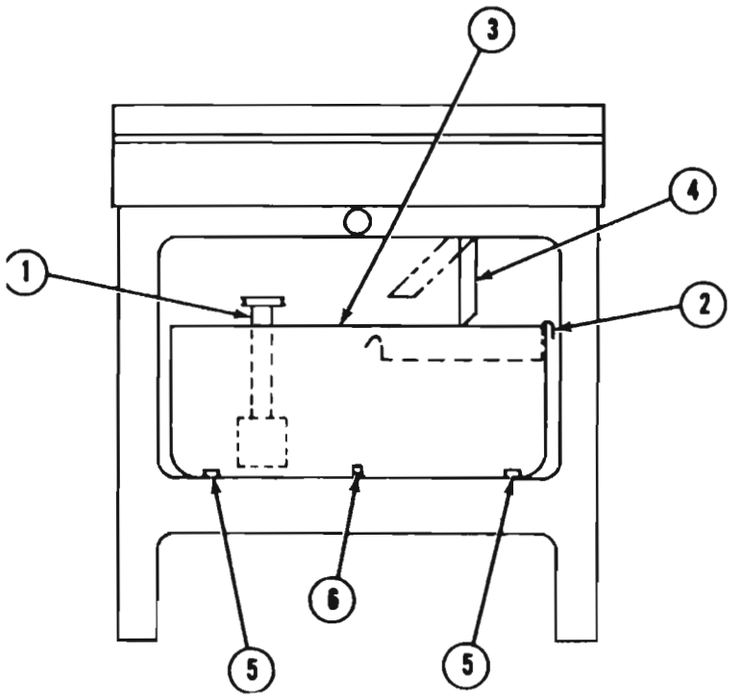


Fig. 95

1. INSTALLATION

Your Sunnen Honing Machine is shipped assembled.

After the honing machine has been placed in the desired location, shim the base of the pedestal if necessary to steady it. *Do not tilt machine to make spindle horizontal.* The sloping spindle (and honing unit) make the operator's job easier, and provide better flow of honing oil through workpiece.

2. POWER SUPPLY CONNECTION

Wiring is complete on all machines shipped for 115 volt, 60 cycle, single phase installations. Simply plug in the cord.

For 230V operation - see wiring instructions under cover plate on motor terminal box.

3. LUBRICATION

Model LBB machines have ball bearing spindles with sealed-in lifetime lubrication. Oil the motor according to the motor manufacturer's instructions. Avoid over-lubrication.

Regularly put a few drops of SAE-20 oil on the Feed Screw threads and on the Feed Screw itself at front and rear of machine housing. Also put a few drops on the feed rod where it enters back of spindle. Oil all joints in the foot pedal linkage regularly.

4. HONING OIL SYSTEM

A. GENERAL

Although the honing oil reservoir holds 19 gallons of honing oil, the machine operates best on 12 to 16 gallons. More than 16 gallons increases the chances of overflow from sludge buildup; less than 12 gallons will cause interruption in the flow of oil if much is trapped in work pans, etc.

Best honing results are obtained only when a continuous and ample supply of the proper Sunnen Honing Oil is used. Do not dilute, cut, or change the honing oil in any way. Consistent results cannot be expected if anything except the full-strength recommended oil is used.

B. FILLING SYSTEM

Fill reservoir. Check that honing oil level is above the pump outlet connection. Point oil jets down toward anti-splatter pad. Start the Honing Machine motor and wait a few seconds for oil pressure to build up. Turn Total Volume Control Valve (8A, Fig. 2) counterclockwise slightly. Adjust oil flow to each jet with its independent Oil Jet Control Valve (8B), opening Total Volume Valve further as needed. Total Volume Valve may then be used to shut entire supply off, leaving individual settings unchanged.

C. CLEANING SEDIMENT TRAY

To clean the Sediment Tray (2, Fig. 95), open door on front of machine base to gain access to Oil Pump (1), Sediment Tray, and Oil Reservoir (3). Grasp Tray lip which overhangs right side of Reservoir and tip Tray to the left, allowing oil to drain from sludge. Push Drain Pipe (4) to the left, which lifts it out of the way. Remove Tray and dispose of sludge. Install Tray with lip overhanging right side of Reservoir. Pull Drain Pipe to the right (down).

D. CLEANING RESERVOIR

Use one or both oil jets to pump oil from Reservoir into a separate container. When oil level has been lowered to pump intake, oil will stop pumping. Turn motor off. Disconnect oil line near upper left corner of door opening, loosen Clamp Knob (1, Fig. 103), and remove belt from pump pulley. Store belt so it doesn't fall into the Reservoir or otherwise get oil on it.

Remove the two Reservoir Retainers (5, Fig. 95) and slide Reservoir out 4 to 6 inches (Drain

Pipe must be up). Remove Drain Plug (6) from front of Reservoir and drain oil. Remove Reservoir from machine base. Dip or pour out any oil remaining with sludge in Reservoir. Dispose of sludge and clean Reservoir.

Push Reservoir all the way into the machine base and replace the Retainers. Install Tray with lip overhanging right side of Reservoir. Pull Drain Pipe to the right (down). Install Belt and adjust for proper tension (see Oil Pump Belt--To Adjust, Page 37). Connect oil line. Close door on front of base.

5. CHECK-POINTS FOR PROPER OPERATION

A. FEED DIAL END PLAY

CHECK: Set Cutting Pressure Control to 3 and check Feed Dial for end play. If Honing Dial needle moves more than one or two tenths during this check, there is too much end play.

TO
ADJUST: Loosen set screw in collar at rear of housing (Fig. 96). While lightly pushing in on Feed Dial, hold set collar against rear of bushing in housing with light finger pressure. Rotate collar slightly on shaft to give set screw a new contact point and tighten set screw. Feed screw must rotate freely in bushing. If any binding occurs or bushing rotates with feed screw, reset collar.

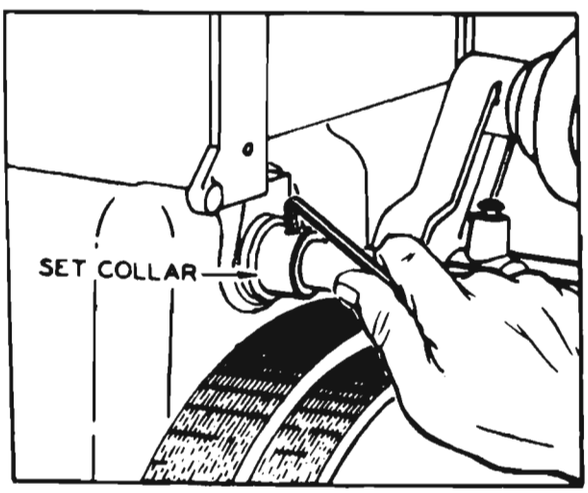


Fig. 96

B. HONING DIAL

CHECK: Set the Cutting Pressure Control to 3. With "0" on the Honing Dial at the 6 o'clock position, the Honing Dial needle should be on the red line.

TO
ADJUST: If needle is not on the red line, loosen set screw in side of Honing Dial bracket and move Dial up or down as needed to set needle on red line (Fig. 97). Tighten set screw.

Now push the Feed Dial in. Needle should return to red line when pressure is released.

Now set the Cutting Pressure Control to 1. Repeat the pressure against the Feed Dial and watch the Honing Dial needle. It should return to the red line. In some cases it will be necessary to advance the Cutting Pressure Dial to about 1-1/2 before the needle will return to the red line. (However, this condition need not affect the operation of the machine. Simply determine the lowest setting of the Cutting Pressure Control at which the Honing Dial needle returns to the red line. Use that setting as the "zero" reference point for making adjustments in the cutting pressure.)

If it is desired to adjust the machine internally to correct the above condition, refer to Paragraph C.

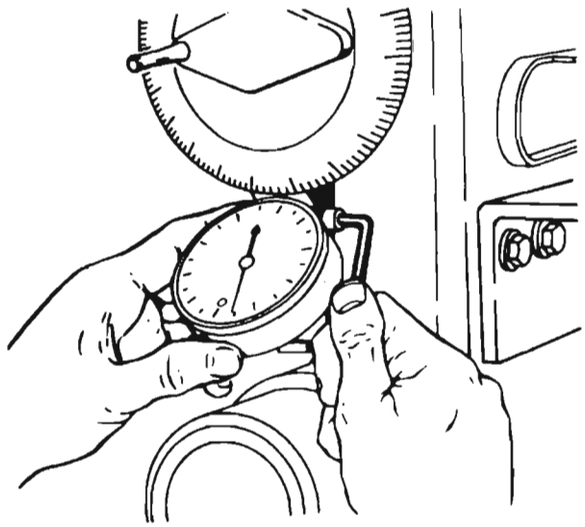


Fig. 97

C. CUTTING PRESSURE CONTROL

CHECK: With cutting pressure set at 1, push in on Feed Dial and see if Honing Dial needle returns to red line when Feed Dial is released.

TO
ADJUST:
1. Make sure Feed Dial is not at extreme end of travel.
2. If honing unit is in spindle chuck, remove it.

3. Make sure that Feed Screw (Fig. 98) moves freely in bushings and collar. Apply penetrating oil at front and back of housing and work it in and out a few times to clean out gum or dirt.
4. Make sure the Honing Dial plunger is clean and works freely.

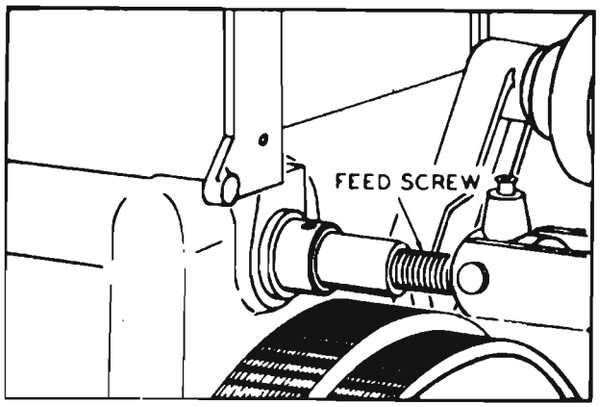


Fig. 98

If these checks do not remedy the problem:

a. Turn Cutting Pressure Control counter-clockwise against stop.
b. Loosen locknut "D" (Fig. 99).
c. Watching the Honing Dial, turn threaded sleeve "C" counter-clockwise (as viewed from rear of machine) slowly until the needle returns to "0".
d. Lock Nut "D" against threaded sleeve "C".
e. To check the adjustment turn Cutting Pressure Control all the way counter-clockwise. Press the Feed Dial all the way in and release it slowly. Needle should not return all the way to red line.
f. Set the Cutting Pressure Control on 1 and the needle should move to red line.

D. OIL FLOW

CHECK: Point oil jets down into the Oil Return Pan. Turn machine ON. Open Total Volume Control Valve slightly. Adjust individual Oil Jet Control Valves for desired volume of oil, opening Total Volume Valve further as needed. Total Volume Valve may then be used to shut entire supply off, leaving individual settings unchanged.

TO ADJUST: If oil flow is insufficient, check first to be sure oil level covers the pump inlet. Make sure the oil pump belt is taut and in good condition.

The screen is held in place by means of a thumb screw underneath. Remove screen for cleaning. Uncouple oil line and use compressed air to blow out system.

E. PEDAL ASSEMBLY (Fig. 100)

CHECK: Crank Arm (1) must hit Lower Stop Pin (2) when Pedal (3) is between 1/4" and 1/2" from floor. When Pedal is released, Crank Arm should just hit Upper Stop Pin (4).

TO ADJUST: Depress Pedal to gain easiest access to Pedal Clamp Screws (5) (one on each side) from front of machine. Using chuck wrench furnished with machine, loosen the Screws. Adjust Pedal Bar (6) in or out to a convenient position, making sure Pedal Bar extends equally on both sides to prevent binding. Retighten Clamp Screws.

Using chuck wrench, adjust Screw (7) to make sure Crank Arm hits Lower Stop Pin when Pedal is 1/4" to 1/2" above the floor.

Rotate Pedal Bar Tension Control (8) clockwise until Crank Arm will just hit Upper Stop Pin (4) when Pedal is desired, rotate Tension Control further.

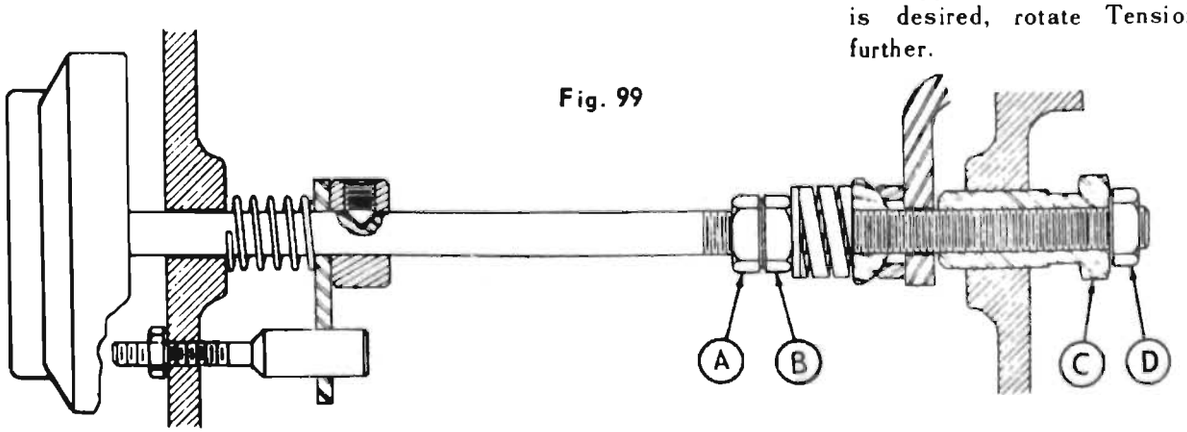


Fig. 99

(If Pedal Bar is readjusted in or out, the preceding two settings may have to be changed.)

FOR OPERATING FROM A SITTING POSITION, turn the Pedal upside down.

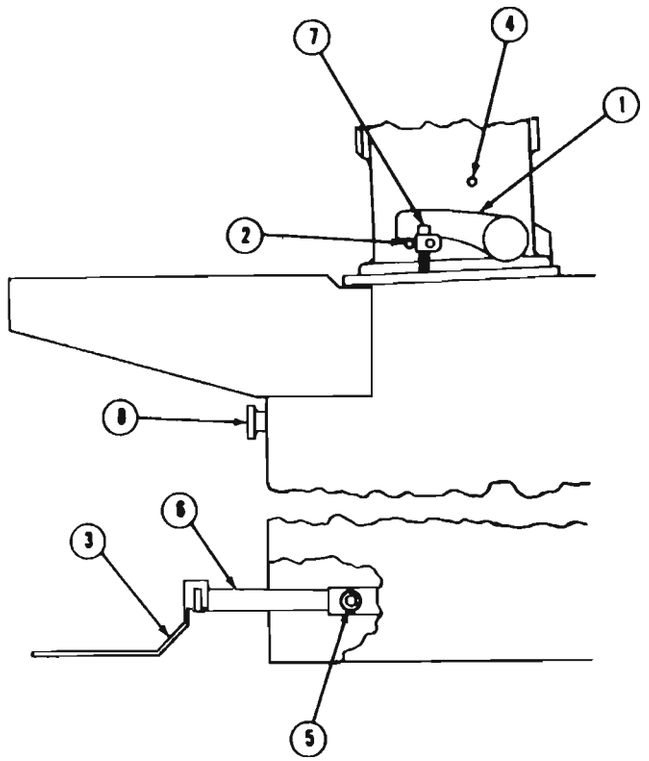


Fig. 100

F. DRIVE BELTS

CHECK: Flat drive belt tension should be such that with motor ON, spindle starts rotating an instant after the brake releases, as the Pedal is slowly depressed.

TO ADJUST: If an adjustment is necessary, open the cover plate to expose the belt adjusting screw (Fig. 101). Turn the adjusting screw clockwise (right) to loosen the belt, counter-clockwise (left) to tighten. Idler should travel 1/2" as Pedal is depressed.

Adjusting the belt may cause the brake to require adjusting. If this happens, refer to I -- Brake Operation.

INSTALLING NEW FLAT DRIVE BELT:

a. Open belt guard on left side of machine.
b. Remove Nut and Bolt (1, Fig. 102) from Feed Arm Assembly (2).
c. Disengage Feed Arm Assembly from Trunnion (3) by springing the feed arms apart and lay it back against belt guard.
d. Slip V-belt off Lower Cone Pulley.
e. Pull Lower Cone Pulley down.
f. Remove old flat drive belts.
g. Install new flat drive belts, making sure belts will run in direction indicated by arrows on belts.
h. Push Lower Cone Pulley up and slip V-belt on it.

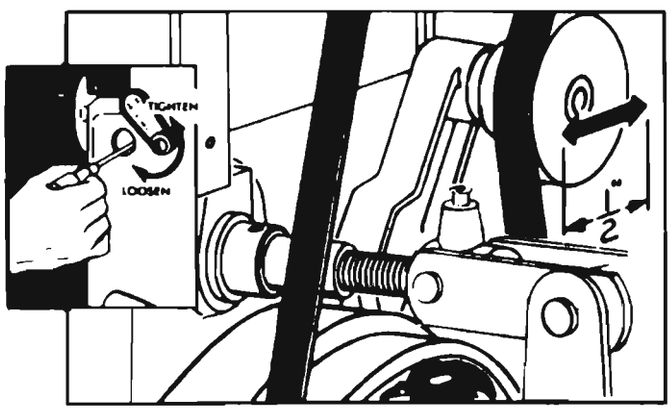


Fig. 101

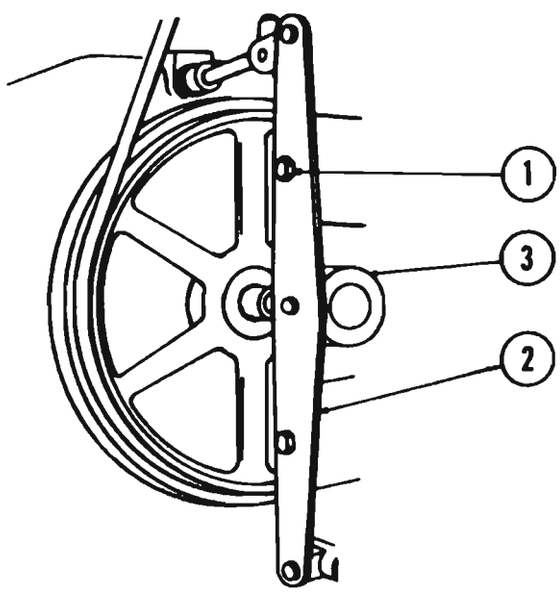


Fig. 102

G. COUNTERSHAFT ARM BUMPER

To prevent countershaft pulley from hitting motor base when motor starts, adjust rubber bumper so that pulley clears motor base by 1/16".

H. OIL PUMP BELT

CHECK: Oil pump belt should be just tight enough to turn the oil pump pulley without slipping.

TO ADJUST: If belt needs adjusting, loosen Clamp Knob (1, Fig. 103) in top of Pump Bracket (2) and move Bracket as needed. Retighten Knob.

INSTALLING NEW OIL PUMP BELT:

Loosen Clamp Knob in top of Pump Bracket. Thread oil pump belt around drive pulley, through idler pulleys, and around pump pulley. Adjust tension and tighten Knob.

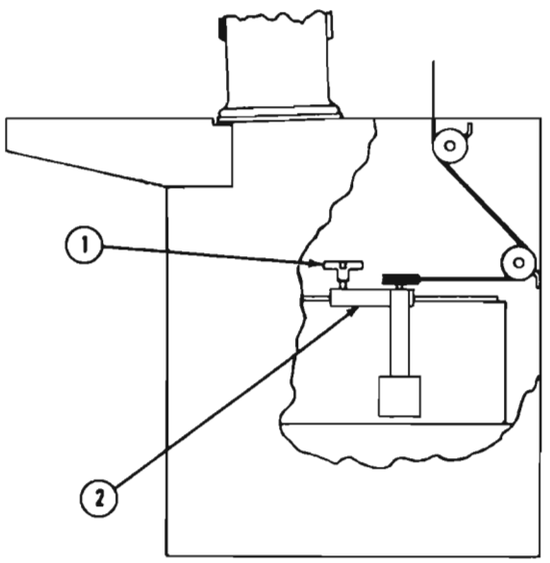


Fig. 103

I. BRAKE OPERATION

CHECK: When Pedal is released, the honing machine spindle should stop instantly.

Note: *Make flat drive belt adjustment before adjusting brake.*

TO ADJUST: Self energizing brakes are used on type LBB Sunnen Honing Machine.

Brake is correctly adjusted when space between lock nut and brake arm is between 1/16" and 1/8" with Pedal released (Fig. 104). A shorter space makes the brake release faster--no space at all will prevent proper braking action. Too much space will delay the brake release and cause undue wear of brake lining and drive belt.

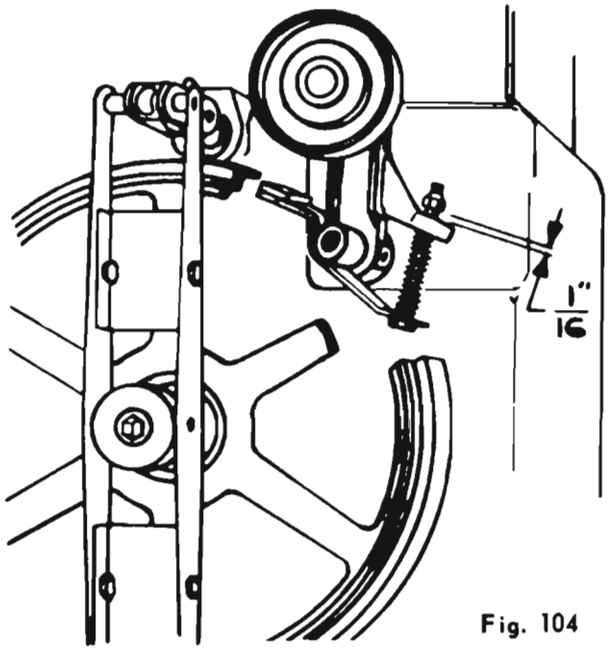


Fig. 104

REPLACING THE BRAKE LINING

Remove old brake lining and mount assembly. Clean inside of pulley. Slip the new brake lining and mount assembly (Repair Part No. MBB-325A) on the bracket as shown, (Fig. 105). Line up edge of leather with edge of pulley.

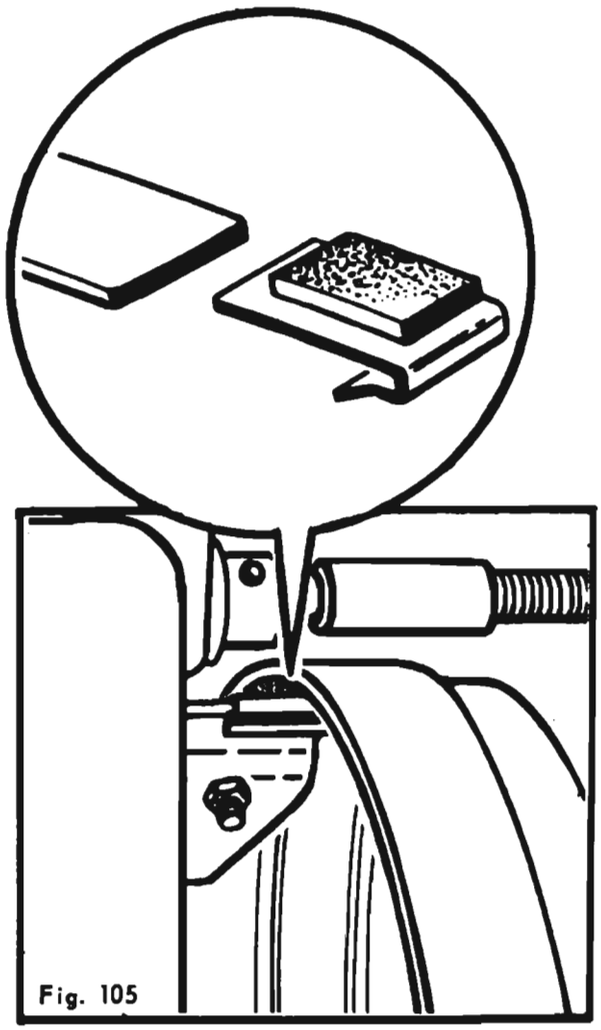


Fig. 105

J. SPINDLE ROTATION

CHECK: With motor "ON" and Pedal depressed, machine spindle should rotate counter-clockwise, as indicated by arrow on nameplate (Fig. 106). (This check is usually required only on original installation or if motor has been replaced.)

TO ADJUST: To reverse rotation of motor, follow instructions under cover plate on motor terminal box for the particular motor being used.

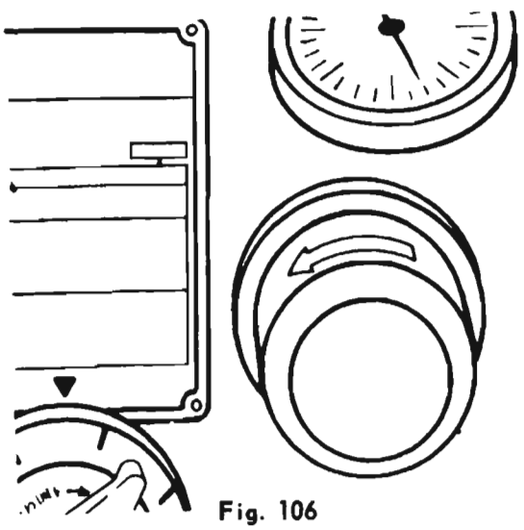


Fig. 106

6. REPLACE ADJUSTING NUT

Facing back of machine, remove bolt from top right side of feed arm assembly (Fig. 107). Spring sides apart and disconnect feed arm from adjusting nut. Now hold nut to keep it from turning and wind Feed Dial counter-clockwise until nut comes off shaft. Simply reverse this procedure to install new adjusting nut.

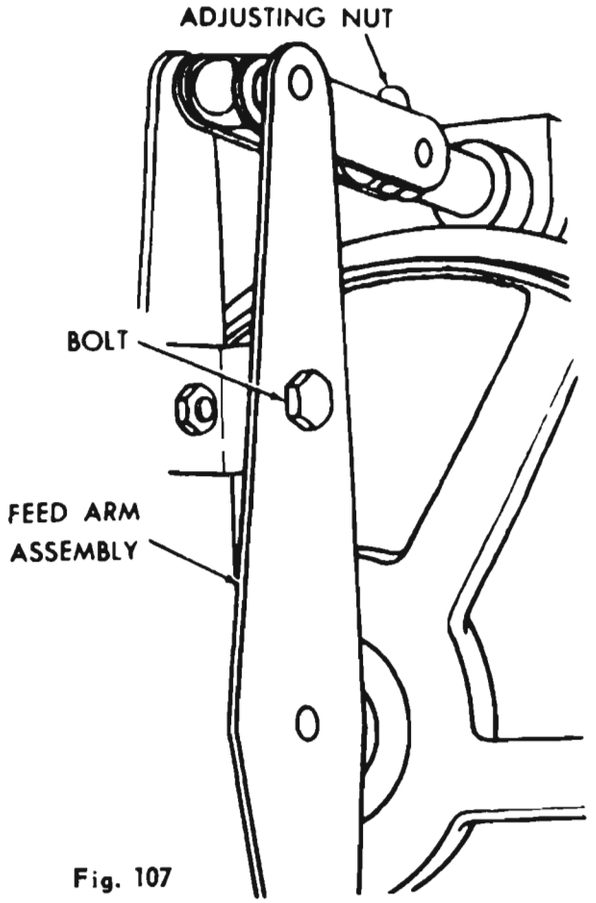


Fig. 107

7. REPLACING SPINDLE BEARINGS

DISASSEMBLY

1. Remove belt guard.
2. Slip belts off motor pulley and jackshaft pulley. Remove motor and switch from machine. Remove upper housing casting containing jackshaft from machine.
3. Remove screw (1) and washer (2) from back end of feed rod (Fig. 108).
4. Turn Feed Dial counter-clockwise (left) until adjusting nut (3) and feed arm assembly (4) are disengaged. Remove washer (5) from feed rod. Remove drive belt.

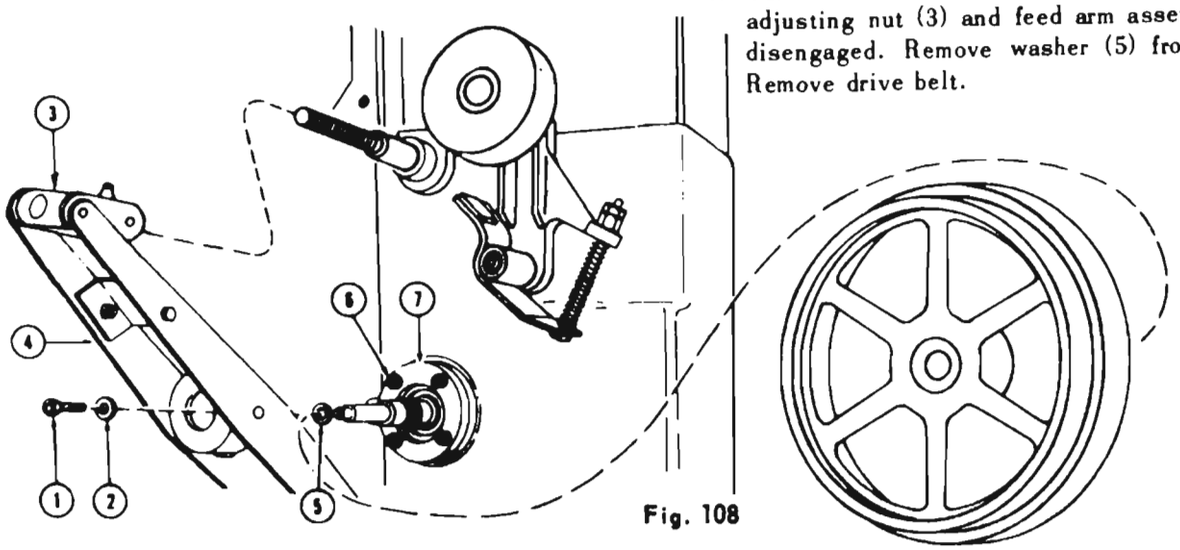


Fig. 108

5. Release spindle brake. Reach down into machine and insert bar in hole located in center of spindle shaft (Fig. 109). Do not allow bar to press against feed screw--it may bend feed screw and cause erratic honing dial readings. Use bar as lever to keep shaft from turning and unscrew pulley, counter-clockwise, about three turns.
6. Hold length of 1-1/8" I.D. steel tubing against hub of pulley and drive pulley against inner race of bearing. Unscrew pulley further and drive it back against bearing, repeating if necessary until front bearing is clear of housing.
7. Remove the pulley. Withdraw spindle assembly through front of housing. Remove spring washer from assembly.
8. Clamp spindle chuck in a vise. Using steel bar of step 4, unscrew and remove spindle shaft.
9. Press front bearing off shaft. If arbor press is not available, place spindle with bearing extending over open jaws of vise, hold block of wood over end of spindle, and use hammer to force spindle out of bearing (Fig. 110).
10. (Fig. 108) Remove four screws (6) from rear bearing retainer plate (7) and pull bearing out of housing.

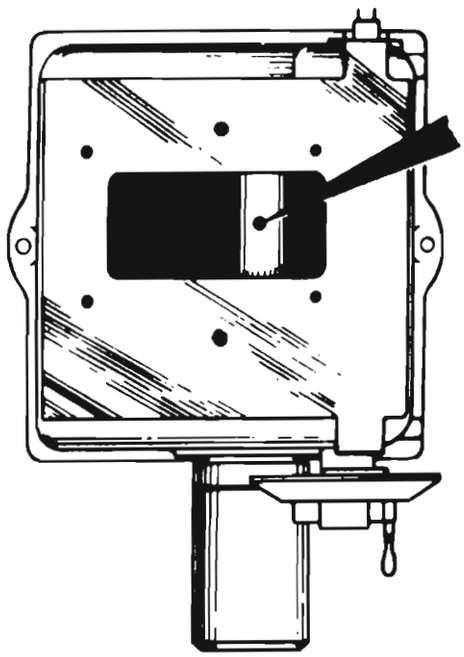


Fig. 109

REASSEMBLY

11. Insert new rear bearing and install retainer plate.
12. Put new front bearing on spindle and press into position by screwing spindle chuck into shaft.
13. Put spring washer over spindle and insert assembly through front of housing.
14. Use bar to keep spindle from turning while threading spindle pulley onto shaft, thus drawing front bearing into housing. Release spindle brake during this operation.

    Caution: *Do not use hammer in assembly or installation of new spindle bearings.*
15. Put flat drive belt in place. Put washer on feed rod, engage adjusting nut and feed arms.
16. Replace screw and washer in end of feed rod and tighten.
17. Replace upper housing casting on top of machine.
18. Replace motor and switch. Replace belts.
19. Replace belt guard.

Front Bearing: *Sunnen MBB-340 or New Departure 933L06X1C.*

Rear Bearing: *Sunnen MBB-335 or New Departure 4993L06X1C.*

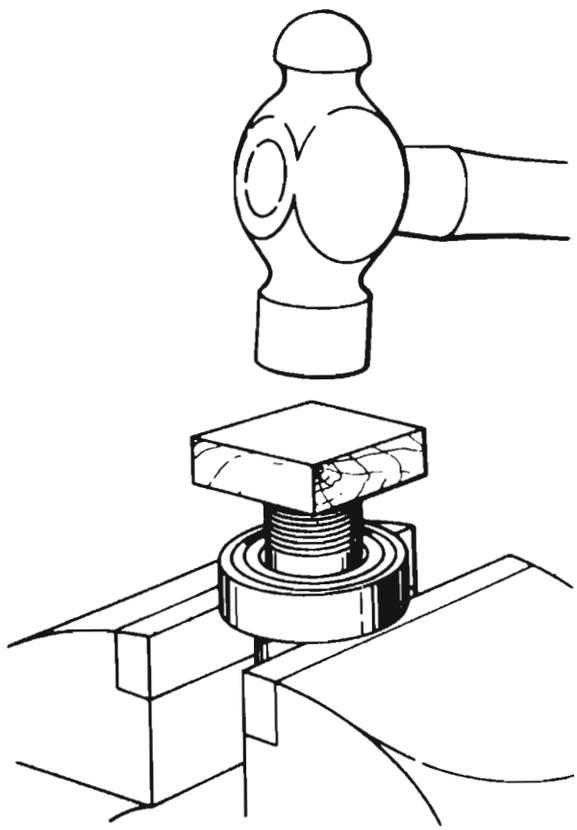


Fig. 110

8. MAINTENANCE OF AG-300 PRECISION GAGE

A. CARE & REPLACEMENT OF STANDARD RANGE GAGING POINTS

The standard range gage points are hardened steel balls which are held in the gaging fingers by ball retainers.

TO PROVIDE NEW GAGING SURFACES: Loosen set screws in ends of gaging fingers just enough to allow gage balls to be rotated. Tighten set screws. Thus the life of the gage ball is extended to many times that of a fixed gage point.

TO INSTALL NEW STANDARD RANGE GAGE POINTS:

1. Loosen set screws in ends of the two gaging fingers just enough to remove old gage balls and retainers.
2. Hold new gage ball in socket of ball retainer and slide assembly into hole in gaging finger, with ball toward face plate of gage and with cone recess in retainer facing forward. (Fig. 111) Tighten set screw in gaging finger, making sure that cone point of set screw enters cone recess in ball retainer.

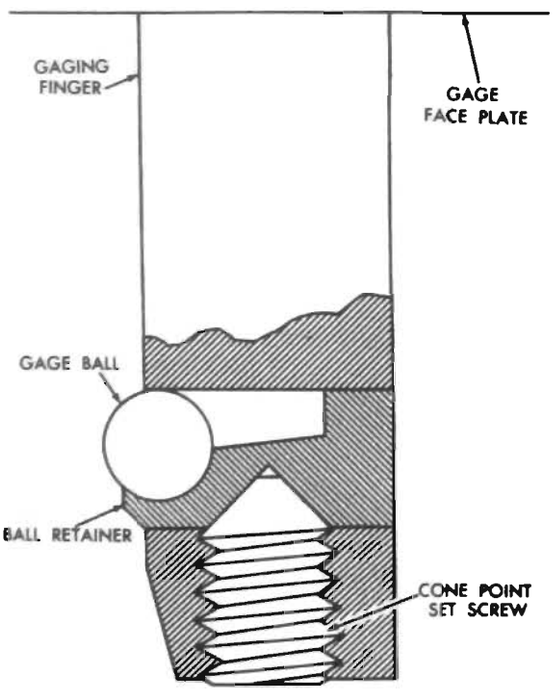


Fig. 111

TO INSTALL NEW STANDARD RANGE CENTRALIZER POINT:

IMPORTANT NOTE: *Two types of standard range centralizer points are included in the replacement point set. Check serial number of your AG-300 gage and install proper points as per following instructions.*

FOR AG-300 GAGES WITH SERIAL NUMBERS UNDER 4000:

Loosen set screw in end of centralizer finger and remove old point. Replace with new point of identical design and tighten set screw *temporarily*. Flat point of set screw must contact flat on side of centralizer point.

Caution: *Do not use gage after a new centralizer point has been installed, until the centralizer point has been calibrated.*

FOR AG-300 GAGES WITH SERIAL NUMBERS OVER 4000:

Screw threaded centralizer point out of centralizer finger and install new threaded centralizer point of identical design. Centralizer point can be distinguished from the spare set screws by its large ground head. (Fig. 112)

Caution: *Do not use gage after a new centralizer point has been installed, until the centralizer point has been calibrated as explained under gage instructions, page 5.*

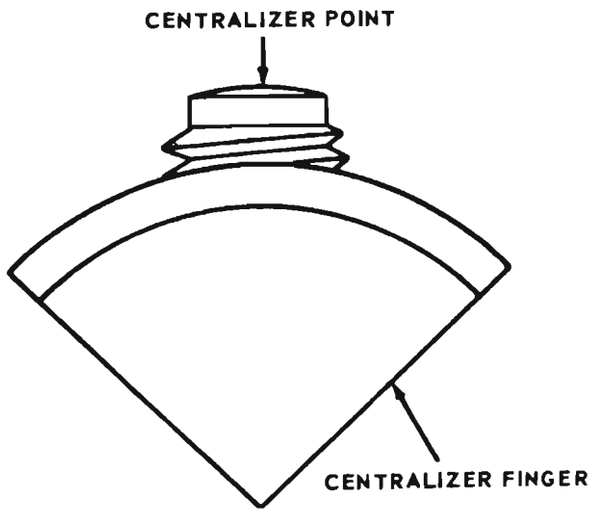


Fig. 112

B. ADJUSTING THE POSITION OF GAGE LOCKING LEVER

If locking lever rotates clockwise past horizontal, reset position as follows: Lock gage by turning locking lever clockwise until finger tight. Insert Allen wrench through hole in lever and unscrew. Rotate lever on shaft to approximately the 2 o'clock position and tighten lever in knob securely.

C. ADJUSTING THE SETTING FIXTURE TO EXTEND ITS SERVICE LIFE

This setting fixture is provided with removable spacers under the brass contact buttons on the back of the fixture. As wear becomes apparent on the setting blocks where they have contacted the gage points, remove one spacer from under each brass contact button. This allows the gage points to contact a new, unworn area on the setting blocks. After all spacers have been removed, a fifth position is available by removing the screws and contact buttons.

CAUTION: *Always be sure the two contact buttons are of equal height from the back plate, by having the same number of spacers under each button.*

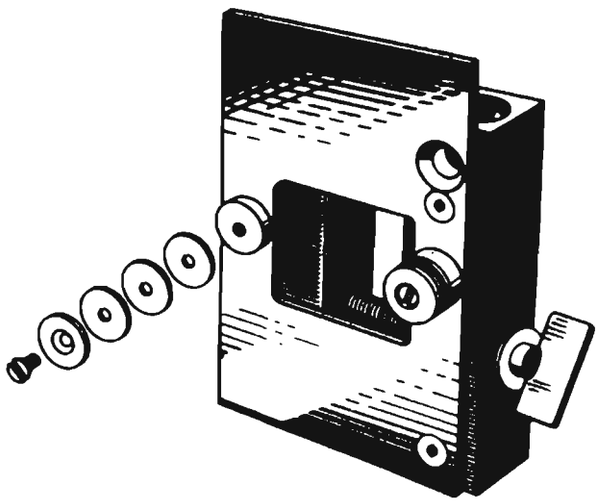


FIG. 115

STONE SELECTION CHART

For Use with Mandrels	For Use with Flow of Honing Oil			For Use Dry		Std. Pkg.
	Roughing	Finishing	Medium Finish	Roughing	Finish	
SL-480 thru SL-660 SL-720 thru SL-1800	SL-1 SL-5	SL-3 SL-13	SL-7	SL-1 SL-5	SL-3 SL-7	6 6
BBN Rod Grinding Outfit	SL-8	SL-17				6
CR Series 1450 thru 1750		CR-4	CR-2	Do not use dry		2
CR Series 1900 and up		CR-14	CR-12			
HB-1000 thru HB-1375 Extension Stone for HB Mandrels SC-1000 thru SC-1375 Extension Stone for SC Mandrels	HB-7 XHB-7 SC-7 XSC-7	HB-13 XHB-13 SC-13 XSC-13			HB-7 XHB-7 SC-7 XSC-7	6 6 6 6
KB Series	KB-7	KB-13		Do not use dry		12
KL Series	KL-5	KL-13	KL-7 KL-14*			12
LH Series	LH-7	LH-13				
LJ Series	LJ-7	LJ-13				
ML Series	ML-5 ML-8*	ML-13 ML-17**	ML-7 ML-14*	ML-5	ML-7	12 12
PL Series	PL-5 PL-8*	PL-13 PL-17**	PL-7 PL-14*	PL-5	PL-7	6 6
UL Series	UL-5		UL-7	UL-5	UL-7	4

*For enlarging pin hole in con-rod and spindle body forgings. ** For extra-fine finishing, if desired, after PL-8 or ML-8 roughing operation.