OPERATING INSTRUCTIONS

for the

SUNNEN

Model "LB"

BUSHING GRINDER

SUNNEN

OIL

Be sure that all moving parts are oiled regularly. Oil before using this machine as it was shipped dry from the factory.

Ball bearings are permanently lubricated and need no oil.

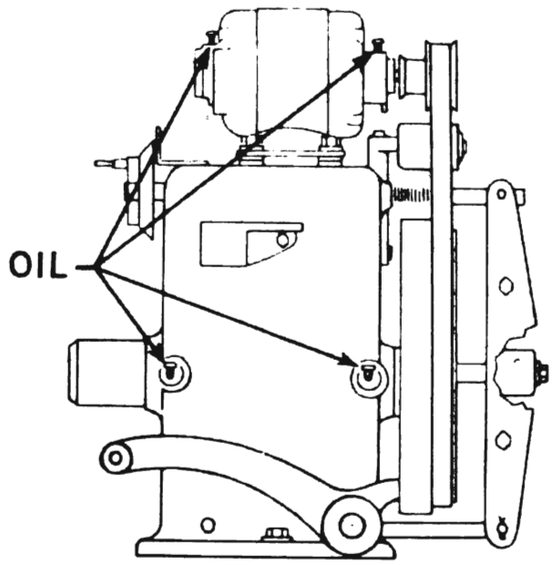

Fig. 1

MANDRELS and STONES

You received ten mandrels, two of each size. One is for roughing and has a No. SL5 roughing stone in it; the other is for finishing and has a No. SL7 finishing stone in it. Don't use the same mandrel for both roughing and finishing. The number on the mandrel indicates in thousandths the smallest size it will grind. For example: No. SL720 Mandrel has a size range from .720" up. Each mandrel overlaps the next size. When roughing, enough metal should be left for the finishing stone so that marks made by the roughing stone will be removed — usually one-half-thousandth to one-thousandth is enough. Do not attempt to finish after a reamer; always use the No. SL5 roughing stone first.

TRUING SLEEVES

There is a truing sleeve for each size mandrel to be used to keep the stone and mandrel parallel. It should always be used when you change stone in a mandrel or when it is evident that the stone is not cutting over its full length.

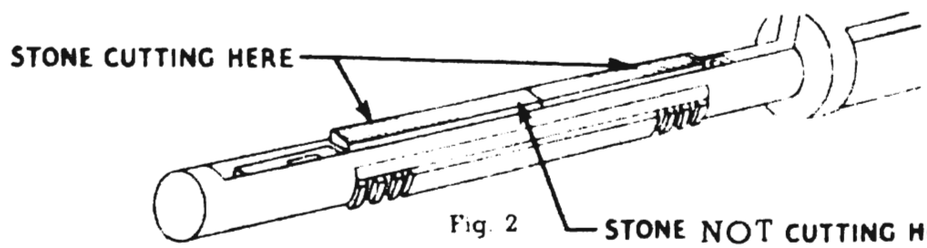

Fig. 2

If a few light strokes of the sleeve over the mandrel show high or low spots on the stone (see Fig. 2) continue to stroke the sleeve until they disappear. Use the truing sleeve just as though you were grinding out the bore, pushing it back and forth reversing end for end frequently, and allowing it to pass each end of the stone about one inch.

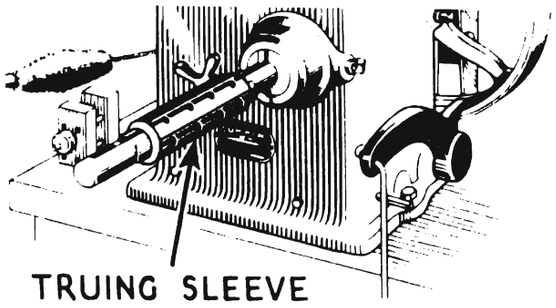

Fig. 3

In spindle bolt bushing work, it is advisable to use the truing sleeve more often since there is very little wear in the center of the stone.

TREATING THE STONE

Stones are treated at the factory and must be treated often when in use or they will become dry. This should be done before starting and two or three times during the job. Dry stones wear rapidly; properly treated stones last longer and cut freely. The Stone Treating Stick contains the correct lubricant for stones used in aluminum, bronze and cast iron. Simply rub the end of the stick along the stone until it appears moist.

Lard is the correct lubricant to be used when grinding steel. It should be applied freely.

THE DIAL MICROMETER STOP

The Dial Micrometer Stop is to set the stone so that it will be expanded only the amount desired when the foot pedal is pressed down. Each number on the dial represents one-thousandth. When the dial is advanced from one number to the next the stone has been set to expand one-thousandth. The dial should not be set to expand the stone more than .010" at a time as that is the full range of the Automatic Stone Feed-Up (See Step One, Page 6).

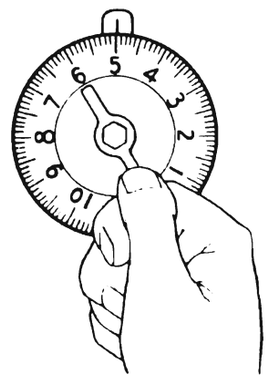

Fig. 4

For all mandrels smaller than No. SL720 the stone will expand .002" for each .001" the dial is advanced

THE FOOT PEDAL and AUTOMATIC STONE FEED-UP

The foot pedal, in addition to controlling the starting and stopping of the spindle, is to expand or feed out the stone the amount set by the dial. Pressing down on the foot pedal, the mandrel starts turning and the stone feeds out to the work. Releasing it, the mandrel stops and the stone retracts.

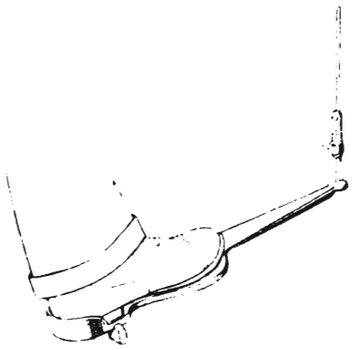

Fig. 5

When the foot pedal is held all the way down so the feed arm is down against stop B (see Fig. 13 on page 6) the stone is automatically fed out to the work under the tension set by the Tension Adjustment.

TENSION ADJUSTMENT

By turning the adjustment nut Fig. 6 to the right or left the Automatic Stone Feed-Up is set to feed out the stone under any cutting tension desired from very heavy to light tension. The cutting tension may be increased or decreased at any time desired by simply turning the adjustment to right or left.

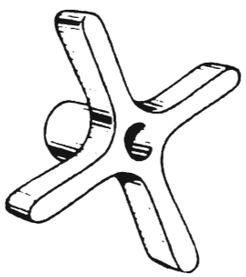

Fig. 6

A little practice will show you the right tension for the job.

USING THE ROUGHING CUTTER with the AUTOMATIC FEED-UP

The Automatic Stone Feed-Up cannot be used with the Roughing Cutter. Turn the Tension Adjustment to the right as far as it will go. This cuts out the Automatic Stone Feed-Up and the Roughing Cutter is used as shown on Page 11.

TWO SPEEDS: When to Use - - How to Change

For small easily handled jobs such as passenger car pistons, water pump bushings, sector housings, etc., use the high speed (415 rpm).

For large, heavy, or awkward work such as connecting rods, spindle bodies, compressor cylinders, large tractor pistons, etc., use the low speed (255 rpm).

To change speed turn off the motor, hold idler pulley back with one hand and move the belt with the other hand.

See Fig. 7.

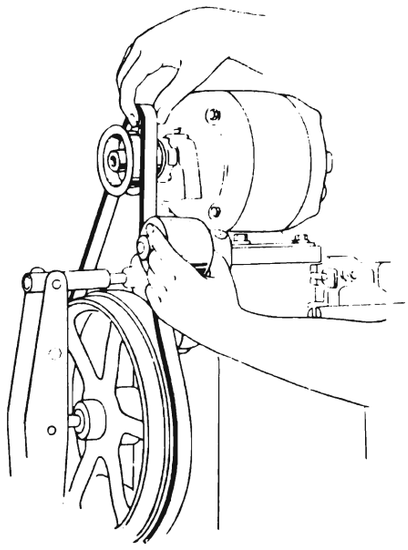

Fig. 7

HOW TO INSERT MANDREL

With the mandrel selector, choose the largest mandrel that will fit in the hole to be ground as illustrated in Fig. 8. Insert the mandrel in the spindle as illustrated in Figs. 9, 10, 11 and 12.

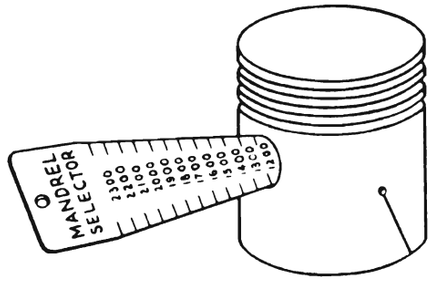

Fig. 8

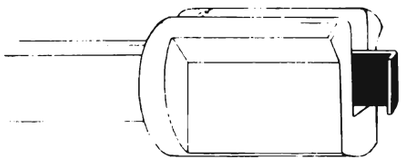

Fig. 9

Pull end of wedge out of mandrel as shown before putting mandrel into the spindle.

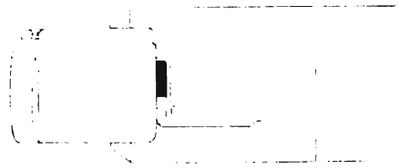

Fig. 10

Mandrel will butt against adjusting link as shown. This lines up the wedge with the slot in the adjusting link so that they will automatically lock together when mandrel is given a quarter turn to the right.

Fig. 11

Showing wedge and adjusting link locked together after mandrel was turned to the right as described in Fig. 10. Push mandrel all the way in spindle and lock in place with set screw.

Fig. 12

Showing a cross section of spindle holding mandrel. Note position of wedge and adjusting link.

HOW TO OPERATE

There are only three simple steps to follow in operating and if followed carefully your pin fitting will be most successful right from the start.

STEP ONE—Setting Machine

With motor on, turn dial to left retracting stone within mandrel. Place work on mandrel and depress foot pedal until feed arm hits stop B. Then as you stroke the work back and forth as shown in Fig. 14, slowly turn dial to the right until you feel the stone start to cut. Take a few strokes to permit the stone to seat, then gauge hole on pin fitting gauge to determine amount of stock to be removed. (Page 8 tells how to use gauge.)

Advance the dial the number of thousandths indicated by the gauge (allowing ½ thousandth for finishing) and start grinding.

The dial should never be set up for more than a .010" cut at a time as this is the full range of the Automatic Stone FEED up.

NOTE: For connecting rods or other heavy or awkward handling jobs it is better to leave motor off until setting is made. Simply follow above but with motor off.

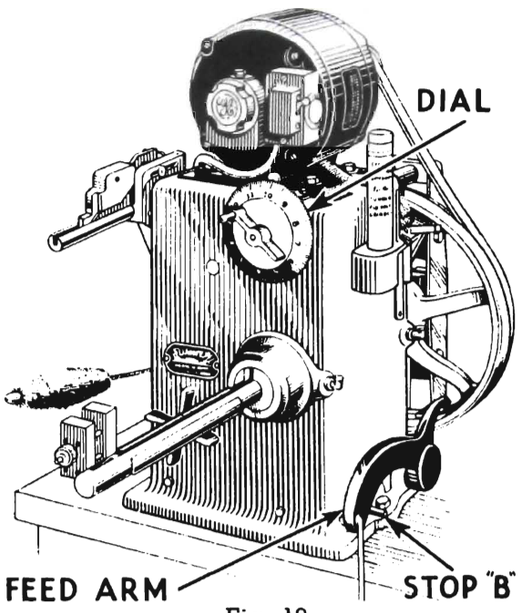

Fig. 13

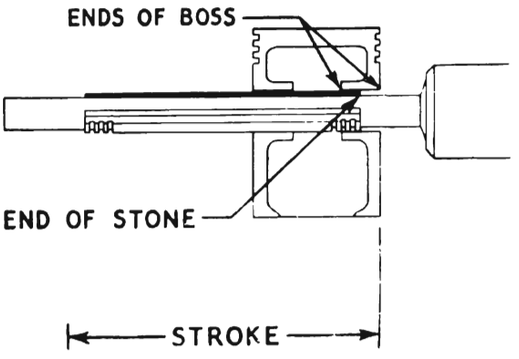

Fig. 14

STEP TWO—Roughing Out

Always put work on before mandrel starts turning. Set Tension Adjustment for a fairly heavy stone tension. Press foot pedal all the way down so feed arm rests on stop B and stroke work back and forth about 100 strokes* per minute. Then as you feel stone start cutting free, release foot pedal and again gauge work. If hole is not yet to size, advance dial the additional amount indicated by the gauge and continue grinding. After the first hole has been ground to size the machine is set to rough out the rest of the work to the same size and it is only necessary to advance the dial for each succeeding part enough to take up for stone wear. This is easily determined by gauging each part when the stone cuts free. NOTE: Reverse work end for end frequently, stopping mandrel before removing work. Take work off stone immediately when you feel it cut free.

* A stroke is one pass of work over stone front to back or back to front.

Fig. 15

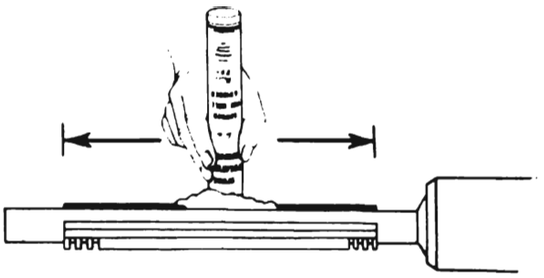

Fig. 16

STEP THREE—Finishing and Fitting

After all parts have been roughed out to size, insert finishing mandrel with No. SL7 Finishing Stone and set the machine as in STEP ONE. Set up on the dial the amount of stock to remove by finishing, as shown by the pin fitting gauge. Try the first pin for fit and when correct, the machine is then set for finishing all other parts to that same size. The dial may require advancing a very slight amount with each part to compensate for stone wear. Be sure that finishing mandrel and stone are true before using. (See TRUING SLEEVES, Page 2).

PISTON PIN VISE

Clamp pin being fitted in the Pin Vise. With the pin held securely in the pin vise it is easy to run on a tight fit without driving and it is easy and convenient to try for a fit.

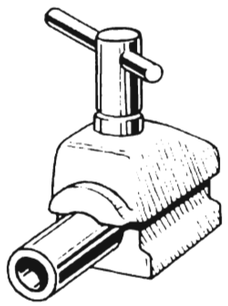

Fig. 17

RECOMMENDED CLEARANCES FOR PISTON PINS

CAST IRON — .001".

BRONZE — ¼ to ½-thousandth (pin should fall through).

ALUMINUM — Pin clamped in rod — thumb push fit (room temperature).
Full floating pin — palm push fit.

PIN ANCHORED TO ONE BOSS — drive fit. (See Note).

NOTE: The best way to fit a pin of this type is to grind the pin hole to size for a drive fit and then relieve the hole to a push fit in the piston boss opposite the anchor screw. This allows the piston to expand and contract evenly in the motor when in use. In pistons of this type it is not necessary to use a finishing stone.

Where the pins have a bearing in the rod, the pin must not be fitted in the piston so tight that piston cannot assume its correct shape under heat, since it will rapidly wear or will seize and score.

PISTON EXPANDERS, ETC.

When expanding pistons in any manner always fit the pins after the piston has been expanded.

HOW TO USE THE DE LUXE PIN FITTING GAUGE

The De Luxe Gauge is a precision instrument and should be handled as carefully as the finest micrometer. Abuse will decrease its accuracy. The Gauge will hande any size hole from .720" to 1.750" in diameter. The hole must be within .006" of the pin size before it can be measured on the gauge.

1. *Place any two of the pins to be* fitted in setting fixture as shown in Fig. 19 and tighten nut.

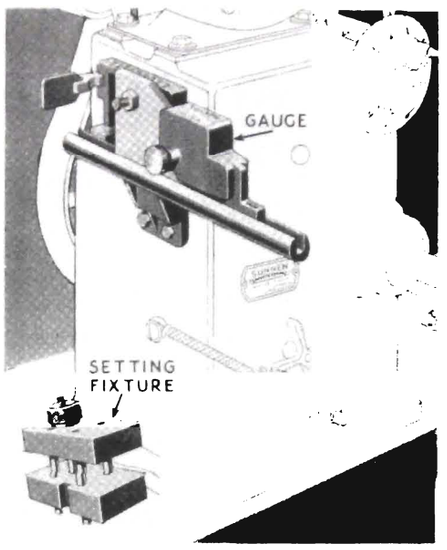

Fig. 18

Fig. 19

2. Place setting fixture on gauge as shown in Fig. 20 so that the upper bar rests on D and slot B fits snugly on C.

3. Hold gauge as shown in Fig. 21. With index finger of left hand on stop F and thumb on E, slide part E back with thumb until setting fixture becomes snug in position shown. Remove hand from setting fixture then tighten nut G as indicated in Fig. 22 and remove setting fixture.

NOTE: To check setting, place setting fixture on gauge and push forward without forcing. The mark on the slide should line up with zero on the scale.

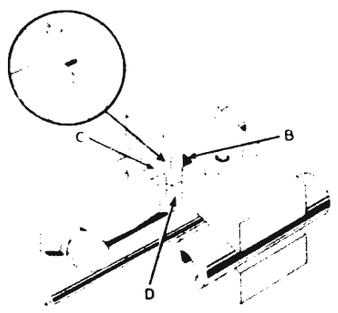

Fig. 20

4. Place work on gauge as shown in Fig. 23 and push forward as far as it will go easily. DO NOT FORCE IT! Be sure that work is held straight on gauge. Scale will indicate amount of stock to be removed to bring hole to zero or pin size.

NOTE: If hole is not large enough to go on gauge, it must **first be enlarged** by using the roughing stone or rough ing cutter.

5. Gauge work occasionally as it is being ground. When gauge is at zero position, hole is the same size as pin. When work gauges on plus side of zero, it indicates the clearance allowed for the fit.

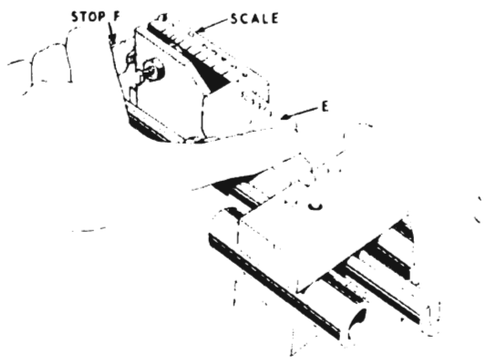

Fig. 21

6. It is a good habit when gauging, not to look at the scale until work has been pushed forward and you are ready to take reading. This will help operator to get proper "feel" and prevent forcing. Use the setting fixture to recheck gauge setting at any time desired.

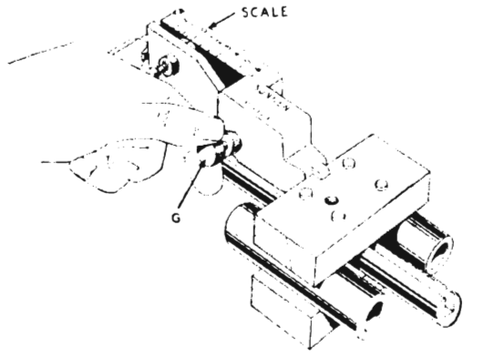

Fig. 22

7. The gauge may be used in fitting other small jobs even though the setting fixture cannot be used. In these cases, the gauge may be set with a micrometer as shown in Fig. 24.

Fig. 23

DO NOT DRAG WORK OFF THE GAUGE. PULL BACK THE ENTIRE **SLIDING PORTION** OF THE GAUGE. **THEN TAKE OFF THE** WORK.

Fig. 24

GRINDING HYDRAULIC BRAKE MASTER CYLINDERS

Fig. 25

(Use Mandrels HB1000, HB1250 or HB1375).

Hydraulic Brake Cylinder Stones are spring loaded to prevent crushing in a badly out-of-round cylinder. Do not use enough stone tension to collapse this spring.

When cylinder feels tapered, start grinding in the smallest part, using light tension and short strokes. As taper is removed more tension can be used and the stroke increased to the full length of the cylinder.

Usually HB7 finishing stone is all that is needed to clean up and polish out the ordinary master brake cylinder. Where more stock is removed the HB5 Roughing Stone will save time.

When grinding with either HB5 Roughing or HB7 Finishing Stone keep the stone wet with lard. After cylinder has been finished to size a good polish can be gotten by cleaning the HB7 Finishing Stone and the cylinder with a rag and then grinding a few more strokes. The stone will be just moist enough to load quickly and bring cylinder to high polish.

WHEEL CYLINDERS can also be finished with these master brake cylinder mandrels.

GRINDING STEP CYLINDERS

(Use Mandrels SC1000, SC1250 or SC1375).

These mandrels are designed to grind close up against the shoulder of these cylinders. Use SC5 Roughing or SC7 Finishing Stone.

GRINDING CONNECTING RODS OR OTHER LONG WORK USE SLOW SPEED

Fig. 26

When grinding large or long awkward work such as connecting rods or heavy castings it is better to adjust the stone to the work with the motor off. Use the rod clamp (Figs. 26 and 27) when grinding connecting rods. It gives the operator much better control over the rod and helps to produce a better job. Set the Tension Adjustment for a medium cutting tension for connecting rods as a heavy tension in these short bushings may cause excessive stone wear or bellmouth.

Fig. 27

GRINDING SPINDLE BODY BUSHINGS

Use the spindle body clamp as illustrated in Fig. 28 to handle this awkward job. Stroke forward so that the rear bushing comes to the center of the stone and on the stroke back toward you, bring the front bushing back to the center of the stone. Reverse the work end for end every few strokes. Be very careful to hold the spindle body steady, when one bushing is off the stone, so that you do not "cock" the bushing that remains on the stone.

Fig. 28

Use the truing sleeve often to keep mandrel and stone true.

HOW TO USE THE ROUGHING CUTTER

Fig. 29

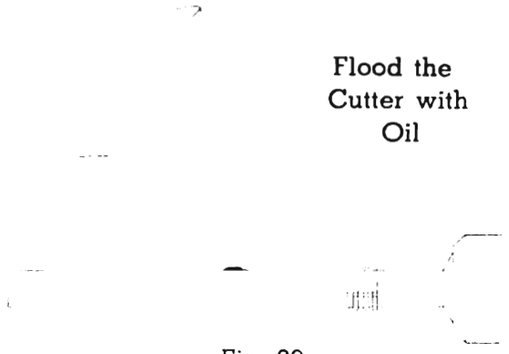

Fig. 30

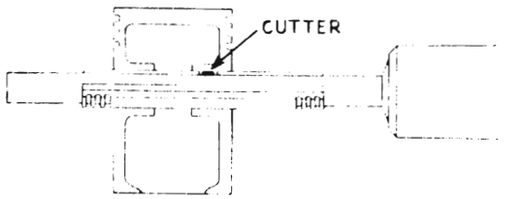

Fig. 31

The Roughing Cutter is a fast roughing tool for bronze and aluminum only, and is used where a large amount of stock must be removed as in new bushings. It does not produce a finished hole.

Select the proper size roughing mandrel for the job and replace the roughing stone with the Roughing Cutter.

Cut out the Automatic Stone Feed-Up by turning the Tension Adjustment Nut to the right as far as it will go.

Set the Pin Fitting Gauge for the size to which the holes are to be finished. FLOOD THE CUTTER WITH OIL AND REPEAT ON EACH BUSHING. (See Fig. 30).

Put the work on the mandrel and hold the surface to be cut directly over the cutter, see Fig. 31. Press the foot pedal all the way down until the feed arm is against stop B. Turn the dial slowly, feeding out the cutter until it starts cutting. Mark the number on the dial where the cutter starts cutting. Now take light cuts by advancing the dial about two-thousandths at a time. Stroke the part slowly and evenly across the cutter blade. Advance the dial another .002" and continue until the hole is within .004" to .005" of the desired size. Check the work frequently on the Pin Fitting Gauge to determine when enough stock has been removed with the roughing cutter. Mark this point with a pencil on the dial so the size can be duplicated in other parts of the set.

To duplicate this size, turn the dial back to the number where the cutter first started cutting. Place the next part on the mandrel and remove the stock as before making sure to stop advancing the dial at the same point. Repeat this operation for each part of the set. DON'T TRY TO TAKE OUT ALL THE STOCK IN ONE CUT OR YOU WILL GO OVERSIZE.

Pass the work slowly over the cutter so the chips can clear.

It is important for size that the last cut be very light. Never use the finishing stone immediately following the Roughing Cutter, the finish is too rough. Take out .003" to .004" with the roughing stone before finishing.

Flood the cutter and mandrel with oil. DON'T USE DRY. Always wipe the oil off the mandrel before placing the stone back in it, since oil is likely to cause the stone to gum up.

CARE OF MANDRELS, STONES and WEDGES

Each mandrel contains an adjusting wedge and stone. When you buy a new mandrel, a new wedge comes with it.

Fig. 32 Standard Wedge

Fig. 33 Extension Wedge

Stones and wedges should be kept in the same mandrels at all times. This means much to the accuracy of the machine and will prevent extra use of the truing sleeve. No. SL5 stone is for the roughing operation and No. SL7 stone is for finish ing work.

Included with each Bushing Grinder is an extension wedge for mandrels No. SL-720 to SL-1500 inclusive, to be used ONLY when both stone and mandrel are almost worn out.

WHEN TO REPLACE MANDRELS

It is essential that mandrels be replaced when the shoes (or guides) are worn down to the mandrel body. Failure to replace a wornout mandrel will result in inaccurate holes. (See "Bell Mouthing", page 14).

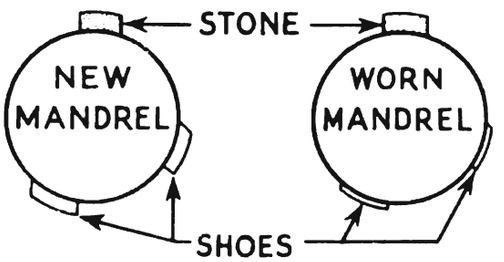

Fig. 34

CHANGING STONES

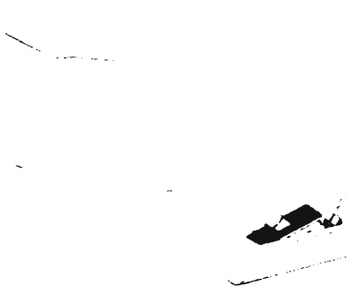

Fig. 35

Insert the sharp end of the chuck wrench into the slot of the mandrel spring latch and unhook the latch off of the stone holder. (See Fig. 35). Remove or raise the back retainer spring. Then, lift the stone out with the fingers. Before putting a stone back in the mandrel be certain that the wedge, stoneholder and inside of the mandrel are clean. Be certain also that the stone seats properly — always use truing sleeve, when a new stone is put in service. (See Truing Sleeve," page 2).

What is the Difference Between a Sunnen Ground Hole and a Reamed Hole?

The sketch at the right represents an exaggerated cross section of a pin and hole, showing the difference between the reamer and Sunnen Methods.

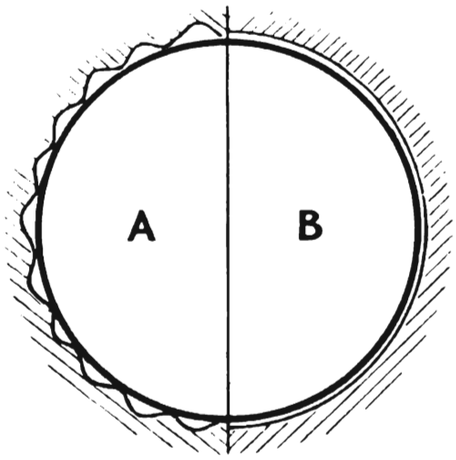

Fig. 36

Section "A" shows the high spots caused by reamer chatter. These vary in height from .00½" to .002" depending on the type and condition of the reamer used.

Section "B" shows how the pin hole is finished by the Sunnen method—perfectly round and absolutely free from high spots — assuring a full bearing surface. No high spots to wear down rapidly and cause pin knock in a few miles but a full bearing surface to resist wear and add thousands of extra miles to the Sunnen ground job.

This chart shows clearly that a free fit by the Sunnen Method has actually less clearance than a hard drive fit by the reamer.

Piston slap, distortion and collapse are to a great extent caused by excessively tight pins. This is caused mainly by the cramping action that the drag transfers to the piston.

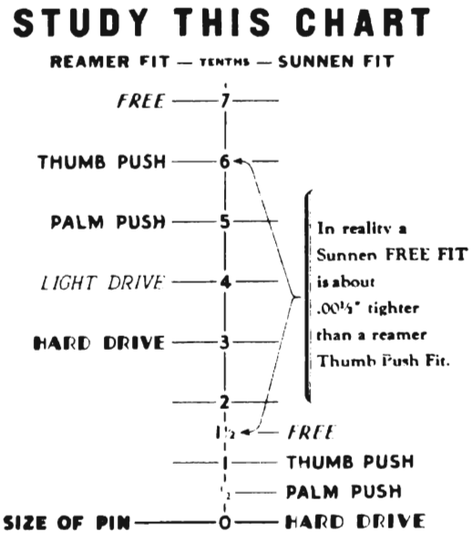

Fig. 37

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 or mandrel to become out-of-true which causes bellmouthing. An untrue condition is easily determined by the "feel" of the work as it passes over the mandrel. Any high spots will feel tighter than the rest of the mandrel. Use the truing sleeve (Page 2.)

B. Wedge may have become bent.

C. Mandrel may be worn out. (See "When to Replace Mandrels," page 12.)

D. Bellmouthing in rod bushings may be caused from using too heavy stone cutting tension.

TAPERED HOLE

A. Operator is not reversing work often enough. This sometimes causes one end of mandrel to become high, thus causing one end of work to be larger than the other.

B. Stone may not be all the way down at back.

C. Use truing sleeve.

STONE NOT CUTTING

A. Stone may have become loaded or glazed. Break glaze by using wire brush lightly or sometimes glaze can be broken by a few very rapid strokes of the work across the stones.

B. Improper stone being used. See Stone Chart — Page 15.

C. Too light cutting tension.

MANDRELS • STONES • TRUING SLEEVES

For SUNNEN PIN HOLE GRINDERS

Mandrel No.	Size Range	Price	Truing Sleeve No.	Price
SL480	.480" to .540"	$1.75	ST480	$0.50
SL540	.540" to .600"	1.75	ST540	.50
SL600	.600" to .660"	1.75	ST600	.50
SL660	.660" to .720"	1.75	ST660	.50
SL720	.720" to .780"	1.75	ST720	1.00
SL780	.780" to .840"	1.75	ST780	1.00
SL840	.840" to .900"	1.75	ST840	1.00
SL900	.900" to .960"	1.75	ST900	1.00
SL960	.960" to 1.020"	1.75	ST960	1.00
SL1020	1.020" to 1.080"	2.00	ST1020	1.00
SL1080	1.080" to 1.140"	2.00	ST1080	1.00
SL1140	1.140" to 1.200"	2.00	ST1140	1.00
SL1200	1.200" to 1.300"	2.00	ST1200	1.00
SL1300	1.300" to 1.400"	2.00	ST1300	1.00
SL1400	1.400" to 1.500"	2.00	ST1400	1.00
SL1500	1.500" to 1.600"	2.00	ST1500	1.00
SL1600	1.600" to 1.700"	2.25	ST1600	1.25
SL1700	1.700" to 1.800"	2.25	ST1700	1.25
SL1800	1.800" to 1.900"	2.25	ST1800	1.25
SL1900	1.900" to 2.000"	2.25	ST1900	1.25
SL2000	2.000" to 2.100"	2.25	ST2000	1.25
SL2100	2.100" to 2.200"	2.25	ST2100	1.25
SL2200	2.200" to 2.300"	2.25	ST2200	1.25
SL2300	2.300" to 2.400"	2.25	ST2300	1.25
HB1000	1.000" to 1.250"	1.75		
HB1250	1.250" to 1.375"	1.75	No Truing Sleeve required with HB	
HB1375	1.375" to 1.750"	1.75	or SC Mandrels. No. HB1375 size	
SC1000	1.000" to 1.250"	1.75	range may be increased to 2.125 in.	
SC1250	1.250" to 1.375"	1.75	by using XHB5 or XHB7 Stone.	
SC1375	1.375" to 1.750"	1.75		

STONES FOR ABOVE MANDRELS

Stones for Mandrels No.	Roughing	Finishing	Price Each
SL480 to SL660 incl.	SL1	SL3	$1.25
SL720 to SL2300 incl.	SL5	SL7	1.40
HB1000 to HB1375 incl.	HB5	HB7	1.40
To Increase Range of HB1375 from 1.750 to 2.125	XHB5	XHB7	1.40
SC1000 to SC1375	SC5	SC7	1.40
V-8 Ford Rod Mandrel	EDN13NO	ELU13J	1.40
Rod Relief Grinder		HH18	2.50

NOTE: It is very important that you have a Truing Sleeve for each size SL Mandrel. Truing Sleeves are used to keep the Mandrel and Stone parallel and in good working condition.

Combination Sets

The following Sets have been arranged for convenience in ordering and are grouped to cover size ranges most usually ordered when adding to the equipment. To order single mandrels, etc., see Page 15.

	Consists of	
Set No. 1 Range .480" to .720" Net Price $26.00	2 No. SL-480 Mandrels 2 No. SL-540 Mandrels 2 No. SL-600 Mandrels 2 No. SL-660 Mandrels 4 No. SL-1 Roughing Stones 4 No. SL-3 Finishing Stones	1 No. ST-480 Truing Sleeve 1 No. ST-540 Truing Sleeve 1 No. ST-600 Truing Sleeve 1 No. ST-660 Truing Sleeve
Set No. 2 Range .720" to 1.020" Net Price $36.50	2 No. SL-720 Mandrels 2 No. SL-780 Mandrels 2 No. SL-840 Mandrels 2 No. SL-900 Mandrels 2 No. SL-960 Mandrels 5 No. SL-5 Roughing Stones 5 No. SL-7 Finishing Stones (Furnished with Bushing Grinder as Standard Equipment)	1 No. ST-720 Truing Sleeve 1 No. ST-780 Truing Sleeve 1 No. ST-840 Truing Sleeve 1 No. ST-900 Truing Sleeve 1 No. ST-960 Truing Sleeve
Set No. 3 Range 1.020" to 1.300" Net Price $31.20	2 No. SL-1020 Mandrels 2 No. SL-1080 Mandrels 2 No. SL-1140 Mandrels 2 No. SL-1200 Mandrels 4 No. SL-5 Roughing Stones 4 No. SL-7 Finishing Stones	1 No. ST-1020 Truing Sleeve 1 No. ST-1080 Truing Sleeve 1 No. ST-1140 Truing Sleeve 1 No. ST-1200 Truing Sleeve
Set No. 4 Range 1.300" to 1.600" Net Price $23.40	2 No. SL-1300 Mandrels 2 No. SL-1400 Mandrels 2 No. SL-1500 Mandrels 3 No. SL-5 Roughing Stones 3 No. SL-7 Finishing Stones	1 No. ST-1300 Truing Sleeve 1 No. ST-1400 Truing Sleeve 1 No. ST-1500 Truing Sleeve
Set No. 5 Range 1.600" to 1.900" Net Price $25.65	2 No. SL-1600 Mandrels 2 No. SL-1700 Mandrels 2 No. SL-1800 Mandrels 3 No. SL-5 Roughing Stones 3 No. SL-7 Finishing Stones	1 No. ST-1600 Truing Sleeve 1 No. ST-1700 Truing Sleeve 1 No. ST-1800 Truing Sleeve
Set No. 6 Range 1.900" to 2.400" Net Price $42.75	2 No. SL-1900 Mandrels 2 No. SL-2000 Mandrels 2 No. SL-2100 Mandrels 2 No. SL-2200 Mandrels 2 No. SL-2300 Mandrels 5 No. SL-5 Roughing Stones 5 No. SL-7 Finishing Stones	1 No. ST-1900 Truing Sleeve 1 No. ST-2000 Truing Sleeve 1 No. ST-2100 Truing Sleeve 1 No. ST-2200 Truing Sleeve 1 No. ST-2300 Truing Sleeve
Set No. 8 (Hydraulic Brake Mandrels and Stones) Range 1.000" to 2.125" Net Price $20.30	Consists of 1 No. HB-1000 Mandrel 1 No. HB-1250 Mandrel 1 No. HB-1375 Mandrel 1 No. SC-1000 Mandrel 1 No. SC-1250 Mandrel 1 No. SC-1375 Mandrel	3 No. HB-7 Stones 1 No. XHB-7 Extension Stone 3 No. SC-7 Stones

SUNNEN

Sunnen Products Co., 7900 Manchester Ave., St. Louis, Mo.

Form PHG 949 10M 9-42

Printed in U. S. America