



SUNNEN[®] HONING TECHNIQUES

DATA FILE: #110

HONING SMALL BORES

(.060 - .3125 IN.) (1,5 - 8,0 MM)



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HONING SMALL BORES

.060-.100 in. (1,5-2,5 mm)

As honing is the most effective method for precision bore sizing and is in wide use today for finishing bores of most all work materials in a wide range of diameters -- there is always the question of, "How small can you go?"

Until a few yens ago, the smallest honing tools were in the 1/8" starting range. Then Sunnen engineers succeeded in designing practical tooling down to a minimum diameter of .100 in. (2,5 mm), the K3 series of tooling.

Even more recently, through a radical change in basic design, Sunnen engineers succeeded in reducing tooling diameters down to .060 in. (1,5 mm). The usage of this tooling D6 and D8 . . . has been wide and successful (*see Figure 1*).

In designing tooling for this .060-.100in. (1,5 -2,5 mm) diameter range, the mandrel shank was changed from a channel cross section to a tubular form and the wedge from flat to a round with a single low angle faced slope contacting the stoneholder. This added materially to the rigidity and strength of this diminutive tooling and filled a long felt need for bore sizing capability under .100 in. (2,5 mm) diameter.

However, honing in these miniature diameters calls for a rather special operating technique because of the workpiece weight and the torque limitations of the tooling.

Spindle Speed

The spindle speed of the honing tool in the miniature diameters should be the top speed of the Sunnen Honing Machine, which is 2500 RPM on the later models. Older models which don't have these high speeds should not be used in the .060 - .100 in. (1,5 - 2,5 mm) range . . . slower speeds result in excessive stone and guide shoe wear and slow stock removal.

Stone Pressure Setting

Also necessary is the light stone pressure control available on the newer Sunnen models. Start honing with both pressure dials set at "0". As a rule, a setting of 1/4 on this scale is the maximum pressure to use with this D6 and D8 tooling (*see Figure 2*). Note that the lower (heavy pressure) scale is set on "0" and the upper (light pressure) scale is set to the first graduation from "0".

Operating Technique

Packed with each mandrel is a detailed instruction sheet, which outlines steps in the assembly and use of this type of tooling. It is important that you go over this instruction sheet carefully as you assemble and put this miniature tooling into use.

Make sure mandrel is centered properly before starting to hone . . . remove runout as described in machine instruction manual.

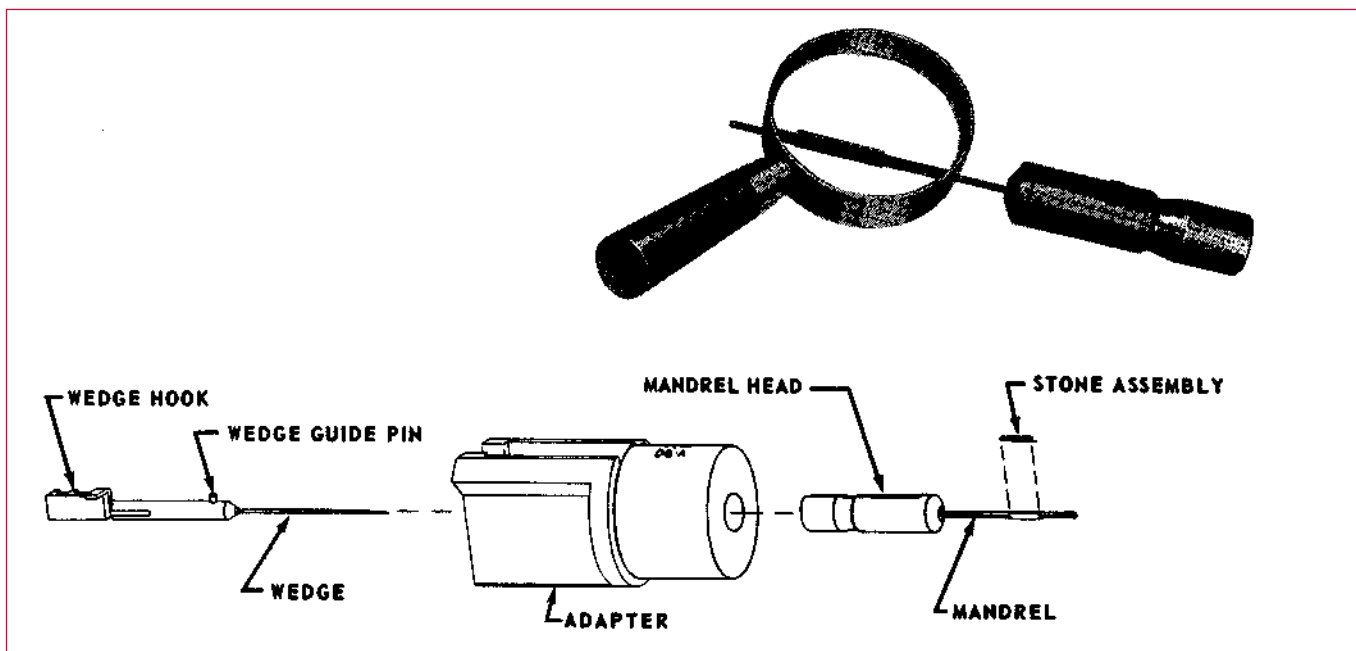


Figure 1, D6/D8 Honing Unit Components

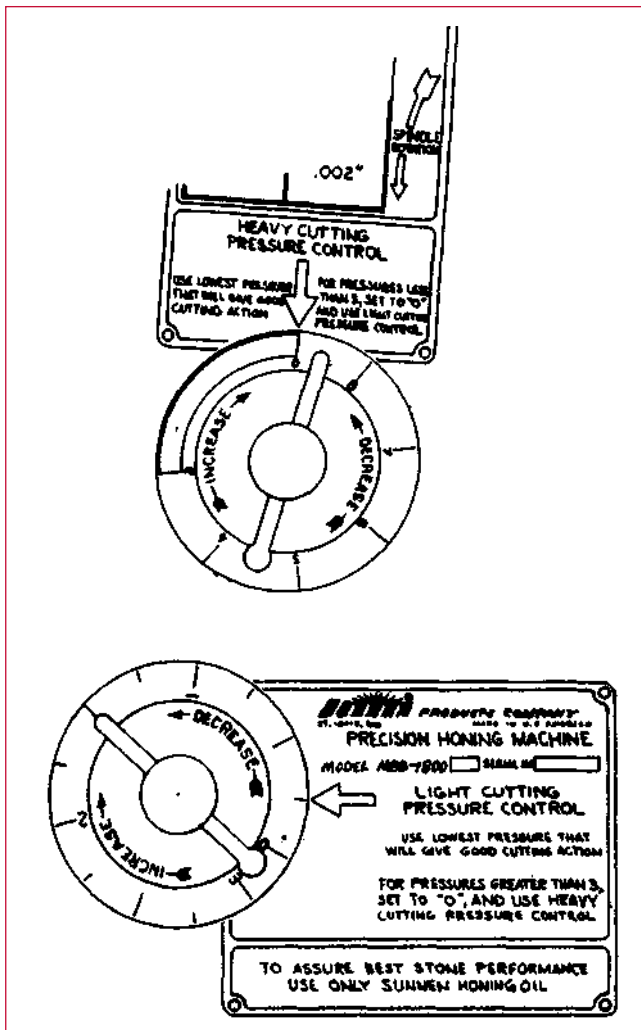


Figure 2, Stone Pressure

Avoid "slamming" down the pedal when starting in a new part; take it down slow and easy, for even a slight burr in the rough hole can grab and twist the small mandrel if the pedal is "tramped".

When parts are to be finish honed after hardening, it is very important to rough hone in the soft stage before hardening to get rid of any burrs that can damage tooling.

Then there is the limit of weight the mandrel will support without deflecting unless the operator helps support the work part while stroking. Deflection should be avoided while the mandrel is rotating. Continued deflection during the honing operation will cause a fatigue crack to develop and the mandrel will break.

Because of the low wedge angle the front end of the wedge must extend beyond the front of the stone as it advances to feed out and compensate for wear. Therefore the front part of the mandrel which protects the advancing wedge point prohibits the honing of blind holes.

The smallest tools that can be used for honing blind holes start in the .100" diameter range; the K3 series of tooling, for which the recommended revolving speeds and stone pressures remain in the same range as for the D6 and D8 series of tooling.

As work diameters get down into the miniature tooling range, it is more important than ever to get a flow of honing oil through the bore (see Figures 3 & 4).

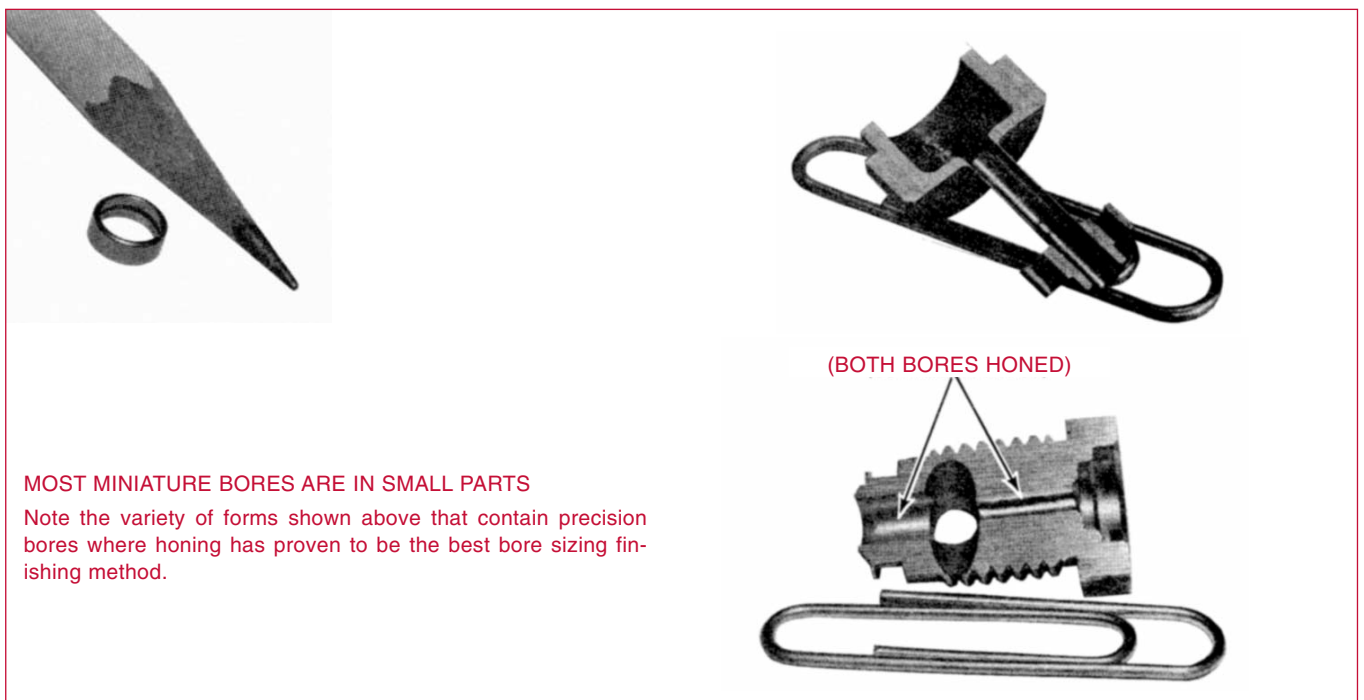


Figure 3, Small Parts

SUNNEN HONING TECHNIQUES

Starting in on a new job, take it easy until you get the hang of it. Use the lowest pressure that will give good cutting action. Even a setting of "0" on both pressure dials may be enough - try it that way to start with and remember, come down easy with the pedal.

NOTE: 1/4 setting on the light pressure scale illustrated in Figure 2; this should be the maximum.

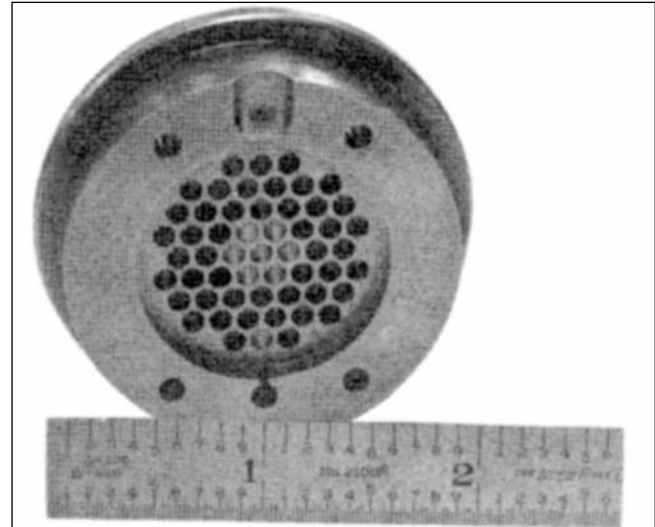
.100-.185 in. (2,5-4,7 mm)

Standard Sunnen Mandrels K3, BL3, K4, BL4, K5, and BL5 are used to hone in the .100-.185 in. (2,5-4,7 mm) diameter range (see Figure 5). These smaller sizes demand the use of the newer Sunnen machines with higher spindle speeds and light cutting pressures, and also introduce another limitation, which we will discuss here.

Aluminum oxide and silicon carbide honing stones are not available in the coarser grits (under 280-grit) The reason for this is that when a coarse grit wears and breaks out of a vitrified bond stone, it takes a chunk of the bond with it, leaving a relatively large hole. Honing stones for diameters less than .185 in. (4,7 mm) are quite small, so this large hole would effectively destroy the stone. Diamond stones as coarse as 150-grit are available all the way down to .100 in. (2,5 mm) diameter because the grits are held in a metal bond, which does not dis-integrate when the worn grit is dislodged.

.185-.3125 in. (4,7-8,0 mm)

Standard Sunnen K-Series, L-Series, and BL-Series Mandrels ... K6, J-K1 BL6, L6, K8, J-K8, BL8, and L8 ... have been successfully honing bores in the .185 - .3125 in.(4.7-8 mm) diameter range for many years. No special precautions need be taken in this range, except that the newer model Sunnen machines with maximum spindle speeds of 2500 RPM, and light cutting pressure capability, are needed for fastest stock removal. Follow the recommendations contained in the SMOPS Guide (ask for Bulletin X-SP-5061 and your bore-sizing will be as easy as A you were honing a .500 or .750 in. (12 or 18 mm) bore. You can hone almost any type bore in this size range, including blind holes.

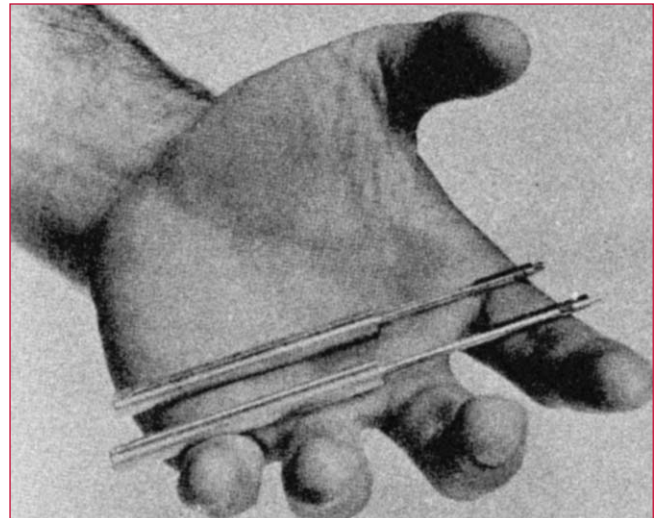


NOT ALL MINIATURE BORES ARE IN SMALL PARTS

Good examples are multiple hole extrusion die heads of hard tool steel containing from a few dozen to several hundred holes that must all be the same size, straight, and have a fine finish.

This one has 55 holes, honed straight, round and to the same size with the some microinch finish.

Figure 4, Small Parts



K-Series and BL-Series Mandrel we available in diameters as small as .100 in. (2,5 mm). You can hone almost any type bore with these mandrels, including blind holes.

Figure 5, Mandrels

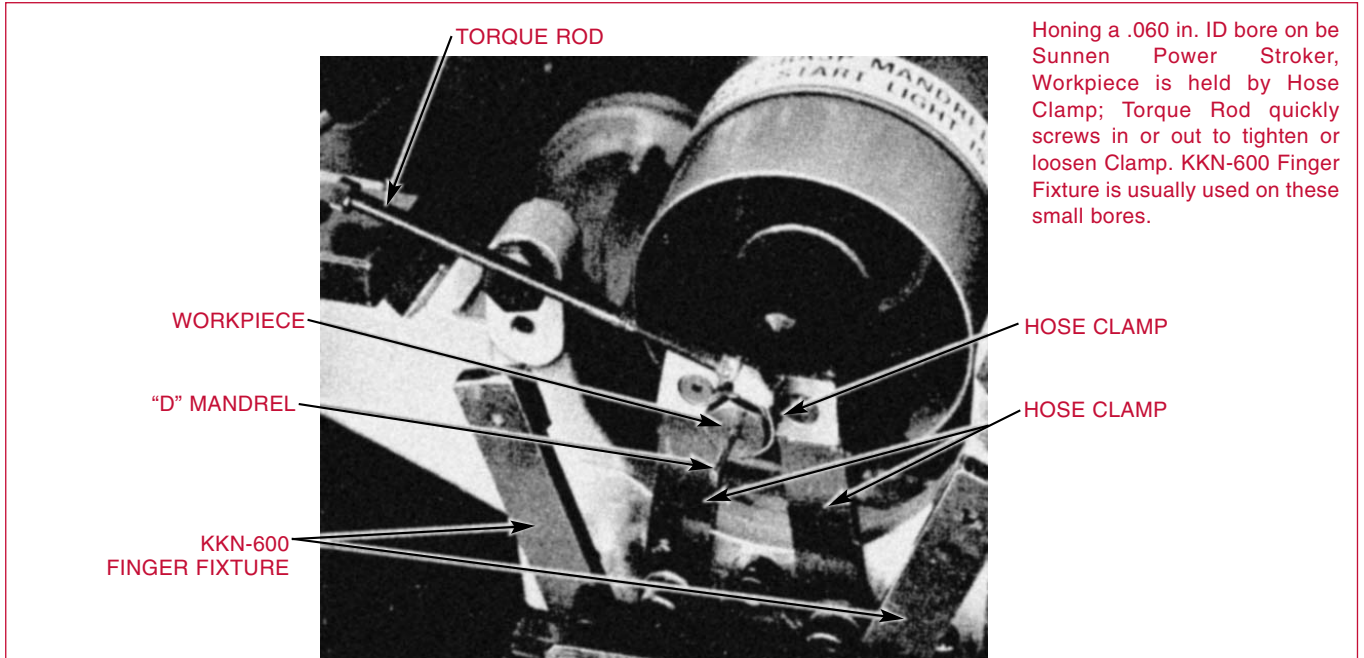
POWER STROKING SMALL BORES

Most bores in the .060-.3125 in. (1,5-8,0 mm) diameter range can be power stroked. In many cases, power stroking does an even better job than manual because the stroke length is consistently correct, preventing the shearing of these small stones by improper stroking (see Figure 6).

On relatively heavy workpieces, correct fixturing is vitally important when power stroking. See Figures

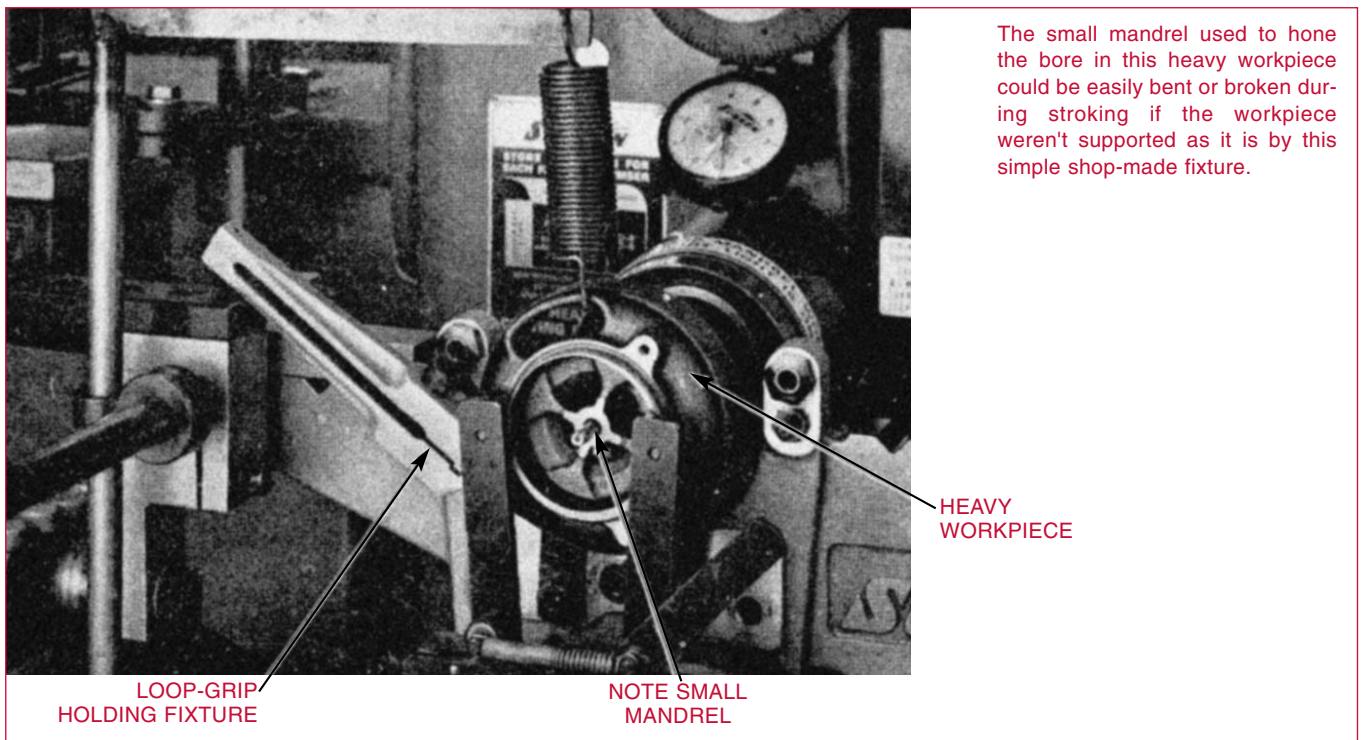
7 and 8 for examples of fixturing for supporting a heavy workpiece with a small bore.

Long parts with small bores are often difficult to power stroke because of the problem of supporting the part in a fixture. As you can imagine, the small mandrels used just can't stand too much weight on them, so long bores are usually more successfully honed by hand because the operator can support them.



Honing a .060 in. ID bore on a Sunnen Power Stroker, Workpiece is held by Hose Clamp; Torque Rod quickly screws in or out to tighten or loosen Clamp. KKN-600 Finger Fixture is usually used on these small bores.

Figure 6, Hose Clamp



The small mandrel used to hone the bore in this heavy workpiece could be easily bent or broken during stroking if the workpiece weren't supported as it is by this simple shop-made fixture.

Figure 7, Heavy Workpiece

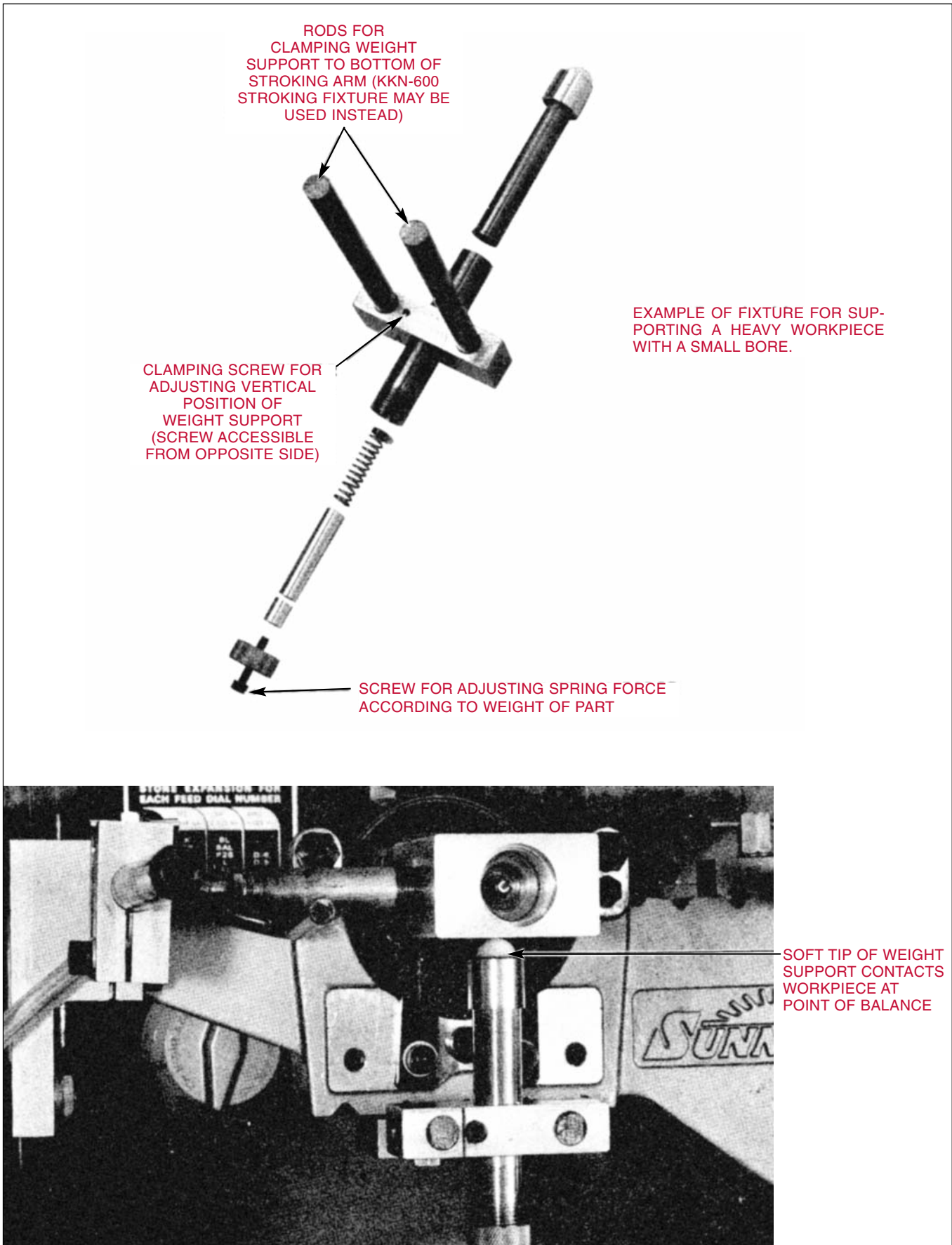


Figure 8, Heavy Workpiece

NOTES

data files

- 101 - Honing Bores With Keyways And Splines
- 102 - Honing Short Bores
- 103 - Honing Blind Holes
- 104 - Obtaining Specified Finishes By Honing
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- 112 - External Honing
- 113 - Fixturing Design Considerations For Automatic Krossgrinding® Machines

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The fully equipped Automotive and Industrial Technical Service Centers in St. Louis is available to help with any honing problem at any time without cost or obligation. Sunnen factory-trained Field Service Engineers cover the entire country and are always at your service - again, no cost or obligation. Call us whenever you have a bore-sizing problem.

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