MAKING AN EDGE-FINDER

In the Oct/Nov issue we published an article on using the edge finder; in this article D.J.P. recaps very briefly on this, then proceeds to detail the design and requirements for making one

In the first Winter Edition of *Model Engineers' Workshop* there was an article on the use of Datums. When doing many jobs in the workshop it is necessary to position a drill or cutter in a precise position over the work surface. One way of doing this is to use an edge or edges of the material as Datum points.

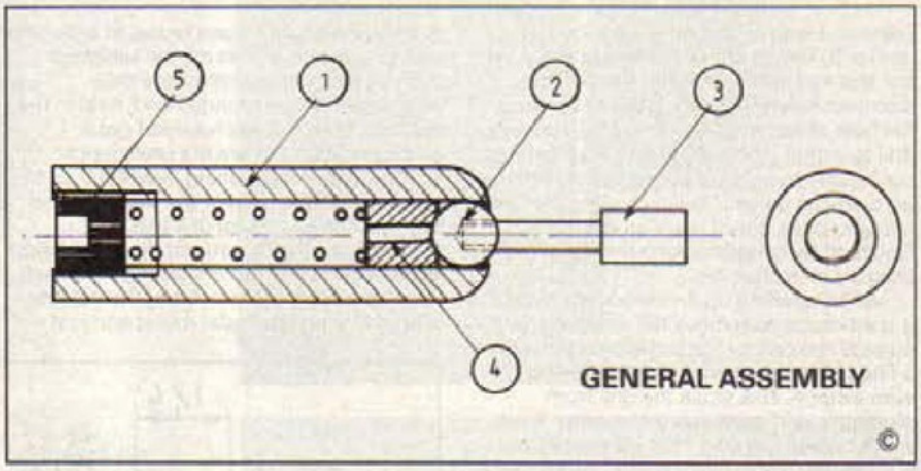
The problem then arises of positioning the cutter or drill exactly over the edge in question, so that the graduated feed screw can be used to position the cutter or drill in exactly the right position. This is where the edge finder (E.F.), described in this article comes in so useful.

It is tempting to try and just touch the edge of the material with the drill or cutter, using engineer's blue, and then winding over the feed half the tool diameter to position the cutter exactly over the edge, but as we all know to our cost this often ends up with an unsightly cutter mark on our latest masterpiece.

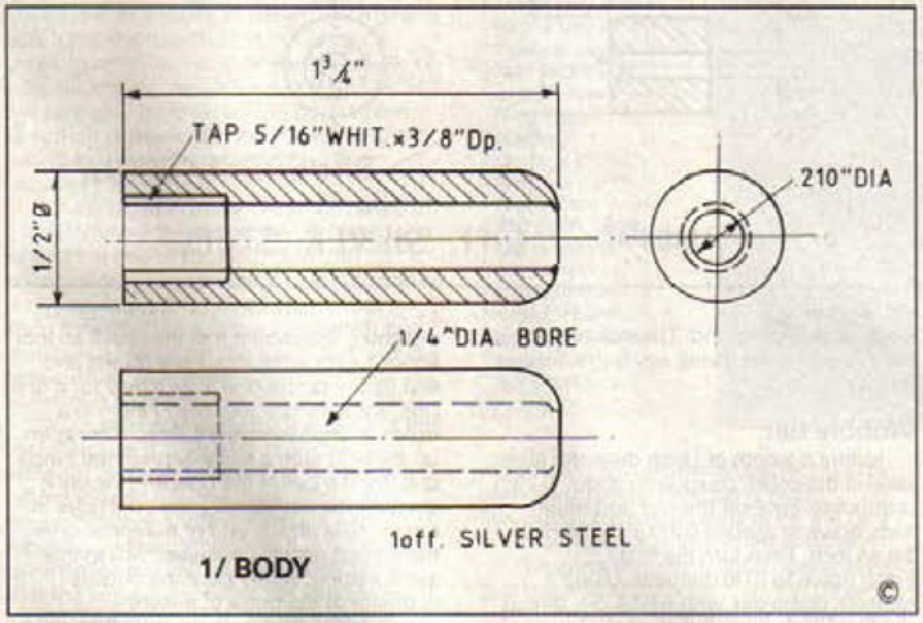
Using the edge finder the job becomes child's play. Position the E. F. in the chuck or collet and set the tip of the wobble bar so that it is about $\frac{1}{4}$ inch below the top surface of the work. Start up the machine and the wobble bar will spin out of true. Using the feed screw, slowly wind the E. F. into the edge of the workpiece. The run out of the wobble bar then gradually decreases as the edge of the material restricts its swing. Continue until the wobble bar is seen to be running dead true; if you go too far, the wobble bar slides along the surface of the work and you must withdraw the E.F. from the work and start again. Once you have the wobble bar running true you have the machine spindle exactly 0.100 inch from the edge of the work i.e. half the diameter of the tip of the wobble bar. Replace the E. F. with the cutter or drill that you wish to use and wind the feed to exactly where you wish to cut.

If you have doubts about the accuracy of this simple device, or your ability to see when the wobble bar is spinning dead true, just try it out in the workshop and you will be amazed at how easy it is to get repeat readings on the graduated dial of your feed screw time after time.

Because old habits die hard, I have used Imperial measurements for its construction, but it is just as easily made out of metric silver steel so that it will fit your metric collets. And the tip of the wobble bar could easily be 5mm, so that you would have to wind over the lead screw 2.5mm to position your tool over the edge of the workpiece.



GENERAL ASSEMBLY



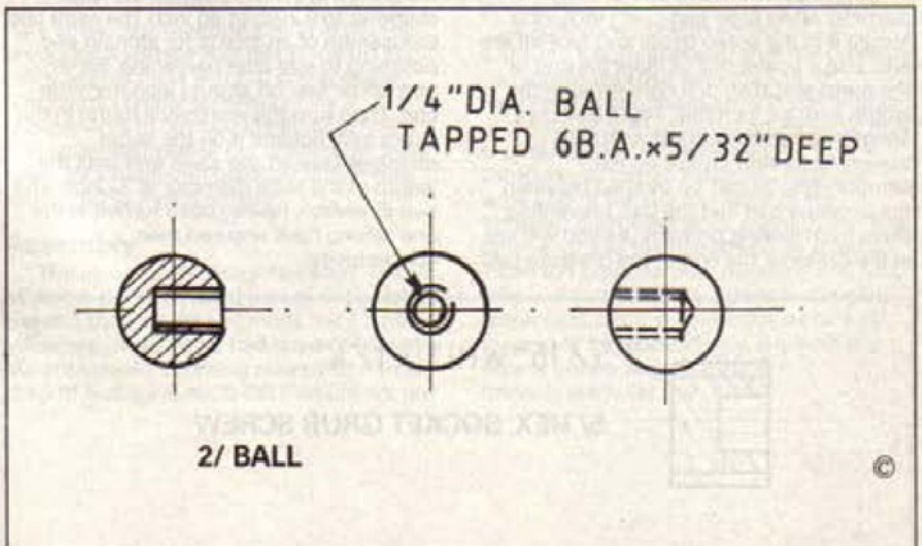
1/ BODY

Just one final point before I go on to describe the construction. If you haven't got a mill, don't jump to the conclusion that this device is no use to you on your lathe. It works just as effectively in the horizontal plane and can be used very effectively with work set up on the vertical slide.

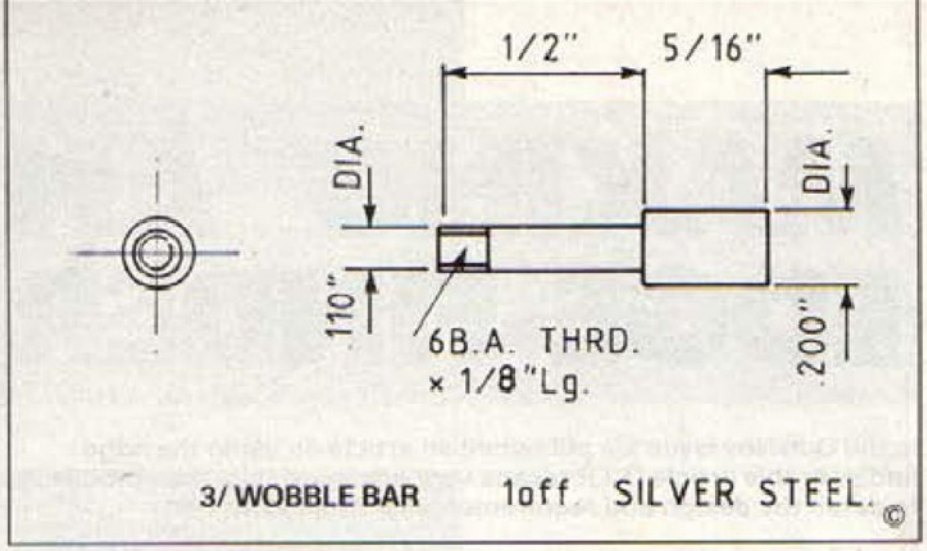
Construction

Cut off a piece of $\frac{1}{2}$ inch diameter silver steel to a length of approximately $1\frac{1}{8}$ inches and position it in the lathe collet/chuck, so that it protrudes about $\frac{1}{2}$inch. Face off the end, and use a centre drill to mark the end of the material. Use any suitable drill, smaller than a No. 4 drill, and drill right through the length of the silver steel. If you are not used to working with silver steel, remember to use a slower spindle speed than for mild steel and use a coolant.

Then turn the steel round in the chuck/



2/ BALL



collet and face off the other end. Do not reduce to length at this stage, just clean up the end and lightly chamfer the outside diameter. Now use a ¼ inch drill to open up the hole already through the steel, but only drill to within ⅛ inch of the end. As this does not require to be an accurate depth, use the graduations on your tailstock spindle or use a rule to put a pencil mark on the drill. Finish off by countersinking the hole with at least a ⅛ inch chamfer.

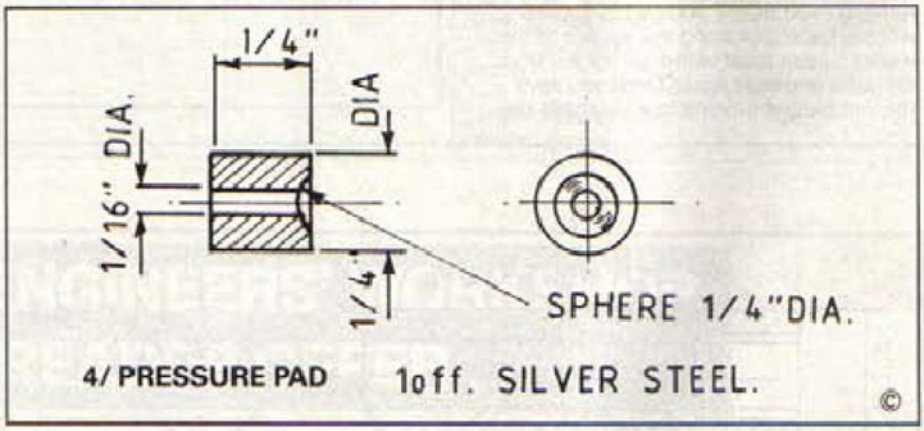
When opening up an already drilled hole it is advisable to remove the sharp cutting edge of the drill by lightly touching them on a fine grinding wheel and then rubbing with a stone. This stops the drill from digging in and produces a smoother finish, while cutting a tighter hole. Of course you will need to resharpen the drill before using it again for normal drilling.

While on this setting, use the tailstock chuck to hold a 5/16 inch Whitworth tap to start a thread in the end of the body. Use plenty of cutting compound and repeatedly back off the tap to clear the swarf or you will find that the body starts to turn in the chuck/collet. Tap to a depth of about ¾ inch.

Now again turn the work round in the chuck/collet and open up the smaller diameter with a suitably prepared No. 4 drill. Now you will realise the value of not previously finishing the length, for it is possible to carefully face off the end of the material until the length of the smaller diameter is reduced to only a few thousands of an inch. This is necessary to leave the maximum amount of material to retain the ball end of the wobble bar in the body, while at the same time allowing the ball to protrude through the hole to allow a good degree of wobble. Finish off by turning a suitable radius on the outside diameter to give a pleasing effect.

Pressure pad

Cut a piece from a length of ¼ inch diameter silver steel just over ¼ inch long. Mount it in the collet/chuck and face off the end. Use a centre drill to mark the end of the metal and then drill right through the length with a ⅛ inch drill. This hole is not obligatory, but does assist with final assembly, as with grease on the components, air can be trapped between the pressure pad and the ball, preventing them from sealing properly. As you will see in the drawing, the end of the pressure pad is shown with a concave radius to allow the ball to seat into it. This can be achieved with a ¼ inch radius cutter, or a drill sharpened with a rounded end, held in the tailstock chuck. If you have not got a suitable cutter and are not proficient at handheld drill sharpening, it will suffice to lightly indent the end of the pressure pad with a ¼ drill or countersink to a depth whereby the flat face round the indentation is reduced to a width of about ⅛ of an inch. After removing any burr from the outside diameter, turn the metal round and just clean up the other end. The exact length is not critical, so removing any burrs finishes this part.



Wobble bar

Mount a length of ¼ inch diameter silver steel in the collet/chuck with about 1¼ inch protruding. Face off the end and rough turn, down to around 0.210 inch diameter, for an inch. Then turn the first ½ inch down to 0.110 diameter. Using a tailstock dieholder, with a 6BA die, thread the first ¼ inch. Now finish off the large diameter to 0.2005 of an inch; the extra half thousandth of an inch is for stoning and polishing to size after hardening. Either part-off or saw off about ⅛ inch from the end. Then turn the workpiece round in the chuck and, holding it on the larger diameter, face off the sawn end until the length of the large diameter is 5/16 inch. The two diameters having been turned in the one setting have ensured their concentricity.

We now need to prepare the ball, which is going to be the other part of the wobble bar. It is made from a perfectly standard ¼ inch ballbearing, which has to be softened, drilled and tapped, and then rehardened.

To soften the ball it has to be heated to cherry red and then allowed to cool slowly. When I was working as a toolmaker, we used to have a box of powdered chalk into which we put heated components to ensure that they cooled slowly. The average household is not likely to have this facility, but I have found that ordinary dry cement serves the purpose.

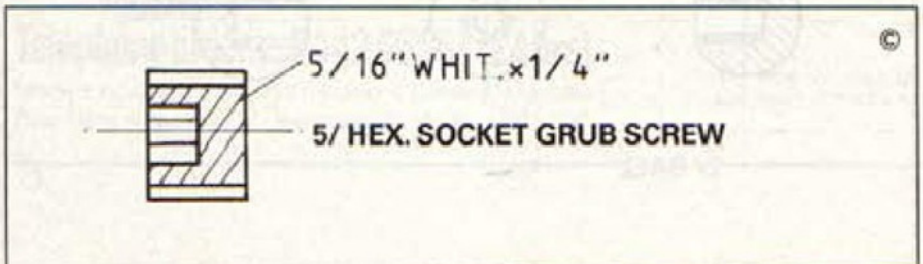
I used a length of wire with a small circle bent at one end, into which the ball rested, to hold it in the flame of my propane torch. Once it was cherry red, I dropped it into a tobacco tin containing fresh cement and covered it over. When I later removed it, it was quite soft enough to be drilled and tapped.

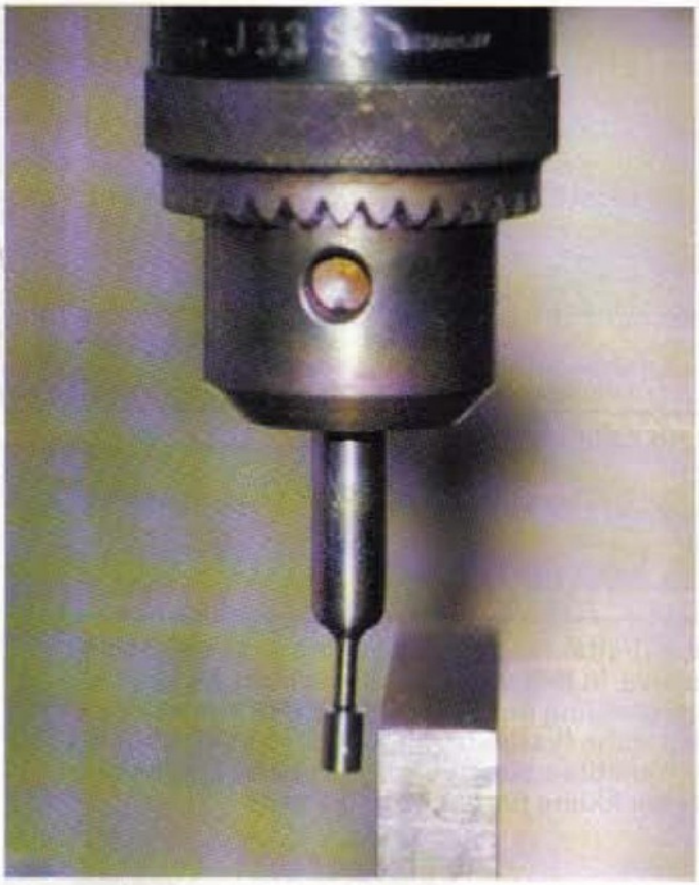
Holding the ball

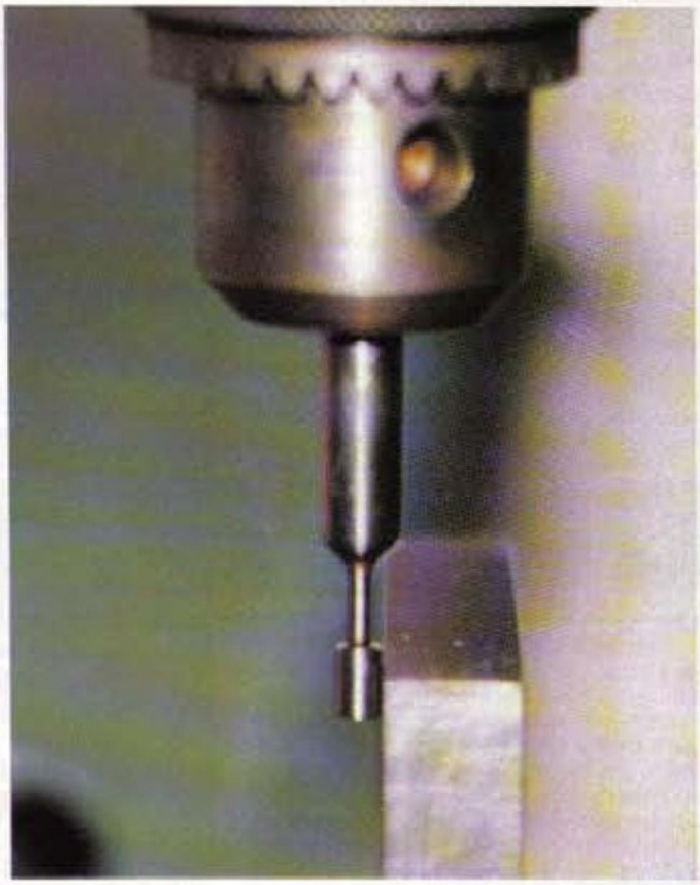
How exactly does one hold a small ball to be able to drill and tap it? The easiest way is in a collet, with a short piece of ¼ inch bar pushed into the collet first to stop the ball from going in too far. If you don't possess a collet, an alternative method has to be found.

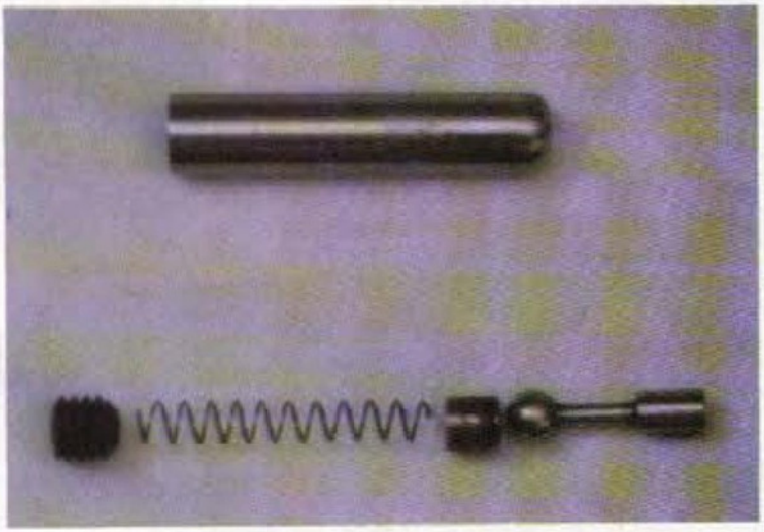
Take a short length of brass, about ½ inch diameter, and mount it in the chuck so that about 1 inch protrudes. Face off the end and lightly centre-drill it, as a lead for a drill. Drill, with any drill less than ¼ inch, to a depth of approximately ⅝ inch. Then open up the hole with a suitably prepared ¼ inch drill. Try the ball in the hole and ideally it should protrude about ⅛ inch. If it goes in too far, face off the end of the metal until the correct result is obtained. Still in this same setting, lightly skim the outside diameter of the brass to ensure concentricity. Now part or saw off as close to the chuck as is reasonably convenient. Place the piece sawn off into the chuck the other way round and after facing off the end, turn the outside diameter down by about 0.010 inch to within ⅛ inch of the end which has been drilled. Remove the metal from the lathe and, using a hacksaw, cut two slots centrally and at 90 degrees to each other longitudinally in the end containing the hole to a depth of about ½ inch. You will then have a type of split collet which you can place in your chuck. When the chuck is tightened it will close on the end containing the hole and clamp the ball tightly without marking it.

With the ball mounted in either a collet









Top left: Although the chuck appears stationary due to the use of flash, it was in fact turning. It can be seen how the run-out is decreasing as it nears the workpiece. Top right: Here the wobble bar is now running true. Right: The components ready for assembly.

or your specially made jig, face off a very small flat. This is so you can use a centre drill to mark the end, before drilling with a No. 43 drill to a depth of about $\frac{3}{16}$ inch. Use a 6BA taper tap mounted in the tailstock chuck to carefully tap the hole to a depth of $\frac{3}{16}$ inch, finishing off with a plug tap. The ball will probably be fairly tough, so use plenty of cutting compound. The rehardening can be left to later, when you do the other necessary hardening.

As will be seen in the drawing, I used a $\frac{1}{4}$ inch Whitworth grub screw by $\frac{1}{4}$ inch long to seal the end of the body and put pressure onto the spring. If a suitable screw is not available, it is just as easy to cut a short length off of a $\frac{1}{4}$ inch Whitworth bolt and, having faced off the sawn end, put in a screw driver slot, either with a slotting cutter or a hacksaw.

Silver steel was used for the parts of this tool, because it is so easy to harden and temper. I hardened the end of the body, where the ball sits, the large diameter of the wobble bar and the pressure pad, and I rehardened the ballbearing. It is necessary to reharden the ball and I certainly think that the large diameter of the wobble bar should be hardened, as in use it receives a lot of rubbing as it makes contact with the surface of metal. However, with the limited use this tool would get in a home workshop the pressure pad and body end could probably be left soft.

The body was heated at the one end to cherry red and quenched into oil. Similarly I did the same with the large end of the wobble bar. The pressure pad was strung on a piece of wire and heated throughout to cherry red before quenching. The ball bearing was heated in the same way as for the annealing, but this time it too was quenched in oil. I used old engine oil discarded from my car for the quenching. (Leave it uncovered for a few hours first so that any dissolved hydrocarbons will evaporate). This produced perfect results without subjecting the parts to the likelihood of cracking, as is often the case when silver steel is quenched in water.

The parts were then lightly polished, so that the colour produced by heat could clearly be seen. I then heated all the hardened components until they were a dark straw, before requenching in oil. This produced a surface that has stood up to many years of use without any apparent detriment. I finally polished all the components to remove the heating colour. The large diameter of the wobble bar was carefully stoned and polished until it was exactly 0.200 inch diameter.

Assembly

The assembly is straightforward. First of all screw the silver steel part of the wobble bar into the ball. When I made my E.F. many years ago, I had never had any trouble with the components coming apart, but a small drop of Nutlock (Loctite 241), would not go amiss if it is readily available. In fact on reflection, with modern locking components, it would probably be quite satisfactory to just drill the ball and make the small end of the wobble bar a push fit into it. It could then be assembled with Loctite 601, and would probably be quite serviceable.

A light compression spring, of just sufficient length to ensure that the pressure pad makes contract with the ball, is required. Do not use too much pressure or you will find the tool is not as sensitive as it should be. Lightly grease all the components before assembly. Push the large end of the wobble bar into the threaded end of the body and right out the other end until the ball sits on its seating. Insert the pressure pad, recessed end first, followed by the spring. Screw in the grub screw until it is just below the surface of the end of the body. Finally, wipe off any excess grease and your edge finder is ready for use.