MODEL ENGINEERS' WORKSHOP

Optical Centre Finder

'Bluey' wrote this useful article which appeared in Model Engineers' Workshop, issue One in 1996. Anyone familiar with his distinctive writing style will immediately realise that 'Bluey' is one of the pen-names Stan Bray used when he was Editor of MEW.

Thanks to Bill Coombs 'Cornish Jack' for help in preparing this version.

HOME MADE PRE

O P T I

When you are setting-up work or marking out, do you sometimes sigh "oh for a pair of eyes"? In this ingenious feature 'Bluey' comes to the rescue with an easily made pair of aids for your workshop. You'll find this optical centre-punch and centre-finder indispensable and they'll cost a fraction of what you'd pay for commercial items.

The completed optical centre-finder in the milling machine; in actual use it would be brought closer to the work than shown in order to line it up accurately.

Centre punching is a tricky business although in theory there is nothing to it! What *should* happen is that the centre punch should be used at the junction of two scribed lines and should be drawn along one until the intersection is felt and then at that point tapped with a hammer. I am sure most of us follow this excellent advice only to find that the punch has slipped out of position before being hit and we then have to start laying it an angle and trying to retrieve the position. (It is rather like sawing the legs of a chair to make it shorter — we keep going a bit more and a bit more until the whole thing becomes quite a mess.) The result is often an elongated punch mark more or less on the spot required but because of its shape, a drill, and particularly a small diameter one, is likely to wander some way from where we really want it to be.

The optical centre punch

I had seen advertised an optical centre punch and at an exhibition actually saw one. I must say that I was quite impressed.

However, buying things that can be made is not my way and so next day it was into the workshop and a start was made on scheming out an optical punch for myself. Although made from odds and ends which happened to be around my own workshop there is nothing required that is not very easily obtainable.

The actual punch is 3/8ths in. diameter and, whilst my own was already around in the workshop and was pressed into use, there is nothing difficult about making one from silver steel, hardening and tempering it to a straw colour. The actual sizes shown suited me, but there is no need to comply with them if convenient materials are to hand. The point on the centre punch is shown as an included angle of sixty degrees, which is the angle I prefer. Technically speaking, the angle should really be ninety degrees to allow the drill to seat better in the punch mark, sixty degrees being normally used for initial marking-out and the mark then opened out with a punch at ninety degrees. However, all this is a matter for the individual.

The support body

The support body was machined from a piece of 1in. diameter aluminium but could just as easily be mild steel or brass if these are more convenient. The central hole should be bored or reamed to a good fit as there must be no slop on the punch when it is inserted. A groove is machined in the end and this accepts an 'O' ring which stands just proud of the actual body and so prevents the thing from sliding around whilst being lined up.

The insert

The original optical insert was made from perspex and actually machined from a piece of sheet material, no other being available. Also, originally it was parallel; there was no magnification and not as much illumination as one might have wished for, so, whilst visiting the 1990 Model Engineer Exhibition, I purchased a piece of 20mm diameter acrylic rod from College Engineering Supplies. I then made a new insert with a domed top which gave more light at the base and also provided a degree of magnification. Acrylic is not quite so easy to machine as perspex as there is a tendency for it to string. However, both are quite reasonable to work with.

Polishing

The insert must be highly polished and this was done with Solvol Autosol which can be obtained from most car accessory shops. It is rubbed on with a cotton cloth and then buffed hard to give a good finish. I should point out that it is essential that the original machining must also be to a fine finish to prevent excessive polishing being required. I also polished the support body by the same method.

Very fine marks (cross hairs) must be made across the bottom of the insert and these line up at the place where the centre punch mark is to be made. These can be done in the lathe using a sharp pointed tool which is drawn across the face, the lathe then rotated through ninety degrees and the operation repeated.

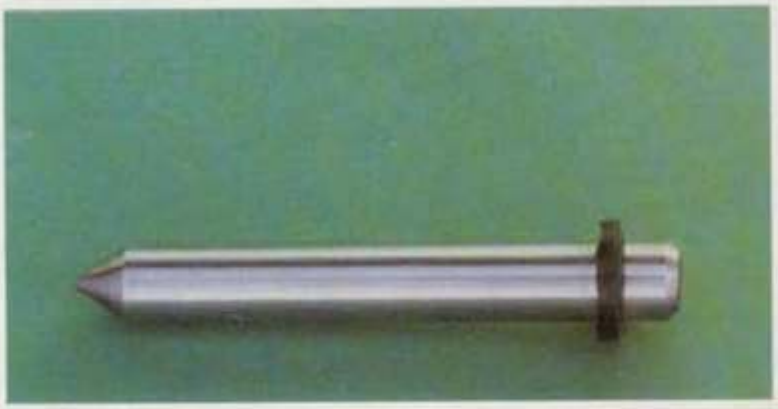
CISION

C S

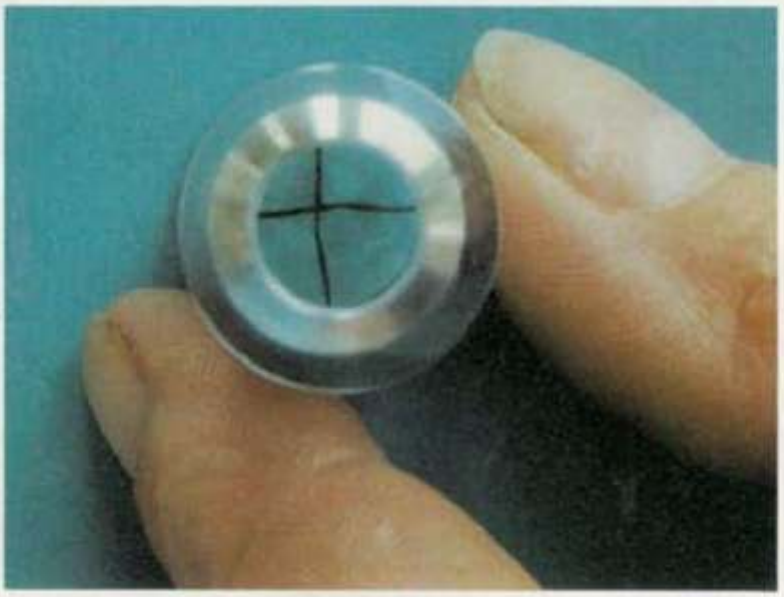
Of course, such an instrument relies on accuracy in the first place. There must be no slop on either the optical insert or the punch, as this would immediately lead to errors when in use. Care must therefore be taken to ensure that the point on the punch is made accurately. If the three-jaw chuck of the lathe is not one hundred percent accurate then set the punch up in the four-jaw chuck. Failing this, use a larger diameter piece of metal than required and turn the parallel shank and the point in one setting. Part off the excess larger diameter material and the punch *must* be right. Similar precautions must be taken with the insert and, in particular, care must be taken to ensure that the tool used to scribe the cross hairs is absolutely on centre height.

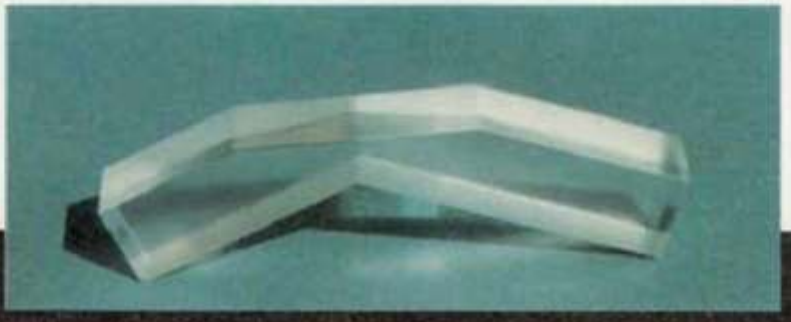
The centre-finder

The centre punch proved a delight to use, making marking-out both extremely quick and very accurate. Fired with enthusiasm, I looked at a very expensive piece of equipment in the form of an optical setting-up guide. We all know the problems: some form of pointer or a wiggler is put in the milling machine and



Top left, the body of the optical centre punch; this one is from aluminium but almost any material will do. Top right, the magnifying lens for the tool. Made from acrylic, it is a simple turning exercise; shank must be a good sliding fit in the body and the large diameter rounded at the end to provide magnification. Next down, the centre punch. This, too, should be a sliding fit in the body; the 'O' ring at the top has no effect on the operation of the tool but makes it easier to handle. Next down, the ends of the body and magnifier. The 'O' ring recessed in the body prevents accidental movement when adjustments are made. Black felt-tip pen ink wiped over the base of the magnifier picks out the cross-hairs. Near right, the body with magnifier ready to be positioned over the work. Far right, when the body is in the correct position the magnifier is removed and replaced by the centre punch.





brought to the work. Sometimes the setting can be done quite easily and no real concentrated visual observation is needed. On other occasions it is impossible to get the light exactly as required to see what one is up to, and if the light shines on the point of interest then it casts a shadow that makes it impossible to see exactly what is happening. Usually in these circumstances we resort to the use of a magnifying glass, which invariably is covered with dirt when needed, or hides itself away in a corner of the workshop (like on the marking-out bench) and cannot be found until other methods of setting up have been resorted to!

But an optical centre finder sounded quite formidable, and judging by the price they must be made of pure silver. So if I can make an optical centre punch, why not an optical centre finder? I picked up a piece of aluminium of what I thought would be a suitable diameter and started experimenting. Originally I made the optical insert from two pieces of perspex which were to be joined. That caused problems as any adhesive would have upset the optics. I then hit on the idea of making it from a single piece of material.

The material I used was thicker than required and was very scratched and so I had to machine all faces. This will not be necessary if the correct thickness of material is available. Perspex is not hard to come by in sheet form, a quick look in the Yellow Pages under plastics will, in most areas, reveal several suppliers and most of these keep boxes of odds and ends. The betting is that if you pay a visit to one then you will come home with bits of PTFE and all sorts of things.

My thicker diameter material was fly-cut with a very fine feed and this produced an almost polished finish all over, the only parts that really have to be polished up to a mirror finish are the two square ends and the twenty two and a half degrees chamfer. Again Solvol Autosol was used for the final polishing.

Top, the assembled optical centre-finder; it is absolutely essential that the lens lines up centrally in the body if accuracy is not to be impaired. Next down, back to the optical centre punch instrument for a moment and a good view showing the inked cross-hairs. At far left, the body of the centre-finder showing how the slot has been milled out to accept the lens. Near left, this frontal view of the body shows the two angles required accurately to position the lens. The angle value of the body itself is not critical, provided, of course, that it is matched precisely by that of the lens. Below left, the centre-finder lens. In the prototype, this was cut from a sheet of Perspex and polished. The angle enables the operator to look round the corner to the point of setting.

The body

The body was made, in my case, from 1 in. diameter aluminium, but brass or mild steel would do equally well. The bar was first machined as required in the lathe and then the slot was milled out with a 3/8 in. diameter cutter in two separate operations. The first operation was to machine a slot 11/16 in. deep and 3/4 in. long. The work was then carefully re-positioned in the vice and a second slot machined at an angle of forty five degrees so as to intersect the first slot at 3/4 in. from the end.

Assembly

The two components were assembled ensuring that the protruding end was parallel to the body. To do this, temporarily fix it in place, stand the assembly vertically on a surface plate or, if you do not have a surface plate, on the drilling table or some similar object. Check right round the body to ensure that it is upright. When you are quite sure it is right, the assembly can be permanently secured with an epoxy adhesive ensuring that the adhesive does not touch the polished twenty two and a half degrees angled face. When the adhesive has thoroughly set, any excess can be scraped off.

The whole unit is now mounted in the lathe ensuring it is absolutely centralised, and the cross hairs engraved in the same manner as with the centre punch.

Using the centre finder

To use the centre finder, mount it in the spindle over the work. Adjust the table in either direction until the cross hairs are located exactly at the point required. Lock the table in position and raise the spindle to remove the centre finder which is replaced with the cutter. Do not, of course, alter the table position until cutting has started.

The tool proved remarkably easy to make and is one of the most useful little devices I have ever made.

A final view of the optical centre punch outfit; left is the punch itself, at right the support body and sight.