

No.140

JULY 2008

MODEL ENGINEERS' WORKSHOP

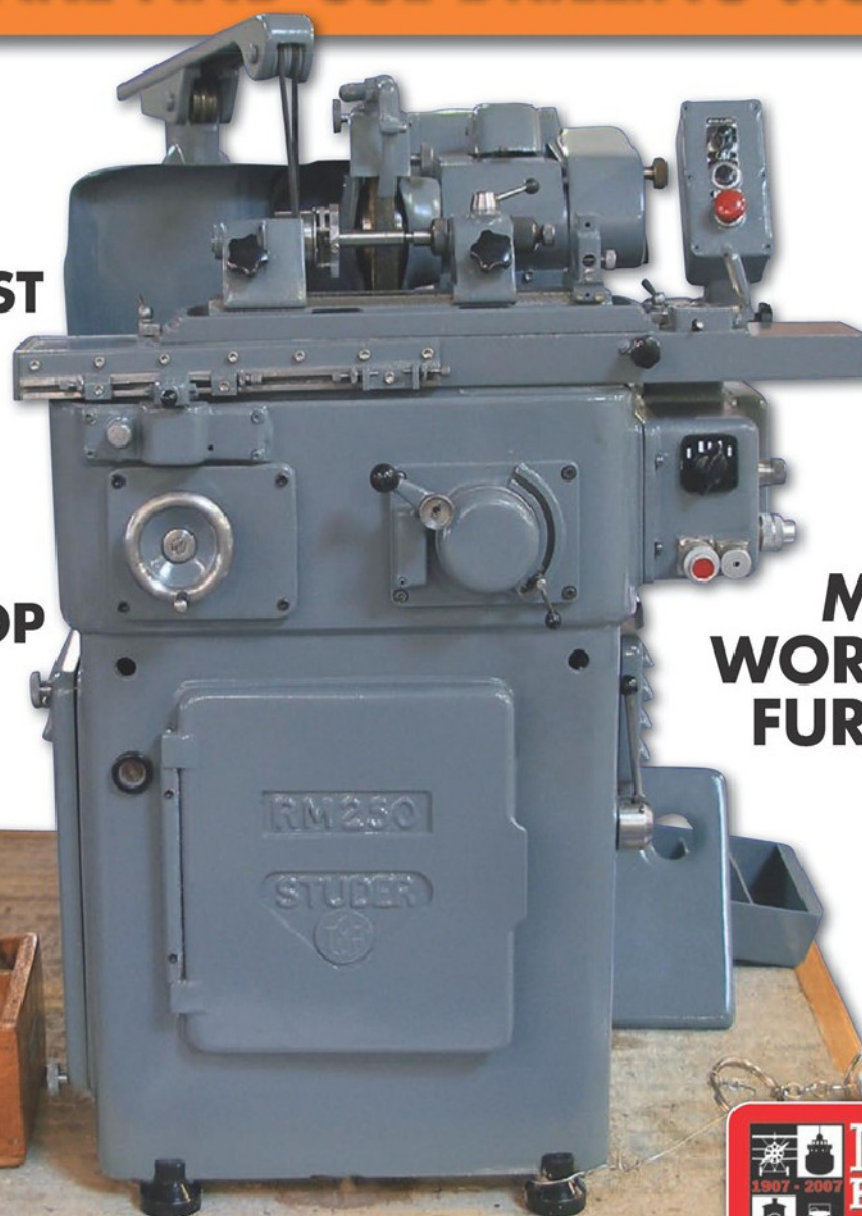
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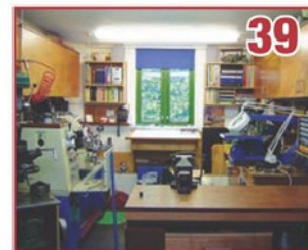


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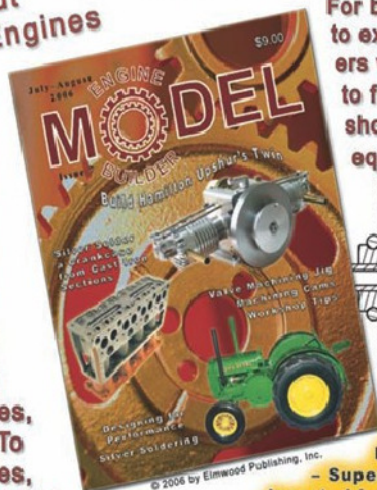
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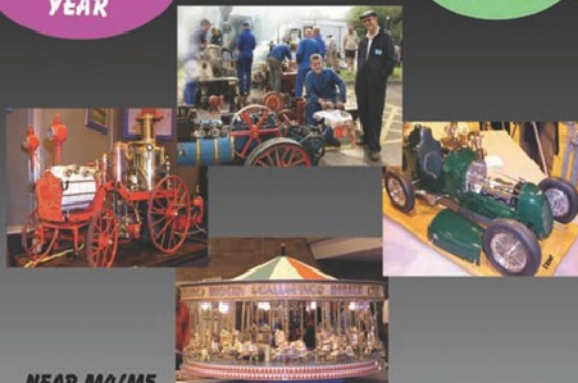
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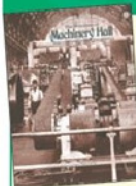
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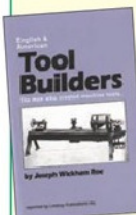
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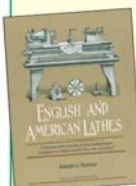
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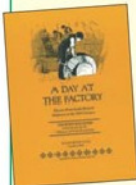
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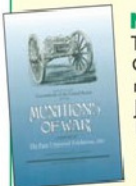
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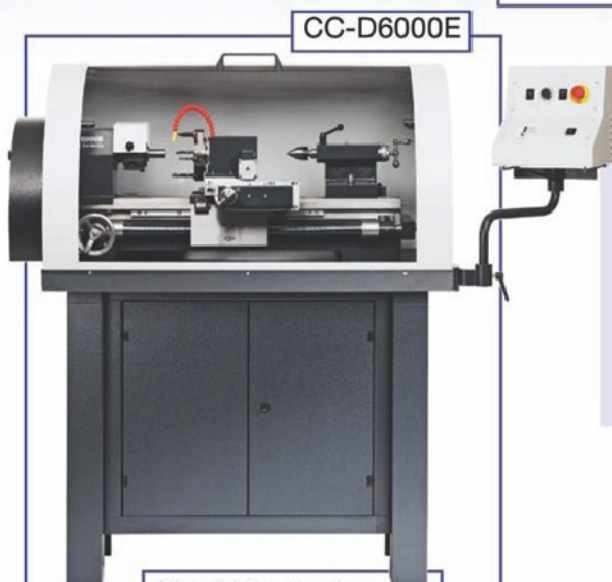
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Feed 0,085 and 0,16 mm



D6000E High Speed

Centre distance 600 mm
Centre height 135 mm
Power 2,0 kW, 230 V, 50 Hz
Spindle speed infinitely variable
100 - 5000 r.p.m.
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David Clark

The Harrogate Exhibition

Well, I went to the Harrogate Exhibition and thoroughly enjoyed myself. It was again an excellent exhibition. Lou Rex, the organiser and his team of helpers put on a grand show. I wandered around for a couple of days talking to readers and the trade as well. I spent too much money as usual but I only visit exhibitions twice a year so feel justified in spending a few pounds.

Slight changes to this issue

I have had to make some slight alterations to the contents of this issue. While at Harrogate (or possibly just before) I picked up a nasty little bug. It was probably food poisoning but could have been a virus. This has left me with insufficient time to do the Practical Engineer (fitting a chuck to a backplate) and the MACH 3 articles. Scribe a Line is also absent. Fortunately, I had finished well over half of this issue before travelling to Harrogate. Dave Fenner stepped in and edited a couple of articles for me and also wrote the Harrogate review pages, thank you Dave. I have taken this opportunity to ask Dave to update us on his motorbikes and workshop and his commentary appears next.

Hark back to the workshop - Dave Fenner writes;

I have to confess to being something of a "grasshopper mind" and therefore am totally unsuited to long term dedication to a single project. Since vacating the editorial chair, a number of projects and shifts of interest have taken place. Regarding the bikes, the mechanical work on the Bonneville reached an effective conclusion with the rebore and wheel rebuild but a tank repaint is still on the cards, the Rickman was fitted with home made rear pegs, and the Honda burst into life at the first kick this spring after the winter lay up.

Working with the Mini-Lathe has occupied a large slice of time over the last six or seven months, and regular readers will be familiar with the series of outcomes described in the pages of MEW. At Harrogate, I collected a sizeable chunk of cast iron from College Engineering, and I hope that lurking inside it, is an extended cross slide, just waiting to get out.

A device, which I briefly started to investigate, is the Hilsch vortex tube. I had come across a reference to this in a tooling supplier leaflet, which advertised

ON THE EDITOR'S BENCH

a device based on this principle for air cooling workpiece's, thus offering a cleaner alternative to liquid coolant. Compressed air is fed tangentially into the tube and exits at opposite ends, one end becoming hotter and the other colder. My Mark 1 version did indeed show a few degrees of difference, but would clearly need improvement for effective work cooling. Any reader interested in following this up, will find starter information on the internet by Googling "Hilsch vortex tube".

The escalating price of oil has caused a reappraisal of domestic and workshop heating and the re-commissioning of the (for several years) neglected multi-fuel stove. A recent offer of about four tons of beech was thus too good to miss, but left me with the problem of splitting the logs. Another one of these "method investigations" ensued, and, if our editor agrees, I'll report briefly on this in a future issue.

The Denford Orac CNC lathe has now been retro fitted with Arc drivers controlled from a PC running Mach 3 software. One notable job done on the machine was to cut the tread profiles on four wheels for a driving trolley. At present this looks a bit like a "seven and a quarter gauge skateboard", but it is intended to be coupled to a "Toby" style electric tram engine. From an ergonomic viewpoint the Orac still leaves much to be desired, but it is fully functioning and the new software is light years on from the original. Again, with editorial agreement, the refit may form the subject of a future article, which would include circuit detail for the interface board designed by John Curtis. (Yes please, Editor.)

Away from machines and tooling, a couple of engine projects have occupied my mind. Many model engineering projects require the use of castings and it seems to me that one of the barriers, particularly to the newcomer, is the cost of castings and of raw materials especially the copper, brass, bronze variety.

The first was a water cooled horizontal four stroke engine (1.25in bore x 2in. stroke) designed mainly "on the hoof", using material to hand from the scrap box. It has been run successfully and when the slow running carburettor settings have been sorted out, it may be the kind of thing that can be set up as an operating display, with the ability to chug away for hours at a time (like full size stationary engines) rather than the short duration runs usually seen.

The second is a home design based on the advert picture of the Stuart Puffin oscillating steam engine. It is built mainly from 5/8in. square aluminium bar, and after a hesitant start, followed by a fair time spent running in, it now purrs away

quite happily on about 8psi of compressed air. Clearly these latter projects do not relate to MEW, but short write ups may be offered to sister magazine "Model Engineer".

Articles in this issue

Harold Hall has written about making and using drill jigs and, at a reader's request, has described his saddle stop. While designed for a Myford lathe, this stop could be adapted to almost any make of lathe and will be a useful accessory for most readers. It is different from the stop I described last month in the Practical Engineer series as it can be used on a Myford fitted with a gearbox which my version could not. Jim Whetren has built a useful swivelling base for his vice and a spin indexer. He is also responsible for the really quick change toolpost article.

We also see the conclusion of the two part grinding wheel article and the start of a two part article on workshop furniture. Anything that helps to keep the workshop tidy and tools in check should make good reading and if you put one or two of the ideas into practise, it makes the workshop so much easier to use. I speak from experience, I am one of the most untidy workers ever, getting tools out and not putting them away. I have to make a big effort to tidy everything away after use. Sometimes I just used to buy the drill or tap again rather than spending hours looking for it, not so easy now I live in the middle of nowhere.

SIEG/Arc Euro Trade KX1 CNC mill

Ketan of Arc Euro Trade has sent me the following. "Can we expect to see an in depth independent review of the Sieg KX3 & KX1 anytime soon? I do not see how you can expect orders from serious users without it. MEW is a waste of time in this respect. Will the editor ever get down to cutting metal?" This was from Terry Tusin by feedback form to Arc Euro Trade.

I think Mr Tusin has misunderstood the reasons for the MACH 3 series. The prime intention is to teach you how to set up and program a CNC mill. Yes we will start cutting metal but I have deliberately kept the page length short so as not to upset too many readers and I have shown how to set up the X, Y and Z datum's and how to set up the tool offsets table. We do have to walk before we can run. The articles will get very complex as the series moves on and hopefully even the most competent CNC programmers will learn something useful. Please bear in mind that I too have to learn as I go as although most G code programming systems are similar, they are not all exactly the same and MACH 3 is no exception.

Continued on page 58...

MAKING AND USING DRILL JIGS

Harold Hall increases accuracy and productivity

The understandable desire of the workshop owner to make immediate progress on the job in hand means that pausing to make a useful item, such as a drilling jig, is all too often a task that is bypassed. What then are the purposes and benefits of a temporary halt to the project? Putting the reasons for making a drilling jig in a nut shell, they are; ease of carrying out the task in hand; increased productivity, especially where a batch of parts is to be made; consistency of the parts for which the jig is being used and greater accuracy! Of course, in many cases a component will benefit by more than one of the above conditions when a jig has been made and used. Let us consider therefore what is probably the simplest jig possible and one that gives all the above benefits.

A simple drill bush

Consider the need to make a fairly common component such as that shown in **Sk. 1**. It can be seen that this is a split collar intended to be clamped onto a spindle and having machined the recess, it must be drilled and tapped to take the cap screw for clamping the part. However, with the limited access to the recess, marking out the position is far from easy but with a simple bush that fits into the recess there is no problem, see **photo 1**. Once the hole has been started, the bush can be removed for completing the hole unaided. This simple device satisfies all the above reasons for making a jig as the following explains.

1. With making the drill bush taking only a couple of minutes, it is certainly easier than attempting to mark out the position of the hole, even for a single item.
2. If a batch of parts is to be made then the time taken to carry out the process would without doubt be reduced.
3. With more than one part being made, a consistent result would certainly be achieved.
4. With the bush having been made a close fit in the recess, a high degree of accuracy would result, even for a single component.

Sk. 1

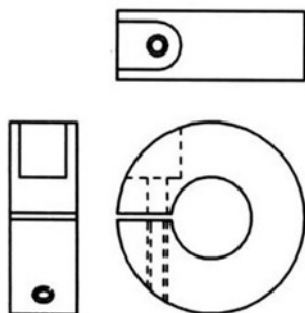


Photo 1. A simple drill bush makes this task an easy one.

Photo 2 shows a similar but slightly more complex task where a hole needed sighting in a split bush but in line with a hole in the frame into which it is to be fitted. **Photo 3** shows the reason for the requirement.

More complex requirements

Most applications for a drilling jig will of course be more complex than the single bush shown above but will range from the quite simple to the very complex. They will also come in very many forms with two factors particularly having an impact on this. Obviously, the greater the number of parts to be made using it the greater is the justification for making a more complex jig that will better achieve the aims, typically, productivity and accuracy.



Photo 2. With a hole having to line up with a hole in the frame, a longer bush achieves the required result.

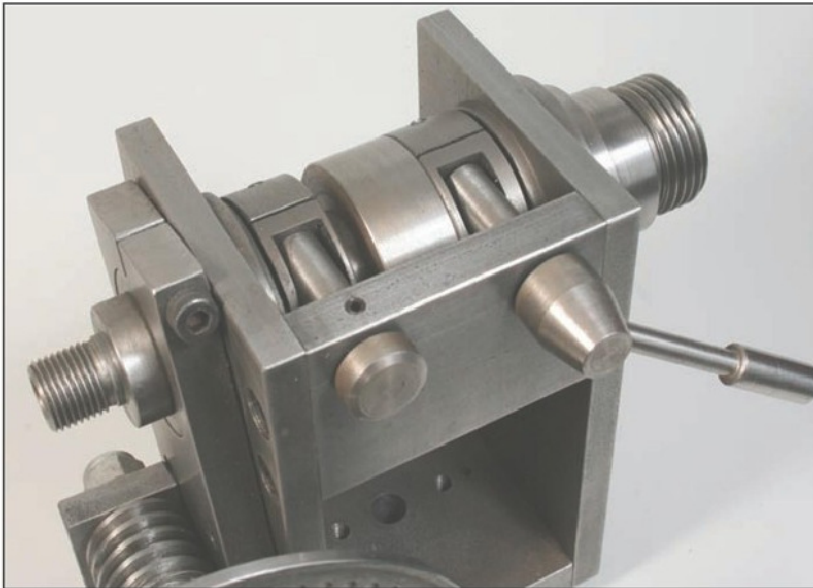


Photo 3. This shows the reason for the operation in photo 2.

Secondly, and the one that cannot be covered in detail in this article is the very wide range of workpiece shapes that exist. Because of this, only some pointers in their use can be covered.

Having chosen to consider a drilling jig for the part being made, there are three factors that have to be decided upon.

First, will the jig simply be a flat plate requiring external devices to position and hold it in place, or will it be complete with provisions for locating and clamping the part into the jig?

Secondly, will the jig just mark out the position of the holes using a smaller drill than the holes ultimately required, or will it enable the holes sizes required to be drilled directly?

Thirdly, is the drill to be guided just by the plate with which the jig is made or are hardened bushes to be fitted.

Whilst the above cover the basic design of the jig, there is a fourth decision that needs to be addressed, that is, what level of precision is required in the hole placing?

I should add at this stage that my comments relate to drilling what are essentially flat items, beyond that, workpieces could range from a simple bracket to complex shaped items.

Flat plate jigs

The simplest form of flat plate jig will be to use the first one of a batch of parts being made as a template to position the holes in the remaining ones. This is relatively straight forward but if the part is quite thin and has large holes, say 10mm diameter into 4mm thick, then it should be used solely to mark out the hole positions using a smaller drill, say 3mm diameter.

For a small batch, say 10 to 25 off, then making basically the same part but out of thicker material should enable the 10mm hole to be drilled through the template directly. A plate thickness equal to or greater than the largest hole diameter should be aimed at.

At what stage you start to use hardened bushes will of course depend on many factors and it is therefore impossible to give a precise ruling. Typically, with the jig having a 10mm thick plate, 200 or more

holes at 4mm diameter may be perfectly acceptable. However, at 10mm anything in excess of the 25 mentioned above may be a problem. This would certainly be the case if the drill chuck was not that accurate and the end of the drill did not run true. In this case, the soft jig plate would soon be opened up.

The above methods do of course depend on the number and position of the holes, being such that adding clamps can be done without blocking out the position of



Photo 4. A form of toolmakers clamp that has distinct advantages in some cases.

some of the holes. You could of course drill some holes and then move one of the clamps to enable more to be drilled but this is rather messy and only acceptable for a very small quantity of parts.

Very useful forms of clamp for the process are the non standard form of toolmakers clamps, available from Arrand Engineering, shown in photo 4 and in use in photo 5. The process shown does rely on the hole sizes being small enough for the assembly to be safely hand held.

The flat plate jig approach is particularly appropriate where large (say wider than 75mm) flat components are to be drilled in smallish quantities. In this case, making a more complex jig would be expensive and only appropriate where large quantities are involved.

A variation of this type of jig worth considering is to make a larger plate and fit pins or screws around the edge to locate it onto the part being drilled, see Sk. 2. Clamps as in photo 5 would still of course be necessary.

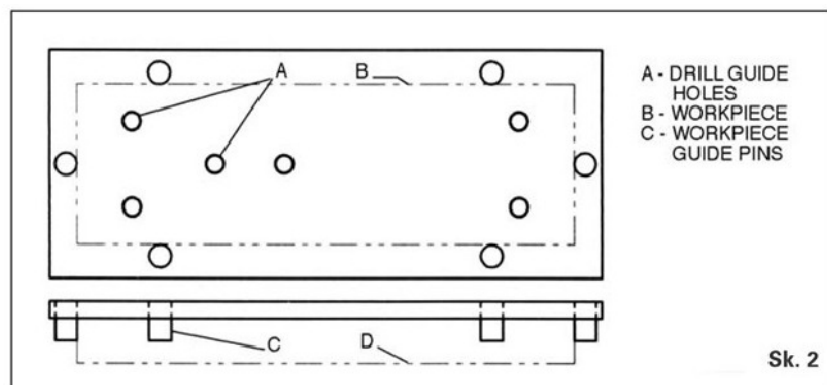
Two part jigs

I use the term two-part loosely meaning a jig with top and base plates. Locating posts, clamps and bushes, would add other parts. These have considerable benefits over the top plate only jig but are of course more complex to make and in most cases only applicable where larger quantities are to be made. However, this may not always be the case and necessity may dictate otherwise.

Where a larger quantity of parts is to be drilled then stacking the parts, enabling more than one part to be drilled at a time, would be worth considering and is a



Photo 5. The clamps in photo 4 in use.



Sk. 2

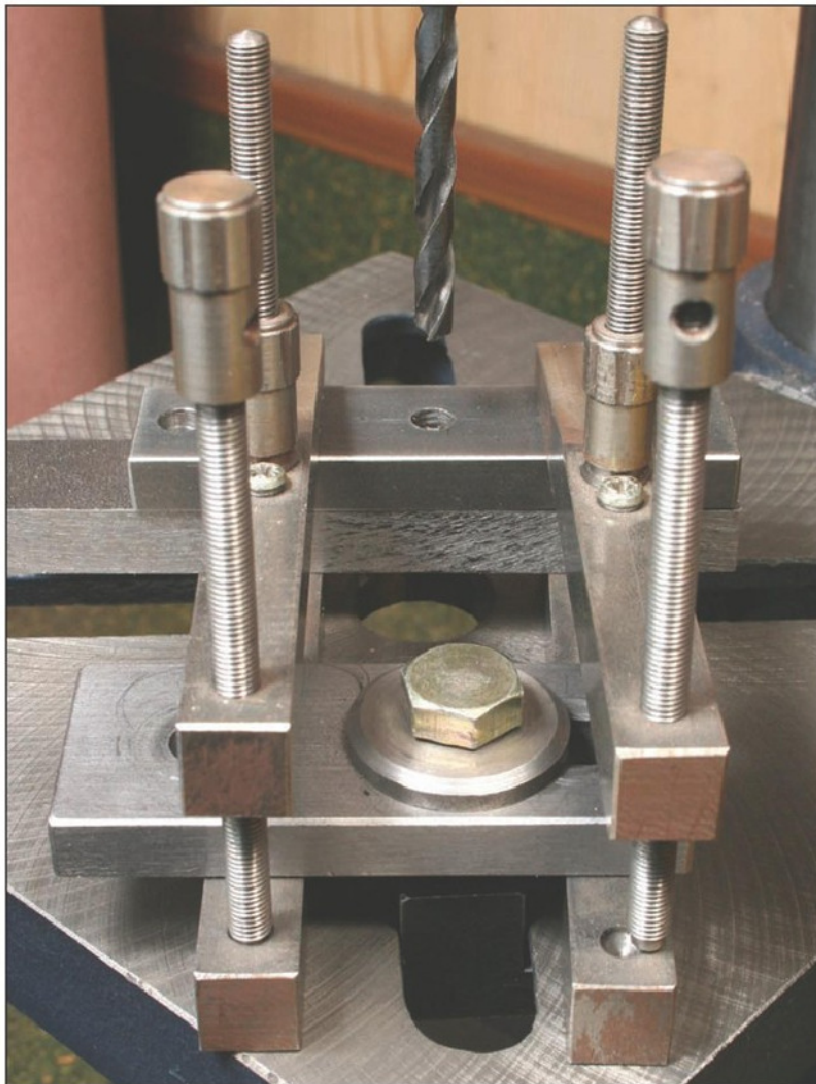


Photo 6. A distinct advantage of the clamp seen in photo 4 is that it can be fastened to the machine table for heavier drilling applications.

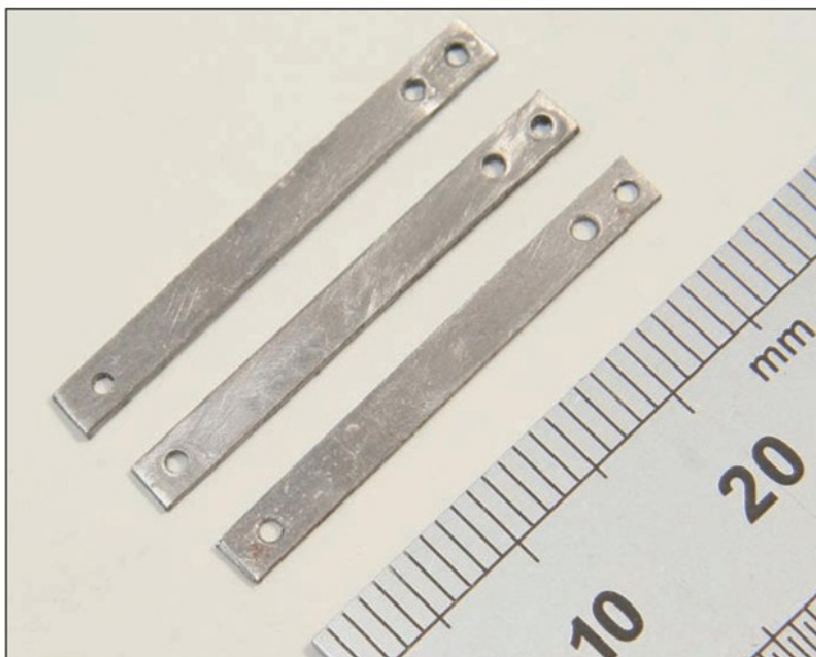


Photo 7. Some very small parts having been drilled.



Photo 8. The ultimate location for the parts in photograph 7.

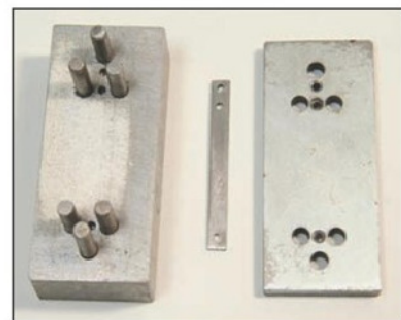


Photo 9. The jig that made the process of drilling the parts in photograph 7 an easy operation.

definite advantage of the two part jig. This though would depend on the thickness of the parts being drilled, say three off if 3mm thick but only two off if 5mm.

One such area where two part drill jigs are very beneficial is in the manufacture of very small parts. These can be so small that marking them out accurately by hand is almost impossible. Being small though, drill sizes will also be small and clamps and drill bushes are therefore unlikely to be necessary.

Photo 7 shows some parts that were required for a model of a Monmouth cart, **photo 8**. As only ten parts were required, a simple flat plate jig would have been more than adequate had they been larger but working at such small sizes, the jig seen in **photo 9** was all but essential.

From the photograph, it can be seen that it consists of a base and a top plate with six pins to locate the part being drilled, that is, one either end and two on each side. The pins are long enough to locate the top plate also. Note that the lower plate is thicker so as to adequately hold the pins.

When working at this size, making the jig accurately would still need some considerable skill if made and marked out by hand. Because of this, using the part's dimensions and the diameters of the pins, the co-ordinates of the holes to be drilled in the jig were calculated. With that done the holes were positioned on the milling machine using the micrometer dials on the lead screws to set the holes in the positions calculated. With that done, the parts were placed into the jig three at a time and drilled. The jig certainly met all four benefits that I laid down at the start, that is; ease of use; improved productivity; consistency; and accuracy. Incidentally, the hole size was 1mm and drilled with my mini sensitive drilling machine, **photo 10**.



Photo 10. The hole size was 1mm and a sensitive drilling machine was required.

Larger drill jigs

Larger versions than that above will work similarly but will no doubt need larger quantities to be made to make them worthwhile. If the job in hand requires a quantity of say 20 plus, then making a jig is worth considering, especially if the project requires accuracy and consistency of the part being made. Sk. 3 shows a larger version of that seen above and whilst following the same principles it includes a clamping facility that is preferable for larger parts and holes.

Earlier in the article, I referred to accuracy being the fourth consideration. The holes in the small jig above were placed using the mill's micrometer dials, not so much that accuracy was crucial but at such a small size, even an error of only 0.2mm, if marked out manually, would be visually very apparent on such a narrow item, being just 3mm wide. Some larger components would also

need their holes accurately placing, say if setting out gear centres, but for others, marking out the holes in the jig plates by the rule, scribe and square method would be more than adequate.

Bushes

If the quantity and size of the holes to be drilled is considered to warrant it then hardened bushes should be fitted to the jig. Sk. 4 shows the normal form though they can be made without the head. Making these is straightforward with silver steel being the obvious choice of material to be used in the home workshop. The sketch shows the shank having two diameters, the smaller being a close sliding fit in the hole in the jig enables the bush to start in line with the hole. The top third of the shank should be a tight fit in the top plates but not so tight that it distorts the plate which could be a problem, particularly if the jig is quite narrow. For reasons that will be explained later, the bush should have a polished finish on its shank and head.

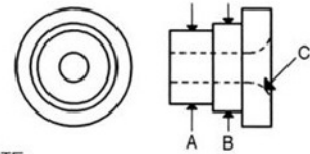
Having made the bushes, they require to be hardened and for the reader who is not that conversant with the process the following should help.

Hardening and tempering

Readers who are experienced in hardening and tempering steel components can bypass these notes. You probably know more about the subject than me. I having done no more than harden the occasional cutter. That having been said, any failures that I have had were with my early attempts so I now appear to be on the right track.

If you are not yet equipped for the task then you will need a brazing torch, a brazing hearth and a pair of large pliers that you do not mind abusing in the flame. For occasional use with small items, a small brazing torch with built in gas canister will do fine. For the hearth, a few house bricks will do as a last resort, but much better to get some firebricks from the local builder's merchant. You will of course need a bucket of cold water though some do recommend oil but I find water adequate for my requirements.

Place your bushes in the corner of the hearth and heat them until they are a bright



NOTE:
'A' TO BE A CLOSE SLIDING FIT IN THE JIG'S TOP PLATE, WITH 'B' BEING A TIGHT FIT. EFFECT SHOWN EXAGGERATED

'C' TO BE A GENEROUS BELL MOUTH OPENING IN THE BUSH TO HELP GUIDE THE DRILL BEING USED

Sk. 4

red colour, boiled carrots often being quoted as a good reference colour. This though is an over simplification of the requirement as colours can so easily take on a different impression depending of the ambient light levels. For fire safety reasons most will chose to carry out the task outside so it is essential that on a sunny day you find a shady place to carry out the task, also out of the breeze if windy. Something to just shade the workpiece will not be sufficient. It is essential that you are in total shade so that your eyes become tuned to the lower light level. With that requirement being met then boiled carrots is a good comparison.

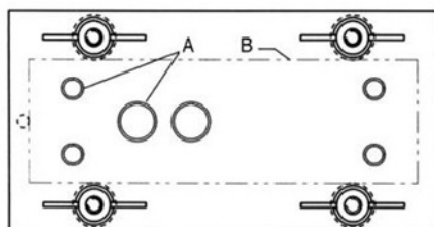
Having heated the bush to that level it does need to be held there for some time, five minutes being about right. The time is dependent on the workpiece's bulk and for thicker components a longer time will be required; you may like to seek out more guidance on the matter, ref. 1. During the time that you are holding the temperature at the appropriate colour, you will have to remove the flame every few seconds from the part being hardened to stop it getting hotter, care is therefore needed.

Once it has been decided that the part has been held at the temperature sufficiently long, it must be removed from the flame and quickly plunged into the water. Whilst in the water it must be kept on the move so that the part is continuously in contact with cold water, removing it only when it has fully cooled.

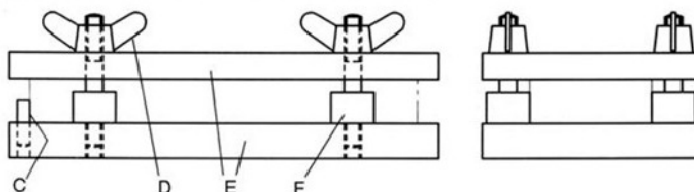
The part will now be too hard, and therefore brittle, for almost all purposes and needs to be tempered. The amount though depends on the parts ultimate use, typically softened very little for a lathe tool but much more for a spring. In the case of a drill bush, I have no data to give me a value but would suggest somewhere around the middle of the two extremes.

The process is the same as that for hardening, that is, heat to the required temperature and then rapidly cool in water. There the similarity ends though as the temperature is much lower. Ideally, the part would be heated in a temperature controlled oven as the tempering temperature is even more critical than that for the initial hardening. This though will be a facility that the vast majority of home workshop owners will not have access to and the brazing torch will once more have to be used.

Again the part's colour will be used to determine that the correct temperature has been reached, not red heat this time



- A - DRILL GUIDE HOLES
- B - WORKPIECE
- C - WORKPIECE END STOP
- D - WORKPIECE CLAMPING WING NUTS
- E - JIG TOP AND BOTTOM PLATES
- F - WORKPIECE AND TOP PLATE GUIDE POSTS



Sk. 3



but by the colours that develop on a metal's surface at lower temperatures. For the colours to be seen adequately, the metal must have a polished surface and because of this the black surface that resulted when hardening the component has to be removed and the surface polished. The reason for polishing the surface when the bush was turned should now be obvious as if the bush was left

with a rough turned surface, it would now be difficult to polish it in its hardened state.

When tempering cutting tools that have a shank, it is normal practice to apply the heat to the non working end and watch the colours run up the shank to the working tip, a process that has two benefits. The main one being that the critical portion of the tool, the cutting edge, is outside the

flame and the colour can be seen more easily. This is especially so when the cutter has to be left quite hard and needs the colour to be only the lightest straw shade. The other advantage is that the shank, being in the flame, will be the hottest and therefore is tempered to a higher degree. This gives a softer shank with a harder cutter and is obviously better as the softer shank will be less likely to fracture.

Unfortunately, the above tempering process is not possible with a bush as there is no shank to which the heat can be applied. One process often suggested to overcome this problem, but one that I have not tried, is to lay the component in a bed of sand in a metal tray being heated from below and watching as the colour of the part changes. An alternative is to provide the bush with a temporary shank by fixing it to the end of a short piece of steel with a screw and then using the same process as for a cutter with a shank.

Having briefly explained the process of heating the part, it must still be decided what colour the bush should be heated to give. The colours range from the lightest straw colour at the lower temperature through to a dark blue at the higher temperature and span a range of very roughly 200 to 300 degrees centigrade. For a drill bush, I would suggest a mid range colour where the straw colour has developed into a dark orange and where the blue colour is just beginning to appear.

When the colour is reached, the part must be plunged into the water in the same way as when being hardened. However, there is a difference, that is that it must be done very rapidly as the heat in the shank will

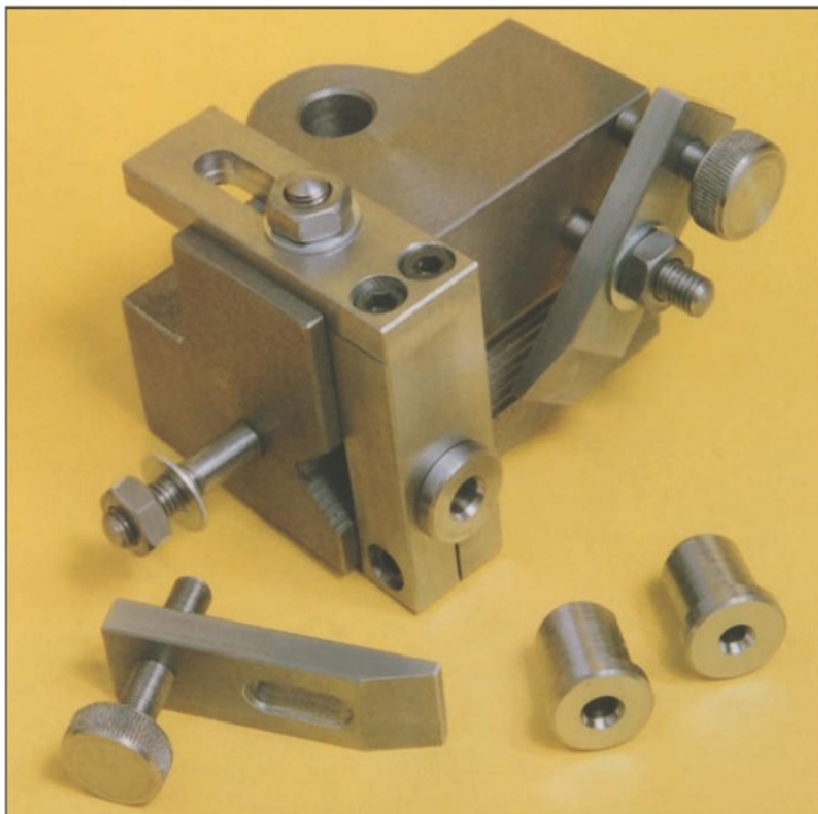


Photo 11. A versatile cross drilling jig.

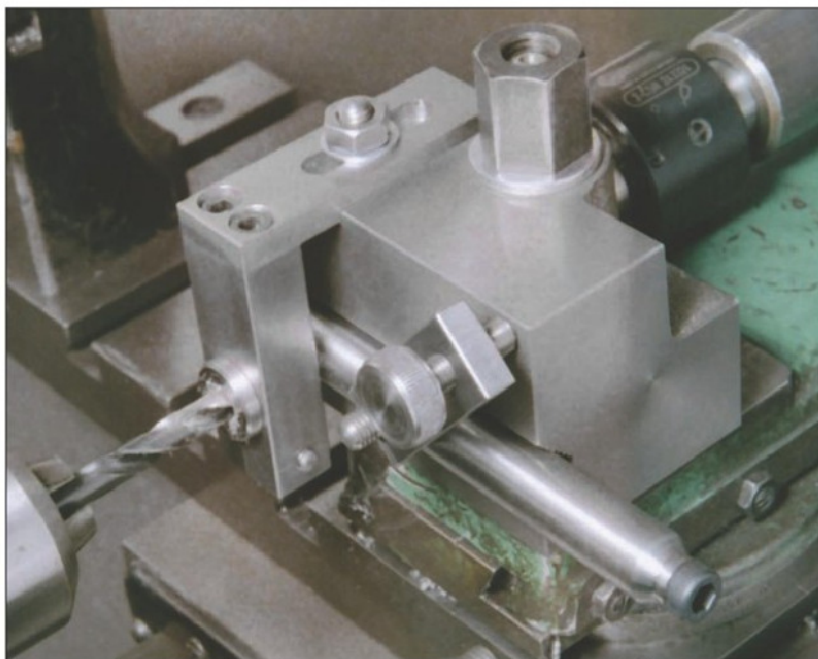


Photo 12. The cross drilling jig in use on the top slide. Note how the jig has been made to hold the part exactly at the lathes centre height.



Photo 13. A jig for drilling 6 holes on a PCD together with a locating plug. It has two sets of six holes for slightly different diameters.



Photo 14. The cylinder being drilled.



Photo 15. The end cover being drilled.



Photo 16. The parts having been drilled.

cause the colour at the working end to continue changing, any delay and the device will be tempered at too high a temperature. This is particularly a problem when tempering a tool with a large shank and a small head, typically a boring tool. As a drill bush is relatively bulky this should not be a problem in this case.

Three drilling jigs

Early in the article, I stated that drilling jigs could be used for a very wide range of tasks and that as a result it could only cover the subject generally. However, to encourage the reader to consider their use more often, I will finish briefly with three actual examples, two quite common and the other very special.

Without doubt, no other workshop task has produced more designs for a drilling jig than the task of cross drilling a shaft or collar, illustrating that in most cases there is not just one design for the job. The methods also show that design can range from the very simple to the quite complex as examples published in MEW have shown, **ref. 2**. **Photo 11** shows a very adaptable jig that can be used either on the lathe top slide as seen in **photo 12**, or with it having a flat back, on the drilling machine. This is commercially available in kit form with its construction having been featured in *MEW*, **ref. 3**.

The second jig is for a common task in the home workshop involved in model engineering, which is drilling the end flanges and cylinder block of a typical steam engine. **Photo 13** shows the jig and a plug for locating it when drilling the end of the cylinder as seen in **photo 14**. The jig positions itself directly onto the end covers for drilling as these have a small boss for locating them when fitted to the cylinder block, **photo 15**.

If the jig is marked out using a rotary table or a dividing head then accuracy is guaranteed and as four sets of holes are to be drilled then making the jig is more than worthwhile. The jig is worth making if only for the accuracy of the results, **photo 16**. Incidentally, since the holes were drilled in

the jig in **photo 13**, a second set of holes has been drilled should you be confused.

The third jig is very special and is unlikely to be required in the home workshop, that is, unless the owner is going to make the boring head, **ref. 4**, where it will be all but essential. The task is to produce a partial hole on the edge of a round component and for this to be tapped M6, a seemingly impossible task as about a third of the hole is in the component with the other two thirds appearing to be in fresh air.

For this to be achieved, a drilling jig was produced with a close fitting hole into which the component being made was fitted. This was then drilled as shown in **photo 17** and the two, that is the part and the jig, tapped before the workpiece was removed. **Photo 18** shows the jig after being used together with the required component, this having been completed with other operations since being drilled and tapped. The partially tapped hole can be clearly seen in the component, also in the jig itself. If required, the jig could have

been used for more than one part by drilling more holes round the periphery of the large hole, though in this case only one part was needed. Even with there only being one part to be made, the jig was all but essential as an alternative method would have been difficult to find.

Not just a scribe and centre punch job

I do hope this article has convinced you that positioning holes in a workpiece is not always a rule, scribe and centre punch task, but that there are other, and often better, methods for placing a hole in the required position. ■

References

- Ref. 1.** "Hardening, Tempering & Heat Treatment" Workshop Practice Series No. 1 available from www.myhobbystore.com
Ref. 2. Model Engineers' Workshop articles for cross drilling jigs. A. Issue 5, page 48. B. Issue 9, page 24. C. Issue 33, page 18. D. Issue 39, page 65. E Issue 110, page 24.
Ref. 3. Cross Drilling Jig, Model Engineers' Workshop, issue 113, page 12. Kit supplier, Hemingway Kits, 126 Dunval Road, Bridgenorth, Shropshire, WV16 4LZ. Tel 01746 767739, E-mail info@hemingwaykits.com, web site www.hemingwaykits.com Kit reference HK1410 "Tidy" Cross Drilling Jig.
Ref. 4. A miniature Boring Head, Model Engineers' Workshop, issue 126, page 12.



Photo 17. Using a jig to drill and tap a partial hole in a round component.

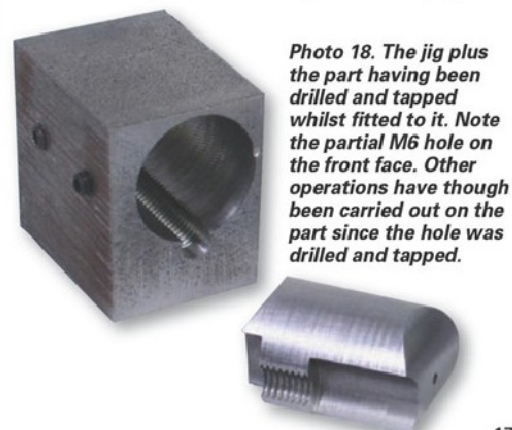


Photo 18. The jig plus the part having been drilled and tapped whilst fitted to it. Note the partial M6 hole on the front face. Other operations have though been carried out on the part since the hole was drilled and tapped.

THE C3 MINI LATHE 8

Dave Fenner adds DRO hand wheels to the topslide and cross slide and also fits taper roller spindle bearings and finally examines the radius turning attachment

Before launching into the substance of this article, I would like to thank Mr G McLatchie who wrote to me giving details of some of the equipment he has devised for use with the Mini Lathe. A bracket has been made to fit the toolpost, which allows a conventional mains powered pistol drill to be located and used on work held in the chuck. For heavier items, this would clearly deliver considerably more power than the mini tool suggested in the last article. He has also engineered a toolpost mounting for the Arc tailstock turret system, preferring to mount this on the cross slide rather than in the tailstock. A further refinement is the use of the hex drive system, frequently found as adapters for cordless tools, to give a quick change facility, perhaps for drilling and tapping.

DRO handwheels

One of the accessory kits offered for the lathe by Arc is the DRO arrangement for the topslide and cross slide, which take the form of a readout assembly fitted behind each handle. As the readout electronics are "geared" to 20 tpi, the system requires a different screw pitch and hence the kit includes replacement lead screws, also the cross slide feed nut and topslide base, each of which is appropriately tapped. The kit arrives in moulded protective expanded polystyrene packing, the individual components being further wrapped and protected, **photo 1**. Also included is a six page instruction leaflet which gives a series of clear captioned pictures.

Critics will point out that these DRO's operate by measuring rotation of the particular screw, hence unlike slide type readouts, they will not correct for backlash so you need to remember to work consistently in one direction. For lathe work, unlike milling, it must be said that this is unlikely to be of great significance since most tools will be operated in one direction. What they will do is first change the screw pitch from 1mm to 20tpi, which means less handle twirling between extremes. Secondly, you will no longer need to count turns and finally you will be able to switch between imperial and metric readings at the touch of a button.



Photo1. The DRO kit showing interior wrapping and protective outer.

Cautionary note

If your workshop is like mine and unheated, all the equipment will be subjected to variations of temperature and humidity, those experienced during the winter months being of particular concern. Notably this winter, my solar powered calculator went completely haywire and as usual, the digital calipers gave me a low battery signal. The same type of battery is fitted to the DRO handwheels, and in

one case this too had "gone down" in storage. A couple of spares are included with the kit. For cold workshop conditions, it may be worth considering removing the batteries after work to prolong their life. Battery changing involves removing a couple of small screws to release the compartment cover, fine if you are regularly working on minute parts, but for the more cack handed like me, this is an opportunity to lose screws. An easy

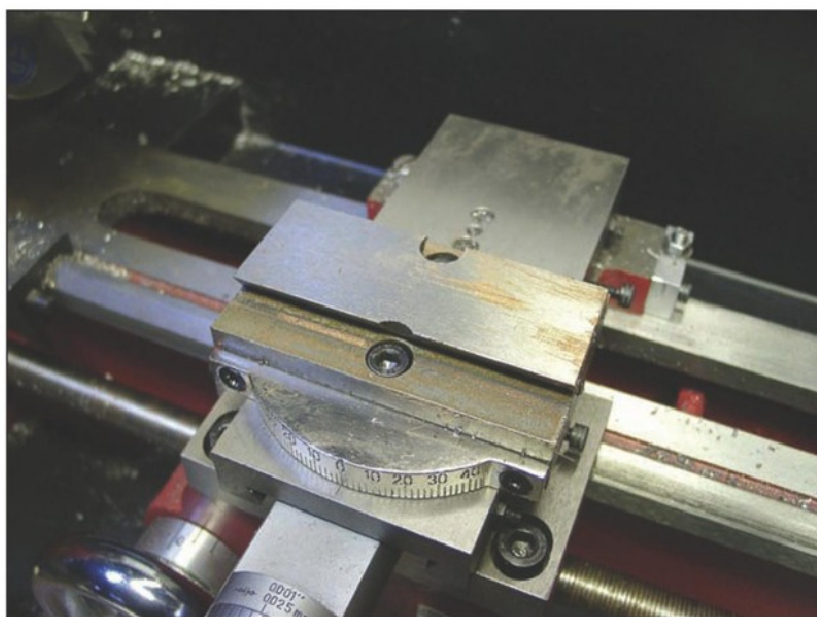


Photo 2. The topslide moving parts have been removed....

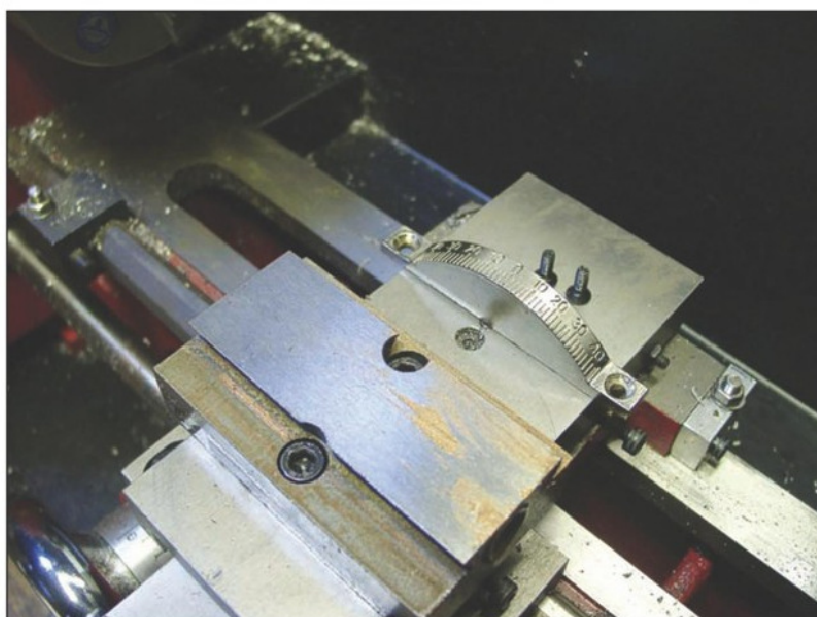


Photo 3.and the protractor scale detached.

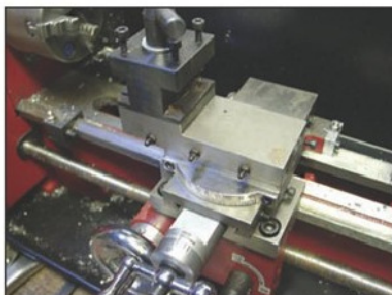


Photo 4. Upper section and scale reassembled on new base.

alternative would be to fit the battery cover, omit the screws, and apply a piece of masking or electrical tape as a retainer.

In a similar vein, it must be noted that these DRO units are not proof against the ingress of oil or coolant suds. So if you use coolant on your C3, then I suggest it be applied sparingly by brush. (In any case you do not want it getting into the motor or control electronics.) Flooding with high pressure coolant as per industrial practice is definitely not on. Again, one of my dodges for winterisation of equipment is to spray generously with WD40. Clearly this should not be allowed on the readout surface. I have been told that in one model engineering club, members who use these devices, have come up with a slip on protective cover, which might be made from a thin brass frame and Perspex window.

Topslide conversion

For the Topslide readout conversion, the main stages are as follows;

Slacken the gib screws and wind back the handle until the screw disengages then slide off the upper part of the topslide. Remove the handle and feed screw, **photo 2**. Remove the protractor scale, **photo 3** and transfer to the new base. Remove the two Allen screws holding the topslide base and lift this away to fit the replacement. Lubricate, then slide the upper section onto the lower dovetail and adjust the gib screws to allow the slide to be moved by hand but with some resistance, **photo 4**. Apply Copaslip or similar lubricant to the feed screw then wind this in, **photo 5**.

Fit the replacement feed screw retainer, then its two retaining screws. Check that the feed screw rotates freely as the screws are tightened. Slide the DRO head over the screw, then fit a small set screw ensuring that it enters the keyway (shown in **photo 6**) in the feed screw. Fitting this (for me) tiny M3 grub screw really had me wishing for smaller fingers, however, the technique adopted was to magnetise a small jeweller's screwdriver after which, engaging the screw proved to be no problem. Next fit the three screws which retain the head. The supplied label may then be applied to hide these screws. The operation is completed by adding the shroud, spacer washer and handle.

After fitting the DRO head and its three fixing screws, I encountered a minor problem in that the shroud would not enter its mating counterbore in the head. The second assembly (still in the box) was also checked and found to be the same. The cause may be just the paint applied to the head and certainly the solution proved to be quite simple. A scraper was gently

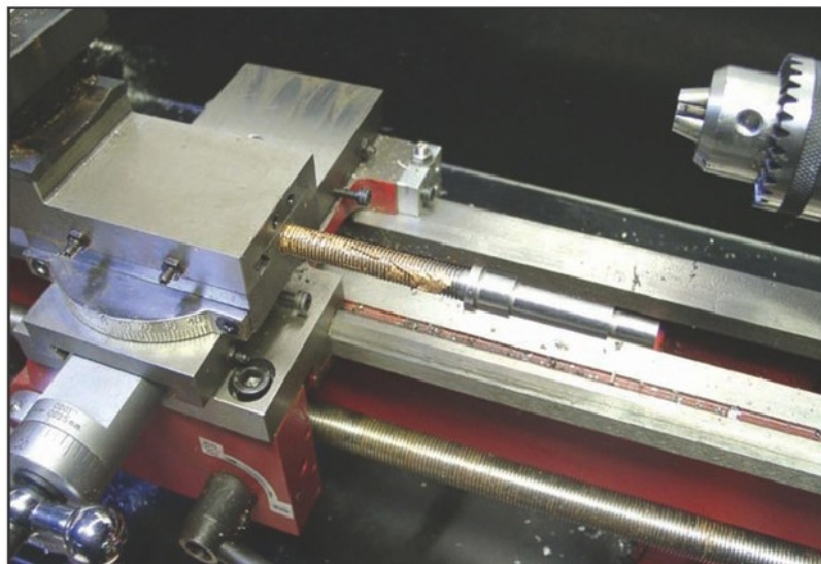


Photo 5. The new leadscrew is greased and wound in.

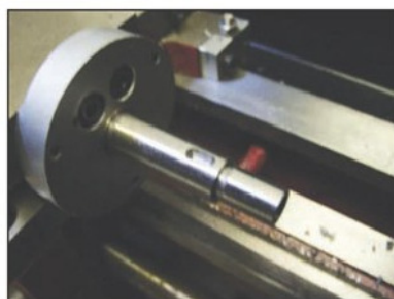


Photo 6. Close up showing the keyway.



Photo 7. A scraper is employed to ease the counterbore.

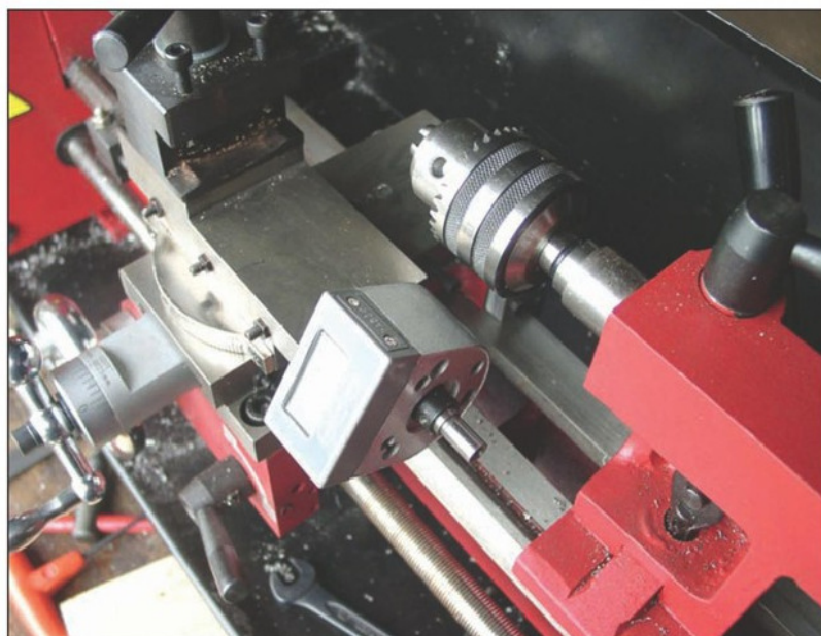


Photo 8. Canting the readout head improves clearance.

worked around the bore, **photo 7** and after a couple of minutes, the shroud slipped easily into place. The second head was given the same treatment.

Having fitted the topslide DRO, it was noted that it might be possible for it to foul the tailstock chuck when turning small

diameters. An alternative mounting position is therefore proposed, rotating the head 60 degrees towards the operator, **photo 8**. This brings it back away from the machine centre line and the tailstock chuck. In order to try out the mod quickly, I simply set the mounting bracket up in the



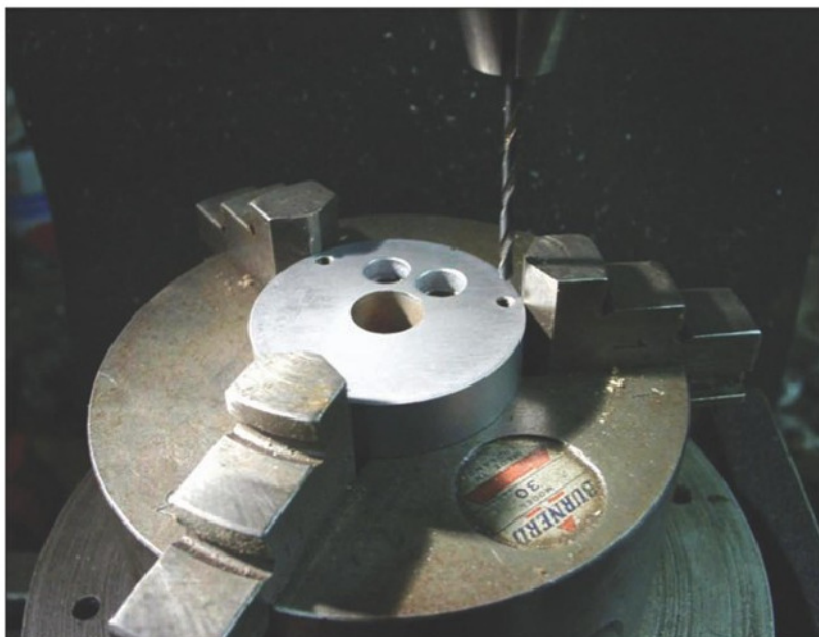


Photo 9. Picking up the hole position.
Note spacers need to be added to avoid marking chuck.

mill, on a rotary table. This made it easy to pick up on one of the existing holes, using a 2.5mm drill, **photo 9**. Next, index round 60 degrees then drill 2.5mm for three equally spaced positions at 120degrees. Note that **photo 9** was taken before the two parallel spacers, visible in **photo 10**, were added. The three locations were first spotted with a centre drill before drilling through 2.5mm, **photo 10** and tapping M3. As mentioned in earlier articles, the tap was kept square to the work by my general purpose tapping guide, **photo 11**.

After completion of the work, the bracket was refitted and the head reassembled, now canted over. A secondary advantage of this modification may also be that the battery compartment is now more accessible. This mod could be carried out using the Mini-Lathe to mark out and perhaps drill the holes. This would entail fitting the headstock dividing attachment (60 tooth wheel) and the guided punch, then gripping the bracket very lightly in the three jaw chuck. The punch should then be accurately aligned with one of the existing holes, and the chuck tightened. Then index round 60degrees and punch. Repeat for positions 2 and 3 at 120 degree intervals.

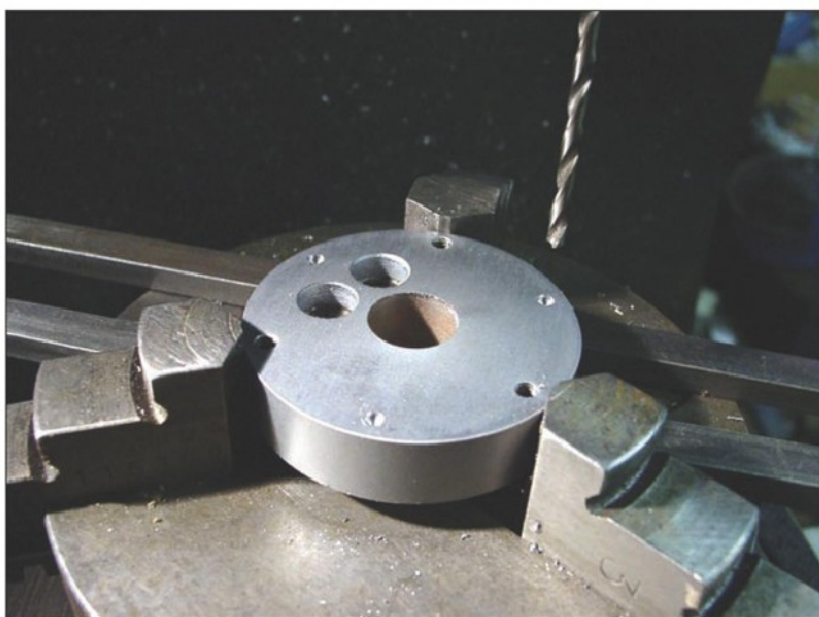


Photo 10. Three new positions are spotted and drilled...

Cross slide conversion

Details of the conversion parts are shown in **photo 12**. For the cross slide, the sequence is generally similar, but starts with the removal of the two cap screws holding the feed nut in place. This is then removed by winding the handle. The existing screw and retainer are then removed and the new ones fitted. The feed nut (screw holes facing upward) is then wound on to the screw, **photo 13**, the two cap screws fitted (but not tightened) to retain it and then the head and handle fitted. A series of steps is given in the instructions to adjust the feed nut. These aim to first set its height to match the leadscrew, (using the middle screw jacking downwards) then to eliminate backlash by a slight tilting action induced by the front and rear retaining screws, and are as follows:

- 1) Loosen all three screws.
- 2) Wind the cross slide out towards the operator until it contacts the dial.
- 3) Tighten the centre screw until the handle becomes stiff to turn.
- 4) Loosen the centre screw until the feed handle just turns freely.



Photo 11.then tapped ensuring the tap is held perpendicular to the work.

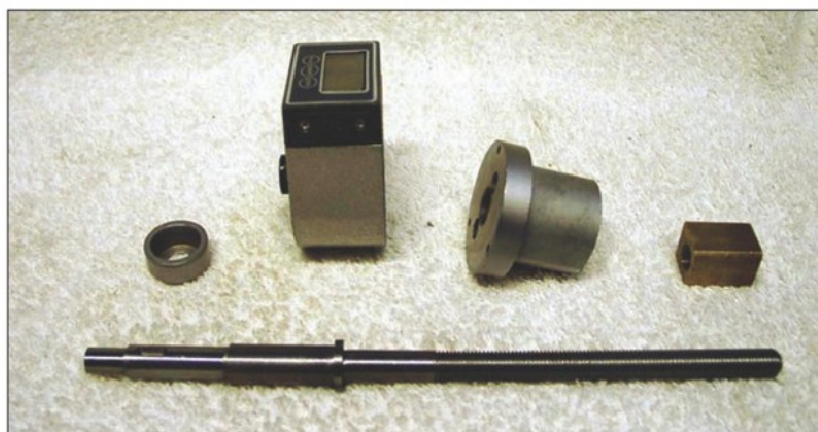


Photo 12. The new components for the cross slide conversion.



- 5) Tighten the screw nearest the operator until the handle becomes stiff to turn.
- 6) Slacken the same screw until the handle just turns freely.
- 7) Nip up, but do not tighten, the third screw farthest from the operator

After fitting both read out heads, it was felt that these are accessories which will be very much to the taste of many enthusiasts, but perhaps not all. On one hand, they offer major advantages in giving a clear reading of the dial position, the facility to zero at any point, to avoid counting (miscounting) handle turns and to instantly change from imperial to metric readings. On the other hand, as can be seen from **photo 14**, rotation of the topslide is now restricted but still can be moved in excess of 30 degrees. Whether this restriction is a cause for concern will depend very much on the type of work undertaken and techniques practised.

Bearing change

If my understanding of history is correct, the Mini Lathe was based on an earlier Russian designed machine, which featured a headstock fitted with a pair of taper roller bearings. The Chinese manufacturers decided to change the specification of the bearings and employ ball bearings, which fitted the same housing and shaft dimensions. It may be that this was a cost driven modification, or it may be that they considered the maximum spindle speed of about 3000 rpm to be better handled by ball rather than taper roller bearings, which can also generate significant drag if installed with excessive preload.

For the vast majority of work, the ball races fitted as standard, are quite up to the demands placed upon them, however in the best model engineering traditions of quarts and pint pots, some owners wish to fit bigger chucks and turn heavier chunks of metal and in these situations, the extra load capacity and stiffness offered by taper roller races can convey advantages in terms of reduced vibration and improved finish. From one bearing catalogue, it appears that in this instance, the load capacity of the taper roller bearing is about double that of the corresponding ball race.

The procedure is essentially that of unscrewing various parts at the change gear end, releasing the bearing retainer and drawing the main spindle out and over the bed. Note that some modern versions of the Mini Lathe have a speed sensing disc which must be refitted close to the same axial position (requiring modification to spacers). Earlier machines may not embody this. Due to the TR bearings having a different axial dimension to the originals, after fitment, the spindle will move towards the tailstock by about 1.25mm and the dimension between the inner faces of the two inner tracks will increase by some 2.5mm. When they undertake bearing conversions, Arc inserts a machined spacer (with keyway), however, if the lathe has already been dismantled, then this requires the use of a second lathe. An alternative approach is therefore proposed which is intended to give the same result but arrived at more easily by the home enthusiast without access to additional machinery.

Photo 15 shows an early state of play with the chuck, splashback, change gear

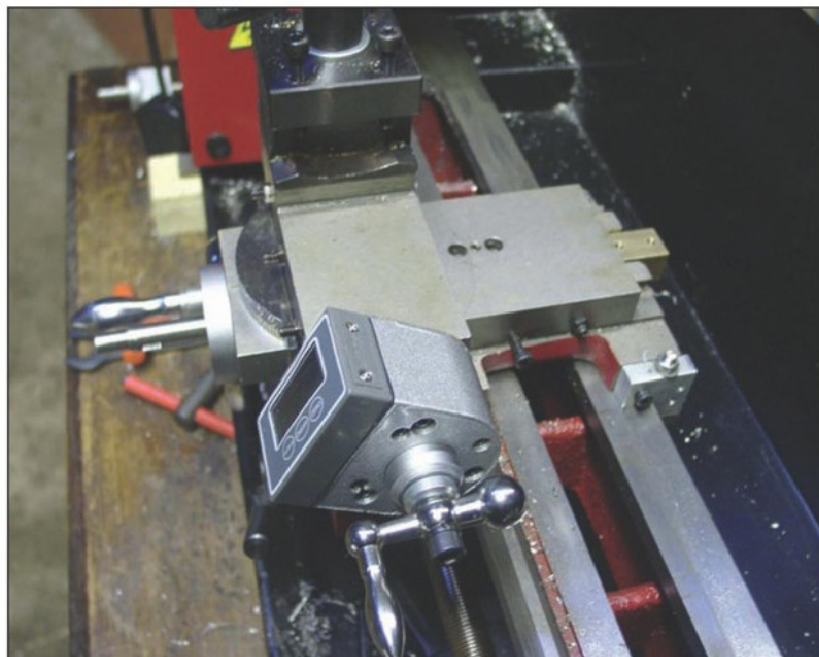


Photo 13. The feed nut is wound on to the screw.

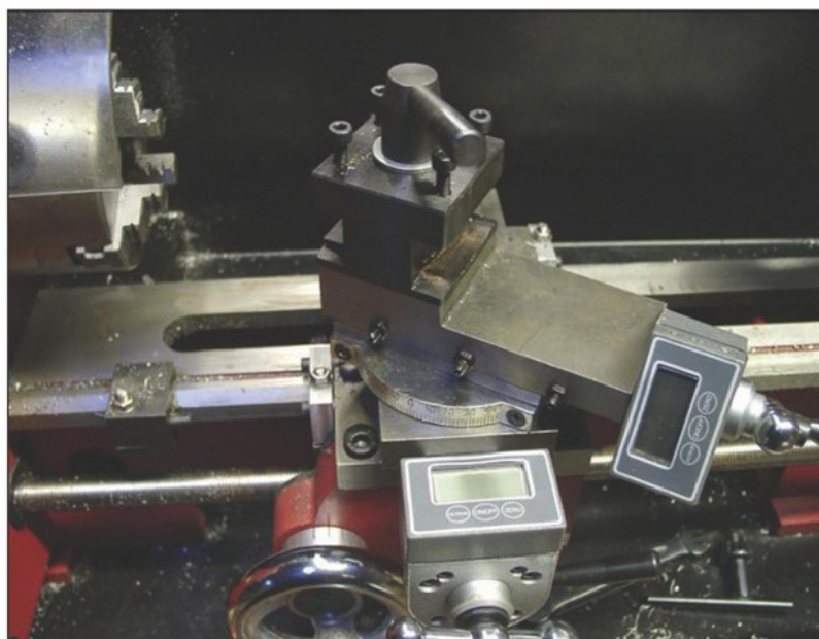


Photo 14. Rotation may still exceed 30 degrees.

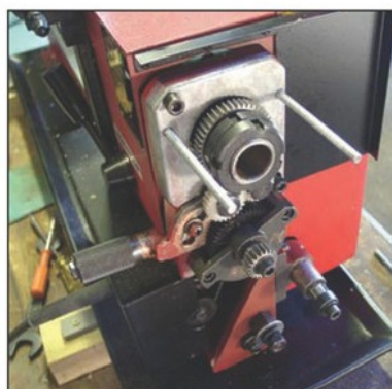


Photo 15. Change gears removed and tumbler cluster screws slackened.

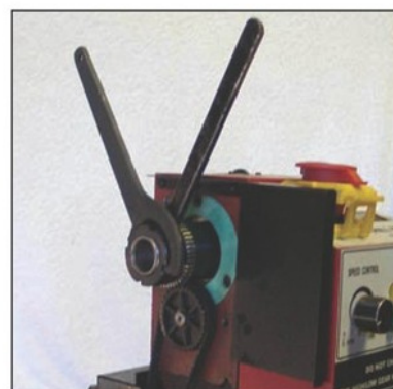


Photo 16. Two C spanners used to remove the ring nuts.



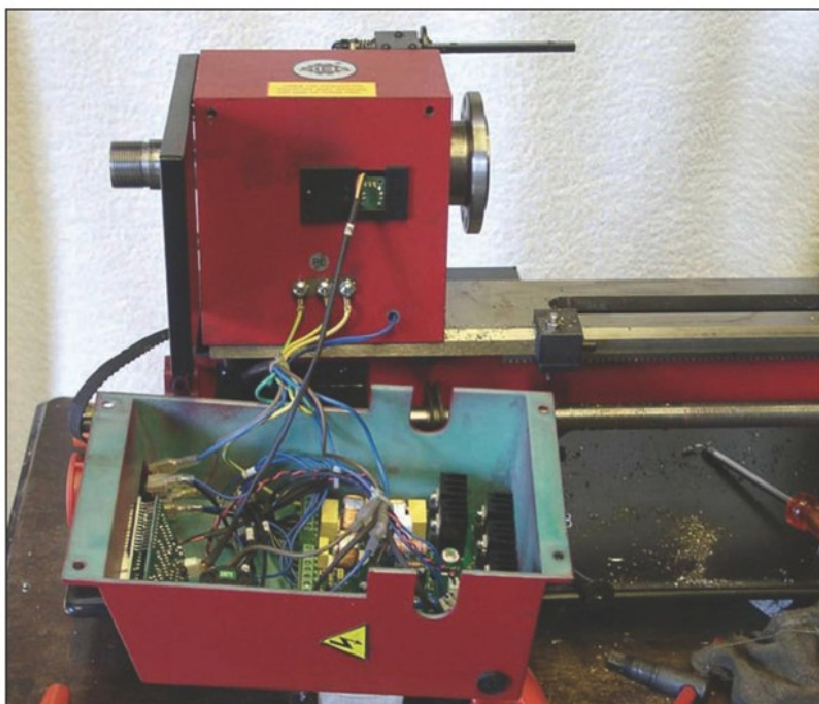


Photo 17. The control panel detached, the sensor board is still held in place on the headstock.

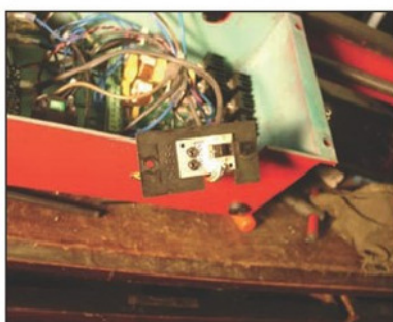


Photo 18. Close up showing the slotted opto sensor.



Photo 19. The sensor disc and spindle spacers can be seen through the aperture.

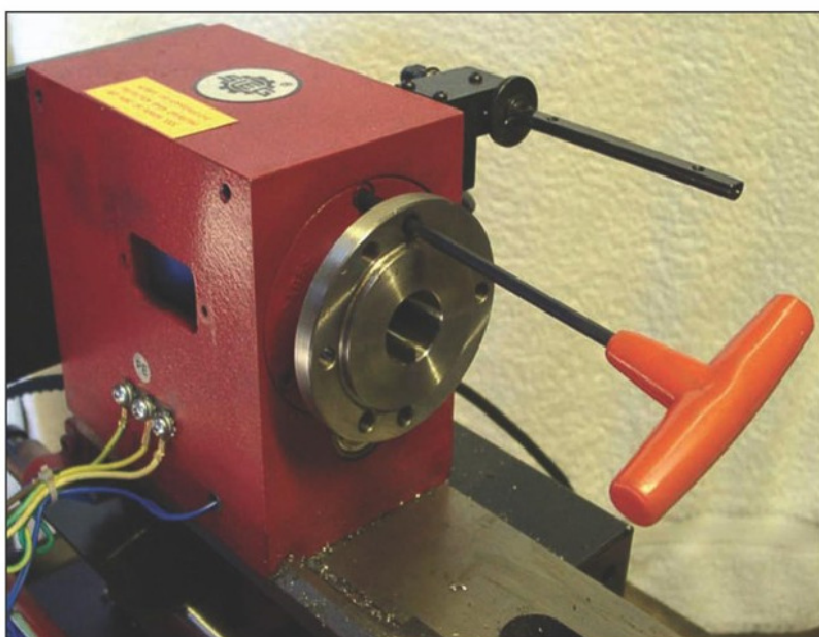


Photo 20. Three screws are accesses through holes in the flange.

cover, and gear train removed. The two Allen screws retaining the tumbler assembly have also been slackened. In **photo 16**, this has also been taken off, and a pair of C spanners is used to release the two ring nuts on the spindle. With these cleared, the steel gear can be removed, (and its key carefully stored). To release the drive pulley, its circlip is removed, after which the belt can be "walked" off the pulley and the pulley slid off its shaft. This then gives clearance to remove the rear bearing cover after undoing its three Allen screws.

The four screws are then undone, allowing the control panel to be drawn back. **Photo 17** shows this and the location of the speed sensor board, which is still fixed to the headstock. This small board can be seen in **photo 18**, the slotted sensor being visible. The aperture in the headstock can be seen in **photo 19**, and through it, the slotted sensor disc.

Attention then turns to the front end of the headstock and removal of the three screws holding the bearing cover, **photo 20**. The way is now clear to draw out the spindle. It will depend on the particular fit of your machine as to whether this is easy or difficult. After a couple of perfunctory taps with a mallet, I chose to set up the puller arrangement whose components (M10 screwed rod, square RHS, and aluminium flat) are shown in **photo 21**. **Photo 22** shows the thing in use. From **photo 23**, it can be seen that during the exit process, the front bearing was forced along the spindle making contact with, and bruising the nose of the key, **photo 24**. This minor damage was dressed off with a file.

To remove the bearing from the spindle, Arc recommends the use of a hydraulic press with suitable attachments. Unfortunately no suitable attachments were to hand so two other methods were tried, both successful. The first harks back to my student days in the 60's, when I needed to remove the bearing from a rear half shaft on a 1936 Singer Le Mans. A trip to the local garage provided the answer. They kept a block of lead especially for such duties, parked in a corner on the floor. The shaft was simply held vertical and smacked down on the block. After a few whacks, the bearing fell away. My alternative is a block of aluminium, **photo 25** and, as with the lead, the softer material avoids damage to the spindle end. Alternatively, **photo 26**, shows a gadget knocked up a few years ago which also worked here. It was intended as a spring compressor for suspension struts, the compression being applied by two lengths of M16 screwed rod.

It then remains only to dismount the bearing left in the rear of the headstock. Arc use a purpose made gripper and a slide hammer. Whilst I could lay my hands on a slide hammer, a gripper was entirely another matter. I therefore resorted to using a brass drift inserted through the headstock (and the interior parts).

The way was now clear to consider reassembly and whereas Arc produce and fit a purpose machined spacer, it was thought that for many home workers, it would be easier and equally effective to fit two spacer rings, one immediately inboard of each inner track. Each is easily made from a short length of wire, 18g at the front, 0.8mm at the rear. The front is a simple ring made by winding the

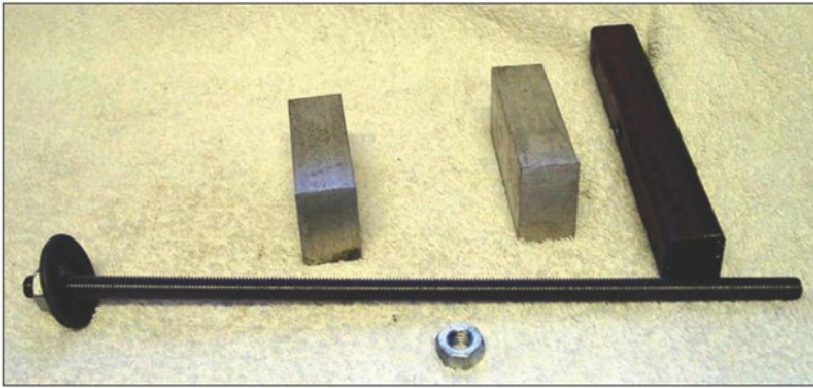


Photo 21. Components for a "Heath Robinson" puller.

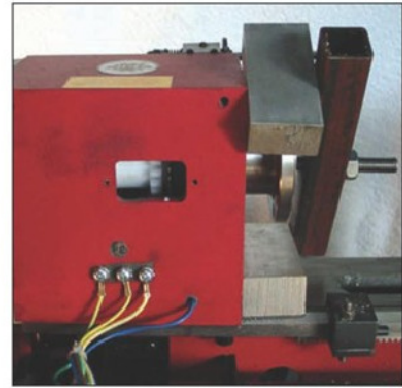


Photo 22. The puller in use.

galvanised soft steel wire around a bar (say about 25mm diameter to allow for spring back). I wound on about three turns, then snipped to size. That for the rear is treated similarly, but was made from 0.8mm Mig welding wire. After forming to a circle, more bends were applied to give a "wavy" washer effect. The two rings are shown in **photo 27**. Once installed, as the rear bearing is adjusted up, this will then apply pressure to the stack of spacers, gear and sensor disc, bringing them back close to original axial position. One other small mod is suggested by Arc. A small step is turned on the rear end of the rear spacer, to ensure that it clears the cage of the adjacent bearing.

Fitting the new bearings then follows normal practice. Anyone who has changed car wheel bearings will find a familiar scenario. After cleaning the housings, the two outers are fitted to the headstock. I used first a nylon mallet, followed by hammer and brass punch. You can detect when the track has bottomed by the change in sound of the blows.

To push the first inner on to the spindle, you ideally require a length of tube slightly larger than 30mm bore. My scrap box

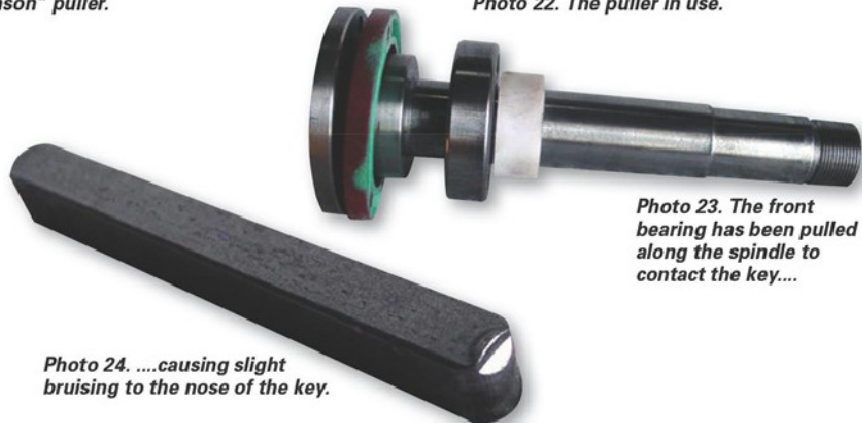


Photo 23. The front bearing has been pulled along the spindle to contact the key....

Photo 24.causing slight bruising to the nose of the key.



Photo 26. Method two - a suspension compressor.



Photo 25. Method one - the aluminium block.



Photo 27. The two wire ring spacers.

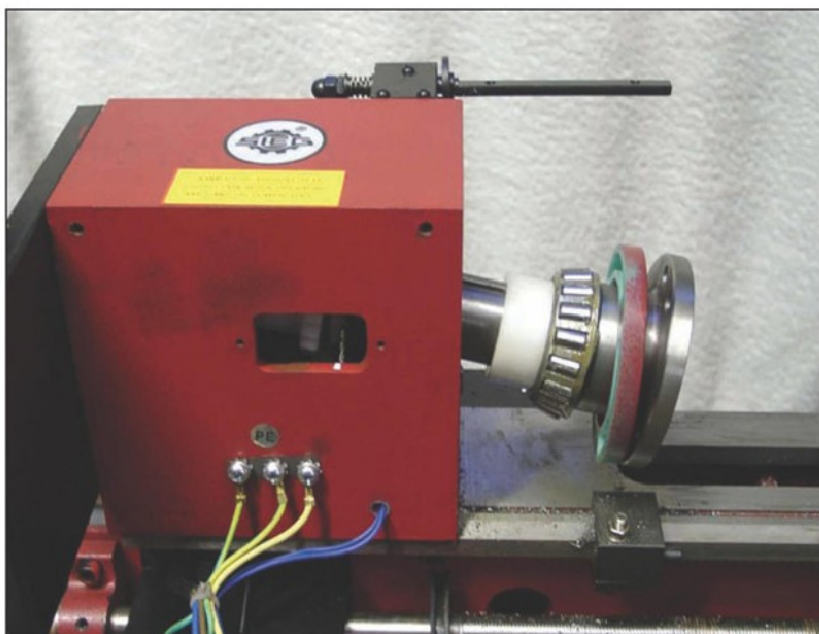


Photo 28. Spindle assembly is fed through the spacer, disc and gear.



Photo 29. End float is checked with a clock gauge.

contained part of a Land Rover hub assembly which served to do the job. The bearing is then greased, and the spindle, with its long key in place, fed into the headstock. Care is needed to line up the various parts so that they slide over the key, **photo 28**.

The rear spacer may then be added, followed by the rear bearing inner track. I eased this into approximate position, again using the brass drift as a punch, working from side to side. After assembling the outer spacer, key and gear, the first of the ring nuts was screwed on and wound up to push the bearing into position. One point to note here is that the spacer will have moved along the spindle slightly and therefore can foul the gear key. I chose to file a little off both parts to achieve clearance.

Spindle end float was checked with a clock gauge, **photo 29** and the ring nut progressively tightened until no movement could be detected. The second nut was then added and the two locked. In this type of arrangement, I back off the first nut a tiny amount to compensate for the change in setting caused by its movement along the thread when the locknut is tightened against it. The spindle was then checked for end float and freedom of rotation.

Brief digression on taper roller bearing adjustment

Referring to an old copy of an SKF General Catalogue, I came across a paragraph on bearing stiffness, which commented that in most cases this is high enough to be disregarded, but can be of significance

in applications such as machine tool spindles. It was then noted that roller bearings have greater stiffness than ball bearings, and that the stiffness can be enhanced by preloading.

I also consulted a couple of car workshop manuals. Jaguar, in the 1950's, recommended end float of 0.003 to 0.005in. while in the 80's, Ford's approach was to torque up to 20 - 25 Nm (15 - 18 lbf ft) while rotating the hub, then to back off half a turn and re-tighten using fingers and thumb. In the absence of a suitable dial gauge, this latter method should work here. The initial torque up will move the bearings against frictional resistance to a zero end float position and the subsequent finger tightening will avoid any excessive preload. On this latter point, a tool maker who worked at the Timex watch factory told me that on receipt of each new Schaublin lathe, one of their first actions was to wind up the spindle bearing preload to further increase the stiffness. Whether it caused a reduction in life is not known.

The speed sensor was then located, and a quick check made to ensure that the disc would run correctly in the slot without fouling. (The slot is actually about 4mm wide, so will tolerate quite a bit of leeway.)

With this in place, the control panel housing can then be remounted and its four screws fitted. The remaining components are then refitted, as a reversal of the dismantling procedure.

Initial experience

I did wonder whether it might be possible to gauge the improvement in rigidity due to the bearing change. In an earlier article, I described an inverted part off tool arrangement operated with the spindle running in reverse and commented that when parting off with the tool, audible vibration could be detected. At the time, I thought that a more substantial mounting bar for the tool might offer an improvement. However, after completing the bearing change, I used the same tool to part off steel bar, and this time there was no audible vibration effect. In fact it seemed to part off as sweetly as the rear toolpost on my Super 7. Certainly there appears to be no downside regarding this modification; the machine runs as expected, just as smoothly to maximum speed. Perhaps a case of full marks to the original Russian designers.

Radius turning attachment

For applications in the amateur sector, these attachments usually feature a cutting tool which may be set to a radius, and is then swept around the surface being generated. The sweeping action is typically controlled by a lever type handle, and rotates about an axis which for true spherical generation must intercept with the lathe spindle axis.

Two main formats are in use, where the rotation axis may be either vertical (the handle moving horizontally), or horizontal as in this case. Traditionally, this is one of those devices which tended to be home constructed. Many designs have appeared from various authors over the years, not only in MEW but also "Model Engineer" and suppliers such as Hemingway offer kits.

However, the competitive pricing of this item from Arc does shift one's thinking along the make or buy spectrum, towards



Photo 30. Radius turning attachment.

the buy decision. **Photo 30** shows the main components "out of the box" and loosely assembled. The aluminium base plate brings the pivot line up close to the lathe centre line height.

To fit the device to the lathe, the topslide is first removed and the same fixing screws used to hold down the aluminium base plate. The tool is then adjusted to give the desired radius and locked in place. Here it could be found worthwhile measuring the swinging bracket, **photo 31** to obtain a datum dimension from outer face to pivot line, which might then be used for accurate adjustment of the tool tip position. In the photo, a piece of 8mm rod has been passed through the pivot holes and the measurement taken over this. 4mm is then deducted to give a reference dimension for zero radius.

Before fitting the base plate to the lathe, first check whether the centre screw for the cross side nut projects upwards above the cross slide. Mine did, so it was screwed out a couple of turns, and a few thous filed off the top, before retightening.

If you intend to produce radii for aesthetic rather than accurate dimensional criteria then forge ahead, fit the accessory with no more ado, and proceed to enjoy. However, if you wish to machine spherical parts to tight tolerances then there are a couple of easy mods to upgrade the device. First check the pivot height. This is easily done as shown in **photo 32**. A length of 8mm rod is mounted in the chuck, and one of the mounting brackets fitted and manoeuvred to bring its pivot bar close to the rod. The height of each can then be measured from the base plate. Ideally these should be identical, but most likely, production tolerances of the various components will stack up to create a slight mismatch. In my case, shimming up was required, and the quick and easy answer was to cut a couple of shims from thin card, **photo 33**. Of course the best engineering solution would be metal shims, but for the relatively light forces involved, card, paper or plasticard should all be viable. If the pivot height does not match the lathe centre height, your radiused forms will not be truly spherical, but very slightly lemon shaped.

Another minor shortcoming, easily corrected, concerns the end float of the cast swinging frame on its pivots. For accurate work, it is useful to be able to



Photo 31. Measurement to establish reference.

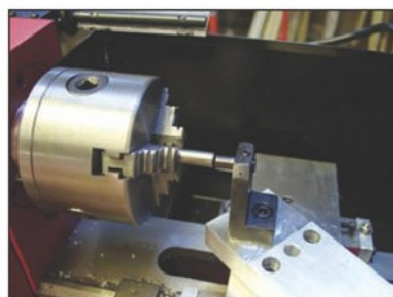


Photo 32. Preparing to check pivot height.



Photo 33. A couple of thin card shims.

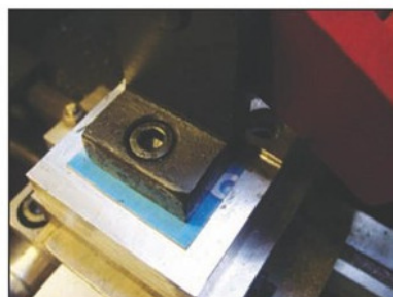


Photo 34. One of the shims in place.

position the cutting edge on centreline in plan. I added a wavy washer, made as before from 0.8mm Mig welding wire, to the pivot farther from the operator to bias the frame to the load side. In a similar manner, the tool location allows the bit some sideways movement. Limiting this movement and adding a micrometer feed for the tool bit will be upgrade exercises for another day.

Once the attachment is fitted and lined up at 90 degrees to the lathe axis, the cross slide is moved to bring the tool edge to centreline viewed in plan.

How you use the gadget will then depend on what you wish to produce. The radiused parts I have produced tend to be hemispherical ends, e.g. for gas cylinder fittings. For this type of work, the tool radius may be set at the outset and then the saddle moved towards the chuck



Photo 35. Radiusing brass.

between "sweeps", under the control of the leadscrew handwheel, until the full form is achieved. Conversely, if the work is more nearly a sphere such as a ball handle, the pivot line position along the bed must be set correctly from the start and feeding down to radius is accomplished either by moving the tool bit inwards between sweeps, or by commencing with the assembly positioned off centre towards the operator then progressively moving the cross slide inwards between sweeps, finishing on centre line. Note though, that this latter system may cause problems due to variation in effective tool cutting angles.

Photo 34 illustrates one of the shims in place with the unit fitted to the Mini-Lathe, and **photo 35** shows work in progress to produce a radiused end produced on a piece of brass hex bar. ■



MAKING AND USING A SADDLE STOP

Harold Hall comes to a dead stop

Have you ever made an item of workshop equipment and found it so useful that you wondered why you had not made one earlier?

At the top of the list of such items in my workshop is my saddle stop. It was made to a very simple design and took only an hour or two to make and has repaid the time spent many times over. Even so, the advantages are not just a part being made in less time as often this aspect of using a saddle stop is very marginal but its real advantage is in an easier operation and a better quality end product. What then are its uses?

Boring a blind hole

This is a common workshop task and one where the benefits of using a saddle stop really become apparent. It is not that easy as visibility of the result being achieved is very limited, especially if the hole is deep and not much bigger than the boring tool being used to make the hole. In this case, visual contact with the machining taking place is almost zero.

There are though two ways of carrying out this operation using the basic stop described. Method one is to set up packing to the depth of the hole being made and position this between the saddle and the end of the stop, using the saddle traverse to hold this in place. **Photo 1** shows this being done using my distance gauges that I use extensively for such operations, these also being near the top of my "why did I not make this earlier" list.

If the reader has a set of slip gauges then these could be used but such tasks rarely need the accuracy with which they are made and being expensive and of little use in the average workshop, it is likely that most workshops will not possess a set. However, depth is seldom that critical and a scrap of flat bar will often be more than adequate. Typically, if the hole needs to be 18mm deep, two pieces, one 10mm and the other 8mm thick would suffice.

With the spacers held in place, the top slide can then be advanced until the tip of the boring tool just contacts the front of the stationary workpiece to be bored when the packing can then be removed, **photo 2**. Having completed that stage, using only the saddle, the tool can be traversed into the workpiece until the saddle contacts the stop. This will be with 18mm movement of the tool ensuring the bore is to the correct depth.

An alternative method is to bring the saddle up to the stop but this time without any packing, and again the tip of the boring tool is advanced until it contacts the part being machined. In this case, the saddle is then moved away and the top slide advanced by 18mm. The machining process will then take place in the same way. The method is simpler than using

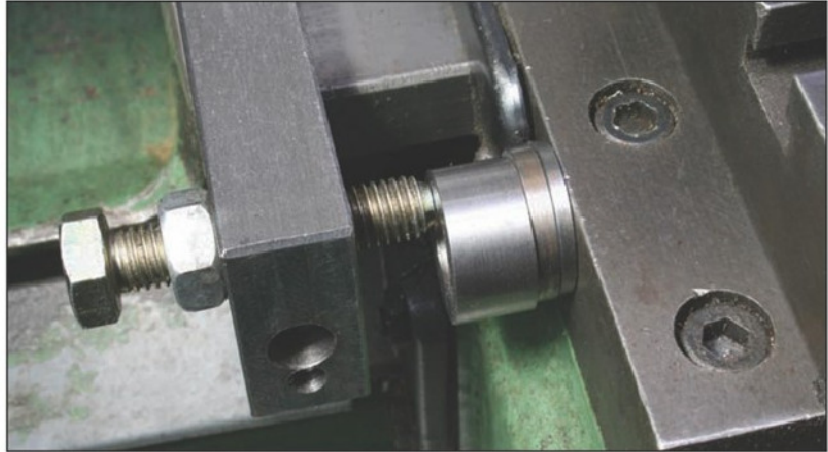


Photo 1. Setting the saddle stop using simple gauges.



Photo 2. When boring a blind hole, the boring tool is traversed using the top slide to just touch the front of the workpiece with the gauges still in place. The hole will then be the correct depth once the gauges are removed.

packing but is open to errors due to mistakes in calculating the number of turns and part turns of the top slide leadscrew whilst the packing method is all but foolproof, probably the reason why I prefer it. Invariably, working to metric dimensions on an imperial lathe prods one in the direction of using packing.

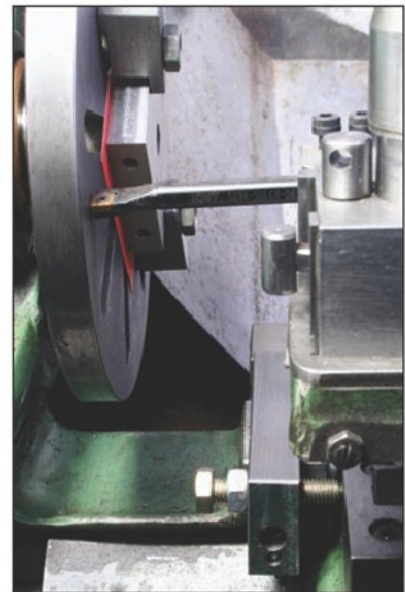


Photo 3. Setting up for boring a through hole in a workpiece mounted on to the faceplate. Note the piece of card between workpiece and the faceplate to allow the tool to just pass completely through.

If you prefer the packing method then a combination of the two methods can be used for more precise dimensions. Assume a required depth of 18.5mm then the lathe could initially be set up for 18mm as above but before commencing machining, traverse the top slide by just 0.5mm to give the required result of 18.5mm.

Protecting the faceplate

A frequent operation is to bore a through hole in a part mounted on the faceplate in which case the problem is not getting the



depth of the hole just right but to avoid the cutter contacting the faceplate surface. Normally, a thin piece of hard card would be placed between the workpiece and the faceplate surface and the part bored taking care as the tool breaks through, one lapse of concentration though and one has a damaged faceplate, not that serious but it does not look good.

In this case, with the saddle against the stop the tip of the boring tool is brought up to touch the faceplate, **photo 3**, after which the top slide will be set back say 0.1mm ensuring that the boring tool stops just short of the faceplate's surface as it breaks through the part being machined.

Machining to a step

A very frequent requirement is to machine a workpiece to a step but having a depth necessitating this being done with a number of passes. The problem is virtually the same as boring a blind hole though the operation is fully visible and therefore much easier. It does though need a degree of concentration at the end of each pass, perhaps having to work to the lead screw's dial readings and setting up the saddle stop to set the step's position makes it less demanding. In this case though there may not be any surface to use as a reference for the initial set up and the first pass may have to be done unaided. With the first pass complete, lock the saddle and set the stop at this position. For this it will be necessary to use the stops inherent adjustment to be sure that it is only just contacting the lathe's saddle. Completing the machining will now be very easy, **photo 4** though if the length is critical the top slide can be advanced slightly to finalise the step's position providing the part was initially turned a little short, still using the stop of course.

And in reverse

A less frequent requirement, but still not that unusual, is to machine to a right hand step as in **photo 5**, a situation that requires the stop to be positioned on the other side of the saddle as in **photo 6**.

Headed pins, or similar

Sometimes a requirement surfaces to make a batch of headed components requiring the heads to be the same thickness, **photo 7**. Screws would have a similar requirement. This is an easy operation with the head against the chuck jaws and just facing each head in turn with the saddle locked in position. It does though need the cross slide to be moved well back so that the top slide does not interfere with the action of removing the finished part and fitting the next one for machining. Setting the saddle stop will allow the saddle to be wound well away from the chuck making it easy to remove and fit the workpieces unhindered.

Similarly, if using a back stop then typically machining a batch of spacers that do not have heads can also make use of the saddle stop for the same reasons. These simple examples illustrate that the saddle stop can be particularly beneficial when producing batches of components.

Milling on the lathe

It should not be overlooked that the saddle stop can be very useful for some situations where milling is being carried out on the lathe. Unfortunately though,

milling tasks are much more varied than those when turning and giving examples is not easy. One such operation that I remember has surfaced is the need to machine two faces at the same level but it being impossible to traverse the cross slide from one surface to the other. This was due to other facets of the workpiece, or the clamps being used to secure the item, preventing the cross slide from being traversed. I should add that I am talking about a part mounted on the vertical slide.

To overcome the problem the saddle has to be moved away from the cutter to allow the cross slide to be traversed so that the second surface can be reached. Having moved the saddle there is then a problem to return it so that the second face is machined at exactly the same level, but if the saddle stop is used it will be very easy to achieve the required result. This is a typical case where setting up the stop may result in the task taking longer to complete, the benefit being that the two surfaces will be at the same level with absolute certainty.

Calibrated saddle stops

Designs are available for saddle stops having calibrated adjustment rather than the simple screw seen in the photographs and whilst very useful occasionally, the simple stop will be more than adequate

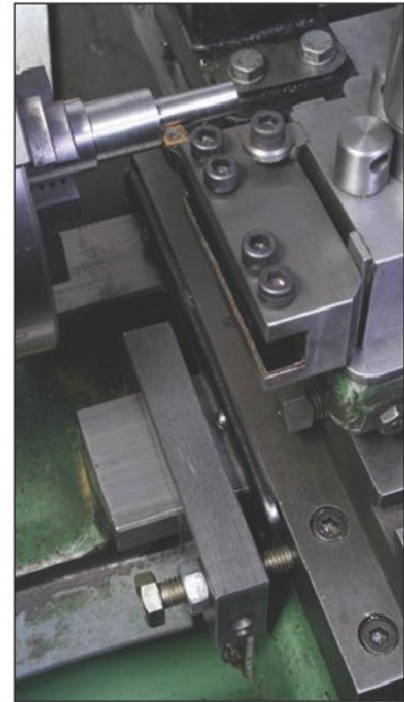


Photo 4. Machining to a left hand face, the step being set by the saddle stop at the bottom of the photograph.

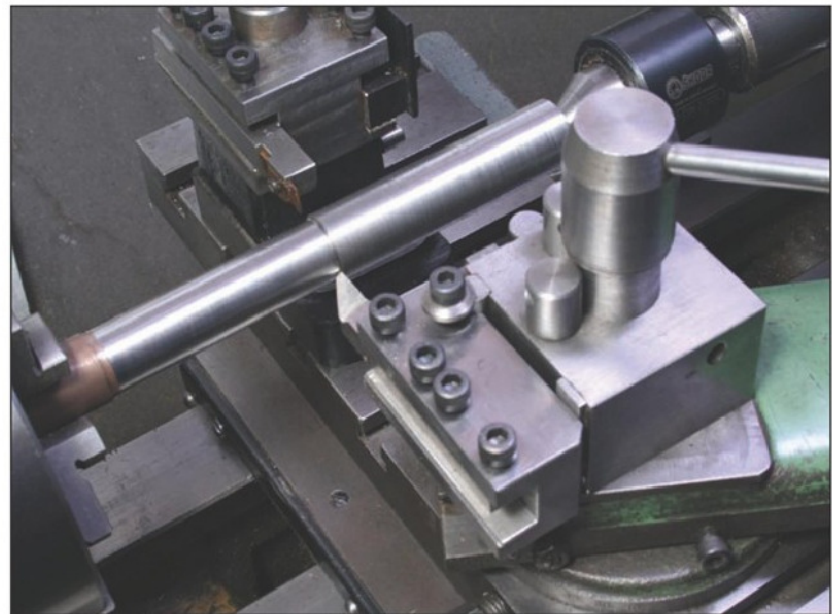


Photo 5. Machining to a right hand face.



Photo 6. For a right hand face, the stop has to be moved to the other side of the saddle.



Photo 7. A saddle stop can be of considerable help when producing batches of identical parts, in this case setting the thickness of the pin heads.

for the majority of the tasks for which a stop can be used. There is though one exception and that is if the reader possesses one of the smaller lathe's that do not have a top slide fitted. In this case, a calibrated stop would be more worthwhile, though even here not absolutely essential.

An even more advanced saddle stop is one having a turret enabling the saddle to be stopped at more than one position but these are only worthwhile if the reader frequently finds it necessary to make batches of small and quite complex components.

A simple saddle stop (Photo 8)

This is seen in the photographs being used on a Myford Series Seven lathe having a flat bed format but would be easy to change dimensionally for fitting to other flat bed machines. It would also be easy to adapt for fitting to a lathe having dovetail slides.

A lathe having a bed where the saddle travels on inverted V surfaces would be rather more of a problem but far from impossible, perhaps just machine a notch to clear the V as shown in **Sk. 1** together with some changes in dimensions.

Manufacture

This is very simple and only two points are worth a comment. There is rather a lot of metal to be machined away to produce the 50mm x 23mm cutout making it time consuming, the following will though reduce the work involved, especially if a band saw is available. Using say a 6mm slot drill, machine a slot along the innermost edge of the cutout then remove the bulk of the metal by just sawing at either end. You may even find a use for the scrap of metal that results. The corners will then need squaring up using a suitable file.

The Support Pin (3) is riveted into the Clamp Plate (2) and then needs to be filed

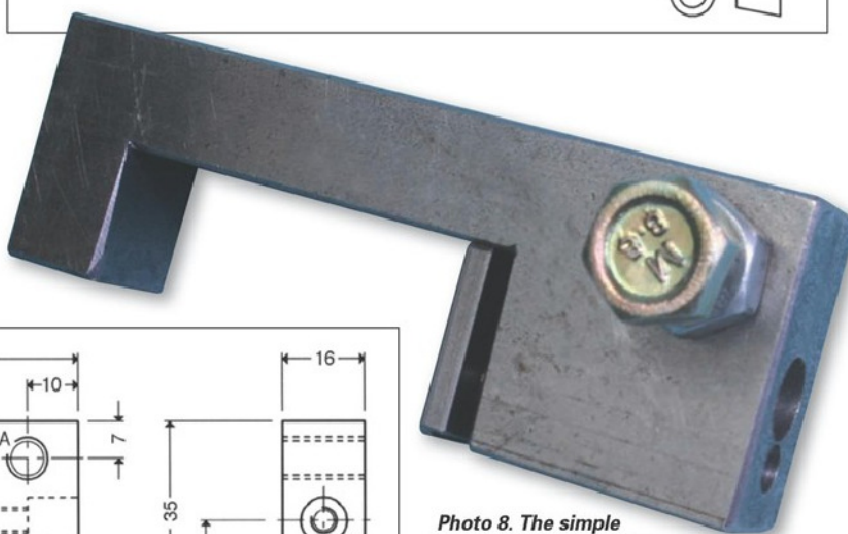
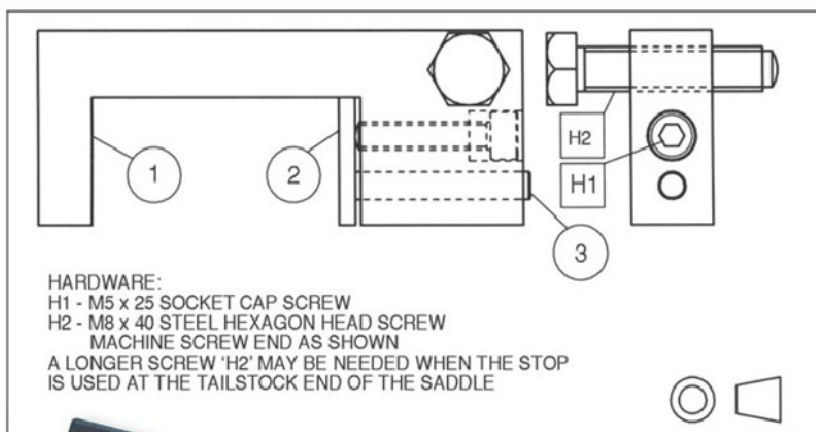
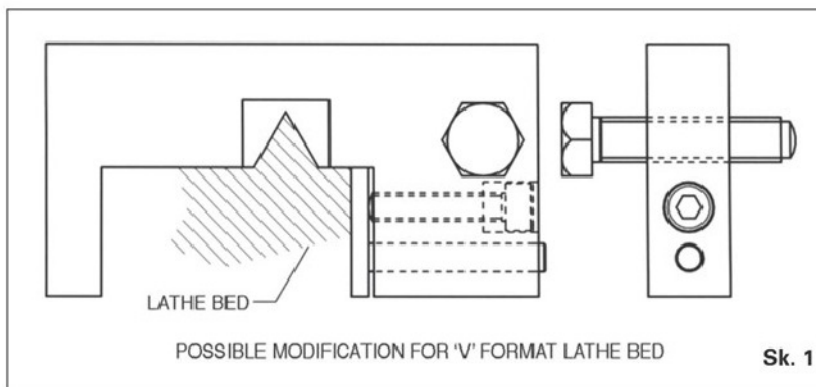
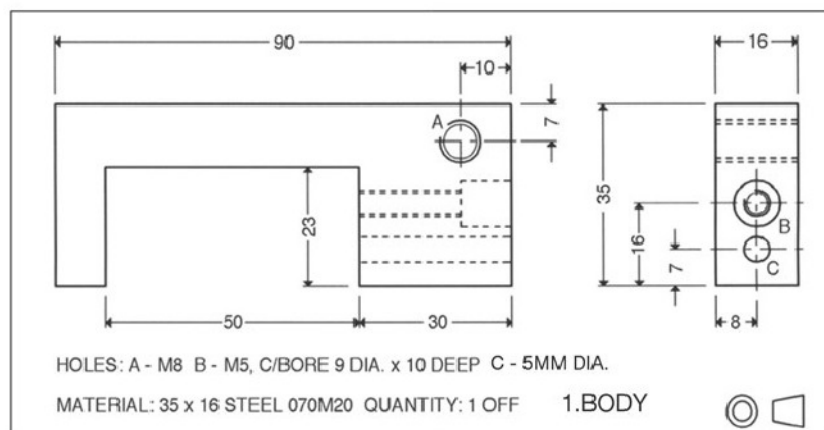


Photo 8. The simple saddle stop seen being used in the other photographs.



flush so that the assembly mates with the edge of the bed accurately. Some readers may prefer this assembly to be captive within the body a feature that is not difficult to achieve using the following method. Drill and tap the outer end of the support pin M3 and on assembly fit a screw and washer. It may though be necessary to make the pin a millimetre or two longer.

One final point, if a thread dial indicator is fitted to the lathe then a longer screw (H2) may be needed when it is fitted as shown in **photo 6**.

The above illustrates a number of tasks that will benefit from using a saddle stop and whilst there are very many more, most can be set up using techniques similar to those described. ■

GRINDING WHEEL SELECTION, SAFETY AND DRESSING ②

Michel Christiaens looks at the safety aspect and the dressing

Take care

Using grinding wheels can be dangerous... or not. It all depends on the way you use and handle them. There are some general rules not to be neglected.

- 1) Select the correct wheel for your work. Inspect it carefully for cracks and other damage. "Ring" the wheel, see **fig. 10**. This means hanging the wheel free and gently tapping it with, for instance, the handle of a screw driver. The sound should be clear, sonorous. If it sounds dull, don't even think of using that wheel because there are most certainly hidden imperfections in the wheel that can make it fly apart when used! Do not bump or drop the wheel, it is more fragile than you might expect.
- 2) Never exceed the maximum safe speed for the wheel. What this speed is can be seen on the blotter(s) stuck to the wheel (see **photos 3, 4 & 5** in the last issue). It is given in revolutions per minute and as the maximum permissible surface speed. The RPM is applicable to that particular wheel alone! Don't think it is of any value for whatever diameter of grinding wheel. It is not! A bigger wheel running at the same speed runs at a higher surface speed. This means the velocity with which a point (abrasive grain) on the periphery of the wheel travels. It is given as "Surface Feet Per Minute (S.F.P.M.) or in Metres per Second (m/s). Wheels with vitrified or silicate bond have a speed limit of 6500 S.F.P.M (33

m/s to 35 m/s). Resinoid and rubber: 9500 S.F.P.M (48 m/s - 50 m/s).

- 3) Never make the hole in the grinding wheel bigger. And never force the wheel on the spindle either. It should slide on with very little play.
- 4) Use clean, well recessed, matching flanges at least a third of the diameter of the wheel, see **fig. 11**.
- 5) Use a clean, smooth blotter on each side of the wheel under each flange, see **fig. 11**.
- 6) Tighten the nut just enough to hold the wheel firmly. Do not over tighten! It could damage the grinding wheel and make it a collection of dangerous projectiles.
- 7) Mount all the appropriate wheel guards. Adjust the dust extraction and coolant nozzle(s). Keep the work rest adjusted within 3 millimetres (1/8in.) of the wheel face, see **fig. 12**.
- 8) Stand aside and allow the wheel to run idle for at least a minute before using it.

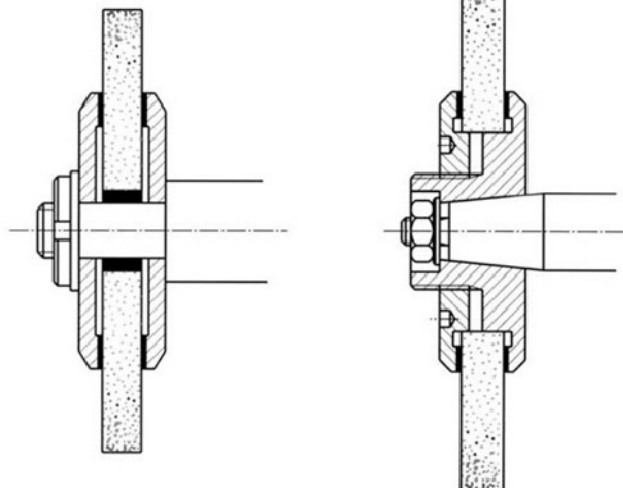


Fig. 11

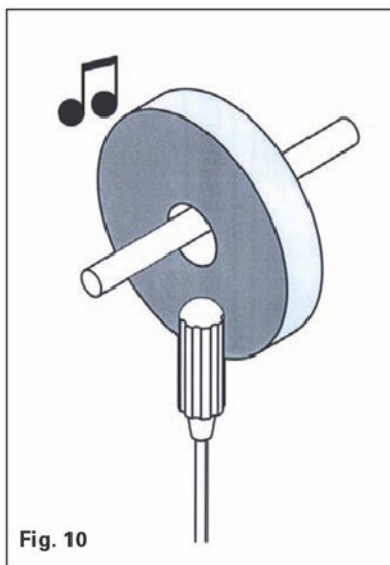


Fig. 10

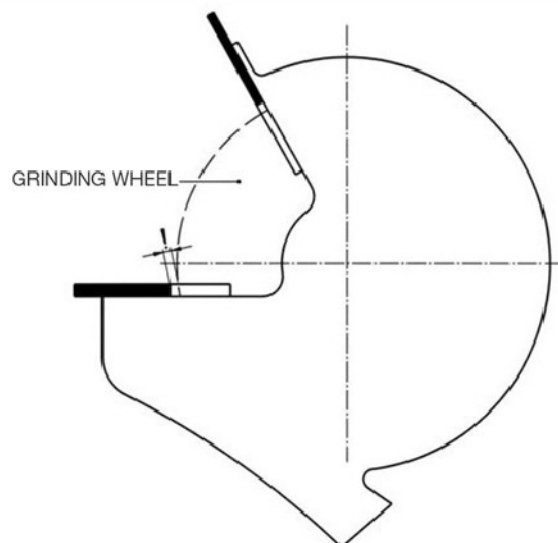


Fig. 12



Photo 7. Balancing weights on a mounted grinding wheel.

- 9) Dress the wheel if out of true. More on that further on.
- 10) Make contact with the wheel without bumping or impact.
- 11) Grind only on the face of straight wheels. Use cup wheels for side-grinding.
- 12) Never force grinding so that the motor slows down.
- 13) Store wheels not in use with care.

Truing the wheel

A freshly mounted grinding wheel will hardly ever run true from the beginning and it is necessary to true it. Moreover, on precision grinding machines the grinding wheels are carefully balanced. In **photo 7**, you can see the little brass weights used to that end. In the home workshop, the wheels used are generally of rather small diameter, running at quite moderate speed. It is then not absolutely necessary to balance the wheels, though it would do no harm. Balancing is a complicated task and it involves the use of some special tools.

When in use for some time, the cutting power of the wheel may drop. It then is necessary to dress the wheel. There is a difference between truing and dressing but the two are very narrowly related. Truing restores the proper shape of wheel and makes it, well... run true. Dressing cleans away foreign particles and exposes sharp new cutting edges on the grinding faces. There are several means to accomplish this task.

Dressing stick

The simplest and cheapest is a dressing stick, **photo 8**. This silicon carbide stick is an economical way to keep aluminium oxide wheels true and ready for use but it is not the most effective. The very hard abrasive of the stick tends to blunt the cutting grains too much.

Wheel dresser

This is a tool (see **figs. 13 & 14** and **photo 9**) where hard, ribbed or star-shaped wheels do the work of taking off some of the periphery of a grinding stone thus making it run true or to expose new, sharp cutting grains. The tool can be used in two different ways.



Photo 8. Dressing stick.

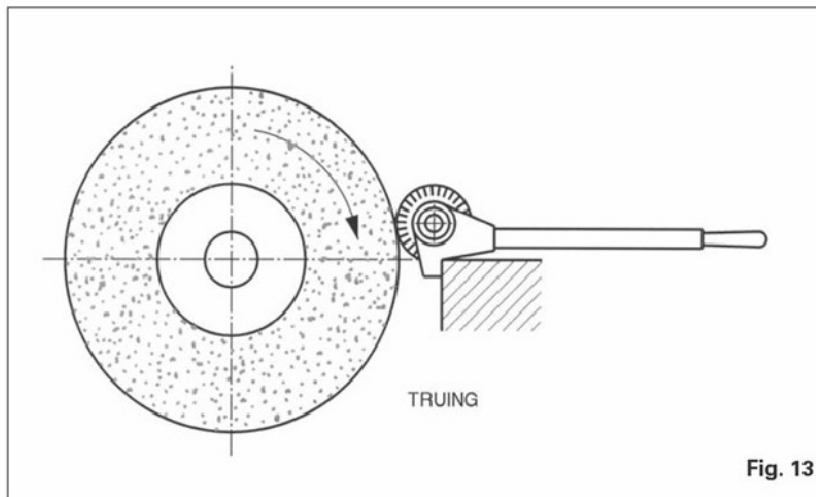


Fig. 13



Photo 9. Wheel dresser.

To true the wheel, see **fig. 13**;

- Move the tool rest back to allow room for the dresser feet;
- Hook dresser feet over the tool rest;
- Raise the handle to bring the cutter wheels in firm contact with the grinding wheel;
- Traverse cutters back and forth across the wheel;
- Re-adjust the tool rest to its normal position!

To dress the wheel, see **fig. 14**;

- Make sure the rest is in proper distance from the wheel as for normal use;
- Place the cutter head of the dresser on the tool rest;
- Firmly push the dresser (without "bumping") into the grinding wheel;
- Traverse cutters back and forth across the wheel;
- Only take off just enough material to present a new, sharp cutting face of the wheel. It usually takes only a few seconds.

Diamond dresser

They come to us as single point and multi point dressers.



Photo 10. Single point diamond wheel dresser.



Photo 11. Multi point diamond hand wheel dresser.

Single point dressers must be used mounted on the grinding machine in some way, see **fig. 15** and **photo 10** usually on precision machines. This dresser is used as shown in **fig. 16**. Different forms can be seen in **fig. 17**.

Multi point dressers, **photo 11** can be used offhand and give good results. Sometimes a form of this kind of dresser is used mounted on the machine as well, **photo 12**. In **photo 13**, a wheel dresser is shown permanently mounted on a surface grinder. The multi point dresser can be moved back and forth with a handle and adjusted radially with a graduated barrel.

The most difficult part

In choosing the right grinding wheel the most difficult part is... finding one! Obviously there are countless combinations of form, dimensions and specifications and so it is totally impossible for anyone to stock them all.

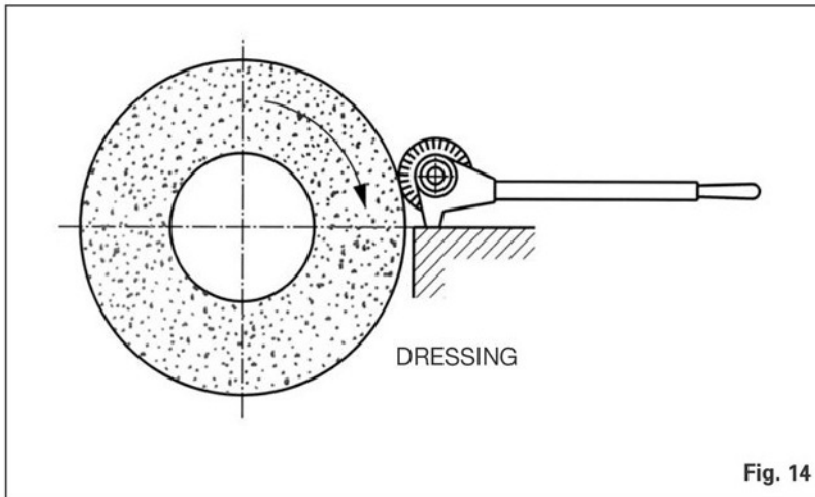


Fig. 14

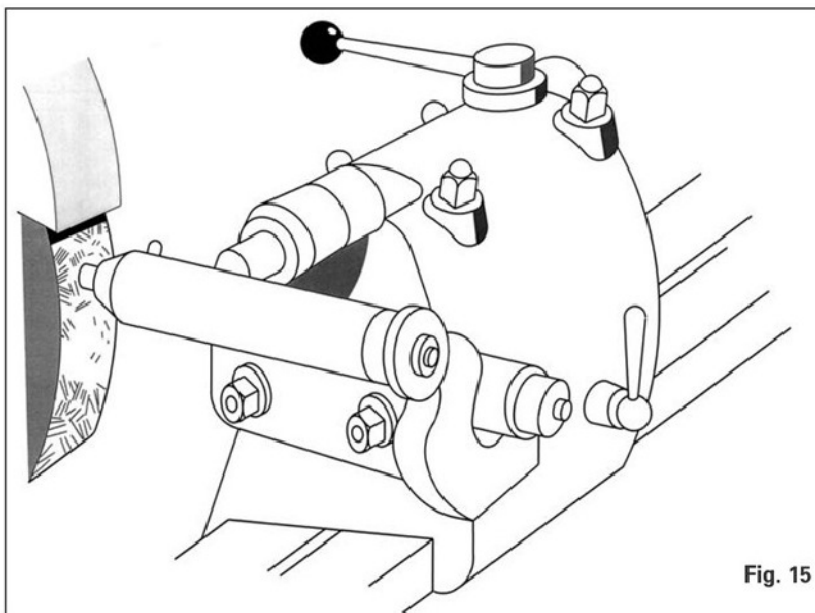


Fig. 15

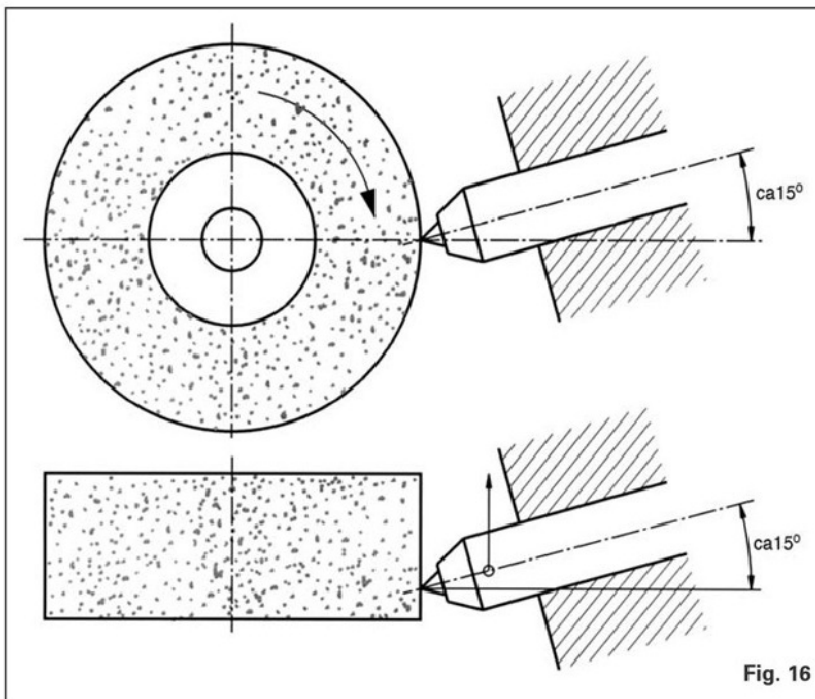


Fig. 16

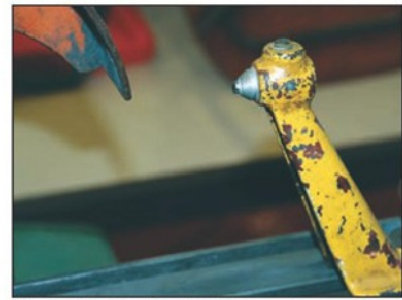


Photo 12. Multi point diamond machine wheel dresser.



Photo 13. Multi point diamond dresser permanently mounted on a surface grinder.

Most sellers necessarily have a limited choice to offer and, as Murphy will have it, hardly ever precisely what you are asking for. Placing an order with the "big boys" (i.e. the manufacturers) is not an option unless you buy 10 wheels, if not more, of the same size and specification at once. So, in most instances we will have to curb our wishes. ■

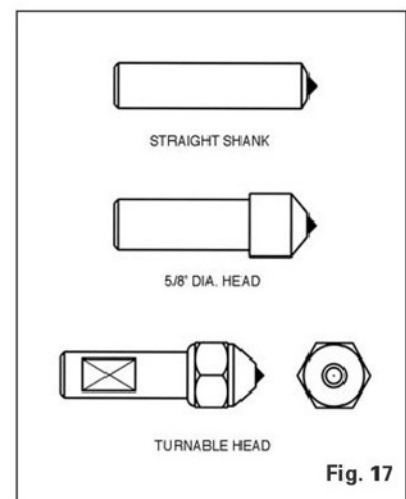


Fig. 17



A Really Quick Change Toolpost

Background and Evolution

The topslide of my lathe contains an inserted M8 threaded spigot secured with three M3 screws and a dowel. It also has two spring-loaded domed plungers, **photo 1**.

The purpose of these is to locate the supplied four-way tool post on station, with the dimples on the underside, **photos 2 & 3**. Although it appears a very imprecise way of doing things, it is surprisingly accurate. When the handle is released, the tool post is lifted clear of the

slide by the springs and the tool post can be spun easily, coming to rest on the plungers. Every time this is done, the tool post is always square to the topslide.

I have never used this tool post, preferring an easier method of setting a tool on centre, **photo 4**. Although I was happy with this setup, I wanted a quick change toolpost and started looking at the items available. Several things came to light, they are very expensive and the QC part is somewhat lost, as most types use some sort of tool to lock and unlock the

Productivity improvement from Jim Whetren

tool holder. The Piston type is lever operated but a suitable size is almost 4in. tall at the top of the nut.

I decided to purchase the Archibald item from Hemingway kits, **photo 5**. This suited me as it was low and lever operated, but the facility to allow the tool holder to project below the topslide made for a large overhang and the body was on the small side for my topslide, almost missing the plungers. I found insufficient room for lock nuts and spanner on the height adjusters, so used a counter grub screw to lock from below, **photo 6**.

I found a simple form of piston type toolpost on the website of Makoto Ishimura, and decided that this would do the trick. I did however change the gender of the dovetails, as I already had a set of tool holders which I could use, **photo 7**.

The finished item provides instant tool changes and rotation of the toolpost; it is also low in profile, **photos 8 & 9**. I added two small dimples to the bottom to locate the toolpost square and at a suitable angle to allow a knife tool to take facing cuts, **photo 10**.

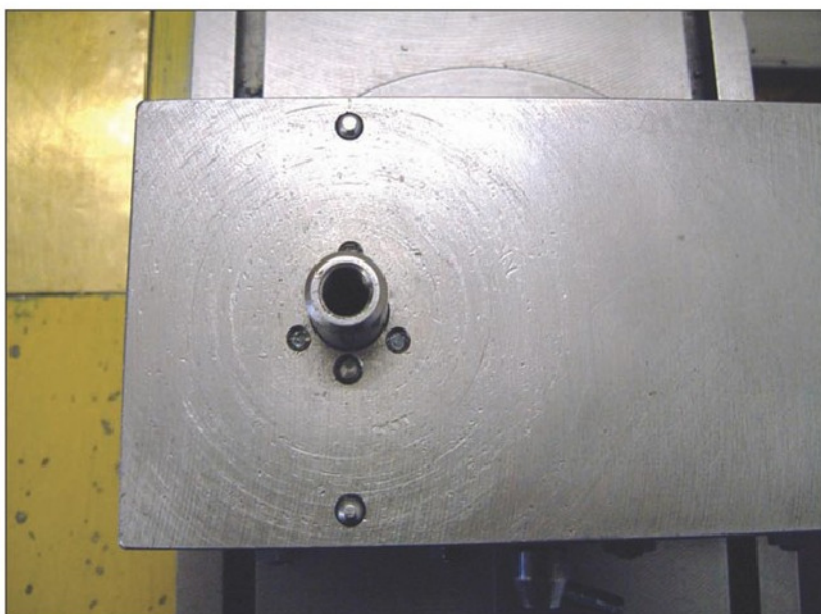


Photo 1. Plan view of topslide showing threaded spigot, retaining screws and spring plungers.

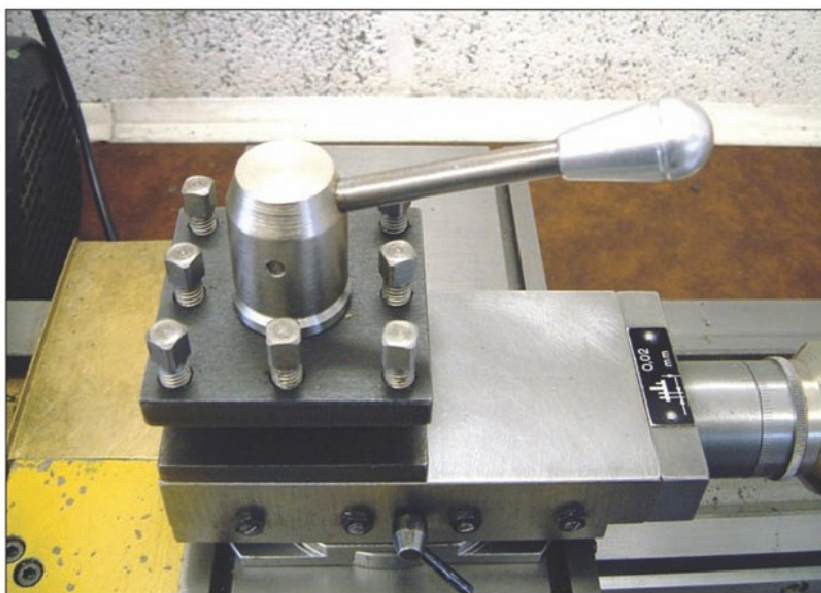


Photo 2. Four way toolpost in position.



Photo 3. Underside view of toolpost showing dimples.

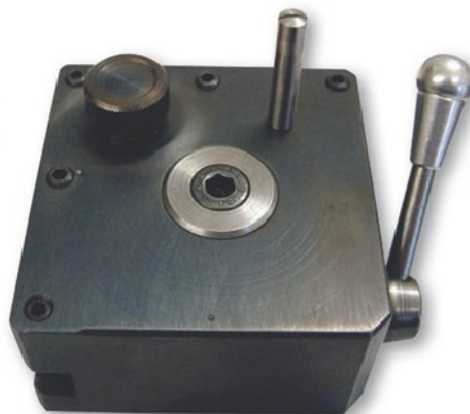


Photo 4. A two tool toolpost which allows screw adjustment of the cutting height.

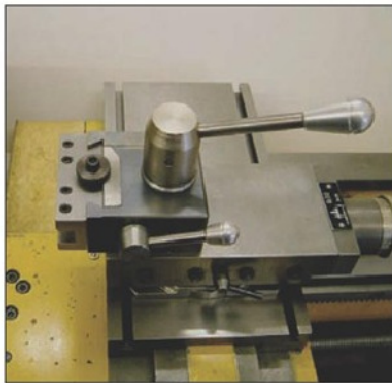


Photo 5. Toolpost from Hemingway Kits.

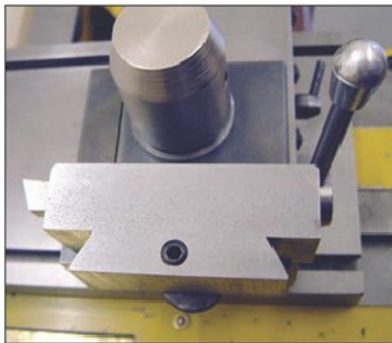


Photo 6. A grub screw on the underside is used to lock the height setting.



Photo 7. This set of toolholders had already been made.

GENERAL ARRANGEMENT

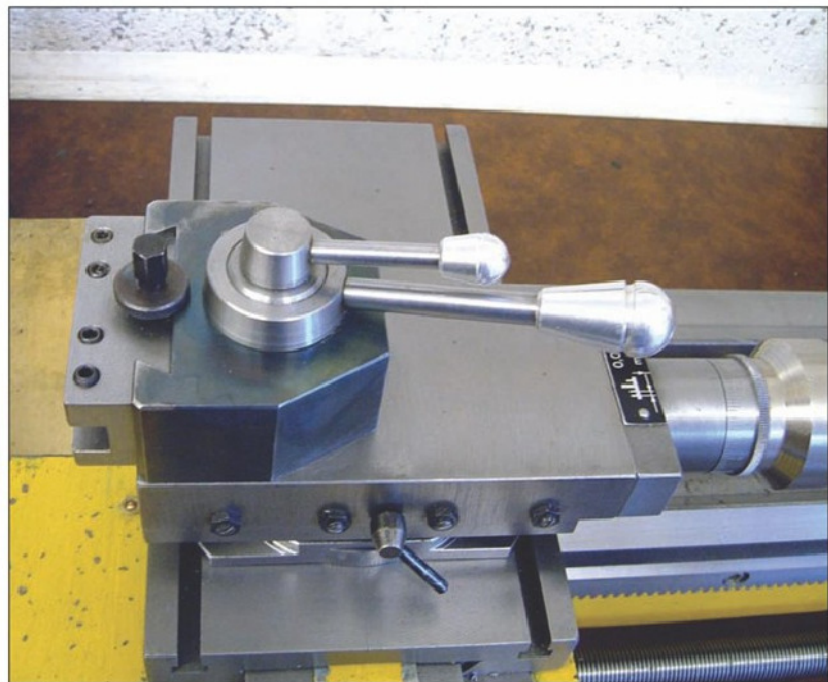
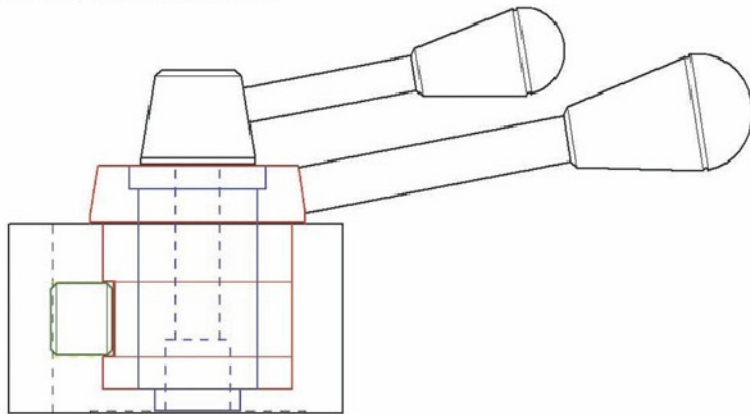


Photo 8. Piston type toolpost installed.

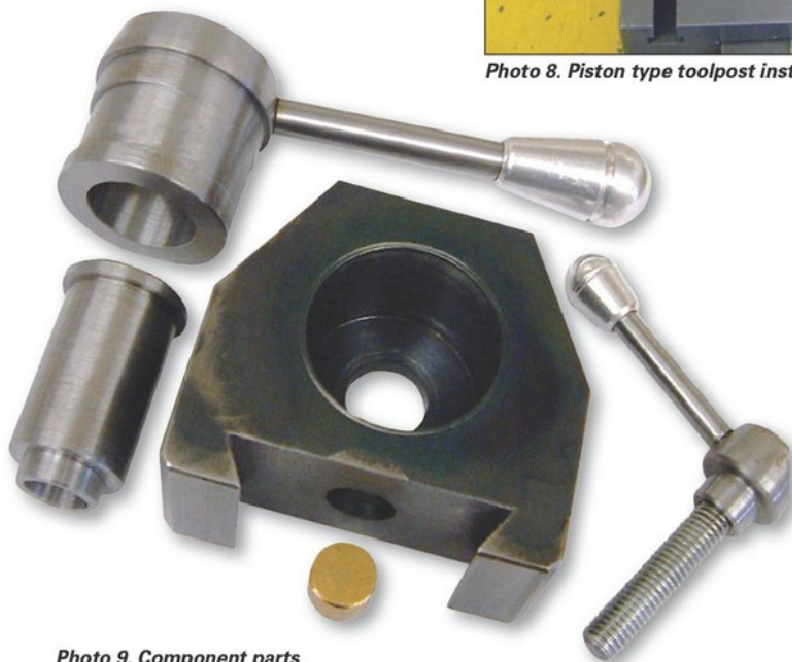


Photo 9. Component parts of piston type toolpost.



Photo 10. Two pairs of dimples for square and facing settings.

The Body (fig. 1)

The size to suit my topline is made from a piece of 2¼in. x 1¼in. MS 2½in. long. The width of this piece should match the width of the relevant topline.

Machine the four sides square to the drawing dimensions by milling or turning and choose the face to receive the dovetail. Measure to the centre of this face, and with a square scribe a line across

the top. At the same measurement, scribe another line at right angles and centre punch the intersection.

Set in the four jaw chuck with the centre mark running true to drill a hole the size of the tool post stud fitted to the topline. I must mention that I am averse to such large studs, as it makes the fitting of tool posts cumbersome. Both my Cowells and earlier Drummond lathes had such studs which were replaced with a similar diameter short spigot for location, tapped with a suitable thread for an Allen screw or handle for securing. If the stud should ever be required, then it could be provided with a short thread to fasten it to the spigot and restore things back to normal.

However, drill the appropriate size hole right through the piece and bore out to 35mm dia. and to a depth of 28mm. Now, or at the end, mount by the bore on the inside jaws of the three jaw chuck and turn the 0.5mm dia. relief in the bottom to 40mm dia.

Mount in the milling vice to machine the dovetail on the chosen face. Although drawn as made, for the reasons given, when I made a subsequent tool post for the Cowells, I reversed the gender of the dovetails to the 'proper' way, which is a better arrangement.

With a large end mill either remove material from the centre to a width of 36mm and 8mm deep as in fig. 1 or form a step either side 11.5mm wide and 8mm deep. Form the dovetail faces with a 1in. dia. 45deg. cutter, remembering to set the cutter 0.04mm above the bottom of the slot and apply the feeds into the cut. When the cutter is almost at the full width of the angled face, lower it to the correct depth and take another pass in the same direction to finish the bottom of the slot. Repeat for the other face, ensuring the dovetail will be central when finished.

Remove the sharp edges, and in the centre of the dovetail make a centre mark to locate the hole for the piston. Locate a centre drill in the punch mark and form a deep centre. Drill a 6mm pilot hole and open this to a size to finish with a ½in. reamer.

The block can be left as it is with chamfers on all exposed corners or the rear corners can be removed as in fig. 1 which gives a lighter appearance.

Piston (fig. 2)

This is just a piece of ½in. dia. silver steel, faced and chamfered both ends to a length of 12mm.

Clamping Sleeve (fig. 3)

Grip a piece of 1in. dia. FCMS in the 3 jaw chuck with about 48mm protruding. Centre, and drill the diameter of the fixing screw or the toolpost stud, for a depth of 44mm to the lips of the drill. If using a spigot as in the sketch, open the hole to the required size and depth with a boring tool or a suitable drill.

Turn down the diameter to 22mm for 38mm and form the 16mm spigot on the end to a length of 3.5mm. Check the length by slipping on the Body to ensure the spigot doesn't protrude beyond the relief at the bottom to allow firm clamping. Skim the 1in. dia. to clean up, and then part off to leave the 4mm collar at the top.

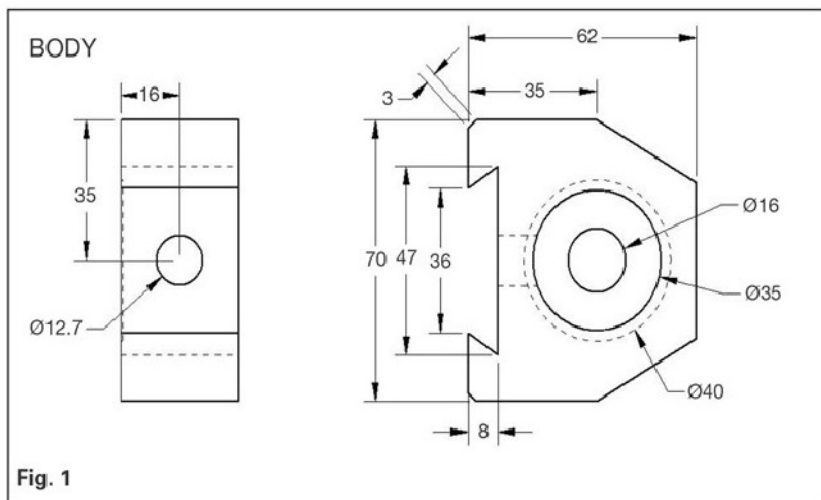


Fig. 1

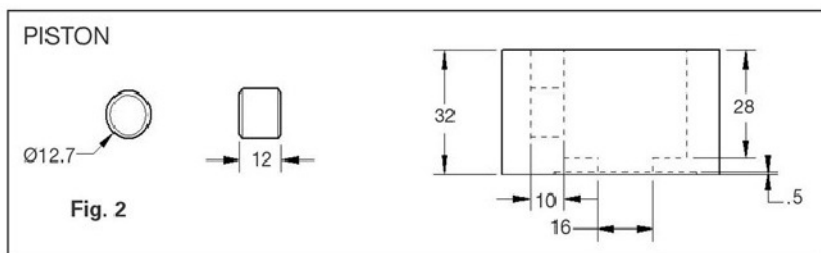


Fig. 2

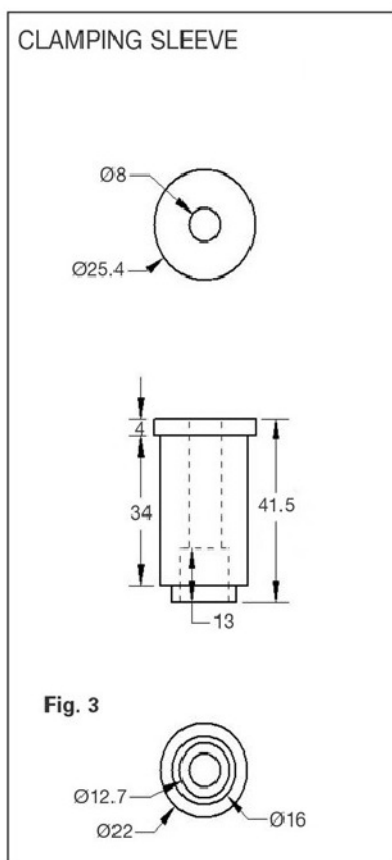


Fig. 3

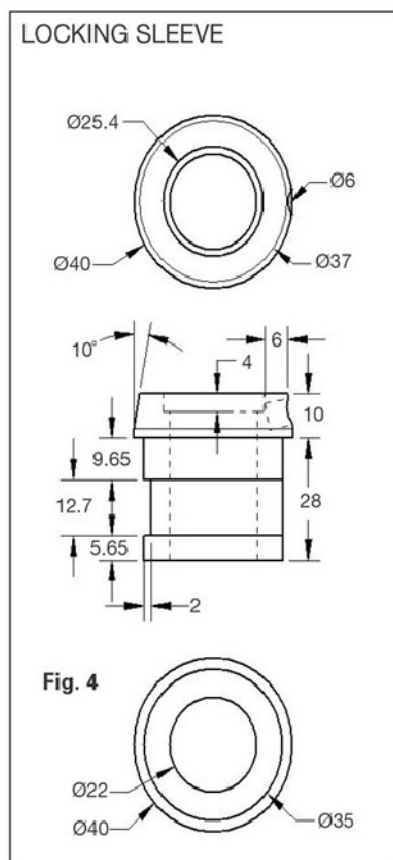


Fig. 4

TOOLHOLDERS

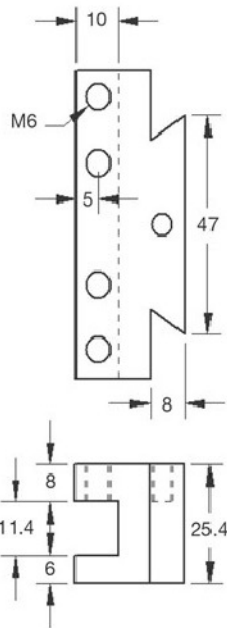


Fig. 5

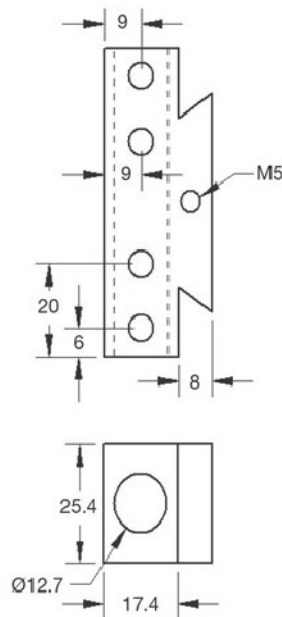


Fig. 6

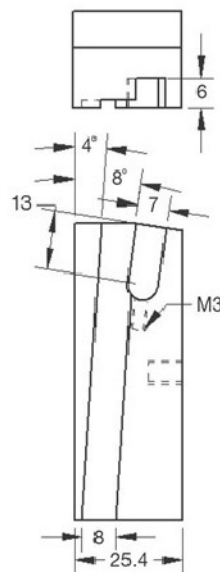


Fig. 7

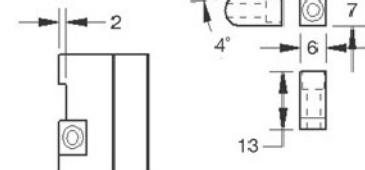


Fig. 8

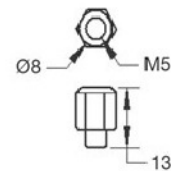


Fig. 9

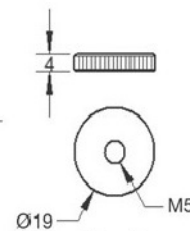


Fig. 10

Locking Sleeve (fig. 4)

Grip a piece of 1½ in. dia. FCMS in the three jaw chuck with about 44mm protruding. Centre and drill a 6mm pilot hole followed by larger drills to finish the bore to 22mm with a boring tool. Turn down to the 35mm dia. for a length of 28mm and touch the corners with a chamfering tool. Transfer to the four jaw chuck and set the 22mm bore running true.

Offset the piece by 2mm and start to form the eccentric groove as in the sketch. When the tool has penetrated about 0.5mm, fit the body in place with a piece of silver steel in the piston bore to check if it is entering the groove. (Don't use the prepared piston as the chamfer will be misleading.) Adjust the width either way to achieve this. The fit in the groove isn't important, as long as the piston enters easily and the groove is reasonably central. Continue removing material at these settings until the depth of 2mm is reached.

Remove from the chuck and saw off, leaving enough to face the top to size. Refit in the chuck gripping the 35mm dia. and set to run true in the bore. When running true, face the top to length and form the 10° angle with the top slide. Open up the seat for the clamping pillar to a depth of 4mm.

Have a trial assembly now by sliding the sleeves together and inserting into the body. Place a suitable bolt through the central hole, securing it with a nut and large washer. Check that with the clamping sleeve locked to the body, the locking sleeve can be turned easily with no end play, removing material where and if needed.

It only needs the hole for the handle as fig. 13, and the piece is finished. The locking handle figs. 11 & 12 will be dependent on the tool post mounting method chosen.

Tool Holders (fig. 5-10)

These simple items are made from lengths of 1 in. square bar and have the advantage of being able to touch up the tool in situ using a Worden standard work slide. It is a good idea to quickly draw file the length of material to flatten any nibs

or dings so that when the required lengths are cut off, they can be ganged together, as many as the vice can hold, to machine the dovetails.

Use the body as a gauge, aiming for a stiff, push fit. It is surprising how much slack is gained when the sharp edges are removed from the dovetails. They should drop into the toolpost under their own weight.

There are three types of holder, four if you count the one for ½ in. square tools. As I use ¾ in. square tools, they were made to this size fig. 5. The one with the ½ in. bore was intended to hold boring tools, fig. 6 but as I prefer to use a swing boring tool holder, photo 11 so it is used

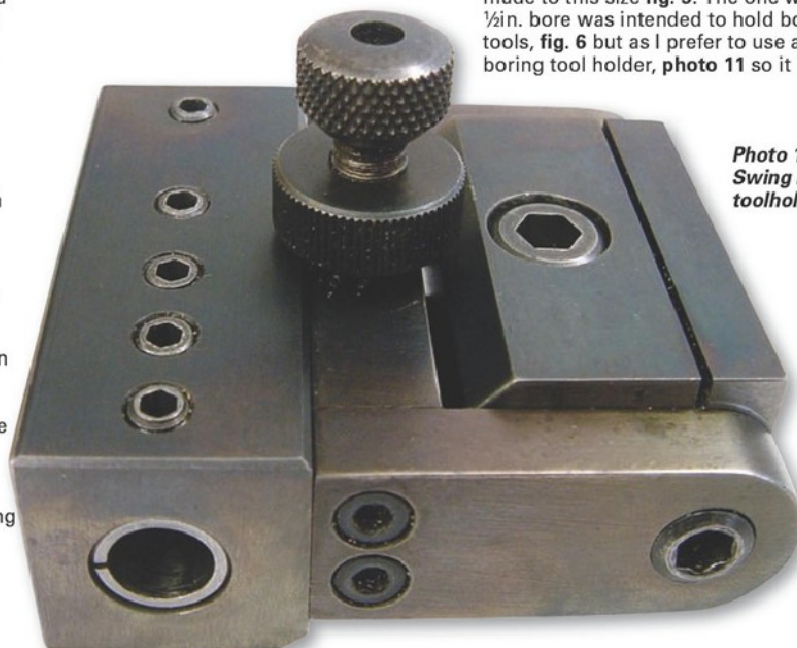


Photo 11.
Swing boring
toolholder.

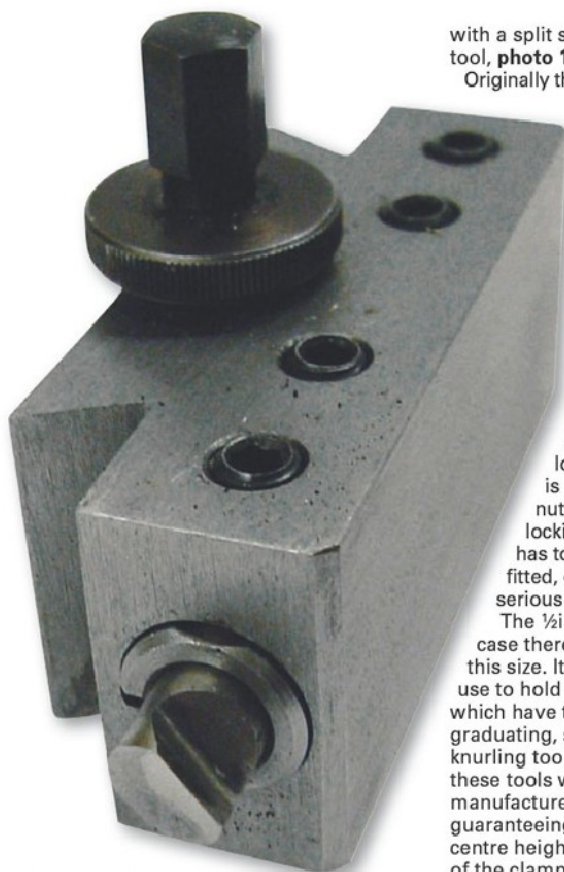


Photo 12. Toolholder with finishing tool held in split sleeve.

with a split sleeve to hold a fine finishing tool, **photo 12**.

Originally the height was set with a 2BA Allen screw with a knurled disc run up to the head, and locked with a nut, or in my case, the M6 grub screw. The grub screw could sometimes be awkward to get at, so the Allen screw was replaced with a piece of studding and the discs locked in position with the 8mm AF nuts tapped blind as **fig. 9**. This also provides a convenient means for picking up the toolholders.

In use the height is set by adjusting the disc and then locking the toolholder. The disc is held with the fingers while the nut is tightened with a spanner, locking the position which only has to be altered if another tool is fitted, or there has been some serious regrinding.

The 1/2in. holder remains empty in case there is a need to hold tools of this size. It does however have a regular use to hold three tools I have made which have to be at centre height, namely graduating, spherical turning, and knurling tools. The clamping bars of these tools were set in position during manufacture in my old toolpost, guaranteeing replacement at the correct centre height. A piece of material the size of the clamping bars was fitted in the holder and set with the tool setting gauge and the adjuster locked.

Now when either of these tools is required, it is fitted into this holder and is automatically correctly set. There is also the advantage in that it is removed and replaced as a unit, and can be easily interchanged with other tools as work proceeds.

Parting Tool (**fig. 7**)

The parting tool holder is made from a piece of 1in. x 3/4in. material as this keeps overhang to a minimum. In the absence of suitable material, mine is a built-up item, **photos 13 & 14**.

The top of the blade slot is at the centre of the front face and is milled to a depth just deeper than the maximum blade width with the vice set to 4deg. to allow the intended blade to just slip into place, bearing in mind that they vary slightly in width. The vice is turned a further 4deg. to mill the 7mm wide slot 6mm deep for the clamp piece.

Further angle setting and machining can be spared by providing the relief for the edge angles of the blade to be gripped by running a triangular Swiss file along the bottom slot until the blade is gripped. The blade is set vertical by adding a narrow strip of suitable shim material at the lower location. Measure the top of the blade, then the bottom, subtract, halve the answer and that's the thickness of the shim.

The little wedge block is easily filed up from an odd piece of scrap, and the angled blade location filed and undercut as with the previous piece. The piece is accurately centred at the square end and drilled tapping size for a turned down M3 Allen screw. The top front end of the holder is angled at 8deg. for extra clearance and appearance. The wedge block is inserted to act as a guide for drilling the tapping hole in the main

HANDLES

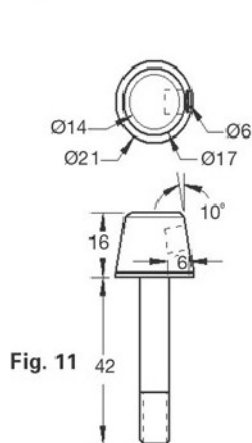


Fig. 11

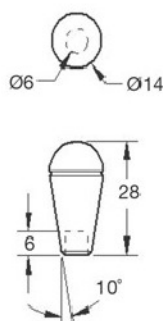


Fig. 12

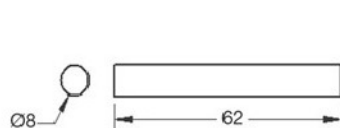
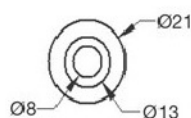


Fig. 13

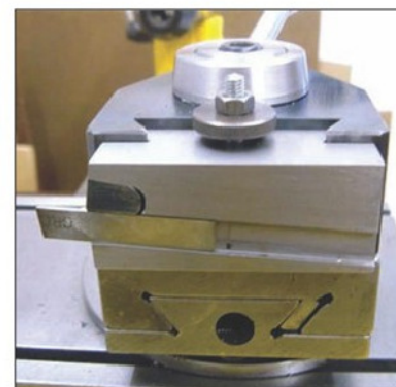
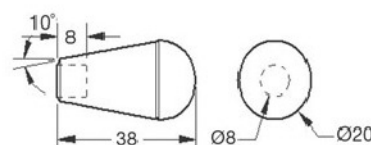


Photo 13. Blade side view of parting toolholder.

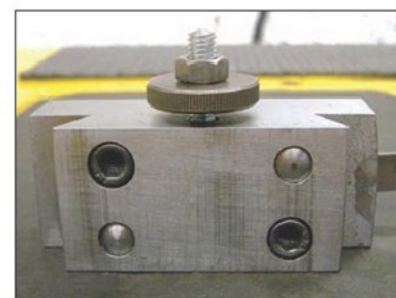


Photo 14. Reverse view shows screwed and dowelled construction.



Photo 15. The two part blade holder mounted in toolholder.

body. After opening the hole in the clamp, it can be used as a tapping guide to tap the thread. The block is then counterbored for the Allen screw.

An alternative holder can be produced from two pieces of $\frac{1}{2}$ in. square bar, the length of a tool holder, dowelled together. The pieces are stacked in the vice level at the ends and the dowel holes drilled and reamed. After deburring all round, they are married together with a thin piece of card trapped between, and the angled slot cut as before with the relief filed in both pieces. The card is removed, and the blade fitted with the narrow shim at the bottom, the blade should be held firm when the holder is squeezed together. The dowels hold the pieces together and aligned for clamping in the $\frac{1}{2}$ in. square tool holder, flush with its face, **photo 15**.

I have used both of these holders to part off MS up to 19mm dia. with no problems. That is not to say they are a substitute for a decent rear parting blade for serious work, but it is a convenient way to part off small pieces as work progresses.

The Smaller Lathe

I have made a miniaturised version of this toolpost for my Cowells lathe and it has also been a success, **photos 16 & 17**. The toolpost is detailed in **Sk.1** and the tool holders in **Sk. 2**. Apart from their size, the items are the same, except for the gender of the dovetails and the method of adjusting and locking the tool height. ■

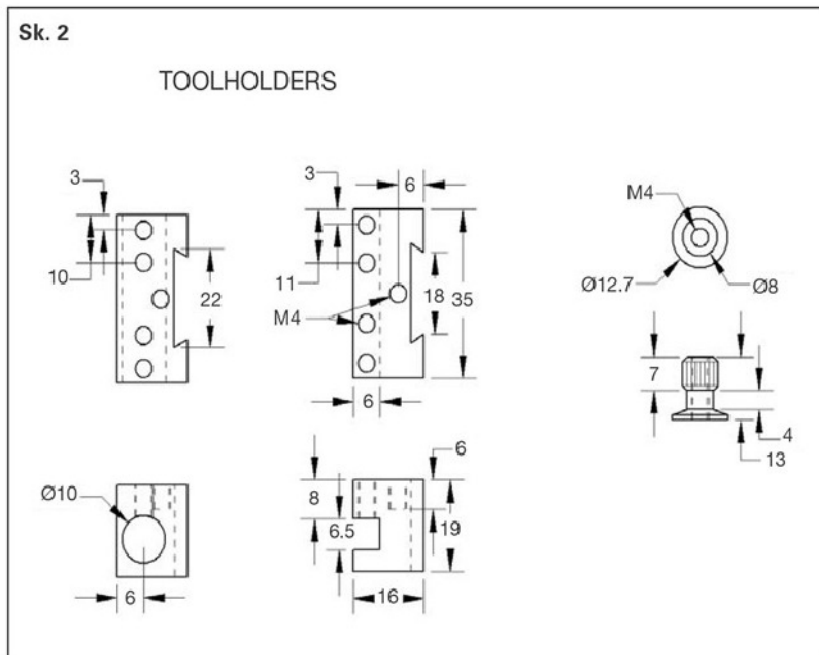
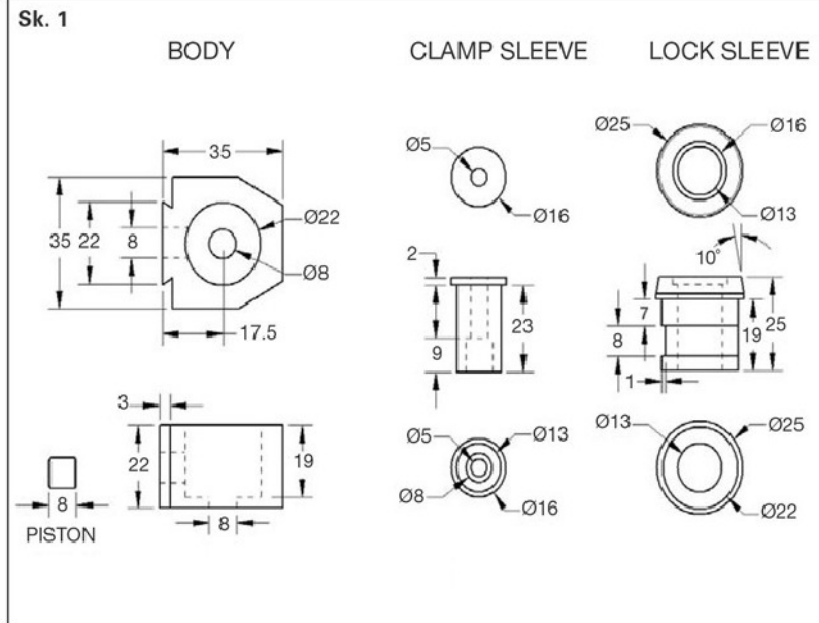


Photo 16. Miniaturised version fitted to Cowells lathe.

Photo 17. Close up view with toolholder.

OFFICIAL INSTRUCTIONS FOR THE CLARKSON AUTOLOCK CHUCK

The Clarkson Autolock Chuck is automatically self-tightening and has been designed to prevent the cutter slipping, pushing into the chuck, or pulling out into the work and to ensure that cutters run concentrically.

Assembly instructions

Clean component parts before assembly

1. Insert the collet 'C' into the bore of the sleeve 'B' ensuring that the driving flats of the collet engage in the mating slot of the sleeve.
2. Insert sleeve and collet assembly into the chuck body 'A' and screw sleeve in until the flange meets the face of the body.
3. Insert cutter and screw into collet until it locates on the centre 'D' and becomes tight.
4. Take the Autolock spanner and give a final tighten to the sleeve.

The following points will confirm that assembly is correct:

- (a) The flange face of the sleeve and the end face of the body must be in contact.

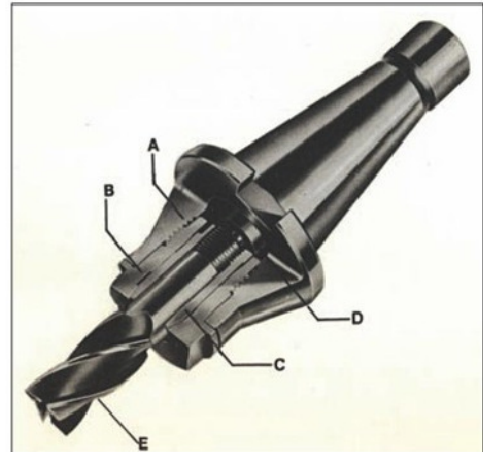
- (b) When the threads of the cutters shank and collet are just engaged, it is possible to move the collet axially.

After the cutter has been screwed in this movement should have been eliminated.

To RELEASE after cutting, screw the sleeve 'B' half a turn using the spanner. The cutter may then be screwed out of the collet.

If Cutter turns in the chuck under the effect of cutting forces, the split collet 'C' is forced into the taper seating of sleeve 'B', thus increasing the grip on the shank.

Heavy cutting forces transmit a turning action to the sleeve 'B', locking it more tightly against the face of the body 'A', ensuring complete rigidity.



I would like to thank Anthony Deeming of Clarkson Osborn for permission to publish this extract from the Clarkson Autolock Handbook. ■

IN OUR NEXT ISSUE

Coming up in issue 141, on sale 16 July 2008

Harold Hall looks at sharpening drills.



Fitting a chuck to a back plate.

Setting lathe tools with a cheap digital height gauge.



(Contents may be subject to change)

DON'T MISS THIS GREAT ISSUE – see page 10 and subscribe today

MAKING WORKSHOP FURNITURE ①

Stuart Walker fits out his new workshop

In common with home furniture, a lot of items can be purchased at quite a reasonable price but if you're trying to make the best possible use of limited workshop space there is a lot to be said for making much of it yourself to ensure the space works in the way best suited to your needs. I have found that plywood based furniture works best for me and this short article is based on my recent experience of fitting out my new machine shop, **photo 1**.

Design

I wanted to create a workshop that is comfortable, can be easily kept clean and is uncluttered, that is to say, everything is stored in a logical way and it's just as easy to put things back in their place as it is to put them down where you are working. It is, without doubt, worth having a careful look at what furniture is available off the shelf to see what can fit, or be simply modified to fit, so that you can make up your mind over the best value for money.

When considering the options, it's worth making a well considered list of your own needs including key dimensions and take time to prepare drawings with cutting lists that make the best use of standard sheet sizes - if in doubt, make cardboard mock-ups to better consider your design options. Remember that design is a compromise, so there is everything to be gained in producing more than one solution and assessing value against your list of needs.

Work benches

The key aspects to consider when designing workbenches include: size, height, rigidity, work fixing, finish, under bench use and surrounding space, **photo 2**.

Large work benches are useful, but if space is at a premium a small, well located bench, which could be temporarily extended may be perfectly adequate.

Space on and around the bench is all important and island units offer far more advantages than those standing against a wall. I find it useful to line up work benches in small workshops with door openings so as to best accommodate those occasionally long lengths. Standard benches are about 900 high, which may suit most, but there is a lot to be said for making your own to ensure comfortable working, **photo 3**.

The best benches I've used are heavy and robust frameworks using either cast iron or structural steel. Apart from welding benches that are steel covered, I prefer to use hard plywood tops with projecting hardwood edges suitable for securing work clamps. For heavy work, there are advantages in using steel angle edges and a sacrificial top surface that can be easily replaced when worn or damaged.



Photo 1. An overall view of the new workshop.



Photo 2. A typical workbench.

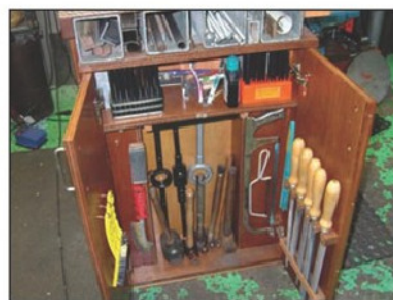


Photo 3. End view of a workbench.



Photo 4. A typical wall mounted cupboard. Note the use of studding to support the small shelves.



Photo 5. The 'R8' cabinet. The ER collets are in wooden blocks on the bottom shelf.

Planning what goes under the bench can pay dividends when it comes to rationalizing hand tools.

Wall Cupboards

The key aspects to consider when designing workshop cupboards include: size, height above ground for sight

and reach, shelving layout, door swing clashes, rigidity, wall fixing and finish, **photo 4**.

Most of my cupboards are wall mounted, framed in 3/4in. plywood glued and screwed to 1/2in. plywood backing. This backing provides rigidity to the box, keeps the inside clean and allows it to be simply



Photo 6. Collets can be stored in a tray rather than thrown in a drawer.



Photo 7. Sliding trays enable easy access to lower items.



Photo 8. Cutters are stored upright in blocks to protect cutting edges.



Photo 9. Larger milling cutters are stored on dowels.



Photo 10. Drawers are ideal for small thin tools like taps and dies.



Photo 11. The drawers have dividers positioned as required.



Photo 12. Drawer knobs are made from brass bar.

screwed directly to the wall. I find it useful to screw a batten to the wall that defines the bottom edge and allows you to support the completed unit whilst trying it for position and final fixing onto the wall. The main shelves in my cupboards are fixed because this strengthens the frame, with the secondary shelving dry screw fixed later to ensure flexibility in the detailed planning, **photo 5**.

The doors are a single sheet of $\frac{3}{4}$ in. plywood with adjustable kitchen unit type hinges. The insides of the doors are useful for hanging tooling reference charts.

Drawer units

Key aspects to consider during the design of drawer units include: size, depth, full or part opening, runner loading, rigidity, height above ground for sight and reach, storage layout and finish.

In order to waste as little room as possible, I normally use 16 gauge steel fabricated drawer sides with $\frac{3}{4}$ in. plywood fronts and $\frac{1}{2}$ in. plywood for the bases and backs. Heavy duty steel ball race runners, which provide full drawer opening are the best way of supporting the drawer, but some saving may be achieved by using runners that restrict full opening, though I consider this to be false economy.

The photographs show some alternative arrangements for drawer management systems. The top drawer contains a fixed collet rack, **photo 6** but the two centre drawers have sliding trays, **photos 7 & 8** and the bottom one has lift out cutter stands, **photo 9**.

Small tool drawer sets

The key aspects to consider when designing small tool drawer sets include: overall size of unit to best suit the available space, the size of the individual drawers to best suit the equipment and ease of removing and replacing the drawers when using the contents.

In my design, the two drawer unit sides are made from $\frac{3}{4}$ in. plywood which are grooved $\frac{1}{4}$ in. deep to make a nice sliding fit for the $\frac{1}{4}$ in. thick plywood base which forms both the drawer bottom and side runner, **photo 10**.

Hardwood is used for the drawer fronts with whatever wood comes to hand for the sides and backs, which are glued and screwed to the plywood base. It makes for a neater finish and easier assembly if the corner joints are set into small registers and screw fixed. Internal dividers are pinned and glued to suit individual drawer needs, **photo 11**.

Making the individual drawers does involve a lot of time consuming repetition and it is worth making stops and jigs to suit the equipment you have to hand. I found a radial arm saw offered the quickest solution.

The drawer runners need to be fine sanded after the varnish has hardened and given a good waxing to ensure a smooth action. The knobs are made from brass bar stock and fitted with countersunk raised head wood screws, **photo 12**.

Bar Stock drawers

The key aspects to consider when designing drawers for bar stock include: length, weight, durability, visibility of stock and runners.

On completion of the electrical wiring, I found myself with surplus 3in. square



galvanised trunking. This works very well as a drawer and runner set for two foot long drawers, with the lid being used as a base runner and the box as a drawer. It needed a piece of flat bar pop-riveted to the ends to stop the sides from spreading and to act as a handle, **photo 13**.

Drawers don't have to be in metal and the plywood drawers I made up for the new bandsaw base worked well.

Mobile Units

There is a lot to be said for making as many floor mounted mobile units as possible for the smaller machine items. These units are best fitted with swivelling braked castors and, where appropriate, jacking screws for levelling so that the workshop can be easily reconfigured to best suit the work in hand. I have found this to be so successful that many of my small machines and equipment are now fitted on castor mounted units that are made with suitable drawers and cupboards that contain the relevant tooling and replacement parts.

In the early days I used 50mm diameter wheels but soon found it was false economy and I'd recommend no less than 75mm diameter. Whilst on the subject of castors, I've more recently been using temporary castors on a Boxford 10 20 lathe that was recently purchased and is currently undergoing restoration. It was very convenient to bolt the castors on as the lathe was being off-loaded and enjoy the facility of being able to easily move it into and around the workshop during the rebuild before eventually removing the castors and setting it down on its levelling pads for final commissioning. The Boxford rebuild has been an interesting project and may well be the subject of a future article. However, getting back to the subject of workshop furniture, I've set out below some examples of my mobile work units.

Open shelf units

The key aspects to consider when designing mobile shelf units are: size, height, strength, stability, surface finish and manoeuvrability.

My mobile shelf units have been designed as space savers and the example shown in **photo 14** was made to go in front of a floor mounted drilling machine, **photo 15**. Both are on wheels and can be easily moved to suit the requirements of the work in hand. The units carry the heavier pieces of kit for use on the milling machines, which includes a large dividing head, quick indexer, large rotary table, vertical milling heads and the slotting head. The shelves are faced with galvanised steel sheet to help slide these heavy items with relative ease and resist any contact surface corrosion tendency. The lowest shelves for the heavy pieces of kit are set 13 inches above the ground and the highest at no more than 36 inches to simply accommodate my hydraulic lifting trolley, **photo 16**. Clearly, with stage lifting these trolleys can lift much higher and I used mine for lifting the larger wall mounted cupboard units into position single handed.

Cupboards and worktop extensions

The design criteria for mobile cupboards and worktop extensions are flexibility in use and ease of storage. The example, **photo 17** is a wheeled cupboard unit that contains a small 25mm belt linisher with



Photo 13. Galvanised trunking is used to store material. Square plastic guttering is a useful alternative.



Photo 14. A mobile shelf unit....



Photo 15.fits in front of the pillar drill.



Photo 16. A hydraulic table is very useful in the workshop.



Photo 17. This mobile cupboard stores a small belt finisher and polishing supplies. It doubles as a useful work surface.

all associated grinding and polishing bits and pieces. Whilst the worktop is suitable for mounting and using the finisher in an area where the unfriendly dust can be removed out of harms way, it's also useful as a mobile work top for other tasks including as an extension to any of the work benches which are all made to the same height.

Bandsaw base

This is not strictly furniture and I would not normally advocate the use of plywood for metal cutting machine bases, **photo 18** but it has worked for me and others may be interested.

The low cost Far Eastern bandsaws that seem to find their way into most home workshops have the most dreadful pressed metal base, which makes the machine noisy and not very space efficient.

By replacing the metal base with a robust plywood box base on wheels with integral drawers and shelf space for work in hand, maintenance tools and short bar end stock, the additional mass has transformed the machine into a smooth running saw with useful storage and good manoeuvrability. To help contain the sawdust I slid a shallow baking tray between the top of the two support columns. The table was extended with box and angle section supported by threaded rod, **photo 19**.

A roller extension was also made to fit on a workmate to make it easier to accurately cut heavy long bars, **photo 20**.

Tool holder stands

Photo 21 shows some of the stands that have been made up from plywood and hardwood off-cuts as the workshop has been developed.

The purpose of these stands is to keep the tools organised for convenient use, and as far as the cutting tools are concerned, protecting their sharp edges.

Next month, we will look at the materials used for the cupboards, the tools used and the final finishing. ■



Photo 18. The new base for the bandsaw has several useful drawers....



Photo 19.and has a useful extended table.



Photo 20. A workmate is used as a roller material support.

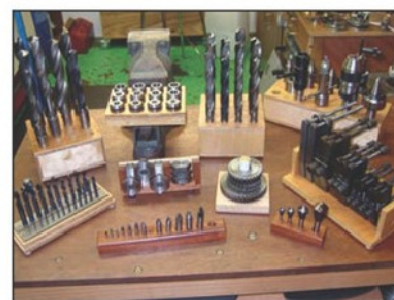


Photo 21. Various stands are made from plywood offcuts as the need arises.

AN OUTSIZE HASTY PURCHASE

Jim Whetren modifies
a white elephant

Background

When I ordered the kit for the George Thomas versatile dividing head, I went the whole hog and also ordered the milling kit and the swivel base designed by Mr. L. Downs.

As I had mounted the dividing head on an adaptor plate to attain the centre height and Tee slot spacing of my lathe's cross slide, the revised mounting holes in the body casting would not allow fitting to the swivel base without drilling additional mounting holes, which was not desirable. Typically, I had not thought it through before placing the order.

Having spent several days looking at this lump of cast iron, (an expensive door stop) I realised that it would provide a swivel base for my spin indexer, and moreover; a swivelling base for a machine vice.

Brilliant! But with an overall flange diameter of over 6 inches, the next problem was how to cut the circular Tee slot on a 4 inch rotary table?

Swivel base casting (fig. 1)

This is a substantial lump of iron to machine and involves some interrupted cutting. The casting was held by the circular boss in the reverse jaws of a 6in. four-jaw chuck, but due to the taper of the boss, only the tips of the jaws were in contact, **photo 1**.

The casting was rotated until even contact was made on the steps of all of the jaws and the cored hole in the base was set running true. A pair of twiddling



Photo 1. A precarious grip.



Photo 2. Useful four-jaw twiddlers.

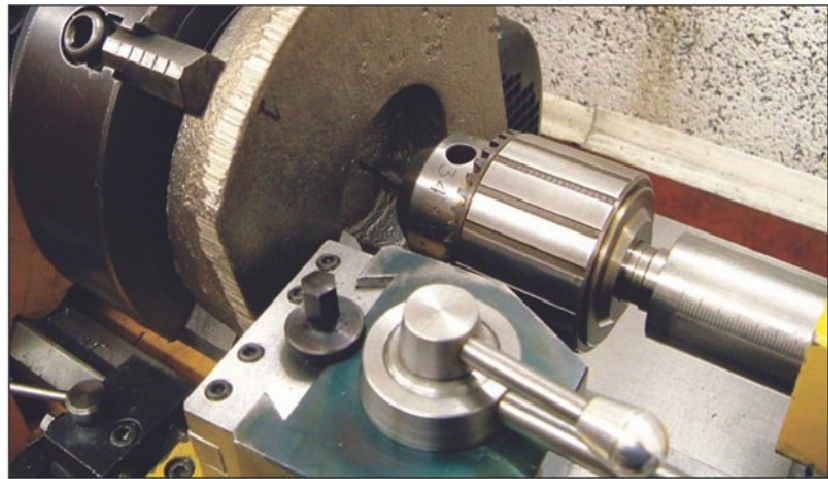


Photo 3. Centre drilling.

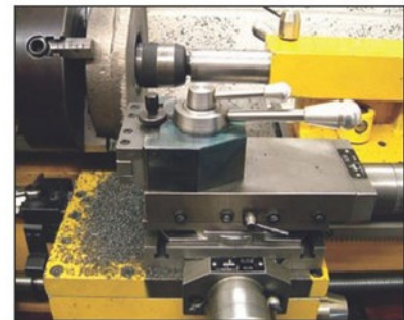
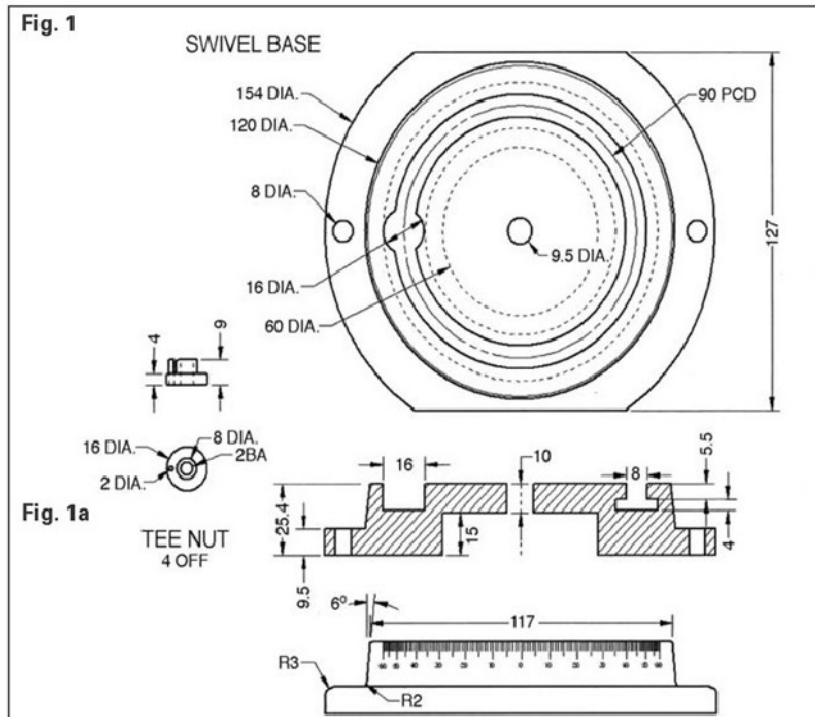


Photo 4. Centre back up.

knobs allows horizontal pairs of jaws to be adjusted together, which speeds up the setting process, **photo 2**.

A centre was made in the bottom of the hole to allow additional support to be provided with a rotating centre. This was one of the rare occasions when the topslide required mounting in its alternative position, **photos 3 & 4** to allow the outside edge of the casting to be reached.

The base flange was faced to clean up and another cleaning cut taken along the outside edge. With the tailstock withdrawn, the cored hole was opened up

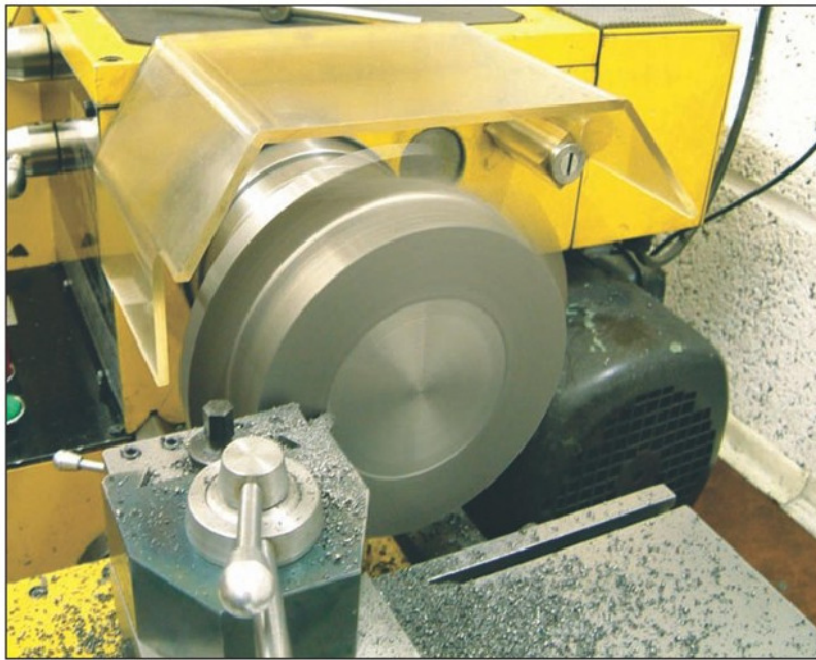


Photo 5. Final facing.

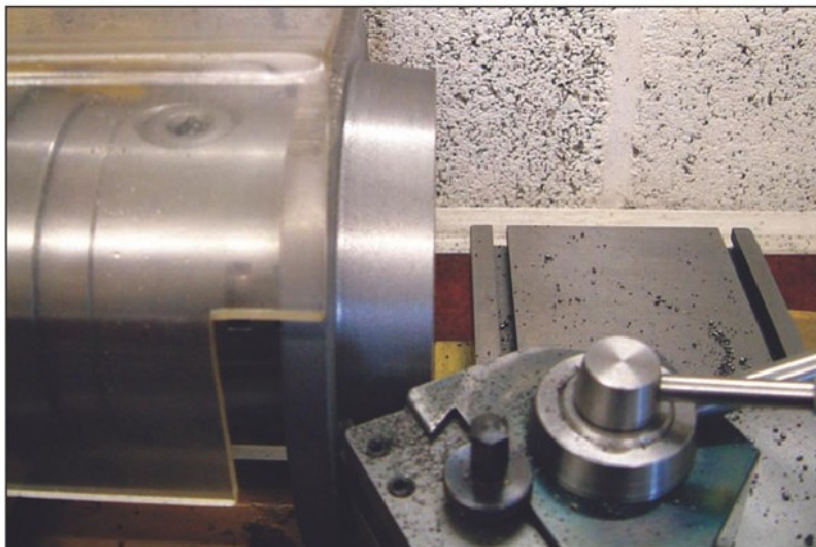


Photo 6. Finishing the taper.



Photo 7. Ready to ream.

with a boring tool to 60mm dia. to a depth 1mm greater than the clearance for the tips of the jaws of the three jaw chuck and then used to mount the casting.

The carbide tool was used to face the top of the boss and clean up the tapered portion and the top of the flange, **photo 5**. A round nose HSS tool was used to finish turn the taper on the boss at 6deg. and provide a radius at its junction with the flange continuing the cut to finish the top of the flange, **photo 6**.

The centre hole was opened up to 6mm as this was the largest drill able to clear the chuck jaws. The casting was clamped to the table of the pillar drill and aligned with the 6mm drill. This was replaced with a 9mm drill followed by 9.5mm, ready to ream to $\frac{3}{8}$ in. dia., **photo 7**.

This hole was used to mount the casting on the mill table on a card washer to finish the two straight portions of the flange. Although everything seemed secure enough, two clamps were also used as backup, **photo 8**.

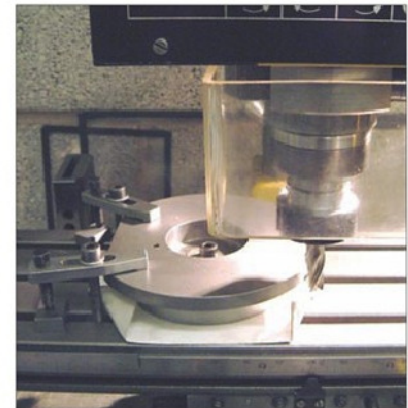


Photo 8. Finishing the straight sides.



Photo 9. Diminutive rotary table.



Photo 10. Overload.



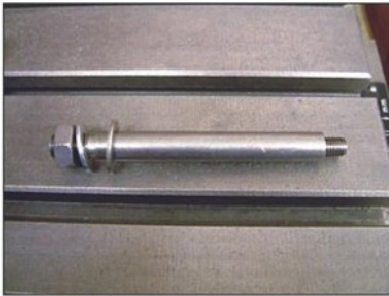


Photo 11. Threaded pin.



Photo 12. Ready to go.



Photo 13. Slot cutting.



Photo 14. Starter hole.

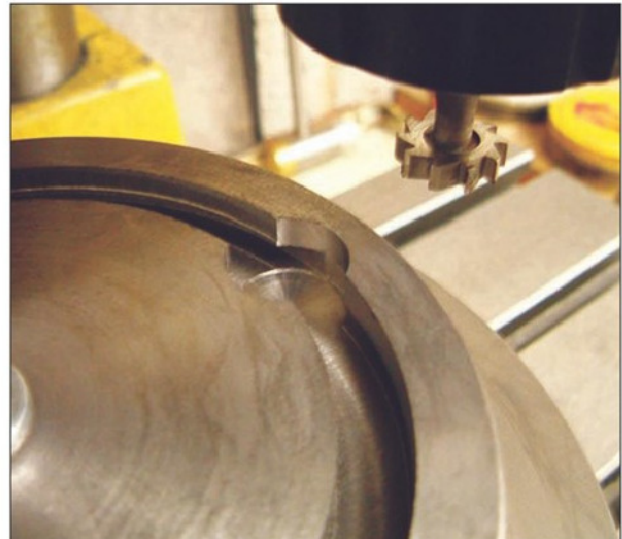


Photo 15. The finished 'T' slot.



Photo 16. Slot cleaned up.



Photo 17. Completed.

The challenging bit

I have a 4in. geared rotary table, which has a $\frac{3}{16}$ in. dia. centre hole, which I use for location and setting purposes. There is an M6 threaded, flanged bush fitted in the bottom of the hole used for mounting work on a suitable hollow pin. The size difference is shown in **photos 9 & 10**.

A piece of $\frac{3}{16}$ in. dia. bar was threaded M8 at one end and M6 at the other in order to clamp the work on the rotary table, **photo 11**. With the rotary table fitted to the mill, the casting was located on the card

washer and secured with a nut and washers on the stud, **photo 12**.

An 8mm slot drill was aligned with the top of the stud and the table moved to the left by a distance of 45mm. The slot drill was fed in to a depth of 9.5mm and then raised to take a cut of 4mm around the slot, **photo 13**. This is where it is handy having a workshop vacuum cleaner. After a good suck, a further 4mm cut was taken, followed by a final cut of 1.5mm, the slot being cleaned out after each pass.

With the slot at its starting point, a $\frac{3}{16}$ in. dia. end mill was fed down to a depth of

10mm to provide access for the Tee slot cutter, **photo 14**. There then followed a very slow process of cutting the Tee slot with much relief when it was finished, **photo 15**. As can be seen, I was a bit too enthusiastic with the end mill. **Photos 16 & 17** show the base machining completed.

Tee Nuts

To avoid having to make traditional tee nuts, which would need inner and outer radii for clearance in the circular tee slot, I opted for simple circular nuts, **fig 1a**, which made fitting a lot easier and would

be quite suitable for the compressive loads involved in the clamping. The flange was drilled to accommodate a 2mm dia. pin to prevent rotation when inserting the screw, **photo 18**.



Photo 18.
A 'T' nut.

The Spin Indexer

The body of this item is another large and awkward casting to hold. The centre of the base was found and lightly punched. This mark was used to locate a pair of dividers set to 45mm, and a light circle was scribed at the PCD of the Tee slot and the four mounting hole positions marked, as per **fig 2** and punched.

An angle plate was bolted to the table of the pillar drill and the casting was fastened to this with a piece of M10 studding with nuts and washers using a strap piece to bridge the large bore. Additional support was provided at the free end with some packing wedges. A small spirit level was used to bring the base level with the bubble in the same position as when tried on the drill table, ensuring all was parallel, **photo 19**.

The punch dot in the centre was aligned under a setting point and the angle plate finally tightened. A deep centre was made followed by drilling in stages to 9.5mm x

12mm deep then reaming the hole $\frac{3}{16}$ in. dia. for the swivel pin.

With a combination of swinging the drill table and shifting the angle plate, each mounting hole was located and drilled 4mm dia. I found that with the split point drill, the drill could be fed straight in without the need for using a centre drill first.

The casting was clamped to the drill table on its base to spotface the mounting holes, which being drilled undersize meant that the pilot was working, thus ensuring the larger diameter did not wander, **photo 20**. The

holes were finally opened up to 5mm diameter for the fixing screws.

A Vice

When I bought the Hobbymat mill/drill, I did not have a suitable milling vice, so made a built-up item. I followed the simple design of the one supplied by Cowells for their vertical slide. The moving jaw is fastened to its plate with an Allen screw and the tightening screw only pushes forward. With the jaw nipped up, the screw is tightened fully and then the Allen screw finally tightened, which ensures the jaw is hard down on the base and any lifting eliminated. With a hard steel ball in the end of the adjusting screw, a very tight grip is provided and this vice was used successfully for all milling work for a number of years, **photo 21**.

Having since graduated to a Groz precision vice and then to a Soba Pin type vice which is currently used, this home made attempt has been lying at the back of a shelf. I thought it could be used as a swivelling vice and brought it out once again.

Vice adaptor plate

A 120mm long piece of 2in. x $\frac{1}{4}$ in. MS flat was cut off and lightly punch marked at its centre. Dividers set to 45mm were used to scribe two arcs for the mounting bolts. The dividers were then set to 60mm and two arcs made at both ends of the piece.

The mounting holes were marked and punched as per **fig 3**. With the plate clamped to the drill table, the centre hole was centred, drilled and reamed for the swivel pin. The mounting holes were then drilled 5mm and all burrs removed. With the piece in the bench vice, the corners were filed off to within about 2mm of the scribed arcs on the ends. An arbor 25mm dia. with a $\frac{3}{16}$ in. dia. spigot tapped M5 was set in the three jaw chuck

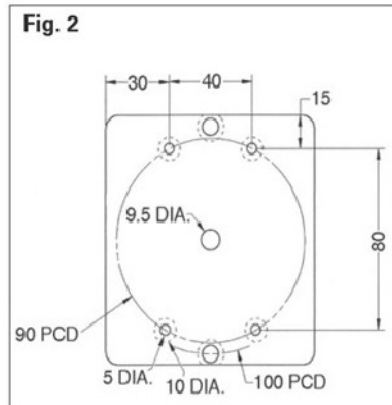


Fig. 2

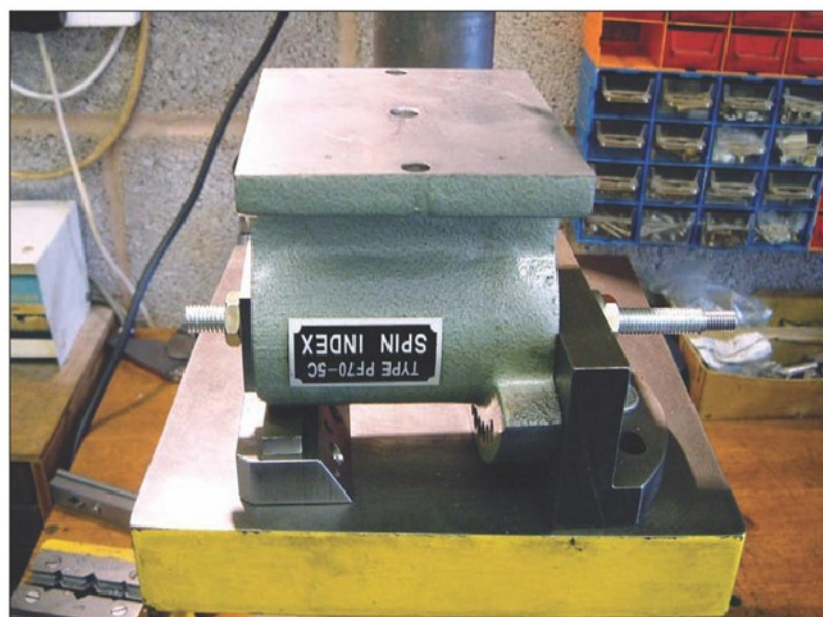


Photo 19. Drilling setup.



Photo 20. Spotfacing.

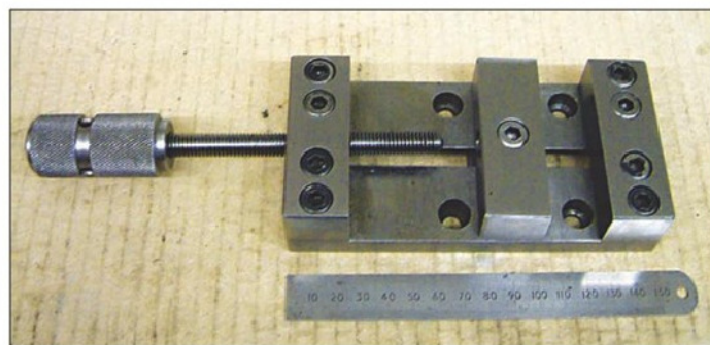


Photo 21. Built up vice.

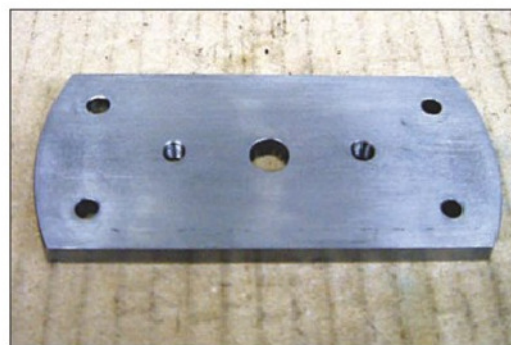


Photo 22. Vice adaptor.

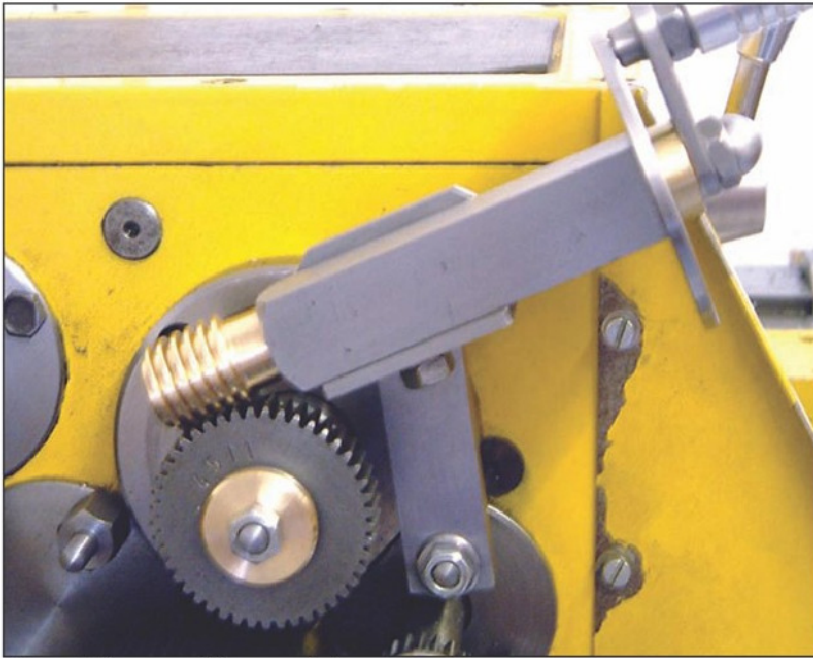


Photo 23. The worm driven mandrel.



Photo 24. One hole pitch equals one deg.

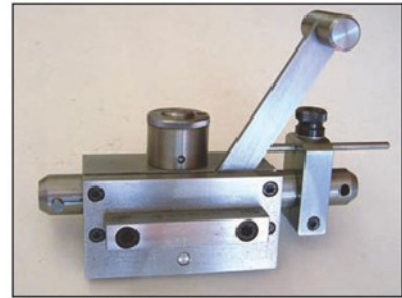


Photo 25. Graduating tool.

and the plate fitted to this with an Allen screw and large washer.

The ends were cleaned up at an angle of 6deg. to match the base angle. The finished plate is shown in **photo 22**.

Graduation and numbering

For graduating degree markings on work held in the chuck, I use a 45T change wheel fitted to the rear of the mandrel, driven by a worm, **photo 23**, which carries a division plate with 8 holes, each representing 1 degree of rotation, **photo 24**. The lines are cut with a Hemingway graduating tool, **photo 25**.

With the workpiece held in the three-jaw chuck by the 60mm bore, one of the flat edges of the clamping flange is set vertical with the indexing pin engaged in one of the holes. The line cutting tool should align with the centre of the flat. It was decided that divisions of 60deg. either side of zero should be adequate for any envisaged use, so the indexing handle was wound clockwise $7\frac{1}{2}$ turns in order to start at a 60deg. line.

The tool was set to provide a single unit line of 6mm length, and the tool brought up to just touch the face of the work with the cross slide and the feed screw dial set to zero. The depth drum was set to 10 and 0.10mm in-feed applied then all slides locked.

The tens line was cut, then the index handle advanced one hole anticlockwise and a unit line cut. Repeat three times followed by a five line and so on until the required number of graduations are completed.

Because of the size of the workpiece and the angled face of the scale, the number stamping had to be done in situ. In order to hold the number stamps for accurate repeatability, the hand turning rest was fitted to the lathe bed with the tool rest replaced with a tapped pillar holding a Cowell's lathe tool holder, **photo 26**.

The work was wound back to what will become the zero line and a setting pin used to align the punch holder with this

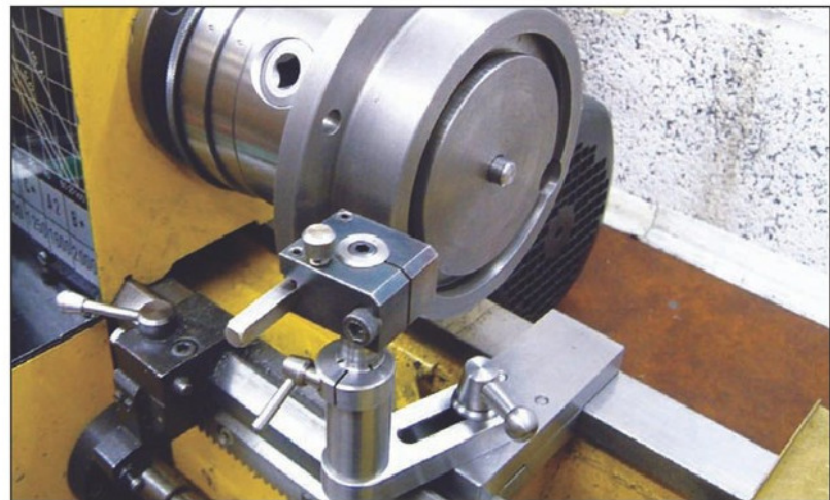
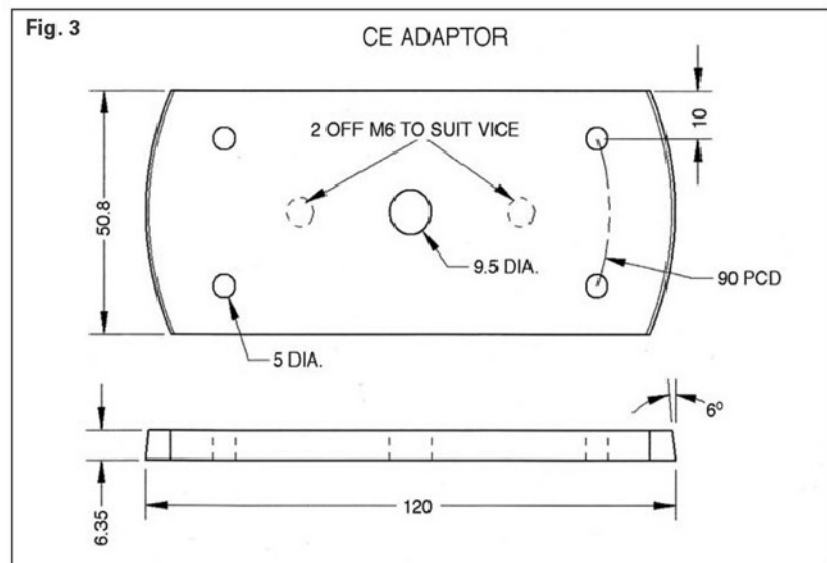


Photo 26. Stamp holder.



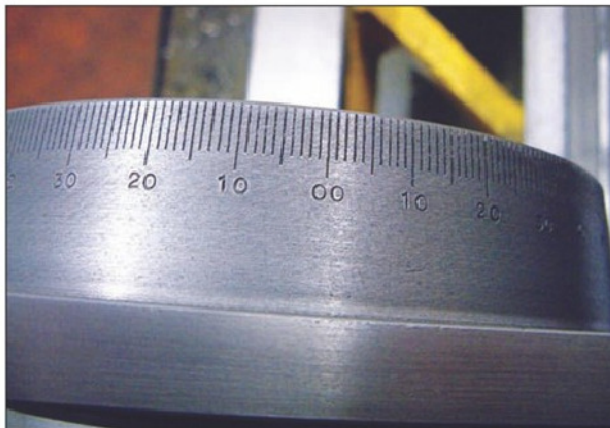


Photo 27. Scale prior to cleaning.

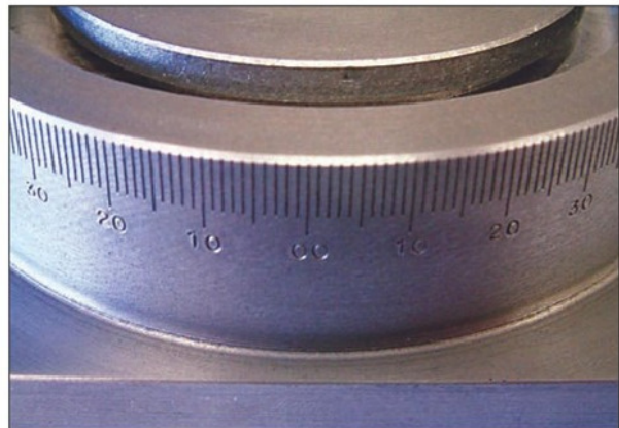


Photo 28. The finished scale.

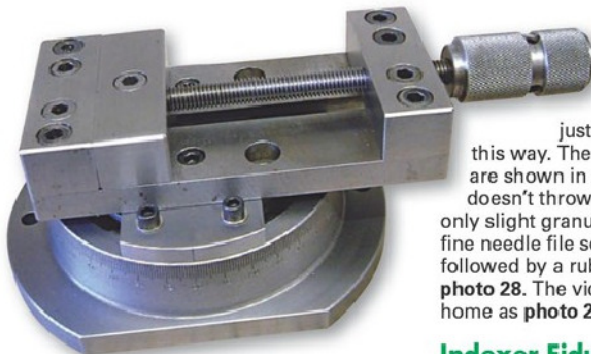


Photo 29. Vice fitted.

line, ensuring that the punch will approach the work at 90deg. to the tapered face.

The index handle is turned one hole clockwise and a zero stamped. Turning the index handle two holes anticlockwise another zero is stamped. Because of the eight holes in the index plate, one complete turn anticlockwise sets the position for the number one followed by two more holes for the zero, repeating up to the sixty degree position.

The work is wound back to zero and the process repeated clockwise to the other sixty degree position. There is no reason why the graduations shouldn't start at a

sixty position and continue in the same direction until the other position is reached. It just suited me to do things this way. The lines and numbers as cut are shown in **photo 27**. As cast iron doesn't throw up any curls of swarf, only slight granular edges to the lines, a fine needle file soon removed these, followed by a rub with some Scotchbrite, **photo 28**. The vice was tried out in its new home as **photo 29**.

Indexer Fiducial Line

As the front of the base fell short of the face of the degree scale, a small block was used to make up the distance and carry the line. This prompted another large work holding problem to machine a flat face to receive the extension block.

With one mounting flange in the slot in the bottom of the vice, the base was set vertical with a square against the bottom of the vice and the jaw tightened. Two screw jacks were placed under the overhang just in case, **photo 30**.

A 10mm end mill was fed in 10mm to cut a flat 1mm deep x 40mm long, centred on the edge of the mounting flange. This accommodates a piece of flat material 3.5mm thick, which has been filed to profile to sit neatly in the housing. It will

be finally secured with two M3 countersunk Allen screws.

The two adapted swivelling work-holders are shown in situ in **photos 31 & 32**.

All in all, I am quite pleased with the way things have turned out, even if I am at the moment still unable to swivel my new dividing head, but the casting wasn't wasted. The availability of this item does mean that a vice or other work holding device can be adapted to angular setting quite readily. ■



Photo 30. Another oversize setup.

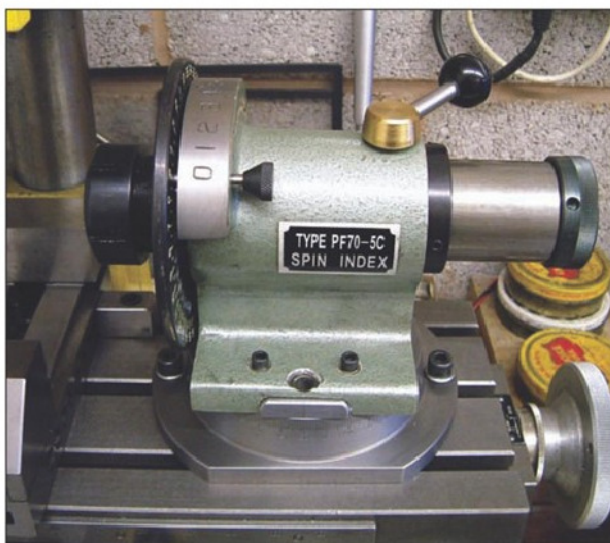


Photo 31. Indexer in situ.

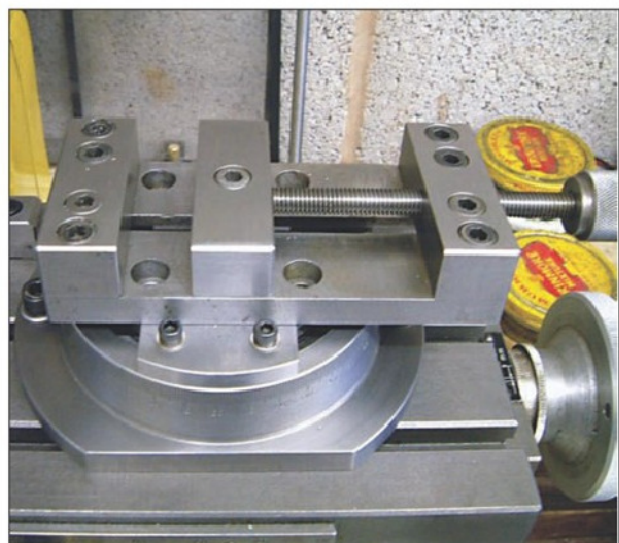


Photo 32. Vice in situ.

Low Voltage System For The Work Shop

Chris Smith adds amps and reduces volts

Background

After returning back to my workshop, with the power supply which a friend had given me, with the understanding that it needed some attention, I gave it a quick test and found that two of the four diodes making up the bridge rectifier, had, had the leads pulled out. These diodes are 70A rated, and after looking through my electrical bits, I came across a small quantity of these. The two faulty ones were replaced, and the unit tested, and found to be working fine. This transformer unit, with the rectifier pack, had two outputs of 12v and 24v D.C. (direct current) as well as a voltage-compensating switch; this is used to increase the secondary voltage, when a heavy load has pulled the voltage down. While I will find the 24v and the compensating voltage handy, it is not necessary for most workshops. A space was found to put it in the workshop and then, using the old styled 5A three pin mains switched sockets, I proceeded to wire up a low voltage system. I positioned one near the drilling machine and one on the work bench. For the milling machine, due to a shortage of the 5A sockets I had to use a small, two pin metal plug and socket, while for the lathe I made do with an un-switched socket.

More than just lighting

At first I was only thinking of using lights on the system so I just wired the sockets up using two core cable off an old lawn mower, the cores having a cross sectional area of approximately 0.5mm². This all seemed to be working fine till I introduced a cross slide drill, (more on this later) this caused such a voltage drop that a rethink became necessary. Tests carried out on the drill, found that it took 10A when using the lathe socket, and could be brought to a stall state by hand. There

was also a complete absence of power from the drill. The cable was replaced with 2.5 mm² twin and earth and the earth wire was paralleled up with one of the cores to help reduce the resistance. The length of the cable from the power supply to the lathe socket turned out to be fourteen feet, so no wonder there was an absence of power reaching the drill. While carrying out this modification, a two pole three way switch was introduced on the lathe low voltage supply, so as to give forward and reverse, and an off position. These

switches are what I had in stock and had become surplus to requirements, as not all of my sockets are switched, the off position is very handy. If you are lucky and have 5A 3 pin switched sockets, then you will only need two pole two way switches for reversing as the off position will not be needed.

Using the drill at the same time as a light was on, showed up another unexpected happening. The D.C. drill motor started to generate feedback into the system, causing the light to become brighter. After a lot of experimenting to get rid of the feedback, that did not involve complication, I decided that the lights are best run directly from the transformer secondary, before it goes into the rectifier, see fig. 1.

Building a system

For anyone wishing to make his or her own 12V system, the following is what you will need to know.

- 1) Will it just be used for lighting?
- 2) Will it be used for power tools?
- 3) What size transformer will you require?
- 4) If power tools are to be used, what rectification will be needed?
- 5) Will the power unit be plugged into a thirteen-amp socket?
- 6) How much protection will be required?

If the system is only to be used for lighting there will be no need for D.C. (direct current) and the lamps can be run straight off the A.C (alternating current) output of a 12v transformer. Each 12V20W lamp will take 1.66A and a 100 V.A. transformer will run five lamps; individual

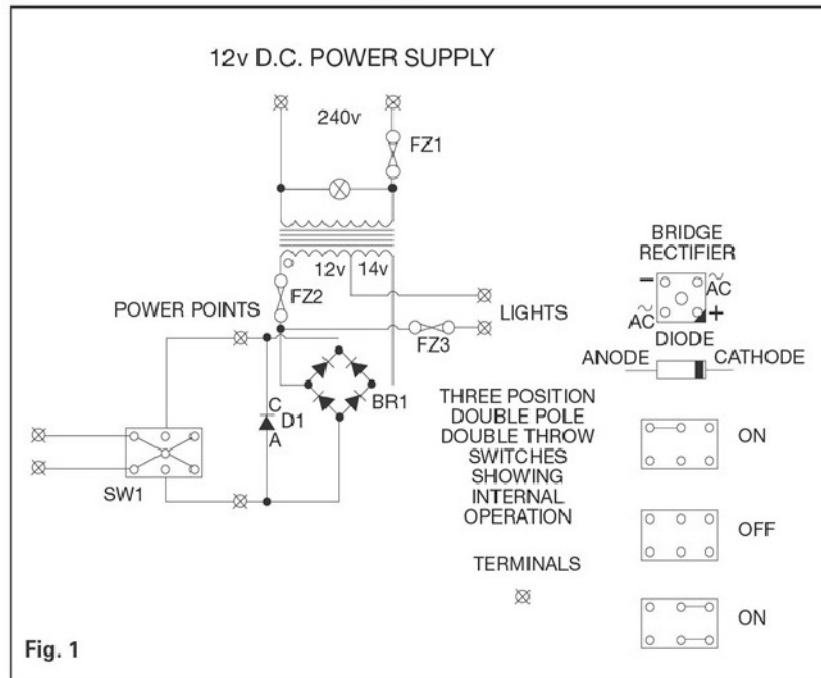


Fig. 1

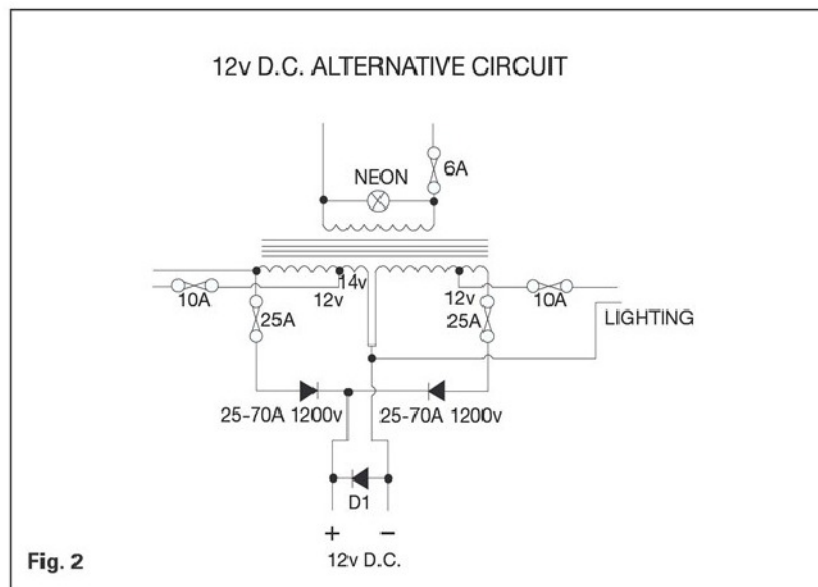


Fig. 2

transformers can also be used. The use of power tools means that the A.C. (alternating current) output of the transformer will have to be turned into D.C. (direct current), the voltage drop across the rectifier, used for turning A.C. current to D.C. current, will mean that the A.C. output of the transformer will have to be 14v. The V.A. rating of the transformer will need to be about 300V.A., this may sound rather large, but the fact is unless you know who has made the transformer, the copper rating can be so high, that the transformer can have poor regulation (volts drop on full load) due to the high internal resistance, so increasing the V.A. will help to reduce this risk. The rectifier will need to be a bridge-rectifier with a voltage of 50rrmv, no less (repetitive reverse maximum voltage). This will have a working voltage of 35v. A current rating of 50A will be ample. The bridge rectifier to these ratings is shown in the drawing fig. 1. There is a centre hole through the rectifier to secure to the heat sink, and with normal use, a heat sink made from a piece of aluminium, to the approximate sizes of 200mm x 200mm x 3mm will be adequate. Fix the heat sink vertically and mount the rectifier at about one third of the way up the heat sink, and on the vertical centre line. The heat will be rising up the heat sink, so the rectifier does not want to be too near to the top. The enclosure, to house the components, must have plenty of ventilation.

One point worth mentioning here is that the voltage figures given have been on the r.m.s. (root mean square) basis, a form which is the general form used for alternating current. Because the waveform is sinusoidal, the peak voltage is higher by a factor of 1.414, so a nominal 12volt supply may be able to give about 17volts if the current demand is small. For the applications I have used, lighting and low voltage tools, this is likely to be of no consequence, however it should be borne in mind if a supply is linked to voltage sensitive equipment.

Fuses

If the unit is to be plugged into a thirteen-amp socket, the plug will contain the fuse, and no further fusing of the main supply will be needed. It is also a help, if the socket contains a neon lamp, which will help to safeguard against walking out of the workshop, and leaving the transformer unit switched on. For safety it is always best to have a neon indicator on the enclosure as well. Fuses will also be needed to protect the transformer against a short circuit fault developing in the rectifier, and one to protect the external wiring. A diode is also fitted across the rectifier output. This is to protect the rectifier against high levels of back electromotive force, which can be generated from D.C. equipment. The enclosure to house the components is left up to the individual. A drawing of a basic circuit using a bridge rectifier is shown in fig. 1, while an alternative circuit, again using full wave rectification is shown in fig. 2.

Transformer details

The transformer shown in fig. 1 uses a 2inch stack of 248 laminations made from 400/50 material. The primary (240v winding) is wound with 386 turns of 0.9mm diameter copper wire with a grade

two covering for approximately 200°C. The secondary of fig. 1, is wound with 22 turns with a tapping at 20 turns using 2.65 mm diameter copper wire, again with a grade two covering for approximately 200°C. Between the primary and the secondary windings there is an earth screen. This will give a continuous output of 10amps and will give the much higher outputs, for the short periods encountered when using 12v D.C. power tools.

Transformer details for fig. 2 are exactly the same as fig. 1, only with two secondary windings. This transformer has been designed for two secondaries, so no changes are needed to the gauge of the wire, on the primary.

The drawing only shows one D.C. output, but this does not prevent adding more outputs. This is also the same for the lighting circuits. Fusing can also be changed to individual requirements.

Parts list and costing guide

The following is a guide to the parts needed and an approximate price that you can expect to pay for new parts.

			£. P
BR1	Bridge rectifier	50 rrmv 35volts working	9.00
D1	Diode	1N4007	0.50
Switch	20A on off on	two pole two way	14.00
Fuses	FZ1 FZ2 FZ3	motor rated fuses	0.60 each
Fuse holders	FZ1 FZ2 FZ3		3.00 each
Neon indicator		200/250v	1.00
Power diodes	25A 100v to	70A 1200v	2.50 to 10.00 each
Transformer		240v prim/14v+14vsec	70.00 approx.

Note: Motor rated fuses are not instant blow, so they will stand an overload for a short period.

As I have stated, my power supply was one that a friend gave me, which needed some attention and is the one in use in my workshop. The transformer specified in this article, is one that I actually made up, to the details given. The 70A/1200v diodes shown in fig. 2, are what I actually used as

these were what I had to hand, but there is no reason why these diodes cannot be reduced down to 25amps 100 volts, which on a full-wave rectifier system will give up to 50amps. The switched 5A sockets have so far stood the current passing through them, and for switching the lighting circuits they will be alright, while the switching of the motors is either carried out with the two pole switch, or with the switch on the actual device.

Low Voltage Power Tools

The introduction of a 12v system into the workshop, will open up a new avenue for running not only the lighting, but also 12v power tools, whether they are ready made or of your own manufacture. The first tool that I converted to run on my twelve-volt supply was a Toshiba battery drill which was given to me, by a friend, because it needed a new battery and he thought because of its age, that it did not warrant the expense. Finding the battery charger was faulty, I then wondered if the battery was all right. I spent a bit of time repairing the charger,

but the battery was found to be past it. Although it had been laying around the workshop for some time, I didn't have the heart to throw it away. Then, with the arrival of the 12v power supply, this was an ideal time to convert the drill to run on it. I took it apart and soldered a



Photo 1. General view of the 12volt drill.



cable to the clips, which makes contact with the battery; the cable was then taken directly to the 12v supply. This drill has two speeds, forward and reverse and has the usual torque settings. This is a great asset when drilling and tapping holes, which do not require a high standard of accuracy like mounting plates, etc. The drill is left permanently attached to the power supply so that it is always, at the throw of a switch, ready to use and I hope it will be for a long time to come, see **photos 1 & 2**.

A series of tests was carried out on battery drills, current measurement being made on a meter having an 80A moving coil movement. The results are summarised in **Table 1**. The first tests involved using a car battery; the other tests were carried out using the power supply. The Toshiba drill was put into high gear, and stalled, by just gripping the chuck. When going into the lower gear it was virtually impossible to stop. The

Drill voltage	Drill make	Approx. R.P.M.	Battery Voltage No load	Battery Voltage On load	Stall Current	Normal Running Current
12v	Toshiba	1300	12.4	11.33	50A	
12v	Toshiba	440	12.4	11.92		5A-20A
12v	Unknown	430	12.4	11.88	30A	
12v	Unknown	430	12.4			5A-20A
			Power supply No load	Power supply On load		
12v	Toshiba	1300	12.7	9.46	42A	
12v	Unknown	430	12.7		25A-30A	

Table 1

unknown make of drill, was also impossible to stall, as when it started to reach towards the stall point, the direct drill device moved into the high torque setting and slipped.

Safety Warning

I used a car battery for testing, as it is a source of pure D.C., but I would not recommend anybody using this for a low voltage power supply, without being warned about the danger of fire, or an explosion if a short circuit takes place on any devices, or wiring, that it is feeding. A typical car battery is capable of delivering several hundred amps and hence a fuse must be fitted directly on the battery terminal, with a current rating no greater than the cable rating. Each device must also be fused if less than the cable rating. The battery should also have an isolating switch, which should be turned off at all times when the system is not in use. If housed in an enclosure, adequate ventilation must be given to prevent the build up of gas.

Lighting Conversion

Again at the behest of one of my friends, I was cajoled into converting a standard machine light to take standard domestic 12 volt halogen bulbs, as shown in **photo 3**. Due to the heat produced, this became quite an interesting exercise, which also lead on to the building of a robust design of lampholder, **photo 4** which was then produced in several forms including one particularly useful version with a magnetic base. It is hoped to describe these in detail in a future article. ■

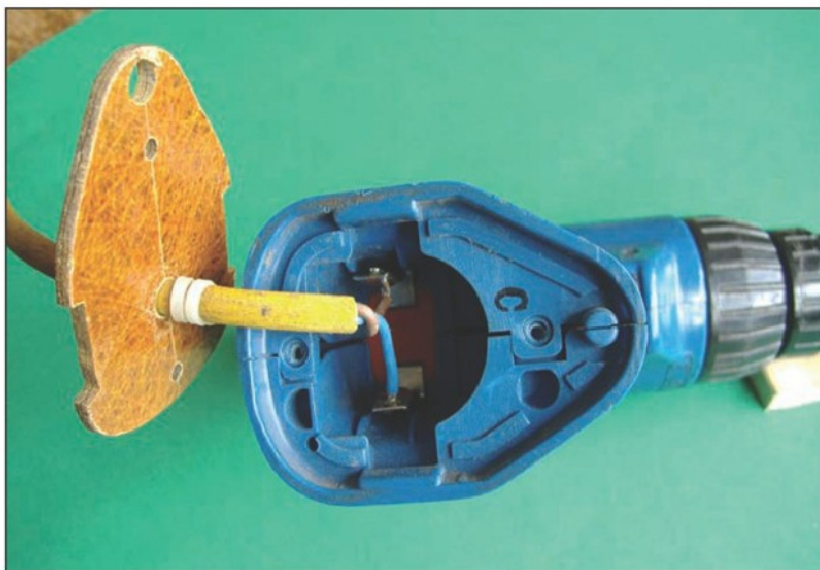


Photo 2. Interior view showing wiring connections.



Photo 3. Machine light converted to take halogen units.



Photo 4. Robust home built 12 volt light.

Harrogate 2008

Dave Fenner visits the National Model Engineering and Modelling Exhibition

We determined that this year, we would combine the visit to the Harrogate show with one to the National Railway Museum in York. My last visit there was in the early 1980's and how it has changed for the better. In short, most definitely worth a visit, and if you do go, try to allow a full day, rather than the afternoon we had available. Arriving on Friday morning at the "National Model Engineering and Modelling Exhibition", the initial appraisal, confirmed after a more detailed look round, was that once again, Lou Rex B.E.M. and his team had assembled a

superb array of exhibits and exhibitors whether from a competition, club or trade viewpoint. I would reiterate the comment that has been made in the past, that perhaps because this event is not allied to any publication or club, it has gained the reputation as "The Friendly Show".

The exhibition is now in its fifteenth year, and it is interesting to read in the programme foreword by Lou, that when they first surveyed the extent of Hall 1 many years ago, they seriously wondered about how to fill it. Nowadays, the exhibition fully occupies not only that original hall but also Hall 2 located beyond the food area. It is to the credit of the

Harrogate show, that clubs as far afield as Edinburgh and Oxford, are prepared to travel the distance.

No doubt many readers will have attended the event in person, but for those unable to make the trip, hopefully the selection of photos and captions (of essentially workshop kit) will give at least a flavour of what was on offer. At the time of taking photos, judging was still in progress, **photos 1 & 2** - it was notable just how much time and attention the judges devote to the assessment of competition entries.

In addition to the "Engineering" content there is much on display from other



Photo 1. Judges Ivan Law and Dennis Monk deep in thought examining the MES Abrasive band machine entered by Mr G Jackson - in the background, Mike Chrisp, former editor of *Model Engineer*.



Photo 2. Judge Barry Jordan and the 1/4 scale Studer Grinder from Malcolm Leafe. Barry won "Best in Show" in 1998 with his acclaimed model of a Bridgeport. Nowadays he also pursues his artistic interests painting horses.

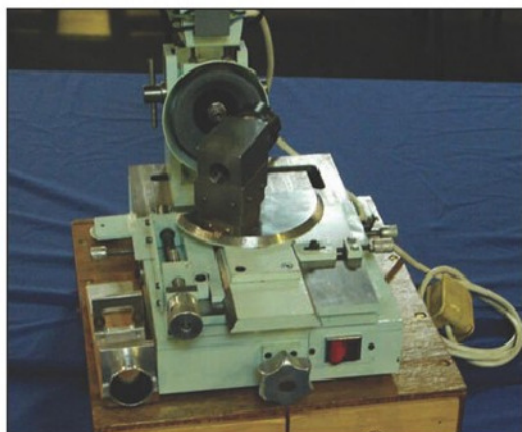


Photo 3. The Four Facet Drill Grinding Jig from Mr P J H Bowler is mounted on a purpose made stand incorporating two storage drawers.



Photo 4. The Bending Rolls entered by Mr P Martindale are based on the classic George H Thomas design, but have been scaled up using larger diameter rolls and gears, to cater for material 12 inches wide. Bronze bearings are employed.

interest sectors such as model aircraft, model boats, smaller scale model railways (live steam and electric), hot air engines and the superbly crafted miniatures from the Guild of Model Wheelwrights. For those with a passion for i.c. engines, the 1/8 scale Bentley engine built by Mr M Sayers was a real eye opener. I understand that a demonstration run was planned to take place, but due to pressure of time, I was not able to observe this.

While it must still be a minority group interest in the hobby setting, it was notable that new developments are appearing on the CNC front. Arc Euro Trade showed two Chinese CNC mills from the Seig factory. Whereas in the past, manual machines have been brought across to the UK, then stripped and converted, these are factory built from the word go, as CNC. It does begin to look as though plug and play may have arrived. One pleasant surprise was the demonstration of Cam Barn by their lead developer Andy Payne. This looks like

a powerful and potentially useful piece of software supplied either free or at an attractive price, to speed up the creation of milling part programmes.

Competition

This year the Workshop Equipment category saw something of a renaissance, with six exhibits from five entrants, including one, a four facet drill grinding jig from stalwart enthusiast Paul Bowler who has pretty well single handedly supported this section in some recent years. The entry from Malcolm Leafe - a superb quarter scale replica of a Studer grinder, raised again the debate, as to whether a model of a workshop machine should be in this category, in that one can question whether it is capable of serious work. In fact this entry was moved to a different section where it was awarded a first place. A selection of the competition entries is given in **photos 3 - 7**, and the results were a First for the Stent by Mr T Bratten, a Second for

Mr P J H Bowler's Four Facet Drill grinding Jig, and joint Thirds for Mr Martindale's Bending Rolls and for the Kennet Tool & Cutter Grinder and Abrasive Band Machine, both produced by Mr G Jackson.

Club Stands

Photo 8 shows a locomotive wheel displayed on the West Riding Small Locomotive Society stand by Mr J Grabsch. Nothing unusual in that you might say, but on closer inspection this one was not cast iron but steel, and had been produced by spark erosion/electrochemical machining from both sides thus creating accurate spoke profiles. Mr Grabsch acknowledged that this method was uneconomic, but felt that a two stage approach, employing rough milling followed by ECM may prove viable in the future.

It is always interesting to be given some insight into the method used by model engineers. **Photo 9** shows the cam

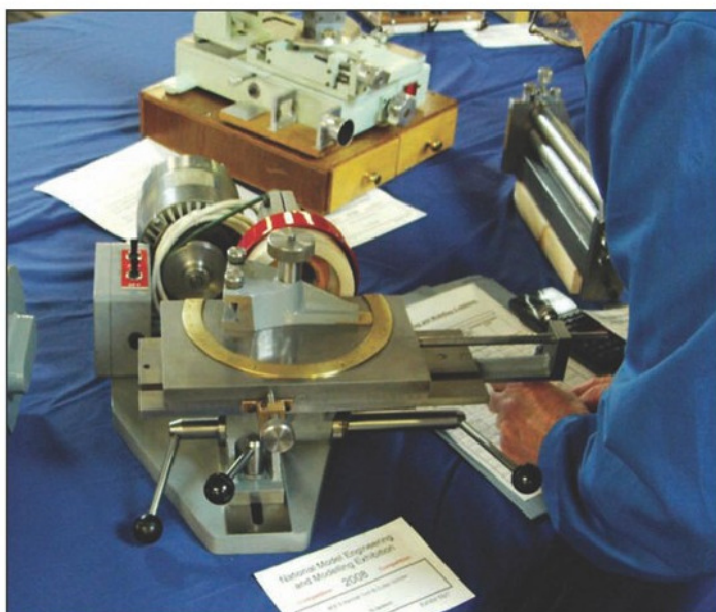


Photo 5. One of two entries from Mr G Jackson, this being the Kennet Tool & Cutter Grinder to the MES design.

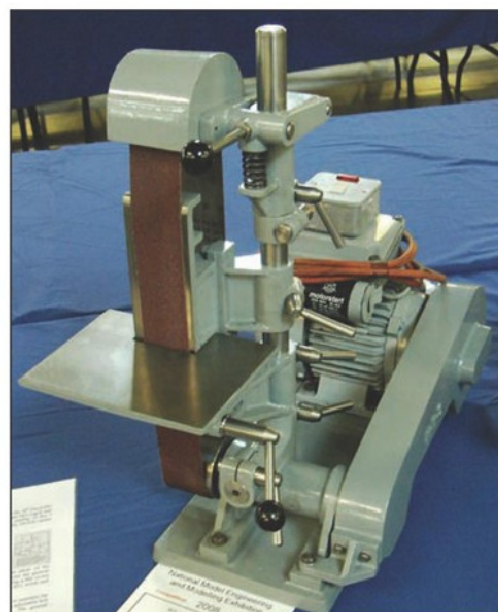


Photo 6. An excellent Abrasive Belt Machine, again from Mr Jackson who clearly appreciates the MES product range.



Photo 7. A Tool and Cutter Grinder to the well known Stent design, shown with accessories by Mr T Bracken gained a First.



Photo 8. Locomotive wheel from Mr J Grabsch produced largely by electro chemical machining.

grinding jig devised by Mr M Sayers of the Pickering Society, along with other tooling and parts for his Bentley engine. **Photo 10** shows the completed engine.

Several items of workshop kit were to be found on the Tyneside Society stand, notably the George Thomas style Staking Tool by Mr L Hall, **photo 11** the Wood Carving Clamp shown by Mr C Manns, **photo 12** and the Four Facet drill Grinding Jig by Mr D Manns, **photo 13**. The last item here appeared to include the ingenious use of part of a vertical slide.

SMEE often tend to be thought of as the "granddaddy" of model engineering and were once again in attendance showing models and equipment and giving demonstrations. In addition to his GHT bending rolls, Mr C Ager displayed a Between Centres Boring Bar, **photo 14** and a GHT design Rotary Table, **photo 15**. The info card for the boring bar noted that it

was based on a GHT concept and used material salvaged from a car suspension. The Bending Rolls, **photo 16**, shown by Mike Chrisp, are shorter, and have a more chunky appearance than the popular GHT style, and are probably capable of handling heavier but narrower sections. One unusual item here was the Spark Eroder, **photo 17** shown by Mr M Fagg.

From Keighley & District Society came the freelance Sensitive Pillar Drill by Mr A King, **photo 18** and the Stepped Collet chuck from Mr J Wilcock, **photo 19**.

An excellent example of a straightforward accessory set found on the Pickering Society stand was the set of Tailstock Dieholders, **photo 20** shown by Mr K Shutt.

Amongst the some one hundred and twenty odd items arrayed on the Bradford stand, two exhibits caught my eye, the well presented Versatile Dividing Head, **photo 21** by Mr D Watts, and the Rear

Parting Tool for a Colchester Bantam, **photo 22** from Mr M Turner. It was a nice touch to display the latter item on a "mini pallet". One wonders if he has built a miniature fork lift to move it.

The display from York City and District Society was well up to their usual high standard, and featured amongst the workshop equipment were a beautifully finished Roller Filing Rest for the ML10 lathe, **photo 23** from Mr M Waters, a Surface Gauge and Angle Plate, **photo 24** by Mr J Chambers and a Co-Axial Centering Gauge, **photo 25** by Mr N Davison. This final item bore similarities to the design described by Peter Rawlinson in Issue 118 of MEW and makes a useful addition to the workshop measuring equipment arsenal.

In contrast to previous occasions, the visit this year was just for a single day. Oh, that more time had been available! ■



Photo 9. The cam grinding jig employed by Mr M Sayers.

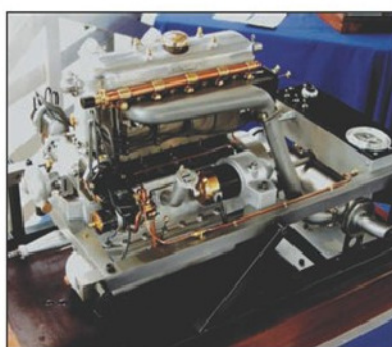


Photo 10. Mr Sayers' superb completed Bentley engine. Note this is not a static exhibit, it really does run.



Photo 12. This woodcarving clamp, by Mr C Manns, allows the work to be rotated in two planes for access.



Photo 13. A Four Facet Drill Grinding Jig from Mr D Manns.

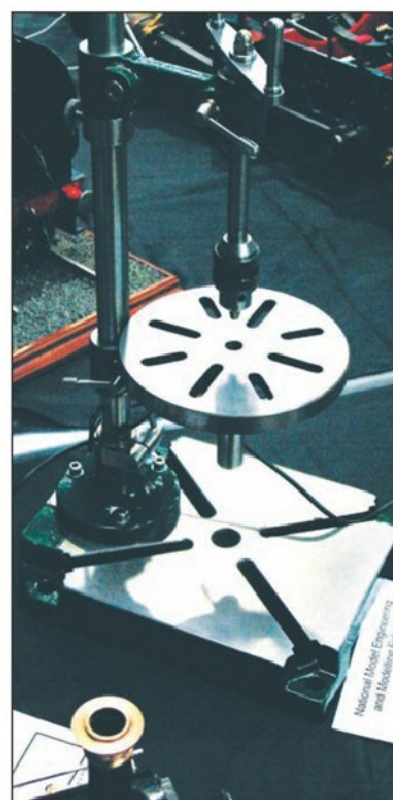


Photo 11. A high standard of workmanship is evident on this GHT style Staking Tool by Mr L Hall.

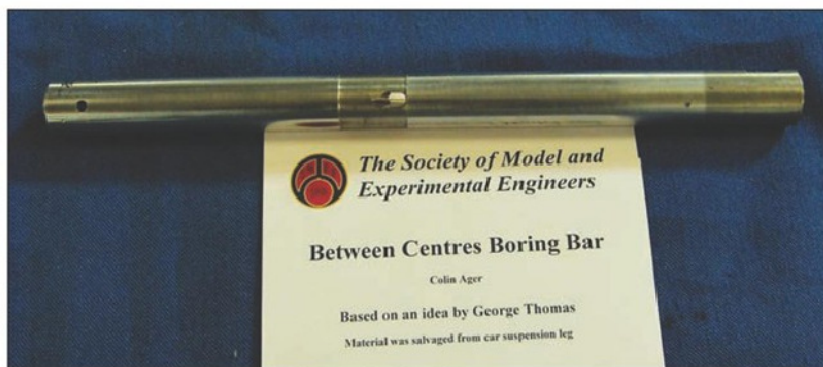


Photo 14. Between centres Boring Bar by Mr C Ager.



Photo 15. Small Rotary Table to the GHT design also by Mr C Ager.

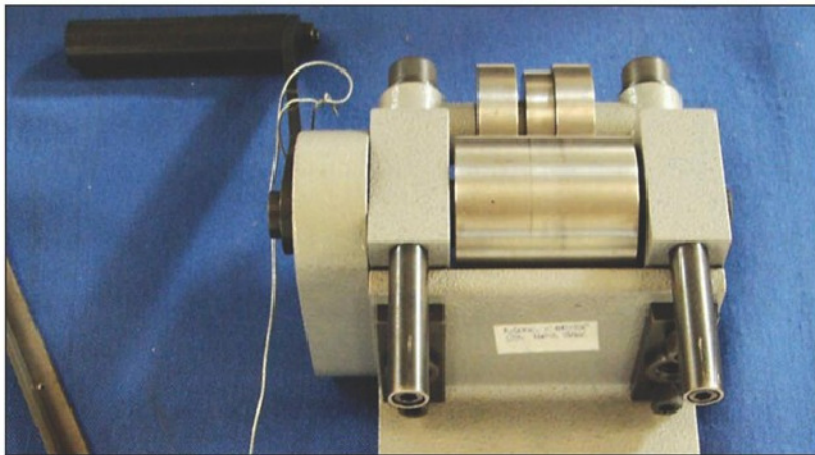


Photo 16. Bending Rolls from Mike Chrisp.

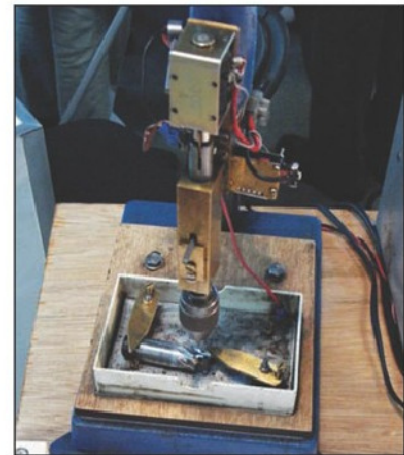


Photo 17. Mr M Fagg's Spark Eroder - just the thing for a broken tap.



Photo 18. A freelance designed Sensitive Pillar Drill by Mr A King.



Photo 19. Also from Keighley and district, Mr J Wilcock offered this Stepped Collet Chuck set.



Photo 20. Multisize Tailstock Dieholder by Mr K Shutt.



Photo 21. Versatile Dividing Head from Mr D Watts.



Photo 22. Mr M Turner's Rear Part Off Tool.

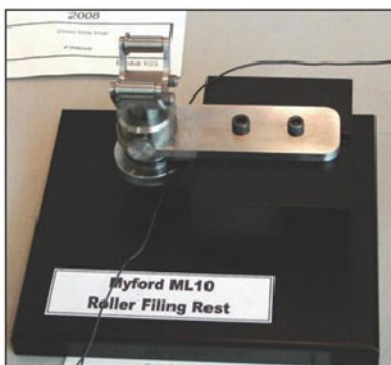


Photo 23. Roller Filing Rest for the ML10 lathe - Mr M Waters.

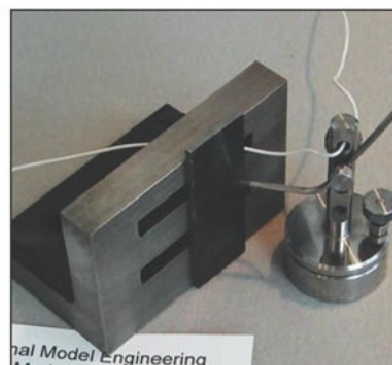


Photo 24. Surface Gauge and Angle Plate by Mr J Chambers.

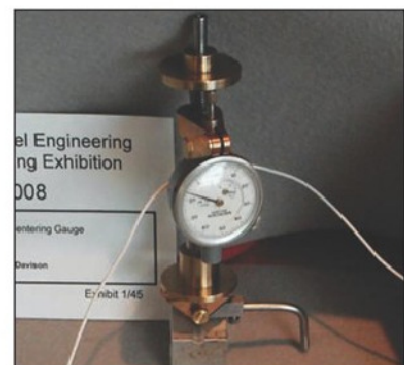


Photo 25. Co-Axial Centering Gauge made by Mr N Davison.

To help you get the best from The Model Engineer exhibition

These notes are written purely for guidance. Full information is contained in the Competitors' Information booklet which is sent to every entrant as part of the information package. If you have an item and are unsure as to the Class into which it should be entered, leave that section blank and we will take care of it. The Judges have the right to move any competition exhibit into another class if they feel that by doing so its chances of gaining higher marks or a more appropriate award are improved.

If the item is offered as a Loan exhibit please indicate this by writing Loan on the form in the box identifying the Class. Loan models are not judged but carry all other privileges associated with competition entries.

Part built models are particularly welcome in the Loan Section; visitors like to see work in progress, and entry does not preclude the item being entered in competition when completed.

The classes listed below are those associated with mainstream model engineering.

Club exhibits

Where a club is exhibiting, each model should be entered on a separate entry form and clearly identified as a club exhibit by entering Loan/Club in the class section box. This ensures that we have a full record of all models on display during the show and facilitates matters of administration and insurance.

Additional forms

If you do not wish to deface your copy of the magazine we are happy to receive photocopies of the entry form, one for each model. We will be pleased to send out extra forms if required, so if you know of a modeller who is not a reader of one of our magazines but who you think may wish to participate, please advise them to contact our Exhibitions Office, or simply photocopy the entry form for them.

The success of the show depends largely on the number of models on display. Your work could well be the stimulus which inspires someone else to start in the hobby. There can be no doubt that this event is our showcase on the world of modelling in all its aspects. Every modelling discipline needs more and more participants, and it is by displaying not only the crème-de-la-crème, but also examples of work of a more achievable standard, that people are encouraged to join into the wonderful world of modelling, in whatever aspect.

We look forward to seeing a sample of your work at the show!

Engineering Section

- A1 Hot air engines.
- A2 General engineering models (including stationary and marine engines).
- A3 Internal combustion engines.
- A4 Mechanical propelled road vehicles (including tractors).
- A5 Tools and workshop appliances.
- A6 Horological, scientific and optical apparatus.
- A7 General engineering exhibits - not covered by the above

Railway Section

- B1 Working steam locomotives 1" scale and over.
- B2 Working steam locomotives under 1" scale.
- B3 Locomotives of any scale, experimental, freelance or based on any published design and not necessarily replicas of full size prototypes, intended for track duties.
- B4 Scratchbuilt model locomotives of any scale, not covered by classes B1, B2, B3, including working models of non-steam, electrically or clockwork powered steam prototypes.
- B5 Scratchbuilt model locomotives gauge 1 (10mm scale) and under.
- B6 Kitbuilt model locomotives gauge 1 (10mm scale) and under.
- B7 Scratchbuilt rolling stock, gauge 1 (10mm scale) and under.
- B8 Kitbuilt rolling stock, gauge 1 (10mm scale) and under.
- B9 Passenger or goods rolling stock, above 1" scale.
- B10 Passenger or goods rolling stock, under 1" scale.
- B11 Railway buildings and lineside accessories to any recognised model railway scale.
- B12 Tramway vehicles.

Marine Models

- C1 Working scale models of powered vessels (from any period). Scale 1:1 to 1:48
- C2 Working scale models of powered vessels (from any period). Scale 1:49 to 1:384

- C3 Non-working scale models (from any period). Scale 1:1 to 1:48
- C4 Non-working scale models (from any period). Scale 1:49 to 1:384
- C5 Sailing ships and oared vessels of any period - working.
- C6 Sailing ships and oared vessels of any period - non-working.
- C7 Non-scale powered functional models including hydroplanes.
- C8 Miniatures. Length of hull not to exceed, 15in for 1:32 scale, 12in for 1:25 scale, 10in for 1:16 scale; 9in for 1:8 scale. No limit for smaller scales.
- C9 For any model boat built from a commercial kit. Before acceptance in this class the kit must have been readily available for at least 3 months prior to the opening date of the exhibition and at least 20 kits must have been sold either by mail order or through the retail trade.

Scale Aircraft Section

- D1 Scale radio control flying models
- D2 Scale flying control-line and free flight
- D3 Scale non-flying models, including kit and scratch-built
- D4 Scale flying radio controlled helicopters

Model Horse Drawn Vehicle Section

- G1 Carriages & other sprung vehicles. (Omnibuses, trade vans etc.) Wagons, carts and farm implements. Caravans.

Junior Section

- J1 For any type of model, mechanical or engineering work, by an under 14 year old.
- J2 For any type of model, mechanical or engineering work, by an under 16 year old.
- J3 For any type of model, mechanical or engineering work, by an under 18 year old.

All entries will be judged for standard of craftsmanship, regardless of the modelling discipline, i.e. a boat will not be competing against a military figure. Providing a model attains sufficient marks it will be awarded a gold, silver or bronze medal.

Model Vehicle Section

- K1 Non-working cars, including small commercial vehicles (e.g. Ford Transit) all scales down to 1/42.
- K2 Non-working trucks, articulated tractor and trailer units, plus other large commercial vehicles based on truck-type chassis, all scales down to 1/42.
- K3 Non-working motor bikes, including push bikes, all scales down to 1/42.
- K4 Non-working emergency vehicles, fire, police and ambulance, all scales down to 1/42.
- K5 Non-working vehicles including small commercial vehicles (e.g. Ford Transit) scale from 1/43 or smaller.
- K6 Any available body shells including Concours, in any scale or material, to be judged on appearance only.
- K7 Functional model cars/vehicles which must be able to move under its own power of any type. Can be either free-running, tethered radio controlled or slot car, but must represent a reasonable full size replica.

DUKE OF EDINBURGH CHALLENGE TROPHY

Rules and Particulars

1. The Duke of Edinburgh Challenge Trophy is awarded to the winner of the Championship Award at the Model Engineer Exhibition.
2. The trophy remains at all times the property of MAGICALIA PUBLISHING LTD.
3. The name of the winner and the date of the year in which the award is made will be engraved on the trophy, which may remain, at the discretion of MAGICALIA PUBLISHING LTD., in his/her possession until required for renovation and display at the following Model Engineer Exhibition.

4. Any piece of model engineering work will be eligible for this Championship Award after it has been awarded, at The Model Engineer Exhibition, a Gold or Silver medal by MAGICALIA PUBLISHING LTD
5. No model may be entered more than once.
6. Entry shall be free. Competitors must state on the entry form:
 - (a) That exhibits are their own bona-fide work.
 - (b) Any parts or kits which were purchased or were not the outcome of their own work.
 - (c) That the model has not been structurally altered since winning the qualifying award.
7. MAGICALIA PUBLISHING LTD. may at their sole discretion vary the conditions of entry without notice.

COMPETITION RULES

1. Each entry shall be made separately on the official form and every question must be answered.
2. Competition Application Forms must be received by the stated closing date. LATE ENTRIES WILL ONLY BE ACCEPTED AT THE DISCRETION OF THE ORGANISERS.
3. Competitors must state on their form the following:
 - (a) Insured value of their model.
 - (b) The exhibit is their own work and property.
 - (c) Parts or kits purchased.
 - (d) Parts not the outcome of their own work.
 - (e) The origin of the design, in the case of a model that has been made by more than one person.

NOTE: Entry in the competition can only be made by one of the parties and only their work will be eligible for judging.

4. Models will be insured for the period during which they are in the custody of MAGICALIA PUBLISHING LTD.
5. A junior shall mean a person under 18 years of age on December 31st in the year of entry.
6. Past Gold and Silver medal award winners at any of the exhibitions promoted by MAGICALIA PUBLISHING LTD. are eligible to re-enter their model for the 'Duke of Edinburgh Challenge Trophy'. Past winners at any of the exhibitions promoted by MAGICALIA PUBLISHING LTD. will not be eligible for re-entry into the competition unless it has been substantially altered in any way.
7. MAGICALIA PUBLISHING LTD reserve the right to:
 - (a) Transfer an entry to a more appropriate class.
 - (b) Describe and photograph any models entered for competition or display and to make use of any such photographs and descriptions in any way they may think fit.
 - (c) Refuse any entry or model on arrival at the exhibition and shall not be required to furnish a reason for doing so.
8. Entry into the competition sections is not permitted by:
 - (a) Professional model makers.
 - (b) Anyone who has a financial interest in the direct supply of materials and designs to the public.

NOTE: If unsure, please contact the Competition organisers prior to the show.

9. The judges' decision is final. All awards are at the discretion of the judges and no correspondence regarding the awards will be entered into.
10. Exhibitors must present their model receipt for all models collected at the end of the exhibition and sign as retrieved.
11. The signed release for each model must be presented to security staff when leaving the exhibition complex with display model(s) after the close of the exhibition.

IMPORTANT NOTE: PLEASE MAKE COPIES, INCLUDING PHOTOGRAPHS, OF ALL INFORMATION RELATING TO YOUR MODEL, AS MAGICALIA PUBLISHING LTD WILL NOT ACCEPT LIABILITY FOR ANY LOSS.

CLOSING DATE 3RD SEPTEMBER 2008

THE MODEL ENGINEER EXHIBITION

19th - 21st September 2008 Ascot

Please return completed form to:
Model Engineer Competition,
9 Tranmore Lane, Eggborough,
E. Yorkshire DN14 OPR

ENTRY NO.

OFFICE USE ONLY

CLASS	ENTRY NO.

ENTRY FORM - COMPETITION & LOAN MODELS

PERSONAL DETAILS (Please print)

Surname _____ Forename(s) _____ Age: _____

Address _____

_____ Post Code: _____

Home Tel No _____ Daytime Tel No _____

Model Club or Association _____

Have you entered before? (Y/N) _____

Do you purchase or subscribe to a Magicalia Publishing Ltd magazine? (Y/N) _____

How many years have you been a modeller? _____

Mail Order Protection - please tick this box if you would prefer not to receive mail from other companies which may be of interest to you ☐

MODEL DETAILS - PLEASE TICK BOX IF MODEL IS FOR LOAN ☐

Entry Class (competition entries only) _____

Model Title (to be used for catalogue and display card) _____

Model Description _____

Model Scale _____ Length _____ Width _____ Height _____ Weight _____

Type of construction _____

Parts not made by you and commercial items _____

Have you supplied a photograph? (Y/N)

Are you supplying Judges Notes? (Y/N)

Value of Model (Magicalia Publishing Ltd will not insure the model unless a value is entered) £ _____

Name and address of your local newspaper _____

N.B. Please make a copy of this form and any photographs enclosed for your own reference.
Please note that Magicalia Publishing Ltd will not accept liability for any loss of documents or photographs submitted with this form.

...continued from page 11

Also Ketan has received a couple of other phone calls from readers of MEW saying that the series did not start at the beginning but went in at the deep end. Having programmed CNC mills for the past 25 years or so, perhaps I find it to easy and miss out the basics that readers are looking for?

So, what I would like readers (and Mr Tusin) to do is to email me or phone me with their ideas and tell me what they would like to see covered in this series. The only emails I have had are "what is MACH 3 and where do I get it. MACH 3 is a control program that runs on a PC and drives stepper motors and spindle motors via the PC's parallel printer port.

It can be downloaded in trial form from <http://www.machsupport.com/>. It will run short programs as it stands but needs upgrading for long programs. Documentation can be downloaded free as well. MACH 3 can be installed without the drivers so you can play with it even if you don't have a CNC mill.

I hope to publish a couple of articles shortly dealing with the construction of a CNC router, which will use MACH 3 as the control software. I have seen a photograph of part of the machine and it looks superb.

KX1 comprehensive review

I will do a comprehensive review of the KX1 CNC mill in issue 141. Although I have had a couple of very minor teething problems they were possibly because my machine is the first factory built prototype. I would recommend the KX1 as an entry into CNC milling with no reservations whatsoever. It is quite simply "A superb machine and well worth the money". It is sure to find a home in many workshops and I would like to think that many schools will be installing it as well.

John Stevenson

The KX1 was designed by John Stevenson of L Stevenson Engineers of Nottingham. John complained that I had not mentioned him in issue 139 so I am giving him a mention in this issue so here goes. John, please put the dog out and empty the bin! Seriously though, if you have a Denford or similar CNC that you would like to convert to MACH 3 or an old CNC that you would like to retrofit with a modern controller, talk to John (and remind him to put the dog and bin out).

Dates for your diary

Please email david.clark@magicalia.com if you would like your event listed here. Please let me know at least 2 months in advance.

The date of the Guildford Model Engineering Society 2008 Model Steam Rally and Exhibition has been changed to the 12th and 13th of July. Don't forget your Wellington boots.

Leeds society of model & experimental engineers invite owners of 3½in. and 5in. gauge locomotives and scale traction engines to their August Rally to be held on Saturday and Sunday 9th & 10th August at the track site in the grounds of Eggborough Power Station

The editor's workshop

Despite illness, the workshop has seen some improvements. The Boxford CNC has been placed on a workbench (I had to remove it from the car prior to travelling to Harrogate) and some of the switches have been tightened up. It has not been tested yet as the mains cable is partially cut through and needs replacing. I have assembled a new Sealey bench mounted drill and bolted it to the work bench for stability. (How many of you bother to bolt your drill down?) The horizontal bandsaw has been moved into the workshop. This left very little room to move and the saw will have to be dragged round to use it as it is right against the shed wall. I also need to have the head raised to close the shed door.

In the brick shed, I have assembled a new (small) Axminster work bench. I have trimmed the length of the top to slightly over the width of the cabinet and have purchased a 300mm x 450mm granite surface plate to fit on it. While working in industry, I rarely marked anything out other than the occasional casting although the surface plates were always constantly in use for checking work. While at Harrogate, I purchased a 300mm digital height gauge for under £60, this to be used for marking out steam engine castings.

I have obtained four more (slightly stronger than the ones used on the Myford) machine mounts for the Senior mill. I hope too fit these in the first week of June so I can progress with installing the inverter and the digital readout. I find that a digital readout is essential on a mill for fast working and cutting out errors while I personally would not bother using readouts on the lathe.

I have purchased the 'Trojan' a single cylinder marine slide valve engine and the 'Borderer' a double cylinder piston valve marine engine. Both casting sets are mainly in bronze and both engines are available from Reeves 2000, see advert in this issue for their catalogue. The 'Trojan' is particularly suitable as a beginner's engine; it is reasonably priced and does not require much in the way of additional materials to finish it. The 'Borderer' is more advanced but I want to see how the piston valve gear works as I want to use a similar system in a small oscillating engine in the future. Reeves do a wide range of castings for engines and a good selection of tools, materials and sundries.

(located on the A19 just north of M62 Junction 34). For further details, contact Geoff Shackleton Tel 01977798138.

Bristol Model Engineering and Hobbies Exhibition will be at the Thornbury Leisure Centre on the 15th 16th and 17th August. I got totally lost trying to find this event last year even with the help of an online map printout. I was so annoyed that after the show, I went out and bought a Sat Nav.

Warco are holding their open day on the 12th & 14th September 2008.

The Official Model Engineer Exhibition is on the 19th - 21st September 2008 at Ascot racecourse.

"Richmond's" rebuilt Super Seven

There was great interest shown at Harrogate on the Sino readout on "Richmond's" rebuilt Super Seven. This lathe drew a lot of people and I don't think there were less than three people around it at any time during the two days I was at the exhibition. "Richmond" asked me to mention that he will be designing an updated version of the cross slide power feed on this lathe and will publish the design in MEW in a future issue. This is unlikely to be much before Christmas.

Subscription gifts

The digital calliper was a big success. Over 200 of you took advantage of the calliper offer and at the time of writing, you should all have received yours. I did get one email from a reader who was a bit disappointed that it was a 100mm calliper and not a 150mm as shown in the photograph. The advert clearly stated 100mm but the picture was of a 150mm one as they did not have a photo of the 100mm one. I have received one of the callipers and it is a well made item and I hope the majority of readers will be happy with it.

However, to avoid this happening in the future, I have told the subscription people that I want to be involved with all future offers and I want to check the product out before authorising its use. I will also suggest products for them to use.

Overseas subscriptions

I have asked the subscription people to look into offers for overseas readers. They are open to the suggestion and it may happen eventually although not immediately. I have also suggested six monthly subscription rates as when you convert 12 months issues to cash, it becomes a lot of dollars. Tell me what would make you subscribe if you live overseas, free gifts, money off, longer or shorter subscription periods, anything else? A gift that comes to mind is a book from the Workshop Practice series. It would be within a reasonable budget, not too dear to post and useful to the reader. What do you think?

Articles supplied

Articles have to a certain extent dried up. I still get the odd one but not as frequently as I have been receiving them. This could be because summer is with us and readers' are not spending as much time in the workshop as during the winter. I still have plenty of articles to use and am not desperate for any but please keep them coming, they will all be used eventually. I now have a filing cabinet to store them in; before I stored them in plastic boxes. This means I can now get a bit more organised, edit articles in advance and get a better idea what I have in stock. If you would like to write articles for MEW, please email me or write for contributors' notes and an agreement.

Right, that is all for this issue. Next issue should be back to normal with all the regular features.

PS, I am working on a Workshop Special due to be on sale just before the *Model Engineer* exhibition. Watch out for an announcement in the August issue. This special will only be available in the UK from W.H.Smiths, overseas readers will only be able to get it by pre-ordering.

NEW ITEMS!

Chronos

Engineering Supplies

Online Catalogue - www.chronos.ltd.uk

SEE US AT THE GUILDFORD STEAM RALLY JULY 12th - 13th!!

GLANZE THREADING, PARTING & PROFILING LATHE TOOLS SETS

NEW TOP QUALITY INDEXABLE TOOL SETS FROM GLANZE

THIS SET INCLUDES THE FOLLOWING GLANZE INDEXABLE LATHE TOOLS
 10/12MM SHANK EXTERNAL THREADING TOOLS HOLDER WITH 2 X 60 DEGREE METRIC CARBIDE INSERTS
 10/12MM SHANK INTERNAL THREADING TOOL HOLDER WITH 2 X 60 DEGREE METRIC CARBIDE INSERTS
 10/12MM SHANK PROFILING TOOL WITH 2 X 5MM DIAMETER CARBIDE INSERTS
 10/12MM SHANK PARTING TOOL WITH 2X2MM CARBIDE PARTING INSERTS
 SUPPLIED IN A GOOD QUALITY FITTED CARRY CASE COMPLETE WITH TORX KEY



CODE	SHANK SIZE	PRICE
777450	10MM SQUARE	£115.00
777460	2MM SQUARE	£125.00

INDIVIDUAL GLANZE THREADING TOOLS 60° METRIC

Complete with one three sided carbide insert & Torx Key

CODE	TYPE	SHANK	PRICE
722100	INTERNAL	10MM SQ	£24.00
722210	INTERNAL	12MM SQ	£24.00
SIR0016	INTERNAL	16MM SQ	£28.95
775100	EXTERNAL	10MM SQ	£24.00
775118	EXTERNAL	12MM SQ	£24.00
SER16K16	EXTERNAL	16MM SQ	£28.95

INSERTS	TYPE	PRICE
CODE		
1116A60	INT FOR 10 & 12MM TOOLS	£7.25
1116A60S	SET OF 10 ABOVE	£69.50
1616A60	INT FOR 16MM TOOLS	£7.25
161RA60S	SET OF 10 ABOVE	£69.50
11ERIA60	EXT FOR 10 & 12MM TOOLS	£7.25
11ERIA60S	SET OF 10 ABOVE	£69.50
16ERAA60	EXT FOR 16MM TOOLS	£7.25
16ERAA60S	SET OF 10 ABOVE	£69.50



NEW STYLE 100MM SOBA ROTARY TABLE CODE - 111310

BRAND NEW DESIGN AND EXCLUSIVE TO CHRONOS!
 TABLE DIA - 100MM
 CENTRE - 2 MORSE TAPER
 OVERALL HEIGHT WHEN HORIZONTAL - 55MM
 CENTRE HEIGHT WHEN VERTICAL - 75MM
 THIS UNIT COME COMPLETE WITH T NUTS, STEP CLAMPS AND STUDS TO HOLD WORK TO THE TABLE
 THE HAND WHEEL CAN BE DISENGAGED ALSO.

£69.95



BORING HEAD SET !!

BRAND NEW FROM SOBA AND EXCLUSIVE TO CHRONOS!!
 THIS SET COMPRISES OF THE FOLLOWING:

40MM MICRO BORING HEAD WITH GRADUATED METRIC DIAL
 2 MORSE TAPER SHANK - TAPPED 10MM
 3 MORSE TAPER SHANK - TAPPED 12MM
 10MM PARALLEL SHANK
 3 ASSORTED 8MM DIA HSS BORING BARS
 1 TOOL STEEL ADAPTOR TO ACCEPT 5MM HSS TOOL STEEL
 1 X 5MM DIA HSS TOOL STEEL
 1 X 8MM DIA HSS TOOL STEEL
 SUPPLIES IN A NICE WOODEN STORAGE BOX
 ALSO AVAILABLE IN IMPERIAL!!

SOBA OPTICAL CENTRE PUNCH
 GET IT RIGHT EVERYTIME !!
 ACHIEVE PRECISE PUNCH LOCATION
 IT IS SUPPLIED WITH 2 PERSPEX RODS
 WITH EITHER CROSS HAIR OR BULLSEYE
 TARGET. THESE ARE PRECISION MADE
 SO AS TO MAGNIFY AND ILLUMINATE
 THE WORKPIECE TO BE PUNCHED.
 THE 48MM INCH DIAMETER BODY IS FITTED
 WITH A SLIP RESISTANT BASE
 PUNCHES 9.5MM DIAMETER 60° OR 90°

SOBA HSS CENTREDRILL SETS

QUALITY HSS CENTREDRILLS
 IN A HANDY STORAGE CASE
 ASSORTED QTYS OF EACH

CODE	TYPE	PRICE
133000	SET 10 IMP BSI-BS6	£24.00
133100	SET 12 MET I-5mm	£22.00

NEW SOBA MAGIC VICES



Ordering No.	Length		Width		Height		Jaw Width		Jaw Opening		Jaw Depth		PRICE
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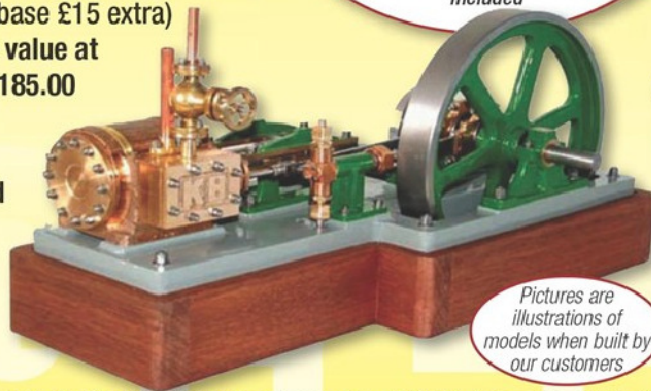
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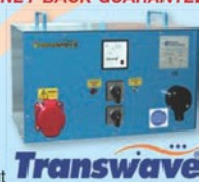
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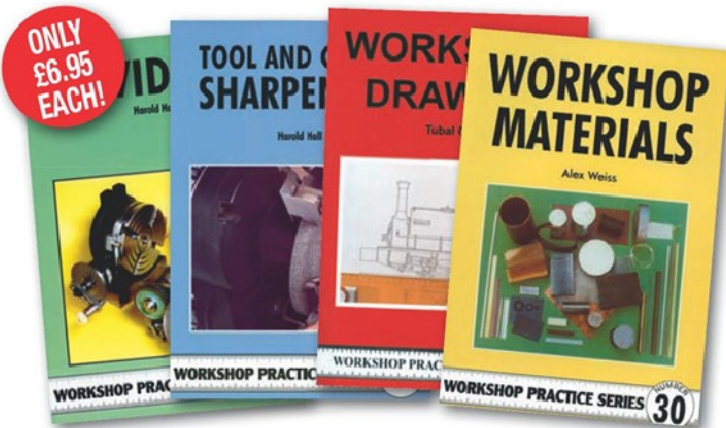
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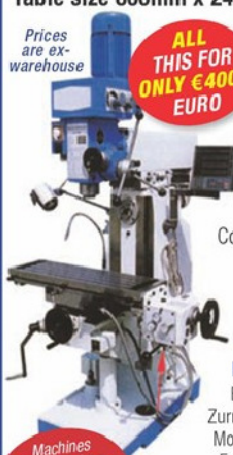
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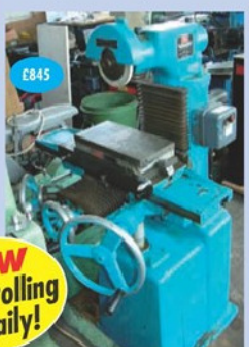
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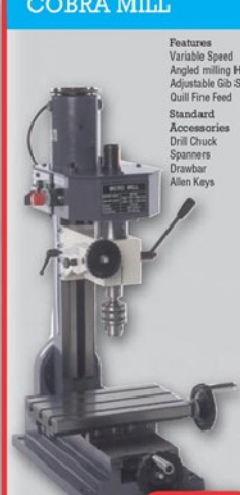
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