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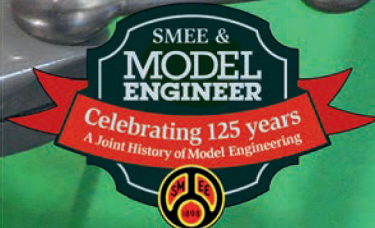
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# MODEL ENGINEERS' WORKSHOP

THE MAGAZINE FOR HOBBY ENGINEERS, MAKERS AND MODELLERS JANUARY 2023 ISSUE 323 WWW.MODEL-ENGINEER.CO.UK

## Lever Tailstock for Myford Lathes

Pete Barker's great design is adaptable to many other lathes as well.



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## COLLET CHANGEOVER

Rod Jenkins modifies his collets to fit a different lathe.



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■ MAKE MALCOLM TIERNEY'S HANDY ACCESSORIES FOR CENTRING WORK. ■ GEOMETER INTRODUCES BEGINNERS TO DIFFERENT TYPES OF VALVE. ■ MAKE A SPINDLE STEADY FOR SECURING LONG WORK IN THE LATHE. ■ THE ARTFUL DODGER ON WHY IT'S GOOD TO MAKE LISTS. ■ RIVETING HEAD. MAKING ONE TOOL TO COMPLETE ANOTHER. ■ MAKE AN EDGE FINDING PROBE FOR YOUR MILLING MACHINE. ■ WORKSHOP PHOTOGRAPHY: MAKE SURE YOUR PHOTOS LOOK GOOD IN PRINT. ■ PLUS ALL YOUR REGULAR FAVOURITES!

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This issue was published on June 17, 2022.

The next will be on sale on July 22, 2022.



# On the Editor's Bench

## Bovington Tank Museum

I celebrated my birthday in November and to mark the occasion a few days later my two brothers took me for a day out at the Bovington Tank Museum in Dorset. We had been before, but that time my youngest brother was literally a babe in arms!

All three of us share a fascination with armoured vehicles since childhoods filled with model kits. It was remarkable to see so many of the machines we knew so much about for real, many of them being among the last few of their kind. The whole story of tanks is covered, from Little Willy, following their development up to the present day. Exhibits include Tiger 131, the last working Tiger Tank. We had hoped to see the Sherman that also featured in the film *Fury*, praised for its realistic depiction of tank combat, but it is presently undergoing an overhaul.

The museum is exceptionally well presented, the staff are friendly (and the food is good too!) I think it is important to note that while the museum is dedicated to machines whose prime purpose is destruction, it doesn't glorify war. The extensive recreation of First World War trenches is both disturbing and thought provoking,



and the exhibits don't shy away from the physical and mental impact of combat on soldiers. A particularly moving section features vehicles from Operation Herrick in Afghanistan, including a troop carrier partially destroyed by an improvised explosive device (IED).

The photo shows a Churchill AVRE, with its bucket-like petard mortar which was used at short range to demolish fortifications. I chose this one to feature as my dad did his national service in the Royal Engineers and has many great stories. One time an instructor retrieved a dummy petard round which had served as a doorstop for many years and was directing a soldier in the use of the mortar inside a hanger where tanks were serviced. My dad who was nearby heard the almighty bang. Unfortunately the colour code on the 'dummy' had changed many years earlier and rather than being totally inert, it had propellant but fortunately no explosives. The poor chap who had placed the round in the Petard (it is a muzzle loader) narrowly avoided having his arm blown off, but what was effectively a concrete missile destroyed the girders over the hanger door and bits bounced around causing multiple damage elsewhere.

Most of dad's army stories involve major damage to property. He was a despatch rider and one duty was to ride ahead to a junction to direct tanks, whose drivers had limited visibility. He recalls arriving at a t-junction rather late, to find an angry squire standing by a trail of Sherman tank tracks leading through his (smashed) gate and looping around on his extensive lawn, before heading back through his hedge to rejoin the road,

Neil Wyatt



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# Contents

## 9 Make a Myford lever-action tailstock attachment.

This beautifully executed design by Pete Barker can be adopted to suit many other types of lathe as well.

## 15 Beginner's Workshop

This month Geometer introduces a range of different valve types.

## 16 An Effective Edge Finder

Fergus Malcolm looks at different types of edge finder and explains his own design and how to use it.

## 24 Artful Dodges

John Smith explains why you should always make a spare.

## 26 Extending the versatility of a 'Parrot Vice'

Further modifications to get the best out of these flexible workholders, from R. Finch.

## 32 Safely turning long objects in a lathe

Brett Meacle describes a spindle steady to help avoid accidents when turning long workpieces in your lathe.

## 39 Digital Read Outs

Introducing beginners to the world of DROs and how they can speed up working and improve the accuracy of your machining.

## 40 Celebrating 125 years of Model Engineer magazine

ME magazine is 125 years old, and so is the Society of Model and Experimental



Engineers, we take a look at their shared roots.

but first he had to make some useful accessories.

## 44 Centring a rotary table on a mill

Malcolm Tierney explains a set of simple accessories you can make to help speed up this tricky task.

## 46 From the Model Engineer Archive

To mark 125 years of ME will be looking at their archive in 2023. This month we take a trip back to 2001.

## 47 A Multi-Tool Holder for grinding rotary rivet heads

Will Doggett decided to grind up his own heads for his rotary riveting tool,

## 56 Workshop Photography

This month we look at how resolution, compression and cropping can affect the usability of our images.

## 61 Adapting Schaublin collets for a Pultra lathe

Rod Jenkins had to find a way to make a small buttress thread.



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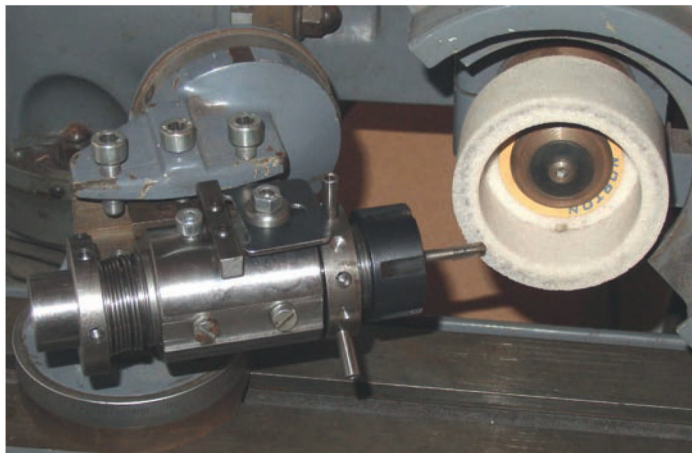




# Coming up...

## in our next issue

Jacques Maurel explains how you can sharpen worn taps to extend their life.



## Regulars

### 3 On the Editor's Bench

The editor enjoys 'an Engineer's Day Out'.

### 22 Scribe A Line

Another bumper postbag of readers' thought and observations. We are always keen to hear from you – send an email to [meweditor@mortons.co.uk](mailto:meweditor@mortons.co.uk).

### 38 Readers' Tips

This month we find a simple way to extend the battery life of an angle gauge.

### 52 On the Wire

More news from the worlds of hobby and full size engineering.

### 66 Readers' Classifieds

Another selection of readers' sale and wanted ads.

## ON THE COVER

The cover of this issue shows Peter Barker's lever tailstock for Myford lathes, his neat design mimics the appearance of castings. See page 9 for more details.

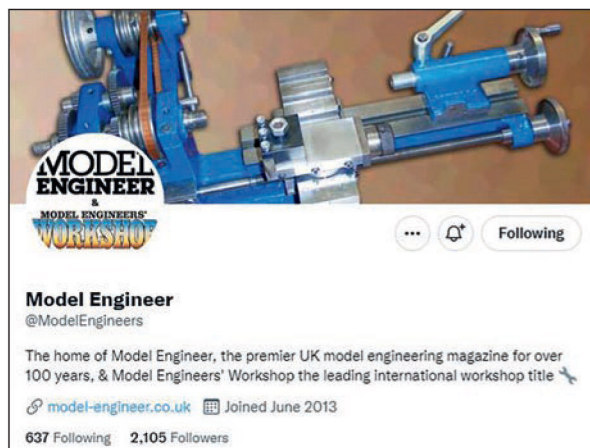


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[www.model-engineer.co.uk/differential](http://www.model-engineer.co.uk/differential)

### Other hot topics on the forum include:

#### Experimental Pendulum Clock

More to interest those fascinated by clock movements by SillyOldDuffer.

#### Something for 9yr old to make

This question received 'an amazing selection of ideas' by David Hill 5.

#### Has anyone found a good notebook for hobby engineers?

Remember when we used to use pen and paper? Looking for a substitute for the Black n' Red A67966 by Brad Amos.

#### Come and have a Chat!

As well as plenty of engineering and hobby related discussion, we are happy for forum members to use it to share advice and support. If you feel isolated by the lockdown do join us and be assured of a warm welcome.

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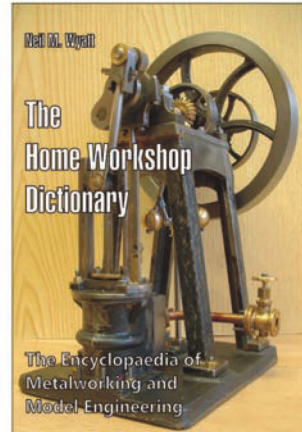
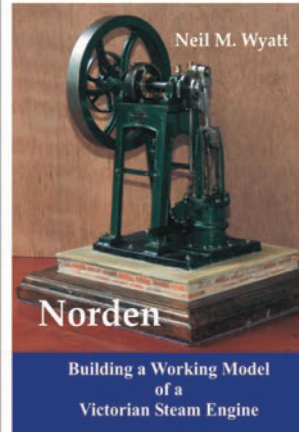
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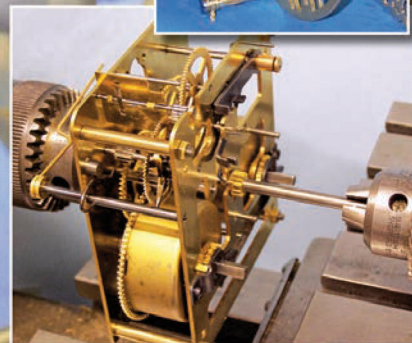
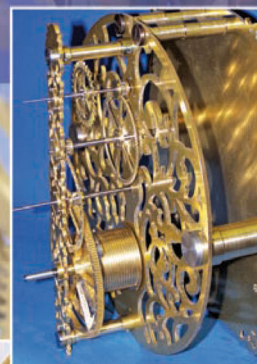
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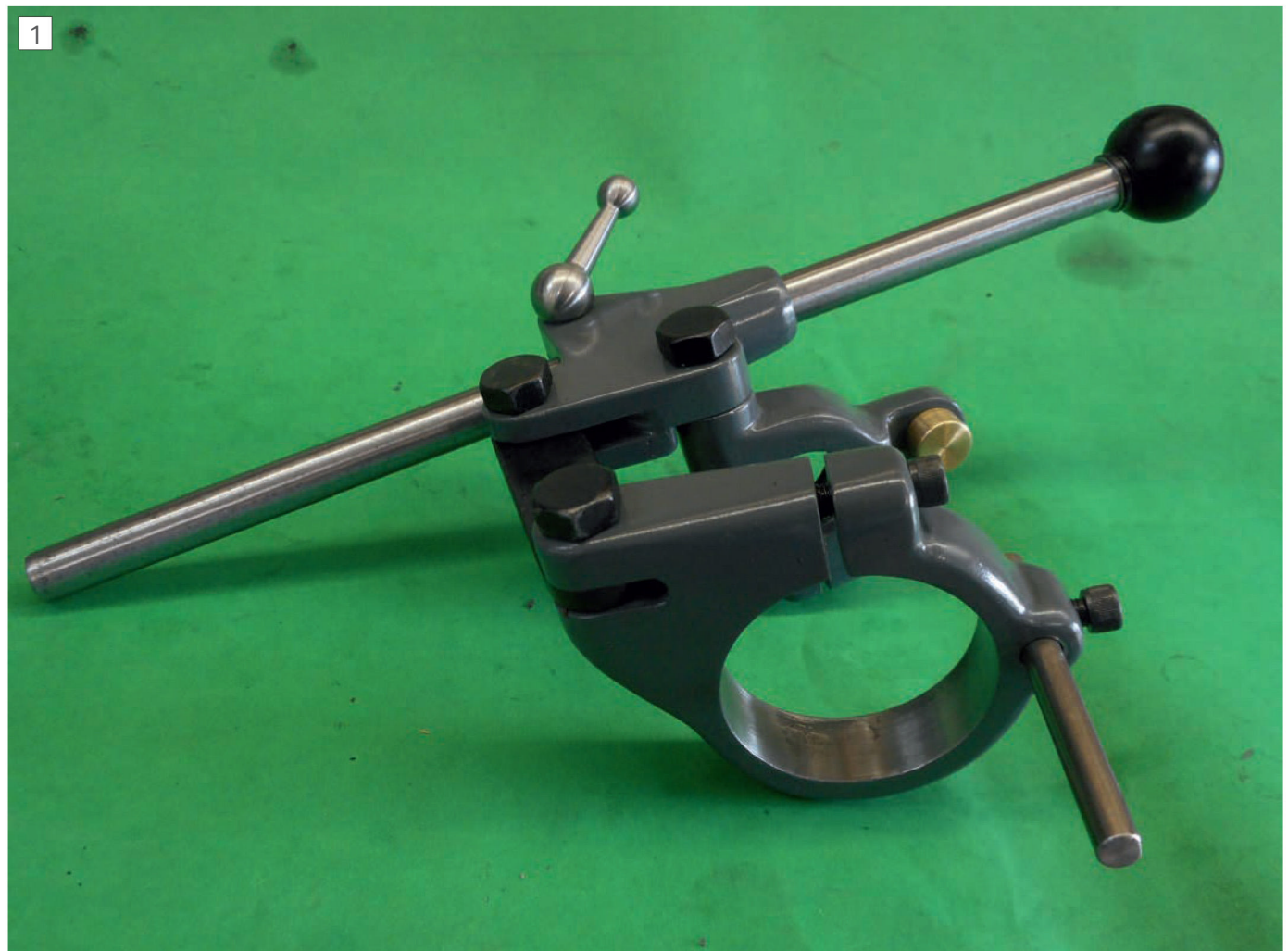




# Make a Myford lever-action tailstock attachment



Pete Barker builds a useful drilling accessory for Seven Series lathes using bar stock. The design is adaptable to fit almost any other lathe.



*Lever attachment is shaped to resemble the original Myford accessory.*

**G**rowing tired of constantly winding the tailstock quill in and out while drilling holes on the lathe, I recently raided the scrap box to make the lever attachment seen in **photos 1, 2 and 3**.

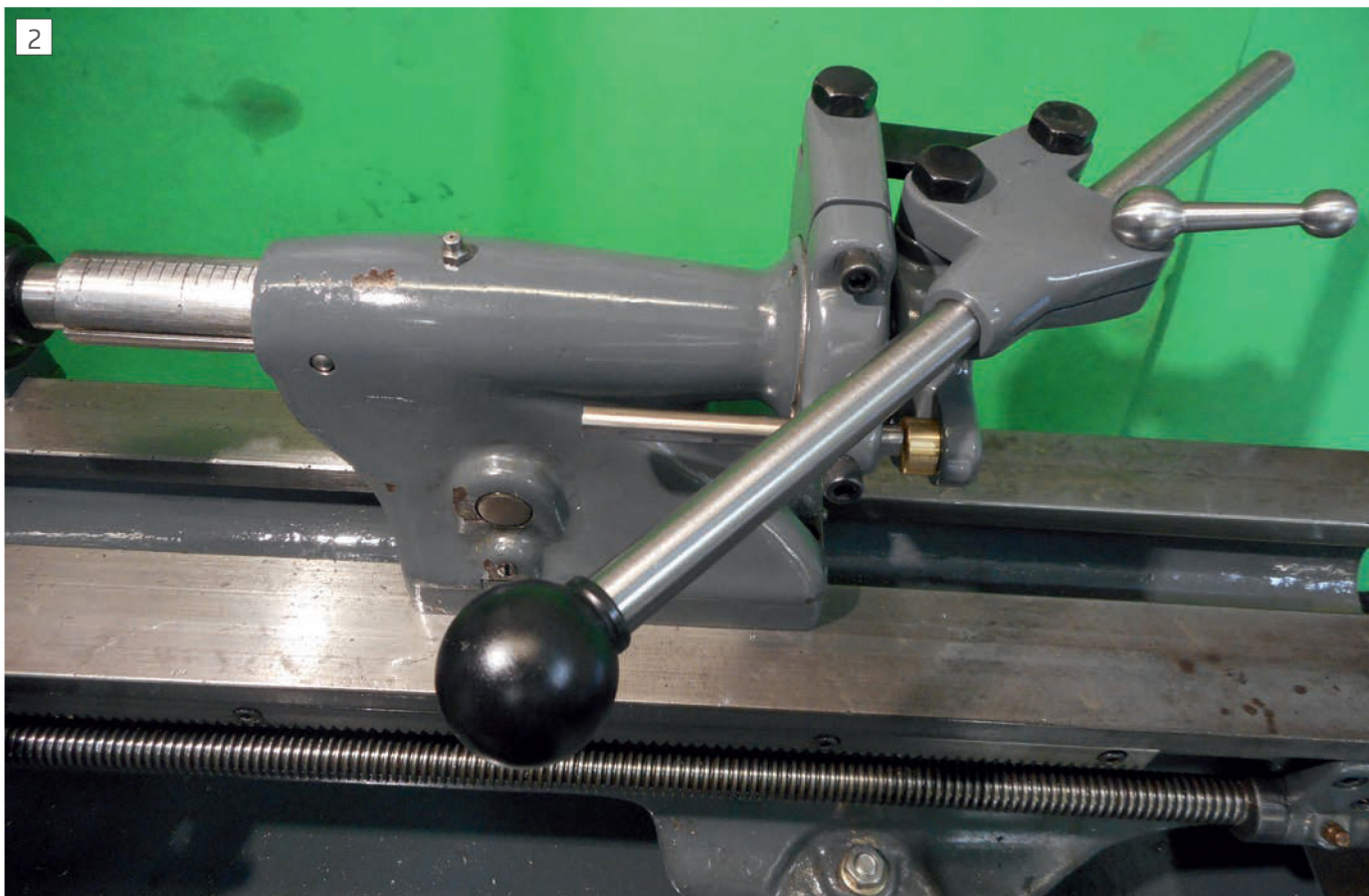
The accompanying **figures 1 to 4** (and 5 to 7 to follow) show all the essentials to make the device. The blow-by-blow

machining methods are closely detailed in a thread on the model-engineer.co.uk forum titled "Myford Lever Action Tailstock Design and Build". <https://www.model-engineer.co.uk/forums/postings.asp?th=177402>

Thanks to input from forum members with access to the no-longer-made Myford lever tailstock attachments,

I was able to produce a reasonable facsimile from some offcut pieces of 3/4" flat plate. The end result looks the part in my vintage machine shop and is a very useful accessory for drilling holes ranging from sub-1/16th up to 1". And its capacity for rapid pecking motion takes all the anxiety out of centre-drilling with those so-easily-broken tips.





*The handle slides in out of the way when not in use and is offset to allow full quill extension without interference.*



*The attachment looks as if it came with the lathe in 1957 and not out of the scrap box in 2022.*



## Marking out and dimensions

I won't go into too much detail and repeat what is already said on the website but there are a few oddball things worth noting. For the most part, the job is a matter of basic lathe work and milling that needs little comment, with quite a bit of bandsaw use to create the outside shape. Then a belt liner, various files and finally emery paper were used to round off all the corners and make the pieces of flat plate look more like a period-correct casting.

The drawings are dimensioned in inches to match Myford practice. I have used fractions, which may seem rather old-fashioned in this digital age, but marking out is most easily done with a rule, scribe and dividers. I also used a scribing block with a sheet of glass as a surface table. With marking blue unavailable during Covid lockdowns, I substituted blue marker pen, which rubbed off too easily during initial machining, **photo 4**, so used some spray-can red paint after that. I still centre-popped around the profile to make sure I did not lose it, **photo 5**.

Very few dimensions on the whole job are critical so a rule is good enough for layout work. But do precisely measure the diameter of the body of your tailstock before boring the large hole in the main clamp as it can vary from lathe to lathe. Make the hole a thou or two bigger so it is a free sliding fit.

The only other critical dimensions are on the three shouldered pivot bolts. The drawings call for them to fit the  $\frac{7}{16}$ " reamed holes in the clamps and connecting link so exact size will depend on the exact size of hole your reamer makes. Turn the bolts to be a neat sliding fit in the holes. You could even drill the holes  $\frac{7}{16}$ " if you have no reamer and make the bolts to fit the slightly larger resulting hole. Lengths of the shoulders on the bolts are best made to match the distance measured with a depth micrometer or digital caliper between the surfaces they mate with, as it may vary by a few thou depending on your machining.

You will notice some differences between the drawings and the photos. This is where some improvements were suggested and made during construction. The drawings reflect the best practice, sometimes learned after the fact. Most notably, I have eliminated

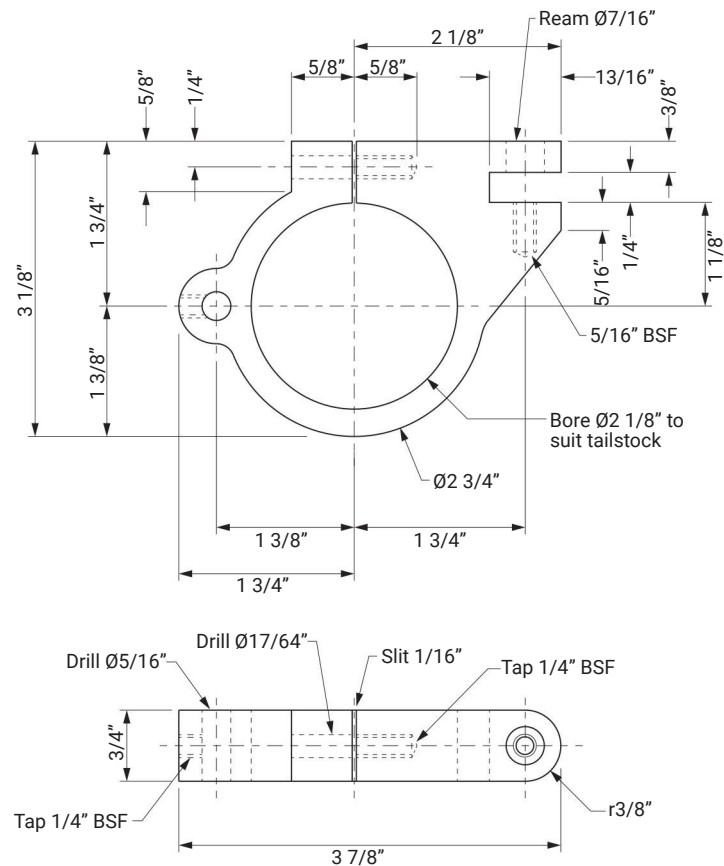


Figure 1

Tailstock Clamp

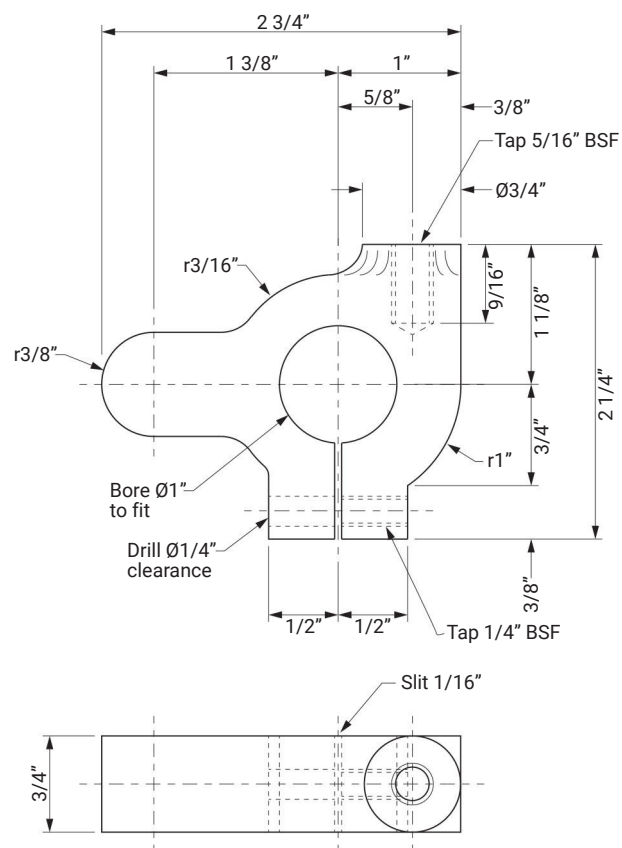


Figure 2

Quil Clamp



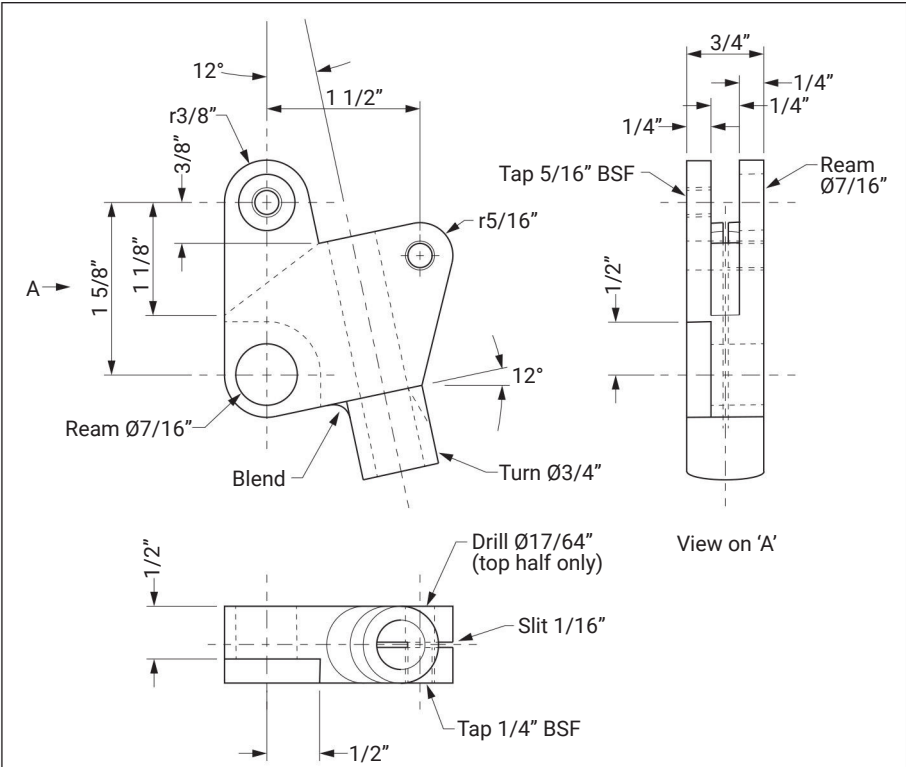
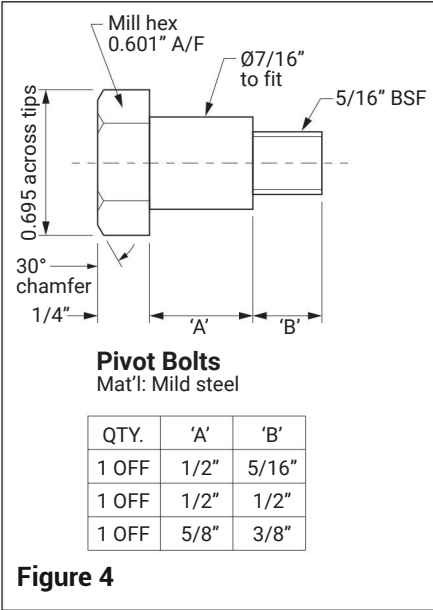
the Acme thread in the quill clamp, which Myford used on its early versions of the attachment. Instead, the drawings show the later style plain 1" bore that clamps on to the outer diameter of the thread. If you wanted, you could leave a small step in the end of the bore for positive drive, but it does not appear to be essential.

Also, I changed to the later type depth stop with a plain shank and clamping bolt rather than the earlier threaded rod variety. So, the drawing leaves the quill clamp full thickness all across and the make-up brass button seen in the photos is eliminated.

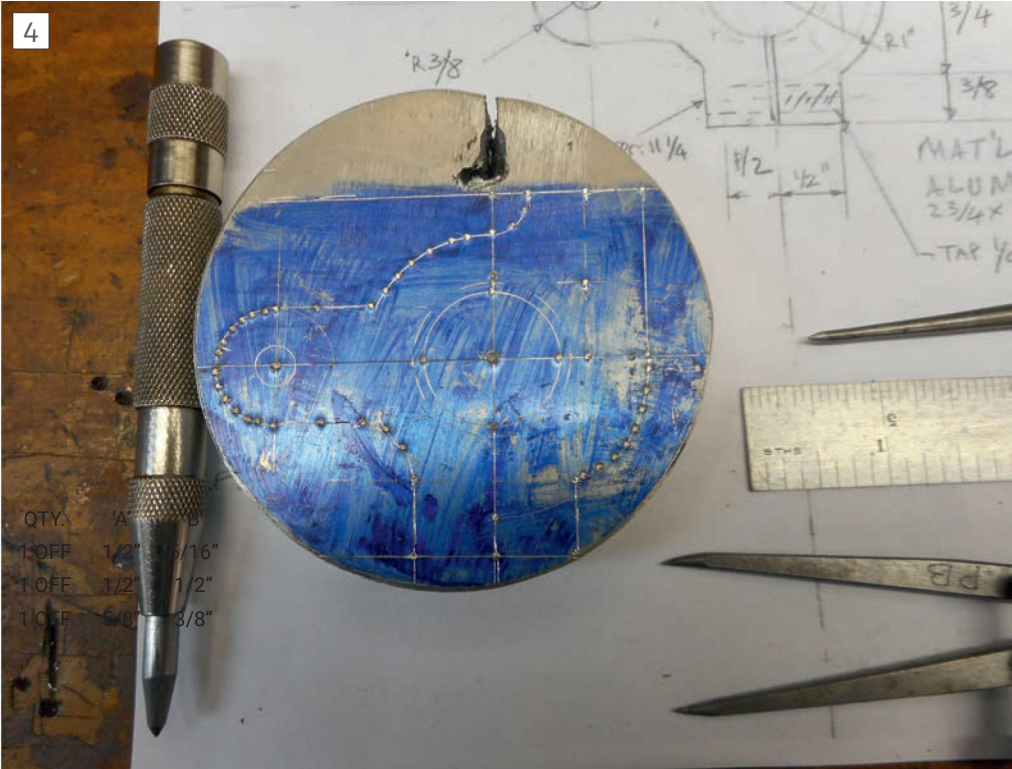
### Materials

I made all three main pieces from 3/4" flat plate, **photo 6**, which worked well. Steel was used for the main tailstock clamp and the handle bracket. Aluminium was used for the quill clamp, because that is what I had. Steel is obviously the most robust for tooling, but all three pieces could be made from a good grade of aluminium such as 6061 T6, or what used to be known as Duralumin. With this option, you could even cut the outer shapes with a hand hacksaw and file to final shape without too much effort. Conversely, you could make it all from steel and simplify the shape to straight lines if you wished.

As it was, I used a low-cost horizontal bandsaw for all the cutting work. A series of straight cuts with the job held sticking out the side of the vice brought the job close to the line. The few concave curves were done with a combination of



**Figure 3** Handle Bracket



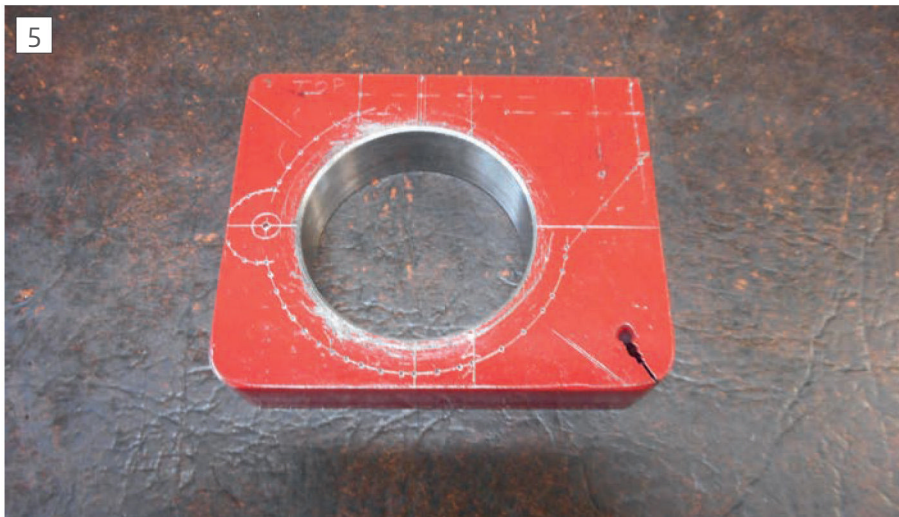
Simple layout equipment was used. Centre punch marks preserve vital dimension during multi-stage sawing, machining and finishing.

drilled holes and using the bandsaw in its vertical position to cut freehand. The rough-cut shape can be seen in **photo 7**.

The little bit of time then spent rounding off all the corners not only

resulted in a pleasing casting-like look but is much easier on the hands than working around sharp edges and corners that one sees on some shop-made tooling. Your hands are your most





Hole was bored before bandsawing the outline, to make clamping easier on the faceplate.



Raw materials were selected and developed with the aid of cardboard templates. The hex bar was discarded as too small.



The bandsaw made quick work of the outer profile and even the 1/4" wide slot

valuable tools. Look after them. The finished shapes can be seen in **photos 8 and 9**.

In this concluding instalment we have **figures 5 to 8**.

### The fiddly bits

The small pieces, as seen in **photo 10**, need little explanation beyond the drawings. The link is a piece of common flat bar. Pivot bolts are mild steel, the handle a simple length of bright mild steel with an aluminium ball turned up for the end. Plastic substitutes are commonly available from engineering suppliers, requiring perhaps the end of the handle to be sized and threaded to suit.

The only two notable pieces of machining work are the making of the rather complexly shaped handle bracket and the BS (British Standard) hexagons on the pivot bolts. After being cut to shape on the bandsaw, the handle bracket was mounted on an angle plate attached to the lathe faceplate, see **photo 11**. The hole for the sliding handle was then accurately drilled and reamed. While set up, the outer diameter of the bracket was turned round. I made my bracket a full 1" wide here and turned a tapered shape on it. The drawing shows a simpler 3/4" parallel turned section that is easier to do.

The clamping slit in the bracket was cut in the bandsaw using a drill press vice held in the bandsaw vice to hold the job laterally. The ball handle for the clamping is a rather complex job, detailed on the website, requiring a ball turning tool. It is a nice piece of period correct detail but a 1/4" Allen-head cap screw would do the job just as well.

To mill the Myford-sized BS hexagons on the pivot bolts, I clamped each bolt into a T-slot on the Myford's vertical milling slide and milled one flat to the required dimension. Then a digital protractor was used to set that first flat at 30 degrees to mill the next flat, and so on around the circumference until the hexagon emerged, see **photo 12**.

To dress them up, the bolts were oil blackened by heating with a propane torch until black and then dropped into a tin of unused motor oil. The result looks the part, discourages corrosion and is reasonably durable.



8



## Conclusion

Using nothing more than the low-cost horizontal bandsaw, the lathe and basic benchwork, a most useful tool was made, which also looks as if it came with the lathe in 1957. But the lever arrangement could be modified to suit almost any lathe. More modern lathes could have a modified clamp held to their square tailstock body with either a square hole for clamping, or even by screws into holes drilled and tapped into the body.

The lever mechanism transforms the tailstock into virtually a horizontal drill press, making it much quicker and easier to use on everything from tiny to huge hole drilling, **photo 13**. Plus, it can still be used to hold a tailstock centre in place by use of the standard quill clamp. Yet it still works perfectly for tensioning a tailstock centre before nipping up the barrel clamp. So, I doubt I shall see the return of the tailstock handwheel in the foreseeable future. I am very happy with the end result of a very enjoyable project to make. ■

*Belt linisher and some filing provided the final shape.*

9



*Riffler files are ideal for this sort of work. Aluminum makes shaping easier too.*



## BEGINNERS WORKSHOP

These articles by Geometer (Ian Bradley) were written about half a century ago. While they contain much good advice, they also contain references to things that may be out of date or describe practices or materials that we would not use today either because much better ways are available or for safety reasons. These articles are offered for their historic interest and because they may inspire more modern approaches as well as reminding us how our hobby was practiced in the past.

# Beginner's Workshop

## VALVES

### GEOMETER describes some types and their uses

**I**N ITS VARIOUS FORMS, the valve is an essential part of engines, pumps and pressure systems depending for their function on the retention or flow of gases and fluids—air, water, petrol, oil, etc.

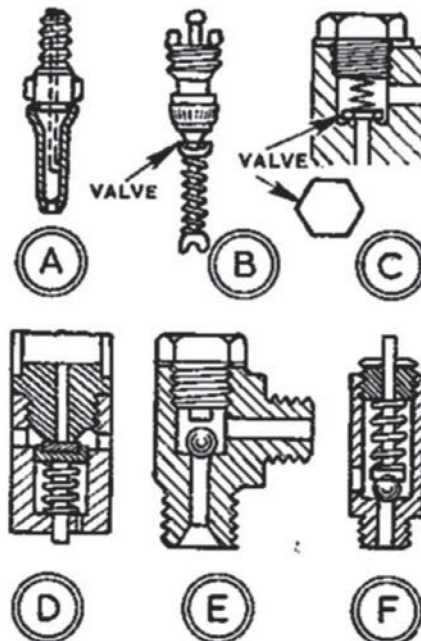
The simple valve works automatically from the difference in pressure existing on opposite sides. When pressure is higher on the side from which the valve permits flow, it operates. Otherwise, it remains closed, either by gravity, natural resilience, spring pressure, or because of the higher pressure on the opposite side—the actual means depending on the type of valve.

Some of the most common examples of valves are those used in cycle and motor tubes, where retention of pressure and absence of leakage are important—for which reason rubber is used for sealing. The cycle valve, *A*, employs a sleeve of thin rubber tube pushed on the central core, which is drilled and provided with a side hole covered by the rubber, pressure lifting this for the air to pass. In fitting, the central core is wetted, and the rubber pushed on until the end, passing over a swelling, contracts in a groove. Sealing in the stem is made on the rubber on the swelling.

For tubes of motor vehicles, the valve used is the Schrader having a core as at *B*, screwed into and removed from the stem with a slot-ended cap. An integral rubber ring seals the core into the stem, while the actual valve is a tiny rubber ring in a brass cup.

#### Testing for leaks

An advantage of these valves is that excess pressure can easily be released by depressing the central plunger, using a match stick. This can also be done to clear dirt causing slight leakage, although a cap with a rubber seal is always advisable. To test for leakage, the end of the valve stem can be wetted, or the wheel positioned with the valve at the top for immersion in a jar of water—this is applicable also to cycle valves.



Neither valve is suitable for pressure containers for petrol or paraffin, owing to the effect of these on rubber.

The valves used for car petrol pumps are of plastic-fabric material. These are resistant to petrol and of hexagon shape, *C*, to permit flow. They rest on small raised seatings and, with use, can become grooved so as not to seal properly, pump action then being affected. Turning the valves over to the good side, or removing the grooving by rubbing on a smooth file, are alternatives to renewal.

The valve used in the pump of a blowlamp or other pressure container, *D*, is a small special rubber disc (Neoprene) in a brass cup, spring-loaded on to a conical seating. A rising pump handle indicates this valve is faulty.

The common non-return valve, *E*, for water or other liquids, is a ball in a housing. For water, a brass or gun-metal housing and rustless steel ball are used. A leak-proof seating is

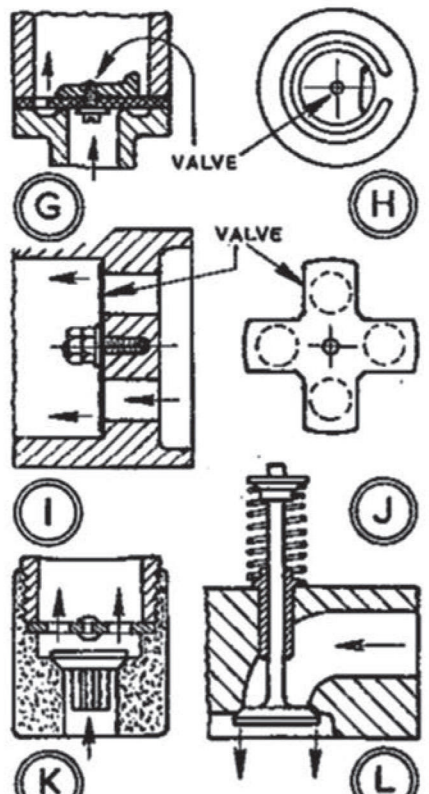
made by tapping down a similar-size ordinary steel ball. The cap should restrict lift for rapid functioning. A small boiler safety valve, *F*, is of similar construction, but spring-loaded and with an adjustable cap to regulate pressure.

The valve in a domestic pump is a flap type of leather with a brass or cast iron weight on top, *G*. A narrow neck of leather attaches the valve to the ring, sealing the pump body, *H*. It should be flexible, and if necessary may be thinned with a knife.

A special flap valve of thin flexible steel, *I* and *J*, is sometimes used for crankcase breathers on engines, and for crankcase air intakes of small industrial two-stroke engines. The arms or blades must cover the holes through which the air flows. Bright uneven areas can indicate wear—perhaps resulting in leakage.

A popular valve for stirrup and other water pumps is the conical seating metal type, *K*, with three guide wings below the head. Seating is done by grinding in with abrasive paste.

The poppet valve, *L*, is the standard internal combustion engine type. Originally inlet valves of this sort were fitted with light springs and automatically operated by the suction of the piston. Grinding in is with abrasive paste as for the other.





# An Effective Edge Finder

Fergus Malcolm makes an aid to accuracy that also helps tackle the curse of round column mill head adjustment

**T**here is nothing new under the sun, and I quite expect someone will be along to say his granny had one in 1922. Anyway, this describes a device I evolved, and how it can reduce the nuisance of changing the head height of a round column mill/drill.

Most vertical spindle milling machine owners will be familiar with the edge finder in one or another shape or form.

**Photograph 1** shows (A) a split cylinder finder, and (B) a Huffam (a similar function is usually included in a wiggler set). The upper shaft is gripped in the chuck or collet, the spindle set rotating, and the displaceable lower indicator or sensing part is used to find the position of an edge. It is brought lightly into contact, the initial "touch" setting this diameter precisely concentric with the spindle rotation axis. A tiny further advance causes a sideways displacement along the edge, providing a visible indication.

This automatic exact concentricity with the spindle axis is a valuable feature, being independent (within reason) of the concentricity with which the shaft is gripped. Further, the ability of the sensing part to move protects from minor damage. However, a degree of skill is required to gauge the exact point of contact, as the displacement is gradual. To help with this aspect, alternative devices with battery powered indicator lights are available. A ball race pressed into a short shaft is reported to improve sensitivity.

Many of these alternatives are not designed to self-centre and thus need to run accurately concentric, with the additional risk of harm from hard contact. What would be ideal would be a non-electrical device having the self-centring feature, and high sensitivity. As I also wanted a greater sensing diameter (see later), I tried a ball race as the indicator.

## The Device

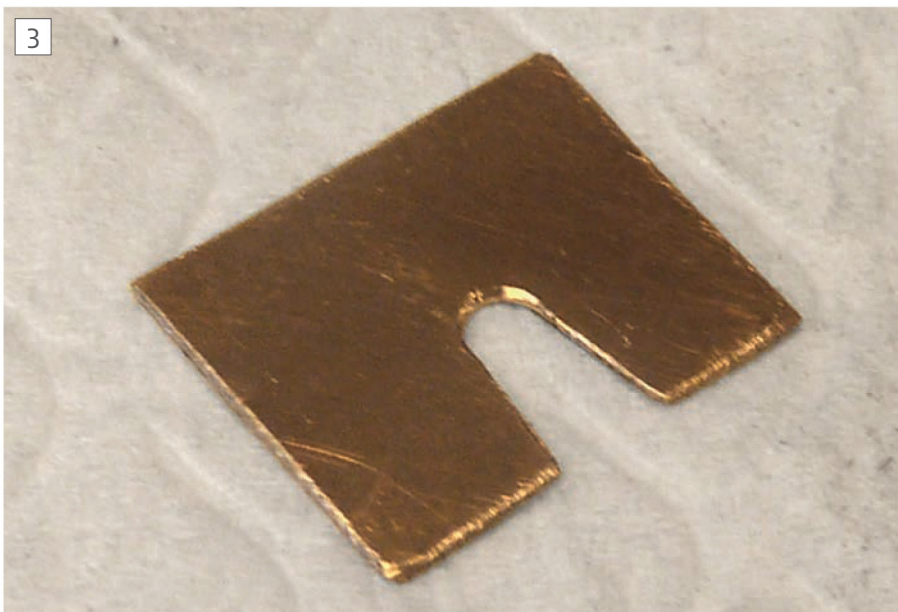
**Photograph 2** shows how this is made from an ordinary split cylinder finder, simplicity itself though finicky to







New Edge Finder



Spring Keeper

assemble. The parts are held together firmly by the existing internal spring. Firstly a small spring keeper is needed, see **photo 3**. Though just about any small thin metal piece might do, it is all too easy for it to jump out. For safety, always keep fingertips well clear of the hook end of the stretched spring! It

may also be a good idea to have a small hook tool available to recover the spring if released, **photo 4**, easily made from mild steel MIG wire, or maybe out of a thin paperclip.

The task is to unhook and remove the original indicator part, and to replace it with the ball race. The existing spring



Hook



Assembling

will very likely be satisfactory. The hook anchor piece to retain the spring needs to engage in the bore of the ball race.

Practical advice is to grip the shaft section with soft jaws in a vice and include something underneath to block downwards escape of the spring and anchor which otherwise will unerringly disappear down a gap in the floor! Pull the indicator section far enough up, trap the spring with the keeper, then unhook it. Now offer the ball race to the spring and hook on the new anchor, **photo 5**, then carefully release the spring. The quick and cheerful anchor can be a



washer that just sticks in the bore of the ball race. Once convinced, it is easy to turn up a cosmetically superior anchor, **photo 6**, which is flanged to retain it in the ball race. The bore has two diameters to catch the doubled over MIG wire, which is then bent to form the hook.

### Edge Finder Design Choices

The use of the modified device differs subtly from the usual edge finders. When the outer of the ball race doesn't make contact it rotates with the shaft, but with light contact it stops. To discern this easily, dots can be marked on the ball race outer. Selecting a suitable ball race needs to have regard to the diameters of the shaft section being used, in my case 9.5mm and 6.5mm. The inner of the ball race should be in contact right round, but the outer must always be free. I used a 606ZZ (6x17x6), which has dust shields both sides. Full rubber seals would likely introduce too much drag, and of course the ball race must be free running, if gummed up it won't do. It is unfortunate that the sizes of standard metric bearings have been contrived to ensure the radius of the outer is never a convenient whole number of millimetres!

When "just touching" on my machine the outer race rotates slowly and evenly, and this intermediate condition is

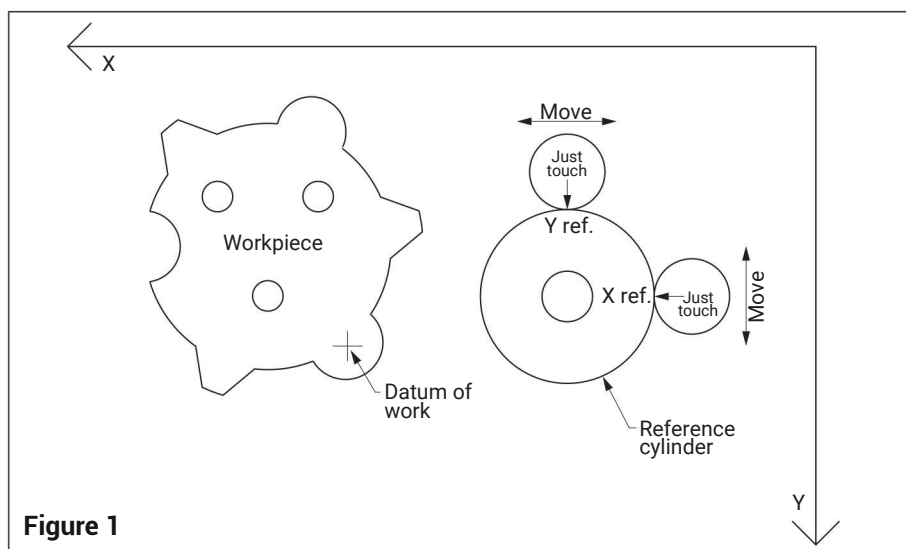


Figure 1

generally consistent to 0.01mm. It is thus unambiguously the "correct" point. Does this perhaps depend on the right level of vibration? If you are able try this, report your experience.

### Restoring the Datum of a Round Column Mill Spindle After Height Change

Many a contraption has been devised to get over the loss of datum if the head of a round column mill/drill must be loosened to change the height. A simple method would be to sense origin points of X and Y on a reference cylinder

(a basic form of cylindrical square) fixed to the table. The scheme must allow checking at different heights to cope with the necessary range of head position. Obviously ordinary edge finders are poorly suited to this, but the ball race type works nicely. It is very desirable that the mill has digital readouts if the potential accuracy is to be achieved easily.

The reference cylinder might, for example, be a capstan socket sleeve, the outer diameter hopefully being accurately sized and parallel. I made mine from a hydraulic piston of diameter 35mm.



Ballrace and Anchor





rough centre of the lateral contact zone as the measurement position for each reference coordinate is entirely adequate. This knowledge makes the process quick and easy.

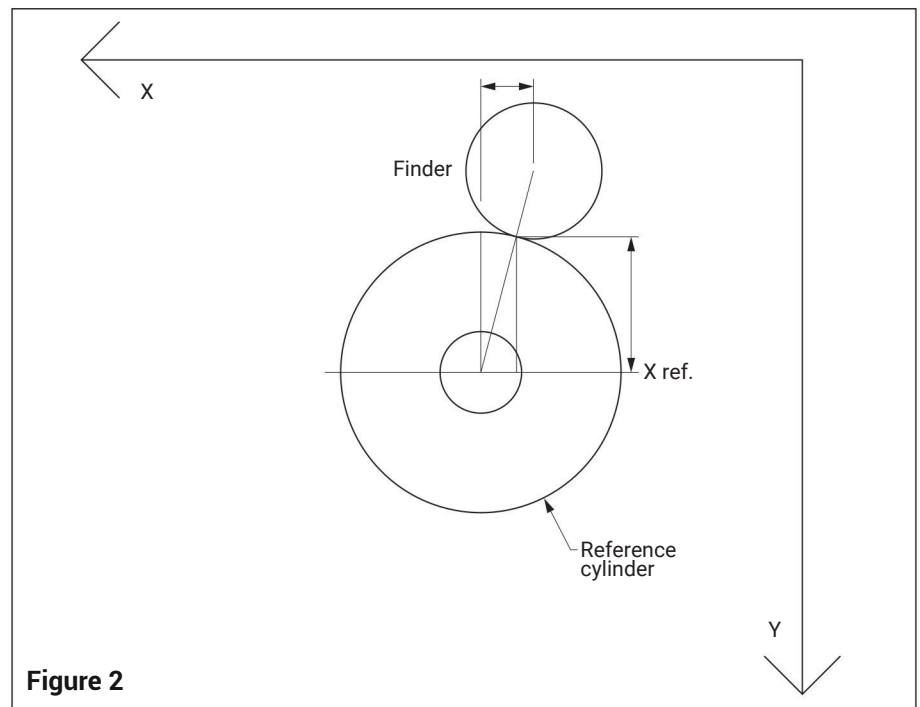
With the readouts zeroed on the cylinder, the table is now moved to the work piece, whose datum is established as normal. When it is a casting, the best placement will often be a shrewd guess, normally difficult to re-determine exactly. Once the work datum is decided, write down the translations from Xref and Yref, then zero the readouts to set the work-space origin. Thereafter, if the head is moved, it is only necessary to re-find the cylinder reference points and move directly by the recorded values to the work datum.

### Reference Cylinder

Another possibility is a large piston pin. The outer of the ball race keeps the shaft well clear to allow contact over a range of heights. Obviously, the reference cylinder must be accurately orthogonal, and an extender to increase the range of the edge finder may sometimes be necessary.

The procedure is quick and definite, see **fig. 1** and **photo 7**. Establish reference coordinates of the cylinder as follows. In fig. 1, find the X axis point by advancing X while moving the Y axis back and forth across the contact zone to find the "just touch" point. Zero the X readout to give the Xref position. Repeat the procedure to define the Yref point. There is no need to work out the actual centre of the cylinder.

I was initially surprised that from "clear", advancing by just 0.01mm resulted in a touch indication that was unchanging over a lateral zone of about one millimetre. I suspected I had overlooked something, but a bit of basic trigonometry is enlightening.



**Figure 2**

with an exaggerated angle of 15°. The diameter of the ball race aids the process by further widening the

Of course, a little planning is beneficial to ensure the expected range of head height can be covered. To this end I have two cylinders, 100mm or 60mm high. Using the travel of the quill plus the edge finder projection potentially provides a 120mm range. This does depend on the mounting height of the reference cylinder relative to the work piece. An extender for the edge finder can be made to provide for a larger change of head height, or to avoid winding the quill fully out. This need not run true, since self-centring will apply overall, and the edge finder pressure is extremely low. A threaded adapter to fit a Clarkson collet might also prove useful. ➤

### For a 35mm diameter cylinder (radius 17.5mm)

| offset by angle (degrees)          | 0.5       | 1         | 1.5       | 2         |
|------------------------------------|-----------|-----------|-----------|-----------|
| $17.5 * \sin(\text{offset angle})$ | 0.15mm    | 0.31mm    | 0.46mm    | 0.61mm    |
| thus lateral zone                  | 0.3mm     | 0.6mm     | 0.9mm     | 1.2mm     |
| $17.5 * \cos(\text{offset angle})$ | 17.4993mm | 17.4973mm | 17.4940mm | 17.4893mm |
| difference from 17.5mm             | 0.0007mm  | 0.0027mm  | 0.006mm   | 0.0107mm  |

Thus over a Y zone of 1mm, the error in X is less than 0.01mm. For clearer enlightenment, **fig. 2** is drawn

touch zone. Therefore, slight lateral displacement causes a negligible error, and in practice just taking the



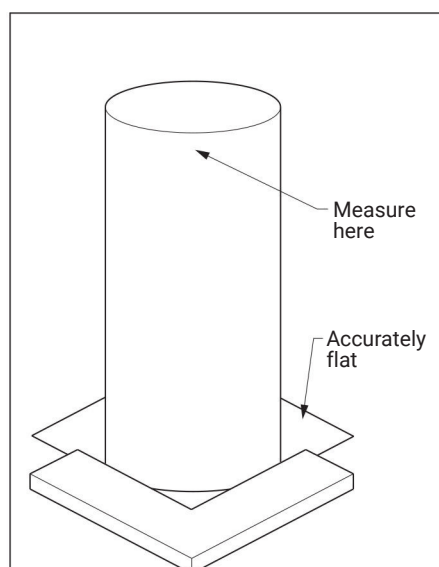
As an experiment, I made the extender shown in **photo 8** from 7/16" (11mm) aluminium, and it proved the point very well. Despite quite poor concentricity, the identical contact point was found with and without the extender. A better extender is on the "to do" list.

Importantly, this whole procedure can be invoked retrospectively when the need to change the height of the head is belatedly discovered. All that is necessary is fit the cylinder and reverse the steps to measure and record how far Xref and Yref are from the work datum.

### The Reference Cylinder

The reference cylinder is indeed just a basic cylindrical square. These are available commercially but are usually of "tool room" accuracy and cost. However, it is not too difficult to make an adequate device for our purposes either from scratch, or from a capstan sleeve or hydraulic piston. Both the latter will have an accurate, hardened and ground or polished diameter. It may, though, be necessary to face the end to make it accurately flat and orthogonal.

**Figure 3** indicates a measurement setup to determine out of square. The cylinder is placed on an adequately flat surface, to which is fixed a thin L shaped guide. The cylinder is rotated by hand, keeping it pushed into contact with both inside faces of the guide. The out of square is found using a dial/clock gauge set near the top of the cylinder.



**Figure 3**

Alternatively, it might be possible to use the edge finder itself. Mark the high point, then face down the end on a diamond plate or other flat abrasive surface, biasing the pressure in the required direction to true it up. Repeat until good enough.

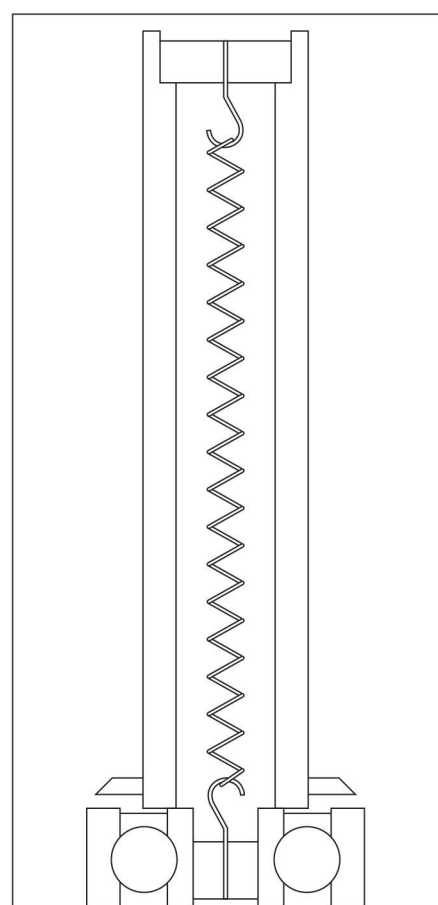
It is likely that methods and accessories will evolve with experience of the more unusual situations. A difficult case is where the work is bolted directly to the table, with the head right down and using a short cutter to maximise rigidity. Spacers for the cylinder can be turned up to have precisely parallel end faces, or a ground block can be used. A second cylinder might serve as an intermediate step to



*Dust Guarding*



*Finder Extender*



**Figure 4**



enable a large change in height, and this would surely make you seriously regret not having bought a dovetail column mill in the first place!

### Avoiding Contamination

Clearly it is a good idea to return the edge finder to a clean container after each use, rather than keep it in a tray of drills and swarf. Ordinary ball race dust shields may still not prevent the ingress and build-up of fine debris long term. An "umbrella" guard at the foot of the shaft should delay this, see **fig. 4** and **photo 9** (the guard was turned from nylon using tools for metal, and it shows!) Another option would be a race with only an upper dust shield, which would allow cleaning in solvent from time to time, with any debris able to drop clear.

### Assessment of Edge Finding Performance

Many of us will have checked the likely offset of an edge finder by sensing on either side of an up stand of known thickness and determining the fudge factor using a digital scale. I tested things as follows, using my reference cylinder:

|                              |         |                            |
|------------------------------|---------|----------------------------|
| Reference cylinder diameter  | 34.97mm | (Mitutoyo digital caliper) |
| Ball race outer diameter     | 16.99mm | (Mitutoyo digital caliper) |
| So centre to centre distance | 51.96mm |                            |
| Actual table movement        | 51.94mm | (Chinese capacitive scale) |

So out by about 0.01mm a side! But wait, how much clearance is there in the ball race? Bolting down the ball race inner, and with gentle pressure checking the excursion of the outer with my imperial dial gauge, the answer was slightly less than 0.001". Thus either a case of near perfection or of inept misunderstanding. I must say I was pleased, even if it proves very little.

It might be possible to do better than this general-purpose ball race, which will have been made with enough clearance to allow for shrinkage when the inner and outer diameters are fitted. Instrument quality ball races with minimal internal clearance are available. However, the 0.01mm a side bearing clearance might be the reason for the intermediate "correct" point of slow rotation. As the outer race is brought just into contact, the initial very light pressure may cause the balls to ride up the curve of their

track. As soon as hard contact is made, the outer will run at full speed without slip. Opinions please on whether the ball race radius should be taken as 8.50mm or 8.49mm when determining an edge.

### In Conclusion

Everything outlined above is easy, quick and cheap to do to a standard commensurate with mill/drill accuracy. It has worked very well for me so far, though it is early days. Used as a straightforward edge finder, accuracy is simple to accomplish provided the large sensing diameter does not interfere or lead to errors, and your arithmetic is adequate to subtract the ball race radius. Always provided that digital readouts are fitted, it makes retrieving the datum on a round column mill very straightforward.

If you have the means to try this out, give it a go and report your experiences via Scribe a Line. ■

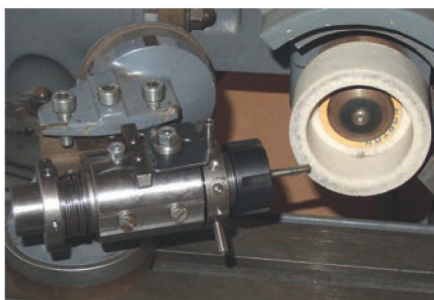
# In our Next Issue

Coming up in issue 324

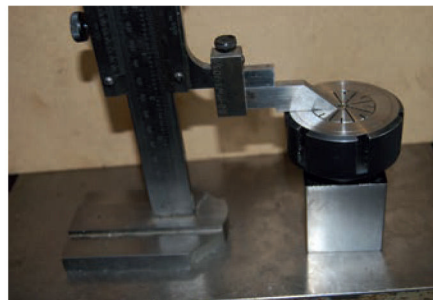
On sale 20th January 2023

Contents subject to change

Look out for your copy of MEW 324  
the February 2023 issue:



**Jaques Maurel** on tap sharpening.



**Martin Berry** makes a collet block stop.



**Laurie Leonard** shares what he's learnt about casting metal.

DON'T MISS THIS GREAT ISSUE-SEE PAGE 54-55 FOR OUR LATEST SUBSCRIPTION OFFER



# Scribe a line

YOUR CHANCE TO TALK TO US!

Readers! We want to hear from you! Drop us a line sharing your advice, questions or opinions. Why not send us a picture of your latest workshop creation, or that strange tool you found in a boot sale? Email your contributions to [meweditor@mortons.co.uk](mailto:meweditor@mortons.co.uk).

## Mystery Object - 1

Dear Neil, having read the latest issue of MEW and in the Scribe a Line Section there is a letter from Hawk Gripen from South Africa asking what the item he has sent in a photo of is.

I think he will find that it is a low temperature plastic welding tool, how it operates is that a plastic filler rod is fed down the bent tube and as it is drawn along the seam of the items to be welded the heating element fuses the two edges together and melts the plastic filler rod into the weld, just like you were using an electric manual arc welding kit.

Unlike the manual arc or MIG welders you don't get a bright arc caused by the welding, so you don't need a dark visor to stop you getting arc eyes. In a way it works just like an electric soldering iron but using plastic instead of solder.

It appears that the other part of the apparatus is just as controller that allows you to vary the heat for different



plastics in a similar way that you can use a heat controlled soldering iron for soldering white metal kits together.

Of course they should be supplied to suit the mains voltage of the country where it is used.

**J. R. Kirby, Stoke Lewington, London**



## Mystery Object - 2

Dear Neil, the mystery item in the December issue MIGHT be an aspirating soldering iron, but a jolly big one!

I attach a photo of one I have for de-soldering components on PCB's (although in general I normally use a "solder sucker") I can't imagine what the one illustrated minus the rubber bulb could be for, but the general layout is similar to the small one in my photograph. Just a guess!

**Mike Matthews, by email.**

## Shear Tool

Dear Neil, I found this on YouTube recently (search vertical shear lathe tool), and feel readers should be appraised of its contents. Having owned a lathe for well over 50 years - it certainly goes to show that you can always learn something new.

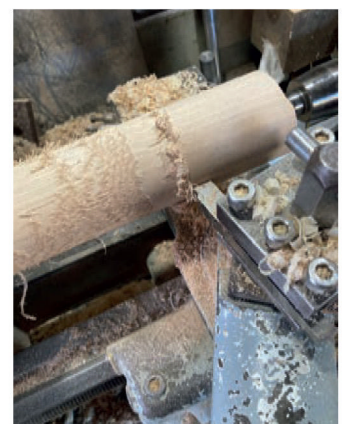
I have tried it on aluminium, the results were an almost ground quality finish. As the video explains, it is just for light finishing cuts.

The swarf formed is novel, as it forms a vertical sheet, quite unlike the more

normal curly swarf produced in normal turning. It also works on wood, as the attached pic demonstrates.

**Brian Howett, by email.**

***Hi Brian, I've come across these before. Another way to make them is to grind a tool like a d-bit, hold it in a boring bar holder and angle the tip to suit. I think the quote was 'the swarf comes off like gossamer', Neil.***





## CAD Query – 1

Dear Neil, I refer to Graham Meeks enquiry regarding 2D Cad Packages. I have run Librecad on Linux for many years and cannot recommend it highly enough. From their website librecad.org:

"LibreCAD is a free Open Source CAD application for Windows, Apple and Linux. Support and documentation are free from our large, dedicated community of users, contributors and developers"

I find it straightforward, reliable, accurate and powerful. Until recently I used it on a 12 year old machine and had no problems at all.

**Nigel Musson, by email.**

## CAD Query – 2

Dear Neil, no doubt there are a lot of packages on the market. I myself use Draftsight 2D, from Dassault Systems, the same company that makes Solid Works.

It comes with a annual subscription of €120/year and works in a very much similar way to Autocad. Some icons look a bit different, but most of the keyboard shortcuts are the same as in Autocad. Success to Graham in finding a usable package.

**Bernhard van der Steen, Netherlands.**

## CAD Query – 3

Dear Neil, Graham Meek requested recommendations for a 2D CAD package in issue 322. I have grown to love QCAD which is open source and, in basic form, free. I have paid the relative small amount (about £40) for the professional version (it's a perpetual license) and I use this on both Windows and Linux. It can also be run on Mac OS and Unix. I also purchased the book 'QCAD - An Introduction to Computer- Aided Design (CAD)' from the QCAD website for about £30 and can recommend that for shortening the learning curve. QCAD does things differently to AutoCAD and I initially found this very frustrating but a little perseverance in the early days was well worth the effort.

**Mark de Barr, by email.**

## Screw Manufacture

Dear Neil, I asked about this subject in the magazine about two years ago to see if anyone knew about screw manufacture, but it got no replies. The photo shows a wood screw from 1876, essentially the same as a modern one.

Since then I have found several articles online, these tell you how but there are no pictures of machinery to do it. Maybe if you share this in Scribe a Line someone could come up with information on the type of tools needed.

**Sid Rawlings, by email.**



## CAD and Rust

Another reader has expressed some difficulty with a recent transition from 32-bit processor architecture to 64. Mr. Graham Meek of Gloucestershire and others facing such troubles may find that they are well-served to run Windows 8.1 (or any other operating system they may care to name) in a Virtual Machine.

While this sounds difficult, I promise that it is not, terribly. A piece of software called 'VirtualBox' is available gratis and makes this relatively accessible. Many YouTube videos have been made demonstrating how to solve this problem.

Barring that approach, I have found that FreeCAD (which is not only gratis but Open Source) to be an excellent piece of software.

Mister Alan Moore of Leeds describes some approaches for rust and zinc plating removal, followed by steps to prevent further corrosion. To those advice I'd like to add my recommendation of a bath composed of both Citric Acid and Sodium Gluconate. The former is available in the US at any decent supermarket; I cannot imagine it is difficult to procure in the UK. The latter is available from bulk sellers in small quantities on eBay. Sodium Gluconate is used industrially as both a food additive and a steel surface protectant. I cannot speak to its flavour, but for steel, it works the biz.

**R. James Scheffler, Medford, Massachusetts, USA.**

## Atlas Lathe

Dear Neil, I have what I think is an Atlas 10" Model D or F Lathe. I inherited it from my father many years ago. He was an enthusiastic model engineer and used it to make a model traction engine in the early 1950's which won awards at the Model Engineer Exhibition. It hasn't really been used since he completed the model in 1952, maybe some light

use up until his death in 1982. It is in good condition (apart I guess from the motor, electrics and belts) having been kept in a warm dry environment. It has the instruction manual and many accessories such as a 4-jaw chuck, milling attachment and steady rest, plus wood turning accessories and tools.

I have hung on to it for many years (I guess in memory of my dad) I had intended to get it going and use it (I was allowed to in my childhood), but that never happened and I am now in my 70's so I need to find it a new home.

Your advice please; is it worth anything to anyone? Would it be appropriate to advertise it in your magazine? I'm not too worried about getting too much for it but would like it to go to a good home. Any ideas? Your suggestions on how I should proceed will be gratefully received.

I have attached photos of the lathe and the model engine it produced.

**Keith Newman, by email**

This is an elderly but capable machine that comes with many accessories such as a vertical slide. We have agreed a classified ad (see the Readers' Ads on page 66) and I hope Keith will receive a sensible offer for this machine. Neil.





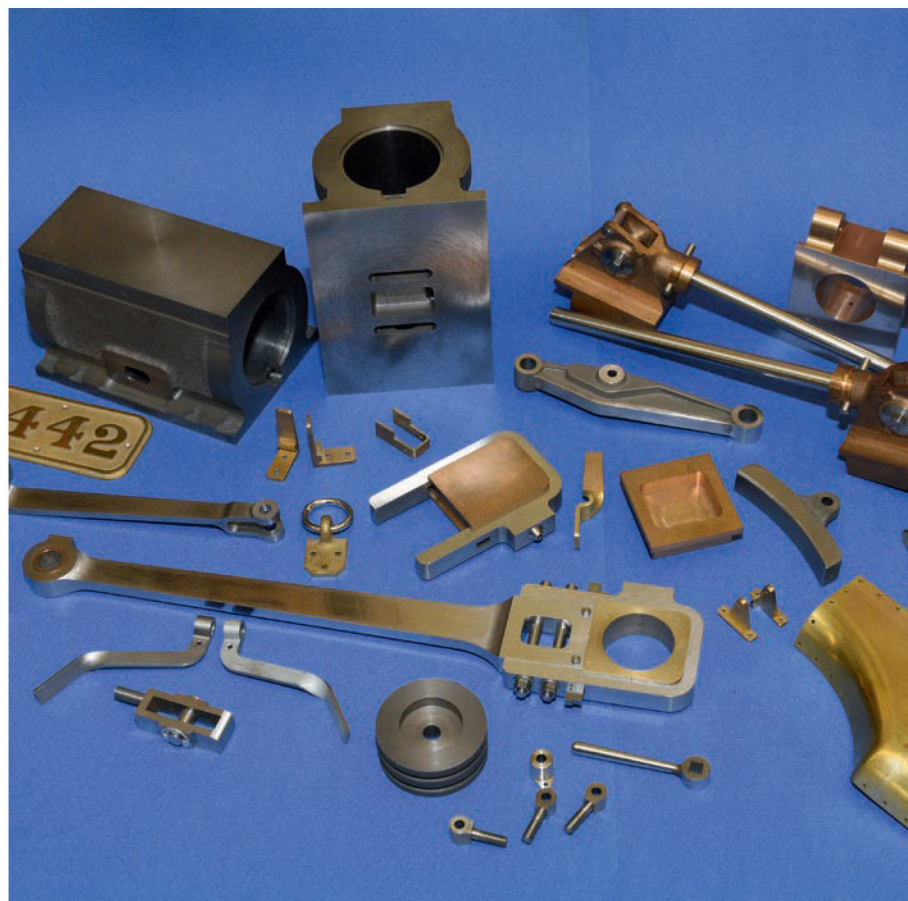
## Artful Dodge #3 —

# Always make a spare

Essential reading for beginners and valuable to old hands, this series by the late John Smith shares some of his wealth of skill and experience from over half a century in hobby engineering.



I usually make at least one spare



Parts from the spares box.

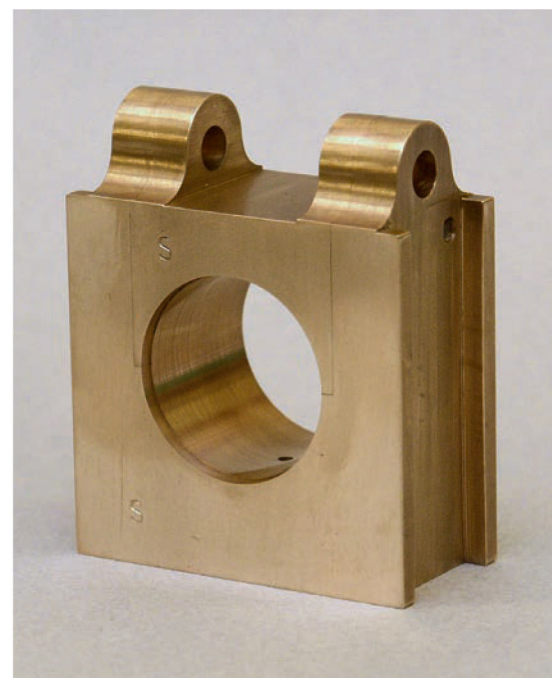
Even when we have a plan for how we are going to make a part for a model, we sometimes make a mistake, and the part is spoilt. Sometimes we don't make a mistake at all, but something happens over which we have little or no control. Examples of this would include:

- coming across air bubbles in a casting,
- a workpiece fracturing when it is bent in the fly press,
- a silver soldered joint which is sound but just looks horrid,
- a tap which breaks and cannot easily be removed

This is particularly frustrating when

we are right at the end of a long series of machining processes. **Photograph 1** shows an axle box which was spoilt on the very last pass of the boring tool because I made a mistake when adjusting the cross slide. I can't remember just how many separate set-ups are required when making an axle box, but it's a lot. And it's the set-ups which take the most time; the actual machining can often be undertaken quite quickly.

To avoid having to recreate all the set-ups needed to make a new part from scratch, I usually make at least one spare. **Photograph 2** shows the current contents of my spares box. I know; two



Locomotive axle box.

complete crosshead assemblies and two almost complete cylinders is a bit over the top – but I'm glad that they were there if needed.

The keen-eyed among you will spot that the axle box is stamped S for spare, so the pain of this mistake was bearable.

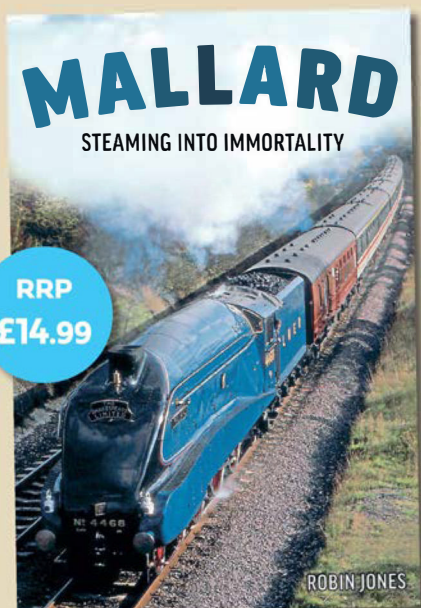
Always stamp parts, so that when you have to take your model apart for painting or repair, you know which part goes where when you reassemble the model. This is particularly important for parts like axle boxes which all look identical but which are made for a specific pair of horns; putting an axle box in the wrong place will stop the wheels going round when the coupling rod is fitted. ■



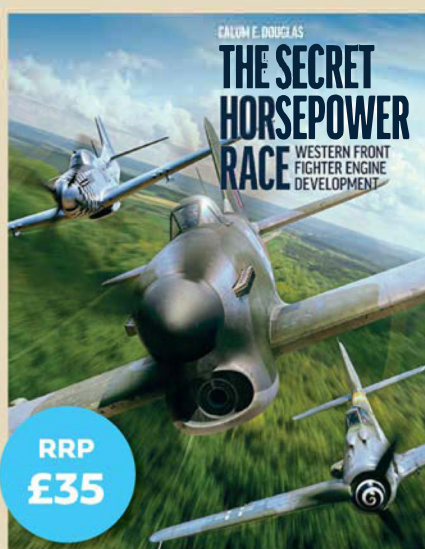
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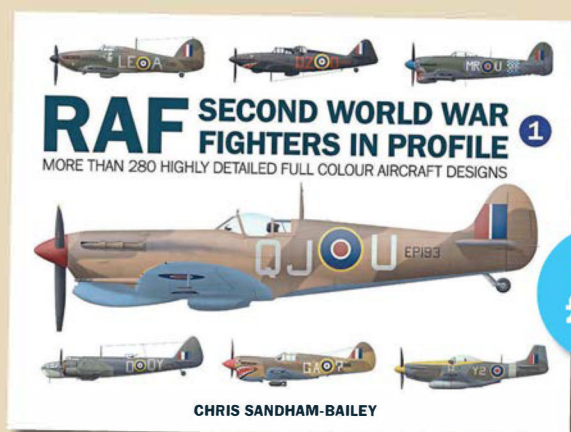
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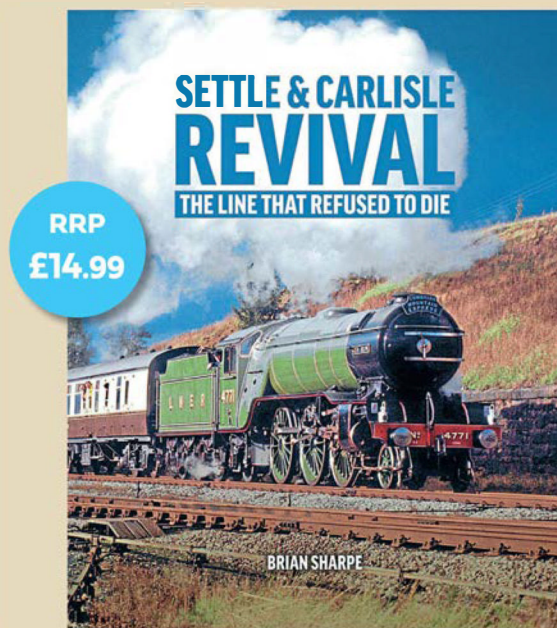


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# Extending the versatility of a 'Parrot Vice' – Part 2

R. Finch adds some extras to his 'universal' vice.

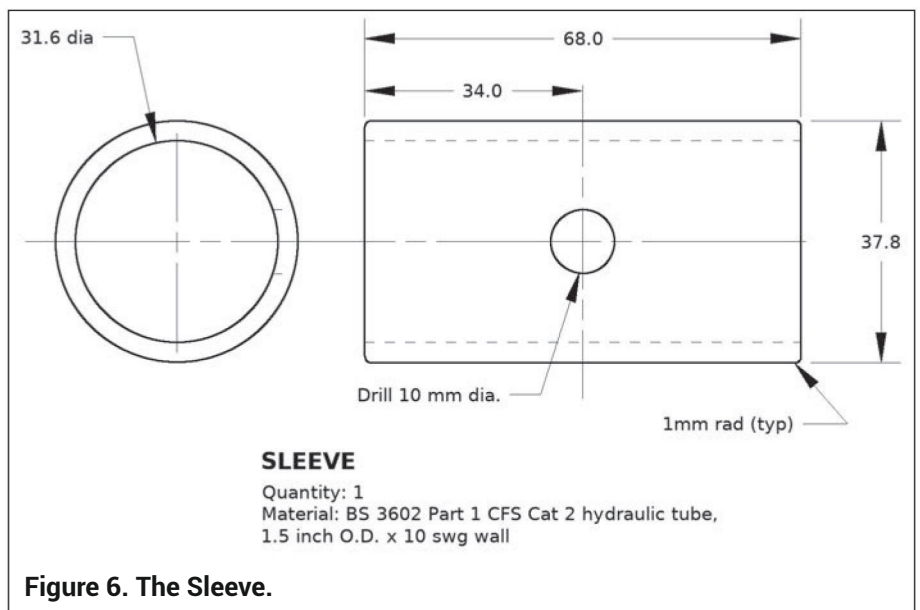
**T**he snug can be removed, have one end sawed off and the other end faced. Then it was down to hard work to saw the corners off the part of the main body which is to be turned down to 31.4mm, **photo 14**. This outside diameter dimension is made to fit the bore of the hydraulic tube used to make the sleeve, **fig 6**, so this diameter should be adjusted to suit the tubing.

The main body is then placed in the four-jaw and centred. I had already marked out a centre at the end to be turned down, so that it was easier to get the body running truly as the drilled centre can be fitted onto a live centre in the tailstock. The main part where the Sleeve fits is turned first, until the sleeve just fits on smoothly without shake. Then the short section where the retaining ring fits is turned down to 25mm and screw-cut M25 x 1.5. I finished the thread off with a conduit die. At this point, the retaining ring can be screwed on to the M25 x 1.5 thread and the outside diameter turned down until it is 37mm in diameter. This is not critical providing that it is small enough to be able to fit the vice over it. The retaining ring can then be removed. Now that the outer part of the nominal 31.4mm diameter has been turned, a fixed steady can be put on this section to allow the live centre to be removed and the stepped hole down the centre to be drilled. When the holes have been drilled, the body is secured in the drilling machine, or milling machine) vice to have the four 8mm diameter cross holes drilled and the 4mm hole for the key drilled. When drilling the 8mm holes, I used a vice stop to make sure that they were all at exactly the same distance from the end. This is important for the correct working of the clamp. This completes the main body.

The remaining parts can be made in any order. I made the sleeve next, **fig 6**.



*The corners sawn off.*



**Figure 6. The Sleeve.**

The sleeve is a cold finished seamless hydraulic tube to BS 3602 Part 1 CFS Cat 2 which has a fairly precise 1½" outside

diameter to fit hydraulic compression fittings and has a nominal wall thickness of 10 s.w.g or 0.128 inches. This tubing



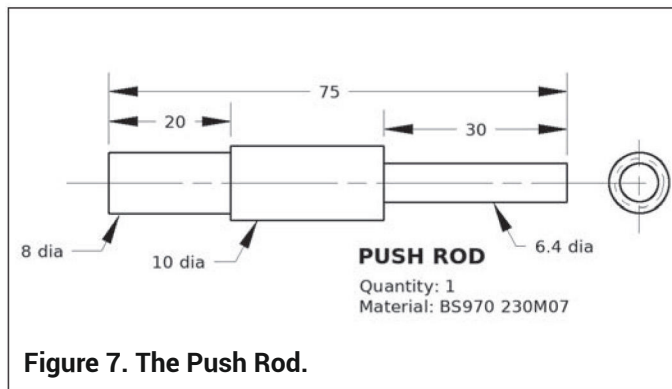


Figure 7. The Push Rod.

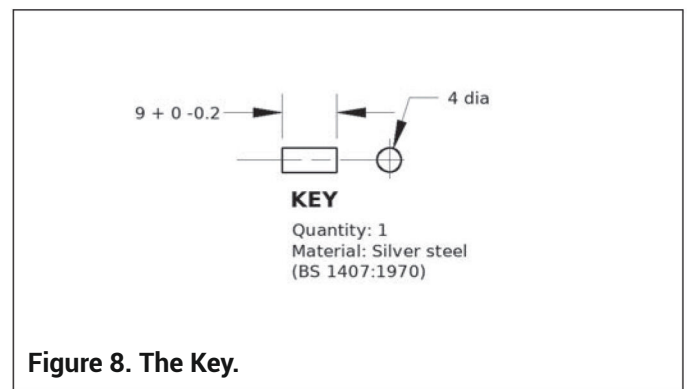


Figure 8. The Key.

may be difficult to source - I got mine from M-Machine) **ref 4**. I found that the outside diameter was just too large to fit into the Parrot vice, so I set up the whole length that I bought, 300mm) into the four-jaw to get it running concentrically and, using a fixed steady, faced off the end. Using the fixed steady about 80mm from the free end, I turned it down a little at a time until it just fitted easily into the main cross-hole in the body of the vice. It can then be cut off and the raw edge faced off. The central hole in the sleeve is drilled 10mm so that the M10 star knob can be screwed into the tapped hole in the vice body to lock the vice into the sleeve.

The push rod, **fig 7**, is a straightforward turning job which requires no further explanation other than to ensure that both ends are truly concentric. I turned the 6.4mm part first using 10mm stock held in a collet before turning round and holding the 6.4mm diameter part to turn the 8mm diameter part. Similarly, the key is just a short length of silver steel with the ends faced off, **fig 8**.

The last part to make is the cam lock, **fig 9**. I used some 20mm diameter steel and turned it to 18mm diameter, before drilling 6.7mm right through and then tapping M8 by 40mm deep. Then, starting at 17mm from the end, the groove is machined 1.5mm deep to give a diameter of 15mm and a flat-bottomed width of 5mm. The 45° chamfer is turned before parting off to 55mm long. This completes all the parts.

### Assembling the Additional Support Arm

The parts required for assembly are shown in **photo 15**, laid out in order, showing the Snug and locking handle in position in the 38mm bore. The locking

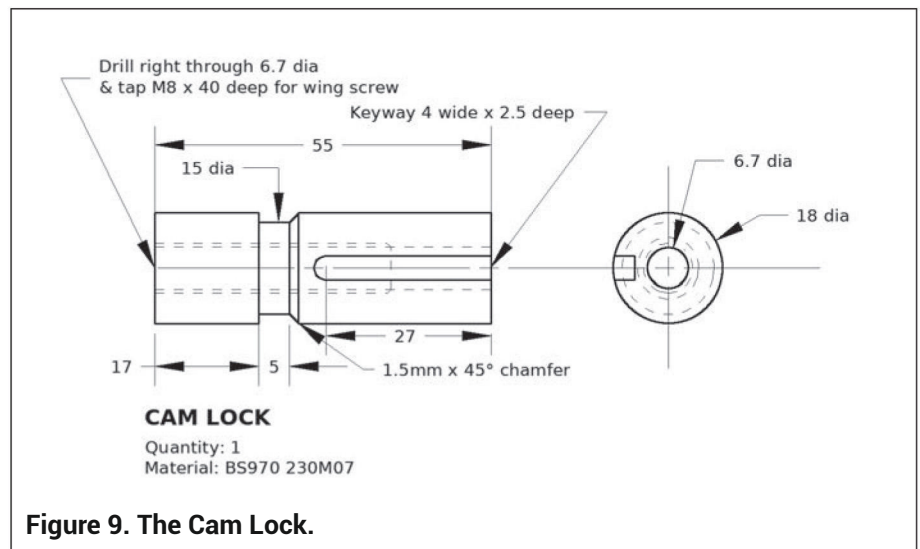


Figure 9. The Cam Lock.



The Additional Support Arm parts ready for assembly.

lever was from Axminster Tools as mentioned before and the wing screw came from WDS Components, ref 2). The wing screw is WDS Number 8200-229.

For assembling the other parts, the wing screw screwed into the end of the cam lock about three or four turns. The push rod is inserted so that it just protrudes



The push-rod entering the Main Body bore.



The Cam Lock in position ready for the steel balls and the key.



The ball bearings and the key in place.



Sliding the Sleeve on - note the slight saw-cut to indicate the centre line of the 10mm hole.

into the 38mm bore where the snug is fitted, **photo 16**. Now the wing screw is pushed or pulled until the groove in the cam lock is visible through the 8mm diameter holes and the keyway is visible through the 4mm hole, **photo 17**. The four 8mm ball bearings can be inserted, along with the key into the Main Body, **photo 18**. When all four balls and the key are inserted, the sleeve can be slid on. Note that I marked each end of the sleeve with a shallow saw-cut in line with the 10mm hole - it makes it much easier to align the vice star knob with the hole, **photo 19**. Finally, the wing screw is removed, the retaining ring is screwed on and tightened and the wing screw is replaced. The additional support arm can now be fitted to the offset arm, **photo 20**. The wing screw is used so that it does not have to be removed from the additional support arm when the vice is removed. This completes the main vice accessories.

### Using the vice

As built, the vice has several ways to use the locking screws. Firstly the offset arm is simply locked on to the bench spigot using the Bristol lever. I did drill and tap a hole in the end for using a star knob, but this is not essential. The offset arm can be fitted either facing to the left or to the right - depending on the job involved and the handedness of the user. When the additional support arm is added, it can be locked by turning the Bristol locking lever on the snug. This can be fitted either way too. Using the Bristol locking lever leaves the sleeve free to rotate. The wing screw can be





The Additional Support Arm mounted on the Offset Arm.



The vice can be positioned at any angle you like!



The hardwood jaw facings and screws.

tightened to lock the sleeve. If the vice is now added to the additional support arm, the M10 star knob on the vice base can be located through the 10mm hole in the sleeve and tightened on to the arm body diameter. The wing screw in the end of the additional support arm locks both the sleeve from rotating and the additional support arm from rotating. The Bristol locking lever can then be slackened off and the vice star knob also slackened off. This leaves the vice and the arm still locked by the wing screw. Slightly loosening the wing screw on the end of the additional support arm now unlocks both the arm and the vice, allowing them both to be adjusted to exactly the required location. Whilst this is not as secure as the Bristol locking lever or the star knob, it makes it easier to adjust the vice. Once in the correct position, the other two locks can be used to make the vice mounting as rigid as

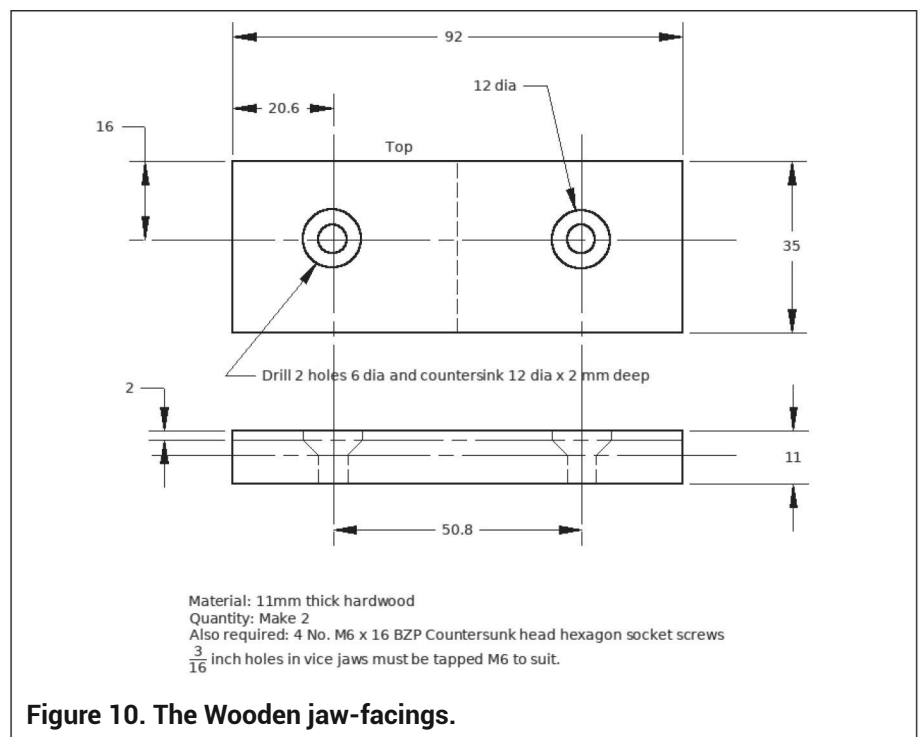


Figure 10. The Wooden jaw-facings.

possible. **Photo 21** shows how the vice can be set at pretty well any angle and orientation that you fancy!

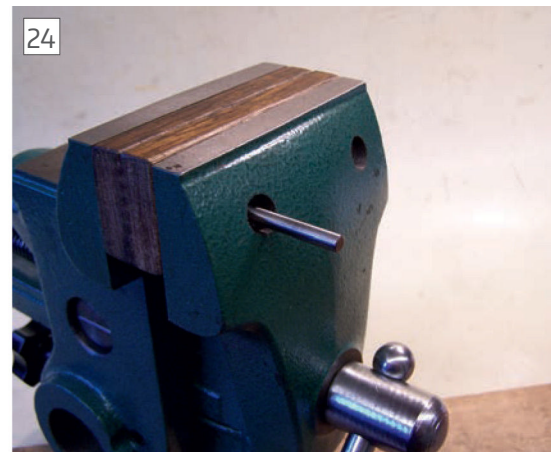
### Jaw Facings

I decided as soon as I bought the vice that jaw facings were essential, as the vice as supplied has plain cast-iron jaws. If using these to hold wood, the wood is likely to become bruised and if using them for holding metal, damage

to the jaws was inevitable. I decided that I would make a pair of hardwood jaw facings for woodworking and a pair of steel jaw facings for metalwork and welding. As the wooden jaw facings needed to be reasonably easy to swap, I decided to fasten them on with countersunk hexagon socket screws, **photo 22, fig 10**. If you are only going to use the vice for woodworking, then the wooden facings can be attached to



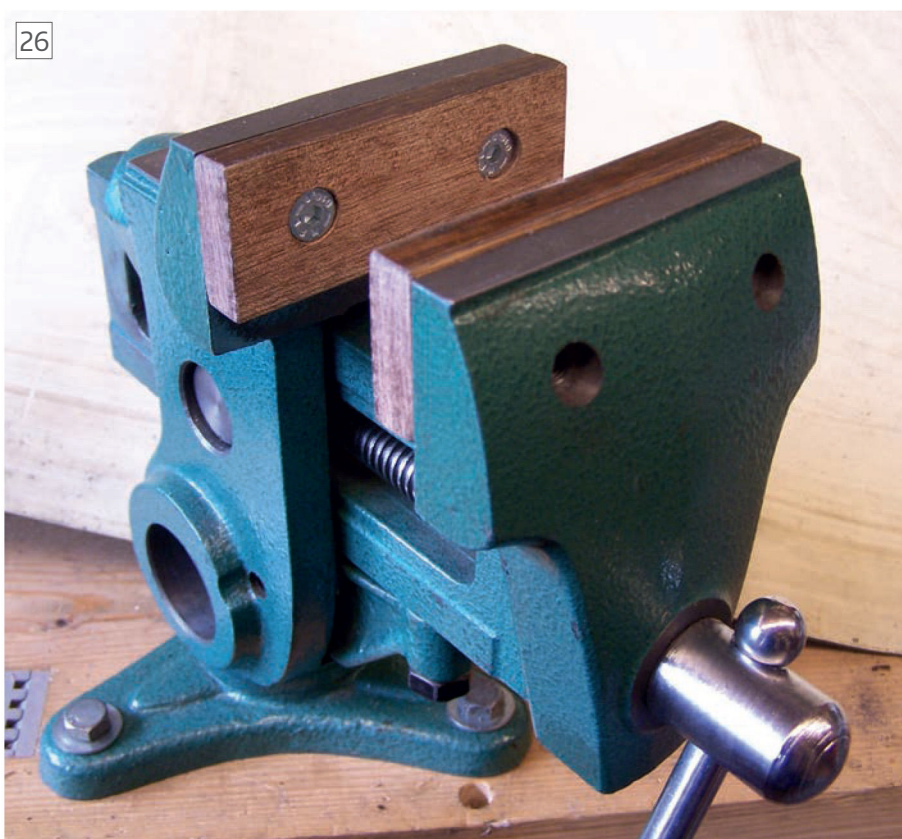
The transfer punch to mark the hole centres.



Marking the hole centres using the transfer punch.



The reminder to fit them the right way up!



The wooden jaw facings in place.

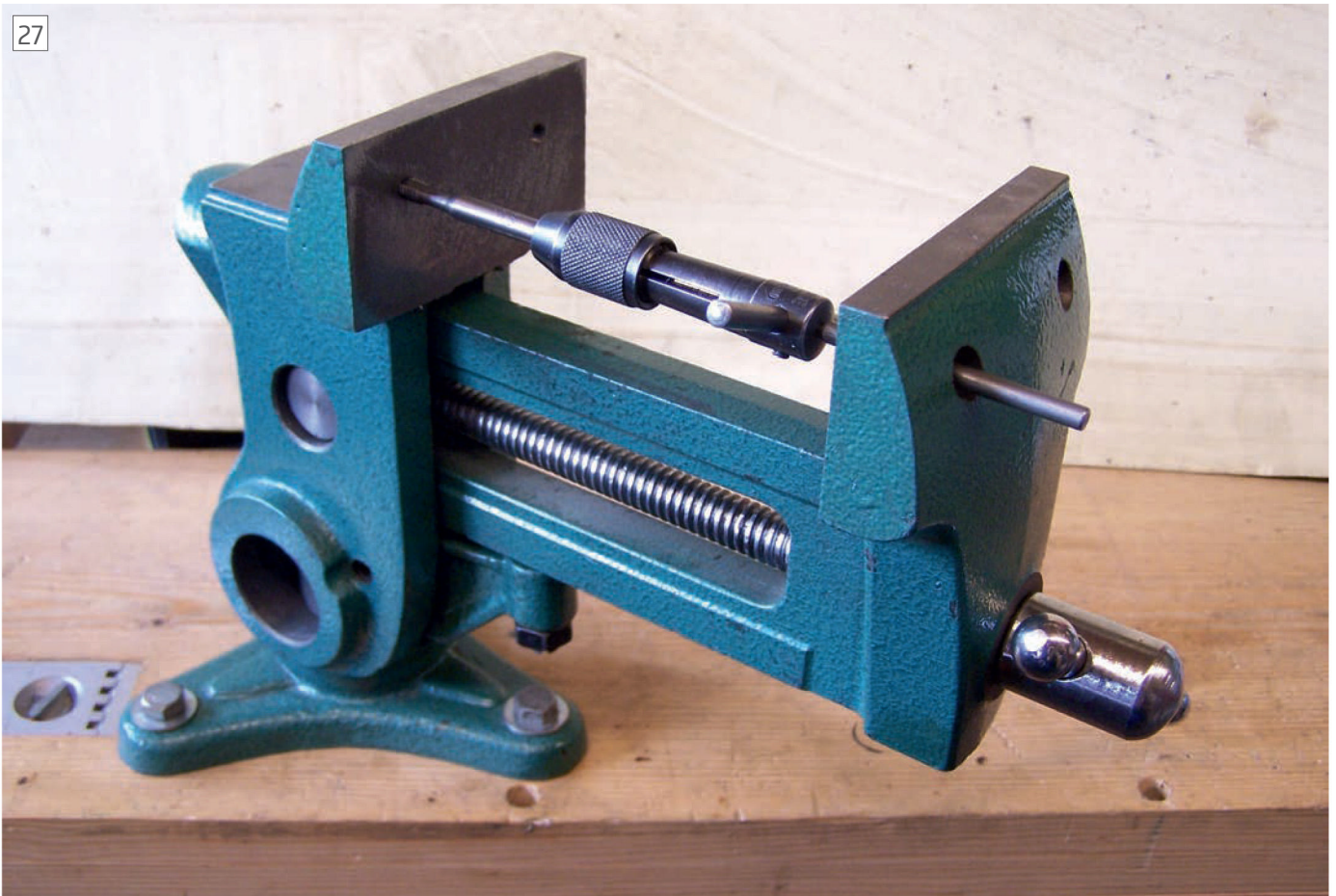
the jaws using wood-screws in from the back of the jaw, but if the jaw facings are to be changed often, then I would recommend the use of the countersunk screws into the facing of the jaws.

The vice jaws themselves have 5mm holes already drilled, actually  $\frac{3}{16}$ "', so I decided to use these to locate the centres of the holes in the jaw facings using a small custom-made transfer punch. This punch is a simply a 65mm length of  $\frac{3}{16}$ " diameter silver steel, turned to a 60-degree point, hardened and tempered, **photo 23**. The jaw facings are pieces of hardwood 100mm x 35mm x 11mm thick. I used pieces of mahogany recovered from a small bookcase that I had salvaged when it had to go. A pair of the jaw facings were gripped in the vice in the correct location and then the punch used through the holes in the jaws to mark the jaw facings, **photo 24**. The jaw facings were then drilled 6mm and countersunk on the face to accept the M6 x 16mm countersunk hexagon socket screws. I marked the hidden face of each jaw so that they would be replaced in exactly the same position in which they were drilled - the factory-made holes were not quite on the same centres or depth from the top of each jaw, **photos 25 & 26**. As the outer faces of the jaws were tapered, I decided to tap the jaws from the inside using the custom-made transfer punch to align the tap wrench with the holes to make sure that the tap was properly aligned, rather than guess by lining it up by eye with a tapered surface, **photo 27**.

I also made a pair of steel jaw facings, but the one attached to the fixed jaw was longer at one side so that an earth

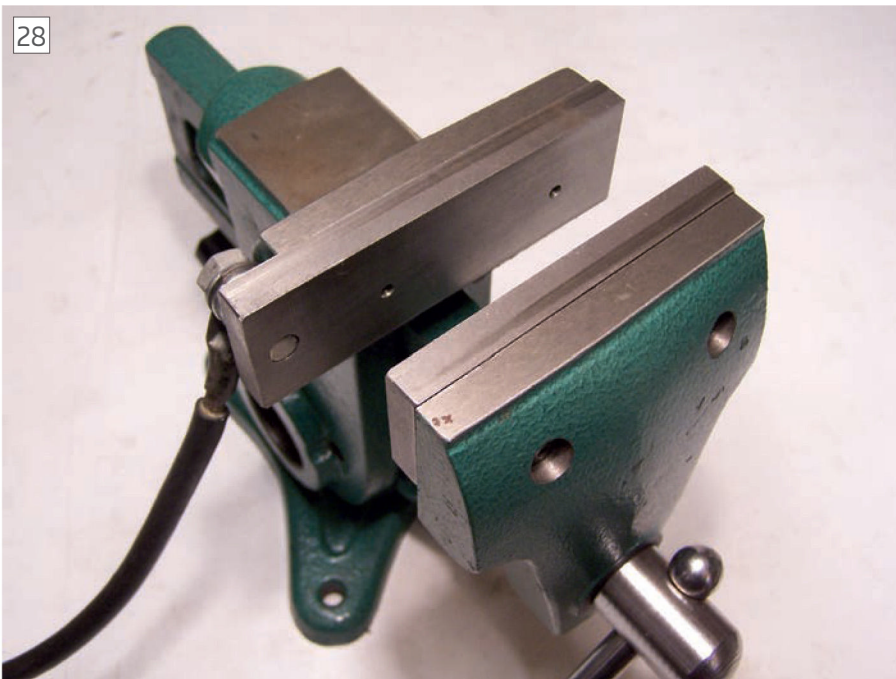


27



Tapping the jaws M6 using the transfer punch to guide the tap wrench.

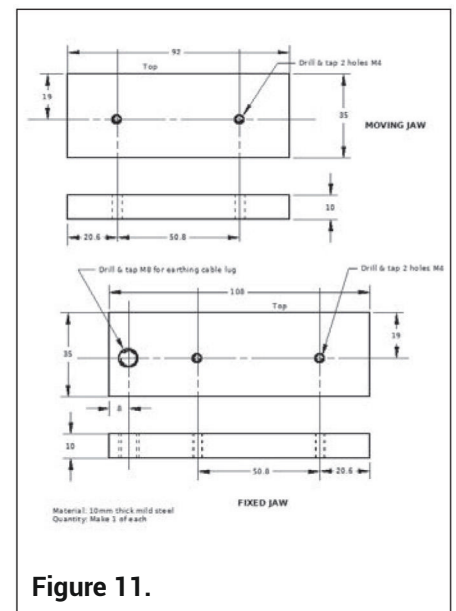
28



The earth return on the main body for welding.

return to the MIG welding set could be attached using an M8 tapped hole, **photo 28, fig 11**. I did not want the welding current to pass through the vice screw and nut nor the mounting

spigot as there was a possibility that some parts may well become welded together accidentally. The steel jaw facings were made from 10mm x 35mm bright mild steel bar, but this time,



I used M4 countersunk screws put through the M6 tapped holes in the vice jaws and screwed into the steel jaw facings from the outside of the vice jaws. I did this to make sure that any weld spatter didn't accidentally weld the screws to the jaw facings.

● To be continued



# Safely Turning Long Objects in A Lathe



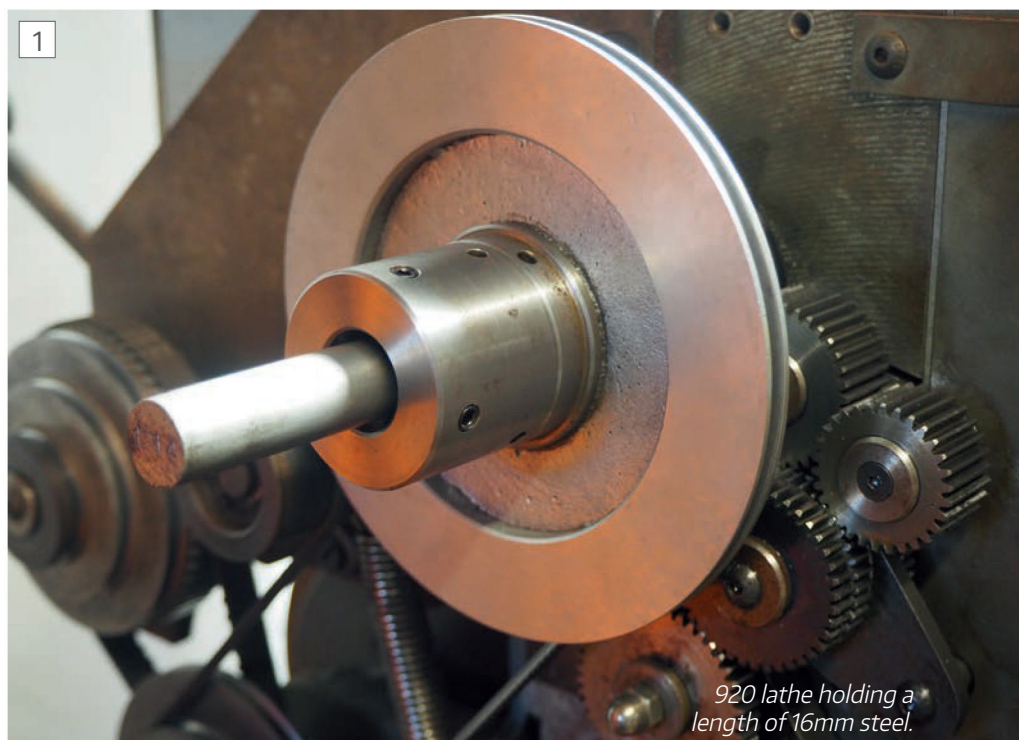
**Brett Meacle shows how to secure long workpieces and avoid accidents including how to make a spindle steady to help.**

In lathe work there are many and varied ways of doing a job. Technology moves on but sometimes methods from the past still satisfy the requirements. One job that comes up occasionally is a need to work on a long workpiece that although it can fit through the spindle bore needs support at both ends of the headstock. This is for a couple of reasons. One to stop it flailing about for safety, which is a most important consideration. Even with support do not allow it to stick out very far and be mindful of the chuck speed. Secondly, to support it concentrically to ensure greater machining accuracy of the workpiece at the chuck end.

A rear spindle steady or spider as they were called, fits the bill for such a job, **photo 1**. Basically, it's a 3 or 4 screw contraption just like old school bell chucks and cat heads, used to hold the work concentric and steady.

While I was thinking about making a spindle steady to support long work on the outboard side of the headstock, it was a good time to think about options for extending work up the bed end as well.

A cat head, **photo 2** is another useful accessory for holding work that needs support in a fixed steady rest. Jobs include long items, forgings, hexagons, squares or any non-circular work too large to fit inside the spindle bore and requiring machining operations to be done, even if only to accurately face and centre drill for use of a normal live or dead centre for further operations. The shape of the work will not allow the fixed steady fingers to support it or even rotate. The cat head is fitted to the tailstock end of the work, and this provides support and a true round surface for the steady rest fingers to run on, **photo 3**. For accuracy the cat head needs setting using a dial indicator for the work to run true. The number of

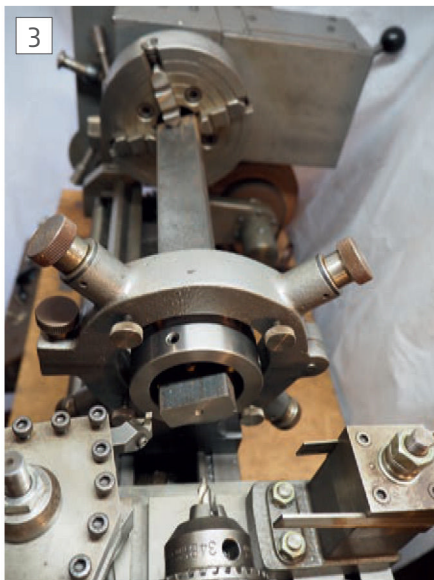


920 lathe holding a length of 16mm steel.



Cat heads & brass headed screws.





Large cat head holding flat bar.



Cat head using tailstock centre support.



Internal cat head supporting a large tube.

adjusting screws depends on the job, Square, non-circular objects need four screws. Hexagons are best indicated true with three screws, but four screws can be used in a pinch. You can make one with both sets of holes drilled around a common hole or two separate cat heads depending on your preferences.

**Photograph 4** shows another style of cat head for holding long workpieces supported by a normal tailstock centre.

Another useful addition, particularly if you are working with larger size tubes that won't fit into a fixed steady for support is an internal cat head/ spider. I modified a cheap rotating live centre by adding an extension to the nose piece to create this internal cat head. Different length adjustment screws can be used to suit various size tubes.

Once the tube is set to run true, the usual facing and outside diameter turning operations can be accomplished but also the inside diameter can be machined for a short distance, **photo 5**.

Making any of these accessories is a good learning experience for beginners as no great accuracy is required, some simple turning and boring. A few adjustment screws to centre the work and in the case of a cat head a nice smooth surface for the steady rest fingers to run on.

### Design stage

The initial modification made to a couple of 920 style lathes, was to incorporate the rear steady into the bearing adjustment locknuts, **photo**

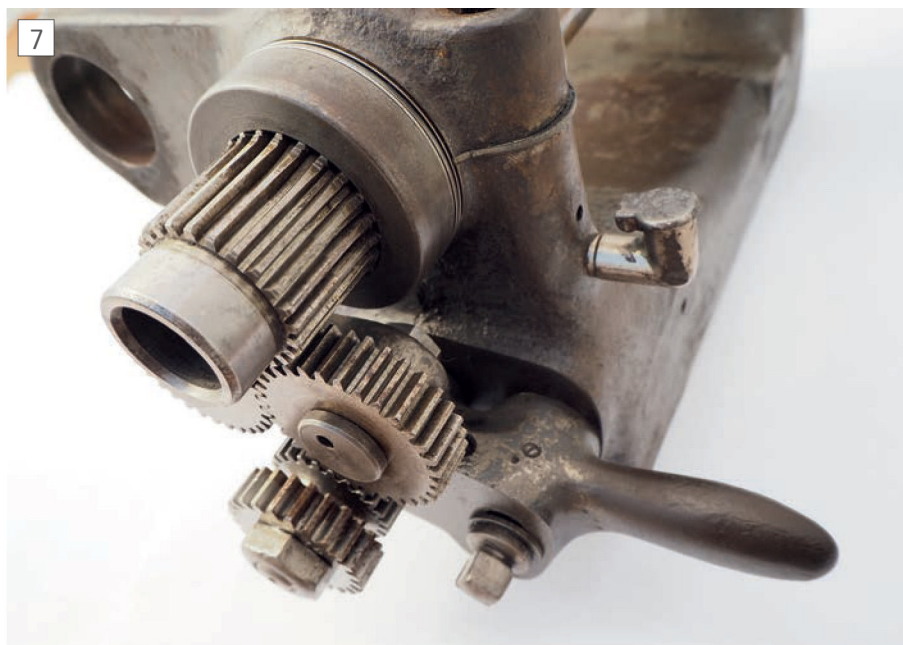


Completed threaded unit with dummy spindle.

**6.** Screw cutting the extension piece to thread onto the end of the spindle with it becoming a locknut for the bearing adjustment instead of the usual grub screw acting on the thread's arrangement. I suspect the newer generation of mini lathes and possibly other lathe styles, a rear steady can be attached in the same way by replacing one of the locknuts. As Mike Cox highlighted in his article in Model Engineers Workshop 304, a spindle extension is a good modification to lengthen the spindle to stop swarf

dropping into the change gear area. Incorporating the adjustment screws to use it as rear spindle steady is a bonus, and it may also make life easier for the mounting of a mandrel handle to assist with slow speed screw cutting. This design of spindle steady is always fitted in place on the lathe, as it was an easy operation to modify the sheet metal headstock door to allow it to close.

I subsequently bought a vintage South Bend 9" lathe and during overhauling and upgrading, I decided a rear steady would be a good accessory



South Bend 9" Spindle.

for this lathe as well. The South Bend lathe arrangement did not allow a threaded fitting as it only had a short plain spigot on the end of the spindle, **photo 7**.

Myford Super 7 lathes have both a screwed section and a plain portion, allowing some choice, but because the change gear covers on both these lathes are cast items and don't lend themselves to being modified easily. A quickly replaceable version was decided on, only being fitted when required.

I did not want to use the spindle bore as a fitting method as used with some other accessories. This would further reduce the diameter of work able to pass thorough the spindle which on a Myford is only about 16mm to begin with.

While I was thinking about options on how to attach something to a plain turned hollow shaft securely, another project I was working on, gave an idea that I reasoned could be transferred to this job.

That project was a parts backstop that clamped into the rear of the spindle. The design was from Graham Meek's excellent book, "Projects for your Workshop" from Tee Publishing. To reduce damage to the adjustable stop rod by the usual clamping screws, the clamping arrangement used a split section that closed tightly to grip the rod using the forces exerted by an external collar and set screw, **photo 8**. The beauty of this design was when making stop rods, there is no machining



Lathe Backstop.

long flats or grooves along the length of the rod and no damage to the rod from repeated adjustments. I started to think, why not increase the size to grip the outside of the spindle, allowing a firm grip, no damage to the spindle surface and fast fitting/removal.

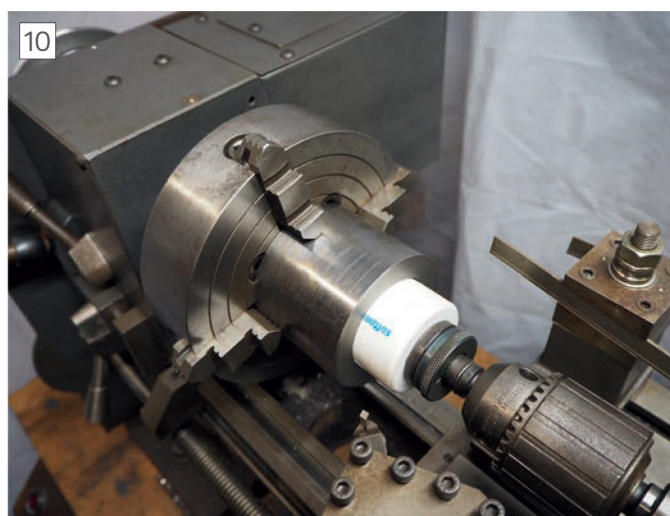
To assist with making any accessories for your lathe spindle, I recommend making a replica of the spindle nose thread. This assists greatly with the final sizing of any new chuck backplates, collet chucks or other spindle accessories you are making, even tweaking purchased threaded components that don't quite fit.

A dummy spindle copied from your lathe with the threads screwcut to size using the three wire measurement method, will then ensure your accessories will fit like a glove.

A copy of the rear spindle section is useful in the case of fitting a threaded extension but even with a plain portion end, still acts as a plug gauge assisting with the final sizing of the bore of the rear steady. As with any gauge reduce the diameter a small amount, say 0.15mm, for a short section at the end.



Dummy Spindles and Master chuck.



Holesawing solid bar to make thick wall tube.



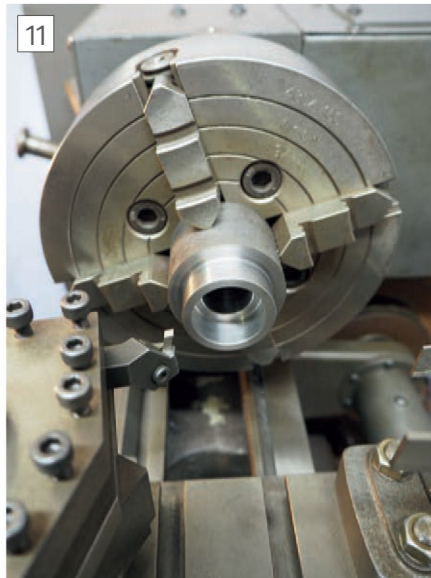
This lets you know when you are almost on size.

**Photograph 9** shows a dummy spindle nose thread, the master chuck and the rear spindle copies, both threaded and plain section, made for use in machining the rear steadies in this article. They are designed to mount in the master chuck, but holding in an ER collet chuck would also work. Repeatability with these in the master chuck is excellent as they refit in the same position every time. Because of this they were also used for the final finishing of the outside dimensions and chamfers.

## Machining

The actual machining is straightforward, you are only aiming for nice smooth fits and concentric holes.

The machining operations for all these accessories is similar as all are basically just thick-walled tube with some spaced adjuster screws. Random hollow bar which is a thick-walled tubing is available in various wall thicknesses. This reduces the need to create a bore but if necessary, you could also work from solid stock. If making from solid, using a holesaw from each end allows the centre to be removed, leaving the tube plus a usable slug of material to save on wastage. **Photograph 10** shows cutting out the centre of a piece of 76mm diameter bar to make a large cat head, the bore then only required cleaning up to final size. If you are making a cat head, once you have some suitable thick walled tube finished to length, it's just a matter of drilling and tapping some holes for



*Machining spindle Steady body.*

adjuster screws and machining a smooth track for the fixed steady rest fingers.

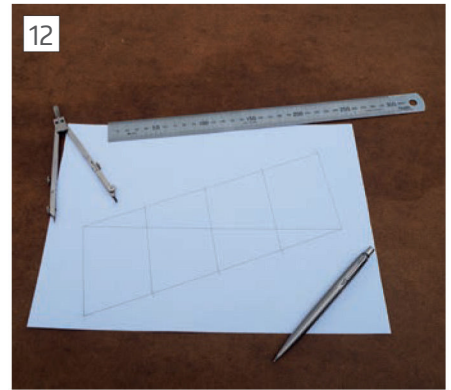
Making a threaded spindle steady is a matter of setting the material up in a chuck, boring the recess to suit the thread, creating a runout groove to assist with the screwcutting, and whilst the boring bar is set up machine the through hole to match the spindle bore.

Set up the lathe and screwcut the thread to fit the dummy spindle. Face the end and chamfer any sharp edges.

Drill any required holes and tap the adjustment screw holes. Finally mount on the dummy spindle to finish the outside diameters and chamfers.

## Slip on Version

**Figure 1** shows the slip on version has two components, the main body and a clamp ring plus the screws.



*Old school geometric construction.*

A socket set screw in the clamp ring applies pressure to the collet fingers of the main body, with close machining the actual movement to lock the steady onto the spindle is minimal.

Make the clamp ring first and use it to size the steady body for a close fit. The clamping ring is simple turning, facing and boring to a fine finish, chamfer the bore to ensure it will seat correctly on the steady body, clearing any radius left from the toolbit.

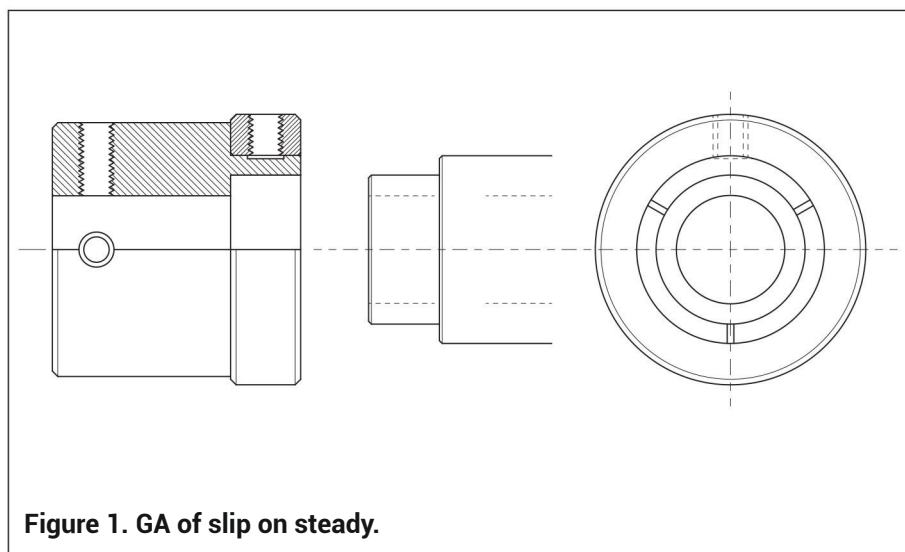
The steady body can be set up in a 3 or 4 jaw chuck. Machine the recess and collet finger section a close smooth fit to the spindle and clamp ring, **photo 11**. At the same setting, bore the hole through the full length to be the same diameter as the spindle bore.

Transfer to the mill for further operations.

The setting out of the slitting saw cuts and tapped holes around the steady body or the cat heads depends on your available equipment. You could use a dividing head or rotary table set vertically, you could scribe lines with a horizontal vee tool bit while still in the lathe chuck, using the chuck jaws as indexing stops. Another option is to place in a vee block and scribe lines using a height gauge in conjunction with an engineer's square or vernier protractor

Even if you are equipmentally challenged, because these jobs do not require extreme accuracy, a satisfactory job can be achieved with simple methods. You could calculate the circumference of the job, divide a strip of paper into the required divisions using old school Geometric Construction, **photo 12**.

Attach the paper strip to the workpiece and use the marks to align the holes/ saw cuts using a pointer or as



**Figure 1. GA of slip on steady.**

# WHAT IS AVAXHOME?



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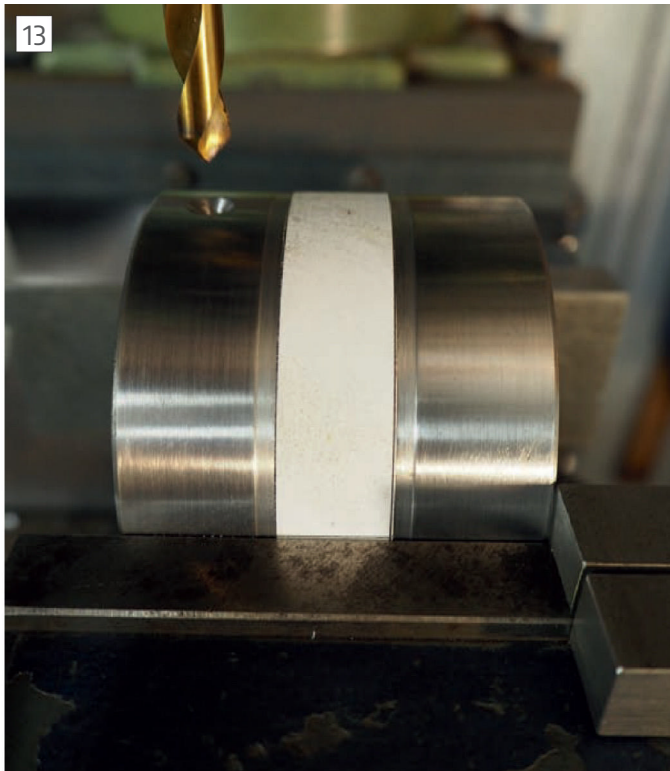
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Large cat head with paper dividing aligned to the vice jaw.



Vice Stop used to help set out screw holes.



Temporary GHT dial graduations.



Slitting saw operations.

I did, some convenient point, lining the marks up with the top of the vice jaw in **photo 13** or **photo 14** aligning with the mill vice jaw stop. The vice jaw stop serves two purposes, one to keep the work under the spindle in the same spot as it is rotated around the division marks and in this case to act as a convenient datum to line up the division marks. The marks don't have to line up with the actual slot or hole, they are just a convenient dividing reference.

When I first upgraded my lathe and lacking facilities to divide and graduate the larger GHT locking dials, I produced a paper strip graduation set by using a

CAD Program and printer. Attached to the dial with clear tape, the result while not as long lasting a proper graduated and numbered dial, works surprisingly well and keeps you in production until you have the tooling and skills to do a more permanent job, **photo 15**. It's also not a bad idea for a trial run to see if you like your setup before setting it in stone so to speak.

I chose to slit the collet section into 3 segments to ensure a good clamping action on the plain spindle section. A small slitting saw cutting from the inside outwards will require less burr removal in the bore and only a quick dress with

a needle file on the outside diameter, **photo 16**.

A flat is also machined for the clamp screw to bear on, allowing the clamp rings removal without a raised burr causing problems, **photo 17**. The socket set screw is modified with a flat end to transfer the clamping pressure and reduce damage.

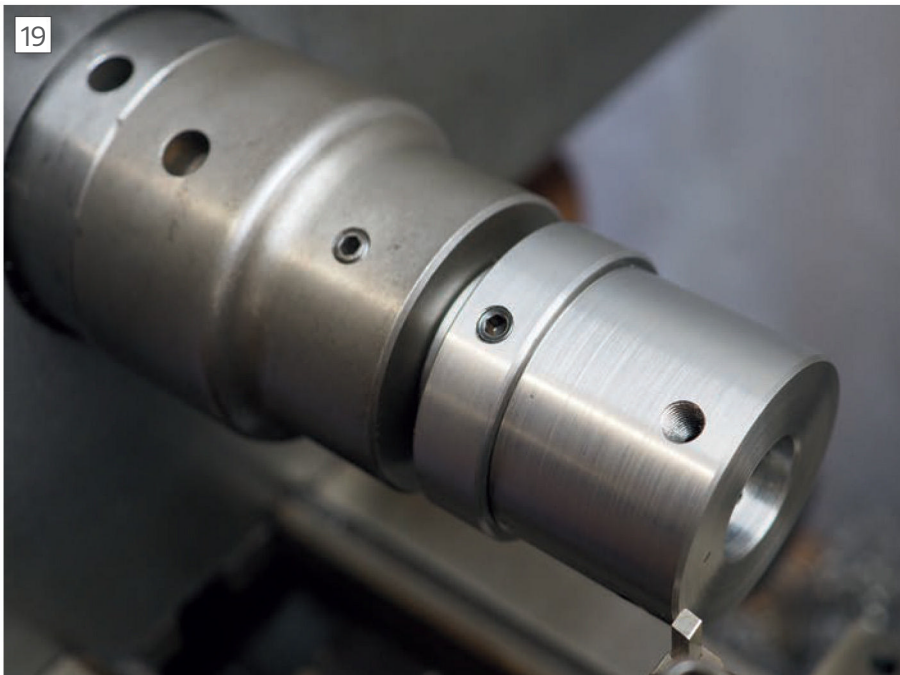
The holes drilled with a suitable sized tapping drill to suit your thread choice.

You can tap the holes by hand with acceptable results but as I had previously made a sliding tap holder for the lathe, this was set up in the mill to do the job, **photo 18**.





Flat to reduce damage from grub screw.



Finishing outside diameters and chamfers.

Once you have the components finished, you can clamp them onto the dummy spindle to finish the outside diameters and chamfers, **photo 19**. This step can be skipped with careful setting up of each component during the various stages of machining them, particularly if you only make a simple plug gauge to size the bores.

The only other thing to do is to make the adjuster screws. Some designs of steadies / spiders, and cats heads show long bolts or screws and locknuts but I prefer to use socket set

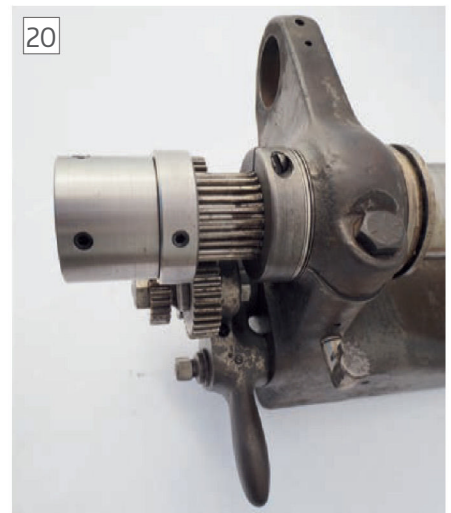
screws preferably without any length protruding on the outside diameter. You could just face the end of the grub screw flat but I like to modify the socket set screw by inserting a brass tip into the end, to reduce damaging the workpiece.

**Photograph 20** shows the finished item installed on a South Bend 9" lathe and a final **photo 21** fitted to a Myford Super 7.

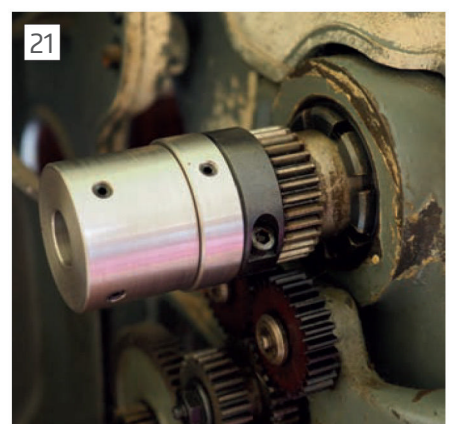
These items are not used every day but are some of those handy to have accessories that may save the day when needed. Alternatively they are a quick



Sliding tap holder for accurate tapping.



South Bend Lathe.



Myford Lathe.

job to make when needed to save the day. Once completed you will have some useful accessories for your lathe and will have gained more experience and confidence to tackle more demanding tasks on your learning journey. ■

# Readers' Tips



## Extend Battery Life

TIP OF  
THE MONTH  
WINNER!



**This month's winner is Norman Billingham from Sussex, with a simple tip that will help extend the battery life of angle gauges (and perhaps one or two other devices).**

A handy gadget to have around the workshop is one of the little digital inclinometers - not all that accurate but good enough for many machine setups. However, I find that it's very easy to press the on/off button by accident when returning the gauge to the soft storage pouch, leaving the device turned on to run down the battery.

I get round this by using a drop of superglue to attach a washer to the front panel – the battery lasts a lot longer.

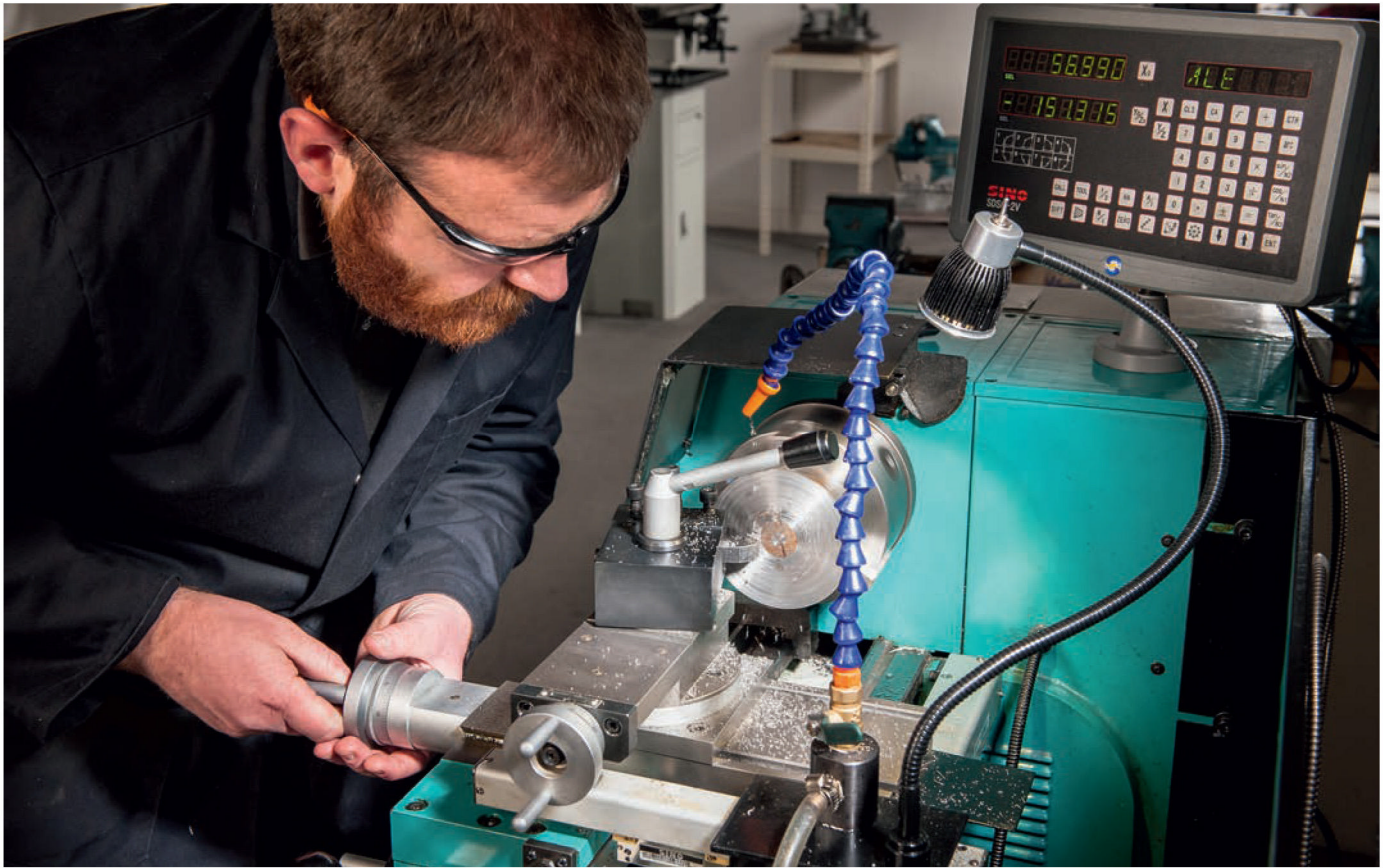
**We have £30 in gift vouchers courtesy of engineering suppliers Chester Machine Tools for each month's 'Top Tip'.**

Email your workshop tips to [neil.wyatt@mytimemedia.com](mailto:neil.wyatt@mytimemedia.com) marking them 'Readers Tips', and you could be a winner. Try to keep your tip to no more than 600 words and a picture or drawing. Don't forget to include your address! Every month I'll choose a selection for publication and the one chosen as Tip of the Month will win **£30 in gift vouchers from Chester Machine Tools**. Visit [www.chesterhobbystore.com](http://www.chesterhobbystore.com) to plan how to spend yours!

Please note that the first prize of Chester Vouchers is only available to UK readers. You can make multiple entries, but we reserve the right not to award repeat prizes to the same person in order to encourage new entrants. All prizes are at the discretion of the Editor.



# Digital read outs



*An Axminster lathe fitted with dual axis digital readouts*

**D**igital position readouts for machine tools have become increasingly affordable in recent years. Once fitted to a machine, be it a lathe, mill or bench drill, you can stop worrying about backlash and start achieving greater accuracy in all your machining work.

Most DRO systems use a read head that slides along some form of scale. It isn't particularly important whether the head or the scale is the moving element, as long as it is well protected from swarf, cutting fluid and away from the risks of being mechanically damaged. It is also important the scale and head are fixed securely and well aligned. Specialist suppliers can usually offer detailed advice on the fitting of their systems to more popular machines.

The simplest and cheapest option is simple capacitive scales. These are similar to ordinary digital calipers and some people have adapted cheap calipers to make basic DROs for relatively short movements, but for

longer scales dedicated readouts are cheaper and easier to fit.

While these work well in easy to see locations, such as a depth gauge for a drill press or a lathe tailstock the small displays can be very difficult to see in many situations. It is possible to fit a remote readout and one very popular self-build system based around an Android tablet can be found at the website [yuriystoys.com](http://yuriystoys.com). Another downside of capacitive scales is their

vulnerability to dirt which can cause unstable or inaccurate readings, although a quick wipe-down with a solvent like propanol usually cures the problem.

More advanced and accurate DRO systems are based around other types of sensors such as etched glass or magnetic sensors, such as those supplied by Machine-DRO. These units use a remote display unit and these often incorporate a range of useful 'extra' features, for example guiding you to the right places to drill a ring of holes such as for a cylinder cover. Such features can even reach the level of 'manual cnc' where the readout can lead you through a complex machining operation, such as the generation of a compound curve, step by step. However, the fundamental gain from any DRO system is the ability to make accurate movements without having to take into account backlash in the leadscrews or read graduated handwheels and (a real bonus) to convert easily between metric and imperial measurements regardless of the system of the machine.



*A high-quality three axis DRO kit from Machine-DRO*



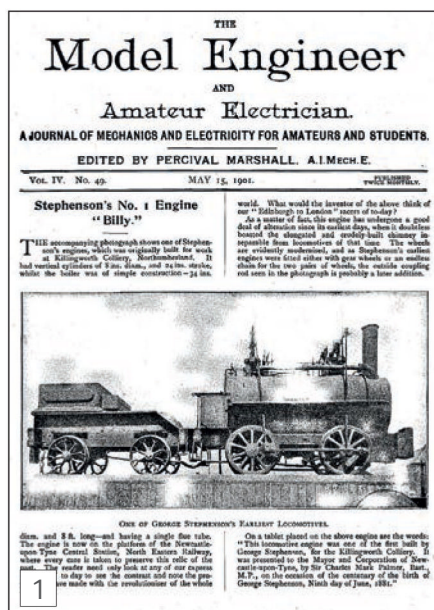


## 125 Years of Model Engineering

The 125<sup>th</sup> Anniversary of both SMEE and Model Engineer takes place in 2023. Model making in the sense we know it today has its roots in the Industrial Revolution. Like model boat building that played an important part in the design and specification of ships for the Admiralty, early model engineering had a significant role in the evolution and dissemination of knowledge of the new technologies then being introduced. The development of model engineering as a hobby coincided with the changes in society that occurred during the latter part of the nineteenth century.

## A new Magazine and a new Society

The Model Engineer and Amateur Electrician was first published in January 1898. Edited by Percival Marshall, this magazine rapidly gained an enthusiastic readership and soon led to a meeting of amateur engineers. This meeting was held on October 4th, 1898 and resulted in the formation of the Society of Model Engineers which was subsequently renamed in 1910 to The Society of Model and Experimental Engineers (SMEE) to better describe the activities of the emerging Society.

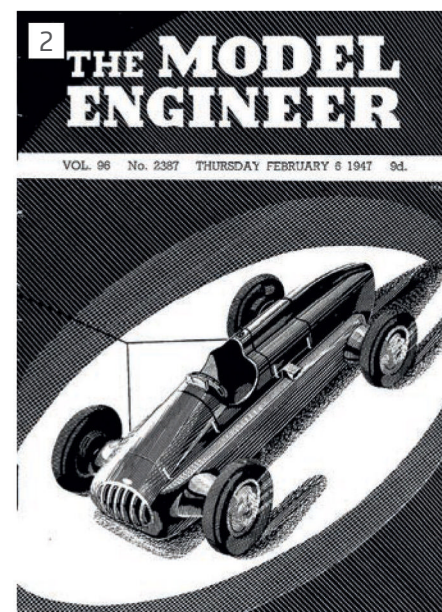


*The Model Engineer and Amateur Electrician from 1901.*

## Model Engineer Magazine

Over the following 125 years the magazine Model Engineer has supported the model engineering hobby. It has always had a strong interest in steam-powered models and especially live steam railways, but over the years areas such as internal combustion engines, military models, carts, carriages and farm equipment, electricity and electronics, model boats, astronomy, the history of engineering,

full-size engineering and, of course, workshop tools and techniques have been covered to various degrees. Today it has a very broad focus on all aspects of model engineering, it also covers areas such as clockmaking, internal combustion engines, Stirling engines and all sorts of other engineering models. ME also covers other topics such as toolmaking and has features of wider interest to hobbyists such as museum visits and the workings of steam and internal combustion engines.



*The Model Engineer in 1947.*

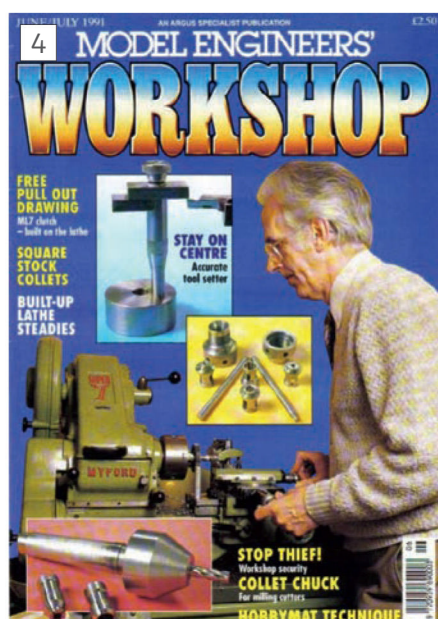




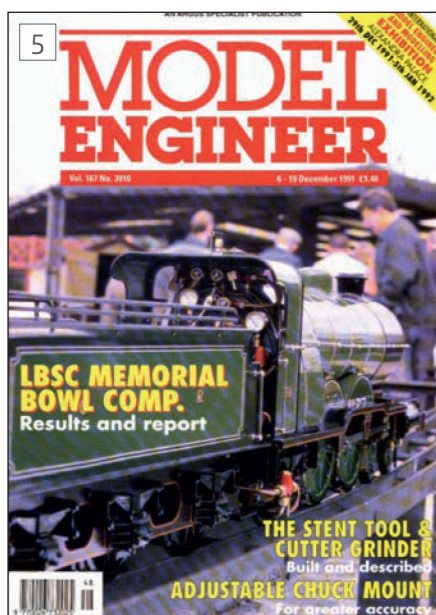
ME in 1974.

## Model Engineers' Workshop

In 1990 Model Engineer spawned an offshoot title – Model Engineers' Workshop, the magazine you hold in your hands which is now over thirty years old itself. These days MEW focuses on tools and techniques, while ME concentrates on modelling although there is always a degree of crossover. MEW may be a lot younger, but its heritage and roots go back to 1898 as well. Catering for all aspects of hobby engineering from modelling to car and bike restoration the magazine covers traditional workshop machines such as lathes, grinders and milling machines but in recent years has widened its coverage to include CNC, CAD and 3D printing.



Model Engineers' Workshop in 1991.



ME in 1991.

## The Society of Model and Experimental Engineers

The SMEE has also flourished, the society survived two World Wars and has witnessed the introduction of technology that was barely a dream in 1898 including the motor car, aeroplane, wireless, television and computer. At the same time, the tools and equipment available to model engineers have improved beyond recognition. Treadle driven lathes are a thing of the past and complete CNC machining centres are beginning to appear in the amateur's workshop. For more than 100 years members of the Society have continued to make models and apply new technologies to their work.

The Society has also changed during the last century. We own our own home: Marshall House, a large four-storey property in South London accommodating a range of facilities for all our members to enjoy. In common with many other organisations and to protect members' interests, some years ago the Society adopted the status of 'Company Limited by Guarantee'. The Society's affairs are managed by a Council of elected members headed by a chairperson.

The Society aims to continue to meet the needs of all model engineers whether their interests are making models of machinery including locomotives, traction engines and stationary engines or whose interest is making clocks and tools.

The experimental side of model engineering has always been a significant part of the Society and is growing. For many years this has included electronics, for example the paper by W. B. Hall in 1993. This area now includes the application of digital readouts, CAD, CNC control of mills, routers or lathes, 3D printing, spark erosion, robotics, and the use of external services such as arranging laser cut locomotive frames. These shared interests are specifically catered for by the Digital Group in which any member may participate. Meetings are structured but less formal than those in the regular schedule of the Society and



ME in 2001.



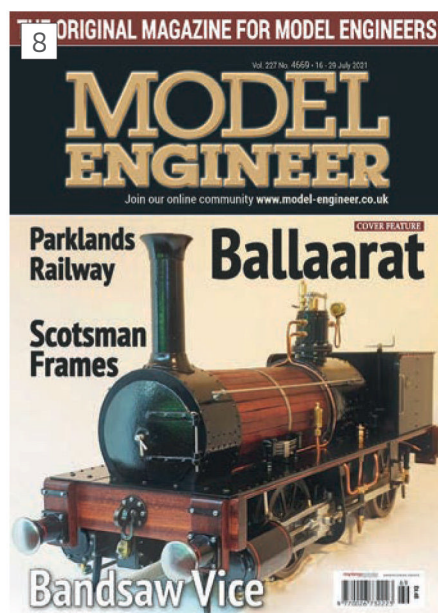
ME in 2011



often carried out over the internet using conference software leased by the Society. This makes it easy for distant members, as well as those within reach of Marshall House, to participate.

## The Model Engineer Exhibition

This exhibition is the longest established model engineering exhibition, having taken place for well over 100 years! Over the years the publishers of Model Engineer and the SMEE worked together to organise many Model Engineer Exhibitions, celebrating every aspect of model and hobby engineering. These were often huge affairs and even attracted royal visits and patronage. Unfortunately changes in the market compounded by the impact of Covid-19 have seen a hiatus in the exhibitions, but as the world returns to normal, we are looking for ways to at least sustain the prestigious competitions that attracted entries of exceptional standard at each exhibition.



ME in 2021, bang up to date.

## Plans for Celebration

As readers will know, Mortons Media Group has taken over Model Engineer and Model Engineer Workshop magazines. To mark the 125<sup>th</sup> Anniversary celebrations, SMEE has teamed up with several of Mortons publications, including Model Engineer and Model Engineers' Workshop, and will have an SMEE stand at several events

throughout next year. We are kicking off the anniversary with The London Classic Bike Show at Kempton Race Course.

This is a one day show and SMEE were originally only going to have static displays of our models. However, SMEE has always been a society that likes a good challenge, so they are pulling out all the stops to really make a success of their part of the event and will have a training lathe available to give demonstrations.

Their main aim at the show is to promote the SMEE training courses and hopefully attract new members.

There will be large number of stalls amongst the Autojumble sections that will be selling engineering tools and material, so it is a good chance to stock up for your latest project.

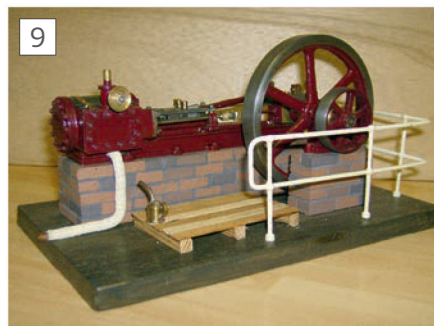
Other anniversary events will be announced throughout next year and will be publicised in MEW and ME, in the SMEE Journal, and on the forum at [www.model-engineer.co.uk](http://www.model-engineer.co.uk) and the SMEE website.

## So What is Model Engineering?

Model engineering is a very broad term, although many people's image of a model engineer is someone who makes miniature steam locomotives or traction engines the hobby covers a vast range of activities. Let's start by looking at steam-based models, as this is where the hobby really started.

## Stationary Steam Engines

A great place to start in model engineering is with a relatively simple stationary engine. In the past the 10V from Stuart Models was a popular choice as it can be made on a small lathe and the unmachined kit comes with a full complement of fixings.



A semi-scale model of a Buxton and Thornlea stationary engine.

It remains a good choice, but today there are many other designs ideal for beginners, notably simple oscillating engines which usually reward the builder by running well. Naturally as skills build there are many more complex stationary engine subjects such as beam engines, mill engines and compound marine engines to challenge your skills.

Stationary engines can be run on steam from a boiler (that should be tested in the same way as a loco boiler, see below) but many people run their models on air from a compressor.

## Locomotives

Live steam locomotives tend to be classified by the width of the track they run on (gauge) rather than the scale. Practical gauges range from tiny examples in 00 gauge up to 10-inch gauge and above. A popular scale for small models is 38mm 'garden gauge', while for those who wish to make locomotives capable of pulling the builder around a track 3 1/2", 5" and 7



Outstanding detail on the backhead of a locomotive by Pete Thomas and David Aitken.

1/4" gauges are most popular. 2 1/2" or Gauge 3 is having something of a resurgence of late being something of a crossover between scale running and passenger hauling.

One important factor to bear in mind with live steam locomotives is the need for a boiler to be certified and regularly inspected and pressure tested for insurance purposes. Clubs generally have their own inspector who deals with members' boilers for free or a nominal cost, so if you build your own boiler it is a good idea to join a club and seek the guidance of their inspector before making any expensive mistakes. Naturally being in a loco-focused



club also brings you access to their track – few people have the space for a track at home! An increasingly popular alternative is to build engines with electric or IC engines, particularly with a younger generation who are less familiar with the days of steam railways.

## Traction Engines and Steam Wagons

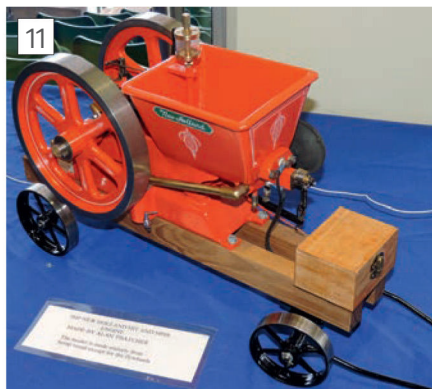
From huge ploughing engines, colourful showman's engines and relatively speedy steam wagons building a model with wheels gives you the flexibility to run it anywhere. Naturally a boiler certificate is essential if you wish to run in public – such models are usually welcomed at full size traction engine rallies. Other interesting subjects for modelling include road rollers, dredging engines and 'portable engines' that have a steam engine mounted on a boiler but were usually pulled along by a horse.

## Stirling Engines

Few people realise that Stirling and other 'external combustion' engines can be among the most efficient of prime movers – some will even run on the heat from a cup of hot coffee! Even so, their power to weight ratios are often very low and they require careful work to achieve a good performance, but this challenge encourages some people to seek ever better performance from their engines. There are also esoteric variations such as flame-lickers or 'gulpers' that pose their own challenges.

## Internal Combustion

Spark ignition engines have been a popular subject since the early days of model engineering and the hobby has played a critical part to the development of small glow-plug and compression ignition engines. Today makers of IC engines are broadly split into two camps – those who make high-performance engines to power



*A hit and miss hopper engine by Alan Thatcher.*

model such as aircraft and boats and those whose priority is making close scale working models of full-size engines. Naturally there is considerable cross-over between these categories. Prototypes modelled range from multi-cylinder aero engines to single cylinder 'hit and miss' stationary engines.

## Gas Turbines

The exciting world of working jet engines has led to the development of many new techniques in model engineering,

such as the balancing of turbines, spot welding of thin stainless steel sheet and the use of high-speed ceramic bearings. Many of these engines are used in flying models that can exhibit spectacular performance.

## Clock Making

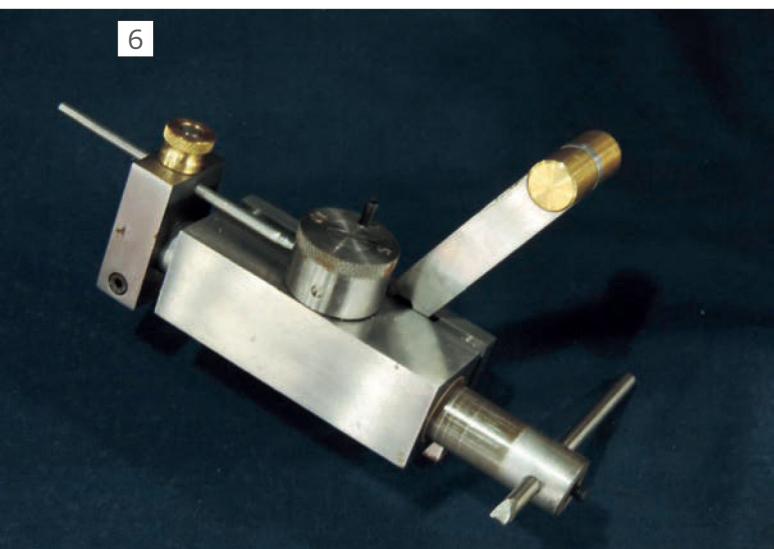
A rather gentler but popular area of model engineering that suits those with modest sized equipment and the ability to work to close tolerances and high finishes is clock and instrument making. Although not strictly models, such work is always accepted as part of the hobby.

## Tool Making

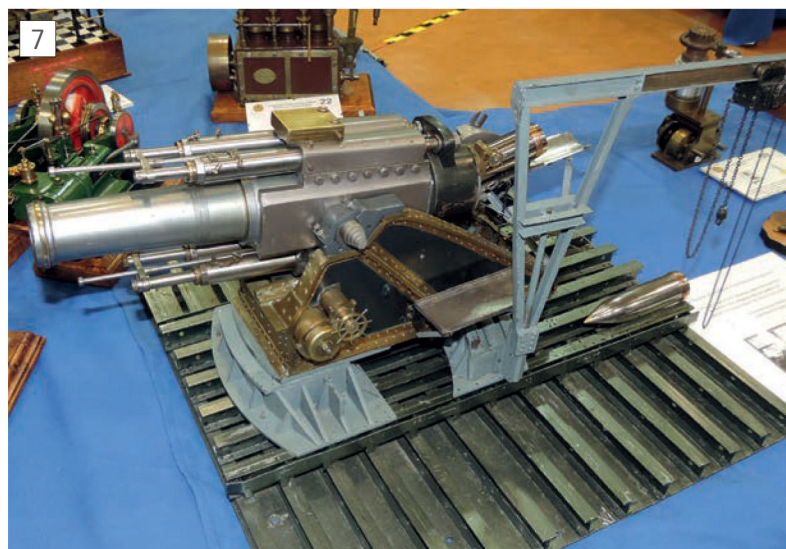
It is almost inevitable that at some point you will end up making tools of jigs to allow you to carry out some specialist tasks, but some model engineers get completely wrapped up in this side of the hobby and rarely if ever make a model! There is a special satisfaction to making a specialist tool and seeing it perform well.

We have only scratched the surface of the pool of possible model subjects, some other areas include:

- Tanks, field guns and other military models
- Farm wagons and implements
- Steam cars
- Power units for high-speed steam and IC hydroplanes
- Ornamental turning – creating decorative and complex objects with special lathes



*A well-made graduating tool by S Green exhibited at the Doncaster show.*



*A remarkable model of a coastal defence gun by Admiral Bacon.*

# Centring a Rotary Table on a Mill

Malcolm Tierney describes his approach to simplifying a task that can be a bit of a chore.



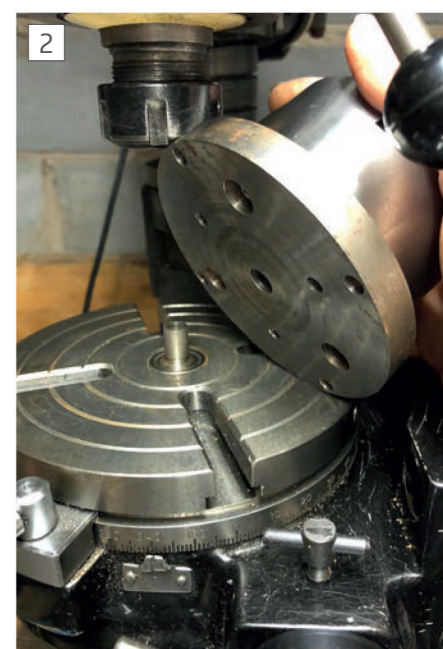
*The tapered plug.*

**M**uch as I enjoy using machines to enable my many and various projects clocking objects on the mill does not add to the pleasure. One of the best purchases that I ever made was a rotary table. I saw a great idea for centring a rotary table under the mill spindle by Tom of Tom's Techniques on YouTube. A tapered pin was turned to match the taper in the centre of the rotary table and a half inch shank turned onto the piece in the same set up in the three-jaw chuck on the lathe in order to obtain concentricity, **photo 1**.

The centring pin being loaded into a half inch collet in the spindle, the quill is lowered into the table until it stops at which point the table is centred on the quill. Safari so goody as Biggins used to say. But now for some work holding. I turned a back plate with a register to fit my lathe's 3 jaw chuck with a 10mm bore in the centre and four clear holes in the flange to bolt it down. I then turned a tapered pin to fit the tapered bore in the rotary table with a 10mm stub to fit the bore of the chuck back plate. Thus the three-jaw chuck can be centred on the rotary table under the mill's spindle without using a dial gauge.

**Photograph 2** is the pin to centre the table under the quill about to be plunged in order to centre the table.

In **photo 3** we see the chuck on its backplate and a centring pin in the table with its ten-millimetre diameter shank projecting above the table.



*Inserting the tool into the rotary table.*





Chuck centring plug in place.



The 3mm shank plug, as well as other setting up accessories such as a cylindrical square.

The next item to make was a plug with a 3mm bore, which may be seen in **photo 4**. Into this I can fit turned pins in order to register a hole in a part over the table centre. The pins have 3mm shank to drop into the plug.

I hope that this may reduce the hours of nudging and checking for some of our readers.

# MODEL ENGINEER

## NEXT ISSUE

### Dynamometer

Graham Astbury describes the dynamometer he built to determine the output characteristics of his rewind single-phase electric motor.

### Guinness Engine

Cliff Almond considers how to tackle the motion of his 7¼ inch gauge 0-4-0T Guinness locomotive *William Spence*.

### LOWMEX

Julie Williams reports from the Lowestoft model engineering exhibition organised by the Halesworth Model Engineering Society.

### A4 Locomotive

Robert Hobbs builds a 2½ inch gauge model of Gresley's streamlined A4 locomotive *Mallard*.



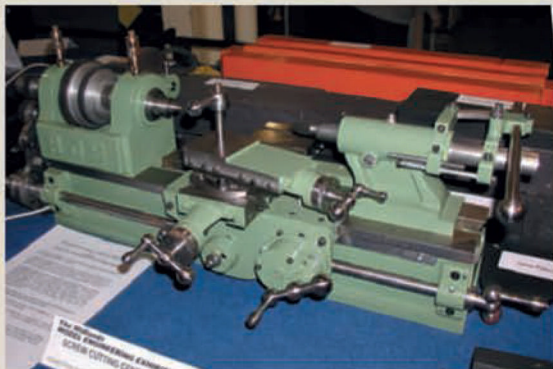
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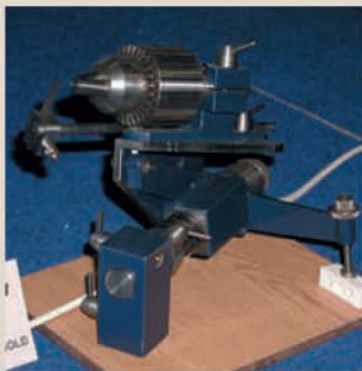


# From the Model Engineer Archive

Each issue in 2023 will feature some historic content from Model Engineer relevant to workshops, tools or techniques. This page from Model Engineer Volume 187, No. 4160 is Neil Read's report on tooling at the Midlands Model Engineering Exhibition held at Castle Donington in 2001.



Above: Mr A. J. Stevens' well made and nicely finished centre lathe.



Left: 4-facet drill sharpening attachment exhibited by Mr. D. Arnold.

Right: Victoria milling machine by Mr M. Leafe with swivel vice and other items. Shown grouted to the floor and ready to work, it is difficult to believe that this photo is of a model. Note the excellent proportions of the hand wheels, tools and accessories.



## MACHINES AND TOOLING AT CASTLE DONINGTON

**Neil Read**

gives a brief account of the machine tools and workshop equipment on display at the recent Midlands Model Engineering Exhibition.

As a keen enthusiast for machine tools and the type of workshop equipment of interest to the amateur, it is always a pleasure to visit exhibitions and admire the work of this type produced by others. This can also be a somewhat frustrating experience, as often the standards achieved by the various exhibitors so exceeds one's own that you are left with a vague sense of inadequacy. How can anyone achieve such fine workmanship using tools which are probably not dissimilar to the ones many of us own? All the exhibitors deserve our congratulations and thanks, but space restrictions prevent us dealing with more than the highlights.

This year, there were several significant entries in both the competition class and display only category. Prominent among the latter was a one-man show by Barry Jordan whose work needs no introduction from me. Barry was on hand for much of the exhibition to talk about his beautiful models to a steady stream of visitors. The high spot for me was the opportunity to see his 1/5th scale Dean Smith and Grace heavy duty gap bed lathe again. Somewhat nostalgic too, as I was once responsible

for the purchase and installation of a similar machine into my, at that time, employer's works. I still remember the visits to the DSG factory to test the new machine prior to accepting delivery. Barry also had a part-finished model of a Jones and Shipman 1400L surface grinder entered in the competition class. A note attached to the machine warned visitors of wet paint — a reference, no doubt, to last year's show at Donington when Barry's DSG lathe was so new that one of the Judges came away with paint on his hands!

In the competition class, the first prize was awarded to a superb model of a Victoria milling machine by Mr. Malcolm Leafe. Everything about this model looked 'right'. The builder (alas, his name did not appear in the show guide) had achieved true scale appearance in important details like the hand wheels and the electrical cables. The machine was grouted to the 'concrete' floor and was displayed with some typical tools like a hide hammer and a swivel vice. The paintwork was just right and it is difficult to tell from a photograph whether the machine is full size or not. Truly an outstanding exhibit!

The 3 1/2in. centre height, screw-cutting lathe entered by Mr. Alfred Stevens appeared to be well built and finished. Much care had obviously been expended on fitting the various mating surfaces and scraper marks were visible on the bed, cross-slide and top-slide components. Only one minor point of concern occurred to me and that was that Mr. Stevens had chosen to mount

the top-slide to the cross-slide using the method adopted by Myfords on their old ML7 lathe. This is a very simple and robust method but it does prevent the top-slide swivelling through 360deg., an arrangement that greatly facilitates screw cutting and other turning tasks. Nevertheless the machine has many practical features and should serve Mr. Stevens well for many years to come.

A wheel-cutting engine displayed by Mr. Derek Collier was a substantial and well turned out machine of interest to actual and potential horologists. The machine followed the usual practice for this class of instrument and had a wide range of adjustment. Judging by the size and robust build of this exhibit, Mr. Collier has some large clock projects planned! Next to this exhibit on the display table was a four-facet drill sharpening attachment by Mr. D. Arnold. The four-facet method for sharpening twist drills was first described in *Model Engineer* by the late Professor D. Chaddock (*M.E.* 3494, 2 August 1974, p738) although the technique had been known in industry for some years previously. This was in the course of his description of building the Quom tool & cutter grinder. It is not clear on which machine Mr. Arnold plans to use his attachment but the unit was well made and finished and obviously designed for hard work. Mr. Arnold has avoided the use of special collets to hold the drills, as suggested by Professor Chaddock, by the simple expedient of using a Jacobs chuck. 



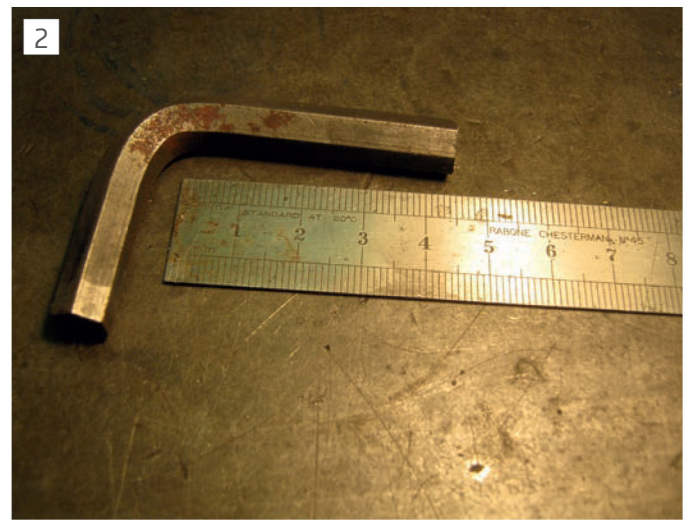
# A Multi-Tool Holder for Grinding Rotary Riveting Heads – Part 1



After making his rotary riveting tool, Will Doggett thought that he should also make the riveting head for the tool as he had made everything else apart from the thrust bearing the screws and nuts. To achieve this led to making a pair of toolpost holders for his multi tool.



The riveting tool from the previous article.



The key.

The riveting tool from issues 318 – 320 is shown in **photo 1**. To make the riveting heads, the hexagon key that was left over from the riveting tool cutters would be the donor for the two new riveting heads or possible more than two if there were enough key left after cutting them, **photo 2** shows the last part of the key.

The dimensions were taken from the original riveter i.e. length and groove size, then the key was cut to a little over the length required this is because it was cut freehand and not necessarily very square, the squaring up will be done when the hexagon is in the lathe's chuck.

When I made the cutters for the riveting head holder the multi tool that I used to make the cutters with was held on the lathe with a bit of a lashup. I used the multi tool holder from the tap sharpening tool that I had made some time ago, this was bolted to a piece of

angle that was held in the tool post so the next task was to make a better holder for the multi tool to fit in the lathe tool post in a different way.

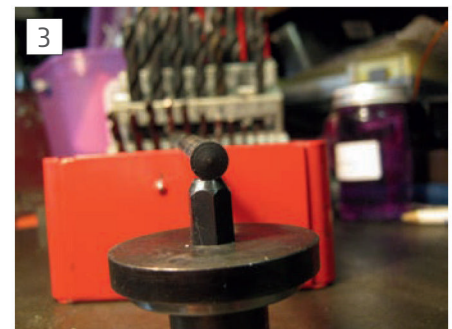
With a proper holder for the multi tool to fit the lathe tool post this would allow me to do some grinding in the lathe on small parts if required at a later date.

## Checking

To check whether my idea to make the riveting head would work, I first checked the radius size, **photo 3**, this is an 8mm drill sitting in the radius. The next check was to see if the diamond cutter would fit this size. **Photograph 4** shows that it will if held at an angle, the 8mm drill will be used as a gauge when grinding the groove.

## New multi tool holder

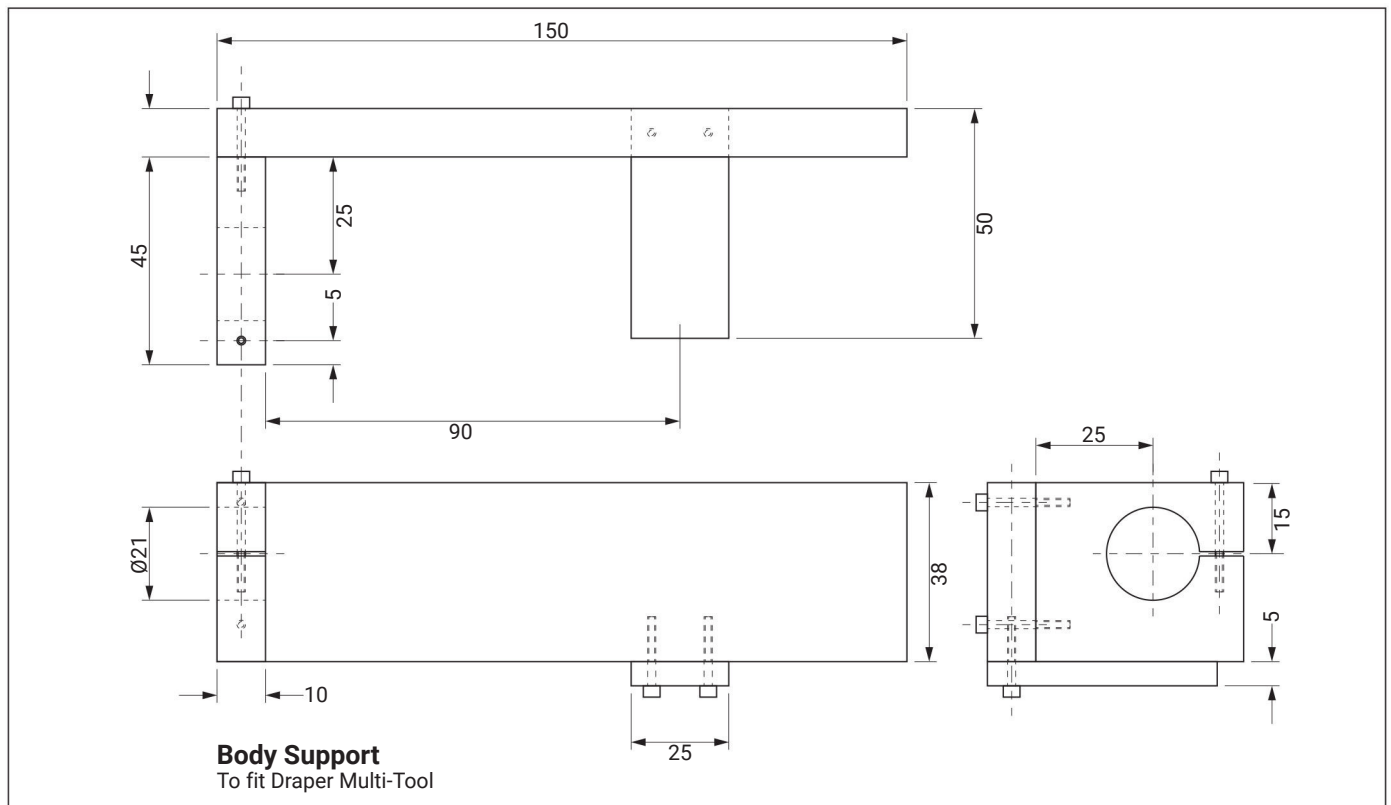
I then proceeded to make a new multi tool holder as using the tap sharpening



Checking size, this also shows the required shape of the finished heads.



Checking shape.



tool holder was ok but had it limitations. To make the new one rather than design a new tool holder from scratch I looked for the old drawing on the computer that I used when I made for the tap sharpening tool to give me a guide to make the support body for the multi tool to be held in. the drawing was then printed off to use in the workshop. When I looked at the drawing I was surprised that I had used screws to hold it all together and not welding as I seem to do a lot of now **fig. 1**.

Having found the drawing and had a good look at it I realised that to get the cutters to the correct position in the

lathe I would require both left hand and right hand holders for the multi tool as the right hand one's body would be in the way when cutting at right angles to the chuck face.

The reason for this is the cutting wheels are small and I require them to be as near to the lathe chuck as possible, so the multi tool requires to be next to the chuck and not the support holder. It must be parallel with the face of the lathe chuck for some jobs such as cutting to length. So this will be the right handed holder. At other times I will require the cutter to be at 90 degrees to the face of the chuck so the left hand tool holder will

be the one required to form the cutting face on the finished hexagon cutter.

The only reasoning for calling them left hand and right hand is the multi tool fits to the right of the holder in the right hand and to the left in the other holder as you look at them from the back of the holders.

### The materials

The materials were the next to be looked for and I found they were not all the same size as the original multi tool holder this is not a problem as the drawing was only going to be a guide for the more important dimensions of the end piece.

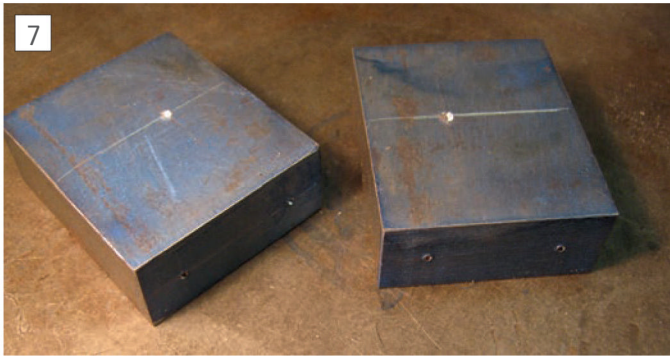


5  
*Cutting one end piece.*



6  
*The parts.*





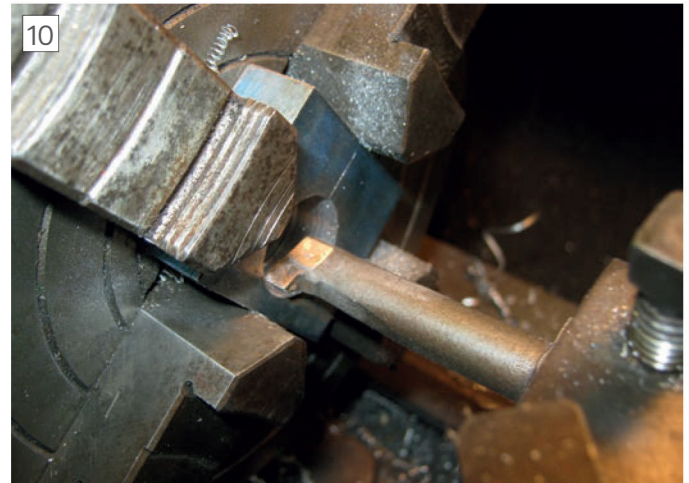
Two ends.



Thread ring.



Centring the block.



Boring the block.

As you will see the back section is not same thickness and there is an additional tool post piece screwed to it, this gives rigidity to the smaller section of the back.

I then cut the part to size, **photo 5** shows the end piece being cut to length on the bandsaw. The parts are shown in **photo 6** after they were cut to size. Also on the bandsaw the square looking metal parts are the end pieces 16 x 38 x 45mm The parts underneath are the backs these are 6 x 38 x 155mm. To the front are the parts that fit the tool post, these are 10 x 20 x 155. The other small pieces are 5 x 25 x 50mm to support the multi tool at about the middle of the body as I didn't like the idea of all the weight on the thread end

The first thing I did after cutting the parts to size was deburr them. I then marked the end block out from the dimensions on the sketch for the holes. **Photograph 7** shows the end blocks marked out ready to machine.

The tool holder large hole is done in the lathe's four jaw chuck. As you can see in the drawing this hole is 21mm in diameter, it is this o/d size for the thread ring that I had made for the tap

sharpening tool. This protects the multi tools thread when it is clamped in the holder, it is shown in **photo 8**.

After positioning the block in the four-jaw chuck with a centre held in place with another centre in the tailstock and a clock gauge used for centring, **photo 9**, the block was centre drilled then drilled with a 15mm drill. The hole was then opened up with a boring bar, **photo 10**, to the size of 21mm. The block was then removed from the chuck and the second was also machined in the same way.

After the large hole was machined, the other holes were drilled and tapped the clamping slot was marked out halfway down the bore on the far side to the two fixing holes, then the slot was cut with a hacksaw through to the bore. This slot can be just seen in the block at the top of **photo 11**.

The back pieces were then marked out for the fixing holes. These attach the backs to the end block. They were drilled for M5 socket head screws and the backs and the end blocks were assembled.

To get the position of the tool post support piece in relation to the backing piece, I set the height of the Dixon tool

post halfway on the adjusting screw, then put the tool post piece in the tool post with the right-hand backing piece held in position with the hole on the centre line of the chuck jaws. I marked the backing piece from the top of the tool post piece.

The operation to mark and drill the fixing holes was next, from the line marked on the backing piece I measured down 5mm. This is half the tool post piece thickness and put another mark on the backing piece, a line was then marked along the length of the back.

The first hole's position on the back plate was marked 50mm from the head end and 20mm down from the top, this was drilled through with a 4mm drill.

The back piece was then turned over and a line was marked on the front face 20mm from the top. This was then marked out at about 40mm centres two more times, these marks were then drilled 4mm and countersunk.

The tool post piece was also drilled for an M4 screw but this was 45mm from the end and in the middle of the 10mm width, this was then tapped.

To complete the drilling and tapping I put a 4mm screw in the first hole on





the back plate and screwed this to the tool post piece, then checking the tool post piece was parallel with the back I clamped them together. The other two holes were then drilled through to the tool post piece.

The clamp and screw were then removed I then put the tool post piece in the machine vice and drilled and then tapped it with M4 tap the reason for doing it this way there is only one lot of marking out to do this is on the backing piece.

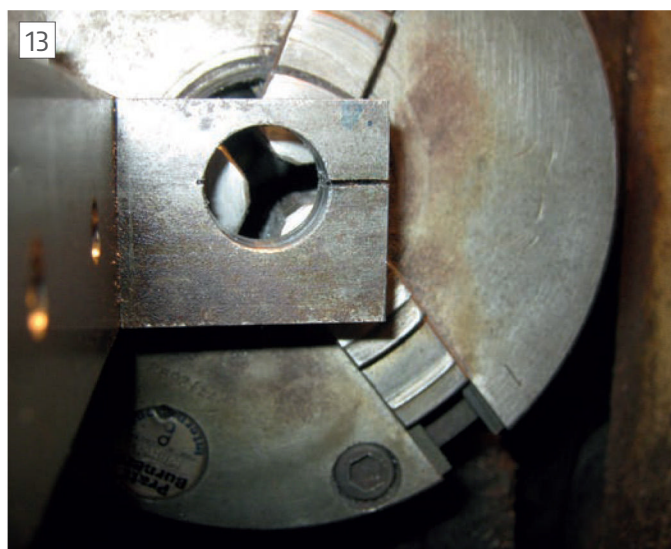
This operation was then repeated on the left-hand tool holder.

The parts that have had their holes drilled, and some of them tapped, for the right-hand carriage are shown in **photo 11**. The small rusty piece on the right of the photo was going to be welded on after the other tool holder is machined.

*Parts after drilling and tapping.*



*Testing fit.*



*Lining up with the chuck.*

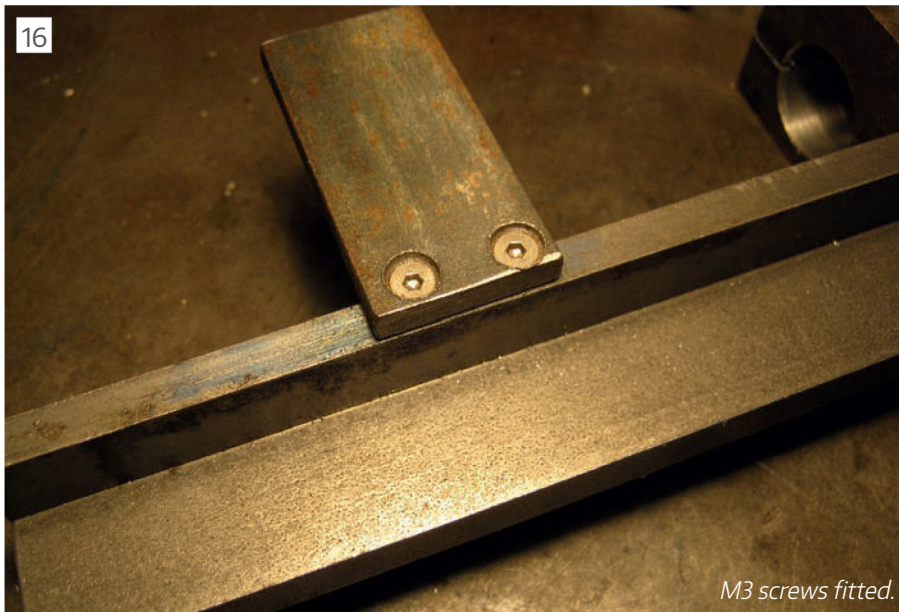


*One nearly finished.*



*The two assembled.*





M3 screws fitted.



The other side.

The first tool holder, the right-handed one without the grinder body support was tested for fit in the lathe tool post, **photo 12**, to check the height was correct and the tool was on the centre of the lathe chuck, **photo 13**. The left-handed one, also minus the grinder support as these will be fitted at the same time to both left- and right-hand tool holders, was also checked.

**Photograph 14** shows the screws that hold the tool post rail to the right hand tool holder.

The two assembled tool holders are shown together in **photo 15**, the right hand one is at the bottom of photo.

The grinder body supports I was going to weld on I thought I would try and screw in place. It required some small screws to hold it to the back plate, the screws I found in the screw box were M3 x 12 countersunk these would just

about fit the 6mm back plate. This was marked out with a line across it at 80mm from the front this mark is the start of the support, a centre line was put on the back plate, then the first hole's position was marked 85mm from the front. A second hole was marked 14mm away from the first, then these were centre popped. The same marking out was done on the other tool holder.

Both tool holders were then drilled with a 2.5mm drill and the holes were tapped, first with a M3 taper tap and then a finishing tap.

The grinder body supports were then marked out; a line was marked 3mm in from the end. The centre of the piece was found across the steel and the holes were marked 7mm either side of this centre line. They were then centre popped, drilled 3.5mm and countersunk with a 6mm drill. **Photograph 16** shows

the M3 screws in the countersunk holes and **photo 17** shows the other side of the grinder body support in position.

The manufacture of the two multi tool holders was now finished I thought!

But as I was looking at one of the holders that was standing on my desk in the upright position an idea came to me why not make a bracket to hold the multi tool in a vertical position to allow the tool to cut horizontally? This would allow me to cut across the face of a piece held in the lathes chuck using the lathes cross slide to move the cutter across to form grooves or slots if required when making special screws and the like.

### The bracket

The bracket was be made from a piece of angle 60 x 90 x 135mm that I found, **photo 18**. To make it fit the lathes tool post I cut the 135mm down to 100mm then, **photo 19**, the 60mm was then reduced to 25mm in depth, **photo 20**. The 90mm section was then cut at an angle to reduce the bulk on the up stand, **photo 21**.

After cutting the angle, the lathe's QC (quick change) toolpost was set to the middle of its height adjustment then the angle was clamped in it, after this the tool holder with the cutter fitted was centred in line with the lathe chucks centre line, **photo 22**, and the tool holder was then clamped to the angle, **photo 23**.

The angle bracket and multi tool holder were then removed from the tool post and put on the bench **photo 24**, then I marked the tool holder at the angle's top. This is the line for marking the fixing holes on the tool holder, so these two parts are now ready for marking out.

The part that was thought to be scrap was not wasted as it was used to set the height when setting up the angle in the tool post, this is because the angle was not thick enough to be clamped in the tool post, **photo 25**. This will be welded on to the bottom of the angle after the drilling and tapping is done as my days of fiddling with packing in the lathe are long gone.

The tool holder part that was to be held in the tool post when it was horizontal is now the vertical part that is going to be held with the angle bracket.

● To be continued

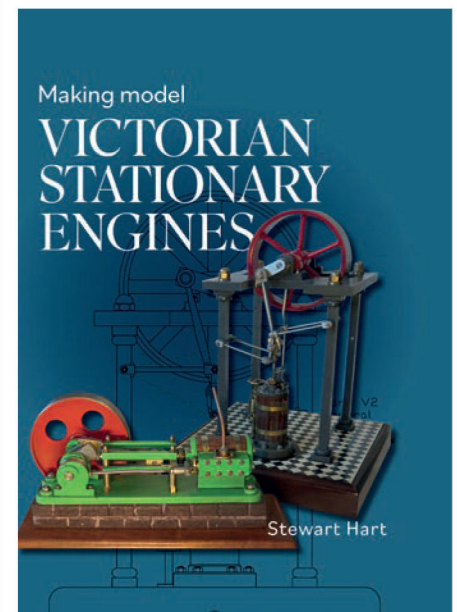


### Rust and Dust



Readers who prefer a 'weathered' appearance to their models will be interested these new Lifecolour Compact Rust and Compact Dust pigment sets available from Airbrushes.com. The two sets each include two paints, three liquid pigments and a bottle of dry pigment for building up realistic deposits of dust or rust. The locomotive in the second photo was weathered with Lifecolour pigments from a different set, but shows the realistic effects that can be achieved.

### Making Model Victorian Steam Engines



This new book by Stewart Hart details a series of model based on three real Victorian steam engines but using a set of common components. Whilst being characterful and attractive models, the designs are still suitable for those with limited machining experience and a modestly equipped workshop. The book has 176 pages and over 380 illustrations including scale plans and colour photographs. Written in trained toolmaker and manufacturing engineer Stewart Hart's concise and accessible style, this is an ideal book of projects for anyone looking to get started in modelling stationary steam engines.

The book is a hardback, and costs £19.99 and is published by the Crowood Press. It is available through online retailers and local bookshops.



## The Midlands Garden Rail Show Saturday 11th & Sunday 12th March 2023 at Warwickshire Event Centre



Plans are "on track" for the 2023 Midlands Garden Rail Show, organised by Meridienne Exhibitions, taking place on Saturday 11th and Sunday 12th March for one of the leading model railway events dedicated to garden rail.

This event features the larger gauges of O Gauge, G Scale, Gauge 1, 16mm and more.

There will be nearly 15 layouts and clubs at the event. Plenty of

inspiration if you are planning your own garden railway be it live steam, gas or coal fired.

Confirmed layouts include the 16mm Association Modular Layout, Belbroughton in O Gauge, Midsummer Norton in Gauge 1 and Warton Road Preservation Society in Gauge 3

Confirmed clubs include Coventry Model Engineering Society, Bromsgrove Society of Model Engineers and the National 2 1/2"

Gauge Association among others.

Over 30 leading suppliers will also be at the show to help you create your dream garden railway selling everything you could need including locomotives, rolling stock, track and accessories.

For further details on the exhibition and suppliers attending please see [www.midlandsgardenrailshow.co.uk](http://www.midlandsgardenrailshow.co.uk). Tickets are available now via the website or they can be purchased on the day of your visit from the ticket office.

## The right temperature for a 300-year-old church

"Steam usually maintains a high pressure and temperature in our assignments, but in the beautiful church of Kättilstad in Östergötland Sweden, the pressure is no higher than under the lid of a kettle on the stove when everything is as it should be. That was the challenge," says Johan Söderberg at FVB, who has worked on a somewhat unusual project.

"For some reason, air collected in the cooler parts of the system and built up a counter pressure back there. The problem had grown slowly over a long time without anyone thinking about it, until the day the system could no longer run," says Johan Söderberg.

How do you best heat a church that is almost three hundred years old so that the interior, paintings, and pipe organ are not harmed? The solution has been for the church to be heated briefly, only when needed, which makes the visitors feel like the church is warm and cozy.

The painted wooden barrel vault is the key to it working so well. During the renovation in 1932, the church was equipped with a heating duct, but with beautiful cast iron radiators along the



walls instead of elements under the pews. When the wooden radiator covers are heated up, moisture is added to the church room. When the heating system is at rest, the radiator covers instead absorb the same amount of moisture. The short-term increases in temperature with indirect heat is very gentle on the interior.

"With the choice of low-pressure steam, there is no risk of anything freezing, and at the same time the effect is as high as possible once the system is in operation. The necessary controls

can be limited to ensure that the system is running for different lengths of time depending on how cold it is, which is something that has been handled by the booking system for a few years now," Johan Söderberg explains. He continues: "The result is that the Kättilstad church is one of the churches with the most sustainable heating in Sweden, even though the boiler is fired with oil. Only 5-30 liters of oil are burned before each church service, and soon it will be converted to bio-oil."

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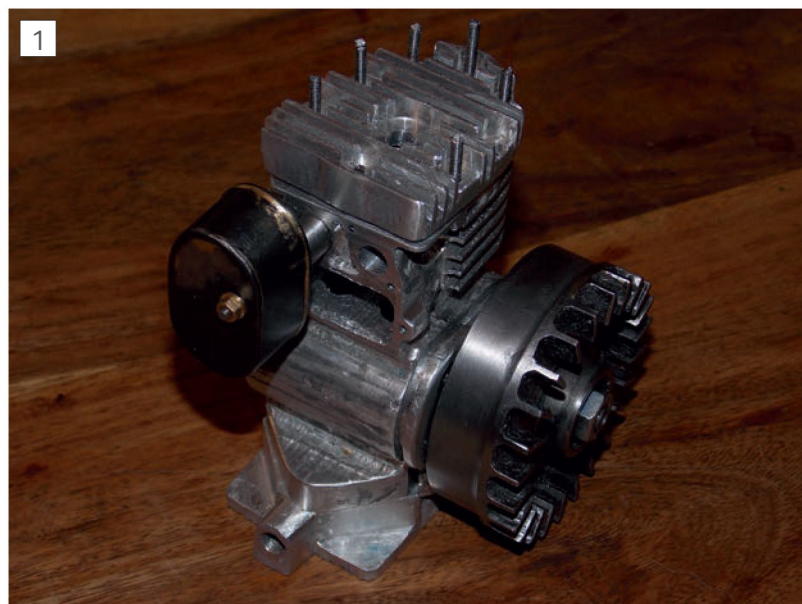
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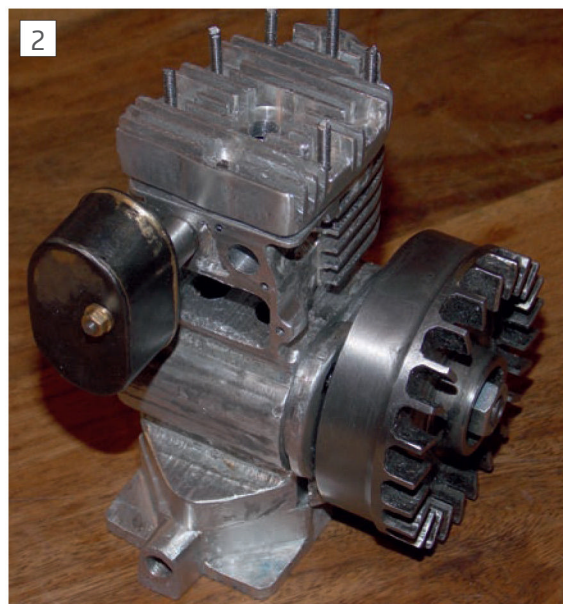
# Workshop Photography

## Part 2

We can't all be professional photographers or even access the most sophisticated of photographic equipment, but there are many simple things we can do to improve the quality of our workshop images.



*This picture is sharp and detailed, but rather dark, has a lot of empty space and the part-finished engine is at a slight angle.*



*Hopefully a retouched image shows the model in a better light*

Last month we started looking at the technical aspects of an image, covering correct exposure, ensuring the image is sharp and using the correct colour balance settings. There are a few other technical issues to consider, especially if you are submitting images for publication. When images are published, they will almost always be 'retouched' by the designer. Usually this is just a case of tweaking the colour balance and contrast to optimise the image for publication and cropping it to best fit in the page, **photos 1 and 2**. In some cases it may be necessary to crop out elements such as trailing wires or distractions or apply more dramatic corrections.

### Resolution

The resolution of an image for publication is often poorly understood as printers usually speak in terms of 'dpi' rather than pixel counts. The dpi, or dots per inch, of an image is a measure

of how finely it is displayed or printed. At a typical reading distance 300 dots per inch is roughly equal to the eye's resolution, so this is what is preferred for normal printing as a sharp image will look crisp but without any signs of 'pixelisation' or other artefacts, **photo 3**. Art prints may go higher and for everyday items such as handouts from a computer printer a lower resolution, typically 220 dpi, is quite usable. Computer screens used to be about 96dpi as we typically view them from further away, but modern ones often use higher values.

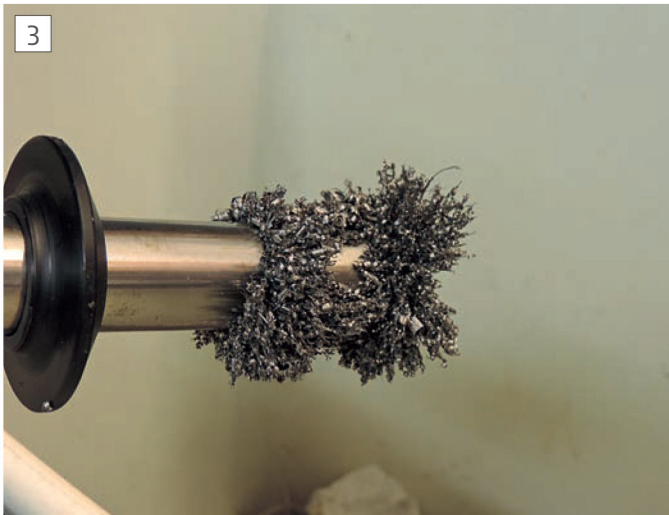
What this means when publishing photographs is that the pixel count of the image should be 300 dpi when the image is printed. MEW is printed at A4 size, 297mm high by 210 wide, which is about 8 x 10 inches. This means a full page portrait image (one taller than wide) need to be 3,000 pixels high. A typical landscape image that is cropped

to fit a full page might need to be 4,000 pixels wide.

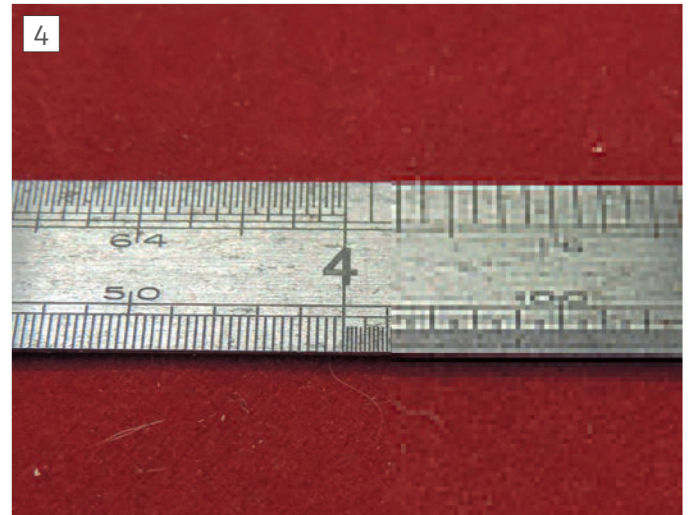
If you multiply 4,000 by 3,000 you get 12 million, and experience shows that a minimum of 12 megapixels is the minimum for a good a cover image on the magazine. You also need allowances for cropping to the best part of the image and for printer's 'bleed' to prevent white areas at the edges when the pages are cut to size. The upshot of this is that 12 megapixels is an ideal size for general images to accompany articles, as after any cropping (or rotation) they generally still have plenty of resolution to be used up to the full width of a page. Images of this size are regularly used for the cover, but ideally will be somewhat higher than this (48 megapixels is ideal for a cover before any cropping).

This doesn't mean that your images can't be printed if you have a lower resolution camera or you can't get close enough to the subject to fill the





*This picture of magnetised swarf has some sharp detail.*



*The right-hand side of this image shows the pixelization and loss of detail caused by down sampling.*

frame. Many of the images we use are far smaller than a full-page width. It is also possible to resize images, this typically makes them look rather soft, if not out-of-focus. Fortunately, there is some excellent software available, I use Gigapixel AI, that can resize images while retaining their sharpness. The down side is that you lose detail, but at least the resized images appear sharp. In the past we have even recovered usable images from tiny thumbnails, but this is time consuming, and it doesn't flatter the contributor. It also limits the possibility to crop an image, I will discuss cropping in more detail later.

These days cameras and even phones have great resolution (my phone is 48 megapixels) computer storage is cheap and there are easy ways to share large files. A rule of thumb is to take photographs for printing or publishing at the highest resolution possible unless your camera can achieve over 16 megapixels. Never resize 'down sample' your images below 12 megapixels to make them easier to send by email, if you do you are just throwing away detail and sharpness and your images will look flatter and less engaging on the page.

**Photograph 4** is an extreme example of the effect of down sampling an image.

## Compression

A closely related and often misunderstood matter is compression. Compression is a way of reducing the file size of an image. For art prints, file formats that use lossless compression (and/or higher colour depth) are often used, such as TIFF.



*The affect of over-compression is more subtle, but results in loss of detail and a blotchy appearance (right hand side of image).*

More extreme 'lossy' compression reduces the detail and subtlety or colour in an image. In practice, however, the algorithms used are very good and ordinary JPEG images are perfectly acceptable for publication, as long as the level of compression is not too extreme. The difference between high quality and low quality JPEG compression is shown in **photo 5**. Different cameras and editing packages use different ways of measuring JEG compression but in general if you use a 'high' quality setting any loss of quality will be negligible.

RAW images are produced by higher end cameras. These have the original data off the camera sensor, which makes them huge (a 12-megapixel image may take 48 megapixels of storage, for example). While they are ideal when lots of retouching and digital processing is to be applied, they complexities involved mean they are not suitable for submission for all but specialist printing purposes.

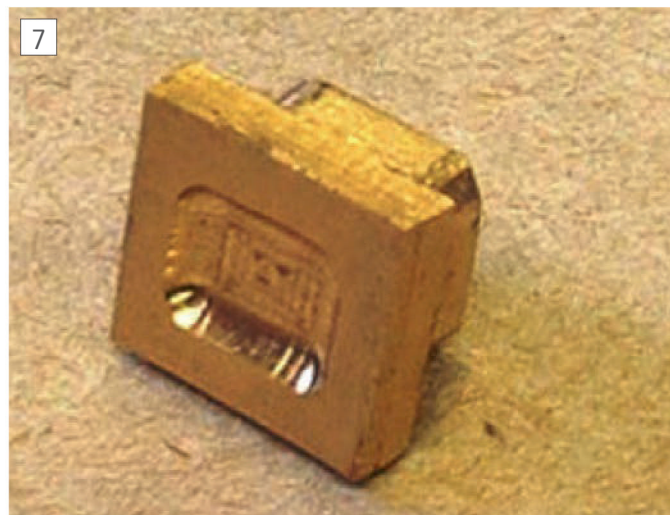
## Cropping

We will look at composition later, but it's worth discussing cropping. If you are preparing a picture for your own use you





*This small steam engine slide valve is clearly rather lost in the frame.*



*Over-aggressive cropping means the picture becomes unacceptably soft, at best.*

may want to improve it by cropping it down to better balance the composition, concentrate on a point of interest. You may also rotate and crop to compensate for mis-alignment of the camera. The potential problem is that cropping will reduce the size of the image and if you crop too aggressively the image may become too small to use.

Another issue is that you don't know exactly how the image will be used in the final publication, **photo c**. An uncropped image allows the designer more flexibility. A less aggressive crop may also save an image even if it means the subject will appear small.

**Photographs 6 and 7** show an image with the subject rather small and how cropping it to a good composition produces a very poor image (the crop has been resampled to make it the same size as the original). Obviously the ideal here would have been to get closer to the subject when taking the original photograph.

A designer will tell you never to crop your images and to leave that task to them, but if you do feel strongly that an image needs cropping try and crop it somewhat oversize to give the designer some latitude to allow for bleed or to have the option to choose between landscape or portrait formats, for example. **Photograph 8** shows one of my own photographs that I cropped rather badly trying to highlight the clamp in the middle.

Obviously if you are photographing at high resolution, say 48 megapixels, you can crop more aggressively than if

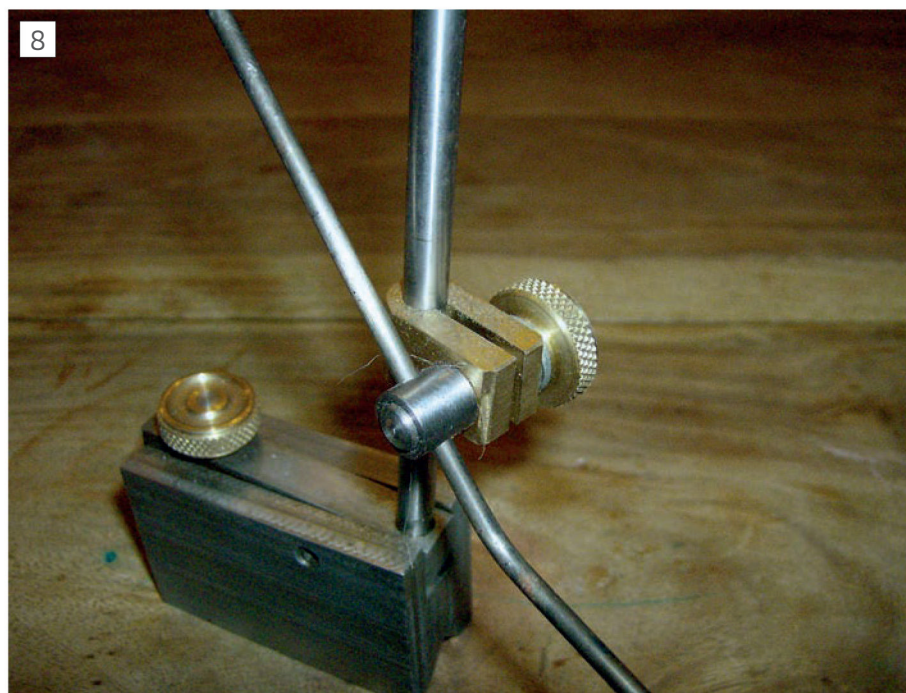
you are using a low pixel count camera, **photos 9 and 10**. With a low pixel count, it's best to get in close to the subject (as long as the focus is sharp) in the first place rather than try and cut out a small part of a big image.

### Labelling

Many published images have numbers on them and sometimes have annotations. It's often tempting for people submitting images with an article to do this themselves, but there are several reasons why this shouldn't be done.

Numbering and annotations need to

be in the magazine's house style. This means using certain fonts and sizes, and it's unlikely that a contributor will use the correct font. The editor may also decide not to use a photo because the quality is poor, does not add to an article or may want to reorder images. Having numbers on them can then cause real problems as the designer then has to crop them out or resort to 'photoshopping' them out. **Photograph 11** shows my own innovative approach to labelling... it would have been better to rephotograph the item on a plain sheet of paper and let a designer add the figures.

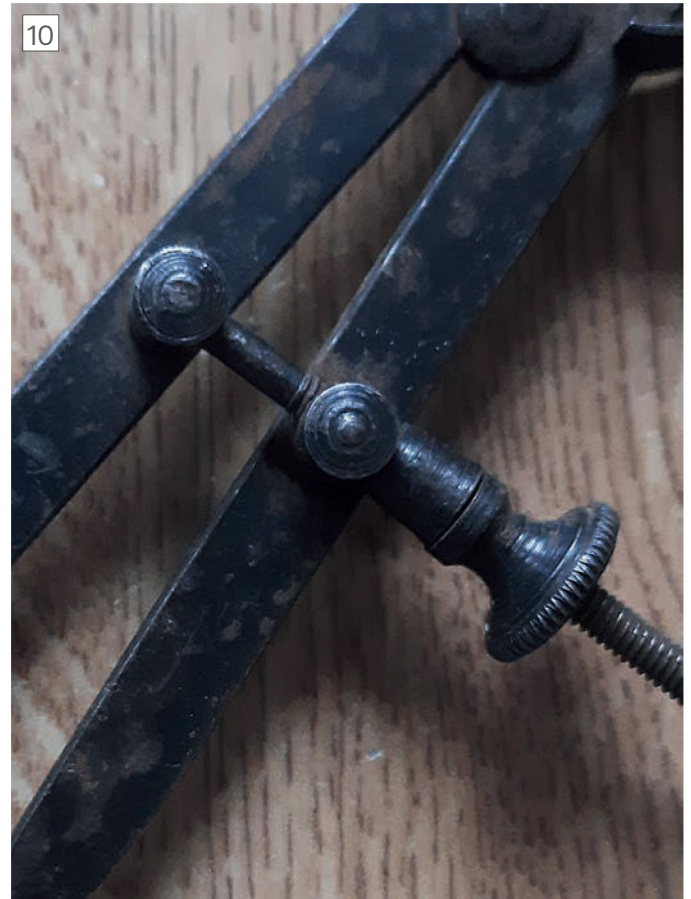


*I did not make a very good job of cropping this image.*

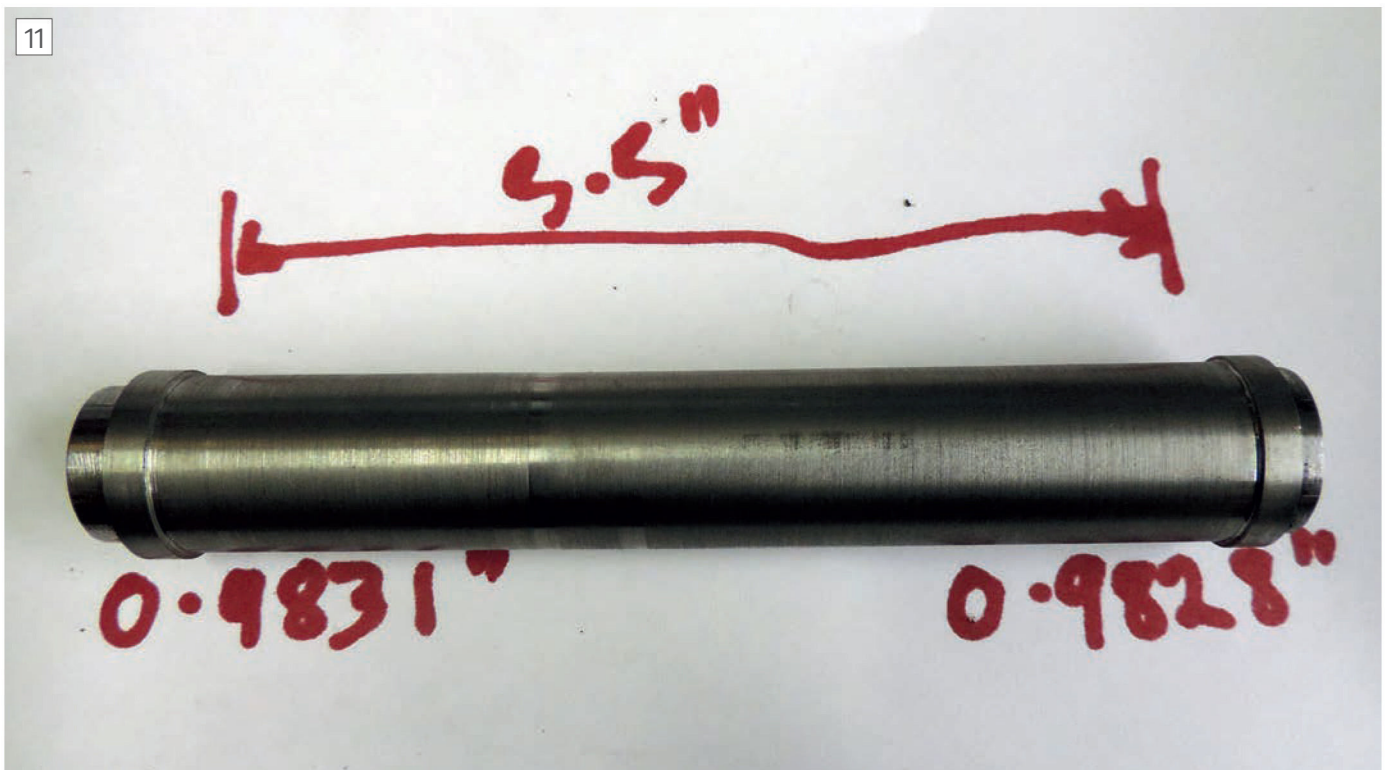




*This is 48-megapixel image taken with a phone camera.*



*The crop from a large image still shows plenty of detail.*



*An extreme example of poor labelling of an image!*

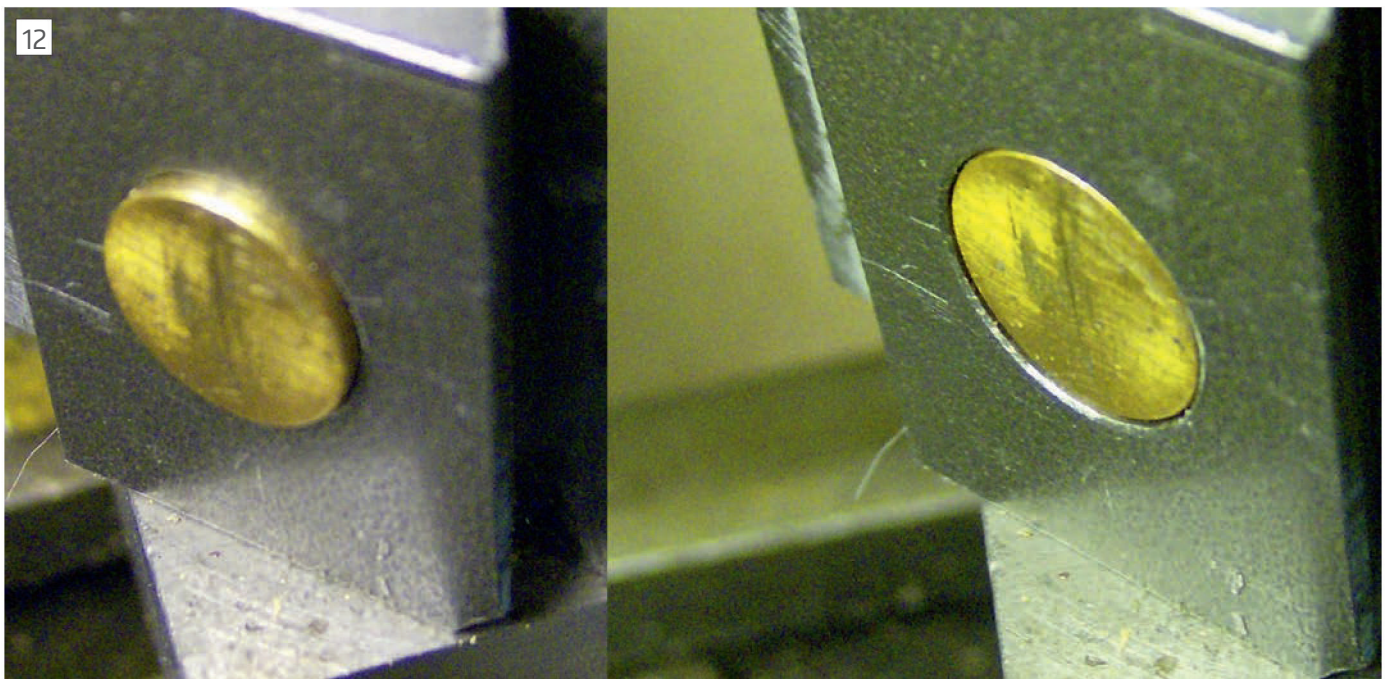
A contributor also has no way of knowing what size the picture will be used at, so any annotations are

unlikely to be the ideal size or colour to appear balanced and readable. Having annotations on an image limits

the ability to crop it to fit in an article. Removing annotations or numbering can be done but is difficult and always







*This example of a composite photo has three faults – the left-hand half is not sharp, the camera angles are different and worst of all, the two pictures have very different colour balance.*

degrades the image. Using annotated images as supplied is sometimes the only option, but it rarely looks good on the page.

In short, never add numbering to photos. As for annotations the answer is to supply two copies, one 'clean' and one annotated so that the designer can copy your annotations to suit how the photo is use.

## Compositing

Sometimes images may be 'composited' from more than one picture. This often makes it hard for readers to follow the logic of what is going on (especially when authors use numbering such as 4a, 4b etc.). A good composite at high resolution may be usable, but often we see an image where one part is lower resolution or a different colour balance to the other, **photo 12**. These are very difficult to correct and present well. It's better to avoid compositing images, but if you wish to do so, send the original photographs as well so the designer can retouch the originals before combining them.

## Filenames

To conclude, a final note on filenames. When submitting pictures for publication it's a great help to keep the file names of photographs as simple as possible. This helps ensure the right



*Hopefully readers will agree this is a good example of workshop photography.*

images are linked to the right places in the text. The worst things to do are to name each photograph with its caption and provide no references in the text to help in placing them. The simplest solution is to name them "photo 1.jpg" and so on, but you could replace the word photo with something relevant to the article. In the text of an article make sure you use photo references (like those throughout this article) so designers can get your images as close as possible to

the relevant text and readers can refer to images at an appropriate point. Finally, put your captions in a numbered list at the end of the article.

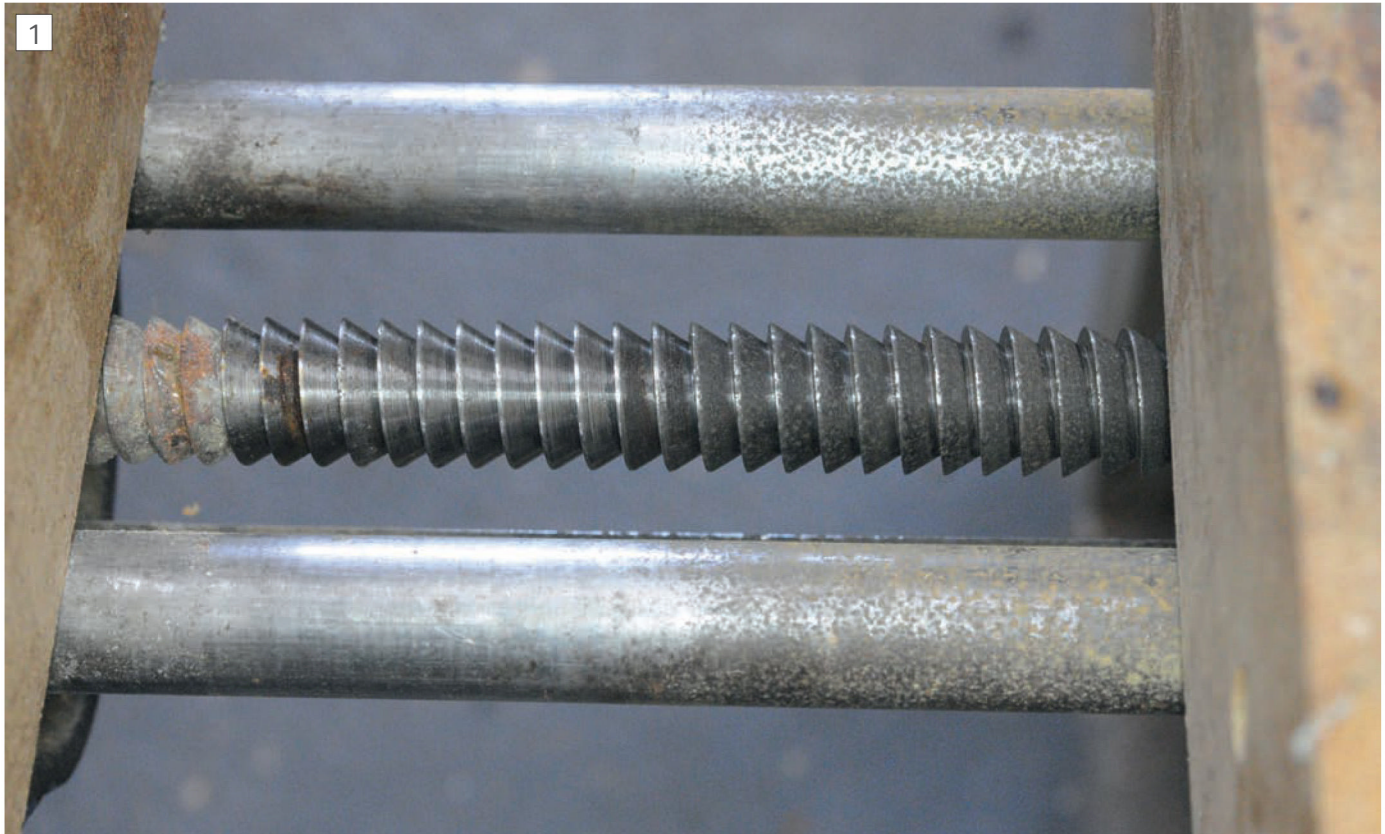
Finally, to end this instalment, hopefully **photograph 13** proves I can take decent workshop photos as well as the awful examples in this article. Next time I will look at things like composition and lighting, and how a little care in preparing your photographs can greatly improve your results. ■



# Adapting Schaublin Collets for a Pultra Lathe



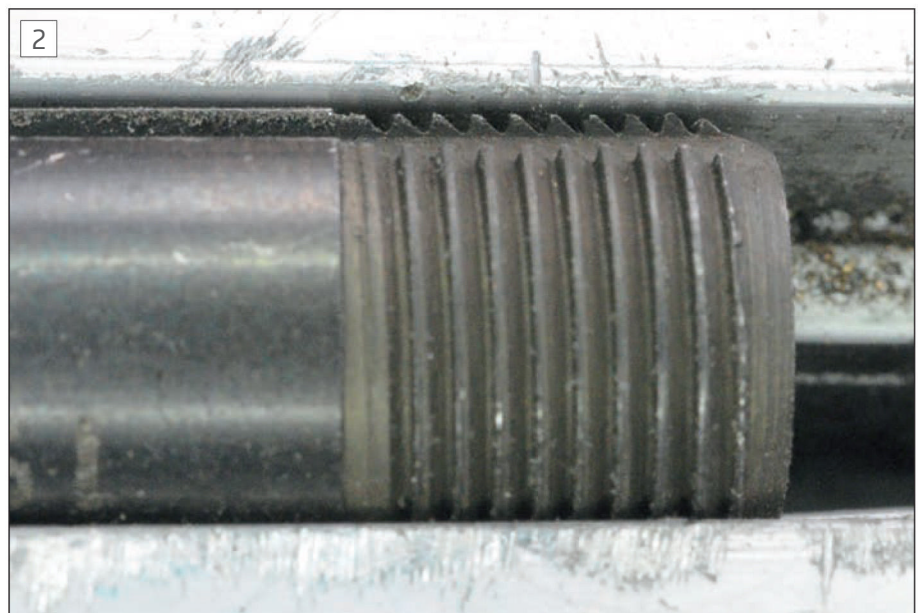
Rod Jenkins tackles the challenge of cutting an Internal  $\text{Ø}9.83\text{mm} \times 0.833\text{p}$  45°/5° Buttress Thread



*Vice buttress thread.*

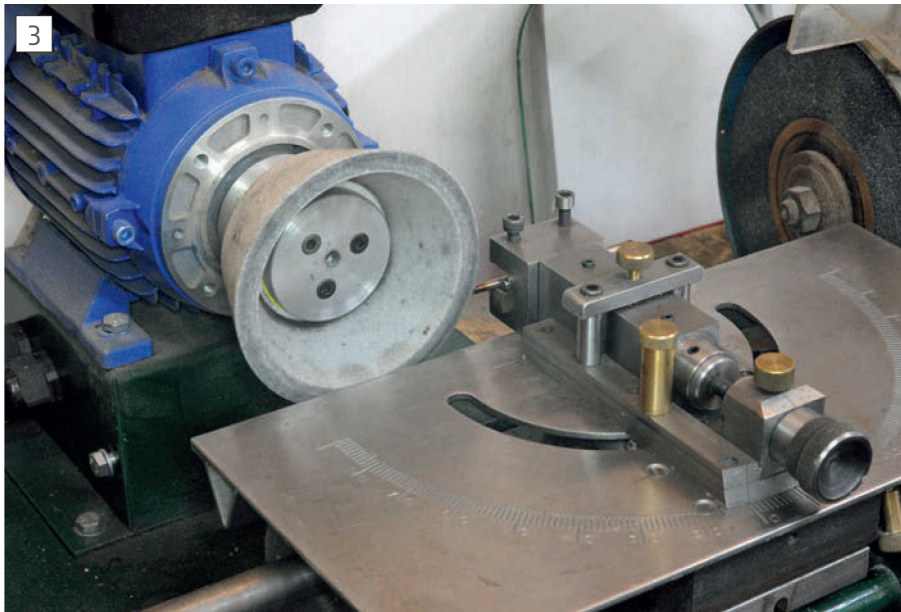
**W**hat kind of crazy thread is that? Well, it's the thread on Schaublin W10 collets. If you want to use a Schaublin collet in a Pultra 10mm lathe then you are going to need a draw bar with a suitable female thread. That was the challenge. Where to start? OK, I know what a buttress thread looks like; I've got one on my Record woodworking vice, **photo 1**. The Schaublin thread is a little smaller. Also, it differs from most other buttress threads I have known in a having a 5° angle on the leading edge rather than being perpendicular. Usefully, the male thread profile on the collet is sectioned by the keyway, **photo 2**, and it can be seen that the crest and root are both well rounded.

Grinding a conventional internal threading tool in this size and shape



*Schaublin collet thread.*





*D bit grind.*

from a lump of high-speed steel (HSS) bar would be tricky but by using a 1/8" round HSS bar inserted in a holder small enough to go down the bore of the draw bar I can grind all the angles using my Worden tool grinder. The holder was made from a length of 5/16" diameter

mild steel bar, cross drilled and reamed 1/8" for the tool blank, which was retained by a screw in the end. I reduced the working end of the blank to a D shape, **photo 3**, and then, after rotating through 90° was able to grind the 45° and 5° angles with a little bit of relief by

angling the table to 2°, **photo 4**. Space in the bore of the draw bar is tight so I left enough of the tool protruding to cut the thread and trimmed the other end flush with holder, **photo 5**.

Where does that 0.833mm pitch come from? A question posed on the always helpful Model Engineer Forum ([www.model-engineer.co.uk](http://www.model-engineer.co.uk)) elicited the response that if we think in fractions, then for the various sizes of collet: W10 is 10/12 mm pitch, W15 is 15/12 mm pitch and W20 is 20/12 mm pitch. So the weird decimal numbers do have some logic to them. However, though these pitches may be straightforward to set up on a metric lathe, finding a 0.833mm pitch setting in the gearbox of my imperial Myford Super 7 was going to take some searching.

By now, I am sure that many gearbox equipped Myford owners know about the 33/34 trick. The Reverend David Hoskins, back in Model Engineer No.3955, introduced us to the concept of replacing the 24-tooth gear on the tumbler stud with either a 33 or 34 tooth gear and selecting an appropriate

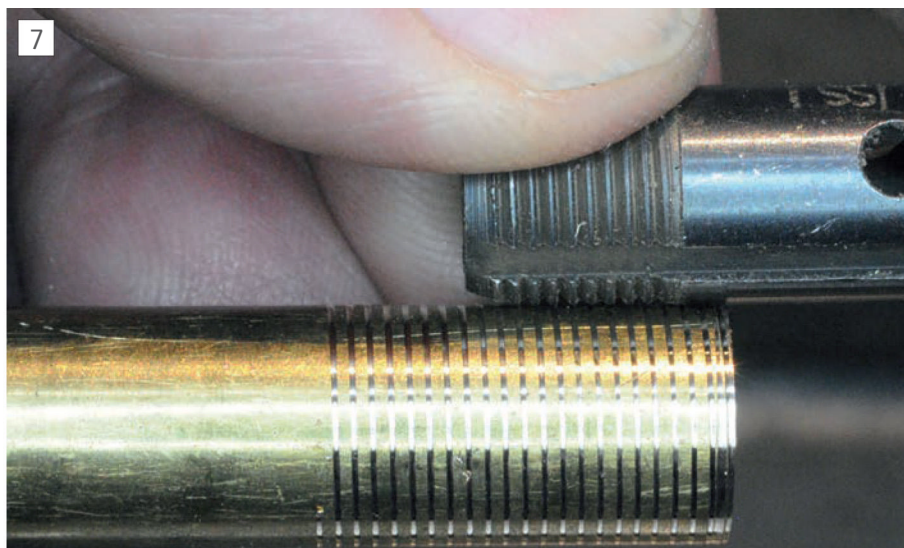


*Grinding the angles.*

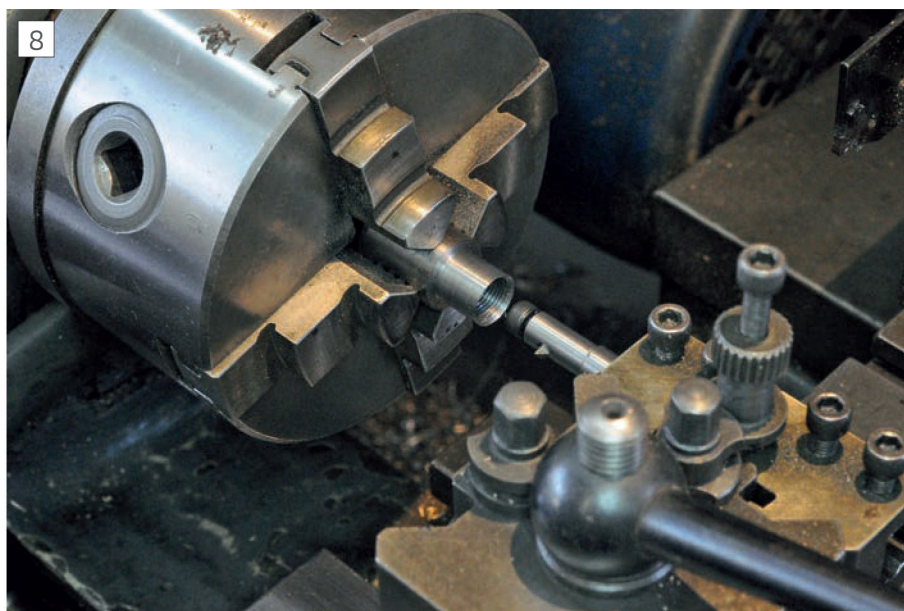








Scratch pass.



Cutting the thread.



It fits!

I produced tables of wacky thread pitches which can be produced by replacing the 24-tooth gear.

I did a scratch pass on a scrap of brass and compared it with a Schaublin collet, **photo 7**. It looked promising.

I now had to determine the core (tapping) size of the hole to cut the thread. A search through my library of books, including an old Machinery's guide to screw threads, and the internet failed to find a definition for this thread. However, the ME forum came up trumps again with a link to the current Schaublin catalogue which had a drawing for a tap to cut these threads and showed the diameter to the bottom of the thread (truncated) to be 8.8mm.

So, I had all the data and the lathe set up to cut the pitch. I drilled the draw bar blank for the core diameter. There was nothing unconventional about cutting the thread. As usual when cutting a non-standard thread, the straightforward option is to leave the clasp nuts closed at all times and reverse the motor to withdraw the cutting tool. This was made easier by my having a VFD controlled motor. I set the lathe headstock pulley on the slowest (non back-gear) speed and cut the thread with the speed wound down to minimum. Then I withdrew the cut with the cross slide, reversed the motor and wound the speed up to the maximum to withdraw the tool before making the next cut at slow speed, **photo 8**. Even though the tool looks fairly substantial it still required a couple of spring passes before it would stop cutting. Now it was just a case of cut and try until the collet would screw into the draw bar, **photo 9**.

That was an interesting and satisfying project. I was lucky that I was able to find a simple way of setting up the lathe to cut the correct thread but even without that option one of the thread calculators available on the Internet would, I am sure, have come up with a usable solution. ■



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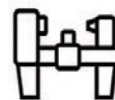


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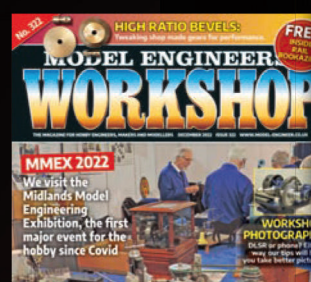
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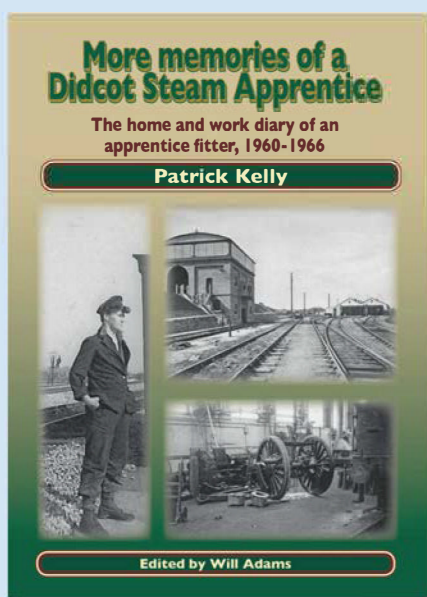
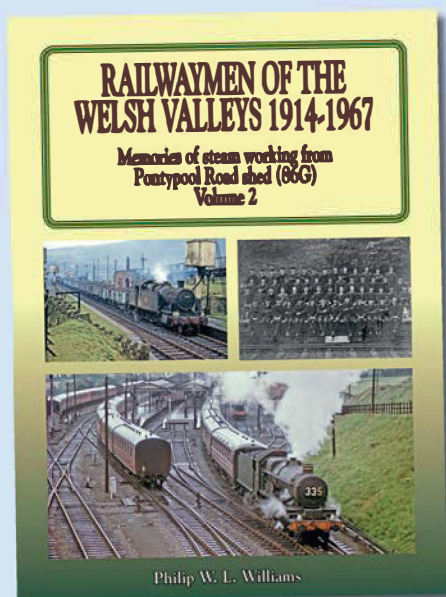
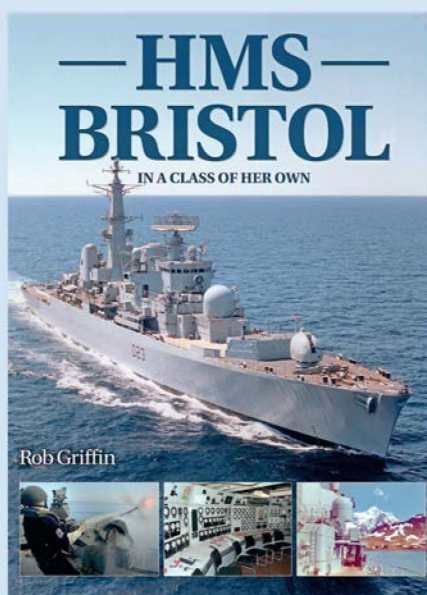
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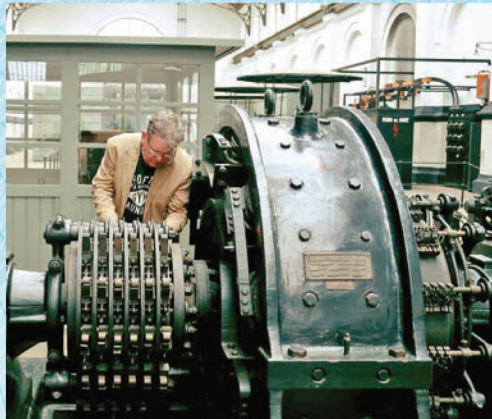
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