THE MAGAZINE FOR HOBBY ENGINEERS, MAKERS AND MODELLERS

No.305

MODEL ENGINEERS' WORKSHOP

Join the conversation at: www.model-engineer.co.uk

JULY 2021

INSIDE

- Tapping Guide for a Drill Press
- Adaptors for the Diamond Tool Holder
- Making Joe Noci's Electronic Lead Screw
- EMCO Screwcutting Clutch
- Theasby's Wrinkles
- Data Tables

And much more!

Bluetooth DRO for a Myford

Vertical Slide for Small Lathes

COVER STORY

Introducing Milling Machines

£5.25
mytimemedia ENGINEERING GROUP
05
9 770959 690140

GET MORE OUT OF YOUR WORKSHOP WITH MEW

MODEL ENGINEERS' WORKSHOP

Published by MyTimeMedia Ltd.
Suite 25, Eden House, Enterprise Way,
Edenbridge, Kent TN8 6HF
+44 (0) 203 855 6105
www.model-engineer.co.uk

SUBSCRIPTIONS
UK - New, Renewals & Enquiries
Tel: 0344 243 9023
Email: help@me.secureorder.co.uk
USA & CANADA - New, Renewals & Enquiries
Tel: (001)-866-647-9191
REST OF WORLD - New, Renewals & Enquiries
Tel: +44 1604 828 748
Email: help@me.secureorder.co.uk

CURRENT AND BACK ISSUES
Tel: 01795 662976
Website: www.mags-uk.com

MODEL ENGINEERING PLANS
Contact: www.myhobbystore.co.uk/contact
Website: www.myhobbystore.co.uk/me-plans

EDITORIAL
Editor: Neil Wyatt
Tel: +44 (0)1689 869 912
Email: neil.wyatt@mytimemedia.com

PRODUCTION
Designer: Andrew Tompkins
Illustrator: Grahame Chambers
Retouching: Andrew Tompkins
Ad Production: Andrew Tompkins

ADVERTISING
Business Development Manager: Angela Price
Email: angela.price@mytimemedia.com

MARKETING & SUBSCRIPTIONS
Subscriptions Executive: Beth Ashby-Njiiri
Email: beth.ashby@mytimemedia.com

MANAGEMENT
Group Advertising Manager: Rhona Bolger
Email: rhona.bolger@mytimemedia.com
Tel: 0204 522 8221
Chief Executive: Owen Davies

mytimemedia
print & digital media publishers

Model Engineers' Workshop, ISSN 0959-6909, is published monthly with an additional issue in August by MYTIMEMEDIA Ltd, Enterprise House, Enterprise Way, Edenbridge, Kent TN8 6HF, UK. The US annual subscription price is 52.95GBP (equivalent to approximately 88USD). Airfreight and mailing in the USA by agent named WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Periodicals postage paid at Brooklyn, NY 11256.
US Postmaster: Send address changes to Model Engineers' Workshop, WN Shipping USA, 156-15, 146th Avenus, 2nd Floor, Jamaica, NY11434, USA. Subscription records are maintained at DSB.net Ltd, 3 Queensbridge, The Lakes, Northampton, NN4 5DT. Air Business Ltd is acting as our mailing agent.

On the Editor's Bench

No Progress at Home

For a variety of reasons, I still have not been able to make any progress with my new workshop, aside from some minor work to temporarily fix some leaks in the roof and to repair the door. I'd like to thank the readers who have sent me a variety of advice and ideas. One problem I have is that the very long (16 foot) roof beams were fabricated from two pieces and have sagged, I have various schemes for jacking them up and reinforcing or replacing them. One thought is a 'false' wall dividing the space in two to break them into a double span. I cannot wait to get past the planning stage and put some of these ideas into action.

Shows are Returning!

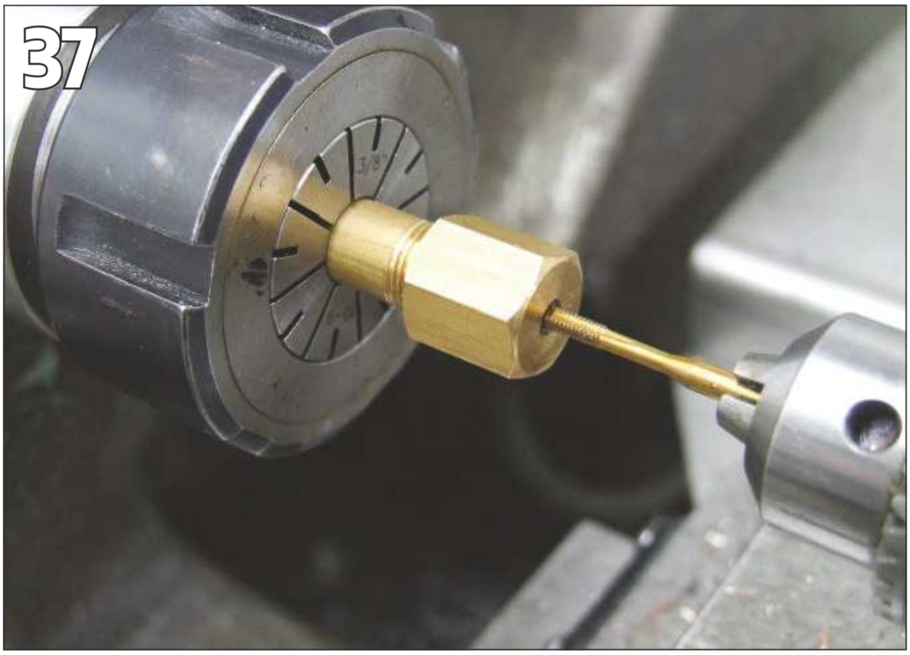
I am hoping that, by the time you read this the medical evidence will have supported a further relaxation in the measures to control the Covid 19 pandemic. As of today, the tension between returning to a more normal way of life and the need to keep 'new variants' under control fills the front pages. I have no idea which way things will go in the short term, but the longer-term outlook is good even if there are a few more delays.

Since the last issue I received my second dose of the Oxford/AstraZeneca vaccine, with just the mild side effect of feeling a bit tired for a day pr two. As more and more people are vaccinated, it does seem that we are, hopefully, getting past the worst and one sign of this is that this issue announces the planned return of the Midlands Model Engineering Exhibition in October, as well as the International Model Boat Show in November. I am sure that these, and any other modelling related events will be very busy if they go ahead.

Hopefully, there will continue to be more good news about more events across the UK in the coming months. I look forward to going along and meeting readers, suppliers and from across the hobby– both old friends and new faces.

Contents

37

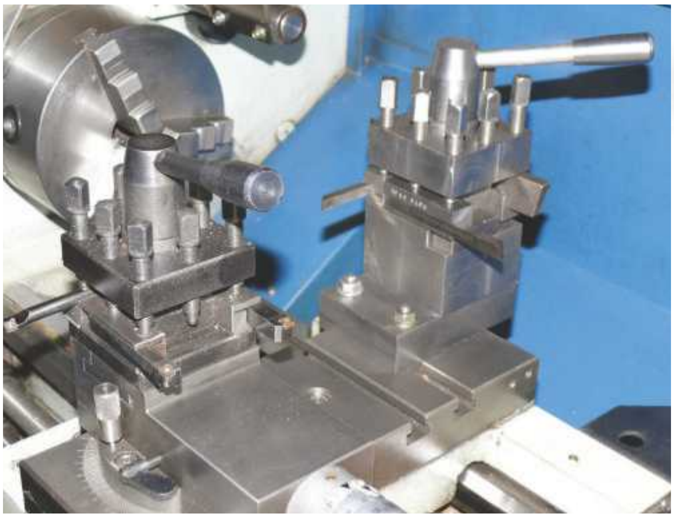


42

Coming up...

in our next issue

In our next issue we feature a rear toolpost designed by regular contributor, Howard Lewis.



Regulars

ON THE COVER »»

A Bridgeport milling machine is lightly built by industrial standards, but probably the largest practical option for a hobby workshop. Our introductory article on page 42 offers some more modest alternatives.

HOME FEATURES WORKSHOP EVENTS FORUMS ALBUMS

Visit our Website

www.model-engineer.co.uk

Why not follow us on Twitter: twitter.com/ModelEngineers hashtag #MEW

THIS MONTH'S BONUS CONTENT

Log on to the website for extra content

Visit our website to access extra downloads, tutorials, examples and links.
www.model-engineer.co.uk/extracontent

Joe Noci's Electronic Lead Screw
See what inspired Duncan Webster's ELS project in the thread:

Enhancing a EMCO Maximat V10P Lathe using Electronics - ELS Et-Al...
The thread has plenty of useful images and discussion.

Plus:

What is your favourite "unusual tool that you find useful" ?
Why not share yours?

Taper due to tailstock height misalignment
Is it an issue... or not?

Can one buy pliers with parallel jaws that lock like mole grips?
Do you have any examples?

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.

CLASSIFIEDS EXTRA SUBSCRIBE ARCHIVE SUPPLIERS

More Versatility for the Diamond Tool Holder

R. Finch adapts his Diamond tool holder to accept smaller toolbits

Over the years, I have struggled with re-sharpening lathe tools and now I have a large collection of weirdly shaped toolbits, none of which seem to give a good finish on any work. In view of this, I purchased a 'Diamond' tool-holder from Eccentric Engineering at the Doncaster Exhibition for use on my 4" centre height lathe, **photo 1**. The tool-holder has proved to be excellent in performance and I now use it for all my straightforward turning (usual disclaimer). I also bought their grinding jig for re-sharpening the toolbits. I already had four ¼ inch square toolbits which would do for replacement toolbits as I used up the toolbit supplied with the tool, so I felt that these might outlast me. However, I also had a large quantity (12) toolbits which were 3⁄16 inch square, so I asked at the Doncaster stand whether the tool-holder could take these 3⁄16 inch square toolbits. The answer was no – it would only take ¼ inch square or round toolbits.

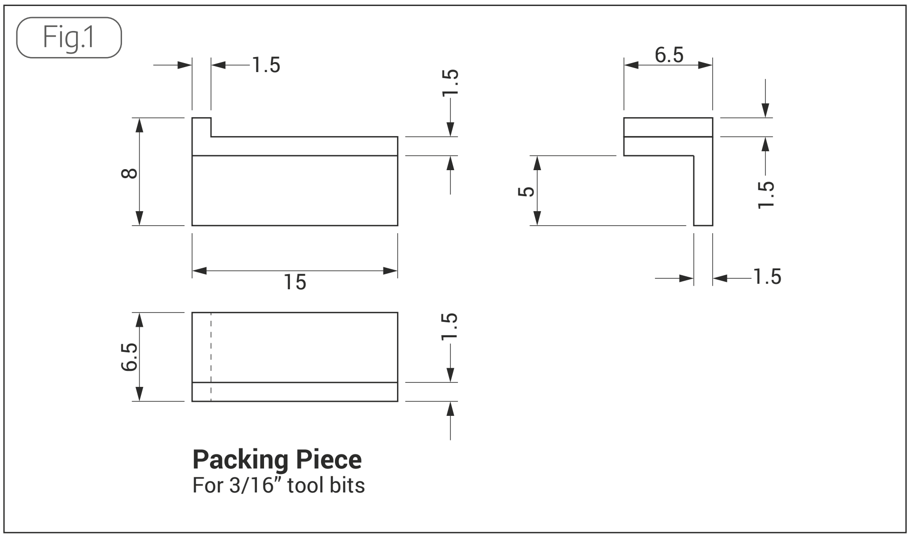
The 'Diamond' tool-holder

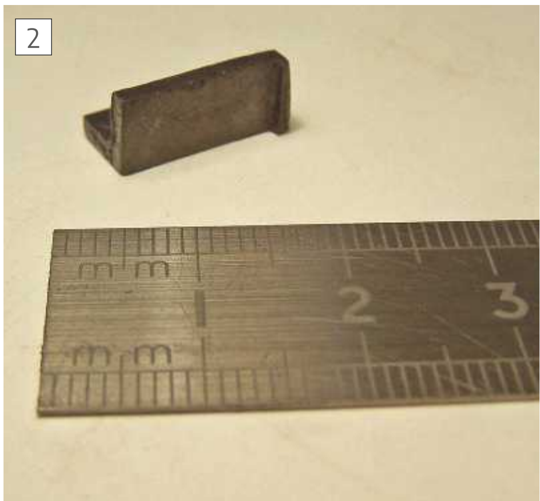
Holding smaller toolbits

Looking at the tool-holder, it seemed to me that it would be possible to insert a small 'L' shaped packing piece onto a 3/16 inch square tool to make it up to 1/4 inch square so that the tool-holder would grip the toolbit and packing piece as one and hold the smaller toolbit securely. After a bit of thought, I decided that machining from the solid would be easier than trying to bend a bit of 1.6mm thick sheet into an L-shape. The dimensions are as in **fig. 1** and just to make the drawing clear, the item is shown in **photo 2** and fitted to the tool-holder in **photo 3**. The small flange at the top is there to stop the packing piece falling out of the tool-holder when fitting the toolbit into the tool-holder.

Making the packing piece

I started off with a length of 8mm square mild steel bar and machined it down by 1.5mm for a length of 18mm. Using the vice stop and table stops, I turned the bar through 90° towards the front of the milling machine and again machined it down by 1.5mm, but only for a distance of 13.5mm. To mill the recess, I rotated it a further 180° and this time machined it down 5mm wide by 5mm deep to form the recess for the 3⁄16 inch square tool. I machined this recess



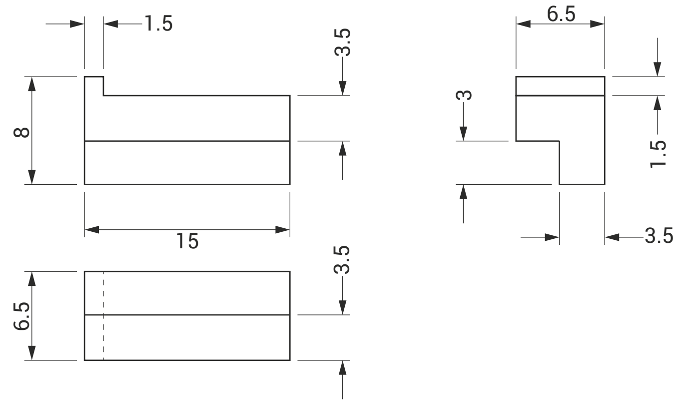


The packing piece

The 3⁄16 inch square toolbit with the packing piece

The first cut is the deepest!

Fig.2



Packing Piece
For 1/8″ tool bits

18mm long. I had to make sure that the 'flange' was on the right part to sit onto the top of the tool-holder. This can be seen in **photo 3**. At this point I simply sawed off the small piece and filed the end smooth. This now effectively makes the tool-holder smaller for the 3/16 inch toolbit and the toolbit and packing piece are the same size as the standard toolbit supplied. I made another with a smaller 3mm recess so as to take ⅛ inch square or round toolbits if needed, **photos 4** to **8**. The dimensions of this packing piece are shown in **fig 2**.

Re-sharpening

Now that I could grip a smaller toolbit in the tool-holder, it only required sharpening. Unfortunately, a smaller toolbit could not be secured in the original sharpening jig supplied with the tool-holder, **photo 9**. I did contemplate making a similar packing piece to fit the jig but decided that it might be a bit difficult to make it just the right size, so I decided to make a separate jig to hold the toolbit for sharpening using the bench grinder.

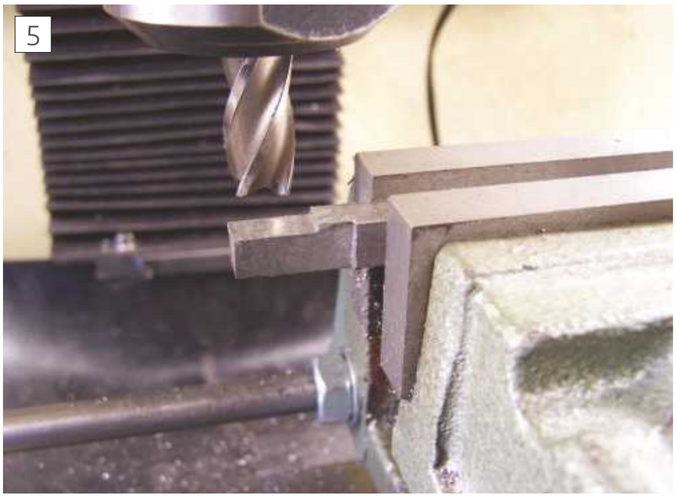
The instruction sheet that came with the tool-holder showed how to grind the toolbit using a standard 200mm diameter grinding wheel – all the correct angles were built into the jig, so unskilled tyros like me hopefully could re-sharpen the toolbit correctly. However, the sharpening jig supplied by Eccentric Engineering was designed to take ¼ inch square toolbits and to be used on a standard 200mm bench grinder by being placed on the flat tool rest. The instructions also stated that "On a smaller grinder you will have to drop the tool rest below centre" which was helpful but did not state by how much. I have a standard 150mm bench grinder so needed to determine by how much the rest needed to be lowered.

The tool is fixed in the jig such that the top edge of the toolbit is anywhere between 17 and 20mm above the tool rest, depending on the amount protruding from the jig when set for a 200mm wheel. When using a 150mm wheel, there is a reduction to three-quarters of the diameter, so to maintain the geometry, the toolbit height would have to reduced in direct proportion, so instead of the tip of the toolbit being say 18mm above centre height, it would need to be three-quarters of 18mm or 13.5mm. As the original tool grinding jig holds to tool 18mm above the centre line, it would have to be lowered by 18 – 13.5 = 4.5mm for the 150mm wheel. Whilst this does indeed set the tool jig height correctly, it then leaves the 'flat' diamond face distinctly hollow ground because of the curve of the grinding wheel. Smaller wheels exacerbate the problem of the hollow ground curve.

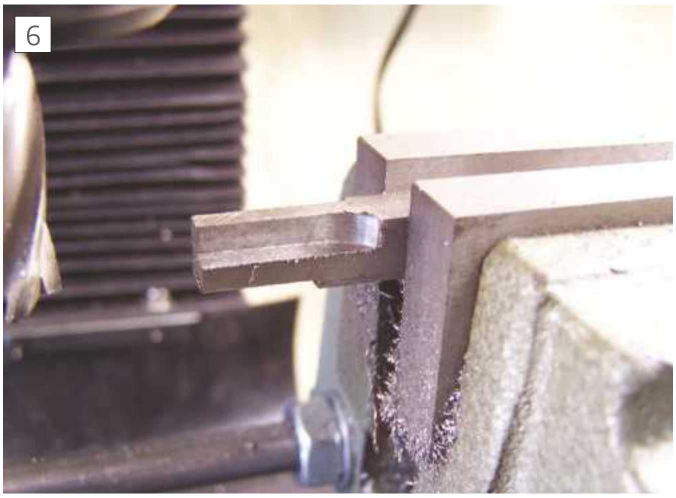
As a consequence of this difficulty of setting the grinding wheel rest down by 4.5mm, I decided to design my own jig to hold the toolbit. It would have to satisfy two criteria in that it would have to be straightforward to set up and it would have to take any size of toolbit since I could now use ⅛th, 3⁄16th or ¼ inch square and round toolbits.

The sharpening jig re-designed

Previously, I had modified a bench grinder to take a cup grinding wheel so



The second, shorter cut



The recess for the toolbit

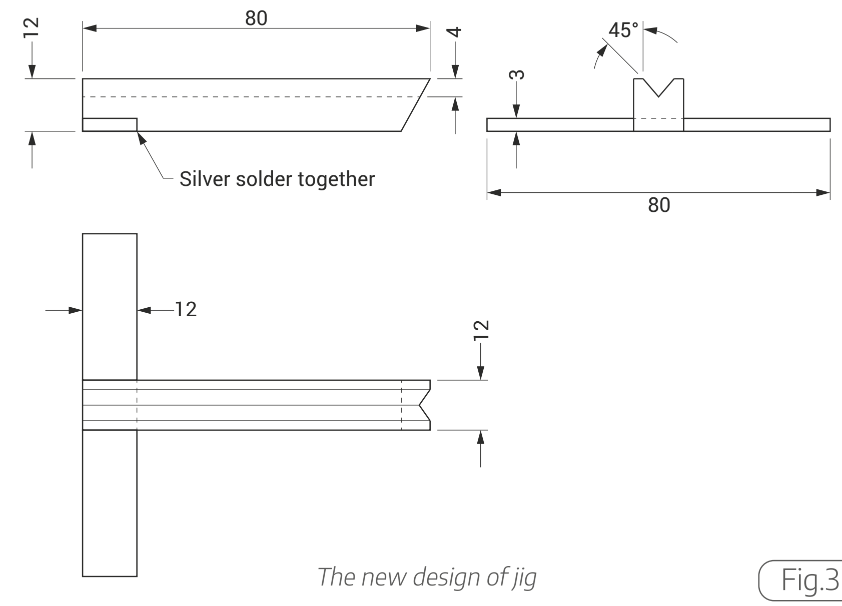
The packer still attached to the parent metal

I could use the flat surface of the cup to grind the diamond shaped surface to be flat rather than hollowed. Fortunately, the instructions supplied with the tool-holder (ref 1) stated that the correct geometry would be such that the diamond shape is at 57° from the front to back corner, so I made a simple jig, **fig. 3**, to hold the toolbit square on to the grinding wheel with the tool rest set at the complementary angle of 33° to the wheel, photo 10. This jig sits on the grinding rest against a simple parallel fence to allow the jig to side sideways to allow the toolbit to move across the surface of the wheel. The toolbit is simply held into the groove and against the grinding wheel by finger pressure and can be easily removed for inspection during the sharpening process.

This jig can also be used on a standard grinding wheel, providing that the tool-rest on the grinder is set to the tangent to the wheel, **photo 11**. The template has a 33° angle on it and the black line is level with the tip of the toolbit when placed on the grinding rest. The hollow ground tool works just as well as a flat ground tool, but it is a little less repeatable when re-sharpening as the tangent has to be set by eye.

Building the jig

This is quite simple to make but holding the 12mm square steel bar to mill the vee groove was not easy. The material of the bar is not critical – I used 080A15, but any mild steel can be used. The first thing that I did was to machine the 33° angle on to the end of the parent bar before setting up to mill the vee groove (fig 3). Eventually, after trying my tilting angle vice and various V block arrangements, I came up with the set-up shown in **photo 12**. Note that although the front clamp looks as if it is tilted, it



The new design of jig

Fig.3

The packers – 3/16 on the left and 1/8 on the right

The grinding jig supplied with the tool-holder

is actually vertical – it is just the macro lens on the camera which is distorting things slightly. This set-up allows full visibility of what is actually going on, but the bar is a bit long with a considerable overhang. To minimise the risk of chatter with such an overhang, I used a new slot drill (my slot drills do not get sharpened yet as I have not made a suitable jig to sharpen them). Very light cuts were taken but quite quickly the groove was machined in without problems.

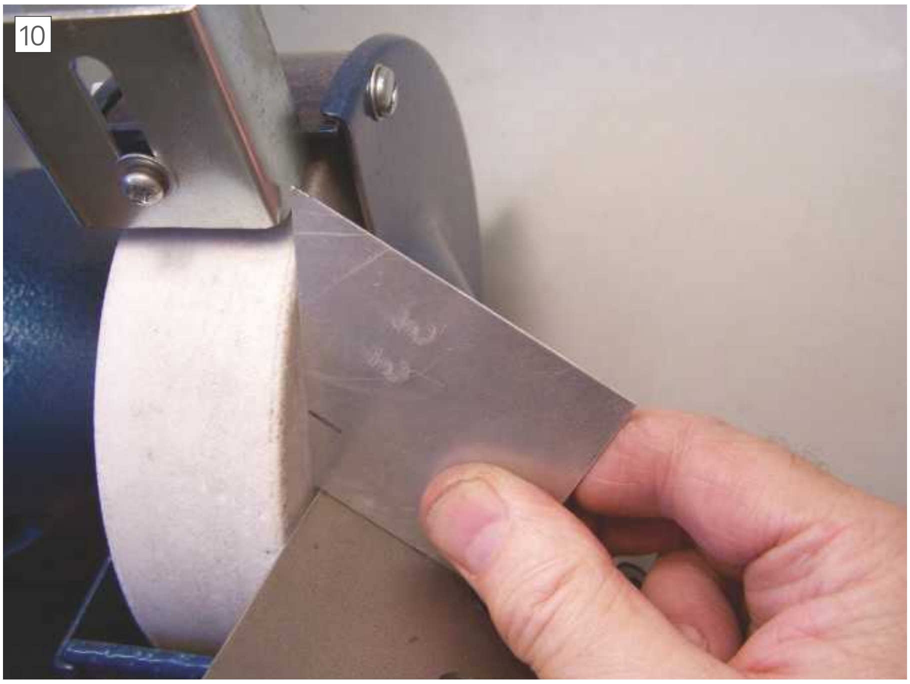
Having machined the vee groove, I cut off the appropriate length of the bar, faced the end off and machined the recess to take the guide bar. This was 12mm wide and 3mm deep. The vee groove must not be deeper than 6mm or else when grinding a long toolbit, the end of the toolbit will be lifted up by the grinding rest fence and the angle ground on the end of the toolbit will be incorrect. I did use a hacksaw to cut a very small groove into the bottom of the vee to make sure that the toolbit would always sit properly in the groove. If the cutter used to make the vee does not have really sharp corners, then it is possible that the vee will have a slight radius at the bottom – the hacksaw groove eliminates this very simply and effectively.

The steel guide bar is then silver soldered to the bar containing the vee groove. I took care to ensure that the guide was at 90° to the bar, but a slight error here will make little difference to the angle ground on to the toolbit. It is good enough if it looks at 90° measured by using an "engineer's eye". Obviously, the dimensions of the jig will need to be varied to suit your own grinder. After cleaning up, I decided to give the jig and the two packing pieces a rust resisting black oiled finish by heating up and dunking each part in oil, **photo 13**. I use rapeseed oil as this has a high flash point and is of a reasonably low viscosity when cold. It is also suitable for vegetarians and those with a nut allergy. I cannot be allergic to nuts myself as I have dozens of them in the workshop in all sorts of sizes and materials.

Using the new jig

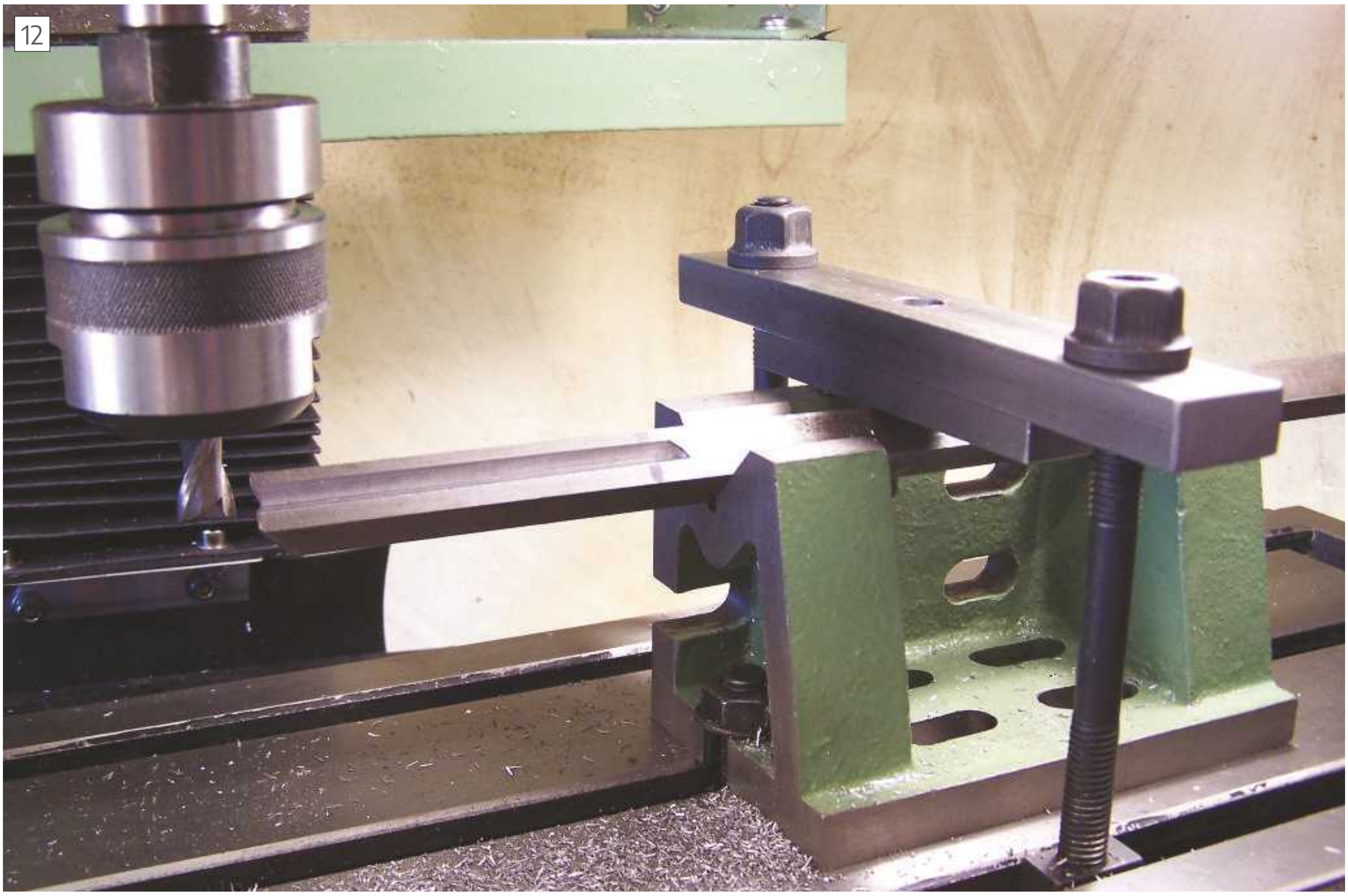
The grinding rest is set at the appropriate angle (33°) using a small aluminium angle gauge (photo 10). As the grinding wheel is flat, it is easy to set the grinding rest repeatedly at the correct angle, so minimising the amount to be ground off when resharpening. The jig is placed on the grinding rest with the toolbit held in the vee groove by finger pressure and held against the face of the wheel whilst being traversed across the face. The sharpening is quick and progress can be viewed easily by just lifting the toolbit out of the vee and it can be replaced exactly in the same way. This system will take any size of square or round toolbits, as the bottom of the vee groove is above the fixed fence on the grinding rest so the tool can be any length, **photo 14**. Note that this photo was taken with the grinding wheel stationary for obvious safety reasons. Although it looks as though the jig is in contact with the wheel, there is a clearance of about 2mm.

For turning brass, the tool-holder manufacturer suggested honing a small flat on the tip to prevent dig-ins, which seemed a good idea but would require it to be ground off again when reverting

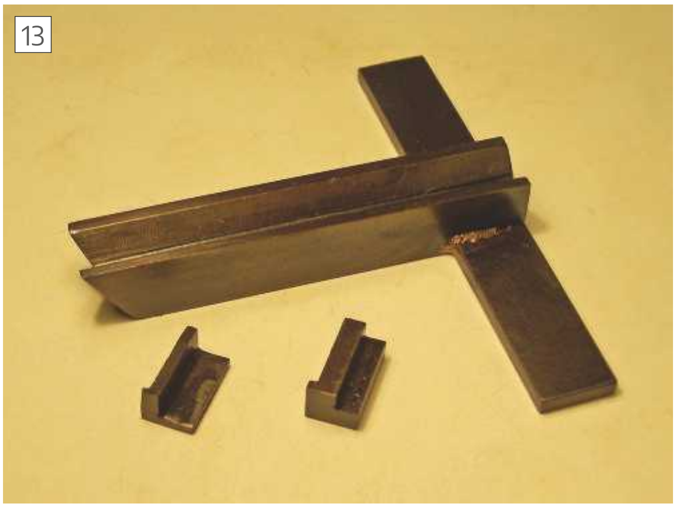


Setting the tool-rest at 33° using a template

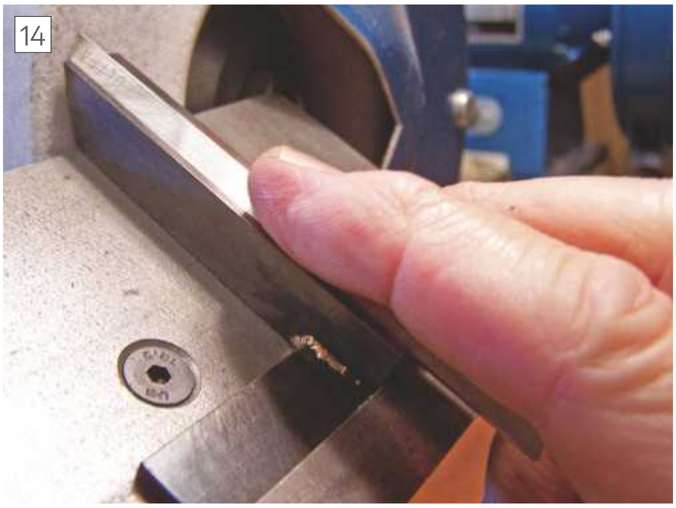
Setting the 33° angle as a tangent to the wheel



The set-up for machining the 45° vee



13 The finished jig and packing pieces with their oiled finish



14 Grinding the end – posed picture

to turning steel. It seemed to me that a second tool ground without any top or side rake would be simpler as it could be reserved for brass and would not require a re-grind when changing back to steel. However, the supplied jig would not be able to do this and I would be back to free-hand grinding with the weird angles appearing as I tried to get the tool correctly ground. In order to get the top flat with no side or front rake, the angle of the tool-rest has to be set at 14° instead of 33°, so a simple setting can be arranged using a second template. When a round toolbit is used, care is required to avoid the bit rotating in the vee but, with a bit of practice, a good flat surface can be formed. This allows round toolbits to be ground for forming radii when turning.

Conclusions

The Diamond tool-holder is an excellent piece of equipment (usual disclaimer) and the versatility of it can be increased simply by small additional packing pieces. The simple jig described allows the resharpening of any size tool bit. Resetting the grinder rest at 14° allows a toolbit to be ground without any side or front rake for turning brass. ■

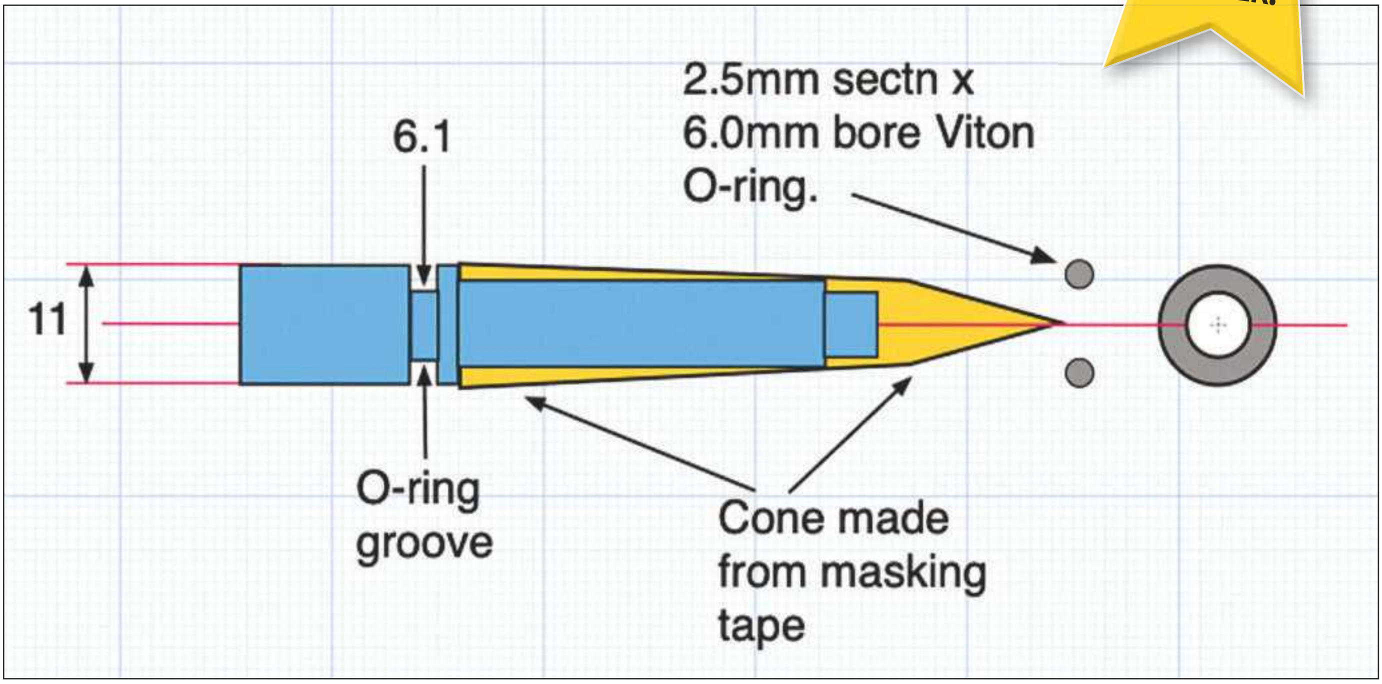
Reference

Instruction leaflet for The Diamond Tool Holder, Eccentric Engineering, **www.eccentricengineering.com.au**

Readers' Tips

Fitting Small O-Rings

TIP OF THE MONTH WINNER!



This month our lucky winner of £30 in Chester gift vouchers is Nigel Morgan from Suffolk who offers some practical guidance on the use of fiddly little o-rings.

The task was to fit a small Viton O-ring (2.5mm section x 6.0mm bore, making external diameter 11.0mm) to its groove in a brass shaft (unfortunately I omitted to take a suitable photo at the time).

At first sight it appeared inconceivable that this tiny O-Ring could stretch sufficiently to get into place in its groove without breaking or at least suffering damage in the process. However, the following procedure (found courtesy of a Google search) worked well and might help others contemplating the same problem.

Firstly, the edges of the O-ring groove were very carefully smoothed with the finest emery paper to remove any sharpness but without rounding them significantly.

Then the four O-Rings were boiled in a small tin for at least 15 minutes (no seasoning is needed!). While this was going on, the brass shafts (which included a threaded portion in my case) were wrapped in masking tape in a conical shape so that the larger end made the same diameter (11.0mm) as the largest part of the shaft. Thus, the idea is that when the O-ring is slid on, this cone will progressively stretch it from 6.0mm at the small end to 11.0mm (internal diameters) at its largest. Finally, the cone and the O-ring groove were liberally smeared with O-ring lubricant.

The shaft was then arranged vertically in a vice (using soft jaws to avoid damage) and the hot O-ring fished out of the boiling water and slid on to the cone as quickly and firmly as possible – all in one easy movement. When it reached its final destination (the groove) it simply dropped into place and contracted to its former diameter immediately without any apparent damage. My packet of O-rings included a spare, so I was able to experiment first (always a good idea) before tackling the job for real – there were four to be done.

I was frankly amazed that it all worked so well and would say "don't forget Google" for other workshop conundrums that arise.

Nigel Morgan

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** marking them 'Readers Tips', and you could be a winner. Try to keep your tip to no more than 400 words and a picture or drawing. Don't forget to include your address! Every month I'll chose 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 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.

Building the Noci ELS

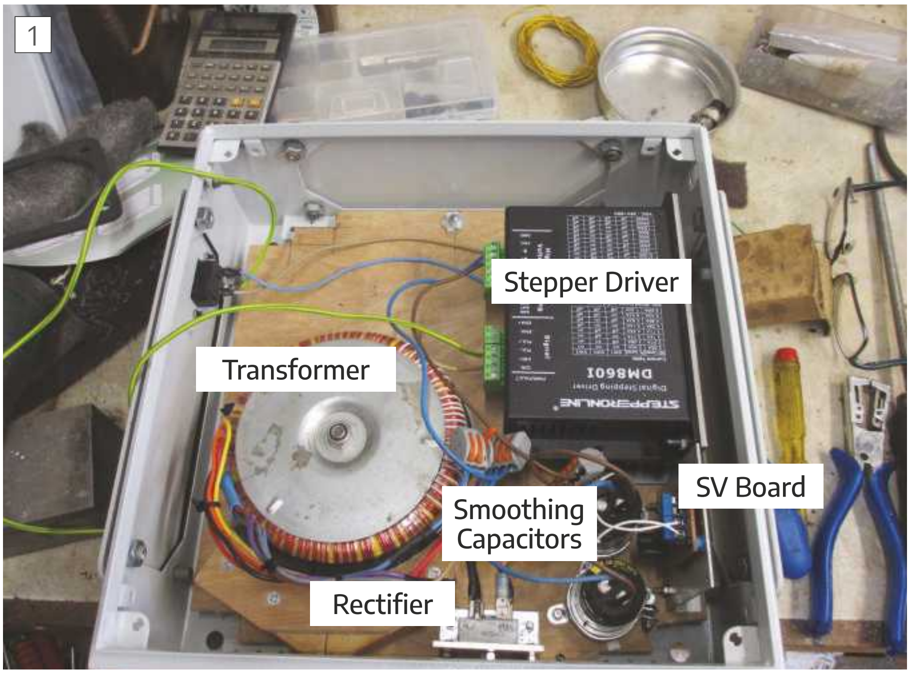
Duncan Webster builds an Electronic Lead Screw for his lathe.

Possibly one of the least helpful titles for an article! The answer to the first query is easy, Joe Noci designed the electronics, I just built it, and if I can do it so can you. There is no need to understand the software, just wire it up and it works. (Joe's build is documented on the Model Engineer forum in the thread "Enhancing a EMCO Maximat V10P Lathe us-ing Electronics - ELS Et-Al..." at **www.model-engineer.co.uk/forums/postings.asp?th=125682)**

So what is an ELS? It's an Electronic Leadscrew for your lathe, instead of being driven by change wheels/ Norton gearbox, the leadscrew is driven by a stepper motor. My lathe is a metric Myford 254S, it does have a screwcutting gearbox, but even to get the full range of metric threads I have to change the drive gear setup, to cut imperial some really odd combinations have to be set up, and I really hate fiddling with changewheels. With the ELS I can cut imperial and metric threads with equal ease, and it stops under electronic control, so no panic stricken grabs for the half nut lever. As a bonus extra it will work in normal turning mode, allowing me to change the feed rate on the fly to optimise surface finish.

So how does it work? A stepper motor is a specialised motor which advances by a small angle every time a pulse is sent to it's driver unit. In my case the motor/driver combination is set up to rotate 1/400 turns for one pulse, and the leadscrew is driven by a 2:1 tooth belt, so one pulse = 1/800 leadscrew turns. Driven by a second much smaller toot belt direct from the lathe spindle we have an encoder (**ref. 1**) which outputs a train of pulses as the spindle rotates, in my case 1000 pulses per rev. It makes the following explanation a lot more understandable if for the moment we assume 800 pulses per rev. The electronics doesn't care.

1

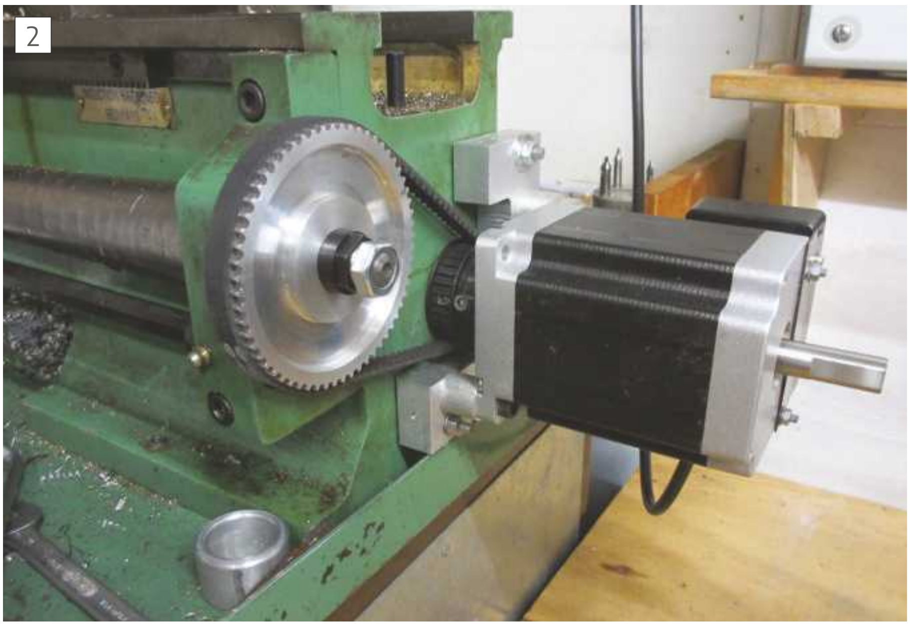


PSU with driver.

If every time the electronics receives a pulse from the spindle encoder it outputs a pulse to the stepper driver, the leadscrew will rotate at the same speed as the spindle and as I have a 3mm pitch leadscrew I would cut a 3mm pitch thread. If The electronics outputs a pulse every 2 spindle pulses I would cut 1.5mm pitch and so on. What if I want to cut 2mm pitch? I'd like to send a stepper pulse every 1.5 spindle pulses, but you can't have half a pulse. What it does is send a stepper pulse after 1 spindle pulse, then after another 2, then after 1 and so on. The error involved is very very small, and is not cumulative. This technique can be extended to any required thread pitch using a bit of clever maths called Bresenham's Algorithm. This need not trouble us further, if you want more information Google it, it is built into Joe's software, and it just works.

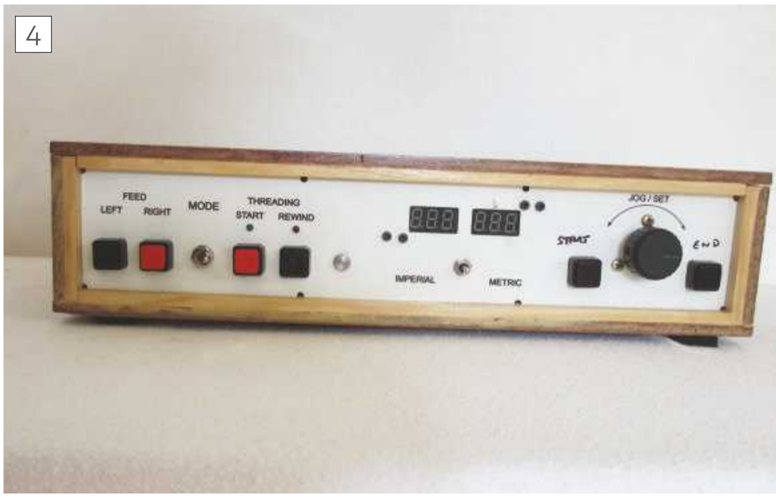
This would all be very well if we only wanted to do one pass, but we want to do lots, and to maintain alignment

2



Stepper 1.

Encoder.



Front panel.

between subsequent cuts. To achieve this the spindle encoder is a bit cleverer than so far indicated. The 1000 pulses come on 2 channels giving what is called a quadrature output, this enables the electronics to know which direction the spindle is turning, and there is a third channel (Z) which outputs one pulse per rev. If we always start the pass with the saddle in the same position along the bed and the spindle in the same angular orientation, then alignment is assured. What we do is before the first pass position the saddle clear of the job to the tailstock end and press a button to define 'thread start', with the half nuts engaged advance the saddle along the bed using the stepper motor to the left hand end of the thread and press 'thread end' (prosaic lot us engineers!). The electronics counts the steps, so it knows where the saddle is relative to the start point. Then press 'rewind' to return the saddle to the start position. Due to backlash in the leadscrew/half nuts this isn't necessarily exactly the same as the first start point, but it doesn't matter, as soon as the stepper starts driving to the left this backlash will be taken up. When you then press 'start' the electronics waits until it gets the one per rev spindle pulse before it starts the stepper, when you reach the end of the thread it stops the stepper and you can back out of the cut, press 'rewind', advance the tool and carry on. This all relies on the stepper motor being able to start the leadscrew from stopped to full speed within one spindle revolution, which is why you need such a big stepper motor. My set up will reliably cut 3mm pitch at 150 rpm, at 190 rpm it starts to miss the odd pulse, at 200 rpm it gives up the ghost completely. At 150 rpm and 3mm pitch the saddle is moving down the bed at 450mm per minute which is quite fast enough for me thank you. I've had it doing 1mm pitch at 500 rpm, even faster. Later on, we'll see how to improve this performance if you wanted.

Note that with this setup, if the spindle slows down when the tool contacts the work it doesn't matter. I am led to believe that this is not the case with Mach3.

By selecting 'feed' instead of 'thread' you can then set a feed rate in mm/sec. This does not require synchronisation with the spindle, so the spindle encoder is not used, good job as the pulses would be coming a bit fast at 2000 rpm, even this electronics has its limits. You can change the feed rate during cutting. The 254 has a separate hexagonal feed shaft for doing plain turning and facing. When using this, feed rates are 1/6 of what they would be if you were using the leadscrew. Currently the electronics doesn't allow for this (it could do) but this is not as bad as it sounds, if you just divide the spindle rpm by 100 and set the feed rate to this figure in mm/sec you actually get a rate of 0.1mm per rev, which is not a bad starting point. I used 4 thou per rev for years on my ML7, it didn't have a screwcutting gearbox, and as I said earlier I hate messing with changewheels. This hex feed shaft is driven from the leadscrew by a pair of gears inside the gearbox. I can disengage the gearbox entirely, but when the hex shaft is turning so is the rest of the gearbox.

So having gone through the basics of how it works, how is it implemented? Start with the power supply. If you don't have a well-equipped junk box, the easiest way would be to buy a 60v 5A switch mode power supply. I had a 35V toroidal transformer, rectified and smoothed this gives about 50V, and it seems to work OK. The 5V needed to power the electronics was derived from a few turns of thin white flex round the toroid and a little board with bridge rectifier, smoothing capacitor and a 7805 voltage controller. Had I not already had all this in stock, a second 5V switch mode supply would be a lot easier, but being a Yorkshireman using what you've already got is very attractive. This is all shown in **photo 1**.

The stepper motor controller (**ref. 2**) was bought off ebay, as was the enclosure, which unusually wasn't the most expensive part, but I think I got it at a very good price. I made a plywood backplate to support everything inside the enclosure, the big transformer sits in a wooden cradle screwed to the backplate and lined with sponge. To let out any heat the rubber gaskets under the side panels were ditched and replaced with spacers so the panels stand off by a few mm. I have no intention of using this in the rain, and you'd have to try fairly hard to get in contact with any mains wires, which are in any case heat shrinked.

The stepper motor (**ref. 3**) (again off ebay) is mounted off a 20mm aluminium plate bolted to the end of the lathe bed. I had expected to have to adjust the thickness of the spacers under the three mounting bolts to get it all square, but it was pretty good with just one 3mm washer under each stud. The GT3 section belt was sized by scaling Joe's. I could fit bigger pulleys, so could get away with a narrower belt. I made a dummy motor (just a plate with the four mounting holes and a central spike for the pulley) so I could mount the pulleys in situ, get the belt tension right and spot through for the motor bolts. Slotted holes for the ally plate/bed studs allow final adjustment. The existing leadscrew had a woodruffe key to allow fitting of a leadscrew hand wheel, it looked a bit lightweight for this application, but I then found a taper lock bush device available from RS which could cope with the torque and only cost £12 (**ref. 4**). Saved having to cut another keyway if nothing else. This is all shown in **photo 2**. I will make a belt guard in the near future.

The spindle encoder, **photo 3**, is mounted on the existing change wheel quadrant and is driven by a small toothed belt. The drive pulley was bored out the same as a change wheel, and a very kind chap who I contacted via the ME forum put a keyway in it for me. I'm ashamed to say I've lost his details so I can't thank him here. He will know who he is. I was going to find a scrap change wheel and loctite the tooth belt pulley on, but this is altogether better.

Now to the clever bit. The front panel, **photo 4**, houses all the push buttons, display etc. I just drew it up in CAD, sent the dxf to an engraver and got it back finished to size, all holes in place for the princely sum of £15. Not worth bodging it at that price. Unfortunately, I forgot the 'thread start' and 'thread end' lettering, so that will be done on a separate bit and glued on. The material is Trafolite, a hard plastic laminate with 2 layers of white sandwiching a layer of black, thus if you engrave part way through you get black letters on a white background. The back panel is just 16g aluminium and supports the various sockets. The top, sides and base are plywood with glued on 6mm square to form slots to locate the front and rear panels.

The electronic brain is a Nucleo board, think Arduino on steroids. Rather than switching the pulses to the stepper motor direct from the Nucleo there is a little board carrying two transistors which form an interface. This board is also used as a splitter to provide 5V and ground to the various other bits that need it. Starting from the left we have feed left and right, mode to select between normal feeding and screwcutting, threading start and rewind. The display in the middle shows the tpi or pitch for screwcutting, or the feed in mm/sec for normal turning the switch underneath selects imperial or metric. The knob labelled 'jog/set' is another encoder, which is used to set the tpi/pitch/feed and to move the saddle along the bed to set thread start and end. With one exception this all went very easily, mainly because I just copied Joe's schematic. Where I had a problem was with the input from the lathe start/stop buttons. The electronics need to know when the main spindle start/stop buttons have been pressed. I have a VFD (variable frequency drive) controlled by the original lathe push buttons. These buttons are momentary contact, so even if they had spare contacts wouldn't have been any use. With the help of yet another contributor to the ME forum I found at least one way of getting a signal from the VFD itself, but it turned out to be energised when the VFD output frequency fell below a low value. As the output frequency ramps down when the stop button is pressed, this signal did not appear until a couple of seconds or so after the stop button was pressed. Not good enough, I eventually finished up with another little board carrying a relay which reacts instantly to the buttons being pressed and gives a volts free set of contacts for the ELS electronics. All this is visible in **photo 5**.

Nothing is ever this simple though. When I installed my milling machine, I put it at the tailstock end of the lathe, far enough away so that the table traverse handwheel would clear the end of the lathe bed. You've guessed, it didn't clear the stepper motor which is now sticking out at that end. Fortunately, I noticed this before I power fed into it! Lifting even a fairly small milling machine on your own using levers and fulcra is not easy, but I've lifted it by 50mm and clearance is restored. I feel quite pharonic (google it). Next step is to make and fit one of Joe's rattle dampers, **ref. 5**, but that can wait. This should make it run faster (it's pretty quick now!)

So how long did this all take me? From starting to finishing a very long time, but I kept on getting sidetracked onto other things, and even when I got the electronics wired up and double checked I got into a funk about powering it up. Eventually I just told myself not to be silly and plugged it in. No magic smoke, and after sorting out the push button issue above and reading the instructions again it works, just like that. If I had got all the bits together before starting, I could have done it in a couple of weeks, less if using switch mode power supplies. This has been immensely satisfying and makes a change from making little puffers. Why not have a go? You don't need to understand how it works, and you certainly don't need to understand the software, just follow the schematics, check, check and check again and it works, magic.

Finally thanks once again to Joe for sharing his design and putting up with my endless emails. ■

References

1. Spindle encoder E6B2-CW26C

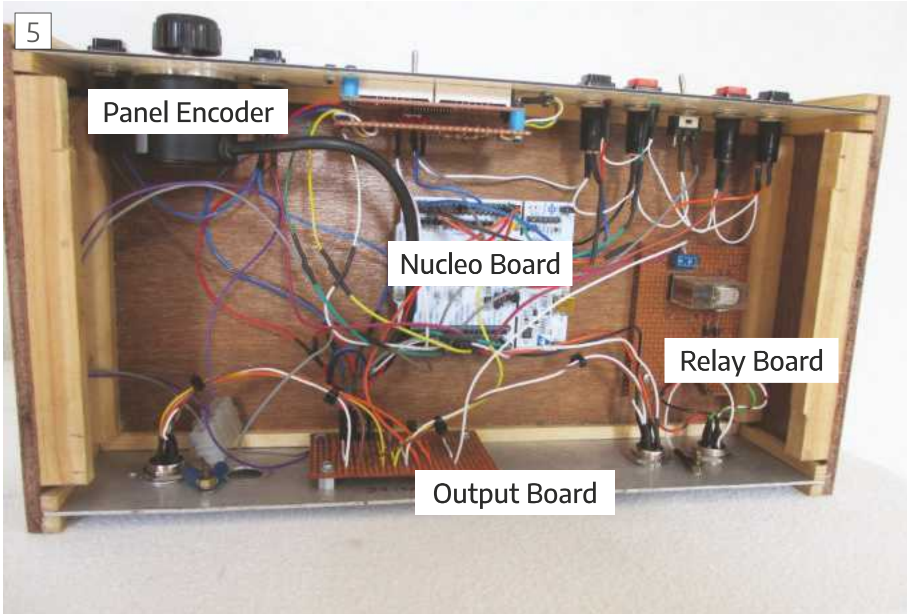
2. Stepper motor controller DM8601

3. Stepper motor NEMA34 HJ1456B 8.4 Nm

4. Taper lock type bush RS part# 7784950 or Trantorque 184CO112 (more expensive)

5. https://www.model-engineer.co.uk/forums/memberpostings.asp?c=161611&p=11, scroll down to 07/11/18

5



Inside control box.

Scribe a line

YOUR CHANCE TO TALK TO US!

Drop us a line and share your advice, questions and opinions with other readers.

Cutting Fluids

Dear Neil, the contribution from Peter King on the subject of cutting fluids which appeared in issue 304 reminded me of a batch machining saga back in the 90's. A specialist CNC firm had asked me to take on a job which was essentially a nuisance to them, putting grooves into M10 Allen screws. They also reported an unsatisfactory experience on tip life and wondered if I could get better results. The screws were held in a home brew collet shown in photo1 and the job run on a Herbert 2D capstan. This arrangement allowed the parts to be loaded and unloaded without stopping the spindle saving a significant amount of time over several thousand parts. Each groove required a special carbide tip ground to size at some cost. The two tools are illustrated in photo 2. The job was started with the machine as it had been previously set up with the coolant tank filled with white suds. After some experiments with feed and speed, the yield was about thirty parts per tip. The first change was to drain the machine and fill with a neat cutting oil, possibly BP Cilora. That gave a sizeable advantage, moving up to about 150 parts per tip. Thinking sideways, the real breakthrough came after a conversation with a local heat treatment specialist who was able to first anneal all of the Allen screws, then after machining, restore them to their correct specification. Machining the annealed screws raised the performance up to around 1500 parts per tip.

I would echo Peter's comments about mist cooling and add a further caveat concerning neat cutting oil. Again back in the 90's, I had another Herbert 2D stripped down to serve purely as a heavy duty "horizontal drilling machine". Parts to be drilled prior to tapping M10 or M12 were located in a capstan mounted fixture which allowed rapid loading/unloading of several hundred parts per hour. The coolant was the same neat oil, and when the machine was worked hard, a significant pall of blue smoke was generated over and around the machine. The quick and dirty answer was to set up a fan to blow fresh air at the operator.

For most model engineers, rapidity in machining is not of the essence, and the problem is unlikely to arise, however for those who do have a commercial interest, this is a safety issue worth keeping in mind.

Dave Fenner

Edge Finding

Dear Neil, I've enjoyed the articles on edge finders over recent months. I'm a little surprised however that traditional methods are not occasionally mentioned.

A method which has remained my one of choice was taught to me by the Metal Work Teacher at school in the early fifties even before my apprenticeship. Understandably he wouldn't let us do it ourselves until he thought we were capable.

The method is to wind the tool close to the work piece, then holding a cigarette paper (signs of the times) at one end, carefully offer the free end into the tool/workpiece gap. Then equally carefully, wind the tool towards the workpiece. The tool will eventually snatch the cigarette paper out of your hand. It will almost always shred the paper neatly along the cutting edges of the tool without even scarring the workpiece. Almost a guarantee of zero clearance. "Fag" papers are now a rarity but any thin paper will do e.g. newsprint. I seem to remember "Fag" papers were about 2 thou thick.

In this modern age H & S people will be horrified by it. All it needs however is care and confidence.

Jim Perry

Hi Jim, my approach is to stick half a 'blue Rizzla' to the work with spit, which avoids any risk of chewed up fingers. Blue are the thinnest grade and are about 1 thou thick. As a non-smoker one packet lasts me ages! – Neil.

Data Sheets

Dear Neil, I have just received April 2021 issue of Model Engineers Workshop and have seen a major mistake in the printing of this issue. The four centre pages are intended for the Model Engineers Workshop Data Book, however the tables for drill sizes and decimal sizes have only three correct pages as one page has been printed in double!!!

There is always a problem for overseas readers in as much that the given telephone numbers for contacting the magazine including the renewal operation has a UK telephone number which is not obtainable when calling from outside the UK.

For your information I have complete sets of both the Model Engineer and the Model Engineers Workshop, correctly bound from the first issues. I doubt there are not many readers who also have both complete sets, around the World.

Philip T. Bellamy, Switzerland.

Well spotted Philip, I am confounded as to how the repeat arose, as the submitted copy for that page had two different tables side by side. We will print the missing page as soon as we can without spoiling the ongoing sequence.

The 0344 243 9023 number is a special non-geographic rate for UK readers so it costs no more than 01 or 02 calls, wherever they live or if they call on a mobile phone. The 'rest of the world' number printed below it, +44 1604 828 748 will take you through to the same call centre. - Neil.

On the Wire NEWS from the World of Hobby Engineering

THE MIDLANDS MODEL ENGINEERING EXHIBITION

Thursday 14th to Sunday 17th October 2021 at Warwickshire Event Centre

Meridienne Exhibitions have confirmed their intention to deliver the Midlands Model Engineering Exhibition this October.

They will continue to monitor and act on advice from the Government and respond accordingly to guidance throughout the coming months, to ensure the event can safely be delivered with compliance to any Covid-19 requirements that may be in place at that time.

Tickets are expected to go on sale in late July. Make a note in the diary now of the dates and see www.midlandsmodelengineering.co.uk for all the latest information.

The exhibition showcases hundreds off models from societies and individuals for visitors to enjoy along with a wide range of outside attractions, workshops and lectures as well as all the leading suppliers. The event attracts thousands of visitors and is supported by around 50 specialist suppliers with displays by over 40 clubs and societies. With upwards of 1,000 superb models on display.

Why not be part of the show and enter your work in the 32 competition and display classes? Cash prizes and trophies will be awarded to the best entries. Entry forms are available on the website.

STOP PRESS: Meridienne Exhibitions have also announced that the **International Model Boat Show**, one of the UK's Leading Marine Modelling Exhibitions will take place on **Saturday 6th & Sunday 7th November 2021** at Warwickshire Event Centre. See **www.modelboatshow.co.uk** for all the latest information.

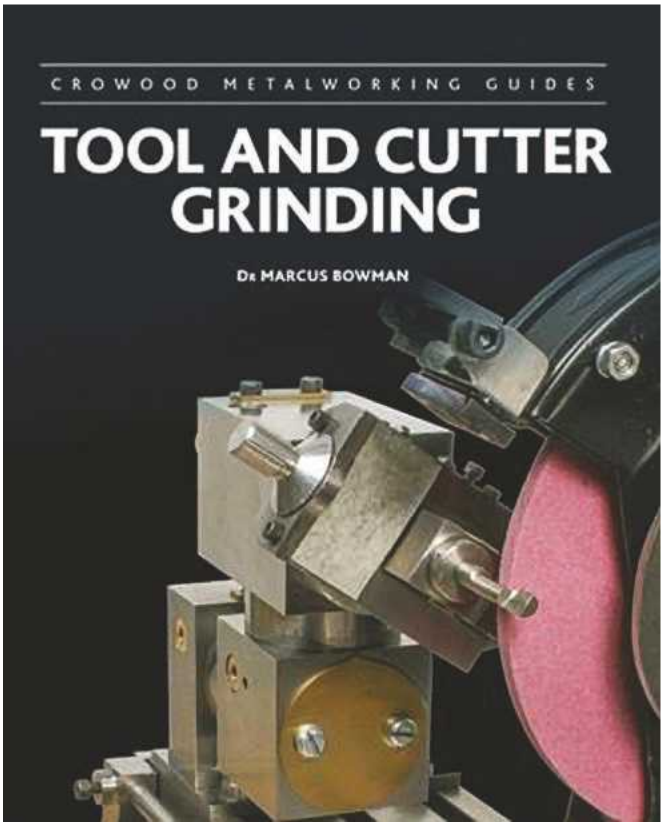
Tool and Cutter Grinding by Dr Marcus Bowman

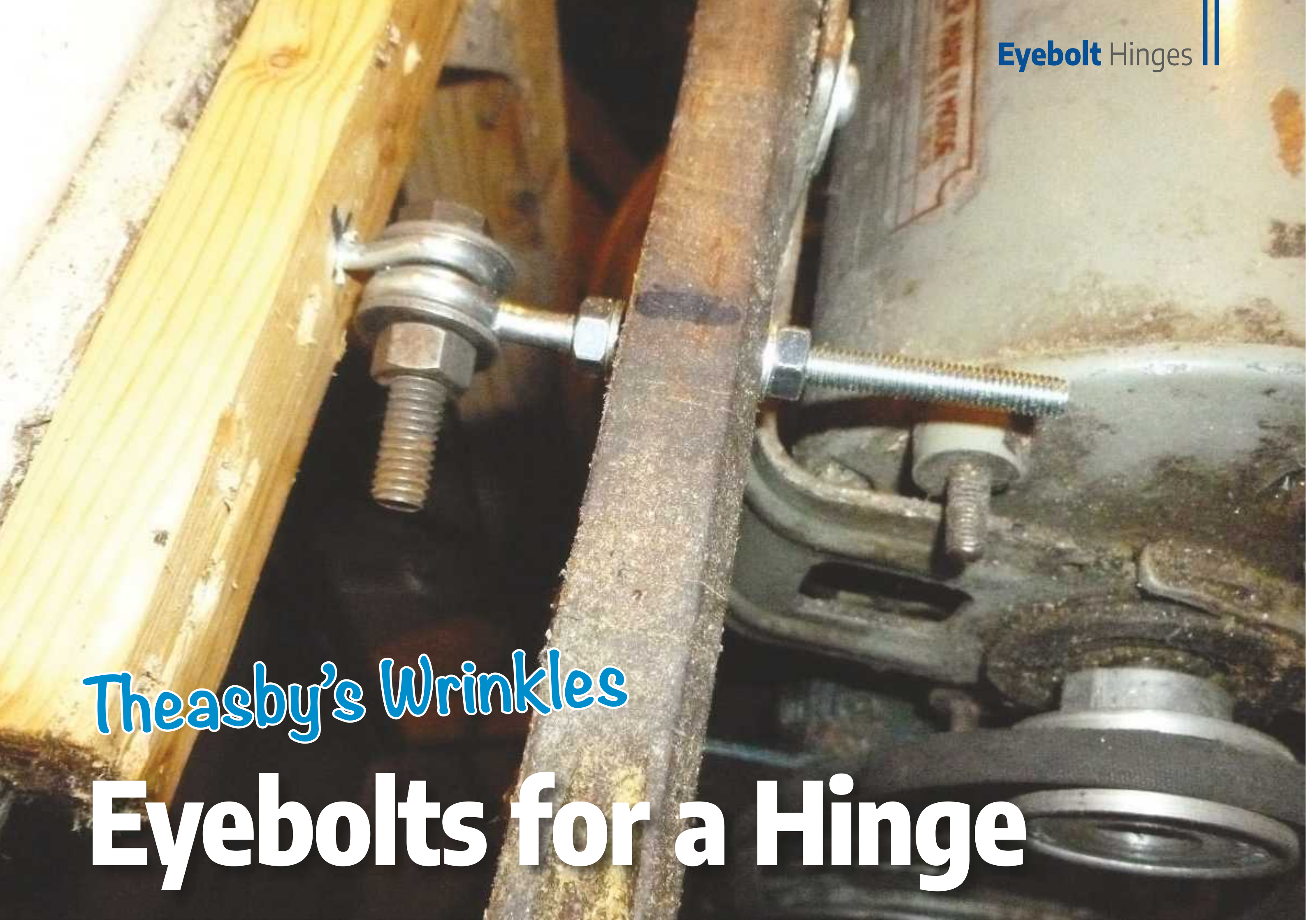
The Crowood Press have just announced the latest addition to their metalworking guides range. Dr Marcus Bowman has been a lifelong maker of models, clocks, and workshop accessories, in a wide range of materials, and he enjoys using both hand and machine tools. This is his fifth Crowood Metalworking Guide.

The cutting edges on engineering tools must lie at precise angles to ensure effective cutting, and sharpening must recreate the original geometry of each tool. This book provides an understanding of what is involved in sharpening typical lathe, milling, drilling and threading tools. With over 550 photographs and illustrations, Marcus' new book covers sharpening techniques for the most used engineering tools, screwdrivers and gravers, lathe, milling, reaming, drilling and threading cutters.

Containing a wealth of information including guidance on making useful accessories, this book covers the ground we felt was missing from his earlier book on sharpening workshop tools. Clearly the two volumes are meant to complement each other though we suspect this second volume will prove the most useful in the engineering-focused workshop.

260 x 215mm, 144 pages, ISBN 9781785008603, Hardback £16.99, visit **www.crowood.com** for more details.





Theasby's Wrinkles

Eyebolts for a Hinge

Geoff Theasby creates stowable storage for a power hacksaw

Some time ago I bought a power hacksaw, which may be home-made, it is fairly basic. Not having space in my tiny workshop, I hinged it to hang from the front of my workbench, near the drill press, where it is not in the way. However, the sheer inconvenience and contortions required to fasten the hinges from below whilst Deborah supported the weight, meant small hinges and screws had to be used, since large hinges and screws were too big to fit easily. The little hinges were too small and kept bending. risking collapse.

After considerable cogitation, I hit upon the solution. In my local, old-fashioned ironmongers, I found eyebolts, some threaded M6, and some with wood screw threads. Fitting the latter into the edge of the wooden bench and the eyebolts into the wooden saw base, spaced appropriately, the saw could be offered up, eye-to eye, so to speak, helped by my glamorous assistant, and either a bar slid through both, or two M8 bolts inserted and nutted up. Rather than support the free end with a prop, risking inadvertent trips, I screwed more eyebolts into a ceiling joist and the base, which was then held up by polypropylene rope (for radio aerial mast support guys) of a suitable length for it to sit level. A box containing a suitable switch is to be fitted. This will be a No-Volt Release, but if the power goes off I'll be in the dark, and can't work anyway, so the risk of being caught by it starting unexpectedly is minimal. ■

Bench and hacksaw in place.

A Digital Readout for a Myford Series 7 Lathe

Jacques Van Damme uses wire encoders instead of digital scales

Many of us dream of a digital readout for our metal lathe. Such a 'DRO' allows the turning tool to be put back on exactly the same spot, which offers a solution for errors due to the backlash that is always present on the screw shafts with which the cross slide is driven. Something like this, **photo 2**, especially helps in making screw threads. The great interest in this attachment is evidenced by the many videos on YouTube, the contributions on Model Engineering websites and in many forum discussions.

1

Wire encoder.

However, the high cost is a deterrent. And not only that; attaching linear scales to a small lathe is quite a challenge. They take up too much space. This is not so bad for the X-axis, because there is usually some space available at the rear of the lathe, but on the Y-axis, the cross slide, that is a disaster. Additionally, this scale can cover access to the cross-slide T-slots and hides the cross table set screws. Mounting a reversed parting tool at the rear of the workpiece, such as I like to do, or pulling the turning tool across the lathe bed with the help of a taper turning attachment mounted behind the lathe bed, is then impossible. The available working space between the centers of the lathe is also shortened by the width of the guard above the ruler. Nobody likes to drill some holes in the machine. That must be kept to an absolute minimum.

An extensive industry has emerged for selling DROs, with even specific packages to supply a particular brand of lathe with a DRO. For my own Myford from the 7 series, this takes soon around 450 to 700 British pounds, not including shipping costs, and maybe also customs fees as I'm living in Belgium. Then you have to put the whole thing together, usually drill some holes in the machine and then your lathe with hooks, brackets, cables, cover plates and a swing arm, looks like a monstrosity of a mad scientist.

2

Myford ML7, toolholder removed to show setup.

3

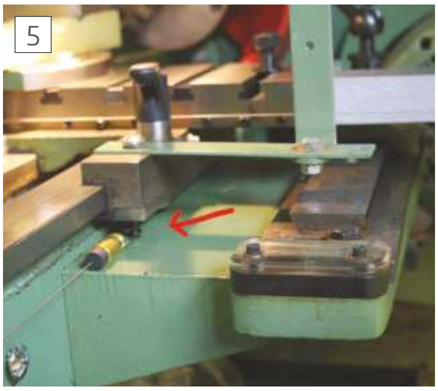
Wire encoder with readout.

4

Angle bracket at the rear of the bed for X-axis setup. I also sprayed it with a spray can in machine green.

I thought this could be better. So, I was inspired by David Haythornethwaite's article "Digital readouts on the smaller lathe", ref. 1. He used wire encoders by a British company, called BW Electronics, instead of linear scales. He is delighted with the accuracy of these wire sensors and the space saving on his Myford. But this set also costs around 400 British pounds. And the screen of the readout is quite small. It is placed on the wall behind the lathe or on the splashguard, which is not very convenient if you wish to operate the push buttons there. Maybe it is even a bit dangerous, you have to bend over for it. He spent much attention to the guarding of the measuring wire by fitting a telescopic casing around it to protect from chips and cutting oil. I think it is necessary to protect scales from chips and cutting oil as the moving parts are right next to the cross table. But a wire? There is a plastic film around and what moves is a long way behind the cross table in a down closed reel.

5



A screw hole is already provided on the underside of the cross table.

6

Both readouts in a Velleman project box.

7

The wire encoder cable ends in colored wires, with a braided shielded.

8

Connections to the display.

According to our many ministers in Belgium (we have 47), in order to combat corona's economic crisis, we must now mainly buy in our own country, and we should also generously spend our savings. But in my own country I have not been able to find any 'wire encoder'. Yes, in China, they can be found in abundance. I have been careful and started ordering only one. After some sorting out data and comparing the different offers, I went for of a combination of the wire encoder CALT CESI-S800 with a digital readout CALT HB961. With a cable length of 80 cm, this encoder was more than long enough

Fig.1 *Connection data*

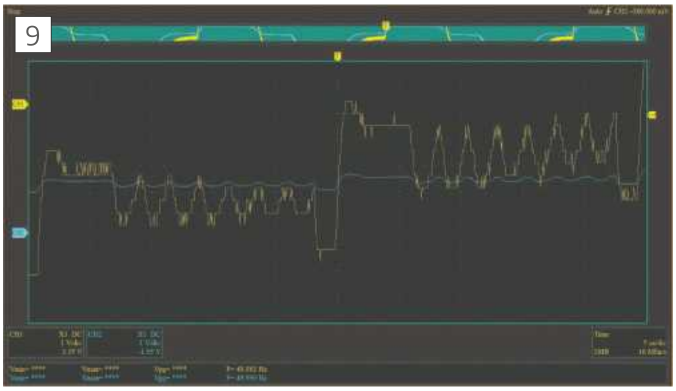
CALT CESI-S800 wire encoder

Signal	A	B	Z	A-	B-	Z-	Vcc	GND
Color	Green	White	Yellow	Brown	Gray	Orange	Red	Black

CALT HB961 digital readout

Connect	1	2	3	4	5	6	7	8	9	10
with	24V DC	24V DC	13	14	15	16	17	18	19	20

1 = 24 V to USB output
1 = 24 V to DC - DC print and adjust at 11 V DC
2 = 5 V to Touch DRO print
3 = 30mA, not used
4, 5, 6 and 7 = 0 V to Touch DRO print, to USB output and to cable shield
16 = J2 = relay to 15 or 17, normally connected with 15
19 = J1 = relay to 18 or 20, normally connected with 18



9
Signals on the oscilloscope, the pulses are around 15 KHz.

10
Front Y-axis mount.

for the X-axis, **photo 3**.

The mount of the X-measuring cable behind the bed of the lathe was a piece of cake. A Myford already has some tapped holes in a line, 4 inches apart. I folded a copper strip in the shape of an L and screwed it on the last two screw holes, **photo 4**.

The cross table has already a screw hole down at the rear, **photo 5**. I put a short screw in it and hooked a loop around it for the end of the wire encoder. A paper clip was most convenient to form the loop. The paperclip can be a bit wide and has been soldered closed so that no stretch or play is possible.

The decoder was connected to the readout and the readout was placed in a project box at the front of the Myford cabinet, **photo 6**.

These wire encoders operate according to the RS422 standard, the same standard as the conventional glass-and magnetic DRO digital scales which are abundant in the trade. These are connected accordingly, **photos 7** and **8**, **fig. 1**.

Without any programming, the readout works like a charm, you can also enter a zero point and two relay outputs are provided. Other types of readout can be set with the push buttons. You have to wait a while after switching on the power because the system will set itself

11
The Y-axis wire encoder with paper clip. The tool holder is removed for clarity.

up first. I have not yet been able to come up with an application for both relays.

Out of curiosity, I looked at the signal on the oscilloscope and it looks like this: the yellow blocks on channel 1 come out of B and the green line on channel 2 originates from A, **photo 9**.

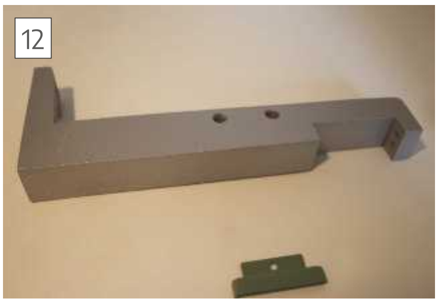
The signals B- and A- are exactly the same but reversed. They are not used.

Encouraged by this result, I then ordered a second set for the Y-axis.

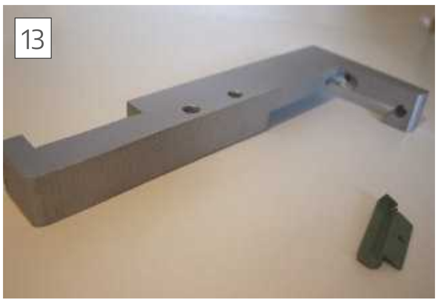
There the setup of the wire encoder is a bit more complicated. First a hook has to be made for the wire, again with a paper clip. To do this, a hole must be drilled in the cross table, 1 cm from the cross slide on the right and at the very front. The hole is tapped M4 so a screw can be fitted, **photos 10** and **11**.

The wire spool should be placed some way behind the cross table so that it does not get in the way of any taper turning attachment or parting tool holder. This requires a bracket. The bracket must be able to be secured to the rear end of the cross carriage and must be thin enough at the bottom so as not to bump against the table when moving the cross slide forward over the cross table, **photos 12** to **14**.

Two more holes are needed in the rear face of the cross slide and I tapped them M4. The bracket has become 21 cm long and was milled at the bottom over 8 cm with a dovetail cutter so that the bracket can slide smoothly over the cross table. I made the bracket from OBO wood (*appears to be like MDF – Ed.*) but it could equally well be made from Ertalon or aluminum, as long as the material is strong enough for wire tapping. On the tail of the bracket is a wide notch for the reel of the wire encoder, which is held by two M4 bolts. On adjusting the reel up or down in the notch, the wire can be run perfectly horizontal, nicely parallel to the carriage.



12
The bracket for the Y-axis. I sprayed the OBO wood with a paint can of silver.



13
Back of the bracket. Drilled two more holes in it and tapped M8, can always come in handy to attach something to it.

14
Bottom of the bracket. Mark the two holes to screw the bracket to the cross slide. Their position must be accurate. The trench is made on both sides with a dovetail cutter.

The wire will leave the T-slots open and the set screws accessible.

Even taper turning is possible without hindrance.

Wire encoder.

The wire allows the T-slots of the cross table open and does not hinder the adjustment screws of the cross table. The workspace between the centers of the lathe is thus only shortened by 1 cm, **photos 15** and **16**.

In conclusion, the use of wire encoders offers clear advantages. It is cheaper, it works amazingly accurately, it is less unwieldy and does not compromise the functionality of the machine. Only limited surgery on the lathe itself is required: three holes need to be drilled and M4 tapped. Any modeler who can make a locomotive or a steam engine must be able to do this, even if the cross slide has to be removed temporarily to drill two holes in it. It was additionally fun to invent and create.

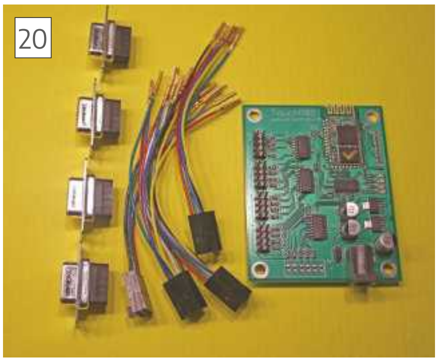
But I saw even more possibilities. I wanted to check whether this setup can also be expanded with TouchDRO, ref. 2, so that the readout could appear wirelessly over Bluetooth on the screen of an Android tablet and the advantages of this free software could be used. I had already left enough space in the project box to provide the TouchDRO circuit board and an USB connection for a tablet, and I ordered a TouchDRO PCB from Uncle Sam.

It took a long time, almost a month, but finally the PCB arrived from the States.

I had pre-loaded and viewed the TouchDRO app, which can be downloaded for free from Google Play, on an Android tablet. It is of course also possible on a smartphone that has

Bluetooth.

TouchDRO, the touch screen.



TouchDRO PCB.

Android as its operating system. Android has the advantage that screen touch can be used, which makes operation very easy, **photo 19**.

It is amazing what you can do with TouchDRO. Take a look at this YouTube video: ref. 4.

Just touch and you set the zero point, or you go from mm to inch, or you switch from absolute to incremental values, and much, much more. Unbelievable right? And all that for free too.

You can find everything about TouchDRO at ref. 5 and there is also a forum at ref. 6. Don't worry, you should not need this forum if you follow my explanation, and you don't have to program anything.

The PCB that you need to be on our wire encoders is the "Wireless DRO adapter for glass/magnetic scales" from the TouchDRO 'store'. When our Belgian post delivers it at the front door, they will add import duties and VAT on top of the cost. I presume, in UK there will be something similar.

Here is how it comes out of the package, **photo 20**.

You do not need the supplied DB9 connectors. You do need two of the four cable bundles, one for the X-axis and one for the Y-axis.

If you look down on the PCB, you will see the connection for both axes indicated with 'X' and 'Y'.

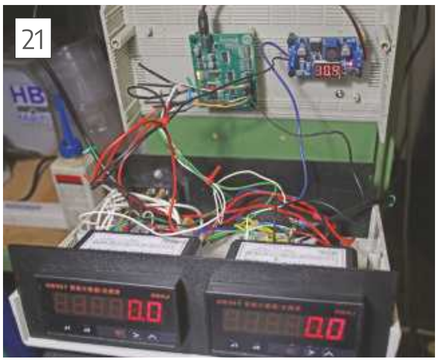
Fig. 2

Our wire encoders work according to the RS422 standard. The drawing shows the signals connected to reversed A and reversed B, but it is of course equally possible with signals A and B. Reversing the pulse train will only require touching a button on the TouchDRO screen.

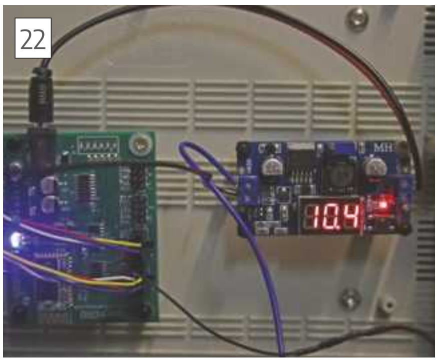
This PCB requires 7 to 12 V power. You can take it from point 1 (24 V) and from point 4, 5, 6, or 7 (0 V) of the readout and lead it to a DC-DC adjustable 'step-down' regulator. In **photo 21**, the different connection for the readout are listed on the white stickers.

Why have a DC - DC adjustable 'step down' regulator placed between the display and the board? From the TouchDRO forum, it became clear to me that the TouchDRO requires a very stable power supply between 7 and 12 V. Hence, I adjusted the regulator to 10.4 V, **photo 22**.

From point 1 (24 V) and from points 4, 5, 6, or 7 (0 V) I also derived power

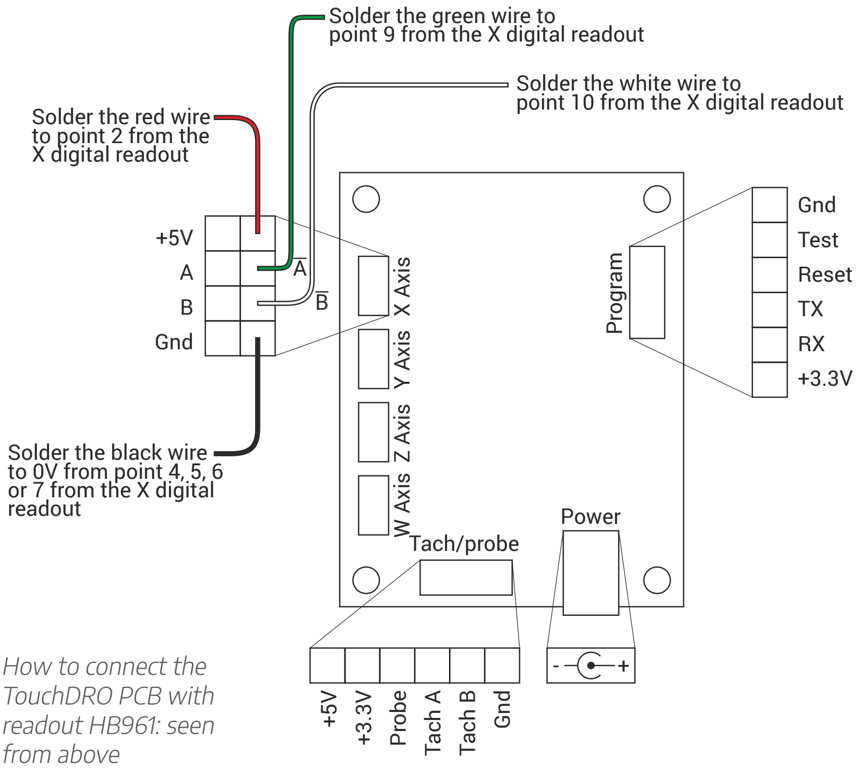


TouchDRO and DC - DC step down are located in the back of the opened project box.

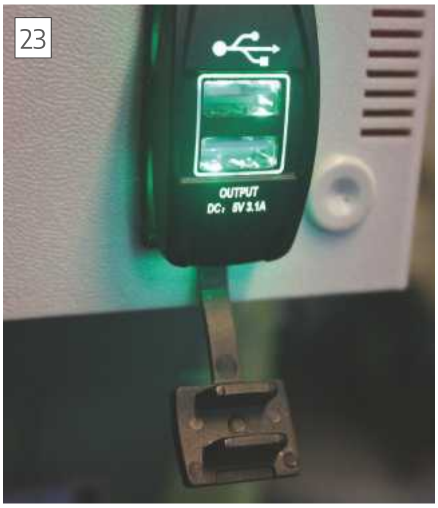


TouchDRO and DC - DC step down in operation. Various points are flickering.

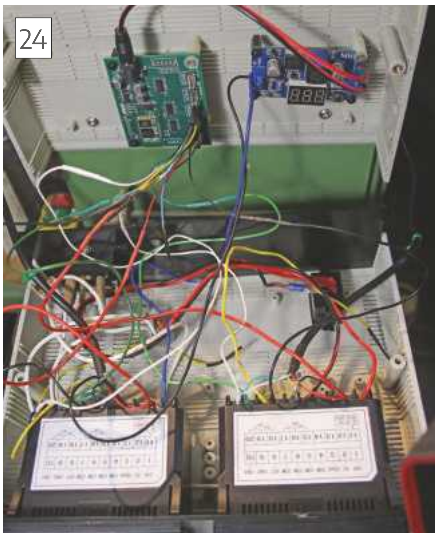
Fig.2



How to connect the TouchDRO PCB with readout HB961: seen from above



USB panel output.



TouchDRO, DC-DC step down and both readouts connected in the opened project box.

for an USB output. For that I mounted a 24 V panel output and fitted it on the Velleman project box. This will come in handy later to provide the tablet or smartphone with power and to be able to charge it, **photo 23**.

I used a 500mA fuse, that is sufficient for normal use. If the tablet is also being charged via the panel output, a fuse of approximately 2 A will be needed. I once measured the current on loading the tablet; when switching on, it shows a short peak of 1.3 A and then falls to 460mA, **photo 24**.

And then, the moment of truth, once all connections in the project box are completed, it finally can be switched on. The PCB produces a series of colorful lights, the blue light flickers.

Now also the tablet can be switched on and the wireless Bluetooth connection still has to be established. In the settings of the tablet: click on 'Bluetooth'. Then a list of Bluetooth devices will appear which the tablet can find nearby. Search device 'HC - 05 '. Click here. If you now click 'connect' a code will be requested. The code is '1234'.

You can leave the 'settings'. Click the TouchDRO logo. Click on 'Connect' at the top right. "DRO - Connected" appears above on the left. Good luck! **Photo 25**.

Get started! TouchDRO starts immediately, faster than the readings on your project box. On the menu you can adjust the machine settings and perform a calibration. You can lay down the tablet on a desk or place it on a firm gooseneck to have the operation at hand, **photo 26**.

Conclusions

TouchDRO works not only with digital scales but also with wire encoders. It works quickly and precisely and can be read wireless from a Myford lathe on the screen of a tablet or a smartphone.

You can make a full digital readout for a 'small' lathe yourself for a fraction of the cost of an 'industrial' unit. The DIY construction is also less unwieldy, is much less traumatic for the machine and does not impose any restrictions on the functions of your lathe.

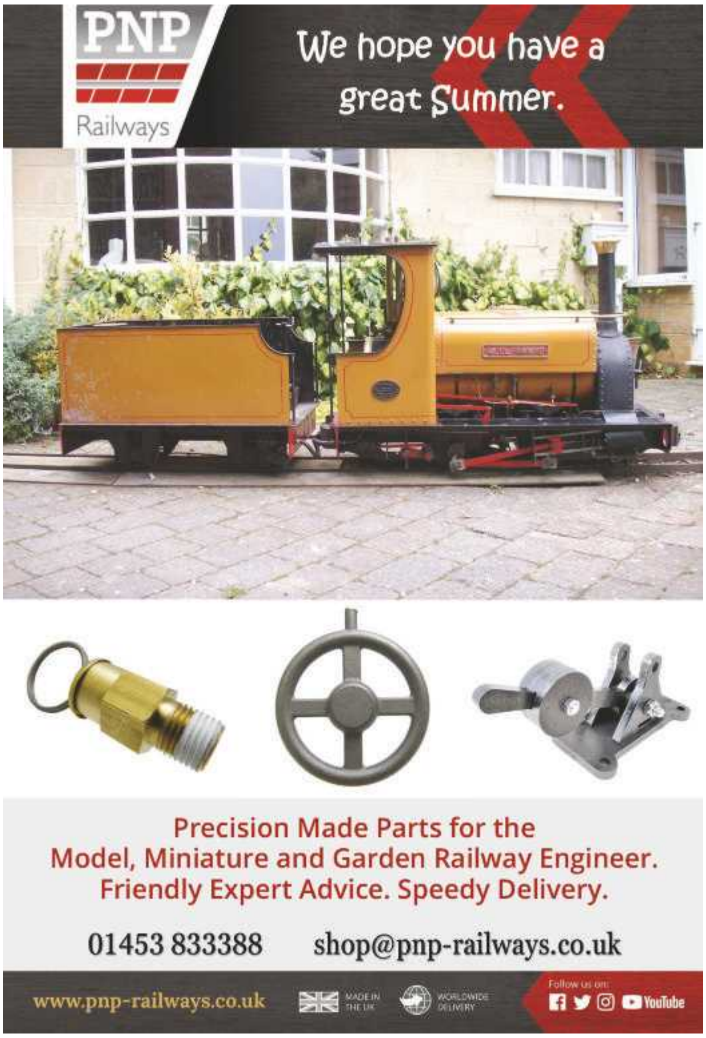
This article appeared in Dutch on the local ME website (Antwerp), ref. 7. Thanks for their permission to publish it in MEW.

References:

1. www.haythornthwaite.com/DRO%20For%20The%20Smaller%20Lathe.pdf.
2. www.touchdro.com/
3. www.kmyca.be/wp-content/uploads/2020/07/Digitale-uitlezing-voor-myfort-Draaibank-met-Meetkabels.pdf
4. www.youtube.com/watch?v=3ijoXYkF6SA
5. www.touchdro.com/
6. forum.yuriystoys.com/index.php
7. www.kmyca.be/wp-content/uploads/2020/08/Digitale-uitlezing-voor-Myfort-Draaibank-met-meetkabelsVervolg.pdf

The reading can be followed on the tablet.

Project box closed, with digital readouts, and tablet on top of a gooseneck


PNP
Railways
We hope you have a great Summer.
Precision Made Parts for the
Model, Miniature and Garden Railway Engineer.
Friendly Expert Advice. Speedy Delivery.
01453 833388
shop@pnp-railways.co.uk
www.pnp-railways.co.uk
MADE IN THE UK
WORLDWIDE DELIVERY
Follow us on:
YouTube


metalcraft™
Hand powered metalforming tools
Handy for so many jobs
Punching
Cutting
Riveting
Bending
Rolling
Scrolling
Twisting
Also suppliers of a wide range of steel, fixings, clock components & much more.
Call today for your free catalogue and if you quote our promo code* MMENGW21, we will send you our demonstration DVD free of charge.
J & C R Wood Ltd, Dept MMENGW21, 66 Clough Road, HULL HU5 1SR
Tel: 01482 345067 Email: info@jandcrwood.co.uk
OR Visit our on-line store at
www.metal-craft.co.uk

David Piddington

I must pass on the sad news that David Piddington passed away at the end of April. A well-known figure in the model engineering field, David was a contributor to Model Engineers' Workshop. He was a kind and gentle man, and I had the pleasure of meeting him and Mary, his wife, and seeing his beautifully organised workshop. My thanks to Chris Deith and Geoff Stait for the following obituary:

David was an extremely skilled modeller and was employed by A.J. Reeves for very many years until the company's change of ownership and move from Marston Green. At Reeves David was responsible for drafting some of the designs and produced many patterns for castings. To customers he was best known as their technical adviser answering the vast majority of the queries that came into the company and he kept meticulous records of customers who had purchased sets of drawings of many of the designs he had been involved with. After leaving AJ Reeves he went to work with the late John Barrett at Barratts Steam Models Ltd and remained with them until his retirement.

David was a lifelong member of the Birmingham Society of Model Engineers and did a significant amount of work in sorting and cataloguing the society's extensive library of books and drawings etc. and took a great deal of pride in the finished catalogue which was distributed to all the members.

In addition to his involvement in the design and drafting at Reeves and his committed involvement with the Birmingham Society he was also a prolific author producing a wide range of workshop tools and accessories and stationary engine designs for publication In the model engineering press over many years. In addition to writing under his own name he wrote under the pseudonym A J Yallup and occasionally as Stuart Rome. Perhaps his best-known model was the stationary steam engine 'Monarch' and its derivatives and fittings.

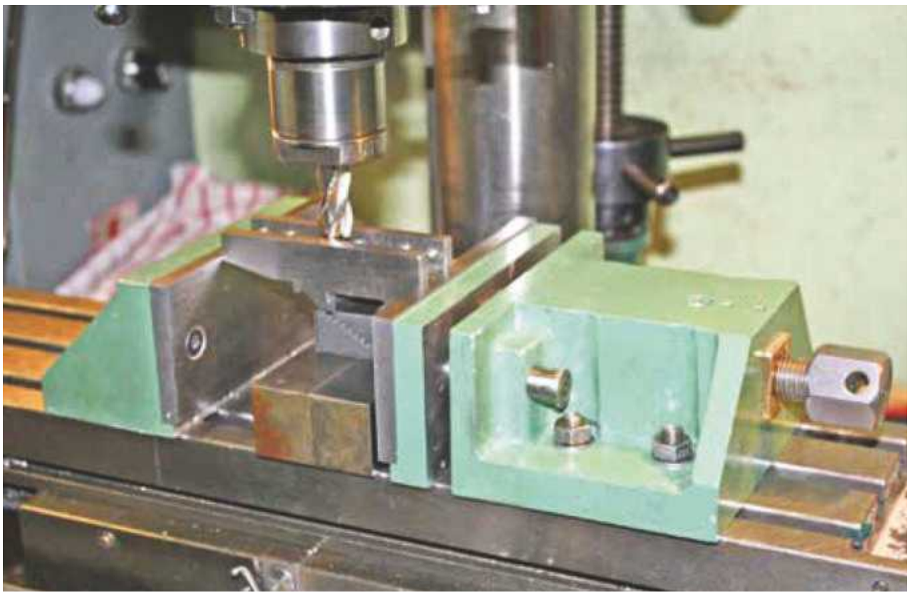
Such was his interest in the model stationary engine in 1992 he joined the judging panel of the Midlands Model Engineering Exhibition and remained a member of the judging team until ill-health prevented him continuing some 24 years later. He thoroughly enjoyed his involvement with the exhibition and could often be seen most days at the exhibition stewarding and discussing model engineering with all, the exhibition was regarded as a holiday! Although suffering from increasing ill health which obliged him to give up his licence he still managed, through the good offices of friends, to visit the exhibition for a couple of further years after giving up judging and stewarding.

Outside of model engineering his chosen form of transport was a motorcycle and as a devout Christian he was a member of the Christian Motorcyclists Association. Unfortunately he suffered with Parkinson's disease which obliged him first to give up his much loved motorcycling which he deeply regretted.

David was a very modest man who did not enjoy being in the limelight and in his passing the hobby has lost a dedicated and highly knowledgeable modeller and author.

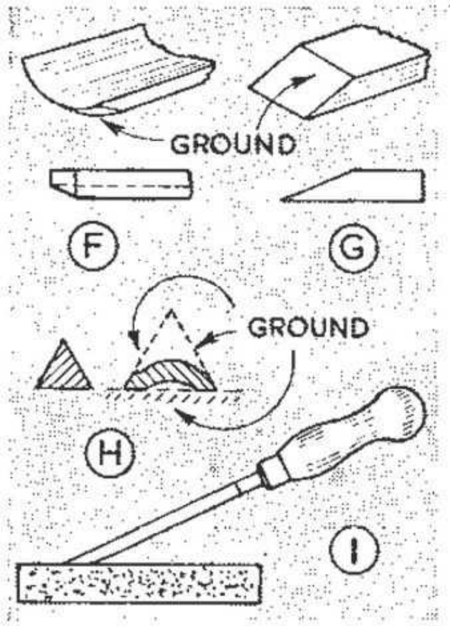
He leaves a wife Mary and a daughter Miriam and we extend our deepest condolences to them both.

David Piddington



David's Table-length Milling Vice was serialised starting in MEW 230.

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 are 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.



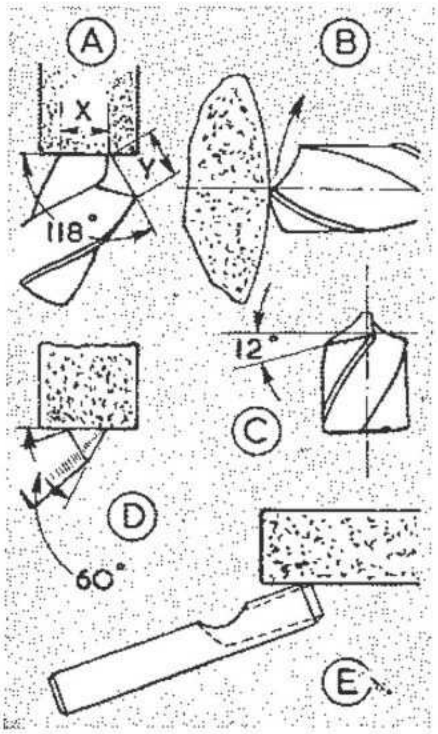
Sharpening drills and tools

In order to ensure complete accuracy in the workshop, it is essential for drills and other tools to be sharp. Details of the correct methods of sharpening these tools' are given

By GEOMETER

MAINTAINING. DRILLS, Centre punches, chisels, scrapers, etc., keen and accurate is one, at least, of the secrets of producing good work. It involves the use of grinding, wheel, hand-hones and oil-stone.

Hand hones are small abrasive slips obtainable in various shapes and sizes, for finishing tools to a fine edge after grinding. They are usually rubbed on tools. The oil stone, (a larger abrasive block), rests on the bench while tools are applied for finishing.



Thin oil, such as cycle oil, should be used on an oil stone to float particles of metal away;, hand hones may also be fed with thm oil and both types, when dirty and clogged, can be scrubbed in paraffin. As with grinding wheels, the area of working should not be restricted for the hone or stone to become locally worn.

For work on the grinder,, whether or not preliminary, it is desirable for the drive to the wheel to be by power or foot treadle, leaving both hands free for the tool.

Drill sharpening

For most work, twist drills have an included angle of 118 deg. and a clearance from each cutting edge of about 12 deg. The cutting edges or lips are straight and equal as seen in plan and clearance is curved on large drills, though it can be in the form of a flat on very small drills.

The angles, while desirable, are not rigid in that a drill would not cut if ground otherwise. In practice, slight variations occur and even where a jig is available for maintaining accurate angles, free-hand grinding is often preferred.

In sharpening a drill, it is applied to the face or the periphery of the wheel, horizontally and at the appropriate angle *A*, with the cutting edge horizontal. Care is observed that the cutting edges X, Y, are maintained as nearly as possible the same. Holding the drill as at *A* in contact with the running wheel, the nose is then lifted as at B, thus providing the clearance as at C.

A small drill can be applied twice to the grinding wheel at an angle producing a flat for clearance at each cutting edge. On a very tiny drill the flats can be produced rubbing on an oil'stone, or hand-honing with the drill in parallel-jaw pliers.

Punches and chisels

A centre punch with an' angle of 60 deg., *D*, is sharpened by applying to the periphery or face of the wheel, twisting between fingers. Direction of twisting is not important, but the rate should be fast to avoid flats.

A tubular punch *E* for making holes in gaskets can be ground in a similar fashion. A chipped or ragged cutting edge, however, should first be squared on the face of the wheel. Afterwards the chamfer can be produced. Overheating can be avoided by dipping in water, and the chamfer hand-honed at the finish.

A gouge or half-round chisel *F* can be ground, not by twisting, but turning with wrist movements, firmly held-and finally hand-honed.

With a normal wood chisel G, care is required to produce a true flat, a square cutting edge and not to overheat. Frequent cooling is essential and a coarse wheel initially desirable. Badly damaged edges involve extensive grinding, without which cutting angles are changed and the edges becoming " dubbed off."

Triangular and hollow-ground scrapers H can be ground flat on the faces for sharpening, then hand-honed. A wood chisel, however, is better finished or maintamed sharp on an oil stone I, rubbing at the appropriate angle, then passing the flat side of the blade along the stone to remove the feather edge.

Model Engineers' Workshop Data Book

MODEL ENGINEERS' WORKSHOP DATA BOOK

UNIFIED THREADS COARSE (UNC)

SIZE NO./ in.	OUT DIA. in.	CORE DIA. in.	PIT CH TPI	TAP DRILL mm	DEP TH %	DIA. 60% in.	DIA. 70% in.	APPROX METRIC CONVERSIONS OUT DIA. mm	PITCH mm	DIA. 60% mm	DIA. 70% mm
no.1	0.0730	0.054	64	1.55	62	0.061	0.060	1.85	0.40	1.56	1.51
no.2	0.0860	0.064	56	1.85	60	0.073	0.071	2.18	0.45	1.85	1.79
no.3	0.0990	0.073	48	2.10	64	0.084	0.081	2.51	0.53	2.13	2.06
no.4	0.1120	0.081	40	2.35	64	0.094	0.091	2.84	0.64	2.38	2.30
no.5	0.1250	0.094	40	2.65	67	0.107	0.104	3.17	0.64	2.71	2.63
no.6	0.1380	0.100	32	2.85	67	0.115	0.111	3.51	0.79	2.92	2.82
no.8	0.1640	0.126	32	3.50	68	0.141	0.137	4.17	0.79	3.58	3.48
no.10	0.1900	0.139	24	3.90	71	0.159	0.154	4.83	1.06	4.05	3.92
no.12	0.2160	0.165	24	4.50	76	0.185	0.180	5.49	1.06	4.71	4.58
1/4	0.2500	0.189	20	5.10	80	0.213	0.207	6.35	1.27	5.42	5.26
5/16	0.3125	0.244	18	6.60	77	0.272	0.265	7.94	1.41	6.90	6.73
3/8	0.3750	0.298	16	8.00	78	0.329	0.321	9.52	1.59	8.36	8.16
7/16	0.4375	0.350	14	9.40	77	0.385	0.376	11.11	1.81	9.78	9.55
1/2	0.5000	0.406	13	10.80	79	0.443	0.434	12.70	1.95	11.26	11.02
9/16	0.5625	0.460	12	12.20	80	0.501	0.491	14.29	2.12	12.73	12.47
5/8	0.6250	0.513	11	13.50	84	0.558	0.547	15.87	2.31	14.18	13.89
3/4	0.7500	0.627	10	16.50	82	0.676	0.664	19.05	2.54	17.18	16.87
7/8	0.8750	0.739	9	19.50	79	0.793	0.780	22.22	2.82	20.15	19.80
1	1.0000	0.847	8	22.50	74	0.908	0.893	25.40	3.17	23.06	22.67
1-1/8	1.1250	0.950	7	25.00	80	1.020	1.002	28.57	3.63	25.90	25.46

MODEL ENGINEERS' WORKSHOP DATA BOOK

ISO METRIC THREADS SPARK PLUGS

SIZE	OUT DIA. mm	CORE DIA. mm	PITCH mm	TAP DRILL mm	DEP TH %	DIA. 60% mm	DIA. 70% mm	APPROXIMATE INCH CONVERSIONS OUT DIA. in.	PITCH TPI	DIA. 60% in.	DIA. 70% in.
M10 X 1.0	10.0	8.77	1.00	9.20	65	9.26	9.14	0.394	25.40	0.365	0.360
M12 X 1.25	12.0	10.47	1.25	10.90	72	11.08	10.93	0.472	20.32	0.436	0.430
M14 X 1.25	14.0	12.47	1.25	12.90	72	13.08	12.93	0.551	20.32	0.515	0.509
M18 X 1.5	18.0	16.16	1.50	16.75	68	16.90	16.71	0.709	16.93	0.665	0.658

ISO METRIC THREADS CONDUIT

SIZE	OUT DIA. mm	CORE DIA. mm	PITCH mm	TAP DRILL mm	DEP TH %	DIA. 60% mm	DIA. 70% mm	APPROXIMATE INCH CONVERSION OUT DIA. in.	PITCH TPI	DIA. 60% in.	DIA. 70% in.
M16 X 1.5	16.0	14.16	1.50	14.50	82	14.90	14.71	0.630	16.93	0.586	0.579
M20 X 1.5	20.0	18.16	1.50	18.50	82	18.90	18.71	0.787	16.93	0.744	0.737
M25 X 1.5	25.0	23.16	1.50	23.50	82	23.90	23.71	0.984	16.93	0.941	0.934
M32 X 1.5	32.0	30.16	1.50	30.50	82	30.90	30.71	1.260	16.93	1.216	1.209
M40 X 1.5	40.0	38.16	1.50	38.50	82	38.90	38.71	1.575	16.93	1.531	1.524

UNIFIED THREADS FINE (UNF)

SIZE NO./ in.	OUT DIA. in.	CORE DIA. in.	PITCH TPI	TAP DRILL mm	DEPTH %	DIA. 60% in.	DIA. 70% in.	APPROX METRIC CONVERSIONS OUT DIA. mm	PITCH mm	DIA. 60% mm	DIA. 70% mm
no.0	0.0600	0.045	80	1.30	58	0.051	0.049	1.52	0.32	1.29	1.25
no.1	0.0730	0.056	72	1.60	59	0.063	0.061	1.85	0.35	1.59	1.55
no.2	0.0860	0.067	64	1.90	58	0.074	0.073	2.18	0.40	1.89	1.84
no.3	0.0990	0.077	56	2.20	57	0.086	0.084	2.51	0.45	2.18	2.13
no.4	0.1120	0.086	48	2.45	61	0.097	0.094	2.84	0.53	2.46	2.39
no.5	0.1250	0.097	44	2.70	67	0.108	0.105	3.17	0.58	2.75	2.68
no.6	0.1380	0.107	40	3.00	65	0.120	0.117	3.51	0.64	3.04	2.96
no.8	0.1640	0.130	36	3.60	65	0.144	0.140	4.17	0.71	3.65	3.56
no.10	0.1900	0.152	32	4.20	64	0.167	0.163	4.83	0.79	4.24	4.14
no.12	0.2160	0.172	28	4.80	62	0.190	0.185	5.49	0.91	4.82	4.71
1/4	0.2500	0.206	28	5.60	67	0.224	0.219	6.35	0.91	5.68	5.57
5/16	0.3125	0.261	24	7.10	65	0.282	0.277	7.94	1.06	7.16	7.03
3/8	0.3750	0.324	24	8.60	71	0.344	0.339	9.52	1.06	8.75	8.62
7/16	0.4375	0.376	20	10.00	71	0.401	0.395	11.11	1.27	10.18	10.02
1/2	0.5000	0.439	20	11.60	71	0.463	0.457	12.70	1.27	11.77	11.61
9/16	0.5625	0.494	18	13.00	74	0.522	0.515	14.29	1.41	13.25	13.08
5/8	0.6250	0.557	18	14.50	79	0.584	0.577	15.87	1.41	14.84	14.66
3/4	0.7500	0.673	16	17.75	67	0.704	0.696	19.05	1.59	17.88	17.69
7/8	0.8750	0.787	14	20.75	66	0.822	0.814	22.22	1.81	20.89	20.67
1	1.0000	0.898	12	23.50	73	0.939	0.928	25.40	2.12	23.84	23.58

BRITISH ASSOCIATION THREADS (BA)

SIZE	OUT DIA. mm	CORE DIA. mm	PITCH mm	TAP DRILL mm	DEPTH %	DIA. 60% mm	DIA. 70% mm	APPROXIMATE INCH CONVERSIONS OUT DIA. in.	PITCH TPI	DIA. 60% in.	DIA. 70% in.
0	6.00	4.80	1.00	5.20	67	5.28	5.16	0.236	25.40	0.208	0.203
1	5.30	4.22	0.90	4.60	65	4.65	4.54	0.209	28.22	0.183	0.179
2	4.70	3.73	0.81	4.00	72	4.12	4.02	0.185	31.36	0.162	0.158
3	4.10	3.22	0.73	3.50	68	3.57	3.49	0.161	34.79	0.141	0.137
4	3.60	2.81	0.66	3.10	63	3.12	3.05	0.142	38.48	0.123	0.120
5	3.20	2.49	0.59	2.75	64	2.78	2.70	0.126	43.05	0.109	0.106
6	2.80	2.16	0.53	2.40	63	2.42	2.35	0.110	47.92	0.095	0.093
7	2.50	1.92	0.48	2.10	69	2.15	2.10	0.098	52.92	0.085	0.083
8	2.20	1.68	0.43	1.85	68	1.89	1.84	0.087	59.07	0.074	0.072
9	1.90	1.43	0.39	1.60	64	1.62	1.57	0.075	65.13	0.064	0.062
10	1.70	1.28	0.35	1.45	60	1.45	1.41	0.067	72.57	0.057	0.055
11	1.50	1.13	0.31	1.25	67	1.28	1.24	0.059	81.94	0.050	0.049
12	1.30	0.96	0.28	1.10	60	1.10	1.06	0.051	90.71	0.043	0.042
13	1.20	0.90	0.25	1.00	67	1.02	0.99	0.047	101.60	0.040	0.039
14	1.00	0.72	0.23	0.82	65	0.83	0.81	0.039	110.43	0.033	0.032
15	0.90	0.65	0.21	0.75	60	0.75	0.72	0.035	120.95	0.029	0.028
16	0.79	0.56	0.19	0.65	61	0.65	0.63	0.031	133.68	0.026	0.025
17	0.70	0.50	0.17	0.58	59	0.58	0.56	0.028	149.41	0.023	0.022
18	0.62	0.44	0.15	0.50	67	0.51	0.49	0.024	169.33	0.020	0.019

MODEL ENGINEERS'WORKSHOP DATA BOOK

BRITISH STANDARD WHITWORTH THREADS (BSW)

SIZE	OUT DIA. in.	CORE DIA. in.	PITCH TPI	TAP DRILL mm	DEPTH %	DIA. 60% in.	DIA. 70% in.	APPROX METRIC CONVERSIONS OUT DIA. mm	PITCH mm	DIA. 60% mm	DIA. 70% mm
1/16	0.0625	0.041	60	1.25	62	0.050	0.048	1.59	0.42	1.26	1.21
3/32	0.0938	0.067	48	1.95	64	0.078	0.075	2.38	0.53	1.98	1.91
1/8	0.1250	0.093	40	2.65	65	0.106	0.103	3.17	0.64	2.69	2.61
5/32	0.1562	0.116	32	3.30	66	0.132	0.128	3.97	0.79	3.36	3.26
3/16	0.1875	0.134	24	3.90	64	0.155	0.150	4.76	1.06	3.95	3.81
7/32	0.2188	0.165	24	4.70	63	0.187	0.181	5.56	1.06	4.74	4.61
1/4	0.2500	0.186	20	5.30	65	0.212	0.205	6.35	1.27	5.37	5.21
5/16	0.3125	0.241	18	6.80	63	0.270	0.263	7.94	1.41	6.85	6.67
3/8	0.3750	0.295	16	8.10	70	0.327	0.319	9.52	1.59	8.31	8.10
7/16	0.4375	0.346	14	9.50	69	0.383	0.373	11.11	1.81	9.72	9.49
1/2	0.5000	0.393	12	10.80	70	0.436	0.425	12.70	2.12	11.07	10.80
9/16	0.5625	0.456	12	12.40	70	0.498	0.488	14.29	2.12	12.66	12.39
5/8	0.6250	0.509	11	13.70	74	0.555	0.544	15.87	2.31	14.10	13.80
11/16	0.6875	0.571	11	15.25	75	0.618	0.606	17.46	2.31	15.69	15.39
3/4	0.7500	0.622	10	16.75	71	0.673	0.660	19.05	2.54	17.10	16.77
13/16	0.8125	0.684	10	18.25	73	0.736	0.723	20.64	2.54	18.69	18.36
7/8	0.8750	0.733	9	19.50	75	0.790	0.775	22.22	2.82	20.06	19.69
15/16	0.9375	0.795	9	21.25	71	0.852	0.838	23.81	2.82	21.64	21.28
1	1.0000	0.840	8	22.50	71	0.904	0.888	25.40	3.17	22.96	22.55
1-1/8	1.1250	0.942	7	25.25	72	1.015	0.997	28.57	3.63	25.79	25.32

MODEL ENGINEERS'WORKSHOP DATA BOOK

MODEL ENGINEER (WHITWORTH FORM THREAD)

SIZE	OUT DIA. in.	CORE DIA. in.	PITCH TPI	TAP DRILL mm	DEPTH %	DIA. 60% in.	DIA. 70% in.	APPROX METRIC CONVERSIONS OUT DIA. mm	PITCH mm	DIA. 60% mm	DIA. 70% mm
40 TPI SERIES											
1/8	0.1250	0.093	40	2.65	65	0.106	0.103	3.17	0.64	2.69	2.61
5/32	0.1562	0.124	40	3.40	70	0.137	0.134	3.97	0.64	3.48	3.40
3/16	0.1875	0.155	40	4.20	69	0.168	0.165	4.76	0.64	4.27	4.19
7/32	0.2188	0.187	40	5.00	68	0.200	0.196	5.56	0.64	5.07	4.99
1/4	0.2500	0.218	40	5.80	68	0.231	0.228	6.35	0.64	5.86	5.78
5/16	0.3125	0.280	40	7.30	78	0.293	0.290	7.94	0.64	7.45	7.37
3/8	0.3750	0.343	40	8.90	77	0.356	0.353	9.52	0.64	9.04	8.96
32 TPI SERIES											
1/4	0.2500	0.210	32	5.70	64	0.226	0.222	6.35	0.79	5.74	5.64
9/32	0.2813	0.241	32	6.50	63	0.257	0.253	7.14	0.79	6.53	6.43
5/16	0.3125	0.272	32	7.20	73	0.288	0.284	7.94	0.79	7.33	7.23
3/8	0.3750	0.335	32	8.80	71	0.351	0.347	9.52	0.79	8.92	8.81
7/16	0.4375	0.397	32	10.40	70	0.413	0.409	11.11	0.79	10.50	10.40
1/2	0.5000	0.460	32	12.00	69	0.476	0.472	12.70	0.79	12.09	11.99

BRITISH STANDARD BRASS THREAD 26 TPI (WHITWORTH FORM)

SIZE	OUT DIA. in.	CORE DIA. in.	PITCH TPI	TAP DRILL mm	DEPTH %	DIA. 60% in.	DIA. 70% in.	APPROX METRIC CONVERSIONS OUT DIA. mm	PITCH mm	DIA. 60% mm	DIA. 70% mm
1/4	0.2500	0.201	26	5.50	68	0.220	0.216	6.35	0.98	5.60	5.47
5/16	0.3125	0.263	26	7.10	67	0.283	0.278	7.94	0.98	7.19	7.06
3/8	0.3750	0.326	26	8.70	66	0.345	0.341	9.52	0.98	8.77	8.65
7/16	0.4375	0.388	26	10.20	73	0.408	0.403	11.11	0.98	10.36	10.24
1/2	0.5000	0.451	26	11.80	72	0.470	0.466	12.70	0.98	11.95	11.82
5/8	0.6250	0.576	26	15.00	70	0.595	0.591	15.87	0.98	15.12	15.00
3/4	0.7500	0.701	26	18.25	64	0.720	0.716	19.05	0.98	18.30	18.17

BRITISH STANDARD CYCLE THREAD 26 TPI

SIZE	OUT DIA. in.	CORE DIA. in.	PITCH TPI	TAP DRILL mm	DEPTH %	DIA. 60% in.	DIA. 70% in.	OUT DIA. mm	PITCH mm	DIA. 60% mm	DIA. 70% mm
1/4	0.2500	0.209	26	5.70	62	0.225	0.221	6.35	0.98	5.73	5.62
5/16	0.3125	0.272	26	7.30	61	0.288	0.284	7.94	0.98	7.31	7.21
3/8	0.3750	0.334	26	8.80	70	0.350	0.346	9.52	0.98	8.90	8.80
7/16	0.4375	0.397	26	10.40	68	0.413	0.409	11.11	0.98	10.49	10.38
1/2	0.5000	0.459	26	12.00	67	0.475	0.471	12.70	0.98	12.08	11.97
9/16	0.5625	0.522	26	13.60	66	0.538	0.534	14.29	0.98	13.66	13.56
5/8	0.6250	0.584	26	15.25	60	0.600	0.596	15.87	0.98	15.25	15.15
11/16	0.6875	0.647	26	16.75	68	0.663	0.659	17.46	0.98	16.84	16.73
3/4	0.7500	0.709	26	18.25	77	0.725	0.721	19.05	0.98	18.43	18.32

MODEL ENGINEERS'WORKSHOP DATA BOOK

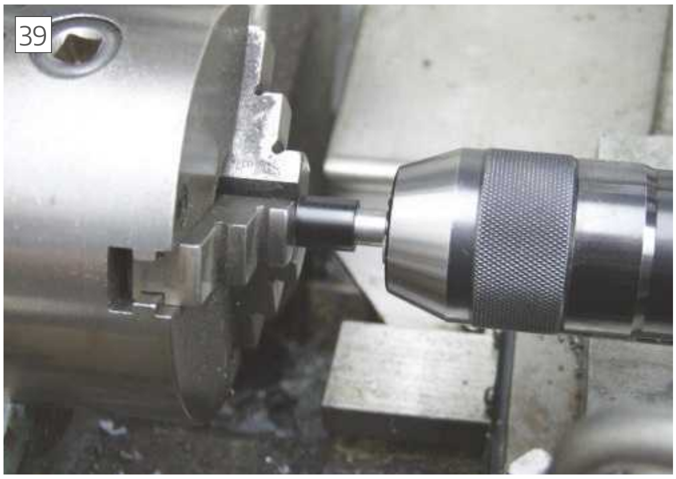
BRITISH STANDARD FINE THREADS (BSF) (WHITWORTH FORM)

SIZE	OUT DIA. in.	CORE DIA. in.	PITCH TPI	TAP DRILL mm	DEPTH %	DIA. 60% in.	DIA. 70% in.	APPROX METRIC CONVERSIONS OUT DIA. mm	PITCH mm	DIA. 60% mm	DIA. 70% mm
3/16	0.1875	0.147	32	4.10	65	0.163	0.159	4.76	0.79	4.15	4.05
7/32	0.2188	0.173	28	4.80	65	0.191	0.187	5.56	0.91	4.86	4.74
1/4	0.2500	0.201	26	5.50	68	0.220	0.216	6.35	0.98	5.60	5.47
5/16	0.3125	0.254	22	6.90	70	0.278	0.272	7.94	1.15	7.05	6.90
3/8	0.3750	0.311	20	8.40	69	0.337	0.330	9.52	1.27	8.55	8.39
7/16	0.4375	0.366	18	9.90	67	0.395	0.388	11.11	1.41	10.03	9.85
1/2	0.5000	0.420	16	11.30	69	0.452	0.444	12.70	1.59	11.48	11.28
9/16	0.5625	0.482	16	12.90	68	0.514	0.506	14.29	1.59	13.07	12.86
5/8	0.6250	0.534	14	14.25	70	0.570	0.561	15.87	1.81	14.48	14.25
11/16	0.6875	0.596	14	15.75	74	0.633	0.623	17.46	1.81	16.07	15.84
3/4	0.7500	0.643	12	17.00	76	0.686	0.675	19.05	2.12	17.42	17.15
7/8	0.8750	0.759	11	20.00	75	0.805	0.794	22.22	2.31	20.45	20.15
1	1.0000	0.872	10	23.00	74	0.923	0.910	25.40	2.54	23.45	23.12
1-1/8	1.1250	0.983	9	25.75	78	1.040	1.025	28.57	2.82	26.41	26.04
1-1/4	1.2500	1.108	9	29.00	76	1.165	1.150	31.75	2.82	29.58	29.22

Developing an Edge Finder

Roger Vane describes how he designed and developed an electronic edge finder, together with detailed drawings so that you can make your own - Part 4

Insulating sleeve and probe body blanks are now ready to be pressed together.



Fitting the probe blank to the insulating sleeve.

The two part-finished probe units.

Machining the probe blanks is straightforward, with concentricity not a real issue as finish machining will take place after assembly to the main bodies. The probe blank for the ball-end needs to have a 3mm hole partly drilled and also the flat-bottomed recess for the spring. The 3mm hole should not be drilled all the way though to the end of the blank so as to avoid influencing the machining of the seat due to any slight eccentricity. **Photograph 38** shows the insulating sleeves and probe blanks prior to fitting and final machining.

We can now fit the probe blanks into the insulating sleeves using the lathe as a press, **photo 39**. Hold the stem in the tailstock and smaller bore end of insulating sleeve against tailstock jaws, with the jaws just open wide enough to accommodate 0.310" diameter.

Next, face the sleeve and probe blank at the 'outer' end to be flush with each other. At the 'inner' end ensure that the probe black protrudes from the insulating sleeve, allowing around 0.010" protrusion so that the end of cartridge clears insulation to make good contact with the probe.

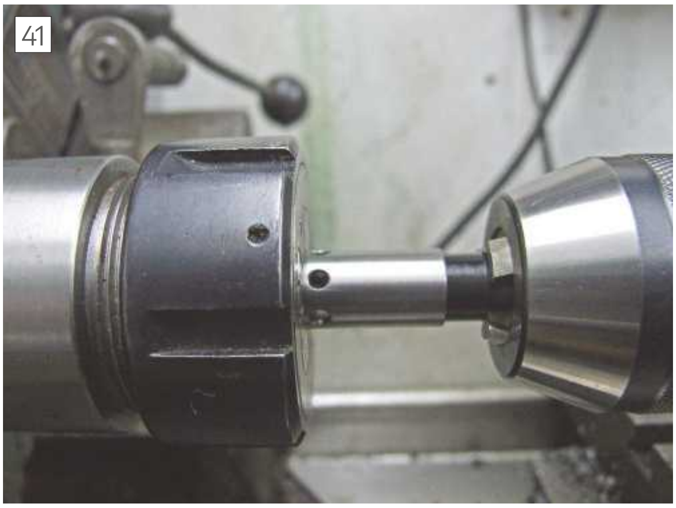
The assemblies can now be turned down to provide the for interference fit in the body, with around 0.001" about right. **Photograph 40** shows the two probe blanks fitted to their insulating sleeves - note the protrusion of the boss through the insulating sleeve.

Next, press fit the probes into the main body, **photo 41**, again using the lathe as a press. Here, it is advisable to use a collet to hold the main body to avoid distorting what is a fairly thin-walled tube. The tailstock chuck jaws should bear upon the steel as well as the plastic to ensure that the probe is pushed fully home without damage - the reason for facing the outer end of the probe and insulating sleeve now becomes apparent.

The bodies, complete with probes are shown in **photo 42** - note the slight protrusion of the insulating sleeve and probe blank from the main body - these will be faced off flush with the main body when finishing the probe.

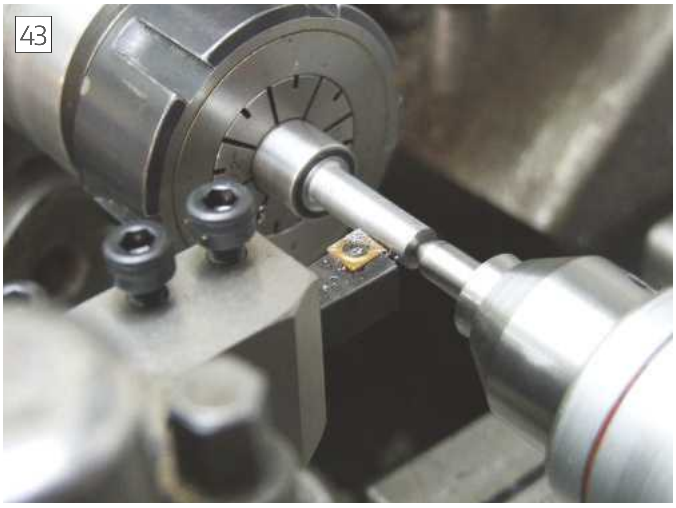
Finishing the probes

Next, we can finish the simpler of the two probes - the fixed one. Ideally the body should be held in a collet of known accuracy, as we are aiming for



Pressing the probe and insulating sleeve into the main body.

The bodies are now ready for the probes to be machined.



Machining the fixed probe to finished diameter.

Machining the ball seat - using a feeler to help gauge depth of cut.

the best concentricity between main body and probe, together with a size of 0.2500” diameter, which is a good test of finish machining skills. It helps to have tailstock support to control the forces crated by the cutting tool.

Photograph 43 shows the final cut being taken, which achieved a size of half a thou over the nominal finished diameter, following which I decided to polish to remove the final half a thou and achieve a better finish. Job done, so then I moved on to finish machine the ball-ended probe.

The stem of the ball-ended probe is in clearance to the gauging diameter, so exact size is not critical, but it should allow for overrun of the ball which has been designed at around 0.010” (each way), so a total diameter reduction of 0.030” seemed more than adequate, and therefore a finished diameter of 0.220” has been specified. Again, it is wise to use a tailstock centre when machining this, as an accurate centre will allow the 3mm diameter hole, and more importantly the ball seat, to be concentric with the main body.

Once the 3mm hole has been drilled, it is time to finish the probe by machining the seat for the ball. For this operation I used a ¼” ball-ended slot drill. The depth of the ball seat is 0.045” from the end face of the probe, which of course now has a 3mm hole in it. To gauge depth I placed a 0.025” thick rule on the end of the probe and touched it with the cutter, **photo 44**. This gave me a datum to zero my tailstock micrometer, after which I machined the seating by advancing the cutter 0.070” (0.045” for the seat plus 0.025” for the rule).

If you don’t have any form of accurately measuring the movement of the tailstock barrel, then marking the end of the probe with a marker pen (or similar) will allow you to see the remaining ‘land’ between the seating and the edge of the probe - around 0.015” is ideal. It’s just to avoid a sharp edge between the seat and the stem of the probe. I used a cutting compound, together with slow speed and feed to provide for a good finish, **photo 45**.

Miscellaneous parts (ball-ended probe only)

The final parts to complete the ball-ended probe are the moving parts, which consist of a ball, M2.5 x 30 capscrew and spring. These are shown assembled in **photo 46**.

Ball

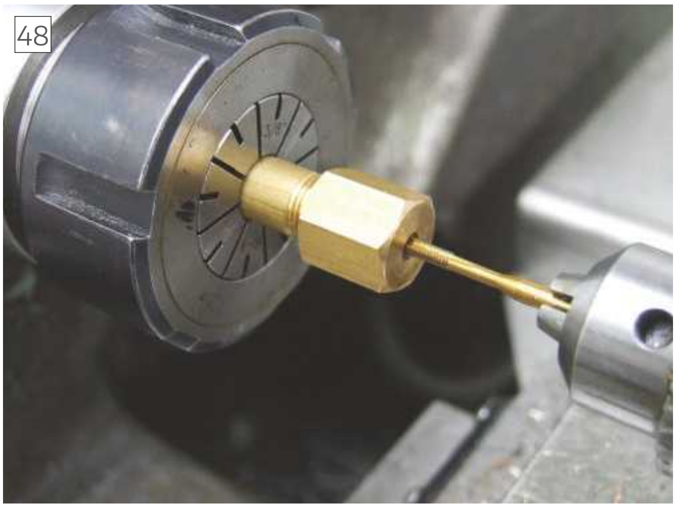
The ball can be made from either bronze or stainless steel, both of which can be obtained from model engineering suppliers. I found that these were spot-on size, which is exactly what we need. Although I test drilled and tapped both stainless and bronze balls without any problems, my preference for this project was bronze purely on the matter of wear - it’s easier to replace a ball than the probe body, although re-seating the probe body would be possible. Given our usage it is unlikely that wear would be a problem, so use whatever you can obtain easily.

Holding the ball in the simple holder (fig. 2.7), the first operation is to

The ball seat has now been formed - note the 'land' rather than a sharp corner.

The probe moving parts.

Spot facing the ball prior to producing the M2.5 threaded hole.



Tapping the ball M2.5.

drill an M2.5 tapping size hole to a maximum depth of around 0.220" to avoid breaking though or deforming the surface of the ball.

Then, just to make a neat job, I machined a flat on the ball using a 3.5mm 3-flute cutter in order to avoid raising a rough edge when tapping the M2.5 hole. This requires an infeed of just 0.020" from the first touch of the part-drilled ball, **photo 47**. Then drill and tap M2.5 to depth, **photo 48**.

Once done, remove the ball from the holder and gently stone off any burrs thrown up by either the facing or tapping operations.

Spring

I used a short length of stainless spring as sold by our model engineering suppliers for use with safety valves, although any suitable spring that you have to hand would be suitable. I made my spring around 0.3" long after flattening the ends on the grindstone. The spring needs to be sufficiently strong to 'snap' the ball back into it's seat if displaced, but not too strong to require excessive force to move it.

Final assembly and testing

The edge finder with the plain probe only needs the fitting of the cartridge and end cap/contact spring to complete, assuming that the cartridge has been tested and works ok. I did experience some problems where Araldite had been deposited on the wire and formed an insulating barrier which was quickly removed.

Assembly of the ball-ended edge finder is a little more involved, requiring the addition of the capscrew, spring and ball, which I fitted 'finger tight' to allow for future removal if required. To fit the ball you will need a long hexagon key (2mm AF) - I found that a tee-handled key was suitable for this.

As for testing, this can be achieved by fitting into a chuck or collet of known accuracy and the brought up to the edge of a component until it lights up and the slide reading noted (or DRO zeroed). Then if the chuck is rotated in steps of, say, 90 degrees you will get a good indication of accuracy. For the ball-ended edge finder displace the ball slightly and then withdraw, repeating and noting the reading to assess repeatability.

References and sourcing

I purchased the materials required from the following sources, with which I have no connection apart from being a satisfied customer. There will, of course, be other suppliers of these materials.

LED and resistors: Bright Components - **www.bright-components.co.uk**,
The Component Shop - **www.componentshop.co.uk**
Acrylic tube 10mm od x 1.5mm wall: eBay
Acetyl (white and black): Noggin End Metals - **www.nogginend.com**
Spring 3⁄16" x 23swg stainless: Polly Model Engineering
www.pollymodelengineering.co.uk
Low melt solder (70 deg): Eileens Emporium -
www.eileensemporium.com ■

An Easy Tapping Guide

Bob McMenemie describes a simple but invaluable aid to getting a fiddly job done well

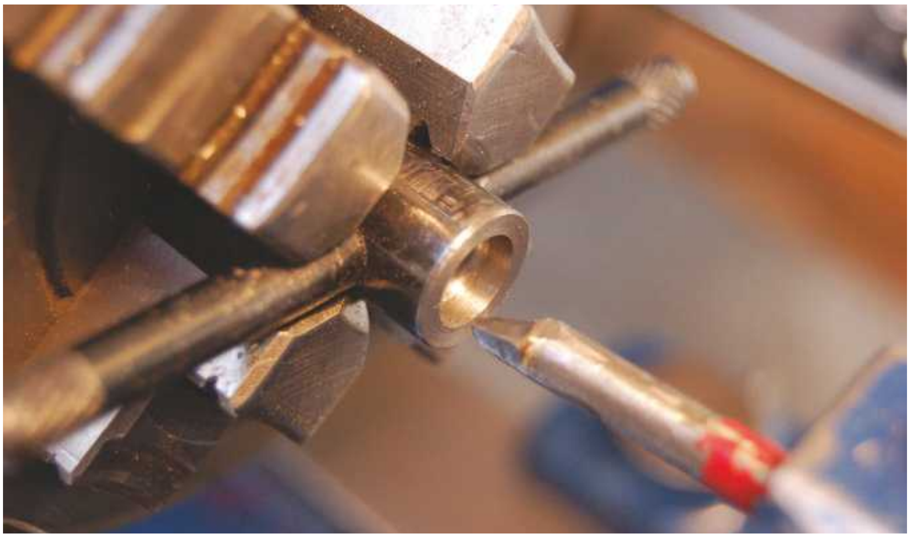
We all know the importance of starting a thread perpendicular to the work surface, otherwise the tap could wander from the centre line and cause all sorts of problems. There are fixtures you can make or buy that will ensure the tap keeps to its correct position, these tapping guides are a real benefit if you have one.

But hey! Why bother when you most probably have the main body of the tool already at your disposal – a bench drill press.

The idea is to make a fitting for the tap holder which is a round bar in line with the main axis of the holder and is fitted on the end of the holder, the bar is put in the chuck of the press drill and lightly hand tightened, with the tap firmly fitted in the tap holder the work is centralised over the hole to be tapped as normal.

The drill press chuck is then slightly loosened so that the tap holder can be rotated by hand with the chuck stationary, and the round bar is able to move up and down in the chuck, the tapping by hand can now begin.

Unplug the drill press before fitting the tapping guide!



Boring the tapping holder head.

Making the fitting

A piece of steel for the bar must have a diameter able to fit in the press drill chuck, the one I made is 10mm diameter mild steel, and about 40mm long. The bar is given a centre hole at one end to accommodate a lathe centre set in the tailstock later.

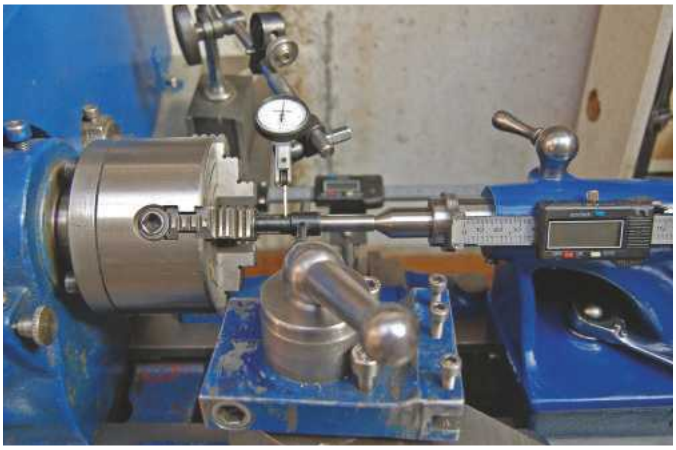
The tap holder must be bored out to suit the above diameter, there is not a lot of length available to bore out of the holder due to its own tommy bar, about 10mm, but the depth of bore need only be about 4mm. A carbide tool is necessary for this, HSS won't touch the hardened steel. A reasonably good fit is necessary here as the bar will be Loctited in the holder.

It might seem a small amount to bore out, but the piece does not need to have massive strength it is only for guidance purposes. I used ordinary Loctite which has served its purpose for a number of years, probably Loctite 638 would be more suitable as it has a longer adjustment time.

If carbide tooling is not available another option is to make a sleeve which will overlap the tap holder head which is about 14mm in diameter and turn the other end to suit the drill press chuck.

It is necessary that the axis of the bar sits in line with the axis of the holder as best as possible and to make sure it is, the chuck of the tap holder is tightened up and held central in the lathe chuck, the turned area just before the tommy bar is checked with a dti and adjusted to be on centre.

The bar is now offered up to the tap holder and with a tailstock centre applied to the centre hole in the bar, Loctite administered to the joint and pressed home, the work is rotated and the axis is set as central as possible. ■



Fitting the bar to the holder.

The tapping guide in use.

Introducing Milling Machines

Until twenty or thirty years ago most home workshops did not contain a milling machine and it was common to carry out milling on the lathe, still a good approach for the beginner and to be covered in a future issue. The advent of truly affordable benchtop machines has brought them in the easy reach of most hobbyists.

A typical vertical mill bears a superficial resemblance to a bench drilling machine, having a vertical spindle that can be move up and down, but there are several detailed differences. The whole machine will be much more rigid and the spindle will be designed to take heavy sideways loads, as well as up and down ones. There will be provision for moving the spindle up and down (the z-axis) by small, accurate, amounts and locking it in place. Instead of a simple table on which to fix the work, there will be a larger one that is capable of being moved accurately back and forth and side to side (the x and y directions). These differences enable 'cuts' to be applied in three dimensions allowing complex shapes to be machined using special cutters.

These differences mean that a typical milling machine can serve as a rather ponderous drilling machine, but a drilling machine, even if fitted with an x-y table, will rarely be capable of satisfactory milling work.

Horizontal mills have a spindle placed so that cutters run sideways over the work table, often supported by a stout over-arm arrangement. They are less common in hobby workshops as they are less flexible in use, but are often capable of heavier duty for their size. Some larger machines have both a 'vertical head' and a horizontal spindle.

Vertical milling machines can be broadly divided into two types - benchtop mills and turret mills. As the name suggests the benchtop machines are smaller and well suited to the needs of a hobby workshop. The Conquest Super variable speed mill is typical of many machines produced by SEIG in China and is a popular choice with beginners, **photo 1**. It is one of their X2 range which is almost as varied as their range of mini-lathe models.

1

Chester UK's Conquest Mill is a popular entry-level machine.

An example of a machine at the larger end of the bench mill field is the WM18, **photo 2**, a robust mill, capable of a wide range of milling applications. Available in metric with R8 spindle taper it has a 1.1kw variable speed motor and metal gears. Table travel is an impressive 565 by 370mm.

The turret type of mill, often colloquially called a 'Bridgeport' after a leading manufacturer, is floor-standing (rather than mounted on a stand) and will have the table mounted on a robust 'knee' that allows it to be moved up and down, **photo 3**. With suitable cutters these mills can remove metal at an astonishing rate – they are usually fitted with automatic feed at least in the x-axis, in order to exploit their capabilities to the maximum. Such machines are neither cheap nor small, but something of this type is almost essential if you intend to produce ambitious models such as four-inch scale traction engines and machine all the large components yourself.

The last issue's general advice about buying lathes also applies to milling machines, but some special issues to consider are:

- Belt drive or gear drive – belt drive tends to be quieter and more reliable than gear drive, especially for smaller machines.
- Table size and travel – check both the size and the travel - a huge table is not much good if it can't move very far!
- Spindle taper – R8 is technically superior to Morse taper, as it releases more easily, however, if your lathe has an MT3 spindle it can share tooling and collet chucks with an MT3 mill.
- Round column or dovetail column – while you can get more machine for your money with a round column mill bear in mind that it can be very difficult to keep the spindle accurately aligned when you move the head up and own. A dovetail column always keeps the spindle aligned.
- Tilting head or column- - these can seem very handy extras, but are not essential as a tilting vice will often suffice for angled cuts.

Using a Milling Machine

In many ways a milling machine is more intuitive than using a lathe. The milling cutter has to be held in the spindle (using a proper milling collet chuck, not a drill chuck) and the work is securely fixed to the machine's table or held in a vice on the table. The cut is set by adjusting the X, Y and Z axes of the mill to align the cutter with the work, and the actual cut is taken by moving one of the axes.

The correct depth of cut for any

machine will depend on its size and rigidity and the type of cutter used. A general rule of thumb for modest machines is that the typical depth of cut should not exceed about one-half of the cutter's diameter. When using small or fragile cutters the depth of cut should be further be reduced.

Cutter Holders

Although some cutters can be fitted directly into the mill spindle, the majority have cylindrical shanks (usually in a limited range of metric or imperial sizes) that may or may not have a screw thread. These are designed to be held in suitable collets that, in turn, fit in holders which you have to match to your mill's spindle taper (typically R8, MT2 or MT3 for smaller mills).

The most common system for holding cutters is the ER (Extended Range) system which is available in many sizes, ER25 and ER32 (the number is the outside diameter in millimetres) are popular. Each ER collet will hold a range of cutter diameters, typically with a 1mm range for larger sizes and 0.5mm for very small sizes.

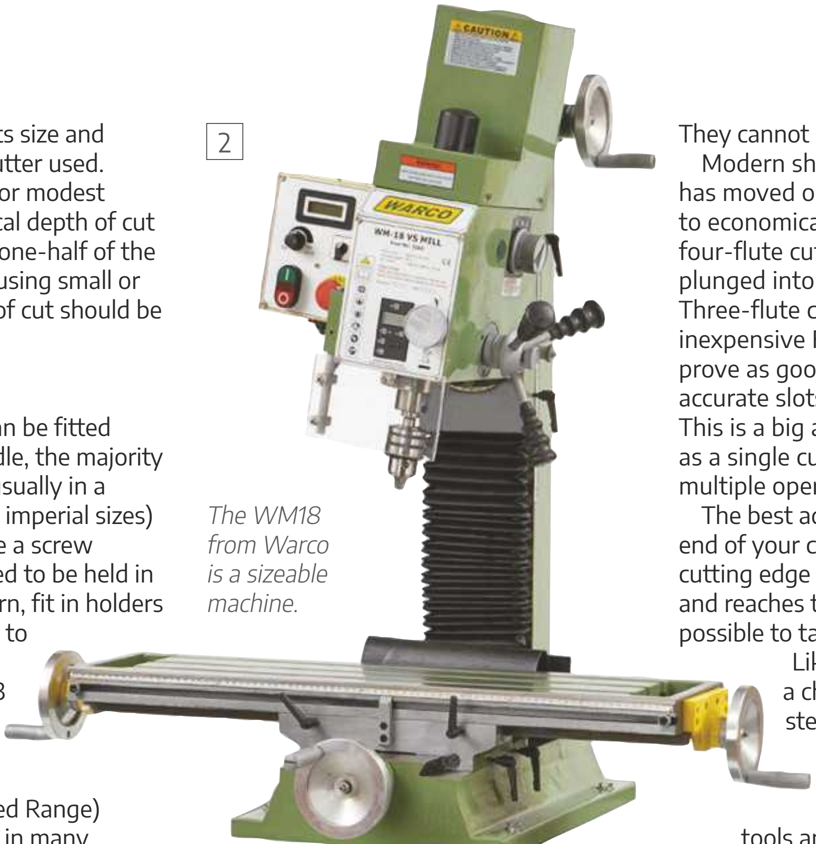
You may also come across various other systems including some 'ER-alike' systems – these can be harder to find spare or extra collets for and are rarely any cheaper than ER systems. You may also come across collet chucks for threaded cutters to the Clarkson and Osborne (also known as 'posilock') designs - they both take the same cutter sizes. Bear in mind that you can hold threaded cutters in plain collects (using the smooth part of the shank), you can't use threaded collets for plain shank cutters.

It is worth mentioning that some cutters, including FC3 'throwaway' cutters, come with plain 6mm or ¼" shanks with a small flat – these are designed to be held in very simple holders and secured with a grub screw.

Milling Cutters

In the recent past the commonest milling cutters were end mills and slot drills, and these are still likely to be regularly encountered, **photo 4**. Slot drills have two cutting edges and are excellent for cutting a slot to an exact width or for plunging into the work like a drill, as they have asymmetric cutting edges on the end that cut right to the centre. End mills have four cutting edges are normally used to cut only on their sides as they tend to 'wander' if cutting a slot.

2



The WM18 from Warco is a sizeable machine.

They cannot be plunged into the work.

Modern sharpening technology has moved on, and it is now possible to economically sharpen three and four-flute cutters so that they can be plunged into work, just like a slot drill. Three-flute cutters, including the small inexpensive FC3 throw-away cutters, prove as good, or better, for cutting accurate slots as traditional slot drills. This is a big advantage for production as a single cutter can be used for multiple operations.

The best advice is to take a look at the end of your cutter before using it, if one cutting edge is longer than the others and reaches to the centre, then it will be possible to take plunging cuts with it.

Like lathe tools, you also have a choice between high speed steel (HSS) and tungsten carbide tools. Carbide tools run at around three-times the speed of HSS tools and need to be worked fairly hard to enjoy the advantages they

3

This Bridgeport Mill is typical of those found in commercial engineering workshops and much favoured by hobbyists fortunate enough to have the space for one.

Left to right: Slot drill with threaded shank, four flute end-mill, 'rippa' cutter, three-flute carbide end mill, FC3 'throwaway' end mill.

offer. Slower running HSS tools are both cheaper and more forgiving (in particular they are less likely to chip if abused) and are recommended for beginners.

Rippa Cutters

Rippa end mills have serrated edges; they don't leave as good a finish as ordinary cutters, but they work more efficiently and are useful for removing metal faster if you have a medium-sized mill.

Fly Cutters

A fly cutter is a single point tool, often a bar of high-speed steel in a holder, sharpened rather like a knife tool that is used at slow speed (because of the large diameter it sweeps) to take broad shallow cuts across a surface, **photo 5**. The disadvantage with fly cutters is they need to be fed across the work very slowly, but as long as the mill spindle is accurately perpendicular to the work they can leave a very smooth, accurate finish. They are also relatively inexpensive.

Face Mills

Face mills often use tungsten carbide inserts to provide the cutting edges. They are chiefly used for taking wide, relatively shallow, cuts across a surface. While they do not leave as fine a finish as a flycutter, they are faster to use.

Slitting Saws and Side and Face Cutters

Slitting saws are literally small circular saws used for cutting off material or making thin slots. Side and face cutters

A simple home-made flycutter.

6

Dovetail and t-slot cutters

are thicker and have teeth that extend on to their sides. Many beginners make the mistake of running slitting saws too fast and blunting them. In fact, a typical 75mm slitting saw is best run as a speed as low as 70 to 80 rpm when cutting steel.

Special Cutters

A whole host of specially shaped cutters are available, such as for cutting dovetails and t-slots or for making concave or convex shapes, photo 6. It is best not to invest in too many 'specials' at the start until you have a clear idea of the sort of work you will be carrying out.

Cutter Speeds

Speeds for milling cutters are broadly in line with those for lathe work, except you should use the diameter of the cutter. This means small cutters often run fast – perhaps a few thousand rpm for small tungsten carbide cutters, while larger cutters, especially HSS ones should be operated at much lower speeds. Last month's chart for lathe cutting speeds can also be used to estimate milling cutter speeds.

> If the milling machine has excessive play in its slides or is not well set up, the work can also suddenly move forwards being 'grabbed' by the cutter.

Conventional and Climb Milling

If you think of the side of a milling cutter cutting into the side of a workpiece, there are clearly two ways in which you can move the work past the cutter. Conventional milling pushes the work against the rotation of the cutter. This tends to stop the tool 'digging in' and prevents the work being 'grabbed' by the cutter. For these reasons it is the recommended way for beginners to work.

Allowing the work to move past the cutter in the direction it is rotating is called 'climb milling' because it has the tendency to cause the cutter to 'climb out of the work'. If the milling machine has excessive play in its slides or is not well set up, the work can also suddenly move forwards being 'grabbed' by the cutter. This can cause damage to the cutter or to the work, so climb milling is best left to the experienced who are confident that their machine is both rigid enough and well enough set up to climb mill successfully.

You may ask why climb mill at all? There are two reasons. First it can produce a better finish and a very light final climbing cut in the reverse direction can be used on lighter machines to take advantage of this. The second reason is that because it forms chips that start think and finish thin it reduces the shock of the tool's cutting edges leaving the work - a major cause of excessive tool wear in high-speed CNC milling.

To sum up, unless you have a rigid machine with little or no backlash (such as a CNC machine with ballscrews) it is best to avoid all but the lightest of climbing cuts. ■

A Vertical Drilling/Milling Slide for The Small Lathe

Terry Gorin describes a slide designed for his Unimat but potentially for any small lathe

Slide components

When needed, the headstock and spindle of the Unimat SL1000 lathe can be mounted vertically, with the spindle at 90 degrees perpendicular to and above the bed, thereby adding a Z axis for drilling and milling operations. Spindle axial movement within the headstock is approximately 25mm, but movement was not originally indexable. An indexing screw, previously added as a modification, enables the spindle and cutting tool to be set a pre-determined height above the cross-slide but a vertical slide will be required if the workpiece, of necessity, also needs to be raised above the cross-slide.

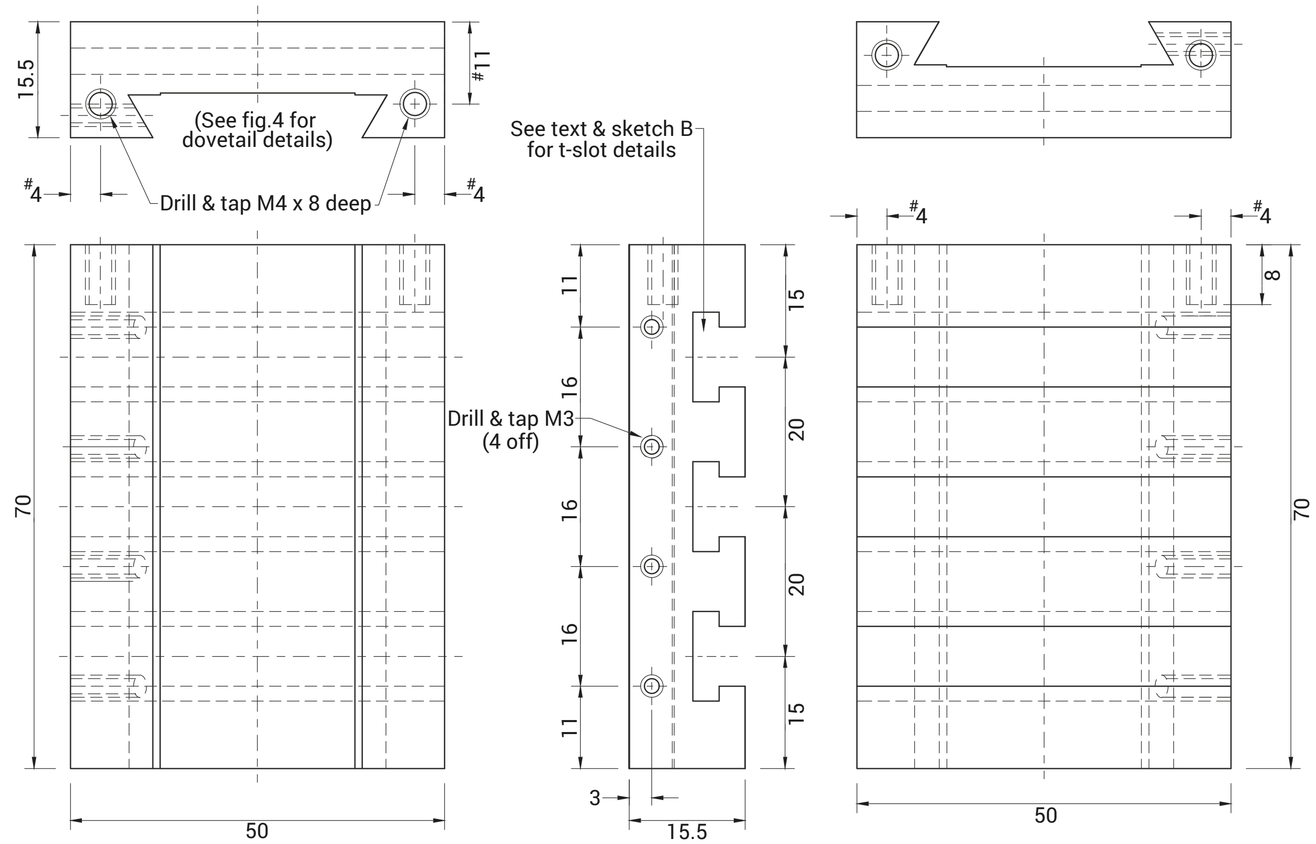
Design

A vertical version of the existing Unimat cross-slide was a possibility, but I was not sure of the rigidity of a workpiece relying on the compound effect of three round bar slideways! A conventional dovetail slide, suitably sized for this small lathe, was the final choice. Stock size BMS material was used for the main components for ease and simplicity of construction. In a commercially available slide the base plate and male slide are usually combined in cast iron, but I considered that the BMS bolted construction described here will give adequate rigidity for its intended use. The separate, finished components of the slide are detailed in **fig. 1** and **fig. 2** and **photo 1**. **Figure 3** and **photo 2** show the components assembled.

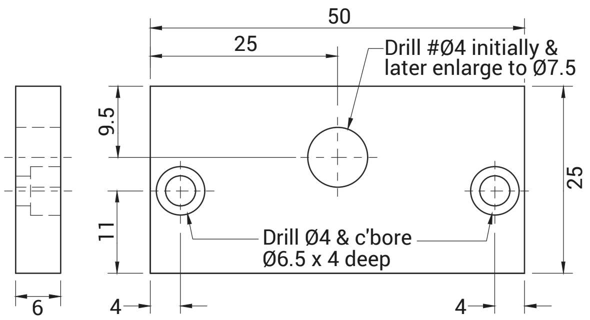
Not having machined dovetails before meant searching the internet and the MEW forum for information. The website 'johnf'sworkshop/

A vertical version of the existing Unimat cross-slide was a possibility, but I was not sure of the rigidity of a workpiece relying on the compound effect of three round bar slideways!

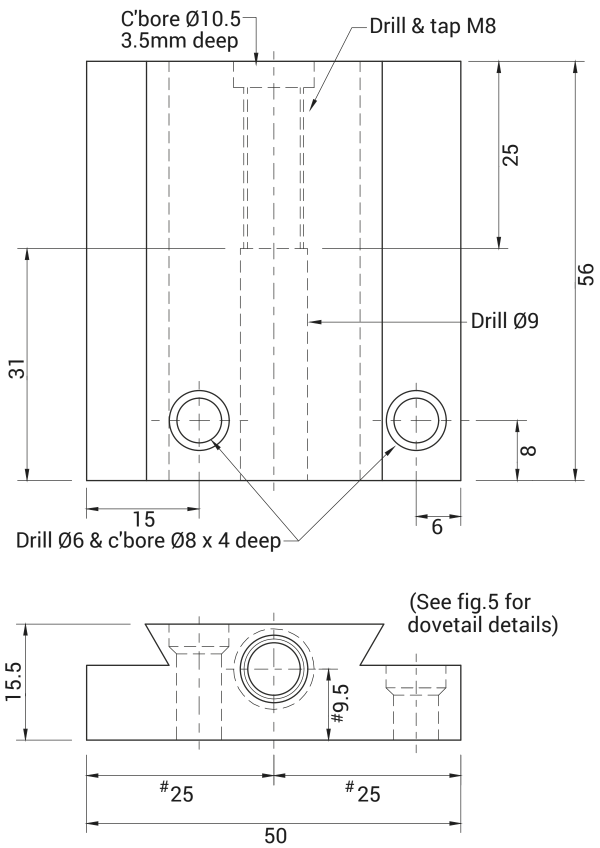
Fig.1



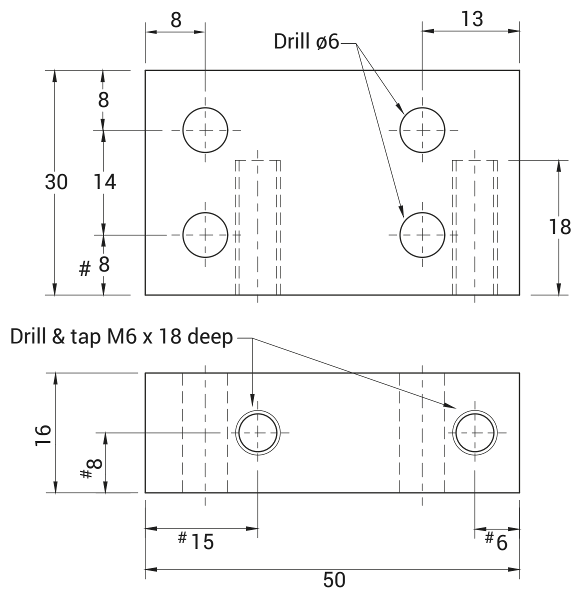
(1) Female Slide
Mat'l: BMS



(3) Feedscrew Bracket
Mat'l: BMS



(2) Male Slide
Mat'l: BMS

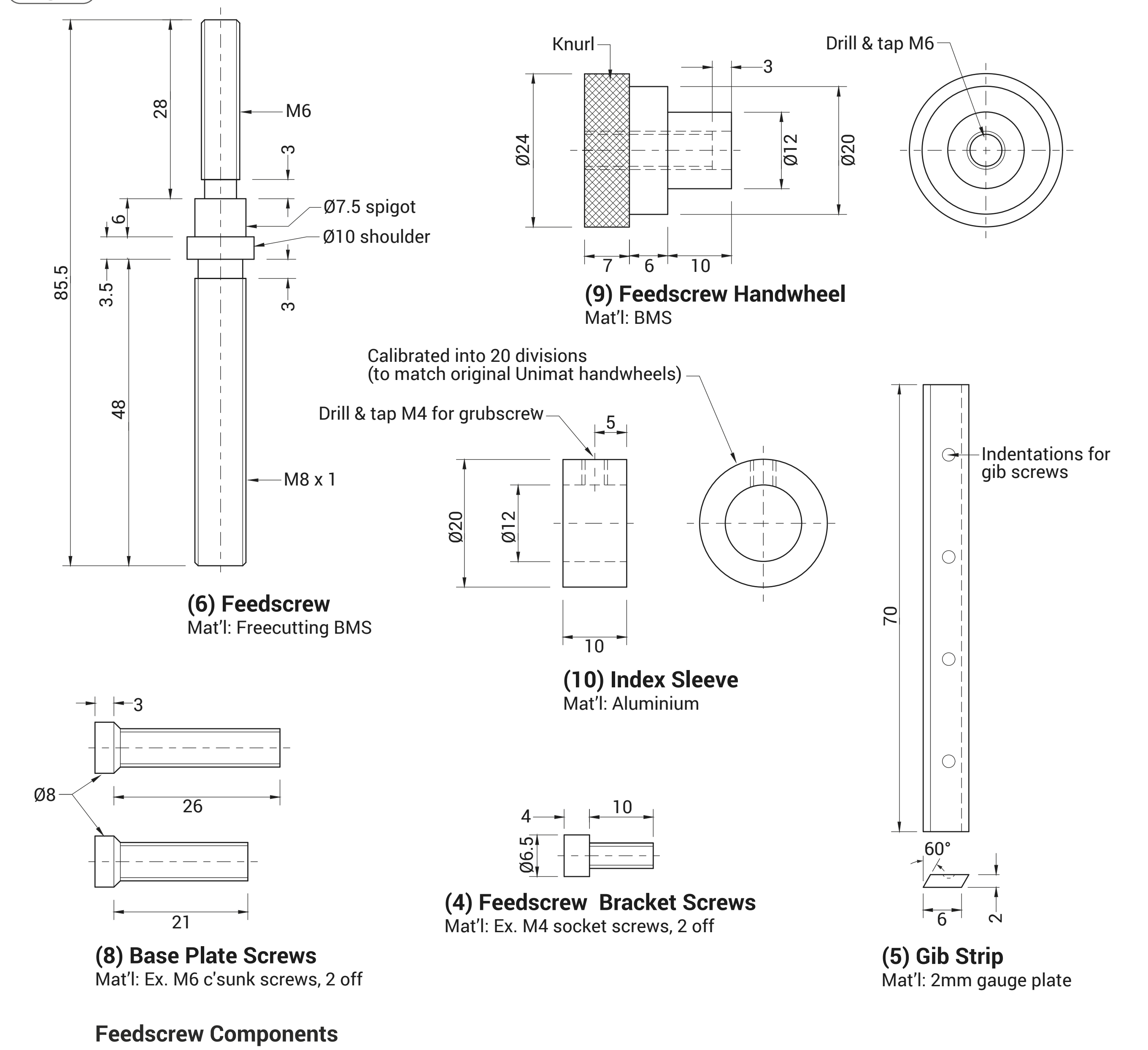


(7) Base Plate
Mat'l: BMS

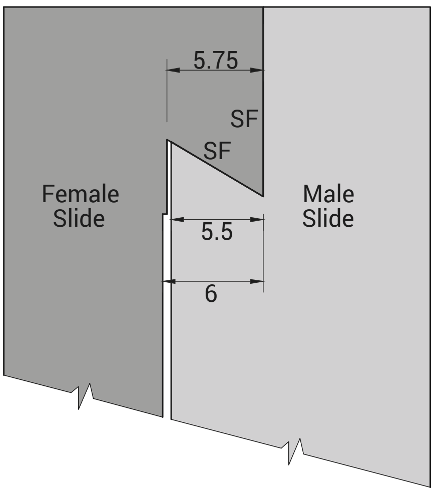
Dovetail slides

All dimensions in millimeters unless otherwise stated

Fig.2



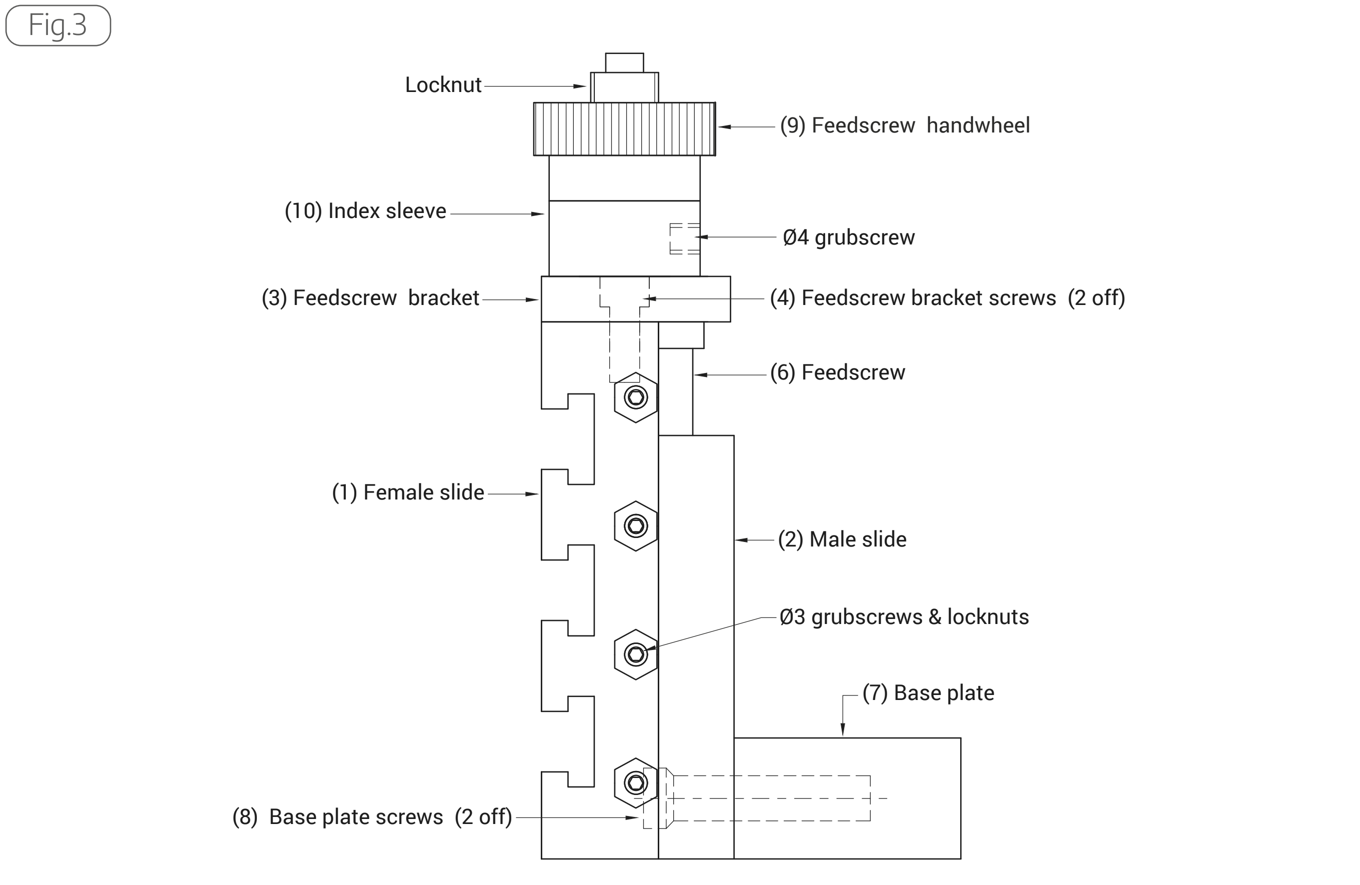
making dovetails' finally helped my understanding of the essentials of what I was trying to achieve, which was not trying to match a new dovetail to an existing (needing some knowledge of dovetail geometry mathematics) but simply creating new male and female dovetails needing only to match each other and sliding on two faces only. **Sketch A** shows schematically the only dovetail dimensions needed for this small slide, and repeated in **fig. 4** and **fig. 5**, to produce the sliding faces shown as SF in the sketch. For a larger slide these dimensions might be increased but, more importantly, similar differences between them would still be necessary to ensure the clearances between surfaces that are not meant to be in sliding contact.



Sketch A. Dovetail Schematic

Construction

All machining was carried out using the Myford lathe and vertical slide with all milling using cutter adaptors with drawbar (as per MEW article from June 2014), my first project after purchasing the Myford. The female slide (1) and male slide (2) were fabricated first, in that order, and all milling was carried out with the workpieces reliably bolted, not vice held, direct to the vertical slide. Not wanting any clamping bolt holes to show in these relatively small slides when finished, I decided to temporarily increase lengths of both components,



Vertical Slide Assembled

Slide assembled

as fig. 4 and fig. 5, (Having determined that the total increased lengths of the slides, plus tool clearances, were within the Myford cross-slide traverse). Both were then cut from 50 x 16 mm BMS (bright mild steel) and holes drilled and counter-bored to the depths shown to ensure that clamping bolt socket heads are clear of the cutters when milling. For machining the dovetails, both slide workpieces in turn, were bolted, as indicated in **photo 4**, to the central slot of the Myford slide, parallel to and perpendicular to the lathe bed and spindle. The workpieces when mounted in this position also fell comfortably within the vertical traverse of the Myford slide for machining both slides. When first mounting the Myford slide, and checking for horizontal and vertical alignment, also took care that the bottom of the slide cleared the front edge of the saddle when at its lowest. **Photograph 3** shows from left to right the large T-slot cutter, 8mm diameter slot drill, dovetail cutter and woodruff cutter used for machining the slides.

Female Slide (1)

Referring to fig. 4, machining was

Tools used

carried out in the stages shown in the drawing and described below. Stage 1 – single pass facing cuts were taken to the full length and width of the workpiece using the large T-slot cutter (too large for the T-slots on this slide but proved excellent as a facing cutter). Saddle locked before cutting. Thickness of slide then reduced to about 15.5mm, not a critical dimension.

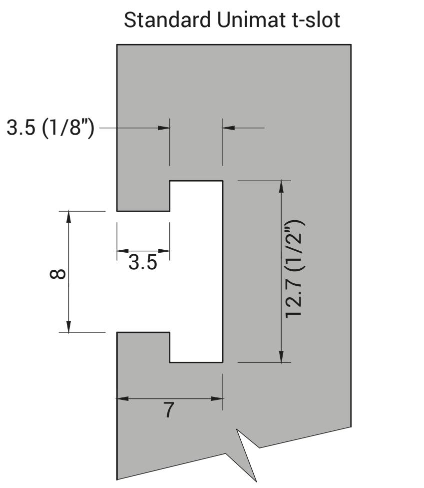
Stage 2 – an 8mm dia. slot drill was used to mill out the central recess of the dovetail. Using the Myford leadscrew in conjunction with the cross-slide and vertical slide feedscrews, progressive cuts were taken to the final depth and width shown. The saddle locked between and before final cuts. Photograph 4 shows the completed recess with the dovetail cutter mounted for the next stage.

Stage 3 – The 25mm dia. 60-degree cutter, was used to cut the lower dovetail first, (only because it was more easily visible for a first attempt!) The cutter was advanced the 5.75mm dimension into the milled recess and saddle again locked (and not unlocked until completion of both upper and lower dovetails). By combination of slide feedscrew and cross-slide, cutting to the lower dovetail was continued, until the lower 11mm dimension was reached, see **photo 5**, the workpiece then raised to cut the top dovetail, see **photo 6**, until the upper 11mm dimension reached. These dimensions were only to centralize and create a female dovetail width proportional to the size of the slide, absolute accuracy was not essential. The male dovetails will be cut to match.

Cutting T-slots

The part finished female slide was next re-bolted vertically to the Myford slide top and bottom slots, with the dovetails facing the vertical slide and the 20mm centre line spacings of the slots marked out on the slide face to be machined, as fig. 1 and detailed in **Sketch B**. In turn, each slot centre line was first centralised on the 8mm dia. slot drill and milled to the full 7mm depth. The imperial sized ½" x ⅛" woodruff cutter then replaced the slot drill, at the same height and, when aligned with the bottom of the previously cut slot, and fed through in a single pass, produced a finished T-slot of same size as the Unimat standard slot. The same procedure then repeated for the remaining slots, as **photo 7**. The slide was then set aside, but the Myford slide not yet removed.

Milling female slide



Sketch B. Milling T-slots

Male Slide (2)

Referring to fig. 5, the machining was again carried out in stages as described below and shown in the drawing.

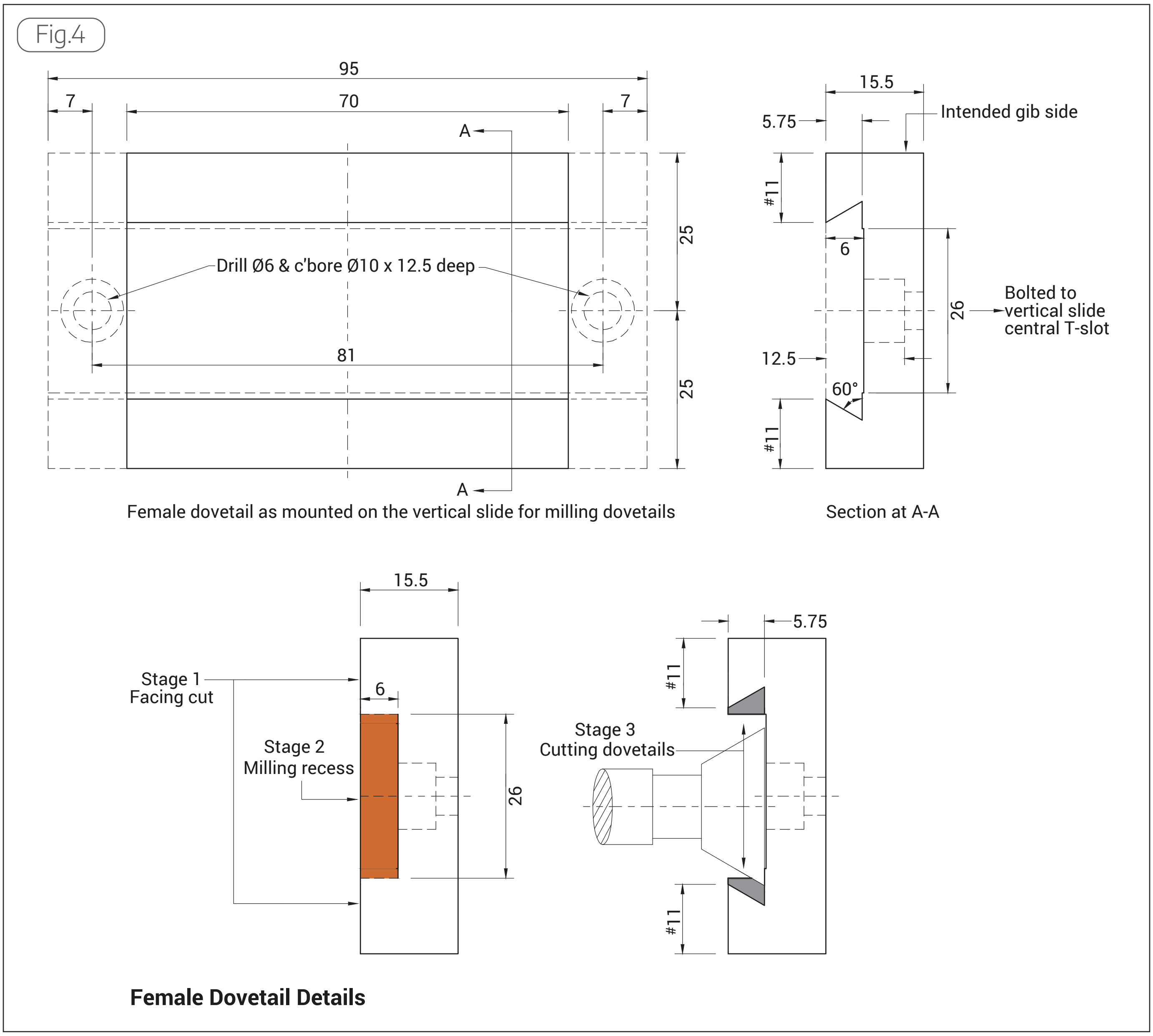
Stage 1 – As before, facing cuts were taken to the full length and width of the workpiece with the saddle locked.

Stage 2 – The 8mm dia. slot drill was used to mill the recesses shown. The saddle again locked between and before final cuts.

Stage 3 – The top of the workpiece was marked as the gib side of the finished slide. When finished, the non-gib (or 'plain') sides, of both the male and female slides to be flush when assembled. The difference in width of the gib and 'plain' sides of the male slide dovetails, indicated in fig. 5 as 13 and 11, is needed to accommodate the 2mm thick gib and facilitated the cutting and fitting of the dovetails by 'trial and error'. The lower dovetail was started first. The workpiece was advanced 5.5mm by leadscrew until the tip of the dovetail cutter was just 'shaving' the depth of the previously milled slot, as fig. 5, and the saddle locked (and not unlocked until completion of both upper and lower dovetails). By cross-slide and slide feedscrews the lower dovetail was cut, from below, until the initial depth reached was about 0.5mm less than the final depth (11mm) required. The workpiece was next lowered to the gib dovetail position and progressively cut, from above, until the female slide was just able to engage and slide over

Milling lower dovetail

Completing upper dovetail



Female Dovetail Details

the male slide (indicated as initial cut). The workpiece was then returned to the lower 'plain' dovetail and, with the female slide now able to slide up into close contact with its male, further cutting and testing carried out until, by sight and touch, the 'plain' sides of both female and male slides were flush. At this point the workpiece was finally, again raised to complete the gib dovetail. A short length of 2mm thick gauge plate, but slightly narrower than the completed gib, shown in fig. 2, was prepared as a test piece. Further cutting and testing of the gib dovetail was continued until the gib test piece slid easily into its slot (Indicated as Final cut). (The gib sides of both male and female slides should now be marked to ensure correct assembly later when completing). The part finished male slide was removed from the lathe and set

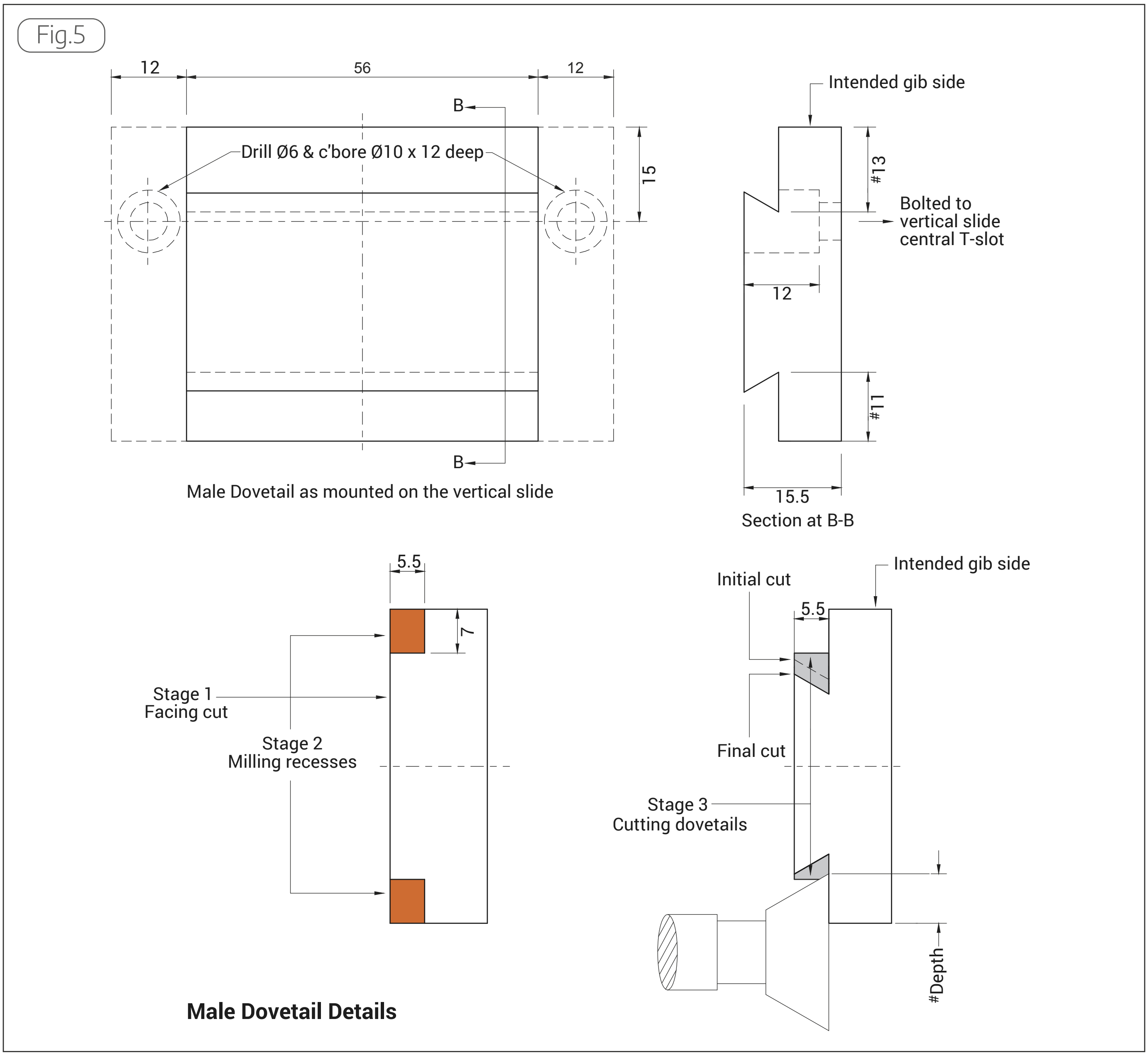
7

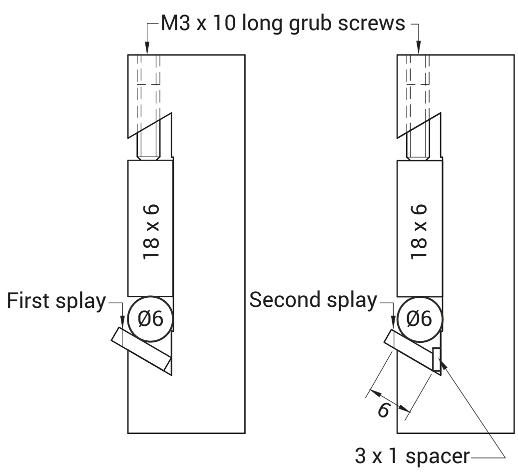
Milling T-slots

aside. The now surplus, elongated ends of both male and female slides could now be sawn off and both square turned to their final lengths as shown in fig. 1.

Completion of female slide

The Feedscrew bracket (3) was next fabricated. The 4mm dia. holes in the bracket were drilled and counter bored but the central hole position was drilled 4mm dia. only at this point. The bracket was then aligned and clamped to the top of the female slide, as fig. 3, the positions of the M4 tappings, at the top of the female slide, were spot drilled through the 4mm dia. holes at the top of the bracket, and then drilled and tapped to the depths shown in fig. 1. The previously marked gib side of the slide was then drilled and tapped M3 for the gib screws to complete the slide. Gib Strip (5) was initially cut 8mm



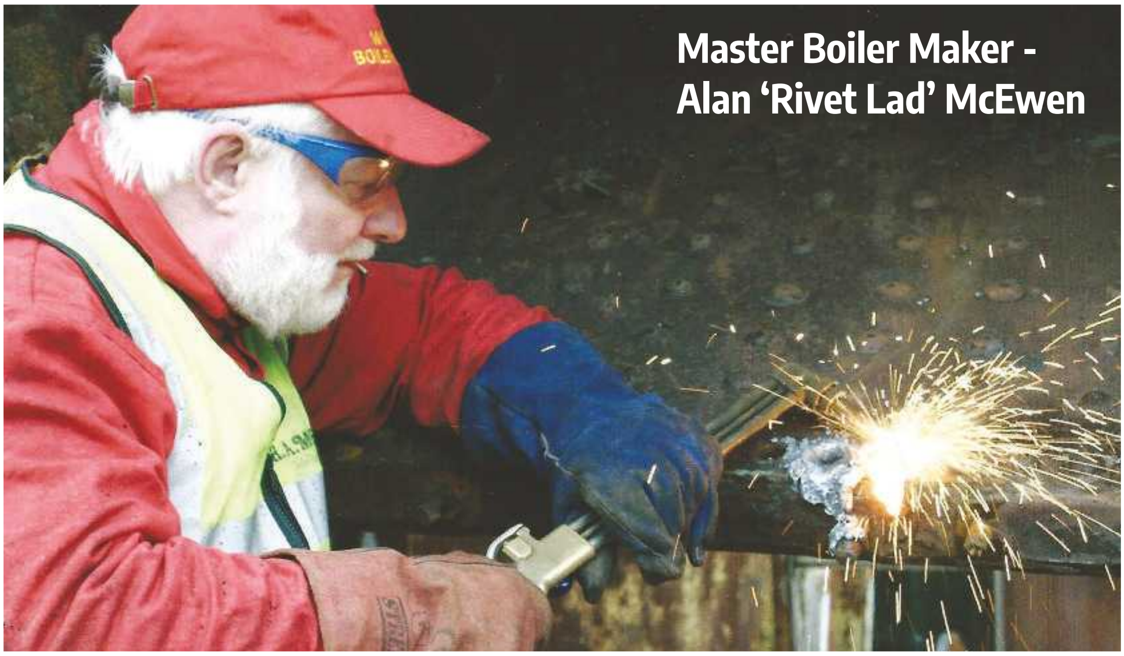


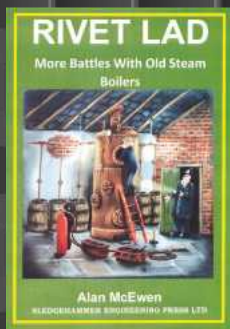
Sketch C. Milling Gib Splays

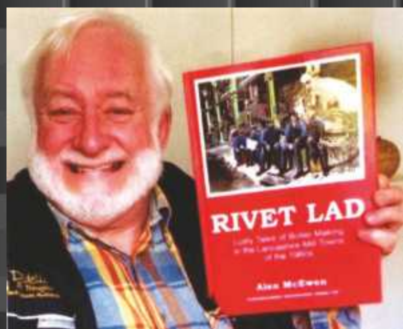
wide to enable the edges to be splayed using the completed female slide as a fixture as indicated in **Sketch C**. For the first splay cut, the gib was clamped tight against the lower dovetail using a 6mm dia. parallel and 18 x 6mm packing piece, all held in place by grub screws. The assembly then held in a milling vice clamped to the Myford slide, now remounted, checked for horizontal and vertical alignment, and the first splay milled by slot drill. For the second splay the gib was reversed, set to protrude about 5mm from the vice towards the operator, and the first splay clamped tight against a 3 x 1 packing as indicated. The packing to prevent damage to the female slide when cutting and the protrusion for checking gib width, when and after cutting second splay. To complete, the gib was next 'sandwiched' between male and female slide dovetails, the grub crews tightened to mark locations, and these then centre pointed and enlarged by 3mm dia. drill tip. These indentations have proved adequate for this slide, but a larger version would benefit from indentations milled at the appropriate angle.

● To be continued

Bringing British industrial history to life







When Master Boiler Maker and author, Alan McEwen was a young sprog, he loved banging and hammering on rusty old boilers; now that he is an old hog, he just prefers others to bang and hammer! Alan McEwen's Boiler Making adventures and also 'potted histories' of several Lancashire and Yorkshire Boiler Making firms, can be read in RIVET LAD *- Lusty Tales of Boiler Making in the Lancashire Mill Towns of the 1960s.* The book is crammed with 'hands on' technical information of how Lancashire, Locomotive, Economic, and Cochran Vertical boilers were repaired over 50 years ago. The book's larger-than-life characters, the hard as nails, ale-supping, chain-smoking Boiler Makers: Carrot Crampthorn, Reuben 'Iron Man' Ramsbottom, Teddy Tulip, genial Irishman Paddy O'Boyle, and not least Alan himself, are, to a man, throw-backs to times gone by when British industry was the envy of the world.

Alan McEwen's first RIVET LAD book: *RIVET LAD – Lusty Tales of Boiler Making in the Lancashire Mill Towns of the Sixties* published September 2017 is now priced at £25 plus £3.00 postage and packing to UK addresses.

Alan's second RIVET LAD book: *RIVET LAD – More Battles With Old Steam Boilers* was published in September 2018. **Now priced** at £25 including postage and packing to UK addresses.

BOOK BUNDLE SPECIAL OFFER

Both RIVET LAD books can be purchased together for £40 plus £5 postage and packing to UK addresses.
To place an order please telephone 01535 637153 / 07971 906105. All our books can be ordered on our website www.sledgehammerengineeringpress.co.uk or email: lankyboilermaker@btconnect.com.
Overseas customers contact Sledgehammer by email for postage costs.
We accept payment by debit/credit card, cheques, cash and postal orders made out to SLEDGEHAMMER ENGINEERING PRESS LTD.
World From Rough Stones House, Farling Top, Cowling, North Yorkshire, BD22 0NW.

Testing a Three Phase Motor

David Dunn uses an transformer and capacitor to run small three phase motors from a single phase supply.

Most of MEW readers are practical folk who, with a variety of hobbies, out of sheer necessity dabble in mechanics, woodwork and electrical matters as a matter of course.

Various articles have appeared from time to time referring to the use of and conversions to three phase power. To some, electrical knowledge is almost a black art and indeed has many facets.

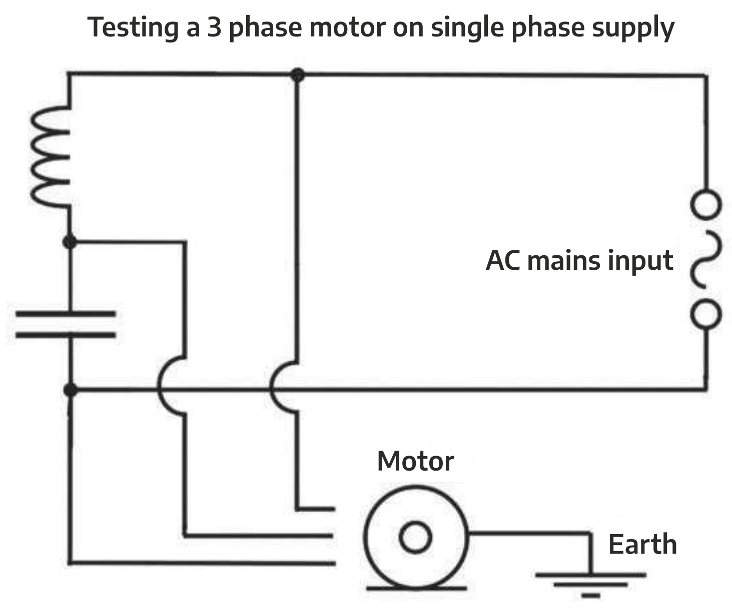
It can also be dangerous, but then many of our activities have potential for injuries when the brain is not in gear. I have to say (or our editor would) that all the usual hazards of mains wiring are present of course, and if you are not confident you can do the work safely, find someone who can. Switching off the supply and standing on a rubber mat is always a good precaution when working with high voltages. An error could be fatal.

It does not seem to be common knowledge that even if you only have a single-phase supply, it is easy to check or make use of a 3 phase motor using a simple device. It is the same principle that the commercially available inverters use. I offer this little tip mainly for the convenience of readers who may come across 3 phase motors with unknown qualities (often at scrap price in auctions and garage sales) and this is an easy test of the unknown.

There are technical limitations relating to the actual components regarding the power available and I suggest that without delving deeper into the theory it is only used for light use or testing, but commonsense applies.

The circuit diagram, **fig. 1**, shows the set up. it is easily assembled in a few minutes with soldered or chock block connectors as required. I have for some years used three phase motors to run items this way as a permanent installation several times. Components must be installed in a suitable box of course. A capacitor

Fig.1



Motor rating plate

and an inductor is required to produce the third phase. I used a transformer (from my "junk" store) which is simply a mains input primary with various windings on the secondary-the output side – only the primary is used and the criteria is simply that it can pass the required current and has a fairly substantial iron core. A transformer of the type used to provide the required 110 volts for building site appliances is quite suitable. The capacitor must be one suitable for AC mains use, not an electrolytic type. The value is not critical, 8 microfarad or more will work, the one pictured is from an old fluorescent tube unit, or a starter capacitor from a refrigerator, but most induction motors have a starter capacitor which would be suitable. The motor has a plate affixed, **photo 1**, which gives specifications and at the quoted 1.1 Amp its needs are easily catered for.

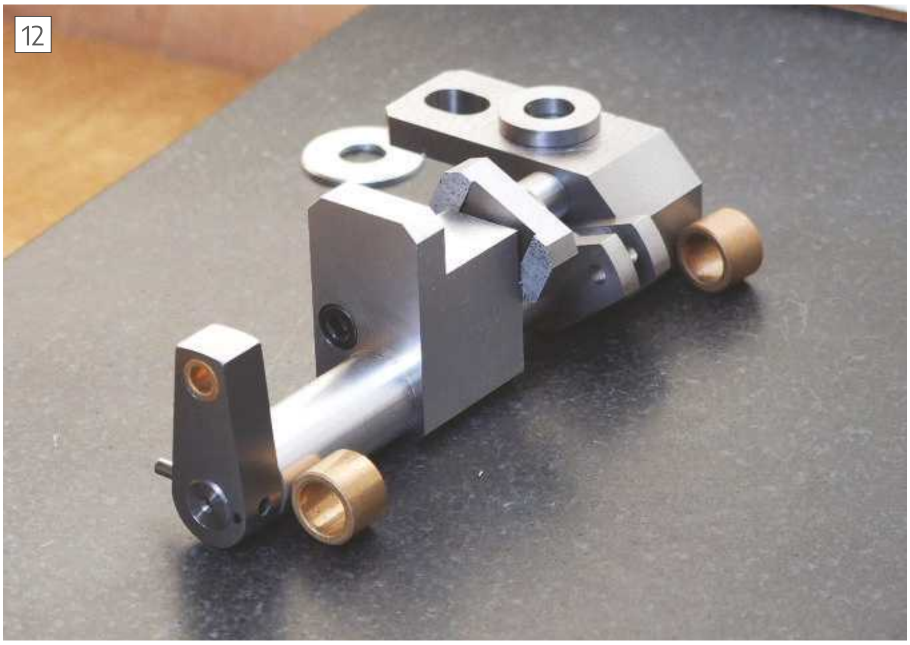
Connect up as shown, using the three "live" wires of the motor. The earth should be obvious, and it is a good idea to connect that first as a precautionary measure. It does not matter which order the three wires are connected. "choc blocks" are handy for test purposes. The wires to the transformer and the capacitor are soldered. Motor connections, **photo 2**, are usually self-explanatory and may or may not be marked. The example had no markings inside the cover, The fourth connection has a (green) earth wire to the frame leaving the other three for the phase wires. A length of 4 core cable happened to be handy and that was used to make the test. Colours of 3 phase wiring have been changed over a few years and have also been different in several countries. Do not rely on those alone: white, red, black, grey, yellow and blue may be found. Earth is usually a green or green/ yellow stripe.

Ensure the motor can't fall if it 'jolts' when switched on. Make sure all connections are inaccessible before connecting the supply and switching on. Assuming the motor turns, then changing over any two of the motor connections will change the direction of rotation. ∎

Motor connections

Fitting a Screwcutting Clutch to the Emco Maximat Super 11

Graham Meek describes an accessory thirty-three years in the making - Part 2.



12

Lower bearing assembly.

Now is the time to assemble the lower bearing assembly, **photo 12**. I thought this part of the conversion was going to give me the greatest headache as there is no machined face under the headstock end hold down bolt. In fairness to Emco the machined face is not required for the hold down bolt. To minimise the effect of the rough cast surface there is an aluminium washer between the bed and the lower bearing. A further clamp on the front of the bed, **photo 13**, ensures the assembly cannot twist about the hold down bolt. A pre-assembly of the unit will be found an advantage. The common 8.5mm dimension allows these two faces to be aligned on a flat surface and the M5 capscrew tightened. The pillar between the two parts aids to further rigidity and the above pre-assembly. However, the lower bearing assembly cannot be tightened on the machine just yet. Using a piece of BMS the same size as the eventual drop link but a little longer. Try the alignment of the top bell crank clevis with the lower clevis. If the bar slides freely in both, start tightening the hold down bolt and the clamp on the bed. Take it in stages checking each time the fit of the bar in the clevis and the freedom of rotation of the trip rod lever in its bearings. Once satisfied that all is both securely tightened but the parts are still free to move things can move on.

Make an embryo drop link, a little longer than drawn, but only produce the reamed and tapped hole in the one end only. Remove the control unit from the bedway and assemble the embryo drop link. Returning the control unit with the drop link is not easy. Place some rag in the void beneath the headstock. Holding the drop link lower the control unit through the bedways onto this rag. Now feed the drop link down towards the lower bearing. At the same time coax the control unit back up into its correct position and slide the support bar beneath. By slightly lowering the back end of the ram and manipulating the connecting link from the changewheel end. Slip the connecting link onto the ram dowel. Assemble the phosphor bronze slider, (short end nearest the

Fig.6

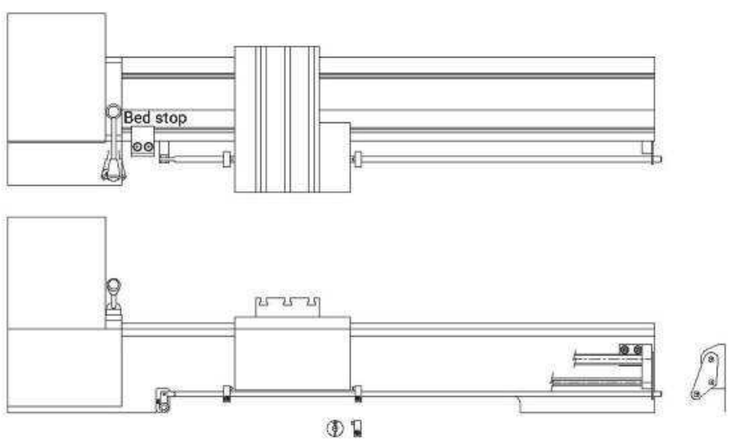
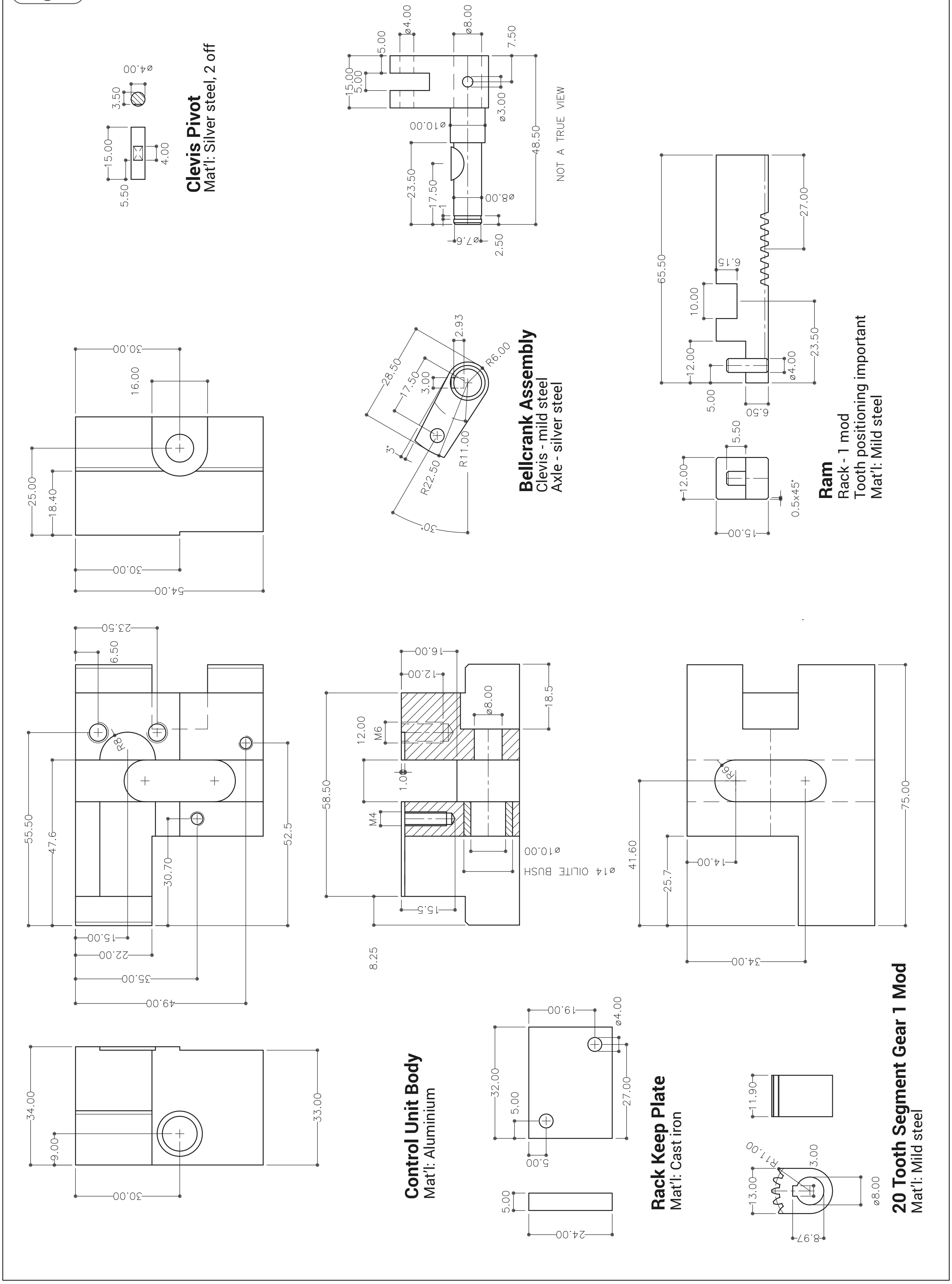
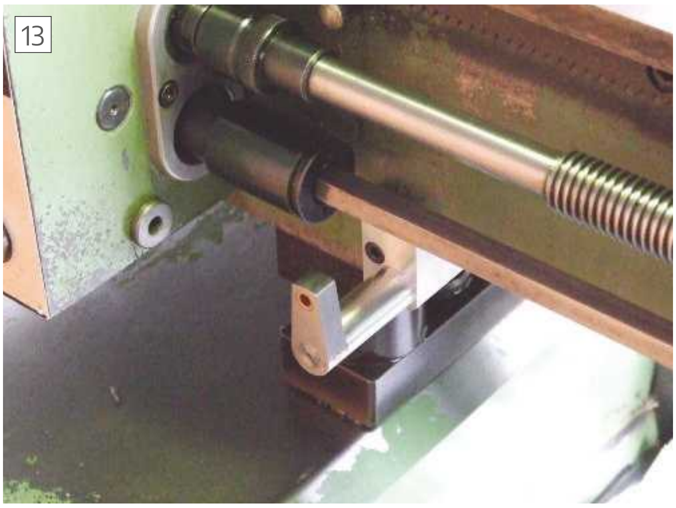


Fig.7


Clevis Pivot
Mat'l: Silver steel, 2 off
NOT A TRUE VIEW
Bellcrank Assembly
Clevis - mild steel
Axle - silver steel
Ram
Rack - 1 mod
Tooth positioning important
Mat'l: Mild steel
ø14 OILITE BUSH
Control Unit Body
Mat'l: Aluminium
Rack Keep Plate
Mat'l: Cast iron
20 Tooth Segment Gear 1 Mod
Mat'l: Mild steel



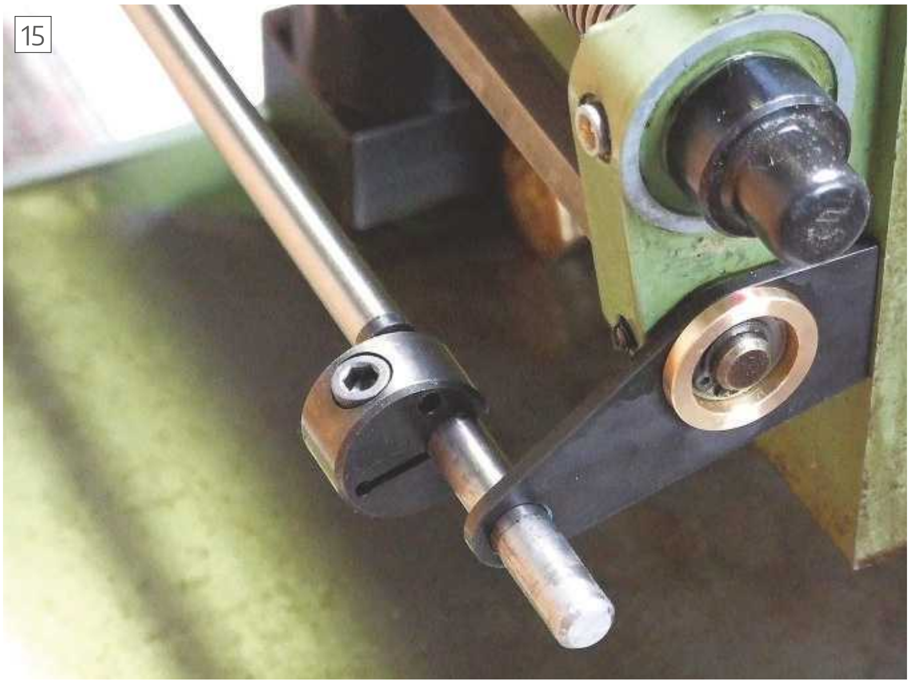
Trip rod lever.

Trip rod attachment and stop.

operator), the slider operating lever and the bed clamp; but do not fully tighten. Put the control lever on and locate the flat on the lever. Urge the assembly towards the headstock and lock in place. Select neutral and check that the bell crank is 30 degrees above the horizontal, it should be if assembled correctly.

Slip the drop link between the lower clevis. Ensure the trip rod lever on the outer end is vertical. Then using a sharp 4mm drill spot through onto the drop link. This is done using finger and thumb, a bright spot, not a dimple is all that is required. Regrettably, the disassembly has to take place again, and the drop link finished off. If the drop link was at all tight during the last assembly just drawfile the faces around the holes. The removal of 0.03mm, or 0.001" off each face will make a huge difference. Then for the last time the above procedure is followed to insert the drop link. It is very difficult to be precise about the length of this link. Slight variation of the headstock laterally on the bed and the bed casting thickness around the hold down bolt are all going to affect this length. Not to mention the build up of dimensions in the parts being fitted. The theoretical length is 151.31mm, but the link on my machine worked out at 150mm dead.

Once the first portion is milled the cutter is withdrawn, the table returned to the start position and the rod moved along the set-up.



Support for trip rod, tailstock end.

The trip rod and stops were the next thing to be made, **photos 14** and **15**. The trip rod has a 1⁄16" slot running along the bottom and this slot stops 60mm from the tailstock end. At this point the rod becomes a bearing in the support plate, further the carriage cannot get this far along the bed without removing the tailstock. The slot was machined in three stages on a lash-up on the FB-2 milling machine table. Two mild steel blocks are clamped to the table in-line and parallel to the X-axis movement. A gap is left in the middle of these two blocks, this is for one of the three clamps and packing pieces to get the trip rod up off the table. After milling the flat, drilling and reaming the hole for the trip rod pivot pin the slot can be milled using a 1⁄16" woodruff key seat cutter. This slot is milled 1.3mm deep, it only needs really to be 1mm deep, but the extra depth is to allow for any mismatch as the rod is moved along the table. Once the first portion is milled the cutter is withdrawn, the table returned to the start position and the rod moved along the set-up. The cutter is then advanced towards the rod and the previously milled portion of the slot manipulated onto the cutter. With the cutter locating the rod radially, urge the rod against the blocks and clamp up. Return the cutter to its original depth setting and proceed with the next phase. The final phase being a repeat of the above. However anyone with a larger machine may be able to do this in one hit.

The stops at first glance look to be a complicated part, **photo 16**, (please note

Fig.8

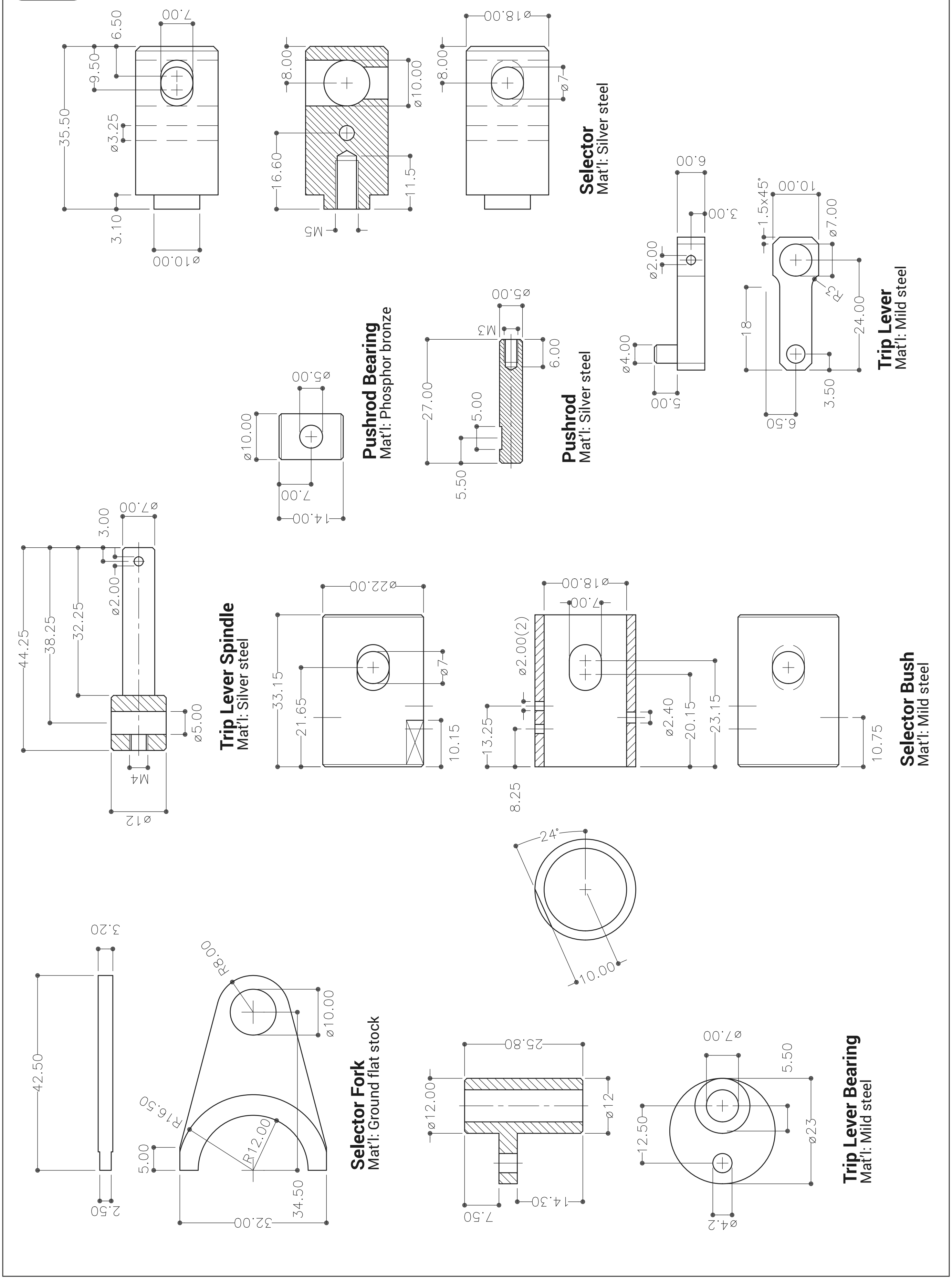
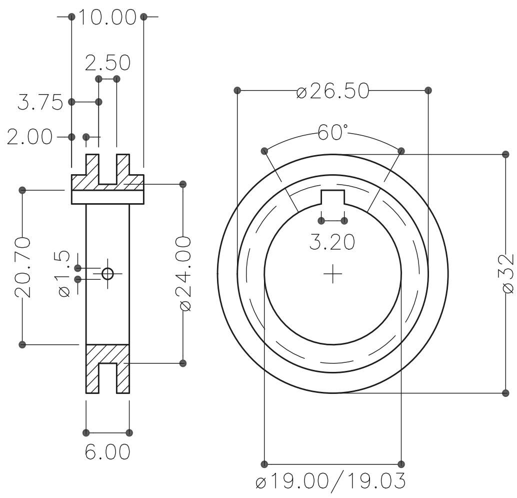
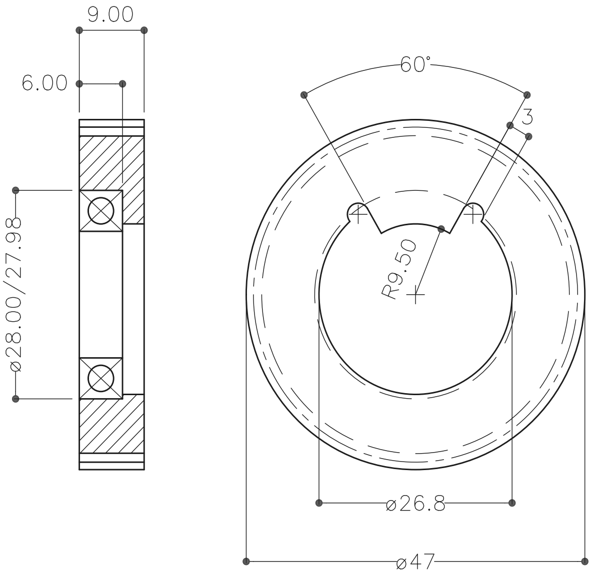

Selector
Mat'l: Silver steel
Pushrod Bearing
Mat'l: Phosphor bronze
Pushrod
Mat'l: Silver steel
Trip Lever
Mat'l: Mild steel
Trip Lever Spindle
Mat'l: Silver steel
Selector Bush
Mat'l: Mild steel
Selector Fork
Mat'l: Ground flat stock
Trip Lever Bearing
Mat'l: Mild steel

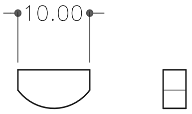
Fig.9



Dog Clutch
Mat'l: EN8

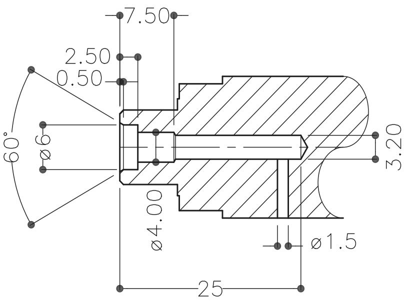


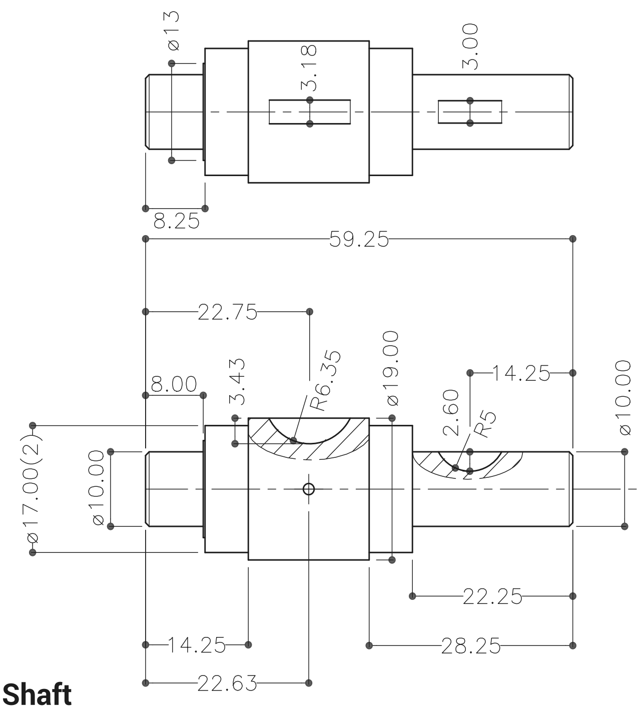
Dog Clutch Gear Assembly
Mat'l: EN24T
Bearing - 17 x 28 x 6 17286VRS



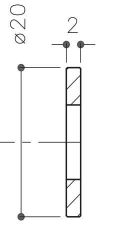
Modify standard 404 key thus

Press fit oiler detail





Dog Clutch Shaft
Mat'l: 01 tool steel



Gear Spacer
Mat'l: Mild steel

Trip rod stop, note snug.

these are the prototype stops and differ from the drawing). All work on these parts can be carried out in the milling machine vice once the blanks have been produced. All the holes are first drilled and reamed using coordinate location. The blank being held in the machine vice with a vee block on the moving jaw side of the vice. Then using the top of the vice jaws and dowels in the 3 and 10mm diameter holes, combined with the appropriate stack of slip blocks or a drill shank. There are all the makings of a miniature Sine bar to orientate the part as required. With the part held to the extreme righthand end of the machine vice and the second blank in the bottom of the vice at the left hand end to balance gripping forces. At this first set-up it is possible to drill and ream the 1.5mm diameter snug hole. Mill the flat and produce the slot using a tee slot or woodruff cutter. If a stop has been set to locate the part the second part can be machined in the reverse order. Producing the M6 capscrew location and 2mm wide slot can be done in exactly the same manner. Actual machining time from turning the blanks to finishing the parts, was under two hours.

As the original Oilite bush is being removed from the feed shaft, some form of long term lubrication facility is needed. This comes in the form of a felt pad in the top of the phosphor bronze bearing piece which is pressed into the support plate. The plate is orientated by the flat which is located against the bed face, see photo 13. The whole assembly is retained by the M5 cone point grubscrew which originally held the Oilite bush. This screw does not need to be that tight. Too tight and there is a risk of collapsing the bore, while severely damaging the outside diameter. Which will make any subsequent removal to replenish the felt pad with oil interesting. The 16.05mm diameter is intentional, this is the size of the Oilite bush used. The 0.05mm is the Press Fit allowance the manufacturer of the bush has chosen for a standard 16mm H7 hole (reamers that give an H7 tolerance are readily available.)

This screw does not need to be that tight. Too tight and there is a risk of collapsing the bore, while severely damaging the outside diameter.

Some readers may notice that there are several parts on this attachment that have been ground, this is not really required. A good turned finish is all that is necessary. I have the convenience of a toolpost grinder. This allows me to produce several different parts and then have a session bringing the parts to their respective diameters, the lifetime habits and requirements of a Toolmaker die hard.

When setting up to machine a thread the stop has to be set in advance of the actual finishing point, this being the delay, or lost motion mentioned earlier. This is where the handwheel dial is a great help. With the motor off, engage the control lever in the direction of travel, let us say towards the headstock. Ensure full engagement of the dog clutch by turning the chuck by hand a couple of times and keeping gentle pressure on the lever. The handwheel dial is set to zero at the end of the thread in hand, and the stop provisionally set. Return the lever to neutral, wind the saddle back towards the tailstock, select the speed range, (I would not go higher than 400 RPM, slower until accustomed to the unit), and start the motor. Again engage the lever to the left, then using the handwheel continue to feed the carriage towards the headstock until the leadscrew stops revolving, (remember to engage the coupling). The distance from zero is the amount the stop has to be moved along the trip rod towards the headstock, it is also a measurement of the lost motion. Either make a mental note of this dimension or like me write it down. It will assist in setting up in the future. If the travel is beyond zero, then this is the amount the stop needs advancing along the rod towards the tailstock to get the saddle to stop at the zero mark on the dial. Adjust the stop and recheck the setting. Carry out the same procedure at the beginning of the thread, i.e. the tailstock end in this case. Finally checking both settings with the clasp nuts engaged, as moments of inertia need to be taken into account, settings can vary slightly with mandrel speed and the pitch of screw being cut. This sounds a long and protracted method but in practice it is quick and quite simple really. Further as the reader gets to use the attachment more and more, the amount of travel required to trip the clutch will become a known quantity, (the dimension mentioned above), and can be dialled in from the outset, I seem to recall the Hardinge was around 15mm, but do not quote me on this as it is now nearly 40 years since I last operated one.

●To be continued

FREE PRIVATE ADVERTS

MODEL ENGINEER | MODEL ENGINEERS' WORKSHOP

Did You Know? You can now place your classified ads by email. Just send the text of your ad, maximum 35 words, to neil.wyatt@mytimemedia.com, together with your full name and address, a landline telephone number, whether it's a for sale or wanted and stating that you accept the terms and conditions for placing classified ads – see below. Please note, we do not publish full addresses to protect your security.

Coronavirus advice is changing!
Please follow local government advice in Wales, Ireland, Scotland or England as appropriate, especially if you are considering buying or selling items for collection. Please respect the needs of delivery drivers to protect their own safety and, if receiving a parcel take sensible precautions when handling anything packaged by someone else.

Machines and Tools Offered

■ Myford 7 or Super 7 bed, SK57768. £25. **T. 01926 624456. Warwick**.

■ Boxford Power Feed Saddle, Tail Stock, Lead Screw. Vertex 4 inch Milling Vice, 6" Rotary Table, 8"x5" Milling Table. Reasonable Offers. **T. 01462 434698. Hertfordshire**.

■ Refillable oxygen bottle type ALbee (size of aqualung bottle) and propane bottle, welding torch regulators some brazing rods and wire. £100 ono. **T. 01273587046. Peacehaven**.

■ Neilson Compressor CT1619 with 50 litre tank. Clarke filter, lubricator, air drill, air chisel, die grinder, hoses £80 lot. Buyer collects. **T. 01543 876745. Staffordshire**.

Parts and Materials

■ Plastow 3" Burrell traction engine 50 plus castings, list price £609. will accept £350, to go in one lot. Fully machined set of gears spur and bevels, gear cut and splined list price £1178. will accept £500. Set front and rear ali wheel rims. list price £88. will accept £40. Part finished tender in brass £100. Part finished crank, splined £75. Set ali tender and boiler formers £50. Pair used hornplates £50. Photos available buyer to collect. **T. 01902 343724. Wolverhampton**.

Magazines, Books and Plans

■ Model Engineers' Workshop nos 1 to 140 with data sheets in mint condition, £140. Sorry cannot split. Buyer collects. Cash on collection. **T. 01722 329919. Salisbury**.

Wanted

■ Cowells ME lathe with accessories. Must be in perfect condition. I am too old to buy new, distance no object. **T. 01986 853776. Ipswich/Norwich**.

■ Manual for BOXFORD Model A, or info on where I can find one. Thanks. **T. 01723 892952. Filey, N. Yorkshire**.

YOUR FREE ADVERTISEMENT (Max 36 words plus phone & town - please write clearly)

❑ WANTED ❑ FOR SALE

Phone:		Date:		Town:	

NO MOBILE PHONES, LAND LINES ONLY

Please use nearest well known town

Adverts will be published in Model Engineer and Model Engineers' Workshop.

The information below will not appear in the advert.

Name ....

Address ....

....

....

.... Postcode..............................

Mobile .... D.O.B..............................

Email address...

Do you subscribe to Model Engineer ❑ Model Engineers' Workshop ❑

Please post to:
ME/MEW FREE ADS, c/o Neil Wyatt, MyTimeMedia Ltd, Enterprise House, Enterprise Way, Edenbridge, Kent TN8 6HF
Or email to: neil.wyatt@mytimemedia.com

Photocopies of this form are acceptable.

Adverts will be placed as soon as space is available.

Terms and Conditions:
PLEASE NOTE: this page is for private advertisers only. Do not submit this form if you are a trade advertiser. If you wish to place a trade advert please contact David Holden on 07718 64 86 89 or email david.holden@mytimemedia.com

By supplying your email/ address/ telephone/ mobile number you agree to receive communications via email/ telephone/ post from MyTimeMedia Ltd. and other relevant 3rd parties. Please tick here if you DO NOT wish to receive communications from
MyTimeMedia Ltd: Email ❑ Phone ❑ Post ❑
or other relevant 3rd parties: Email ❑ Phone ❑ Post ❑

All advertisements will be inserted in the first available issue.
There are no reimbursement for cancellations.
All advertisement must be pre-paid.
The Business Advertisements (Disclosure) Order 1977 - Requires all advertisements by people who sell goods in the course of business to make that fact clear.
Consequently all trade ads in *Model Engineers' Workshop* carry this 'T' symbol

MODEL ENGINEERS' WORKSHOP CLASSIFIED

Wishing to sell your Lathe, Mill or Complete Workshop?
Full clearances carefully undertaken
Speak to:
Malcolm Bason of MB Tools
01993 882102
Re-homing workshop machinery for 20 years!

ALWAYS IN STOCK:
Huge range of miniature fixings, including our socket servo screws.
ModelFixings.co.uk
also the home of **ModelBearings.co.uk**
- Taps, Dies & Drills
- Adhesives
- Engine & Miniature bearings
- Circlips, etc. etc.

Tel/Fax +44 (0)115 854 8791 Email: info@modelfixings.com

www.model-engineer.co.uk

To advertise here please email angela.price@mytimemedia.com

Complete home Workshops Purchased
Essex/Nottinghamshire locations
Distance no object!
Tel: Mike Bidwell
01245 222743
m: 07801 343850
bidwells1@btconnect.com

BA SCREWS IN BRASS, STEEL AND STAINLESS
SOCKET SCREWS IN STEEL AND STAINLESS ● DRILLS ● RIVETS ● TAPS ● DIES ● END MILLS SLOT DRILLS etc
Phone or email
lostignition8@gmail.com
for free list
ITEMS MAIL ORDER LTD
Mayfield, Marsh Lane, Saundby
Retford, Notts. DN22 9ES
Tel/Fax 01427 848880
www.itemsmailorderascrews.com

LASER CUTTING
CNC Folding and Machining
Fabrication and Welding
All Locomotive & Traction Engine parts.
Your drawings, E-files & Sketches.
m: 0754 200 1823 • t: 01423 734899 (answer phone)
e: stephen@laserframes.co.uk
Well Cottage, Church Hill, North Rigton, LEEDS LS17 0DF
www.laserframes.co.uk

GB BOILERS
COPPER BOILERS FOR LOCOMOTIVES AND TRACTION ENGINES etc.
MADE TO ORDER
Constructed to latest standards. UK CA stamped.
Over 20 years experience
No VAT
Enquiries, Prices and Delivery to:
Telephone: Coventry 02476 733461
Mobile: 07817 269164 ● Email: gb.boilers@outlook.com

CLOCKMAKING METALS AND BOOKS
CZ120 Compo Brass Sheet/Blanks, CZ121 Brass Bar
CZ126 Brass Tube, EN8 & Mild Steel, Std Silver Steel
Gauge Plate, Suspension Spring Steel
Wheel & Pinion Cutting, Horological Engineering
BRASS PRICES REDUCED
Send Two 1ST Class Stamps For Price List
I.T.COBB, 8 POPLAR AVENUE,
BIRSTALL, LEICESTER, LE4 3DU
TEL 0116 2676063 Email: ian@iantcobb.co.uk
www.iantcobb.co.uk

Meccano Spares
New Reproduction and Pre-owned Original Meccano Parts.
www.meccanospares.com
sales@meccanospares.com
Tel: 01299 660 097

To advertise here please email angela.price@mytimemedia.com

M-MACHINE
Unit 6 Forge Way, Cleveland Trading Estate
Darlington, Co. Durham. DL1 2PJ
Metals for Model Makers
Contact us for Copper, Brass, Aluminium, Steel, Phosphor Bronze, etc.
PHONE & FAX 01325 381300
e-mail: sales@m-machine.co.uk
www.m-machine-metals.co.uk

TAPS & DIES
Excellent Quality manufactured-supplied

British-box HQS taps dies cuts stainless
ME5(33pcs) **ME4** (30pcs) **BA3**(35pcs) has all Model Eng 32+40tpi BA, BSB, MTP etc
THE TAP & DIE CO
445 West Green Rd, London N15 3PL
Tel: 020 8888 1865 Fax: 020 8888 4613
www.tapdie.com & www.tap-die.com

webuyanyworkshop.com
Re-homing model engineers' workshops across the UK
It's never easy selling a workshop that has been carefully established over a lifetime. I will buy your workshop so you don't have to worry about finding a new home for much loved workshop equipment and tools.
Please email photos to
andrew@webuyanyworkshop.com
Or to discuss selling your workshop, please call me on **07918 145419**
All equipment considered: Myford, Warco, Chester, classic British brands etc
Polly steam locomotives also purchased, especially those needing a bit of 'TLC'

THINKING OF SELLING YOUR LATHE, MILL OR COMPLETE WORKSHOP?
and want it handled in a quick professional no fuss manner?
Contact Dave Anchell, Quillstar (Nottingham)
Tel: 0115 9206123
Mob: 07779432060
Email: david@quillstar.co.uk

Cowells Small Machine Tool Ltd.
Cowells Small Machine Tools Ltd.
Tendring Road, Little Bentley, Colchester CO7 8SH Essex England
Tel/Fax +44 (0)1206 251 792 e-mail sales@cowells.com
www.cowells.com
Manufactures of high precision screwcutting lathes, 8mm horological collet lathes and milling machines, plus comprehensive accessory range.
Talk directly to the manufacturer

To advertise on these pages contact Angela Price at angela.price@mytimemedia.com


HOME AND WORKSHOP MACHINERY
144 Maidstone Road, Foots Cray, Sidcup, Kent, DA14 5HS
tel: 0208 300 9070 - evenings 01959 532199
website: www.homeandworkshop.co.uk
email: sales@homeandworkshop.co.uk
visit our eBay store! click link on home page;
homeandworkshopmachinery
RotoCAMM MDX-40A CNC Routers £2000 each
Check out our eBay store to view our large amount of stock!
Stanier precision vice 55mm jaw New / New Zealand £195
Myford Super 7, ML7R, ML7 MI10 Speed 10 Change wheels Genuine £10 - £37
Viceroy buffer £345
Archer No.2 1/2" reversable tapping head £120
Emco Compact 5 £1500
Meddings 6" power hacksaw £300
Warco 3F 3MT £750
Bridgeport milling machine 42" x 9" (metric) £3750
Myford lathe rare Conrod jig £245
MYFORD SUPER 7B PCF £3250
Drummond lathe £325
Harrison Graduate wood lathe 240V £1375
Boxford AUD gearbox + power cross feed, 4 way tool post + light £1300
DP / MOD gear cutters £20 each, please enquire for availability
Ajax UP Universal Mill £1750
Smart and Brown Model L second operation lathe £750
MYFORD SUPER 7B 3 1/2" x 31", gearbox, clutch, power cross feed £3750
Denbigh No.6 Fly press £345
Boxford AUD MK11 lathe, gearbox, PCF £1825
Quorn tool and cutter grinder £1000
MYFORD SUPER 7B 3 1/2" x 31", gearbox, clutch, power cross feed £3250
Goliath 5R 8" guillotine £80
Union G14 14" pedestal grinder £750
Tripus 240v switch £90
Myford rifle / bridge felts 5 for just £20
Meddings Driltru pedestal drills 1/2" & 1MT models £295 each
Edgwick centre lathe 7 1/2" x 44" 240 volts £1400
Fobco 7 EIGHT 7/8" capacity pedestal drilling machine £1000
Neat cut and soluble cutting oils £10 each
Large Vee Blocks 12" bar £425
Union centres 7.5" x 24" £425
Pipe centre 4MT 4-8" £245
Colchester Mascot VS2000 fixed steady £575
Keetona Box-Form 100" 14g box and pan folder £2950
Please phone 0208 300 9070 to check availability.
Distance no problem – Definitely worth a visit – prices exclusive of VAT
Just a small selection of our current stock photographed!
Worldwide Shipping
POWERED BY barclaycard
VISA