No. 330

FROM THE BEVEL BOX

Experiments with Bevel Gears and Differential Gearboxes.

MODEL ENGINEERS' WORKSHOP

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■ A TELESCOPIC CROSS FEED SCREW FOR MYFORD SUPER 7 LATHES. ■ A SHOP-MADE POWER HACKSAW. ■ BRINGING A SWISS TOOL GRINDER BACK INTO USE. ■ MMEX 2023 – 125 BIRTHDAY TALKS PROGRAMME. ■ LIFE WITH AN ADCOCK AND SHIPLEY MILLING MACHINE. ■ FITTING AND JOINING PIPES. ■ CALIPER STORAGE SOLUTION. ■ PLUS ALL YOUR REGULAR FAVOURITES!

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MODEL ENGINEERS' WORKSHOP

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Editor: Neil Wyatt
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By post: Model Engineers' Workshop, Mortons Media Group, Media Centre, Morton Way, Horncastle, Lincs LN9 6JR
Tel: 01507 529589 **Fax:** 01507 371006
Email: meweditor@mortons.co.uk
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Group advertising manager: Sue Keily
Advertising: Angela Price
aprice@mortons.co.uk Tel: 01507 529411
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PUBLISHING
Sales and Distribution Manager: Carl Smith
Marketing Manager: Charlotte Park
Commercial Director: Nigel Hole
Publishing Director: Dan Savage
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The next will be on sale on July 22, 2022.

On the Editor's Bench

Talks at MMEX 2020

Later in this issue in news about the Midlands Modelling Exhibition is exciting news about the return of lectures. This year the talks will be given by well-known contributors to Model Engineers' Workshop and Model Engineer magazines, and I'd like to express my gratitude to everyone who has offered to take part.

I'm hoping to attend all the talks and look forward to some interesting discussions after each one. I hope that plenty of readers will be able to come along for at least one of an interesting and varied programme of lectures.

I will be giving one of the talks myself. It's grown out of a talk I gave to the SMEE in 2018 on my experiences with 'fused filament' 3D printing. I will be updating it to reflect some of the lessons I have learned since, and my more recent experiences

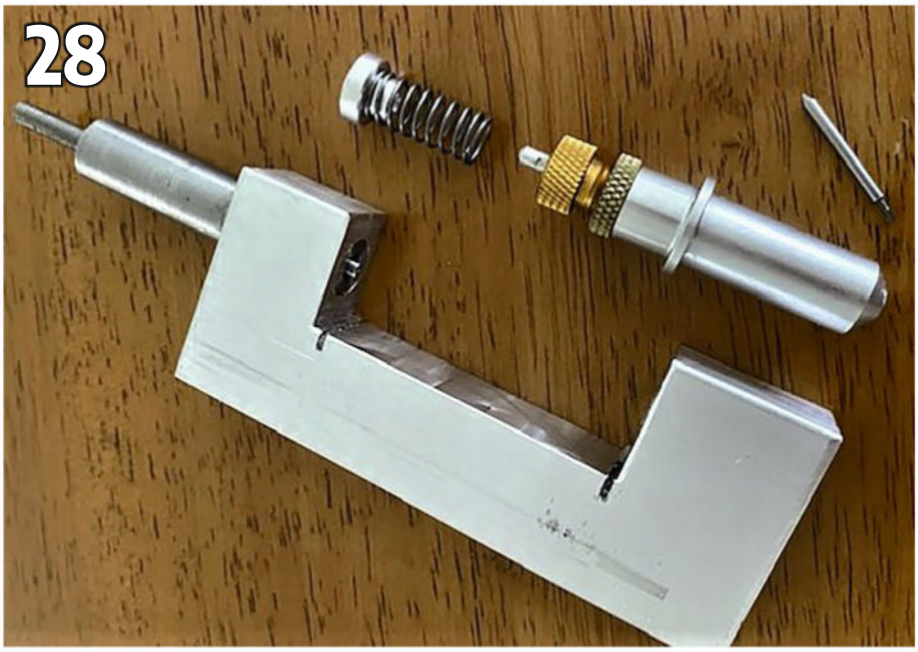
of SLA or resin printing. I will also be running demonstrations of 3D printing on the SMEE stand, which will be a new challenge for me!

If you have any questions about 3D printing, or issues you'd like explored or even have an item you are interested in having 3D printed, drop me an email at meweditor@mortons.co.uk and I will see if it's something I can cover at the show.

The photo shows one of my more recent models, printed on the Halot One Pro – the figures are Tamiya ones..

Neil Wyatt

Contents

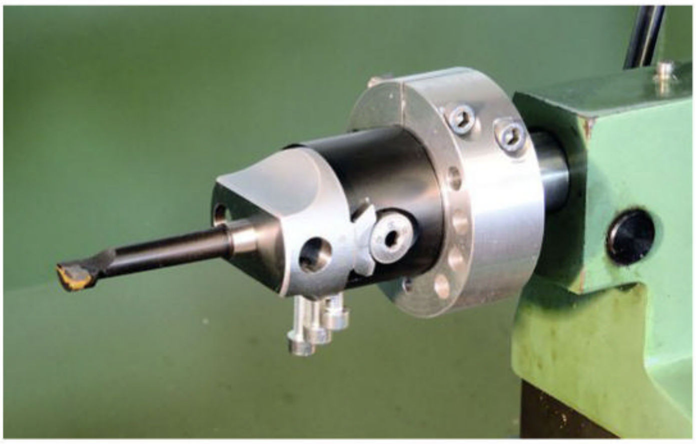


See page 54-55 for details.

Coming up...

in our next issue

Keith Keen adopts a boring head for use on the lathe tailstock.



Regulars

ON THE COVER

Our cover shows John Smith demonstrating how to guide a tap to create an accurate screwed hole. For more details, see pages 50-51.

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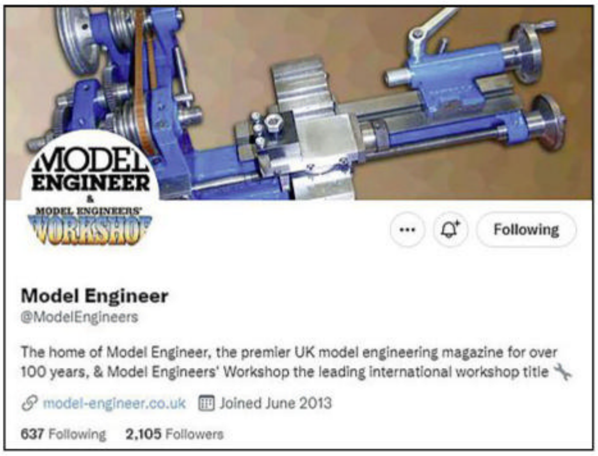

THIS MONTH'S BONUS CONTENT

Log On to The Website for Extra Content:

Check out the free plans available for download at.
www.model-engineer.co.uk/freeplan

Other hot topics on the forum include:

Workshop Clock It doesn't seem to like the workshop; a light hearted complaint from Iain Downs

Rotary broaching How can I succeed at rotary broaching by Daniel Brannan

Old tools restoration Different approaches to rescuing old tools by Sonic Escape

Wave Washer in Myford Resettable Dial Article, MEW 328 Discussion relating to Pete Barker's article – see Scribe a Line – by Hopper

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. Come and join us – it's free to all readers!

CLASSIFIEDS EXTRA SUBSCRIBE ARCHIVE SUPPLIERS

One Man and His Mill – Adcock & Shipley 2E

Andrew Johnston bought this hefty mill on impulse, but has found it a very useful machine in his workshop.

I had a small workshop, with a pillar drill and lathe, while I was at school. The machines were sold when I left school and started working away from home. Fast forward some years; now that I have a property with a double garage, I have been able to build up a workshop again. My first machine tools were a Harrison M300 lathe and a Bridgeport vertical mill. Both of these machines were chosen as being suitable for a 4" scale traction engine build. I am a professional engineer, mainly in electronics and signal processing, but my only formal craft qualification is O-level metalwork.

Acquiring the Mill

After setting up a basic workshop I kept an eye on adverts, both online and in magazines, looking for further purchases of machines and tooling. In due course I saw a trade advert for an Adcock & Shipley 2E universal horizontal mill, **photo 1**, at an advantageous price. I had briefly used a Cincinnati horizontal milling machine back in the 1970s, while training at the Royal Aircraft Establishment at Farnborough. I am normally quite cautious when it comes to purchases. But in this case the price was so low that I threw caution to the wind. I phoned the trader and checked that the mill was complete with overarm and arbor support. I was assured that this was the case and I agreed to purchase the mill. It was also to be supplied with 1" and 1-1/4" arbors. The mill weighs well over one and a half tons, which I can't move by myself, so I asked the trader to organise delivery. Cost of the mill was £175, and delivery was £200. The mill was duly delivered using a Hiab lorry. At my insistence the mill was placed inside the garage, on the concrete floor, rather than on the gravel drive

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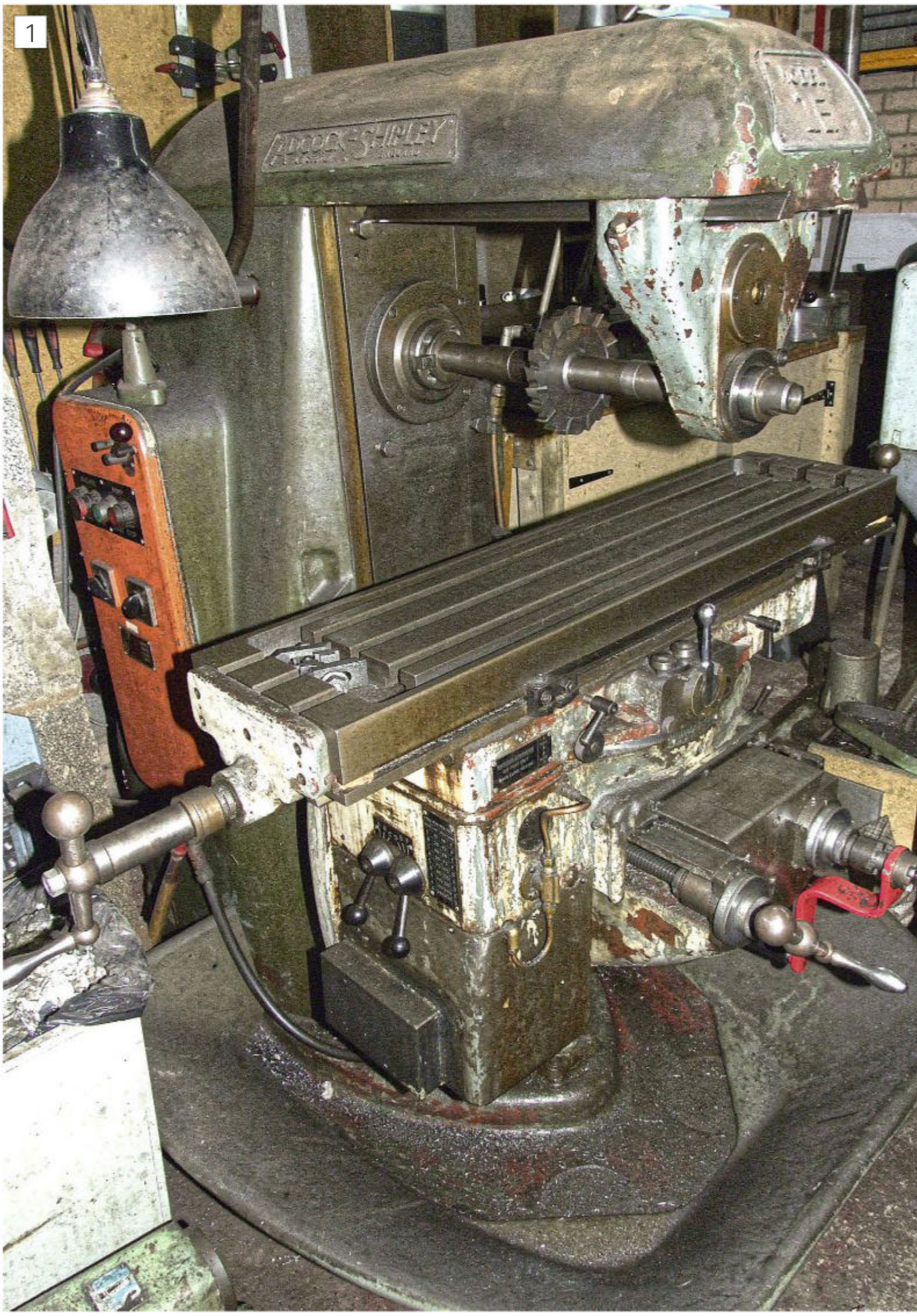


A&E 2E Horizontal Milling Machine

2 Main Electrical Panel

3 Speed Change Arrangement

outside. After delivery I discovered that the supplied arbors were 1" and 32mm. I queried this with the trader and was told in no uncertain terms that 32mm was the same as 1-1/4". I received a phone call from the company owner shortly afterwards, who apologised and said that he had told his colleague, equally forcefully, that 32mm was not the same as 1-1/4" when it came to arbors. We agreed that a 1-1/4" arbor would be supplied for the cost of the postage.

The Mill and Controls

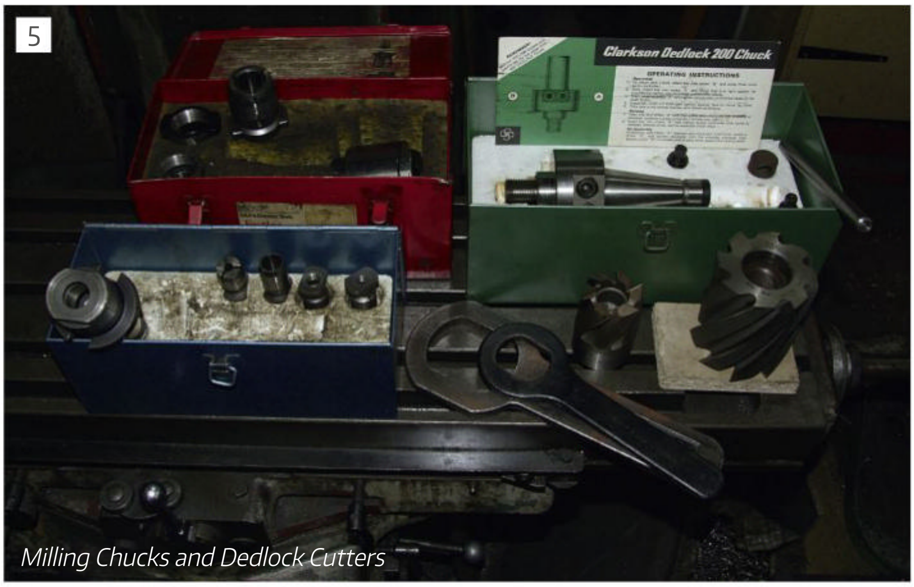
The Adcock and Shipley 2E is a universal horizontal mill. This means that the table can be swivelled allowing helices and spirals to be machined in conjunction with a universal dividing head. The 2E is a fairly small horizontal mill with travels of 23" in X, 8" in Y and a maximum of 16" between spindle centre and table top. My example has metric dials. The mill has a nett weight of 3,472lbs. It has been moved up and down my workshop twice, using rollers and a crowbar, before settling in the place shown. Several feet were knocked off the end of wall, visible on the left in photo 1, to accommodate the mill.

Electrically the mill has three motors: a dual speed spindle motor, a 1hp motor for the table X-axis power feed and a fractional horsepower coolant pump. The main spindle motor is two pole in high speed range and four pole in low speed range. As well as switching poles the motor configuration changes from star to delta when moving from high to low range. In the high range the motor is 5hp, but in low range, due to the change to delta, is 4hp rather than 2.5hp. I have a 3-phase supply at home, so connection was simple via an isolator and a 5-pin 3-phase plug although the neutral is not connected.

The main electrical panel is shown in **photo 2**. The lever switch top right is the main isolator. Below that are two sets of on/off push buttons, for the spindle motor on the left and the coolant pump on the right. Below the pushbutton switches are two rotary switches. The one on the left controls spindle direction and the one on the right is for high and low speed ranges of the X-axis feed rate motor.

The main spindle taper is INT40. These are self-releasing tapers. The drive is via two dogs rather than relying on friction within the taper. The spindle is driven by fixed multiple belts to a gearbox. Spindle speed is changed within the gearbox by a ring and lever on the righthand side of the column, **photo 3**. The lever at the top can be rotated to bring sets of three speeds, marked on the outer ring,

4 Feed Rate Plate and Levers



5 Milling Chucks and Dedlock Cutters

6 Vertical Milling Attachment

to line up with the label on the left. The four sets of three speeds are delineated by the thicker radial lines on the outer ring. One of the three speeds in each set is selected by the lever on the inner ring which can be horizontal (as shown), up, or down. Below the rings is a lever operated electrical switch which changes between the high and low speed range of the spindle motor. In photo 3, with the electrical switch in high range, the spindle speed is set to 234rpm. There are 12 speeds in high range from 60rpm to 1200rpm, and another 12 in low range from 30rpm to 600rpm.

In use the spindle motor runs continuously, and the spindle is engaged with a clutch lever. The clutch levers (one on each side of the column) can be seen in photo 1, towards the top of the column and leaning forward, partially hidden by the low voltage light.

The table X-axis feed is engaged by the vertical lever in the centre of the table at the front. The table moves in the direction that the lever is moved. The lever actuates an electrical switch which enables the feed motor. A range of nine feed rates, in both high and low speed ranges, are selected using two, three position, mechanical levers, **photo 4**. The table feed is all geared, with the final drive to the leadscrew being a pair of skew gears.

The Y and Z axes have adjustable mechanical stops to limit movement. Rather than mechanical stops the adjustable stops on the X-axis trip the feed lever and thus disengage the table feed.

Accessories

As part of the general workshop equipment I have a range of accessories such as machine vices, angle plates, a rotary table and a dividing head. For the A&S mill specifically, I have bought Int40 adaptors, Clarkson style collet chucks, in smaller and larger sizes, with both imperial and metric collets. I also bought a Dedlock200 chuck. Although the Dedlock system is obsolete commercially I have managed to obtain enough cutters to make it worthwhile having the chuck, **photo 5**. The only Adcock and Shipley accessory I have for the 2E, is a vertical milling attachment, bought on an auction site, **photo 6**. All of the accessories are second-hand.

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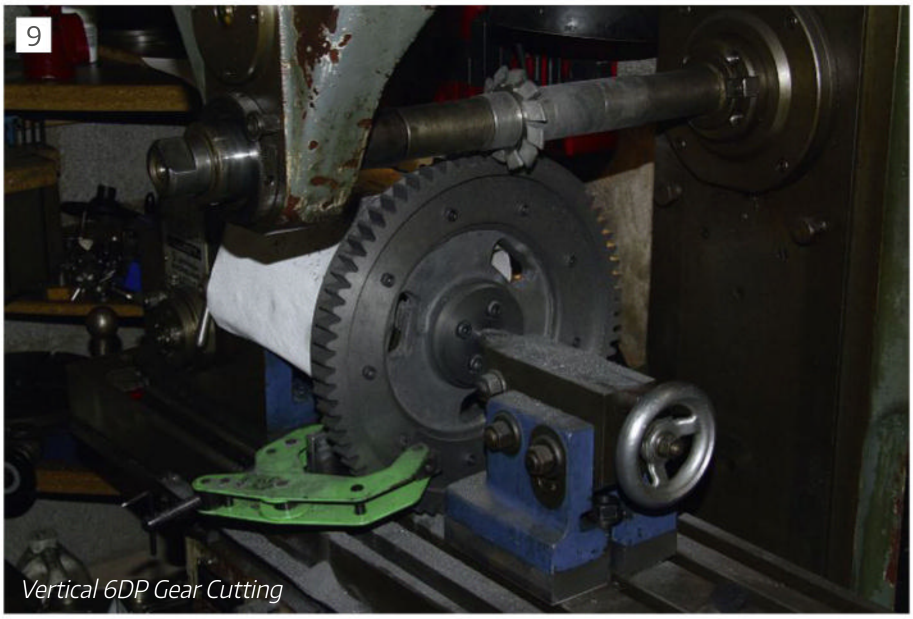
HSS Milling Cutters

8

Slab Milling Hot Rolled Steel

9



Vertical 6DP Gear Cutting

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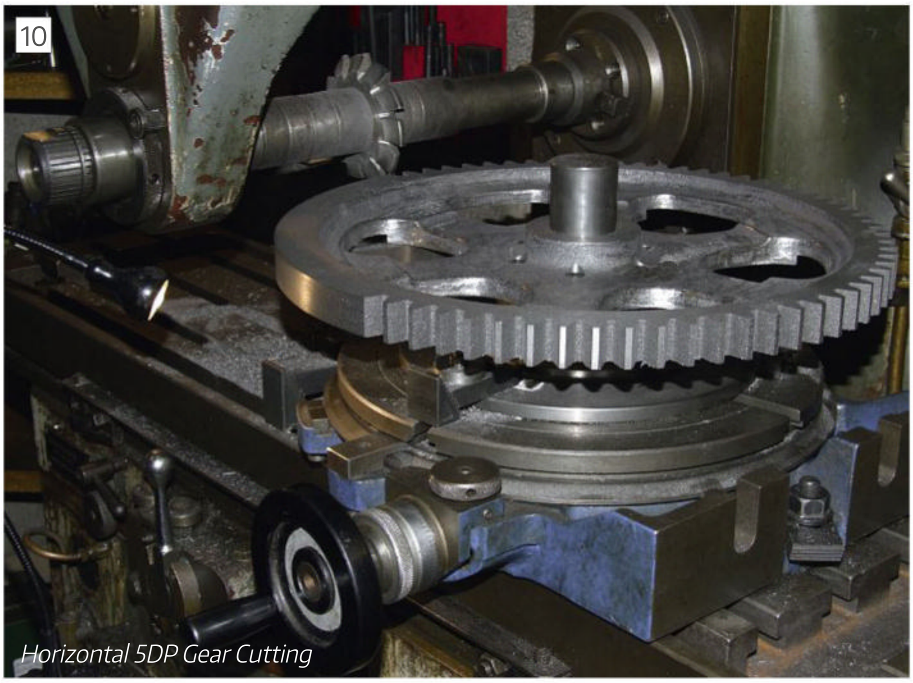


Horizontal 5DP Gear Cutting

I have 63mm and 80mm insert face mills on Int40 tapers which are useful for cleaning up large areas. The spindle speeds cover a range fast enough for the face mills; however, feed rates are the limiting factor and mean that the spindle speeds also need to be limited. The mill would have been designed for use with HSS cutters, so the feed rate limit is not a surprise. I have also been buying HSS cutters for the horizontal mill over the years, almost all second-hand or new old stock, **photo 7**.

The mill came with a drawbar threaded 5/8'' BSW. I made another drawbar, threaded M16, for the new face mills and accessories.

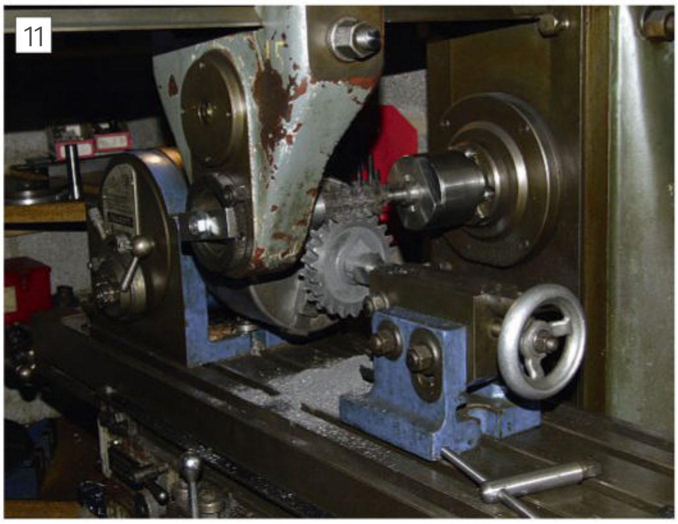
Using the Mill

Although bought with no clear idea in mind of the work to be done the horizontal mill has proved to be very useful. The working area is smaller than my Bridgeport but the horizontal mill is considerably more rigid and powerful. Consequently, it can shift metal when there is a need, **photo 8**. I mostly run HSS cutters and flood coolant.

As well as normal milling operations the mill is useful for gear cutting, both vertical, **photo 9**, and horizontal when the gear is too big to fit under the spindle, **photo 10**.

The mill also proved useful for free hobbing a worm wheel after gashing on the mill with an involute cutter and the table set over at the helix angle, **photo 11**. The hob was homemade from silver steel and was designed with a screwcut end to fit a Clarkson style chuck.

On a universal mill the table swivels,



Free Hobbing a Worm Wheel

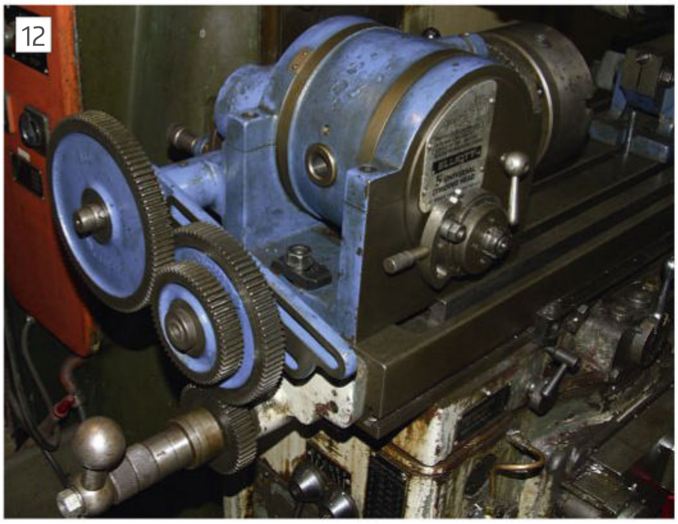
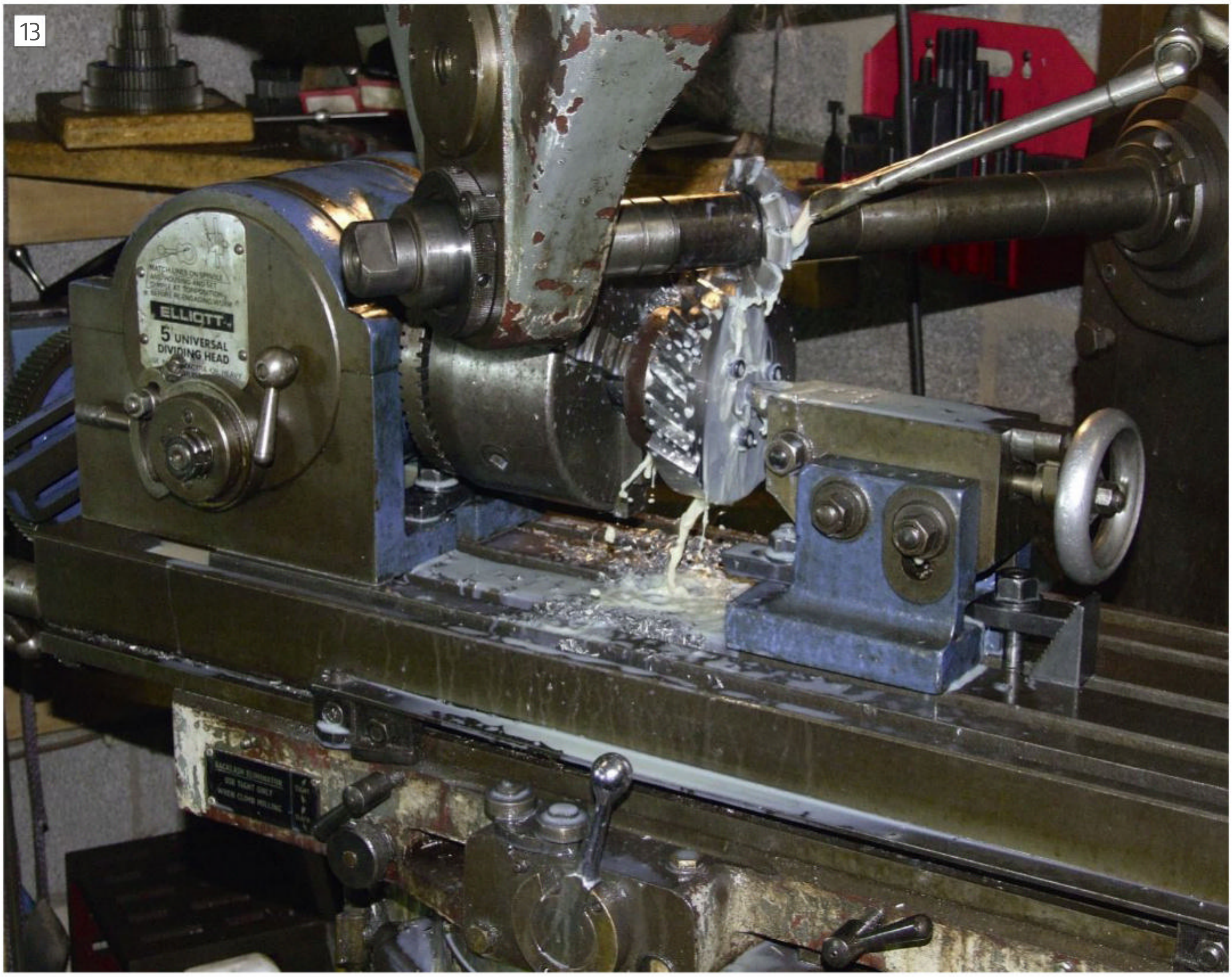


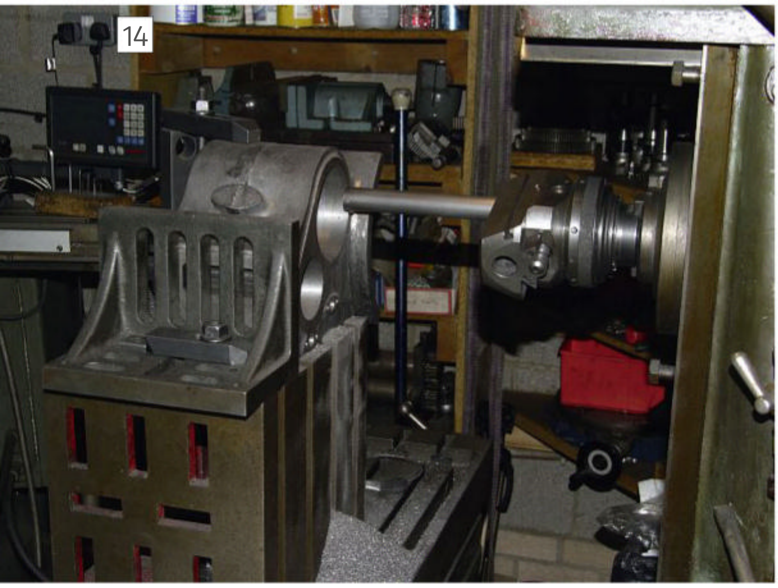
Table to Dividing Head Gearing



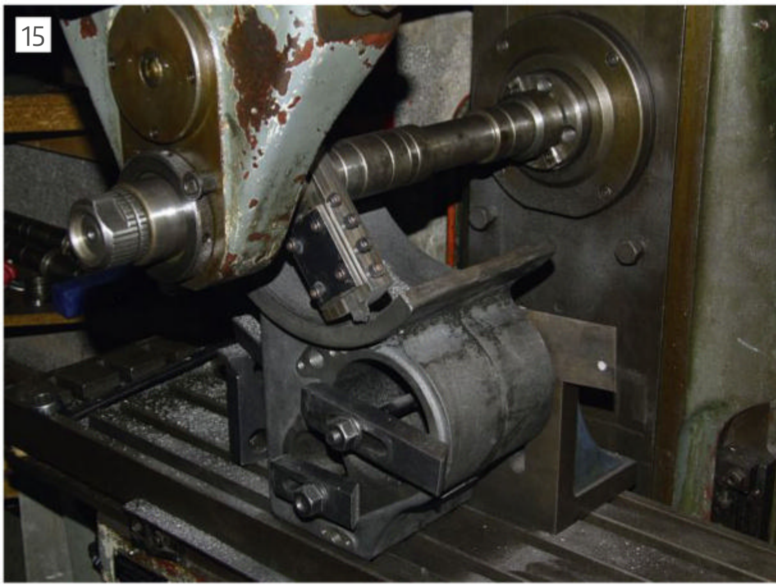
Cutting a Helical Gear

allowing the machining of helices and spirals. One use for this is the production of helical gears. To machine a helical gear a universal dividing head is geared to the table feed so that as the gear blank rotates it also moves axially. The table is swivelled to the helix angle of the gear to be cut. The combined rotation and axial movement mean that the work moves in a helical path past the cutter. For cutting a helical gear the gearing between the table and dividing head is shown in **photo 12**. The cutting of a helical gear is shown in **photo 13**.

The mill can also be used as a



Horizontal Boring



Fly Cutting an 8.6" Diameter Surface

simple horizontal borer with a boring head, **photo 14**. This setup has been extensively used for the cylinders and liners on my traction engines.

The rigidity of the mill is also helpful when fly cutting large diameters. In **photo 15** an 8.6" diameter is being fly cut on a 4" scale traction engine cylinder, using an HSS tool bit and a homemade fly cutter. Note the curved end to the fly cutter body. The fly cutter body is 8" diameter which helps to simplify the tool setting. For diameters larger than 8" the table can be set at the correct radius using gauge blocks, minus 4", against a suitable reference surface. The tool bit is then adjusted to just touch the reference surface, without moving the table. In photo 15 the depth of cut was 1mm and the feed was 0.2mm per rev.

Conclusion

Although the A&S 2E mill was an impulse buy it has turned out to be surprisingly useful, in particular to support the build of my 4" scale traction engines. If room is available, I would thoroughly recommend acquiring a horizontal mill to complement the more commonly found vertical mills. ∎

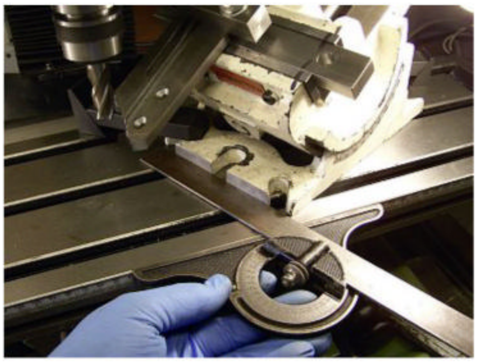
In our Next Issue

Coming up in issue 331, September 2023

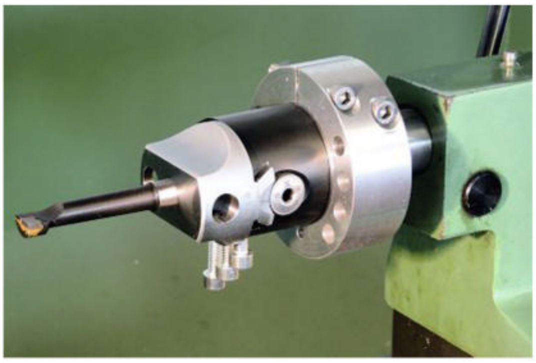
On sale 16 August 2023

Contents subject to change

Ken Lonie makes a large rotary table from an automotive flywheel.



R. Finch explains how to go about milling compound angles.



Keith Keen adopts a boring head for use on the lathe tailstock.

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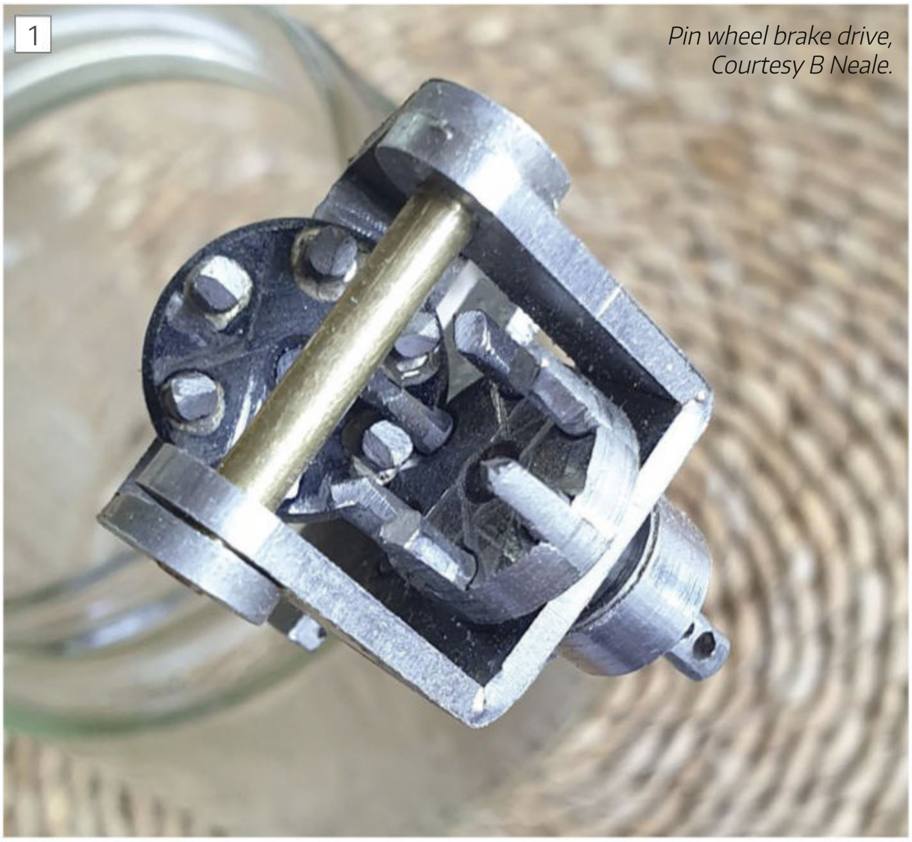
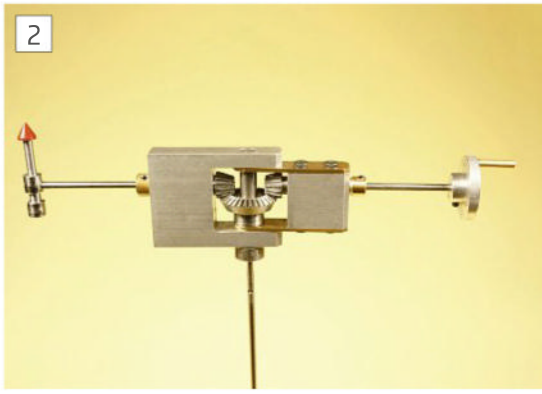
Bob's Better Bevels – Postscript, part 1

Bob Reeve dives into the big box of better bevels that resulted from his experiments


Pin wheel brake drive, Courtesy B Neale.

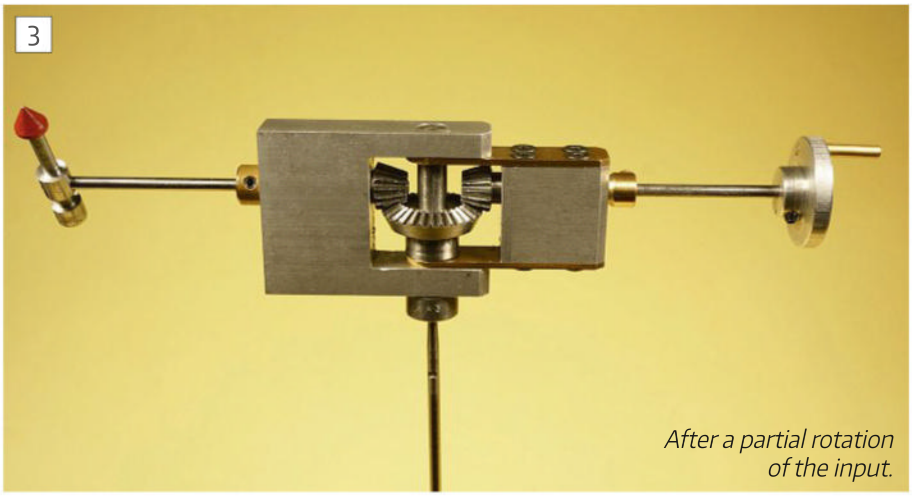

Alternative drive using bevels.

Part five of Bob's Better Bevels (MEW 322), was about high ratio bevels. It finished with the question as to what to do with all the bevels I had produced. What follows provides a couple of answers.

The first example was a suggestion for an alternative solution for a variable angle drive. This was required to actuate the brake on the tender of a locomotive being built by fellow SMEE member Brian Neale. **Photograph 1** shows the original solution which was effectively a pair of inserted tooth bevels which might also have been described as a pin-wheel drive.

Space was very tight, and the entire mechanism had to fit in a 1" cube. An alternative using my standard bevel gears is shown in **photo 2**. The bevel wheels already existed, so the design has not been optimised for the space available. The 15 & 30 tooth Mod. 0.5 bevels could easily have been made with fewer teeth or smaller teeth if necessary and the rectangular aperture in which the gears sit is only just above the required size. The vertical rod is just a support for display purposes.

There was, however, the question of reversing the direction of rotation. At first glance the pin wheel drive reverses the direction as does the bevel gear drive; or does it? **photo 3** shows the bevel gear drive rotated a small angle from photo 2. Which certainly looks like the input and output rotate in opposite directions.


After a partial rotation of the input.

However **photo 4** shows the variable angle drive folded up. The handle and pointer have been aligned at the top. Rotating the handle through a small angle again now has a different outcome.

This time, **photo 5**, they appear to rotate in the same direction! In words of their own choosing, readers may wish to describe how the rotations can be both the same and opposite!

For the next example I wanted something that would use more than 3 bevels, preferably with at least one of the high ratio bevels. I decided that a differential gear drive might provide just such an example.

Photograph 6 shows a simple differential as might be found in a conventional car powered by an internal combustion engine. The drive is provided by the small handle, and for a car, the wheels would be attached to the two shafts protruding at right angles to the drive.

The shaft at the bottom is in two parts, meeting at the centre in a running joint. The idea being to provide alignment and rigidity for the sun and planet gears. It is a replica of the axial shaft through the model.

It sort of worked –sometimes! At other times it would seize solid and remain so until I started to dismantle it, when it would suddenly free up and work again. When I showed fellow SMEE members, there were useful suggestions like "How about a squirt of oil", but no satisfactory explanation of what was going on.

There was a consensus that the gear locations could probably be improved so that was the starting point for a re-design. **Figure 1** shows the new design. Which provided a more ridged yolk for the sun and planet wheels, each with individual control over the meshing with its neighbours.

Details of this arrangement can be seen in **photo 7**. This was a slightly different approach to the usual method of adjusting the mesh of bevels by sliding them along the shaft on which they are mounted. The two planet bevels

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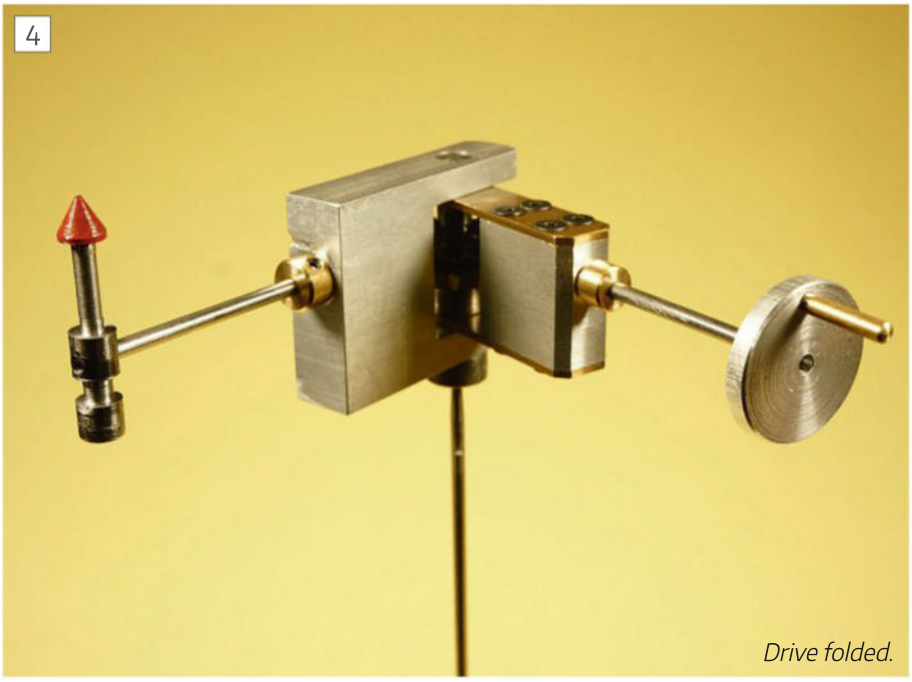
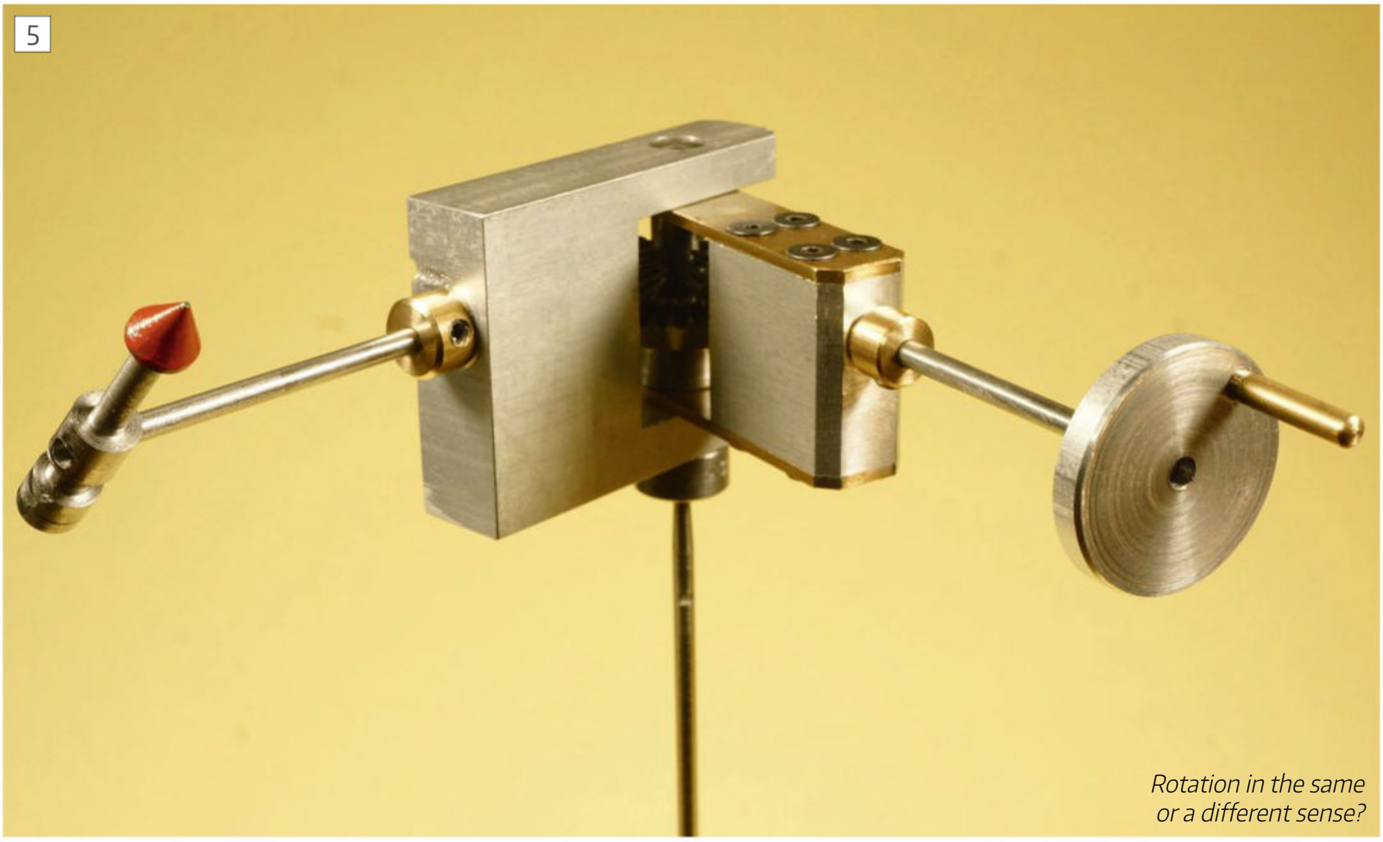
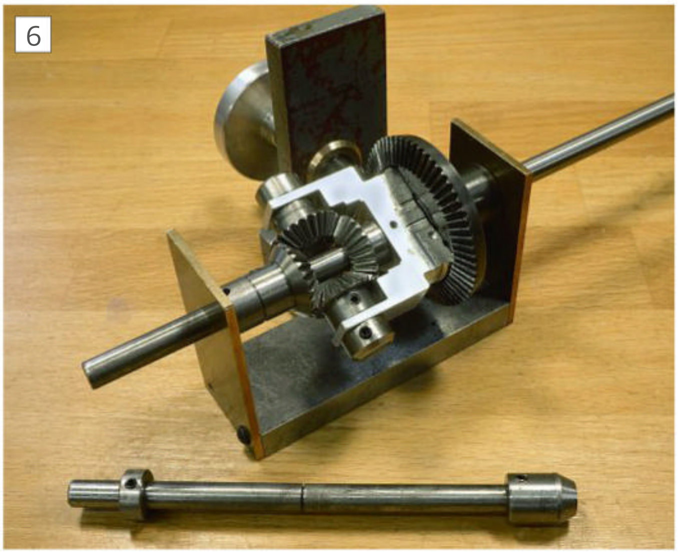


Drive folded.

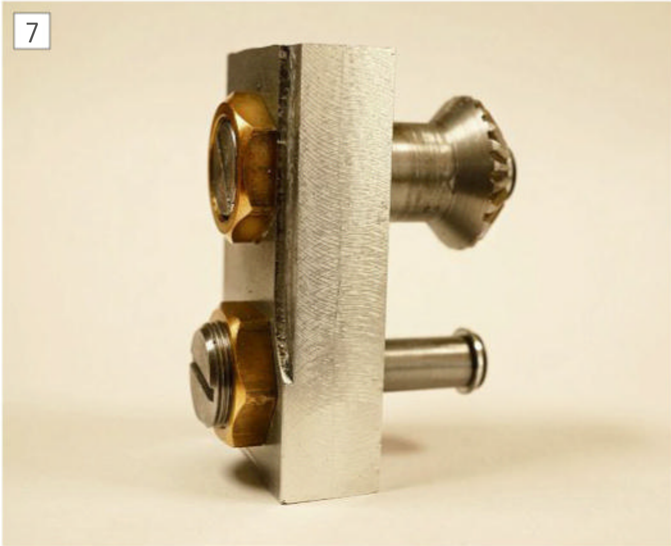
5



Rotation in the same or a different sense?

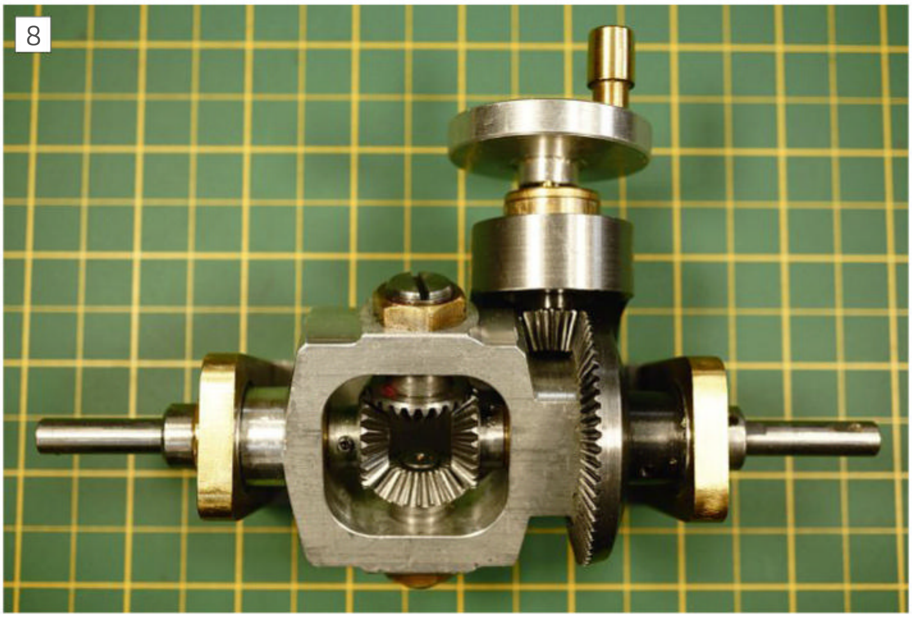


Simple differential.



New fitting arrangement.

Figure 1. Improved differential design.



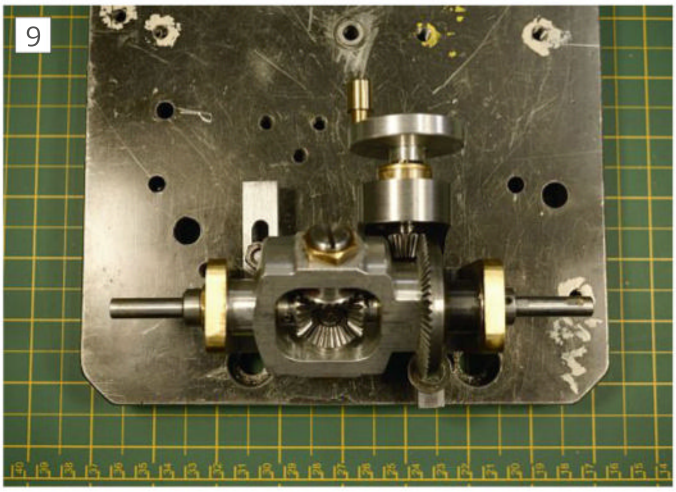
Finished experimental differential.

are free to rotate on their mountings but constrained by a shoulder on the threaded end of the shaft and a fixed washer at the other end. The fine thread and lock nut allows careful adjustment for optimum mesh. The example shows the shafts mounted in a scrap of aluminium used to ensure a snug fit of the threads in the aluminium yolk.

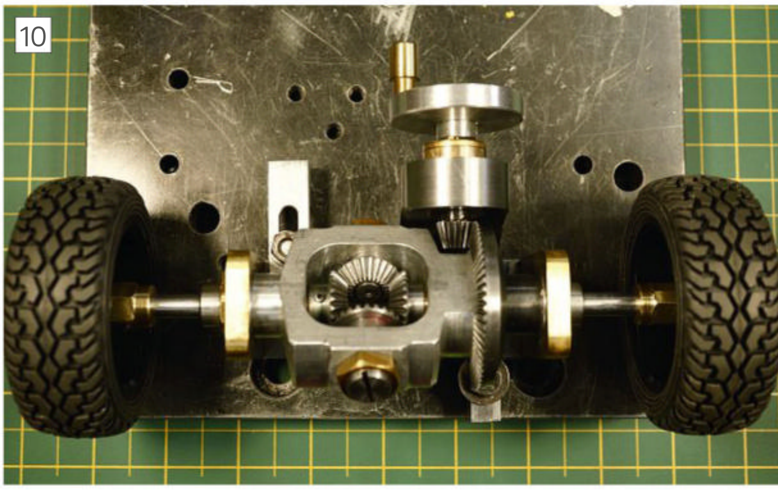
The arrangement for the (axial) sun wheels was similar, but the shaft did not have a washer and rotated within the axial threaded sleeve. It was retained by a collar at the outer end and the bevel fixed at the other end.

This version worked much better than the previous one. It needed a bit more work to add ball bearings for the yolk rotation and for the addition of an operating handle; **photo 8**.

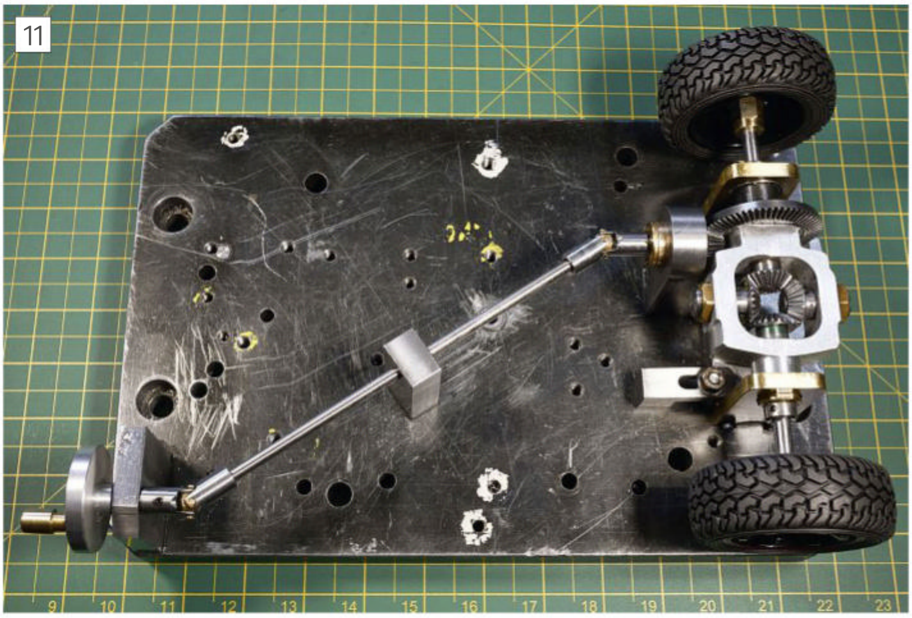
Initially there was still an occasional tendency for it to seize up until on one such occasions I noticed a distinct click as I dismantled it. It suddenly occurred to me that the same sort of click sometimes occurred when dismantling a locking taper. I began to suspect that the modifications to the tooth geometry might well result in a locking taper if forced into mesh too far. Careful adjustment of the end float on each of the four bevels fixed the problem by providing tighter control on the maximum mesh. However, there did seem to be some sort of servo action which encouraged over-meshing. Not what might have bene expected since bevels, like helical spur gears, exert axial loads on their mounting shafts. These loads would tend to push the ›



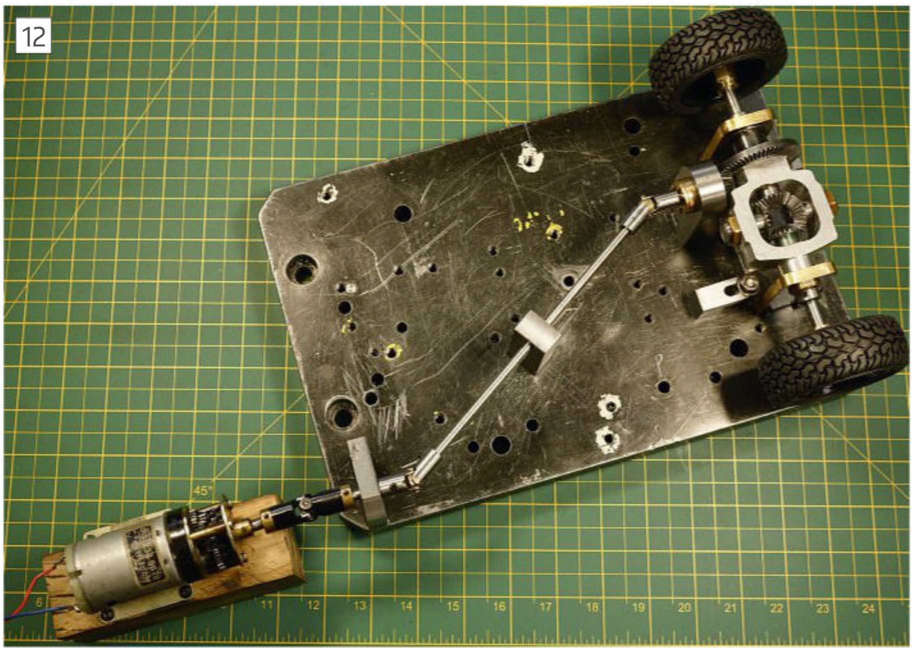
Differential attached to base plate.



Road wheels fitted.



New handle arrangement.



Motor experiment.

bevels apart. Possibly worthy of further investigation at a later date.

There was an immediate need for fixing the differential to something substantial to keep it in place when turning the handle.

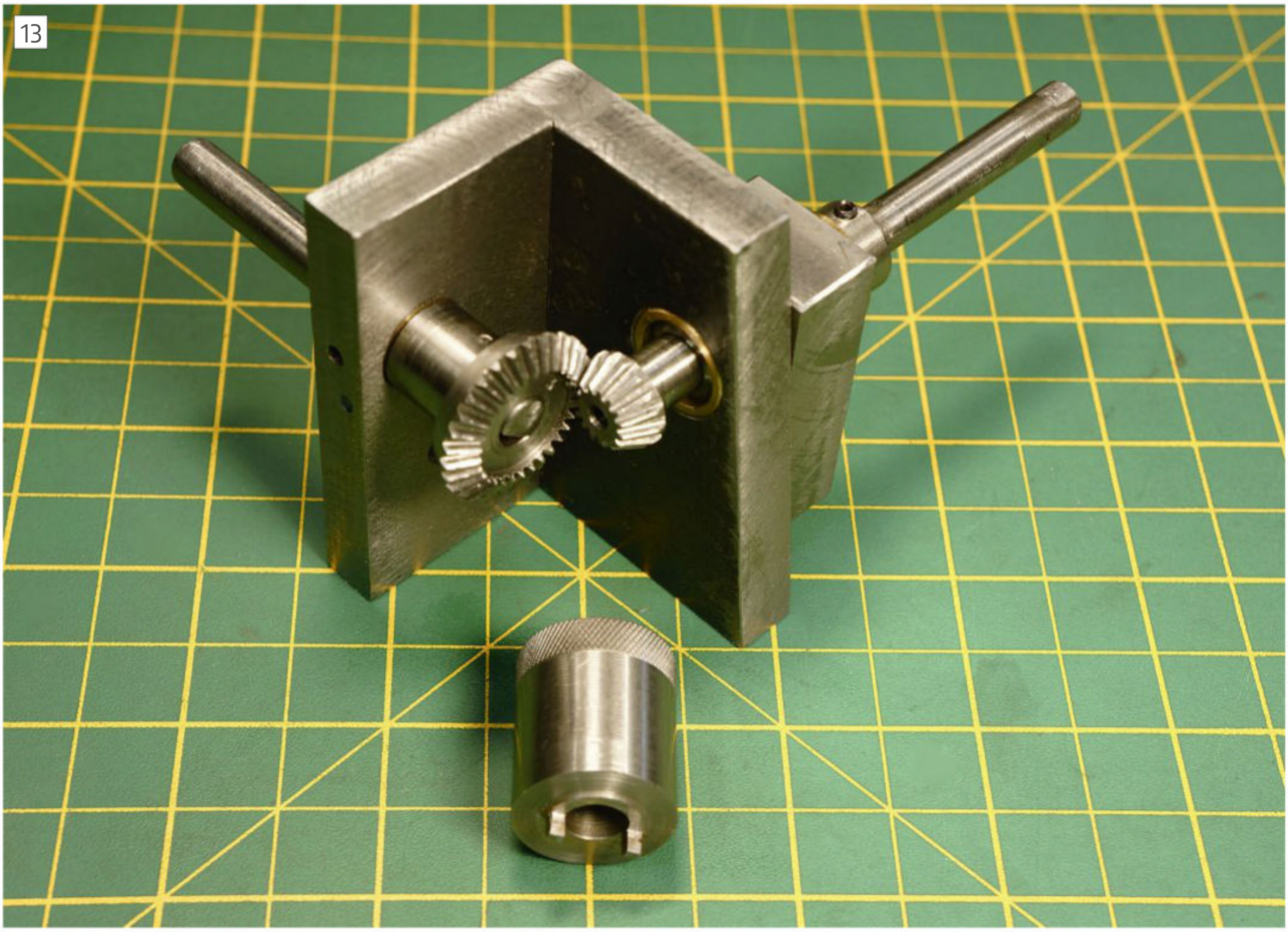
Photograph 9 shows the differential clamped to a rather scruffy, but substantial steel plate. The plate came from a heap of military surplus and has been repurposed many times.

In order for the differential to demonstrate how it worked in practice I felt it needed a bit more elaboration to be a convincing demonstrator, starting with some road wheels from the internet, **photo 10.**

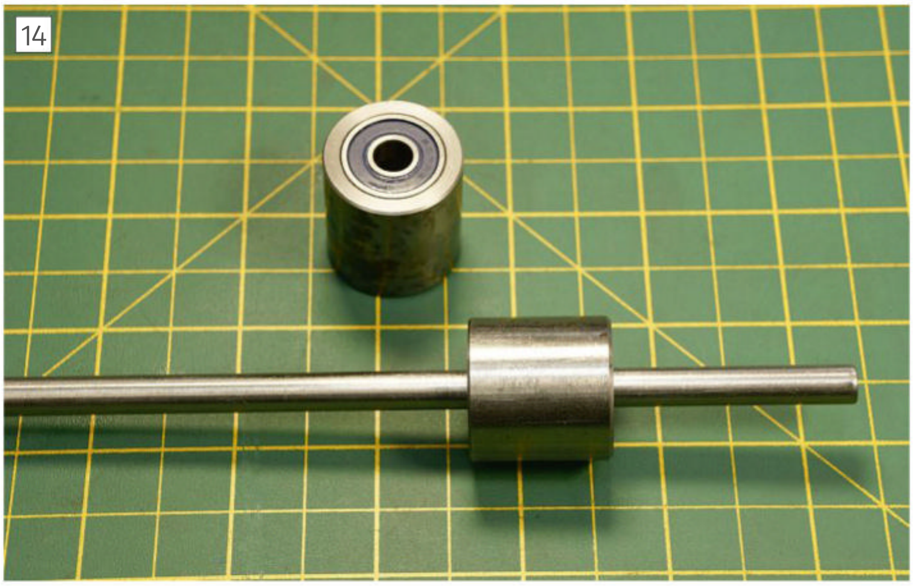
But the operating handle was now inconveniently in the middle of the plate and the model would have benefited from demonstrating how the drive would be applied in automotive practice. The handle was moved to the edge of the plate, which might well be considered a corollary of Parkinson's Law (Ref 3) i.e. "Equipment expands to occupy the space available"; **photo 11**. The eagle eyed might also spot that the two universal joints have yet to be aligned correctly.

The demonstrator then replicated automotive practice for a front engine, rear wheel drive car, the only thing missing was an engine. In deference to the move to electric cars I decided to use an electric motor. I plead poetic license at this point, since no electric car that I know of has this type of drive train, but some do have differentials.

Photograph 12 shows the result. Which was not intended to be the final layout, but more of a test bed to find what power and speed might be



Troublesome arrangement...



Cassette bearing arrangement.

appropriate for the motor.

At that point a visitor arrived and parked a four wheel drive version of the Fiat Panda on our drive. That had a transverse engine, which did drive the rear wheels (as well as those at the front). Such a layout, would be more compact, and must surely have used yet another pair of bevels!

My first attempt at a suitable bevel arrangement to power the demonstrator was unsuccessful. I had opted for a 2:1 increase in speed, but the torque requirements to do this were beyond the simple sheet metal mounting provided with the motor. It was seen visibly bending under the strain.

My second attempt incorporated a more robust mounting for the gears and a separate mounting for the motor. That didn't work either! The original problem with the differential was that it would lock solid without any obvious provocation and the same thing was happening again. **Photograph 13** shows the construction, with brass bushed bearings similar to those used earlier. The tool in the foreground was to adjust the mesh of the bevels.

Puzzled, I put the gears back on the test rig where they behaved impeccably. The problem had to be in the bearing arrangement. Since the gears worked with the ball bearings on the test rig, I changed the design to ball bearings using a cassette type arrangement as shown in **photo 14.**

● To be continued

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

Beginner's Workshop

Fitting and joining PIPES

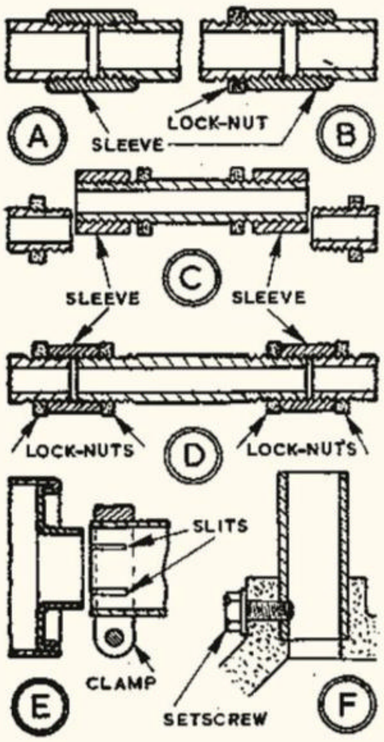
By GEOMETER

OF simple WAYS of joining pipes, the more common are by screwed fittings when there is sufficient wall thickness; by clamping when walls are- thin; and by sleeves placed over or inside the pipes, then soldered or brazed, when' it is required to make permanent attachments.

Screwed fittings are used for conduit and water pipes, the end of each pipe being threaded and screwed into a sleeve *A*. In the case of water pipes, leakage is prevented by screwing the sleeve to the end of the thread on the pipe, using jointing compound. Serrated jaw grips or pipe wrenches are used for the screwing together and dismantling.

Pieces of straight pipe can be joined in this way to make a permanent system. However, if pipes are long, bent, or sections need to be removed -without undue disturbance, a running sleeve joint *B* must be used where required. One piece of pipe is threaded far enough for the sleeve to be run back clear, when, if the pipes are flexible, they can be pulled sideways and one screwed out. The joint on the long thread is made with a lock-nut, using a ring or grommet of yam or tow treated with jointing compound. This is wound round and the lock-nut pulled tight.

On this principle, a piece of pipe can be fitted between two others, C and the sleeves run on to these, then the lock-nuts screwed up, *D.* Most simple pipe and domestic water systems have joints of this type, and correctly installed it should be possible to remove and renew damaged sections without undue difficulty.



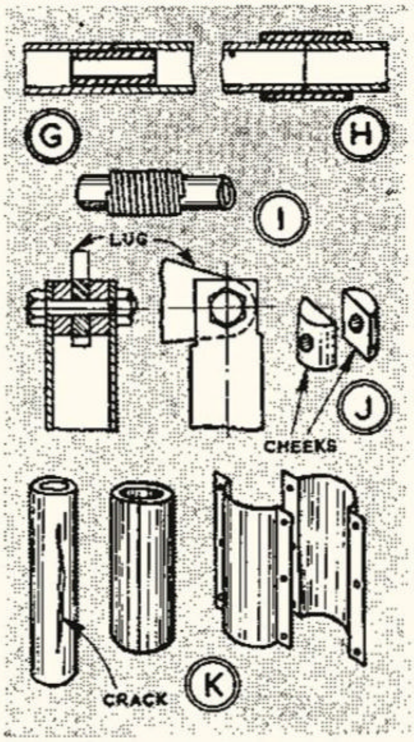
Other types of fittings

Air pipes and exhaust systems of i.c. engines often employ clamp fittings, of which *E* shows an example. The pipe locates with a good fit over another or on a spigot and is slit in a number of places to be held with a clip and bolt or a worm-drive clip. Leakage at the ends of slits is prevented by their being shorter than the spigot or other part.

A pipe of medium wall thickness, round and accurate to size, may be a push fit in a casting and secured by a setscrew entering a hole in the side *F.* Removal of the setscrew permits the pipe to be twisted and pulled out and in fitting it should be ascertained, with a rod or wire, that the holes are in line.

Pipes may be permanently joined as G and H by a sleeve inside or out. When they are of brass, copper or steel and to be soldered, the surfaces should be tinned beforehand. An internal sleeve may be kept central by its being a tight fit in one pipe, or by drilling a small hole and fitting a pin.

Pipes which are to be brazed should be clean and have flux applied and may be drilled in several places to run the brazing material in, when the sleeve is inside. For a structural purpose, where an internal solid plug could be used instead of a hollow sleeve, the latter is better for brazing, because of the easier and more uniform heating-that is, a solid plug may not heat sufficiently for the brazing to run through the joint. A pipe which is cracked may be repaired and strengthened by binding with clean wire, then soldering over, I.



For a structural purpose, a firm mounting for a pipe or tube on a flat lug, to permit of movement as on a camera tripod, is as J. The tube is slit to accept the lug, and drilled crosswise for a bolt. To maintain the shape and admit of the joint being tightened solid or to the degree of friction required, a pair of cheeks are sawn and filed (or machined) from rod which will just push into the tube. They do not require fixing other than by the bolt passing through.

A split water pipe can be temporarily repaired without dismantling, *K.* Any bulge is hammered down, then a piece of rubber and canvas car water hose is slit lengthwise and sprung over (the bore should be approximately the same as the outside of pipe). Fixing is with a halved sheet metal clamp, formed round a bar, flanged and drilled for screws and nuts.

A Small Machine Saw

Alan Jackson took fright at parting large diameters and didn't enjoy hacksawing, so he made a machine powered saw and it's been serving him well for over thirty years.

I made this saw in about 1980. Trying to part off a 2-inch mild steel bar in the 4.5inch Denham lathe I had then was a terrifying experience, leaving the only alternative, a hand powered hack saw. Whoever came up with the name 'hack' saw must have been joking, because my saw never hacked, it just slowly cut a less than straight cut through the bar no hacking whatsoever. So I decided to mechanise the hacking process as best I could.

In the company I then worked at there was an industrial version in the machine shop, which could effortlessly saw through 2 inch and larger steel sections. You can see my efforts at making a smaller version in **photo 1**. I made the patterns and had the castings made by a local foundry at a then reasonable price. It is very difficult to do this in today's world due to health and safety rules etc. Resulting in closing these small, and, sorry to say, large enterprises down, but that is progress, I suppose.

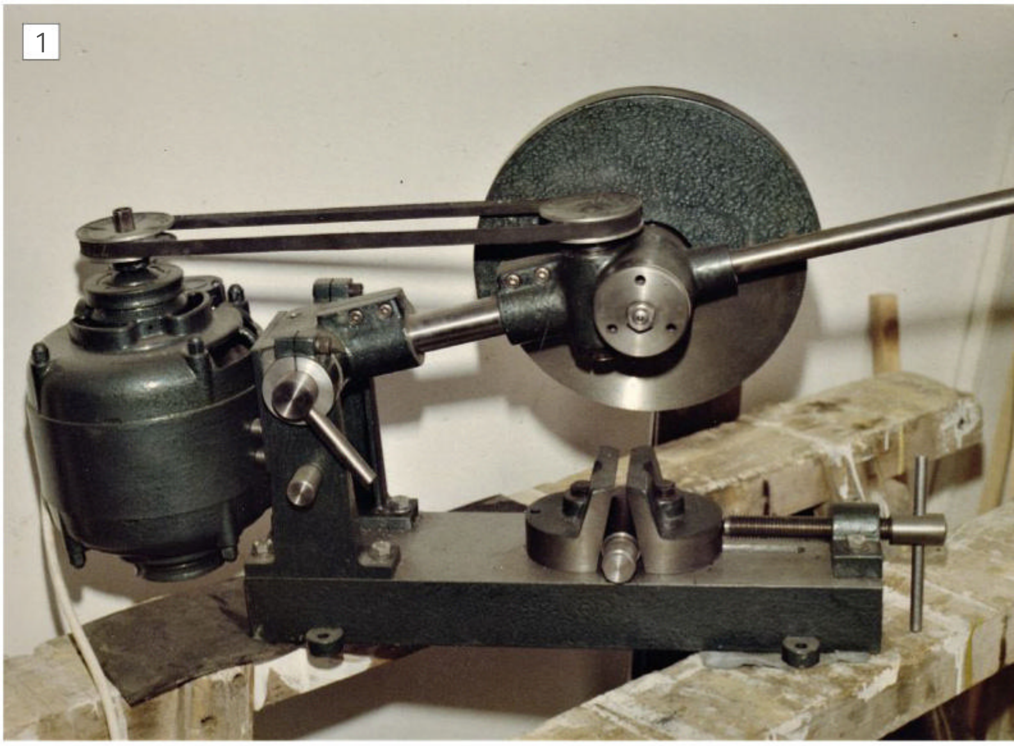
(Note to self "I must not be too cynical")

It looked just the business, but it only looked, it did not walk the walk as they say.

The motor was geared down 1 to 6 by the worm drive at the sawblade spindle but it was just not rigid enough. The circular blade just chattered like mad.

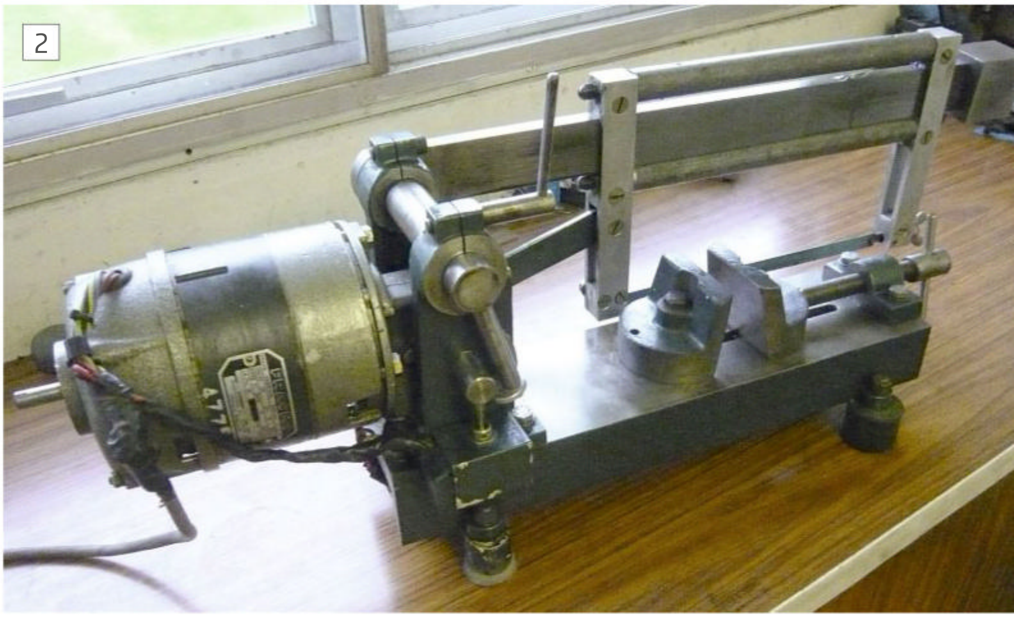
I tried adding some inertia to the blade by adding a weighted flywheel, (actually a 4-inch chuck) but it did not help much.

So I had to give up with this design and converted the rest of the parts to a conventional reciprocating saw shown in **photo 2.** This has worked reliably for more than 30 years. It is slow, to cut through a 2-inch bar will take about 30 minutes or so, but it does a clean square cut. I know the better option today



1

My first attempt was to make a circular cut off saw.



2

My second attempt at conventional reciprocating saw.

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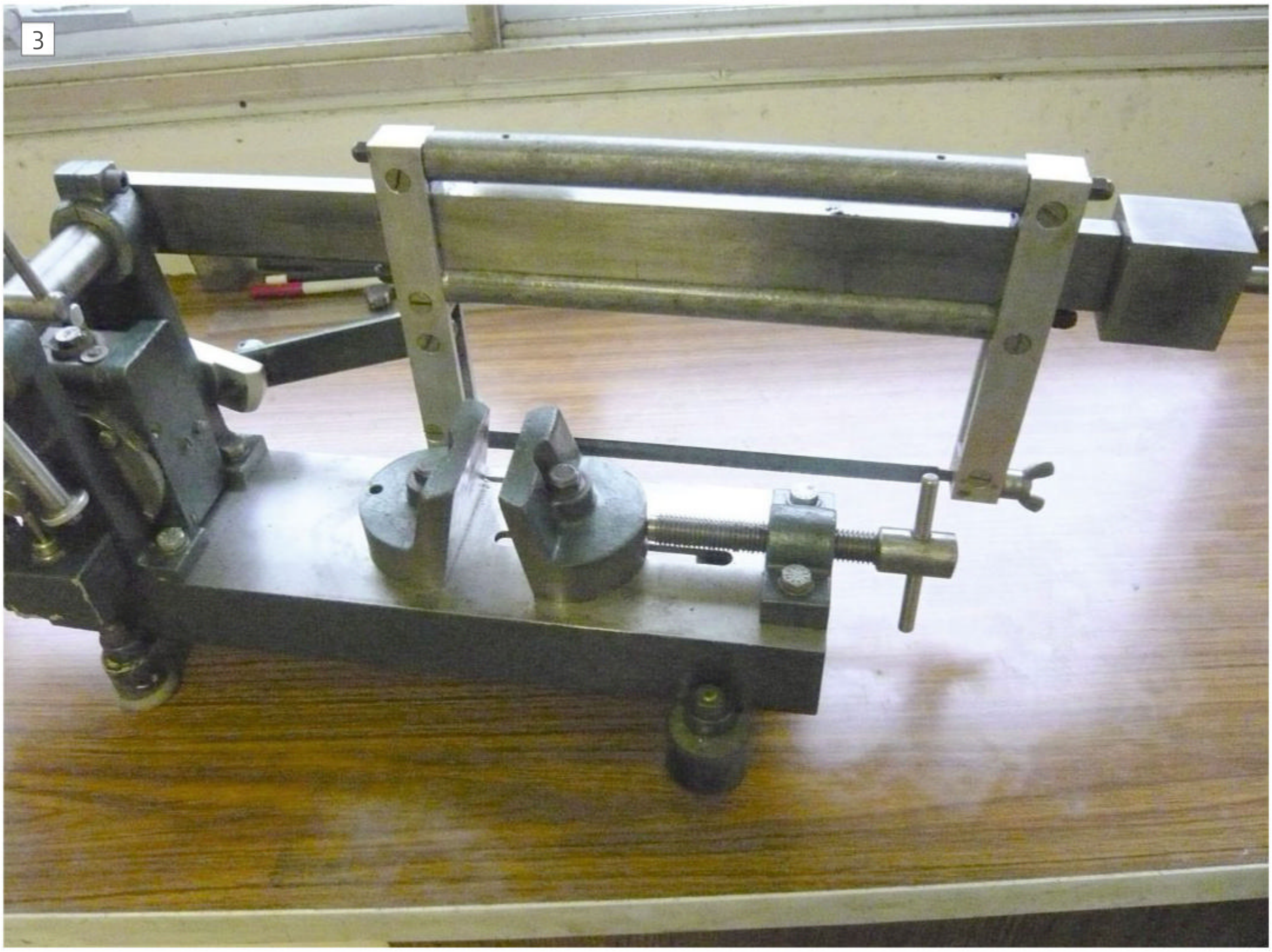


Righthand side view.

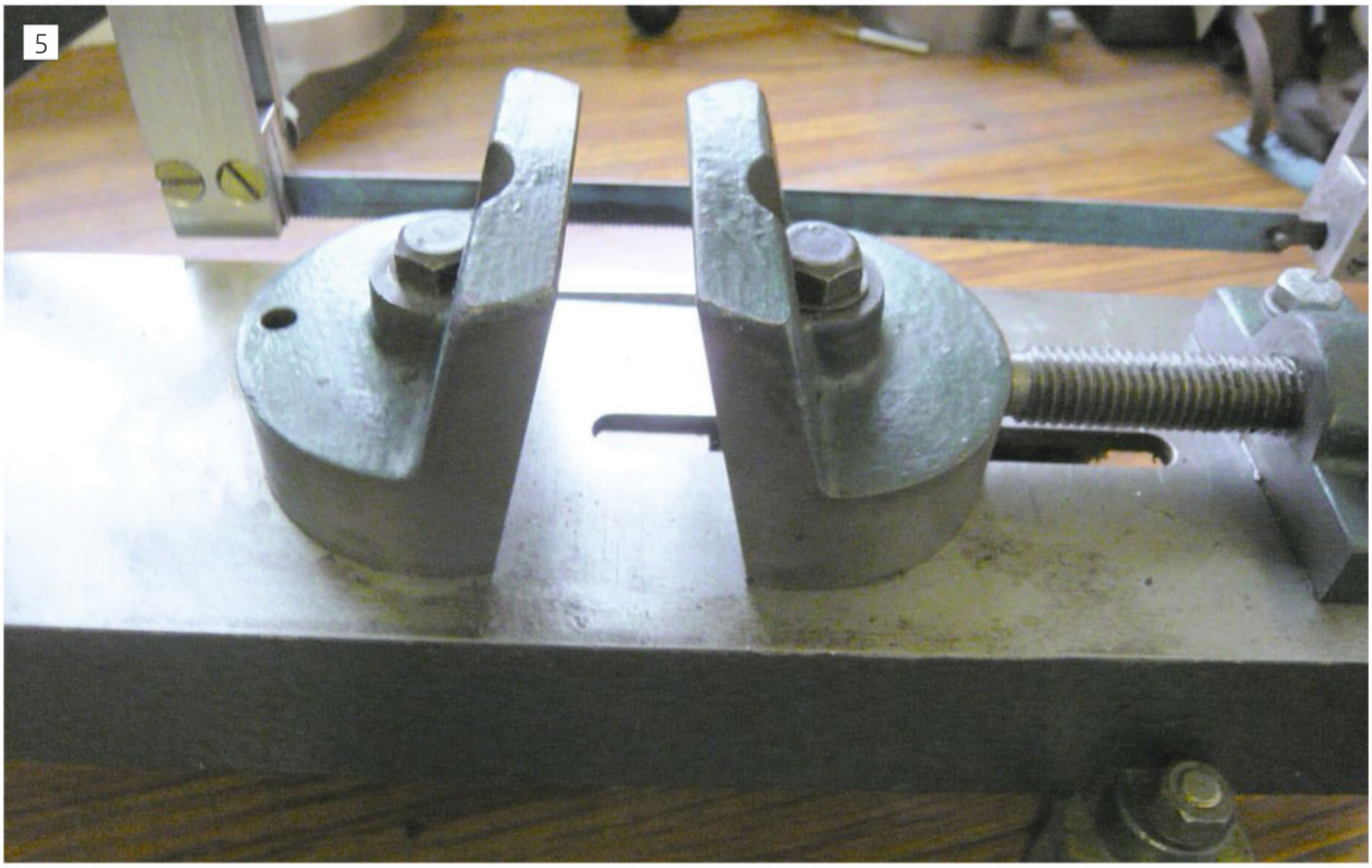
The pivoting arm locked in the setting position.

would be a band saw, but my little saw does not take up much room and does its best.

Photograph 3 shows the righthand side view. The base is made from a length of 4" x 2" steel channel. I remember it took a lot of effort to produce a smooth flat top surface by hand. Four mounting points fixed by screws on the inside have rubber support blocks added to them. The vice jaws slope at 10 degrees to the vertical. I reasoned that this would hold the part to be sawn firmly down to the base. It has proved to be most useful, smaller round or square sections etc. can also be clamped by adding a larger round section between the vice jaws as a spacer, and angle sections are nicely held down to the base with their edges face down. The jaws can be rotated in 15-degree increments to 45 degrees, an indexing pin is inserted in the rear jaw to hold its position.

The pivoting arm is a length of 2"

5



A closer view of the vice jaws.

6

The pivoting arm in its parked position.

7

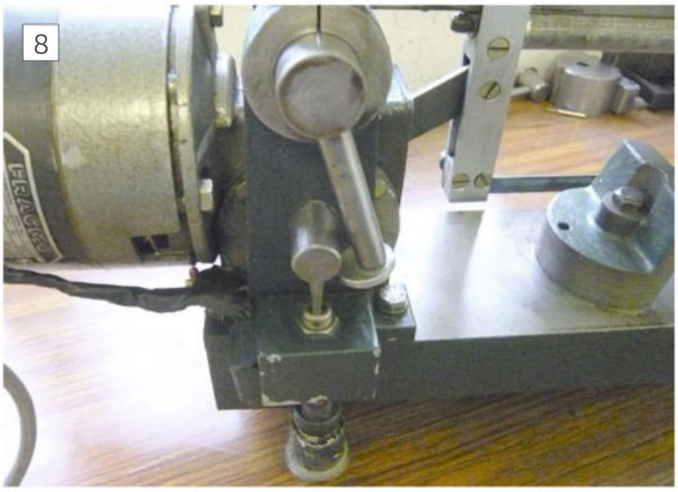
Label on the single phase worm geared motor.

x 1/2" mild steel bolted to the end of a 1" dia bar spanning the two vertical supports. The support points are split and can be clamped to the pivot bar. One side is clamped up just enough for free movement and the other clamp has a lever to clamp and lock the pivot arm in the high setting up position.

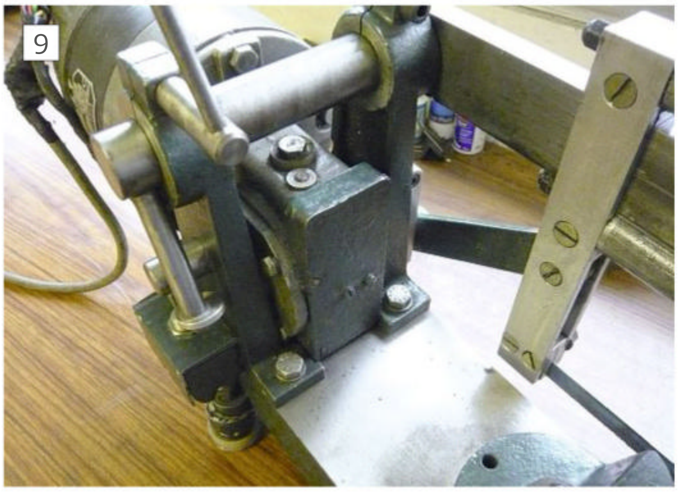
The sliding saw frame is simply constructed from aluminium 1" x 1/4" flat bar spaced out widthwise by aluminium spacers and lengthwise by 1/2" steel galvanised pipe sections. The whole assembly is tied together by tension bars inside the pipe sections. The lower pipe section has a flat machined on it to face against the underside of the pivoting arm. A 10" hack saw blade with the teeth cutting on the return stroke fits into the frame.

Photograph 4 shows the pivoting arm locked in the setting position held by the far support point being clamped by its locking lever. **Photograph 5** is a closer view of the vice jaws.

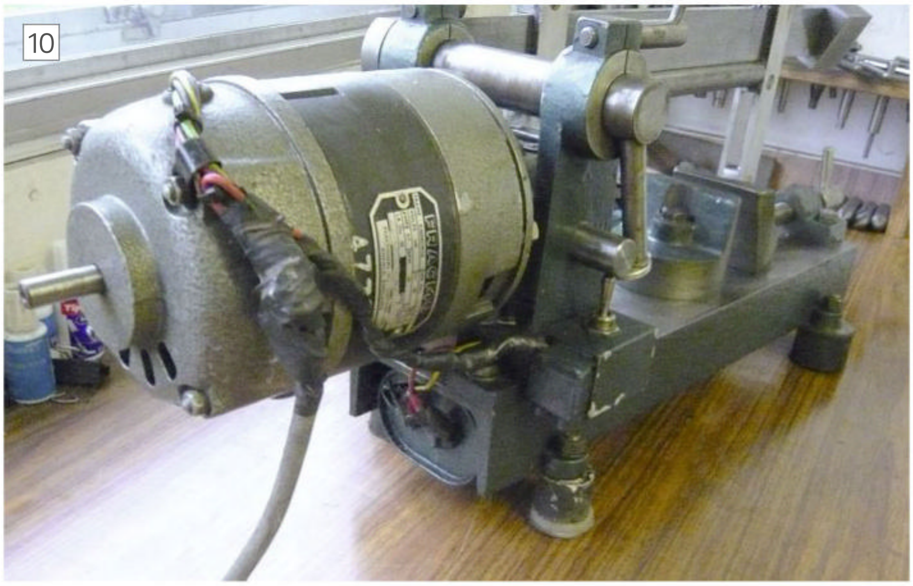
Photograph 6 shows the pivoting arm in its parked position . The label on the single phase worm geared motor **Photograph 7** shows it runs at 56rpm which seems about the right speed. ›



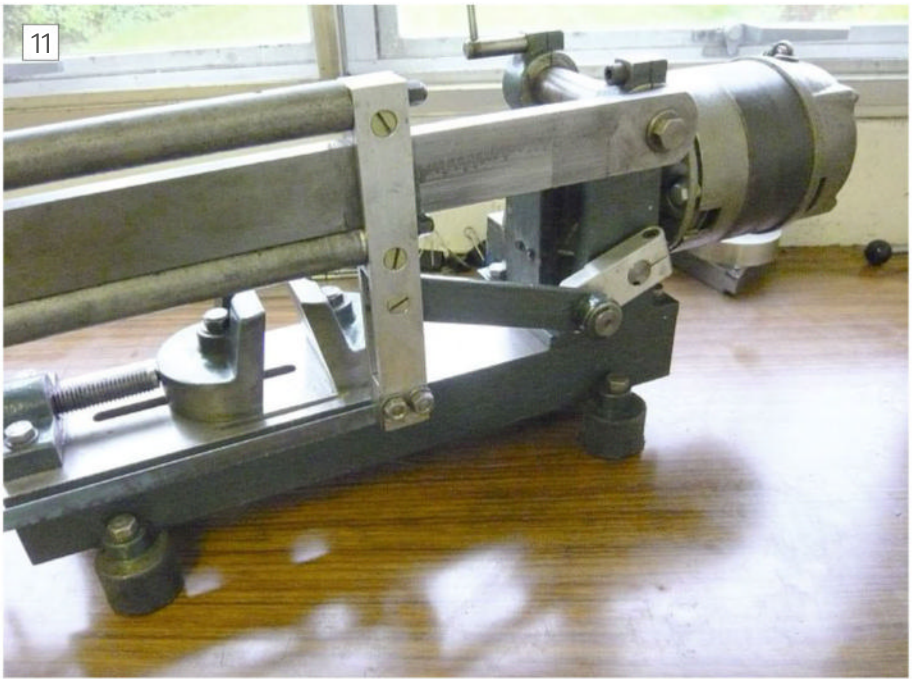
The pivot bar extending through the support.



The motor gearbox squeezed in between the pivot supports.



Motor start and run capacitor mounted under the base inside the channel.



The crank arm and connecting bar.

The motor can run in either direction but I found that it cuts better on the return stroke so the output spindle turns anticlockwise. The righthand pivot support has a clearance hole for this output spindle.

The lefthand support shown in **Photograph 8** shows the pivot bar extending through the support and this has a stop limit bar extending downwards, onto which an eccentric disc is mounted. A centre off, two-way, switch is mounted just below the stop limit bar. The eccentric disc is rotated and locked in position, so that as the pivoting arm reaches its lowest point against the stop the eccentric disc moves the switch to the off position. The switch can also be moved to the other on position which will reverse the motor direction. I have tried this out with the saw blade reversed it is not much different from the anticlockwise direction. However it does present a unworn part of the blade into operation.

Photograph 9 shows the motor gearbox squeezed in between the pivot supports. The base of the gearbox has tapped mounting points, enabling it to be bolted to the base.

Photograph 10 shows the motor start and run capacitor mounted under the base inside the channel section. Please excuse my rather scruffy wiring.

The crank arm and connecting bar are shown in **photograph 11**. Oilite bearings are fitted at the rotating points. the saw has a stroke of 3".

That really sums it up maybe one day I will get a band saw, but now I am at the crossroads between upsizing my workshop and dare I mention it downsizing. ∎

Scribe a line

YOUR CHANCE TO TALK TO US!

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

CNC Router

Dear Neil, I am looking at buying a CNC router from China. A semi-professional / hobby type router size 6090 with a 2.2 KW spindle drive bwin linear bearings, ballscrews, Nema 34 drives and motors. It is for wood/ light metals. Has anyone had experience of going through this process. The machines I am looking at are from Blue Elephant, LentCNC and Alpha CNC companies; has anyone had experience of these companies. Can anyone recommend an alternative supplier they have experience of. Or can anyone recommend a UK based supplier that has a similar reasonably priced machine.

Any advice would be greatly welcomed. Contact me at email below.

John Mcphee

Importing machine tools direct in this way is a tricky business, machines may not be to the same specifications or safety standards as those for the UK market, and if something goes wrong you won't have recourse to the same protections as if you bought from a UK supplier. If anyone has recommendations on the best way forward for John, I am happy to pass on emails – Neil

Myford Dials – Washer Details

Dear Neil, a UK reader has asked about a source for the EPL25 wave washer used to set the friction in the resettable Myford dials in my article (MEW 328). Apparently not all suppliers worldwide use this code number for the 25mm x 32mm wave washer.

UK online supplier Bearingboys.co.uk stocks Wave Spring Washer W61510 that will do the job. It has less wave height and one reader reports increasing the main hub width from .220" to .260" to compensate. Another reports that springfasteners.co.uk sells a wave washer with a closer wave height, listed as an EPL24.

They also stock the required 32mm internal circlip, listed as D1300/0320.

Your local bearing shop may well stock them too. The wave washers are used to set the preload on bearings in electric motors, so a commonly used item. And the 32mm internal circlip is a standard size. 32mm being the size bore it fits into, so it will be a bit bigger in its uncompressed state.

Happy twiddling.

Pete Barker, Australia

Waverley

Dear Neil, I am writing to say how nice it was to see a picture of the Waverley in your July 2023 editor's bench. I grew up in Appledore on the river Torridge in North Devon and we often saw the Waverley sailing to or from Bideford. It was lovely to see her looking good despite the contretemps with Brodick Pier and I hope she has many more years left.

Tom Cooksley, by email.

Component Tester

Dear Neil In recent issue 228, of the magazine Model Engineers Workshop, appears an article (page 44) on the construction of kit JYE Techs M162 LCR electronic component tester kit for testing resistors, capacitors and inductors. The article was written by Stub Mandrel. Where can this kit be purchased? Do they have a website for ordering this kit?

Geoff Grosguth, by email

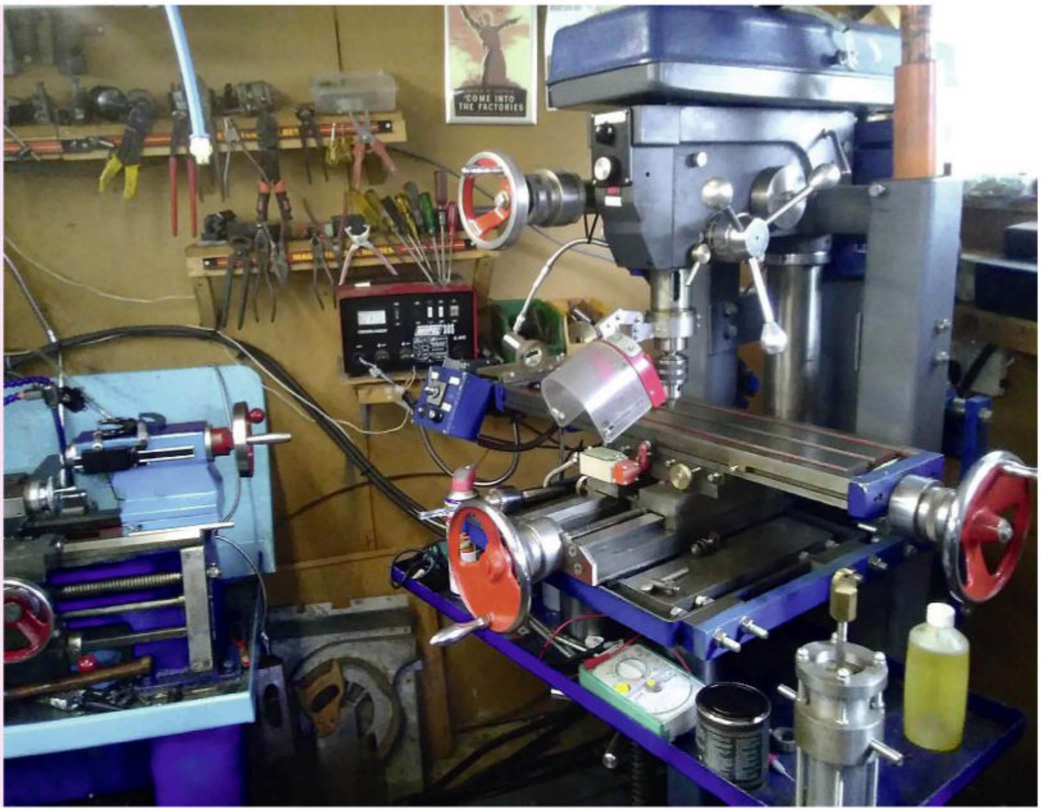
Hi Geoff, there are various sources, but JYE Tech's website is: jyetech.com/m162-lcr-meter/ - Neil.

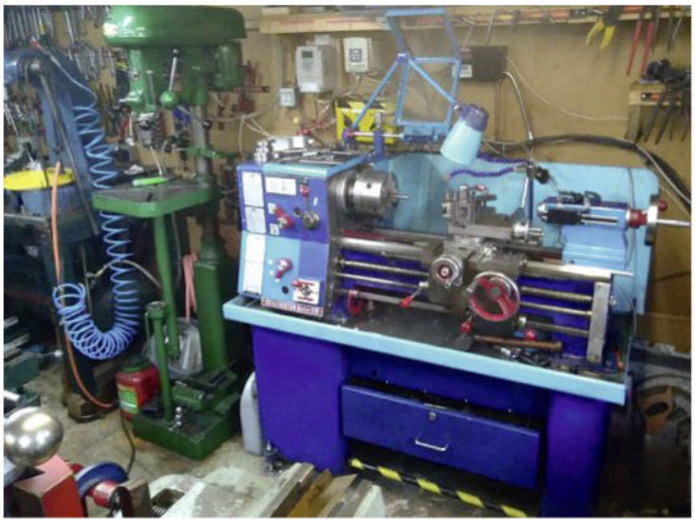
A Reader's Workshop

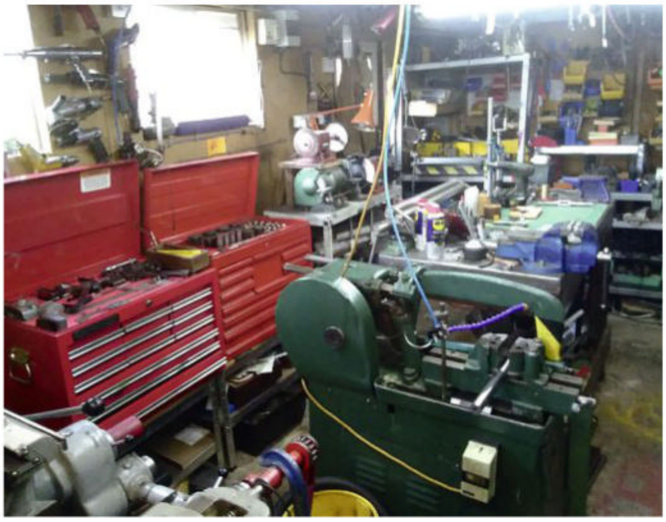
Dear Neil, please find attached photographs of my workshop.

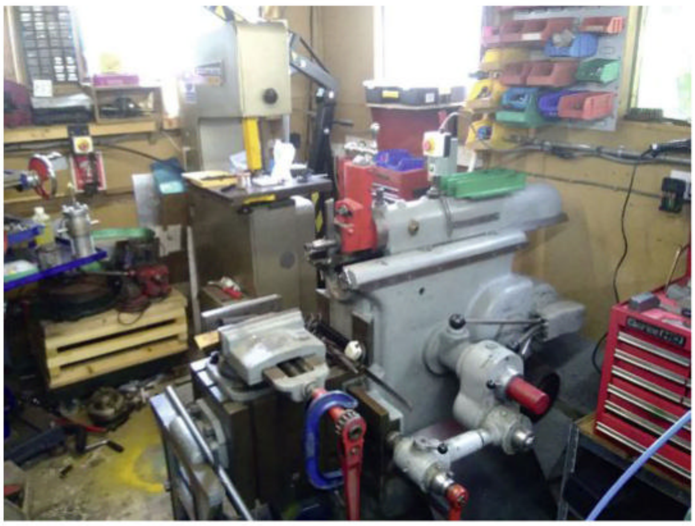
The machinery has been collected from colleges because they no longer wanted it. I have restored the lathe. The milling machine I made from a pillar drill. Most of the machinery you see has been restored by myself.

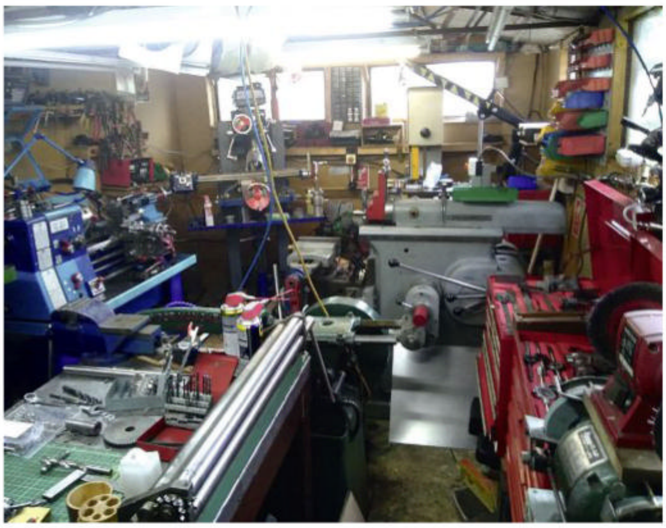
Patrick Neal, by email











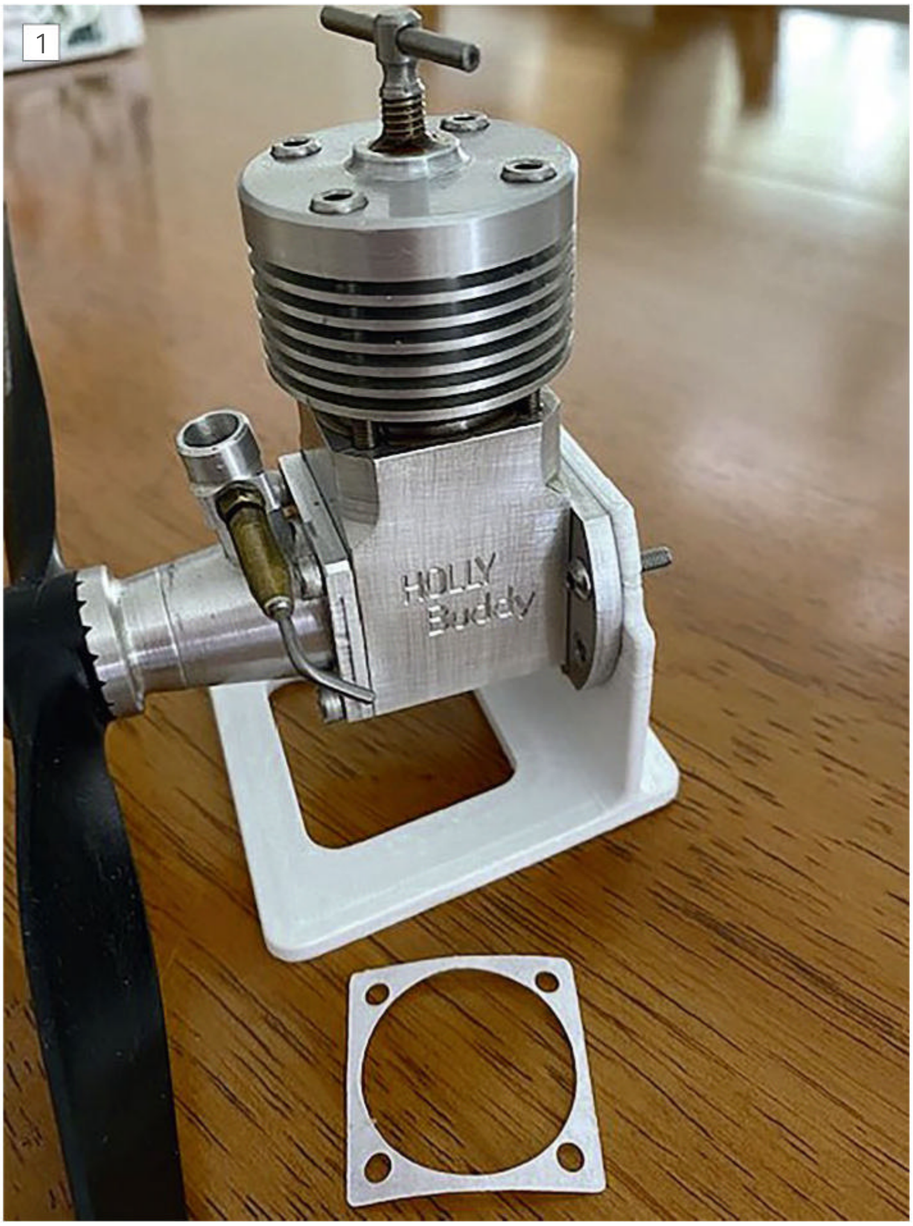
Cutting Small Gaskets with a CNC Mill

Ron Sharp explains his approach to making accurate gaskets for internal combustion engines.

For some time now I have been making small internal combustion engines – and although they frequently use metal to metal joints, when required, sealing can be improved by the use of either gaskets or joint compounds. The compounds are not ideal as if the joint must be dismantled there may be a problem of residue – scraping aluminum faces is not ideal. I decided to use gaskets and after some experimentation have evolved a system which works well and can produce small and intricate gaskets in heavy paper or thin card. **Photographs 1** and **2** illustrate some gaskets cut recently.

This article assumes that you have a CNC mill or router and are familiar with its operation and the generation of G-Code from drawings. There are no special machine requirements, but the Z-axis should be capable of small movements (0.1mm) under automatic control. My current mill is a home converted Optimum BF20L – shown in **photo 3**. It runs on Mach 3 and I have found it to be capable and easy to use. It has proved to be excellent for the small work I do. As can be seen, I have fitted fans to cool the X and Y stepper motors as it can get pretty warm in my shed here in Brisbane, Australia.

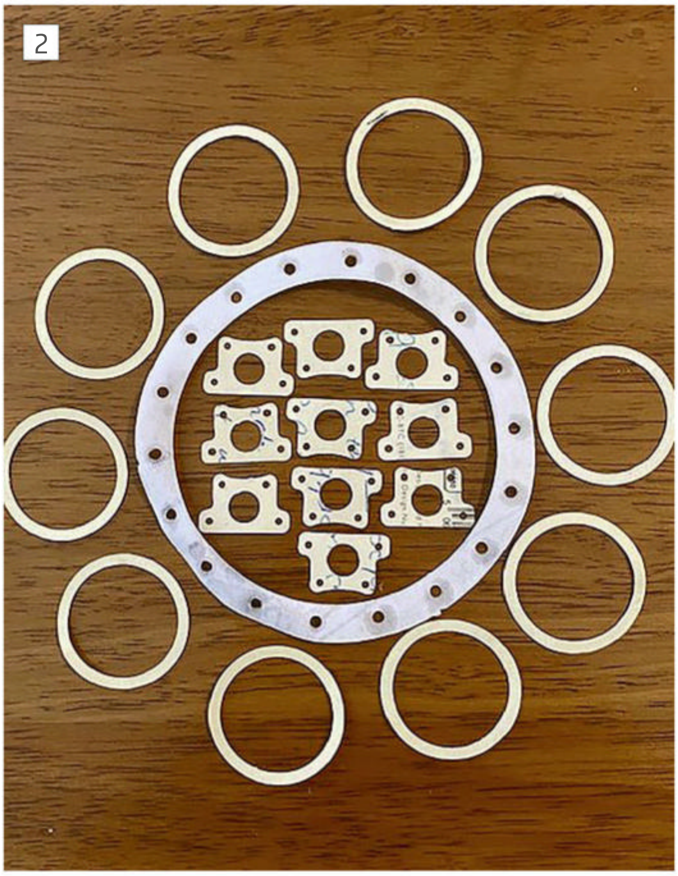
It will be necessary to get a vinyl cutter holder with some blades (around $20 Australian – maybe £10 in the UK) and to make a mount to hold it in the mill chuck. Full details of a suitable unit are included below.



'Holly Buddy' motor made recently with one of the two crankcase gaskets required.

Summary method

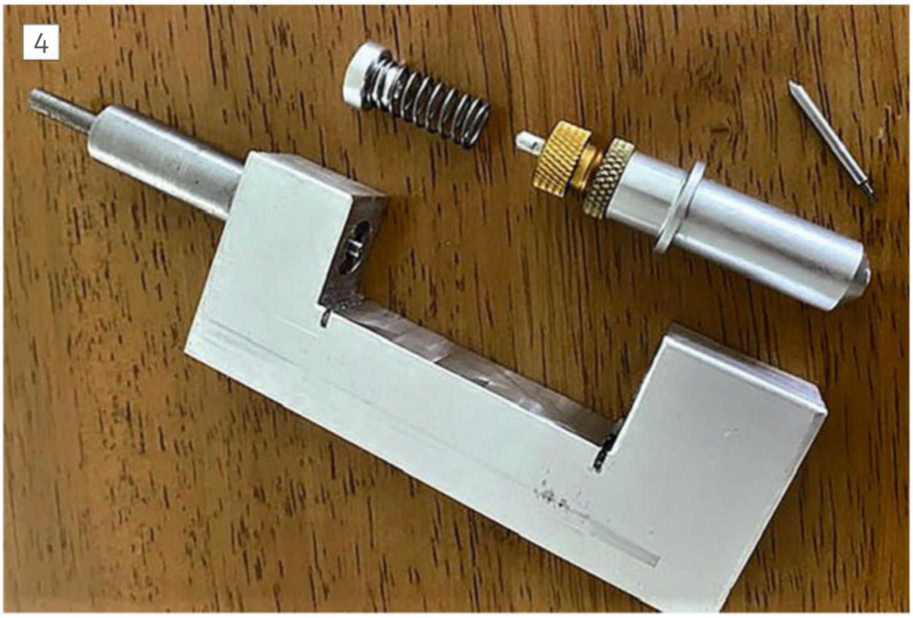
1. Prepare a drawing of the required gasket – format to suit your CAM software.
2. Using the CAM software prepare G-Code for the gasket outlines and a separate G-Code drilling file for any small holes for bolting etc. Holes above say 6mm can be included with the outlines as the cutter will be able to handle these.
3. Purchase the vinyl cutter holder with blades and make up the mount to hold it in the chuck.
4. Prepare a suitable piece of softwood to mount the gasket material – must be reasonably smooth and flat.
5. Glue the gasket material onto the wood mount and allow the glue to set.
6. Install the wood mount onto the mill and set the X and Y axes to your chosen zero.
7. Using a sharpened tube cut the small



Some gaskets for my Bentley Rotary motor. The big one is 0.1 mm thick and the small ones are 0.4 mm.

My Optimum milling machine showing some 3D printed CNC conversion components. The axis drives are mounted on aluminum parts not seen.

holes using the 'Drilling Code'.
8. Fit the vinyl cutter in place and cut the outlines with the 'Outline Code'.
9. Remove the mount from the mill and soak in solvent until the gasket is released. - Clean off any excess solvent.



The Cutter Holder partly dismantled. The purchased Blade Holder has the gold anodised adjustment rings and the blade can be seen next to it.

Detailed Description

1 and 2 The drawing and G-Code.
As mentioned above it is assumed that the reader is familiar with the operations up to generation of suitable code for the machine to be used.

A key issue is the depth of cut to be called up for the Z-axis. I have found that it is best to be conservative as it is easy to tear the top surface of the gasket sheet if the first cut is too deep. For paper I tend to use a total depth of 0.2 to 0.3mm – and to call up two passes. For thin card a depth of cut of 0.5 mm and 2 to 3 passes. The process of cutting is quick in any case but if the material is torn or not cut sufficiently deep then starting again (clean the wood mount, re-glue the material, allow to cure etc.) is time consuming and frustrating. Typically, I use a cutting speed of 100 mm per minute although I am sure a much faster speed could be used.

3 The Vinyl Cutter.
Essentially the cutter unit to be purchased will consist of a small cylindrical holder and a number of blades – numerous examples are available through online suppliers. It can be seen in **photo 4** – the item with the gold anodised adjustment rings. The replaceable blade is next to the holder.

This holder unit has tiny ball bearings installed to hold the blade and to allow

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Assembled Cutter Holder.

Three dimensional representation of the Cutter Holder.

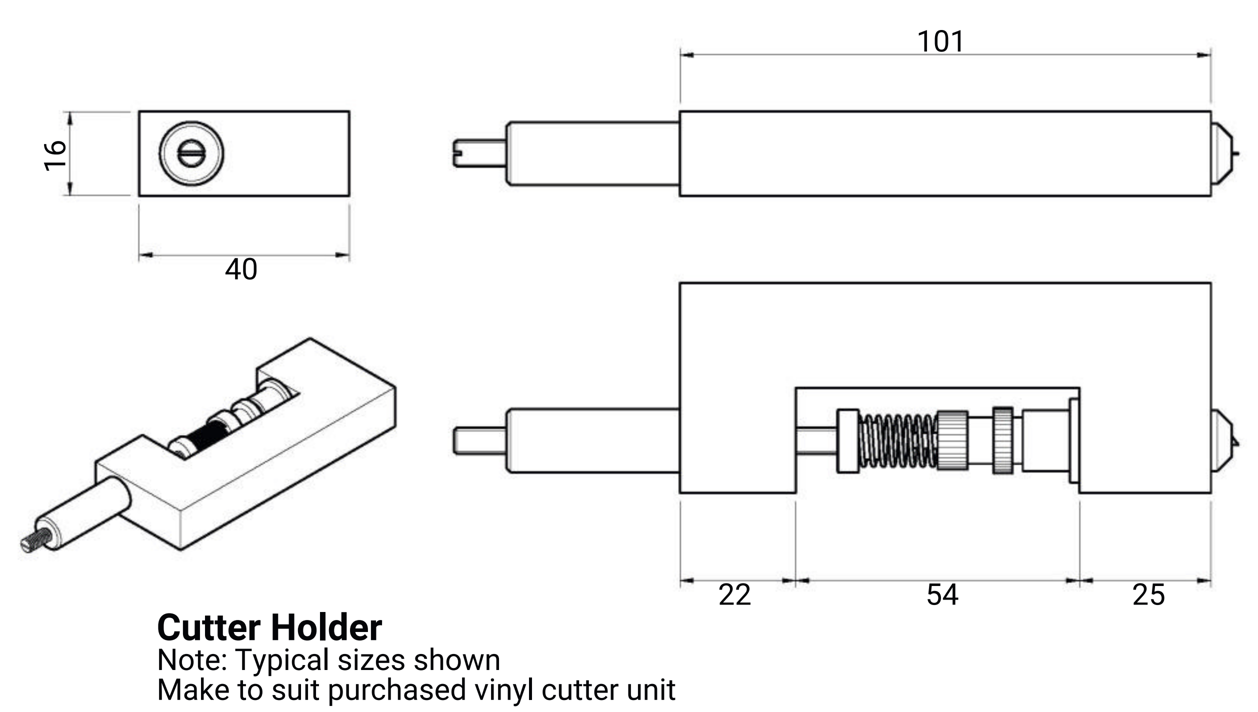

Figure 1

it to rotate to follow the cut outline via a castor action. The blade is prevented from falling out by a magnet arrangement. The length of blade that projects from the holder can be adjusted – normally by a knurled adjuster with a lock nut.

In use only fractions of a millimeter will project, and this is best adjusted by trial. If too much blade projects the blade may penetrate below the sharpened area and tear the gasket. It is easy to start with only a small projection – then holding the cutter by hand take a test cut on the gasket material – ensuring that the bottom of the blade holder is in contact. This will indicate if the cut that can be achieved is deep enough.

The blades as supplied typically have cutting angles of 30, 45 and 60 degrees. I always use a 45-degree blade which is theoretically capable of cutting to a depth up to 1 mm. I have not used material over 0.5 mm. One blade should last a very long time on this application.

As an aside – here in Australia there is a strong market for vinyl wrapping vehicles (often expensive 4-wheel drives) to prevent scratching. I have personal knowledge of one blade being used daily for weeks on end and cutting many hundreds of metres before being replaced. Cutting model gaskets is not likely to wear out one blade.

In use, for the final cut, the bottom of the holder slides across the surface of the gasket material and if it is rigidly held (in the machine chuck) it seems likely to dig in and damage the gasket surface. As a result, I believe it should be installed in a fabricated mount that provides a spring controlled floating action in the vertical plane. The drawing shows the unit I made (originally for cutting vinyl sign material for model aircraft). It works well and is easy and quick to make.

An aluminum body cut from 16*40 flat bar – 101 mm long. It is cut to a 'C' shape as shown. One end is bored 11.5mm to be a good sliding fit on the purchased blade holder. Check the size of the holder you have. The other end is bored (reasonably closely in line with the first bore) to take a 12mm extension to hold in the machine chuck. This extension is drilled and tapped for a 5 mm screwed rod to hold the spring and allow some adjustment. Drill a 5 mm clearance hole almost all the way through and tap only the top 5 to 6 mm. This extension is then bonded into the body.

The spring I use is 9 mm overall diameter and has a free length of 20 mm. There are 10 turns of 0.8 mm wire. In use it requires 600 to 700 grams of force to lift the blade holder from its seat.

Sufficient space must be provided within the cutout to allow removal of the blade holder unit when required.

The blade itself may be removed when required by inserting a small screwdriver between the coils of the spring and pressing down on the top shaft sufficiently to allow a grip to be obtained (with tweezers) on the blade. Take care not to impact the cutting portion of the blade with the tweezers.

The unit I made is shown in **photo 5** with a 3D representation in **photo 6**. A suitable unit is illustrated in **fig. 1** but sizes can be altered to suit.

4 Wood Mount.

Clearly the gasket material must be securely held to allow cutting. This is done by adhering it to a piece of softwood which can in turn be mounted on the mill. As above the faces of the wood must be smooth and parallel. It should be a little bigger than the gasket to be cut – not much bigger as it will have to fit into a solvent bath as the final step in the process.

5 Glue the Gasket Material to the Wood Mount.

I did not find it possible to cut the gaskets at all unless they were glued down. No doubt a laser could be used – but would be another expense and complexity.

Any adhesive used would have to hold the material firmly and then be capable of easy and clean removal when cutting was complete. A solvent would be required.

Initially I tried shellac. It held the material but was slow to dry and sometimes was too brittle and the gasket would pop off before cutting was complete. Shellac is easily removed with methylated spirits.

Photo-mount spray was easy to use and worked well. It could be removed with acetone but tended to leave a sticky residue on both the gasket and the wood mount.

Finally, a brief sojourn into building tiny model aircraft and the penny dropped – balsa cement. Largely replaced by other adhesives balsa cement is still available at a model shop and a tube will go a long way in gasket cutting.

Simply cut the gasket material just bigger than the wooden mount, spread some cement on the wood and place the gasket in place. I always clamp a suitable flat item on top to ensure the gasket is fully down and to ensure a smooth top surface. The oversize gasket material will prevent any glue contacting this clamp plate. After a few minutes the clamp plate can be removed and the glue left to cure – I allow 30 minutes or so as the evaporation of the cement solvent is retarded by the gasket.

6 Install the mount on the mill and set the X and Y axes

When the glue is dry mark the position of the origin for your G-Code and the mount can be installed on the mill. Small ones can be held in a vice and if too big can be secured direct to the mill table. I have only cut one gasket type that was too big for the vice.

Using a pointed probe or similar position the origin and set X and Y axes to zero. At this stage I always rub a thin layer of Vaseline onto the surface of the gasket where cutting will take place as I believe this helps to prevent tearing. All traces of the Vaseline are removed when the gasket is freed in the solvent bath.

7 Using a sharpened tube cut the small holes using the drilling G-Code.

Prepare suitable sharpened tubes for the holes to be cut. I have two – one for 2mm holes and one for 3.2mm. Both are made from 3.2mm stainless steel tube from the model shop. The small one is turned down for a short length and lightly filed to sharpen. The bigger is sharpened on the inside with a centre drill. They seem to last forever.

Load the drilling G-Code. Install the tube in the chuck and set the Z-axis to suit. At this stage I normally prepare for manual drilling by 'inhibiting' the Z-axis (in 'Settings' on Mach 3) and selecting 'Single BLK' on the Mach 3 'Program Run' page. By then keying 'Cycle Start' with the left mouse button you can step through the program – pausing at each hole position and gently drilling the hole by means of the hand control (capstan). Alternatively leave the Z-axis active and run the program to drill the holes fully automatically but I feel that with

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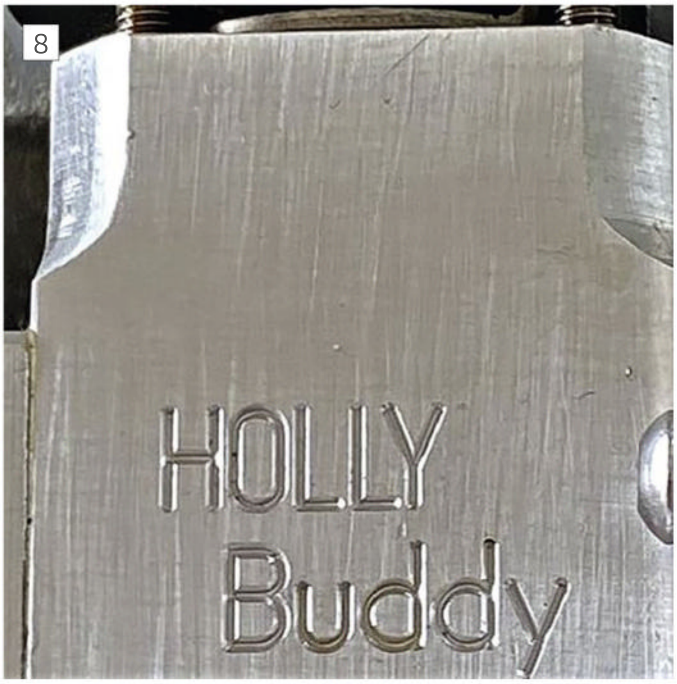
Gasket and mount after cutting.



Close up of the engraving on my 'Holly Buddy' to illustrate the fine mill control possible.

manual control it is easier to protect the sharpened tube end. When all holes are complete return the mill to origin point. As the gasket is glued in place, the little round offcuts will not block the cutting tube.

8 Fit the vinyl cutter in place and cut the outlines

Install the cutter unit in place in the chuck. Note that before installing the cutter unit the mill spindle should be isolated as to inadvertently start the spindle with the cutter unit in place would be exciting to say the least.

Set the Z-axis height. I use an electronic method – bringing the blade gently down onto the copper side of a piece of printed circuit board sounds an alarm when contact is made. I then set the Z-axis to 1.6 mm. Another method is to bring the blade down onto a piece of soft metal of known thickness and watch for the blade holder to rise in the mount as contact is made.

When satisfied that the height is correct set the cutting speed – I use a very conservative 90 to 120 mm per minute as it is more important to get a good result than to save a few minutes. Start the program and the mill should cut out the gasket with no problems. It is novel and enthralling to have the machine running through a program and cutting with the spindle silent. A gasket after cutting is shown still attached to the mount in **photo 7**.

9 Remove the mount from the mill and soak in solvent

Pour some acetone into a suitable container. As only a shallow bath is required, I use a big jar lid for small mounts and a biscuit tin lid for big ones. Place the mount upside down in the bath and allow it to soak for 10 to 20 minutes. The gasket should fall away cleanly. I return the gasket to the bath for a final rinse and clean the mount of remaining glue while it is still wet. The acetone does not appear to affect the gasket paper material in any way. Save the acetone for re-use.

Job done.

Comment on CNC for the milling machine.

Clearly these gaskets could not be cut without a CNC mill. The same goes for any number of tasks which greatly broaden what can be achieved with CNC and the pleasure that can be derived.

In order of complexity CNC operation can achieve:

Powered operation of the mill axes – removing the requirement for manual winding of the handwheels.

Powered operation of the mill axes – over clearly defined and accurate distances and at user defined speeds. One feed speed can be used for machining and a different speed for return to start point.

Operation of more than one axis at the same time. This can be used to generate angles and circles etc. or to speed movement to a required position.

Use of CAM software opens up numerous additional possibilities including cutting complex shapes, automatic or semi-automatic drilling of patterns of holes, engraving of letters and numerals on workpieces. Once started one has complete freedom from machine operation and only loose supervision is required. I often tidy my workshop while the machine is running.

As one example I have attached **photo 8** which shows (much enlarged) the engraved script on the side of my 'Holly Buddy' motor. The letters are 4 mm high and cut with a 60-degree engraving tool at 3000 RPM.

Subject to certain requirements, the effects of machine backlash can be minimised/eliminated without changing any mechanical components of the mill.

Conversion of a small mill is not difficult – and nor are the electrical and computing requirements particularly complex. It is not an expensive project and I recommend anyone who has been considering it to give it a go. I have converted three (very different) mills. If the editor permits I will be happy to provide a description of the setup on my Optimum mill. The principles can easily be used on other units. ∎

Getting an old tool grinder up to speed

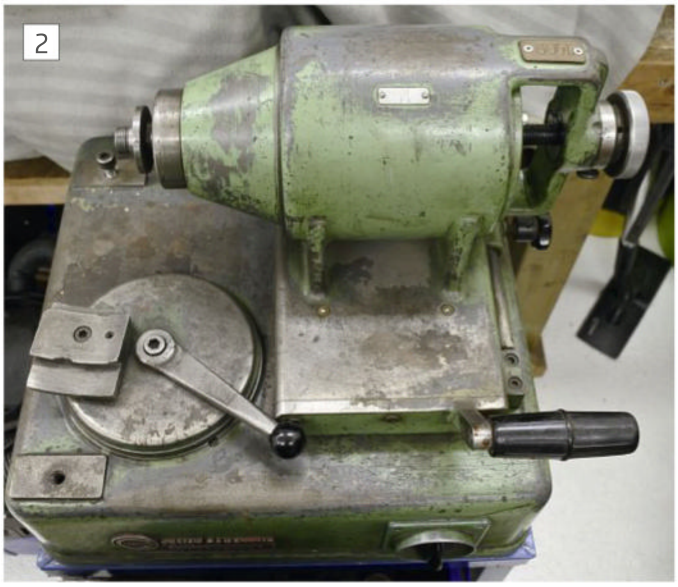
Finally getting his hands on a tool grinder, Johannes Schiff soon finds out it requires some in-depth electrical repair work – and a wheel guard.

I had for quite some time (passively) been looking for a tool grinder that could meet my needs for grinding HSS turning tools, scraper tool tips etc. While grinding tool bits off-hand at the bench grinder usually satisfies my needs, having a tool grinder where more repeatable results can be achieved would be a leap forward in my little hobby workshop. By sheer accident I came across a grinder at an online auction site, having spotted the item just a few minutes before the auction ended. Quickly throwing in a bid in a state of affection (who doesn't immediately fall in love with old cast-iron machinery?), I ended up with the winning bid without really knowing whether the grinder was complete, which accessories were needed to actually use it etc. From the brief item description, I essentially only "knew" it was a machine in running condition wired for 3-phase operation, installed on a (homemade) fabricated machine stand. The grinder came with some of the original fixtures and a set of assorted grinding discs, **photo 1**.

Machine identification and design

After picking the grinder up at the buyer, I conducted some intense name-plate searching on the Internet. It turned out to be a tool grinder similar (or possibly identical) to the Swiss "Saturn HKS600", but mine is labelled under the name of

Tool grinder along with the included accessories.



Overview of the grinder.

Leads as found when disassembling the stator from the motor housing.

a Swedish company. The intended use seems to have been sharpening saw blades and other tools for woodwork. Not quite the application I had in mind, but I was still thrilled to have a solid base onto which I could start shaping my own tool grinder.

The machine is quite sturdily built, with a fairly heavy base casting. It is possible to move the complete grinder motor/spindle about 90mm along the periphery of the tool to be ground, using the handle visible at the bottom right of **photo 2**. The motor can be fed in towards the tool bit using the wheel/dial at the rear of the motor, visible to the right in photo 2. The original fixtures are installed on a curved dovetail, integral to a body that can be rotated along (partial) graduations and locked in place on the base casting, visible at the bottom left of the photo. For my tool grinding purposes, the intension is to initially make use of the original fixtures and at a later stage design and build a more "Worden-like" tiltable table to be located in front of the grinding wheel.

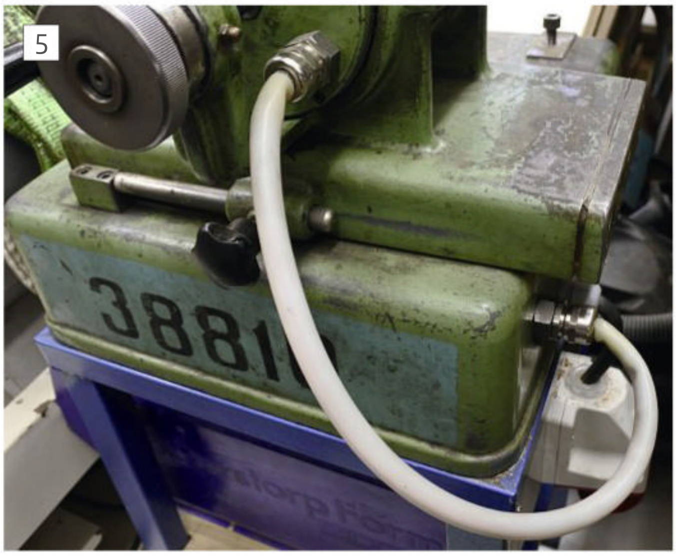
Detailed picture of damaged leads. Just visible at the top right is the routing of the first new wires and silicone-rubber insulating tubes.

Repairing the motor

First of all, an important note – never conduct any repair work on electrical equipment by yourself if in doubt about the correct procedure, local regulations etc.

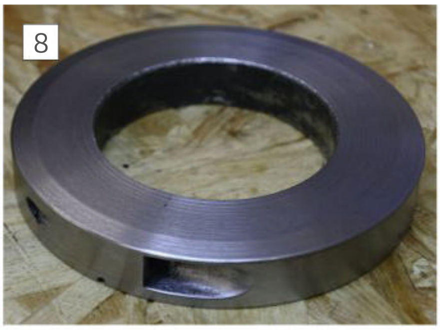
Being very curious to learn whether the grinder actually worked, I simply plugged the cord in (having checked it was properly connected to the ground lead) and turned the switch to "on". The workshop residual-current device (RCD) immediately tripped, but it was noted that the motor did pick up some speed. Repeating the test just tripped the RCD again. So much for "working condition"...

Encouraged by Black Fingernail's article in MEW 319 (however hoping to dodge a complete motor rewind), this certainly being anything but an off-the-shelf motor, I removed the motor from the grinder and commenced disassembly. When removing the rear motor cover to uncover the stator windings, it was discovered that the electrical insulation of the external leads soldered to the motor windings had completely deteriorated to a point where the copper strands shorted out on the cast-iron motor housing, **photos 3** and **4**. At this stage, my initial enthusiasm had dropped to a moderate level of discouragement. By removing the damaged wires and checking the individual windings for continuity, it did however appear that the windings themselves, along with the winding insulation, were not damaged – there



Protected wires, now including cable glands.

Grinder with Ø125mm cup wheel installed, showing the Ø70mm seat for a wheel guard.



Hole for M4 clamping screw milled, drilled and tapped.

Fondue, anyone?

was still some hope to bring this motor back to life without a complete rewind!

After spending quite some time getting hold of wire with the appropriate temperature rating, the damaged wires were replaced. I fused together the new leads with the stator winding copper leads carefully using the oxy/acetylene torch. Silicone-rubber insulating tubes were then pushed over the joints and the leads were routed around the stator using high-strength, temperature-resistant thread, **photo 4**. The knots of the threads were covered in epoxy resin to prevent loosening over time. Everything was then sprayed over with a few layers of conformal coating, the idea being that the conformal coating, apart from assuring electrical insulation, would assist with holding everything in place. I then wound fiber-reinforced high-temperature tape around the leads, routed as similar as possible to the factory insulation, and covered everything with two or three additional layers of conformal coating.

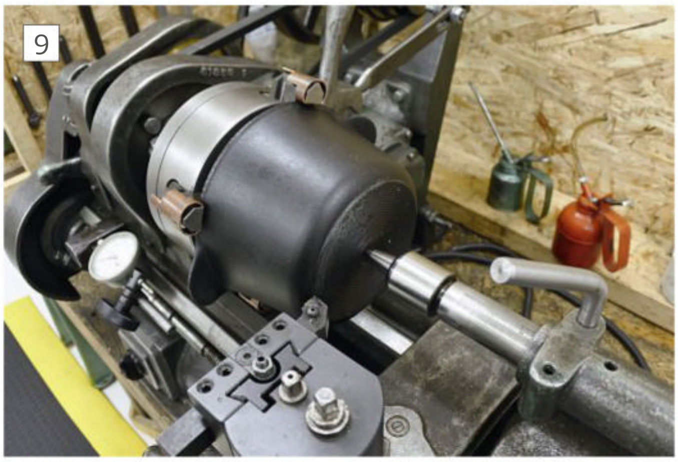
The root cause of the damaged wires was likely a combination of corrosion and possibly a poor selection of wire insulating material (still, the wires held up for quite a few decades!). In addition, it is not unlikely that the wires had been mechanically damaged due to the lack of cable glands from the base casting to the motor. Rather than providing some type of strain relief, someone had bodged up the conduit using a piece of garden hose and electrical tape. Room for improvement!

To avoid future mechanical damage to the wires inside the motor, the motor back cover and the base casting were therefore threaded to accept cable glands, **photo 5**. This taken together with the more modern wire insulation material, it is hoped that similar damage to the motor can be avoided in the future.

Having triple checked all the electrical connections, the receptacle was plugged in and the switch turned to the "on" position. The motor immediately spun up to speed, indicating that the electrical issue had been resolved.

Making a wheel guard

One item missing from the grinder was a proper wheel guard. Historically taking safety precautions somewhat



Fondue pot setup in the lathe.

Installing screws to securely retain cast-iron pot on steel clamp.

lightly, standing next to a completely exposed grinding wheel (knowing me, probably a second-hand grinding wheel) at 2,800rpm did not speak to me. Or rather, it did speak to me – a wheel guard was definitively required! The motor housing has provision for holding a guard, a 70mm diameter seat at the grinding-wheel side, **photo 6**. I won't include any drawings of the wheel guard, as any dimensions will be specific to the grinder in question. The general approach can however be adopted to similar grinder designs.

Next up was to decide on a suitable wheel guard design. The easiest solution would probably have been to fabricate a guard by welding some simple pieces of steel sheet together. This solution was disregarded as it likely would have created a distorted wheel guard from applying heat unevenly during welding. It was also deemed to look a little out of place on an otherwise "stout" cast-iron machine.

Still, I was not keen on machining a relatively thin wheel guard out of a solid steel bar. I suppose I enjoy the challenge of making the best possible use of the materials at hand – turning 80% of the material into chips would go very much against this little (but cumbersome) principle of mine. My collection of odds and ends didn't present any real alternatives either. Spending a few evenings in general indecisiveness, I started thinking about cast alternatives. Could I source a brake disc, or some other cast object with a suitable shape? Searching the Internet for possible solutions, I stumbled over another auction – this time a cheese fondue kit, including a cast-iron pot! From the photos and scarce dimensions given in the auction description, it seemed to fit a 125mm cup disc quite nicely. It was not my proudest moment, but I decided to place a (low) bid and - voila - I once again became the highest bidder of a somewhat out-of-place item. Possibly a match made in heaven for the Swiss legacy of the grinder, **photo 7**! Admittedly, the wall thickness of the fondue pot is probably at the thinner end of what is suitable for a wheel guard. Still, I'm confident that it will contain pieces of a grinding wheel if I ever had the misfortune of a wheel burst.

Centering the assembly on the rotary table.

I managed to find a suitable piece of hot rolled steel in the scrap cabinet that could be used to manufacture a clamp, fitting the 70mm seat of the grinder. This is visible to the right in photo 7. The internal diameter of the piece of steel was clamped in the 3-jaw chuck at the lathe and the outer diameter and front face of the workpiece turned true. A small-angle chamfer was added to the face closest to the grinder motor. The workpiece was then flipped around in the lathe chuck, trued up axially against the chuck jaws and the other side faced. The piece was then taken out of the lathe and fixed in the mill. A counterbored hole for a M4 clamping screw was then milled, drilled and tapped, **photo 8**.

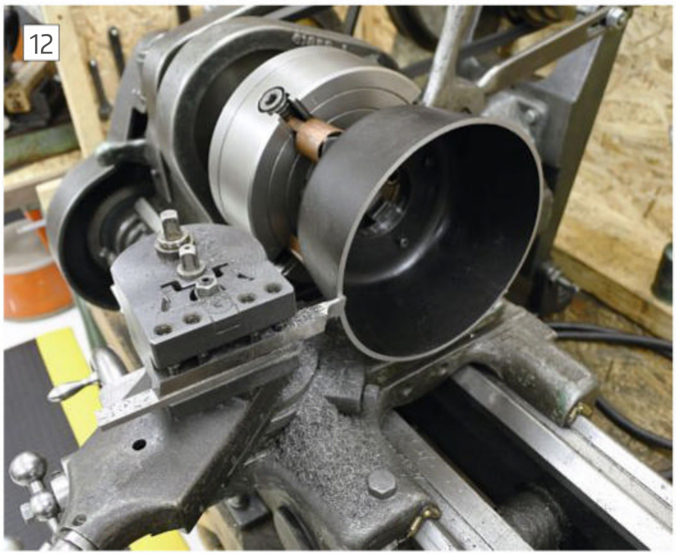
Now, turning the attention to the fondue pot. The pot was centered up as well as possible in the 4-jaw chuck. The chuck jaws were tightened gently, to avoid cracking the pot. In hindsight, turning a wood blank to fit the inside of the pot for this operation might have been a good idea. The lathe was run at a slow speed and a hole for a live center drilled in the bottom, **photo 9**. The molten cheese containing days of this pot were now certainly over!

The bottom of the pot was then trued up and a recess made in the pot to match the outer diameter of the steel clamp. Next, a 63mm pilot hole was cut in the bottom using a hole saw.

The pot was then taken out of the lathe and pressed together with the steel clamp. The whole assembly was then centered on my expendable rotary table, **photo 10**, and positioned in the drill press. Make sure to locate the screw holes such that they won't interfere with the slot to be cut in the clamp at a later stage (see photos later).

Four M4 clearance holes were drilled through the cast-iron pot, while the steel clamp received corresponding holes drilled and tapped for M4. The screws were installed using "medium" Loctite, **photo 11**.

The whole assembly was then setup in the lathe, now being able to securely tighten the chuck jaws onto the outer diameter of the steel clamp. The pot was



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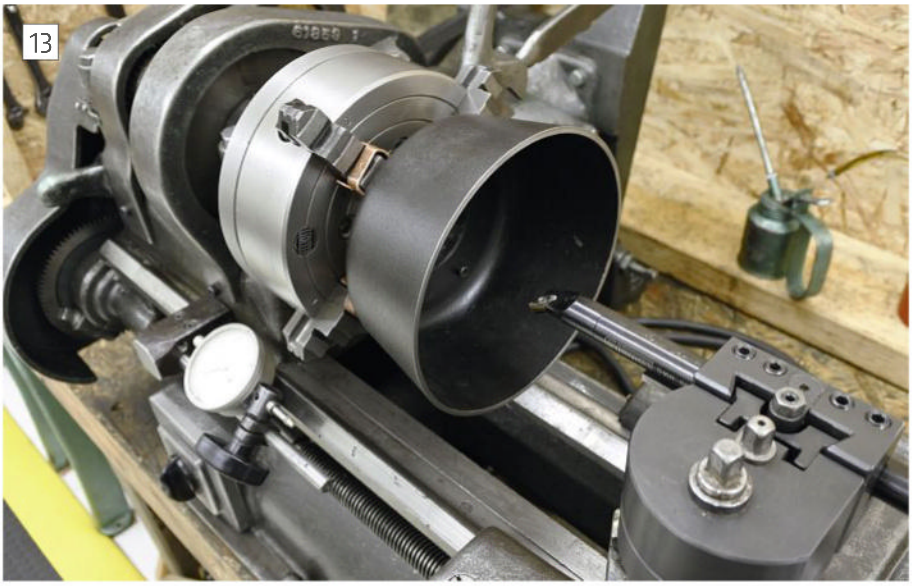
Parting off the pot to length.

14

First test-fit of wheel guard to grinder.



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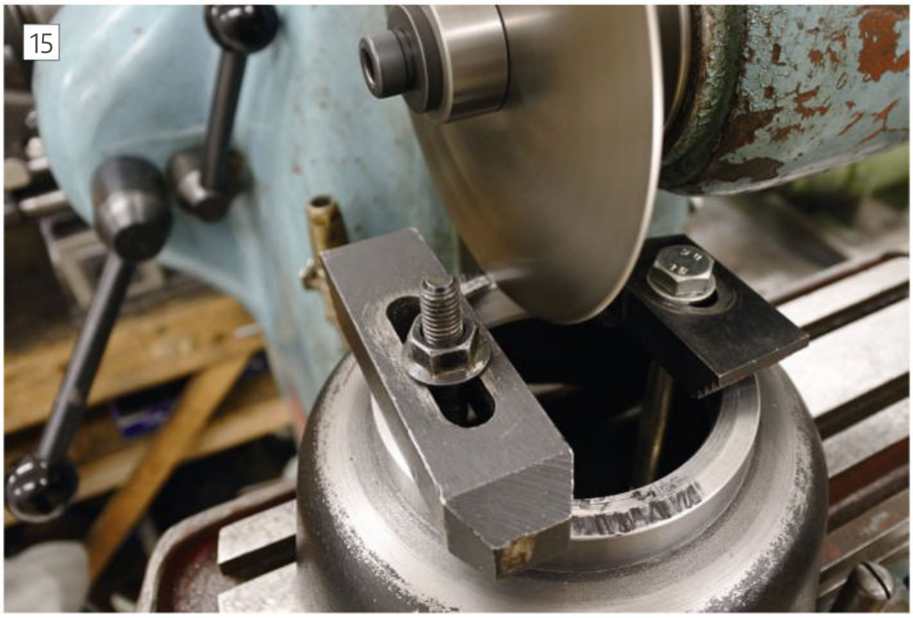
Boring the Ø70mm hole to size.

parted off to the appropriate length to suit the 125mm cup wheel, **photo 12**.

Finally, the inner diameter of the pot and steel clamp was bored to the final 70mm of the mating seat on the grinder. Multiple passes were made to "sneak up" on the final dimension, **photo 13**. The test assembly on the grinder indicated a good fit, **photo 14**.

Next up, the assembly was fixed to the milling machine and setup for cutting a slot in the clamp using a slitting saw. A slot was cut just shy of the cast-iron pot, **photos 15** and **16**.

The final operation was to cut an opening in the side of the wheel guard. The opening is required for accessing the spindle with a wrench when tightening up the grinding wheel and, of course, to give access for workpieces to actually contact the grinding wheel when grinding. I located the opening diametrically opposed to the slot cut in the clamp. The exact position is not very critical, as it is an easy matter to



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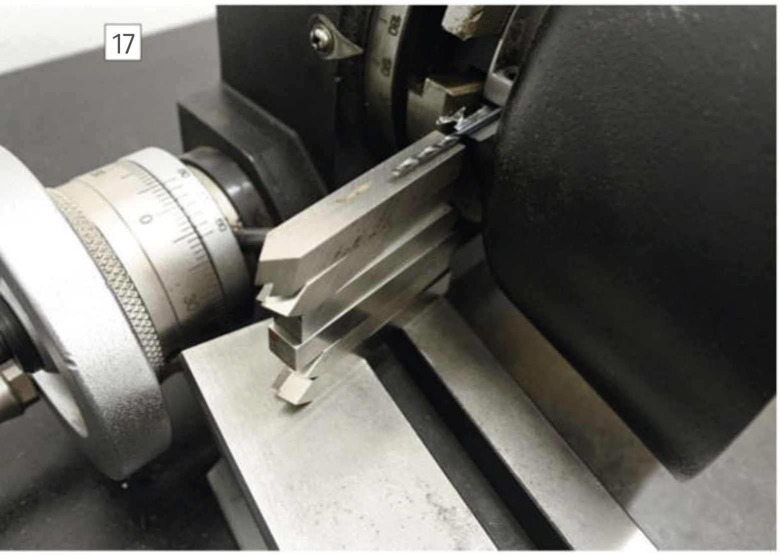
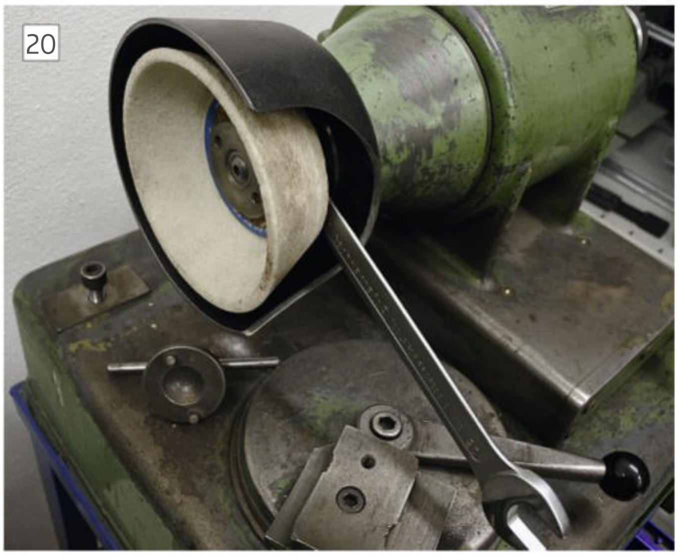
Cutting a slot in the steel clamp using a slitting saw.

16

Slot cut in the steel clamp.



Drill bit used to locate the horizontal position of the slot.

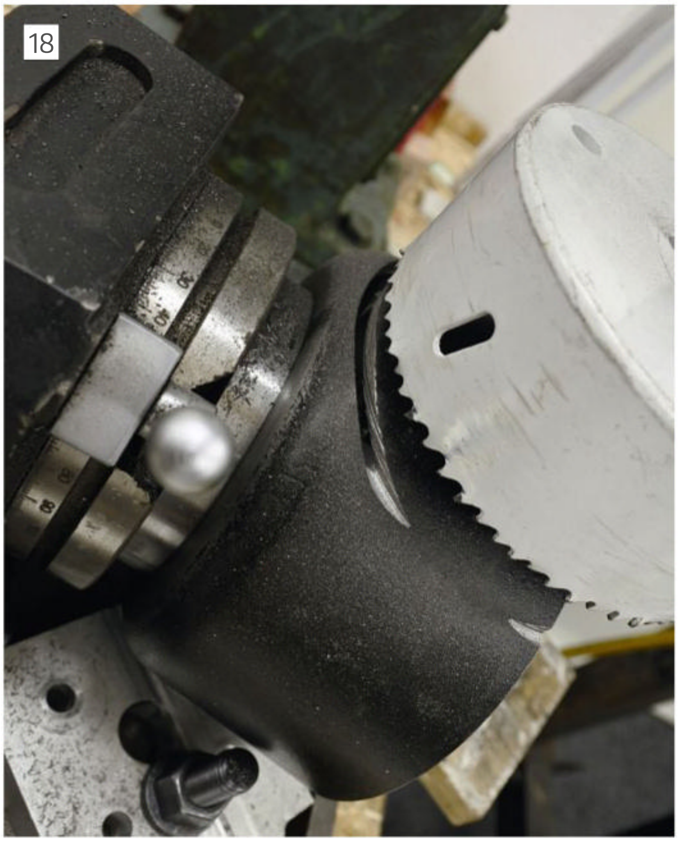


The wrench fits!

turn the wheel guard on the grinder to move the opening to a suitable position. Still, to facilitate getting the opening in an as correct position as possible, the wheel guard was once again mounted to the rotary table. A drill bit of suitable diameter inserted into the slot assisted in eyeballing the horizontal position of the slot, **photo 17**. Conducting work at the surface plate, the center height of the slot was conveniently marked out using a scribing block.

The rotary table was then turned 90 degrees and positioned in the drill press, ready for center drilling and cutting the opening using a hole saw. As is custom for most jobs in my hobby workshop, the Z-height was just enough to not allow the workpiece and tool in question to easily fit under the spindle. After using a center drill to spot the hole, I therefore had to drill out the hole for the hole-saw guiding drill bit using a separate drill bit of the same diameter. The hole saw could then be snuck into the drill chuck, and the guiding drill bit added from the inside of the wheel guard. Running the drill press at the absolute lowest speed possible, the opening was cut, **photo 18**.

The opening was then finished by hand filing the roughly cut surface, **photo 19**. A trial assembly on the grinder showed that a wrench indeed could be inserted behind the grinding wheel, **photo 20**.



Cutting the wheel-guard opening using a hole saw.

Finishing off the opening using hand files.

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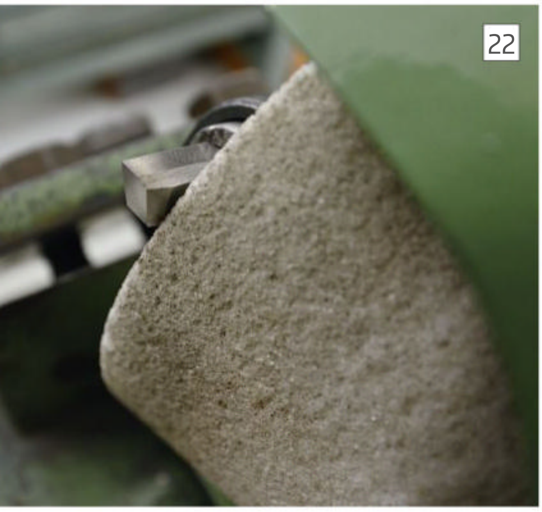
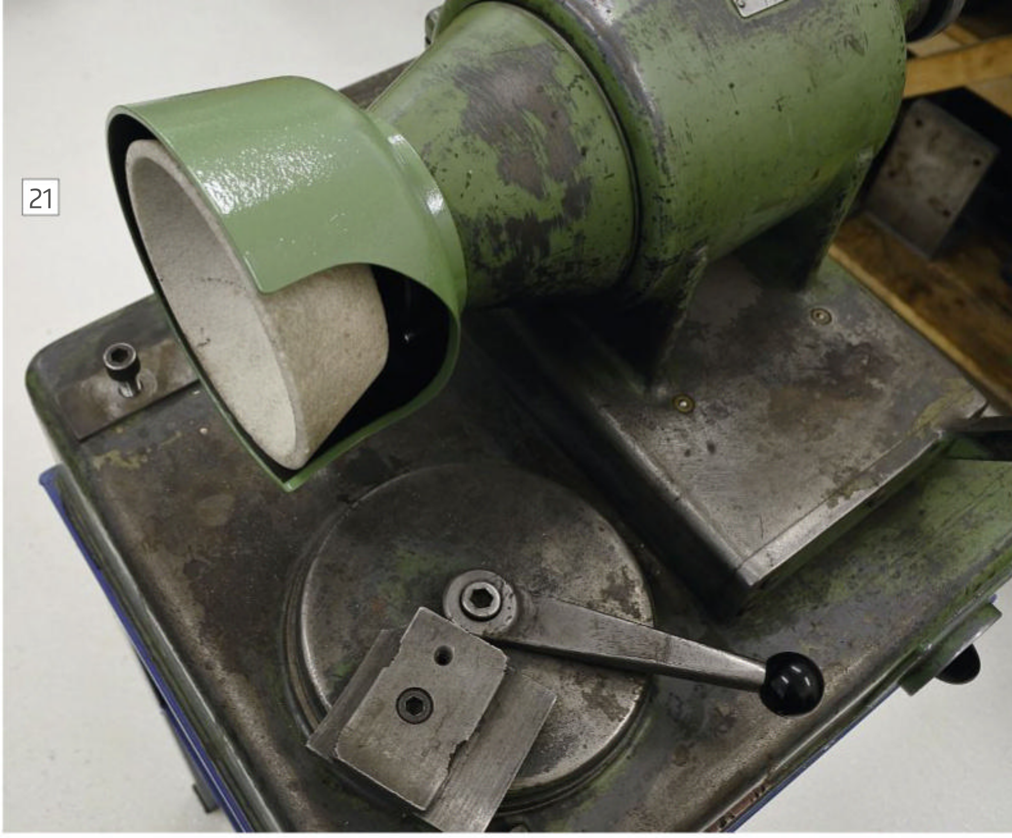


HSS tool bit ground on the freshly repaired grinder.



Finished wheel guard.

To conclude the project, the wheel guard was coated using rattle-can spray paint, matching what remained of the original paint. The final result can be seen in **photo 21**.

Conclusions

The tool grinder is now, roughly 5 months after actually purchasing it, ready to be used. While it was not in a condition to be used for my intents and purposes at the get-go, it is now ready to be pressed into service using the original accessories. **Photograph 22** shows a HSS tool bit that has been ground using the grinder. My plan going forward is to design and make a tiltable table to be located in front of the grinding wheel. ∎

The Creality Halot-Mage Pro

We look at Creality's latest 3D resin printer, which has a number of significant enhancements over earlier models.

1

The Creality Halot-Mage Pro resin printer.

2

The 'Mage Arch' is a flip up lid that provides easy access. Note vent pipe at left.

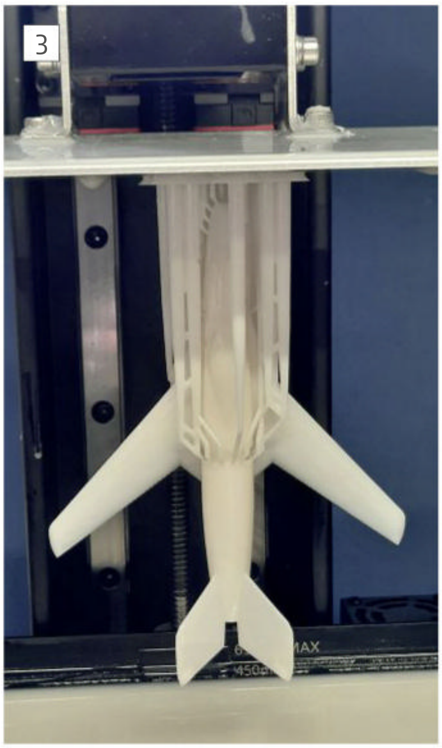
The Halot-Mage Pro is Creality's top of the range model and physically it is considerably bigger than its predecessors at 335 x 270 x 610 mm in size and 13.3kg in weight, **photo 1**. The machine came packaged to a high standard, inside a stout outer box with plenty of foam packing.

Design

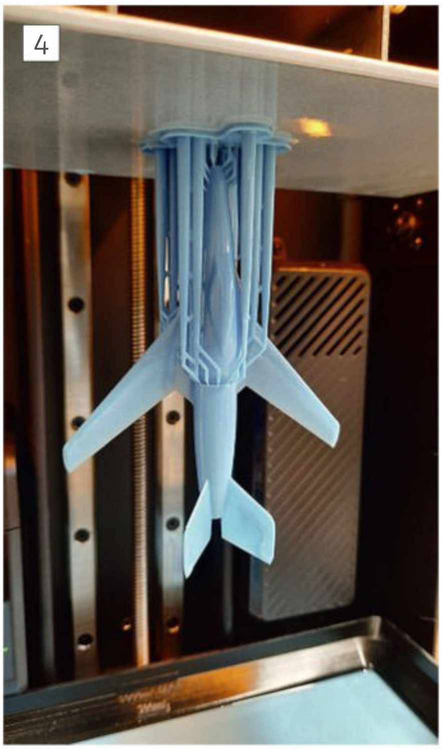
It's a big, good-looking machine. The most noticeable feature of the Halot-Mage Pro is that instead of having a UV shield in the form of a large lift-off lid, it has pivoting guard that lifts up to give excellent access to the machine, **photo 2**. The 'Mage Arch' is a great feature as it means you don't have to reserve an area for the lid. This means you can use it in a similar amount of space as a smaller machine.

Speed

The most notable feature of the Halot-Mage Pro is speed. It's immediately



Test print of P1110 model on Halot One Pro took over eleven hours.



Identical model printed on the Halot-Mage Pro took just over three hours.

The 'smart pump' has manual controls as well as automatic functions.

Pipe clips and joiners on the build plate.

A section of my 'ventilation system'.

noticeable how the build platform moves much faster when raising and lowering.

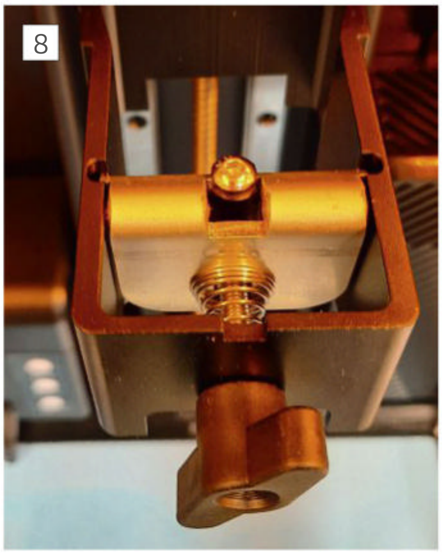
The time taken to raise and lower the build plate draws out the printing process. The Mage Pro has a larger, more powerful motor drive than most printers allowing it to move the platform faster yet without stalling. The machine is noticeably faster than the Halot One Pro even in standard mode with ordinary resins, but it also has a so-called 'Dynax mode' used with special 'fast' resins.

In Dynax mode the build plate lifts and lowers in just 1.2 seconds, this really does mean prints appear much faster. Creality's claimed figures are 170mm/hr and 70mm/hr in the two Dynax modes, compared to typical 25 to 50mm/hr speeds of other printers. I printed exactly the same, tall, model on both the Halot One Pro, **photo 3**, and the Halot-Mage Pro (in Dynax mode with fast resin), **photo 4**. The calculated print times were 11 hours 20 minutes and 3 hours 35 minutes, respectively.

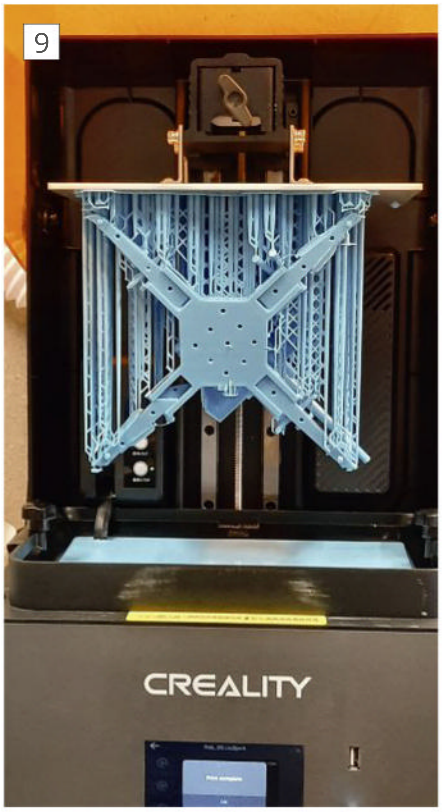
I found the high-speed resins give reliable results when used in Dynax mode but you must use the correct 'high speed' settings for these resins in the slicer. Clearly being limited to a smaller range of resins means there are fewer things you can do in the Dynax modes, but I found that there was no visible impact on print quality.

Print Volume and Resolution

One often heard criticism of resin printers is that the build plates are rather smaller than those of SLA printers. The Halot-Mage Pro has a larger, higher resolution 10.3" 8K LCD screen. This gives a build volume of 228 x 128 x 230



Simple but useful cam lock for the build plate.



Making use of the printer's capacity.

mm, about 9 x 5 x 9 inches. The 29.7um X/Y resolution compares to a more typical 50um resolution. This gives even better antialiasing and although printed surfaces have a visible texture, this is so fine it is more of a satin finish effect that completely disappears under paint.

Smart Pump

Larger prints use more resin. The resin vat of the Halot-Mage Pro is bigger and deeper, having a capacity of about a litre, but this does not impose a limit on the volume of an object that can be printed, as the printer has an integral 'smart pump', **photo 5**. This appears to be a peristaltic pump and uses a flexible pipe to suck resin in and out of the vat. It has simple manual controls but can also be used in 'automatic' mode. This detects when the resin level gets low, and it automatically tops up the vat to 500ml. I used a tissue stuffed into the top of the resin bottle to keep out light and dust, but I will print a better cover. They claim it can transport a litre of resin in half an hour, but I found it operates rather faster than that.

Air purifier

The Halot-Mage Pro has an integral carbon filter, much larger than the earlier printers. It also comes with an extendable vent tube. This makes using the machine indoors more practical as the pipe can be poked out of a window. The tube diameter is about 40mm. I fitted a piece of kitchen drain pipe to the rafters of my workshop and arranged it to vent through the rear wall. I then extended it using large diameter flexible pond hose. I designed pipe clips and pipe joiners in Alibre Atom 3D, and printed them on the Halot-Mage Pro, **photos 6** and **7**. I'm pleased to say vent pump happily sustains air flow despite the whole run being about 4m of pipe. I plan to expand it so it can be used for general fume extraction when anodising, soldering or doing light brazing. I will add a fume hood on the end of a flexible tube with an integral fan, that I can suspend from the ceiling off a hook above any process. I realise this system won't cope with hot air, but like a cooker hood it will mostly be sucking in cool air.

Build plate release

It's a fairly small point, but the Halot-Mage Pro has an interesting clamp arrangement for the build plate; a knob at the front operates a cam that wedges the plate securely, **photo 8**. This makes it easy to release and replace the build plate. Combined with the flip-up lid these oldest ideas make handing complete prints more straightforward.

Software

For slicing, the printer comes with Halot Box, this is the same program as reviewed with Halot One Pro. It is effective, but has some quirks. It also comes with a year's licence for Chitubox; this is a very advanced slicer with STL editing capabilities. I haven't been able to explore this fully yet.

The HALOT-MAGE PRO uses Creality's HALOT OS, which uses a relatively simple menu-driven interface operated through a good sized, clear colour LCD touch screen. Unfortunately my wifi connection is rather flaky in my workshop, and although I have been able to connect the printer to my home network, I haven't been confident to make use of printing from my phone, PC or Creality Cloud as I'm worried about the signal dropping out. Instead I have used the print via USB drive facility, which I find simple to use.

I would like to get a better connection sorted for my workshop, and as the printer also supports RJ45 a long quality cable will be the most reliable answer. With this installed I will be able to control or monitor jobs remotely from the Creality Cloud app or web interface. The convenience of being able to send a job from my PC and check on progress on my phone would be good on dark rainy nights when the workshop is locked up! It's also possible to install a USB Camera for remote monitoring.

In Use

I've printed a number of test items on the Halot-Mage Pro, all using the 'fast resin'. Initially I had few issues with parts being slightly warped. I thought this was due to poor support, but it turned out I forgot to select 'high speed resin' rather than 'Standard resin' in the Halot Box slicer program. After using the right setting my prints came out as expected.

One of my first prints was the set of pipe clips and joiners for the ventilation system in photo 6.

I tried printing a huge STL of a 88mm Flak 37 I downloaded from Thingiverse. This made use of almost all of the printer's build volume, **photo 9**. Unfortunately the ends of the legs did not print properly, this turned out to be a flaw in the model, not a fault of the printer – these parts had walls of zero thickness that didn't print, and parts 'joined' to them obviously fell off. Aside from the this the large and complex

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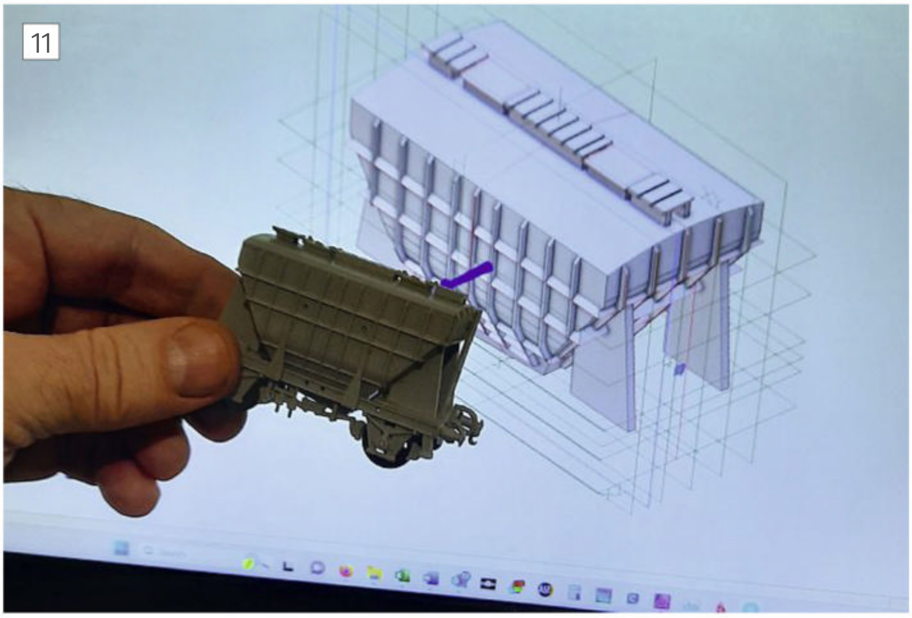
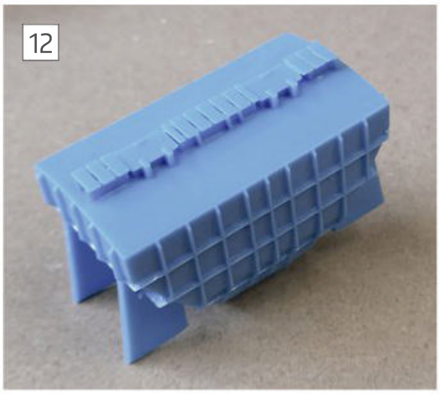
High print quality.



Design for the hopper of a Presflo cement wagon.



1:76 scale print of the hopper.

Comparing two prints of the P1110, the chip on the wing was clumsiness with forceps.

model printed perfectly, **photo 10**.
To test the resolution of the printer, I designed some 'intake meshes' for a 1:35 Stug III model. These have 0.2mm wide bars on a 0.5mm pitch and took only 18 minutes to print in Dynax mode, **photo 11,** a longer wash is needed to stop unset resin clogging some of the holes.

I am looking at 3D printing a 3 ½" gauge 'Presflo' cement wagon to two behind my electric shunter. As a trial I drew up a CAD model using the Dapol (formerly Airfix) model at 1:76 as a guide, **photo 12**. In time I will add and improve the details, but I did a quick test print at 1:76 which turned out very well, **photo 13**.

I mentioned a test of the same print on the Halot-Mage Pro and the Halot One-Pro, this was a 1:72 version of my P110 model, deliberately oriented to give a tall print. Speedwise, the Dynax mode was the difference between 'this evening' and 'tomorrow morning'. To my eyes there wasn't any noticeable difference in quality despite the print only taking a quarter of the time, **photo 14**. What I would like to see is a somewhat tougher fast resin, as the Creality Fast Resin supplied for the test is in the 'crisp but brittle' category better suited to models than working parts – you might spot a small chip I broke off the wing when using forceps to handle the model.

Conclusion

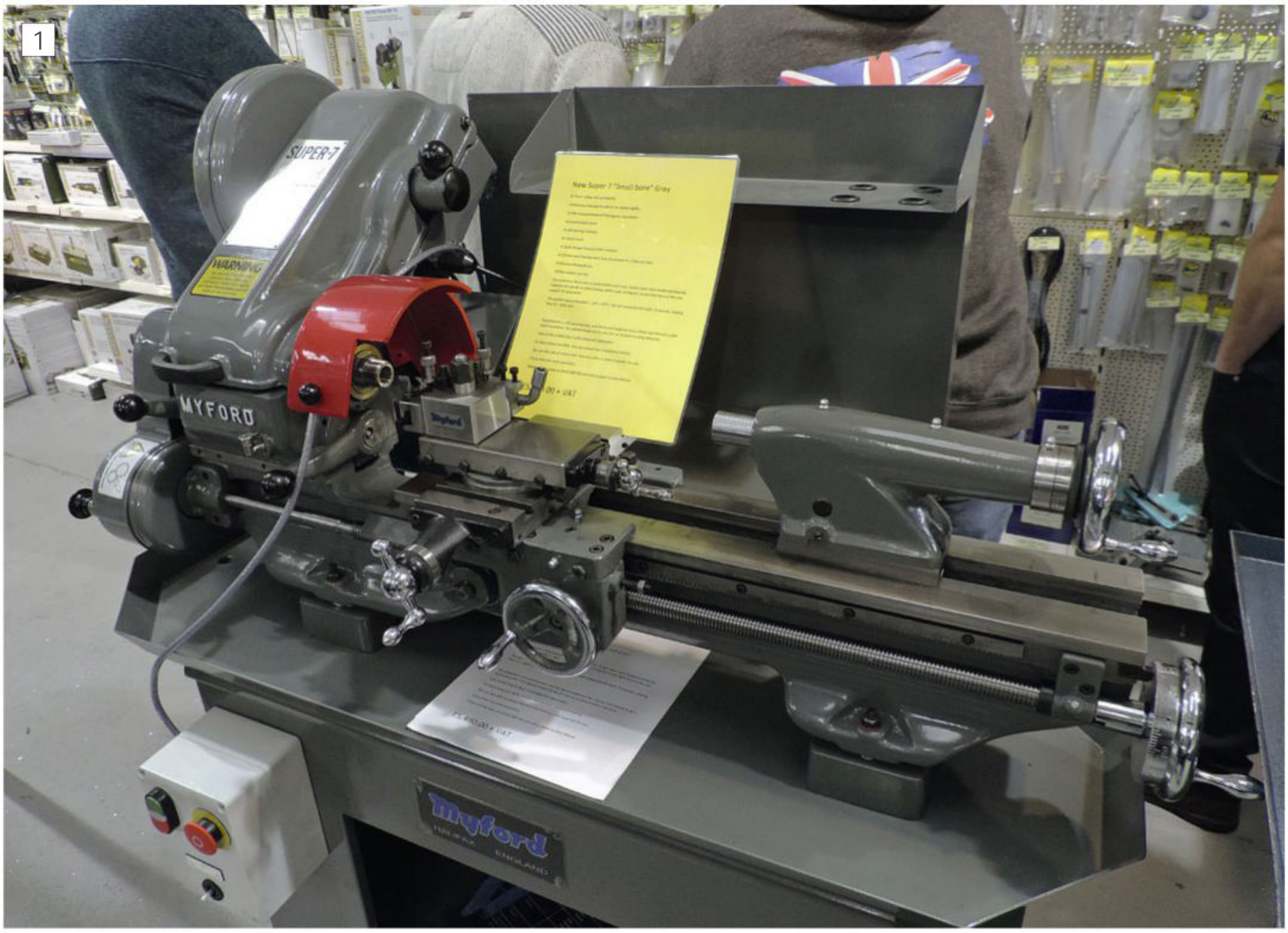
The Halot-Mage Pro is and advanced resin printer with a large build volume and capable of very delicate work, even when running in the high speed Dynax mode. This alone will make it attractive to many people, but the addition of several ease-of use features such as the flip up cover, ventilation system and smart pump greatly add to its ease of use. I'm looking forward to further testing its capabilities.

Visit the Creality Store

You can view the Halot-Mage Pro online at https://bit.ly/3NjiqcE or scan this QR code:

A Telescopic Cross-Slide Feedscrew for the Myford Super 7

Graham Meek describes a useful modification for anyone who uses the Myford Taper Turning attachement.



A Myford Super 7 lathe at MMEX 2022, a mainstay of the model engineering hobby over the second half of the twentieth century, these lathes are still available 70 years after their introduction.

When using the taper turning attachment on the Myford Super 7 lathe, **photo 1**, the instructions are that the cross-slide feedscrew bracket be detached and allowed to hang on the feedscrew, usually upside down. After a couple of times using this method, I was not happy with the feedscrew bracket just hanging there on the feedscrew, the setup had all the potential of an accident waiting to happen. Anything dropped and impacting on the feedscrew bracket is going to potentially bend the feedscrew. Similarly the sleeve of a smock coat could quite easily catch the ball handle and again bend the feed screw. Admittedly this is not such a problem with the power cross feed models due to the larger diameter feedscrew thread, but one still has the task of realigning the feedscrew bracket at the end of the session, which is not always an easy task.

These first sessions with the taper turning attachment were about the time that George Thomas was describing his modifications to the Myford cross- ›

slide micrometer collars in the Model Engineer, details of these improvements can be found in "The Model Engineers Workshop Manual" by GHT, chapter 15, page 164. Reading through the articles as they were being published, I thought it would be a good idea to add the needle roller bearings to my own lathe. Thus a spare, ball handle, feedscrew bracket and feedscrew were ordered from Myford's. In the meantime a start was made on the new feedscrew bearing and collar that would eventually take the needle roller bearings. As I was about to drill and ream the 9.54mm or 3/8" bore the penny dropped, rather than Loctite the feedscrew into this bore. What if the feedscrew could telescope inside this bore then the need to dismantle the feedscrew bracket during taper turning would be unnecessary. A Woodruff key in the feedscrew and a keyway in the 3/8" bore would ensure a positive drive from the ball handle to the feedscrew, the whole assembly being retained by an M6 capscrew fitted where Myford's chrome slotted ballhandle retaining screw normally resides.

To use the taper turning attachment in future this would simply mean slackening off the M6 by 30 long capscrew, or removing it completely, then by turning the ball handle a couple of turns

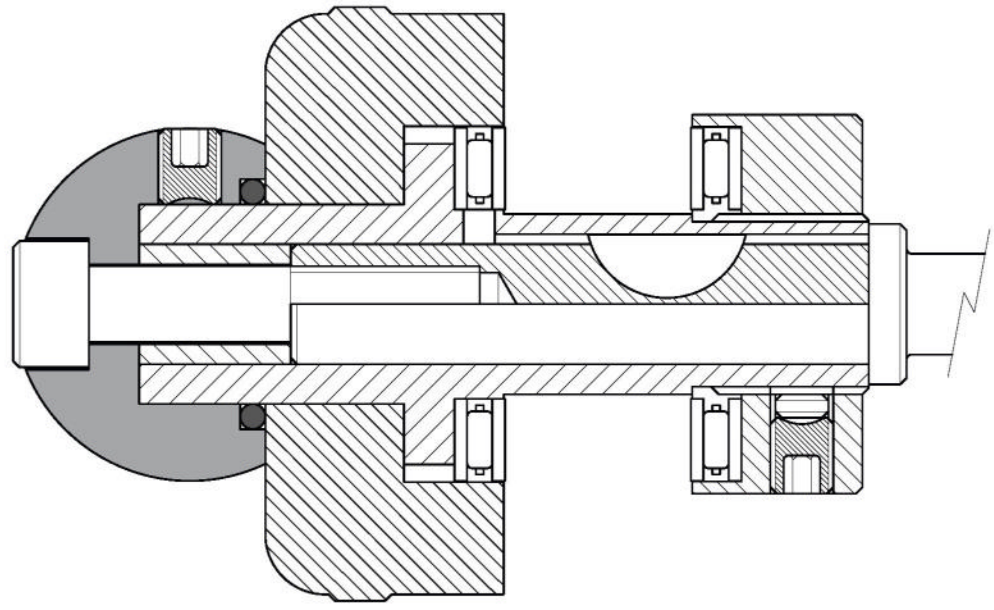


Figure 1

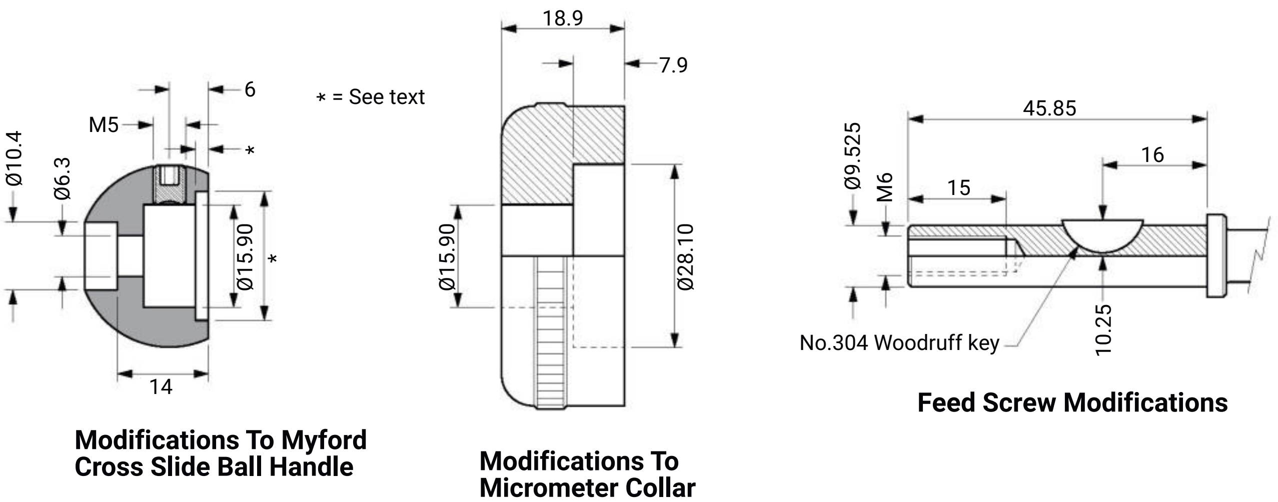


Figure 2

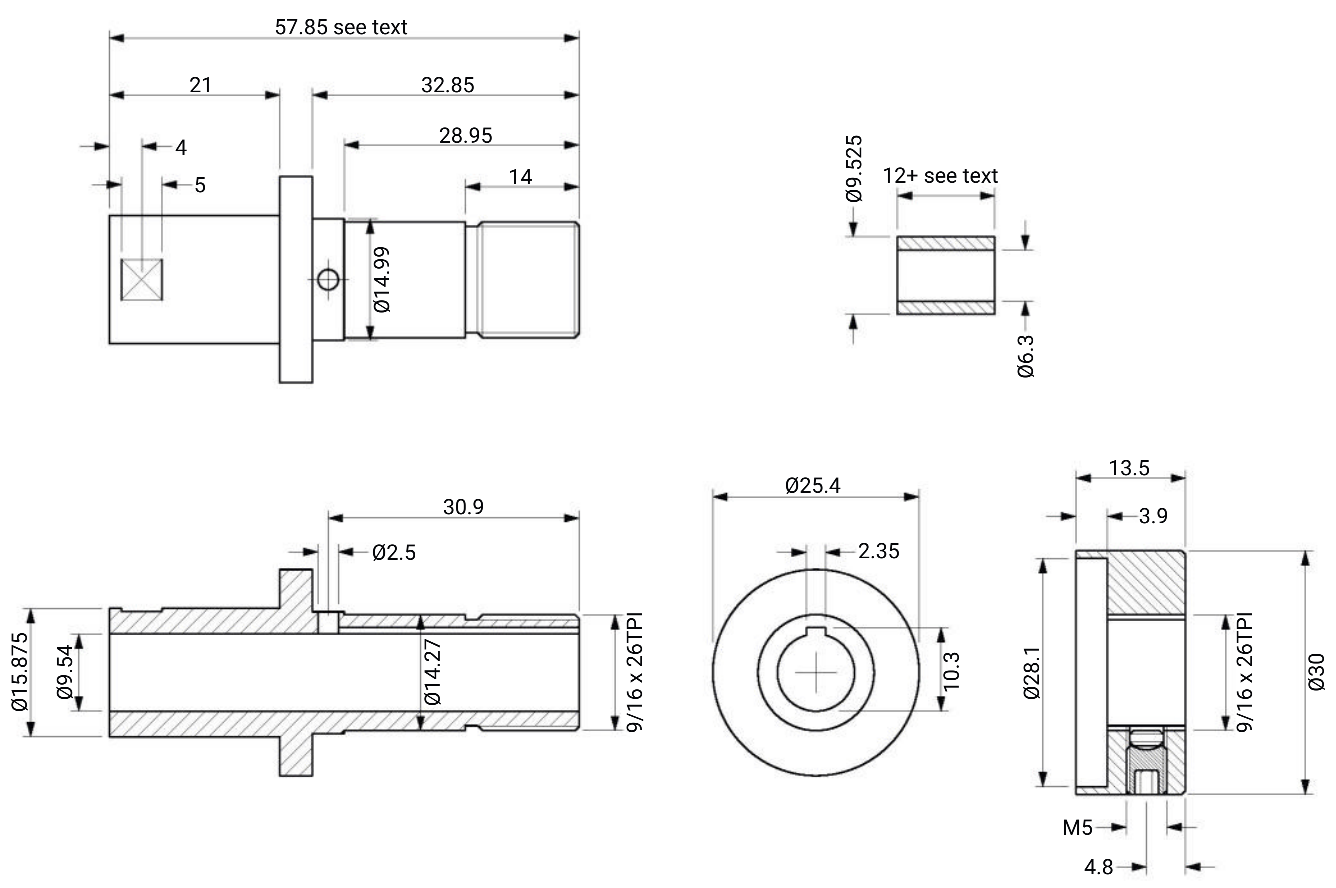


Figure 3

clockwise there is instantly play in the system to allow the crossslide to float under the influence of the taper turning attachment. The taper machining cuts still have to be put on using the topslide as before, which incidentally can be set at a fairly shallow angle to make use of some very fine adjustments towards the final stages of producing the taper.

The modification is detailed in **figs 1, 2** and **3.** I regret to say I have not taken any photographs to include with this article as the lathe in question was passed on many years ago when I acquired my Emco Maximat Super 11, the only photograph I do have is a Polaroid and does not come out very well when scanned. It was only recently when having a long overdue tidying up session in the workshop following my retirement that the original ballpoint sketch came to light. Therefore the reader who is contemplating adding this to his or her Myford would be well advised to read the articles by GHT mentioned earlier as the modification is primarily George's, I have just added a refinement.

My modification retains a friction setting dial, this can be arranged by using the nip on an oring as the friction medium or the reader could do as I did and make a friction spring similar to that used on GHT's versatile dividing head to provide friction for the sector arms. Details of such a spring can be found in fig. 22, detail 34 on page 81 of "Dividing and Graduating", of course the outside diameter will need reducing. Not knowing which way the reader might opt to go these dimensions are marked thus (*) in the drawing for the modifications to the ball handle. Obviously, the centre dial locking arrangement favoured by GHT in his article on the lathe micrometer dials cannot be used with this setup. I would however advocate the fitting of the locking mechanism, which George used on the feedscrew, it is a useful addition when using friction dials.

The reader will notice from the drawings that the overall length of the new feedscrew bearing also carries a (*). The reason for this is initially the feedscrew bearing needs to be produced slightly oversize on length, as does the 12mm long spacer. When the feedscrew modifications have been completed the feedscrew bearing is fitted to the feedscrew and the 12mm spacer with some Loctite 603 on the outside diameter dropped in the bore. The assembly is then locked up with an M6 capscrew, a final check is made to ensure the feedscrew bearing is hard up against the shoulder of the feedscrew and all is left to set, preferably overnight. Needless to say the amount of Loctite used needs to be minimal, as we do not want to end up with the feedscrew permanently attached as well. Some grease applied to the end of the feedscrew shaft will help to stop Loctite migrating along the shaft. When all is set, a light facing cut is taken over the end of the feedscrew bearing and spacer to bring both faces flush whilst establishing the 21mm dimension. With the removal of the tedium of re-aligning the feedscrew bracket the taper turning attachment did see a lot more use after fitting this attachment.

Readers' Tips

CHESTER MACHINE TOOLS

Digital Caliper Storage

TIP OF THE MONTH WINNER!

This month's winner is Derek Spedding who got fed up of losing his digital calipers. This works for mechanical vernier calipers too!

Forever losing my digital calipers I made up a wooden hanger to fit on a cupboard door.

It was made out of a bit of scrap walnut as per the picture. It works great, however I still manage to lose them, but not quite as regularly as before.

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 600 words and a picture or drawing. Don't forget to include your address! Every month we'll choose a winner for the *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.

Artful Dodge #10 –

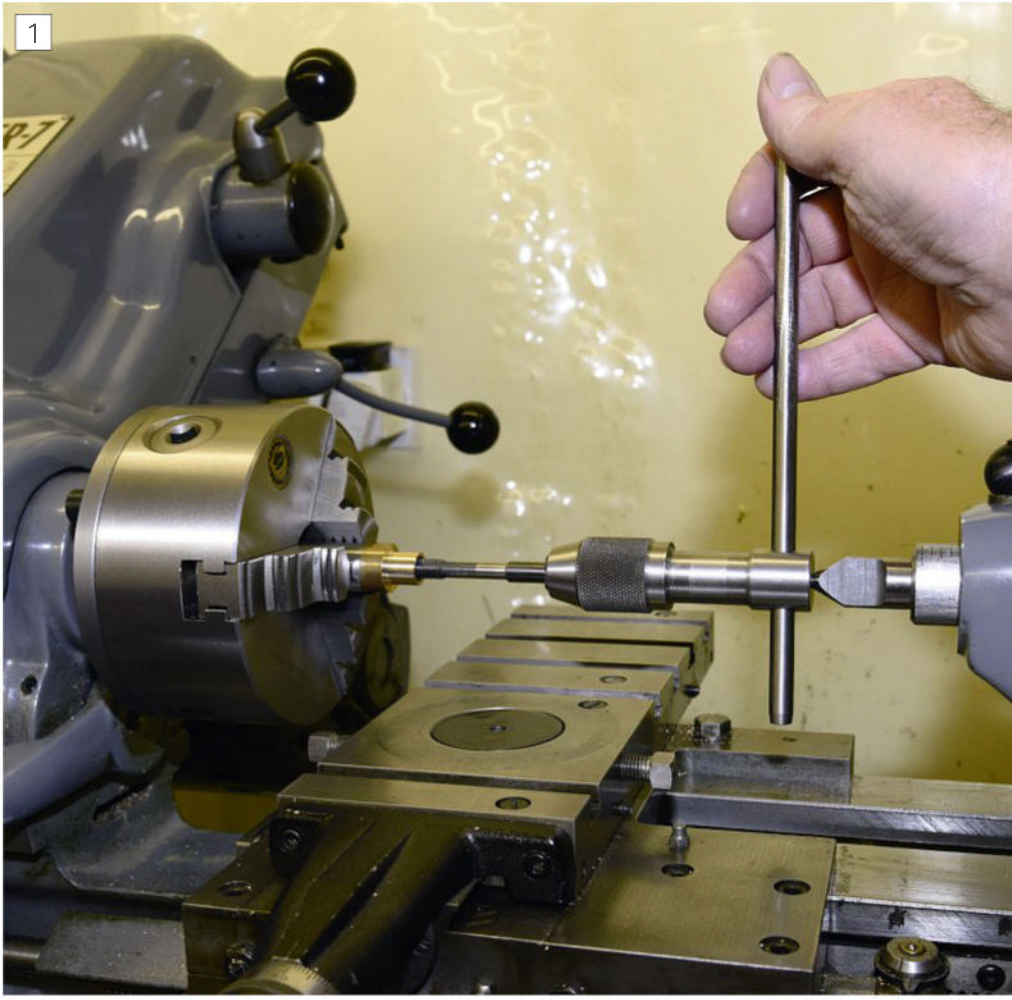
How to produce high-quality tapped holes

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

The first necessity when tapping is to ensure that the tap is coaxial with the hole to be threaded. In the lathe, this is easy to achieve. For many years I have used *Moore & Wright* T-handle, chuck-type tap wrenches. These can be supported on a tailstock centre and give good results, **photo 1**. I believe that these are still available from *Eclipse* and other manufacturers. Put the lathe in back gear so that the chuck does not rotate, twist the tap holder half a turn while turning the tailstock hand-wheel to keep the centre engaged.

I then bought an *Arrand* threading attachment, **photo 2**, which features a 2MT shank, to fit the lathe tailstock, and a 5/8" spigot. A carrier or body is provided, to which a number of different die holders can be bolted. A chuck holder and a small chuck to hold taps is also provided. I purchased an additional body and chuck holder to which I attached a ½"/13mm drill chuck for cutting larger threads; this is the body on the right in photo 2. I never use the attachment under power; I am happier cutting threads by hand. Put the lathe into back gear and pull the lathe belt by hand to turn the workpiece after each cut of the tap or die.

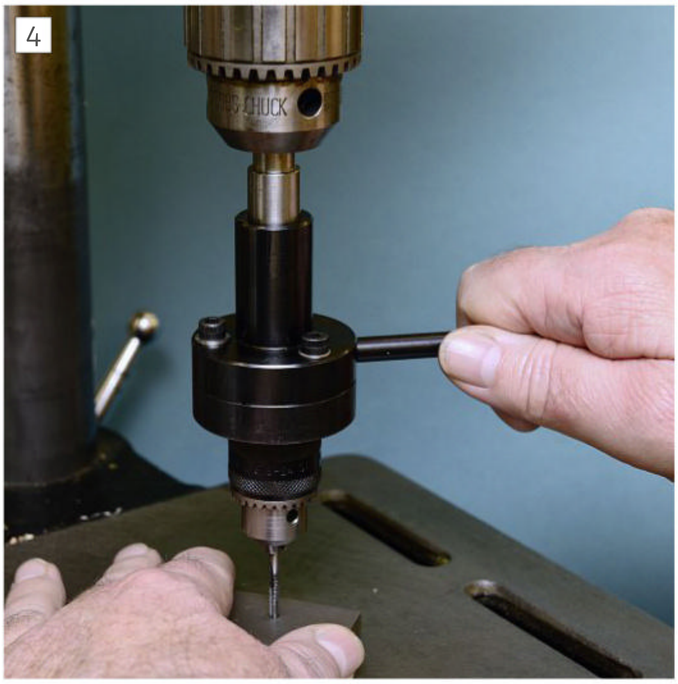
These threading attachments are excellent, but most of the holes we need to tap are not on the centreline of the lathe, so we need a means of holding taps coaxial with holes when we are tapping holes in rectangular components, bar and plate. It can be done by eye, but that is not wholly satisfactory. **Photograph 3** shows the simple attachment you need to transform your drilling machine and lathe threading attachment into a sensitive, hand-operated tapping machine. The attachment takes just a few minutes to make, but you will use it time and time again. **Photograph 4** shows the attachment in operation. Use your precision "tapping machine" for cutting the first three or four threads only, then transfer the work to the vice and use a traditional chuck-type tap wrench.



T-handle tap wrench supported from the tailstock.

When tapping, we have to remove the tap occasionally to clear swarf from the flutes of the tap. Failure to do this can cause damaged threads, taps which become stuck and even broken taps. When you tap, advance the tap half a turn, then reverse it for one turn to break the swarf and bring it back to the point where the tap begins to cut again. Repeat this sequence for three or four

Arrand threading attachment, we believe these are no longer available but other makes in the same style can be found.



Tapping guide in use.

Shop made tapping guide.

turns before removing the tap from the hole for cleaning. Swarf must also be removed from a die during the cutting of a thread. A cutting fluid is helpful. I have found that *Trefolex* works well for threads of 6mm or larger. For smaller threads I use *Dormer Super Cut*.

Now to the topic of "depth of thread". Most engineers' reference tables will give one size of tapping drill, but not necessarily the same size. For example for M6 x 1.0mm ISO metric coarse, some tables specify 5.0mm as the tapping drill for mild steel and some specify 5.1mm. In fact, there is no one correct tapping drill. It depends on the material and the quality of work required. For steel I usually use a depth of thread of 75%; for cast iron 70%; and for brass 80%. With very small threads, and for hard materials like silver steel, I reduce the depth of thread, to avoid tap breakage. It's a fact that depths of thread of 60% provide more than sufficient strength.

Every thread defined has a major diameter and a minor diameter. For example, an M6 x 1.0mm ISO metric coarse thread has a major diameter of 6.00mm and a minor diameter of 4.884mm. The percentage depth of thread (D) is calculated as:

D = ((Dmajor – Dtapping)/(Dmajor – Dminor)) x 100%

It's a bit of a nuisance to have to calculate the drill size needed for a specific depth of thread. It will probably turn out to be a size like 5.05mm, which you will have to order in. To avoid all this nonsense, can I recommend a book? It's *Guide to World Screw Threads*, edited by P A Sidders and published by Industrial Press Inc., ISBN: 0-89381-1092-9. Not only does this book have full details of any thread we are likely to come across (including BA and ME threads), it also gives nut and bolt dimensions and tables of tapping sizes. For example, for M6 x 1.0mm ISO metric coarse, it offers the following tapping drill sizes, each with the corresponding depth of thread:

4.8mm (98%); 4.9mm (90%); 5.0mm (82%); 5.1mm (73%); 5.2mm (65%)

This saves an awful lot of time. On the subject of how deep the tapped hole must be for acceptable strength, most experts advise that the depth of the threaded hole for mild steel should be at least 1.0 times the major diameter; that for cast iron, brass or phosphor bronze should be at least 1.5 times the major diameter; and that for aluminium should be at least 2.0 times the major diameter. I generally make the threads as deep as possible, whilst realising that this does not increase the strength of the fixing by very much at all.

Should a tap break in a component in which you have invested a lot of time, a friendly local engineering firm with a spark erosion machine will be able to cut the tap out without damaging the threaded hole. ∎

Jaw Regrinding - Pete Barker

On the **Wire** NEWS from the World of Engineering

Commendation For Young Model Engineer

The youngest member of Peterborough Society of Model Engineers, James Barrett, has been awarded a Certificate of Commendation by the Federation of Model Engineering Societies. As an additional prize, James was also awarded a voucher from Polly Engineering.

The presentations were made at a meeting of the Society on Monday June 5th 2023. The award was for his activities within the Society and for his project, which was to make an adaptor to enable ER40 collets to be used in a milling machine with an INT40 taper. Once the machining had been completed the tapers were blued and scraped to ensure a perfect fit.

The photo shows James being presented with his Certificate of Commendation and Polly Engineering voucher by Bob Polley and Peter Squire of F M E S. James was sponsored by the Peterborough Society.

Dr Junade Ali Named Youngest Ever IET Fellow

Dr Ali studied for a Master's degree aged 17 and has successfully become the youngest ever Fellow of the Institution of Engineering and Technology (IET) and is believed to be the youngest ever Fellow of a professional engineering institution.

With the average age of a newly-elected IET Fellow normally above 45, in order to secure Fellowship, Dr Ali demonstrated personal responsibility for significant technological innovation and independent contributions to original research that have resulted in international recognition.

These contributions have included developing cybersecurity techniques adopted in products built by Apple and Google, developing software to help de-escalate cyberwarfare situations (including in relation to North Korea) and conducting research to reduce burnout amongst software engineers.

Despite dropping out from secondary school and not having an undergraduate degree, whilst working as a software engineer, Dr Ali began studying for a Master's degree aged 17, graduating with a distinction grade and winning his university's "Best Overall Masters" award. At 23 years old, Dr Ali achieved the unprecedented achievement of becoming a Chartered Engineer, the terminal regulatory status for engineers in the UK. He later was awarded a PhD having focused his studies on cryptography.

Reacting to the news, Junade said: "I am truly honoured and humbled to receive this distinction. I never thought I would be able to reach the high bar of Fellowship, let alone be the IET's youngest Fellow. I am truly grateful to the IET and the wider engineering community for supporting my professional development over my career."

00 Gauge Wagons Support Locomotive and Paddle Steamer

On the river Medway and the Thames Estuary the General Steam Navigation Company (GSN) worked closely with the New Medway Steam Packet Company and, in 1936, GSN acquired the New Medway Company outright, but retained the name for trading purposes. These promotional wagons are a product of the cooperation between the General Steam Navigation Locomotive Restoration Society, based at Blunsdon on the Swindon and Cricklade Railway, and the Medway Queen Preservation Society, based on Gillingham Pier. The two societies have commissioned this joint batch of 00 models from Dapol and sales will help the restoration of PS Medway Queen and of locomotive 35011, General Steam Navigation.

The wagon design fits the MQPS theme of fictional wagons that might have been seen at Gillingham pier if there had been a rail connection, but at the same time is very relevant to the General Steam Navigation Locomotive Restoration Society. The wagons are available in two colours, red and grey, from either society at £12.90 per model plus £3.75 per order for UK P&P. Two wagons in different colours and UK P&P totals £29.55. The running number is 23 for the year of issue.

You can order by post from Richard Halton (for MQPS), 2 Drury Close, Hook, Royal Wootton Bassett, SN4 8EL. Cheques payable to "R Halton" please.

For more information on the two societies go to www.35011gsn.co.uk and www.medwayqueen.co.uk\

Workshop Fans

With summer here, now is a great time to consider fans and air conditioning to keep you cool in the warmer weather.

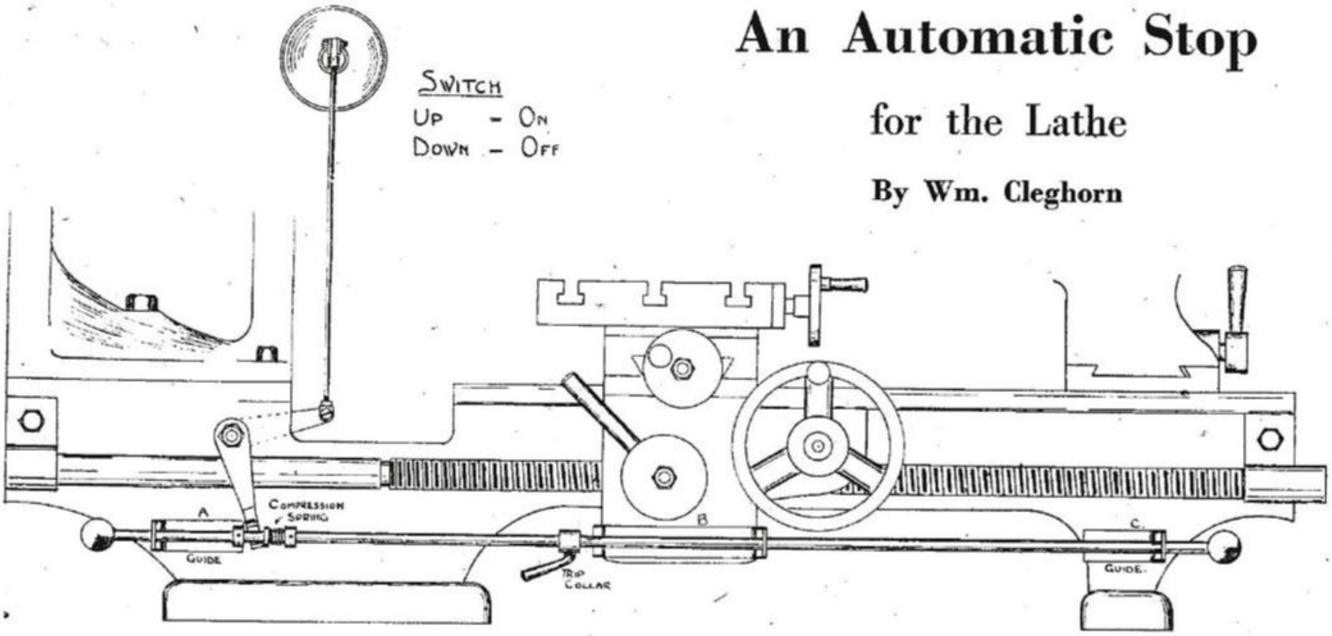
Thankfully, at Machine Mart, we stock a wide range of products, designed for both domestic and industrial usage.

The robust and portable Clarke CFF18B High Velocity Floor Fan is ideal for creating powerful air flow. It is suitable for both domestic and commercial locations such as homes and office spaces where effective ventilation is needed. It has an 18"/457mm fan diameter and 100W 230V motor with 3 speed control. The durable steel construction with carry handle also makes it a tough piece of kit, easy to transport.

Machine Mart also sell three Clarke Portable Air Conditioning Units. The most powerful of these is the Clarke AC13050 Air Conditioning Unit. Like the other models in this range, the AC13050 is a multi-functional 3-in-1 remote controllable mobile air conditioner/dehumidifier/3 speed fan. It provides quick, effective and efficient cooling and drying inside home or office environments. It also contains eco-friendly R290 Gas which meets environmental directives and has a low global warming potential.

For more details, go to www.machinemart.co.uk.

From the Model Engineer Archive



An Automatic Stop

for the Lathe

By Wm. Cleghorn

THE automatic stop described below was, at first, paradoxical though it may sound, not intended to be one. It was merely desired as a remote control for the motor-switch to obviate leaning over the lathe when switching on or off, a proceeding which may be dangerous to one's skin or clothing when a sharp corner of the work in hand is projecting beyond the chuck or faceplate. The reader will, at this juncture, remark, why not move the switch to a position of greater safety? This solution, besides being too obvious and easy, would not properly meet the case, as there would still be a stretch if the switch were placed at either end of the plate; for it is a long-bed model, and it could not be placed underneath at the centre because of drawers in the bench upon which it stands. It was, therefore, decided upon that the best way would be to put a spindle through the lathe headstock casting, and this spindle, by means of suitable levers, would operate the switch. The long, ¼-in. diameter, steel push-rod which makes the stop automatic was not added until a Drummond 3½-in. lathe had been examined closely and the advantages of an automatic stop were fully appreciated. This rod, the fitting of which entails only a small amount of extra work, was soon added, and now gives, in addition to automatic control, instant hand control from any position on the lathe-bed. The ends of the push-rod may be finished off with small red fibre knobs as shown, or they may be left plain for the sake of simplicity.

Drilling the lathe-bed is not recommended if it can possibly be avoided. An alternative method would be to carry the lever-spindle in brackets clipped to the bed; drilling, however, although it is likely to weaken the lathe slightly, makes the attachment an integral part of the machine, and consequently less inclined to become displaced and cause any trouble. The rocking-shaft carrying the levers is a piece of 5/16-in. B.D.M.S., and passes through two 5/16-in. holes *in line* with each other. Care must be taken over the drilling of these holes, and their position placed so that they do not weaken the lathe unduly; any ribs in the casting should be carefully avoided.

The switch in use happened, fortunately, to be a Crabtree 5-amp. tumbler-switch which had once formed half of a two-pole main-switch of the type not often seen in these days of ironclad and bakelite main-switches. In this type there were two tumbler-switches, side by side, having their knobs connected together by means of a wooden or ebonite bar, the knobs being drilled and tapped (6 B.A. in this case) for attachment of the bar. It will be seen that a switch of this type lends itself readily to modification, and the attaching of levers or links is greatly facilitated. In the arrangement shown, a small fork-end is fastened to the switch-knob, a tie-rod from this leading down to the back-lever. The tie-rod referred to was only used to evade the trouble of moving the switch and altering the existing wiring; a much better arrangement would be to have the switch mounted immediately behind the lathe-bed so that it could be operated directly by the back-lever, thereby dispensing with the tie-rod.

The two brackets supporting the ends of the push-rod, and also the centre-piece attached to the saddle, are made from 3/16 in. by ¾-in. flat mild steel bar. Each bracket is held in its place by means of two No. 2 B.A. steel setscrews screwed into the lathe-bed; the brackets are made in such a manner that the push-rod may be instantly detached when not required or to give accessibility for cleaning purposes. This detachment is achieved by slotting the holes which carry the rod and fitting a small hook, made from 1/16 in. sheet mild steel, to each bracket; these hooks, three in all, retain the push-rod in its working position.

When considering the fitting of the push-rod, the writer was at first inclined to be doubtful concerning the effect which the momentum of the rotating parts of the lathe would have upon stopping, instantly, the movement of the saddle. To make certain, several tests were made, during which the travel after switching-off was never in excess of 1/16 in. This was with the normal set of change-wheels in use for giving a fine self-acting feed of approximately 154-t.p.i. When cutting coarser threads, and with the back-gear in use, the travel may, possibly, exceed this very slightly, and will, of course, have to be allowed for when setting the trip-collar. A small compression spring is fitted to the push-rod at the point where it engages the forked lever. This spring is intended to impart a little resilience

(*Continued on page* 259)

THE MODEL ENGINEER

Vol. 85 No. 2107

Percival Marshall & Co., Limited
Cordwallis Works, Maidenhead

September 25th, 1941

To celebrate 125 years of Model Engineer magazine and the Society of Model and Experimental Engineers, each issue in 2023 features fascinating historic content from Model Engineer relevant to workshops, tools or techniques. These pages are from Model Engineer Volume 85, No. 2107 – September 25, 1941, a momentous month in WW2 as the battle of Stalingrad commenced and the United States started work on the Manhattan Project that would lead to the first nuclear bombs. At the beginning of the next month, Germany made the first successful launch of a V2 (A4) Rocket. In the quieter world of home workshops, readers were invited to consider this design for an automatic lathe stop..

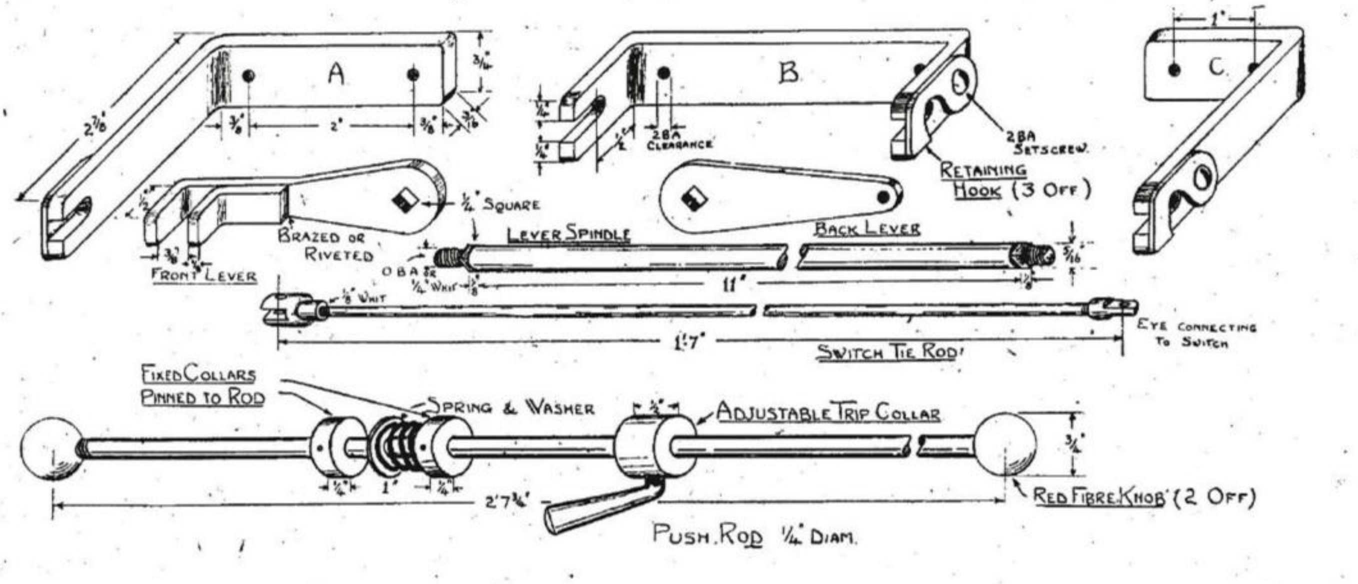
An Automatic Stop for the Lathe

(Continued from page 254)

to the motion, and also to avoid any damage likely to be caused by the aforesaid momentum.

To refer to the sketch for a moment, it may be advisable to point out that the dimensions given are only meant for general guidance, as every attachment likely to be made will vary according to the type of lathe to which it is applied, and also to each individual maker's ideas upon the subject. There is hardly any need for further remarks upon the construction, and the writer claims no originality for the idea, as it was probably invented by Mr. Heath Robinson many years ago.

The writer is of the opinion that a device such as the one described, which switches off the "juice" and so stops the lathe completely, is an improvement upon those automatic stops which throw out a clutch and merely stop the movement of the saddle, as in the latter case the tool is left rubbing against the revolving work to the detriment of its edge. This is only an expression of opinion, and must not be taken as a gauntlet thrown down as a challenge to debate the merits and demerits of automatic stops.



Model Engineers' Workshop and Model Engineer at the Midlands Model Engineering Exhibition

Exciting news about the forthcoming exhibition at Warwickshire Event Centre Thursday 12th to Sunday 15th October 2023

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Exciting news about the forthcoming exhibition at Warwickshire Event Centre Thursday 12th to Sunday 15th October 2023

As regular readers will be aware, Model Engineers' Workshop and its sister publication Model Engineer are teaming up with the Society of Model and Experimental Engineers to celebrate our joint 125th birthday in 2023. To mark the occasion we will be attending the Midlands Model Engineering Exhibition, organised by Meridienne Exhibitions.

News from Meridienne Exhibitions

Meridienne are pleased to confirm some special attractions this year including John Wilks' newly completed 10 ¼ inch gauge LNER P2 "Cock O' The North" which will be on display at the exhibition.

John was a prolific locomotive builder and sadly passed away in November 2022. This is the last of five fully working exhibition standard scale steam locomotives he completed during his lifetime since 1963. The locomotive is built entirely from works drawings and original research and reflects Gresley's most advanced Express passenger 2-8-2 with Lentz poppet valve gear, Kylchap exhaust and ACFI Feedwater pump as built in its unique semi streamlined form in 1934. The 3-cylinder locomotive has a TIG welded steel boiler with superheaters, and is based at Stapleford Miniature Railway.

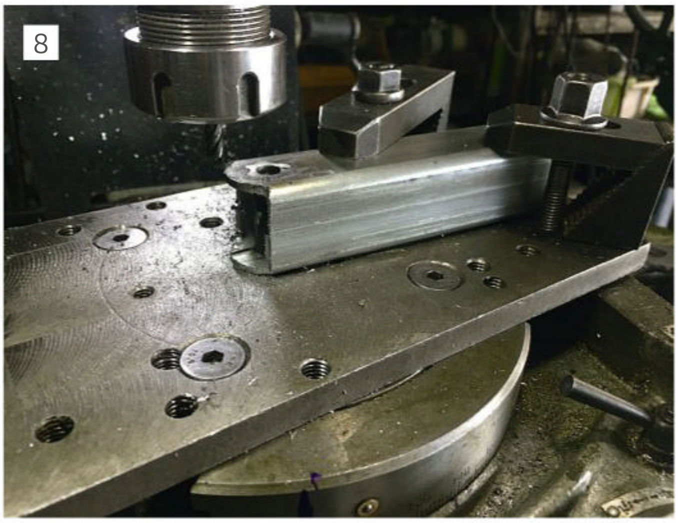
Magazine Talks Programme

the exhibition will see the return of lectures in 2023 which will be presented by Model Engineer and Model Engineers' Workshop to celebrate our 125th anniversary. There is a full range of talks from leading magazine contributors and the timetable is below so you can plan which day to visit the exhibition.

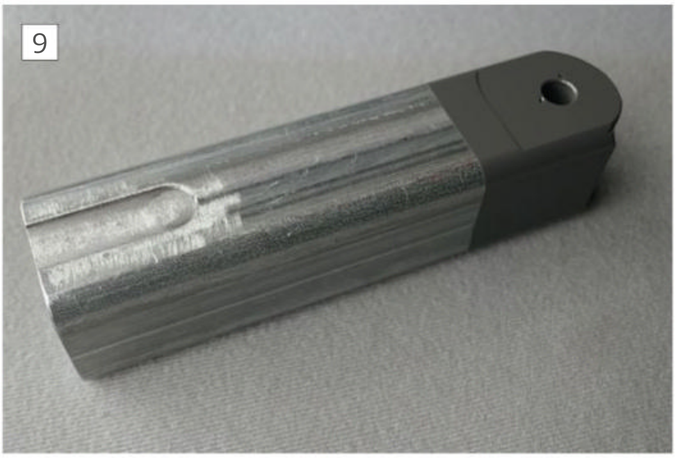
Day	11.15am		1.00pm		2.15pm	
Thursday 12th October			**Roger Froud**	A development in Steam Injector design	**Neil Wyatt**	3D Printing for Model Engineers
Friday 13th October	**Stew Hart**	Designing and building model stationary engines	**Roger Backhouse**	The remarkable Jim Crebbin and his experimental locomotives	**Duncan Webster**	A dummies guide to steam engine valve gear
Saturday 14th October	**Bob Reeve**	Why metals behave the way they do	**Chris Gabel**	Powder coating in the home workshop	**Mark Noel**	Hear the Earth: how to design and build a seismometer
Sunday 15th October	**Roger Froud**	Why a CNC milling machine is so useful	**Presentation of Awards 2.00pm onwards**			

Universal Belt Grinder Part 2

Paul Lousick describes his design for a compact belt linisher which uses a 4" angle grinder and can be used with either a 50 x 914mm abrasive belt or grinding wheels.



Rounding end of grinding rest support.



Clearance slot.

Grinding Rest Support

Drill a 12mm dia hole thru the grinding rest sliding support and bevel the outside of the holes (weld prep). Then weld the hollow rod in position and machine or grind flush, **fig. 11**. If the weld bead cannot be completely removed from the inside of the support frame, a small slot can be machined on the outside of the sliding parts for clearance, **photos 8** and **9**.

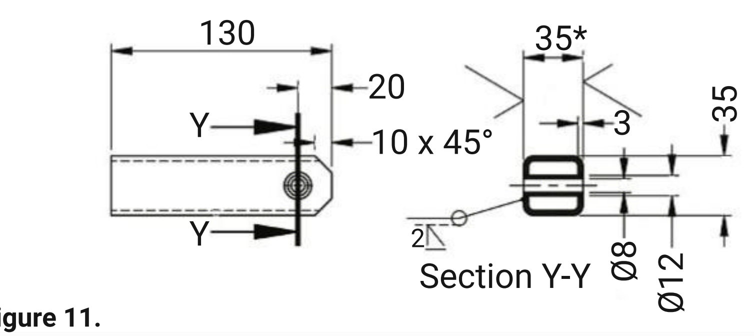


Figure 11.

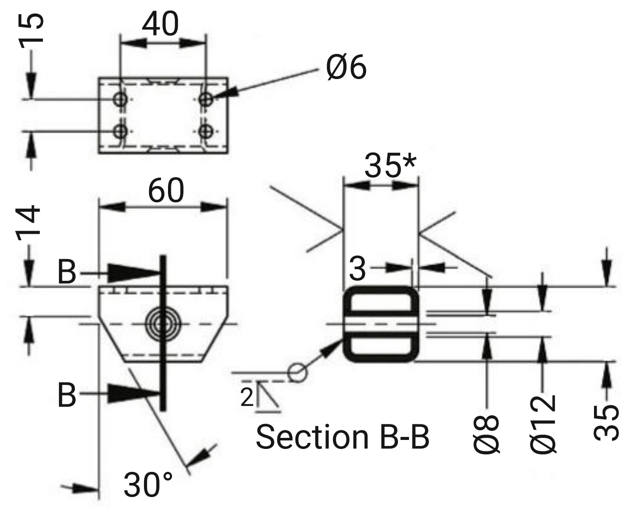
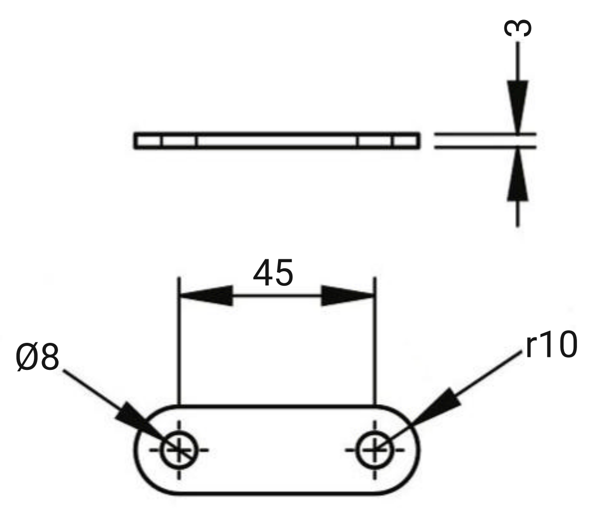


Figure 12.



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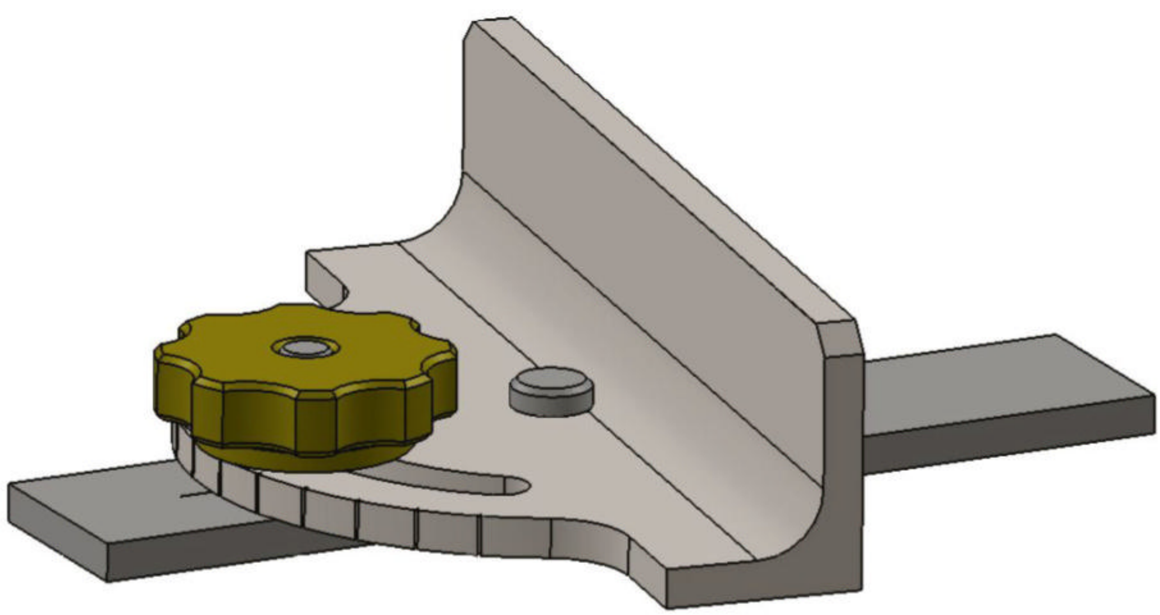

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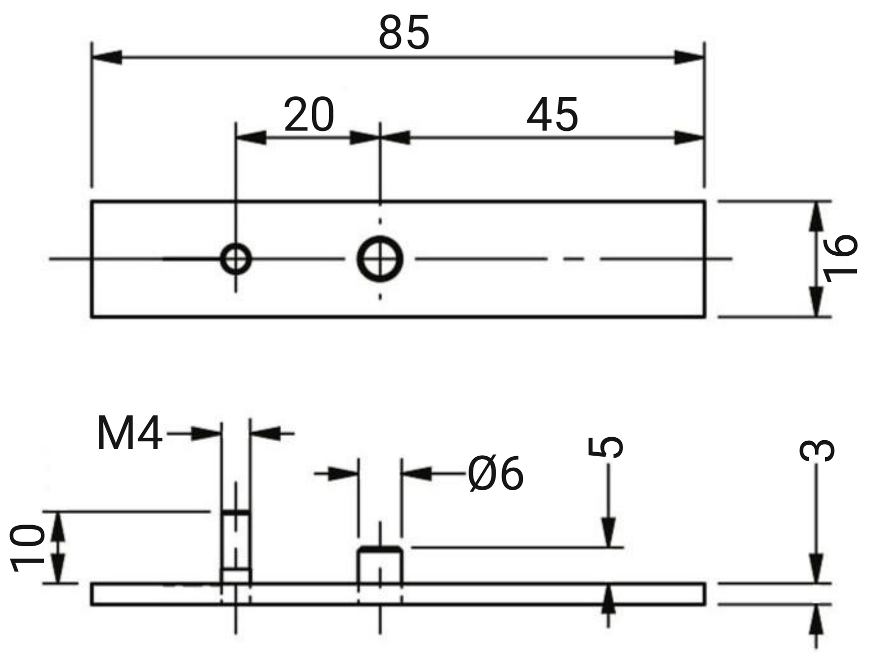


Figure 15.

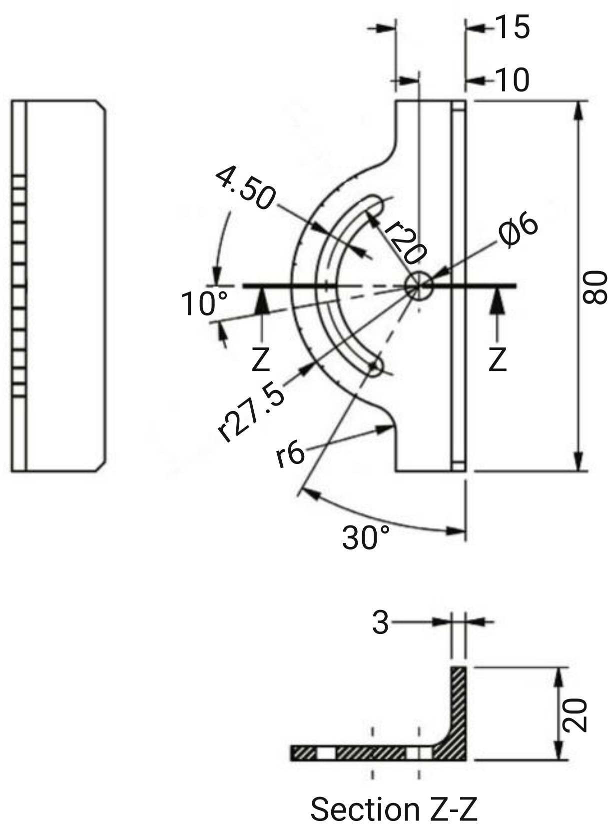


Figure 16.

The grinding rest pivot is made in a similar fashion to the sliding support. The overall width of the support and the pivot should be the same width for the link plates to clamp properly on both parts, **fig. 12**.

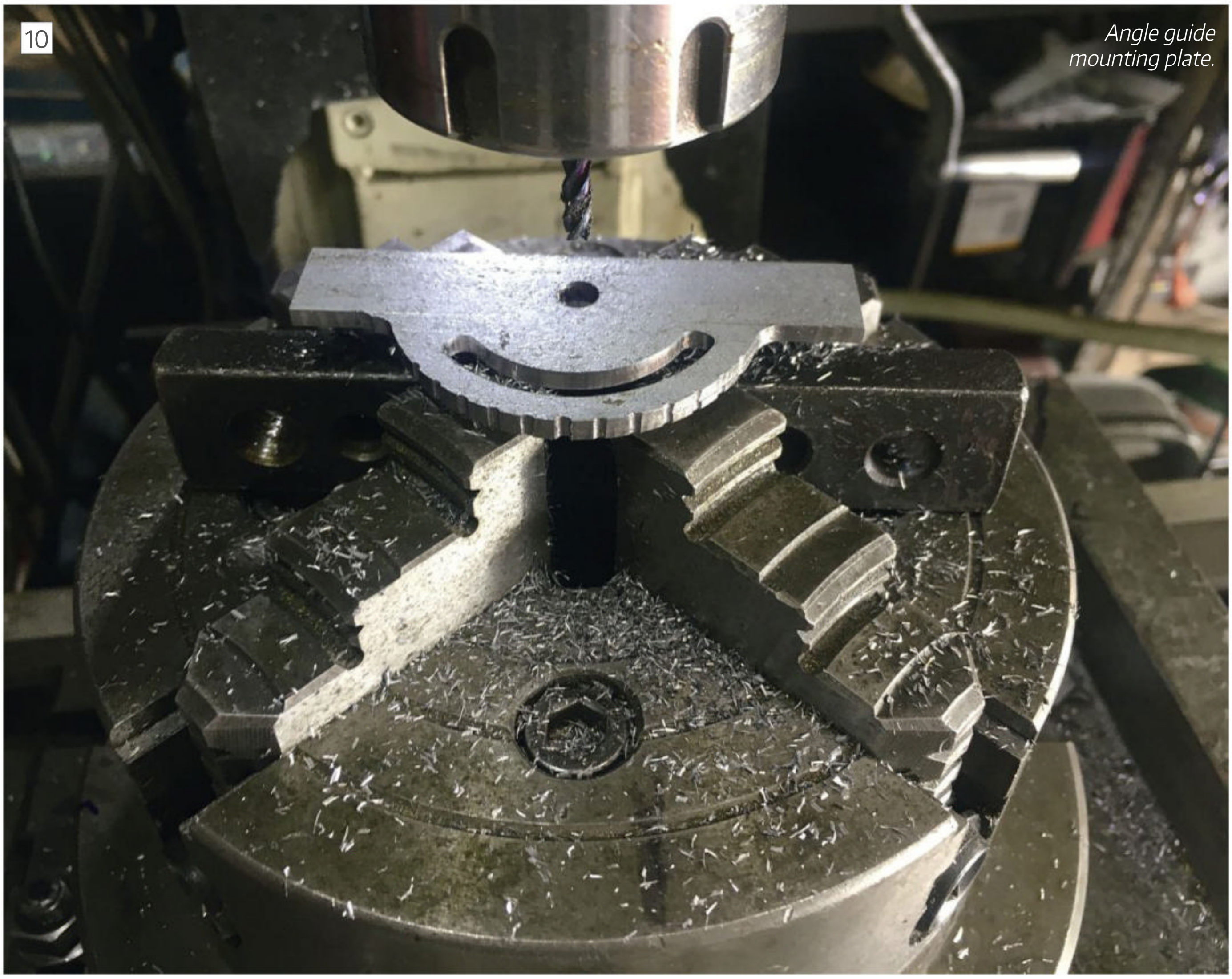
Two link plates are required for the grinding rest assembly. Weld the head of the clamping bolts (or machine a slot) to one of the plates to prevent it from spinning, **fig. 13**.

Angle Setting Guide

The guide assembly may be engraved with divisions for setting it to a particular angle or used without engraved marks and set to an angle with another tool (protractor, digital angle gauge, etc.), **fig. 14**.

The angle guide mounting plate should be a slide fit with the slot in the grinding rest. Drill the holes for a neat fit with the pins and bevel the underside for welding the pins to the plate. Machine the bottom surface flat after welding, **fig. 15**.

Make the top swivel from a piece of angle. The hole for the pivot should be a slide fit with the pin. All surfaces should be smooth, and edges rounded. **Fig. 16**. Milling the outside radius and the



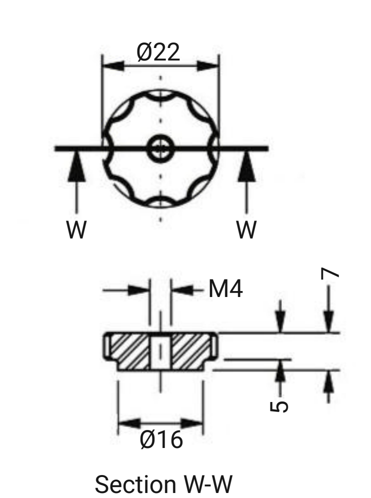


Figure 17.

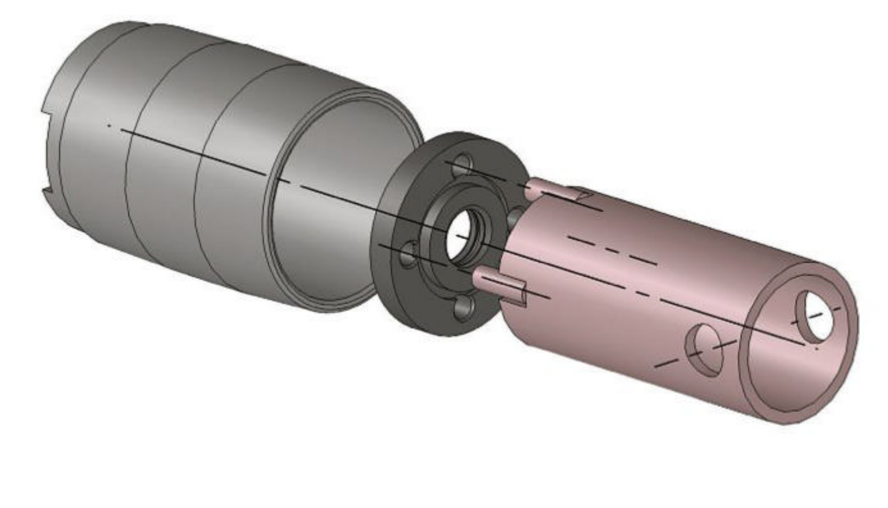


Figure 18.

curved slot of the guide on a rotary table, **photo 10**.

The locking nut was made from brass and can be made as shown or have a knurled edge, **fig. 17**.

Belt Drive Pulley

The pulley for the abrasive belt is mounted on the angle grinder shaft and held in place with the locking nut that was supplied with the grinder. A special tube spanner is required for tightening and removing the nut, **fig. 18**.

The pipe size for making the pulley is not critical and may be changed but the inside diameter must be large enough to accept the angle grinder lock nut. Cut the pipe longer than required for holding in the lathe chuck and turn one end to make it square to the axis. Clean up the bore *(minimum cut)* and make the end plate to suit this diameter.

Clamp the end plate to the pipe and weld together. Mount in the lathe chuck by the open end and face cut the end plate to make it square to the axis. Turn the OD of the pipe to clean up the outside surface, excess weld and the taper. Bore the mounting hole to suit the angle grinder. Reverse the part in the chuck, cut to length and turn the remaining taper. Machine the slot to suit the driving boss on your angle grinder, **fig. 19**.

The special spanner was made from a piece of pipe and the pins from the shank of old twist drills. The dimensions should be modified to suit your angle grinder nut. A bar is inserted thru the hole at the end for turning the spanner, **fig. 20**.

Optional On/Off Switch

The angle grinder could be turned on by the existing switch on the handle but this requires you to press in the safety button prior to squeezing the lever. To make it easier, I tied a cable tie around the start lever to keep it permanently on.

The cable was cut and separate on/off switch added. The switch is mounted in a plastic enclosure because like most electrical power tools are double insulated and does not have an earth wire, **photo 11**.

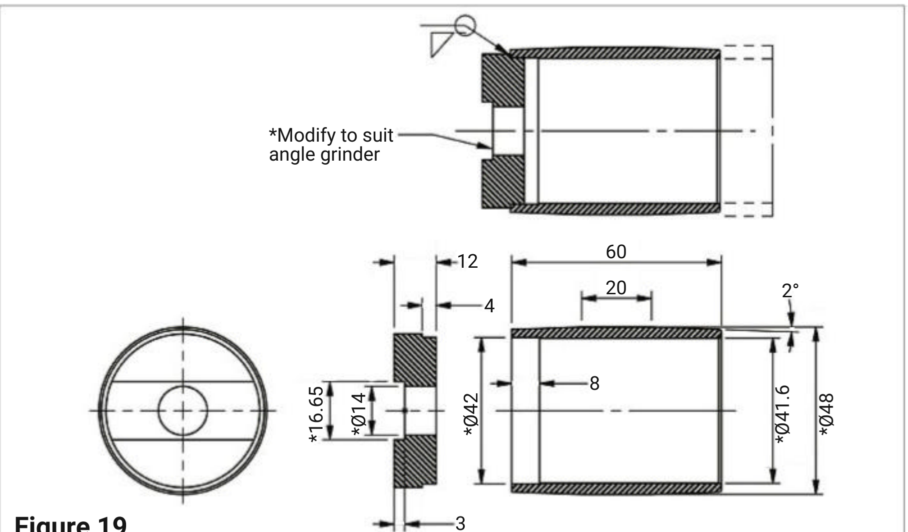


Figure 19.

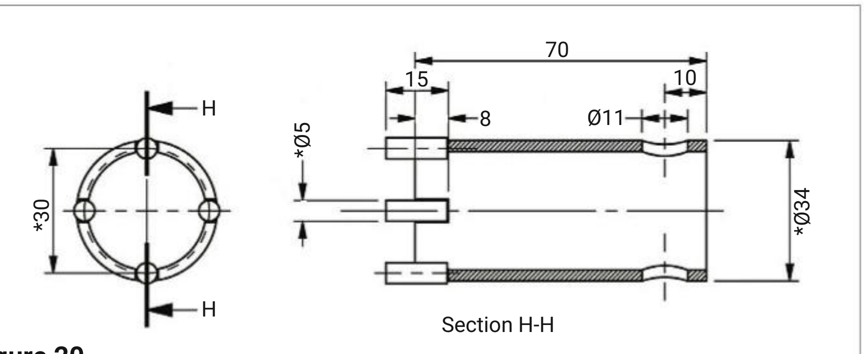
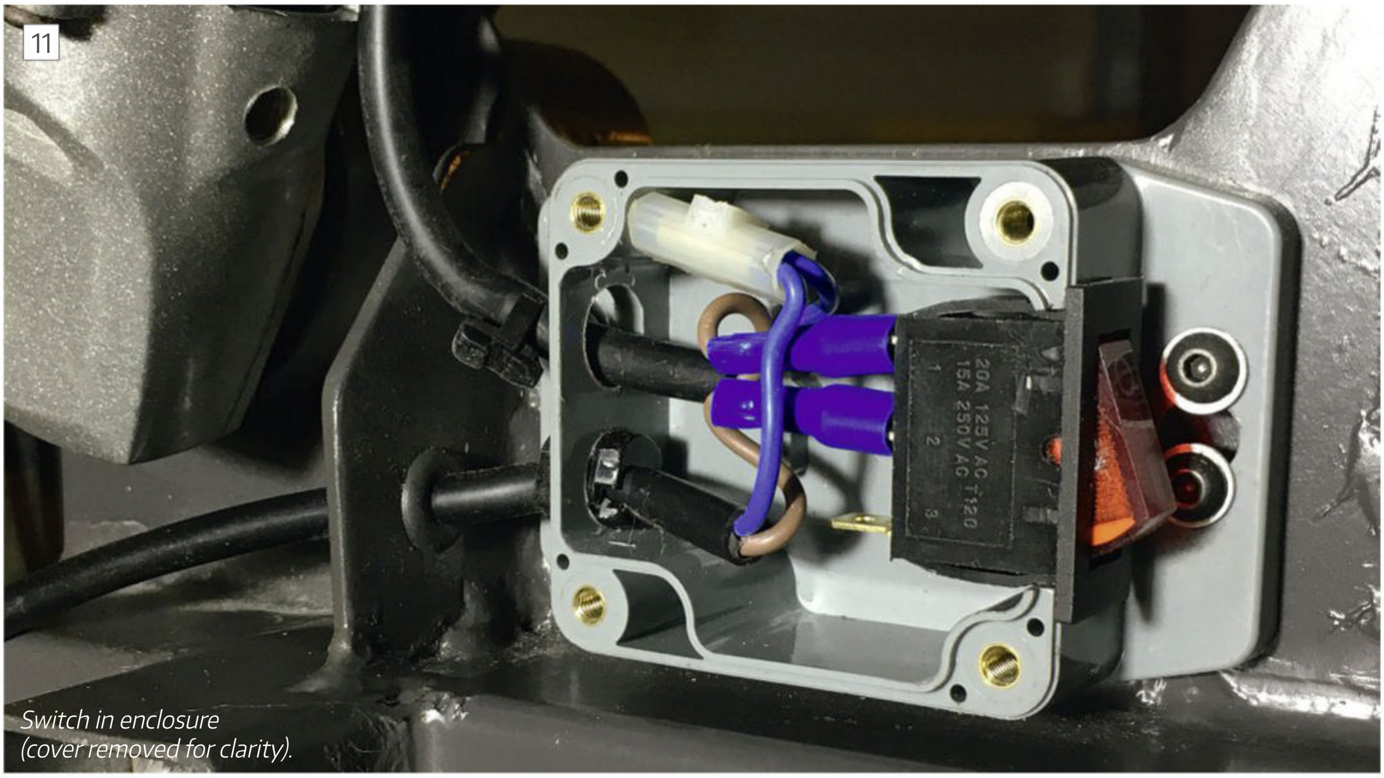


Figure 20.



Switch in enclosure (cover removed for clarity).

Grinder in use.

Safety

Ensure that safety glasses are worn when operating the grinder. Even though the sparks are directed down and away from you, some also are carried around on the belt as shown in **photo 12**. When using with grinding wheel a suitable guard fashioned from sheet metal should be fitted – no drawings are provided as the size of this will depend on the wheel used, also make sure that the wheel is suitable for the speeds employed.

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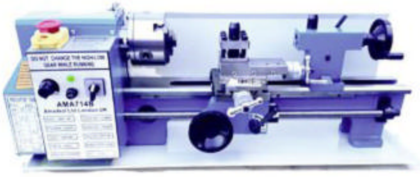
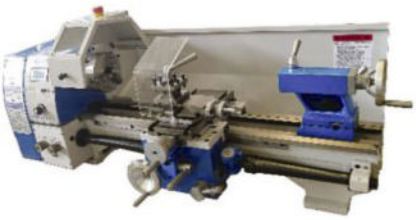


AMA714B Mini lathe
Brushless Motor

SPECIFICATION:
Distance between centers: 350mm
Taper of spindle bore: MT3
Spindle bore: 20mm
Number of spindle speeds: Variable
Range of spindle speeds: 100-2250mm
Weight: 43Kg

Price: £694



AMABL250Fx750

SPECIFICATION:
Distance between centers: 750mm
Taper of spindle bore: MT4
Spindle bore: 26mm
Number of spindle speeds: Variable
Range of spindle speeds: 50~2500rpm
Weight: 140Kg

Price: £1,904
W 2 Axis DRO - Price: £2,280

AMABL290VF Bench Lathe (11x27) - power cross feed - BRUSHLESS MOTOR

SPECIFICATION:

Distance between centers: 700mm
Taper of spindle bore: MT5
Taper of tailstock quill: MT3
Motor: 1.5kw
Weight: 230Kg

Price: £2,782
W 2 Axis DRO – Price: £3,150

AMAVM25LV

SPECIFICATION:
Model No: AMAVM25LV (MT3) / (R8)
Max. face milling capacity: 63mm
Table size: 700×180mm
T-slot size: 12mm
Weight: 120Kg

Price: £1,431.00
W AXIS POWERFEED - Price: £1,659
W DRO – Price: £1,921
W DRO + PF - Price: £2,210

E3 Mill R8 Metric Brushless Motor

SPECIFICATION:
Max. drilling capacity: 32mm
Max. end milling capacity: 20 mm
Max. face milling capacity: 76mm
Motor: Input- 1.5KW
Packing size: 1050x740x1150mm
Net weight: 240kg

Price: £2,560.00

AMAVM32LV

SPECIFICATION:
Model No: AMAVM32LV (MT3) / (R8)
Max. face milling capacity: 76mm
Table size: 840×210mm
T-slot size: 14mm
Weight: 240Kg

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