

No.299

THE BEST MAG FOR MAKERS, MODEL AND HOBBY ENGINEERS

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DECEMBER 2020

INSIDE

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- **Improving a Pan Folder with Stew Hart**
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And much more!



Bandsaw Attachment



Unimat Tap and Die Holder

This Year's Stephenson's Trophy Winner

COVER STORY

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Published by MyTimeMedia Ltd.
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Model Engineers' Workshop, ISSN 0959-6909, is published monthly with an additional issue in August by MYTIMEMEDIA Ltd, Enterprise House, Enterprise Way, Edenbridge, Kent TN8 6HF, UK. The US annual subscription price is \$2.95GBP (equivalent to approximately \$8USD). Airfreight and mailing in the USA by agent named WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Periodicals postage paid at Brooklyn, NY 11256. US Postmaster: Send address changes to Model Engineers' Workshop, WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Subscription records are maintained at DSB.net Ltd, 3 Queensbridge, The Lakes, Northampton, NN4 5DT. Air Business Ltd is acting as our mailing agent.



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On the Editor's Bench

A slightly belated hello to all readers, I'm afraid that due to the latest lockdown in the UK, this issue will be with you about a fortnight later than usual. There may be some smaller delays over the next few issues, but we hope to be back to a more regular schedule by early 2021.

Today a second (and possibly a third) vaccine for Covid-19 has been reported as having over 90% efficacy, so hopefully we are beginning to see an end to this terrible virus which has caused so much tragedy around the world. I'm pleased to bring some good news from closer to home. Around ten days ago Andy Tompkins, the designer who works with me on MEW, and his wife were both hospitalised with Covid-19; today he got in touch to say they are both home and on the road to recovery, albeit still feeling rather under the weather. In the meantime, I'd like to thank Yvette Green, Designer for Model Engineer and previous designer for MEW for stepping in to help out with this issue.

Online Meetup

Recognising that many of us are missing regular club meetings, two online 'meetings' of forum members were held in October and November. Lasting about an hour, these are informal group chats where people share interesting tools or examples of their work. No camera is necessary to join - you can just use a microphone, and even if you haven't got a microphone you can still watch and listen and use the 'chat' function to share typed comments. If you would like to join in, visit the forum at www.model-engineer.co.uk for news of the next online meetup.

Trade News

I've had more than the usual amount of news from the trade this issue, and we have run out of room to expand 'On the Wire', so I'd just like to summarise a few things that may be useful to readers.

Aircraft modellers and anyone looking for realistic metallic finishes should take a look at the new 'Aircraft Perfect Model Set' by Lifecolour and available from Airbrushes.com. They also have a 'War on the Road' set which may sound irrelevant to our sort of models, but the colours are for concrete, tarmac and plaster and look potentially useful for those who want to make realistic settings for models of all sorts, from road vehicles to stationary engines.

Another paint supplier, Manchester based HMG Paints Ltd have been awarded a UK Business Hero Award from the British Chambers of Commerce. Announced by The Greater Manchester Chamber of Commerce, HMG were honoured with the award after converting alcohol stocks into hand sanitiser, to support locally and nationally, during the pandemic. Based on World Health Organisation (WHO) recommended formulations, thousands of litres of HMG's hand sanitiser has been provided to key workers, care providers and charities throughout the COVID-19 crisis.

Finally, Meridienne Exhibitions taken the decision to postpone the Midlands Garden Rail Show to Saturday 22 and Sunday 23 May 2021. Please see the website www.midlandsgardenrailshow.co.uk for all the latest information.

Neil

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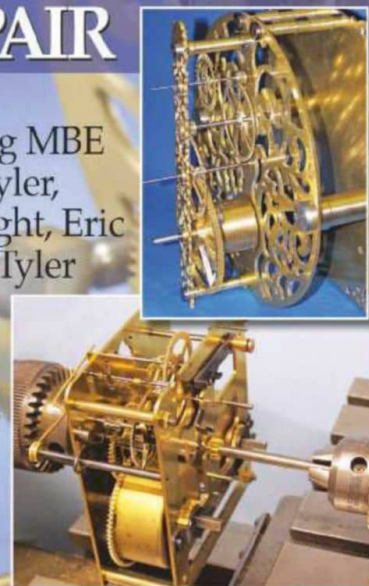
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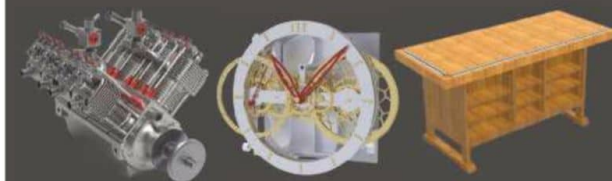
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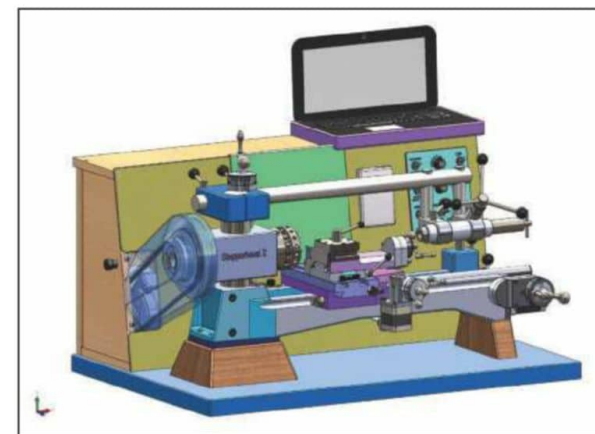
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Coming up... in our next issue

The Next issues features several articles to celebrate our 300th issue, plus we start a short series where Alan Jackson revisits his award winning Stepperhead lathe to look at how it might be further improved, 25 years on.



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ON THE COVER >>>

This month's cover shows Ian Johnson's quick change tool making the swarf fly on his SIEG KX1 CNC mill. Ian's tooling was the winner of the popular vote in this year's Stephenson Trophy competition, see page 9 for details.



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Would you like to join in a Virtual Model Engineer's Meeting?

In October we ran our first experimental online meet-up, and held a second in early November. A third meeting is planned for December but we haven't yet fixed the details. Go to the forum at www.model-engineer.co.uk search for the thread 'virtual meet ups' to express your interest.

Testing Models

Some interesting results of tests on model turbines.

Myford ML7 faster speed

Advice on breaking the 1000rpm barrier!

'War Department' (arrow) Marking

You must have seen these marks on old government surplus tooling and the like. Discover just how old this mark is!

Come and have a Chat!

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

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The Stevenson Trophy Competition 2020 The Results

I'm delighted to present the results of the 2020 Stevenson Trophy Competition. This is the third year of the competition, the trophy being funded by readers and members of the www.model-engineer.co.uk forum in memory of John Stevenson. In accordance with John's feelings about competitions and 'glass case models', all entries had to be a piece of practical workshop equipment i.e. a tool, jig, fixture or a modification to or accessory for

an existing piece of equipment. The entries were all profiled in issue 297 and online voting, open to all, ended on the 31 October.

Voting this year was brisk and all of the entries gathered a respectable number of votes, indeed the results were so close that the difference between first and third place was only 2%! But despite this there was not a tie, so I can announce the winners as:



John Stevenson

First Place: Ian Johnson's quick change tool system for a Sieg KX1 CNC mill



Second Place: Alan Jackson's Grinding Wheel Dresser



Third Place: Bernard Tower's Tailstock Turret

Congratulations to everyone who entered; I hope to be able to present Ian with the Trophy in the not to distant future, subject to the ever-changing rules around Covid 19.

A Tailstock Tap and Die Holder



Terry Gorin returns with a new accessory for the Unimat SL1000.

The main purpose of this holder, on this small lathe, is for central alignment and starting, by 'hand' pulling, of male and female threads. Small threads, up to perhaps M5, could be started and completed on the lathe but larger threads are best finished on the bench.

Unlike most conventional lathes, large and small, the Unimat tailstock was designed to clamp, not slide, on the lathe bed and with limited quill traverse. The sliding headstock mandrel provides the axial movement needed, when drilling against a tailstock held drill bit, but cumbersome trying to screw cut by 'hand pulling' a sliding workpiece against a fixed tap or die.

The design of this sliding tap and die holder is based on those available elsewhere. The completed components

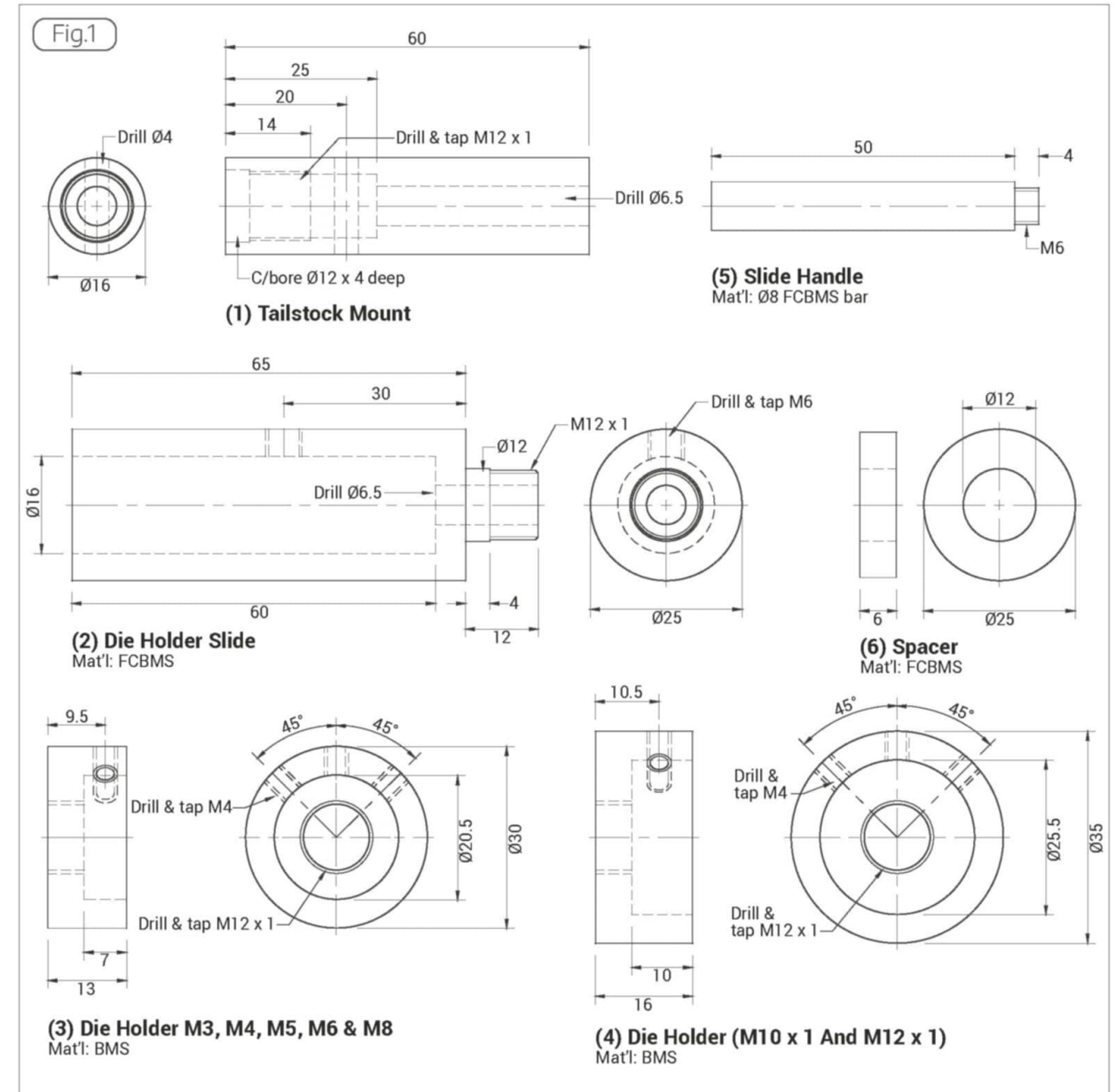


Die holder components.

detailed in **fig. 1** are shown separately in **photo 1** and assembled and mounted on the Unimat, in **photos 2 & 3**. It is straightforward to fabricate but I found it easier to initially cut and thread the spigot of the slide handle (5) longer than shown to accommodate a lead-in taper. After threading, the spigot was turned to the finished length shown.

The M12 spigot of the die holder slide (2) is to enable the Unimat tailstock chuck to fully engage for tapping as photo 2. Spacer (6), showing in photo 3, is needed when mounting the die holders (3) and (4) to limit protrusion of the spigot and ensuring threading dies seat correctly. ■

Tap holder on the lathe.

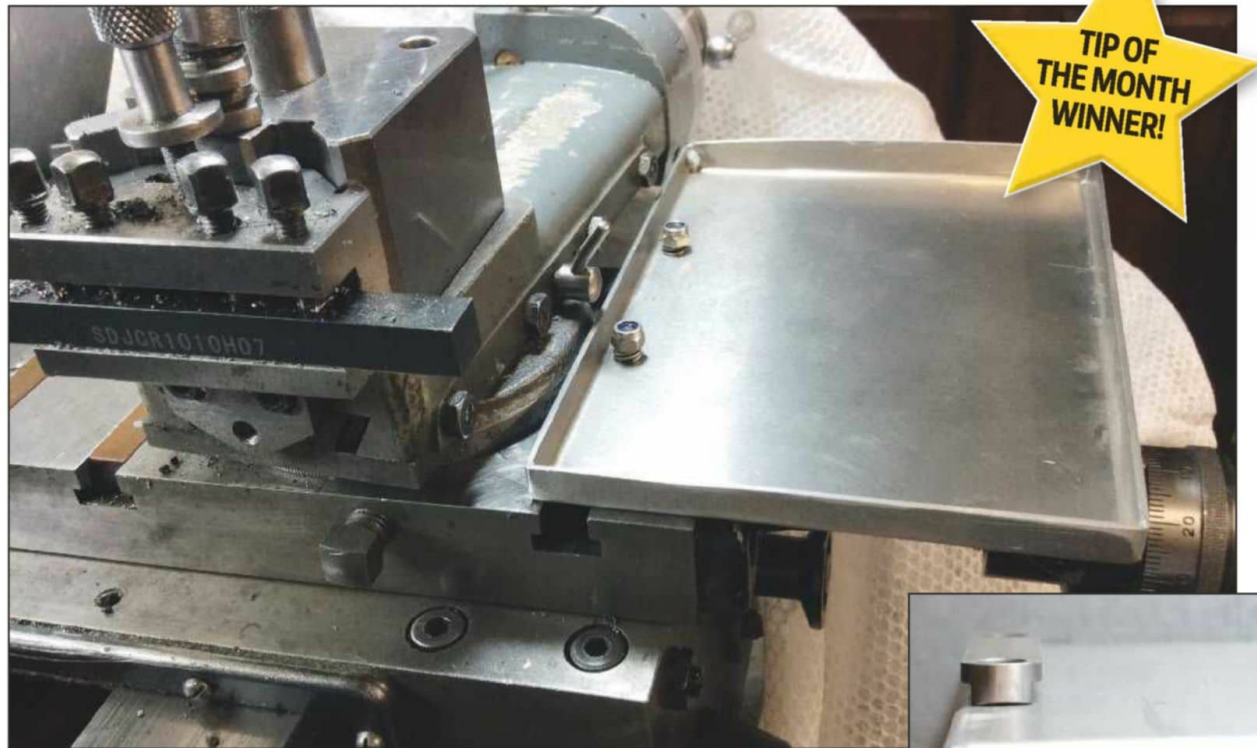


Unlike most conventional lathes, large and small, the Unimat tailstock was designed to clamp, not slide, on the lathe bed.



Die holder on the lathe.

Readers' Tips



A Bits and Bobs Tray

This month our lucky winner of £30 in Chester gift vouchers is Bernard Towers who describes an easily removed tray for holding small tools.

This tray came about when drills /taps etc. are used repetitively but not worth tooling up a tailstock turret. The thing is where to put three or four small items (1mm drills etc) without losing them and having them easily to hand when required. You need a 2 inch length of t nut in any material, two 4mm socket heads or countersunk screws and 2 4mm Nyloc nuts with a couple of pieces of 4mm id spring out of the scrap box.

The tray is made from 1.6mm aluminium sheet so the sliding action will not mark the cross-slide and it finishes up at 155mm x 110mm with a sidewall of 10mm and the corners

are joined with Technoweld to tidy them up. The t-nut can be made from almost any material from nylon to steel and can be assembled from two pieces of material screwed or riveted together as it is not under any great strain.

On my Super 7 the holes in the tray were drilled 8mm from the edge and equidistant from the centre of the tray. The screws go through the t-nut from the bottom (counterbore for socket head, or countersink for countersunk screws) and up through the tray with a short spring and then a Nyloc nut. It's just a matter of adjusting the length of the spring so as you press on the nut a gap is made between the tray and nut allowing you to slide the tray into the cross-slide t-slot. There is no reason that this idea could not be used on similar machines with t-slotted cross-slides and also fitted on the far end of the cross-slide.

We have £30 in gift vouchers courtesy of engineering suppliers Chester Machine Tools for each month's 'Top Tip'. Email your workshop tips to neil.wyatt@mytimemedia.com marking them 'Readers Tips', and you could be a winner. Try to keep your tip to no more than 400 words and a picture or drawing. Don't forget to include your address! Every month I'll chose a selection for publication and the one chosen as Tip of the Month will win £30 in gift vouchers from Chester Machine Tools. Visit www.chestershobbystore.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.

On the Wire NEWS from the World of Hobby Engineering

A new title from Crowood Press: Ceramic Burners

This book covers the materials needed to make ceramic burners and explains how to silver solder them. It discusses LPG and holding tanks, as well as connecting pipework and electronic and mechanical automatic gas-control systems to monitor the boiler pressure. In addition, there is advice on how to set up, install and operate each burner to provide optimum heating to the boiler. A summary of the Boiler Test Code Volume 3 that applies to home-made gas tanks is included, together with a list of useful suppliers with their contact details.

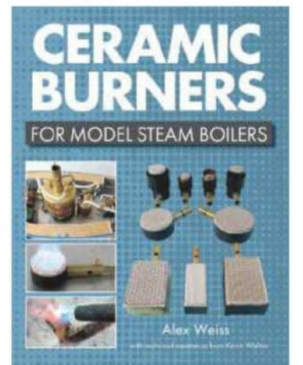
The book provides all the information you need to build and operate:

- Three burners, with one variant, for boilers with 42mm, 35mm and 28mm horizontal flues
- Two round burners for vertical boilers with fire boxes
- Two different sizes of rectangular burner, with one variant, for use in horizontal water-tube or pot boilers

- One small round and one tiny oblong burner for use in Mamod and Wileco boilers

The burners described are straightforward to make and simple to use to heat the water in boilers that meet the 3 bar litre limit in the UK Boiler Test Code.

Alex Weiss established a model engineering workshop over forty years ago and has written numerous books and articles, mainly about model making. All the burners described in this book have been designed, built and tested in working boilers by Alex and Kevin Walton, who has provided extensive technical support. RRP: 16.99 from all usual book suppliers.



A Covid Update from Reeves 2000

These *Crazy Covid Times* as we call them at Reeves have presented all sorts of challenges and, to date, we have managed to overcome them with relatively few issues. At Reeves it's all about planning. As early as February we sat and discussed a 'what if' scenario.

What potential supplier issues could there be?

It turned out that the suppliers were pretty much functioning as normal and there was little to worry about. A couple of suppliers did close for a period of time, but this had no noticeable impact on stock. The foundries kept running without issue – in fact, the turn around times improved to 2 weeks which is pretty impressive.

How do we keep customers safe?

At Reeves we made a decision in mid-March (pre official lockdown) to send all orders to the UK carriage free, regardless of value or weight. It was our tiny contribution to the cause – basically 'do what Boris says, stay at home, Reeves will send you your order carriage free so you don't need to make a non-essential trip'. We know model engineers will argue the 'non-essential' trip bit. We planned for this to go on for about 3 weeks... some 94 days later we were still supporting our customers with free carriage!

How to keep ourselves safe?

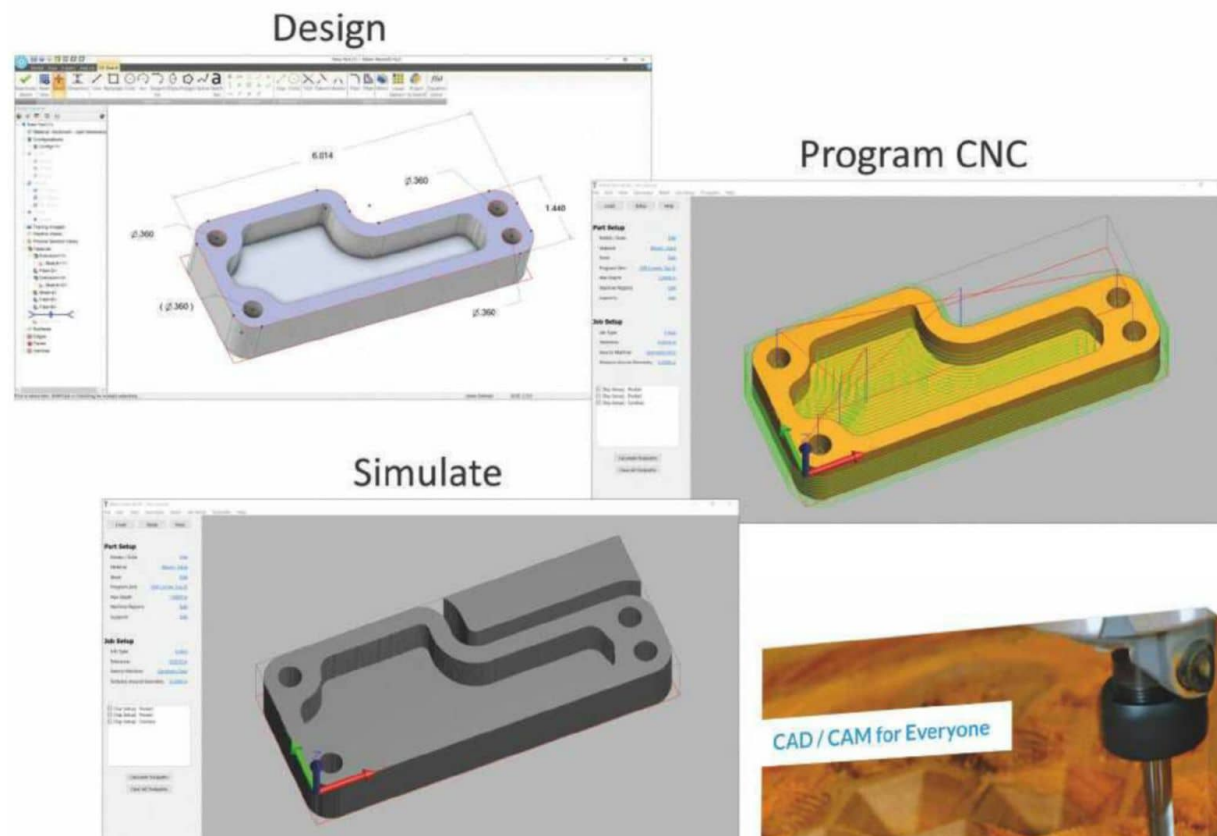
We keep safe by being sensible. All the usual precautions are taken – hand sanitizer, face masks and good old-fashioned common sense. We insist on facemasks being

worn in the shop so please don't be offended if we ask you to pop one on. To date this has worked, and we hope it will continue to do so for the foreseeable future.

How to keep sane and most importantly how to keep the chocolate supplies flowing?

We have kept sane because of our customers – The kindness shown has been extraordinary. People have gone above and beyond to support us. Just when you think you're going crazy there will be a phone call or an email with a quick thank you. It makes a huge difference at this end. That small action resets everything and reminds you it will all be ok in the end. Our customers have been patient and understanding, particularly with some of the postal delays (most of which now seem to be sorted). One of our main concerns was running out of chocolate. Thankfully a number of kind customers stepped in and sent chocolates – you know who you are, so special thanks to you all.

As with many other ME suppliers we did not use any aspect of the Furlough Scheme or ask for any Government assistance. We have kept on going throughout because of our customers and suppliers so from Reeves all we can say is 'thank you'.



EXCLUSIVE: Alibre launches Alibre Workshop CAD/CAM

Alibre, LLC has launched a new 3D CAD/CAM product called Alibre Workshop that looks to compete in the hobby engineering space. It is a full-featured 3D CAD system alongside a full-featured CAM system. Alibre claims this new product has the most CAD and CAM functionality for its price class (390 GBP one-time purchase in the UK) of any product on the market. It is targeted mostly at project-building where machining parts from wood, plastics, or other similar materials occurs. A free trial is available at www.alibre.com/workshop.

Alibre Workshop's primary focus is ease-of-use during CAM programming, and Alibre says it is the fastest way to get from model to G-Code. Hobbyists and smaller shops may like the simplicity of being able to focus only on the most important options during toolpath creation, but high-throughput job shops may find the somewhat automated toolpath creation approach to be limiting. Alibre's marketing suggests the product is ideal for individuals and small shops. Alibre Workshop surfaces only the critical options during toolpath creation and makes assumptions elsewhere to minimize the amount of user input that is needed. It also features optional automatic feeds and speeds based on the material, though they can be overridden to any values appropriate for a specific machine, bit, and material.

The CAM software offers various 2.5 and 3-axis toolpaths for roughing, finishing, profiling, and drilling. It has tools to create support structures, toolpath simulation, and the ability to do flip-machining. The CAD allows creation of precise 3D parts and assemblies, as well as the creation of simple 2D drawings.

Alibre Workshop's licensing is a one-time-purchase model, so there is no requirement to pay every year, which may be ideal for smaller shops or hobbyists who want to own their software. Design data can be kept anywhere, including locally on a user's machine. The software does not impose any limitations on use, so you can use it to make money as well as have unlimited projects. The software has good interoperability and can import 3D models from other CAD packages, as well as using image and vector-based machining.

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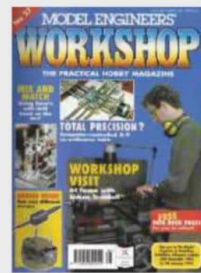
From the Archives:

Three-Way Toolpost

This classic design by Dave Lammas was published in MEW Issue 27, January/February 1995.

Look at almost any modern hobby lathe, and you will see that it comes fitted with a square block toolpost, capable of holding four tools. In practice, you can usually tell anyone who has tried to run their lathe with four tools fitted by the plasters on their hands! Dave Lammas came up with a simple and elegant solution – the three way toolpost, a design that doesn't leave you with a tool pointing straight out at the lathe operator. Dave Lammas was a prolific writer in Model Engineer and Model Engineers' Workshop, covering subjects ranging from quirky models to an advanced hardness tester.

Before you start to say 'Oh no not another gimmicky toolpost' let me state that this design has now been in use by me for a long time and by friends or other model engineers in this country and abroad for almost ten years. I have yet to hear of anyone who has tried the system wanting to go back to the awkward old fashioned 4 way toolpost with all its drawbacks. In fact one user in Australia was kind enough to write in Model Engineer magazine that the designer of the 3-way toolpost should have been awarded a knighthood for



The three-way toolpost originally appeared in ME in 1985, and the design was so effective it became really popular and universally known as the 'Lammas Toolpost', and can be made in a size to suit any lathe. In 1995 a posthumous article in MEW introduced the idea to MEW readers. It's possible to carve one out of a solid block of steel or cast iron, but three sizes of casting are available from Blackgates Engineering that make machining a relatively straightforward exercise.

the greatest advance in lathe design for many years. Perhaps he should have written to some other department because I never did get that knighthood. At a display a few years ago the toolposts were shown together with a notice saying 'Better than a 4-way, quicker than a quick change'. Perhaps at this stage the advantages should be briefly explained. It is well known that the biggest defect of the 4-way is the fact that the following tool fouls the work under certain conditions of use. This means in effect that separate shaped tools must be used for each type of operation, for example

a tool used for plain turning cannot normally also be used for facing cuts, if the toolpost is rotated slightly to bring the turning tool into position for facing the following tool immediately fouls the turned portion, with the 3-way toolpost there is ample clearance even when it is rotated through quite a large angle.

It will therefore be appreciated that although holding one less tool it can perform more operations, in addition anyone who has caught their hand on a sharp cutting edge with the 4-way type will be pleased to know that with the new system there are only two cutting edges to watch out for

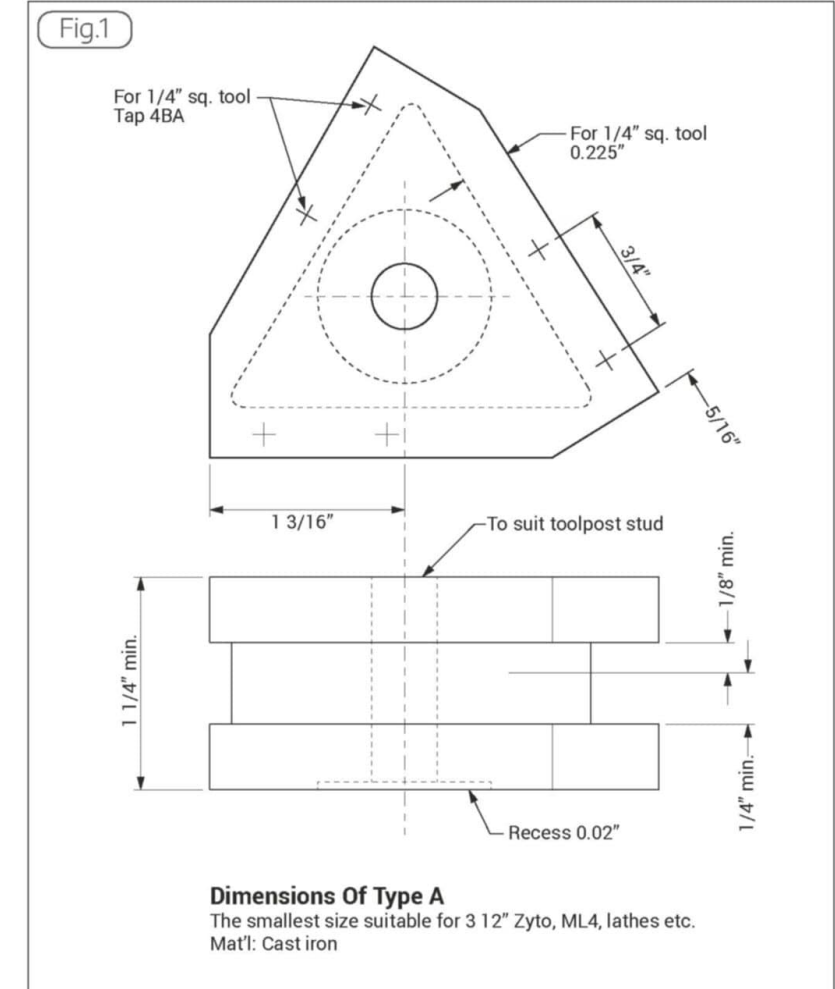
instead of three. Taking the other point regarding speed of use; it is readily seen that a toolpost holding 3 tools can be changed over more quickly than the complete removal and replacement of the single quick change type. There is another important aspect to consider here as well, how many individual quick-change holders do you need to buy to get best use from the System? They are not cheap.

Summarising the advantages of my method we can say:

- 1) Less danger of accidental injury.
- 2) Fewer shapes of tool do more work.
- 3) Fouling of workpiece does not occur.
- 4) Fast interchange of tools.
- 5) Cheap to use because the simple casting can be machined entirely on the lathe with which it will be used.
- 6) Because it is cheap we can afford more than one toolpost. Thus the first is loaded with raked tools for cutting steel or aluminium, the second is loaded with zero-rake tools for brass or cast iron.
- 7) By the same token, one toolpost can be machined 'upside down', meaning that it will then hold tools for cutting towards the tailstock.
- 8) Need another for tipped tools? No problem, just order another casting.

By now I reckon even the most sceptical reader should be admitting there may be something to it after all. If still doubtful just ask someone who has used it for in while, it is a fairly safe that they wouldn't go back to the bad old ways.

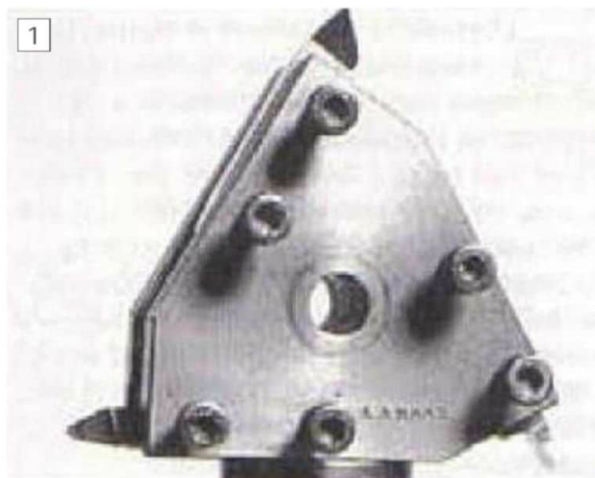
In the first place the idea was developed for my own use but after it had been seen by fellow model engineers requests to 'make me one' came thick and fast. Mine was designed for an ancient 3 1/2 inch



Winfield lathe which is of similar size to the Myford ML4 and the Zyto. Soon I had to design a larger version to fit the Myford ML7 and similar lathes. The casting supplier now stocks three sizes A, B and C. A is the original. B fits ML7 and C is the largest for the Boxford lathe or similar machines.

Construction

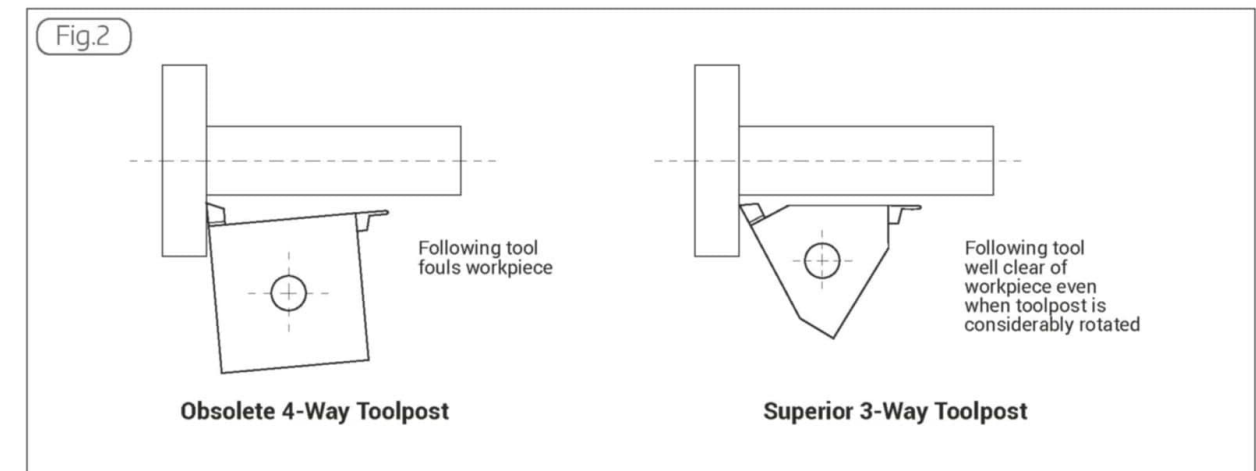
The casting as received is fully shaped but needs machining on all surfaces as indicated on the GA. drawing. The overall size is not critical, just taking of sufficient to clean up is usually enough.

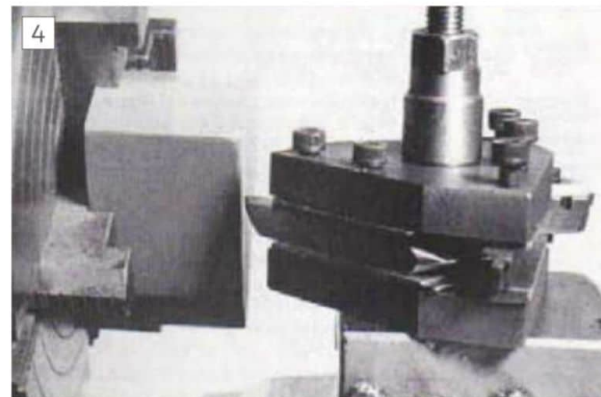
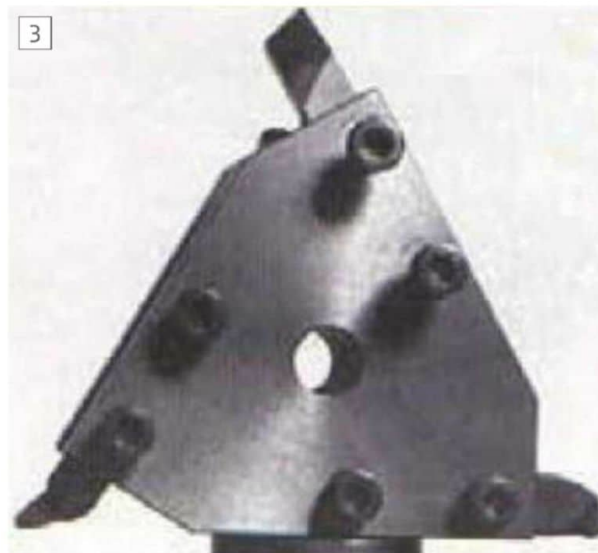


The Lammas Three Way toolpost loaded with raked tools for cutting steel and aluminium.



Another similar toolpost loaded with zero-rake tools for cast iron and brass. Note one holder is loaded for carrying triangular tungsten carbide tips.





Facing the casting in the chuck, using a HSS tool set in a previously made three way toolpost

This version is loaded with asset of tools for right hand cutting.

Facing

Grip the casting firmly in the 4-jaw chuck, top outwards with the base resting against the face of the chuck. Take a roughing cut to remove the skin from the cast iron then take at least one more cut of around ten thou (0.010 inch) to achieve a good finish.

Reverse in the chuck pressing the newly machined face hard against the chuck body and repeat the treatment, this leaves top and base flat as well as parallel to each other.

Marking out the central hole

The diagram for this operation shows where to scribe the lines with respect to the finished dimensions of the toolholder. All drawings refer to type A toolholder only, as detailed drawings are supplied with the castings. When scribing the three lines allow for the fact that at least $\frac{1}{8}$ inch will have to be added to the $1\frac{3}{16}$ inch dimension.

In any case it is quite easy to see if the lines cross at the centre of the

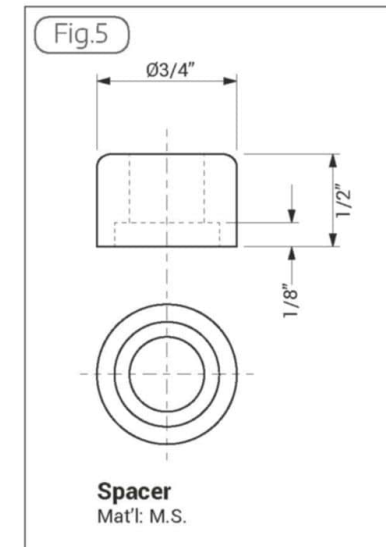
casting. Don't just rely on two line crossing or errors can easily arise, just like navigating a boat in choppy waters when compass bearings apt to be slightly out.

Having found the centre, 'pop' it with the centre punch then drill it through to suit the toolpost stud of you lathe, making it a close though free fit. The recess round the hole at the base is to ensure that swarf does not get trapped close to the stud. The recess does not have to be accurately concentric with the hole so just set it up in the chuck

'near enough', remove about 20 thou (0.002 inch) or so to a diameter of roughly 1 inch.

Machining the sides flat

This can be done, either by flycutting or end milling. Place the casting on the topslide using the toolpost stud to clump it down. It is a good idea to first of all turn and bore the special clamping collar, (Spacer, fig. 5) to be used with the toolpost. Like recessing the base its shape makes certain that a firm grip over a good area can be guaranteed,



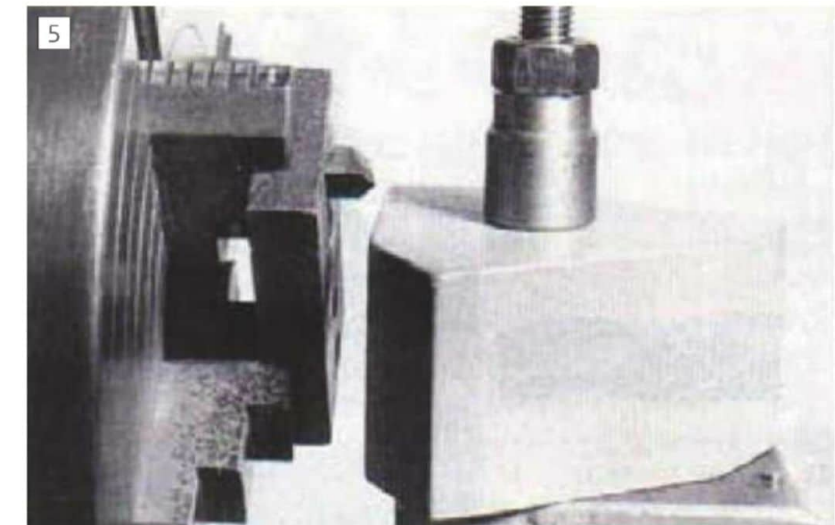
you do not want the toolpost shifting during machining any more than when it is in use for its legitimate purpose.

The endmill or flycutter can be held in the lathe chuck. If it only cuts over a smallish diameter, say $\frac{1}{2}$ inch, it will be necessary to take several cuts with different sizes of packing.

Turn upside down to complete the coverage. A larger diameter flycutter can do the job in one pass. The various sides of the casting are readily aligned parallel to the face of the chuck by placing a rule across the jaws then moving the saddle until one face of the casting traps the rule.

Milling the tool slots

When all the sides are machined flat bring one side up against the tailstock centre to scribe a short lie along it



Flycutting the faces of the casting, which is mounted on the topslide

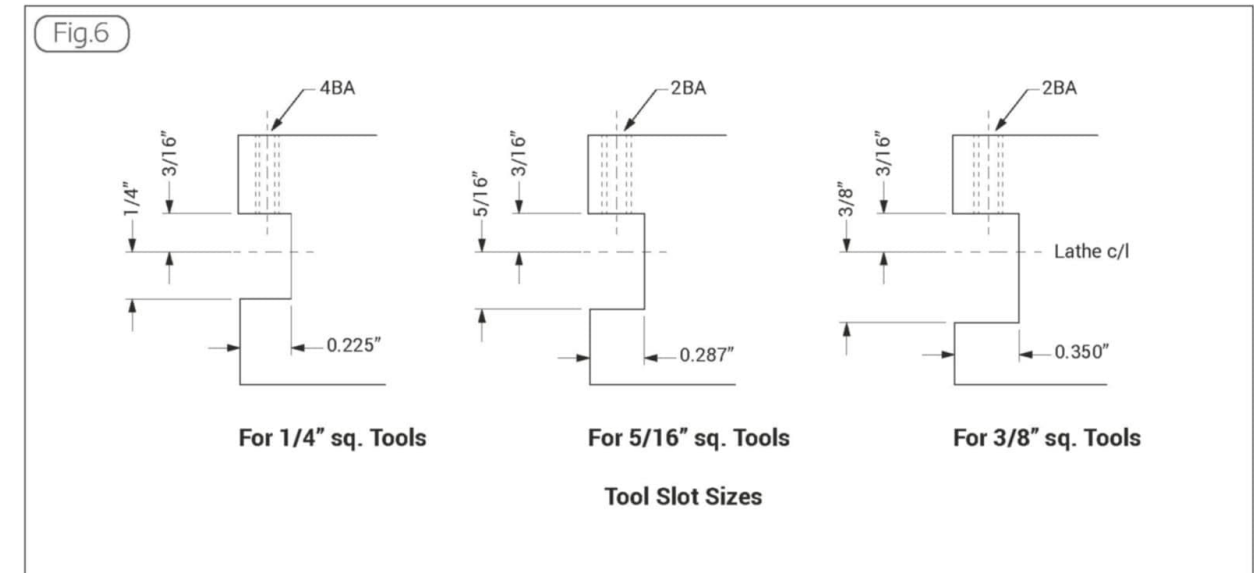
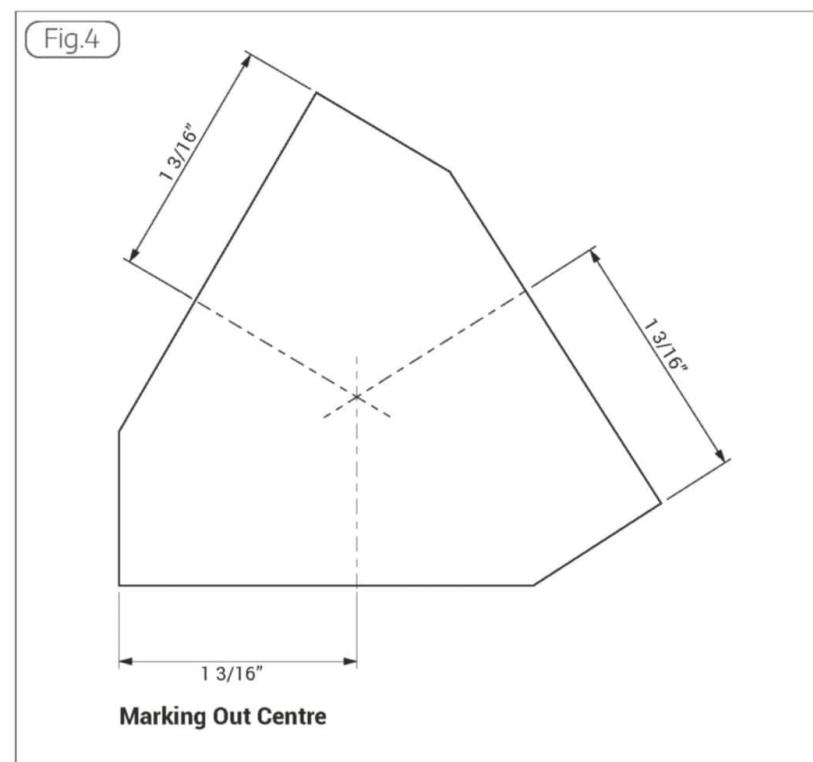
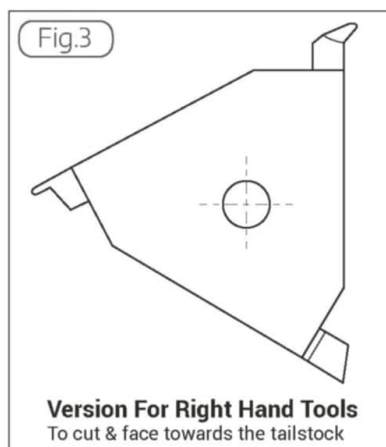
indicating lathe centre height. Now decide what size of lathe tool you intend using- Years ago I bought $\frac{1}{2}$ inch square tools which were reasonably cheap at the time, but as prices increased I changed over to $\frac{1}{4}$ inch square tools, which are perfectly adequate for model engineering purposes. There is four times as much steel in a $\frac{1}{2}$ inch tool as in a $\frac{1}{4}$ inch one and the only advantage with the larger one is that it conducts heat away from the cutting edge more quickly. This might be a factor to consider in industrial work aiming for maximum rates of metal removal but is irrelevant for most of our jobs. So far as rigidity is concerned $\frac{1}{4}$ inch size has always proved to be satisfactory.

Whether deciding on $\frac{1}{4}$, $\frac{3}{16}$ or $\frac{3}{8}$ inch square the rule is that the top of the

tool should be at centre height. As the cutting edge is ground lower in successive re-sharpenings the tool is raised a corresponding amount by thin packing strips below it. At least $\frac{1}{8}$ inch should be allowed above centre height to accommodate this movement.

Therefore another line must be scribed on the side of the toolpost blank $\frac{1}{8}$ inch or so above the line already made, then a third line is scribed below centre height equal to the thickness of the tool. It is only necessary to do this on one side since all three slots will be milled one after the other at the same setting.

If a slot drill or end mill the same size as the slot is available just place packing beneath the toolpost sufficient to raise it so that the end mill coincides with the slot position.



Set the casting parallel to the face of the chuck and tighten down firmly. Since large forces are generated when milling do not attempt to cut the slot in one pass but take a series of shallow cuts around 40 thou (0.040 inch) at a time, this will minimise the risk of movement by the toolpost. The total depth of cut should be about 25 thou (0.025 inch) less than the width of the lathe tools to be used. It is a mistake to have the slots too wide.

Where an endmill smaller than the slot is being used it will be necessary to pack the toolpost up in stages. Take the metal out with a series of cuts as described above, then place more packing below and take a second series of cuts. Retain the packing pieces so that the other slots can be dealt with in the same manner.

Completion of a set of toolposts intended for turning steel, brass etc. as well as one for right hand cutting, is facilitated if they are all dealt with as a batch. For instance, face the top and bottom of all the castings before proceeding to flycut the sides. Flycut them all before milling the slots. Do not forget to turn the 'right hand' one upside-down before marking out and milling the slots.

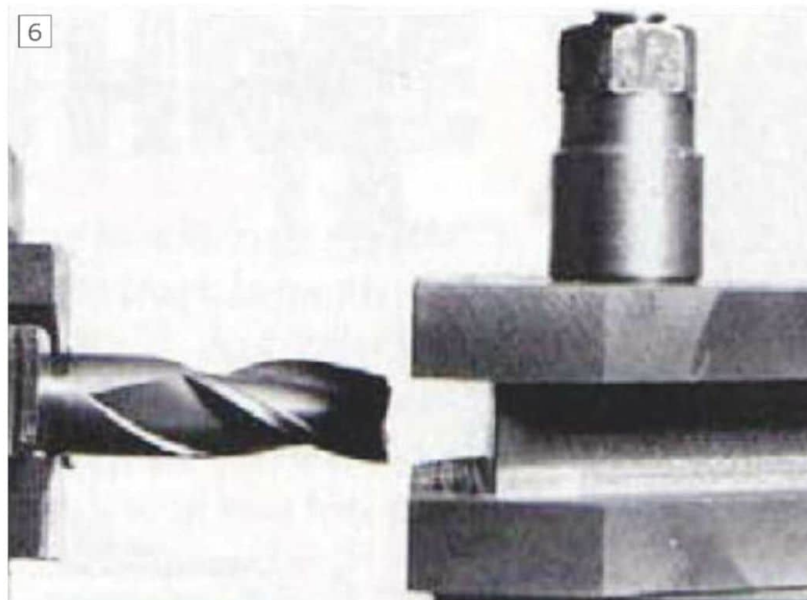
Tool Clamping Screws

The old 4-way toolpost was often fitted with square-headed screws which are rather clumsy looking, some modern toolposts are fitted with socket grub-screws thought by some to look quite neat as they sit flush with the top of the toolpost. Think again about these because they invariably fill up with fine swarf that is not easy to remove, their designer should have foreseen that fault. The best method is to use socket cap-screws which being clear of the surface are far less likely to accumulate swarf. Get some that are not too long though. If using $\frac{1}{4}$ inch square tools in slots milled for that size only it will be best to employ 4BA cap screws. If 2BA were used the holes would be too close to the edge. 2BA is the ideal size for larger slots.

Only two screws per slot are drawn, which is only enough for new or only slightly worn tools. If you want to use short ends of HSS another hole must be drilled and tapped between the existing ones.

Indexing stop

I have not drawn this item partly because I do not use one but also because readers wishing to replace



Cutting the tool slots. This is carried out using an end mill in the chuck. The casting is raised on suitable packing.

their old 4-way toolpost will already have part of the mechanism attached to the topslide. It might then be possible to adapt this to the new 3-way posts or at least to make similar new parts that will fit in.

As mentioned earlier one of the big advantages of the 3-way system is that the toolpost can be used at various angles to the topslide giving greatly improved versatility. It does not always have to be at right angles to the slide. The conventional indexing stop mechanism would probably interfere with this feature. An adjustable stop designed to catch one corner of the toolpost can be fitted to the top of the topslide if ability to return to a pre-set position is deemed essential for certain operations, such as making a large number of small screws for instance.

The tools

Careful selection of a few basic tool shapes will enable one to perform the majority of turning operations without too many tool changes.

A knife tool, round nosed tool and recessing or small parting off tool will handle most jobs. I like to use a more substantial parting tool in a rear toolpost in any case, so perhaps the small one could be replaced by a roughing tool. Loading the steel, brass and right-hand toolposts with a similar selection will go a long way towards speeding up ones lathework, leaving more time to concentrate on the interesting parts of the task

instead of constantly hunting for odd tools of assorted rake angles then wasting time setting them up.

There is no reason why another toolpost could not be kept loaded with boring tools or maybe a boring tool, an internal recessing tool and an internal screwcutting tool. Likewise and external vee screwcutting tool, a square thread tool and a chamfering tool already to hand would be very useful there is plenty of scope in this system.

Storage of toolposts on a rack consisting of short lengths of $\frac{3}{8}$ inch diameter steel set in a wooden block adjacent to the lathe also helps to speed things up, the tool for the job can be selected without having to think about it and changed instantly. How often have you attempted to do a job with the wrong shaped tool just because it happened to be fitted to be fitted in the 4-way turret and it seemed too much trouble to change it?

When you manage to get away with bodging things in this manner it may seem alright. When the job goes wrong and you have to start again from scratch with the other tool, you begin to wish things were better organised. I believe my toolposts will meet this requirement in an entirely satisfactory manner.

Castings supplier

Castings for the A, B and C toolposts are still available from Blackgates Engineering, www.blackgates.co.uk, look under *equip castings*. ■

Improvement to Pan Folder



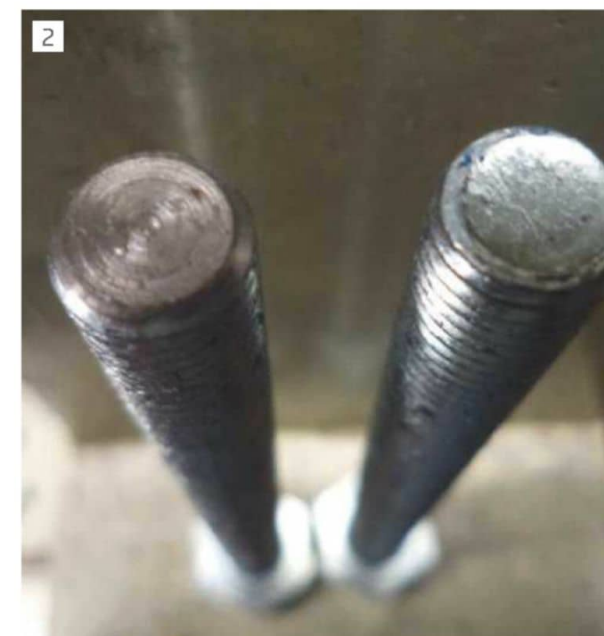
Stewart Hart tunes up a birthday present.

My son asked me what I would like for my birthday, so I asked for a pan folder for folding metal. "No problem" he said; a couple of weeks later he said he was having problems getting a metal folder he could only find plastic ring binder folders. It made me wonder where I went wrong with his upbringing, I ended up ordering the folder myself, and billing him for it.

I want the folder for doing the plate work on the 5 inch gauge Horwich Crab I'm building, I ordered a 24 inch version just to give myself a bit of extra capacity. So that I could store it under the bench I bolted it to a length of box section allowing me to grip it in the 'work mate'. To test it I tried bending a 16 inch length of 1.5mm thick mild steel sheet. I was disappointed in the result, it didn't give



Witness mark showing the bolts had slipped.



Drillin Bolts before and after facing off. g steam passage.



Drilling ex Locating Washers tack welded in place. haust passage.

a nice sharp bend, the bar that clamps down on the sheet had moved with the bending pressure. On inspecting the clamping arrangement, it became obvious what was happening. The bolts screwed down onto the flat face of the clamping bar, you could in fact see a scrape mark on the new paint where they had slipped, **photo 1**.

To fix the problem I first faced the end of the bolts off flat, **photo 2**, being thread rolled their ends were slightly concaved and uneven not helping the situation. I then made some 5mm thick washers and tack welded them to the bar for the bolts to locate into and stop them slipping, **photo 3**. I then repeated the test this time I got a nice sharp bend – problem sorted, **photo 4**. ■



Pan Folder mounted on 'work mate'.

Theasby's Wrinkles Rubberised Grips



Geoff Theasby gets a handle on small tools...

I have accumulated several hand tools, pliers of various types, etc, and overheard some comment whilst out and about regarding liquid rubber. I had previously tried fabricating a paper tube and filling it with bath sealant, but it was too viscous, and a tool dipped therein came out all lumpy and unattractive, although it didn't drip whilst drying.

I looked up the price of liquid Neoprene, £21 for 250 ml. PlastiDip is similar, but still £15 per 250 ml. However, liquid latex is just the job, at £11 per litre. A short length of 20 mm diameter pvc pipe, plugged at one end, is held rigidly and upright, say, in a vice or clamp out of the way. This is filled with latex and the tool handles dipped in and put aside to dry overnight. Small ones first, then larger ones as the level falls. This is repeated over several days and the coating, which does drip a little, dries to a transparent, non-slip finish. It is also said to be an electrical insulator and has other useful properties.



Four sets of pliers with dipped handles.

Photograph 1 shows the results, mostly with one leg uncoated to show the contrast. There are a few lumps

were the coating has accumulated whilst drying, but it is much better than the first try. ■



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At this time, we would usually be announcing our next Warco Open Day. With the current Covid-19 restrictions it is not possible to hold this popular event. In the meantime, please view our Used Machine list on our website. Our showroom is now closed to the public.



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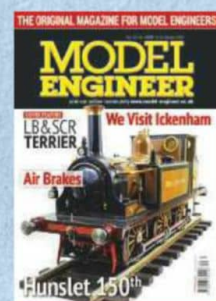
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From the Archives:



S C R E W S

and how to fit them

AS COMMON FIXING devices, screws are often taken for granted. vet on their correct choice and fitting depend the good appearance and soundness of construction of work in which they are used.

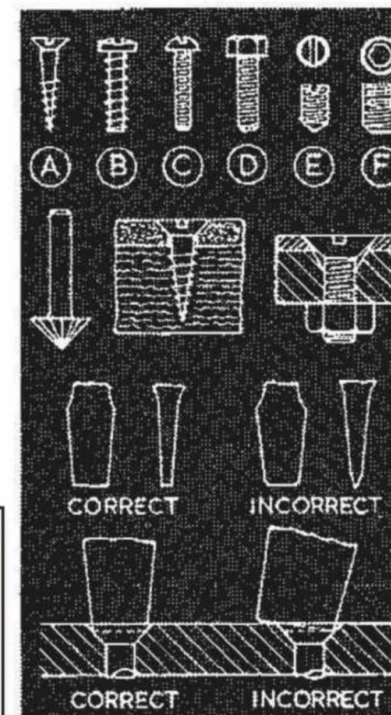
As is well known, they are of various sorts, shapes and sizes, those illustrated being the most frequently used. The woodscrew *A* may be in steel or brass, with a countersunk, round, or cheese head, or with a raised head, partly countersunk, partly round – often used in fixing interior panels and fittings in cars, when the head is chromium plated. The countersink angle is 90 degrees. Large screws with square spanner-heads are screw bolts, or coach screws; dowel screws have a thread each end and no head.

These articles by Geometer (Ian Bradley) were written about half a century ago. While they contain much good advice, they also contain references to things that are out of date or describe practices or materials that we would not use today either because much better ways are available 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.

The self-tapping screw *B* is in hardened steel, and can only be shortened by grinding. It may be provided with a countersunk, round, or sun head – partly rounded. This screw is used for fixing sheet metal panels. The outer panel (or part) is drilled clearance for the screw, and the interior panel drilled the core diameter. The screw is then forced through, cuts its own thread and pulls tight. It is often used for minor fittings in motor bodies. In other than sheet metal, it can only be driven a limited distances.

The ordinary metal screw *C* has a thread like a bolt, and a countersunk, round, or cheese head. It can be in steel or brass. When provided with a hexagon head *D*, it is a set-screw or sometimes a set-pin. Its uses are widespread.

The grubscrew *E* has a 120-deg. pointed end and a screwdriver slot. It is commonly used for fixing collars,



and small wheels to shafts. the bosses being drilled and tapped to take it. It has the most neat appearance when just flush with the boss.

The headless socket screw *F* has a hexagon socket to take a key or spanner to tighten it. It is used much like a grubscrew, but can be obtained with a variety of ends – pointed, oval, hollow, flat, and with a small plain portion, when it is termed a dog point. It is in hardened steel.

Choosing the screw

The choice of screws is narrowed by the materials being fixed, their thickness, and where the screws will be placed. Woodscrews can only be used in wood, suitable plastics, or similar materials. Self-tapping screws can be used on occasion in these materials and in sheet metal. Metal screws and setscrews can be employed in tapped holes, or in clearance holes, and for wood, etc., when nuts and washers are fitted.

The length of screw is often governed

by the thickness of materials – a woodscrew, for example, should not penetrate a panel for the point to emerge. Similarly, the size is frequently governed by the thickness of the material into which a screw enters edgewise, both from the point of view of splitting the material, and to obviate the head of the screw over-lapping the edge.

In the case of grubscrews, they should be large enough to secure the pulley or collar firmly, but not so large as to distort or split the boss.

Countersinking

Two countersinking drills (or rose bits) are required, one for metal, one for wood. The one for wood will not cut metal, and the metal one may chatter in wood. Drills with only two flutes may be used with discretion in metal, when the angle has been altered.

Before countersinking a clearance hole should be drilled, then the countersink run in so the head of the screw will just lie flush – for which operation care is required to produce neat, uniform work. The continuing hole for a woodscrew may then be made with a bradawl, if the screw is small; if lame, a core drill should be run in. This is important for hardwoods in which screws can be wrung off in fitting – particularly brass.

In larger sizes, woodscrews are smeared with grease when fitting – to enter and remove easier.

When a metal panel is being fixed with countersunk screws, a countersink with a more acute angle can be used on occasion; the screw head will then bite on and hold the panel more firmly. An altered drill can be used for this type of countersinking.

Correct screwdriver

The width of the blade of the screwdriver should be almost the diameter of the screwhead, and its thickness so as just to enter the slot in the screw. The blade should be square and flat, not rounded at the ends, or sharpened like a chisel. A blade which is too narrow will damage the screw head, and may be twisted or broken itself, while one which is too wide will not drive the screw properly, and will score the surrounding surface.

New Bearings for a Tom Senior Vertical Milling Attachment



Laurie Leonard decided to fit new bearings to the arbour of his M1 Vertical Milling Attachment.

My Tom Senior M1 seems to have had rather a rough life before my time. I have undertaken several projects to refurbish various aspects of it, and I have managed to actually mill metal with it on occasions.

I was about to use the mill to make a part for a cross drilling jig, as described in an article in MEW, but the previous job on the mill had required the vertical attachment to

be swung to the horizontal position. Having swung it back I thought it was good practice to check that indeed it was vertical. A simple check with a clock gauge and a Morse tapered parallel test bar, **photo 1**, was deemed to be in order, a two minute task, then on to the milling job. In the process of this check I happened to put pressure on the test bar and noticed a significant deflection on the clock gauge. Looking further into it I found

that there was play amounting to a good five thou. Although not critical for the job in hand I could not ignore it so took the head off for investigation.

Bearing Replacement

With the head removed from the mill it was a case of dismantling it to look for the play. Removing the front cover of the input shaft gives access to a hex nut which, when removed, permits the drive gear to be removed

from the input shaft and hence the removal of the shaft.

Photograph 2 shows the view into the casting after the drive shaft had been removed. With this clear and the two end covers removed from the arbour, the latter assembly can be removed from the housing.

A peg spanner nut, shown in **photo 3** taken during rebuild, secures the drive gear and clamps the inners of the bearing races to the arbour shaft. As is always the case, no peg spanner with the right span was available so one was made as shown in **photos 4** and **5**. Note that the nut is split and an Alan screw is used to lock the nut after tightening. With nut removed the assembly can be dismantled. A bearing puller is required for this operation and the one I had to hand, part commercial and part homemade, is shown in **photo 6**.

Photograph 7 is an exploded view of the parts when removed (a simple statement but it was not that simple to get them apart). A close up view of the two bearings is shown in **photo 8** where the numbers can be read. There seemed to be a lot of play (see discussion later) in the Morse taper end bearing and it felt rough, so I set out to trace replacements. This proved to be interesting. I noted that each bearing carried the word "thrust" marked on it. I have not met this before. Each bearing had the letters 'ACD' as part of the bearing number and this is critical as it appears to turn the bearing into a thrust, angular contact, bearing instead of a simple race. The bearings were not that readily available, different suppliers having one and not the other. Also, over time the numbering had changed. There was also the choice of budget versus named manufacturers. I had previously put new main shaft bearing in the mill and had argued at the



Underside of Peg Spanner.

time that my use did not warrant the difference in price between budget and named. Having had two budget bearings and rejecting both (rough) I ended up paying for the named bearings, so this time I went straight for named bearings.

Rebuilding was relatively straight forward. Before the end covers were removed from the arbour they were marked, **photo 9**, so that they could be put back in the same positions. Probably not required but it is possible that the three fastening holes were not in fact symmetrically drilled such that the covers would only go back in one position. The covers themselves are shown in **photos 10** and **11**. The



Bearing Puller.

cover in photo 10 fits on the draw bar end as shown in photo 2 and the cover in photo 11 with the oil seal fits on the Morse taper end shown in **photo 12**. When this photograph was taken the shaft assembly had not been pushed fully into the housing hence there does not seem to be enough room for the spigot on the cover.

So far so good but I had managed to damage the thread on the end of



Checking that the Head has been Set Vertical.



View into Casting with the Input/Drive Shaft Removed.



The Peg Spanner Nut.



Top of home made peg spanner..



Close up View of the Removed Bearings.



Marking the Cover to Ensure Correct Re-assembly.



Plain housing cover.



Housing Cover with seal.



Morse Taper End of Head.



Damage to Shaft Thread.

the shaft, **photo 13** when removing it. This was cleaned up later prior to re assembly with a needle file.

The input/drive shaft, shown exploded in **photo 14**, was re-assembled and its cover replaced to complete the job.

Discussion

All the work was relatively straightforward but there was more thought and research in the project than the above suggests.

Firstly, I mentioned the play in the Morse end bearing. Having ascertained

that this was an angular contact bearing then 'loading' it i.e. tightening the inner axially in relation to the outer of the race may well have got rid of this play. Examining drawings found on the www.model-engineer.co.uk forum it could be seen that there is no direct means of adjustment other than using shims or machining one of the spacers. Note that although the internals of my head were similar to those shown in the drawing the size of the spacers differed as can be seen in photo 2.

As the bearing was rough, I decided that a replacement was in order and to consider the loading from there. Threads on the above web site discuss this together with a means of locating the arbour shaft and its bearings. The question of the required loading was also discussed but I found no definitive answer there or generally on the web, so I referred the point to the bearing manufacturer. To test my rebuild I re-assembled the head with some new grease and when nipping up the final end cover I rotated the arbour to see if the nipping was loading the bearing. Initially I found that it made the arbour very hard to turn so undid the cover



Input/Drive Shaft Assembly 'Exploded view'.



'Calibration' shim material in place.



Checking the Gap between the Cover and the Casting at One of Three Points.

and re tightened. This time it was better but still stiff. I have previously found that the oil seal imparts quite a drag, but the stiffness was greater than this. Arguing that the loading would have been set on initial build by machining of the components and that bearings are precision components so my new bearings should be the same size as the originals, I hardened the covers up. Using the variable speed drive, I then ran the mill at slow speed and checked for noise and bearing temperature increase before cranking up the speed. The bearing cannot be physically touched directly but the housing ends had always got quite warm. With the new bearings there was only a slight increase in temperature.

The manufacturer agreed that the initial loading was probably built in by machining the spacers and offered to produce new ones. I declined the offer using the 'like for like' argument above.

I ran the mill for a while in this condition but was concerned about

the finish and play could still be detected at the cutter. What next? I decided to increase the loading on the angular contact bearings but how and by how much?

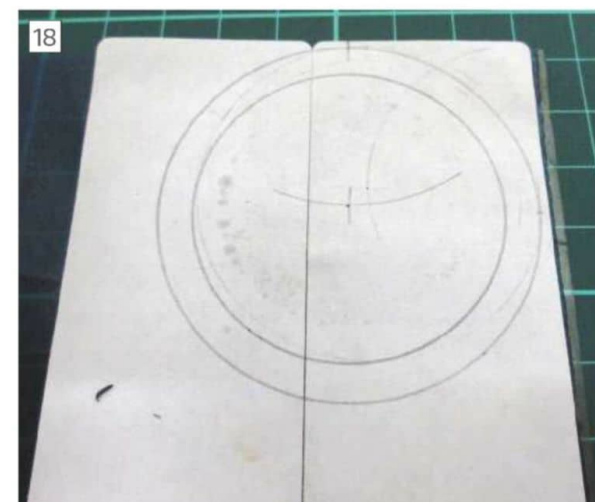
I cut three pieces of steel shim and positioned then as shown in **photo 15**. I then carefully tightened the end cover down so as to load the bearing evenly whilst turning the shaft until there was a noticeable increase in the tightness of the shaft. At this point feelers were used to measure the gap between the cover and the casting near the location of each securing screw to ensure that the cover had been tightened down evenly, as in **photo 16**. Subtracting this reading from the thickness of the steel shim gave the thickness of suitable loading shim which was in the order of 2 thousandths of an inch. I had a stock of plastic shim (I do not like the idea of plastic shim either but it seems to work) and proceeded to cut a plastic shim. To assist with the cutting I stuck self adhesive labels to a piece of the shim



Self Adhesive Labels Stuck to Shim Material.

material, **photo 17**. The profile of the shim was then drawn onto the label, **photo 18**, and the shim carefully cut out, **photo 19**, and then removed from the backing paper, **photo 20**.

The head was reassembled with the shim in place, **photo 21**, and the new configuration tested. Slight play still seemed to be present, so a



Shim Profile Drawn onto Label.



Shim/Label cut Out.



Shim with Label removed ready for fitting.



Shim in Place on Race Outer.

further shim was cut and added. This time the play had gone but the head ran hot. I have concluded that this may not have been "that" hot but bearing in mind (sorry about that!) that the temperature was being felt at the casting and not at the bearing itself I removed the additional shim and retested the set up with a clock gauge on the cutter chuck and loading the latter by hand. No slop could be detected by feel and the clock reading only changed by about half a thou. I did not have any one thou shim to see if this would make an improvement and decided to leave well alone.

Secondly there is the aspect of spending money on an old machine. To date I have put new bearings in the main mill shaft, fitted a variable speed drive and a DRO system. Quit or spend more? I argued that having got this far the £100 for the new named bearings was needed as it is in the vertical mode that I use the mill the most. Unless I was going to accept the potential error from the play it had to be done, I add enough errors myself without having one built in!

On the negative side it is questionable how long the mill will go on for after such an investment as

the gears in the head are quite worn, see photos 2 and 7. I argued that the remaining life of the mill should see me out. I see little chance of getting replacement gears at reasonable cost (or making them).

Conclusion

Not a definitive outcome to date due to the bearing loading question but in service the play seems to have gone. The head does not get anywhere near as hot as it used to, but the bank took a bit of a hammering. ■

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**MODEL
ENGINEER**

- **Britannia**
Norm Norton makes a new ashpan and grate for his Modelworks 'Britannia' locomotive.
- **Lister Engine**
David Churchman builds a half size model of a Lister 'D' stationary engine.
- **Tree Tops**
John Arrowsmith recalls a very hot August day spent at the Tree Tops Railway in rural Buckinghamshire.
- **Wenford**
Hotspur completes a set of lamp brackets for his 7¼ inch gauge Beattie well tank.

Content may be subject to change.



Drilling Holes on a Diameter



John Garnish shares an idea used by REMAP, the charity which helps people with disabilities achieve greater independence by accessing the skills of local volunteers across the UK.

Our work for REMAP often involves drilling rows of accurately spaced diametral holes through telescopic tubing, to provide length adjustment on crutches, walking frame legs, walker handles and the like, **photo 1**. The holes must be accurately on a diameter to ensure that the locking clips will pass through both tubes. It is difficult to do this accurately by hand, and certainly very fiddly to set up, especially when an array of holes is needed.

Fortunately, the slots on the mill/drill table provide a quick and easy solution. Choose a short stub of rectangular steel bar that will rest on the shoulders of the slot and set a small vee-block on top. I was lucky enough to find that everything fitted



Leg extensions.

as it was, but it would be a simple job to machine the block to fit both slot and vee-block. With a pointer in the drill chuck, align the table on the Y-axis so that the drill will be over the centre of the vee-block, **photo 2**. Alignment by eye is good enough for this particular application (say, ±10 thou) but other more accurate methods can be used if required. This need be done

only once. With a second vee-block set up in the same way, alignment is automatically ensured by the slot in the mill table, **photo 3**.

With these components available, it takes less than a minute to set up and clamp a tube with the assurance that every hole will be exactly on a diameter (as accurately as the table was set in the first place!) ■



Setting a vee-block.



Drilling a walker handle.

ON SALE 4 DECEMBER 2020

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Scribe a line

YOUR CHANCE TO TALK TO US!

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

Colour and the November Issue

Dear Neil, What has gone wrong with the colour reproduction in the November 2020 issue?

From the cover onwards, a high number of pictures are heavily yellow biased!

Initially, on the cover, I thought it was showing the milling of wood, not iron or steel!

On other pages I assumed it was brass or bronze being shown, but no, the text said steel or cast iron!

Usually, these are shown as having a bluish tint, but never yellow unless it's something rusty.

This miscolouration is general through all the editorial matter, but not the adverts.

Davina Elaine Hockin, Portishead

Hi Davina, That's most interesting. I am viewing my copy under diffuse daylight which can make a big difference. Looking at the cover, it looks OK here, but there are effects like the famous blue/gold dress or Billie Eilish's trainers that mean one person's interpretation of an image can be very different to someone else's perception.

Our photos are often hard to colour balance due to the preponderance of large flat areas of neutral colours and the fact that most are taken by amateurs under uncontrolled ambient light - often a mix of light sources. The ads are usually taken under studio conditions by a professional.

As you can imagine our designers do their best to retouch images to get a good balance, but sometimes it's a struggle to get some images to look right. On the whole, we try to balance the images in a single article similarly.

It's possible that there was an issue at the printers although the output is automatically monitored continually and checked by eye on a sample basis, we sometimes get a few odd copies.

It will be interesting to know if other readers have perceived the same effect - Neil.



Mystery Item

Dear Neil Richard Arwel's mystery item (MEW 297) is really no mystery at all. It's 'THE UNIQUE' dial gauge (British patent No. 23947-11), predecessor to the ubiquitous DTI of the modern era. It uses a spring-loaded lever to translate a small movement of the button into rotational movement of the indicator arm, instead of the rack and pinion gear of the DTI. Its end to end deflection is 15 thou. I inherited a similar one, which saw many years of use by my grandfather, who was a toolmaker. When I was about eight, I was instructed in how to centre a workpiece in a 4 jaw chuck on his home-built treadle lathe, using this very indicator.

Richard Palmer, by email

Archive Articles

Dear Neil, I recently came across an old copy of Model Engineer from January 1980. Inside was an interesting article by Don Gordon entitled 'High Precision Low Cost'. The theme was scaling up techniques and tooling used by watch makers to sizes more appropriate for the Model Engineer. The article is the first in a series which I think would interest many MEW readers. What do you think about running the series again in From the Archives?

Joe Harland, Melbourne, Australia

Hi Joe, I will look into this, in principle it seems possible. Do any other readers have suggestions? - Neil.

Cutting High Speed Steel

Dear Neil, you asked for readers' ways of doing this. I have an old Wolf angle grinder set up in a pivoting stand bought some years ago - pictures attached.

The stand was rather cheaply made but with some fettling it works well enough, including the rather ingenious cam-operated vice. I'm using the 1mm thick cutting discs sold by Bosch; with patience, they cut HSS bits OK and there is relatively little waste of an expensive material.

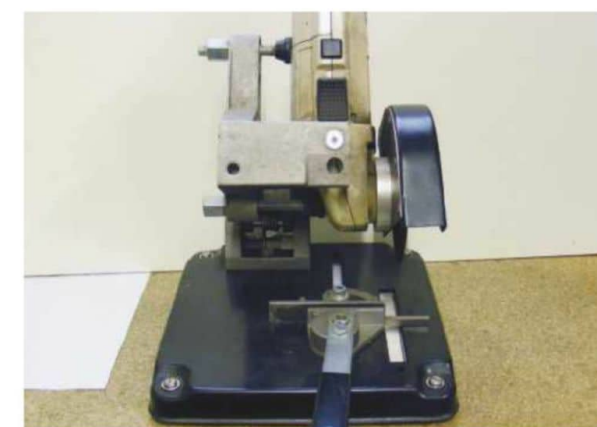
I haven't seen the stands on sale recently but there seems no reason why they should not still be available. In use, of course, the resultant stream of sparks is away from the operator and, we hope, from any flammable material.

Power to the editorial elbow at a difficult time!

George Winspur, by email

P.S. I'm enjoying the archive material. You point out how soldering has changed and I wondered whether some details - flux and solder composition, techniques, etc - could usefully have been included.

Thanks George, I wonder if any readers could offer articles on how different aspects of our hobby and engineering in general have changed over the years - Neil.



Scribing Block Identified!

Hi Neil, apropos my article on Covid/ workshop, when re-examining the vast scribing block last week, I found a small metal label that had fallen off it (which I have remounted on it). Which identified the make and model for those interested. It is a 'KINEX' manufactured in Czechoslovakia with a model number of: - UN 25 1857, BO/11. Should I ever need to 'mark-out' something the size of an 8" centre height lathe casting or a 5ltr 6cyl Diesel engine block it will be very useful...

Peter King, New Zealand

Tailstock DRO

Dear Neil, I read with great Interest the 'Tailstock DRO' by Duncan Webster. I would like to know a lot more about this device with a view to making one. Will you be doing an article on this?

John Chappell, Australia

Hi Jim, I've bent Duncan's arm ever so slightly and he is preparing a brief article. - Neil.

Using Alibre Atom3D

Dear Neil, as a subscriber and regular reader of MEW, I always look forward to getting my copy in the post, I wonder if you can help me out. I followed up on the Alibre Atom3D software free trial and was very impressed, especially their tutorial, and also the articles which were published in editions 274 to 279 of MEW. I have now purchased my own copy of the software from Mintronics as the lockdown provided the opportunity to learn a whole new skill and 3D printing.

I have a fair experience of AUTOCAD which I used professionally until I retired and one of the useful features was the ability to use function keys to flip on and off features like grid, on/off object snap, grid snap, ortho etc.

Are such features available in the ATOM software? Has anyone discovered any short cut features, either by function keys, or soft keys such as CONT/X for example during use of the package? I know how to get grid snap on and off by going through the features menu, but it is not as fast as using a function key.

I feel that these features, and many more, probably exist and are used by the professional Alibre users. I wondered if you or others users have found any useful hidden tricks?

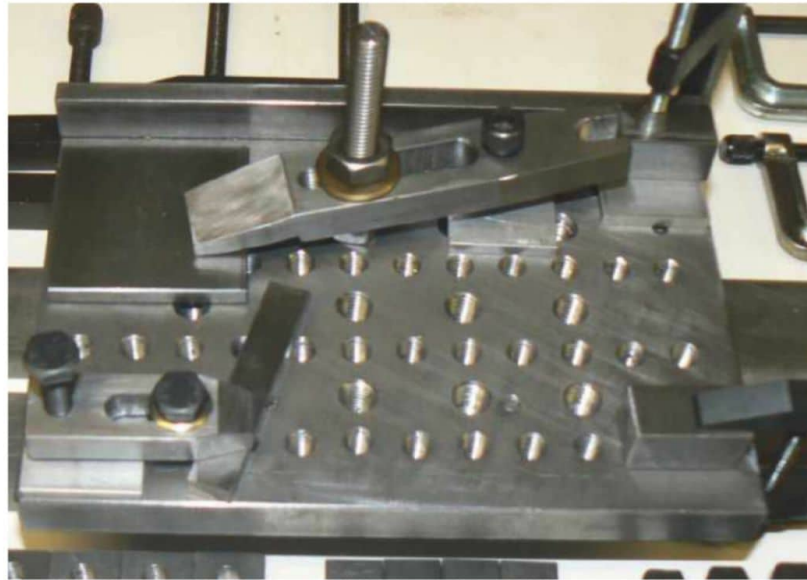
Vic Whittaker, by email.

Hi Vic, As the 'hobby' version of Alibre, Atom3D doesn't have all the features of its bigger (and more expensive brother) but as I and others have found it does seem to meet the needs of many hobbyists. I'd be happy to receive any Alibre Atom3D tips or ideas from readers - Neil

A Work-holding Sub-Table

Rod Renshaw makes an accessory to improve accuracy and convenience

The sub-table is very useful for small or awkwardly shaped workpieces which can be difficult to clamp securely and in the correct orientation to the drill. This happens a lot in repair work where a part of a domestic item may have all curved surfaces. Clamping such an object may require carving a recess in a piece of wood into which the object can be clamped down. It's often a time-consuming and irritating task to get the object both secure and correctly aligned. It may be easier in difficult cases to do this with the sub-table on the bench. Once the object is clamped securely to the table, the whole sub-table can be slid around on the drilling machine table to enable positioning under the drill. If multiple holes need to be drilled the difficult clamping operation only needs to be done once, and the holes must be parallel to each other. The sub-table is held by its feet to the table of the drilling machine by the clamp, and the clamp is clamped up tight before each hole is drilled.



The sub table.

The use of the sub-table can be developed further, by those workers who think they may find the ideas listed useful. Not everyone will want to

use these ideas; it depends very much on the work to be done and the other machines available to do it. Those workers with fully equipped machine shops will not need to improvise like this but everyone has to start somewhere and most start with a basic set of kit.

So, ideas for extending the use of the sub-table:

A BMS flat is clamped to the drilling machine table with small g clamps or toolmakers clamps, parallel to and touching the side of the sub-table foot, to form a fence. The flat is generally use is $\frac{3}{4}$ " x $\frac{1}{4}$ " by 12" long but anything will do as long as it is reasonably stiff and has one straight edge. Then by sliding the sub-table along the drilling machine table and at the same time keeping the side of the foot pressed against the fence, (slackening the clamp for sliding, and then clamping before drilling each hole) - then a series of holes can be drilled in a straight line. I find it simplest to position the fence from side to side across the table of the

drilling machine but it does not need to be accurately aligned, just firmly clamped, **fig. 3** and **photo 5**.

Take precautions against swarf getting between the sliding parts, temporary aprons made of paper and duct tape can be tried, and I find an old toothbrush useful.

Square off one end of the fence illustrated in **fig. 3** and measure the displacement between the end of the fence and the end of the adjacent foot using a depth gauge or the step facility of a digital slide gauge. Start off with both ends in line if possible, to simplify the measurements and arithmetic. I find it useful to keep written notes so I get the spacing correct. This will enable a series of holes in a straight line and at fairly precise distances apart to be drilled, **fig. 4**.

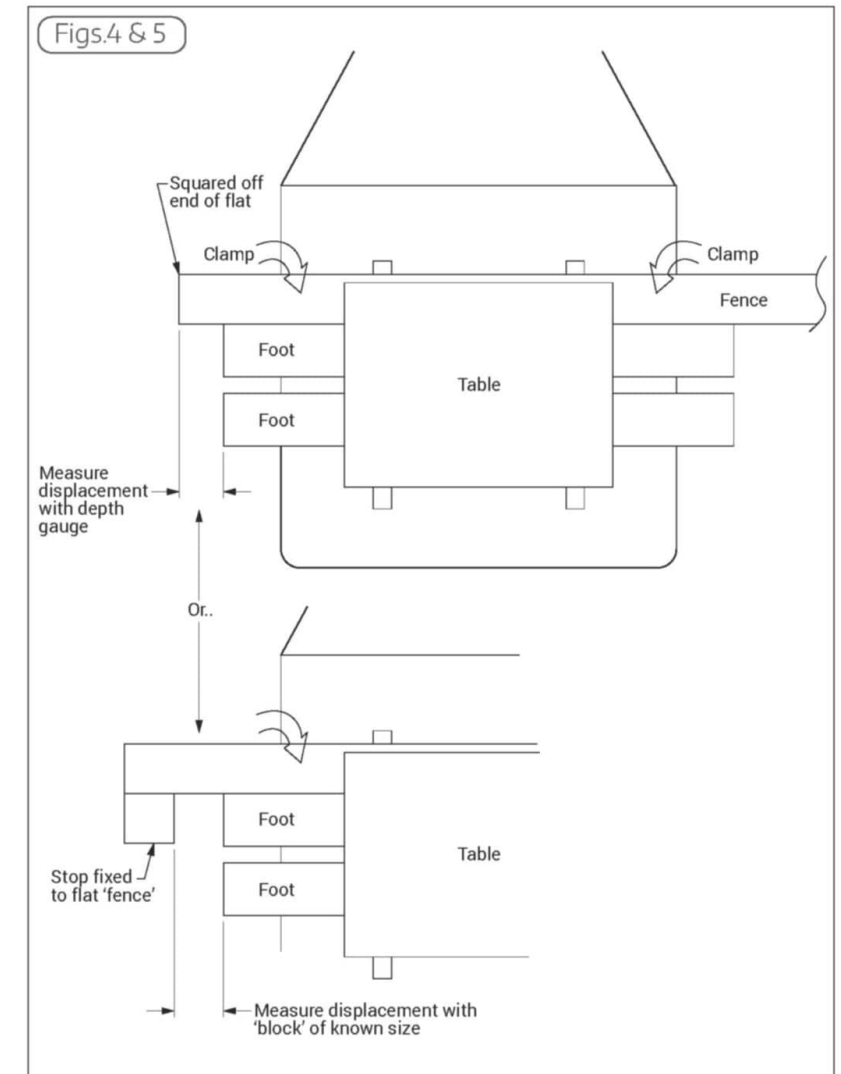
Alternatively, one could use a small block secured near one end of the fence to form a stop. Then a series of improvised space blocks can be inserted between the stop and the end of the foot to control the displacement of the sub-table, **fig. 5**. This is a useful idea for repetitive work.

Without unclamping the fence, insert a piece of flat stock between the fence illustrated in figure 3 and the side of the foot. This moves the sub-table forward by the width of the stock and enables a second row of holes, parallel to the first row, to be drilled, **fig. 6**, this step can be repeated for additional rows but the depth gauge and/or measurement stop arrangements will have to bridge an increasing gap between fence and foot, so plan ahead for this.

If you don't have a long piece of stock the right width or thickness for the displacement you need for the second row of holes, then file or machine a short piece to the right size, cut it in two and use these two pieces as space blocks between the fence and the sub-table foot, positioning one block near each side of the drilling machine table. Alternatively, turn a piece of scrap in the lathe to the needed diameter, part off two thick slices and use these 'rollers' as spacers. Or look around to see what you have that is the correct size that you have two of - old bearings, rollers out of old bearings, bits of silver or precision ground steel too short for anything else, even nuts (as in bolts!) Or coins may be the right size. It can be a little awkward to ensure the spacers don't get lost as you slide the sub-table along but the trick does work. Save the blocks or rollers, keep them in pairs, they may be useful again, **fig. 7**.



Use with guide. Use with guide.



How I Became a Contributor to MEW



The name of Peter Shaw will be familiar to regular readers of MEW, in his 'lockdown story' he explains how this came to be.

Let me introduce myself: my name is as above; at the time of writing, July 2020, I am 77 years of age; six years ago I had a mild heart attack and had two stents fitted; 12 months ago I was diagnosed with lung cancer and placed on a form of chemotherapy; and now I am under lockdown due to Covid-19 (Coronavirus), which, if I do become infected, will almost certainly be bad news. In educational terms I achieved three GCE "O" levels, none of which was English, and a City & Guilds Full Technological Certificate in Advanced Telephony and Digital Elements & Switching Principles. Those are my paper qualifications, which you understand, do not in any way reflect what I have learned both privately and at work and for which there are no certificates.

So why am I writing this article? Well, for as long as I have been taking MEW, there has been a constant call from the Editors for articles, and short articles in particular – it seems that long articles are plentiful. My aim therefore is to show that you do not need to be an engineering genius to be able to become an author for MEW. In fact, all you need to be able to do is to have the ability to write up your engineering based project, no matter how simple, in a manner which readers can understand. You do need to be able to produce reasonable drawings and take reasonable photographs. You absolutely do not need to have a degree in engineering or indeed in any subject, neither do you need the latest AutoCAD release – I use a CAD program dating from 2006, but reasonable hand-drawn drawings are acceptable as they will be redrawn by the in-house team. Nor do you need the latest camera – my camera is best described as a cross between basic point and shoot, and professional, but you do need to be able to produce photographs which are blur free,

sharp and clear and with a minimum resolution of 3 megapixels.

A further concern you may have is that you will find that there are people who know a lot more than you do. Do not let this worry you, it may be that your project may contain a different way of accomplishing something, or a method of achieving a result when the obvious method cannot be used. Above all, remember that the ME fraternity in addition to the experts, also consists of people just starting out and to whom a certain procedure may be new.

In addition, I want to show that I slipped into Model Engineering almost by accident, certainly when I first started down this trail, I had no idea that I would eventually have a number of articles published in MEW.

The Early Years

In 1954 I entered my local grammar school where during the next three or four years my craftwork teacher showed us the delights of 2D drawings, soft soldering of tinplate objects, making wired edges, screwcutting with a die, brazing using a coke hearth for heating, and very basic usage of the school's Portass lathe. Craftwork was not only metalwork, but covered woodwork as well, and it has to be said that the principles that teacher imparted in both woodwork and metalwork have never left me, not that I was particularly good at either subject, but at least I was aware of the basics.

In 1959 I left school and started work as an apprentice telephone engineer and hence all forms of craftwork ceased until 1971, when I joined a specialist group where production of one-off metal cases to hold specialist equipment was a necessity. As part of this I had to learn how to tap holes in bar material, mainly 2BA, 4BA, 6BA and 8BA. Unfortunately, I did not know about the need for tapping drill sizing and thus managed to break a

number of taps. This situation was only rectified some 10 or more years later when a colleague who was also a Model Engineer told me about Tubal Cain's *Model Engineers' Handbook*, and Blackgates Engineering where at their Drighlington shop I found Len Mason's book *Using the Small Lathe*.

Getting into Model Engineering

By the 1980's, I had also acquired all the trappings of family life – mortgage, run-down car, two children, permanently hungry Labrador etc., and then my son and I decided to build a modern image OO gauge model railway in the loft. We bought a number of different models one of which was a Class 45 diesel. What we did not realise was that this model was meant for finescale OO gauge modelling, not the relatively coarse scale we were using. As a result, any track defect resulted in the model derailing, so much so that I determined that it needed new coarse scale wheels. This, of course, required the use of a lathe and so I attempted to make one using Meccano parts and my trusty Black & Decker drill for power. As you might expect this was a total failure and hence I started looking for a suitably cheap and small lathe. Enter the Unimat 1.

Unimat 1 (Photo 1) and Hobbymat MD65 (Photo 2)

I do not know where I found the Unimat 1, but as I thought this lathe should have been able to turn the wheels, especially as I was using brass rather than steel, I bought one. In practice, it took far too long, so much so that the project was quietly abandoned, and I never did make the replacement wheels. Nevertheless, the Unimat 1, which is actually more of a toy than a serious lathe, did serve to show me what could be done and I decided to upgrade to something more powerful – the Hobbymat MD65.

I looked at buying new and thought the Hobbymat somewhat expensive which really was rather silly considering what I did eventually spend when I bought the Warco 220. Nevertheless, although a new Hobbymat was available nearby, I did not buy it, but started watching adverts and before not too long, a second-hand Hobbymat appeared. I bought this lathe which came with an odd assortment of tools and set about learning how to use it. It wasn't long before I discovered that it was too small for some of the jobs I attempted, plus I kept catching the back of my right hand on the tailstock, sometimes with a leakage of the red fluid! Nevertheless, it did serve me well as an early learning exercise.

In addition to learning how to use the lathe, I discovered how to make cutting tools from silver steel and successfully made a countersink tool and a metric threading tool for use on the Hobbymat. Incidentally, I found that cutting a thread at 250rpm, the Hobbymat's minimum speed, was a somewhat frightening experience and this resulted in buying and fitting a slow speed adaptor and making a mandrel handle.

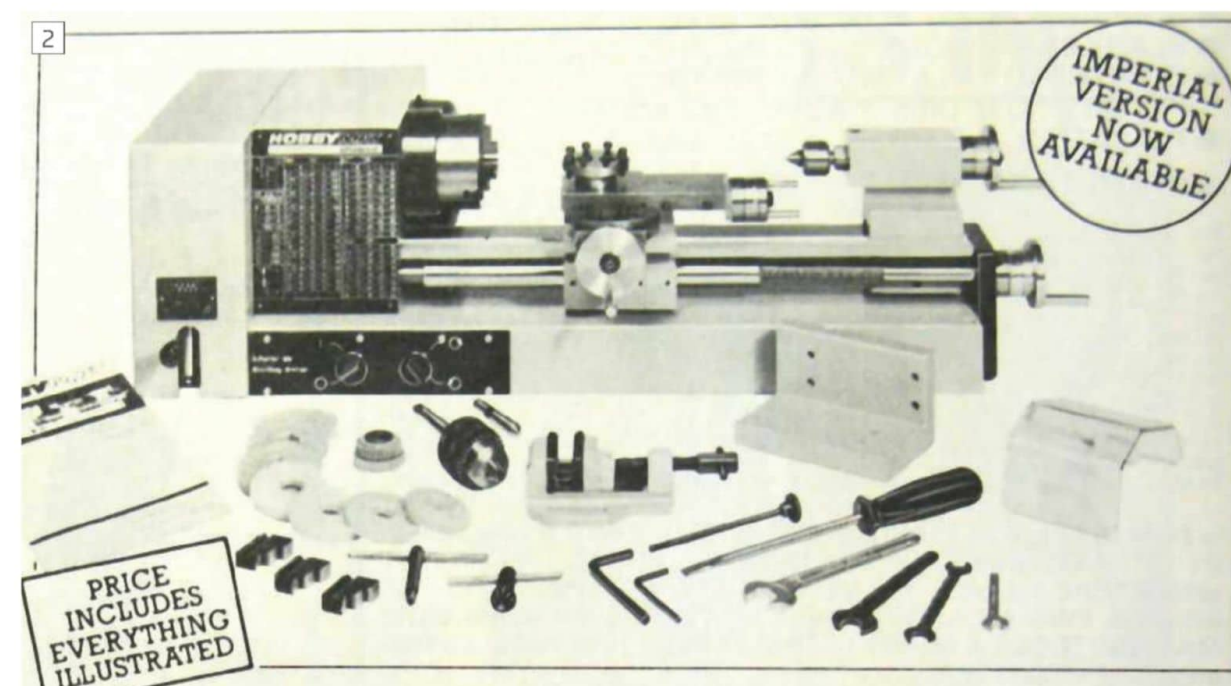
Another discovery was that I had no interest in building models: all I wanted was to learn how to use the tools, make additional tooling as necessary, and to make or repair odd bits and pieces as they turned up.



Unimat 1. From the front of the instruction manual and clearly showing the toy like structure.

All of this took place during the late 1980's and early 1990's and eventually I decided that the time had come to upgrade to a larger lathe. Now through taking ME magazine I had become aware of the Boxford series of lathes and indeed the ME10 would have been my ideal lathe, but on viewing a couple of second hand Boxford lathes, and having had a run-in with a neighbour, and a separate one with one of his relatives, I was somewhat cautious about installing a lathe which could possibly be described as

a small industrial machine. I therefore decided to abandon any thoughts of a Boxford and started looking at smaller bench mounted lathes such as the 918, Warco 220 and Myford Series 7. On comparing the specifications and prices, the Myford was ruled out on cost whilst the 918 appeared to offer a lot but in comparison to the Warco 220 suffered from reduced travel on the slides and tailstock, only 6 mandrel speeds against the 9 of the 220, and despite having a quick change gearbox, was the least heavy machine.



Hobbymat MD65. From an advert by CZ Scientific, the then importers.

And so, the Hobbymat was part exchanged for the Warco 220.

Another reason for buying a smaller lathe was that I was due to take early retirement and we had decided to relocate to the edge of the Lake District following said retirement, hence the need for a lathe which was at least manageable in terms of weight. The Warco 220 at 125kg was actually the heaviest of the three yet by removing as much of the ancillary equipment as possible, I was able, just, to move the lathe by myself in a small trailer. In addition, the relocation meant I could start again by building suitably sized benches for my height – I had made the mistake at the old house of making the main workbench too high and too deep with the result that I could not reach the back of the bench.

The Warco 220 (Photo 3)

Through experience, it has to be said that this is not perhaps the best of lathes yet within its limitations is capable of doing good work. Having said that, I do not regret buying the lathe. I did make some mistakes when I bought it – in addition to buying the 160mm 4-jaw independent chuck, and the 200mm faceplate, I should have bought the associated vertical slide, the fixed steady and the mandrel indexing adaptor. This meant that I had to design and build my own versions of the fixed steady and indexer, whilst the vertical slide I did eventually buy was actually meant for another lathe but was easily adapted

for the 220. I kept the drill chuck and the live centre from the Hobbymat but had to buy MT1-MT2 adaptor sleeves.

The standard lathe does not have a T-slotted cross-slide but there was an adaptor available which added T-slots to the rear of the cross-slide but which must not have been available via Warco. In addition, the lowest mandrel speed is 125rpm, still rather high for screwcutting under power, hence when I mentioned these to Warco, I was offered both a T-slotted cross-slide and a speed reducer along the lines of the Essel Engineering version for the Hobbymat. The T-slotted cross-slide was a replacement for the standard cross-slide and required the transfer of the lead-screw arrangements between the two cross-slides which caused problems with adjustments – eventually cured by making a replacement lead-screw for the new cross-slide. The speed reducer did work but was not particularly easy to use and so was returned.

Incidentally, it appears that Mashstroy, the makers of the lathe, had themselves designed a speed reducer, a drawing of which appears in some early manuals, but not in mine.

Since buying the lathe and setting up my new (current) workshop, I have made a mandrel indexer adaptor, fixed steady, indexing adaptor using changewheels, self releasing mandrel handle, self-releasing drawbars and extractor. I have also bought an 80mm diameter 4-jaw independent chuck for which I had to make a backplate

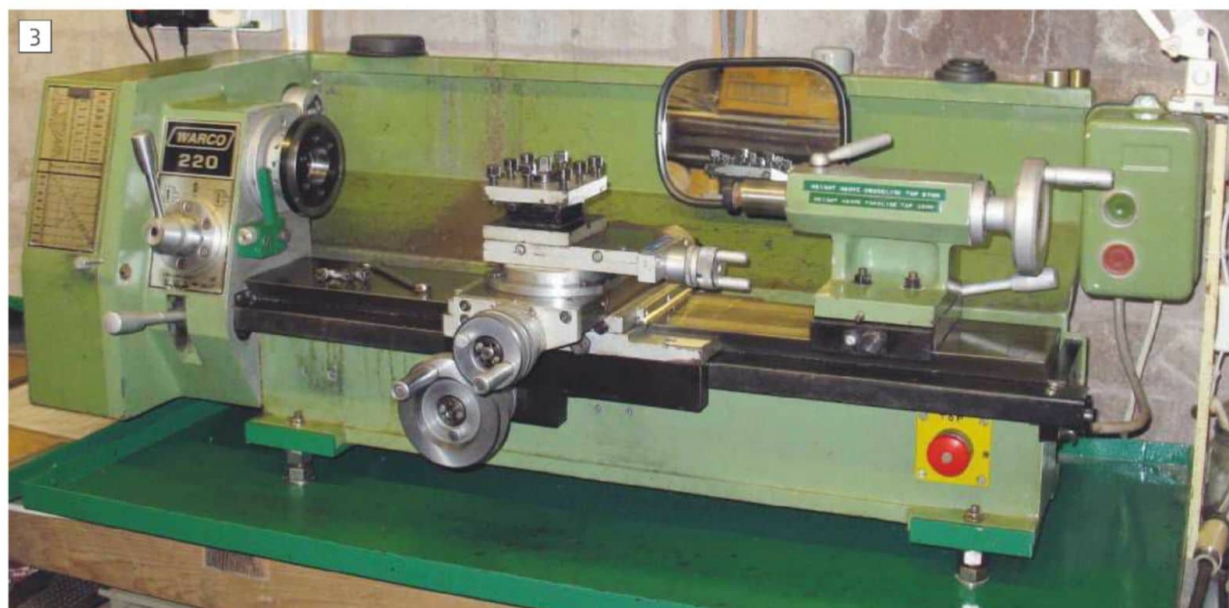
(made from aluminium as a temporary expedient, but still in use).

Initial writing attempts

I suppose like a lot of people, I did not think I was capable of producing articles suitable for publication, however, when in 2005 my DOL switch failed necessitating a repair, I wrote it up and submitted it. This article was not immediately published, but a further submission about a Self-Releasing Mandrel Handle and submitted around the same time was published in 2006. This second article was thus my first successful attempt at article writing.

Later articles

Since that first attempt, I have submitted a number of articles which have been published. Realising that there are a number of model engineers whose abilities and knowledge are far superior to mine, I have gradually moved towards a system whereby my articles are aimed at discussing what I have attempted and why, the inevitable problems and mistakes, and how I overcame them, the idea being to encourage other amateur engineers that making mistakes is perfectly normal, and that one should not be discouraged by them. I have also produced a small number of articles based on experiments, and whilst it may be said that I am re-inventing the wheel, these articles are, in a way, showing how my learning is proceeding – self education by experimentation. ■



My Warco 220 after many years of use.

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Photo 1: An apex roof

Buying and improving a workshop shed



Photo 2: A pent roof.

Types of shed

There are two main types of shed roof, the apex roof, **photo 1** and the pent, **photo 2**. The pent roof has a roof that is high at the front and slopes towards the back. The pent roof is pointed at the middle and slopes down at both sides from the middle.

There is more than one type of cladding, the first is feather board, this is where the plank is tapered on the width and overlapped at the edges. This type of construction is usually found on cheap sheds and fence panels. Feather boards should be avoided at all costs. The second type is shiplap, **photo 3**. This is a tongued and grooved construction and is much more waterproof than the feather board shed. Another type is called log lap, **photo 4**. This is much more substantial and is recommended for areas where the weather is more likely to be bad such as

open moorland and Scotland.

The first stage in choosing a shed is to look in your local garden centre first. I don't recommend the local DIY centre, the quality is usually rather poor. Walk around the outside of the shed, go inside and jump up and down to check the thickness and quality of the floor. Walk around inside the shed to check the headroom. If you intend to buy a vertical mill, the drawbar may need to be removed. This might be difficult in a pent roof but ok in an apex roof shed if the machine spindle is in the centre of the apex. Get as many brochures and price lists as you can. There can be substantial differences in prices between suppliers for the same size and quality of shed.

The door fittings

The door will need to be mounted on substantial hinges, **photo 5**. You will need a



Photo 3: Tongued and grooved construction.



Photo 4: Log lap construction.



Photo 5: Strong hinges are important.



Photo 6: Fit a substantial bolt and quality padlock.



Photo 8: Fence posts under the shed. The bricks are to stop the dog getting under.



Photo 9: The shed partially erected.



Photo 7: The finished shed. This one is 8ft. X 12ft.

strong bolt fitted that can also double as a padlock holder, **photo 6**. You will also need toggle latches fitted. From a security point of view, at least some of the holes in the door bolt and the hinges should be replaced with coach bolts so that they can't be unscrewed and access gained. Decide which side the door is to open if you have a preference (and a choice).

Check what the width of the door is and then check this against the largest machine that needs to go through the door. If there is plenty of clearance, the extra expense of double doors will not be necessary. Also, you can remove the side of the shed to enable a large machine to be placed inside. This is easier with a pent roof but is still possible with an apex roof. If the delivery van has a tail lift, the machine may be able to slide straight on to the work bench. I have done this on more than one occasion and it makes life easier.

Are windows required?

You might say yes, but if you only intend to use the shed after work, it will be dark a lot of the time and lights will be necessary. Then windows will not be essential. No windows = better security, the choice is yours.

If you do go for a shed with windows, consider fitting the windows with wire reinforced glass. This is the opaque glass with a wire mesh inside

it. This will help to deter burglars. You will probably have to change the windows anyway as most sheds come with polycarbonate windows rather than glass. Another deterrent is a venetian blind. Most burglars do not want to get tangled up with them and they also hide the expensive equipment that would otherwise be seen through the window.

Preparing the base

The ground where the shed is to go must be prepared and be level. You need to level the ground in advance before the shed people arrive. They will not want to hang around. They will want to erect and be on their way. The shed will be erected quickly, **photo 7** and within an hour, they will probably be gone.

Tanalised bearers

If possible purchase tanalised bearers to go under the shed. If bought from the building manufacturer, they can be delivered with the shed. This I feel, is better than putting the shed directly onto the ground. You can also use wooden fence posts to do the same job, **photo 8**. Always check which way the floor runners go on the shed floor and put the bearers at 90 degrees to them. The bearers are best placed onto concrete breeze blocks. It is fairly easy to level the blocks with a spirit level before the shed arrives. Too many

blocks and bearers are better than too few. If the shed is on a slope, use two layers of blocks rather than one.

The shed arrives

Free access to the garden is essential as the erectors will not normally lift the shed over fences or walls. If they cannot get access to the shed area, they will leave the shed as close to it as they can for you to erect. Erecting a shed yourself is not a major problem if you have someone to help you although it may be a bit heavy in the larger sizes, **photo 9**. The worse bit is lifting on the roof, as the roofing felt is very heavy.

The roof will probably come ready felted except for the join at the top if an apex roof and fully felted if a pent roof. The apex roof must be pretty strong as you may need to walk over the top to tack the felt down. A lightweight friend may be needed if you are a bit on the large size. The roof may bend a bit but there should be no ominous cracks.

If putting heavy machinery in, put MDF, chipboard or plywood on the floor. Minimum thickness should be 10mm although laminate flooring may be suitable as it is very strong. If you move machines in the shed with an engine hoist, the load on the wheels would probable send it through the floor if the floor is not reinforced sufficiently. ■

Workshop security

Your workshop may contain kit worth thousands so don't rely on a rusty padlock to protect yourself from the opportunist. We suggest a multi-action approach



Fitting a PIR light

It's a sad fact of modern life, but theft can affect us all. Whether it's a rise in insurance premiums or worse, a break-in. Living in a relatively low crime area, I had a rude awakening recently when returning from a trip to hear that several sheds in my road had been broken into. Fortunately, mine was not among them, but my neighbour's shed door had been forced and several expensive items stolen. It certainly made me think twice about my security measures.

You may have the most sophisticated security system fitted to your home, but it's easy to overlook the workshop. Sadly, power tools are stolen to order these days. Whether you have a garden shed or converted garage, this is a prime target. Many of us have fully-equipped workshops, and intruders will steal anything not bolted down. So what can we do to reduce the risk of theft in the first place?

Awkward approach

Firstly, make life as difficult as possible for an unwelcome visitor. Shrubs and small trees may enhance the garden by concealing the workshop, but can often help a potential burglar by providing cover. The less foliage there

is growing around an outbuilding the better, so make sure the building looks neat and tidy on the outside. And you're much more likely to hear footsteps on a gravel path than on paving slabs or concrete, especially during the night.

One of the best deterrents is to fit a passive infra-red device (PIR) to the exterior of the workshop. When movement is detected by a sensor, the light illuminates. On the downside, PIRs can sometimes be set off by small animals, so be careful where you locate the sensor. You don't want to annoy neighbours either, so follow the maker's instructions carefully to find the best location.

You can adjust the beam and angle, and a manual override means it can be set to switch on automatically at dusk – ideal for those winter woodworking evenings. A PIR will require a mains power supply, so you will have to get the unit certified by a qualified electrician.

Doors and windows

Consider how you would gain entry to your workshop if you lost all the keys. If you have a timber shed, how easy would it be to force the door? Traditional T-hinges found on budget sheds are hopeless, especially as most are surface-mounted. If you want to retain the

original ledged and braced door, it will probably need reinforcing around the edges. This will enable you to fit steel butt hinges, preferably 100mm. Security hinges are better, as they have interlocking studs on each leaf to make it more difficult to force them with a crow bar. I've inserted brass hinge bolts on my workshop door, which are cheap and easy to fit.

On the opening side of the door, a simple mortice lock is fairly easy to pick. Augment this with a heavy hasp and staple. If possible, use bolts as well as screws to mount these fittings. For greater security, fix the hasp and staple with steel plates mounted to the inside of door and frame.

Although you need as much light as possible in the workshop, simple curtains at each window means prying eyes cannot see what's inside when you're not there. It's better to make internal shutters from sheet material, which can be fitted in place at the end of a working session. Don't use boards too thick (12mm is suitable) as they will be heavy to lift up and down. Secure shutters with simple turn buttons around the edges. If you know someone who is handy with welding gear, a steel grille fitted to the inside of each window would make the workshop even more secure.

You could consider replacing glass with clear acrylic or polycarbonate sheeting. Far tougher than glass, these materials can be sawn and drilled easily, though they're not cheap (www.screwfix.com). Such sheeting is ideal as secondary glazing, which helps soundproof and insulate the building.

Locks and alarms

Generally, the more you pay for a padlock, the higher its security rating and quality. Don't skimp here, as cheap locks can be forced or cut with bolt croppers. A closed body padlock means its shackle is less exposed and will be harder to cut through. With any exterior lock, a few squirts of WD40 every now and then will keep it working efficiently. Padlock alarms give an audible warning if tampered with.

A simple alarm system is recommended for any workshop. Although we tend to ignore car alarms going off (which sound similar), one of these devices should make any burglar think twice. The units are battery-operated with external or internal sirens.

For power tools (in storage cases), toolboxes and machines, a locking cable is a great solution. Mount the anchor on a wall or floor and simply thread the cable through the kit and lock them together. Some of these gadgets have sirens, too.

Security marking

The good news is that police forces do recover a lot of stolen tools. Unfortunately, many of these cannot be returned to their owners as identification is not always possible. Make an inventory of every tool and piece of kit in your workshop, photographing each item, if possible. With a digital camera you can keep records on your computer and update details easily. Keep receipts of new kit bought and note model and serial numbers of power tools and machinery.

If you have a mini-tool, mark your postcode and house number on power tools and machinery. With cordless tools you could always engrave them inside the battery compartment. You may want to check the warranty first if it's a new tool. Even better is the Alpha Dot marking system, tested here. Easy to use, it means you can mark lots of workshop and household items quickly and unobtrusively.

Neighbourhood watch

It costs nothing to join a Neighbourhood Watch scheme, but knowing that neighbours are keeping an eye on your property can be reassuring when you're not there. Visit www.neighbourhoodwatch.uk.com for more information, particularly if you're interested in setting up a new scheme.



A window alarm

Insurance

Most insurers will add an outbuilding to your household and contents insurance, handy if you have a small shed or garage workshop. But cover will be limited (I was quoted between £2500 and £5000 maximum contents), although if you list individual kit and show you've taken extra security measures, you may be able to negotiate a better deal. There are likely to be plenty of restrictions, including personal use only of the workshop and possibly agreeing to receive no visitors. It makes a big difference whether your woodworking is just a hobby or if there's a commercial element to your work.

If you choose commercial insurance, it will probably entail a visit from the insurer, as each workshop is obviously different.

The structure of the building is important. A flimsy, shiplap timber shed will be much more of a risk than a block or brick-built structure. Not just with regard to theft, but fire as well. Contents, type of heating and security will all be taken into account when assessing the risk.

While it's not possible to give guidance regarding premiums or cover, a broker that seems more helpful than many is Walker Midgley, www.walkeridgley.co.uk or phone 0114 2502770. If any reader has any tips or can recommend an insurer please let us know, so that we can pass on the information.

Fitting a wired alarm



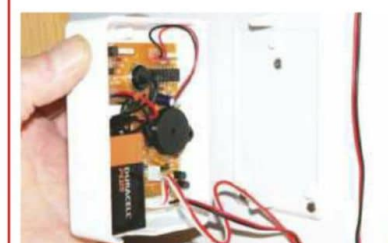
1 Drill the wall to mount the backing plate of the control panel



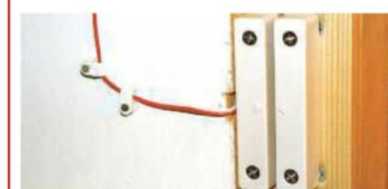
2 Fit the siren to the exterior, high up and out of reach



3 Pin the siren and contact wires in place with clips provided



4 The inside of control panel, powered by 9V battery



5 Door contacts are mounted no more than 10mm apart



6 Use the key to activate alarm. This gives you, typically, 15 seconds to exit or enter your workshop

From the Archives:

Twist Drill Sharpening by the Four Facet Method

Giles Parkes

I am an old newcomer to engineering workshop practice and I don't suppose I shall live long enough to learn to sharpen twist drills properly freehand. I have made many attempts and I sometimes succeed in getting a drill which cuts true and to size, but what I want is consistency. Many devices have been studied and tried for grinding the clearance correctly, but I can't make most of them produce an accurate drill repeatedly.

As all proper engineers know, the first essential is to have two cutting edges of equal length and at the same angle to the axis of the drill. The second is to have the clearance equal on each side and the third is to be able to change angles and clearances for different materials. Provided that the drill can be offered to the grindstone at a predetermined angle, it should not be difficult to obtain a consistently good drill. I therefore turned my thoughts to a jig to make this possible, and at the same time I chanced upon articles by D. A. G. Brown on four facet drill sharpening (Model Engineer Vol. 172 Nos. 3690 and 3692). His jig makes it almost impossible not to grind a drill properly, but it is confined to small



One thing that many people find a challenge is accurately resharping twist drills. In 2000 Giles Parkes rose to the challenge of making a quick to use but accurate jig using the 'four facet geometry'. Although the reason for this was to achieve repeatable good results, it is worth bearing in mind that four-facet drills are less likely to wander and can be more free-cutting than conventionally ground drills.

drills up to about 3mm. I wanted to sharpen larger drills to the same high standard, and ER20 spring collets provided the next answer when I was told that they will hold a drill accurately by the lands. They have the advantage that each collet has a holding range of 1mm, so all drills from 3mm to 13mm, metric or Imperial can be held in relatively few of them.

My Jig

A piece of 1inch square mild steel, 125mm long is drilled 14mm longitudinally through its centre, has a 16 degree Included angle recessed taper in one end, turned accurately to fit the collets, and a 25mm diameter 1.5 pitch metric thread cut over the taper for the collet nut (Fig. 1). ER collets and collet nuts are readily available from the usual hobby suppliers. I also



ER20 spring collets, normally used in the Morse taper chuck (right) can be fitted to the square holder (left) and used to hold a wide range of drill diameters.

find it convenient to stamp a number on all sides of the square holder, in order to identify which facet is being ground. The components are shown in photo 1. The flexible collet then holds

Fig.1

COLLET HOLDER FOR FOUR FACET DRILL SHARPENER

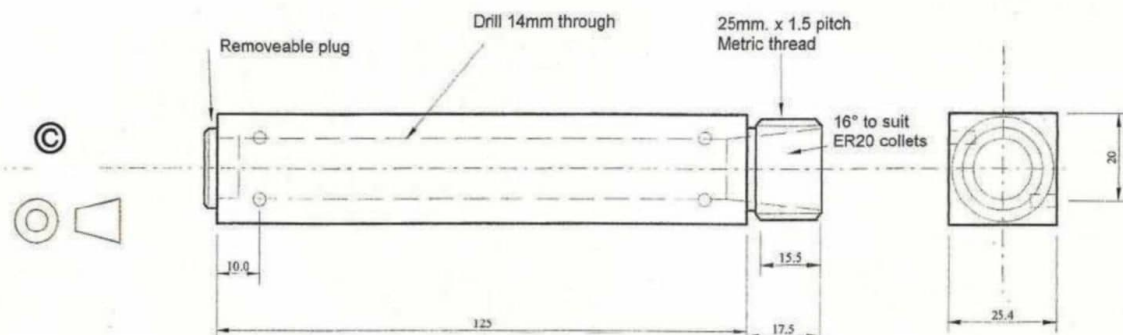
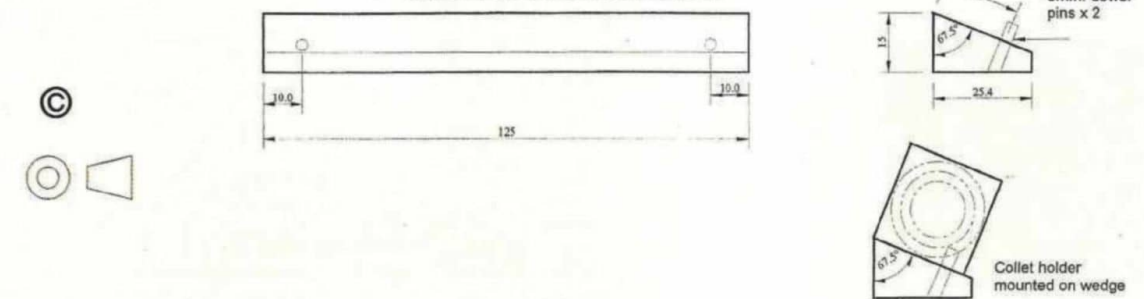


Fig.2

WEDGE FOR SIXTH FACET

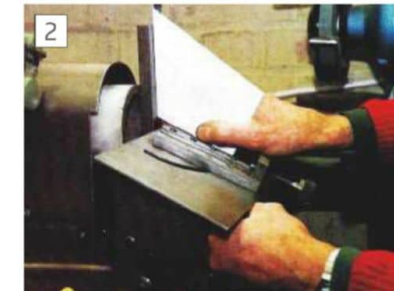


the drill, with cutting edges more or less parallel with two of the vertical sides of the 1inch square, and the drill tip is applied, in my case, to the face of the grinding wheel on a Worden grinder. The table is set down to 121 deg. to the face of the wheel to provide the 118 degree tip angle (photo 2) and the feed slide is set over to give the 25 degree secondary clearance (photo 3). The table, complete with jig and drill is then passed across the face of the wheel, with the tip of the drill just touching the wheel (photo 4). After turning the jig over, through 180 degrees, the other side of the drill is ground at the same setting. Feed is then applied via the feed screw and further passes are made, turning the jig over after each pass until the facet just reaches the cutting edge of the drill. The slide is then set over to give the 10 degree cutting facet and a very careful lick taken off each lip until all four facets meet at a point in the centre of the drill (photo 5). If, on inspection, they are seen not to do so it is simplicity itself to take a further lick off whichever facet is wrong, though if the set-up is accurate there should be no wrong facet!

Any grinding rest on which angles can be accurately set and a fine feed incorporated should enable drills to be ground by this method, on any grindstone.

Any square holder which will accurately hold a drill centrally could be used instead of the spring collet holder, but all metric sizes from, say, 3 to 13mm would require 100 different holders!

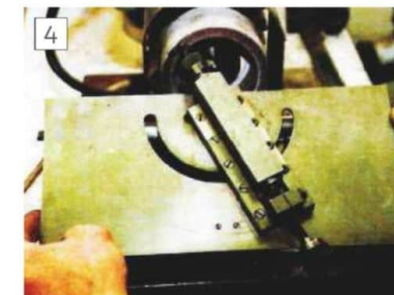
The maximum length of drill that can be ground with this jig on the Worden is about 7in., but this can be increased by using a longer feed slide. I lengthened my Worden feed slide by 1 inch, and this enabled me to sharpen an 8 inch long 1/2 inch drill with a No. 1 Morse taper shank.



Setting the tip angle by tilting the table.



The angle of the slide creates the clearance.



Traversing the table to sharpen the drill.



A sharpened drill in the ER20 spring collet.

Six Facets

Derek Brown's further articles on the subject (M.E. Vol. 177 Nos. 4023 and 4025) progress to six facet drills. These present no problem with this jig, but you will need an addition to cope with the sixth facet, i.e. a wedge of 22½ degrees, the same length and width as the collet holder (Fig. 2). It is equipped with two dowel pins which locate in two holes in the holder and it fits in the slide, thus rotating the holder 22½ degrees. The feed slide is set over to 35 degrees and the sixth facet ground, turning the holder over on the wedge after each pass, until all six facets are seen to meet at the point on the tip of the drill. Derek Brown's article gives the back-off angle for the sixth facet as 45 deg. but as I am not an engineer, I think that 35 deg. looks better and, as it is only clearance, enough is as good as a feast.

Since the wedge raises the holder in relation to the feed screw, you may need to insert a small block between feed screw and holder to achieve proper feed. If you prefer, all these facets can be ground with the drill lips in the horizontal instead of the vertical plane. In that case, use the slide to set the drill tip angle and the table adjustment for the facets. Your preference will depend on whether the feed slide or the table adjustment is easiest to set.

The greatest benefit of this device, apart from producing sharp drills, is that the operation can be inspected as it progresses. The whole jig can be lifted away from the grinding wheel and the tip of the drill examined before replacing the jig to grind further, as required, from exactly the previous position. ■

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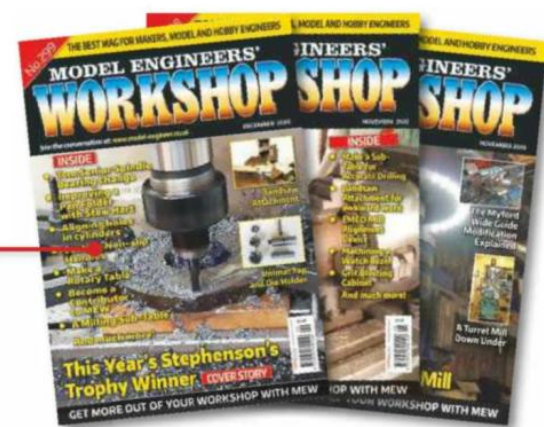
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A 5" Diameter Rotary Table

Ian Strickland details the making of a fine piece of workshop tooling based on an original design by G.G. Tardrew.

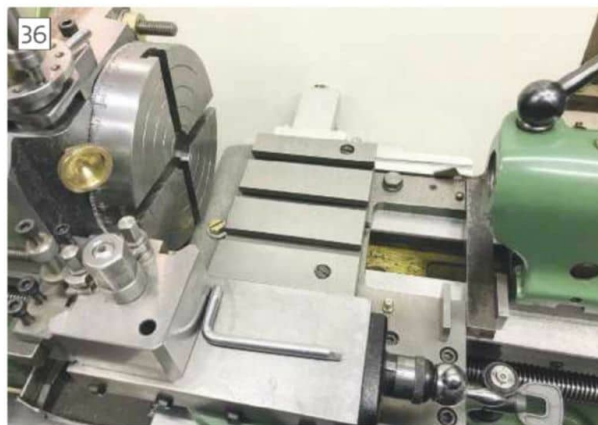


Photograph 35, next the rotary table was setup vertically on the lathe clamped to a large angle plate clamped to the lathe bed, to engrave the degree lines around the lower edge of the table top. The direction of cut was towards the tailstock. A threading tool was used on its side to engrave the lines. Two different thickness spacers were used between the saddle and the left hand side of the tailstock base to ensure that the graduated lines were all the correct length.



Engraving the degree marks.

Photograph 36 shows the setup for engraving the degree lines of different lengths. A parallel bar is held against the right hand end of the saddle with a strong magnet at the rear of the saddle from a defunct hard drive, so that spacers can be used for the different line lengths. When a longer degree line has been cut to the correct length the tailstock is brought up to the bar and locked. The thicker spacer is for the individual degrees, while the thinner spacer is for the fifth lines. No spacer is used for the longest lines.



Stops for engraving the different lengths of the degree lines.

Photograph 37 shows the setup to guide the number stamps for marking the degrees.

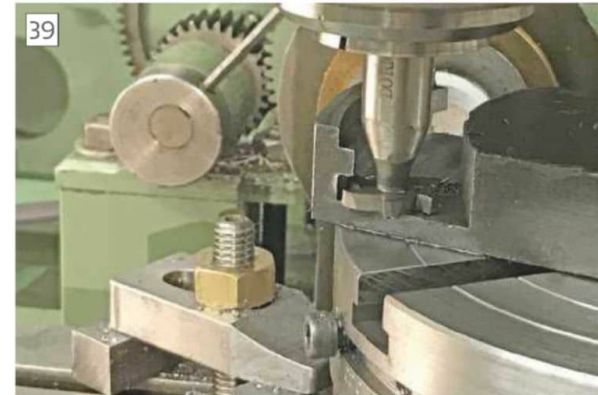
In **photo 38** one can see the degree lines and the table being used to make the curved stops to fit around the periphery of the table for use when a job requires the table to turn a certain number of degrees. M4 tapped holes were drilled and tapped at 10 degree spacing so one can adjust the stops as required. The stops have slots so they can move 11 degrees. The groove around the side of the table top is to



Setup for guiding the number stamps.



Curved stops being formed.



Wide slot for clearance for the Woodruff cutter.



Slotting the grub screw heads.

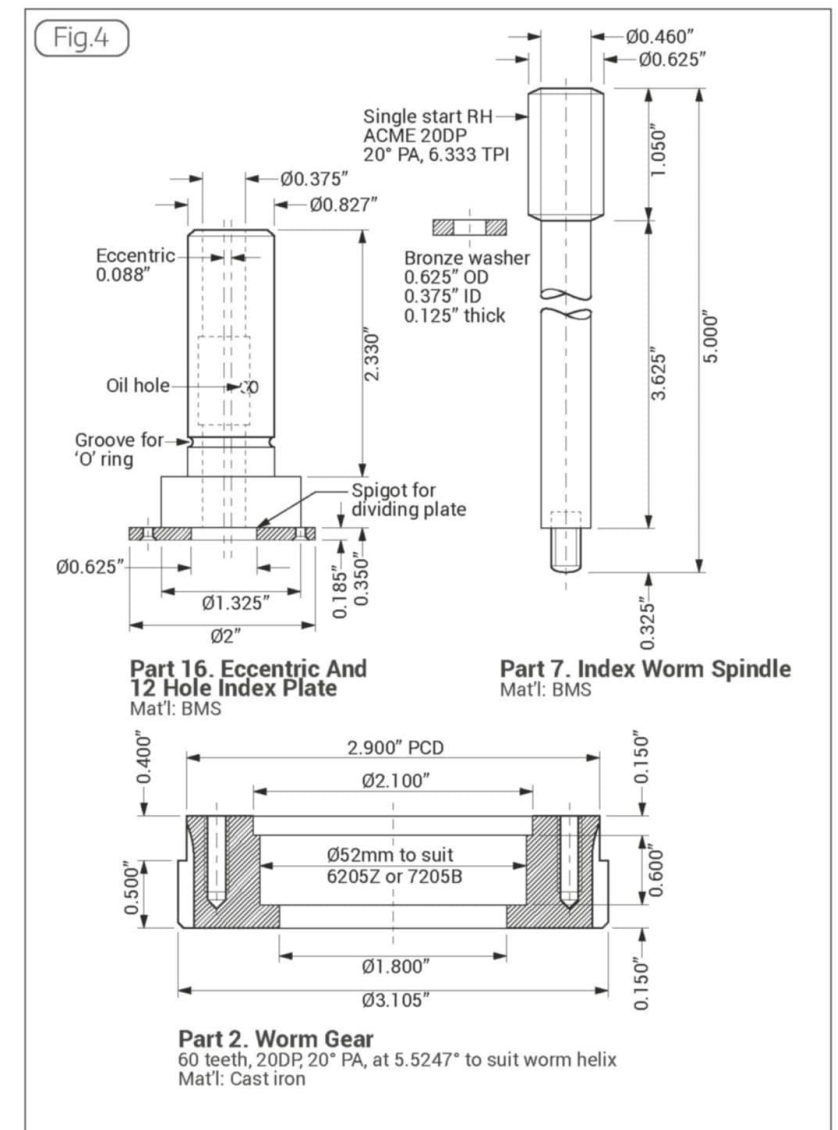
provide the alignment guide for the stops. The groove is $\frac{3}{16}$ " high and $\frac{1}{8}$ " deep.

The slab of steel is 2" wide so two stops can be formed at once. **Photograph 39**, here a wide slot was provided to give lateral clearance for the Woodruff cutter forming the backs of the two embryo stops. This was necessary as the cutter was grabbing the workpiece when cutting on both sides and was in danger of damaging the work. The clamp nearer the camera was removed for this photo to be taken.

After this photo was taken, I drilled eight $\frac{3}{8}$ " BSW tapped blind holes 0.825" deep at 30° spacing for additional clamping points in the rotary table top, as I had difficulty holding the steel bar satisfactorily with only four T slots. In **photo 40** the grub screws to be fitted to the tapped holes to keep the swarf out of the threaded holes are having the screwdriver slots cut in pairs having locked each grub screw with a half nut. The table is then rotated through 90 degrees to cut the next pair, and so on. A novel use for the rotary table.

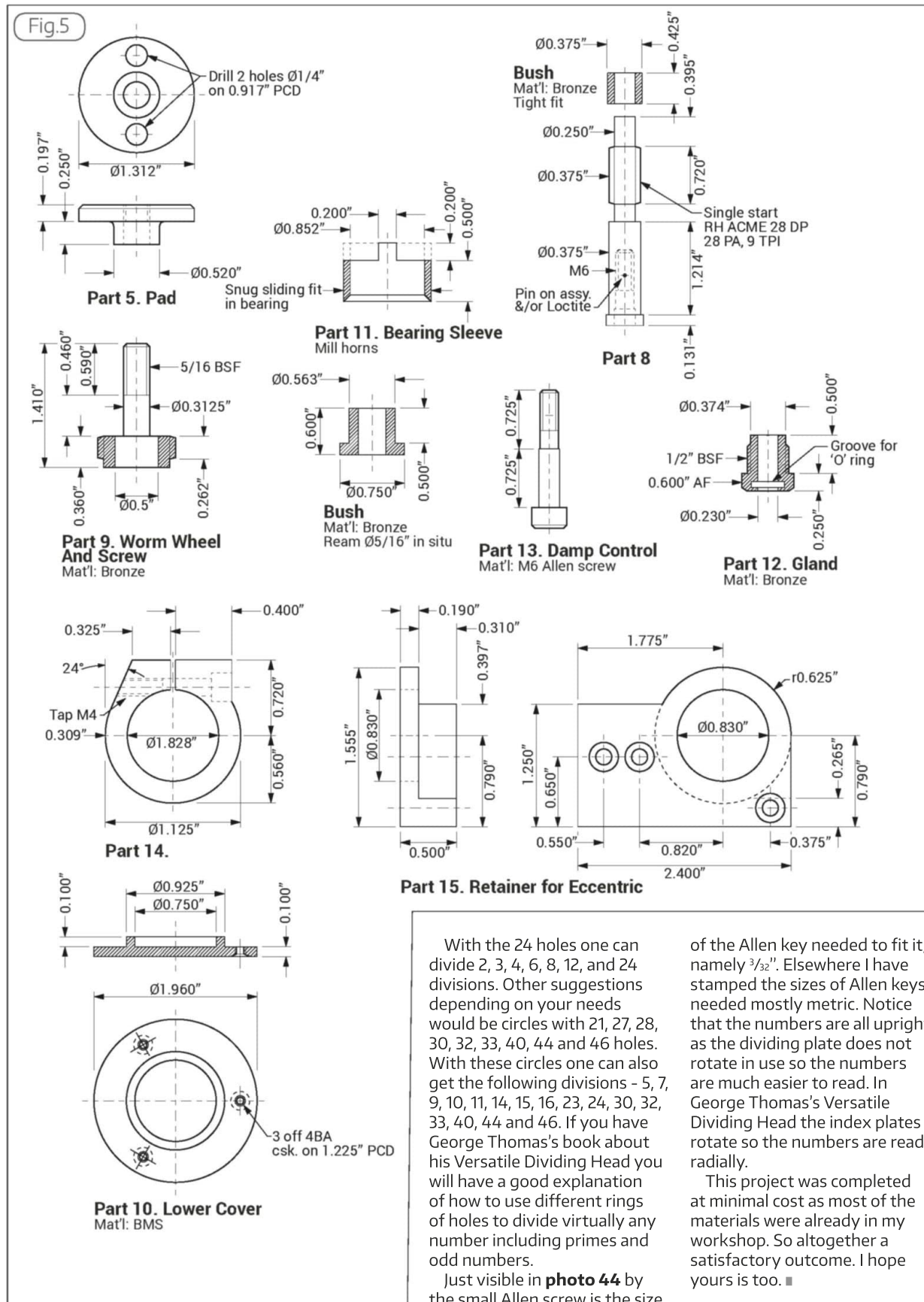
Photograph 41 shows the setup for milling the flat for the U shaped brass stop. The rotary table has an unseen clamp to the rear. In **photo 42** we see the moveable stops and the brass fitting against which they stop. Under the right hand moveable stop is a pointer. There is another one at 90° to the left hand side which is just visible. The screw holes are over size to allow for aligning the reference line at precisely 90° from the front pointer.

The penultimate photo, **photo 43**, is of the finished and painted rotary table with the large dividing plate with 24 holes, so that moving the plunger from one hole to the next rotates the table a quarter of a degree.

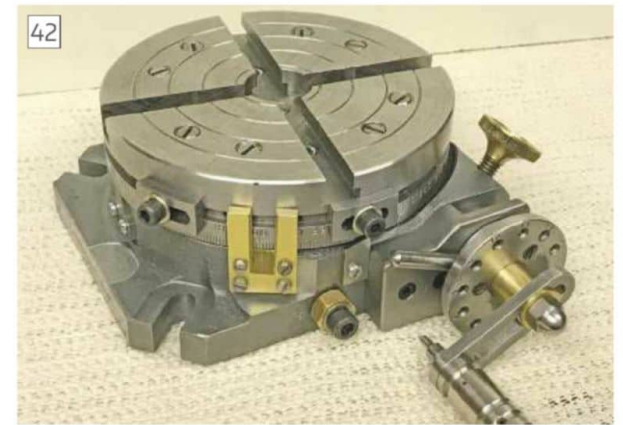


Also one can see the oiler nipple for oiling the dividing worm shaft and eccentric quill. There is scope on the larger dividing plate for several circles of holes of different numbers

for dividing other numbers. Also one could make other dividing plates with a variety of different circles of holes for a wider range of dividing if required.



Milling the flat for the 'U' shaped brass stop.



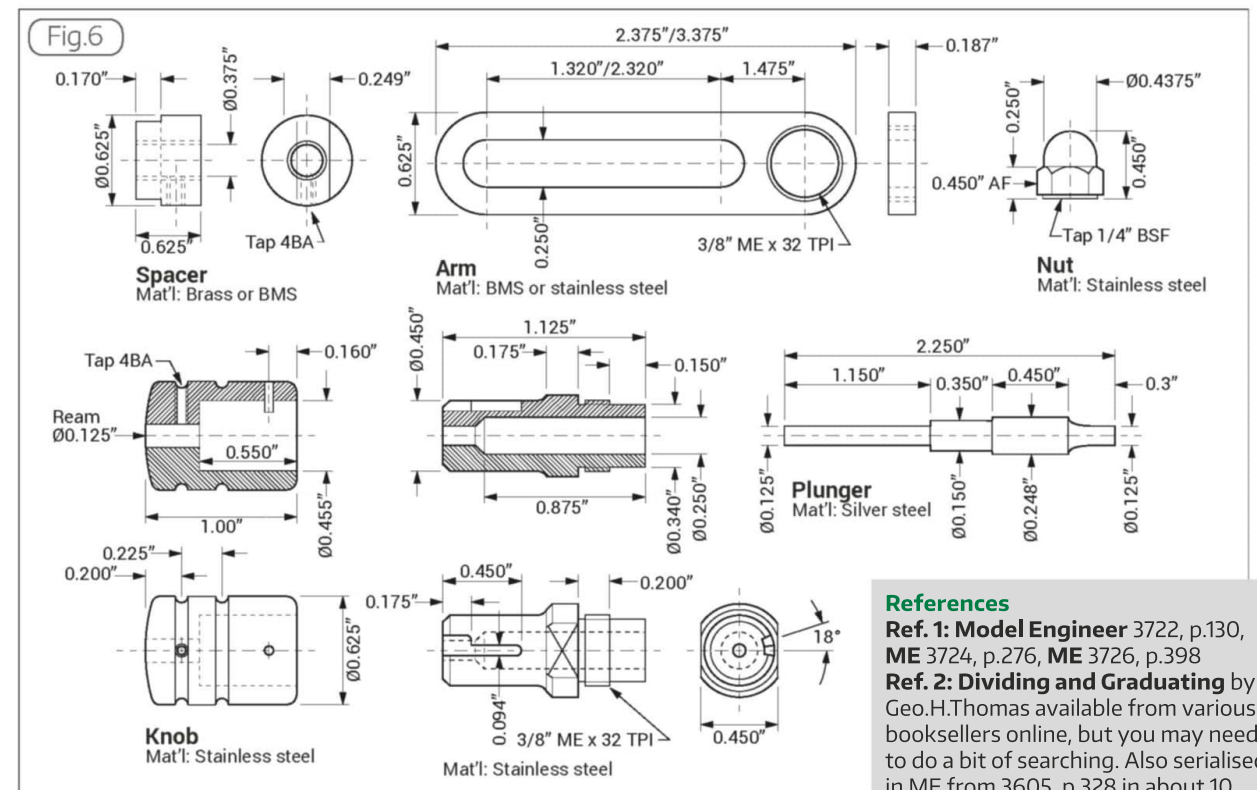
The moveable stops and the fixed brass stop.



Completed, painted, notice the oiler nipple for the eccentric quill.



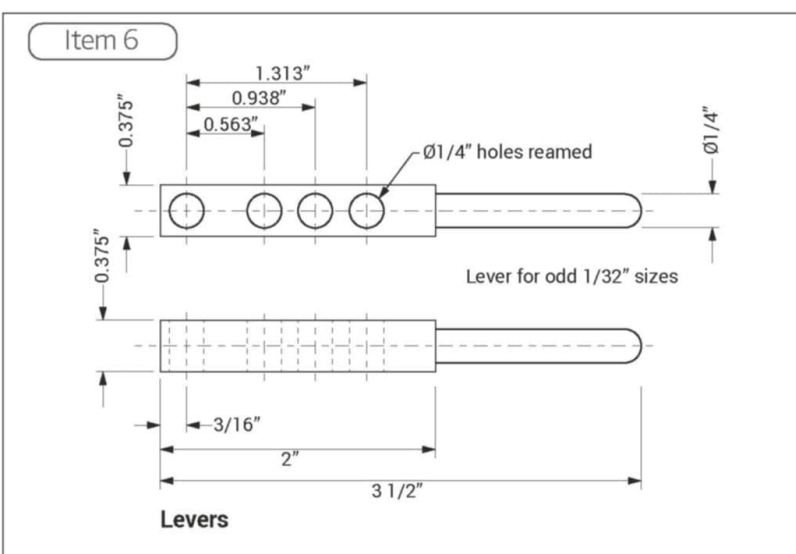
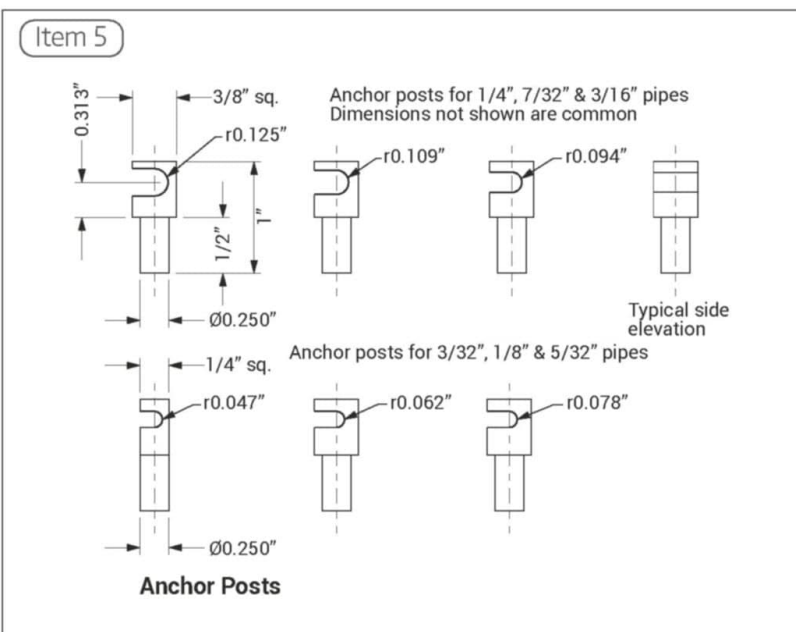
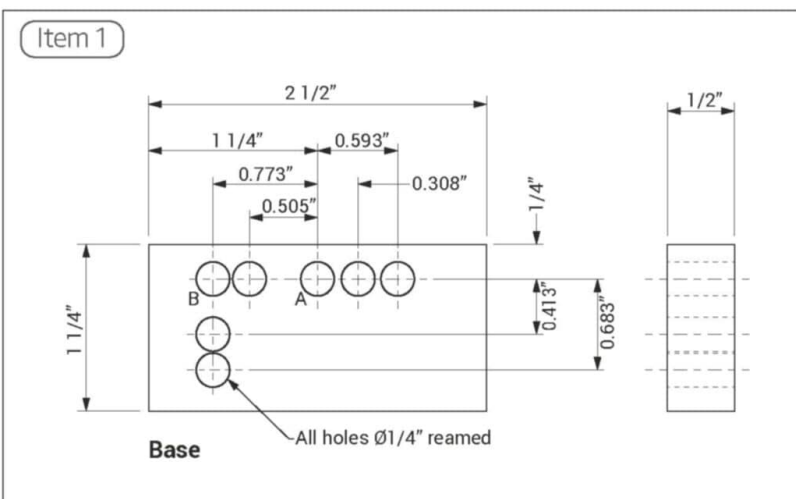
Close up of the 3.5 dividing plate.



References

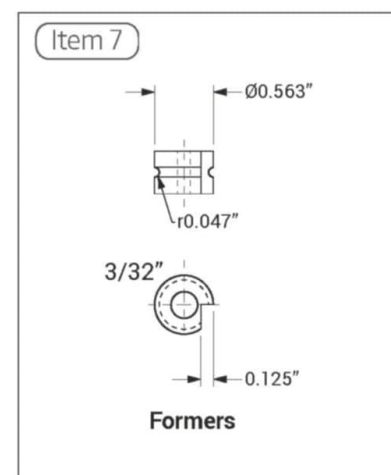
Ref. 1: Model Engineer 3722, p.130,
ME 3724, p.276, **ME** 3726, p.398

Ref. 2: Dividing and Grading by Geo.H.Thomas available from various booksellers online, but you may need to do a bit of searching. Also serialised in ME from 3605, p.328 in about 10 episodes to 3812, p.533.



From the Archives: Elegant Pipework Amended Figures

Several readers noticed problems with the dimensions in some of the figures in issue 297 about Derek Brown's pipe bender. We did redraw all the figures because the original copy wasn't very legible. Unfortunately, that led to introducing errors. Many thanks to Nick Farr who listed these corrections: item 1 Base, bottom hole centre should read 0.683" below the top five hole centres, item 5 Anchor Posts, from bottom of the shoulder to centre of the radii should read 0.313", item 6 Levers, lever for odd 1/32" sizes, middle hole of the three should read 0.938" from common data point, item 7 Formers, top left hand 1/4" former diameter should read 1.5", bottom left had 3/32" former, notched dimension should read 0.125". Thanks also to Andy Rodgers who posted corrected drawings on the forum. ■



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An Aid to Cutting Corners on a Bandsaw



Richard T. Smith makes an attachment for an attachment.



Stop body screwed to saw attachment.



Stop with extra setting clamp.

The bracket is attached to the underside of the support plate by two M6 tapped holes which I added, **photo 20**. I found I needed to trim the corner opposite the screws before remounting on

the saw. A proper stop rod was cut from silver steel. I turned down some bar to make a replacement locking screw initially leaving the head round. Having screwed it in tight I marked the direction I wanted the flats to be

in before milling two flats. I made a second smaller but similar moveable stop block with the clamp handle facing the operator, **photo 21**.

The stop has proved useful in several ways. If you are cutting to a

depth you have the air pressure off and move the table until the work is touching the saw blade. Move the stop rod until it is against the block on the cylinder. Clamp the rod in the fixed bracket. Bring the moveable clamp block up against the fixed stop bracket and tighten the clamp. Now release the fixed clamp and move the stop rod out until the gap between the two clamp blocks is the desired depth of cut. Clamp the rod in the fixed clamp block. This takes longer to describe than to do! If you are cutting right through something you can push the stop rod

in and leave it unclamped so that the table movement is pushing it out. When the end of cut is approached pull the stop rod out a bit more than the amount left to cut and clamp it with the fixed clamp. The saw will cut through and then jump to the stop. The saw blade is forced back a small amount by the pressure. If you lock the clamp it will come forward as the teeth continue cutting. You can use this action to take very small steps.

Trimming the corners of a square to make an octagon means setting the square edges at 45 degrees and I

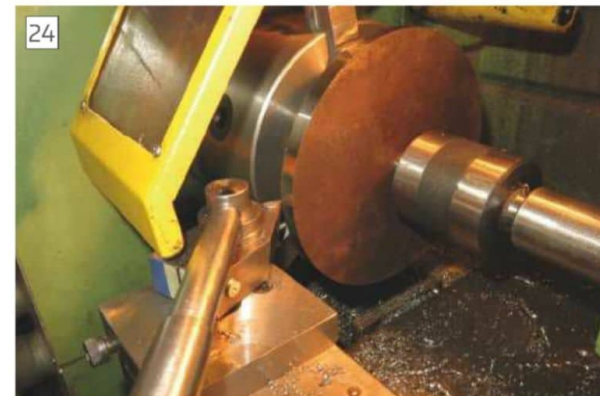
made a simple gauge out of two pieces of scrap. **Photograph 22** shows it in use setting a 160mm square for corner cutting. This square was from the same material as the table and is a bit rusty and is about the largest the jig will conveniently handle. It may be possible to reverse the jig on the table and make longer corner cuts by turning the work over and cutting in two directions but I am not planning to explore this! **Photograph 23** shows the finished octagon still on the saw. This blank had a 12mm diameter hole in the centre and I mounted it in the



Setting for a 45 degree corner cut.



A 160mm square with corners cut.



The 160mm square turned round.



Turning the no hole pivot.



Sawing the no hole pivot off.



Facing and thickening the no hole pivot.



Milling the end slot in the G-clamp.



Sawing out close to size.



Finish milling the G-clamp.



Pivot and G-clamp attached to the main body.

lathe by trapping it between a live centre and the three jaw chuck. I kept checking the tailstock pressure and had no problems turning it round with a 0.8 radius insert, **photo 24**. Out of interest I faced the outer part and then turned it around with the chuck jaws on the faced area and part faced the other side. Measuring around the rim the thickness varies between 8.24 and 8.26mm.

Hole free blanks

It seemed logical to adapt the jig to produce disks without a central hole. I had seen videos where superglue is used to attach thin parts to carriers so that they can be worked on and then separated by heating. Although I had never tried it, it seemed a good way to go. The existing pivot piece was planned to be interchangeable so a two part alternative with a pivot glued to the work and a pin screwed into the radius setting strip was be possible.

The pivot was turned from some 44mm diameter BMS with a 12mm diameter spigot drilled blind 8mm diameter and countersunk, **photo 25**. I made a groove with the parting tool and then cut it off with the saw, **photo 26**. The face to be glued was then cleaned up to finish exactly 5mm thick- **photo 27**. The pin was turned from some 12mm diameter scrap, threaded M10 on end and turned down to fit in the pivot the other end.

To hold the work while sawing some form of clamp was needed. The location of the pivot varies with blank size so any form of screw positioned over the pivot would also have to be moveable. Instead I decided on a G clamp to be attached inline with the smallest pivoting position. In the best tradition of these things I had a piece of 1/2 ins aluminium with a couple of holes in it and this determined some of the dimensions! I already knew that not a lot of clamping force was needed, an

M6 wing nut worked OK on the original setup, so I was happy with a light duty clamp. Two pieces were cut out of my scrap, and the cut edges machined square as before. A 20mm slot drill was used to cut the slot forming the inside of the 'G', **photo 28** and the inside piece sawn out, **photo 29**. Finally, the sawn edges were machined with the slot drill, **photo 30**. What is the bottom of the clamp was made to match the height of the pivot top above the saw table being 25 +5 = 30mm. The second piece of sawn off aluminium was held in the vice and milled to match and one end squared up. The two pieces were joined at right angles with two M6 screws and an M8 tapped hole made in the end above. An M8 caphead screw holds the assembly against the main body, **photo 31**. I turned down the end of some bar to 5mm diameter and used the parting tool to make a shallow groove for a circlip, then turned down and threaded M8 as the clamping screw. I



Clamp screw and pad fitted.



No hole pivot superglued to blank.

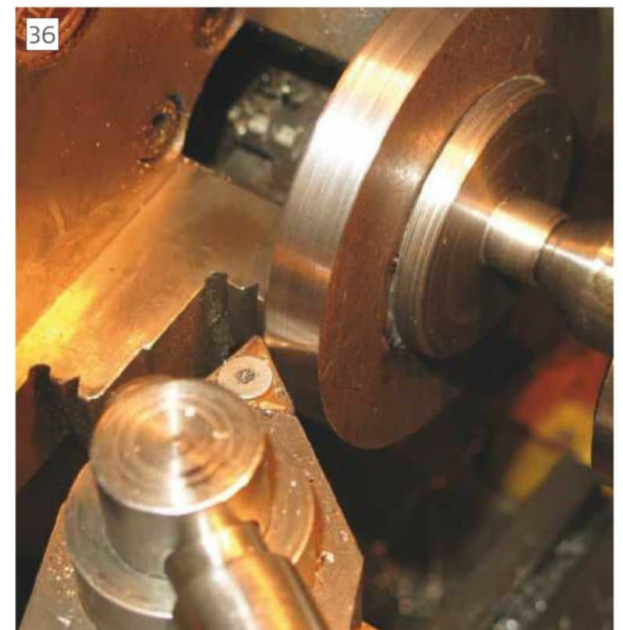


Setting the first corner and clamping.

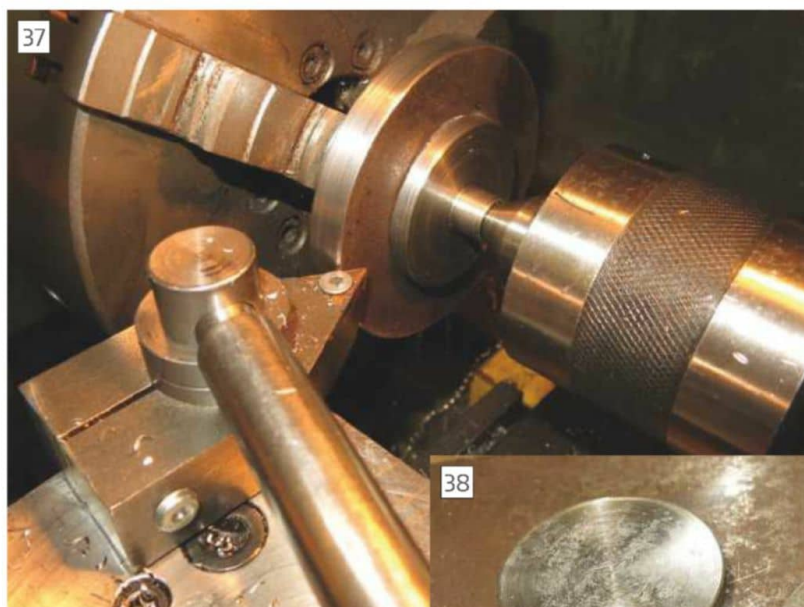
left the head round when I parted off, as I said before not much clamping force is needed. I made a foot for the clamp as a sloppy fit to be retained loosely by a circlip, **photo 32**. For a trial I used some more of the 80 x 10mm flat that I had, sawing an 80mm piece off. I scribed a central square to locate the pivot, cleaned up the surfaces, and superglued them together, **photo 33**. I left it overnight to be sure it was well set then sawed off the corners setting it with the 45 degree tool, **photo 34**. **Photograph 35** shows the blank ready for mounting in the lathe and **photo 36** shows it turned down. Rotating my insert tool, I could break the inside edge and then the outside edge, **photo 37**. To separate pivot and disk I heated it with a torch, it took more heat than I had expected and left flaky deposits, **photo 38**. These were easily scraped off with a screwdriver.



Blank with corners cut and superglued on pivot.



Breaking back edge on blank turned between jaws and centre.



Breaking front edge.

The original feed attachment is proving more useful than I had imagined hence some of the photos. I started on this because I wanted to produce a 60mm diameter disk and it has been an interesting project. The guided power feed itself is proving really useful and I am gaining confidence to cut closer to the finished size reducing final machining. ■



After separating with blow torch.

To separate pivot and disk I heated it with a torch, it took more heat than I had expected and left flaky deposits.

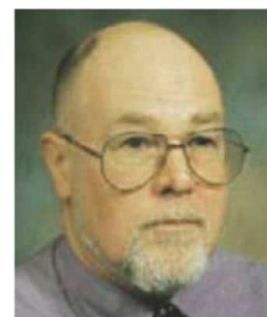
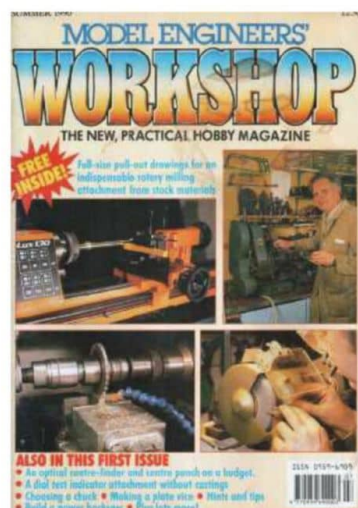
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"HERE'S A SET OF FAT GIMLETS."

Benches

Stub Mandrel says that one thing is true of every workshop – there is never enough bench space!



Arc Euro trade supplied this relatively light stand for use with their mini-lathes

For larger lathes and milling machines, it is likely they will be supplied with their own stands, but for mounting 'benchtop' machines a good solid bench is sufficient. You can either buy a suitable bench or make your own. Beware of relatively flimsy benches made from pressed-steel angle with light tops. While these are fine for assembly benches or working on car parts, they don't have the rigidity needed to support

machine tools. That said, there are some excellent workbenches available in 'flat pack' but they use heavier grades of angle and generally have thicker, more solid benchtops. Good advice is to view the bench made up in a showroom before buying, or at least read a few reviews, to avoid disappointment.

One easy way to get a nice solid bench is to use old kitchen units. The thick melamine-finished chipboard

tops are usually very solid, but you will probably need to reinforce the units with heavier timber or angle iron. As mentioned before, lighter benches are fine for assembly, painting and even smaller machines, such as grinders, but you should always make sure they are solid and don't wobble – at a push attaching them to the wall with brackets can make a nearly-good-enough bench into a decent one. ■

Make your own Bench

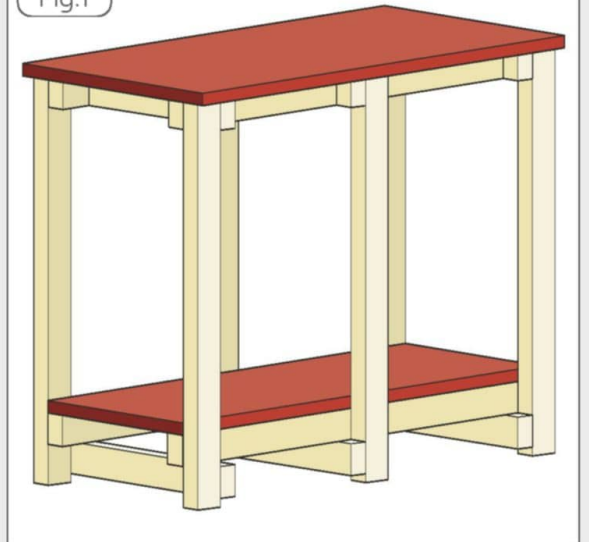
The frame of the bench should be as solid as possible, the simple options for a stout bench are angle-iron or timber. Timber has the advantages of being lighter and easier to work and better at absorbing vibrations. The 50 x 75mm 'studding' timber sold for making partition walls is an ideal material. It has a good finish, is free from knots and is straight, yet because it is used in huge quantities by the building trade it is often cheaper than rough-sawn timber.

Figure 1 shows a simple but robust bench, easily made from timber studding.

The drawing shows a simple bench frame built up from such timber, sizes can be varied to fit your needs, but a typical size would be 600mm deep, 1200mm long, a metre high. The six legs and rails ensure it doesn't sag in the middle. The spaces between the legs can be fitted out as shelves and doors from plywood fitted to the front. The tenon joints for the upper rails are made with two saw-cuts and then the waste material is chiselled out. It is best to hold the bench together with wood screws rather than nails or glue. **Figure 2** shows the method of construction; actual dimensions should be chosen to suit your needs.

The design allows the three back legs to be screwed directly to the wall behind for extra support, while the front of the top overhangs slightly, making it more comfortable to work close to the bench.

Fig.1

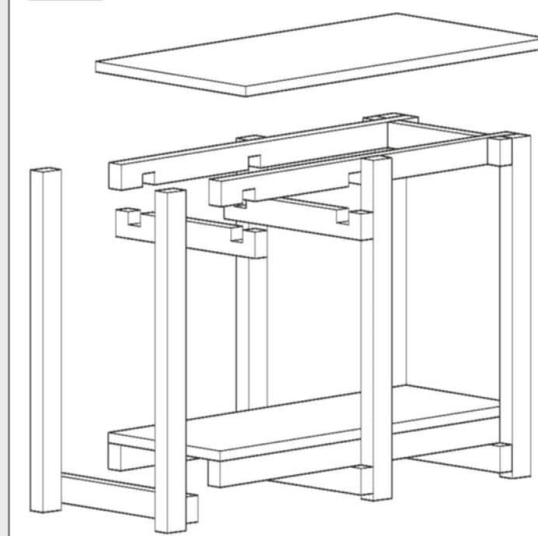


The benchtop can be made of many different materials. Thick kitchen worktop material is surprisingly durable and deadens vibration. Thick plywood is a stronger material for supporting heavier machines but it will need a couple of coats of good varnish to stop oil from sinking in. The benchtop is best fitted by screwing through it into the top rails, rather than using 'fixit blocks' or brackets from underneath.

For benches that will not be used for heavy machines, a light duty version can be made by using smaller-section timber and fitting a top from 20mm 'furniture board' or plywood. Other variations include adding pull-out drawers, perhaps salvaged from kitchen units. It is also possible to adapt old furniture units – those made from plywood can be very robust, but be cautious of using chipboard-based units for anything other than light-duty.

Most benches are about a metre high, but if you decide to make your own you can choose the height that is most comfortable for you. A traditional guide is that when a bench vice is fitted, the top of it should be level with the bottom of your elbow – this is a comfortable height for filing and sawing. You might find a bench height that is ideal for handwork is a bit low for working at smaller machines, the simple answer to this is to fit raising blocks under the machine's feet. Raising blocks can be solid, or made from short sections of square, thick walled steel tubing.

Fig.2



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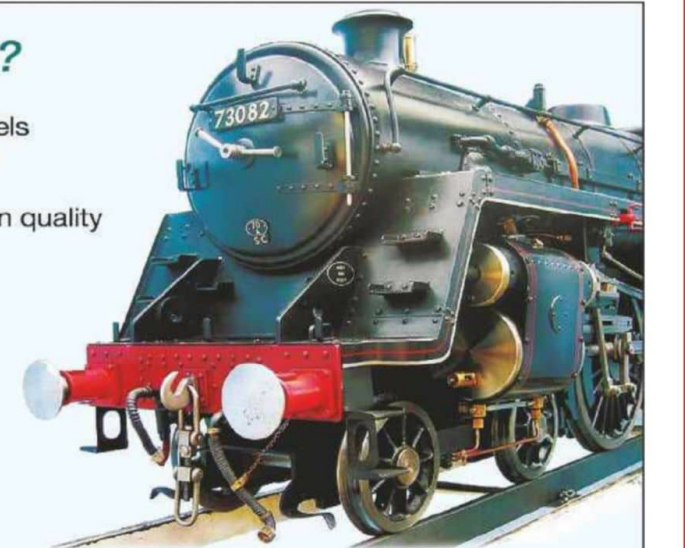
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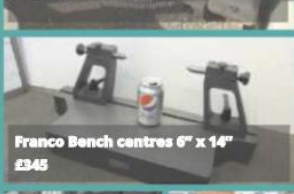
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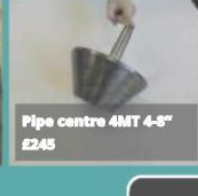
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