No.293

THE BEST MAG FOR MAKERS, MODEL AND HOBBY ENGINEERS

MODEL ENGINEERS' WORKSHOP

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

MAY 2020

New Series: Toby Kinsey's Desktop Gear Hobber

Alan Jackson makes a Surface Grinder

INSIDE

COVER STORY

Readers' Workshop: Patrick Cubbon

£5.25

93

mytimemedia ENGINEERING GROUP

9 770959 690140

GET MORE OUT OF YOUR WORKSHOP WITH MEW

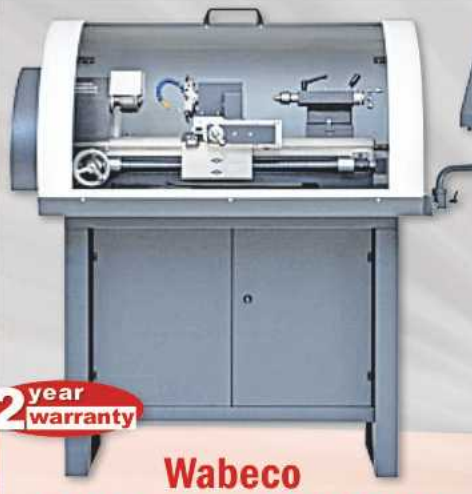
PRO MACHINE TOOLS LIMITED

Tel: 01780 740956
Int: +44 1780 740956

Up to 5 year warranty on selected WABECO Machines!

1885 WABECO 1885

Precision machines made in Germany for the discerning engineer!



2 year warranty

Wabeco CNC Lathe CC-D6000

- Centre Distance – 600mm
- Centre Height – 135mm
- Speed – 30 to 2300rpm
- Power – 1.4 KW
- Size – 1215 x 500 x 605mm
- Weight – 150Kg
- NCCAD/ NCCAD Pro

1885 WABECO 1885

Wabeco produce quality rather than eastern quantity

CNC machines are offered with a variety of CNC control and software systems, and still be used as manual machines.

Wabeco produce precision made machines by rigorous quality control and accuracy testing.

All lathes and mills are backed by an extensive range of tools and accessories

5 year warranty

Wabeco Mill F1210

- Table – 700 x 180mm
- Z axis – 280 mm
- Speed – 140 to 3000rpm
- Power – 1.4 KW
- Size – 900 x 610 x 960mm
- Weight – 101Kg

Wabeco Lathe D6000

- Centre Distance – 600 mm
- Centre Height – 135mm
- Speed – 30 to 2300rpm
- Power – 1.4 KW
- Size – 1230 x 500 x 470mm
- Weight – 150kg

5 year warranty

Wabeco Lathe D4000

- Centre Distance – 350mm
- Centre Height – 100mm
- Speed – 30 to 2300rpm
- Power – 1.4 KW
- Size – 860 x 400 x 380mm
- Weight – 71kg

5 year warranty

Wabeco CNC Mill CC-F1410

- Table – 700 x 180mm
- Z axis – 280 mm
- Speed – 140 to 3000rpm
- Power – 1.4 KW

- Size – 950 x 600 x 950mm
- Weight – 122Kg
- NCCAD/NCCAD Pro

2 year warranty

EMCO · 1885 WABECO 1885 · CERIANI · swiss tec · TE CO · GOLmatic Maschinenbau · PROXXON · EMCO Hobbymaschinen

MORE MACHINES AND ACCESSORIES ON LINE

Our machines suit the discerning hobbyist as well as blue chip industry

We regularly ship worldwide

Please contact us for stock levels and more technical detail

All of our prices can be found on our web site:

www.emcomachinetools.co.uk

PRO Machine Tools Ltd.
17 Station Road Business Park, Barnack, Stamford, Lincolnshire PE9 3DW
tel: 01780 740956 • int: +44 1780 740956
email: sales@emcomachinetools.co.uk

MODEL ENGINEERS' WORKSHOP

Published by MyTimeMedia Ltd.
Suite 25, Eden House, Enterprise Way,
Edenbridge, Kent TN8 6HF
+44 (0)1689 869840
www.model-engineer.co.uk

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

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

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

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

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

ADVERTISING
Business Development Manager: David Holden
Email: david.holden@mytimemedia.com

MARKETING & SUBSCRIPTIONS
Subscription Manager: Kate Hall

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

mytimemedia
print & digital media publishers

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

On the Editor's Bench

Coronavirus and MEW

May I send my best wishes to every reader and their families and friends at this difficult time. I hope you are keeping well and coping with the constraints that the coronavirus pandemic has imposed on our lives.

This is a difficult time for everyone, but if there's any way you think MEW can help, such as sharing information or ideas for mini-projects and the like do let me know.

As I'm sure everyone realises with the present situation, keeping magazines in print isn't easy. That said, we appreciate that getting a regular copy of the magazine is a big plus, especially for anyone who has to self isolate. Naturally those of us who work on the magazines are keen to keep them in production too!

While most of us work from home, the Coronavirus has affected our operations and especially our overseas distribution and advertising. As a result, editors of all MyTimeMedia titles have been asked to make several changes, with the aim of keeping the magazines going. For MEW one of these is going to a longer publication cycle. Obviously, this still better than a cancellation!

This won't reduce the number of copies subscribers get, but it will mean you have to wait a little longer for each issue. Your renewal dates will be pushed back so you still get the full 13 issues.

There are other changes made to make sure we can keep getting the magazine out to readers. These include having to reduce the number of pages and incorporating some 'archive' content – but after all it is out 30th birthday this summer! I've decided to use some of the content from our 25 year special, as this went out of print very quickly and many people could not get a copy at the time. Be assured that whatever happens I will be doing my level best to make sure MEW is still a good read.

I'm also aware that many readers won't be able to go to the newsagent for MEW, so we have arranged a great subscription offer - three issues for £1. This offer includes not just the digital option but also the print AND digital subscription bundle. This is well worth looking at as a digital subscription brings you access to the digital archive, which will give you plenty to be reading during the 'lockdown'.

Please, don't be shy to make the best of the forum at www.model-engineer.co.uk as a way of keeping in touch with like-minded friends. While most of the forum is concentrated on engineering issues, we have a 'Tea Room' topic for general chat and every reader is welcome to come and join in with good company.

Best wishes to you all, and I look forward to the days when we can, once again, meet up with old and new friends at shows and events in the future.

Contents

Coming up...

in our next issue

Coming up in our June issue, number 294, another great read

Regulars

ON THE COVER >>>

Our cover shows Patrick Cubbon's workshop, with an ML7 lathe at left and an EW lathe at right. See page 31 for this first instalment of our new, occasional series featuring Readers' Workshops

HOME FEATURES WORKSHOP EVENTS FORUMS ALBUMS

Visit our Website

www.model-engineer.co.uk

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

THIS MONTH'S BONUS CONTENT

Log on to the website for extra content

Visit our website to access extra downloads, tutorials, examples and links.
www.model-engineer.co.uk/extracontent
Any questions? If you have any questions about our recent Alibre Atom3D or current Lathework for Beginners or Milling for Beginners series, or you would like to suggest ideas or topics for future instalments, head over to **www.model-engineer.co.uk** where there are Forum Topics specially to support these series. Our Web forum has been exceptionally busy over recent weeks and we have been pleased to welcome many new members. The forum is a 'safe space' for anyone with an interest in model and hobby engineering to come and join one of the busiest and friendliest model engineering forums on the web at **www.model-engineer.co.uk** 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 or lonely do join us and be assured of a warm welcome.

Websites for the Bored
This is where we got the list in this issue from, but there are already many more excellent suggestions of engineering-themed websites to help keep you busy.

CLASSIFIEDS EXTRA SUBSCRIBE ARCHIVE SUPPLIERS

PRO MACHINE TOOLS LIMITED

Tel: 01780 740956
Int: +44 1780 740956

emco · WABECO 1895 1895 · CERIANI · TECO · GOLmatic Maschinenbau · EMCO Hobbymaschinen · PROXXON · swiss tec Since 1865

Precision European made machine tools for the discerning engineer!

Wabeco CNC Mill CC-F1410

- Table – 500 x 200mm
- Z axis – 280mm
- Speed – 140-3000 rpm
- Power – 1.4 KW

2 year warranty

Wabeco Lathe D6000

- Centres – 600mm
- Centre Height – 135mm
- Speed – 30-2300 rpm
- Power – 1.4 KW

5 year warranty

TECO Mill VF400

- Table – 450 x 160mm
- Z axis – 320mm
- Speed – 365-1800 rpm
- Power – 250 W

Ceriani Lathe David 203

- Centres – 500mm
- Centre Height – 200mm
- Speed – 100-1800 rpm
- Power – 0.75 HP

Wabeco Mill F1210

- Table – 500 x 150mm
- Z axis – 280mm
- Speed – 140-3000 rpm
- Power – 1.4 KW

5 year warranty

Ceriani Mill David 403

- Table – 420 x 160mm
- Z axis – 300mm
- Speed – 100-3000 rpm
- Power – 1.5 KW

ACCESSORIES

Lathe Chucks, Drill Chucks, Tipped Tools, Boring Bars, QCTP, HSS Tools, End Mills, Slot Drills, Machine Vices, Clamping Sets, Slitting Saws, Arbors, Boring Heads, Radius Mills, DROs, Rotary Table, CNC fits, Collet Chucks, Collet Sets, Flanges, Face Mills, Shell Mills and Much More...

Wabeco CNC Lathe CC-D6000

- Centre Distance – 600mm
- Centre Height – 135mm
- Speed – 30-2300 rpm
- NCCAD
- Power – 1.4 KW

2 year warranty

TECO Lathe MD 200

- Centres – 300mm
- Centre Height – 52mm
- Speed – 250-2000 rpm
- Power – 250 W

MORE MACHINES AND ACCESSORIES ON LINE

Our machines suit the discerning hobbyist as well as blue chip industry

We regularly ship worldwide

Please contact us for stock levels and more technical detail

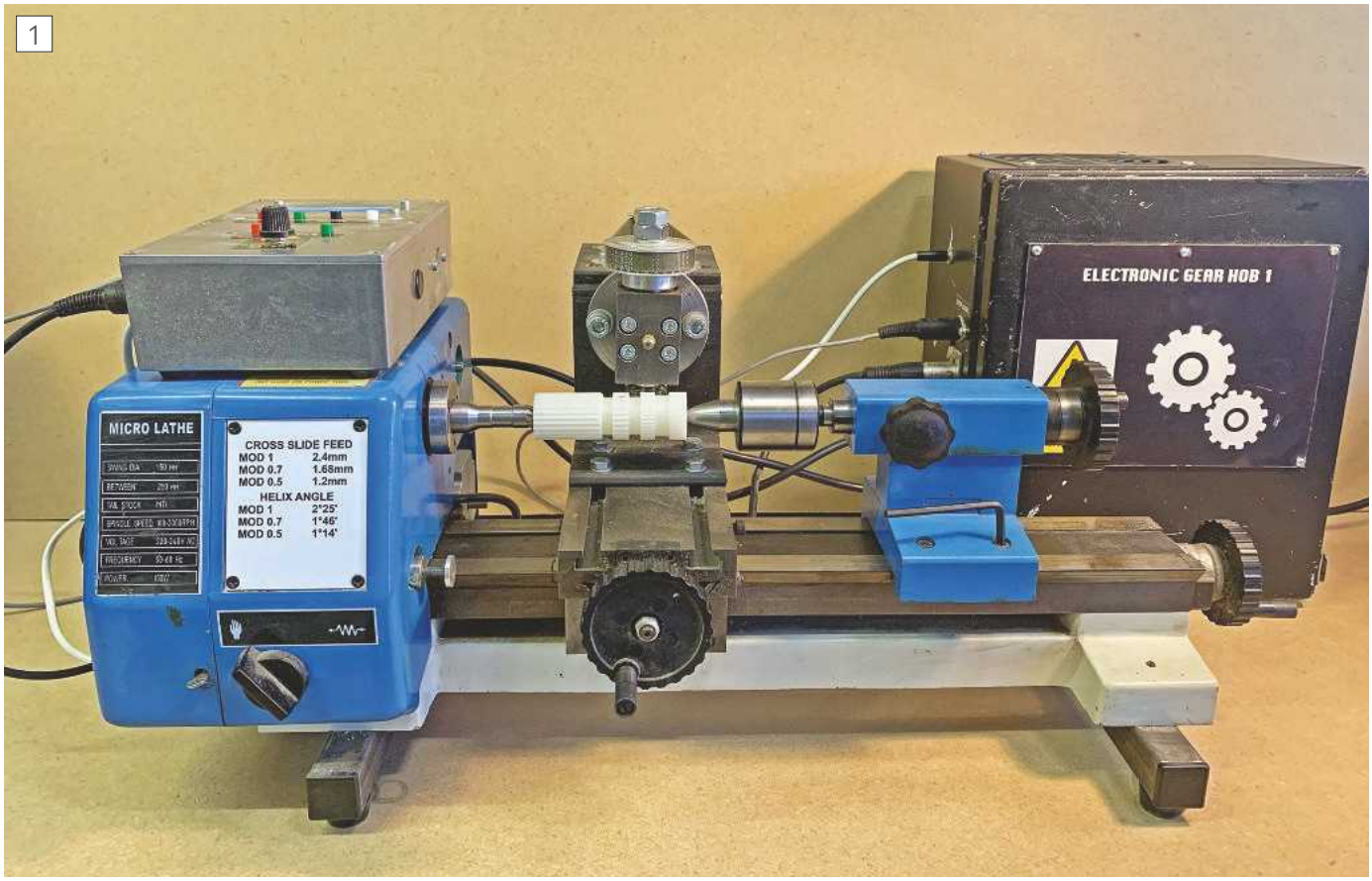
All of our prices can be found on our web site:

www.emcomachinetools.co.uk

PRO Machine Tools Ltd.
17 Station Road Business Park, Barnack, Stamford, Lincolnshire PE9 3DW
tel: 01780 740956 • int: +44 1780 740956
email: sales@emcomachinetools.co.uk

Desktop Gear Hobbing

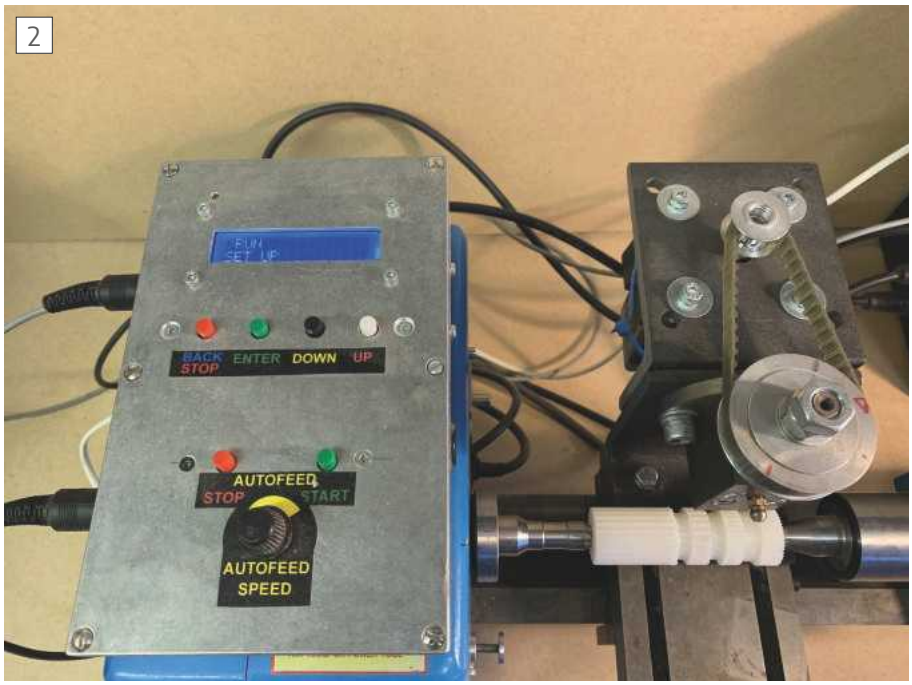
Toby Kinsey has designed this fascinating piece of gearmaking equipment



The MEGS desktop hob.

One of my occupations is as a model maker for a small toy and games invention company. We often have to construct prototype toys and use small Module gears for various gearboxes and mechanisms. The deadlines are often quite tight and to avoid the wait for gears to be delivered, the company stocks a range of small plastic moulded gears in different sizes, from 9 teeth up. These are mainly 0.5 Module, but we do keep some bigger module gears as well. These are generally sourced from companies such HPC (**ref. 1**). But due to the way the world seems to work it is invariably the case there isn't a gear with the right number of teeth for a particular job or there is only one gear left when you need two!

Another issue is the bores of even the small gears are quite large, 3 or 4mm being common. This leads to lots of machining up of little sleeves to reduce



The control box for MEGS

the bore down to suit the 1 or 2mm shafts we use.

I also work on my own personal projects at home, but lack of deep pockets has stopped me from building up a stock of gears in the way that a company can afford to do. This was a limiting factor on what I was able to do at home as again, you never seem to have the right gear for the job in hand. I was faced with the choice of having wait while I ordered a particular gear or "borrowing" gears from work.

Selection of gear hobs.

The Sieg C1 mini lathe as I received it.

The solution to the gear issue I came up with is desktop gear hobbing with the Mini Electronic Gearhob Setup, or "MEGS", **photo 1**. Pushing a few buttons, **photo 2**, you can select the number of teeth of the gear you desire, and it will produce you a gear up to 30mm in diameter. See **ref. 2** for a video of MEGS in action.

Gear Hobbing

The journey that led to MEGS began when I thought would be useful to have a way of making gears myself. Of the ways to make gears I thought, a small gearhob would be the thing.

As many of you will know, a gear hob works by rotating a blank of material at the same time as a cutter or hob is rotated about an axis 90 degrees to the axis of the blank. The hob has spiral groove cut round it like a thread, with gashes cut to provide a cutting edge, **photo 3**. The blank is rotated in proportion to the cutter, i.e. cutting a 10-tooth gear the blank needs to rotate at 1/10th the speed of the cutter spindle. The beauty of hobbing gears is you only need one cutter to cut any size gear for any given module, unlike cutting gears on a mill using a dividing head and involute cutters. Where each cutter will only produce the right teeth form when cutting gears with a limited range of number of teeth. You can get an involute cutter that will cut a gear of between 12 and 14 teeth. You will need another cutter to cut the next few sizes up and so on. Which all means you will need a range of cutters to cover all eventualities. Another advantage of producing my own gears was that I could produce a long length of a particular gear and then part if off to just the right thickness, as and when needed.

As I was only going to need to work in plastic or the odd bit of brass I wouldn't need anything too substantial. But looking around on the web the options seemed rather limited.

There were commercial hobs, but these were a bit too mighty in both construction and price.

College Engineering Supplies, (**ref. 3**), sell the castings for a small tabletop hob. The requirement to make a fair few gears for the hob just to function was slightly off-putting. It also looked like it would take quite a long time to complete and it would be handy to have something producing gears fairly soon.

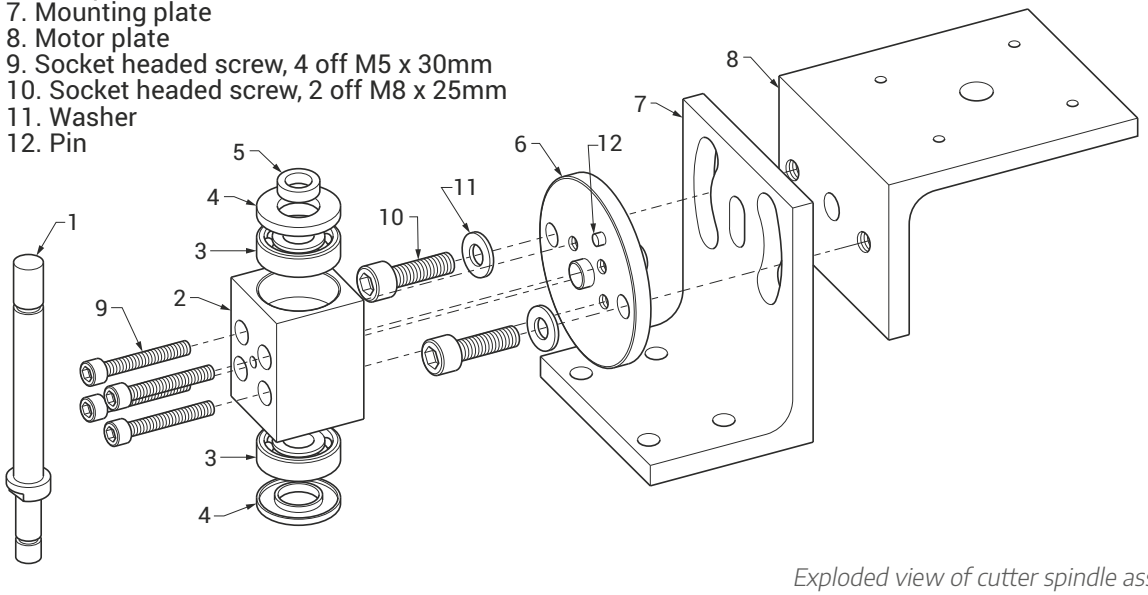
As it turned out, ironically, it took me seven years of, admittedly sporadic

Cutter spindle assembly components.

Fig.1

Spindle Assembly

1. Spindle
2. Bearing block
3. Bearing (annular contact Nachi 7200)
4. Dust cover
5. Collar
6. Backplate
7. Mounting plate
8. Motor plate
9. Socket headed screw, 4 off M5 x 30mm
10. Socket headed screw, 2 off M8 x 25mm
11. Washer
12. Pin



Exploded view of cutter spindle assembly.

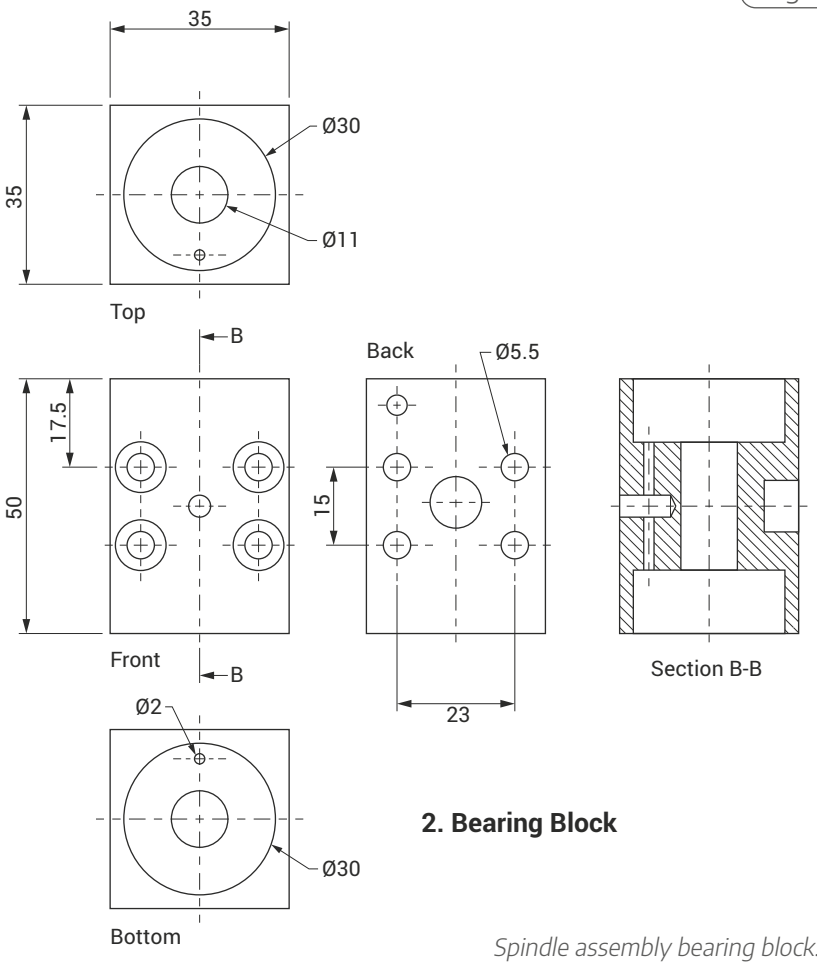
work, before I had a made a functioning hob anyway! Due to long periods where it was tucked away under a workbench after I had hit a problem while I pondered my next move or just dealing with life in general.

MEGS is still very much work in progress. Not being one to do a lot of drawing beforehand, I tend to sketch in 3D as it were. MEGS has had bits taken off, bits added, bits modified as new directions present themselves and issues arise. There are probably (certainly) aspects of this project that would make a proper engineer wince, due to my model making background, but it works for me. I also need to say I only needed to make metric module gears but of course it could be used for Imperial Diametrical Pitch gears.

Early Ideas

After finding nothing on the web that was suitable, I wondered if there was a way for me to make a gear hob. Then it occurred to me. All a gear hob is an x-y table with a way of rotating the work, a cutter mounted on a spindle and a means to gear the x-axis to the spindle. Well I had a machine that met most of those requirements already- my milling machine. All I had to do was find some way of reading the speed of the mill's spindle and drive some sort fixture, holding the work mounted on

Fig.2



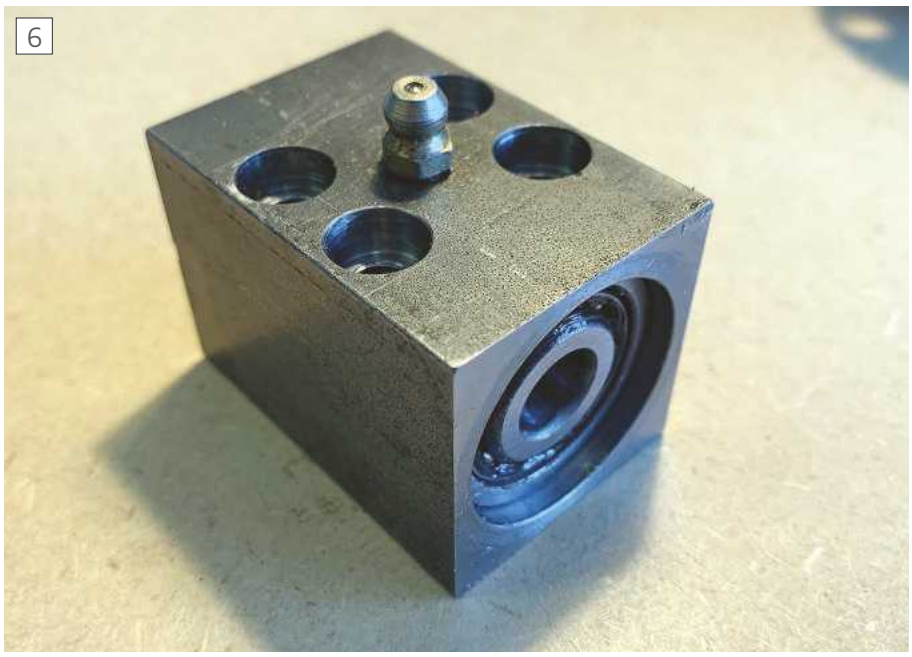
2. Bearing Block

Spindle assembly bearing block.

the table, and bingo! Genius, what an original idea I thought. A quick search on the web for this particular route to cut gears brought me down to earth, as other people had been there long before me. After digging around I found a mention on a Model Engineering forum from John Stevenson about gear-less hobbing. A quick email exchange later and I was pointed to Model Engineers' Workshop 108. Therein an article by Brain Thompson, titled Gear Hobbing Without Change Gears, explained how a mill was used in just the way I had envisioned. The rotations of the spindle were counted and via some electronics, a stepper motor connected to the work was rotated at the correct speed for the gear that was being cut. A stepper motor is an electrical motor that has the ability to be rotated by a small fixed amount, normally 1.8 degrees (200 steps/revolution. This is a 'step'. Under computer supervision, stepping the motor can very precisely and repeatedly control the speed of rotation and how many rotations.

In the end I decided against this approach for several reasons. The main one being setting up the mill for hobbing would take some time Then, I was sure, as soon as it was set for gear hobbing, I would need to do some milling and have to remove the hobbing setup. All a bit of a faff. It is one of the reasons I have never been a fan of multipurpose machines and would rather have more machines dedicated to a task they do well, and which has limited setup time, than one all singing dancing machine.

So my thoughts turned to maybe a standalone unit. Then another brainwave. It occurred to me if I could get hold of a mini lathe that would be a good basis for a gearhob. It had the x-y movement; I could hold the work using the existing headstock and tailstock. I could mount a new spindle on the cross slide to hold the cutter. Not too expensive if I could get hold of a cheap second hand one and not too large to store in my somewhat crowded workshop/garage. Sorted! It was then that I happened to mention to a colleague about what I was thinking, and he said he had a small lathe he wasn't using. Sometimes these things are meant to be! A deal was done and I was the proud owner of a Chinese Sieg C1 lathe, **photo 4**. It had barely been used and indeed was still largely covered in protective wax.


6

Spindle bearing block with bearing inserted.


7

Backplate for spindle assembly.

Construction

After a clean up I decided to use the existing lathe motor and remount it on a bracket on the cross slide driving a new spindle I would make. I could then mount a stepper motor where the lathe motor had previously been Then all I had to do was impose some electronics between the two and off I go.

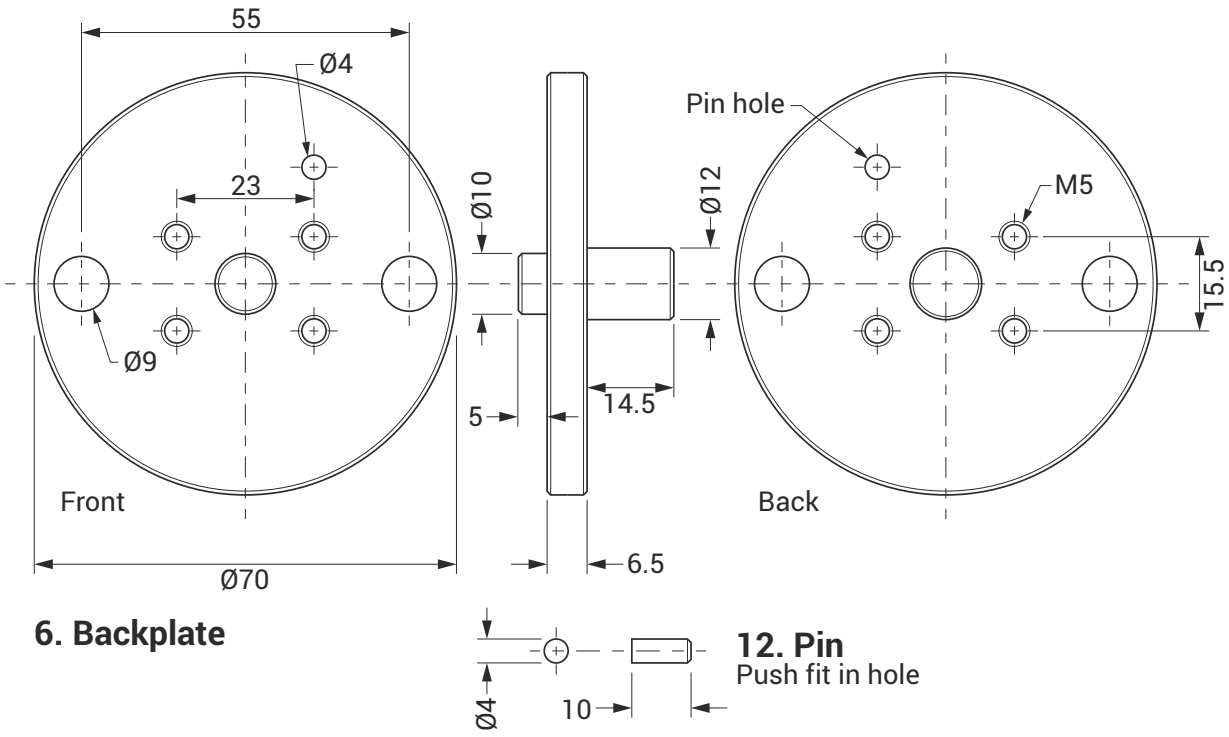
As you could imagine it didn't turn out to be quite that simple!

As I said before I didn't do many drawings before hand and used a lot of materials I had floating round my workshop. What follows isn't intended to be a detailed step-by-step account of how to build a small gear hob. More just to be indicative of what I did and the various answers to the problems I encountered. I adapted the sizing of a lot of the components to whatever lay to hand. People I am sure will have better or different ways of doing things and can adjust accordingly to what they have access to. And as I have said it is still evolving but it is at a stage where it is now a useful addition to my workshop and I can cut gears with relative ease.

The first thing I made was the spindle assembly to take a hob cutter, **photo 5**, **fig. 1**. I started with the bearing block, **photo 6**, **fig. 2**.

A piece of 35 x 35mm steel block was cut to length faced and bored through the centre in the 4-jaw chuck. Each end was then opened out to take an annular contact ball race. These can be used in opposed pairs to take an axial

Fig.3



Spindle assembly backplate.

loading as well as radial force. The ones I used where Nachi 7200s with a 10mm bore, 9mm depth and 30mm overall diameter (**ref. 4**). A 2mm hole was drilled connecting the two bearing recesses. On the front of the block a hole was drilled to intersect the 2mm drilling and tapped for a grease nipple. The bearings could have probably been packed with grease when installed and that would have been fine. But I must have picked up a vibe from my other occupation where I work on a farm, and where every bit of machinery has a multitude of grease nipples, so I thought I would follow suit. It saves from ever having to dismantle to re-grease.

More holes were through drilled from the front face and counter-bored to take M5 socket headed bolts. The rear face had a blind hole drilled to take a spigot from the next component, the back plate, **photo 7**, **fig. 3**. A 4mm blind hole was also drilled on the back of the bearing block to take a short length of bar to act as a anti rotation dowel between the block and the back plate

The back plate was made from piece of 70mm round bar. It was turned back to leave a spigot that fitted into the recess on the back of the bearing block. On the other side it was turned back to leave another spigot to engage into the motor mount and mounting bracket. It was drilled and tapped to match the holes through the bearing block. It had two holes drilled to allow the M8 socket headed bolts to pass through it to retain it to the mounting bracket. The bearing block was then bolted to it with four M5 x 30mm socket headed bolts.

The reason for the back plate is to allow the axis of the cutter to be varied from the perpendicular to allow for the helix angle of the cutter. Each cutter size has a slightly different angle and the spindle must be set off from the vertical axis by this amount. This is so the teeth of the cutter are parallel to the axis of the work. The setup allows the clamping bolts to be slackened and the assembly rotated to set the angle. It also allows the easier change over of cutters by rotating it to the side, which allows more clearance between the end of the spindle and the cross slide. It also allows in the future the possibility cutting of helical gears where the teeth are cut at an angle to the face of the gear.

I was fortunate that the Sieg C1 has two t-slots running from the front of the cross slide to the rear, which makes mounting to it very easy, **photo 8**.

●To be continued

T-slots in the crosslide of the lathe.

Readers' Tips

Sturdy DTI Mount

TIP OF THE MONTH WINNER!

This month our lucky winner of £30 in Chester gift vouchers is Peter J. Love with his clever solution for holding a DTI on his Alpine mill.

I have very recently taken out of service my 1980's Alpine mill and replaced it with a new Axminster ZX30M, much to my wife's bemusement I then set about taking it to pieces and fitted (1) a Three axis DRO (2) a Three phase motor and VFD (3) a Spindle speed RPM readout (more on that in another MEW submission) and (4) a Powered cross table assembly.

However, a nuisance that I have never got to grips with is a solid fixing point for a DTI. I made a split clamp that worked ok, but the aesthetics would have made any machinist snigger. I then had a brainwave, I had in my collection of bits a spare 3/8" chuck with 3/8" x 24 internal thread, when fitting the Z axis sender mounting, I had the forethought to leave about 30mm studding extra. It was then a simple matter of turning down a piece of 12 X 1.75mm studding and cutting a 3/8" X 24 thread on the other end for the chuck, joined together with a 12mm extension nut. I am very pleased with the result and I can now clamp a range of bracket fittings etc and remove the assembly when not required.

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

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

Cuts accurately, again and again

Axminster Engineer Series
MCB115 SHD
Swivel Head Bandsaw

£395.96 Inc.vat (normally £439.50)

Code **700103**

★★★★

"Stable, easy-to-use machine, cuts accurately. I like the ability to move it around the workshop, with the retractable handle."

A versatile, medium sized metal cutting bandsaw with several notable features. Ideal for smaller fabrication jobs, especially those which require materials precisely cut at various angles.

- **Quick release head swivels from -45° to +60°**
- **3 speed belt drive to cope with a wide variety of materials**
- **Adjustable length stop and automatic downfeed stop**

Axcaliber High Carbon Bandsaw Blades
1640mm x 12.7mm (10, 14 & 24 tpi)
Codes: 340685, 340686 & 340687
From £8.75 inc vat

Axcaliber metal cutting bandsaw blades

Manufactured at Axminster using advanced CNC machining, high precision digital measuring equipment and specialised heat treatment facilities. These blades consistently cut straighter with harder, longer-life teeth which give a superior finish to the work. More information at axminster.co.uk/axcaliber.

Axcaliber®

AXMINSTER
Tools & Machinery

To see the quality of this machine, **visit one of our stores**, search **axminster.co.uk** or call **0800 371822**.

For the complete Axminster experience and to keep up with Skill Centre courses, events, news and much more, browse our website or follow us on social media.

Axminster • Basingstoke • Cardiff • High Wycombe • North Shields • Nuneaton • Sittingbourne • Warrington

Rated **'Excellent'** on Trustpilot

From the Archives:

Twist drill Sharpening by the Four Facet Method

Giles Parkes, MEW Issue 64, February/March 2000

One thing that many people find a challenge is accurately resharpening 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.

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 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.

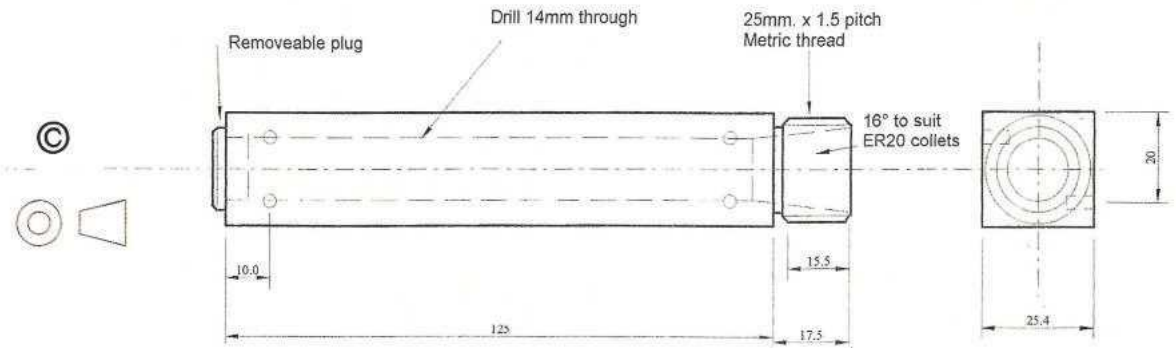
ER20 spring collets, normally used in the Morse taper chuck (right) can be fitted to the square holder (left) and used to hold a wide range of drill diameters.

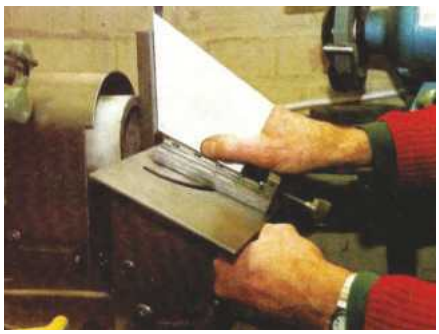
My Jig

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 find it convenient to stamp a number on all sides of the square holder, in order to identify which

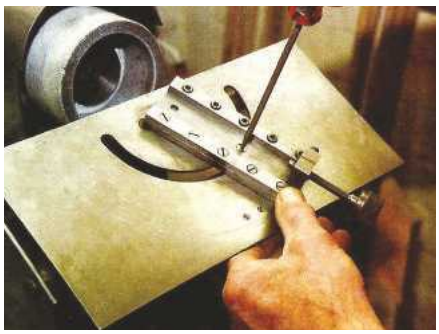
Fig.1

FIG. 1 - COLLET HOLDER FOR FOUR FACET DRILL SHARPENER

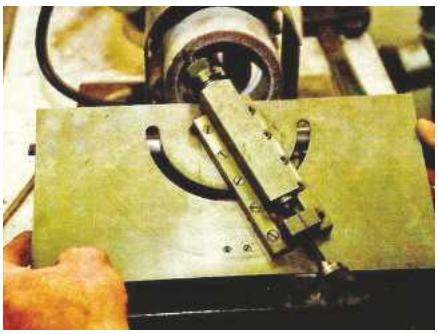




Setting the tip angle by tilting the table.



The angle of the slide creates the clearance.



Traversing the table to sharpen the drill.

facet is being ground. The components are shown in **photo 1**. The flexible collet then holds 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!

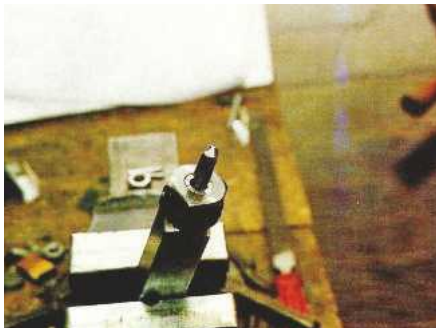
Any grinding rest on which angles can be accurately set and a fine feed incorporated should enable drills to be ground by this method, on any grindstone.

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 ½ inch drill with a No. 1 Morse taper shank.

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,



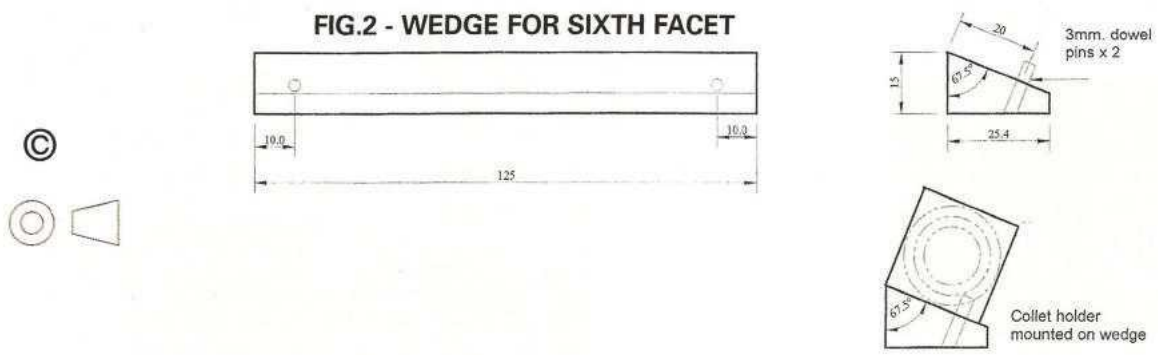
A sharpened drill in the ER20 spring collet.

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.

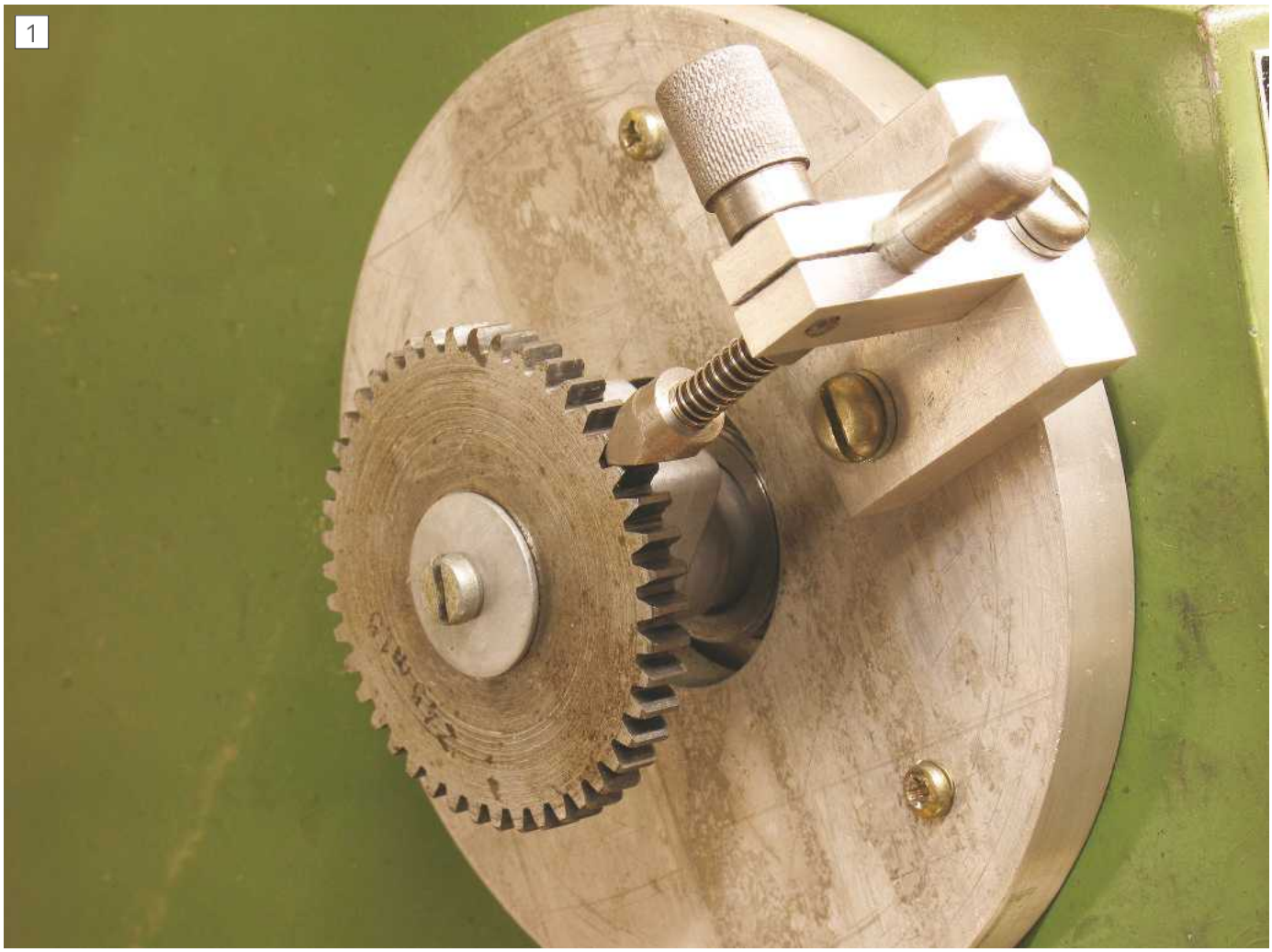
The greatest benefit of this device, apart from producing sharp drills, is that the operation can be inspected as it progresses. The whole jig can be lifted away from the grinding wheel and the tip of the drill examined before replacing the jig to grind further, as required, from exactly the previous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

Fig.2



Dividing on the Warco 220 Lathe

Peter Shaw describes a mandrel dividing attachment for this popular lathe that can be adapted to fit many other benchtop machines



Completed device.

Users of this lathe will no doubt be aware that limited simple dividing by 2, 3, 4, 6 and 12 can be accomplished using the pre-drilled holes in the mandrel flange along with a simple accessory which bolts onto two pre-drilled and tapped in the headstock housing. If you have not got one, then drawings for this accessory were published in MEW 135, February 2008.

Divisions of 2, 4 and 6 are quite useful on their own as along with a suitable filing rest, one can produce spanner flats on a bar, a square end on a bar or a hexagon for use as a nut. But what if you need to divide by 8, say for a cover with 8 fixing holes? Well, you could rig up something to engage with the 32 teeth gear wheel semi-permanently mounted on the mandrel inside the gearbox. This same device would also give you 16 and 32 divisions if you need them.

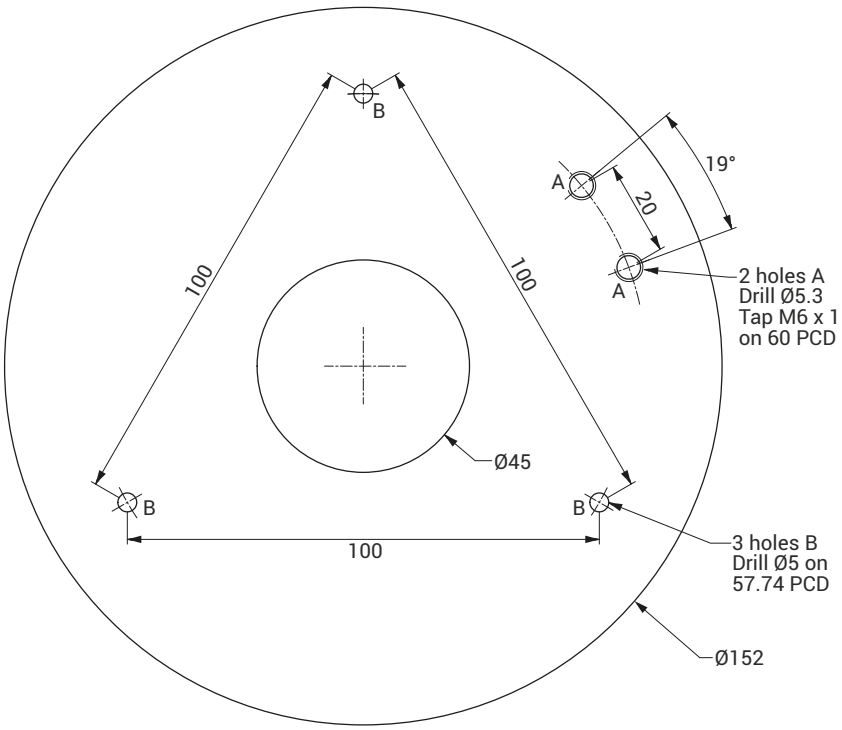
Life gets somewhat more difficult, though, if you want something else. Suppose you want to mark graduations around a disk with a M6 tapped hole through the centre with a view to being able to adjust the device, whatever it may be, by 0.1mm. M6 has a pitch of 1mm, therefore, if you could divide the disk into 10, then you could adjust by 0.1mm and hence problem solved. But how do you do it? Or, as I did recently, I wanted 40 long graduations of 5mm length around the periphery of a ring, with a further 40 short graduations of 3mm length to subdivide the main 40 divisions. The answer is to use a dividing mechanism mounted on the rear of the mandrel and which uses the lathe changewheels as the master device. Even so, there is problem in

that I required 80 graduations, and the largest changewheel available is 64 teeth. The answer is to use the 40 teeth wheel and a detent which either slots in between two teeth (thus giving 40 graduations) or sits astride a tooth (thus giving a further 40 graduations spaced between the original markings). Taken to it's logical conclusion, the greatest number of graduations this method can give is 128 (2 x the largest changewheel of 64 teeth). Even so, there are a number of divisions which cannot be achieved, and for these it will be necessary to use some form of gearing using two or more changewheels. The design presented here is the simple version using a single changewheel.

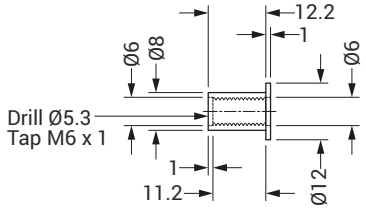
The essential ingredients of such a device are firstly some means of rigidly attaching a changewheel to the rear of the lathe mandrel, and secondly, rigidly attaching a detent to the lathe itself such that the detent can lock securely into the changewheel thus preventing its rotation whilst suitable marking of the workpiece proceeds. It was this latter ingredient which caused me most concern as I ended up using the gearbox cover itself to locate the detent. This cover, being hinged could be considered to be somewhat flexible and hence could contribute to some inaccuracy, however, on my lathe, once the gearbox cover lock is engaged, it does seem reasonably rigid. The cover itself is reasonably thick at about 1.75mm; indeed, it is thick enough for there to be three 4mm tapped holes which are used to hold in place the protective shield for the end of the mandrel. Finally, the actual strain on it is, I think, quite small, and in the end it worked satisfactorily.

To fasten the changewheel to the mandrel requires a device which can be made to expand to grip the inside of the mandrel and to which the changewheel is then attached. Now, to remove the device requires the expansion device to be slackened but there is a problem that the expanding cone may not slide out of its sleeve and thus one may have to hit the end of the operating screw to force it to release. I do not like this, because the shock loading is transmitted through the mandrel bearings, so this design eliminates that by making the operating screw bi-directional such that one way it forces the expanding cone to tighten up, whilst in the other direction it forces the cone to release. Some may think this is unnecessary, and indeed, if you so wish, then you could simplify matters by not providing that feature. **Photograph 1** shows the completed device.

Fig.1



Gearbox Cover Adaptor Plate
Mat'l: Aluminium, MDF or equiv. 13.2mm thick
Hardware:
Screws - 3 off pan/hex head or equiv. M.S. M4 x 0.7 x 25
Washers - 3 off M.S. for M4



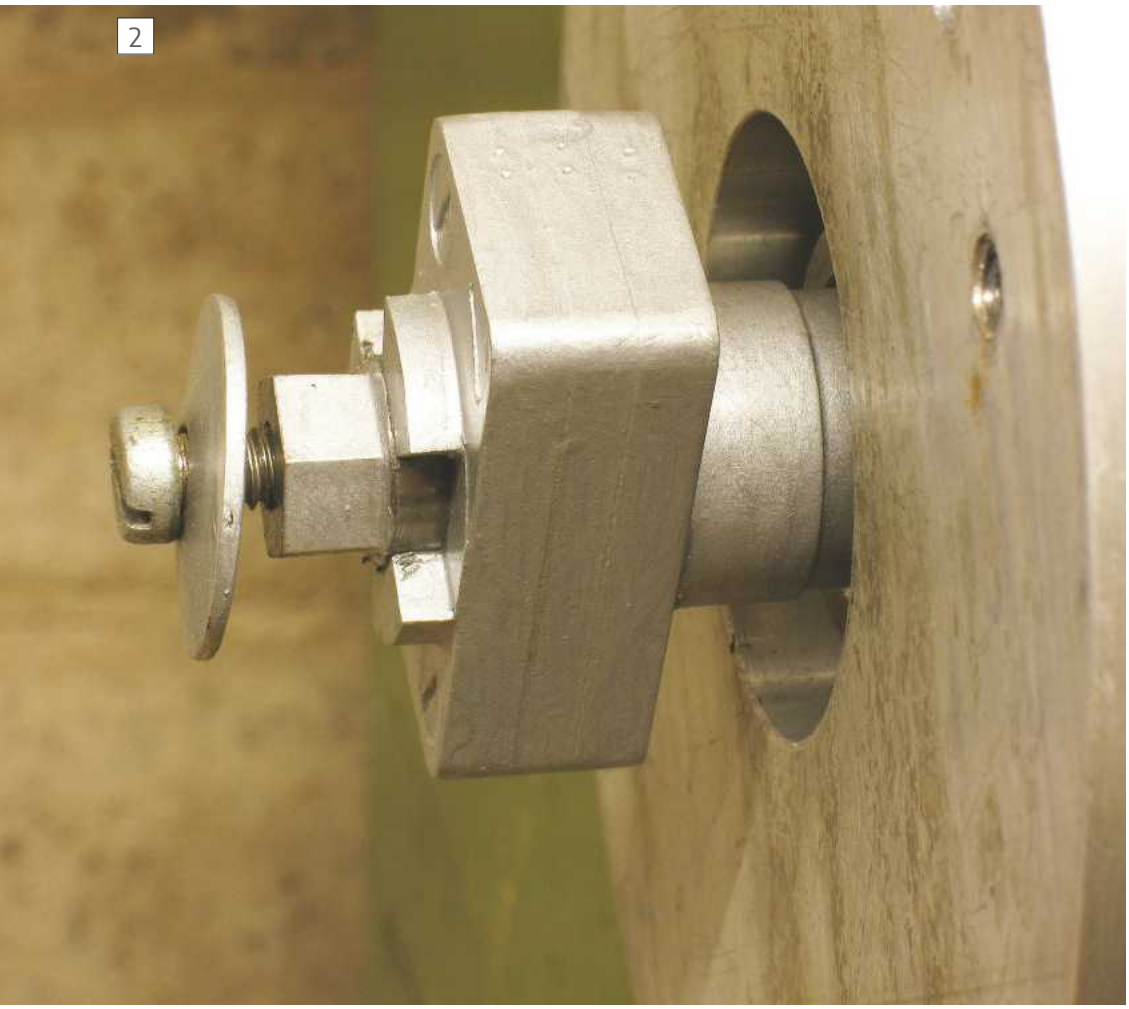
Optional Insert
Mat'l: M.S. 2 off

Gearbox Cover Adaptor Plate (Fig.1)

This is made from a piece of aluminium, MDF, or equivalent about 13.2mm thick. Steel and/or brass could be used but would be rather heavy at this thickness and diameter. Using thinner material will require modification to the two screwed holes (to provide sufficient thickness for tapping), and the length of the pillar (see later). I used a thickness of 13.2 mm because that is what I have readily available.

Making this item poses difficulties with the marking out. I must confess that I made mine by trial and error and only created the drawing afterwards. I suggest that the following would be the method I would use were I to have to make another item and be working from the drawing.

First cut the stock to an approximate octagonal shape, followed by rounding off the corners of the octagon to reduce the initial shock loading when turning the rim later. Now mount the stock in the 4-jaw independent chuck and adjust for best concentric running. Set the smallest centre (Slocombe) drill in the tailstock chuck and make a shallow hole in the face of the stock such that one point of a pair of dividers may be located in what is now designated as the centre of the stock. Set the dividers as near as possible to 28.87mm, ie fractionally less than 29mm and mark a circle. This will be the Pitch Circle Diameter (PCD=57.74mm) for the three 5.0mm fixing holes. Reset the dividers to 30mm and mark a short arc, perhaps 30mm long, for the two 6mm tapped holes (PCD = 60mm). It may help to use a dry



Bearing Housing and Expander – in situ. Note the 3 pairs of dots for alignment purposes.

marker or equivalent either before or after to highlight these markings.

The central hole may now be drilled from the tailstock using the largest drill available, eg ½ in, followed by enlarging the hole to 45mm diameter using a boring tool.

There is a problem in that the central hole through the disk has to be large enough to allow the gearbox cover to be opened without the disk fouling the end of the mandrel: this is why the original shield was dished. I found this out the hard way – I could not open the gearbox cover after initial installation and had to widen the hole. On reflection, what I should have done was to either taper the hole or make a step in it thus allowing the disk to provide protection to, or from, the end of the mandrel akin to that provided by the original dished shield.

Following completion of the central hole, remove the stock from the 4-jaw chuck, clean up the edges of the bored hole – there may well be some burrs thrown up by the turning operation, change the 4-jaw chuck for the 3-jaw self-centring chuck and remount the stock on the 3-jaw chuck by tightening the internal jaws outwards to grip the inside of the bored hole whilst pressing the disc towards the face of the chuck. The rim of the embryo disc can now be turned using light cuts to avoid causing the work to slip on the jaws. Finally, remove from the chuck and clean up to remove the inevitable burrs. The drawing shows a diameter of 152 mm, but it will not matter if it is more or less than this, indeed anything from 150 mm to 155mm will be satisfactory.

To mark the three fixing holes, select a point on their PCD such that the two 6mm tapped holes will be approximately equidistant between any two of the fixing holes. Lightly centre punch this point, set the dividers to 100mm and mark a short arc crossing the PCD at each of two other places. If marked correctly, the distance between these two points should be 100mm. If correct, then all three holes may be drilled 5mm. The two 6mm tapped holes are 20mm apart, so mark two appropriate points on the short arc, drill 5.3mm, and tap M6 x 1. This concludes the work on the Gearbox Cover Adaptor Plate.

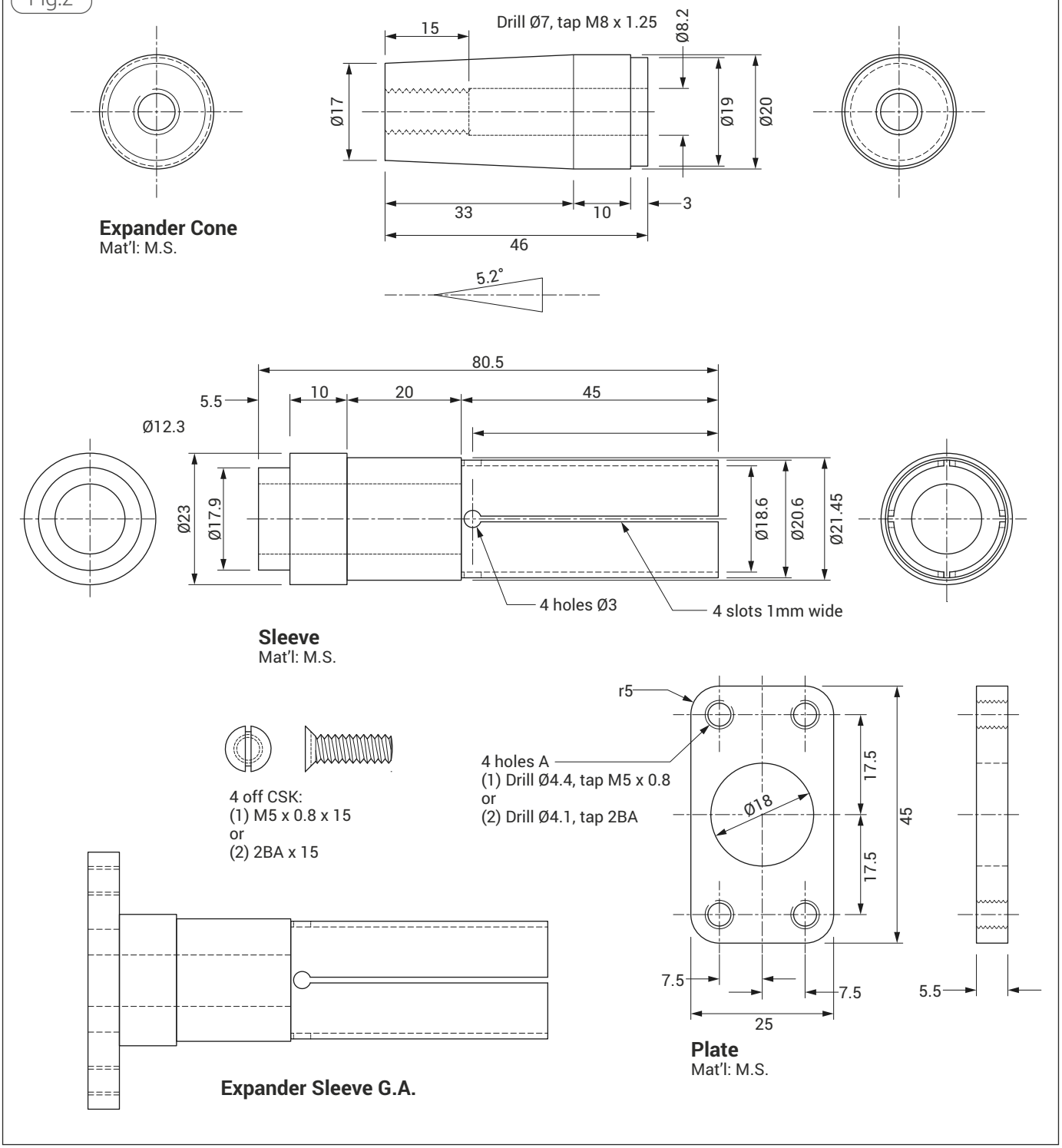
Figure 1 also shows an Optional Insert. If using aluminium, the two tapped holes may be satisfactory, but ultimately may wear and become unusable. Furthermore, if using MDF, it is highly unlikely that satisfactory tapped holes can be made. The answer in both instances is to use steel inserts as shown in the drawing inserted from the underneath of the Adaptor and fastened in place by a suitable adhesive such as an epoxy resin. Note that the head may be recessed into the Adaptor if desired.

Bearing Housing and Expander Plate

These are shown in **photo 2**. Start by cutting two pieces of steel slightly larger than that ultimately required. Carefully file, face or mill one of the large surfaces on each piece to the best finish possible remembering that these surfaces will eventually become the bearing surfaces for Part B of the Expander Bolt. Fasten the two parts together using an adhesive such as epoxy resin or possibly cyanoacrylate. Leave at least overnight under slight pressure for the adhesive to fully cure.

Once cured, the sides of the combined parts may be filed to size, paying particular attention to getting them square and parallel. Next, the visible surface of what will be the top section should be made suitable for marking out, e.g. by the application of a suitable marking fluid. Using jenny or odd-leg calipers, mark out the four holes A (Fig. 3) and the central hole. If your calipers do not close down sufficiently to allow close marking, then mark from the opposite side. Also, when marking for the centre hole, mark from all sides thereby creating two sets of very close, parallel lines enclosing a small square, thus enabling the centre of the piece to be determined should the caliper setting be slightly awry. Centre punch the corner intersections and the centre of the square. Using dividers mark out two circles, 15mm diameter and 26mm diameter, for the central hole and the outer limit for the changewheel coupling

Fig.2



segments. Mount the combined parts in the drill vice using paper between the sides and the vice jaws and drill the four holes A to the desired tapping size (4.4mm for M5x0.8 or 4.1mm for 2BA). Also drill a small hole through the marked centre: this hole will be used later for alignment purposes. Finally mark the individual parts on the end with a pair of matching dots to aid later re-assembly, round off the corners with a file and then separate the combined parts into their individual components. This may be done by means of a sharp blow with a soft or plastic faced hammer, failing which it will be necessary to heat the component until the adhesive starts to fail – about 120 degrees C.

Expander Sleeve Plate (Fig.2)

Having separated the parts, clean up the glued surface, and tap the four holes to the desired size. Although not shown on the drawing, it may be desirable to lightly counterbore the corner holes prior to tapping. Now mount the plate in a 4-jaw independent chuck using parallel packing pieces if necessary and set to run true using the previously drilled hole as a guide. If necessary, lightly skim both surfaces and reduce to the required thickness. Finally, drill and bore the central hole, and remove any burr resulting there from.

●To be continued

Why not try 3 issues for £1?

PRINTED, DIGITAL or BOTH!

- Get your first 3 issues for £1 (saving £13.97)
- No obligation to continue
- Pay just £3.46 for every future issue (saving 31%) if you carry on**
- Delivered conveniently to your door
- Significant savings on **DIGITAL** only and **BUNDLE** options available

If you have enjoyed this issue of **Model Engineers' Workshop**, why not claim the next **3 issues for just £1**? The magazine covers machine and hand tools; accessories and attachments; materials and processes and provides guidance on the selection, commissioning and use of tools and equipment. The essential guide for any workshop!

3 SIMPLE WAYS TO ORDER

BY PHONE
0344 243 9023

ONLINE
me.secureorder.co.uk/MEW/341FP

POST
Complete this form and return to:
Model Engineers' Workshop Subscriptions,
MyTimeMedia Ltd,
3 Queensbridge,
The Lakes, Northampton,
NN4 7BF

*Calls are charged at the same rate as standard UK landlines and are included as part of any inclusive or free minute allowances. No additional charges with this number. Overseas calls will cost more.
**Future savings based on the current annual shop price.

GET 3 ISSUES OF MODEL ENGINEERS' WORKSHOP FOR £1

☑ Yes, I would like to subscribe to Model Engineers' Workshop with 3 issues for £1 (UK only)

I understand that if I am not 100% satisfied, I can cancel my subscription before the third issue and pay no more than the £1 already debited. Otherwise my subscription will automatically continue at the low rate selected below.

YOUR DETAILS (MUST BE COMPLETED)

Mr/Mrs/Miss/Ms..... Initial ..... Surname .....

Address .....

.....

..... Postcode .....

Country..... Tel .....

Email .....

INSTRUCTIONS TO YOUR BANK/BUILDING SOCIETY (please select option)

Originator's reference 422562

❑ **PRINT ONLY:** £1 for 3 issues followed by £11.25 every 3 months
❑ **DIGITAL ONLY:** £1 for 3 issues followed by £8.99 every 3 months
❑ **BUNDLE (DIGITAL & PRINT):** £1 for 3 issues followed by £13.50 every 3 months

Name of bank.....

Address of bank .....

..... Postcode .....

Account holder.....

Signature..... Date .....

Sort Code

Account Number

Reference Number (official use only)

Instructions to your bank or building society: Please pay MyTimeMedia Ltd. Direct Debits from the account detailed in this instruction subject to the safeguards assured by the Direct Debit Guarantee. I understand that this instruction may remain with MyTimeMedia Ltd and if so, details will be passed electronically to my bank/building society.

DIRECT Debit

Please note that banks and building societies may not accept Direct Debit instructions from some types of account.

TERMS & CONDITIONS: Offer ends 17/10/2021. MyTime Media collects your data so that we can fulfil your subscription. We may also, from time to time, send you details of MyTime Media offers, events and competitions but you always have a choice and can opt out by emailing us at unsubscribe@modelengineersworkshop.co.uk. Please select here if you are happy to receive such offers by email ❑ by post ❑, by phone ❑. We do not share or sell your data with/to third parties. Details you share with us will be managed as outlined in our Privacy Policy here **www.mytimemedia.co.uk/privacy-policy**.
Please visit **www.mytimemedia.co.uk/terms** for full terms & conditions

CODE: 341FP

Suppliers Of Quality · Machine Tools ·

· Engineers And Founders · Purveyors Of Quality Steam Models

Repairs To Models · And Machinery ·

THE ENGINEERS EMPORIUM

L.A. Services Ltd

Est. 1983

01455 220340

The Economy

Half full size model open crank, hit and miss engine

Castings & Drawings for home machining

The standard set includes

- **Two cast iron flywheels**
- **Cylinder head**
- **Base casting**
- **Hopper casting**
- **Liner material**
- **Piston material**
- **Rocker arm**
- **Governor arm**
- **Bearing caps**
- **Drawings in book form**

£375 ex works

Addition parts we can supply to help the build along

Cut gears	£62.50
Cam profile	£2.50
Oil cups (2)	£4.50
Piston rings (3)	£36.50
Springs (6)	£5.50
Crank web profile (2)	£3.50
Cam follower Brg	£1.50
Crank guard casting	£34.50
Head gasket (2)	£4.50
Spark plug	£7.50
Transfers	£5.50
Timing plate profile	£12.00
Gib keys (2)	£ 4.50

UK post £16.50

Offer Purchase the std castings & the parts listed left at the same time for **£495** ex works (saving £65 over buying the parts individually)

The Red Wing

Open crank hit and miss petrol engine.

Fully functional 1/4 scale model runs on petrol with a working hit and miss governor.

This comprehensive kit of parts* includes

9 bronze castings,
13 grey iron castings, inc SG Crank shaft,
pre cut timing gears,
bushes, small fixings*,
springs, name plate,
piston rings, spark plug,
piston material.

Ex works £ 575

UK post £16.50

* additional parts required
**A detailed construction book is available as a extra

A3 paper drawings and construction notes in booklet form**.

Model T Ford

new wood cased trembler coils.
Ideal for model or full size stationary engines.

Trembler coil points

direct replacement original **K W.**
Will fit most coils.

During the current situation we are offering free UK postage on our kits

Exhaust castings

flywheels

Gas bag casting

Call for free Catalogue

WWW.THEENGINEERSEMPORIUM.CO.UK INFO@THEENGINEERSEMPORIUM.CO.UK

ECC RW 04 20 offer

On the Wire

NEWS from the World of Hobby Engineering

Because of the coronavirus situation, different companies are tackling the situation in different ways. Here are some of the updates we have received.

Warco

The safety of both our customers and team will always be our biggest priority. Because of the unfolding situation with coronavirus, our showroom and premises are currently closed to members of the public. This means it won't be possible to view our products in person for the time being. This was a decision we reached before the latest government advice which now mandates the closure of most public spaces.

All orders are still being processed as normal and our online store is still running 24/7.

While we're still open to receive calls, the number of staff we have onsite is reduced, which may have an impact on our availability over the phone at the moment. If you are finding that our phone lines are busy, we're very sorry. We would encourage you to contact us by email using the contact form on our website or to leave an answer phone message and we will get back to you as soon as we can.

The hours we are available over the phone have changed slightly. From Monday to Friday our open time is 8:30am - 4:30pm (previously we were available until 5:00pm). Up to date opening time information can always be found on the website.

At the moment delivery services within the UK are running as normal. There has been a change at the point of delivery because of the new safe distance requirements. Postal workers and couriers no longer require a signature and instead a note of recipient name is taken.

We are experiencing high demand at the moment so our normal delivery times are extended at the moment. We would like to apologise for any inconvenience caused.

Chester Hobby Store

Due to the uncertainty at this moment in time with COVID-19, Chester Machine Tools would just like to let you all know that we are still open and taking internet, email and telephone orders. We have limited staff in the office and warehouse at the moment so please bear with us at this time.

Our showroom is currently closed to the public due to the safety of both our customers and staff. This means it won't be possible to view our products in person for the time being.

You can still contact us by all the conventional methods, live chat on our website, **LINK**, email sales@chestermachinetools.com or call us on 01244 531631. If you want something to look through we can send you a catalogue just email us your name and address to sales@chestermachinetools.com and we will send one out to you.

We look forward to hearing from you.

All the best and stay safe, thank you for your understanding at this time.

Robert Davies-Litherland, Chester Machine Tools

Arc Euro Trade

The current situation is constantly evolving, with new regulations and guidelines coming into play daily.

Taking this into consideration, and after much discussion amongst our team, we have taken the decision to re-open as of Monday with dispatches commencing Tuesday 14th April.

In line with government guidelines, our team will be working on a staggered basis. As a result, there may be some delay in processing and dispatch of orders.

The safety of our team remains at the forefront of our decision.

We hope our products can bring some joy in these difficult times..

Team ARC Euro Trade.

CuP Alloys

Glen and Shaun are working alternate days in order to keep fulfilling orders. They ask customers to wash hands after handling packages and stay safe.

Allendale

Our warehouse is working hard to make sure you get your orders as quickly as possible whilst keeping deliveries safe. While we work to keep everyone safe, there may be slight delays due to high demand.

In line with recent government measures, our show room and demonstration area is temporarily closed until further notice.

Journey through London's curious transport history online

London Transport Museum's Covent Garden doors might be closed as the Capital settles into staying indoors but are open to virtual visitors online!

Enjoy online exhibits, quizzes and games, behind the scenes videos and interactive family activities to experience the delights of the Museum's collection from home.

Keep kids entertained during the Easter holidays with **downloadable activities** inspired by cartoon character 'Billy Brown of London Town'

Explore hidden gems from the Museum's collection up-close in Google Arts and Culture galleries

Step inside Hidden London: the Exhibition on a curator led video tour with transport broadcaster Tim Dunn

Take part in quizzes, competitions and games on Twitter and Facebook

Browse the Museum's **online shop** for fun family games to play at home

Sign-up to the Museum enewsletter for a weekly dose of curious stories, fun facts and online shop offers

From curating virtual galleries and building an **online hub** for its much-loved family fun activities to compiling transport-themed Spotify playlists, London Transport Museum is open online and sharing its collection to help people feel inspired and uplifted while they settle into staying indoors.

For families who were looking forward to visiting the Museum in Covent Garden over the Easter holidays, a new online activity hub will offer fun problem-solving games, word searches, quizzes and colouring-in pages to help recreate the experience at home. Available to download from today (Monday 6 April) these activities are inspired by 'Billy Brown of London Town' - a vintage cartoon character who used playful rhymes to keep passengers on their best behaviour when using public transport during the Second World War.

During its closure, London Transport Museum will continue to bring its collection to life online for kids and adults alike, by adding new objects and digital exhibitions to its Google Arts & Culture site.

Since its launch in 2019, more than 500 artefacts and artworks from the Museum's collection have been digitised on the platform — including many objects housed at its Depot in Acton and not on display in the Museum in Covent Garden.

Visitors to Google Arts & Culture can browse examples of outstanding 20th century graphic art from the Museum's transport poster collection, see the intricate details of historic maps, photographs, and vehicles revealed, discover little-known facts about the Underground and find out which objects are curator favourites and why.

A behind the scenes video tour of the Museum's highly acclaimed Hidden London exhibition is also available on the Museum's YouTube channel , featuring transport historian and broadcaster Tim Dunn.

Inspired by some of London's most secret spaces belonging to the oldest subterranean railway in the world, Hidden London: the Exhibition brings together the largest number of rare archive photos, objects, vintage posters, diagrams and decorative tiles from disused stations in one location for the first time. This video tour with Tim Dunn takes visitors through a warren of atmospheric and immersive recreated secret spaces on the Tube network that have incredible stories to tell about London's past and present.

A Simple Drill Grinding Aid

A newcomer to our hobby was having trouble sharpening drills, so Howard Lewis made a simple aid for him

Using angle gauge.

This is NOT a precision drill grinding jig, purely an aid. It needs to be set (preferably by clamping) parallel to the face of the grinding wheel.

The grinding is manual, and totally under the control of the operator.

In use, the drill is laid in the vee and one lip brought into gentle contact with the wheel and rotated. When that face is satisfactory, the second face is given the same treatment.

It is important that both lips of the drill are the same length, if it is to cut to size. Unequal lengths will bring the point off centre, resulting in an oversize hole.

Drill grinding gauges are available, or a steel rule can be used, to check that the lips are of equal length

The sharpening aid is just a piece of ½ inch (12mm) thick aluminium, with a vee groove machined into it, at an angle, on one side, and with the underside milled to a 10 degree angle, to provide a clearance.

Operations

Having milled the aluminium to a rectangular block, it needed to be set up to mill the vee groove. Initially, I tried to set up the block in a three way swivelling vice, but made the settings in the wrong order and finished up with the block sitting at a most peculiar angle.

Going back to basics, the block was set at 59 degrees with the aid of a digital angle gauge, to produce a tip angle of 118 degrees, **photo 1**. Note the small error on the angle gauge!

Once this had been done, the vice was tilted up at 45 degrees, so that an end mill would cut the 90 degree vee. **Photograph 2** shows this in progress.

For this I used a 12mm end mill, aimed at the mid-point of one edge of the block; and gradually plunged in to 0.350" (8.89 mm) deep, to leave half the depth of metal at the front edge.

Having completed this work, the

Milling the vee.

The Final Cut.

vice was reset to 10 degrees, and the block was clamped whilst supported on parallels

Since the one edge of the block was going to finish below the jaw of the vice, the position of the jaw was found by moving the table until the end mill just moved a piece of paper "secured" to the vice jaw with oil. The dial on the Y Axis was set to zero. As machining proceeded, with the cutter being traversed along the X Axis, the final cut, of the three need to cover the block, was stopped 0.040" (1 mm) from the zero position on the Y Axis dial, **photo 3**.

When the block had cleaned up over its full width, it was removed from the vice and the tiny "flange" along the one edge, and the other burrs were removed by hand filing.

The end result is shown in **photo 4**. ■

Finished jig.

The John Stevenson Trophy 2020

Many readers and forum members will remember John Stevenson, a contributor to MEW but best known for his larger-than life presence on the Model Engineer forum.

Funded by many donations in his memory, the Stevenson Cup was first awarded in 2018. The cup is engraved "John Stevenson, 1948 – 2017, Remembered by his many friends" with "Awarded for Excellence in Practical and Useful Workshop Equipment" on the plinth.

The John Stevenson Trophy is presented for just that, a well-made and usable piece of tooling, a modification to a machine or an accessory for a tool where the fact it works well is more important than making it look good. Unlike traditional judged trophies, we decided on a different approach to reflect John's reticence about traditional competitions. After a call for nominations, a small panel of judges selected a shortlist, on which there was an online vote.

In 2018 it was won by John Ashton and in 2019 the award went to Michael Cox.

In a strange twist of fate, the current coronavirus lockdown means that it's unlikely there will be any traditional engineering competitions over this year's exhibition season. The 'virtual' nature of the Stephenson Trophy competition means that we can forge ahead with it this year.

In view of the unusual circumstances, we have decided to once again make the competition open to all. Any reader or forum member may enter their own work. We have also extended the deadline until the end of June to allow people to make (or finish off or simply tidy up an existing project) during this lockdown period.

A short list will then be prepared by the organisers, so that award of the cup can be judged by a popular vote. Voting will be via a poll on the forum and open to all.

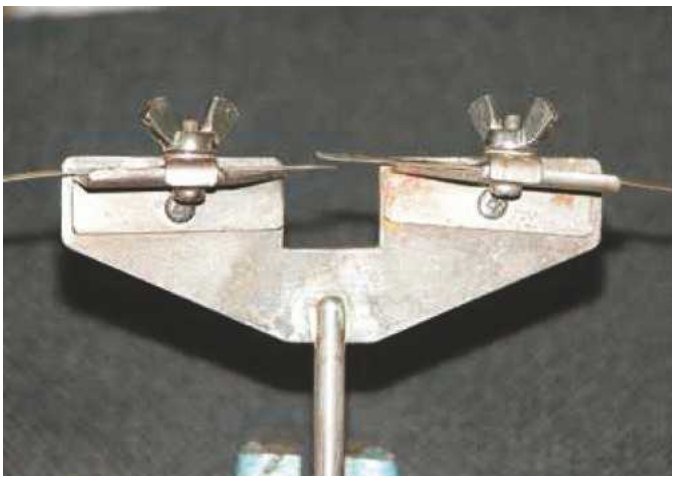
The winner will be announced online and in the magazine.

To enter, just send four good photographs of your entry with up to (about) 500 words of description by email to neil.wyatt@mytimemedia.com no later than 31 July 2020.

Naturally, we still have to have some formal rules for the competition, these are:

All entries must be a piece of practical

John Ashton's 2018 winning Screw Modification Fixture which appeared in MEW 250.



Gary Wooding's Bandsaw Blade Repair Jig.

workshop equipment i.e. a tool, jig, fixture or a modification to or accessory for an existing piece of equipment. One entry per person.

All entries to the competition must be materially your own work (commercial parts etc. are allowable but please be clear about what these are) and not have been entered to the competition before.

A short list of entries will be selected by the competition organisers, a group of people who knew John and are familiar with his views on workshop equipment.

Criteria for inclusion on the shortlist will be that the tooling is practical and capable of being used for accurate work in a home workshop setting. It should demonstrate ingenuity, good design, economical use of materials and be appropriately finished for its function.

By entering you confirm your permission to feature the entry in the magazines or on the forum. If practical, you may be invited to display your entry at a model engineering exhibition in the future.

The winner will be selected by a popular online vote by forum members. Readers who join the forum in order to vote will be allowed to do so. Voting will be strictly one vote per person.

Alan Wood's Laser Centring Tool.

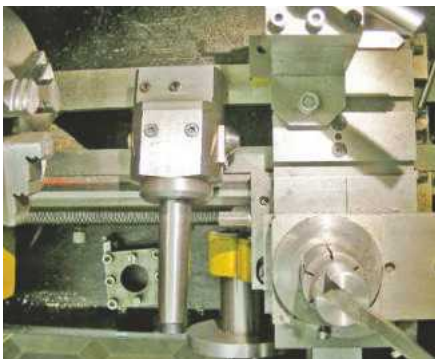
In the event that the judges consider invalid votes have been cast or that an attempt has been made to unduly influence the result of the vote any questionable votes will be disregarded or entries may be disqualified.

The trophy will remain the property of the competition organisers. The winner will take responsibility for ensuring safekeeping of the trophy until the next exhibition. The trophy must be returned in good condition, in the supplied packaging, in good time for award to the winner of the subsequent competition.

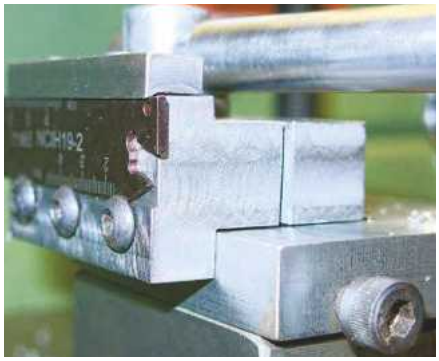
The winner may arrange for their name and the year of the award to be professionally engraved on the base of the trophy at their own cost.

No alternative prizes, cash payments or awards will be made. In all matters relating to the competition, decisions made by the organisers are final.

To inspire you, the photos show the entries for the 2018 and 2019 competitions:



Mike Cox's Ball Turning Tool.



Richard T. Smith's Tooling System.

Warren Jacobs' Easy Quick Change Toolpost.

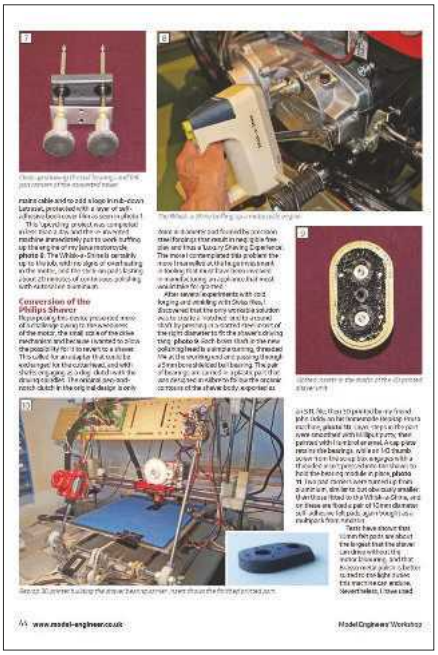
Indexer by John Hinkley

Tumbler Reverse by David George

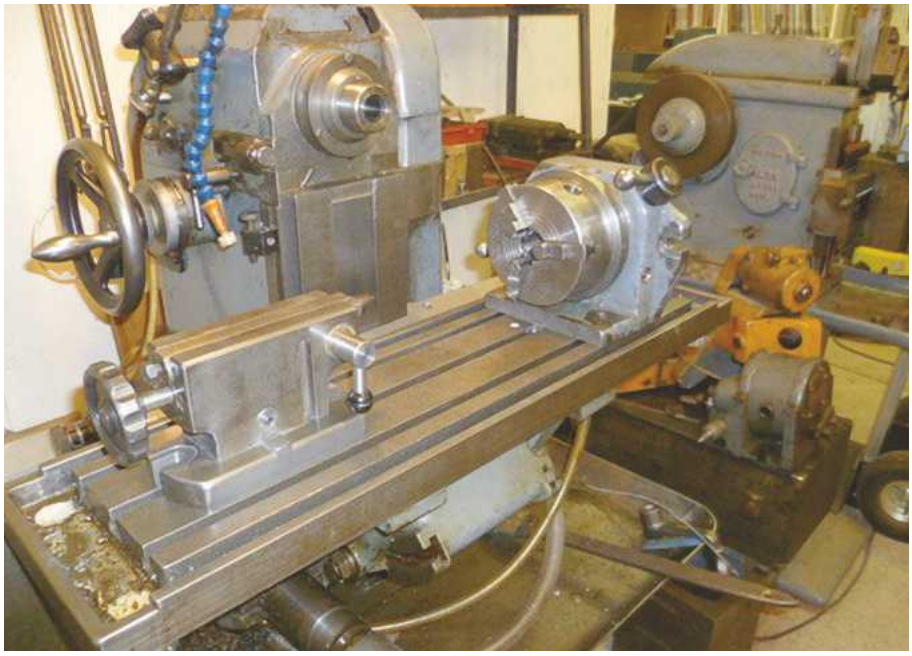
Grinding Rest by Rik Shaw made to Harold Hall's popular design:

Pillar Drill Modification by Bob McMenemie

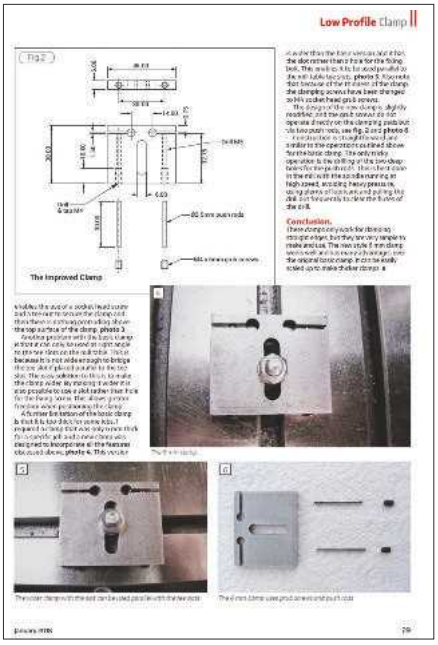
Facing Head by Brett Meacle



Whisk-a-Shine and Whisker-Shine by Mark Noel.



Repurposed Cincinnati Dividing Head Tailstock by John Cuckson.



Finally, Low Profile Clamps by Mike Cox, the 2019 winner.

Readers' Workshops - Patrick Cubbon

Patrick Cubbon describes his workshops – a portable one from 1963 and the current accommodation

The portable workshop

Entrance area with Dore Westbury mill.

Nu-Tool bench drill.

›

Smaller Cowell's drill and bench vice.

EW and Myford ML7 lathes, note the tri-leva speed change.

Model Engineering and a workshop has always been part of my life since schooldays. A flat bed Drummond lathe with central leadscrew and electric motor belt drive to a flywheel, with a disconnected treadle, took pride of place in my first Workshop in the Isle of Man in the attic under the rafters of a Victorian family house. This workshop was dismantled in 1963, the lathe emigrated to Australia with its new Owner, and I left home to start a lifetime career in Peterborough as a Mechanical Development Engineer with Perkins Diesel Engines remaining there until retirement in 2007. I arrived in Peterborough with an Austin A35 car and a portable workshop in the boot. In **photo 1** you can see a small twin cylinder steam engine, at that time it was only part built (ME 1953 No 2736 Oct. article was inspiration)

The portable workshop, and later an EW lathe, were incorporated into various garage arrangements following house purchase in 1974.

First a bench along the side wall, then extended round to face the car front bumper with a brick wall to separate garage from coal storage. Next extra workshop space was gained by knocking down the wall and storing coal in an outside bunker. A wooden partition separated garage from workshop with a bench over the car bonnet and the car out of sight.

Of course, in time the flat roof garage cladding deteriorated and water ingress resulted. At this point my wife and I decided to convert the garage into two separate rooms, a craft room for her with a window at the front, and a new workshop to the rear. The garage was reroofed and insulated.

Photograph 2 shows the entrance to the 10ft x 8.5ft workshop is through a south facing door with restricted opening allowing fitment of a small angled shelf with plastic trays and storage space beneath.

The Dore-Westbury Mark 2 milling machine resides above a substantial cupboard filled with various items of tooling.

Next, moving round the workshop, **photo 3**, is a Nu Tool 5/8 ins. bench drill with cross vice. The blue shelving is Big Dug supply, whilst the small bench lathe is L C Mason design driven by a variable speed sewing machine motor, the left hand pulley is from a discarded washing machine.

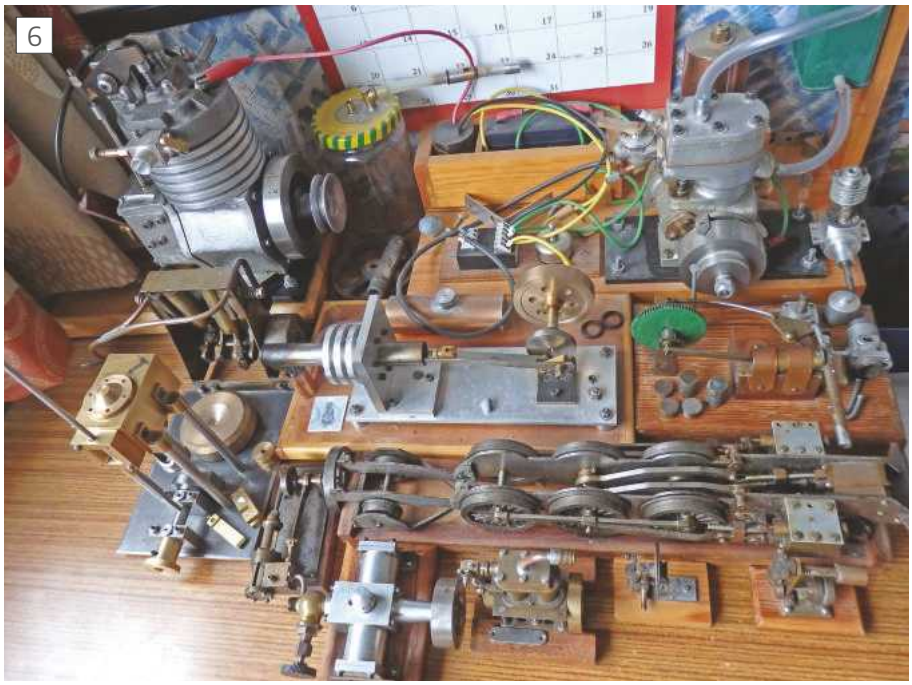
Plenty of storage in this corner, **photo 4**, a 3/8 ins. Cowell drill, and a hefty 4ins. Record vice. Under the bench, below the vice, is a tea trolley most useful to pull out and position alongside the Myford. Hidden from view is trusty vacuum cleaner indispensable for swarf removal.

The final corner of my workshop is in **photo 5**. The EW lathe is a favourite with back gear and screw cutting facility.

The Myford ML7 Tri Leva with gearbox was purchased in 2005 shortly before retirement.

Further workshop space has been found by spilling out into No. 1 Garden shed for grinding and metal storage. Even so, No. 2 shed contains a band saw, Workmate, wood working tools and a shelf full of paints.

Photograph 6 shows a table top display, products of Model Engineering over the years, not prestigious, mostly without castings, and representing enjoyment and a thought provoking hobby. ∎

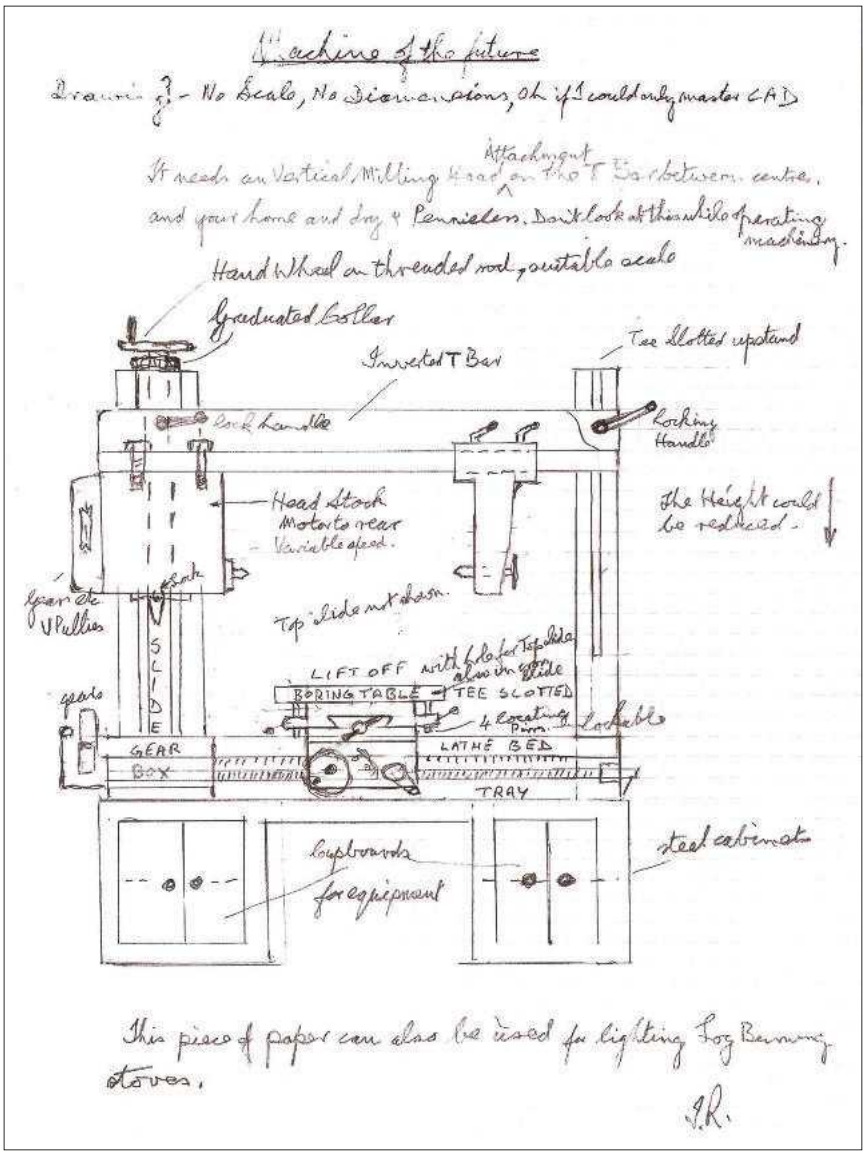


A collection of items made in the workshop.

Scribe a line

YOUR CHANCE TO TALK TO US!

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



Ideal Lathe

Dear Neil, the attached "back of the envelope" type sketch is the result of a discussion between a friend of mine and myself on a cold snowy evening in Scotland. The discussion was about the article in MEW 291 Page 35 - Scribe a Line. The sketch turned out to be more of a multi purpose machine e.g. it does not need to be so high, but a CAD expert professional draughtsman could put all that into proper detail, if he thought it worth his while.

About CNC machines - in my opinion the "hobbyist" only gets the assembly work after the machine has produced the bits without a saw or a file being near any of it. It's probably "sour grapes" with me because I don't have CNC, but it is marvellous what can be produced by such machines, given they are fed the correct instructions! It could be a necessity if the "Cottage Industries" of the past were making a "come back" to make the investment and enterprise viable.

I know engineering is a serious business, but we can't have our noses to the grindstone all of the time, can we? (Especially on a cold snowy evening!).

Ian Rose, Kirriemuir, Angus

Safe-De-Speeder

Dear Neil, I was pleased to see the letter from Nigel Morgan (Issue 292) about the Safe-De-Speeder - at least someone read my article! I have to confess to not thinking through other possible uses for the Safe-De-Speeder - and I shall be using mine more often, both in the lathe and the milling machine, for tapping holes. The only question is - why didn't I think of it myself? Thank you Nigel.

R Finch, by email

Cheesy Screws?

Hi Neil, I am restoring a Triumph Tiger Cub and have difficulty obtaining 2ba cheese or philister head screws. Do you know of a supplier for these please? I should add the screws must be pozi or Phillips head. Thanks!

Alan Westgate, by email.

Thoughts for Beginners

Dear Neil, Trying to help newbies, it is becoming clear that some want to come into the hobby, which is good, but do not know enough to recognise their limitations in either knowledge or equipment. Witness the thread on the Forum where someone was complaining that their new 3 jaw had a tiny runout, (which was actually good for a 3 jaw) and wanted to eliminate it.

The expectation of a low priced hobby machine being capable of bettering an expensive Toolroom machine augers for disappointment, unless the more knowledgeable provide guidance, with articles such as the Basic Lathework and Milling series.

I am a Rolls Royce trained Engineer, and spent my working life in engine development, not machining, so there are large gaps in my experience and knowledge.

Helping, and making newbies aware of their shortcomings, has to be done diplomatically, or they will feel that we are an unsympathetic and rude lot! Lots of bitten tongues, at times!

Howard Lewis, Peterborough

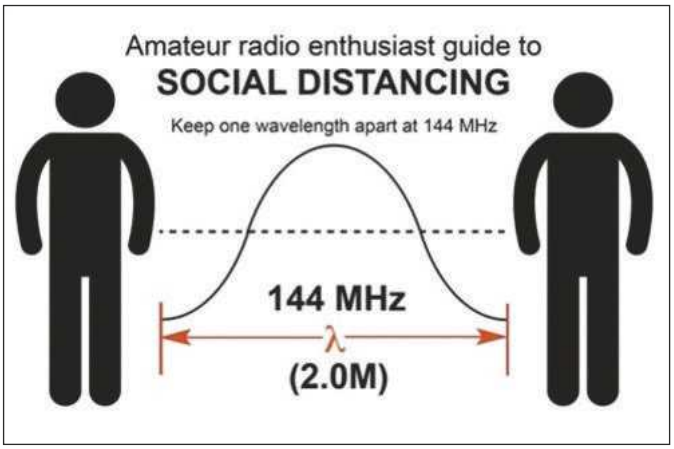
Viceroy Change Wheels

Dear Neil, I trust this finds you well during this difficult time. Included in the July edition of Model Engineers Workshop Richard Wilson produced an article on the Viceroy 280 synchro, in the text he referred to a translation set for which he had sourced the drawings. I have searched the Denford forum in vain, I'm just wondering if you can help in any way?

David Donaldson, by email

I can't help with the drawings, but I can ask if any readers know where they may be found? – Neil.

Social Distancing



Dear Neil, With our hobbies, we have no time to be bored! How do you like the attached?

Geoff Theasby, by email

SMEE Update

Dear Neil, Even before recent announcements, the SMEE Council had debated the effect this virus will have on meetings held in Marshall House. Although the Kemsley Room will only hold about 60 members (and therefore could not be classified as a large gathering), we are nearly all in the vulnerable age range. We also sit quite close together and these are ideal conditions for the virus to spread. Many people come to Marshall House via public transport, which is a potential source of infection. Even one case of the virus in the room would then require all of us to self-isolate for 14 days and a deep clean of Marshall House would be necessary.

With this in mind, the SMEE Council has reluctantly decided to postpone the lecture programme, rummage sales, courses and other meetings until further notice. We will offer money back to students that have pre-paid for SMEE Courses or, if they prefer, a place when we next run it.

Council will still meet, but they will do this on-line via AnyMeeting. Any important decisions will be communicated vie email, the SMEE website and The Journal.

Members are reminded that they can still communicate with each other via the website 'forum' facility. Think of this as a temporary replacement for the Marshall House tearoom!

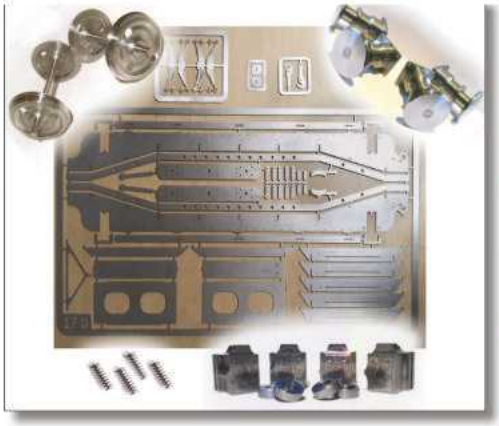
These are extraordinary times and call for extraordinary measures. The overriding priority is to protect our membership and keep them safe.

Stay healthy and vigilant.

SMEE Chairman and Directors

Wagon Kits & Parts

Contact 17D :
Email: sales@17d.uk
Tel: 01629 825070 or 07780 956423



GWR Loriot-M Complete Kit

Kit includes all laser cut steelwork,
Laser engraved ply wood "planking"
Fully machined buffers and axle boxes with ball race bearings.
Suspension and draw-hook springs
CNC machined wheels and axles

5" gauge version:
£329.00

7¼" gauge version
£429.00

These kits are designed to be tig-welded together, but could also be silver-soldered.
Only extras required are rivets, screws/nuts, glue and paint.

Prices ex-works & excluding VAT

5" g. Wagon Chassis Set £139.00
also available in 7¼ g. version £195.00

Wagon Buffers:

A range of buffers available in 5" & 7¼" from around £45 a set of 4

Wheels
17D make a large variety of wheels and axles

Miniature Railway Specialists

Locomotives, Rolling Stock, Components
CNC Machining Services

www.17d-ltd.co.uk
17D Limited, Units 12 & 13 Via Gellia Mill, Bonsall, Matlock, Derbyshire, DE4 2AJ

NEWTON TESLA — SMOOTH, QUIET, HIGH PERFORMANCE VARIABLE SPEED CONTROL FOR LATHES AND MILLING MACHINES

Supplier to industry since 1987 of high power speed control systems from 100W to 2,200,000W,

MITSUBISHI INVERTERS from £122 inc VAT

HIGH PERFORMANCE INVERTERS
For serious machining duty.
240V 1-phase input, 220V 3-phase output, for you to run a dual voltage (Delta wired) three phase motor off your 1-phase supply.
Six sizes from 0.1kW (0.12hp) to 2.2kW(3hp).
Built-in user keypad, display and Speed Dial.
Unique Integrated Emergency Stop Function.
Advanced Torque Vector control for optimum performance. High Reliability.
Fully CE Marked and RoSH Compliant.
Compatible with our Remote Control station Pendants.
Supplied pre-programmed at no extra cost.

REMOTE CONTROL STATIONS from £66 inc VAT

Remote control station Pendants suitable for use with all our Mitsubishi Electric and IMO iDrive Inverters.
Industrial grade push buttons and controls.
Featuring START, STOP, FORWARD, REVERSE, RUN/JOG, & Variable Speed potentiometer.
3-wire control - Behaves like a No-Volt-Release.
Beware of low quality copies of our original tried and tested controls.
Fitted with 2-metre length of control cable ready for connection to drive, and supplied with wiring diagram.

VARIABLE SPEED CONTROL PACKAGES

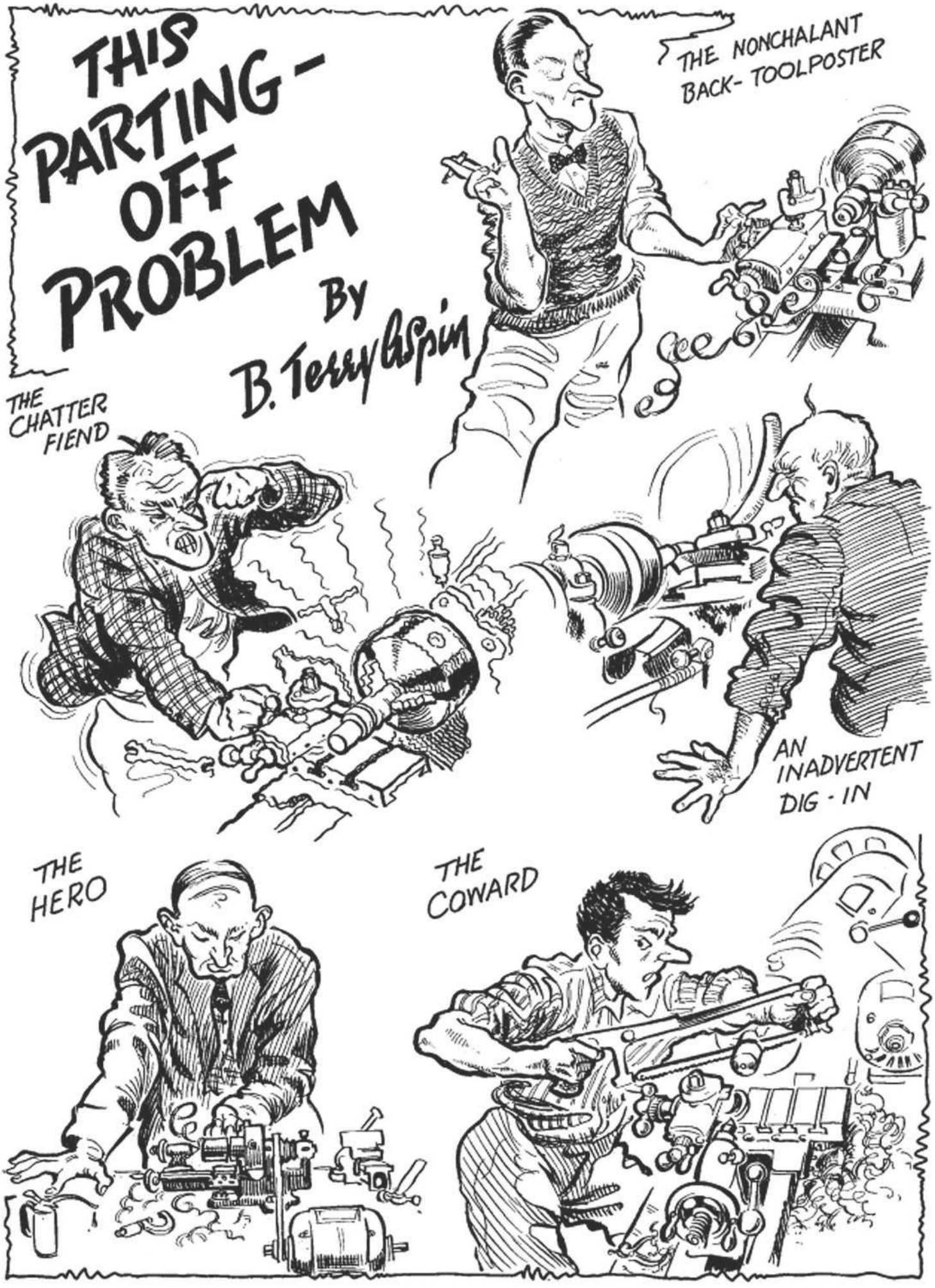
The 'original' & best lathe speed control system.
Pre-wired systems, and Inverter, Motor, Remote packages available to suit wide a range of metal and wood turning lathes, *including;* ***MYFORD ML7***, Super 7, ***BOXFORD***, & ***RAGLAN*** lathes, Wood turning lathes including; ML8 and MYSTRO and ***UNION GRADUATE***.
Pre-wired ready to go! Power Range: 1/2hp, 1hp, 2hp and 3hp.
Super smooth control across entire speed range, giving chatter free machining and excellent finish unattainable with 1PH motors!
Powered from domestic 240V Single Phase mains supply.
Made in the UK, ISO9001:2008 Quality Assured.

Our Pre-wired Lathe Speed Controllers are now covered by a 10-Year Warranty

Newton Tesla (Electric Drives) Ltd,
Warrington Business Park, Long Lane, Warrington,
Cheshire WA2 8TX, Tel: 01925 444773 Fax: 01925 241477
E-mail: info@newton-tesla.com
Visit www.lathespeedcontrol.com for more information.

VISA MasterCard

MITSUBISHI ELECTRIC AUTOMATION SYSTEMS
NEWTON TESLA
Automation Dealer


THIS PARTING-OFF PROBLEM
By B. Terry Lathe
THE NONCHALANT BACK-TOOLPOSTER
THE CHATTER FIEND
AN INADVERTENT DIG-IN
THE HERO
THE COWARD

Websites for the Bored

During the current 'lockdown' many readers will no doubt be making themselves busy in their sheds and workshops, if only to avoid a long list of DIY jobs... but we all need to sit down and relax sometimes and the internet is a potential goldmine of fascinating information on engineering topics. We're seeing a huge increase in activity on our forum at **www.model-engineer.co.uk** and many new members, so please do come and join in. But there's plenty of other interesting websites to find, as suggested by forum members.

My own suggestion is the Bovingdon Tank Museum's YouTube channel, especially the wonderful Tank Talks by David Fletcher. The best place to start is his 'Bottom 5 British Tanks'!

www.youtube.com/user/TheTankMuseum

I also recommend the TED Talks, this really is worth a look. The range of subjects is vast, and the quality of speakers is very high.

www.ted.com/talks

PGK PGK suggests the National Technical Museum Prague

www.ntm.cz/en/en-expozice/astronomie

As well as 'Tips from Shipwright":

www.youtube.com/user/TipsfromaShipWright/videos

Nick Clarke 3 says "One of my favourite places to visit on the annual family pilgrimages by road to the Adriatic in the 60s and 70s (father the only driver!) was the Deutsches Museum in Munich."

www.deutsches-museum.de/

Click on the Union Flag in the top right hand corner of the screen if it does not automatically sense your location and English as a language choice.

Michael Gilligan suggest the Smithsonian Museum:

www.sil.si.edu/DigitalCollections/trade-literature/scientific-instruments/CF/SIsubject_2-drilldown.cfm

---

IanT could suggest a long list but one I've mentioned before and which I think is well worth revisiting - is Ed Hume's Gauge '1' Shay build. Over 600 photos, plus 12 videos - you do not need to be a G1 enthusiast (I'm Gauge '3' myself) to enjoy and learn something from Ed's site. The Loco is based on the 3.5" Kozo design of course...

www.flickr.com/photos/edhume3/sets/72157614192042835/

He also plugs the Gauge '3' Society:

gauge3.org.uk/

Choochoo Baloo recommends "3blue1brown" YouTube channel for excellent explanations of various maths topics, at various levels. For example: the recent COVID-19 statistics.

V8Eng reminded us that the Science Museum Group has lots of stuff online including the NRM. Not quite the same as when I used to turn handles and press buttons on engines in display cases at South Kensington as a lad but plenty of interactive things.

www.sciencemuseum.org.uk/

Martin Perman is a volunteer at the Internal Fire museum in west Wales:

www.internalfire.com/

He also recommends:

www.newarkairmuseum.org/

Meunier suggests a YouTube video that follows the manufacture by a Rolls-Royce owned German company of a 13,600hp 20 cylinder diesel engine, one of four installed on a SeaCat ferry between Malta and Sicily. It shows the whole process from casting the crank-case through to in-service with good engineering insights.

www.youtube.com/watch?v=Md9PX8iezRo

Finally, if you want to enjoy some of the most extreme workshop adventures, try Coli9n Furze's YouTube channel:

www.youtube.com/user/colinfurze

Thanks to all the forum members hwho made suggestions, for more suggestions, and clickable links to most of the above suggestions, you can view the whole thread at:

www.model-engineer.co.uk/forums/postings.asp?th=153669&p=2#2564751

Or search the forum for 'websites for the bored'.

Choosing Steels

Stub Mandrel offers some advice on choosing the right steel for the job

One of the first challenges for anyone taking up engineering as a hobby is making the right choices of materials. Often the easy way out is to simply choose materials that other people have used successfully for similar applications, but sooner or later you will find yourself wanting to make better informed decisions. A particularly confusing area is choosing between different steels. You will often see descriptions like 'bright mild steel', 'black bar' or 'case hardening steel'. While this may help you get something more or less right, it helps to understand the more formal designations used by steel stockholders and which you may come across in articles from time to time.

There are two systems you will probably come across in the UK. The longest standing are the 'Emergency Numbers'. These were established during the Second World War to promote consistency in the products of different steel manufacturers. Clearly if you wanted steel for making guns or armour in wartime, you wanted to be able to specify the composition whatever the source, rather than having to work out which of each manufacturer's range of products would suit. These numbers all take the form of the letters EN followed by a number for the composition of the steel and sometimes a letter to show how it has been heat treated. In very rough terms the higher the number the higher the carbon content of the steel.

Although the EN numbers should have disappeared by now, in practice they are still widely used, but you may also come across more modern British Standard designations which take the form of nnnMnn, where the letter 'n' stands for a number. There are also European Steel numbers and names, as well as designations used in Germany, USA and Japan and elsewhere; if you need to convert to these, I suggest you take a look at the article 'Steel Grades' on Wikipedia.

Let's just take a look at the commonest carbon steels you are likely to come across, and which will meet most of your hobby needs.

EN1aPb was used for these locomotive wheels which involved complex milling with small cutters.

Mild Steel

Mild steel is not a specific material, but rather a catch-all for steels (iron alloys) that have relatively low-levels of carbon. This means that generally they can't easily be hardened (unlike high-carbon steels) and they are relatively ductile (easy to bend). While this limits their applications, it does make them relatively easy to produce and they are especially suited to 'drawing' or 'cold rolling' into sized bars and flats. They are also generally easy to machine.

Though mild steels have a low carbon content, they are still classed as 'carbon steels'. The 'mild steels' most commonly encountered in the UK are designated EN1a, EN3 and EN8.

EN1a

Also known by the instantly forgettable code of 230M07, you are still more likely to find 'bright mild steel' classified as EN1a. EN1a is available as round, square and flat bar with a good finish and fairly accurately sized (you can buy accurate ground bars as well). It is a great all-round material for parts that are not going to be highly stressed or subjects to high levels of wear. It might not be the ideal material for making machine tools for use in a factory but is usually fine for making your own devices. It machines easily and gives a good finish, the variant EN1a Pb has added lead and is even freer machining.

It's low carbon content makes it virtually (but not totally) impossible to harden but it can be case hardened (although EN1a Pb doesn't case harden well). It should not be welded.

Bright drawn metal has a lot of 'locked in' stress. If you do any asymmetrical machining of EN1a bar don't be surprised to see it bend like a banana! This, rather than its relatively low strength, makes it unsuitable for parts such as crankshafts.

In practice, you are likely to find that EN1a is the most useful general purpose, inexpensive material for non-critical components but is best avoided for bolts, studs or high wear/load parts.

EN3

EN3, also known as 070M20, is a slightly higher carbon content mild steel that is suitable for welding and one of its main uses is for making steel fabrications. It

has good machineability, but isn't quite as pleasant to work as EN1a, being best machined with a lubricant.

It is typically available as bright drawn bars and a hot rolled bars. Hot rolled steel is less accurately sized and has a poor finish but it is stress-relieved, so it is the ideal alternative to bright bar for asymmetrical or heavily machined parts. It is also suitable for making lightly loaded fixings.

EN3 can be case hardened.

EN8

EN8, or 080M40, is actually a medium-carbon steel but it is usually classed as a 'mild steel'. It is stronger than EN3 but does not machine so well and a cutting fluid of some sort is essential to get a reasonable finish. It is generally available as bright drawn round bars.

Like EN1a and EN3 it tends to bend rather than break, which can be a useful property in situations where complete failure would cause a hazard. Unlike EN3 and EN1a it is reasonably easy to harden EN8 to increase its surface hardness and wear resistance, but it does not become as hard as high-carbon steels.

EN8 welds well and even fairly thick sections (up to 18mm) can be welded without preheating. It is a good choice for parts or fixings that have to bear moderate loads where going to a higher carbon steel would be overkill.

High Carbon Steels

When you are making heavily loaded parts like crankshafts, gears, pistons or pivots you are likely to turn to one of the high carbon steels. These are generally more expensive than mild steels and more difficult to machine to a high finish, so you will only choose them when their special properties are needed. Let's look at the commonest examples: EN16, EN19 and EN24. Their high carbon content allows them to be hardened through heat treatment, and they can be supplied in as-produced condition or in the T (heat treated) condition which has less stress and better machineability.

EN16

EN16 is also known by the European designation 605M36. It is a strong steel that is a step up from EN8 in terms of its ability to withstand wear and shear loads. In smaller sizes it is usually supplied in the 'T' condition (heat treated) as EN16T which maximises its shock resistance and helps machineability.

Although it is stronger than EN8, it still has a certain degree of give which makes it a good choice for load bearing and stressed parts such as connecting rods. It is not too demanding to machine but you do need to use cutting fluid.

EN19

EN19 or 709M40 is a really strong steel ideal for gears and other highly stressed components. It is quite tough to machine and the use of carbide tooling is recommended but not essential. Use plenty of cutting fluid, especially with HSS. Unlike EN16 it is easy to polish to a good finish.

EN 19 is also available in heat treated (EN19T) condition. One specialist product are accurately drawn hard-chromium plated bars which can be useful for things like guide bars.

EN24T

EN24T, which is also listed as 817M40, is a very strong steel that is usually supplied in the 'T' condition. It is very wear resistant, but this can be increased even further by induction hardening or nitriding. It can be hardened in the workshop by heating followed by oil quenching, but it should be tempered at a relatively high temperature to prevent brittleness. For this reason, sharp edges and corners should be avoided - it has less resistance to shock loads than EN16 and EN19.

It is a demanding metal to machine, but with carbide tools and high surface speeds you can achieve a very good finish straight from the tool.

Silver Steel and Gauge Plate

Silver steel and gauge plate don't fit in to the normal steel classification. They are high-carbon steels that are formulated to be suitable for hardening and tempering by relatively poorly controlled processes. This means they can be brought to fairly accurate levels of hardness in the home workshop without the need to use any complex apparatus. Silver steel is usually supplied as accurately ground bars (although it is available as squares as well). The USA equivalent is 'drill rod' although this does not contain the molybdenum which helps minimise distortion when hardening silver steel. Gauge Plate, as its name suggests, is supplied as sheets of plate ground to an accurate thickness.

They are supplied in an easily worked condition, then hardened and tempered. The process is to heat them to a good red heat (for silver steel often described as the 'colour of a boiled carrot') and keep them there for a time depending on the thickness of the item. They are then rapidly quenched in water or brine (for silver steel) or oil (for gauge plate). This will leave them 'glass hard' and brittle. After cleaning off any scale or oxide film, they can then be heated to temper them to the required compromise of hardness and toughness. Finally, the tool is cleaned and can be honed to a keen edge.

Other Steels

There isn't room to explore other steels – such as chrome-molybdenum alloys or stainless steels here, but hopefully we can explore them in future articles. ■

Silver steel and gauge plate can be used to make special tools.

MODEL ENGINEERS' WORKSHOP

SUBSCRIPTION ORDER FORM

DIRECT DEBIT SUBSCRIPTIONS (UK ONLY)

Yes, I would like to subscribe to *Model Engineers' Workshop*

☐ Print + Digital: £13.50 every 3 months

☐ Print Subscription: £11.25 every 3 months

YOUR DETAILS MUST BE COMPLETED

Mr/Mrs/Miss/Ms.....Initial .....Surname .....

Address .....

.....

Postcode ..... Country .....

Tel ..... Mobile.....

Email ..... D.O.B .....

I WOULD LIKE TO SEND A GIFT TO:

Mr/Mrs/Miss/Ms.....Initial .....Surname .....

Address .....

.....

Postcode ..... Country .....

INSTRUCTIONS TO YOUR BANK/BUILDING SOCIETY

Originator's reference 422562

DIRECT Debit

Name of bank.....

Address of bank .....

.....

.....Postcode .....

Account holder .....

Signature..... Date .....

Sort code ☐☐☐☐☐☐ Account number ☐☐☐☐☐☐☐☐

Instructions to your bank or building society: Please pay MyTimeMedia Ltd. Direct Debits from the account detailed in this instruction subject to the safeguards assured by the Direct Debit Guarantee. I understand that this instruction may remain with MyTimeMedia Ltd and if so, details will be passed electronically to my bank/building society.

Reference Number (official use only) ☐☐☐☐☐☐☐☐☐☐

Please note that banks and building societies may not accept Direct Debit instructions from some types of account.

CARD PAYMENTS & OVERSEAS

Yes, I would like to subscribe to *Model Engineers' Workshop, for 1 year* (13 issues) with a one-off payment

UK ONLY:

☐ Print + Digital: £56.99

☐ Print: £47.99

EUROPE & ROW:

☐ EU Print + Digital: £64.95

☐ EU Print: £55.95

☐ ROW Print + Digital: £64.95

☐ ROW Print: £55.95

PAYMENT DETAILS

☐ Postal Order/Cheque ☐ Visa/MasterCard ☐ Maestro

Please make cheques payable to MyTimeMedia Ltd and write code MEW0520P on the back

Cardholder's name.....

Card no: (Maestro)

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐☐

Valid from..... Expiry date..... Maestro issue no.....

Signature..... Date.....

TERMS & CONDITIONS: Offer ends 29th May 2020. MyTimeMedia collects your data so that we can fulfil your subscription. We may also, from time to time, send you details of MyTimeMedia offers, events and competitions but you always have a choice and can opt out by emailing us at unsubscribe@modelengineersworkshop.co.uk Please select here if you are happy to receive such offers by email ❑ by post ❑ by phone ❑. We do not share or sell your data with/to third parties. Details you share with us will be managed as outlined in our Private Policy here http://www.mytimemedia.co.uk/privacy-policy. Please visit www.mytimemedia.co.uk/terms for full terms and conditions

POST THIS FORM TO: MODEL ENGINEERS' WORKSHOP SUBSCRIPTIONS, MYTIMEMEDIA LTD, 3 QUEENSBRIDGE, THE LAKES, NORTHAMPTON NN4 7BF

Please visit **www.mytimemedia.co.uk/terms** for full terms & conditions

CODE MEW0520P

HURRY OFFER CLOSES 29th May 2020

PRINT + DIGITAL SUBSCRIPTION

- 13 Issues ***delivered to your door***
- ***Great Savings*** on the shop price
- ***Download*** each new issue to your device
- A ***75% discount*** on your Digital Subscription
- Access your subscription on ***multiple devices***
- Access to the ***Online Archive*** dating back to Summer 1990

PRINT SUBSCRIPTION

- 13 Issues ***delivered to your door***
- ***Great Savings*** on the shop price
- Save up ***to 23% off the shop price***

SUBSCRIBE TODAY

From the Archives:

A Small Instrument Vice

This neat tool by Len Walker appeared in Issue 47, December 1997

This neat little vice was described as 'perhaps one of the simplest toolmaking exercises in the book, but a useful piece of equipment for all that' back in 1997. This delicate device designed to be held in a larger bench vice does require some care in its construction and so offers a good test of your skills.

This is a simple, easy to make version of the traditional instrument maker's vice. It is invaluable for securely holding small parts while carrying out accurate filing or similar operations. With the shank gripped (between soft jaws) in a bench vice, it brings small work up to a more convenient working height, with improved visibility. The shank can be quickly set at any angle, to suit the job in hand. A few construction notes may help.

The finished vice. A plain jawed version with a file handle in place of the vice tail would please any fisherman who ties his own flies.

Detail 1. The fixed jaw

Made from ½ inch square BMS, cut and filed to length. Mark off and mill or file the vee, which must be at 90 degrees to the sides. Drill and tap the ¼ inch BSF tapping hole, accurately square in both planes. This can be achieved if the work is clamped to the drilling machine table, then drilled and tapped at one setting, using a taper tap held in the drill chuck to ensure a true start. Aim for a good 'standard' thread — use a cap screw as a gauge. Chamfer both ends of the thread to ensure that there are no sharp edges left which, when case hardened, might damage detail 6,the clamping screw. File ¼ inch and 1/16 inch chamfers and set aside.

Detail 2. The moving jaw

This is also made from ½ inch square BMS. Leave over length (say 2 ¼ inch long) to make it easier to hold while drilling. Drill, then ream the 0.265 inch diameter hole. Drill at the ¼ inch diameter reamed hole position - but only 7/32 inch diameter. Also drill and tap the 6 BA hole, at the 0.250 inch dimension shown. Cut to final length and square up the ends. File the ¼ inch and 1/16 inch chamfers, and set this aside.

Detail 3. Locking screw

Make this from a 6 BA grubscrew, the end 'pip' being polished.

Details 4 & 5. The handle

This can be made as an assembly, with one end solid and with the other as a loose cap, riveted on. Alternatively, the centre portion can be made from 1/32 inch diameter silver steel and fitted with a loose cap at each end (which, on reflection, is probably easier). Most important - remember to assemble the handle through detail 6 before riveting!

Detail 6. The clamping screw

Turn this from ½ inch diameter EN8 (for toughness). Chuck a 3 ¾ inch length, face the end and centre. Pull 2 ¾ inches out of the chuck and grip securely. With support from the tailstock centre, turn the 0.265 inch diameter to a running fit in the fixed jaw. Turn the retaining groove as shown, then undercut and screwcut the ¼ inch BSF thread, a close fit in that in the fixed jaw.

Turn the 7/16 inch diameter and part off. Reverse and holding on the 0.265 inch diameter, form the 5/8in. spherical radius and polish. Mark off, then drill and ream the 0.156 inch diameter hole. Toughen, then polish the 0.265 inch diameter and the shoulder.

Reaming Details 1 and 2 together

Assemble the clamping screw through the moving jaw and screw into the fixed jaw. Line up both jaws and firmly grip together. With the assembly raised on a 1 inch parallel, the 7/32 inch diameter hole in moving jaw can be lined up, and the assembly securely clamped to the drilling machine table.

Now drill and ream 1/4in. dia. through both jaws—this ensures a correct 'line up'. Lightly chamfer both holes.

Both jaws can now be casehardened, protecting the threads during this process. Clean out the threads and other holes, ensuring that the finished bores are smooth.

Detail 7 The guide pin

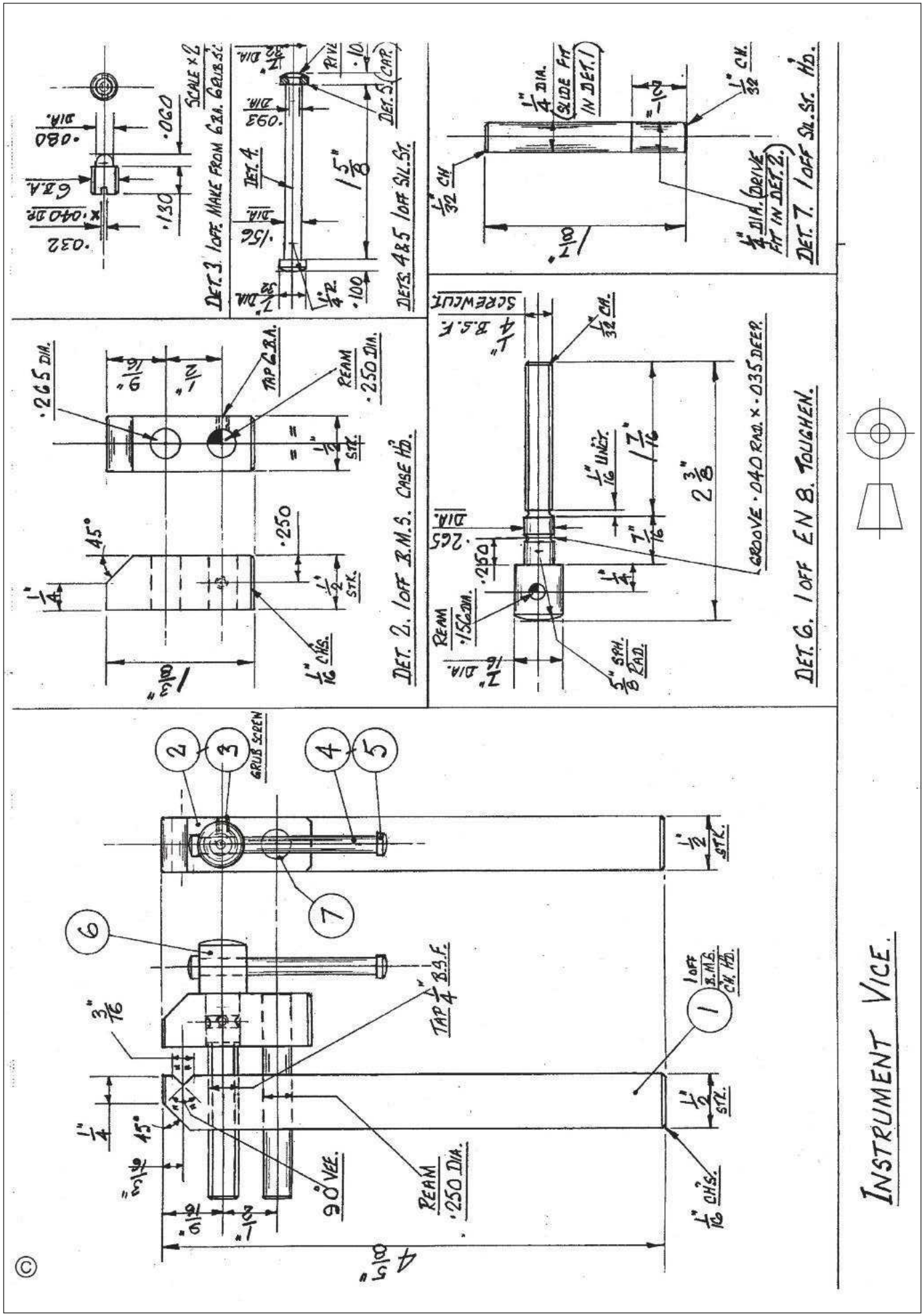
A part which can be made from silver steel, a drive fit in the moving jaw and a slide fit in the fixed jaw. Harden, temper and polish. Alternatively, it can be made from a ¼ inch diameter. x 2 inch long commercial dowel.

Any required adjustment of diameters can be made by using a medium oilstone (well oiled) while the dowel is rotating in the lathe. Polish finally using 600 grit wet or dry paper, with a few drops of light oil. To ensure the accuracy of line-up on assembly, the fixed jaw can be used as a guide for assembling the guide pin. Using the clamping screw to hold the two jaws together, insert the pin through the hole in the fixed jaw to line up with the hole in the moving jaw and press it into the latter. This should ensure that the moving jaw and pin moves smoothly in and out when the clamping screw is turned. Ease slightly if required; smooth operation is essential.

Thoroughly clean everything, getting rid of any grit or swarf and assemble. A drop of Nutlok or similar will secure detail 3, the retaining screw. Lubricate with a light oil.

Finally, a passing thought from just pre-war toolmaking apprenticeship days. I remember one of the 'old boys', every inch a master craftsman, saying to me "Lad, the only one you really hurt by doing bad work is yourself". Nearly sixty years on, I can't improve on his comment!

Go to it - work well, and work safely. ■


INSTRUMENT VICE.
DET. 1 OFF MILD STEEL HD.
DET. 2. 1 OFF B.M.S. CASE HD.
DET. 3. 1 OFF MILD FROM C.R.A. GAUGE SK.
DETS. 4 & 5 1 OFF SIL. ST.
DET. 6. 1 OFF EN 8. TOUGHEN.
DET. 7. 1 OFF SIL. ST. HD.
GRUB SCREW
TAP B.S.F.
REAM .250 DIA.
90° VEE.
GROOVE .040 RAD. × .035 DEEP.
SCALE × 2

A Bench Top Surface Grinder

Alan Jackson describes his shop-made surface grinder

1

Front view with the table in mid position

A small bench top surface grinder would be a very useful workshop addition. To expect to be able to generate a smooth accurate surface with a small, relatively light, machine is almost an act of provoking the vibration spirits to do their worst. Surface grinders are precision machines that can work to fine limits and produce smooth accurate surfaces. To do this they have to provide a solid platform that can absorb and not generate any additional vibrations. This generally translates into a large, heavy, solid machine made from cast iron, making full use of its vibration absorbing qualities. An experienced toolmaker friend once told me that they used to let the surface grinder run all day to let it get settled to achieve a good result.

Well my plan was to make one for my workshop which did not take up too much space and was not too heavy to be mounted on a bench, or to be more correct, not even a bench but an old recycled kitchen unit.

A front view of the finished grinder is shown in **photo 1**, with **photo 2** showing the full left hand travel (No! the wall does not restrict the travel it just happens to be close) and **photo 3**, the full right hand travel. For reference the magnetic chuck measures 10" long x 5" wide. The max height that can fit on the magnetic table is about 8" (See **photo 4**) although the magnetic table can be removed to gain a couple of inches more. **Photograph 5** shows an operator's view.

A while ago I dismantled my Dore Westbury milling machine and added the vertical milling head on to a Tom Senior M1 horizontal milling machine. As a result of this I was left with the bottom

2

Front view with the table travel far left

3

Front view with the table travel far right

half of the Dore Westbury machine, comprising the table, cross slide and bench base mounting with its vertical column and support hub.

I was also very lucky in finding and buying a Dumore type 57 grinding head on eBay. It is intended for toolpost grinding operations on a large lathe. Luckily no one else bid on it and I got it for £200 which was a bargain. An internet search showed that these American Dumore toolpost grinders are expensive and well thought of. This saved me all the problems of having to design and make my own grinding spindle and motor drive arrangement. I do not think that whatever I came up with would have been better than the Dumore.

It came, as an unused kit, in a large plastic suitcase with a 1HP single phase 50/60 c/s motor suitable for 240 VAC. The kit contained various diameter pulleys, flat belts and grinding wheels. All I had to do was mount this grinding head on the lower part of the Dore Westbury milling machine and Bob's your uncle, so I thought!

The Dumore spindle is designed to rotate the grinding wheel in an anticlockwise direction. This is to suit its purpose as a lathe toolpost grinder. Rotating the spindle clockwise will cause the grinding wheel to unscrew. I kept to this convention, which meant that the table would be moving towards the left direction when cutting. This essentially dictated the layout of the machine. There may have been an advantage in reversing this, in that the grinding dust would be away from the operator. It would have meant modifying the spindle thread from a lefthand to a righthand thread. To be honest I did not think of this at the time, but even in retrospect it is not really a problem as it is. On the plus side the capstan handwheel seems much better positioned to the righthand side for operation by a right-handed operator.

4

Front view with the wheel at max height

The vertical column support casting on the Dore Westbury was much too tall to mount the grinding head so I cut it in half and turned the top part down to fit into the bored out lower half, then Loctited the two parts together to form a much shorter support hub, **photo 6**. The four bolts that secure this hub to the base casting were countersunk for hex socket screws. This gave a flush surface which also allowed more travel for the cross slide, because the original protruding bolt heads hit the cross slide restricting further movement. Two of these bolts, diagonally opposite each other were intentionally overlong, so that they protruded beyond the lower casting face, which was spot faced, enabling 16 mm columns to be attached and extend down below the bench top, **photo 7**.

A 12 x 50mm rectangular bar spanning these columns provided a central mounting for the vertical feed nut mounting tube, with the feed nut located at the top of the tube. The reason for this arrangement was to position the vertical feed nut high enough, inside the vertical support column, to allow the feed raising/lowering screw to have enough vertical travel to be able to position the grinding wheel to be lowered to about 1" above the table and be elevated to its maximum height above the table

›

which is about 10 inches. I would have liked to have been able to lower the grinding head so that the grinding wheel could touch the table, but this would have meant cutting the vertical column support down just a bit too much. In any case a magnetic table will be used in most instances and this will add about 2" in height which solves any problem here. At the lowest point the vertical support column clears the rectangular cross bar by about 1.5".

The vertical feed screw is the original table screw repurposed. A top extension piece has been added. This enables, the also original, table feed hand wheel and dial to be positioned high enough for accessible operation at the top of the extended upper tube. This also gave the handwheel a good clearance space away from the motor, **photo 8**.

The vertical support column is also the original support column repurposed by cutting it down to fit. The original spiral groove for elevating the milling head is now redundant. I have cut a keyway groove the full length of the column to prevent the grinding head from rotating when it is not fully locked by the clamp


5

Operator's view


6

Vertical Support column shortened


7

Vertical feed nut mounting tube

levers. A key fitting this groove is held in position at the clamp hubs, **photos 9** and **10**.

A sleeve was made to fit inside the top of the vertical support column and Loctited in position. The sleeve extended upwards at 1.500" diameter to provide a mounting to fit the Dumore mounting casting and clamping arrangement. A further 1.250" dia. Tube is Loctited to the top of this sleeve, and extends upwards, as previously stated, for the vertical feed handwheel, again photo 8.

So far so good, the vertical feed works well. The clamping force for the vertical column is set to be just slightly stiff but


8

Vertical feed handwheel mounting

allow vertical movement. The weight of the vertical moving parts, column, motor and grinding head, ensure that the down feed is responsive to adjustment set at the vertical handwheel. Of course, the column clamps can be fully locked but I have not found this necessary.

The motor and drive

The original motor supplied with the head was a single phase 1 hp. 50/60 c/s with its own built in on/off switch. It was mounted on a spring loaded platform that provided the tension for the belt drive to the spindle. I thought that this would be perfect for the service

Keyway mounted in the vertical support casting

Keyway groove in the vertical column

required. However, when I tried it out it produced a serious amount of vibration that translated into the surface being ground. I made sure that the grinding wheel was correctly mounted etc. The label on the grinding wheel stated that the wheel was balanced. The wheel was dressed with a diamond as instructed. Still no improvement. Great if you want patterned finishes but useless as a surface grinder. I even constructed a separate, rubber isolated, mounting arrangement with the motor mounted directly on the bench but the same problem prevailed. I am no expert on electric motors, but put this problem down to the motor being made for the American market where 60 c/s is the norm; as opposed to UK 50 c/s. I purchased a three phase half HP motor and ran it via an inverter; thinking this would solve the problem. It was a definite improvement but still left the ground surface with vibration markings to the surface. It seemed that this was as good as it was going to get for my home made surface grinder.

I have an old Clarkson tool grinder I only occasionally use, after I spent some time a while ago sharpening everything I had. It has its own half HP three phase motor. So, in desperation I thought it was at least worth it to try this motor. The difference was very noticeable. It ran very smoothly, and the ground surface was markedly improved, with no noticeable vibration markings. Obviously, this was a motor made for such purposes, carefully balanced etc. An advantage with an inverter control is that the motor speed can be set to where it seems to run most smoothly, this minimises vibration due to any resonance etc. In my case about 3000 rpm seemed good. The other motor was put on the tool grinder where it works quite well enough. It is a much more robust machine and the small vibrations do not seem such a problem. This gave me the encouragement I needed, and the surface grinder project was now back in business. In an attempt to further improve isolation, the motor is mounted on a wooden platform with a rubber sheet below the motor lugs, **photo 11**.

●To be continued

Motor mounting table

FREE PRIVATE ADVERTS

MODEL ENGINEER MODEL ENGINEERS' WORKSHOP

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

Classifieds and Coronavirus

For the duration of the coronavirus outbreak, it is unlikely that people will be able to collect items. Please also avoid unnecessary trips to the post office etc.
Anyone selling or buying must do so on the clear understanding that despatch/delivery is likely to be delayed until it is safe to do so. If you buy or sell something for collection make sure both parties are happy to wait until after the lockdown to finalise the deal.
Please respect the needs of delivery drivers to protect their own safety and, if receiving a parcel take sensible precautions when handling anything packaged by someone else.

Machines and Tools Offered

■ Adolf Erikson shaping machine. 240 volt, tooling, dial gauge, 2 vices on stand. £350. **T. 01560 80083. Launceston.**

■ Workshop clearance, 5 toolmakers parallel clamps 3-6 ins. £15. 4 vee blocks various, £20. 5 inch face plate screw fitting £15. 1 Magnetic base switch type £10.
T. 020 8363 5936. Enfield, London.

Parts and Materials

■ Full set of castings, frame steel and full set of drawings for a 31/2 inch Don Young 43x 2-6-0 loco. Unused project. Buyer collects £250 or sensible offers please. **T. 01293 519087. Sussex.**

Wanted

■ A 3" (1:4) running Fowler DCC are Foster DCC traction engine, my 4" is now to big for me.
T. 0049 711574987. Germany

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

❑ WANTED ❑ FOR SALE

Phone:		Date:		Town:	
NO MOBILE PHONES, LAND LINES ONLY				Please use nearest well known town	

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

The information below will not appear in the advert.

Name .....

Address .....

.....

.....

..... Postcode.....

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

Email address.....

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

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

Photocopies of this form are acceptable.
Adverts will be placed as soon as space is available.

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

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

BERWYN STEAM FABRICATIONS

High Quality welding and fabrication of Steam Boilers 7¼ gauge upwards | 4 inch traction engines to fullsize Narrow gauge steam Locomotives

Our workshop facilities offer:

Full CNC milling and Manual Turning/Milling, Slotting, Fabrications in a wide range of materials. Restorations & rebuilds, including new builds. 6 inch Devonshire Agricultural and Road Locomotive boilers and fully machined components including Cylinder Blocks, wheel hub assemblies. Part built or fully built models to your requirements.

Currently building: • 6 inch Devonshire Agricultural and Road locomotive • 7¼ Romulus Boilers • 7¼ Improved Design Tinkerbell Boiler • 7¼ Thomas Two Boiler.

Please call or email Chris Pickard to discuss your requirements...

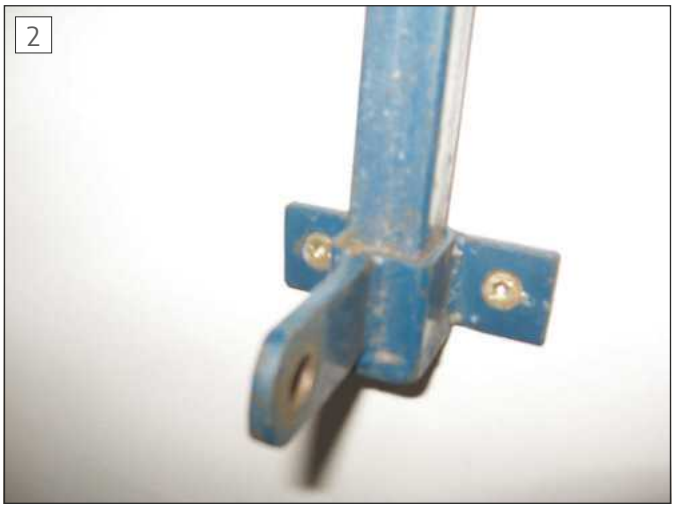
01691 860750 • sales@powysteelfabrications.co.uk

www.berwynboilers.co.uk

Workshop drawing board

Stan Nesbitt describes a long-serving piece of draughting equipment that could prove useful to those readers who have not embraced CAD

Wall Fixing



Bottom Bracket

This drawing board was originally 6 x 3ft and was installed in an outdoor workshop in 1995. Recently I moved my metal working tools and machines to an indoor workshop. The board needed to be reduced in length to 5ft to fit the only available wall, but it is adequate for most projects. The indoor workshop is finished to the same standard as other rooms in the house and provides a very cosy retreat.

This board holding arrangement allows vertical stowage and takes up very little space, although it requires the area below it to be clear of benches etc. to allow lowering to the working position. All the necessary parts may be available in your scrap box, but a welder will be essential. Photograph 6 shows the board resting on a temporary support. The fixing brackets, top & bottom are secured by wood screws into rawlplugs, see **photo 1**. Note the two laths of wood 2 x ¼ inch which are necessary to prevent the levers going over "top dead centre" to facilitate easy transfer to the stowed position.

The bottom bracket in **photo 2** is secured to the wall and contains a spigot with a 10 mm drilled hole which is position C (see dimensioned drawing, **fig. 1**).

Sliding Bracket

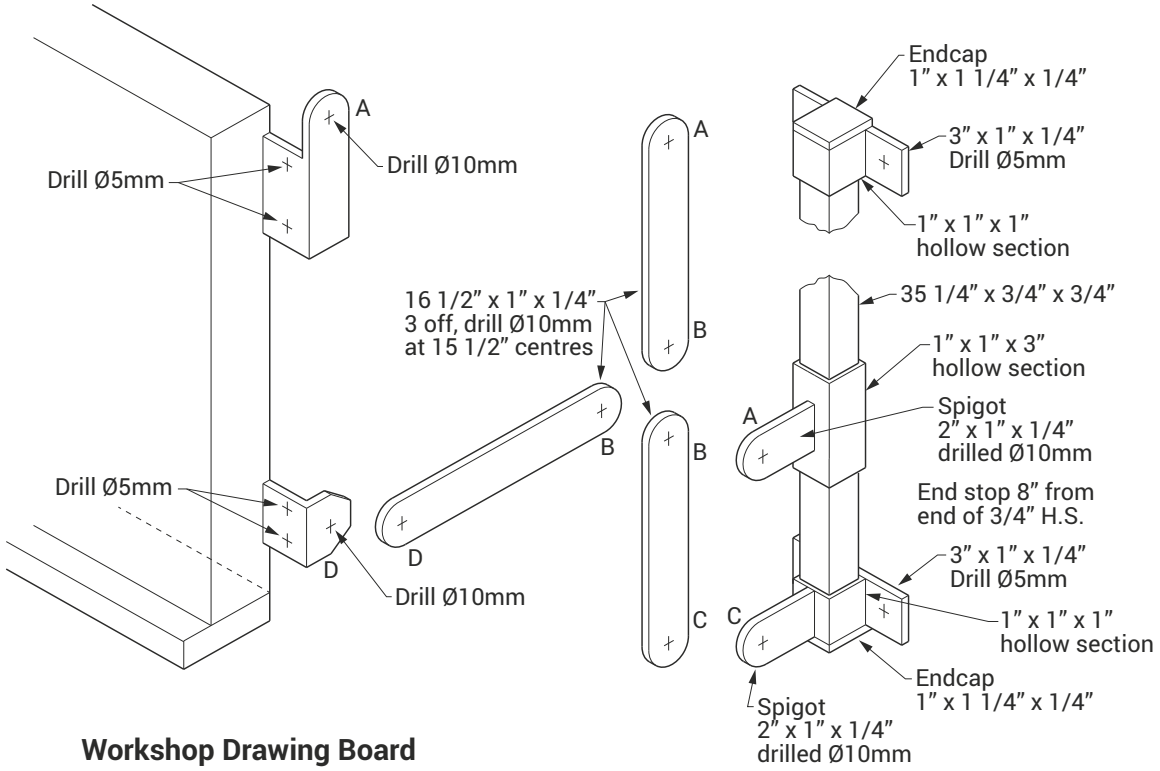
Top Bracket

Photograph 3 shows the sliding member resting on the end of travel stop and this must be installed prior to securing the top bracket to the wall. The spigot drilled 10 mm will connect to both the upper lever and the top fitting on the back of the board, position A (see drawing). **Photograph 4** shows the top bracket secured to the wall at 71 inches from the floor. The bottom bracket holes should be drilled once the ¾ inch square verticals are inserted top and bottom. It is vital to ensure the two verticals are parallel and a long spirit level should be used. The brackets on the back of the board are shown in **photo 5**.

Photograph 6 shows initial connections at position D to the bottom board fittings. Bolts are inserted in the sliding member to make them handy for the final fitting at position A. The board needs to be tilted to the vertical position and balanced on a support until the bolts can be installed at position A. It may be necessary to use a step ladder to afford a more comfortable working position.

The most tedious stage is to install the bolts at position A which unites the top

Fig.1



Workshop Drawing Board

5

Back of Board

Initial Assembly

Working Position

16 ½ inch lever, the sliding member and the top of board fitting. Flat washers should be installed between all moveable parts with additional flat washers as necessary to improve alignment. Shake proof nuts should be used and tightened enough to allow easy but firm movement of the structure. Oil or grease may be used on the sliding parts if necessary.

Photograph 8 shows the drawing board in the vertical stowed position and will remain without any additional locking.

Photograph 7 shows the board in the working position which is achieved by pulling outwards on the bottom of the board. Of course, drawings in preparation can be stored on the board which provides a safe and clean storage area. ∎

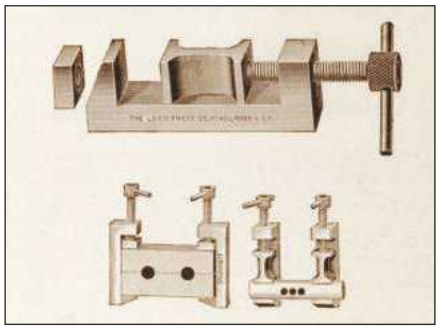
Stowage Position

In our Next Issue

Coming up in issue 294
On Sale 29th May 2020
Content may be subject to change

Look out for our June issue, number 294:

Martin Berry makes a set of pulley blocks.

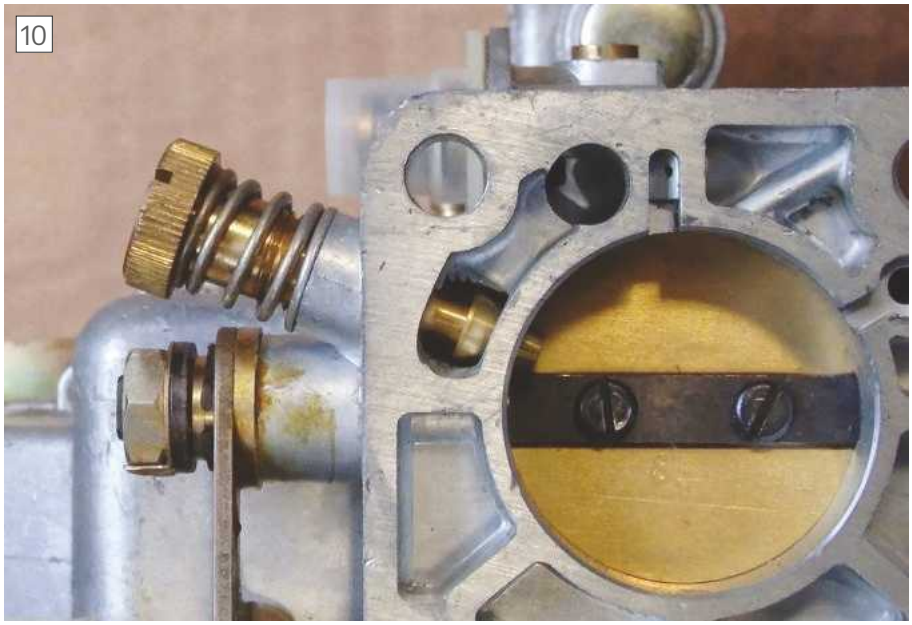


Stew Hart makes some 19th century-style clamps.

Duncan Webster makes an Arduino Tachometer.

"Coax"- Achieving Accurate Coaxial Chucking

Jacques Maurel looks at various ways of making standard three jaw chucks easily adjustable - Part 2



Carb adjuster.

Maintaining the contact between chuck and back plate in good condition.

We don't want to loosen (before adjusting) and tighten after the chuck setting screws, so the contact force (between chuck and backplate) must be sufficient to avoid any play or sliding due to the machining forces. But the contact force must not be too high, or the adjusting screws will be hard to drive.

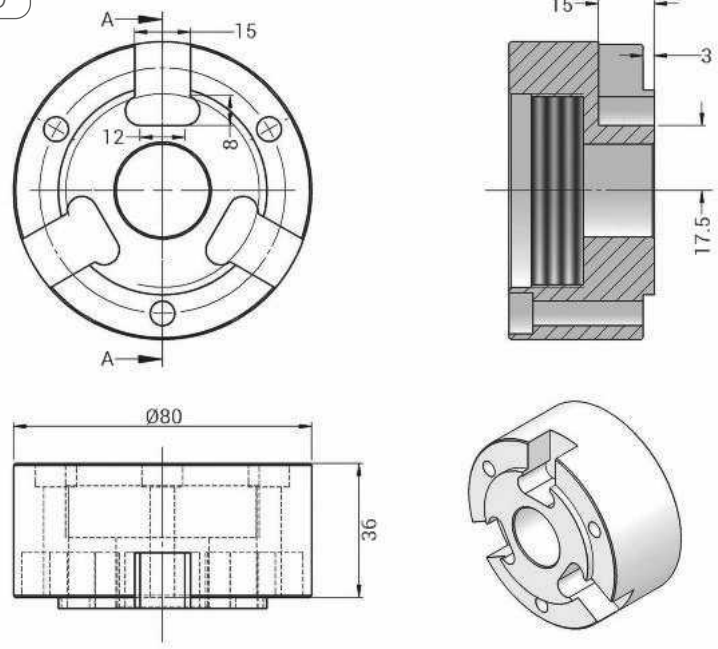
This problem is not so acute, as the adjusting screws are all tightened before machining, this gives a strong grip on the chuck body.

However, something must be done to prevent the (not too tightened) back plate retaining screws to get loose due to the machining vibrations.

The maximum machining force was estimated to 2000N for small lathes (when parting off). From a static equilibrium calculation, the axial force for the set screws should be near 2000N (to keep contact between plate and chuck) so 6000N for the 3 screws; if the friction coefficient is 0.1, 600N will be necessary against friction but we have also to allow force for bending the screws shanks!

The ideal solution should be a long screw or stud of a small diameter (for low bending force) and/or with spherical ends (so no bending). To prevent unscrewing, some spring must be set under the screws head or the nuts (consider the idle adjusting screw on carburetors, shown on **photo 10**, only pushing against a spring but not unscrewing despite strong vibrations as the thread contact is maintained by the spring).

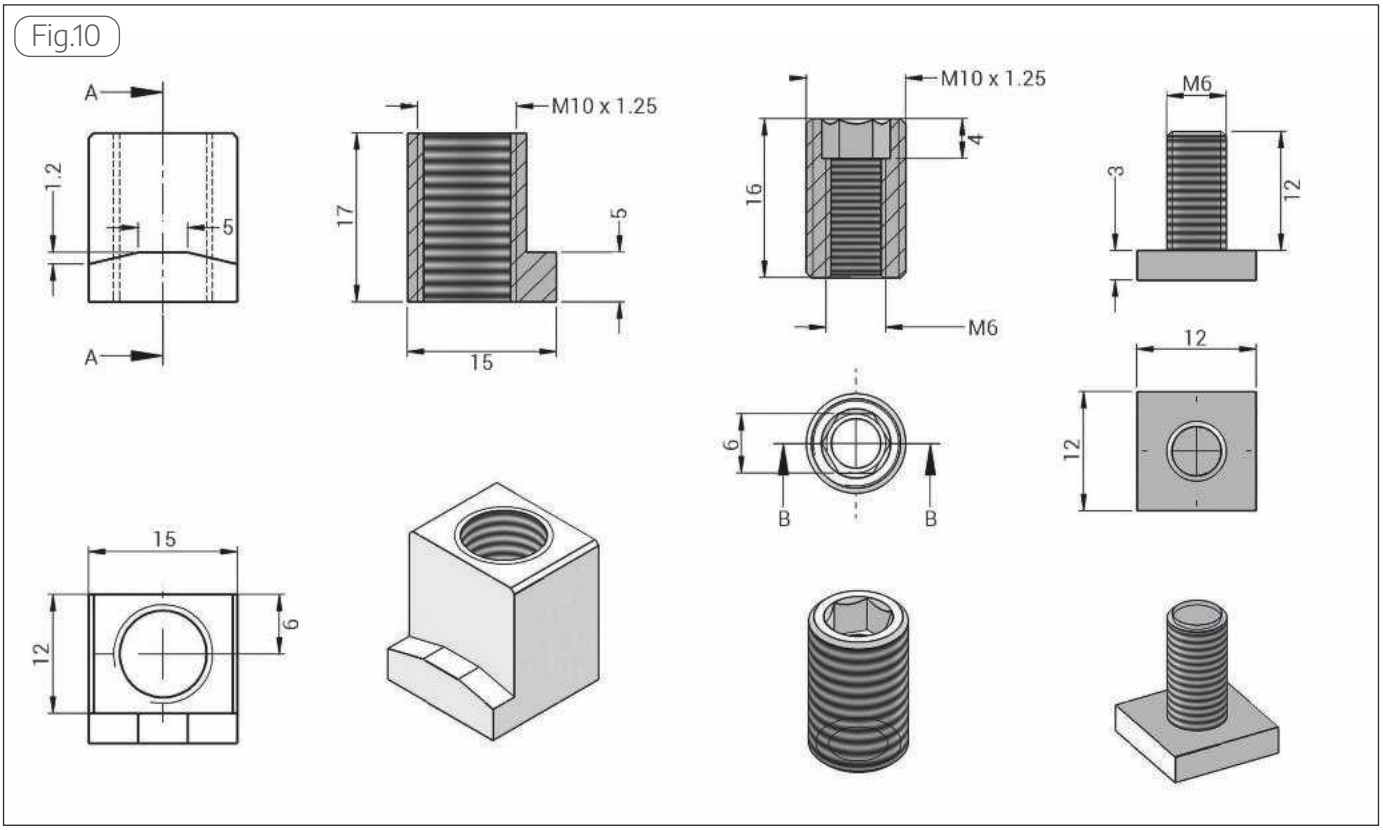
Fig.9



The solutions:

See **photo 11** (used for the solution shown on photo 9 and fig 8) using a long M6 screw, the centre part being machined to 4.8mm diameter. A Grover washer is used as spring, this is no more than a one loop helical spring with a rectangular section wire, but there are dents at the ends that bite the parts and spoil the surfaces when unscrewing , so grind off these dents for our use (make just a small flat). For this diameter, the compression "until flat" force is near 110N (measured and determined by a software study, see **fig 11**). The screw head is modified to lodge this washer while keeping a non-protruding head. **Photograph 12** shows another solution (for a 165mm diameter chuck) using M8 screws with 6mm diameter centre part and head modified for a 8mm diameter Grover washer, the tapped

›



holes having been machined deeper in the chuck body.

Photograph 13 (used for the solution shown on photo 7 and fig 5) uses a long bolt passing through the chuck body that must be drilled through and the holes sunk for the conical screw heads. The conical head is machined from a hex one, a 3mm hex bore is machined inside. The centre part is 4.8mm in diameter, the spacer is used to fill the counterbore (that contained the previously used screw head). Of course, there must be some room behind the backplate to lodge the nut.

See **photo 14** (used for the solution shown on photo 2 and fig 2) using a long M6 stud machined from a threaded rod (quality 8-8) the centre part being 4.8mm in diameter. The M6 tapped hole is machined in the bottom of the M8 hole already tapped in the chuck body. Here a stack of two Belleville washers (parallel stack, full contact between the washers) is used as spring as there is some room to fit these washers. The washers dimensions are diameters 6.3 and 16mm, thickness 0.8mm, height 1.3mm, the "until flat" force is near 1000N so 2000N for two washers stacked in parallel.

Screw with Grover washer.

Screw with reduced shank.

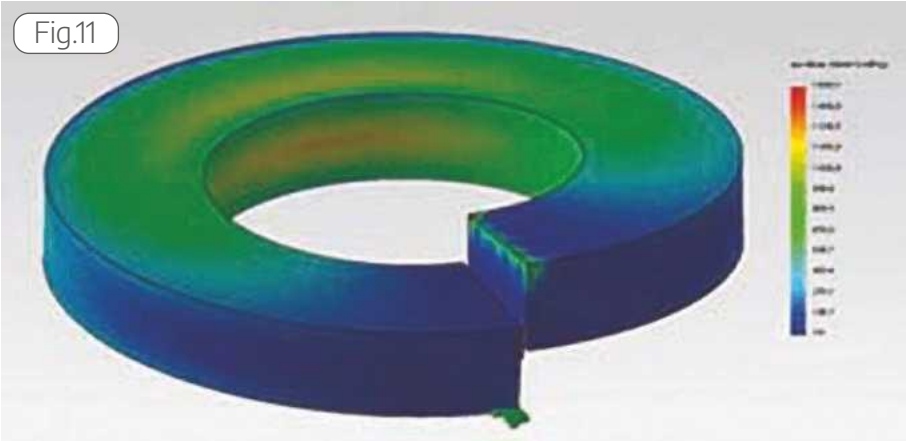
See **photo 15** for the solution I used on my Burnerd chuck; the screw and the washer have spherical contacts, the nut is sunk in a 10mm hex bore.

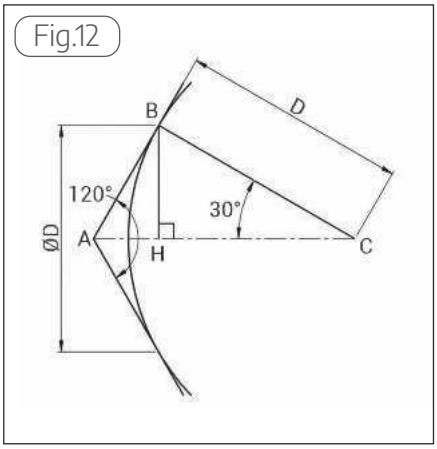
The bore, **photo 16**, is made by rotary broaching (see Malcolm Leafe's article in this issue), the grey iron chips are easy to remove (like small gravel) from the bottom of the hole.

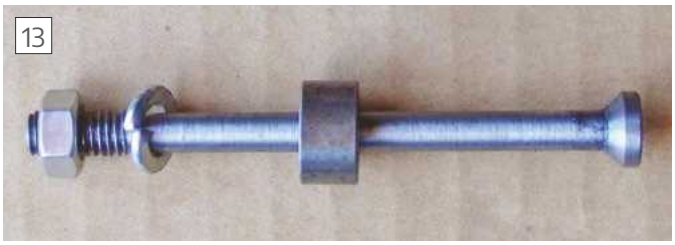
A spherical surface is machined under the screw head see **photo 17** and under the washer, the sphere contact is against a 120° conical surface, the circle line contact diameter is 8mm, just equal to the sphere radius as can be seen on **fig 12** (R = BC). It's necessary to turn the outside diameter of the Grover washer to 10mm as it is usually bigger.

How to give 2000N force with the screws or nuts:

I tried to control the torque (see **photos 18** & **19**) when tightening as there is a relation between axial force and torque,

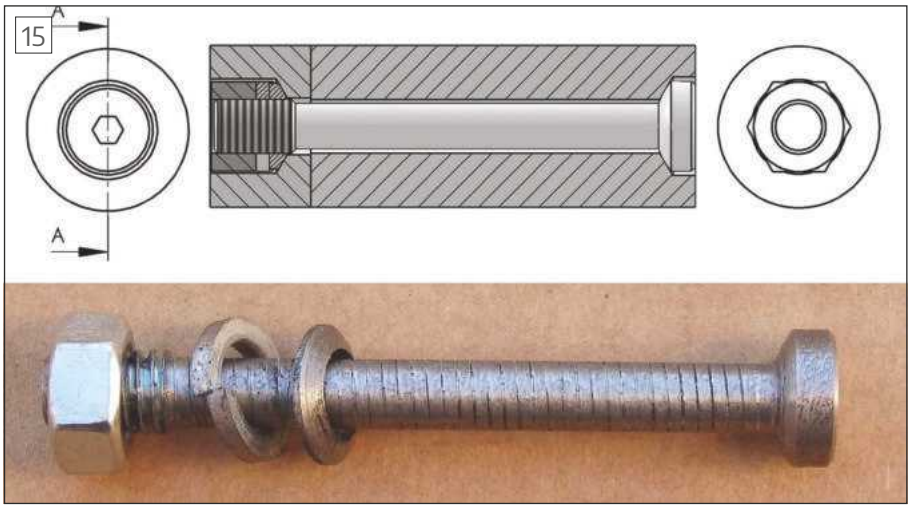






Cone head screw.

Long stud.



Screw and washer with spherical contact.

for the ISO screws and nuts:
C = 0.18xFxd (1)
F = axial force in N; **C**= tightening torque in Nm: **d**= thread diameter in m; **0.18** = coefficient for standard screwing (may vary from 0.15 for a good lubrication to 0.2 for a bad one).

For the M6 screws and studs: C = 2000x0.18x0.006 = 2.16 Nm so exert 21.6N (if the wrench lever is 0.1m long).

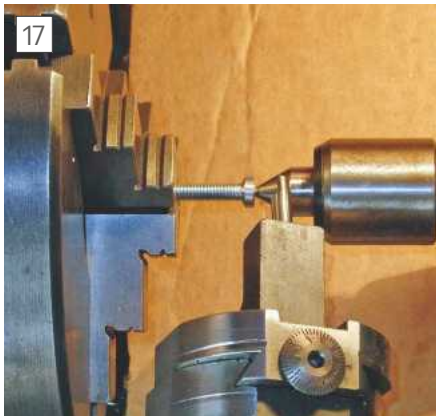
This method is not accurate (due to the not well known friction coefficient), but easy to use to get an even force for the 3 screws without fiddling.

I tried another (and more accurate, but more complex) method that can be seen on **photo 20**. A DTI is used to measure the screw or stud elongation **ΔL**, as from the "Hooke's" law: **ΔL = FxL/SxE (2)**

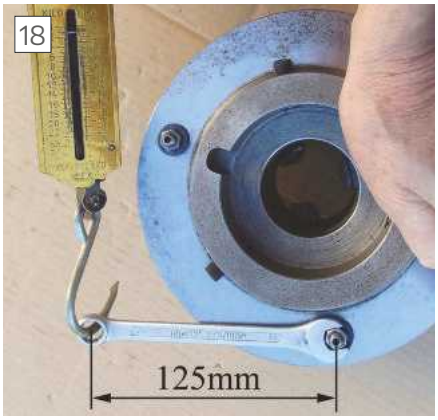
ΔL = elongation in mm; **F** = tensioning force in N; **L**= screw/stud length in mm; **S** = screw/stud section in mm²; **E** = Young's modulus in N/mm² (**E** = 200000N/mm² for steel).

For this method, you must have access to the screw/stud end (to set the DTI stem on) and the screw/stud should be long (best accuracy). The chuck body deformation is neglected as it's very sturdy.
Figures for the example in **photo 20**:
ΔL = 2000x65/18.09x200000 = 0.035mm

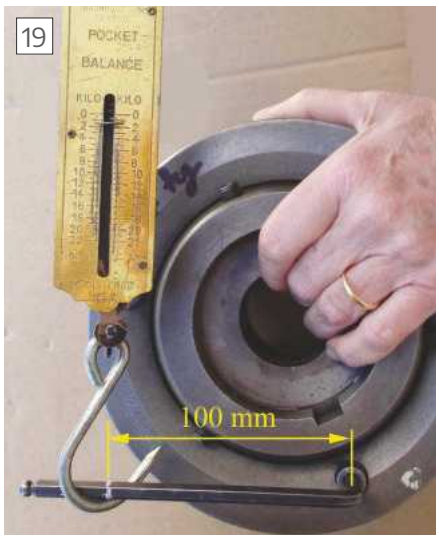
Hexagonal broached holes for nuts.



Machining conical surfaces.

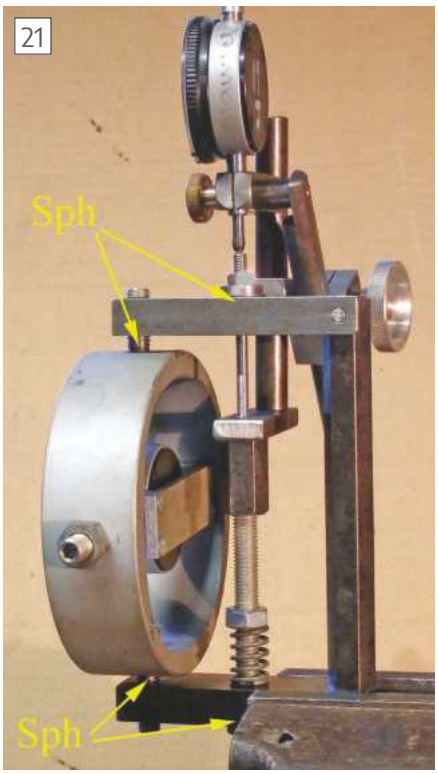


Applying torque to spanner.



And to an Allen key.

Measuring stud elongation.



Stud elongation test apparatus.

I've rigged up a test bench (**see photo 21**) for an M6 stud (diameter 4.8mm, length 50mm, in the centre part). It's possible to check the actual force with a ring dynamometer, and the stud only elongation with a DTI. The "Sph" indicate spherical contacts to get an isostatic loading. The results are as follows:

- Tightening torque 2.5Nm (for 2000N).

So formula (**1**) should become:

C = 0.21xFxd

There is not a great difference in torque whether the thread is lubricated or not.

- Elongation: 0.04mm. So in formula (**2**) take E = 138000 N/mm².

Notes:

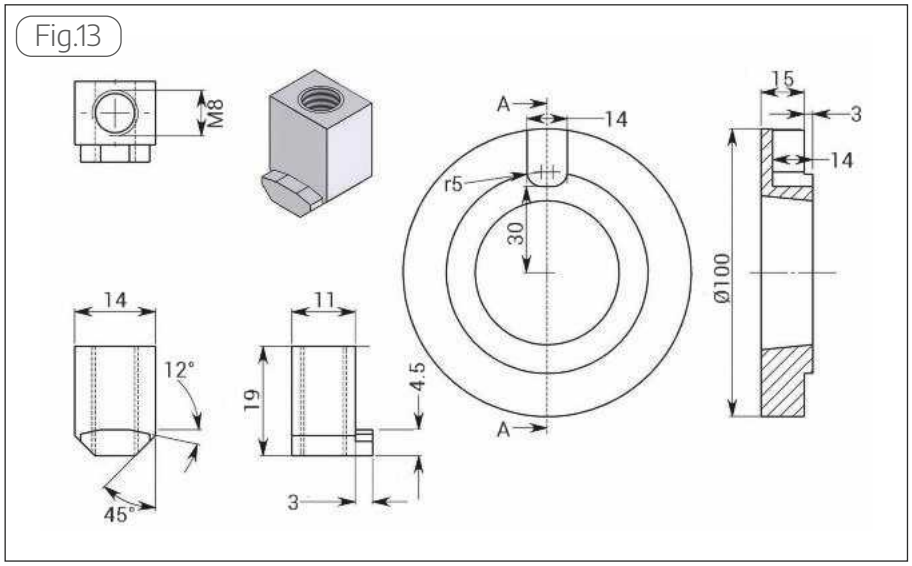
I think that the "torque method" is easier to use and sufficient for our need.

Don't worry about the small diameter (4.8mm) as for 2000 N the security coefficient is about 5.8 with an ISO 8-8 quality steel (yield stress = 640 N/mm2).

Example for a "Präzimat" lathe chuck (see **photos 22** & **23** and **fig 13**)

Machine the original backplate: remove 1mm from the centring register diameter, machine the plunger grooves with a milling machine. It's not possible to use a differential screw here (no room for it) so a plain M8-14 screw is used, it's pushing on a 6mm diameter hard steel ball. The retaining screws are M8-40 (quality ISO 8-8) machined to 6mm diameter in the centre part, the head is machined to lodge a Grover washer (dents ground off as already described). The tapped holes in the chuck body must be deepened. ■

Präzimat lathe chuck.

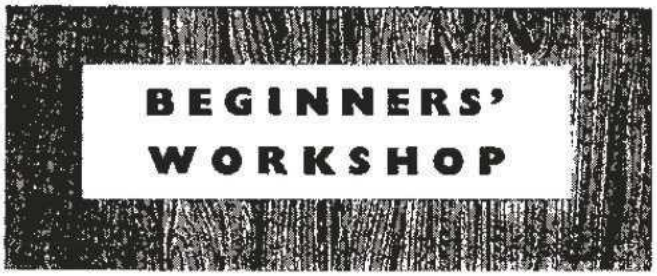


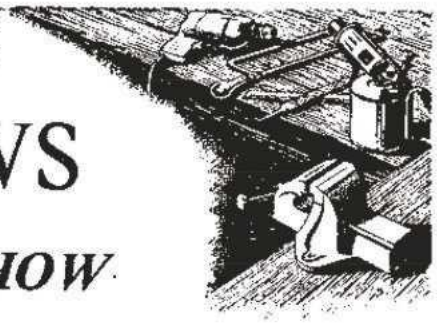
Back plate for Präzimat chuck.

From the Archives:

This article originally appeared in *Model Engineer*, 1st September 1955

In the first article of a series designed to help the younger element GEOMETER gives some helpful advice on





SAWS AND HOW TO USE THEM

ALMOST ALL METALS commonly found in workshops-iron, mild steel, cast iron, brass, copper-can be cut easily by hand if the correct saw is used. The exceptions are steels which have been hardened and tempered for special purposes.

The metal saw differs from the wood saw in that it employs separate blades which have been specially hardened and tempered for metal cutting. Because of this, the blades cannot be sharpened with files like wood saws, so when worn out they must be renewed. As they are hard, or semi-hard, they are liable to crack or break if twisted or wrung excessively.

Tubular frames for rigidity

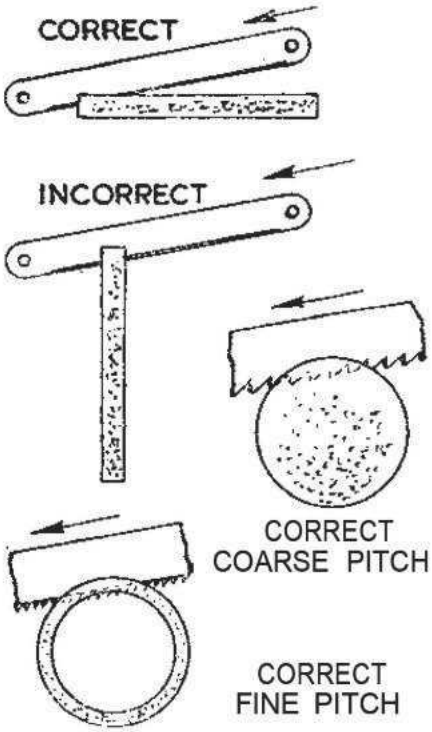
Frames to take metal saws, or hacksaws as they are known, are made in a variety of sizes and designs for blades 9 in., 10 in. and 12 in. long. The standard non-adjustable frame takes blades of one length, but there are adjustable models of similar design which take all lengths of blade. Tubular frames are, in general, more rigid than those of flat section.

For many purposes, the depth of cut with a hacksaw is limited by the depth of the frame+-i.e., the distance from the blade to the back of the frame. Special frames are available for exceptional depths of cut, however; these are called girder frames. A light frame, known as a junior, and formed from solid rod takes short fine toothed blades.

Under no tension

A pad handle is made to take a standard hacksaw blade? or portion of blade, the projection bemg adjustable. This has the advantage that it can be entered in awkward places where a standard or junior frame would be obstructed, and can also be used for cutting down wide sheets of metal. As the blade is not held in tension, more care is necessary when using the pad handle.

Standard hacksaw blades have teeth of 14, 18, 24 and 32 pitch. This term " pitch " means the number of teeth in 1 in. Blades with the smaller numbers of teeth are called coarse pitch, and those with the greater numbers of teeth are of fine pitch. Pitches of 18 and 24 are commonly used for general work; 14 pitch can be used if the metal is very thick; 32 pitch can be used for sheet metal or thin-walled tubing.



The right and wrong ways of cutting

Junior blades are 6 in. long of 32 pitch, and have a pin at each end for mounting in the frame. Circular blades have a spiral tooth, and these are mounted in a standard hacksaw frame employing clips. These enable one to cut as with a fretsaw but in metal.

There are other types of saws and frames for particular purposes. Saws which are parallel in vertical section and without any set on the teeth are slitting saws; these produce a straight smooth-sided cut, but should not be used for general sawing. Hacksaws, junior saws, and similar blades, have a set on the teeth which provides clearance in the cut.

Choosing the blades

When choosing a blade for a particular job remember a coarse pitch of tooth for large sections and soft metals such as aluminium; and a fine pitch for harder metals such as cast steel or silver steel, and for thin sheet metal and thin-walled tubing. Shorter blades will serve the same purpose as long ones in many cases and are more economical. Long blades are better if the section of metal is large.

The blade should lie snugly against the side of its attachments, with the pins firmly in the holes, and should be put in tension so as not to whip or bend when in use ; the blade should remain firm and straight and should not be over-tensioned. For making long cuts down the sides of sheets, the blade can be mounted at right-angles to the frame, by turning the fittings through 90 degrees before mounting the blade.

How to make a cut

A cut should be started with short. strokes, guiding the blade with thumb or fmger. When a start has been made, the strokes should be long and firm using the full length of the blade.

This method ensures that all the teeth are equally worn and therefore a smooth cut will result. If only the middle of the blade is used for a long time, when the ends of the blade are brought into use they tend to " seize." This is due to the set not being worn. For this reason a new blade should not follow in the cut made by an old blade.

Cutting metals is a matter of knowledge rather than knack and the correct and incorrect of cutting are illustrated.

From the Archives:

Electric Arc Welding

Stan Bray, MEW Issue 3, Winter 1990/91

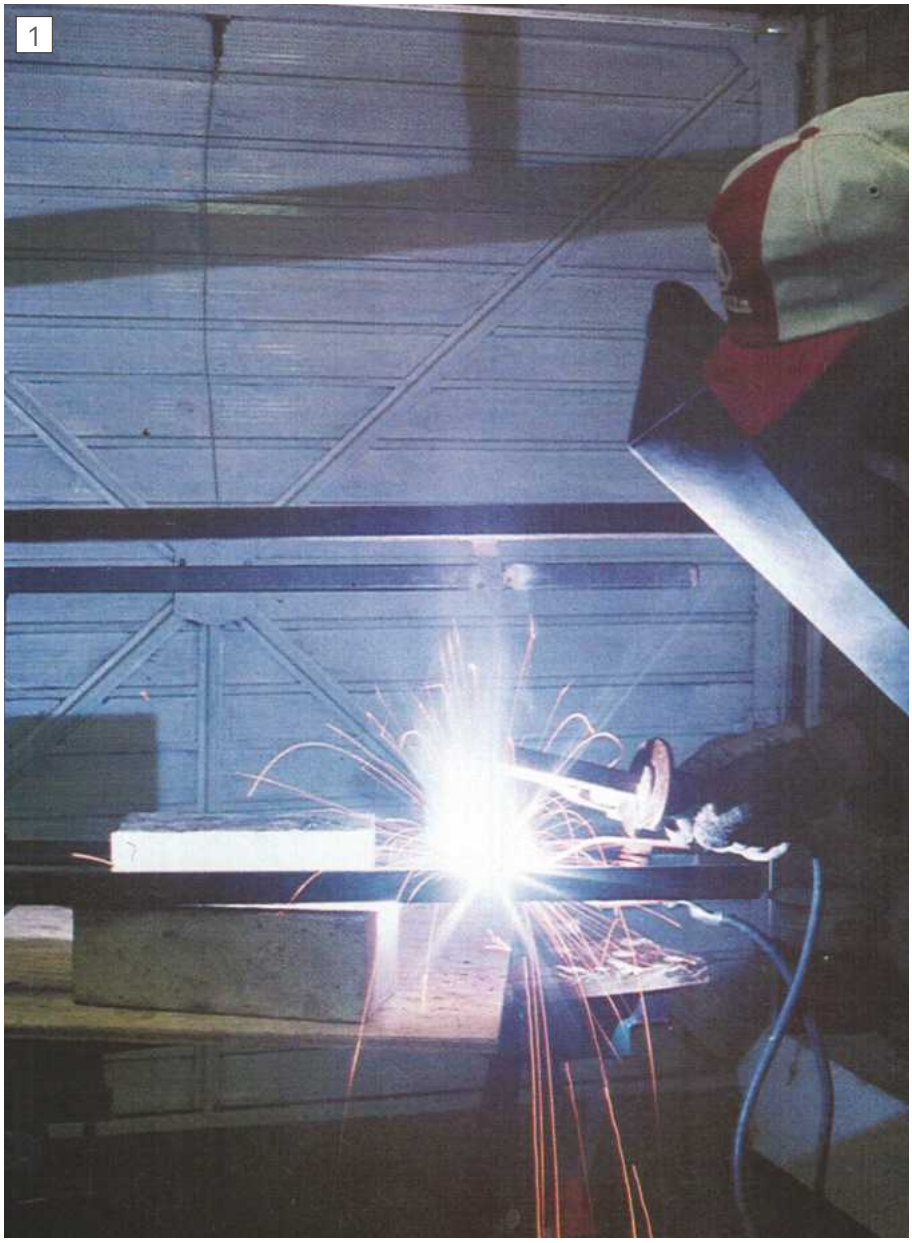
One of the features of early issues on Model Engineers' Workshop were short how-to articles that managed to give a good overview of tools or techniques unfamiliar to some readers. This short piece by Stan Bray on electric arc welding is an excellent example that should be just as useful to anyone starting out with a 'stick welder' today as it was twenty-five years ago.

Arc welding is something that needs a great deal of practice to become even moderately efficient in; such skill cannot be passed on merely by writing about it. The types of joint construction and details of equipment are another matter and perhaps some of these facts will be passed to readers through this article.

Welding is a process of joining metals by softening the edges and then fusing them together. Many years ago, it was always a source of wonderment to watch the local blacksmith mending farming equipment by welding. There was none of the sophistication that we know today; both pieces were put in the furnace until they were almost white hot and then hammered together, sometimes with a form of lap joint. On other occasions the two pieces were simply hammered together. Of course, it took many beatings and required a great deal of skill, something that was rarely appreciated...

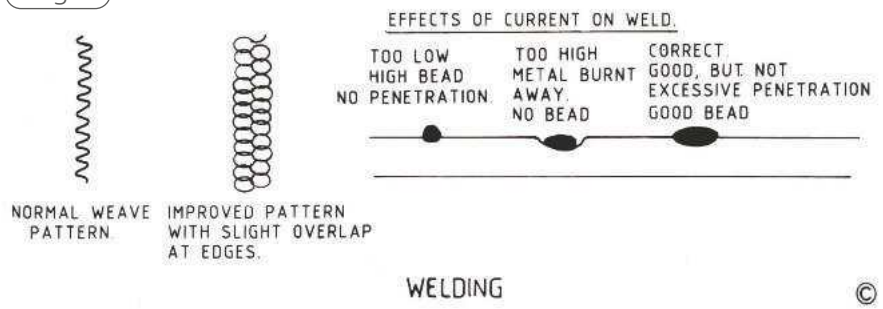
There are now many forms of welding used for different purposes, but it is proposed here to deal purely with electric arc welding. The reasons are simple. Firstly, a number of the projects in the magazine have called for welding. Whilst this does not necessarily mean arc welding, that certainly would be the quickest method. Then there is the fact that electric welders have, over the years, dropped in price to a level where a large number of home enthusiasts can now afford them. The third and most important reason is that a number of readers have written to say that they have bought small welding sets but cannot get the best from them.

It is not possible for a mere magazine (even though it is MEW!) to pass on welding skills. A good welder earns a great deal of money because acquiring such skill is not easy and top people are not easy to find. We can offer some hints and tips on the best way to go about things but, when it comes down to it, the final result will only come with continual practice, and self-criticism.



Arc welding in progress, note the use of protective gear.

Fig.1



2

A typical arc welding set, relatively cheap to buy they are the sort of equipment that will prove useful over a long period.

The equipment

Whilst for industrial purposes there is a choice of many types of electric welder, for the average person in their home workshop the choice is narrowed to about three types – partly because a welder is needed that can be plugged directly into the normal thirteen amp socket. There are M.I.G. welders these days, very fine pieces of equipment, but comparatively expensive. These will do a very good job, and they actually weld the metal through a film of gas, a process which has many advantages. We will be dealing with their use in detail at a later stage. In this issue we are concerned with pure arc welding and so two choices of equipment are left. The oil-cooled set or the air-cooled set.

Oil cooled welders

The main advantage of an oil-cooled welder is that it can be used for continuous welding operations over a long period. The disadvantages are that they are the more expensive type, and they are invariably more bulky and much heavier. This is rather inconvenient unless the operator has a very large workshop where the equipment can have a corner allocated to it.

Air-cooled welders

For competitive price and for size of equipment the air-cooled welding set will come into its own. Most have thermal cut-outs to prevent welding being carried on or for too long a period and so ruining the transformer. As a rule, the time allocated before the set cuts-out is ample for home workshop usage. Prices obviously vary according to quality and often also govern the power available; it is as well to get a set with as much power as practical within the limits of one's pocket.

Electrodes

Arc welders work as a result of the heat created via an electric arc. To make this arc, an electrode – more commonly known as the welding rod – is used. This is a steel rod coated with a flux. As the arc is in progress, the rod melts away and so gets continually shorter. The question of the correct electrode or rod to use is not an easy one to answer. There are very many varieties, mainly designed for different purposes and so the manufacturer's instructions must be used as a guide as to whether or not that type of electrode is suitable for the job in hand. They also come in different sizes.

Most home welders will need one of the smaller diameter rods. Current rating of the transformer (all have a range of settings) will depend on the diameter of the rod used as well as the thickness of the metal to be worked on. Here again, practice is the important thing but a rough guide is to use one amp of current for every one thousandth of an inch thickness of welding rod.

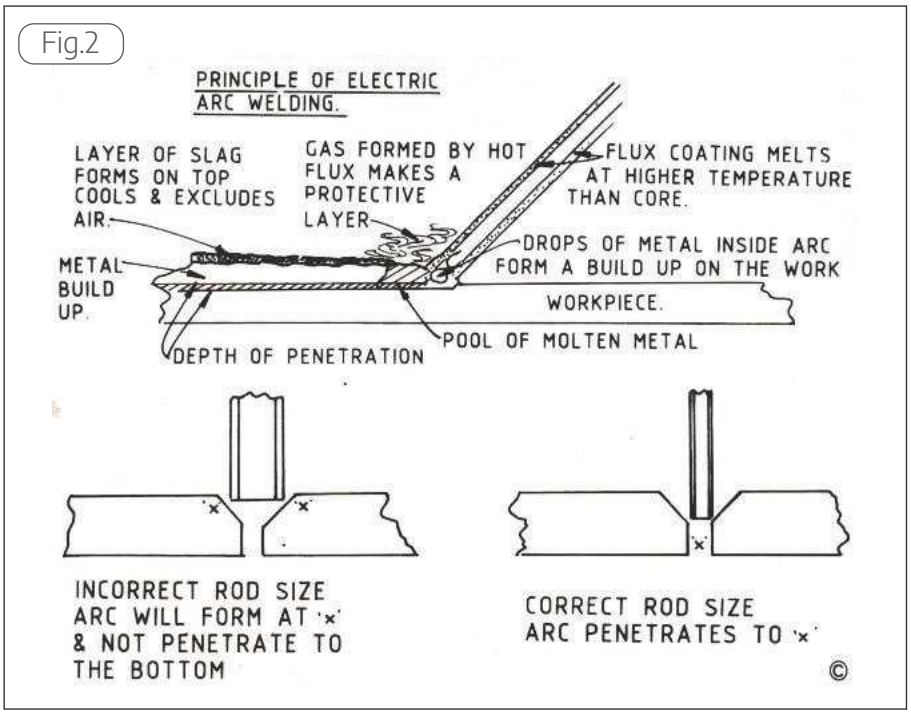
Safety

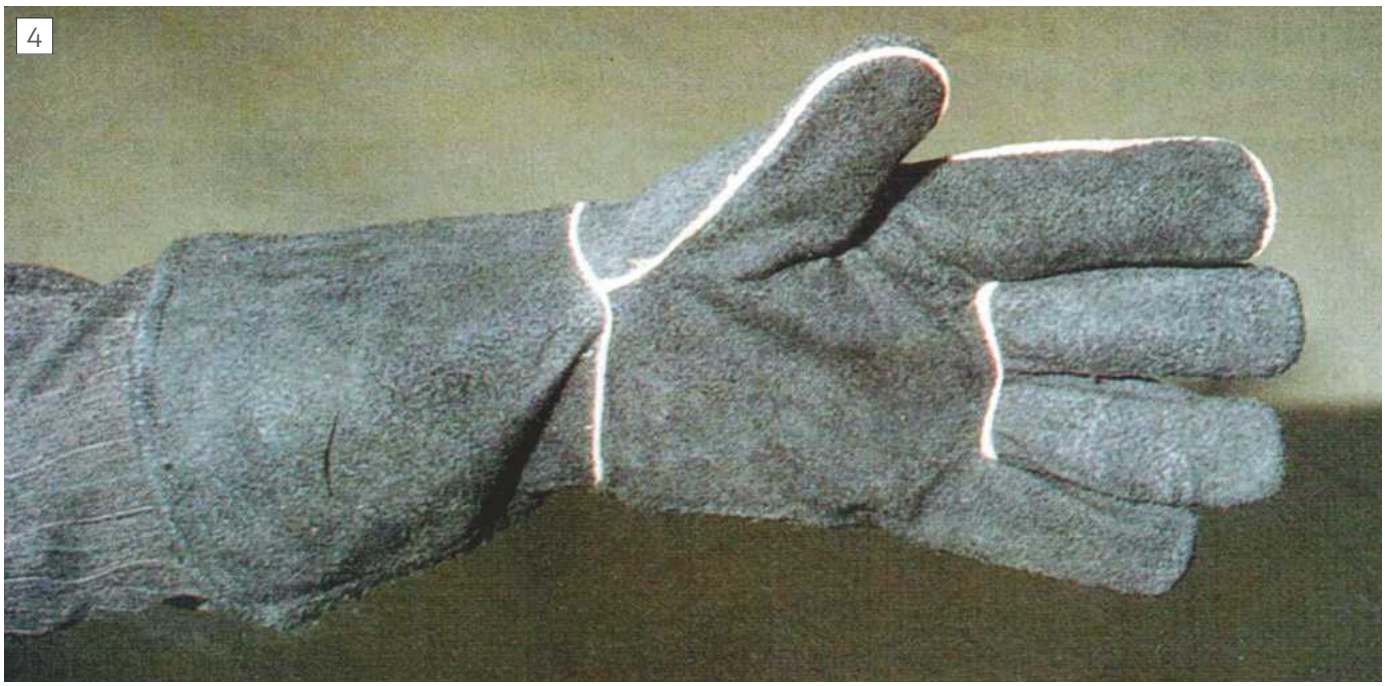
Safety in welding is, like all other engineering practices, of the highest importance. There is a particular danger

3

Face protection is essential.

Fig.2



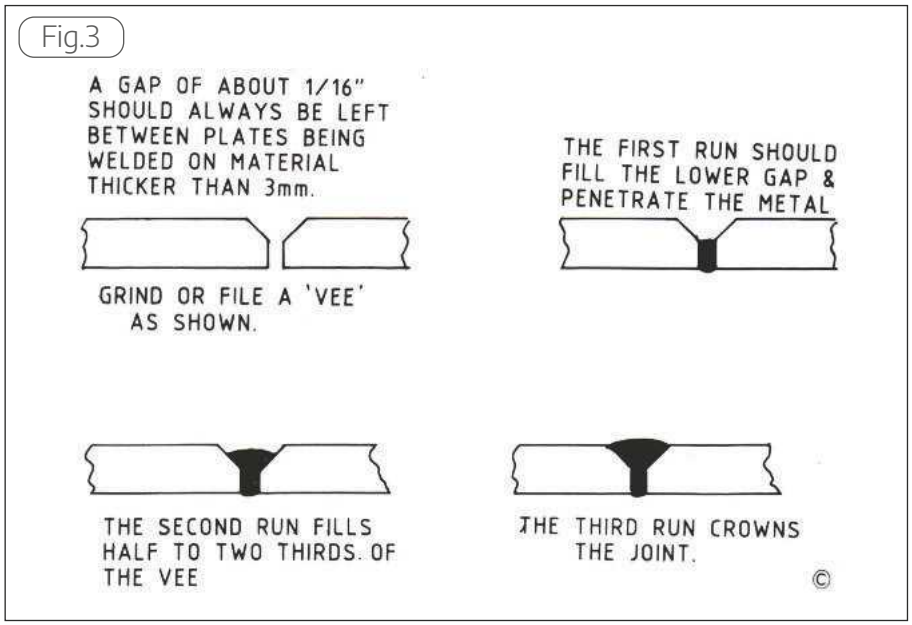


Good stout gloves should always be worn; if possible the gauntlet type such as these from Machine Mart.

in this case from the arc itself. The eyes must be protected with a properly made piece of dark welding glass at all times. When the arc is in operation, both ultraviolet and infra-red rays are created, and these can cause very nasty skin burns. In particular, they can affect the eyes, there being a particularly painful effect known as 'arc eyes'. Different grades of protective glass are designed for different current ranges in use and it is better to use a heavier one than necessary. The use of a lighter type than that recommended can result in permanent eye damage. If a welding set is purchased new then, as a rule, the manufacturer supplies a hood or shield with the correct glass already fitted. The glass can be either in a hood or a face shield. The hood is better, as it gives greater protection, but some welders find they can use a shield better than the hood and prefer it that way. Never be tempted to use sun-glasses or even glasses designed for gas welding purposes for arc welding; the arc can cause permanent eye damage.

Other vulnerable parts of the body should also be protected; arms should be covered, and necks also covered by a heavy overall or coat. Gloves should always be worn to protect the hands from burns. It hardly needs saying that slippers, sandals, etc., should not be worn. Remember that hot pieces of metal fly off the work when welding, and you must be protected.

Welding sets should be switched off as soon as work is finished - you are dealing with heavy and dangerous



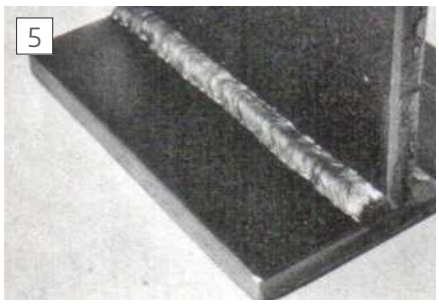
electric currents, and whilst there is no danger under normal circumstances, it is silly to get careless.

The arc

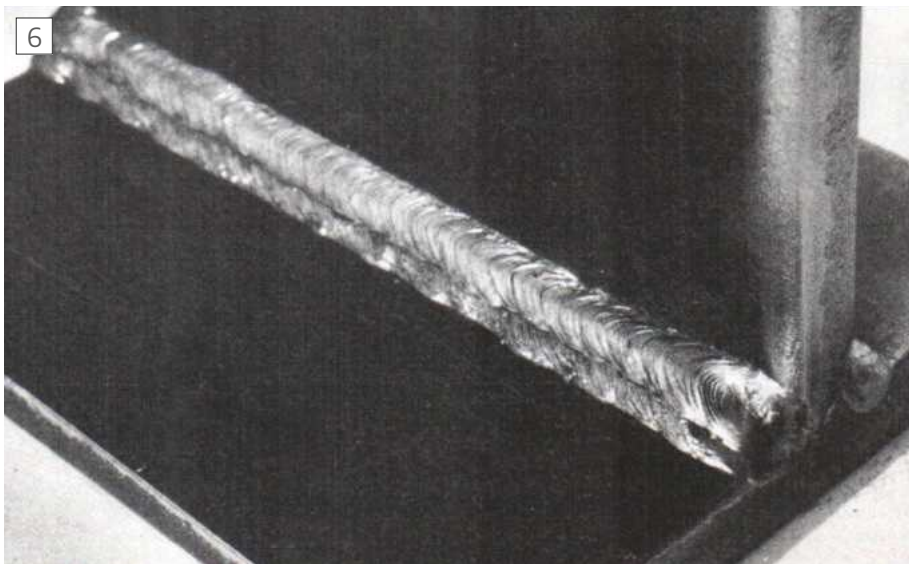
The arc is created by striking the electrode on the work and quickly removing it to a suitable distance where the arcing effect will continue. This, for the beginner, is far from easy and the electrode will tend to stick. If this happens, the set must be switched off at once if a quick sideways jerk does not immediately free it. A cold electrode is always difficult to strike with, and a good tip is to clamp an additional plate of metal to the job. Make a couple of strikes on that to warm the electrode and then start on the actual work. The arc will be much easier to strike and maintain in position. Anyway, the practice strikes on the spare metal plate enable one to get the feel of things, and it is much better than trying to start straight away directly on the work.

Direction of weld

Always arrange the work so that it lies flat whilst being welded. Trying to work up and down is nearly impossible, and every effort should always be made to work on a horizontal plane. It is normal to weave from side to side when welding in order to get better coverage; this weaving effect must not be exaggerated and should only cover the



A typical example of a good quality weld where the electrode has made a single pass.



A typical weld with three passes of the electrode.

equivalent of the rod diameter on each side of the straight seam being welded (total three times the rod diameter) If it is necessary to take a second run over the top, ensure that all deposited slag is first chipped away.

Coverage

All seam joints when possible, should be welded on both sides. Plates should never be butted directly up to each other but a small gap left to allow the pool of molten metal that is formed to run in and fill it. Any metal over 3mm thick should have a small vee along the seam to allow penetration of the welding material to take place.

In the case of angled joints, fillets should be built up along the edges of the metal. Again, a slight gap should be left between the metal to allow the weld to flow into position. Seams should be made along both edges.

Where two different thickness metals are to be joined, it is an advantage to reduce the thicker one at the point of the weld to a thickness similar to the thinner material. If lap joints are made, then an undercut on one or both of the materials will allow better penetration.

Cast iron

Special electrodes are available for welding cast iron and these can be used for building up broken castings, etc. Care must be taken in the selection of electrodes as some leave a deposit that is difficult to machine. Almost inevitably, there will be some distortion when welding cast iron as there is with all welding operations.

Bronze welding

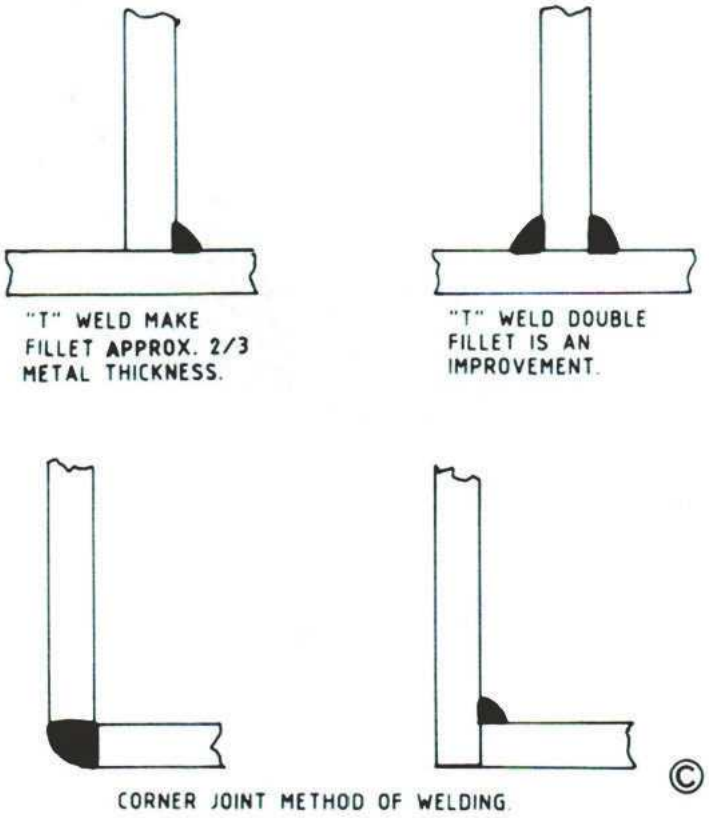
Bronze welding rods can be used for welding together dissimilar metals as well as bronze, etc. They are comparatively easy to use but might not be easily available. Stainless steel is difficult to weld without a M.I.G. welder but it may be possible to use a bronze rod on small stainless steel welds.

Conclusion

As stated at the beginning of this article, successful welding will depend almost entirely on practice.

Try as we may we cannot give any more than a brief account of the process in this short article. It is recommended that plenty of practice is done on scrap material before attempting the more important jobs. Under no circumstances should the unskilled welder try making boilers; this is a job for the expert. Only a qualified coded welder should be entrusted with such work and, in all probability, an insurance company would not accept a boiler for insurance purposes unless it had been made by such a person. This apart, small home welders can be very useful for the home workshop and enlarge the scope of workshop activities considerably. ∎

Fig.4



A Storage Story

Robin King shares the lessons learned from his experience of workshop moves

The ML10 re-assembled, grease cleaned off, and in pristine condition out of the crate after 9 years storage; the crate has hold down bolts through the base to hold the bed in place and all loose parts were bubble wrapped and held securely.

Right and wrong; chucks and faceplate to the left were greased up/sealed in poly bags and like new but 4 jaw and catchplate were just in a cardboard box. The rust is clear as is some on the collets which were in the collet box in a plastic bag but the bag was tied not taped closed.

The editor's recent mention of an impending house move and need to put his workshop into storage has reminded me of two such events that I've undergone in the last twenty plus years due to domestic upheavals, one involving short term storage, the other much longer term, and the lessons learned from them which may be of use to others. In short, I got it both right and wrong and realised that better planning would have avoided a lot of problems, unnecessary work, and cost.

After twenty years in one home I had a small workshop 6' by 9' in the back of the garage with bench, Myford ML10, bench drill and stand, Adept shaper, bandsaw, and the usual collection of castings, part built loco's, tools, materials etc. The first move was into a three month rental property pending the permanent move locally. While the rented house's garage could accommodate some items, I had to find somewhere else for a large proportion, solved by the kindly offer of a friend of the use of her summerhouse down the back garden. That all worked well until I had to retrieve everything and discovered that wheeling a wheelbarrow uphill through the garden, loaded with an ML10 in a crate, took a great deal of effort! The whole job took several car trips, fortunately over no great distance.

Fifteen years later I did it all again, but this time delays in house sales and purchase resulted in the intended six to eight weeks storage extending to nine years before I could set up the workshop again in it's new home some one hundred and eighty miles away. By then the workshop had expanded to include a Boxford lathe, Arboga mill, welding and brazing equipment, and a great deal more. The container site was near my old home so there was enormous frustration in being unable to get on with any of my loco projects or even do basic household repair jobs during that time as inevitably the tool that I needed was in storage far away. Latterly I found storage near my new home which helped considerably.

The following thoughts are based on temporary storage needs related to a UK relocation; if you are considering anything further afield think about talking to a specialist relocation firm.

Plan Ahead!

Forward planning pays off. If you are relocating locally then plan on local storage, if further afield then storage close to your destination will ultimately make life a lot easier. The storage facilities and methods can vary according to the planned timescale and availability.

Bear in mind that you've probably invested a lot of money and time in building up a workshop, projects, materials stock etc over many years, so how much is it worth to you? If you value it then protect it. Storage can be very costly so it's worth taking a hard look at what you have and asking yourself if it's worth keeping, can it be turned into cash, or is it fit to skip? The less you have to store the less it will cost.

To Insure or Not?

Some, but not all, household insurance policies provide cover for workshop contents while in storage but talk to your insurers to confirm details. Specialist insurers like Walker Midgley will provide cover but will need to discuss with you the specific terms. Commercial storage facilities will usually require that you provide your own contents insurance cover.

Storage Facilities – Where?

As Doctor Joad used to say on the Brains Trust 'it all depends...'.

Family and Friends - For short term storage, and assuming that you can't store items at your current home, you might be lucky enough to have family

and friends who will oblige with a space in the back of the garage, garden shed etc, so it's worth asking, particularly if they can keep an eye on items for you and provide some security, but see 'Records' later regarding keeping track of what's stored where.

Lock Up Rental – occasionally available, a lock up garage/store might be worth considering, however they tend to be either single or in small groups and with limited physical security so might not be suitable. Security of tenure is also a consideration; a week's notice from the owners to leave could present a major problem.

Commercial Storage Facilities – these range from a few sea containers in a yard, an organised and secure container compound, secure storage buildings containing individual lock up rooms with twenty four hour monitoring, to commercial storage firms who will collect/pack/store and finally deliver stored items to your new home, and the cost increases proportionately. It's worth inspecting and assessing the facilities yourself before making a choice.

The important factors to consider in making a choice are:

- Vehicle access; being able to park by a container will reduce physical effort considerably;
- Limits on access hours; bear in mind travel distances if far away; twenty four hour access is useful;
- On site security; helpful and welcomed by insurers;
- Contactability; are the site operators readily available if needed?
- Cost;
- Containers - check if they are insulated or not; older ones are generally not and are prone to condensation problems. Either way both need to be regularly opened up and ventilated to minimise mould and corrosion developing on stored items. The frequency depends on where it is located, and local climate so assess that over a period of time.

Organising Yourself

Manpower – how much of this can you and do you want to do yourself? If you can get help then make the most of it, otherwise it's hard slog as I learned from experience. Either way remember that you are only human and will be manhandling heavy items so protect yourself accordingly, overalls, gloves and protective footwear should be the basics. Bend the knees not the back!

Records – Keep records of what is stored where. It's a pain in the neck to do but nothing like as much as knowing that you have a particular item but can't find it because it must be in one of thirty unlabelled boxes behind the twenty you've just climbed over! The simplest ways are either a handwritten pad or better a simple spreadsheet on the computer. Label and number each box and list it on the spreadsheet with it's contents and it will ultimately save you a lot of time. If various boxes/items are stored in different locations e.g. spread among family/friends log it on the spreadsheet. Digital photos are worth taking as well.

Machinery and Big Bits – Depending on the machinery you have, if you can justify the cost then it's worth using the services of a specialist machinery mover, e.g. Landylift or similar who can safely transport machines for you and without dismantling them. It is possible to do it yourself with a decent trailer or van but manhandling something like an assembled Boxford lathe and cabinet takes a lot of effort, and help. I stripped mine down into sub assemblies to move it on my own but it's due for a rebuild anyway. If possible, crate up smaller machines and fully protect them within the crates. **Photograph 1** shows the chipboard crate I made for the ML10 and with it fully greased up it came out in pristine condition. A hydraulic lifting table and sack truck are a great help in shifting parts and boxes.

The Corrosion Menace – Taking Precautions

Prevention is better than cure. I made a big mistake in assuming that our final house move would go to plan and storage would only be for a couple of months so didn't protect some of my machinery etc as well as I should have resulting in inevitable rust problems. Greasing and oiling machinery slides and exposed metal parts works, so too do proprietary products from suppliers like Frost Auto Restoration, Arc Euro Trade etc. Waxoyl sprayed into casting voids, machine bases etc will give long term protection.

Good protection from the start avoids the long job of trying to de-rust and clean up tools later, **photo 2** of my Burnerd 4 jaw chuck and Myford collets tells its own story and I'd thought they were well protected in a box.

Packing and Protecting

Larger items and machines can be further protected by wrapping in several layers of polythene, taped up. Suitable rolls are readily available from builders merchants at modest cost.

Small tools/parts etc can be packed in labelled plastic takeaway cartons, other items wrapped up in bubble wrap/polythene sheet, all securely taped shut before sealing up in cardboard boxes. Individual items like chucks benefit from being oiled/greased and placed in sealed polythene bags. Bear in mind that an A4 2,500 sheet paper box containing a set of castings can weigh 50lbs plus so needs careful taping up and handling; a commercial tape gun is useful. Fill any voids in boxes with bubble wrap or similar; a solidly filled box will protect the contents during handling. Label/number/record!

Bigger items need individual wrapping, bubble wrap/polythene/tape. Avoid newspaper as it absorbs and retains moisture.

Books, magazines, and drawings will absorb moisture and deteriorate appreciably in storage if not properly protected. I made that mistake and lost a large number of bound volumes of M.E. as a result. Those that I had sealed up in polythene bags, both magazines and books, then sealed in cardboard boxes, had remained in good condition. The best option is the sturdy plastic crates with lids, but they are costly if using a large number.

Moving It

If DIY, then a van with tail lift is a good option, though do check the load limits on both the lift and the van all up weight, which are easily exceeded! Estate cars are useful but have limited load capacity. A hydraulic lifting table and sack truck are very useful at this stage.

Organising Storage

To state the obvious, think in terms of which order do you need to retrieve items to put into your new workspace. Putting the bench at the back of the storage space when it's the first item needed to take out might not be a good idea but is easily done when under pressure. A few digital photos of the contents in store can be a useful reminder of what's where.

Do bear in mind that storage firms will not allow storage of flammable liquids, LPG cylinders etc in containers or buildings so you'll need to accommodate them elsewhere.

Finally...

Moving and storing a workshop is not a five minute job. The essential factor is to give yourself enough time to think through and plan the job and all should go well. Good luck! ■

MODEL ENGINEERS' WORKSHOP CLASSIFIED

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

MODEL ENGINEERS' WORKSHOP CLASSIFIED

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

ALWAYS IN STOCK:
Huge range of miniature fixings, including our socket servo screws.
ModelFixings.co.uk
also the home of **ModelBearings.co.uk**
• Taps, Dies & Drills • Adhesives
• Engine & Miniature bearings • Circlips, etc. etc.
Tel/Fax +44 (0)115 854 8791 Email: info@modelfixings.com

www.model-engineer.co.uk

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

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

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

Model Engineering Products Bexhill
Manufacturers of 5" gauge diesel outline battery electric locos and accesssories
Telephone: 01424 223702
Mobile: 07704 256004
email:modelengineerssupplies@gmail.com
17 Sea Road, Bexhill-On-Sea, East Sussex TN40 1EE
Visit our website:
www.model-engineering.co.uk

To advertise please email david.holden@mytimemedia.com

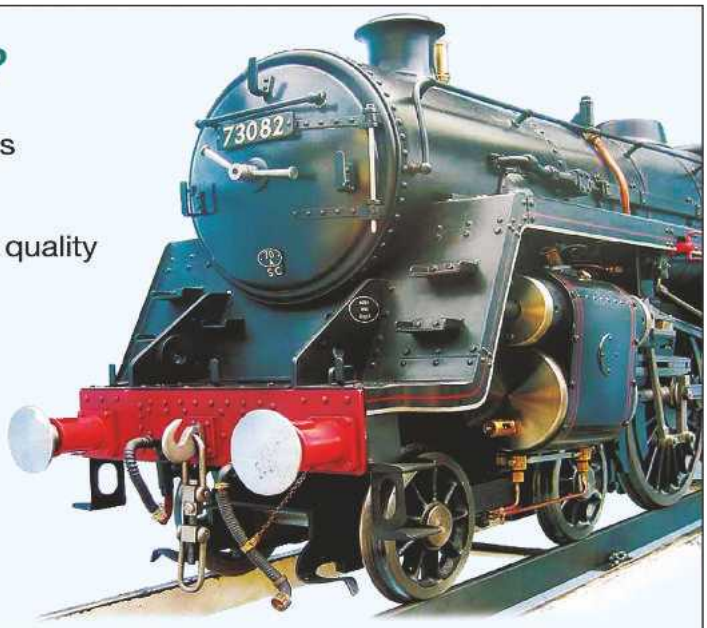
GB BOILER SERVICES
COPPER BOILERS FOR LOCOMOTIVES AND TRACTION ENGINES etc.
MADE TO ORDER
Constructed to latest European Standards
7¼" guage and P.E.D. category 2 Specialist
NO VAT NO VAT
Enquiries, Prices and Delivery to:
Telephone: **Coventry 02476 733461**
Mobile: 07817 269164 • Email: gb.boilers@sky.com

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

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

Don't know what it's worth?

- Good prices paid for all live steam models
  Locomotives from gauge 1 to 10¼ inch
  Traction engines to 6 inch scale
  Part-built or broken through to exhibition quality
- A no-obligation offer and firm decision over the telephone
- Fully-insured collection nationwide
- Payment in full on collection



Speak to the experts

STATIONROADSTEAM.COM

Build, buy & sell all types and sizes of locomotives, traction & stationary engines
Call Mike or Jayne Palmer on **01526 328772**

Station Road Steam Ltd, Unit 16 Moorlands Industrial Estate, Metheringham, Lincs LN4 3HX
Open daily Monday to Friday from 8am to 6pm, visitors welcome by appointment

To advertise on these pages contact David Holden at david.holden@mytimemedia.com

GOOD NEWS

Camden DIGITAL EDITION

ORDER A BOOK AND BE READING IT A MINUTE LATER ON YOUR COMPUTER, LAPTOP, TABLET OR YOUR MOBILE PHONE!

DIGITAL EDITIONS currently available include:

Design Procedures for Walschaerts' and Stephenson's Valve Gears • Ashton • £ 6.00

Don Ashton's final edition of his well known book on designing Walschaerts and Stephenson's valve gear is available again, re-printed by us. Originally published as two separate booklets back in 1976, this is the 2007 combined and updated edition, the major change being the inclusion of much more information on the use of the computer to ensure any given layout gives the best possible valve events. To get the best from this book you will have to be reasonably proficient in mathematics and be computer literate. With these you should be able to lay out top-notch Walschaerts or Stephenson's valve gear for any model steam locomotive, traction or marine engine. 43 text pages with numerous drawings, diagrams and tables.

A printed edition of this book is also available • £14.45 inc. UK P&P

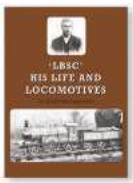
Lathe and Planer Tools • {1908} • £ 3.90

Originally Published by *The Industrial Press* in 1908, then reprinted by *Lindsay Publications* in 1986, but out of print for many years, we have brought this back as a Digital Edition because it is just very good. Written many years before diamond tipped tools were introduced, in fact at a time when most machine shops would have forged there own tool steel, this concentrates largely on the correct shape of the tools for various turning or planing operations and how to achieve them. Like most American books of this period, it is clear, concise and to the point; discard the out-of-date information and there is still much here of value. 40 pages. 59 illustrations and engravings.

Building Small Boilers for Gas Firing • £10.00

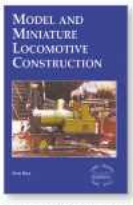
Here Alex Weiss covers the materials, tools and techniques needed to build smaller copper tubed, gas fired, boilers that can be soldered in a single session. With a capacity of under three bar/litres, boilers of this size require less-extensive independent testing for public operation. Full description of how to build three vertical and three locomotive boilers, complete with drawings and copious constructional photographs. Aimed at the beginner who wants to build gas-fired boilers to run his smaller Stuart type stationary models from, or to fit to their 16mm NG or Gauge 1 locomotives, there is a lot here that will be of general use to builders of larger copper boilers. 120 pages with drawings and all colour photographs.

'LBSC" His Life and Locomotives • £12.00



Brian Hollingsworth's biography of the most famous of all model locomotive designers. There can be few model engineers who have not come across 'LBSC's' designs or writings: 112 designs published over 44 years, over 3000 articles published in *Model Engineer* and other magazines, the last only a month before his death ageed 84. And he built 55 small steam locomotives himself. But what made him famous was his style of writing - informative, opinionated and down to earth, they gave the ordinary man the confidence to realise that he could build models if he wanted to, and then told him how to do this. Fascinating and highly readable! 112 pages. Over 220 B & W photos and drawings.

Model and Miniature Locomotive Construction • £12.00



Well known author on model engineering matters Stan Bray covers the construction of model and miniature locomotives from Gauge 1 to 7 1/4" gauge, with the accent on the passenger hauling gauges. The bulk of the book is Stan passing on hints, tips, ideas and practices he has picked up over fifty years as a model engineer, and he covers the subject with chapters on each major part, such as frames, axleboxes, valve gear, cylinders, boiler, platework etc. He also covers electric and I.C. powered locomotives, a subject not covered before in a book like this. 208 pages. 158 drawings. 300 B & W, and 32 colour photographs. 12 charts.

Digital Editions may be ordered and downloaded 24 hours a day, every day of the year! No postage to pay!

They are not ebooks, so cannot be read on a Kindle or similar but can be moved from device to device, for example from a home computer to a tablet if required.

Digital Editions can ONLY be ordered on our website

Barrow Farm Rode Frome Somerset BA11 6PS 01373 830151

See our full range and buy online at:
www.camdenmin.co.uk

THE MOST VERSATILE TOOL FOR TURNING & FACING

It's easy to see why our best selling turning tool is the SCLCR. It can turn and face a bar without altering the toolpost, and the 80° nose angle gives much more strength than a 60° (triangular) insert. The NJ17 insert cuts steel, stainless, cast iron, phosphor bronze, aluminium, copper, brass etc. Please state shank size required - 8, 10 or 12mm square. Spare inserts £6.94 each for 8-10mm tools, £8.11 for 12mm.

SPECIAL OFFER PRICE £20.00

USE THE OTHER 2 CORNERS FOR ECONOMY!

Our SCRCR rough turning tool uses the same inserts as the SCLCR tools above. The good news is that it uses the other two corners! These very strong 100° corners are rigid enough for rough or intermittent turning. The insert is mounted at 75° to the lathe axis. 10mm sq section (for CCMT06 insert) and 12mm section (for CCMT09 insert).

SPECIAL OFFER PRICE £31.90

PROFILING WHEELS or SHAPING AXLES & PILLARS?

If you need to create complex shapes, our SRDCN button tool is invaluable. The 10mm square shank holds a 5mm dia cutting insert, and gives great versatility, superb strength and excellent tool life. The late Mr D Hudson of Bromsgrove SME used these tools for many years to profile the special form of tyre treads for his self-steering wheel sets with great consistency. Spare inserts just £5.87 each.

SPECIAL OFFER PRICE £34.00

TURN SMALL DIAMETERS with LIVE CENTRE IN PLACE!

The SDJCR tool uses a 55° insert, allowing access to small diameter components when using a tailstock centre. It can also profile back-angles. The NJ17 insert cuts steel, stainless, cast iron, phosphor bronze, brass, copper, aluminium etc. Shank size 8mm or 10mm square section. Spare inserts just £6.94 each.

SPECIAL OFFER PRICE £20.00

A TOP QUALITY BORING BAR FOR YOUR LATHE

Bar Dia.	Min Bore
8 mm	10 mm
10 mm	12 mm
12 mm	16 mm

Here's your chance to own a top quality boring bar which uses our standard CCMT06 insert. Steel shank bars can generally bore to a length of approx 5 times their diameter. Please state bar dia required - 8, 10 or 12mm. Spare inserts just £6.94 each.

SPECIAL OFFER PRICE £20.00 ea or buy all 3 sizes for just £55.00!

INTRODUCING THE GROUNDBREAKING NEW KIT-QD PARTING TOOL!

The new and innovative KIT-QD parting tool has a more secure insert location, stronger body and improved insert design compared to the original KIT-Q-CUT. It has an increased maximum reach of 23mm, giving over 1.3/4" parting capacity in solid bar. As previously, the tool fits the vast majority of ME lathes, including ML7 & ML10 machines, regardless of toolpost type. It comes complete with the key to locate and eject the tough, wear resistant insert. Cuts virtually all materials. Spare inserts just £11.07 each.

SPECIAL OFFER PRICE £69.50

EXTERNAL THREADCUTTING TOOL

These tools use the industry standard 16mm 'laydown' 3-edge inserts. With tough, tungsten carbide inserts, coated with TiAlN for wear resistance and smooth cutting, threads can be cut at very slow speeds if required. Tools are right hand as shown. 55° or 60° insert not included - order separately at £5.65. See our website for more info.

SPECIAL OFFER PRICE £36.50

INTERNAL THREADCUTTING TOOL

These tools use the industry standard 11mm 'laydown' 3-edge inserts. With tough, TiAlN coated tungsten carbide inserts, quality threads can be cut with ease. Tools are right hand as in picture. 10, 12 and 16mm diameters available. 55° or 60° insert not included - order separately at £5.65. See our website for more info.

SPECIAL OFFER PRICE £20.00

DORMER DRILL SETS AT 60% OFF LIST PRICE!

All our Dormer drill sets are on offer at 60% off list price. The Dormer A002 self-centring TiN coated drills are also available to order individually in Metric and Imperial sizes. Please see our web site for details and to place your order.

TURNING, BORING & PARTING TOOLS COMPLETE WITH ONE INSERT.

Please add £3.00 for p&p, irrespective of order size or value

MasterCard VISA VISA Electron Maestro

DONCASTER EXHIBITION 8-10 MAY '20

GREENWOOD TOOLS

Greenwood Tools Limited
2a Middlefield Road, Bromsgrove, Worcs. B60 2PW
Phone: 01527 877576 - Email: GreenwTool@aol.com

Buy securely online: www.greenwood-tools.co.uk

HOME AND WORKSHOP MACHINERY

144 Maidstone Road, Foots Cray, Sidcup, Kent, DA14 5HS
Tel: 0208 300 9070 - evenings 01959 532199
Website: www.homeandworkshop.co.uk stay safe!


Colchester Mascot 1600 lathe + tooling £10500 'just in from a university'


Harrison M250 5" x 20" £2750 each


DP / MOD gear cutters £20 each, please enquire for availability:


'Museum Piece for the Connoisseur' Oldest in existence owned privately by original 'Myford (Nottingham)' complete with history. Myford ML1 lathe 3 1/8" centre height One off! £2250


Boxford MODEL A £950


Boxford 125 TCL CNC less software £1500


RJH Gryphon 8" grinder complete with built in extractor £750


Always looking for quality workshops to purchase!
Myford Connoisseur / 1" Big Bore, standard 5" 3 jaw chuck, inverter, poly vee belt / 3000rpm headstock speed, hardened bed, industrial stand, 'Chris Moore's actual lathe' never used £14000


Union Buffer complete with Extractor £1475


Strong quality made bench £175


Startrite 14-S-5 bandsaw electronic brake added £1250


Myford dividing head in exceptional condition £495


Alldays & Onion hearth / farriers forge Nice condition £425


Boxford 260 VMC mill less software £1950


Myford Super 7B gearbox (PCF) cabinet stand very nice £4450


Startrite SD 12" Planer / Thicknesser £950


Neat cut and soluble cutting oils £10 each


Tipped tooling + 10 tips 6mm—20mm from £35—£50


Chester Coventry long bed lathe + DRO £2500


RJH 8" bench grinder £345


Colchester Student 1200 round head gap bed lathe very nice order £1375


Ajax UP Universal Mill £1750


Chevalier 50" x 10" 40INT mill £6250 Nice!


Myford Super 7B + stand (late model just in) £4450


Morgan Rushworth BP50 / 16 50" x 16G box and pan folder £1750


Myford 254 Plus Vari-Speed long bed lathe + hardened bed £5450


MEP Falcon Mitre cut off saw £1450


Tripus on / off 240 volts switch wired new / old stock £90


Myford ML7 / / Super 7 Rifle and bridge felts 5 for just £20


Denford Viceroy 16" Sharpedge Grinder 240 Volts £295


Clarkson Mk1 Tool and cutter grinder £845


Startrite 175 / 12" sawbench + sliding table cuts 4 1/8" at 90 degrees £1175


Various Traveling and fixed Steadies From £20

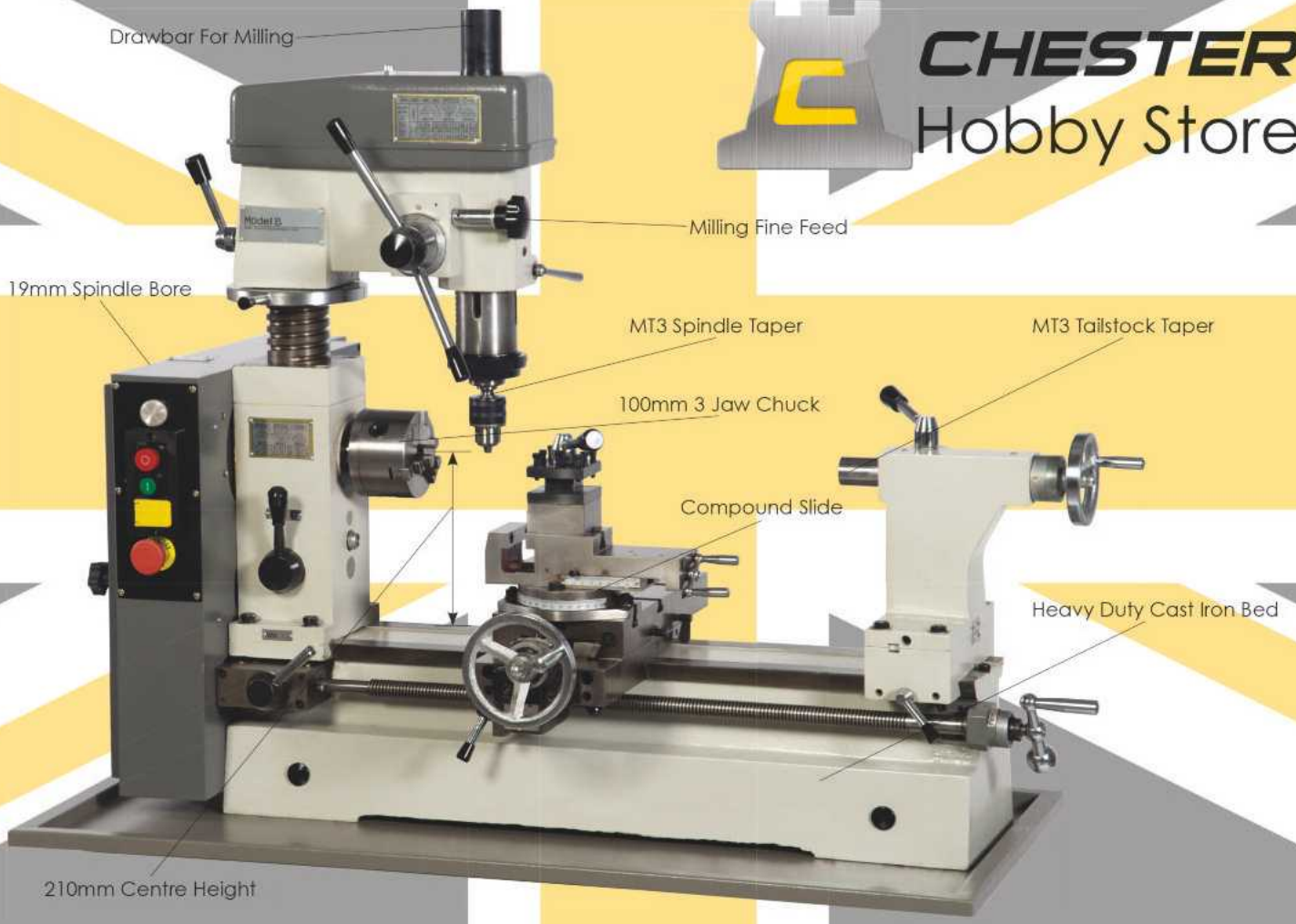

Tom Senior M1 horizontal + adapted knuckle head / 240 volts £950 just arrived!

Please phone 0208 300 9070 to check availability.
Distance no problem – Definitely worth a visit – prices exclusive of VAT
Just a small selection of our current stock photographed!

WorldWide Shipping

POWERED BY barclaycard
VISA MasterCard Maestro JCB

CHESTER Hobby Store



Model B

~~£ 1,258.95~~ **£1,099.00**

FEATURES

- Large swing 420mm/16"
- All tapers MT3
- Cast iron construction
- Taper bearing headstock
- Compact space saving design

STANDARD ACCESSORIES

- 3 jaw self centring chuck with internal and external jaws
- MT3 steel centres
- 1-13mm drill chuck and arbor
- Drawbar for milling head
- Dual purpose compound
- Machine vice
- Change gears
- Set of 5 carbide lathe tools
- Allen keys
- Spanners
- NVR switch gear
- 4 position indexing tool post
- Lathe chuck and drill chuck guards
- Manual and parts list

Centre Height	210mm
Swing Over Bed	420mm
Swing Over Cross-slide	130mm
Between Centres	520mm
Width of V Bed	139mm
Tool Size	12mm
Spindle Bore	20mm
Spindle Taper	MT3
Spindle Speeds	Lathe:160-1360rpm Mill:117-1300rpm
Metric Threads	0.2-3mm
Imperial Threads	8-120TPI
Copound Slide Travel	80mm
Cross-slide Travel	185mm
Tailstock Quill Travel	80mm
Tailstock Taper	MT3
Headstock Bearing	Tapered roller
Max. Swivel of Compound Slide	360°
Longitudinal Leadscrew Pitch	4mm
Cross-slide Leadscrew Pitch	3mm
Milling Table Size	300x150mm
Chuck Mounting	Plain back
Drive	V belt
Motor Power	3/4kW (0.5hp)
Power Supply	240v
Net Weight	155kg
Dimensions	930x690x1090mm
Stock Code	LAT-MODB
Standard UK Mainland Delivery	**£66.00**

For more information contact our **Sales Team**, call us on **01244 531631**, email us at **sales@chesterhobbystore.com** or visit **www.chesterhobbystore.com**

Prices may be subject to change without notice