

No.284

THE MAG FOR MAKERS, MODEL AND HOBBY ENGINEERS

MODEL ENGINEERS' WORKSHOP

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

SEPTEMBER 2019

INSIDE

- Make a One-Handed Depth Gauge
- Inverters in my Workshop
- A Chuck Jaw
- Handy Scribing Blocks
- Jock's Mill

Image courtesy of NASA

COVER STORY

Remembering Apollo 11

GET MORE OUT OF YOUR WORKSHOP WITH MEW



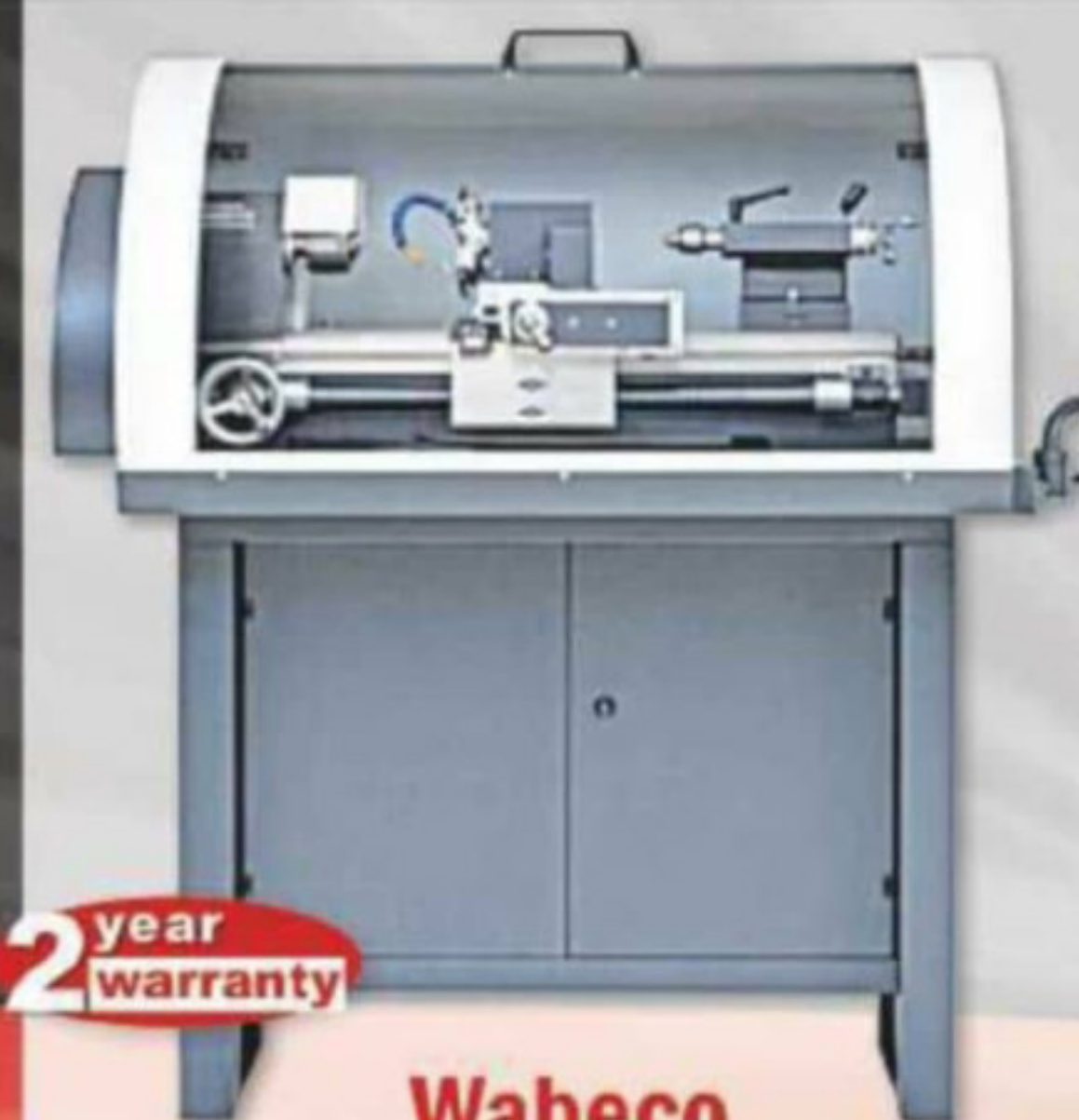
PRO MACHINE TOOLS LIMITED

Tel: 01780 740956
Int: +44 1780 740956

Up to **5 year warranty** on selected WABECO Machines!



Precision machines made in Germany for the discerning engineer!



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

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

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



Wabeco CNC Mill CC-F1410

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



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

www.emcomachinetools.co.uk

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:

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
Tel: +44 (0) 7718 64 86 89

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

© MyTimeMedia Ltd. 2019
All rights reserved ISSN 0959-6909

The Publisher's written consent must be obtained before any part of this publication may be reproduced in any form whatsoever, including photocopies, and information retrieval systems. All reasonable care is taken in the preparation of the magazine contents, but the publishers cannot be held legally responsible for errors in the contents of this magazine or for any loss however arising from such errors, including loss resulting from negligence of our staff. Reliance placed upon the contents of this magazine is at reader's own risk.

Model Engineers' Workshop, ISSN 0959-6909, is published monthly with an additional issue in August by MYTIMEMEDIA Ltd, Enterprise House, Enterprise Way, Edenbridge, Kent TN8 6HF, UK. The US annual subscription price is \$2.95GBP (equivalent to approximately 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 Jamaica NY 11431. US Postmaster: Send address changes to Model Engineers' Workshop, WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Subscription records are maintained at DSB.net Ltd, 3 Queensbridge, The Lakes, Northampton, NN4 5DT. Air Business Ltd is acting as our mailing agent.



Paper supplied from wood grown in forests managed in a sustainable way.

On the Editor's Bench



Photograph courtesy of NASA

Remembering Apollo 11

Like many readers, I have been following the Apollo 11 lunar mission as closely as when I was a space-obsessed six-year old. Using a marvellous website apolloinrealtime.org I have been able to watch highlights including the launch, landing and return, and many points in between exactly fifty years on from when they happened. I even set an alarm for the small hours to watch Neil Armstrong's 'small step' to make up for having to watch a recording as a boy!

I watched as much of the TV coverage of the whole Apollo programme as my parents would allow; I made all the Airfix models - the Saturn V, the Lunar Module and even Sea King 66. I went on to follow the triumphs and tragedies of the Space Shuttle programme and only a few nights ago I was staring up in wonder as the International Space Station passed overhead.

For those days in 1969 almost the whole world was gripped by the drama of Apollo 11, which must stand as one of the most remarkable engineering achievements of all time. Many of the engineering solutions found during the 'space race' are now part of our every day lives, but NASA's approach to managing and driving forward such a complex engineering project was equally innovative. It certainly set alight my young imagination with so many interests I still have today.

Yesterday was the fiftieth anniversary of the safe return of Armstrong, Aldrin and Collins. Today has been the second hottest day on record for the UK.

Are returning to the moon and tackling the global challenges facing the human race incompatible? I hope not, and that we can again find inspiration and unity of purpose, and that a new generation can be inspired to meeting these and the other challenges in our future.

Don't Forget the Midlands Model Engineering Exhibition

Regular readers will know how important I feel model engineering exhibitions are for our hobby - and topping up our personal enthusiasm. The Midlands Model Engineering Exhibition is on Thursday 17th - Sunday 20th October 2019 at Warwickshire Event Centre. As well as the usual array of outstanding models on display and in steam, expect plenty of trade stands and demonstration s and lectures on an array of workshop techniques.

See www.midlandsmodeleengineering.co.uk or call 01926 614101 for all the details, competition entry form and to book discounted tickets in advance.

Neil Wyatt



Tracy Tools Ltd
Unit 1, Parkfield Units,
Barton Hill Way,
Torquay TQ2 8JG

Visit our brand new website
www.tracytools.com

We ship anywhere in the world

PRODUCTS

- Taps and Dies
- Centre Drills
- Clearance Bargains
- Diestocks
- Drill sets (HSS) boxed
- Drills
- Drill set (loose) HS
- Endmills
- Lathe Tooling
- Reamers
- Slot Drills
- Specials
- Tailstock Die Holder
- Tap Wrenches
- Thread Chasers



Tracy Tools Ltd
Tap & Die Specialist, Engineer Tool Supplies

Tel: 01803 328 603
Fax: 01803 328 157
Email: info@tracytools.com
www.tracytools.com

MAIDSTONE-ENGINEERING.COM

30 years experience providing fittings, fixings, brass, bronze, B.S.M, copper and steel



For all your model engineering needs.

Metals
O Rings
Gauge Glass
Graphite Yarn
Jointing
Steam oil
Cutting tools
And so much more.

Copper TIG welded Boilers

TEL: 01580 890066 PROMPT MAIL ORDER

Browse our website or visit us at 10/11 Larkstore Park, Staplehurst, Kent, TN12 0QY

metalcraft™
Hand powered metalforming tools
Handy for so many jobs

Punching Cutting
Riveting Bending
Rolling Scrolling
Twisting

Also suppliers of a wide range of steel, fixings, clock components & much more.

Call today for your free catalogue and if you quote our promo code 'MMENGW19', we will send you our demonstration DVD free of charge.

J & C R Wood Ltd, Dept MMENGW19, 66 Clough Road, HULL HU5 1SR
Tel: 01482 345067 Email: info@jandcrwood.co.uk
OR Visit our on-line store at
www.metal-craft.co.uk

AMADEAL Ltd.
www.amadeal.co.uk

See our vast range of mini-lathes, bench lathes, milling, grinding and boring machines, both manual and CNC.
For professional or hobby purposes

All machines we sell are fully guaranteed, and we aim to give product support that is second to none.

We stock all kinds of spare parts for all of the machines that we carry. If you require parts and they're not listed on the website, drop us a line or email us and we might be able to help you.

(Between 8am-8pm) Tel: (+44) 0208 558 4615 or 07887 945717 or (+44) 0208 558 9055 (Between 11-4pm)

Unit 20 The Sidings, Hainault Road, Leytonstone, London E11 1HD
Monday - Friday (11am-4pm) or at other times by calling for prior arrangement.

Jeadon Engineering

www.jeadon.com

Supplier of quality preowned engineering equipment from all types of cutting tools, measuring equipment, work and tool holding.

From top brands including Dormer, Titex, Moore & Wright, Mitutoyo, Seco, etc.
New stock added daily.

enquiries@jeadon.com | 07966553497

gandmtools
Just a small selection from our current stock

Buy online now at: **www.gandmtools.co.uk**

Ajax Extron 5" x 30", Centre Lathe, Tooled, 1ph, £1250.00 plus vat.

Tom Senior Major Vertical/Horizontal Milling Machine, 3ph, VGC, £2250.00 plus vat.

Perris Bench Lathe with Chuck, Faceplate, Motor, 1ph, £650.00 plus vat.

• Telephone enquiries welcome on any item of stock. • We hold thousands of items not listed above.
• All items are subject to availability. • All prices are subject to carriage and VAT @ 20%. • We can deliver to all parts of the UK and deliver worldwide. • Over 7,000 square feet of tools, machines and workshop equipment.

Opening times: 9.30am -1pm & 2pm - 5pm Monday to Friday. Closed Saturdays, except by appointment.
telephone: 01903 892 510 • **www.gandmtools.co.uk** • e-mail: sales@gandmtools.co.uk

G and M Tools, The Mill, Mill Lane Ashington, West Sussex RH20 3BX

Contents

9 One Hand Operated Depth Gauge

Stew Hart brings a design from the 1920s back to life as a useful tool for your workshop.

14 Drehen un Schweissen

As a one-off special we look at two excellent new books from a German model engineer.

15 The United Nations Mill

Jock Miller tells the story of his multi-national milling machine.

18 Double Trouble and a Three Phase Solution

Gary Ayres recounts his experiences with fitting three phase upgrades - and features his steampunk central heating.

29 Right, Left and Centre

Stephen Bondfield has some tips for bringing misaligned lathe jaws into order.

34 A Lathe Saddle Multi Stop

This versatile stop designed by Roger Vane for the Myford Super 7 is adaptable to most other similarly sized lathes.

41 Triboelectric Powder Coating for the Home Workshop

This month, Chris Gabel details how to make your own powder spray gun.

46 Lathework for Beginners

Neil Wyatt offers a selection of tips, encouragement and reminders for newcomers to turning.



52 Don't let Broken Fasteners Break Your Heart

Howard Jennings offers some sound counsel for dealing with messy breakups.

59 Dragon's Den or Dream Workshop

We kick off a short series from Des Bromilow about how he made his workshop dream a reality.

67 Scribing Blocks

These neat blocks from Derrick Marsh provide a quick and easy aid to marking out.



SUBSCRIBE TODAY!
GET YOUR FAVOURITE
MAGAZINE FOR LESS
DELIVERED TO YOUR DOOR!

See page 50 for details.



Coming up... in our next issue

Coming up in our October issue, number 285, another great read



Regulars

3 On the Editor's Bench

The Editor remembers Apollo 11 and the first Moon landing.

13 Readers' Tips

An alternative way to hold small screws.

26 Scribe A Line

This month sees several letters from our overseas readers.

66 Readers' Classifieds

Another selection of your classified advertisements

70 On the Wire

New taps and dies, and a new book on workshop casting.

ON THE COVER >>>

On July 16, 1969, the huge, 363-foot tall Saturn V rocket launched from the Apollo 11 mission from Pad A, Launch Complex 39, Kennedy Space Center. Onboard the Apollo 11 spacecraft were astronauts Neil A. Armstrong, commander; Michael Collins, command module pilot; and Edwin E. Aldrin Jr., lunar module pilot, heading to carry out the first landing on the moon. On page 3 the editor remembers the impact these events had on him at the time.



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. This month as mentioned in Scribe A Line, you can access a scan of the 1976 Model Engineer series by Robin Dyer on a Clayton Steam Wagon:

www.model-engineer.co.uk/clayton



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.

Where are you? Come and join one of the busiest and friendliest model engineering forums on the web at www.model-engineer.co.uk

Which Stuart models can be done on a 7x14 lathe with no mill?

■ Choosing models suitable for modest sized lathes.

Gear Spec for Threading Dial

■ Do you have a broken threading dial or want to add one to your lathe? If so, what sort of gearwheel does it need?

Wiggler or Edge Finder?

■ Which works best? Forum members tell you why!

PLUS: Model and tool builds, problem solving and engineering chat!

CLASSIFIEDS EXTRA SUBSCRIBE ARCHIVE SUPPLIERS

Ex- display items now for sale. Check our End of Line

Visit Our Aylesford Show Room!
Open Monday-Friday 10am-4:30pm & 1st Saturday of the month 11am-4pm
 Request your **FREE Catalogue** today!
01622 793 700
www.dream-steam.com

Dream Steam

Locomotives | Rolling Stock | Track | Accessories | Upgrades | Fixing kits & Washers | Chuffers | G Scale Figures | Curve Setters

BRAND OF THE MONTH: ROUNDHOUSE As stockists of Roundhouse Locomotives, we have a varied range for instant dispatch but you are able to order any Roundhouse loco from us online, which allows you to collect loyalty points!

We hold a wide range of Roundhouse spares, enhancements and home builder parts in stock for instant dispatch!

In Stock Now*

Bertie	Blue, 32mm	£660
Jennie	Blue 32mm	£785
Little John	DHR Blue, Red Buffers	£602
Clarence	Brown, R/C, Insulated wheels	£1,710
Lilla Maroon	R/C Insulated Wheels 32mm	£1,809

On Order

Lady Anne	Due Jan 2020
Billy	Due TBC
Lilla	Due TBC
Silver Lady	Due TBC
Russell	Due TBC

Please note all loco's 'on order' can be altered to your own specification requirements. Deposit of only £200 required.

Full Range of cast white Metal items in Stock*

*In stock as of 13/05/19, please note these loco's may no longer be available, check stocks online or call. Please note basic range takes 4 weeks from initial order and other locomotives are in batches. Batch dates will be in product description. Locomotives in stock will state instant dispatch available.

PECO 32mm (5M32) Track

Flexi Track - 12 Pack	SL600x12	£110.00
Flexi Track - 4 Pack	SL600x4	£38.00
Flexi Track - Single	SL600x1	£10.00
Setrack Curve - 6 Pack	ST605x6	£48.00
Setrack Curve - Single	ST605x1	£8.50
Setrack 38 Radius Curve - Single	ST607	£8.50
Setrack 38 Radius Curve - Six Pack	ST607x6	£48.00
Right Hand Point	SL695	£45.00
Left Hand Point	SL696	£45.00
Y Point	SL697	£45.00
Small Radius Right Hand Turnout	SL691	£45.00
Small Radius Left Hand Turnout	SL692	£45.00
Wagon Turntable and Crossing	SL627	£20.00
Rail Joiners - 24 Pack	SL810	£3.50

45mm (G45) Track

Flexi Track - Six Pack	SL900x6	£79.00
Flexi Track - Single	SL900x1	£15.00
Setrack Curve - Six Pack	ST905x6	£45.00
Setrack Curve - Single	ST905x1	£8.50
Setrack Straight - Six Pack	ST902x6	£45.00
Setrack Straight - Single	ST902x1	£8.50
Right Hand Point	SL95	£60.00
Left Hand Point	SL96	£60.00
Point Motor Mounting Plate	PL8	£3.60
Metal Rail Joiners - 18 Pack	SL910	£6.00
Insulating Rail Joiners - 12 Pack	SL911	£3.10
Dual Rail Joiners - 6 Pack	SL912	£6.00

SUMMERLANDS CHUFFER
 These highly developed and precision engineered chuff pipes that can bring the real sound of a working steam loco
A wide range always in stock!
 Specials can be ordered on request
£29
 inc. P&P

MAMOD DON'T FORGET YOUR MAMOD ELECTRIC LOCO CHARGER

MTLGO	£452.00
MK3	From £336.00
MST	From £336.00
MBruneLOG	£440.00
1351BO	From £325
1351TR	From £495.00
BGS-CC-N	£520.00
MTDR	£39.00
MTNK	£39.00
MGWN	£44.00
MGVAN	£50.00
MTDR-T	£45.00

DSW

Upgrade Cylinders	£52.00
Ceramic Gas Burner Set	£90.00
Three Wick Meths Burner	£45.00
Dead Leg Lubricator	£29.00
Steam Regulator Kit	£38.00
Small Brass Chimney Cowl	£4.00
Brass Cab Hand Rails	£4.20
Brass Side Tank Hand Rails	£5.20
Brass Smoke Box Hand Rails	£3.10
Cylinder Covers	£12.00
Brass Sand Boxes	£12.50
Brass Tank Tops	£9.40
Lubricating Oil	£3.00
Meths Burner Wick	£1.90
Curve Tipped Syringe	£2.10
460 Steam Oil 500ml	£5.50
220 Steam Oil 500ml	£5.50
Solid Fuel Tablets	£3.50
Water Filler Bottle	£4.00
Meths Filler Bottle	£3.00

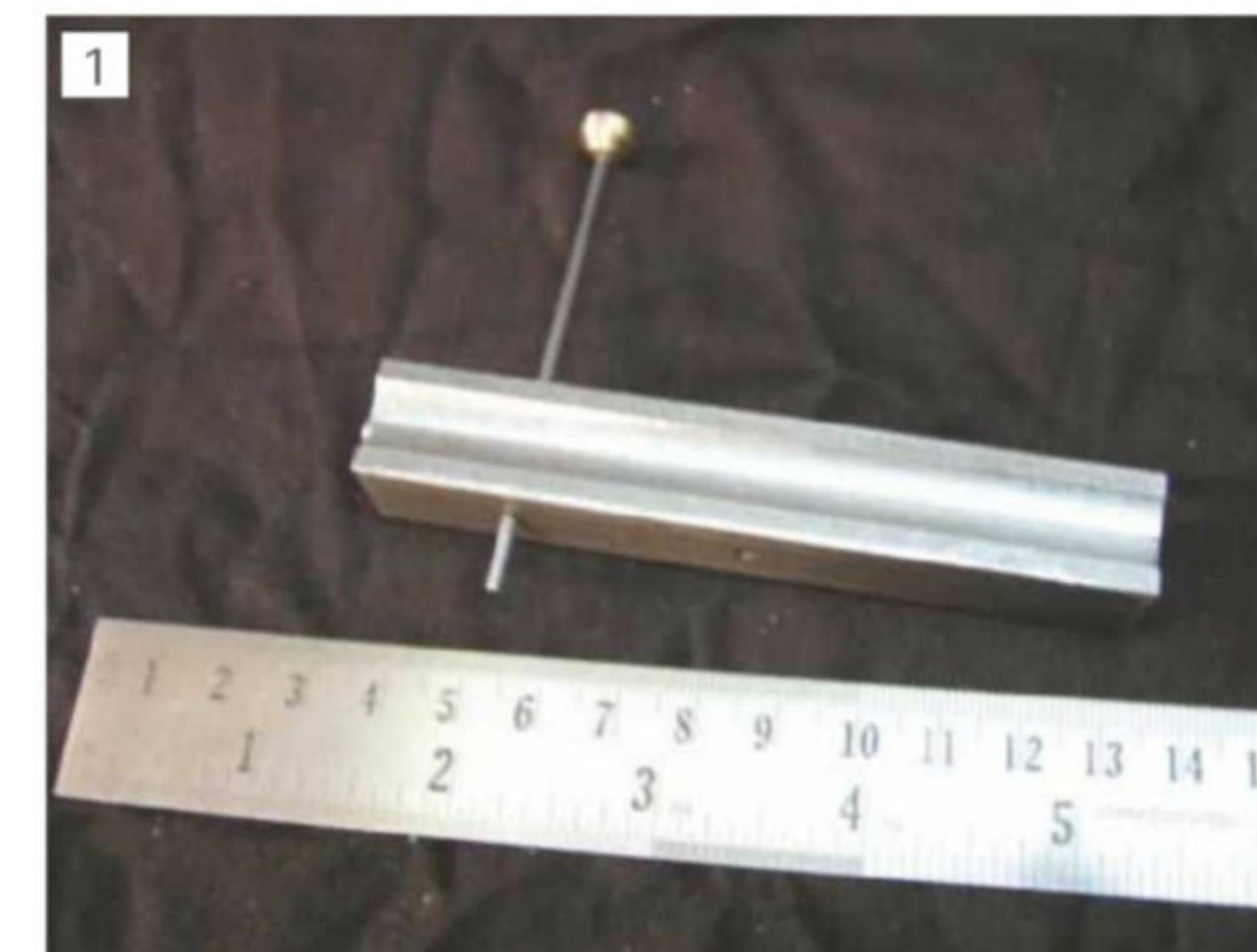
BACHMANN

Percy and the Troublesome Trucks Set	90059	£390.00
Thomas with Annie & Clarabel Set	90068	£390.00
Thomas' Christmas Delivery	90087	£410.00
Toby the Tram	91405	£250.00
Thomas the Tank Engine	91401	£225.00
James the Red Engine	91403	£230.00
Annie Coach	97001	£80.00
Clarabel Coach	97002	£80.00
Emily's Coach	97003	£80.00
Emily's Brake Coach	97004	£80.00
Troublesome Truck 1	98001	£59.50
Troublesome Truck 2	98001	£59.50
Ice Cream Wagon	98015	£56.00
Tidmouth Milk Tank	98005	£39.00
S.C. Ruffley	98010	£70.00
Explosives Box Van	98017	£56.00
Open Wagon Blue	98012	£56.00
Open Wagon Red	98013	£56.00
Sodor Fruit & Vegetable Co. Box Van	98016	£56.00
Sodor Fuel Tank	98004	£56.00
Spiteful Brake Wagon	98021	£70.00
V Dump Car (Oxide Red)	92504	£46.00
G' Flat Wagon with Logs	98470	£79.00
"LS" Skeleton Log Car	98490	£79.00
"LS" Speeder Orange	96253	£90.00
"LS" Speeder PRR	96251	£90.00
"LS" Speeder Santa Fe	96252	£90.00

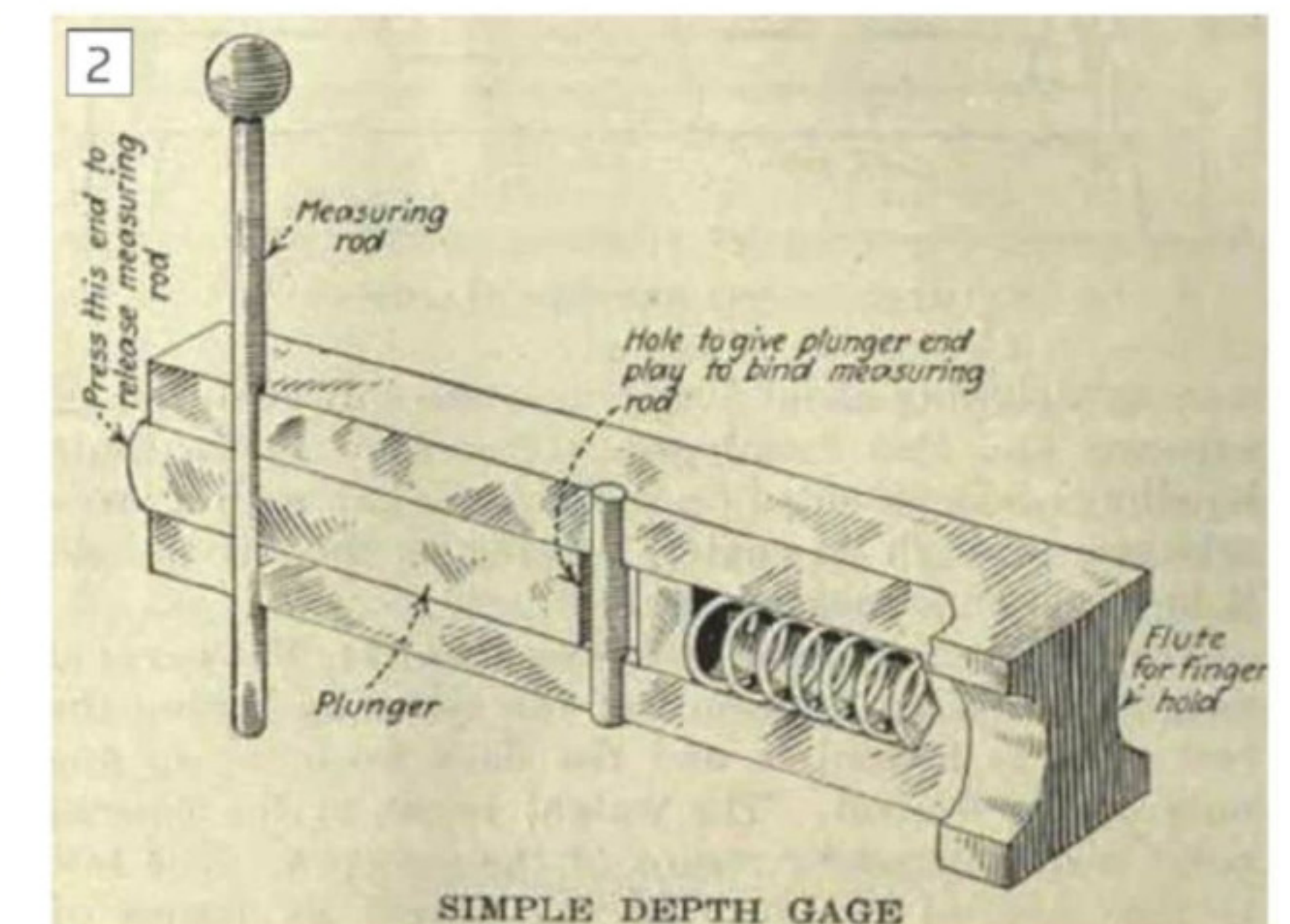
Set-a-Curve
 Available in 32mm and 45mm with a wide range of Radii
£15
NEW!
MSS 3/4 SIDE TANK - £300
MSS TANKER - £55
MSS TANKER KIT - £53

One Hand Operated Depth Gauge

Stewart Hart recreates another historic tool that makes an ideal weekend project.



Depth Gauge



Graphic Depiction

Whilst browsing through an old 1920 American Machinist magazine I spotted a design for a simple "One Hand Operated Depth Gauge". I could see straight away that this was a well-designed little piece of kit, which would fit in the hand nicely, and be easy to use. It could easily be made by someone new to the hobby with limited equipment, and it would be a worth while addition to anyone's tool box, **photo 1**.

The gauge was depicted by a very nice piece of graphic art in the magazine it's a pity that graphic art illustrations have been replaced by modern photography and 3D CAD, as I can really appreciate the artistry and skill involved, **photo 2, fig. 1**.

It can be made from any odd bits of material you have lying about, there is no need for you to slavishly follow the drawing it can be scaled up or down, you just need to follow the general idea and methodology, **photo 3**.

Starting with the Body Part 3:- I used a piece of 5/8" square mild steel bar, but equally as well you could use hexagon or round bar with a flat milled down the base. Face the bar off to length and mark across the diagonals to find the centre and mark it with a centre pop. Then centre it in the four jaw chuck using a wobble bar and a DTI, **photo 4**, centre drill nice and deep, followed by a 10mm drill to depth: - don't drill the cross holes yet, **photo 5**.

Plunger Part 1:- You can use silver steel



Material

or better still mild steel as its cheaper, cut a length off the full depth of the hole plus 3 or 4mm, face it off, then clamp it into the body so that both parts can be drilled together. On the centre line drill the 2mm and 3mm holes through both parts so that they will line up perfectly. Using the 3mm drill, line the plunger on centre in the vice and then open the hole up to 6mm, **photos 6, 7**.

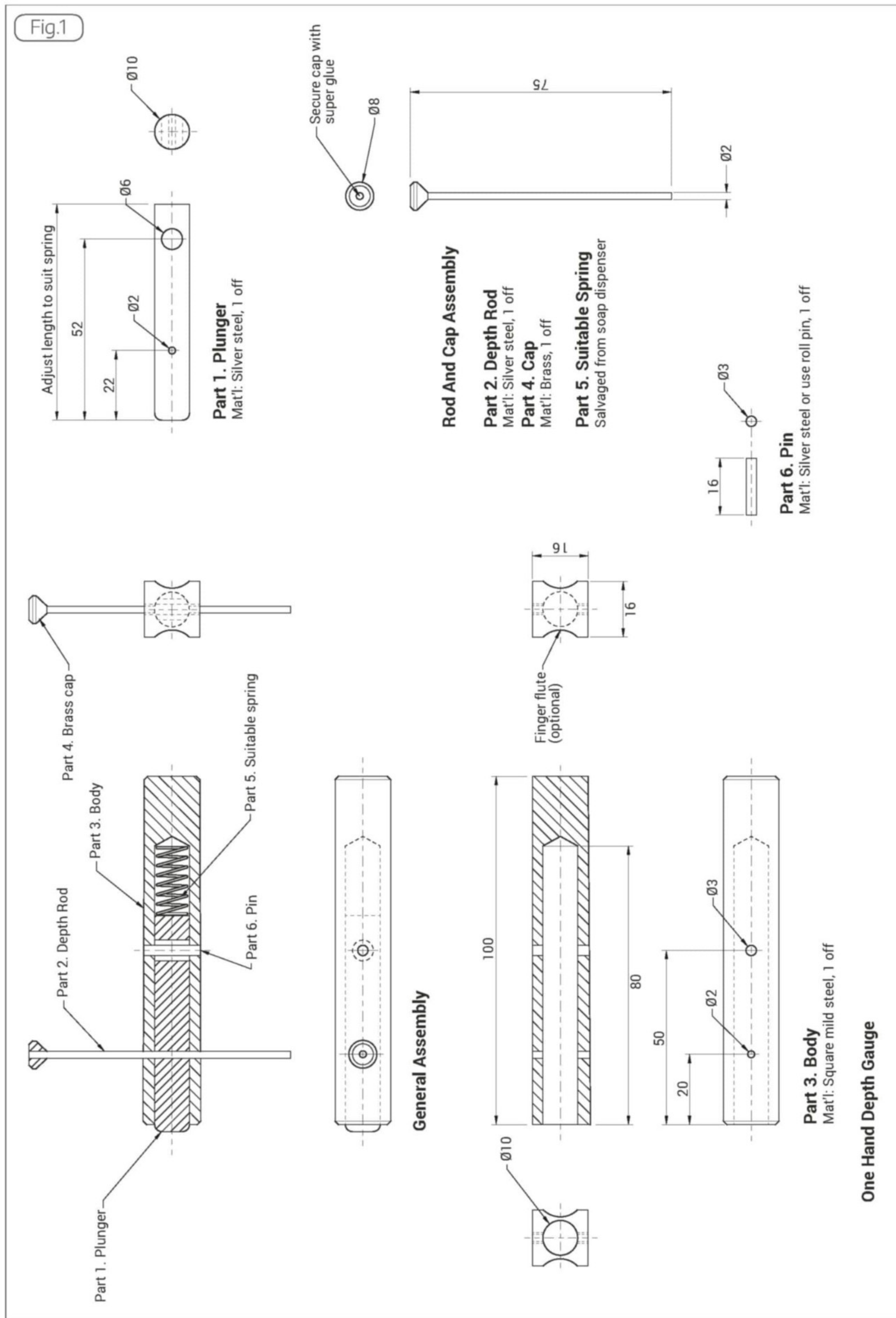
Next you need to find a suitable spring, I salvaged a spring from a pump type soap dispenser, reduce the length of the Plunger to suite the spring so that holes line up, making sure you reduce the correct end:- yes I did make that mistake, so don't ask! **Photographs 8,9**.

Rod and Cap Assembly Parts 2 and 4, the rod can be made from silver steel and the cap from brass or mild steel. You can

BACHMANN EUROPE PIC **DSW WORKS** **MAMOD** **MSS** **ROUNDHOUSE** **SUMMERLANDS CHUFFER** **PECO**

facebook **twitter**

Dream Steam Ltd, Ground Floor Suite, Vanguard House, Mills Road, Aylesford, Kent, ME20 7NA
 Call us: 01622 793 700 or send an email to sales@dream-steam.com
 www.dream-steam.com | sales@dream-steam.com | @dreamsteamworks | facebook.com/dreamsteamworks



Clock centre true with wobble bar and DTI



Drilling to depth



Drilling body and plunger together



Drilling Plunger 6mm



Reduce length of plunger to suite spring



Spring Salvaged from pump soap dispenser

make the rod any diameter or any length you want, the cap is a simple bit of turning just drill to suit the rod and chamfer it off so it's comfortable to use, **photo 10**, I held it in place with super glue, **photo 11**.

An optional little feature is the finger fluting down the body this just makes it a more pleasant fit in the hand, I used a bull nosed milling cutter in the milling machine, **photo 12**, but you could just as easily do it with a half round file.

Before you finally put all the parts together ensure you have a nice flat base by rubbing the base on fine emery paper on a piece of plate glass, **photo 13**, clean everything off and ensure there are no

burs and sharp edges and assemble with Pin Part 6 or a spring roll pin, **photo 14**.

To use couldn't be simpler, just place the gauge on the part to be measured, push the rod to depth, the friction from the spring with keep it in position, zero your digital Vernier on the thickness of the body then take the direct depth reading over the rod:- job done, **photo 15**.

I know that Mr Meticulous will point out that you're actually measuring at a slight angle so there will be an error in your Vernier reading, but come on, we're only talking about half a Gnat's whisker, and who's worried about that. ■



Turning the cap



Cap secured with super glue



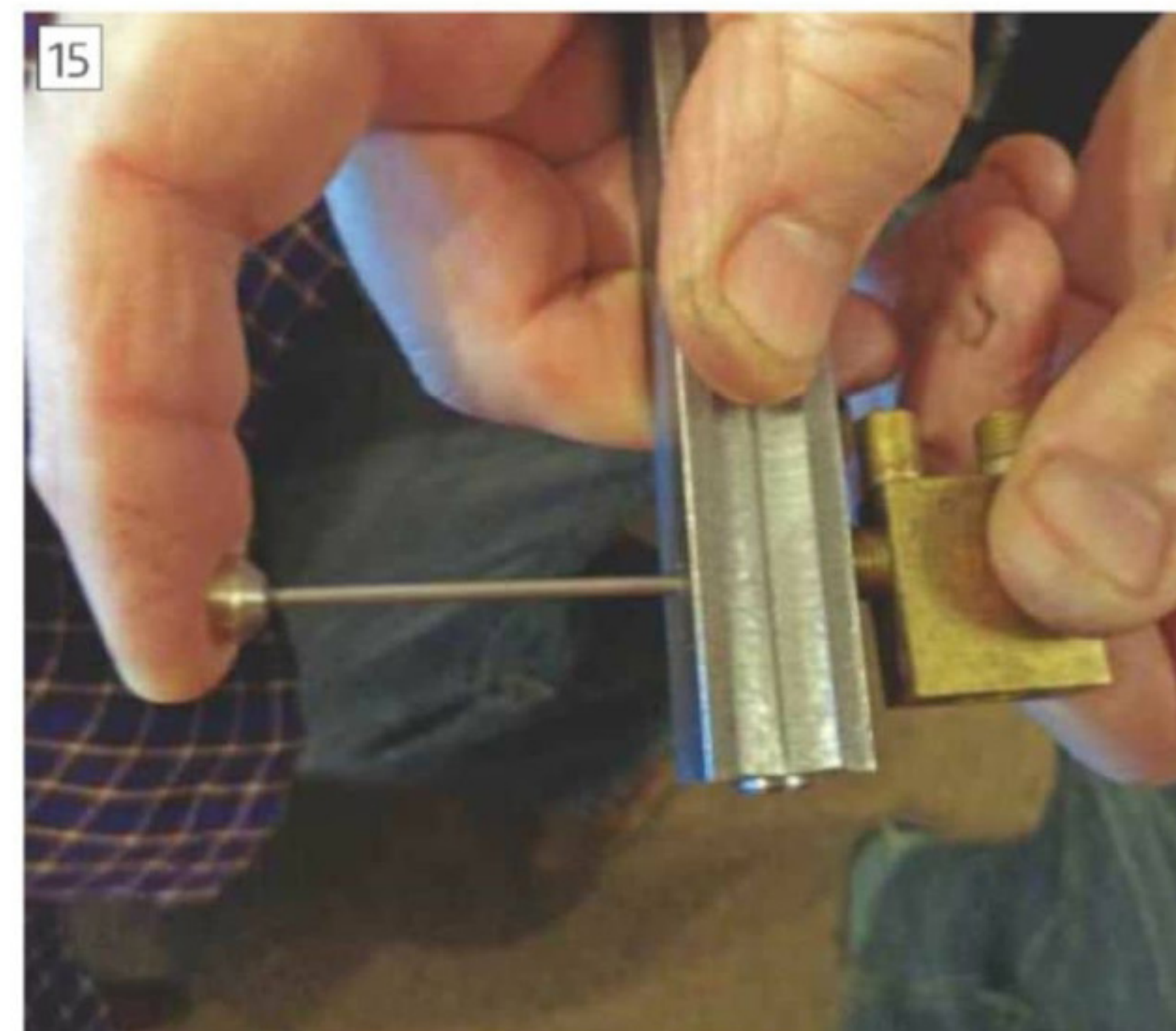
Fluting the body with a bull nosed end mill



Making sure the base is flat



Parts for assembly



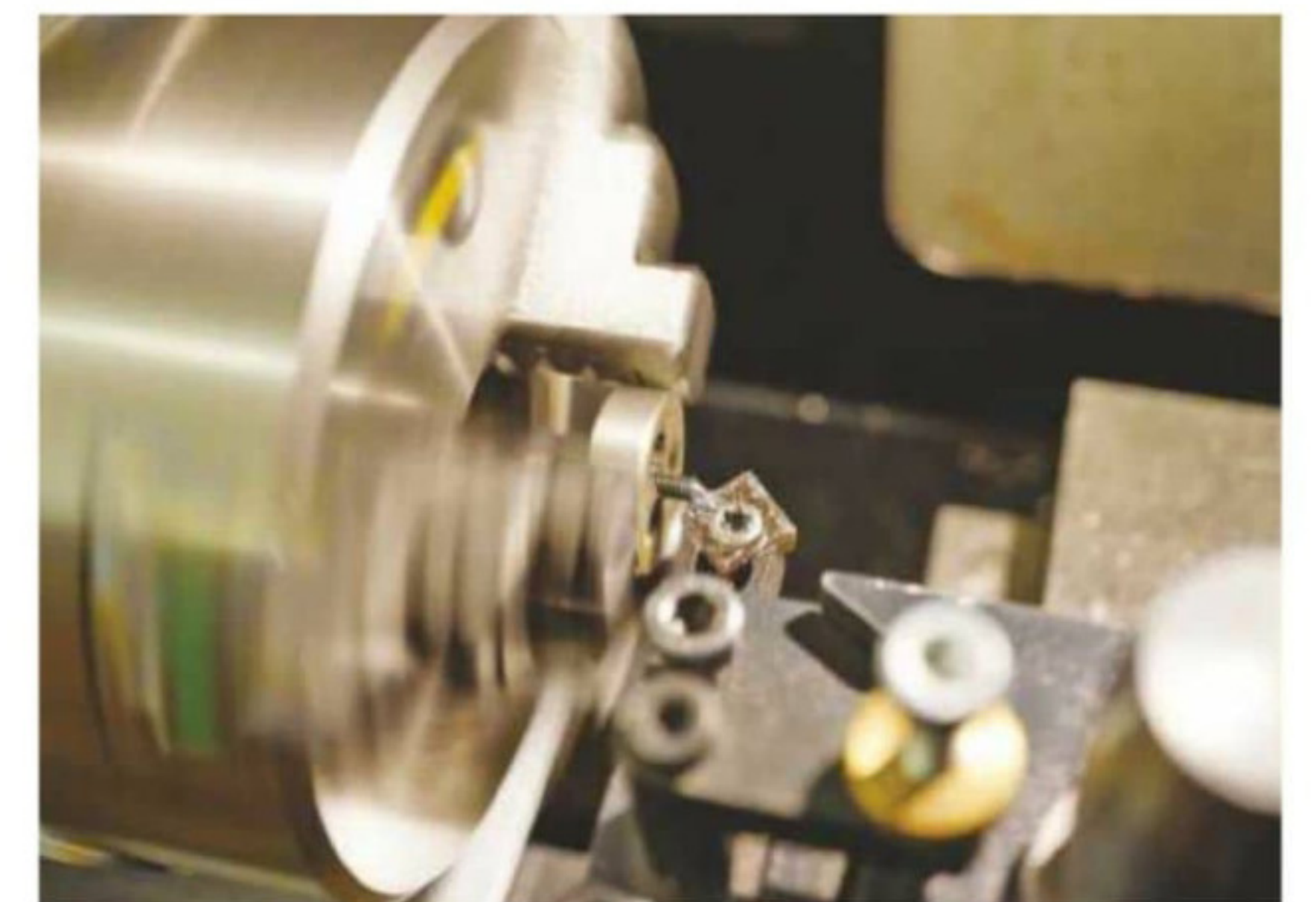
Measuring a hole depth

Readers' Tips

CHESTER MACHINE TOOLS

TIP OF THE MONTH WINNER!

A Holder for modifying small screws



This month our lucky winner of £30 in Chester gift vouchers Keith Beaumont who has an interesting way of holding screws for modification.

If you have a requirement to modify small sized threaded screws and you do not have one of the clever tools for that purpose mentioned in previous MEW articles, a simple method of holding the screw is to use a split die of the same thread. Put the screw into the die and then put the die into the self-centring chuck, making sure you have the split between any two jaws. Tighten the chuck

and the screw is then locked enabling it to be machined. Either end of the screw can be machined in this way, as there is plenty of clearance behind the die. To ensure the die is clamped parallel with the SC chuck I nip the screw in the tailstock drill chuck and bring it forward to the SC chuck before tightening.

Keith Beaumont.

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

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

Drehen und Schweissen

Now for something completely different - John Olsen reviews a new book by Dr Frank Reig.

If you know what the title says, then you might be interested in this pair of books by Frank Reig. They are a pair of excellent books for amateur, "Drehen" being about turning and Schweissen being about welding. They are aimed at hobby metal workers and vintage vehicle enthusiasts.

"Drehen" starts with an introduction to the home metal workshop and then an introduction to the properties of the materials we deal with as amateurs, including some useful advice on hardening and tempering and where to get materials in small quantities. Reading drawings and measuring and marking out are covered, as well as some sensible and practical advice on safety. Having covered workshop basics in the first two chapters, chapter three gets us into lathes, with a brief introduction to their history, then a lot of useful information about the types of machines available to amateurs, from small to large. The pros and cons of the various types and of new and used are discussed and this would provide a useful reference for anyone considering a purchase. Setting up and caring for the machine are not neglected, and in this chapter alone there are 90 pages of good information. Chapter four takes us into actually using the lathe and the principles and techniques of cutting metal. Cutting tools and the various means of mounting them are also covered. The next chapter covers work holding techniques. Chucks, faceplates, turning between centres, and collet chucks and how to set work up are included. Then chapter six covers the actual cutting, using carbide or HSS, with discussion of the capabilities of the different sizes of lathes and some types of work including taper turning and thread cutting. Finally Chapter 7 briefly describes some possible projects, such as making a tool post grinder, changing the motor to a VFD, and using an electric motor for the fine feed, which

would permit leaving a favourite screw thread set up on the banjo if you don't have a gearbox.

Schweissen follows a similar structure, with the first chapter being a very similar introduction to the home workshop. Chapter 2 starts us on the preparation of metal for welding by cutting and grinding. In chapter three we start on the actual welding, with first some information about the types of joints and then an introduction to the commonly available types of welding and advice on equipment available for the amateur, covering oxy-acetylene, Stick, MIG/MAG and TIG. This chapter actually forms the bulk of the book and covers each technique in good detail. There is enough information here to get you started on your chosen technique. I found this book particularly useful since I was in the process of choosing a TIG welder when I received the book. From the information in the book, I decided that it would be worth my while to spend a little extra and buy a machine that was a bit more expensive than I had originally considered, but with the benefit of having AC capability, so

that it can weld aluminium in addition to all the usual material. It also gave me an HF start capability, which turns out to be very useful, both when using the machine for standard stick welding and for TIG. The use of DC for stick welding is also a bit of a bonus, and I am getting much better welds with that than I used to with my old AC only machine.

Chapter four goes on to discuss brazing and cutting with oxy acetylene or oxy propane. Next chapter six covers welding on vehicles, including the regulations governing this in the German context. Finally, Chapter 7 describes and illustrates some typical amateur welding projects and how the author tackled them.

Either of these books would make a valuable addition to the library of any Model Engineer or vehicle restoration enthusiast, the only real downside being that you will need to be fluent in German to make good use of them. They are very well illustrated, in colour, and conclude with some useful reference material. ■



The United Nations Mill

Jock Miller describes a milling machine with multiple origins, with photos by Peter King.

The following may interest readers; this is where an Emco 'FB2' Milling Attachment for an Emco Maximat 11 Lathe has been enhanced to make it a very useful small machine. I obtained the basic machine some years ago via a friend in South Canterbury (New Zealand) who purchased a complete workshop from the Receivers of a bankrupt business (there were three Maximat 11's complete with the FB2 Milling Attachments – two 3 phase and one single phase). He had an extensive home workshop and kept the single phase FB2 but never used it, he was able to sell it to me and from the detail appearance it had never been used.

Milling Head (Austria)

The Emco FB2 was manufactured in Austria to a high standard. The head has six geared speeds in an oil bath, a keyed round column and the only 'defect' was the original 'lever' rack and pinion down feed which was graduated in whole millimetres. It has a 2MT spindle with 120 – 2000 rpm, **photo 1**.

Compound Table (Sweden)

I was able to purchase a heavy duty Arbrog (Swedish) compound table 245mm



The mill, note vice and dial gauge.

x 580mm as the second major item (as new), **photo 2**.

The Base (NZ)

This is fabricated from two pieces of 6 x 3" heavy walled rectangular hollow section (RHS). with a 2" square RHS between, 500mm long with 1 1/2 x 1/2" flats welded on top. The top surfaces planed were planed flat, **photo 3**. The left hand RHS contains the electrics including the Emco motor condenser and a switch panel. The right 6 x 3" has a small drawer for spanners and other tooling.

The Down feed (NZ)

I replaced the right gearbox access panel as a mounting for a worm and the 44 tooth worm wheel which works out that one turn of the hand wheel equals 1mm – and is graduated in 0.01mm, **photo 4**. I also shifted the quill lock lever to the opposite side with a new lock bolt (M8). I drilled the head 8.5mm right through to accommodate and clear the worm shaft. The worm and worm-wheel can be disengaged, and the original down-feed lever attached if required for drilling.

The Dust Guard (NZ)

The dust guard, an aluminium sleeve replaced the plastic original and this hides a special nut on the top of the spindle that locates the captive long M10 cap screw that acts as Morse Taper tool retainer (it is reduced to M8 on the end for normal Morse tooling), **photo 5**. Ejection of the tooling is using the above (no Hammers!).



The compound table and power feed.

The machine looks complicated but all the 'extras' appeared over several years to make a very useful machine.

Elevating hand wheel (NZ).

To make easy operation of raising the head, a small gearbox with 1:1 bevel gears and a horizontal shaft with a hand wheel on each end was fitted (original hand wheel plus a 1:1 replica of the original), photo 5.

The Power Feed (Taiwan and NZ).

To fit the "Align" power feed unit, see photo 2, the Arboga long travel feed screw was bored at the outer end and a cross keyway milled for an extension through the Align mounting bracket. A substantial cast iron spacer fixed the Align unit. The original "Arboga" cross feed ball handle and micrometer dial was fitted outboard of the unit. The power supply is a 230v/110v single phase transformer provided under the left hand swarf tray, to drive the unit.

The cross feed screw modifications (NZ). Are to provide for the "Align" over travel switches, the cross feed screw was extended and a new hand wheel and micrometer dial provided.

The Digital Readout (UK/NZ)

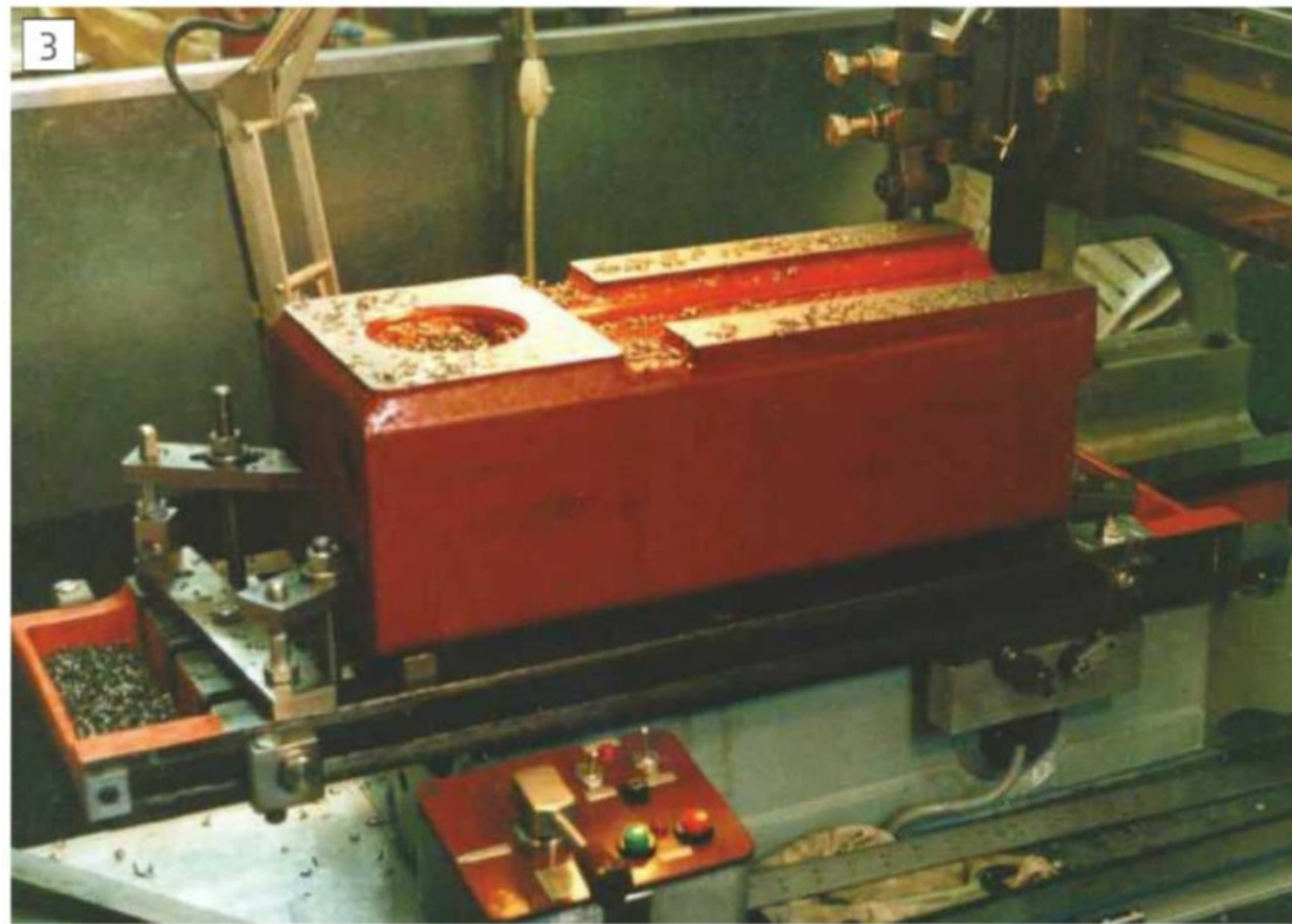
This is an M.B.S. unit was fitted at the right hand end of the front of the table. The 1/2" x 3/16" aluminium strip 'protects' the small diameter wire (metric or imperial).

The Vice (NZ)

Seen in photo 1, this looks a bit "overkill" but well worth its manufacture – ex-castings from South Canterbury, 130mm wide x 50mm deep soft jaws and a 130mm max' opening. The swivel base is machined from 1" mild steel plate.

The Down feed dial (China & NZ)

This is a Dial Gauge of 50mm travel x 0.001" mounted on 20 x 6mm Stainless Steel flat bar attached to 4mm Stainless Steel plate 1.5mm recessed to Outer Diameter of the Quill and bored to clear Morse Taper Tooling. With the end of the quill tapped for three M3 countersunk screws. The bar passes between the gearshift levers just clearing the face of the head. A small bridge with 3mm cap



Planing the fabricated base.



The opposite side of the mill.

screws to keep the bar close to head is fitted and supports the round D.T.I anvil with a plastic sleeve to keep dirt and swarf at bay, photo 1.

The Rotary table (NZ)

This is 4" diameter, photo 6, and has been machined from castings and to design of the late Geo. Martin junior of South Canterbury and has adjustable stops to enable the ends of coupling rods etc. to be radiused.

Conclusion.

The machine looks complicated but all the 'extras' 'appeared' over several years to make a very useful machine. Unfortunately, in N.Z. and I suppose the U.K. sales of the FB2 have been replaced by the cheaper far-Eastern units generally not as well finished or as accurate as the original. When I have visitors to the workshop, I call it my "United Nations" machine. ■



The head with geared raising handle and spindle cap.



Rotary table.

A winning combination in the engineering workshop



SC4 Bench Lathe and Turning Tool Set
Package Deal

£1,821.96 Inc.vat

Code 720690

Sold separately
SC4 Lathe – £1798.99
Turning Tool Set – £118.99

Glanze

7 Piece Replaceable Tip Turning Tool Set 10mm

A useful set of tools for the keen model engineer. These turning tools are fitted with tungsten carbide tips for a superior surface finish and longer lasting tool life. A torx key is included.



Axminster Engineer Series SC4 Bench Lathe

Its very modern, compact design and many useful attributes make this machine the ideal lathe for the enthusiastic model engineer, small component manufacturer or in a teaching environment. We also use this model for teaching in our Skill Centre.

- Electronically variable spindle speed range of 125-2,000rpm
- 1,000W high torque, brushless motor gives near silent running
- Metric and imperial thread cutting, simple change wheel setting
- Integral splash guard, optional drip tray and floor stand
- Full range of accessories available, tooling, steadies etc



AXMINSTER
Tools & Machinery

To see the quality of these products and arrange a demonstration, visit one of our stores, search axminster.co.uk or call 0800 371822.

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

Price may be subject to change without notice.

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

★ Trustpilot 9.7/10



Double Trouble, and a Three Phase Solution:



Inverter and Control

Gary Ayres describes his motor upgrades on a lathe and drill press.

2017. My Summer of setbacks.

Sometimes, just as all appears to be ticking along quite nicely, out of the blue a whole flurry of things goes wrong. This can be quite a pest, especially when the mishaps and malfunctions start to stack up on top of each other. But – serious disasters aside – one tends to utter a few profanities, then acclimatise to the new circumstances and get on with putting them right. And – if we are lucky – sometimes in doing so we end up with something better than that with which we started.

For me, last Summer saw major camper van brake failure, having to replace the keyboard on this laptop and the unexpected demise of my jigsaw, one of my hand drills, my lathe and my floorstanding drill press – all within a few short weeks that also saw me paying for some very expensive dental treatment. The cumulative effect on my bank balance was significant, but – as we all know – to live with non-functional machines is insufferable and there is little you can do except either replace them or buy (or make) the required components and fix them. You will be pleased to know that the focus of this article will be solely on the fixing of the lathe and the drill press, which entailed replacing their single phase motors with three phase ones

and connecting them (one at a time) to a shared inverter.

The Lathe

My main lathe is an imported machine, purchased a few years ago from Amadeal, with 750mm between centres and a 250mm swing over the bed. It's of reasonable quality, is as big as I can squeeze into the allocated space in my small garden shed workshop and has always been a pleasant machine to use. Until recently it had a 0.75 kilowatt single phase motor with variable speed control, which – though workable enough – I always felt was leaning towards the underpowered side. One sunny Summer morning I went into my workshop to do a bit of basic turning for some job or other. I pressed the green button on the control



Recycling



Main backplate

box. There was a single clicking sound, and all the lights went out. No movement or sound from the motor. Nothing. Repeat several times to the point where I'm forced to face an unpalatable fact: something is wrong.

Replacing the speed control board didn't solve the problem. First hypothesis disconfirmed, along with additional financial outlay. A further process of elimination – facilitated over the phone by Amadeal's very friendly and helpful technician – led me to the point at which it was clear that I needed to replace the motor. One of the features of this lathe which I had always enjoyed was its smooth and easy speed control via a rotary controller. This I was not prepared to lose, but I also fancied the improved reliability and performance that a three phase motor would offer, especially as the motor which I decided to buy was – at 1.1 kilowatts – more powerful than the one it was to replace. As we all know, a three phase motor requires an inverter if it is to run on a single phase supply. The inverter and its external control device, both – along with the new motor – supplied by Newton Tesla, are shown in **photo 1**.

All good so far, but as the new motor was more powerful than the old one, so it was physically larger in all dimensions and the business end of the lathe required some major modifications in order to accommodate it. Much of the existing housing for the old motor and main drive became redundant as it was simply too small to house the new power plant. **Photograph 2** shows most of it lying outside my house en route to the recycling depot.

With all of this as well as the old motor gone, the lathe was left with only the splashback, part of the motor housing and the arched steel plate which is visible in **photo 3**. I shall call this plate the 'main backplate'.

Motor Mount Plate

The old motor mount plate (which does not appear in photo 3) was too small for the



Boring the new motor mount plate

As we all know, a three phase motor requires an inverter if it is to run on a single phase supply.

new motor and is now in my box of useful bits for future and imaginary projects. To replace it I made a new motor mount plate out of 8.5 mm mild steel plate. Please allow me at this point to put in a good word for the Evolution Rage range of saws. I have the smallest mitre saw which is very compact in size and reasonable in price but slices effortlessly through thick steel with a minimum of heat, sparks and fuss. It allowed me to easily achieve some of the angled shapes I was looking for in this project. No personal interests lie behind this plug – I am simply a satisfied



Main spindle pulley before modification

The result of these various processes is a significantly chunkier drive system than the one which was originally on the machine...

customer.

Not unusually, the face of the new motor has a raised collar which is concentric with the spindle, and - outside of this - four mounting holes tapped M6. I cut a hole in the new motor mount plate with a hole

very small and thin v-belt and pulleys with similarly small grooves. The main spindle pulley was originally a double pulley which offered two speed ranges alongside the variable speed drive. This pulley in its original form is shown in **photo 5**.

I decided to beef up the drive system, and ordered a length of link belting in A-section. You will see in photo 5 that the main pulley has a wide bore to accommodate the rear end of the spindle, so replacing it with an off-the-shelf A-section pulley was not an option. The answer was to keep and modify the existing pulley. As my two Myfords are in my workshop in France, and I have no other metalworking lathe here at home, modifying the pulley myself wasn't an option either so I took it to a local engineering firm who turned an A - section groove into it for me. Due to limited space on the pulley, the two small grooves could be replaced by only one bigger one, so the new configuration



Main backplate spacing

an A-section pulley of the correct bore from RDG tools, a company with which I have always found it pleasant and straightforward to deal. This new pulley came with a tapped hole and set screw but it did not have a keyway. The new motor has a key in its spindle, so I cut a keyway in the pulley on the lathe, using a tool of the appropriate size which was moved back and forward via the carriage handwheel until the required depth was achieved, **photo 7**.

It felt good to be able to make use of the lathe despite its still motorless condition! The result of these various processes is a significantly chunkier drive system than the one which was originally on the machine, **photo 8**.

As I sometimes move my machines



Completed drive



Motor pulley keyway cutting

saw and then bored it out to accommodate the collar. For this I used a boring head mounted in my significantly modified Sieg X1 Micromill which is powered by the drill press and was featured in the article 'Flat Belt Frankenstein' (MEW 238), **photo 4**.

The boring operation itself was successful, but it was right at the very end of it that the motor on my drill press failed (more of which below). Fortunately, my dear friend the Dore Westbury milling machine saved the day, allowing four screw holes to be drilled in the plate. A trial fit saw the collar on the motor face snugly nestled in the bored hole, and the motor screwed securely to the plate.

The Drive

At this point the job became a little more complicated. The drive of the lathe as originally purchased was provided via a

was to have just a single speed range. The overall diameter of the pulley was also of necessity reduced, but this was not a problem as I had been advised by Newton Tesla that a 1:1 ratio between the motor and spindle pulleys was appropriate for this application.. Furthermore, again due to the limited room available on the pulley, we were not in a position to be choosy over the exact location of the new groove. The result of this was that in order to keep the motor and spindle pulleys in line when each was properly mounted it was necessary to move the motor forwards by a couple of centimetres or so. To achieve this, the main backplate stands back from the headstock courtesy of an arrangement of screws and nuts which can be seen in **photo 6**.

With regard to the small drive pulley on the original motor, it did not seem practicable to re-machine it, so I bought



Tapping the main casting

between locations, I wanted to ensure that the motor was attached to the lathe in as robust a manner as possible, therefore in addition to the face mounted setup described above, the motor is fitted with three feet. Two of these sit squarely on a thin rubber pad at bench level, and one is bolted laterally to two tapped holes in the main casting, **photo 9**, held at the correct distance from it by spacers made of three thicknesses of drilled mild steel bar. The finished motor mounting job is shown in **photo 10**.

Motor Housing

Due to having had to remove the original motor housing, I was left with an open gap above the motor down which anything placed on the headstock would surely fall. Again, using the Evolution Rage, I cut a piece of 3.5 mm steel (which had been reclaimed from the base of an Ikea coffee table) into what I feel is quite a pleasing shape, and fixed it on as a cover over the offending gap. To my eye, this gives the machine a kind of 'industrial' look which I quite like, **photo 11**.

We're not done yet though. Despite the motor being pushed forward to align the pulleys, it still also protrudes further at its other end in the tailstock direction of the lathe than did its predecessor. This necessitated my cutting back the splashback and only remaining part of the motor housing, **photo 12**.

However, like much else in this not-particularly-straightforward conversion, it required a degree of tinkering. I didn't want to confine the new motor too much and risk problems with overheating, but to cut away the splashback and forward part of the motor housing assembly to an adequate degree to allow the air to flow would have unacceptably weakened the integrity of the sheet metal structure. I got round this by cutting some large ventilation holes with hole saws of various sizes, **photo 13**.

These appear to be sufficient to keep the motor cool (and indeed may even be unnecessary), but in turn could leave the fan end of the motor vulnerable to the



Motor mounted!



Headstock with cover



Modifying the splashback

ingress of swarf, so I pressed part of an unused stainless steel cooker hood into service as a swarf guard. This does the job while remaining open at the end towards the tailstock, allowing plenty of air to flow through to the motor. Admittedly not the most accomplished piece of sheet metal work in the world, but it works. It can be seen in **photo 14**, which shows the finished conversion.

The drill

As noted above, the motor on my imported floorstanding drill press malfunctioned following the sustained use of the machine to power the flat-belt converted Sieg X1 micromill (back in photo 4). Once again, I called upon the expertise and friendly counsel of John Newton of Newton Tesla, who advised me that single phase motors tend to react badly to being switched on and off a large number of times in succession. This was certainly the case in widening the hole in the lathe's new motor mount plate, as of necessity I was taking very light cuts with the boring head to avoid slippage of the flat belt of the mill's custom drive setup and needed to stop and restart the motor after every pass to adjust the depth of cut of the boring head. I do not feel that this particularly reflects a flaw in the flat belt setup, which I will happily use again with the new drill motor. Flat belts do tend to slip to a degree under a certain load, and had I used the Sieg in its original form for this operation, I would have been taking equally light (or even lighter) cuts to avoid stripping the mill's plastic drive

Fortunately, my dear friend the Dore Westbury milling machine saved the day...

gears (it was frustration with these gears that led me to convert the mill in the first place). Truth to tell, a bigger mill would have been more suitable, but there was no bigger mill available which was eligible for the job. The Dore Westbury - although not large - would have handled the operation much more robustly, but the drawbar for my boring head is too wide to pass through the DW's spindle. I therefore had no option other than to embark upon the boring operation using the drill press powered Seig, blissfully unaware at that point that it was going to cost me. It was fortunate that it was just at the moment that I had completed the boring operation that the drill press motor failed, or I would have been stuck.

The annoyance of having to buy my second new motor in a matter of weeks was tempered by the realisation that I could now have a variable speed drill press with a three phase motor. This was an exciting thought! The only downside would be witnessing the further dwindling of my bank balance, but by this point I was past caring. A further consultation with Newton Tesla confirmed my suspicion that it is unnecessary to purchase a second inverter to run a second three phase motor, provided that (a) the two motors are of the same rating, and (b) you don't try to run them at the same time. I therefore purchased another 1.1 kw three phase motor along with two three phase plugs and one three phase socket. The arrangement - with perhaps a little tidying up of cables still to do - is shown in **photo 15**.

This arrangement would make sure that only one of the machines is connected to the inverter at any given time (and when you think about it, it's quite a good idea - for a variety of reasons - not to operate two machines at the same time).

Pulleys - Again!

I was happy to discover that the new motor for the drill press was exactly the same size as the old one, and it bolted straight on to the mounting bracket with none of the kind of modification work that the lathe had required. The only complication was that while the old motor had a flat milled into its spindle, the new one had a keyseat and key. This necessitated my cutting a keyway in the motor step pulley. The structure of this pulley was such that the only possible position for the keyway was in the reinforced section which was drilled for the set screw, **photo 16**.

The set screw now presses upon the key. Given that in theory this does nothing to prevent longitudinal movement of the pulley upon the motor spindle, I drilled and tapped a second hole at the opposite side of the pulley's bore and spotted a recess for a second, smaller set screw in the motor spindle. Again, the keyway for this pulley was cut on the lathe, but the job was a much longer one than cutting the keyway in the lathe drive pulley, as



Ventilation holes



Ready for takeoff



Three phase supply



Modified drill motor pulley

the drill's pulley is made of a much harder alloy with an almost granular consistency which impressively resisted the advance of the cutting tool. I am no metallurgist, so we'll leave it there, but suffice to say that if I find myself having to cut many more keyways in pulleys made of this material, I'll be looking to acquire an arbour press and some broaches.

I had seen a video online about a similar conversion in which the owner had removed the central jackshaft from his machine and inverted the rear pulley cone, resulting in a direct drive between front and back pulleys, with only one belt. This, he said, was not only a simpler setup, but also a quieter one. This idea appealed to me, but Newton Tesla advised against it because although three phase motors are not particularly vulnerable to overheating, there is nevertheless some risk of this occurring if the machine is run at low speeds for lengthy periods. This is because the fan is running slowly and so cools the motor less effectively. Keeping the central jackshaft would retain a broader range of speeds and provide a mechanical advantage, offering low spindle speeds while still allowing reasonable motor speeds. I followed this advice and left the central pulleys alone, **photo 17**.

The result is a variable speed drill press which is formidable for its size and offers some of the exquisitely slow speeds that guys with beautiful old camelbacks like to show off on youtube. It is also worth noting here that there is a common belief that inverter-driven three phase motors lack torque at the low end of the speed range. I am reliably advised that with modern inverters of good quality this is not the case, and my newly converted drill certainly bears this out. Even at its very lowest speed (of a glacial 18 rpm), it delivers an assured and - it seems - unstoppable degree of torque.

A drill like this deserves a bit of bling, so as a finishing touch I ordered and fitted a vertical digital readout purchased from Arc Euro Trade. This looks good, but appears to also be a solidly-made instrument and I have no doubt that it will also prove useful. I also replaced the original keyed chuck



The drive - if it ain't broke, don't fix it



DRO and chuck

with a new keyless one of 5 mm - 20 mm capacity from RDG Tools, **photo 18**.

I also plan to install new digital tachometers to both machines (the one on the lathe having fallen victim to an instance of clumsiness on my part while I was working on it) but the delivery date has now passed on my second attempt to order these from two different sellers on ebay so whether and when I shall receive them I am unsure.

On Paint and Colour

Now, a brief note on the paintwork and colour scheme. The lathe was originally decorated in a blue and cream scheme. Colour is important to me, and although I'm generally fond of blue I have never

particularly liked it on machine tools. I was pleased to see the handsome gunmetal grey finish on the motor for the lathe when it arrived, even though it would be hidden on the completed machine. Picking up the cue from this, I took the opportunity to cover the blue areas of the lathe in a dark grey gloss DIY spray paint from the Rust-oleum 'Painter's Touch' Multi-purpose paint range. I will not pretend that I did a proper job of the paintwork. It was 'quick and dirty'; a cover-up job, and it will serve me right if it doesn't look good for long. One day, of course, I may do a proper strip down and repaint of the machine. For now, though, I was pleasantly surprised by the quality of the paint, its ease of use and the relative durability of the finish despite the provisional nature of its application. I also looked forward to the lathe and drill being colour co-ordinated in a restrained grey-themed livery - until, that is, the motor for the drill press arrived, and emerged from its packaging resplendent in bright blue! This can be seen in **photo 19**, which shows both machines in their completed state. I draw the line at painting the motor grey, though. In fact I have decided that I'm growing to rather like blue on machine tools...

In Use

As is the case for many of us, the lathe

As is the case for many of us, the lathe and drill press are fundamental tools in my workshop...



19 Lathe and drill press complete



20 Light tube, lens and part of shell for steampunk pump housing/lamp – work in progress



21 Finished punk housing

and drill press are fundamental tools in my workshop, so unsurprisingly they were pressed into service as soon as they were operational with their new motors installed. They have both been used on a project I am currently working on. The smaller of our two woodburning stoves has a built-in back boiler which heats two radiators on the floor above via a system of vertical copper pipes which ascend the wall in the corner of the room. It is, in effect, a mini wood-fired central heating system. On installing it we left the copper pipes on view as a design choice. Unfortunately, the visual appeal was compromised by a rather ugly green pump mounted on the pipes, so I decided to build a housing to conceal it. The light tube, lens and part of the shell for this artefact can be seen in **photo 20**.

Photograph 21 shows the finished pump housing for the small central heating system that runs off a woodburner with a back boiler, doubling up as a lantern with dimmable red LED's shining through an old theatre lamp lens. It sits in the corner of the chimney breast in our bedroom, the woodburner being off-camera to the left.

Using both machines on these projects has been a pleasure, and my initial impression is that the drill press in particular really shines. This may be because I was already used to the lathe having variable speed, but not so the drill. In any case, I am no longer sorry that the old motors failed, and look forward to calling upon the services of both machines – transformed as they are – for many jobs in the future. ■

In our Next Issue

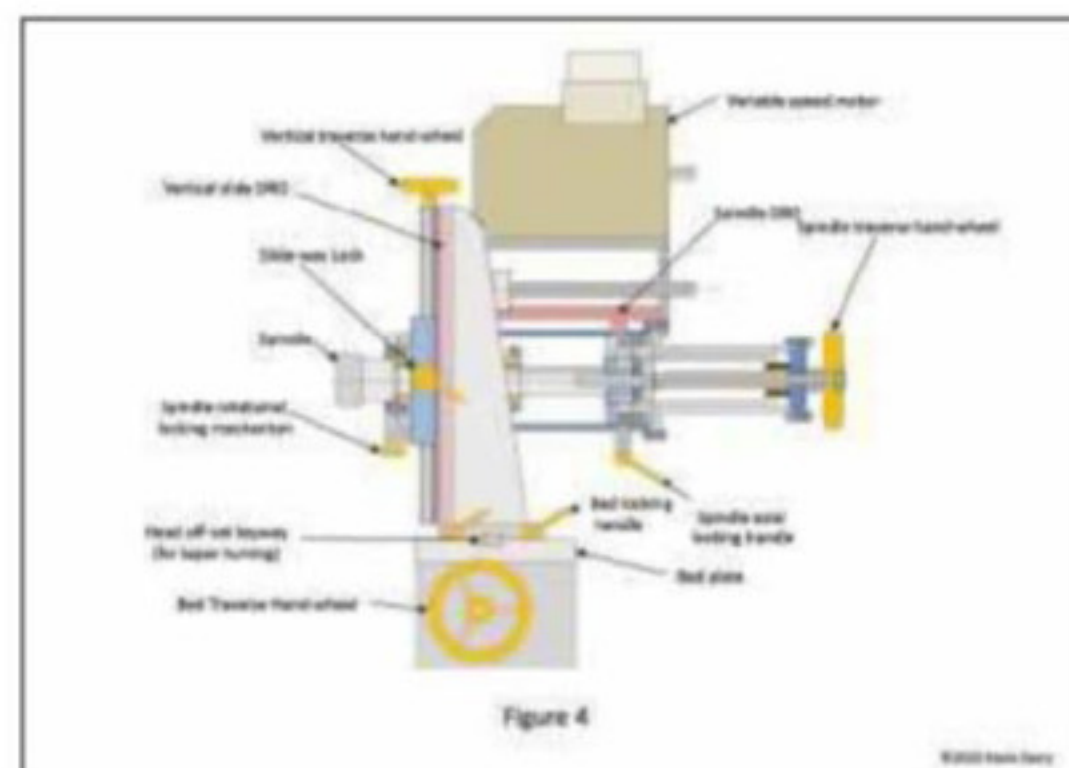
Coming up in issue 285
On Sale 6th September 2019

Content may be subject to change

October's issue, number 285, is shaping up to be one with something to interest every reader:



John Crammond reverses the feed on a compound table.



Kevin Barry explains horizontal boring on the lathe.



R Finch improves a milling vice.

The hemingway ahead

Send £2 (refundable) for our latest workshop catalogue or visit our website

Discerning craftsmen the world over trust Hemingway Kits to add precision, productivity and capability to their workshops.

Order with confidence from our 40 page catalogue or secure website and add real "satisfaction" to every job.

- TOP DESIGNERS
- HUGE RANGE
- GREAT SERVICE

Hemingway Kits
126 Dunval Road, Bridgnorth
Shropshire WV16 4LZ
United Kingdom
Tel/Fax: +44 (0) 1746 767739
Email: info@hemingwaykits.com

www.hemingwaykits.com

FOR SALE "The Great Marquess" 3½" Gauge LNER 2-6-0.



Designed and built by the late Martin Evans. Three documents of correspondence from Martin Evans and my late father, (one written as a certificate of proof and authenticity). Photos of the build process and the full-size steam engine detailing the design dated and numbered by Martin. Engineering drawings folder with developments and copied articles of the engine build.

The engine has been in the family for many years and the engine should be returned back in to the model engineering community and to be enjoyed by someone who understands the incredible contribution the late Martin Evans had made.

We only want serious/genuine offers to be made, further photos can be sent if required.

For More information please email;

benfawcett2012@gmail.com or call 07854 119442

MIDLANDS MODEL ENGINEERING EXHIBITION

THE SHOW FOR MODEL ENGINEERS



THURSDAY 17th to
SUNDAY 20th
OCTOBER 2019

Thursday - Saturday 10am - 5pm
Sunday 10am - 4pm

WARWICKSHIRE
EVENT CENTRE

...more than just an exhibition
- it's an experience...

Meet over 35 clubs & societies. See nearly 1,000 models. Learn from the experts in the workshops & lectures. Buy from over 50 specialist suppliers.

ENTER YOUR WORK NOW

Why not enter your work and be part of the exhibition? There are 16 competition and 16 display classes. Call 01926 614101 or see our website for more information. Trophies, cash prizes and certificates are given to winners.

BOOK YOUR TICKETS NOW

ADMISSION PRICES	ONLINE TICKETS*	FULL PRICE TICKETS**
Adult	£9.50	£10.50
Senior Citizen	£8.50	£9.50
Child (5-14 yrs)	£3.00	£4.00

* Tickets are available via our website at discounted prices until midnight Tuesday 15th October 2019.
** Full price tickets are available on the day from the ticket office. Please call SEETickets on 0115 896 0154 if you would like to book a ticket by phone.
Last admission 1 hour before closing.

SPONSORED BY
THE MAGAZINE FOR MODEL ENGINEERS
ENGINEERING in Miniature

EXHIBITION LINK BUS
from Leamington Spa Railway Station (not Sunday).

FREE PARKING
Ample free parking for over 2,000 vehicles.

FREE SHOW GUIDE
upon entry to the show.

GROUP DISCOUNTS: 10+ enter code GRP10 on website. Lecture programme, exhibitor list & bus timetables online.

www.midlandsmodelengineering.co.uk

Organised by Meridienne Exhibitions Ltd
All information subject to change, correct at time of printing.

Meridienne Exhibitions LTD
@MeridienneEx



DON'T MISS THIS GREAT ISSUE - SEE PAGE 50 FOR OUR LATEST SUBSCRIPTION OFFER

Scribe a line

YOUR CHANCE TO TALK TO US!

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

Supersize Me

Dear Neil, to "supersize me" (MEW 283) had many pitfalls! The post-mortem on the breaks brings back memories of an agricultural problem that may give an answer? A 2" Dia solid roll shaft would break for no initially obvious reason. Close inspection after several had snapped showed an interesting pattern of rings getting bigger from one point, where a tiny mark caused by a hammer blow on assembly acted as a stress raiser! In use the shaft adopted a curve between the two bearings (about 10' or 3m apart). At any one time the front of the shaft was in compression whilst the rear was in tension, effectively bending the shaft back and forth with every rotation! The tiny indentation starts the crack that then runs straight through the shaft until it breaks.

The drill shaft was extended with 16mm black bar in a hole 25mm. The O/D of the black bar would have many surface imperfections which would under these conditions act as stress raisers. The rotary impact hammer(drill) would impart considerable force into the shaft! Some would be absorbed and converted into a bending force, in this case between the bottom of the hole and the drilling machine. With the hole being 25mm and the shaft 16mm there would be room to bend even in the hole. The weight of the extended drill would also reduce the force available at the tip for drilling or chiselling. Supporting bushes along the length, just smaller than the hole might well help along with a smooth shaft or a larger smooth shaft.

And what did I do with a broken shaft 2" diameter? Use oxy acetylene to cut both the ends into a 45° cone, then weld it back together - I never had one break on the weld!

Noel Shelley, Norfolk.

Bombe & Colossus

Hi Neil, there is a book: title Colossus, by Jack Copland & others, this describes the 'how what and why' of the decryption of 'Enigma' and 'Tunny' etc. Much of it is by those who did it and built these machines, however, the maths in some of the articles will put anyone of less than 250 IQ into mental freefall. Nevertheless, it is a fascinating read and if one can follow the basic procedures, an understanding is gained of what a colossal advance was made in a very short time. Further, it reveals an insight into how able those few geniuses were. If reading it makes your brain implode - I am not responsible!

Peter King, New Zealand

Bombe Continued

Dear Neil, I like to give you a follow up about the working of the Bombe.

Some one brought me in contact with a former member of my Model engineering association. Unbelievably, he lives about 8km from my home. His name is Bert Stam and I visited him.

He has built 4 Enigma machines because this interests him a lot. A fifth is under construction. This is an alternative to a bombe. In principle the working is more or less the same. Both are codebreaking calculators. Enclosed a picture of all kind of parts and one of his complete Enigma's which he made.

But moreover, about a year ago he visited the Bletchley Park museum, so he could fully explain the workings. All in all very interesting.

Henk Salij, Ridderkerk, Netherlands.



Thank You Michael Cox!

Dear Neil, I wanted a personalized winding key for my clock(s). According to the literature, the square hole is "formed by filing with needle files". For me a horrifying proposal. But I used Mike Cox's rotary broaching device, proposed in MEW number 241 (May 2016), page 24. Used in the lathe, to be concentric and obviously adapted to square holes. Amazing what a super-simple item as this one can do. I could never invent that. I used a piece of brass rod and made the sphere at the other end of my key with Mike Cox's ball turner (MEW 259, autumn 2017, page 53). The key was made much easier and faster than I expected. The result is of a high level.

Bernard Zaegel, The Netherlands

South Bend Lathe Spares

Dear Neil, further to the request for information on South Bend lathe spares, we had a company in Australia make a clone known as Hercus. My lathe is a 1948 Hercus and is very similar to the 9-inch South Bend. A company with a stock of Hercus parts may be helpful as so many parts were similar. This company is AMH or australianmetalworkinghobbyist.com

The postal address is 54 Peel Street, Holbrook, New South Wales 2644

Hope this may help.

Edward Millington, Australia

Rust Never Sleeps

Dear Neil, ref. Issue No 282 John R. Yeomans email 'Rust'. I use phosphoric acid which I get from TM Chemicals Ltd. Under the name SCALE-X, tmchemicals.co.uk.

I use it neat from the bottle without dilution. Obtain a hank of wire wool plain without soap. Take a suitable bit of this and dip it in the acid as required. Then rub the rusted surface until the rust has gone.

This should give a nice grey finish. When you are satisfied get some kitchen paper and rub the steel as dry as you can. Do not wash off in water. You will have a thin protective coat on the steel.

You can then paint it when you are ready.

Regards

Hugh Castellan

Gimmel Rings

Dear Neil, thanks so much for Gary Wooding's superb MEW 283 article, making Gimmel Rings. I have just read this while having my morning cup of coffee. It just shows the British character, when the chips are down, we can do it! So enjoyable to read, I can see me returning to the article many times to take it all in again.

John Parry, Island of Jersey.

Clayton Steam Wagon

Dear Neil, A recent post on ME was by someone looking for details for a steam lorry and I have found drawings on the internet for a Clayton steam wagon which was published by ME in 1976 but am reluctant to post it on MEW because of copyright laws. The archive magazines do not go back to 1976 and therefore, I could not give a link to the issue. Attached is a copy of the file which could possibly be added to the article reprint section.

Paul Lousick, Australia

Thanks Paul, I have put your PDF in the reprints section of the website: www.model-engineer.co.uk - Neil



Right Left and Centre.

Stephen Bondfield looks at correcting mismatched chuck jaws



Low cost chuck.



The closed jaws of a good quality chuck.



Rear end view of chuck.

Sometimes, what at first appears to be a "bargain" money saver, eventually transpires to be a costly waste of time, money and effort.

The following might be of some interest to readers who have purchased low cost lathe chucks from various sources and have discovered that the jaws do not close with equal parity – the surfaces of the closing jaws do not meet and align without there being an irregular and varying space in between, **photo 1**.

If we examine the effects of such an arrangement upon the result of our turned item we would see nothing very much other than a slight eccentricity when the object in the chuck is in rotation. This is of no real consequence if the dimension that we are machining is less than the initial diameter of the stock piece in the jaws of the chuck, and the result should be a round, concentric item; facing off doesn't present a problem, neither does drilling the end of the workpiece or parting off. However, if we decide to remove the item from the

chuck for one reason or another and then try to relocate it in the chuck, we would find that the drilled hole appears to be rotating slightly eccentrically, the same with the outer surface. In trying to re-machine or tap the hole that we have previously drilled we might also risk breaking the drill bit or tap if the departure from the original position is too great. We would have to start again only to find that the same fault recurs and that trying to achieve exact centre comparative to the rotating outer surface is futile, because, we have begun at a starting point where there is an inherent fault; the chuck jaws do not grip the workpiece in such a position that will allow it to rotate concentrically, comparative to the centre of the drill in the tail stock chuck or the cutting tip of the tool in the tool post.

If possible, the most obvious thing to do at the time of purchase is to thoroughly examine the opening and most important, the closure of the jaws. Bear in mind that if the jaws appear to be significantly misaligned this may mean they have simply



Try any title for

£3*

The summer should be about sunshine and relaxing, so this year why not treat yourself to any of our magazines for just £3 with no obligation to continue! You could even treat someone else...

Save up to 86%!

- Range of great titles to choose from
- No obligation to continue
- Great future savings
- Delivered conveniently to your door

SAVE 79%

3 ISSUES FOR £3 THEN £10.50 EVERY 3 MONTHS

SAVE 81%

3 ISSUES FOR £3 THEN £11.75 EVERY 3 MONTHS

SAVE 83%

3 ISSUES FOR £3 THEN £11.00 EVERY 3 MONTHS

SAVING 80%

3 ISSUES FOR £3 THEN £11.25 EVERY 3 MONTHS

SAVING 80%

3 ISSUES FOR £3 THEN £11.00 EVERY 3 MONTHS

SAVING 81%

3 ISSUES FOR £3 THEN £11.45 EVERY 3 MONTHS

SAVING 80%

3 ISSUES FOR £3 THEN £11.45 EVERY 3 MONTHS

SAVING 80%

3 ISSUES FOR £3 THEN £11.50 EVERY 3 MONTHS

SAVE 86%

5 ISSUES FOR £3 THEN £15.25 EVERY 3 MONTHS

SAVE 80%

3 ISSUES FOR £3 THEN £11.25 EVERY 3 MONTHS

SAVING 77%

3 ISSUES FOR £3 THEN £10.25 EVERY 3 MONTHS

SAVING 76%

3 ISSUES FOR £3 THEN £9.65 EVERY 3 MONTHS

SAVING 80%

3 ISSUES FOR £3 THEN £10.80 EVERY 3 MONTHS

SAVING 79%

3 ISSUES FOR £3 THEN £10.50 EVERY 3 MONTHS

SAVING 77%

3 ISSUES FOR £3 THEN £9.99 EVERY 3 MONTHS

Prefer a Digital or Bundle Sub?

Offers available online at: www.mytimemedia.co.uk/SS19P

SUBSCRIBE SECURELY ONLINE:

WWW.MYTIMEMEDIA.CO.UK/SS19P

CALL 0344 243 9023** AND QUOTE SS19P

TERMS & CONDITIONS: Offer ends 30th September 2019. Subscriptions will begin with the next available issue when order is placed. You can cancel your subscription before the third issue and pay no more money than the £3 already debited. Otherwise your subscription will automatically continue at the low rate selected above. This is a UK offer only. The prices above relate to trial print subscriptions. Digital and Bundle trial subscriptions are also available online at www.mytimemedia.co.uk/SS19P. 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@mytimemedia.com. 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 <http://www.mytimemedia.co.uk/privacy-policy>. Please visit www.mytimemedia.co.uk/terms for full terms & conditions.

*UK only Direct Debit/Continuous Credit Card offer only
**Calls are charged at the same rate as standard UK landlines and are included as part of any inclusive or free minutes allowances. There are no additional charges with this number. Overseas calls will cost more.

been inserted in the wrong order! With a three-jaw chuck, try swapping two jaws over before rejecting it out of hand.

With the chuck jaws closed and the item held in one hand, hold it up to a light source and examine the rear view of the chuck from the backplate end. With the other free hand, key the jaws to open and close. There shouldn't be any variation of light space between the meeting surfaces of the three closed jaws, **photo 2**. Do the same with the front, face view of the chuck. If there is any disparity it should reveal itself by this examination, **photo 3**. You will have to decide to discontinue the purchase or to buy, with the knowledge that you have sufficient resources of expertise and tooling to be able to do something remedial about the discrepancies that you observe when the chuck is held up in front of your eyes. If you have ordered your purchase through a mail order source and discover when it arrives that there are these faults, you are confronted with the task of complaining to the supplier about the standard of the item and its usability on your lathe. If the supplier is not the manufacturer, then there may be the need to demonstrate to the supplier that the item is unusable in its existing state. This all adds up to frustration

centring assembly. A set of feeler gauges can be helpful to obtain a fairly accurate estimate as to the quantity of metal to be removed from the 60 degree surfaces of each jaw, that will allow the closure of the jaws in sequence, to align with sufficient closeness to provide a secure, concentric grip in order to enable greater accuracy when turning or drilling the work piece.

In order to achieve this objective it is necessary to construct a fixture to hold each jaw, **photo 6**, and to locate it securely, in the vice of a milling machine or a surface grinder, to serve as a guide to allow accurate removal of metal to correct the discrepancy of the chuck jaw, **photo 7**.

The item was made from a scrap piece of hexagonal, 25mm <A/F> mild steel bar approximately 60mm long. Obviously the length of this fixture could be varied to accommodate larger chuck jaws. A section of metal 35mm long by 14mm deep was removed from the bar by the use of a 16mm end mill, held in a collet, in a vertical milling machine. At one end, a hole drilled and tapped 6mm, to a depth of 10mm, and positioned 5 mm above the centre line of the bar, serves as a clamping point to securely hold the jaw in place ready for machining, **photo 8**. The 6mm bolt that is



Chuck jaw showing surfaces of unequal length.



The three jaws and the surfaces to be corrected.



Fixture and securing bolt.

and dissatisfaction in the equation of the situation, which is "a waste of time, money and effort."

The problem is not the fault of the scroll, concealed within the body of the chuck, but upon the finished machined surfaces of the chuck jaws, at the gripping end, which should all be 60 degrees to each other, and being equal in length, **photo 4**. Although this measured error may be small, **photo 5**, it does have a significant effect upon the final result of any machining activity, to produce an object that is concentric without it being discarded as waste.

This error can be corrected by the removal of each individual jaw and a comparison made between its neighbours in the sequence of closure of the self

screwed into this hole must be tightened against the chuck jaw very securely, without displacing the horizontal position of the jaw in the clamping fixture. The necessity for the assembled parts to be secure must be emphasised because of the extreme forces that are involved in the process of machining each jaw, although only a small quantity of metal is being removed.

The choice of hexagonal bar that forms the matrix of the fixture is exactly the right form for the task, because each side corresponds to the 60 degree angle of each of the six surfaces at the ends of the three jaws (360 divided by 6 = 60).

With the jaw securely located in the fixture, placing the fixture on one or the other < right and left > of the lower of its



Fixture with jaw.



Fixture assembly located in machine vice.



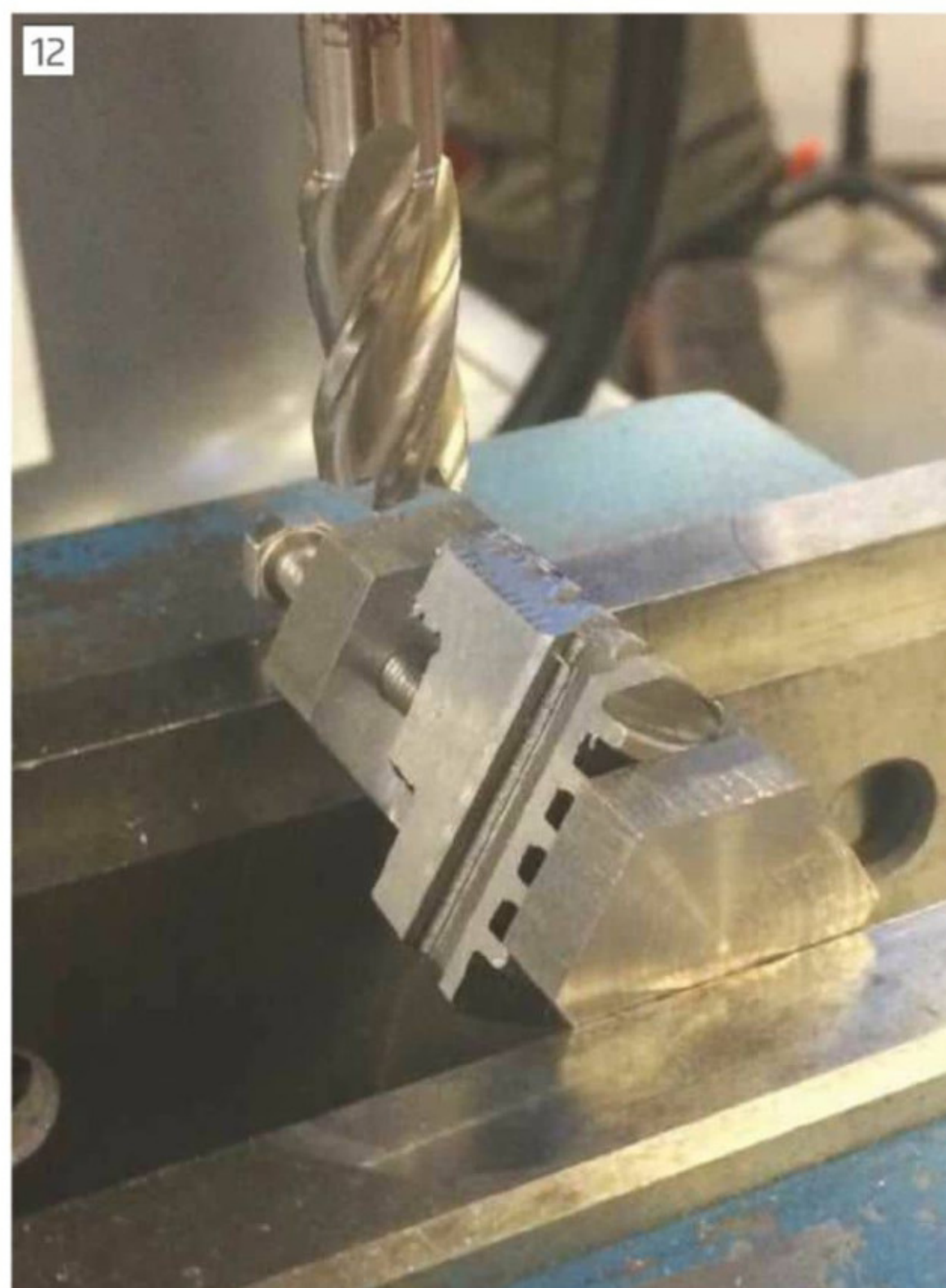
Positioned 60 degrees left.



Positioned 60 degrees right.



Surface removed by shallow cutter action.



Same jaw, right side surface being machined.



Securing jaws open under light pressure, restrained by circular band.

six sides, the chuck jaw is positioned to the corresponding horizontal plane, of the side which forms the base, this is very convenient for the purposes of machining, to accurately recreate the 60 degree angle of the jaw. Rotating the fixture by 60 degrees to its adjacent side and repeating the machining action enables both surfaces of the same jaw to be altered comparative to each other, **photos 9,10**. However, one jaw surface might require more metal to be removed than the other to bring the jaw into close parity with its neighbours in the sequence of closure.

For this reason, it is necessary to remove the jaw from the clamp fixture at intervals and refit it to the chuck to examine its position comparative to the jaws preceding and following. This action can be time consuming and tedious but is entirely necessary to achieve any degree of accurate integration of the three jaws. Furthermore if the item to be machined is a jaw that grips the external circumference of larger circular objects, caution must be exercised because although the 60 degree angle dimensions at the closing centre have been corrected it does not necessarily follow that the inner surfaces of the outer circumference of the jaws are also concentric. This dimension might have to be machined with a boring tool whilst all three jaws are fitted in the chuck and with an object secured in place at the centre of the chuck.

As for the machining actions, most low cost chuck jaws are fairly soft and because



Machining an old chuck. Method to recreate the tips of the three jaws.

only a small quantity of metal needs to be removed it is possible to machine them using ordinary high speed steel milling cutters rotating at approximately 350/400 RPM, **photos 11, 12**. Take care to do exactly that, only make light, shallow cuts.

Because of the possibility of vibration, it is a good thing to check the security of the jaw in the fixture and the latter in the vice of the milling machine at intervals.

After all the jaws have been checked

for closure it might be found that the very ends of each jaw have become rather pointed as the result of the extended 60 degree surfaces. In this instance it is necessary to re machine the ends to recreate the surface which actually comes into contact and grips the surface of the work piece. For this action, a single, circular piece of steel piping can be fitted over each corresponding step of all three jaws to contain and restrain them when they are opened and held under light pressure, **photo 13**. Using a boring bar through this 'hole' metal can be removed from the ends of each jaw, **photo 14**, thereby creating surfaces which can be applied to close concentrically around the workpiece item held in the jaws, gripping it securely.

If the method of grinding is chosen to remove metal from the surface of the chuck jaw, make sure that the entire clamping system, machine vice and clamping fixture is secure on the magnetic table of the surface grinder.

The accuracy or rather the concentricity of the rotating chuck comparative to the cutting surface of the tool in the tool post is only as accurate as the rotating shaft of the headstock spindle and the backplate upon which the chuck is mounted. Any free movement of these component parts, caused by worn bearings or a loose backplate, will have a corresponding effect upon the workpiece held in the chuck. It is therefore worthwhile to make sure that all three components are integrated to form a secure, common centred turning plane. ■



£1150

WM180 LATHE FITTED WITH 2 AXIS DRO

- 2 axis DRO with magnetic scales
- 300mm between centres
- 600w reversible motor
- Maximum swing 180mm
- Supplied with 3 and 4 jaw chucks and fixed and travelling steadies as standard

£1,995



WM250V LATHE

- Dependable inverter drive with AC induction motor
- 550mm between centres
- Maximum swing 250mm
- 1.1kw reversible motor
- Supplied with 3 and 4 jaw chucks and fixed and travelling steadies as standard

£1,625



WM250 LATHE

- Brushless motor
- 550 mm between centres
- 1.1kw reversible motor
- Maximum swing 250mm
- Supplied with 3 and 4 jaw chucks and fixed and travelling steadies as standard

Stands and a wide range of accessories are available for our lathes and mills

All prices include VAT and UK mainland delivery



£1150

WM14 MILLING MACHINE FITTED WITH 3 AXIS DRO

- Table size 400 x 200mm
- Dovetail column ensure positive head location
- Head tilts +/- 90°
- Digital depth scale
- 500w motor

2B12 DRILL

- 2MT
- Chuck capacity 3 – 16mm
- Throat depth 178mm
- Table size 290 x 290mm
- Motor 650w

£354.90



200mm/8" and 305mm/12" forms now back in stock

ITEM NO.	7006	7025
SPECIFICATION	200mm	305mm
Shearing thickness: mild steel	1 mm	1 mm
Shearing thickness: Aluminium, soft brass, copper	1.2mm	1.2mm
Bending thickness	1mm	1mm
Bending angle	90°	90°
Rolling thickness	1mm	1mm
Min. rolling diameter	29mm	39mm
Dimensions		
L x W x H	320 x 180 x 250mm	480 x 290 x 350mm
Net weight	17.5kg	45kg
Price	£194.25	£236.25

NEW RANGE OF LED WORKLIGHTS

- Very bright
- Low power consumption
- Strong magnetic base or permanent base fixing
- Flexible arm total length 700mm
- Articulated arm total length 840mm
- 25 watt low voltage bulbs with inbuilt transformer

Flexible arm with magnetic base Item No.9710 **£55.00**

Flexible arm with permanent base fixing Item No. 3204LED **£50.00**

Articulated arm with magnetic base Item No. 3204 **£78.60**

Articulated arm with permanent base fixing Item No. 8930LED **£64.05**



Our next Open Day will take place at Warco House on **7th September from 9 am to 1 pm**. Our full range of machines and accessories will be on display in our showroom and we will have a good selection of shop soiled and used machines on offer at bargain prices. On-site catering. Free entry and parking.



A Lathe Saddle Multi-stop

Part 2

Roger Vane presents a refined design for lathe saddle stop worthy of any machine.

Photograph 19 shows the clamping holes being drilled, together with the buttons and parallel described by Paul.

The first milling operation is to machine a 10mm slot in, but as this is a guide for the guide pegs it needs to be accurate and above all, consistent. I would have milled to initial slot using a slot drill slightly smaller in diameter than 10mm, with 3/8" diameter being ideal. Then finish with a 10mm slot drill - finishing the slot at 10mm allows the heads of capscrews to be fitted easily.

I appear to have used a non-standard tee-slot cutter and made my peg keys and tee-nut bar to suit. As such, a cutter may not be available to all so I have drawn the tee-slot based on a standard 8mm cutter which is available from Arc Euro Trade and others (usual disclaimer). It has a maximum diameter of 16mm with a 'width' of 8mm. The 'neck' at 7mm will easily clear the 10mm slot. If you use a different cutter to this, you may need to re-dimension the guide pegs and tee-nut bar to suit the revised slot. **Photograph 20** shows the tee-slot being machined.

Stop Body (fig. 5)

5.1 Stop body fabrication

The stop body is fabricated from four parts, which is shown on the drawing



Milling the tee-slot in the mounting bar (Paul Clark)



One method of setting the mounting bar on the milling machine table (Paul Clark)

(fig. 5), together with the completed fabrication. The individual parts will be silver soldered together.

The parts themselves are straightforward to make, being made from mild steel flat and round bar. The parts are shown in **photo 21**.

Squareness is most important here, so assembly with tight-fitting pins is the best option to achieve this. The holes for the pins should be coordinate drilled on the milling machine, rather than relying on marking out

and a drill press. Although I have specified 1/8" diameter pins, they can be any size you like as long as they are close fitting.

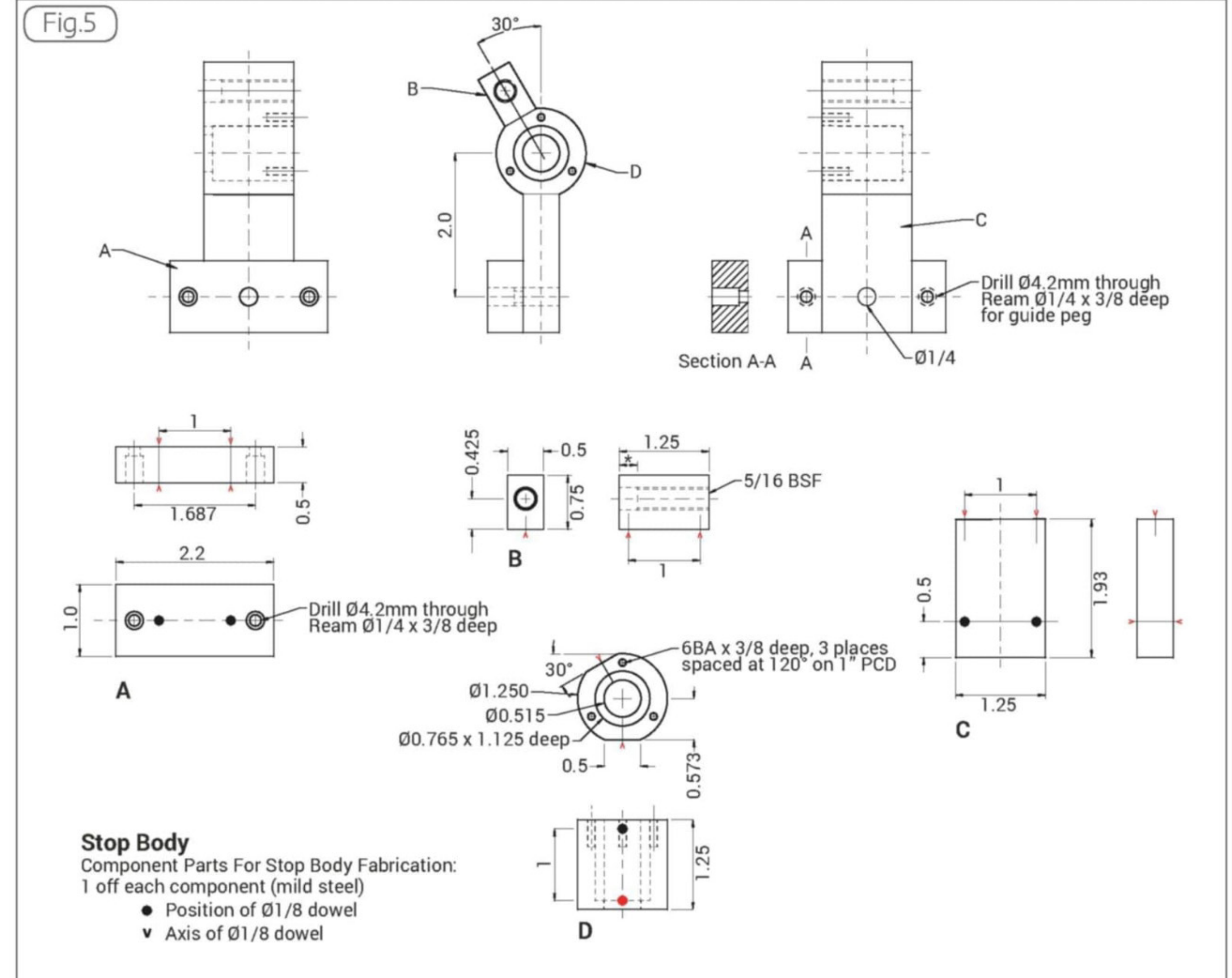
One minor point to be aware of is that part 'B' has a 5/16" BSF tapped hole through it, but you will probably find that your taps will not go any deeper than about 1", so the remaining 1/4" or so will need to be in clearance.

Also, the angled face on part 'D' is best put on using an indexing head to achieve the 30 degrees required.

Once the component parts have been



The component parts for the stop block before silver soldering (Paul Clark)



made, they need to be cleaned up prior to silver soldering. It is worth placing centre pop marks all over the faces to be joined, as this will provide a tiny gap for the silver solder to run into. I find that an automatic centre punch is ideal for this type of job as the punch marks will be consistent.

Photograph 22 shows the body fabrication assembled prior to silver soldering.

The assembly can now be silver solder together, ensuring that the component parts don't move as they are heated.

Stop - small parts (fig. 6)

Before we start making the small parts for the stop assembly it is worth showing the individual parts as in **photo 23**.

This photo is of my own, 20 year old stop assembly, and there is a detailed difference to be aware of. I made my floating bush to take a light spring to control the action of the bush in the body housing, but further thought has questioned the need for this. The drawing (6.1) shows a plain bush without the spring, which should be perfectly satisfactory. If anyone making this multi-stop feels that they would like to include the spring, then it should be no problem to modify the bush to suit your

chosen spring. Sourcing a relatively light spring will probably be the biggest problem here, as most springs available from 'our' suppliers seem to use much thicker wire as their diameter increases. My spring is made



The stop block assembled and ready for silver soldering (Paul Clark)

from 18 gauge wire and came from a mixed pack purchased many years ago.

6.1 Guide bush

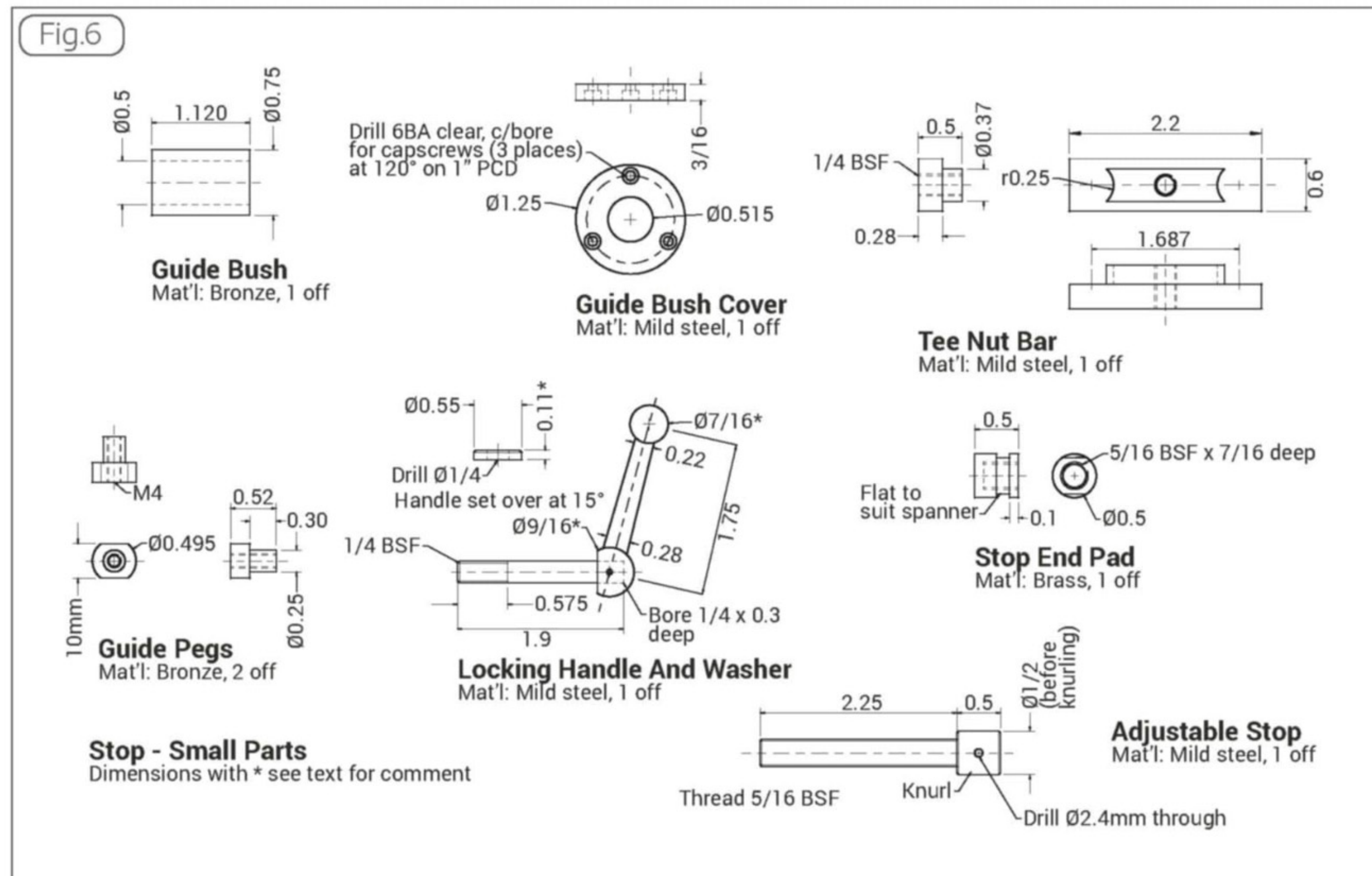
Although there shouldn't be any misalignment if the drawings and guidelines have been followed, I have included the floating guide bush to hopefully eliminate the effect of any minor misalignment.

The bush has been designed to allow for a small axial movement of 0.005" in the housing, together with a radial movement of 0.007" maximum deviation from centre line. It is a straightforward turning job.

6.2 Guide bush cover

This part can either be made from steel bar or cut from a piece of 3/16" plate. I would normally make an item such as this from steel plate, with the three holes for the 6BA capscrews being drilled and counterbored to match the stop body on a 1" PCD. I would also drill the centre hole to match a standard mandrel that I have 'in stock' (I never throw these away as they can be useful) - around 3/8" would be ideal.

Now that the holes have been drilled the part can be sawn from the main steel plate and the corners trimmed using a hacksaw



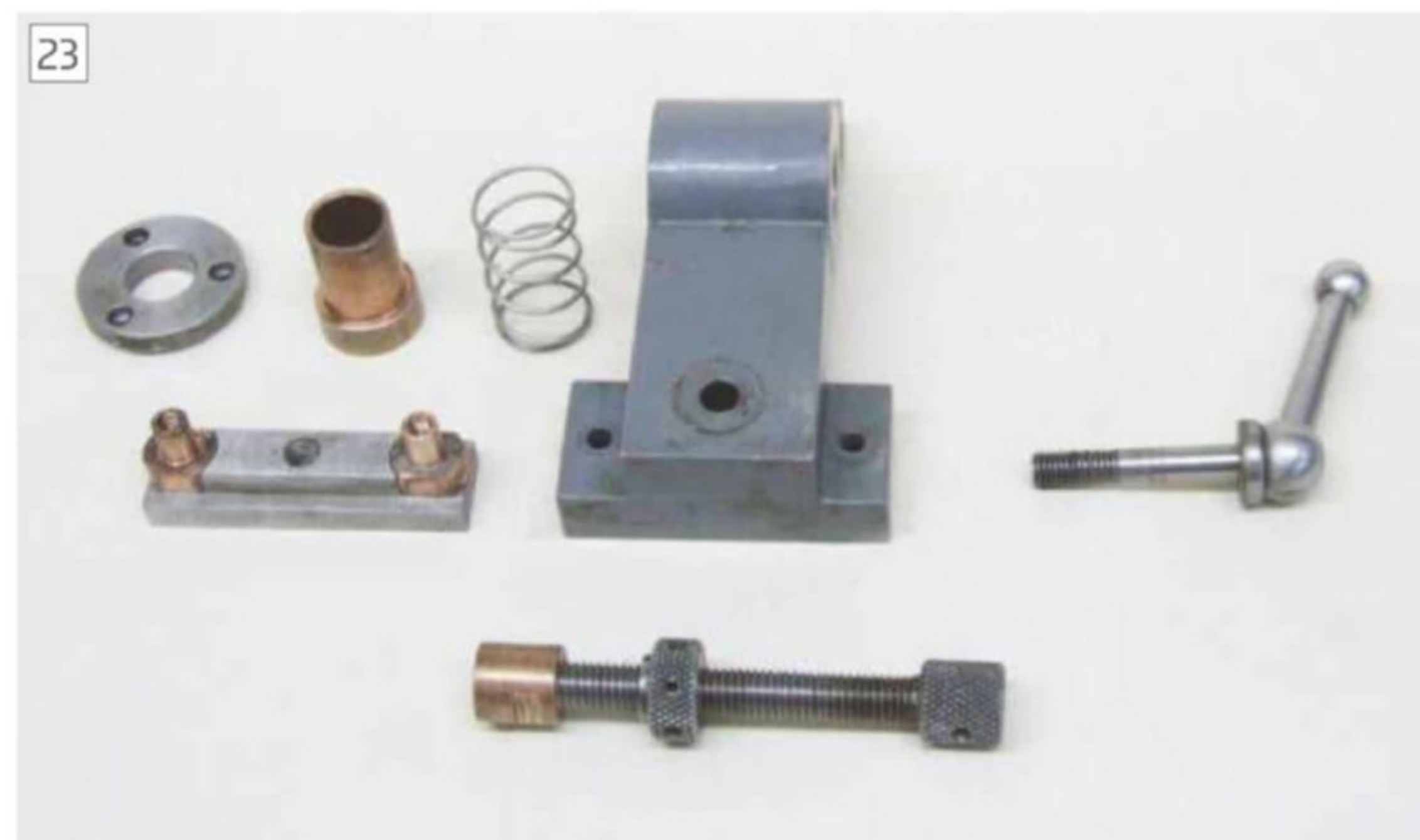
to reduce the impact of interrupted cuts. Following on from this it can be mounted on the mandrel and the diameter cleaned up to 1.25". All that remains is to remove it from the mandrel and hold in a 3-jaw chuck to bore the central hole out to 0.515". Job done!

6.3 Tee-nut bar

Before we start milling the steps in the tee-nut we must mill the raw material to the size to give clearance within the tee-slot. For the tee-slot as drawn the material needed is 5/8" x 1/2", with the 5/8" dimension reduced to 0.60" to provide some clearance within the tee-slot.

From now on this is made just like a standard tee-nut, except that it is 2.2" long. The important point here is that the two faces which actually clamp in the tee-slot are in the same plane. This is easily achieved if the material is held in a vice and both clamping faces machined at the same depth setting without removing the material from the vice. If your vice doesn't have recesses in the jaws, then you could use parallels to achieve the same result. **Photograph 24**, taken for another project, shows the milling operation under way.

Before removal from the vice the central 1/4" BSF hole should be drilled and tapped to ensure that it is perfectly square to the clamping faces. This is also an opportunity to provide the recesses for the guide pegs by milling away the central part of the tee using a 1/2" end mill, as shown in **photo 25**. The tee-nut bar can now be removed from the vice and deburred.



The stop block and parts

6.4 Guide pegs

The guide pegs are made from bronze bar and are designed to locate the stop assembly in the mounting bar. This requires that they should be a close fit in both stop body and tee-slot.

To make them, chuck a length of 1/2" phosphor bronze and skim the diameter to 0.495" to provide just a slight clearance when guiding the tee-nut bar - this will locate the tee-nut bar without any binding. Now face, drill and tap for M4, and then turn the 0.250" diameter to 0.30" long. I tapped M4 because I wanted to use button head screws for neatness.

Now move the material to an indexing

head on the milling machine and machine the flats to provide a smooth sliding fit in the mounting bar slot. There should be an equal amount of material removed from each flat face. This should apply to both pegs, otherwise the stop assembly may not maintain squareness with the mounting bar. Return to the lathe and part off and then reversing in the chuck and facing back to an overall length of 0.520".

Repeat the process for the second guide peg. **photo 26** shows the guide pegs fitted into the stop body, whilst **photo 27** shows their relationship with the tee-nut bar and how they stop it from turning.



Milling the clamping faces on the tee-nut



Machining the recesses in the tee-nut bar (posed)



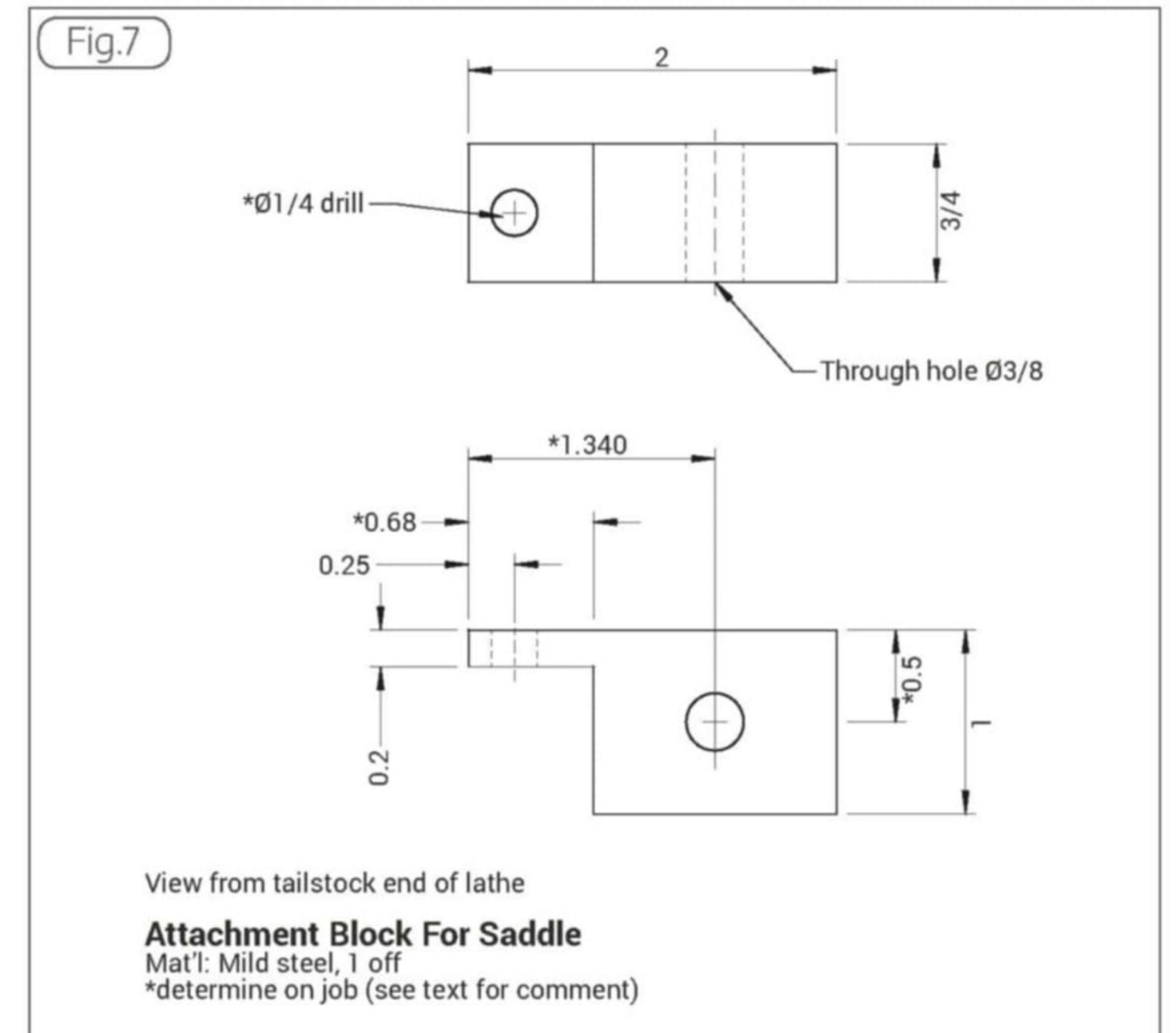
The guide pegs have now been fitted to the stop block, shown with the tee-nut bar



The tee-nut bar and ball handle have now been assembled

with a captive stud and the handle is then oriented by changing the thickness of the washer. A tip: turning the tee-nut bar through 180 degrees can help to overcome any major misalignment of the handle.

Just one further comment on ball handles. One of the problems with the Radford style ball turning tool is that as the ball being turned gets smaller the slide on the tool extends more towards the chuck, meaning that when turning a smaller ball the material has to protrude a greater distance from the chuck, which is not good practice. I made an ER32 collet chuck which is only 2" diameter rather than the 4" diameter of my 3-jaw chuck. This allows the slide to clear the body, so removing the conflict. With this arrangement there is no need for the material to protrude any more





The machined attachment block for the saddle before drilling the hole for the stop rod (Paul Clark)



Marking the hole position for the stop rod in the attachment block on my machine (posed photo)

than is required by the ball design.

6.6 Adjustable stop

This item is best made at the same time as the Length Screws (item 3.1) as it is identical apart from the thread length.

6.7 Stop end pad

A nice easy part to make. Chuck a length of 1/2" diameter brass and then face, drill and tap 5/16" BSF by 7/16" deep max. Now transfer to the indexing head and machine the flats to suit a spanner of your choice. (I chose a OBA spanner at 0.413" across flats measurement). Finally, transfer back to the

lathe to part off and then clean-up the flat face if necessary. That's all there is to it.

Attachment block for saddle (fig. 7)

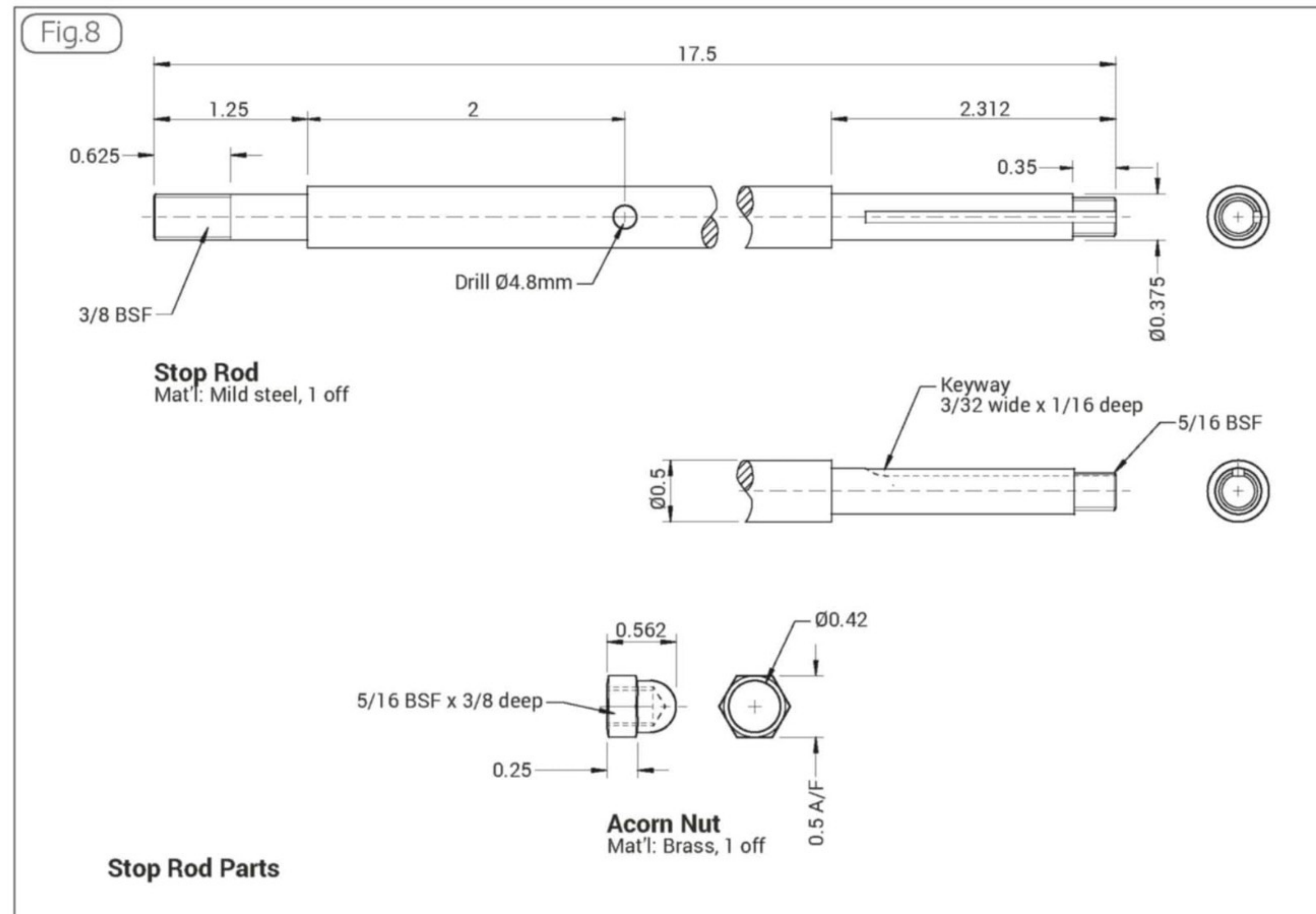
7.1 Attachment block

I made my attachment block from a 2" length of 1" x 3/4" mild steel, where you will see that Paul has used 1" x 1" section (presumably the remains of a 12" length from which he made the mounting bar). It is not that important which section you use, but you will have to compensate by increasing the length of the stop rod at the attachment end if using the larger material. The important point here is that there are

several dimensions marked with an * which will probably be unique to your particular lathe. Certainly, some of Paul's dimensions were different to mine.

When drilling the attachment block for the screw holding block to saddle casting it should be a good fit to prevent any fretting when the attachment is in use, which could cause inaccuracy. The saddle is tapped 1/4" BSF on my machine, but best to check your own.

Photograph 28 shows Paul's lathe with the attachment block fitted prior to marking the hole position for the stop rod, and you can see that he has achieved a nice



The completed stop assembly

snug fit in relation to the saddle casting.

The remaining operations on the attachment block are to mark out and drill the hole for the stop rod. This is aided by 'spotting' the hole position using the guide bush and punch shown on the drawing fig. 9. The guide bush and punch are shown in use in photo 29, where the hole position in the attachment block is spotted using the stop unit as a guide. This photograph shows a posed picture of my attachment block. You will see an open-ended slot and threaded hole on the top face of this block - this is for fixing my coolant pipe to the saddle, bearing in mind that this was the intended use for the tapped hole in the saddle.

All that remains now is to drill the hole to attach the stop rod, ensuring that the hole is square to the face of the attachment block.

Stop unit final assembly

We can now complete the assembly of the stop unit by adding the guide bush, guide bush cover and adjustable stop, which is all very straightforward. The completed assembly is shown in photo 30.

Stop rod and details (fig. 8)

8.1 Stop rod

The stop rod is made from a length of 1/2" diameter mild steel which has reduced diameters and threaded portions at both ends for attachment to the saddle and turret.

The 'turret end' also has a keyway for the indexing hub which is best machined using a Woodruff cutter as shown in photo 31, where either a number 304 or 305 would be ideal. I personally don't like using small diameter slot drills as they are easily broken (and expensive). I used the indexing head to hold the stop rod for this operation, but any means of holding the rod in a true horizontal position would be acceptable.

At the saddle end the stop rod just has a plain section and a 3/8" BSF thread for a standard nut. It also has a 4.8mm hole drilled in it a couple of inches away from the reduced diameter. The position for this is not critical as it is only used for orientating the turret against the adjustable stop when installing



Milling the keyway on the stop rod using a Woodruff cutter (posed)



The completed keyway and acorn nut

the unit on the lathe. Ideally this should be in the same orientation as the keyway to make alignment of the stops easier.

8.2 Acorn nut

I made an acorn nut for the turret end of the stop rod, just to provide a little hand protection from the end of the stop rod. They are easy to make from hexagon brass

bar (1/2" A/F in this case). Simply chuck the hexagon bar and face, drill and tap, following which the 'nut' can be parted off. To form the spherical form on the end of the nut it is screwed onto a simple threaded mandrel and the ball-turning attachment used to produce the form.

Photograph 32 shows the finished keyway and the acorn nut.



An alternative view of the multi-stop unit

Assembly and removal

Before we attach the saddle stop to the lathe, I've included one final photograph, **photo 33**, showing an alternative view of the assembled unit for reference.

To assemble the attachment onto your lathe is easy apart from locating the mounting bar on the back of the lathe bed. Here you are almost working 'blind' and may need to stand on your head. Once that has been done, we need to fit the stop unit onto the mounting bar and the attachment block onto the saddle.

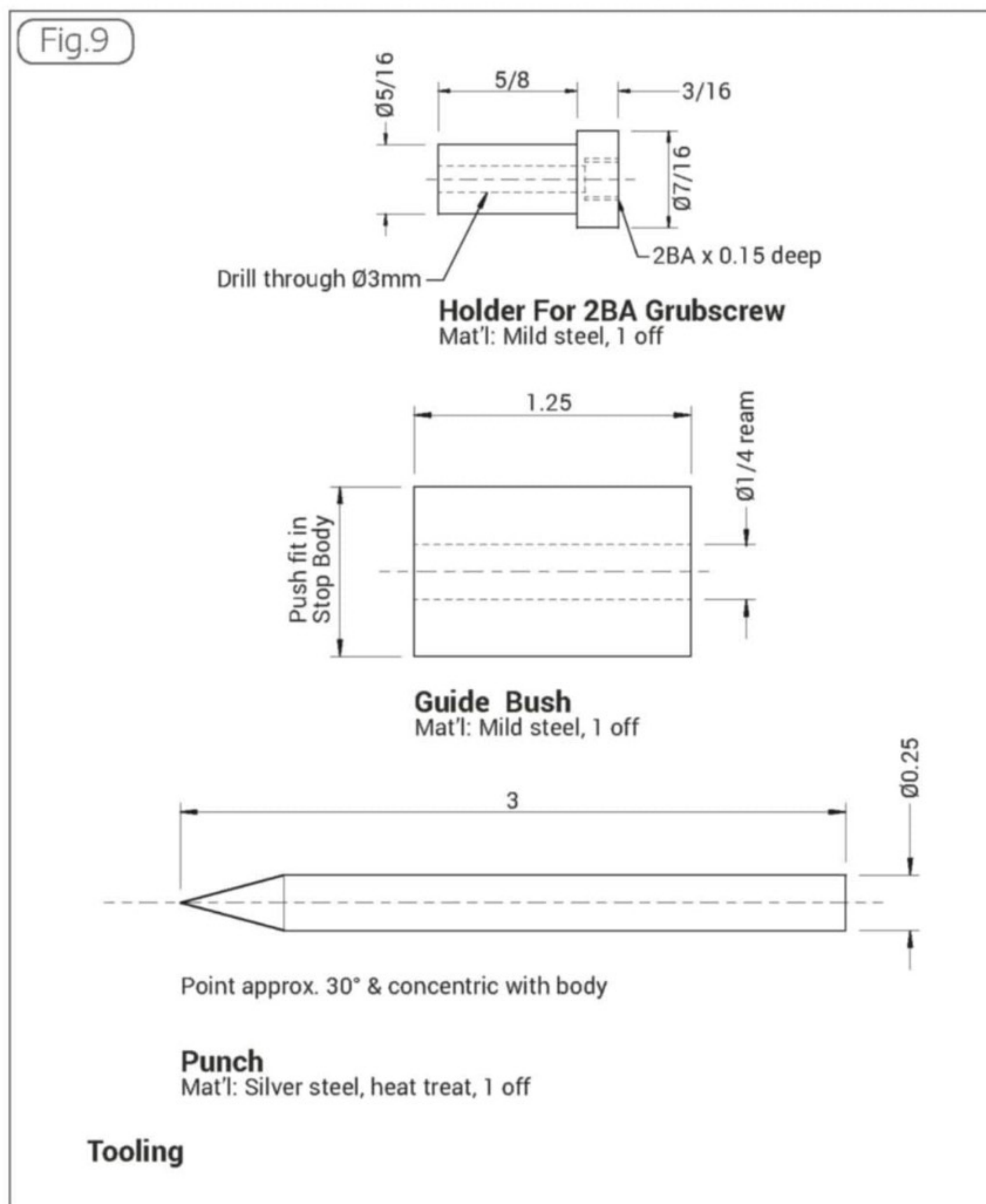
Now we can fit the turret to the right-hand end of the stop bar, doing the acorn nut up fully. The stop rod is then passed through the stop assembly and the end fitted into the attachment block.

All that remains now is to orientate the length screws on the turret against the adjustable stop on the stop assembly - this is where the tommy bar hole in the stop rod comes in useful. Once you are happy with the positioning of the stops then tighten the nut at the headstock end and your new saddle stop is ready for use.

If, for any reason, you need to remove the stop unit, simply remove the screw holding the attachment block to the saddle, unclamp the stop assembly and slide the whole lot off the mounting bar. Replacing it is just as easy, sliding the stop unit onto the mounting bar and then refitting the attachment block to the lathe saddle.

Final comments

Thanks go to Paul for supplying the photos that I couldn't, such as the stop body details before fabrication, and also for suggesting some minor simplification to a couple of items and for proving the figures. ■



Triboelectric Powder Coating for the Home Workshop

Part 2

Chris Gabel looks at a practical alternative to paint.

Curing the powder

Powder should come marked with the correct curing temperature. This polyester powder from Electrostatic Magic needed 10 minutes at 180 degrees C and the bag was labelled with that information. The oven was pre-heated. My first two samples were a sheet metal framing bracket and a mild steel ball handle, still attached to its stock material.

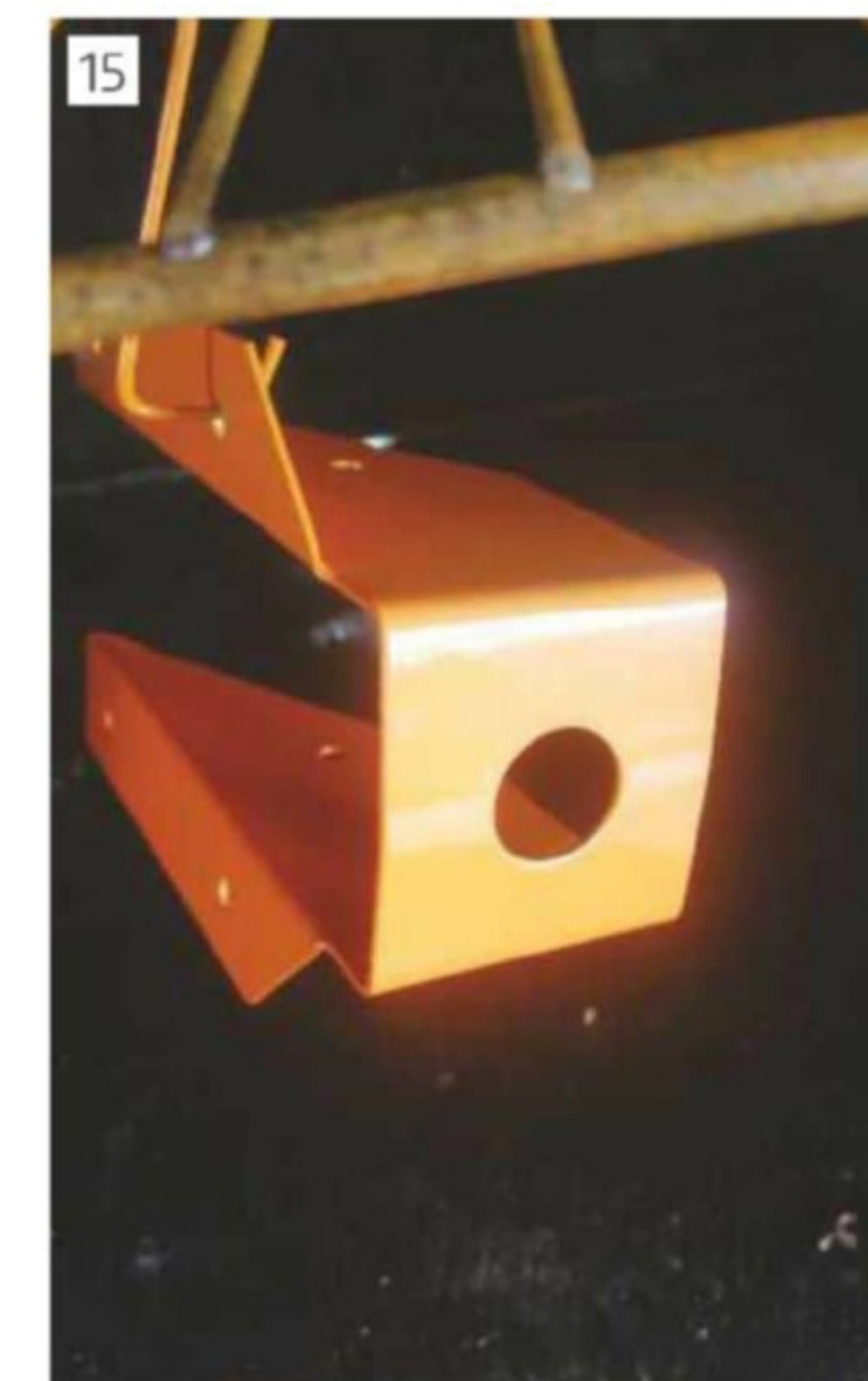
I found that the sheet metal sample quickly attained the oven temperature, but the heavier diameter 20mm piece took several additional minutes, **photos 15 & 16**. Timing starts when the coating is at 180 degrees C. This is also indicated by the powder acquiring a granulated look at about 110 degrees C as it starts to fuse.

Measuring target object temperature requires more subtlety than using the oven thermostat. The oven thermostat is situated at the right rear top of the oven cavity. This probably gives a good indication of fan circulated air, but powder coated objects of differing mass will require different times to reach the heat soak 180 degree temperature. The oven thermostat is ok as a general indicator, but it does not indicate the actual temperature of the work. For this an infrared Laser Thermometer works a treat. This is an excellent tool which reads emitted temperature at a distance. A laser pointer ensures you are reading the correct spot. From China they are around £5 with Amazon having them at £10, **photo 17**.

At the end of the required curing time, the oven is turned off and the part is allowed to cool naturally. When placed in the oven, the first fusing of the powder is obvious as it shows a textured granulated appearance. Some coatings and effects require two different powder colours, and it is suggested the work is removed at this granulated stage, the second powder is applied and then returned for full curing.

Cleaning

Powder can go everywhere. I have always been opposed to air blow guns in the workshop on safety grounds. They always had the ability to blast swarf and other bits in unpredictable directions. However, with powder it seems to be the only way to clean clothing and equipment in an efficient manner. Although the powder is not sticky, it does persist, and an air blast does dislodge it. Keep on wearing the dust respirator during cleaning too, photo 7 showed that if you have good grounding



Suspension hooks must not mar the powder coat.

and not too much air pressure, almost of the powder goes on the target object.

Compressed Air Supply

Compressor air quality and control is important. It needs to be dry and controllable. When you compress air, a characteristic of compressed air is that it can't contain the same amount of water

vapor as the ambient air if it is compressed to a smaller volume and cooled. The water is squeezed out of the air just like squeezing a sponge. The first solution is to have an in line regulator/water filter, **photo 18**. The drain is at the bottom and can be emptied while the system is pressurised. Cartridge moisture filters can be added right at the gun too. These are usually grapefruit sized pods which contain a desiccant to stop water vapor affecting the powder charge.

The powder gun I built requires air at about 5 to 6 psi. Some regulators have difficulty going that low. In order to achieve this a small valve and air flow gauge was also installed on the tail end of the powder gun, **photo 19**.

Note the red 16 gauge grounding cable with a bullet connector on the end. This enables easy disconnection to the grounding system.

Additionally, the air quality in your workshop is important too. The whole coating process is based on static charge. Damp cold workshops or garages with high humidity let the charge leak away and powder adhesion becomes poor, so aim for a workplace with a normal 50% relative humidity.

Triboelectric Powder Gun Construction

A powder gun body with valve could be fabricated from scratch without too much trouble, but stock spray guns of the type described below are inexpensive and easy to come by. I therefore decided to modify an off the shelf spray gun. The successful



Sheet metal and low mass items cure quickly.

ISSUE NEXT ISSUE **MODEL ENGINEER** NEXT ISSUE NEXT ISSUE

Steamy Weekend

Confession time for Geoff Theasby as he tells us all about his weekend in Sheffield.

Muncaster Engine

Jason Ballamy creates a set of columns for his stationary engine.

New Lanark

Roger Backhouse's latest Engineer's Day Out takes him to Arkwright's mill on the River Derwent.

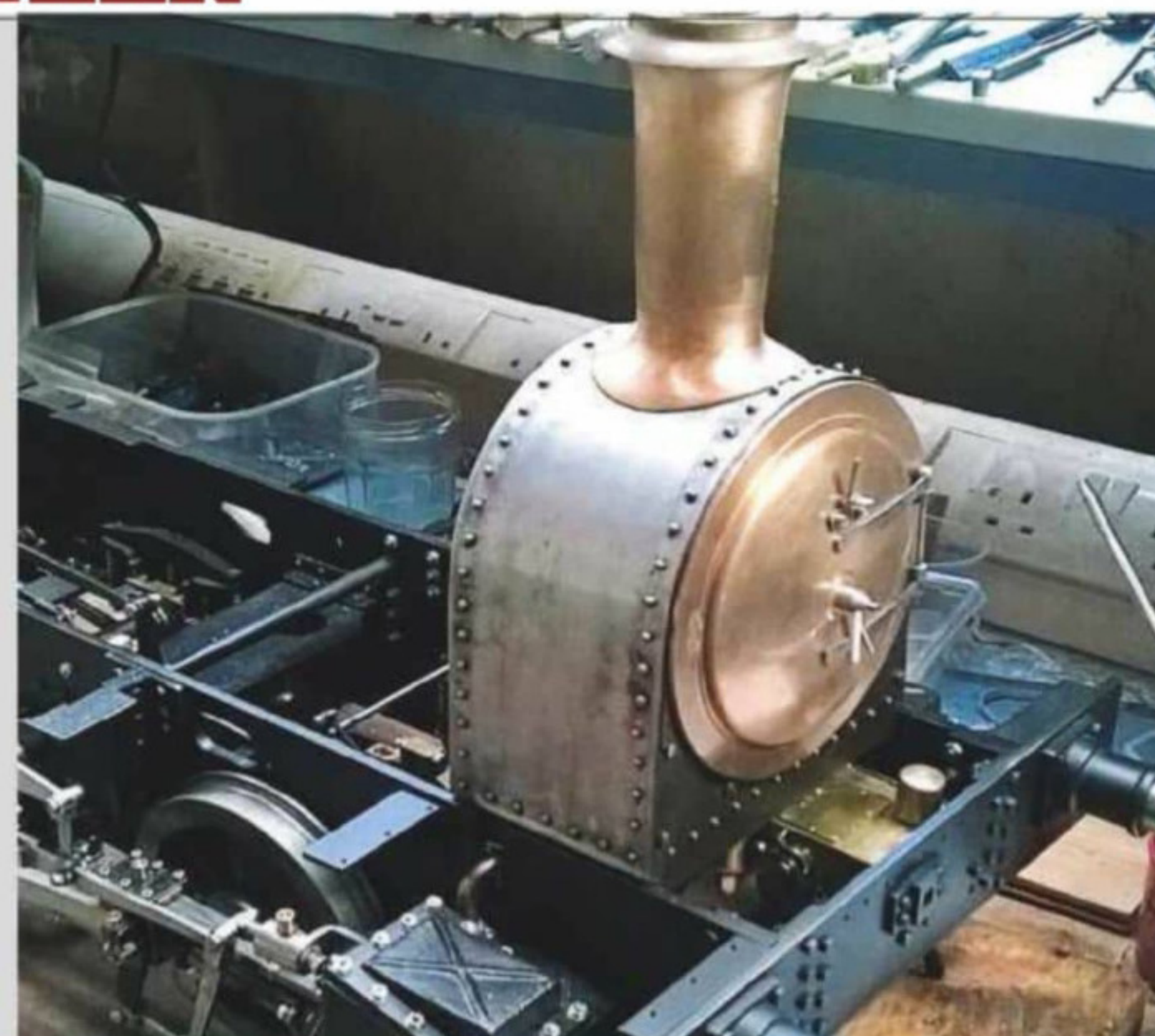
Beam Compass

Stewart Hart needed to draw some large arcs and so made a beam compass to do the job.

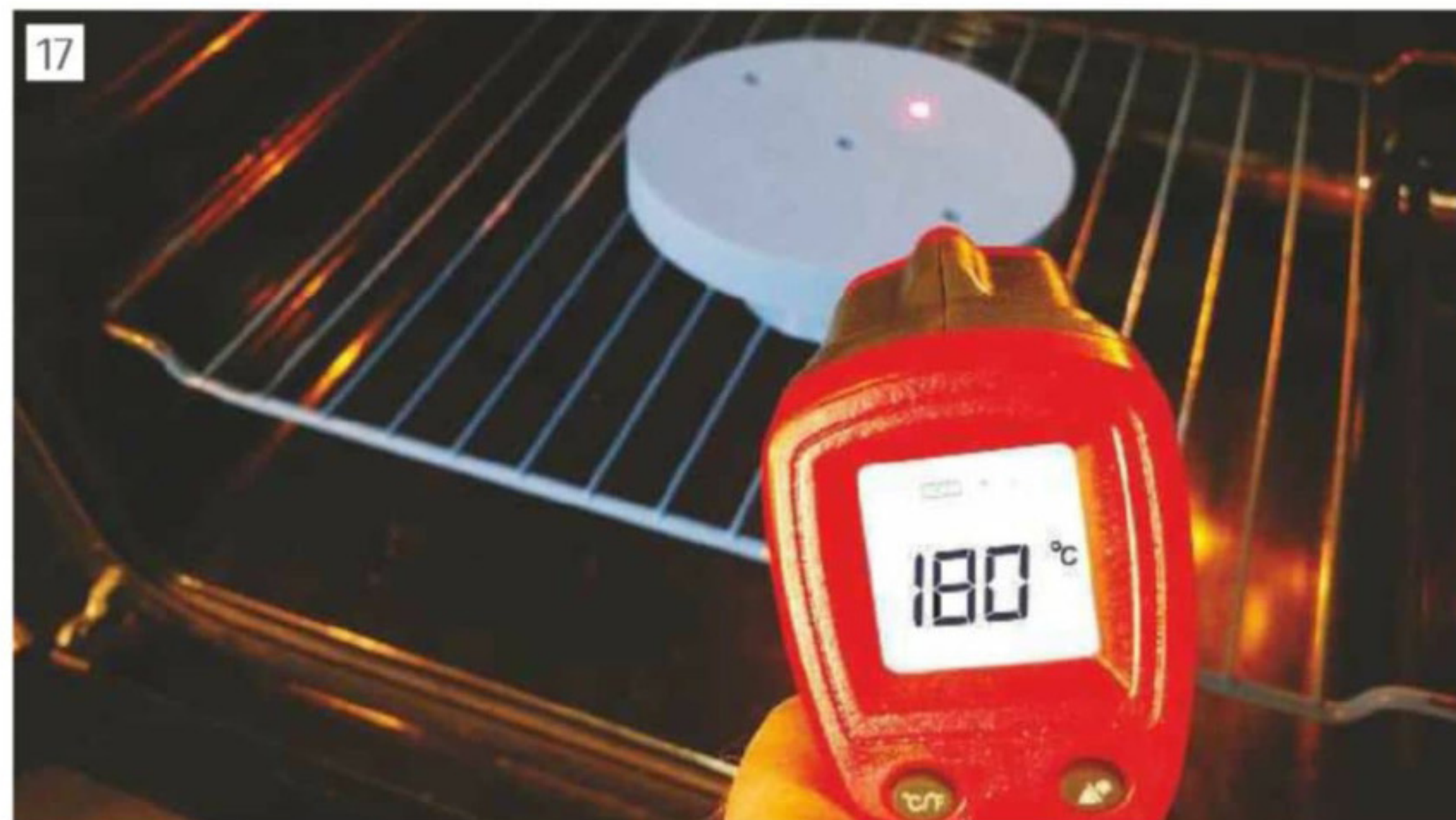
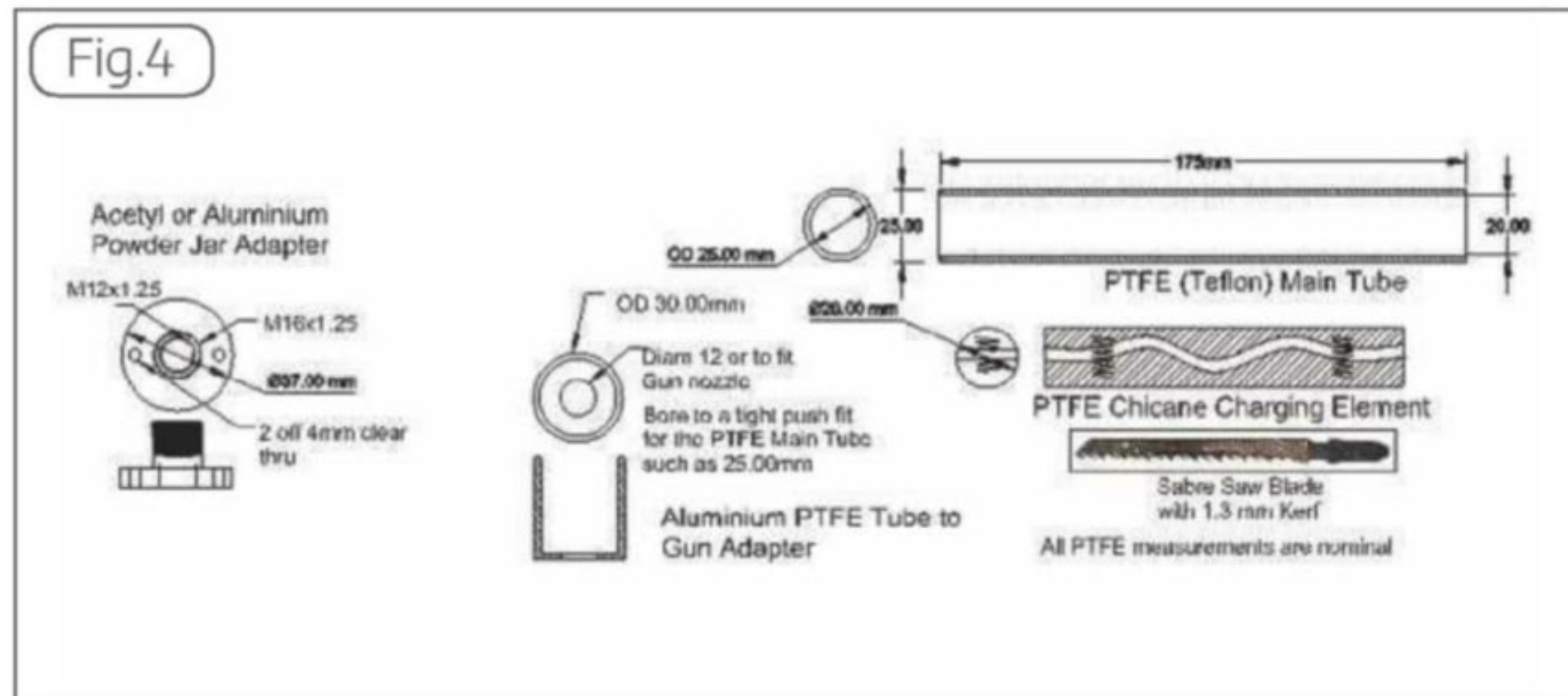
Bridget

Jon Edney constructs a 7¼ inch gauge Bridget, to Ken Swan's design.

Content may be subject to change.



ON SALE 16 AUGUST 2019



A Laser guided thermometer ensures proper curing.

build was based upon rebuilding an underbody coating gun, **photo 20**.

These are normally used to apply thick gooey black coatings to the underside of your car. This gun differs from regular paint guns in that it is designed to suck a viscous fluid from deep tall containers. It is a siphon feed gun with the container located underneath the gun body. The feed tube has an internal diameter of 8mm and the nozzle has an exit opening of 5mm. Modifications are simple with only two parts needing machining, in addition to the construction of the PTFE triboelectric charging section, **photo 21**.

First, the underbody can connector and dip tube need to be disassembled. The dip tube is to be reused, and the thread sizes on this connector cap needed to be measured. I found the connector cap readily unscrewed from the gun body, but the dip tube, although threaded, was held into the cap with adhesive as well. This adhesive joint was broken by heating the cap and tube to about 200 degrees C. Degradation of the glue was indicated by tell-tale wisps of smoke. The tube was easily unscrewed after that treatment. The underbody can connector needs to be replaced with a connector which joins a powder coating jar lid to the gun body, **photo 22**.

I made mine from acetyl round, but aluminium would work as well. The acetyl connector needs a tapped thread for the feed tube and an external thread to screw

into the gun. A plastic lid from the powder jar was drilled to accept the dip tube. The lid was fastened to the acetyl connector with two M4 screws. The tube was cut to length after bending it in a slight arc so the powder



A wall mounted air regulator and moisture trap.

would be siphoned from the corners of the powder jar. Very little clearance is needed between the end of the tube and the bottom of the powder jar. The second part was an aluminium cup connector which attaches the PTFE section to the nozzle end of the gun, **photo 23**.

This needs to be aluminium, as it serves as the grounding pathway for the PTFE section as well. The dimensions for this are dependent on the diameter of the PTFE main tube. I wanted this to be a press-fit for the tube, to enable disassembly for easy cleaning. Machining PTFE is different. It is highly compressible and can change dimensions after machining. It also changes with temperature. An easy fit in the cold workshop became a difficult fit in the warm house. So "cut and try" works better than trying to machine to .01 of a millimetre. The material is also soft. Placing roller bearings on my steady rest stopped marking the surface. An adjustable reamer worked well in arriving at the internal bore diameter.

The PTFE/Teflon material is what imparts the charge to the polyester coating powder. The powder needs to pass close by PTFE surfaces at the correct velocity. Looking at the original patents, and YouTube videos of DIY triboelectric powder guns, it is apparent that forcing the powder down a narrow gap between two adjacent PTFE surfaces is the preferred method. Indeed, it appears that two thin sheets of PTFE with a concertina fold pattern seems to do the job and is used in many commercial designs.

My approach was different. I set out to make the whole charging unit out of PTFE round stock. I purchased two lengths of PTFE, one of 20mm diameter, which would make the charging elements, and one of diameter 25mm which would make the main



A Gun mounted flow control and bullet ground connector.



An underbody coating gun.

tube and would hold the element.

The core charging element would have a dimension of 20 x 120mm long. This was chosen on economic grounds. The chicane or concertina shaped path needed to be cut through the length of the PTFE section. I originally tried using a 2mm sintered abrasive tile cutting blade, the kind held in a saw frame. This gave an unacceptable rough cut. The second method was to use an electric hand jigsaw (sabre saw). The blade was 6mm wide and had a kerf of 1.3mm. The PTFE stock was held in the vice. A Sharpie was used to mark a suggested cutting line. This worked well giving a surprisingly even cut. Irregularities were carved away using a Dremel cone shaped bur.

The springs are 7.5 diameter by 15. The hole in which to seat the spring was Diameter 7mm by 8 deep. The spring can



Main connector for PTFE tube.



Components for the siphon feed powder gun.



Powder Jar connector detail.



Suggested chicane cutting path drawn on PTFE stock.

be screwed into the hole and is held quite firmly. The two halves could then be placed into the main PTFE tube. The springs created a tight fit and maintained the powder gap.

The main PTFE tube was bored on the lathe. The steady-rest with bearings worked well, **photo 26**. The PTFE is flexible as well as soft. The inner bore was finished to size using an adjustable reamer.

The Aluminium cup which is to hold the PTFE tube and charging element was bored just undersize to hold the PTFE unit by a tight hand press fit. The cup is held in place by the nozzle part screwing into the gun body. PTFE rod is irregular, so measure and machine to fit.

The gun was assembled with its charging element and the powder jar was filled to about a third full. The results were highly gratifying, with the powder exiting the gun and flowing to the target object with excellent attraction and good thickness buildup.

The scale of the objects being coated made little difference. Tiny items as well more massive shapes all coated well, **photo 27**.

In conclusion, I consider this a welcome addition to my workshop kit. I find the powder coating easier to use than paint. The lack of solvents and a short processing time are a plus. Keeping painted work dust free while drying is no longer a problem. I was surprised to find the process still worked in wintry conditions and look forward to assessing the technique in the dry hot days of summer.

Further work

My original idea was to use a low pressure high volume spraygun, **photo 28**.

This is quite a complex gun and will probably be appropriate, but considerable experimentation is yet needed to get powder flow and air distribution modified for use with powder.

It is hoped to produce a gun with an acetyl tube, and radial charging element, but with non-destructive modification which would enable the gun to easily be restored to normal use. ■

Suppliers

Triboelectric Systems and Powder:

- Electrostatic Magic, Nottingham.
 - Nordvic Pulver, Denmark Eastwood
 - "Hotcoat" Corona System:
 - UK distributor Frost Restoration, Warrington
- (Note that Triboelectric and Corona powders are not necessarily interchangeable).

Plastic Acetyl and PTFE stock:

- Available from a number of our advertisers.
- 250 or 300ml PET jars with lids used for siphon powder jars
- The Plastic Bottles Company, Ulverston

Kapton Tape:

- Easily found online, also from Electrostatic Magic



Completed charging elements with springs.



A steady-rest with bearings is helpful.



Small parts coat well with this process.



Gravity spray gun, a work in progress.

PRO MACHINE TOOLS LIMITED

Tel: 01780 740956
Int: +44 1780 740956

EMCO

1885 WABECO 1885

CERIANI

TECO

GOLmatic
Maschinenbau

EMCO
Hobymaschinen

PROXXON

SWISS
tec
Since 1985

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



Wabeco
Mill
F1210

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



Wabeco
CNC Lathe CC-D6000

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



Wabeco Lathe
D6000

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



Ceriani Lathe David 203

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



TECO
Mill
VF400

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



Ceriani
Mill
David
403

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

TECO Lathe MD 200

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



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...



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

Lathework for Beginners

PART 13 - TURNING

This ongoing series will build into a complete guide to using an engineering lathe. This month Neil Wyatt looks at some random advice for those developing their turning skills.

Sponsored by:
arc **eurotrade.co.uk**
UNBEATABLE VALUE ENGINEERING PRODUCTS



A selection of items parted off on a mini lathe.

Be Not Afraid

When I switched on my first lathe and took my first cut, I was really nervous. I'd never used one in school and the teachers had put off curious minds by telling us how dangerous they were. The more you use your machine, and the more experience you get the more confident you will become and the results you get will improve. Recently a forum user

showed results he got by sharpening some carbide tools. The results were very good in contrast to those he got when he started out with the same tools a year ago. The parting examples in **photo 1**, were done on a mini lathe, the bar at right is 1" in diameter and the parting tool was 3mm wide HSS one. The secret is not fancy tooling or a rear toolpost, but a well-set up lathe, cutting fluid and the confidence to

make a proper cut rather than 'prodding' the work.

Obviously use common sense and don't just plunge tools into the work willy-nilly, but do remember that carbide tooling of all kinds needs to be made to work – "keep up the feedrate", as Tubal Cain used to say!

Familiarity Breeds Contempt

The flip side of this is that, hopefully, every



Polycarbonate safety shield.



Ear defenders and ear plugs.



Standard goggles can be used over spectacles.



UVEX produce many lightweight but effective designs of goggles.

time you use your lathe nothing dramatic or dangerous happens. Unfortunately, the consequence of this is that we can become complacent, but MEW doesn't want to lose readers, any more than you want to lose fingers or eyes... so no apologies for a few reminders about safety:

Chuck guards are chiefly there to stop you starting the lathe with a key in the chuck, rather than protecting you from rotating work. In fact they are typically removable so you can attach large work and accessories like faceplates. But do get in the habit of replacing them afterwards.

So what about guarding the work and protecting yourself from spraying chips and coolant? Let me remind you of my simple solution, a sheet of polycarbonate attached to a magnetic base – it's the easy to use guard that gets used and can serve for lathe or mill, **photo 2**.



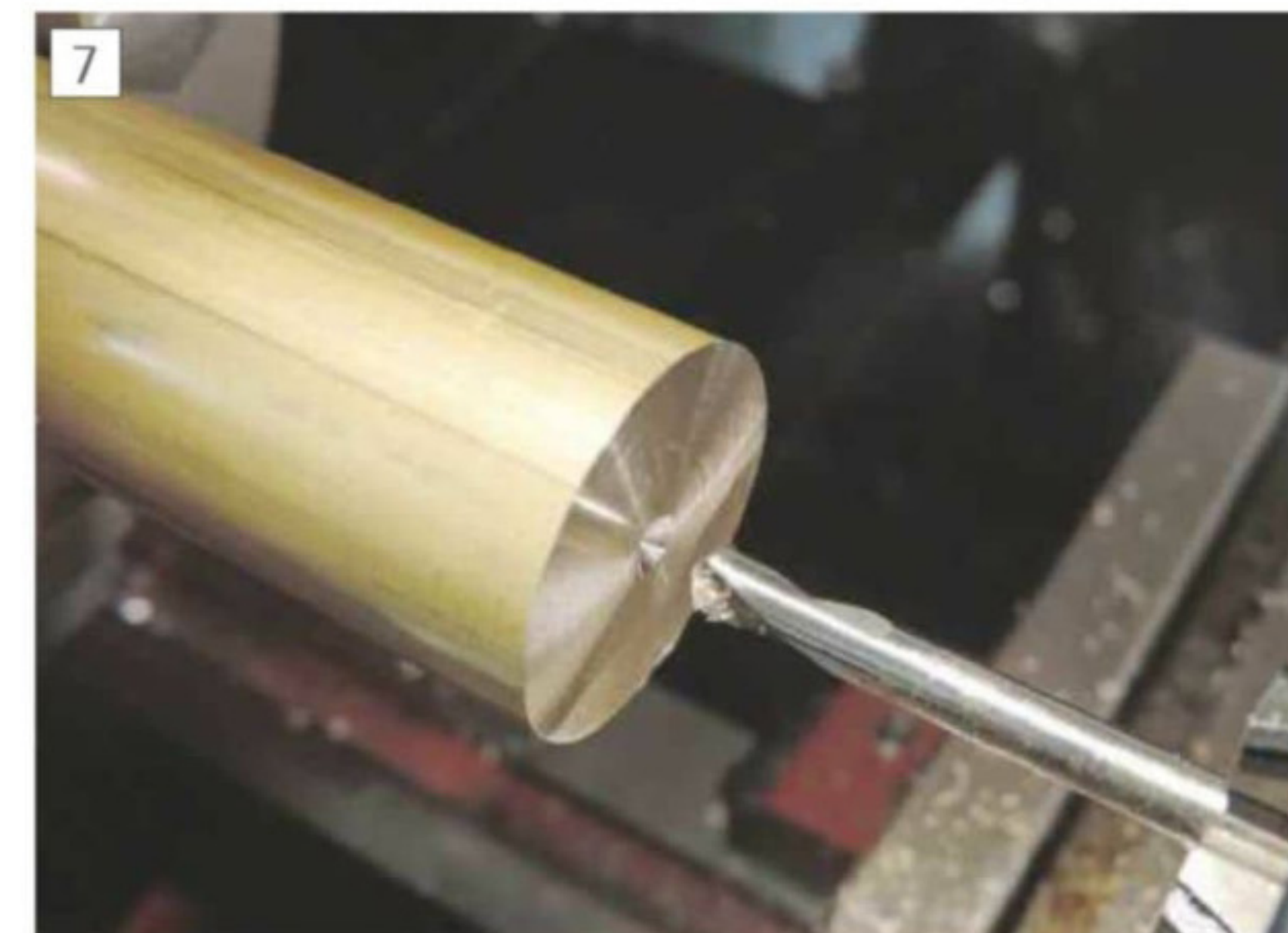
Centre drills, the bane of many a workshop.

Noise isn't normally an issue for turning, but sometimes a hollow tube or similar can ring like a bell (or even shriek...) Often a change of speed can help, but if not use earplugs or ear defenders, **photo 3**.

Most importantly, protect your eyes, especially important when working copper alloys as those chips get everywhere and being non-magnetic are a huge challenge to get out of eyes. My workshop contains half a dozen pairs of ordinary safety glasses, **photo 4**, so there's always one handy. But if you aren't a spectacle wearer and want something more comfortable, consider something like the Uvex sportstyle range, **photo 5**.

Centres and Centres

Bear in mind that centre drills are meant for putting in specially shaped holes to accept centre, that long thin, snappable protrusion



A stub centre drill or spotting drill.



Lathe bed protector, worth its weight in wood.



The credit card diamond sharpener.



Tailstock setting bar, used between centres with a dial indicator in the toolpost.

is just there to create an oil reservoir and stop the tip of the centre from bottoming out, **photo 6**. If you have a rotating centre, consider grinding the protrusion back to a stub so it's less likely to snap. For starting holes, proper spotting drills or 'stub centring drills' are much better, **photo 7**.

Make a Bed Protector

No apologies for mentioning this again! The effort involved in screwing a short section of square timber to the back of a flat bit of wood is minimal, yet over the life of your lathe it only needs to stop a heavy chuck bashing into the bed once to have earned its keep, **photo 8**.

Keep Sharp

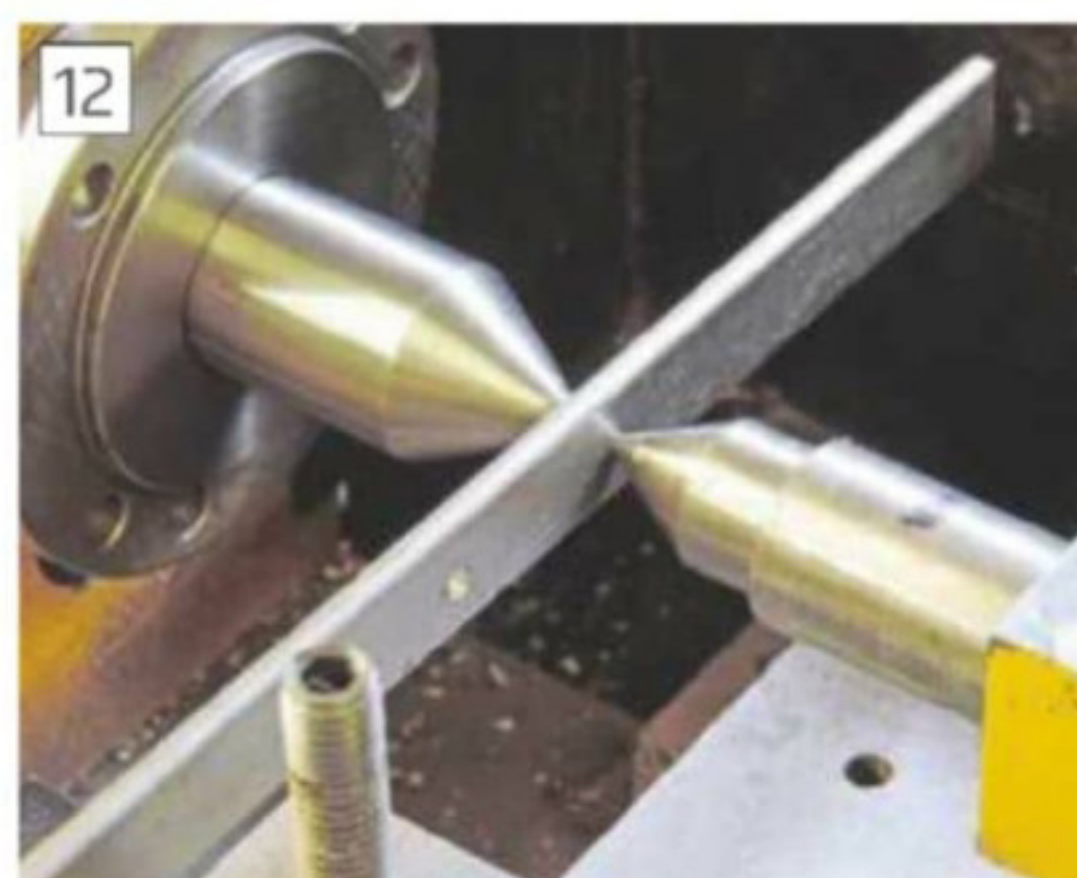
If you use HSS tools, always watch out for your tools losing their edge. The little 'credit card' diamond sharpener, **photo 9**, is always worth keeping to hand. A few strokes on the cutting face of a tool can restore the edge.

Quick Alignment

Most lathes allow you to offset the tailstock for taper turning or simply to achieve the greatest accuracy. If you are turning longer objects and need taper-free results then you will need to put in the effort to adjust the tailstock spot-on, refer back to the setting up aid I showed in part 6 of this series, **photo 10**. For quick and dirty adjustment, line up two opposed centres by eye, **photo 11**. If you want a slightly better alignment, drill a clean hole through a flat



The simplest way to set the tailstock in a hurry.



A little more effort gives a result good enough for most work.



Turning a balanced handle with thumb and forefinger.



Improvised boring bar.



Improvised running down tool.

bar. Adjusted so it's perpendicular to the lathe axis, as in **photo 12**, it will be good enough for everyday non-critical work.

Balanced Handles

Have you ever wondered why so many lathe handles have a little ball opposite the handle? These 'balanced' handles are not balanced by weight, but to allow you to use your hands to apply a 'balanced couple' to both ends of the handle as in **photo 13**. Practice this technique as it lets you turn a handle more smoothly to get a better finish when hand-feeding.

Be Inventive

Don't be afraid to try out interesting solutions to awkward problems, here are a few examples

Another challenge was boring out a long hole in an iron casting for a Potts Spindle. To get the required dimensional accuracy demanded boring it with the work on the cross slide and using the lathe as a boring machine. But the castings had a horrible, hard skin, even in the cored hole. Back then I didn't have a carbide boring bar, so I improvise the solution in **photo 14**, using the 4-jaw chuck let me offset the tool. Obviously with such an overhang the tool vibrated and finish was horrible, but I got under the skin and was able to finish the task with a hefty HSS boring bar.

One challenge I faced some time ago was making a lot of 10BA studding. I



Adaptor requiring shortening.

had some TIG welding rods that took a passable thread from a die, but only if it was reduced in diameter. This promised to be a long job as I could only turn down short section at a time before it 'rolled over' the top of even a very sharp tool. The solution was a bar in the toolpost with a hole for the rod. The challenge then became aligning and securing the cutting tool, but fortunately the exact diameter wasn't critical as the thread would be formed by the die, **photo 15**. A permanent and more elegant solution would be a proper running down toolholder with an adjustable tool and interchangeable bushes for different diameter rods.

Recently I offered to shorten an adaptor for someone, but neither of us had realised it was threaded internally

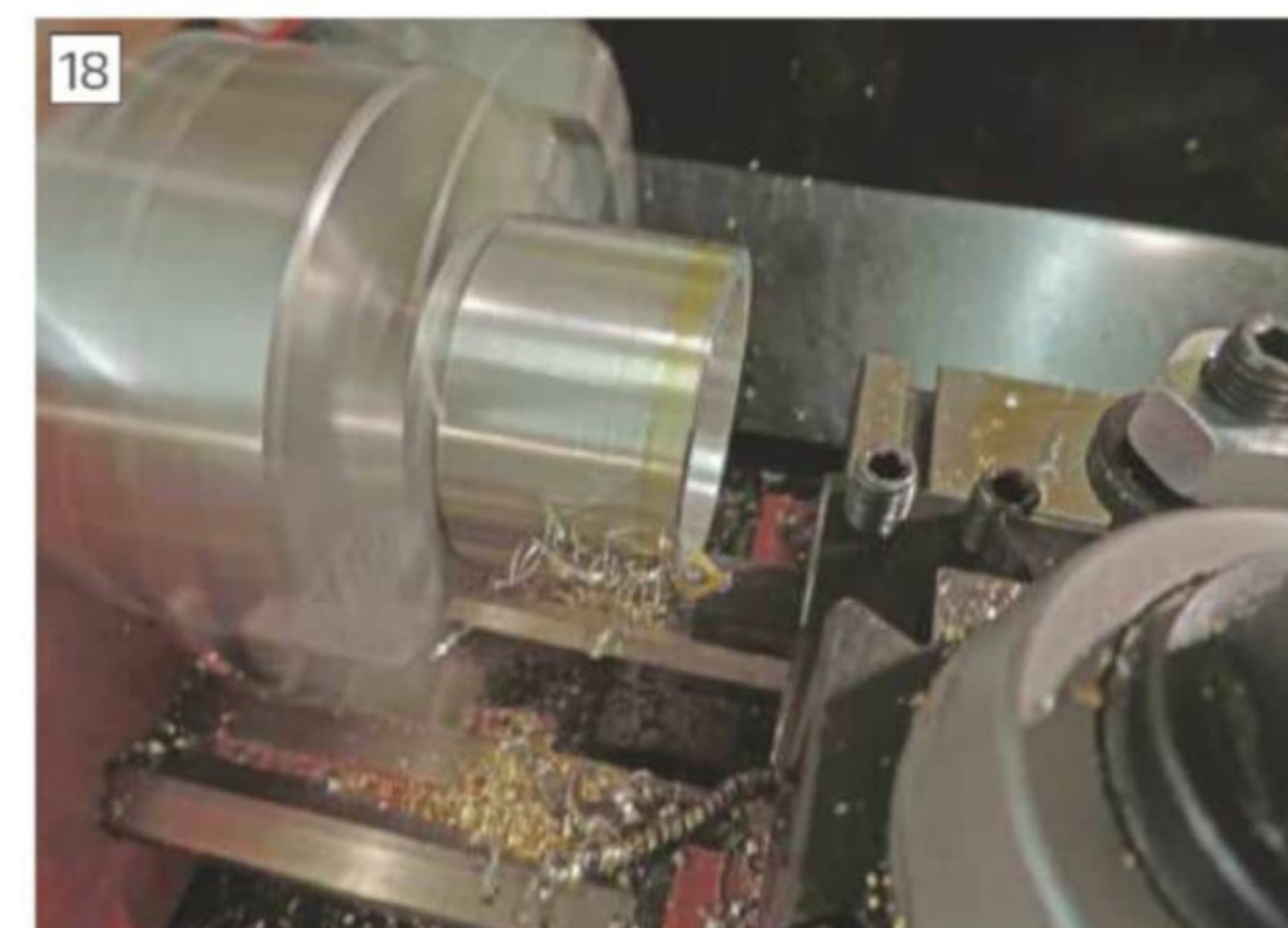


Parting the end off the adaptor, thread protected by a screwed ring.

as well as externally - meaning that I couldn't hold it easily by the threaded end. Merely wrapping a soft shim around the external thread was an option but wouldn't guarantee security for a heavy parting operation on the overhung part. I could have made a hefty threaded mandrel, but I had an aluminium tube just the right size to make a threaded ring that fitted securely and could be held in the chuck, **photos 16, 17**.

Tools Don't Need to be on Centre Height

Don't get me wrong, most tools work best at, or near, to centre height, but there are times when you can break the rules. When I needed to chamfer and face the adaptor, it was an obvious task for a 90-degree TCT insert tool aligned with the axis of



Chamfering the end.



Internal chamfer with tool raised well above centre height.



Various tiny toolbits from HSS.



Tiny internal threading tool.

the lathe, **photo 18**. But in practice, the internal chafer wasn't possible because the base of the tool fouled the work. One solution would be to grind away part of the toolholder, but I wasn't quite ready to mess up the tool for one quick job. The simple solution was to raise the toolholder about 10mm in the QCTP, **photo 19**. The tool was now not set optimally, but quite capable of giving a decent finish to a light chamfer.

HSS is Your Friend

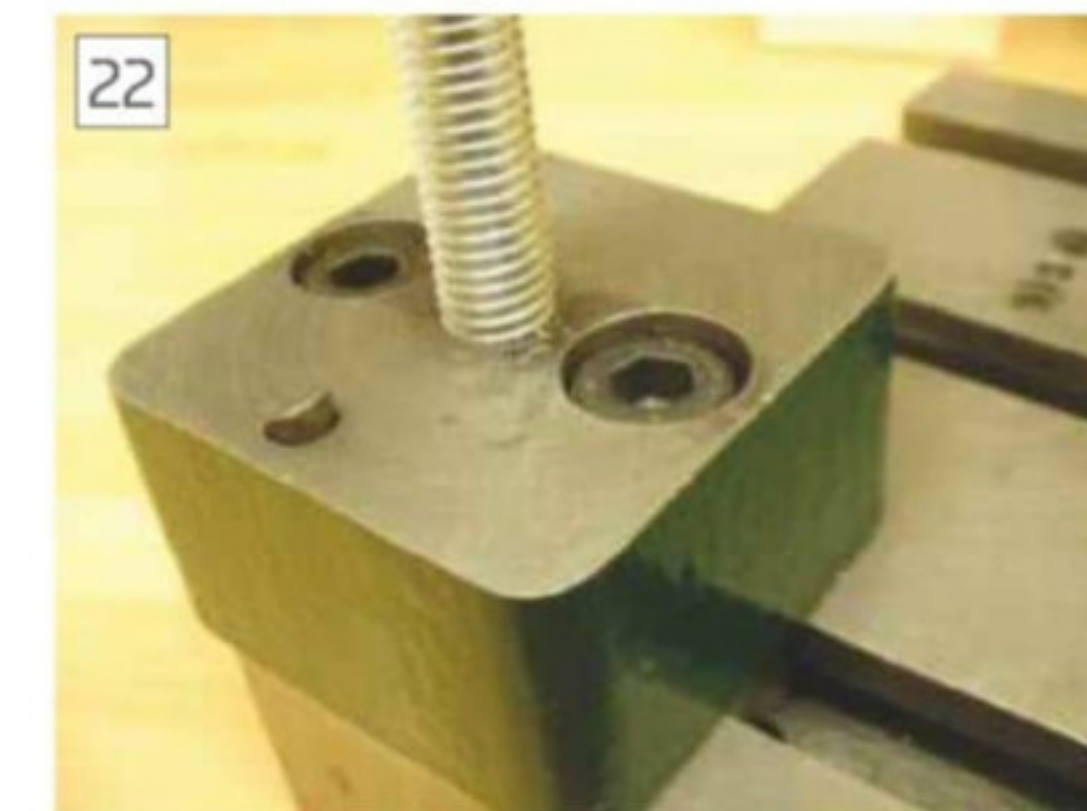
I am a fervent convert to indexable carbide tools, but I am not blind to the big advantage of HSS - flexibility! HSS is available in many sizes, typically square or round, and readily ground to make different tools. Those broken centre drills are also a ready source of small bits of HSS...

Photograph 20 shows a selection of 1/8" (3.2mm) square HSS toolbits, these were all ground to allow me to turn the rather critical internal shape of an ER25 closing nut. All used in a 3/8" boring bar, A is a square ended grooving too, B and C are right and left hand internal knife tools and D is a screwcutting tool. I wouldn't repeat the exercise, having found how cheap it is to buy the ready made nuts!

The tool in **photo 21** is an internal threading tool ground on the end of some 3/16" hss. It may look crude but this is my go-too tool for creating 1mm and 0.7mm pitch threads.

Solid as a Rock

A recent forum query asked about Tubal



A smaller alternative to the Gibraltar Toolpost - perhaps the 'St. Michael's Mount' version?

Cain's 'Gibraltar Toolpost', a massive replacement for the standard compound slide on his Super 7 lathe to give extra rigidity for tasks such as parting and using form tools. For most lathes a simple alternative is a simple block of cast iron or steel, about 50mm square. This needs to be fitted with a suitable stud for mounting the toolpost and a suitable arrangement for attaching it to the cross-slide. My version in **photograph 22** has the additional refinement of a hardened detent for indexing a four-way toolpost.

And finally...

Never throw anything away! **Photograph 23** shows

some of my collection of small mandrels, each of these is marked with a dot opposite number 1 jaw, so they can be re used, a huge timesaver and a good use for offcuts. I can always turn a new one up when I need perfect concentricity. ■

Arc Euro Trade

The various accessories featured in this series including a wide range of toolposts for mini lathes and the featured Arc SC4-500 lathe are available from Arc Euro Trade.



A random collection of mandrels.

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/MsInitialSurname
 Address
 Postcode Country
 Tel Mobile
 Email D.O.B

I WOULD LIKE TO SEND A GIFT TO:

Mr/Mrs/Miss/MsInitialSurname
 Address
 Postcode Country

INSTRUCTIONS TO YOUR BANK/BUILDING SOCIETY

Originator's reference 422562 
 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 MEW0919P on the back
 Cardholder's name
 Card no: (Maestro)
 Valid from Expiry date Maestro issue no
 Signature Date

TERMS & CONDITIONS: Offer ends 5th September 2019. 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 or by post. We do not share or sell your data with third parties. Details you share with us will be managed as outlined in our Privacy 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 MEW0919P

**HURRY
OFFER
CLOSES**

5th September
2019



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**

MODEL ENGINEERS' WORKSHOP

Get your favourite magazine for less, delivered to your door when you subscribe today!

Model Engineers' Workshop is ideal for enthusiasts who operate a home engineering workshop for both model construction or to support an engineering related hobby. The magazine covers machine and hand tools; accessories and attachments, materials and processes. It provides guidance on the selection, commissioning and use of tools and equipment. It is the essential guide for any workshop.



**SAVE 75%
ON DIGITAL
ISSUES****

TERMS & CONDITIONS: Offer ends 5th September 2019.

**This digital discount is only available when you subscribe to the 'Print + Digital' package. You can still get a great discount on the digital package, please visit the URL stated below for more information. Please see www.mytimemedia.co.uk/terms for full terms and conditions.

SUBSCRIBE SECURELY ONLINE

 <https://me.secureorder.co.uk/mew/MEW0919P>

CALL OUR ORDER LINE Quote ref: MEW0919P

 **0344 243 9023**

Lines open Mon - Fri - 8.00am - 8.00pm GMT & Sat - 9.30am - 3.30pm GMT.

Calls are charged at the same rate as standard UK landlines and are included as part of any inclusive or free minutes allowances. There are no additional charges with this number. Overseas calls will cost more.

**DIGITAL
SUBSCRIPTIONS
AVAILABLE ONLINE!**

Don't Let Broken Fasteners Break Your Heart

Howard Jennings offers some advice for lovelorn engineers...

Picture the scene – you are tightening or more likely trying to undo a screw, stud or bolt and that dread hits your stomach as the torque suddenly changes, it all gets easier and the head or stud just comes away. Horror! It always happens with an assembly/job that is near completion or has a great deal of time/money invested in it. This has happened to me personally quite a few times. In recent years dealing with vintage cars (1930's) I have been asked many times if I can remove bolts/studs that have broken into old castings etc. There is unfortunately no definitive solution to this sort of problem. I have found that each one is a special. However, I thought penning this article would assist newcomers and maybe there would be some ideas for the more experienced to carry away in the 'techniques to pull me out of the mire' toolbox you carry in your head.

Where to start?

So, it has happened, you have had the expletives session now what? My first advice is, if possible, come away from the job! Have a cuppa, gain thinking time, if possible, sleep on it. Hard personal experience has shown me that rushing at this sort of problem almost always makes things worse. If you have access to Electro Discharge Machining (EDM) and the cost/time warrants it, wonderful you are home and dry! I have no such access, so I have had to resort to some more crude approaches using the machines I have.

Off the shelf tools

The first tool that has to get a mention is the stud extractor, **photo 1**. As you can see, I have a decent SKF set. However, I cannot remember one occasion when I have had success with this sort of tool. I don't know why I have stuck to the rules drilled the correct size hole, but they never seem to deliver. My main experience here is to pay close attention to how you drill the hole. The broken end of the fastener will be uneven, if you can, set up on a milling machine or make up a drill guide. Then carefully drill in starting with a centre drill if at all possible. Some 'dragging' around



Stud Extractors

of centre drill I find necessary to find the centre of the broken fastener will almost certainly be needed. Remember you can be fooled by the thread as you only see part of it and this can make it appear that the centre of the broken fastener is where it isn't! This can easily result in drilling into the thread and so things get worse. When you have drilled the right size hole for your stud extractor, insert the right size, I tap them in with a hammer and gingerly start to try and turn it anti clockwise. If luck and the gods

There is unfortunately no definitive solution to this sort of problem. I have found that each one is special.

of engineering are with you the broken fastener starts to turn and you breathe a sigh of relief, you chuck the offending bit of thread in the scrap bin and move on.

So, it hasn't worked, what next? A few years ago, I noticed that Tracy Tools (no connection) were selling some left hand fluted drills. I bought some as an add on to an order. I put them away and nearly forgot all about them. Then two broken stud jobs just appeared from nowhere. You will have noticed, **photo 2**, the left hand fluting on the stud extractors the left hand fluted drills work in same way. But the big difference is that they drill in and cut left handed so if your broken fastener wants to move it just unscrews itself trying to resist the torque of the cutting action. Of course, your machine has to run in 'reverse'. This is so much easier these days with electronic control. If you are struggling on a broken fastener on a job that has to be done away from the workshop then the high torque battery powered gun drill is a god send as they always run in reverse. I cannot over emphasise again how important careful centring of the drilling is and the use of a drill guide to get the drill to go in straight.

I have had very good and satisfying results with the above left hand drill technique. Usually the broken bit of fastener releases suddenly unscrewing itself a bit like a flag going up telling you 'you have won'!



The Arc of triumph

Sometimes the head of the fastener breaks off and leaves a part of the original fastener sticking up proud of the face. This to me is good news and my favourite broken fastener removal technique swings into action. However, in the past with this scenario I have resorted to using grips or cutting screwdriver slots to try and unscrew the remaining fastener. In my experience this rarely works! Worse still you can be left with nothing to grip on to with a remaining fastener ripped up and 'rounded' off. Thinking about the situation, fasteners jam for a reason. Likely causes of jamming are corrosion or sometimes galling where metal surfaces sliding on each other stick or friction weld themselves together. Aluminium is the favourite for this kind of adhesive/friction welding type action. Galling is the situation most likely when tightening fasteners on assembly and a prudent



Left hand fluted drills



External Stud extractors

precaution is to use some copper based grease. But this is 'shutting the door after the horse has bolted' so to speak.

So what's to be done? This may sound drastic, but my favourite technique is to arc weld on another piece of metal! I usually drill a counter sunk hole in a piece of flat bar slip it over the remaining fastener and depending on the size of the fastener and amount of metal involved use the maximum welding current I can get away with. The countersink acts as a weld prep. The remaining fastener is heated to red hot before the heat is conducted away. You don't need to be that good at welding for this to work, but practice first! The heating expands the fastener in the hole and with luck crushed/loosened any corrosion. It is pretty brutal but usually works. Of course, we are talking steel fasteners – I can see a sort of soldering equivalent working with brass or even aluminium fasteners it all depends on the heat the job can stand. Fortunately, such fasteners are rare and in my experience don't often cause such

trouble – do they?

My favourite story on this approach was the day my daughter was replacing the exhaust on her car. All was well most of the exhaust came off no problem. I was

doing something else at the time, on hand for advice. Then the call came, a fastener had broken off on the cast iron exhaust manifold attached to the engine. One look told me that taking the manifold off the cylinder head and drilling out the fastener was a nonstarter the bolts looked well corroded. As space was tight and a bit of the fastener was sticking out, we tried stud extractors, **photo 3**, that fit over studs, to no avail. So out came the arc welder I drilled a hole in a square block of steel, counter sunk it, then slipped over the remains of the stud and welded it on at full power. I think we were dealing with an M8 size fastener. The remaining bit of fastener and the block went red hot for a few seconds. I left it to cool then gingerly applied an adjustable spanner to the now welded on block and... it began to turn. Out came the broken piece of fastener, block welded on, the thread in the casting was undamaged, daughter amazed, the day was saved!

More recently another daughter needed a bicycle for a new job. I had an old bike to hand, it was from a jumble sale awaiting



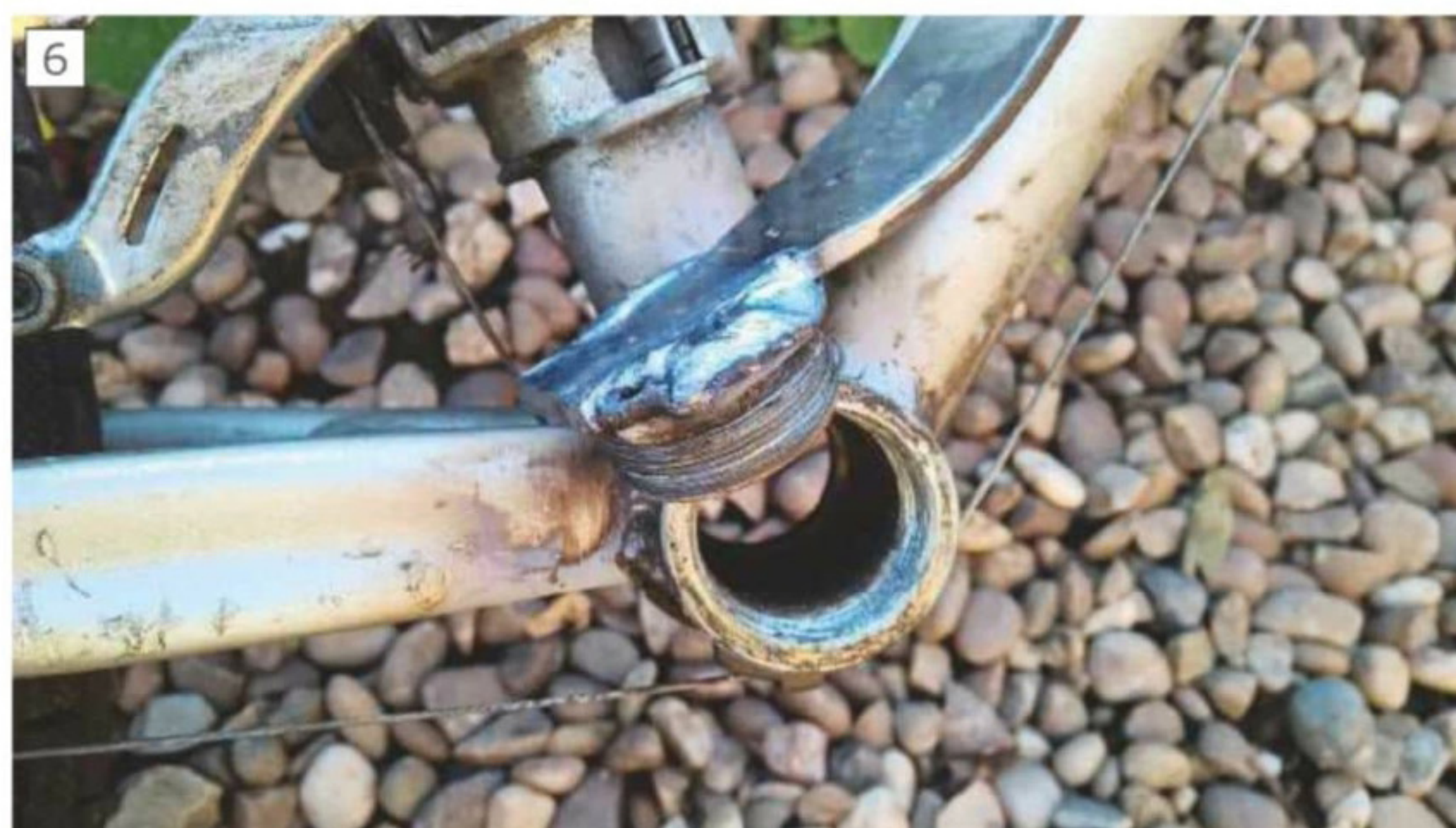
Bottom Bracket



Opposite bearing

stripping for parts. I got the bike going it was 'rideable' but it wasn't long before we discovered the reason for its appearance at the jumble sale. The bottom bracket, **photo 4**, bearings for the pedals were 'rough' and constantly 'loose'. I unscrewed the bearing cup and the horrors were there to see. The bottom bracket bearings, where the pedal axle runs, were a mess the bearing cage had broken up and condition of the bearing cups was very poor. I looked on the internet and found a complete replacement set was quite inexpensive. However, removing the other bearing cup, **photo 5** was a nightmare, it just would not move. Even clamping the flats on the cup into a six inch vice and using the frame as a lever would not budge it. So, as you can see in photo 6, my favourite removal technique swung into action. I welded on a steel bar, this was risky as the thread in the aluminium of the frame could have thrown in the towel and fallen to bits. As

I got the bike going. it was 'rideable' but it wasn't long before we discovered the reason for its appearance at the jumble sale.



Cup removed by welding a bar on it



Broken Screw in Vice

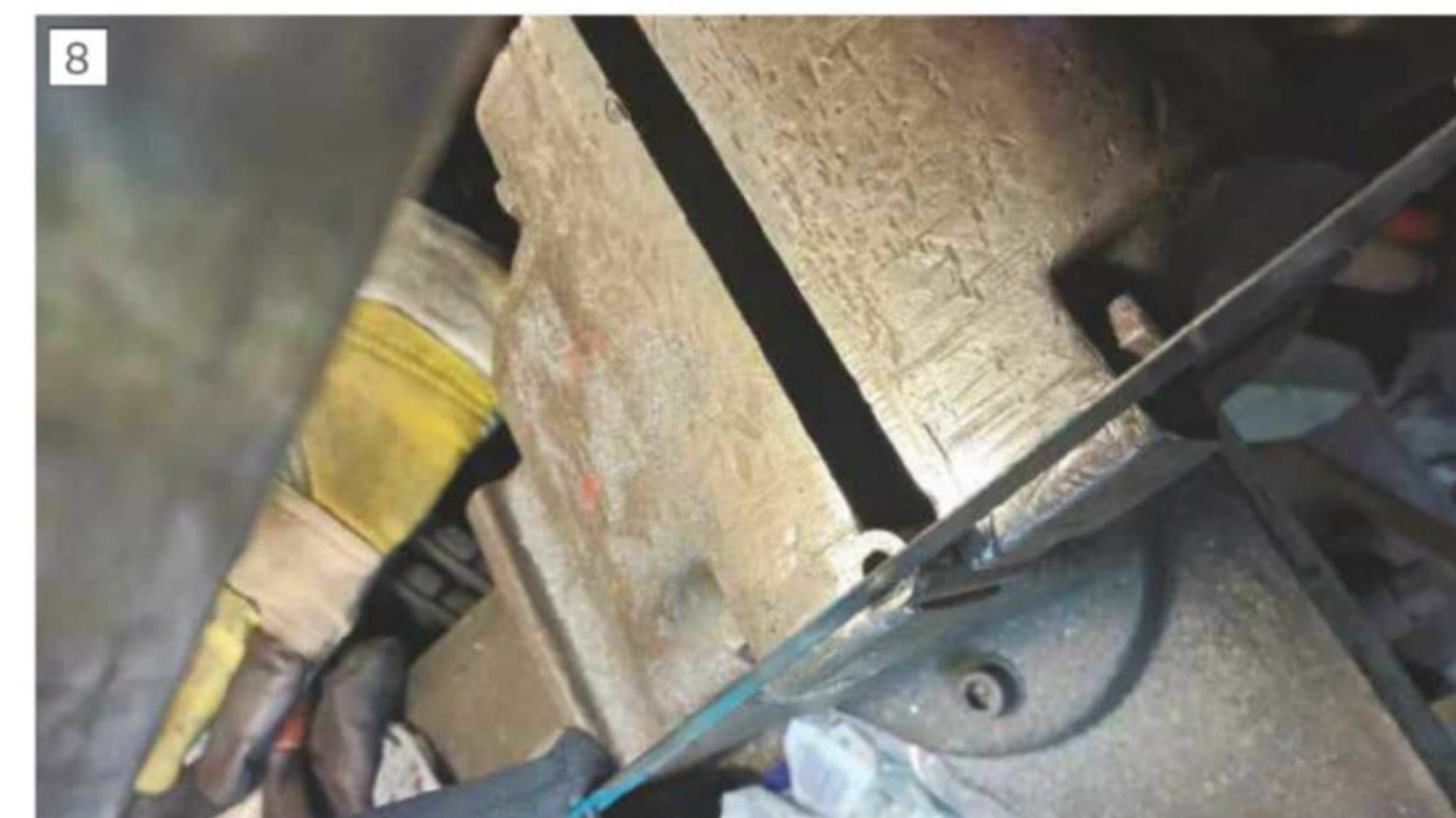
A few years ago, I picked up an old vice at a scrap yard. The corrosion didn't look too bad but when I got it home, I found it was solid, nothing moved.

you can see the gods of engineering were with me and the cup came out relatively easily once the cup had cooled from the welding, **photo 6**. I suspect in this case the zinc plating on the cup had become almost soldered together with the aluminium of the thread in the frame the expansion and contraction broke the 'joint'. The new components went in OK, job was a good un!

Old Vice

A few years ago, I picked up an old vice at a scrap yard. The corrosion didn't look too bad but when I got it home, I found it was solid, nothing moved. I just gunged penetrating oil into it and left it. Months later still the same. I tried to dismantle it, but to no avail and annoyingly one of the fasteners on the quick release mounting plate sheared off, **photo 7**. As you can see a significant part of the fastener thread remained above the casting surface. At this point it was tempting to put some grips on the thread and try to unscrew it. However, I know this situation of old! This approach can easily result in the remaining thread shearing off leaving nothing to 'get hold of' forcing a drilling out session. As you can imagine setting up this vice to drill out the fastener would be a right pain! So I opted for the weld on head approach, photo 7 shows the broken screw.

Photographs 8, 9 and 10 show a piece



Sawing side off a drilled out bar



Hole side opened

of bar drilled to slide on the thread and a section cut out from the side and two flats added to aid the final removal. There is nothing 'pretty' here this is a brutal rough process. I then welded the new head on photos 11 and 12. Note that I just caught the cooling process on camera at dull red, it started at white hot! The final 'coup de grâce' I could now use grips to remove

the broken screw after cooling, **photo 13**. **Photograph 14** shows the fastener removed on the way to the scrap bin.

Broken Taps!

Well here's an old chestnut. I am stretching the 'fastener' bit of my title, but I hope you find my bit of experience here useful. The horrible crack sound of the tap failing has



Weld on head prepared



Weld on head ready for welding



Welded on head red hot



Removing screw with welded on head using grips

happened. If luck is with you the tap itself shatters and with a bit of patience the bits can be 'juggled out with a scriber. I find a old HSS hack saw blade ground back to a long thin strip with hook ground on the end useful here, **photo 15**. You can slide this tool down the tap flutes and depending on how broken up it is drag bits out.

What's to be done if the remaining tap is still one piece? Well in such a case my approach is to break up the tap by grinding away the tap centre with a diamond burr. These are relatively cheap and the long pointed ones that you see in sets for machines like a Dremel can with care cut into the HSS or hardened steel of a tap. Then you are back to 'picking' it out or with luck you can get enough torque on it to unscrew it using a screwdriver.

Adhesives etc

I have had some experience using adhesives for drills stuck in holes, namely thread locking type adhesives. Some years ago, a friend suddenly appeared at my door to say he had a drill trapped in a deep hole. He had been drilling a very long hole about 300-400 mm deep and his extended drill had come apart and the drill trapped down the hole. On examination the shaft had been attached to the drill by a spigot joint where the drill shank had been turned down and fitted



Screw removed and on its way to the scrap bin

in to a drilling in a steel shaft. It looked like a silver soldered joint that had not run properly and the joint had failed due to the drilling torque. I had some thread locking adhesive to hand and based on anything was better than nothing I coated the inside of the spigot with the adhesive and carefully inserted the shaft down the hole feeling for the shaft to fit onto the drill. It was left over night to set. To my amazement I got a phone call next day to say the drill had released when he turned

the machine on, day saved.

A little bit of speculation here. My thought (I have not tried this) is that if a suitably deep hole can be drilled into a broken fastener and a good adhesive joint made with a really good epoxy onto a close fitting sort of plug with a head (turned down bolt say) it might just save the day. This might offer a way out of a broken fastener problem where heat e.g. welding is just not going to be possible.

One other thought, if you find a fastener is broken flush with the face the welding technique might be possible. I haven't come up against such a problem however, it seems reasonable to speculate that a block could be prepared with a smaller hole that the broken fastener and countersunk. With careful welding (a MIG might be good) a head could be welded on that will enable the removal of the broken piece.

Well there it is some experience that may help with those pesky broken fastener problems that arise from time to time. This article is a bit like an insurance policy something you keep to hand hoping you never need it. If you remember nothing else from my words here keep this. The first rule with these problems' is don't rush to a solution. ■



Hacksaw pick



MY DEARS! Quality Books & DVDs for novice model engineers....

The books and DVDs listed below will help the beginner have an enjoyable and fulfilling introduction to the wonderful world of model engineering.

Full descriptions of each item will be found on our website:

www.camdenmin.co.uk

in the sections as named in green below.

ENGINEERING PRACTICE:

Metal Turning on the Lathe • Clark • £18.84

The Mini-Lathe • Wyatt • £18.84

Fundamentals of Machine Lathe

Operation • 95 mins • DVD £30.72

Workshop Practice No. 6 Measuring & Marking Metals • Law • £10.05

Workshop Practice No. 23 Workshop

Construction • Weiss • £10.05

Workshop Practice No. 38 Tool and Cutter

Sharpening • Hall • £10.05

Milling (David Clark) • Clark • £18.84

Fundamentals of Milling Machine

Operation • 120 mins • DVD £30.72

Brazing and Soldering • Lofting • £18.84

Engineering Materials • Tindell • £18.84

Sheet Metal Work • Bowman • £18.84

Workshop Projects • Watkins

NOW HALF PRICE! • £ 6.85

Metal Finishing Techniques • Weiss • £17.60

CONSTRUCTION MANUALS:

(becoming more advanced the further down the list you get)

Build a Wooden Oscillating Engine

Gearing • £10.85

Building Stirling Engines without a lathe

Hoejfeldt • £ 9.20

Building Stirling I • Warbrooke • £ 9.05

Building a Small Steam Engine

220 mins • Double disc DVD £36.00

"Ellie" The Steam Tram • Allison • £15.20

Building the ClisShay • Maynard • £18.20

The Project Book (NEW Fifth Edition)

Poulter & Hines • £16.15

Building the Shay • Hiraoka • £47.45

BUILDING STEAM MODELS:

Model Steam Locomotives

1954 • Greenly rev. Steel • £ 20.80

Peter Angus Locomotive Builder

Angus • £38.45

DIGITAL EDITIONS:

(these MUST be ordered on our website for downloading direct on to your computer, laptop, iPad etc.)

Model & Miniature

Locomotive Construction

Bray • £12.00

Building Small Boilers for Gas Firing

Weiss • £10.00

Prices shown **INCLUDE U.K. Post & Packing**; buy two or more items and **SAVE**, often considerably, on postage. Savings, and overseas postage automatically calculated if you order online.

If ordering by post and paying by cheque or Postal Order, please make this payable to: **Camden Miniature Steam Services**

CAMDEN MINIATURE STEAM SERVICES

Barrow Farm Rode Frome Somerset BA11 6UB UK

Buy online at: www.camdenmin.co.uk

or phone 01373 830151 to order

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 £6.86 each for 8-10mm tools, £7.99 for 12mm.

SPECIAL OFFER PRICE £39.20

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 £39.90

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 £5.79 each.

SPECIAL OFFER PRICE £39.20

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 10mm square section. Spare inserts just £6.86 each.

SPECIAL OFFER PRICE £39.20

A TOP QUALITY BORING BAR FOR YOUR LATHE

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, 12 or 16mm. Spare inserts just £6.86 each.

SPECIAL OFFER PRICE £42.58

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 £10.75 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 £13.65. See our website for more info.

SPECIAL OFFER PRICE £43.80

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 dia's available. 55° or 60° insert not included - order separately at £11.37. See our website for more info.

SPECIAL OFFER PRICE £43.80

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

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

The Digital Readout & Measurement Specialists



- Lathes
- Mills
- UK Brand
- Hobby
- Industrial
- Optical
- Magnetic

If you have a lathe or milling machine then you will appreciate the need for a quality digital readout system to provide consistent accuracy and repeatability in machining.

ems-i provide both **optical** and **magnetic** systems to machine builders, re-builders and main dealers so you can be assured of performance, quality and service.

Our specialist encoders, for smaller machines, allow for neater installation and integration in limited spaces without performance compromise. Perfect for Myford, Boxford, Viceroy, SIEG etc.



0116 279 3035 : facebook.com/ems.systems
info@ems-i.co.uk : www.ems-i.co.uk



Powerful 3D CAD Software for Precision Engineering

- o A powerful and affordable 3D design package
- o Easy to learn, easy to use and precise modelling of your projects
- o Export to CNC machines, 3D printers and more, or create 2D drawings
- o Create single parts and combine them into moving assemblies
- o Also available, Alibre Atom3D - A design package tailored to hobbyists and model makers



For more information please contact
MINTRONICS on 0844 3570378,
email business@mintronics.co.uk
or visit www.mintronics.co.uk

Dragon's Den or Dream Workshop?



We all have our own idea of what the 'perfect' workshop would be to meet our needs. Des Bromilow made his dream workshop a reality and documented the build for readers. Let's make a start!

This article outlines the design, planning, construction, and internal fit out of a shed at my property in Australia. I work in a varied range of interests including machining, welding, casting, robotics (CNC, electronics), woodwork, and composites. Over the years, I have "made do" with storing my tools in garden sheds, and working either on the veranda, or in the driveway. When we moved and purchased our property, one of the selection criteria was a decent sized backyard to permit a dedicated shed for me to work in. We moved into the property over seven years ago, and the last photos in this article were only taken a few weeks ago. I've tried to keep the concepts outlined in this article fairly general in their direction, so it will fall upon anyone looking to copy design elements to tailor them to your local conditions and regulations.



available space loaned itself to creating an office or clean room area separated from the main workshop area. This was designed to capitalise on the space which was left over after the rainwater tank was designed in.

The 'office' is nominally 3m x 4m and has a stud wall between itself and the remainder of the workshop. A door reduces debris from the main workshop from entering the room, thereby reducing the chances of metal filings getting into any electrical projects.

Since I do a reasonable amount of "hot works" - namely welding, forging, and casting I tried to make sure that my shed design had an area designed to minimise fire risk, whilst providing storage and working space. This area is known as a "hot works area", "welding bay", or "Ronson's cave" - Ronson is the name of the baby dragon which is the resident mascot for hot works, and is named after the Canadian WWII armoured vehicle.

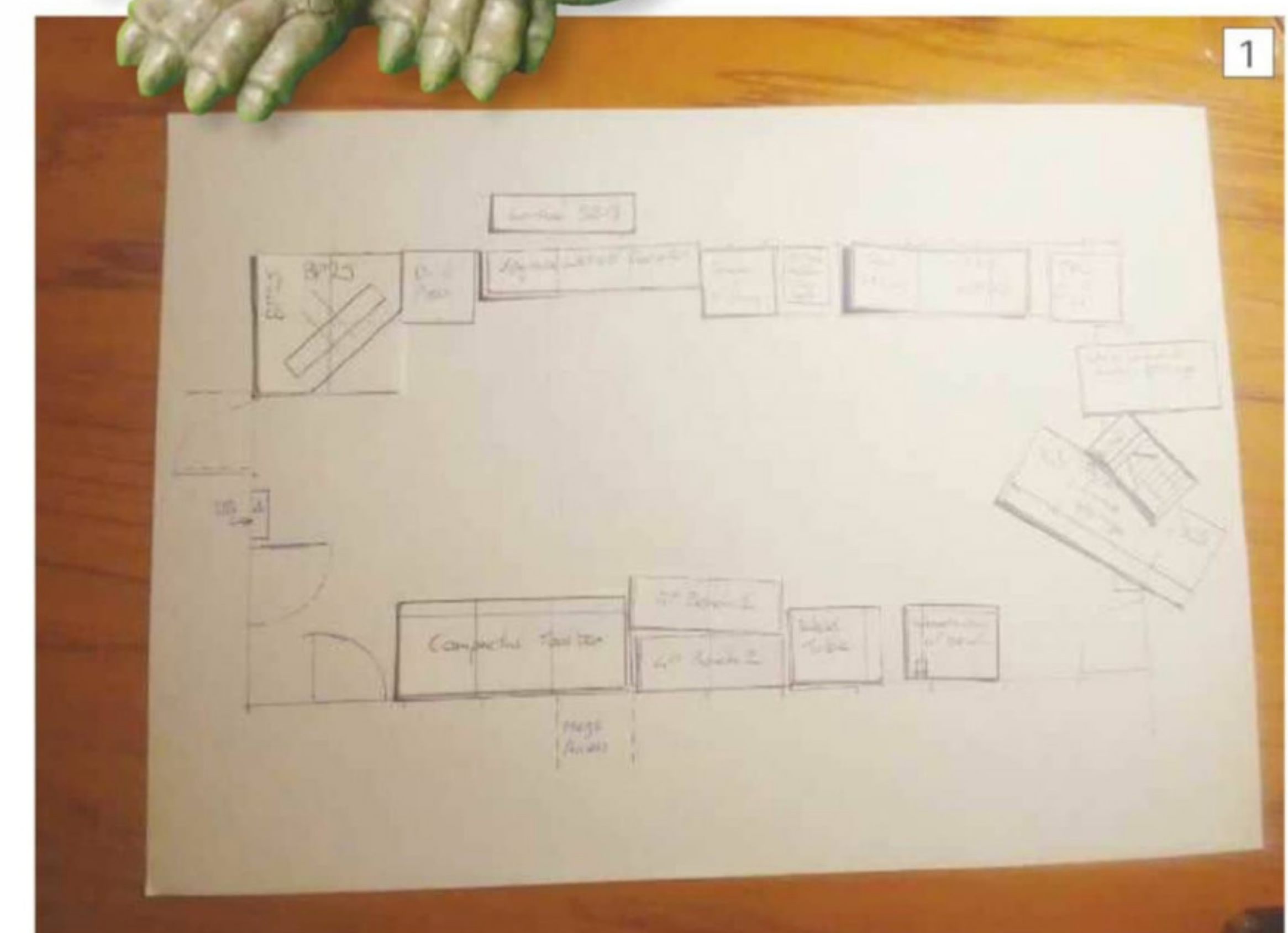
The hot works area is outside the main workshop so I do not have to worry about where the grinding sparks go whilst working. The hot works area is

Shed Design

The shed design started with determining what space I had available on my house block, and the constraints of shed construction outlined by the local council and planning regulations. I then started modelling shed layouts using gridline paper, and some small-scale footprints of the machines I expect to use (milling machine, lathe, shaper, drill press, bench for desktop machines).

A number of layouts were considered and the one settled on was based on a long narrow shed with metalworking tools along one side, and woodwork and general work on the other side. The metalwork side was also designed so that long stock coming out of the lathe headstock would pass over the shaper and drill press area. Another feature designed into this layout is that all grinding works (bench grinder, T&C grinder, etc.) are located far from the slides of the big lathe and milling machine and separated from the slides of the desktop machines by a partition wall. **Photograph 1** outlines the design sketches used to determine the floor plan.

I do dabble in electronics (microprocessors, robotics and CNC), so an area to work on that was needed. The



Planning the layout

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

VARIABLE SPEED CONTROL PACKAGES



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.



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.



6m x 4m with a concrete floor, and a roof above that. That bay is designed for use for welding and forge work. I have never been able to accurately estimate the effect of rising heat from my furnace, so I planned the casting area to not have a roof over the top, and for the floor to be suitable for use around molten metal. Given that concrete will explode (spall) when exposed to heat, I chose to pave the casting area floor with fired clay-based pavers instead of cementitious based flooring materials. This means that the clay pavers should not spall when exposed to heat, but if they are cracked, replacement is a simple case of levering up the damaged paver and replacing it. The paved hotworks area is shown in **photo 2**.

I did consider a cinder floor as an option but given that the hot works area



Paved area for hot work



Mezzanine

forms part of the entrance to the main workshop, I was concerned about being able to drive heavy vehicles into the workshop. The absence of a roof over this floor meant that rain falling on a floor made of compacted material would deteriorate and fail in a short time and require constant maintenance.

With the main areas of the shed planned based on expected usage, the issue then was storing the various materials, partially completed projects, and other things I seem to accumulate.

Looking at comparative pricing for sheds, and the constraint I had for my available footprint, I looked at a few designs based on wall mounted shelving, mezzanines, and other storage options above the main floor. There was a marginal increase in costs between a high wall shed with shelves above the work area, and a shed with a proper rated mezzanine floor, **photo 3**. The higher roofline brought other benefits including natural cooling during the Australian summers, no foreseeable height restrictions on moving machines within the shed, and implications for the design of the rainwater tank. Those benefits outweighed the slight cost increase.

A rainwater tank was designed (part of

the energy efficiency rating scheme used in my council), and I designed the tank stand to provide a storage enclosure underneath it – **photo 4**. This gives me a decent head pressure for the collected water, and allows me a storage option for gases, flammables and other materials I may wish to store outside my main workshop.

The basic design was settled, then



Water tank

proposed to the council planning authority for endorsement. Once endorsed, the design sketches were passed through an engineering company for design and certification. The certified design was then submitted for building approval and I arranged detailed fabrication design and quoting by a number of manufacturers.

The final design had a wall height of 4m, with a ridge height of 4.6m. The main works area is 12m long, and 6m wide, and the hot works bay is 4m long, by the same 6m wide. The roller door between the workshop and the hot works bay is 3.4m high and can comfortably allow entry of a 4T hiab truck. The office located at the other end of the workshop is 3m wide, and 4m deep.

The engineering design took into account the other elements including slab design, ground considerations (active soil) and various loading forces.

Pad and Slab

The area where I live has soil containing some clay, and this means that the ground type had to be factored into the engineering design of the shed floor.

When I gave my sketches to the engineer, I indicated that the main floor was to be 100mm thick everywhere, except where

the machines (milling machine, lathe, etc) would be – those areas were to be made 150mm thick. That thickness was taken from the bolt down instructions for the Bridgeport milling machine. I have seen too many sheds with cracked floors when the floors were only 75mm thick and machines or large vehicles brought in. The engineer suggested that concrete was relatively cheap, and that having steps or level changes in the floor would aggravate the concreter more than the cost of extra concrete – I ran the models of the concrete volume/cost, and decided to make the floor a uniform 150mm thick, and not have to worry about where things were put in the future.

The engineer then designed the various thickened beams which add stability and strength to the shed, and the floor design was complete.

A Few Features in the Floor.

The biggest feature of the floor is the inclusion of a number of “Elephant foot ferrules” in the floor, **photo 5**. Originally designed for creating threaded holes in cast panels for tilt up construction, these ferrules were cast in the floor on a grid pattern of 2 x 2m. Each ferrule is able to take the load of a M16 grade 5.5 bolt in shear and tension. I can use the points in the floor to pull a disabled car into the workshop, pull a chassis straight, anchor a lifting frame, or whatever I want. Each ferrule added \$10 AUD to the cost of the shed – another small investment to add considerable versatility to the shed. I also added a few ferrules near the roller door for locking the roller door in place (increased security) and in two locations added nest of M12 ferrules in a 200x200mm square arrangement. These nests, **photo 6**, will be used for anchoring floor mounted tools such as pipe benders, or vices. In Australia, the ferrules are available through Reid (reid.com.au) and they can supply the ferrules, chairs, caps and reinforcing bars needed, **photo 7**. All up the ferrules added \$200 AUD to the cost of my shed, whereas the



Ferrules in floor

after-market roller door locking option would cost \$140 AUD each, so the small investment has already paid off.

To Pour the Floor

The shed project had been progressing for several years. Each step in a sequence leading towards pouring the slab for the shed.

I cleared the land – removed all the overgrown native garden the previous owners had left, and then removed the underground reticulation pipes in the area. As part of the fencing rebuild, I put in a retaining wall which allowed the area to be levelled properly.

Once the ground was level, I then marked out the borders of the shed slab, and had the topsoil removed. Typically this is only done to a depth of 100mm in my area, but due to the clay soil underneath, and my intent of making the footing work easier, I removed all soils to a depth of 300mm (500mm in the tank stand area) and had the soil replaced with compacted yellow brickies sand. This sand is clean of any organic materials and forms the pad under the slab.

Prior to placing the sand, a pest control treatment was done to protect against

termites. This treatment was repeated again just before the plastic sheeting was installed for the concrete pour.

With the pad prepared, the concreting contractor then dug the footing beams, installed the formwork, laid down the moisture barrier (200-micron plastic sheet), reinforcing mesh, and I installed the elephant foot ferrules, **photo 8**.

Another termite treatment spray was performed, and the concrete was poured in over the top.

The slab was sized so there is a gap between the edge of the slab, and the back of the overlapping cladding. This is a deliberate design choice and prevents the cladding sheets touching the concrete. Many people erect the shed including cladding, then pour the slab to the wall sheets using the wall sheets as formwork for the slab. This is a cheaper option, but the alkali concrete corrodes the cladding where they touch, and in approximately 10 years time, the owner is replacing the bottom of their cladding sheets. By designing a gap (typically 5mm) the corrosion risk is removed. The resulting gap caused by this is later closed with bitumen impregnated foam, and flashing tape to



Ferrule nests



With reinforcing bar and cap

stop vermin or snakes entering the shed under the cladding.

The concreting contractor was consulted regarding the finish of the concrete for the floor. I was particularly concerned about having slip hazards. The main workshop, and office area has a tooled burnished finish – as typically used in house slabs. This means that I can roll machines around easily, and do a good job sweeping the floor. Whereas the hot work area has a trowelled finish – slightly rougher, and non slip when wet. I can sweep it easily, but there is always a slight residue of dust due to the surface. I had considered what is called “broomed finish” but determined that it would be too rough to sweep easily, and would make moving the furnace harder. My furnace weighs over 700kg and moves on four wheels – two of which have steel tyres, so floor “roughness” is noticeable.

Some other features of the floor are centred around the floor of the tank stand shed, and the drainage around it. Once the tank-stand was in place, I cast the mass footings, then added some electrical conduit between the inside of the tank shed and the main shed. This conduit was sized (40mm) so electrical and alarm cables can be ran between the buildings. The floor and drains of the tank shed and interposing space (pavements) were all cast as one piece. The pavement has a cast in drain channel, and all surfaces slope to direct water away from the shed foundations, and into drains which take the water away from the structure, and into the stormwater piping.

Once the main shed slab had been poured and cured, work was completed on the stormwater piping, and other conduits in the trench which go to the shed. This trench contains the main stormwater pipe which takes excess stormwater away from the shed, 2 x 50mm communications conduits, and a 50mm HD electrical conduit (containing the 16mm² three phase electrical submain cable), **photo 9**.

The communications conduits are designed so network cables (fibre and copper), alarm cables, and other ELV cables can be ran between the house and the shed. This means all bends are “sweep bend” type, which maintain a radius which is suitable for fibre optic cables and makes pulling cables through easier.

All conduits are trenched in at the appropriate depths and separation distances as dictated by the relevant electrical standards. This compliance to standards also includes underground marker tape, mechanical securing, armouring at above-ground locations, and suitability of bedding sands.

Shed Erection

The shed erection was a task which involved marking out the slab for the chemset anchors, drilling and setting those, craning into position the columns, attaching the rafters, and tying the portal frames back into the other frames via the



Almost ready to pour.



Trench for power supply



Cable ladder

purlins and girts.

In my case, this shed was too big for me to erect by myself, so I engaged a local contractor to assist me. Several small issues were found during the erection, and those were fixed “on the fly” – often by cutting and welding, and in other cases by simply adding additional members to the structure.

Whilst the frame was being put up, a few extra elements were added, including a folded mesh cable ladder up each side of the main workshop, **photo 10**, mounting girts for the switchboard, and some headers in the welding bay. These headers are to add some additional shade in the open bay, but with minimal impact on ventilation or heat loss.

Once the frame was erected, a layer of sarking was installed on all walls to act as an anti-condensation layer. The sarking

reduces the condensation a little via its small insulation effect, but mostly serves to direct any condensation between the cladding sheet and the sarking, keeping the girts dry, and preventing water coming into contact with the internal lining. The sheets of sarking were covered by the external cladding which was screwed to the framing as per normal practise, **photo 11**.

A tip – manhandling pieces of sarking, and 4m long pieces of cladding can be difficult – by using a number of magnets, it was possible to hold the sarking in place, and then affix the cladding without having the sarking move. We used old hard disk magnets, with lengths of survey tape added for increased visibility as shown in **photo 12**.

A note about the cladding. Consultation with my neighbours as part of the planning process included asking about colours and visual impacts. My nearest neighbour



Fixing cladding



Tagged magnet



Skylight

requested that the wall facing them was matched to their fence and roof – easy – nearly every fence and roof in the district is that same green colour. I was concerned about the one wall facing my own house. At 12m long, and 4m high, a solid block of green would be visually intimidating, and make the distance between the house and shed seem smaller. It is accepted that light colours visually “open up” a space, so I made that wall a cream colour – as much to visually alter the space, but also to help with the sun exposure (this wall faces north).

Another tip regarding sun exposure came with the roofing. A lot of people will fit a translucent panel in their roof as a way of getting natural light into the shed. In my case I placed one sheet of fibreglass sheeting in the roof – specifically in the south facing side. Had I placed it in the north facing roof side, I would have had

direct sun, along with the increase in heat. By placing it in the south, I still get sufficient sunlight to work without lights, but a considerable reduction in heat. I added a short sheet of roofing metal under the fibreglass sheet where the mezzanine passes underneath – this reduces the amount of light slightly, but means a person walking up on the mezzanine is reduced to less heat being in close proximity, and it reduces fading of things stored on the mezzanine. This skylight (measuring 2,000x 700mm) lights up the entire workshop floor (12m x 6m) for walking around and non detail work. The skylight is shown in **photo 13**. I have talked about north and south based on my home being in the southern hemisphere... if I was building this same shed in the northern hemisphere, I would place the translucent sheets in the roof on the northern side to reduce heating effects

(we northern hemisphere types should be so lucky! – Ed.)

It is becoming a common practise in industry to place translucent sheets in the walls rather than the roof to achieve a similar effect of increasing lighting without heat. Lining the shed walls makes this option unsuitable.

Once the walls were clad, safety mesh was wired into the roof area, and the insulation was rolled on as each pair of sheets was lifted up and screwed down. After the roof sheets, it was ridge-capping and flashings, doors, gutters, etc which were added to complete the weather sealing.

The roller door was fitted into position, and the personal access doors fitted in place. This was the minimum to get the shed lockable, and further security has been added including strengthening to the doors and fitting better locking to the doors. The door openings were flashed in as part of the cladding work.

Flashings were needed on the underside of the roof where the welding bay wall joins the workshop to prevent birds entering the shed. A Christmas laser projector was screwed to the wall in the welding bay projecting against the roof and roller door to prevent the invading swallow population from trying to roost or nest in the bay. This projector runs for 3 hours each evening covering dusk, and the hour afterwards, and has proven very effective at deterring the winged vermin without endangering our own native birds. As shown in **photo 14**, the laser can cover a fair bit of the welding bay.

Finally, the shed was erected, weather tight and lockable.

Shed Lining

A lot of sheds are not lined – and for many this is not an issue. Given that my neighbours are reasonably close, and I live in a place with noticeable Australian summers, I looked at lining and insulating my shed as part of the project. I also knew that if I didn't insulate the shed during construction, I would find it difficult to “get around to it” once machines, power, etc had been installed.

The first thing to do was insulate the north wall with the same insulation type



Laser for bird deterrent

used on the roof. Care was taken to keep the insulation out of the cable ladder (now within the wall profile) so it did not create a significant de-rating issue for the cables once installed.

What do you line a shed with?

I had several options to consider including plasterboard, plywood, particleboard, and others. Each had their pros and cons... so I looked at other builds and asked on a few forums for advice. Cost did play a factor in the final decision.

Criteria in the decision:

1. something I could work with for the construction - not needing specialised tools, or skills I didn't already have, or could get quickly
2. ability to hang things off the walls once lined (shelves, electrical fittings, etc)
3. moderate impact resistance - no one wants damage to walls, but a lengthy repair afterwards is insult to injury)
4. able to be painted easily to make the walls lighter, cover stains, etc
5. construction with 1-2 people only - and minor scaffolding if at all
6. cost and availability
7. sound deadening - nice to have

Options considered:

Plasterboard (gyprock) with stud walls - easy to build, moderate cost, strong walls provided you hang things off the studs. Synopsis - meets 1, 4, 5 and 6 easily, and 2 and 3 with some restrictions

Plywood - based on thickness and grade, the walls met all criteria except 6. Plywood with thicknesses below 15mm were cheaper but needed a stud wall for strength which took the cost higher than plasterboard. 15, 18 and 21mm plywood were prohibitively expensive. Synopsis - meets 1, 2, 3, 4, 5 and 7 - cost was high.

Particleboard - most grades of particleboard were similar to plywood for cost and constraints, however the particleboard used for flooring showed a lot of promise. It handled the spans I was using without a stud wall and allowed me to



Installing wall lining

affix things to the wall anywhere. There was one side which took paint well (the other being wax treated for water resilience), and I received some very competitive pricing options for this product. Synopsis - meets 1, 2, 3, 4, 5, 6, and 7.

Sheet metal - I did consider lining the inside of the shed with sheet metal in the form of galvanised sheets, or colourbond sign sheets. The pricing was comparable to plasterboard, and still needed a studframe to address the issue of spanning the distance between wall girts. I was concerned that the sheet metal would act like a drum skin with respect to quietening noise in the shed. Synopsis - meets 1, 4, and 5, and 2, 3 and 6 with some restrictions

I chose particleboard and ordered the required number of sheets to floor my mezzanines, line my walls, and build a few workbenches as well. Overall the order came out to nearly 100 sheets of 3.6m x 0.8m at 19mm thick. The calculations for the sheets showed that I would end up with a number of offcuts too short to use for lining the walls. These remainders were subsequently reserved for building shelving.

The only places stud frames were needed was for creating partition walls, and in two

places where the girts were of differing depths (door frames). These frames were built and secured in position, and the lining commenced.

The walls were prepared by ensuring that there was a girt or attachment rail every 1200mm or less. This meant adding lengths of studding off brackets in some areas where the fascia purlin was not suitable to attach the lining due to being in a different plane than the girts. I also added a length of 30x30x3 Angle Iron (aka equal angle (EA)) above and below each cable ladder to provide a rigid steel strip for attaching the cable ladder covers. These pieces of EA were installed at the same time as the cable ladder - before the external cladding was applied.

Temporary flooring sheets were placed, and clamped, on the mezzanine joists so the upper sheets were lifted into position and screwed in place. The sheets were supported from the bottom on a pair of temporary stands which were moved along the wall as the work progressed as shown in **photo 15**.

Once the high section of the wall lining was in place, the temporary flooring on the mezzanines was removed and replaced with permanent flooring for all internal mezzanines. The external mezzanine (welding bay) was floored with decking timber for any rain which blew in could drain off the flooring easier. The treated decking timber was later sealed with marine varnish to provide a low maintenance floor surface.

The low lining sheet was packed up off the floor by steel packers, then screwed to the girts and cable ladder covers with the appropriate tek screws. Care was taken during the lining to keep joints tight, and the cable ladder opening as level as possible to aid with the future placement of covers.

Photograph 16 shows the completed higher and lower wall panels installed on the North stud wall.



Completed panels

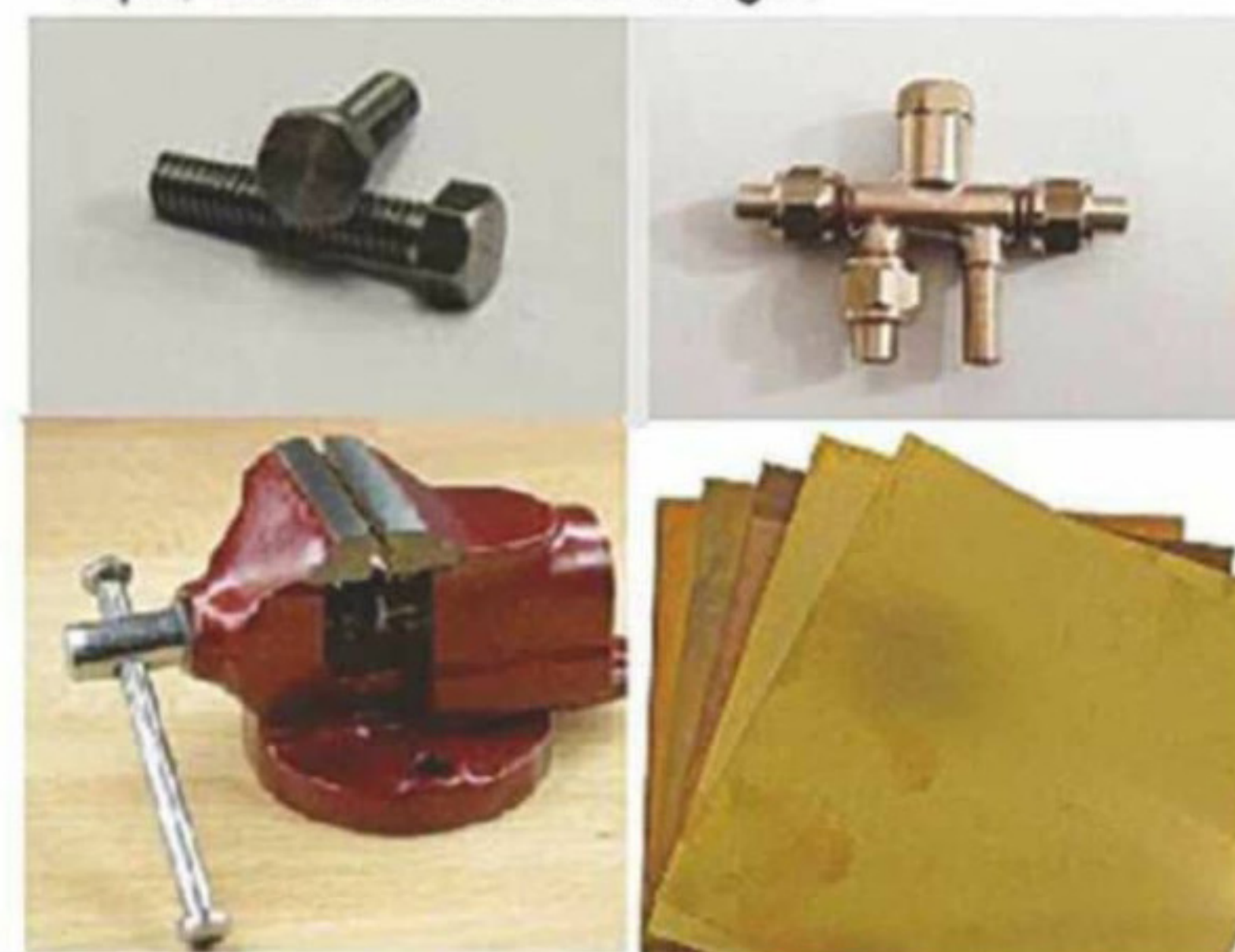
●To be continued

macc models
Engineers Supplies Ltd

www.maccmodels.co.uk

We stock a vast range of materials in bar, tube and sheet. Including brass, copper, phos bronze, stainless steel, bright mild steel and aluminium.

We also stock a wide range of British made taps, dies and steam fittings.



MODEL ENGINEER

BECOME PART OF THE ONLINE COMMUNITY FOR MODEL ENGINEER MAGAZINE

- Get access to exclusive competitions and giveaways
- Exclusive articles and advice from professionals
- Join our forum and make your views count
- Sign up to receive our monthly newsletter
- Subscribe and get additional content including Online Archives dating back to 2001*
- Register for free today and join our friendly community!

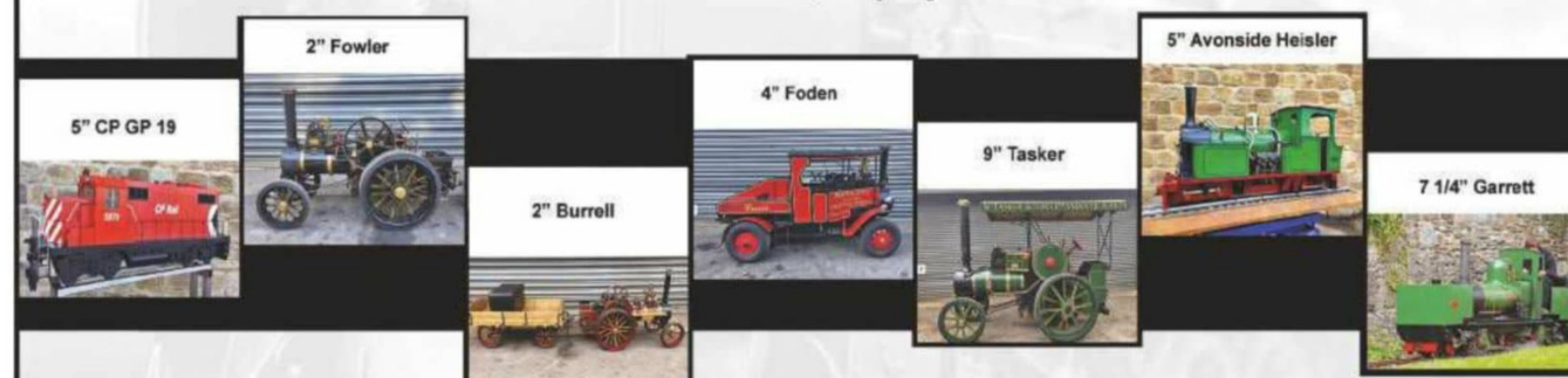
WWW.MODEL-ENGINEER.CO.UK

* only available with digital or print + digital subscriptions

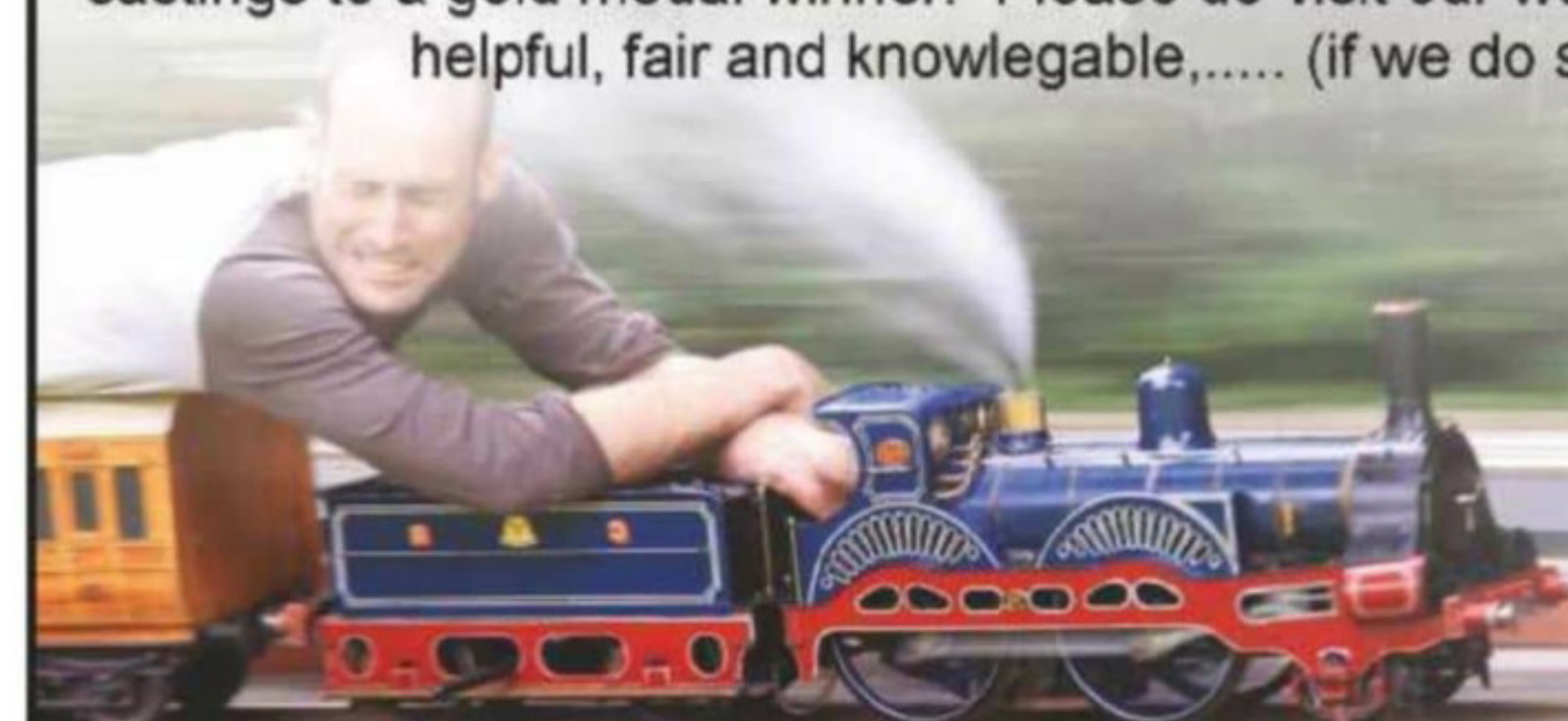
FOLLOW US

The Steam Workshop Now Incorporating D.Hewson Models

All steam models bought, sold, exchanged, valued, restored, repaired, finished, painted, lined,and of course,.....played with!



We always have a huge number of models in stock, and are always interested in anything from a set of castings to a gold medal winner. Please do visit our website, or simply give us a bell for the most friendly, helpful, fair and knowlegable,..... (if we do say so ourselves),..... service available.



By Enthusiasts



For Enthusiasts

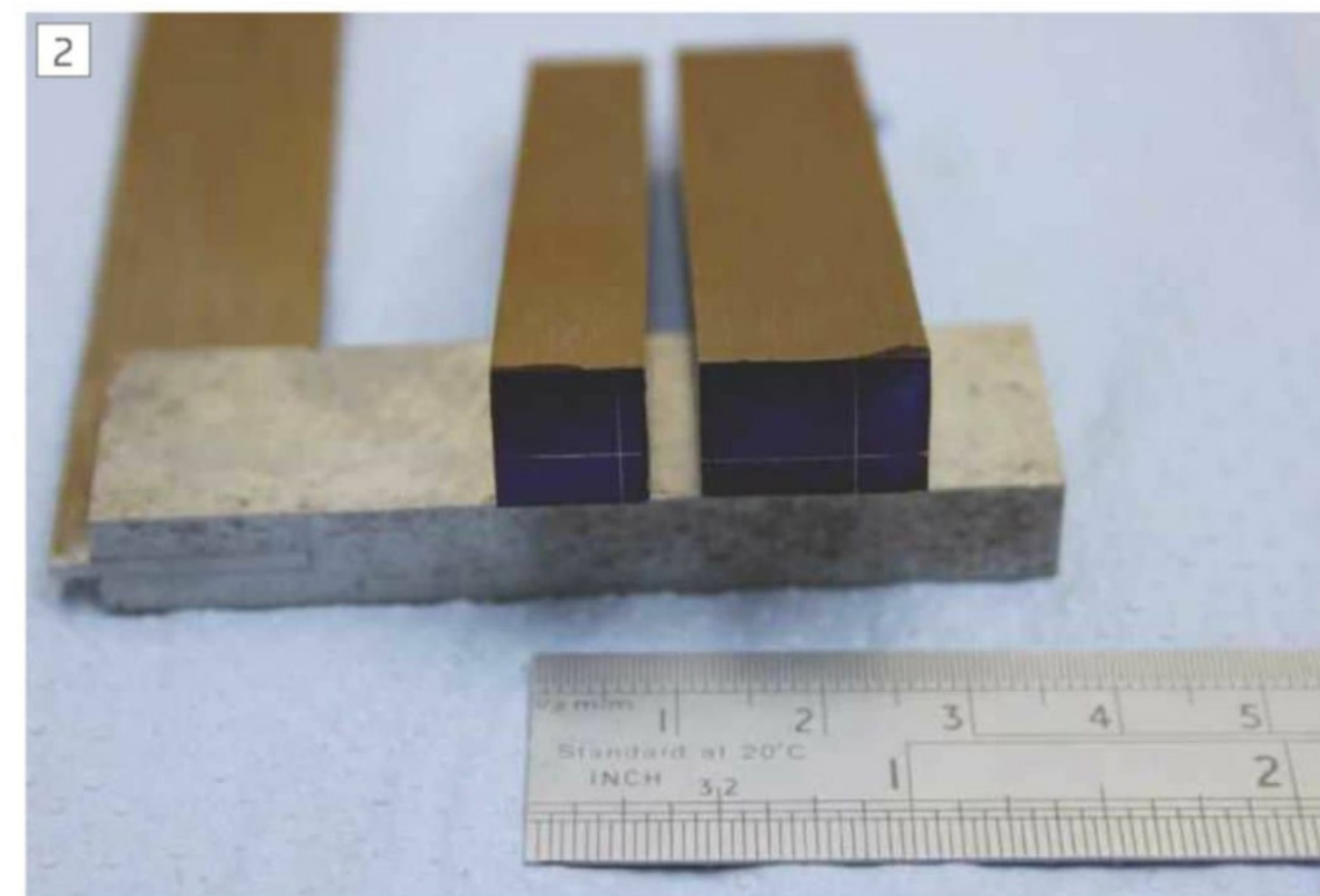
07816 963463

www.steamworkshop.co.uk

tools required are a file and vice to hold the piece being worked on). The better equipped shop may choose to simply mill the metal to size but remember that this is meant for beginners. In order to protect the sides of the metal from damage in the vice one can use soft jaws or the beginner (me) can use a little piece of copper from an old copper pipe to act as soft jaws, **photo 1**. After many days of filing the pieces should be coming to size. It is important to keep the sides of the material parallel as these form the datum for each measurement. Once mine were almost to size I moved away from filing and on to sanding. Using a piece of glass that was one a display cabinet sliding door (approximately 3 – 4 mm thick) I placed a piece of wet and dry paper on the surface and used this to lap the sides flat (checking regularly that things remained parallel). Once the pieces are to size and the ends flattened too, the selected ends were painted with marking blue and the



Filing in vice



Marking out completed

scribing points marked, **photo 2**. For my simple beginners' version, I used a set square ruler and scribe to draw the lines. The point was centre marked (hammer and centre pop or automatic centre pop). Drilling of the holes is the next part and quite possible the most scary part.

For the actual scribing tool, I used a hand sewing needle with a diameter of approximately 0.8 mm. Once again this was chosen because it is what was to hand. The needles are tough, readily available and cheap to replace (thanks to my darling wife who has not yet noticed the shortfall in her sewing box ... yet). Various needle sizes can be found here at www.jjneedles.com.

The drilling was done using very small pecking plunges, removing only a little material at each plunge, **photo 3**. If one were to use proper replaceable carbide scribing tips, the tips are slightly larger

but might be a little close to the corner of the smaller block and definitely more expensive than my solution. As said at the beginning, this project can be taken to any extreme the reader is wanting to go. The depth of my holes was 10 mm which was a nerve racking depth and would probably not be repeated.

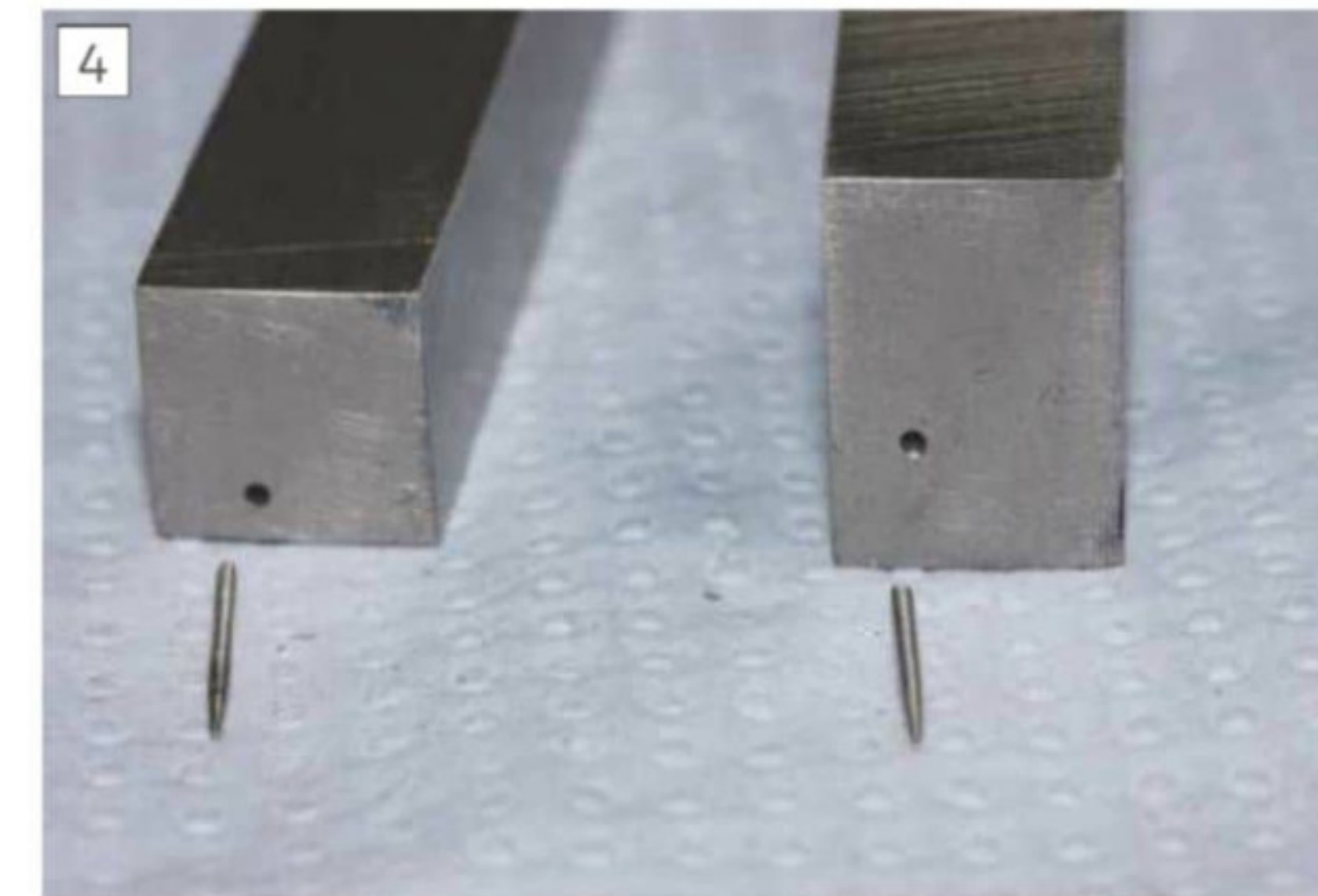
Once the holes were drilled the needles were cut. These are very tough and were cut by filing (I was beginning to miss that) with a triangular file. Once the needle was deeply scored it could be snapped off quite easily with a pair of pliers. My needles were cut to a length of 15 mm in order to allow for a 5 mm protrusion. After a test fitting the needle shafts were roughed a little with wet and dry paper to provide a key for the adhesive, **photo 4**. Loctite 603 Retaining Compound was used to hold the scribing points in place, **photo 5**. Some replaceable carbide

scribing tips are threaded and so the reader would have to adapt the plans as appropriate for them. Stamping numbers on the blocks helps to identify which size one is scribing. I stamped the height so that the number was visible uppermost when being used. This means that when the tip is 2mm from the surface the top of the block reads 2mm. Having finally put all the parts together and cleaned up it is time to calibrate the scribing blocks. Using a rule and a hammer or pliers the tip of the scribe can be moved or tapped to the correct level. One could go to extremes with accuracy and calibration, **photo 6**, but the project is intended to be a basic skill refresher with the bonus of a hand gadget at the end.

Once completed the blocks alone would provide the user with the following



Ready to drill



Blocks almost complete



Blocks complete

quick and readily available scribing measurements:
Metric block A alone would give 2, 4, 6, 8 mm
Metric block B alone would give 3, 5, 7, 10 mm

Other heights available are:
12 mm (10mm side of block B and 2mm of block A)

13mm (10mm side of block A and 3mm of block B)

14mm (10mm side of block B and 4mm of block A)

15mm (10mm side of block A and 5mm of block B)

16mm (10mm side of block B and 6mm of block A)

17mm (10mm side of block A and 7mm of block B)

18mm (10mm side of block B and 8mm of block A)

19mm (15mm side of block B and 4mm of block A)

20mm (10mm side of block A and 10mm of block B)

21mm (15mm side of block B and 6mm of block A)

23mm (15mm side of block B and 8mm of block A)

The missing sizes could be achieved by the use of a 1mm slip gauge of homemade slip of 1mm (more filing). The blocks could be even more useful if combined with a set of 1-2-3 (3-2-1) blocks or other variations of the idea.
The imperial blocks give a range from 1/8 to 1 1/2 inch:

Imperial block A alone would give 1/8, 1/4, 3/8, 1/2 inch
Imperial block B alone would give 3/16", 5/16, 7/16, 9/16 inch

Other heights available are:
5/8inch (1/2inch side of block B and 1/8inch of block A)

11/16inch (1/2inch side of block A and 3/16inch of block B)

3/4inch (1/2inch side of block B and 1/4inch of block A)

13/16inch (1/2inch side if block A and 5/16inch of block B)

7/8inch (1/2inch of block B and 3/8inch of block A)

15/16inch (1/2inch side of block A and 7/16 of block B or 3/4inch side of block A and 3/16inch of block B)

1 inch (1/2inch side of block B and 1/2inch of block A)

1 1/16inch (3/4 inch side of block A and 9/6inch of block B)

1 1/8inch (1 inch side of block B and 1/8inch of block A)

1 3/16inch (3/4inch side of block A and 7/16inch of block B)

1 1/4inch (1 inch side of block B and 1/4inch of block A)

1 5/16inch (3/4inch side of block A and 9/16inch of block B)

1 3/8inch (1 inch side of block B and 3/8inch of block A)

1 1/2inch (1 inch side of block B and 1/2inch of block A)

Again, the addition of a 1/16inch slip would open up more possibilities as would using the 1-2-3 (3-2-1) blocks.

The imperial blocks have nice range and no gaps, but I think that the metric ones are just as useful (even with the gaps). In making this project I have learned / refreshed a lot of skills long since forgotten. I also think that the project fulfils the brief of being a simple project for beginners a handy toolbox gadget and provides plenty of opportunity for further development. Thanks to my dad for his workshop and to Ray for his patience all those years ago. ■

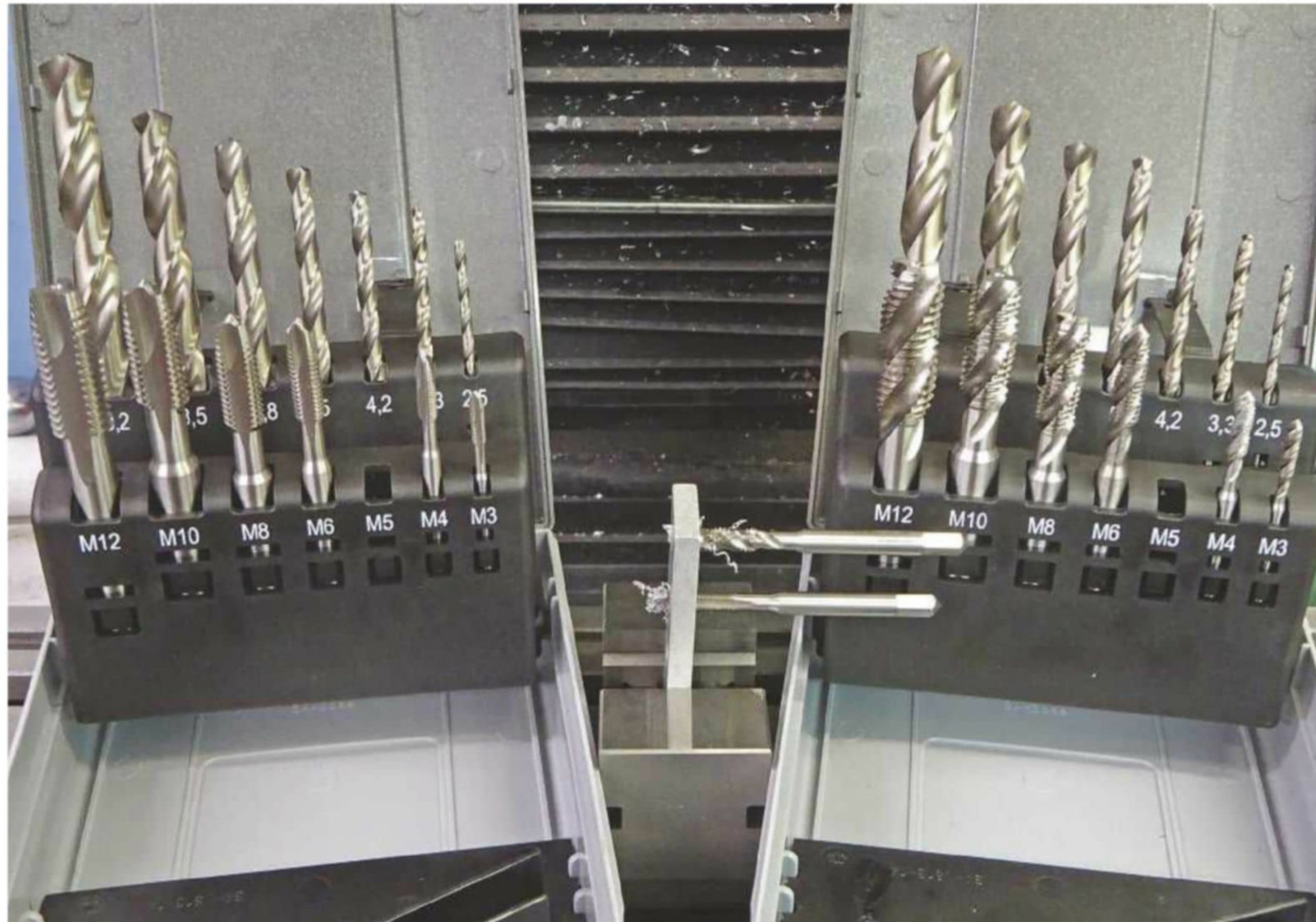


Calibration tool

On the Wire

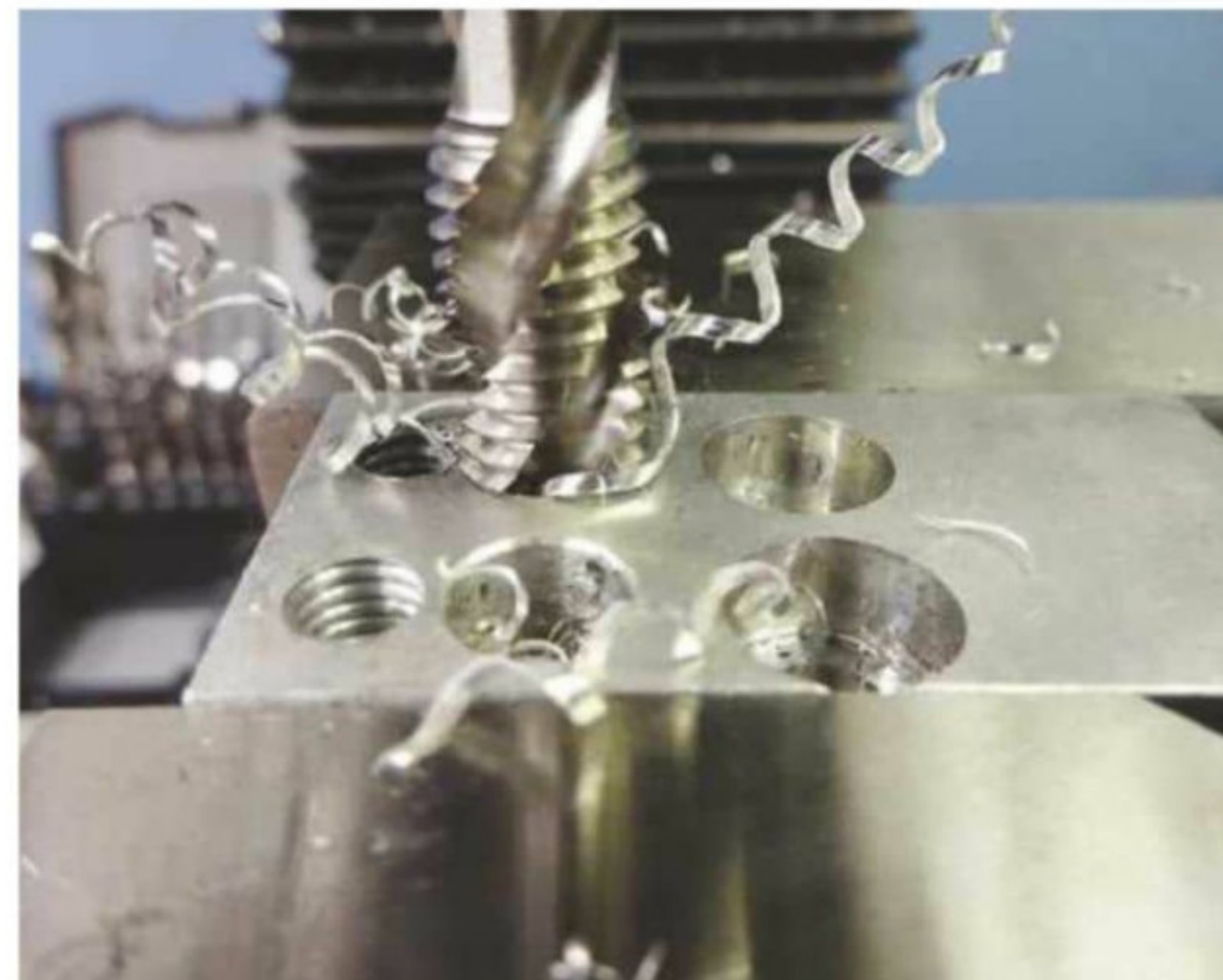
NEWS from the World of Hobby Engineering

New Arc Euro Trade Taps and Dies



Those that regularly visit the forum will no doubt have noticed the adverts for Arc Euro Trade's new range of taps and dies that have recently been added to their extensive portfolio of items. As well as the traditional style of HSS taper, second & bottom taps in both Metric fine and metric coarse series they also now do the same sizes in Spiral flute and spiral point "machine" taps made from the more durable HSS-Co5, a high-speed steel with 5% added cobalt. The main advantage of these machine taps (which can also be used by hand) is the shape of the flutes and point that make them better for tapping under power as the swarf is ejected from the hole.

In the case of Spiral flute taps they as the name suggest have flutes that are shaped in a helix much like a milling cutter or drill bit and will allow the swarf to be pushed up out of the hole in long spirals so they do not need to be backed of every turn to break the swarf. This works best with materials that are ductile such as steel and aluminium but I have found they also work well on brass and aluminium producing a pile of fine swarf around the hole. The spiral flute taps are ideal for blind holes as the swarf won't build up in the hole allowing them to tap right to the bottom, but are Ok to use in



through holes unless particularly deep.

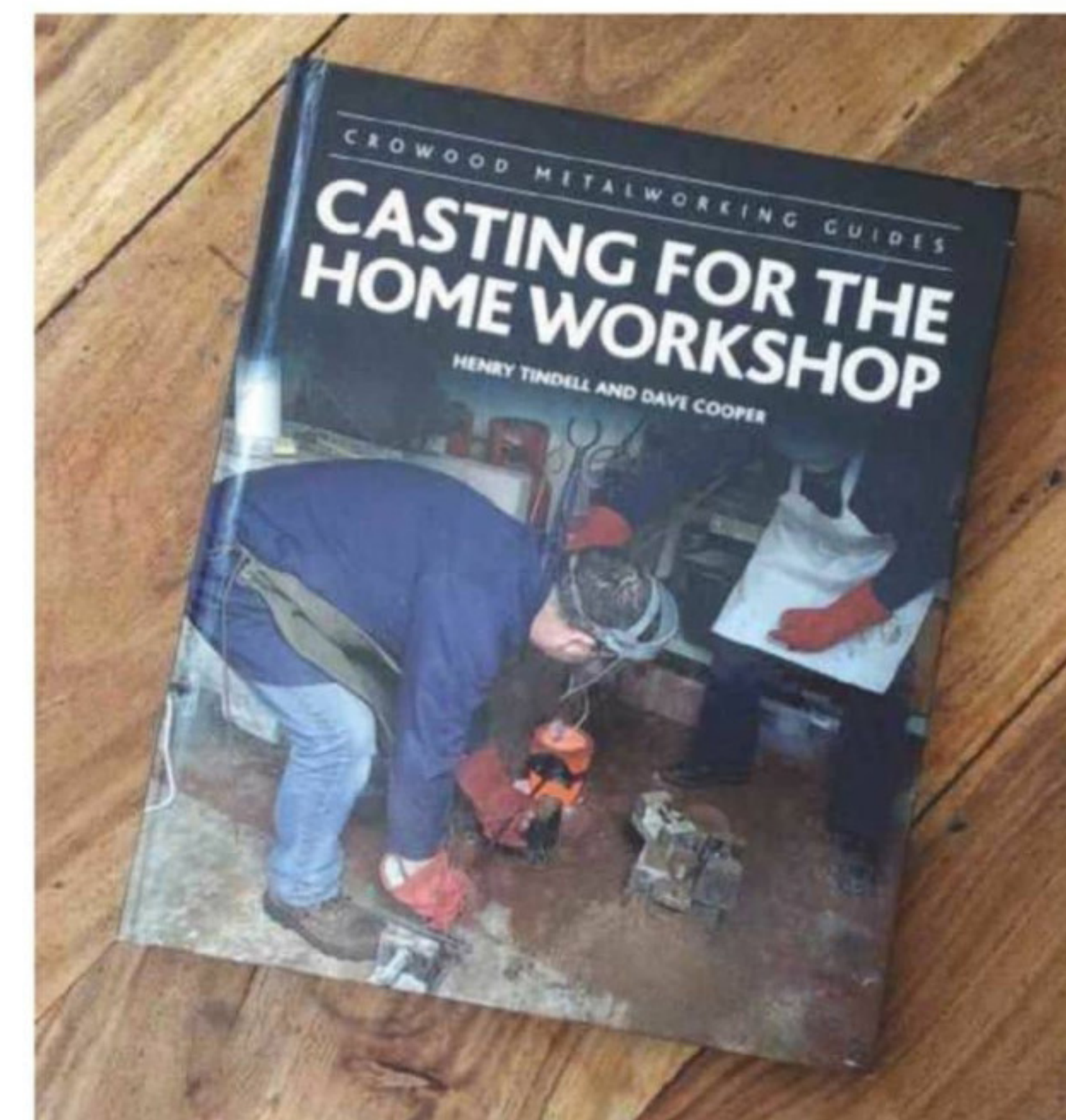
The spiral point taps have an angled leading edge to each flute which works in the opposite way to the spiral Flute design and pushes the swarf forwards of the cutter. This makes them best suited to through holes where the swarf will exit on the far side of the hole, they can be used for blind holes if the hole is a lot deeper than the thread length required but you may end up with curls of swarf in the bottom of the hole that will be hard to get out.

As well as selling individual taps ARC also do sets shown in the accompanying photo which contain a tapping size drill and matching tap across the range of M3 to M12, you only need one tap of any size rather than the traditional three as the lead in taper is

very short particularly on the spiral flute ones. I have tried these on a number of materials and found them to work well with even the M12 Spiral flute being able to power tap mild steel using the SX2.7's tapping function. Next months Milling For Beginners will cover their use in more detail.

To complement the new taps which also include BSP sizes there are solid dies again in both Metric coarse and fine or complete tap & die sets with wrenches and stocks included. Together with the existing range of individual tap wrenches and dies stocks.

Jason Ballamy



Casting for the Home Workshop

This latest addition to the Crowood Metalworking Guides series has been written as a joint effort by Henry Tindall, a chartered engineer with experience of orthopaedic implants, and Dave Cooper, who trained as a coremaker and has worked at both ferrous and non-ferrous foundries. Both authors are also hobby engineers, and this book draws on their wealth of experience to give a comprehensive guide to all aspects of casting in the home workshop. The book itself is a well-produced 178 page hardback consistent with other titles in the series.

The book covers everything from the fundamentals of casting through to the treatment of finished castings, covering everything on the path between, including designing and making castings and the use of different materials. It also has some useful appendices covering safety, casting data and a comprehensive glossary. It has many excellent photographs and particularly clear diagrams. My only criticism is that some of the index entries are a page out. More importantly, it's a good read, and comes highly recommended.

Casting for the Home Workshop is published by Crowood Press and has a cover price of £14.99.

All advertisements will be inserted in the first available issue. There are no reimbursements for cancellations. All advertisements 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

MiChec Engineering
3D modelling • 2D drawing • Design • CAD conversion • Prototyping • 3D printing
www.michec.co.uk
enquiries@michec.co.uk
07973749698

To advertise here,
please call
David Holden on
07718 64 86 89

Cowells Small Machine Tool Ltd.
Cowells Small Machine Tools Ltd
Trenting Road, Little Bessing, Colchester CO2 8JL Essex England
Tel/Fax +44 (0)1206 351 792 e-mail: sales@cowells.com
www.cowells.com
Manufactures of high precision screwcutting lathes, 8mm horizontal collet lathes and milling machines, plus comprehensive accessory range. Talk directly to the manufacturer

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

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

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

ems-i The Digital Readout & Measurement Specialists



- Lathes
- Mills
- UK Brand
- Hobby
- Industrial
- Optical
- Magnetic

If you have a lathe or milling machine then you will appreciate the need for a quality digital readout system to provide consistent accuracy and repeatability in machining.

ems-i provide both **optical** and **magnetic** systems to machine builders, re-builders and main dealers so you can be assured of performance, quality and service.

Our specialist encoders, for smaller machines, allow for neater installation and integration in limited spaces without performance compromise. Perfect for Myford, Boxford, Viceroy, SIEG etc.



UK's Smallest Magnetic Encoder

0116 279 3035 : facebook.com/ems.i.systems
info@ems-i.co.uk : www.ems-i.co.uk

CNC Cutting service Wood, Metal, Plastic & CNC Conversions

- Need a part for your loco or model CNC machined?
- Need fine engraving done onto metal?
- We have lathes, mills, plasma cutters, laser engravers.
- CNC Machine conversions (both lathes and mills).
- Custom PCB design.

NO job too small give us a ring today for a chat!

Routout cnc + Tiggy Aviation
Tel: 01664 454795
www.routoutcnc.com

webuyanysteam.com



Looking to sell? Send photos to
value@webuyanysteam.com
to see what we would pay.
Or call us on **0115 677 0347**

webuyanysteam.com



Looking to sell? Send photos to
value@webuyanysteam.com
to see what we would pay.
Or call us on **0115 677 0347**

CLOCK CONSTRUCTION & REPAIR

Books by:
John Wilding MBE
FBHI, E. J. Tyler,
John G. Wright, Eric
Woof, John Tyler
and others.

**SPRINGS
BEARINGS
FRAMES
DIALS etc.**

FREE Catalogue
Telephone: +44 (0) 1420 487747
www.ritetimepublishing.com




All advertisements will be inserted in the first available issue. There are no reimbursements for cancellations. All advertisements 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!

ModelFixings.co.uk
also the home of **ModelBearings.co.uk**

ALWAYS IN STOCK:
Huge range of miniature fixings, including our socket servo screws.

- Taps, Dies & Drills
- Adhesives
- Engine & Miniature bearings
- Circlips, etc. etc.

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

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

BA SCREWS IN BRASS, STEEL AND STAINLESS

SOCKET SCREWS IN STEEL AND STAINLESS • DRILLS • RIVETS • TAPS • DIES • END MILLS SLOT DRILLS etc

PHONE FOR FREE LIST

ITEMS MAIL ORDER LTD
Mayfield, Marsh Lane, Saundby
Retford, Notts. DN22 9ES
Tel/Fax 01427 848880

Model Engineering Products Bexhill

Manufacturers of 5" gauge diesel outline battery electric locos and accessories

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

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 Rington, LEEDS LS17 0DF
www.laserframes.co.uk

MiChec Engineering
3D modelling • 2D drawing • Design • CAD conversion • Prototyping • 3D printing
www.michec.co.uk
enquiries@michec.co.uk
07973749698

GB BOILER SERVICES
COPPER BOILERS FOR LOCOMOTIVES AND TRACTION ENGINES etc.
MADE TO ORDER
Constructed to latest European Standards
7 1/4" gauge and P.E.D. category 2 Specialist
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 2576663 Email: **ian@iandcobb.co.uk**
www.iandcobb.co.uk

Meccano Spares

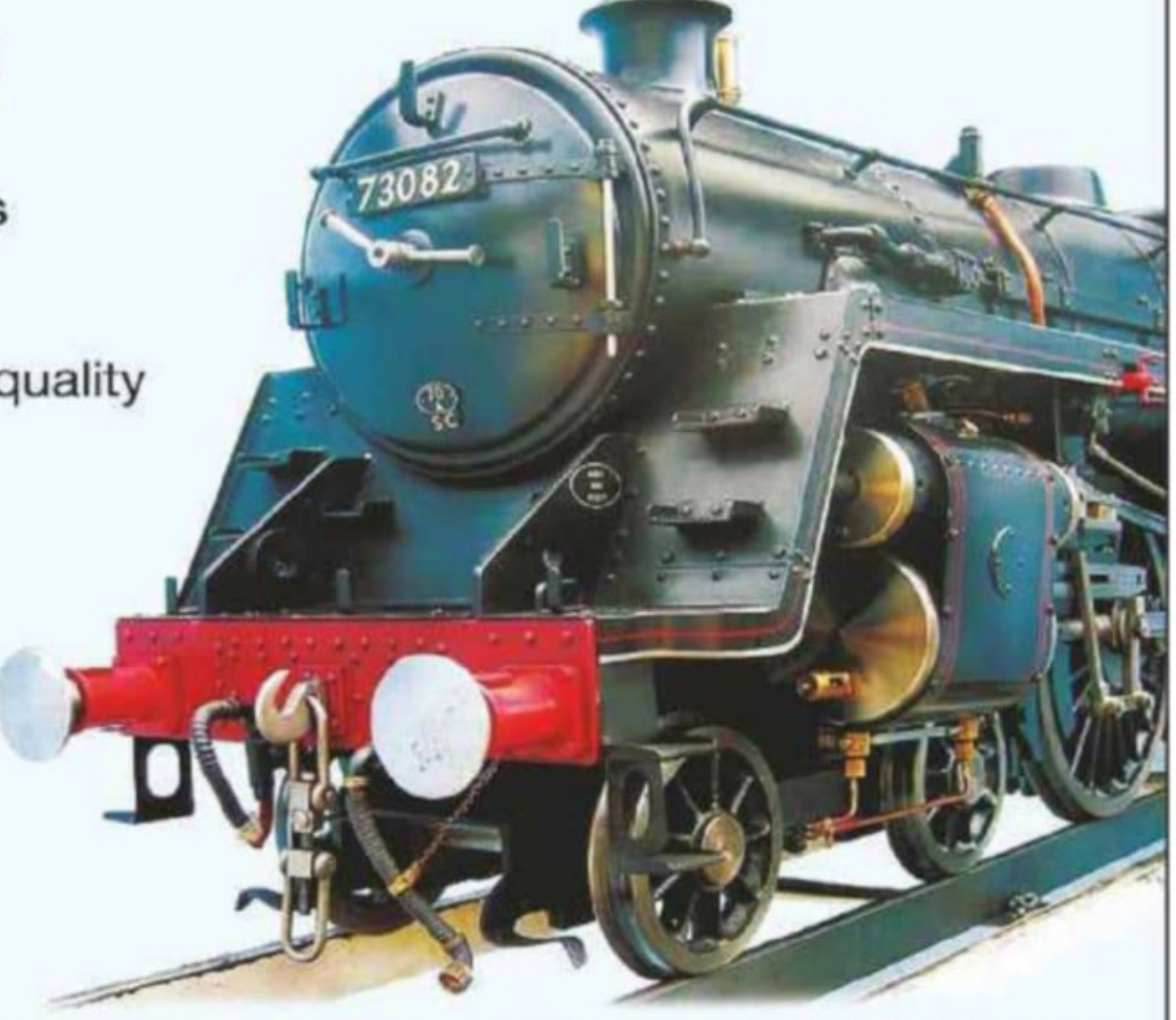
New Reproduction and Pre-owned Original Meccano Parts.
www.meccanospares.com
sales@meccanospares.com
Tel: 01299 660 097

Don't know what it's worth?

- Good prices paid for all live steam models Locomotives from gauge 1 to 10 1/4 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



Jeadon Engineering

www.jeadon.com

Supplier of quality preowned engineering equipment from all types of cutting tools, measuring equipment, work and tool holding. From top brands including Dormer, Titex, Moore & Wright, Mitutoyo, Seco, etc. New stock added daily.



www.jeadon.com | enquiries@jeadon.com | 07966553497

REEVES MODEL ENGINEERS 2000

The World's Largest Stockists of Model Engineering Supplies

Trade Counter Fully Stocked and Open to Callers - ALL WELCOME

Reeves 2000, Appleby Hill, Austrey, Warks CV9 3ER

Tel: 01827 830894 9:00am-4:00pm Mon - Fri Closed Sat & Sun

sales@ajreeves.com http://www.ajreeves.com

Castings and drawings for over 170 models



For exclusive offers visit our website www.ajreeves.com

images for display purposes only. Actual item supplied may differ from image

or follow us on Facebook

Stockists of major brands for the Model Engineer including

REEVES MODEL ENGINEERS 2000

reilang **LOCTITE** **HYLOMAR** **SIEVERT** **GUHRING**

HOME AND WORKSHOP MACHINERY

Genuine Used Machines & Tooling

144 Maidstone Road, Fooks Cray, Sidcup, Kent DA14 5HS

Tel: 0208 300 9070 - Evenings: 01959 532199 - Fax: 0208 309 6311

www.homeandworkshop.co.uk • sales@homeandworkshop.co.uk

Opening Times: Monday-Friday 9am-5.30pm • Saturday Morning 9am-1pm

10 minutes from M25 - Junction 3 and South Circular - A205

£425 Clarke 917 vacuum forming machine

£20 each Taps and Dies

£375 Myford Speed 10

£425 Harrison lathe vertical slide

£625 Micrometers Various! 0-16" / 300mm

£100 Denford Viceroy 10" chisel grinder

£195 Back in! Stanier 55mm precision swivel machine vice from NEW ZEALAND 'Finest Engineering'

£4950 Myford Super 7B lathe hardened bed

£1250 Sedgewick TA315 12" sawbench

£10 Each Cora 'neat cut'

£950 Still wrapped from new! Vertex tool and cutter grinder

£625 Q & S Terrier 8" hacksaw

£425 Jones and Shipman (8" throat) arbor press

£345 Lurem C 210 B Combination machine (inverter)

£1750 240 volts nice selection

£345 original as new! Burmed D13 8" 4 jaw chuck

£1475 Union buffer + built in extractor

£845 Clarkson tool and cutter grinder

£3250 Colchester Colt 6.5" x 40" centres

£4250 Myford Super 7B lathe + inverter

£3250 Myford non standard wheels

£10-£49 Union 12" pedestal grinder

£375 Union buffer

£495 3.5 TON 9ft forks pallet truck £495

£425 Rjh buffer

£3950 Denford Turn 270 Pro CNC

£30 each Myford chuck & nose collets

£20 each Angle plates + surface plates

Special 5 for £20 Myford ML7 / Super 7 Rifle / Bridge bed felts

£90 Tripus (German) on/off switch

£525 Union 10" pedestal grinder

£845 Tom Senior Mill

£1475 Wadkin BL150 wood lathe

£45 Each Bridgeport coolant trays

£345 12" x 12" x 24" Angle plates (pair)

£4250 Colchester Mastiff 10.5" x 60" + gap bed

£1225 240 volts! Sieg Z3 3MT variable speed heavy duty drill (built in inverter)

£625 Boxford AUD MKIII lathe

£1400 Worcester 3 TON power press

£625 Like new! Hegner fretsaw (German)

£1850 Myford VMB mill

£625 Myford VMB mill

£725 Myford gearbox, leadscrew and guard

£295 Harrison M300 large 18" faceplate

£1275 Emco Unimat accessories Boxed!

£40 Startrite 275 12" saw bench cuts up to 4 1/8" thick!

£30 each 123 blocks

£40 R8 collets 6mm 10mm 12mm 16mm set

£40 R8 collets 1/4" 3/8" 1/2" 5/8" set for

choice! Myford dividing heads;

£40 each Harrison L5 L5A L6 travelling steadies

£40 each Colchester student travelling steadies side and bottom mount

£40 each Colchester Bantam 2000 fixed steady

£375 Colchester Student 1800 / Master 2500, Triumph, Mastiff fixed steadies

Coming in; Myford VMB mill

£20 & £30 each Record BS300E bandsaws

More details on Web Site

Please PHONE 0208 300 9070 to check availability or to obtain our list

DISTANCE NO PROBLEM! • DEFINITELY WORTH A VISIT • ALL PRICES EXCLUSIVE OF VAT

Just a small selection of our current stock photographed!

We are currently seeking late 'Myford Super 7B' & 'Super 7 large bore' model lathes!

SHIPPING WORLDWIDE



Chester D Series Drills

A hobby workshop must have!



CHESTER
Hobby Store



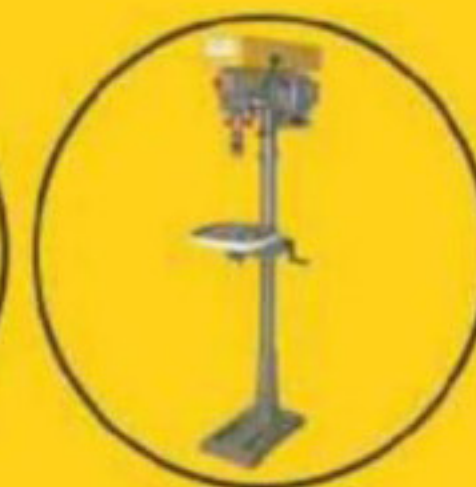
D13



D16



D19



D20

	D13	D13R	D16	D19	D20
Throat	104mm	125mm	165mm	178mm	178mm
Drilling Capacity	13mm	13mm	16mm	20mm	20mm
Chuck Size	1-13mm	1-13mm	3-16mm	3-16mm	3-16mm
Spindle Travel	50mm	60mm	80mm	80mm	80mm
Spindle to Base	350mm	535mm	620mm	600mm	1250mm
Spindle to Table	210mm	415mm	450mm	410mm	800mm
Table Size	165x160mm	190x195mm	300mm dia.	290x290mm	285x285mm
Spindle Taper	B16	MT2	MT2	MT2	MT2
Spindle Speeds	600-2500rpm	460-2890rpm	210-2580rpm	120-2580rpm	120-2580rpm
Height	585mm	800mm	990mm	1000mm	1630mm
Base Size	280x175mm	200x330mm	230x400rpm	430x270mm	460x275mm
Motor	0.25kW	0.37kW	0.55kW	0.65kW	0.65kW
Weight	17kg	29kg	42kg	86kg	70kg
Price (inc VAT)	£114.45	£1943.25	£273.00	£326.55	£313.95

Standard Accessories: Drill chuck, chuck guard, manual and parts list.

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