No.268

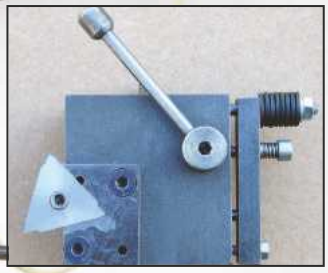
GET MORE OUT OF YOUR WORKSHOP WITH MEW

MODEL ENGINEERS' WORKSHOP

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

JUNE 2018

INSIDE



A solution for Safer Parting Off

2018. THE YEAR OF ENGINEERING SUPPORTER

COVER STORY

Revisiting the Dore Westbury Mk 1

£4.99

mytimemedia ENGINEERING GROUP

9 770959 690133 68

YOUR FAVOURITE WORKSHOP MAGAZINE

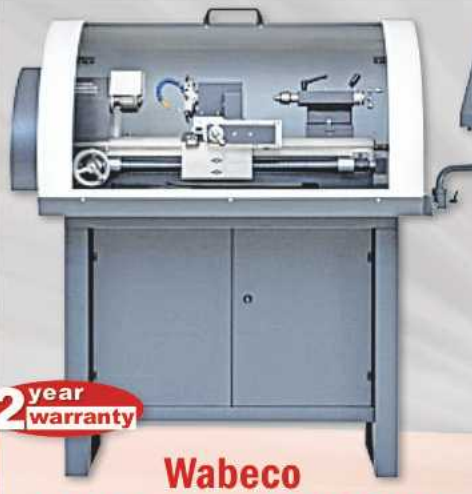
PRO MACHINE TOOLS LIMITED

Tel: 01780 740956
Int: +44 1780 740956

Up to 5 year warranty on selected WABECO Machines!

1885 WABECO 1885

Precision machines made in Germany for the discerning engineer!



2 year warranty

Wabeco CNC Lathe CC-D6000

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

1885 WABECO 1885

Wabeco produce quality rather than eastern quantity

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

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

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

5 year warranty

Wabeco Mill F1210

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

Wabeco Lathe D6000

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

5 year warranty

Wabeco Lathe D4000

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

5 year warranty

Wabeco CNC Mill CC-F1410

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

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

2 year warranty

EMCO · WABECO · CERIANI · swiss tec · TECO · GOLmatic Maschinenbau · PROXXON · EMCO Hobbymaschinen

MORE MACHINES AND ACCESSORIES ON LINE

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

We regularly ship worldwide

Please contact us for stock levels and more technical detail

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

www.emcomachinetools.co.uk

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

MODEL ENGINEERS' WORKSHOP

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

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

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

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

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

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

ADVERTISING
Business Development Manager: David Holden
Email: david.holden@mytimemedia.com
Tel: +44 (0) 7718 64 86 89

MARKETING & SUBSCRIPTIONS
Subscription Manager: Louisa Coleman

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

mytimemedia
print & digital media publishers

Model Engineers' Workshop, ISSN 0959-6909, is published monthly with an additional issue in August by MYTIMEMEDIA Ltd, Enterprise House, Enterprise Way, Edenbridge, Kent TN8 6HF, UK. The US annual subscription price is 52.95GBP (equivalent to approximately 88USD). Airfreight and mailing in the USA by agent named Air Business Ltd, c/o Worldnet Shipping Inc., 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, Worldnet Shipping Inc., 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Subscription records are maintained at dsb.net 3 Queensbridge, The Lakes, Northampton, NN4 7BF.
Air Business Ltd is acting as our mailing agent.

On the Editor's Bench

Jim Whetren

I'm sorry to report the passing of James (Jim) Whetren, at the age of 71. A prolific contributor to Model Engineer's Workshop over many years, Jim originally worked for Royal Enfield, although not in an engineering role, then went on to serve in the Royal Navy and the Fleet Air Arm. On leaving the services, he realised an ambition to join the traffic police, as well as becoming a qualified firearms instructor. He was a self-taught engineer, and a rather private person, so few people actually saw his work first-hand. However, many of his excellent designs were written up for Model Engineer, including a series of improvements for the Worden Grinder and an automatic carriage stop for the Prazimat lathe – among many, many others. His radius grinding attachment for the Worden is still available in kit form from Hemmingway.

My thanks to David Hayward for letting me know the sad news; I am sure all readers of Model Engineers Workshop will join me in expressing our condolences to Jim's family and friends and our appreciation for his contributions to our hobby.

Flight of Fancy

Last weekend, at my brother's suggestion, we visited the Scottish National Museum of Flight at East Fortune, near Edinburgh. The site is a former WW2 RAF airfield, and mostly comprises the original buildings, and unlike many such museums is very spacious and uncrowded. The Museum's centrepiece is Concorde G-BOAA, the aircraft that famously flew in formation with the Red Arrows. Following the Paris Concorde crash, G-BOAA was never upgraded, and made its final journey from Heathrow to East Fortune by road and ship.

The museum has many other exhibits including military and civil aircraft, many with a Scottish connection such as Scottish Aviation Twin Pioneer and a home-built Druine Turbulent. It also includes some unfamiliar aircraft, such as an Aero S0-103 – a Czech built MIG-15.

There's also a gallery called Fantastic Flight which has a very varied selection of hands-on educational exhibits, aimed at youngsters but may of which appeal to adults too. My brother and I successfully landed the R34 airship simulator, for example.

Possibly the most surprising exhibit, was a Green Goddess fire engine – it's hard to believe that it's over forty years since they were brought out of reserve during the national fire service strike in 1977.

arceurotrade.co.uk

UNBEATABLE VALUE ENGINEERING PRODUCTS

SIEG SC2 & SC3 HiTorque Lathe Offer

Buy this SC3-400 for £775.00*...
(Incl. VAT)

...and get Starter Set 2 for £180.86* (Incl. VAT)
(normal price £258.37 when purchased separately)

SC2-300 HiTorque Lathe + SC2/SC3 Lathe Starter Set 2: Total £898.66* (Incl. VAT)

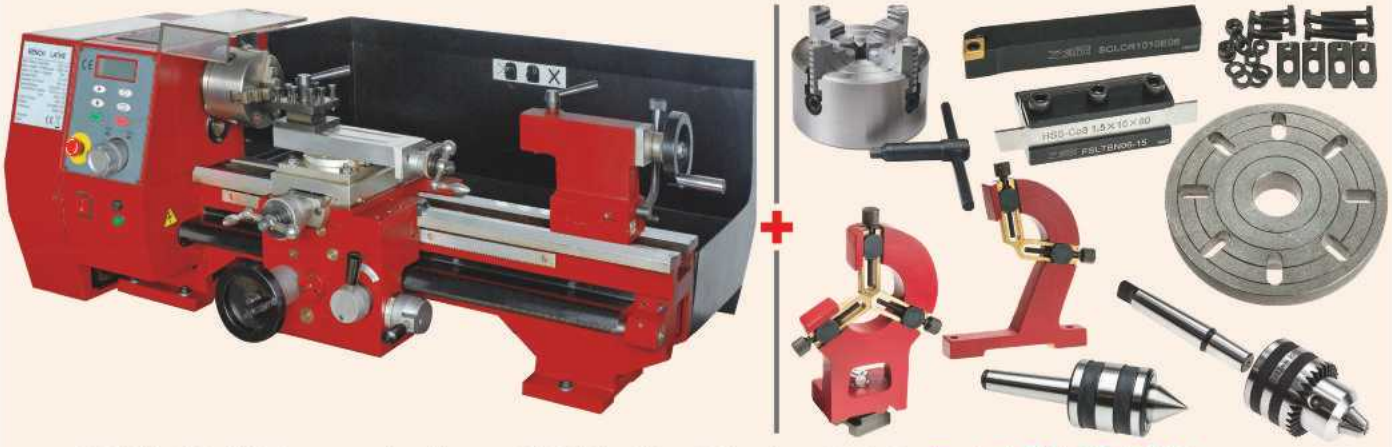
SC3-400 HiTorque Lathe + SC2/SC3 Lathe Starter Set 2: Total £955.86* (Incl. VAT)

Code	Description	Price	Delivery
080-020-00220	SC2-300 HiTorque Mini-Lathe	£717.80	£27.50 (UK Mainland)
080-020-00320	SC3-400 HiTorque Mini-Lathe	£775.00	
MAY18-SC2-SS2	SC2-300 HiTorque Mini-Lathe + SC2/SC3 Lathe Starter Set 2	£898.66	
MAY18-SC3-SS2	SC3-400 HiTorque Mini-Lathe + SC2/SC3 Lathe Starter Set 2	£955.86	

SIEG SC4 HiTorque Lathe Offer

Buy this SC4-510 for £1,475.00*...
(Incl. VAT)

...and get Starter Set 3 for £206.69* (Incl. VAT)
(normal price £295.26 when purchased separately)



SC4-510 HiTorque Lathe + SC4 Lathe Starter Set 3: Total £1,681.69* (Incl. VAT)

Code	Description	Price	Delivery
080-020-00375	SC4-510 HiTorque Lathe	£1,475.00	£65.00 (UK Mainland)
MAY18-SC4-SS3	SC4-510 HiTorque Lathe + SC4 Lathe Starter Set 3	£1,681.69	

*** For orders placed and dispatched before 15th June 2018 only.**

Offer limited to one per buyer (hobby sale only). Subject to availability.

Arc Euro Trade Ltd.
10 Archdale Street, Syston, Leicester, LE7 1NA.
Web: www.arceurotrade.co.uk Phone: 0116 269 5693.

Handling and carriage rates to most UK mainland destinations are based on order value:
£0-£10 = £1.40, £10-£25 = £2.45, £25-£60 = £3.50, Over £60 = Free (unless otherwise stated)

ALL PRICES INCLUDE VAT E. & O. E.

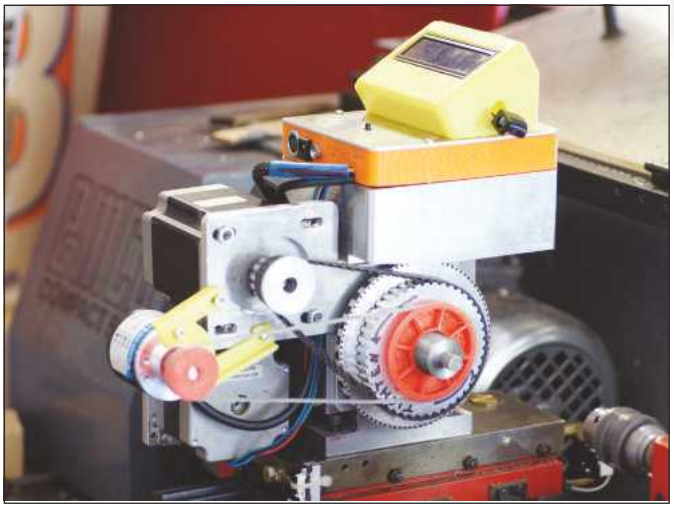
Contents

See page 52 for details.

Coming up...

in our next issue

Coming up in our next issue, MEW 269 another great read.



Regulars

ON THE COVER >>>

This month's cover features Glynn Davies' fine Dore Westbury Mk. 1 mill, as featured on page 27 of this issue.

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

This month you can find detailed plans for John Olsen's Unimat toothed belt drive at **www.model-engineer.co.uk/unimat**

Any questions? If you are a beginner and you have any questions about our 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 the series.

So, why not come and join one of the busiest and friendliest model engineering forums on the web at **www.model-engineer.co.uk?**

Drummond Shaper Feed

Shapers seem to be enjoying a renaissance. This thread discusses improving the auto feed drive on a Drummond machine.

What did you do Today & the Workshop Progress Thread

Been a busy bee in your workshop? Join in and share your workshop triumphs and tragedies – and other engineering related stories.

How to Remove a Chuck from a Boxford Model A

The old chestnut – what's the best way to remove a screw on chuck without damaging the backgear of a lathe?

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

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

Garden Railways

Visit Our Aylesford Show Room!
Open Monday-Friday 10am-4:30pm & 1st Saturday of the month 11am-4pm

Request your FREE Catalogue today!

Collect Loyalty Points Online

01622 793 700

www.dream-steam.com

PayPal VISA JCB Maestro MasterCard

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

BRAND OF THE MONTH: ROUNDHOUSE

In Stock Now*

Millie	Black, 32mm	£650
Millie	Victorian Maroon, 32mm	£650
Sammie	32mm & 45mm	£650
Bertie	Blue, 32mm	£650
Bertie	Yellow ,32mm	£650
Bertie	Maroon , 32mm	£650
Bertie	Deep Brunswick Green, 32mm	£650
Bertie	Maroon , 45mm	£650

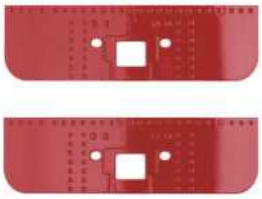
As stockists of Roundhouse Locomotives, we have a varied range for instant dispatch but you are able to order any roundhouse loco from us online, which allows you to collect loyalty points!

Large stocks of the Roundhouse white metal parts including loco lamps, metal jacks, buckets and much more available to purchase!

Home builder parts including basic pressure gauge, Basic radio control kits, buffer sets, buffer overlay plus more also available!

On Order

Bulldog	Due June 2018
Little John	Due Sept 2018
Bulldog	Due Oct 2018
Lady Anne	Due Nov 2018
Katie	Due Jan 2019
Russell	Due Jan 2019
Lilla	Due Feb 2019
Billy	Due March 2019



Many Home Builder parts and kits available to order online!*

Full Range of cast White Metal items In Stock*

*In stock as of 11/04/18, please note these loco's may no longer be available, check stocks online or call. Please note basic range takes 4 weeks from inital order and other locomotives are in batches. Batch dates will be in product description. Locomotives in stock will state instant dispatch available.

Dream Steam Works manufacturers a range of upgrades and enhancements for old Mamod,MSS, IP Jane &PPS Janet locos.

Upgrade Cylinders	DSUPCYL	£72.00
Ceramic Gas Burner Set	DSUPGBS	£90.00
Three Wick Meths Burner	DSUP3WMB	£45.00
Dead Leg Lubricator	DSUPDLDL	£29.00
Steam Regulator Kit	DSUPSRK	£35.00
Small Brass Chimney Cowl	DSENSMCWL	£4.00
Brass Cab Hand Rails	DSENCH	£4.20
Brass Side Tank Hand Rails	DSENSTHR	£5.20
Brass Smoke Box Hand Rails	DSENSBXHR	£3.10
Cylinder Covers	DSENCYCV	£12.00
Brass Sand Boxes	DSENSBX	£12.50
Brass Tank Tops	DSENWTT	£9.40
Lubricating Oil	SWLUB30	£3.00
Meths Burner Wick	DSWWK6	£1.90
Curve Tipped Syringe	DSWCTS	£2.10
460 Steam Oil 500ml	DSW460SO500	£5.50
220 Steam oil 500ml	DSW220SO500	£5.50
Solid Fuel Tablets	980001	£3.50
Water Filler Bottle	DSWWFB	£4.00
Meths Filler Bottle	DSWMFB	£3.00

BACHMANN

Tank Car North Star	98098	£28.50
V Dump Car (Oxide Red)	92504	£46.00
G' Flat Wagon with Logs	98470	£79.00
"LS" Skeleton Log Car	98490	£79.00
"LS" Jackson Sharp Passenger Cars Coach	89399	£87.00
"LS" Speeder Orange	96253	£90.00
"LS" Speeder PRR	96251	£90.00
"LS" Speeder Santa Fe	96252	£90.00
16mm Scale Fireman and Driver	16-703	£19.95
16mm Scale Sitting Man and Woman	16-704	£19.95
16mm Scale Standing Man and Woman	16-705	£19.95
G Scale Grazing Cows	22-199	£24.95
G Scale Horses Standing and Grazing	22-201	£24.95

PECO

32mm (SM32) 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	£44.00
Setrack Curve - Single	ST605x1	£6.90
Setrack 38 Radius Curve- Single	ST607	£6.90
Setrack 38 Radius Curve - Six Pack	ST607x6	£44.00
Right Hand Point	SLE695	£45.00
Left Hand Point	SLE696	£45.00
Y Point	SLE697	£45.00
Small Radius Right Hand Turnout	SLE691	£45.00
Small Radius Left Hand Turnout	SLE692	£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	£40.00
Setrack Curve - Single	ST905x1	£8.00
Setrack Straight - Six Pack	ST902x6	£40.00
Setrack Straight - Single	ST902x1	£8.00
Right Hand Point	SL995	£54.00
Left Hand Point	SL996	£54.00
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

Set-a-Curve

Available in 32mm and 45mm with a wide range of Radii

£15

BACHMANN

Percy and the Troublesome Trucks Set	90069	£390.00	
Thomas with Annie & Clarabel Set	90068	£390.00	
Thomas' Christmas Delivery	90087	£210.00	
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	£58.00	
Emily's Brake Coach	97004	£58.00	
Troublesome Truck1	98001	£59.50	
Troublesome Truck 2	98001	£59.50	
Ice Cream Wagon	98015	£56.00	
Tidmouth Milk Tank	98005	£39.00	
S.C Ruffey	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	

SLATERS

Festiniog Railway Ashbury First Class 4-Wheel Carriage Kit	16C01	£73.50
Festiniog Railway Third Class Ashbury 4-Wheel Carriage Kit	16C02	£73.50
Dinorwic Slate Wagon Kit	16W01	£20.00
Festiniog Railway 2 Ton Braked Slate Wagon Kit	16W03	£26.60
Festiniog Railway 2 Ton Unbraked Slate Wagon Kit	16W04	£25.40
War Department Light Railways K Class Skip Wagon Kit	16W06	£20.00
Dinorwic Quarry Slab Wagon Kit	16W08	£25.50
Dinorwic Quarry "rubbish" Wagon Kit	16W09	£25.50

Slaster's Mek-Pak	0502	£5.00
Slaster's Mek-Pak Brush	0505	£3.70

MSS

Side Tank Locomotive (32mm/45mm)	909003	£200.00
Saddle Tank Locomotive (32mm/45mm)	909013	£230.00
Side Tank Locomotive Kit (32mm/45mm)	909011	£190.00
Maroon Tender (32mm/45mm)	911403	£53.00
Green Tender (32mm/45mm)	911405	£53.00
Black Tender (32mm/45mm)	911401-BL	£53.00
Blue Tender (32mm/45mm)	911402-BL	£53.00
Maroon Passenger Coach (32mm/45mm)	911201	£53.00
Blue Passenger Coch (32mm/45mm)	911201BL	£53.00
Log Wagon (32mm/45mm)	911501	£53.00
Goods Van (32mm/45mm)	911101	£53.00
Guards Van (32mm/45mm)	911001	£53.00
Coal Wagon Grey (32mm/45mm)	911505	£53.00
Coal Wagon Unpainted (32mm/45mm)	911505-1	£53.00
Pair of Flat Bed Wagons (32mm/45mm)	911301	£57.00
Straight Track	910003	£34.00
Curved Track	910005	£34.00
Left Hand Point	910001	£24.40
Right Hand Point	910002	£24.40

WE HOLD A FULL RANGE OF MSS SPARES AND UPGRADES FOR OLD MAMOD & MSS LOCOS

MAMOD

Telford	MTELG0	£452.00
MKIII	MK3 From	£336.00
Saddle Tank	MST From	£336.00
Brunel	MBrunelOG	£440.00
Brunel Goods Set	BGS-CC-N	£520.00
Tender	MTDR	£39.00
Tanker	MTNK	£39.00
Goods Wagon	MGWN	£44.00
Guards Van	MGVAN	£50.00
Telford Tender	MTDR-T	£45.00

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

£25 inc. P&P

BACHMANN EUROPE Plc | DSW DREAM STEAM 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

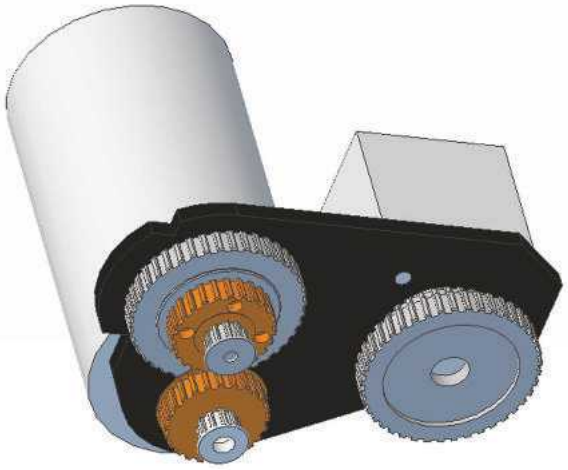
Toothed Belt Drive for the Unimat 3

John Olsen improves the drive arrangements of this well made benchtop lathe.

John has kindly provided CAD drawings to accompany this article. They can be downloaded from www.model-engineer.co.uk/unimat in pdf format.

I first bought my Unimat 3 nearly thirty years ago and took no time at all to become thoroughly disenchanted with the O-ring drive belt system. Although small, the lathe itself was quite evidently capable of some good work, but the irritation of disentangling the drive belt from itself, and all too frequently replacing them rapidly lead to the desire for changes. So around 25 years ago I built this toothed belt drive system. At the time I thought I should write it up for the benefit of others, but the difficulty of producing a useful set of drawings caused this idea to fall by the wayside. The drive itself has survived all these years, first being used with the original motor, then with one of the permanent magnet motors such as the current Unimat 4 is supplied with. A year or so back that too in its turn died, and so the motor was replaced with a jack shaft fitted to the existing drive plate. This is now driven via a poly V belt drive from a small three phase motor with an AC speed controller. The poly-V pulleys have two steps, so I have a total of 8 ratios plus the variable speed feature from the controller. The only downside is that I cannot fit that system to the milling attachment.

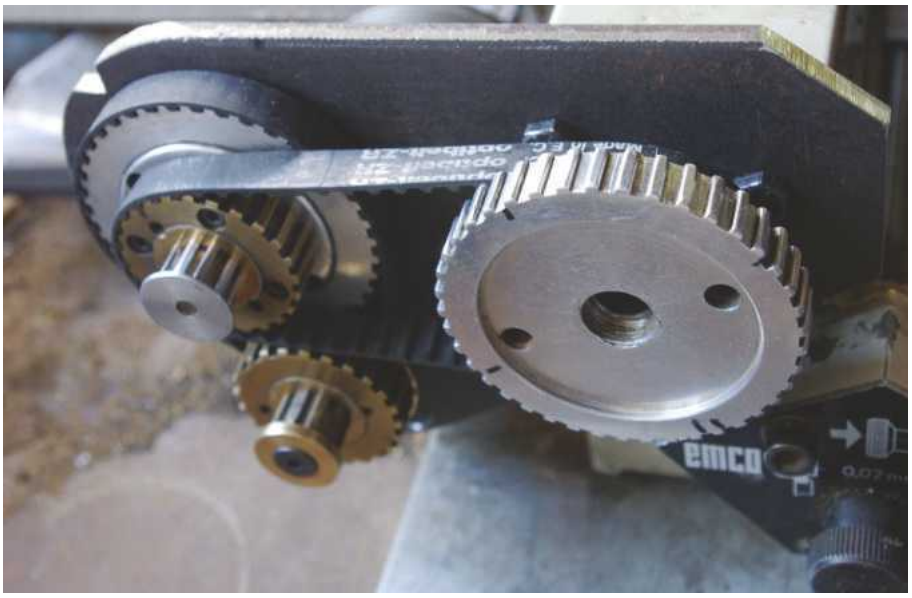
Fig.1



Unimat Toothed Belt Drive Assembly

The drive I will describe here, **fig. 1**, does not include the poly-V belts and the speed controller. The special features of the arrangement described are that it all fits inside the original plastic cover and provides speed ratios similar to the original belt drive. It can work with either the original old Unimat motor, which was a series wound universal type, or with the later larger diameter permanent magnet type. It can be used on the milling attachment or the lathe. Speeds can be changed readily, the belt being able to be moved from one wheel to another as required. All machining for the original was done using the Unimat itself. The equipment available included the milling attachment and the simple direct dividing attachment.

When I first started looking into the design, I decided to rely on the fact that these toothed belts can run without a tensioner, provided the tension is within a reasonable range. (This does not necessarily apply when they are used for timing applications.) The problem then was to find a set of sizes that would allow ratios similar to the original pulleys. In the process of investigating this I found that the speed table provided on the lathe owed more to someone's imagination than to the speeds that the lathe actually ran at. No doubt the intention was to provide a guide to the sort of speed attained under typical conditions, since the speed of these small universal motors can vary considerably with load. However, the errors were quite large, and do not line up at all with the actual ratios that the original belts provide. The toothed belt has one advantage, the smallest pulley it can use is actually smaller than the original small pulley, so in fact we get a wider range



The new 6mm plate fitted to the lathe, before drilling for the guard. The less than perfect spacing of the teeth on the large wheel is noticeable.

of speeds than the original. I used ten teeth, and would not suggest using anything smaller for a potentially heavily loaded application like this. A significant constraint was the desire to do the dividing on the available attachment, which had plates with 24, 30, 36 and 40 divisions.

For the counter shaft, the largest wheel that seemed likely to fit in was forty teeth. A similar sized wheel seemed possible for the large wheel on the main spindle. That would give an overall reduction for the lowest speed of 16 to 1. Assuming a motor speed of around 4,000 RPM, that would be a lowest speed of 250 RPM with the motor switch at full speed, and something less with the diode switched in for half speed. After some messing around with wheels and belts finding what would work, I established that I could not use forty for the large main shaft wheel and still have a workable pair for the high-speed set. What I came up with was 10 driving 41 for the low speed pair, and 24 driving 30 for the high-speed pair. By providing the same wheels on the countershaft, we can obtain the overall ratios in **table 1**.

Ok, so the 4.1 to 1 and 5.1 to 1 are really a little closer than we would like, but the same objection actually applies to the originals. If you are able to divide by other ratios than the simple set provided, you might be able to find a better compromise.

A posed photograph showing the kind of set-up needed to mill the wheels using the Unimat. Note that when set up in this way the dividing attachment only has one screw clamping it to the table, see text for a suggestion.

Table 1 – Drive Ratios

Motor shaft	Countershaft driven	Countershaft driver	Main spindle	Overall ratio	Overall ratio (alternative wheels)
Low range					
10	40	10	41	16.4 :1	16.4 :1
10	40	24	30	5:1	6.8:1
High range					
10	N/A	N/A	41	4.1:1	4.1:1
24	N/A	N/A	30	1.25:1	1.7 :1

A view of the drive from below showing the thin flange fitted to the larger wheel on the motor shaft. This should almost touch the 40 tooth wheel on the countershaft.

The original calculations and measurements I took are long gone, but I have just done some recalculation. The idea would be to reduce the size of the 24 tooth slightly and increase the size of the 36 tooth to maintain the overall belt tension. According to what I have found, if the spacing of the shafts is kept at 83.5mm, then you should be able to use any of the following pairs.

Driver	Driven
22	32
21	33
20	34

Taking the last one, you would get overall ratios as seen in the last column of the table. Since these would give a better spread, you may wish to try this, but you will need arrangements to divide the different size wheels. Having not tried this I cannot totally guarantee that the alternative sizes will give the correct tension, but they look OK on paper, or rather on the spreadsheet. The way this is done is that you calculate the belt length for a pair of wheels and a given spacing. Because the belt will flex around its neutral axis, an allowance is made for the belt thickness.

So we need the following wheels to duplicate the arrangement I used:

Three with 10 teeth
Two with 24 teeth
Two with 30 teeth
One with 40 teeth
One with 41 teeth

You will also want a 41 tooth and a 30 tooth for the milling attachment as well. I am assuming that you have this attachment, since it would be difficult to make this drive without it. All of these wheels, apart from that annoying 41 tooth job, can be cut with the standard direct dividing attachment. Plan B would be to scrounge access to a suitable milling machine with a dividing attachment. If you can do this, then you could consider trying the alternative ratios. We are all set now to acquire some suitable bar and start cutting. But there is one catch you will have to bear in mind. The spacing we end up with for the three shafts are not the same as the originals. They are close, just close enough to make the original holes get in the way, so you will need a new mounting plate. Ideally this needs to be either 3/16" or 5mm. I used a piece of 1/8 material that I had, and

Picking up a centre punch mark using a sticky pin. Note that the position of the punch mark had to be adjusted.

although it has served, it is not really stiff enough. As part of the preparation for this article I have made a new plate. I wanted to use 5mm material but that was not obtainable in a wide enough piece, so I used 6mm. I will show the size of the spacers and recesses in the wheels to suit this. If you can get the 5mm material that would be ideal, but there will be two adjustments you need to make, discussed below.

There is not too much the Unimat itself can do to a piece of plate this size, other than drilling all the holes, so unless you have access to a metal cutting bandsaw you have a fun job to look forward to with hacksaw and file. You could chain drill outside the line with a small drill to save some work. Now, I set out the holes on mine once I was able to mount the plate on the machine and then set out the wheels with the belt and check the spacing that way. This is probably the best way to do it, since you want to get the centres right. This will help avoid any problems with the belts jumping a tooth under load. I found that with my slightly flexible plate this can happen, but not enough to cause any real problems.

I will not show all of the dimensions that I have measured from my machines for the layout of the mounting holes in this plate. The reason for this is that the two machines I have are not consistent in the actual pattern of the holes relative to the respective shaft. A plate that perfectly matches my milling head would not match my lathe. Practically the difference is only a millimetre or so, but if you laid out the holes on a new plate from mine there is a good chance you would find it did not fit very well

The way to tackle this plate is to make the outside shape and the slotted mounting holes exactly the same as your original, by tracing around it with a scriber. Include the two keyhole-style mounting holes, but not the motor or countershaft holes. If you are making a plate to use only on one machine, it might be better to omit the keyhole part and just make two plain holes in the correct position. After cutting it out, set it up on the machine. Make up a template as per the sketch, set this over the shaft of the machine, and mark through in the best place for the motor shaft and the countershaft. The mill shaft is smaller, so if you are doing one for the mill use the smaller size hole given. I would suggest that the tolerance on the distance from the lathe or mill shaft to the countershaft or to the motor shaft is about +0 - 1mm, since mine has been working all these years with the distance at 1mm less than I have calculated as optimum. You don't want to go over the ideal distance because the belt won't go on, but you can go a little under. The tolerance on the distance between the countershaft and motor shaft is tighter, since the belt is shorter.

There are two key dimensions. First both the countershaft and motor shaft centres should be 83.5mm from the centre of the lathe spindle. Secondly the countershaft and motor shaft should be 43.5mm apart.

Fortunately, it is easier to maintain a close tolerance, since we can mark out both of these on the flat metal and are not trying to match the screws on the lathe or milling attachment. Since your milling attachment may also differ from your lathe, you may have to file the holes a little to allow fitting the unit to both and still provide workable belt tension. I have shown a photograph of picking up a hole with a sticky pin when setting up to drill and bore, on a somewhat larger machine than the Unimat. For those not familiar with this device, you take a normal pin, embed the end in some plasticine, and grab it in a chuck or stick it to the end of the mill. Set the machine rotating and the end of the pin can with a bit of practice be persuaded to be on the centreline of rotation. A traditional approach was to use a finger nail, but I have heard of this causing minor accidents, so a stray piece of metal or wood is to be preferred. Once it is rotating dead on centre, you can bring it down and line it up with a centre punch mark, or even a scribed line.

An alternative approach would be to fill the existing holes so that you can reuse the existing plate, but this would require welding or brazing equipment. The original for my machine provided slotted holes for the motor so that the position could be changed when used on the milling attachment. This allows having the power switch in a good position for either case. Not having the means to mill slots in such a large item, I drilled holes corresponding to each end, and then found that in practice I was perfectly happy to just leave the motor in the lathe position all the time. This means the switch is not quite as close to the front when milling as might be ideal, but on a Unimat it is not far away. The counsel of perfection would be to find another suitable motor, make two of these drives, and have one for each use. That would save some setting up time when changing from lathe to mill too.

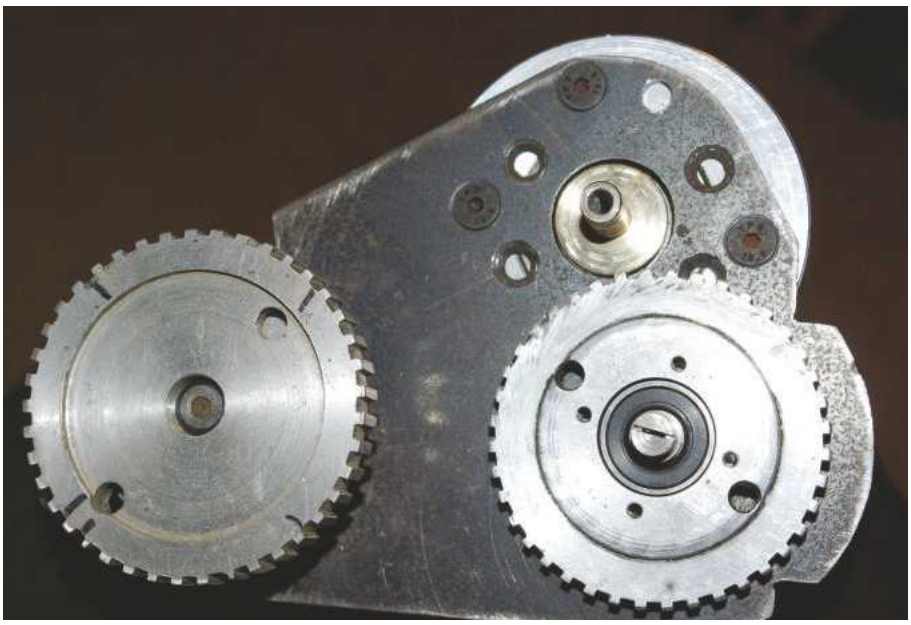
By providing the holes in the edge of the plate, we can fit the original Unimat belt cover. These can most easily be spotted through once the cover can be tried in place. If you have used the thicker material, you will need to file a chamfer on the front edge to allow the cover to clip into place.

Boring a hole for the motor on the new 6mm plate.

›

You should also file a chamfer on the plate edge around the main shaft to allow better access for putting the fine feed belt in place. I have found it very satisfying that the machine can look standard but have such a terrific improvement "under the bonnet", so to speak. The toothed belts do not quite make it into a geared head lathe, but they come a lot closer than the original drive.

So on to the wheels. Cutting the blanks is a big job, particularly since I had to cut the larger ones from the bar with a hand hacksaw. It may pay you to ask a supplier to provide suitable slices of aluminium bar, even if you have to pay a cutting fee. Some of my wheels are brass and some aluminium, this depending mostly on what I had. On one wheel I made use of the ability to use Easiflo silver solder with brass to add a flange to the side. If you use aluminium you will need to attach the flange with countersunk screws, which must not protrude and catch on the belt. It should be noted that these timing belts require restraining against sideways movement. Commercial wheels generally provide a flange each side of each wheel. For short belts like these we can get away with one flange for each direction. This is good since we hardly have room for the extra flanges. We are able to make use of the larger wheel next door in some cases. By not having flanges on both sides we make it possible to shift the belt without having to remove the tension. The arrangement shown allows you to get the belt on or off from any position. For instance, with the belt off, to get it onto either of the inside positions, first loop the belt over the main shaft large wheel until on the smaller of the two. Now you can bring it across onto the driving wheel on either the motor shaft or the counter shaft. To get it onto an outside pair you must simply remember to put it onto the small wheel first, since that has the flange. The countershaft belt can also be wangled into position with everything assembled, before the main belt is put on



A plate with the wheels partly assembled into place. This is my original plate, as can be seen by the number of holes.

of course.

Once you have the blanks, they must be turned to the correct inside and outside diameters. Now, with the passage of time I must admit that I am not totally sure about the details of how I did this, but I think that I bored the holes and then set the wheels up on a stub mandrel to turn the outside and to cut the teeth. A couple of the larger wheels have holes that suggest that they have been set up on the faceplate at some point, which would be a good way of getting the inside hole and the outside face concentric. This is important to avoid wobbly wheels. Use some parallel packing behind so that you don't have to cut up to the faceplate. The 40 and 41 teeth wheels are rather large items for the Unimat to turn, and since you don't yet have your new toothed belt drive, you are going to have to manage with the old belts for the moment. Lots of very light cuts is the way to go. Kerosene, known in the United Kingdom as paraffin, is a good lubricant for cutting aluminium.

The wheels for the main shaft, and for the milling spindle, require a screw thread. This is 14mm by 1mm pitch on the main shaft and 12mm by 1mm on the mill. Not having taps this size, I used a set of four plastic gears from an old household appliance to temporarily turn the Unimat into a screw-cutting lathe. All four gears had the same number of teeth, giving the needed 1mm pitch. Four were needed to avoid getting a left-hand thread. The lathe was turned by hand for this process. I have included a photograph of this to show the idea but have not included details. If you can get access to a better means for screw-cutting these, do so, as it is not much fun. The advantage over tapping them is that they do come out concentric with the shaft. Taps for both the Unimat sizes are available, eg 12mm by 1mm and 14mm by 1mm, but they are not likely to be cheap.

A number of the parts require fitting to ball races, either on the countershaft or in the wheels. If you are really skilful you can aim for the correct light press fit, but I would suggest going for a nice easy sliding fit and then using a drop of Loctite on final assembly. Try to be accurate with the depth of the seatings and with the thickness of the spacer on the mounting boss. If you err one way you will be putting clamping pressure on the bearings and if you err the other way there will be end float on the shaft. A few thou of end float is fine.

Cutting the wheels requires a parallel sided cutter for the larger wheels, and an angled cutter for the small wheels. I used a small woodruff style cutter for the parallel ones. This was home-made from silver steel. A disc was turned on the end to the correct thickness, 1/10 of an inch or 2.54 mm. The cutting teeth and the backing off were filed by eye using a small triangular

The two large wheels for the countershaft. These screw together trapping the bearings inside.

file. The trick is to file until you just meet the cutting edge of the last tooth. The teeth do not have to be all the same depth or angular spacing, so long as they all cut. Also make sure you are making a cutter which will cut in the correct direction of rotation. The cutter is hardened by heating to the colour of a boiled carrot, then cleaned up and tempered to a light straw colour. Otherwise you could probably buy a suitable cutter, either 1/10" or 2.5mm would do. A slot drill could be used. These do tend to cut a little over width, especially on a small machine like the Unimat, where we may not have quite the same rigidity as say a Bridgeport mill.

The small wheels were cut using a fly cutter. The tool in this was a piece of round high-speed steel, ground to match a tooth on the belt as closely as I could manage. This is not ground to match the gap in the belt between teeth, it should match a tooth outline, but may be a little wider. Note that these belts are not terribly fussy about minor defects in the wheels. Try not to leave sharp edges or burrs. You should use a fine file to chamfer all the corners.

Since I took no photographs with the original machining, I have posed a photograph showing the sort of arrangement that I used. One thing to note is that as shown, there is only one screw holding the dividing attachment to the milling table. It would be better to provide two, possibly by drilling the dividing attachment at the left side to match the other T slot. An alternative is to mount the dividing head directly on the lathe bed and mount the milling attachment to the cross slide. There is, or was, an attachment made for this, a T screw with a thread to match the threaded hole in the end of the column. This can be seen in the picture of the drive fitted to the milling attachment, screwed into the end of the column on the right.

The assembly for the motor shaft poses a bit of a challenge due to the small sizes and the need to attach it all firmly to the shaft. My original assembly here had all brass wheels, which allowed using easiflo to join them all together. If you do this, you must not overdo it since you will not be able to get into the teeth to remove any blobs. The way I have shown in the drawings should work with aluminium wheels and

The assembly for the motor shaft poses a bit of a challenge due to the small sizes and the need to attach it all firmly to the shaft.

A simple thread cutting attachment for the Unimat. One gear has a short shaft with a fork to match the lead-screw end, the other has an expanding mandrel to go into the end of the spindle.

parts, which are cheaper. Two grub screws are used to secure the larger wheels, at the same time pinning the bosses on the inside of the smaller wheels. The inner flange is trapped against a shoulder on the motor shaft. To secure the outer sleeve to the wheel we rely on Loctite. Ideally the grub screw should be 2.5 mm but I used 3mm since it was available. This opens out one tooth space slightly, but again the belts do not seem to object. The two sleeves almost meet in the middle of the larger wheel. If the grub screw holes are drilled and tapped with the whole assembly together you can be sure they are all in the right places. Note that the grub screw is going through the sleeve on the small wheel so that it is pinned and cannot turn. The shaft on the permanent magnet motor that I had is long enough for this to work, even with the 6mm plate but may need checking with your parts as the outer grub screw will be quite close to the end of the motor shaft.

If you have the original style of motor, the outer flange on the 10 tooth wheel needs to be countersunk to suit the screw that goes into the end of the shaft. The flange on the 30 tooth wheel needs to be added after cutting the teeth. Mine is brass and so I used easiflo. If you use aluminium, use small (M2) countersunk head screws near the edge to secure it. This flange goes on the motor side on assembly and should be very close to but not rubbing on the 40 tooth wheel on the countershaft.

With the original motor, I had to use a pin through the inner small wheel, with a screw through the outer flange into the end of the shaft. The pin must be just long enough that it goes through the wheel and shaft but does not stick up into the tooth space. I no longer have all the parts, so you may have to figure some of that out for yourself if you still have one of those motors. The original pulley was held against the pin by a screw into the end of the shaft. A similar arrangement to that shown here uses a pin through the same hole in the shaft to secure the inner wheel. A screw into the end then holds the whole assembly together. You will need to check the shaft diameter and pin location against your own set-up since I no longer have any way of checking that. I do recall that drilling the pin hole accurately was a challenge, and Loctite was needed to help stop things slipping in use.

The two larger wheels for the countershaft are both bored to take bearings. The 24-tooth wheel also has a countersunk screw inside to mount the 10 tooth wheel. This is not very elegant, since it puts the screw inside where it is inaccessible if it ever comes loose. However, with the depth of the bearing in the wheel, there was not enough material for an adequate thread in this part' so the thread is in the flange part, which is long enough. The 24-tooth wheel also has four counter-bored holes to take the screw that hold the two larger wheels together. These should be set out on the smaller wheel, drilled to tapping size, then spotted through onto the larger wheel while the two are held in alignment. A bearing can be used to maintain alignment while this is done. The bearings are 8mm inside by 20mm outside by 7mm wide. Fully sealed bearings should be used. The slot provided on the end of the boss is to make assembly easier, by using a screwdriver each end. The process is to mount the ten-tooth wheel onto the 24 tooth, screwing the countersunk screw from inside into the tapped hole in the flange. A little Loctite would not hurt here.

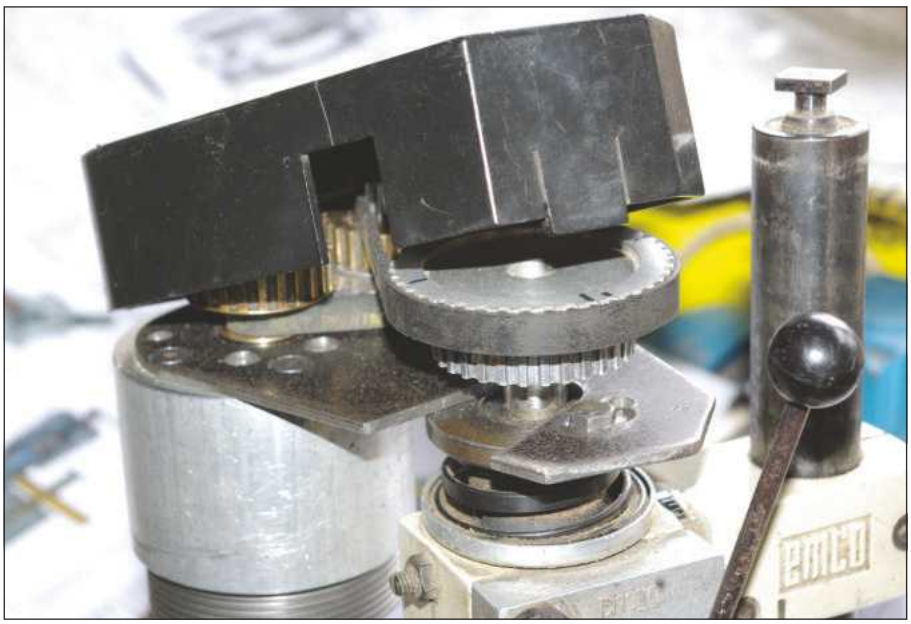
Next mount the bearings into the wheels, also using Loctite if required. Put the boss into the larger wheel from the correct side, and screw onto the backing plate with the countersunk screw from the other side. Now put the two smaller wheels onto the assembly and screw together with the four M3 cap screws. It is not necessary to put the countershaft belt onto the large wheel first, it can be put on when all of the assemblies are in place.

The 30-tooth wheels for the lathe spindle and the milling spindle are recessed on the inside to allow them to go far enough onto the shaft. The critical feature is that the slight bosses on the inner faces of the wheels on the main shaft, the countershaft, and the spindle should all line up. The countershaft is fixed so that leaves us to play with the recess mentioned above on this shaft, and the position of the motor wheels on their shaft as discussed above. With the 6mm plate I have checked the sizes of these. The recess on the 41-tooth wheel should be 2mm and the boss on the motor side of the inner flange should be 4.25. If your plate is 5mm the recess would increase to 3mm and the boss would reduce to 3.25. Some individual adjustment of these dimensions may be needed. I have checked these figures both with 3-D Cad modelling and by making a 6mm plate for my machine, so they should be pretty close.

That leaves us with the difficult 41 tooth wheel. I made this with the aid of some 1/10 inch graph paper. I cut off a length 82 squares long by the width of the wheel and turned the wheel to size so that the paper just neatly wrapped around it. I then marked with the scriber at one edge to show where the teeth should be, both edges of each tooth being marked. The teeth were then cut by lining the cutter up carefully with the marks. This would not do for cutting high speed gears, but toothed belts are wonderfully tolerant. Once you have been around the wheel, you can try a belt in it and adjust any teeth where the belt does not fit happily. Since you need two wheels with 41 teeth, you have the choice of doing them as a pair, and possibly botching them both up at once, or separately, which will halve the impact of any disaster. I think I did mine separately, partly because they do not have the same size hole. Looking at them with the benefit of many years hindsight, they don't look all that accurate, but the belts do not seem to mind too much.

The thread on my 41 tooth wheels engages by about 2mm on my lathe and mill spindles, which is not generous but seems to be enough. If you find you are getting significantly less, you may wish to screw this wheel up against the 30 tooth wheel and then drill though both the wheels with a suitable tapping size, say for M4 or M5. The inner wheel can then be tapped and the outer wheel opened out to clearance size and countersunk. The wheels can then be held together with the screws.

I mentioned earlier that mine has been used with two different styles of Unimat motor, and in its current guise does not have either type. So far as I can, the drawings (available at www.model-engineer.co.uk/unimat)are shown for the current style of permanent magnet motor, but bear in mind that my example was new 9 years ago and current production may differ. The important thing is to get the belt centres correct, and also to get the belts lined up on the different wheels so they are not bearing hard on the flanges. The other thing to keep in mind is that there is not a lot of room in there. The recess on the side of the 41-tooth gear is to clear the spigot on the inside of the plastic cover, so that tells you there is not a lot of extra space. The first time I tried mine there was a funny scraping noise from this point, as I had not put the recess in. The inner gear on the main shaft can have its recess adjusted to move the pair closer to the back plate, and a little spacer could be added inside the recess if you go too far.



The original plate, set up on the milling attachment and showing that there is room for the cover to close over all the works.

One thing to bear in mind is that although this modification will greatly increase the ability of the Unimat to take relatively heavy cuts, you should be a bit circumspect about actually using that facility too freely. These small motors will only take so much. I got about 15 years out of the original motor, and not quite so long out of the permanent magnet one, just under 10 years. I suspect the wood saw may actually have been the culprit in the latter case. I would also suggest that either style of motor might benefit from a strip down and clean up around the brushes every few years, since I think the build up of carbon may be one thing that causes problems. For the sometimes demanding work the machine has done the motors have actually done quite well.

I have often been asked if the toothed belts lead to any tendency to patterns on the work. This does not seem to be a problem at all. Any patterns I have ever seen have been from other causes. The usual cause for chatter on a Unimat is dull tooling. These small machines will teach you to notice when the tooling is getting blunt. Incidentally a good test for the state of a tool is to try to take a shave off a thumbnail, with the tool held in your hand, not on a machine. A sharp tool will take a very delicate little scrape off a nail, but a dull one will just skid over the surface. Do not try this with woodworking tools like chisels.

Speaking of the capacity of the machine and thinking of those far off days when it was new, one of my earliest projects on it was a Stuart 10V. The set of castings for this came as a free gift with the purchase of the lathe. Harold Hall described making a 10V with a small lathe and no milling equipment. Well, I did have milling equipment, in the form of the Unimat milling attachment, but on the other hand my lathe at 46mm centre height was a little smaller than Harold was discussing. I can assure you that if necessary you can make a 10V on a Unimat. There are some very challenging set-ups needed, including mounting the column on the faceplate to bore the cross-head, and also the other way around to turn the feet. For this the proper cast iron T-slotted faceplate is needed, not the aluminium catch plate that the basic machine comes with. On the other hand, I would suggest that if your ambitions lie in the direction of stationary steam engines, you should probably consider a larger lathe. Still, no lathe is ever actually large enough, since the ambitions tend to grow with the size of the available machine, and my Unimat still gets used for the small bits where it is needed. I hope that this article might help give some Unimats a new lease on life. ■

Digital Caliper to Digital Height Gauge

Will Doggett gives an old caliper a new lease of life.

I had a digital 'vernier' calliper that every time I wanted to use it the battery was flat. It was only a cheap one that was in a box of bits from a car boot sale. Then some months later I was using a height gauge to mark some parts out and thought there must be an easy way to do this job other than taking a reading of the datum making a note of it then adding or subtracting the dimension with the datum all done on the usual scruffy piece of paper. I then thought of a digital height gauge!

The idea of switching from imperial to metric also appealed to me as I use both imperial and metric measurements, also setting the datum line at zero and just adding or subtracting the dimensions to mark out would make it a lot easier. Resetting the datum was a matter of pressing the datum button at the correct point on the part being marked out. As the height gauge is not in daily use I could remove the battery when not used so I started on the gauge. As you can see it's fairly easy to do.

Digital height gauge

Method

First, I removed the battery and then stripped the vernier down and put the bits in a box for safekeeping. The screws and small parts were put in a separate small tin. The only thing to be careful of is there are copper strips one on the side between the steel shaft and the clamping screw and the two on the printed circuit board under the plastic cover! These are easily lost and are required on reassembly so they were put in the tin with the screws .The first thing to go was the depth rod as this is not required for the finished height gauge. I kept the other parts and reused them as you can see from the finished photographs. The main steel measuring arm/rule is the first piece to be modified.

The next operation involves using a mini drill grinder or something similar with a cutting disk on it, as the parts are hardened. This part of the job must done with care and some eye protection. The operation is best done out of the workshop because of the grit from the cutting wheel getting on the machine tools.

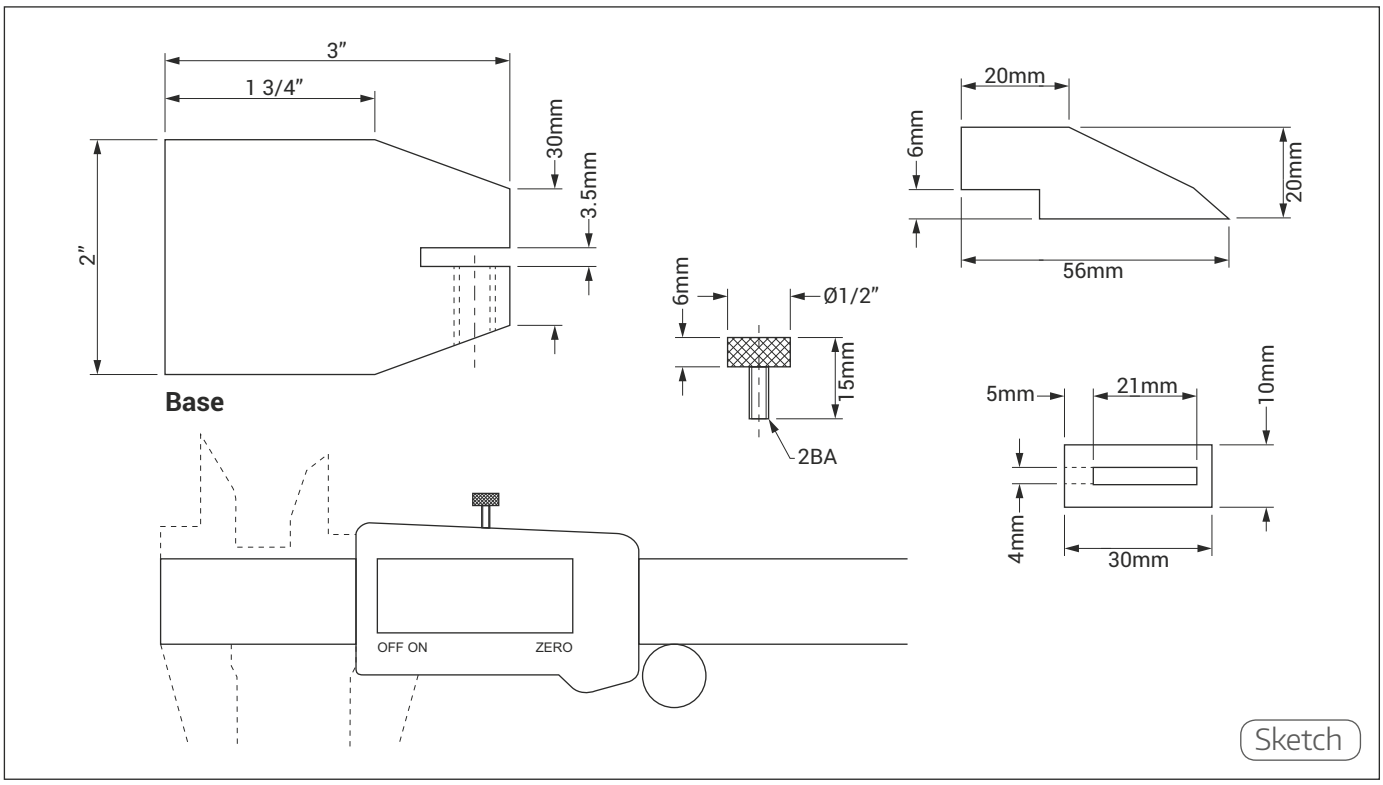
The **sketch** shows the parts to be removed, and the dotted areas are the bits that we cut off. The larger measuring part of the arm/rule is ground off as close to the main body as possible (as this can be used later), to make it flush all the way down, then the small arm on the other side is removed and discarded. This must be done in stages with frequent cooling or it will tarnish the steel. The measuring arm/rule requires the main rule part to be flush all the way down so that it will fit and not stick out from the base.

The measuring head fitted to the readout can be left on if you wish, but I think it

> The idea of switching from imperial to metric also appealed to me as I use both imperial and metric measurements

Clamp arm

The base



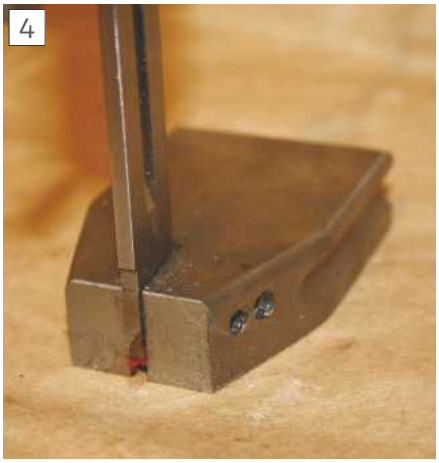
is worth the effort to modify it. If the measuring head is to be done as I did you will need to remove the small arm at the back as well as grind the measuring arm to the shape in **photo 2**. The clamp arm is about 8mm high. This also has to be done with care, after the cutting is done the parts are cleaned up on a bench grinder Now the grinding is finished the parts need to be cleaned, you can then reassemble the head onto the shaft/rule and check that it still works? If so we can move on.

Base

The next job was the base this is shown in the sketch and **photos 3** and **4**. This was made from a piece of 3 x 2 x ¾ inch mild steel. The sides were marked out for the taper and then I used the mill to shape them, or you can do it on the lathe with a milling cutter or a fly cutter,

The next task was to put the slot in the base for the gauge's rule. This I did with a slitting saw, with the base set at 90degrees in the vice to a depth to accommodate the rule and a good fit, as photo 4 and the Sketch. I then put a rounded slot in the sides of the base just to make it look better, but this is not necessary to do. I also milled a recess in the base to reduce the drag when moving the gauge on the surface plate, **photo 5**. I then put some hot melt wax in the recess to make it look better.

To hold the rule in place I put two 2BA-grub screws in from the side as in photo 4. Before fitting the rule deburr and clean up the base with emery then fit the rule and tighten the screws. At this stage it is best to check the rule is square with the base.



Base with slot

Under side of base

> The measuring head fitted to the readout can be left on if you wish, but I think it is worth the effort to modify it.

Scriber

The clamp

Close-up of readout

Zeroing

Scriber

The marking head or scriber was the next part to make this can be the large measuring arm removed earlier or a larger one made from some 4mm plate to the dimensions that are shown on the sketch. **Photograph 6** shows the finished part complete with file marks!

Clamp

After this, some form of fixing is required for the scribing arm to be fixed to other arm. This was a piece of mild steel again, this time 12 x 10mm and 30mm long or something similar. This has a slot cut in it in the centre that will fit width and depth of the arm dimensions. The one I made is shown on the sketch and **photo 7**. A small clamping screw is used to hold the two parts together, this has a 2 BA thread on it and the corresponding thread in the end of the clamp. The clamp screw is made from ½ inch round bar and is 12mm overall length, with a badly knurled head as can be seen in **photo 8**. This clamp is very similar to the clamp on a normal height gauge. All that was left to do was clean the other part up, assemble them and then test it. **Photographs 9** and **10** show the test this was successful as you can see.

Conclusion

The test showed that yes, it was worth all the messing about with an unreliable digital caliper.

To use the height gauge switch it on move the scriber point to the start/datum position, press the zero button, now move the head up or down to add or subtract the dimension required. Using the locking screw to stop the scriber moving mark the line as required.

As it sits on the back of the bench and is ready to go as fast as you can put a battery in it (I leave the battery out as said at the start as it runs them down when not in use.) I am sorry for mixing imperial with metric, but I have an imperial lathe and a metric mill at home, so it's second nature to me, also most of the material I use is imperial. Converting to one or the other measuring system, if you wish to make one, will not make much difference to the finished tool. ■

Marking

Reducing Mini Lathe Cross Slide Backlash

A new approach for mini lathe owners from Keith Beaumont

I think many users of the Sieg Mini-Lathe might agree that its most irritating feature is the backlash on the cross-slide and its method of adjustment. This article describes my method of improving it.

Two counter-bored setscrews that pivot about another screw between them hold the cross-slide lead screw nut. The instruction book tells you to loosen all three, gently tighten the centre screw to contact, then gently tighten either of the fixing screws until you are satisfied with the backlash, followed by gently tightening of the remaining fixing screw. The effect of this method is to tip the nut along its axis, causing it to take up any play. It works, but clearly is bearing on the top of the internal thread at one end and the base at the other end. Not exactly a precision method. And unfortunately, the backlash does not take long in returning requiring you to go through the sequence again.

The excellent website **www.minilathe.com**, has several contributors offering their preferred method of adjusting this nut. Some have detailed methods of slitting the nut to allow the natural spring tension to grip the lead screw but admit that the backlash still returned.

This method had some attraction to me, so I purchased a spare nut from Arc Euro Trade to see what I could do to it. Clearly, some method of tightening the slit nut is called for, but space restrictions have caused the amount of metal below the thread to be minimal. Certainly not enough to support a screw of any strength.

Looking at it from all angles I thought it possible to slit it at 45 degrees through the thicker top surface. This would allow sufficient metal to drill and tap for a 4 BA set screw, centrally placed, therefore providing a means of clamping the nut onto the lead screw and controlling backlash.

And, unfortunately, the backlash does not take long in returning requiring you to go through the sequence again.

1

Keith's alternative approach to slitting the cross-slide nut.

Photograph 1 shows the nut after slitting with a 1/16 slitting saw and fitted with the 4BA setscrew. The original nut fitted to my lathe is bronze. The spare, as can be seen, is cast iron and I was apprehensive about how much compression it would take before cracking. In the event, I was able to totally shut the slit by tightening the screw.

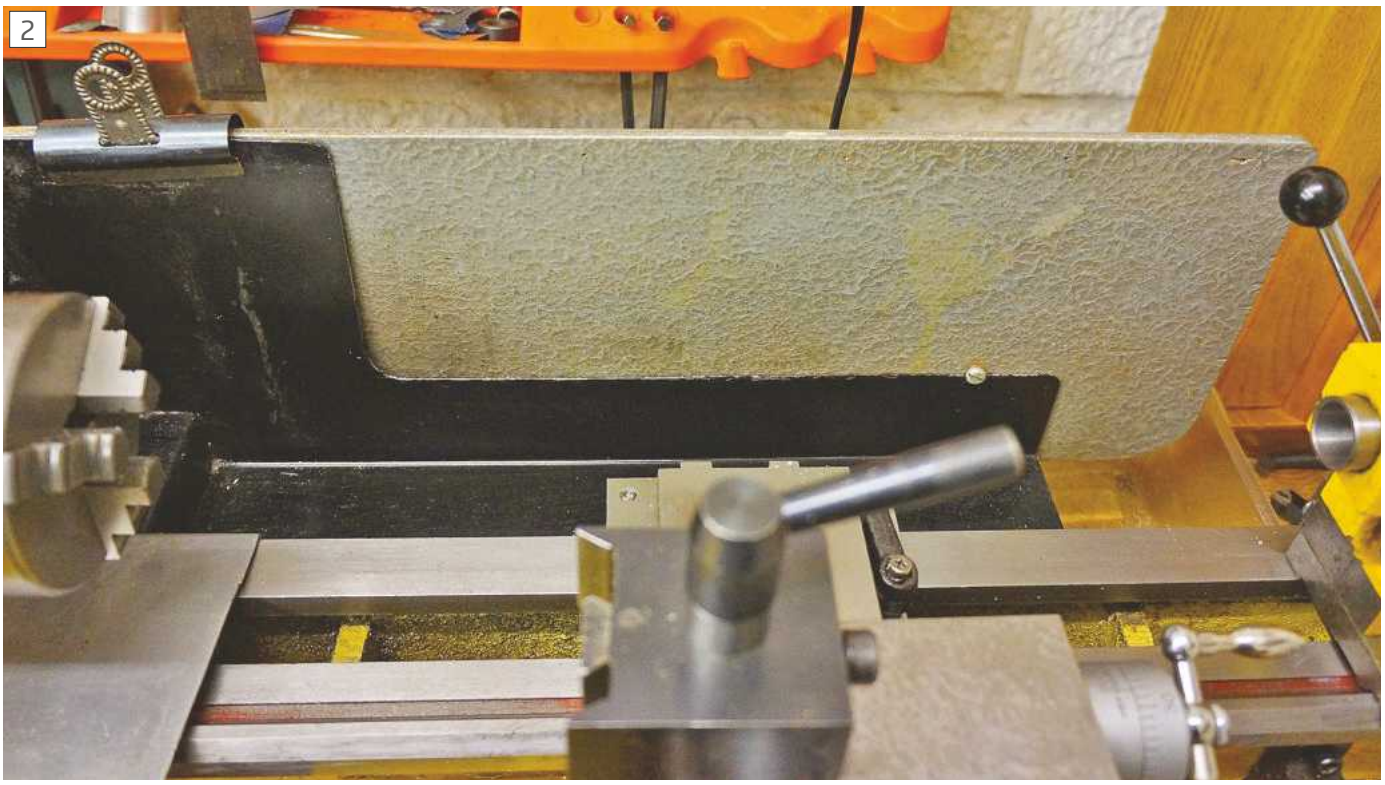
In preparation for the strip down to fit the modified nut from Arc Euro Trade, I also purchased two needle roller thrust bearings that they sell for putting under the tool post lever. These were to be inserted into the graduated dials after boring them out so that they just protruded by 0.025". It is convenient to do this to the top slide dial first, then fit this to the cross slide to enable machining of the second one. They are conveniently interchangeable.

The cross slide was duly stripped down sufficient to replace the lead screw nut with the modified version. At this point I had not tightened the adjuster other than to make contact.

Another irritation with this lathe is the fact that you cannot wind the cross slide fully forward without hitting the splash back. Some people have suggested removing it altogether, but my solution several years ago was to cut it away, sufficient to allow the cross slide to go fully forward, replacing the cut away with a piece of painted plywood, fixed top left with a bulldog clip and resting on a protruding screw head bottom right, **photo 2**. This can be removed in seconds and allows adjustment of the nut when the saddle is fully at the tailstock end and cross slide fully forward.

Trial fitting the new nut showed that the dimension from centre of thread to top surface allows for the original centre pivot screw to be screwed out. This I did not

›



The removable plywood panel in the splash guard.

intend to do. I therefore wound the slide fully back, gently screwed the pivot screw to contact the top surface of the new nut and without disturbing it, wound the nut away so that I could measure the depth of the protruding pivot. In my case this was just 0.020". I then made a shim suitably drilled and fixed the new nut in position.

After reassembly of the cross slide, I set about adjusting the tightness of the 4BA set screw and winding back and forth to get the right feel. With the cross slide fully forward the lead screw obviously has less wear than the middle so some allowance had to be made, but I could not get the right feel and eliminate the backlash. I spent a couple of hours tightening and slacking off the screw, getting a crick in my neck leaning over to see what I was doing. All very disappointing after all that work.

It got to the point that I had tightened the screw to its maximum and still had backlash! That was clearly barmy!!

Then I had the Eureka Moment! The dreaded backlash is not in the nut – it is, in fact, movement in the two fixing screws! The clearance holes for the fixing cap screws allow for movement of the nut when machining pressure is applied, especially as all the instructions advise not to over tighten them.

My answer was simple. Tighten the two cap screws hard. I was then able to adjust my new nut to give .0.003" backlash, which I can live with. (Take care not to overtighten, many years ago I stripped one of the threads on my cross-slide nut – Ed.)

All this took place two years ago and with the lathe in constant use in that time, making a Chenery Vee-Twin 4 stroke engine, I have had no cause to re-adjust the nut.

The fitting of the thrust washers to the dials made tightening of that assembly much improved. Just watch out for the flat spring! ■

Parts from Arceurotrade.co.uk

Needle Roller Thrust Bearing
AXK1024+AS+AS
C3-95 MET Cross Slide Feed Nut

WARCO

ALL NEW SUPER MINI LATHE

£599.00

Now fitted with metal leadscrew handwheel and calibrated dial at no extra cost. An accurate sensitive longitudinal feed.

Additional features:

- 100mm 3 jaw self centering chuck
- Steel gears fitted to headstock
- Steel change gears
- Brushless 450w motor
- Steel and aluminium handwheels

SPECIFICATION:

Centre height: 90mm
Distance between centres: 350mm
Speed range: 50-1100/120-2500 rpm with back gear for maximum torque. Hardened and ground slideways Weight: 39 kg
Wide range of accessories available including fixed and travelling steadies, 4 jaw chuck, vertical slide, quick change toolpost. Huge range of cutting tools.

WM12 VARIABLE SPEED MILL

£685.00

- Compact, versatile milling machine
- Infinitely variable speed control
- Dovetail column ensures positive head location
- Available in metric and imperial versions

SPECIFICATION:

Head tilts. Calibrated 45° - 45°. Very powerful 600w motor. Back gear for maximum torque in low range. All steel gears. Longitudunal traverse 250mm. Cross traverse 165mm. Digital rev counter. Weight 54kg

NEW DRO WM14 MILLING MACHINE

£1,095.00

Same features as our established WM14 milling machine, with 3 axis DRO fitted as standard.

- Magnetic scales
- X Y and Z traverses
- Switchable between metric and imperial
- Compact illuminated digital counter

SPECIFICATION:

Table size: 500 x 140mm
Longitudinal traverse: 330mm Distance spindle to table: 280mm
Speed range: 50 – 2,250rpm infinitely variable, with back gear for maximum torque Motor: 500w.

NEW DRO WM180 LATHE

- Fitted with 2 axis DRO
- Magnetic scales
- Supplied 3 and 4 jaw chucks, fixed and travelling steadies, face plate.

SPECIFICATION:

Centre height 90mm
Distance between centres: 300mm
Speed range 50 – 2,500rpm infinitely variable
Weight 70kg

£1,095.00

In addition to these new DRO versions, we will continue with our standard machines. All prices quoted include VAT and UK mainland delivery, excluding Highlands and Islands.

Our next exhibition is the Midlands Model Engineering Exhibition, Leamington Spa, 18th to 21st October 2018.

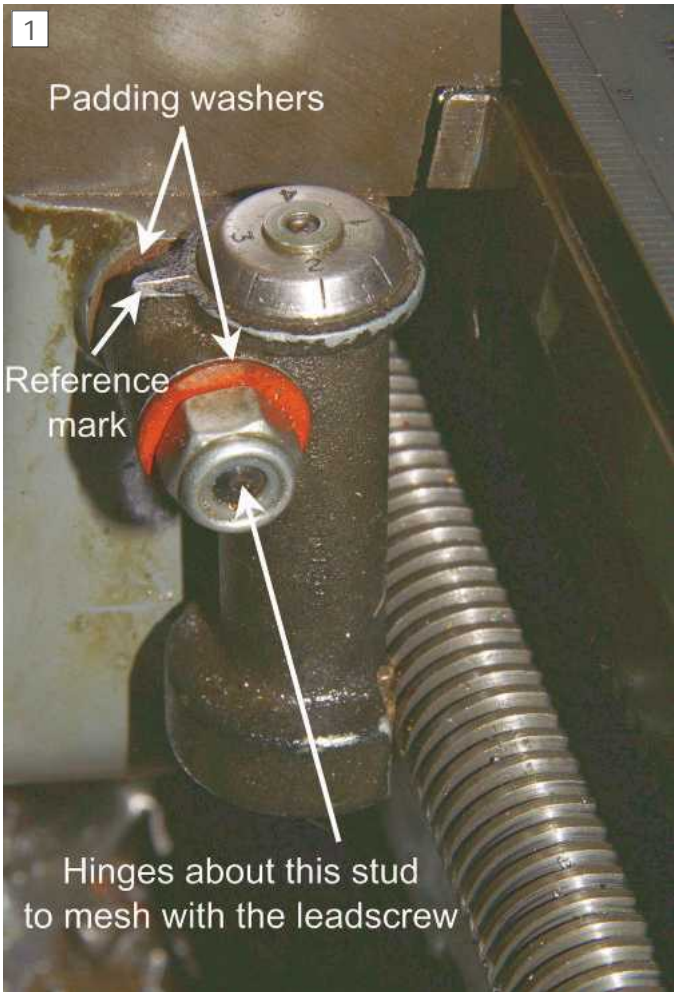
Our next **Open Day** is on Saturday, 21st July 2018, 9am to 1pm, at Warco House.

T: 01428 682929 Warco House, Fisher Lane, Chiddingfold, Surrey GU8 4TD
E: sales@warco.co.uk W: www.warco.co.uk

WARCO

Using a Thread Dial Indicator

Many lathes come fitted with a thread dial indicator the supplied instructions are often hard to follow, Trevor Hills helps out.



A Myford thread indicator, engaged with the leadscrew.

A Mini-lathe thread indicator, engaged with the leadscrew.

When I started to use a lathe to cut threads I found the descriptions in books of how to use a thread dial indicator rather difficult to follow. It was clear that it is used to indicate when to engage the half-nuts on the leadscrew and so make sure successive cuts of the thread are correctly aligned, but even Martin Cleeve makes heavy weather of it in his book Screwcutting in the Lathe, invaluable reference though this is. Maybe my mind works in a different way from experienced machinists, so I decided to look at it from first principles. This note is the result and while many readers, practised in the art,

Calculating the Highest Common Factor or Greatest Common Divisor

Some calculators can do this for us, and Excel has a worksheet function GCD which is the same thing.

Or we can list all the factors of the smaller number in order, e.g. 20 has factors 1, 2, 4, 5, 10 and 20, and try to divide the larger number by each factor in turn, starting with the largest. Then pick the first one which exactly divides. So for the example in **table 3** of 20 and 96, the largest of this list of factors of 20 which exactly divides 96 is 4.

It's even easier for the Myford indicator because in this case n is 16, a power of 2, so we attempt to divide t by 16, 8, 4, 2 and 1 in that order and the HCF is the first which divides exactly.

A general way to calculate the HCF is Euclid's Algorithm but it is probably overkill for the examples we are likely to meet here.

Table 1—Numbers specific to a lathe	
Imperial leadscrew	**Metric leadscrew**
d = n ÷ TPI of leadscrew	d = n × leadscrew pitch

Table 2—Calculation for the thread needed	
Imperial leadscrew	**Metric leadscrew**
t = d × TPI needed	t = d ÷ pitch needed

will find its contents obvious I hope it will help others.

What is a thread dial indicator?

For the uninitiated, as I was, **photo 1** shows a Myford indicator on the right-hand side of the carriage, hinged back on its stud to mesh with the leadscrew; this leadscrew has 8 threads (or turns) per inch (TPI). I'll mostly use the Myford indicator in the illustrations as that was most convenient for photography. When installing this indicator, it is important to adjust its position on the stud so that when the carriage half-nuts are engaged the indicator can be meshed with the leadscrew with one of the lines on the dial aligned with the reference mark. This can be done using fibre washers placed either side of the indicator as shown.

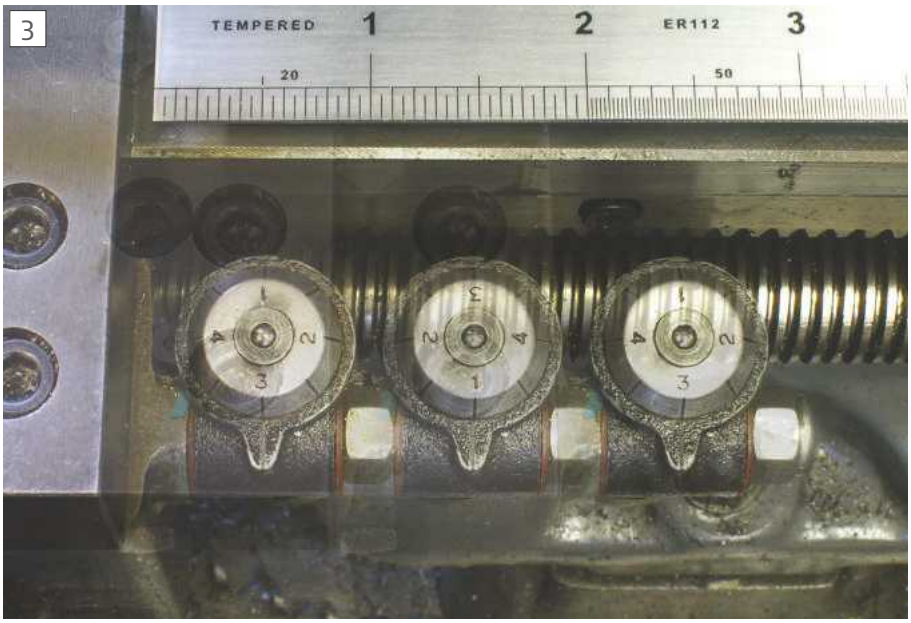
Photograph 2 similarly shows a Mini-lathe indicator meshed with its leadscrew, which in this case is of 16 TPI.

With the half-nuts engaged the carriage, with the indicator, moves with the threads on the leadscrew and the indicator dial doesn't rotate. But when the half-nuts are disengaged the indicator dial rotates as the carriage is moved along the bed.

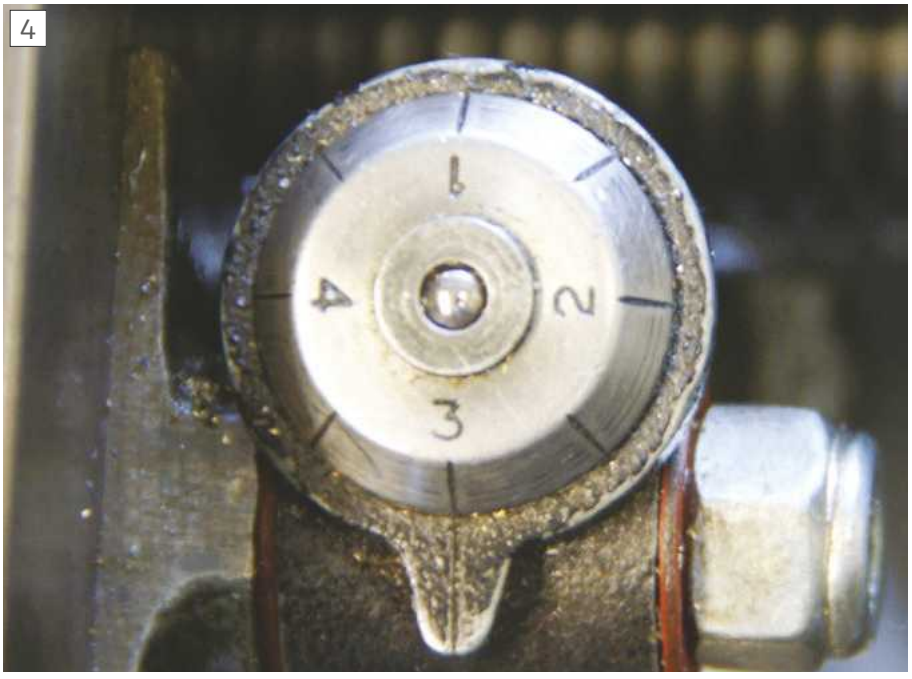
Correct use of an indicator makes it possible to speed up the job by allowing, in many cases, the half-nuts to be disengaged between successive cuts—rather than leaving them engaged and reversing the lathe to get back to the start of the next cut (which always works but can be tedious, especially where this needs to be done manually). But how do we interpret the marks on the indicator to tell us when to re-engage the half-nuts, especially if, as in the Myford case, there is no helpful chart attached to it?

Numbers specific to a lathe

First, we need to look at the particular lathe and indicator. The principles apply to an imperial lathe with a leadscrew measured in TPI, or a metric lathe where the pitch of the leadscrew is specified in millimetres, but the details are a bit different—in the tables the differences are set out side by side. The first step is to find out, with the half-nuts disengaged, how far the carriage moves along the bed for one complete turn of the indicator dial—call this distance d (inches or mm). See **photo 3** for a multiple exposure picture of a Myford indicator in three successive positions an inch apart. The left and right exposures show the indicator dial one complete turn apart (2 inches in this case).



Myford indicator at position 3. When the half-nuts are engaged there are 8 marked positions available, four of them numbered, and 8 additional positions half way between the marked ones, making 16 (n) in all.



A Myford indicator with the carriage in three positions an inch apart.

For an indicator without internal gearing (like the Myford one) this distance can be calculated by noting the number of teeth on the indicator worm wheel (n) and the pitch of the leadscrew and applying the appropriate formula in **table 1**.

More generally, even if the indicator is geared, n is the number of turns of the leadscrew for one complete turn of the indicator.

Note that n and d are constant for a particular lathe and indicator, and so only need to be found once.

Calculation for the thread needed

Next, we calculate, for the thread we wish to cut, how many turns (t) of the thread there are in the distance d. This is shown in **table 2**. To be more precise, the TPI or pitch of the thread we are cutting is that corresponding to the actual gearing we

›

I don't know about you, but as far as I can remember the last time I met HCF or GCD was at school, but here it is.

have set up for the leadscrew, even if this entails an approximation to what we want.

Now the interesting bit—we need to find the highest common factor (HCF), also known as the greatest common divisor (GCD), of n and t. I don't know about you, but as far as I can remember the last time I met HCF or GCD was at school, but here it is. Guidance on how to calculate the HCF is shown in the box.

The HCF of n and t gives the number of equally-spaced places on the indicator dial you can engage the half-nuts for the first cut, and then re-engage for correct alignment on successive cuts.

Examples

Simple examples are shown in **table 3**. In both these cases, on successive cuts we can re-engage the half-nuts at any one of 4 equally spaced positions on the indicator dial, one of which had been chosen for the first cut. So for the Myford indicator, having engaged for the first cut at a numbered mark (for example as in **photo 4**), re-engage on subsequent cuts at the same or any other numbered mark. Alternatively, we could use the four un-numbered marks, but we must be consistent.

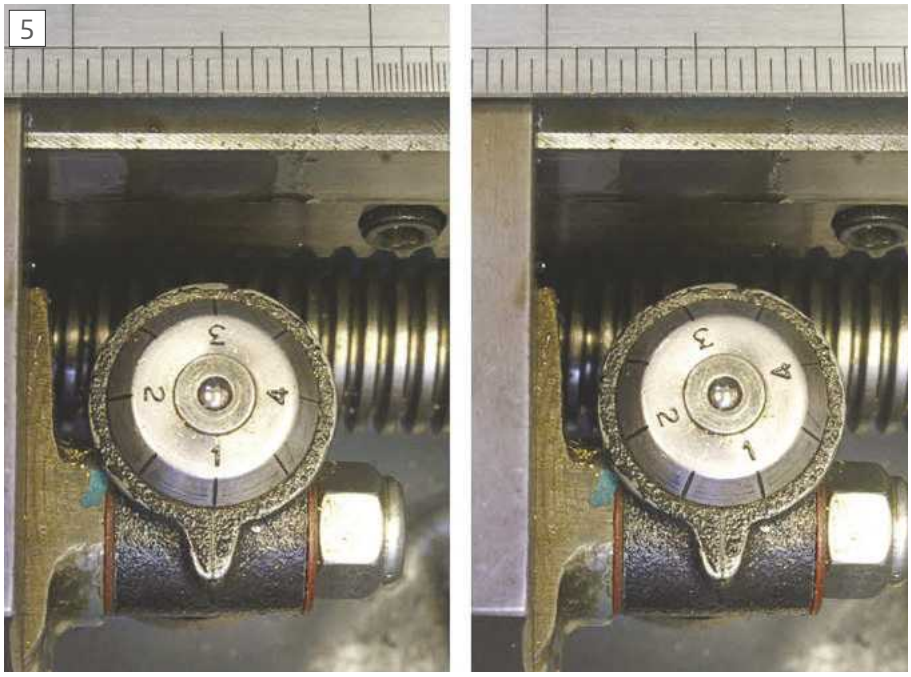
If t turns out not to be a whole number, we can't use the indicator and we typically have to resort to methods which leave the half-nuts engaged all the time. An example for the metric lathe in **table 3** is to cut an M4 thread which has a pitch of 0.7 mm, giving t = 171.428... Also, cutting a metric thread using an Imperial leadscrew or vice versa, especially if using an approximate gear ratio to drive the leadscrew, is likely to give a value of t which is not a whole number. For example, Myford's recommended gearing to cut a thread with 1 mm pitch actually gives 25.3968...TPI rather than 25.4 TPI. In this case t = 50.793..., but even exact gearing would give t = 50.8.

Here's a more complicated example, taken from Martin Cleeve's book, showing how an indicator can work when cutting a metric thread using an Imperial leadscrew:

Suppose we have a lathe with an Imperial leadscrew of 4 TPI and the indicator has 16 teeth but is geared down by 5 to 1. Then we will get one complete turn of the indicator dial for 80 turns of the leadscrew, so n = 80 and d = 80 ÷ 4 = 20 inches. Now imagine we want to cut a thread with a pitch of 1 mm, and we happen to have a set of gears to drive the leadscrew which includes a gear of 127 teeth. This means we can set up a ratio to give exactly the right pitch, which in Imperial terms will be 25.4 TPI. This gives t = d × TPI needed = 20 × 25.4 = 508, a whole number. The HCF of 80 and 508 is 4, so we can engage the half-nuts at any one of 4 equally spaced points on the indicator.

Table 3—Simple examples

Imperial leadscrew (Myford)	Metric leadscrew
n = 16	n = 20
Leadscrew has 8 TPI	Leadscrew has 6 mm pitch
d = 16 ÷ 8 = 2 inches	*d* = 20 × 6 = 120 mm
For ¼ inch BSF (26 TPI)	For M8 (1.25 mm pitch)
t = d × TPI needed	*t = d ÷ pitch needed*
= 2 × 26 = 52	= 120 ÷ 1.25 = 96
So number of places on dial is	So number of places on dial is
HCF of 16 (n) and 52 (t)	HCF of 20 (n) and 96 (t)
= 4	= 4



A Myford indicator shown with the half-nuts engaged at a mark (left), and at the next intermediate unmarked position (right).

Dual-start threads

We can often use the indicator when cutting a multiple-start thread too. As an example, suppose we want a dual-start thread of 12 TPI using the Myford indicator. In this case, calling this 'turns per inch' is more helpful than threads per inch, because we want the nut on the thread to advance one inch when turned 12 times. So, cutting the first start, we calculate the HCF of 16 and 2 × 12 = 24, which is 8. So we can re-engage the half-nuts when the indicator is at any one of 8 equally spaced points on the dial. Let's choose any one of the 8 marked lines (**photo 5**, left). Then for the second start we can choose any of the 8 positions in between the marked ones (**photo 5**, right).

It is evident that if we want to cut a dual-start thread of, for example, 16 turns per inch, we have a problem. On the first start we can engage in any of the 16 available positions. But then for the second start we have no intermediate positions left on the indicator. So in this case we would have to resort to some other way of setting the position to cut the second start, such as turning the mandrel through 180° with the tumbler gears disengaged. ■

Model Steam Road Vehicle Society

JUNE 23rd - 24th

ANNUAL RALLY 2018

NTET Authorised Rally

Tewkesbury Rugby Club

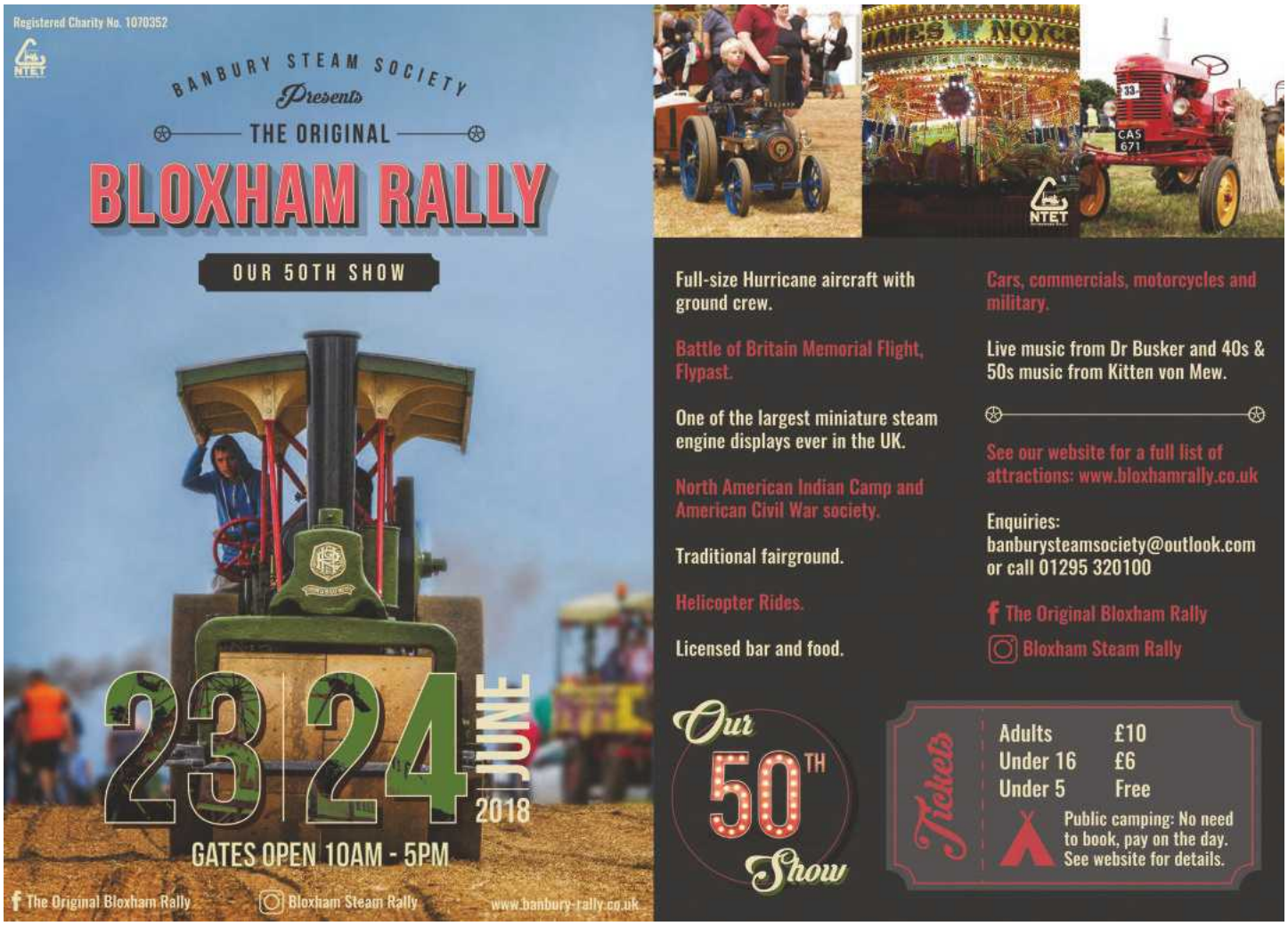
Gander Lane Tewkesbury GL20 5PG

Craft and Model Tents, Cars , Engines and Much, Much More!

All Forms on website

www.msrvs.co.uk

Admission £5.00 accompanied under16's free



One Man and His Mill

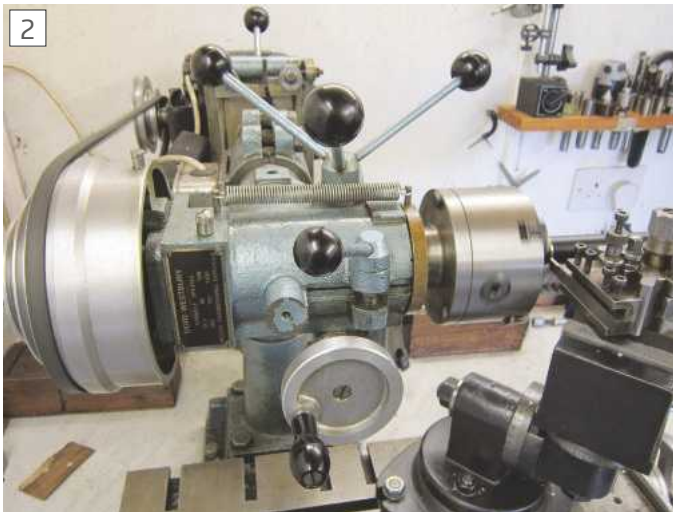
Glyn Davies and his Dore Westbury Mk1

Once the only realistic option for many model engineers, this machine was designed by Edgar T. Westbury and Arnold Throp (of Dore, Sheffield) and was originally marketed as a part-machined kit.

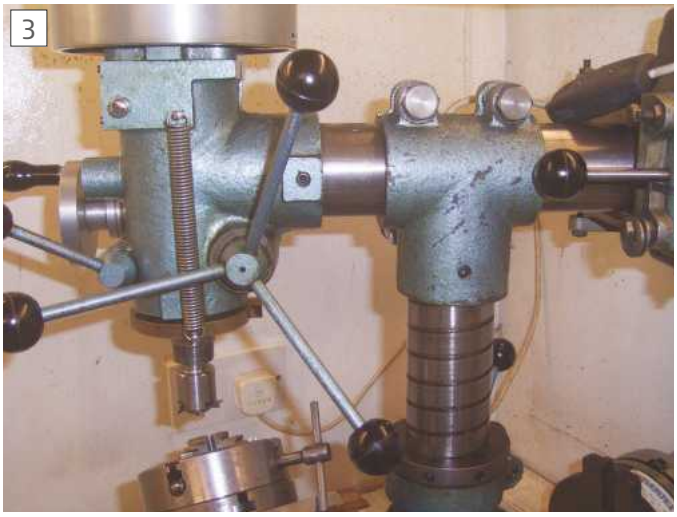
I bought my Dore Westbury Mark 1 vertical milling machine about twenty years ago, which was before the proliferation of the far eastern machines that are available now and probably offer more for the price. But it was a time before the internet, so the choice was rather limited to what the various machinery dealers that advertised in MEW had in stock. I wanted something that would perform better than was possible using the vertical slide in the Myford 7. The machine I bought was a Mk1 but seemed to have a Mk2 table and hand wheel dials. Though constructed by someone from a kit, the standard of workmanship seemed good, so it followed me home, **photo 1**. I'll use this article to give my assessment of the machine, to describe the modifications and improvements I've made and to conclude with a description of some home-made accessories that enhance the capability of the machine.

Where the Myford 7 and vertical slide fall short as a milling machine is in the rigidity of the table and slides. The Dore Westbury has quite meaty X and Y slides that use stock rectangular Bright Mild Steel bar for their slide ways. Play in these slides can be removed in the lateral case by adjusting the gib strips, and in the vertical case by shimming the clamp bars. This system is the same as for the saddle adjustment on the Myford; it is well proven and the lack of dovetails has not been an issue. So the rigidity of the table and its amount of available travel in the X and Y axes are a big improvement over the lathe arrangement. My only gripe in this area with my machine is the backlash in the leadscrews – with the handle nuts properly adjusted, there is still 20 thou of play in the hand wheels and this means that it is vital to clamp the non-moving axis using its clamp screw when taking a cut. The dealer I bought the machine from offered a good deal on a Vertex four inch machine vice, so I bought that as well. The problem I had when I began to use the mill was that the cast-in tee slots in the table didn't match the fixing points for the vice. I had a suitable tee slot cutter and so decided, with some trepidation, to machine a continuous tee slot down the centre of the table. I was

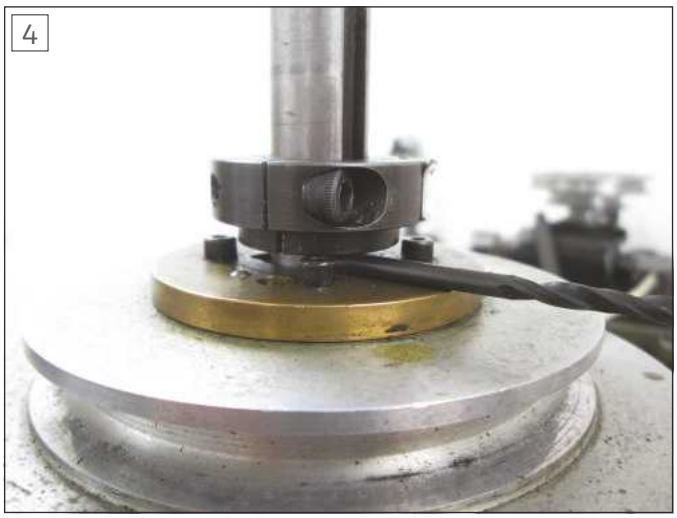
The Dore Westbury Mk1 milling machine



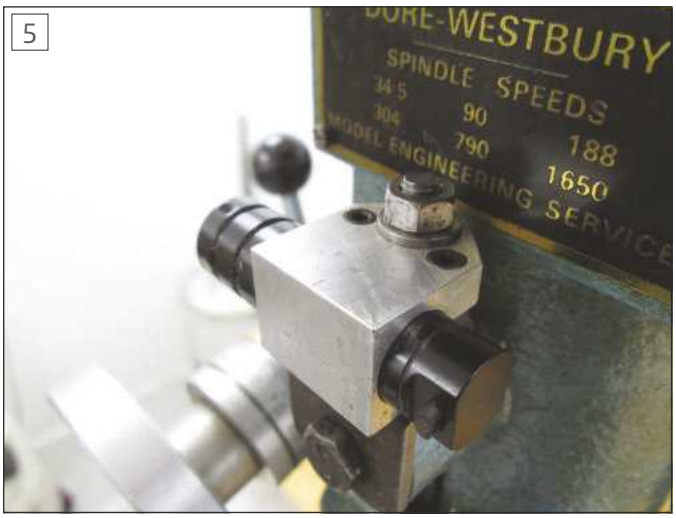
Using the machine as a lathe to part off cycle handle bars



The grub screws added to secure the columns



The spindle depth stop

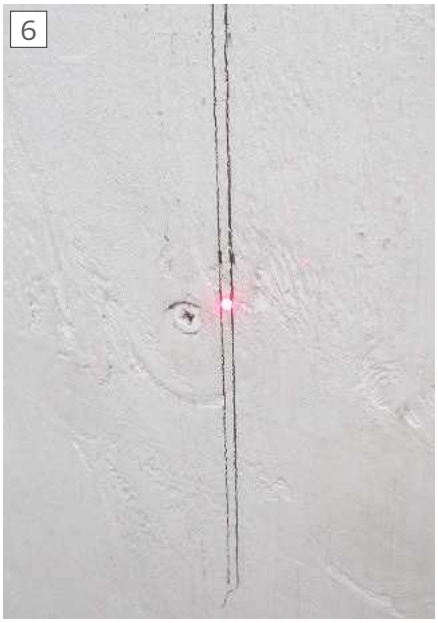


The laser mounting

worried that such major surgery would result in the table bowing, but it thankfully didn't and the need to reposition the headstock to complete the full length of cut didn't produce any dog-legging along the cut.

One of the benefits of the Dore Westbury is in the degree of adjustability of the headstock – its vertical and horizontal columns mean that it can be rotated in the horizontal and vertical axes as well as being moved in and out and up and down. It can, at a pinch be used as a lathe with a terrific centre height if the spindle head is rotated 90 degrees and a tool post held in the machine vice, **photo 2**.

An early issue I had with the horizontal and vertical columns is in their method of attachment to the cast column head and spindle head. They are simply loctited. I think the use of industrial anaerobic adhesives was the new big thing when the machine was designed, but the strength of the bond achievable was over estimated by the designer. It wasn't long before I had the spindle head twist during a milling operation. I thought I hadn't tightened the clamp bolts, but on investigation, found that the loctited joint had moved. Both the cast iron columns have a good ground finish and it's not surprising that even with high strength stud lock, the joints are not very strong. I drilled and tapped the column head and spindle head for an



The lines on the wall and the laser dot

M8 grub screw and deeply counter sunk the vertical and horizontal columns for the screw points. With the screws tightened and in conjunction with copious amounts of Loctite 270, nothing has moved since, **photo 3**.

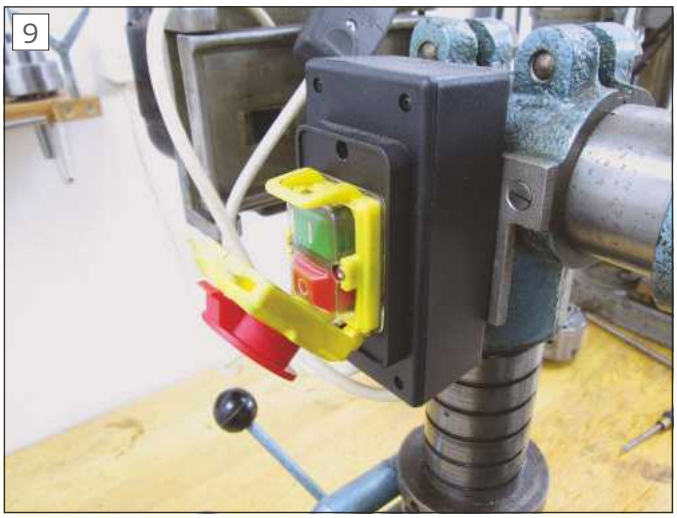
Speaking of Loctite – I seem to remember that I also had trouble with the back gear slipping, which I traced to the fact that the back gear double gears were also fixed their shaft solely by Loctite. I drilled a 1/8" hole at the joint and loctited in a dowel to preclude any further movement.

When I bought my machine, it wasn't quite finished in that the three axis dials had not been engraved. It was easy to establish that the X and Y lead screws were 10 threads per inch and then engrave the dials with 100 divisions; each division then giving one thousandth of an inch movement of the table. The quill fine feed dial was trickier. The Z axis fine feed handle turns a worm shaft that turns the quill pinion that moves the quill (a bit like in the

With the screws tightened and in conjunction with copious amounts of Loctite 270, nothing has moved since...

The new spindle bearing dust shield

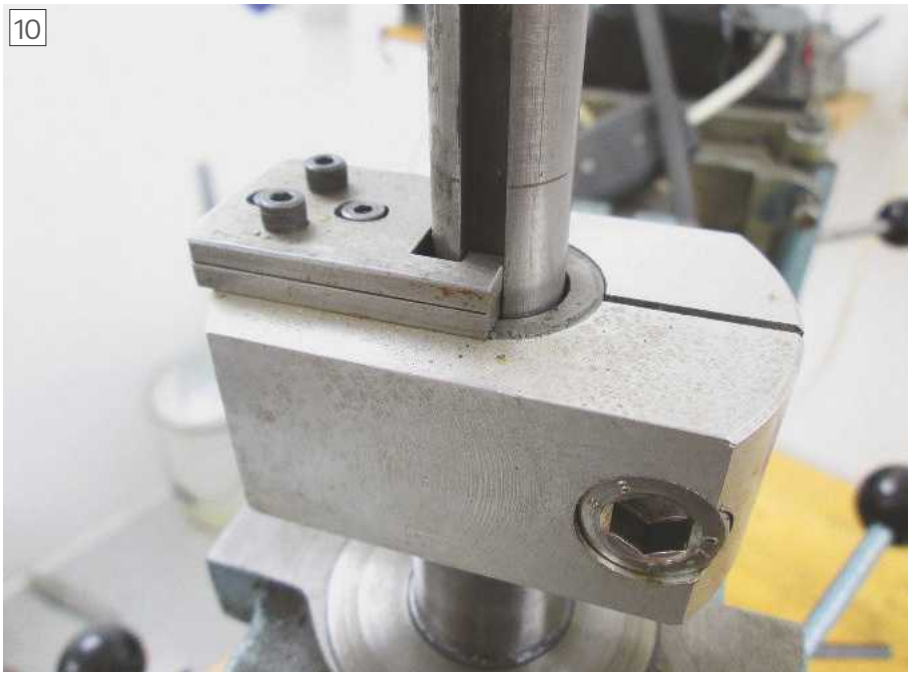
The modified bearing lock nut



The NVR switch

Gracie Fields Thing-ummy-bob Song!). Rather than measure the worm wheel pitch and count the number of teeth on the pinion and measure the pitch of the rack on the pinion, I counted the number of turns of the hand wheel required to move the quill through its full travel and measured the travel. This showed that the hand wheel moves the quill on average 125 thousandths of an inch per turn and I engraved the dial accordingly. Herein lies one of the shortcomings of the machine. Whilst turning either of the X or Y screw handles through ten divisions will result in a cut removing about ten thousandths of an inch of material from the work, such doesn't seem to be the case with the Z axis wheel. Perhaps it's because you have to slacken the quill clamp, then turn the dial, then re-clamp the quill. And if you have a lathe chuck screwed to the spindle nose, the quill return spring isn't strong enough to support the spindle weight and it drops as soon as you release the clamp. Anyway, this brings me to my first vital accessory – the spindle depth stop, **photo 4**. This is a split ring that clamps to the part of the spindle that protrudes above the pulley assembly. If I need to increase the Z axis cut by a given amount, I clamp the quill, then find a drill whose diameter matches the depth of cut required and place this on top of the drive pulley, then slide the depth stop down so it touches the drill and tighten the depth stop

> Not our main dining table, I should add - this six by three solid oak gem cost £25 from the local council recycle shop!



The spindle rotation lock

clamp screw. I then turn the Z axis wheel until it won't go no more and I know I've put on the required cut. This procedure is something of a faff, but does produce the desired result.

The next issue with the Dore Westbury is the circular column. My machine has the long column that normally protrudes down through the dining table on which I have my machine mounted. Not our main dining table, I should add – this six by three solid oak gem cost £25 from the local council recycle shop! The long column has been a life saver on occasion and allows a gap between milling cutter and table far greater than can be achieved with other similar class machines. There is a disadvantage and this stems from the fact that releasing the column clamps allows the column to swing and lose its X-Y register. I debated what to do about this. I have seen some machines where the owner has bolted a strip of ¾" by ¼" steel bar vertically to the machined and tapped pads on the column base and then has a ring clamped to the column above the screwed height adjuster. The ring has a lug that touches the steel bar. The column can then be swung aside and raised or lowered, and so long as the clamp ring lug is brought into contact with the bar, the axial alignment of the spindle will be preserved. The trouble with this is that the bar and clamp ring limit the lowest position that the column can be dropped to before the spindle head fouls the ring and bar. This is probably acceptable on the Dore Westbury Mk2 machines with their much greater quill travel, but would be a limitation on the Mk1.

I discovered that there are available from China small laser lights that are designed to be mounted on hand guns, are powered by four LR44 batteries and have an on/off switch at their back end. I obtained one (for about a fiver) and made a housing and mounting bracket to fix it to the spindle headstock on the tapped pad above the quill clamping lever. The mounting bracket was a piece of angle iron that

›

allows the light to be rotated horizontally and vertically if required, **photo 5**. I had long ago acquired a Hilger and Watts precision clinometer and here at last was an opportunity to use it. I discovered that my machine sits on its table with a 5 minute back slope, so used the clinometer to draw two parallel lines about 5 mm apart on the workshop wall, 5 minutes off vertical. The distance between the lines is equal to the diameter of the laser dot, **photo 6**. The distance from the laser to the wall is about four feet and the column can now be swung aside and returned accurately to its original azimuth.

Whilst the Dore Westbury addresses the matter of table flexibility when compared to milling in the lathe, its headstock arrangement is clearly not as rigid as a lathe. The spindly column and cross tube and lack of meat in the quill assembly all limit the depth and speed of cuts that can be taken, as well as the accuracy achieved. One improvement I thought I could make was to change the angular contact spindle bearings for taper rollers. If the spindle loading was primarily axial, then the angular contact bearings would be a better choice, but most milling and facing operations generate a radial load on the spindle and I figured that changing to taper rollers would result in less deflection of the spindle in the quill. The Timken part numbers for a taper roller that has the same shaft and housing diameter as the standard bearing are 15578 (inner) and 15520 (outer). The inner race of the taper roller protrudes further from the bearing and this means that the standard Nilos bearing shield cannot be used. Instead, I ground an old slitting saw so that its outer diameter was a smidgin (technical term) less than the quill diameter, interposed the saw between the bearing inner race and the spindle abutment and relocated the bronze quill return spring clamp ring so that it covered the saw, **photo 7**. At the other end of the quill, I needed to thin one of the two spindle bearing adjusting nuts to recover the lost upward travel of the quill, **photo 8**.

The final modification relates to the motor switch and simply replaces the original surface mounted light switch with an up to date No Volt Release switch. The switch was from eBay and the box it's mounted in from Maplins. The switch incorporates a big red off button that is easy to find when panicking, **photo 9**.

Now to the accessories. I needed to machine an 8mm female hexagon in some motor cycle handlebar ends that I was making and decided to do it by using a single point slotting tool in the Dore Westbury chuck, in conjunction with the rotary table. For this to work, it was necessary to eliminate all rotary movement of the spindle. The gizmo I came up with consisted of an aluminium body that clamped to the pulley bearing diameter of the spindle head cover casting. Fixed to this body are two steel plates with lugs that engage the driving slot in the spindle. The fixing screw holes in the plates are elongated to allow one plate to be fixed snugly against one side of the slot; the other against the other side. This completely eliminated any rotational play whilst allowing the quill to move freely vertically and I was able to successfully make my bar ends, **photo 10**.

The Myford and Dore Westbury mandrel handles

The spindle handle drive collar

The Myford catch plate tool bit holder

The Myford catch plate tool bit holder fixed to the catch plate

Some time ago I made one of the most useful accessories there is for the Myford lathe - a mandrel handle. This gets a lot of use and virtually all my screw cutting is done using it. I even used it to re-machine the worn belt groove in the motor pulley! I often thought that a spindle handle would be useful on the Dore Westbury for tapping operations. What delayed my making one was the difficulty in machining the keyed bush that drives the spindle. I considered broaching it using the rotation stop described above, but then realised that it would be simple to get some one inch bar stock, drill it 5/8" for the spindle and then cut a slot in it using a slitting saw in the Dore Westbury and weld in some rectangular bar at the same time as I welded the handle to the bar stock. It worked a treat and I can now tap threads that are co-axial with their tapping holes, **photos 11** and **12**.

The final accessory is dead simple – an HSS tool bit holder that replaces the driving lug used with the Myford catch plate. This makes a 4 ½" fly cutter that can admittedly only take light cuts and needs the slowest back gear, but has its occasional use when it becomes invaluable, **photos 13** and **14**.

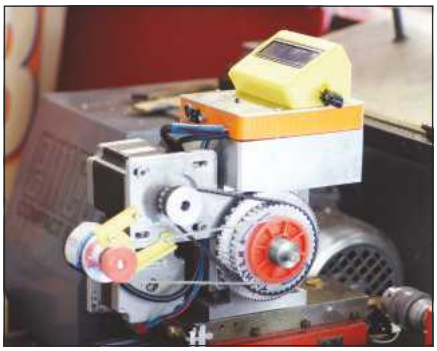
So that's it – after twenty years with a Dore Westbury, I don't think I'd part with it even though a nice far east machine with DRO, X and Z axis powered feed is beckoning. The fact that a Dore Westbury is pictured on the front of Mr Arnold Throp's book 'Vertical Milling in the Home Workshop' also makes it rather special. ■

In our Next Issue

Coming up in issue 269
On Sale 15th June 2018

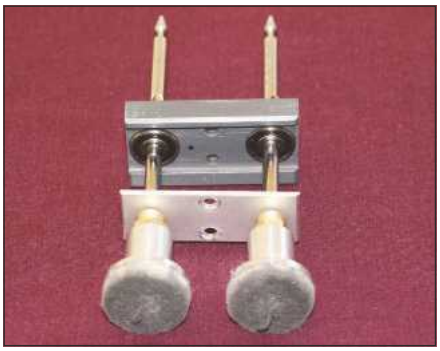
Content may be subject to change

This July issue, number 269, of Model Engineers' Workshop has the following goodies in store:



Simon Davies describes his shop-built CNC Toolchanger.

Peter Barker returns to the subject of chuck care with a guide to servicing chucks.



Whisk-a-Shine - another 'womble' project!

DON'T MISS THIS GREAT ISSUE - SEE PAGE 52 FOR OUR LATEST SUBSCRIPTION OFFER

On the Wire NEWS from the World of Hobby Engineering

25th National Model Engineering and Modelling Exhibition 2018

Hopefully, this issue of MEW will reach you just in time for the 25th National Model Engineering and Modelling Exhibition at Doncaster Racecourse from the 11 to 13 May. The Racecourse is ideally located in the heart of the UK, within easy reach of Doncaster Railway Station, Robin Hood Airport, and with excellent road links.

Now in its 25th year it is once again looking forward to being supported by a huge number of individuals, clubs and societies from around the country.

The 2018 exhibition will once again see well over a thousand exhibits as well as one of the UK's largest trade exhibitions of its kind which means your interests are well and truly catered for, whether looking for those final bits and pieces to finish a current project, or even some fresh ideas for a brand new one.

There will be radio controlled helicopter flying demonstrations, live steam model railways, locomotives, boats, traction engines and aeroplanes as well as R/C truck displays supported by over 60 working models.

As always, the 'Live Steamers' will be faithfully running every day outside the exhibition halls. Don't forget to pay them a visit and check out the action. Visit **www.thedoncastershow.com** for more details.

International Model Boat Show 2018

The 2018 International Model Boat Show will be returning from Friday 9 – Sunday 11 November to the Warwickshire Event Centre.

The show will as usual provide visitors with a packed exhibition hall with over 600 fantastic models from over 25 club and society displays. The excellent and varied display of models from early warships to modern power boats and ships will be complemented by action on the large indoor boating pool.

In addition to all the boating action, the Tamiya Truckin team will be demonstrating and driving their 1/14 scale radio-controlled models on a roadway system over 80 metres square. This fantastic arena will feature radio controlled 1/14 scale trucks, plant and machinery.

This year the award for the best society/club display will be sponsored by the magazine "Model Boats". Last year King Lear Model Boat Club came 1st, in 2nd place was Bournville Radio Sailing & Model Boat Club and in 3rd position was The Lifeboat Enthusiasts Society. Who will win this year?

Over twenty specialist suppliers will also be present offering visitors everything they could need for their boat builds and other modelling needs.

Tickets are on sale at discounted prices from **www.modelboatshow.co.uk**.

Don't Forget Dad!

Save up to 39%!

6 issues for £19.99*

Show the men in your life how important they are this Father's Day with a subscription to their favourite magazine for less than £20!

SAVING 26%

6 ISSUES FOR £19.99
~~FULL PRICE £27.00~~

SAVING 38%

6 ISSUES FOR £19.99
~~FULL PRICE £32.40~~

SAVING 39%

6 ISSUES FOR £19.99
~~FULL PRICE £33.00~~

SAVING 33%

6 ISSUES FOR £19.99
~~FULL PRICE £29.94~~

SAVING 33%

6 ISSUES FOR £19.99
~~FULL PRICE £29.94~~

SAVING 37%

6 ISSUES FOR £19.99
~~FULL PRICE £31.50~~

SAVING 23%

6 ISSUES FOR £19.99
~~FULL PRICE £26.10~~

SAVING 22%

5 ISSUES FOR £19.99
~~FULL PRICE £25.50~~

SAVING 37%

8 ISSUES FOR £19.99
~~FULL PRICE £31.92~~

SAVING 20%

5 ISSUES FOR £19.99
~~FULL PRICE £24.95~~

SAVING 30%

6 ISSUES FOR £19.99
~~FULL PRICE £28.50~~

SAVING 30%

6 ISSUES FOR £19.99
~~FULL PRICE £28.50~~

SAVING 24%

6 ISSUES FOR £19.99
~~FULL PRICE £26.40~~

SAVING 16%

6 ISSUES FOR £19.99
~~FULL PRICE £23.70~~

SAVING 16%

5 ISSUES FOR £19.99
~~FULL PRICE £23.75~~

SUBSCRIBE SECURELY ONLINE:

WWW.MYTIMEMEDIA.CO.UK/FD18P

CALL 0344 243 9023** AND QUOTE FD18P

Don't miss out!
OFFER ENDS
29TH JUNE 2018

*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.

TERMS & CONDITIONS: TERMS & CONDITIONS: Offer ends 29th June 2018. Subscriptions will begin with the next available issue when order is placed. For full terms & conditions visit www.mytimemedia.co.uk/terms.

A High Speed Engraving Attachment

Keith Johnson made this device to fit his CNC Wabeco 1210 Vertical Milling Machine, but it would suit most other CNC mills of similar capacity. Part 2

Position material against dowels and securely clamp, **photo 10**, check with a thin feeler gauge at each dowel location that material is properly located. Pocket mill, profile end then four slots and drill holes to complete, **photo 11**.

Anti – Rotation Mounting Slot fig. 3

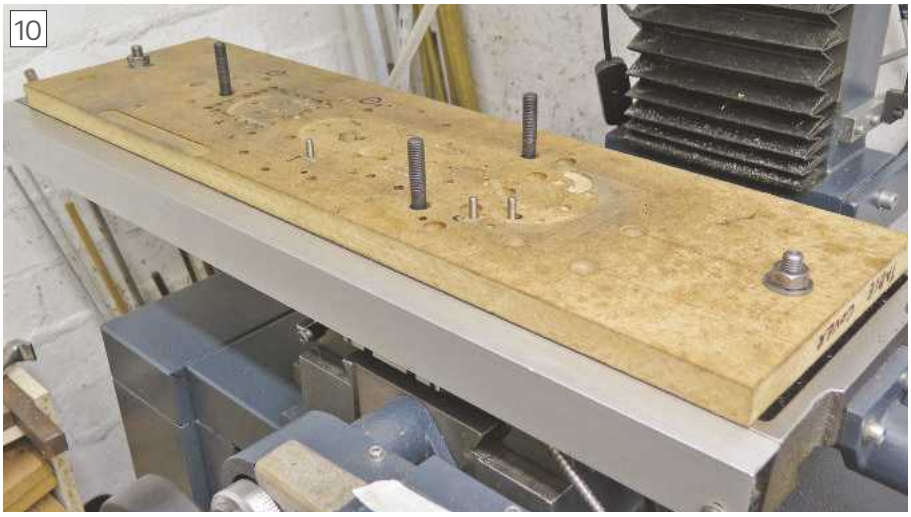
There is one milled slot 6mm x 20mm drawn in red located on the centre line and not dimensioned. This slot is for an M5 cap screw that fits into a drilled and tapped axial hole, in the end of a 12mm diameter x 300mm long bright steel bar.

The 12mm bar being clamped in the Wabeco machine bracket that is provided for holding a cutter guard. The exact position needs to be checked on the machine before milling this slot through the plate. The 12mm diameter mount can be seen in photograph 1 of the completed unit.

Motor Mounting Plate – fig. 4

Material - Bright Drawn Steel Flat - 75 x 180 x 4. 8

Once again position against dowels and clamp, check, pocket mill and drill all holes.

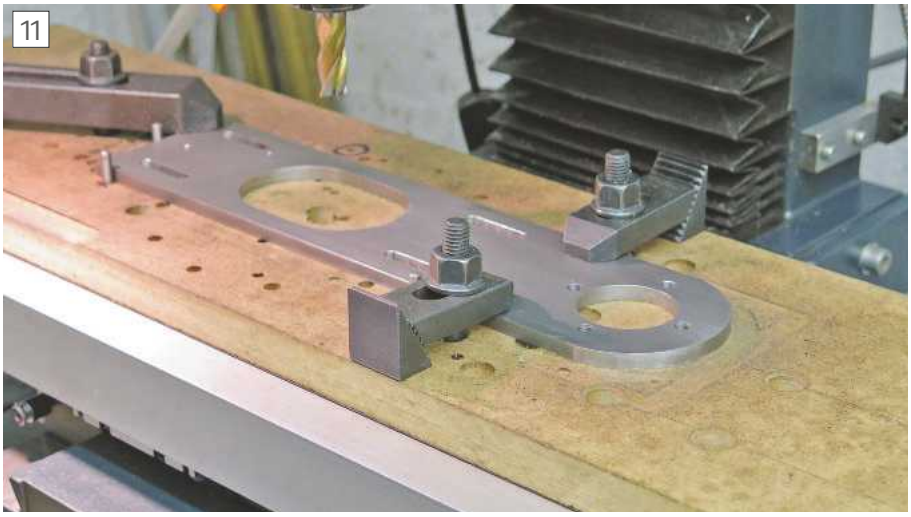


Location Dowels and Clamp Studs in Place

Removing Sharp Corners – fig. 3 and 4

The only operation remaining is milling corner radii on both plates (six corners in total to make safe). A simple set up using three dowels and a clamp, located each plate corner in turn for milling to shape.

To remove dowels from cover board, place a Jacobs drill chuck over the dowel and securely tighten the chuck with a key. Twist and pull upwards in a straight line, out it comes, **photo 12**. Remove cover board from table, store until needed next time.



Located and Clamped for Machining

Motor Mounting Plate – fig. 4 – Spacer Studs

Material - Bright Drawn Steel - 12. 7 A/F Hexagon Bar

Material - M6 Steel Allthread

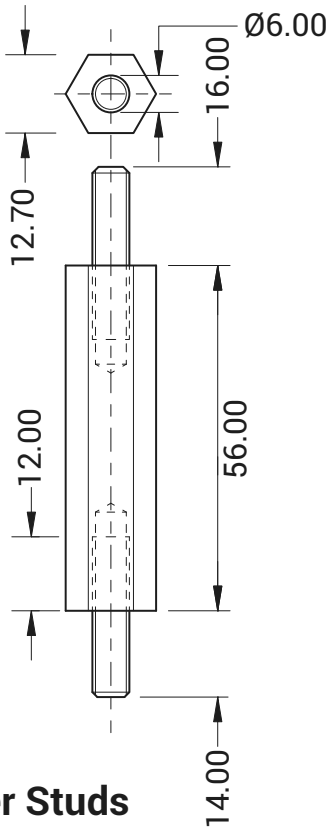
Part off four pieces of hexagonal bar slightly over finished length, grip in chuck locating against a backstop. Face one end flat, centre drill, drill, tap to known depth, (lock two nuts onto the tap to indicate depth required), repeat for all blanks.

Load into chuck tapped end first and against backstop, Face second end flat to correct overall length. Tap as before, repeat to complete the set of identical components.

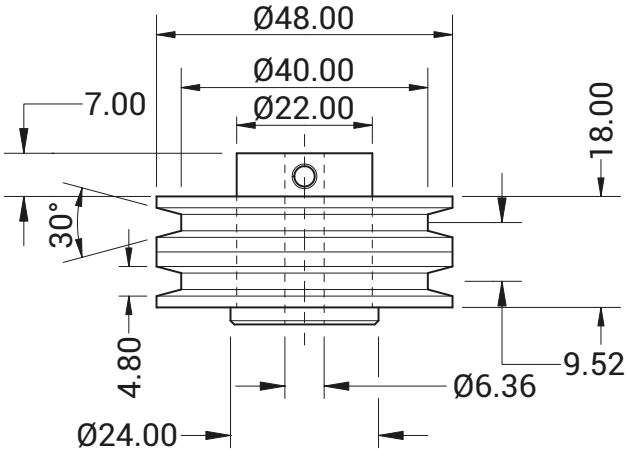
Part off eight pieces of M6 allthread and chamfer one end only. Screw on and lock together two nuts at the other end. Prepare all studs in this way.

Clean out all tapped holes in hexagonal bodies, hold body in bench vice, apply favourite fitters glue to chamfered end of stud and quickly wind in to bottom of tapped hole, fit all eight allthreads and allow to set.

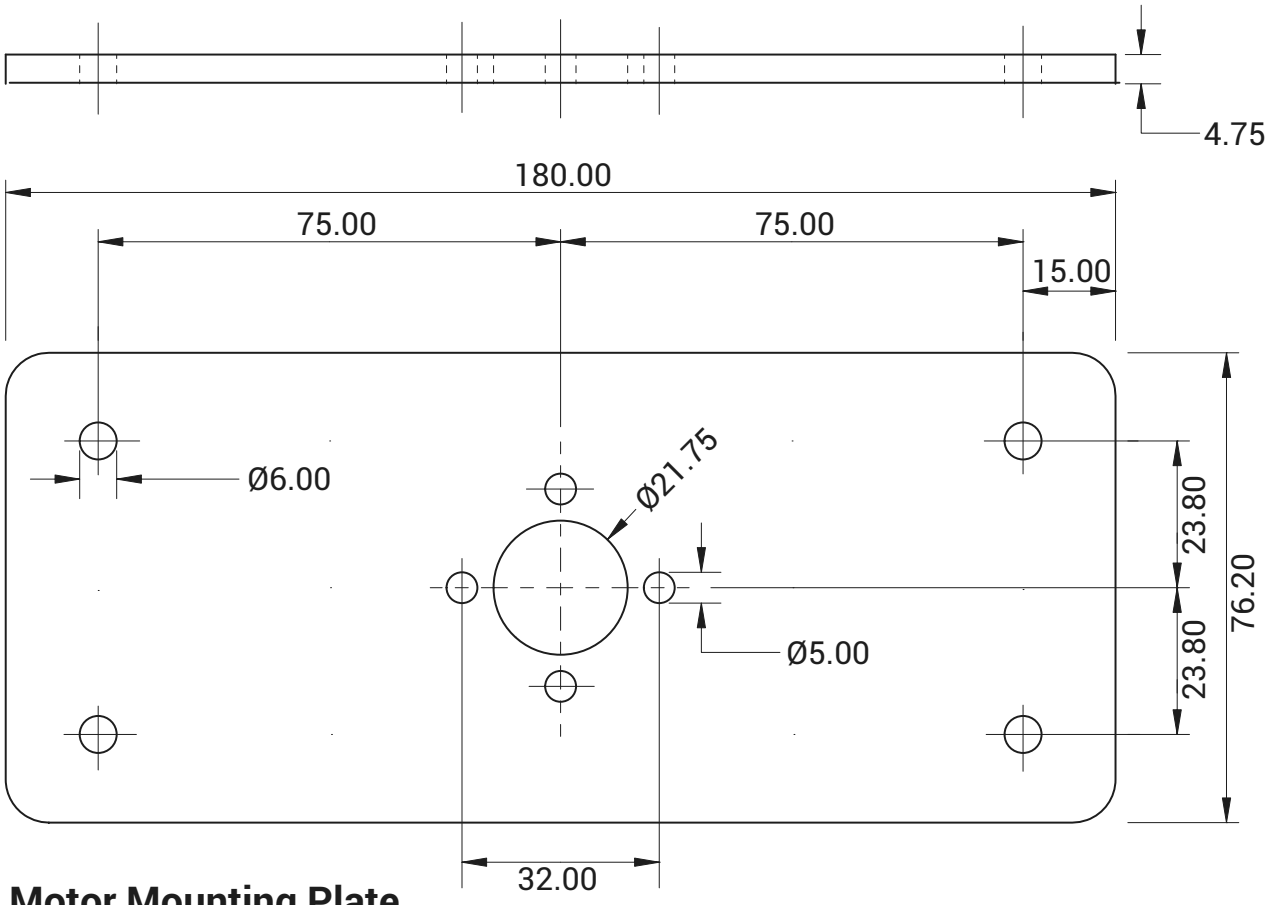
Fig.4



Spacer Studs



Motor Pulley



Motor Mounting Plate

Remove all nuts and clean off any residual glue, place a washer and finger tight retaining nut on one end only of all four items, **photo 13**. Chuck in lathe with washer pushed back against chuck jaws. Carefully face and chamfer thread to finished length for all 4 items, **photo 14**.

Repeat for second ends, sizing and chamfering to their required length.

Motor Mounting Plate – fig. 4 – Motor Pulley

This item consists of a steel centre piece and two aluminium discs all secured together with your fitters' glue, **photo 15**. When fully cured hold in a 3-jaw chuck, centre drill and steady with a revolving tailstock centre. Turn and groove to sizes on drawing, drill through, reamer bore to size, carefully part off. Face end flat, drill and tap for clamp screw to complete.

Welding Polyurethane Belts

Over the years I have tried a variety of methods and various heat sources. This is my best method and gives me a good reliable weld every time, spanning all diameters of belt that I use. It does however require a simple few parts to be made.

Removing Dowels

Ready for Sizing

The heat source is a 75-Watt electric soldering Iron with a detachable bit. The original soldering bit has been replaced with a brass turned part (no suitable size copper in stock when I made this Item). This is turned to fit the irons body, the protruding piece is about 60mm long and milled to 12mm square, the front end is faced flat.

As per the original design this part is held in place with the side clamp screw. The belt to be welded is secured at each end, in a pair of small Vee blocks with clamps.

A simple MDF base plate onto which are screwed two strips of wood, spaced so that the Vee blocks slide without wobble within these guide rails. A third piece of wood is screwed across the guide rails a little way in from the left hand end, this acts as a stop to position the fixed Vee block.

I secure the fixture down, close to the front of my workbench with a single carver clamp positioned over this fixed block.

Cut the belt to desired length with a sharp knife, keeping the ends visually square.

Position each end of this cut length into the blocks and secure with clamps, with about 6mm protrusion of belt, through the blocks at each end, **photo 16**.

Now everything is clamped in place check set up, by sliding the right-hand block leftwards until the belt ends meet, feel or look for correct alignment of belt ends. Clean the square end of the soldering iron to remove any oxidisation etc, switch on and allow time to heat up.

Using the freshly cut end of the stock piece of belt frequently check the iron temperature, do this by pressing the end of belt, on the flat end of the iron. When the material starts to melt and forms a collar, switch off the iron, its hot enough.

Immediately place the bit between the Vee blocks push the blocks together so that both ends melt to form the collars, remove iron and quickly push the ends together, hold firmly together for about 30 seconds. Leave clamped for about 10 minutes, remove from clamps, trim weld with nail clippers (this method is dust free, as opposed to grinding).

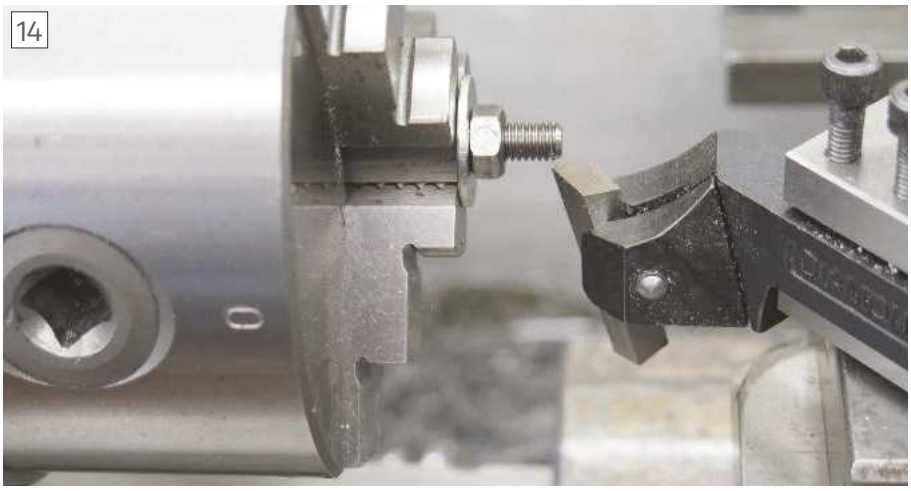
Poor welds can be caused by overheating or dirt, always clean the heating bit. When the material melts quickly and bubbles its probably too hot. Another cause of weld failure is often due to not being cured, caused by early removal from the clamps.

Power Supply Circuit Diagram – fig. 5

Years ago, I rescued from a skip the battery charger belonging to a mobility scooter, at last I thought here is a project to use this find on. However not quite so lucky when checked, it was for 24-volt operation and had other faults. Not to be beaten, I have stripped out all of its components, to save the two-part louvered case. I made a new aluminium front panel engraved with details of supply etc. using this attachment.

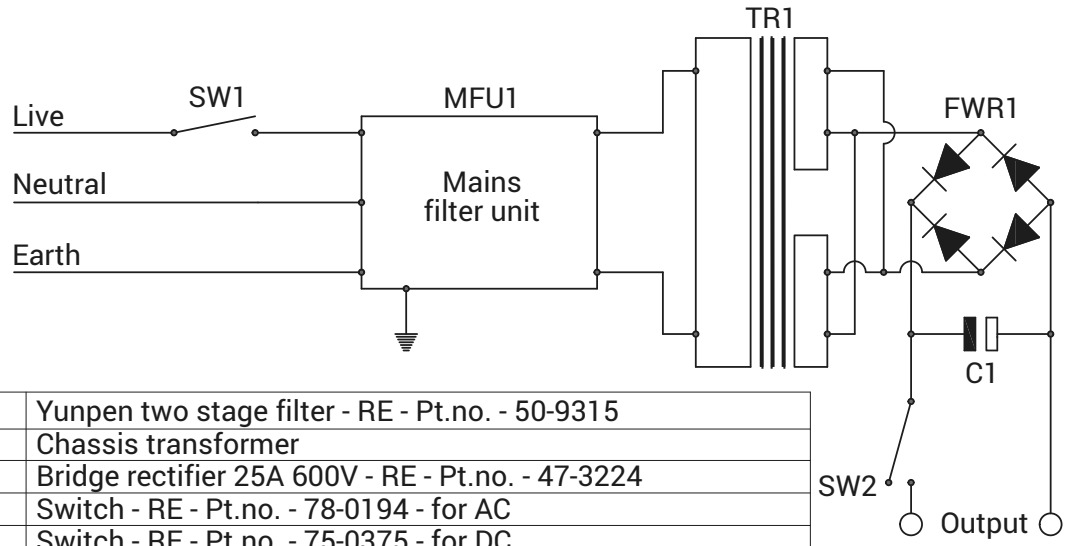
This case measures 200 x 200 x 200mm, a perfect size for the components we require in this power supply, with space to mount all items on the base. Both on/off switches for AC and DC together with the 12 Volt DC output sockets, are front panel mounted.

The circuit is typical of many power supply units both simple and reliable. The



Face and Chamfer to Size

Fig.5



MFU1	Yunpen two stage filter - RE - Pt.no. - 50-9315
TR1	Chassis transformer
FWR1	Bridge rectifier 25A 600V - RE - Pt.no. - 47-3224
SW1	Switch - RE - Pt.no. - 78-0194 - for AC
SW2	Switch - RE - Pt.no. - 75-0375 - for DC
C1	Electrolytic capacitor - 10000 mF 40V - RE - Pt.no. - 50-4007

RE = www.rapidonline.com

Power Supply Circuit

transformer has a single wound primary for 230V operation, the secondary is dual wound to supply 9V per winding, these 9V outputs require connecting together in parallel. For the transformer I used, each secondary winding was marked 0 - 9 0 - 9 to indicate correct pairing. The resulting 9V AC is connected to a full wave bridge rectifier.

These devices are usually square with a centre mounting bolt and require securing to a metal chassis to act as a heat sink. The connectors are always located at the corners of the square, usually the DC output positive (+) is marked, the negative output connection being diagonally opposite. The two remaining inputs are for the 9V AC from the transformer, but it's worth checking with a meter to check your connections.

The smoothing capacitor is also marked to indicate its positive connection and must be connected to + from the rectifier.

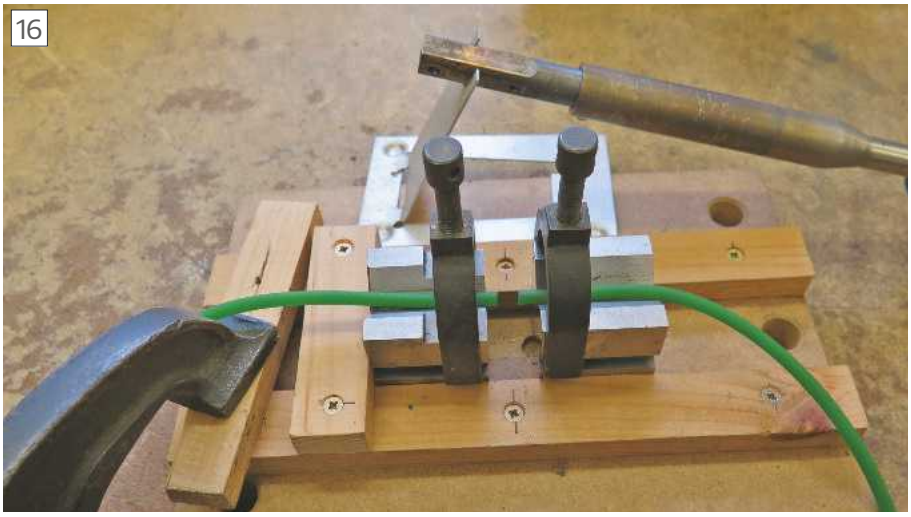
Finally, a small variation, the DC Switch only operates an automotive relay coil. The contacts of this relay directly control the DC motor, easily handling its start/run current demands. The 20amp automotive blade fuse for DC is mounted externally, using an in-line blade fuse holder fitted to the figure of eight wire that connects motor to power supply, **photo 17**.

Spring Loaded Pen – fig. 6

This is a simple but very useful item I use to prove engraving or other toolpaths, prior to committing the cutter to metal and potentially scrapping an expensive component.

This version was made using two types of free pens given out by a large high street bank. Original pens were the retractable type with a clicker button at the top, we need one.

Start of Motor Pulleys



Belt Welding Fixture

Strip pen to pieces and save the ink tube, the type with little side crimps, also save the compression spring. Sling the rest in the bin.

Current pens are straight without the clicker button, we need one. Strip the pen keeping everything except the ink tube, sling this in the bin, it has no little side crimps.

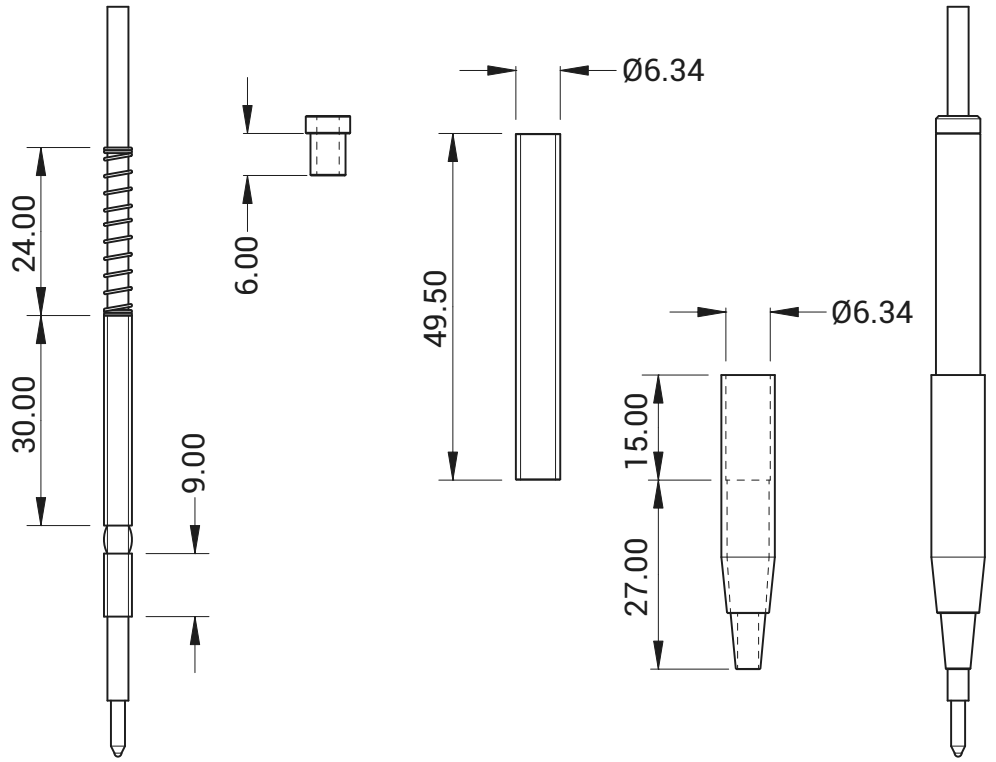
Refer to drawing, a few bits of thin walled brass tube for spacers, a piece of 6.35 tube completes the shopping list, just a bit of drilling and reaming to complete, photo 18.

Next time you go into the bank with the pens do not tell them how we modify their products, just smile and have a couple more for spares.

On the machine table I use a thin piece of plywood A4 plus a bit in size, held down with two studs and nuts.

Paper is secured to this with masking tape, **photo 19**.

Fig.6



Spring Loaded Pen

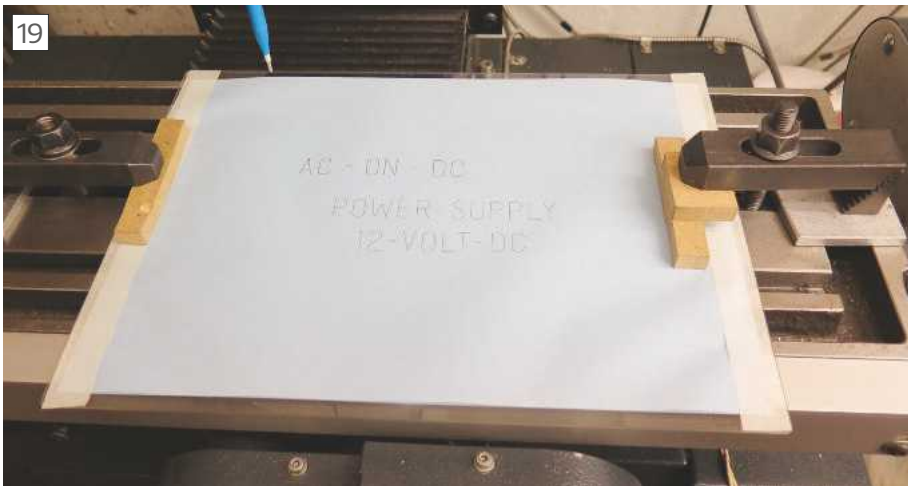
17

Completed Power Supply

18

Spring Loaded Pen

19



Proving G Code File

Sub – Table to hold work for Engraving

This is made from 3 pieces of MDF, the table top is 450mm x 180mm x 18mm. With two raising blocks 180mm x 50mm x 18mm all secured together with wood screws through the table, holding the blocks flush at each end.

On top of the table along one edge, a gauge plate strip 300mm x 12. 7mm x 6. 35 with ends machined square is secured with 2 x M4 cap screws and nyloc nuts.

Using this Sub – Table

With this table on your workbench position the plate that's ready for engraving, against the guide bar and flush with the left-hand edge. Mark positions for holding down studs either side of component and about 12mm out from its edges. At these positions drill 10mm diameter holes through the table top.

● To be continued

Scribe a line

YOUR CHANCE TO TALK TO US!

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

Geoff Garrett's Mystery Tooling

Dear Neil, I have a similar shell type cutter to that which Geoff Garrett seeks an arbor for; marked on the drive end is:-Clarkson 1.5" Diam x 2⅜", above the slot with an internal thread.

The arbor is a No. 2 Morse Taper, shank thread R.H. UNF12TP1 (0.744" diameter). The unthreaded part (0.765" diameter) is lettered LE, M/D, Type B, No 2 M.T. and matches the hollow ground diameter. In the cutter, the drive dog is a separate item and is free to turn on the arbor.

Although the cutters are included in an old copy of Buck & Hickman's catalogue there is no sign of the arbors.

I hope this may be of some interest to Mr. Garrett.

I enjoy your magazine but sadly I am still in the "pony express" era and depend on my daughter in law for contact with the outside world – "shed bound"!

Ian Rose
Kirriemuir, Angus

Domestic Engineering

Dear Neil, My front door faces west and the rain used to get into the lock, making the pins which the key operates and are on the underside of the lock, go stiff.

The door manufacturers say to oil the lock now and then but during a period in a locksmiths' shop when I was much younger, the foreman said not to oil locks of this kind because the oil gums up the pins and creates problems. He said to use powdered graphite (available in a flexible plastic squeezy bottle) instead or to rub a soft pencil lead along the teeth on the key.

However, prevention being better than cure, I made the escutcheon from materials to hand, hence the rather thick surround for the lock.

The hinges on my back gate have become stiffer over the years because its rarely used and there is no way of getting oil into the hinges.

Having bought a new gate, I've knocked out the pins on the new hinges and made a pair of stainless steel bolts with a countersunk hole in the bolt heads and a small diametrical hole just under the bolt head so it will be possible to lubricate the hinges in future.

The job is finished off with a nylon plug to keep the rain out of the holes.

Colin Porter
Blackpool

Toolroom Trauma

Dear Neil, the article in Issue 267 by Jason Ballamy was informative and helpful.

But horror of horrors! All the photos showed cutting tools reposing directly on machined surfaces. Bad for the machined surfaces; bad for the business end of the cutting tools. When I was an apprentice, we were taught never to lay metal articles directly on machined surfaces. Some of the longer lathes had purpose made timber covers for the exposed sections of bed not in use. These were often used to store cutting tools. Alternatively, a timber topped table was nearby to store cutting tools. This is a practice I have observed ever since, but which seems to have lapsed over the years.

Cedric C. Lodge
By email.

Electric Chuck Key

Dear Neil, I read with interest the article on the hand brace for changing chuck jaws (our current issue) it got me thinking that was my fathers technology in the 50 & 60, we now have cordless drills, so I made up a chuck key for it, it takes approximately 45 turns to take out one set and again to put in the new set and of course all will have to be reversed again at some stage, all in all a lot of turning.

The tool took about an hour to make, is about 85 mm long ,the drill chuck end is hexagon 11mm across the flats and the other end to suit the lathe chuck, I stepped down the end 9mm a little so I can use it on 2 chucks see accompanying photo.

Love the magazine and look forward to it every month.

Peter Nillesen
Amiens, Queensland,
Australia

There are more letters on page 56

FORNCETT INDUSTRIAL STEAM MUSEUM

STEAM UP DAYS 2018

Sunday 6th May

Sunday 3rd June

Sunday 17th June

Sunday 1st July

Sunday 5th August

Sunday 2nd September

Sunday 16th September

Sunday 7th October

for more details about the museum and events above

forncettsteammuseum.co.uk

01508 488277

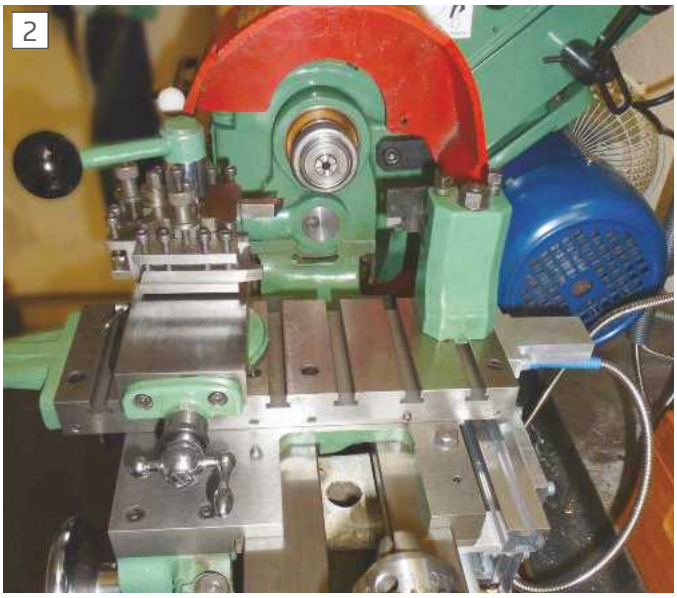
forncettsteammuseum@gmail.com

Machine-DRO readout kit for Myford 7-series lathes

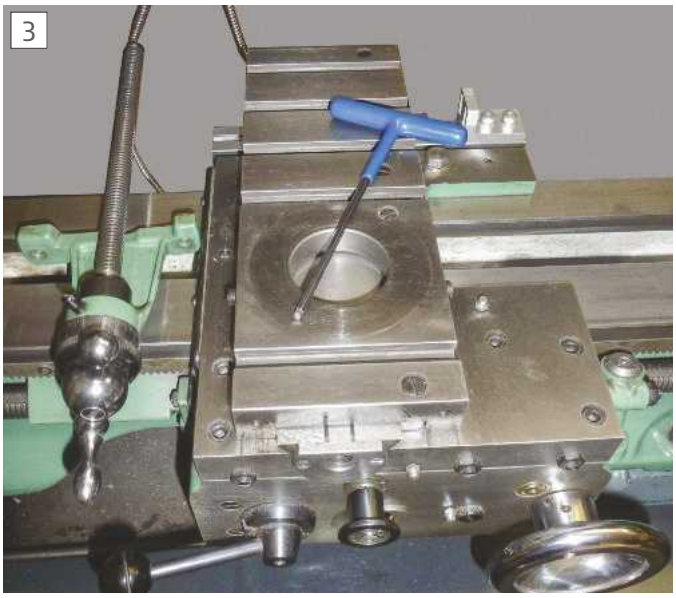
'Crankpin' concludes his review of this new 2-axis DRO kit

Last month, I reported that Machine-DRO had developed a new modification for the cross slide. This upgrade replaces the simple bolt-on encoder supplied in the standard DRO kit with an embedded magnetic tape and extension piece. This frees up the entire surface of the cross slide and allows easier access to the carriage locking mechanism. Fitting will involve tapping the cross slide with two M6 fixings and machining a slot 2mm deep by 10mm wide and 180-200mm in length on the under surface of the cross slide. M-DRO launches this in May. A comparison of the two arrangements is shown in **photos 1** and **2**. The process of fitting is quite straightforward and requires removal only of the cross slide, careful machining and importantly, use of a milling machine or less satisfactorily, access to another lathe with a vertical slide. The pack supplied consists of the new rear bracket, a bracket for the reader head, fixing bolts and magnetic strip with cover. When complete there is now full protection for the reader

Comparison of the cross slide with original and...



...new optional cross slide modification.



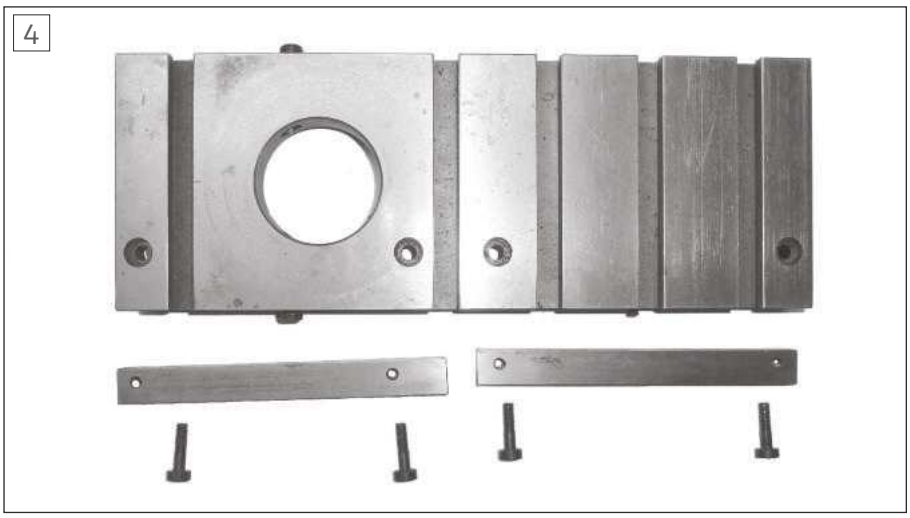
Dismantling the cross slide

and a much neater arrangement with easier routine cleaning of the cross slide.

The first stage is to remove the cross slide lead screw and if fitted, the existing encoder and bracket, **photo 3**, after which the cross slide gib strips should be removed and the underside given a clean to remove any traces of oil with a solvent, **photo 4**.

Because of the long, shallow slot which has to be cut, if using a mill with a swivelling head, it is important to first check the tramming. The cross slide may now be mounted on the mill table and its location accurately set for both X and Y axes. There wasn't a lot of room on my small mill and the set-up may look a little precarious, but the cut is shallow and Myford cast iron is superb to machine. The depth of cut is critical and it was gratifying to find that the cross slide was perfectly flat, **photo 5**.

The slot is not cut centrally on the underside and again, its position needs accuracy. **Photograph 6** shows a light surface cut and the new bracket aligned for marking the fixing hole centres. The length of the S7 slide caused a bit of a problem with my bench top drill press but by swinging the head to the side there was just sufficient room with the slide clamped to a heavy angle plate. **Photograph 7** shows the check on depth so as not to break into a T slot. The edge of the bracket must line up with the edge of the slide and once in place the slot can be cut in both parts to full depth and length. I found later it was not necessary to take the slot right up to the tool post hole. The final cut is shown in **photo 8**. The next stage just requires the self-adhesive magnetic strip and its cover to be laid into the slot and pressed down flat.



Removal of gibs for cleaning nnderside of cross slide

Checking flatness of cross slide

Trial surface cut to align the bracket

Maximum depth of tapping drill

Turning now to the encoder, this is attached to the new bracket, **photo 9**, and tightened into place on the previously fitted saddle bracket, **photo 10**.

This also shows the strip of white card which is necessary, as described last month, for setting the correct gap between the encoder and protective shield covering the magnetic strip. The armoured cable is secured to the main plate and the job is done, **photo 11**.

Evaluation of the M-DRO kit

"Evaluation" may be a pretentious description to apply here. For a user versed in CAM, the facilities offered by the display console will no doubt be second nature. But for me many of the offered functions took some time to appreciate.

My first activity after fitting the cross-slide modification was to establish the accuracy of the read outs compared with the lathe's index handles.

Having cleaned and adjusted the cross and top slides their movement was now smooth—too much so as I discovered later. The first step was to mount a 0-0.5" (Mitutoyo) digital dti and compare its measurements with those from the M-DRO

›

Milling slot to full depth with bracket fixed in place

Encoder on new bracket

display and the Myford index dial for the cross slide, **photo 12**. The foot of the dti abutted against the flat end of a round rod clamped at centre height. The dti plunger was set parallel to the cross slide to reduce any cosine errors. All three indices were set to zero and the cross slide dial turned to each increment without reference to either of the digital displays until their readings were taken.

Both the Mitutoyo and M-DRO displayed movement to 5 decimal places; this (excessive) accuracy is retained for **table 1**. Each value represents the mean of 5 repeated measurements.

Although the S7 dial readings were long considered unreliable due to an inability to set precisely the coincident lines in a repeatable way, it was surprising to find how accurate they actually were compared to the Mitutoyo's readings. The greatest difference, for the 0.5" advance, appeared to be 0.0003".

Comparing the readings from the Mitutoyo to those from the M-DRO, the differences, to five decimal places, were less than 0.001" except for the 0.020" advance where it was 0.0012". No claim is made for which of the two DRO devices used was the more accurate but there was no evidence of any practical difference.

Stage 2 was to put a 2MT Arrand test bar in the mandrel with a PGMS rod aligned at 90^0 in the tool post. A 1 inch a slip was inserted as shown in **photo 13** to check carriage accuracy. After removal and bringing the PGMS to just touch the end of the test bar, the DRO showed an accurate movement, **photo 14**.

Similarly the slip was interposed halfway along the test bar and cross slide movement checked, **photo 15**. In this case an equally reassuring value was recorded on the M-DRO display of 1.00039"

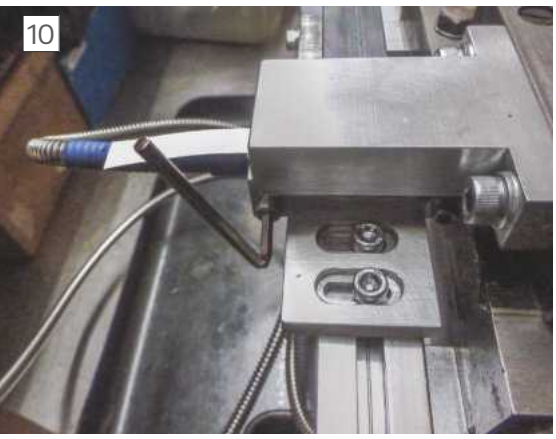
Within the limits of this simple method, the M-DRO system had demonstrated accuracy. The key test would be accuracy in metal turning. Here a problem was encountered in that a regular difference of around 0.003" was showing in the diameters between a (Mitutoyo) vernier reading and that on the M-DRO unit after turning mild steel rod. Assistance was sought from Allendale who promptly offered various reasons; one of which was then suspected as the culprit. In easing the two cross slide gibs it had caused the slide to shift very slightly when cutting. Accordingly the tests were repeated but this time the gib grub screws were tightened before each cut.

An acceptable correlation between measured and displayed values was now obtained. **Photograph 16** shows one example where a recorded diameter of 0.36181was matched by a measured reading of 0.3620", **photo 17**.

Thereafter I had to adjust and endure a stiffer movement to the cross slide than previously. Clearly the small allowances one permits in normal lathe maintenance

Table 1 – comparison between DRO and DTI readings

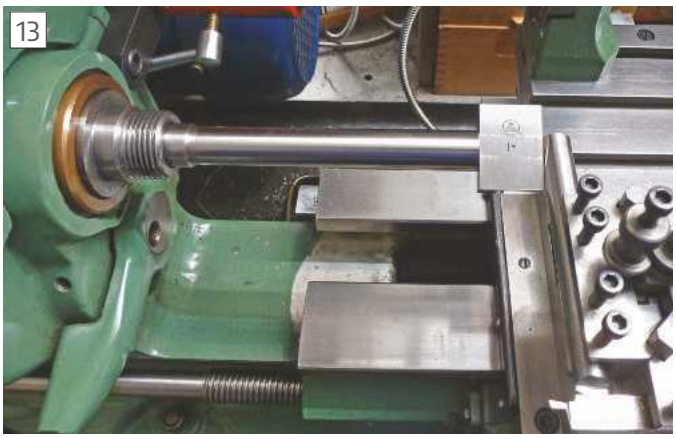
S7 dial	Mitutoyo	M-DRO
0.010"	0.00986	0.00972
0.020"	0.01996	0.01875
0.050"	0.05001	0.04913
0.100"	0.09977	0.09878
0.25"	0.24992	0.2501
0.50"	0.49966	0.50015



Adjusting gap between encoder and mag strip cover

Final arrangement

Sensitive dti to compare output with that of M-DRO



A 1 inch slip to check carriage movement

M-DRO output for the 1 inch slip

show up as inaccuracies on the display with this kit's resolution. Another revelation concerned the reliance I had always placed on countering backlash when using the lead screw hand wheel to control the length of a cut. The carriage DRO output showed me otherwise.

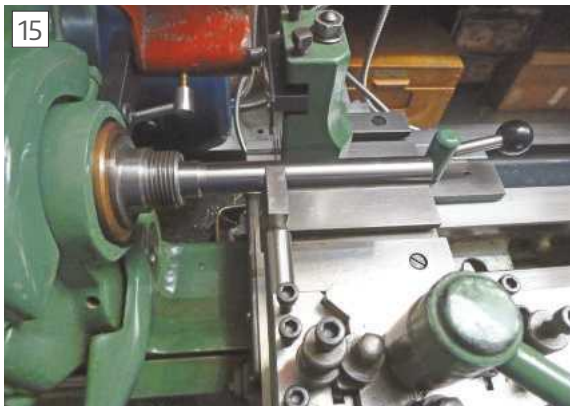
Conclusions

Installation of the Allendale M-DRO hardware was accomplished with ease thanks to clear instructions provided. Their new cross slide modification, although requiring some careful machining, provides a significant improvement in that the cross-slide surface is clear with the encoder and magnetic strip well concealed.

For the MCD-700 display console by contrast, I found the operating instructions to be a little confusing, maybe due to a lack of CNC practical knowledge.

The 4 supplied booklets cover both mill and lathe applications and are richly illustrated with helpful pictograms. Yet a single dedicated booklet for lathe use would have been more welcome. A few minor errors were present in the user manuals and these were referred to Allendale. Commendably they replied that the manuals would be revised immediately. Additionally, it was recommended that I view their instruction videos on *YouTube*. This seems typical of the customer care and hand-holding the company provides.

The system read-outs are evidently



The 1 inch slip to check cross slide movement

accurate once influences of the lathe's behaviour are recognised. One of these influences is adjusting the Myford slides for *"silky smoothness"* (as recommended by Geo. Thomas!). Doing so is likely to reveal minor discrepancies compared to micrometer readings after machining with a measuring system this sensitive. These discrepancies between display and measurement may be avoided by accepting a tighter movement of slide ways and ensuring there is no lateral play in cross slide or carriage. Allendale can also recommend changes to the console setting for an appropriate linear compensation.

The 5 micron sensitivity (0.00004 of an inch) of the M-DRO is undoubtedly overmuch for model engineering purposes and such sensitivity should not be interpreted as reflecting equivalent movement at the cutting tool tip when machining. That 5th decimal place is surely superfluous whereas the 4th is useful in rounding to "a thou". These same M-DRO components are designed for use in industry applications like tool room lathes and mills as well as for model engineering so such sensitivity is to be expected.

The top slide of the average lathe is reported to lengthen by about 0.0001" for a 1° change in temperature. Consequently, together with other factors reflecting age and condition of most model engineering lathes, very small differences between displayed and actual dimensions of finished-turned items must be tolerated with kit like this.

A digital read out, on mill or lathe, is a valuable accessory only if the operator can have full confidence in the validity of its readings and especially their reproducibility. The M-DRO data from machining described here was one example of many repeated tests leading to confidence that the displayed values are certainly accurate enough once the slide way adjustments are addressed. We become familiar with and compensate for idiosyncrasies of our own lathe. A high-resolution measurement system like this will not replace that experience and knowledge. It can however provide both improved identification of those idiosyncrasies and machining accuracy. ■

M-DRO showing new 0.36181" diameter

Mitutoyo vernier recording 0.3620" diameter

CROFTON BEAM ENGINES

Crofton, Marlborough. Wilts. SN8 3DW
Web: croftonbeamengines.org
croftonbeamengines
croftonbeamengs

- Coal fired Lancashire boiler
- Two Cornish pumping engines installed 1812 and 1846
- Pumping 600 tons of water an hour
- Still working as hard as they did from the day they were installed

Bringing our industrial heritage to life pumping water to the top of the Kennet and Avon canal.
Set in a beautiful Wiltshire rural setting.
Parking.
Cafe and picnic area.
Easy access to the busy canal and locks.

Get up close on our steaming events:

May 5-7
May 26-28
June 23-24
July 28-29
August 25-27
September 29-30
October 28

Open from 10.30am to 4.30pm

We are also open with engines static every day except Wednesday until the end of September from 10.30am to 4.30pm

THE KENNET & AVON CANAL TRUST

Supported by The National Lottery® through the Heritage Lottery Fund

heritage lottery fund

Come & See The World's Largest Collection of HISTORIC TROLLEYBUSES

- and ride on some of them !

2018 RUNNING DAYS

(Open 10.30am - 4.30pm unless stated otherwise)

- 5, 6 & 7 May
- 26, 27 & 28 May
- 16 & 17 June
- 30 June & 1 July
- 28 July *(Open 10.30am - 10.00pm)*
- 29 July *(Sandtoft Gathering - Open 10.00am – 6.00pm)*
- 11 &12 August
- 25, 26 & 27 August *(Reading Trolleybus weekend)*
- 8 & 9 September
- 22 & 23 September *(2-Day Steam Rally)*
- 14 October
- 27 & 28 October
- 17 November *(Open 10.30am - 6.00pm)*

We are at Belton Road Sandtoft Doncaster North Lincolnshire DN8 5SX
24-hour Information Line: 01724 711391 Email: trolleybusmuseum@sandtoft.org
For full up-to-date details of what's on, visit www.sandtoft.org

Sandtoft Transport Centre Limited – a Company Limited by Guarantee (Registered in England no.1747475) and a Registered Charity (no.514382)

ACCREDITED MUSEUM

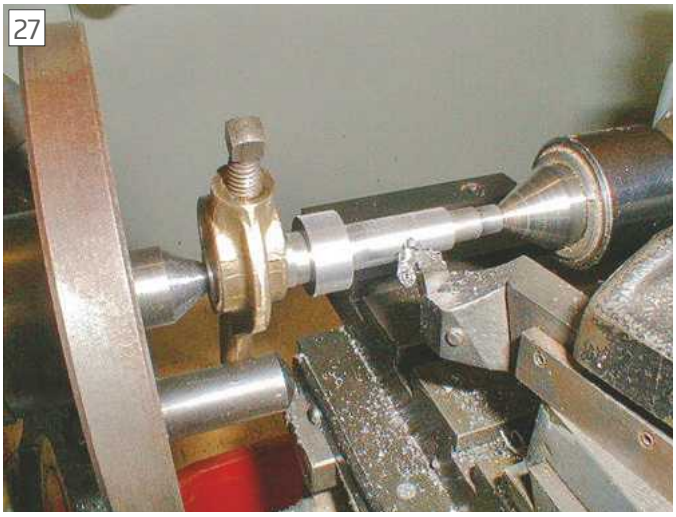
THE TROLLEYBUS MUSEUM at Sandtoft

Modifications to a SIEG C0 'Baby' Lathe.

Tony Bird describes how he got the best out of this little machine - Part 2.

Roughing out collet holder

Taper bore of collet



Turning collet holder

Truing holder in place

We have now come to the part that the lathe was bought for, making an 8mm holder for the collets and chucks from the Boley lathe. The holder was roughed out on a larger lathe, **photos 25** and **26**, and finished in the Sieg, **photos 27** and **28**. The holder was fitted into a nut that had been threaded 14-mm and a draw bar was made to fit the collets. A collet and 4-jaw chuck from the Boley lathe fitted in the Sieg, **photos 29** and **30**.

The range of Boley 8-mm collets went in size from 0.02-mm to 7.00-mm in increments of 0.02-mm, after 4-mm it was not possible to put a rod through the collet, for what the Boley lathe was intended for this didn't matter much, but for a model engineer it was a bit of a pain! So, it was decided to modify a ER 11 collet chuck to fit into the headstock of the lathe, along with the chuck, collets from 4-mm to 7-mm were purchased. The chuck as purchased had a Morse taper which was removed after a clearance hole for a work piece was drilled, **photos 31** and **32**. As with the 8-mm collect holder a nut tapped 14-mm was used to hold the chuck to the mandrel, **photo 33**. **Photograph 34** shows the chuck mounted, later a E25 collet chuck was fitted to a homemade back plate so the collets from the larger lathe could be used, **photo 35**. Now it is possible to buy a E25 collect chuck for the Sieg, which is a good bet as it gives a size range from 1-mm to 16-mm.

With a small lathe, it is easy to run out of space between the head stock and tailstock, a way of saving a couple of centimetres is to use a collet rather than a Jacob chuck in the tailstock. These are not really collets, just a means of holding a drill, a holder is made and fitted in much the same way as it was for the 8-mm collets, but it has a

›

Collet in holder

Four-jaw in holder

Taper and collet holder as bought

Drilling a mounted collet

Finished!

Fitted to the lathe

Collet holder on C0

thread inside. The holder for drills is made from a nut and bolt and hopefully **photo 36** explains how they are made. The holder fitted with a centre drill is shown in use in **photo 37**.

A die holder was made for the tailstock, **photos 38** and **39**, and a tap holder was made that used part of the die holder as a guide, **photo 40**.

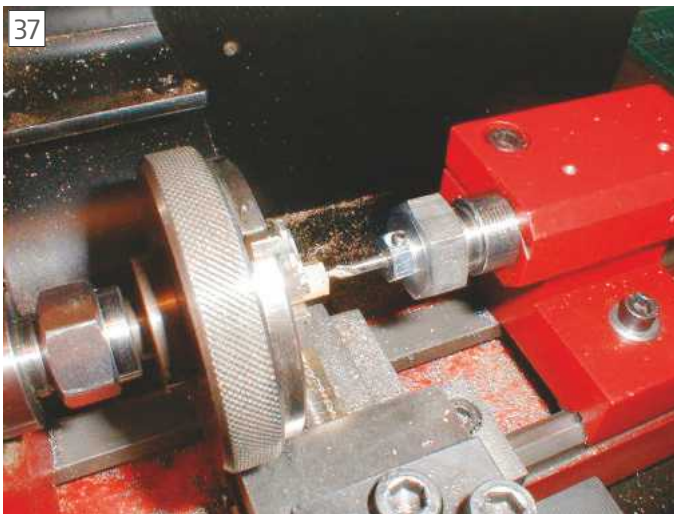
The tool post as fitted was held to the cross slide with a bolt and it was found to move a lot when adjusting it, so a rigid post was made, **photo 41**.

A depth stop for use with the E25 collet chuck, **photo 42**, was made along with a stop acting on the saddle, photo 43.

A DRO was fitted to measure saddle movement, **photo 44**.

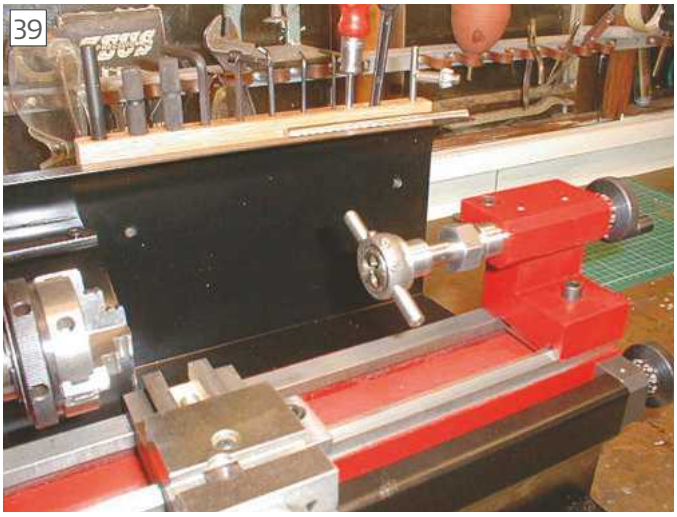
The tool mostly used on the Sieg is the smallest of the tangential Diamond Tools, **photo 45**, it is quite impressive at removing

Tailstock drill holders



Using drill holder

Die holder parts



Die holder in use

Tailstock tap holder

Toolpost alteration

Depth stop

metal, **photo 46**. The smallest of these tools seems to have been discontinued which is a shame for small lathe owners.

When some wood turning was required to be done a larger pulley for higher speed was made and fitted, **photos 47** and **48**.

A plastic 4-jaw chuck from another lathe was tried but wasn't a success, **photo 49**.

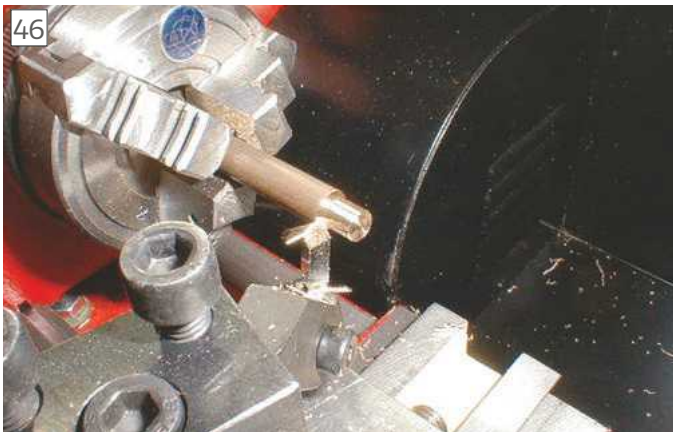
Other than the initial work done to get the lathe working the rest of the modifications and additions took place when a need came up. The lathe has remained more or less the same for seven or eight years and now looks like **photo 50**.

In the lathe's ten years of working life it has done a lot of work and the author wouldn't be without it. It does excellent work mostly making repetitive components such as boiler fittings, but it is quite capable of turning wheels and the like for the smaller locomotive. ■

Depth stop in use

DRO fitted

Diamond tool holders



Using the diamond tool holder

Larger pully for wood turning

Wood turning

Plastic 4-jaw chuck

The SIEG C0 as it is now.

Readers' Tips

CHESTER MACHINE TOOLS

Every Reamer in its Place and a Place for Every Reamer

TIP OF THE MONTH WINNER!

Steve Sellars wins this month's Chester Vouchers with his neat storage solution for reamers and drills.

I will admit that I am not the most tidy of people, but perhaps I am working on it!

I have never been too keen on putting reamers or drills into a drawer, so they bounce off one another, and like most of us I get a little fed up of looking through various boxes to locate exactly the right size reamer I require.

I have tried various tubs and dividing methods even machining old breadboards to make boxes, which never quite cut the mustard!

Having a number of plastic trunking odds and ends of different sizes I decided to cut a number of pieces to the length of the longest reamer. The cap strip was cut short to allow for a simple size indicator and would highlight those missing tools which had not been returned to the drawer after use.

Shorter reamers can be doubled up in one piece of trunking with labels placed at each end, a blob of silicon will separate these or even a piece of polystyrene.

If you have the deeper steel drawer unit drawers, a wooden lift out box would allow reamers to be stored safely on top of already stored reamers to use space to best advantage.

Eventually as the collection grows I will dedicate one drawer to Imperial and one to Metric.

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

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

MODEL ENGINEERS' WORKSHOP

SUBSCRIPTION ORDER FORM

DIRECT DEBIT SUBSCRIPTIONS (UK ONLY)

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

☐ Print + Digital: £13.50 every 3 months

☐ Print Subscription: £11.25 every 3 months

YOUR DETAILS MUST BE COMPLETED

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

Address .....

.....

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

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

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

I WOULD LIKE TO SEND A GIFT TO:

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

Address .....

.....

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

INSTRUCTIONS TO YOUR BANK/BUILDING SOCIETY

Originator's reference 422562

DIRECT Debit

Name of bank.....

Address of bank .....

.....

.....Postcode .....

Account holder .....

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

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

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

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

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

CARD PAYMENTS & OVERSEAS

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

UK ONLY:

☐ Print + Digital: £56.99

☐ Print: £47.99

EUROPE & ROW:

☐ EU Print + Digital: £64.95

☐ EU Print: £55.95

☐ ROW Print + Digital: £64.95

☐ ROW Print: £55.95

PAYMENT DETAILS

☐ Postal Order/Cheque ☐ Visa/MasterCard ☐ Maestro

Please make cheques payable to MyTimeMedia Ltd and write code MEW0618P on the back

Cardholder's name.....

Card no: (Maestro)

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ☐☐☐

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

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

TERMS & CONDITIONS: Offer ends 14th June 2018. MyTimeMedia Ltd & Model Engineers' Workshop may contact you with information about our other products and services. If you DO wish to be contacted by MyTimeMedia Ltd & Model Engineers' Workshop please tick here: ❑ Email ❑ Post ❑ Phone. If you DO wish to be contacted by carefully chosen 3rd parties, please tick here: ❑ Post ❑ Phone. If you wish to be contacted by email by carefully chosen 3rd parties, please tick here: ❑ Email

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 MEW0618P

PRINT + DIGITAL SUBSCRIPTION

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

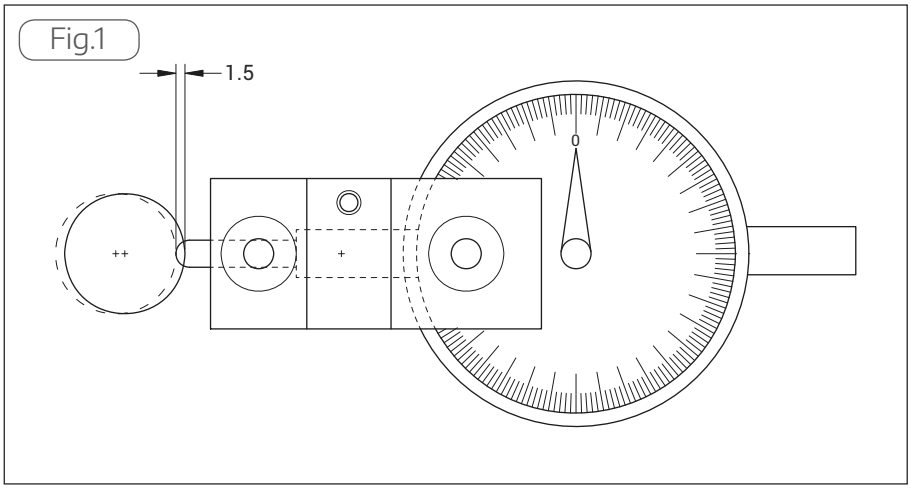
PRINT SUBSCRIPTION

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

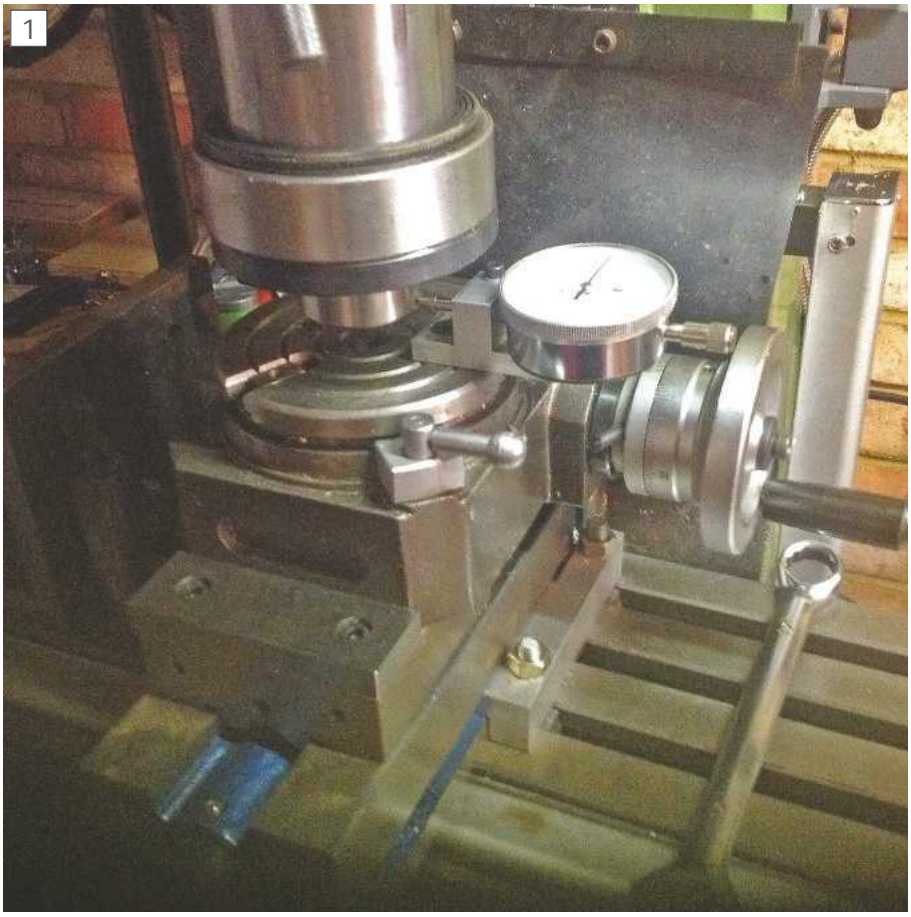
SUBSCRIBE TODAY

A Low-Profile Centring Tool

John Hinkley explains this aid to accuracy on milling machines where there is restricted headroom.



Let's face it, when it comes to aligning the centre of our rotary tables with the mill spindle, we all have our own favourite method. I have a preference for using the axial indicator tool. Others use a wiggler device or a combination of witchcraft and fag papers. Each to their own. A recent forum thread addressed this situation and added an additional conundrum - what to do if there is restricted headroom between the work and the spindle? There were various suggestions including the use of collets directly in the spindle in place of the usual collet chuck to achieve greater headroom, but still the axial centre-finder needs a considerable depth to function as intended. A few quiet moments relaxing in the bath (my usual source of inspiration) and I decided on a different angle of attack. What if, instead of holding the centring device in the spindle, the means of determining the concentricity was attached to the rotary table?

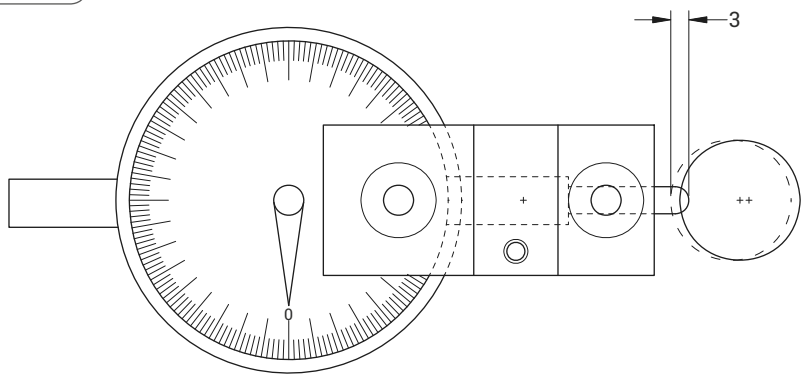


Demonstrating the setup

To try out the proof of concept, I drew up a simple clamp in my favourite CAD system for a dial gauge, to be attached to the rotary table, and a representation of the dial gauge – **figure 1**. I positioned the end of the gauge "probe" up to the spindle represented by the dotted circle. Using the rotate facilities of the CAD program, I rotated the gauge around the table centre by 180°. This resulted in a displacement of the probe's tip by a small amount. Next, I measured the distance between the tip of the dial gauge probe and the dotted circle using the program's dimensioning tool – **figure 2**. I divided that by 2 and moved the "rotary table" assembly by that amount towards the dotted circle. Hey presto, the rotary table and the spindle are aligned, at least in the X-axis.

What if, instead of holding the centring device in the spindle, the means of determining the concentricity was attached to the rotary table?

Fig.2



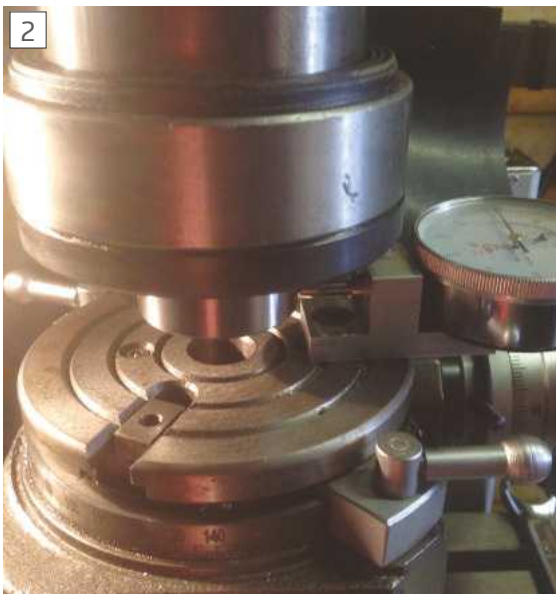
Rotate the CAD rotary table by 90° and repeat the procedure in the Y-axis. The virtual rotary table was now aligned with the spindle axis.

Theoretically, the alignment can be done in four rotations of the rotary table. However, in practice, I suspected that it would take twice that number, or more, depending how close the initial positioning was to the axes. Time to cut some metal and see if it would work in the real world!

I made the bracket shown in **figure 3** to mount the dial gauge onto the rotary table. To align the clamp with the centre of the table, I ensured that the spigot was a close fit in the tee slot of the table. On mine, the slots are 11mm wide and the table has three slots.

Photograph 1 shows the temporary mounting of the rotary table in the vice to illustrate the use of the tool in a restricted headroom situation. In practice, the centring tool only requires a distance of 30mm between the table and the spindle. Before anyone writes to the editor - NO, no machining was carried out with the vice and rotary table in this configuration! It was simply a posed photo-shoot to demonstrate the tool in use.

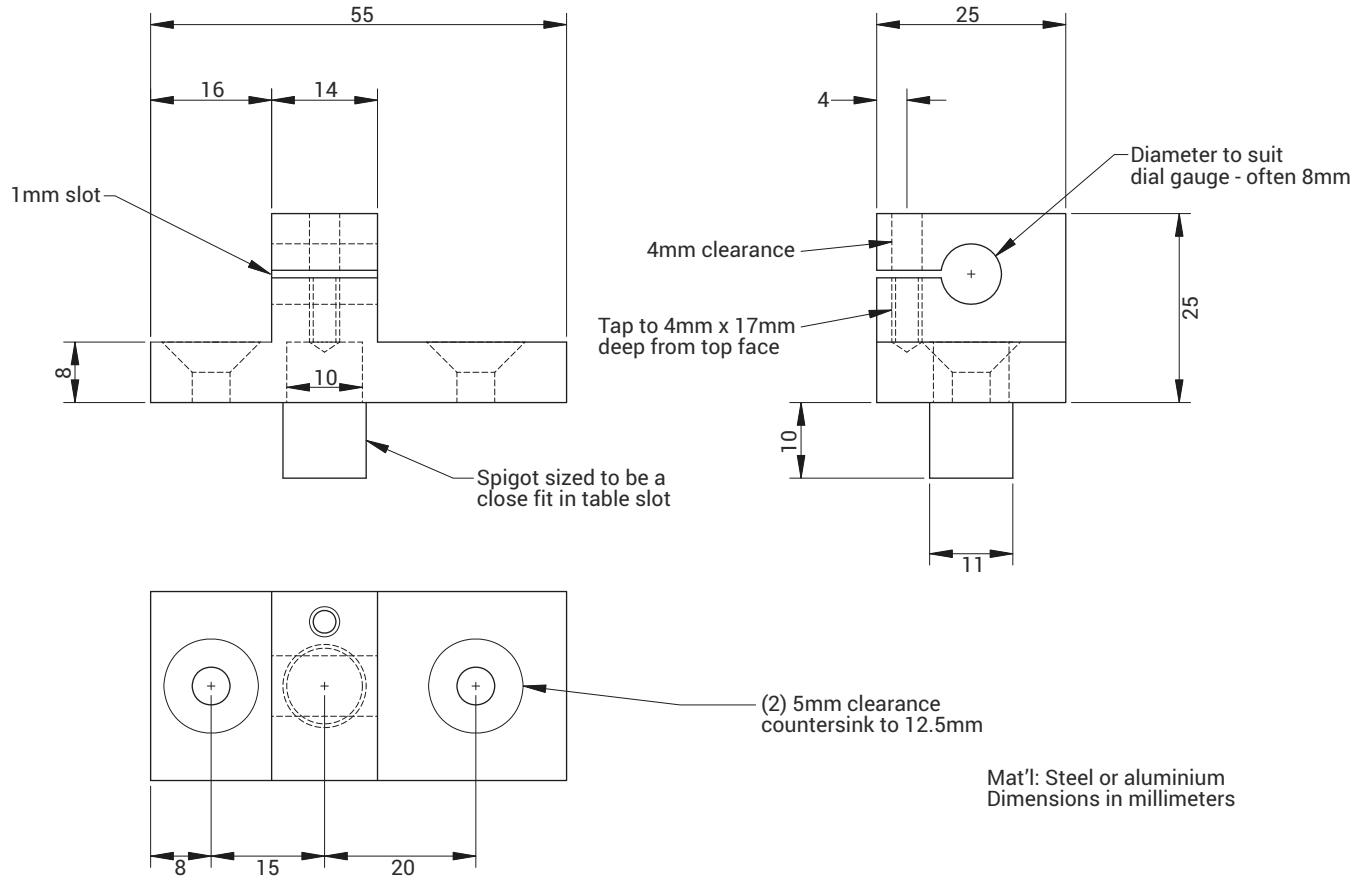
2

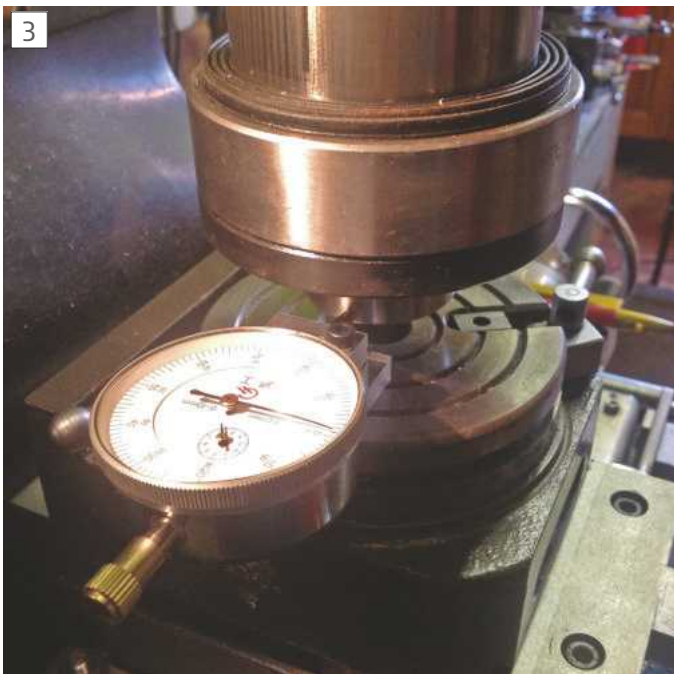


First x measurement

Aligning the rotary table to approximately central to the spindle (though deliberately slightly off-set), the spindle was lowered until the dial gauge plunger contacted the outside of the mill spindle with room for the dial plunger to have a free depth of travel. I rotated the spindle by hand to check for run-out. The

Fig.3





Second x measurement

Measuring the y displacement

dial gauge I was using didn't detect any run-out at all, but it is only graduated to 0.001mm per division. Better than I can aspire to machine to! The rotary table was then aligned to be parallel with the mill's X-axis by eye. By then slowly moving the table in the Y-axis, the dial gauge indicated a "high point". This represents the centreline of the spindle in the X-axis and the dial gauge bezel was reset to zero, **photo 2**. A reading was taken on the table degree graduations. Adding 180° to the latter figure, the table was rotated until that angle was under the pointer. Another reading was taken on the dial gauge. By simply moving the mill table, and so the rotary table, by half the indicated "run out", the rotary table is thus moved towards the spindle centre, **photo 3**.

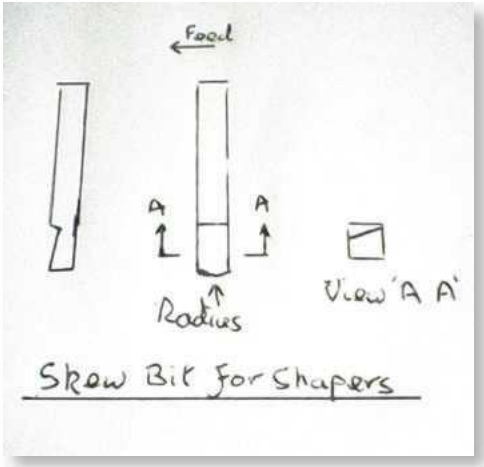
Now I rotated the table by 90° as described in the theoretical description above and the measuring process repeated, **photo 4**.

In practice, the operation did, in fact, only take a couple of revolutions of the table and a couple of minutes at most to achieve concentricity. I checked the set-up with the axial indicator and was delighted to find I was within very close tolerance - ten to 15 microns at most, as measured on the DRO.

The basic concept is readily adaptable to work with other rotary tables, provides a quick way to centre a rotary table, particularly where headroom is restricted and is easily made in an afternoon from material often available in the scrap box. ■

Scribe a line *continued from page 40*

Shaping Up Again



Dear Neil, as a bit if a shaper and planer fan, I've been following Bill Morris's series on shapers with great interest, but have a couple of points I'd like to raise. In MEW 265, in Fig 2 Bill shows some typical cutting tools. One that maybe isn't so well known is the skew bit for finishing cuts (sketch attached). It has a very shallow radius on the cutting edge, about 10 degrees of rake, but a side rake of about 30 degrees, and is fed in the direction shown in my sketch. When this is used with a finishing cut of about 5 thou (no more) it will give a wonderful, almost polished finish on cast iron and steel. The cuttings from steel come off in long very fine spirals, almost like coarse wire wool.

There is a small typo, I think. When referring to 'The flat nose tool D is the traditional one for fine finish-', from Fig 2 it should, I think, read 'The flat nose tool E-'

In MEW 266, when dealing with the cutting of internal keyways, Bill says that the clapper box needs to be locked. This isn't strictly necessary, not when cutting a keyway in the bottom of a bore anyway, as lifting of the clapper box on the return stroke will do no harm, unless the tool rod is a closeish fit in the bore. What he doesn't mention is that with the long projection of this type of tooling, when cutting normally on the forward stroke, the tool can be prone to dig in and judder, leaving a rough finish on the bottom of the keyway. The solution is simple: Lock the clapper box down, turn the tool bit around and cut on the return stroke. The finish will be much better, in fact I always cut my internal keyways by this method.

Richard Wilson
By email

PRO MACHINE TOOLS LIMITED

Tel: 01780 740956
Int: +44 1780 740956

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

Precision European made machine tools for the discerning engineer!

Wabeco CNC Mill CC-F1410

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

2 year warranty

Wabeco Lathe D6000

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

5 year warranty

TECO Mill VF400

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

Ceriani Lathe David 203

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

Wabeco Mill F1210

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

5 year warranty

Ceriani Mill David 403

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

ACCESSORIES

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

Wabeco CNC Lathe CC-D6000

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

2 year warranty

TECO Lathe MD 200

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

MORE MACHINES AND ACCESSORIES ON LINE

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

We regularly ship worldwide

Please contact us for stock levels and more technical detail

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

www.emcomachinetools.co.uk

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

A 'switch off' attachment for parting off safely

Jaques Maurel describes a device for avoiding some of the trauma associated with parting off. This article can be read in conjunction with his article The Star System

Parting off is frequently a disturbing operation due to the risk of the tool jamming in the work piece with the following results:

- Tool broken.
- Work piece spoiled: moved or taken out from the chuck jaws.
- Spindle stalled.

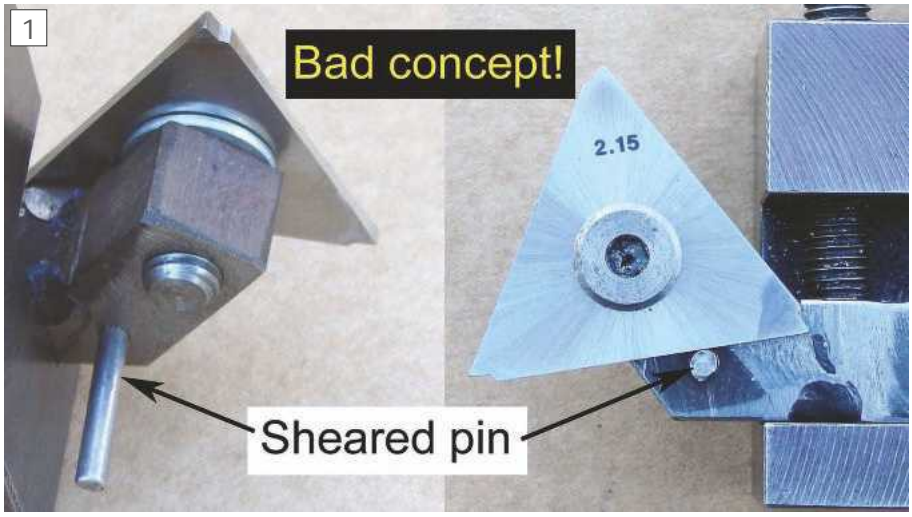
Having experimented with parting off, I decided to contrive a "switch off" attachment, the tool being withdrawn from the work piece at a chosen cutting force.

Principle:

The tool is set upside down, with the lathe turning backwards (it's possible to have it turning forwards, with the device set on a rear tool post if the spindle is of the threaded type, but the drawings must be modified in this case).

The tool is clamped on a vertical slide, the movement of which is constrained but freed for a chosen force. For 1.6mm width parting off blades, I've chosen 2000N (450 Lbs). It's important for the tool to be reset quickly to its working position, so I've made and experimented with many solutions:

- A shear pin.

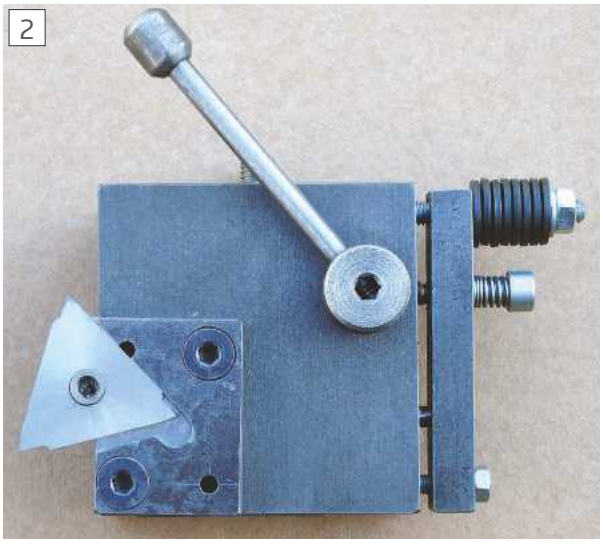


- Friction.
- A "Ball lock" type device.

The "sheared pin"

This is a "fuse", needing time to replace, but we really want more of a "circuit breaker" that can be reset instantaneously. A shear pin is usually used to protect the lathe's lead screw against overload.

I've used this arrangement with a Dormer triangle parting blade, **photo 1**. This concept is not good, as the blade is digging in more while the pin is shearing. This gives a nasty strike to the lathe. The resetting is done by pushing in 2 mm of the 3mm sacrificial pin (and locking it with a grub screw).



The "friction" solution

This solution, **photo 2**, is not easy to make because of the great force (2000N) chosen and the low friction ratio "f" between the rubbing parts (near f = 0.1) which led to a "multistrip" solution, see **figure 1** showing 6 pairs of surfaces in contact, the left one being the dovetail, similar to a multidisc clutch. This figure is far from complete, it's just to show the principle, the moving parts are yellow coloured. The friction force is given by a lever loaded by Belleville washers.

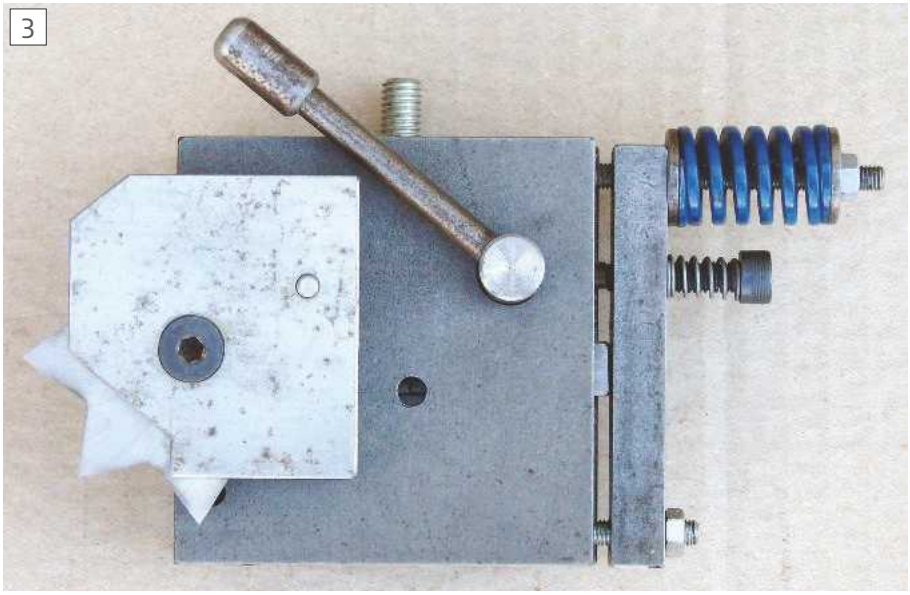
The real problem is due to the fact that when parting off, the cutting force is sometimes suddenly increasing (caused by micro-binding) but not sufficiently for a clear "switch off" so you can't see that the tool has moved slightly out from the center height, and so is not working properly. This is mainly at the cut end, near the center.

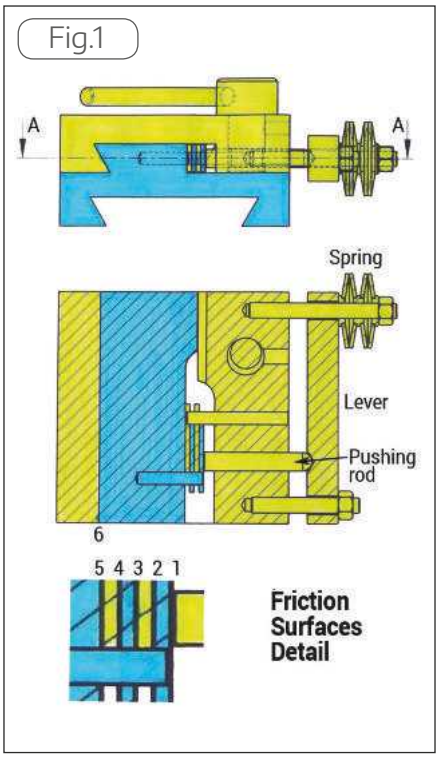
This is an important point as this can also occur when the tool holder is not clamped on the toolpost with a sufficient force. The HSS tool will rub and blunt rapidly when nearing and passing over the center "pip", while for a carbide tool the tip will be pulled out from its holder.

The "ball lock"

The ball lock design, **photo 3** and **figure 2**, proved to work perfectly well, so was adapted in the following way:

The slider is of the "dovetail" type, the advantage being that the gib can be



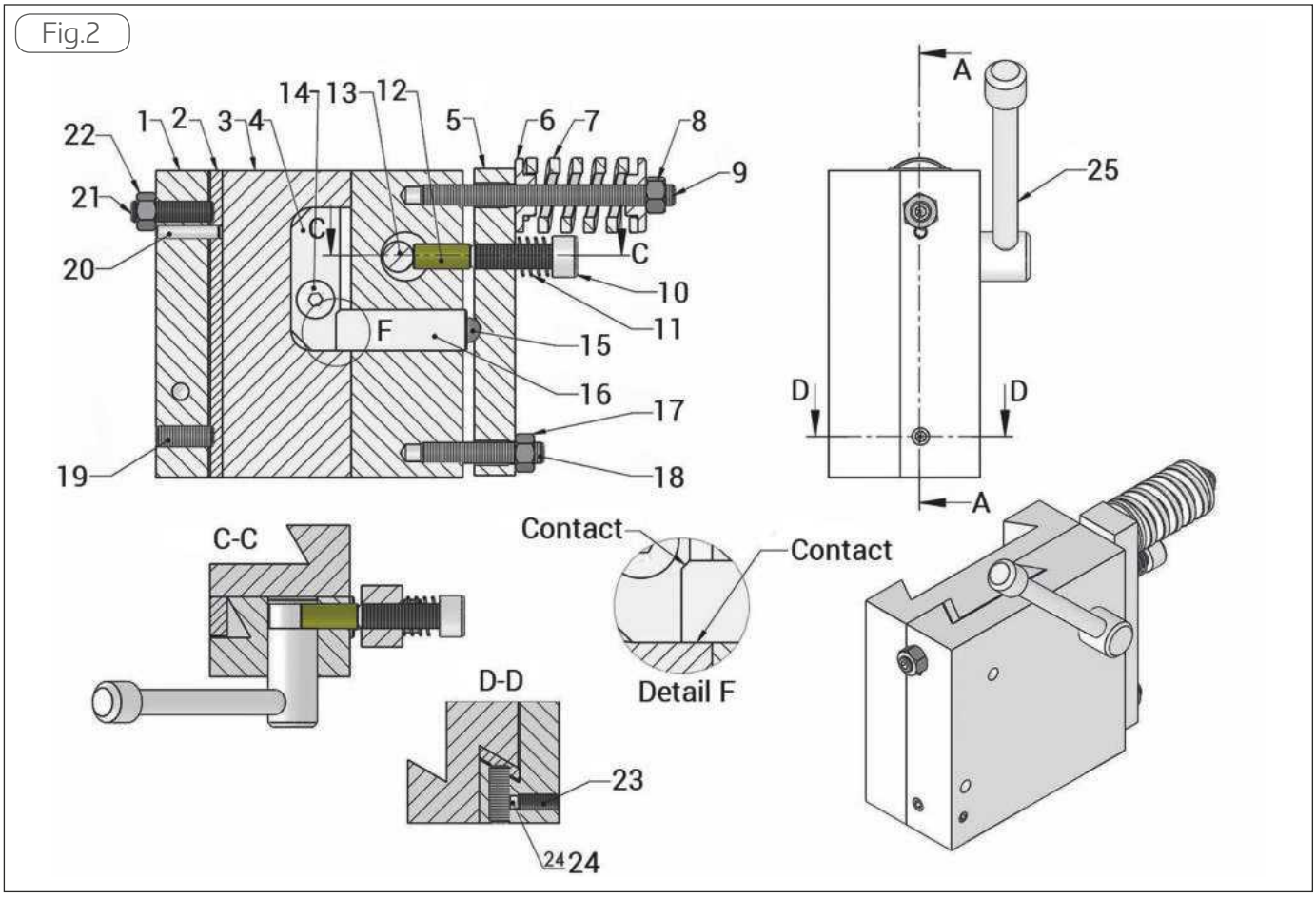


adjusted for almost no play; yes, ideally the gib should be on the other side but there was no room there for it. The locking action is made by parts 4 and 16, the active contact being on a slanted (45°) plane of small width. For the "switch off" force, part 16 is pushed rightwards (by 1mm), and so the loading lever 5 compresses the spring 7 (by 2mm). The tool is freed and can move vertically with a 25mm throw. It's easy to adjust the force of the spring and thus the "switch off" force. I didn't use a ball as it would have given a longer throw so too great a force on the spring.

By pulling the lever 25, the spring action is released, and the slider can be set back quickly in its working position (eccentric 13 pushing 12, 10, 5 compressing the spring 7 and so relieving the force on part 16).

Use and experiments:

This device was contrived for the use of narrow cut off blades (1.3 to 2.2mm width). It works well with HSS blades, I now use the **"star system"** (MEW 265) shown in **photo 3**, with1.3 and 1.5mm blades to cut a maximum diameter of 30mm. Free cutting mild steel and brass give no problem. Aluminium alloys can be sticky, in this case, it seems that the chips are stuck in the groove and so the blade is pushed out from the work piece, hence the 25mm throw (15mm should be sufficient). My



first attempts were with a too small 10mm throw and fortunately the belt slipped and the spindle stalled! With enough throw, it's possible to cut even the most sticky alloy, with many "switchings off" and quick resetting. Of course, the groove's faces will be well scratched. Some hard steels are also prone to "digging in" but the blade is just pushed out slightly in this case. Wind back the cross slide, reset the blade and come back slowly in the groove as there is a big chip to machine off before the parting can be carried on. If many "switchings off" are occurring, check if the cutting edge is sharp and not scored. It's easy to set a new one with the "star system".

Note: The use of a good lubricant greatly diminishes these binding problems.

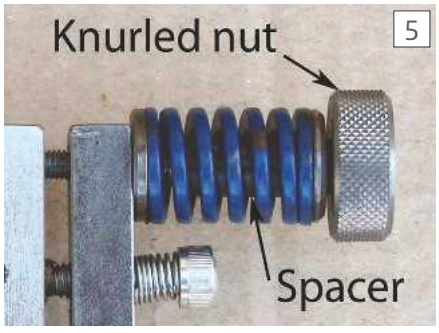
The device was primarily contrived to protect carbide tipped tools (2.2mm tip width). It works well in aluminium alloys, but didn't work well in steel pieces as the big chip occurring when "switching off" always chipped the tip. It's not really a problem as these tools work well in steel: good side clearance (1.6mm blade width for 2.2mm tip) and the dimple in the tip make narrow chips that waste off easily.

A solution to solve this problem is shown in **photo 3**: A spacer (tubing) is set between the spring washers and a knurled nut replaces the hex one.

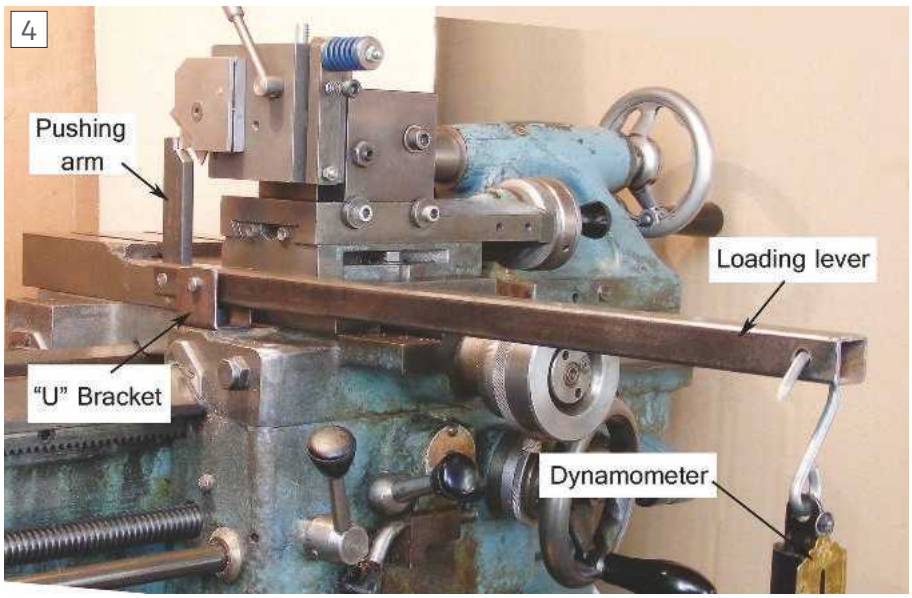
- For cutting steel the nut is hand tightened to lock the attachment (3 mm throw between spring washers and spacer).
- For cutting the other materials, the nut is unscrewed so its back is flush with the stud end.

Adjustment of the "switch off" force

Photograph 4 shows the setup; the lever is made from 20mm square tubing (2mm thick) the ratio is 10/1 (400/40mm) the center pivot is a plain 8mm diameter cold rolled steel bar set in a u-bracket. The u-bracket is sawn off from 25x40mm (2mm thick) tubing. The bracket is clamped to the carriage with a tee bolt on the front bracket of the travelling steady. A special arm is made from 8x20mm flat steel in which a notch is made to apply force to the parting blade edge safely. A plain Ø8mm steel pivot is also used between this arm and the main lever. A 250N capacity spring balance is used at the lever end so 2500 N (562Lb)can be exerted on the parting blade; with a longer lever (of the same section) it's possible to exert 4500N (1010Lb) on the tool with no problem using the 20mm square tubing.



5



4

Table 1: Switch off Attachment – Dovetail Version

N°	Quantity	Name	Material	Notes
1	1	Slider	Cast iron	
2	1	Gib	Cast iron	
3	1	Bracket	Cast iron	
4	1	Cam	Hard steel	See text
5	1	Loading lever	CRS	
6	2	Spring washer	FCMS	
7	1	Loading spring		See text
8	1	M5 nut	8	
9	1	Long stud (62mm long)	8-8	Threaded rod
10	1	Adjusting screw CHc M6-20	8-8	
11	1	Small spring		See text
12	1	Pusher	bronze	Ø6 ; 14 mm long
13	1	Eccentric	steel	0.5% carbon
14	1	Screw FHc/90 M5-15	8-8	
15	1	Loading ball Ø6 mm	Hard steel	
16	1	Lock	Hard steel	See text
17	1	M5 nut	8	
18	1	Short stud (30mm long)	8-8	Threaded rod
19	1	Adjusting screw Hc M5-14	8-8	
20	1	Dowell	Silver steel	Ø3 ; 15 mm long
21	1	Adjusting screw Hc M5-20	8-8	
22	1	M5 nut	8	
23	1	Locking screw Hc M4-10	8-8	
24	1	Pad	brass	Ø3 ; 2mm long
25	1	Relieving lever	CRS	Ø6 ; 70 mm long

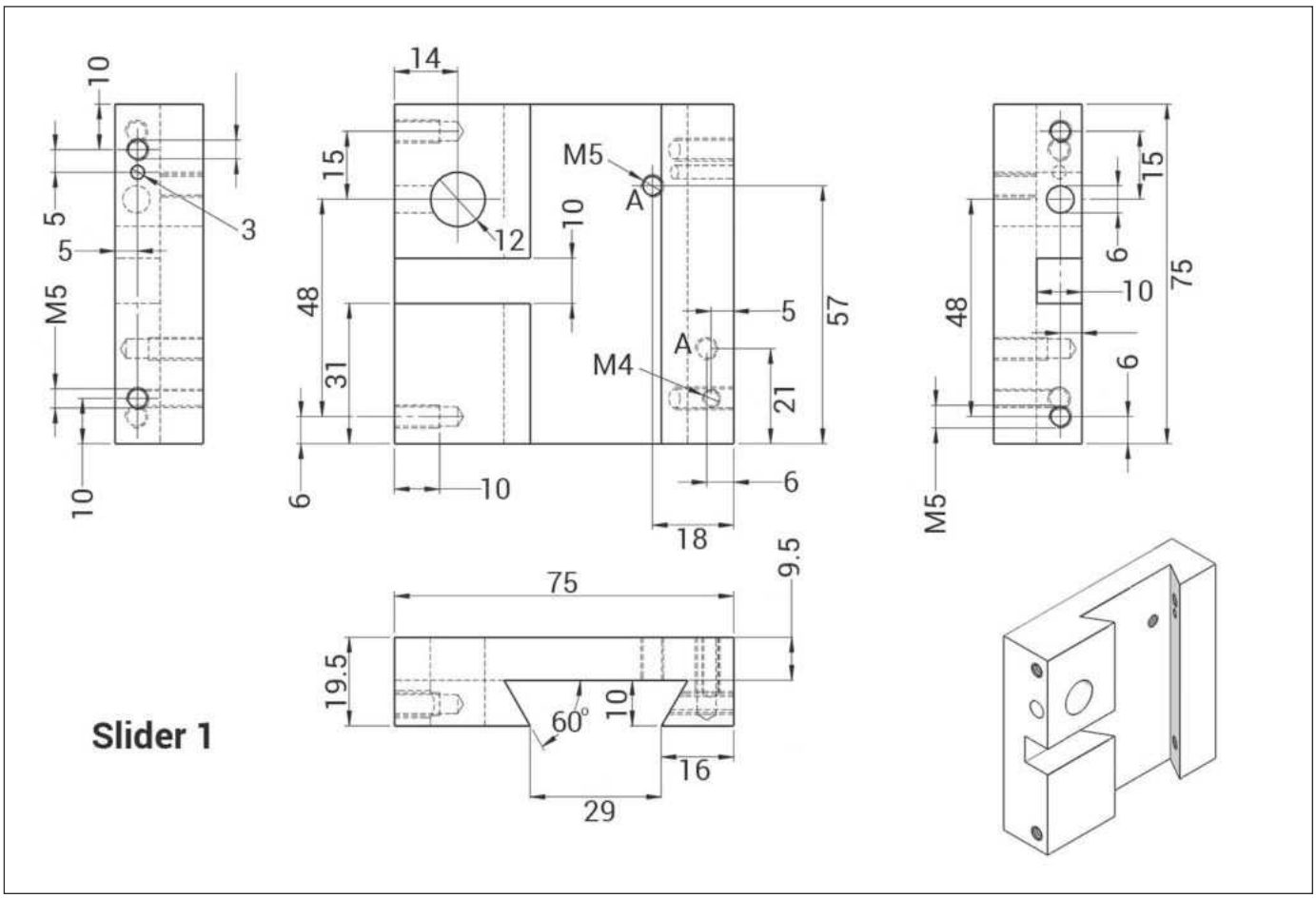
(8-8 – a stainless steel; FCMS – free cutting mild steel, CRS – cold rolled steel)

Switch off Attachment – Dovetail Version

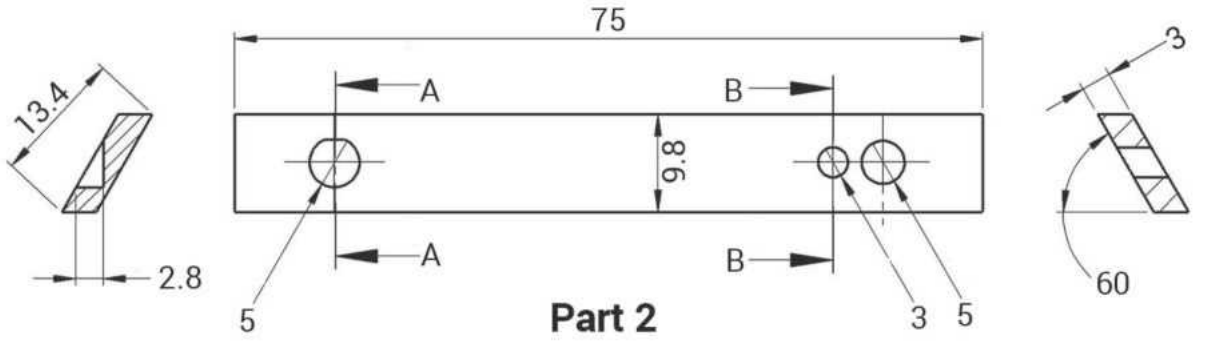
The various parts of the device are detailed in **table 1**, the machine part numbers refer to the diagrams.

The dovetail slide, parts 1, 2, 3, 19, 20, 21, 22, 23, 24

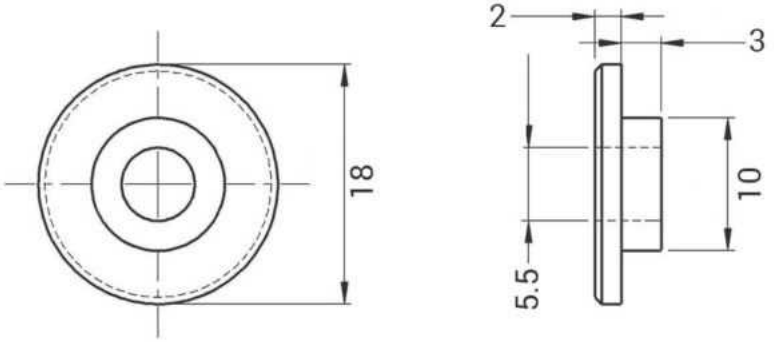
The rear part of the bracket 3 must suit your tool post. No problem for machining the dovetails between 2 and 3. The gib is dowelled by part 20, the adjusting screw 22 is locked by the locknut 21. The adjusting screw 19 (which must not protrude out from



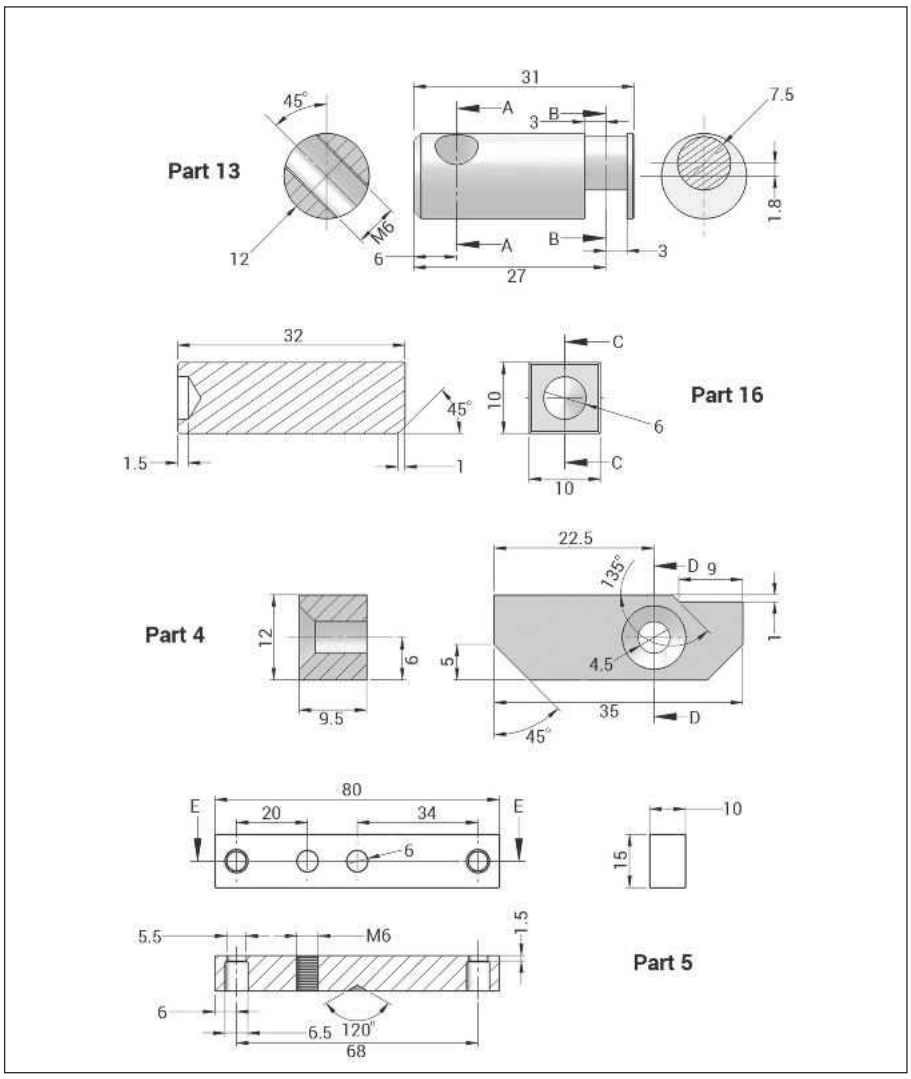
Slider 1



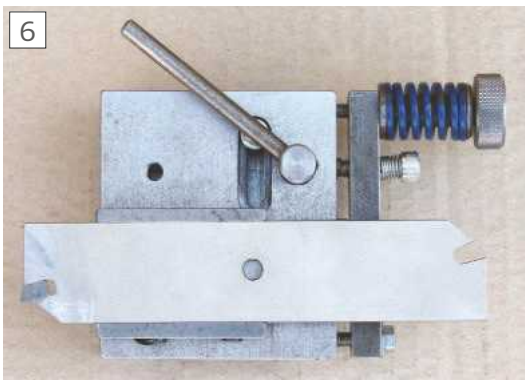
Part 2



Part 6



6



part 1) is locked by screw 23 pushing the brass pad 24.

Note: the two M5 tapped holes marked **"A"** on the slider drawing (see part 1) are for fixing the **"star system"** blade holder.

Hint for gib drilling: Clamp the parts: 1, 2 and 3 together using small wedges (flatened small nails by hammering) set in the play (about 0.5 mm) between 1 and 3 at the opposite of the gib.

You can now drill the Ø3 mm for the dowell, and the Ø4.2 mm holes (the tapping dimension for M5 thread) with a standard drill, and finish the bottom (which will be in the gib) with a flat end one (made by off-hand grinding).

The locking device, parts 4 and 16

Parts 4 and 16 should be made of hard steel (small area and high force on the slanted contact surfaces) 0.5% carbon steel can be used but must be quenched and tempered. I machined these parts from an octagonal

Fig.3

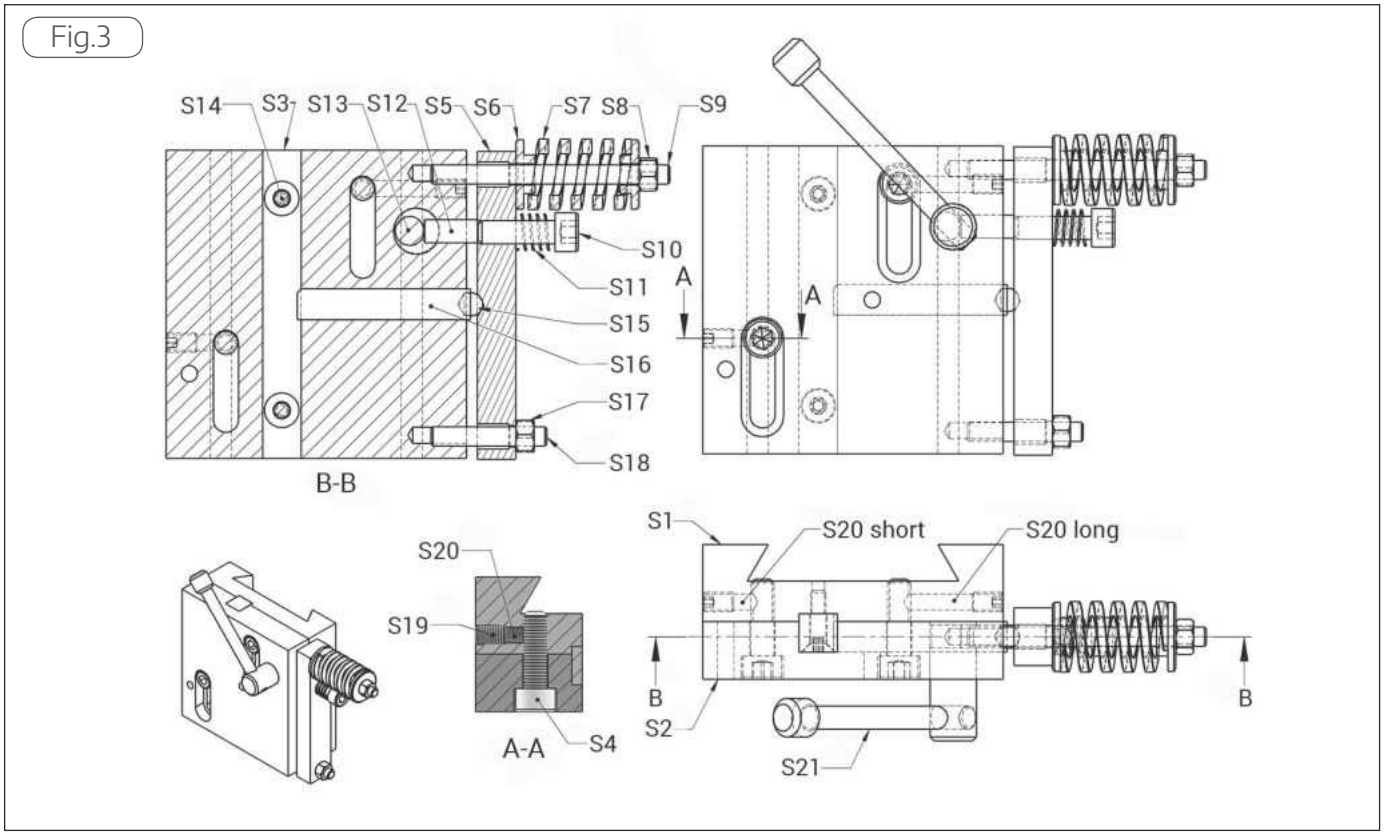
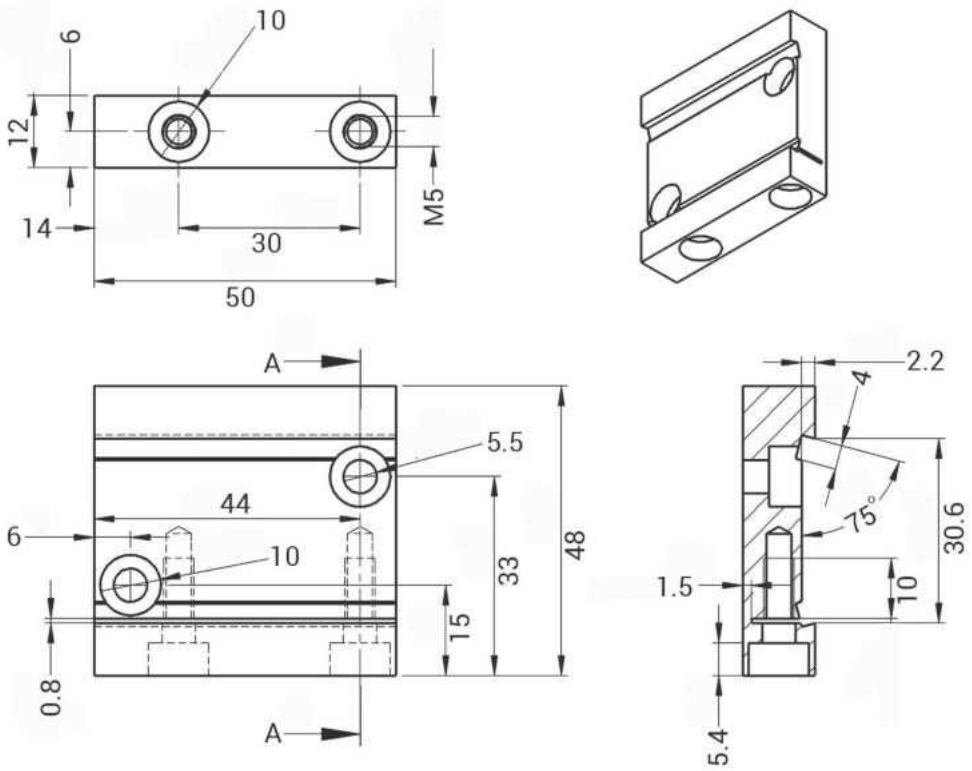
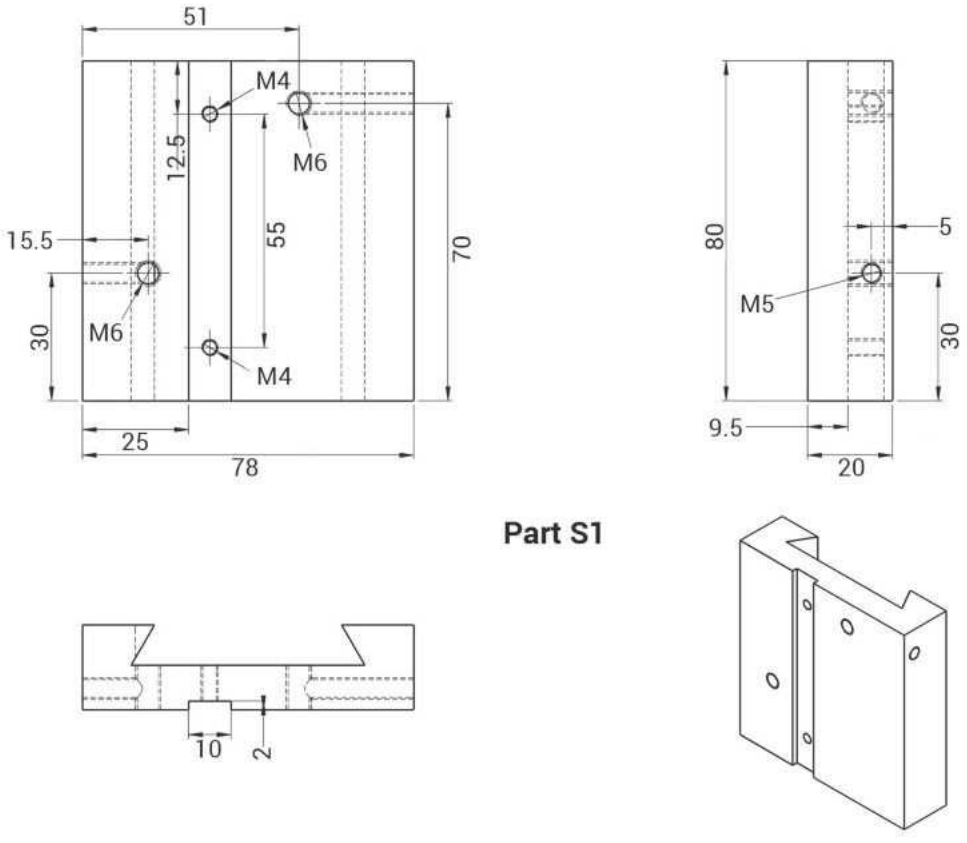


Fig.4



Parting Blade Holder (Iscar)
2.2mm width, 31.2mm high, 150° Vee angle



Part S1

rod (one used for rock chisels) with no heat treatment, this worked well. Some fine adjustment must be made as the contact between 4 and 16 should be only on the slant surfaces, the back of part 16 leaning on part 3 (see figure 2).

Loading spring, 7:

It's a "stiff spring" the type used in sheet metal punching jigs. Dimensions: Internal diameter 10.5mm, external diameter 18.4, rectangle thread (2.5x3.8) 5 turns, free length 31mm,
stiffness k = 67.5N/mm (I've rigged up a jig for measuring k). About 4mm compression is needed for the switch off force to be 2000N. I think that a common valve spring could easily do this job.

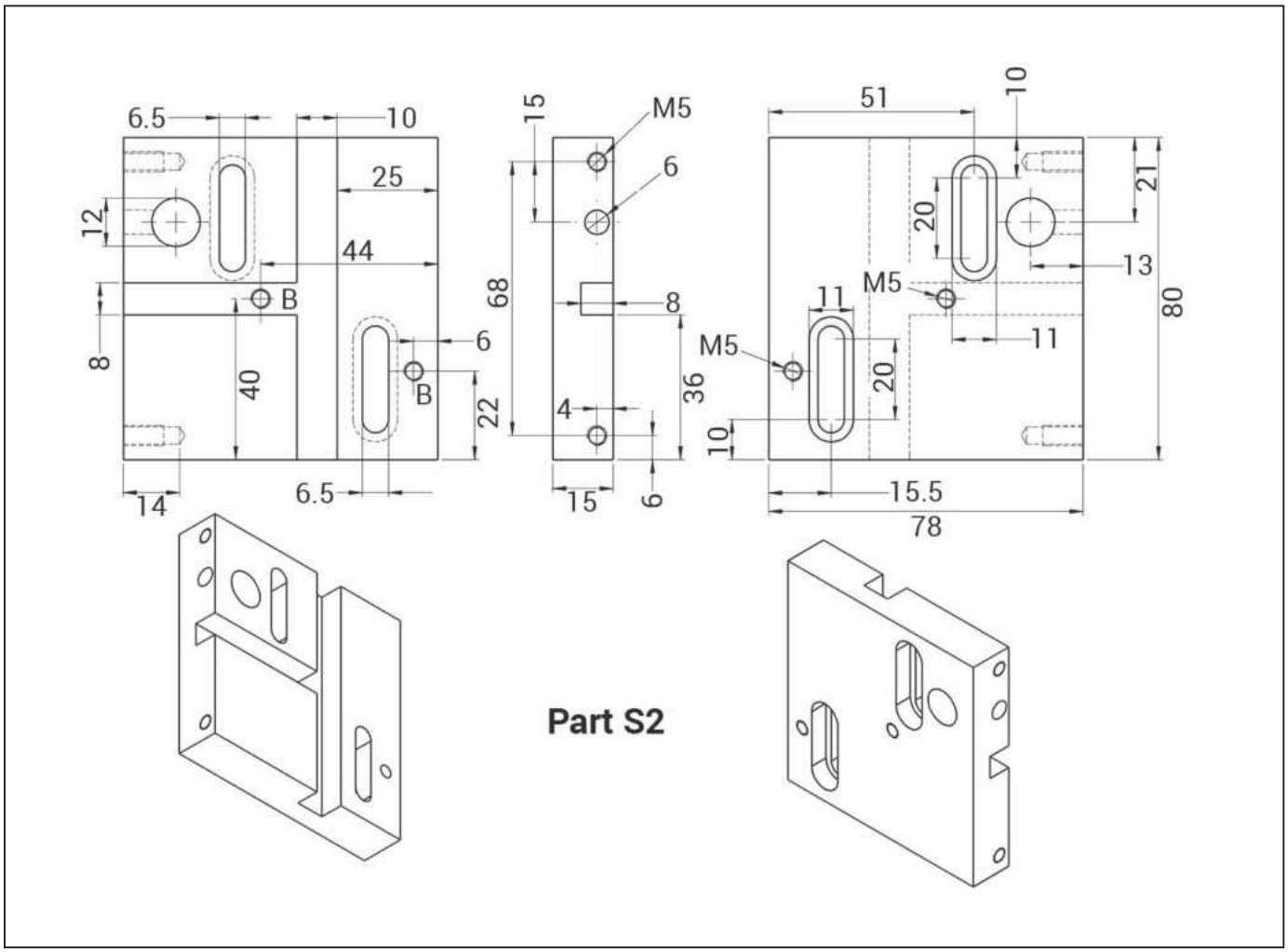
Relieving device

The eccentric cylinder on part 13 was made by packing 2.7 mm under one jaw of the 3 jaw self centring chuck, the sliding surface must be smooth to avoid wear of the pusher 12; the contact must be well greased. The screw 10 is adjusted to just contact part 12 with no force, the small spring is here to prevent part 10 unscrewing, it's easy to find such springs in DIY stores (external diameter 8, thread diameter 0.8, 5 turns).

● To be continued

Table 2: Parts list for no dovetail version

N°	Quantity	Name	Material	Notes
S1	1	Bracket	Cast iron	
S2	1	Slider	Cast iron	
S3	1	Cam	Hard steel	
S4	2	Retaining screw CHc M6-19	8-8	
S5	1	Loading lever	CRS	
S6	2	Spring washer	FCMS	
S7	1	Loading spring		
S8	1	M5 nut	8	
S9	1	Long stud (62mm long)	8-8	Threaded rod
S10	1	Adjusting screw CHc M6-20	8-8	
S11	1	Small spring		See text
S12	1	Pusher	bronze	Ø6 ; 14 mm long
S13	1	Eccentric	steel	0.5% carbon
S14	2	Screw FHc/90 M4-15	8-8	
S15	1	Loading ball Ø6 mm	Hard steel	
S16	1	Lock	Hard steel	
S17	1	M5 nut	8	
S18	1	Short stud (30mm long)	8-8	Threaded rod
S19	2	Locking screw Hc M5-12	8-8	
S20	2	Brass pads	Brass	See text
S21	1	Relieving lever	CRS	Ø6 ; 70 mm long



FREE PRIVATE ADVERTS

MODEL ENGINEER MODEL ENGINEERS' WORKSHOP

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

Machines and Tools Offered

■ For free – Smart and Brown Model L34 Instrument lathe, no power feeds, screwcutting, 3-jaw chuck fitted plus 20 R5 collets. This machine is very heavy fitted on cast aluminium base, nine speeds, buyer collects. **T. 01704 872629. Near Southport.**

■ Drummond 4" Round Bed Screw Cutting Lathe. 3 and 4 Jaw Chucks and Face Plate. Vert/Slide - Boring Table Some Change Wheels – Tooling. Old but sound condition. £150 ONO. **T. 01902 788491. Wolverhampton.**

■ For Sale. Warco lathe model 12/27 belt driven head. Comes with usual accessories, about 30yrs. old in good working order, needs a little TLC. Buyer collects. Phone for details, pics. available. Price £1200 ONO. **T. 01708451564. Upminster.**

■ Crompton Greaves ¾ hp motor, 1425 rpm, 1 phase. 5/8" shaft, resilient mount, new, unused, £95. SIEG bench hacksaw machine 1phase. Max cut 130mm, as new, £260 ONO. **T. 0121 689470. Birmingham.**

Magazines, Books and Plans

■ Lifetime's collection of Model Engineering magazines. From 1950s to recent looking for a new home. Collection please. £50 or nearest offer. **T. 07966 144537. Aberystwyth**

Wanted

■ Portable spot welder, hand operated jenny, accessories for Myford 254S. Also spares to suit clarkson tool and cutter grinder, taps, dies, reamers new or as new preferred, Wolf 8" 250 volt bench grinder, No. 1 flypress. **T. 0151 512 0538. Birkenhead.**

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

Phone:		Date:		Town:	

NO MOBILE PHONES, LAND LINES ONLY

Please use nearest well known town

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

The information below will not appear in the advert.

Name .....

Address .....

.....

.....

..... Postcode.....

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

Email address. .....

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

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

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

Terms and Conditions:
PLEASE NOTE: this page is for private advertisers only. Do not submit this form if you are a trade advertiser. If you wish to place a trade advert please contact Duncan Armstrong on 01689 899212 or email duncan.armstrong@mytimemedia.com

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

Lathework for Beginners

PART 5 - WORKHOLDING

This ongoing series will build into a complete guide to using an engineering lathe. This month Neil Wyatt takes a closer look at cutting tools.

In the earlier parts of this series, all of the workholding has assumed the use of a self-centring 3-jaw chuck, **photo 1**. This was for several reasons, the main one being that lathes are almost always supplied with a 3-jaw chuck as a standard fitting; I won't keep typing self centring, as virtually all three jaw chucks are of this type. For a beginner, the 3-jaw chuck has one big advantage – it is very easy to use.

3-Jaw Self Centring Chucks

The 3-Jaw is essentially a 'rotary vice' whose jaws are moved in and out to secure work by a spiral-faced plate known as a 'scroll' from its resemblance to an end of view of a rolled piece of paper. Circular and hexagonal work is automatically held concentrically with the chuck to a good level of accuracy, virtually any other shapes that fit in the jaws can be held but they are less likely to be concentric.

The smallest 3-jaw chucks are typically tightened using a knurled ring around the body, together with short 'levers' for a final 'nip up'. These chucks are known as 'lever scroll' chucks and typically have reversible jaws to allow for internal and external gripping of a range of diameters.

A 100mm (4") 3-jaw self centring chuck by Zither, with its alternative jaws, key and test sheet. This chuck has proved very accurate in use.

The standard 3-jaw sc chuck supplied with the Arc SC4-500 lathe, without jaws fitted. You can see the scroll, key socket, front oiling point and the maximum speed (4,200 rpm) marked on the body.

Larger 3-jaw chucks usually have three bevel gears that turn the scroll - a t-handled chuck key fits into a socket in the bevels, **photo 2**. Never, ever, leave the key in a chuck – the consequences of starting the lathe with the key in place are not pleasant.

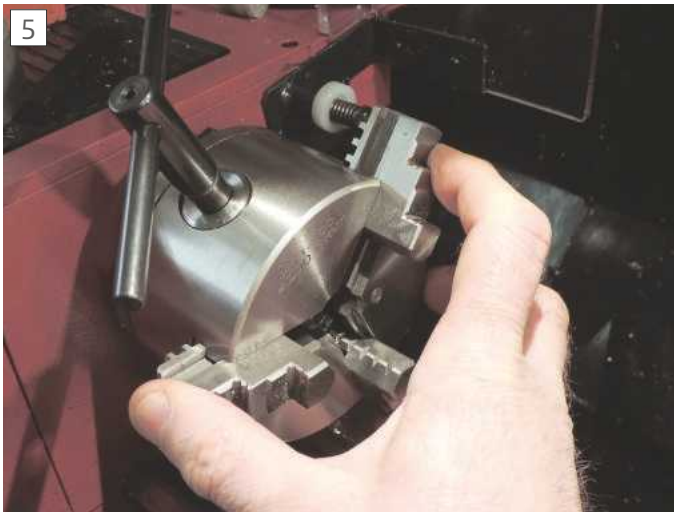
Such chucks normally have two sets of jaws, called 'internal' or 'external' according to whether or not they fit with the long end towards or away from the centre of the chuck. I.e. internal jaws are chiefly intended to hold work inside them.

That said, it is perfectly normal to use external jaws to hold the outside of larger diameter bar, **photo 3**, or internal jaws on the inside of hollow work, **photo 4**. This may sound confusing, but in practice it is often quite obvious which set of jaws to use for which workpiece. One thing to take care with is that the stepped side of the jaws does not give such a secure grip so avoid

›

Large diameter work held on the step of internal jaws, the large overhang means only light cuts can be taken.

How internal jaws can be used to hold a hollow disc – this is a blank for a poly-vee pulley.



Using finger pressure to ensure all three jaws are equally engaged with the scroll.

Many chucks have the jaw slots numbered.

combining heavy cuts and large overhangs.

Many experienced machinists will criticise the accuracy and repeatability of 3-jaw chucks. The 'runout' of a 3-jaw chuck may be as much as 0.10mm without it being defective, although modern manufacturing methods mean that many mid-range 3-jaw chucks may have an accuracy and repeatability as good as 0.02mm when they are new. Over-tightening and wear can, of course, lead to the chuck's accuracy declining.

It is easy to measure your chuck's runout by chucking a piece of accurately finished steel (such as a piece of ground rod) in the lathe and using a dial test indicator or even just eyeballing the rod against the tip of a tool held in the toolpost and rotating the chuck by hand. Measurements close to 0.02mm near the chuck jaws and a little more 100mm from the chuck are excellent, but a worse result is not unusual. If the runout of your chuck appears excessive, there are several steps you can take.

> Many experienced machinists will criticise the accuracy and repeatability of 3-jaw chucks

Maximising 3-Jaw Accuracy

If the runout appears grossly excessive check that all of the jaws are fitted properly. It may be that one or more jaw is simply not engaged far enough in the scroll; use one hand to push all three jaws towards the centre of the chuck and 'wind' them outwards until the errant jaw 'clicks' into position, **photo 5**.

If a significant error remains, say a millimetre or two and the jaws don't meet neatly in the middle when fully tightened, the jaws may not be in the correct order. If so, then you may need to swap the places of two of the jaws. Better quality chucks will usually come with the jaws numbered and matched to individual slots in the chuck body so make sure they are not just in the correct order, but also the correct slots for the very best results, **photos 6**, **7**.

If further errors remain, check that:

- The rod is truly straight – roll it on a flat surface while viewing it edge on against a bright light.
- There is no swarf between the chuck and its backplate/fixing flange.
- The work, chuck jaws and scroll are scrupulously clean.

It is remarkable how little dirt is enough to put the work out of concentricity, sometimes you can't even see what is causing the problem, yet a wipe over with a tissue can restore the chuck's accuracy!

You may also find that one of the

Arc Euro Trade

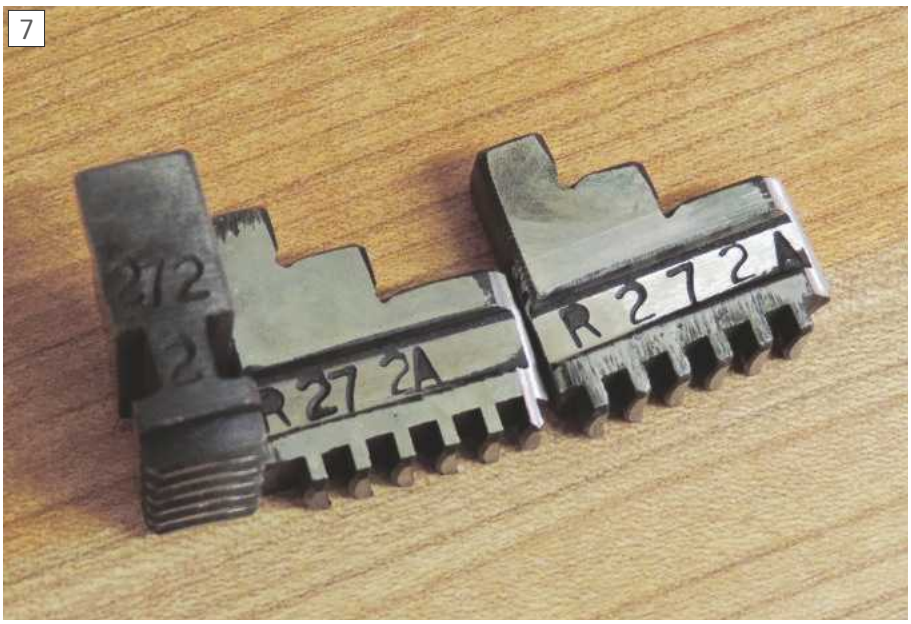
Three and four-jaw self centring chucks and four jaw independent chucks at various levels of affordability and accuracy are available from Arc Euro Trade, together with Morse taper and ER collet systems as well as backplates and faceplates.

tightening sockets is marked (often with a '0') you are likely to find that using this socket will consistently give the best results, as it will have been the one used when setting up the chuck at the factory.

Even with an old chuck, as long as it holds the work securely, there are several ways to deal with this potential source of inaccuracy:

- Accept it – where work simply needs to 'look' concentric, such as when making screws from hexagonal material or there is simply no requirement for extreme accuracy.
- Take all cuts at a 'single setting' – in other words do not remove the work from the chuck until all cuts have been made, ensuring they are concentric. Obviously, the part of the work obscured by the jaws cannot be turned, but it is usually possible to grip the work by a 'stub' which is cut or parted off later.
- Use a micro-adjustable chuck that can be moved on a backplate to achieve greater concentricity – such chucks can cost many times the price of a standard 3-jaw.
- Use soft jaws – these are unhardened jaws, sometimes in two pieces, that can be machined in position to suit the work diameter. They are ideal for repeat jobs needing a high standard of accuracy.
- Hold a short end of bar, slightly larger than the work's diameter, in the chuck and bore it to suit the work. Carefully mark the position of jaw 1 on it so you can replace it in exactly the same orientation and slit it opposite to the jaw 1 marker, **photo 8**. You can now fit the work inside this 'collet' and grip it using the chuck to get a good level of concentricity.
- Use an independent chuck or a collet, we will look at these options in more detail later.

7



Individual jaws usually have serial numbers that match the chuck, the end of these jaws also bears a number 1,2 or 3 to match the chuck slots.

Other Self-Centring Chucks

Self centring chucks need not have three jaws, and 4-jaw SC chucks are not unusual, **photo 9**. Often thought of as being intended for square work, they will happily hold round, octagonal and even hexagonal (try it!) work with the same level of accuracy as a 3-jaw. Some people choose to use an SC 4-jaw as their main chuck, but this is not common practice.

In the past 2-jaw SC chucks were not uncommon, as it is possible to make cheap ones that use two simple screw threads of opposite hand, rather than a scroll. Modern versions tend to use a scroll, allowing work and tools to enter the body of the chuck. They are much rarer today, but still available.

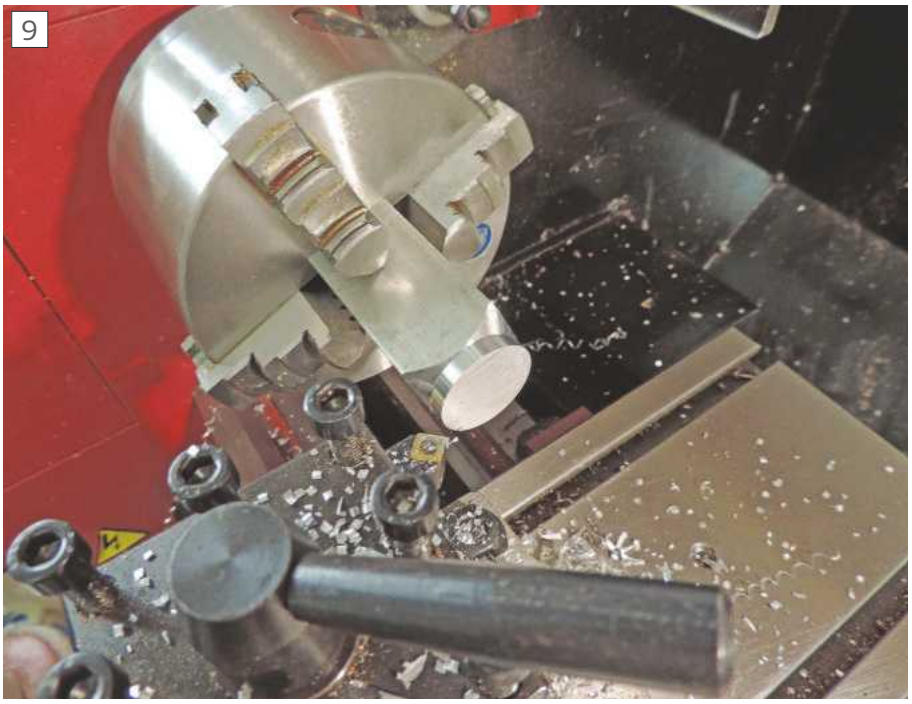
8

This simple bush was bored in place to allow the repeatable holding of small work. The mark aligns with jaw 1.

Their big weakness is that work only held at two points is much more likely to shift in the chuck jaws, so they are often, but not always, supplied with 'soft jaws' that can be machined to snugly hold the work.

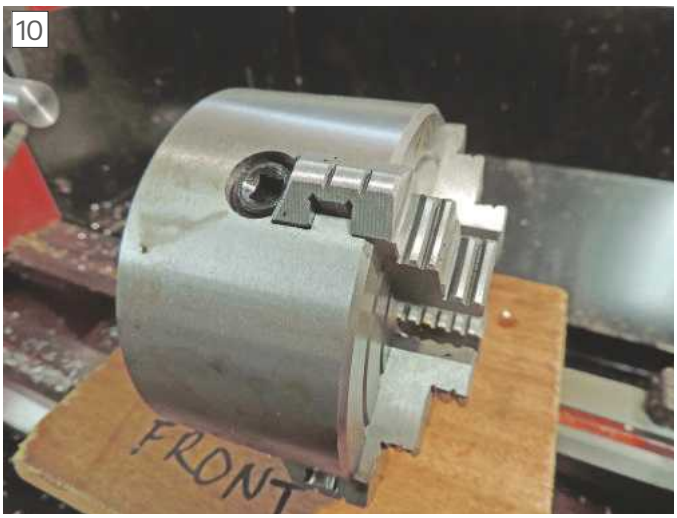
Another variant is the 6-jaw self centring chuck. These are not primarily meant for hexagonal work (best held in a 3-jaw), but for holding large diameter or thin walled tubing. With six jaws you can apply considerably more clamping pressure without distorting such relatively fragile workpieces.

9

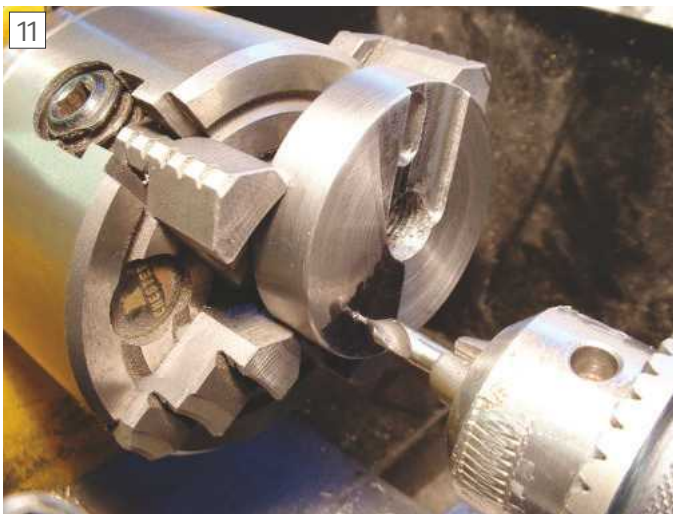


This self-centring 4-jaw chuck makes a task like putting a concentric spigot on square stock simplicity itself.

It is remarkable how little dirt is enough to put the work out of concentricity...



The independent 4-jaw chuck has a separate adjuster for each jaw.



Using a 4-jaw ticket to offset the backplate for a box tool.

4-Jaw Independent Chucks

After the 3-jaw, the 4-jaw independent chuck, **photo 10**, is probably the commonest type you will encounter and will probably be quite high on your list of desirable accessories. It typically has four reversible jaws each of which is moved by its own screw.

In the past, when a reasonably accurate 3-jaw was beyond the means of many hobbyists, the more affordable 4-jaw independent (I will just use 4-jaw) was probably more common. If used with some sort of indicator, or even just a piece of chalk in the toolpost, to show where the 'high spot' is on the work, by carefully adjusting opposing jaws the work can be centred to whatever level of precision your patience allows. There are still plenty of lathe users who only use a 4-jaw chuck, and with plenty of practice the setup time can be little longer than using a 3-jaw. It is also possible to hold work more securely in a 4-jaw – as well as having more contact points, you can generally apply more securing force without damaging its accuracy.

A set of MT3 collets, these metric collets have an M12 drawbar thread at the back.

This ER collet chuck is chiefly intended for holding milling cutters, but it can also be used in a lathe with a matching taper.

The four jaws can be adjusted completely independently, and you can even reverse some of the jaws and not others. This means it is very easy to offset work or hold irregular shapes such as castings securely, **photo 11**.

When you need to align such an object with an irregular or offset outline it is useful to mark a centre on it, possibly centre punching it. This can be aligned with the point of a centre in the tailstock. For the maximum accuracy, one technique is to fit a centre in the tailstock, and then clamp an second with its point in the centre-punched hole and the tailstock centre. A DTI set to take a reading on the body of the second centre will show any inaccuracy in the alignment of the work.

Collets

Collet systems offer a reliable, accurate and repeatable way of holding work concentrically with the spindle of the lathe. Small watchmaking lathes often use little 8mm collets that fit directly in the spindle, but for larger machines there are many different collet systems that can be used. The simplest approach is to use Morse taper collets that fit directly in the spindle, **photo 12**, these usually have to be secured

The ideal solution for a lathe is a flange mounted collet chuck, like this ER32 example fitted to the SC4.

The 3-jaw chuck fitted to this SC4 uses four M8 screws, while the 4-jaw requires four. The board has a tab to fit between the shears and protects the bed when changing chucks.

in place using a drawbar through the spindle's bore.

A popular alternative is to use the ER collet system. These have the advantage of a wide range of capacities for a given collet (typically 1mm for larger sizes), reducing the number of collets required for full coverage considerably. ER collets are also a popular choice for holding milling cutters, so if your lathe and milling machine share the same spindle taper an obvious choice is a taper mounted ER chuck that can be fitted to both machines, **photo 13**, this way you can meet both machine's needs with a single chuck and set of collets. Alternatively, it is possible to get ER chucks that fit directly to the lathe flange. The steel bar in **photo 14** is 300mm long and passes right through both collet and chuck, it would not be possible to do this with the milling chuck. ER collets have excellent grip – as evidenced by the deep cut in the carbon steel bar.

● To be continued

An example of a fully machined backplate.

Mounting Chucks

Historically, most lathes had a combined thread and register arrangement for fitting chucks – this was popular because it was cheap, easy to manufacture and, if well made, accurate. Its disadvantages are two-fold – it is easy for chucks to get jammed in place and if the lathe is run in reverse it is possible for the chuck to unscrew with disastrous results.

As most modern lathes are easily reversed, it is now more usual for their spindle to have a large diameter flange with a shallow register to locate chucks concentrically. The D-series of lathe fittings uses special pegs and cams to allow rapid chuck changes but is normally only found on high end (particularly CNC) machines. Most hobby lathes use studs and nuts or machine screws to hold the chuck in place, **photo 15**. Normally three or four fixings are used, and most lathe's flanges are drilled to allow either configuration. It is important to make sure the chuck, flange and register are clean. The fixings should be done up securely but not overtightened.

Most lathe spindles have a Morse Taper socket which allows the easy fitting of various accessories such as centres and taper-mounted chucks, all you need to do is select the appropriate size taper (MT3 is typical for bench lathes). Unfortunately, there is no such standardisation for the 'spindle nose', and normally only a relatively small selection of chucks can be obtained that will fit directly to your lathe. In practice it is usual for a 'backplate' that suits the spindle nose to be fitted semi-permanently to the chuck.

Backplates can be supplied fully machined, **photo 16**, in which case you just fit them to the chuck, as unmachined blanks or, most often, as part machined blanks. Part machined blanks to suit your lathe are fitted to the spindle, allowing you to turn a register and drill fixing holes to suit your chuck. For the best results it is normal to make the register a close, shake-free push fit in the chuck. If you have an inaccurate 3-jaw chuck, you can make the register undersize, this allows the chuck to be moved slightly on the backplate to achieve the maximum concentricity.

MODEL ENGINEERS' WORKSHOP CLASSIFIED

HOME AND WORKSHOP MACHINERY

Genuine Used Machines & Tooling

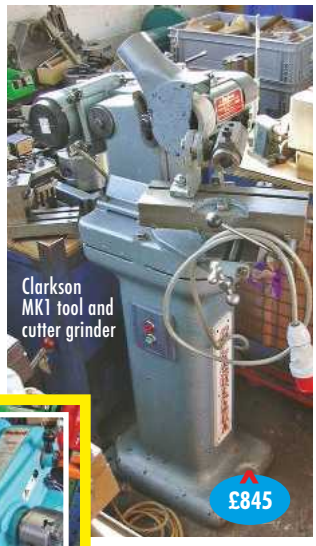
144 Maidstone Road, Foots Cray, Sidcup, Kent DA14 5HS

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

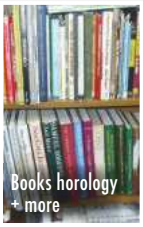


MYFORD GENUINE PARTS

Running out fast!

Purchased from Nottingham

*Check the **web site** for full list!*



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 MACHINE TOOLS

HOBBY STORE

LATHE
MACHINES

WWW.CHESTERHOBBYSTORE.COM

WE ARE ONE OF THE LARGEST STOCKISTS OF HOBBY LATHES AND ACCESSORIES IN THE UK...

T: 01244 531631

IMPERIAL

LAT-CONQ-DRO-I

CONQUEST SUPER LATHE
£429
Swing Over Bed: 180mm
Swing Over Cross Slide: 100mm
Distance Between Centres: 325mm
Supplied with a range of standard accessories.
Optional accessories also available to purchase.

IMPERIAL

LAT-DB8VS-I

DB8VS LATHE
£999
Optional Stand Available
Swing Over Bed: 210mm
Swing Over Cross Slide: 110mm
Distance Between Centres: 400mm
Supplied with a range of standard accessories.
Optional accessories also available to purchase.

IMPERIAL

LAT-DB11GVS

DB11GVS LATHE
£1,687
Swing Over Bed: 280mm
Swing Over Cross Slide: 145mm
Distance Between Centres: 700mm
Supplied with a range of standard accessories.
Optional accessories also available to purchase.

LAT-CENT

OPTIONAL STAND AND TRAY AVAILABLE

CENTURION 3 IN 1 MACHINE
£1,484
Swing Over Bed: 420mm
Swing Over Cross Slide: 270mm
Distance Between Centres: 500mm
Supplied with a range of standard accessories.
Optional accessories also available to purchase.

INCLUDES 2 AXIS DRO

LAT-CRAF-DRO

CRAFTSMAN LATHE
£2,359.50
Swing Over Bed: 300mm
Swing Over Cross Slide: 200mm
Distance Between Centres: 450mm
Supplied with a range of standard accessories.
Optional accessories also available to purchase.

GREAT RANGE AVAILABLE

CHUCKS

LATHE CHUCKS
PRICES START FROM
£67.42
3 JAW / 4 JAW / INDEPENDENT / 5C /
PLUS MANY MORE

WWW.CHESTERHOBBYSTORE.COM
SALES@CHESTERHOBBYSTORE.COM

FIND US

ALL Prices Inclusive of VAT

CHESTER MACHINE TOOLS . HOBBYSTORE
Hawarden . Clywd Close . Hawarden .
Chester . CH5 3PZ
UNITED KINGDOM