

No.263

MERRY CHRISTMAS AND A HAPPY NEW YEAR!

MODEL ENGINEERS' WORKSHOP

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

JANUARY 2018

Milling for Beginners - Part 2



Restoring
a DTI

INSIDE

- A Low Profile Clamp
- Quadrilla
- Suds Pump
- Controlling Condensation



YOUR FAVOURITE WORKSHOP MAGAZINE

PRO MACHINE TOOLS LIMITED

Tel: 01780 740956
Int: +44 1780 740956

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



Precision machines made in Germany for the discerning engineer!



Wabeco CNC Lathe CC-D6000

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

Wabeco produce quality rather than eastern quantity

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

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



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



Wabeco Mill F1210

5 year warranty

- 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

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



5 year warranty

EMCO

WABECO

CERIANI

**SWISS
tec**

TECO

GO!matic
Maschinenbau

PROXXON

EMCO
Hobymaschinen



2 year warranty

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

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: 01733 688964

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

Chairman: Peter Harkness

mytimemedia
print & digital media publishers

© MyTimeMedia Ltd. 2017

All rights reserved ISSN 0959-6909

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

Model Engineers' Workshop, ISSN 0959-6909, is published monthly with an additional issue in August by MYTIMEMEDIA Ltd, Enterprise House, Enterprise Way, Edenbridge, Kent TN8 6HF, UK. The US annual subscription price is \$2.95GBP (equivalent to approximately 88USD). Airfreight and mailing in the USA by agent named 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.



When you have finished with
this magazine please recycle it.

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



On the Editor's Bench

Season's Greetings

When I was a youngster I used to get very confused by the fact magazines on sale were always dated a month early. Since then I've learned it's all about them sitting on the shelves for up to a month and the vendors not wanting them to appear out of date.

At the risk of shaking the foundations of the publishing world, however, I've decided to use this issue to send you the best wishes for Christmas and the New Year from everyone at Model Engineers' Workshop and MyTimeMedia.

Special thanks go to Dave, the ME forum's SillyOldDuffer for creating our cover image with the power of Photoshop – please don't write in with health and safety warnings about operating a mill adorned with fairy lights...

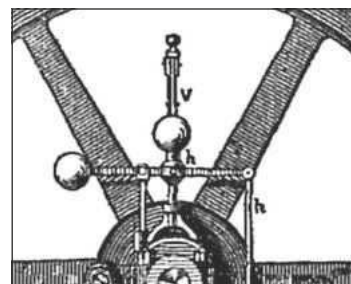
On My Bench

To confess, my bench is a scene of chaos at the moment – probably a good thing as it means I'm getting a bit busier with several projects moving forwards.

The recent weather inspired me to dismount my weather station (which hasn't worked for a few years) from its very long pole. After removing various bits of wildlife (spiders, harlequin ladybirds and lichen growing in my anemometer!) the main problems were that the wind vane had lost its tail and the anemometer had seized completely. Forty minutes of ultrasonic shaking in corrosion remover freed up the aluminium body, but the ball races are well past redemption. I can salvage the body but the rest needs rebuilding.

I successfully cast a complex little governor bracket for a stationary engine, which then demanded some delicate machining. A thick base that was machined off at the end made this much easier, so the next job is the governor itself.

Naturally I'm sure you would be disappointed if I wasn't doing some 3D printing as well. My 1/6 Vickers Light Tank's turret is taking shape in stages, it's rather big so the main shell is in ten parts. I've discovered that a leading brand of superglue, despite being a gel does NOT have gap filling properties and have had to resort to epoxy instead.



John Stevenson Trophy

I'd like to thank everyone who so generously contributed towards a John Stevenson Trophy. The details of the trophy competition will be announced in the New Year, in time for the first award to be made at the Doncaster show.

If a job's worth doing....



Over 70 challenging projects for the small workshop owner. Proven solutions for:

- Work Holding and Positioning
- Tool Holding and Positioning
- Manipulating Tools
- Stand -Alone Machine Tools
- Drives and Major Attachments



Hemingway

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

www.hemingwaykits.com

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

AMADEAL Ltd.

www.amadeal.co.uk

See our vast range of mini-lathes, bench lathes, milling, grinding and boring machines, both manual and CNC.

For professional or hobby purposes

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



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



(Between 8am-8pm)

Tel: (+44) 0208 558 4615 or 07887 945717 or (+44) 0208 558 9055

(Between 11-4pm)

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

Manufacturer of Steam Fittings for Model Engineers

3" to 6" Scale

From Lubricators, Water Gauges
Gauge Glass Protectors, Whistles & Sirens

Email us at sales@rabarker.co.uk

or visit our web site @ www.rabarker.co.uk

Phone No: 01245 462100 Mob: 07980 855510

RABARKER
Engineering

NO 11 OYSTER PLACE
MONTROSE ROAD,
CHELMSFORD, ESSEX, CM2 6TX

Trade Enquiries Welcome



gandmtools

Just a small selection from our current stock

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



Alexander 206C
Cabinet Mounted
Cutter Grinder, 3ph,
£650.00 plus vat.



Boxford HSR500 High
Speed CNC Router,
1ph, £975.00 plus vat.



RJH Double Ended Bench Buffer,
1ph, £325.00 plus vat.

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



Opening times: 9am -1pm & 2pm - 5pm Monday to Friday. Closed Saturdays, except by appointment.
telephone: 01903 892 510 • www.gandmtools.co.uk • e-mail: sales@gandmtools.co.uk



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

Key Type Engineering Drill Chucks



(chuck key included)

Code	Capacity	Chuck Taper	Price
040-010-00100	0.4-4mm	JT0	£14.45
040-010-00200	0.6-6mm	JT1	£10.82
040-010-00300	1-10mm	JT2	£8.80
040-010-00320	1.5-13mm	B16	£15.11

Keyless Drill Chucks - Heavy Duty



Code	Capacity	Taper	Length	Diameter	Weight	Price
040-011-00006	0.2-6mm	JT1	70.6mm	34mm	312g	£26.65
040-011-00010	0.2-10mm	JT2	90.2mm	44mm	666g	£27.53
040-011-00013	0.2-13mm	B16	100.6mm	49mm	931g	£23.53
040-011-00016	0.2-16mm	JT6	112.2mm	54mm	1250g	£25.54

Micro Drill Adaptor

The Micro Drill Adaptor is like a miniature quill and is designed for drilling small holes using a lathe, mill or pillar drill.



The shank has an internal, spring return, sliding spindle keyed to it with a JT0 taper to suit a small JT0 drill chuck.



A knurled ring is mounted to the spindle via a bearing and is used to manually feed the

spindle even when the adaptor is rotating at high speed.

- Sensitive fingertip control.
- Helps prevent drill breakage.
- Accurate drilling of small holes with large machines.
- 1/2" straight shank.
- JT0 chuck taper.

040-015-00400	Micro Drill Adaptor	£15.28
040-010-00100	0.4-4mm Drill Chuck JT0	£14.45

ER20/MT2 Milling Collet Chuck Set with 8 Collets



- Taper Shank: MT2.
- Drawbar Thread: M10.
- Collet Nut Type: T1.
- Collet Nut Thread: M25x1.5.
- Collets Included: 2mm, 3mm, 4mm, 5mm, 6mm, 7mm, 8mm and 10mm.
- Spanner Included: 30mm AF.

050-110-20500 £88.87

ER25 Milling Collet Chuck Sets with 6 Collets



- Choice of Taper Shank.
- Collet Nut Type: T2.
- Collet Nut Thread: M32x1.5.
- Collets Included: 4mm, 6mm, 8mm, 10mm, 12mm and 16mm.
- 'C' Spanner: Included.

Code	Size	Shank	Drawbar Thread	Price
050-110-25500	ER25	MT2	M10	£67.76
050-110-25510	ER25	MT3	M12	£79.24
050-110-25520	ER25	R8	7/16" UNF	£83.40

ER32 Milling Collet Chuck Sets with 6 Collets



- Choice of Taper Shank.
- Collet Nut Type: T2.
- Collet Nut Thread: M40x1.5.
- Collets Included: 6mm, 8mm, 10mm, 12mm, 16mm and 20mm.
- 'C' Spanner: Included.

Code	Size	Shank	Drawbar Thread	Price
050-110-32500	ER32	MT3	M12	£72.97
050-110-32510	ER32	R8	7/16" UNF	£88.62

30mm & 38mm Boring Head Sets & Arbors



Code	Size	Price
060-290-10302	ø30mm Boring Head + Set of 2 ø6mm Cutters	£52.06
060-290-10380	ø38mm Boring Head + Set of 2 ø8mm Cutters	£66.04
060-290-10012	ø12mm Straight Shank Arbor	£12.91
060-290-10020	MT2 Arbor (M10 DB Thread)	£14.32
060-290-10030	MT3 Arbor (M12 DB Thread)	£15.01
060-290-10080	R8 Arbor (7/16" UNF DB Thread)	£15.68

50mm / 2" Boring Head Sets & Arbors



Code	Size	Price
060-290-00400	ø50mm Boring Head + Set of 9 ø12mm Cutters	£70.04
060-290-00500	ø2" Boring Head + Set of 9 Cutters ø1/2" Cutters	£70.04
060-290-00600	MT2 Arbor (M10 DB Thread)	£14.39
060-290-00700	MT2 Arbor (3/8" Whit DB Thread)	£14.39
060-290-00800	MT3 Arbor (M12 DB Thread)	£15.72
060-290-00900	MT3 Arbor (3/8" Whit DB Thread)	£15.72
060-290-01000	R8 Arbor (7/16" UNF DB Thread)	£15.72

Contents

9 A MODERN APPROACH TO CONDENSATION MANAGEMENT

Another interesting and practical application of modern technology from SillyOldDuffer.

14 BULK PRODUCTION OF TOOLHOLDERS

Richard T. Smith describe his approach to machining a batch of matching parts.

20 RESTORING A VINTAGE DIAL TEST INDICATOR

The man who never knowingly threw anything in the bin, Mark Noel, resuscitates a nice old DTI.

27 MIKE'S WORKSHOP – LOW PROFILE CLAMPS

These robust but compact milling clamps from Mike Cox are simple to make and use.

30 MILLING FOR BEGINNERS

Jason Ballamy explores spindle tapers and taper tooling.

34 QUADRILLA

Michael Belfer puts an end to his drill storage troubles, and no, it's nothing to do with Godzilla!

38 MOUNTING ITEMS ON A FACEPLATE

Mounting and balancing work on a faceplate made easy by Andy Johnston.

40 SIMPLE CUTTERS FOR CLOCK PINIONS AND WHEELS

Ted Knight explains how to make clock gears using your own cutters.



47 A SUDS PUMP

This straightforward pump was made for a Raglan Lathe by John Firth, but could be made to suit almost any machine.

53 ONE MAN AND HIS MANY LATHES

Stan Nesbitt takes a walk down memory lane.

60 IMPROVING A SMALL HORIZONTAL BANDSAW

An ingenious approach to holding smaller stock from Norman Billingham.

62 A SCREWCUTTING CLUTCH FOR THE MYFORD ML7

Graham Meek concludes his description of this useful accessory.

68 SHAPING UP

Bill Morris explores the clapper box and ratchet drive, among other shaper mysteries.



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

See page 18 for details.

Coming up...

in our next issue

Coming up in our next issue, MEW 264 another rewarding read.



Regulars

3 ON THE EDITOR'S BENCH

Have your workshop projects stalled?

24 ON THE WIRE

KIT-Q-CUT reborn!

44 SCRIBE A LINE

Do you have a Merlin engine in your workshop?

59 READERS' TIPS

This month, Henry Helps Out.

67 READERS' CLASSIFIEDS

Another fine selection of readers wants and offers

ON THE COVER >>>

This month's festive workshop scene is from ME forum member SillyOldDuffer. He says he wants a new parting tool for Christmas...



HOME FEATURES WORKSHOP EVENTS FORUMS ALBUMS

Visit our Website

www.model-engineer.co.uk

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



THIS MONTH'S BONUS CONTENT

Log on to the website for extra content

- Download an STL of Darren Conway's LOO spindle nose protector featured in MEW 263.
 - Wire Gauge to Imperial Sizes – download a useful chart.
- 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.



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

Bearings for a Gyroscope

- What sort of bearings will give the best performance?

Myford Correct Oils

- What are the best lubricants for 7-series lathes?

HELP what is it?

- It's a huge model of a mining complex, but can anyone identify what was being mined?

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

CLASSIFIEDS EXTRA SUBSCRIBE ARCHIVE SUPPLIERS



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

Garden Railways



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

Request
your **FREE**
Catalogue
today!

Collect Loyalty Points Online
01622 793 700

www.dream-steam.com

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

BRAND OF THE MONTH: ROUNDHOUSE

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



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

In Stock Now*

Millie - Deep Brunswick Green - 32mm - £628
Millie - Victorian Maroon - 32mm - £628
Sammie - 32mm & 45mm - £628
Bertie - Blue - 32mm - £628
Bertie - Yellow - 32mm - £628
Bertie - Maroon - 32mm - £628
Bertie - Deep Brunswick Green - 32mm - £628

On Order

Silver Lady	Due Dec 2017
Russell	Due Feb 2018
Bulldog	Due June 2018
Little John	Due Sept 2018
Bulldog	Due Oct 2018
Billy	Due Nov 2018
Lady Anne	Due Nov 2018
Karen	Due Nov 2018
Katie	Due Jan 2019
Russell	Due Jan 2019

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!

*In stock as of 08/12/17, please note these loco's may no longer be available, check stocks online or call.
Please note basic range takes 4 weeks from initial order and other locomotives are in batches.
Batch dates will be in product description. Locomotives in stock will state instant dispatch available.

Dream Steam Works manufactures 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	£78.00
Three Wick Meths Burner	DSUP3WMB	£45.00
Dead Leg Lubricator	DSUPDLDL	£26.60
Steam Regulator Kit	DSUPSRK	£31.20
Small Brass Chimney Cowl	DSENSMCWL	£3.30
Brass Cab Hand Rails	DSENCCH	£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	DSENTTT	£9.40
Lubricating Oil	SWLUB30	£2.60
Meths Burner Wick	DSWWK6	£1.90
Curve Tipped Syringe	DSWCTS	£2.10
460 Steam Oil 500ml	DSW460SO500	£5.20
220 Steam Oil 500ml	DSW220SO500	£5.20
Solid Fuel Tablets	980001	£3.50
Water Filler Bottle	DSWWFB	£3.20
Meths Filler Bottle	DSWMFB	£2.60

Set-a-Curve

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

SM32 Buffer Stop!
Out now!
£4.50



Bachmann
16mm Figures
now in Stock!
£22
Wide range of G scale
figures in stock!
£10.40 a pair!

MAMOD

Telford	MTLGO	£452
MKIII	MK3	From £336
Saddle Tank	MST	From £336
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

PECO

32mm (SM32) Track

Flexi Track - 12 Pack	SL600x12	£97.00
Flexi Track - 4 Pack	SL600x4	£36.00
Flexi Track - Single	SL600x1	£9.00
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	£42.50
Left Hand Point	SLE696	£42.50
Y Point	SLE697	£42.50
Small Radius Right Hand Turnout	SLE691	£42.50
Small Radius Left Hand Turnout	SLE692	£42.50
Wagon Turntable and Crossing	SL627	£16.00
Rail Joiners - 24 Pack	SL810	£3.10

45mm (G45) Track

Flexi Track - Six Pack	SL900x6	£75.00
Flexi Track - Single	SL900x1	£13.00
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	£5.40
Insulating Rail Joiners - 12 Pack	SL911	£3.10
Dual Rail Joiners - 6 Pack	SL912	£5.50

BACHMANN

Percy and the Troublesome Trucks Set	90069	£17.00
Thomas with Annie & Clarabel Set	90068	£17.00
Thomas' Christmas Delivery	90087	£210.00
Toby the Tram	91405	£165.00
Thomas the Tank Engine	91401	£225.00
James the Red Engine	91403	£230.00
Annie Coach	97001	£58.00
Clarabel Coach	97002	£58.00
Emily's Coach	97003	£58.00
Emily's Brake Coach	97004	£58.00
Troublesome Truck 1	98001	£59.50
Troublesome Truck 2	98001	£59.50
Ice Cream Wagon	98015	£56.00
Tidmouth Milk Tank	98005	£39.00
S.C. 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

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



MSS

Side Tank Locomotive (32mm/45mm)	90903	£206.00
Saddle Tank Locomotive (32mm/45mm)	90903	£230.00
Side Tank Locomotive Kit (32mm/45mm)	90901	£180.00
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 Coach (32mm/45mm)	911201BL	£53.00
Log Wagon (32mm/45mm)	911501	£53.00
Goods Van (32mm/45mm)	911101	£53.00
Guards Van (32mm/45mm)	911101	£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

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



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

A modern approach to **Condensation Management**



Silly Old Duffer uses an Arduino Uno Micro-controller to monitor and manage a condensation problem.

Condensation is quite a problem, **photo 2**. Not only is it the bane of many a home workshop, it causes serious damage in warehouses, homes, factories, construction projects, museums, and other public buildings. I'm lucky; my workshop does not suffer from condensation. Unfortunately, my home's entrance hallway has become vulnerable since double-glazing and a well-sealed front-door were installed two years ago. A desire to stop mould and disintegrating wall-paper led to this project, but the principles apply to a workshop too.

Air contains water vapour and, in certain conditions, that moisture will condense on a cold surface. Condensation deposits water in the form of micro-droplets rich in dissolved oxygen. Air-born moisture is highly penetrative and capillary action finishes the job. Metal, glass, walls, ceilings, and electronics are all vulnerable. Corrosion,



RaspberryPi Data Logging the Arduino in a Damp Hallway



Condensation – a warning

water-damage, malfunctioning electronics and mould are all likely consequences. In serious cases there is risk to health. Metals are particularly vulnerable to condensation because of their good thermal conductivity.

Quite a lot of advice available on condensation can be misleading. Not that it's wrong, but rather that it comes from people who have dealt with their particular problem in their particular way. Many suggestions are based on experience and – as we all know – experience is built on a dung-hill! The underlying issue is that the method used to solve a winter condensation problem in a shed in Yorkshire is unlikely to work well in Florida, Sukkur, or Darwin. The advice might even be entirely the wrong thing to do.

As always in Engineering it is best to understand what lies behind a problem before trying to fix it. Once understood, root-causes can be tackled and a generic solution developed, **photo 3**.

There are four inter-linked factors that determine whether or not water vapour will condense on an object or not. They are: the temperature of the object itself and the temperature, relative humidity, and pressure of the air. Fortunately, air pressure has a relatively small effect and can be ignored for our purposes.

Figure 1 graphs the relationship between dew point, air temperature and relative humidity. Air temperature and humidity are the main drivers but their relationship to the likelihood of condensation is not immediately obvious. However, if ambient temperature and relative humidity are measured, it's possible to calculate the dew point. Dew point is defined as the maximum temperature at which water vapour will start to condense. An object below dew point temperature will collect condensation from the air. Changes of temperature or humidity inside a workshop can cause condensation on any object below the new dew point. And moving metal or electronics from cold storage into a warm workshop is risky.

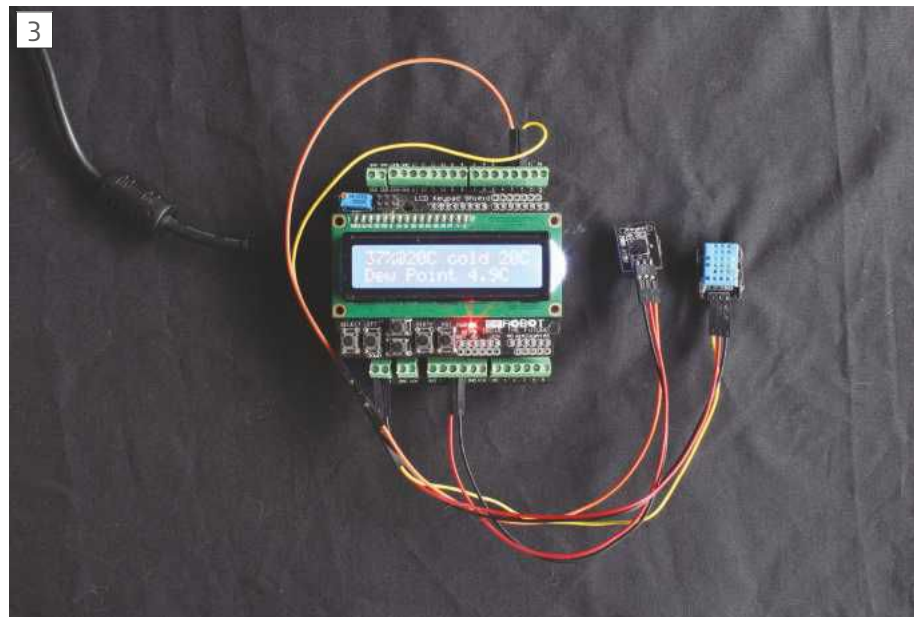
Writing this article at my dining table I see that the ambient temperature is 20°C and that the relative humidity is 41%. Those two numbers mean I'm physically comfortable. They also mean that the dew point in my dining room is about 5.9°C. From this I can predict that a cold drink taken out of my refrigerator at 4°C will collect condensation whilst a can from my larder at 10°C won't. Confirmation that the prediction is correct can be seen in **photo 4**.

At 25°C / 41% RH the dew point rises to about 9°C: this suggests that whacking heat into a cold workshop is more likely to cause condensation than letting the room and its contents warm up slowly together.

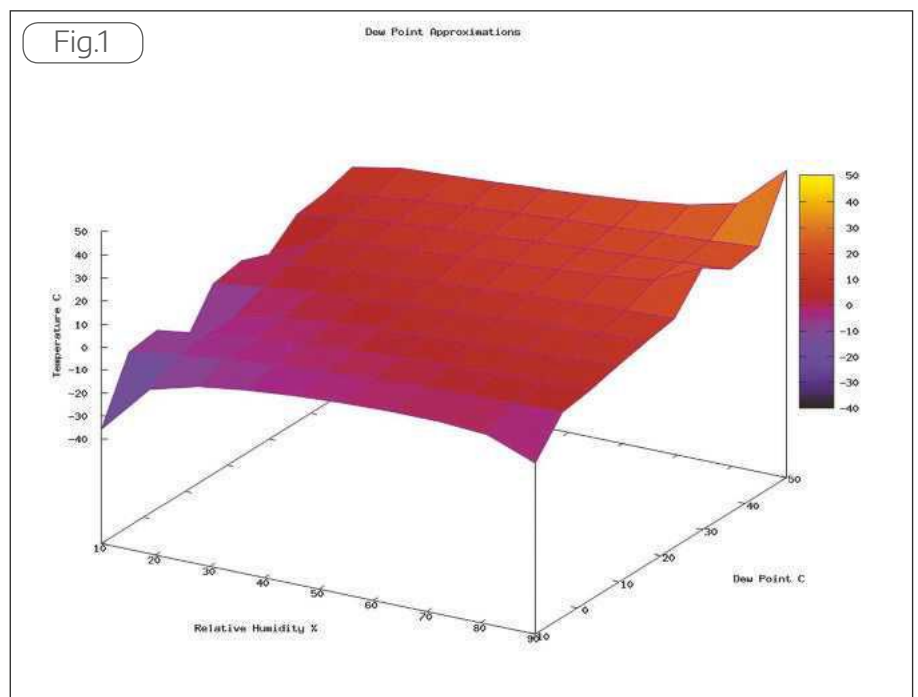
Temperature and humidity vary hugely outside my West of England dining room. Climate and weather make a huge difference as do man-made conditions in the room itself. Condensation occurs in hot humid countries as well as cold ones; it all depends on the dew point. Kitchens and Bathrooms are much more likely to be humid than an unoccupied bedroom. Apart from condensation, excessive humidity is bad for another reason. Life becomes very uncomfortable when high-humidity prevents sweat cooling by evaporation. Very few of us would choose to indulge our hobby in a sauna!

The most important point is that it is the combination of temperature and humidity relative to the temperature of an object that matters. A complication is that humidity and temperature are both influenced by a combination of natural and man-made factors. Both factors are changeable and, without measurement, it's difficult to know which individual counter-measure is appropriate. This is why simply heating a workshop sometimes controls condensation and sometimes it doesn't.

When it comes to counter-measures there may be obvious preventatives. Open flames and boiling water are prodigious



The completed project



dew point, Air Temperature and Relative Humidity

sources of water vapour, best avoided. Unwelcome visitors. Better ventilation will help. A vent near floor level works better than an open window because air laden with water vapour tends to sink. Self-contained oil or gas heaters are to be avoided; without a chimney water produced by combustion is dumped straight into the air in the room. A workshop suffering from rising damp, dripping plumbing, porous walls or a leaky roof needs to have these problems fixed first. Restricting airflow by keeping small tools wrapped up in boxes and by providing covers for large tools and stock will help. Wooden tool boxes are better than metal ones. Corrosion due to condensation can be reduced by keeping metal surfaces painted or well oiled. Some coolants are water based and their

evaporation should be reduced if possible. Chemical absorbent dehumidifiers and anti-corrosion paper may help.

Varying the temperature of a workshop by heating is likely to cause condensation unless the temperature is never allowed to fall below 16°C. If heating alone is used it is important that the room be well ventilated. Proper ventilation is more than cracking open a window! It means that a flow of air will be maintained, and that incoming air will be dry. Cost is the chief objection. Keeping a well ventilated workshop permanently at or above 16°C could be expensive!

A newly built workshop is a special case. It may need to be thoroughly dried out before use. New concrete, plaster, and other construction materials are wet, wet, wet. A

4



Prediction Confirmed – Cold Can on the Right

period of ventilation, perhaps fan-assisted, is in order until the damp has dispersed. A lean-to workshop erected against the weather side of a house may be very damp until the house wall has had time to dry out.

Once basic counter-measures have been taken we can concentrate on dew point issues. Comparing the dew point and temperature of a condensation prone object will tell us when the combination of temperature and humidity is going to cause trouble. Sounding a simple alarm may be sufficient. Prompting the operator to improve ventilation by opening a window or turning an extractor fan on may be all that's needed. But beware - this makes the risky assumption that fresh air is less humid than workshop air!

Provided we understand what causes condensation and have a way of measuring the factors, an engineer can look at ways of preventing condensation with active controls. Possibilities include:

- 1) Heating to make individual objects warmer than the dew point. Keeping lathes and milling machines above the dew point by attaching a small electric heater to the body works.
- 2) Increase the dew point by cooling the air, not likely to be practical.
- 3) Reduce humidity by switching a on dehumidifier with a humidistat.
- 4) Maintain temperature and humidity with an air-conditioning unit.

Air-conditioning is much used in industry to prevent condensation. In humid climates air-conditioning is desirable in domestic buildings for comfort and might already be fitted to a home workshop. The main objection to air-conditioning is cost. Cost is particularly objectionable in moderate climates where condensation and high humidity are unpredictably intermittent. In these circumstances a portable dehumidifier is more appropriate, small units starting at about £60. A 300W humidifier capable of extracting up to 20

5



A 300W Dehumidifier

litres of water per day from a decent sized room costs about £150. Dehumidifiers work by blowing air through a chiller kept just below the dew point, **photo 5**. Water vapour condenses on the chiller and is collected in a tank. Dry air emerges on the other side and clean water is a useful by-product. In larger rooms it is important to ensure that air is thoroughly circulated. If not condensation may still occur in remote corners.

It's important to ensure that dehumidifiers and air-conditioning units are not over-stressed by asking too much of them. They can only control air-quality within a limited space. Open doors and windows will cause a dehumidifier to try and dry out the world. For this reason, joint use of good ventilation and a dehumidifier is a no-no.

Calculating the dew point

Wikipedia documents a number of formula for calculating the dew point. They are of varying accuracy. The simplest formula only works when humidity is greater than 50%. More accurate approximations involve the use of constants tweaked to improve dew point accuracy within a target temperature range.

Given accurate data the literature suggests that the approximation I used will vary from the actual dew point by no more than 0.4%. That potential is not achieved here because the temperature and relative humidity data delivered by the sensor I used are inferior. Small program changes would allow more accurate sensors to be used.

The calculation is (temperature in Celcius):

constant b = 17.67

constant c = 243.5

$\gamma = \log(\text{relative_humidity} / 100) + ((b * \text{temperature}) / (c + \text{temperature}))$

$\text{dew_point} = c * \gamma / (b - \gamma)$

Measuring relative humidity

Relative humidity may be calculated by comparing temperature readings from a matched pair of thermometers, one of which is cooled by keeping the bulb wet. Being wet, the bulb measures temperature at 100% humidity. The other thermometer measures actual temperature, and the difference between 'dry-bulb' and 'wet-bulb' measurements is proportional to the relative humidity of the air, from which the actual relative humidity may be calculated.

Another way of measuring humidity is with a hygrometer made from human hair. A strand of hair under load has the interesting property of lengthening with increasing humidity. In a typical instrument three twisted strands of hair about 200mm long move a pointer against a scale. The hygrometer is calibrated with wet-bulb/dry-bulb thermometers but is less accurate.

In the good old days, chaps sat recording wet-bulb/dry-bulb temperature pairs manually and calculated humidity from them later. Later, rather expensive pen-recorders were used to collect the data, but the calculations remained tedious. We don't have to do that today. This is just as well, because I didn't fancy spending an uncomfortable night in my workshop, not at my age.

Table 1 allows dew points to be found from air temperature and relative humidity. It is handy when moving items from hot to cold environments.

The table is used as follows. Use the intersection of workshop air temperature in the left-hand column and select humidity from the top of the table. As an example, the intersection of 20°C and 45% RH is a dew point temperature of 9°C. Therefore, a sheet of metal moved into the workshop from a cold store below 9°C will collect condensation. The same metal sheet will not collect condensation if it is 11°C or warmer.

The Electronics

This project uses an Arduino Uno



Table 1
dew point from Air Temperature and Relative Humidity Table

Relative Humidity %														
Air °C	100	95	90	85	80	75	70	65	60	55	50	45	40	35
41	42	41	40	39	38	37	36	34	33	32	30	29	27	25
39	40	39	38	37	36	35	34	33	31	30	28	27	25	23
37	38	37	36	35	34	33	32	31	29	28	26	25	23	21
35	36	35	34	33	32	31	30	29	27	26	25	23	21	19
33	34	33	32	31	30	29	28	27	26	24	23	21	20	18
31	32	31	30	29	28	27	26	25	24	22	21	19	18	16
29	30	29	28	27	26	25	24	23	22	20	19	18	16	14
27	28	27	26	25	24	23	22	21	20	19	17	16	14	12
25	26	25	24	23	22	21	20	19	18	17	15	14	12	10
22	23	22	21	20	19	18	17	16	15	14	13	11	10	8
20	21	20	19	18	17	16	15	14	13	12	11	9	8	6
18	19	18	17	16	15	15	14	12	11	10	9	7	6	4
16	17	16	15	14	13	13	12	11	9	8	7	6	4	2
14	15	14	13	12	12	11	10	9	8	6	5	4	2	1
12	13	12	11	10	10	9	8	7	6	4	3	2	0	
10	11	10	9	8	8	7	6	5	4	3	1	0		
8	9	8	7	6	6	5	4	3	2	1				
6	7	6	5	4	4	3	2	1						
4	5	4	3	3	2	1								
2	3	2	1	1										

microcontroller, a temperature sensor and a humiture sensor to take readings and do the calculations. A humiture is a portmanteau word for a single sensor that measures both humidity and temperature. It is used to measure air temperature and

humidity. A separate temperature sensor is stuck to a suitable 'cold-object'. The microcontroller polls the humiture and temperature sensors at a set time interval (4 seconds), collects data, performs a calculation, and reports results. It is also able to make decisions based on data, for example to raise an alarm if condensation is likely. The microcontroller is easily reprogrammed to add or refine functionality. The basic circuit, **fig. 2**, is simple. No soldering is needed if built as shown in **photo 6** using an Arduino Uno, a terminal shield, an alarm module, humiture module and temperature module, with interconnections using female to male breadboard connector jump wires. (Search the web for breadboard connector or breadboard jumper).

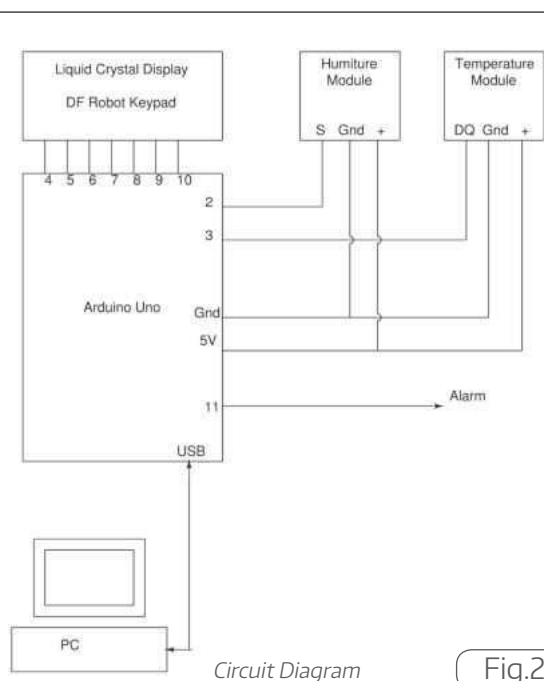
Functions provided

The completed project provides some useful functions. Temperature, relative humidity and the resulting dew point are all displayed giving an immediate indication of the likelihood of condensation. The humiture may be moved into nooks and

crannies to search out sources of damp, though remember to allow a few minutes between each reading. If a condensation alarm is required, the body of the second temperature sensor should be blue-tacked to a suitable cold object: one on which condensation is likely to occur. This could be a window pane, lathe, exterior metal door, or lump of metal in storage. Anything that has already attracted condensation is suitable.

Another useful feature is that the program outputs timestamped data on the Arduino's USB port. A terminal emulator or data capture program on a host computer can capture that data for later analysis. After 'Data Logging' it is possible to graph changing temperature and humidity over an extended period allowing the times that condensation occurs to be identified. Values are sent to the data logger once per minute.

The Arduino is programmed to output high (+5V) on pin 11 whenever the dew point / cold object comparison indicates that condensation is likely. An asterisk appears on the LCD. Pin 11 could be used to sound an alarm (such as the YL-44 Active Buzzer Module) or to operate a 250VAC 10A relay relay module. This last would allow the Arduino to switch on a dehumidifier unit or a heater. I shall



provide no more than a circuit diagram, **fig. 3**. It is not difficult to build but constructors will have to provide their own understanding of mains powered safety issues and the need to provide a proper enclosure, appropriate components and suitably engineered wiring.

Arduino and sensors

The sensor is a DHT11 humidity device pre-wired into a Keyes module. Humidity modules are widely available from a variety of vendors. Mine came in a set from SunFounder via the web. The DHT11 is the most basic of a family of similar sensors, the others providing more accuracy and precision whilst operating over a wider range of temperature. The DHT11 measures temperature between 0 and 50°C $\pm 2^\circ\text{C}$ and relative humidity in the range 20 - 90% $\pm 5\%$. This is sufficient for this project.

There are three connections to the sensor +5V, 0 (GND), and Signal. Some variants of the module have four connections, one of which is unused. The connections will be marked +, -, S or similar. The DHT11 spends most of the time asleep. It is queried by pulling the signal line down to zero volts and negotiating a short handshake. After a short wait the DHT11 replies by sending a 40 bit binary number back down the signal line. Binary 0 and binary 1 are differentiated by

The sensor is a DHT11 humidity device pre-wired into a Keyes module. Humiture modules are widely available from a variety of vendors. Mine came in a set from SunFounder via the web. The DHT11 is the most basic of a family of similar sensors, the others providing more accuracy and precision whilst operating over a wider range of temperature. The DHT11 measures temperature between 0 and 50°C $\pm$ 2°C and relative humidity in the range 20 - 90% $\pm$ 5%. This is sufficient for this project.

There are three connections to the sensor +5V, 0 (GND), and Signal. Some variants of the module have four connections, one of which is unused. The connections will be marked +, -, S or similar. The DHT11 spends most of the time asleep. It is queried by pulling the signal line down to zero volts and negotiating a short handshake. After a short wait the DHT11 replies by sending a 40 bit binary number back down the signal line. Binary 0 and binary 1 are differentiated by



Programming the DHT11 is beginning to look like hard work now that we know that there's a handshake, time dependencies, and a requirement to decode 40-bit variable length numbers! Consequently, you will be pleased to hear that Arduino libraries are available to do the heavy lifting. I used the SimpleDHT library. It provides a function that queries the DHT11, decodes the 40-bit reply, and returns the temperature in Celsius and the percentage relative humidity, just like that.

To be continued



Bulk Production of Toolholders



Richard T. Smith describes some approaches useful whenever you need to make a batch of matching parts.

Previous articles described my prototype tooling system which included one insert holder. I subsequently bought a selection of inserts being three for steel with tip radii of 0.2, 0.4, and 0.8mm and two for aluminium with tip radii of 0.2 and 0.4mm – so I needed five more insert holders complete with pillars.

I started with the pillars. Their height is the most critical dimension – they all need to be the same height so that the handle clamps tight in the same place. The M10 thread of the clamp has a pitch of 1.5mm which corresponds to 360 degrees of position variation. So .01mm variation produces $(360/150 = 2.4)$ degrees variation. Some variation up to ten degrees or so would not be a problem.

First thing was to check that the adaptor plate front edge (which the parting tool locates against) was square with the lathe, **photo 1**.

I bought some 1¼ ins. Diameter EN1A mild steel and cut off a piece and held it in the three-jaw chuck with 70mm sticking out and faced the end. Then I turned 55mm down to 30mm. dia. and drilled an 18mm diameter hole down the centre with the full bore to the same depth. As a guide I put a piece of tape on the tailstock quill to mark the start point and cut a piece of card to use as a depth gauge, **photo 2**. I changed to the parting off tool and cut off approximately 26mm, then changed back to the turning tool and faced the end, then back to the



Squaring the adaptor plate

parting tool to part off the second piece. I repeated this until I had a dozen parts – I decided to make some spares while I was setup.

The problem then was how to finish these to an exact length and bore them to go over the 20mm diameter cylindrical nut. If I held them in the three-jaw chuck there

would be marking, unless something soft was placed around the part and this could lead to error. There is also the problem of measuring the part length while held in the chuck. I could have held the part away from the chuck face enough to get a calliper jaw into the gap although I really wanted to use a micrometer to measure. Each of the



Card depth gauge



Grooving the soft jaw material



Temporary stop, to be used to set jaws



Facing soft jaws

dozen parts would have to be individually measured. I looked at articles about making 'spiders' as depth stops and I am sure I'll end up making one some day. In the end the soft jaw approach with a pocket to accurately locate the part seemed the best approach.

Looking around I found a short length of 1 1/2 ins. Square aluminium enough to cut three pieces slightly longer than the chuck jaws. A drawing confirmed that this could work. The first step was to mill a 20mm deep groove to fit over the jaws. Some time back I had bought a 10mm diameter endmill specifically for aluminium but had no way of holding it. All my cutters have been threaded shank and this was plain. I have not long made a spindle lock for the mill (see MEW 261) so was happy to buy a 3MT x 10 collet to hold this cutter. The spindle lock is functional but still needs tidying up, it wasn't drawn and evolved as I went along. The cutter was very impressive, and I made the groove a snug push over the jaws, **photo 3**. Next, I cut the piece into

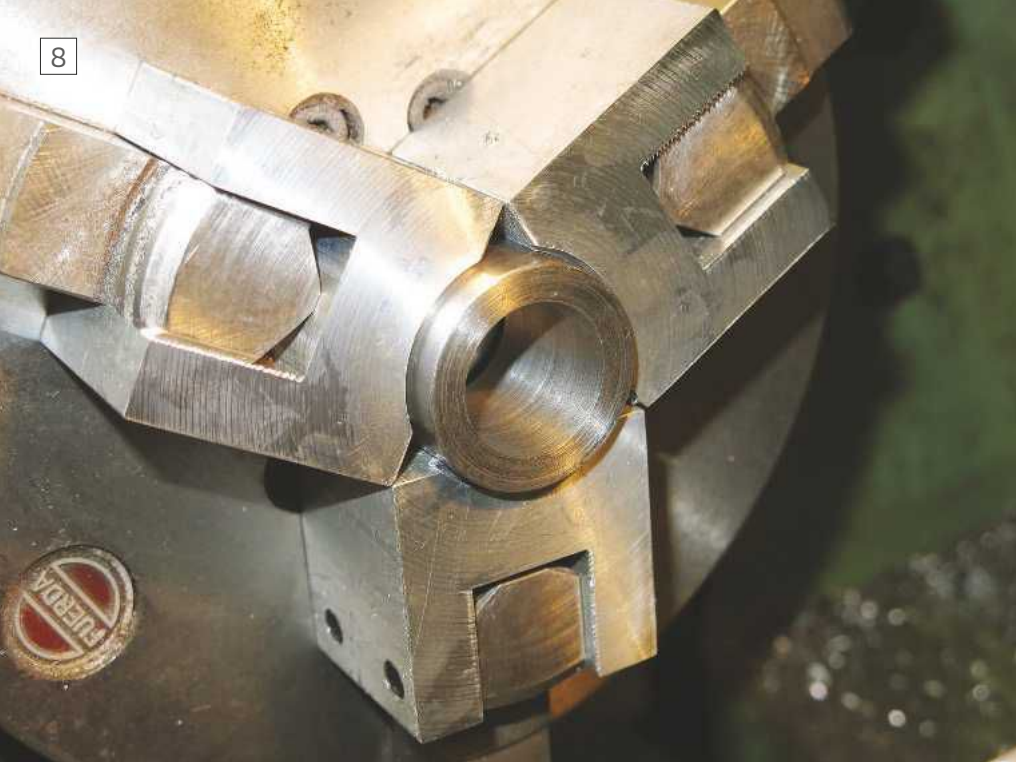


Setting with spacer



Trialling boring bar depth

three and drilled and tapped two M6 holes into each piece and fitted flat headed grub screws. To give the soft jaws something to grip on while the pocket was bored I needed something to be held right at the back of the jaws past the end of the pocket and about 8mm long. I got the diameter – 22mm, from the drawing and in order to position it and remove it decided to use an M6 screw into a central threaded hole. To make it easy to locate I made it stepped to a larger diameter. This was the next thing to make, **photo 4**. I fitted the soft jaw blanks to the chuck and gripped a piece of 25mm diameter aluminium tightly and faced off the ends. These faces locate against the chuck, so I cleaned up the edges and numbered them and then fitted them back on the chuck. I then tapped the jaws down against the chuck body then gripped the bar again tightened up the grub screws and faced off the second set of ends, **photo 5**. Removed the bar and put in the stepped spacer using the M6 screw to position it, **photo 6**, then removed the screw. Now I



Testing fit of part in soft jaws

blank sits on the first step of the jaws and the jaw must not overlap the hole which is to be bored. Two jaws gripping the width of the blank are in line with the hole and needed packing (soft jaws) to achieve this. The sawn end of the blank was OK and gripped straight onto the blank. I made another soft jaw for the opposite end partly to avoid marking the machined end of the blank and partly to improve the balance. The jaws were made from 40 x 10mm aluminium as a tight fit over the steel jaws and with grubscrews in one side as backup, **photo 9**.

The soft jaws were fitted, and the first blank positioned using the centre in the tailstock in the centre drilling in the blank to locate it, **photo 10**. I have a sharp 18mm drill which I used before boring out (300 rpm). The first blank I bored to size (800 rpm) then took a 0.4mm facing cut. This left a very ragged finish on the hole so subsequently I faced after drilling before boring. The facing cut was to provide a

could bore the pocket. Fitted the boring bar and set the saddle stop so that the boring bar wouldn't reach the stepped spacer, **photo 7**. Bored out until one of the parts just fitted then added a touch of depth with the topslide and faced the bottom of the pocket and slightly past the full diameter to relieve the corner.

To finish the parts I decided to trim them in two stages, the first to about 25.5mm and the second to final length. I positioned the tool approximately correct and zeroed the scale on the topslide handwheel, checked the topslide still had some movement and locked the carriage. Loaded the first part, **photo 8**, and took a cut and then removed it and measured it with the micrometer. There was a little variation around the circumference, but the basic length was 25.63mm. I repeated this for all the parts measuring each time and getting virtually the same results each time. I then advanced the topslide by 0.63mm and went through them all again. Unlocked the carriage and fitted the boring tool and bored the first part out until it slid over a test gauge. Zeroed the cross-slide scale and changed the part. Bored it out to the zero, filed the edge and used some emery tape to clean up the corners then checked with the gauge before removing the part. The inner end of the bore needed cleaning up and I used a small needle file and emery tape to deburr it. This was repeated for all the parts.

The insert holders are made from 40 x 20 bright mild steel bar and the nominal overall finished length is 75mm. I cut six blanks with the bandsaw 78mm long and squared one end in the lathe as the next one was sawing. The blanks were gripped in the 4-jaw chuck approximately centred and faced off. When all six were done I centre drilled the position of the 30 bore hole, holding them in the vice on the mill against a stop.

To mount the blanks in the four-jaw chuck I made some more soft jaws. The



Soft jaws for four jaw chuck



Positioning first blank

location at right angles to the bore which could be clamped to the mill table before cutting the insert seat. To change blanks, I loosened the sawn end jaw and one side jaw. Having finished the batch I realised that the holes were all very slightly off centre. I am not sure if the error was made drilling the centre holes or when clamping in the chuck.

In order to mill the step for the insert to sit on I clamped some guides to the mill table. The hole in the blank dropped over a stud so that the blank could be clamped down to the table. The main guide was aligned in the Y direction using a clock gauge. A separate stop located the machined end of the blanks. I marked the first blank at 61mm from the machined end and cut the recess to this mark using my 25mm insert cutter and repeated this for the other four blanks. The depth was 4mm using the depth stop. To cut the 7-degree slope on the locating face I put the vice back on the mill (aligned in the X direction with the clock gauge) and clamped the blanks



Setting angle of blank in vice



Matching blanks with inserts fitted

with a 7-degree tilt using my digital angle gauge, **photo 11**. I used a 10mm slot drill and aligned it by eye to just take out the corner so that the insert would sit nicely.

Next, I decided to do the clamp screw holes while I still had all the sides of the blanks to locate on. I put the M10 tapping drill in the mill and positioned the vice so that the drill would just miss the dovetail at the bottom. I rigged up a stop as before and located a centre drill on a marked up blank. First, I drilled the tapping holes in each block in turn, then changed to the 10.5mm clearance drill and set the depth stop to go just over halfway and drilled all the clearance holes. The plan was then to counterbore for caphead screws and this is where it all went wrong. I have a stepped drill for M10 which produce a nice 16.5mm diameter counterbore but has a long clearance drill so I couldn't use it. I thought I could get a 16.5mm diameter slot drill as a counterbore but couldn't find one, and soon

realised that if I had I wouldn't have liked the price! I did have a 16mm slot drill, so I decided to use that and reduce the screw head diameter as necessary. Having loaded the cutter and started the bore I found I had run out of quill travel – which is a pain on a round column machine. I adjusted the head and tried to line up on the partial bore – and was partially successful. Next time I will use M10 x 40 bolts and go straight on to tapping the M10 threads.

Each of the five different inserts was fastened to a blank with an M4 screw, **photo 12**. The sixth blank is a spare. The holders were finished off as described in the previous article. The inserts are of two grades suitable for steel and aluminium and have tip radii of 2,4 or 8. I painted the flat ends with binary code for the radii and colours for the grades ie. blue for steel and green for aluminium, **photo 13**. ■



Cunningly colour coded blanks

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 
 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 V1265 on the back
 Cardholder's name
 Card no: (Maestro)
 Valid from Expiry date Maestro issue no
 Signature Date

TERMS & CONDITIONS: Offer ends 26th January 2018. MyTimeMedia Ltd & Model Engineers' Workshop may contact you with information about our other products and services. If you DO NOT wish to be contacted by MyTimeMedia Ltd & Model Engineers' Workshop please tick here: ☐ Email ☐ Post ☐ Phone. If you DO NOT 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**

**HURRY
 OFFER
 CLOSES**
 26th January
 2018



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

DIGITAL
SUBSCRIPTIONS
AVAILABLE ONLINE!

MODEL ENGINEERS' WORKSHOP

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

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



TERMS & CONDITIONS: Offer ends 26th January 2018.

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

SUBSCRIBE SECURELY ONLINE

 <https://me.secureorder.co.uk/mew/V1265>

CALL OUR ORDER LINE Quote ref: V1265

 0344 243 9023

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

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

A portrait of a man with a grey beard and mustache, wearing a blue baseball cap with a red logo and a red polo shirt. He is standing in front of a wooden building with a green door.

The impressive control panel with its umpteen knobs, neon bulbs and matrix display is now the centrepiece in my workshop...

[illegible]

Model Engineers' Workshop



The case opened, showing the clockwork mechanism.



Parts that make up the home-made hand puller.



Assembled hand puller.

knobs, neon bulbs and matrix display is now the centrepiece in my workshop and impresses visitors more than the gadgets I make. During a recent deep excavation beneath my workshop bench I rediscovered this old DTI between a coal seam and a layer of dinosaur bones, and decided that now was the time to try to restore the instrument.

John Bull is frequently depicted in British folklore as a jolly rotund Englishman dressed in taut breeches and waistcoat, calling upon citizens to 'do their duty' for Queen and Empire. When not engaged in such noble activities he was putting his name to sweets, footwear, cutlery and other items where his dependable stature assured that these products were fit for the home and the colonies. This industrious chap even found time to create my quality dial test indicator, where his skill in watch making provides a resolution of 0.0001" or 2.5 microns, as inscribed on the dial. Nevertheless, the years spent languishing in the damp had taken their toll, with the hands partly rusted, the plunger sticking and flecks of mould on the face. The main pointer was touching the dial and this, together with scratches on the rear, suggested that someone had attempted a repair before.

Photograph 2 shows the tools that were

used in the restoration, most of which you will also have to hand, including instrument screwdrivers and a permanent marker pen. The only peculiarities are an interdental brush (from your supermarket or pharmacy) and a pen oiler (from eBay or Amazon).

Also shown is a purpose made hand puller, more of which anon. The first job was to remove the four 4BA screws that held the back plate, then the six 10BA screws that secured the bezel and glass, **photo 3**. The gear train and main components could



Removing the DTI main pointer with the hand puller.

then be inspected, **photo 4**. Before the mechanism and case could be thoroughly cleaned I was still faced with the task of removing the hands - the main pointer and subsidiary pointer - before the dial could be taken off. Prodding, pulling and levering with fingernails and screwdrivers was to no avail and I was reluctant to apply excessive force owing to the risk of damaging the delicate bearings. A key problem was that the gap between the underside of the hands and the clock face is only about 0.5mm, making it difficult to insert a lever of sufficient strength without damaging the painted face. It became clear that the safest option was to apply a force between each hand and its supporting shaft (or 'pinion' in horological parlance). However, the difficulty was that neither pinion protruded through its respective hand, but was recessed by a fraction of a millimetre. Moreover, these pinions were only about 0.5mm in diameter and had become seized



Bending up the main hand to restore its shape and prevent scuffing.



Restored John Bull DTI testing runout on a milling machine spindle.

to the hands by corrosion. Special watch hand pullers are available from a number of horological suppliers and on eBay for a bargain. However, I was not convinced that the chunky fingers of the budget versions would fit beneath the DTI's hands, nor was I prepared to spend a significant sum on

Prodding, pulling and levering with fingernails and screwdrivers was to no avail, and I was reluctant to apply excessive force...

a pukka model since this might only be a one-off restoration.

Among the dinosaur bones were several parts from a Jurassic printer (they were clever you know!), including rollers, 6mm chromed shafts and some 3mm diameter chromed spindles with reduced ends, **photo 5**. A 40mm length of the 6mm shaft was drilled lengthways and tapped M3, then a narrow slot and groove ground at the end using a Dremel tool to form a pair of thin fingers that would fit just beneath the DTI's hands. Two of the rubber rollers were pressed onto the shaft to form a handle, then part of the thinner printer spindle passed down the shaft, with an M3 screw to propel it downwards. The completed hand puller is shown in **photo 6** and in action in **photo 7**; after the fingers are slipped beneath the DTI's hand, the screw is used to drive the spindle down against the pinion, releasing the hand. The operation was still a struggle and only



Scruffy old Baty DTI as purchased.

...nor was I prepared to spend a significant sum on a pukka model since this might only be a one-off restoration.

successful after penetrating oil had been left to do its work for 24 hours.

Now the hands were free they were burnished with wire wool, repainted with permanent marker and given a thin coat of silicone oil to prevent further corrosion. The DTI face was cleaned gently with soapy water and put aside to dry, while the clockwork mechanism was thoroughly cleaned in paraffin aided by the various brushes shown in photo 2. Once the paraffin had completely evaporated all accessible pinions and sliding parts were sparingly lubricated with the pen oiler - a clever tool that will doubtless find other uses in the workshop wherever pinpoint application is required. The DTI rear cover and front face were then re-attached, and the hands pressed back on in zero positions with the plunger at the end stop. At this point it was noticed that the main hand was scuffing the dial but this was rectified by carefully bending the (spring steel upwards



Levering out the circlip on the Baty DTI to release the front bezel.

until the shape was restored and the hand was clear, **photo 8**. Scratches on the (plastic) watch glass were removed using Brasso polish and the front reattached, finally restoring this vintage instrument back to working condition, **photo 9**.

Encouraged by this success, I decided to tackle another dial test indicator, this one made by Baty and purchased from eBay for a few pounds, **photo 10**. At first it seemed that the case had been swaged together preventing access to the seized movement.

However, closer inspection revealed that the bezel was secured by a wire circlip hidden in a deep groove filled with debris, **photo 11**. Removing this gunge and winking out the clip has exposed the workings and now another restoration is underway! ■

Resources

Precision horological watch hand pullers:
www.ofrei.com/page1678.html

In our Next Issue

Coming up in issue 264

On Sale 26th January 2018

Content may be subject to change

Look out for the February issue, 264, of Model Engineers' Workshop, for even more fascinating tales from the workshop:



By popular demand - **Jock Miller's** Taper Turning Attachment.



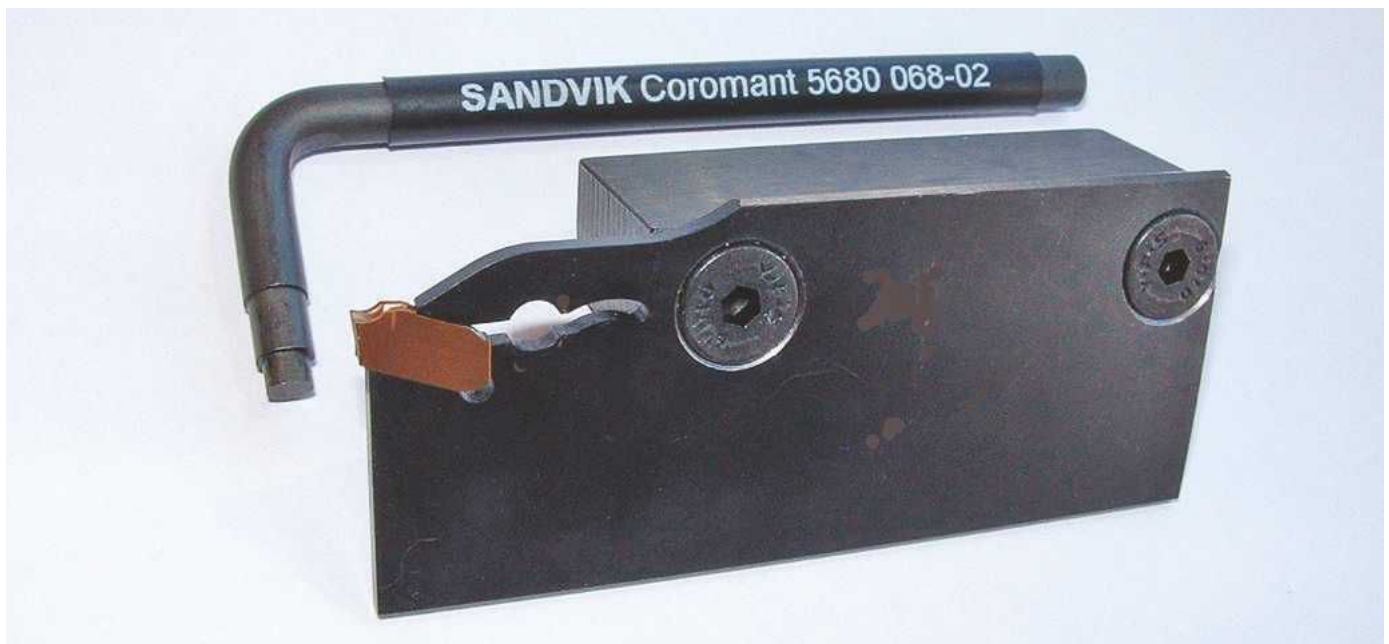
Bunker corners - **John Smith** shares his technique for complex 3D bends.



A heavy duty clamp-drill from **Stewart Hart**.

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

Parting is such sweet sorrow! The end of an era, and the beginning of an exciting new one!



Back in 1995, Greenwood Tools invited the model engineering fraternity to "Wake up from your worst nightmare" with the very successful introduction of the innovative KIT-Q-CUT parting tool (based on the Sandvik Q-Cut system). Since then, the tool has received many accolades from model engineers and the model engineering press. People said it "changed their lives", and was "the best thing since sliced bread".

2018 brings the introduction of the replacement for KIT-Q-CUT.

The groundbreaking new **KIT-QD** parting tool (based on the Sandvik QD system) has a better insert location, stronger body and improved insert design. Existing users of the original KIT-Q-CUT have tested the new KIT-QD with very positive results. John Roberts said "Changing the insert takes seconds using the new design application tool. The ease with which this tool parts off a variety of

materials is staggering. Highly recommended". Stuart Hardy tested the new tool on EN1A, EN8, EN25T, cast iron, 316 and 314 stainless steel, bronze, brass and aluminium bronze. He said "Generally speaking the KIT-QD is better than the KIT-Q-CUT. It cuts better, and inserting the insert is much better. A good step forward – it gets a 'thumbs up' from me".

The KIT-QD parting tool will be unveiled at the London Model Engineering Exhibition at Alexandra Palace from 19-21 January 2018, and will be your new 'part-ner' through thick and thin!

Users are reassured that inserts for the original KIT-Q-CUT will still be available for the immediate future.

Once launched in January you will find more details and order KIT-QD at www.greenwood-tools.co.uk/ or call them on 01527 877576.

REMAP to be at Ally Pally

Remap, the charity of volunteers that custom make bespoke engineered products for disabled people to help provide independence will be at the 2018 London Model Engineering Exhibition.

Remap started in 1964 when a design engineer custom-made some equipment for his disabled sister to make life a little easier for her. He soon realised there was a demand for such products, the charity boomed and now comprises of 70 local groups throughout the UK and over 900 volunteers!

Bespoke items are designed, created and made solely for the

individual such as an independent eating tool for a double amputee, an adapted saddle so that a little girl can still enjoy horse riding, a wheel chair that is compatible with a baby carrier so a mum can take her baby for a walk.

At this year's Exhibition Remap will be displaying some of their unique engineered designs.

The Exhibition is held at Alexandra Palace, London for Friday 19 to Sunday 21 January. For more information and tickets visit www.londonmodelengineering.co.uk.

The no.1 Silver Solder Supplier for the Model Engineer

With over 100 years of brazing experience, you can count on us for the supply of various low temp, medium temp and high temp silver solders in a variety of sizes to suit every job.



Silver Solder Rods



Silver Solder Fluxes



Soft Solders



Brazing Ancillaries

All our products are fully labelled to state alloy, size and specification. You know exactly what you are buying! All from stock for immediate despatch.

Payments available at the exhibition:



We also stock the full range of SIEVERT® HEATING EQUIPMENT

Order online with **free delivery**, or visit us at our exhibition stand to see the **comprehensive range** in person!

Grab yourself a bargain at our exhibition stand and receive **discounted prices!**

Visit us at London Model Engineering Exhibition 2018

from Friday 19th - Sunday 21st January 2018 - doors open at 10:00am
Venue: Alexandra Palace Way, London, N22 7AY - find us on **Stand 5**
Purchase your ticket on the door or book in advance at www.londonmodelengineering.co.uk

web: www.cupalloys.co.uk | tel: 01909 547 248

All details correct at time of print, November 2017. Please check website for up to date information. Errors and omissions excepted.

THE SOUTH'S MAJOR SHOWCASE OF MODEL ENGINEERING & MODELLING



LONDON MODEL
ENGINEERING EXHIBITION

A GREAT DAY OUT FOR ALL AGES



FRIDAY 19th to
SUNDAY 21st
JANUARY 2018

Great Hall, Alexandra Palace, London N22 7AY

10am-5pm Fri & Sat, 10am-4.30pm Sun

Last entry Friday & Saturday 4.00pm Sunday 3.00pm.

The Model Active Zone will close at 3.30pm on Sunday.



MEET THE CLUBS AND SOCIETIES

- Over 45 national & regional clubs and societies attending
- See nearly 2,000 fantastic models on display
- Exciting demonstrations

LOTS TO SEE AND DO

- Model trains, boats & tanks
- Passenger carrying locomotives
- Radio control planes & trucks in fabulous Model Active Zone
- Meccano, Horology & more...

OVER 55 LEADING SPECIALIST SUPPLIERS PRESENT.

EVERYTHING HOBBYISTS NEED UNDER ONE ROOF!

Sponsored by

ENGINEERING
in Miniature

Join us on



London Model
Engineering
Exhibition

Follow us on



@MeridienneEx

Car Parking for 1,500 Vehicles & **FREE** Showguide

BOOK YOUR TICKETS NOW

TICKET	ONLINE TICKETS*	FULL PRICE TICKETS**
Adult	£11.00	£12.00
Senior Citizen	£10.00	£11.00
Child (5-14 yrs)	£3.00	£4.00

* Tickets are available via our website at discounted prices.

** Full price tickets are available on the day from the ticket office.

Please call SEE Tickets on 0871 3861118 if you would like to book a ticket by phone. Calls cost 13p per minute plus network extra's.

For groups of 10 or more, 10% discount applies. Quote GRP10 online.

www.londonmodelengineering.co.uk



Organised by Meridienne Exhibitions Ltd

All information subject to change, correct at time of printing.



The Digital Readout & Measurement Specialists



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

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

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

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



UK's Smallest
Magnetic Encoder



0116 279 3035 : [facebook.com/ems-i.systems](https://www.facebook.com/ems-i.systems)
info@ems-i.co.uk : www.ems-i.co.uk

Expo
www.expotools.com

We sell 5000+ quality products for Modellers!

This is just a small selection from the ranges we offer!

Please buy from your local stockist whenever possible. In case of difficulty obtaining items you can order direct at: www.expotools.com **TRADE ENQUIRIES WELCOMED.**
Expo Drills & Tools, Unit 6, The Salterns, TENBY SA70 7NJ. Tel: 01834 845150 (Mon to Fri 9am-5pm)

Albion Alloys - Precision Metals

We stock the entire Albion Alloys range of superb precision metals. Suitable for a large number of purposes. Please visit our website to view the sizes available - www.expotools.com



If you are interested in getting an Albion Alloys Stand please call us!

Expo HARD WIRE CUTTERS

Unique lever action reduces effort required by up to 60%!

Safety Lock

Hard Wire Cutters
Overall length: 190mm

CODE:75580

These superb quality side cutters feature a unique lever system that make substantial labour savings.

Price: £17.95

Expo
www.expotools.com

Code: 78090 Expo Professional 8pc Super Thin Combination Spanner Set

Superb Quality!



Locking method:

Sizes 4 - 9mm have both open ended and ring spanner, so can be used together to tighten nuts against each other (fig A)



8pc set contains sizes:
3.2, 4, 5, 5.5, 6, 7, 8, 9 and 10.
Sizes 4 - 9mm have both open ended and ring spanner.

Price: £14.95

Code: 77598 Large 110g 0.7mm Loctite Multicore Solder Roll

Ideal for all wiring applications in Model Railways, Model Cars, Model Boats etc.



Very Special Offer - while stocks last!

Price: £3.95

Expo 2017 Catalogue

Expo
www.expotools.com

2017 CATALOGUE

Free!

www.expotools.com

The new Expo 2017 Catalogue is now available. To get your free copy please visit your local model shop or order one online at www.expotools.com

Maidstone-engineering.com

PROMPT MAIL ORDER

Phone 01580 890066

info@maidstone-engineering.com



Copper Welded Boilers to order



16mm live steam



**B.M.S
Brass
Phos. Bronze
Copper
St. Steel
Gauge Plate
Silver Steel**

**C.I Bar
P.T.F.E
Nylon
Stainless Tube
Screws & Nuts
Studding
Rivets**

**Rivet Snaps
Drills
Reamers
Slot Drills
End Mills
Taps & Dies
Silver Solder**

**Flux
O Rings
Gauge Glass
Graphite Yarn
Jointing
Steam Oil
Cutting Oils**

Mike's WORKSHOP



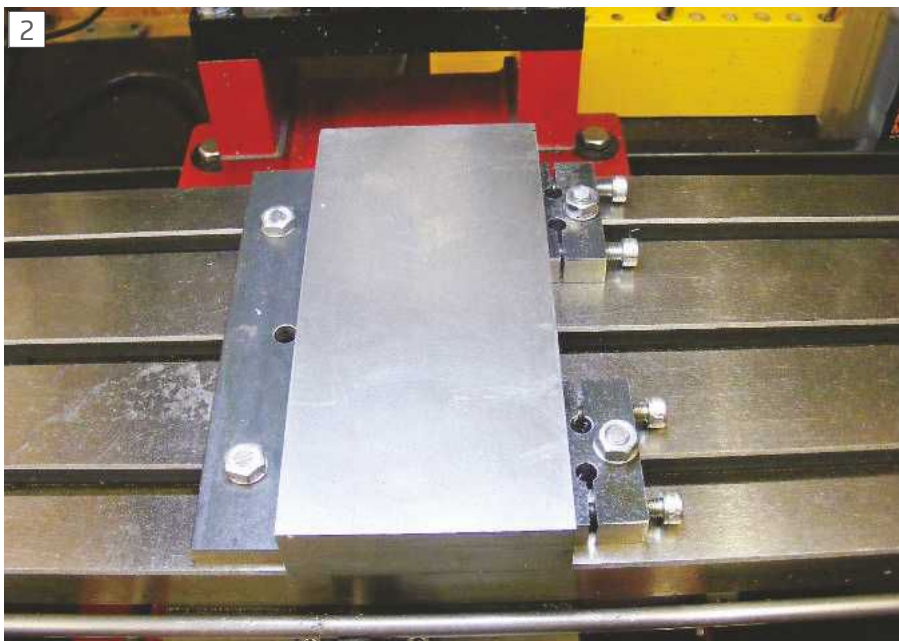
Low profile clamps for the mill table

This month Mike Cox describes an unusual but effective workholding device.

There are many kinds of clamps that can be used on the mill table to restrain the work piece during milling. The commonest is of course the milling vice. Vices are always restricted in size and not generally suitable for large work pieces. In this case the work piece can be clamped directly to the mill table. Most clamps clamp the work between the upper surface of the work and the mill table and such clamps must of necessity protrude above the upper surface. This is fine for making a slot because it is usually possible to arrange the clamps in position that are not in the way of the milling cutter. However, if, for example, it is required to fly cut the whole of the top surface then the clamps will be in the way.



The basic low profile clamp.



The clamp in use securing a large block of steel.

One way around this is to fly cut part of the surface with the clamps on another part and then move the clamps to the fly cut part and finish of the rest of the surface. This is a not always easy and there is scope for errors to occur. The way round this is to use low profile clamps to clamp the work by the edges. In this way the clamps do not interfere with a clear run of the cutter over the whole of the surface.

There are several designs of low profile clamp that have been published and several, by Harold Hall, have appeared in the pages of this magazine over the years. In this article I will introduce another style of low profile clamp. The advantage of this style of clamp is that it is very easy to make. They are attached to the mill table using a normal tee bolt or tee nut that puts little strain on the tee slots.

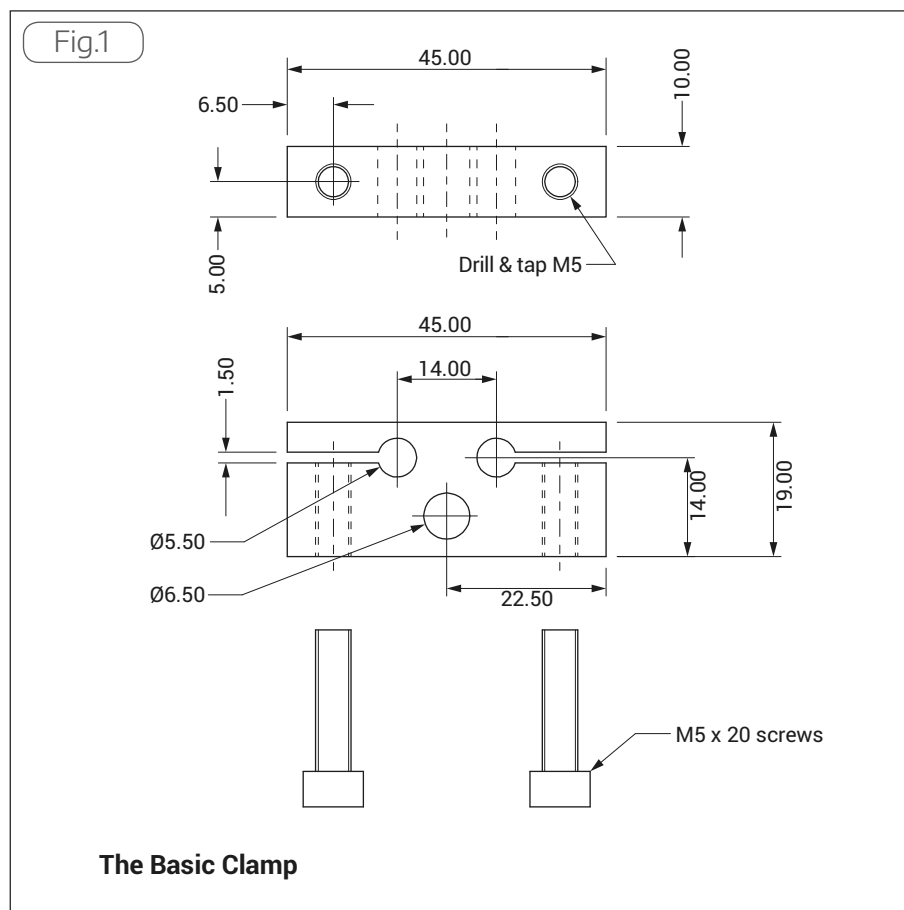
The basic design.

I made my first set of low profile clamps many years ago and they have been used frequently.

These clamps only work for clamping straight edges, but they are very simple to make and use.

I will illustrate the basic design by describing the construction of a clamp 10 mm thick, as shown in **photo 1**. The dimensions are given in **fig. 1**. The clamp was made from a piece of 10 mm thick steel that was cut out and milled on the edges to make a block 10 x 19 x 45 mm. The hole positions were marked out and drilled on the bench drill. The two slots were then cut using a 1.5 mm slitting saw in the mill. The final step was to tap the two holes for the M5 socket head screws. The tapping was carried out using a taper tap, followed by a second tap and a plug tap. The final step is to screw in the two M5 screws. If the screws will not screw in sufficiently because the hole is not threaded all the way through, then the end of the screw can be turned down.

Photograph 2 shows the clamps in use holding a large piece of steel. One edge of the work is supported against a fixed stop bolted firmly to the mill table. On the other side the low-profile clamps are butted up to the work and fixed firmly in position. The work is then clamped by tightening the socket head screws.



Some variations.

The basic clamp described above works very well but it does have some limitations.

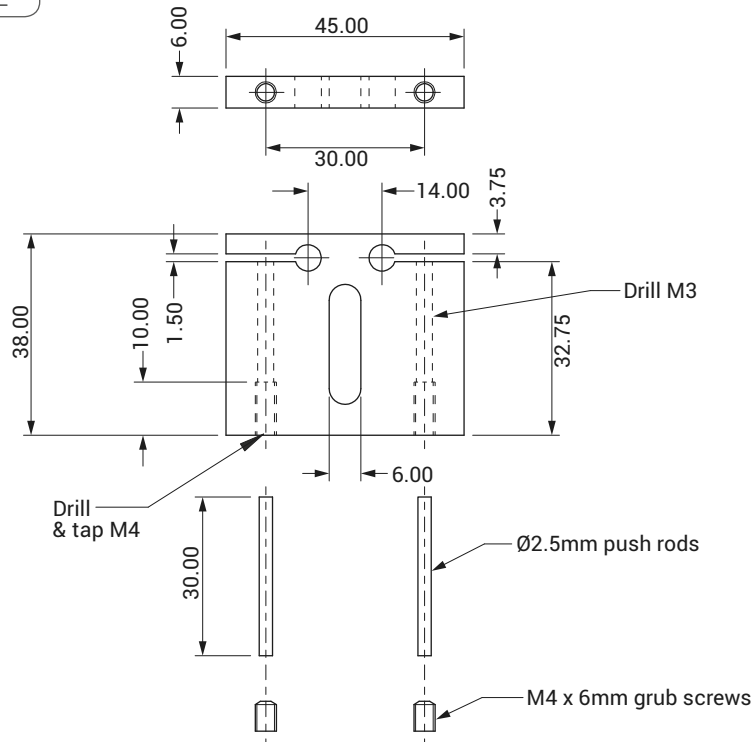
Firstly, the tee bolt and nut stick up above the top surface of the clamp. This does not usually limit machining the top

surface of an object, but it is a hazard because it is relatively easy to run the cutter into it whilst moving the table about. This can result in damaged cutters. For 10 mm thick clamps it is possible to counter bore the hole for the bolt that fixes the clamp to the mill table. This



A clamp with a recessed securing screw.

Fig.2



The Improved Clamp

is wider than the basic version and it has the slot rather than a hole for the fixing bolt. This enables it to be used parallel to the mill table tee slots, **photo 5**. Also note that because of the thinness of the clamp the clamping screws have been changed to M4 socket head grub screws.

The design of the new clamp is slightly modified, and the grub screws do not operate directly on the clamping pads but via two push rods, see **fig. 2** and **photo 6**.

Construction is straightforward and similar to the operations outlined above for the basic clamp. The only tricky operation is the drilling of the two deep holes for the push rods. This is best done in the mill with the spindle running at high speed, avoiding heavy pressure, using plenty of lubricant and pulling the drill out frequently to clear the flutes of the drill.

Conclusion.

These clamps only work for clamping straight edges, but they are very simple to make and use. The new style 6 mm clamp works well and has many advantages over the original basic clamp. It can be easily scaled up to make thicker clamps. ■

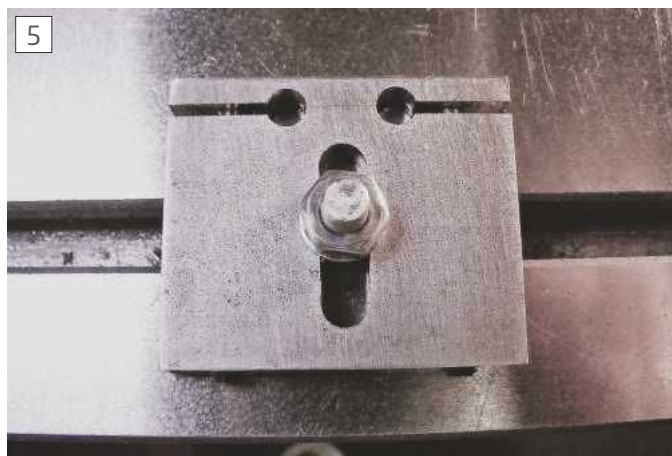
enables the use of a socket head screw and a tee nut to secure the clamp and then there is nothing protruding above the top surface of the clamp, **photo 3**.

Another problem with the basic clamp is that it can only be used at right angle to the tee slots on the mill table. This is because it is not wide enough to bridge the tee slot if placed parallel to the tee slot. The easy solution to this is to make the clamp wider. By making it wider it is also possible to use a slot rather than hole for the fixing screw. This allows greater freedom when positioning the clamp.

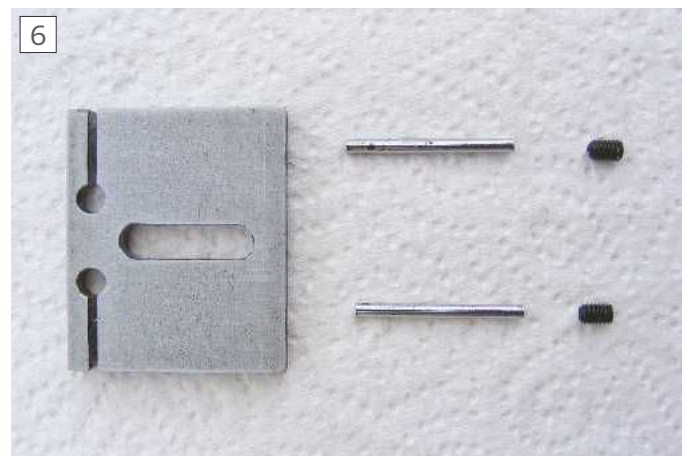
A further limitation of the basic clamp is that it is too thick for some jobs. I required a clamp that was only 6 mm thick for a specific job and a new clamp was designed to incorporate all the features discussed above, **photo 4**. This version



The 6 mm clamp.



The wider clamp with the slot can be used parallel with the tee slots.



The 6 mm clamp uses grub screws and push rods

Milling for beginners



PART 2 - SPINDLE TAPERS AND TAPER TOOLING

Sponsored by:
arceurotrade.co.uk
UNBEATABLE VALUE ENGINEERING PRODUCTS

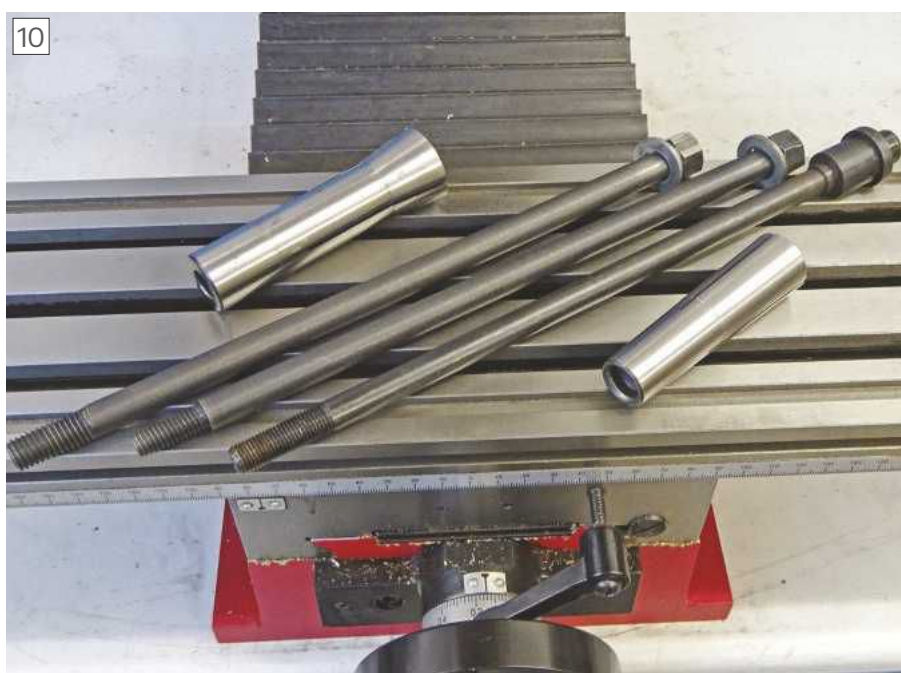
This new series will build into a complete guide to using a milling machine. This month Jason Ballamy starts right at the beginning by taking you on a tour of the new SX2.7 bench top Mill

Spindle Tapers

On the vast majority of milling machines different tooling is attached using a hollow taper inside the machine's spindle. Rarer exceptions include some very small mills, such as the XO, which use a male taper in combination with a securing screw to hold small chucks. This month I will look at the common types of spindle taper and the tooling used with them.

Morse taper

Up until fairly recently this was the type of taper you were most likely to find on the smaller bench top milling machines, usually in size 2 or 3. Being quite a shallow taper (around 3 degrees included angle) it is what is known as a self-locking taper so will stay in the spindle under vertical loads but side loads and intermittent cuts could loosen the taper. For this reason, milling tooling should be held into the taper socket using a drawbar, this is essentially a long bolt that bears against the top of the spindle and threads into the end of the tooling's taper. Depending on the age of the tooling



Taper tooling and selection of drawbars



R8 and Morse Taper collets

and also if it is metric or imperial you will find that the thread can vary between M12 and 3/8 Whitworth so you may need two drawbars, **photo 10**.

The taper tooling can be removed in one of two ways; if the machine is equipped with a self ejecting drawbar simply by undoing the bar which after a turn or two will apply downward force which will break the grip of the taper. If the machine is not so equipped the quill should be locked and the drawbar undone about 1 full turn, then with a copper faced hammer give a firm tap to the head of the drawbar and that should loosen the taper without excessive force. Try to avoid putting a cold tool into a warm machine as the heat will transfer to the tooling which will expand slightly and become tighter in the socket and will require a lot more force to eject.

R8 Taper

This has been used on larger turret mills, such as Bridgeports, for a number of years



End Mill Holders and Weldon shank cutter



ER Collet chucks and bearing nut

and is becoming a lot more common on the mid-sized hobby machines due to the fact it is a lot easier to remove the tooling from the spindle as the steeper taper (about 16.5 degrees included angle) is not self locking so just a gentle tap on the drawbar or less effort is needed on a self extraction bar to break the taper's grip. The R8 spec also includes a keyway which engages on a small stud inside the spindle that makes tightening easier as the tooling does not rotate as the drawbar is tightened, this is of most use if using R8 collets.

INT/ISO/DIN Tapers

These are more the domain of larger commercial machines but the smaller 30 size does crop up on one or two bench top sized machines. They have a notched flange which will take the drive as well as a taper and short parallel section for alignment. There are slight variations between the various types as to the notches, parallel section and method of retention so make sure you know the details of your particular machine as it is quite easy to pick up a bargain tool at a show and then find it is not quite right when you get it back to the workshop.

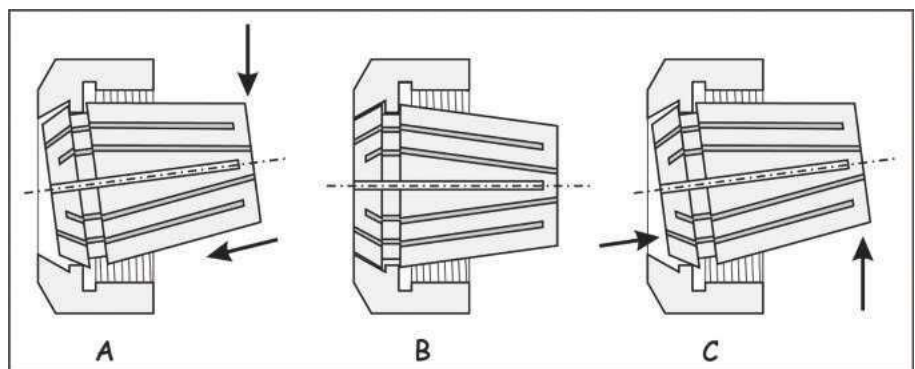
Interchangeability with the Lathe

As lathes also have Morse tapers in the head and tail stocks it is possible to use the same tooling between both machines, though I would not treat that as a major issue if choosing between a MT or R8 separate as you will find in time you acquire machine specific tooling for each machine or an adaptor can be employed for occasional use.

Tool Holding

Direct Fit/ Finger Collets

The simplest way to hold cutting tools is by using a collet that fits directly inside the mill's spindle which in most cases will be either Morse taper (MT) or R8. These are collets shaped to fit the relevant taper with several saw slots at the wider end and threaded at the other, so they can be drawn into the taper which will cause the wide end to close down onto the cutter. They only



Correct fitting and removal of ER collets

Inspecting the inside of an ER collet nut reveals an internal flange that has been machined eccentric to the main axis of the nut. This is not a machining error but is designed that way to lock onto the groove of the collet and aid its release from the chuck body.

For this feature to work properly, the collet must be mounted in the nut first before fitting the assembly into the chuck body. To mount the collet in the nut, insert it at an angle, turn slightly and push it into the nut until it clicks into place on the eccentric flange. The cutter may now be fitted and the assembly tightened hard into the chuck body.

To remove the cutter, slacken and undo the nut until resistance is felt. Then, using a collet wrench, further undo the nut until the collet is felt to release from the chuck body. Removal of the collet from the nut is the reverse of the mounting procedure.

hold items within a very small deviation of the nominal size so cannot be used to hold drills or imperial cutters in metric collets, so you will need a collet for each shank size you wish to hold. Their main advantage is the very minimal projection from the end of the spindle which can be used to advantage when room between table and head becomes a bit restricted and as the cutter is closer to the spindle bearings they give a very rigid holding method. There are a number of other collet systems often specific to a single manufacturer of machines or tooling which are too numerous to cover in this beginners' series, **photo 11**.

End Mill Holders

Also known as Weldon holders after the company that first put a flat on the shank of a cutter, these consist of a cylindrical

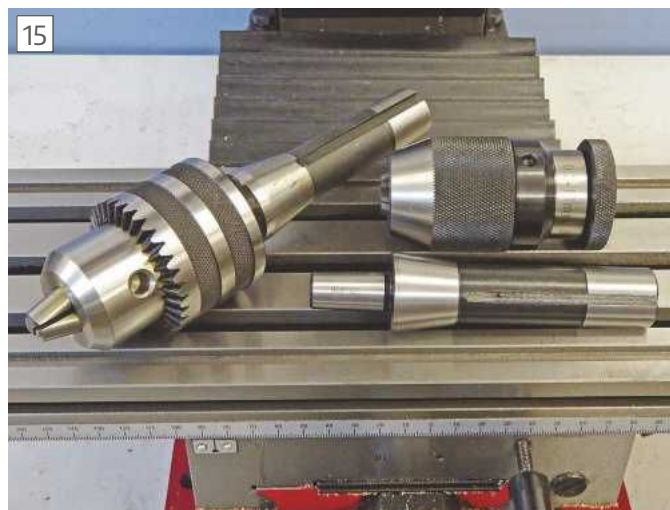
head on the end of a MT or R8 shank that is bored to take the common shank cutter diameters and has a threaded hole at right angles with a grub screw that bears against the flat on the cutter's shank. Like the direct collets these are one size only and should also only be used with cutters that have a flat on the shank so not ideal for screwed or plain shank ones though if pushed you could grind your own flat to get out of trouble. They do have the advantage of a smaller head diameter than some of the collet chucks which will allow access into smaller spaces and make seeing small cutters, that are sometimes obscured by a large collet nut or the machine's spindle, easier, **photo 12**.

Collet Chucks

The traditional collet chuck of choice was a "Clarkson Autolock" which used a collet



Typical ER starter set plus bearing nut



Drill chucks and drill chuck arbor

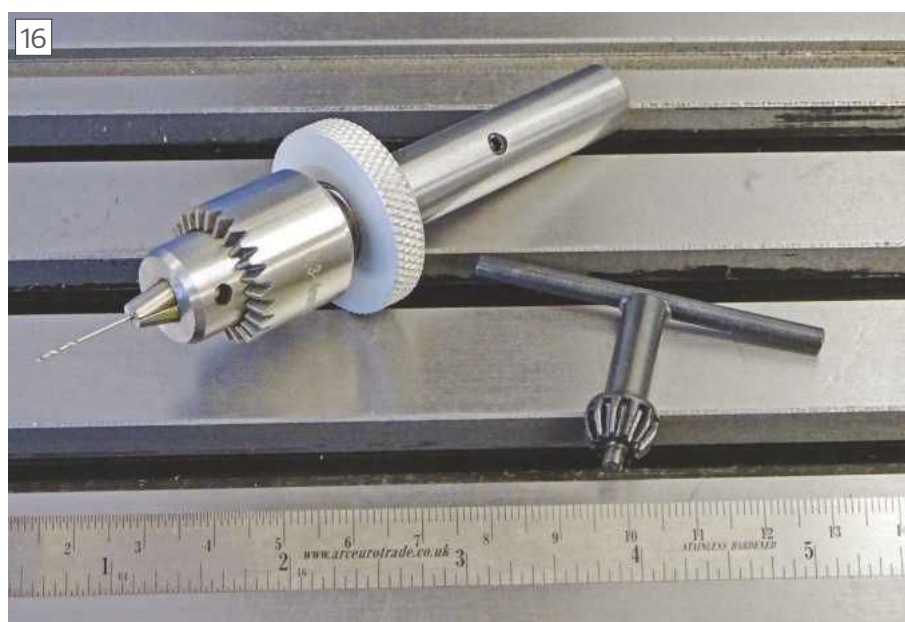
that was threaded at the upper end and when used with threaded shank cutters gave a very positive grip of the cutter which should it slip in the collet was pulled up tighter rather than pulled out of the chuck. As with the other types above these are one collet per shank size and you are limited to using threaded shank cutters.

The more versatile ER type collet chuck has seen a big increase in popularity both in industry and hobby use in the last 10 years or so. For our use it's biggest advantage is the fact that each collet will cover a range of sizes, mostly from nominal size down to 1mm less, or in the very small sizes from nominal down to 0.5mm less, which means they can be used for drills in incremental or fractional sizes and also for work holding with the right fixtures which we will look at later. The ER collets are slotted from both ends which allows full contact along the length of the tool giving a better grip than other collets, **photo 13**.

ER collet chucks come in a range of sizes from the very small ER11 to large ER50 sizes, the number indicates the diameter at the largest end of the main rear taper. As a general guide an ER 20 would be about right on a X1 size machine, ER 25 on a X2 and the ER 32 on a SX2.7 and SX3 mill. Purchasing the chuck with a basic range of six collets generally gives a saving over buying individually so it is a good way to start off and then additional collets can be added as and when required or when finances allow. I would also suggest that a ball bearing collet nut to suit the size holder is obtained at the same time as this makes tightening the nut a lot easier as less of your effort goes into overcoming friction between nut and collet, **photo 14**.

Drill Chucks

Surprisingly most new small mills are supplied with a drill chuck rather than a milling chuck, maybe it is due to the fact that a mill makes for a very accurate drilling machine when the X and Y axis dials or a DRO are used to position the holes. The supplied chucks are usually of the keyed variety and you may soon find that you



Micro Drill adaptor plus chuck

want to add a more convenient keyless one to your tooling collection. My personal preference is to have a slightly smaller 0.2-10mm keyless chuck as most of the time that suits the size of drills I use and the larger supplied chuck can be put to use for anything over that size.

Apart from some of the very expensive commercial chucks which have integral shanks you will need a drawbar type drill chuck arbor to mount your new chuck on, these have a suitable taper to fit your spindle on one end and a smaller taper to fit into the chuck body on the other. Your chosen chuck should specify the mounting taper either in the paperwork and/or on the actual chuck and is going to be a J or B followed by a number which signify the type of taper and its size. To mount the chuck on the arbor clean both mating surfaces then place the chuck onto the arbor's taper and with the chuck facing upwards bring the arbor down firmly onto your bench which will seat the taper. The chuck is generally left on its arbor for the rest of its life, but should the need arise

to separate the two then a pair of removal wedges should be used. These reduce the risk of bending or damage as they apply an even pressure behind the chuck, **photo 15**.

When using very small drills in the region of 1.0mm or less there is not a lot of feel back through the quill lever to indicate how the drill is progressing and breakages can result from applying too much pressure. One way to avoid this is to use a more sensitive drilling attachment or a micro drill adaptor which still uses the mill's spindle to rotate the drill but the up and down movement is achieved with finger and thumb around a knurled ring giving a lot more feedback to how the drill is cutting, **photo 16**.

Boring Heads

These consist of a two-part head where the halves are joined by a dovetail and a fine adjustment screw allows one half to move relative to the other. Therefore, by placing a cutting tool in the lower moving half of the head it is possible to alter the diameter of the circle the cutting tip is swinging at



Boring head set



Stub milling Arbor and Flycutter

which allows any size hole to be cut within the range of the head and its cutters. These heads are usually sold in a set complete with some cutters which can vary from HSS to Brazed carbide tipped through to holders that in turn take smaller HSS tool bits. Indexable insert holders are also available, **photo 17.**

As well as forming holes boring heads can also be used to machine curved surfaces such as the underside of a chimney saddle or shape the end of a tube so it will join another neatly. They will also "turn" the outside of a round item with a suitably shaped tool, don't be tempted to use one of the supplied tools for this by running the machine in reverse, as most of the small heads are only screwed onto their arbors and could come undone.

Boring and Facing Heads

These are basically a larger version of a boring head but with the added feature of being able to advance or retract the tool as

the head rotates which allows for machining large items that may not fit into a lathe.

Stub Milling Arbors

These are used to hold such things as slitting saws and gear cutters. The tapered or straight mounting shank has a parallel arbor sized to suit common cutter bores, a series of spacer rings allow for different thicknesses of cutter to be accommodated as well as their position along the length of the arbor to be adjusted. It is also possible to gang up cutters with suitable spacers between which is useful for things like cutting cooling fins. The tooling and spacers are retained on the arbor by either a nut or a screw at the end, the screwed type can be useful when using slitting saws to cut work standing vertically out of the milling vice as it allows the saw to get closer to the vice jaws which in turn means less unsupported work sticking out of the vice. Much like the boring heads don't be tempted to run these arbors in reverse

as it may loosen the retaining nut/screw, **photo 18.**

Fly Cutters

It's a bit debatable – is this a cutting tool or tool holder? As they hold a HSS or insert tool I will include them here. The fly cutter is a very useful and economic tool for metal removal particularly when working on large surfaces and is capable of giving a very fine finish. The large head on the end of the shank is cut across at an angle and slotted to take the square shank of a tool, the larger ones having an offset head to counteract any imbalance. An HSS toolbit can quickly be touched up with a diamond stone to or reground with a basic bench grinder to give a sharp cutting edge many times over so keeping tooling costs down.

Shell Mill Arbors

Probably not used that much on the smaller machines but as the name suggests they are used to hold large diameter shell mills and will also take the more modern indexable face milling cutters. The load is transferred to the cutter by two lugs on opposite sides of the holder and a central screw keeps it in place, **photo 19.**

Do keep all spindle sockets and tooling tapers clean as any swarf will throw things out and can get stuck to one of the surfaces and can go unseen particularly if stuck in the socket. Also avoid having your tooling rolling about on a cluttered bench, small dents and bruises will raise a burr that will stop the taper engaging accurately. Either make or buy a rack with a series of holes in it or use a draw with suitable dividers to keep each item in. ■



Shell mill and arbor

For a full list and links to the items featured which are available from Arc Euro Trade, <http://www.arceurotrade.co.uk>, who also sell the X series of mills see the accompanying thread on Model Engineer Forum <http://www.model-engineer.co.uk/forums/postings.asp?th=131318>

Quadrilla

Michael Belfer 'improves his relationship with drills'

Quadrilla has helped me resolve the love-hate relationship I have had with drills – both the bits and the devices, for around 60 years. That was when my grandfather gave me a three-fold present. A small hand-drill, a flat blade screw driver, and my first beginner's Meccano set. Together these ignited my life-long passion for engineering – designing and making things, anyway.

I love drilling because it always seems the easiest of the machining tasks and gets the quickest results with the lowest chance of messing the work up. What I equally hate, on the other hand, is the ease with which those who can free-hand grind the bits when their edges dull, somehow magically produce equal angled sides, of equal length. Try as I could, I could never achieve this, and trying multiple different drill grinding tools and attachments has improved my results, but not brilliantly so.

So my approach was to accumulate lots of bits so I could usually lay hands on one. Initially, I had only a small round stand for 1/16" to 1/4" bits. This wasn't too demanding on storage, but move on a few decades and we are talking about including Numbers 1-60, fractions to 1/2", letters, and eventually, metric from 1mm to 13mm in 0.5



Completed Quadrilla mounted on my drill Press



Storage for bulk drill bits, hex keys, and other items

mm steps about 125 sizes, if my arithmetic is correct. (Although I could never fathom why sizes A and E, having exact fractional equivalents, were ever included).

By and large, my sloppy habit of drill and drop – on the bench, the drill press table, or into a box "to be sorted and/or ground eventually" drove me to the arrangement seen in **photo 1**, together with 4 drill indexes which together take up a sizeable amount of bench surface, as well as inviting themselves to be knocked over and requiring the picking up, sorting, and

replacing of their contents – not a trivial task with the smaller sizes.

Enter Quadrilla

Quite a few years ago I partially improved this situation with a rotating mount for the fractionals drill index, mounted off the side of the drill press at eye level (my drill press is bench mounted) and tilted forward to allow reading the sizes off the drill index and much more often returning the bit to its rightful place. (It was positioned and oriented in much the same place as

my current solution, the Quadrilla, seen installed and mostly populated in **photo 2**). This original rotating Fractions drill index still left the numbers, letters, and metric drill indexes occupying bench space with irksome access, however.

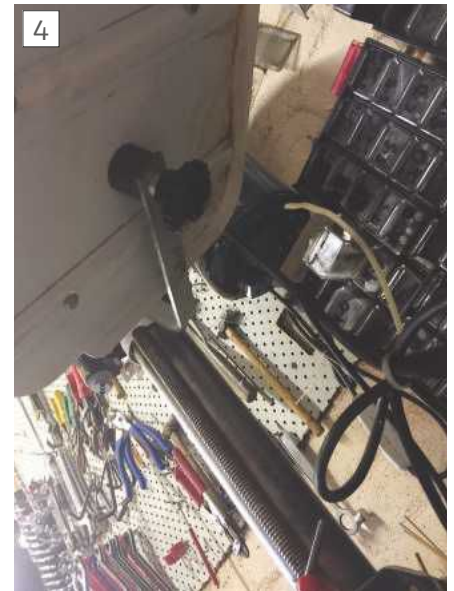
I found a light but rigid (due to pressed-down edging) piece of enamelled steel about 11" square by the roadside (placed there for recycling, no doubt) with rounded corners, seen in **Photos 3, 4 and 5**. It gave me the idea of checking my four drill indexes for easy placement around what I now thought of as a base plate. The Quadrilla concept was born – centres and outlines were marked on the base plate, together with measurements of the drill index centre holes, height above base and diameter, **photo 5**.

Clamping column

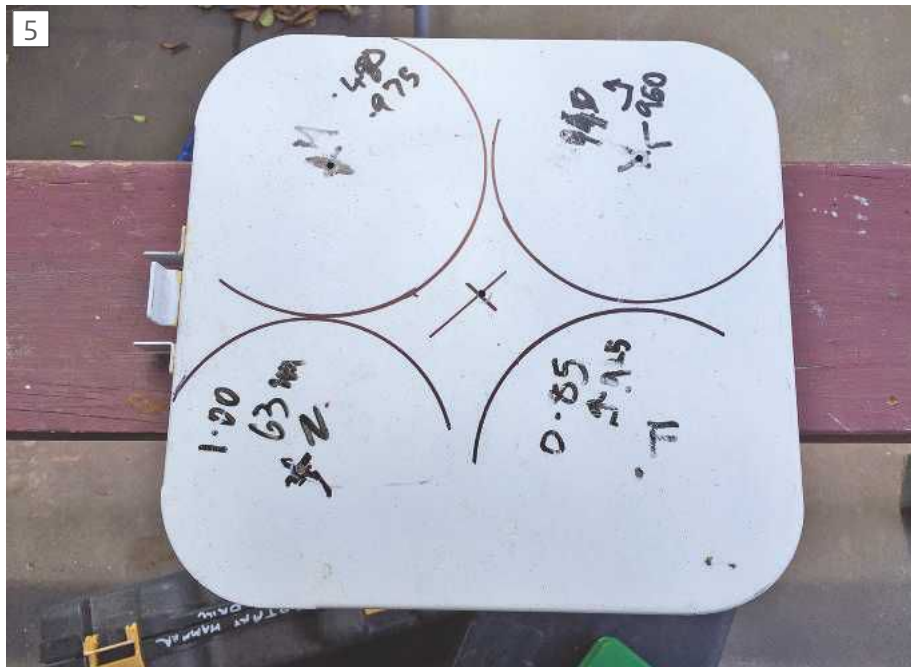
Photograph 7 shows the clamping column, topped by one of the four knobs liberated from roadside furniture a long time earlier, "just in case". This type has a hex socket moulded in, that conveniently captures the head of a hex 5/16" Whitworth (in my case) bolt that extends down through the outer tubing of the clamping column to screw into a cylinder nut drilled and tapped through 5/16 Whitworth. The disassembled parts of the clamping column can be seen in **photo 6**, noting that the wooden plug is just to keep all the parts radially aligned, and the shoulder on the nut is a free running fit in the drill index centre hole, but a little less in height than the thickness of the drill index plate surrounding its centre hole. **Photograph 8** shows trial assembly of two drill indexes onto the base plate, to check position, clearance at bottom, free turning when unclamped, and being held firmly when clamped by just a quarter turn of the knob. This had to be done for each clamping column as finished, because Murphy dictates that all drill indexes will have different dimensions,



Underneath view of Quadrilla Baseplate



And again, showing drill press column



Baseplate marked for drill index positions and dimensions



Components of a clamping column – Clamping Column

of course. The cylinder nuts are at this stage already fastened to the base plate by short 5/16 Whitworth bolts, the heads of which are visible in photo 3, the underside of the baseplate. A washer trimmed to the outside diameter of the clamping column tube pushes down on the tube as the knob is turned, so that the drill index is clamped between the tube bottom and the baseplate.

The column height obviously determines how far down amongst the drills the hand has to reach for the clamp/unclamp action and I chose mine also to allow the use of standard length bolts readily to hand, allowing about 3 turns of engagement into the cylinder nut. The wooden plugs were bits of old broom handle.

There is no precision required in any of the dimensions other than the shoulder of the cylinder nut which must not be higher

than drill index material thickness at its centre or the drill index will just spin and not be able to be clamped.

Mounting on the drill Press

A simple bent strap of steel is held to the column by means of standard plumbing fittings, and the degree of baseplate tilt can be adjusted by a wing nut on the clamp. This is just obscured by the drill spindle in **photo 9**, from which it can possibly be guessed that the drill press feed handle will interfere with the drill tops while turning – if I find this too irritating I will swing the whole fixture around to the left of the drill press column from its current position on the right, no rework other than loosening and tightening should be required.

The underside baseplate views, photos 3 and 4, show the slightly different knob (same source) used for baseplate clamp/

Quadrilla is a tool that has given me much satisfaction in being a useful addition to my workshop...

unclamp. Besides being larger it has a moulded-in stud of I think 1/2W rather than the captive bolt head arrangement, this is more suitable for something that spends all its life upside-down. It clamps the supporting strap against a blob of metal made into a big brother of the clamping column cylinder nuts, tapped right through to suit this knob's thread, of course. From on top, the head of the short bolt attaching it to the baseplate is seen in **photo 10**. To prevent the blob working loose over time, aided by vibration, a 1/4" Whitworth bolt was fixed as a key through to the blob, seen with its hex abutting the larger bolt head hex as an additional but probably unnecessary action.

The Name

Obviously, Quadrilla came about as a



Trial assembly of one drill index and CC

method to manage four drill indexes, and its name describes this. But the arrangement that resulted, with the four in orbit at the corners of a square and each rotating in its corner, reminded me very much of four couples dancing, each in its own circle, in a corner of the square they slowly revolved around. This dance, seen often in period dramas from the 19th and earlier centuries, is called a Quadrille, and so I felt justified in borrowing the term in naming Quadrilla.

Incidentals

It may seem that in use, it would be convenient to adjust each drill index clamping knob to a level of friction that allows the drill index to just be turned and leave it like that. Two things rule this out. One is that various friction forces tend to tighten and untighten the knob at inconvenient times if left only partially. The unbalanced weights of the drills around the index, together with vibration if any, will move around (dare I say dance?) so as to deposit the largest sizes facing towards the bottom of the baseplate tilt. This is not always convenient, but don't ask me how I know!

The keen sighted may notice that some of the metric drills have been deposited upside down in their index. This is because my metric drills above 10mm have reduced shank diameters, and a set of plastic plugs to match these diameters to



Jostling for position



Another view of Quadrilla as currently installed

the index holes lies awaiting attention in my bucket of Round Tuits. Also, the trial assembly staged in photo 7 was mistakenly taken with the numbers clamping column on the Letters drill index, obviously the numbers clamping column is the one with shortest required column height. Oops.

Conclusion

Quadrilla is a tool that has given me much satisfaction in being a useful addition to my workshop that also helps with storage and space, those perennial foes. It has functioned exactly as first envisaged, and even better, was made almost entirely from recycled and/or liberated materials. I hope I may inspire any other home machinists wanting to tame their drill storage and access problems to do something similar. It was simple to construct, which took probably less time than writing it up. ■



All in place

BRITAIN'S FAVOURITE PHASE CONVERTERS...

CE marked and EMC compliant

THE ONLY PHASE CONVERTER MANUFACTURED IN BRITAIN TO ISO9001:2008

by **POWER CAPACITORS LTD**
30 Redfern Road,
Birmingham
B11 2BH

Transwave®

CONVERTERS

SUPPLYING THE WOODWORKER & MODEL ENGINEER SINCE 1984

POWER CAPACITORS LTD
30 Redfern Road,
Birmingham
B11 2BH

STATIC CONVERTERS from £342 inc VAT

3-YEAR WARRANTY/MONEY-BACK GUARANTEE

240-volt 1-phase input, 415-volt 3-phase output. Single or multi-motor operation via socket/plug or distribution board. Eight sizes from 1.1kW/1.5hp to 11kW/15hp.

Ideal solution for "one machine at a time" environments. Output retrofits directly to existing machine wiring loom so no modification to machine necessary. Manual power adjustment via switch using voltmeter as guide.

Transwave
CONVERTERS



JAGUAR CUB INVERTERS from £196 inc VAT

5-YEAR WARRANTY/MONEY-BACK GUARANTEE

240-volt 1-phase input, 240-volt 3-phase output (i.e. dual voltage motor required). SOFT START-STOP, SPEED CONTROL, BRAKING, MOTOR PROTECTION and JOG FUNCTIONS. Simplified torque vector control giving enhanced performance at low RPM. Four sizes from 0.4kW/0.5hp to 2.2kW/3hp.

IMO

JAGUAR VXR INVERTERS from £296 inc VAT

5-YEAR WARRANTY/MONEY-BACK GUARANTEE

240-volt 1-phase input, 240-volt 3-phase output (i.e. dual voltage motor required). SOFT START-STOP, SPEED CONTROL, BRAKING, MOTOR PROTECTION and JOG FUNCTIONS.

Advanced vector control giving optimum performance at low RPM. Four sizes from 0.4kW/0.5hp to 2.2kW/3hp.

IMO



ROTARY CONVERTERS from £539 inc VAT

3-YEAR WARRANTY/MONEY-BACK GUARANTEE

240-volt 1-phase input, 415-volt 3-phase output. Single or multi-motor operation via socket/plug or distribution board.

Eleven sizes from 1.1kW/1.5hp to 22kW/30hp. Ideal solution for multi-operator environments or where fully automated "hands-free" operation is required

irrespective of demand. Output retrofits directly to existing machine wiring loom so no modification to machine necessary. Some sizes suitable for welding applications.

Transwave
CONVERTERS



REMOTE CONTROL STATION £74 inc VAT

2-YEAR WARRANTY/MONEY-BACK GUARANTEE

Suitable for all IMO inverters, this remote pendant allows you to access the software of the inverter remotely, bypassing the buttons on the inverter itself. START, STOP, FORWARD, REVERSE, RUN, JOG, SPEED POTENTIOMETER. NO-VOLT RELEASE safety feature and two metre length of 7-core flex as standard.



Transwave
CONVERTERS

NEW iDrive2 INVERTERS from £142 inc VAT

2-YEAR WARRANTY/MONEY-BACK GUARANTEE

240-volt 1-phase input, 240-volt 3-phase output (i.e. dual voltage motor required). SOFT START-STOP, SPEED CONTROL, BRAKING, MOTOR PROTECTION and JOG FUNCTIONS.

Low-Cost, general purpose simplified torque vector control. Entry level performance suitable for the majority of applications. Four sizes available from 0.4kW/0.5hp to 2.2kW/3hp.

IMO



CONVERTERS MADE IN BRITAIN SINCE 1984; 3-YEAR WARRANTY ON ALL CONVERTER PRODUCTS; BS EN 9001:2008 QUALITY ASSURED MANUFACTURING ENVIRONMENT; CE MARKED PRODUCTS COMPLIANT WITH EMC REGULATIONS, THE LOW VOLTAGE DIRECTIVE and BS EN ISO 61000-3-2:2006.

Inverter-Metric Motor-RCS packages from £253 inc VAT • Imperial Packages from £339 inc VAT



Ideal for Myford & Boffa lathes



Metric Motors from £48 including VAT



Imperial Motors from £149 including VAT



NO SURCHARGE FOR DEBIT & CREDIT CARD PAYMENTS

FREEPHONE 0800 035 2027 or 0121 708 4522

transwave@powercapacitors.co.uk • www.transwaveconverters.co.uk



Mounting Items on a Faceplate

Andy Johnston makes an awkward task easy for you.



View of complete gadget mounted in vice



Two lengths of angle iron welded together



Centring an item using a dial gauge

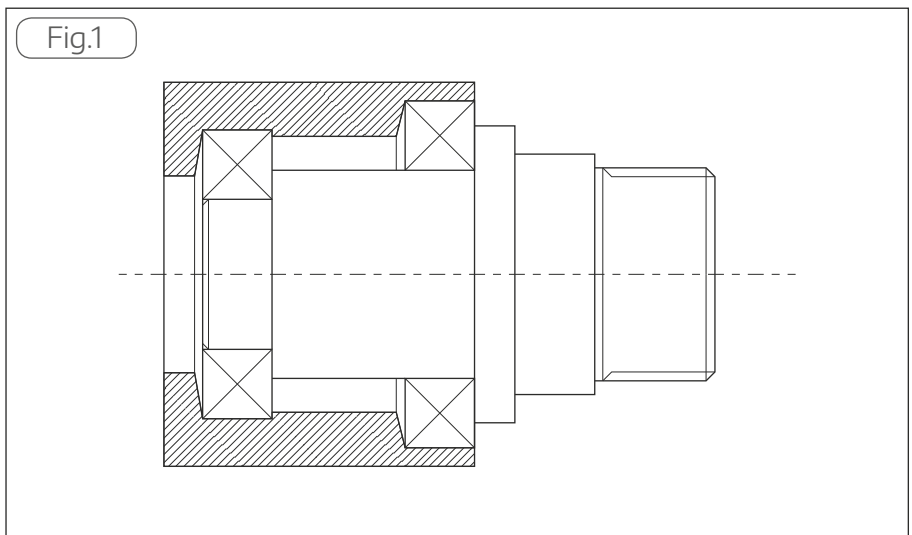


Centring to a centre pop mark with a scribing block

It is always awkward trying to mount items on a faceplate, we don't have enough hands, and is especially difficult when trying to centralise an item be it cylindrical, a bore or to a centre punch mark, **photo 1**.

The base for my gadget was sourced from some lengths of angle iron from an old iron-framed bedstead welded back-to-back with a revolving shaft mounted in a housing which is bolted to the base, **photo 2**. I used four small socket head bolts screwed into the bottom of the housing.

The shaft has a nosepiece turned to suit your faceplate, mine is for a Myford ML7R. There are two ball bearings mounted on the shaft which are a close fit in the housing. There is a hole drilled right through the housing and the shaft between the ball bearings for a locking shaft.



Sketch of housing and spindle (Uncropped)



Setting up for balancing the faceplate



Weight added

A workpiece is clamped in place and can be perfectly centred using a dial gauge. In this case it is a previously machined bore which was being centralised, **photo 3**. It could be an item which required centring on a centre pop and a scribing block can be used for this, **photo 4**.

Static balancing anything on a faceplate is now very easily done by turning the gadget upright, **photo 5**. Suitable weights can be added to balance the mass or at least reduce the out of balance forces, in this example the small weight is to the fore in **photo 6**.

Figure 1 is only what I can remember of the internals of the shaft and housing as I made it up as I went along about 30 years ago. The only thing holding the assembly together is Loctite Bearing Assembly Fluid on the top outer bearing raceway.

Odd items in a four-jaw chuck could also be set up with this gadget, the final accuracy being carried out once transferred to the lathe. I've used it extensively since it was made and wouldn't be without it. ■

Simple Cutters for Clock Pinions and Wheels

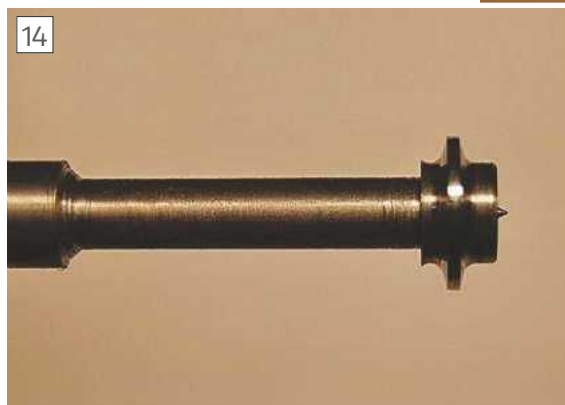


Ted Knight - Part 2

Bring back the cross slide by distance Y, the pinion tooth height. This is the position for the final cut when the form tool feed is inwards. Then, without moving the top slide, use the cross slide for the feed and saddle movement for the cut, **photo 13**. Polish the flanks to take out any tool marks and break the sharp corners. Then reduce the shank diameter to about 5 mm, **photo 14**. I reduce the shank diameter because less heat is needed for the hardening process. This is also a good time to make a hardwood copy for polishing the pinions.



Cut for final tooth height



Reduce shank diameter

Next, we cut the teeth. I use a slitting saw in the mill to cut the teeth, **photo 15**. How many teeth you have is decided by the space needed between them for sharpening. I find that six or eight teeth give the best space. With the piece set up in the mill set the bottom surface of the saw blade on centre height using the previously turned centre cone as a guide, **photo 16**. To make the rake angle, lower the saw by a small amount. If you lower it by ten percent of the tooth height, Y in **table 3**, the angle will be close to six degrees. Take the first cut to form the pinion cutting surface then index around for the remaining teeth, **photo 17**. Lower the saw to cut the backs of the teeth. A straight edge resting on the saw will help guide for the best position, **photo 18**. Then take out the waste between, **photo 19**. Clean up, and de-burr ready for

backing off, hardening and final sharpening, **photo 20**. To cut the back-off I take a file and remove the sides and top at the back of each tooth. Leave a very small land at the back and sides of each tooth. Sharpening after, hardening, is to cut away with a diamond flat or oilstone at the cutting surface until the small land is cleared.

Making the wheel cutter.

Making the wheel cutter is very similar so I will only mention the differences.

The radius of the wheel teeth is different from that for the pinions, so a new form tool is needed, **table 4**. Set this form tool at an angle from the new cutter blank and cut the left flank, taking it into the shank making a semi-circle, as before. Next, cut another semi-circle, at exactly the same depth, to the left of the first, **photo 21**. This will be the datum for the



Cut the teeth

Table 1 – Module Numbers and Drill Sizes

Module	Drill Size	Diameter
0.20	0.3	0.42
0.25	0.4	0.53
0.30	0.5	0.63
0.35	0.6	0.74
0.40	0.7	0.84
0.45	0.7	0.95
0.50	0.9	1.05
0.55	1.0	1.16
0.60	1.1	1.26
0.65	1.1	1.37
0.70	1.2	1.47
0.75	1.2	1.58
0.80	1.2	1.68
0.85	1.3	1.79
0.90	1.4	1.89
0.95	1.5	2.00
1.00	1.6	2.10

Table 2 – Cutter Blank Sizes

Module	A	B
0.20	0.9	0.6
0.25	1.2	0.8
0.30	1.5	1.0
0.35	1.7	1.1
0.40	2.0	1.3
0.45	2.2	1.4
0.50	2.4	1.6
0.55	2.7	1.8
0.60	2.9	1.9
0.65	3.2	2.1
0.70	3.4	2.2
0.75	3.7	2.4
0.80	3.9	2.6
0.85	4.1	2.7
0.90	4.4	2.9
0.95	4.6	3.0
1.00	4.9	3.2

form tool when it is re-set for the right flank and must be an exact distance from the first. Set the form tool angled for the right flank into the new datum, **photo 22**. Do not move the top slide. Note the cross-slide position, this will be where the right hand cut finishes. Move the saddle to the right, first by the distance from the datum to the left flank and then by the distance P in table 4 to bring the tool to the final position for cutting the right flank. With the



Saw blade on centre height



The first cut



Straight edge guide.



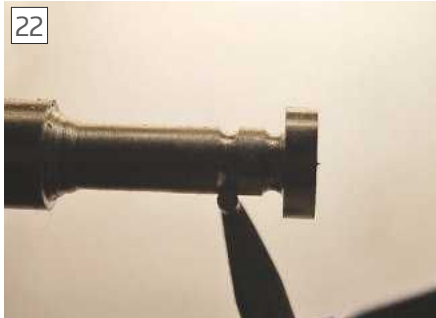
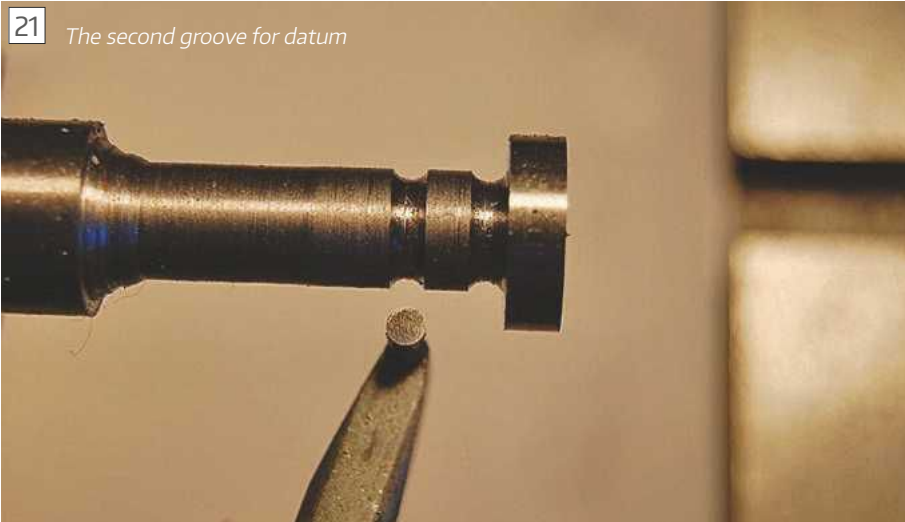
The waste removed.



Start backing off

right flank completed, **photo 23**, withdraw the tool from the final position by distance Q, the tooth height, in table 4. This is the

position of the form tool to bring the wheel cutter to the correct tooth height. For the rest of this wheel cutter, follow on in the



Form tool angled for the right flank

Table 3 – Pinion details

Module slide angle	Number of Leaves	X	Y	Top
0.20	6	0.77	0.41	70
0.20	7	0.79	0.45	73
0.20	8	0.80	0.48	75
0.20	10	0.81	0.52	78
0.25	6	0.97	0.51	70
0.25	7	0.99	0.56	73
0.25	8	1.00	0.60	75
0.25	10	1.02	0.65	78
0.30	6	1.16	0.62	70
0.30	7	1.18	0.67	73
0.30	8	1.20	0.71	75
0.30	10	1.22	0.78	78
0.35	6	1.35	0.72	70
0.35	7	1.38	0.78	73
0.35	8	1.40	0.83	75
0.35	10	1.43	0.91	78
0.40	6	1.55	0.82	70
0.40	7	1.58	0.89	73
0.40	8	1.60	0.95	75
0.40	10	1.63	1.04	78
0.45	6	1.74	0.92	70
0.45	7	1.78	1.00	73
0.45	8	1.80	1.07	75
0.45	10	1.83	1.17	78
0.50	6	1.93	1.03	70
0.50	7	1.97	1.11	73
0.50	8	2.00	1.19	75
0.50	10	2.04	1.30	78
0.55	6	2.12	1.13	70
0.55	7	2.17	1.23	73
0.55	8	2.20	1.31	75
0.55	10	2.24	1.43	78
0.60	6	2.32	1.23	70
0.60	7	2.37	1.34	73
0.60	8	2.40	1.43	75
0.60	10	2.44	1.56	78
0.65	6	2.51	1.34	70
0.65	7	2.57	1.45	73
0.65	8	2.60	1.55	75
0.65	10	2.65	1.69	78
0.70	6	2.70	1.44	70
0.70	7	2.76	1.56	73
0.70	8	2.80	1.67	75
0.70	10	2.85	1.82	78
0.75	6	2.90	1.54	70
0.75	7	2.96	1.67	73
0.75	8	3.00	1.79	75
0.75	10	3.05	1.96	78
0.80	6	3.09	1.64	70
0.80	7	3.16	1.78	73
0.80	8	3.20	1.91	75
0.80	10	3.26	2.09	78
0.85	6	3.28	1.75	70
0.85	7	3.36	1.90	73
0.85	8	3.40	2.03	75
0.85	10	3.46	2.22	78
0.90	6	3.48	1.85	70
0.90	7	3.55	2.01	73
0.90	8	3.60	2.14	75
0.90	10	3.66	2.35	78
0.95	6	3.67	1.95	70
0.95	7	3.75	2.12	73
0.95	8	3.80	2.26	75
0.95	10	3.87	2.48	78
1.00	6	3.86	2.06	70
1.00	7	3.95	2.23	73
1.00	8	4.01	2.38	75
1.00	10	4.07	2.61	78

*The right flank completed*

same way as for the pinion cutter except for cutting the teeth. Because this will be cutting brass there is no need for rake angle on the cutting face. Keep the slitting saw at centre height photo 16.

Using your cutters

The form tool will be very fragile in the smaller sizes. It will break if set slightly above centre height.

When you are making your pinion blank, remember to put a small cylinder on the end with a diameter the same as the cutter tooth width for easy centring. Finally, **photo 24** shows how things can go wrong. The pinion cutter snapped at the shank because I foolishly put a sharp corner at the junction between shank and body thus making a stress raiser. The pinion with the bent leaf or tooth was because I was too hasty when parting off. ■

*And finally.***Table 4 – Wheel Details**

Module	Drill size	Form Tool D	P	Q
0.2	0.47	0.63	0.94	0.63
0.25	0.59	0.79	1.18	0.79
0.3	0.71	0.94	1.41	0.94
0.35	0.82	1.10	1.65	1.10
0.4	0.94	1.26	1.88	1.26
0.45	1.06	1.41	2.12	1.41
0.5	1.18	1.57	2.36	1.57
0.55	1.30	1.73	2.59	1.73
0.6	1.41	1.88	2.83	1.88
0.65	1.53	2.04	3.06	2.04
0.7	1.65	2.20	3.30	2.20
0.75	1.77	2.36	3.53	2.36
0.8	1.88	2.51	3.77	2.51
0.85	2.0	2.67	4.00	2.67
0.9	2.1	2.83	4.24	2.83
0.95	2.2	2.98	4.47	2.98
1	2.4	3.14	4.71	3.14

Super Detailing Parts

A selection from our growing range..



LMS Tender
Axlebox Covers
7 1/4" g. £13.85 ea



BR/LMS Loco buffer
Step & plate kit
7 1/4" g 18.50



7 1/4 g. Timken covers, stainless
£6.50 ea

Lost wax cast Brass
Diesel Buffer Beam Detailing Kit



5" g. £37.00
7 1/4" g. 54.00

7 1/4" g. Steam Heat / Carriage Warming
Valve & Hose £14.96 ea



7 1/4" g. £18.50 ea

More 5" g. parts in
development

7 1/4" g. Locomotive Lamp Irons
- Angled or Straight
£19.95 set



Email: sales@17d-miniatures.co.uk

Phone: 01629 825070

Prices shown excluding VAT



MINIATURES

MINIATURE RAILWAY SPECIALISTS
LOCOMOTIVES, ROLLING STOCK, COMPONENTS
CNC MACHINING SERVICES

www.17d-miniatures.co.uk

17D Miniatures, Units 12 & 13 Via Gellia Mill, Bonsall, Matlock, Derbyshire, DE4 2AJ



NEW!

**BROWN & MAY 4" SCALE
AGRICULTURAL TRACTION ENGINE
HIGH DETAIL DRAWINGS USING
WORKS ORIGINALS**

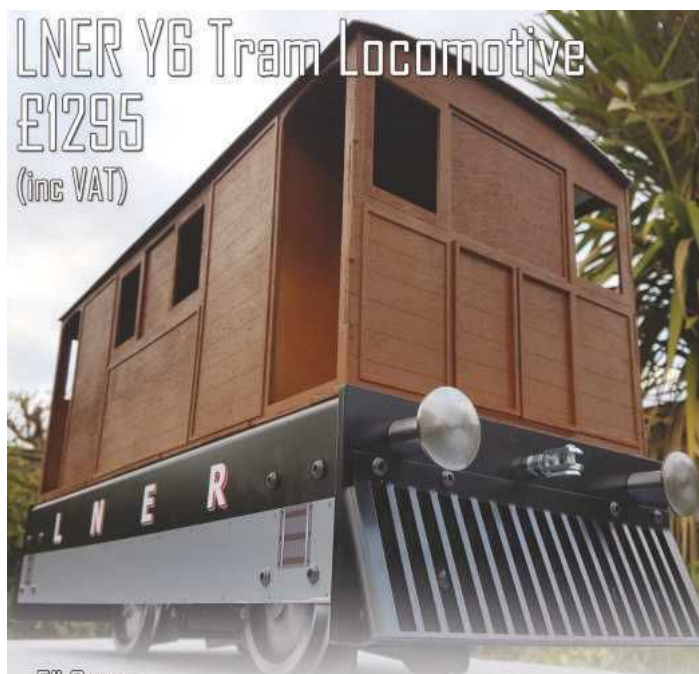
Drawings, laser cut parts, castings
and materials now available.

Contact Yorkshire Model Engineer Supplies
for further information.

Tel: 01482 786 534

**Or visit our website:
brownandmayminiaturete.co.uk**

LNER Y6 Tram Locomotive
£1295
(inc VAT)



5" Gauge
26" long, 15" high and 11" wide.
Laser cut exterior grade plywood body
Powder coated chassis, and cowcatchers
LNER graphics (alternatives available)
Sprung buffers
Digital speed control



01704 546 957 / www.phoenixlocos.com

Scribe a line

YOUR CHANCE TO TALK TO US!

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

SMEE Courses

Dear Neil, congratulations on your new articles on lathe work for beginners. I'm sure they'll help many entering "the hobby" for the first time. Buying a lathe is a daunting task, and starting to use one a fascinating experience but many successful model engineers have started with very little previous knowledge.

At SMEE we've recognised that though many would like to make better models and develop engineering skills they haven't had training to make it possible. Few schools now teach the workshop skills once commonplace. Evening classes are hard to find.

So once again we're running courses to help newcomers start model engineering. Our Basic Training course starts in February 2018. Here experienced model makers discuss setting up a workshop, desirable equipment, and basics of using machines and hand tools. In fact, we'll be demonstrating using a Sieg lathe from Arc Euro Trade very similar to that in your article.

Each day session consists of lectures, discussion and demonstrations. All are held at the Society's base in South London with its meeting room, library and well-equipped workshop. We've had people come from as far as Doncaster and Dublin to join classes and participants have been very satisfied with training, going on to make interesting models or tooling, plus restoring classic cars and bikes.

Our second course starts in May 2018 and runs over six monthly sessions covering construction of a small oscillating steam engine and boiler. Our tutors demonstrate a variety of metal working techniques. Students make the celebrated "Polly" engine designed by "Tubal Cain". Techniques described are applicable to many other small engineering projects.

After each session delegates make parts in their own workshops in time for the next session. These courses are open to all but other SMEE courses including a milling course and the practical tool grinding course are for members only.

These courses are very popular as they demonstrate basic metal

work techniques now rarely taught in schools. They aren't 'hands on' courses but many participants have been inspired to enjoy model engineering and making metal components".

Techniques described or demonstrated include safe use of hand tools, turning parts, drilling and reaming, sheet metal work, soft soldering, silver soldering for strong joints and using a milling machine to cut slots and shape metal.

All our volunteer tutors are keen model engineers or toolmakers.

I welcome enquiries. Further information on the SMEE website www.sm-ee.co.uk or write to SMEE Courses organiser courses@sm-ee.co.uk

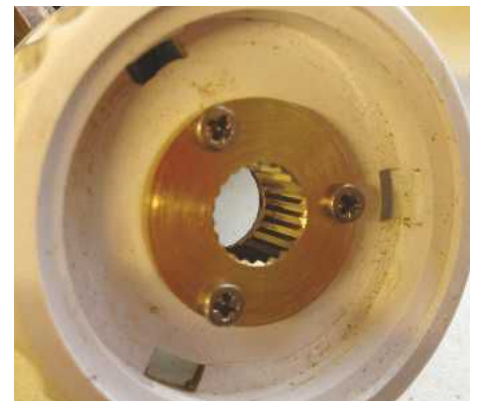
Allen Berman, SMEE Chairman

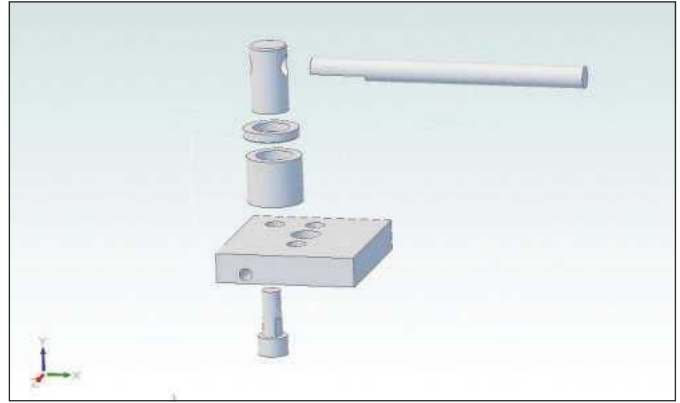
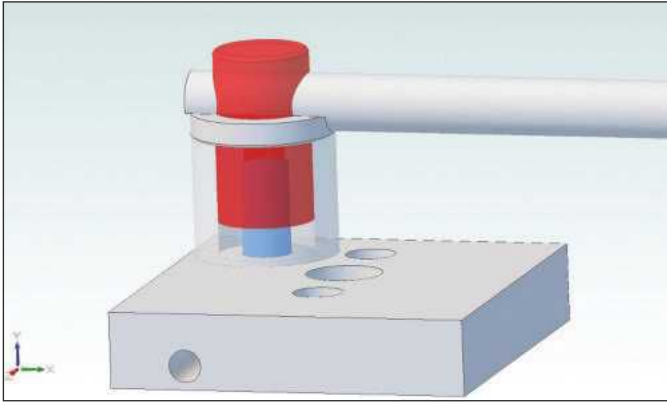


Fixed in my workshop

Dear Neil, in response to Gary Ayre's suggestion for examples of interesting domestic workshop tasks, here's a repair I did to the stripped spline on my shower knob. I made the brass flange and planed the spline on my lathe. Still ok after four years!

Mike Holmes, Derbyshire.





Toolpost Clarification

Dear Neil, I thought I should reply to Bryce Clifford's letter in the Autumn Special issue.

Because my lathe has a slot on top of the top slide to mount the original toolpost (MEW 255) I was able to easily fit an adaptor plate instead. I was therefore free to relocate the toolpost to minimise both the tip overhang and the arc through which it moves. The movement of the cross slide needed when tip is moved to a new cutting position is also minimised. The M10 caphead screw which serves as the toolpost is counterbored into the bottom of the adaptor plate.

To prevent it rotating there is a cross drilling in the adaptor plate in line with the head which contains a brass plug with an M8 screw behind it which clamps the head. To rotate the M10 caphead screw to change the handle locking position you loosen the M8 screw and rotate the M10 caphead screw and then reclamp it. The flats on the M10 caphead are simply there for convenience when doing this. In practice I have only had to make this adjustment once. If the washer or cylindrical nut or the M10 caphead wear and need to be replaced, then the adjustment will be handy.

The cylindrical nut is blind threaded M10 and does not reach the bottom of the caphead before the handle locks down the washer onto the pillar bolting it rigidly to the adaptor plate. The cylindrical nut is 20 mm diameter and was used as a gauge when boring the pillars which slide freely over it. The washer on top of the pillar is 5 mm thick and serves to spread the load from the two places where the handle passing through the cylindrical nut presses down and

to protect the top of the pillars. If the washer wears it can be simply replaced and if it is not exactly the same thickness as the original the handle will lock in a different position which can then be adjusted as described above.

There is only one critical dimension which is the height of the pillars as changing this changes the position the handle locks in – which is why all the pillars must be as near the same height as possible. As long as the pillars slide over the cylindrical nut they do not have to be a close fit to locate them. The insert holders are bored to fit the pillars so use one as a gauge and again the fit is not critical as the screw at the slit end will clamp it up tight.

I have attached two diagrams which I hope will make things clear. I have not included drawings because the dimensions will be specific to my lathe although I have mentioned the dimensions that I used. I am using triangular TC**16030* inserts which have a 7-degree angle with tip radii of 2, 4, and 8 (the last digit in the code).

I was pleased to see the letter from Peter Wilton in the August edition – it's nice to see someone has read the article! I had thought of adding an adjusting screw but because I have located my toolpost near the top left corner of my adaptor plate and the pillar is 1 mm from the edge there is nothing to screw against. In practice, having set the height once I have changed the inserts a few times without having to reset it (they are made to a tight tolerance).

Richard T. Smith

Hob(son's) Choice



For readers following Jeff Thyer's interesting series on Gear-Hobbing on the MYFORD lathe and indeed, those with a Jacobs Gear Hobber, may find it useful to know that a convenient source of constant-velocity joint for the blank/hob drive set-up is to buy or salvage a constant-velocity joint from a HONDA GXV120 (or similar models) self-drive lawnmower. The size is about right and there is ample load capacity. The last attachment illustrates the component.

I also have an appeal to readers: I wish to acquire accessories for my (now ancient) Taiwanese machine tools and recognising that the manufacturer would have exported to their immediate neighbours which means those in the Pacific rim area, I would like to assemble a contact diary of used machinery vendors from these countries: Taiwan, Hong Kong, Philippines, Vietnam, Korea, Vladivostok (Russia), Malaysia, Indonesia and Japan. I am seeking personal referrals from those who have had successful dealings with vendors in these countries. A general internet search is not a substitute for personal experience

as business in Asia is very much person-to-person. I welcome your e-mail and name contacts so please forward these directly to me at: pyralog@yahoo.co.nz

Andre Rousseau.

NEWTON TESLA**SMOOTH, QUIET, HIGH PERFORMANCE VARIABLE SPEED
CONTROL FOR LATHES AND MILLING MACHINES****Supplier to industry since 1987 of high power speed control systems from 100W to 2,200,000W,****MITSUBISHI INVERTERS from £122 inc VAT****HIGH PERFORMANCE INVERTERS**

For serious machining duty.
240V 1-phase input, 220V 3-phase output, for you to run a dual voltage (Delta wired) three phase motor off your 1-phase supply.
Six sizes from 0.1kW (0.12hp) to 2.2kW(3hp).
Built-in user keypad, display and Speed Dial.
Unique Integrated Emergency Stop Function.
Advanced Torque Vector control for optimum performance. High Reliability.

Fully CE Marked and RoSH Compliant.
Compatible with our Remote Control station Pendants.
Supplied pre-programmed at no extra cost.

VARIABLE SPEED CONTROL PACKAGES**The 'original' & best lathe speed control system.**

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



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

REMOTE CONTROL STATIONS from £66 inc VAT

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

Fitted with 2-metre length of control cable ready for connection to drive, and supplied with wiring diagram.

**Newton Tesla (Electric Drives) Ltd,**

Warrington Business Park, Long Lane, Warrington,
Cheshire WA2 8TX, Tel: 01925 444773 Fax: 01925 241477

E-mail: info@newton-tesla.com

Visit www.lathespeedcontrol.com for more information.



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

Visit our brand new website
www.tracytools.com

We ship anywhere in the world

PRODUCTS

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



Reamer



Taper Shank Drill HSS



Taps & Dies

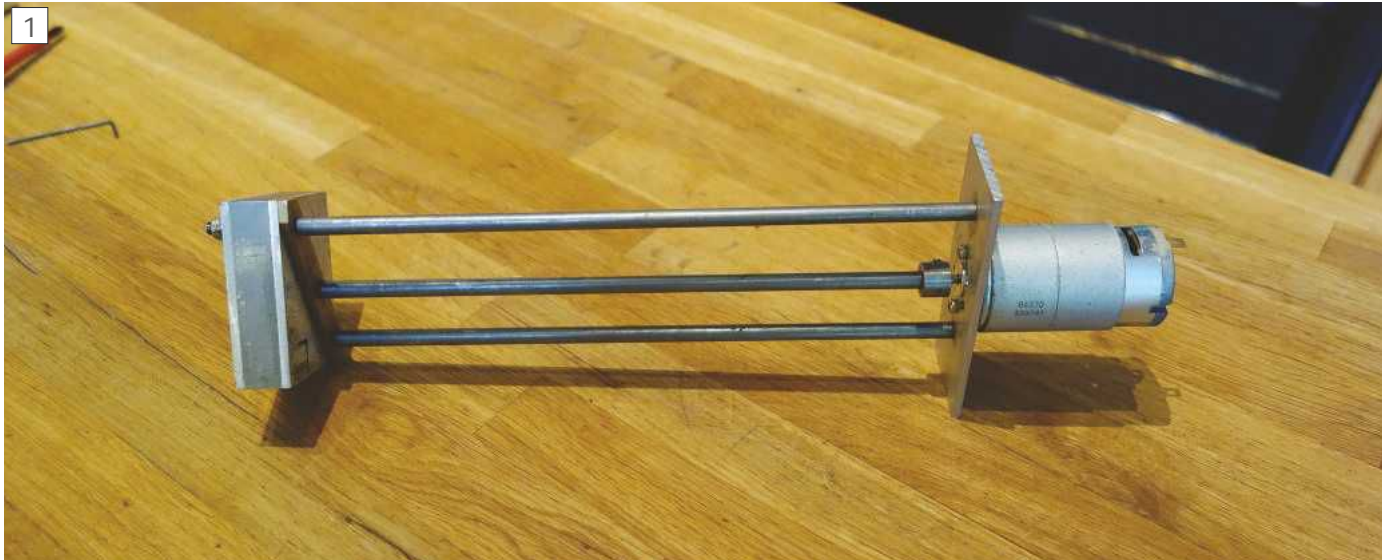
**Tracy Tools Ltd**

Tap & Die Specialist, Engineer Tool Supplies

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

A Suds Pump

John F. Firth makes a new suds pump for his Raglan 5" lathe.



Complete suds Pump

I am a retired Mechanical Engineer with 32 years working in the Deep Mines UK Coal Industry in the UK. I started work as an Apprentice Mechanic at Rossington Colliery in Yorkshire in 1961. After 9 years as an Apprentice and a then a Mechanic (Fitter). I qualified as a Mechanical Engineer, and went on to a successful career as a Mechanical Engineer at four UK Coal Mines, then moved on to several other establishments in the coal mining industry.

My Father was Winding Engineman in the deep mined coal industry and he had always built steam models for most of his life, using various lathes.

He wanted to build a new 3 1/2" gauge locomotive and decided to acquire a Raglan 5" Lathe in 1964 for the princely sum of £650. He continued to use it regularly until the mid 80's when age got the better of him and he passed it on for me to use in 1986. He had always complained that 'This Lathe' would be better if it had a coolant pump and system fitted, but he never got round to doing anything about it.

I installed the lathe in its new resting place in my workshop and made it ready for use. Over a period of some 12 months I completed several small jobs, but I quickly came to the same conclusion of my Dad, and that the finish I was getting was nothing like that I used to get when turning at my lathe at work in the 1960's. They were all fitted with a Coolant Pump system as standard, and it occurred to me that my lathe would benefit substantially from a retro fit of such a device.

So I decided that it was well overdue



Pump Motor

that I did something about it. This article is intended as a source of information and as a guide to anyone wishing to follow a similar route to a homemade suds pump, **photo 1**. Suds is the familiar term for a mixture of soluble oil and water used as coolant and cutting fluid for machining. The details shown in this article are taken from the actual used design for my lathe. What I consider to be the important points and measurements are referred to below.

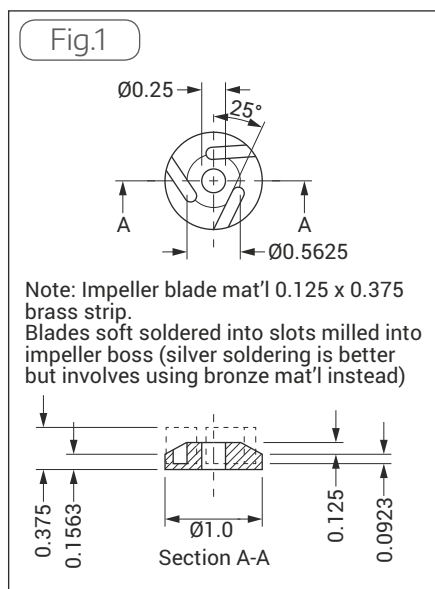
It is left to the builder to interpret the needs of his own system requirements, however if this design is followed reasonably closely this pump configuration should perform perfectly well for many years. (This actual pump has been

operating now for some 4/5 years, with only a need for cleaning the tank and pump suction once every year or so).

When I examined the Tray of the lathe I found it to be fitted with a suitable waterproof sump and drain for the use of coolant system, and when I looked at the documentation supplied with the lathe it was obvious that one was offered as an option with a new lathe purchase.

Obviously with the amount of time having elapsed it was going to be seriously problematic to acquire the actual pump system designed for this lathe, the makers of which had long-gone into liquidation.

This left me with several options. The first approach was to purchase a bespoke 'Off



the Shelf' system (for example see Arc Euro Trade's Catalogue). This approach would solve the problem pretty well effectively and immediately, and I am absolutely sure it would have been a very effective solution.

The next was to research the internet looking for guidance and inspiration. As I expected there was a wealth of videos and ideas on the topic, all of which had resulted in a successful solution to this subject.

Having studied these for some little while I thought that many of the solutions (although beautifully carried out) were more complex, costly, and technically challenging than I wanted to spend time on.

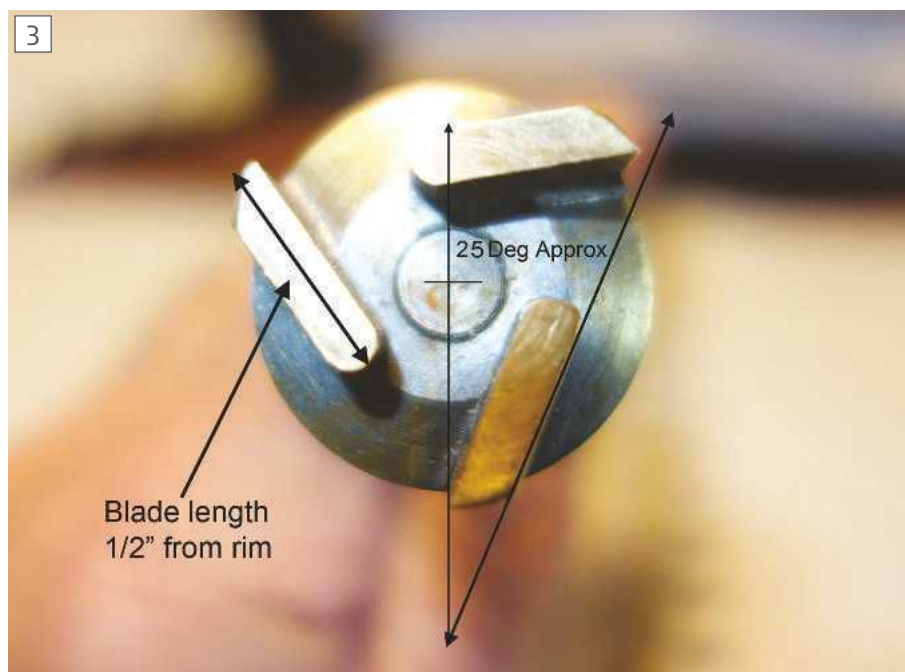
I needed something that I could have running from start to finish in less than half a day in the workshop, very simple in design, inexpensive to build using readily available parts but robust and reliable, with very simple electrics, no speed control and the ability to run for long periods either 'on snore' (with very little fluid coming through) or with the output valve closed without damage or problems. These requirements caused me to seek a rather different and hopefully simpler solution.

My approach was to design my own Pump System from scratch. The first consideration was finding a suitable pump, able to run continually on snore or against a closed valve without damage, using readily available parts from the scrap box (if possible).

The second consideration was how to power such a pump without recourse to the use of a 240 V supply, instead using a low voltage power supply. This would reduce the inherent risks of using liquid near to mains voltage.

A search of the scrap box and the internet did not really yield much in the way of suitability for my needs other than many bits of pieces of metal and screws that could be put to use if a suitable design could be developed.

However, a visit to my local electrical hobby store yielded 6 – 12V motors for £5, (83 pence each) sitting there in the shop window, and just waiting for someone like me. These



Impeller blade angles

motors were actually unused and brand new, and they were of a type normally designed and used in Battery type hand power tools and drills, **photo 2**. These were of really good quality and would be suitable to run at low loads such as these almost continually.

The Motor

The next task was deciding on the type of pump required.

- It had to be able to run at the high speeds developed by these types of motor.
- It had to be tolerant of a small amount of metallic debris entrained in suspension in the Coolant tank, without damage.
- It had to be self lubricating.
- It had to be self priming.
- It had to be able to run at a consistently lower voltage and -
- It had to be very low cost, easily installed and maintained.

- It had to be easily made in the workshop, hopefully in less than a day.

I considered that all these considerations could be covered by using a fully submerged centrifugal pump, made to large tolerances, using materials that would be able to withstand total immersion, with bearing materials that would allow the soluble oil content of the cutting fluid to provide sufficient lubrication to the pump impeller shaft. And, of course it had to last a long time without significant maintenance.

The Impeller

The first decision was to decide on a suitable impeller/pump casing layout and size.

I have had much experience of using centrifugal multistage turbine pumps however for this pump high efficiency is not needed, so the pump impeller curves and



Finishing impeller to size

the delivery volute curves are not critical, when all we need to achieve is get a pump that actually pumps, so after some thought I chose a diameter of 1" for impeller body. This would be turned from a scrap piece of brass bar and bored and reamed to 1/4". No real attempt was made to create a drawing of the impeller using ACAD, but just relying on common sense to provide the right look and feel for the job, **fig. 1**.

The Blank impeller was bored and reamed to 1/4" and Loctited onto a short stub of 1/4" silver steel rod to allow it to be mounted vertically in the chuck of the Rotating table on the milling machine.

The three 1/8" Vane slots were then milled at 120° into the impeller blank at 25° to vertical and 50% into the depth of the impeller rim, **photo 3**. This depth is more than needed however needs to be enough to ensure that each blade is soft soldered securely into the impeller, each a tight fit in its own slot.

Following machining the blade slots, three blades were made by hand from 3/8" x 1/8" brass flat ready to solder into the Runner. Each blade was left some 30 thou long to be machined to length in the lathe later

The Runner was then removed from the machining mandrel using a little heat to soften the locktite, it was cleaned up and each blade was securely soft soldered into its slot. I should point out that I did seriously consider silver soldering for this part of the work, but I decided to make the blades a very good fit in the impeller with a harder soft solder, and the use of brass allowed me to use off-cuts of brass bar and strip and made the material used much less expensive.

In order to ensure that the pump always 'picked up' I decided it would be prudent to design the pump case to run fully submerged in the coolant tank, which involved making a long motor/shaft arrangement to place the motor outside (above) the tank, with the pump body well below the tank coolant level. This would ensure that the pump always



Details of the impeller in situ



Top cover, pump casing and bottom cover parts

picked up on starting.

The length of the Pump Casing/Motor support rod is really dependent on the size of coolant tank you wish to use. I had a suitable tank available and decided that a

pump shaft of 9" in length would give me a liquid level range of some 10 litres, which has proved to be more than adequate for a lathe of this size in my view.

At this point the 1/4" Pump Impeller shaft length was arbitrarily decided at 9" long. (But within reason this could be almost any length you want).

It was assumed that this length would allow the Motor assembly to be at some 2" above the top of the coolant tank, leaving some 7" available to be placed below water/coolant level. In the event, the pump motor face was mounted directly on the top of the tank and I actually got 8" submersion in the liquid.

The Runner was now refitted to the unfinished final pump shaft for machining in the lathe (again using Loctite). It was then placed in the lathe where it was faced up, and the vane tips and bottom edge were machined to finished size, **photo 4**.

Sizes are not that critical here, as we need to make sure that the impeller can handle some small amount of swarf debris without binding or seizing up, but it should also be noted that if the impeller clearance to the bottom cover is too great there will be much slippage of liquid here and this could lead to poor pump performance.



Suction end

8



Expanded view of complete pump

above the Top cover to make sure that the impeller bearing position is maintained and properly controlled.

Top Cover, Pump Casing and Bottom Cover Assembly

Photograph 6 shows the items laid out in assembly order. Obviously, the length of the machined Pump Column ends is made to suit the layer thickness for the Bearing/ Pump Body Assembly. **Photograph 7** shows these parts assembled.

It should be also noted that this type of pump could be left running for extended period with little or even no flow passing through the pump. It is important to ensure that in this event precautions are taken to ensure that some flow always takes place. In my case the hole for the impeller shaft in the top pump cover was made some 50 thou oversize, and the bearing strip was packed away from the top cover with a single 50 thou washer at each end.

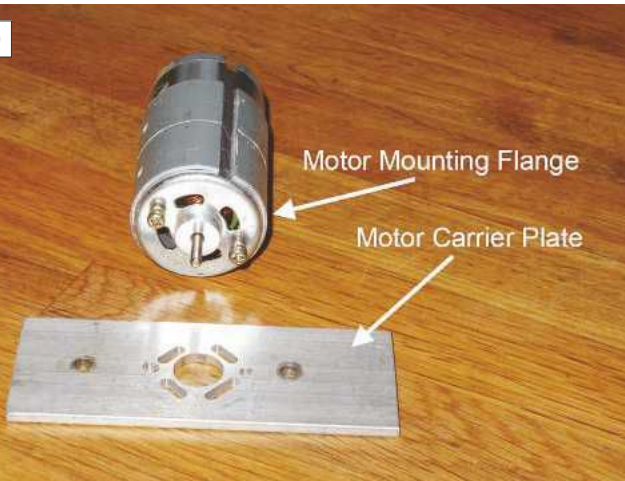
This arrangement ensured that some excess flow was always forced through this gland area creating steady stream of coolant escaping from the gland and continually washing new coolant across the bearing. (Obviously care needs to be taken that this hole is not too big, otherwise significant flow could take place here, causing the pump to fail to create sufficient head at the nozzle).

All of the pump parts are shown in **photo 8**. The motor mounting plate layout is dependent on the motor fittings, dimensions and shaft sizes. The motor I used conveniently had tapped holes for end plate mounting.

This particular motor had a machined mounting stub at the shaft end of the motor. This enabled a fitting hole to be machined into the mounting plate to ensure secure positioning. The mounting plate was made from a scrap length of aluminium 1" x 1/8" strip, **photo 9**.

The marking out points for hole positions were transferred from the pump casing end of the pump to create the

9



Motor Mounting Arrangements

The outlet pipe position was marked out and drilled to line up with the centre of the thinnest case position above the volute space created. Once again this is not critical on placement.

The Pump casing covers (two) are once again non-critical parts, constructed from a piece of scrap aluminium plate from an old workshop low voltage power supply. These were cut to the same size as the pump casing to form the top and bottom covers.

The position of the top cover shaft gland was marked off to the position needed to create the 20 thou clearance to the impeller. This position sets out all other points needed to ensure that the motor, impeller and casing are all aligned correctly.

The holes on the pump casing are set in 3/8" squared on the opposite corners, these are used both to locate both pump end plates and also the motor mounting columns above the pump.

From these holes the motor mounting plate can be marked out and machined for the motor then drilled for the support columns as well.

An impeller shaft bearing plate made from phosphor bronze strip was included

I suggest a clearance of some 20 thou to be about right. This has proved to work well so far.

Also note the rounded leading edge on each impeller blade to allow smooth flow at the vortex hopefully preventing some cavitation noise.

Once again, the design of the pump casing and volute layout is not all that critical for such a small pump where efficiency is not all that important and clearances are deliberately left a little on the generous side due to the possibility of particles on entrained metal in the coolant liquid.

The pump casing is made from a 2 1/2" x 1/2" BMS cut off at 2" long. The actual size is unimportant really.

The blank casing was centred in the lathe and bored in the centre at 1.25".

The Impeller at 1" diameter is to be placed in the casing to create the 20 thou (+/- 10 thou) clearance shown in **photo 5**. This is the position that determines the final layout of the Pump/Motor position.

Once the hole is bored the pump casing it is transferred to the milling machine to cut the Volute relief area. This is not critical for this use and there is quite a lot of leeway in my view as to how it should look, but it just serves to create an area of slow flow and high pressure.

Care need to be taken that the remaining metal is thick enough to retain the outlet pipe, which in my case was drilled to suit a length of stainless steel pipe I had in stock, it was then to be Loctited in position later.

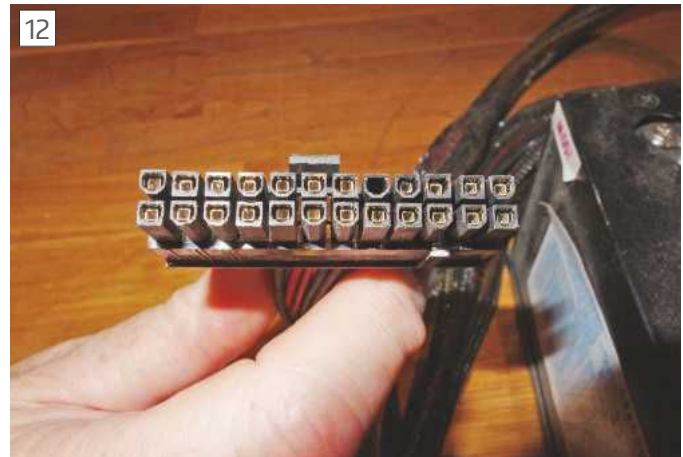
10



PC Switched Mode Power Supply



Pump Power Supply Front Panel



20 Pin ATX PC Photograph Motherboard power Plug

centres for the three positions needed at the motor end.

You may note that this motor has four ventilation slots in the mounting end of the motor. You will also note that these slots have been transferred to the motor mounting plate to ensure that ventilation is maintained, and the motor does not overheat in extended running periods.

The motor used and tank available will all have a bearing on the top end arrangement for the pump, but I am pretty sure that nothing here is beyond the skill of many model engineers, especially as most of the fitting sizes are for the most part not that critical.

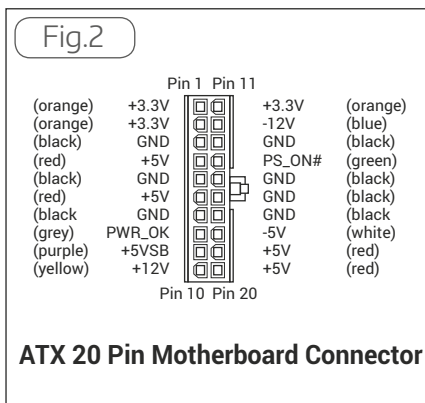
I have done a search on the internet using the search term 'Cordless Drill Motor' and there are literally hundreds of them available at voltages up to 24v, so supply should not be a problem. A recent search for the 'Johnson 550 DC Motor' rated at 12v and 21000 rpm or a generic type of product of similar size seems to come near the mark for this project, but once again the type is not critical here.

Setting Up

Obviously, the impeller has to run confined in the casing between the top and bottom plates. In order to prevent the impeller seizing up, and to create the back clearance need to ensure sufficient slippage of liquid out of the back seal, the impeller needs to be reduced in width.

I made the impeller 20 thou thinner than the 1/2" space created for it between to two pump plates. The setting of the impeller is important by the careful adjustment at the motor shaft coupling, to prevent binding on either plate and make sure of a free running pump. This setting is maintained by the motor bearings. There is a little thrust applied to these bearings by the reaction to the pumped water on the impeller, but as the pressure is only around 2 psi the amount of thrust on the impeller is only just over 1.5 lbs force. This has not been a problem so far after 3 years of running.

At full flow and 12volts supply this motor was taking 4 A at 3V. A recent measurement of output at full flow with my new flexi tube fitted has shown a measured flow rate of



30 fluid ounces per minute (1.5 pints/Min). In my view this is more than enough for most turning jobs on a lathe of this size.

The finished pump was shown in photo 1, and a video of the completed suds pump running can be seen here.

<https://www.youtube.com/watch?v=gyHTgDln3Ts>

Videos of the Suds Pump Test Runs may be seen here.

1. <https://youtu.be/q7P-4zai-Y4>
2. <https://youtu.be/RJXYnblT4K4>
3. <https://youtu.be/BDx29YoDs2k>

I have decided to include a description of the actual power supply solution I used for my Suds Pump system. Readers will be all too well aware of other ways to supply power to a pump designed such as this and may well desire to create a different solution to this problem.

Power Supply

My DC power supply for this project was one of the many uses I have found for old PC switched mode power supplies, **photo 10**. It was first set up to power my two 12-volt LED spot lamps.

I originally set up the power output board with three terminals at 3, 5 and 12 volts.

Many have utilized a PC power supply for things other than powering a computer and I have seen several articles on the uses and conversion of a PC switched power supply. Such articles may be a rich source of information on the details for anyone wishing to undertake such a conversion. They commonly have voltage outputs of 3,

5 and 12 volts, mostly at moderate to high amps of up to some 35A.

I chose to strip down the power supply and solder every 3, 5 & 12 volt rail lead together to bring a common high amp output for each voltage. These were then taken to four terminals on an output plate with a low voltage power supply on/off switch.

The terminals were 0v, 3v, 5v. & 12volt. I have tried all three for this pump but mainly use 3 and 5 volts and vary the output if needed. The PC switched power supply is turned on and off with a small DC switch connected to the control power signal.

My ATX Plug was of the type shown below, and the power switch is between pin Pin 14 (Green) and any ground pin e.g. 3, 5 or 7 (Black), **fig. 2, photo 12**.

It should note that this low voltage switch only controls the output from the power supply. It does not remove the power from the power supply and isolate it from mains voltage. The main board remains live for as long as the mains power to the power supply is left switched on. Most of these types of switched power supplies have a built-in mains switch, but the power must be disconnected from the power supply before the case is opened for working on the circuit inside.

These details can be resourced on line by looking for a 20 pin ATX Power Connector. Other types of power supply are widely available and suitable information should be consulted prior to carrying out any work.

Notes

This kind of work entails working in the mains voltage side of a power supply (even though only the low voltage leads are the ones needing any alteration). Proper precautions should be taken to ensure that you remain safe when carrying out electrical work. If you are not skilled or proficient at this kind of work, please ensure that you seek the help and guidance of a professional electrician.

Should any reader want to address points of clarification or have questions or helpful comments, I can be contacted at jffirth@btinternet.com where I will endeavour to reply promptly. ■

*UK Offer only

Avoid the long queues and treat your loved one with a gift subscription to their favourite magazine. You get to save money, and they get their magazine delivered direct to their door! You could even treat yourself...

Don't miss out – subscribe today!

The Perfect
Christmas Gift for under
£20

Save up to
37%!

 SAVING 29% 8 ISSUES FOR £19.99 FULL PRICE £26.00	 SAVING 35% 6 ISSUES FOR £19.99 FULL PRICE £30.90	 SAVING 23% 6 ISSUES FOR £19.99 FULL PRICE £26.10	 SAVING 37% 8 ISSUES FOR £19.99 FULL PRICE £31.92	 SAVING 33% 6 ISSUES FOR £19.99 FULL PRICE £29.94	 SAVING 35% 6 ISSUES FOR £19.99 FULL PRICE £30.60	 SAVING 37% 6 ISSUES FOR £19.99 FULL PRICE £31.50
 SAVING 30% 6 ISSUES FOR £19.99 FULL PRICE £28.50	 SAVING 37% 8 ISSUES FOR £19.99 FULL PRICE £31.60	 SAVING 29% 8 ISSUES FOR £19.99 FULL PRICE £28.00	 SAVING 24% 6 ISSUES FOR £19.99 FULL PRICE £26.40	 SAVING 30% 6 ISSUES FOR £19.99 FULL PRICE £28.50	 SAVING 37% 8 ISSUES FOR £19.99 FULL PRICE £31.60	 SAVING 29% 8 ISSUES FOR £19.99 FULL PRICE £28.00
 SAVING 26% 6 ISSUES FOR £19.99 FULL PRICE £27.00	 SAVING 30% 6 ISSUES FOR £19.99 FULL PRICE £28.50	 SAVING 30% 6 ISSUES FOR £19.99 FULL PRICE £28.50	 SAVING 33% 6 ISSUES FOR £19.99 FULL PRICE £29.94	 SAVING 33% 6 ISSUES FOR £19.99 FULL PRICE £29.94	 SAVING 33% 6 ISSUES FOR £19.99 FULL PRICE £29.94	 SAVING 33% 6 ISSUES FOR £19.99 FULL PRICE £29.94

SUBSCRIBE SECURELY ONLINE:
WWW.MYTIMEMEDIA.CO.UK/XMAS17P3
CALL 0344 243 9023 AND QUOTE XMAS17P3**

BY POST: PLEASE COMPLETE THE FORM AND POST IT TO THE ADDRESS PROVIDED
QUOTE REF: XMAS17P3

YOUR DETAILS: (This section must be completed)

Mr/Mrs/Miss/Ms..... Name.....
Surname.....
Address.....
Postcode..... Country.....
Tel/Mob.....
Email.....
D.O.B.....
(Complete if the subscription is for yourself)
Magazine.....
Price.....

GIFT RECIPIENT (Complete 'Your Details' first)

Mr/Mrs/Miss/Ms..... Name.....
Surname.....
Address.....
Postcode..... Country.....
Tel/Mob.....
Email.....
D.O.B.....
(Complete if the subscription is for a gift recipient)
Magazine.....
Price.....

PAYMENT DETAILS

Please make cheques payable to MyTimeMedia Ltd and write code: XMAS17C and magazine title on the back.

☐ Postal Order/Cheque ☐ Visa/Mastercard ☐ Maestro

Card no: (Maestro)

Cardholder's name:

Valid from Expiry date Maestro issue no

Signature Date

**SEND TO: MYTIMEMEDIA LTD. SUBSCRIPTIONS,
3 Queensbridge, The Lakes, Northampton, NN4 7BF**

TERMS & CONDITIONS: Offer ends 31st January 2018. *UK offer only. All subscriptions will start with the first issue in 2018. For full terms & conditions visit www.mytimemedia.co.uk/terms. From time to time, your chosen magazine & MyTimeMedia/David Hall Publishing/AV Tech Media Ltd may contact you regarding your subscription, or with details of its products and services. Your details will be processed in full accordance with all relevant UK and EU data protection legislation. If you DO NOT wish to be contacted by MyTimeMedia Ltd/David Hall Publishing/AV Tech Media & your magazine please tick here: ☐ Email ☐ Post ☐ Phone If you DO NOT wish to be contacted by carefully chosen 3rd parties, please tick here: ☐ Post ☐ Phone If you DO wish to be contacted by carefully chosen 3rd parties, please tick here: ☐ Email

One Man and his Many Lathes



Stan Nesbitt recalls his workshop companions over fifty-two years in the workshop.

The period covered by this article amounts to 52 years and is greatly condensed but hopefully still contains the essence of my experience. Sadly, I do not have photographs covering the earliest years. Many of the other photos are from old prints, so apologies if they do not reproduce well. Whilst I have often struggled to purchase lathes, they have always repaid me with their increased sale value.

Home Made Wood Turning Lathe

Whilst stationed at RAF Laarbruch from 1964 to 1967 (now Weeze Civil Airport) in Germany and living in a local town called Kevelaer, I was friendly with a local chap. He knew I was interested in Lathes and he said his father had made a lathe which was now just sitting in his back garden and he said I was welcome to have it. It was constructed from angle iron and heavy steel tubing but had roller bearings in the headstock. The maker had been captured in Russia in 1943 and did not return home until 1953. As there was a spare room in our flat I was able to use this machine there and was given basic instruction by a pal who was an aircraft fitter. The lathe was shipped back to RAF

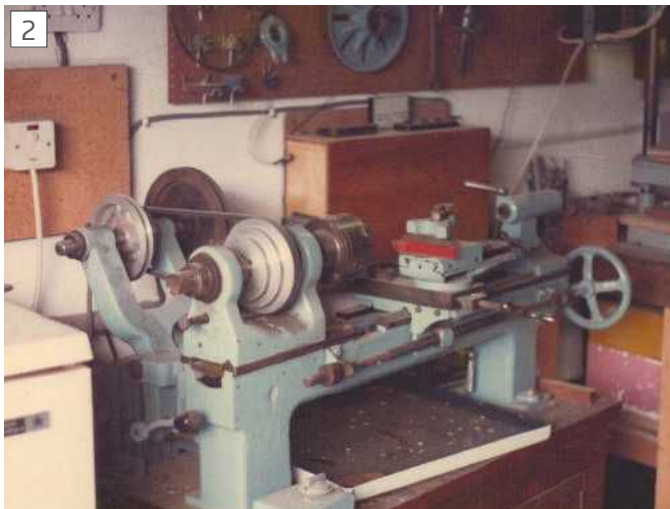


Arundel Wood Turning Lathe

Ballykelly, my final posting. Eventually I sold this lathe to my brother for £5 and he quickly adapted to the wood turning craft. The lathe is still in his shed but he seldom uses it now. I wonder what the maker would think if he knew his creation was still operational so many miles from his home.

Unimat Lathe

Purchased on easy payments from my wife's Freeman's catalogue! Living in married quarters I had to operate this lathe on the kitchen table but I still found it very useful. This lathe was sold in 1969 to a pensioner living in a small terrace house in Belfast for £40.



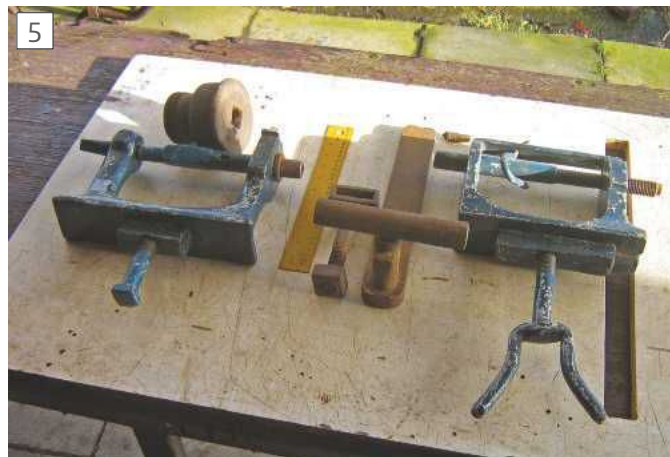
Karger plain lathe, modified with ex-wagon brake lead screw!



Harrison Union Graduate wood turning lathe



Harrison L5a



Parts of the 19th century lathe

Living in married quarters I had to operate this lathe on the kitchen table but I still found it very useful.

Myford ML4

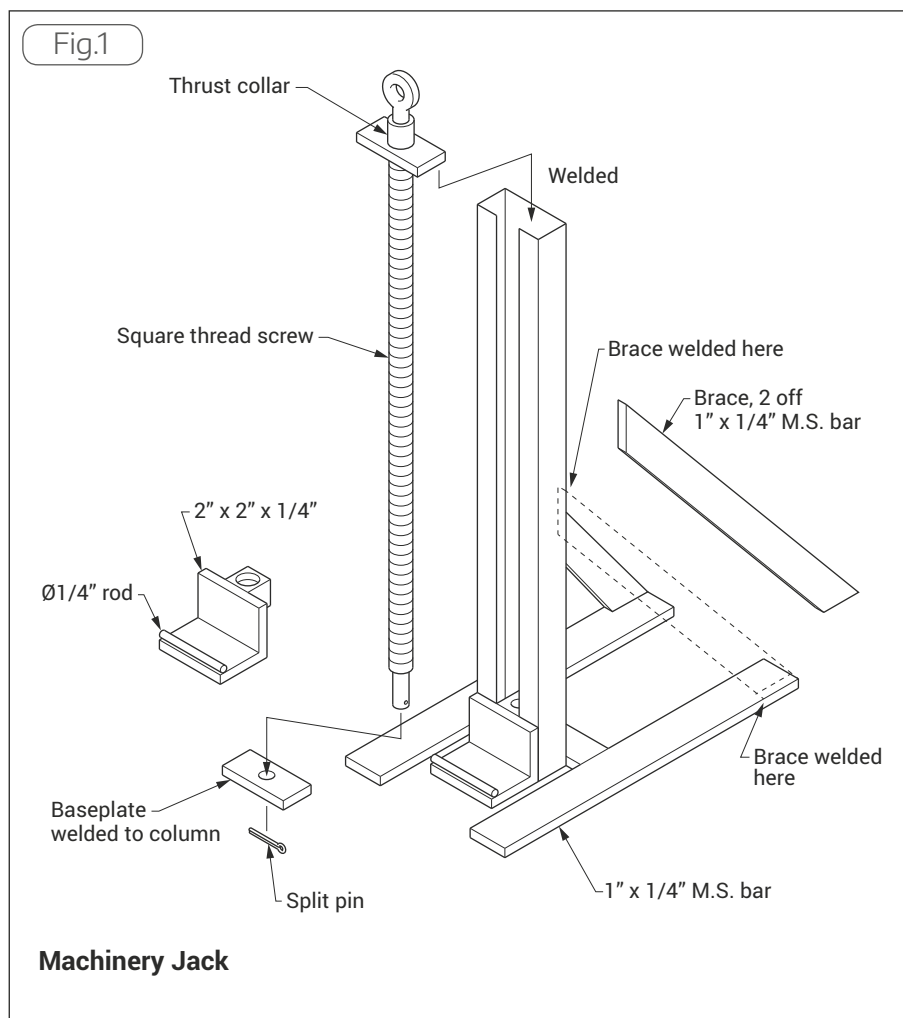
I spotted this lathe in a small engineering works in Limavady Co Londonderry and the proprietor agreed to sell to me for £20. Back then c1969, when credit cards were unheard of, he agreed to accept a post-dated cheque. Those were bleak years when a corporal's take home pay was about £15 per week, post dated cheques were often resorted to. When I was demobbed in June 1969 this lathe moved with me to Ballymena where I had started a job of Training Supervisor at the new Michelin factory. When dismantled the bed could be carried by one man. I used this machine for several years, but I found the gear setting up quite tedious and tended to limit my activities to plain turning. As I was becoming more interested in wood turning I sold this lathe for £40 c1973 and bought a new Arundel Wood Turning lathe.

Arundel Wood Turning Lathe

This lathe, **photo 1**, paid for itself many times over and turning could be done on both ends of the headstock. I still have this lathe and recently when I was without a metal turning lathe I made a metal turning attachment using an adapted cross vice.

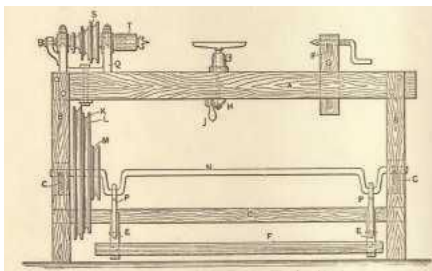
German Plain Metal Turning Lathe (Karger)

After about 4 years with Michelin I secured a position as a Training Officer with a new factory opening in Craigavon making Printed Circuit Boards. This appointment involved 4 months training in West Berlin at the parent factory in 1974. The Berlin



Wall was very much in evidence at that time. One day when I was passing an unused room in the factory I spotted a small plain lathe sitting unused on the floor. My German was good enough to ask one of the Directors if I could buy the lathe. He very kindly said I could have it at no cost. On my Friday afternoon off I crated up the lathe carefully bolting it to the bottom of the crate. The proprietor's PA arranged for it to be shipped from Hamburg to Belfast. However, when I returned home I had to pay £70 to the Belfast shipping agent for import duty

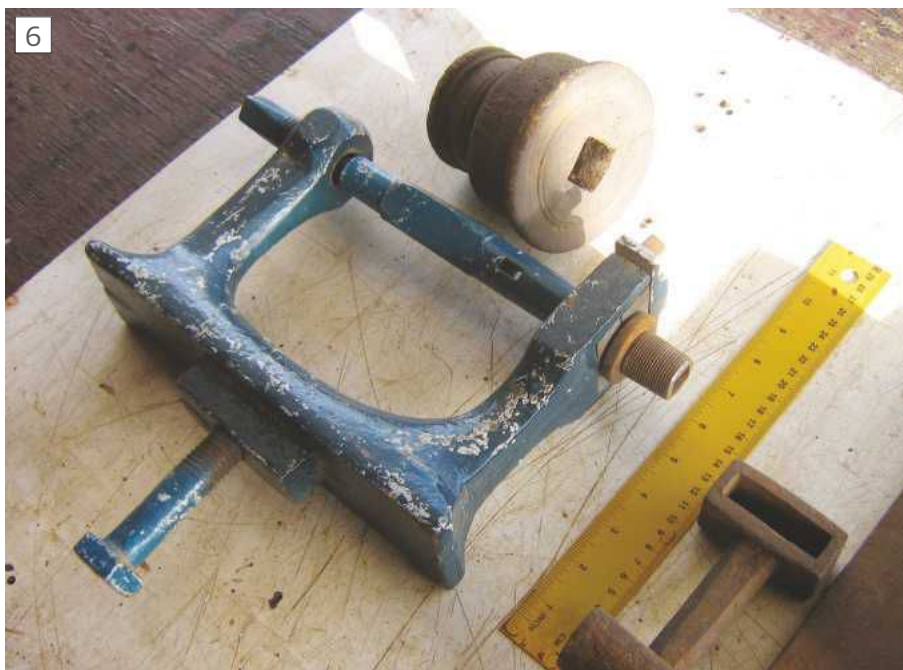
etc. I made a number of modifications to improve this plain lathe. The flat belt pulleys were replaced with 3 step vee pulleys. A lead screw (an ex wagon brake control screw) was fitted to enable longitudinal feed without the use of the top slide, **photo 2**. The large face plate hanging on the wall behind the lathe was obtained as follows. I made wooden pattern at home and when I was attending a Home Office training course in Wakefield I had a casting made by Blackgates Engineering. The fitting to the headstock was carried out by a local engineering firm.



When I acquired the Harrison L5A I sold this lathe to a chap who made jewellery, for £200.

Harrison Union Graduate Wood Turning Lathe

I was lucky to acquire this top of the range, long bed wood turning lathe from a government surplus sale, **photo 3**. During that period, I turned newell posts, balusters and billard table legs for a local joinery works. Although it was already a large lathe, I added a bed extension to cope with 6 feet of material between centres. Material which is six inches square and six



The simple headstock



Reverse of the headstock



Parts offered up to reconstructed wooden bed

feet long rotating at 500 revs can be quite scary when roughing out. Hence the use of the 4-jaw self centring chuck which is more secure than a prong centre. However, when automatic lathes started to appear, this type of work dried up. I sold this lathe for £400 which enabled me to purchase the Harrison L5A.

Harrison L5A

When I lived in local village during the early 1980s there was a small precision engineering works directly across the road from my bungalow. On one of my visits to his shop I spotted this lathe, an ex-technical school model, which was not in use. He offered to sell it to me for £400 and a local farmer delivered it, leaving it on a pallet in the middle of my garage. It was a very heavy machine which included its cast iron base with attachments, **photo 4**. I fitted a castor on each corner and easily wheeled it into position. The seller provided two $\frac{3}{4}$ inch soft wood boards and advised that if the lathe was positioned on the boards



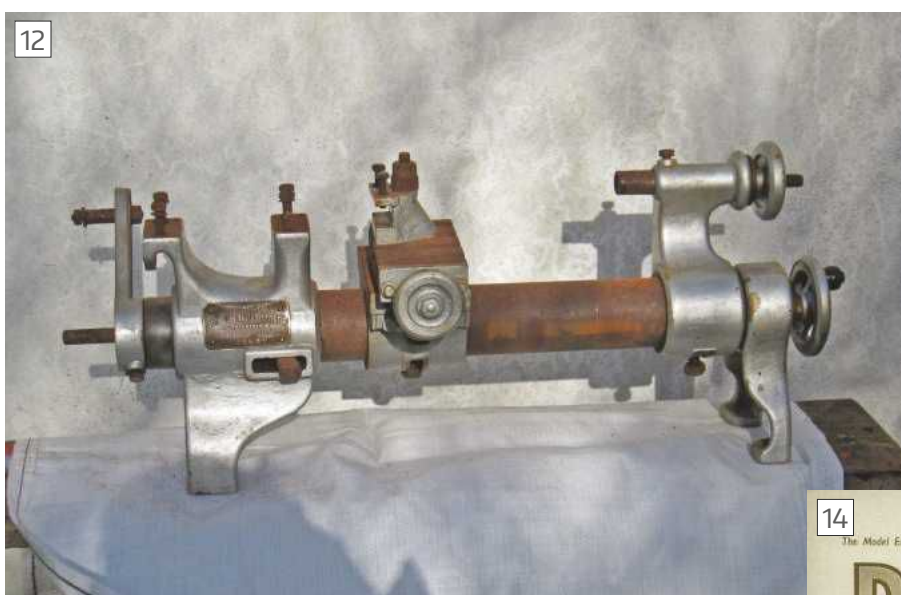
Arrangement for headstock nose bearing adjustment



Parts of the bearing



The tailstock is strange to modern eyes



Drummond Round Bed Lathe



Maker's plate

there would be no need to bolt it down. From a local scrap yard, I obtained a vertical style car jack and modified it for lifting heavy machinery capable of lowering to $\frac{1}{2}$ inch and withdraw, **fig. 1**. This machine was a proper professional geared head lathe with automatic feeds and a large capacity, but it was quite noisy in use even after I had renewed the Headstock bearings. I changed the 3-phase motor to single phase and repainted the whole machine. When I removed to my present location the castors burst through my trailer floor.

Initially the lathe was installed in a large wooden shed until the house was built. During the years when I was manufacturing hardwood garden furniture, this lathe was very useful when maintaining my other machinery. When I decided to sell the Harrison, I advertised it in a local newspaper as was usual at that time. I received a few phone enquiries from a Belfast man and he eventually arrived with his son to view the lathe. They had been dropped off by relative who had gone off shopping. I switched the lathe on and it was obvious that the older man had been a lathe operator. He was beaming as watched the lathe and moved various levers. However, after a few minutes his son started moving other levers as his father continued

Over the years I have found that a lathe can prove a useful investment and nearly always increases in value.

14
The Model Engineer, September 15, 1938

DRUMMOND LATHES FOR ALL MODEL-MAKERS

See them at the 'M.E.' Exhibition

STANDS 13 & 16 (S. TYZACK & SON LTD.)

STANDS 25, 26 & 27 (BUCK & RYAN LTD.)

When examining the features of the "Drummond" lathe, note particularly the patented tailstock which facilitates work setting without the use of packing etc.

Drummond Lathes are designed specially for model making and similar work and are capable of performing nearly all the machining operations on any model. When examining these machines note particularly their strength, ease of operation, completeness of equipment, and other superior features. Both models are available with treadle or electric motor drive.

IF YOU CANNOT VISIT THE EXHIBITION—WRITE:-
DRUMMOND BROS. LTD. RISE HILL, GUILDFORD

The lathe advertised in Model Engineer



The snappily named CJ0623B 9x30 lathe



Headstock of the lathe showing gearbox ratios

to operate. Alarmed by this development I stopped the lathe and asked them to leave my property. Although the father would have liked the lathe, he had no money and I gathered that his son never really intended to purchase the machine. It was a dark winter's evening and as I live in the country devoid of any street lighting, they were obliged to set off on foot, telephoning for their lift to pick them up. Some days later the man rang to apologise for the occurrence. Now I know why many advertisers append their adverts with the words "No Time Wasters". This lathe was sold for £800 and the lifting device mentioned earlier went as part of the sale. Over the years I have found that a lathe can prove a useful investment and nearly always increases in value.

Antique Lathe c.1870

Many years ago, when visiting a local scrapyard I asked the proprietor if he had any old lathes. He sold me the subject lathe for £5.00 but it didn't seem worth while trying to restore it due to it's crude construction, **photos 5 - 11**. However, it may have more merit than first impressions would have suggested. I now understand that it was manufactured about 1870. This design, a two-speed lathe, was intended for turning wood and light metal. The 1919 book on Lathe Design, Construction & Operation by C Perrigo describes this type of lathe with a wooden bed and a headstock with babbit metal bearings and square taper mandrel, **figs 2 and 3**. The old "chain lathe" has a tailstock of similar design. Perhaps one day I will find the time to restore this lathe, if only to sit as a display model and as an example of this stage of lathe development.

Drummond Round Bed Lathe

One of my work mates acquired this lathe and traded it to me for some work completed, **photos 12 and 13**. Sadly, there are pieces missing, the mandrel, the stepped pulley, bearings and gearwheels. This lathe merits a thorough restoration and when time permits I hope to bring it



This view shows the impressive capacity of the lathe.

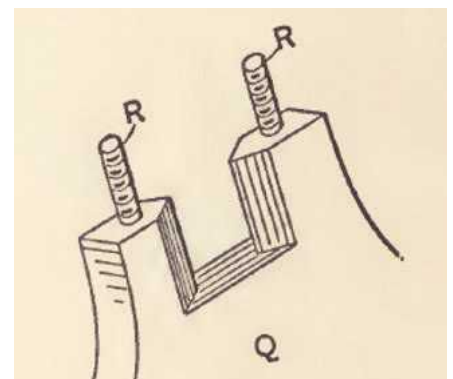
back to life if only to sit as a showroom model and as another example of a stage in lathe development, **photo 14**.

CJ0623B 9 x 30

This machine, my present lathe, purchased from Amadeal, may be considered as a bargain basement lathe, **photo 15**. However, when one considers the specification, this design is very competitive at the price. The variable speed from 50 to 3,000 rpm forward and reverse, the Norton type gearbox for imperial and metric thread cutting and its adequate proportions are its main attributes, **photo 16**. Unfortunately for a relatively large lathe, **photo 17**, the tailstock locking mechanism is inadequate. The two stems of the cams flex under load and one must resort to tightening the holding nut which is tedious. I am aware of modifications to correct this and hopefully I will soon

attend to this problem.

Lathes will normally outlive their owners and be passed on to another good home. Even when a lathe suffers rough usage, neglect or abandonment, it may eventually become a "barn find" and perhaps a restoration project and so the lathe lives on. ■



PRO MACHINE TOOLS LIMITED

Tel: 01780 740956
Int: +44 1780 740956



Precision machines made in Italy for the discerning engineer!

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...**



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

Ceriani 400 Series Mill

- ISO30 Spindle
- Table size - 580 x 150mm
- Travel - 420 x 160 x 300mm (XYZ)
- 1.5 KW Motor
- 100-3000 rpm vari-speed
- Weight - 150 Kgs



- Optional splash-back and safety guard



Ceriani 203 Lathe

- Centre height - 100mm
- Centre distance - 500mm
- Swing over gap - 260mm
- Spindle bore - 20 or 30mm
- Motor - 1 HP
- Weight - 80 Kgs



- Semi Norton gearbox
- Vari-speed option
- Four selectable feed rates plus screw cutting

EMCO

1885 **WABECO** 1886

CERIANI

swiss tec

TECO

GOLmatic
Maschinenbau

PROXXON

EMCO
Hobymaschinen



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

Readers' Tips



Sucker for punishment



We all lose time parts from time to time; Bob Lamb wins this month's Chester Vouchers with a tip for finding those elusive little objects.

I discovered this yesterday and thought I should share it with others.

No matter how often I tell myself to carefully dismantle anything OVER A RECEPTACLE I don't always do it. Last night was no exception and, as I was changing a tool bit, I dropped the tiny torx screw onto the floor.

The floor is, of course, stained and multicoloured so it is difficult to find anything that I drop. I did my normal sweep first with a broom and then with a magnetic pickup tool - no success. I have to add that there are many small nooks and crannies for things to get lost in and I nearly gave up. It then occurred to me that I could use my Henry vacuum, but I didn't fancy rummaging through the bag to try and find a tiny screw amongst all the other debris.

The solution was to take the nozzle off the end of the hose and replace it after covering the end of the hose with a small piece of white cotton rag. It was still easy to push on the nozzle with the thin rag in place. I switched on Henry and after hoovering every crack I could see I switched off, took off the nozzle and checked the rag OVER A CONTAINER. Bingo the screw was there together with a few other nuts and washers.

Simple - and it encourages cleanliness.



Bob Lamb

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.

Improving a Small Horizontal Bandsaw



Norman Billingham fits a sub-vice to his bandsaw



The bandsaw vice as supplied



The drill vice as purchased

The small horizontal bandsaws available from most suppliers of machine tools for model engineers are invaluable bits of kit, especially if you are getting on in years. Cutting discs from the end of a piece of 2" mild steel bar by hand is not something you'd want to do too often. I bought my saw from Chester Machine Tools a few years ago when it was on special offer, but they are widely available. Mine is the smallest size. It was remarkably cheap and is pretty crude, but since I replaced the cheap blade which came with it with a better, bimetallic one, it has served me very well.

However, they do have limitations. In particular, the short, swivelling, moving jaw of the vice is fine for the intended job of cutting lengths from long pieces of bar stock, but it's a serious limitation when you want to cut a short piece or need to hold a part close to the blade. **Photograph 1** shows the vice on my saw as it was supplied (plus a bit of rust – the saw lives in the



The bandsaw vice rear jaw after removal of the jaw plate and drilling for sub-vice mounting



Screws fitted to sub-vice



The new sub-vice mounted and ready for use

garage and is neglected!) The distance from the vice operating screw to the blade is about 4.5", which means that something like 6" of bar has to be available for it to grip safely. If, like me, you often buy metal in the usual 12" lengths sold by ME suppliers, then you can only use about half the length before it becomes too unstable to hold.

I found I could get round the problem by using a second vice, taking advantage of the fact that a small

drilling vice will fit nicely vertically through the throat of my small saw. I don't claim any originality for this idea, but it's helped me a lot.

Photograph 2 shows the cheap vice which I bought; I think I picked it up at one of the shows for few pounds. It's a pretty nasty device by engineering standards but it's only 65 mm wide and drops vertically through the throat of the saw without fouling.

Photograph 3 shows how I removed the (largely useless) rear jaw plate from the saw vice and drilled two 8mm clearance holes in the rear jaw. I checked the positions fairly carefully then drilled the holes by hand using an electric drill. Not hyper-accurate but it didn't need to be.

The vice I bought has a steel base plate set into the casting at the jaw end, so I removed it, clamped it to the saw vice rear jaw, spotted the two holes through then drilled and tapped to take two M8 cap screws and refitted the plate to the drill vice, **photo 4**. The vice can then be mounted vertically on the saw, **photo 5**. The mounting holes were positioned so that the saw blade just clears the vice jaws, by about 1 mm.

In use, the moveable blade guide has to be retracted to clear the

sub-vice and allow the blade to be lifted, but this has never been a problem and the set-up makes the saw much more versatile. Of course, the maximum diameter which can be gripped safely is smaller, but this is not much of a limitation and more than compensated by much greater versatility. The sub-vice can easily be removed in a couple of minutes and the saw returned to its original design. ■

ISSUE MODEL XT ISS THE NEXT ENGINEER SUE NE

- **Barclay Well Tanks**
Terence Holland starts work on the boiler.
- **Out and About**
Martin Wallis recalls his visit to the Gloucester Vintage and Country Extravaganza.
- **Otago LBSC Memorial Run** Jim Woods reports from Otago on their LBSC 50th Anniversary Run.
- **A Day Out in York**
Roger Backhouse spends a day with the York Model Engineers.
- **LNWR Tool Chests**
Chris Rayward makes the lids for his Webb tender tool chests.
- **Steam Hammer**
Ray Griffin makes the valve chest and piston valve for the Stuart steam hammer and adds the lever assembly.

Content may be subject to change.



ON SALE 5 JANUARY 2018

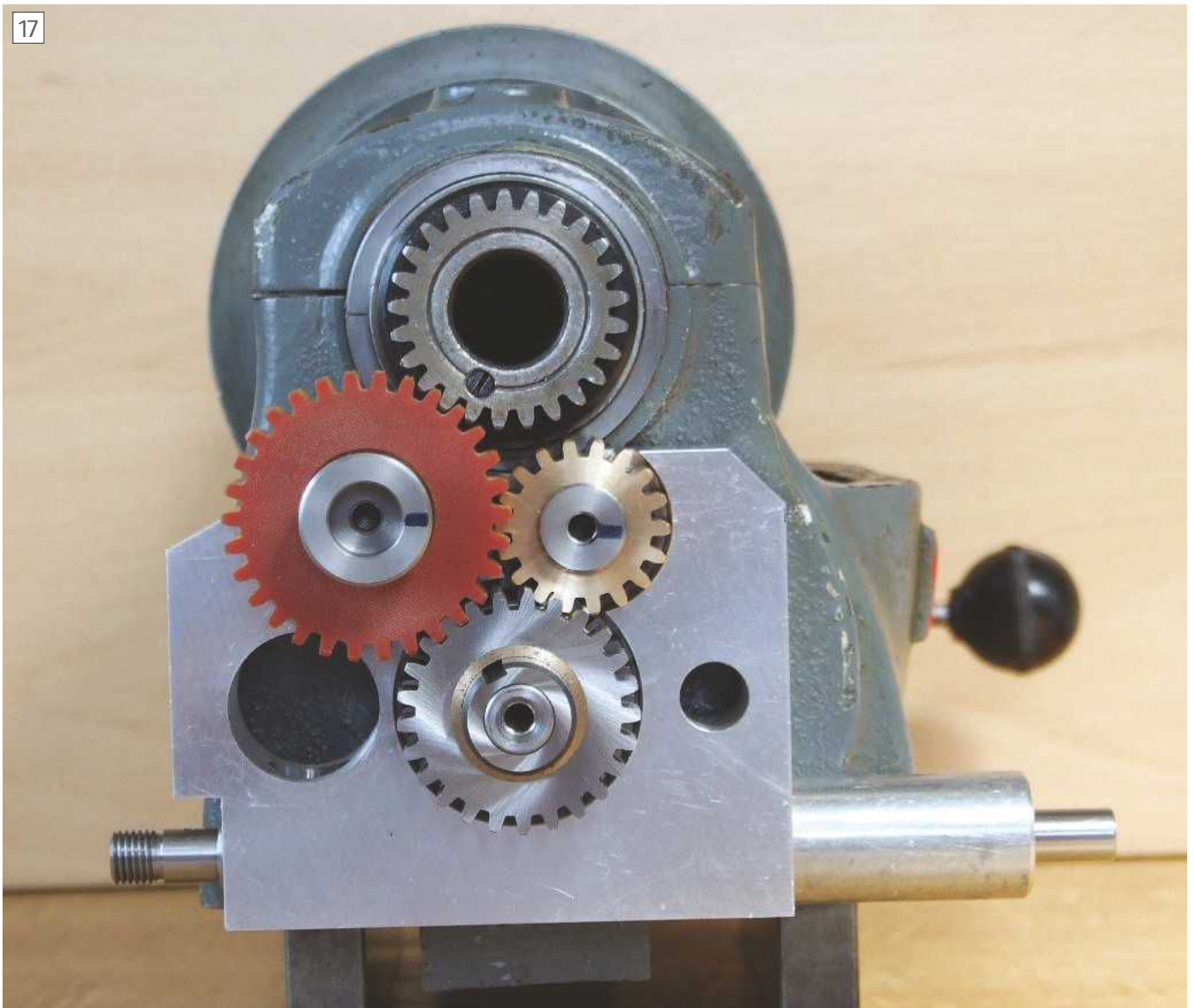
The development and design of a



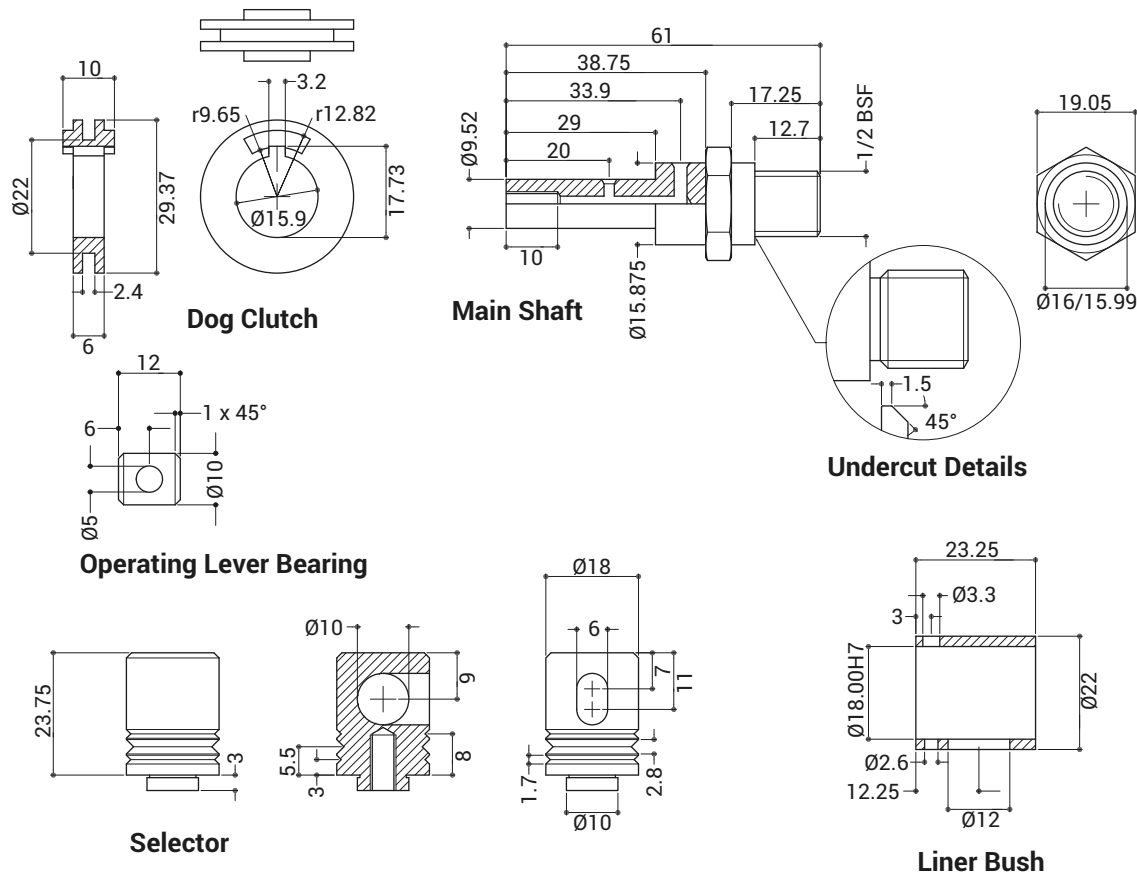
Screwcutting Clutch for the Myford ML7

Graham Meek recounts how he came to revise his design for the ML7 and gives advice on its making and use - Part 3

17



Trial assembly



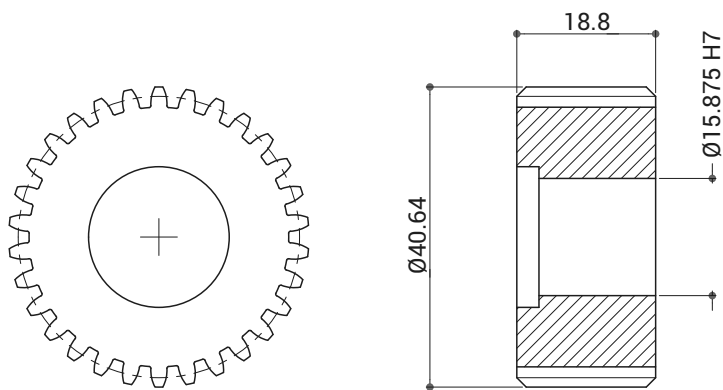
The basic dimensions of this bush for those who wish to order one are, 12 O/D, 8 I/D by 12 mm long. This could quite easily be turned from phosphor bronze, PB, but it will not have the porous nature of sintered bronze or the oil retaining properties. Therefore, an oil hole needs to be provided for the occasional squirt. Might I suggest a hole in the side of the main body extension rather than on the top where dirt and dust will congregate which will more than likely migrate into the bearing. Another Oilite bush is used at the rear of the main body for the operating shaft. This time the bush sizes are 1/2" O/D x 3/8" I/D x 5/16" long. This bush again can be manufactured from PB with a similar oiling arrangement. However, this bush needs to be fitted after the operating shaft is installed so any oil will need to be pre-drilled and lined up with the corresponding hole in the main body. It goes without saying that the 1/2" hole in the main body needs to be a reamed or bored hole in order for this bush to be a good fit. This bore also wants to be in-line with the opposite end and this can be achieved by gripping on the boss once this has been pressed into the main body. A good chuck is required for this operation. If the readers chuck is at all suspect then I would recommend using a 4-jaw chuck. Clocking the extension boss to ensure concentricity and then running the clock along the two sides of the main body

to ensure these are parallel with the lathe centre-line.

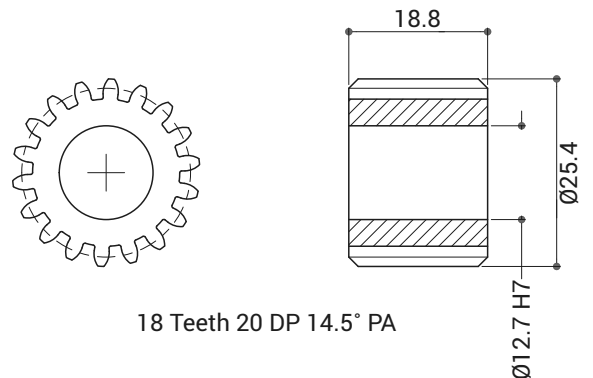
Connecting the operating shaft to the selector is the operating lever. This is locked into the operating shaft by a short push-rod and an Allen grub screw. The length of the push rod depends on the length of the Allen grub screw used, and is therefore ascertained on assembly. The operating lever turns the radial movement of the selector shaft into the linear movement of the operating lever bearing. This bearing allows the operating lever to slide within the selector as the respective centres change due to the angular or radial displacement of the operating shaft. The operating lever was made from silver steel, it does not have to be. Mild steel, (BMS), would serve equally as well and would possibly make tapping the M3, (or similar) hole in the end easier. The size of the BMS wants to be close to 5 mm diameter, 0.01 mm undersize will give a nice easy fit in the phosphor bronze operating lever bearing. The diameter of the lever bearing would also benefit from being about 0.01 mm undersize. I had better point out at this stage that these tolerances only apply provided the respective holes for the various parts have been reamed. I cannot recommend any clearance for a drilled hole which really is not suitable for this type of work. D-bits are a very good alternative to expensive reamers and are easily

sharpened when dull. These clearances will allow the bearing to rotate freely in the selector as well as slide laterally to accommodate any misalignment between the relative hole centres. The purpose of the M3 tapped hole in the operating lever is to aid insertion and extraction of the lever. The lever is threaded onto an M3 cap screw about 35 mm long and this then makes things a lot easier. Once the lever is locked in place the cap screw is removed. It will also be found a whole lot easier if the shank end of a 4.9 mm diameter drill is used to align the holes in the operating shaft and the operating lever bearing prior to inserting the operating lever. To make the operating lever even easier to insert the end is chamfered with a 15-degree chamfer about 0.5 mm wide.

A good chuck is required for this operation. If the readers' chuck is at all suspect then I would recommend using a 4-jaw chuck.

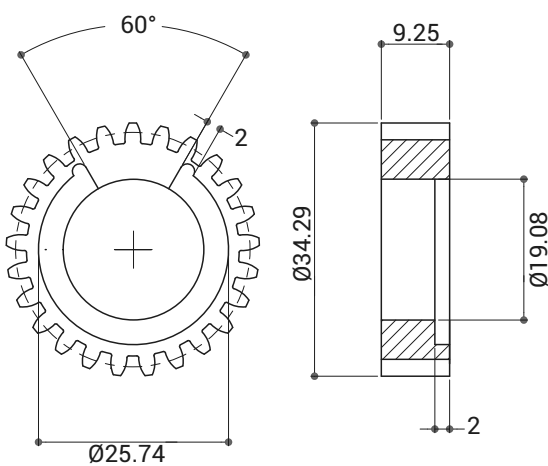


30 Teeth 20 DP 14.5° PA

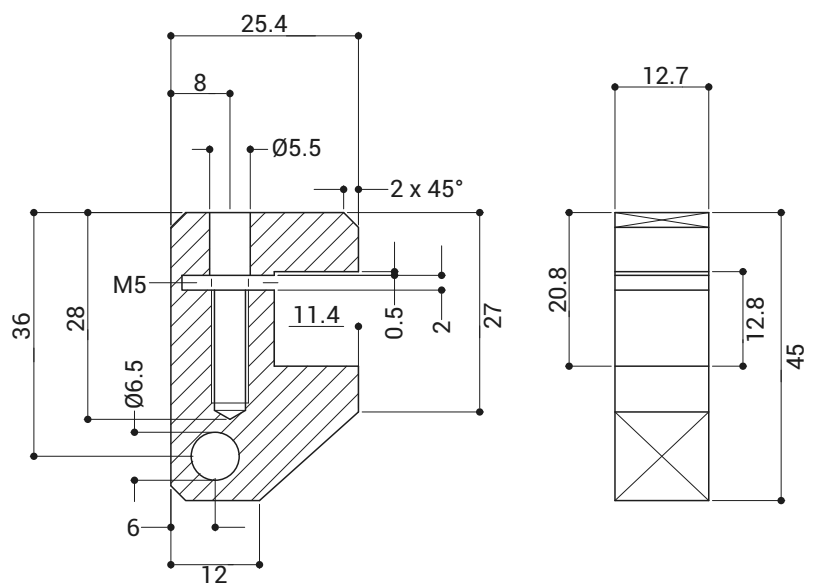


18 Teeth 20 DP 14.5° PA

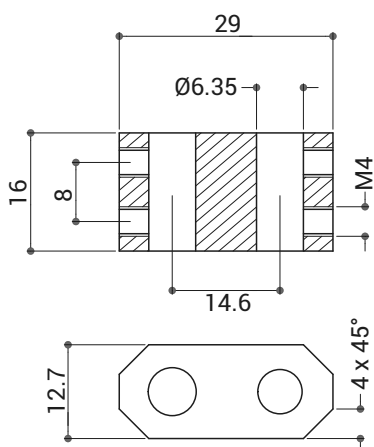
Idler Gears



Dog Gear, 2 Off
25 Teeth 20 DP 14.5° PA

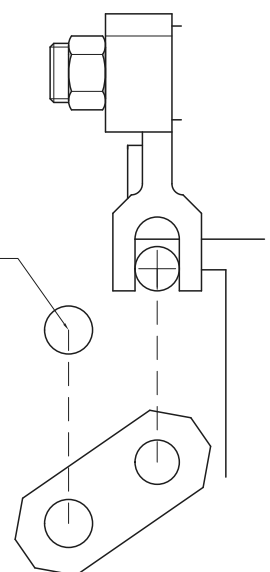


Super 7 Trip Rod Support Bracket



Suggested Connector Block

Trip Rod Position In S7 Support Block



On the operating shaft sits the trip lever which connects the trip rod assembly to the operating shaft. The manufacture of this part needs no description from me as it is pretty straight forward. The 2 mm diameter dowel hole does need to line up with the operating shaft and some constructors might like to do these two items together. Alternatively, the holes could both be drilled using coordinate location to the pre-reaming size and then reamed to size on assembly. Again, although a 2 mm diameter dowel hole is specified the reader could with advantage use a 3/32" dowel if preferred. However, I do need to point out that on no account should this dowel be omitted. This little dowel is all that is stopping a collision between the tool and the chuck. Relying solely on the nut alone to hold this lever against the force of the trip rod is a recipe for disaster.

Attaching the trip lever to the trip rod running along the bed is accomplished by a 1/4" diameter connecting shaft running between the headstock casting and the countershaft casting. On most machines there is just enough room for this to pass through easily. Should this not be the case on the reader's machine then three options are open. One is to shim the countershaft casting away from the headstock casting. Another is to reduce the size of the connecting shaft, to say 6 mm or 7/32". Finally use a rectangular section mild steel connecting link. In the original design a block to connect the connecting shaft with the trip rod was designed. This was intended to lie at an angle of 45 degrees to the vertical when fitted. Should options 2 or 3 be taken then this block will need modifying in line with the chosen option. The length of the connecting shaft has not been specified, purely because I have not received this information from any constructor. The maximum length of the connecting shaft is determined by the connecting block missing the rear of largest faceplate fitted to the spindle. This position being reached when the operating ball handle is pushed fully towards the left. The trip rod length is also not specified as this will vary with the between centres dimension of each lathe variant and the position of the connecting block.

The trips are exactly the same as those used on the S7, they are intended to fit such that they impinge on the carriage casting, just below the wiper, see **photo 18**. A more general picture of how things are designed



Earlier Wiper assembly, courtesy of Ken Willson

to go together is shown in photo 5, but this is for the S7 so it does not have the ML7 'Dog leg' connector block. At this location the trips are easy enough to adjust and see. The bracket which sits at the tailstock end is also borrowed from the S7 unit, it can just be made out in photo 5.

When setting up to machine a thread the stop has to be set in advance of the actual finishing point, this is where the 'Handwheel Dial' is a great help. Let's consider setting up to cut a thread, with the motor off, engage the ball handle in the direction of travel, let us say towards the headstock, ensuring full engagement by turning the chuck by hand. The handwheel dial is set to zero at the end of the thread in hand and the stop provisionally set. Return the ball handle to neutral, wind the saddle back towards the tailstock a little and start the motor. Again, engage the ball handle to the left, then using the handwheel continue to feed towards the headstock until the leadscrew stops revolving. The distance from zero is the amount the stop has to be moved towards the headstock. If the travel is beyond zero then this is the amount the stop needs advancing towards the tailstock to get the saddle to stop at the zero mark on the Dial. Adjust the stop and recheck the setting, carry out the same procedure at the beginning of the thread, i.e. tailstock end in this case. Finally checking both settings with the clasp nuts engaged, as moments of inertia need to be taken into account, settings vary with mandrel speed and pitch of screw being cut. This sounds a long and protracted method but in practice it is quick and quite simple really. Further as you get to use the attachment more and more, the amount of travel required to trip the clutch will become a known quantity and can be dialled in from the outset, I seem to recall the Hardinge was around 5mm, but do not quote me on this as it is now nearly 30

years since I last operated one.

One thing that is important is that care should be exercised when using the tailstock to support any workpiece, as clearance is needed between the saddle casting and the tailstock base to avoid collision and therefore damage to the lathe.

Whilst theoretically it should be possible to screw cut at 2000 RPM using this set-up I would not want to prove the theory, there could be some expensive scrap. It should be possible to screw cut at about 210 RPM when cutting ME threads, coarser pitches would probably require backgear, and at the end of the day it is down to the user with regard to what he or she feels happy with. I would most certainly recommend slower speeds to start off with until the confidence level rises. You will know when you have reached this level when you are prepared to contemplate cutting an internal thread; the unit works in exactly the same way.

Just for information the bottom speed of the Hardinge, which has an infinitely variable speed range, is 125 RPM, but increasing the speed after setting the stops would alter the stop/start thread setting slightly and was therefore to be avoided. I mention this just to put those on their guard who have inverter drives. It should be pointed out that an undercut should be provided for the tool to run into, alternatively if the tool is allowed to dwell it will cut its own Vee or Acme style undercut depending on the thread being cut, it will not weaken the thread, as the root diameter is constant.

Vee threads finished in this way can be found on some commercial parts today produced on a CNC. More often than not the CNC feathers out the thread, something the old timers used to do manually. Obviously, the CNC lathe has superseded this unit today, but those with screw cutting boxes might wish to add this unit to simplify their screw cutting. ■

I would most certainly recommend slower speeds to start off with until your confidence level rises.

Fine Scale **GWR Models for the 21st Century**



Fair Rosamund 5" gauge designed by N.Evans



Whether you seek the quaint simplicity of Fair Rosamund 0-4-2 tank, the detailed grandeur of the Dean Single or the 'modern' style of a Grange or Castle we should have a design to suit you.



Dean Single 5" gauge designed by P.Rich



With a wide range of well supported designs in 5" and 7 1/4" gauge including the impressive Collett Goods 0-6-0 above, we have something to suit most skill levels and preferences. Should you wish to build any other GWR model, please get in touch as we hold many patterns and due to GWR standardisation, we may be able to help far more than you expect.



In addition to the drawings, castings, laser cut parts and lost wax castings which you might expect from a supplier, we also supply CNC cut/drilled brass platework. Most variants of GWR tender are catered for, in various gauges/scales (incl. 1.5" & 1.54" : ft for 7 1/4"). Platework/cab/tanks/cab windows, etc for our own and other GW models - please enquire.

Don't forget we are one of the largest suppliers of fittings, materials, etc to the model engineering hobby!

Catalogue: £2 UK Posted or download from website:

www.pollymodelengineering.co.uk

See us at the London Model Engineering Exhibition - with a new Polly Kit Loco on display!

Polly Model Engineering Limited Atlas Mills, Birchwood Avenue, Long Eaton, Nottingham NG10 3ND

Tel: 0115 9736700 email: sales@pollymodelengineering.co.uk

FREE PRIVATE ADVERTS



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

■ Myford Super 7 lathe, with Amolco milling attachment on maker's stand and many attachments, offers around £950. **T. 01328 823 244. Fakenham, Norfolk.**

■ RJH Trimtool lathe tool grinder, reversing, single phase. £250. Three phase motor with reversing switch, Brook Gryphon 1/2 hp 2850 rpm, £40. Large bench shear, Samson brand, £50. **T. 0161 761 4556. Bury, Lancashire.**

■ Warco bench drill 5 speed 1 phase 13mm Chuck very little use, good as new cost £109 would accept £75 ono. **T. 07519 129840. South Woodham, Essex.**

■ SIEG SX2P Hi Torque Mill, brushless motor, R8 spindle taper. Upgrades include gas strut counterbalance, brass gib strips,

thrust bearings fitted to X & Y axes. £500. **T.01536482916. Northampton.**

Parts and Materials

■ Copper tubing 7/16" OD 11 1/2" long, 13 pieces 16 gauge. 3/4" OD 18 gauge 4 pieces 11 1/2" long £35. **T. 0161 320 7754. Stockport.**

■ Casting set 3 1/2" Britannia. Quality unmachined castings 68 bronze wheels Cl, flanged boiler plates, barrel and smokebox. Castings 2" Burrell showman's engine Thetford Town, bronze cylinder boiler kit with flanged plates, twisted brass, name plates and maker's instruction plates. Sensible offers accepted. **T. 01328 823 244. Fakenham, Norfolk.**

Magazines, Books and Plans

■ Original Plastow Drawings for Fowler

Princess Showmans Engine. Shows dimensions for 3" and 4" scales. 13 sheets of drawings plus photographs never used. £25 post free. **T 01772 673410. Newton with Scales, Lancashire**

Wanted

■ ACME die nut. I have a need for a die nut 1/2" x 10 or would anyone be brave enough to lend me one? **T. 01691 659739. Oswestry.**

■ Wanted Simple Vertical Head for a Tom Senior M1 milling Machine or if anyone has made one a workshop drawing. **T. 00356 21440603. Malta.**

■ Set of detail drawings, part-built or complete Tender, for 8 wheel Gresley A3 Pacific, in 71/4" gauge, ideally to the design of Henry Greenly. **T. 07939 626885.**

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 ☐

Shaping Up

Bill Morris describes the origins and functions of shaping machines.

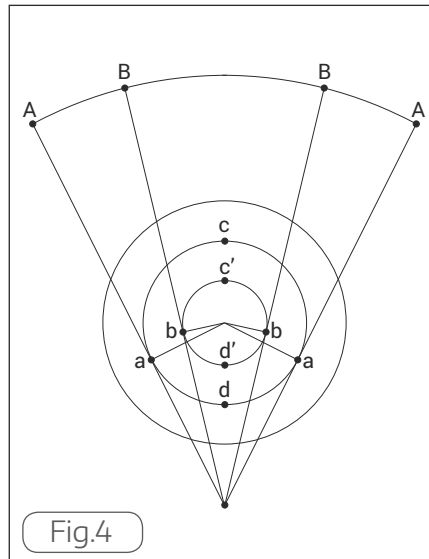
Figure 4 analyses the geometry of the shaper stroke. When the crank pin is set at position "b", the stroke takes place over the arc "B-B". When the pin is moved further from the centre of the bull wheel to position "a", the stroke takes place over the longer arc "A-A". The cutting stroke is over the longer arc a-c-a or b-c'-b and the return stroke is over the shorter arc a-d-a or b-d'-b. Since the return stroke takes place over a shorter arc, it is also quicker. Conversely, for a given stroke rate, as the cutting arc gets longer, it has to traverse a longer distance in the same time, so the cutting speed rises.

Structure of the ram

The ram is a massive casting with generous dovetail vees below, **photo 11**. The front end has a circular seat machined on it for the base of the tool slide and ways on the under side to guide the upper end of the top link as the initial position of the ram is set. The upper link locked into place by the ram anchor nut. **Photograph 12** shows the very generous proportions of the ram dovetails. Alongside the ram is a 700 mm long straight edge that I made as a set of three tested against each other, to guide my scraping when I first restored the machine 22 years ago.

The flat and the left hand edge of the dovetail slide for the ram are machined on the top of the body casting and adjustment is made on the right hand side by means of a heavy gib strip which is held down on top of the base by three stout keeper bolts whose position is adjusted by three screws and lock nuts., **photo 12**. When I first acquired the machine, I was puzzled by my inability to remove all shake from the ram, a very necessary condition if dovetail slides with parallel edges are to be produced on the machine. This was in spite of my tightening the gib screws hard. Eventually, I discovered that none of the gib screws had been tapped all the way through. Presumably the shaper had been used only

The slide itself is of conventional dovetail slide construction with a gib strip and locking screw.

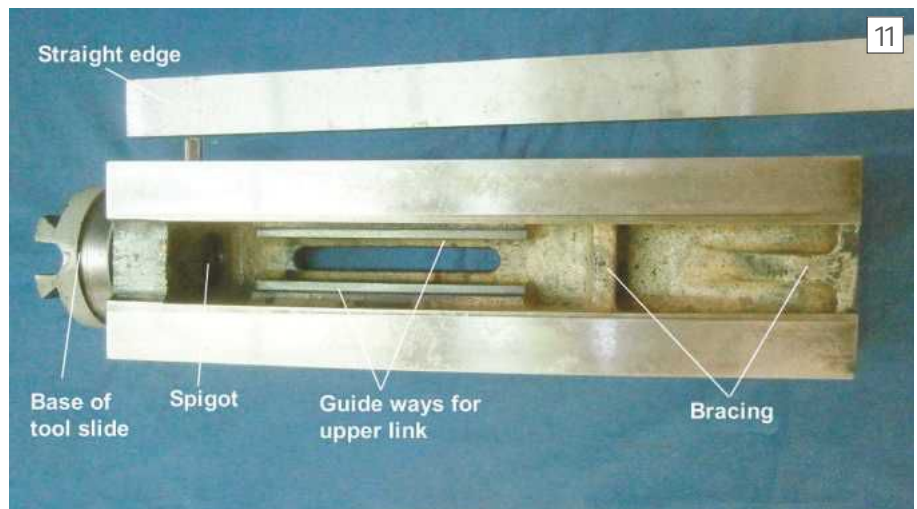


Stroke diagram

can be machined, though the width of such surfaces is limited by the travel of the slide, which is 90 mm. The slide itself is of conventional dovetail slide construction with a gib strip and locking screw. It is necessary to have a locking screw for the slide as, once the position of the slide is set, the force and vibration of the cut tends to move the slide down and increase the depth of cut without being asked. The feed screw is provided with an adjustable thimble so that the depth of cut can be monitored. As an aid to setting up for shaping truly vertical surfaces, I machined a flat on the left hand side of the tool slide, parallel to its axis of movement. This is visible in **photo 19** and can be set to vertical off the machine table using a large square.

Clapper box, photo 14

The clapper box base has on it two stout shoulders through which a fixed shaft



Underside of ram.

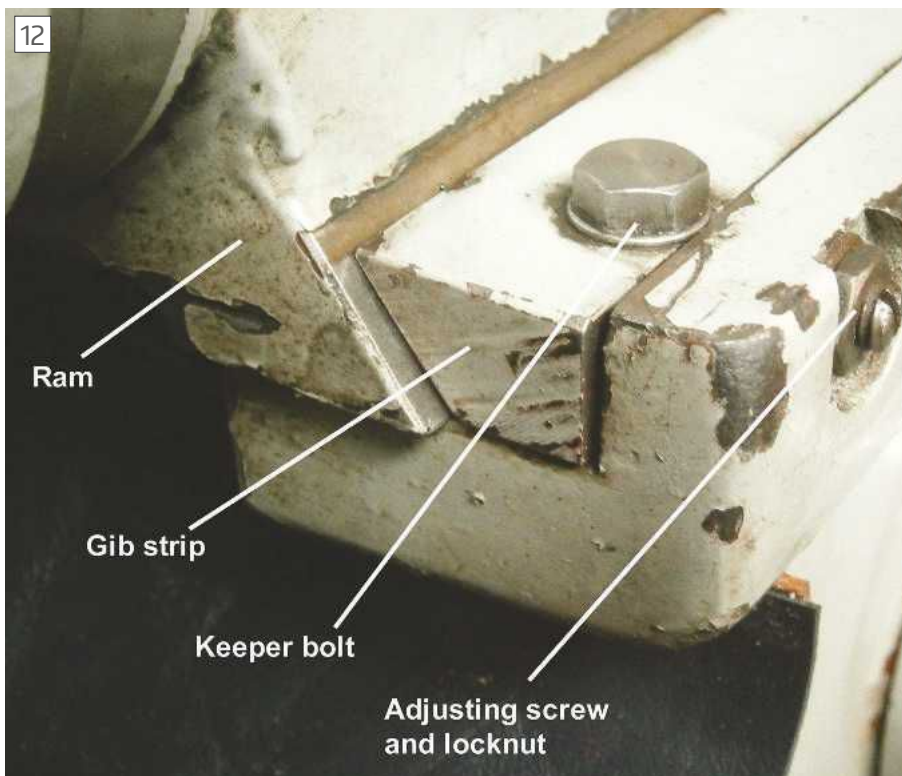
as a hack machine for this to have remained undiscovered by previous owners. Even so, adjustment of this type of strip needs some patience. The keeper bolts have to be tightened enough to allow sideways movement of the strip by the adjusting screws while not locking up the ram when finally tightened hard.

The cutting end

The tool slide, **photo 13** has a large spigot that fits into the end of the ram and is locked against the ram and prevented from rotating by a cam operated by the squared-end tilt-lock shaft. It is possible to rotate it through 90 degrees each way from the vertical so that angular surfaces

passes to form an axis about which the clapper rotates in short arcs. The clapper fits closely between the two shoulders and carries a lantern toolpost. The base is secured to the tool slide by a screw for an axis and can be set over about 15 degrees either way, when it is locked in position by the set-over locking bolt. On large shaping machines, the set over is aided by means of a worm and toothed sector.

On the cutting stroke the clapper is forced back firmly against the base by cutting forces, while on the return stroke, its inertia causes it to swing forwards about its shaft, so lifting the tool away from the work piece. At the beginning of the forward stroke, inertia again forces it back against



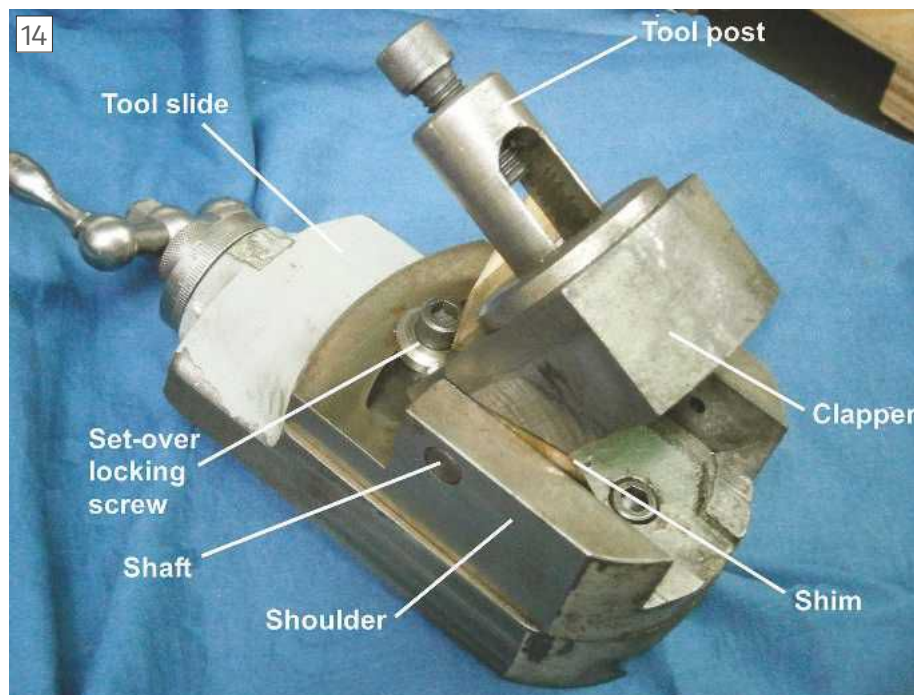
Gib strip of ram.

the base with a "clap". For good work, it is important that the clapper should be a close fit in its base, but there is no means of adjusting this, presumably because no wear was expected, given that the side faces are never moving when loaded. However, I found that there was slight sideways play, either through wear or generous manufacturing tolerances, so I inserted a thin brass shim to take up the play. In some jobs, it is necessary to lock the clapper box and I drilled and tapped a hole through one of the shoulders for a locking screw.

Cross table feed

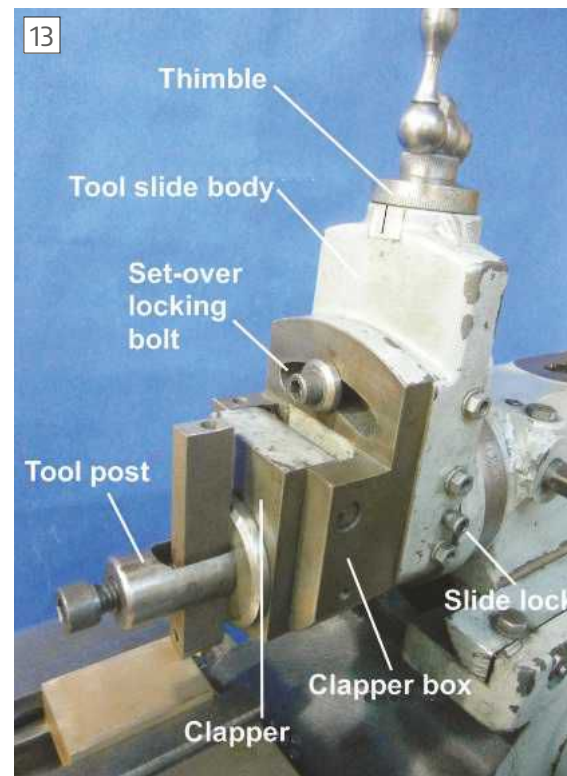
Now that we have the ram and its attached tool reciprocating, we can turn attention to the means of feeding the workpiece across below the tool to generate a surface, **photo 15**.

The end of the bull wheel shaft has a driving disc attached to it which rotates with the bull wheel and acts as a crank. A tee slot is machined across the disc to accept a tee bolt that carries a hardened drive pin. The drive pin is locked into its chosen position by a clamp. Running on the drive pin is a two-piece connecting link that is adjustable in length according to whether the table is high or low, and the far end of the link runs on another crank pin in the form of a shouldered bolt. Larger machines usually have a sun and planet gear, each with an equal number of teeth interposed between the bull wheel shaft and the driving disc, so that the centre distance between the driving disc and crank remains constant. As the driving disc rotates, the connecting link oscillates back and forth, providing that the drive pin is somewhere other than



Clapper box details.

centred, and this causes the crank at the other end of the connecting link to rock back and forth. The crank has a stout spring-loaded pawl that can be rotated to drive the ratchet wheel in either direction and which can be withdrawn from the ratchet wheel to stop the feed. It is important that the feed should take place on the non-cutting stroke of the ram. The feed per revolution is increased by moving the crank pin further out along the driving disc and four steps of feed are possible, between 0.006 in to 0.025 in



Tool slide and clapper box

(0.15 to 0.63 mm) per stroke of the ram. The mechanism is shown exploded in **photo 16**.

The ratchet wheel is pinned to the threaded cross shaft which runs in bearings in the apron and passes through a feed nut. This latter carries a spigot which sits in a hole in the back of the table and drives it along the cross rails machined on the apron. The cross shaft has a squared end for a handle used to move the table by hand and the other end has a fine thread so that the shaft

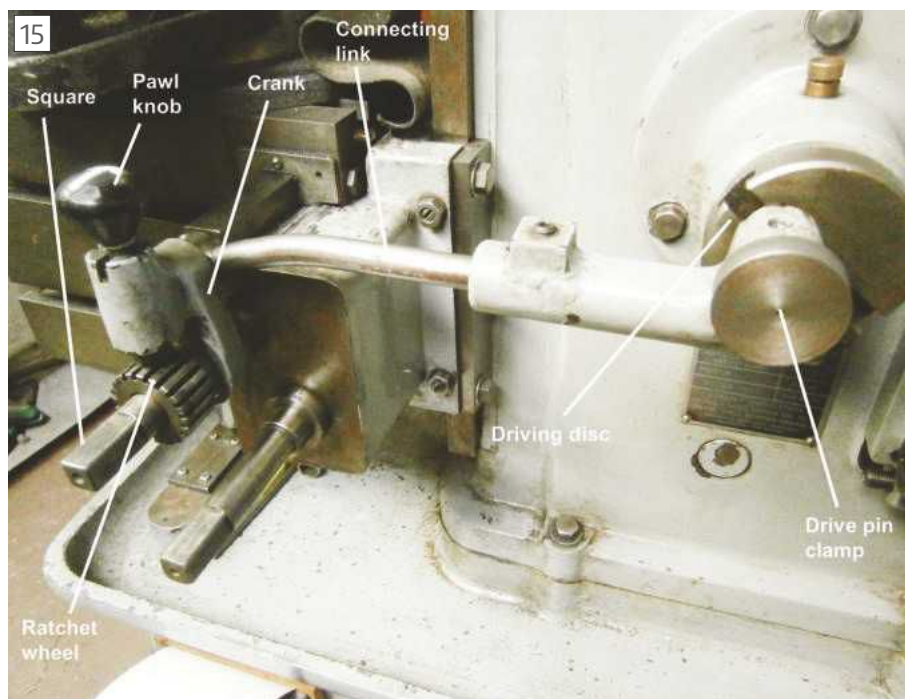
Ideally, both keepers should be equipped with soft-faced locking screws, an omission I have planned to make good for 22 years.

can be adjusted by means of a nut and locknut, to have enough drag to prevent the ratched wheel going backwards as the pawl passes over the teeth of the ratchet wheel. **Photograph 17** shows the details. Note how a portion of the feed screw is bare of threads at each end so that feed automatically stops if the operator is distracted at the end of a run.

The table hangs, as it were, on the cross rails of an apron, and gib strips top and bottom at a right angle to each other remove all play. It is usual for shaping machines to have rectangular cross rails, as dovetail ways would have a wedging action under the intermittent load.

Vertical table feed

The squared end of the vertical feed shaft has been noted in photo 4, and **photo 18** shows some details. The other end of shaft carries a helical "skew" gear pinned to it and this gear drives another one at right angles to it. Though free to rotate, the latter gear is held captive in the apron by two locknuts and is threaded for a vertical drive shaft, itself held captive in the base of the body



Cross feed mechanism.

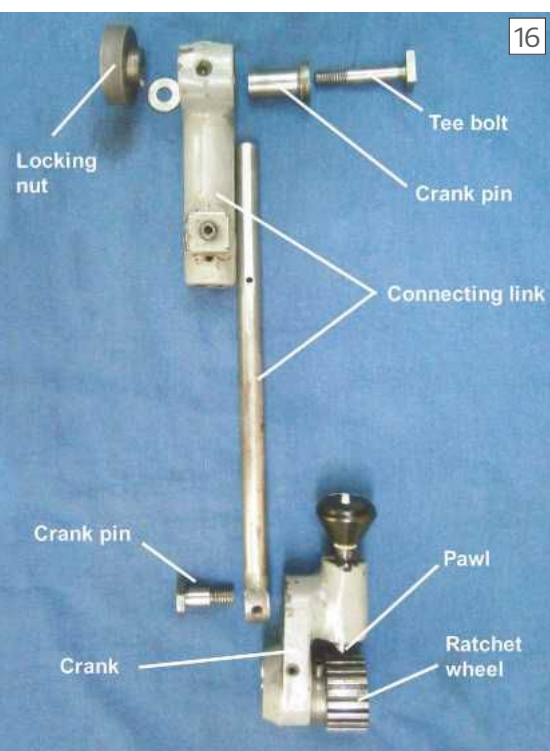
and locked against rotation. Thus, when the skew gears rotate, the vertical one climbs or descends the stationary vertical drive shaft, carrying the apron with it.

The apron is carried on rectangular vertical ways machined on the face of the body and are made accurately at right angles to the plane of the ram movement. It is held against the face of the ways by substantial keeper plates on each side and there is an adjustable gib stip on the right hand side, **photo 19**. Since the slides do not usually move when under cutting load, no wear is to be expected, so that once the keepers are

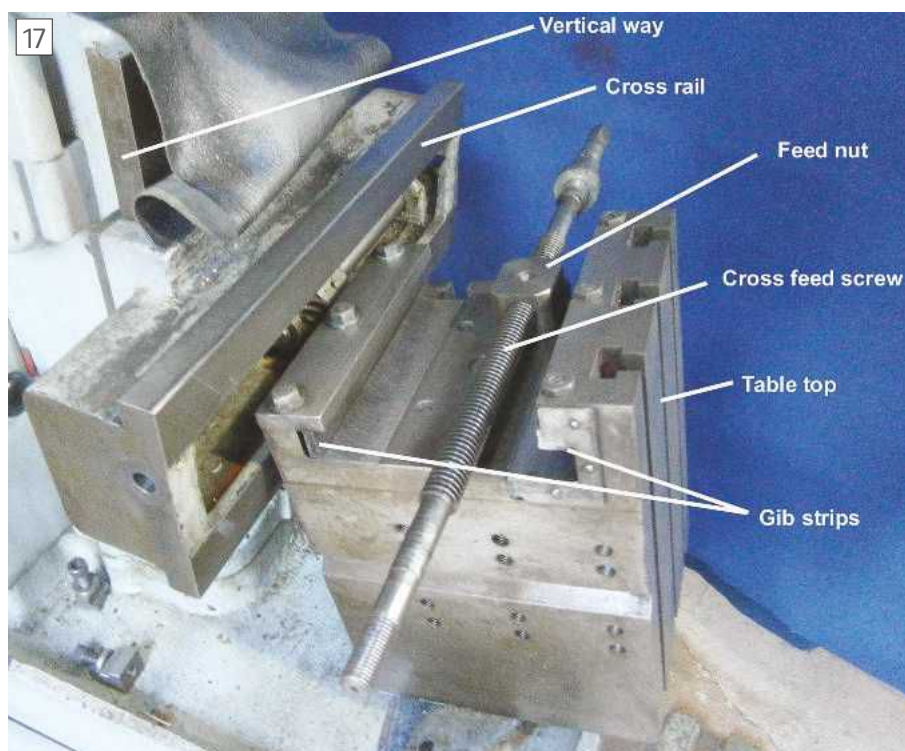
adjusted using shims and rocking taken out by means of the gib, they should need no further attention. Note that in photos 18 and 19 the original scraper marks are still clearly visible on the table slides. Like the table cross movement, vertical movement should be adjusted to be a little stiff so that movement under load is reduced to a minimum. Ideally, both keepers should be equipped with soft-faced locking screws, an omission that I have planned to make good for 22 years.

The table

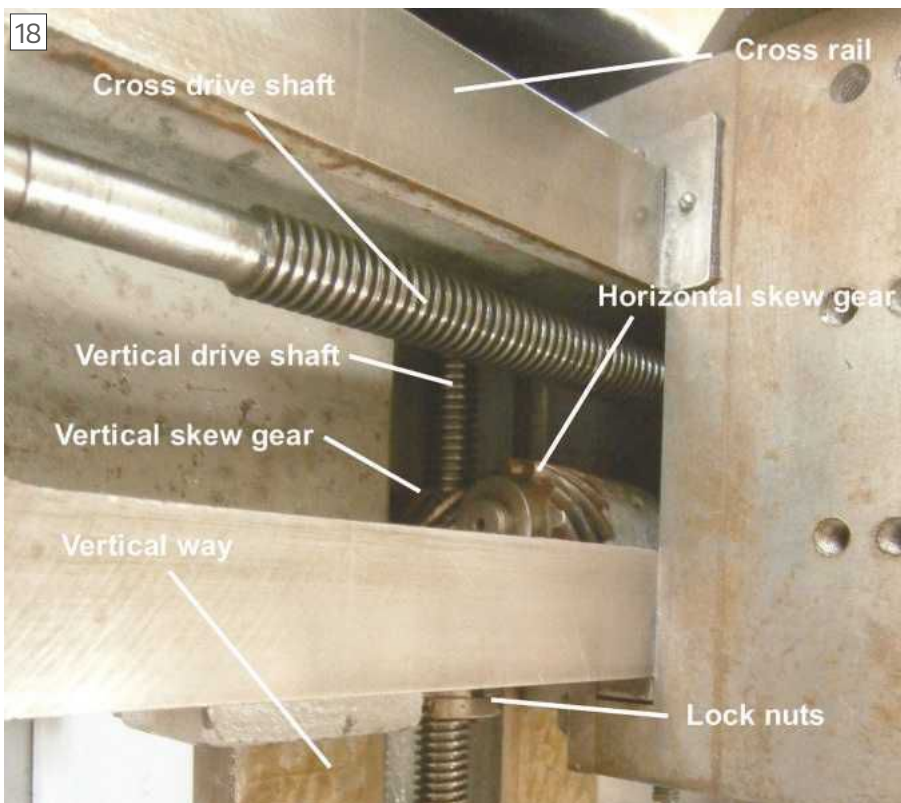
The table, which measures 260 mm (10.2



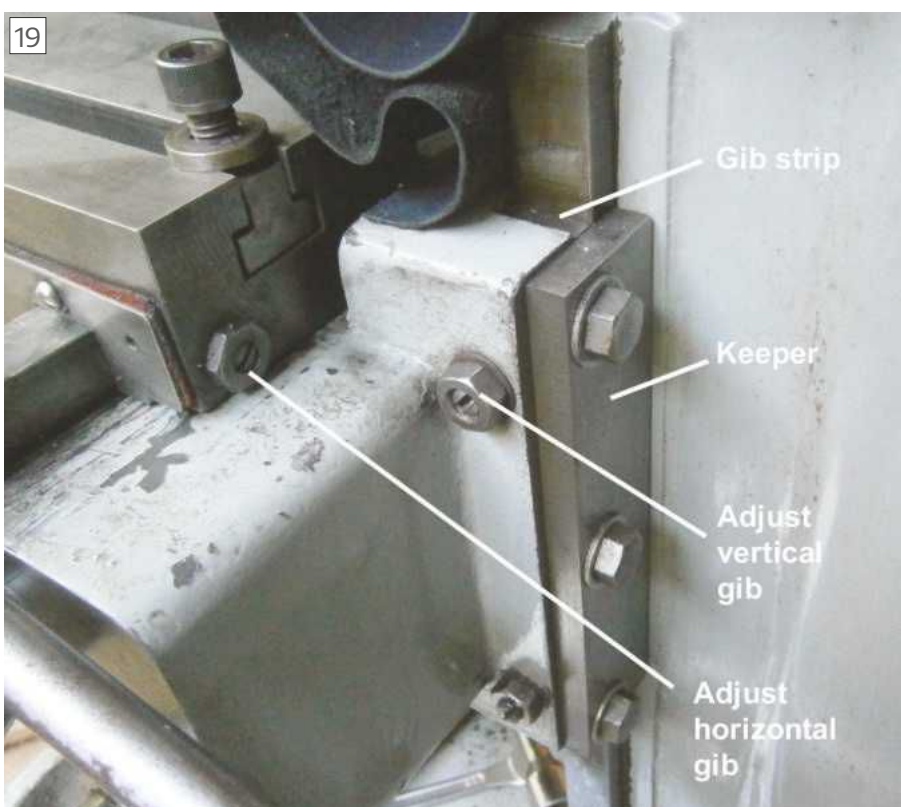
Cross feed mechanism exploded.



Cross slide feed screw and nut.



Elevation of apron.



Gib strips of apron.

in) long, 175 mm (6.9 ins) wide and 190 mm (7.5 in) high has already appeared in several of the photos. A ribbed box casting, it has tee slots on the top and right hand side with a vertical vee on the left hand side for attaching shafts. What is not easily apparent is that it is in two parts, a thinner part that connects with the apron ways and

the main part that is secured to the other via a central spigot and three large securing bolts, **photo 20**. This arrangement allows the table to be rotated through a limited range of angles or even to be re-positioned so that a different face is uppermost. This is not something that I would recommend to be done except in case of dire need, as

I took a possibly easier way out by screwing a surface-ground wear strip to it and carefully shimming it to the correct contour.

getting the table back to its normal position is rather like adjusting a lathe tailstock when the set-over has been disturbed: even with the aid of a dial indicator one tends to move back and forth, eluded by the happy "just right" central position.

Bolted to the underside of the table is a fitting that carries a support leg to resist some of the downward cutting forces. It is locked in position by a bolt bearing against a flat machined on the leg and the lower end runs on a guide surface machined on the base. Inevitably, this surface wears concave with repeated hammering from the cutting forces and then, if adjusted to run on the concave part, it tends to raise the table a little in other parts, so that the face of a workpiece may end up convex. The surface could of course be filed and scraped flat and parallel to the table movement, but I took a possibly easier way out by screwing a surface-ground wear strip to it and carefully shimming it to the correct contour.

In the next article, Bill will describe how he set up and aligned the shaper. ■



Table adjustments.

ALL LIVE STEAM ENGINES WANTED

including **BROKEN** or **JUST WORN OUT** • **PART BUILTS** considered

- **ALL LOCOS WANTED** from GAUGE 1 to 10 1/4" especially BRITANNIA, A4, A3, SADDLE TANK and anything large and unusual.
- **ALL TRACTION ENGINES WANTED** from 1" to 6" including SHOWMANS, BURRELLS and PLOUGHING etc.
- **ALSO WANTED STATIONARY ENGINES, BEAM ENGINES, VERTICALS, HORIZONTALS, STUART TURNER** etc.
- **ANY ENGINEERED SCALE BUSES, LORRIES, CARS** etc considered.

Telephone for a fast friendly service seven days a week!

TELEPHONE: **01507 606772** or **07717 753200** and ask for Kevin
Don't forget to visit our self catering holiday cottages on: **www.railwaycottages.org**

We will collect, and possibly in your area today!

Cowells Small Machine Tool Ltd.

Cowells Small Machine Tools Ltd.
Tendring Road, Little Bentley, Colchester CO7 8SH Essex England
Tel/Fax +44 (0)1206 251 792 e-mail sales@cowells.com

www.cowells.com

Manufactures of high precision screwcutting lathes, 8mm horological collet lathes and milling machines, plus comprehensive accessory range. Talk directly to the manufacturer



M-MACHINE

Unit 6 Forge Way, Cleveland Trading Estate
Darlington, Co. Durham. DL1 2PJ

Metals for Model Makers

Contact us for Copper, Brass, Aluminium, Steel, Phosphor Bronze, etc.

PHONE & FAX 01325 381300

e-mail: sales@m-machine.co.uk
www.m-machine-metals.co.uk

CNC Cutting service Wood, Metal, Plastic & CNC Conversions

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

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

Routout cnc + Tiggy Aviation

Tel: 01664 454795
www.routoutcnc.com

THINKING OF SELLING YOUR LATHE MILL OR COMPLETE WORKSHOP?

and want it handled in a quick, professional no fuss manner? Contact David Anchell, Quillstar (Nottingham).

Tel: 0115 9206123 Mob: 07779432060

TAPS & DIES

Excellent Quality manufactured-supplied



British-box HQS taps dies cuts stainless
ME5(33pcs) **ME4** (30pcs) **BA3**(35pcs) has all Model Eng 32+40tpi BA, BSB, MTP etc

THE TAP & DIE CO

445 West Green Rd, London N15 3PL
Tel: 020 8888 1865 Fax: 020 8888 4613
www.tapdie.com & www.tap-die.com

For more than 25 years I have been serving model engineers, offering services including the supply of top quality 'used' machines and accessories, valuations, pre purchase inspection of third party machines plus general advice and information.

For an online stocklist plus details of services available please go to my website or contact David Anchell direct.

www.quillstar.co.uk

Telephone: 0115 9206123 • Mobile: 07779432060

any age, size or condition considered - any distance, any time

ALL STEAM LOCO'S WANTED

ALL PART BUILT MODELS WANTED

ALL WORKSHOPS CLEARED SWEEP CLEAN

All 5" Gauge Loco's Wanted

Hunselt, Simplex, Speedy, BR Class 2, Horwich Crab, BR 8400 tank, Maid of Kent, Black Five, Jubilee, Royal Engineer, B1 Springbok, Torquay Manor.

All 7 1/4" Gauge Loco's Wanted

Hunselt, Hercules, Jessie, Romulus, Dart, Bridget, Holmeside, Paddington, GWR Mogul 43xx, GWR King, Black Five, A3, B1, etc.

All 3 1/2" Gauge Loco's Wanted

Titch, Juliet, Rob Roy, Firefly, Jubilee, Maisie, Doris, GWR Hall, Britannia, Hielan Lassie, Etc.

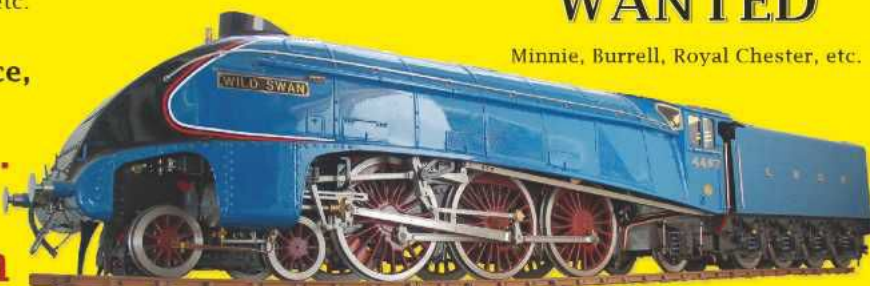
ALL TRACTION ENGINES WANTED

Minnie, Burrell, Royal Chester, etc.



For a professional friendly service, please telephone:

Graham Jones MSc.
0121 358 4320
antiquetsteam.com



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

MODEL ENGINEERS' WORKSHOP CLASSIFIED

SOCKET SCREWS
Cap. Csk. Button. Grub. Shoulder
METRIC. BA. BSF. BSW. UNF. UNC
Hexagonal & Slotted Screws Nuts & Washers,
Dowel & Spring Pins. HSS Taps & Drills. Draper Tools.

NO MINIMUM ORDER • PROMPT SERVICE

Special Offer * Workshop Discount Pack *****
30 different packets of socket, hex, and slotted screws

Metric..... M2 to M6
Catalogue value of pack is over £50.00
Pack on offer for only £25.95 + £2.95 p&p

Order today and benefit from a very useful stock of screws in your workshop!

You will not be disappointed • Refund Guaranteed
www.emkayscrewssupplies.co.uk
Email: emkaysupplies@talktalk.net
• Tel: 01634 717256 •

Model Engineering Products Bexhill

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

Telephone: **01424 223702**
Mobile: **07704 256004**
email: modelengineerssupplies@gmail.com

17 Sea Road, Bexhill-On-Sea, East Sussex TN40 1EE
Visit our website:
www.model-engineering.co.uk

SPG TOOLS

• Mills • Lathes • Bandsaws
• Accessories • Tooling

Tel: **01455618825**
07786182253

www.spgtools.com

Variable Speed Lathes Now With Brushless Motors www.toolco.co.uk

*** 1130GV-B - 1.5kw motor** *** 1014VB - 750w motor**

*** 38mm spindle bore** *** Huge range of accessories for all machines**

Unit 4, Ebley Industrial Park, Westward Road, Stroud, Glos GL5 4SP (Just 4 miles from Junct 13 M5 Motorway)

Tel: 01453 767584
Email: sales@toolco.co.uk

View our full range of machines and equipment at our **Stroud Showroom**
Phone for opening times before travelling

www.themultimetallshop.co.uk

MULTI METALS

OVER 5000 ITEMS

Online suppliers of Metals and Engineering supplies
• No minimum order & Free Cutting Service

www.themultimetallshop.co.uk

www.themultimetallshop.co.uk

Ride On Railways

UK manufacturer of 5" and 7 1/4" gauge railway equipment

Tel: 01708 374468 • www.rideonrailways.co.uk

To advertise in Classified please contact David on: 07718 64 86 89 or david.holden@mytimemedia.com

For the BEST BOOKs & DVDs for the Model Engineer and the Mechanically Minded, go to:

WWW.CAMDENMIN.CO.UK

or ring or write for a copy of our Free Book & DVD List

CAMDEN MINIATURE STEAM SERVICES
Barrow Farm Rode Frome Somerset BA11 6PS Tel: 01373-830151

MODEL ENGINEER

BECOME PART OF THE ONLINE COMMUNITY FOR MODEL ENGINEER MAGAZINE

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

WWW.MODEL-ENGINEER.CO.UK

FOLLOW US

CLOCK CONSTRUCTION & REPAIR

Books by:

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

SPRINGS
BEARINGS
FRAMES
DIALS etc.

**FREE
Catalogue**

Telephone: +44 (0) 1420 487747

www.ritetimepublishing.com



SPG TOOLS

- Mills • Lathes • Bandsaws
- Accessories • Tooling



Tel: 01455618825
07786182253

www.spgtools.com

Ride On Railways



UK manufacturer
of 5" and 7 1/4"
gauge railway
equipment

Tel: 01708 374468 • www.rideonrailways.co.uk



Lynton &
Barnstaple
7/8" Scale

New Product

£649
full price

regulator kit £89

CASTLE STEAM

We build boilers!
All types of copper boilers
from 0 gauge to 5" gauge.

Castle Steam can build you a boiler that will exactly suit your needs. Boiler plan not quite right for your locomotive? Talk to us as we can modify the design for you. As an example we are currently designing a coal fired boiler for the 2 1/2" Bassett-Lowke "Flying Scotsman" to replace water tube boilers.

G1 boilers: ARM1G £108, Project £140, DEE £216

Also available are advanced kits for locomotive boilers which are fully formed and machined. Solder together for a boiler at about half the cost of a finished boiler.

Please contact us for a list and pricing.

Phone Steve on 07984 920786

or Contact Mike at info.castlesteam@gmail.com

**macc
models**
Engineers Supplies Ltd

www.maccmodels.co.uk

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

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



HOME AND WORKSHOP MACHINERY

Genuine Used Machines & Tooling

Myford Super 7B
+ Sino DRO & Tesla

£3950

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

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

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

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

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

Lots of aluminium - just in!



£1725



MYFORD GENUINE PARTS
Running out fast!
Purchased from Nottingham
Check the web site for full list!



£525
Micrometers
Various!
0-16" / 300mm

£7 each
Steel EN3B
(mild steel)



£845



240 volts!
Boxford TF1020
5" x 20" lathe

very nice!
£1450

£3950



£400



£5750



£625



£425



from
£10



from
£75



£350



very nice!
£1225



£525

Myford non standard wheels
£10-£49



£425



£525



£3750



£2450



£345



£725



just arrived!



£3450



£545



£20 each



£20 each



£525



£345



£30 each



£90



£750 each



£875



Coming in... + more!

- Boxford VM30 mills
- Harrison M300 lathes
- Colchester Colt 40" centre lathes
- Myford 254 lever collet chucks

New even easier to use Web site!



OPEN DAYS

Friday 29th and Saturday 30th

VAT FREE ON

ALL USED

MACHINERY+ TEA!

10AM till 4PM

See Web site for details

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

DRILLING MACHINES

WWW.CHESTERHOBBYSTORE.COM



T: 01244 531631

Throat: 104mm
Drilling Capacity: 13mm
Chuck Size: 1-13mm
Table Size: 165X160mm
Column Diameter: 48mm
Range of Speeds: 600-2500



DRI-D13

D13 DRILL

£99

The ideal entry level drill

*ALL DRILLS COME WITH DRILL CHUCK, CHUCK GUARD, MANUAL & PARTS LIST AS STANDARD

Throat: 165mm
Drilling Capacity: 16mm
Chuck Size: 3-16mm
Table Size: 300mm dia
Column Diameter: 70mm
Range of Speeds: 210-2580



DRI-D16

D16 DRILL

£250

Looking for the next level?

*ALL DRILLS COME WITH DRILL CHUCK, CHUCK GUARD, MANUAL & PARTS LIST AS STANDARD

Throat: 178mm
Drilling Capacity: 20mm
Chuck Size: 3-16mm
Table Size: 290x290mm
Column Diameter: 80mm
Range of Speeds: 210-2580



DRI-D19

D19 DRILL

£296

Upgrade to a little extra

*ALL DRILLS COME WITH DRILL CHUCK, CHUCK GUARD, MANUAL & PARTS LIST AS STANDARD

Throat: 254mm
Drilling Capacity: 32mm
Chuck Size: 3-16mm
Table Size: 420x470mm
Column Diameter: 90mm
Range of Speeds: 150-2700



DRI-D32

D32 DRILL

£525

The ultimate machine

*ALL DRILLS COME WITH DRILL CHUCK, CHUCK GUARD, MANUAL & PARTS LIST AS STANDARD

A WORKSHOP ESSENTIAL



GRI-FLEX

FLEXIBLE DRIVE SHAFT GRINDER

£99

Ideal for small delicate work. Lots of accessories

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

Visit our Website now for Special offers and sign up for Updates and Newsletters!

SUPPLYING HIGH QUALITY HOBBY ENGINEERING PRODUCTS FOR OVER

25 Years

WE WILL BE HERE



ALEXANDRA PALACE MODEL ENGINEERING EXHIBITION

The South's Major Showcase Of Modelling... Not To Be Missed!

Friday 19th to Sunday 21st January 2018
Great Hall, Alexandra Palace, London, N22 7AY



WWW.CHESTERHOBBYSTORE.COM

SALES@CHESTERHOBBYSTORE.COM



ALL Prices Inclusive of VAT

CHESTER MACHINE TOOLS . HOBBYSTORE

Hawarden . Clywd Close . Hawarden .

Chester . CH5 3PZ

UNITED KINGDOM

