

No.90

MAY/JUNE 2003

£3.35

MODEL ENGINEERS' WORKSHOP

THE PRACTICAL HOBBY MAGAZINE

GAS WELDING
Hints and tips

MILLING PROJECTS
Grinding rest accessories

DRILL GRINDING
Using the Quorn



QC TOOLHOLDING

Pro Machine Tools Ltd

Precision Machines Made in Germany
"For the discerning engineer."



F1200



Hi Speed

5 YEAR
WARRANTY



F1210E



CNC



CNC

Longitudinal X-axis	500 mm
Vertical Z-axis	280 mm
Transverse Y-axis	150 mm
Optional	180 mm
Power	1,4 kW, 230 V, 50 Hz
Spindle speed r.p.m.	180 - 3000
Swivel range both sides	90°
Tool holder	MT 2Optional MT3 or SK 30
Drilling stroke	40 mm
Work bench	700 x 180 mm

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 machines are quality rather than far eastern quantity.

All mills and lathes can be supplied fully fitted for CNC machining or can be retro fitted at a later date.

See our web site for details.



EMCO

GOL[®]matic

Pro Machine Tools Ltd

17 Station Road Business Park
Barnack
Stamford
Lincolnshire
PE9 3DW

Tel: (01780) 740956
Fax: (01780) 740957

Sales@emcomachinetools.co.uk

www.emcomachinetools.co.uk

EDITORIAL

Editor

David Fenner
Tel/Fax: 01738 583832

Editorial Administrator

Sarah Paine
sarah.paine@nexusmedia.com

PRODUCTION

Designer

Carol Philpott

Production Manager

Sifa Symons

Printed By

Polestar (Colchester)

Origination by

Atelier Data Services

SALES & MARKETING

Tel: 01322 660070

Group Sales Manager

Colin Taylor

Sales Manager

Tony Robertson

Marketing Executive

Gillian Lawrence

CIRCULATION

Sales Development Manager

Rachel Murthwaite

Circulation Manager

Brian Donnelly

MANAGEMENT

Divisional Publisher

Dawn Frosdick-Hopley

Associate Publisher

Jez Walters

SUBSCRIPTIONS

8 issues UK £27.00, Europe £32.50, US Surface \$47.50,
US Airmail \$53.00, RoW Surface £33.00, RoW Airmail £35.00

UK SUBSCRIPTIONS AND BACK ISSUES:

Highbury Nexus Subscription Services, Link House,
8 Bartholomew's Walk,

Ely, Cambridgeshire CB74ZD

Tel: 01353 654422 Fax: 01353 654400

Email: nexus.subs@highbury-wyvern.co.uk

(8.00am-6.00pm Mon.-Fri.)

USA SUBSCRIPTION AGENT:

Wise Owl Worldwide Publications,
5150 Candlewood Street, Suite 1, Lakewood
CA 90712-1900 USA.

For Visa/Mastercard orders in USA

Telephone (562) 461 7574. Fax (562) 461 7212.

Email: info@wiseowlmagazines.com

Web: www.wiseowlmagazines.com

Postmaster send address corrections to:

Model Engineers' Workshop

c/o Mercury Airfreight International Limited

365 Blair Road, Avenel, NJ 07001, USPS 010876

CANADIAN DISTRIBUTION:

Gordon & Gotch Periodicals

(Toll free 1 - 800 - 438 - 5005)

Published by

Highbury Nexus Special Interests Ltd,

Nexus House, Azalea Drive,

Swanley, Kent BR8 8HU



HIGHBURY
Nexus Special Interests

A SUBSIDIARY OF HIGHTORY HOUSE COMMUNICATIONS PLC

**Highbury Nexus Special Interests Ltd is a
wholly owned subsidiary of Highbury
House Communications plc**

© Highbury Nexus Special Interests Ltd 2003

All rights reserved ISSN 00819-8277

The Publisher's written consent must be obtained
before any part of this publication may be reproduced in any
form whatsoever, including photocopyers,
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.

Contents

11

On the Editor's Bench

Dave Fenner's commentary

12

Milling Projects for Beginners (7)

Accessories to enhance the versatility
of the grinding rest.

17

Internal Boring Bar

Easily made with replaceable tips

18

A Magnetic Picker Upper

A cleaner, easier way to lift ferrous swarf
and filings.

20

Fitting Slip Dials to a Drill/Mill

A straightforward improvement to save
time and frustration.

25

Link Up

Readers' sales and wants.

25

Next Issue

26

Workbench Additions (2)

Woodworking aids and accessories.

30

Oxyacetylene Welding (1)

Maybe out of favour for industrial production,
but versatile, and available for the amateur.

36

Dividing on the Super Seven (2)

Additional methods, equipment, and improvements
outlined.

40

Trade Counter

New items from suppliers.

41

Drill grinding with the Quorn

Several attachments and systems considered.

48

Some Thoughts on Quick Change Tooling

which have evolved over many years in the
workshop.

54

Scribe a Line

Reader to reader.

12



26



30



41



Front Cover

*The rustic setting of the
arguably old fashioned
oxy-acetylene gas welding
set gives clues to some of
the versatility described
by Trevor Marlow on
page 30.*

Compucutter

fully described in machine building manual

Machine Building Manual

(also includes Compumill & Mini machines)

Hardcopy

£25 + p&p (£5 UK)

CD

£25 inc.

Compucut system

Interface

Compucut software

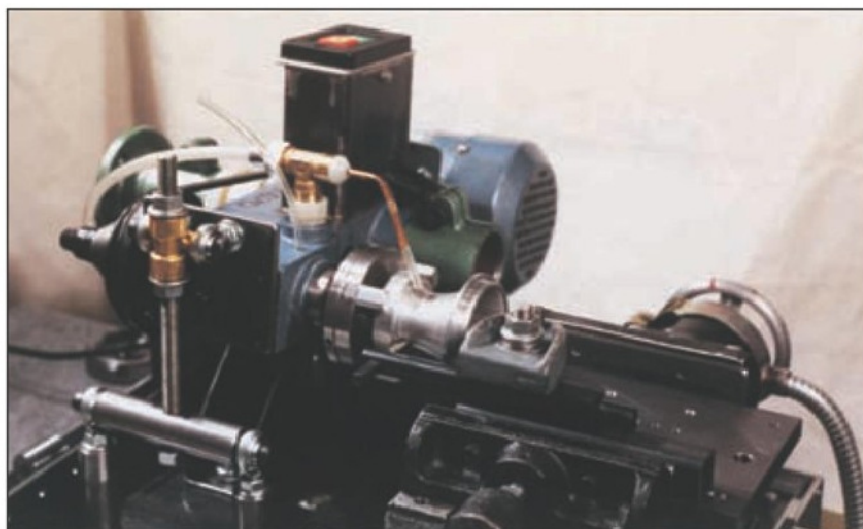
Compucut manual

£250 + p&p (£6 UK)

Compucut Software +

Compucut Manual

£100 + p&p (£5 UK)



shown here in 2 axis mode, turning a pulse jet intake

Note: Compact rigid design utilising readily available iron castings (pillar drill & X, Y, vice)

Tel: (02476) 473851 Email: compucutters@compuserve.com Web: www.compucutters.com

For info pack send SAE to:

Compucut, 17 Lime Tree Avenue, Tile Hill, Coventry CV4 9EY England

DON'T MISS A SINGLE ISSUE!

It can be difficult to find a copy of **MODEL ENGINEERS WORKSHOP** at local newsagents.

The ever-increasing number of magazines being published means that newsagents have less shelf space to display particular titles.

Specialist magazines especially get crowded out. There's a solution to this problem. Most newsagents provide Shop-Save and/or Home Delivery services.

Shop-save incurs no charge - simply ask your newsagent to order a copy for you. It will be kept on one side ready for you to collect.

Home delivered copies are ordered in the same way but generally incur a delivery charge.

A newsagent can order any magazine for you, whether or not the shop normally stocks it. If you buy your copies of **MODEL ENGINEERS WORKSHOP**

from a newsagent and want to make sure you get every issue, just ask at the counter.

To avoid disappointment, fill out and hand this form to your newsagent to reserve your copy:

**PLEASE RESERVE/DELIVER A COPY OF
MODEL ENGINEERS WORKSHOP
FOR ME**

Name: _____

Address: _____

Postcode: _____ **Telephone:** _____

Model Engineering Workshop Ad Index

ADVERTISER	PAGE
BW Electronics	9
Camden	9
Chester (UK) Ltd.....	OBC
Chronos	57
Compucutter	4
Compumil	60
Emco	58-59
Emco (single).....	IFC
Folkestone Engineering.....	7
Glendo Corp.	7
GLR	61
G+M Tools	10
Home and Workshop.....	IBC
IM Service	7
JC Payne.....	9
Machine Mart.....	5
Model Eng. Services	9
Newton Tesla.....	8
Nexus Special Interests	62-63-66
Tracy Tools Ltd	61
Warco	6
Welding centre.....	60

Clarke 6 SPEED METAL LATHE WITH 12 SPEED MILL/DRILL HEAD - CL500M

Full range of accessories available

ONLY £699.95 EX VAT
£822.44 INC VAT

Shown with optional floor stand

ONLY £119.95 EX VAT
£140.94 INC VAT

- 430mm between centres
- Compound slide with 4 way tool post
- Power fed screw cutting facility
- Forward/reverse lathe operation
- Clutch for independent mill/drill operation

Clarke 6 SPEED METAL LATHE

CL430 - Identical specification to the CL500M, (pictured top) but without the Mill/Drill head. N.B.: A Mill/Drill head is not available separately.

ONLY £579.95 EX VAT
£681.44 INC VAT

Clarke METAL LATHE

CL300M

BEST SELLER

ONLY £399.95 EX VAT
£469.94 INC VAT

- Power feed
- Gear change set
- 300mm between centres
- Electronic variable speed
- LH/RH thread screw cutting
- Self centering 3 jaw chuck with guard
- Compound mitre slide and 4 way tool post

Full range of accessories available

Clarke DRILL PRESSES

FROM ONLY £33.95 EX VAT
£39.89 INC VAT

- Safety cutout on belt guard
- Tables tilt 0-45° left and right
- Depth gauge
- Chuck guards

Full range of Drill Vices available

* Includes wet 'T' slot table and worklight

MODEL	CHUCK SIZE	SPD	WAS INC VAT	EX VAT	INC VAT
CDP50D	13mm	5	-	£33.95	£39.89
CDP101B	13mm	5	£70.44	£84.95	£102.57
CDP151B	13mm	5	-	£84.95	£99.02
CDP201B	13mm	12	£140.94	£155.49	£173.70
CDP251F	13mm	12	-	£134.95	£158.87
CDP301B	16mm	12	£176.19	£193.95	£216.44
CDP351F	16mm	12	£179.72	£197.95	£219.19
CDP401B	16mm	16	£211.44	£231.95	£255.94
CDP451F	16mm	16	£234.94	£259.95	£282.19
CDP501F	20mm	12	£469.94	£379.95	£446.44

Clarke 24" SHEET METAL FOLDER

ONLY £39.95 EX VAT
£46.94 INC VAT

ALSO AVAILABLE:
36" Floor Mounted Sheet Metal Folder
ONLY £149.95 EX VAT
£176.19 INC VAT

Machinist

where Quality costs less

44 SUPERSTORES NATIONWIDE

Clarke BENCH GRINDER STAND

BGS1

ONLY £25.95 EX VAT
£30.49 INC VAT

- Complete with bolt mountings and feet anchor holes

Clarke BENCH GRINDERS

FROM ONLY £18.95 EX VAT
£22.27 INC VAT

MASSIVE PRICE CUTS

MODEL	DUTY	WHEEL DIA. (mm)	WAS INC VAT	EX VAT	INC VAT
CBG6RZ	PRO 150	-	£18.95	£22.27	
CBG6SB	PRO 150	-	£14.95	£17.92	
CBG6RSC	HD 150	£32.84	£26.95	£31.67	
CBG6RWC	HD 150	-	£29.95	£35.19	
CBG6RL	HD 150	-	£34.95	£41.07	
CBG6RSC	HD 200	£41.07	£33.95	£39.89	
CBG6RWC	HD 200	£55.17	£39.95	£46.94	

* Supplied with wire wheel. RL models include worklamp.

Clarke DRILL SETS

TITANIUM COATED 30PC

ONLY £24.95 EX VAT
£29.32 INC VAT

- Titanium bits last up to 6 longer than std bits
- Can be re-sharpened

AVAILABLE IN IMPERIAL & METRIC

Clarke 12 SPD MILL/DRILL

CMD1225

ONLY £899.00 EX VAT
£1056.33 INC VAT

Precision engineered with cast iron head, base and column

- Spindle speeds 90-2150rpm
- Calibrated table 1/1000"
- 1/4 Hp, 230v, 1 Ph motor
- Accessories available
- 63mm milling cutter
- 13mm chuck

Clarke TAP & DIE SETS

FROM ONLY £12.95 EX VAT
£15.22 INC VAT

MASSIVE PRICE CUTS

High quality tungsten steel tap & die sets.

TYPE	WAS INC VAT	EX VAT	INC VAT
16pce Metric	£19.92	£14.95	£17.57
19pce UNF	£19.95	£23.44	
24pce UNC/UNF/NPT	£21.95	£25.79	
28pce Metric	£29.95	£35.19	
33pce Metric/UNF/BSP			

28pce BEST BUDGET BUY, 33pce RECOMMENDED - Practical Classics.

Clarke ANGLE GRINDERS

FROM ONLY £13.95 EX VAT
£16.39 INC VAT

Inc. disc & handle

CAG115C BEST BUY Practical Householder

MODEL	DUTY MOTOR	WAS INC VAT	EX VAT	INC VAT
CAG121*	DIY 500w	-	£13.95	£16.39
CAG120*	DIY 550w	-	£16.95	£19.92
CAG115*	PRO 500w	-	£27.95	£32.84
CAG115C*	PRO 720w	-	£29.95	£35.19
CAG230**	PRO 1700w	£46.94	£34.95	£41.07

* 115mm disc #230mm disc

Clarke SOLDERING GUN KIT

REDUCED £12.95 EX VAT
£15.22 INC VAT

WAS £24.95 INC VAT SAVE £1.76

100w, 230v, trigger operated instant heat soldering gun with spare tip

De-Solder tool to remove excess solder • 30w, 230v soldering iron & stand

Hands free magnifier

KIT BOX INCLUDED

Clarke TORCH KITS

CBTSK (left) 5 functions: hot knife, soldering torch, hot blower, pencil flame torch & wide flame. Requires butane gas.

ONLY £19.95 EX VAT
£23.44 INC VAT

CBTI (right) • Uses gas lighter fuel

Adjustable flame (temp up to 1300°C)

REDUCED WAS £25.79 NOW ONLY £19.95 INC VAT £23.44 EX VAT

Clarke SWING ARM & MAGNIFYING LAMPS

FROM ONLY £7.95 EX VAT
£9.34 INC VAT

MASSIVE PRICE CUTS

Ideal for fine detail work

* Lamp Only

MODEL	LENS (MM)	WAS INC VAT	EX VAT	INC VAT
SAL100*	-	-	£7.95	£9.34
SAM75	89	£21.09	£14.95	£17.57
SAM100	120	£46.94	£34.95	£41.07

Clarke MEASURING INSTRUMENTS

MODEL	DESCRIPTION	EX VAT	INC VAT
CM160	150mm Dial Caliper	£17.95	£21.09
CM180	0-25mm External Micrometer	£9.75	£11.69
CM190	25-50mm External Micrometer	£16.95	£19.92
CM200	0-1" External Micrometer	£14.95	£17.57
CM220	0-10mm Dial Test Indicator	£16.95	£19.92
CM100	150mm/6" Vernier Caliper	£8.49	£9.98
CM110	200mm/8" Vernier Caliper	£19.95	£23.44
CM120	300mm/12" Vernier Caliper	£25.95	£30.49
CM130	150mm/6" Locking Caliper	£15.95	£18.74
CM150	6" Dial Caliper	£16.95	£19.92
CM145	150mm/6" Digital Vernier	£29.95	£35.19

Clarke ARC/TIG WELDERS

Variable amperage control

Turbo fan cooled

Low amp operation - ideal for Arc & Tig welding, auto bodywork & thin mildstainless steel

FROM ONLY £129.95 EX VAT
£152.69 INC VAT

MODEL	AMPS	EX VAT	INC VAT
Arc/Tig 90	20-90	£129.95	£152.69
Arc/Tig 120	20-110	£169.95	£199.69
Arc/Tig 150	5-130	£249.95	£293.69

Clarke MIG WELDERS

FROM ONLY £119.95 EX VAT
£140.94 INC VAT

Includes free:

- Face mask
- Earth clamp
- Gas regulator
- Pro90-150TE also inc:
- Welding wire
- CO2 gas bottle

OTHER SIZES & ARC WELDERS AVAILABLE

MODEL	AMPS	EX VAT	INC VAT
Pro 90	25-90	£119.95	£140.94
100E	27-100	£139.95	£164.44
135TE Turbo	30-130	£169.95	£199.69
150TE Turbo	30-150	£179.95	£211.44
165TE Turbo	30-155	£229.95	£270.19

* Turbo fan cooled for longer welding at full output

*MIG150TE Best Buy Auto Express

Clarke AIR TOOLS & SPRAY GUNS

TYPE	MODEL	EX VAT	INC VAT
Air Hammer	CAT29B	£16.95	£19.92
Die Grinder Set	CAT36	£20.99	£24.66
Spot blast gun	SB1	£23.95	£28.14
Grit blast gun	SB2	£23.95	£28.14
6" Dual Action sander	CAT80	£24.95	£29.32
Pro Spray Gun	-	£25.95	£30.49
1/2" Sq Drive Ratchet	CAT22B	£26.95	£31.67
3/8" Air drill	CAT27B	£27.95	£32.84
Super Pro Spray Gun	SP14	£34.95	£41.07
14pce 1/2" Ratchet set	CAT221B	£35.95	£42.24
Super Pro Spray Gun	SP18	£37.95	£44.59
12pce 1/2" Impact wrench set	CAT231B	£39.95	£46.94
High Speed Saw	CAT26B	£28.95	£34.02

Clarke AIR COMPRESSOR

WIZ OIL FREE MINI AIR COMPRESSOR

ONLY £59.95 EX VAT
£70.44 INC VAT

Ideal for airbrush work

1.58 cfm air displacement, 2.8 Bar Max Working Pressure

MODEL	TYPE
1	CTC600 6 dr chs
2	CTC700 7 dr cab
3	CTC800 8 dr chs
4	PRO RANGE
5	CTC103 3 dr ste
6	CTC106 6 dr drc
7	CTC109 9 dr chs
8	CTC105 5 dr tro
9	CTC107 7 dr tro

Clarke

3mm high grade steel

MODEL	SIZE
CWB1000	1000
CWB1500	1500
CWB2000	2000

Clarke

360° double loc

Jaw depth 75mm

Clarke

CAB2P

PRO KIT - CAB2

- Double action tri
- Precision machine

ONLY £24.95 EX VAT

Clarke

FROM ONLY £84.95 EX VAT
£99.82 INC VAT

- Fully portable
- H/Duty pumps
- Auto stop/start control

Clarke

HUGE RANGE OF SPRAY GUNS & ACCESSORIES

* Oil Free • Belt Dr

MODEL	CFM
830	7
835	7
865	7
950	8
1065	9
1555	14
1560	14

ORDER ONLINE

www.machinemart.co.uk

OVER 4000 PRODUCTS - SEE THE FULL RANGE

24hr TELESALES

0845 450 1800
0845 450 1801

(Calls charged at local rate)

4 WAYS TO BUY

- SUPERSTORES
- TELESALES
- WEBSITE
- FAX

VISIT YOUR LOCAL SUPERSTORE OPEN MON-FRI 8.30-6.00, SAT 8.30-5.30

BARNLEY Pontefract Road, Barnley B'HAM GREAT BARR 4 Birmingham Road, Great Barr B'HAM HAY MILLS 1152 Coventry Road, Hay Mills	01226 732 297 0121 358 7977 0121 771 3433 01204 365799	BOLTON 1 Thyrne Street BRADFORD 105-107 Manningham Lane BRISTOL 1-3 Church Road, Lawrence Hill CARDIFF 14 Northgate CARLISLE 85 London Road CHESTER 44-46 City Road COVENTRY Bishop St CROYDON 473-477 Brighton Rd, Sth Croydon DARLINGTON 714 Northgate DEAL (KENT) 182 - 186 High Street DERBY Derwent Street EDINBURGH 163-171 Piersfield Terrace GATESHEAD 50 Lobley Hill Road	01226 732 297 0121 358 7977 0121 771 3433 01204 365799 01274 390962 0117 935 1060 029 2046 5424 01228 591666 01244 311258 024 7622 4227 020 8763 0640 01325 380841 01304 373 434 01332 290931 0131 659 5919 0191 493 2520	GLOUCESTER 221A Barton Street GRIMSBY Ellis Way HULL 8-10 Holderness Road LEEDS 227-229 Kirkstall Road LEICESTER 69 Melton Road LIVERPOOL 88 London Road LONDON 6 Kendal Parade, Edmontown N18 LONDON 503-507 Lea Bridge Road, Leyton, E10 LONDON 100 The Highway, Docklands MANCHESTER 71 Manchester Road, Altrincham MANCHESTER M16 232 6116 169 Chesterfield Road, South MIDDLESBROUGH Mandale Triangle, Thornaby NORWICH Heigham Street NOTTINGHAM 211 Lower Parliament Street	01452 417 948 01472 354435 01482 223161 0113 231 0400 0116 261 0688 0151 709 4484 020 8803 0861 020 8558 8284 020 7498 2129 0161 941 2666 01623 622160 01603 766402 0115 956 1811 0115 956 1811	PETERBOROUGH 417 Lincoln Road, Millfield PLYMOUTH 58-64 Embankment Road POOLE 137-139 Bournemouth Road, Parkstone PORTSMOUTH 271-283 Copnor Road, Copnor PRESTON 53 Blackpool Road SHEFFIELD 453 London Road, Heeley SOUTHPTN 516-518 Portwood Road STOKE-ON-TRENT 382-396 Waterloo Road, Hanley SUNDERLAND 13-15 Ryhope Road, Grange Town SWANSEA 7 Samlet Road, Llansamlet SWINDON 21 Victoria Road TWICKENHAM 83-85 Heath Road WOLVERHPTN Parkfield Road, Bilston WORCESTER 48a Upper Tything	01733 311770 01752 254050 01202 717913 023 9265 4777 01772 703263 0114 258 0831 023 8055 7788 01782 287321 0191 510 8773 01792 792969 01793 491717 020 8892 9117 01902 494186 01905 723451
--	---	---	--	--	--	---	---

NEW! SPRING SUMMER CATALOGUE!

309 NEW PRODUCTS
387 REDUCED PRICES

- Collect from your local
- Order from www.m
- e-mail: sales@mach
- Telephone: 0845 45

The widest choice...

...the best prices!



ONLY
£625.00

Mini Mill Drill

- Variable speed control
- 100-2500 rpm
- Tilting head for inclined machining
- 3 mt spindle
- Table 15" x 3 1/2"
- Imperial or metric lead-screws



ONLY
£998.00

ZX-16 Mill Drill

- Compact gear head machine
- Tilting head
- Speeds 100/1600 rpm
- Table 23" x 6"
- 1/2 hp motor
- 2 mt spindle
- Imperial or metric leadscrews

Optional
stand £149

Major GH Mill Drill

- Geared, tilting head
- 1 1/2 hp motor
- Table size 28" x 8"
- Available 3mt - R8 - Imperial - Metric

ONLY
£1,250.00



All three models are available 3mt - R8 - Imperial - metric



ONLY
£799.00

Economy

- Table size 23" x 7 1/2"
- 3/4 hp motor



ONLY
£985.00

Minor Mill Drill

- 1 hp motor
- Table size 26" x 7 1/2"



Major

- 2 hp motor
- Table size



ONLY
£1,600.00

VMC Mill

- Illustrated with optional d.r.o. and power feed.
- Table size 26" x 6"
- Motor 1 1/2 hp
- Available 3mt - R8 - Metric - Imperial



ONLY
£899.00

1016 Lathe

- 5" centre height x 18" between centres
- Supplied with 3 and 4 jaw chucks, fixed and travelling steadies, face plate,
- 4 way tool post.

Also available 22" between centres with Norton thread cutting gear box £1,099

1224 Lathe

- Gear Head lathe
- 6" centre height x 24" between centres
- Supplied with Camlock 3 and 4 jaw chucks, face plate, fixed and travelling steadies
- Speeds 75/1400
- 2 hp motor
- Gap bed
- Hardened bedways



Ask for our latest
Colour brochures!

PRICES INCLUDE
VAT AND DELIVERY
TO UK MAINLAND

www.warco.co.uk



ONLY
£2,550.00

GH-1322 Lathe

- Superb, compact gear head lathe.
- 6 1/2" centre height x 22" between centres.
- Speeds 70/2000
- Supplied with Camlock 3 and 4 jaw chucks, fixed and travelling steadies, face plate, four way tool post, coolant system, halogen lighting, telescopic lead screw covers and foot operated spindle brake.
- Gap bed. Hardened bedways.

Also available 30" between centres £2,990

WARCO

ONLY
£1,600

Warco BH-600



- 6" Centre height
- 20" between centres
- Power cross feed
- 2 HP single phase motor
- Supplied with 3 and 4 jaw chucks, fixed and travelling steadies
- Face plate
- Tee slotted cross slide
- Rear splash guard
- Cabinet stand
- Hardened bedways
- Speed range 50-2000

Also available 30" between centres



Warco, Fisher Lane, Chiddingfold, Surrey GU8 4TD

Tel: 01428-682929 Fax: 01428-685870/686812

e-mail: warco@warco.co.uk web: www.warco.co.uk



Accu-Finish® gives a sharper, stronger cutting edge that lasts longer and makes better parts

Accu-Finish works on HSS, carbide, coated carbide, cermets and many types of ceramic and PCD/CBN.

Choose the exact tool geometry and set up in just 30-seconds.

Not only is Accu-Finish the most VERSATILE and ADVANCED sharpening system, it's the SAFEST, thanks to its unique low speed spindle technology that grinds WITHOUT heat.



Accu-Finish machines pivot to allow horizontal lapping. Renew carbide inserts and other tools by hand-lapping on the low-speed diamond wheel... it's that safe!



The calibrated table glides parallel to the sharpening wheel. The table can be locked in position if desired.

- Sharpen tools to BETTER than NEW. Accu-Finish gives an extremely sharp, fine edge that reduces cutting forces and works more efficiently.
- IMPROVE tool performance. Making them less likely to chatter, a big advantage when boring.
- SAVE MONEY by doubling, if not tripling, the life of your tools.

Now, make special tools like a toolroom expert.



Accu-Finish® Series II

Contact us for Free Catalog #181002

Phone: 620-343-1084 • FAX: 620-343-9640

e-mail: glendo@glendo.com

Glendo Corporation

900 Overlander Road • Emporia, KS 66801 USA

For the creative machinist.

www.accu-finish.com

Folkestone Engineering Supplies

F.E.S – run by a model engineer enthusiast, for model engineers.

Fast friendly service, competitive prices, no minimum order value, no VAT and large stocks.

Why not ask for our free catalogue or visit our web site.

Fasteners (metric & imperial), ferrous and non-ferrous metals (round, hex, square, flat, etc), also off-cuts (subject to availability). Goods supplied mail order or callers (by appointment) welcome.

Tel: 01303 894611 email metal2models@btopenworld.com

www.metal2models.btinternet.co.uk

A small sample of our stock and prices are shown below.

Metal priced per 300mm/11.8" length,

larger sizes are priced by the 150mm, 75mm and 25mm.

	BMS	Brass	Aluminium	Stainless-Steel
1/4" Rnd	£0.25	£0.44	£0.39	£0.78
1/2" Rnd	£0.68	£1.42	£1.18	£2.68
3/4" Rnd	£1.34	£3.35	£1.97	£5.04
1.0" Rnd	£2.10	£5.75	£3.35	£6.48
1/4" Hex	£0.30	£0.46	£1.00	£1.38
1/2" Hex	£0.68	£1.80	£1.75	£2.60
3/4" Hex	£1.92	£3.71	£3.10	£8.04
1.0" Hex	£2.84	£5.87	£4.20	£10.92
1/4" Sqre	£0.30	£0.79	£0.50	£1.55
1/2" Sqre	£0.87	£2.88	£1.41	£3.77
3/4" Sqre	£1.77	£5.12	£2.65	£5.86
1.0" Sqre	£3.18	£10.36	£4.95	£8.32

Other items in stock
Aluminium,
Brass, Copper,
Steel and
Stainless Steel
tube.
Black Mild Steel.
Nickel Silver
round.
Silver Steel and
Ground Flat Stock

BMS available in EN1A, F/C, EN8, EN16T and EN24T

Socket Screws - price per item (Quantity discount available)

cap head M3x6mm 11p M3x8mm 10p M3x10mm 9p M3x12mm 10p

cap head 1/4"BSFx1/2" 30p 1/4"BSFx3/4" 30p 1/4"BSFx1" 32p

grub/set 4BAx1/8" 16p 4BAx3/16" 17p 4BAx1/4" 16p 4BAx3/8" 21p

grub/set M3x3mm 8p M4x4mm 7p M5x5mm 8p M6x6mm 8p

62 Canterbury Road, Hawkinge, Kent CT18 7BP

Open weekdays (0900-1600)

Saturday mornings (0900-1200)



Desk CNC Machine controller and Cam programming software for Windows computers. Machine DXF, STL, Image files, PCB drilling and milling.

Vector Cad/Cam low cost surface modelling and machining, and wireframe cad/cam for lathe, mill, wire EDM.

IMService:

THE Source for Low Cost Cad/Cam

http://www.imsrv.com

Free demo download,
international credit card orders.

Single to Three phase speed controllers for your lathe or Miller

Are you still changing belts and pulleys? Need to run 3PH machinery from a domestic supply?
Is your miller too fast even in bottom speed? If your answer to any of the above is yes....
Then you need to treat your machine to smooth and quiet variable speed operation.



Complete ready built speed control systems with new 3PH motor are available to suit all Myford ML7, Super7, and Super 7 Plus machines. Systems also available for Tom Senior, Raglan, & Colchester etc. Available in sizes 1/2HP, 3/4HP and 1HP. Prices start from £395 + Carriage & VAT for the 1/2HP. Designed and manufactured in the UK, with FULL 12 months warranty and after sales support.

With a Mitsubishi Electric variable frequency inverter, and a three phase motor, the full potential of your lathe or machine tool can finally be unleashed..!



Mitsubishi Electric single to three phase inverters drives available from £113 + VAT. Available in sizes ranging from 1/3HP to 3HP (2.2kW), and with a full range of options including Push button control stations, Programming keypads, and RFI filters.

Here's what some of our satisfied customers say....

"I was very impressed with the service I received from Newton Tesla. In particular George Newton took considerable time and trouble in explaining how the Mitsubishi E520 AC drive system operated and worked out the connection details for my Colchester Student Lathe. Fitting was straightforward and once I had mastered the programming unit system worked right first time. It was very good value for money!"

Derek Toller, Colchester 'Student' Lathe

"The fitment of the new inverter and the three phase motor has completely changed the use of my 90+ year old Drummond Round Bed lathe. Using the original pulleys to change the speeds at the chuck also entailed changing the flat belts, which was tedious to say the least! The speeds I could obtain were 90rpm, 258rpm and 275rpm. as my lathe is not back geared these speeds did not fit my requirements. With the inverter and the three phase motor I can now obtain speeds from 90rpm to 800rpm without any steps and with much smoother running. I do not now have the problem of "chatter" during machining and the lathe now runs a lot quieter at 'all' speeds. It has also now become a much more useful and pleasant machine tool to use."

Mr A.D. Jones, Drummond Round Bed Lathe.

"I have been meaning to write to you for over a year now, to say how pleased I was with the ML750 Speed Control system and motor you supplied for my Raglan Little-John Mk5 Lathe. I can do screw cutting without using the back gear, and the smoother 3 phase motor has eliminated the noise produced by torsional oscillation of the single phase motor. A 20p piece can be balanced on the headstock casing and hardly moves at any speed."

Mr B. Harding, Raglan Mk5 Lathe.

Call us now for more information and friendly advice, or visit our new website

Newton Tesla

● ELECTRIC ● DRIVE ● LIMITED ●

Units G15 & G18, Warrington Business Park
Long Lane, Warrington, Cheshire WA2 8TX

Tel. 01925 444773 Fax. 01925 241477 Email. Info@Newton-Tesla.com

www.newton-tesla.com



Major credit cards accepted

KITS FOR TWO TOOL AND CUTTER GRINDERS

THE SOPHISTICATED

THE SIMPLE



THE QUORN

THE KENNET

FOR INFORMATION ON THESE AND OTHER KITS S.A.E. TO

MODEL ENGINEERING SERVICES

PIPWORTH FARM, PIPWORTH LANE, ECKINGTON, SHEFFIELD S21 4EY

PHONE 01246 433218

www.lawm.freesevice.co.uk

BANISH STRUGGLES



Sensors can be recalibrated, e.g. to read degrees on a rotary table or teeth for use as a dividing head (see photo)

by fitting BW Electronic's new measuring readout

- large bright LED display
- inch / mm conversion
- zero datum for both axes
- two independent datums
- positions can be preset
- radius / diameter working
- halfway point calculation
- unclip sensors and move them between machines

Complete system (332 display, two 361 sensors, power supply, manual): £425 (incl. VAT and p+p)

BW Electronics, 12 Mussons Close, Corby Glen, Grantham, NG33 4NY
Tel/fax: 01476-550826 • Website: www.bwelectronics.co.uk

THE QUICK-STEP MILL



A tool post mounted milling spindle for the centre lathe. Fitted to a quick-change tool holder, it can be at work in seconds eliminating second set-ups in the milling machine, mandrel making etc..

Milling operations are rapidly and accurately carried out while work is still held true in the lathe chuck.

- Weight 9 lbs
- 9 speeds 110 – 4000 rpm
- Reversible motor 110 or 220V a.c.
- Collet chuck for ER20 collets, 1 – 13mm x 1mm
- Quick change from axial to radial and vice-versa
- Vertical slide with 1 1/2" travel, calibrated 0.001", with additional steps at 1/4"
- Centre finders provided for quick setting to centre height
- Headstock dividing by means of division rings and detent
- Suitable for light grinding e.g. truing chuck jaws
- Quadrant plate available to enable the machine to be inclined for helical milling

For full colour brochure contact:

J C Payne Engineering Limited
Polgraines, Faringdon Road, Cumnor, Oxford, OX2 9QY
Tel/Fax 01865 865223

progress through simplicity

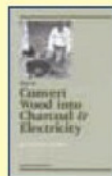
Yet More New Books.....

From Lindsay Publications:



• Screw Cutting & Change Gears • £ 4.65

Two books in one, combining *Manual of Screw Cutting* from 1887 by William Simpson with *Change Gears for Cutting Threads* not within the Range of the Regular Quick-Change Gear-Box, published in 1935 by Machinery. If you need to calculate the gears required for a particular thread, or one not covered by your gear-box, this 48 page booklet, with its many formulae will be invaluable.



• How to Convert Wood into Charcoal & Electricity • [Buxton] £ 8.10

This book perhaps demonstrates where you can end up if you read too many of Lindsay's books. Richard Buxton did just that, and realised he could produce good quality charcoal, and generate electricity at the same time, using the 'Producer Gas' given off during the making of charcoal as fuel for a portable, caravan type, generator. It is a neat idea and the author describes all the stages carefully, but you do need a fairly sophisticated retort, plus "scrubber" for the gas, and to modify the generator motor's carburettor. To a clever person like you none of this should present problems and, when the system is up and running, you have non pollutant fuel, plus electricity. Good stuff! 63 page paperback, well illustrated with drawings, schematics and photographs.



• Telescope Making • [1905] • [Hasluck] £ 9.20

Another reprint from Paul Hasluck, this describes how to build a 3 1/2" portable telescope with altazimuth mounting. It is very detailed and whilst it may be old, is certainly the book to have on constructing such an instrument. However, whilst it describes the calculations involved, what this book does not tell you is how to make the lenses; it is assumed that these will be purchased. Otherwise it is first rate. 160 pages. 218 drawings. Paperback.

AND - from other publishers:



• The Fibreglass Manual • [Noakes] £17.39

Very good guide to using fibreglass, or reinforced plastics, for a whole range of items - all full size, no models, although the techniques could be used in smaller sizes. Includes chapters on making moulds and patterns, polyester & vinylester, and epoxy laminating by hand, phenolic laminating and spray laminating, positive pressure laminating, close-mould laminating, resin casting and much more. 128 page large format paperback, comprehensively illustrated with drawings and photographs.



• Converting a Six String Guitar to Four Strings • [Gingery] £ 5.50

From retired master of writing on engineering matters Dave Gingery comes this new book on one of his retirement projects and it makes a good and different, project for the musical model engineer. If you convert a six string guitar to four strings you create a tenor guitar which sounds and plays like a tenor banjo, but with a sweeter and more resonant tone. Plentiful earlier in the 20th century, as their tone was excellent for playing "mood music", four string guitars are now hard to find, but here Dave tells you how to convert a six string guitar to this configuration - it isn't just a matter of removing two strings! This book covers the conversion of an acoustic guitar, but it is surmised the principles could be applied to converting electrical guitars. Usual Gingery quality instruction - its nice to have Dave back again! 22 pages. 28 photos and drawings. Softcover.

• Making Crucibles • [Gingery]

£ 8.50

We have sold hundreds, if not thousands, of books on making your own furnace, so that you can melt metal, but all of these books assume you will purchase a crucible for use with the furnace. As most of these books were written by Dave Gingery it is logical that Dave's son Vince has now written a book on making your own crucibles. Two methods are described - both depend on making molds, but differ as to how these are used. Either way looks straightforward, and a lot of fun - the second method, which involves concrete molds and some ancillary presses, is probably the best if you melt a lot of metal, and need a lot of crucibles. Covers making the clay for the crucible, firing it etc, and making crucible tongs. Excellent instruction as always from this source. 60 pages. 117 photos and drawings. Paperback.

Prices shown INCLUDE U.K. Post & Packing

(Overseas customers please allow 10% extra for delivery)

MAIL ORDER (no stamp required in the U-K) to:

CAMDEN MINIATURE STEAM SERVICES

FREEPOST (BA1502), Rode, Frome, Somerset BA11 6UB

Tel: 01373-830151 Fax: 01373 - 830516

Website: www.camdenmin.co.uk

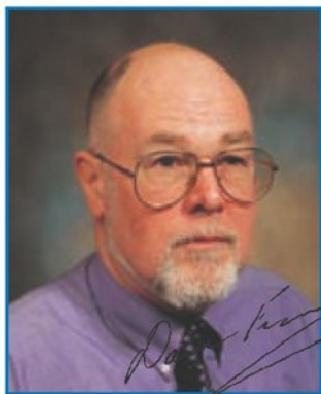


email: sales@gandmtools.co.uk

TELEPHONE ENQUIRIES WELCOME ON ANY ITEM OF STOCK. WE HOLD HUNDREDS OF ITEMS THAT ARE NOT LISTED, FULL STOCKLIST AVAILABLE. ALL ITEMS ARE SUBJECT TO AVAILABILITY. ALL PRICES ABOVE ARE SUBJECT TO CARRIAGE AND VAT AT 17.5%. WE DELIVER TO ALL PARTS OF THE UK & WORLDWIDE. OVER 7000 SQUARE FEET OF TOOLS MACHINES AND WORKSHOP EQUIPMENT

fax 01903 892221





ON THE EDITOR'S BENCH

Learning something new every day

Preparation of Issue 89 of MEW encouraged a rapid bout of computer education. Two of the articles featured computer monitor screen shots which, in the first instance the authors had saved by using the "Print Screen" facility, yielding an inkjet print. In this form they were not suitable for processing to the required standard by our long suffering studio designer, Carol Philpott. Consulting available books and manuals on Windows did not provide any answers, and it was indeed fortunate that contributor Mike Houghton had encountered the problem before, and was able to offer a solution. As it is likely that with the continual advance of computers into workshop activities, the process may be of interest to some readers. I feel that it is worthwhile to publicise the "Save" procedure for the benefit of others who may wish to store screen displays in higher resolution electronic format. To save a screen display:

Press the "Print Screen" button
Click on "Start", "Programs",
"Accessories", "Paint", then "Edit" and "Paste".

It is then possible to paste a copy of the screen image into "Paint" and then save to file probably as a jpg or bitmap. It can then be saved to disk or e-mailed as appropriate. Mike makes the additional comment that the higher the resolution of the monitor, the higher will be that of the image.

A correction

One reader has been in touch as having seen the hacksaw built by Mr D. Richmond depicted on page 51 of issue 88, he had been unable to track down the supplier of the castings. I have since been advised that the castings supplier was E.W. Cowell Ltd., Sydney Road, Watford. This information may assist other readers.

Miniaturisation taken to extremes

A recent lecture given by Mr Peter Rigby to the Scottish Model Engineering Trust left members with a general feeling that their model making scales are in some respects positively gigantic. The title was MEMS or Micro Electronic Mechanical Systems, and illustrated the leading edge industrial work on these devices. Actuators, gear wheel trains, and even ball races are manufactured by processes somewhat similar to those used in micro electronic chip production. The result can be a gear cluster less than the diameter of a human hair. Rotational power is produced by push/pull electrostatic actuators which, when arranged in 90 deg. Vee twin formation give self starting characteristics. Speeds of over 250,000 rpm were mentioned.

Free service from SAGA

The SAGA name frequently conjures up in the minds of the younger generation caricature images of overweight American style geriatrics on holiday. Being nearer the age of sixty than fifty, I now find myself part of their target market. For

Engineering at the College of North West London

One of the best kept secrets of the model engineering world must be the model engineering evening class which has been running at CNWL for over 20 years where enthusiasts are involved not only in the anticipated steam engines, but also model boats and trains, clocks, auto parts, microlites, and more. In a more recent development, around two years ago, the college introduced a new machine shop course where new students studying either model or production engineering, could gain an NVQ level 1 or 2 in Performing Engineering Operations. Other courses cover such things as fabrication and welding. One of the interesting administrative aspects is that the college operates a roll on - roll off system so that many students do not have to wait until September to start a course. Some also find courses that they cannot easily find elsewhere. For further information contact the college on 020 8208 5000 or check out the website www.cnwl.ac.uk

people aged over 50, Saga Circles is a free website service designed not only to help individuals revive past contacts from school, work, and the armed services, but also to make contact with others who share a similar interest. It has been developed to be easy to use and above all, to be secure, as personal details are only available if the user wishes to reveal them. Saga Circles is accessed via the Saga Group homepage at www.saga.co.uk

Bikes at Ingliston

The annual Scottish Motor cycle show took place at the Royal Highland Showground, near Edinburgh 8th-9th March, offering a mouth watering display of machinery and



Jim Whannel's immaculate and very original 1958 Triumph Tiger 100

action for two wheel enthusiasts. Along with many others of a certain age, we made a beeline for the classics display to find somewhere in the region of 200 machines dating from 1903 onwards. Some names, such as Excelsior Manxman, Triumph Tiger 100, and Norton Dominator evoked happy memories of a misspent motorcycling youth, long ago in the days before the Gatso and the 70mph limit. Others such as the immaculate Triton reminded me of my own similar project some thirty years ago which had to be sold due to a house and job move. The buyer was a young American, so it probably went across the pond. The differing varieties of Rickman Metisse also tend to grab my attention as one of these (a Rickman Suzuki) is an ongoing personal project.

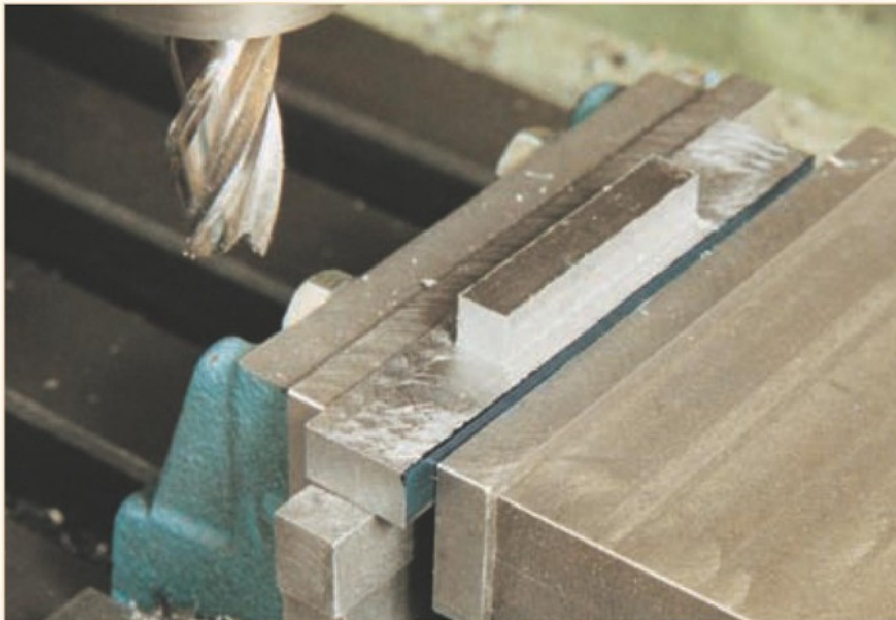
Looking at the more modern exhibits, one might be forgiven for concluding that motorcycles are some way ahead of cars where technology is concerned. Specific power outputs are frequently in excess of 200bhp per litre (normally aspirated), and extensive use is made of aluminium and titanium alloys, and also carbon fibre.



The 1937 Excelsior Manxman

MILLING PROJECTS F

Grinding Res



1. Milling the web on the fence.

In the last issue we completed the adjustable off hand grinding rest. The full extent of its capabilities will though, only be realised by the addition of various accessories. The sections covering these will bring the milling series to an end over the this and the next two issues of the magazine. At this stage, description of the manufacturing processes will be kept to a minimum as by now these should not present a problem. Only where something special surfaces will I go into detail. Much of the article will centre around the use of the accessories and includes photographs to illustrate the operations that can be performed. First however, very important safety considerations must be aired.

The accessories

Fence and stop assembly AS1

This is an essential part of the system being used to accurately guide the part being ground, either across the face of the wheel or down its side. A stop screw can be fitted when required to ensure that the part being ground cannot pass beyond a certain point.

Throughout the series I have emphasised that much milling work can be carried out without using a vice as the work holding device, perhaps to the point of giving the idea that it is not an essential requirement. Where a vice does come into its own, is with the smaller items which

are much more difficult to hold by other means. The adjustable fence (11) is a typical instance. Machine lower web **Photo 1**. Turn over, hold on web just made, and machine top surface to reduce thickness to 6mm. Drill and tap holes. Radius web ends using a file. Note that the two M4 tapped holes are shown blind. If drilled through, then grinding dust will find its way very easily into the threads.

The assembly also requires some

Harold Hall follows up with additions which allow fuller use of the Rest

turned washers. However, where simple parts are required throughout the rest of the series, I will not comment on them in the text, as the drawings should give all the information required.

Photo 2 shows the fence fitted. It can of course be in any one of the three slots. The web which fits into the slot is shorter than the slot permitting coarse adjustment of the stop screw position. Final adjustment will be achieved using the fine feed facility of the rest. You may find it easier to fit the fence (and clamp screw assembly AS 2) to the table if you remove the table from the remainder of the rest.

Swivel base clamp screw, AS 2

This enables an accessory to be fixed to the rest's table where the accessory itself feeds the workpiece, typically when using the end mill sharpening assembly as will be seen in the concluding issues. Manufacture of the clamp screw mount (22) follows very closely that for item 11 above.

Square workpiece holder and swivel base, AS3

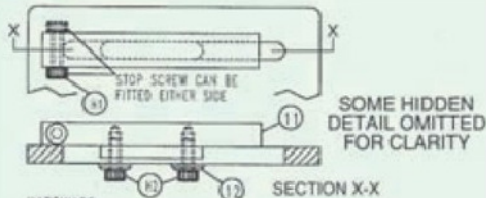
The main purpose of the holder is to hold square section lathe tools but no doubt other uses will surface. The base (31) is

IMPORTANT SAFETY REQUIREMENTS

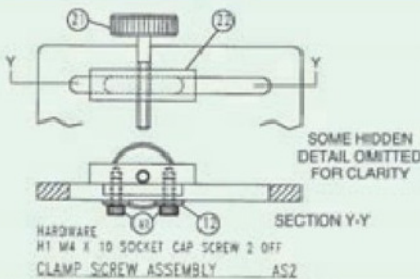
- Do wear safety glasses or face mask, and ensure wheel guard is fitted.
- Due to the item being ground often being unsupported close to the wheel when using the accessories, only take very light cuts. The depth of cut should be controlled by the fine feed and the fence rather than manually.
- Make multiple passes rather than try to remove a great depth at a single pass.
- Keep the overhang of the tool, from the accessory holding it, to a minimum.
- In view of the overhang do ensure the accessory is held firmly down on the rest's table.
- Keep the table and the sliding surfaces of the accessory as free of grinding dust as possible. This results in easier hand feeding and makes for safer working.
- The rest can be used as a conventional off hand grinding rest in which case ensure that the front edge of the table is no more than 1mm from the grinding wheel and the item being ground supported by the rest's table.
- When the grinder is running do not make adjustments to the rest, other than using the table's fine feeds.
- Make sure that all locking levers are firmly tightened before starting grinder.
- Due to grinding dust getting into the locking lever assemblies they can become difficult to undo, but becoming free quite suddenly as more force is applied. This can cause rapped knuckles with unpleasant results. Make a lever extension as per **Sk 1** to prevent this. However, do not use it for tightening the levers, as this may result in over tightening.
- As the grinding rest is not directly mounted off the bench grinder it is essential that both are mounted on a very robust base. If this is not done the rest will be able to move relative to the off hand grinder when in use. At best this may result in inaccurate results but much worse be the cause of a serious accident.

FOR BEGINNERS (7a)

st Accessories

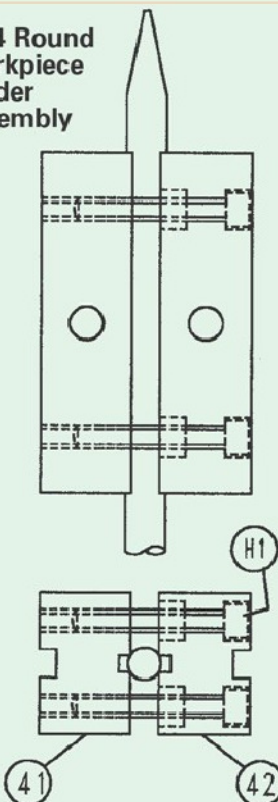


HARDWARE
H1 M3 X 10 SOCKET CAP SCREW 1 OFF
H2 M4 X 10 SOCKET CAP SCREW 2 OFF
FENCE AND STOP ASSEMBLY AS1
AS1 Fence and stop assembly

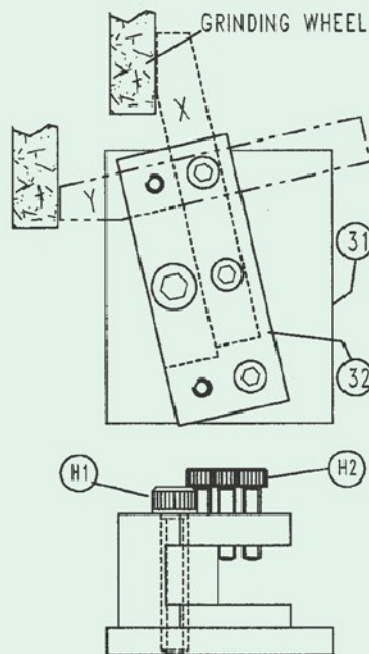


HARDWARE
H1 M4 X 10 SOCKET CAP SCREW 2 OFF
CLAMP SCREW ASSEMBLY AS2
AS2 Clamp screw assembly

AS4 Round workpiece holder assembly



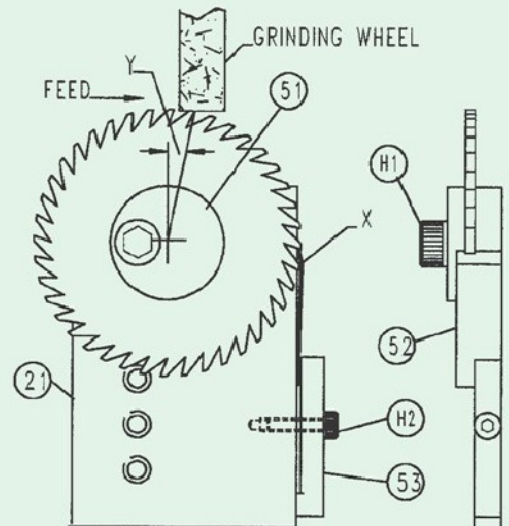
HARDWARE
H1 M4 X 25 SOCKET CAP SCREW 4 OFF



X. POSITION FOR SHARPENING SIDE AND TOP CLEARANCES AND RELIEF.
Y. POSITION FOR SHARPENING FRONT CLEARANCE AND RELIEF.

THE FIXTURE IS GUIDED BY A FENCE MOUNTED ON THE REST TABLE USING THE SWIVEL BASE (21) TO SET THE ANGLE. THIS IS ALSO USED WITH OTHER FIXTURES BUT FOR SIMPLICITY IS NOT INCLUDED ON THEIR ASSEMBLY DRAWINGS.

HARDWARE
H1 M6 X 30 SOCKET CAP SCREW 1 OFF
H2 M4 X 16 SOCKET CAP SCREW 3 OFF

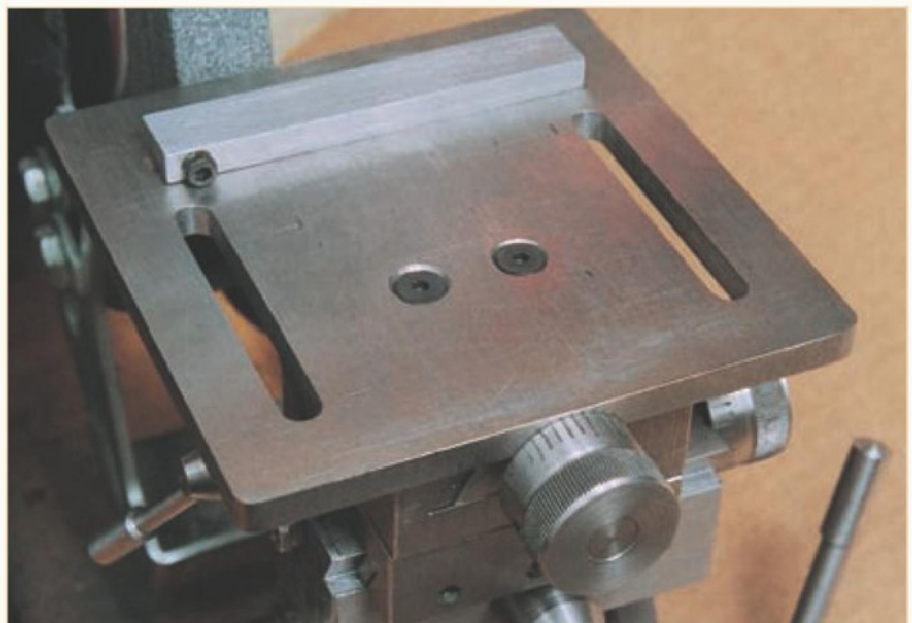


NOTE X. LEAF SPRING (52) MAY REQUIRE BENDING TO ACHIEVE ACCURATE INDEXING HARDWARE

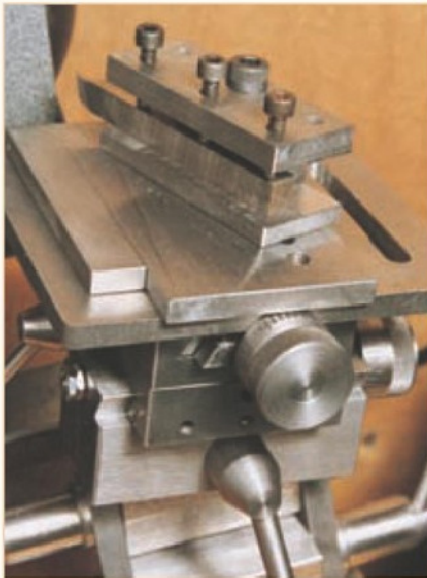
NOTE Y. CLEARANCE ANGLE OF GROUND TOOTH SET BY ADJUSTING LEAF SPRING(52)
H1 M6 X 12 SOCKET CAP SCREW 1 OFF
H2 M3 X 12 SOCKET CAP SCREW 1 OFF

AS5 Slitting saw sharpening assembly

AS3 Square workpiece holder assembly



2. Fence fitted to the rest's table. Note the stop screw at the left hand end.



3. Sharpening a square lathe tool.

used for setting the angle of the workpiece relative to the feed direction and is also used with many of the remaining accessories. For simplicity it is not shown on their drawings but can be seen in the photographs.

To machine the square workpiece holder (32) mount on an angle plate using a parallel to ensure the part is parallel to the machine table. Commence machining groove with an 8 or 10mm slot drill, working to the 5mm dimension. Open up to 13mm using an end mill. Drill and tap holes. Cut a length of 50 x 6mm for the Swivel Base Machine (31) ends to 75mm, again using the angle plate for mounting. Drill and tap holes.

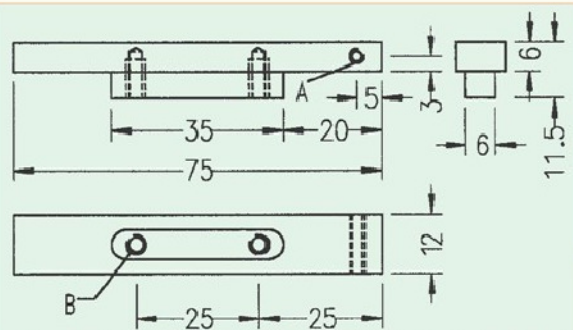
To sharpen a lathe tool, mount the holder on the swivel base at an angle to suit the tool's side relief and with the rest's table angled left to right to suit the tool's side clearance. **Photo 3** shows this operation.

If you have studied the grinding rest in detail you may consider that the angle set using the swivel base would actually be achieved using the rest's swivel facility. This is not so, its use, with a few exceptions, is purely to set the approach angle of the face being ground to the wheel.

When grinding a portion from the side of a workpiece it would seem obvious that the feed direction should be parallel to the side of the wheel, see **Sk2(A)**. However, any small error in the approach angle could cause the part to be additionally ground on its side, as in **Sk2(B)**. In view of this, feed direction is deliberately set to an angle to the side of the wheel to avoid this possibility. **Sk2(C)** shows this arrangement. This may seem like a procedure to overcome the accuracy limitations of the home workshop, it is though frequently adopted practice in industry. **Sk2(D,E and F)** show the same situations relative to the front face of the wheel. This angle, set by the rest's swivelling facility, should only be a degree or two maximum.

Round workpiece holder AS4

This is normally mounted on the swivel

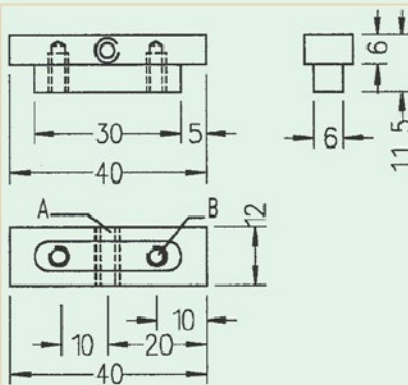


HOLE SIZES A. M3 1 OFF B M4 X 8 DEEP 2 OFF

MATERIAL 12mm SQUARE STEEL 230M07

QUANTITY 2 OFF

11 Adjustable fence

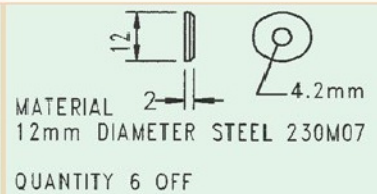


HOLE SIZES

A. M5 1 OFF B M4 X 8 DEEP 2 OFF

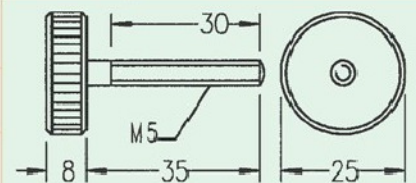
MATERIAL 12mm SQUARE STEEL 230M07

QUANTITY 2 OFF



QUANTITY 6 OFF

12 Washer



MATERIAL
25mm DIAMETER STEEL 230M07
5mm DIAMETER STEEL 230M07

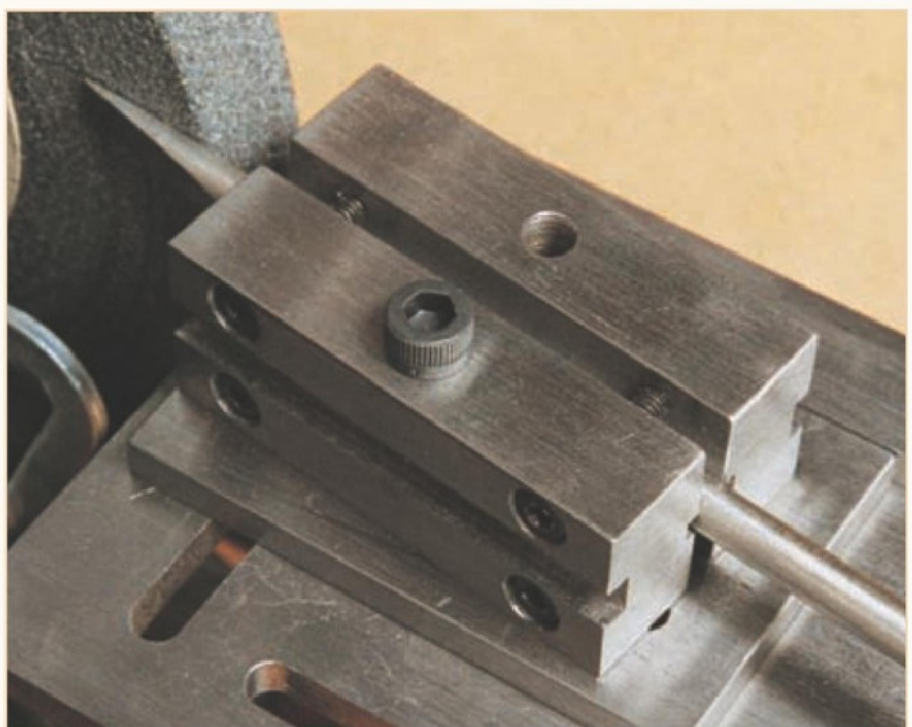
FABRICATE FROM 25mm AND 5mm
MATERIALS

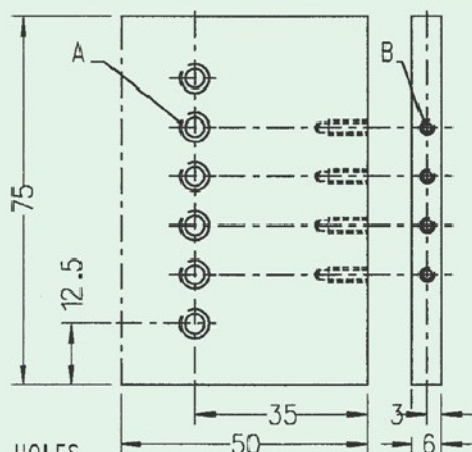
QUANTITY 2 OFF

21 Clamp screw

22 Clamp screw mount

4. Sharpening a screw driver.





HOLES

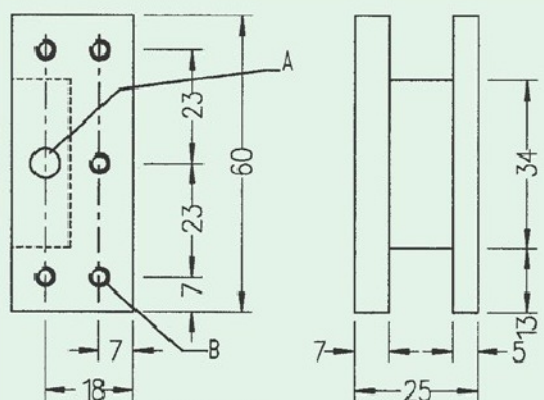
A M6 6 OFF AT 10mm PITCH
B M3 X 8mm DEEP 4 OFF

MATERIAL 50mm X 6mm STEEL 080A15

QUANTITY 1 OFF



31 Swivel base



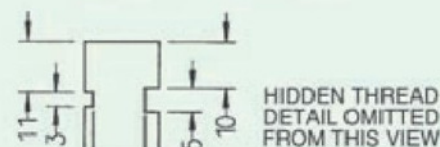
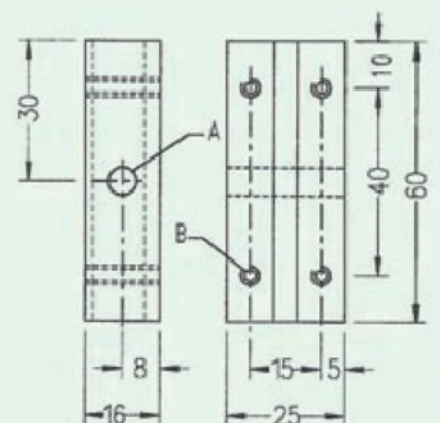
HOLE SIZES

A 6.2mm 1 OFF
B M4 5 OFF

MATERIAL 25mm SQ STEEL 230M07

QUANTITY 1 OFF

32 Square workpiece holder



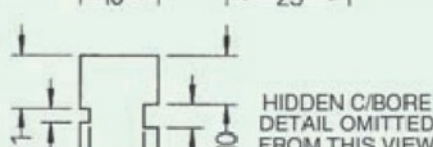
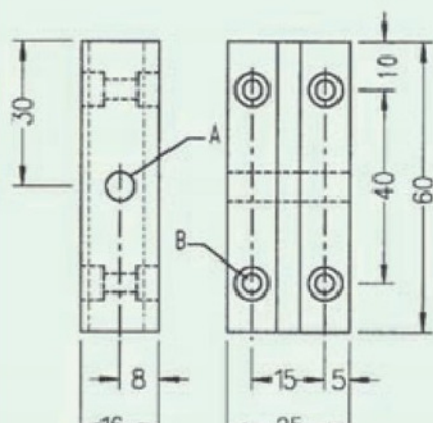
HOLE SIZES
A 6.2mm 1 OFF
B M4 4 OFF

MATERIAL
25mm X 16mm STEEL 080A15

QUANTITY 1 OFF



41 Side one



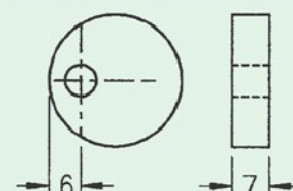
HOLE SIZES
A 6.2mm 1 OFF
B 4.5mm COUNTERBORE
7.5mm X 5mm DEEP BOTH SIDES

MATERIAL
25mm X 16mm STEEL 080A15

QUANTITY 1 OFF



42 Side two



HOLE 6.2mm 1 OFF

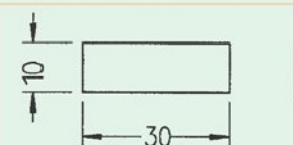
DIAMETER TO SUIT
SLITTING SAW BORE

MATERIAL STEEL 230M07

QUANTITY 1 OFF FOR
EACH BORE SIZE



51 Slitting saw pivot



MATERIAL SPRING STEEL
0.2mm TO 0.4mm THICK

QUANTITY 1 OFF



52 Leaf spring

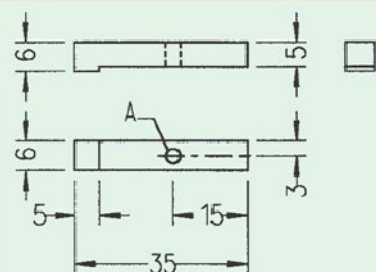
base, similar to using the square workpiece holder, and is used typically for holding screwdrivers, a wheel dresser and round section lathe tools, etc..

Cut two lengths of 25 x 16mm, one each for Side one (41) and Side two (42). Using an angle plate for supporting parts, machine ends and grooves. The grooves

must be central or else they will not align if one part is turned over relative to the other. Drill, tap and counterbore.

When clamping round items, the two halves of the holder should be progressively tightened ensuring that the halves remain parallel to each other, and present flat top and bottom surfaces in

use. During use to sharpen a screw driver (Photo 4) the holder will need to be removed from the swivel base, turned over, and the second side ground. This will necessitate the fine left to right feed being adjusted again as it is unlikely that the result on both sides will be the same without this being done.

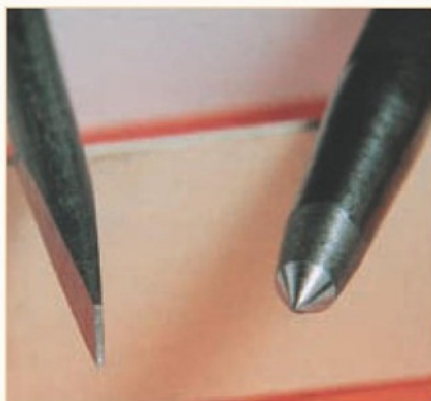


HOLE A 3.2mm 1 OFF

MATERIAL 6mm SQ. STEEL 230M07

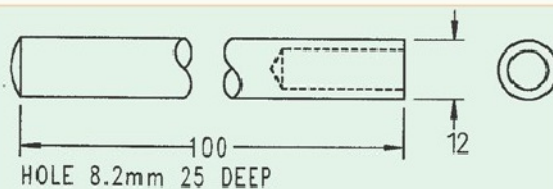
QUANTITY 1 OFF

53 Leaf spring clamp



5. A parallel end to the screw driver is easily achieved, not the case when attempting this by off hand grinding

The screw driver end will now require grinding to bring the thickness to that required. Remove the holder from the swivel base turn on its side and grind the end to establish the required blade width. Do not be tempted to feed this free hand, even for this simple operation it is safer to use the fine feed, assisted by the fence, making multiple passes until the required blade width is achieved. Sharpening a screw driver free hand may seem like a simple exercise but anyone who has tried it will have experienced the difficulty of getting the two sides parallel. **Photo 5** illustrates how good a result can be achieved, and simply, with this accessory. The photograph also shows a centre



MATERIAL 12mm DIAMETER STEEL 230M07

SK1 Locking lever extension

punch which will be discussed later.

Typical other uses are wheel dressing, **Photo 6**, (note this still uses the fence and the swivel base) and sharpening round lathe/boring tools. Note that, with the fence mounted at right angles to that in the photo and the wheel dresser turning through 90 degrees on the swivel base, the right hand side of the wheel can be dressed. However, dressing the side should be kept to an absolute minimum as it will reduce the width of the wheel and therefore its strength.

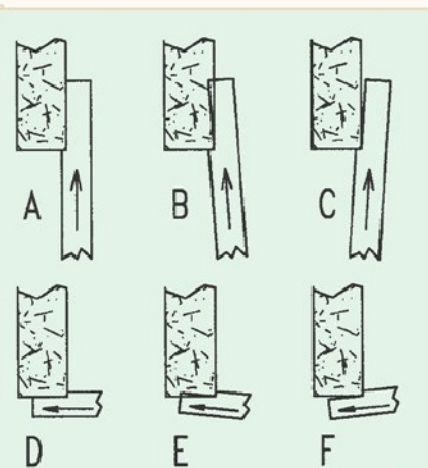
Slitting saw sharpening assembly AS5

This comprises the swivel base with a few simple parts (**51, 52 and 53**) added. The method for sharpening slitting saws should be clear from **Photo 7**. Do remember that the saw is fed by hand with the swivel base held firmly against the fence and the saw against the swivel base. The inward fine feed is used to control depth of cut. With the large teeth on the saw no stop is required. However, with an accurately dressed wheel, saws with very small teeth can be ground when a stop fitted to the fence will be necessary to avoid the wheel touching the adjacent tooth. In this case the left to right feed would be used to accurately set the stop position. The bush on which the saw rotates is drilled off centre to provide adjustment for differing saw diameters. The leaf spring may require bending at "X" as shown, to improve indexing on smaller tooth saws.

This completes the minor assemblies all of which can be seen in **Photo 8**.

End mills and slot drills

Whilst many items, typically lathe tools, screw drivers, etc., can be sharpened free hand with some success, this is almost impossible in the case of end mills and



C AND F ARE THE CORRECT APPROACH ANGLE TO USE

SK2 Workpiece approach angle

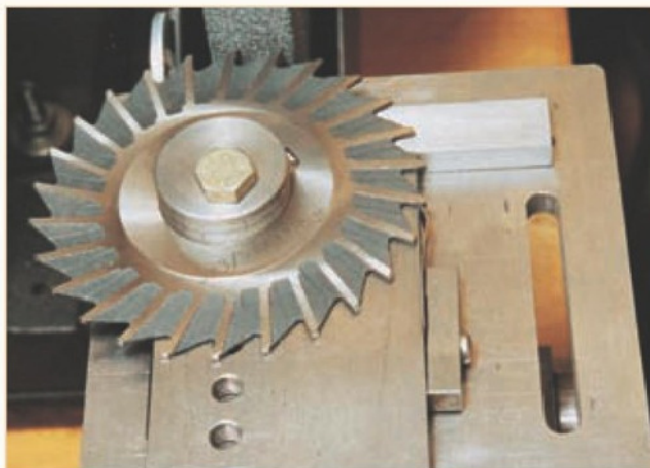


6. The same accessory used for the screw driver is also used to hold the wheel dresser.

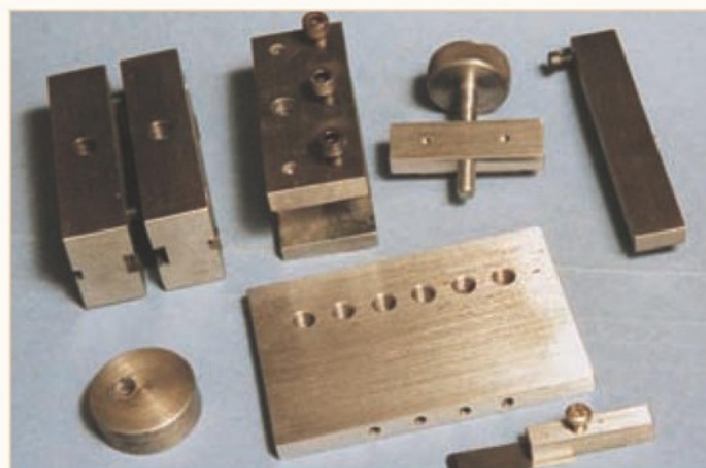
slot drills. An accessory enabling these to be sharpened, both on their end teeth and cutting edges, is the subject for the remaining two issues.



7. Sharpening a slitting saw.



8. The set of minor accessories.



INTERNAL BORING BAR



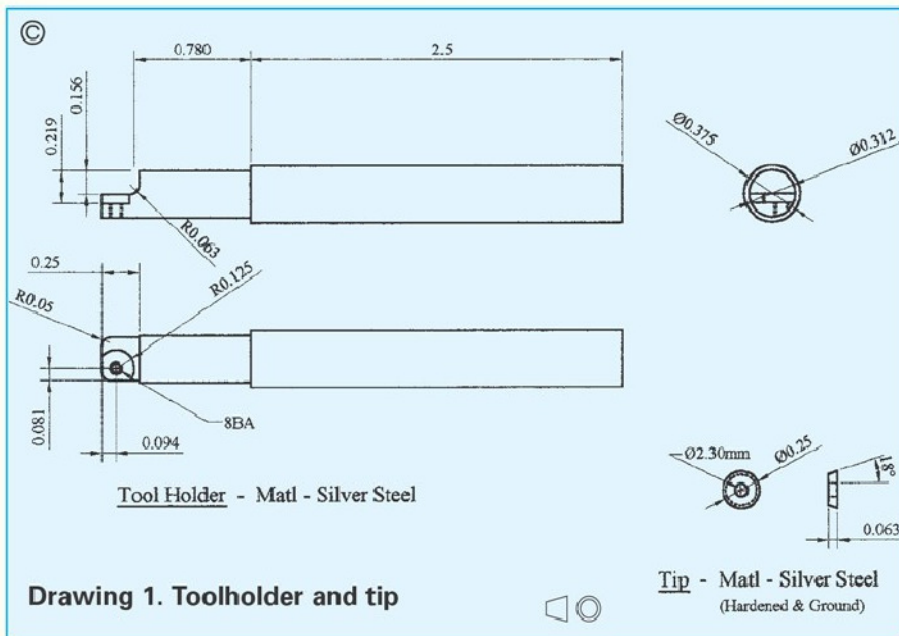
When making a model engine, be it steam or internal combustion, one is frequently making jigs, fixtures and special tools, most of which are applicable only to that particular project. In the process of making the cylinder head for a small two stroke aero engine of my own design, I needed to machine a combustion chamber of 0.625in. diameter, 0.145in. depth with a radius of 0.125in. Accuracy was essential to ensure the calculated compression ratio. I needed a tool to start in a hole of 0.375in. diameter. Achieving accuracy in diameter and depth would not present any problem. But hand grinding an accurate radius would be another matter altogether so far as I was concerned! I use indexable carbide inserts where possible - and therein, I thought, lay the answer! Needless to say, round inserts of the size required could not be found at the time, and there does not appear to be a commercial boring bar for that insert configuration. (I have since come across the 5mm round tips supplied by Greenwood Tools, and it would undoubtedly be possible to redesign the seating to accommodate these.) Anyway, solving problems is one of the satisfactions we gain from our hobby, so - make one!

Tool Holder (Drawing No.1)

Take a 3in. length of $\frac{3}{8}$ in. diameter silver steel and reduce it to $\frac{1}{8}$ in. diameter for about 1in. (The dimensions 0.780in. and 2.50in. shown on the drawing are not critical).

Mill the shoulder, preferably with a radiused endmill. Using an edge finder, or whatever is your customary method, centre the spindle over the position indicated on the drawing. Drill through 1.80mm. Without altering the setting follow with a $\frac{1}{8}$ in. slot drill to take out the insert seating to a depth of 0.0625in. (I reground the end teeth on the slot drill to remove the concavity so as to produce a completely flat surface for the insert to seat on. Alternatively, one could make a D-bit for the purpose). Tap the hole 8BA. Complete by hardening the first $\frac{1}{8}$ in. inch or so to protect the seating and the thread.

Shelley Curtis describes his solution to boring small holes



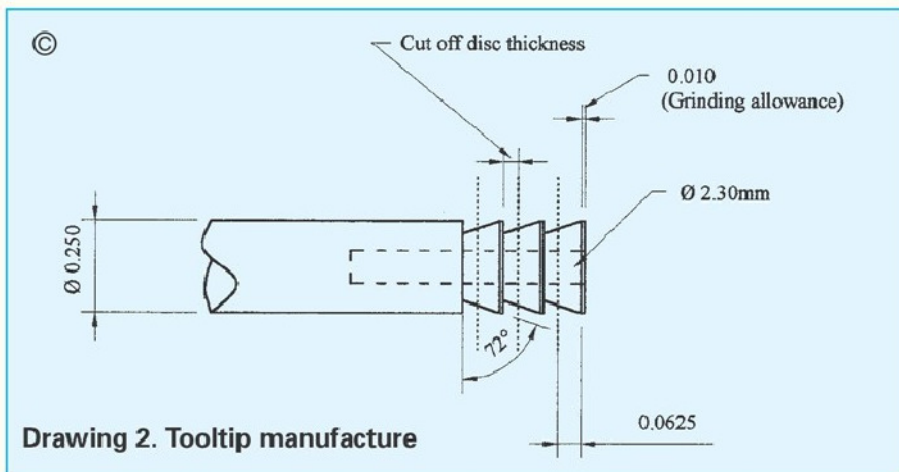
Tool Tip (Drawing Nos.1 & 2)

This is made from $\frac{1}{8}$ in. dia. silver steel, to the dimensions and angles shown in the drawing. Before commencing, note that a cut off disc is used later and its thickness needs to be added to the 0.0625in. and 0.010in. dimensions at the turning stage. Set over the lathe top slide to machine the relief angle, producing the finest surface finish you can, because it will not be ground. (Whilst you have things set up, it's a good idea to take the opportunity to make some spares.) Drill 2.30mm dia. to a depth appropriate to the number of inserts you are making.

After hardening, set up on the tool and cutter grinder. With a cup wheel remove the grinding allowance on the top surface of the insert to produce a sharp cutting edge. (Don't overdo it or the diameter will be reduced). Replace with a cut off disc and part off to length. Repeat for the remaining inserts.

Assemble using an 8BA socket cap screw to secure the insert to the tool holder.

This tool was made for a specific job but I foresee that it will be used in other applications, so it's a welcome addition to the "armoury". Additional tools, to accommodate other radii, can easily be made when the need arises.



A MAGNETIC PICKER UPPER



1. Magnetic Picker Upper finished project.

No, this has nothing to do with record players or gramophones, but is a little weekend project that will find many uses around the workshop and home for picking up small ferrous objects. Examples might include separating filings from sawdust, finding that elusive screw in the ubiquitous muck(!) on the workshop floor, and collecting swarf for transfer to the waste bin. But whatever you use it for, do keep it away from floppy discs and tape cassettes; and colour TV screens and monitors!

Description

The unit is based around one of a pair of focussing magnets salvaged from an old TV set, and is housed in a plastic container. One salvaged from a loudspeaker might serve equally well. The ring shaped magnet is "stuck" on to a $\frac{1}{16}$ in. thick steel disk which rests on a brass spring. The

2. Top removed showing plunger / magnet assemble resting on spring.



Paul Boothby has come up with a cheap and cheerful idea for cleaning up ferrous swarf, filings etc.

Fig. 1 General arrangement

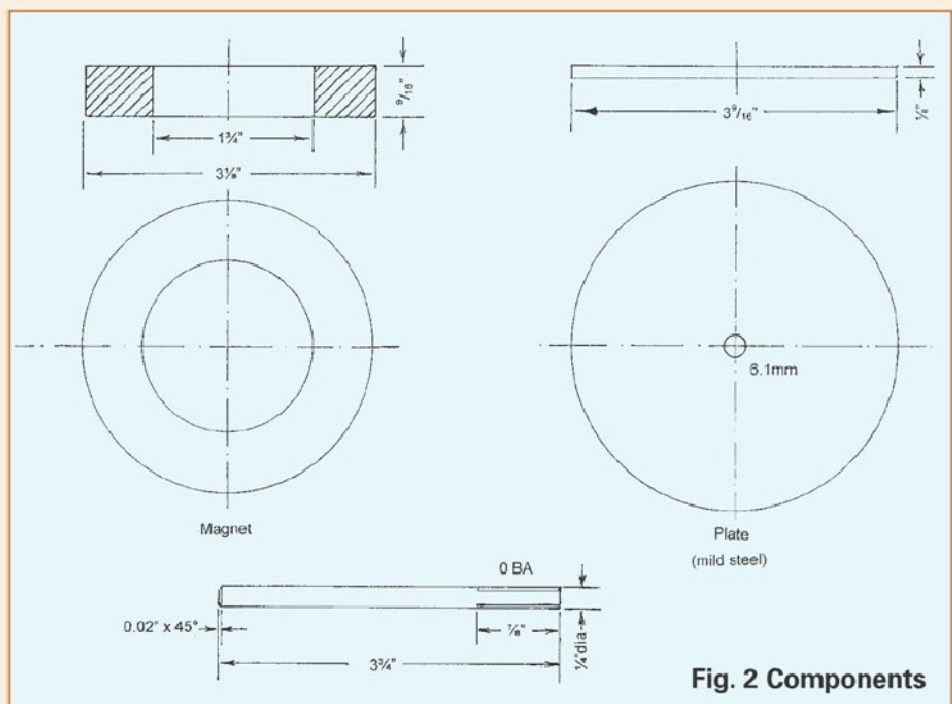
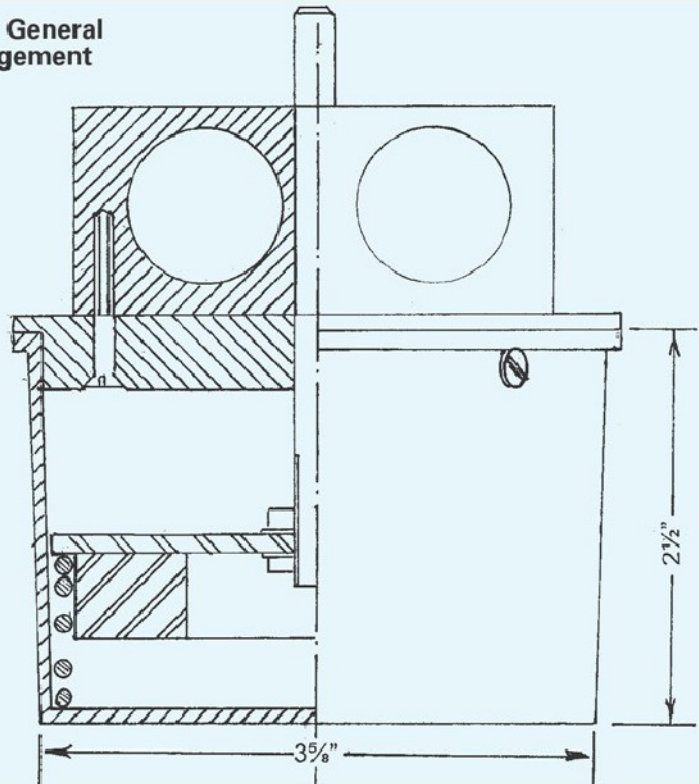


Fig. 2 Components

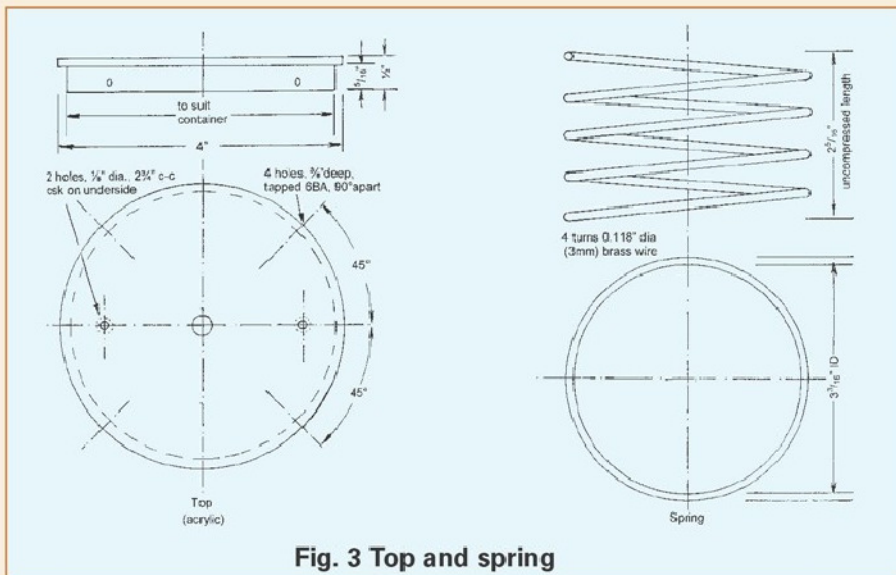


Fig. 3 Top and spring

disk acts as a convenient anchor for the magnet and for the plunger; and therefore its actual size bears little relevance to the operation of the unit. Indeed, the photographs show that two flats exist on this part, simply because it was cut from a piece of 3in. wide plate, rather than from a wider (4in.) piece. The spring holds the magnet away from the bottom of the container. When the plunger is depressed, the disk acts against the spring, and pushes the magnet down to make contact with the bottom of the container. By placing the unit on top of a pile of say, steel washers or swarf, and depressing the plunger, the magnet attracts magnetic material to it. By releasing the plunger, the spring decompresses, the magnet lifts away from the bottom of the container, and so attracted items fall off.

Design considerations and construction

Construction is straightforward, and requires little comment. The container needs to be reasonably tough, and must be non-ferrous. Most margarine type tubs, whose size is ideal, will be too flimsy to use. The prototype was made from an old

fish-food container ("Aquarian" Goldfish Flakes, 50g size). The dimensions shown in the figures are based on this container. UBM sell putty (1 kg size) in suitably robust pots but these are slightly taller than that used. If such a taller pot is used, then the spring and plunger may need to be redesigned. The original snap-on lid used on the fish-food container, although pretty thick, was found to be too flexible: when the unit was lifted from the bench, the lid flexed so much under the weight of the assembly, that it allowed the magnet to move away from the bottom of the container, causing all attracted items to fall off prematurely. (The force compressing the spring was acting through the plunger, fingers and thumb onto the lid, thus flexing and moving the lid, and container bottom further apart). The lid was redesigned lid using 1/2 inch thick acrylic sheet, and held in place with four 6BA cheese head screws. When drilling the holes for these screws, first fit the lid on to the container, and drill through both.

The spring should be made from non-magnetic material to prevent ferrous objects adhering to the rim of the pot after the plunger has been released. Brass seems to fit the bill nicely. It needs to be stiff enough to support slightly more than



3. Interior view showing spring location.

the combined weight of the magnet, the plunger and all attracted materials. If the spring is too weak, then when the plunger is released, the magnet will not rise, and this will prevent attracted materials falling off. Conversely, a spring that is too strong will be awkward to use, and is expected to cause fatigue to the fingers and thumb after prolonged use.

The plunger, like the spring, needs to be made from non-ferrous material, such as brass. Its design shows what appears to be an excess of screw thread. This allows for the initial adjustment of the height of the plunger, and compensation for any of the flexing of the container base when the plunger is depressed. Set the height of the plunger so that the top protrudes 3-4mm above the handle when the magnet touches the bottom of the container.

The handle was made from hardwood, sanded and varnished, and mounted on the top with two 1" x No. 4 countersunk woodscrews.



4. Picker Upper - partly assembled.

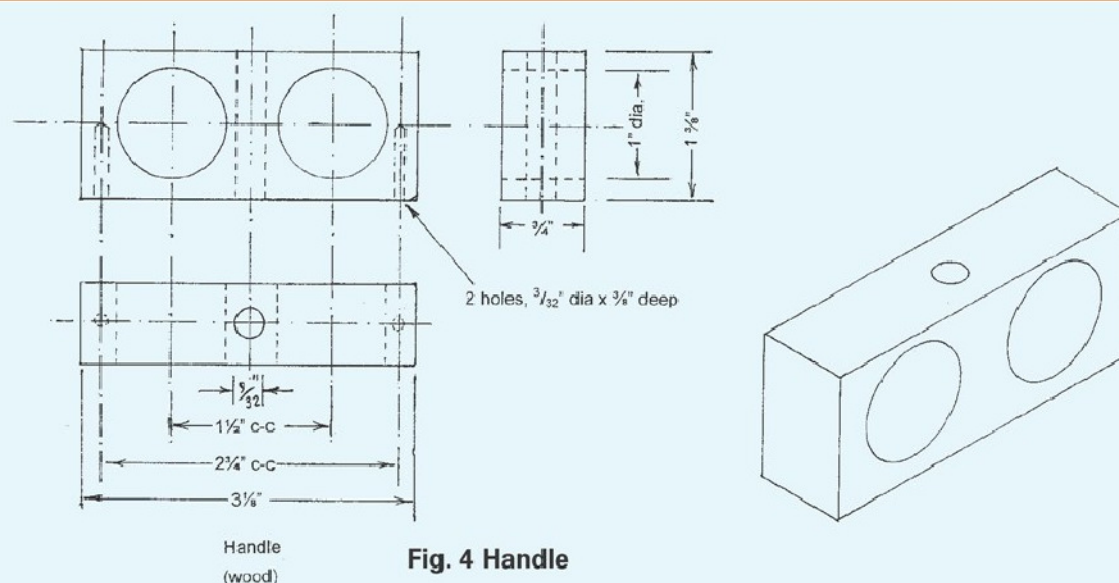
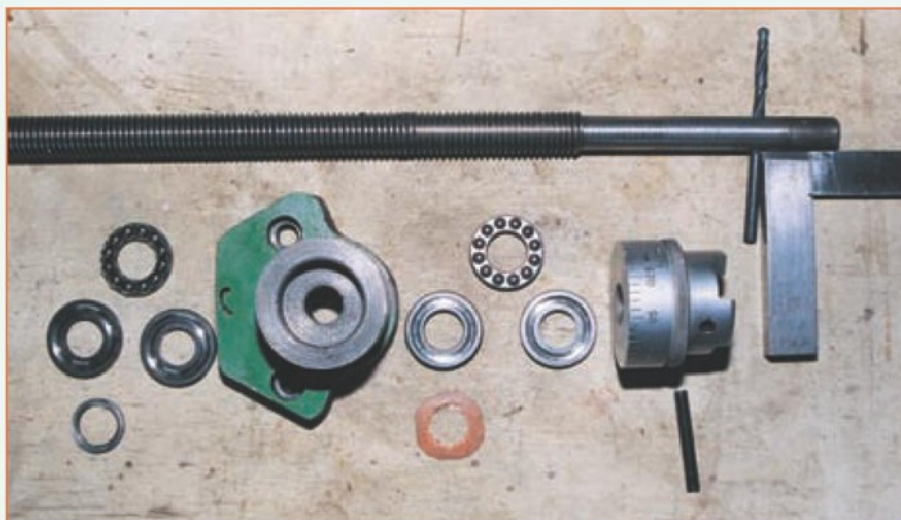


Fig. 4 Handle

FITTING SLIP DIALS TO A DRILL/MILL



1 Components of table X drive. Note angular position of roll pin hole and "moth eaten" shim washer.

My drill/mill is the smallest manifestation of the well known range of Taiwanese machines; it is designated RF-15. The dials have black markings engraved on a satin chrome background, and are very clear; but they were fixed in relation to the shaft rotation. It is possible to use a lead pencil to mark start and finish of settings and to later to remove these marks with an eraser, but this is nowhere near as convenient as the use of slip dials, such as were fitted to my Taiwanese lathe saddle, cross slide and tailstock. I later modified the lathe top slide dial to a slip form using the same concept as the lathe designer had for the original slip dials.

After 15 years or so I finally tired of the pencil and eraser routine and set out to convert the drill/mill to slip dials also, and this article relates to that exercise.

Assessment

In order to devise a suitable arrangement it was first necessary to dismantle the existing X, Y, and Z feed assemblies to determine exactly how they were put

2. Hardwood cradle with knockout hole.



together and their part dimensions. It was intended also to take the opportunity of this dismantling to ascertain whether there was sufficient space to substitute ball screws in order to eliminate the significant backlash in the X and Y table motions. The thrust bearings were found to be stuck in their housing with old grease but were set free with the extractor depicted in drawing 4(a).

The X and Y arrangements as found are shown in drawing 1 and the Z arrangement in drawing 2(a) - this latter will be separately addressed later in the article.

What was immediately apparent was that while the design concept for the X and Y movements was conventional and sound, the detail design and particularly the assembly workmanship was poor. Reference 1 indicates that for thrust ball bearings of the size used the axial clearance should be in the range 0 to 0.075 mm; what was found was for the x movement 1.35 mm and for Y 0.35 mm. The actual axial play of the feed screws in their nuts was almost negligible - so the ballscrew idea was set aside as unnecessary.

3. Boss, dog clutch end and dummy shaft. Also shown is bearing extractor.



Philip Amos describes a simple modification to a Mill /Drill to improve convenience and accuracy

Essentially there were two related problems -

- (i) The collar (**part 2**) was a very loose fit on the screw shaft and hence its axial location against the end of the screwed portion was rather indeterminate - see drawing 5(a) which displays a possible extreme cant of 0.75 mm.
- (ii) The dog clutch/engraved dial was fastened to the screw shaft with a roll pin in a hole very carelessly positioned and drilled. On the X screw the hole was not at right angles to the shaft (see **photo 1**) and on the Y screw the hole was not through a diameter of the shaft.

Design

After consideration of the dimensions of the various parts it was decided that it would be possible to re-machine original part 1 so as to retain the engraved dial and the dog clutch end. To do this the part was carefully cut in two (using a hacksaw to minimise the amount of axial material removed) and the two sawn surfaces faced smooth and at right angles to the axis.

A new boss was designed to extend the dog clutch, and on which a bored out engraved dial could turn. This boss embodied a radial spring loaded ball to provide frictional restraint to hold the dial in its set circumferential position.

The same dimensions apply to both X and Y assemblies, which differ only in the length of the screws, and that the X screw is right handed while the Y screw is left handed (both with Acme threads).

Detail

It was clear at the outset that multiple assembly/dismantling operations would be required. While it is possible to drive out the roll pins and drive them in again, these are really a semi permanent arrangement. To initially remove them, a hardwood block was machined to match the radius of the dog clutch end with a hole drilled opposite the position of the roll pin - see **photo 2**. This block then acted as a cradle to support the dog clutch while the roll pin was driven out with a pin punch into the hole in the wooden block, thereby avoiding damage to the dog clutch/engraved dial surface.

To improve convenience the 5 mm diameter hole for the roll pin was drilled out ½ inch diameter (5.56 mm) and then opened out to accept a No.4 taper pin. The

taper pin (38 mm long) is easy to tap in and out and positively retains the parts in their intended position.

It will be seen from **drawing 3** that provision is made for the new boss to be attached to the dog clutch end by means of two socket head capscrews and that there is also a dowel pin to transmit torque. Together with the main shaft hole and the side hole for the ball and spring, the boss starts to look a bit like a Swiss cheese. The sequence of operations required is lengthy but all are straightforward- the sequence is listed at **Appendix 1**.

From comparison with my lathe it seemed that an appropriate thickness for the engraved dial might be 6 mm. Starting from a scale diameter of 49 mm this means a nominal boss diameter of 37 mm. As the dog clutch end is 40 mm diameter it provides a small shoulder which limits axial movement of the engraved scale ring.

The diametral clearance on my lathe slip dials averages 0.08 mm which corresponds to Tubal Cain's suggested Normal Running Fit - see reference 2. Thus an outside diameter of 36.92 mm was adopted for the boss and 37.00 mm for the engraved dial hole diameter.

The axial length of the engraved dial measured 21.74mm, and the boss axial length aimed for was for this plus 0.08 or 21.82 mm to ensure that the dial could turn freely on the boss without axial constraint.

The side hole in the boss for ball and spring was made 6.5 mm diameter copying the lathe precedent, for a ball 6.35 mm diameter and a stock spring 6.1 mm diameter. The spring selected had a wire diameter 0.8 mm and the axial space available for it was 6 mm. When the ball is fully depressed the spring should not go solid - a solid length of 5.5 mm will result from just over 6½ turns which was adopted.

The dog clutch main hole is a somewhat loose fit on the screw shaft, and it was desired that the new boss should be close fit. Thus when these two parts were to be joined together a short stepped shaft was made to fit both parts and ensure they were coaxial - see **drawing 4 (b)** and **photo 3**.

In order to perform their function the thrust bearings must stand proud of their housing if engaging an item of greater diameter than the outer diameter of the bearing. This is particularly so on the outside of the housing, and can be achieved by the use of shim washers between bearing and housing if necessary.

The final matter to address is the axial length of the stop collar which engages the end of the screw thread. The shape of the thread end is depicted in **drawing 5**. If the collar internal diameter is a close fit on the screw shaft, its axial location will be determined by its engagement with the corner between shaft and thread - this is not a good design to rely on for resisting significant thrust. Measuring the axial space between this corner and the outer transverse surface of the thrust race is quite a problem as most of the normal measuring devices do not seem appropriate. I used gauge blocks and a magnifying lens to observe this (see **photo 4**), but I am not very confident of the accuracy of the result. At any rate I used this information to define the thickness of the thrust collar. The whole assembly can then be checked to see that it rotates freely without any axial play. If tight the thrust



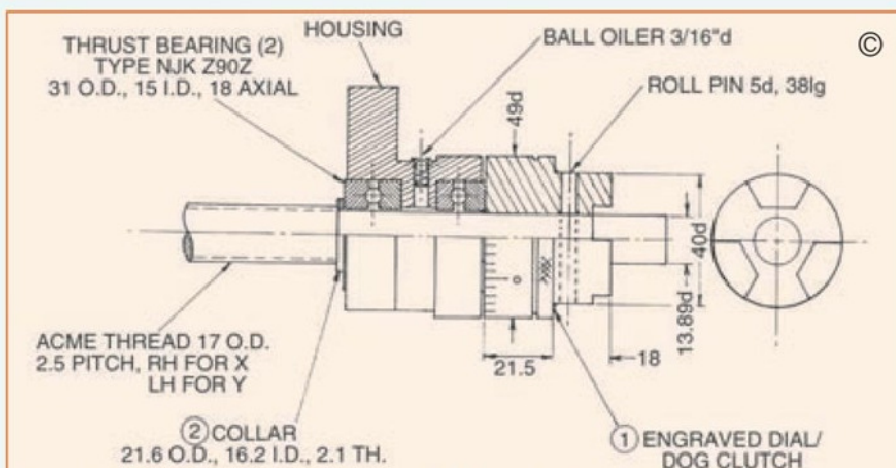
4. Measuring axial gap for stop collar.

collar can be filed or ground thinner. If there is play it can be removed with shim washers.

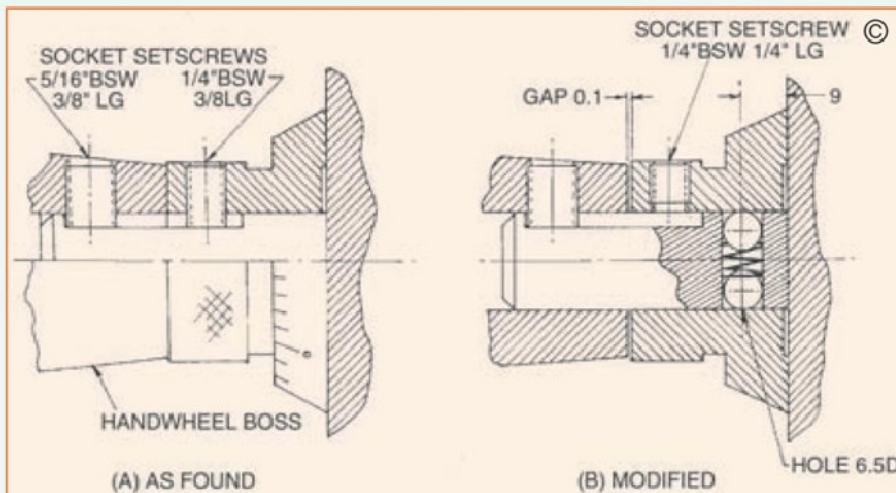
When this desired state has been achieved the stop collar can be secured to the screw shaft with Loctite (680) adhesive, with the other components in position to ensure that the collar is in the correct location.

The inside diameter of the engraved dial

is machined to dimension with the part protected from the chuck jaws with thin card. When assembling the scale ring on to the boss it is necessary to first fit the stepped shaft mentioned above so that the ball and spring can be positioned without falling into the bore. The scale ring can then be moved axially over the boss, depressing the ball against the spring with



Drawing 1 - General arrangement As found X and Y motion



Drawing 2 General arrangement Z motion



5. Components of table X drive after modification.



6. Drill jig and assembly tool.

the flat of a screwdriver blade until the scale ring itself is in position to hold the ball down.

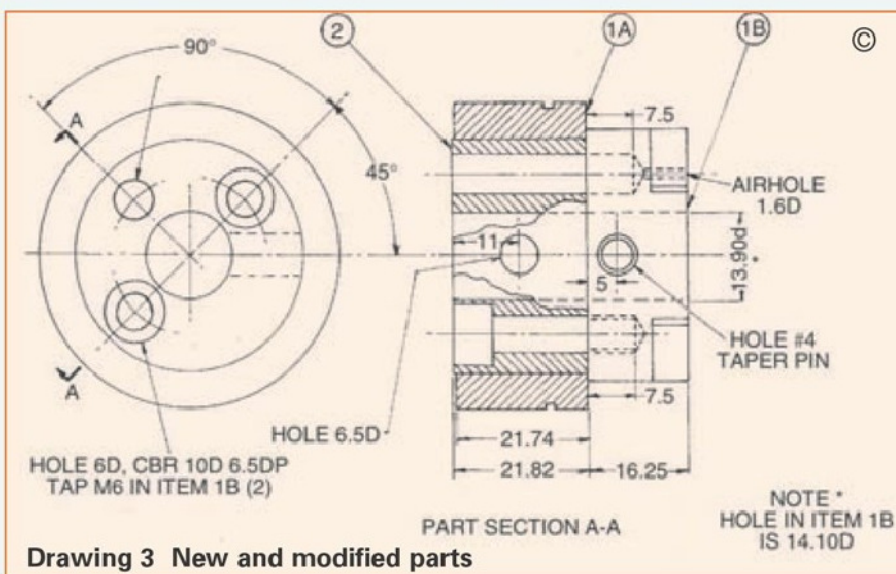
The assembly of the dog clutch/boss and scale ring is then moved axially on to the screw shaft which pushes the stepped shaft out. It is important to note that the spring and ball hole must be radially at right angles to the taper pin hole in the screw shaft, lest the spring and ball expand into that hole and jam the axial movement - in which case it all has to be taken apart and started again.

When all these steps have been completed it only remains to coat the screw thread and the thrust bearings with Molybdenum Disulphide grease and reassemble on the mill/drill.

The components of the X drive arrangement after modification are shown in photo 5.

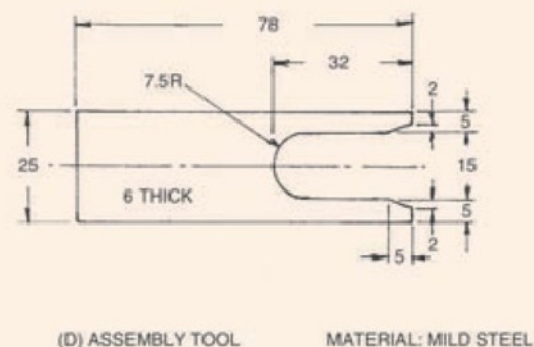
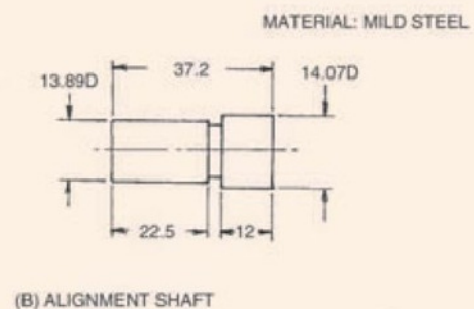
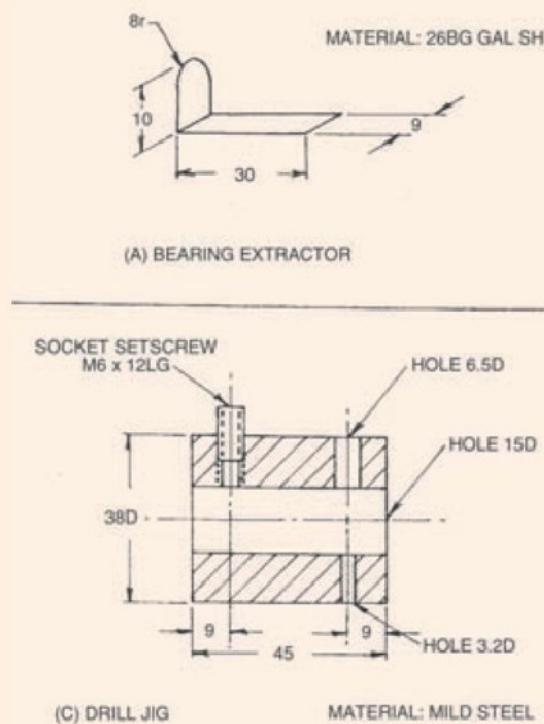
In my case there is now no axial play in the bearings, and the total arrangement backlash is -

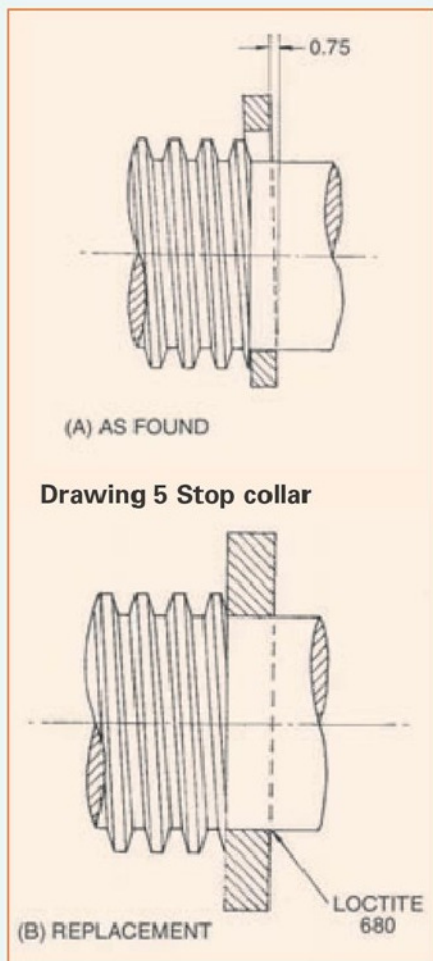
X direction 0.25 mm
Y direction 0.10 mm.



Drawing 3 New and modified parts

Drawing 4 Tools





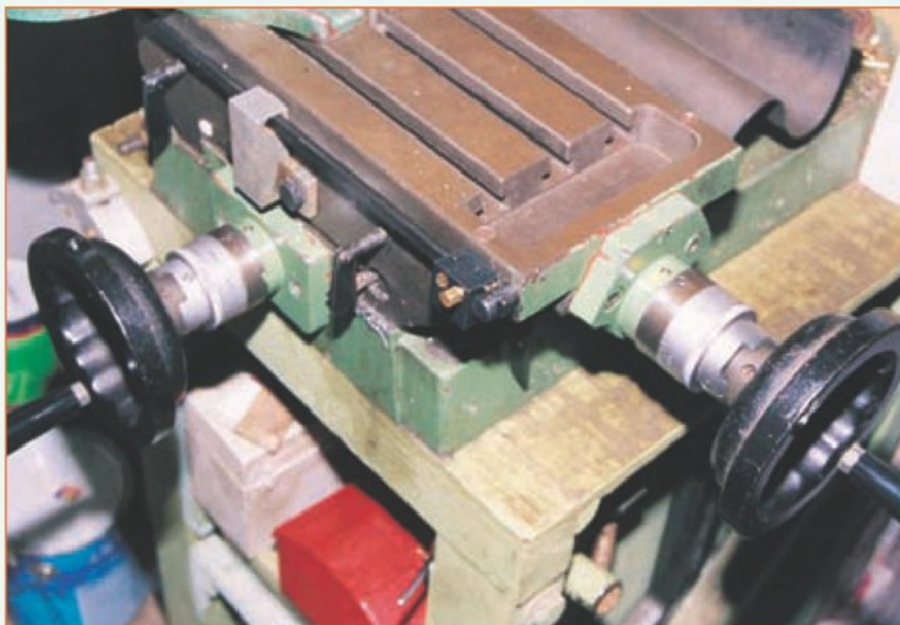
Down feed

In this case there is no axial movement to contend with as both operating handle and engraved ring are secured by socket setscrews bearing on a flat on the operating shaft. When the setscrew for the engraved scale is loosened that scale rotates freely on the shaft - in fact it is a bit on the loose side. There is not much room for means to achieve the required slip scale, but it was decided that if a hole was drilled right through the main shaft in a position clear of the existing flat it would be possible to fit two balls with a spring between them to provide the frictional restraint on the engraved scale.

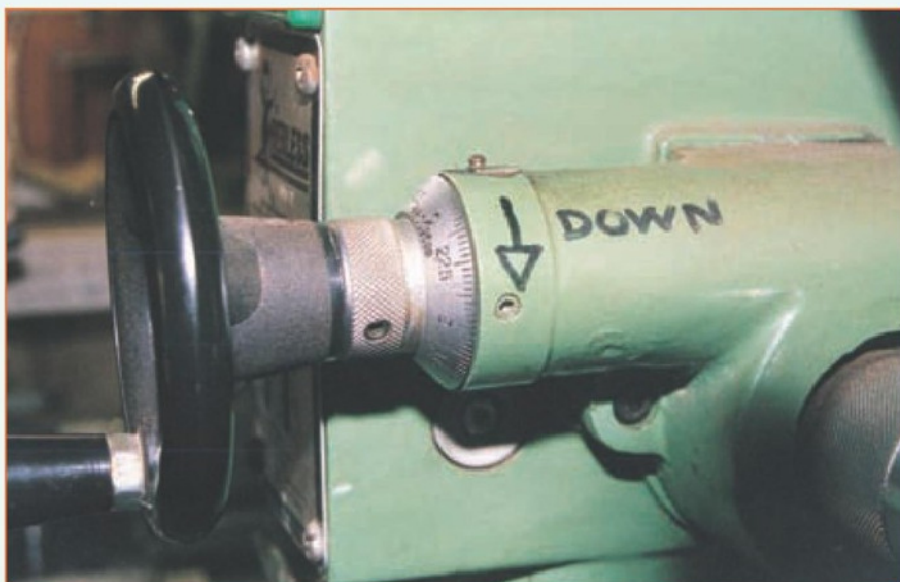
In this case the available axial space for the spring was 5 mm. For wire diameter of 0.8 mm this would allow just over 6 turns before going solid when the balls were depressed to the surface of the shaft.

A simple drilling jig as shown in **drawing 4 (c)** and **photo 6** was made which was held in axial and radial position by a socket setscrew engaging the shaft flat. Using a pistol drill a 3.2 mm diameter hole was drilled through the shaft using the back hole of the jig as a guide; then a 6.5 mm diameter hole was similarly drilled using the front jig hole.

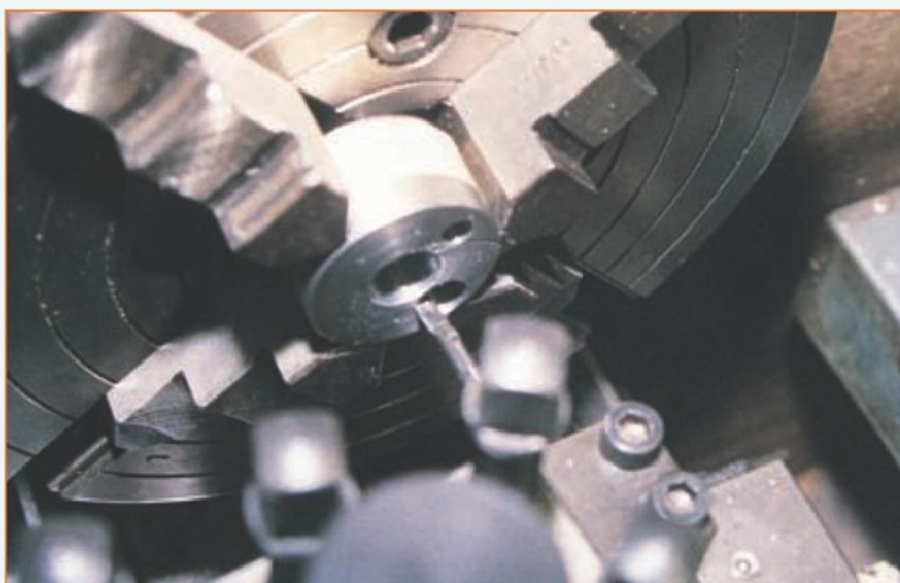
The two balls plus the spring had a free length of 20 mm. Compressing this combination to the 15 mm of the shaft diameter was fraught with difficulty. After several unsuccessful attempts including the loss of a ball and a spring, a tool was made as shown in **drawing 4(d)** and **photo 6** which allowed the combination to be



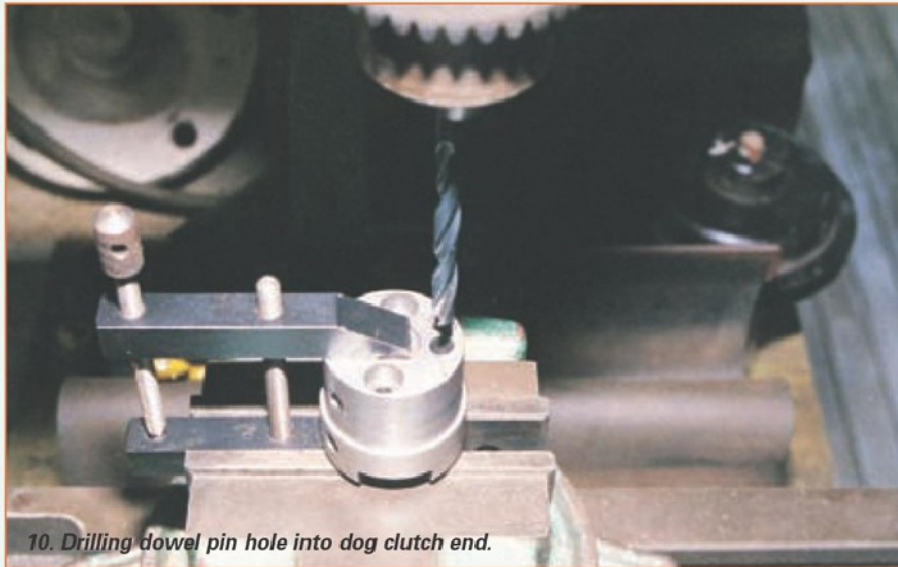
7. Table X & Y drive after reassembly.



8. Quill Z drive after reassembly.



9. Finishing counterbore to size.



10. Drilling dowel pin hole into dog clutch end.

Appendix 1

Sequence of Operations. Dismantling - X or Y Table Movement.

1. By undoing 2 capscrews in the bracket housing and unwinding, unship the feed screw from the drill/mill.
2. Remove handle.
3. Measure axial play and distances from end of shaft to dogs.
4. Mark shaft end and dog end with file nicks for future orientation.
5. Knock out roll pin using wooden support cradle - **photo 2**.
6. Dismantle components, clean in kerosene and inspect.
7. Position dog end on shaft with No. 10 drill through cross hole. Clamp handle to this axially and with its own setscrew to shaft.
8. Remove No. 10 drill and open out progressively to $\frac{3}{8}$ inch diameter.
9. Ream hole for No. 4 taper pin.

Preparation

1. Measure shaft diameter (13.85 mm) and diameter of hole in scale/dog clutch (13.90mm).
2. Hacksaw scale drum from dog clutch end.
3. Face both sawn surfaces with attention to faces being at right angles to axis.
4. Measure resulting thicknesses of scale drum (21.74 mm) and dog clutch end (16.25mm).

Boss manufacture

1. Cut billet (38 mm diameter) to length of two bosses (45 mm each) plus 50 mm for chucking - 140 mm total length.
2. Face both ends in turn in 3 jaw chuck.
3. Skim full length to make circular, half a length at a time.
4. Groove 23 mm from end (i.e. about 1 mm wider than the scale drum).
5. Turn to diameter 36.92 mm as far as groove.
6. Mark centre on end.
7. Layout end for holes and punch centres.
8. Drill, bore and ream main hole 13.90 mm diameter.
9. Part off.
10. Face to length 21.82 mm (equals scale

- drum thickness plus 0.08 mm).
11. Mark off and centre punch side hole.
12. Drill in side of mill/drill hole 6.5 mm diameter.
13. In 4 jaw chuck drill and ream dowel hole 6.35 mm diameter. Drill tapping size M6 (5.0 mm diameter) and counterbore 10 mm diameter 6.5 mm deep (2) initially with 9.5 mm diameter slot drill then opened out with mini boring bar - see photo 9.
14. Make stepped dummy shaft - see drawing 4 (b).
15. Mount on stepped shaft with dog clutch end, clamp together, drill and ream (D-bit) dowel hole 7.5 mm deep and drill air relief hole 1.6 mm diameter - see photo 10.
16. Fit dowel.
17. Drill tapping size M6 in dog clutch end 7.5 mm deep. Remove boss and tap hole M6
18. Open out holes in boss to clearance (6 mm) diameter.
19. Assemble boss to dog clutch end with 6.35 mm diameter dowel and two M6 socket head capscrews 22 mm long.

Scale drum manufacture

1. Drill and bore scale drum to diameter 37.00 mm using boss as gauge (as well as measuring with telescopic gauge and micrometer).
2. Trial assembly on boss with spring and ball with dummy shaft in boss bore.

Stop collar manufacture

1. Measure axial distance from shaft end to end of Acme thread.
2. Assemble two bearings, bearing housing and boss/dog clutch end on shaft fixed with taper pin, and measure axial distance from end of shaft to inner face of inner bearing.
3. Deduct 2 above from 1 above to compute collar thickness.
4. For confirmation also measure this with gauge blocks - see photo 4.
5. Skim 25.4 mm diameter raw material to approx 25 mm but circular.
6. Drill inside diameter $\frac{1}{2}$ inch (13.49 mm).
7. Part off to dimension of gap plus 0.1 mm.

held in place while the engraved scale was moved axially over it. The operating handle was then fixed in position with a 0.1 mm feeler gauge arranged to define the axial gap.

Conclusion

The intended aim to equip the mill/drill with slip dials was achieved, and the amount of backlash reduced to what might be expected in an ordinary machine tool.

Photos 7 and 8 show the arrangements after modification; it is hard to detect any external change in appearance.



References

1. Machinery's Handbook - Revised 21st Edition 1982.
2. Model Engineers Handbook - Tubal Cain 1981.

8. Ream inside diameter to fit screw shaft (13.90 mm).
9. Assemble parts to check for axial tightness or play.
10. Correct by filing or shim washers.

Reassembly

1. When satisfied no axial play in bearings dismantle, and fit scale drum, spring and ball to boss with dummy shaft in boss bore.
2. Coat both bearings and Acme screw with Molybdenum Disulphide grease.
3. Reassemble all parts taking care that the hole for the spring and ball is at right angles to the taper pin hole in the shaft. As the boss/dog clutch end is passed on to the main shaft, the dummy shaft is pushed out. When the spring and ball are beyond the taper pin hole the boss/dog clutch end can be turned until the taper pin can be fitted in its hole.
4. The screw is wound back into its table nut and the housing bracket re-secured with its two capscrews.

Operations For Z quill movement

1. Undo two socket setscrews to remove handle and scale ring.
2. Make drill jig to drawing 4 (c) and photo 6.
3. Secure drill jig to shaft with socket setscrew engaging shaft, and jig end abutting machine casting.
4. Using hand held pistol drill make pilot hole through shaft 3.2 mm diameter with rear jig hole as guide.
5. Likewise open out hole to 6.5mm diameter using jig front hole as guide.
6. Make spring and ball assembly tool to drawing 4 (d) and photo 6.
7. Insert spring and two balls in 6.5mm diameter hole and compress length from 20 mm to 15mm overall with tool.
8. Move scale ring over the balls to abut the machine casting.
9. Re-secure handle to shaft with socket setscrew using 0.1mm feeler gauge for axial gap.
10. Plug hole in scale with shortened socket setscrew.

LINK UP

Would readers wishing to make use of this facility please note that the maximum total value of items accepted for a 'For Sale' entry is £50.
To advertise goods of a greater value, please contact our Classified Advertisement Department. Please indicate clearly if an item is intended for Link Up.

FOR SALE

● For sale: Moore and Wright internal micrometer in padded box, range 2in. to 8in. in very good condition. £30-00 please phone 01442 863 026 (West Herts).

● For Sale: Good home sought for pattern copying router table. Can also be used when rebating, grooving and trimming wood plus cutting finger joints. The unit is 95% finished with first class TIG welded aluminium frame. £20-00 for material, partsbox and sketches. Also dual speed Colchester Student lathe electric motor. 3 Phase, 1.5 – 3

hp, 720-1440 rpm £30-00 Please phone John 01895 236 203 (Uxbridge)

● For Sale: Screwcutting gearbox for Colchester Chipmaster lathe sensible offer (less than £50-00) plus carriage please phone 01322 330 556 (Kent)

EXCHANGE

● Swap: Excel heavy industrial 10in. rotary table, will swap for 6in. or 8in. rotary table or dividing head. Please phone Bill 01429 429 478(Hartlepool)

QUICK TIP

From Mr P Foyle of Basildon, Essex.

When sharpening scissors, the scissors are opened wide and the edge of each blade in turn is held at the correct angle and slid up and down the oilstone. It can be difficult to apply enough pressure and to hold the narrow blade at the right angle consistently. My idea is to reverse the procedure, grasping the blade in a vice, and using the stone in the manner of a file. It is much easier to apply pressure this way, and to maintain the correct angle. Ensure that the stone is kept well oiled. A similar technique may be found useful on garden shears.



IN OUR NEXT ISSUE

Coming up in Issue No. 91 will be



Milling Projects for Beginners

Harold Hall describes a fixture to sharpen end mills and slot drills.

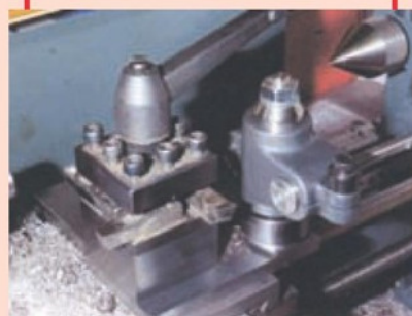
Friction (and bearings)

Philip Amos considers the theory, use, and avoidance of friction.



Improving the Conquest Lathe

Alastair Sinclair outlines his modifications to this popular machine.



A New Approach to Form Relieved Gear Cutters

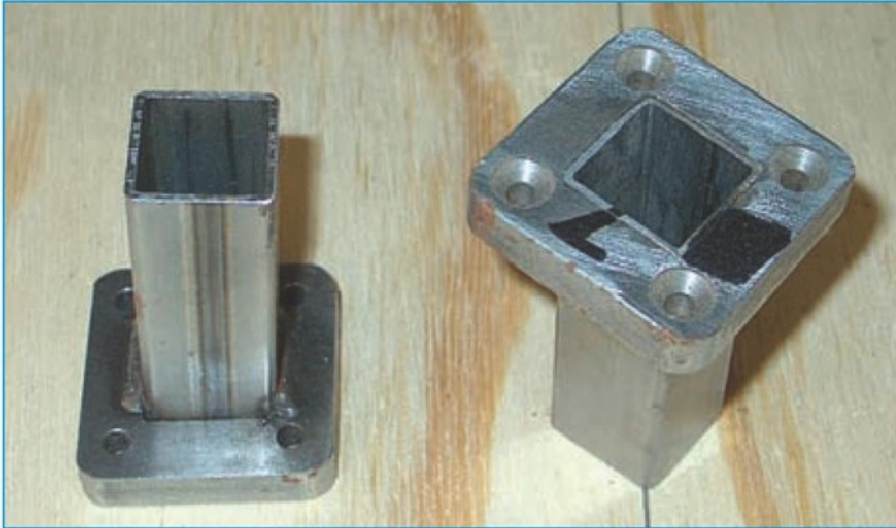
Eric Rumbo has devised a system for producing such cutters which avoids the usual complex "Backing off" machining process".



Issue on sale 20th June 2003

(Contents may be subject to change)

WORK BENCH ADDITIONS (2)



1. Sockets for bench clamps.

This second article follows on from the first with the detailed descriptions of the remaining parts. Safety minded readers should note that in several photographs, guards have been removed to give a better view.

Bench clamps (5)

I do not have an end vice and this system was made up to counter this omission. It consists of a series of Hollow Rectangular Sections (H.R.S.) welded to steel flanges which are set at an angle of 5 degrees, (photo 1). These are then set flush in the bench, one end unit with its taper towards the right, and the remainder set at various distances on the left hand side and with the angle this time to the left. In this way the parts that fit into the H.R.S. will always seat themselves more firmly into the bench receptacles and not have a tendency to lift out under pressure.

The flange holes for the H.R.S. were first machined out at the correct angle before the tubes were fitted and then welded into

position. (As a brief aside make sure that these parts are well supported on the underside by fitting them through a longitudinal stringer or other suitably reinforced part of the bench)

The clamp and end components are modified from a standard clamp system that originally would have been fitted to a timber beam. These, after modification, were bolted to specially made "Tooth stems" (photos 2 & 3). The system works well enough but I need some more fitted into the wings so that they would then be available for use with longer jobs. One end of the clamp can be seen in use in photo 4.

Elektra Beckum saw adaptation (6)

This saw is very good and comes complete with laser alignment. What I did not realise at the time of purchase was that it could not be used in a similar manner to a radial type saw, in that it it was not possible to lock the blade at a fixed height

2. Adjustable clamp.



3. Fixed clamp, commercial and home made parts.



Peter Rawlinson concludes his selection of woodworking aids.

I therefore came up with the additional two parts that give the saw extra versatility, and do not detract from any of its original uses.

The assembly consists firstly of a 10 x 16 mm steel bar bolted into place using a specially shaped gusset, (photo 5). The height has been set to allow 100mm. timbers to be slid underneath. The adjustment is achieved by means of a threaded arrangement consisting basically of a tapped bar working within a tube. A ball bearing is set into the end of the rod and runs freely on the steel bar. This can be seen close up in photo 6, and the adjuster is shown in use in photo 7. Approximately 60mm. of movement is available. The modification works well and does not get in the way of normal use.

Dust suction connector (7)

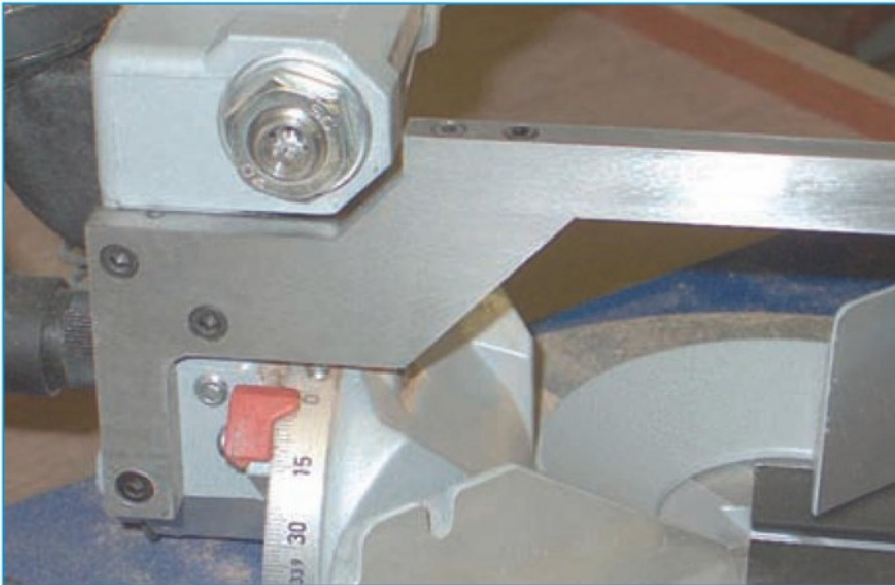
I am given to understand that many hard woods and also M.D.F. (Medium Density Fibreboard) give off nasty chemicals, some of which are carcinogenic in nature. It is therefore best to try to prevent these dust particles getting into the air in the first place. Although wearing a mask will help, a dust extractor is clearly a more desirable solution to the problem.

Most of today's wood working tools are equipped with dust extraction outlets, in the main being 100mm or 4in. diameter male tubes or some close approximation to these sizes. However if a number of tools are available and space is limited then the fitting of each of these to a permanent dust extraction system is very costly and indeed is not feasible if the tools are to be moved around the workshop.

My answer to this is to have one dust extractor with a three or four metre flexible

4. Clamp in use.





5. Close up of bar and attachment.

hose and as we are only using (in general) one machine at a time we can transfer the hose as required between machines. This however is not as easy as it seems as the tube sections vary a little in size and can be either slightly tapered or parallel, so that the hose either fits too easily and then falls off, or is a struggle to put on.

I have made up from a piece of 115mm diameter cast nylon a tapered fitting that clamps on to the flexible hose (with 2 cable ties.) This is bored with a 6 degree inclusive taper and fits nicely on all of the six machines that I have. I also intend to add 100mm dia. outlets to my other machines as I have found that any restriction in suction hose diameter reduces the extractor efficiency considerably. The fitting has been equipped with a simple handle and if I find a problem in the future I can use an elasticated luggage strap to hold it in place. The connector and hose are shown in **photo 8**.

As an aside, the piece of nylon that I had was solid, and naturally I hated the idea of throwing away the central core as swarf. I found that I had a 90mm dia. hole saw which would cut in to a depth of 35mm. I therefore machined the length to

70mm and used the hole saw from both ends. This now leaves me with a piece of nylon some 80mm diameter and 70mm long, potentially more useful than a bin full of swarf. This sounds simple but the operation required suds to be used continuously, and required repeated cuts of just a few thous at a time as the teeth clogged very quickly. Fortunately some time ago, my tailstock was modified, being fitted with a rack and pinion feed instead of the normal screw type arrangement. Even working this way, this it must have taken nearly an hour to remove the core.

Height setting gauge (8)

These devices are, in fact, commercially available from at least one tool catalogue, but making one is a very quick and simple exercise, and therefore worthwhile. It consists of a steel centre section with brass strips top and bottom to give a reasonable foot print, so ensuring that it

7. Height adjuster set for half jointing.



will stand on its own with good stability. Mine is graduated at both ends, one for measuring up (table saw and router) and the other one down (for the radial saw and for setting a stop on the bench drill.) It is first fabricated then set up on the mill for making the step cuts. I chose two millimetre intervals using the D.R.O. for accuracy. In the absence of such gear, it can equally be done using either a clock gauge or by careful attention to the machine dials. The completed gauge is illustrated in **photo 9**.

Hold fast bosses (9)

My older bench features a couple of bosses for Stanley hold down units, and I wanted to incorporate these into the new bench. The commercial items are simple flanged bosses with a series of grooves cast inside. I found that I could replicate approximately by turning these features with a specially ground tool having a nose radius of 3.5 mm. Commercial and home made items are shown in **photo 10**. The bosses are incorporated in the top and in the legs of the bench, the latter for holding long pieces on edge.

Acrylic infill discs (10)

The end wing has a hole through it. This provides a route for the dust hose when the wing is in the lowered position. When the wing is raised for use, the hole is closed with a disc, (**photo 11**), and this stops the gremlins pushing the tools through it.

A second aperture occurs over the bobbin sander. In normal use the bobbin is removed from the sander. There is then an open hole for the saw dust to drop through, and a second disc (**photo 12**) is fitted to save clearing this out.

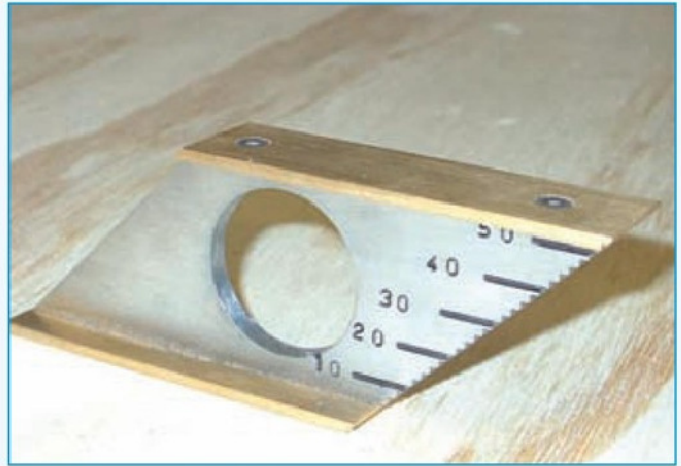
These discs are turned from acrylic (Perspex) 6mm thick. The manufacturing procedure was to first cut out oversize on the band saw, then drill the central hole for the handle. Then, using the central hole, they were then mounted on an arbor and turned (very carefully) to size.

6. The adjuster unit.





8. Dust connector adapter, handle and hose.



9. Height gauge showing increments.



10. Commercial and home made collars.



11. Acrylic disc with handle up.

Tenon cutter guide (11)

This unit is used in conjunction with a table saw for guiding the long side cuts when making tenons. Again such things are available commercially, but at a price. I have made mine to be able to cut both vertically and also horizontally, because I had made some of the parts for an earlier abandoned project.

The base of the accessory consists of a pair of circular discs mounted together with a central pivot pin and radial slots with through bolts for locking the angle into position.

The lower disc has fitted to its underside, a bar that will fit into the mitre fence slot on the table. The fit should be free running with no play. The top disc with a slide (the same as a top slide on a lathe.) will give accurate adjustment for the tenon thickness. The vertical plate fitted to the front of the slide is fitted with

a clamp system to hold the timber that is to be cut. This description so far covers the basic machine and next we move on to my addition. This is a system for swinging the front plate to an angle of 45 degrees. I have therefore pivoted the plate at the bottom and fitted two shaped plates with curved slots to take clamping screws to hold it firmly in place. **Photos 13 and 14** convey some of the detail aspects of the construction. The machining procedures and techniques are relatively straightforward and probably do not require detailing. The device can be seen in use in **photo 15**.

Standardisation of "T" slots (12)

Since I had a number of different mitre squares which could not be interchanged between machines, I decided where possible, to standardise all the machine "T" slots. After giving the problem some thought and taking measurements of the material wall thickness surrounding the existing "T" slots, I concluded that there would be sufficient material left for strength. In the main the better quality mitre gauges featured "T" slots which were $\frac{3}{16}$ in. wide (19mm) and required an undercut of 23mm x 4mm deep, within an overall depth of 10mm. This rather drastic remedy would be applied to three machines, the bandsaw, the table saw, and the sander. The last would also benefit from a new slot at right angles to the face.

Band saw

This tool had been made with sufficient material for the final machined slots. It was set up on the milling machine using a sub table and an enlarger plate, then clamped in place using four machinists clamps which held the table with no problems. The existing slots were first opened out to 19mm wide x 10mm deep and a key seat cutter was then used to cut the "T". This cutter was 16mm dia. x 2.3mm thick so that two cuts were required for each side of the slot. This then gave the required 4mm deep cut.

Sander

The existing slot in the sander table was enlarged in the same way. However there was insufficient material to cut the new one that I planned. I therefore machined

13. Tenon guide showing angular adjustment features.



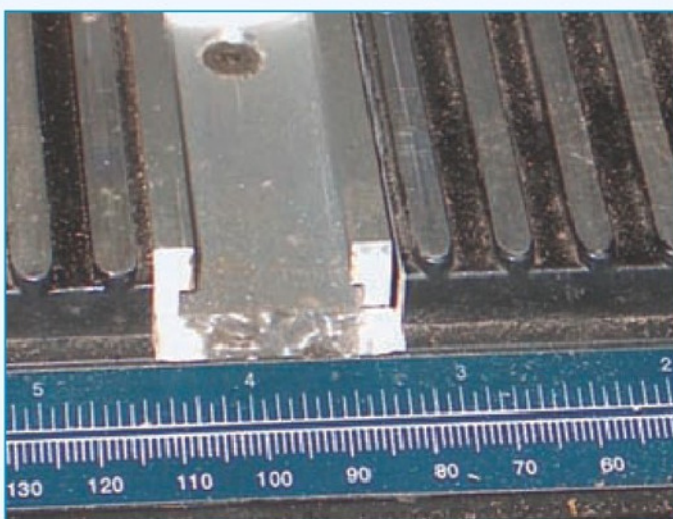
12. Acrylic disc, handle down giving flush surface.



14. The slide adjustment handle was salvaged from a Boxford lathe.



15. The tenon guide in use.



16. New "T" slot inset fitted to table saw.



17. Adapter fitted to fence with featherboard.

the underside flat, screwed into place a 50mm x 10mm. steel stiffener, and proceeded to machine this in the same way as before.

Table saw

The worst case was the table saw which has a table of die cast aluminium approximately 5mm thick. I had already purchased a "T" slot extrusion which was $\frac{1}{2}$ in. deep, (12.7mm) x 32mm.wide. It was then found that standard routers can be used to machine aluminium, and thus could be used to cut the old slot out.

I therefore used my smaller T5 Router and fitted this with a standard $\frac{1}{8}$ in. end mill and machined the old "T" slot out to a width of 32mm. This was cut out using a straight edge as a guide and was most

successful, taking cuts of 2mm. Exact measurements were then taken and two pieces of 8mm square steel were then screwed to the underside of the table and then machined such that the overall depth was 12.8mm. A 50mm wide steel plate was then screwed to these and these then formed a groove 32mm.wide x 12.8mm deep. The "T" slot extrusion was then fitted and screwed into place, as can be seen in photo 16.

I have since found that the aluminium used for making the fence and other items, can be cut very successfully using the Elektra Beckum saw, when fitted with an 80 tooth tct blade. I have also started using my wood band saw on aluminium as well and have found no problems and as yet, no increased wear on the blades.

New saw fence (13)

The table saw when bought was not an expensive model, and the fence was not to my liking, so I decided to build a new one. As the saw was to be bolted in place on the bench it was not necessary to mount the new fence directly on the saw itself, as it could equally be fixed to the bench.

It consists of a sliding bar of 25mm diameter bright mild steel and uses two bronze bushes fitted into an aluminium housing which holds the fence, the measuring vernier, and the lock. The fence itself is made from a piece of 50mm x 25mm aluminium and is fitted with one

"T" slot on the top to take various adapters and a second one on the side which allows it to be mounted on to the slide housing. This allows the fence itself to be pulled back to avoid a "Nip" situation occurring on some operations. I have also made a short fence that can be fitted as an alternative.

Featherboard adapter (14)

This fits on to the top of the fence and gives the added height that is required to fit a vertical feather board. It is made in two pieces for the very good reason that my scrap box did not contain a single piece of aluminium large enough for the job. The fence and featherboard adapter are shown in photos 17 and 18.

I hope that my short foray into the woodworkers territory may in some small way be of help to some other readers. As usual I am always happy to be of help if possible but phone only please and I will not return calls for the obvious reason.

Peter Rawlinson, Charing, Kent
01233 712158.



Tool Suppliers

Axminster Power Tools
Technical advice and information
01297 33656
Order line 0800 371822



18. A rear view of the adapter.

OXYACETYLENE: MUCH MORE THAN JUST A WAY OF



1. A portable and versatile apparatus.

In earlier articles you were invited to consider a cheap MMA ("stick") welder, then introduced to the many virtues and values of the MIG welders, and later given an outline of the special benefits that can be derived from TIG welding in the home workshop. In this the general benefits and practice of oxyacetylene are outlined, with some particular areas of detail to be covered in a follow up.

Even in a well equipped versatile workshop, we may come to realise that we still lack some capabilities. The wish list could include methods for better brazing, softening and cutting metal, and releasing rusted parts. After a period of observation, we come to realise, if we are prepared to pay for it, that one item fulfils these needs and comes in the form of the torches, hoses, regulators, gas bottles etc. that make up an oxyfuel capability, with oxyacetylene (Fig 1) being the most familiar and most popular of such systems.

Why oxyacetylene?

What is so special about oxyacetylene compared with other mixtures? Why oxygen? What is the advantage of acetylene over, say, propane or butane, available as those gases are for immediate collection from the local hardware shop? The answer is, in short, that the combustion of oxygen and acetylene offers the combination of a very high flame temperature and very good heat

Trevor Marlow examines the good old fashioned gas welding process and the allied uses for the equipment.

transfer, having better values than any other common combinations of gases. (MAPP gas is a close second, but isn't generally as popular or available as acetylene, it is not considered further in this article.)

Is the welding of thin steels difficult with oxyacetylene?

The answer is, in short, not at all. In everyday terms, it is an "absolute doddle". Provided you get reasonable equipment, look after it, and set it up properly, particularly re the delivery pressures, then the gas welding technique is incredibly easy. (Welding with oxyacetylene is often referred to simply as "gas welding").

When to gas weld and when not to gas weld

In industry and commerce, oxyacetylene welding is now less widely used because it is a slow process and not well suited to a lot of fabrication requirements. However, let there be no doubt about it, for thin carbon steel sheet or tubing, oxyacetylene

can be an excellent welding method. The fusion of the parent materials is quick and very controllable, allowing very high quality welds. However, when we need to weld greater thicknesses, getting all that material around the weld pool up to appropriate temperatures takes bigger jets, used at higher pressures, so it all becomes much slower, and it takes much more of those expensive gases. With the arc methods, on the other hand, on material above a certain thickness, the required rate of energy input is relatively insensitive to thickness. For thicker material arc methods are better.

And what about brazing?

What can one say? Superb, for starters. You can rocket up to temperature, with a controllable flame containing a spectrum of temperatures that protects from oxidation. It is particularly in brazing jobs that the range of flame types and sizes really comes into its own. For a teensy job, you could choose to utilise a cool, remote part of the outer flame. On bigger jobs there is the opportunity to choose bigger or special tips, and the heating can be made continuous or intermittent to suit your purpose. You will certainly not



2. The ability to know feedline pressure, and to be able to accurately adjust the value, is critical to successful gas welding.



3. Absolutely, totally necessary. Flashback arrestors in each supply line.

CH MORE THAN WELDING

PART 1



4. A small, light torch is exactly right for welding sensible metal thickness, and for any brazing.

struggle to raise the workpiece to the brazing temperature. You thus avoid the pitfalls of not quite reaching the proper temperature, or worse, when you do, having oxidised the job giving major non-wetting problems.

Rusted solid

Persons habitually working on vehicular antiquities (mine is C-reg!) know that the decision whether to even tackle a job will



6. One welding tip screws in to replace another.

rest on their pre-assessment of the rust-jacking problems that will be encountered. (Laboratory trials have shown that the rust bonding forces can be far higher than the strength of the metal parts). Fortunately, with an oxyacetylene capability, a serious rust jacking problem can usually solved in a matter of seconds. Just occasionally there will not be enough access to apply the flame, and there may be destruction of rubber bushes etc. – a small price to pay for an easy solution to an otherwise intractable problem.

Making the most of what we've got

Moving on, we may consider the next valuable asset of an oxyacetylene capability, that being the ability to rapidly and cleanly heat parts of components. You can for instance turn an ordinary spanner into a special (Fig 12) in a matter of seconds, without losing the temper of the jaws of the spanner. Similarly, with a bench vice, you can effortlessly put sharp bends in substantial bar, and with an anvil and hammers, you can locally heat strip, bar etc. and then forge it into almost any shape, sometimes making items that could



5. The torch is made up of valves, mixer unit, and tip.

not be produced in any other way. Panel beating enthusiasts will be familiar with the problem that deformation of steel makes the material work harden and become highly elastic. After a time, you can make no further progress towards the repaired condition, until you do a local heating job with the oxyacetylene torch, up to a bright cherry red being sufficient. The heating takes only a few seconds, but the change to the material properties is truly miraculous. That which was highly elastic, and unworkable, becomes totally plastic. The lightest of hammer blows then causes permanent deformation, allowing you to proceed, quickly and easily, to a most satisfactory completion.

Will it work in a field?

With several metres of hose, you do not need, in the typical workshop, to move things about much. On a suitable trolley, or pick-up truck, the oxyacetylene set is easily moved about the workshop, or further afield. Note that cylinders should be kept upright.

Best for big jobs or small jobs?

One of the beauties of a typical oxyacetylene capability is that you can tackle astonishingly small and delicate jobs, then proceed right through the spectrum of tip sizes and flow rates up to what you might reasonably rate as "industrial". Typically, a torch will have a range of sizes of welding "tip". (It is worth mentioning, in passing, that the simplest of welding tips can be much more sophisticated than they look. If you use a straight bored tip you will get a short, fat flame. If you use a tip with an internal taper (narrowing towards the outlet), you will get a long, narrow, precise flame).

A cut above the rest ...

An oxycutting torch is an extremely



7. The oxycutting unit screws on in place of the welding unit.



8. A small difference in appearance, a big difference in performance. The oxycutting jets.

valuable accessory on suitable welding sets. Typically it fits in place of the welding torch. The oxycutting torch frequently has a range of nozzles, sometimes including a special one for gouging.

Minimising the costs of possessing the oxyacetylene capability

Getting equipped

To make a start you will need cylinders, regulators, hoses, flash back arrestors, and a welding (Figs 1 - 6) and perhaps cutting torch, (Figs 7 & 8). Cylinders will usually be hired from one of the big two, BOC or Air Products. The remaining equipment will be purchased from your local or mail order welding supplier. Long hoses will allow you to chain your cylinders to a wall, short may be used with a cart. When choosing regulators (Fig 2) you may be offered one or two stage units. The former are cheaper but the latter give more precise and consistent pressure control, which in turn leads to better welds.

Flash back arrestors (Fig 3) are a non negotiable part of the kit. These must be permanently installed in each line and are one way of avoiding catastrophic explosive events.

Many texts suggest you should make your own welding cart as a first forming/ brazing/ welding exercise. A fault with some commercial carts is that they will not quite pass through a domestic door, so a self-built item may indeed be a good idea. An added storage box will help avoid losing jets etc (Fig 9)

It is worth remembering that lightweight torches, besides tending to be least expensive, are the least tiring to use, and thus lead to the best performance from the operative. Also, it is the very small jobs that are difficult, and the small set will be the best choice of equipment for those jobs. If you are in any doubt, it is best to choose a small gas set and supplement it with an inexpensive arc welder.

As to ancillaries: buy bridged goggles with flip-up shades (Fig 10). They only cost about a fiver, they are fine over spectacles, and you do not get in the right old tangle that is so characteristic of the separate-lens models. Buy yourself some firebricks so that you can easily assemble working surfaces and hearths.

Cylinder size and rental deals are another area for decision making. Arguably, for the dedicated hobbyist, an oxygen bottle of the "half commercial" size must be about right, with the acetylene being somewhat smaller. *(The cost of hiring cylinders of gas is more reasonable than it appears to a first glance, because of the statutory requirement for periodic proof testing. If you own the bottles you face that expense and the inconvenience of such testing. If you merely hire them, you are not subject to any inconvenience, and the cost is part of the hire charge).*

Some gas welding sets on offer include the cutting capability, others do not. Since possession of the cutting capability is a must, take the trouble to learn to recognise the different tips, torches etc., before you go shopping. Observe that the most expensive sets often do not offer the widest capability, and can hardly therefore offer best value for money. The case for the expensive sets being of higher quality may well be true, but is by no means proven.

Hazards in using an oxyacetylene welding/brazing apparatus

The most obvious hazard comes from that devilish flame, a flame that is in a class of its own for the melting or incineration of anything that gets in its way. Fairly obviously we can have spectacular fires and explosions if that flame is allowed to be incident on almost anything other than the workpiece. In particular, you are unlikely to survive if the flame is allowed to play long on either of the bottles. You should always light up with a spark igniter, never with a naked flame of any kind, since if you happen to be oxygen-rich at the time, your source of ignition can turn into a spectacular and unpredictable firework. Always avoid ingesting any welding fumes, and remember that

simple masks can offer little, if any, protection, since they will not filter fumes. The noxious effects of such fumes are nasty and cumulative. In particular, those from zinc, cadmium and lead are known to cause serious nerve damage. *(If you are working with galvanised material, life is much safer and easier if you locally remove the zinc with an acid, e.g. hydrochloric. Just brush it on and wash it off. You can rest assured that you are most unlikely to then be troubled with hydrogen embrittlement, as steels that have been galvanised are usually too soft to be susceptible to such embrittlement).* Beware that some light alloy castings (e.g. carburettors and the like) may be plated with cadmium. As to the danger from lead fumes, while there is wide awareness that petrol tanks can only be repaired after rigorous procedures to prevent the risk of explosion, it is perhaps less well known that many petrol tanks are made of a material "terne plate", which is essentially steel with a lead coating. Always make sure that there is plenty of ventilation, either natural or machine induced, when you are welding with gas or by any other method.

Do not attempt to do any DIY mods to your gas supply systems, either acetylene or oxygen, as they are both unforgiving. Leave well alone and follow the instructions of the supplier to the letter. The total of risks is more subtle than we can imagine. It is for instance reported that acetylene can form explosive compounds with copper or copper-rich alloys. *(What might you have made your DIY pipe work out of?)* This "Safety First, leave it well alone" principle is the reason why acetylene generators, calcium carbide etc. are not mentioned in this article.

Watching where that flame goes is very necessary when using an oxyfuel torch. Parts of the flame can be reflected from or follow the work surfaces and go off in directions entirely different from those intended or anticipated. You can so easily incinerate nearby plastics or electrical wiring, perhaps leaving yourself with a BIG repair problem.



9. Keeping the small bits handy but safe. A lidded storage box.



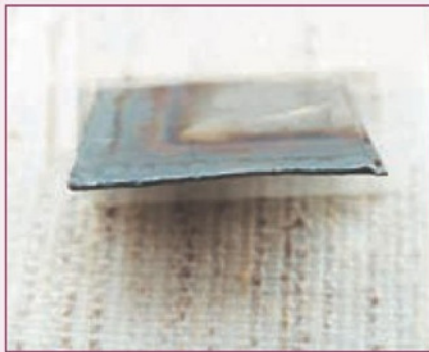
10. Super value for less than a fiver. Flip-up goggles that fit over your spectacles and cannot tangle.

Lighting up time

Before starting, read the directions supplied with the kit, and assemble the regulators, flashback arrestors, hoses, and torch. Note the acetylene hose is coloured red, and its fittings have left hand threads. Set the regulators to deliver around 2 – 3 psi.

There are all sorts of ways to do the actual "lighting up". One popular way is to light with the acetylene torch valve turned on half a turn or so, and the oxygen off. Crack on a little oxygen and then get long white acetylene rich flame, (**Fig 13**) which is a good starting point for further adjustments. You will be aware that you could rapidly fill the room with smuts if you loiter at those settings, so you crack on a touch more oxygen, and while so doing, keep close watch on the changing flame. Any smutting will cease, and as you continue to increase the oxygen feed you will see that the long white flame becomes much diminished, (**Fig 14**) being replaced by a long, transparent, bluish-tinged flame. Such of the white flame as remains has meantime shrunk back to become a relatively teensy cone (hard edged, opaque, and by now intensely white) at the torch tip exit hole, with perhaps just occasional hints of a feathery whiteness extending a short way into the blue flame. You now are very near the wished-for and oft-used neutral condition. It will be explained later that the hottest part of the flame is just ahead of the white cone. Just a little less acetylene, or a little more oxygen, and you are there. Continue to fine tune the flame by variously increasing and decreasing the acetylene and the oxygen, continuing to examine the flame(s) critically and in detail all the while. At times when the acetylene is being turned up, you will observe that the edges of the intense white cone tend to revert to being feathery and less distinct, and the overall flame is bigger than at other times. You have then re-entered the carburising, reducing condition. Now observe what happens if you decrease the acetylene and/or increase the oxygen. After going through the neutral condition, the intense white cone shrinks and takes on hard edges, while at the same time the length of the overall (blue, transparent) flame shrinks to about half of what it was previously. The burning is noticeably noisier than previously. You then have re-entered the distinctly oxidising condition. (**Figs 15 & 16**).

As said, for most of your jobs you will



11. Fusion where you want it and only where you want it. Trial welds along the edges of two very thin sheets.

want to use the neutral condition, which is the half way house between the reducing and oxidising conditions. It is best to approach from the acetylene rich condition, because the transition to neutral is sharp and obvious.

But here is a minor problem...

Having set up the flame correctly, it would be reasonable to hope that you could then press ahead with your welding or brazing without needing to make any more adjustments. Unfortunately, a number of factors come into play which alter the flame characteristic, and so you have to regularly readjust to the preferred condition. On the positive side, you will after the first few occasions make the readjustments without conscious effort or perhaps even realising that you have made them.

Easy exercises to develop your welding skills

Having correctly set up the flame, we can now proceed to a simple trio of welding tasks that will prepare you for almost anything that comes your way. For these exercises you will need some bits of straight sided steel strip, of thickness, say 2 or 3 mm, or thereabouts. Having lit the torch and adjusted to the neutral flame, play that hottest part of the flame on the middle of one of the flat surfaces of the steel. In a matter of seconds, you will see the local surface melt. (the liquid surface looks rather like dirty mercury). Now move the tip side to side slightly, or round and round in little circles, whichever you find easier, thus making the puddle just a little bit bigger. Now, move the puddle slowly along the plate, seeking to keep the puddle width as consistent as possible. Not too difficult, you will agree. Look at the back of the plate, and form an opinion of the degree to which the fusion has reached that far side.

Now put two pieces of the steel side by side, forming a butting edge. Run a puddle along that butting edge, perhaps prodding with a piece of filler wire to encourage the molten corners to merge into one pool. Deliberately seek poor penetration, by keeping that combined pool as small as possible, by making a quicker traverse and



12. Tools can be modified in a trice to reach into those near-impossible locations. (This one was for the nuts joining the carb to the manifold on a 2CV!).

with less transverse movement. When the workpiece has cooled, observe how easily such a one-sided, poor-penetration joint can be destroyed, perhaps even just by the strength in your fingers. Now make another identical butt joint, but this time seek better penetration, by making it more slowly, and making a wider pool. Then, turn the plate over and run another puddle down the join line. Now try to destroy that sample. You will probably find that your two sided weld is as strong or stronger than the parent material. Having made those simple welds in light material, you will be well on the way to competence for any thin-wall job that you are likely to tackle.

What about the thicker stuff?

Things would get much more difficult if we sought to gas weld thicker material, thicker than say 4 mm. Beyond that you will be far better served by connecting up to, say, an MMA or a MIG welder.

And the really thin stuff?

When butt welding really thin material, examine the benefit of putting a teensy 90°, turn-up on each butting edge, as in **Sk1**. At the same time notice how you can make a far better job of making those turn-ups (then getting better butting contact of the up-turned edges, and less distortion of the sheets) if you put a little saw cut every few inches, along the edge that you intend to turn up, extending the cut into the sheet just a smidgeon past the line of intended bending, rather like **Sk 2**. Note that you use a saw to make the cuts, not snips or shears. If you use anything that does not remove a bit of the line of bending, you do not materially improve matters. Flat thin sheet trial welds are shown in **Fig 11**.

Filler technique for steels

Having used the filler wire for that first time (if only to encourage the merger of two pools into one), you will have started to appreciate the several values of the filler. Continue to develop that left hand skill. When you choose to add filler, feed it



13. The starting point for fine adjustments to the flame. A long white cone of excess acetylene.



14. The transition between carburising and neutral conditions. An occasional and transient hint of excess acetylene seen beyond the intense white cone.



15. Early stage of moving from neutral to oxidising conditions. The intense white cone is hard-edged.

into the pool, rather than melting droplets off the end of the rod. Observe that the oft-desired pooling is usually achieved just by judicious prods at the junction of pools. There sometimes is benefit in warming the wire, sometimes not. Sometimes there is benefit in making significant volume additions, sometimes not. (*The filler material for general jobs comes in the form of mild steel rods, usually copper coated, usually 36 inches long, usually 1.6, 2.4 or 3.2 mm diameter*).

Some things are easy, some things are not

When gas welding, some problems may well be obvious before you ever start welding. For instance, for the fillets in a classic T weld, one piece of metal has twice the heat sink of the other. So don't direct the flame into the corner. Bias the flame so that there is greater incidence on the material with the double heat sink.

Because you are working with a flame, welding of protruding material is generally easy. The converse is equally true. Welding at sunken locations is generally difficult, because you so easily get excess heat where you do not want it, and a shortage of heat where you do. So, in those latter situations, beware poor fusion and poor penetration, and beware unwanted fusion at locations adjacent to the weld pool. Always remember where the flame hot spot is: just ahead of that intense white cone. For more heat, move that hot spot nearer to coincidence with the metal surface, or dwell for longer times. For less heat, increase that distance, or reduce the incidence time by diverting the flame. (*The downside of the diversion method is that you also divert the protective atmosphere*).

If things look as though they are going to overheat or you see the early signs of melt through, it can be found quicker to rotate the torch than lift it. Try to keep about ⅛ inch (3 mm) between the workpiece and the end of the intense white cone. For most jobs, this keeps the weld pool dimensions right. At a particular torch setting, on the particular workpiece, your primary control is via travel speed. By control of the weld pool dimension you control the penetration through the thickness. Some welds are made without filler, apart from a preliminary dab to bring two pools into one. With other welds there is frequent addition of filler, usually to bring the level of the weld pool up to the general level of the two surfaces. You will

find that it is easier to weave the flame than to keep it in an exact straight line. At the start or end of a weld you are heating less material, so at those locations, reduce the heat input, either via torch proximity or torch residence time. In oxyacetylene welding, in material thicknesses that make sense, vee prepping etc. is done to allow the heat transfer that will lead to full penetration. (*Unlike the prepping for the arc techniques, where part of the purpose is to provide unimpeded access for the electrodes*).

As in all welding, life is made much easier if you use the range of clamps and magnetic formers that are cheap and readily available. If the parent material has high thermal conductivity, and is of a shape that provides a good heat sink, you will almost certainly need to preheat, other situations may require slow cooling.

Identification of the parent materials as the basis for selection of fillers and fluxes

All weld jobs depend crucially on getting the right filler. Easy for mild steel jobs, but less so for more out of the way alloy compositions. Often, strips of the base material will provide good filler material. With mild and low alloy steels, the familiar copper-coated filler rods are usually quite sufficient. For any piece of parent material more sophisticated than a piece of mild steel, the *less* you know about the exact identity of your parent material, the *less* likely you must be to be using the correct filler rods, and the more likely you must be to make a hash of the job. There are many roads to ruination, for instance cracking, or inability to make a weld, or local loss of corrosion resistance. The message is: for anything over and above mild steel, you have to do your homework, before you can be reasonably confident of success.

To flux or not to flux, that is the question

One aspect of gas welding/brazing practice that can be a little confusing is: when are fluxes used, and when are they not used? That confusion is compounded by some occasional lack of clarity about whether a material is being welded or

brazed. (*There is for instance the process of "brazing welding", that has some distinct differences from both brazing (by not making much use of capillary flow) and from welding (by not melting the parent materials)*). A sensible policy is to simply follow the advice given in respected texts, and if a particular filler and/or flux is suggested, give it a try. A flux may be in the form of a powder or a paste or a coating on the rod, the latter often becoming very friable if you store your brazing rods in a damp workshop. A flux in gas welding/brazing serves variously to remove oxide, or prevent oxidation, both vital if you are to get good pooling/wetting.

Cleanliness is next to Godliness

A lot of materials require special cleaning before welding, and a lot of jobs benefit from a furbishing after welding. For general purposes on mild steel etc., a twisted wire brush on a 115 mm angle grinder takes some beating. (*But not on stainless please. It will subsequently develop rust stains! Buy a special brush with stainless wires*). If you do a lot of jobs, you will soon break even on the cost of an angle grinder dedicated to that wire brush, by saving the time spent changing discs for brushes, and back again. Remember particularly with such brushes: look after your eyes! Cleaning up after welding is particularly important if you have been using an aggressive flux (e.g. on aluminium) otherwise it will continue to be aggressive, and large holes will appear in your workpiece!

Brazing and the oxyfuel torch... a marriage made in heaven

An oxyacetylene unit is near perfect for all soldering and brazing. (*As indeed are almost all oxyfuel systems, and the others may be better and cheaper. Oxyacetylene only retains the crown because of the other things that it does so well*). If you braze or solder, you must do so with appropriate design at the contact points, which usually means making lap joints



16. Distinctly oxidising. The intense white cone is now very small and the secondary blue flame has shortened to about two-thirds of its previous length. A far noisier flame than previously.

instead of butt joints, the lap size being at least three times the thickness of the thinnest sheet. For capillary flow you need a gap at the joints, the ideal value being in the range .001 to .005 inches, dependant on the parent metals and the fillers. If you have to make a butt joint when soldering or brazing, try to use guile to ensure that there are other, lapping surfaces, if the design and circumstances allow. For example: a backing plate when brazing plates that have to butt or a liner tube when brazing tubes that have to butt (Sk 3).

Brazing is very handy when you want to join thick stuff to thin stuff. (because if you weld you might burn through the thin stuff), for delicate items (Fig 17), and for when the joint location is hidden from easy access or contact. (You don't have to see the capillary flow to know that it has happened, if you have set things up properly beforehand). You can braze many dissimilar metal combinations, combinations that you cannot weld because of the possibility of creating some god-awful alloy. Brazing is used to join some special steels, chosen as the only way to do so without significant loss of the strength of those parent metals.

A few cutting remarks

The start procedure for cutting is that an oxyacetylene (or other oxyfuel) mixture, fed by about 4 or 6 small nozzles, heats some part of the start region to incandescence. The internal design of the cutting torch (Fig 7) is such that some of the oxygen is diverted to mix with the combustible gas, while the rest of the oxygen is available to provide the cutting jet, on demand, as a collimated stream. Jets are shown in Fig 8. The supply requirements for each gas are as you might expect, not a lot of fuel gas pressure (say 1 or 2 p.s.i.) for acetylene, and a much

higher pressure (say 15 p.s.i.) of oxygen, the higher oxygen pressure being necessary to feed the cutting stream. The feed of cutting oxygen is usually lever actuated on manual systems. The size of the cutting tip is increased with the thickness of metal to be cut. Maintenance of tip hole diameter and bore smoothness is absolutely vital, otherwise the flow characteristics may be changed, resulting in ragged cutting and reduction of thickness capability. The cutting attachments can be uniquely useful, for instance allowing easy cutting of far thicker material than is possible with most plasma cutters.

Destruction and distress

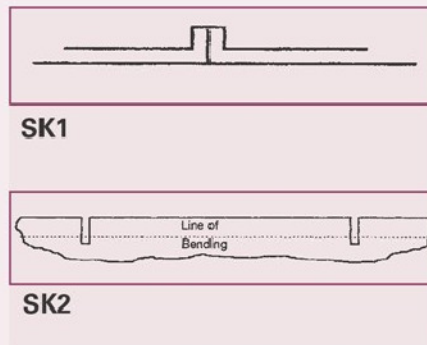
When using an oxyfuel cutter, one working instruction deserves carving on tablets of stone. **Be very, very careful where the sparks and debris are going.** The fire risk is obvious, but that is only one part of it. Even at a distance of several feet, the stream of debris particles will cut through many insulation, and blanket materials, and having done so, will then proceed to devastate anything else that then stands in its way.

Cutting to a pattern

As might be imagined, it is fairly easy to move from freehand manual cutting to various forms of guidance and automation. The opportunities are legion, so we can't go into them in this article. One thing introduces a slight complication into guidance by running the nozzle along simple straight edges and templates, and that is the need to make allowance for the offset distance between the side of the oxygen stream and the side of the cutting nozzle. An advantage of the oxyfuel cutting nozzle not being held in contact with the surface of the workpiece is that there are not the same slip-stick problems that can so detract from accurate and easy plasma cutting.

Keep in mind that...

There must always be a risk of fire with any oxyfuel operation. Always have several fire-fighting capabilities ready, immediately to hand, e.g. a couple of detergent bottles filled with water (to use first), a couple of powder extinguisher canisters (in case one is empty), and a garden hose (to really cool the situation). Many insurers (of house and contents) seem happy with oxygen and acetylene gas cylinders being held on domestic



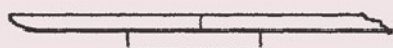
premises provided you are only acting in a non commercial manner, but you must check with your own insurers. Remember that acetylene bottles should not be used in a horizontal position or if they have recently been in a horizontal position. (If you have to go and work in a field somewhere, transport the acetylene in a vertical position. The reason harks back to acetylene being a quirky gas that can, if over about 30 p.s.i., explode without necessity for oxygen or air to be present. So, the acetylene is supplied dissolved in acetone, which itself has been absorbed in a porous material. So, if you lay the bottle on its side you can get acetone coming out with your gas ...)

Ensure that the bottles cannot fall over. (After breakage at the neck, bottles have been known, as projectiles, to travel hundreds of yards and to go right through buildings).

So the conclusion at the end of the day is?

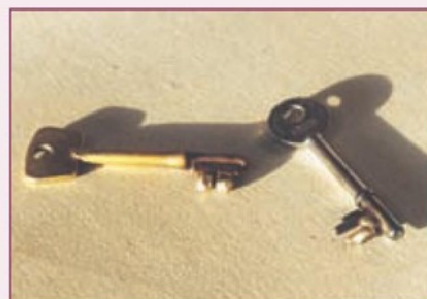
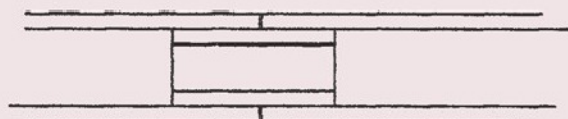
You can now, in a leisurely fashion prepare to agonise over the decision whether to purchase or not to purchase. An angel will sit on one of your shoulders, loudly urging the restraints that "You don't really need it ... awfully expensive ... better to save the money...". On the other shoulder a little red devil will whisper the seductions "Go on ... treat yourself ... think how useful it would be ... think of the pleasure ... now is the time ... there aren't any pockets in a shroud ...".

Since I am totally impartial, I cannot offer advice either way, except of course to point out the obvious: that the angel must have a quite miserable, stagnant existence, while the little red devil must have a lot of fun in a world where all is change and all change is for the better! Have fun, but remember, watch those sparks!



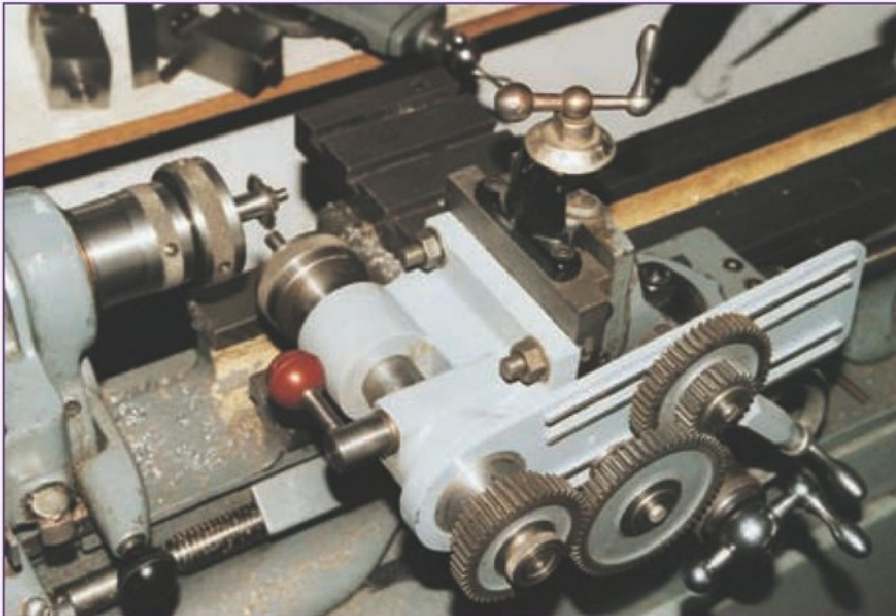
Using a backing plate or liner tube when brazing butt joints

SK3



17. Prior to being re-cut, one broken key and one worn out key have been rescued by a teensy bit of silver braze. No need now to buy and fit new locks!

DIVIDING ON THE SUPER SEVEN (2)



1. The Sparey device, banjo clearly visible.

As I mentioned in my last article, my initial forays into the mysteries of dividing were confined to the most crude methods but, at this stage of my model engineering, it mattered little since I was only concerned with relatively simple jobs. I had already gathered that there were apparently two main approaches to indexed milling in the lathe, the first being by the method of driving the cutter from the lathe mandrel whilst holding and indexing the work by some means on the cross or top slide. The second was by adopting the technique, pioneered by the horological world, of using an auxiliary means of driving a cutter spindle whilst employing some method of indexing the

lathe mandrel. Since my mentor at the time was Lawrence Sparey with his new book 'The Amateurs Lathe', the chapter (including plans) on his own particular version of a dividing device persuaded me that this was the direction to take, and I determined to make one in spite of my lack of experience.

Alas, what do they say about fools rushing in? In spite of my pattern making being successful, the moulding and casting of the aluminium body proved a complete disaster. In the first place I had no moulding sand at my disposal, so I improvised with fine builders sand, using the same material in its driest form for parting powder. Unfortunately I knew practically nothing about the techniques of moulding so that, in

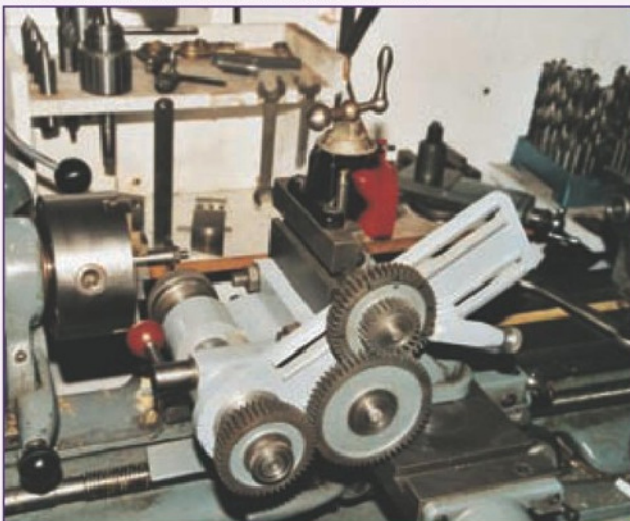
Having earlier dealt with simpler headstock methods, John Brittain now considers other further variations on the theme.

spite of managing to produce an actual mould, all the resultant castings (and there must have been at least six attempts) were deficient in some aspect - usually a large sinkage being the culprit, as I recall. My 'furnace', by the way, was an old iron saucepan set up on an open coke fire which, in itself was fairly satisfactory, but having no knowledge of such details as venting the mould and de-gassing the molten metal, the likelihood of success operating under these conditions was, in retrospect, rather slender. Nevertheless, in spite of these initial setbacks, I conjured up the impudence to have a go at the banjo piece and, wonder of wonders, it emerged from the sand in a high-perfect state. (To this day I can never understand why!) However, in spite of my machining this component successfully, I found that the momentum had been lost and I shelved the project in favour of other ideas. Years later, during which time I had acquired the necessary know-how for moulding and casting, I finally finished constructing the device, more as an entertaining project than a much-needed one, since by then I possessed a milling machine anyway.

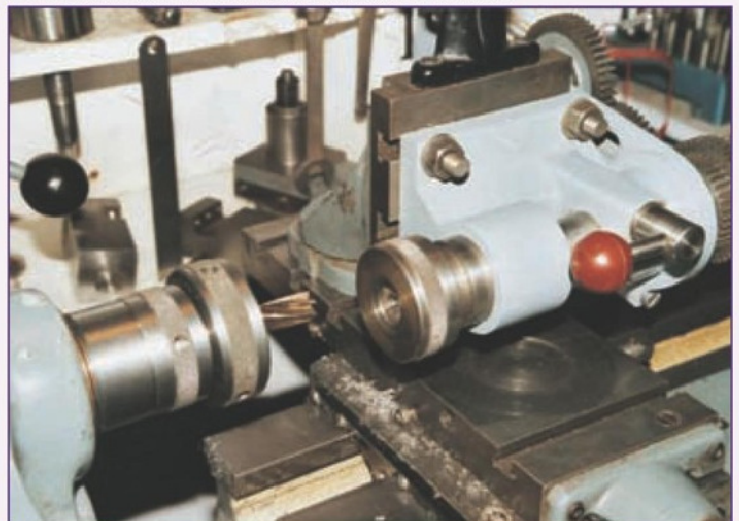
The Sparey dividing device

For those unfamiliar with the late Mr. Sparey's dividing device, a word of explanation: it consists of a main casting

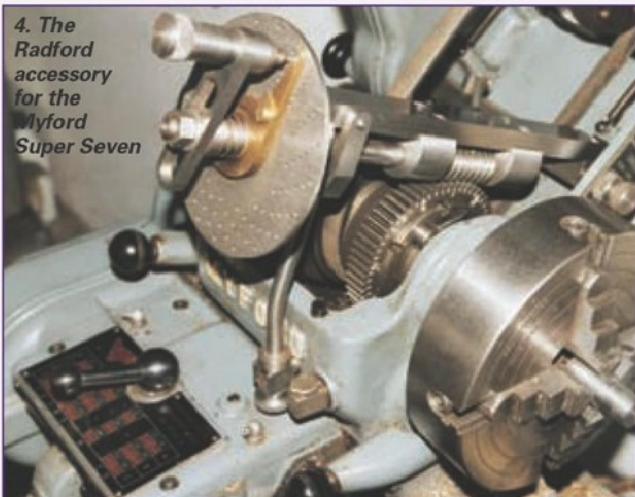
2. The Sparey device located by two bolts.



3. The same unit here set parallel to the lathe bed.



4. The Radford accessory for the Myford Super Seven



carrying a mandrel. On the rear end of the casting is attached a 'banjo' piece. This banjo carries a train of changewheels which can be arranged to gear the mandrel up or down whilst being indexed by a plunger detent. (see **photo 1**) Thus, for example, a 35 tooth wheel located directly on the end of the mandrel and indexed every 5th tooth would obviously give 7 divisions of the headstock, if geared down 2 to 1, 14 divisions and if geared down 3 to 1, 21 divisions etc. By using this method and utilising the complete range of lathe changewheels, it is possible to obtain a very large number of divisions but with one important proviso; the gear on the end of the spindle must contain a submultiple (always the prime number if one is involved) of the required division number - in the above case this number being 7. The mandrel nose is screwed to accept a Myford chuck and bored to accept collets of Mr. Sparey's design.)

In practice, I have found the device to be of a most workmanlike and sturdy design, but with certain limitations. With the vertical slide in its lowest possible position and with the device fixed centrally on it; the difference between its centre height and the lathe's is only about one inch, thus severely restricting the size of work which can be accommodated. The illustration in Mr. Sparey's book showing it

in use indicates that he has fixed it by utilising the centre tee slot of the vertical slide, which means that the device is being held by using its two upper bolt-holes only (see **photo 2**). This, of course makes for a less-than-perfect situation though, in fairness, the resulting setup is reasonably rigid. Furthermore, the cross-slide needs to be retracted rather a long way in order for the work to be positioned beneath the cutter - unless, of course, one chooses to use the cross-slide tee-slot at the extreme end nearest the handle, in which case the reverse applies and the cross-slide needs to be wound forward for nearly all of its travel. (Forgive the three jaw appearance in the photo but the situation is simulated to illustrate this problem of working space. Where possible, I favour mounting the cutter on a stout mandrel held in the four-jaw chuck for maximum rigidity).

When the device is located with its axis parallel with the lathe bed, (see **photo 3**) it seemingly presents a better set-up, but unfortunately there are few machining applications which suggest themselves when in this position. Notwithstanding the above remarks, the device works well when diameters are not too large and is especially useful when the milling of steel components such as clock pinions is attempted. Ironically enough I have found it to be an excellent tool when used on my

milling machine, where the extra space available enables it to become a most useful appliance.

Were I to contemplate re-making this device, I think I would re-design the main casting by offsetting the cylindrical mandrel housing in relation to the base in order to gain more working height whilst, at the same time, being able to fix it centrally to the vertical slide. I feel also that the whole thing could be shortened by up to one inch so that the cross-slide would not require retracting so far. I doubt whether I shall ever do this but some intrepid enthusiast may like to try it and reveal any advantages (or otherwise) which may ensue.

The Radford approach

Meantime, to return to the ongoing saga, as the years went by my dividing requirements gradually became more demanding and I realised that it would be desirable to make the other type of device mentioned earlier - i.e. one which indexed the lathe mandrel. During my student days at Loughborough Training College, I had completed a wall clock case and intended at some time to design and make the works for it. Therefore in 1968 when the late Mr. J. Radford's indexing attachment appeared in the 'Model Engineer' I

5. Showing the added brace.



6. Detail of cranked rod and attachment.



7. Latch arrangement





8. Latch components - released.

guessed that this would suit my requirements admirably. - and what a truly elegant design it proved to be. As I write this I have the very magazine in which it featured in front of me and note that is dated January, 1968, volume 134 number 3336. Again, for the benefit of those who can obtain the plans and might be interested in making it, I offer a brief description:

The device is designed specifically for the Super 7 and consists of a main arm carrying a shaft, part of which is screwcut to engage with the 60 tooth bullwheel, (see photo 4). The arm is arranged to be supported at one end by a cross member located between the sides of the belt guard, and by a cranked rod at the other. This last is held in position by an adjustable nut engaging with a fixture attached to the front of the headstock casting. The upper end of the shaft carries

9. The index pin body is screwed into the arm.



a division plate, detent and fingers and the whole thing operates in much the same manner as the usual form of dividing device used on milling machines.

One of the most impressive characteristics of the tool is the ease and speed with which it can be fitted and removed from the lathe, a few seconds being all that is required. Of course, the principle of applying this type of dividing device for use on lathes is not new but this particular design represents an extremely neat solution to the problem, albeit for a particular machine. Those, by the way, whose machines are not suited to this form of device could do worse than consult Ian Bradley's book 'The Amateur's Workshop', where they will find a design of similar principle which can be applied to most lathes.

Modifications

Mr. Radford's design as it stands is perfectly sound but, like most of us, I like to make alterations if I think I can see any benefit from doing so, and in this case I

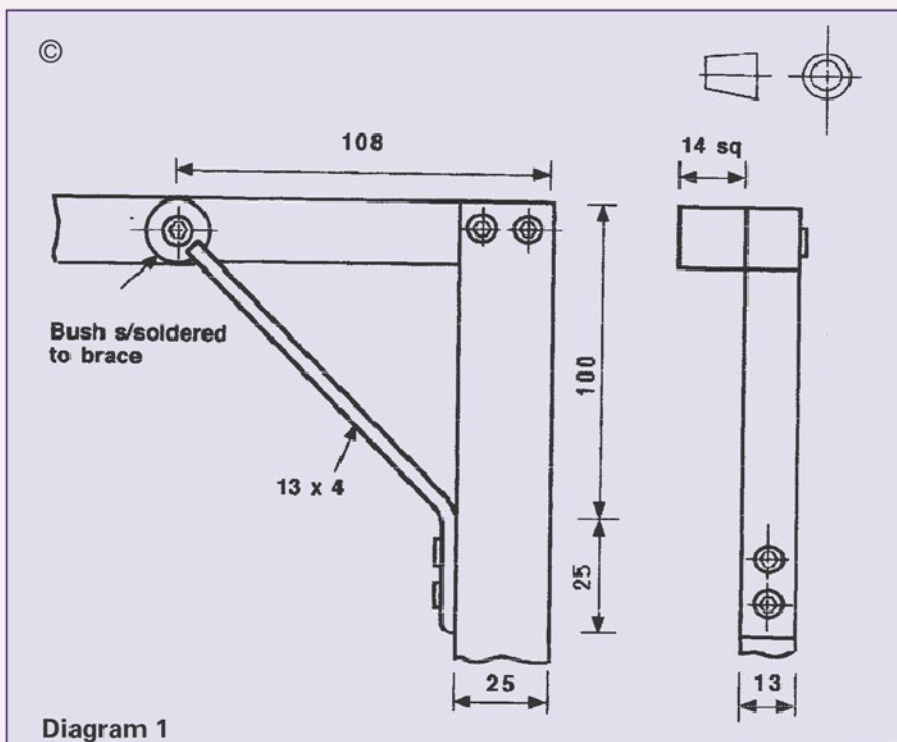


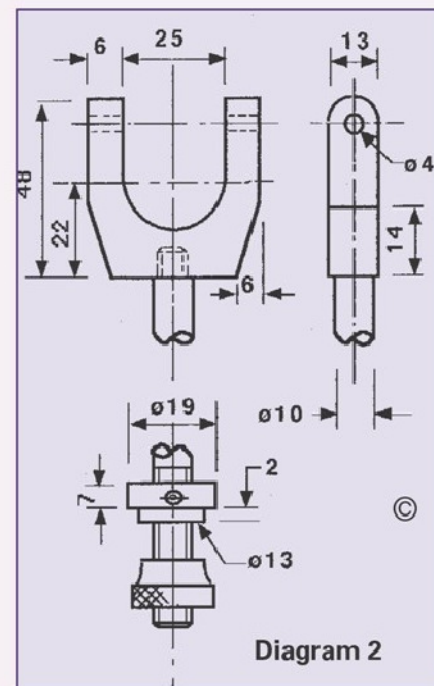
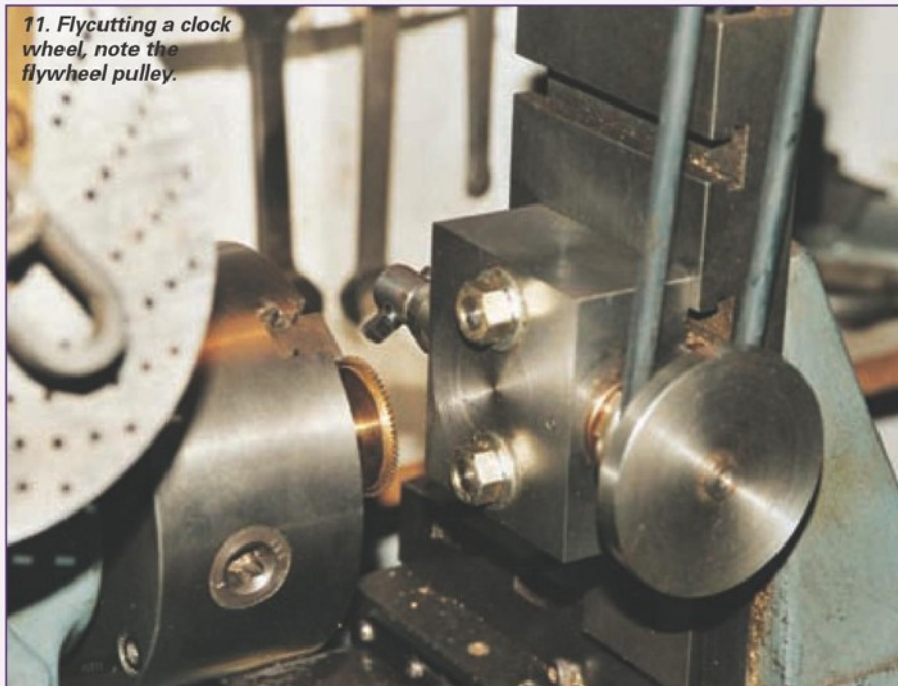
10. The changewheel set on the Harrison to give 0.196in. pitch.

felt that I could modify it to suit my particular eccentricities without compromising its efficiency. Since I hate applying heat to any job where it can possibly be avoided, my first thought was to join the supporting cross-member to the arm by means other than brazing. Accordingly, I began by drilling the end of the arm to receive two cap screws (see Diagram 1) and fastened it to the cross member by one of them. Placing the components in position on the lathe I then adjusted them until the threaded portion of the shaft engaged correctly with the bullwheel before tightening the cap screw. I then removed the assembly from the lathe, spotted the second cap screw position, took the two pieces apart and tapped the second hole. When these components were re-assembled, I set about fitting a diagonal brace to the two pieces in order to ensure complete rigidity. Incidentally, I feel also that the aesthetic aspect of the tool is improved by the addition of this brace (see photo 5).

I have always thought that both the 'U' shaped bracket and its cranked rod (swinging latch) were a little on the light side so I increased the rod to $\frac{3}{8}$ diameter and re-styled the bracket as in photo. The original design allows for quick disassembly of the two main components but since I never intended to take them apart anyway I opted for a hinge pin passing through bracket and arm as shown in diagram 2. This pin can be tapped out any time I change my mind and decide to take the thing apart, but meantime, when not in use, the assembled device sits on a shelf above the lathe ready for instant action!

I suppose my main departure from the original is found in the 'latch' design, where I considered that the various components used to anchor the cranked rod to the headstock casting somewhat fussier than necessary. Accordingly I re-designed them as shown in diagrams 2 and 3 (photos 6, 7 and 8) and can assure anyone who may contemplate making the appliance that the alteration works perfectly well and, in my view, represents





far less trouble to produce.

A further minor alteration concerns the indexing components where, rather than braze the index pin body to its arm, I formed a semicircular end to the arm, drilled, bored and screwcut it and screwcut the body to suit (see **photo 9**) - again avoiding brazing and the need for cleaning up!

Very probably, the item which could cause the biggest headache for some is the approach needed to cut the 16 D.P. worm on the shaft. For those therefore who need a little guidance on this, I will explain:

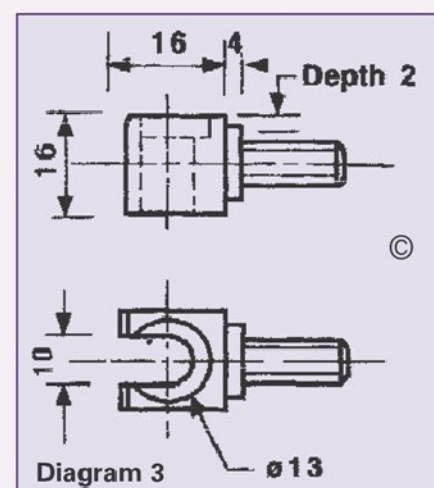
D.P. stands for Diametral Pitch and refers to the number of teeth on a gear per inch of diameter. In this particular case, we need to cut a 16 D.P. worm matching the teeth of a gear which, if of one inch diameter would have sixteen teeth. Now if we imagine that the diameter of this gear is divided into sixteen parts, then it follows that the distance between each tooth (i.e. centre to centre or 'pitch') will be times one sixteenth of an inch. We need therefore to introduce in our gear train once we have imagined setting up for 16 t.p.i. and the way of doing this is as follows:

22/7 can be represented by 220 and 70 tooth gears except that we don't have a 220 changewheel - or, for that matter, a 110 wheel! If, however, we first cancel

down to 110/35 and then we halve the 110, thus obtaining 55/35 and, at the same time set the lathe to cut 8 t.p.i. the end result will be the same i.e. $110/35 \times \frac{1}{2}$ gives the same answer as $55/35 \times \frac{1}{2}$. Having stated this, I must now confess that I did not carry out the job on my Myford lathe simply because I also own a Harrison L5 and the procedure on this machine needs to be slightly different. In this case a 55 tooth gear is paired with a 70 tooth gear and the lathe set up to cut 4 t.p.i., again, $110/35 \times \frac{1}{2}$ works out to be the same as $55/70 \times \frac{1}{2}$ (see **photo 10**) You will, of course, find the actual changewheel set-up in your Myford handbook but without the above explanation!

One point which must be noted; it is imperative that the half-nuts remain engaged during the whole process, so the procedure is to run the lathe backwards after each pass - which, in turn, calls for a reversing switch. It is possible to turn the lathe backwards by hand but the job then becomes a very tedious chore and I would recommend that you take the easier way out and fit that reversing switch if your lathe is without one. Sooner or later it will come in handy when you are faced with the need for cutting one of the less usual threads, and I'd like to bet that it's sooner!

Finally, the last three photos show some of the many uses to which the Radford

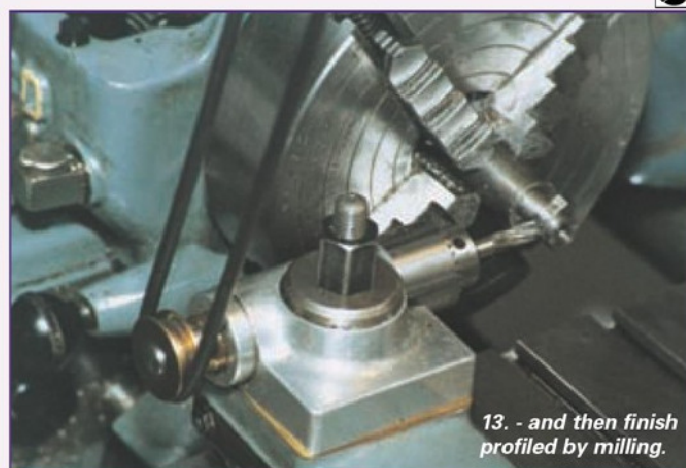
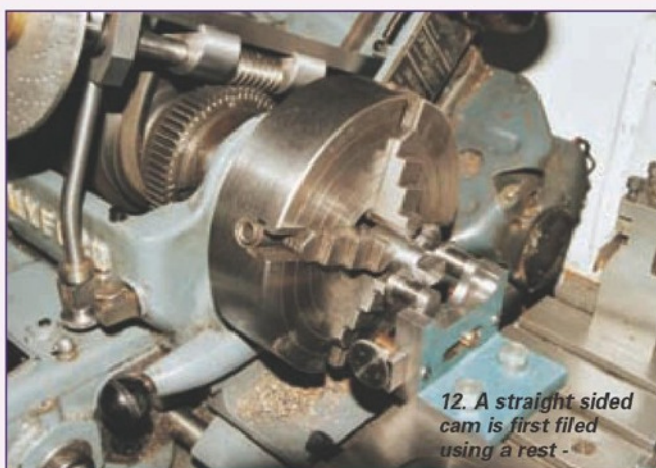


device has been put:

Photo 11 shows a clock wheel being formed with a flycutter (Note the flywheel pulley)

Photo 12 shows a straight sided cam being formed using a filing device.

Photo 13 shows the finish- profiling of the cam. Some will no doubt question the use of a drill chuck for milling. It does not offer high rigidity and positive axial location, however for light duties, I find it a satisfactory solution.



TRADE COUNTER

Please note that, unless otherwise stated, Trade Counter items have not necessarily been tested. We give news of products and services which have been brought to our attention and which we consider may be of interest to our readers.

New grease from Enginewise

CP (Corrosion Preventing) Grease is a new product from Enginewise. It contains active corrosion inhibitors which make it uniquely appropriate for a wide range of model and full size applications.

'Standard' greases provide only barrier protection and conventional water repelling greases tend to emulsify. CP Grease does not emulsify and it has other useful characteristics:

1. A high melting point (above 200 deg C).
2. It is thixotropic – flows easily when shaken/agitated or is subjected to shear forces and gels when such activities cease.
3. It does not contain silicone.

These properties make CP grease particularly suitable for lubricating and protecting cables of all kinds. It is effective at preventing ingress of water based coolants on machine tools and can be used on steam models of all sizes to lubricate and protect valve gear and bearings. Other applications might be found on cars, motor and pedal cycles, boats, light aircraft and horticultural machinery. CP Grease is available in



250gm plastic pots at £9.00 plus p&p.

The company has also announced two further additions to the range. Al-Clean is described as having an acidic dissolving action, very effective in removing oxidation from aluminium and alloy castings, and components. The formulation consists of a mix of organic and inorganic acids with a corrosion inhibitor, and may be applied by brush, spray, or dip. Treated surfaces should be flushed off with clean water before the Al-Clean dies, to provide a surface ready for primer or paint.

XMPX is a higher performance version of the established XMP, having a higher solids content, giving a thicker but still clear film. Possible applications for XMPX might include under bonnet components, plated brightwork and wire wheels on vehicles shipped by sea, and polished steel and cast iron parts on traction engines and steam launches.

These and many other specialist corrosion control products are available direct from Enginewise, tel: 01472 347 400, www.enginewise.co.uk.

The right tool for the job

Having found a little spare time I had settled down in the workshop to complete a few more operations on the Bentley BR2 nose piece. The external features include a tapered section between two flanges with fillet radii. Having taken a few trial cuts with slightly modified part off tools, I had stopped, to await the opportunity to grind up a "proper tool". Later, while thumbing the pages of Model Engineer, I chanced on the Greenwood Tools advert showing their SRDCN button tool. Knowing that a fellow club member had reported excellent results with a part off tool from the same source, I had no qualms about parting with £31.65 including p&p. The tool duly arrived the following day. The carbide tooltip is a 5mm diameter round button which allows you to cut in almost any direction. The round shape also allows the tip to be rotated when the edge wears.



The splined end of the nose piece which carries the prop. and prop. driver had been completed during earlier sessions, leaving the rear end to be dealt with. It was felt that the internal features would be easier to inspect for size, so these were attended to first, using drills and then boring bar, having set over the top slide to the appropriate angle. The external taper section and corner radii were then formed with the new tool, taking measurements with a ball ended micrometer to check wall thickness. Certainly a little care is needed deep in the acute angle corner since the length of edge cutting then extends around more than 90 degrees of the tooltip, and the loading will test most small machines. My technique here was to make repeated approaches from alternate directions into the corner. The finish straight off the tool was found to be quite impressive, with no need to reach for the emery. Readers who have studied the Blackmore drawings for the Bentley will know that a corner radius of 2mm is shown on this part. I think I may be able to live with 2.5mm. Other uses for this type of tool might include operations such as profiling locomotive wheels, and those beautiful but tricky rods typical of Victorian beam engines.

Greenwood can be contacted on 01527 877 576 or www.greenwood-tools.co.uk

Fireside Reading

Now back in print under the Special Interest Model Books banner, Workshop Drawing by Tubal Cain will be welcomed by beginners to the amateur workshop hobby, and seasoned experts alike. Prior to achieving an enviable reputation as a writer and modelmaker, the author's earlier career included work as an engineering designer, and as a teacher of engineering drawing. This practical "hands on" experience results in a clear and concise book which is very much easier to read and digest than some rather bulkier titles which were aimed at the engineering training market.

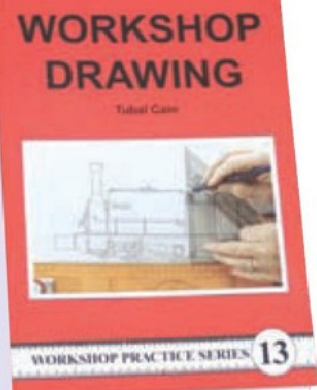
The book extends to 114 pages, in eleven sections with two appendices, one of which sets out very clearly the layout of, and differences between, first and third angle projection. The introduction gives a brief history of the use of drawings for communication and recording, noting that the invention of the blue print

process in 1840 then allowed multiple copies of identical drawings to be distributed to a number of workers.

The following eleven sections then cover: The Rules and 'Grammar' of Drawing; The Conventions of 'Projection'; Hidden Details and Sections; Dimensioning; Conventional Representation; Tolerances; Machining Marks; Making Drawings and Sketches; Reading Drawings; Developments and Intersections; Metric and Imperial Drawings.

Some might try to question, in these days of CAD systems, the relevance of such a work, however, even the very best computerised package is still a GIGO (garbage in – garbage out) system. Without a clear understanding of drawing fundamentals, it is all too easy to produce unintelligible graphical nonsense. Tubal Cain provides a short course which will allow the tyro draughtsman to convey design ideas clearly, also to correctly interpret older drawings. It may in addition, refresh the memory of many an older, seasoned practitioner.

Workshop Drawing (ISBN 1-85486-182-4) is published by Special Interest Model Books and may be obtained from all good booksellers or from Highbury Nexus Customer Services 01322 616 300

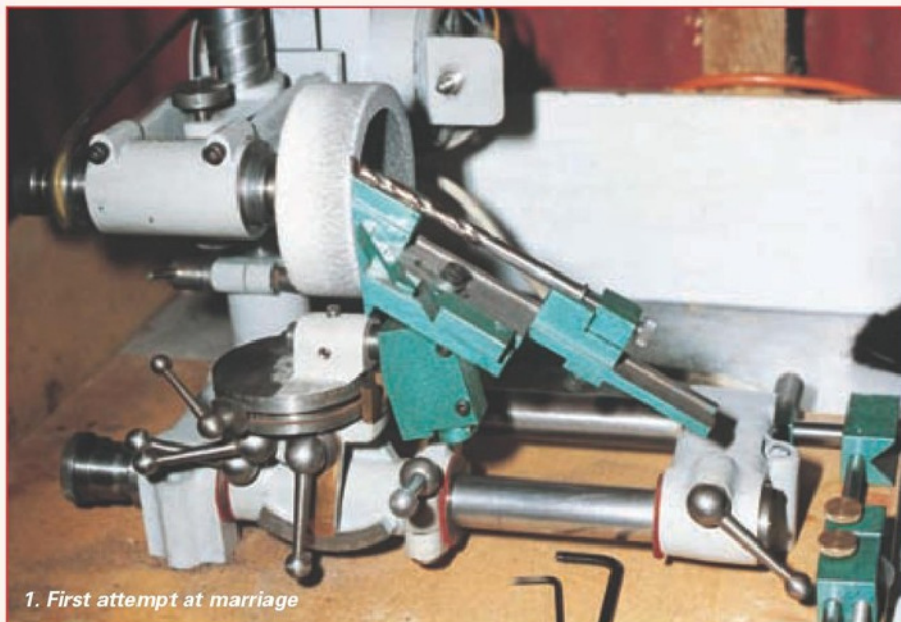


DRILL GRINDING WITH THE QUORN

Bill Morris outlines ways and means of using the ever popular Quorn tool and cutter grinder for more mundane but perhaps more frequently required drill sharpening.

Next to sharpening lathe tools, the amateur machinist's most pressing need is for some sort of device to sharpen drills. Lathe tools can be sharpened after a fashion off-hand, but not so Mr Morse's twist drills except perhaps the larger sizes and at that only after much practice. When I built my Quorn tool and cutter grinder over twenty years ago, I was looking forward to being able to sharpen every cutter type under the sun and was disappointed to find that it would not do what all of us wish to do: sharpen drills; unless one was also the owner of collets, one size for each size of drill. So I carried on making do with a die-cast drill grinding jig for larger sizes and accumulating a box of blunt drills in the smaller sizes against the day when someone would publish an article about how to sharpen them in the Quorn. Very small drills of course can be sharpened using a simple honing jig such as the one described by John Wilding in ME numbers 4136 and 4138; and I can vouch for the usefulness of such a jig. Eventually, with my earnings from writing an article in MEW I bought a drill grinding machine from the USA, complete with two multi-size collet chucks. I had better not identify it, as it seems to be a matter of complete luck whether the drill lips end up with positive or negative clearances and it now lies unused in a dark corner of my workshop.

Philip Amos's articles "Compendium of the Quorn" (MEW 62 and 63) were, I am sure, welcomed by all of the many owners of this machine and they contain much useful information, but very little on drill grinding except to refer to I. Strugnell's Model Engineer article of 7 July 1978. This article describes how to attach a "Duplex" drill grinding jig to the Quorn, using the angular settings and the movements of the Quorn itself rather than of the jig. I had a partially completed Duplex jig in a box, abandoned when I could not complete it for want of a complete series of constructional articles, so recently I did a bit of hard thinking to fill in the missing bits. Soon I had a Duplex jig that, set up on my surface grinder, quickly sharpened the box of blunt drills and those that were sharp but with clearance angles going the wrong way. Ian Strugnell's approach seems unnecessarily complicated and in



1. First attempt at marriage

any case, he built his jig with marriage to the Quorn in mind. Those of us who built the jig to the originally published drawings need a simpler approach to marrying the jig to the Quorn.

Drills larger than 12 mm do not sit happily in the Duplex jig, so I designed and built a jig that will accommodate drills up to 25 mm in diameter. Drills under about 4 mm in diameter are hard to hold in any sort of jig that uses vee blocks, so I also adapted an unused 6 mm Jacobs chuck to hold drills between 4 mm and those tiny ones that can be honed with a Wilding-type jig.

Marriage of Duplex to Quorn

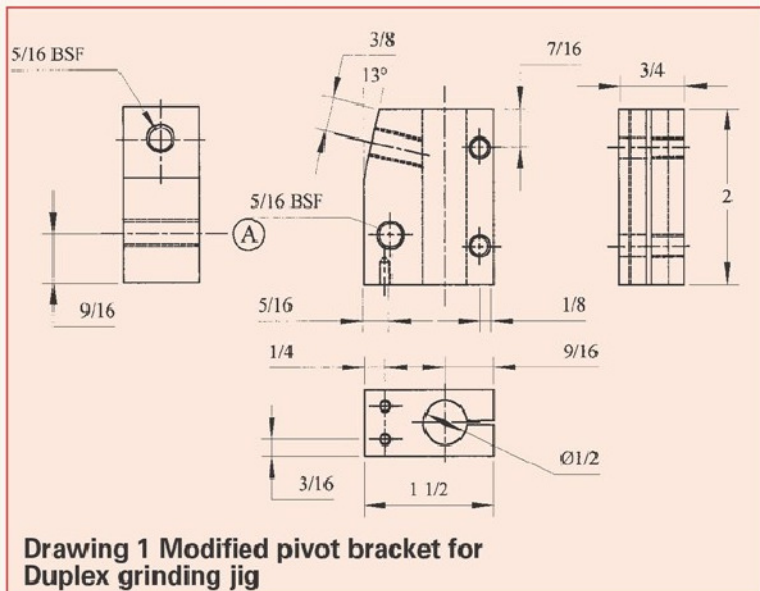
The Duplex jig can be attached simply to the top of the Quorn rotating base by means of a simple peg with either two spanner flats or a tommy bar hole so that it can be tightened securely in the sloping face of the Duplex pivot bracket (**Photo 1**). Attached this way, the rotating base and the tilting bracket of the Quorn are set to zero and the whole jig brought up to the face of a cup wheel as shown in the photo. This is fine so long as there is plenty of length left in your cup wheel, but as it wears, and for small diameter drills, you run out of Quorn bed to the left. This can be got around by relocating the peg in the back face of the Duplex pivot bracket using the tapped hole shown as "A" in my **Drawing 1**, and rotating the Quorn rotating base 90 degrees clockwise. Located this way, the Duplex pivot bracket has to be rotated about the peg until the 13 degree inclined face is vertical and then fixed in

this position on the rotating base (**Photo 2**). The inclined face is only about 18 mm long and there is no convenient datum from which to set it vertical. However, the front edge of the by-now-unused stop arm is a useful length and is parallel to the inclined face of the pivot bracket, so all we need is a usable datum to set it at right angles to the top of the Quorn's rotating base.

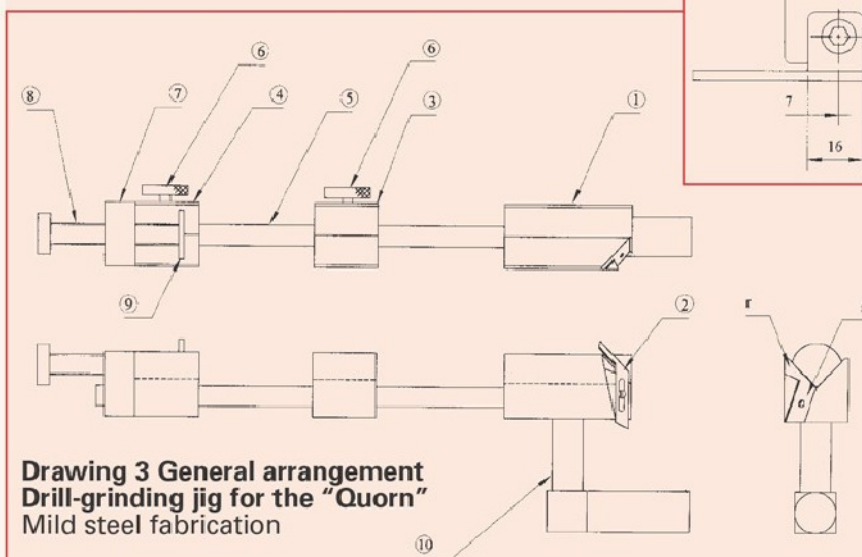
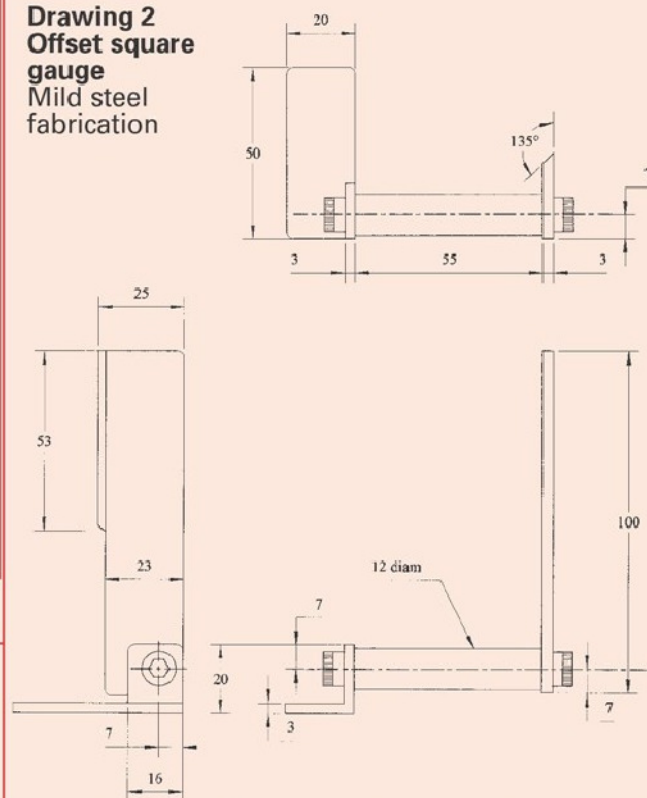
The Quorn rotating base is a substantial casting and it is the work of a few minutes to seat it squarely in a machine vice and mill a datum surface on its top (**Photo 3**). Then, by using a gauge that, for want of a better term I have called an "offset square" (**Drawing 2**), the front edge of the stop arm can be set at right angles to the top of the rotating base. If the Quorn tilting bracket is set at zero, the edge of the stop arm will then be parallel to the face of the cup wheel. **Photos 4 and 5** show front and rear views of the offset square in use.

Jig for four-facet drill grinding

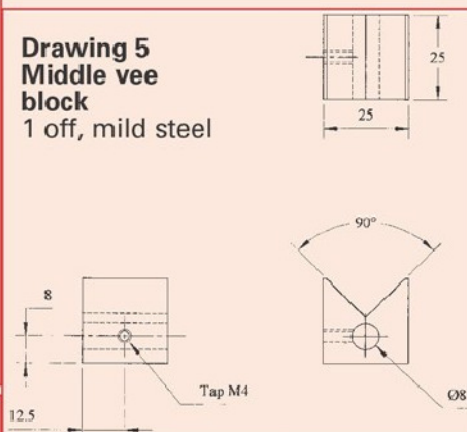
The Duplex jig is by no means easy to construct (though once constructed it is a pleasure to use) so I set out to design a simple jig that could be used in the Quorn with the minimum of fuss and using basic machining techniques of turning and milling or shaping. This led to a jig that will sharpen drills between about 3 or 4 mm and 25 mm in diameter by the four facet method. To use the late Professor Chaddock's words, "Instead of one continuous conical back-off angle the cutting edge is ground with a primary and secondary clearance angle just like an end



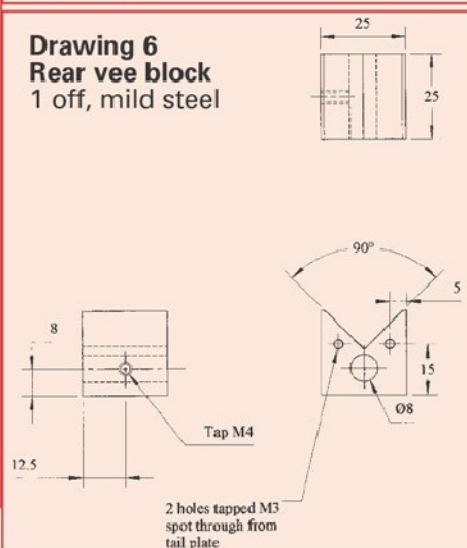
Drawing 2
Offset square
gauge
Mild steel
fabrication



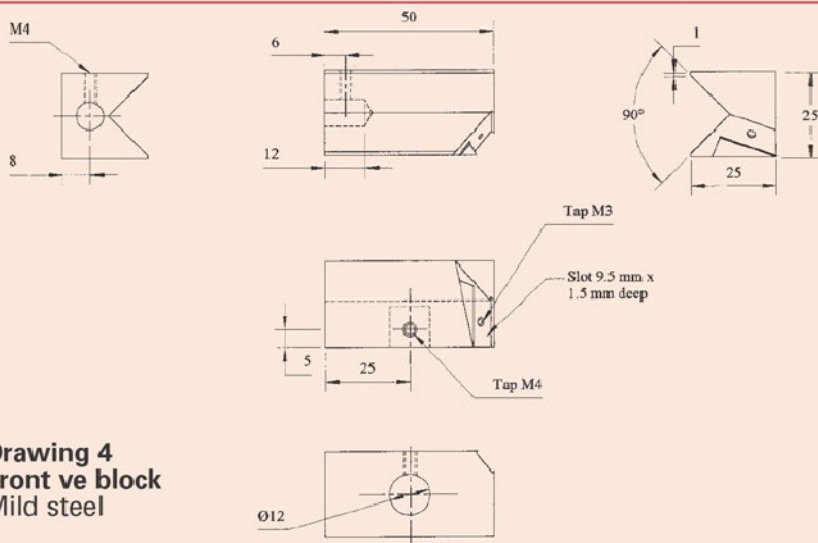
Drawing 5
Middle vee
block
1 off, mild steel



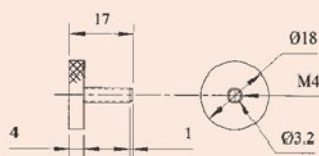
Drawing 6
Rear vee block
1 off, mild steel



Drawing 4
Front vee block
Mild steel



Drawing 7
Thumb screws
2 off, Brass





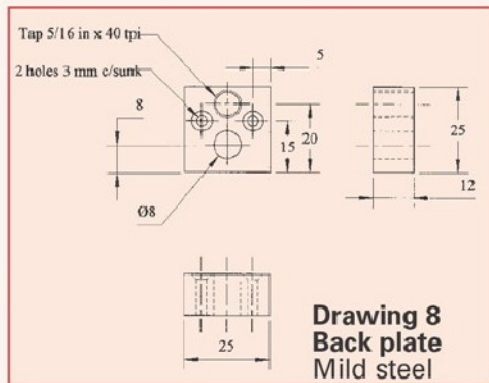
2. Pivot bracket modified

mill in fact. The important difference is, however, that the secondary clearance is taken just so far that the back edge of the primary clearance on both lips of the drill forms an exact straight line across the

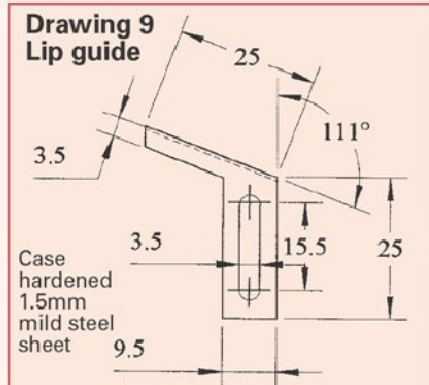
diameter of the drill. The result of this is that the chisel point...is itself pointed...which gives the drill its self-starting and true-running properties." (Photo 6)

I designed the jig in my head as I went along. The drawings came later from the finished item and, lacking the necessary drafting skills to work out how to calculate and draw the complex angles at the nose of the jig, readers should regard the GA drawing (Drawing 3) and the front vee block drawing in particular simply as illustrations rather than an accurate guide to construction. For the latter it is necessary to read the text.

A front vee block (1) has on its front a facet produced by rotating the vee 31 degrees in the horizontal plane and 10 degrees in the vertical plane passing through the axis of the vee. The facet passes through the vertex of the vee. A seat (s) is machined in this facet for the lip guide (2) to slide in and there is relief (r) machined to allow the transverse part of the guide to be lowered to accommodate small drills. An intermediate vee block(3) and a tailstock vee block(4) slide along a



Drawing 8
Back plate
Mild steel



round bar bed (5) and are held in position by knurled thumbscrews (6). A backplate (7) is attached to the rear of the tailstock vee by screws and is threaded for an adjusting screw (8) and pressure pad (9), held in place in the screw by means of a helical spring passing through the central hole. The assembly is attached to the rotating base of the Quorn by means of a fabricated support leg (10).

The sharpening process

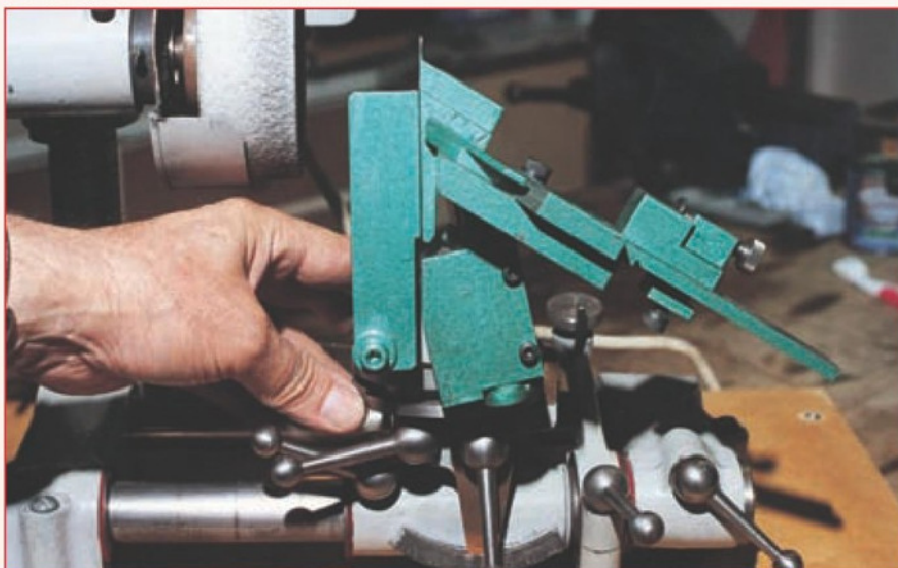
This is perhaps a good point to introduce the actual sharpening process to encourage others to try it, but again to echo Professor Chaddock, "Like most grinding jobs, it is easier to demonstrate than to describe it."

In use, the three vees are aligned by holding the drill firmly in the front vee with the fingers and sliding the other vees along into alignment, locking them in place with the thumb screws. For smaller drills the intermediate vee block can be omitted but for larger drills it is necessary to use it, to ensure that the drill rests on its lands in at least three points or more to prevent rocking (Photo 7). The drill and lip guide are adjusted so that the lip being ground projects a few millimetres beyond the guide while being approximately parallel to the base of the block (Photo 6); and then the tail stock is brought up so that the end of the drill is located by the pad. Advancing the tail stock screw rotates the drill clockwise and so does lowering the lip gauge. You can think of them as being fine and coarse adjustment respectively. Once set, the lip gauge is not disturbed and fine adjustment is made later, during the process of grinding, by means of the adjusting screw.

Although Professor Chaddock and others describe the use of the setting pin



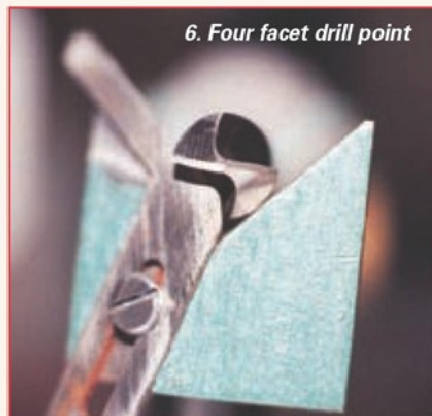
3. Milling datum on rotating base



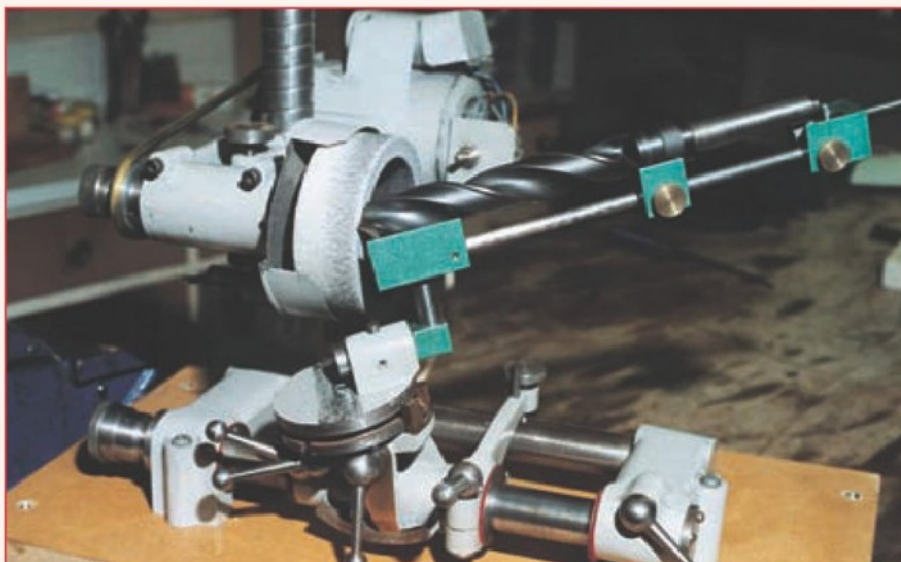
4. Front view of offset square use



5. Rear view of offset square use



6. Four facet drill point



7. Jig accommodates large drills

or other devices to set the lip being ground horizontal, I find that the Mark I Eyeball, combined with adjustments as the drill is being ground, gives satisfactory results.

Set the rotating base of the Quorn at 31 degrees anticlockwise to give the usual point angle of 118 degrees ($118 + 31 + 31 = 180$) and the tilting bracket at 10 to 12 degrees anticlockwise (i.e. nose down) to give the primary lip clearance angle. Then slide the workhead base along to bring the

drill up to the face of the cup wheel and lock it in place on the front bar. Cut is put on by the Quorn micrometer screw. The drill is held in the front vee with the fingers applying a gentle pressure to keep the end of the drill against the tailstock pad and the lip located against the gauge (Photo 8). The workhead base and front bar are then rotated so the drill passes across the wheel and the first facet is ground. It is quite easy to see as it is being ground whether the rear edge of

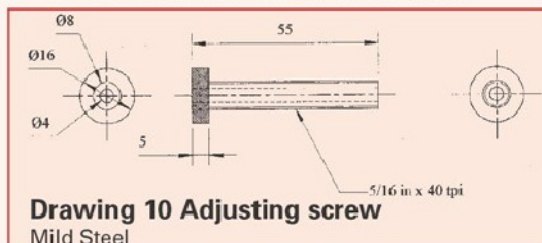
the facet is parallel to the cutting lip and, if it is not, to make minor adjustments by means of the tail stock screw. Once the rear edge of the facet has passed beyond the centre point of the chisel edge, swing the jig clear of the wheel, set the micrometer thimble to zero, rotate the drill through 180 degrees, relocate it in the jig and grind the primary angle on the other lip until the micrometer again reads zero.

The tilting bracket is then reset for the secondary clearance angle of 20 to 25 degrees (Photo 9) and the secondary facets ground until their front edges reach the centre of the chisel edge. The junctions between the primary and secondary clearance facets should then form a straight line as shown in Photo 6. This is the procedure for regrounding a drill that has been ground conventionally, but to sharpen a drill that already has four facets, it is usually quicker to touch up the secondary facets first and then the primary facets need no more than a few kisses from the wheel to produce the straight line across the chisel edge.

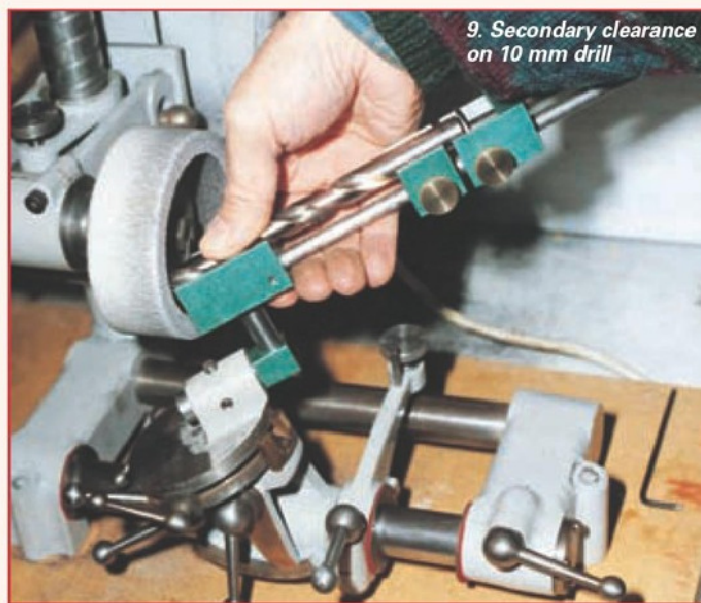
Construction

The vee blocks (parts 1, 3 and 4) and thumb screws (parts 6)

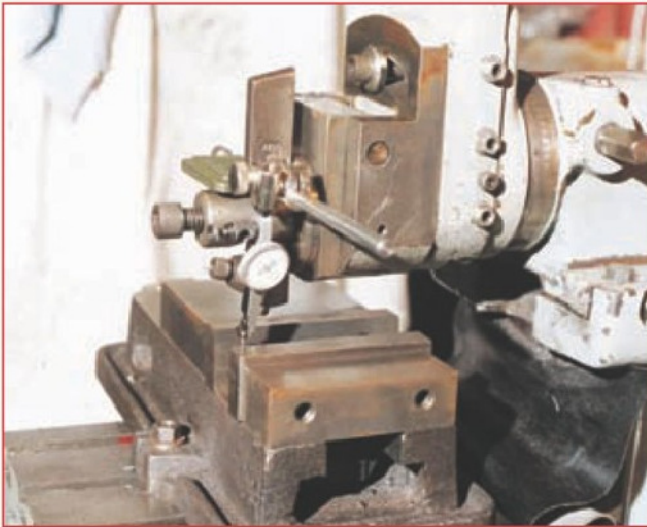
As I have a shaping machine, I found it easiest to make the vees as one piece and cut them up afterwards into three, but those dependent on a vertical slide may have to make the vees in two hits. Start by squaring the ends of a piece of 25 mm square cold rolled mild steel bar and then mark out and lightly emphasise the lines with a fine prick punch. In the shaping machine, the next task is to set the fixed jaw of the machine vice parallel to the movement of the ram (Photo 10). The work



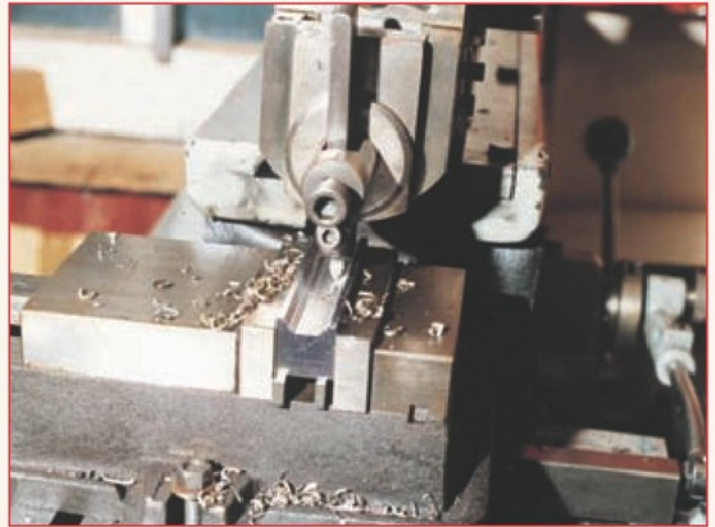
8. Primary clearance being ground on 10 mm drill



9. Secondary clearance on 10 mm drill



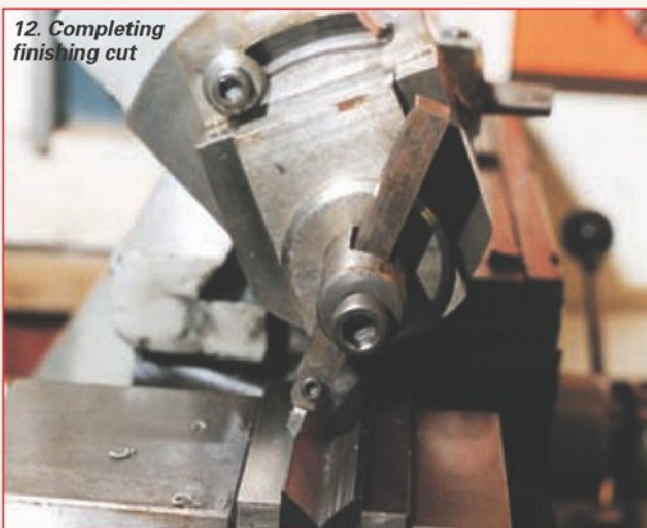
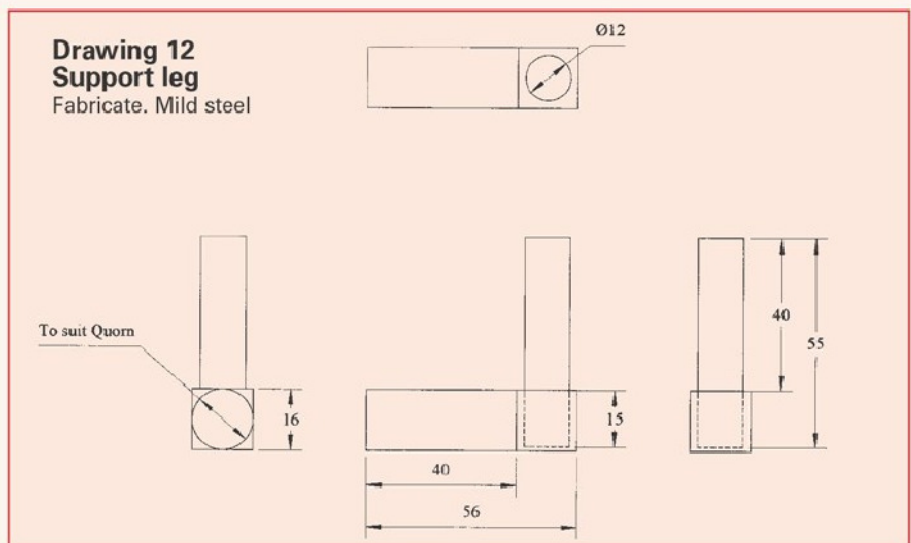
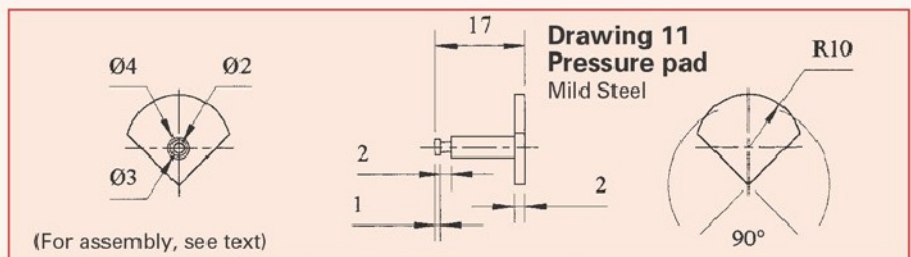
10. Setting fixed jaw parallel to ram movement



11. Roughing a vee

piece is then tapped down firmly on to a pair of parallels and the vee roughed out using a 60 degree vee tool with a rounded nose (**Photo 11**). The tool slide is set vertical for this part and I work from right to left, using the self-act until almost to the bottom of the rough vee. The tool slide is then swung through 45 degrees and the clapper box set over in the opposite direction so that the tool lifts away from the machined surface on the return stroke. The tool is of the shape shown in the photo and you of course need one of each hand. The tool can be fed downwards while doing further roughing almost to the marked line and the finishing cut made by feeding the tool upwards. **Photo 12** shows this process being completed on the left hand side of the vee.

End milling a vee of this size with amateur equipment is quite a substantial undertaking and good finish of the wall of the vee cut with the side of the end mill is very much dependent on having a sharp cutter, well centred in whatever chuck you may have. If you have an angle vice, start by setting the fixed jaw parallel to the movement of the longitudinal slide and set the work piece down on parallels. Then rotate the vice through 45 degrees in the vertical plane to do the machining, necessarily in small steps with the light machinery available to most amateurs. If you don't have an angle vice, things get problematical. You could hold the blank



12. Completing finishing cut



13. Jig drilling vee blocks



14. Making good a drilling error

work piece, rotated 45 degrees on its axis, in a normal machine vice, but the grip and alignment are likely to be uncertain unless the vice is in good condition so that the moving jaw doesn't lift.

Once a long vee has been produced, two quarters can be sawn off and their ends squared and marked out ready for drilling the holes for the bar bed. Obviously these have to be well-aligned and once one had been drilled in the lathe, I used it as a drilling jig, the two parts held in a vee block as shown in **Photo 13** to spot through to the next. If the drill wanders a little, it doesn't matter too much for the intermediate and rear vees, but if the hole in the front vee is not parallel with the vee itself, then the longer the drill, the worse the misalignment of the other two vees. My drill did wander and so I pegged the hole in order to be able set up the front vee in the four-jaw chuck with the mis-drilled hole centred (**Photo 14**). I then bored out the hole, glued in a plug and drilled and bored out a new hole in the lathe (**Photo 15**). The flat-bottomed hole for the support leg is best bored in the lathe. Cross drill and tap the holes for grub screws in the front vee and knurled thumb screws (Part 6) for the other two. While you have the dust cover off the lathe this might be a good point at which to make

the latter which are simple knurling and turning exercises.

It is undoubtedly easier to form the facet on the nose of the front vee using a vertical milling machine rather than a shaping machine, but it can be done on the latter, with a certain amount of effort. In either case, a tilting vice is almost indispensable, indeed, without using a complex jig, I cannot think how else it could be done. My approach was to set over the vee at 10 degrees to the top of the vice jaw and then to tilt the vice 31 degrees. I then milled the facet until it reached the point of the vee. Without the 10 degree angle, the edge of the facet would drop vertically downwards from the apex of the vee and machining the seat for the lip guide would be much simpler, but the 10 degree angle is needed so that the edge of the lip guide leans backwards away from the face of the wheel. Some readers may be able to calculate how much to rotate the vice on the machine table to mill the seat for the lip guide. As my trigonometry stops at a fairly elementary stage, I chose a cut-and-look method, using a narrow end mill and widened the seat once I had the alignment of the vice correct (**Photo 16**).

Back plate (part 7)

This is simple sawing filing drilling and

tapping, followed by spotting through to the rear vee for the tapped fixing holes in the latter. I had a tap $\frac{1}{8}$ in x 40 tpi so I used this because it is finer than the metric series that I usually use. A 0 B.A. size would do just as well.

Lip guide (part 2)

Those who are keen to see things take shape will probably choose this point to make the lip guide. This means a return to basic marking out, sawing and filing to a line on a fairly small scale, something that will be well within the capability of most model engineers. I was not able to calculate the angle of the top lip and measured it from the finished article. It just has to be approximately parallel to the edge of the vee. It is after all simply a fixed resting place for the land of the drill. I did not have any suitable gauge plate so I made mine out of mild steel sheet and milled the slot before cutting out the rest of the guide, then filing it to a very snug fit in its seat.. Note that the bevel is on the back of the guide, facing the tail. I case-hardened the lip of mine and left it glass-hard, something that you cannot do with gauge plate, for fear of it cracking. I would suggest tempering gauge plate to a pale straw colour.

Adjusting screw and pad (parts 8 and 9)

The screw can be threaded using a die, but it must not be a drunken thread, so the die will have to be held in a tailstock die-holder. Drilling right through for the pad and its retaining spring (an idea that I copied from Duplex) has to be taken in easy stages as the hole is classified as "very deep". The knurled bit is simply a stub that is knurled, drilled, tapped and glued on to the end of the screw.

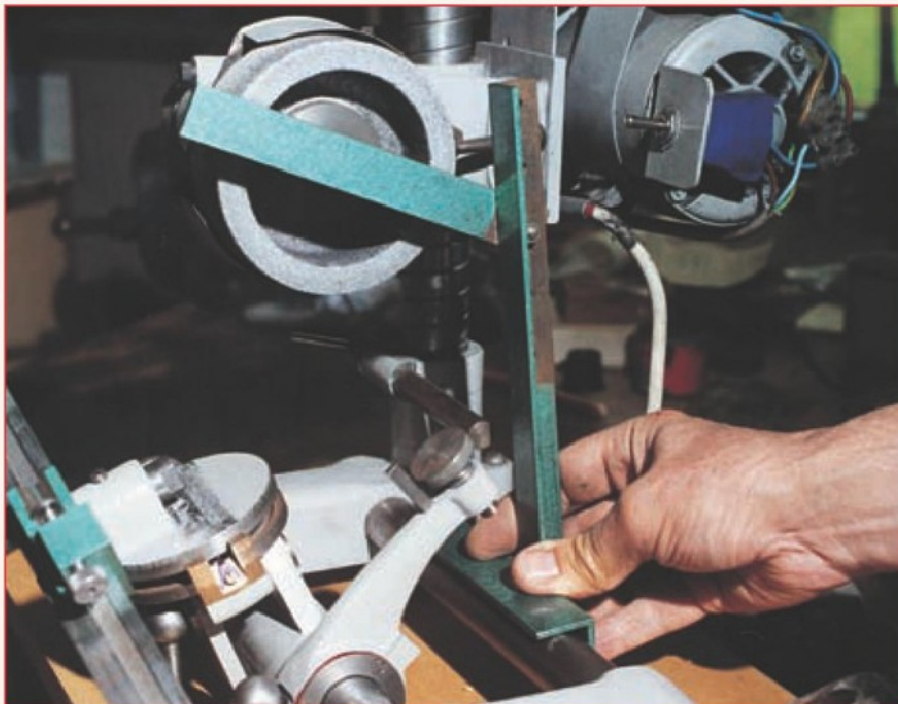
The pressure pad is simple turning. A piece of 20 mm diameter mild steel is turned down to 4 mm to fit snugly in the central hole in the feed screw and then further reduced and grooved as shown to fit whatever tension spring you may have on hand. After parting off, the vee shape is then filed to fit the rear vee block. The two are married together on assembly by snapping the end of the spring into the groove, opening up a loop greater than 4 mm diameter in the other end of the spring and dragging it through the screw on a hook of wire until the pad is held firmly in

15. Re-boring plugged hole



16. Milling lip guide seat on facet





17. Rough and ready wheel setting

place while still being able to rotate.

Support leg (part 10)

This is fabricated from a piece of 16 mm square bar and a piece of 12 mm round. The square piece is centred in the four jaw chuck, centre drilled and the tail centre brought up for support to turn down the square to 16 mm diameter. The square end is then drilled 12 mm and the piece of round bar glued in.

Bed (part 5)

This is simply a 220 mm length of 8 mm diameter cold rolled bar. I did consider using square bar or machining a flat on the round bar and using the thumb screws to locate the vees, but this is a very poor way of ensuring angular alignment. One could of course use square holes, but this would require broaching, a process that is beyond most amateurs reach, including my own.



18. Setting offset square

Offset squares

I give drawings for only one of these, for setting up the Duplex jig on the Quorn, but Photo 16 shows another simple offset square in use, made from three lengths of 25 x 25 x 3 mm cold rolled steel angle screwed and bolted together. I use it to set the face of cup wheels square to the

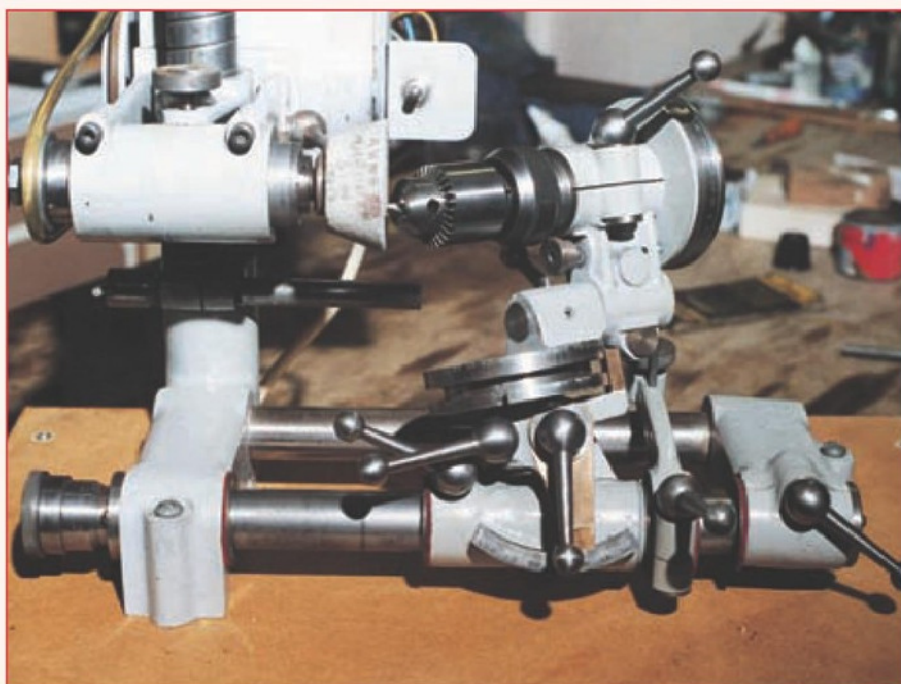
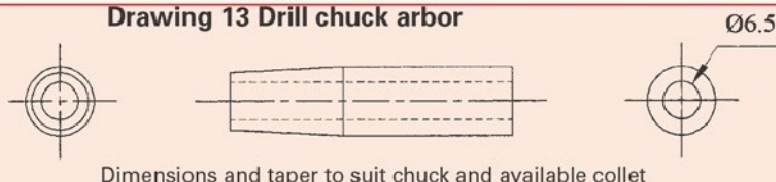
rear (and front) bed of the Quorn when no great precision is needed. Readers are welcome to copy it though I imagine most will already have devised something similar. The Duplex setting square is a simple sawing, filing and drilling exercise, following by facing, drilling and tapping the 12 mm bar M8 or similar for two cap headed Allen screws. Once assembled, it is set square off a surface plate as shown in Photo 18 and the screws tightened. A coat or two of Hammerite paint should then lock things in place as long as you don't drop it. The purist may prefer something more elaborate with dowel pins, but I was in a hurry and it is easy enough to reset it if need be.

Chuck adaptor

I have a set of three Clare collets and have made an adaptor so that they can be used in the Quorn to hold end mills. It occurred to me that I could make a hollow parallel arbor so that a small Jacobs chuck could be held in one of the collets and, if drilled through, used to hold drills down to 0.5 mm in size (readers of MEW No 59 will know it is safe to drill through a drill chuck). The idea is almost too simple to merit a drawing, but I include one for completeness and Photo 19 shows the finished idea. A hand lens is needed to check that the facets are correct, but once one has been correctly set, the other one can be ground after simply rotating the chuck through 180 degrees.

I hope that my explorations will be of use to frustrated Quorn users and as usual I will be happy to hear suggestions and criticisms via the Editor or by e-mail at engineer@clear.net.nz.

Drawing 13 Drill chuck arbor



19. Chuck adapted for small drill grinding

SOME IDEAS ON QUICK CHANGE TOOLING



1. Detail of baseplate showing tapped holes.

I was very interested to read Philip Amos's account of his quick-change tool system in M.E.W. No.81, as I had arrived at a similar system by a different route. I believe some of my devices could also be used with his system, and may be of general interest, as I find them to be very convenient and time-saving. It would be nice to claim that all the items I will describe were the result of purposeful design, but the fact is that many of them more or less turned up as incidental benefits while other targets were being pursued.

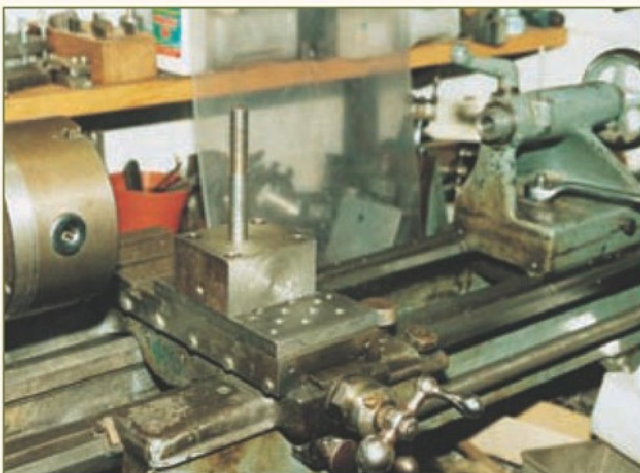
I had better begin at the beginning: forty years ago I bought an old Logan lathe of 5½ in. centre height. It is an American

machine, and similar to a South Bend. On to this I grafted a Myford long cross-slide to enable me to do some small milling jobs. Soon I learned the hard way that the tee-slots in the Myford slide are not very robust and are easily damaged. Resolve: make up some long well-fitting tee nuts (to spread the load) and try to attach things to the cross-slide by clamping flat surfaces directly onto the slide. Next I realised that I had only very occasional use for the rotating top-slide, and I achieved greater rigidity by mounting a steel block on the cross-slide to carry the four-way tool-post, as others have also done. This has now evolved into the arrangement shown in Photos 1 and 2, a piece of 12 mm steel

Amhlaóibh Hennessy summarises his toolholding accessories which have evolved over a number of years.

plate is fixed to the cross-slide by four short ⅝ in. B.S.F. capscrews which engage in 1 in. long tee-nuts. The plate carries an array of holes tapped ⅝ in. B.S.F. Six of these allow the steel block to be mounted in two different positions (for normal and very large jobs): all are available to hold milling jobs by means of studs of various lengths. The work can be very securely held without any danger of damage to the cross-slide. The holes are protected from swarf by a sheet steel cover when not required. For convenience, a hex key for the mounting block screws has been lengthened to clear the stud, Photo 3. The Myford cross-slide can be wound off and can be replaced by the original cross-and top-slides in a few moments if tapers are needed. The mounting block on the Myford slide comes to exactly the same level as the top of the original top-slide, so that tool-posts with tools set to centre height will be correct on either.

An excellent four-way indexing toolpost came with the lathe, but I soon found that four tools were seldom enough, and there were problems when left and right hand tools had to be accommodated. Then I saw the late Dave Lamm's article on his three-way tool-post in M.E.W. No.27, which offered a solution to many of these problems so I proceeded to make up a few toolposts to his design. I made mine the hard way: the top and bottom plates were



2. Baseplate and Block mounted on cross slide.



3. Extended hex. key.

hacksawed (very good for the soul) from 12 mm steel, with a triangular centre piece from 1in. thick aluminium. **Photo 4** shows one in position, and also the sheet steel cover for the base plate. It also shows the clamping nut, which by accident not by design, turned out to be a great success. It is about 2 in. long, and made from 1½ in. diameter stock, and threaded (½ in. B.S.W.) for a length of ¾ in. at the top end. The result is that a few flicks of a finger spins it all the way up or down, making tool-post changes very quick. About 20 seconds brings another set of tools into action. A short ring spanner is used for the final tightening via the hex at the top. The same spanner fits the tailstock locking nut where it normally resides, very convenient to hand, as can be seen in **Photo 4**.

Base plate and block assembly

Fig. 1 shows details of the base plate, and **Fig. 2** the mounting block, stud, and nut. The bottom of the base plate should be quite flat. My plate was pretty good as it stood so after removing the mill scale I tried it on a surface plate and a little scraping soon brought it to a satisfactory condition. The holes for the capscrews have to be counterbored. Having no suitable counterbore I used a twist drill. Purists may be shocked but I find it works. The holes marked B and the corresponding holes in the mounting block must be set out and drilled accurately if the block is to fit in both its positions. The other holes are indicated by crosses to avoid confusion, as their positions are entirely optional. There is plenty of room for more if they are ever required.

The height shown for the mounting block is only approximate. It should bring the top of the block to the same level as the topslide when that is fitted, so that toolposts can be used on either without having to alter tool packing I did this by chucking a piece of silver steel and measuring from its upper surface to the top of the topslide using a vernier height gauge. Repeat the exercise to the top of the base plate (without rotating the chuck) and the difference gives the required height for the mounting block.

The long stud is a legacy from the original four-way toolpost that came with the lathe. Had I decided at the start (as I did later) to retire this toolpost I would have had a shorter stud and an ordinary nut, which would not have had the flywheel effect of the heavy nut. As well as the rapid action already described, the nut and stud I arrived at will also clamp items of a wide range of thickness without additional packing washers.

Lammas style toolposts

Photo 5 shows my basic left and right hand Lammas toolposts, and **Fig 3** gives their dimensions. The first thing to decide is the size of tool to be used: I decided on ¾ in. square as standard, but with the capacity to take ½ in high tools. The height of the tool, plus an allowance for packing, will decide the allowable thickness range of the bottom plate,

A BRIEF ASIDE ON USING THE HACKSAW

Most readers seem to have bandsaws these days, but the hacksaw is a very useful tool when you get the knack of it. Here are a number of points I find helpful when there is much hacksawing to be done.

Select your frame carefully: it should be comfortable, rigid, and with a little bit of weight: many are too light.

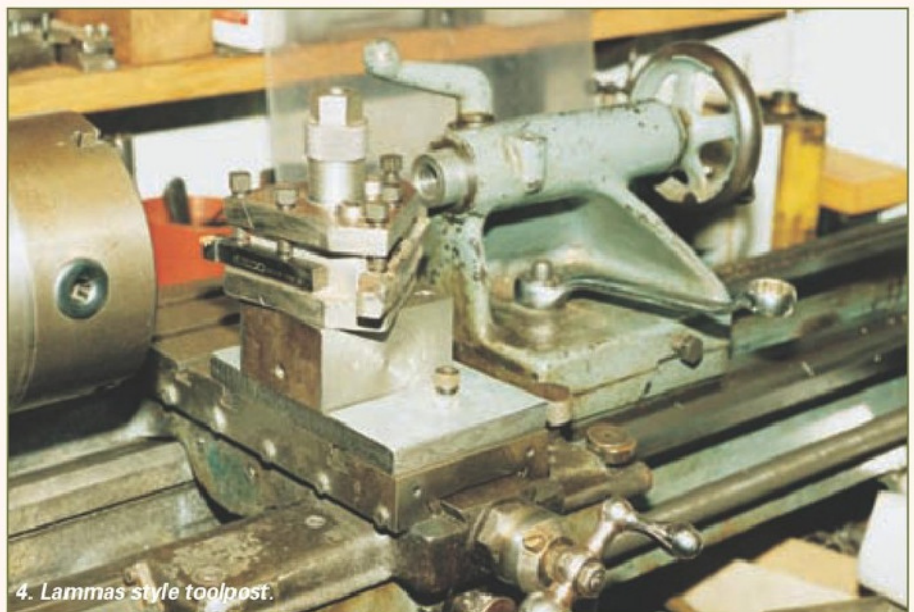
Use all-hard H.S.S. blades of good quality: the bimetal ones have their uses but with prolonged use the backing metal will stretch and the blade will no longer cut straight.

Do not allow the blade to touch the hardened vice jaws: if it does it will also refuse to cut straight.

Set up the work securely in the vice, if possible so that it can be attacked with the forearms horizontal. When cutting plate, the cut should be at about 25 degrees to the surface. This makes it easier to follow a straight line. If the plate cannot be set up at this angle, and there is much sawing to be done, consider standing on something, which of course must be secure, which will raise your feet by eight or nine inches.

Now of course all-hard blades are also all-brittle, and if you wobble in your stroke you will now have two half-blades to add to your sundry stock. But it is well worth while to learn a smooth, even stroke, and enjoy the resulting long blade life and straight cutting.

Finally, never continue cutting until your arms are tiring: you will be certain to wobble and snap the blade. I count the strokes and work in spells of 50 to 70 strokes, depending on how I feel. A few moments rest and I do another spell. It may be relevant here that I am 75 years of age. After about 6 spells I do something else for a while before returning for another session. If you can leave the job set up in the vice you can do a few spells whenever you pass by. It is encouraging to put a pencil mark at the end of the cut after each spell, and it will also give warning when the blade finally begins to get blunt.



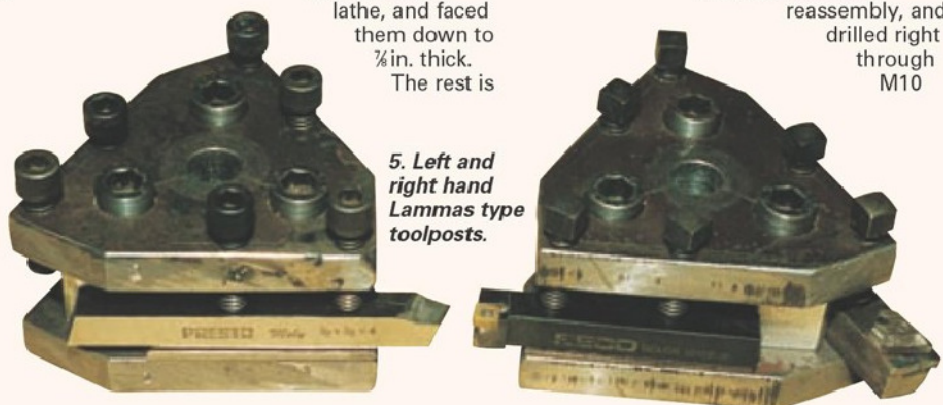
4. Lammas style toolpost.

and also the height of the centre block. My centre blocks are cut from a 2½ in. by 1 in. aluminium bar. I cut these with a 6in.

slitting saw mounted on a spindle in the lathe, and faced them down to ¾ in. thick.

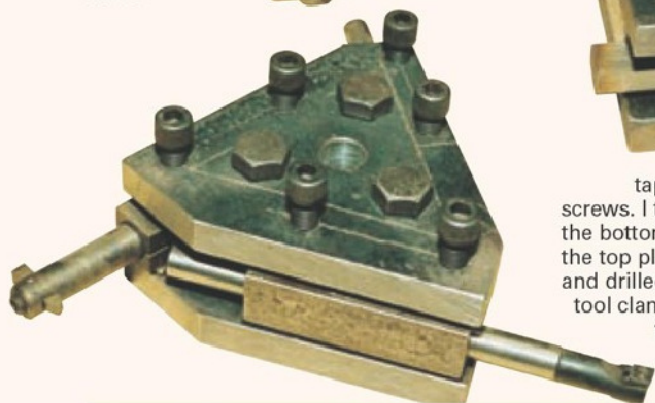
The rest is

straightforward. I marked out the holes in the top plate, drilled the centre holes in all three parts, mounted them on a close-fitting bolt in their correct alignment, marked them for reassembly, and drilled right through M10

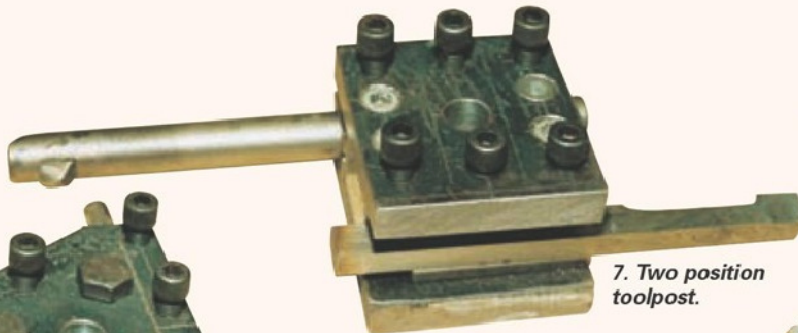


5. Left and right hand Lammas type toolposts.

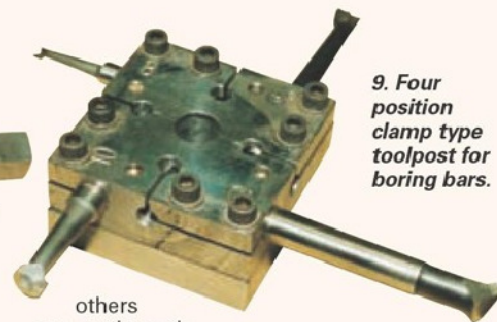
6. Larger Lammas type for boring bars.



7. Two position toolpost.

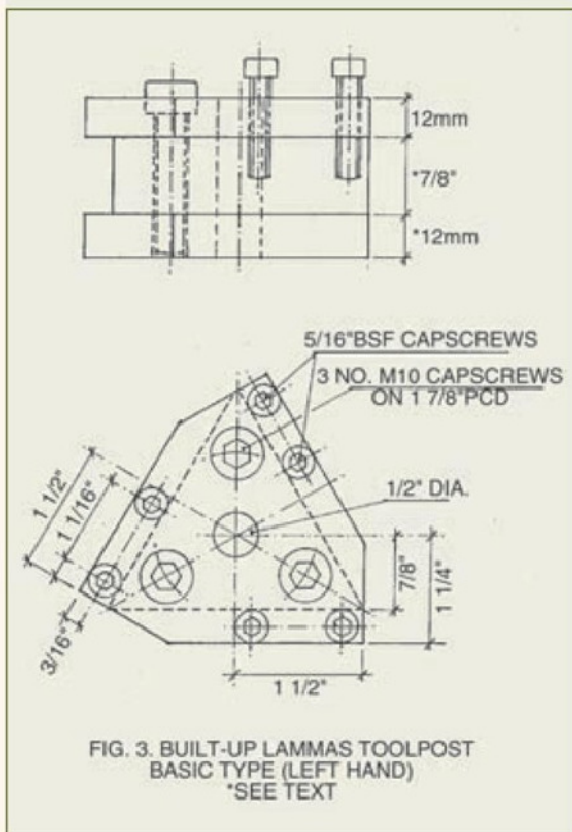
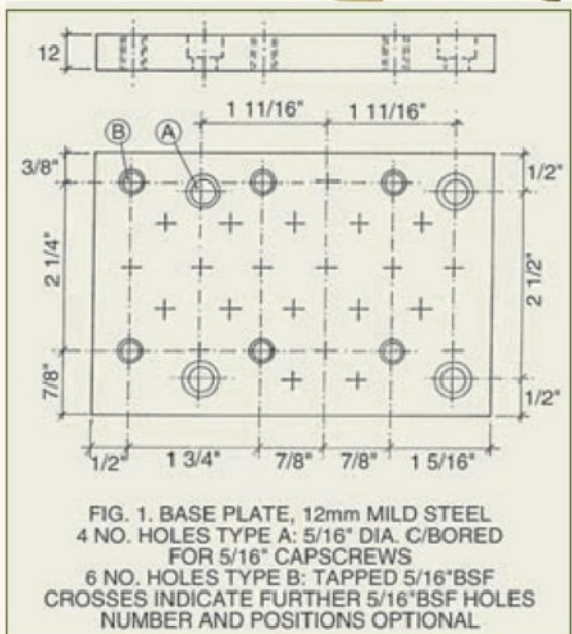


9. Four position clamp type toolpost for boring bars.

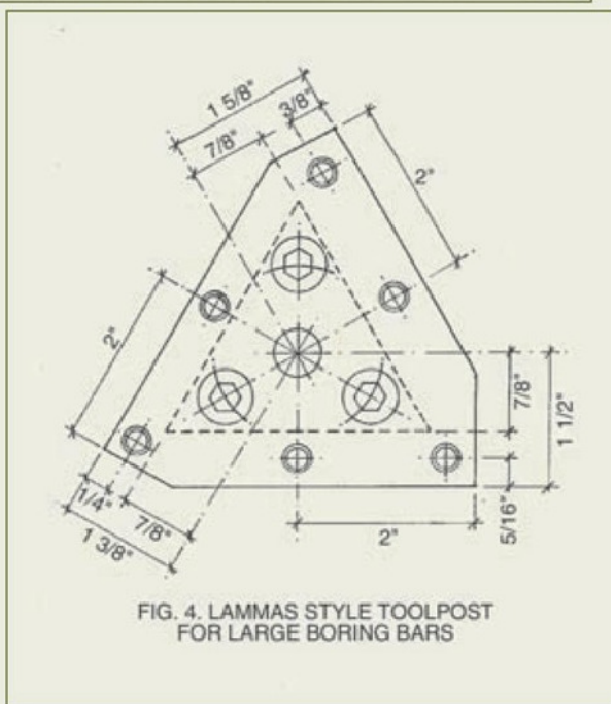
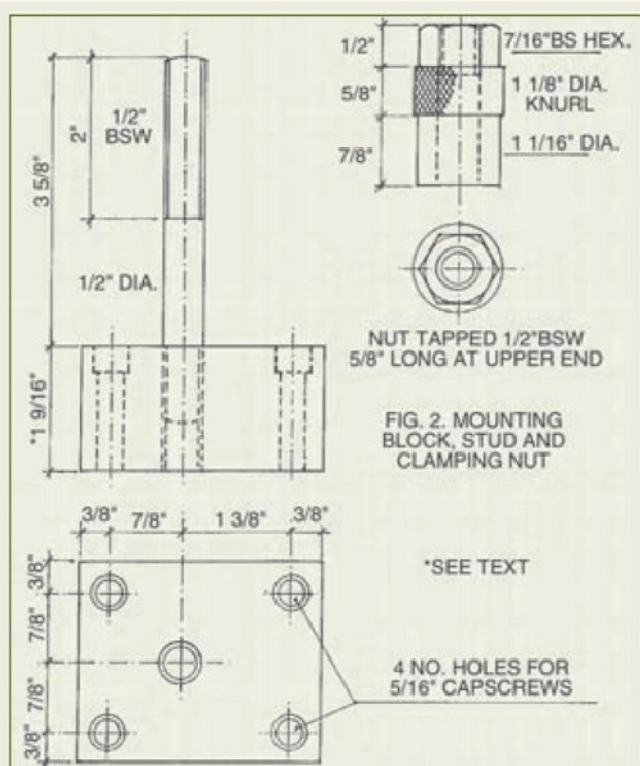


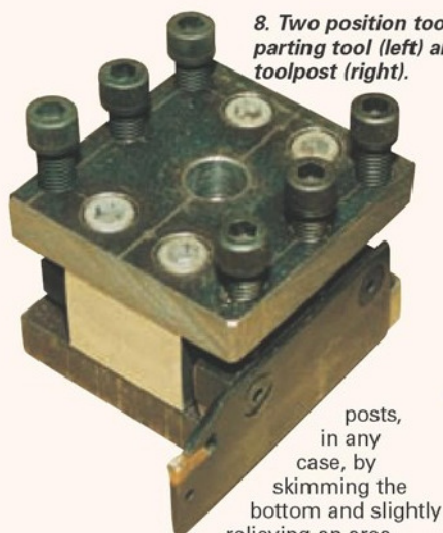
tapping size for the three assembly screws. I then separated the parts, tapped the bottom plate M10, opened the holes in the top plate and centre block to 10 mm, and drilled and tapped the top plate for the tool clamping screws. It will be noted from the photos that some of my assembly screws are sunk flush in the top plates, while

others are partly sunk. The only reason for this is to ensure that the available screws get a good length of engagement in the bottom plate. Another approach could be to use longer screws without counterboring, cut off the surplus length, and skim the base of the assembled toolpost. I finished all the



©





8. Two position toolpost with parting tool (left) and "Guest" toolpost (right).



posts, in any case, by skimming the bottom and slightly relieving an area about 1.5in. in diameter to give secure clamping. All my three-way posts have three assembly screws, either M10 or $\frac{1}{2}$ in. B.S.F., while my two-way and four-way posts have four $\frac{1}{2}$ in. B.S.F. screws. These have smaller heads than M8 screws. **Photo 6** shows a larger three-way post to accommodate boring bars: **Fig. 4** gives its dimensions. Though I have shown capscrews in **Fig. 4** it will be noticed from the photo that I have used hex setscrews for assembly as there is plenty of room on this post.

Larger Tools and Parting Tools

Photo 7 and **Fig. 5** show how a toolpost

can be tailored to suit a specific tool. These large tools would be unwieldy on any but a two-way post. **Photo 8** shows another two-way post for parting tools, and, on the right, what I call my guest toolpost, which is available for the odd tool that may be required from time to time. **Fig. 6** gives its dimensions. I have provided two toolseats $\frac{7}{8}$ in. wide and two $\frac{1}{2}$ in. wide. Two-way and four-way posts, if flat stock of suitable width and thickness is available, will involve much less hacksawing than the three-way ones, and are quite easy to make.

Photo 9 and **Fig. 7** show a toolpost to hold small boring tools. It holds three Orkan H.S.S. tools, two with 10 mm shanks one with 8mm, as well as one tool with a $\frac{1}{2}$ in. shank. As these tools have their cutting edge at the level of the centre

of the shank, the sockets can be bored from the lathe spindle with the embryo toolpost clamped on the mounting block. The form of tool clamping shown is very secure provided that the tool shank is a very close fit in its socket. I suppose the sockets should be finished with D-bits but I enlarged the holes in very gradual stages and finished them with drills which I had freshly sharpened as carefully as I could on my Reliance drill grinding jig. (An excellent tool, incidentally. I have not seen it advertised recently: is it still in production? Mine is the $\frac{1}{8}$ - $\frac{1}{2}$ in. model, but I have persuaded it to handle drills up to 1in.) The tool sockets are drilled to the centreline, where they are met by two $\frac{1}{4}$ in. holes, one from the top and one from the front. The slots were cut with a small slitting saw. It would simplify this operation if the $\frac{1}{4}$ in. holes were a little bigger. There was a small residue in some of the slots beyond the reach of the sitting saw which had to be fiddled out with a piece of hacksaw blade. The photo shows that my toolpost is made up of two pieces. This was dictated by the stock situation.

Tool Height Gauge

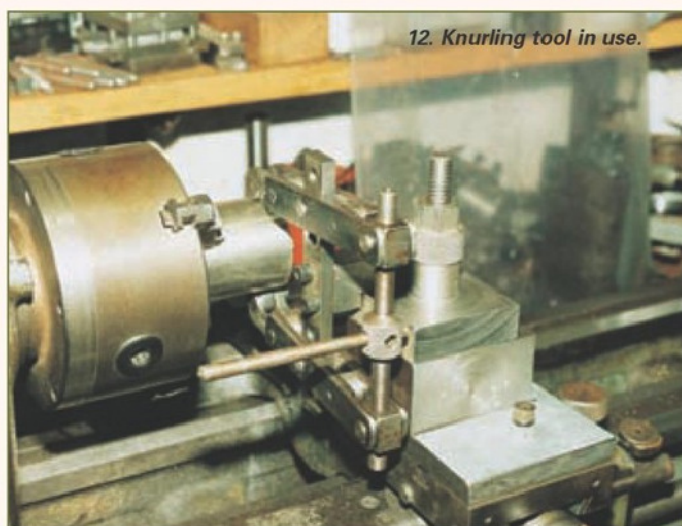
Photo 10 shows the centre height gauge I made to go with the new toolposts. It consists of a heavy base, made from 2 $\frac{1}{2}$ in. by 1 in. channel $\frac{5}{8}$ in. thick, cut to sit level and without rocking on the lathe bed. To this a vertical post is fixed, carrying a short cross-arm which carries a short vertical rod. Grubscrews fix the cross-arm to the post and rod. I set the base of the rod accurately at centre height as follows: I



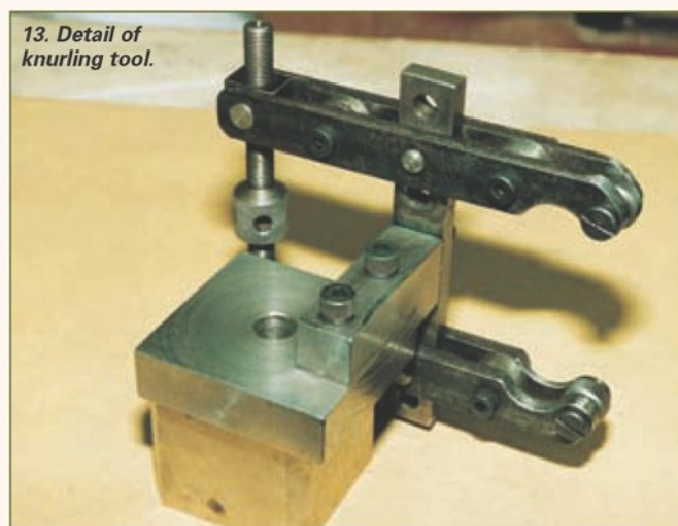
10. Tool height gauge.



11. The packing caddy.



12. Knurling tool in use.



13. Detail of knurling tool.



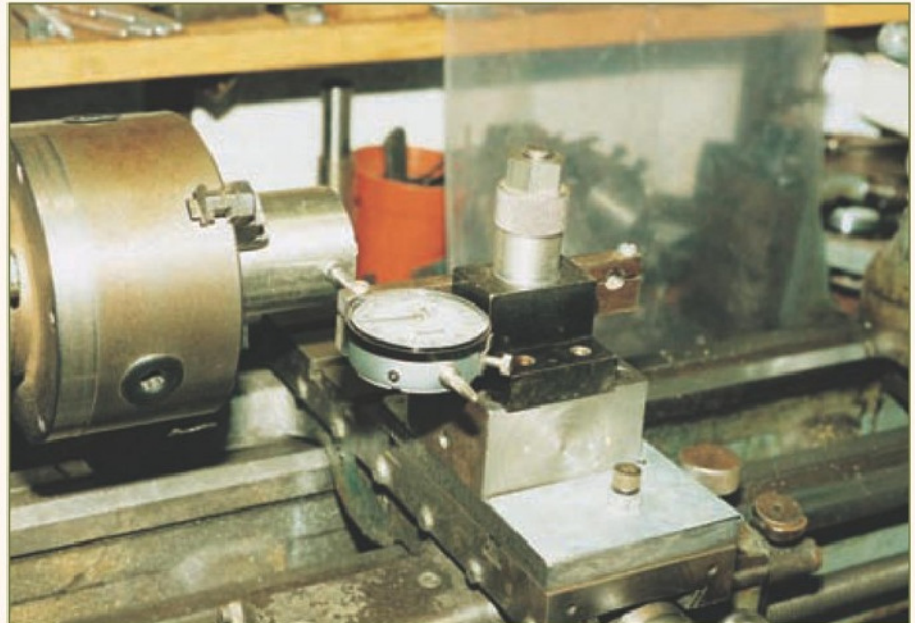
14. DTI and mounting arrangement.

faced both ends of the short rod carefully and finished them with a rub on an oilstone, and I also gave the upper surface of the cross-arm a smooth finish I then chucked a piece of $\frac{1}{4}$ in. round silver steel and verified with a DTI that it was truly centred. I set the short rod with the top end exactly 0.125in. above the top surface of the cross-arm using a step micrometer and clamped it lightly. I then set the gauge on the lathe bed and lowered the cross-arm until the short rod rested on the top of the rod in the chuck. I clamped the cross-arm at this position and then lowered the short rod until its upper surface was flush with the top of the cross-arm, and clamped it there. Of course you have to see that the rod will finish up where tools can be presented to it as shown in the photo.

Photo 11 shows my packing caddy. The result of this, after years of fumbling and making shift, is the joy of pipless facing every time.

Other Accessories

I now had a range of tools which could be brought into use at a moment's notice, each perfectly set to centre height, but there were still the items like the knurling tool and DTI holder which had formerly involved evicting a tool from the tool-post.



15. DTI in use.

The answer was simple: provide each with its own mounting base to be clamped to the mounting block or top-slide, whichever is in position.

Photo 12 shows my knurling tool in position, and **Photo 13** shows a little more detail of it. The tool is a reworked version of one I made over thirty years ago. It can deal with jobs up to $3\frac{1}{2}$ in. diameter. The design took this shape because I wanted to find a use for some left hand taps and dies I had acquired, but it turned out to be good because of the short projection of the knurls from the pivots about which the arms rotate.

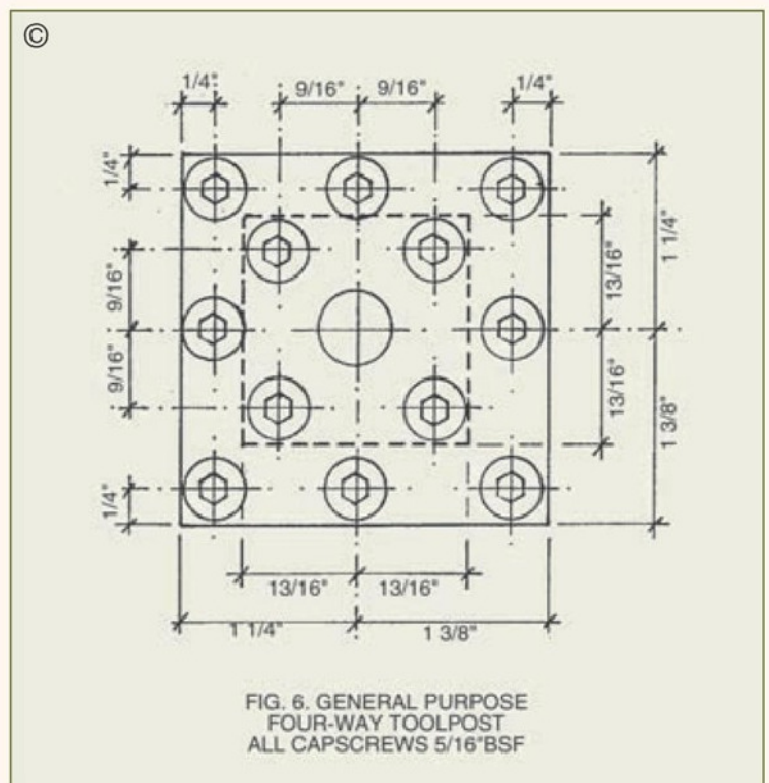
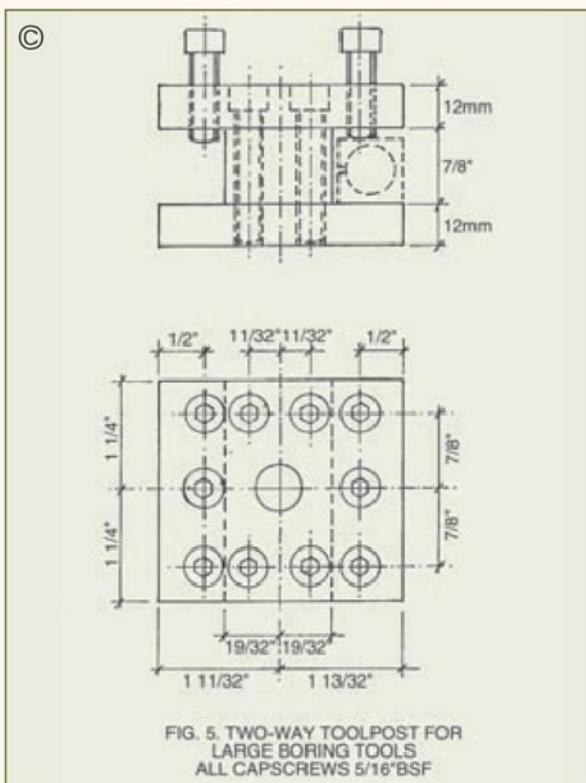
Photo 14 shows the DTI mounting. The DTI can be fitted at the other end to deal with larger workpieces. **Photo 15** shows it in use. The mounting base is as it came

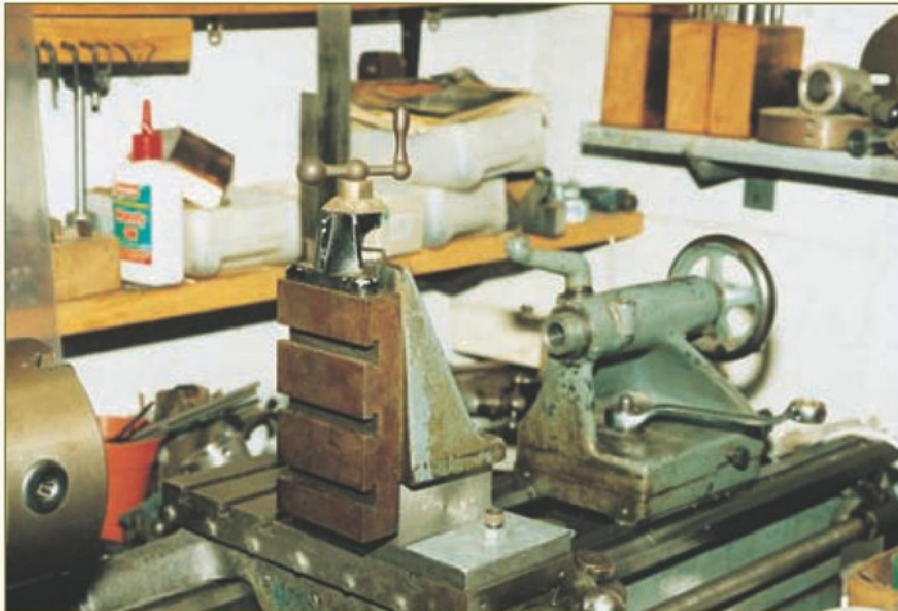
from the scrap-box.

Photo 16 shows a mounting to take a Baty DTI set, and alongside, a forcing bar for starting drills true when drilling from the tailstock.

Photo 17 shows a Myford plain vertical slide securely mounted. This involved drilling a $\frac{1}{2}$ in. hole in the base (is this a sacrilege?) in a position which allows the slide to pass down beyond the face of the mounting block.

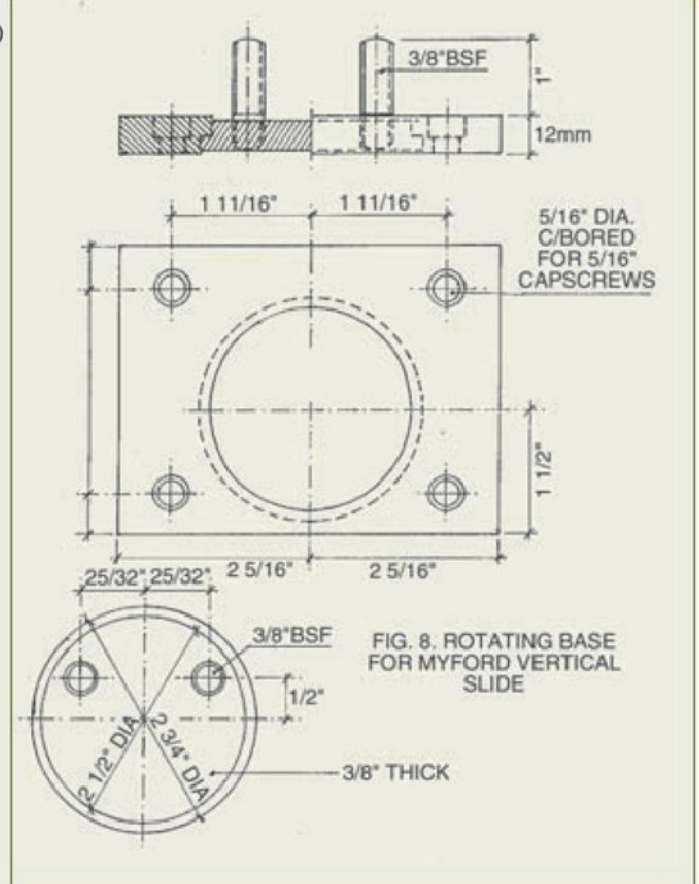
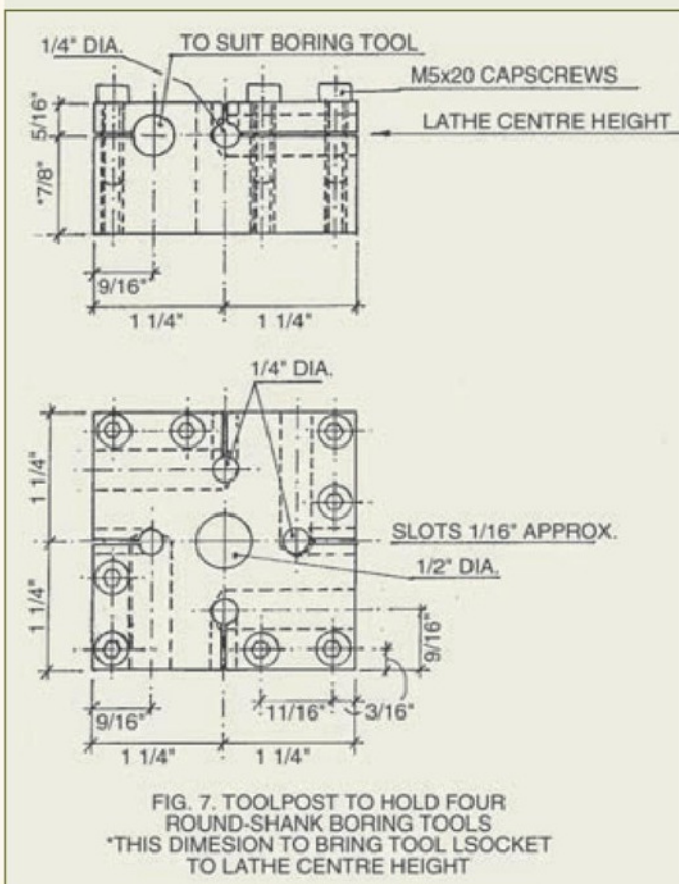
There are many other tools which could be mounted using this system. I have a hand turning rest on the programme, but ball-turning tools, milling spindles, and others also come to mind. This system does not allow for indexing, but I have never felt a need for it. Depends on the kind of work you do, I suppose.





Finally, **Photo 18** shows a device which allows the plain Myford vertical slide to be rotated about a vertical axis. It consists of a plate which replaces the plate shown in **Photo 1**, being fixed to the long cross-slide by the same fixings, together with a circular inset plate which carries two $\frac{3}{16}$ in. B.S.F. studs. These match the holes in the base of the Myford plain vertical slide, which thus can be rotated in a horizontal plane. **Photo 19** shows the rotating piece and the underside of the plate: it has been lightly scraped to give a good seating on the long cross-slide. The extra holes in the round plate serve no purpose, except to record an error in calculation. **Fig. 8** shows details of this item. The round plate is best made first so that it can then be used as a gauge when the hole in the plate is being bored.

I have not given detailed working instructions on the basis of an Irish proverb which translates as "A hint is enough for the knowledgeable", and in any case, anybody wishing to do something similar would have to work out dimensions and other matters to suit his or her own requirements.



SCRIBE A LINE

Mr. John Wilson, of Harlow, Essex, writes:

I have been reading with interest Philip Amos's article on Parting Tool Techniques and having worked as a Maintenance Engineer (serving my apprenticeship with a company that manufactured printing machines, then moving on to maintenance in the wine trade and finishing up the last 10 years, before taking early retirement, in the turned parts trade) I am curious as to why lathes for model engineering are invariably supplied with parting tool holders that are set with several degrees of top rake.

At no time in my 43 years of engineering, have I seen top rake used for parting tools. In the turned parts trade using Swiss automatics & 6 spindle automatics, tool holders such as "A" in the accompanying photo 1 would be impractical, as each time you had to sharpen or change a tool, you would have to reset the tool centre height. Now given that both the smaller Swiss automatics (or sliding head machines) and their bigger brothers the 6 spindle automatics are used to turn any material from plastic, stainless steel cast iron, copper, brass, aluminium & steel in all grades & shapes, to very high finishes & tolerances, one has to conclude that top rake is perhaps unnecessary.

Another interesting point about parting off in the turned parts trade, is that the tool is often a form tool making chamfers or more complicated shape. The photo of tool D shows an 8 mm parting tool that chamfers both edges of the bar as it parts off. This tool is typical of the type used on Swiss automatics.

Tools "B & C" are typical of the parting blades used on the bigger multi spindle machines and were made by J.J. Churchill Ltd of Market Bosworth. They are marked Emprite PM5, and have a hollow ground top face. The tipped blade "A" has been ground away to fit the parting tool holder on my lathe, but I will be making a rear tool post in due course, so that I can mount my parting blades without any rake. The tipped blade is made by Empire tool Co. Memphis and is a P3N C6 TC.

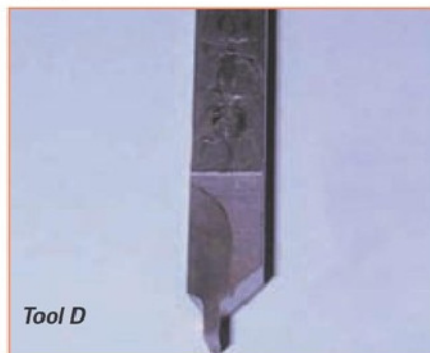
For those not familiar with Swiss automatics or Multi spindle machines, the Swiss autos that I was involved with were sliding head single spindle lathes and,



unlike a conventional lathe, the bar is carried along by the sliding headstock past the tool to turn the appropriate diameter. The tool or tools would rock back and forwards to form various diameters and forms on the bar as it was fed along by the sliding head. The machines we had, could handle material up to 12 mm dia., though bigger machines are made.

The Multi Spindle machines come in various sizes, and ours ranged from 5/8in to 1 3/4in. (the sizes denoting the largest bar the machine can hold). Each had six spindles and a possible fourteen machining operations taking place at some point in the machines cycle. (from a bar being fed out to its stop, fully machined & parted off, which is one full revolution of the drum carrying the six spindles). Unlike the Swiss autos, the multi's feed the bar out a predetermined distance and then the diameters are machined using form tools and/or tools mounted on slides, which move in a similar way to the saddle on a conventional lathe, but with very limited travel. Both the Swiss machines & the Multi's took bars in lengths up to 10ft. long. I hope this is of interest?

On a totally different topic, oh how I agree with the sentiments expressed in "On the Editor's Bench, Real World Engineering". Harlow, where I live and worked for many years used to have a major industrial base, with companies like International Distillers & Vintners (IDV) with their large wine and spirit bottling plant, Shreibers manufacturing furniture, Johnson Matthey had a large manufacturing site making things like catalytic converters, Press Bodies making body panels for Fords, ITT making electronic components, Cossors also in the electronics and defence business. Then there were the numerous small engineering companies making components for bigger companies like Fords.



Now all that is left are a few companies like Cossors who have changed name and shrunk to a fraction of their original size. IDV had two large sites, one is now a Supermarket, the other a warehouse. Johnson Matthey's site is a Supermarket, Press Bodies site is now taken with two car showrooms & a small retail park. Shreibers site is car parking & Tyre & Exhaust repairs.

Successive governments have ignored the situation or dismiss the decline as unimportant, with the result that there are no real jobs left.

I served my apprenticeship with a company in Bow, East London, building printing machines for six years, I then worked as a Maintenance Fitter for IDV for 25 years and for a small Hertford based engineering company for 10 years, all good paid jobs. All three companies are now gone and the chances of our children getting well paid and interesting jobs, where they can take early retirement (at 58 in my case) have long gone. It seems the best they can hope for is shelf filling at a supermarket or cleaning on minimum wages. God help our youngsters, because there is no future for them in industry.

Comment from Dave Fenner

My guess is that Mr Wilson's experience of zero rake tools stems in part from the need to compromise on several counts. First as he says, many different materials were encountered, and if one tool can be used satisfactorily, then why have more. Secondly, before replaceable tips gained popularity, resharpening implied resetting. Thirdly, if a tool such as "D" is used, then it is cutting at more than one diameter, and it will not be possible to set the tool cutting edges on centre unless it is set with zero rake. I understand that the latest tipped part off blades have multiple top grooves and some positive rake. With turning tools in general, much work has been done in the past to determine optimum angles for high speed tools cutting various materials. Using the optimum should give good finish, machining time, tool life and tool loading. This last factor assumes some importance in the amateur context where machine rigidity and spindle power may be somewhat lower than in an industrial setting.

Mr M. Connelly writes by email:

I read the letter in issue 88 from Mr H. Lord and the reply by Bob Loader regarding screw threads and helix angles. I understand the mistake made by Mr Lord and also agree with Mr Loader's calculation of helix angle. I would like to point out that the origin of Mr Lord's mistake is probably the fact that when drawing a thread people tend to draw a saw-tooth pattern when the true form of a thread in plan view is a sine wave. This true form is impossible to see on the

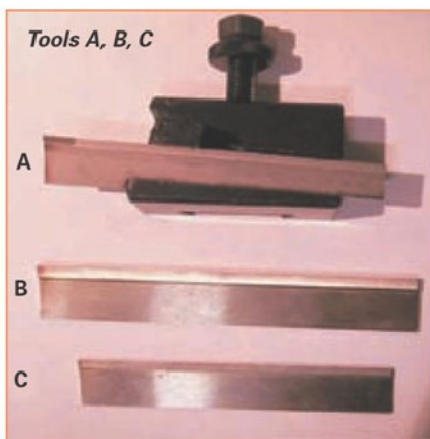


Fig. 1

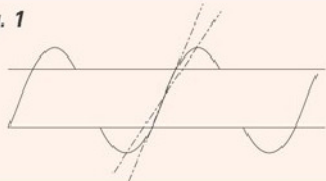
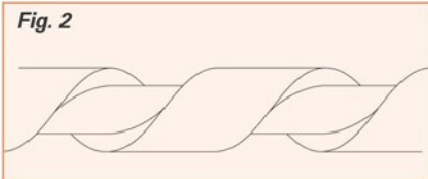


Fig. 2



majority of threads using the human eye and when drawn correctly sometimes looks wrong.

If the thread is drawn with a stretched axis (Fig1) that makes it look like it has a long pitch it is possible to draw the line Mr Lord found the angle of, and also the correct helix angle as calculated by Mr Loader. The source of the error becomes obvious, see figure. With this knowledge of the plan view of the thread it should be possible for Mr Lord to find the best way to machine his chuck jaws to suit the thread he has produced. I know from looking at the thread on my own chuck jaws that the sides are not flat but are lenticular and so must be made to suit this sine curve in some manner. If the thread is drawn completely with a CAD program, (Fig 2) the root of the thread can be seen to be significant as far as the final shape is concerned, the lenticular shape on the jaws seems to match this drawing. I hope this helps in some way.

Mike Thurgood of Milnerton, South Africa, writes:

I entirely agree with what you say in your editorial, Drawings, Standards and Attitude - MEW No.87, December 2002/January 2003. For someone to complain about missing dimensions when clear notes are made on drawings which indicate which parts are intended to fit together is either demonstrating an unfortunate inflexible attitude, or they had a bad business dinner the previous evening! I haven't seen the drawing of the Plans Service Drawing WE 19, but your comments make the situation quite clear. Where exact dimensions are concerned, again I entirely agree with your remarks. It would be unusual for a typical model engineer to go into mass production, which would then certainly require the correct replication of parts when off the shelf replacements are required.

When I construct hot air engines from pre-prepared drawings, a particular dimension may be given for the bore of a cast iron power cylinder, with that of its piston to match. But if the bore of the cylinder is, say, 35 mm and there is plenty of wall thickness I may not bother to bore even to the nearest millimetre: I would most likely go for a slightly larger diameter on the basis that it might provide just a little more power output, whether or not the theorists would entirely agree with this philosophy. What is essential is that the

bore is parallel and honed smooth. Also, of course, that the piston is turned to suit the bore, the right fit being shown by closing the cylinder at its lower end and placing the piston into the bore, when it should just very slowly slide down the cylinder.

But then I am apt to change dimensions or other features on drawings if I think that something doesn't look quite right to me. One such change is the number of attachment screws of a cylinder head to the body. You often see them attached with as few as four or six screws. Although this may be perfectly adequate, it never looks right to me. I will increase the number from nine to twelve, depending on the diameter, but possibly go down one BA size in the process.

Another example: loco wheels. Although the drivers all need to be the exactly the same diameter, at least to start out, they gradually wear in use, but scale locos still manage to run very successfully. However, the crank distances on each wheel must be identical otherwise there would indeed be great problems with the driving links. Therefore whatever dimension is given on the drawing doesn't need to be adhered to, to the nearest ± 0.1 mm, as long as they are all the same. Even loco cylinder bores don't have to be identical to some tiny dimensional tolerance - there's quite a wide latitude, but the pistons do need to be a good fit.

And, no, I am not suggesting that dimensional differences of 10 mm are tolerable, but a millimetre difference in 50 mm diameter for a cylinder bore is generally of no consequence.

Likewise for axles and bearings, providing the one is a good matching fit to the other.

My comments all relate to small dimensional differences, of course. But it's really only when you get to commercial scale work, with thousands of repeat components, that reproducibility becomes essential. As, for example, replacing the tailstock barrel on my mid-1960's Myford Super 7 lathe in 2000. The new barrel was a perfect fit - certainly nothing less to be expected from Myford's.

Arthur Owens of Claverdon writes:

Mike Haughton's article On the Internet is interesting and I would also encourage doubters to take the plunge. Some comments.

Get a virus checker. Products from MacAfee, Sophos, Symantec or F-Prot are well regarded (I use FProt - usual disclaimer). They can be downloaded or in many cases bought on CD. Prices are not that high around £36 inclusive of VAT for the Symantec Norton AntiVirus 2003.

The Internet is not a library. In many respects it is the antithesis of a library. A library is an organised collection of material with controlled indexing and careful arrangement of its collection. Everything is set out in a logical fashion, and its operators have exercised a degree of quality control. (Well that is the theory, anyway!) The Internet is none of those things - which is why search engine results must be interpreted with care. As Mike

says - think about why someone has put content on the Internet (actually usually the Web - which is a subset of the Internet). It isn't necessarily there for altruistic reasons! Furthermore not everything is available free on the Web. Many valuable indexing and full text services are out there and password controlled - you can subscribe to them, but your friendly local University Library will be paying many thousands of pounds a year to access just a single service. You are unlikely to have access at all unless you happen to have similar funds to spare.

Not all colleges and universities will be able to allow Web/Internet access to the public, even for a fee. There is a whole minefield of copyright, contractual and other restrictions which explain this, so don't assume your local college can help. Check in advance. However, recent Government initiatives mean that more and more public libraries offer access for comparatively modest fees.

All sounds a bit negative but (this is the up bit) I used the Web a few years ago when deciding what lathe to buy. No engineer, I bought a Sherline lathe partly because of the speedy response of the British agents (Millhill Supplies - again usual disclaimer), but also because the makers clearly understand that many of their customers are like me, first time buyers and users of small machine tools. Their website is not just an advertisement. All the kit represented comes with full and helpful guidance, which makes few assumptions about previous knowledge - and at the time everyone else seemed to want to sell me something - and that was it.

I have recently been making parts for a REMAP project (lots of references to REMAP in ME and MEW) including machining plastics about which I knew nothing - searches on the Web produced quantities of helpful information. Given my job (a librarian at Coventry University) it is probable I could have found the information at work - although even then it could well have been by doing what I did in Google from home.

Finally, drawings for the same REMAP project have been transmitted to me as email attachments. Wonderfully convenient and flexible.

I could go on! I spend quite a lot of time teaching students how to use the Internet. I make no claim to infallibility, but like Mike, if anyone wants to contact me I am Arthur@arthurowens.demon.co.uk and am happy to take questions or just continue the discussion.

Mr Bernard Langley of Stoke-on Trent writes:

As Chairman of a small family engineering business I have long been a keen reader of your magazine. I do this partly because of my personal practical interests but also because yours is one of the few periodicals to deal with the sort of operations that we actually DO.

One gets the impression that most of the new generation of engineers want to sit in front of a VDU while someone else, or more probably a CNC device runs the actual operation. I think one reason why

model engineering affairs are so well attended by older engineers is that they are bored to death with their daytime occupation of form filling and box ticking and seek release in the evenings at their own lathes..

I have written to you on this topic before but I am driven to say the same thing again by your perceptive leader on p11 of the February/March issue of your admirable journal. From my own observation I would not be at all surprised if more folk attended a model engineering event than came to a "grown up" one.

Like you I am not entirely clear by what is meant by the "knowledge based economy". It seems to mean not getting your hands dirty. I realise that the service industries can contribute to the national cash flow while not "making" anything but my latest figures show that service industries made an export/import surplus of £13Bn but that manufactured goods overall lost £34Bn.

Perhaps some of the folk who are so good with their Myfords in the evenings could do a bit more for us in their day jobs to revive engineering manufacture.

Mr. G K Bartlett of Selly Oak,

Birmingham writes:

Just a couple of quickies first. Trust Ray McMahon to come up with such a simple solution to the lack of a clutch on the excellent B600 type lathe or similar. I had tried to work something out for a couple of years on and off.

Second, why do people seem to need a DTI to set work in a four jaw chuck. I am not boasting but rarely use a DTI for this purpose unless it is really critical. It takes a fraction of the time to first use ref points on the jaws or setting rings then wind a non-cutting edge of the tool a little way from the work surface and judge by eye the run out. Finally, wind the tool closer almost touching the surface and move the chuck in reverse. In fact you can usually let the tool just slightly mark the work surface. This method takes all of a couple of minutes and I have checked it many times with a DTI and not been able to improve on it. A similar method can be used for square work pieces and also for checks on straightness of grip in the chuck.

More importantly ref. Vasilii Zacharov's excellent speed control articles. He has been very careful in the wording to say treat the complete motor and control as a unit and leave as is; i.e. do not try mods unless you are versed in electronics. Please heed this if for no other reason than the lack of transformer isolation in these devices. They fall into my don't-like-to-work-on-category as I would not consider any point on the cct board safe to touch while switched on. The neutral line should be at or very close to earth potential but don't bet on it. I am not over cautious by any means and have little time for the HSE but have received my fair share of electrical shocks in my working life and didn't like any of them. My phobia about non isolation dates back to my few years in TV servicing in the 1950's and believe me TVs in those days

were horrendously dangerous to work on due to the AC/DC Live chassis construction used then.

Imagine the scenario working in domestic property probably crouched with your back against exposed gas or water pipes on a TV with more than likely a two pin mains plug and a fifty-fifty chance of a 240V live metalwork to work on, not to mention connecting earthed test gear to same. Obviously polarity was the first check but the neutral line was not necessarily truly neutral. I soon moved into professional Scientific and Instrumentation Electronic and Mechanical work and was much happier working on equipment which often had quite complex Electronic control ccts floated up at maybe 10kV or more above Earth and often had to float the test gear up with it but you didn't touch it, curtains if you did.

I also learned the first lesson with large industrial X ray equipment 400 kV or more that you never removed the EHT cables on a switched off rig without discharging the cables. The first time you discharged the cables meant you never forgot to do it in future, a great beefy spark several inches long. The cables have quite a large capacitance and hold a charge for a surprising time as the insulation has to be very good.

I have one or two pieces of workshop equipment with DC motors and home built controllers but all but one 12volt and completely isolated. The one mains powered unit is transformer isolated right up to the TRIAC and snubber components. This means that I might curse and swear if a fault appears (as I have little interest in electronics since retirement) but at least I can work on them with safety.

Peter J King of Christchurch, New Zealand writes:

With reference to the letter from Mr Bill Brading MEW 88, February/March 2003. I own or have owned various different drill sharpening jigs, only one sharpens drills as near as makes no difference exactly as per the original sharpening and down to 0.0625in. dia. This is an old "Reliance" No1 size jig that I bought new from Tyzack's shop in Bishopsgate, city of London, about 37 years ago. The "Reliance" (which was horrendously expensive) has apparently disappeared from the market and Tyzack's little 'City' shop is probably history by now. Also when the 'Reliance' is used exactly as per instructions, a very, very light cut with the grinder tends to touch evenly over the whole factory finished 'back off' surface of the drill. Thus obviously replicating the original profile. No other drill jig of my experience will do the same. I have been tempted in the past by various jigs and devices, clearly of the same type as Mr Brading has used, with multiple adjustments etc, none stood up to that standard. I wish that some manufacturer made replicas of these "Reliance" jigs, although there would be little call for the size three model that I also own (0.5 to 2in.) - it looks like it takes two men to lift it. The difference between these and the more

recent arid cheaper jigs appears to be a subtle combination of angles, with the pivot angle to the vertical and the drill trough angled to but not intersecting this

I would recommend that Mr Brading tries to get a second-hand jig of this make. All three sizes are useful and all have the same subtle design.

Mr Ian Burton of Queensland, Australia, writes:

I read with great interest the article by Vasilii Zacharov, regarding electronic speed control using washing machine components, (issue 86). I wonder if such a motor would remove the vibrations inherent in single phase motors?. I'll try it and see.

My lathe, of Taiwanese make, is 40in. between centres, and 8in. swing over saddle. It is over 10 years old, but still accurate. When purchased, the motor (approx 2hp) was D.O.L. start with forward, stop, reverse on the saddle levers. Making any quantity of parts was sure to blow the fuse in the box, (10 A) and if this was up-rated, blew the house fuse also. Even without cutting metal, the motor would cause the circuit breaker (1500w) in my multi-box to trip after 1-2 minutes. The Chinese motor, being very heavy, also took ages to stop, very annoying in a production run.

Eventually it stopped working and was replaced with an Aussie made motor, - very much better and doesn't trip the multi-box. When fitting the new motor, I did some thinking, and when the sketches were finished, had clutch start, and brake stop. I fitted an automotive air conditioner clutch on the headstock input spindle, and another driven from it, to the machine. A bit of fiddling with switches from the local auto store "Supercheap", and a cheap battery charger gives me: handle down - lathe start; handle centre - lathe coast, motor running; handle up - brake on, lathe stop.

What a difference! In the higher gears, there is just enough clutch slip for a "soft" start, same for braking. Brake is by vee belt, and "ferocity" can be controlled by adjusting belt tension. When working hard, I can stall the motor but the clutch won't slip. The machine never pops the 1500w circuit breaker, and the cheap battery charger is still going after 18 months hard (semi-commercial) use.

Thread cutting still takes some thinking about; stop lathe, withdraw tool, stop motor, wait until centrifugal start kicks in, reverse motor, start lathe, etc. I usually write myself a sequence to follow until I get in the groove. In over 36 years as a fitter/turner I have rarely found it worthwhile to disengage the feed nut when screwcutting, certainly never on metric threads. Also many modern commercial lathes reverse at 1.5 to 2 times the forward speed, just for this reason, I think.

Should others wish to pursue the air con clutch idea, one came from an Aussie 1978 Ford Fairlane, and the other from a Swedish Saab. The original cover still fits over the changewheels. Workplace Health and Safety rules.

www.chronos.ltd.uk

CHRONOS LIMITED

NEW CAT 37 OUT
NOW. PHONE FOR
YOUR FREE COPY

SEE US AT GUILDFORD JULY 19/20th

NEW!!

D13+D14 STEEL BACKPLATES



**BRITISH
MADE!**

CODE	TYPE	PRICE
D13ST	125mm D13	£52.00
D13ST200	200mm D13	£60.85
D14ST	200mm D14	£60.85

COMPLETE WITH STUDS + SCREWS!

NEW!!

D14 CAST BACKPLATE



CODE	TYPE	PRICE
D14CA	160mm D14	£28.20

COMPLETE WITH STUDS + SCREWS!

BOXFORD QUICK CHANGE TOOLPOST



CODE	PRICE
CX52B	£125.00

COMPLETE WITH
2 STANDARD
1 PARTING
& 1 BORING
HOLDER

GLANZE PROFILING TOOLS C/W 3 INSERTS!



**SPECIAL
OFFER**

CODE	SHANK	PRICE
CLP6	6mm	£16.95
CLP8	8mm	£17.95
CLP10	10mm	£19.95
CLP12	12mm	£22.95

GLANZE INDEXABLE BORING BARS



**SPECIAL
OFFER**

CODE	SHANK	PRICE
CX105	6mm	£19.95
CX106	8mm	£19.95
CX107	10mm	£19.95
CX108	12mm	£22.95
CX109	16mm	£24.95

SET OF 5 ECONOMY INDEXABLE LATHE TOOLS



CODE	SHANK	PRICE
CX113	6mm	£19.95
CX114	8mm	£19.95
CX115	10mm	£22.95
CX116	12mm	£24.95

NEW!!

BORING HEAD SET C/W TOOLS IN WOODEN BOX



INCLUDES FIVE HSS
BORING TOOLS!

CODE	TYPE	PRICE
NBH2	2MT	£75.00
NBH3	3MT	£75.00
NBHR8	R8	£75.00

NEW!!

SET OF 4 INDEXABLE BORING HEAD TOOLS



FOUR PIECE SET — IDEAL FOR ANY
STANDARD TYPE BORING HEAD
INCLUDING THE WIDELY USED 2"
HEAD COMPLETE WITH FOUR
QUALITY INSERTS

CODE	SIZE	PRICE
BH5438	3/8	£55.95
BH5412	1/2	£55.95

SET OF 7 INDEXABLE LATHE TOOLS INC PARTING TOOL



CODE	SIZE	PRICE
EA60	6mm	£32.00
EA80	8mm	£35.00

12 PC HSS MILLING CUTTER SET



INCLUDES:
6 STANDARD ENDMILLS
&
6 BALL NOSE ENDMILLS
3, 4, 6, 8, 10 & 12MM

CODE	PRICE
SOBN1	£49.95

£36.95

DUSTPROOF HALOGEN LAMP

TOTALLY ENCLOSED HEAD
KEEPS LAMP FREE FROM
DUST, COOLANT ETC, ETC



C/W TRANSFORMER !!!

CE APPROVED	CODE	PRICE
	XM200	£49.95

10 PC ANGLE BLOCK SET



For Setting and Checking Angles

CODE	PRICE
CX57A	£17.00

WAVY PARALLELS



**BACK
IN
STOCK!!**

CODE	PRICE
SO40	£39.95

£29.00

ELECTRONIC DIGITAL MICROMETER 0-25/0-1". RESOLUTION 0.001MM



**2 YEAR
GUARANTEE!!**

CODE	PRICE
MIK1	£65.00

£39.95

SET OF ADJ PARALLELS



CODE	PRICE
SO109	£32.00

£26.95



SECURE ONLINE ORDERING AT WWW.CHRONOS.LTD.UK

PRICES INCLUDE VAT & CARRIAGE (UK MAINLAND)

CHRONOS LTD UNIT 8 EXECUTIVE PK 229/231 HATFIELD RD ST ALBANS HERTS AL1 4TA

PRICES ARE CORRECT AT TIME OF GOING TO PRESS AND ARE ONLY AVAILABLE WHILE STOCKS LAST

TEL (01727) 832793 - 5 LINES FAX (01727) 848130 WEBSITE WWW.CHRONOS.LTD.UK

EMAIL SALES@CHRONOS.LTD.UK



emco Unimat 4 Lathe Machining Centre



- Swing 92mm
- Centre 200mm
- Speeds 130 - 4000rpm (Milling head optional)
- Extensive range of accessories

£299

emco Easycut Portable Bandsaw



- Variable Speed 30-90m/min
- 1kw Motor
- Cutting Capacity 85mm dia x 105mm long
- No need for coolant

£293

emco Compact 5 Machining Centre

Special Offer Millennium Limited Edition Available



- Swing 130mm
- Centre 350mm
- Motor 500w (Milling head optional)
- Made in Austria

£599

emco Unimat Basic



- Swing 110mm
- Centre 200mm
- Varispeed 20 - 2200rpm
- Made in Austria

£499

emco Compact 8E Bench Lathe

NEW

Emco Compact V8 Electronic Varispeed Lathe All German Electronics



- Swing 210mm
- Centre 450mm
- Motor 650w
- Compact V8 Lathe
- Motor 1.4 kw
- Speeds 45-2300

£1615

emco Maximat F1-P Milling Machine

NEW



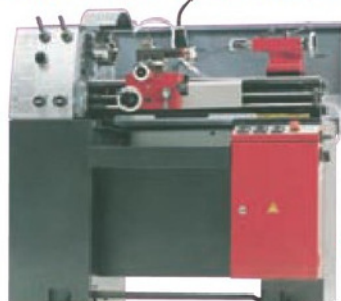
- Table 630x150mm
- 2mt Spindle
- Universal Head
- 120 kgs
- Speed 180-2300rpm
- Made in Austria

Varispeed version 100-4000 rpm

£1468

Ask about our CNC option

emco Maximat Super II CD Lathe



- Swing 280mm
- Centre 650mm
- Geared Head
- 25m or 35m Bore
- Price from £5200.00
- Made in Austria

NEW

230V version now available

emco Emcomat 17/20 Series Toolroom Lathe



- Swing 340-400mm
- Centres 700-1000mm
- Toolroom spec.
- Advanced features, eg. constant surface speed
- Price from £11,500
- Made in Austria

Machines shown with optional accessories – Prices include VAT

emco

**EXCLUSIVE IMPORTER FOR
EMCO AND WABECO
PRO Machine Tools Ltd**

17 Station Road Business Park

Barnack, Stamford, Lincolnshire PE9 3DW

Tel: (01780) 740956 – Fax: (01780) 740957

E-mail: ProMachUK@aol.com

Internet: <http://www.emcomachinetools.co.uk>



Milling Machine F1100E

- Long Travel 260mm
- Cross Travel 150mm
- Vertical Travel 330mm
- Motor 1.4kw
- Varispeed 180-3000rpm
- Drilling Capacity in steel 16mm
- Price £1489.00



Milling Machine F1200E

- Long Travel 260mm
- Cross Travel 150mm
- Vertical Travel 280mm
- Motor 1.4kw
- Varispeed 180-3000rpm
- Drilling Capacity in steel 23mm
- Price £1757.00



Milling Machine F1210E

- Long Travel 500mm
- Cross Travel 150mm
- Vertical Travel 280mm
- Motor 1.4kw
- Varispeed 180-3000rpm
- Drilling Capacity in steel 23mm
- Price £2069.00



NEW option

Ballscrews instead of standard leadscrews



CNC Milling Machine CC-F1200

- 3 axis CNC Mill with toolmaker's accuracy certificate
- Price £3610.00

NEW

High speed spindle option
100 - 7500 rpm



D2000 Series Lathes

- Swing 220mm
- Centre 350mm
- Choice of motors
- Price from £1621.00
- Stock removal 8mm in one pass



CNC option available



D3000E Lathe

- Swing 220mm
- Centres 500mm
- Motor 1.4kw
- Varispeed 45-2300rpm
- Price £2399.00

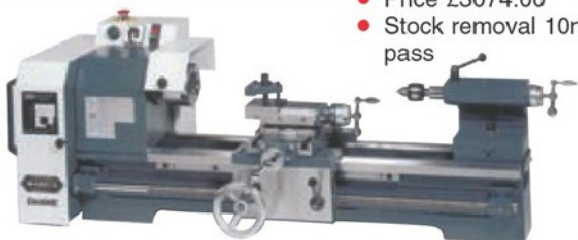


Infinitely variable automatic feed rates



D6000E Lathe

- Swing 270mm
- Centre 600mm
- Motor 1.4kw
- Varispeed 45-2300rpm
- Weight 150kg
- Price £3074.00
- Stock removal 10mm in one pass



CNC Lathe CC-D6000

- D6000E lathe with 2 axis CNC control with toolmaker's accuracy test certificate
- Price £4832.00



Prices include VAT – Machines shown with basic equipment

- Metric machines – true inch machines also available
- 5 Years Manufacturer's Warranty on all Wabeco Machines
- Manual Machines can be retrofitted with CNC add-on package
- Wide range of optional accessories
- Made in Germany



THE WELDING CENTRE

We can be found just off the A3 at Tolworth
293 Ewell Road, Surbiton
Surrey KT6 7AB

TEL: 020 8399 2449
FAX: 020 8399 2448
E-mail: sales@wilstar.co.uk
Web address: <http://www.wilstar.co.uk>

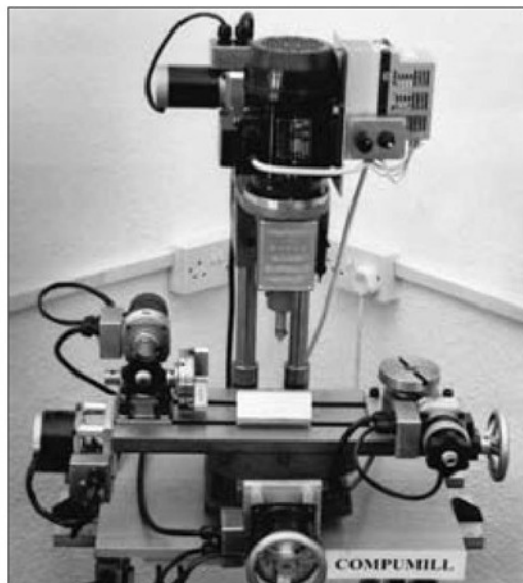
Visit our web site: www.wilstar.co.uk Secure online shopping

TURBO SET GAS BRAZING/ WELDING KIT ONLY £89.95 £105.95	OXY ACETYLENE GAS WELDING KIT Cylinders not included WELDING ONLY £179.95 £211.44 WELDING & CUTTING £219.95 £258.44	
INVERTER ARC/TIG (240v) CEBORA 1365 WELDER 10-135 amps ARC ONLY £359.95 £422.95 ADD TIG KIT EXTRAS £149.95 £176.95 Weight 7.3kg	PILOT 161 150 AMP A/C D/C TIG WELDER 240 VOLT Welds aluminium, stainless steels, mild steels, etc. Torch has current regulator in the handle Push +90 £1495.95 £1756.95	LINCOLN ELECTRIC V140-S INVERTER (240v) (5-140 amps) 2 YEAR WARRANTY Weight 6kg £379.95 £446.95
DC TIG WELDER (INVERTER) (240/110v) WITH BUILT-IN H.F. - DIGITAL DISPLAY (5-160amp) LIST £1349.95 OUR PRICE £899.95 £1057.44 CEBORA 1665 DC HF Weight 11kg DEMO ✓	AC & DC TIG WELDER (INVERTER) (240v) WITH BUILT-IN H.F. (7-160amp) LIST £1945.00 OUR PRICE £1595.00 £1874.13 CEBORA 1835m Weight 10kg DEMO ✓	
ELECTRONIC WELDING HELMETS		
PRO-MASK SHADES 9-12 £99.95 £117.44 Batteries included ARC/MIG & TIG ✓	EYETEC SHADES 10-11 £89.95 £105.95 Solar powered ARC ✓	EYETEC SHADES 10-11 £139.95 £164.44 Solar powered ARC/MIG & TIG ✓
EYETEC SHADES 5-13 £189.95 £223.19 Solar powered Top of the range GRINDING/ARC/MIG & TIG ✓		

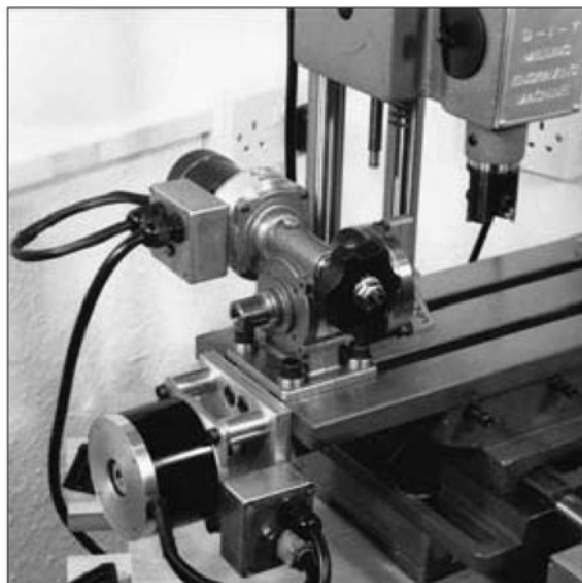
**Have you
seen our
Sister
Magazine,
Model
Engineer
Yet!!!!**

Compumill

fully described in machine building manual



Adapted for CNC



Showing light D.I.Y. dividing head & motor mounting

Tel: (02476) 473851 Email: compucutters@compuserve.com Web: www.compucutters.com

For info pack send SAE to:

Compucut, 17 Lime Tree Avenue, Tile Hill, Coventry CV4 9EY England

G.L.R. DISTRIBUTORS METAL PACKS

SAVE 15% OFF THE CATALOGUE PRICE WITH OUR BUDGET PACKS OF MATERIALS - 2 FEET EACH OF THE SIZES QUOTED BELOW



CARRIER AND PACKING RATES

Up to 1 Kilo - 1st Class Post Up to 2 Kilos - £5.50 Up to 4 Kilos - £5.95 Up to 6 Kilos - £6.50
Up to 8 Kilos - £7.50 Up to 10 Kilos - £8.50 Up to 30 Kilos - £9.50 Over 30 Kilos - At cost

CREDIT CARDS WELCOME - HEAVY PARCELS REQUIRING A WOODEN BOX - ADDITIONAL £3.00

B.M.S. FLATS

AO	1/16 x 1/4 - 3/8 - 1/2 - 5/8 - 3/4	08.30
	1 - 2 - 3 + 3/32 x 3/4, 1.	
A1	1/4 x 3/8 - 1/2 - 5/8 - 3/4 - 1.	05.60
A2	3/16 x 3/8 - 1/2 - 5/8 - 3/4 - 7/8 - 1.	06.90
A3	1/4 x 3/8 - 1/2 - 5/8 - 3/4 - 7/8 - 1.	09.55
A4	5/16 x 1/2 - 3/4 - 1 - 1.1/2.	11.70
A5	3/8 x 1/2 - 3/4 - 1 - 1.1/2.	12.35
A7	1/2 x 3/4 - 1 - 1.1/4 - 1.1/2.	18.00

B.M.S. ROUNDS

B1	1/8 - 5/32 - 3/16 - 7/32 - 1/4 - 5/16 - 3/8.	03.90
B2	1/4 - 5/16 - 3/8 - 7/16 - 1/2 - 9/16 - 5/8.	08.40
B3	5/8 - 3/4 - 7/8 - 1.	13.85
B4	5/32 - 1/4 - 5/16 - 3/8 - 1/2 - 5/8 - 3/4. PGMS	16.80
B5	3/8 - 1/2 - 5/8 - 3/4 - 7/8 - 1. EN8M	18.65

B.M.S. HEXAGONS

C1	5/32 - 3/16 - 7/32 - 1/4 - 9/32 - 5/16 - 3/8.	04.80
C2	1/4 - 9/32 - 5/16 - 3/8 - 7/16 - 1/2 - 5/8.	09.20

B.M.S. SQUARES

D1	5/32 - 3/16 - 1/4 - 5/16 - 3/8.	04.10
D2	7/16 - 1/2 - 5/8 - 3/4.	09.20

BRASS ROUNDS

E1	1/8 - 3/16 - 1/4 - 5/16 - 3/8 - 1/2.	11.10
E2	1/16 - 3/32 - 5/32 - 7/32 - 9/32 - 7/16 - 9/16 - 5/8.16.85	

BRASS SQUARES

F1	1/8 - 3/16 - 1/4 - 5/16 - 3/8.	09.45
F2	1/4 - 5/16 - 3/8 - 7/16 - 1	19.25

BRASS HEXAGONS

G1	5/32 - 3/16 - 7/32 - 1/4 - 9/32 - 5/16	07.80
G2	1/4 - 9/32 - 5/16 - 3/8 - 7/16 - 1/2 - 5/8	21.95

SILVER STEEL ROUND 13" Long

S1	3/32" - 1/8" - 5/32" - 3/16" - 7/32"	
	1/4" - 9/32" - 5/16" - 3/8" - 7/16" - 1/2"	16.20

BRASS ANGLE

H1	1/4 x 1/4 x 1/16 - 5/16 x 5/16 x 1/16	08.60
	3/8 x 3/8 x 1/16 - 1/2 x 1/2 x 1/16	
H2	5/16 x 5/16 x 1/16 - 3/8 x 3/8 x 1/16	
	1/2 x 1/2 x 1/8 - 3/4 x 3/4 x 1/8	14.70

DRAWN STEEL ANGLE

H3	16mm x 16mm x 3mm - 20mm x 20mm x 3mm	11.30
	25mm x 25mm x 3mm	

SEAMLESS COPPER TUBE

J1	1/16 x 28g - 3/32 x 28g - 1/8 x 24g - 5/32 x 24g	05.06
J2	3/16 x 22g - 1/4 x 20g - 5/16 x 20g	04.75

STAINLESS STEEL ROUND 303 F/C

K1	3/32 - 1/8 - 5/32 - 3/16 - 7/32 - 1/4.	08.00
K2	3/16 - 7/32 - 1/4 - 5/16 - 3/8 - 7/16 - 1/2.	20.85

BA STAINLESS STEEL HEXAGON 303 F/C

L1	.152" - .193" - .220" - .248" - .275" - .324".	14.45
----	--	-------

BA BRASS HEXAGON

M1	.152" - .193" - .220" - .248" - .282" - .324".	08.60
----	--	-------

BA STEEL HEXAGON

M2	.152" - .193" - .220" - .248" - .282" - .324".	04.10
----	--	-------

BRASS FLAT SECTION

N1	1/16 x 1/4 - 3/8 - 1/2 - 3/4 - 1	08.60
N3	1/8 x 1/4 - 3/8 - 1/2 - 3/4 - 1	14.75
N4	3/16 x 1/4 - 3/8 - 1/2 - 3/4 - 1	20.65
N5	1/4 x 3/8 - 1/2 - 3/4 - 1	23.50

ALUMINIUM ROUND F/C

P1	3/16 - 1/4 - 5/16 - 3/8 - 7/16 - 1/2	09.35
P2	5/8 - 3/4 - 1	16.00

PHOSPHOR BRONZE ROUND

Q1	1/8 - 5/32 - 3/16 - 1/4	09.00
Q2	5/16 - 3/8 - 7/16	22.85

SILVER STEEL ROUND 13" Long

S2	3mm - 4mm - 5mm - 6mm - 7mm	
	8mm - 9mm - 10mm - 12mm	14.18

G.L.R. DISTRIBUTORS LTD. UNIT C1, GEDDINGS RD. HODDESDON, HERTS. EN11 0NT

Website - www.glrmodelsupplies.com

Tel. 01992 470098 Fax. 01992 468700

E-Mail. Petegrl@btopenworld.com

Send six 1st class stamps for Catalogue. Hardback or CD

Established
1959

TRACY TOOLS LTD.

2 MAYOR'S AVENUE, DARTMOUTH, SOUTH DEVON TQ6 9NF

Telephone: (01803) 833134 • Fax: (01803) 834588 Credit Card Hotline: 01803 839500 (minimum £10)

Eng. Inst.
Assoc.

ALWAYS AVAILABLE

SET No.

1. MODEL ENG TAPS & DIES SET (2 Taps each size)	(TAPPING DRILL SET £5)	TAPS £18 LOT DIES £18 LOT
1/8" x 40, 5/16" x 40, 3/8" x 40, 1/2" x 40, 5/8" x 40, 3/4" x 40, 7/8" x 40, 1" x 40		
2. "SPECIAL" MODEL ENG TAPS & DIES (2 Taps each size)	(TAPPING DRILL SET £8)	TAPS £22 LOT DIES £22 LOT
1/4" x 32, 5/16" x 40, 3/8" x 40, 1/2" x 40, 5/8" x 40, 3/4" x 40, 7/8" x 40, 1" x 40		
3. BA TAP SET (2 Taps each size), & B A DIE SET	(TAPPING DRILL SET £5)	TAPS £18 LOT DIES £20 LOT
0-1-2-3-4-5-6-7-8-9-10 BA		
4. 26 TPI TAP SET (2 Taps each size), & 26 TPI DIE SET, (Cycle or Brass Thread)	(TAPPING DRILL SET £5)	TAPS £18 LOT DIES £18 LOT
1/4" x 26, 5/16" x 26, 3/8" x 26, 1/2" x 26, 5/8" x 26, 3/4" x 26, 7/8" x 26, 1" x 26		
5. BSF TAP SET (2 Taps each size), & BSF DIE SET	(TAPPING DRILL SET £5)	TAPS £18 LOT DIES £18 LOT
1/8", 1/4", 3/8", 1/2", 5/8", 3/4", 7/8", 1"		
6. BSF TAP SET (2 Taps each size) & BSW DIE SET	(TAPPING DRILL SET £5)	TAPS £18 LOT DIES £18 LOT
1/8", 1/4", 3/8", 1/2", 5/8", 3/4", 7/8", 1"		
7. BSW TAP SET (2 Taps each size) & BSW DIE SET	(TAPPING DRILL SET £5)	TAPS £20 LOT DIES £20 LOT
1/8", 1/4", 3/8", 1/2", 5/8", 3/4", 7/8", 1"		
8. BSW TAP SET (2 Taps each size) & BSW DIE SET	(TAPPING DRILL SET £5)	TAPS £18 LOT DIES £18 LOT
1/8", 1/4", 3/8", 1/2", 5/8", 3/4", 7/8", 1"		
9. METRIC COARSE TAP SET (2 Taps each size) & METRIC DIE SET	(TAPPING DRILL SET £8)	TAPS £20 LOT DIES £20 LOT
2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 12.0mm		
10. METRIC COARSE TAP SET (2 Taps each size) & METRIC DIE SET		TAPS £25 LOT DIES £25 LOT
14.0, 16.0, 18.0, 20.0, 22.0, 24.0mm		
11. UNF OR UNC TAP SET & DIE SET:		TAPS £15 LOT DIES £18 LOT
(No. 0 to 12 UNF) OR (No. 1 - 12 UNC)		
12. UNF (OR UNC) TAP SET (2 Taps each size) & UNF (OR UNC) DIE SET	(TAPPING DRILL SET £5)	TAPS £18 LOT DIES £18 LOT
1/8", 1/4", 3/8", 1/2", 5/8", 3/4", 7/8", 1"		
13. UNF (OR UNC) TAP SET (2 Taps each size) & UNF (OR UNC) DIE SET		TAPS £18 LOT DIES £18 LOT
1/8", 1/4", 3/8", 1/2", 5/8", 3/4", 7/8", 1"		
14. GAS PIPE SET (BSP) (1 Tap each size) 1/8", 1/4", 3/8", 1/2", 5/8", 3/4"		TAPS £15 LOT / DIES £20 LOT
15. HIGH SPEED BA TAP SET (USA made) (2 Taps each size 0 - 8 BA)		TAPS £20 ALSO DIES £30
16. 6" LONG HS DRILLS (10 Various sizes between 1/16" - 3/16") SET £6		UP TO 10" LONG SET £12
17. METRIC FINE PITCH 10 Sizes from 3 to 12mm (1 Tap each size)		TAPS £18 DIES £25 TAPS £18 DIES £25
TAP SETS 6 Sizes from 14 to 24 mm (1 Tap each size)		
18. SOCKET REAMERS - 0-1-2 M/T		£18 Each 3 M/T @ £22 Each
19. D-BIT SET - 1/16", 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", (HS)		SET £25
20. COUNTERBORE SET - 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", (Or Metric)		SET £30
21. STR SHANK REAMER SET - 1/16", 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", (Equivalent in Metric)		SET £30
22. CENTRE DRILL SET - 1/16", 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", (H.S.S.)		SET £5
23. SLITTING SAW SET Fine Teeth (3 pieces) from 1/16" - 1/4"	(2" Dia. @ £5 SET)	(3" Dia. @ £6 SET)
24. ENDMILL SET (Threaded Shank) - 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", H.S.S. (Slot Drills Available)		SET £20
25. ENDMILL SET (Threaded Shank) - 3, 4, 5, 6, 7, 8, 10, 12 mm (Slot Drills Available)		SET £20
26. ENDMILL SET (Threaded Shank) - 12, 14, 16, 18, 20, 25 mm (Slot Drills Available)		SET £30

FOR UNITHREAD
TAPS & INSERTS
Call 01803 559595

Also: Selection of Dovetail, Woodruffe, Ballnose, Concave, Spottfacer, Broaches, Knurrs, Carbide Centres, Cycle Taps & Dies, Boring Bars, Left Hand Tap & Dies, Milling Cutters, Reamers, Countersinks, Gear Cutters, Slitting Saws, Acme Taps, Diehead Chasers, Socket Reamers. These are available between 50% & 75% off list price
Open: Monday to Friday 8am to 4pm - Sat to Noon Despatch by return. Overseas P&P P.O.A. Send for new complete Catalogue (Stamp Please)

BRITISH
WARRIOR
BRAND

THE ESSENTIAL WORKSHOP LIBRARY

from NEXUS SPECIAL INTERESTS BOOKS

MODEL ENGINEERING BOOKS

Building Simple Model Steam Engines

Tubal Cain

This book shows how to build four model steam engines and features designs and plans that even a beginner will be able to follow.

1993 1-85486-104-2 210x148mm
112 pages Illustrated paperback £4.95

Building Simple Model Steam Engines II

Tubal Cain

More projects ranging from a delightful little turbine to a larger engine in the style of the magnificent 'Steam Engines of the Highest Class' offered by toymakers before WW1. Fully detailed methods of construction with the beginner in mind.

1997 1-85486-147-6 210x148mm
112 pages Illustrated paperback £5.95

Model Engineering - A Foundation Course

Peter Wright

A new book by an experienced model engineer covering all the basic techniques: understanding engineering drawings, buying materials, marking out, sawing, filing, bending and forming metals.

1997 1-85486-152-2 236x189mm
416 pages Illustrated paperback £16.95

Model Engineers Handbook

Tubal Cain

This third edition comprises a compilation of tables, facts, procedures and data that the author has found invaluable in his model engineering activities. It provides a real mine of information to which you will return again and again.

1996 3rd Edition 1-85486-134-4 210x148mm
240 pages Illustrated paperback £9.95

The Model Locomotive from Scratch

B. Terry Aspin

Based on a series of articles by Chuck, the pseudonym used by the author for a series of articles published in Model Engineer. All the text and illustrations have been specially prepared by the author for this book.

1998 1-85486-165-4 189x214mm
96 pages Illustrated paperback £10.95

Introducing Model Traction Engine Construction

John Haining

This book discusses types in a brief history, choice of model, workshop processes and the tools needed for every stage of construction. Profusely illustrated and full of interesting and useful information.

1983 0-85242-805-7 210x148mm
112 pages Illustrated paperback £6.95

The Countryman's Steam Manual

John Haining

First published in 1982, this new and enlarged edition covers the design, construction and care of steel boilers in general, with formulae and data used by firms of repute. Designs of three vertical boilers are included - the Sentinel, the Caradoc and a 3-inch scale version.

1996 1-85486-136-0 210x148mm
96 pages Illustrated paperback £5.95

An Introduction to Robotics

Harprit Sandhu

An introduction for the amateur to the ideas and concepts of robotics, a discipline that will eventually radically change the way we work. The first part explains how and why robots work and are controlled, while the second part shows you how to make a simple two-legged humanoid robot that can be programmed to walk from a personal computer.

1997 1-85486-153-0 236x189mm
208 pages Illustrated paperback £9.95

The Amateur's Workshop

Ian Bradley

All model engineers are occasionally faced with an operation outside their usual experience, with more than 430 line and photographic illustrations, this book is a comprehensive reference book providing information on setting up a workshop and the use of various machines and tools.

1995 1-85486-130-1 210x148mm
256 pages Illustrated paperback £8.95

The Amateur's Lathe

L.H. Sparey

Virtually the standard work on small (3-1/2 inch) lathe work since its original publication in 1948.

1972 0-85242-288-1 216x138mm
224 pages Illustrated paperback £8.95

WORKSHOP PRACTICE SERIES

Hardening, Tempering & Heat Treatment

Tubal Cain

WPS 1

A comprehensive exposition of the structure of steels and the effects of different heat treatments, particularly in respect of tools. With accurate colour temperature charts.

1984 0-85242-837-5 210x148mm
128 pages Illustrated paperback + 4 pages of colour plates £6.95

Vertical Milling in the Home Workshop

Arnold Throp

WPS 2

Small workshops, including those of model engineers, are making increasing use of small vertical milling machines. This book explains how to use them (and lathe milling attachments) in clear terms.

1984 0-85242-843-X 210x148mm
96 pages Illustrated paperback £6.95

Screwcutting in the Lathe

Martin Cleeve

WPS 3

A fully comprehensive survey of the use of a lathe for all forms of screwcutting in all thread forms, imperial and metric.

1984 0-85242-838-3 210x148mm
176 pages Illustrated paperback £6.95

Foundrywork for the Amateur

B. Terry Aspin

WPS 4

This book is regarded as the perfect introduction to casting work in common metals. This new edition, brings everything right up to date.

1998 1-85486-168-9 210x148mm
112 pages Illustrated paperback £6.95

Milling Operations in the Lathe

Tubal Cain

WPS 5

This book by Tubal Cain, who needs no introduction to Model Engineer readers, is a thorough and practical discourse on how to use the lathe for all types of milling work.

1984 0-85242-840-5 210x148mm
128 pages Illustrated paperback £6.95

Measuring & Marking Metals

Ivan Law

WPS 6

Model engineers and many small workshops do not need, or have access to, much of the sophisticated measuring equipment used in industry. Accurate marking out and measurement by more basic means at all stages of work are comprehensively described.

1985 0-85242-841-3 210x148mm
112 pages Illustrated paperback £6.95

The Art of Welding

W.A. Vause

WPS 7

This book sets out the basic techniques for oxyacetylene welding, brazing, flame cutting and electric arc welding with mild steel, cast iron, stainless steel, copper, brass etc. in sheet, plate or cast form.

1985 0-85242-846-4 210x148mm
96 pages Illustrated paperback £6.25

Sheet Metal Work

R.E. Wakeford

WPS 8

The author is an instructor in metal work and allied crafts and describes clearly all the processes likely to be encountered by the hobbyist in a model or light engineering workshop.

1985 0-85242-849-9 210x148mm
152 pages Illustrated paperback £6.95

Soldering & Brazing

Tubal Cain

WPS 9

Joining metal by one form or another of soft and hard soldering, or brazing with various alloys, are run-of-the-mill jobs in model and light engineering workshops.

1985 0-85242-845-6 210x148mm
136 pages Illustrated paperback £6.95

Saws & Sawing

Ian Bradley

WPS 10

This book examines all types of saw, hand and machine, their use, maintenance and useful tables relating to various applications.

1986 0-85242-887-1 210x148mm
96 pages Illustrated paperback £5.95

Electroplating

J. Poyner

WPS 11

This title will be of value to model engineers and small workshops wishing to plate with any of the customary metals using simple equipment.

1987 0-85242-862-6 210x148mm
64 pages Illustrated paperback £6.25

Drills, Taps & Dies

Tubal Cain

WPS 12

In this book, Tubal Cain discusses drills and drilled holes and threading with taps and dies, primarily by hand. Imperial and metric sizes plus conversions are included together with all standard thread gauges.

1987 0-85242-866-9 210x148mm
104 pages Illustrated paperback £6.95

Making Small Workshop Tools

Stan Bray

WPS 14

Making 14 simple but useful adjuncts to the tool kit for bench and lathe use, taking no more than 3 to 4 hours or involving special materials, yet each able to save considerable time in use as well as aiding accuracy.

1987 0-85242-886-3 210x148mm
97 pages Illustrated paperback £6.95

Workholding in the Lathe

Tubal Cain

WPS 15

Tubal Cain discusses all the practical aspects of the subject, with many photographs to illustrate specific points.

1986 0-85242-908-8 210x148mm
112 pages Illustrated paperback £6.95

Electric Motors

Jim Cox

WPS 16

Principles, characteristics, operation, installation, speed control, braking etc. plus generators, safety, testing and a useful section on identifying and applying scrap motors.

1987 0-85242-914-2 210x148mm
136 pages Illustrated paperback £6.95

Gears & Gear Cutting

Ivan Law

WPS 17

Explanations and reasons for all conventional types of gears are clearly set out in this book together with useful tables and machinery techniques to form an invaluable reference work for anyone dealing with machinery.

1987 0-85242-911-8 210x148mm
136 pages Illustrated paperback £6.95

Basic Benchwork

Les Oldridge

WPS 18

This title details normal bench practice suitable for engineering apprentices. By avoiding broken tools and spoiled work, this book will save its cost many times over.

1988 0-85242-920-7 210x148mm
128 pages Illustrated paperback £6.95

Spring Design & Manufacture

Tubal Cain

WPS 19

Every type of spring and all the necessary calculations are clearly explained as well as materials and methods.

1988 0-85242-925-8 210x148mm
96 pages Illustrated paperback £6.95

Metalwork & Machining Hints & Tips

Ian Bradley

WPS 20

A workshop information pot-pourri combining useful advice and instruction for beginners, with explanations of tools and techniques often familiar in name but not always found described in detail.

1988 0-85242-947-9 210x148mm
96 pages Illustrated paperback £6.95

Adhesives & Sealants

David Lammis

WPS 21

David Lammis covers traditional adhesives, their advantages and shortcomings as well as synthetic products.

1991 1-85486-048-8 210x148mm
144 pages Illustrated paperback £6.95

Workshop Electrics

Alex Weiss

WPS 22

This book deals with electricity in the garage or home workshop and includes everything from fitting a 13 Amp plug to wiring up a new workshop building.

1984 1-85486-107-7 210x148mm
128 pages Illustrated paperback £6.95

Workshop Construction

Jim Forrest & Peter Jennings

WPS 23

This book contains the details for building the floor assembly, walls and roof and covers the peripheral areas including layout, planning regulations, tools, materials, security and insurance.

1995 1-85486-131-X 210x148mm
144 pages Illustrated paperback £6.95

Electric Motors in the Home Workshop

Jim Cox

WPS 24

Detailed advice is given on how to identify and make good use of discarded and surplus motors from both domestic and industrial sources and also how to operate three phase motors from single phase supplies.

1996 1-85486-133-6 210x148mm
144 pages Illustrated paperback £6.95

The Backyard Foundry

B. Terry Aspin

WPS 25

This book covers basic principles, materials and techniques, pattern-making, moulding boxes, cores and core boxes, metals, electric, gas and coke furnaces.

1997 1-85486-146-8 210x148mm
104 pages Illustrated paperback £6.50

Home Workshop Hints & Tips

Edited by Vic Smeed

WPS 26

A selection of useful hints and tips culled from a wide time-scale of the Model Engineer magazine as relevant today as when they were first printed.

1997 1-85486-145-X 210x148mm
128 pages Illustrated paperback £5.50

Spindles

Harprit Sandhu

WPS 27

Spindles describes the design construction and use of a variety of spindles that will be of interest to the amateur engineer and clockmakers.

1997 1-85486-149-2 210x148mm
160 pages Illustrated paperback £6.95

Simple Workshop Devices

Tubal Cain

WPS 28

This is an updated edition of a previously published title, now an essential addition to any model engineer's library.

1998 1-85486-150-6 210x148mm
144 pages Illustrated paperback £6.95

CAD for Model Engineers

D.A.G. Brown

WPS 29

Derek Brown shows how by taking one step at a time the computer can soon be turned into a versatile drawing tool with many advantages over traditional drawing methods.

1999 1-85486-189-1 210x148mm
128 pages Illustrated paperback £6.95

Workshop Materials

Alex Weiss

WPS 30

This book describes the many and varied materials used by model engineers in their workshops.

1999 1-85486-192-1 210x148mm
192 pages Illustrated paperback £6.95

Useful Workshop Tools

Stan Bray

WPS 31

This practical collection covers benchwork, the lathe and milling operations, and includes: marking-out and machining aids.

2000 1-85486-194-8 210 x 148 mm
104 pages; Illustrated Paperback £ 6.95

Unimat III Lathe Accessories

Bob Loader

WPS 32

This author has become an acknowledged authority on the popular Unimat mini-lathe, developing numerous accessories and techniques to assist the model engineer in getting the best from the machine.

2001 1-85486-213-8 210 x 148 mm
160 pages Illustrated Paperback £ 6.95

Making Clocks

Stan Bray

WPS 33

This book explains the terminology of the clockmaker and provides general details of clock construction including layout of wheels and escapements.

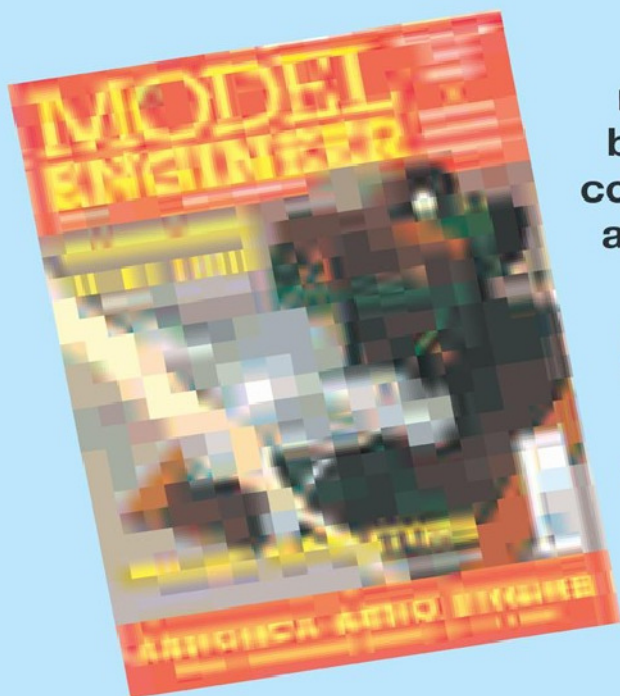
2001 1-85486-214-6 210 x 148 mm
128 pages Illustrated Paperback £ 6.95

Please add £1 p&p for single book orders and 50p for each additional book ordered.

Send payment with your name, address and telephone number to:
Nexus Customer Services, Nexus House, Azalea Drive, Swanley BR8 8HU.
Cheques made payable to Nexus Media Ltd. or phone 01322 616300

SAVE £££'S WITH A SUBSCRIPTION

20% Discount on Model Engineer Model Engineers' Workshop



The best resource for modelling in metal with both magazines offering comprehensive knowledge and advice on a range of subjects. They are a perfect compliment to the serious enthusiast with a home engineering workshop and an interest in the engineering hobby.



Subscribe or renew today by completing your details on the form or phone the credit card hotline now on 01353 654422 quoting

- ☐ Yes I want to subscribe to **Model Engineer** for 1 year.
Please start my subscription with the next available issue.
- ☐ Yes I want to subscribe to **Model Engineers' Workshop** for 1 year.
Please start my subscription with the next available issue.

Is this a subscription renewal? ☐ Yes ☐ No

MODEL ENGINEER (26 issues)

20% Discount

One Year Subscription	UK	£58.00	£46.00
	Europe	£73.00	£58.00
	USA Airmail	\$121.00	\$96.50
	ROW Airmail	£79.00	£63.00

MODEL ENGINEERS WORKSHOP (8 issues)

One Year Subscription	UK	£27.00	£21.50
	Europe	£32.50	£26.00
	USA Airmail	\$53.00	\$42.00
	ROW Airmail	£35.00	£28.00

I enclose a cheque for £..... made payable to Nexus Media Ltd

Please charge my credit card for £.....

☐ Visa ☐ Amex ☐ Mastercard

Cardholder's Name

Card Number

Expiry date..... Signature.....

YOUR DETAILS

Title First name

Surname/Family name

Address

.....

.....

.....

Post/Zip code

Country.....

Telephone

Email

PLEASE RETURN YOUR COMPLETED COUPON TO:

Nexus Media Subscriptions, Link House, 8 Bartholomew
Ely, Cambs CB7 4ZD

Tel 01353 654422 Fax 01353 654400

e-mail nexus.subs@highbury-wyvern.co.uk

US/CANADIAN SUBSCRIBERS PLEASE RETURN YOUR COMPLETED COUPON TO:

Wiseowl Worldwide Publications, 5150 Candlewood St,
Suite No. 1, Lakewood, CA 90712-1900 USA

Tel 562-461-7574 Fax 562-461-7212 e-mail info@wiseowlm

This offer closes 31 May 2003

☐ Please tick this box if you do not wish to receive any further information from Highbury House Communications Plc

☐ Please tick this box if you do not wish to receive any further information from 3rd party companies carefully selected by us

MODEL ENGINEERS' WORKSHOP



CLASSIFIED Advertisements



Send to Model Engineers' Workshop Classified Department, Nexus Special Interests, Nexus House, Azalea Drive, Swanley, Kent BR8 8HU. Tel: 01322 660070. Fax: 01322 616319
All Advertisements will be inserted in the first available issue. There are no reimbursements for cancellations.
All advertisements must be pre-paid.
The Business Advertisements (Disclosure) Order 1977 - Requires all advertisements by people who sell goods in the course of business to make that fact clear. Consequently all trade ads in Model Engineers' Workshop carry this 'T' symbol

WORKSHOP EQUIPMENT

TRUE PHASE CONVERTERS

ESTABLISHED FOR 60 YEARS

- RUN THREE PHASE MACHINES FROM A SINGLE PHASE SUPPLY
- REVOLUTIONARY DESIGN
- OUT PERFORMS OTHER CONVERTORS
- MONEY BACK GUARANTEE



DANEbury ELECTRIC LTD
PHONE, FAX OR EMAIL FOR COLOUR BROCHURE
email: truephasesales@daneburyelectric.co.uk
Web: www.daneburyelectric.co.uk

Tel: 01202 524888 or Fax: 01202 530940

THE PEATOL LATHE



£160 including 3 or 4 jaw chuck. Milling attachment and other accessories available.
Centre height 2 1/4" distance between centres 9 1/2".
Full details send 2 x 2nd class stamps. Price inc. VAT
Peatol Machine Tools, M.E.W., 19 Knightlow Road, Harborne, Birmingham B17 8PS Tel: 0121 429 1015
www.peatol.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 (UK) Ltd (Nottingham).

Tel 0115 9255944 Fax 0115 9430858

TOOLCO

The home of good quality used tools and machinery

www.toolco.co.uk

or send for full itemised stocklist.

Unit 4, Ebley Ind Park. Ebley, Stroud, Glos GL5 4SP

Important: Phone for opening times before travelling.
(Just 4 miles J13 M5 Motorway) Tel: 01452 770550
E-Mail: sales@toolco.co.uk Fax: 01452 770771

Operate three phase machinery from your single phase supply system.

Transwave
CONVERTERS

www.powercapacitors.co.uk

Power Capacitors Limited

30 Redfern Road, Tyseley, Birmingham B11 2BH
Tel: 0121 708 2811/0121 708 4522 - Fax: 0121 765 4054
E-Mail: transwave@powercapacitors.co.uk

TOOLS PURCHASED - hand tools & machinery whole or part collections - old and modern. Will call. Tel: Alan Bryson, Taunton (01823) 288135.

WE BUY, SELL & EXCHANGE

TOOLS, MACHINERY, MATERIALS, PART BUILT LOCOS, MODELS ETC.

WORKSHOP TOOLS, MACHINES, MODELS WANTED - WE COLLECT & PAY CASH

M.E. SALE & EXCHANGE

Compass House, High St., Rotherfield, Sussex.
Phone (01892-85) 2968
Long S.A.E. for List

2 off Adcock Shipley IES Millers good for parts or repair **£100.00 each or £150 for the pair.** Norton 18" x 6" hydraulic surface grinder **£450.00.** Nicholas Horizontal Miller top condition 8" x 20" table **£350.00.** Small tool and cutter grinder floor mounted **£250.00.** Jones and Shipmen 540 18" x 6" surface grinder stripped down for repair **£300.00 plus lots of collets for auto etc thread chases for die heads, large dividing head £80.00, large rotary table £85.00**

MANY OTHER PARTS ring or make an offer 0121 386 3622

ENGINEERS TOOL ROOM

The tool supplier for Professional & Model Engineers

CUTTING TOOLS: HSS - COBALT - COATED

Drills: Metric, Fractional, Jobbers, Long Series, Boxed Sets

Reaming: Metric, Fractional Hand and Machine.

Threading: Taps, Straight Flute, Spiral Flute, Boxed Sets, Metric, Imperial, Unified, BA.

Dies: Split Dies, Solid Dies, Die Nuts, Metric, Imperial, Unified, BA.

Milling: End Mills, Slot Drills Plain and Screw Shank, Horizontal Cutters, Slitting Saws, Collets.

Turning: HSS Tool Bits, Tungsten Carbide Tipped Turning Tools, Insert Tools, Collets.

Measuring: Micrometers, Verniers, Dividers, Callipers, Setting up Tools

Workshop Machinery: Lathes, Milling Machines, Pillar Drills, Band Saws

Machining Services: full machining service available, turning, milling, grinding, wire and spark eroding, tool and mould making

"New" Tool Catalogue available FREE - Send for one today

CHECK OUT OUR SPECIFICATIONS & PRICES BEFORE ORDERING YOUR MACHINES - Contact us for a Quotation

Part Exchange on some machine tools welcomed
Part: 01443 777167 Fax: 01443 773347 Mobile 07770 988840

Web Site: www.engineerstoollroom.co.uk
Email: regpugh@aol.com

262 PARK ROAD, CWMPARC, TREORCHY, MID GLAMORGAN CF42 6LE

QUICK CHANGE TOOLPOST c/w 3 toolholders, takes 12mm shank tools. Suitable for ML7 or similar lathes £30. Tel: 01555 751740 (Lanarkshire).

SIEMENS 1.5HP VARIABLE SPEED INVERTER single to three phase, little used £150 ono. Tel: 0161 794 6505 (Manchester).

PRIVATE SALE 10" Regal lathe with accessories, ready to run, ideal modelling lathe, offers around £750.00 Tel: 01293 428033 (Surrey).

COLCHESTER BANTAM 5 1/2" x 23", single phase, power feeds, gearbox, 3 & 4 jaw, faceplate, steady, 4 way t/post, excellent order, £975. Tel: 0117 9625409 (Bristol).

ELEVEN BOXES No 1 3/16 thick belt hooks £7.50 each. Four 0-4 belt lacers £15 each. Tel: 01202 744168 (Dorset).

TRIPAN TOOLPOST with interchangeable tool holders for sale. £100 set of 8. Tel: 01803 770435 (Devon).

WANTED fixed steady for a Smart & Brown model A lathe, in good order. Tel: 01223 891655 (Cams).

MYFORD ML10 including two 3 jaw chucks, 4 jaw, faceplate, vertical slide, steadys, change gears, many extras, handbook £950.00. Tel: 0115 978 0663 or mobile 07989 510749 (Notts).

MYFORD ML7 LATHE including 4 jaw chuck, faceplate, vertical slide and variable speed control, vgc £850. Tel: 01255 240047 or 01206 760049 (Essex).

MYFORD SUPER SEVEN LATHE 7"x20", many expensive accessories, non commercial use, fine condition. Tel: 0207 2237289 or 07803 669677 (London).

DORMER FASTLOCK CHUCK 3MT, new £120. Myford Posilock chuck R8 Imp/Met collets, new £100. Tel: 01935 824936 (Somerset).

VINTAGE LATHE ON STAND 3 jaw, 4 jaw, chuck, faceplate, vertical milling attachment £200 ono. Tel: 01932 225530 (Surrey).

PHASE CONVERTER Up to 7 1/2 HP 415V from 240V, like new, can be seen working £325 ono. Tel: 020 7266 0123 (London).

THREE PHASE CONVERTER as new, 4HP, very little used £270 ono. Tel: 01435 872222 (East Sussex).

ML7/S7 WOODEN CABINET STAND professionally made, very strong & rigid, drip tray & raising blocks £60. Tel: 07768 316633 (E Yorks).

PHASE CONVERTERS 2HP TO 50HP

A Top Quality Range of Static and Rotary Converters to run 3-phase 415v machinery from 240v single-phase supply.

For further details contact:

Motorun Phase Converters

23 Waldegrave Road, Teddington, TW11 8LA
Middx. Tel: 020 8977 0242 Fax: 020 8943 3326
Ansaphone Service After Hours



TAPS + DIES

- SAME DAY POST -
www.tapdie.com

(Every size stocked/manufactured/supplied)
20 years - Excellent quality - Lowest prices

BSW/BSF, UNC/UNF, Metric, BA, ME, Cycle, BSB, Specials, Taps & Dies sold individually or boxed.

THE TAP & DIE CO. (Dept ME) 445 West Green Rd, London N15 3PL, UK. Tel: 020 8888 1865. Fax: 020 8888 4613



HI-TEC 3-PHASE CONVERTERS

Speed Controls, Forward & Reverse Switches, Static and Rotary Phase Converters 0.8kW to 45kW to run 3 phase 415 volt machinery from a Single Phase. We can also supply Transformers and Components.

Website: www.phaseconverters.co.uk

BOOST ELECTRICAL ENGINEERING
Tel: 01959 534073 Fax: 01959 532726

(24 hr update) **www.tradesalesdirect.co.uk** (Trade Prices)

Don't wait for the next issue! Check out the Internet Web Site above. It contains a stocklist of used lathes, millers, grinders, drills, saws, miscellaneous machinery, accessories, items of interest, etc. A stocklist is also available 'FREE' by post.

Contact: David Anchell, Quillstar Ltd, Lower Regent Street, Beeston, Notts. NG9 2DJ
Tel 0115 9255944 Fax. 0115 9430858 or you can send an e-mail to: david@tradesalesdirect.co.uk.

WORLDWIDE SHIPPING. TRADE SALES DIRECT IS A SUBSIDIARY OF QUILLSTAR LTD.

DivisionMaster "Indexing Without Pain"



- Convert your rotary table, dividing head, or headstock dividing attachment to CNC
- All divisions up to 999
- Any angular movement up to 360 degrees
- Positions rotary axis to $\pm 1/200$ th degree (90:1 ratio rotary table)
- Will drive stepper motors rated up to 2A/phase (available to order)
- Motor mounts available for Vertex HV4, HV6, and BSO
- Any worm drive ratio up to 5000:1

Controller + PSU: £250 + VAT
(Motor & mount extra)

DivisionMaster Ltd

11a Poplar Grove, Sale, Cheshire, M33 3AX

Tel: 0161 973 4278 Fax: 0161 973 6534

Email: sales@divisionmaster.com

Website: <http://www.divisionmaster.com>

Clarke

STILL OUR
FIRST CHOICE

MORE
STOCKS

ANY
of these
most popular
machines, when
ordered to PAISLEY'S
come carriage free
& VAT paid, direct from
Clarke's Main Warehouse.



DOWN TO EARTH PRICES NOW

The Choice of discerning engineers

These machines win on performance
**DON'T MISS OUT, we're
rated specialists nationwide**

Private Modelmakers, Industrial Concerns
and Schools loyally served, supported by
masses of appreciative letters from our customers,
from over the entire nation, for all to read when visiting.

30 years establishment, as lifelong toolmakers &
retailers: A well proven combination for offering best
possible service & advice, with no fuss & misleading doubts.

If not served by us before, **TEST US** for an initial introduction.
Just 27p SAE will bring you a most in-depth informative brochure,
followed by a **FREE** Clarke's

impressive 2003 195 page A4 colour catalogue.

SHOP AROUND by all means
so would we, but these fantastic
offers should apply the brakes.

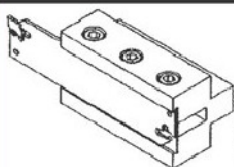
Enjoy an impressive demonstration
of these 3 exceptional. No sales
pressures. The lookalikes have been
well scrutinized and not our choice.

**PAISLEY
MACHINE
TOOLS**

BE THERE IF YOU CAN
195 Leylands Road, Burgess Hill,
West Sussex RH15 8HR
Tel: (01444) 242266 Mobile
07748697290

Give us a ring for a chat - **VISITING BY APPOINTMENT**

MEDIUM DUTY PART-OFF SYSTEM



**£89.50
incl. VAT & P & P**

System comprises of:-

Five 2mm wide carbide inserts
Double-ended insert blade
Blade holder & Allen key
Extraction Tool
Max. Part-off diameter 130mm

As reviewed in
**M.E. Workshop
No 87**

Spare inserts available @ £4.80 incl. VAT and P & P

Now available for Myford size m/cs fitted with 'T00' size Dickerson tool posts

CLARKE ENGINEERING Tel: 01603 722023
FULL MONEY BACK GUARANTEE

Bede

Tools & Machinery

The North East's supplier
of new & used tooling and light
machinery for the model engineer

email: bedetools@yahoo.co.uk

RING FOR DETAILS

0191 428 6575

www.eternaltools.com
secure ordering online

DIAMOND WHEELS

All Shapes for all machines:
Quorn, Worden, Stent, Bench Grinders

Prices from: £34.95 inc VAT



"Bring life to old carbide tools"

Eternal

tel: 020 8880 0974

83 Mount Pleasant Lane - London E5 9EW

CALL TODAY!

LATHE PARTS

Lathe Parts and Gears for most
makes of machines + accessories.
Reconditioning and cutting service.

For more information call

077208 70891

or see www.latheparts.co.uk

R.A. ATKINS

MYFORD ML10 LATHE MAKERS STAND.....	£575
MYFORD SPEEO 10 LATHE 18 BENCH.....	£625
MYFORD SUPER 7 LATHES, choice from.....	£850
MYFORD SUPER 7B LATHES, from.....	£1,450
EMCOMAT 7 LATHE CABINET STAND.....	£600
BOXFORD AUD LATHE 5x22 FULLY EQUIPPED.....	£1050
COWELLS, 90ME LATHE WELL TOOLED.....	£925
BGA UNIV MILL TOOLED MAKERS STAND.....	£975
ELLIOT 00 OMNIMILL TOOLED.....	£800
EXCEL 2AF MILL TURRET as new.....	£1450
FOBCO STAR 1/2" 1M/T PILLAR DRILL.....	£195
Q&S 6" BULLDOG HACKSAW.....	£350
UNIV MILL HEAD SUIT ELLIOTT 181 MILL unused.....	£150
MYFORD PLAIN VERTICAL SLIDE.....	£90
MYFORD DIV HEAD 2 PLATES.....	£300
MYFORD GEARBOX SUIT SUPER 7.....	£400

**100'S MODEL ENGINEER TOOLS & EQUIPMENT
WE URGENTLY REQUIRE TO BUY WORKSHOPS**

**HUNTS HILL HOUSE, HUNTS HILL, NORMANDY,
GUILDFORD, SURREY GU3 2AH**

Tel: (01483) 811146 Fax (01483) 811243

7 1/4 ROMULUS immaculate, as new, professionally
built, twin injectors, vacuum brakes, excellent, top
quality steamer, powerful, hauls 25 people all day,
new boiler certificate £7,500. Tel: 01442 384087
(Herts).

**TWO 12VOLT 1/2 HP 2 SPEED 2900RPM GEC HD
MOTORS** £15 each. Several 12V gearmotors
GRATIS. Six Loco 5" spoked driving wheel castings
£15. Tel Tom: 01582 762066 (Herts).

LASER CUT PARTS for various locomotives and
traction engines. Tel: 01302 721611 for details.

GENERAL

PRECISION MACHINING FOR MODEL ENGINEERS

Trade enquiries welcome. Est. 36 years.

Write G. Plume

137a Erith Road, Bexleyheath,

Kent DA7 6BT

or Tel: 01322 554516 anytime

**Advertising in
MEW WORKS!!**

SERVICES



Lathe Bed and Slideway

REGROUNDING ON CHURCHILL
8' X 2' SLIDEWAY GRINDER

Contact Greg Lexster at:

G. Lexster Machine Tool Services

Unit B4, 46 Holton Road, Holton Heath,
Poole, Dorset BH16 6LT

Tel/Fax: 01202 620652

MODELS & MATERIALS

SUPER METALS SUPPLIED BY BULLDOG AIRCRAFT

All material is of Rolls Royce quality and supplied in bar, sheet etc
Choose from alloy, bronze alloy, stainless steel, tool steel, copper, brass, bronze,
titanium billets, inconel sheet, aluminium sheet ... sizes from 1/2" to 6" Dia.
PHONE OR FAX YOUR REQUIREMENTS TO

BULLDOG AIRCRAFT

8 RIDGEWAY CLOSE, FAIR OAK, HANTS. SO50 7FZ
Tel: (+44) 02380693207 / FAX: (+44) 02380602146 / MOB: 07881541172

GREENWOOD TOOLS

Greenwood Tools have established themselves as the biggest
supplier of indexable insert tooling to the model engineering
fraternity in the UK. This has been achieved by understanding the
requirements of model engineers, and supplying top brand,
industrial quality cutting tools at prices affordable by individual
hobbyists. They currently have many special offers available on
their website, www.greenwood-tools.co.uk

MAGAZINES

MODEL ENGINEER WORKSHOP MAGAZINES for sale, Nos
1-88 inclusive, offers to Tel: 01323 503088 (E Sussex).

WANTED TO COMPLETE SET for binding Model Engineers
Workshop Nos 33, 39, 58 and 59. Tel: 01530 832645 (Leics).

MODEL ENGINEERING SUPPLIES (BEXHILL)

www.model-engineering.co.uk
EMAIL: diesel@17bexhill.fsnet.co.uk
MODEL LOCO ROLLING STOCK COLOURED BROCHURE £1.75 INC P.P.
MATERIAL CATALOGUE £1.25 INC P.P.
VISIT OUR SHOP FOR GOOD USED LATHES AND TOOLING PLUS RAW
MATERIALS AND FASTENERS
Phone/Fax 01424 223702 Mobile 07808 212236
17 Sea Road, Bexhill-on-Sea, E. Sussex, TN40 1EE

SOCKET SCREWS
Cap. Csk. Button. Set (Grub). Shoulder
METRIC. BA. BSF. BSW. UNF. UNC
Hexagonal & Slotted Screws Nuts & Washers.
Dowel & Spring Pins. Dormer HSS Taps & Drills. Draper Tools.
NO MINIMUM ORDER PROMPT SERVICE
Send 4 x 1st class stamps for our latest catalogue (refundable)
Special offer ***** Workshop Discount Pack *****
36 packets of socket, hexagonal and
slotted screws up to a max. size of
2BA - 5/16" - M8. Various threads / lengths.
Catalogue value of pack is over £35.00
Pack on offer to you for only £19.55 + £2.45 p/p
Send for this offer and benefit from a very
useful stock of screws in your workshop.
You will not be disappointed. Refund guaranteed.
Emkay Screw Supplies (MEW) 74 Pepps Way
Strood Rochester Kent ME2 3LL
Tel: 01634 717256 www.emkaysupplies.co.uk Mail Order Only
Email: emkaysupplies@onetel.net.uk

BA FASTENERS IN BRASS STEEL & STAINLESS

SPLIT PINS, TAPER PINS,
ROLL PINS, TAPS, DIES, DRILLS,
NUTS WASHERS,
RIVETS, MATERIALS
Send Stamped addressed envelope plus two first class
stamps for 28 Page List (Overseas £1.50) Quote MEW.
"ITEMS" MAIL ORDER LTD,
46, ST. MARTINS ROAD, NORTH LEVERTON,
RETFORD NOTTINGHAMSHIRE DN22 0AU
Telephone 01427 884319 Fax 01427 884319

BLACK-IT!

Easy to use Chemical Blacking for Iron and Steel
Produces a professional satin black finish in less than 15 minutes
Standard kit (4 X 500ml) ideal for modelmakers £27.99
Large kit (4 x 2 Litres) £64.99
Black-It! kit for Brass £18.99
All prices include VAT & next day delivery
Pixel-Plus, Brynccroes, Pwllheli, Gwynedd LL53 8EH
Tel/Fax 01758 730356 Access, Visa & Switch accepted
For more details, visit our web site at www.black-it.co.uk

READERS' OFFER

SAVE £6 ON RETAIL PRICES

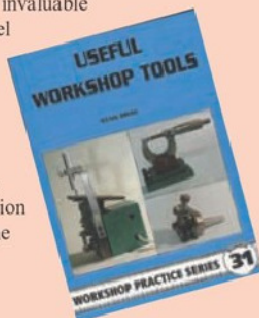
THREE NEW TITLES IN THE WORKSHOP PRACTICE SERIES from NEXUS SPECIAL INTERESTS BOOKS

USEFUL WORKSHOP TOOLS

Stan Bray

210 X 148 MM; 104 PAGES;
30 B+W PHOTOS; 70 LINE DRAWINGS;
1-85486-194-8; PAPERBACK £ 6.95

Workshop Practice Series No. 31. A
collection of fifteen invaluable
additions to the model
engineer's armoury
of tools and
equipment from the
former editor of
Model Engineer's
Workshop magazine.
This practical collection
covers benchwork, the
lathe and milling
operations.



MAKING CLOCKS

Stan Bray

210 X 148 MM; 128 PAGES;
100 B+W ILLUSTRATIONS;
1-85486-214-6;
PAPERBACK £ 6.95

Workshop Practice Series No. 33. An
introduction to the fascinating
world of horology for
the complete beginner.
This book explains the
terminology of the
clockmaker and provides
general details of clock
construction including
layout of wheels and
escapements, all of which are
fully described and illustrated.

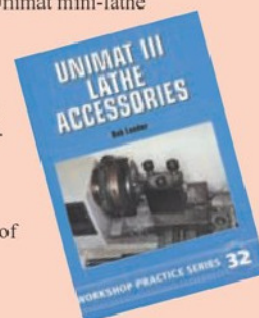


UNIMAT III LATHE ACCESSORIES

Bob Loader

210 X 148 MM; 160 PAGES;
160 B+W PHOTOS; 70 LINE DRAWINGS;
1-85486-213-8; PAPERBACK £ 6.95

Workshop Practice Series No. 32. An acknowledged
authority on the popular Unimat mini-lathe
has developed numerous
accessories and
techniques to assist the
model engineer in getting
the best from the machine.
The projects in this book
increase the scope of the
machine & advise on the
performance of a number of
tricky operations.



SPECIAL OFFER THIS MONTH - BUY ALL THREE BOOKS FOR £15.00 SAVE £6.00 ON CURRENT RETAIL PRICES

To order please call the credit card hotline on 01322 616300 or send a cheque made payable to Nexus Media Ltd.
Customer Services, Nexus House, Azalea Drive, Swanley, Kent, BR8 8HU.
Online ordering www.nexusonline.com

FOR INDIVIDUAL PURCHASES PLEASE ADD £1 FOR P&P

HOME AND WORKSHOP MACHINERY

QUALITY USED MACHINE TOOLS

NOW WITH
LARGER PARKING
AREA!!

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

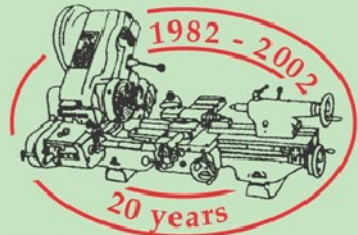
Telephone 020-8300 9070 – Evenings 01959 532199 – Facsimile 020-8309 6311.

www.homeandworkshop.co.uk

stevehwm@btopenworld.com

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

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



LATHES

BOXFORD TUD 4 1/2" x 20" MK11 3 jaw chuck, cabinet stand, hand feeds.....	£395
BOXFORD CUD 4 1/2" x 20", changewheels, 3 jaw chuck, cabinet stand.....	new selection just in £750
BOXFORD CUD 5" x 22" MKIII, c/wheels, 3 jaw chuck, 4 way toolpost.....	£1,400
BOXFORD BUD 5" x 22" MKIII, c/wheels, power cross feed, T-slotted cross slide.....	£1,400
BOXFORD AUD 5" x 22" MKIII, gearbox, power cross feed, T. slotted cross slide, cabinet stand.....	very nice £1,625
BOXFORD AUD 5" x 30" MKIII, gearbox, power cross feed, T. slotted cross slide, cabinet stand.....	very nice £1,950
BOXFORD AUD 5" x 30" MKIII, gearbox, power cross feed, T. slotted cross slide, cabinet stand.....	even nicer £2,450
COLCHESTER CHIPMASTER 5" x 20", gearbox, variable speed, 3 jaw chuck, face plate, 4 way tool post.....	Just £950
COLCHESTER BANTAM 1600 model, 5" x 20", geared head, power feeds, gearbox.....	£1,400
COLCHESTER BANTAM 2000, 6 1/2" centre height x 30", between centres, 11/4" bore, 16 speeds, D13 camlock fitting, 3 & 4 jaw chucks in very nice condition.....	£3,250
COLCHESTER BANTAM 2000 as above but latest model made.....	£3,750
COLCHESTER STUDENT Square head, 1500 revs / 2 speed motor model, geared head, gearbox, imp/met, power cross feed & gap bed, dual dials, 3 Jaw chuck, taper turning, coolant, etc.....	£2,950
COLCHESTER STUDENT 1800 6 1/2" x 40" + gap bed, 19" swing, 3 & 4 jaw chucks, Dickson tooling, taper turning, dial indicator, coolant, splash back, very nice, metric dials.....	£3,750
COLCHESTER MASTER 2500; short and long bed lathes.....	COMING IN!!
COLCHESTER TRIUMPH 2000 7 1/2" x 50" full screwcutting gearbox and power feeds, gap bed, 3 & 4 Jaw chucks, Dickson tooling, face plate etc.....	now £4,950
HARRISON L5, 4 1/2" x 24", fully toolled, complete with clutch.....	one of the best start up deals £950
HARRISON L10, 5 1/2" x 24", geared head, semi gearbox, 3 jaw chuck, gap bed, power feeds, clutch.....	£1,400
HARRISON L40, 5 1/2" x 24", geared head, gearbox, gap bed, power feeds, tooling, coolant.....	£1,725
HARRISON M250, 5" x 20", gearbox, power feeds, 3 & 4 chucks, Ex-services.....	nice condition £2,950
HARRISON M250, 5" x 30", long bed, gearbox, power feeds, chucks, Acutrite III DRO on cross-slide, dual dials.....	In very nice condition £3,250
HARRISON M300 6" x 24", geared head, gearbox, power feeds, 3 jaw chuck, Dickson toolpost.....	As is £1,850
HARRISON M300 6" x 40", geared head, gearbox, power feeds, gap bed, 3 jaw & 4 jaw chucks, fixed steady.....	In very nice condition £3,450

HOBBYMAT MD200 (just come in and almost mint).....	£345
HOBBYMAT MD65 2 1/2" x 12" Screwcutting Lathe with changewheels and some tooling.....	£425
MYFORD ML7 3 1/2" x 19", lathe, 3 jaw chuck.....	we have a large selection of this popular model £750
MYFORD ML7T 3 1/2" x 19", Tri-lever, changewheels, 3 jaw chuck, lever tailstock, cabinet stand.....	very clean £1500
MYFORD ML7B 3 1/2" x 19", gearbox, 3 jaw chuck and tooling.....	£1,250
MYFORD SUPER 7 3 1/2" x 19", changewheels, 3 jaw chuck and tooling.....	Choice £950 - £1,150
MYFORD SUPER 7, 3 1/2" x 19", 3 jaw chuck, power cross-feed.....	Late model Choice
MYFORD SUPER 7 3 1/2" x 31", changewheels, 3 jaw chuck and tooling.....	Choice £1,400
MYFORD SUPER 7, 3 1/2" x 31", (long bed) power cross-feed, induction hardened bed, industrial stand and doors, green machine.....	£2,950
MYFORD SUPER 7B 3 1/2" x 19", gearbox, 3 jaw chuck and tooling.....	£1,250
MYFORD SUPER 7B, 3 1/2" x 19", gearbox, Power Cross Feed, cabinet stand, tooling.....	£2,750
MYFORD SUPER 7B, 3 1/2" x 19", gearbox, Power Cross Feed, Hardened bed, 3 jaw chuck and tooling on stand.....	£3,400
excellent condition from new and NOT re-conditioned.....	
RAGLAN CAPSTAN 10" x 24" 6 Station Turret, cut of slide, collet chuck (lever) & collets, bar feed, variable speed, coolant.....	£950
SMART AND BROWN 1024 Tool-room lathe, full screwcutting gearbox and power feeds complete with 3 & 4 jaw chucks, collet set, steadies and equipment.....	In very good condition £1500
VICEROY TDS 1 GBL 5" x 24", gearbox, power slides, 3 MT tailstock complete with fixed steady.....	£1,400
VICEROY TDS 1 GBL 5" x 24", gearbox, power cross feed complete with 3 / 4 jaw chucks, steadies, Dickson tool post, tooling, cabinet stand and.....	A very rare imperial model at only £1,950

MILLING MACHINES..... V - VERTICAL, H - HORIZONTAL

ADCOCK AND SHIPLEY IES Horizontal/Vertical Head, 30" x 8" powered table and feed gears, coolant.....	£1,625
BOXFORD VM30 vertical variable speed / 30 INT head, table 21 1/2" x 6" + Abwood vice and chuck.....	£1,500
BRIDGEPORT vertical belt head 2 speed (short motor) head, R8 powered head, gearbox table, 42" x 9" table.....	Very nice £2,250
CENTEC 2B Horizontal, 1" arbor, table powered, 3 ph motor, single phase main motor.....	£725
CENTEC 2B Vertical/Horizontal, quill feed 2MT head, 25" x 5" table, pedestal model.....	£1,400
ELLIOT '90' OMNIMILL V/H 3 Morse taper quill universal head, 28" x 7 1/2" powered table.....	Just in £1,850
ELLIOT '90' OMNIMILL V/H 3 Morse taper quill universal head, 28" x 7 1/2" powered table.....	probably the best one around on the second hand market Just in £2,750
ELLIOT Turret mill R8-10 speed 70-3000 rpm, table 45" x 10" (powered).....	£1,500
EMCO FB2 Vertical 6 speed quill feed head 2 MT, powered 24" x 6" table, full coolant tray.....	now only £1,500
HARRISON horizontal, 31" x 8" powered table.....	still good value £625
HARRISON H/V 30 INT swivel head & clutch, 30" x 8" table/powered.....	£1,950
HARRISON Vertical 30 INT swivel head & clutch, 30" x 8" table/powered.....	£1,950
MARLOW VERTICAL TURRET TYPE MILL, 3 Morse Taper.....	A favorite mill for its height under the head £750
RAGLAN vertical mill 2 Morse taper, 2 speed motor, variable speed 175-2220 rpm, stand.....	give away £750
SIP RF30, vertical milling/drilling machine complete with accessories.....	Still only and New £799
TOM SENIOR MODEL E vertical mill complete with cabinet stand.....	single phase and rare £2650
TOM SENIOR MODEL E vertical mill complete with cabinet stand.....	
single phase and rare in excellent condition + Tom Senior swivel vice and geared conversion gear, one meticulous owner from new- must see good home £3450	
TOM SENIOR JUNIOR horizontal mill with a vertical head (sleeve to be made), table: 20" x 4 1/2", powered.....	£1200
TOM SENIOR M1 horizontal, 25" x 6" powered table, 1" arbor.....	£575
TOM SENIOR M1 V/H, 25" x 6", 2 motor taper, 1" arbor.....	Selection £1,200 - £1,450
TOM SENIOR M1 V/H, 25" x 6", 2 motor taper, 1" arbor.....	VERY LATE 240 VOLT MACHINE £1,950
TOM SENIOR ELT MAJOR, 2 motor taper quill feed head, powered 37" x 8 1/2" table in.....	£3,200
VICEROY AEW vertical mill, 30 INT swivel head, powered table 34" x 8",.....	Very clean £1,625

DRILLS

ARBOGA ER 25 / 25" Radial Drill speeds (8) 100-2900 RPM.....	clean table £1,425
ASQUITH 14-54 001 Mk2 (5mt) Radial Drill.....	£3,950
FOBCO 1/2" Bench, tilting table.....	£325
FOBCO 1/2" Pedestal drill tilting table.....	£345
MEDDINGS MB10 high speed drilling machine with 240 volts.....	£375
MEDDINGS 1/2" pedestal drill.....	£245
MEDDINGS 2 Morse taper pedestal drills (new type lighter drill).....	Choice £275
MEDDINGS 2 Morse taper quality bench drills.....	Choice only (each) £325
POLLARD CORONA Pedestal 1/2" V1 Morse.....	From £100
SIP HDP 600B 1/2" 2MT Bench Drill, table operated by rack, speeds: (16) 162 - 3000 rpm.....	New £175
STARTRITE Mercury 1/2" 4 speed bench drill.....	£225
STARTRITE EF1 3 Morse taper, power up / down, 12 speeds, 80 - 2800 rpm.....	In excellent condition £950
GRINDING / BUFFING	
BRIELEY drill point grinder complete with cabinet stand and parts.....	£375
CLARKSON MK1 Tool and cutter grinder complete with universal head and centres.....	£550
MILFORD 12" Pedestal Grinder.....	£325
VICEROY Grinder, pedestal model.....	£145
VICEROY Buffers, pedestal models.....	Each £250

MISCELLANEOUS / FABRICATION MACHINERY

HARE MODEL 51T complete with hydraulic indexable table.....	Just £425
EMI-MEC SPRINT spindles and collets, bsa no.48 direct spares, smart and brown lever compound slides + lever collets, hardinge finger feed collets.....	Just in
GEORGE ALEXANDER 4MT collet adapter and two collets.....	£50
SWEENEY AND BLOCKAGE NO.2 flypress complete with ball.....	very clean £225
MARLCO notch broaching fixture + notch broach.....	£425
CLARKSON drill point grinding attachment for CLARKSON MK1 & MK11 grinder.....	£425
HARCOS universal head for tool and cutter grinder.....	£245
MYFORD vertical slides just in.....	£95 / £155
MYFORD VM-D milling attachment for ML7 and Super 7 lathes.....	As new £675
BCA 12" horizontal / vertical rotary table.....	very nice £425
QUANTITY of slips, height gauges, squares, straight edges, micrometers, cubes, angle plates and miscellaneous measuring tools.....	Just in
COPE AND DRAGS.....	WOOD £20 / METAL £30
TONGS (a varied selection).....	Each £5
FLAMEFAST DS 130 ceramic chip forge.....	£345
FLAMEFAST DS 100 hearth.....	£140
MARLCO Broaching Press.....	£425
JONES AND SHIPMAN 4" x 24" bench centres.....	very nice example £245
TOM SENIOR slotting head.....	£450
STARTRITE 18-5-5 Woodworking / non ferrous bandsaw (5 speed bandsaw).....	£950
DIAMOND fret saw, variable speed.....	£345
RJH BT 125 Fretsaw, variable speed.....	£345
SMART AND BROWN / CLARKSON H3-H5 toggle presses.....	Each £195 / £275
ARRAND 2MT long milling spindle.....	As new £75
VERDICT CLOCKS, Long/Short Metric and Imperial models.....	New £40
FLAMEFAST LD300 Soldering Iron Stove.....	£75
GRANITE 18" x 12" Surface Plate.....	£140
VIBROSEAR Nibbler.....	Just in £425
TRIUMPH BURNERD 4 Jaw Chuck.....	£245
TRIUMPH face plate D14.....	£70
JONES AND SHIPMAN Broaching Press + Stand.....	£375
ABB Inverter & 1/2 hp motor, wired up.....	£250
SIP 7" bandsaw, horizontal & coolant.....	New £750
WELLSAW hacksaw.....	As is £145
DUPLEX D29 toolpost grinder.....	£345
BOXFORD (imperial only) thread dial indicator.....	£65
ABWOOD 6" swivel/tilt machine vice.....	Each £345
VANCO, 1" finisher / vertical + extractor.....	£495
BURNERD, D14 lever collet chuck + collets.....	£400
BURNERD, L0 lever collet chuck + collets.....	£400
VERTEX Dividing head.....	New £245
VERTEX 6" - 8" - 10" rotary tables.....	good value equipment New From £135
MYFORD ML7 / Super 7 rear tool post.....	£40
MYFORD 254S rear tool post.....	New £40
MYFORD Vertical slide / fixed type (copy).....	£99
LOCKWOOD QUAD HEADED 2mt Die Holder.....	quality equipment New £40
LOCKWOOD QUAD HEADED 3mt Die Holder.....	quality equipment New £40
LOCKWOOD Test Bar / 2mt Boxed.....	quality equipment New £39
LOCKWOOD Test Bar / 3mt Boxed.....	quality equipment New £42
MAGNETIC chuck - 18" x 6" fine pole.....	Never used £325
TOM SENIOR Model E pedestal stand.....	£150
UNION tool and cutter grinder stand.....	£135
50 INT Tooling: Selection.....	Just in
STARTRITE 352 woodworking band saw.....	£975
STARTRITE 14-S-5 woodworking band saw.....	£775
ALCOSA GF 080/1 Rapid Melting Furnace.....	£300
MYFORD Burnerd Gripitri 3 Jaw Chucks.....	Boxed £225
COLCHESTER D13 Burnerd 4 Jaw 8" light body independent chuck.....	one off £225
RJH 4" Unisher / Vertical complete with built in extraction.....	£625
MICROMETERS and associated measuring tools.....	Still packaged as new
POTTERY WHEELS, kilns and associated equipment.....	Just In Cheap
SPECAC Powder type press.....	£225
HARRISON L6 metric gearbox.....	As is £250
HARRISON L6 tailstock.....	£245
NEW FROM NEW ZEALAND:- Machine vice, 55mm. Jaws precision miniature type ideal for vertical slides and smaller milling machines such as BCA now with the swivel base.....	£134
Vice on own.....	£85
Swivel base on own.....	£49
SIP 1 TON MOBILE CRANE Manufactured 2000 (used just once).....	As new £375
MITUTOYO grade A set of slips.....	£245
F.J. EDWARDS 24" hole cutter.....	£525
Large bench vice.....	£70
LINK 1.5 ton vehicle crane + top hat.....	£625
MITUTOYO 103-913 metric set micrometers.....	£275
NORTON / EDWARDS arbor presses.....	£75 / £145
AJAX 6" hacksaw.....	£425
SURFACE plates from 12" x 12" to 36" x 36".....	Very nice from £30
WEBER 1 1/2 ton mobile garage crane, late blue colour.....	£495
ELLIOTT 1250 STURDMILL vertical head.....	One off (rare) £525
RJH Inisher 4" wide belt, pedestal.....	£345
STEEL STOCK different stock rolling in almost daily.....	to callers only
ELLIOT U1 / U2 Slitting head.....	£475
SWAGE BLOCKS.....	£125 / £145
J & S Universal grinding vice.....	Choice £275 / £325
BOX TABLES: Grade A and B, many sizes.....	£40 - £150
SLIPS / GAUGES Metric / Imperial, New Sets: 87 / 81 piece.....	£215 / £145
HORIZONTAL METAL BANDSAW 6" x 4 1/2" capacity.....	New £170
COLCHESTER STUDENT / MASTER Round head, face-plates, small / large.....	£50 / £80
QUALTERS AND SMITH 6" Hacksaw.....	£345
BORING HEADS 2 / 3 Morse, R8 Taper, Max. Capacity 4 1/2" round bar.....	New, each £90
ODONI Machine Bed Clamps (pair).....	Special £24.50
HEIGHT GAUGES by Chesterman, Shardlow, Moore and Wright.....	From £95
ELLIOTT 10M Shaper, 10" stroke.....	£325
DIE BOXES.....	From £45
TRANSWAVE 3HP Converter.....	New £295
TRANSWAVE 5.5HP Converter.....	New £385
TRANSWAVE MT & RT rotary converters.....	From £485
CROMPTON PARKINSON 3/4 HP, resilient mount, Boxford / Myford Super 7 Type motor.....	New £140

News: We have just
had some Adcock and Shipley
2E horizontal mills in
good condition at only
£295 each + VAT

WE ARE CONSTANTLY CHANGING OUR STOCK FASTER
THAN THE ADVERTS CAN KEEP UP WITH US!!!

PLEASE PHONE 020 8300 9070 TO CHECK AVAILABILITY OR TO OBTAIN OUR LIST
DISTANCE NO PROBLEM!! DEFINITELY WORTH A VISIT ALL PRICES EXCLUSIVE OF V.A.T.

NEW STOCK ARRIVING
EVERY DAY, IF YOU
DON'T SEE WHAT YOU
ARE LOOKING FOR, JUST
RING FOR UPDATES!!



- 2-Axis DRO from **£615** inc vat
- Made in the UK
- 5 year No-Fault Warranty
- 10 micron Accuracy

Conquest Lathe

NOW INCLUDES TEST CERTIFICATE



VARIABLE SPEED

STANDARD ACCESSORIES

• 80MM 3-JAW CHUCK

• Q.C.T.P. WITH 3 TOOL HOLDERS

£395

Price includes VAT & Delivery*



920 Lathe Deluxe

- SWING OVER BED: 229MM
- SWING OVER CROSS SLIDE: 133MM
- DISTANCE BETWEEN CENTERS: 500MM
- SPINDLE BORE: 19MM
- TAPER IN SPINDLE NOSE: MT3
- MOTOR: 1/2HP
- 6 SPEEDS: 100-1800RPM
- NET WEIGHT: 100KG

STANDARD EQUIPMENT:

- 4" 3-JAW CHUCK WITH 2 SETS OF JAWS
- 7" 4-JAW CHUCK WITH REVERSIBLE JAWS
- STEADY REST • FOLLOW REST
- MT2 DEAD CENTRE
- MT3 DEAD CENTRE
- 4-WAY TOOL POST
- FACE PLATE
- TOOL BOX & TOOL KIT
- TRAY & SPLASH GUARD



£699

Price includes VAT & Delivery*

Model B-Super

- SWING OVER BED: 420MM
- DISTANCE BETWEEN CENTERS: 500MM
- MILL DRILL SPINDLE TAPER: 19MM
- TAILSTOCK BARREL TRAVEL: 80MM
- 7 SPEEDS 160-1360RPM
- SWING OVER CROSS SLIDE: 160MM
- SPINDLE TAPER: MT3

- DRAW BAR: M12
- CROSS SLIDE TRAVEL: 180MM
- MOTOR: 1/2HP
- NET WEIGHT: 155KG

STANDARD EQUIPMENT

- 4" 3-JAW CHUCK
- 2 DEAD CENTERS
- 1/2 DRILL CHUCK
- CHANGE GEARS
- MT3 CHUCK ARBOR



£699

Price includes VAT & Delivery*

Centurion

- SWING OVER BED: 420MM
- DISTANCE BETWEEN CENTERS: 520MM
- MILL DRILL SPINDLE TAPER: MT3
- TAILSTOCK BARREL TRAVEL: 80MM
- 7 SPEEDS 160-1360RPM
- SWING OVER SADDLE: 160MM
- SPINDLE TAPER: MT3

- DRAW BAR: M12
- CROSS SLIDE TRAVEL: 200MM
- MOTOR: 2 x 1/2HP
- NET WEIGHT: 230KG

STANDARD EQUIPMENT

- 4" 3-JAW CHUCK
- 2 DEAD CENTERS
- 1/2 DRILL CHUCK
- CHANGE GEARS
- MT3 CHUCK ARBOR



£1100

Price includes VAT & Delivery*

Champion Mill

- DRILLING CAPACITY: 20MM
- END MILL CAPACITY: 25MM
- FACE MILL CAPACITY: 63MM
- TABLE SIZE: 150x630MM
- NUMBER OF SPEEDS: 4
- SPEED RANGE: 400-1640RPM
- SPINDLE TAPER: MT3
- TILTING HEAD: 90° LEFT & RIGHT
- MOTOR: 1/2HP

From

£585

Price includes VAT & Delivery*



STANDARD ACCESSORIES

- 1-13MM DRILL CHUCK & ARBOR

Eagle 25 Mill/Drill

- MILL/DRILL CAPACITY: 25MM
- TABLE SIZE: 190 x 585MM
- FINE FEED
- NUMBER OF SPEEDS: 12
- SPEED RANGE: 100-2150RPM
- SPINDLE TAPER: MT3

- SPINDLE TRAVEL: 100MM
- MOTOR: 1HP

Price

£699

Price includes VAT & Delivery*



STANDARD ACCESSORIES

- 1-13MM DRILL CHUCK & MT3 DRILL CHUCK ARBOR
- EAGLE FACE MILL CUTTER
- T3 TILTING VICE
- M12 DRAWBAR
- NVR SWITCH GEAR
- INTERLOCKED CHUCK GUARD
- MANUAL AND PARTS LIST

Eagle 30 Mill/Drill

- MILL/DRILL CAPACITY: 32MM
- TABLE SIZE: 210 x 740MM
- FINE FEED
- NUMBER OF SPEEDS: 10
- SPEED RANGE: 80-2300RPM
- SPINDLE TAPER: MT3
- SPINDLE TRAVEL: 130MM
- TILTING HEAD

- MOTOR: 1HP
- HIGH/LOW GEARBOX

Price

£899

Price includes VAT & Delivery*



STANDARD ACCESSORIES

- 1-13MM DRILL CHUCK & MT3 DRILL CHUCK ARBOR
- EAGLE FACE MILL CUTTER
- V100 MACHINE VICE
- M12 DRAWBAR
- NVR SWITCH GEAR
- INTERLOCKED CHUCK GUARD
- MANUAL AND PARTS LIST

626 Turret Mill

- MILLING CAPACITY: 25MM
- DRILLING CAPACITY: 32MM
- TABLE SIZE: 152 x 740MM
- FINE FEED
- NUMBER OF SPEEDS: 9
- SPEED RANGE: 190-2100RPM
- SPINDLE TAPER: MT3 OR R8
- TILTING HEAD
- MOTOR: 1 1/2HP

Price

£1340

Price includes VAT & Delivery*

STANDARD ACCESSORIES

- ONE SHOT LUBRICATION
- HALOGEN WORK LIGHT
- MACHINE STAND
- DRAWBAR
- MANUAL AND PARTS LIST



Craftsman Gap Bed Lathe

- SWING OVER BED: 300MM
- SWING OVER GAP: 450MM
- SWING OVER SADDLE: 170MM
- DISTANCE BETWEEN CENTERS: 570MM
- SPINDLE BORE: 36MM
- SPINDLE NOSE TAPER: MT5
- CROSS SLIDE TRAVEL: 150MM
- COMPOUND TRAVEL: 89MM
- TAILSTOCK BARREL TAPER: MT3
- TAILSTOCK BARREL TRAVEL: 92MM
- RANGE OF SPEEDS: 50-1250RPM
- MOTOR: 1 1/2 HP
- NET WEIGHT: 398KG

STANDARD EQUIPMENT:

- 6" 3-JAW CHUCK WITH 2 SETS OF JAWS
- 8" 4-JAW CHUCK
- STEADY REST
- FOLLOW REST
- STAND
- FACE PLATE
- SPLASH GUARD
- THREADING DIAL
- 4-WAY TURRET TOOL POST
- 3MT DEAD CENTERS
- T-SLOTTED CROSS SLIDE
- HALOGEN WORK LIGHT

£1550

Price includes VAT & Delivery*



Super LUX Mill

- MILLING CAPACITY: 25MM
- DRILLING CAPACITY: 32MM
- TABLE SIZE: 240 x 800MM
- FINE FEED
- NUMBER OF SPEEDS: 6
- SPEED RANGE: 95-1600RPM
- SPINDLE TAPER: MT3
- TILTING HEAD
- MOTOR: 1 1/2HP

Price

£1500

Price includes VAT & Delivery*

STANDARD FEATURES

- POWERED HEAD ELEVATION
- CAST IRON STAND
- ANGLE TILTING HEAD
- MANUAL AND PARTS LIST

